



AASHTOWare BrDR Steel Design Tool v7.8

Carolyn Kois, P.E.

Overview

- History
- Capabilities and Limitations
- Design Process
- Features: Design Input
- Features: Design Output
- Additional Information
- Future Direction and Enhancements

History

- Introduced with version v7.2
- Standalone tool with data export supported to BrDR
- Design TAG Established in 2024 to investigate future enhancements
- Direct integration with BrDR in progress for v7.9

Capabilities and Limitations

Design Specifications

- AASHTO LRFD 9th and 10th Editions

Layout

- Single or multi-span straight girder bridges with or without skew are supported
- Splayed or curved girder bridges are not currently supported

Materials

- Can specify different materials for flanges and webs, however cannot specify different materials for positive vs. negative flexure regions

Design Process

- Input validation checks if a design is possible with the parameters, geometry and maximum plate sizes defined in the input
- Initial design for
 - Proportionality
 - Constructability
 - Permanent Deformation
 - Flexure and Fatigue
- Flange transitions
 - Simple spans at 20% and 80% points
 - Multi-span – based on uniform load contraflexure

Design Process

- Shear design
 - Web thickness
 - Transverse stiffener design
 - Bearing stiffener design
- Optimize design
 - Lowest steel volume within input parameters
 - Design ratio greater than minimum design ratio

Design File Library

AASHTOWare Bridge Design: Steel Design Tool

File

- New
- Open
- Save
- Save As
- Print
- Recent
- Library**
- Configuration
- User Settings
- Help
- License
- Close

Import

Appurtenance | Material | Vehicle

Type: Generic

Distance from edge to centroid

Reference line

Load

Width

Effective wind height

Back

Front

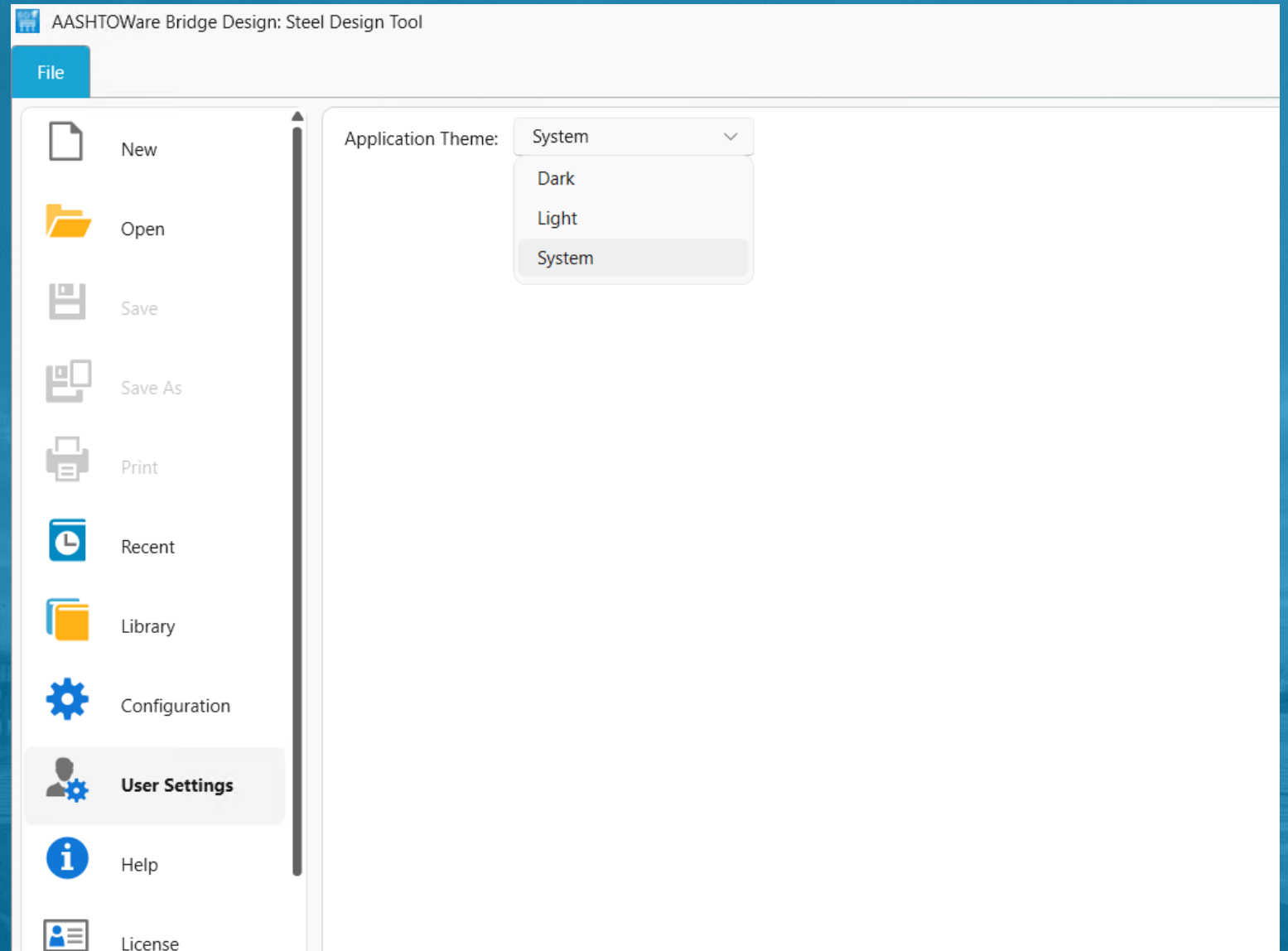
Generic shape

Name	Description	Library type	Distance from edge to centro (in)	Width (in)	Effective wind height* (in)	Barrier load (kip/ft)
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New Duplicate

Design File

User Settings



Design File

Help

AASHTOWare Bridge Design: Steel Design Tool

File

 New

 Open

 Save

 Save As

 Print

 Recent

 Library

 Configuration

 User Settings

 **Help**

 License

Support

 Steel Design Tool Help
Getting help using Steel Design Tool

 Getting Started
See what's new and find resources to help you learn the basics quickly

About AASHTOWare Bridge Design: Steel Design Tool

Version: 7.8.0.3001 (64-bit)

Technical Support
Website: <https://www.aashtowarebrdr.org/bridge-rating-and-design>
Email: BrDR@promiles.com

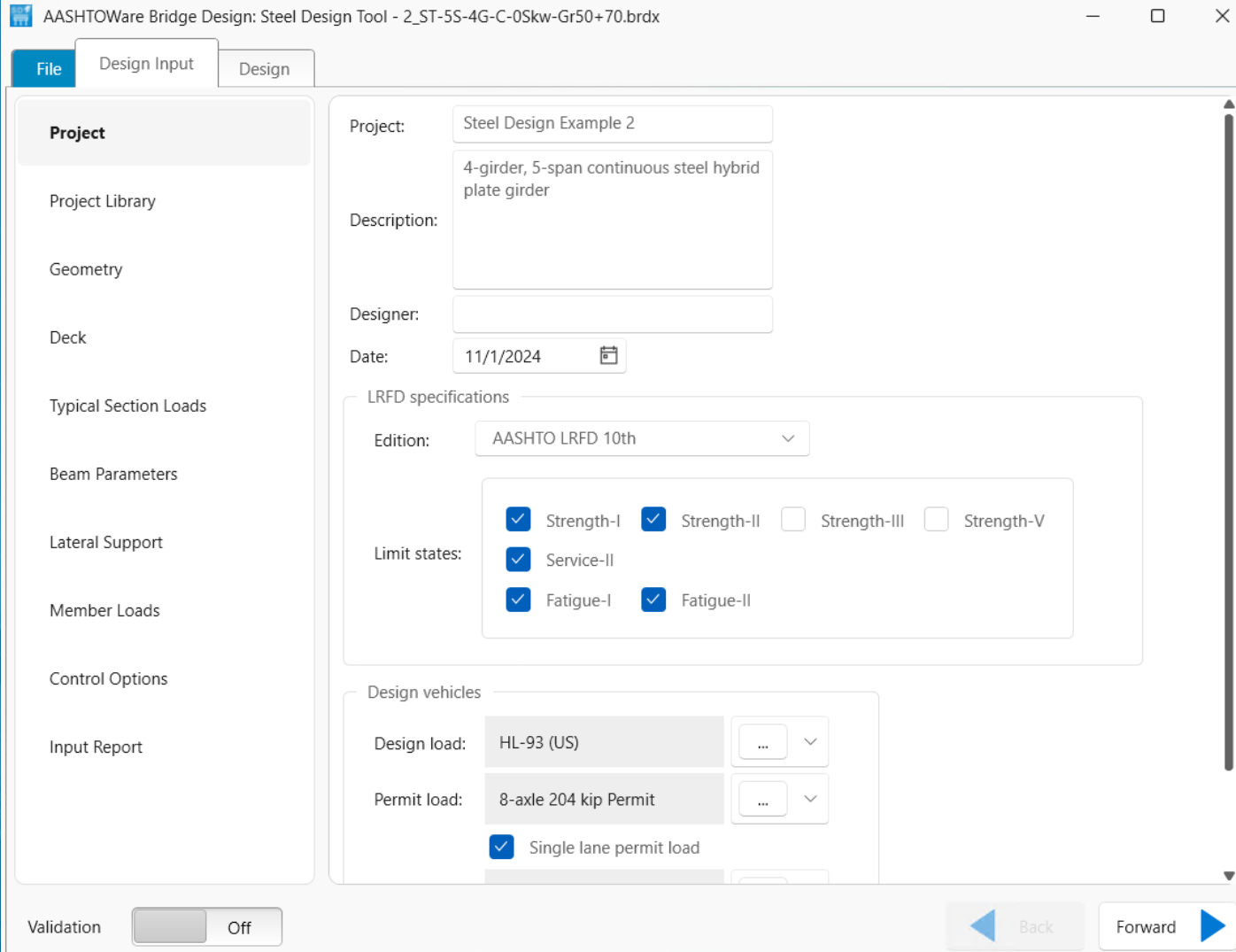
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Design Input

Project

- AASHTO LRFD Bridge Design Specification Edition
- Limit states to consider
- Design vehicles



The screenshot displays the 'AASHTOWare Bridge Design: Steel Design Tool' interface, specifically the 'Design Input' tab. The window title is 'AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx'. The interface includes a sidebar on the left with a 'Project' section containing options like 'Project Library', 'Geometry', 'Deck', 'Typical Section Loads', 'Beam Parameters', 'Lateral Support', 'Member Loads', 'Control Options', and 'Input Report'. The main area is divided into several input fields: 'Project' (Steel Design Example 2), 'Description' (4-girder, 5-span continuous steel hybrid plate girder), 'Designer' (empty), 'Date' (11/1/2024), 'LRFD specifications' (Edition: AASHTO LRFD 10th), 'Limit states' (Strength-I, Strength-II, Strength-III, Strength-V, Service-II, Fatigue-I, Fatigue-II), and 'Design vehicles' (Design load: HL-93 (US), Permit load: 8-axle 204 kip Permit, Single lane permit load). At the bottom, there is a 'Validation' section with a toggle set to 'Off' and navigation buttons for 'Back' and 'Forward'.

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Project: Steel Design Example 2

Description: 4-girder, 5-span continuous steel hybrid plate girder

Designer:

Date: 11/1/2024

LRFD specifications

Edition: AASHTO LRFD 10th

Limit states:

☒ Strength-I ☒ Strength-II ☐ Strength-III ☐ Strength-V

☒ Service-II

☒ Fatigue-I ☒ Fatigue-II

Design vehicles

Design load: HL-93 (US)

Permit load: 8-axle 204 kip Permit

☒ Single lane permit load

Validation Off

Back Forward

Design Input

Bridge Geometry

- Number of spans and span length
- Number of beams
- Support skew
- Number of design lanes
- Support constraints

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Superstructure definition type: System definition

Number of spans: 5

Number of beams: 4

Girder spacing: 12 ft

Support skew: 0 Degrees

Number of design lanes: 3

Spans:

	Span	Length (ft)
>	1	190.00
	2	240.00
	3	240.00
	4	240.00
	5	190.00

Supports:

	Support	Support type
>	1	Roller
	2	Roller

Validation ☐ Off

Back Forward

Design Input

Deck

- Concrete Material
- Reinforcement Material
- Thickness
- Overhang
- Haunch
- Composite or non-composite
- Shear connector detail

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Deck concrete: Deck Concrete

Deck total thickness: 9.5 in

Deck structural thickness: 9 in

Deck reinforcement

Material: Grade 60

	Support	Start distance (ft)	Length (ft)	End distance (ft)	Bar size	Clear cover (in)
>	1	0.00	1100.00	1100.00	6	2.000
	1	0.00	1100.00	1100.00	5	1.500

Deck overhang: 4.8675 ft

Haunch depth: 4.5 in

Validation Off

Back Forward

Design Input

Typical Section Loads

- Appurtenances
- Wearing surface
- Diaphragms
- Load distribution method

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Stage 2 load distribution: ☒ Uniformly to all girders
☐ By tributary area
☐ By percentage: Exterior: 50 % First interior: 50

Wearing surface: Thickness: 2.5 in Density: 150 pcf

Appurtenance loads:

Parapet Median Railing Generic Sidewalk

Back Front

	Name	Stage	Load type	Measure to	Edge of deck distance measured from	Distance at start (ft)
>	42" F-shape	Stage 2	DC	Back	Left Edge	0.00
	42" F-shape	Stage 2	DC	Back	Right Edge	0.00

Validation ☐ Off

Back Forward

Design Input

Member Loads

- Distributed
- Concentrated
- Pedestrian

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

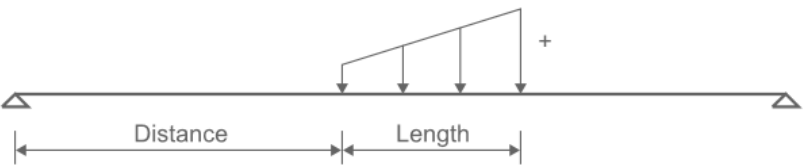
Lateral Support

Member Loads

Control Options

Input Report

Distributed Concentrated Pedestrian



	Beam	Name	Stage	Load type	Support	Start distance (ft)
>	1	SIP forms	Stage 1	DC	1	0.0
	1	Misc steel wei...	Stage 1	DC	1	0.0
	2	SIP forms	Stage 1	DC	1	0.0
	2	Misc steel wei...	Stage 1	DC	1	0.0
	3	SIP forms	Stage 1	DC	1	0.0
	3	Misc steel wei...	Stage 1	DC	1	0.0
	4	SIP forms	Stage 1	DC	1	0.0
	4	Misc steel wei...	Stage 1	DC	1	0.0

New Duplicate Delete

Validation Off

Back Forward

Design Input

Beam Parameters

- Web depth
- Top Flange and Bottom Flange
Min./Max. width and increment
- Web, Top Flange, Bottom Flange
Min./Max. thickness and increment
- Use transverse stiffeners
- Steel materials
Web, top flange, bottom flange,
transverse stiffeners, bearing stiffeners

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Section configuration

Web	Min	Max	Increment
Depth	96 in	96 in	
Thickness	0.7500	0.7500	1/16"

Top flange	Min	Max	Increment
Width	20 in	24 in	2 in
Thickness	1.3750	2.1250	1/8"

Bottom flange	Min	Max	Increment
Width	22 in	26 in	2 in
Thickness	1.3750	2.1250	1/8"

☒ Use transverse stiffeners

Beam	One sided	Max spacing (in)
> Exterior	☒	288
Interior	☒	288

Validation

Back Forward

Design Input

Lateral Support

- Top Flange Lateral Support
- As a range
- At discrete locations

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Top Flange Lateral Support:

Ranges Locations

Support	Start distance (ft)	Length (ft)	End distance (ft)
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New Duplicate Delete

Validation ☐ Off

Outlook Forward

Design Input

Control Options

- Moment redistribution
- Appendix A6
- Plastic analysis
- Longitudinal reinforcement in negative moment capacity
- Deck reinforcement development length

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

☐ Allow moment redistribution

☐ Use appendix A6 for flexural resistance

☐ Allow plastic analysis

☐ Ignore longitudinal reinforcement in negative moment capacity

☐ Consider deck reinforcement development length

LTB gamma E method:

☒ Method A

☐ Method B

Validation

Back Forward

Design Input

Input Report

AASHTOWare Bridge Design: Steel Design Tool - 2_ST-5S-4G-C-0Skw-Gr50+70.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Lateral Support

Member Loads

Control Options

Input Report

Project

Project: Steel Design Example 2
Description: 4-girder, 5-span continuous steel hybrid plate girder
Designer:
Date: 11/01/2024

LRFD specifications

Edition: AASHTO LRFD 10th
Limit states: Strength-I, Strength-II, Service-II, Fatigue-I, Fatigue-II

Design vehicles

Design load: HL-93 (US)
Permit load: 8-axle 204 kip Permit
Single lane permit load: True
Fatigue load: LRFD Fatigue Truck (US)

Design ADTT: 700

Project Library

Appurtenance

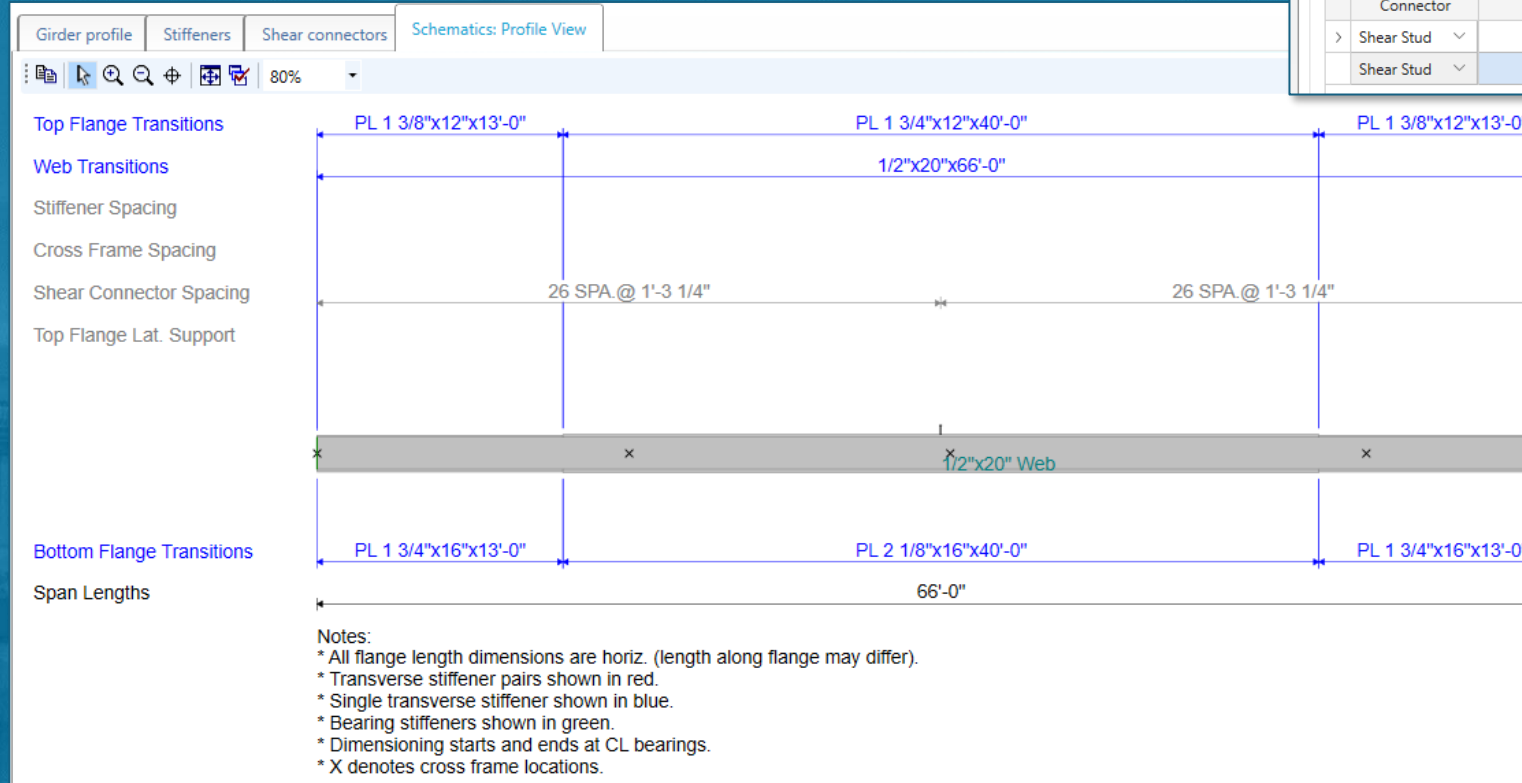
Parapet

Name	Description	Distance from edge to centroid (in)	X1 (in)	X2 (in)	X3 (in)
42" F-shape			12.0000	3.3750	4.8750

Validation ☐ Off

Back Forward

Design Output



Shear Connectors								
Stud Height:		6.000 in						
Steel Minimum Tensile Strength:		60.000 ksi						
Shear Connector	Number per Row	Number of Spaces	Transverse Spacing (in)	Support	Start Distance (ft)	Length (ft)	End Distance (ft)	
> Shear Stud	2	26	9.100	1	0.000	33.000	33.000	
Shear Stud	2	26	9.100	1	33.000	33.000	66.000	

Design				
Design input	Design review	Shear connector design	Beam: 1	Minimum design ratio: 1
Design run				
Design run	Description		Critical design ratio	Pin
1-I1.1	G1 - Design (Volume = 28.0ft^3)		✓ 1.010	

Girder profile						
Web:						
Depth (in)	Thickness (in)	Support	Start distance (ft)	Length (ft)	End distance (ft)	
> 20.000	0.500	1	0.000	66.000	66.000	

Design Output

DL and LL Actions for each load case and load stage

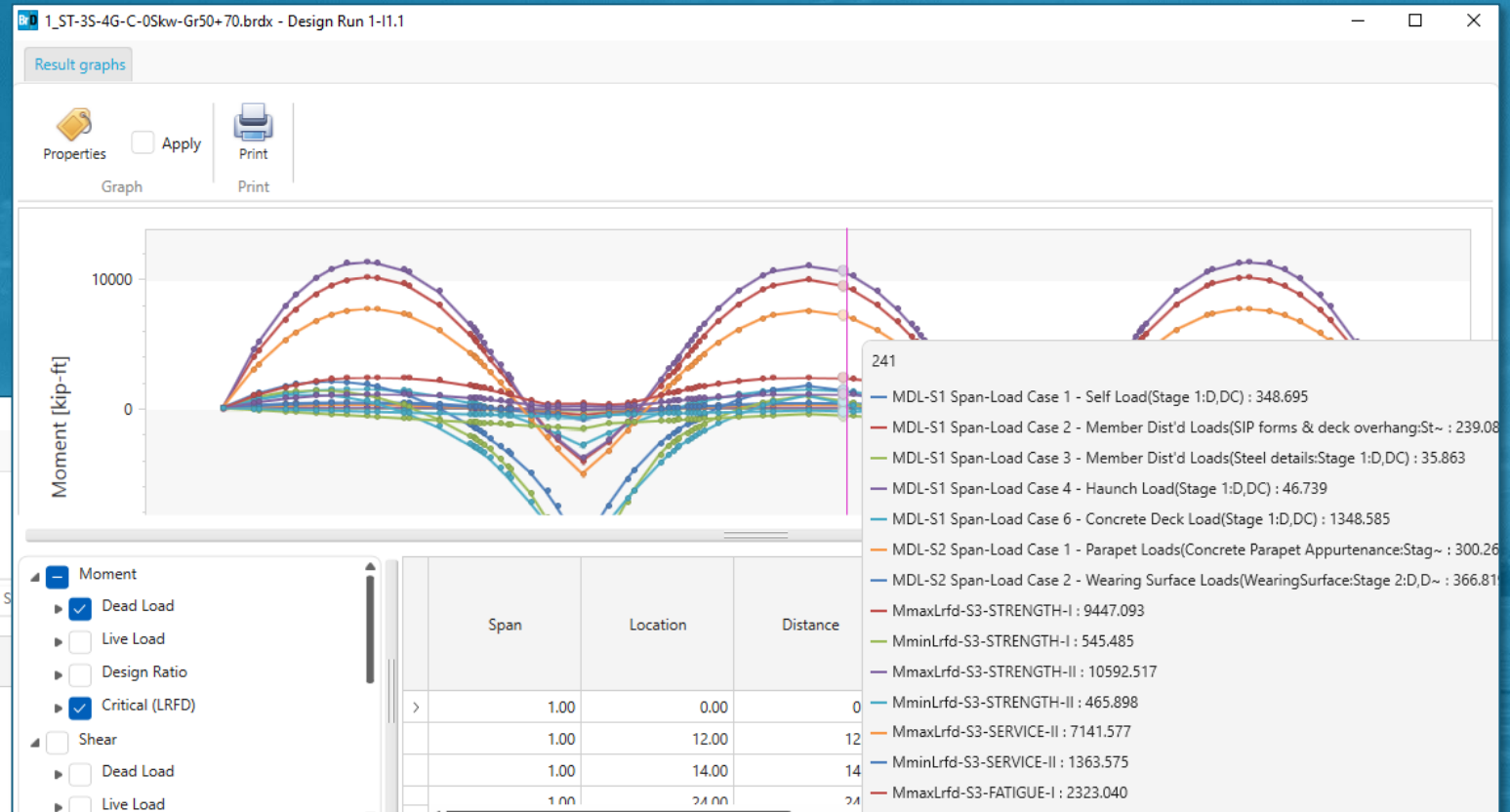
1_ST-3S-4G-C-0Skw-Gr50+70.brdx - Design Run 1-11.1

Tabular results

Print

Report type: Dead Load Actions Stage: Stage 1 Dead load case: Load Case 1 - S

	Span	Location	Moment (kip-ft)	Shear (kip)	Axial (kip)	Reaction (kip)	X deflection (in)	Y deflection (in)
	1	0.00	0.00	18.03	0.00	18.03	0.0000	0.0000
	1	12.00	191.82	13.94	0.00		0.0000	-0.1568
	1	14.00	219.00	13.25	0.00		0.0000	-0.1816
	1	24.00	334.45	9.84	0.00		0.0000	-0.2954
	1	28.00	371.06	8.47	0.00		0.0000	-0.3350



Design Output

Detailed Specification Checks

1_ST-3S-4G-C-0Skw-Gr50+70.brdx - Design Run 1-11.1

Specification checks

Properties ☐ Apply ☒ Generate

Articles: All articles

Format: Bullet list

Report

Specification filter

Superstructure Compon

- Stage 1
- Stage 2
- Stage 3
 - G1
 - Span 1 - 0.00
 - Span 1 - 12.00
 - Span 1 - 14.00
 - Span 1 - 24.00
 - Span 1 - 28.00
 - Span 1 - 36.00
 - Span 1 - 42.00
 - Span 1 - 48.00
 - Span 1 - 56.00
 - Span 1 - 60.00
 - Span 1 - 70.00
 - Span 1 - 72.00
 - Span 1 - 84.00
 - Span 1 - 96.00

Specification reference

Specification reference	Pass/Fail
1.3.2.1 Design Philosophy - Limit State - General	General Co
✓ 2.5.2.6.2 Criteria for Deflection	Passed
4.6.2.7.1 I-Sections - Lateral Wind Load Distribution in Multibeam Brid	General Co
5.4.2.6 Modulus of Rupture	General Co
5.4.2.8 Concrete Density Modification Factor	General Co
6.10.1 Estimated Flange Lateral Bending Stress Proportioning	General Co
6.10.1.1.1b Stresses for Sections in Positive Flexure	General Co
6.10.1.10.1 Hybrid Factor, Rh	General Co
6.10.1.10.2 Web Load-Shedding Factor, Rb	General Co
✓ 6.10.1.6 Flange Stress and Member Bending Moments	Passed
✓ 6.10.1.7 Minimum Negative Flexure Concrete Deck Reinforcement	Passed
6.10.1.9.1 Webs without Longitudinal Stiffeners	General Co
✓ 6.10.11.1.2 Transverse Stiffeners - Projecting Width	Passed
✓ 6.10.11.1.3 Transverse Stiffeners - Moment of Inertia	Passed
✓ 6.10.2 Cross-Section Proportion Limits	Passed
✓ 6.10.4.2.2 Flexure	Passed
NA 6.10.5.3 Special Fatigue Requirement for Webs	Not Applicable
6.10.6.2.2 Composite Sections in Positive Flexure	General Comp.

Spec Check Detail for 2.5.2.6.2 Criteria for Deflection

2 General Design and Location Features

2.5 Design Objectives

2.5.2 Serviceability

2.5.2.6 Deformations

2.5.2.6.2 Criteria for Deflection
(AASHTO LRFD Bridge Design Specifications, Ninth Edition)

Steel Plate - At Location = 28.0000 (ft) - Right Stage 3

Section within Top Flange Continuous Bracing Region

Calculation of Deflection

Span Length = 140.000 (ft)

Vehicular Load Deflection Limit = Span Length / 800 (Article 2.5.2.6.2)

Vehicular and/or Pedestrian Load Deflection Limit = Span Length / 1000 (Article 2.5.2.6.2)

HL-93 (US)

Vehicle	Deflection
Design Truck	-0.471 (inches)
Design Lane	-0.307 (inches)
Pedestrian	0.000 (inches)

Vehicle	Deflection (inch)	Deflection Limit (inch)	Design Ratio	Pass/Fail
Design Truck	-0.471	2.100	4.456	PASS
0.25*Design Truck + Design Lane	-0.424	2.100	4.948	PASS

OK

Design Output Reports

1_ST-3S-4G-C-0Skw-Gr50+70.brdx - Design Run 1-11.1

Engine outputs

Properties Apply Open folder

Output

Category	Description
> Reinforcement Development Len...	Stage 2 Deck Reinforcement Development Length Calculations
Reinforcement Development Len...	Stage 3 Deck Reinforcement Development Length Calculations
FE Analysis	Stage 3 3 Infl Lines Finite Element Model and Load Cases
FE Analysis	Stage 3 3 Infl Lines Element Actions, Support Reactions, and Nodal Displacem
LL Distribution	Live Load Distribution Factors Calculations
LL Distribution	Live Load Distribution Factors Calculations Summary
Specification Checks	Stage 3 Spec Check Results

LRFD Dist Factor Summary.TXT - Notepad

File Edit Format View Help

Bridge: .
Bridge ID: NBI Structure ID:
BID:

Superstructure Def: .
Member: G1
Member Alternative: G1

Date: 8/2/2024 Time: 11:56:34 AM

AASHTO LRFD Bridge Design Specifications, Edition 9, Interim 0

Moment Distribution Factor Schedule

Start Distance (ft)	End Distance (ft)	Single Lane DF (Lanes)	Multi Lane DF (Lanes)
0.00	103.50	0.875(L)	0.938(R)
103.50	177.04	0.875(L)	0.938(R)
177.04	277.96	0.875(L)	0.938(R)
277.96	351.50	0.875(L)	0.938(R)
351.50	455.00	0.875(L)	0.938(R)

Shear Distribution Factor Schedule

Start Distance (ft)	End Distance (ft)	Single Lane DF (Lanes)	Multi Lane DF (Lanes)
0.00	140.00	0.875(L)	0.938(R)
140.00	315.00	0.875(L)	0.938(R)
315.00	455.00	0.875(L)	0.938(R)

Deflection Distribution Factor Schedule

Start	End	Single Lane	Multi Lane

Ln 1 Col 1 100% Windows (CRLF) UTF-8

BrDR XML Report Viewer

Bridge ID :
Bridge :
Superstructure Def : Steel Design Tool Example 1
Member : G1
Analysis Preference Setting : NA

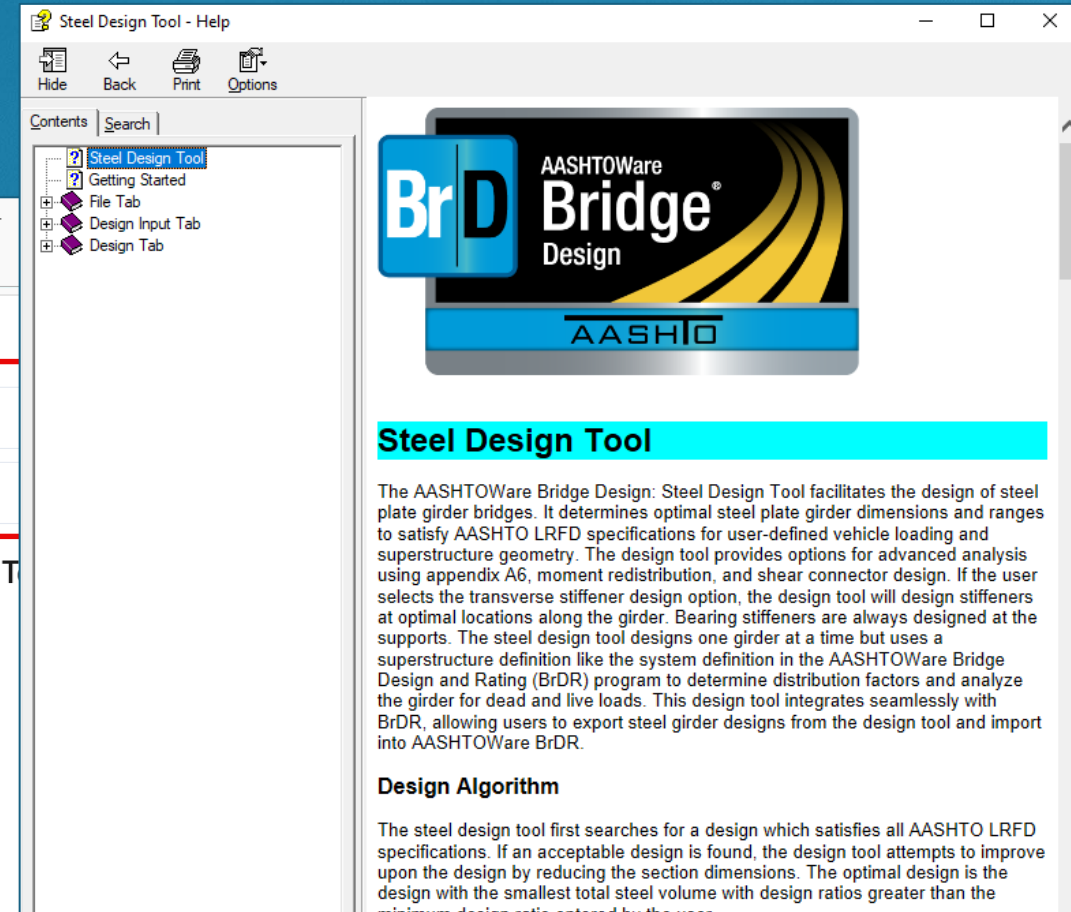
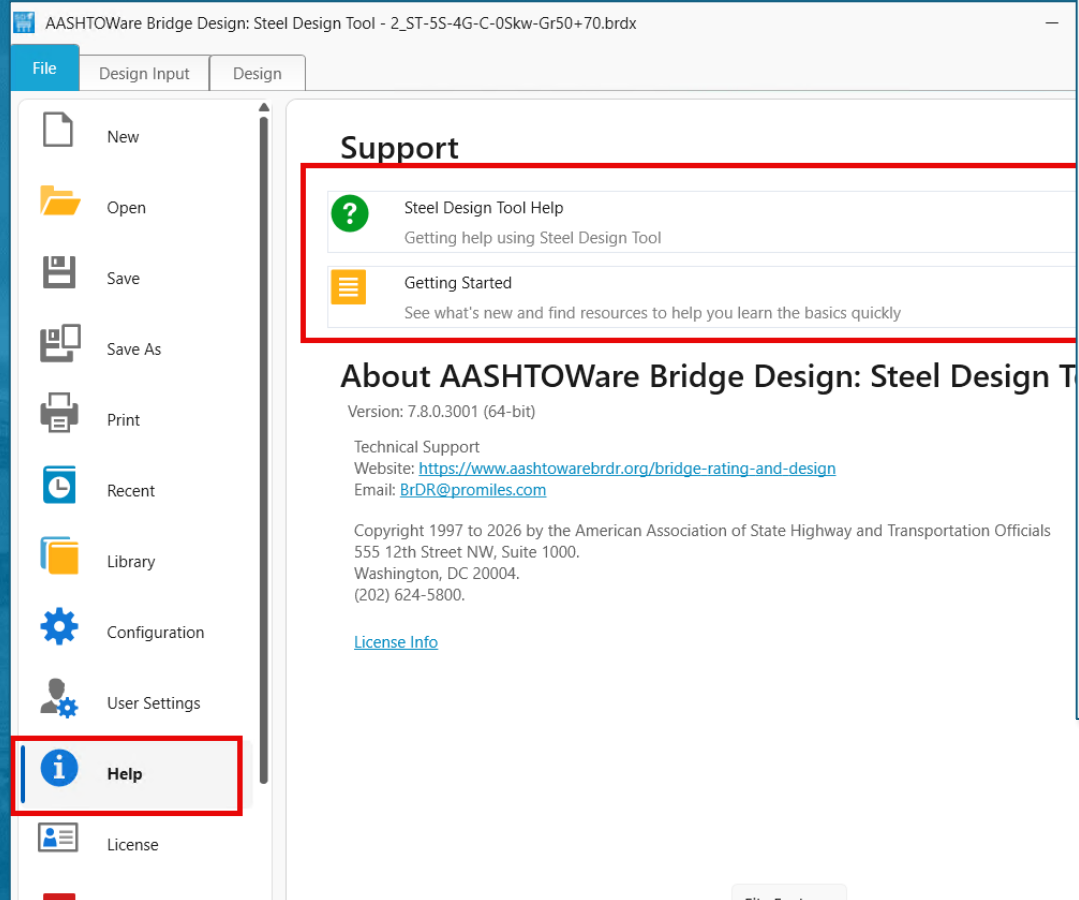
AASHTO LRFD Specification, Edition 9, Interim 0

Specification Check Summary

Article	Status
Flexure (6.10.7.1.1, 6.10.7.2.1, 6.10.8.1.1, 6.10.8.1.1, 6.10.8.1.1)	Pass
Shear (6.10.9)	Pass
Fatigue (6.10.5.3, 6.6.1.2.2)	Pass
Serviceability (6.10.4.2.2)	Pass
Constructability (6.10.3.2.1, 6.10.3.2.2, 6.10.3.2.3)	Pass
Transverse Stiffeners (6.10.11.1.2, 6.10.11.1.3)	Pass
Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3.2, 6.10.11.3.3)	NA
Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3, 6.10.11.2.4)	Fail
Shear Connector (6.10.10.1, 6.10.10.4)	NA
Field Splice (6.13.2.6, 6.13.2.7, 6.13.5.3, 6.13.6.1.3a, 6.13.6.1.3b, 6.13.6.1.3c)	NA
Minimum Negative Flexure Concrete Deck Reinforcement (6.10.1.7)	Pass
Deflection (2.5.2.6.2)	Pass

Additional Information

Help and Methodology



Additional Information

Design example files provided with installation

The screenshot shows the Steel Design Tool software interface. The main window displays the 'Getting Started' section, which provides information about the design project examples. A file explorer window is open, showing the contents of the 'SteelDesign' folder located at 'C:\Program Files\AASHTOWare\BrDR78\SteelDesign'. The file explorer lists four design example files: 1_ST-3S-4G-C-0Skw-Gr50+70.brdx, 2_ST-5S-4G-C-0Skw-Gr50+70.brdx, 3_ST-3S-5G-C-46Skw-Gr50.brdx, and 4_ST-1S-6G-C-35Skw-Gr50-Sdwlk.brdx.

Getting Started

Four Steel Design Tool's design project examples are provided with the software.

Design Project Examples

File name	1-ST-3S-4G-C-0Skw-Gr50+70.brdx	2-ST-5S-4G-C-0Skw-Gr50+70.brdx	3-ST-3S-5G-C-46Skw-Gr50.brdx	4-ST-1S-6G-C-35Skw-Gr50-Sdwlk.brdx
General Description				
Number of spans	3	5	3	3
Span lengths (ft)	140 - 175 - 140	190 - 3 @ 240 - 190	88	88
Number of girders	4	4	5	5
Girder spacing (ft)	12	12	7.6	7.6
Deck overhang (ft)	3.5	4.8675	2.3	2.3
Web depth (in)	69	96	44	20
Support skew angle	0	0	-46	-35
Composite	Yes	Yes	Yes	Yes
Deck thickness (in)	9.5	9.5	8	8
Steel grade	Web 50 ksi Flanges 70 ksi	Web 50 ksi Flanges 70 ksi	50 ksi	50 ksi
Loading				
Live load	HL-93	HL-93	HL-93	HL-93
Permit vehicle	Yes	Yes	Yes	Yes
Fatigue vehicle	Yes	Yes	Yes	Yes
Pedestrian load	No	No	No	Yes

SteelDesign

C:\Program Files\AASHTOWare\BrDR78\SteelDesign

Name	Date modified	Type	Size
1_ST-3S-4G-C-0Skw-Gr50+70.brdx	7/14/2026 9:23 PM	AASHTOWareBrDR.brdxFile	38 KB
2_ST-5S-4G-C-0Skw-Gr50+70.brdx	7/14/2026 9:23 PM	AASHTOWareBrDR.brdxFile	39 KB
3_ST-3S-5G-C-46Skw-Gr50.brdx	7/14/2026 9:23 PM	AASHTOWareBrDR.brdxFile	52 KB
4_ST-1S-6G-C-35Skw-Gr50-Sdwlk.brdx	7/14/2026 9:23 PM	AASHTOWareBrDR.brdxFile	43 KB

Future Direction and Enhancements

- Performed a gap analysis to identify areas for potential enhancement
- Integration into BrDR in v7.9
- Work with the Design TAG to plan next phase of enhancements after integration

Future Direction and Enhancements

Design Algorithm

- More variability in geometry and design input, and additional options on design optimization

Schematics

- Additional graphics and schematics

Design Results

- Additional design results for splices, diaphragms, bearings

Staged Construction and Constructability

- Advanced evaluation of temporary stresses, staged construction, deck pour sequencing

A blue-tinted photograph of a bridge over water. In the foreground, there are large, dark rocks. A small boat is visible on the water in the middle ground. The bridge spans the width of the frame, with several support pillars. The sky is filled with soft, white clouds.

Questions