AASHTOWare™ BRIDGE DESIGN AND RATING

BrDR 7.5 and 7.6 Adoption

Mike Johnson, P.E. Idaho TD

2025 Rating and Design Bridge User Group Meeting

Boise, ID | August 12-13, 2025

7.5 and 7.5.1 Features

- WiX Installer – Phase 2
- License Mechanism
- Azure Connection
- Database Maintenance and Encryption
- Report Tool – Phase 1
- Grid Copy and Paste
- ARC Tool Usability
- Precomputed Data Window Filter
- MBE 2022 COBS Approved Ballot Update
- LRFR Concrete Moment Redistribution
- Square Rebars
- Truss and Gusset Plate Adjacent Vehicle Analysis
- Use Concurrent Moment for Cb Calculations
- Truss and Gusset Plate Adjacent Vehicle Analysis
- Truss Gusset Plate Shear Analysis
- LFR of curved girder > 300’ radius
- Culvert Design Tool Final Iteration
- Rating Method Rename
- 3D Mesh Generation
- LRFD Maximum Aggregate Size Input
- LRFD Modulus of Rupture
- Variable Axle Spacing for Permit Truck
- Net Area Deduction for Truss LRFR
- General Preference Additions
- Advanced Multi-Cell Box

AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 and 7.6.1 Features

- Installer updates and desktop license service
- Migration to .NET 8
- ARC Tool 2.0
- Help Ribbon
- LRFD spec updates
- MBE spec updates
- Evaluate all LRT scenarios
- Sunset Madero engine
- Persist print settings
- Auto calculate effective flange width
- Bottom flange lateral support
- Culvert bent bars
- Cover plate development length
- Alternate Cb
- MCB Web POI

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BrDR 7.5

2025 Rating and Design Bridge User Group Meeting

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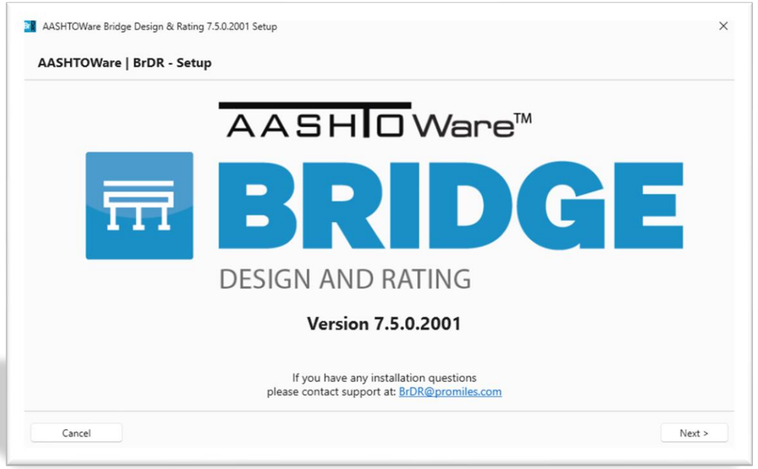
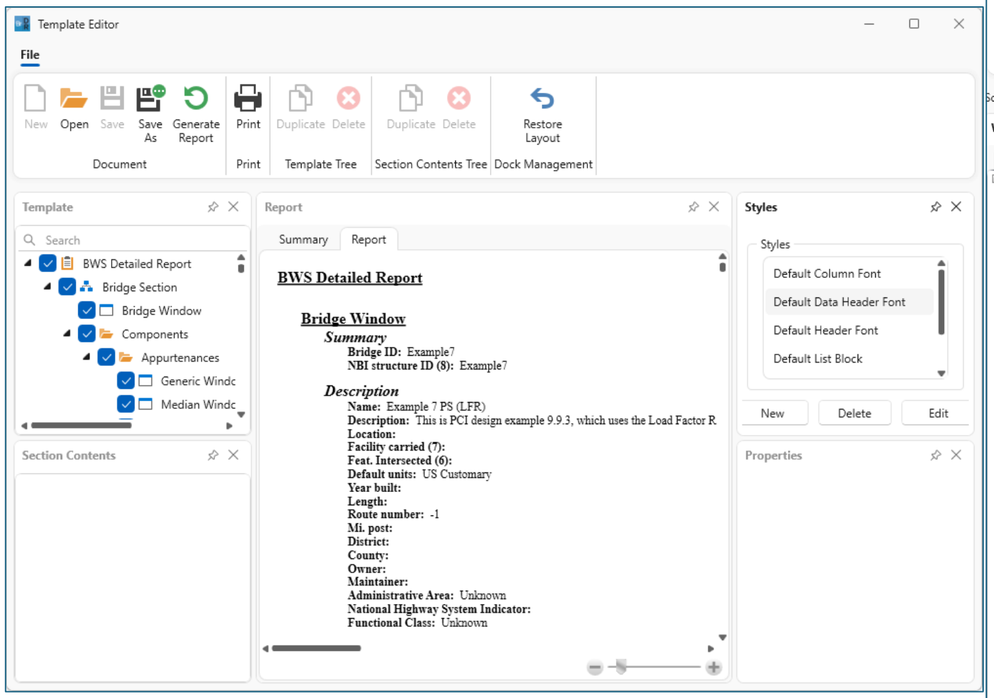
7.5 Installation and Access

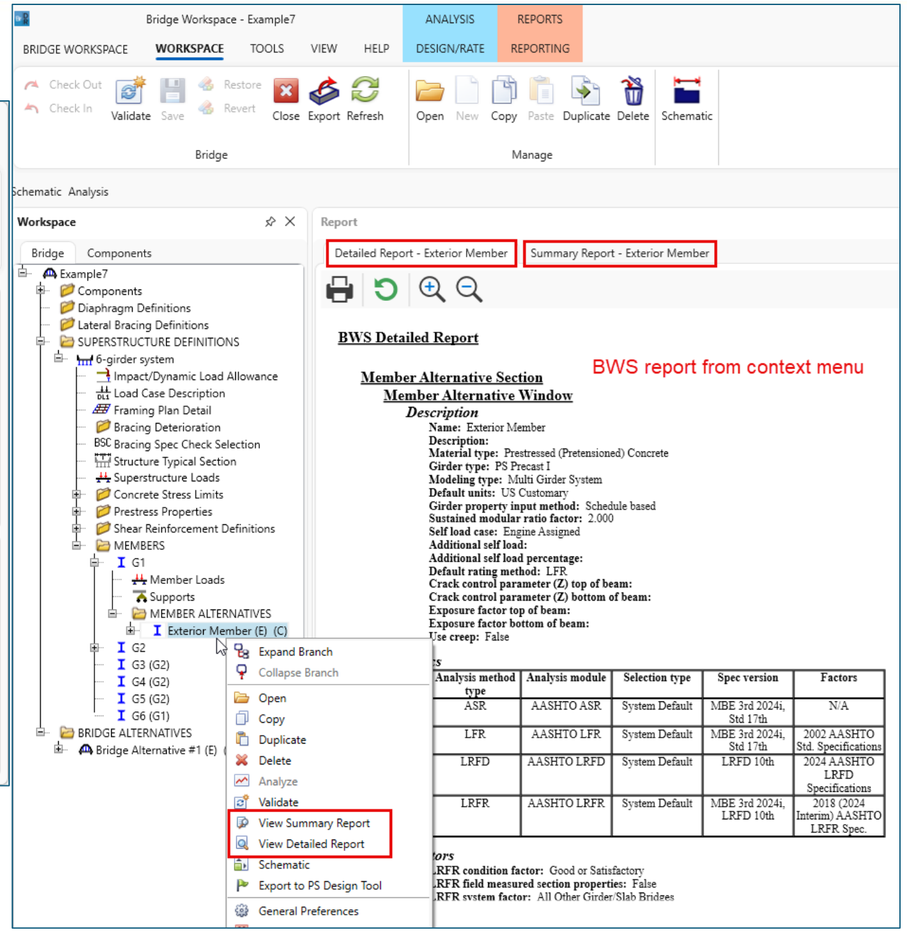
- WiX Installer – Phase 2
  - New UI, error logs for troubleshooting
  - ***Modify installation***
- License Mechanism
  - ***Same license for BrDR and Design Tools***
  - Export model with cryptographic signature
  - Offline mode
- Azure Connection
  - Azure Multi-Factor Authentication
- Database Maintenance and Encryption
  - Encrypt database connection
  - Database reconnection



7.5 Reporting and User Interface

- Report Tool Phase 1
  - BWS tree driven reporting
  - Report Tool Template Editor
  - Report Tool Viewer
  - ***Only for <u>prestressed</u> members***
  - ***Other girder types will be in v7.8***

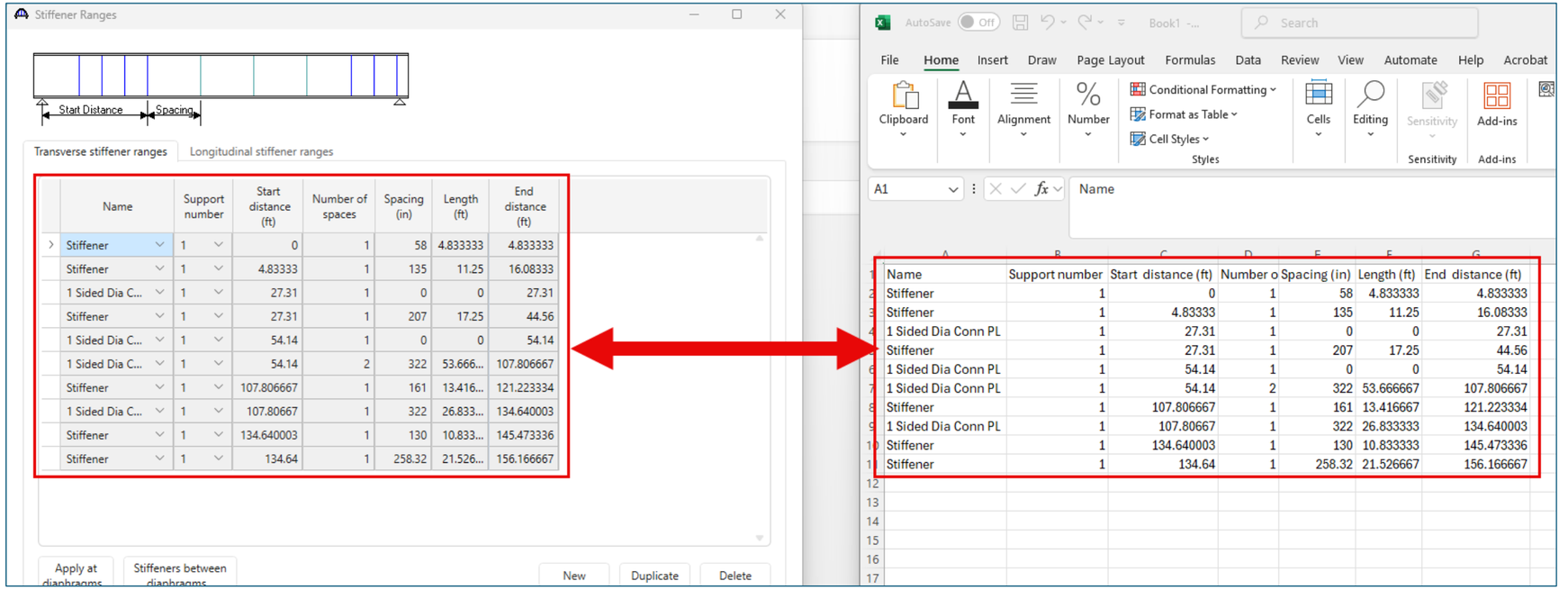




BRIDGE DESIGN AND RATING

7.5 Reporting and User Interface

- Excel Like Grid Copy and Paste
  - BrDR and Design Tools
  - Single click select, double click edit
  - Click and drag selection



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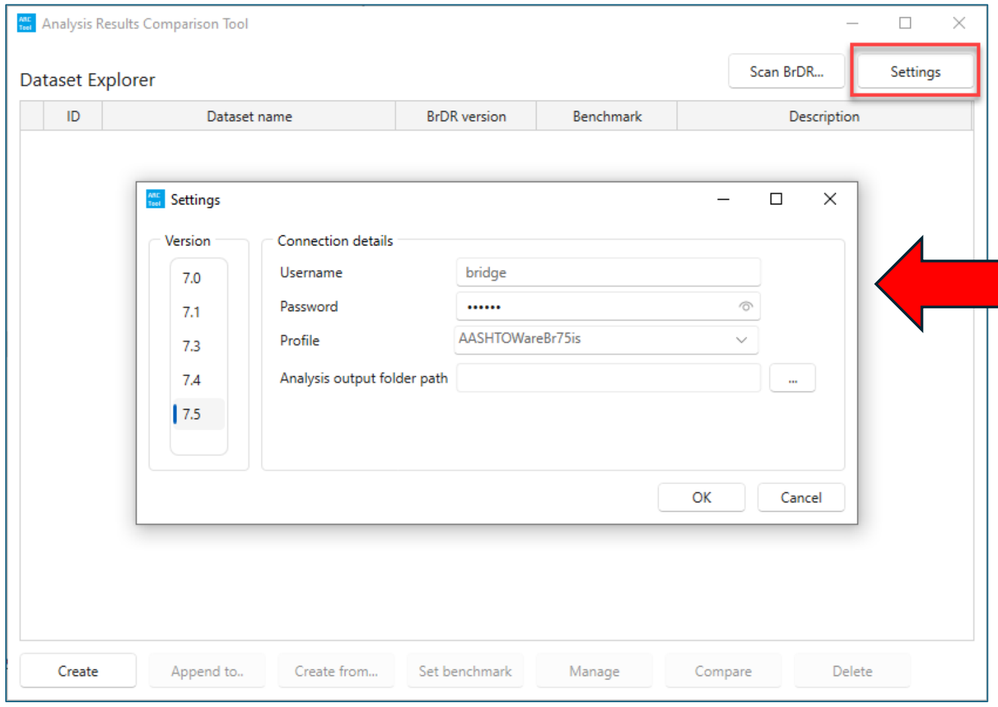
7.5 Reporting and User Interface

- ARC Tool Usability
  - ***Settings window for connection detail***
  - Display more details



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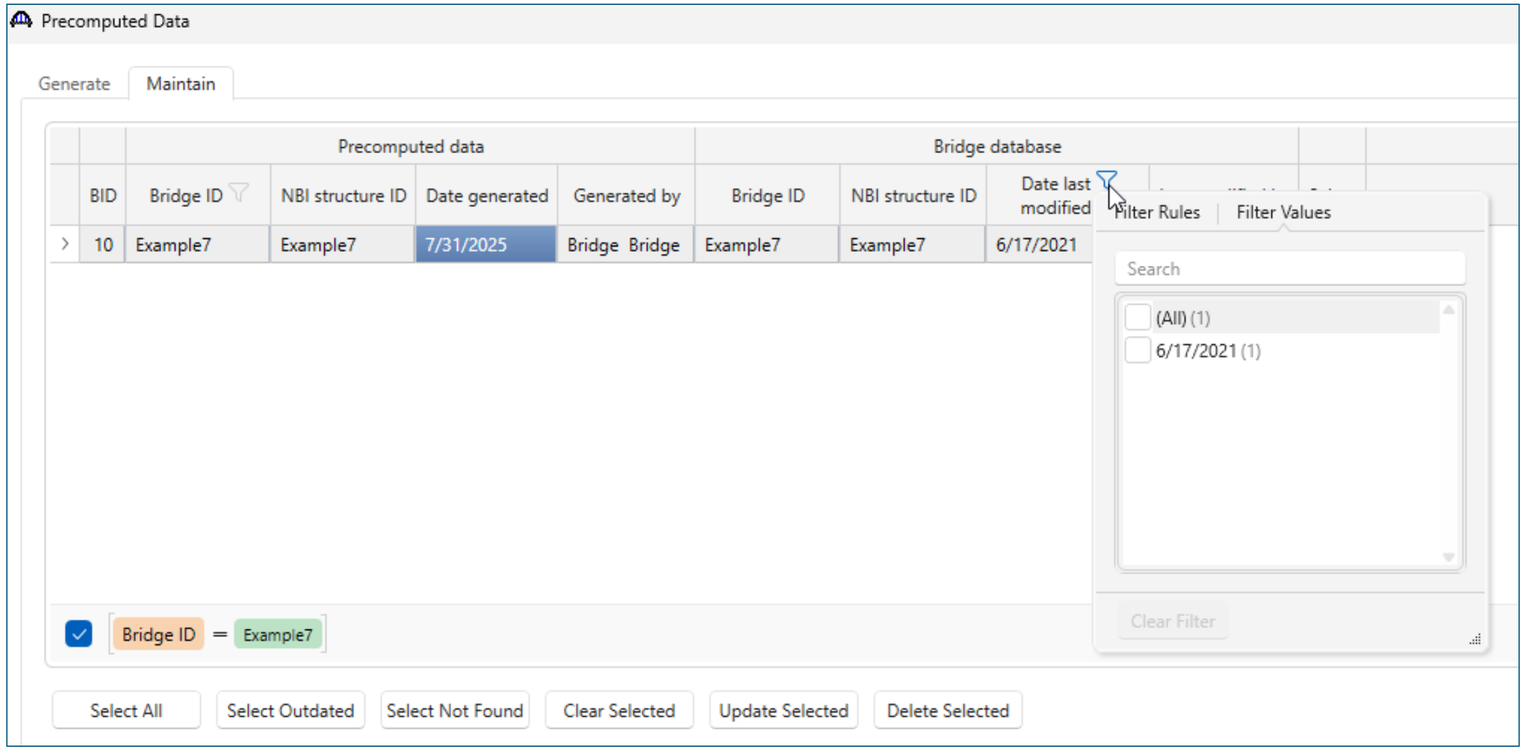
7.5 Reporting and User Interface

- Precomputed Data window Maintain tab filter
  - Filter options for all columns



AASHTOWare™ BRIDGE DESIGN AND RATING

7.5 Analysis Engine

- MBE 2022 approved ballot items
  - ***Concurrent actions for shear evaluation***
  - Control options for optional consideration of
    - ***Iterative shear rating***
    - Modify MCFT Theta
    - Modify size effect

For the purposes of load rating and application of MCFT it is permissible to modify the LRFD Article 5.7.3.4.2 as follows:

1. In areas of low strain where the section remains uncracked, that is $M_u < M_{cr}$, the strain ε_s may be assumed to be zero regardless of values of M_u and V_u; therefore, θ can be taken as 29 degrees.

2. For reinforced concrete members with web reinforcement $Av < Av\,min$, the beta should be adjusted by applying the size effect. For prestressed concrete beams, if $fpc/f'c$ is greater than or equal to 0.02, regardless of the amount of shear reinforcement, the size effect may be neglected.

β can be taken as shown below-

$$\beta = \frac{4.8}{(1 + 750\varepsilon_s)}$$

7.5 Analysis Engine

- Concrete moment redistribution for LRFR
  - Considered only if control option is checked
  - Adjust percent of moment redistribution at each pier (up to 20%)
  - Evaluate controlling rating factor to achieve
    - Critical positive flexure RF = Critical negative flexure RF

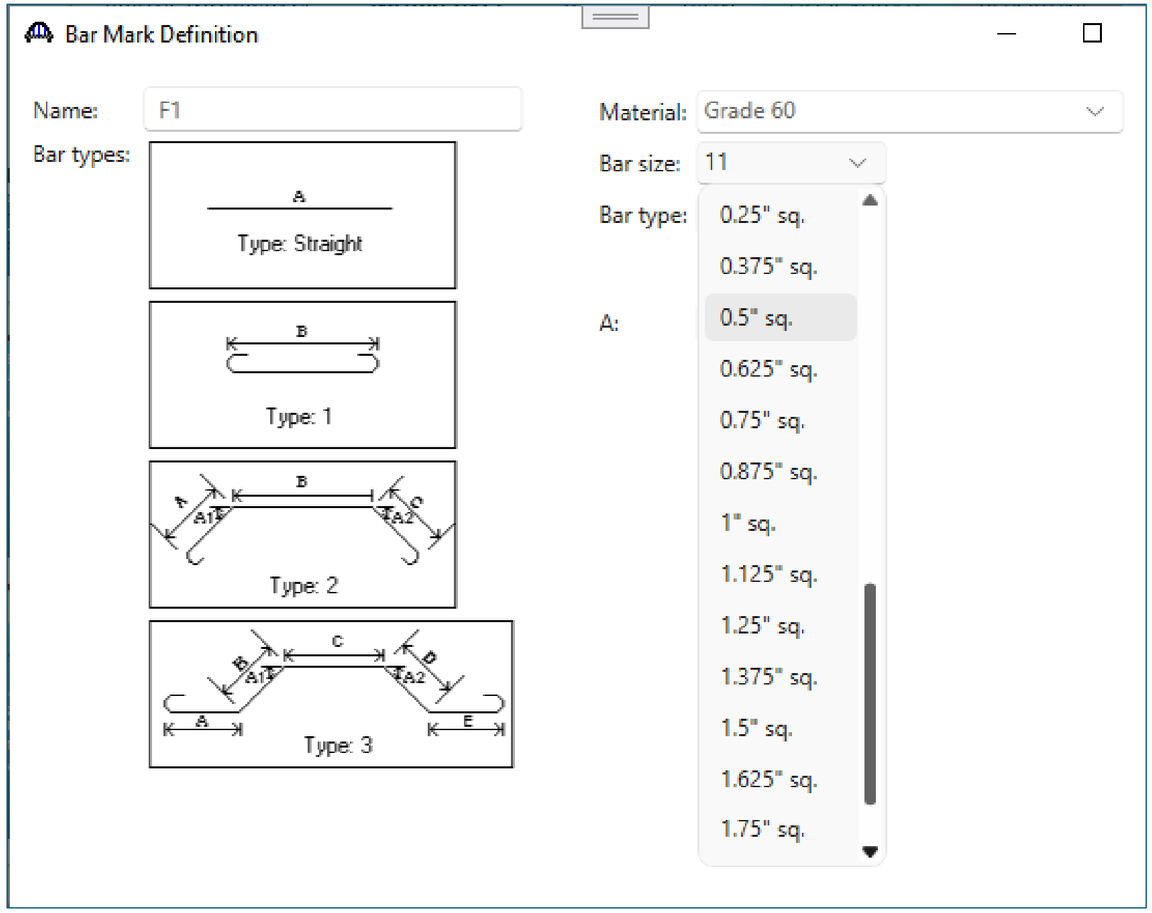
5.6.3.4—Moment Redistribution

In lieu of more refined analysis, where bonded reinforcement that satisfies the provisions of Article 5.10.8 is provided at the internal supports of continuous spans, negative moments determined by elastic theory at strength limit states may be increased or decreased by not more than $1000\varepsilon_t$ percent, with a maximum of 20 percent. Redistribution of negative moments shall be made only where ε_t is equal to or greater than $1.5\varepsilon_{tl}$ at the section at which moment is reduced, where ε_{tl} is the tension-controlled strain limit specified in Article 5.6.2.1.

Positive moments shall be adjusted to account for the changes in negative moments to maintain equilibrium of loads and force effects.

7.5 Analysis Engine

- Square Rebars



AASHTOWare™ BRIDGE DESIGN AND RATING

7.5 Analysis Engine

- Concurrent moment for Cb computation
  - Control option needs to checked
    - LRFD
    - LRFR
- Truss and Gusset Plate Adjacent Vehicle Analysis
  - LFR
  - LRFR

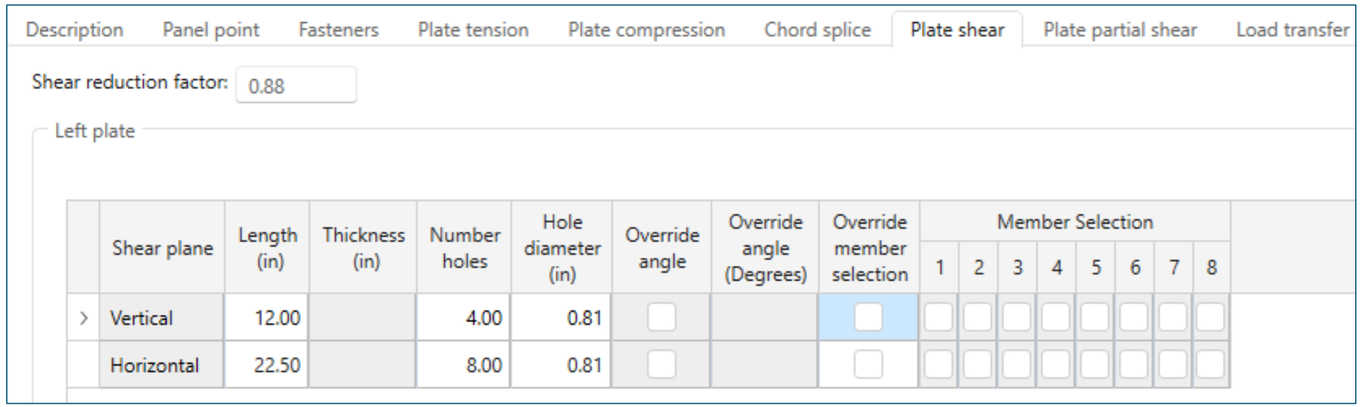
Strict application of the C_b provisions would require the consideration of the concurrent moments along the unbraced length. This would necessitate the calculation of:

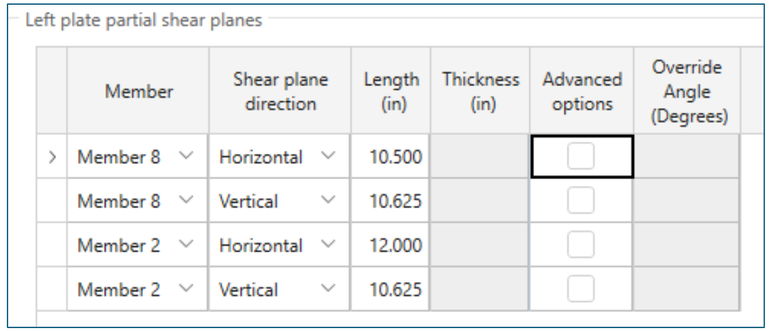
(1) the maximum possible value of f_2 at the brace point with the higher compressive stress using the critical moment envelope value, along with calculation of f_{mid} and f_0 using the concurrent moments, and

(2) the maximum possible compressive value of f_{mid} using the critical moment envelope value, along with the calculation of f_0 and f_2 using the concurrent moments.

7.5 Analysis Engine

- Gusset plate shear analysis overrides
  - Override for shear plane force contribution
  - Override for shear plane inclination
  - Override for partial shear plane along non-truss member

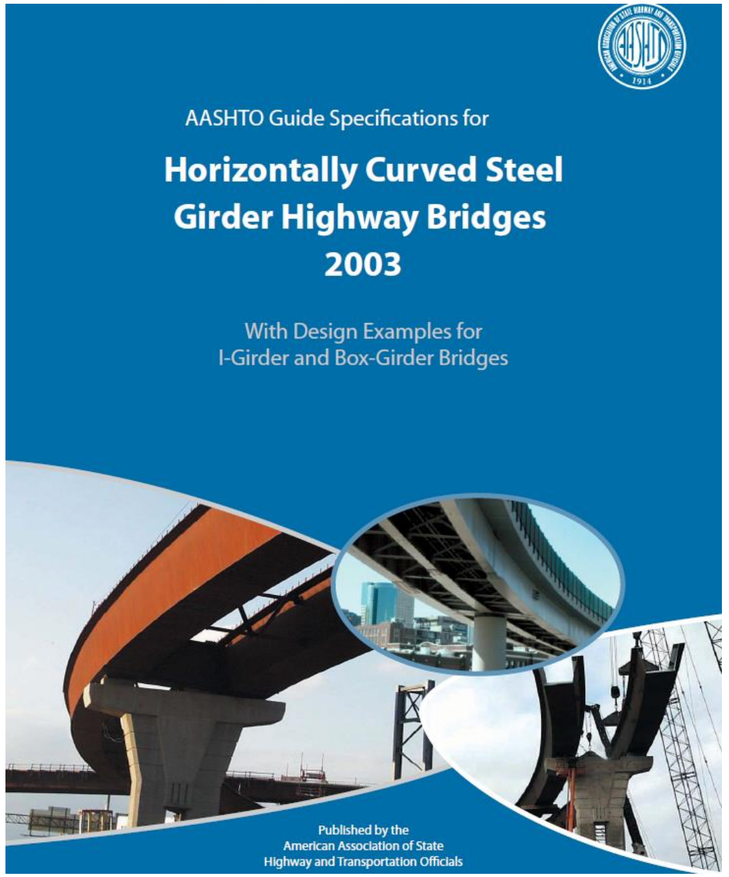




AASHTOWare™ BRIDGE DESIGN AND RATING

7.5 Analysis Engine

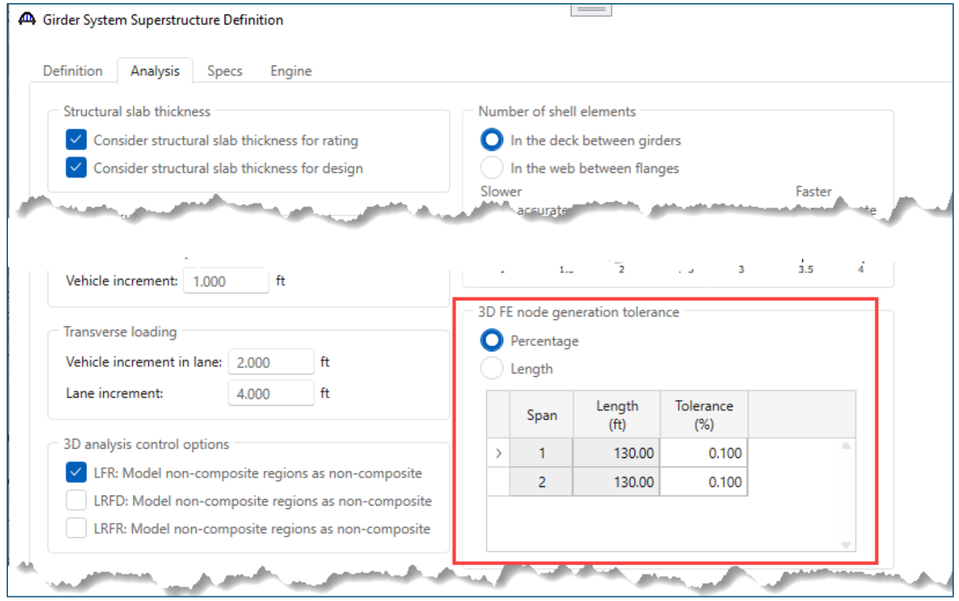
- Ignore curved girder span limit for LFR
  - ***AASHTO Guide Specifications*** for Horizontally Curved Steel Girder Highway Bridges 2003 applies to spans up to 300’
  - History of construction problems with spans > 300’
  - Ignore span limit for rating with warning

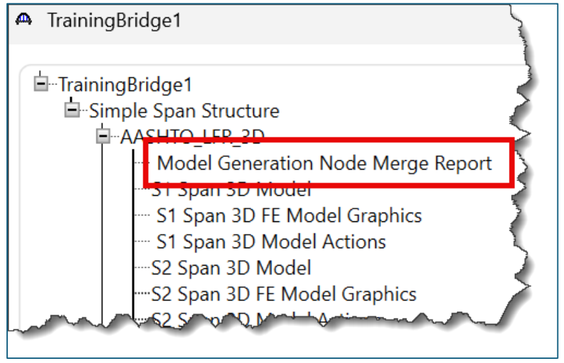


AASHTOWare™ BRIDGE DESIGN AND RATING

7.5 Analysis Engine

- Culvert Design Tool improvements
  - Consider cutoff bars for final design
  - Consider horizontal joint for design
  - Consider horizontal leg of interior wall reinforcement in top slab
- Rating method rename
  - Rename LFD to LFR
  - Rename ASD to ASR
- 3D Mesh generation improvements
  - Limit small elements
  - ***Improve results and speed***

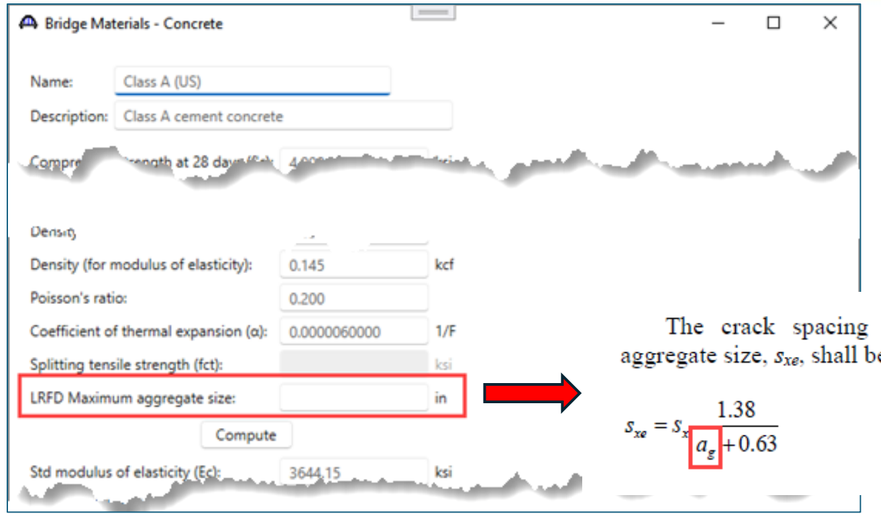




AASHTOWare™ BRIDGE DESIGN AND RATING

7.5 Analysis Engine

- LRFD maximum aggregate size input
  - Default value is 1.0
- Split modulus of rupture input
  - LRFD and Standard Specification
- Allow variable axle spacing
  - ***For permit trucks***
  - LFR and LRFR
  - LRFR permit LL factor based on maximum axle spacing
  - Facilitates envelope permitting
- Net area deduction input
  - Truss LRFR



The crack spacing parameter as influenced by aggregate size, s_{xe}, shall be determined as:

$$s_{xe} = s_x \frac{1.38}{a_g + 0.63} \qquad (5.7.3.4.2\text{-}7)$$

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BrDR 7.5.1

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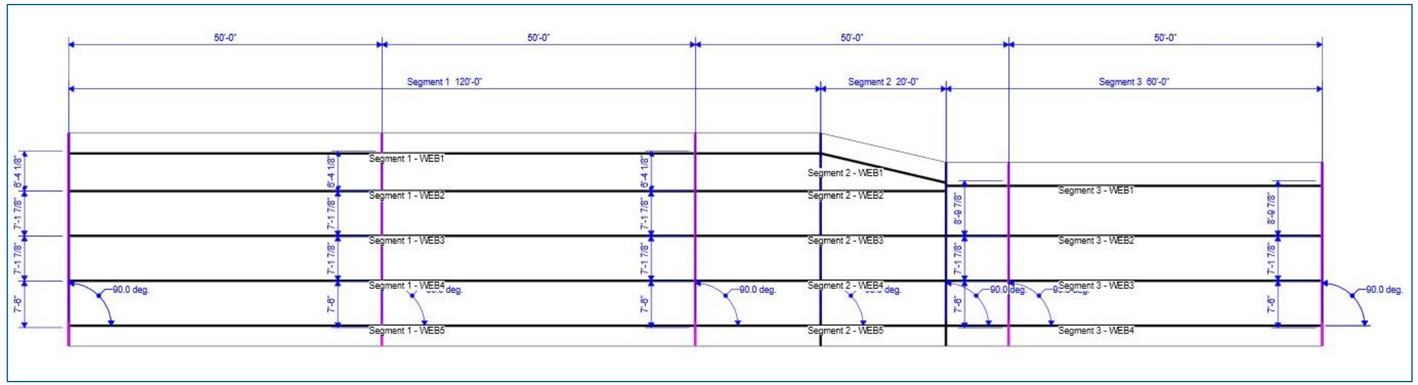
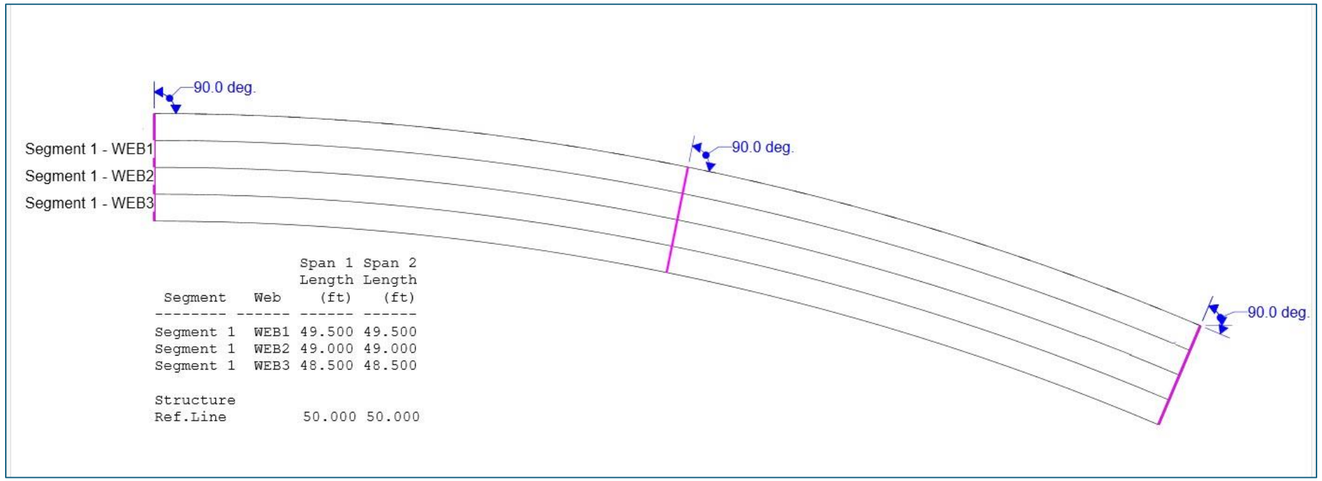
7.5.1 Analysis Engine

- Advanced concrete multicell box
  - Define multicell box in multiple segments
  - Each segment can have different number of cells
  - Define horizontal curvature
  - Line girder only – LFR and LRFR
  - Integral pier modeling





Segment	Web	Span 1 Length (ft)	Span 2 Length (ft)
Segment 1	WEB1	49.500	49.500
Segment 1	WEB2	49.000	49.000
Segment 1	WEB3	48.500	48.500
Structure Ref.Line		50.000	50.000

AASHTOWare™ BRIDGE DESIGN AND RATING

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BrDR 7.6

2025 Rating and Design Bridge User Group Meeting

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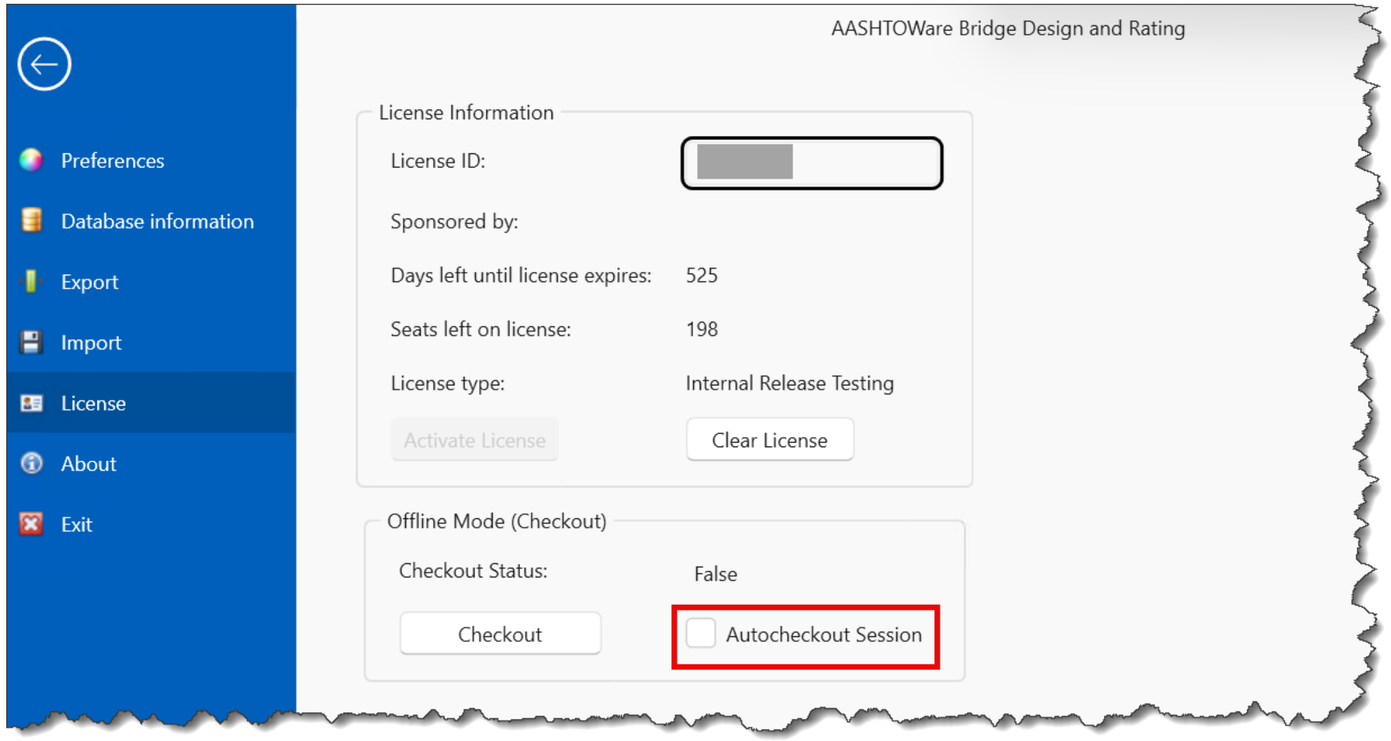
7.6 Usability Improvements

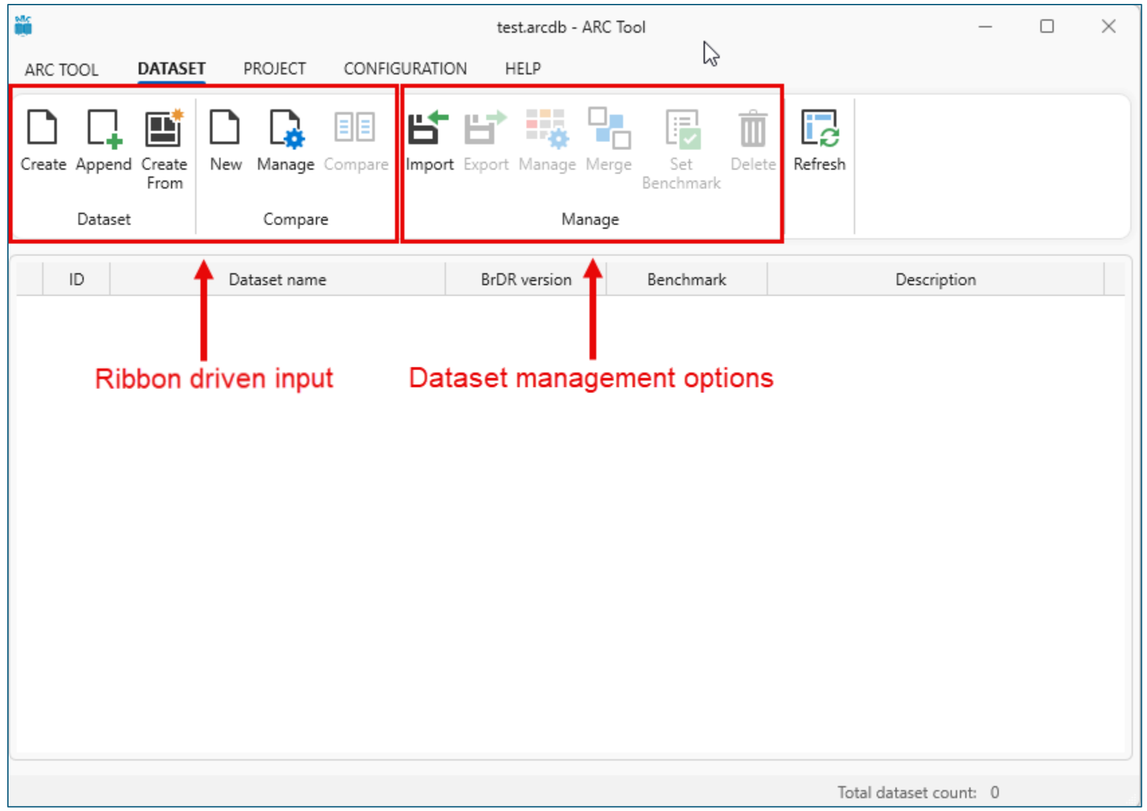
- Installer and desktop service
  - Better logging and error reporting
  - Auto-checkout license (for offline mode)



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Usability Improvements

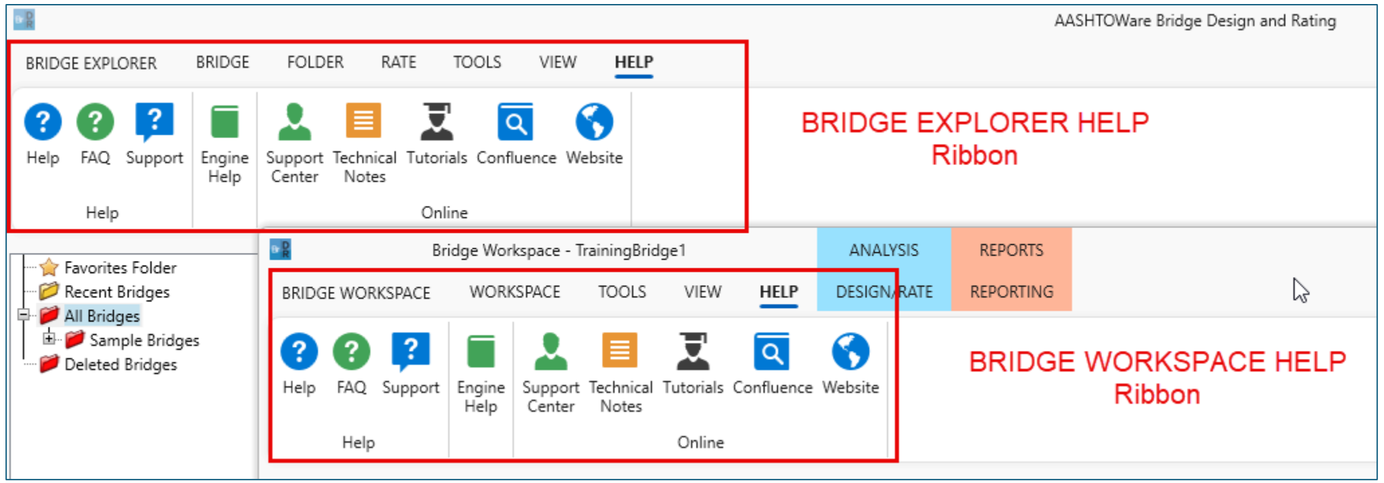
- ARC Tool 2.0
  - Import, export, and merge datasets
  - Customizable dataset comparison option
  - Auto analysis timeout and file clean up options
  - Datasets based on file explorer folders



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Usability Improvements

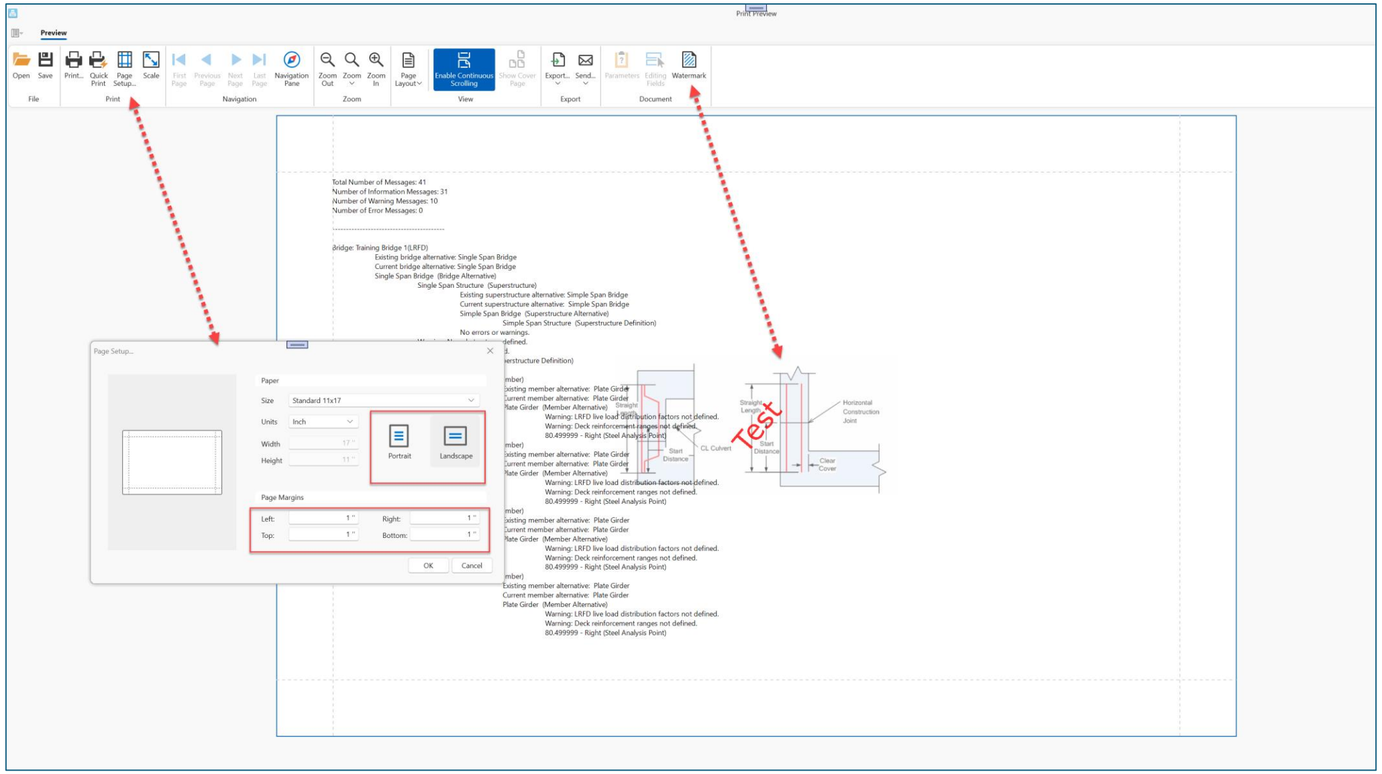
- Help ribbon
  - Bridge Explorer and Bridge Workspace



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Usability Improvements

- Persists print settings –Saves print settings

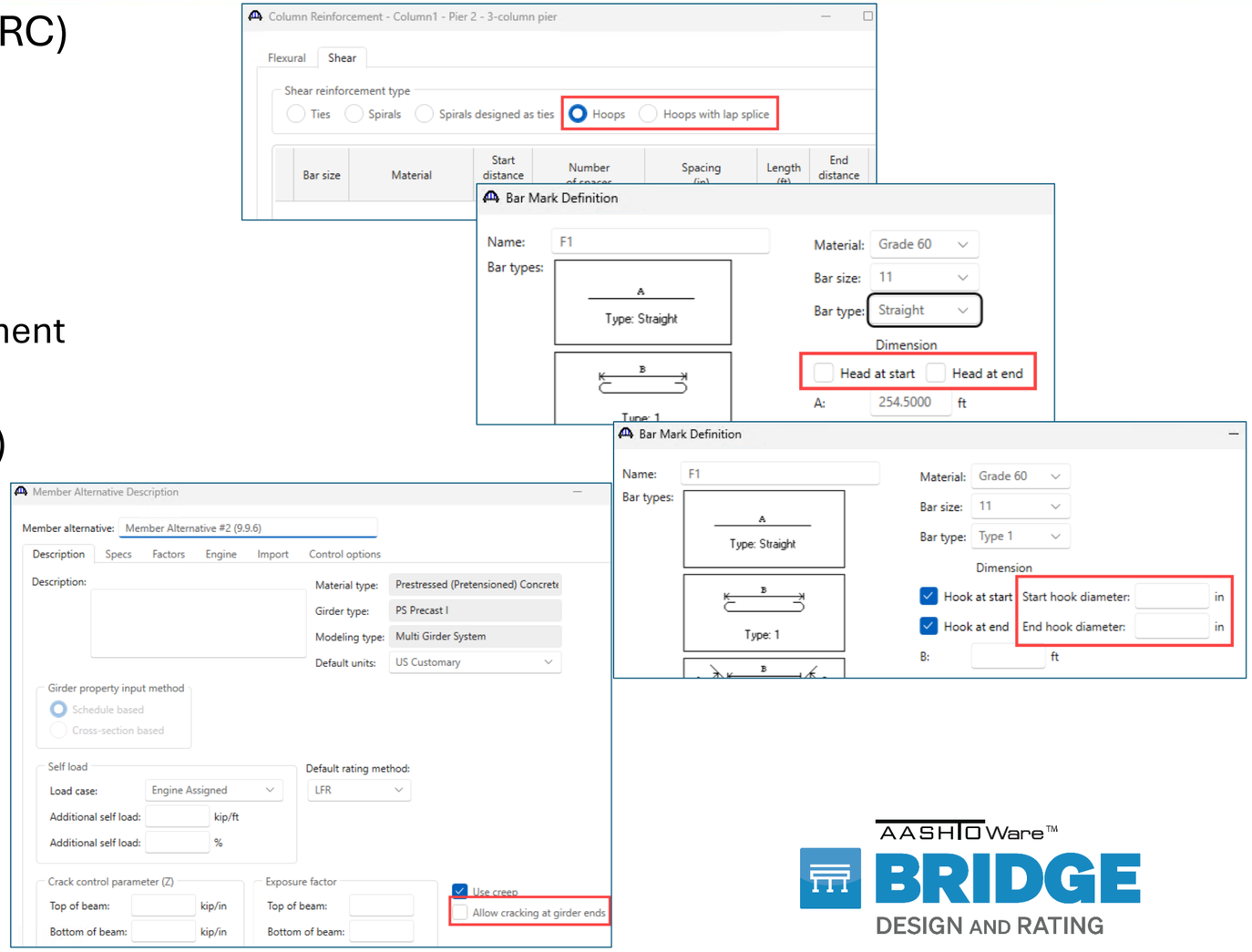


AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- LRFD 10th Edition Specification Updates (PS and RC)
  - Instantaneous and time dependent deflections
  - Reinforcement development length computation
  - Reinforcement for tensile stress in concrete
  - Beam continuity connection simplification
    - Allow limited cracking at girder ends
  - Horizontal transfer tension tie reinforcement requirement

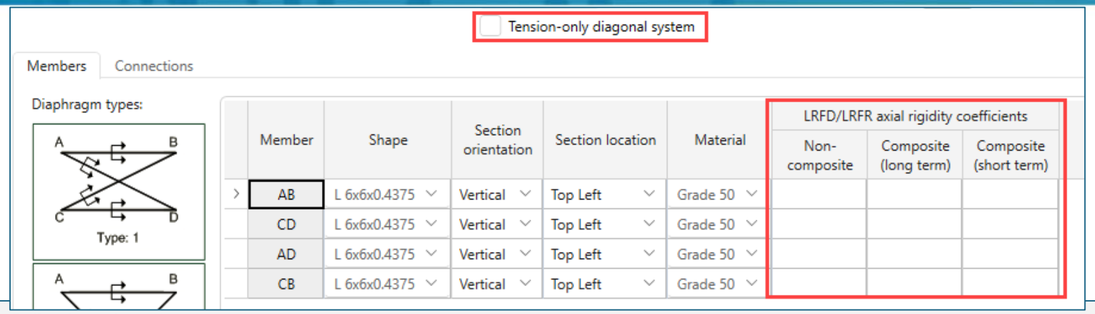
- LRFD 10th Edition Specification Updates (Culvert)
  - Structural plate box moment
  - Reinforced concrete culvert live load
  - Replace LS with AW

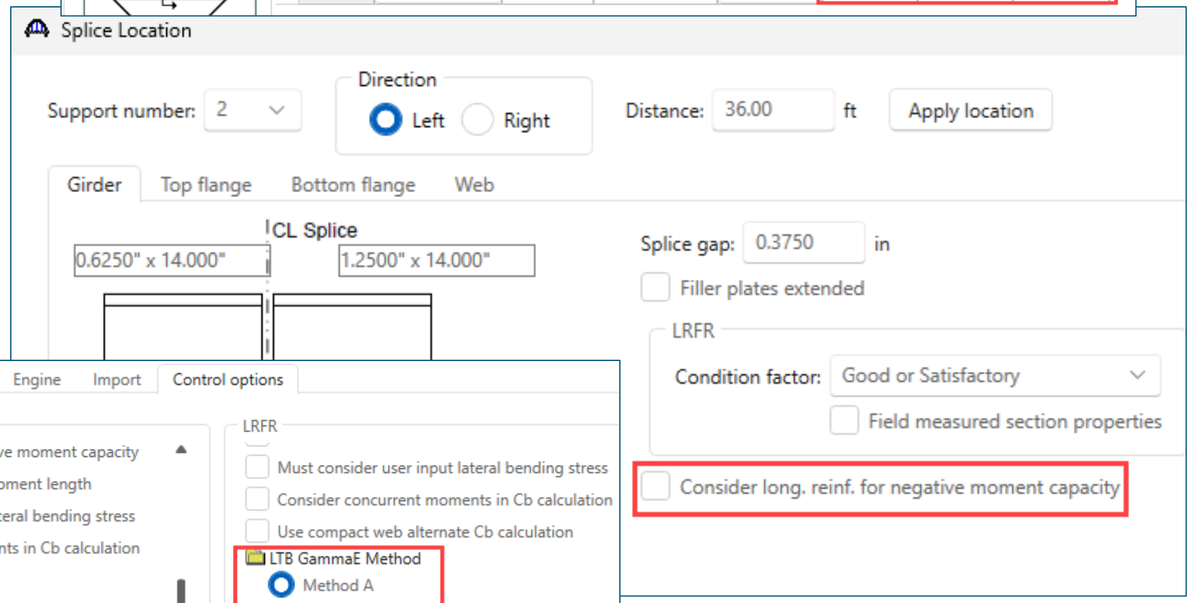


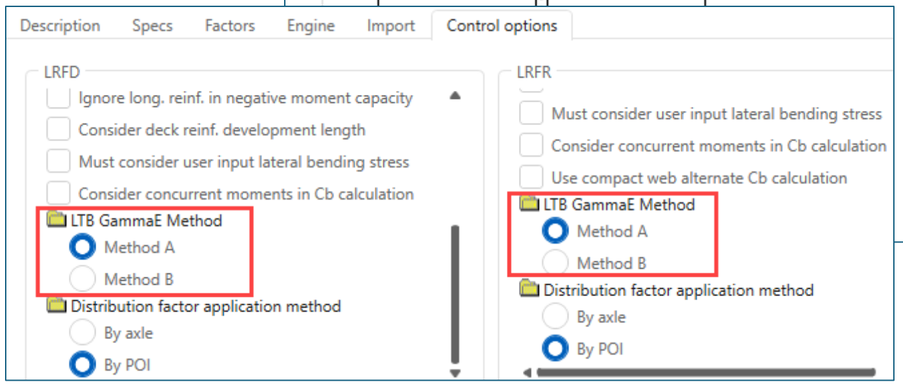
AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- LRFD 10th Edition Specification Updates (Steel)
  - Cross Frame
    - NCHRP 12-113 - Axial rigidity reduction factor
    - Stability check
  - Girder/Floorbeam/Stringer
    - Lateral Torsional Buckling
    - Splice negative moment resistance
    - Splice both thread included for shear plane in transition length
    - Stitch bolts of built-up I girder
    - Shear connector cluster
    - Flexural resistance of tee and double-angle
    - New ASTM F3148 bolt



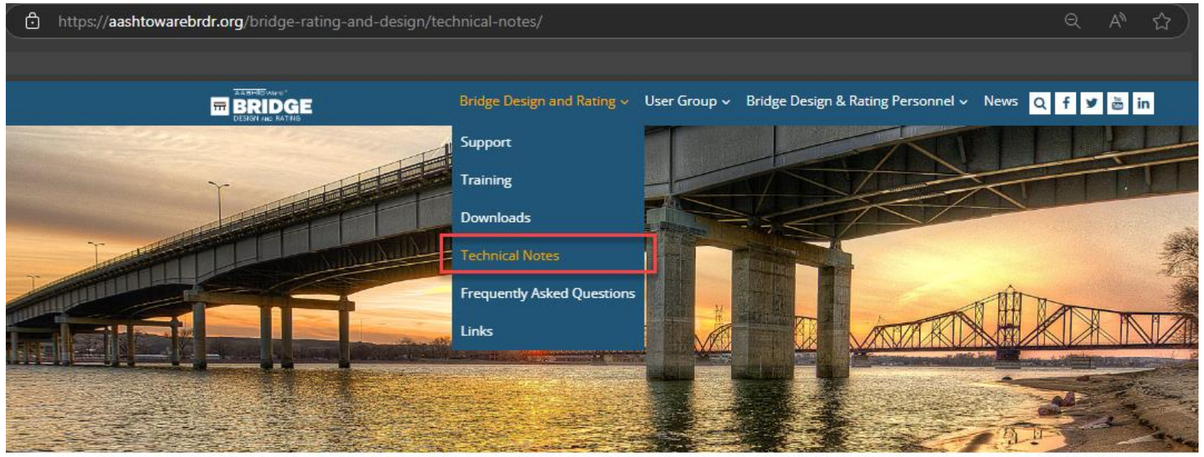


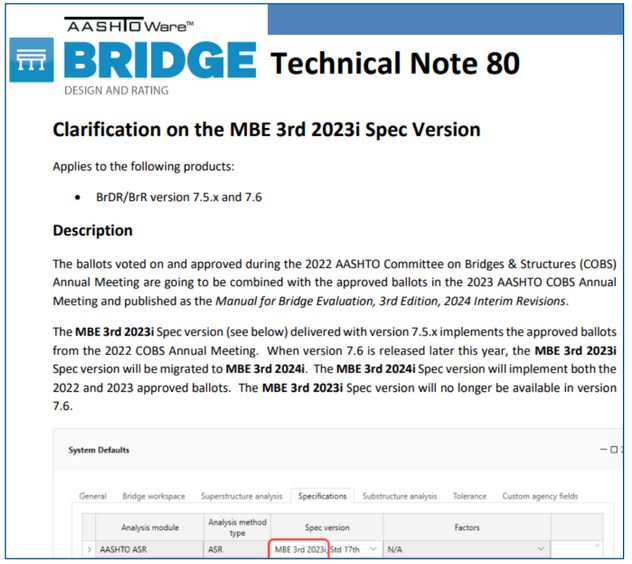


AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- MBE 2024 Interim Specification Updates
  - ***AASHTO has not published MBE Spec Updates since 2022.***
  - ***Refer to Technical Note 80 for additional information***





AASHTOWare™ BRIDGE DESIGN AND RATING

Technical Note 80

Clarification on the MBE 3rd 2023i Spec Version

Applies to the following products:

- BrDR/BrR version 7.5.x and 7.6

Description

The ballots voted on and approved during the 2022 AASHTO Committee on Bridges & Structures (COBS) Annual Meeting are going to be combined with the approved ballots in the 2023 AASHTO COBS Annual Meeting and published as the *Manual for Bridge Evaluation, 3rd Edition, 2024 Interim Revisions*.

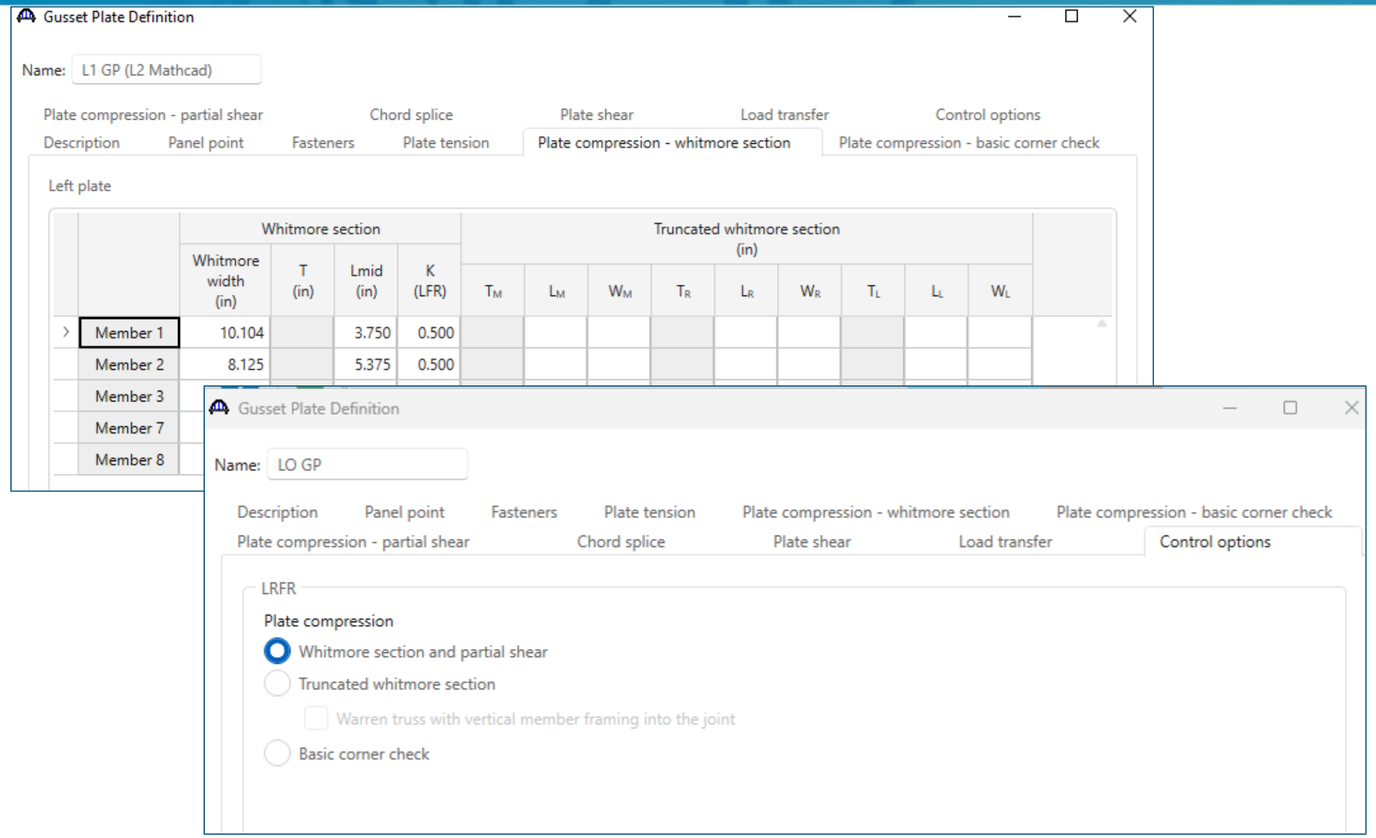
The **MBE 3rd 2023i** Spec version (see below) delivered with version 7.5.x implements the approved ballots from the 2022 COBS Annual Meeting. When version 7.6 is released later this year, the **MBE 3rd 2023i** Spec version will be migrated to **MBE 3rd 2024i**. The **MBE 3rd 2024i** Spec version will implement both the 2022 and 2023 approved ballots. The **MBE 3rd 2023i** Spec version will no longer be available in version 7.6.

AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- MBE 2024 Interim Specification Updates
  - Permit Vehicle considered Notional
    - For ADTT > 500
      - All span lengths:
        - 0.2 klf lane load for negative moment and shear in contraflexure zone
      - Spans between 200’ and 300’
        - 0.2 klf for all actions

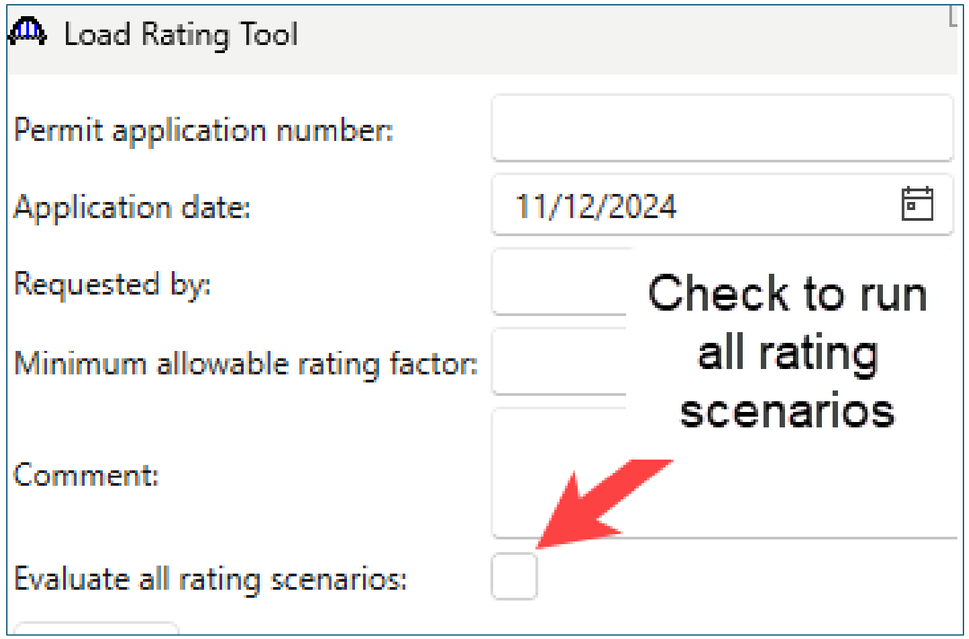
- Gusset plate compression resistance
  - Whitmore section and partial shear
  - Truncated Whitmore section
  - Basic corner check



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

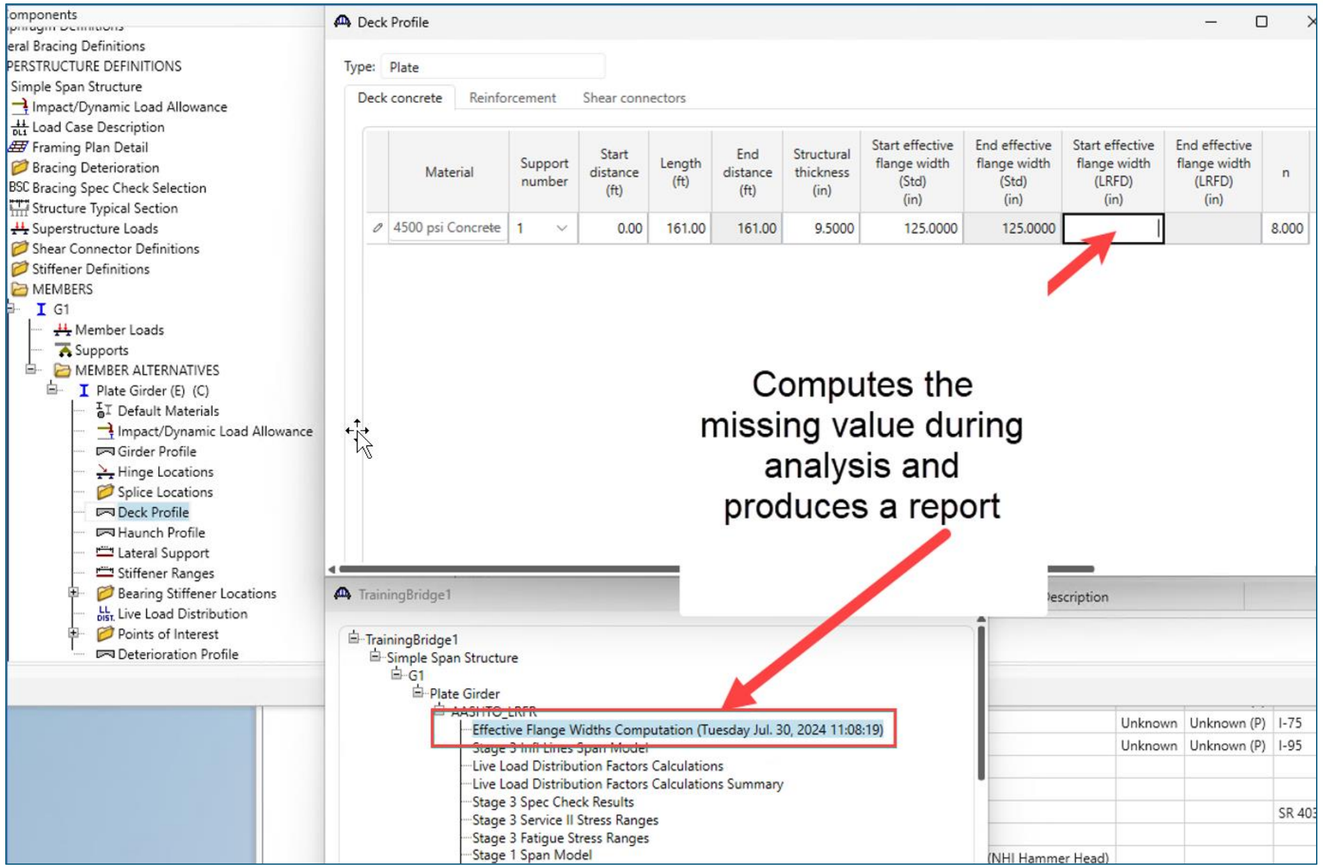
- Rating Tool API
  - Scenarios defined in System Defaults
  - ***Passing scenario does not end analysis***
  - Evaluate all scenarios
  - RF reported for all scenarios



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- Automatically calculate effective flange width if missing for
  - Steel girder
  - PS girder
  - ***No update required for LRFR (for LFR model)***

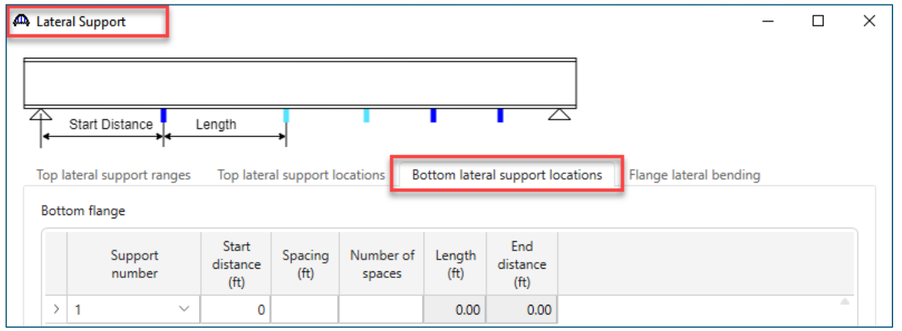


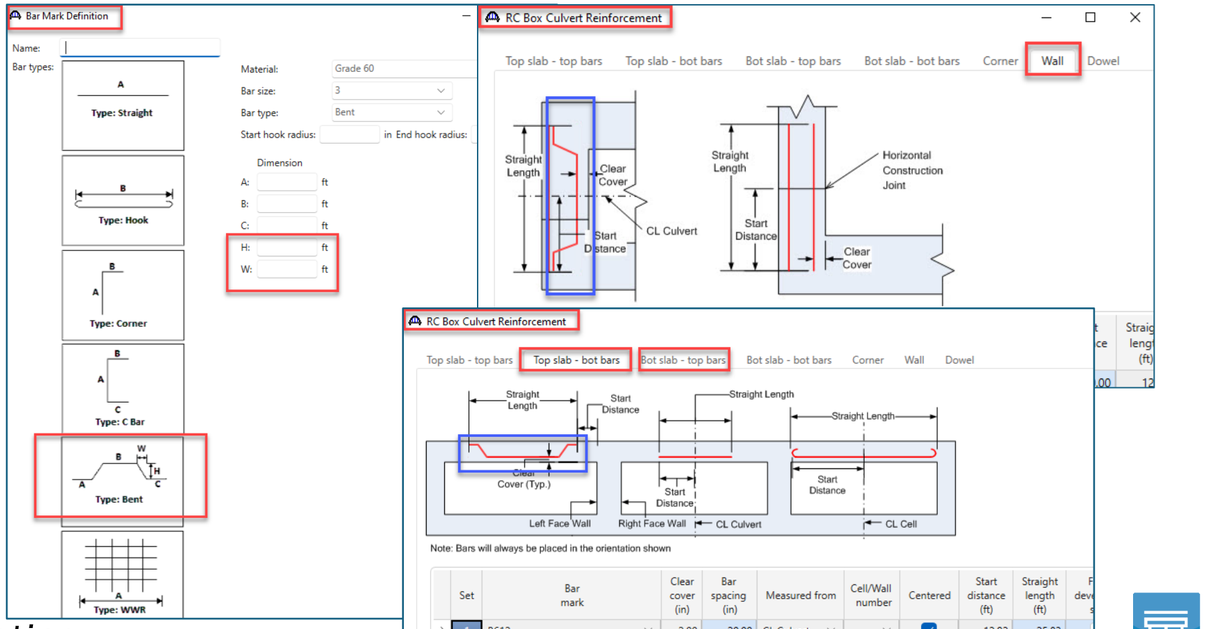
AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- Bottom flange lateral support
  - Girder, floorbeam and stringer

- Bent reinforcement bars for culvert
  - Top and bottom slab for positive moment
  - Wall
  - Custom bar slope



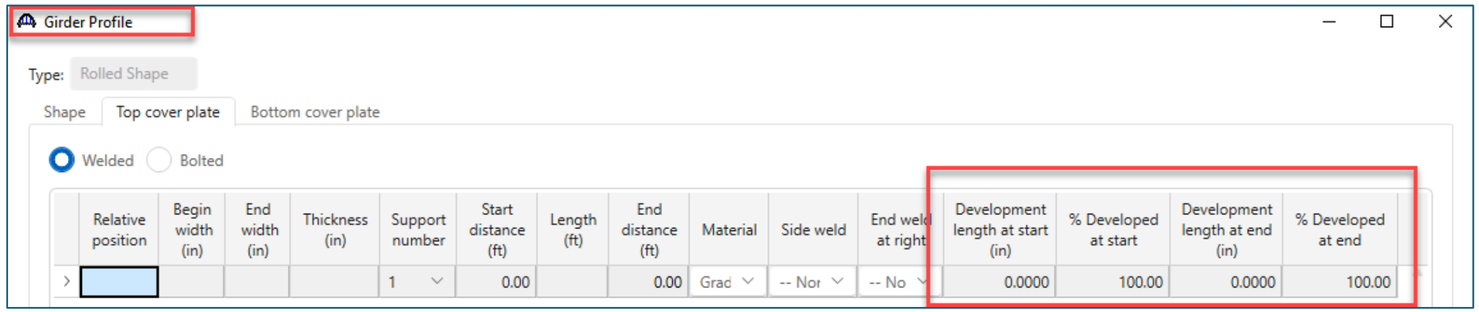


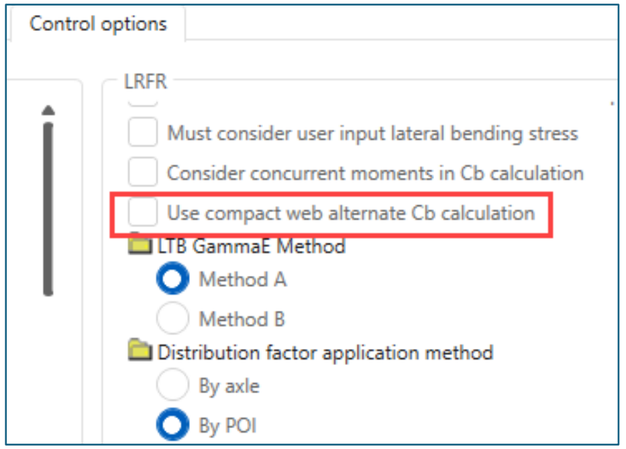
AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

- Cover plate development length
  - Girder, floorbeam and stringer
  - Control option to consider only fully developed cover plate

- Alternate Cb computation method
  - ***Based on AISC Equation C-F1-5***
  - Compact web section only
  - Both envelope and concurrent moment analysis

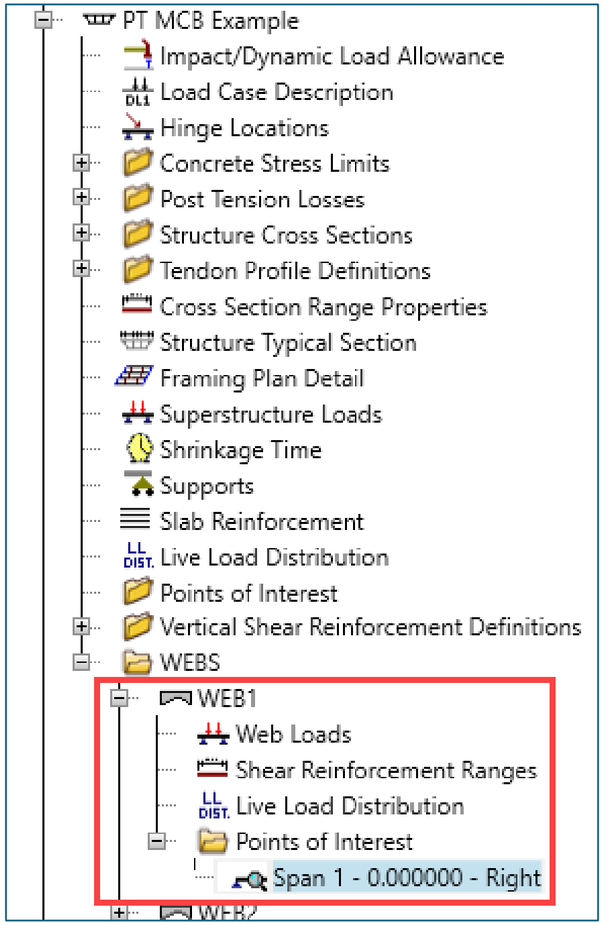




AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Analysis Engine

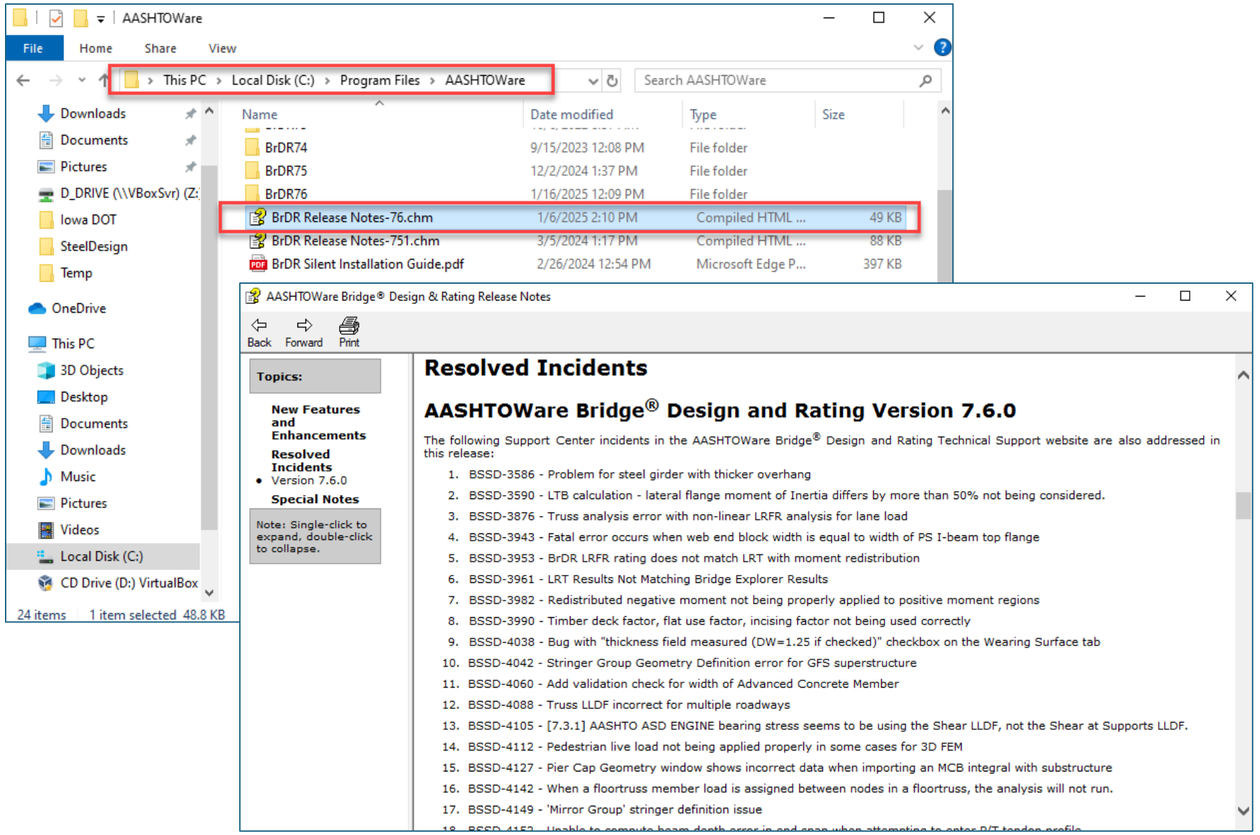
- Multi-cell box web points of interest
  - Standard multi-cell box
  - Advanced multi-cell box



AASHTOWare™ BRIDGE DESIGN AND RATING

7.6 Maintenance

- Sunset Madero engine
- Maintenance items
  - BSSD-1457, 1765, 3693, 3732, 3976, 4224, 4539, 4554, 4694, 4695, 4741, 4769, 4832, 4865, 4877
- Refer to release notes for release bug fixes



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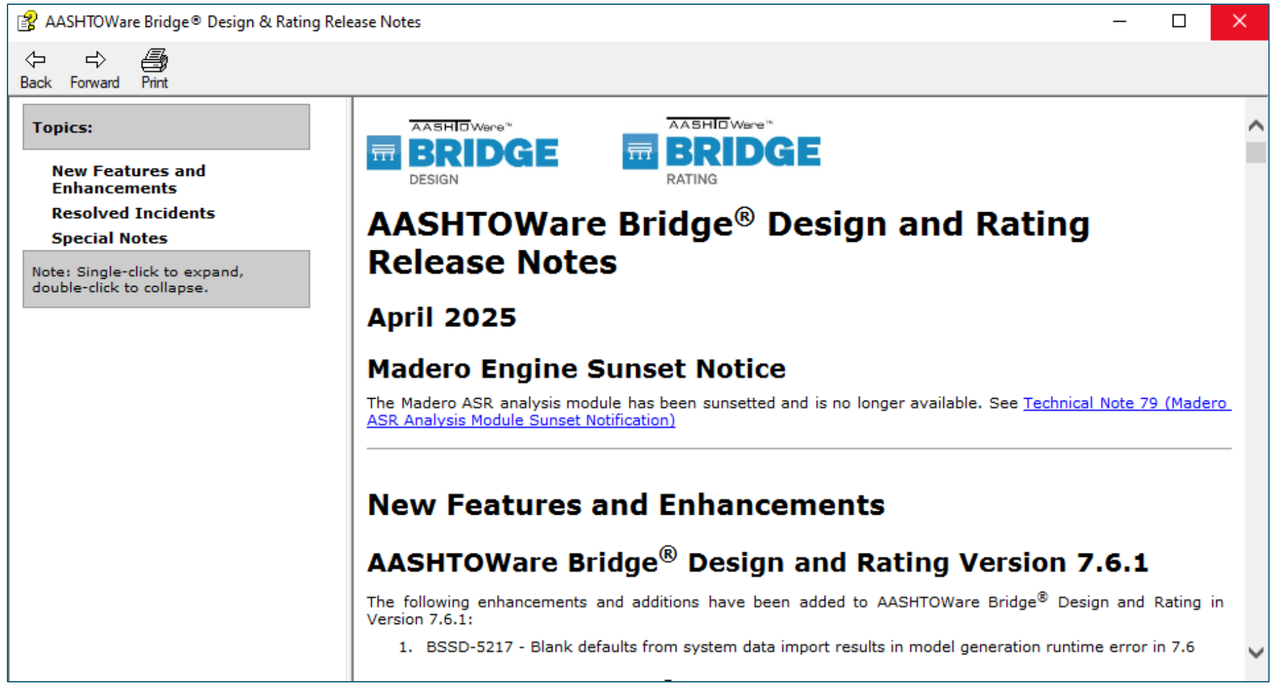
7.6 Maintenance Update (7.6.1)

- V7.6.1 released on 4/28/2025
- Issues addressed
  - 1 maintenance
  - 6 urgent or critical bugs
  - 30 additional bugs
  - No database migration required from 7.6



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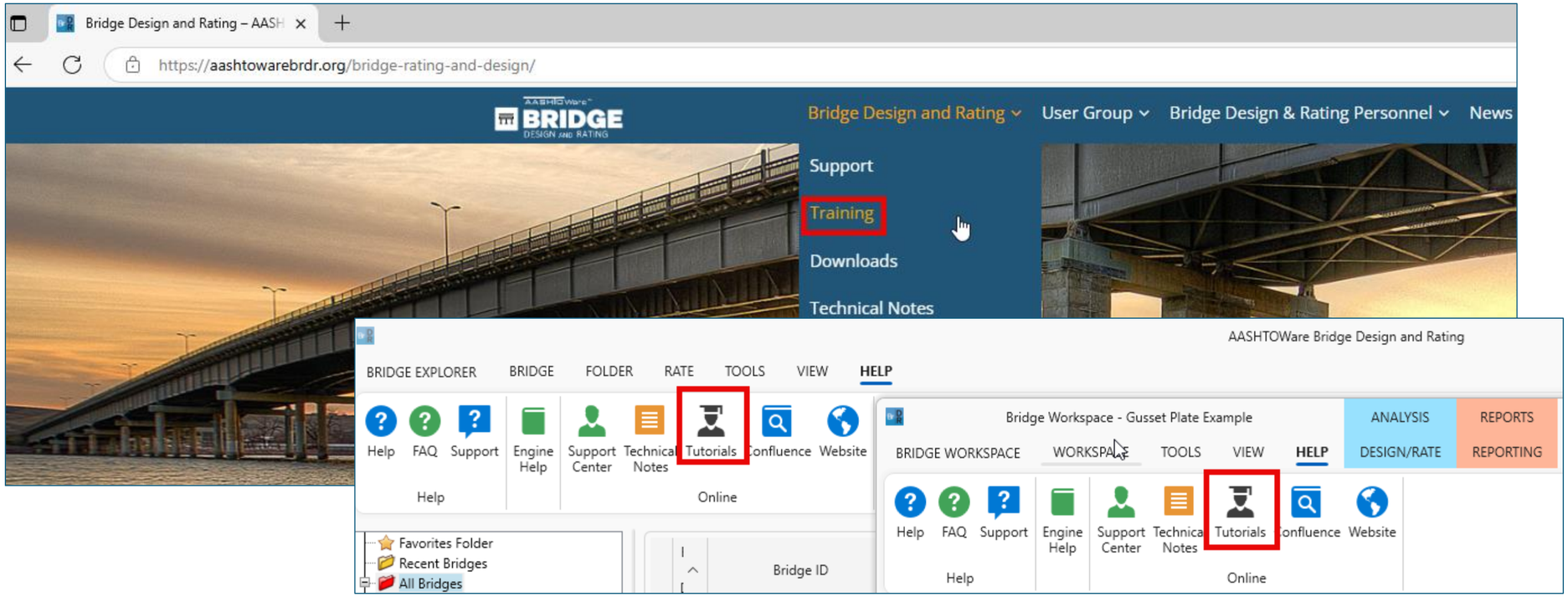
Training Resources - Website

- AASHTOWare Bridge Design and Rating Training page
- Directly accessible from BE and BWS ribbon



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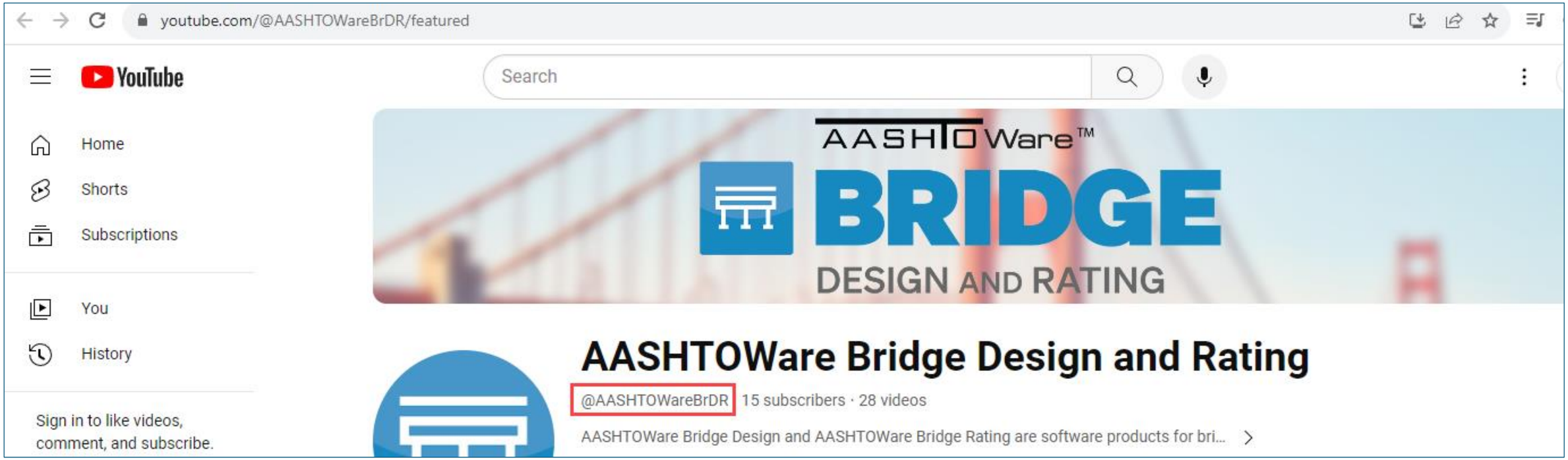
Training Resource – YouTube Channel



Latest Training Resources: Updates and New Manuals

- Update all existing training manuals to 7.5 and later
- New training manuals
  - Getting started with Steel Design Tool
  - Getting started with Active Directory in BrDR
  - Getting started with the Bridge Copy Utility
  - Getting started with BrDR BrM Integration
  - RPT – Report Tool 2.0
  - Efficient Data Transfer: Copying and Pasting Between BrDR and Excel (https://www.youtube.com/@AASHTOWareBrDR)
  - ARC2 – Arc Tool 2.0
  - T7 - Truss LRFD Net Area Deduction In LRFR Truss Rating with BrDR 7.5.0
  - STL14 – LRFD Cb Calculation using Concurrent Moments in LRFR Rating with BrDR 7.5.1
  - 3DFEM5 – Mesh Generation and Dead Load Analysis Example
  - LRFR Concrete Moment Redistribution (“Feature” section)
  - LRFR Concrete Moment Redistribution with BrDR 7.5.1
  - MCB5 – Advanced MCB Example
  - Permit Rating with BrDR 7.6.0
  - 3DFEM6 – Axial Rigidity Coefficient Example with BrDR 7.6.0
  - STL16 – Lateral Torsional Buckling Resistance with BrDR 7.6.0
  - TGP1 – Truss Gusset Plate Example with BrDR 7.6.0

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Questions?