

AASHTOWare Bridge 7.5 Enhancement Highlights

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AASHTOWare RADBUG
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General Enhancement (E)

E1: Advanced Concrete Multicell Box

E2: Report Tool Phase 1

E3: Grid copy and paste

E4: Licensing Mechanism

E5: WiX Installer Phase 2

E6: Capacity Calculator 2.0

E7: ARC Tool Usability Improvements

E8: Update Tutorial

E9: Truss and Gusset Plate Adjacent Vehicle Analysis

E10: Gusset Plate Shear Analysis Improvements

E11: MBE 2023 Interim Update

User Group Enhancement (UG)

UG1: LFR of Curved Steel Girder Spans > 300'

UG2: LRFR Concrete Moment Redistribution

UG3: Culvert Design Tool Final Iteration

UG4: Precomputed Data Window Filter

UG5: Square Rebar

Maintenance Work (M)

M1: Database Maintenance

M2: Rating Method Rename

M3: 3D Mesh Generation Improvements

M4: LRFD Maximum Aggregate Size Input

M5: LRFD Modulus of Rupture Input

M6: Variable Axle Spacing for Permit Trucks

M7: Concurrent Moments for C_b Calculation

M8: Net Area Deduction for Truss LRFR

Service Unit Work (SU)

- SU1: General Preference Additions

E1: Advanced Concrete Multicell Box

- Define multicell box in multiple segments
- Each segment can have different number of cells

Span lengths Segment data

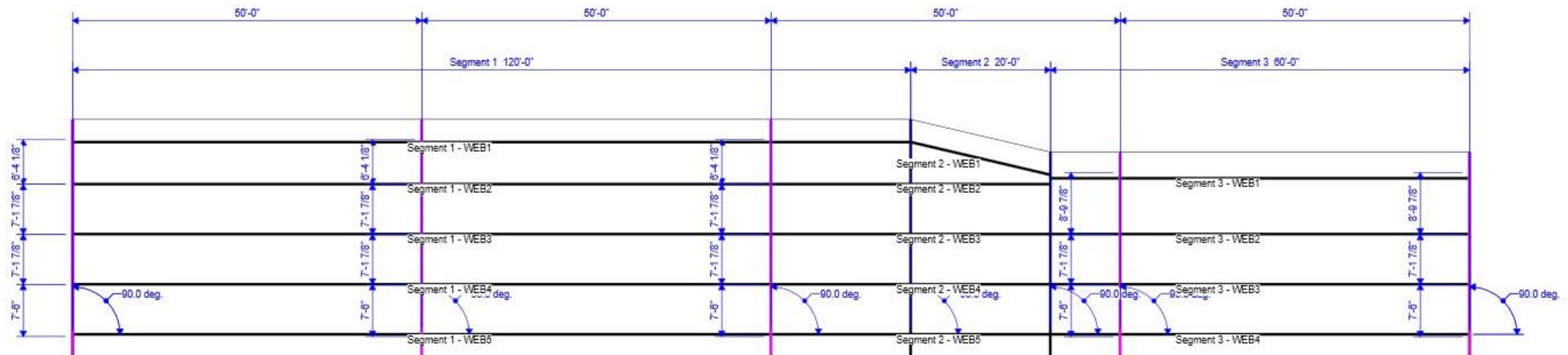
Enter span lengths along the reference line:

Span	Length (ft)
> 1	50.00
2	50.00
3	50.00
4	50.00

Span lengths Segment data

Enter segment lengths along the reference line:

Segment	Length (ft)	Number of cells	Include in analysis
> 1	120.000	4	<input checked="" type="checkbox"/>
2	20.000	4	<input checked="" type="checkbox"/>
3	60.000	3	<input checked="" type="checkbox"/>



E1: Advanced Concrete Multicell Box

- Define horizontal curvature
- Line girder only – LFR and LRFR
- Update for integral pier modeling

Horizontal curvature along reference line

Horizontal curvature

Superstructure alignment

Curved

Tangent, curved, tangent

Tangent, curved

Curved, tangent

Distance from PC to first support line: ft

Start tangent length: ft

Radius: ft

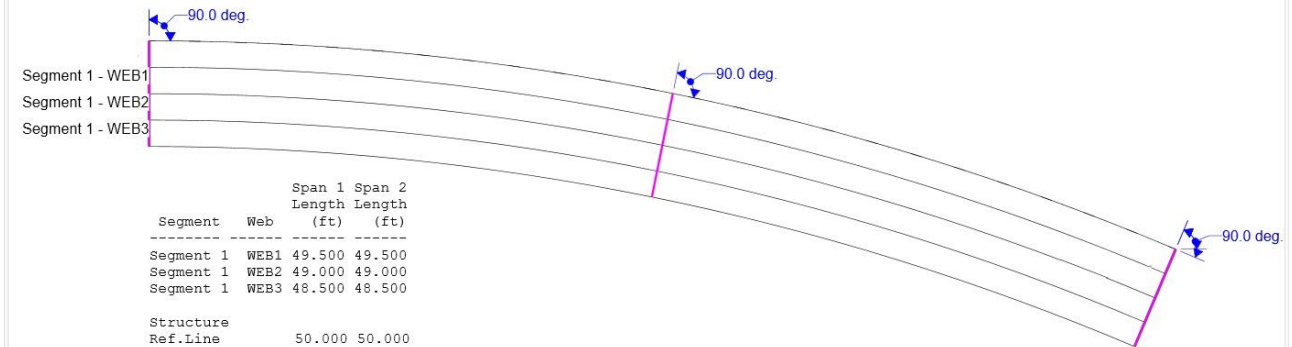
Direction: ▾

End tangent length: ft

Distance from last support line to PT: ft

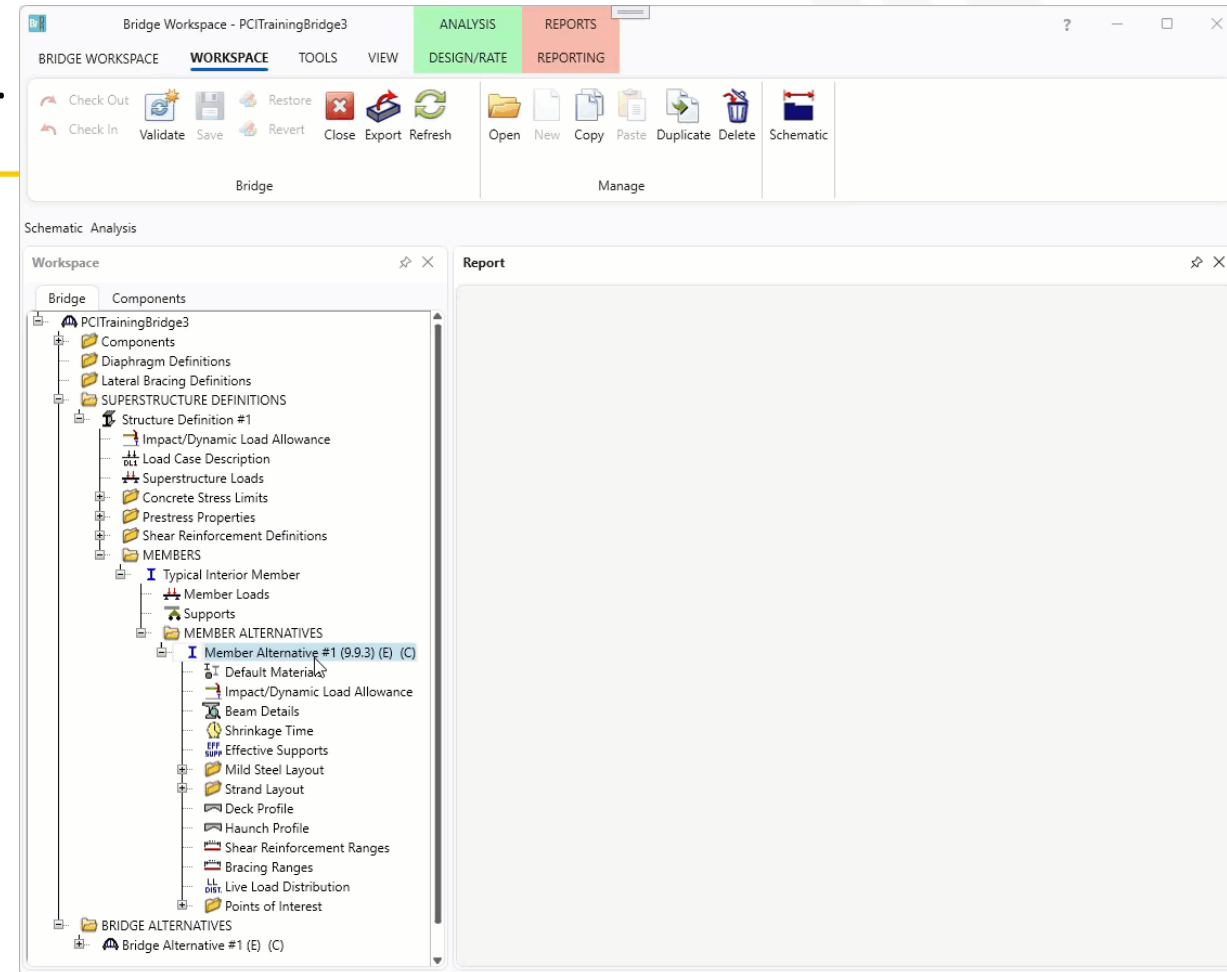
Design speed: mph

Superelevation: %



E2: Report Tool Phase 1

- BWS tree driven reporting
- Report Tool Template Editor
 - Custom BWS Report Templates
 - Drag and drop addition
- Report Tool Viewer
 - BWS tree report preview
 - Select one or more templates
- Only for superstructure with prestressed members



E3: Grid Copy and Paste

- Extend the copy and paste functionality to all grids for
 - BrDR
 - Design Tools
- Grids have “Excel-Like” behavior
 - Single click to select
 - Double click to edit
 - Click and drag selection

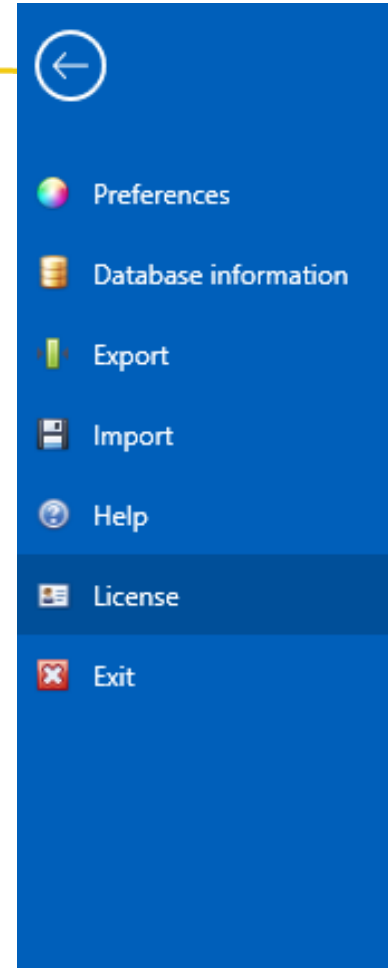
Stiffener Ranges

Transverse stiffener ranges | Longitudinal stiffener ranges

Name	Support number	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> Stiffener	1	0.00	1	58.0000	4.83	4.83
Stiffener	1	4.83	1	135.0000	11.25	16.08
1 Sided Dia C...	1	27.31	1	0.0000	0.00	27.31
Stiffener	1	27.31	1	207.0000	17.25	44.56
1 Sided Dia C...	1	54.14	1	0.0000	0.00	54.14
1 Sided Dia C...	1	54.14	2	322.0000	53.67	107.81
Stiffener	1	107.81	1	161.0000	13.42	121.22
1 Sided Dia C...	1	107.81	1	322.0000	26.83	134.64
Stiffener	1	134.64	1	130.0000	10.83	145.47
Stiffener	1	134.64	1	258.3200	21.53	156.17

E4: License Mechanism

- BrDR Desktop Service – BrDR and Design Tools use the same license
- All license types have a single installer
- Secure exported model with cryptographic signature
- Offline use with license checkout mode (Agency Unlimited Only)



License Information

License ID: [REDACTED]

Sponsored by:

Days left until license expires: 58

Seats left on license: 97

License type: InternalReleaseTesting

Activate License Clear License

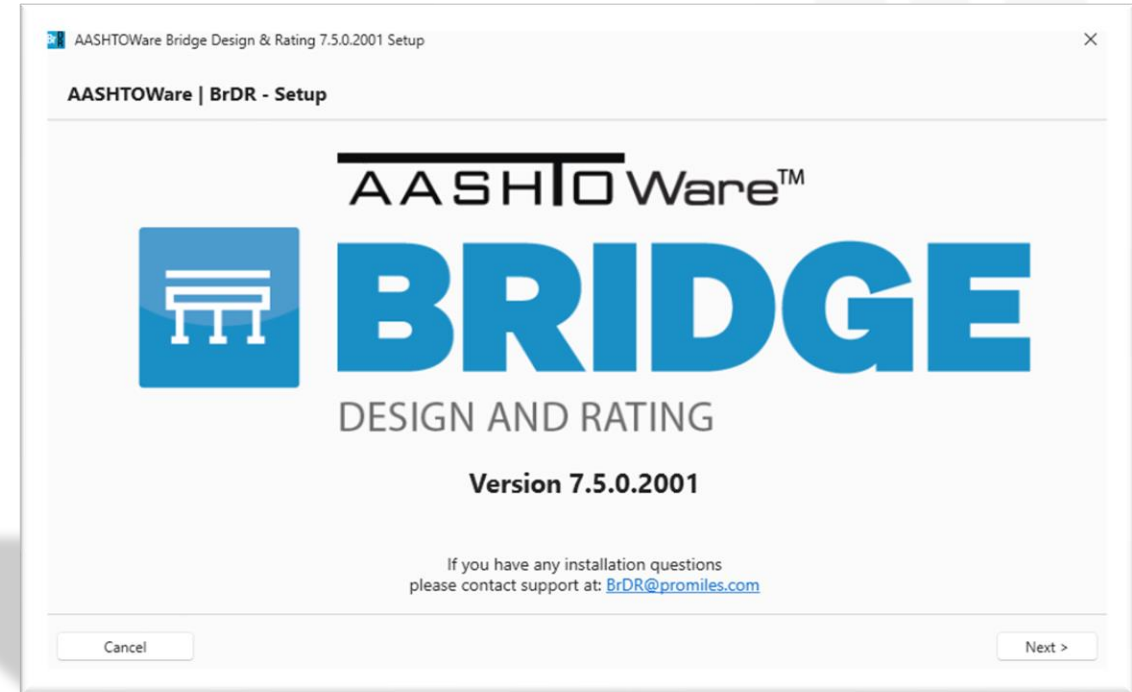
Offline Mode (Checkout)

Checkout Status: False

Checkout

E5: WiX Installer – Phase 2

- New UI
- Improved error handling and recovery
- Improved silent installation commands
- Improved installer modify capability
- Installer upgrade capabilities
- Upgrade to WiX v4 and .NET 6 support

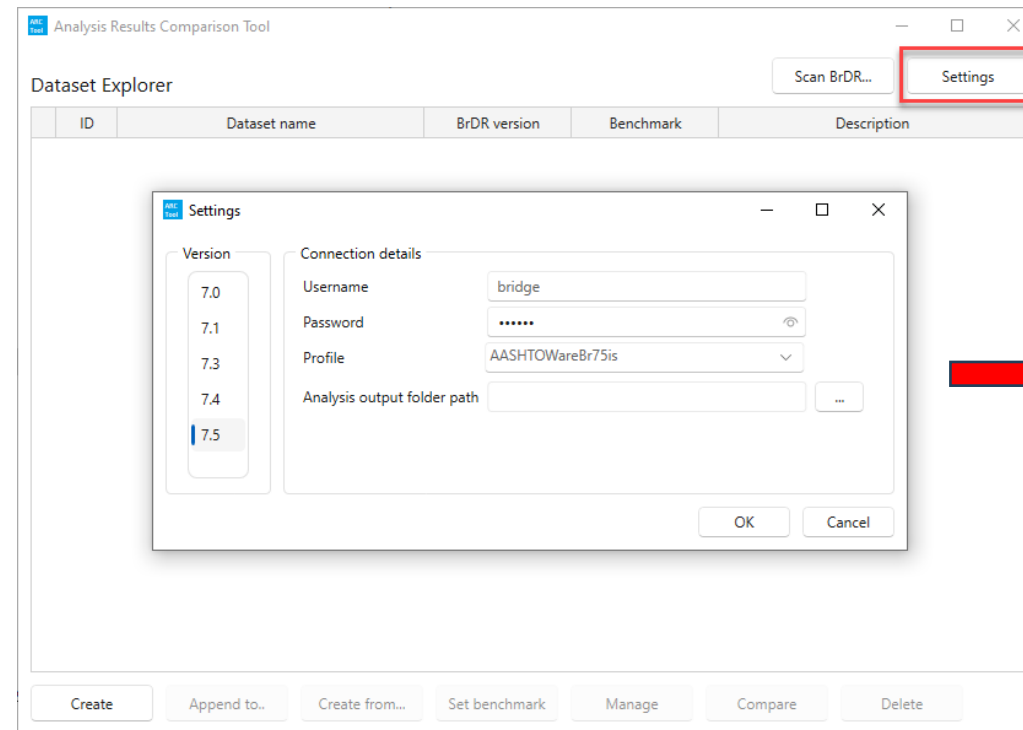


E6: Capacity Calculator 2.0

- Will be used with Engine 2.0 modules
- Based on Cross Section 2.0

E7: ARC Tool Usability

- Settings window for connection settings
- Relocate ARC Tool database
- Add additional columns in UI



E8: Update Tutorials

The screenshot shows a web browser window with the URL <https://www.aashtowarebridge.com/bridge-rating-and-design/training/>. The page features a dark blue header with navigation links: Bridge Management, Bridge Design and Rating, Bridge Personnel, and News. A search bar and social media icons for Facebook, Twitter, YouTube, and LinkedIn are also present. The main content area includes a video player with a list of topics: Superstructure definition and member alternatives, Analysis settings and results, BrD 7.2 - Prestressed Concrete Design Tool (with sub-items: In-Depth System Presentation and Hands-On System Demonstration), and a section titled Tutorials. The Tutorials section is a vertical list of expandable items: 3D FEM Analysis, Advanced Concrete, Bridge As-Built Plans and Models, Culvert, and Distribution Factor Analysis. Each item has a plus sign icon on the right side.

E9: Truss and Gusset Plate Adjacent Vehicle Analysis

- For LFR
 - Truss LFR already supported
 - Gusset plate LFR will be supported
- For LRFR
 - Truss LRFR will be supported
 - Gusset plate LRFR will be supported

E10: Gusset Plate Shear Analysis Improvements

- Consider members for shear plane ignored by AASHTO engine.
- Consider shear plane other than horizontal
- Override partial shear plane angle for partial shear plane along a non-truss member

Description Panel point Fasteners Plate tension Plate compression Chord splice **Plate shear** Plate partial shear Load transfer

Shear reduction factor:

Left plate

Shear plane	Length (in)	Thickness (in)	Number holes	Hole diameter (in)	Override angle	Override angle (Degrees)	Override member selection	Member Selection								
								1	2	3	4	5	6	7	8	
> Vertical	12.00		4.00	0.81	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Horizontal	22.50		8.00	0.81	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Left plate partial shear planes

Member	Shear plane direction	Length (in)	Thickness (in)	Advanced options	Override Angle (Degrees)
> Member 8	Horizontal	10.500		<input checked="" type="checkbox"/>	
Member 8	Vertical	10.625		<input type="checkbox"/>	
Member 2	Horizontal	12.000		<input type="checkbox"/>	
Member 2	Vertical	10.625		<input type="checkbox"/>	

E11: MBE 2023 Interim Update

- Consider concurrent actions for load rating related to shear
- New control option “Consider iterative shear rating”
 - 6A.4.2.1 Shear rating
 - 6A.5.8 Longitudinal reinforcement rating for shear
- New control option “Modify MCFT theta”
- New control option “Modify MCFT 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 $A_v < A_{v\min}$, the beta should be adjusted by applying the size effect. For prestressed concrete beams, if f_{pc}/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-

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

UG1: LFR of Curved Steel Girder Spans > 300'

- 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

UG2: LRFR Concrete Moment Redistribution

- New LRFR control option “Allow moment redistribution”
- General process
 - 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.

UG3: Culvert Design Tool Final Iteration

- Depth of fill not adjusted based on top slab design
- Reinforcement development handling
- Consider cutoff bars for final design
- Consider horizontal joint for design
- Horizontal leg of interior wall consideration for top slab

UG4: Precomputed Data Window Filter

- Filtering option in all columns of the Maintain tab

Precomputed Data

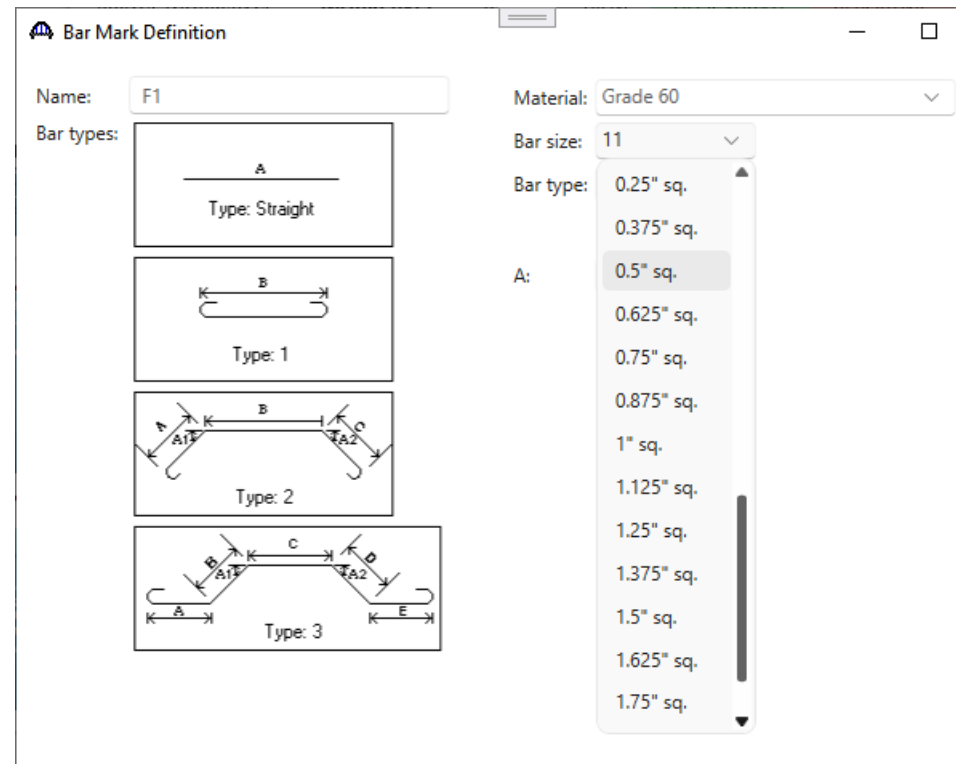
Generate Maintain

Precomputed data					Bridge database				
BID	Bridge ID	NBI structure ID	Date generated	Generated by	Bridge ID	NBI structure ID	Date last modified	Last modified by	Select
32	17941	17941	7/27/2023	Bridge Bridge	17941	17941	7/27/2023	Bridge Bridge	<input type="checkbox"/>
> 33	12684	12684	7/27/2023	Bridge Bridge	12684	12684	7/27/2023	Bridge Bridge	<input type="checkbox"/>

Select All Select Outdated Select Not Found Clear Selected Update Selected Delete Selected

UG5: Square Rebars

- Consider square rebars with nominal diameter

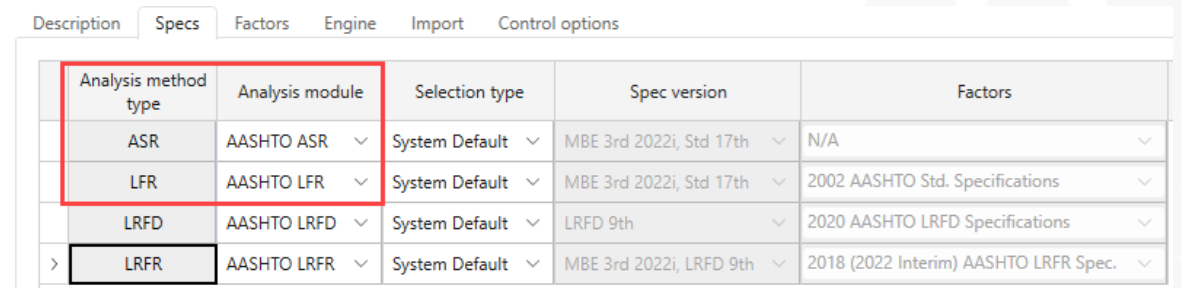


M1: BrDR Database Maintenance

- Database connection pooling
- Reconnect to database automatically
- Encrypt database connection
- Additional Azure connection type
 - Azure MFA
 - Azure Integrated Active Directory

M2: Rating Method Rename

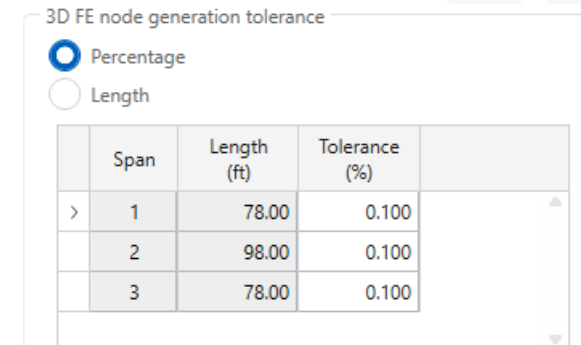
- Rename ASD rating to ASR rating, LFD rating to LFR rating
 - AASHTO engine names
 - Manual for Bridge Evaluation UI notations
 - Method of Solution names
 - Domain API property and method names
 - Analysis API - System type constants
- Does not impact UI notations from ASD or LFD Spec



Analysis method type	Analysis module	Selection type	Spec version	Factors
ASR	AASHTO ASR	System Default	MBE 3rd 2022i, Std 17th	N/A
LFR	AASHTO LFR	System Default	MBE 3rd 2022i, Std 17th	2002 AASHTO Std. Specifications
LRFD	AASHTO LRFD	System Default	LRFD 9th	2020 AASHTO LRFD Specifications
LRFR	AASHTO LRFR	System Default	MBE 3rd 2022i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.

M3: 3D Mesh Generation Improvements

- Limit small elements
- Node merging percentage or length tolerance by span instead of hardcoded 0.1% for all spans



	Span	Length (ft)	Tolerance (%)
>	1	78.00	0.100
	2	98.00	0.100
	3	78.00	0.100

M3: 3D Mesh Generation Improvements

- Model Generation Node Merge Report

ModelGenNodeMergeReport.txt - Notepad

File Edit Format View Help

Model Generation Node Merge Report

Summary

SUCCESS: All girder nodes are defined within the desired tolerance!

Member Nodes

System Length Tolerance = 0.0010 (ft)

G1

--

Distance (ft)	Source Type	Node Type	Added At (ft)	Span	Member Node In Span
0.0000	SECTION CHANGE	NEW	0.0000	1	1
0.0000	TENTH	MERGE	0.0000	1	
0.0000	BRACE	MERGE	0.0000	1	
0.0000	SUPPORT	MERGE	0.0000	1	
16.1000	TENTH	NEW	16.1000	1	2
27.3110	BRACE	NEW	27.3110	1	3
32.2000	TENTH	NEW	32.2000	1	4
36.6667	SECTION CHANGE	NEW	36.6667	1	5
40.0000	TENTH	NEW	40.0000	1	6

M4: LRFD Maximum Aggregate Size Input

- Default value is 1.0

Bridge Materials - Concrete

Name:

Description:

Compressive strength at 28 days (f'c): ksi

Initial compressive strength (f'ci): ksi

Composition of concrete: ▼

Density (for dead loads): kcf

Density (for modulus of elasticity): kcf

Poisson's ratio:

Coefficient of thermal expansion (α): 1/F

Splitting tensile strength (fct): ksi

LRFD Maximum aggregate size: in

Compute

Std modulus of elasticity (Ec): ksi

LRFD modulus of elasticity (Ec): ksi

Std initial modulus of elasticity: ksi

LRFD initial modulus of elasticity: ksi

Std modulus of rupture: ksi

LRFD modulus of rupture: ksi

Shear factor:

Copy to library... Copy from library... OK Apply Cancel

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

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

M5: LRFD Modulus of Rupture Input

Bridge Materials - Concrete v7.4.1

Name: Class A (US)
Description: Class A cement concrete

Compressive strength at 28 days (f'_c): 4.0000006 ksi
Initial compressive strength (f'_{ci}): ksi
Composition of concrete: Normal
Density (for dead loads): 0.15 kcf
Density (for modulus of elasticity): 0.145 kcf
Poisson's ratio: 0.2
Coefficient of thermal expansion (α): 0.0000006 1/F
Splitting tensile strength (f_{ct}): ksi

Compute

Std modulus of elasticity (E_c): 3644.149254 ksi
LRFD modulus of elasticity (E_c): 3644.149254 ksi
Std initial modulus of elasticity: ksi
LRFD initial modulus of elasticity: ksi
Modulus of rupture: 0.4798574 ksi
Shear factor: 1

Bridge Materials - Concrete v7.5

Name: Class A (US)
Description: Class A cement concrete

Compressive strength at 28 days (f'_c): 4.000 ksi
Initial compressive strength (f'_{ci}): ksi
Composition of concrete: Normal
Density (for dead loads): 0.150 kcf
Density (for modulus of elasticity): 0.145 kcf
Poisson's ratio: 0.200
Coefficient of thermal expansion (α): 0.0000060000 1/F
Splitting tensile strength (f_{ct}): ksi
LRFD Maximum aggregate size: in

Compute

Std modulus of elasticity (E_c): 3644.15 ksi
LRFD modulus of elasticity (E_c): 3644.15 ksi
Std initial modulus of elasticity: ksi
LRFD initial modulus of elasticity: ksi
Std modulus of rupture: ksi
LRFD modulus of rupture: 0.48 ksi
Shear factor: 1.000

M6: Variable Axle Spacing for Permit Trucks

- Evaluate variable axle spacing for permit trucks
- Applicable to both LFR and LRFR
- LRFR permit live load factor based on maximum axle spacing

M7: Use Concurrent Moments in C_b Calculations

- New LRFR and LRFD control options “Consider concurrent moments in C_b calculation”
- Use concurrent moments along unbraced length
- Based on LRFD C6.10.8.2.3

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.

M8: Net Area Deduction for Truss LRFR

- Add new input for truss net area deduction
- For existing models
 - Use LFR effective area deduction with a warning

SU1: General Preference Additions

- LRFR Condition Factor
- LRFR System Factor
- Additional self load
 - As load per unit length
 - As percentage



Questions?

A blue-tinted photograph of a long bridge over a body of water. In the foreground, there are large, dark rocks. A small boat is visible on the water in the middle ground. The sky is filled with light clouds. The text "Thank you!" is overlaid in the center in a white, bold, sans-serif font.

Thank you!