Agenda

- AASHTOWare Bridge Web Services
- Regression Testing Tools
  - Bridge Management
  - Bridge Design and Rating
- Bridge Design and Rating Modernization
- T-19 Pooled Fund Study
AASHTOWare Bridge Integration through Web Services

• What is a web service?
  • A standardized way for software to communicate through the internet.

• What benefit does it offer to AASHTOWare Bridge Users?
  • Allows the AASHTOWare Bridge users to communicate bridge rating information between the BrDR and BrM software via multiple standards.
  • Eliminates the need for users to merge databases.
AASHTOWare Bridge Integration through Web Services

- Funded by the AASHTOWare Research, Innovation, and Product Improvement (RIPI) Program

- **Phase 1** complete with BrM 6.0 release
  - Framework ready and available within BrM.
  - BrM has ability to send and receive load rating information to and from BrDR.

- **Phase 2** planned for completion with BrDR 7.1 release in 2020
  - Complete the same framework in the BrDR software as already completed in BrM.
  - Will have the interface and ability to send and receive load rating information to and from BrM.
Redesigned data linkages

• Existing Bridge Integration is a highly coupled solution requiring agency to merge BrM database with BrDR database
  • Both BrM and BrDR access the integrated database in production environment

• The redesigned data linkages provide a set of RESTful services that can be connected to from anywhere via HTTPS
  • No longer needs to merge databases, information exchange is on-demand
Phase 2

• Will implement a REST web service client within BrDR to consume the REST web services provided by BrM

• All existing Bridge Integration features will be provided

• Existing “Update BrM Rating Results” feature will be enhanced to support the BrM Load Rating Module

• BrM NBI rating will be available in BrDR for timely and accurate decisions on performing load rating
April 2019 AASHTOWare Bridge Task Force Meeting

- HDR did a presentation on the project
  - Julia Rivera and John Reese
- Our 2 contractors are participating in the Software Advisory Team
- We are willing to continue to work with T-19
Other Data integration endeavors

- BrDR - FHWA Bridge Information Modeling Standardization (HIF-16-011)
  - Evaluated AASHTOWare IFC Bridge Converter
  - Extracted BrDR data and created a model
Other Data integration endeavors

- WIS DOT had a project to extract data from AASHTOWare Bridge Rating and created an IFC file that was then used to import into 3 different software packages.
Automated Software Testing Implemented into the BrM Development Cycle

- Performs basic, automated testing to ensure new enhancements/bug fixes/implementations haven’t broken existing/working functionality
- Additional testing safety net
- Katalon Studio is the tool used to create automated unit tests, database upgrade scripts, and build steps
- BrM developers are alerted via email if any of the automated tests fail, allowing the issue to be resolved instantly
Automated Regression Testing Tool Continued

• As the system grows and encompasses more sophisticated methods of analysis, the need for more efficient regression testing becomes a higher priority

• Long-Term Benefits of Automated Regression Testing:
  • Expedited testing time
  • Expedited time to release new versions of the software
  • Reduced costs
  • Beta TAG can focus a higher percentage of their time on testing new functionality and not on previously tested components of BrM

• 24 Automated Test Cases currently and growing
• Allows users to quickly compare two large data sets that were produced by two separate program optimizations

• Determines what is the same, what is different, and how different are the selected programs

• Analysis is provided and comparable in list as well as graphical output
BrM 6.3 Release – Program Comparison Tool

Program Comparison

Program 1: TAMP1-SCR-ALL-6
Scenario 1: TAMP1-SCR-ALL-2E

Program 2: TAMP1-SCR-ALL-6
Scenario 2: 2tn per year

Chart

Graph: Bar
Graph By: Deck Area
Year: All Years
Subdivision: All Segments
Category: All Categories

Program 1: TAMP1-SCR-ALL-ST-MAINT-NBIS_JBE, Scenario 1: TAMP1-SCR-ALL-2B vs Program 2: TAMP1-SCR-ALL-ST-MAINT-NBIS_JBE, Scenario 2: 2tn per year by Deck Area

Year: All Years, Subdivision: All Subdivisions, Category: All Categories

Program 1

Program 2

Same in Both
Same Work Dil Yrs
Same Bridge Dil Work
Unique to Program

Deck Area
0 500k 1,000k 1,500k 2,000k 2,500k 3,000k 3,500k 4,000k 4,500k 5,000k 5,500k 6,000k 6,500k 7,000k
BrM 6.3 Release – Program Comparison Tool
BrM 6.3 Release – Program Comparison Tool

Program 2: TAMP1-SGR-ALL-ST-MAINT-NBIS_JBE, Scenario 2: 2tn per year by Project Cost Total

Year: All Years, Subdivision: All Segments, Category: All Categories
Regression testing is a type of software testing that seeks to uncover new software bugs, or regressions, in existing functional and non-functional areas of a system after changes such as enhancements, patches or configuration changes, have been made to them.

- Wikipedia

- Expected regression

- Unexpected regression

– Wikipedia
What is regression testing?

- Differences between two versions of BrDR can occur for different reasons:
  - The software was changed intentionally to address a change in the AASHTO specification
  - The software was changed intentionally to address a coding defect
  - The software was changed intentionally to implement a user requested enhancement
  - The software was inappropriately changed thus introducing a defect
What is regression testing?

- Differences between two analytical engines can occur for different reasons
  - Differences can occur when the two engines produce different results because of differing assumptions
  - One engine is more rigorous or refined than the other
  - Differing interpretations of the AASHTO specifications
  - One or both engines have a defect
BrDR Regression Comparison Tool

- Funded by AASHTOWare RIPI Program
- 1st release: TN 50 in Dec 2016 for 6.8.1
- 2nd/Latest release comes with 6.8.2 installation
- Keeping it current
- Contractor has used it for many years but only more recently available for end users
- Based upon NCHRP Report 485
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BrDR – Graphical Results

Graphical view of Report ID comparison.

Event 1
Event 2

Graph

Location

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• 6.8.3 release – October 2018
• Modernization Phase 1
  • Legacy user interface coupled with both the legacy and modernized analysis modules
• Modernization Phase 2 – Summer 2019
• 6.8.4 release
  • MBE 3\textsuperscript{rd} Edition with 2019 Interim and bug fixes
  • Last release of the legacy system, and maintenance, specification updates, and support will cease effective June 30, 2021
• 6.8.4 release
  • Only critical bug fixes will be incorporated into 6.8.4 going forward
• 7.0 release
  • Modernized user interface coupled with the modernized analysis module
  • Also includes 3 Load Rating Tool enhancements
User Group Training Meetings

• **Bridge Design and Rating**
  
  RADBUG
  
  July 30-31, 2019
  
  South Lake Tahoe, CA

• **Bridge Management**
  
  BrMUG
  
  September 17-18, 2019
  
  Louisville, KY
## Task Force members

<table>
<thead>
<tr>
<th>Chair</th>
<th>Todd Thompson</th>
<th>South Dakota</th>
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<tbody>
<tr>
<td>Chair</td>
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<tr>
<td>Vice Chair</td>
<td>Eric Christie</td>
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<td>Beckie Curtis</td>
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<td>Craig Nazareth</td>
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<td>Kent Miller (Bruce Novakovich)</td>
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<td>David Hedeen (Mark Faulhaber)</td>
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<td>Derek Constable</td>
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<td>Dean Teal</td>
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<td>FHWA Liaison – BrDR</td>
<td>Tom Saad</td>
<td>FHWA</td>
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BrDR Regression Testing Tool

• Any questions?
• Eric Christie, AL DOT
• Todd Thompson, SD DOT
Thank you