Dodge County GRS-IBS Showcase Agenda

Thursday, August 25th 2016
Juneau Community Center

8:00 Check-in, Coffee, and Conversation

8:30 Welcome and Logistics for the Day WisDOT - Scot Becker and James Luebke

8:45 GRS-IBS Technology Overview

- WisDOT General ABC Update — WisDOT - Bill Dreher
- GRS-IBS Overview — FHWA - Jennifer Nicks
- GRS-IBS Construction — FHWA - Daniel Alzamora

9:30 Break

10:00 GRS-IBS Dodge County Projects

- Dodge County Perspective — Dodge County - Peter Thompson
- Design Considerations — Design Engineer– Kristofer Olson (Omnni)
- WisDOT Perspective — WisDOT – James Luebke
- Lessons Learned — Project Leader – Brad Abraham (R.A. Smith National, INC.)
- Q&A and Field Trip logistics — WisDOT – James Luebke

11:30 Lunch (provided)

12:30 Field Trip to Site (bus transportation provided)*

- Safety protection will be required (shoes, vests, and hard hats) and will not be provided.
- Site #1 CTH KW over Pratt Creek B-14-217 West Abutment (60% complete structure)
- Site #2 CTH S over Shaw Brook B-14-216 East Abutment (90% complete structure)

2:30 Q&A and Wrap-up Discussion

- Future uses of GRS-IBS
- Comments and questions about the project
- Closing Remarks

3:00 Adjourn

2016 Dodge County GRS-IBS
Showcase Contacts

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Dodge County GRS-IBS SHOWCASE

August 25th 2016

Today's Agenda

- GRS-IBS Overview
- Break
- Dodge County Sites
- Lunch
- Site Visit
- Wrap-up

Additional Items

- Breaks – slideshow, displays, talk to others…
- Site Visit – Active site (safety first)
- PDH's emailed after the showcase
- See BOS website for presentations and additional resources

Some History…

WisDOT's GRS-IBS History

2011 2012 2013 2014 2015 2016 2017

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Chippewa LET-Showcase

Preliminary 8/3/10
Plans Let: 3/13/12
Showcase: 5/11/12

2011 2012 2013 2014 2015 2016 2017

6

Dodge County

County Interest: 3/21/14

2011 2012 2013 2014 2015 2016 2017

7

EDC-3 Regional Summits

St. Louis: 10/23/14

2011 2012 2013 2014 2015 2016 2017

8

Dodge County

Design:	2014
Data and Plans	2015
LET:	2/16
Begin Work	5/16

2011 2012 2013 2014 2015 2016 2017

9

WisDOT GRS-IBS Milestones

Chapter 7 WBM	8/2012
GRS Standards	1/2013
GRS Design Steps	8/2015
FHWA Aid Grant	6/20/16
PS Box Girders	1/2016

2011 2012 2013 2014 2015 2016 2017

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Special Thanks!!!

- **Dodge County**
- FHWA
- WisDOT
- Omnni Associates
- UW TIC

Joe Balice, Rory Rhinesmith, Scot Becker, Lynn Cloud, Kris Olsen, Dan Alzamora, Judy Wilson, Jeff Melville, David Esse, Dave Kopacz, Mary Forlenza, Brian Fields, Michael Erickson, Dan Grasser, Oscar Winger, June Coleman, Don Miller, Jennifer Nicks, Tanya Iverson, Bill Dreher, Peter Thompson, Donna Brown-Martin, Eric Heggelund, Steve Pudloski, Bill Oliva, Bob Arndorfer, Najoua Ksontini, David Hunt

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Dodge County GRS-IBS Showcase

And…Thanks for your participation!!!

- **24 WisDOT**
- **30 Consulting Firms**
- **18 County**
- **And more…**

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Dodge County
GRS-IBS SHOWCASE

August 25th 2016

Dodge County GRS-IBS SHOWCASE

William Dreher, PE
Structures Design Chief
WisDOT – Bureau of Structures

1

Why ABC in Wisconsin?

- It Is Our Mission!
  - Provide leadership in the development and operation of a safe and efficient transportation system.
  - Finding innovative and visionary ways to provide better products and services…

2

Why ABC Now?

- There is a Need & Opportunity!
  - Needs of our customers for less disruption and more safety.
  - The opportunity provided by our Partners at FHWA (Highways for Life, SHRP2, and EDC)
  - FHWA – Accelerated Innovation Deployment (AID) Grant – Todays Showcase!

3

WisDOT's ABC Goals

- Develop Accelerated Bridge Construction options to facilitate safe and efficient transportation systems that better serve the public.
  - Safer projects
  - Shorter and less disruptive impacts to the traveling public
  - Higher Quality
  - Potential cost savings
  - Opening up the field, more contractors may be able to build these types of bridges

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WisDOT ABC Team

- **The Team included:**
  - Guidance – State Trans. Innovation Council (STIC)
  - Department Bridge, Geotech, and Contract Administration Experts
  - FHWA Resources and Support
  - *Consultant, Contractor, and Fabricator Support*
- **The Objective**
  - Develop the Policy, Guidance, Standards, and Provisions to implement ABC tools and solutions, and get out in front of projects…….

To Meet Project Needs

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Our Process of Development:

- **Research –** Development of Technologies
- **Customize –** Project/Site Specific Details and Specifications
- **Standardize –** Program & Corridor Approach
- **Institutionalize –** System-wide Policy & Applications
- Learn, Document, and Project to other Elements

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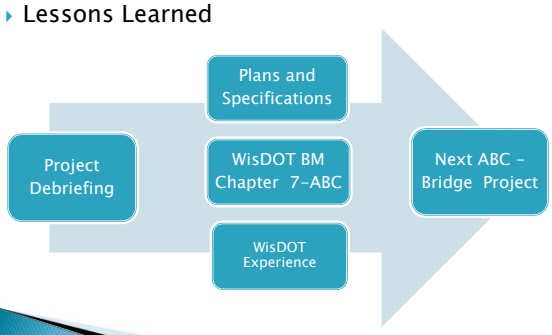
WisDOT Perspective

- Lessons Learned



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Future Objectives

- **Development of Precast Abutment Standards**
- **Refinement of GRS-IBS Super Structure Options**
- **Precast Approach Slabs**
- **UHPC Applications (Connections & Decks)**

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We would like to thank:

- FHWA – Accelerated Innovation Deployment (AID) Grant (Ewa Flum & Dan Alzamora)
- Dodge County Highway Dept. (Peter Thompson)
- WisDOT SW Region's Local Program (Michael Erickson)
- And all of you for your interest in this technology

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Questions?

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Geosynthetic Reinforced Soil Integrated Bridge System

Dodge County, WI

GRS-IBS Showcase

August 25, 2016

Efficiency through technology and collaboration

U.S. Department of Transportation
Federal Highway Administration

What is GRS IBS?

- Accelerated construction technique
- Utilizes compacted granular fill and geosynthetic reinforcement in alternating layers.

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GRS - Composite Material

Concrete

- Aggregate
- Water
- Cement

GRS

- Aggregate
- Closely-spaced geosynthetics

Image source: FHWA

3

GRS IBS - Composite Design

Concrete Abutment

- Steel reinforcement provides tensile strength
- Spacing and sizing of reinforcement plays a role in strength and serviceability

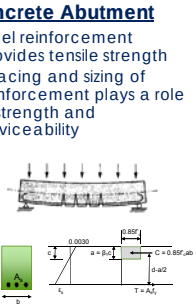

Image source: FHWA

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GRS IBS - Composite Design

GRS Abutment

- Geosynthetic reinforcement provides tensile strength and added compressive strength
- Facing, as well as spacing and properties of reinforcement play a role in strength and serviceability

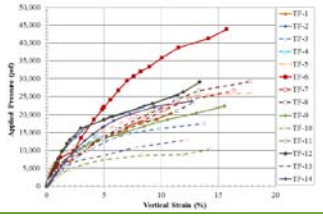

Image source: FHWA

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Why Consider the GRS IBS?

- Lower costs
- Accelerated bridge construction
- Smooth transition eliminating the "bridge bump"

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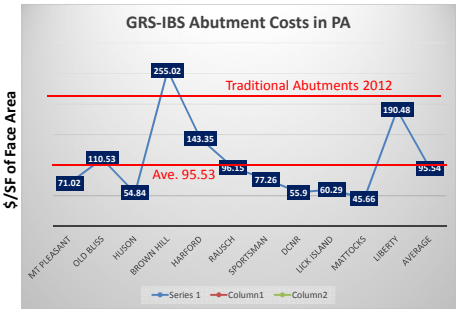
Comparable Abutment Costs



Accelerated Bridge Construction

- GRS IBS is quick and simple to build (weeks vs. months for conventional construction)
- If using PBES for the superstructure, a bridge can be replaced in about 4 weeks depending on the project complexity
- Design can be easily modified in the field

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Eliminating the bridge bump -

- The GRS IBS alleviates "the bump at the end of the bridge"

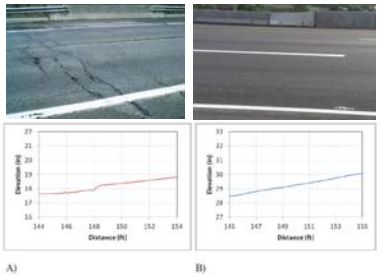

Figure 18. Surface profile for bridge joints a) on a bridge without GRS-Abutments (CR 27 Bridge Nr. 3340760) as compared to b) the GRS-Abutment at CR 27 Bridge Nr. 3340730

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GRS IBS – Where should GRS IBS be considered?

- Water crossings (creeks, rivers, flood plains, tidal zones)
- Grade separations (at grade crossings of road, rail, trails)
- Low volume local roads (ADT less than 400)
- High volume and high loads (ADT in the thousands)
- Load combinations (Seismic, lateral, thermal, uplift)
- Unusual geometries (Skew, longitudinal grades, transverse grades)
- Superstructure types (Adjacent concrete boxes to steel girders with semi-integral abutment)
- Material selection (Facing, geosynthetic reinforcement, fill)

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GRS IBS – Where should GRS IBS not be Considered?

- GRS IBS should not be considered at:
  - High water velocities?
  - Deep Scour?
  - Excessive Settlement?
- Obstacles or design considerations?

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GRS IBS – Example Projects

- Different types of crossings
- Different types of superstructures
- Different roadway geometries
- Different types of facings
- Different types of fill materials
- Different types of geosynthetics
- Different designers, from in-house to consultant
- Different construction delivery method, in-house to contracted

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DE – Chesapeake City Road over Guthrie Run (2013)

FL – CR 107 over Lanceford Creek Nassau County (2014)

HI – Saddle Road Bridge (2012)

Designed for PGA x F_{pga} ground acceleration (PGA=0.6g F_{pga}=1.0)

18

Image source: FHWA

IL – Great Western Trail over Grace St. (2011)

Use of stone columns to improve foundation soils

Image source: FHWA and Village of Lombard

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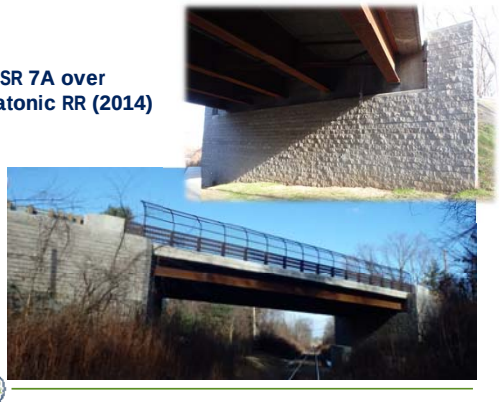
LA – Maree Michael Canal, Vermilion Parish (2015)

MA – SR 7A over Housatonic RR (2014)



MD – Allegany County (2014)

ME - Knox County Beach Bridge (2013)

MI – Keefer Rd. (2014)

MO – Rustic Road Project (2015)

NE – Sand Creek (2014)

NJ – Gloucester County Bridge #4-H-5 over Edward's Run on Jessup Mill Road (2015)

NY – CR 38 St. Lawrence County (2013)

OH – Bowman Rd Bridge (2005)

PA – Mattocks Rd Bridge, Greenwood Township (2014)

PR – Yauco PR2 (2014)

SC – Airline Rd, Anderson County (2014)

SD – 8th Street Bridge, Custer (2014)

WA, Cheney Plaza Bridge (2013)

WV – VA Hospital, Clarksburg (2013)

Questions and Comments

Image source: PA DOT

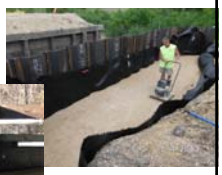
CONSTRUCTION OF GRS-IBS

Geosynthetics

Geogrids

Geotextiles

Facing Types



Reinforced fill materials

Open Graded Fill

Well Graded Fill

Excavation

Reinforced Soil Foundation

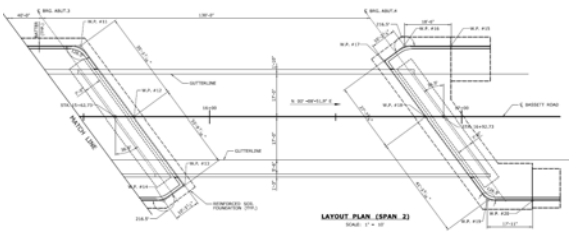
Reinforced Soil Foundation

Block Placement *(First Row)*

Block Placement

Block Placement (corners)

Block Corners



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Block Corners

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Block Corners

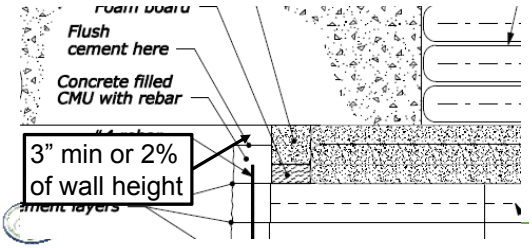
Fill Placement

Fill Compaction

Fill Compaction

Abutment Construction

Top of wall details



Top of wall details



Top of wall details



Top of wall details


Top of wall details


Placement of superstructure

- Set Back: The distance between the back of the facing block and the front of the beam seat


Approach Construction


Approach Construction


Approach Construction


Rip Rap Installation

QUESTIONS?

EDC Web Site
www.fhwa.dot.gov/everydaycounts

Taking effective, proven and market–ready technologies and getting them into widespread use

Dodge County
CTH KW & S
GRS-IBS Bridge Design

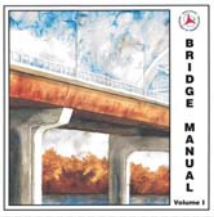
August 25, 2016

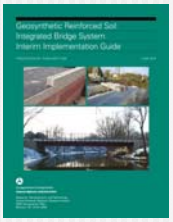
Design Process

- Data Gathering
- Hydrologic & Hydraulic Modeling
- Subsurface Investigation
- Planning Meeting/Agency Coordination
- Preliminary Design
- Permitting/Reports
- Final Design & PS&E

Data Gathering

- **Manual Reviews**
  - WisDOT Bridge Manual Chapter 7 – Accelerated Bridge Construction
  - FHWA GRS-IBS Interim Implementation Guide





Data Gathering

7.1.4.2.2 Application

In some cases GRS-IBS abutments may not be suitable for a particular bridge location and there are specific limitations that can cause concern. As with any preliminary bridge planning, the site should be thoroughly investigated for adequacy. The designer shall investigate the potential viability of using of GRS-IBS for any proposed bridge. The designer should be aware of the common criteria for use and the limitations of GRS-IBS systems. Some of the common criteria for usage of GRS-IBS are the following:

1. Scour potential at the abutment locations has been evaluated and is within acceptable limits
2. Water velocities are less than 5 ft/s
3. Adequate freeboard is provided (See Bridge Manual Chapter 8.3.1.5)
4. Soil conditions permit shallow foundations.
5. Low-volume roadways
6. Single span structure with a span length less than 90 feet
7. Abutment wall height less than 22 feet (measured at the maximum wall height, from the top of the RSF to the top of the wall)
8. Wingwalls are parallel to roadway
9. Maximum skew angle of 15°
10. Short and long term settlements are tolerable
11. Differential settlement along the length of the abutment is tolerable to avoid twisting of the superstructure
12. Suitable construction materials available

H & H Modeling

- **Velocity**
  - CTH KW

HYDRAULIC DATA

Q_{100}	836 C.F.S.
VELOCITY	4.48 F.P.S.
HIGH WATER	EL. 803.45 (100 YEAR)
HIGH WATER	EL. 801.30 (2 YEAR)
WATERWAY AREA	187 S.F.
DRAINAGE AREA	24.1 SQ. MILES
OVERTOPPING FREQUENCY	= N/A
SCOUR CRITICAL CODE	= 8

  - CTH S

HYDRAULIC DATA

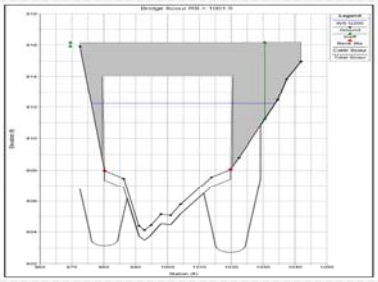
Q_{100}	771 C.F.S.
VELOCITY	4.56 F.P.S.
HIGH WATER	EL. 812.28 (100 YEAR)
HIGH WATER	EL. 810.67 (2 YEAR)
WATERWAY AREA	169 S.F.
DRAINAGE AREA	25.8 SQ. MILES
OVERTOPPING FREQUENCY	= N/A
SCOUR CRITICAL CODE	= 8

H & H Modeling

- **Scour – 200 yr event**
  - CTH KW

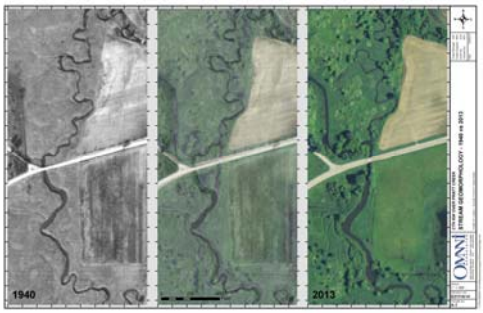
H & H Modeling

- **Scour – 200 yr event**
  - CTH S



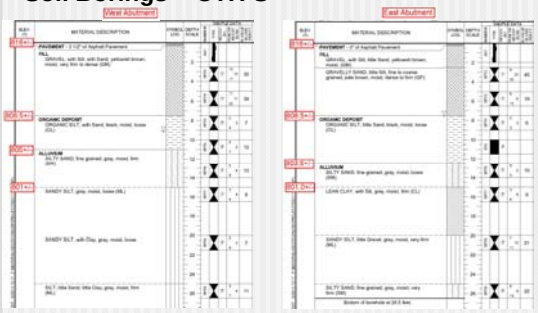
H & H Modeling

- **Geomorphology – CTH KW**



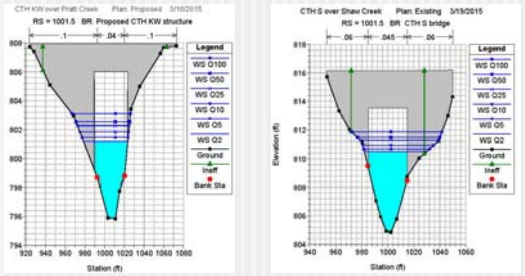
Subsurface Investigation

- Soil Borings – CTH S



Design - Constructability

- Controlling Water During Abutment Construction



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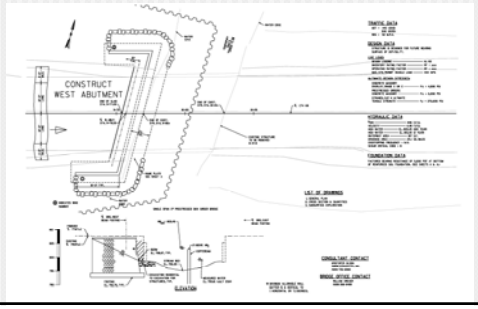

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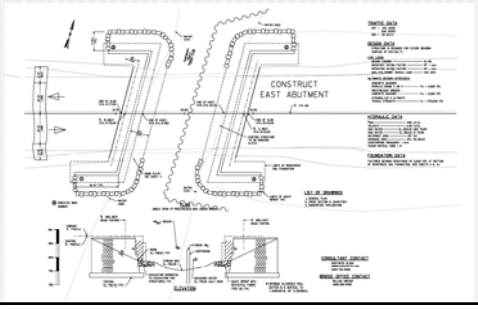
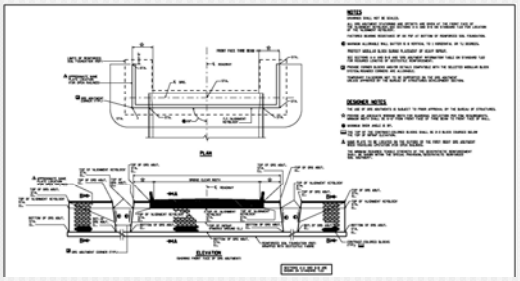


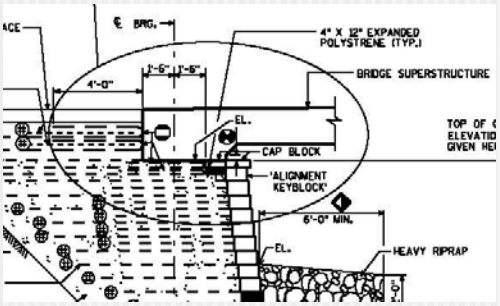
Design - Details

- GRS-IBS Abutments



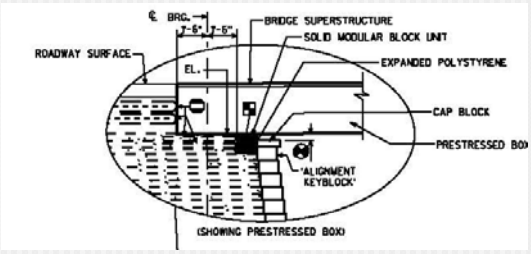
Design - Details

- GRS-IBS Abutments



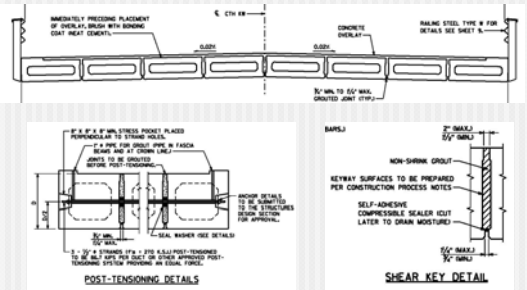
Design - Details

- GRS-IBS Abutments



Design - Details

- Precast Prestressed Concrete (PPC) Box Beams



Dodge County
WisDOT Perspective

August 25th 2016

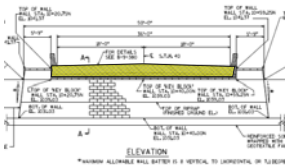
GRS Abutments

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

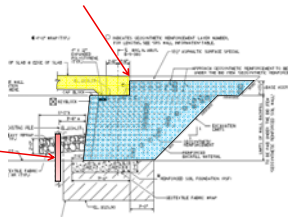
U.S. Department of Transportation
Federal Highway Administration

2

Chippewa County



- Concrete slab cast on GRS
- No approach slab used



Existing timber piles support false work

3

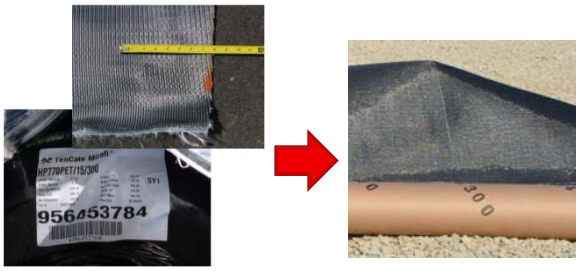
Chippewa County

Less Complex Construction Methods

Reduced Construction Time

4

Fabric



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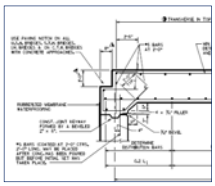
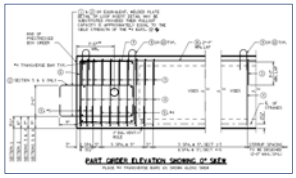
Superstructure



Completed Flat Slab



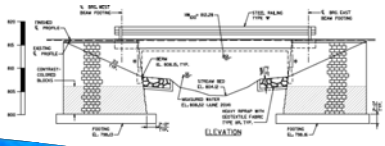
Re-Work Prestressed Box Girders

6

Dodge County

GRS Abutments (vs. Chippewa Project)

- Similar SPV and Plans
- Reinforcement Strength: 30% reduction (2% strain/min.)
- Cofferdam Bid Item
- Project Showcase



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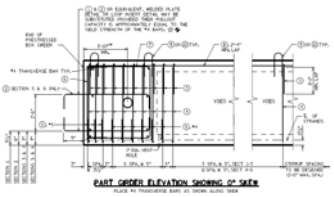
Other Projects…Iron County

PS Box Girders

- A1 Abutments
- Composite Deck



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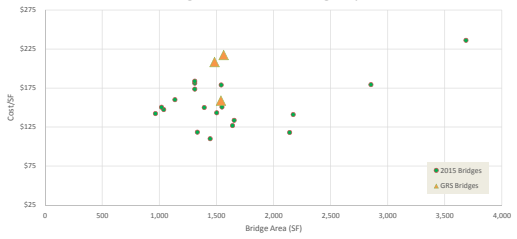
Costs

Total Costs
Bridges over Water (single span)



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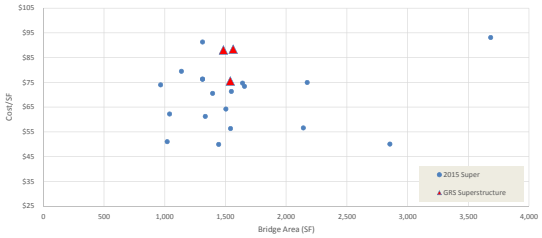
Costs

Superstructure Costs
Bridges over Water (single span)



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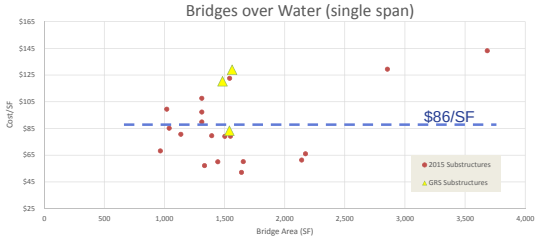
Costs

Substructure Costs
Bridges over Water (single span)



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Future Works

- Monitor Structures
- Continue to stay connected
- Address Lessons Learned
  - Identify or rule out potential candidates
  - Improve Design Guidance
  - Construction

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GRS-IBS
SHAW BROOK & PRATT CREEK

LESSONS LEARNED

THE PLAYERS

- CONTRACTOR: JANKE GENERAL CONTRACTORS
- PROJECT LEADER: BRAD ABRAHAM – RA SMITH NATIONAL, INC.
- WISDOT LOCAL PROGRAM MANAGEMENT CONSULTANT: TERI SCHOPP - DAAR
- BLOCK SUPPLIER: ROCHESTER CONCRETE PRODUCTS
- GIRDER/BEAM SUPPLIER: SPANCRETE

CONSTRUCTION PROGRESS SO FAR

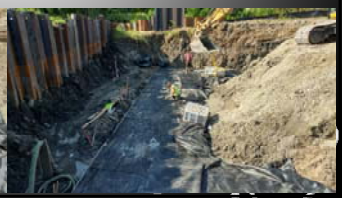
- SHAW BROOK BRIDGE (CTH S)
  - BOTH ABUTMENTS @ 90% COMPLETE
  - GIRDERS ARE SET AND GROUTED

CONSTRUCTION PROGRESS SO FAR

- PRATT CREEK (CTH KW)
  - WEST ABUTMENT IS 75% COMPLETE
  - EAST ABUTMENT IS UNDER CONSTRUCTION

REINFORCED SOIL FOUNDATION (RSF)

- USED 18" OF 3" DENSE GRADED BASE FOR ADDITIONAL SUPPORT
- USED 6" OF ¾" DENSE GRADED BASE TO ALLOW FOR EASIER LEVELING OF THE RSF

BLOCK WALL CONSTRUCTION

- SETTING THE STARTER BLOCKS
  - CORRECT LAYOUT
    - FULL BLOCKS IN THE CORRECTNERS
  - CALCULATING THE LOCATION USING THE BLOCK SUPPLIER WALL DESIGN
    - BATTER
  - LEVELING – UTILIZING A LEVELING MATERIAL
    - ¼" OF MATERIAL ALLOWED PER SPEC

BLOCK WALL CONSTRUCTION

- 90 DEGREE CORNERS VS. ROUNDED CORNERS


BLOCK WALL CONSTRUCTION

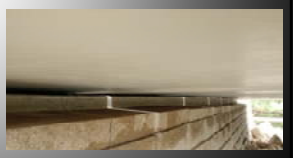
- FABRIC
  - TYPE OF FABRIC
  - PLACEMENT OF FABRIC
  - KEEPING THE BLOCKS LEVEL
  - OVERLAPPING IN THE CORNERS
  - HEIGHT OF FABRIC ADDING UP OVER THE COURSES
  - COVERING THE VOIDS – IN BOTH GRANULAR AND CONCRETE BACKFILL
  - PLACEMENT OF FABRIC IN THE CORRECT DIRECTION


BLOCK WALL CONSTRUCTION

- BACKFILLING
  - USING OPEN GRADED STONE
  - LIGHTWEIGHT COMPACTION
  - OVER-EXCAVATION BEHIND THE LAYERS OF FABRIC
  - FACE OF WALL
  - STRIPS OF FABRIC AT THE BACK OF THE BLOCKS TO SEAL THE VOIDS (CONCRETE)

BLOCK WALL CONSTRUCTION

- BEARING CLOSURE
  - NON-WEIGHT BEARING
  - EASIER THAN TRIMMING BLOCKS TO FIT
  - LEAVING IT ¼" LOW TO PREVENT THE GIRDERS FROM RUBBING ON IT
  - INCORPORATING REINFORCEMENT (ADDENDUM #1)
  - USING A CORNER BLOCK



GIRDERS

- GRAVEL AND FABRIC HAS TO BE LEVELED TO A SET ELEVATION
- POST TENSION DUCT SEAL WASHERS HAD TO BE TRIMMED

GROUT/DECK/OVERLAY

- INVESTIGATE THE USE OF A DIFFERENT MATERIAL IN THE TENSIONING POCKETS
  - EPOXY SEALER
- GRADE E
  - IS THERE ANOTHER MATERIAL THAT CAN BE USED?
    - ASPHALT OVERLAY
    - ALTERNATE GRADES OF CONCRETE DEPENDING ON PROJECT SPECIFIC ITEMS

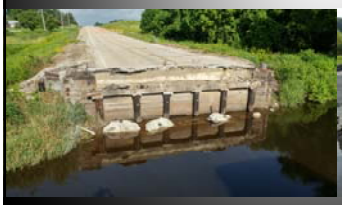
OTHER ITEMS

- USING STEEL BEAM GUARD POSTS WITHIN THE GRS-IBS LIMITS
  - MUST PUNCH THROUGH THE FABRIC
- USING STEEL SIGN POSTS WITHIN THE GRS-IBS LIMITS
  - MUST PUNCH THROUGH THE FABRIC
  - HOLES FOR WOOD POSTS
- HOW DO THESE TWO ITEMS AFFECT THE GRS-IBS SYSTEM?

THOUGHTS/TAKEAWAYS

- THE RIGHT SITE AND CONDITIONS WILL MAKE THE PROJECT EASIER
- BEING ABLE TO WORK ON BOTH ABUTMENTS AT ONCE
- ROUNDED CORNERS ARE THE BETTER OPTION
- UNDERSTAND WHAT THE INCIDENTALS ARE FOR THE ITEM
- CONSIDER REQUIRING COMPREHENSIVE DETAILS FROM THE WALL DESIGNER
- TAKE THE QUESTION OUT OF THE DESIGN PROCESS – MAKE REQUIREMENTS SINGULAR
- COMMUNICATION IS KEY THROUGHOUT THE ENTIRE PROCESS

QUESTIONS?



GRS-IBS SHOWCASE
Q&A and Field Trip

Questions So Far?

2

Field Trip

- 11:30 Lunch
- 12:30 Buses Leave
- Visit Site #1 – 30 mins +/-
  - Brief site description
  - Time to observe and discuss
  - Q&A
- Visit Site #2
- 2:30 Buses Return
- Active Site….SAFETY

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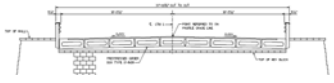
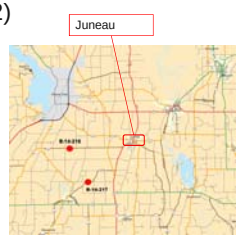
Field Trip

Two Structures (Site #1 and #2)

- Four GRS Abutments
- Prestressed Box Girders (17”)
- 2” Concrete Overlay
- Type W Railings





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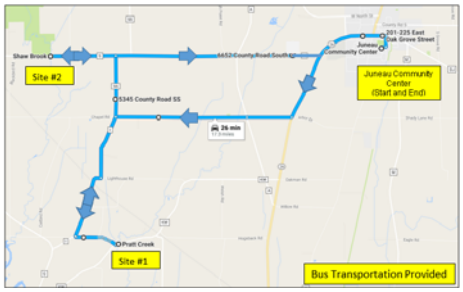
Field Trip



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Field Trip Questions?

Lunch will be served soon

7

GRS-IBS SHOWCASE
WisDOT Futures Uses

GRS Abutments

WisDOT Future

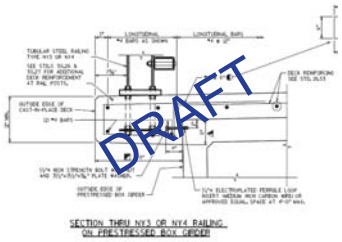
- Several Interested Counties (GRS or PS Box Girders)
- WisDOT Lessons Learned (Dodge County)
- Additional Prestressed Box Girder Projects
- FHWA Coordination and Updates

2

County Sites

3

Open Rail (under development)



SECTION THRU NY3 OR NY4 RAILING ON PRESTRESSED BOX GIRDER

4

Grade Separations
Multiuse Paths

5

Misc. or Buried Structures

6

Showcase Questions?

- GRS-IBS Overview
- Dodge County Sites
- Site Visit

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Again….
Special Thanks!!!

- **Dodge County**
- FHWA
- WisDOT
- Omnni Associates

Joe Balice
Rory Rhinesmith
Scot Becker
Lynn Cloud
Kris Olsen
Dan Alzamora
Judy Wilson
Jeff Melville
David Esse
Dave Kopacz
Mary Forlenza
Brian Fields
Michael Erickson
Dan Grasser
Oscar Winger
June Coleman
Don Miller
Jennifer Nicks
Tanya Iverson
Bill Dreher
Peter Thompson
Donna Brown-Martin
Eric Heggelund
Steve P.
Bill Oliva
Bob Arndorfer
Najoua Ksontini
David Hunt

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Dodge County GRS-IBS Showcase

- Email certificates of attendance with PDHs
- Downloadable information

- **And…Thanks for your participation!!!**