



AASHTOWare PS Design Tool v7.8

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Outline

Presentation

- History
- Capabilities and Limitations
- UI and Features
- Future Direction

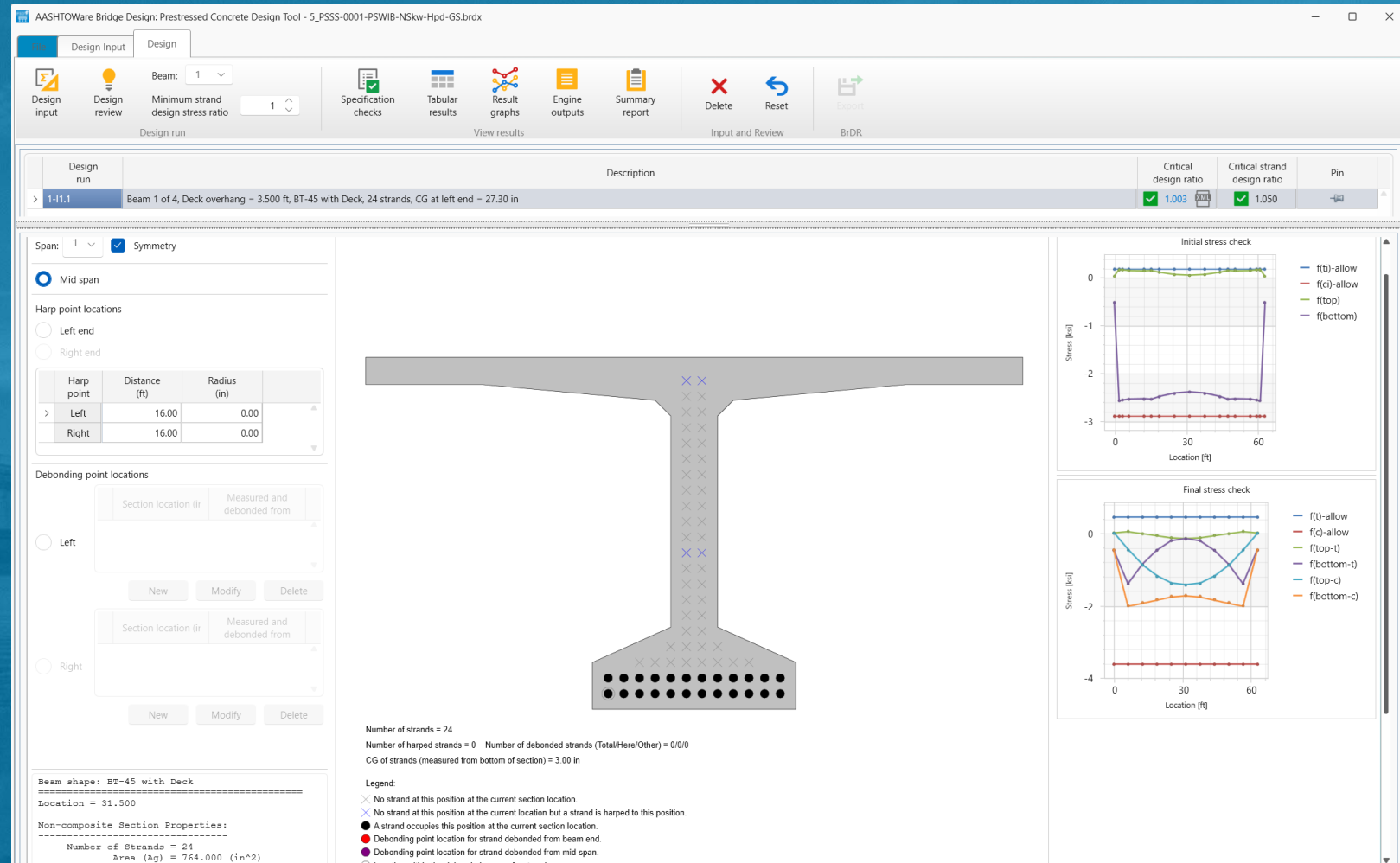
Live Demo

- Enter the project
- Perform design input run, review, and iterate

Questions

PS Design Tool

Analysis and design of prestressed concrete beams with harped and debonded strand patterns



Capabilities and Limitations

Design Specification

- AASHTO LRFD, 6th through 10th editions
- Strength, Service, Fatigue Limit States, and Stability

Loads

Live Load

- Vehicular: Design, Permit, Fatigue
- Pedestrian

Dead Load

- Girder, Deck, Wearing Surface, Diaphragms
- Appurtenance: Median, Parapet, Railing, Sidewalk, Generic

Capabilities and Limitations

Structure Definition

- Girder System (constant girder spacing and one skew)
- Girder Line (can be used for variable beam spacing)

Beam Shapes

- Adjacent and Spread Box Beam
- Narrow and Wide Top Flange I Beam
- Tee Beam with 2 or 3 Stems

Capabilities and Limitations

Strand Configurations

- Initial Design: Straight, Straight and Debonded, Straight and Harped
- Final Design: Any Combination of Straight, Debonded, and Harped

Input

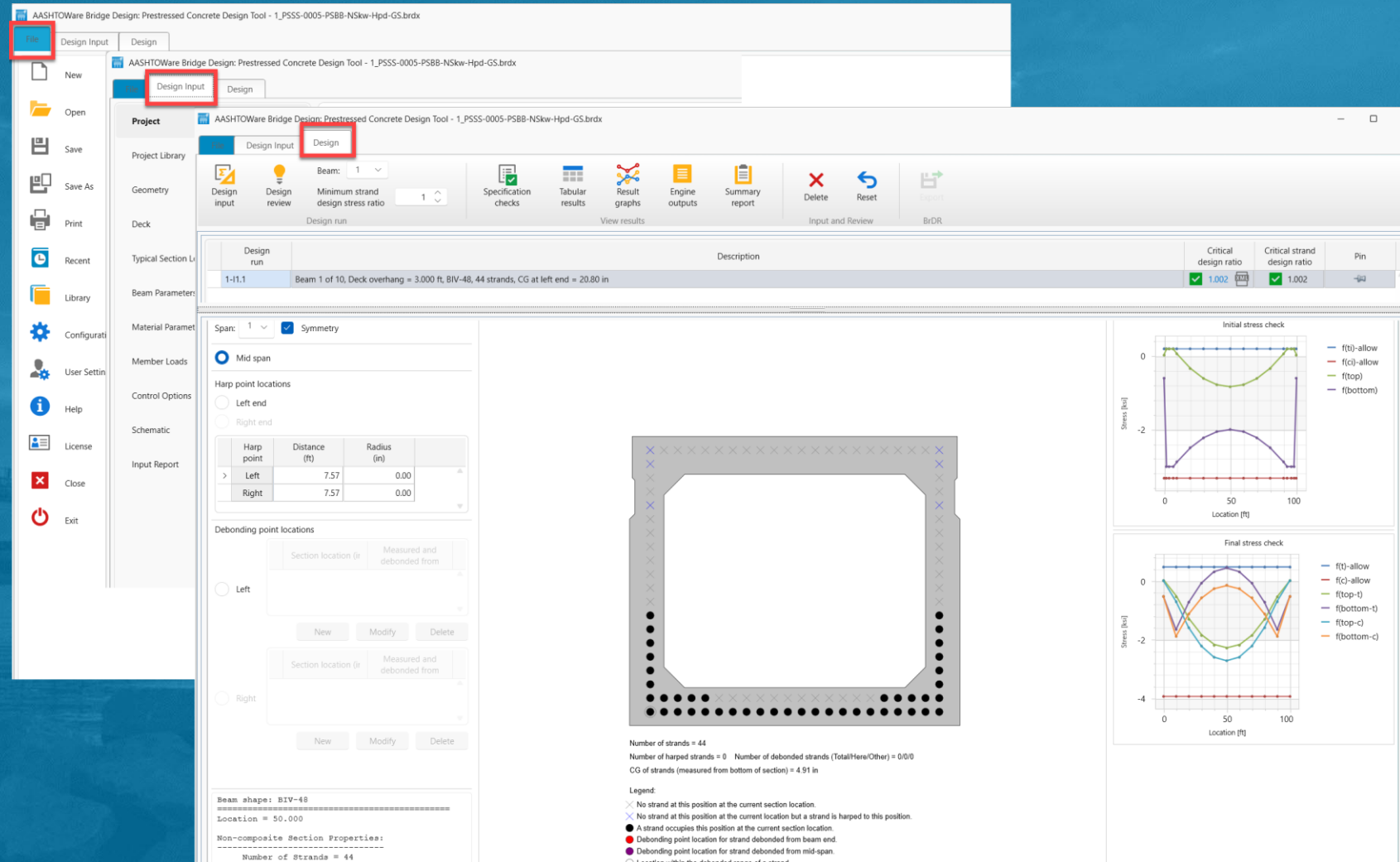
- Fixed
- Variable (Parametric)

Program Organization

File Tab: Common and PS Design Tool specific file operations

Design Input Tab: Data input for initial design

Design Tab: Results of initial design plus input tweaks and final design results



File | Print

- Print Preview and Print of Input Data

(Output Data printout available in Design Summary Report)

The screenshot displays the AASHTOWare Bridge Design: Prestressed Concrete Design Tool interface. The main window has tabs for 'File', 'Design Input', and 'Design'. The 'File' tab is active, showing a sidebar with options: New, Open, Save, Save As, Print (highlighted), Recent, Library, Configuration, User Settings, Help, License, Close, and Exit. Above the sidebar are 'Print' and 'Print Preview' buttons. The 'Print Preview' window is open, showing project details and a table of railing data.

Project

Project: 5_PSSS-0001-PSWIB-NSkw-Hpd-GS
Description: single span, I beam - wide top flange, non-skewed, harped strands
Designer: ProMiles
Date: 02/15/2022

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

Design vehicles
Design load: HL-93 (US)
Permit load:
Fatigue load:

Structure definition type: System

Project Library

Appurtenance

Railing

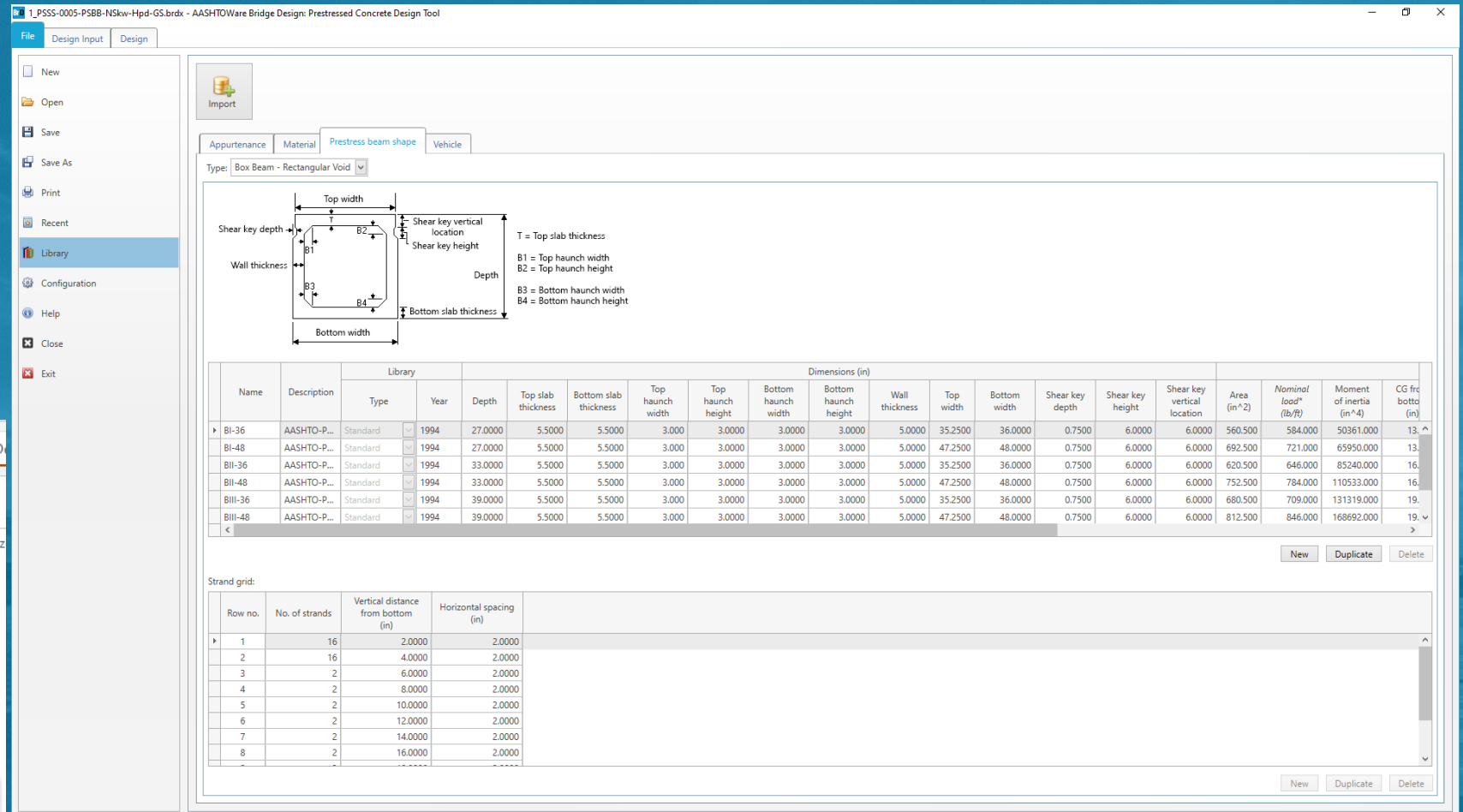
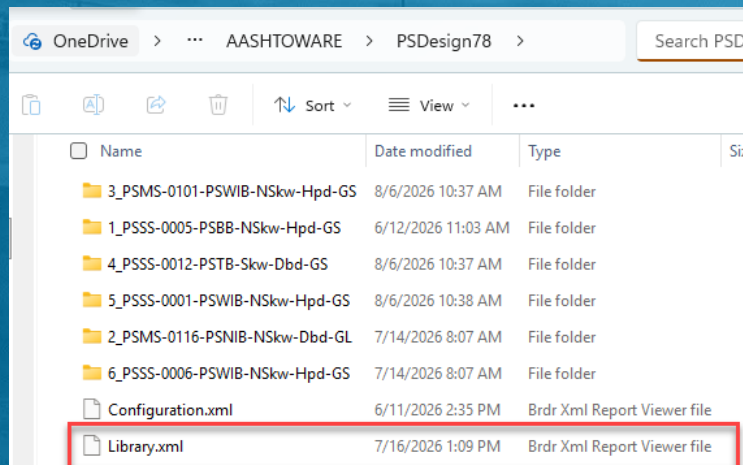
Name	Description	Distance from edge to centroid (in)	Width (in)	Effective wind height (in)	Railing load (kip/ft)
Steel Railing		10.0000	2.0000	41.0000	0.

Print

File | Library

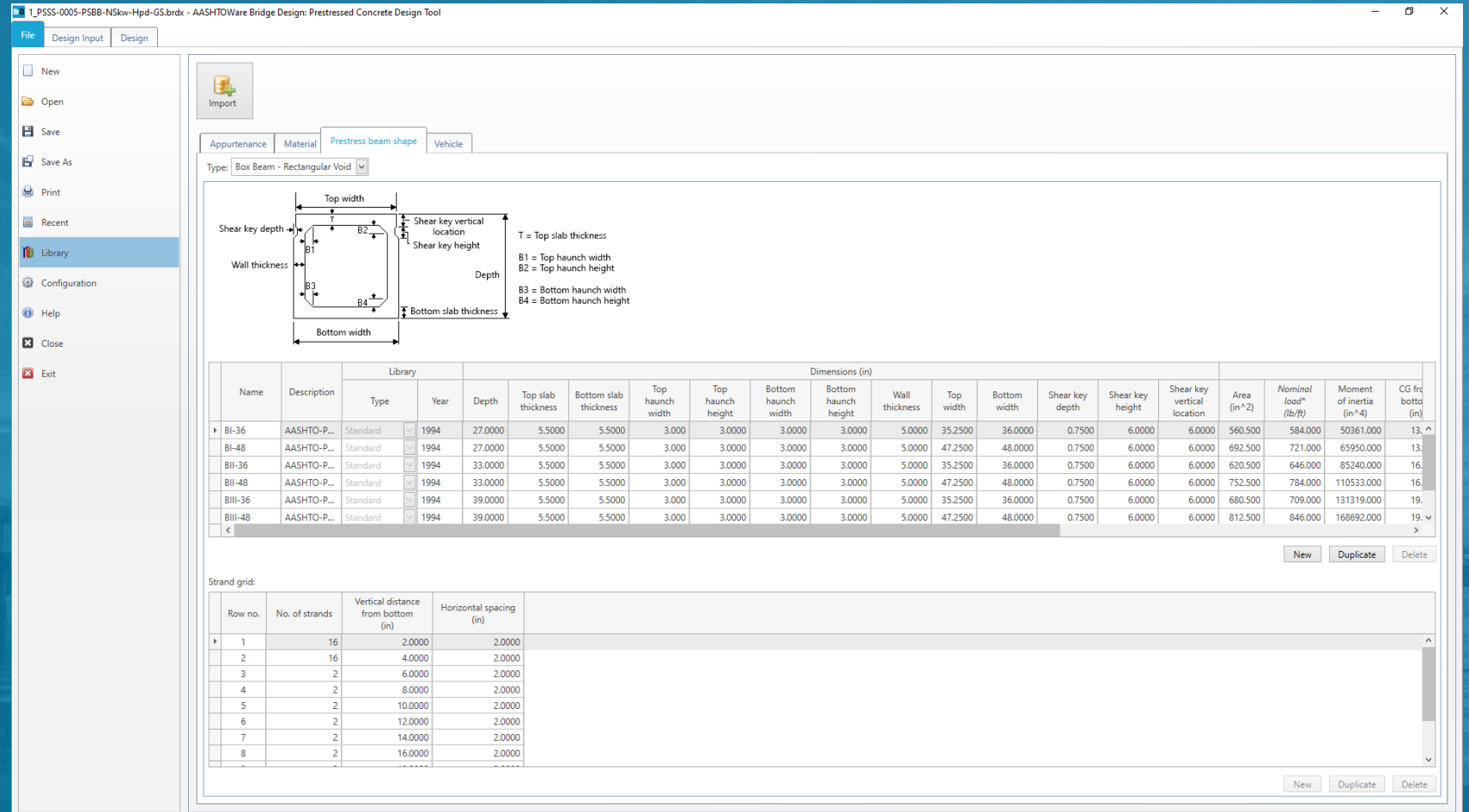
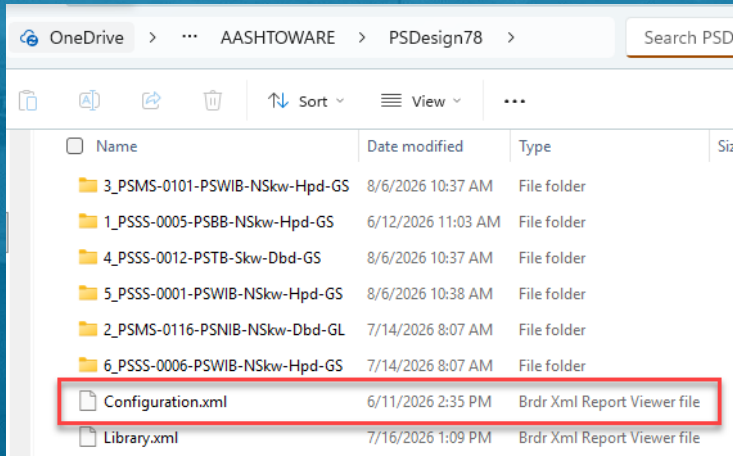
Program Library

- Can be imported from BrDR
- Stored in XML file



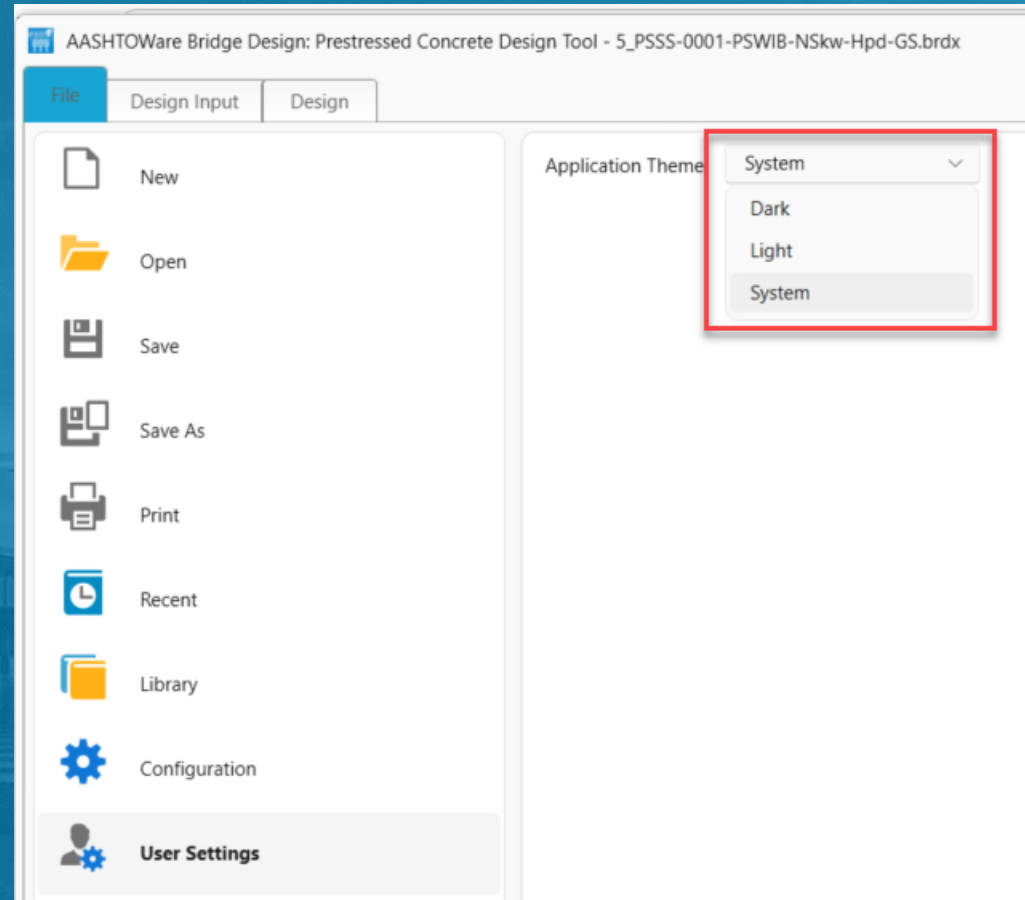
File | Configuration

- Can be used like templates quickly create new bridge designs
- Stored in XML file



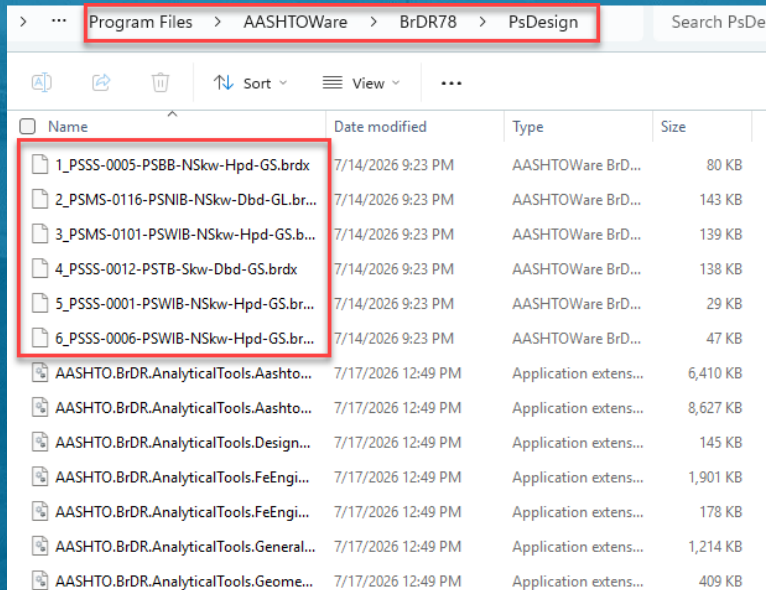
File | User Settings

Set application theme



File | Help

- Program Help
- F1 Button
- Example Input Files Included with Install
- Input Stored in XML Files



AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 5_PSSS-0001-PSWIB-NSkw-Hpd-GS.brdx

File Design Input Design

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

Support

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

About AASHTOWare Bridge Design: Prestressed Concrete 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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Washington, DC 20004,
(202) 624-5800.

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Getting Started

Five Prestressed Concrete Design Tool's design project examples are provided with the installation.

Design Project Examples

File name	1_PSSS-0005-PSBB-NSkw-Hpd-GS.brdx	2_PSMS-0116-PSNIB-Skw-Dbd-GL.brdx	3_PSMS-0101-PSWIB-NSkw-Hpd-GS.brdx	4_PSSS-0012-PSTB-Skw-Dbd-GS.brdx	5_PSSS-0001-PSWIB-NSkw-Hpd-GS.brdx	6_PSSS-0006-PSWIB-NSkw-Hpd-GS.brdx
Structure definition type	System	Line	System	System	System	System
Basic beam type	Box beam - adjacent rectangular void	I beam - narrow top flange	I beam - wide top flange	Tee beam - double stems (tees, webs)	I beam - wide top flange	I beam - wide top flange
Simple or continuous	Simple	Simple	Continuous	Simple	Simple	Simple
Number of spans	1	1	3	1	1	1
Number of beams	10	1	4	6	4	4 to 5
Girder spacing (ft)	4	12	12	5	7	8.5 to 11.67
Skewed	No	No	No	Yes	No	No
Composite	Yes	Yes	Yes	Yes	N/A	Yes
Deck included in beam	No	No	No	No	Yes	No
Strand layout	Harped	Straight/Debonded	Harped	Straight/Debonded	Harped	Harped
Live load	HL-93	HL-93, LRFD Fatigue Truck	HL-93	HL-93	HL-93	HL-93, LRFD Fatigue Truck
Pedestrian load	No	Yes	No	No	No	No

General Description

Structure definition type	System	Line	System	System	System	System
Basic beam type	Box beam - adjacent rectangular void	I beam - narrow top flange	I beam - wide top flange	Tee beam - double stems (tees, webs)	I beam - wide top flange	I beam - wide top flange
Simple or continuous	Simple	Simple	Continuous	Simple	Simple	Simple
Number of spans	1	1	3	1	1	1
Number of beams	10	1	4	6	4	4 to 5
Girder spacing (ft)	4	12	12	5	7	8.5 to 11.67
Skewed	No	No	No	Yes	No	No
Composite	Yes	Yes	Yes	Yes	N/A	Yes
Deck included in beam	No	No	No	No	Yes	No
Strand layout	Harped	Straight/Debonded	Harped	Straight/Debonded	Harped	Harped

Loading

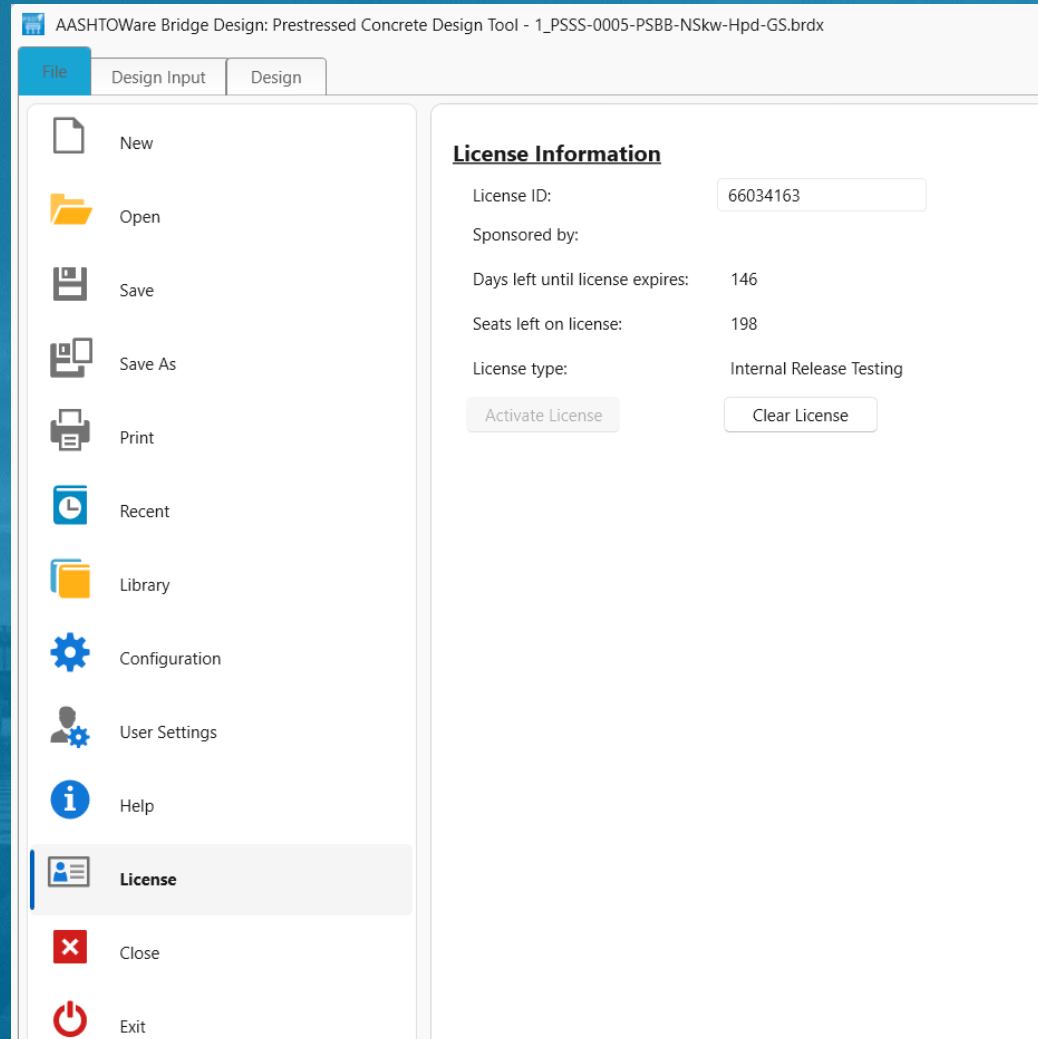
Live load	HL-93	HL-93, LRFD Fatigue Truck	HL-93	HL-93	HL-93	HL-93, LRFD Fatigue Truck
Pedestrian load	No	Yes	No	No	No	No

Design Algorithm

The Prestressed Concrete Design Tool estimates the strand layout based on a simple span analysis of the span. Design of beams for structures made continuous for live load is performed by starting with the first span and continuing with the second, then third, etc. For multi-span structures, the design tool will choose

File | License

- General License information
- Activate and clear license



Design Input | Project

- General Info
- Design Specs
- Structure Definition Type
- Validate for missing information

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 1_PSSS-0005-PSBB-NSkw-Hpd-GS.brdx

File name

Project: 1_PSSS-0005-PSBB-NSkw-Hpd-GS

Description: single span, PS box beam, non-skewed, harped strands

Designer: ProMiles

Date: 2/15/2022

LRFD specifications

Edition: AASHTO LRFD 10th

Limit states:

- ☒ Strength-I
- ☐ Strength-II
- ☒ Service-I
- ☒ Service-III
- ☒ Fatigue-I

Design vehicles

Design load: HL-93 (US)

Permit load:

Fatigue load:

Structure definition type: System

Validate for missing information

Validation: Off

Forward

Defaults to current edition

Girder system or Girder line

Navatation

Design Input | Project Library

Library items available for project

Includes:

- Appurtenances
- Materials
- PS beam shapes
- Vehicles

Create new or copy from Program Library

The screenshot displays the AASHTOWare Bridge Design software interface. The left sidebar shows the 'Project Library' section, which includes a list of items: Project, Geometry, Deck, Typical Section Loads, Beam Parameters, Material Parameters, Member Loads, Control Options, Schematic, and Input Report. The main window shows a cross-section diagram of a box beam with dimensions labeled: Top width, Bottom width, Wall thickness, Shear key depth, Shear key vertical location, Shear key height, Depth, Top slab thickness, Bottom slab thickness, Top haunch width, Top haunch height, Bottom haunch width, and Bottom haunch height. A 'Select Item' dialog box is open, showing a list of items with columns for Name and Description. The list includes items like BI-36, BI-48, BII-36, BII-48, BIII-36, BIII-48, and BIV-36, all described as AASHTO-PCI items. A blue arrow points from the 'Copy from library...' button in the 'Input Report' section to the 'Select Item' dialog box. The 'Input Report' section also contains a table for the 'Strand grid' with columns for Row no., No. of strands, Vertical distance from bottom (in), and Horizontal spacing (in). The table lists 6 rows of strands with varying vertical distances and horizontal spacings. At the bottom of the interface, there are buttons for 'New', 'Duplicate', and 'Delete' for the 'Strand grid' section, and a 'Validation' toggle switch set to 'Off'.

Name	Description	Depth	Top slab thickness	Bottom slab thickness	Top haunch width	Top haunch height	Bottom haunch width	Bottom haunch height	Wall thickness	Top width	Bottom width	Shear key depth	Shear key height
> BIV-48	AASHTO-P...	42.0000	5.5000	5.5000	3.0000	3.0000	3.0000	3.0000	5.0000	47.2500	48.0000	0.7500	€

Row no.	No. of strands	Vertical distance from bottom (in)	Horizontal spacing (in)
1	22	2.0000	2.0000
2	22	4.0000	2.0000
3	2	6.0000	2.0000
4	2	8.0000	2.0000
5	2	10.0000	2.0000
6	2	12.0000	2.0000

Design Input | Geometry

Girder Line

- Define single girder
- Dead load data and LLDFs must be entered

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 2_PSMS-0116-PSNIB-NSkw-Dbd-GL.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Beam Parameters

Material Parameters

Member Loads

Control Options

Input Report

Number of spans: 1

Number of beams: 1

Girder spacing: 12 ft

Support skew: 30 Degrees

Number of design lanes: 3

Span length

Beam projection left end

Right end

Spans:

Span	Length (ft)	Beam projection (in)		Lift distance (in)
		Left end	Right end	
> 1	50.00	6.00	6.00	24.00

Supports:

Support	Support type
> 1	Pinned
2	Roller

Design Input | Geometry

Girder System

- Define entire cross section
- DL and LLDFs are computed
- Allows variable (parametric) input

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 1_PSSS-0005-PSBB-NSkw-Hpd-GS.brdx

Design Input | Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Material Parameters

Member Loads

Control Options

Schematic

Input Report

Number of spans: 1

Number of beams: Min: 10 Increment: 0 Max: 10

Out-to-out deck width: 42 ft

Deck overhang from beam centerline: Min: 3 ft Increment: 0 ft Max: 3 ft

Girder spacing: Min: 4 ft Max: 4 ft

Support skew: 0 Degrees

Number of design lanes: 2

Span length

Beam projection left end

Right end

Spans:

Span	Length (ft)	Beam projection (in)		Lift distance (in)
		Left end	Right end	
> 1	100.00	6.00	6.00	24.00

Supports:

Support	Support type
> 1	Pinned
2	Roller

Variable data

Design Input | Deck

Girder Line

- Must enter tributary width and effective flange width

Girder System

- Bar spacing for continuous spans can be left blank and will be computed during analysis

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 2_PSMS-0116-PSNIB-NSkw-Dbd-GL.brdx

Design Input | Design

Project

Project Library

Geometry

Deck

Beam Parameters

Material Parameters

Member Loads

Control Options

Input Report

☐ Deck is included in beam shape

Deck concrete: Class A

Deck total thickness: 8.5 in

Deck structural thickness: 8 in

Deck reinforcement

Material: Grade 60

Support	Start distance (ft)	Length (ft)	End distance (ft)

Girder Line

Tributary width

At start: 12 ft At end: 12 ft

Effective flange width

At start: 12 ft At end: 12 ft

Haunch depth: 0.5 in

Edge of the haunch to edge of the beam: 0 in

☒ Composite deck

Slab interface

Interface type: Intentionally Roughened

Set defaults

Cohesion factor: 0.28 ksi

Friction factor: 1

prestressed Concrete Design Tool - 3_PSMS-0101-PSWIB-NSkw-Hpd-GS.brdx

Girder System

☐ Deck is included in beam shape

Deck concrete: Class A (US)

Deck total thickness: 8.5 in

Deck structural thickness: 8 in

Deck reinforcement

Material: Grade 60

Support	Start distance (ft)	Length (ft)	End distance (ft)	Bar size	Clear cover (in)	Measured from	Bar spacing (in)
> 1	0.00	340.00	340.00	4	3.3750	Top of Str...	
1	0.00	340.00	340.00	7	2.0000	Bottom of...	6.0000

New Duplicate

Haunch depth: 0.5 in

Edge of the haunch to edge of the beam: 0 in

☒ Composite deck

Slab interface

Interface type: Intentionally Roughened

Set defaults

Cohesion factor: 0.28 ksi

Friction factor: 1

K1: 0.3

Design Input | Typical Section Loads

Girder System Only

Stage 2 Load Distribution

- Uniform, by area, or by percentage

Load Types

- Wearing Surface
- Appurtenances
- Exterior Diaphragms

Diaphragm Wizard available only if geometry is fixed

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 5_PSSS-0001-PSWIB-NSkw-Hpd-GS.brdx

Design Input | Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Material Parameters

Member Loads

Control Options

Schematic

Input Report

Stage 2 load distribution: ☒ Uniformly to all girders
☐ By tributary area
☐ By percentage: Exterior: 10 % First interior: 20 %

Wearing surface: Thickness: 2 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)	Distance at end (ft)	Front face orientation
> Steel Raili...	Stage 2	DC	Back	Left Edge	0.00	0.00	Right
Steel Raili...	Stage 2	DC	Back	Right Edge	0.00	0.00	Left

New Duplicate Delete

Exterior diaphragm loads:

Girder bay: 1 Copy bay to... Diaphragm wizard...

Support	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)
	Left girder	Right girder				Left girder	Right girder	
1	0.00	0.00	0.00	1	0.00	0.00	0.00	
1	0.00	0.00	21.00	2	42.00	42.00	42.00	
1	63.00	63.00	0.00	1	0.00	63.00	63.00	

Design Input | Beam Parameters

Similar Input for Girder Line and Girder System

Parameters for

- Beam Shape Selection
- Initial Strand Configuration
- Vertical Shear (and Splitting) Reinforcement

The screenshot displays the 'Design Input' tab for 'Beam Parameters' in the AASHTOWare Bridge Design: Prestressed Concrete Design Tool. The interface includes a sidebar with navigation options: Project, Project Library, Geometry, Deck, Typical Section Loads, **Beam Parameters**, Material Parameters, Member Loads, Control Options, Schematic, and Input Report.

The main content area is divided into several sections:

- Beam shape selection:** Includes a dropdown for 'Beam type' (set to 'I Beam - Wide Top Flange') and a checkbox for 'Sufficiently connected to act as a unit'. Below this, the 'Depth range' is selected with radio buttons, showing 'Min depth: 63 in' and 'Max depth: 72 in'. A callout points to the 'Specific shape' dropdown with the text 'Select a depth range or a specific beam'.
- Strand configuration:** Includes radio buttons for 'Straight / Debonded' and 'Harped' (selected). The 'Harped' section shows 'Min distance from harped strand to beam top: 2 in', 'Max number of harped strands: 16', and 'Harp point locations: 0.4 L'. A callout points to the 'Harped' radio button with the text 'Strand configuration for initial design'.
- Vertical shear reinforcement:** Includes a checkbox for 'Use 2 ranges - min range 1 length: 3 ft'. Below this, 'Range 1' and 'Range 2' are defined with 'Material: Grade 60', 'Bar size: 8' (for Range 1) and '5' (for Range 2), and 'Number of legs: 2' for both. A callout points to the 'Range 1' section with the text 'Shear reinforcement parameters'.
- Pretensioned anchorage zone:** Includes a checkbox for 'Evaluate horizontal transverse tension tie' (checked) and a field for 'Bearing edge distance: in'. A callout points to this section with the text 'LRFD 5.9.4.4.3'.

Design Input | Material Properties

Similar Input for Girder Line and Girder System

Input Data for:

- PS Loss Calculations
- Beam Concrete Strength (can be modified later)
- Stress Limit Factors

The screenshot displays the 'Material Parameters' section of the AASHTOWare Bridge Design software. The interface includes a sidebar on the left with navigation tabs: Project, Design Input, Design, Project Library, Geometry, Deck, Typical Section Loads, Beam Parameters, Material Parameters (selected), Member Loads, Control Options, Schematic, and Input Report. The main panel contains the following settings:

- Beam curing method:** Moist cured (radio button), Steam cured (radio button, selected).
- Exposure factor:** Top: 1, Bottom: 1.
- PS strand:** 0.6" (7W-270) LR.
- PS loss method:** AASHTO Approxima (dropdown).
- Consider creep:** (checkbox, unchecked).
- Allow cracking at girder ends:** (checkbox, unchecked).
- Consider deck differential shrinkage loads:** (checkbox, unchecked).
- Average humidity:** 65 %.
- Transfer time:** (input field) Hours.
- Deck placement age:** (input field) Days.
- Final age:** (input field) Days.
- Beam concrete compressive strength:**
 - Concrete composition: Normal (dropdown).
 - f'c: 8 ksi.
 - f'ci: 7 ksi.
- Stress limit factors:**
 - Corrosion condition: Moderate (dropdown).
 - Set defaults (button).
 - Initial allowable compression: 0.65.
 - Initial allowable tension: 0.0948.
 - Final allowable compression: 0.6.
 - Final allowable tension: 0.19.
 - Final allowable DL compression: 0.45.
 - Final allowable slab compression: 0.6.
 - Final allowable compression (LL + 1/2 (Pe + DL)): 0.4.

Design Input | Member Loads | LLDFs

Different Input for Girder Line and Girder System

Girder Line LLDF:

- Required user input
- Allows Variation with within range

Girder System LLDF

- Calculated by program
- Can be overridden by user
- Constant within range

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 2_PSMS-0116-PSNIB-NSkw-Dbd-GL.brdx

File Design Input Design

Project
Project Library
Geometry
Deck
Beam Parameters
Material Parameters
Member Loads
Control Options
Input Report

Distributed Concentrated Pedestrian **LLDF**

☐ Use 1 lane distribution factors for permit load

Live Load Distribution Factors

Beam: 1
Action: Moment

Girder Line input required

Support	Start distance (ft)	Length (ft)	End distance (ft)	Variation	Distribution
> 1	0.000	50.000	50.000	Constant	1 lane 0.

Distributed Concentrated Pedestrian **LLDF**

☐ Use 1 lane distribution factors for permit load

☒ Override Live Load Distribution Factors

Optional override for Girder System

Beam: 1 Copy to beam...
Action: Moment

Support	Start distance (ft)	Length (ft)	End distance (ft)	Distribution factor (lanes)	
				1 lane	Multi-lane

Design Input | Control Options

Similar Input for Girder
Line and Girder System

Defines:

- Shear Computation Method
- Gross or Transformed Section Properties for PS Loss Calculations
- Stage 2 and 3 Analysis for Multi-span bridges
- Deflection Multipliers

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 4_PSSS-0012-PSTB-Skw-Dbd-GS.brdx

File Design Input Design

Project

Project Library

Geometry

Deck

Typical Section Loads

Beam Parameters

Material Parameters

Member Loads

Control Options

Schematic

Input Report

Shear computation method:

☒ General procedure

☐ Simplified procedure

Loss & stress calculations:

☒ Use gross section properties

☐ Use transformed section properties

Multi-Span analysis:

☒ Continuous

☐ Continuous and simple

Deflection Multipliers

	At erection	Final
Beam weight:	1.85	2.40
Prestress:	1.80	2.20

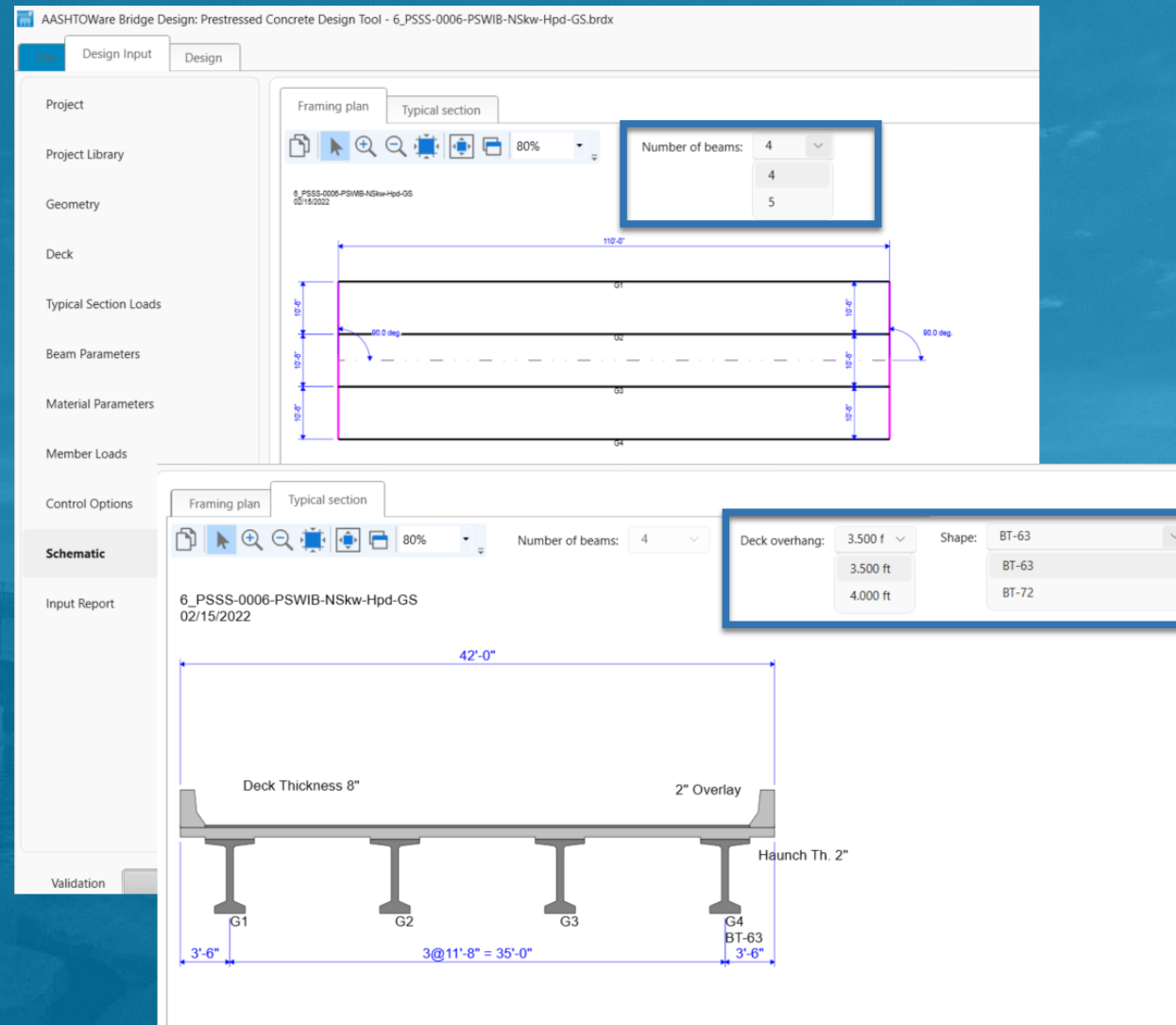
Set defaults

Design Input | Schematic

Girder System Only
Displays

- Framing Plan
- Typical Section

Can view all scenarios
when variable geometry
and beam depth range
input is used



Design Input | Input Report

- Available for Girder Line and Girder System
- Summary of Input Data
- Can be printed from the File tab

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 6_PSSS-0006-PSWIB-NSkw-Hpd-GS.brdx

Design Input | Design

Project

Project: 6_PSSS-0006-PSWIB-NSkw-Hpd-GS
Description: This example includes iterations for number of beams, overhang width, and beam shape.
Designer: ProMiles
Date: 02/15/2022

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

Design vehicles
Design load: HL-93 (US)
Permit load:
Fatigue load: LRFD Fatigue Truck (US)

Structure definition type: System

Project Library

Appurtenance

Parapet

Name	Description	Distance from edge to centroid (in)	X1 (in)	X2 (in)	X3 (in)	Y1 (in)	Y2 (in)	Y3 (in)	Y4 (in)	Additional load (kip/ft)	Median unit load (kcf)	Calculated properties	
												Net centroid (in)	Total load (kip/ft)
Jersey Barrier	Standard New Jersey Barrier		12.0000	2.0000	7.0000	0.0000	19.0000	10.0000	3.0000		0.1500	7.8801	0.505

Material

Concrete

Name	Description	Compressive strength at 28 days f'c (ksi)	Initial compressive strength f'ci (in)	Coefficient of thermal expansion (1/F)	Density for DL (kcf)	Density for modulus of elasticity (kcf)	Poisson's ratio	Composition of concrete	Modulus of rupture (ksi)	Shear factor
Class A	Class A cement concrete	4.061		0.000060000	0.150	0.145	0.200	Normal	0.483	1.000

Design | Design Run

Design Input Run (I)

- Initial design
- Based on design input data

Design Review Run (R)

- Based on design input with user modifications

AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 6_PSSS-0006-PSWIB-NSkw-Hpd-GS.brdx

Design Input | Design

Beam: 1

Minimum strand design stress ratio: 1

Specification checks | Tabular results | Result graphs | Engine outputs | Summary report | Delete | Reset | Export

Design ratio based on stress and flexure checks

Design run	Description	Critical design ratio	Critical strand design ratio	Pin
1-I1.1	Beam 1 of 4, Deck overhang = 3.500 ft, BT-63, 40 strands, CG at left end = 32.12 in	✓ 1.013	✓ 1.013	Pin
1-I1.2	Beam 1 of 4, Deck overhang = 3.500 ft, BT-72, 32 strands, CG at left end = 36.60 in	✓ 1.010	✓ 1.010	Pin
1-I1.3	Beam 1 of 4, Deck overhang = 4.000 ft, BT-63, 42 strands, CG at left end = 32.12 in	✗ 0.191	✗ 0.191	Pin
1-I1.4	Beam 1 of 4, Deck overhang = 4.000 ft, BT-72, 34 strands, CG at left end = 36.60 in	✓ 1.042	✓ 1.042	Pin
1-I1.5	Beam 1 of 5, Deck overhang = 3.500 ft, BT-63, 34 strands, CG at left end = 32.12 in	✓ 1.045	✓ 1.045	Pin
1-I1.6	Beam 1 of 5, Deck overhang = 3.500 ft, BT-72, 28 strands, CG at left end = 36.60 in	✓ 1.004	✓ 1.004	Pin
1-I1.7	Beam 1 of 5, Deck overhang = 4.000 ft, BT-63, 36 strands, CG at left end = 32.12 in	✓ 1.031	✓ 1.031	Pin
1-I1.8	Beam 1 of 5, Deck overhang = 4.000 ft, BT-72, 30 strands, CG at left end = 36.60 in	✓ 1.032	✓ 1.032	Pin

Overall design ratio

Naming system (1-I1.1)
 1 thru # - Beam number
 I or R - design input or design review
 1 thru # - Input dataset number
 1 thru # - Trial number

Strand pattern | Beam details | Beam Properties

Span: 1 | Symmetry

Mid span

Harp point locations

Left end

Right end

Harp point	Distance (ft)	Radius (in)
Left	44.40	0.00
Right	44.40	0.00

Debonding point locations

Initial stress check

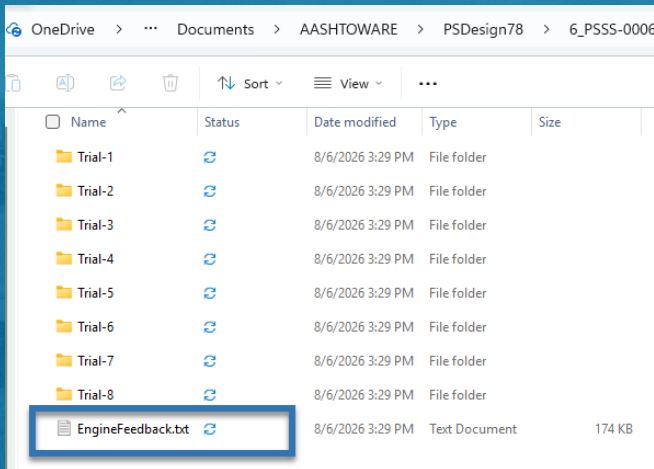
Stress [ksi]

Location [ft]

f(t_i)-allow
 f(c_i)-allow
 f(top)
 f(bottom)

Design | Engine Feedback

- Log of Engine Progress
- Contains Warnings and Error Messages



AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 6_PSSS-0006-PSWIB-NSkw-Hpd-GS.brdx

Design Input | Design

Design run

Design run	Description
1-I-1.1	Beam 1 of 4, Deck overhang = 3.500 ft, BT-63, 40 strands, CG at left
1-I-1.2	Beam 1 of 4, Deck overhang = 3.500 ft, BT-72, 32 strands, CG at left
1-I-1.3	Beam 1 of 4, Deck overhang = 4.000 ft, BT-63, 42 strands, CG at left
1-I-1.4	Beam 1 of 4, Deck overhang = 4.000 ft, BT-72, 34 strands, CG at left
1-I-1.5	Beam 1 of 5, Deck overhang = 3.500 ft, BT-63, 34 strands, CG at left
1-I-1.6	Beam 1 of 5, Deck overhang = 3.500 ft, BT-72, 28 strands, CG at left
1-I-1.7	Beam 1 of 5, Deck overhang = 4.000 ft, BT-63, 36 strands, CG at left
1-I-1.8	Beam 1 of 5, Deck overhang = 4.000 ft, BT-72, 30 strands, CG at left

Strand pattern | Beam details | Beam Profile

Span: 1 | ☒ Symmetry

☒ Mid span

Harp point locations

Harp point	Distance (ft)	Radius (in)
> Left	44.40	0.00
Right	44.40	0.00

Debonding point locations

EngineFeedback.txt

File | Edit | View

Beginning design
Beginning validation...
Completed validation...

Design iteration = 1 -----
Number of beams = 4, Deck overhang = 3.500 ft, Shape = BT-63 (AASHTO-PCI Bulb-Tee BT-63)

Beginning design trial 1 -----
By Tributary Area was selected for Stage 1 dead load distribution method on the Superstructure Loads window DL Distribution tab!
The Parapet load of a Parapet location entered on the Structure Typical Section window is zero!
The Parapet load will not be applied!
Starting FEA
Stage 1 Model Method: Span
FEA - Initiating finite element analysis...
FEA - Building model...
FEA - Creating nodes...
FEA - Creating elements...
FEA - Creating support constraints...
FEA - Adding load cases...
FEA - Verifying finite element model...
FEA - Preparing linear solution...
FEA - Performing linear solution...
FEA - Successful finite element analysis...
Stage 2 Model Method: Span
FEA - Initiating finite element analysis...
FEA - Building model...
FEA - Creating nodes...
FEA - Creating elements...

Critical design ratio

Critical design ratio	Critical strand design ratio	Pin
1.013	1.013	🔒
0.191	0.191	🔒
1.042	1.042	🔒
1.045	1.045	🔒
1.004	1.004	🔒
1.031	1.031	🔒
1.032	1.032	🔒

Initial stress check

Location [ft]

f(t_i)-allow
f(c_i)-allow
f(top)
f(bottom)

Also available in Engine Outputs

Initial stress check

Location [ft]

Legend:

- $f(t_i)$ -allow
- $f(c_j)$ -allow
- $f(\text{top})$
- $f(\text{bottom})$

Design | Strand Pattern

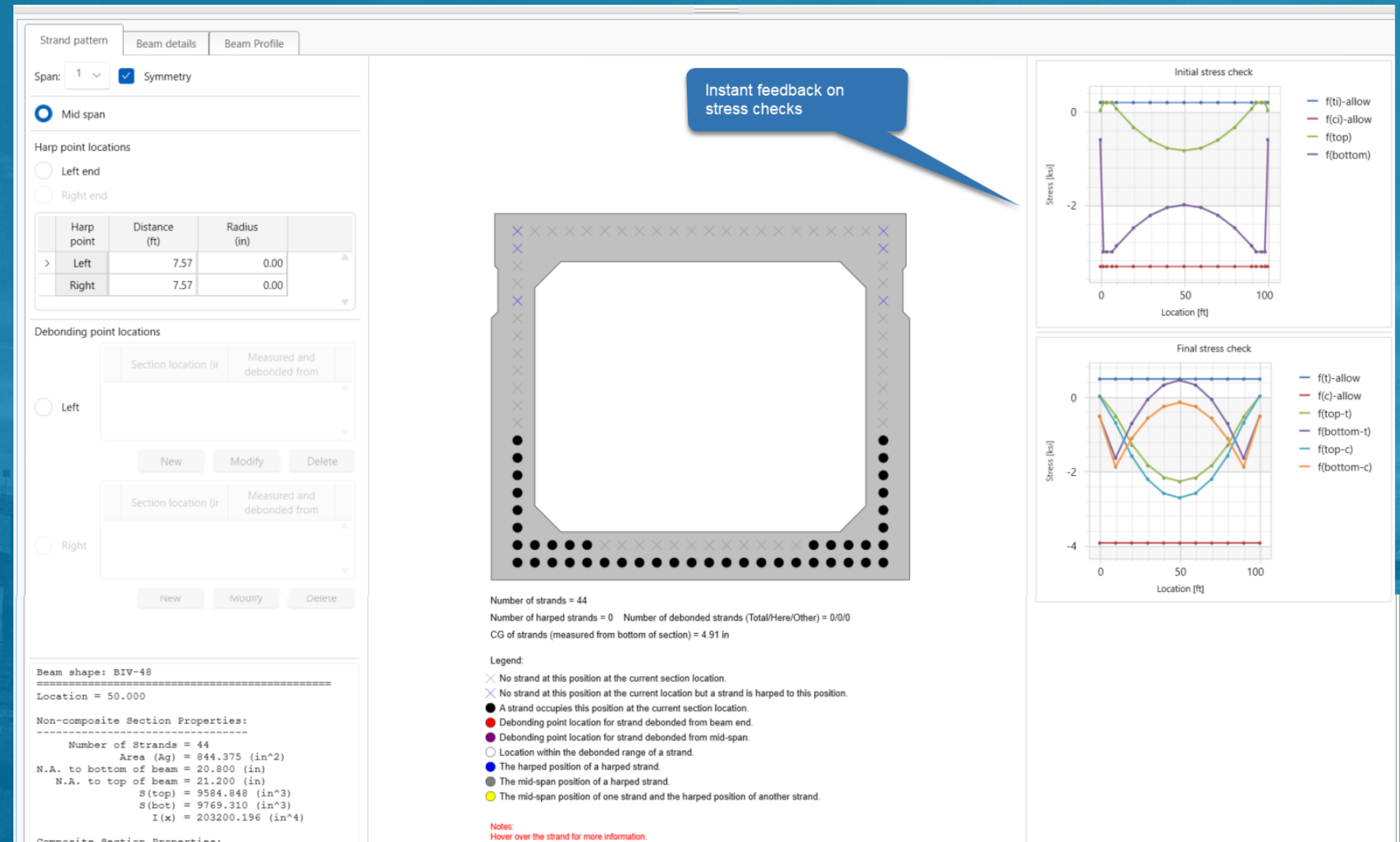
Displays Strand Pattern as Initially Designed at

- Mid-Span
- Harp Points
- Debonding Points

Displays Initial and Final Concrete Stress Diagrams

Allows Modification of Strand Patterns

Modified Patterns can be Design Reviewed



Design | Beam Details

Displays concrete strength and initial design of:

- Vertical shear reinforcement
- Deck reinforcement
- Positive moment continuity reinforcement

Allows modification of strength & reinforcement

Run Design Review to evaluate modifications

Strand pattern | Beam details | Beam Profile

Beam shape: BT-72 f'c: 7.0000 ksi f'cd: 5.5000 ksi

Vertical shear reinforcement

Reinforcement	Extends into deck	Span	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> Range 1	☒	1	0.33	1	0.00	0.00	0.33
Range 2	☒	1	0.33	4	6.00	2.00	2.33
Range 2	☒	1	2.33	2	4.00	0.67	3.00
Range 2	☒	1	3.00	13	6.00	6.50	9.50
Range 2	☒	1	9.50	2	6.00	1.00	10.50
Range 2	☒	1	10.50	51	8.00	34.00	44.50
Range 2	☒	1	44.50	2	13.00	2.17	46.67

Deck reinforcement

Support	Start distance (ft)	Length (ft)	End distance (ft)	Bar size	Clear cover (in)	Measured from	Bar spacing (in)
> 1	0.00	340.00	340.00	4	3.3750	Top of Str...	6.0741
1	0.00	340.00	340.00	7	2.0000	Bottom of...	6.0000

This bar spacing was computed by analysis engine. Can modify to 6 inches for design review run

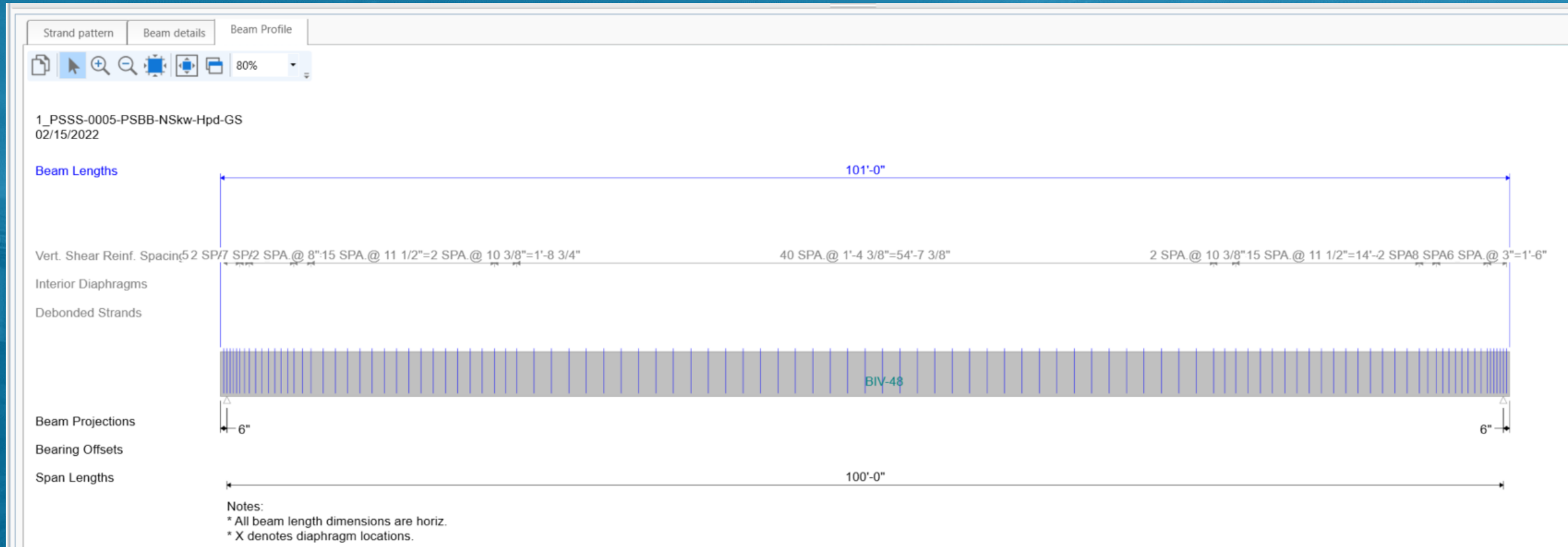
New Duplicate Delete

Positive moment continuity steel

Span	Left support				Right support			
	Material	Distance (in)	Number of bars	Bar size	Material	Distance (in)	Number of bars	Bar size
> 1					Grade 60	3.00	10.00	5
2	Grade 60	3.00	11.00	5	Grade 60	3.00	11.00	5
3	Grade 60	3.00	10.00	5				

Design | Beam Profile

Displays Beam Schematic with Dimensions and Annotations



Design | View Results | Specification Checks

Detailed Spec Check Output

- Each stage
- Each POI
- Each article
- Detailed calculations

The screenshot displays the ProMiles software interface. The left pane shows a tree view of the project structure, including 'Superstructure Component', 'Prestress Calculations', and 'Stage 3'. The main pane shows a list of specification checks with their status (Pass/Fail) and a 'Generate' button. The right pane shows a detailed view of the 'Spec Check Detail for 5.9.2.3.2b Tensile Stresses'.

Specification checks

Properties ☐ Apply ☒ Generate

Articles: All articles (dropdown), Format: Bullet list (dropdown), Report

Specification filter

Specification reference	Pass/Fail
5.6.3.5.2a Instantaneous Deflections	General Comp.
5.6.7 Crack - Deck Control of Cracking by Distribution of Reinforcement	Not Applicable
5.9.2.3.2a Compressive Stresses	Passed
5.9.2.3.2b Tensile Stresses	Passed
5.9.4.3.2 Bonded Strand	General Comp.
5.9.4.4.3 Horizontal Transverse Tension Tie Reinforcement	Not Applicable
Computation of Vp	General Comp.
Cracked_Moment_of_Inertia Section Property Calculations	General Comp.
PS_Basic_Properties Calculation	General Comp.
PS_Gross_Composite_Section_Properties PS Gross Composite Section	General Comp.
2.5.2.6.2 Criteria for Deflection	Passed
5.4.2.5 Poisson's Ratio	General Comp.
5.4.2.6 Modulus of Rupture	General Comp.
5.4.2.8 Concrete Density Modification Factor	General Comp.
5.5.4.2 PS Strength Limit State - Resistance Factors	General Comp.
5.6.2.2 Rectangular Stress Distribution	General Comp.
5.6.3.2 PS Flexural Resistance (Prestressed Concrete)	Passed
5.6.3.3 Minimum Reinforcement	Passed
5.7.2.5 Minimum Transverse Reinforcement	Passed
5.7.2.6 Maximum Spacing of Transverse Reinforcement	Passed
5.7.3.3 Nominal Shear Resistance	Passed
5.7.3.4 Procedures for Determining Shear Resistance	General Comp.
5.7.3.5 Longitudinal Reinforcement	Passed
5.7.4 Interface Shear Transfer	Passed
5.7.4.2 Minimum Area of Interface Shear Reinforcement	Passed
5.9.4.3.2 Bonded Strand	General Comp.

Spec Check Detail for 5.9.2.3.2b Tensile Stresses

5 Concrete Structures
5.9 Prestressing
5.9.2 Stress Limitations
5.9.2.3 Stress Limits for Concrete
5.9.2.3.2 Stresses at Service Limit State
5.9.2.3.2b Tensile Stresses
(AASHTO LRFD Bridge Design Specifications, Tenth Edition)

PS Box Rect Void - At Location = 0.0000 (ft) - Right Stage 3

Input:
f'c = 6.50 (ksi)

Section Properties: Gross
Ag = 844.38 (in^2) epg = 13.00 (in)
St = 9584.85 (in^3) Sb = 9769.31 (in^3)
Stc = 21322.62 (in^3) Sbc = 12169.06 (in^3)
Pe = 200.78 (kip)
lambda = 1.00

Service III Loads:
Max MDL1 = 0.00 (kip-ft) Min MDL1 = 0.00 (kip-ft)
Max MDL2 = 0.00 (kip-ft) Min MDL2 = 0.00 (kip-ft)
Pos MCS = 0.00 (kip-ft) Neg MCS = 0.00 (kip-ft)
Pos MLL+I = 0.00 (kip-ft) (Vehicle: HL-93 (US) - Tandem + Lane)
Neg MLL+I = 0.00 (kip-ft) (Vehicle: HL-93 (US) - Tandem + Lane)

Summary:

Final Tension Stresses Due to Permanent and Transient Loads:
(Service III: PS + DL + LL)

Final Allowable Tensile stress limit bottom = 0.48 (ksi)
Tensile stress limit top = 0.48 (ksi)

	Top Beam (ksi)	Bottom Beam (ksi)
PS:	0.035	-0.505
DL:	-0.000	0.000
C&S:	-0.000	0.000
LL:	-0.000	0.000
Sum =	0.035	-0.505
Allow =	0.484	0.484
DR =	13.994	99.000

Design | View Results | Tabular Results

Detailed Tabular Results:

- Dead and Live Load Actions
- Each Stage
- Each Load Case
- Each POI

Can be viewed and printed

1_PSSS-0005-PSBB-NSkw-Hpd-GS.brdx - Design Run 1-11.1

Tabular results

Print

Report type: Dead Load Actions Stage: Stage 1 Dead load case: Load Case 1 - Self Load(Stage 1:D,DC)

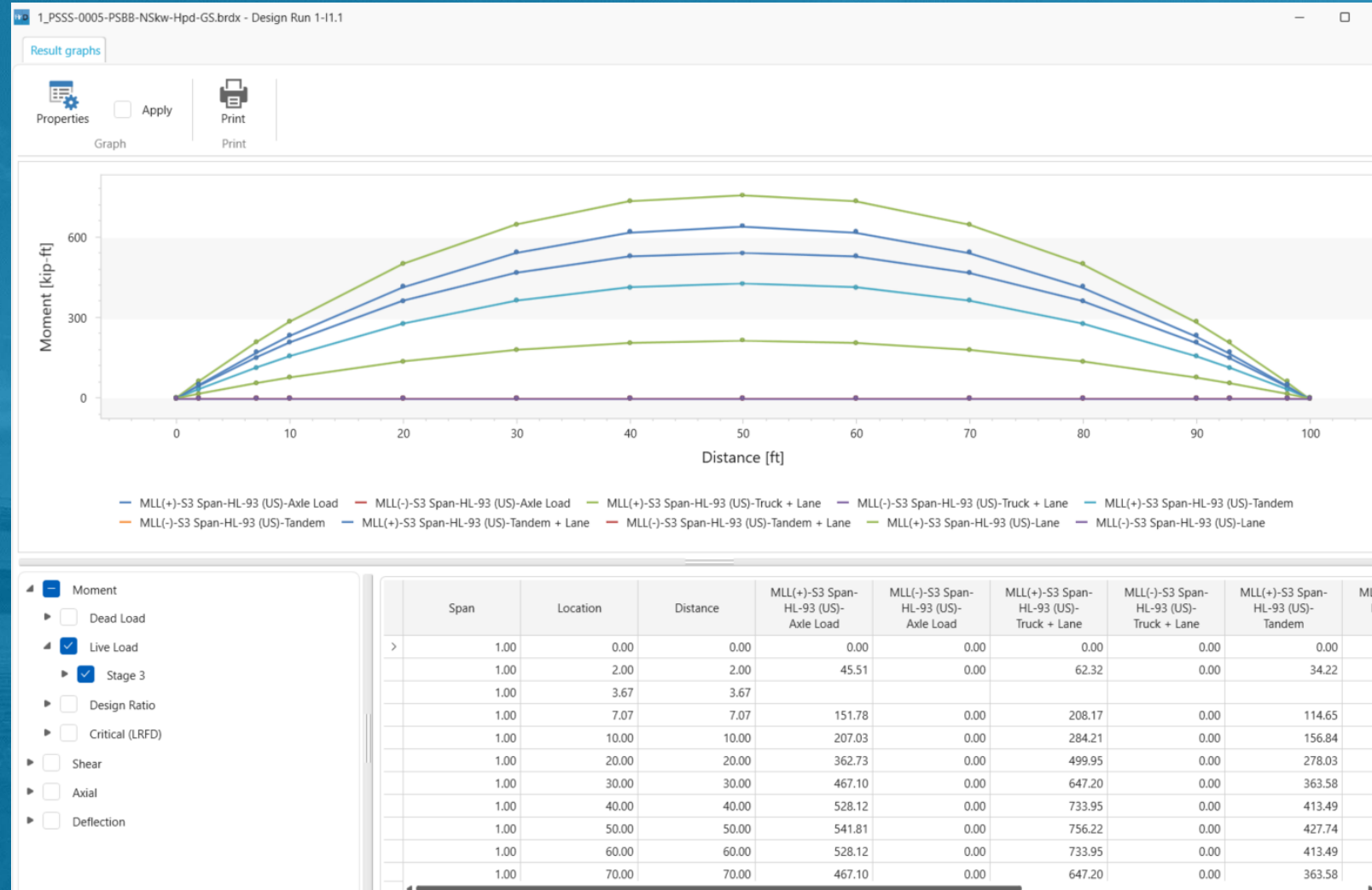
	Span	Location	Moment (kip-ft)	Shear (kip)	Axial (kip)	Reaction (kip)	X deflection (in)	Y deflection (in)
>	1	0.00	-0.00	44.42	-0.00	44.42	0.0000	-0.0000
	1	2.00	87.06	42.64	0.00		0.0000	-0.0000
	1	2.00	87.06	42.64	-0.00		0.0000	-0.0000
	1	7.07	292.02	38.13	0.00		0.0000	-0.0000
	1	10.00	399.76	35.53	0.00		0.0000	-0.0000
	1	20.00	710.68	26.65	0.00		0.0000	-1.2924
	1	30.00	932.77	17.77	0.00		0.0000	-1.7694
	1	40.00	1066.02	8.88	0.00		0.0000	-2.0723
	1	50.00	1110.44	0.00	0.00		0.0000	-2.1760
	1	60.00	1066.02	-8.88	0.00		0.0000	-2.0723
	1	70.00	932.77	-17.77	0.00		0.0000	-1.7694
	1	80.00	710.68	-26.65	0.00		0.0000	-1.2924
	1	90.00	399.76	-35.53	0.00		0.0000	-0.6831
	1	92.92	292.02	-38.13	0.00		0.0000	-0.4879
	1	98.00	87.06	-42.64	0.00		0.0000	-0.1392
	1	100.00	-0.00	-44.42	0.00	44.42	0.0000	-0.0000

Load Case 1 - Self Load(Stage 1:D,DC)
Load Case 2 - Member Dist'd Loads(Interior Diaphragm as uniform load)
Load Case 3 - Concrete Deck Load(Stage 1:D,DC)
Load Case 4 - Railing Loads(Steel Railing Appurtenance:Stage 1~
Load Case 5 - Sidewalk Loads(Sidewalk Appurtenance:Stage 1:D,D~
Load Case 6 - PS Transfer Forces (Stage 1)

Design | View Results | Results Graphs

Results Graphs with Corresponding Tabular Results:

- Dead and Live Load Actions and Deflections
- Each Stage
- Each Load Case
- Each POI
- Design Ratios
- Envelopes
- Can be viewed and printed



Design | View Results | Engine Outputs

Various Output Files from Engine:

- Finite Element Analysis Models and Results
- Live Load Distribution Calculations
- Specification Check Summary

The screenshot displays the ProMiles software interface. The main window, titled '1_PSSS-0005-PSBB-NSkw-Hpd-GS.brdx - Design Run 1-11.1', features a toolbar with 'Engine outputs', 'Properties', 'Apply', and 'Open folder' buttons. Below the toolbar is a table listing various output files categorized by 'Category', 'Description', and 'File name'.

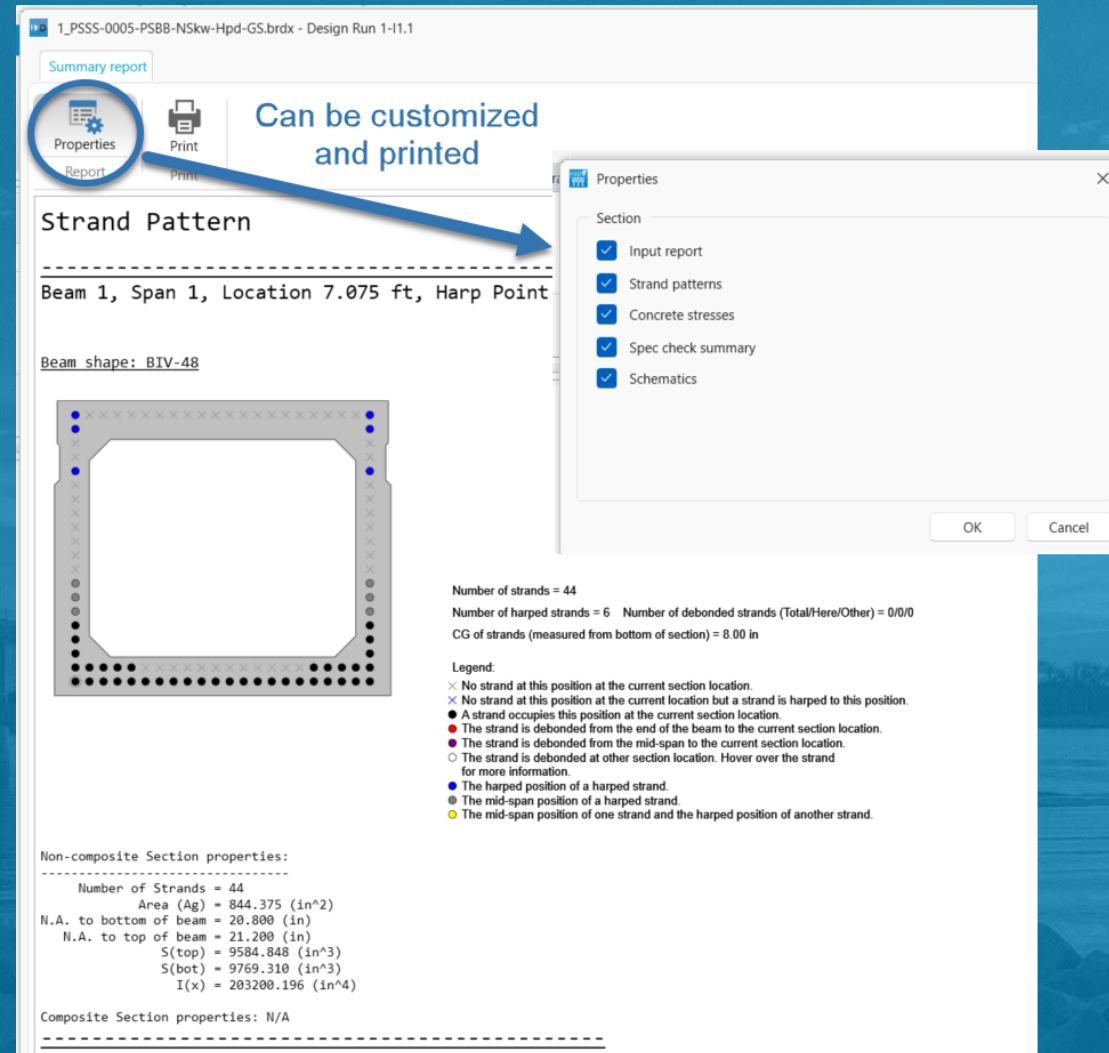
Category	Description	File name
FE Analysis	Stage 3 3 Infl Lines Finite Element Model and Load Cases	S3 Infl Lines Span.XML
FE Analysis	Stage 3 3 Infl Lines Element Actions, Support Reactions, and Nodal Displacements	S3 Infl Lines Span Actions.XML
LL Distribution	Live Load Distribution Factors Calculations	LRFD Dist Factor Calcs.TXT
> LL Distribution	Live Load Distribution Factors Calculations Summary	LRFD Dist Factor Summary.TXT
FE Analysis	Stage 1 Finite Element Model and Load Cases	S1 Span.XML
FE Analysis	Stage 1 Element Actions, Support Reactions, and Nodal Displacements	S1 Span Actions.XML
FE Analysis	Stage 2 Finite Element Model and Load Cases	S2 Span.XML
FE Analysis	Stage 3 Element Actions, Support Reactions, and Nodal Displacements	S3 Span Actions.XML
Specification Checks	Stage 3 Spec Check Results	Stage 3 Spec Check Results.XML

An inset window titled 'LRFD Dist Factor Summary.TXT' shows the content of the selected file. It includes the date and time (8/6/2026 4:57:26 PM), the specification reference (AASHTO LRFD Bridge Design Specifications, Edition 10, Interim 0), and a 'Moment Distribution Factor Schedule' table.

Start Distance (ft)	End Distance (ft)	Single Lane DF (Lanes)	Multi Lane DF (Lanes)
0.00	100.00	0.191(A)	0.268(A)

Design | View Results | Summary Report

- Combines Multiple Section of Output
- Sections are selectable by User
- Can be viewed and printed



Design | Design Run Pinning

Pinned Design Runs

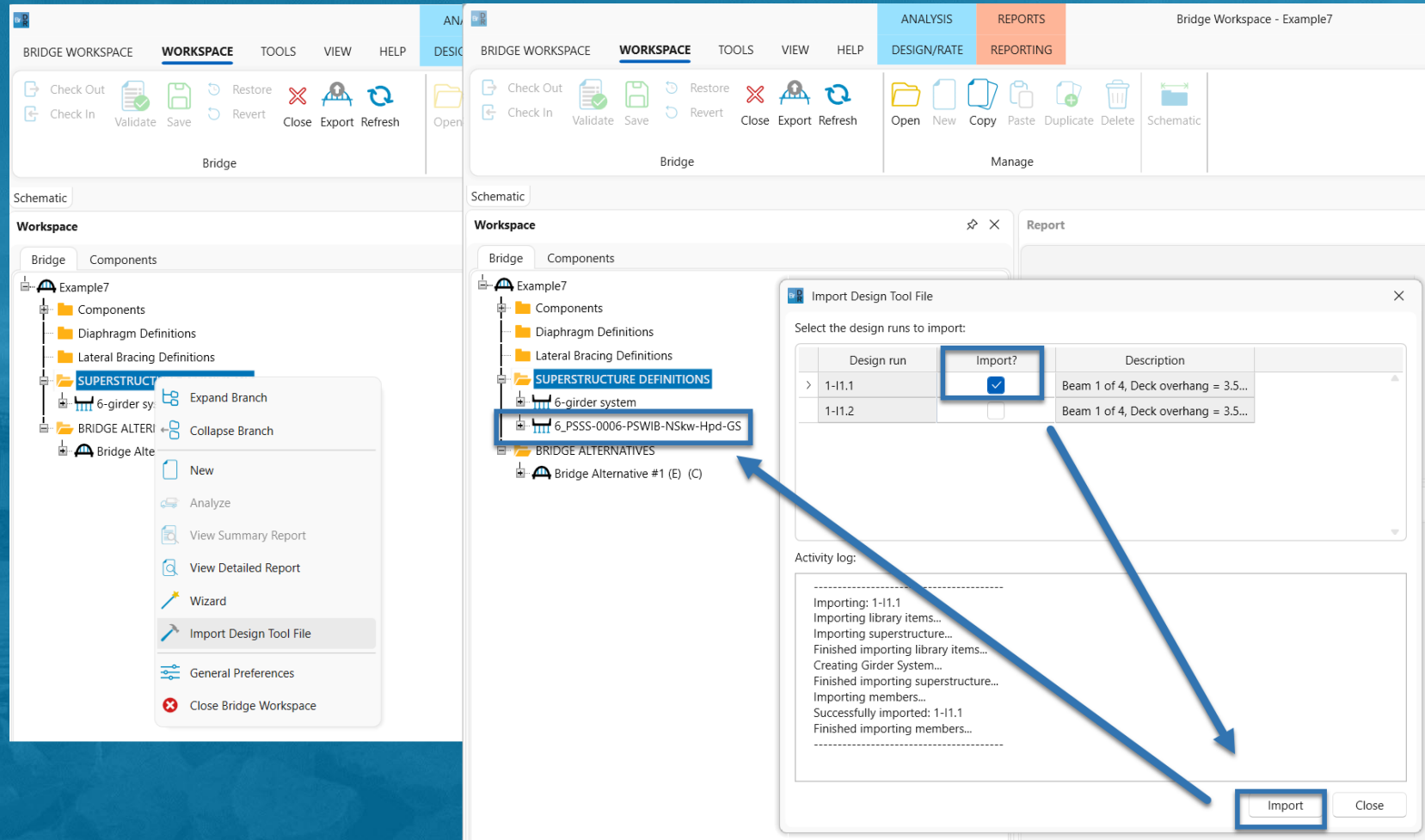
- Can be exported to BrDR
- Design runs are saved with input file and will be reanalyzed when input file is reopened

The screenshot shows the AASHTOWare Bridge Design software interface. The title bar reads "AASHTOWare Bridge Design: Prestressed Concrete Design Tool - 6_PSSS-0006-PSWIB-NSkw-Hpd-GS.brdx". The "Design" tab is active, showing a toolbar with icons for Design input, Design review, Specification checks, Tabular results, Result graphs, Engine outputs, Summary report, Delete, Reset, and Export. The Export icon is highlighted with a blue box. Below the toolbar, a table lists design runs. The table has columns for Design run, Description, Critical design ratio, Critical strand design ratio, and Pin. The Pin column contains a pin icon for each row. The row for design run 1-I1.2 is highlighted, and its Pin icon is also highlighted with a blue box.

Design run	Description	Critical design ratio	Critical strand design ratio	Pin
1-I1.1	Beam 1 of 4, Deck overhang = 3.500 ft, BT-63, 40 strands, CG at left end = 32.12 in	✓ 1.013	✓ 1.013	Pin icon
> 1-I1.2	Beam 1 of 4, Deck overhang = 3.500 ft, BT-72, 32 strands, CG at left end = 36.60 in	✓ 1.010	✓ 1.010	Pin icon (highlighted)
1-I1.3	Beam 1 of 4, Deck overhang = 4.000 ft, BT-63, 42 strands, CG at left end = 32.12 in	✗ 0.191	✗ 0.191	Pin icon
1-I1.4	Beam 1 of 4, Deck overhang = 4.000 ft, BT-72, 34 strands, CG at left end = 36.60 in	✓ 1.042	✓ 1.042	Pin icon
1-I1.5	Beam 1 of 5, Deck overhang = 3.500 ft, BT-63, 34 strands, CG at left end = 32.12 in	✓ 1.045	✓ 1.045	Pin icon
1-I1.6	Beam 1 of 5, Deck overhang = 3.500 ft, BT-72, 28 strands, CG at left end = 36.60 in	✓ 1.004	✓ 1.004	Pin icon
1-I1.7	Beam 1 of 5, Deck overhang = 4.000 ft, BT-63, 36 strands, CG at left end = 32.12 in	✓ 1.031	✓ 1.031	Pin icon
1-I1.8	Beam 1 of 5, Deck overhang = 4.000 ft, BT-72, 30 strands, CG at left end = 36.60 in	✓ 1.032	✓ 1.032	Pin icon

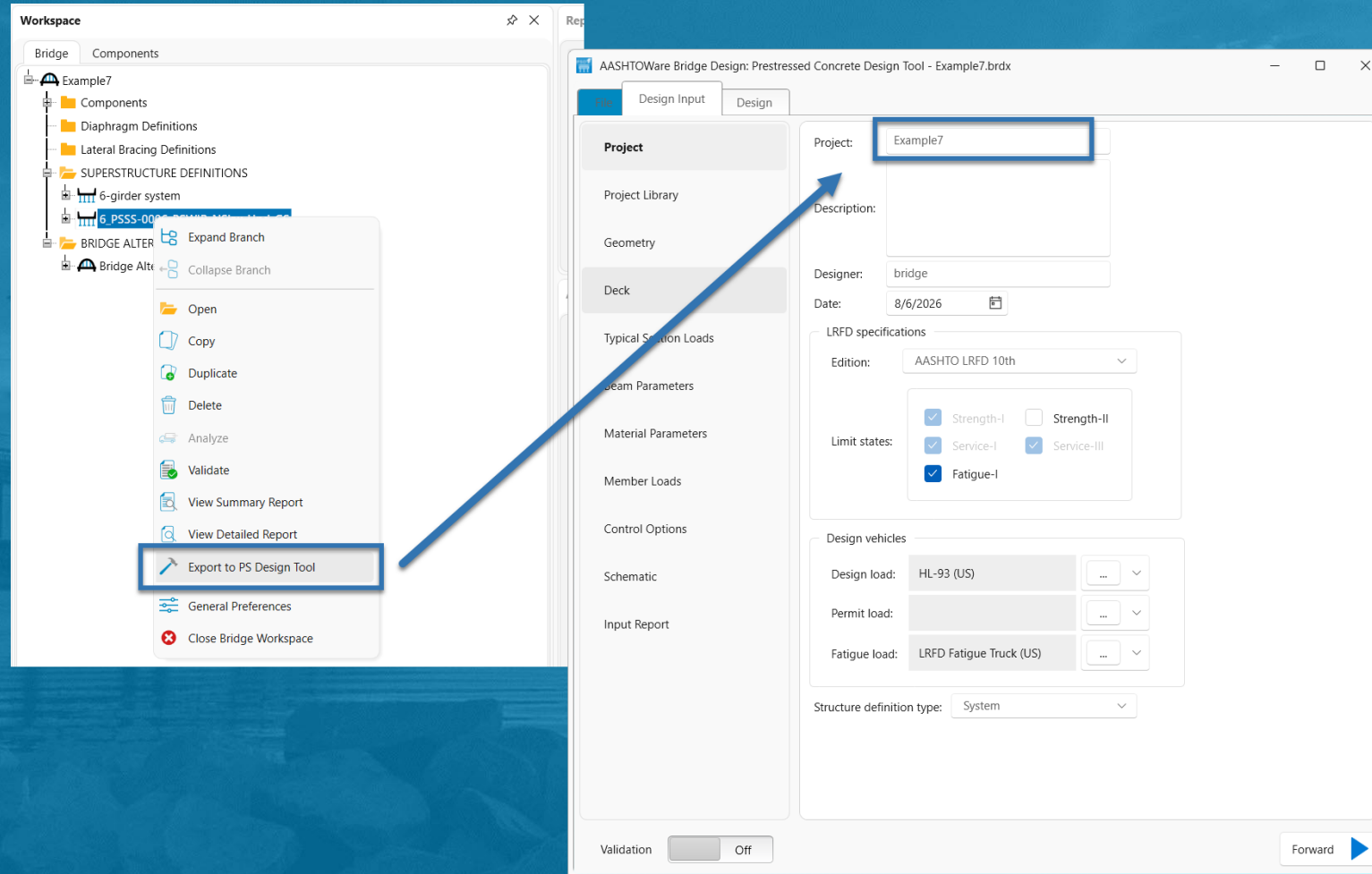
Design | BrDR Export/Import

From PS Design Tool to BrDR



Design | BrDR Export/Import

From BrDR to PS Design Tool



Future Direction

Integration with BrDR

Some other improvement ideas from BetaTAG Testing

- Improvements to strand design algorithm
- Strand editing in tabular format
- Strand and beam Visualization
- Design algorithm for mild steel in girder
- Dedicated stirrup range for splitting resistance

Questions / Comments