WisDOT Structural Engineers Symposium

Program Agenda
June 7, 2016

7:30 a.m. Registration

8:00 a.m. Welcome & Secretary's Office Remarks – *Mark Gottlieb, WisDOT Secretary*

8:10 a.m. BOS Director's Perspective – *Scot Becker, BOS Director*

8:20 a.m. Consultant Review Topics – *Najoua Ksontini, Design Supervisor; Dan Breunig, Consultant Review Engineer; Matt Allie, Hydraulic Design Engineer*

9:20 a.m. Structures Estimating – *Fred Schunke, WisDOT Estimating Engineer*

9:35 a.m. Design & Construction of Post-Tensioned Integral Pier Caps – *Randy Thomas, CH2M*

10:00 a.m. Break (Beverages and Snacks)

10:20 a.m. Bridge Management – *Philip Meinel, Development Engineer; Josh Dietsche, Development Supervisor; Bria Lange, Development Engineer*

10:55 a.m. Automation, Policy, and Standards – *Dave Kiekbusch, Development Supervisor; James Luebke, Development Engineer; Andrew Smith, Development Engineer*

11:55 a.m. Lunch

1:00 p.m. South 1st Street Bascule Bridge – *Michael Delemont, AECOM*

1:25 p.m. Construction Topics – *Bill Dreher, Design Chief; Joe Balice, FHWA Division Bridge Engineer*

2:05 p.m. Ancillary Structures – *Ben Koeppen, Maintenance Engineer; Anthony Stakston, Regional Ancillary Structure Inspection Engineer; Vu Thao, Design Engineer*

2:35 p.m. Break (Beverages and Snacks)

2:55 p.m. Research Updates – *Bill Oliva, Development Chief*

3:10 p.m. Accelerated Bridge Construction – *James Luebke, Development Engineer; Bill Oliva, Development Chief*

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/design-policy-memos.aspx

BOS Director's Perspective

Scot Becker
Wisconsin DOT
June 7, 2016

Director's Perspective Overview

- Welcome to the 2nd Transportation Structural Symposium
- BOS Accomplishments / Looking Forward
- National Trends and Challenges

Fun Facts – The last 2 years Since our First Symposium

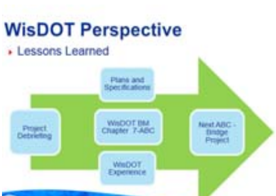
- How many bridges were built? Other structures?
- How many bridges were designed? Other structures?
- How many bridges were rated by BOS?
- How many bridges were inspected?

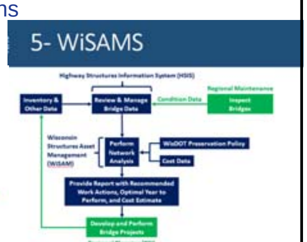
Progress of St. Croix

Drones Pilot for Bridge Inspection

Today's Agenda

- Consultant Presentations
- Bureau Items





BOS Accomplishments - Looking Forward

- New Improved Bureau Web Site
- Bridge Aesthetics
- Fiber Reinforced Polymer (FRP) Policy
- Timeliness Initiative
- Implementation of Bridge Preservation Policy & Updated WisDOT/FHWA PM Agreement

BOS Looking Forward

- Ancillary Structures Program
- WiSAM (Wisconsin Structures Asset Management)
- Fabrication Phase II Project
- MASH Research and Implementation
- Accelerated Bridge Construction Program Development

National Trends and Challenges

- New 3 year frequency of LRFD Manual Versions with no interims
  - Wisconsin led this effort
- Interstate Truck Weight Exceptions – FAST Act
- LRFD Sign Structures
- National Tunnel Inspection Program
- Bridge Information Modelling

Wisconsin Transportation Structures Program

- We want your Feedback and Input
  - BOS - How are we doing?
  - 3rd Symposium?
  - Innovations?

Once Again Welcome!

Consultant Review Reports and Consultant Performance

Najoua Ksontini
Supervisor - Consultant Review and Hydraulics
Bureau of Structures
June 7, 2016

Goals of Presentation

- Provide an overview of some consultant review business metrics
- Discuss consultant performance and plan submittal timeliness

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Consultant Review Metrics

- BOS provides reviews for all bridge, culvert, and retaining wall preliminary plans and some sign structure preliminary plans
- BOS provides QA reviews for some, not all submitted final structure plans

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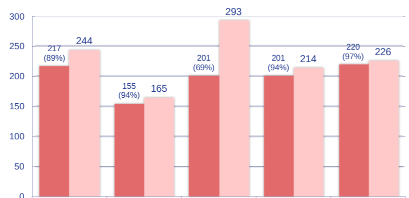
Consultant Review Metrics

Preliminary Plans Reviewed
(Bridges and Culverts)



	2011	2012	2013	2014	2015
Preliminary Plans Reviewed	217	155	201	201	220
Preliminary Plans Submitted	244	165	293	214	226

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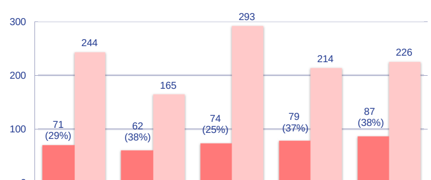
Consultant Review Metrics

Final Plans Reviewed
(Bridges and Culverts)



	2011	2012	2013	2014	2015
Final Plans Reviewed	71	62	74	79	87
Final Plans Submitted	244	165	293	214	226

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Consultant Review- Reviewers

- BOS utilizes a mix of in-house staff and consultant staff to perform preliminary and final plan reviews
- Currently BOS has seven staffing contracts providing for consultant review services on a part-time or as needed basis.
  - 3 staffing contracts for preliminary plan review services
  - 2 staffing contracts for final plan review services
  - 2 staffing contracts for sign structure plan review services

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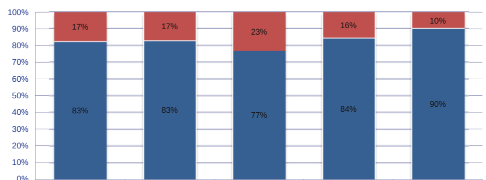
Consultant Plan Submittal Timeliness and Performance

- BOS tracks and compiles consultant plan submittal timeliness and performance data
- Consultant performance data is based on the consultant evaluations completed by BOS reviewers for each preliminary and final plan review.

Plan submittal Timeliness

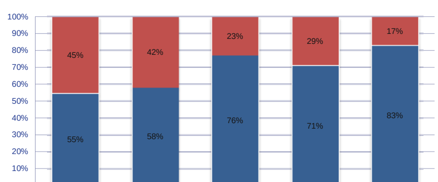
Preliminary Plan Submittals - On Time vs. Late*
*Late = received less than 3 months prior to PSE date



	2011	2012	2013	2014	2015
Late	73	47	106	64	31
On Time	347	233	354	348	288
Total	420	280	460	412	319

Plan submittal Timeliness

Final Plan Submittals - On Time vs. Late*
*Late = received less than 2 months prior to PSE date

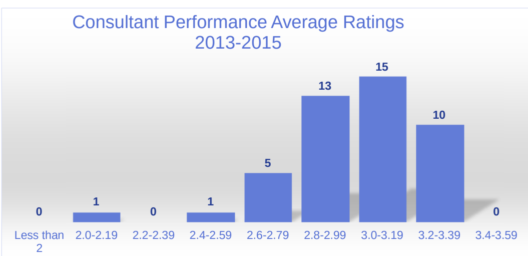


	2011	2012	2013	2014	2015
Late	184	117	105	119	54
On Time	222	163	355	293	265
Total	420	280	460	412	319

Consultant Performance Ratings

- The consultant evaluation rating uses a scale of 1 through 5, with a rating of 3 reflecting a satisfactory performance that meets expectations.
- Data from 2013 through 2015, showed BOS had completed consultant evaluation ratings for 45 consultant firms.
- The compilation of the data results in a single average rating for each of the consultant firms

Consultant Performance Ratings



Questions?

Recent and Upcoming Changes to Consultant Review Process

Najoua Ksontini
Supervisor - Consultant Review and Hydraulics
Bureau of Structures
June 7, 2016

Goals of Presentation

- Discuss implementation of the On-Time Plan Submittal Improvement form
- Discuss upcoming improved documentation of review processes and expectations
- Discuss changes to consultant review evaluations

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On-Time Plan Submittal Improvement Form

- Policy was set forth in a memo dated March 2nd, 2016.
- Form is intended to gather information about the reasons for past-deadline final structure plan submittals.
- BOS will categorize those reasons and will be able to provide suggestions to Region and consultant staff about process improvements.

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On-Time Plan Submittal Improvement Form

- Form is required when:
  - Final structure plans are submitted past due date (i.e. 2-month prior to PS&E date), or
  - Each time a revised final structure plan is submitted after the due date, unless the revised submittal in is response to a BOS QA review.
- Form is not required for structure addenda and post-let revision submittals

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On-Time Plan Submittal Improvement Form

- Form is available on the BOS web site and would need to be E-submitted along with the plan submittal
- Form should include a detailed description of the reasons that caused the past due date submittal and what could have been done differently to achieve the required two-month window prior to PSE

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Documentation of Review Processes and Expectations

- Several policy items related to consultant plan submittals and review processes are currently provided in BOS design policy memoranda that are found on the BOS web site
- BOS will incorporate these policies in Chapter 6 of the Bridge Manual

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Documentation of Review Processes and Expectations

- The documentation in the Bridge Manual will cover:
  - Consultant preliminary structure plan submittal expectations and review process
  - Consultant final structure plan submittal expectations and review process
  - Structure plan addenda submittal expectations and process
  - Structure plan post-let revision submittal expectations and process

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Consultant Evaluations

- Currently, BOS provides consultant performance evaluations for all preliminary and final plan reviews
- Evaluations are returned to design consultants and Region contacts when reviews are complete

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Consultant Evaluations How are they used?

- Consultant evaluation "average scores" are incorporated by Region Project Managers or Local Program Management Consultants into the consultant contract close-out evaluation
- Consultant evaluation "average ratings" are used by BOS to develop a consultant performance ranking

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Consultant Evaluation- Preliminary Review

DESIGN CONSULTANT PERFORMANCE EVALUATION REPORT

Project I.D.	Structure:
Highway:	County:
Project Name:	
District Contact:	Region:
Consultant:	

Type of Structure: ___ Stream Crossing ___ Grade Separation ___ Retaining Wall
___ Rehabilitation ___ Other ______

Average Rating______

1 – Unacceptable Performance 2– Below Average 3 – Satisfactory
4 – Above Average Performance 5 – Outstanding
(See rating system in FDM 8-25-5)

Preliminary Submittal Reviewer:______ Date:______
Hours:______

1. Completeness and clearness Preliminary plan submittal ☐
2. Hydrologic and Hydraulic Calculations ☐
3. Preliminary Structure selection ☐
4. Preliminary Plan details and Engineering ☐
5. Plans submitted with sufficient lead-time for review ☐

Preliminary Submittal Comments: ______

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Consultant Evaluation- Final Plan Review

FINAL PLAN SUBMITTAL PORTION OF THE DESIGN CONSULTANT PERFORMANCE EVALUATION REPORT

Project I.D.	Structure:
Highway:	County:
Project Name:	
District Contact:	Region:
Consultant:	

Type of Structure: ___ Stream Crossing ___ Grade Separation ___ Retaining Wall
___ Rehabilitation ___ Other ______

Average Rating ______

1 – Unacceptable Performance 2– Below Average 3 – Satisfactory
4 – Above Average Performance 5 – Outstanding
(See rating system in FDM 8-25-5)

Final Submittal Reviewer(s): ______ Date: ______
Hours: ______

1. Preliminary Plan Review Comments Addressed ☐
2. Bidability ☐
3. Quality of Final Design Thoroughness ☐
4. Constructability/Plan Detail Thoroughness ☐
5. Completeness of Final Structures Plans Submittal ☐
6. Plan Submitted on Time – 2 Months prior to PS&E (1 if not on time, 2 if with late with justification, 3 if on time) N/A
7. Final Review Comments Addressed Appropriately/Thoroughly ☐

Final Plan Submittal Comments

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Consultant Evaluations- Upcoming Changes

- In the future, BOS will not provide performance evaluations for preliminary plans for "minor" rehabilitation work.
- Minor work may include polymer overlays, painting, slope repairs, etc..
- Preliminary plans for this type of work will still be reviewed and comments will be provided.
- BOS will indicate when an evaluation is not provided.

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Consultant Evaluations- Upcoming Changes

- In the future, average rating for final review evaluations will reflect a weighted average that places more weight on the more significant aspects of the submittal such as design and plan quality.

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Contacts and resources

- Questions regarding structure plan submittals and review processes should be directed to:
  - Najoua Ksontini Najoua.Ksontini@dot.wi.gov (608) 266-2657

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Questions?

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Common BOS Review Comments

Dan Breunig
Consultant Review Engineer

Comments largely related to detailing and constructability concerns, but design errors are important

- 80% Constructability Comments
  - Dimension errors
  - Bar steel callout errors
  - Not enough information to build
- 10% Bidability Comments
  - Incorrect bid items
  - Work detailed in plans but no bid item for work
- 10% Design Comments
  - Insufficient designs or overly conservative designs

Most Common Review Comments

- Geotechnical Reports and Piling Design
  - Several examples of misunderstandings of how to interpret the geotechnical reports and translate that to a modified gates piling design.
  - Some borings are not going deep enough, and skin friction piles cannot develop enough resistance within the boring depth. Has resulted in designs with too many piles, not driven deep enough, and driven to a resistance less than the pile's maximum driving resistance.
  - Incorrect subsurface exploration border sheet.

Most Common Review Comments

- Ratings – Different programs, different results
  - Several different design/rating programs are used in the design community.
  - BOS has access to many of these, but uses an in-house program to actually rate structures (culverts, prestress, steel, slabs).
  - Occasionally, design changes are requested in order to satisfy BOS' in-house software.

Other Common Review Comments

- Drafting Program Errors – incorrect dimension scales - dimensions all off by a constant factor.
- Design computations somehow not making it through to the final plan, typically due to a drafting error or error in an automated process.
- Construction Joint Locations and Bar Couplers
  - For staged construction and widenings, it is preferable to lap transverse deck bars rather than use bar couplers. Saves $$$ and reduces bar congestion.

SSR Training Resources

Matt Allie
Hydraulic Design Engineer
WisDOT Bureau of Structures

Outline

- Objective
- Background
- Resources
- Support

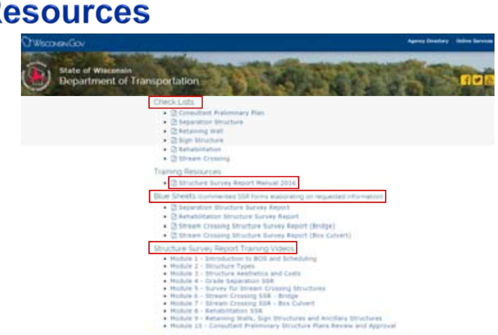
Objective

- Provide comprehensive SSR resources for:
  - Region – when submitting structure for BOS design
  - Consultants – when submitting preliminary structure plans for BOS review or design
- SSRs are most valuable when containing complete and accurate information

Background

- Previously, SSR training presentations given at WisDOT Region offices
- SSR forms updated in 2012
- Update and expand upon SSR training materials
- Recommended by the BOS Timeliness Initiative Final Report

Resources

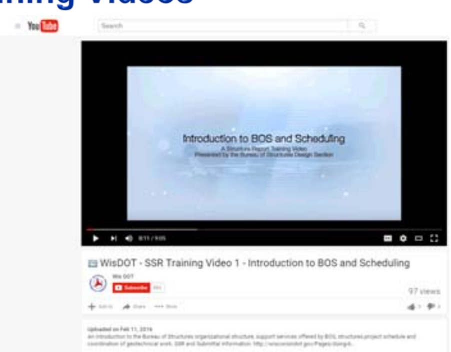


Submittal Checklists

SSR Blue Sheets

SSR Training Manual

Training Videos

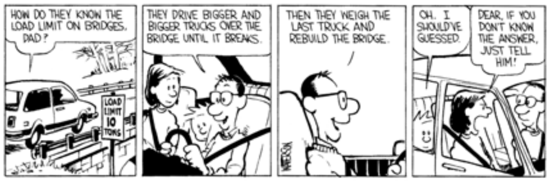


Support

- BOS continues to provide support for filling out SSR forms and using training materials
- Please direct inquiries to Najoua Ksontini

- **Questions?**

Cost Estimating for Structures



Estimating Engineer

- Estimating Engineer for WisDOT since January 2015
- What estimating engineer does.
  - Review estimate development processes and find ways to improve estimate accuracy.
  - Make updates to FDM 19-5 for Estimates and Estimating Page.
    - http://wisconsindot.gov/rdwy/fdm/fd-19-05.pdf
    - http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/tools/estimating/default.aspx
  - Develop updated training materials, make presentations like this, and join any meetings when project estimates are discussed.
    - Organize and run quarterly Estimating User Group meetings.
      - Members are from Planning, Design, Program Control, and Bureau of Structures.
  - Review the bids and estimates for a Letting to prepare for the awards meeting, and reviewing estimate documentation and major items in PS&E estimates before the Letting.

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Topics being Discussed

- Engineering Estimate Accuracy (EEA) Performance Measure
- Construction Cost Index
- Estimator Files
- Bid items that cause inaccurate estimates
- Mobilization
- Bascule Bridge Projects
- Lump sum bid items
- Special Provision Items (SPVs)

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Engineering Estimate Accuracy (EEA) Performance Measure

- FHWA/WisDOT Stewardship Agreement (Sept 2010) goal
  - 50% of estimates should be within 10% of low bid
- WisDOT goal
  - 60% of estimates within 10% of low bid
  - 75% of estimates within 15% of low bid
  - Goals tracked in Estimate accuracy report
- WisDOT external MAPSS measurement—
  http://wisconsindot.gov/Pages/about-wisdot/performance/mapss/measures/accountability/on-budget.aspx

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Engineering Estimate Accuracy (EEA)Performance Measure

- Estimate results for last six years
- Includes breakdown by region, number of bidders, funding category, and work type.
- Structure projects make up 30% of the entire program since 2011.
- Available on online:
  http://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrces/tools/estimating/estimate-accuracy.pdf

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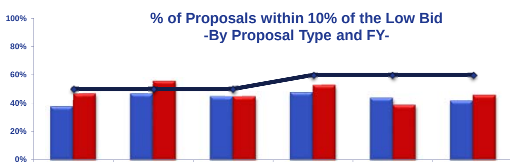
Bridge Project Estimates within 10%



	FY11	FY12	FY13	FY14	FY15	FY16*
Total	38%	47%	45%	48%	44%	42%
Structure	47%	56%	45%	53%	39%	46%
Target[1]	50%	50%	50%	60%	60%	60%

* Data through May 2016 Bid Letting

[1] The performance measure target was 50 percent for FY09-FY13. As part of WisDOT's continued efforts to strive for continuous improvement, the target was increased to 60 percent in FY14.

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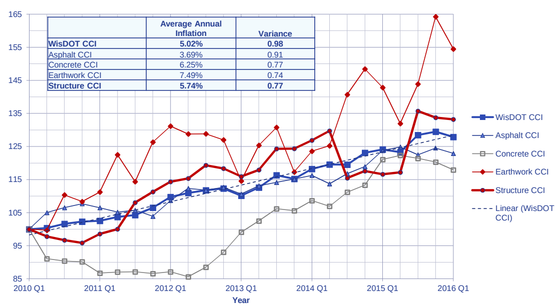
Construction Cost Index(CCI)

- The Chained Fisher Construction Cost Index
  - Accounts for changes in type and usage of items
  - Eliminates issue of updating the base period
    - Able to accommodate usage for the current year and base year
  - Performs better than fixed-weight indices when prices and quantities are volatile
- The Federal Highway Administration (FHWA) uses a Chained Fisher approach— http://www.fhwa.dot.gov/policyinformation/nhcci.cfm

Construction Cost Index

	Average Annual Inflation	Variance
WisDOT CCI	**5.02%**	**0.98**
Asphalt CCI	3.69%	0.91
Concrete CCI	6.25%	0.77
Earthwork CCI	7.49%	0.74
Structure CCI	**5.74%**	**0.77**



Construction Cost Index

- The CCI does not include SPVs items.
  - If enough is spent on special provision items instead of standard items, there will be a dip in the index.
- The CCI does not include Lump Sum items such as Mobilization and Traffic Control Project.
- The WisDOT CCI is consistent with other states.

Estimator Files

- A lot of you are using Estimator for estimating your structures.
- We have made a user guide to merge Estimator files.
  - http://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrces/tools/estimating/estimator-merge-estimates.pdf
- Recommend sharing your Estimator files with project designers along with this user guide.
  - Decrease the chances for errors from reentering items.
  - Decrease the workload with reentering items.

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Bid items that cause inaccurate estimates

Item Number	Item Description	Weighted Percentage 1% or greater	Weighted Percentage 10% or greater	Occurrences
502.0100	Concrete Masonry Bridges	59%	7%	295
203.0600.S	Removing Old Structure Over Waterway With Minimal Debris	43%	5%	182
206.1000	Excavation for Structures Bridges	15%	0%	461
203.0200	Removing Old Structure	14%	1%	463
509.2500	Concrete Masonry Overlay Decks	46%	3%	71
505.0605	Bar Steel Reinforcement HS Coated Bridges	12%	0%	258
517.1800.S	Structure Repainting Recycled Abrasive	9%	1%	77
504.0100	Concrete Masonry Culverts	25%	5%	56

Data includes July 2013 to March 2016

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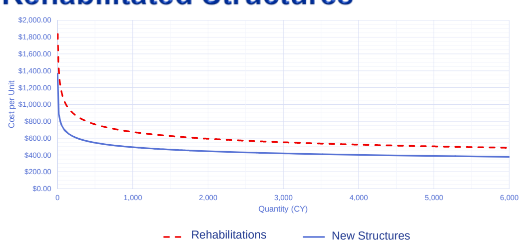
Concrete Masonry: New vs. Rehabilitated Structures



Includes statewide low bids of Concrete Masonry (502.0100) from January 2014 to March 2016

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Concrete Masonry Bridges

- Concrete Masonry Bridges is about $100 to $200 more expensive on Rehabilitated Structures
  - Lower production rates (higher costs) when work is on the superstructure only.
  - Formwork may be more difficult to complete against existing beams, especially when preserving existing concrete girders.
  - Staged construction increase costs.
- Prices seem to have lowered since the cement shortage, but can vary according to contractor bidding.
  - Most recent prices show certain contractors bid around $500/CY and others bid $600/CY.
  - It is difficult to always know who is going to bid on your project but the large complex projects will often include Kraemer North America, Lunda and Zenith Tech.

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Earthwork Items

Item	Description	Estimate	Bid	Accuracy
205.0100	Excavation Common	$148,449,667	$140,538,768	**5%**
208.0100	Borrow	$32,900,927	$23,043,401	**30%**
206.1000	Excavation for Structures Bridges (structure)	$8,605,129	$18,708,900	**-117%**
206.2000	Excavation for Structures Culverts (structure)	$3,567,601	$4,441,862	**-25%**
206.3000	Excavation for Structures Retaining Walls (structure)	$1,508,045	$3,218,972	**-113%**

Data includes July 2013 to March 2016

- Contractors will bid cubic yard earthwork items at a low cost and increase their prices for related lump sum items.
- The total amounts for earthwork is closer when total project costs are considered.
- Designers need to evaluate the total project cost and should not get worried about larger lump sum items or low bids for earthwork.
- The department has a comprehensive Unbalanced bid Analysis that is detailed in CMM 2.10.2.1
  - http://wisconsindot.gov/rdwy/cmm/cm-02-10.pdf#cm2-10.2.1

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Mobilization

- Roadway Designers use a percentage of the total estimate.
  - The mobilization tool on the estimating page allows designers to get more specific percentages.
    - http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/tools/estimating/est-tools.aspx

Structures

Type:	2011 -2015	2011	2012	2013	2014	2015
Sample Size	361	84	72	55	69	81
1st Quartile	5.6%	5.0%	6.0%	5.7%	6.7%	6.1%
Median	7.8%	6.7%	7.5%	7.9%	8.3%	8.7%
3rd Quartile	9.9%	8.8%	9.3%	10.6%	10.9%	10.6%
High Outlier Bound	20.8%	18.0%	17.3%	22.4%	21.0%	22.1%
Trimean	7.8%	6.8%	7.6%	8.0%	8.5%	8.5%

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Mobilization

- Structure engineers typically don't dictate to the roadway designers what percentage to use.
- Could provide recommendations on projects.
  - The project designer should be made aware of project requirements that would increase mobilization costs.
- Specialty bridge projects such as bascule bridge projects, should be using higher than average mobilization prices.

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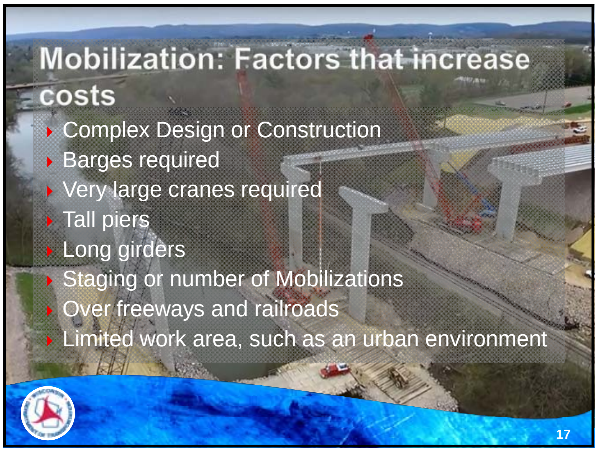

Mobilization: Factors that increase costs

- Complex Design or Construction
- Barges required
- Very large cranes required
- Tall piers
- Long girders
- Staging or number of Mobilizations
- Over freeways and railroads
- Limited work area, such as an urban environment

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Bascule Bridges

- WisDOT needs to do a better job estimating these types of projects.

Proposal #	Project #	Estimate	Bid	Accuracy
20110809017	4998-02-71	$13,299,135	$13,477,696	1.3%
20120710015	4140-23-71	$3,441,312	$4,811,300	28.5%
20130611009	4065-15-71	$5,650,016	$4,639,146	-21.8%
20140408014	1302-00-71	$1,303,408	$1,367,058	4.7%
20150512040	4990-03-71	$1,377,089	$1,534,911	10.3%
20150714022	9995-03-60	$1,751,571	$2,808,515	37.6%
20150811009	4140-20-74	$2,367,450	$3,616,663	34.5%
20160510027	9210-17-60	$1,140,848	$1,750,825	34.8%

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Bascule Bridges

- BPD has started to look into these types of projects more closely.
- WisDOT needs to monitor the number of bascule bridge projects each year.
  - There are only a few contractors for this type of work.
- Industry has stated that the provisions for these specialty bridges are so stringent, that the cost of the items continue to rise.

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Lump Sum Items

- Many of the following points come directly out of AASHTO: Practical Guide to Cost Estimating.
  - https://bookstore.transportation.org/collection_detail.aspx?ID=122
- Lump sum items should only be used when an item of work can be easily defined but not all the components or details can be clearly determined.
- The more breakdown of a lump-sum item there is, the greater the likelihood that an accurate lump-sum estimate can be developed.
  - Easier to verify estimate prices with similar items.
  - Use units that reduce risk from the contractor.

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Lump Sum Items

- Using lump-sum items typically transfers the unknowns to the contractor.
  - Girder Surface Repair in linear feet or square instead of each unit. Contractor is then paid for work completed instead of bidding higher price when amount of repair is not
- We need to do a better job of balancing risk between the contractor and the DOT.
  - Risk = Cost
    - Try not to be prescriptive for the means of construction and materials. Specify the requirements for the final item.
- Most lump-sum items are very different from one project to another. Using past bid history is often not a good indicator for future bid price of lump-sum items.

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Why we should avoid SPVs

- Bid history is difficult to obtain. Estimate prices are less accurate.
- Contractors have to interpret the SPVs, increasing risk and cost.
- Non-standard items may be in short supply and are more expensive.
- Old special provision items may not reflect changes to General Requirements in the Standard Specifications.
- New special provision items may not have been approved by tech committees.
- WisDOT spends about 25% of its program on special provision items and that is too much.

22

Why we should avoid SPVs

- If the result for a task is the same for an SPV and a standard bid item, then use the standard bid item.
  - The bid item is consistent for all projects.
  - Bid history is much easier to find.
  - Experience with common items reduces costs and risk.
  - Standard bid items are more available.
- If you must use an SPV, use SPV libraries maintained by the Bureau of Structures.

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Feel free to contact us with your ideas to improve WisDOT Estimates.

Thank You!

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Estimate Engineer
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Proposal Mngmt. Chief
Phone: (608) 266-3721

Website:
WisDOT Employees -
http://dotnet/consultants/estimates/index.shtm

Consultant –
https://trust.dot.state.wi.us/extntgtwy/consultants/estimates/index.shtm

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Design and Construction of Post-Tensioned Integral Pier Caps

Randy Thomas, PE
Senior Structural Engineer
CH2M

Learning Outcomes

Today's talk is on the design and construction of post-tensioned concrete integral pier caps used for steel I-girder bridges on the Zoo IC Project. At the end of the session, you will be familiar with:

- Fundamental design parameters
- Benefits of a collaborative design approach
- Design and detailing considerations affecting constructability and quality of finished product

2

Presentation Outline

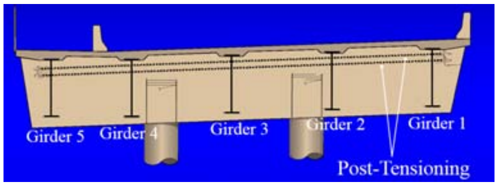
- Introduction
- Case Study: Zoo IC Project
- Design & Detailing Considerations
- Closing
- Questions

3

Introduction

Definition of Integral Pier Cap

- Cap resides entirely or mostly within the depth of the girder framing
- Integrally connected into girder framing system
- Can be any material (steel, concrete, PT concrete)



Why consider an integral pier cap?

- If site geometry is restrictive
  - Clear span prohibitively long/expensive
  - Pier cap overhangs roadway
  - Project economics and/or roadway geometrics favor a shallow superstructure
- Eliminate joints & bearings
  - As compared to using an inverted Tee Pier
- Common applications
  - Heavily skewed ramps
  - Low level viaducts

Integral Cap Type Selection

- Steel
  - Box beam likely required – complicated connections
  - Non-redundant for NBIS condition inspections
- Mildly Reinforced Concrete
  - Concern for cracking and corrosion
  - Tends to sag over time (creep)
- Post-Tensioned Concrete
  - Internally redundant
  - Small deflections / no sag
  - Clean look, similar to adjacent conventional piers
  - Concern for corrosion of hidden elements – can be mitigated through proper detailing

ch2m:

7

Construction Sequence

1. Form, pour, and strip columns

2. Build falsework

ch2m:

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Construction Sequence

3. Erect structural steel

4. Tie rebar

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Construction Sequence

5. Place ducts

6. Set side forms

10

Construction Sequence

7. Pour concrete

8. Strip forms

11

Construction Sequence

9. Push strand

10. Jack strand

12

Construction Sequence

12. Pour deck and parapet

11. Grout tendons and cast pour-backs

13

Case Study: Zoo IC Project

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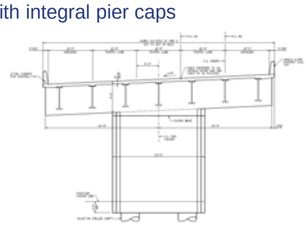
Zoo Interchange Project

- 2 Steel I-girder bridges with integral pier caps
- 2 designers
  - BOS
  - CH2M
- 2 construction lets
  - Zoo Core1 FPSE May 2014
  - Zoo Core2 FPSE May 2015
- 2 design schedules
  - Prelim: Concurrent
  - Final: Staggered



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Bridge B-40-852 (SW Ramp)

- 3-lane, 3-span, 550-ft long
- 1900-ft radius curve
- 84-in webs
- 1 straddle pier
- Designed by BOS

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Bridge B-40-787 (WN/WS Gore)

- 3-lane, 5-span, 750-ft long,1450-ft radius curve, tapered
- 1 straddle pier, 2 hammerheads, 69-in webs
- Designed by CH2M as part of Forward 45

ch2m:

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Zoo IC – Design Schedule

- The Zoo structures design team recognized the potential for collaborative design early in the process
- Preliminary Plans (Jan 2013)
  - Integral cap locations identified, specifics TBD
- Design Workshop (May 2013)
  - Review example CH2M designs
  - Establish design criteria, fundamental design decisions, design methodology/tools
- Final Plans Esubmit – staggered by 1 year
  - B-40-852: Feb 2014 (May 2014 FPSE)
  - B-40-787: Feb 2015 (May 2015 FPSE)

ch2m:

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Facilitating Collaborative Design

- Forward 45 advanced the final design of B-40-787 PT integral straddle pier, to match B-40-852 schedule and capture synergies
- Design teams co-located at Barstow project office in Waukesha
- Over-the-shoulder reviews
  - No direct responsibility for checking each other's work
  - Provide opinion/advice
  - Identify common or similar elements of design
  - Adopt consistent design approach (evolves over time)
  - Trouble shoot together

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Benefits of Collaborative Design

- Design Efficiencies - 2 birds with 1(+) stone
  - Selection of analysis tools
  - Approach to detailing
  - Special provisions
- "Incidental" Quality Control
  - 2 design teams offer a degree of independent thought
  - Qualitative comparisons – Why are things different?
  - Quantitative comparisons – proportional gut check on size, qtys
- Consistency
  - End products look very similar (uniformity within interchange)
- Constructability
  - Lessons learned during bidding/construction of 1st bridge can be applied to 2nd bridge in real time

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Fundamental Design Parameters

- Prestress Type
  - HS Bars: good for short, straight tendons; lower PS losses; shallow blockout
  - HS Strand: higher capacity; easy to curve tendons; higher PS losses; deeper blockout
- Depth of Cap
  - Aesthetics, structural depth, tendon pathways
- Articulation
  - Bearings, hinges, pins?
  - Accommodate PT shortening, cap torsion
- Design Methodology/Tools
- Corrosion Protection Measures

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Outcomes of Design Workshop

- PS Type: TBD during final design case-by-case
- Increase vertical clearance to 17'-0" (normally 16'-9")
  - Protect against vehicle collision/repairs
- Articulation
  - Straddle: Use pin detail (rebar cluster)
  - Hammerhead: Use hinge detail (rebar row)
  - Rotational release alleviates constraint forces
- Analysis platform: 3D FEM (LARSA 4D)
  - Irregular geometry; integral framing; staging analysis; time-dependent material effects
- Design PT for zero tension (AASHTO allows LL tension)
  - Section remains uncracked; more difficult for salt to penetrate
  - Keep cap "clamped" tightly at girder/cap interface

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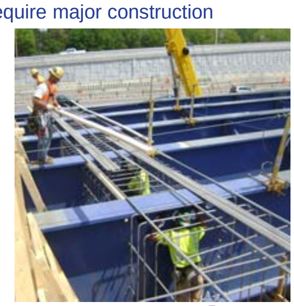
Corrosion Protection Measures

- Cap replacement would require major construction
  - Severe traffic impacts
  - Expensive
- Pier Cap
  - Stainless steel rebar
- PT Anchorage
  - Galvanized or plastic fittings
  - Grouted anchor end caps
  - Pour-back
  - Exterior surface protection
- Girders
  - Zinc Metalized
- Exposed to salt spray



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Design and Detailing Considerations

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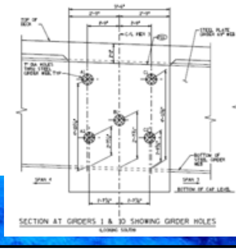
Design and Detailing Considerations

- Holes thru girder webs
  - Lesson Learned: Leave ample room for construction tolerance (7" hole for 4" or 5" duct) (1 7/8" hole for #6 rebar)
  - Offsets unique for each girder - Double check all dims!



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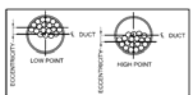
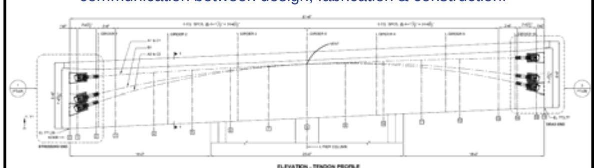
Design and Detailing Considerations

- Duct layout dimensions
  - Clearly distinguish between CL duct and c.g. strand (vertical offset)
  - Craft labor will measure from bottom cap form to bottom of duct, in fractional inches. Requires clear communication between design, fabrication & construction.





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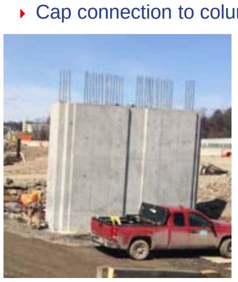
Design and Detailing Considerations

- Cap connection to columns



Rebar Hinge Detail

Rebar Pin Detail

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Design and Detailing Considerations

- End Anchorages
  - Ensure adequate real estate for anchor hardware and rebar spiral
  - Ensure shape of jacking pockets provides adequate room for common jacks

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Design and Detailing Considerations

- Recommend locating X-frames 10’ from face of cap
  - Provides room for formwork
  - Avoids large stresses in x-frames and/or lateral flange bending due to PT shortening (we want PT force in the cap, not the steel)

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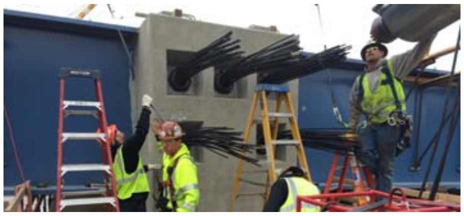
Feedback from Construction Eng

- Concrete Mix for Pier Cap – dense reinforcement
  - Use 6” to 8” slump and ¾” max aggregate
  - Consider requiring super-plasticizer
- PT duct splices
  - Spec should specify heat shrink seal (don’t want duct tape!)

30

Feedback from Construction Eng

- Qualifications for supervisor of stressing operations
  - Spec is not clear how the qualifications of the “qualified individual” will be assessed/approved; suggest requiring PTI certification



ch2m:

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Feedback from Construction Eng

- Surface treatment on pour backs
  - Suggest using a stainable or custom pigmented sealing product over the non-shrink grout
- Duct Grout
  - Include testing for chloride levels (ASTM C1152)
  - Consider adding specific content requirements for the contractor’s Grouting Plan

ch2m:

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Closing

ch2m:

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Parting Thoughts

- B-40-787 is currently under construction. Despite its complex geometry, parts are fitting together nicely.
- A collaborative approach can contribute to higher quality, more efficient designs.
- Feedback from the field is essential for improved designs moving forward.

ch2m:

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Questions

ch2m:

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Wisconsin Structures Asset Management System (WiSAMS)

Philip Meinel
Structures Asset Management Engineer
BOS – Development – Bridge Management Unit

Bridge Management History

- National issue
  - Early 1990s

(Re-branding)

- Goals:
  - Database for inventory and inspection data
  - Deterioration modeling
  - Network-level asset management/planning

Bridge Management History

- "Pooled-fund" software
  - Pros: Collaboration, eliminate duplication of effort
  - Cons: Can be slow developing…hard to please everyone
- WisDOT moves forward in parallel with BrM
  - HSIS database - 2003
  - WiSAMS planning tool - 2015

Structure Asset Management

Structure Asset Management

Implementation

- ***Wisconsin Structures Asset Management System (WiSAMS)***

Policy – WisDOT Bridge Preservation Policy

- ***Bridge Preservation Policy Guide***

Inventory and Condition Data

- ***Highway Structure Information System (HSIS)***

HSI Database

- Major upgrade 2014

HSI Database

- Strive for accuracy
  - Inspections
  - Structure Inventory Data forms

Policy

- FHWA and MAP-21
  - No more Sufficiency Rating (SR) driven program
  - Emphasis on justification for infrastructure investment
  - Data- and performance-driven goals and approach

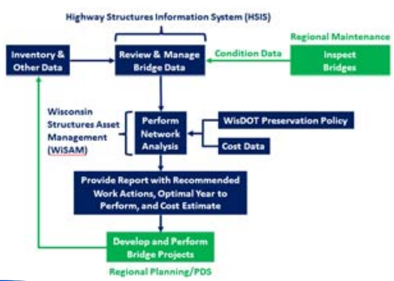
Policy

- WisDOT Bridge Preservation Policy Guide
  - First draft 2015
  - Bridge Maintenance Engineering Judgement & Research
  - Maximize the useful life of bridges in a cost-effective way

Policy

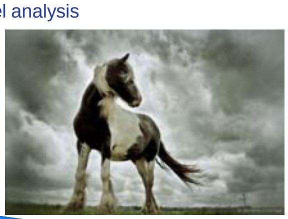
- Preventative Maintenance Agreement
  - Updated in 2016
  - Establishes which maintenance activities are eligible for federal funding
  - More work types are eligible for federal funding

Implementation



Implementation

- WiSAMS – Wisconsin Structures Asset Management System
  - Systematic network-level analysis
  - Planning tool

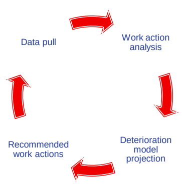


WiSAMS

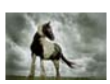
- Where is it at?
  - Coordination and main development in 2015
  - Draft reports released to regions in April 2016
  - Production version of reports to be released July 2016
  - Exciting list of future refinements and new possibilities

WiSAMS

- How does it work?
  - Data pull
  - Work action analysis
  - Deterioration model projection
  - Recommended work actions



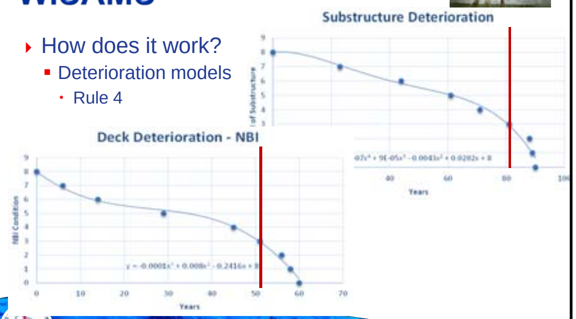
WiSAMS



- How does it work?
  - Rule 4
    - If Substructure NBI < 3, and
    - Deck NBI < 3
    - Then, Replace Structure
  - Rules increase in complexity as program runs through the rule sequence (currently about 60 rules)

WiSAMS

- How does it work?
  - Deterioration models
    - Rule 4

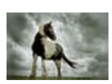


WiSAMS

- How does it work?
  - Recommended work actions

B110001		YEAR	AGE	NO ACTION	OPTIMAL IMPROVEMENT SCENARIO					FIIPS PROGRAM	
				CAI	PRIMARY WORK ACTION	CAI	COST: PRIMARY WORK ACTION	EST. LIFE EXTENSION (YRS)	INCIDENTAL WORK ACTIONS	PROGRAMMED WORK ACTION; PROJECT ID	CAI
FEAT ON/UNDER:	STH 13/16/23-BROADWAY ST over WISCONSIN RIVER 16	2017	62	71.8	(99)OVERLAY DECK - THIN POLYMER / NEW JOINTS	79.9	381310	15		(99)OVERLAY DECK - THIN POLYMER / NEW JOINTS; 61310061	79.9
STRUCTURE TYPE:	DECK GIRDER	2018	63	70.8		78.5	0	0			78.5
MATERIAL:	CONT STEEL	2019	64	69.6		77	0	0			77
NUM SPANS:	5	2020	65	68.2		75.3	0	0			75.3
TOT LENGTH (FT):	680	2021	66	66.8		73.6	0	0			73.6
INVENTORY RATING:	HS19	2022	67	61.5		67.9	0	0			67.9
OPERATING RATING:	HS30	2023	68	60.2		66.3	0	0			66.3
LOAD POSTING:		2024	69	59		64.9	0	0			64.9
LAST INSPECTION:	4/27/2016	2025	70	58	(07)PAINT (COMPLETE)	70.8	1101125	27	(12)REPAIR RAILING OR PARAPET; (14)REPAIR SUBSTRUCTURE - RESTORE CONDITION AND CAPACITY;		63.6
CONSTR HIST:	(1955)NEW STRUCTURE (1972)REPAIR SUBSTRUCTURE (1975)REPAIR SUPERSTRUCTURE (1982)OVERLAY - CONCRETE (1992)NEW DECK	2026	71	57.1		70.1	0	0			62.5

WiSAMS



B110001	
FEAT ON/UNDER:	STH 13/16/23-BROADWAY ST over WISCONSIN RIVER 16
STRUCTURE TYPE:	DECK GIRDER
MATERIAL:	CONT STEEL
NUM SPANS:	5
TOT LENGTH (FT):	680
INVENTORY RATING:	HS19
OPERATING RATING:	HS30
LOAD POSTING:	
LAST INSPECTION:	4/27/2016
CONSTR HIST:	(1955)NEW STRUCTURE (1972)REPAIR SUBSTRUCTURE (1975)REPAIR SUPERSTRUCTURE (1982)OVERLAY - CONCRETE (1992)NEW DECK

- Inventory Data
  - Pulled from HSI
  - History of past work
  - Planning
    - Help prioritize structure work within the region

WiSAMS

- Do-nothing Scenario
  - Condition Assessment Index (CAI)
  - See deterioration of CAI value
  - Planning
    - See negative effect of postponing important structure work

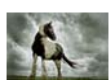
YEAR	AGE	NO ACTION
		CAI
2017	62	71.8
2018	63	70.8
2019	64	69.6
2020	65	68.2
2021	66	66.8
2022	67	61.5
2023	68	60.2
2024	69	59
2025	70	58
2026	71	57.1

WiSAMS

- Improvement Scenario
  - Primary and possible work to combine
  - Cost & life extension estimates
  - Planning
    - More information early in the process = better decisions

OPTIMAL IMPROVEMENT SCENARIO				
PRIMARY WORK ACTION	CAI	COST: PRIMARY WORK ACTION	EST. LIFE EXTENSION (YRS)	INCIDENTAL WORK ACTIONS
(99)OVERLAY DECK - THIN POLYMER / NEW JOINTS	79.9	381310	15	
	78.5	0	0	
	77	0	0	
	75.3	0	0	
	73.6	0	0	
	67.9	0	0	
	66.3	0	0	
	64.9	0	0	
(07)PAINT (COMPLETE)	70.8	1101125	27	(12)REPAIR RAILING OR PARAPET; (14)REPAIR SUBSTRUCTURE - RESTORE CONDITION AND CAPACITY;
	70.1	0	0	

WiSAMS



- Future Development
  - Scoping report
    - Eligible work within existing project limits
  - Prioritization factors
    - Criticality, vulnerability, etc.
  - Element defect deterioration modeling
    - Ex. Delaminations (defect 1080) in deck elements

Questions?

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Chapter 45 Re-Organization

Structural Engineers Symposium
June 7, 2016

Why does Chapter 45 exist?

- Design isn't rating, and vice versa
  - Some design considerations aren't applicable for rating
    - Construction checks
  - Some rating considerations aren't applicable for design
    - Deterioration
- In 2015 let projects (State and Local):
  - New bridge construction: 54%
  - Bridge rehabilitations: 46%

2

Purpose of this Effort

- Create better organization
  - Give everything a home
- Document current practice
  - Not much is new…but new to Bridge Manual

3

This Presentation

- Raise awareness on pending updates
- Give a sense for what to expect
  - Highlight some specific policies/procedures
- **DRAFT, DRAFT, DRAFT!!!**

4

Table of Contents

- Better organization
- Better flow
- Easier to find information on specific policies and procedures for your project

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Table of Contents

6

Table of Contents

7

Applicability

- 45.1.2 Scope of Use
  - State and Local

45.1.2 Scope of Use

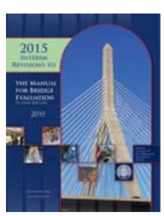
All requirements presented in this chapter are to be followed by WisDOT Bureau of Structures (BOS) staff, as well as any consultants performing load rating or load posting work for WisDOT BOS. Local municipalities and consultants working on their behalf should also follow the requirements of this chapter.

8

Primary Load Rating References

- 45.1.3 Governing Standards for Load Rating
  - AASHTO Manual for Bridge Evaluation (MBE)
  - Wisconsin Bridge Manual, Chapter 45

  - LRFD design code (LRFR)
  - 2002 Standard Spec (LFR)



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When a Rating is Required

- 45.3.2.1 When a Load Rating is Required (Existing In-Service Bridge)
  - Removal and replacement of existing overlay
  - Thin epoxy overlay
    - Quality control for the rating process
    - Review inspection reports for deterioration

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What to Load Rate

- 45.3.3 What Should be Rated
  - Example: Steel trusses

Steel truss structures

Primary elements for rating include truss chord members, truss diagonal members, gusset plates connecting truss chord or truss diagonal members, floor beams (if present), and stringers (if present).

Secondary elements include splices, stringer-to-floorbeam connections (if present), floorbeam-to-truss connections (if present), lateral bracing, and any gusset plates used to connect secondary elements.

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Load Rating Software

- 45.4.1 Rating Software Utilized by WisDOT
  - Steel girder: SIMON, AASHTOWare BrR
  - PS girder: In-house, BrR
  - Slab: In-house, BrR
  - Truss: BrR
  - Other: MDX, CSI Bridge, LARSA, Conspan
- Submittal requirements
  - Typical
  - Complex

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Live Loads

- 45.5 General Requirements

- Live load placement
  - Truck on sidewalk
  - Striped lanes

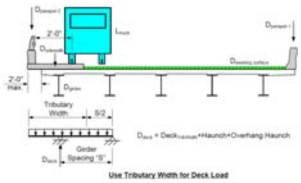

Figure 17.2-18
Distribution of Loads to Exterior Girder for Girder Structure with Raised Sidewalk Design Case 2

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Material Properties

- 45.5.2 Material Structural Properties

- Old information is still there
  - Rebar, concrete, PS strands, structural steel
  - See also AASHTO MBE

- Added information for timber
  - Superstructures (possibly)
  - Substructures (likely)

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Policy - Superstructure

- 45.6 WisDOT Policy and Procedure - Superstructure

- Separated by superstructure type

- Example: PS girder superstructures (45.6.1.1)
  - Different girder spacings by span (1&4, 2&3)
    - With a "made-continuous" deck

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Policy - Superstructure

- Example: steel girder superstructures (45.6.3.1)
  - Plastic analysis - M_Y vs M_P
  - Curvature

16

Policy - Superstructure

- Example: steel truss superstructures (45.6.3.2)
  - Gusset plates

17

Policy - Substructure

- 45.7 WisDOT Policy and Procedure - Substructure
- Separated by substructure type
- Timber piles (45.7.1)

18

Load Posting (45.10)

- General clarification
  - What vehicles to use
  - LL factors
  - Distribution factor (multi vs. single)
- SHVs…

19

Construction Loading (45.12)

- Refer to Wisconsin Standard Specification
  - Section 108.7.3
- "If the engineer directs, submit stamped and signed copies of analyses and associated calculations performed by a professional engineer…"
- "If a PE's analysis is required…"

20

Stay tuned…

- Raise awareness on pending updates
- Give a sense for what to expect
  - Highlight some specific policies/procedures
- 45.8 - Policy and Procedure – Culverts

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Load Rating Culverts

Structural Engineers Symposium
June 7, 2016

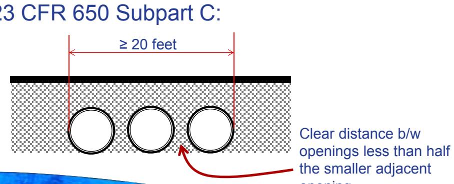
Culverts: Are Load Ratings Required?

- Wisconsin Bridge Manual:
  - Chapter 36 (Box Culverts), 36.1.2:
    - "Current WisDOT policy is to not rate box culverts. In the future, rating requirements will be introduced as AASHTO is updated to more thoroughly address box culverts."
  - Chapter 45 (Bridge Rating):
    - Load Rating Summary Form not required for culverts
    - Insert "placeholder" ratings on plans

2

Culverts: Are Load Ratings Required?

- FHWA requires documented load ratings for all bridges. But when is a *culvert* a *bridge*?
- NBIS-23 CFR 650 Subpart C:



3

Culvert Rating Methods

- 2013 Interim Revisions to MBE
  - **Article 6A.5.12** – Rating of RC Box Culverts (LRFR)
- 2016 Interim Revisions to MBE
  - **Article 6B.7.1** assigns rating factors of Inventory HS20 & Operating HS33 for concrete culverts with…
    - Fill depths of **2.0 ft or greater with known details**, or
    - With **unknown components** (such as culverts w/o plans)

    … if they have been **carrying normal traffic** for an appreciable period and are in **fair or better condition**.

4

Culvert Rating Methods

- MBE does not currently provide explicit direction for other types of culverts.
- Other references:
  - 2002 AASHTO Standard Specifications
  - Current AASHTO LRFD Specifications
  - National Corrugated Steel Pipe Association (NCSPA)
    - Design Data Sheet No. 19 (free download) – *Load Rating and Structural Evaluation of In-Service, Corrugated Steel Structures*

5

Ongoing Research

- NCHRP 15-54:
  - Proposed Modifications to AASHTO Culvert Load Rating Specifications
  - Goal Completion Date: July 2018

6

Ratings Based on Engineering Judgment & Field Evaluation

NBI Culvert Condition Rating	Over-burden	Element in CS4 Under Traffic Lanes?	Inventory Rating	Operating Rating	MVW (kips)	Load Restriction
≥ 5	n/a	n/a	HS20	HS33	190	NONE
4	n/a	n/a	HS12	HS20	190	NONE
3	≥ 6 ft	n/a	HS12	HS20	190	NONE
	< 6 ft	NO	HS12	HS20	190	NONE
		YES	**HS06**	**HS10**	**40**	**20 TON**
2	≥ 6 ft	n/a	HS12	HS20	190	NONE
	< 6 ft	NO	**HS06**	**HS10**	**40**	**20 TON**
		YES	**HS02**	**HS03**	**10**	**5 TON**
0-1	n/a	n/a	**HS00**	**HS00**	**0**	**CLOSURE**

Exceptions:

- Postings and Inventory Ratings were not *increased* based on the new criteria.
- If designed via LRFD, ratings assumed to be Inventory RF1.00, Operating RF1.67, MVW 190k
- If calculated LRFR ratings provided on plans or in submitted calculations, they were not changed.

Exceptions:

- Alternate ratings could be determined through judgment and/or calculations with consideration of:

Condition	Age
Construction Type	Redundancy
Design Load	Live Load History
Similar Structures	ADTT

- Requires Load Rating Summary Form with written justification submitted by professional engineer.

Ratings for New Culverts

- Concrete box culvert requirements:
  - Accurate Load Ratings on Plans
  - Calculation Submittal
  - Per MBE, need not be rated if:
    - Single-span, 8 ft or more of fill
    - Multiple-span, depth of fill exceeds distance b/w faces of end walls
- Pipe culvert requirements:
  - Plans must include design vehicle (HL-93)
  - Load Ratings may be calculated or assigned

10

Thank you!

Specialized Hauling Vehicle (SHV) Rating

Bria Lange
Development Bridge Rating Engineer
WisDOT – Bureau of Structures

What are SHVs?

- Dump trucks, construction vehicles, solid waste trucks, etc.
- Cause forces exceeding HS20 by up to 22 percent.
- Shorter bridges at higher risk for overstress.
- Four (4) single unit posting vehicles: SU4, SU5, SU6, SU7

Important dates

- December 31, 2017
  - All bridges with shortest span less than 200’
- December 31, 2022
  - All other bridges

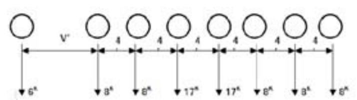
SHV rating is NOT required when:

- LFR/ASR HS20 Operating RF>1.2
- LRFR HL-93 Operating RF>1.0
- LFR/ASR AASHTO legal truck Operating RF>1.35
- LRFR AASHTO legal truck Operating RF>1.35
  - SU4 and SU5 for all spans
  - SU6 for spans above 70 feet
  - SU 7 for spans above 90 feet

NRL screening tool:

Run Notional Rating Load (NRL):

- Operating RF>1.0 – Need not to be rated for SHVs



V = VARIABLE DRIVE AXLE SPACING — 6'0" TO 14'-0". SPACING TO BE USED IS THAT WHICH PRODUCES MAXIMUM LOAD EFFECTS.

AXLES THAT DO NOT CONTRIBUTE TO THE MAXIMUM LOAD EFFECT UNDER CONSIDERATION SHALL BE NEGLECTED.

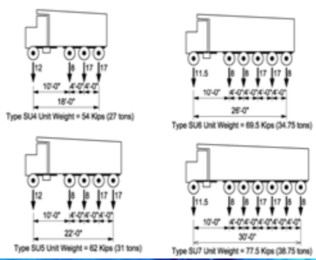
MAXIMUM GVW = 80 KIPS

AXLE GAGE WIDTH = 6'-0"

SHV posting analysis

Run four (4) SHV vehicles:

- Operating RF>1.0 – Posting not controlled by SHVs



Policy and Standards Updates

Dave Kiekbusch, P.E.
Supervisor – Automation, Policy and Standards Unit
WisDOT Bureau of Structures

Updating the Bridge Manual to be Compliant with AASHTO

- Design according to the Bridge Manual. A BOS approval prior to beginning design is required if wanting to implement AASHTO changes prior to Bridge Manual updates.
- 7th Edition, 2016 Interims
  - Published November, 2015
  - Probable Bridge Manual updates by January, 2017
    - Wind speed
    - Increased compressive stress limit for prestressed girders
    - Increase in Fatigue I load factor
    - Strut-and-tie methodology

AASHTO Updates (continued)

- 8th Edition (2017)
  - Likely published later this year, or early next year
  - Updates to Bridge Manual: July, 2017 and beyond!
  - Fairly substantial changes
    - Complete reorganization of Section 5: Concrete Structures
    - Elimination of the simplified method for determining shear resistance of prestressed concrete (no more Vci, Vcw)
    - Changes to bolt shear strength and friction values on the faying surfaces
    - New, simplified field splice design

Future AASHTO Updates

- Every 3 years (2020, 2023, etc.)
- No more interims
  - Meaning no more pink interim sheets!
- BOS is working on generating a work plan for current and future updates, especially with regards to the AASHTO updates being every 3 years
  - Bridge Manual text
  - Bridge Manual standard drawings and insert sheets
  - Bridge Manual design examples
  - In-house software
  - Understanding timeline of proprietary software updates

Aesthetics Policy – BM Chapter 4

- Bridge Manual policy discusses lettings and SMA's before/after August 15, 2016
  - There may be a newer, sooner date
  - Non-geometric (e.g. rocks) formliner and stain are CSS
  - Staining
    - Initial staining cost can be fairly reasonable
    - Re-staining cost can be very high ($20+/SF when considering traffic control)
    - Plain concrete looks better in 20 years than poorly maintained stain

Aesthetics Policy (continued)

- Any railing/parapet in the Standards is not considered CSS
  - Maintenance of paint will be the responsibility of the community and should be defined in the SMA
- Not yet known the impact to:
  - Current projects under construction
  - Impending major/mega projects
- Stay tuned for updated policy, including a memo from Bill Dreher!

No matter the date, you can use either Type I…

Type II

Type III

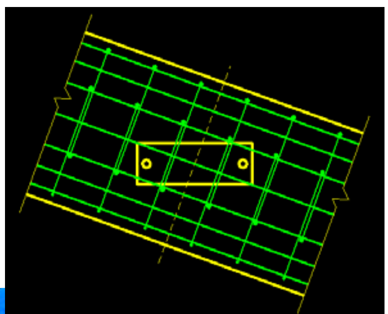
AASHTO Manual for Assessing Safety Hardware - MASH 2016

- From Chapter 30 of Bridge Manual:

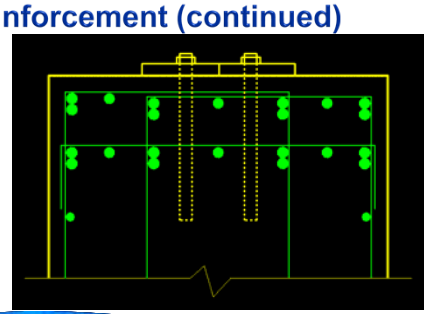
Notice: All contracts with a letting date after December 31, 2019 must use bridge rails and transitions meeting the 2016 Edition of MASH criteria for new permanent installation and full replacement.

BOS understands the urgency of getting approved parapets and railings available for your use!

Anchor bolt conflicts with reinforcement



Anchor bolt conflicts with reinforcement (continued)



Anchor bolt conflicts with reinforcement

- Layout reinforcement with thought to anchor bolt placement
- Provide 4” clear between anchor bolt and rebar
- 5” to 6” clear between bars for tremie and concrete vibration
- Detailing multiple layers is acceptable (use correct structural depth)

Automation, Policy and Standards (Updates)

James Luebke
Development Engineer – APS Unit
WisDOT Bureau of Structures

Piling - Usage

- 2012-2014 Costs Data
  - 75% H-Piles
    - 31% HP12x53
    - 30% HP10x42
    - 14% HP14x73
  - 25% CIP Piles
    - 9% 12 ¾ x 0.375-Inch
    - 6% 10 ¾ x 0.365-Inch
    - 10% other CIP Piles

Note:
Wisconsin has relatively shallow depths with hard bearing layers. Generally making end bearing H-piles an attractive choice.

Note:
H-piles have the potential to accommodate downdrag forces.

Note:
Drilled shafts and spread footings represent very few projects, but are becoming more popular.

2

Piling - ASP 6 Updates/2017 Spec.

- 550.5.2 Piling
  - Adjust pay under the Piling Quantity Variation administrative item if total driven length of each size is less than 85 percent of, or more than 115 percent of the contract quantity

Percent of Contract Length Driven	Pay Adjustment
< 85	(85% contract length - driven length) x 20% unit price
> 115	(driven length - 115% contract length) x 5% unit price

3

Piling - PDA

- Pile Driving Analyzer (PDA)
- Advantages
  - More accurate method
  - Potential cost savings
  - Provides other useful information
- Limitations:
  - Time (24 hours) for analyses and feedback
  - Subcontractor
  - Savings vary

Note:
PDA has saved the department over $3 million over the past years

Structure Backfill - Quantities

- Issues:
  - Backfill payment disagreements (some cases 2 times)
  - Inconsistencies (bid items and graduations)
  - Units
- Design Considerations:
  - Show pay limits on plans
  - Add notes for payment (backfill pay limits only)
  - Better communicate quantities (roadway and structures)

Granular - Quantities

- Abutments, Walls, Culverts, etc.
- Show pay limits on plans
- Note contractor is responsible for excavation limits

Bridge Manual
Draft Updates

Structure Backfill - Gradations

- Plan Inconsistencies:
  - Structural Backfill
  - Structural Backfill w/ 209.2.2 Gradations
  - Granular Backfill

Bridge Manual
Draft Updates

- 2017 Specifications:
  - **Structural Backfill Type A (New Gradations)**
  - Structural Backfill Type B (Old Gradations)

7

Structure Backfill - Units

2017 Specifications:

- Field Disagreements with “CY” Unit
- Added “Tons” Unit

Standards
Draft Updates

- BOS Recommends “Tons”
  - Unless Region directs otherwise
  - Similar to Structural Approaches Slabs (Base Aggregate)
  - Assume **2.0 tons/CY conversion factor**

8

MSE Walls

- Clearly identify wall payments
- Be careful with “Incidental to MSE Wall” for unknown subgrade improvements

9

Cofferdams

- Allows substructures to be poured in the dry
- Construction Protection

- Controls Sediment

Cofferdams

Abutment – Poured Dry

Cofferdams

Pile Encased Pier – Tremie Poured (Protected)

Cofferdams

Pile Encased Pier – Tremie Poured (Assumed Unprotected)

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Cofferdams

- Site and structure conditions vary greatly
- Ensure quality and minimize field disagreements
- Designer Coordination
  - Regional personnel (environmental representative)
  - BOS
  - DNR and others as needed
- Design Options
  - Cofferdam & Dewatering
  - Cofferdam (noted: underwater pour allowance)
  - No Cofferdam (noted: underwater pour allowance & Roadway covers erosion control measures)

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Cofferdams

Pile Encased Piers:

- Historically haven't been required
- Cofferdams are expensive
- Better protection than open pile bent
- Simple forming and pouring operations (compared to a spread footing)

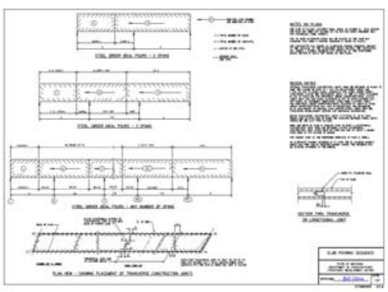
15

Cofferdams – Plan Preparations

- Cofferdam vs. Excavation for Structures
- Underwater pours
  - Difficult to pour structural concrete underwater
  - Strength and long term durability
  - Recommend note to clarify allowances
- When to Include a Cofferdam bid item?
  - Substructure to be poured in the dry
  - Water depths greater than 5 ft (pile encased subs)
  - Other cases

Slab Pouring Sequence

- Std. 24.11



Slab Pouring Sequence

- Optional
  - Limits pour volume < 600 CY Urban (< 300 CY)
  - Acceptable Continuous Pour
- Required
  - Serviceability (minimize deck cracking and deflections)
  - Stresses (sequential pours)
  - Section properties (sequential stages)

Standard 24.11
Draft Updates

PS Girder - Diaphragm

- Standards 19.34-19.38 Updates
- Length measured from girder ends (1/16)
- Revised notes (7/16)
  - 2017 Standard Spec updates
  - Connection requirements

Standards 19.34-19.38
Draft Updates

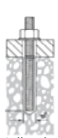
Concrete Anchors

- Types: CIP, Adhesive, and Mechanical
- Design: New vs. Rehabilitation
- Type S or Type L?
- Field substitutions for Type S anchors
- Mechanical types (Screw vs. Expansion)
- Testing

Concrete Anchors

- Types: **CIP, Adhesive,** ~~and Mechanical~~
- Design: **New vs. Rehabilitation**
- ~~Type S or Type L?~~
- ~~Field substitutions for Type S anchors~~
- ~~Mechanical types (Screw vs. Expansion)~~
- **Testing**


CIP


Adhesive


Mechanical

Concrete Anchors

Mechanical Anchors

- Design Memo – 10/21/15 Moratorium
- Removed from 2017 Specifications
- Bridge Manual Updates – July 2016

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Concrete Anchors

Adhesive Anchors

- Updated 2017 Specifications
  - Eliminated Type L and Type S
  - New Bid Items: Adhesive Anchors (Size)
  - Removed proof loads table

- Added CMM Guidance (5-15.7)
  - Added proof load tables
  - Noted railing attachment testing

- Bridge Manual Updates – July 2016

23

Concrete Anchors

Adhesive Anchors on Plans:

- ~~MASONRY ANCHORS TYPE S X/X-INCH. MIN. EMBED XX" IN CONCRETE.~~
- ADHESIVE ANCHORS X/X-INCH. MIN. EMBED XX" IN CONCRETE.

Standards & WBM
Draft Updates

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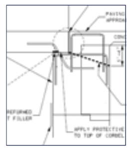
Structural Approach Slabs

- Usage: All bridges with AADT > 3500
- Not required on: Buried structures, Culverts, and **Rehabilitation Projects**
- Contact BOS for detail/pour modifications



25

Structural Approach Slabs

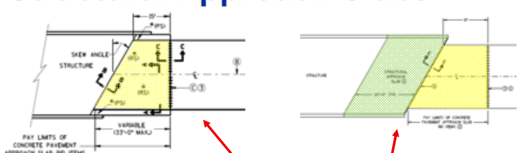


Table 15.1 Bridge Approach Requirements

Criteria	Other Roadways with AADT ≤ 3,500			IH, USH, or Other Roadways with AADT > 3,500
Roadway Pavement Type	Concrete	HMA		N/A *
Bridge Skew	N/A *	Skew ≤ 20°	Skew > 20°	N/A *
Structural Approach Slab	No	No	No	Yes
Concrete Pavement Approach Slab	Yes	No	Yes	Yes

Structural Approaches: See Bridge Manual Chapter 12 Standard Drawings
Concrete Pavement Approaches: See FDM 14-10-15 and SDD 13B2

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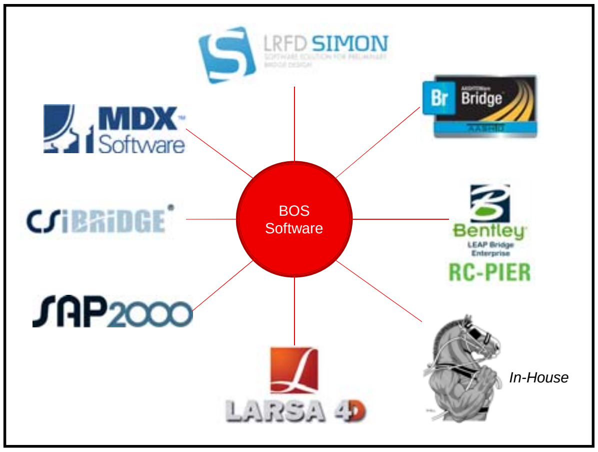
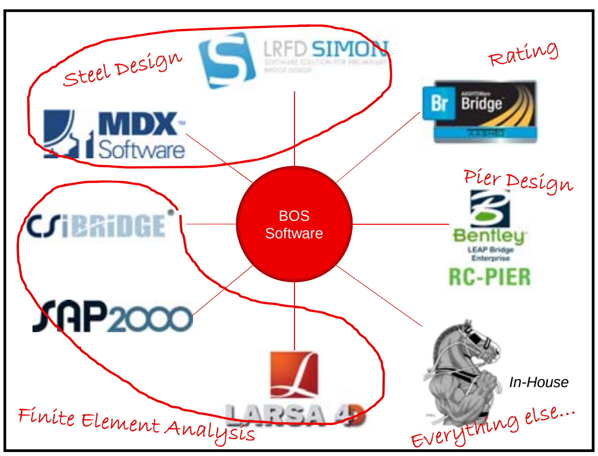
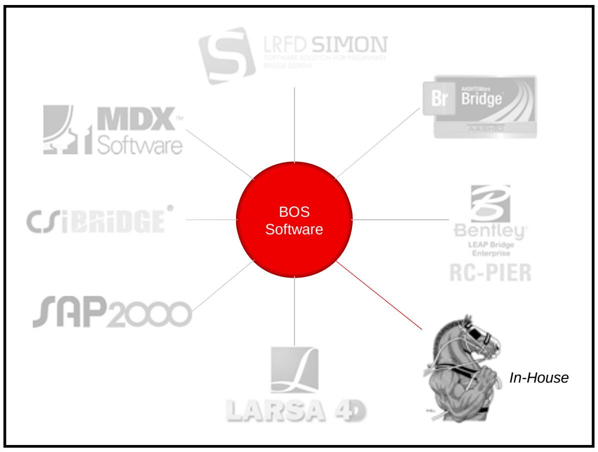
Commercial Bridge Design (& Rating) Software

Andrew Smith, P.E.
Development Engineer
WisDOT – Bureau of Structures

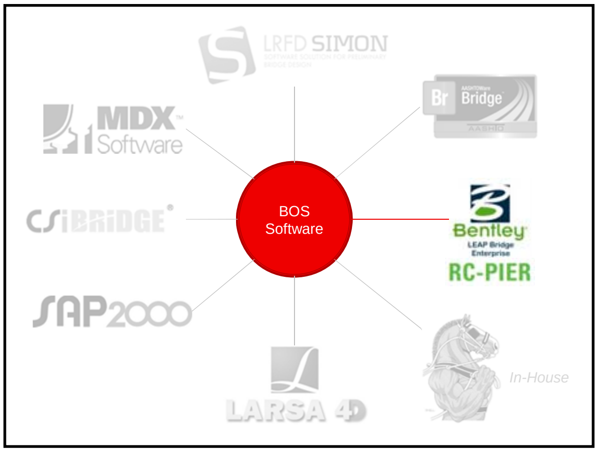






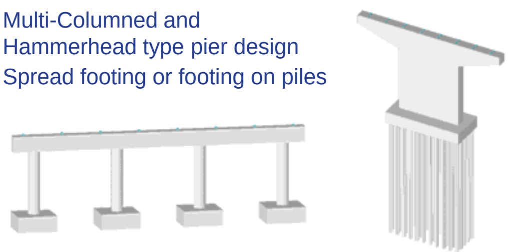
In-House Software

- Work Horse for Design and Rating of
  - Prestressed Girders
  - Steel I-Girders*
  - Concrete Slabs
  - Culverts
- Structure types make up ~ 90% State and Local Inventory



RC-Pier (LEAP Bridge)

- Multi-Columned and Hammerhead type pier design
- Spread footing or footing on piles



RC-Pier

The Good…

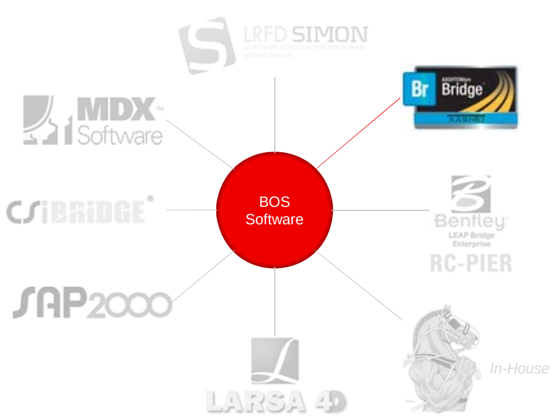
- User friendly interface
- Useful for most common pier (multi-column on piles)
- …

RC-Pier

The Bad…

- Tedious to enter loads and modify
- Automated designs not constructible
- Problems with strut-and-tie modeling
- No pile uplift redistribution

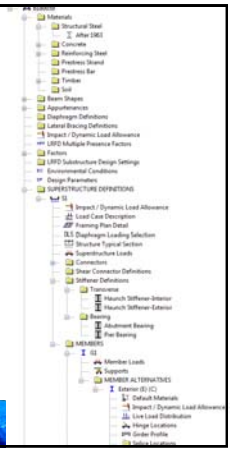
Comments on RC-Pier or Substructure Design Software?



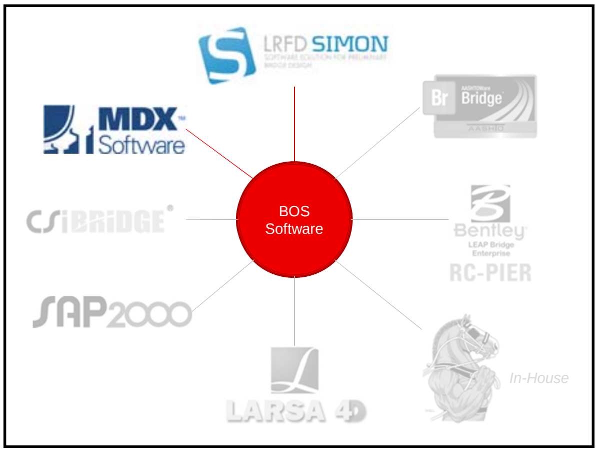
AASHTOWare BrR

Very Good…

- "Crowdfunded" software
- R" for Rating
  - Supports LRFR, LFR, and ASD
- Multiple Structure Types: Common types + Timber, floorsystems, trusses, & more
- BrD version for Design – BOS early stages of evaluation
- 3D analysis capabilities



Comments on AASHTOWare or Other Rating Software?



Steel Design (& Rating)

- Simon
  - Straight, Line-girder Analysis
  - Long history beginning with WisDOT
  - Many older steel ratings maintained in Simon
  - Shifting to BrR for steel rating
- MDX
  - Curved Girders
  - Steel I and Box (Tub) Girders
  - 2D Grid and PEB methods

MDX

The Good…

- Fast
- Prompted for information
- Design and Rating
  - LRFD/R and LFR
  - Curved Steel Structures
- LL DFs calculated based on relative stiffness
- Manageable output

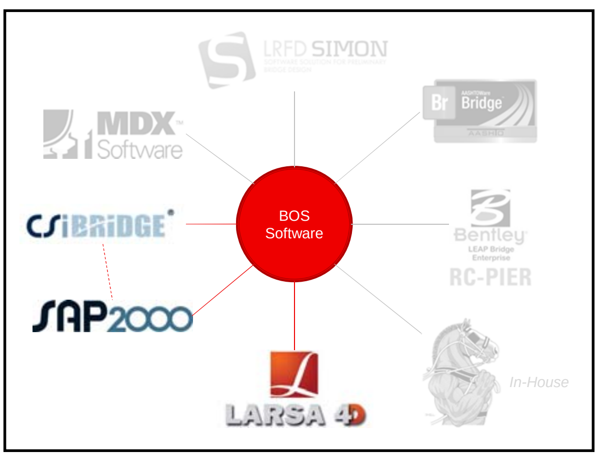
MDX

The Bad…

- "Bad" as it relates to curved and highly skewed structures
- Simplified cross frame analysis
- Neglects I-girder warping stiffness
- Not rigorous enough for
  - Design of bracing members
  - Predicting deflections accurately

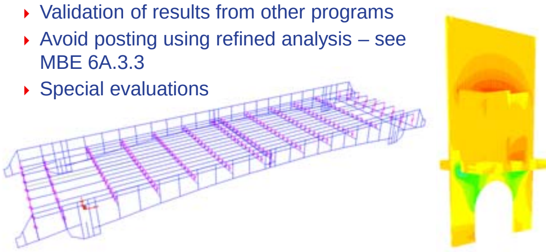
5/13/16	Class 3: Top flange weight was being doubled in girder output weight table for closed box girders. Self weight calculations used for the analy
5/6/16	Class 2: Possibility of LRFD splice location greater than 0.20 unbraced length from brace not reducing Cb. [6.5.3048]
4/29/16	Class 3: Possible problem with slab tension stress in LRFD pour tables. [6.5.3041]
4/2/16	Class 2: The permanent deflection control allowable stress table may not have included the hybrid girder reduction factor. [6.5.3014]
3/30/16	Class 3: The LRFD service moment table may not have included the effect of two trucks plus lane over the pier for max effect. Stress tables a
3/24/16	Class 1: In some cases composite dead loading effects were inadvertently zeroed in single girder project force tables. [6.5.3005]
3/23/16	Class 2: Bracing forces from sidewalk loading if number of exterior girder braces exceeded number of tenth points. [6.5.3003]
2/27/16	Class 2: Problem with use of PINVRAT to generate an LRFD Strength II inventory rating. [6.5.2979]
2/17/16	Class 3: Some locations in LFD Max Performance Ratios table given in inches. [6.5.2970]
2/17/16	Class 1: Possible LFD strength at a pier based on tension flange instead of compression flange. [6.5.2969]
2/10/16	Class 2: Possible LRFD rating problem where a splice coincided with a tenth point. [6.5.2962]
1/30/16	Class 2: An entry for bending in Maximum Performance Ratios table may incorrectly been generated where yielding occurred in bending str
1/30/16	Class 3: Incorrect messages generated concerning inadequate stiffener thickness. [6.5.2951]
1/27/16	Class 3: Possible problem with LRFD "Design Truck+Lane Min LL+I" system output moment values near inflection points. [6.5.2948]
1/12/16	Class 2: Possible problem with LRFD Cb value at pier if straddling brace spacings are significantly different. [6.5.2933]
1/2/16	Class 2: Possible problem with LRFD reactions at hinges table. [6.5.2923]
12/31/15	Class 2: LRFD Service II rating table was not listing ratings at splices. [6.5.2921]
12/24/15	Class 3: LRFD reactions in hinges tables listed spacings instead of locations. Values were correctly listed by locations. [6.5.2914]
12/14/15	Class 3: A stress violation message in the LRFD incremental bending stress table was not issued when slab tension exceeded the allowable. [6
12/2/15	Class 1: Problem with live load effects in girder output of LFD girder system projects when permit truck and HL93 truck are used in combi
11/24/15	Class 2: Possible LRFD shear strength problem for permit loading on right side of pier. [6.5.2857]
10/28/15	Class 3: Permit loading used HL93 factor when combined simultaneously with HL93 loading. [6.5.2857]
10/14/15	Class 3: Only the LRFD 1/3 pouring stress table footnote was incorrect. The pouring stress had been correctly listed as shown by (6.10.3.2.1-
10/12/15	Class 3: Block shear resistance to rupture in bolted flange plates. [6.5.2841]
9/28/15	Class 2: Possible problem with shear capacity at splice locations in LFD. [6.5.2828]
9/18/15	Class 3: Problem with listed capacities in the LFD rating table. Ratings unaffected. [6.5.2817]
9/16/15	Class 2: Possible slight increase in LRFD stud spacing at a few locations. [6.5.2815]
9/11/15	Class 2: Possible problem with cover plated single girder dead deflections. [6.5.2811]
8/24/15	Class 2: Some Service II rating table strengths did not reflect the allowables in the Factored Bending Stress table. [6.5.2793]
8/5/15	Class 3: The amplification factor STEELFACT was not reflected in the weight table. [6.5.2774]
8/3/15	Class 3: Some bottom flange segments in the LFD girder weight table used the top flange thickness. Analysis unaffected. [6.5.2772]
7/25/15	Class 2: The factor STAGFCT was not being used in the rating table. [6.5.2763]
7/23/15	Class 2: The factor WHEELS used in LFD line girder data for amplifying stresses also was being applied to reactions. [6.5.2761]

Comments on Simon, MDX or Other Steel Design Software?



CSI Bridge

- BOS *preferred* Advanced Finite Element Software
- Complicated structure design and/or rating
- Validation of results from other programs
- Avoid posting using refined analysis – see MBE 6A.3.3
- Special evaluations



CSI Bridge

The Good…

- Parametric Bridge Modeling, but also supports general modeling features
- Visually Appealing
- Selectable Data Output… directly to Excel
- Extensive Support (due to relationship to SAP)
- Steel Frame Design

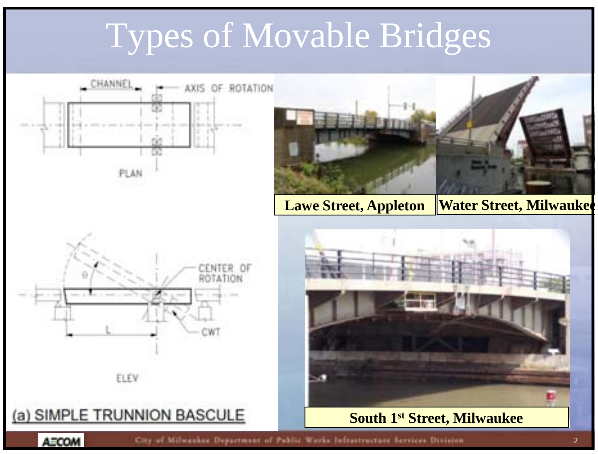
CSI Bridge

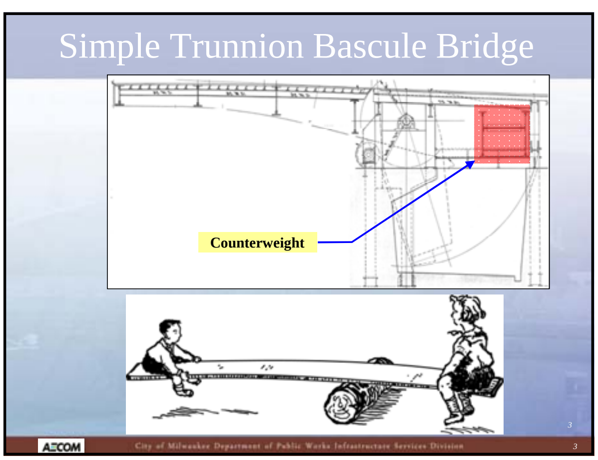
The Bad…

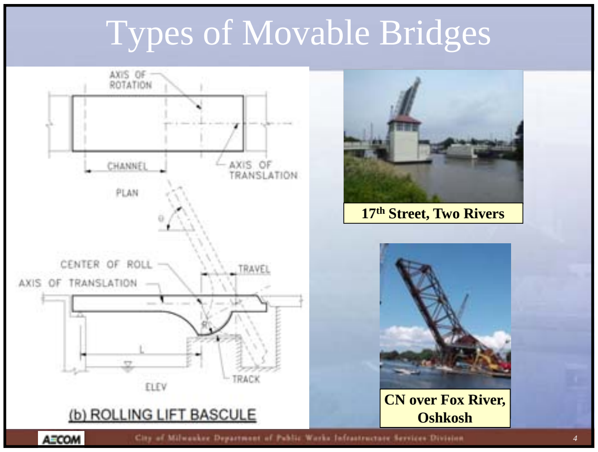
- Parametric Bridge Modeling
- Automesh feature not great
- Design feature only works with linked model
- Rating feature only works with certain structure types
- Vehicle Response Component
- Files not backward compatible
- Cannot save file as older version

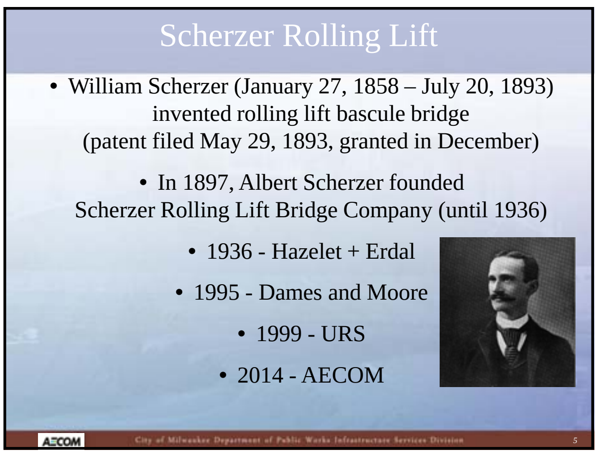
Comments on CSI Bridge or Other FEA Software?

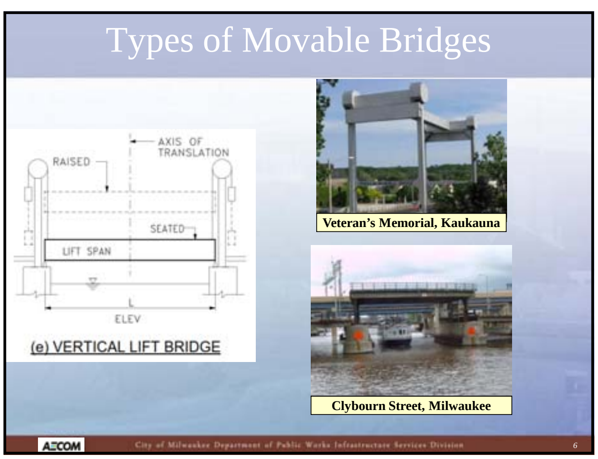

June 7, 2016
SOUTH 1ST STREET BASCULE BRIDGE
Over the Kinnickinnic River Rehabilitation Project
AECOM
Michael Delemont, CWI, PE, SE
WisDOT Structural Engineering Symposium
City of Milwaukee Department of Public Works
Infrastructure Services Division


Types of Movable Bridges
CHANNEL
AXIS OF ROTATION
PLAN
CENTER OF ROTATION
CWT
ELEV
(a) SIMPLE TRUNNION BASCULE
Lawe Street, Appleton
Water Street, Milwaukee
South 1st Street, Milwaukee
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
2

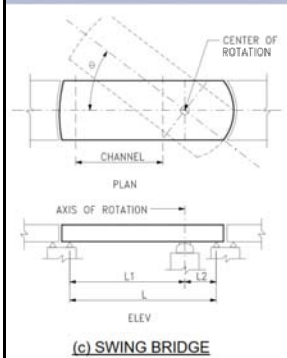

Simple Trunnion Bascule Bridge
Counterweight
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
3


Types of Movable Bridges
AXIS OF ROTATION
CHANNEL
AXIS OF TRANSLATION
PLAN
CENTER OF ROLL
AXIS OF TRANSLATION
TRAVEL
TRACK
ELEV
(b) ROLLING LIFT BASCULE
17th Street, Two Rivers
CN over Fox River, Oshkosh
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
4


Scherzer Rolling Lift
• William Scherzer (January 27, 1858 – July 20, 1893) invented rolling lift bascule bridge (patent filed May 29, 1893, granted in December)
• In 1897, Albert Scherzer founded Scherzer Rolling Lift Bridge Company (until 1936)
• 1936 - Hazelet + Erdal
• 1995 - Dames and Moore
• 1999 - URS
• 2014 - AECOM
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
5

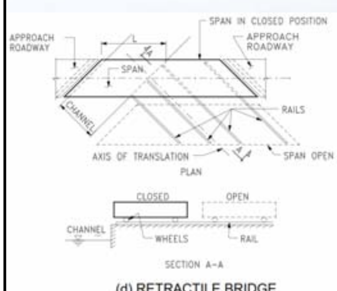

Types of Movable Bridges
AXIS OF TRANSLATION
RAISED
SEATED
LIFT SPAN
ELEV
(e) VERTICAL LIFT BRIDGE
Veteran's Memorial, Kaukauna
Clybourn Street, Milwaukee
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
6

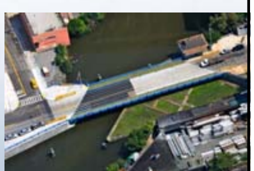
Types of Movable Bridges



CP over Kinnickinnick River, Milwaukee

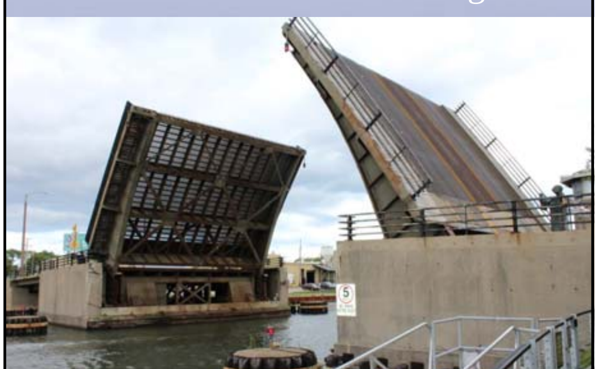
Types of Movable Bridges

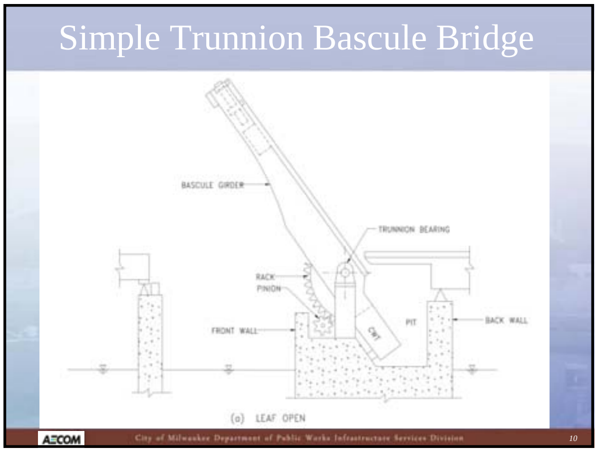




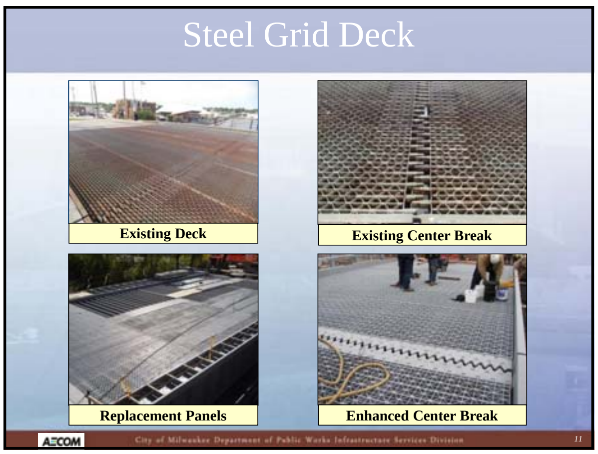
Borden Ave, Queens, NY

South 1st St. Bascule Bridge

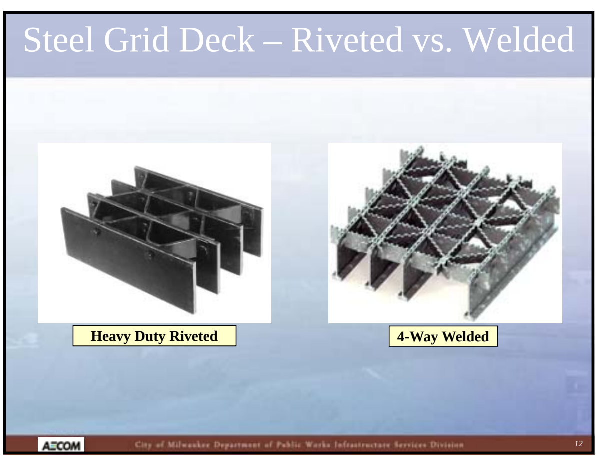




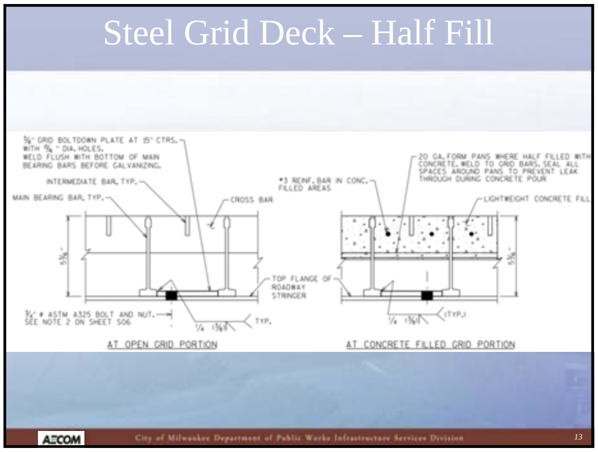
Simple Trunnion Bascule Bridge
BASCULE GIRDER
TRUNNION BEARING
RACK
PINION
FRONT WALL
PIT
BACK WALL
CWT
(a) LEAF OPEN
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
10

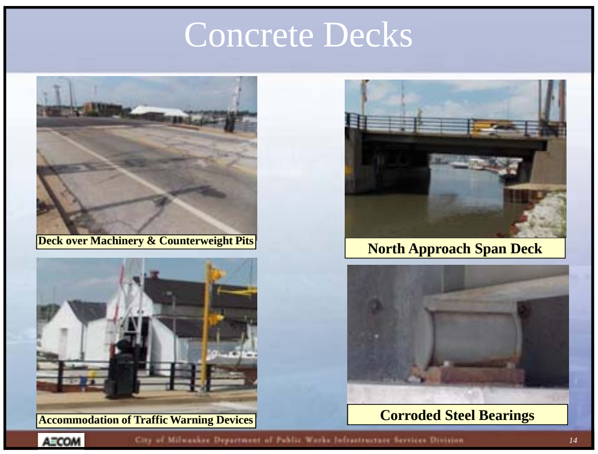


Steel Grid Deck
Existing Deck
Existing Center Break
Replacement Panels
Enhanced Center Break
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
11

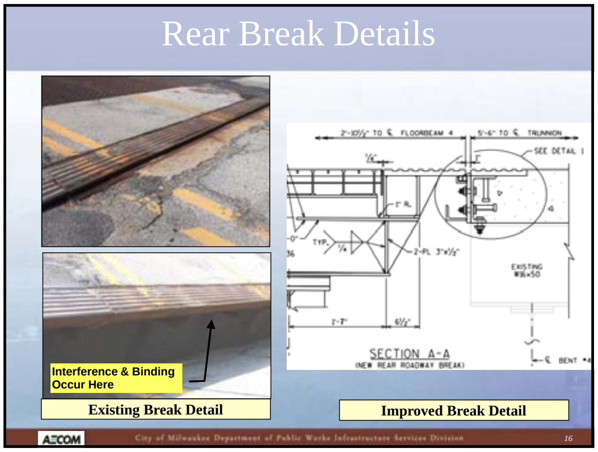


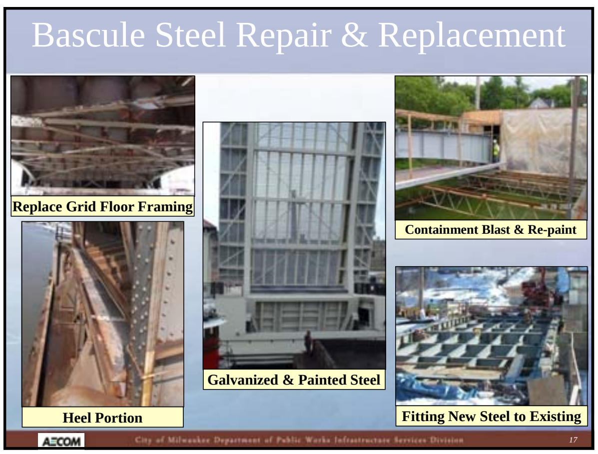
Steel Grid Deck – Riveted vs. Welded
Heavy Duty Riveted
4-Way Welded
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
12

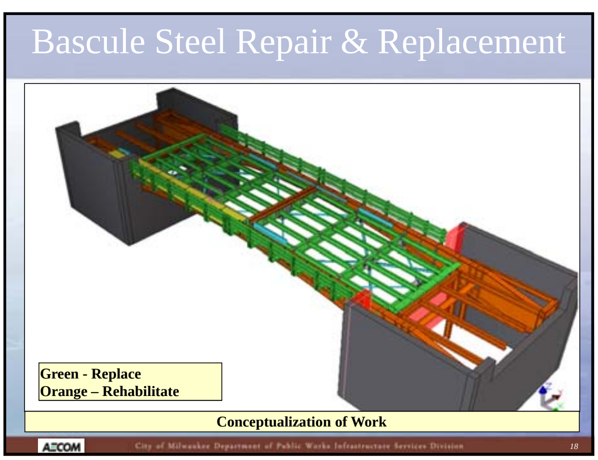

Steel Grid Deck – Half Fill
3/8" GRID BOLTDOWN PLATE AT 15" CTRS. WITH 5/8" DIA. HOLES. WELD FLUSH WITH BOTTOM OF MAIN BEARING BARS BEFORE GALVANIZING.
INTERMEDIATE BAR, TYP.
MAIN BEARING BAR, TYP.
CROSS BAR
TOP FLANGE OF ROADWAY STRINGER
3/4" ϕ ASTM A325 BOLT AND NUT. SEE NOTE 2 ON SHEET S06
TYP.
AT OPEN GRID PORTION
#3 REINF. BAR IN CONC. FILLED AREAS
20 GA. FORM PANS WHERE HALF FILLED WITH CONCRETE. WELD TO GRID BARS. SEAL ALL SPACES AROUND PANS TO PREVENT LEAK THROUGH DURING CONCRETE POUR
LIGHTWEIGHT CONCRETE FILL
(TYP.)
AT CONCRETE FILLED GRID PORTION
City of Milwaukee Department of Public Works Infrastructure Services Division
13

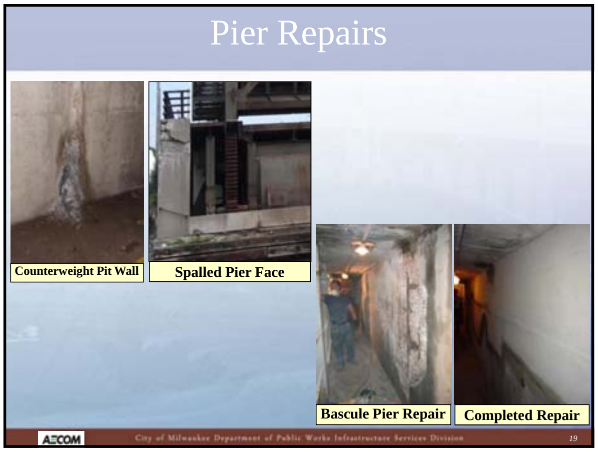

Concrete Decks
Deck over Machinery & Counterweight Pits
North Approach Span Deck
Accommodation of Traffic Warning Devices
Corroded Steel Bearings
City of Milwaukee Department of Public Works Infrastructure Services Division
14

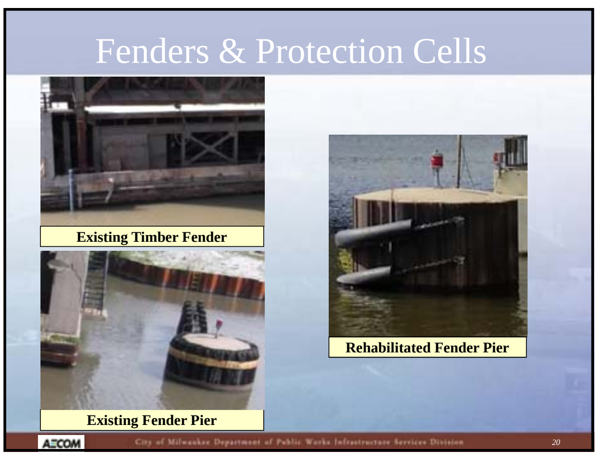

Sidewalk and Railing Systems
Existing Timber System
Slip Resistant Steel or Fiberglass Plate
Galvanized Bridge Railing
City of Milwaukee Department of Public Works Infrastructure Services Division
15

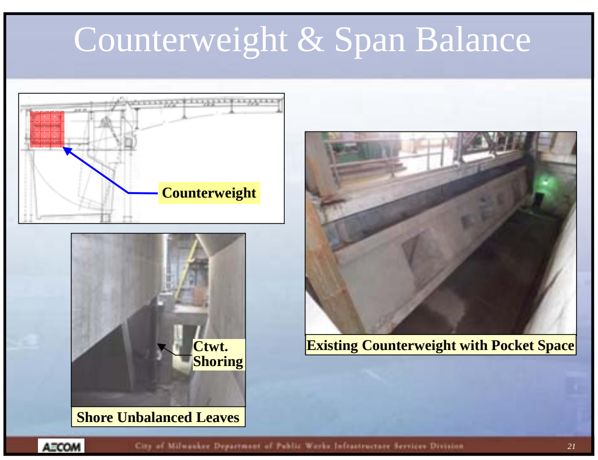

Rear Break Details
Interference & Binding Occur Here
Existing Break Detail
SECTION A-A
Improved Break Detail
City of Milwaukee Department of Public Works Infrastructure Services Division
16

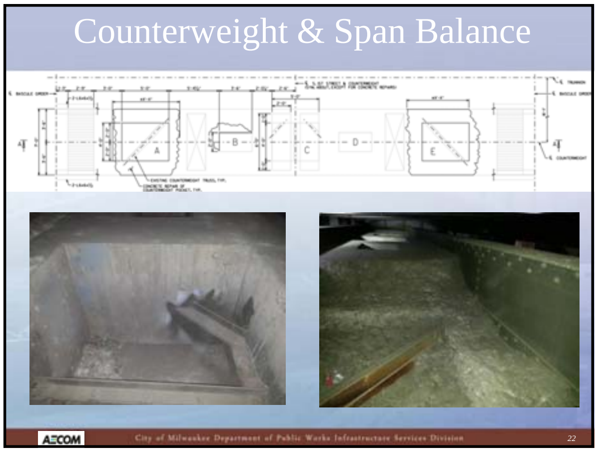

Bascule Steel Repair & Replacement
Replace Grid Floor Framing
Heel Portion
Galvanized & Painted Steel
Containment Blast & Re-paint
Fitting New Steel to Existing
City of Milwaukee Department of Public Works Infrastructure Services Division
17

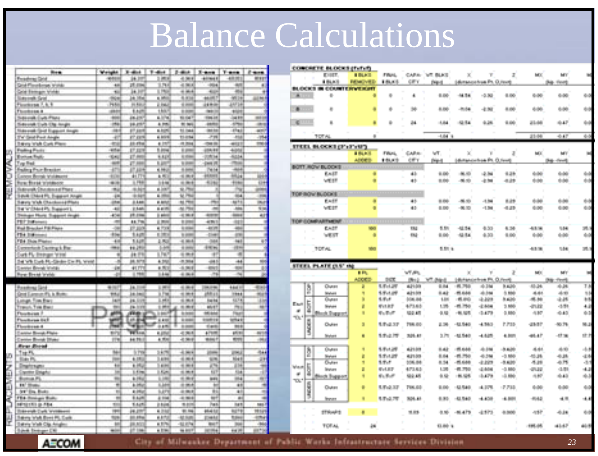

Bascule Steel Repair & Replacement
Green - Replace
Orange – Rehabilitate
Conceptualization of Work
City of Milwaukee Department of Public Works Infrastructure Services Division
18

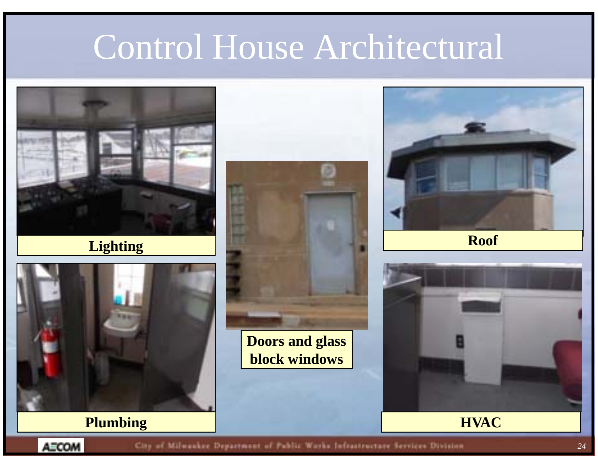

Pier Repairs
Counterweight Pit Wall
Spalled Pier Face
Bascule Pier Repair
Completed Repair
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
19

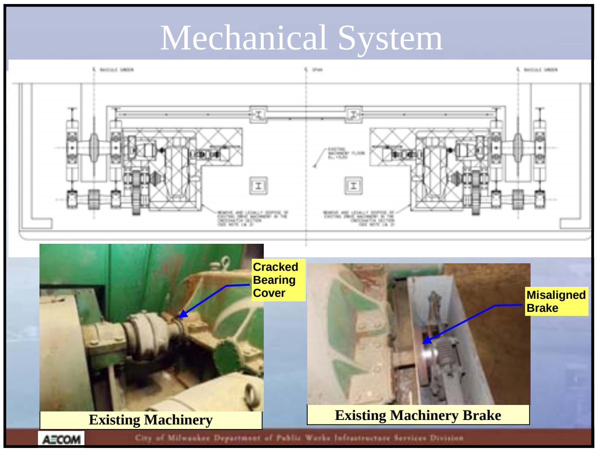

Fenders & Protection Cells
Existing Timber Fender
Rehabilitated Fender Pier
Existing Fender Pier
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
20

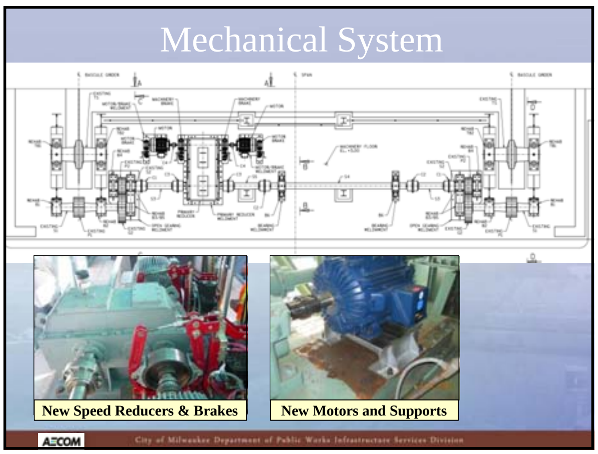

Counterweight & Span Balance
Counterweight
Ctwt.
Shoring
Shore Unbalanced Leaves
Existing Counterweight with Pocket Space
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
21

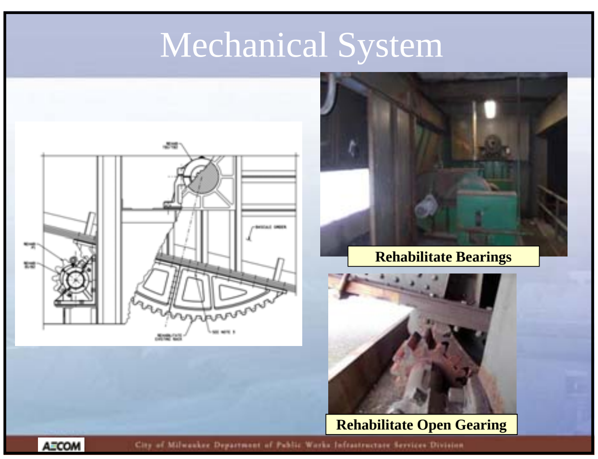

Counterweight & Span Balance
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
22


Balance Calculations
REMOVALS
REPLACEMENTS
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
23

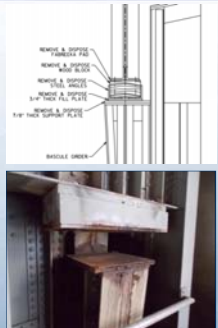

Control House Architectural
Lighting
Roof
Doors and glass block windows
Plumbing
HVAC
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
24


Mechanical System
Cracked Bearing Cover
Misaligned Brake
Existing Machinery
Existing Machinery Brake
City of Milwaukee Department of Public Works Infrastructure Services Division

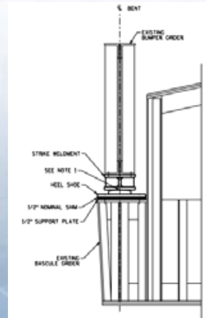

Mechanical System
New Speed Reducers & Brakes
New Motors and Supports
City of Milwaukee Department of Public Works Infrastructure Services Division


Mechanical System
Rehabilitate Bearings
Rehabilitate Open Gearing
City of Milwaukee Department of Public Works Infrastructure Services Division

Mechanical System



Existing Heel Block Assembly



New Heel Block Assembly

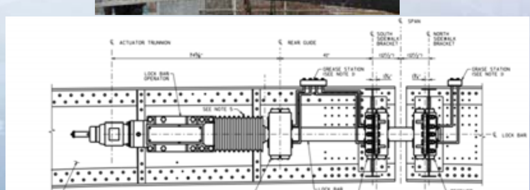
AECOM City of Milwaukee Department of Public Works Infrastructure Services Division

Mechanical System

Existing Inboard Lock with Open Gearing

AECOM City of Milwaukee Department of Public Works Infrastructure Services Division

Mechanical System

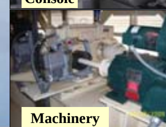


New Centerlock

AECOM City of Milwaukee Department of Public Works Infrastructure Services Division

Electrical System

Dual Power Feeds
Submarine Cables
Relays & PLC
Motors



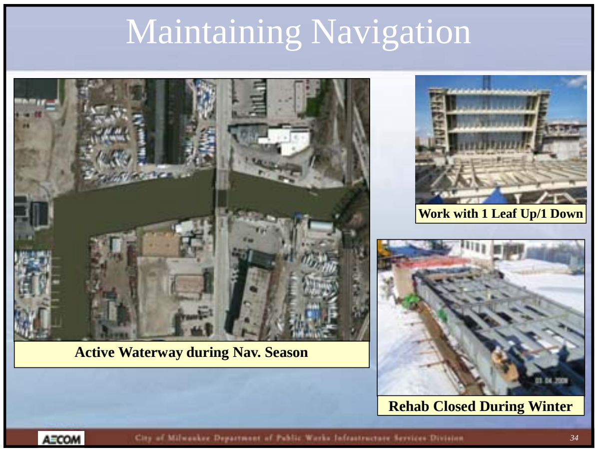
Remote Operation

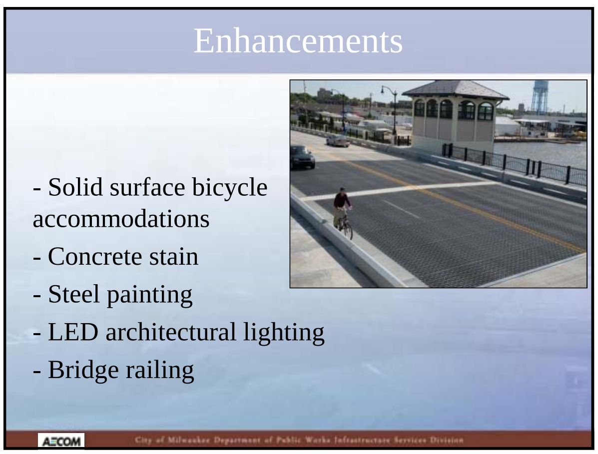
Can operate locally or from KK bridge

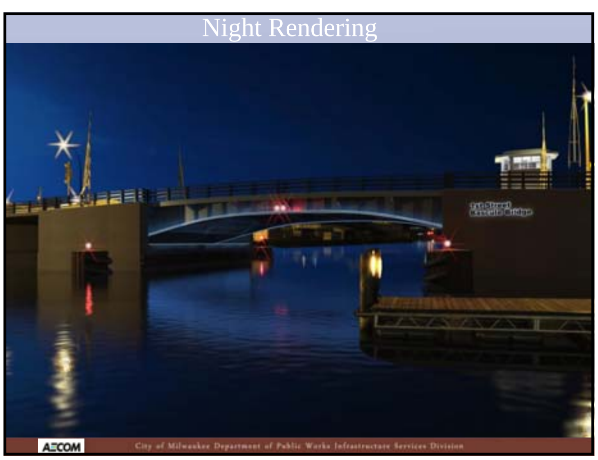
Upgrade communications and console at KK bridge

Traffic Gates

"Motorist gets a lift in Sturgeon Bay"


Maintaining Navigation
Work with 1 Leaf Up/1 Down
Active Waterway during Nav. Season
Rehab Closed During Winter
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division
34


Enhancements
- Solid surface bicycle accommodations
- Concrete stain
- Steel painting
- LED architectural lighting
- Bridge railing
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division


Night Rendering
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division


Questions?
AECOM
City of Milwaukee Department of Public Works Infrastructure Services Division

Construction Topics

Bill Dreher
WisDOT Structures Design Chief

Piling

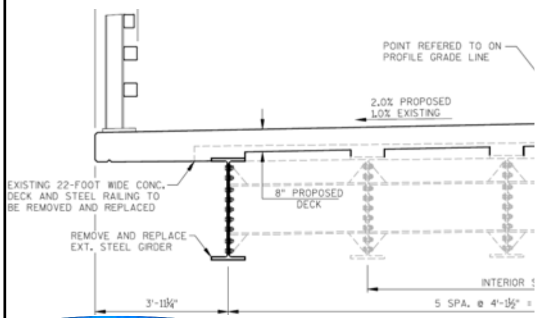
- H Piles for displacement piles
  - H piles tend to drive considerably longer than plan length
  - Work with Geotech engineer

2

Haunches

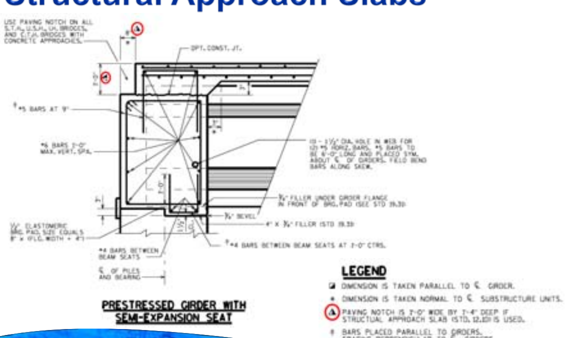
- Limit haunch heights – added DL
  - 54W & 72W

Exterior Girder Deflections

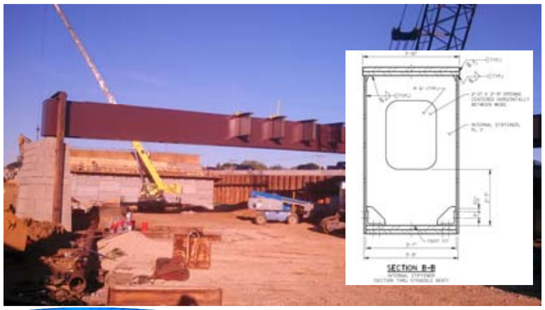


Rustications and Formliners

Structural Approach Slabs



Member Availability



Inspection Access

Specification Changes

- 502.2.11 Crack and Surface Sealers
  - Clarifies materials for crack, deck, and parapet sealing (from the approved products list)

9

Specification Changes

- 502.2.11 Crack and Surface Sealers
  - Crack Sealer?

  Low Viscosity Crack Sealers for Bridge Decks

Specification Changes

- 502.2.11 Crack and Surface Sealers
  - Protective surface treatment?

  Concrete Protective Surface Treatment

Specification Changes

- 502.2.11 Crack and Surface Sealers
  - Pigmented surface sealer?

  Cure & Seal Compounds for Non-trafficked Surfaces on Structural Masonry

  For use on the inside face and top of parapets

Specification Changes

- 505.5 Payment (Steel Reinforcement)
  - Eliminates separate bid items for bridges, culverts, and retaining walls
  - 3 new bid items:
    - Bar Steel Reinforcement Structures
    - Bar Steel Reinforcement HS Structures
    - Bar Steel Reinforcement HS Coated Structures

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Specification Changes

- 513.4 Measurement & 513.5 Payment (Railing)
  - All railing bid items now measured by linear foot
- 2018: look for revisions to 513 including addition of galvanized and painted steel railings (Combination Railings Types "C1-C6")

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SPV Reduction

- SPV's create variability in plans, specifications, and estimates
- SPV's make up approximately ¼ of contract dollars
- Affects bidding, plan review, and construction
- Develop standard bid items for SPV items that are utilized frequently

SPV Reduction

- BOS
  - SPV to STSP
    - 6 complete
    - 18 sent to BPD
    - 40 ready soon
  - SPV to Historic File
    - 29 complete
  - SPV to Standard Specification
    - 3 complete
    - 4 sent to BPD

Innovative Materials

- Self-Consolidating Concrete (SCC)
  - Eliminate problems associated with vibration
  - Less labor
  - Faster construction
  - Improved quality and durability
  - Higher strength
  - WHRP: prestressed concrete girders
    - Investigate material properties (modulus, shrinkage, creep)
    - Related to time-dependent characteristics, flexural stiffness change, prestress losses

Innovative Materials

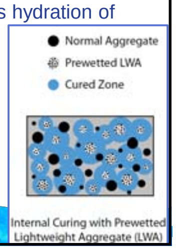
- Polyester Polymer Concrete (PPC)
  - Mixture of aggregate, polyester polymer resin and initiator
  - Placed as a deck overlay using conventional concrete mixing and placement equipment
  - Thickness of ¾" to 1"
  - 4 hour cure time
  - Practically impermeable
  - Expected service life of 20-30 years
  - Estimated cost of placing PPC overlay is $12/SF

Innovative Materials

- Fiber Reinforced Polymer (FRP)
  - Composite material consisting of glass or carbon fibers in resin matrix
  - High strength and stiffness; lightweight and thin
  - Installed relatively quickly; minimizes impact on traffic
  - Corrosion protection (pier columns)
  - Strengthen existing structures (shear and flexure)
  - BM Chapter 40 – July release

Innovative Materials

- Internally Cured Concrete
  - Supplies additional curing water throughout the concrete mixture
    - Uses water absorbed in lightweight aggregate
    - "Curing concrete from the inside out"
  - Prevents early age shrinkage, increases hydration of cementitious materials
  - Lowers the permeability of the concrete



Lead Paint on Steel Girders

- Paint is not a hazardous waste until it is removed from the steel
- If contractor takes possession of steel with paint attached, they are responsible for safe handling and disposal

Lead Paint on Steel Girders

- If paint is removed for repainting, waste must go through DOT disposal process
  - Always assume there is lead paint present
  - Labeling and Disposal of Waste Material
  - Portable Decontamination Facility
  - Cleaning by blasting with grit: Negative Pressure Containment and Collection of Waste Materials
  - Cleaning by hand or power tools: Containment and Collection of Waste Materials

Staging Considerations

- Staged construction joint locations on plans must allow working room for contractor/field staff
- Work with roadway designers to ensure adequate clearances are provided

Bridge Deck Construction

Wisconsin Division Office

FHWA WisDOT

Joint Program Review

Joe Balice, P.E.

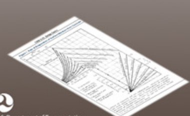
Bridge Engineer

U.S. Department of Transportation
Federal Highway Administration

Review Purpose

Wisconsin Division Office

- Determine if Standard Specifications are consistently administered throughout the Regions
- Identify best practices/opportunities for improvement



U.S. Department of Transportation
Federal Highway Administration

Team Members

Wisconsin Division Office

- FHWA
- WisDOT
  - NE Region Construction
  - Bureau of Project Development
  - Bureau of Technical Services
  - SE Freeways/SE Region
  - Bureau of Structures: Design/Maintenance

U.S. Department of Transportation
Federal Highway Administration

Scope & Methodology

Wisconsin Division Office

- 2015 Construction Season
  - Full-depth concrete bridge decks & Grade E overlays
  - Four Regions – NE, NC, SE, & SW
  - 22 State and local bridge projects
  - Compare program to neighboring states IL, IA
  - Contractor interviews

U.S. Department of Transportation
Federal Highway Administration

Some Observations

Wisconsin Division Office

- Application of fogging/continuous, wet, curing is not timely – Grade A, HPC
- Inadequate length of finishing machine rails results in unnecessary hand finishing

U.S. Department of Transportation
Federal Highway Administration

Curing, Finishing Machine Rails

Wisconsin Division Office

HPC doesn't mean "Hey, Postpone Curing!"

U.S. Department of Transportation
Federal Highway Administration

More Observations

Wisconsin Division Office

- Roles & responsibilities aren't well understood
  - Inspector Quality Assurance
    - Dry runs not performed in consistent manner
    - No written notification to proceed with deck pour
  - Contractor Quality Control
    - Ineffective contingency plans
    - Unacceptable burlap condition

U.S. Department of Transportation
Federal Highway Administration

Dry Runs, Poor Mix Designs, & Holy Burlap!

Wisconsin Division Office

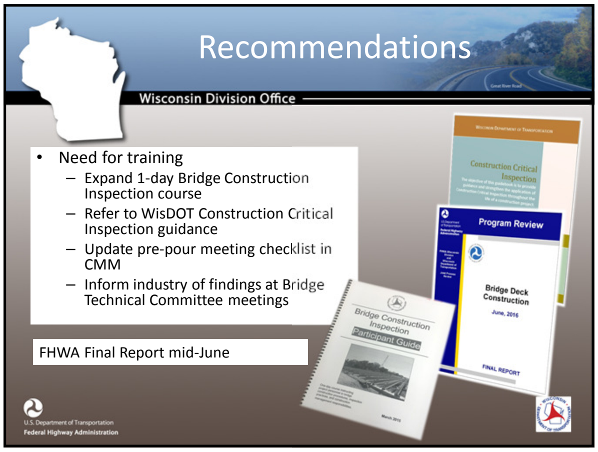
U.S. Department of Transportation
Federal Highway Administration

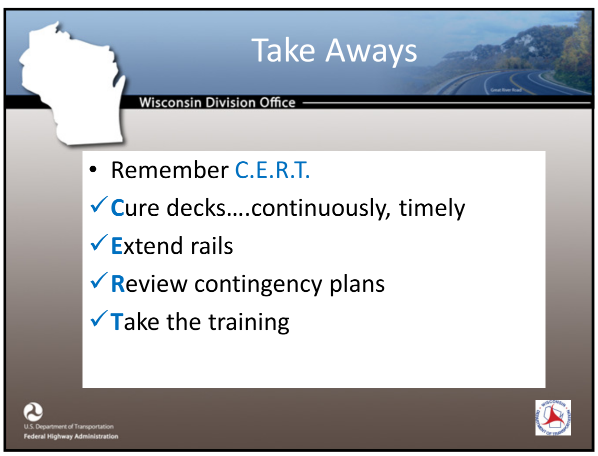
Observed Best Practices

Wisconsin Division Office

- Use of stainless steel in decks for Mega/Major projects and complex structures
- Quality Management Plan
  - Material testing and sampling procedures
  - Verification testing program (QV)
  - Independent Assurance (IA)

U.S. Department of Transportation
Federal Highway Administration


Recommendations
Wisconsin Division Office
• Need for training
– Expand 1-day Bridge Construction Inspection course
– Refer to WisDOT Construction Critical Inspection guidance
– Update pre-pour meeting checklist in CMM
– Inform industry of findings at Bridge Technical Committee meetings
FHWA Final Report mid-June
Construction Critical Inspection
Program Review
Bridge Deck Construction
June, 2016
FINAL REPORT
Bridge Construction Inspection
Participant Guide
U.S. Department of Transportation
Federal Highway Administration


Take Aways
Wisconsin Division Office
• Remember C.E.R.T.
✓Cure decks….continuously, timely
✓Extend rails
✓Review contingency plans
✓Take the training
U.S. Department of Transportation
Federal Highway Administration

Ancillary Structures

Ben Koeppen – BOS Inspection Engineer
Anthony Stakston – NC Ancillary Program Manager

Program Creation

- Transportation Asset Management Plan (TAM)
  - Required for Pavement and Bridge Structures per MAP-21
  - Each State has to submit a TAM to FHWA to be certified by October 1, 2016

Transportation Asset Management

- TAM is a data driven decision-making framework that includes: Risk, Condition, Prioritization, Network, and Operation effects.
- Mission Statement:
  - The aim is to apply the appropriate treatments and activities at the proper time resulting in extended service life at an optimal life cycle cost.

WisDOT Ancillary Program

- WisDOT took the federal mandate from MAP-21 and expanded it to other areas of operation
- Asset Management Groups for WisDOT include:
  - **Traffic Features** (Pavement Marking, Traffic Control Signs, Light Poles, Ramp Meters, etc.)
  - **Roadside Facilities** (Rest Areas, Waysides, SWEFs, Park & Rides, etc.)
  - **Roadway Features** (Salt Storage Facilities, Ramp Gates, Culvert Pipes, Cable Barriers, Crash Cushions, etc.)
  - **Pavement & Bridge Structures**
  - **Ancillary Structures** (Small Bridges, Retaining Walls, Noise Barriers, Overhead Signs, Signal Monotubes, and High Mast Lighting)

Ancillary Program Contacts

- Regional Ancillary Program Managers
  - NC Anthony Stakston
  - NE Brady Rades
  - NW Kyle Harris
  - SE Jason Zemke
  - SW-L David Bohnsack
  - SW-M Shiv Gupta
- Statewide Ancillary Inspection Program Manager
  - Travis McDaniel

Ancillary Program Contacts

- BOS Design Contacts
  - Wind Loaded Structures – Vu Thao
  - Sign Structures – Alex Crabtree, Steve Doocy
  - Noise Walls – Matt Coupar, Jon Resheske
  - Retaining Walls – Emily Kuehne
  - Box Culverts – Danielle DeTennis, Nick Rice
- And <u>many</u> other Bureau and Regional folks that work with these structures.

Ancillary Program Contacts

- Bureau of Structures
  - Maintenance & Inspection
    - Program Managers
- URL: http://www1.wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/strct/inspection-pm.aspx

New Forms

- ID Request Form
  - Standard for all Regions

STRUCTURE NUMBER REQUEST FORM

Construction Project ID:

Type of Structure:

- Bridge (B)
- Overhead Sign (S)
- Retaining Wall (R)
- High Mast Light (L)
- Small Bridge (C)
- Signal Monotube (G)
- Noise Wall (N)
- Miscellaneous (M)

Structure Type Description:

Anticipated Construction Year:

Will this replace an existing structure? Y/N Replaced ID:

Regional Office:

County:

Owner/Maintainer:

GPS Coordinates:

Section/Town/Range:

Roadway:

Location Description:

Estimated Structure Length:

Structure Description:

Requested by: Phone: Date:

Firm or Agency: Email:

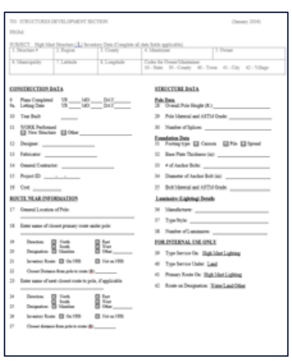
ASSIGNED NUMBER:

REGIONAL PM SIGNATURE: DATE:

DRAFT

New Forms

- Inventory Form(s)
  - Structure Specific (C, R & N, S & G, and L)
  - Updated Directions on Back of Form
  - Consultant Designed – Submit via Esubmit
  - Contractor Designed – Submit to BOS and Regional PM



New/Updated Forms

- Bureau of Structures
  - Maintenance & Inspection
    - Inventory & Rating Forms
- URL: http://www1.wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/strct/inv-forms.aspx

C-Structures (Small Bridges)

- Redefined per 2015 Policy Memo
- Small Bridge Structures require a unique structural design and have a clear opening of 20 ft. or less measured along the centerline of the roadway. This includes:
  - Bridge like structures (i.e. Deck Girders, Flat Slabs, etc.)
  - Box Culverts (with openings 20 ft^2 or greater)
  - Rigid Frames
  - Arches
  - Structures without a floor slab (including arches on footings)
  - Metal Bolted Plate Structures

C-Structures (Small Bridges)

- Bureau of Structures
  - Maintenance & Inspection
    - Policy Memos
      - Small Bridge (C Structure) Definition
- URL: http://wisconsindot.gov/dtsdManuals/strct/policies/inspection/sml-brdg-def.pdf

C-Structures

- Design Considerations
  - Box Culvert wing walls now require epoxy-coated rebar
  - Box Culverts shall be designed for a range of fill (not a single height) [See Bridge Manual 36.5]
    - This range should be detailed on the plans

Walls (Noise and Retaining)

- Noise Barriers are structures constructed to alter the normal noise travel at a site
- Retaining Walls are structures used to provide lateral resistance for a mass of earth or other material to accommodate a transportation facility

Walls (Noise and Retaining)

- Design Considerations
  - Noise Walls
    - If possible, designers should avoid attaching noise barrier to bridge railings [See Bridge Manual 30.3(4)]
  - Retaining Walls
    - Aesthetic and Constructability considerations with top of wall elevations and railings
    - Maintain awareness of right-of-way limits

Wind Loaded Structures

- Presentation by Vu Thao

Wind Loaded Structures

Vu Thao
Structural Design Engineer
SE Region Liaison
Wind Loaded Structures Program Leader
WisDOT / BOS

General Commentary

- Wind Loaded Structures
  - Sign Structures
    - Sign bridges, overhead sign supports and road side sign supports
  - Traffic Signal Structures
    - Monotubes and signal supports (trombone arm)
  - Lighting Structures
    - High mast lighting towers
    - Light poles
  - Others
    - Camera poles
    - Ramp meter structures

General Commentary

- Design Manual Updates
  - WisDOT Bridge Manual
    - Chapter 39
    - Standard details
    - Standard insert sheets
  - FDM
    - Sections 11-55-20 – design guidance for sign structures
    - Section 15-1-20.10 – plan preparation for overhead sign supports
    - SDD plates for concrete bases

General Commentary

- Construction Specifications Updates
  - Standard Specifications
  - Repair SPV's – to be completed later this summer
  - Construction Materials Manual (CMM)
    - Construction Inspection Checklist for Ancillary Structures, See Attachment 1
  - Major implementation in the construction area
    - Utilizing Direct Tension Indicator (DTI) washer in place of turn-of-the-nut method for H.S. bolt field installation
    - Utilizing turn-of-the-nut installation method for anchor rod
    - Eliminate field ROCAP tests – data provided by H.S. bolt manufacturer only
    - Handling and storage

General Commentary

- Construction Resources
  - Installation Procedures
    - Form DT2322 – Ancillary Structures Pre-installation Verification Test of H.S. Bolts
      - Pre-installation test procedure
      - Installation steps
      - QC & QA requirements
    - Form DT2321 – Anchor Rod Installation Tensioning Record
      - Preparation and installation procedure
      - Verification Torque requirement
      - QC & QA requirements

General Commentary

- Construction Resource Cont'd
  - 2014 Training
    - All Region – DOT staffs and consultants
    - Contractors

Contract Plan Development process

- Structure Plans (Structural Engineer)
  - Structure Types
    - Sign bridges
    - Overhead sign supports
      - Multiple structures
      - Unique structures, structure Mounted, and non-standard foundations
    - DMS roadside sign supports
    - Foundation for high mast lighting tower
  - Follow Bridge Design Process
    - Submittals
      - SSR, preliminary and final plans, design computations, PE stamp, structure inventory form, etc…

Contract Plan Development process

- Structure Plans Cont'd
  - Follow Bridge Design Process Cont'd.
    - Exceptions
      - Combined plan for multiple structures of the same type (WisDOT Bridge Manual 6.3.3.3)
      - SSR submittal timing – further discussion
    - BOS Review
      - Optional
      - Sign bridges – preliminary and final plans
      - Overhead sign supports – concentrate on preliminary plans to ensure structure type and size are properly selected

Contract Plan Development process

- Construction Details (Traffic Engineer)
  - Overhead sign supports (contractor design)
    - Standard overhead sign supports
    - Stand alone projects
  - Traffic monotubes (procurement process)
  - High mast lighting towers (contractor design?)
  - Other traffic signal supports and light poles (contractor supplied)

Highlight of Current Design Policy

- Design Specifications for Sign Structures
  - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition and 2015 Interim Revisions
  - Standard Specifications for Highway Bridges, 17th Edition
  - ASD Design until LRFD conversion project is complete
  - Design Specifications to be noted on plans
  - Material specifications to be note on plans, see latest Section 39.3 of the WisDOT Bridge Manual

Highlight of Current Design Policy

- Design Specifications for Sign Structures Cont'd.
  - Fatigue Requirements
    - All wind loaded structures are designed with fatigue loads except the following structures
      - Four chord full span sign bridges carrying type I and II signs with truss type tower supported on concrete footings
      - Full span overhead sign supports on standard bases

Highlight of Current Design Policy

- Sign Structures and traffic monotubes
  - Utilizing Minnesota four chord steel angle truss configuration for overhead DMS sign bridges
  - DMS roadside sign supports to be shielded, and not supported on break-away
  - No flat washer between faying surface of mast arm connection plates
  - Do not detail construction joint on drilled shaft foundation. Consult BOS for further guidance on drilled shaft with wings.
  - Maximum drilled shaft length is limited to 20-ft.

LRFD Conversion

- BOS will be working on LRFD design conversion plan between late 2016 and early 2019
- Tentative efforts
  - Evaluate each structure type and configuration for economic engineering and selection
  - Provide design guidance for various types of structure
  - Re-write Chapter 39 of the WisDOT Bridge Manual
  - Develop new design software
  - Develop new design standards

THANK YOU

Research Updates

Bill Oliva

WisDOT Structures Development Chief

Research Updates – Bill Oliva

Our research explores and develops solutions to current and future transportation needs.

Research results help shape the practices, policies, and standards used to develop and maintain Wisconsin's transportation infrastructure.

Sources of research needs and opportunities

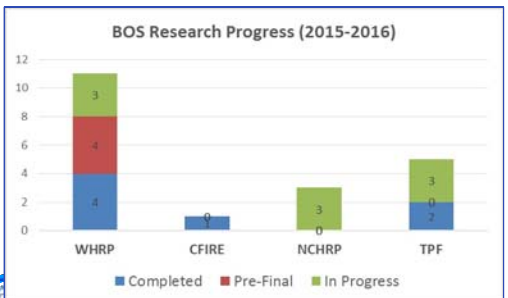
- BOS Initiatives (ABC, SCC, & others)
- Bridge Technical Committee – Industry
- Other DOT's – Pooled Fund (common benefit)
- Structures community & partners
  - Academia
  - FHWA
  - AASHTO
  - TRB (Transportation Research Board)

6/1/2016

Research Programs

- Sources of research development
  - Wisconsin Highway Research Program (WHRP)
  - NCHRP – Staff Participation
  - Center for Freight & Infrastructure Research and Education (CFIRE)
  - Transportation Pooled Fund Studies (TPF)
  - Research Programs (IBRD/IBRC/SHRP2) - FHWA

Where are we with Research?



Evaluation of Thin Polymer Deck Overlays and Deck Sealers - February 2016

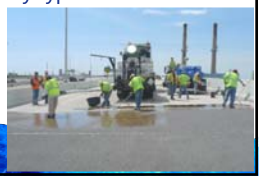
WHRP

- The objectives of this research was to explore the effectiveness and durability of thin polymer overlays with respect to restoring and protecting bridge decks, improving safety, and extending service life
- Research program was performed to study and compare the performance of nine different overlay systems

Evaluation of Thin Polymer Deck Overlays and Deck Sealers - February 2016

- The overlay system with an epoxy resin provided the best overall performance.
- The polyester multi-lift overlay system delaminated from the concrete surface in all nine specimens utilizing that overlay type

WHRP



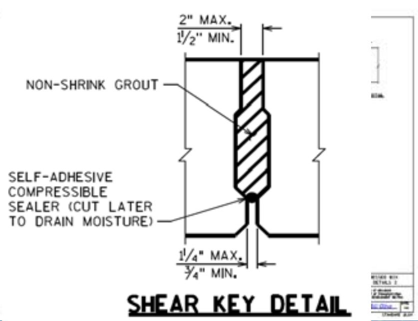
Reflective Cracking between Precast Prestressed Box Girders

- Goal is to eliminate reflective deck cracking in adjacent box-beam bridges.
- Cracking at the shear key locations that reflects to the deck surface.
- Provided recommendations on box-beam and shear key geometry, shear key grout, cast-in-place deck slab concrete, transverse post-tensioning

WHRP

Reflective Cracking between Precast Prestressed Box Girders

- Updated Standard 19.54



WHRP

Where are we going with Research?

- Self Consolidating Concrete (SCC) - Girders
- Staged Longitudinal Construction Joints
- Highly Skewed Girder Structures
- Damaged Prestressed Girders (deck removal and impact)
- Pilot Project to examine bridge Inspection with Unmanned Aerial Systems (UAS) “Drones”

Study of Over Sized Over Weight Vehicles on Complex Bridges

CFIRE

11

Study of Over Sized Over Weight Vehicles on Complex Bridges

The objective of this project is to simplify the overload permitting process executed by WisDOT engineers for complex bascule, arch and rigid frame bridges subjected to OSOW vehicles located on critical freight routes in Wisconsin.

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A few requests of you

- As practitioners, we are interested in you ideas of needs and opportunity
- We are also interested in your participation in providing guidance and oversight to structures research
- Please consider providing ideas or getting involved with WHRP

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WHRP - Structures Technical Oversight Committee

- **William Oliva, Chair – WisDOT**
- **Richard Marz - WisDOT**
- **Darrin Stanke** - Zenith Tech, Inc.
- **David Pantzlaff -** Ayres & Associates
- **Travis McDaniel - WisDOT**
- **Adam Dour -** Lunda Construction Company
- **Professor Mike Oliva** - University of Wisconsin
- **William Dreher – WisDOT**
- **Dave Kiekbusch - WisDOT**
- **David Bohnsack - WisDOT**
- **Professor Baolin Wan -** Marquette Univ.
- **Professor Al Ghorbanpoor -** University of Wisconsin-Milwaukee
- **Tony Shkurti -** HNTB Corporation
- **Joe Balice -** FHWA Bridge Engineer – Wisconsin Division

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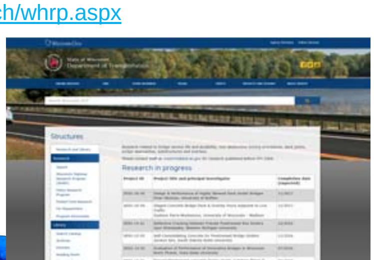
Where to find the results of the research:

- http://wisconsindot.gov/Pages/about-wisdot/research/whrp.aspx



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Accelerated Bridge Construction

James Luebke
Structures Development Engineer
WisDOT Bureau of Structures

Accelerated Bridge Construction

ABC is bridge construction that uses innovative planning, design, materials, and construction methods in a safe and cost-effective manner to reduce the onsite construction time…

-FHWA

2

Accelerated Bridge Construction

ABC is bridge construction that uses innovative planning, design, materials, and construction methods in a **safe** and **cost-effective** manner to reduce the onsite construction **time**…

-FHWA

3

WisDOT ABC Projects
2005 - 2016

4

Overview
- Precast Piers
- GRS Abutments and PS Box Girders
- Bridge Moves - Slides

Source: VTrans

5

Precast Piers
- Past Usages:
  - 2013 – (1) Custom Application
  - 2014 – (1) Standardizing
  - 2015 – (3) Standardizing/Institutionalized
  - 2016 – (1) Standardizing/Institutionalized

6

Precast Piers

- Current Policy
  Evaluation and plan preparations for accommodating a noted allowance for a precast pier option as indicated in this section is only required for I-39/90 Project bridges.
- Policy Direction
  Stronger guidance for statewide evaluation
- Considerations
  - Limitations
  - Project value
  - Geometric compatibility

7

Precast Piers

- Standard 7.05
- Designer
  To determine allowable precast elements

INCLUDE THE FOLLOWING NOTE ON AT LEAST ONE PIER SHEET FOR EACH PIER:

THE CONTRACTOR MAY FURNISH A PRECAST CONCRETE PIER (INSERT ALLOWABLE PRECAST ELEMENTS) IN LIEU OF THE CAST-IN-PLACE PIER WITH THE ACCEPTANCE OF THE SHOP DRAWINGS BY THE STRUCTURES DESIGN SECTION. THE PRECAST CONCRETE PIER SHALL CONFORM TO PRECAST DETAILS IN CHAPTER 7 STANDARDS OF THE CURRENT WISCONSIN DOT BRIDGE MANUAL AND SPECIAL PROVISIONS RELATED TO PRECAST ELEMENTS WITH THE EXCEPTION OF METHOD OF PAYMENT. PAYMENT FOR THE PRECAST PIER SHALL BE BASED ON THE QUANTITIES AND PRICES BID FOR THE ITEMS LISTED IN THE "TOTAL ESTIMATED QUANTITIES" FOR THE CAST-IN-PLACE PIER.

- Contractor
  Use precast segments at their discretion

THE CONTRACTOR MAY USE PRECAST SEGMENTS AT THEIR DISCRETION (E.G. PRECAST CAP ONLY) WITH APPROVAL BY THE BUREAU OF STRUCTURES. SEE STANDARD 7.07 FOR CAST-IN-PLACE BEARING BLOCK DETAILS AND ADDITIONAL NOTES.

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Precast Piers

- In-House Tracking
- Geometric Compatibility

Precast Pier Considerations

Structure Number	B-40-810	B-13-727	B-13-702	B-13-703	B-13-709	B-13-707	B-45-112	B-45-113
Precast Pier	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional
ADT (Adjacent)	97700	1747	71800	71800	71800	2950	44000	44000
Design Speed (Adjacent)	70	50	70	70	70	60	70	70
Pier Length (out to out)	137.17	77.50	95.50	37.00	40.00	61.50	61.25	61.25
Skew	0.88	39.48	4.00	2.04	22.06	0.00	0.59	0.59
PS Girder Width (inches)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Girder Spacing	10.08	6.25	7.00	6.58	6.67	11.50	8.17	8.17
Staged Construction?	No	No	No	No	No	No	No	No
Pier Width (feet, min.)	2.45	3.57	2.59	2.50	3.22	2.42	2.44	2.44
Pier BRG Spacing	10.08	8.10	7.02	6.59	7.19	11.50	8.17	8.17
Extra Column Required?	No	No	No	No	No	Yes	No	No
Designer Comments	None	None	None	None	None	None	Prelim	Prelim
Designer or Entered by	JDL	JDL	JDL	JDL	JDL	JDL	RAC	RAC

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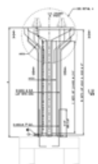
Precast Piers - Opportunities

- IH 39/90
  - SHRP2 Projects
  - Numerous noted allowances

39/90 IMPROVING a gateway to Wisconsin

- Statewide Precast Piers
- Other Opportunities



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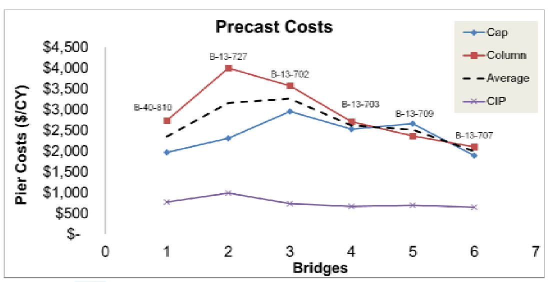
ABC Costs – Precast Piers



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GRS Abutments

- Updates

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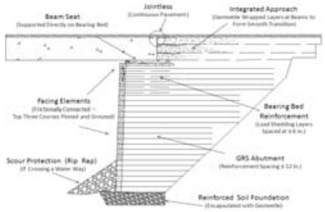
GRS Abutments

- Geosynthetic Reinforced Soil (GRS)
  - Reinforcement (Fabric)
  - Backfill
  - Facing Elements



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GRS Abutments

- GRS History (2011 – Current)
  - FHWA - Every Day Counts (EDC1, EDC2, & EDC3)
  - Demonstration and AID Grants
  - Actively participating and promoting GRS Technology
  - Standard Details, specifications, and experience
  - New tool and not for every location

U.S. Department of Transportation
Federal Highway Administration

14

FHWA Efforts

- States Constructed GRS Abutments?
  - **5** States (2011)
  - **44+** States (2016)
    200+ GRS Structures
  - FHWA EDC 2011-2016

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GRS Abutments - Chippewa Co.

Less Complex Construction Methods

Reduced Construction Time

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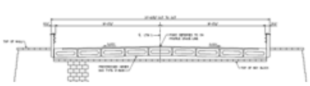
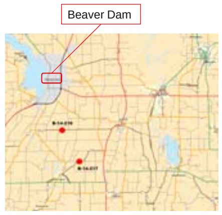
GRS Abutments - Dodge Co.

2016 Construction (February Let)
- Two Single Span Bridges
- Four GRS Abutments
- Prestressed Box Girders
- Cofferdams





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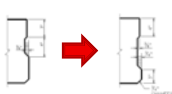
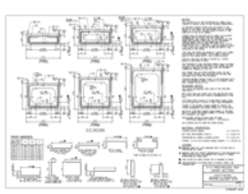
GRS Abutments – Dodge Co.

PS Box Girders
- Improved shear key
- Composite Details





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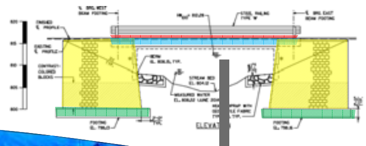
GRS Abutments – Dodge Co.

Construction Schedule:
- Remove Existing Bridge
- Install Sheet Piling
- Excavate for GRS Ftg.
- Install GRS Ftg. & Abutment
- Install PS Box Girders
- Pour Deck



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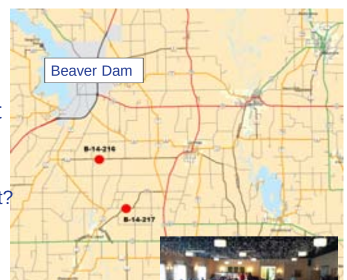
GRS Abutments – Dodge Co.

Schedule:
- B-14-216 - July
- B-14-217 – August
- Showcase
  - Beginning of August?



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GRS Abutments – Dodge Co.

Showcase Tentative Agenda:
- General Overview
- Construction Considerations
- Project Breakdown
- Field Trip to Site
- Wrap-Up Discussion

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GRS Abutments – Dodge Co.

Showcase Attendees:
- FHWA and WisDOT
- Consultant Designers
- Local Owners and others

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GRS Abutments

WisDOT Future
- WisDOT Lessons Learned (Dodge County)
- Monitor Prestressed Box Girder Projects
- FHWA coordination and updates
- Continue to provide technical support

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Accelerated Bridge Construction - Slides

Bill Oliva, P.E.
Structures Development Chief
WisDOT Bureau of Structures

Why Slide in bridge construction?

- All the benefits of other ABC technologies
- Less traffic disruption
- Greater safety for motorists and construction workers (shortened work-zone durations)
- Greater quality and constructability
- May reduced Right-of-Way (FEE) needs

M-100 Bridge Slide in Potterville Michigan

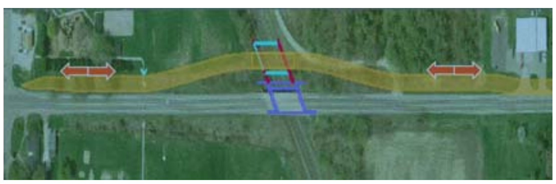
- Permanent bridge deck will be constructed at the temporary location on temporary abutments
- Two-way traffic will be maintained on the temporary road **and on new bridge superstructure with temporary abutments**

M-100 Bridge Slide

- •Original Construction 1940
- •Length of Structure 157’
- •Width of Structure 40’

M-100 Bridge

Maintenance of traffic



M-100 Bridge

M-100 Bridge

M-100 Bridge

M-50 Bridge over I-96 Bridge Slide Design – Michigan

- Existing 4-span 200 foot
- Proposed 2-span 200 foot prestressed box beam
- Demolish the bridge, that'll be a one-weekend closure of I-96

M-50 Bridge

M-50 Bridge

M-50 Bridge