BUREAU OF STRUCTURES

WisDOT Structural Engineers Symposium

Program Agenda
May 22, 2018

8:00 a.m.	Registration
8:30 a.m.	Welcome & BOS Director's Perspective – *Scot Becker*
8:45 a.m.	Contract Plans & Fabrication Shop Drawing Review Changes – *Najoua Ksontini, Kristin Revello*
9:10 a.m.	Wind Loaded Structures Initiative – *Andrew Smith, Mark Maday (CH2M/Jacobs)*
9:30 a.m.	Removing Old Structure Over Waterways – *Bill Dreher*
9:45 a.m.	Small Group (table) Discussion – *All*
10:00 a.m.	Timeliness of Consultant Plan Submittals – *Najoua Ksontini*
10:15 a.m.	Break (Beverages and Snacks)
10:35 a.m.	Automation, Policy, and Standards – *Dave Kiekbusch, James Luebke*
11:15 a.m.	Complex Structures – *Andrew Smith*
11:35 a.m.	SCC Prestressed Girders – *Steve Doocy*
11:50 a.m.	Lunch
12:50 p.m.	Misc. Geotechnical/Structural Topics - *Jeff Horsfall (Bureau of Tech Services)*
1:20 p.m.	BOS Overlay Policy, Marquette Interchange PPC Overlays – *James Luebke, Jason Sadowski (Michael Baker)*
1:50 p.m.	3D Design & Modeling, BIM for Structures – *Danielle DeTennis, Adam Swierczek*
2:05 p.m.	I94 N-S – *Frank Pritzlaff (SE Region PM), Aaron Bonk*
2:35 p.m.	Break (Beverages and Snacks)
2:55 p.m.	Strengthening Program for Local Load Posted Bridges – *Alex Pence, Josh Dietsche*
3:20 p.m.	Small Group (table) Discussion – *All*
3:35 p.m.	Interactive Survey & Q/A
4:00 p.m.	Adjourn

Conference Location: University of Wisconsin-Madison Union South
1308 West Dayton Street
Madison, WI 53715

For today's presentations, agenda, and proof of attendance, please visit:

http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/strct/research.aspx

Welcome - 2018 Symposium

Scot Becker
BOS Director, State Bridge Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

Perspective Over View

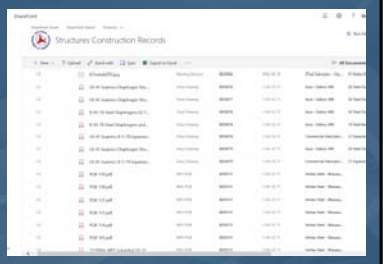
- Welcome
- Agenda Highlight
  - What's new!
  - Continuing Progress

Todays Discussion - Focus Interactive

- Third Symposium – 2014,16,18
- Spend Time Today Discussing Issues, Clarifying Polices, Sharing Innovations, Questions or Concerns

What's New – Fabrication Library

- New Fabrication Improved SharePoint Library Includes Ancillary Structures



BUREAU OF STRUCTURES

What's New – SCC in Prestress Girders

- Self-Consolidating Concrete (SCC) for Prestressed Bridge Girders
- Moving Forward with SCC

BUREAU OF STRUCTURES

What's New – Polyester Polymer Concrete (PPC) Overlay

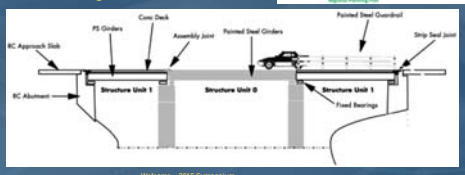
BUREAU OF STRUCTURES

What's New - LRFD Wind Loaded Structures

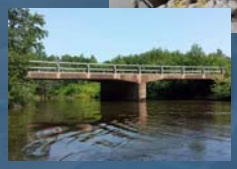
What's New – St. Croix Bridge

Highlight – Continued Progress

- Structures Asset Management
  - Program Generated by Element Condition
  - Emphasis on Preservation
  - Emphasis on Extending Serviceable Life



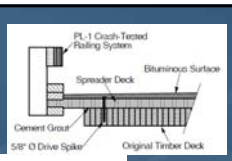
What's New – Local Bridge Program Changes

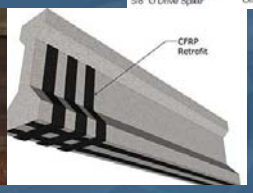


- Local Bridge Program Changes
- Fed State Money Swap
- Replace in Kind Policy
- Minimum Standards Based on Engineering Evaluation

BUREAU OF STRUCTURES

What's New - Local Bridge Strengthening Program





BUREAU OF STRUCTURES

Closing Request

I will repeat myself from 2016 if you recall ☺

- We want your Feedback and Input

- BOS - How are we doing?
- 4th Symposium?
- Innovations?
- Issues?

BUREAU OF STRUCTURES

Contract Plans- Review changes

Najoua Ksontini. P.E.
Consultant Review and Hydraulics Supervisor

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI
May 22, 2018

BUREAU OF STRUCTURES

- Goals of presentation
  - Discuss current plan submittal review process for various types of submittals and various types of structures
  - Discuss changes to review processes for various types of submittals and various types of structures

Stream Crossing and Grade Separation Preliminary Structure Plans

- No review process changes
  - All preliminary plan submittals are reviewed with focus on providing concurrence on Type, Size, and Location
  - Reviewers may provide comments on details contained on the preliminary plans
  - Contact BOS if you need input regarding proposed unusual and non-standard details

Stream Crossing and Grade Separation Final Structure Plans

- No review process changes
  - BOS will perform a Quality Assurance review on a select number of final structure plan submittals
  - Focus of BOS QA review is on structural design adequacy and load capacity
  - Reviewers may provide comments on structural details, constructability and biddability.
  - Contact BOS if you need input regarding proposed unusual and non-standard details

BUREAU OF STRUCTURES Contract Plans- Review Changes 4

Rehabilitation Preliminary Structure Plans

- Review Process changes:
  - BOS will continue to provide comments on preliminary plans for the more complex rehabilitation work such as superstructure replacement, re-decks and joint replacement
  - BOS may not provide comments on preliminary plans for certain types of rehabilitation work such as painting and Polymer overlays
  - Designers will be notified if comments will not be provided

BUREAU OF STRUCTURES Contract Plans- Review Changes 5

Rehabilitation Final Structure Plans

- Review Process changes:
  - BOS will continue to perform Quality Assurance reviews on a select number of final structure plan submittals for rehabilitation work
  - Contact BOS early if you need input regarding unusual and non-standard rehabilitation structural details

BUREAU OF STRUCTURES Contract Plans- Review Changes 6

Retaining Wall Preliminary and Final Structure Plans

- Review Process changes:
  - BOS will provide comments only on a select number of retaining wall preliminary and final structure plans
  - Focus will be on non-proprietary retaining walls, plans with unusual or non-standard details and complex geometry
  - Designers will be notified if comments on preliminary plans will not be provided

Sign Structure Preliminary and Final Plans

- Review Process changes:
  - BOS will provide comments only on a select number of sign structure preliminary and final plans
  - Contact BOS if you need input regarding non-standard sign structure details

Questions?

Fabrication Shop Drawing Review & Process Changes

Kristin Revello, P.E.
Structural Metals and Fabrication QA Inspection Unit Supervisor

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

Presentation Goals

- To provide background on the Bureau of Structures Fabrication Initiatives
- Discuss the outcomes of each Fabrication Initiative, and highlight upcoming changes
- Address how these changes may affect you as designers of structures with fabricated items

Bureau of Structures Fabrication Initiatives Overview

Tier 1

- Began Summer 2014
- Area of Focus
  - Steel Fabrication
- Creation of BOS Teams (Steering and Oversight)
- URS

Tier 2

- Began Winter 2017
- 4 Areas of Focus
  - Prestressed Concrete Girders
  - Retaining Walls
  - Sign Structures
  - Secondary Fabrication Items
- Creation of BOS Teams
- Michael Baker International

Bureau of Structures Fabrication Initiatives
Overview

- Interviews and Surveys were conducted regarding current processes, areas that worked well, and areas where improvements could be made
  - BOS staff
  - WisDOT region staff
  - Consultants
  - Fabricators
  - Steel Producers
  - Other state DOTs
- Other DOT specifications and processes were researched

Bureau of Structures Fabrication Initiatives
Overview

- For each area of focus, the current policy and practices were documented.
- Results of the interviews and surveys were documented, including current shop drawing review practices in other states
- A report for each initiative with findings and recommendations was created by the Consultant with input from the BOS Steering and Oversight Teams.
- Based on the report findings, BOS created an implementation plan for the outcomes that will be covered today.

Bureau of Structures Fabrication Initiatives
Tier 1 Outcomes

- The creation of the Contractor Certificate of Shop Drawing QC Form, DT 2333 for primary steel members.
  - Checklist based on Section 4 AASHTO/NSBA G1.1 Checklist Items
  - A P.E. is required to review the shop drawing and stamp the form, and a Contractor must sign certifying the review has occurred.
- The creation of the SharePoint Fabrication Library to receive steel shop drawings and fabrication documents
- The requirement of weekly Fabricator Progress Reports for primary steel members
- A reduction in the percentage of steel shop drawing reviews performed

Bureau of Structures Fabrication Initiative
Tier 2 Outcomes

WisDOT Fabrication Quality Assurance Program

Program Goal: To consistently enforce submittal of required documentation and enact Quality Assurance

- Provide electronic submittal requirements for fabrication documents
- Provide guidance for roles and responsibilities for all parties involved
- Ensure department quality assurance and contractor quality control roles
- Modify standard specifications and CMM for clarity and enforcement
- Clarify approved fabricator requirements

The WisDOT Fabrication Library Expansion

The Goal: A single comprehensive library for the submittal of all fabrication documents, accessible to all parties (as appropriate).

In March 2018, the new Fabrication Library went live for our users.

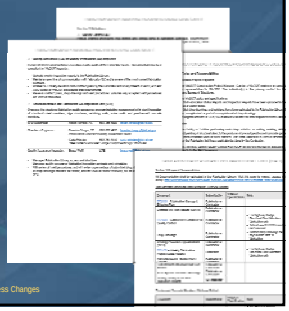
For December 2018 Let and beyond, this will be the mechanism to receive all structure shop drawings and fabrication documents.

Roles and Responsibilities - Reference Guide

Fabrication QA Program
Reference Guide

- Definitions
- Roles & Responsibilities
- SFU Contact Information
- Required Documentation by Structure Type
- Standard Specification References

Is available on the fabrication and Quality Assurance website, and will be referenced in the CMM



QA vs QC

- Although the Department intended to perform QA review of shop drawings, the reality was that we were performing QC in many areas.
  - We reviewed 100% of shop drawings
  - In some cases we were correcting errors, and essentially performing QC for the fabricator and contractor
- The decision was made to realign our processes with QA
  - Reducing the percentages of Department review
  - Look to place the responsibility of shop drawing QC on the contractor and fabricator

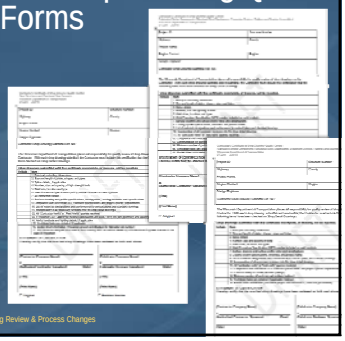
QA vs QC

- The Bureau of Structures has notified WTBA that we will no longer be reviewing all shop drawings.
- The percentages of review, and criteria of selection for each type of shop drawing will be determined by BOS.
- Project staff will be notified when a shop drawing has been selected for review.
- In the Fabrication Library, there is shop drawing status flag to indicate whether the shop drawing has been selected for review, if was reviewed and it needs to be resubmitted, or if it has been accepted.

Contractor Certificate of Shop Drawing QC Draft Forms

- Sign Structures and Overhead Sign Supports
- Retaining Walls
- Fabricated Bridge Components
- Prestressed Concrete Girders
  - Mesh substitutions are still being evaluated

Check lists are based on commonly found errors on shop drawings

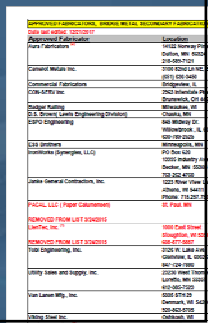


BUREAU OF STRUCTURES

Fabrication Shop Drawing Review & Process Changes

Modified WisDOT Approved Fabricator List

2018 Standard Specification List: Bridge Metal Secondary Fabrication Item



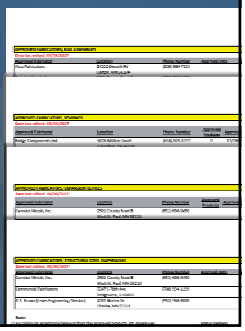
BUREAU OF STRUCTURES

Fabrication Shop Drawing Review & Process Changes

Modified WisDOT Approved Fabricator List

2019 Standard Specification List: Fabricated Bridge Components

- Railings
- Bearings
- Expansion Devices
- Structural Steel Diaphragms



BUREAU OF STRUCTURES

Fabrication Shop Drawing Review & Process Changes

New WisDOT Approved Fabricator Lists

Effective with the 2019 Standard Specification

- WisDOT will be creating 2 new Approved Fabricator Lists
  - Primary Steel Members
  - Sign Structures and Overhead Sign Supports
- In order to fabricate these items, the fabricator will need to be on the appropriate APL prior to the Let.
- Fabricator requirements to be added to these lists and the application & renewal process will be clearly defined for all parties.

Fabrication Progress Reports

- The weekly requirement of Fabrication Progress Reports submitted to the Fabrication Library for prestressed girders, fabricated bridge components, sign structures, and overhead sign supports

Upcoming Changes to Retaining Wall SPVs

For the August 1st 2018 PSE

- Changes will include updates to retaining wall system preapproval process information
- Added requirement of Contractor Certificate of Shop Drawing QC for retaining walls
- Adding requirement for Fabrication Library Submittal
- Updated SPVs to be available prior to June 1st for inclusion in August 2018 PSE projects

2019 Standard Specification
Upcoming Changes

- Working to remove cross-referencing across the structure sections, eliminating conflicts
  - Unique requirements (Such as DT2333 for primary steel members) will be included in the specific structure section
  - Under 105.2 Supplemental Plans and Drawings, adding guidance regarding Fabrication Library Submittal Requirements
- Added requirement of Contractor Certificate of Shop Drawing QC
- Requirement of weekly Fabrication Progress Reports

2019 Standard Specification
Upcoming Changes

- Added clarification in 506.3.1 regarding steel primary members
- Renamed secondary fabricated items "fabricated bridge components" and revised definition
- Requirements to use an approved fabricator from the Department's APL for primary members, sign structures, and overhead sign supports

The Importance of Designer QA/QC
"The Big Picture"

- Consultant Review Unit
  - Performs QA reviews on a percentage of the design plans we receive
- Structural Metals and Fabrication QA Inspection Unit
  - Performs QA reviews on a percentage of the shop drawings we receive

There is a possibility that your design plan and the associated shop drawings may not be reviewed. Any plan errors may not be caught.

The Importance of Designer QA/QC

"The Big Picture"

- RFIs will be the mechanism for the Contractor and Fabricator to clarify possible issues with design plans
- There is a potential increased chance of Errors and Omissions
- Keeping this in mind when preparing design plans, and following your firm's QA/QC plan will help you avoid any potential issues

Questions?

Wind Loaded Structures Initiative

Andrew Smith/WisDOT
Mark Maday/Jacobs

WisDOT Structural
Engineers Symposium
May 22, 2018

BUREAU OF STRUCTURES

JACOBS ch2m

Wind Loaded Structure Initiative

- Primary Purpose
  - Transition to LRFD
- While we are at it
  - Process improvement
- Current Challenges
  - Multiple processes but one design spec.
  - Getting plans in HSI

2

Wind Loaded Structure Initiative

- Wind Loaded Structures Include:
  - Sign Bridge, Cantilever and Butterfly Sign Structures
  - Overhead Sign Supports
  - High Mast Lighting
  - Associated Support Foundations and Anchorages
- Phase 1 - Evaluation:
  - Evaluating Process, Policy, Standards, and Specifications
  - Develop Recommendations for Improvements and Updates

3

Wind Loaded Structure Initiative

Phase 2 - Implementation

Goals and Anticipated Work Products:

- Clarified / Updated Process
- Increased Uniformity / Consistency
- Transition to LRFD Design
- Design Manual Updates (BM, FDM, CIM)
- Specification Updates (Standard Specifications and / or STSPs)

4

Team

WisDOT Work Group:

Andrew Smith – PM Andrew.Smith@dot.wi.gov
Alexander Crabtree – Design Alexander.Crabtree@dot.wi.gov
Steve Doocy – Design Steve.Doocy@dot.wi.gov
Jeff Horsfall – Geotechnical Jeffrey.Horsfall@dot.wi.gov
David Nelson – Development David1.Nelson@dot.wi.gov
William Oliva – Oversite William.Oliva@dot.wi.gov
Carla Principe – Fabrication Carla.Principe@dot.wi.gov
Matt Rauch – Traffic Ops Matt.Rauch@dot.wi.gov
Vu Thao – Design Vu.Thao@dot.wi.gov

5

Team

Jacobs:

Mark Maday Mark.Maday@Jacobs.com
Karl Schmid Karl.Schmid@jacobs.com

6

Schedule

Kick-Off: June 2017

Phase 1 Completion: August 2017

- Evaluation of Current Process
- Stakeholder Outreach
- Evaluation of Other DOT Processes
- Develop Recommendations:
  - Improving Uniformity
  - General Standards Updates
  - Transition to LRFD Design
  - Specification Updates
  - Design Software

7

Schedule

Phase 2 Completion: June 2019

- Design Manual Updates
- Revised Standard Detail Drawings and Insert Sheets
- Standard Specifications, STSP Updates
- Outreach and Training Presentations

8

Tasks & Progress to Date

Review of Current Process:

- Solicited Input from All WisDOT Regions and Central Office
- Identify What Works; Best Practices
- Identify Areas for Improvement

9

Tasks & Progress to Date

Stakeholder Outreach:

- Solicited Input From:
  - Sign Structures Suppliers / Fabricators
  - Contractors
  - DOT Designers (BOS)
  - Consultant Designers

10

Tasks & Progress to Date

Review of Other State DOT's:

Received Input from 10 State DOTs:
Florida, Indiana, Iowa, Michigan, Utah, Texas
North Dakota, Michigan, Virginia, Washington

Three States Using LRFD for Sign Structure Design:
Minnesota, Florida, Washington

11

Tasks & Progress to Date

Initial Recommendations:

Revised / Improved Process
- Clarify Process
- Emphasize Follow Through / Completing All Steps

Improving Uniformity
- Clarification / Concise Direction In BM
- Consistency Between Manuals, Standards and Specifications

General Standard Updates
- Standard for Each Structure Type
- Include Foundations

12

Current / Upcoming Activity

Recommendations:

- Transition to LRFD Design
- Specification Updates
- Design Software

Phase 1 Completion - Summary Report

13

It's Not Too Late!

We Welcome Your Input…

- Any Ideas, Comments or Suggestions?
- Contact Andrew or Any Member of the Work Group

Andrew Smith / WisDOT

Office: (608) 266-0989
Email: Andrew.Smith@dot.wi.gov

Mark Maday / Jacobs

Cell: (414) 975-6129
Email: Mark.Maday@Jacobs.com

14

Thank You

Questions?

BUREAU OF STRUCTURES

JACOBS ch2m

Removing Old Structure Over Waterway

Bill Dreher, P.E.
Structures Design Chief

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

- What are the options?
- What are the differences?
- What are the costs?
- How do I choose?

What are the options?

- Standard Specification
- + 3 choices with varying levels of restrictions

Standard Specification

- Section 203 Removing Old Culverts and Bridges
  - 203.3.2.2 Removal Operations:
    Minimize debris falling onto water surfaces and wetlands as the contract specifies in 107.18 or in the special provisions.

Standard Specification

- Section 107 Legal Relations and Responsibility to the Public
  - 107.18 Environmental Protection:
    Take all necessary precautions to prevent pollution of streams…
    Conduct work operations to avoid or minimize siltation of streams…
    Remove existing structures in large pieces, minimizing the number of smaller pieces that drop into the water. Remove all steel and all concrete pieces or other debris larger than 5 inches.

Standardized Special Provisions (STSP's)

- Designer should coordinate with regional environmental coordinator and DNR to reach consensus on which special to use for the removal.

Standardized Special Provisions (STSP's)

- The lowest level of care is for situations where there is little choice but to drop the structure into the waterway.
- The highest level of care requires a debris capture system to prevent virtually all debris from falling into the waterway.

Standardized Special Provisions (STSP's)

- STSP 203-015: Removing Old Structure Over Waterway
  - Use this special provision where it is not possible to remove the structure without dropping it, or a portion of it, into a waterway or wetland; and that waterway or wetland is not highly environmentally sensitive.

Standardized Special Provisions (STSP's)

- STSP 203-015: Removing Old Structure Over Waterway
  - This special provision is typically appropriate for removing the following structure types:
    - Slab spans, voided slabs
    - Cast-in-place girder bridges
    - Earth-filled bridges
    - Some large trestle bridges

Standardized Special Provisions (STSP's)

- STSP 203-015: Removing Old Structure Over Waterway
  - Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland.
  - Remove large pieces of the structure within 36 hours.
  - The contractor may leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows.

Standardized Special Provisions (STSP's)

- STSP 203-020: Removing Old Structure Over Waterway With Minimal Debris
  - Use this special provision where it is possible to remove the structure without dropping it, or a portion of it, into a waterway or wetland; and that waterway or wetland is not highly environmentally sensitive.

Standardized Special Provisions (STSP's)

- STSP 203-020: Removing Old Structure Over Waterway With Minimal Debris
  - This special provision is typically appropriate for removing all structures types except for the following:
    - Slab spans, voided slabs
    - Cast-in-place girder bridges
    - Earth-filled bridges
    - Some large trestle bridges

Standardized Special Provisions (STSP's)

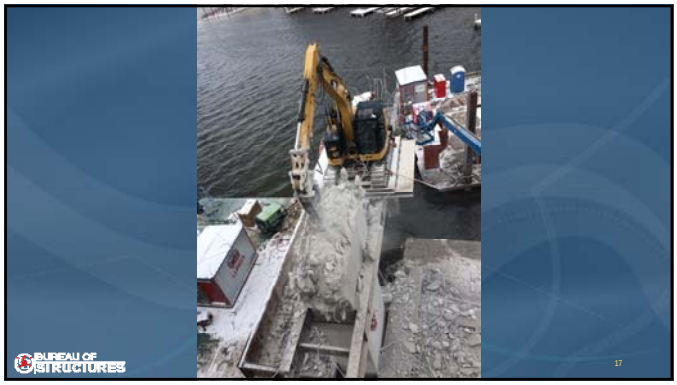
- STSP 203-020: Removing Old Structure Over Waterway With Minimal Debris
  - This special provision will likely be used for most removals.

Standardized Special Provisions (STSP's)

- STSP 203-020: Removing Old Structure Over Waterway With Minimal Debris
  - Remove the existing structure in large sections.
  - Prevent all large pieces and minimize the number of small pieces from entering the waterway or wetland.

Standardized Special Provisions (STSP's)

- STSP 203-020: Removing Old Structure Over Waterway With Minimal Debris
  - Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland.
  - The contractor may leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows.


BUREAU OF STRUCTURES
17

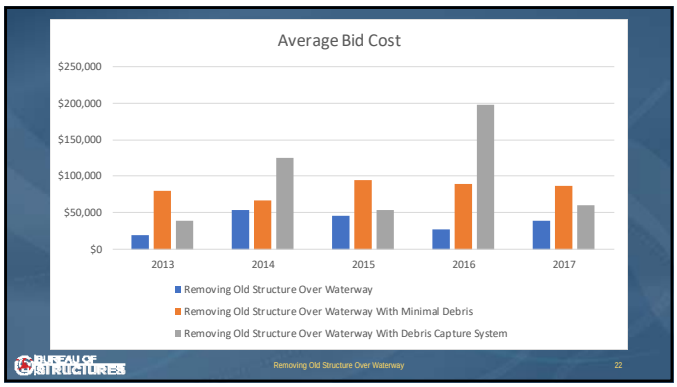
Standardized Special Provisions (STSP's)

- STSP 203-025: Removing Old Structure Over Waterway With Debris Capture System
  - Consider using this special provision where a waterway or wetland is highly environmentally sensitive.
  - Consult with the department's regional environmental coordinator to determine if the affected waterway or wetland is highly environmentally sensitive and if this special provision is appropriate.

Standardized Special Provisions (STSP's)

- STSP 203-025: Removing Old Structure Over Waterway With Debris Capture System
  - Remove the existing structure in large sections.
  - Due to the very sensitive nature of the waterway name, provide a debris capture and containment system that prevents all large pieces and virtually all other debris, including fine particles and slurry, from entering the waterway or wetland.

	STSP 203-015 Removing Old Structure Over Waterway	STSP 203-020 Removing Old Structure Over Waterway With Minimal Debris	STSP 203-025 Removing Old Structure Over Waterway With Debris Capture System
Environmental Sensitivity of waterway	Not high	Not high	High
Allowable Debris		Prevent all large pieces and minimize the number of small pieces from entering the waterway or wetland	Prevent all large pieces and virtually all other debris, including fine particles and slurry, from entering the waterway or wetland.
	Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland.	Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland.	
	Remove large pieces of the structure within 36 hours.		
	May leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows	May leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows	
Removal Restrictions		Remove in large sections	Remove in large sections
Applicable Structure Type	Where it is not possible to remove the structure without dropping it	Where it is possible to remove the structure without dropping it, or a portion of it, into a waterway or wetland	
	For removing slab spans; voided slabs; cast-in-place girder bridges; earth-filled bridges; large trestle bridges.	For removing all structures types except for slab spans; voided slabs; cast-in-place girder bridges; earth-filled bridges; large trestle bridges.	



How Do I Choose?

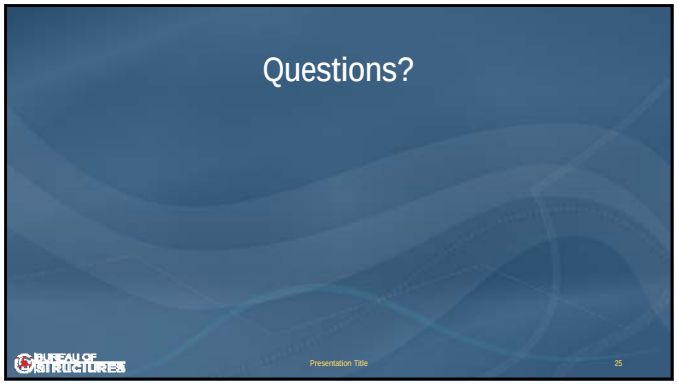
- Review all 3 specials and coordinate with regional environmental coordinator and DNR to reach consensus on which special to use for the removal.
- The special provision language is intended to be a reasonable starting point; however, it may need to be expanded to address additional DNR or other concerns.

BUREAU OF STRUCTURES Removing Old Structure Over Waterway 23

How Do I Choose?

- For unique or difficult removals, consult with the contracting community to assess costs and the feasibility of a particular removal technique.
- Consult with the department's regional environmental coordinator to determine if the affected waterway or wetland is highly environmentally sensitive and which special provision is appropriate.
- Don't make the decision w/o good information!

BUREAU OF STRUCTURES Removing Old Structure Over Waterway 24


Questions?
BUREAU OF STRUCTURES
Presentation Title
25

Timeliness of Consultant Plan Submittals

Najoua Ksontini, P.E.
Consultant Review and Hydraulics Supervisor

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

BOS Plan Submittal Timeline Expectations

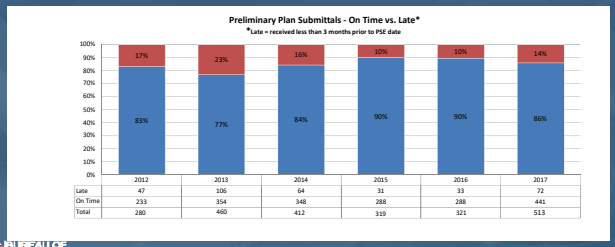
- Preliminary Structure Plans:
  - Project schedule should allow for a minimum of 60 days for BOS review. Adequate time for comment resolution, design, and final plan preparation prior to final plan submittal will determine the date that preliminary plans need to be submitted.
  - For the purpose of tracking, BOS considers preliminary plan submittals to be late if received less than 3 months prior to the PS&E date.

BOS Plan Submittal Timeline Expectations

- Final Structure Plans:
  - BOS requires that final structure plans, structural computations, and other pertinent documents are submitted 2 months prior to project PS&E date

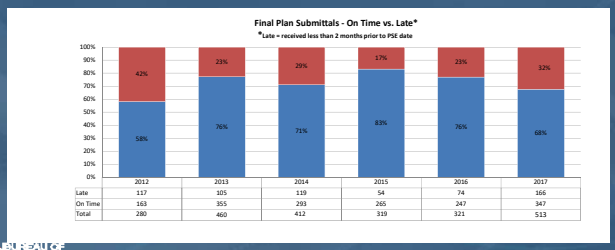
Trends in Preliminary Plans Submittal Timeliness

Includes all types of structures: bridges, culverts , retaining walls, and sign structures



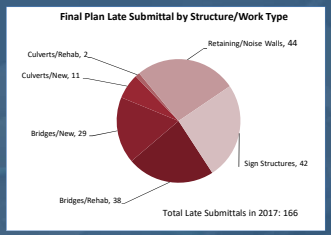
Trends in Final Structure Plans Submittal Timeliness

Includes all types of structures: bridges, culverts , retaining walls, and sign structures



Late Final Plan Submittals by Structure Type

- In 2017, about 166 late final structure plan submittals.
- Evenly divided:
  - new bridges or culverts.
  - rehabilitation bridges or culverts.
  - retaining walls.
  - sign structures.



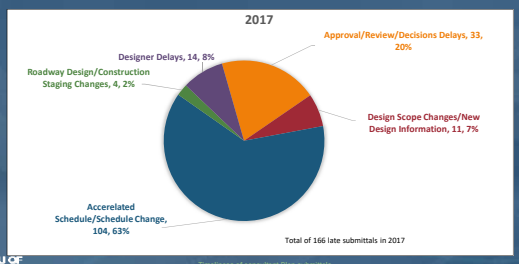
Why are past-deadline final plan submittals concerning to BOS

- We have a limited number of reviewers
- We have limited review time
- When plans are late, we have less time to work through issues with the designer
- We would like to provide input and QA reviews to as many submittals as possible
- Number of final structure plan submittals average about 120 per PS&E

On-Time Plan Submittal Improvement Form

- In March 2016, BOS implemented a new policy requiring designers to submit a form documenting the reasons for past-deadline final structure plan submittals.
- BOS categorized the reasons for past-deadline final structure plan submittals.

Reasons for Past-Deadline Final Structure Plan Submittals



Next Steps

- Designers- Please continue to communicate with BOS when project schedules are accelerated or advanced
- BOS- Will discuss with Regional offices impact of accelerated schedules on structure review timelines

Questions?

Automation, Policy & Standards

David Kiekbusch
Structures Development Supervisor
James Luebke
Structures Development Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

New standards in past two years

- 9.01 – Structure Backfill Limits and Notes
- 9.02 – Structure Backfill Limits and Notes 2
- 9.03 – Wing Fill Sections at Wing Tips
- 13.08 – Pier Cap Reinforcement Details
- 14.11 – MSE Wall – Panel and Block Facing
- 14.12 – MSE Wall – Wire Faced 1
- 14.13 – MSE Wall – Wire Faced 2
- 17.03 – Edge of Deck Flashing
- 27.10 – Steel Expansion Bearing Details
- 30.22 – Conduit Details and Notes
- 40.40 & 40.41 – Moved A4 abutments to Bridge Rehabilitation

Notable Bridge Manual text changes

- Extensive rewrite of Chapter 45 – Bridge Rating (January 2017)
  - Entire chapter rewritten
    - More logical order
    - Better guidance for when and how to load rate bridges
  - Four new rating examples for LFR
    - Reinforced Concrete Slab
    - Single Span Prestressed Girder
    - Two Span Prestressed Girder
    - Two Span Steel Girder

Bridge Manual text changes (continued)

AASHTO 3.8 – Wind Load: WL and WS

- Extensive update to Chapter 13 – Piers, including examples (July 2017)
  - Wind speeds for various limit states
  - Wind pressure is a function of the wind speed, exposure condition and bridge elevation above the ground or water surface
  - WisDOT policy items to simplify wind loading for most bridges

MASH 2016

MASH 2016

Required for all lets after December 31, 2019

- 42SS parapet required for:
  - All Interstate structures
  - All STH and USH with a posted speed ≥ 45 mph
- Railings Type 'M' and Types 'NY 3' and 'NY 4' are TL-2
  - Good for most local and collector roads with design speeds ≤ 45 mph
- Trying to get Type 'M' and Types 'NY 3' and 'NY 4' to TL-3
  - If TL-3 can't be achieved, then a new railing (could be TL-4)

Bridge Maintenance and Bureau of Project Development Coordination

- Maintenance Items
- Erosion Issues
- Design Considerations

Bridge Maintenance Coordination

- Discuss Issues
  - Wing Wall Grading
  - Slope Paving Repairs
  - Approach Details
- Design Considerations

BPD Coordination

- Curb Usage
  - Recommended Increased Usage

BPD Coordination

- Drainage Features
  - Curb Details
  - Flumes (efficiencies, location, etc.)
  - Alternative drainage features

BPD Coordination

- Approach Details
  - Construction Details
  - Site Specific Requirements

Parapets

- Fillet Detail
  - Drainage
  - Damage

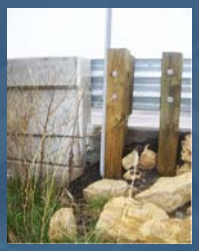
Past Detail

Updated Detail

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 01/18 13

Parapets

- Embankment Fills
  - Drainage
  - Damage



BUREAU OF STRUCTURES BOS Overlay Policy 14

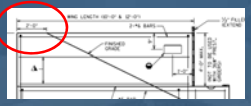
Wing Length

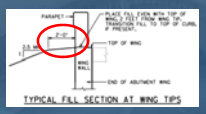
- Past Issues
  - Insufficient Embankment Fills
  - Beam Guard Embedment
  - Erosion Wing Tips

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 1/18 15

Wing Length

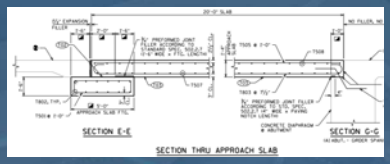
- Updates
  - 2:1 Slope + 2.0 ft (roundup)
  - 2 ft berm (section detail)





Structural Approach Slabs

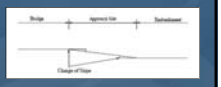
- Past Issues
  - Excessive Settlements
- Updates
  - Usage
  - Guidance



Structural Approach Slabs

- Current Usage
  - Required: IH and USH Bridges
  - Recommended: >3500 AADT
  - Not Required: Buried Structures & Culverts
  - Not Used: Rehabilitation Projects
  - *Design exceptions considered on a project-by-project basis.*

Structural Approach Slabs

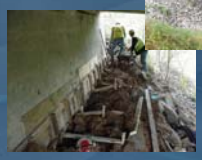


- Guidance:
  - The geotechnical engineer should evaluate approaches for settlement susceptibility and provide recommendations for mitigating settlements prior to approach placement.
  - Structural approach slabs are not intended to mitigate excessive approach settlements.

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 01/18 19

Structural Backfill

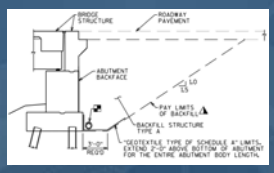
- Material Changes
- Payment of Quantities
- Past Maintenance Issues
  - Slope Stabilities
  - Erosion Issues



BUREAU OF STRUCTURES BOS Overlay Policy 20

Structural Backfill

- Updates
  - Material
  - Geotextile
  - Pay Limits
  - Payment



Backfill placed beyond pay limits or exceeding plan quantities shall be incident

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 1/18 21

Structural Backfill

- Pay Limits
  - Not Necessarily Representative of Actual Limits
  - Payment Purposes Only
    Backfill placed beyond pay limits or exceeding plan quantities shall be incident
  - Excavation Limits – Contractor's Responsible

Precast Piers

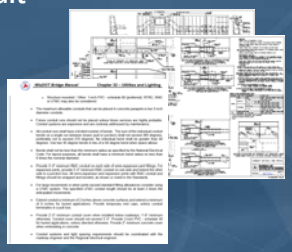
- Past Usages
  - Research Projects – Required
  - Rawson Avenue - Required
  - IH 39/90 – Contractor's Option (noted allowance)
  - Sign Structure Column – Contractor Requested

Precast Piers

- Current Policy
  - Pier configurations shall be determined by providing the most efficient cast-in-place concrete pier design, unless approved otherwise. When the cast-in-place design can accommodate a precast option, include the noted allowance.

Conduit

- Updates
  - Standards (30.21 & 30.22)
- WBM Updates
  - Design Guidance



Local Program bridges

- Railings and parapets to be MASH compliant:
  - Chapter 30 of Bridge Manual gives a MASH TL value for all railings and parapets
- Local road design speed versus posted speed (or no posted/statutory speed)
  - Will be working with Bureau of Project Development to provide guidance

Bridge drainage

- Desirable to maintain 0.50% profile for drainage, with solid parapets (WisDOT preference)
  - Investigating exceptions to the 0.50% criteria, especially for shorter bridges.

Future updates

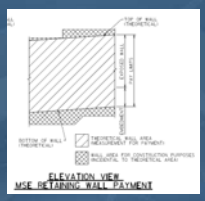
- July Bridge Manual updates
  - Text with regards to AASHTO 8th Edition (Examples in January 2019)
    - Renumbering of Section 5 Concrete Structures (461 references in BM!)
    - New method for prestressed girder shear
    - New steel girder simplified field splice design procedure
  - ½" filler adjacent to ½" bearing pads
- Other
  - Insert sheets are being cleaned up – available as ready
  - Insert sheet(s) with available cells

Automation

- WiSAMS – Wisconsin Structures Asset Management System
  - Automated system to assist with determining the most appropriate course of action for structure maintenance, and eventual replacement, during its life cycle
  - Planners like it, bridge maintenance staff is a little more skeptical…
- Data Warehouse/Business Intelligence
  - Centralized location for all data related to WisDOT structures
  - Used to support important business activities
- BIM for Bridges and Structures

MSE Wall Specifications

- Updates
  - Pay Limits (Plan Values)
  - Shop Drawing Submittal



Shear Design – PS Girders

- Simplified Procedure removed from AASHTO LRFD 8th Edition for Prestressed Sections

V_c = the lesser of V_{ci} and V_{cw}

$$V_{ci} = 0.02\sqrt{f'_c}b_v d_v + V_d + \frac{V_i M_{cre}}{M_{max}} \geq 0.06\sqrt{f'_c}b_v d_v$$

$$V_{cw} = \left(0.06\sqrt{f'_c} + 0.30 f_{pc}\right)b_v d_v + V_p$$

Shear Design – PS Girders

- Update: Use General Procedure

$$V_c = 0.0316\beta\sqrt{f'_c}\, b_v d_v$$

$$\beta = \frac{4.8}{(1+750\varepsilon_s)} \qquad \varepsilon_s = \frac{\left(\frac{|M_u|}{d_v} + 0.5N_u + |V_u - V_p| - A_{ps}f_{po}\right)}{E_s A_s + E_p A_{ps}}$$

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 7/18 34

Shear Design – PS Girders

- Update: Use General Procedure
- Software Updates: In-House (in progress)

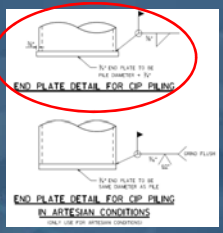
WisDOT policy item:

Web shear reinforcement shall be designed by **LRFD [5.7.3.4.2]** (General Procedure) using the Strength I limit state for WisDOT standard girders.

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 7/18 35

CIP Piles

- Additional Detail (Std. 11.01)
  - End Plate Detail For CIP Piling
- Specifications
  - Welds watertight (2019 spec)
  - Agg. size (2020 spec?)



BUREAU OF STRUCTURES BOS Overlay Policy Updated: 7/18 36

Overlay Guidance

- Past Usages
- Overlay Systems
- Summary of Updates
- Polymer Overlays

BUREAU OF STRUCTURES BOS Overlay Policy Updated: 7/18 37

Questions?

Answers??

BUREAU OF STRUCTURES BOS Overlay Policy 38

My Favorite Complex Structures

Andrew Smith
Load Rating Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

The "Home Sweet Home" Bridge

Category: Movable Bridge

- First Movable Bridge constructed with ABC techniques.
- Bridge operator lives on site

Bridge over Achievement Gap

Category: Box Girder Bridge

- Built by Red Neck and Sons
- Cost: 4 bottles of whiskey
- No children were hurt during construction

Load Rating ~~My Favorite~~ Complex Structures

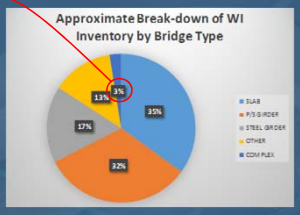
Andrew Smith
Load Rating Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

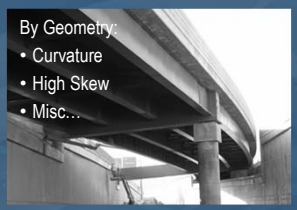
A Band of Complex Misfits



What is Considered Complex?

WisDOT Bridge Manual 45.3.11

By Type (inherent):
- Steel Rigid Frames
- Bascule-type Movable
- Tied Aches
- Other Arches
- Cable Stayed (or suspension)
- Steel Box Girder



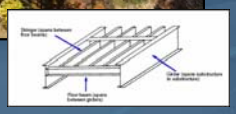
By Geometry:
- Curvature
- High Skew
- Misc…

By Type





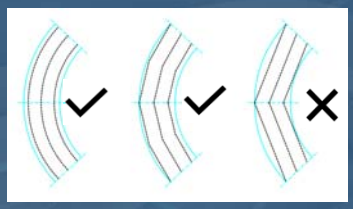


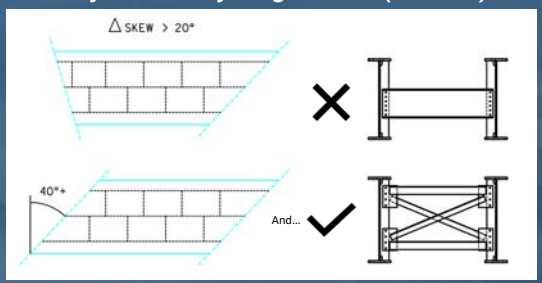
By Geometry: *Curvature*

See LRFD 4.6.1.2.4 and Curved Steel Girder Guide Spec 4.2

- Girders are concentric;
- Bearing lines are not skewed more than 10 degrees from radial;
- The stiffnesses of the girders are similar;
- For all spans, the arc span divided by the girder radius in feet is less than 0.06 radians where the arc span, L_{arc}, shall be taken as follows:



By Geometry: *High Skew (2nd Tier)*



Please contact Rating Unit if…

"Flexible" Supports

Girder Flare

Complex Framing

BUREAU OF STRUCTURES Complex Structures 10

What is required if a structure is categorized "complex"?

Generally… That these complexities are considered in a Load Rating Analysis

Specifically (45.3.11)…

1. Refined analysis is required
   - Design of new "complex" structures will be "refined" by default
2. Must consider certain load effects (e.g. from curvature and skew)
   - Already in national guidance
3. Submit Refined Analysis Rating Form (on website)
   - Flexible format – provide key information

BUREAU OF STRUCTURES Complex Structures 11

What is required if a structure is categorized "complex"?

Generally… That these complexities are considered in a Load Rating Analysis

Specifically (45.3.11)…

1. Refined analysis is required
   - Design of new "complex" structures will be "refined" by default
2. Must consider certain load effects (e.g. from curvature and skew)
   - Already in national guidance
3. Submit Refined Analysis Rating Form (on website)
   - Flexible format – provide key information

BUREAU OF STRUCTURES Complex Structures 12

What constitutes “refined” analysis?

- National resources: AASHTO, FHWA “Manual of Refined Analysis” (in-progress), NSBA G13.1
- Generally considered to be FEA (2D vertical/horizontal, PEB, 3D)
  - Chp 45 not dictating how to perform refined analysis
  - May depend on project requirements
- Refined ≠ Complex
  - A 3D FE model can arguably be more efficient in some situations

e.g. stringer → floorbeam → girder

BUREAU OF STRUCTURES Complex Structures 13

What is required if a structure is categorized “complex”?

Generally… That these complexities are considered in a Load Rating Analysis

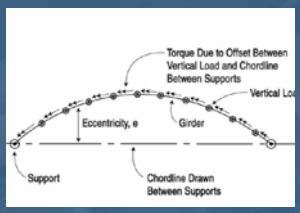
Specifically (45.3.11)…

1. Refined analysis is required
   - Design of new “complex” structures will be “refined” by default
2. Must consider certain load effects (e.g. from curvature and skew)
   - Already in national guidance
3. Submit Refined Analysis Rating Form (on website)
   - Flexible format – provide key information

BUREAU OF STRUCTURES Complex Structures 14

Torsion

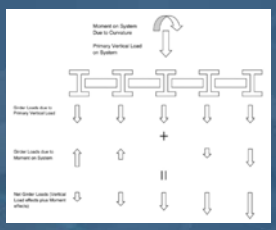
- Caused by eccentric loading (i.e. structure on a horizontal curve)
- Torque is imparted to girders
- Results in additional normal and shear stresses (on top of those imparted from primary bending)
- Box girders and plate girders handle this differently



BUREAU OF STRUCTURES Presentation Title 15

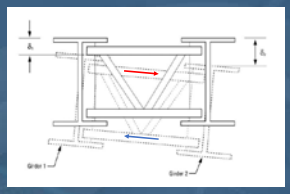
Load Shifting

- Global overturning resisted by force couples
- Additive effect to some girders, relieving effect to others
- Analogous to overturning (moment, eccentric load) in pile groups
- If curve is slight enough, the effects of curvature on the gravity loads (i.e. "load shifting") can be neglected – see LRFD 4.6.1.2.4



Flange Lateral Bending

- Flange Lateral Bending due to curvature effects must always be accounted for per LRFD
- Effects of Skew on f_ℓ are more variable and difficult to predict
  - Investigate effects with discontinuous cross-frames with skews greater than 20°
- f_ℓ due to skew determined by:
  1. Directly (3D FEM)
  2. Approximate eqns. and recommended values – see C6.10.1

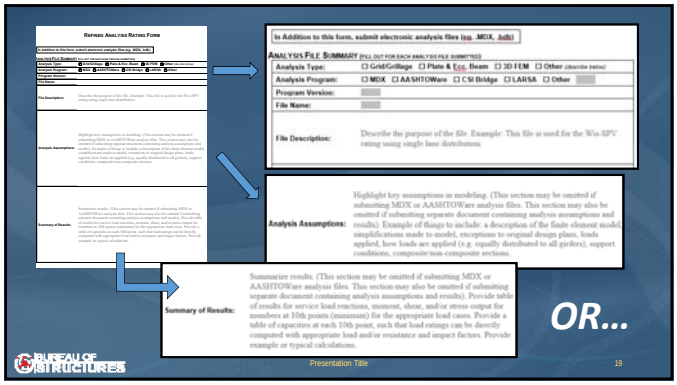


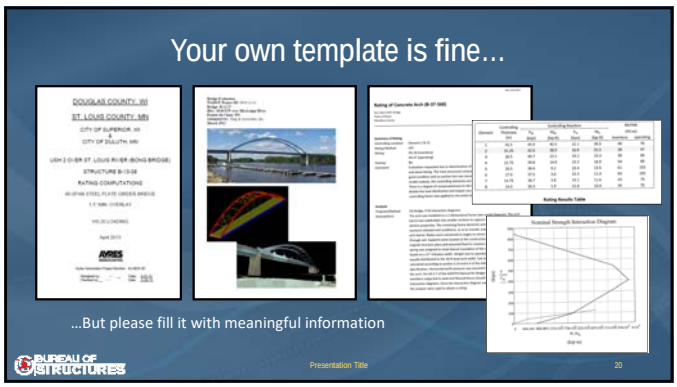
What is required if a structure is categorized "complex"?

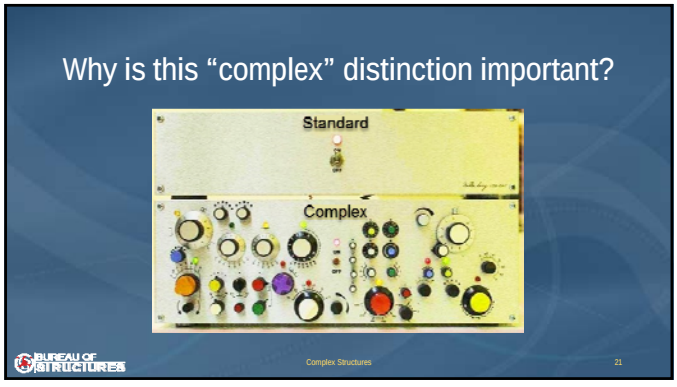
Generally… That these complexities are considered in a Load Rating Analysis

Specifically (45.3.11)…

1. Refined analysis is required
   - Design of new "complex" structures will be "refined" by default
2. Must consider certain load effects (e.g. from curvature and skew)
   - Already in national guidance
3. Submit Refined Analysis Rating Form (on website)
   - Flexible format – provide key information


Rehab Analysis Rating Form
In Addition to this form, submit electronic analysis files (eg. MDX, .bdb)
Analysis File Summary (FILL OUT FOR EACH ANALYSIS FILE SUBMITTED)
Analysis Type: ☐ Grid/Grillage ☐ Plate & Ecc. Beam ☐ 3D FEM ☐ Other (describe below)
Analysis Program: ☐ MDX ☐ AASHTOWare ☐ CSi Bridge ☐ LARSA ☐ Other
Program Version:
File Name:
File Description: Describe the purpose of the file. Example: This file is used for the Win-SPV rating using single lane distribution.
Analysis Assumptions: Highlight key assumptions in modeling. (This section may be omitted if submitting MDX or AASHTOWare analysis files. This section may also be omitted if submitting separate document containing analysis assumptions and results). Example of things to include: a description of the finite element model, simplifications made to model, exceptions to original design plans, loads applied, how loads are applied (e.g. equally distributed to all girders), support conditions, composite/non-composite sections.
Summary of Results: Summarize results. (This section may be omitted if submitting MDX or AASHTOWare analysis files. This section may also be omitted if submitting separate document containing analysis assumptions and results). Provide table of results for service load reactions, moment, shear, and/or stress output for members at 10th points (minimum) for the appropriate load cases. Provide a table of capacities at each 10th point, such that load ratings can be directly computed with appropriate load and/or resistance and impact factors. Provide example or typical calculations.
OR...
Bureau of Structures
Presentation Title
19


Your own template is fine…
DOUGLAS COUNTY, WI
ST. LOUIS COUNTY, MN
CITY OF SUPERIOR, WI
CITY OF DULUTH, MN
USH 2 OVER ST. LOUIS RIVER (BONG BRIDGE)
STRUCTURE B-13-38
RATING COMPUTATIONS
AVRES
…But please fill it with meaningful information
Bureau of Structures
Presentation Title
20


Why is this “complex” distinction important?
Standard
Complex
Bureau of Structures
Complex Structures
21

What are the benefits?

- Consistency
  - In analysis assumptions
  - Among engineers
- Repeatability/Documentation
  (Refined Analysis Rating Form)
  - For timely responses in permitting requests
  - Scoping, Posting, Damage

BUREAU OF STRUCTURES Complex Structures 22

Performing a load rating on a complex structure?

Please contact rating unit:

Andrew Smith
Andrew.Smith@dot.wi.gov
608-266-0989

Josh Dietsche
Joshua.Dietsche@dot.wi.gov
608-266-8353

BUREAU OF STRUCTURES Complex Structures 23

Self-Consolidating Concrete for Prestressed Girders

Steven Doocy, P.E.

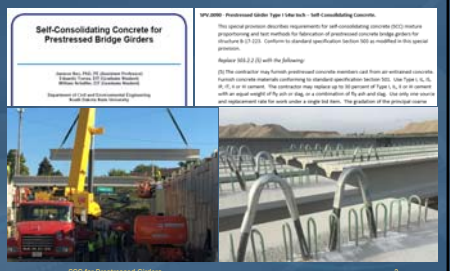
2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

Introduction

- Research
- Test Girder
- Specification
- Implementation



Research Team

- Researchers
  - South Dakota State University
- Industry
  - County Materials
  - Spancrete
- WHRP Team
  - WisDOT
  - UW-Madison

Research

- Goals
  - Develop mixture and testing requirements to supplement the Std. Spec.

(6) The contractor shall determine the proportions for the mix within the following limitations:	
Water/cementitious material ratio (w/cm)	0.35 or less[16]
Cementitious materials content	750-800 pounds per cubic yard
Fine aggregate to total aggregate ratio	0.50 or less
Air content for prestressed I-type girders	6.0 percent maximum
Slump Flow (per ASTM C1611)	25 to 28 inches[17]
Visual Stability Index (VSI) (per ASTM C1611)	0 to 1
Passing Ability by J-Ring (per ASTM C1621)	+/- 2.0 inches difference from slump flow
Column Segregation (per ASTM C1610)	15 percent maximum

Research

- Results
  - Strength
  - Camber
  - Transfer length
  - Losses due to creep and shrinkage

Table 1 Compressive Strength Results

Time	CC (psi)	SCC (psi)
16 hr.	8157	7477
28 Days	11305	10270

Table 2 Camber Results

Time	CC (in)	SCC (in)
Day 1	0.42	0.3
28 days	1.0	1.25

Table 3 Transfer Length Results

Time	CC (in)	SCC (in)	AASHTO (in)
1 Day (Immediately after release)	24.0	19.0	30
28 Days	24.3	20.0	

Table 4 Prestress Losses

Time	CC (ksi)	SCC (ksi)	Type of Losses
1 Day (after release)	10.61	8.877	Elastic Shortening
1st week	11.85	10.59	
2nd week	12.83	11.70	
3rd week	13.03	11.84	Time-Dependent Properties
4th week (28 days)	14.07	12.82	

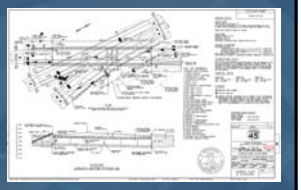
Test Girder

B-40-858

Test Girder

B-40-858

- 28 – 36W girders, 41'-9" long
- County Materials donated a girder (cast 29 total girders, 28 normal concrete, 1 SCC) for proof of concept
- If SCC girder met specifications, we would install it on the bridge

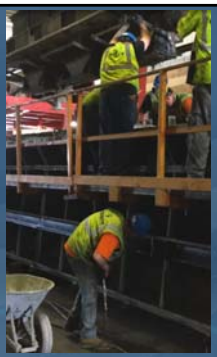


BUREAU OF STRUCTURES SCC for Prestressed Girders 7

Test Girder

Conventional Pour

BUREAU OF STRUCTURES SCC for Prestressed Girders 8



BUREAU OF STRUCTURES SCC for Prestressed Girders 9

Test Girder

SCC Pour

Specification

- SPV for SCC
  - Concise SPV was developed with WisDOT Materials section
  - Specified testing, material and construction information for SCC.


SPV.0090 - Prestressed Girder Type I 54w Inch – Self-Consolidating Concrete.

This special provision describes requirements for self-consolidating concrete (SCC) mixture proportioning and test methods for fabrication of prestressed concrete bridge girders for structure B-17-223. Conform to standard specification Section 501 as modified in this special provision.

Replace 501.2.2 (5) with the following:

(5) The contractor may furnish prestressed concrete members cast from air-entrained concrete. Furnish concrete materials conforming to standard specification Section 501. Use Type I, II, IS, IP, IT, X or III cement. The contractor may replace up to 30 percent of Type I, II, X or III cement with an equal weight of fly ash or slag, or a combination of fly ash and slag. Use only one source and replacement rate for work under a single bid item. The gradation of the principal coarse aggregate source shall meet WisDOT size No. 1 requirements, but the contractor may replace up to 40 percent by weight of the total coarse aggregate with intermediate sized aggregate meeting ASTM C33 size #8 aggregate gradation requirements.

Replace 501.2.2 (6) with the following:

(6) The contractor shall determine the proportions for the mix within the following limitations:

Water/cementitious material ratio (w/cm) [1]	0.35 or less [1]
Cementitious materials content	750-800 pounds per cubic yard
Fine aggregate to total aggregate ratio	0.50 or less
Air content for prestressed I-type girders	6.0 percent maximum
Slump Flow (per ASTM C1611)	25 to 28 inches [2]
Visual Stability Index (VSI) (per ASTM C1611)	0 to 1
Passing Ability by J-Ring (per ASTM C1621)	+/- 2.0 inches difference from slump flow
Column Segregation (per ASTM C1610)	15 percent maximum

For qualification of new mixes, demonstrate passing test results for all required properties. During concrete production using accepted mixes, test air content, slump flow and VSI for every load, and test J-ring and column segregation a minimum of once daily.

[1] The water/cementitious materials ratio is the weight of the total added water plus the aggregate free water, divided by the total weight of the cement, fly ash and slag.

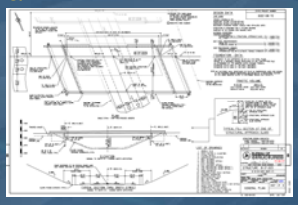
[2] Proportion the mix to provide a uniform quality and consistency with a slump flow no greater than necessary for proper placement and consolidation.

BUREAU OF STRUCTURES SCC for Prestressed Girders 13

Implementation

B-17-223/224

- Looked for longer structure with deeper girders
- 10 – 54W girders @ 127' long (twin structures)
- 223 – mandatory SCC
- 224 – optional SCC



BUREAU OF STRUCTURES SCC for Prestressed Girders 14

Implementation

- Cost??

BUREAU OF STRUCTURES SCC for Prestressed Girders 15

Implementation

Current Data

Camber
- Actual = 4.00”
- Plan = 4.28”

Compressive Strength
- f'_{ci} (actual) = 7,900 psi f'_c (actual) = 12,500 psi
- f'_{ci} (plan) = 6,800 psi f'_c (plan) = 8,000 psi

Success!!

- Started with a little research
- Lead to a SPV
- Implemented on twin structures
- Future cases……
  - Use for all girders
  - Complex concrete pours/tight rebar cages
  - Substructures
  - Other?

Questions

Miscellaneous Geotechnical/Structural Topics

Jeff Horsfall
BTS – Geotechnical Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

Communications

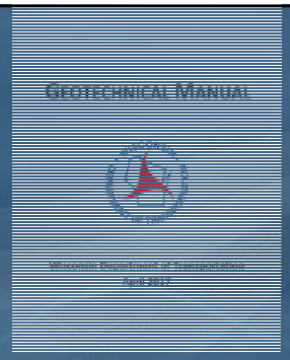
Geotechnical/Structural Topics

- Geotechnical Manual
- Consultant Submittals
- Pre-boring in Consolidated Material (Intermediate GeoMaterial-IGM)

Geotechnical Manual

- Developed in April 2017 and published on the DOTNET

http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/default.aspx



Section 7-1 General

Section 7-2 Foundation Types

Section 7-3 Foundation Analyses and Design

Section 7-4 Subsurface Investigations – All Structures

Section 7-5 Bridges

Section 7-6 Retaining Walls

Section 7-7 Box Culvert, Rigid Frame and Plate Arches

Section 7-8 Ancillary Structures

Consultant Submittals

Special Provisions template gives:

I. SOILS AND SUBSURFACE INVESTIGATIONS

Add gINT soil boring logs and soils laboratory data to the following email addresses.

DOTDTSDGeotechnicalgINT@dot.wi.gov
DOTDTSDGeotechnicalSirLab@dot.wi.gov

Pre-boring in Consolidated Material (Intermediate GeoMaterial-IGM)

550.3.9 Pre-Boring

550.3.9.1 General

(1) Pre-bore holes to the depth the plans or special provisions require. Submit written requests for pre- boring not required under the contract to the engineer for review and approval. Do not impair the capacity of in-place piles or damage adjacent structures by pre-boring operations.

550.3.9.3 Pre-Boring in Rock or Consolidated Materials

(1) For round piles, pre-bore holes at least one inch larger than the pile outside diameter. For other shapes, pre-bore holes at least one inch larger than the greatest diagonal pile section dimension.

(2) Case holes as necessary to prevent introduction of unconsolidated material. Seat the casing firmly into the rock or consolidated material surface. Clear debris from the pre-bore hole before installing the pile.

(3) Firmly seat piles after preboring and backfill within the rock or consolidated material with a cement grout. Remove the casing, backfill the piles with sand or other engineer-approved material, and dispose of excess material.

(4) Do not blast without the engineer's approval.

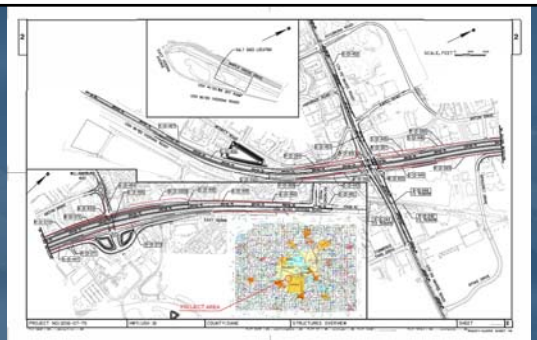
Pre-boring in Consolidated Material (Intermediate GeoMaterial-IGM)

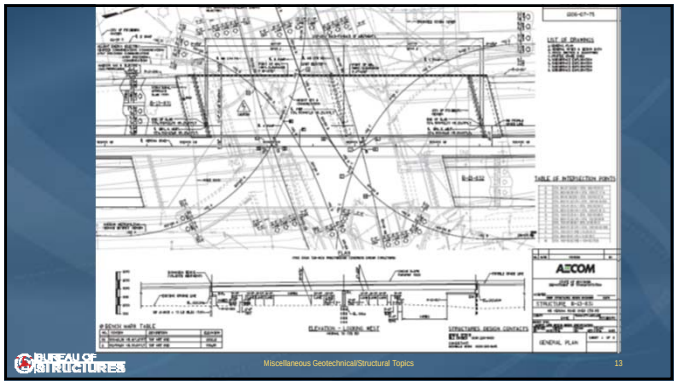
Intermediate GeoMaterial-IGM

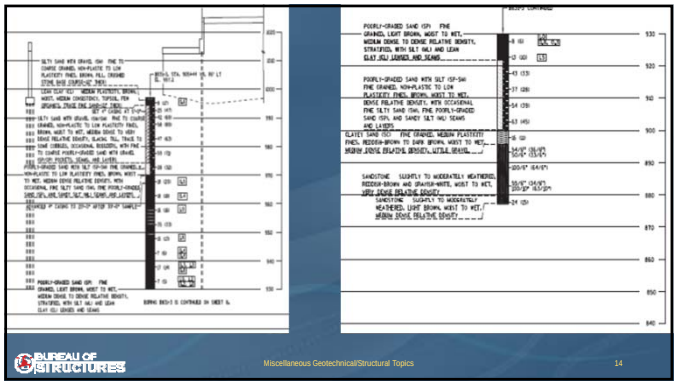
- Cohesive IGMs exhibited unconfined compression strengths between 10 ksf to 100 ksf
- Cohesionless IGMs exhibited blow counts greater than 50 blows per foot (bpf) using a Standard Penetration Test

Project Illustration

B-13-831/832	USH18/USH 151 over CTH PD
Structure Consultant	AECOM
Geotechnical Consultant	SOILS & ENGINEERING SERVICES, INC.







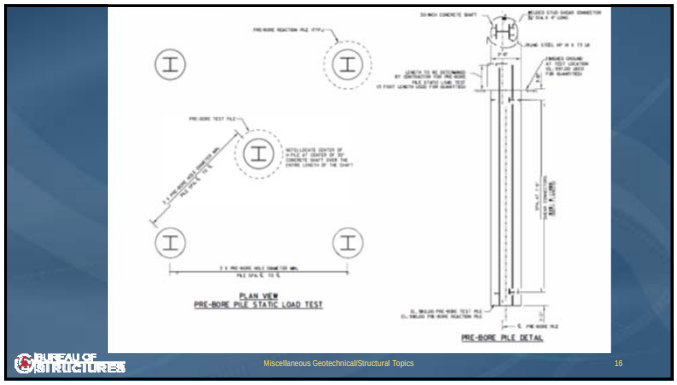
Project Team Foundation Discussion

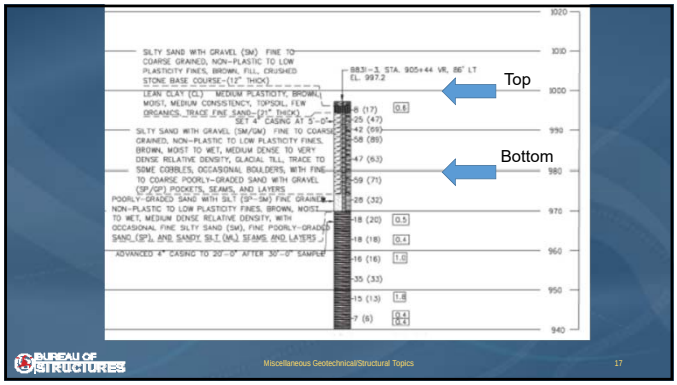
Options

H-piles driven using modified Gates (resistance factor = 0.50)

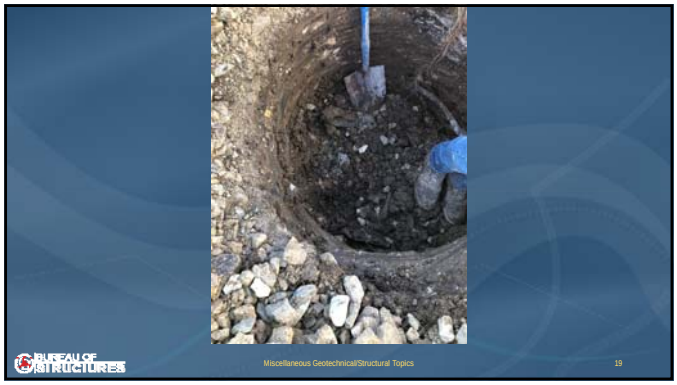
H-piles driven using Pile Driving Analyzer (resistance factor = 0.65)

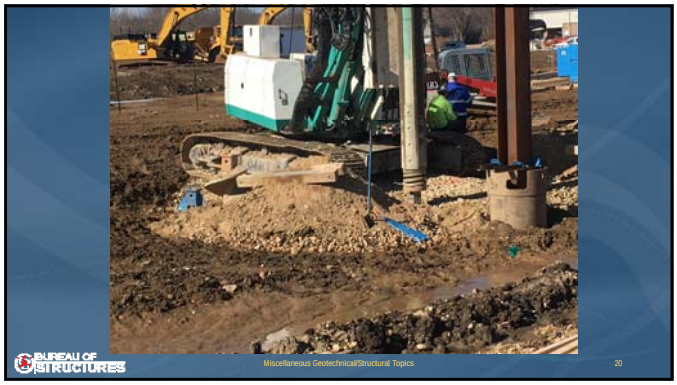
Pre-bored H-piles with a Static Load Test (resistance factor = 0.80)


PLAN VIEW
PRE-BORE PILE STATIC LOAD TEST
PRE-BORE PILE DETAIL
BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
16


Top
Bottom
BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
17


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
18


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
19


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
20

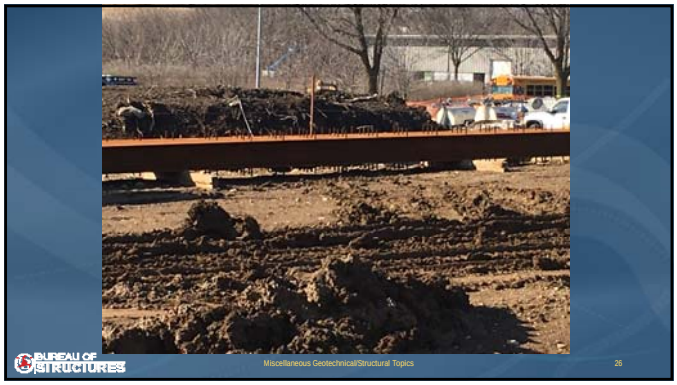

BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
21


02/26/2018
BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
22


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
23


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
24

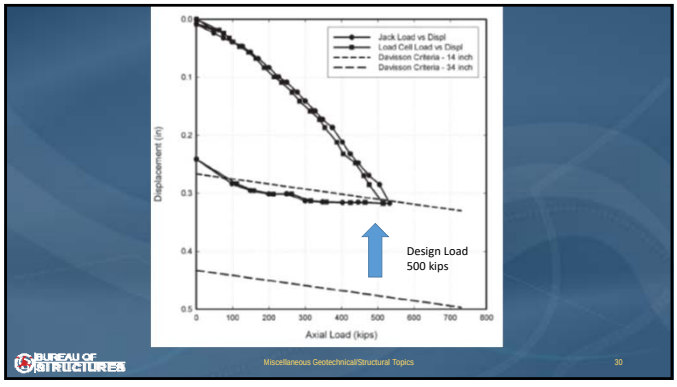

BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
25


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
26


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
27


BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
28


300
TON
BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
29


Jack Load vs Displ
Load Cell Load vs Displ
Davisson Criteria - 14 inch
Davisson Criteria - 34 inch
Displacement (in)
Axial Load (kips)
Design Load
500 kips
BUREAU OF STRUCTURES
Miscellaneous Geotechnical/Structural Topics
30

Questions

BOS Overlay Policy

James Luebke
Structural Development Engineer

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

Current Bridge Manual

- Bridge Manual
  - Section 40.5 – Deck Overlays
    - Guidelines
    - Methods
    - Miscellaneous Item

3 pages

Overlay Methods

- Active
  - Thin Polymer
  - Low Slump Concrete
- Less Active
  - Polymer Modified Asphaltic
  - Polyester Polymer
  - Asphaltic
- Not Active
  - Asphaltic with Membrane

Thin Polymer Overlay (Preservation)

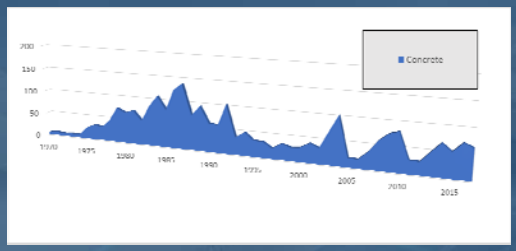
Concrete Overlay (Rehabilitation)

Overlay Methods

- Further Developments
  - Polyester Polymer
  - Asphaltic with Membrane
  - Latex Modified Concrete
- Further Guidance
  - WiSAMS (Wisconsin Structures Asset Management System)
  - Bridge Manual
  - Standard Details
  - Specifications

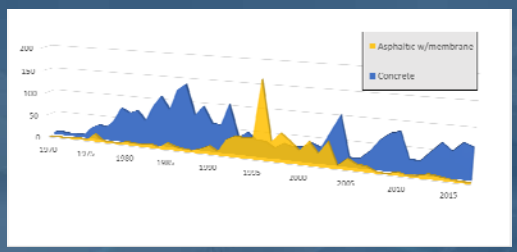
BUREAU OF STRUCTURES BOS Overlay Policy 4

Past Overlay Usages



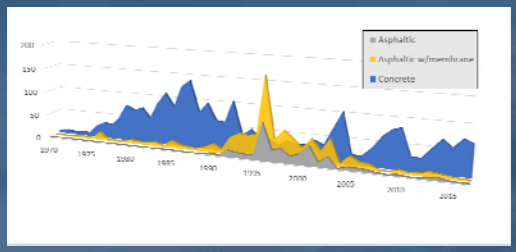
BUREAU OF STRUCTURES Presentation Title 5

Past Overlay Usages

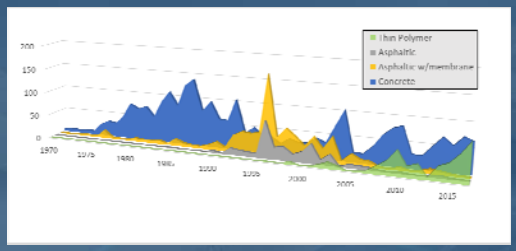


BUREAU OF STRUCTURES Presentation Title 6

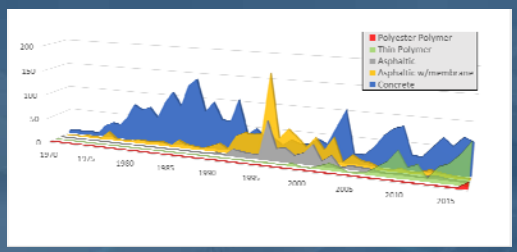
Past Overlay Usages



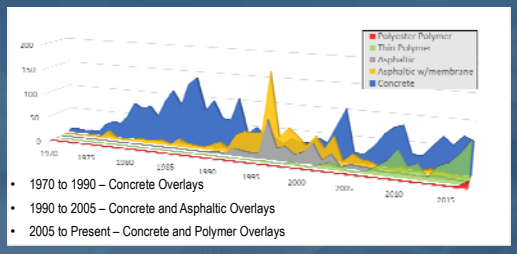
Past Overlay Usages



Past Overlay Usages



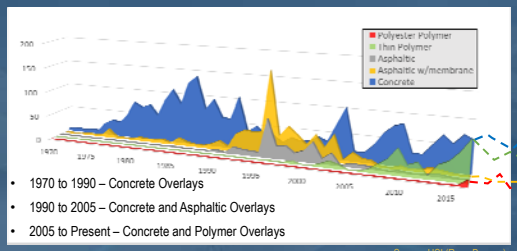
Past Overlay Usages



- 1970 to 1990 – Concrete Overlays
- 1990 to 2005 – Concrete and Asphaltic Overlays
- 2005 to Present – Concrete and Polymer Overlays

BUREAU OF STRUCTURES Presentation Title 10

Past Overlay Usages



- 1970 to 1990 – Concrete Overlays
- 1990 to 2005 – Concrete and Asphaltic Overlays
- 2005 to Present – Concrete and Polymer Overlays

Source: HSI (Ryan Bowers)

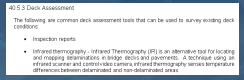
BUREAU OF STRUCTURES Presentation Title 11

Updated Bridge Manual

- Bridge Manual
  - Section 40.5 – Deck Overlays
    - Methods
    - Selection Considerations
    - Background Information

20+ pages

Overlay Advantages, Disadvantages, and Notes


40.5.3 Deck Assessment

The following are common deck assessment tools that can be used to survey existing deck conditions:

- Inspection reports
- Infrared thermography - Infrared Thermography (IR) is an alternative tool for locating and mapping delaminations in bridge decks and pavements. A technique using an infrared scanner and control video camera, infrared thermography senses temperature differences between delaminated and non-delaminated areas.

BUREAU OF STRUCTURES BOS Overlay Policy 12

Polyester Polymer Overlay Usage

- Decks in Good Condition
  - NBI rating of 7 or greater
  - Distressed areas < 5%
  - Less than 15 years* old deck
- General Criteria
  - Traffic Restrictions
  - High Traffic (AADT > 20,000)
  - Remaining life > 20 years

New System Restrictive Usage

BUREAU OF STRUCTURES BOS Overlay Policy 13

Polyester Polymer Overlay Usage

- Decks in Good Condition
  - NBI rating ≥ 7
  - Distressed areas < 5%
  - Deck age <15 years*
- General Criteria
  - Traffic Restrictions
  - High Traffic (AADT > 20,000)
  - Remaining life > 20 years

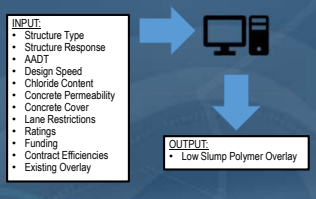
Thin Polymer Overlays

- NBI rating > 7
- Distressed areas < 2%
- Deck age < 10 years*
- No General Restrictions

BUREAU OF STRUCTURES BOS Overlay Policy 14

Overlay Policy

- Overlay Selection
- Resources
  - Region
  - Bridge Manual
  - BOS
- Coordination



BUREAU OF STRUCTURES BOS Overlay Policy 15

WisDOT Structural Engineers Symposium

May 22, 2018

Marquette Interchange PPC Overlays

Presented by:

Jason Sadowski, PE, SE

BUREAU OF STRUCTURES

Michael Baker INTERNATIONAL

Agenda

- Project Overview
- Bridge Preservation
- What is PPC and why use it?
- Marquette Interchange Project
- Construction
- Conclusion

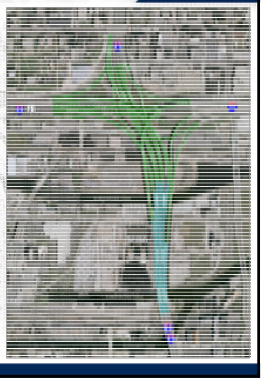
Project Overview

Marquette Interchange Scope

- PPC overlay
- Lighting upgrade to LED
- ITS
- Splice plate painting

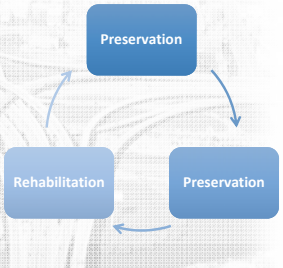
Valley Bridge Scope

- Concrete overlay



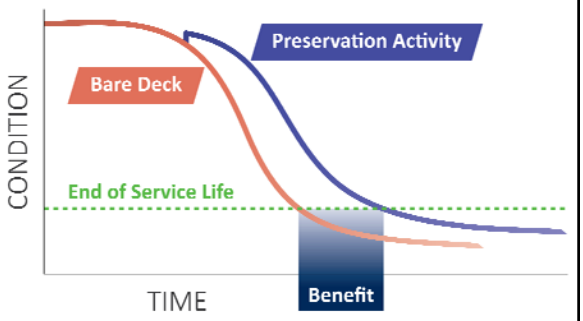
What is Bridge Preservation?

- Extend service life
- Limit traffic impacts
- Optimize life cycle costs
- Cyclical activity



TSP2 BRIDGE PRESERVATION

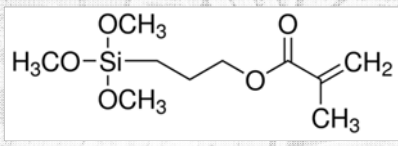
What is Bridge Preservation?



What is PPC and why use it?

Polyester Polymer Concrete

- Binder
- Aggregate
- Sealing Primer



"Gammamethacryloxypropyltrimethoxysilane"

What is PPC and why use it?

Pros
- Impermeable seal
- Fast cure – all temps
- Durability
- Friction

What is PPC and why use it?

Cons
- Cost ($10-$12 / sf)
- Few local contractors
- Fast cure

Identify the right projects!

What is PPC and why use it?

PPC	Thin Polymer
Single course	Two course
3/4” minimum	3/8” typical
Impermeable	Mostly impermeable
20-30 year life	10-15 year life
2 – 4 hour cure	4 – 14 hour cure
Shotblast CSP 5	Shotblast CSP 5
$10-12/sf	$3/sf

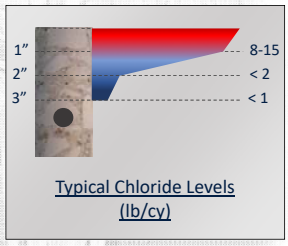
Marquette Interchange PPC Specification

- Co-operative effort
- Experience requirements
- Bond critical performance
- ¾” milling (optional)

Marquette Interchange Structural Design

BOS Criteria

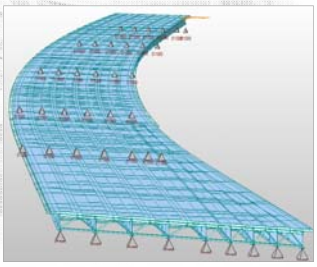
- ✓ Preservation project
- ✓ Age 10 years +/-
- ✓ Avg. NBI 6.7
- ✓ Deck distress < 1%
- ✓ Chloride profile
  (5 lb limit at rebar)
- ✓ Traffic volume
- ✓ Key infrastructure



Typical Chloride Levels (lb/cy)

Marquette Interchange Structural Design

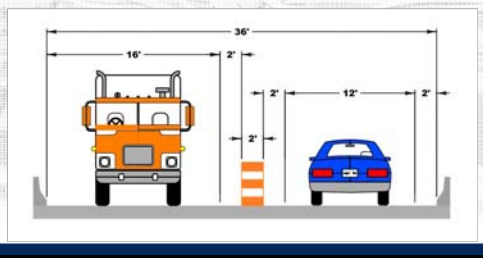
- Complex load rating
- Variable cross slopes & super-elevations
- Traffic control
- Joint locations



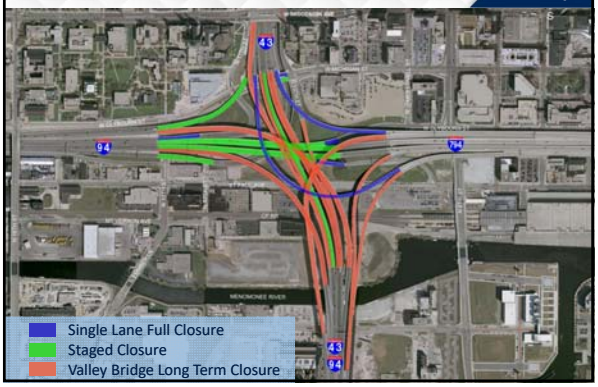
Marquette Interchange Traffic Control

Staged vs. Full Closure

- 16’ clear zone for PPC equipment
- Min roadway width = 36’ for staged construction



Marquette Interchange Traffic Control



PPC Construction Preparation

Milling

- In advance of PPC
- Added PPC quantity
- Profile milling

Shot blasting

- 48” blaster – 6,000 sf/hr
- Spot cleaning

PPC Construction Placement

- 2,000’ per night
- Place uniform thickness
- Keep the paver moving
- Hardness testing

PPC Construction Spot Repairs

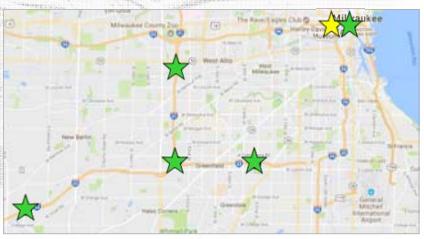
- Sawcut and replace
- Methacrylate sealer to fill cracks

Driving Factors for Utilizing PPC

- Traffic volume
- No joint replacement
- Limited impacts
- Difficulty to re-deck
- Complex structures
- Desire to delay major rehab

Conclusion

- Find the right projects!
- New WBM guidance
- On-going development



Potential Upcoming Southeast PPC Projects

WisDOT Structural Engineers Symposium

Thank You!

3D Design & Modeling, BIM for Bridges and Structures

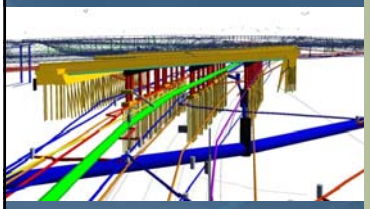
Danielle De Tennis & Adam Swierczek
BOS Structural Automation Engineer & Design Engineer

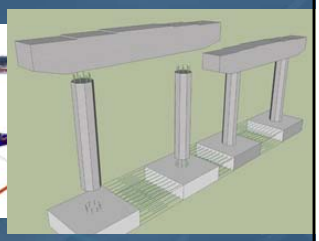
2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

What is BIM for Bridges and Structures?





What is our goal with BIM?

- Create an open data exchange between all involved parties for the lifecycle of the structure
  - Software-independent solutions
  - Streamline data exchanges
  - Eliminate data entry errors

BIM in BOS Design

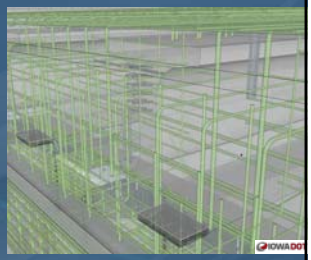
- Preliminary Design
  - Create initial approximate structure geometry
  - Improve geometry coordination with roadway

BIM in BOS Design

- Hydrology & Hydraulics
  - Velocity vectors/flowpaths in X and Y direction – more accurate information leads to better bridge sizing, substructure placement and skew
  - Improved accuracy of scour prediction parameters
  - LiDAR and Bathymetry are easily integrated when developing a model
  - Identify conveyance patterns not readily identifiable in 1D models
  - Easier to model complex floodplains
  - Avoid many assumptions inherent to 1D models

BIM in BOS Design

- Final Design
  - Single source of truth throughout design
  - Improve process for design iterations and late design changes
  - Improve spatial awareness of structural components
  - Streamline quantity takeoffs



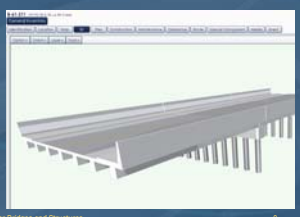
Baraboo Bypass Example Project

BIM in BOS Fabrication

- Move towards 3D model-based shop drawing submittal and review
  - Many fabricators already create 3D models to generate 2D shop drawings Generating and fixing up these plans take up a lot of time.
  - They are looking into ways to eliminate the need for 2D plans, or move them closer to the end of the process so the plans don't need to be regenerated so many times.
- BOS is planning a 3D Fabrication pilot project with a steel structure

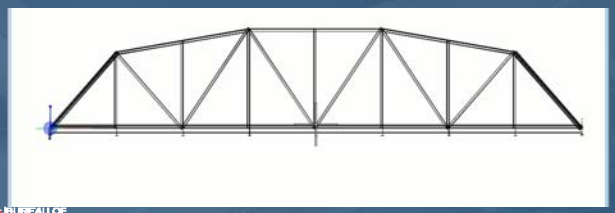
BIM in BOS Bridge Management

- Looking to add 3D models to HSI
  - Models are generated from data already entered in HSI
  - Inspectors can document defects directly on the model
  - Possibility to store design models & as-built models in the future



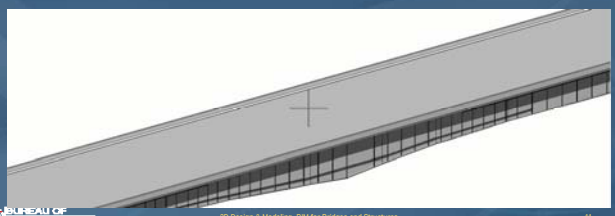
BIM in BOS Bridge Management

IFC Models Generated from AASHTOWare



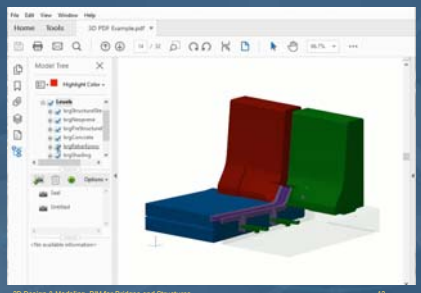
BIM in BOS Bridge Management

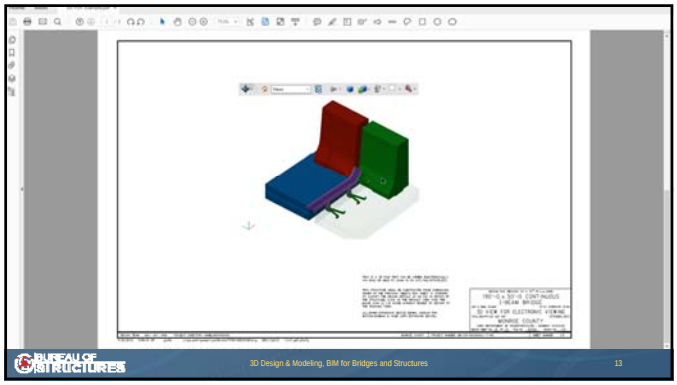
IFC Models Generated from AASHTOWare



BIM in BOS Standards

- PDF plans with 3D Details by Iowa DOT
  - We are looking to adopt 3D details in some of our Standard Details
- BIM "Insert Sheets"
  - Standard models for WisDOT PS girder shapes, etc.




BUREAU OF STRUCTURES
3D Design & Modeling, BIM for Bridges and Structures
13

IH 94 North South Project Overview

Frank Pritzlaff, P.E.
South/Central Segment Design Project Manager

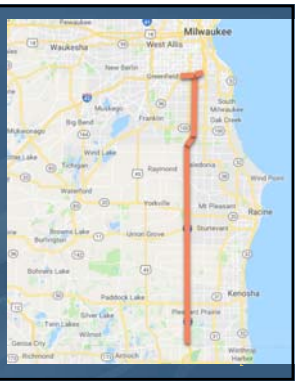
2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

IH 94 North South Program Overview

- Current Scope of Work
  - Approximately 19 Miles of Reconstruction in 3 Counties under Accelerated Schedule
- Quantity Highlights
- Staging Concept
- Unique Roadway Elements

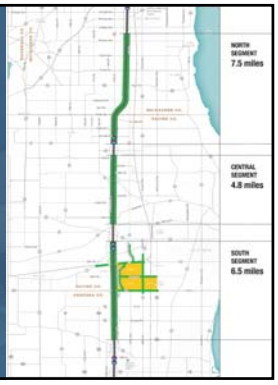


BUREAU OF STRUCTURES

IH 94 North South

IH 94 North South Scope of Work - State

- Work Zone Prep Contract
  - February 2018 Let
- South/Central Packages ($200M - $250M expected)
  - May 22, 2018 Let
- North Package ($175M - $200M expected)
  - August 2018 Let



BUREAU OF STRUCTURES

IH 94 North South

IH 94 North South
Scope of Work – Local Rehab

- STH 20
  - February 2018 Let, June 2018 Completion
- CTH H
  - March 2018 Let, June 2018 Completion
- CTH A
  - March 2018 Let, June 2018 Completion

BUREAU OF STRUCTURES

IH 94 North South

IH 94 North South
Scope of Work – Development

- CTH KR
- CTH H
- Braun Road
- STH 11
- International Drive
- Wisconn Valley Way
  - All Construction Slated Between 2018 and 2021

BUREAU OF STRUCTURES

IH 94 North South

IH 94 North South
Quantity Highlights – South/Central Segments Only

- Common Excavation ~ 844,000 CY
- Roadway Embankment ~ 1,414,000 CY
- Base Aggregate Dense ~ 302,000 CY
- Select Crushed Material ~ 521,000 CY
- Concrete Pavement 12-Inch Special ~ 980,000 SY
- Bridge Deck ~ 76,500 SY
- Retaining Walls ~ 130,000 SF

BUREAU OF STRUCTURES

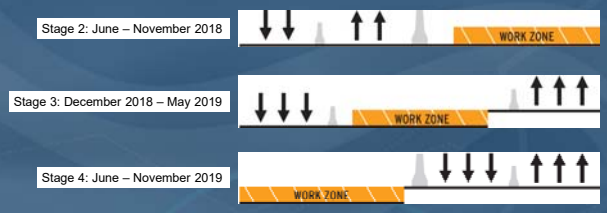
IH 94 North South 6

IH 94 North South
Staging Concept (Accelerated)

- Two lanes in each direction (2/2 traffic)
  - 6 months 06/18 to 11/18
- Three lanes in each direction (3/3 traffic)
  - 6 months split bi-directional 12/18 to 05/19
  - 6 months bi-directional 06/19 to 11/19
- Reduces construction from 30 months to 18 months

BUREAU OF STRUCTURES IH 94 North South 7

IH 94 North South
Staging Concept (Accelerated)



BUREAU OF STRUCTURES IH 94 North South 8

IH 94 North South
Unique Roadway Elements

- Compressed/Accelerated Construction Schedule
- Stage 3 Construction Through Winter
- Approximately 13' Profile Grade Change at CTH KR/Braun Road
- Multiple Adjacent Public and Private Projects
  - CTH K Crossroads, IH 94 Frontage Roads, Wis 45 Rehab, Wis 20/CTH C Roundabout, Foxconn Development, etc.
- Items Left in Place from Previous Prep Contract
- On Site Batch Plant/Crushing/Staging Locations

BUREAU OF STRUCTURES IH 94 North South 9

IH 94 North South Structures

Aaron Bonk, P.E.
Bureau of Structures Design Supervisor
IH 94 NS Structures Lead

2018 WisDOT Structural Engineers Symposium
University of Wisconsin-Madison Union South, Madison, WI

May 22, 2018

BUREAU OF STRUCTURES

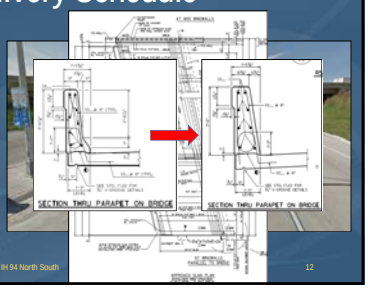
IH 94 NS Structures

Project Site Overview

- 27 Bridges
- 17 Retaining Walls
- 46 Sign Structures

IH 94 NS Structures Design Delivery Schedule

- Original designs and PS&E's in late 2000's/early 2010's
- Project restarted in 2017 with PS&E's set for early/mid 2018
  - Updates to LRFD for Racine/ Kenosha County Structures
  - Standard Updates (Structural Approach Slabs, Parapet Size/ Shape, etc.) for All Structures



IH 94 North South 12

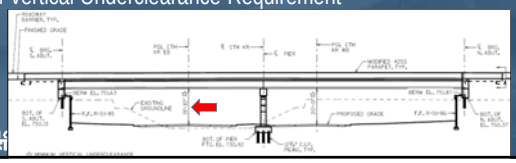
IH 94 NS Structures
Unique Aspects of Design

- Typical prestress girder and slab span bridges…
  - Except for the condensed delivery schedule and "standards" updates required
- Typical vertical underclearance requirements…
  - Except for 6m requirement near Foxconn site
- Typical pier design…
  - Except for requirement not to preclude contractor precast option
- Partial depth precast prestressed deck panels required

BUREAU OF STRUCTURES IH 94 North South 13

IH 94 NS Structures
Foxconn Area Impacts to Structures

- Full Redesign for 2 Interchanges and 2 Overpasses (14 State Structures and 10± Local Structures Impacted)
- Bridge Configurations In Flux Until Early 2018
- 6m Vertical Underclearance Requirement



BUREAU OF STRUCTURES 14

IH 94 NS Structures
Pier Design

- Construction Schedule Dictated ABC (Precast Pier) Option
- Multi-column Piers Designed as CIP, but not to Preclude Contractor Precast Option
- Chapter 7 Bridge Manual Standards

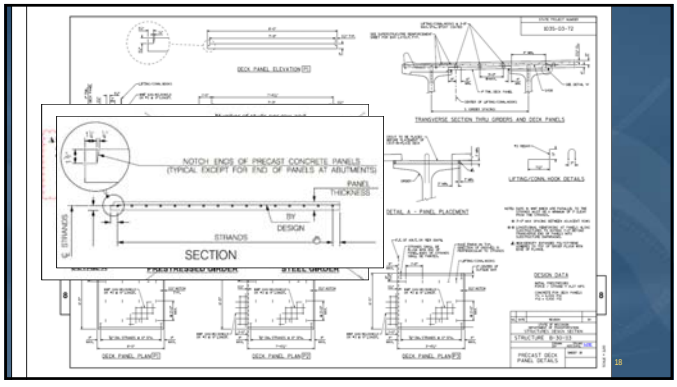
BUREAU OF STRUCTURES IH 94 North South 15

IH 94 NS Structures
Partial Depth Precast Prestressed Deck Panels

- Construction Schedule Dictated ABC (Partial Depth Precast Prestressed Deck Panels for Girder Bridges) Requirement
- Bridges Designed to Require Panel Use

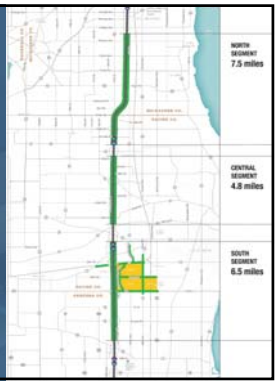
- Refined/Updated Chapter 17.10 Bridge Manual Details

BUREAU OF STRUCTURES IH 94 North South 17



IH 94 North South

Questions?



Strengthening Program for Local Load Posted Bridges

Alex Pence
Rating Engineer – Local System

Josh Dietsche
Supervisor – Bridge Rating/Management Unit

WisDOT Structural Engineers Symposium
Madison, WI

BUREAU OF STRUCTURES

May 22, 2018

Presentation Overview

- Load Postings on the Local System
  - Load Postings
  - SHV Load Posting Evaluation
- Strengthening Program
  - Program Concept
  - Overview of the Local Inventory
- BOS Efforts for Repair and Rehab
  - Assessing Candidate Bridges
  - Repair Methods

Load Postings on the Local System

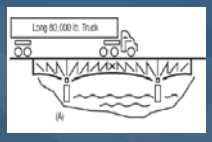
BUREAU OF STRUCTURES

Load Postings

- Bridges are load posted when analysis shows they can no longer safely carry legal-weight traffic.
- What is "legal weight?"

Load Postings: Federal Bridge Formula

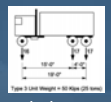
- Federal Bridge Formula (FBF) provides a standard to control spacing of truck axles/weights…to make sure the bridge was designed to support what can legally cross it.

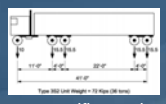


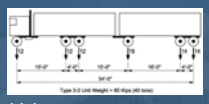
$$W = 500 * [\frac{LN}{N-1} + 12N + 36]$$

Load Postings: Posting Vehicles

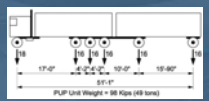
- Based on the FBF, AASHTO has an established suite of posting vehicles.

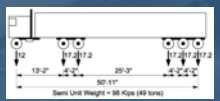






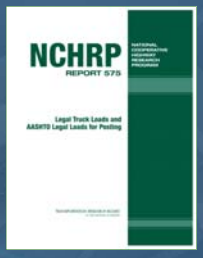
- Wisconsin has two state-specific posting vehicles.





SHV Load Posting Evaluation

- FHWA has mandated that states incorporate SHVs into their posting analysis by December 31, 2017
- Why are SHVs an issue?
  - Legal-weight…
  - …but exceed intended limits of the FBF
- What are SHVs?



BUREAU OF STRUCTURES Mitigating Load Postings on the Local System 8

SHV Load Posting Evaluation: Load Models

BUREAU OF STRUCTURES Mitigating Load Postings on the Local System 9

SHV Load Posting Evaluation: Results

- So what was the outcome?
  - Some new postings
  - Some lower load postings

Posting Level	Local-Owned	
	Current	w/ SHV
40 ton or greater	372	281
35 ton	52	34
30 ton	11	44
25 ton	17	139
20 ton	100	146
15 ton	110	131
10 ton	71	73
5 ton	34	39
Less than 5 ton	6	6
TOTAL:	773	893

BUREAU OF STRUCTURES Mitigating Load Postings on the Local System 10

Strengthening Program for Local Load-Posted Structures

BUREAU OF STRUCTURES

Mitigating Load Postings on the Local System 11

Strengthening Program: Overall Concepts

- The SHV evaluation effort highlighted load posting on the local system
- Load postings are implemented for safety purposes…
  - …but they restrict the flow of freight
- With support of WisDOT upper management, BOS looks for methods to eliminate postings, when possible
- Strengthening Program For Local Load Posting Structures

BUREAU OF STRUCTURES Mitigating Load Postings on the Local System 12

Strengthening Program: Overall Concepts

- Work with local owners to implement cost-effective, stream-lined process to repair bridges and remove postings
- BOS to provide engineering and oversight for repairs
- Use local crews (with assistance from WisDOT) to perform repairs

Overview of the Local Bridge Inventory

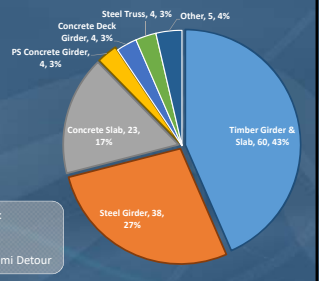
- The local system is…different…than the state system.
  - Generally older
  - Generally much lower ADT
  - Much higher percentage of single-span
  - More variety of superstructure types
    - Timber
    - Concrete T-girder
    - PS Channel
    - Other…


BOS Efforts for Repair and Rehab
BUREAU OF STRUCTURES

BOS Efforts for Repair and Rehab

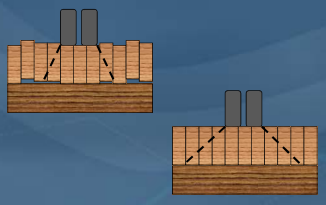
- Want to target "high value" bridges – important for freight & commerce
- Consider life remaining condition
- Not every repair option is feasible for every bridge
- Need to review individually

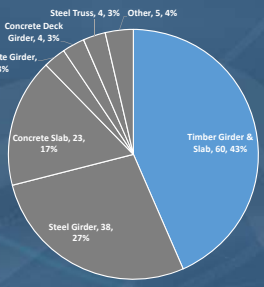
Best Candidates screening group:
- Posting < 40 TON
- All NBI Conditions 5+
- ADT 100+ *or* ADT<100 w/ 10+ mi Detour



BOS Efforts for Repair and Rehab

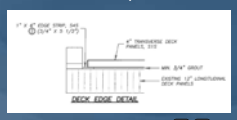
- Timber Slab Bridges
  - Wheel Load Distribution

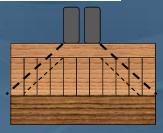


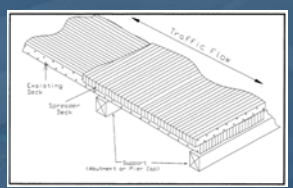


BOS Efforts for Repair and Rehab

- Timber Slab "Spreader Deck"

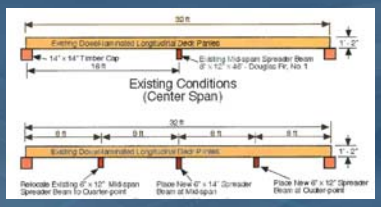






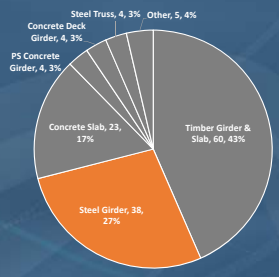
BOS Efforts for Repair and Rehab

- Timber Slab – Reduce overburden and add stiffener beams

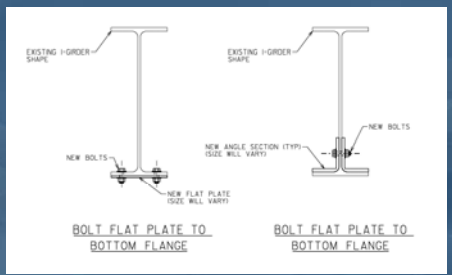


BOS Efforts for Repair and Rehab

- Bolt additional steel section to existing members
  - Can often be done by state or local crews
  - Relatively inexpensive



BOS Efforts for Repair and Rehab

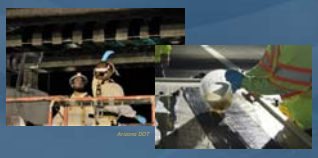


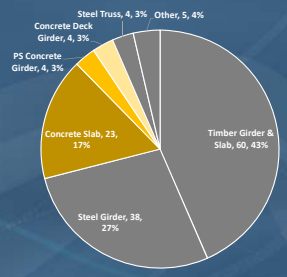
BOS Efforts for Repair and Rehab

- Make girder composite with slab
  - Several installation options available; would be site dependent
  - Girders assumed to be non-composite if plans are not available
  - First step- field verify if studs already exist

BOS Efforts for Repair and Rehab

- Concrete bridges
  - Add rebar
  - Add FRP





BOS Efforts for Repair and Rehab

A. Surface Preparation
B. Priming and Filling Voids
C. Locate Strips/Check Surface
D. Clean and Prepare FRP Strips
E. Coat Strips with Epoxy
F. Place Strips
G. Roll Out to Ensure Total Contact

BOS Efforts for Repair and Rehab

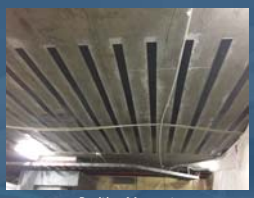
Shear

Flexure

BUREAU OF STRUCTURES

BOS Efforts for Repair and Rehab

Negative Moment

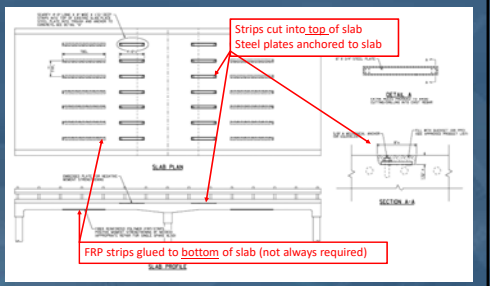


Positive Moment

BUREAU OF STRUCTURES

BOS Efforts for Repair and Rehab

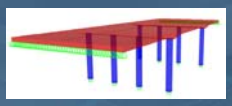
- RC slab retrofit

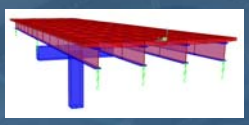


BUREAU OF STRUCTURES

BOS Efforts for Repair and Rehab

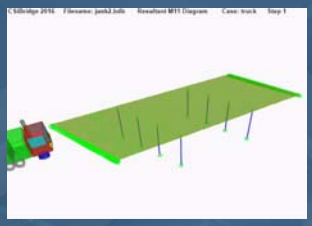
- Refined analysis goes above and beyond the routine or traditional methods of analysis
- Often involves a 3D model of structure
- Takes advantage of a more true live load distribution (less simplifications)





BOS Efforts for Repair and Rehab

- Enormous amounts of data
- Processing data takes most of the time
- Processing required to obtain useful information for design or load rating purposes
- Requires more judgment, assumptions; less conservative



BOS Efforts for Repair and Rehab

- Other options (more case-specific):
  - Removing overburden
  - Install external post-tensioning
  - Add additional substructure units
  - New deck
  - Load testing
  - Enhanced inspection for better information (NDE methods)
  - Other…

Questions?

Alex Pence
alex.pence@dot.wi.gov | 608-267-6880

Josh Dietsche
joshua.dietsche@dot.wi.gov | 608-266-8353

WisDOT Structural Engineers Symposium
Madison, WI

BUREAU OF STRUCTURES

May 22, 2018