



BrDR 7.8

Reinforced Concrete Pier Cap LRFR Analysis

Presented by Krisha Kennelly, PE ProMiles

Overview

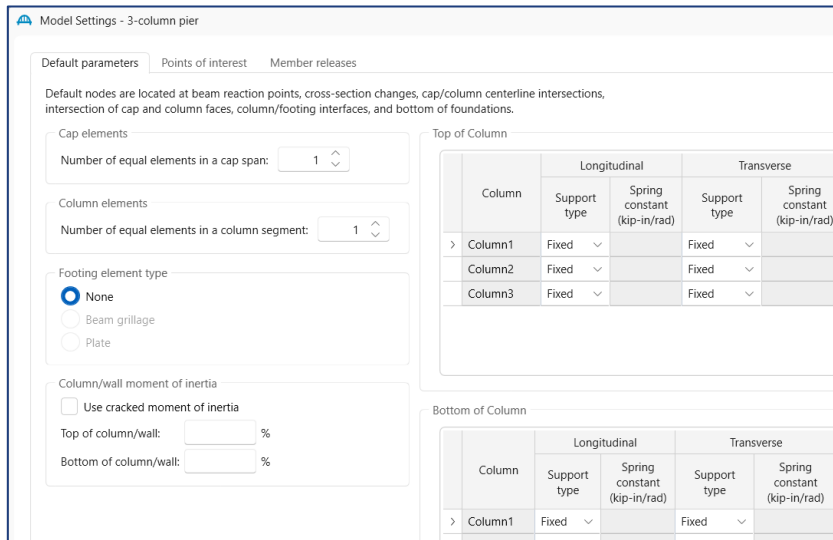
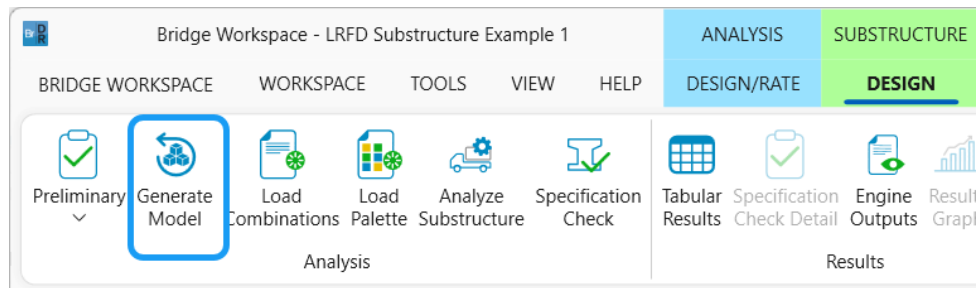
- BWS Changes
- Reinforcement Entry Changes
- Reinforcement Schematic
- Pier Association
- Pier Cap LRFR Load Rating

BWS Changes

- Model Settings
- Live Load Settings
- Points of Interest
- Deterioration

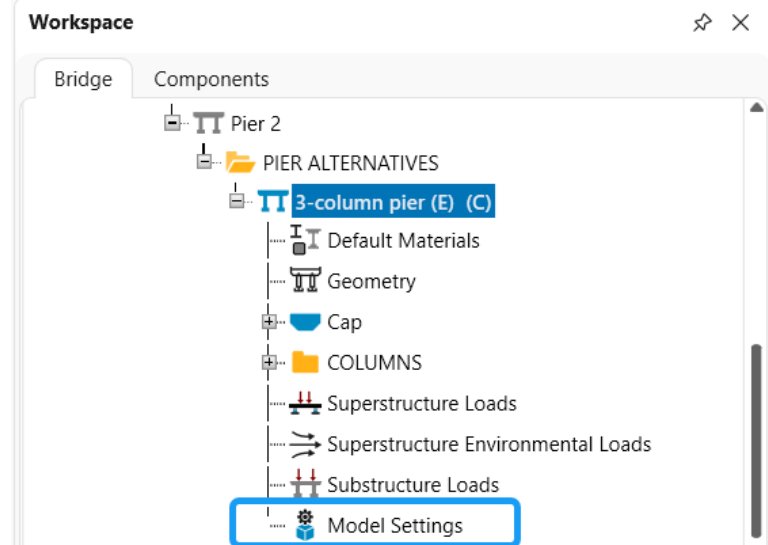
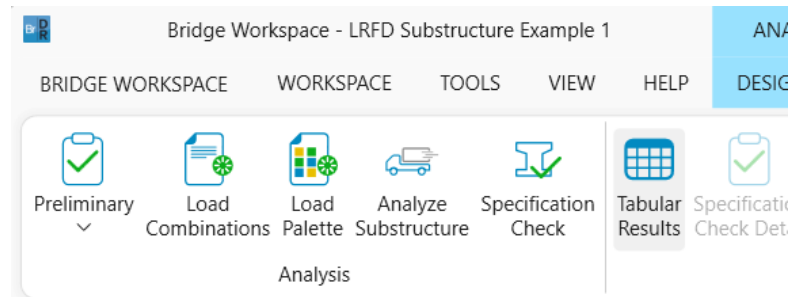
Model Settings

v7.7



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AASHTOWare Rating and Design Bridge User Group Meeting 2026

Live Load Settings

LRFD Design Review

LRFD Substructure Design Settings

Name: Design setting 1

Description:

Design setting type

- ☒ Preliminary
- ☒ Final

Limit states Vehicles Substructure loading

Analysis method type	Analysis module	Spec version	Factors
LRFD	AASHTO LRFD	LRFD 10th	2024 AASHTO LRFD Specifica

Choose the limit states to be included in the analysis:

- ☒ STRENGTH-I
- ☐ STRENGTH-II

Dynamic load allowance

Fatigue and fracture limit states: 15.0 %

All other limit states: 33.0 %

Load Rating

Superstructure Loads-Pier 2-3-column pier

Back span

Span no.: 1

Superstructure definition: 2 Continuous span

Ahead span

Span no.: 2

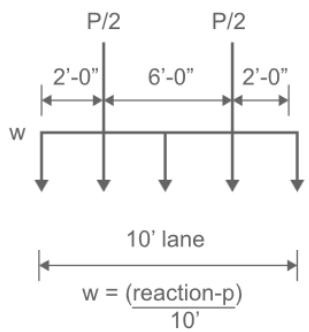
Superstructure definition: 2 Continuous span

DL FR LL settings LL-reaction LL-distribution **Load rating LL settings** BR

Single lane reaction distribution

- ☒ Consider maximum axle load as P
- ☐ Consider entire reaction as P
- ☐ Consider uniform load only

Vehicle single lane reactions will be applied to the deck as shown below:



10' lane

$w = \frac{(\text{reaction-p})}{10'}$

LRFR dynamic load allowance

Fatigue and fracture limit states: 15.0 %

All other limit states: 33.0 %

Points of Interest

v7.7

Model Settings - 3-column pier

Default parameters Points of interest Member releases

Default nodes are located at beam reaction points, cross-section changes, cap/column interfaces, intersection of cap and column faces, column/footing interfaces, and bottom of foundations.

Cap additional points of interest

Distance from left end of cap (ft)

New Duplicate Delete

Column additional points of interest

Column	Distance from bottom of column (ft)

New Duplicate Delete

v7.8

Cap Point Of Interest - Pier 2 - 3-column pier

Distance from left edge of cap: 0.00 ft or Region: Left C

Shear Development Shear capacity Positive flexu

☐ Override schedule

Shear reinforcement

Material:

Bar size:

of legs:

Area: in²

Spacing: in

LRFD

Com

Sx:

Beta

Ther

LRFD

☐

☐

☐

Consider permit load tensile steel stress

Cap

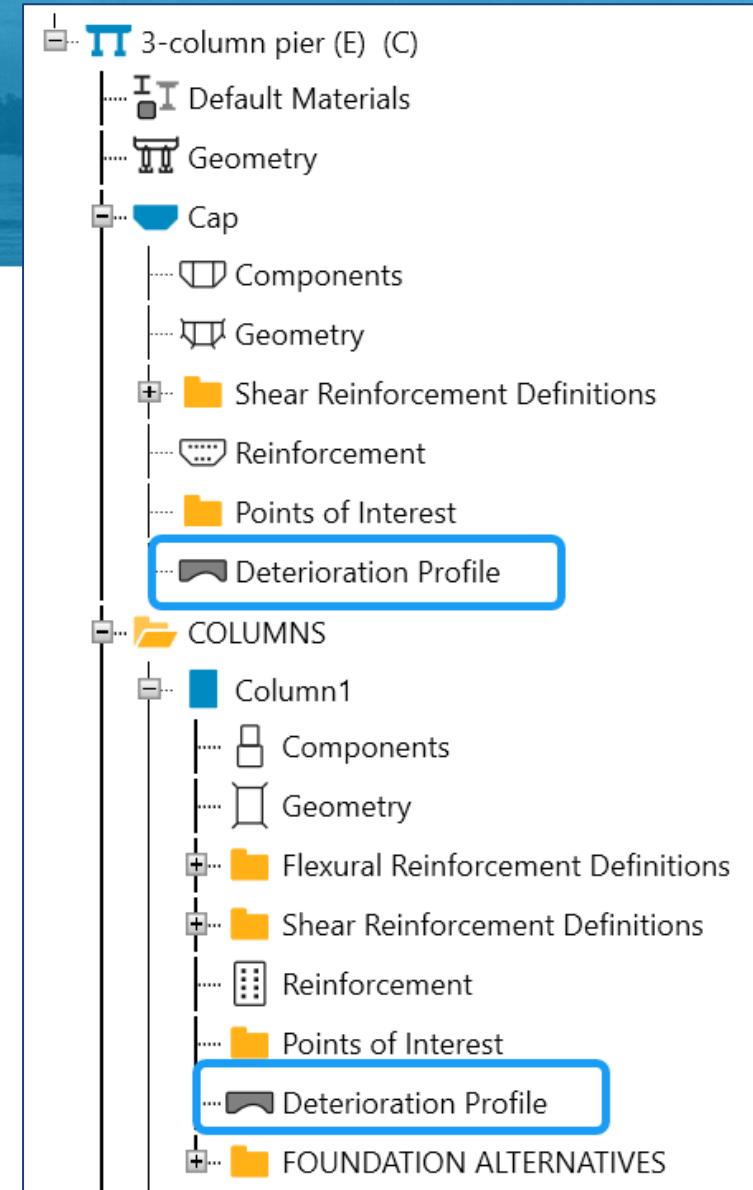
- Components
- Geometry
- Shear Reinforcement Definitions
- Reinforcement
- Points of Interest
- Deterioration Profile

Column1

- Components
- Geometry
- Flexural Reinforcement Definitions
- Shear Reinforcement Definitions
- Reinforcement
- Points of Interest
- Deterioration Profile
- FOUNDATION ALTERNATIVES

Deterioration

- Define concrete section loss and/or mild steel reinforcement loss for cap and column
- Deterioration is only considered for load rating



Deterioration

- Reinforcement is displayed as read-only and deterioration can be defined for it

Cap Deterioration Profile - Pier 2 - 3-column pier

Concrete Flexural Left cantilever shear Column bays shear Right cantilever shear

	Set	Measure from cap	Clear cover (in)	Bar size	Number	Material	Control point	Start distance (ft)	Straight length (ft)	End distance (ft)	Loss start distance (ft)	Loss straight length (ft)	Loss end distance (ft)	Percent loss (%)
>	1	Top	2.625	10	6.000	Grade 60	Left edge of cap	0.500	50.000	50.500			0.00	
	2	Top	5.395	10	6.000	Grade 60	Left edge of cap	0.500	50.000	50.500			0.00	
	3	Bottom	2.625	9	5.000	Grade 60	Left edge of cap	0.500	50.000	50.500			0.00	
	4	Bottom	5.253	9	5.000	Grade 60	Left edge of cap	5.167	40.667	45.833			0.00	

Duplicate Delete

OK Apply Cancel

Deterioration

- The Duplicate button allows multiple loss regions for a reinforcement layer

Cap Deterioration Profile - Pier 2 - 3-column pier

Concrete Flexural Left cantilever shear Column bays shear Right cantilever shear

	Set	Measure from cap	Clear cover (in)	Bar size	Number	Material	Control point	Start distance (ft)	Straight length (ft)	End distance (ft)	Loss start distance (ft)	Loss straight length (ft)	Loss end distance (ft)	Percent loss (%)
>	1	Top	2.625	10	6.000	Grade 60	Left edge of cap	0.500	50.000	50.500	10.00	10.00	20.00	50.0
	1	Top	2.625	10	6.000	Grade 60	Left edge of cap	0.500	50.000	50.500	30.00	5.00	35.00	25.0
	2	Top	5.395	10	6.000	Grade 60	Left edge of cap	0.500	50.000	50.500			0.00	
	3	Bottom	2.625	9	5.000	Grade 60	Left edge of cap	0.500	50.000	50.500			0.00	
	4	Bottom	5.253	9	5.000	Grade 60	Left edge of cap	5.167	40.667	45.833			0.00	

Duplicate Delete

OK Apply Cancel

Deterioration

- Shear reinforcement deterioration grid can help verify your input

Cap Deterioration Profile - Pier 2 - 3-column pier

Concrete Flexural Left cantilever shear Column bays shear Right

	Av (in ²)	Control point	Distance from control point (ft)	Percent loss (%)	
	1.240	Left edge of cap	0.58		
	1.240	Left edge of cap	1.04		
	1.240	Left edge of cap	1.50		
	1.240	Left edge of cap	1.96		
	1.240	Left edge of cap	2.42		
	1.240	Left edge of cap	2.87		
>	1.240	Left edge of cap	3.33		

Pier Column Deterioration

Column Deterioration Profile - Pier 2 - 3-column pier - Column1

Concrete Flexural Shear

	Set	Pattern	Start distance (ft)	Straight length (ft)	End distance (ft)	Loss start distance (ft)	Loss straight length (ft)	Loss end distance (ft)	Pattern with loss
Ø	1	8 #10 bars	-2.500	20.080	17.580			0.00	-- None -- -- Create new -- -- None --

Duplicate Delete

OK Apply Cancel

Pier Column Deterioration

Column Flexural Reinforcement Definition - Pier 2 - 3-column pier - Column1

Name: 8 #10 bars~1 with loss

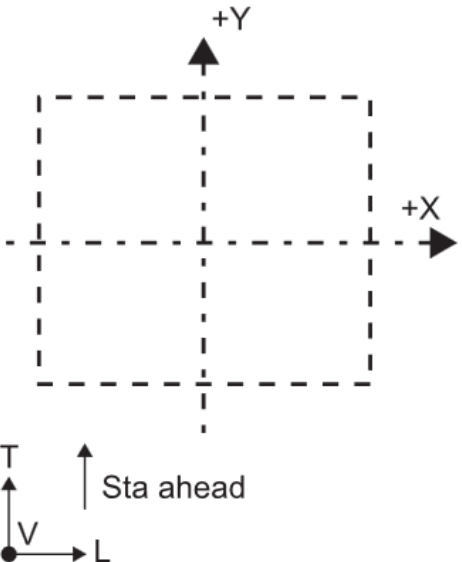
☐ Bundle bars ☒ Contains loss

Bar	Bar size	Material	X (in)	Y (in)	Percent loss (%)
1	10	Epoxied Grade I	14.865	0.000	50.0
2	10	Epoxied Grade I	10.511	-10.511	50.0
3	10	Epoxied Grade I	0.000	-14.865	
4	10	Epoxied Grade I	-10.511	-10.511	
5	10	Epoxied Grade I	-14.865	0.000	
6	10	Epoxied Grade I	-10.511	10.511	
7	10	Epoxied Grade I	0.000	14.865	
8	10	Epoxied Grade I	10.511	10.511	

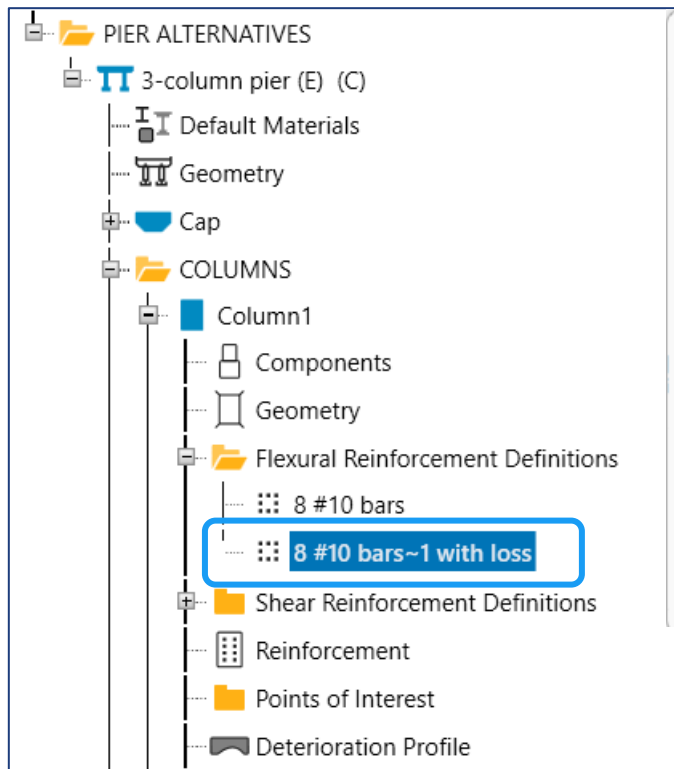
Generate pattern

New Duplicate Delete

OK Apply Cancel



Pier Column Deterioration



Column Deterioration Profile - Pier 2 - 3-column pier - Column1

Concrete Flexural Shear

	Set	Pattern	Start distance (ft)	Straight length (ft)	End distance (ft)	Loss start distance (ft)	Loss straight length (ft)	Loss end distance (ft)	Pattern with loss	
>	1	8 #10 bars	-2.500	20.080	17.580	0.00	5.00	5.00	8 #10 bars~1 with loss	

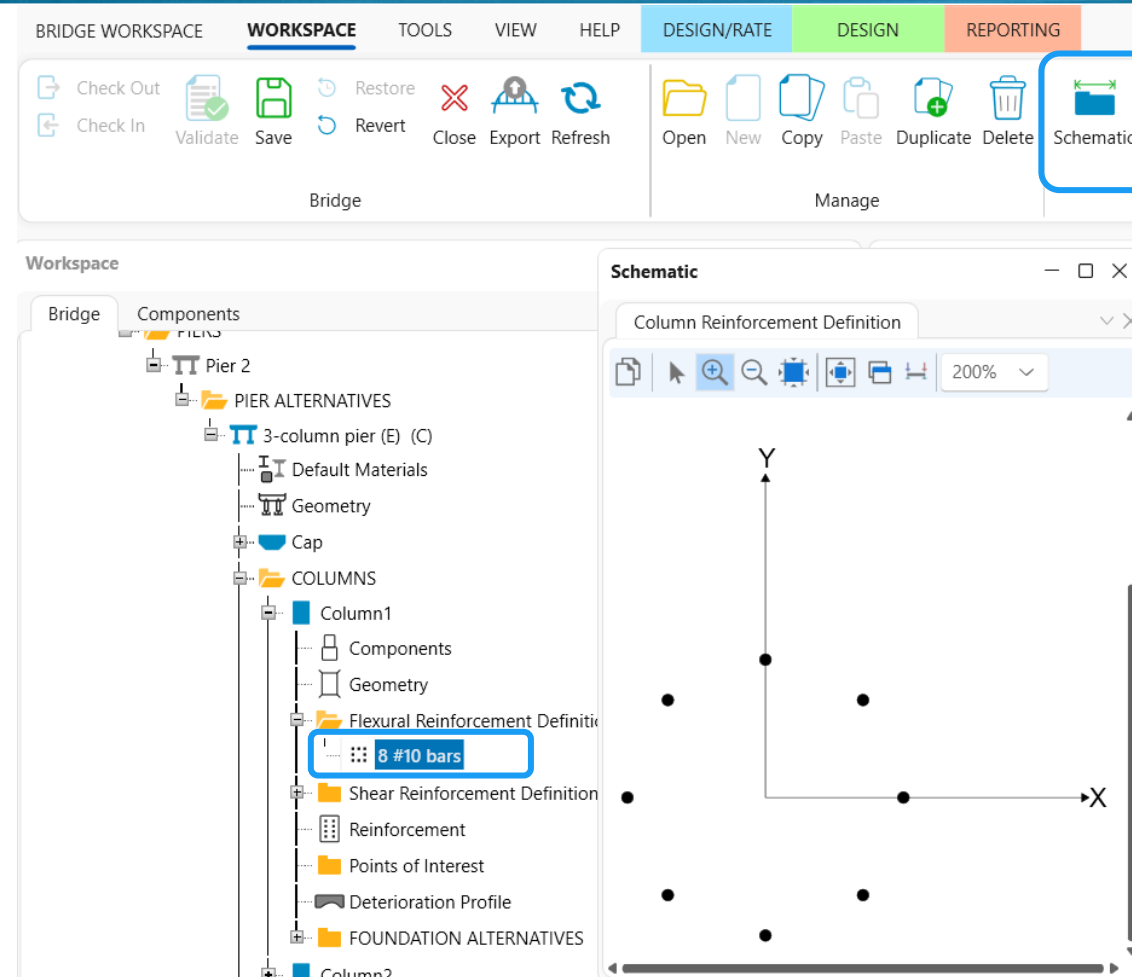
Duplicate Delete

OK Apply Cancel

Reinforcement Entry Changes

- Column Flexural Reinforcement Schematic
- Cap Shear Reinforcement Entry
- Shear Reinforcement Definitions
- Shear Reinforcement Wizards
- Shear Reinforcement Spacing

Column Flexural Reinforcement Schematic



Cap Shear Reinforcement Entry

v7.7

Cap Reinforcement - Pier 2 - 3-column pier

Flexural **Shear**

	Bar size	Number of legs	Material	Measure from	Direction	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	5	4.000	Grade 60	Left Edge of Cap	Right	0.583	1	0.000	0.000	0.583
	5	4.000	Grade 60	Left Edge of Cap	Right	0.583	10	5.500	4.583	5.166
	5	4.000	Grade 60	Left Edge of Cap	Right	8.333	1	0.000	0.000	8.333
	5	4.000	Grade 60	Left Edge of Cap	Right	8.333	12	5.500	5.500	13.833
	5	4.000	Grade 60	Left Edge of Cap	Right	13.833	6	11.000	5.500	19.333
	5	4.000	Grade 60	Left Edge of Cap	Right	19.333	10	5.500	4.583	23.916
	5	4.000	Grade 60	Left Edge of Cap	Right	27.083	1	0.000	0.000	27.083
	5	4.000	Grade 60	Left Edge of Cap	Right	27.083	10	5.500	4.583	31.666
	5	4.000	Grade 60	Left Edge of Cap	Right	31.666	6	11.000	5.500	37.166
	5	4.000	Grade 60	Left Edge of Cap	Right	37.166	12	5.500	5.500	42.666
	5	4.000	Grade 60	Left Edge of Cap	Right	45.833	1	0.000	0.000	45.833
	5	4.000	Grade 60	Left Edge of Cap	Right	45.833	10	5.500	4.583	50.416

Dup & Mirror New Duplicate Delete

OK Apply Cancel

v7.8

Cap Reinforcement - Pier 2 - 3-column pier

Pier cap length: 51 ft

Flexural **Left cantilever shear** Column bays shear Right cantilever shear

☐ Associate reinforcement with associated pier

Column bay: Bay 1

Left column width/diameter: 3 ft Bay length between column faces: 15.75 ft

Right column width/diameter: 3 ft

	Vertical shear reinforcement	Measure from	Direction	Spacing type	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	Definition 1	Left column CL	Right	Actual	1.583	1	0	0	1.583
	Definition 1	Left column CL	Right	Actual	1.583	12	5.5	5.5	7.083
	Definition 1	Left column CL	Right	Actual	7.083	6	11	5.5	12.583
	Definition 1	Left column CL	Right	Actual	12.583	10	5.5	4.5833333	17.1663333

Copy to bay New Duplicate Delete

Shear wizard

OK Apply Cancel

Shear Reinforcement Definitions

v7.7

Cap Reinforcement - Pier 2 - 3-column pier

Flexural Shear

Bar size	Number of legs	Material	Measure from
5	4.000	Grade 60	Left Edge of Cap
5	4.000	Grade 60	Left Edge of Cap
5	4.000	Grade 60	Left Edge of Cap
5	4.000	Grade 60	Left Edge of Cap
5	4.000	Grade 60	Left Edge of Cap

v7.8

2 Continuous span
BRIDGE ALTERNATIVES
2 span bridge (E) (C)
Continuous span steel bridge
SUPERSTRUCTURES
Stiffness Analysis
PIERS
Pier 2
PIER ALTERNATIVES
3-column pier (E) (C)
Default Materials
Geometry
Cap
Components
Geometry
Shear Reinforcement Definitions
Definition 1
Reinforcement
Points of Interest
Deterioration Profile

Cap Shear Reinforcement Definition - Pier 2 - 3-column pier

Name: Definition 1

Material: Grade 60

Bar size: 5

Number of legs: 4.00

Inclination (alpha): 90.00 Degrees

Cap Reinforcement - Pier 2 - 3-column pier

Pier cap length: 51.00 ft

Flexural Left cantilever shear Column bays shear Right cantilever shear

☐ Associate reinforcement with associated pier

Cantilever length from column face: 5.25 ft

Column width/diameter: 3.00 ft

Vertical shear reinforcement	Measure from	Direction	Spacing type	Start distance (ft)
Definition	Left edge of cap	Right	Actual	0.583
Definition	Left edge of cap	Right	Actual	0.583

Shear Reinforcement Wizards

Pier Column Shear Reinforcement Wizard

Shear reinforcement type: Ties

Within cap

Top of cap elevation: 76.000 ft Top of column elevation: 71.330 ft

	Shear reinforcement definition	Measure from	Direction	Spacing type	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	#5 Tie	Top of column	Up	Actual	0.250	6	6.0000	3.000	3.250

New Duplicate Delete

Within column

Interior reinforcement

☒ Maximum spacing: 18.0000 in ☐ Number of spaces: Shear reinforcement: #5 Tie

Measured from bottom of column

Start distance: 0.250 ft

	Shear reinforcement definition	Number of spaces	Spacing (in)
>	#5 Tie	6	6.0000

Measured from top of column

Start distance: 0.250 ft

	Shear reinforcement definition	Number of spaces	Spacing (in)
>	#5 Tie	6	6.0000

Shear Reinforcement Spacing

- Enter actual or maximum spacing
- AASHTO engine uses this entered maximum spacing as the spacing in this region

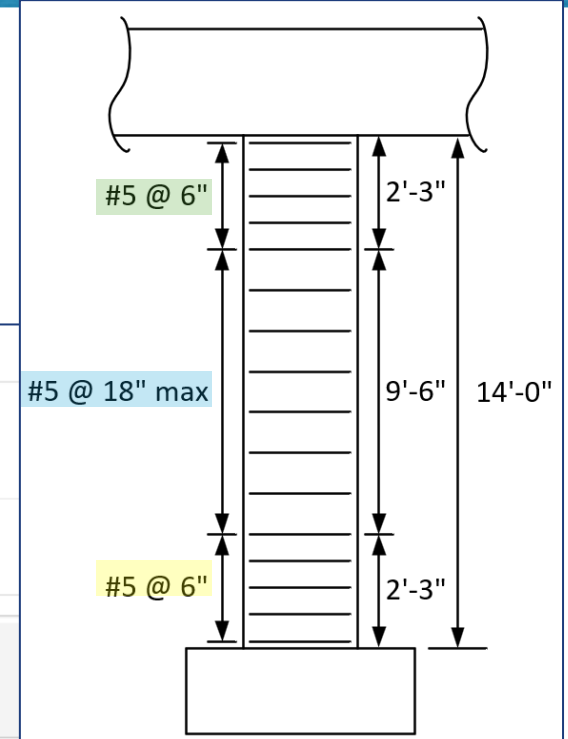
Flexural | **Shear**

☐ Associate reinforcement with associated pier

Shear reinforcement type

☒ Ties ☐ Spirals ☐ Spirals designed as ties ☐ Hoops ☐ Hoops with lap splice

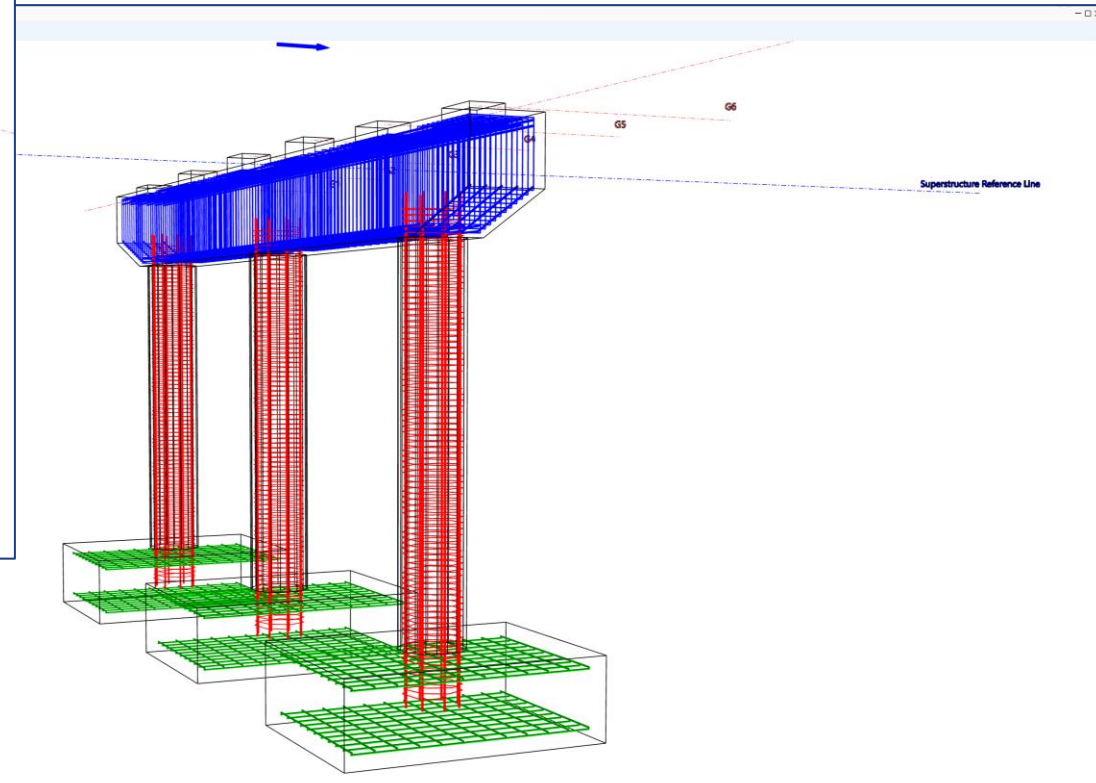
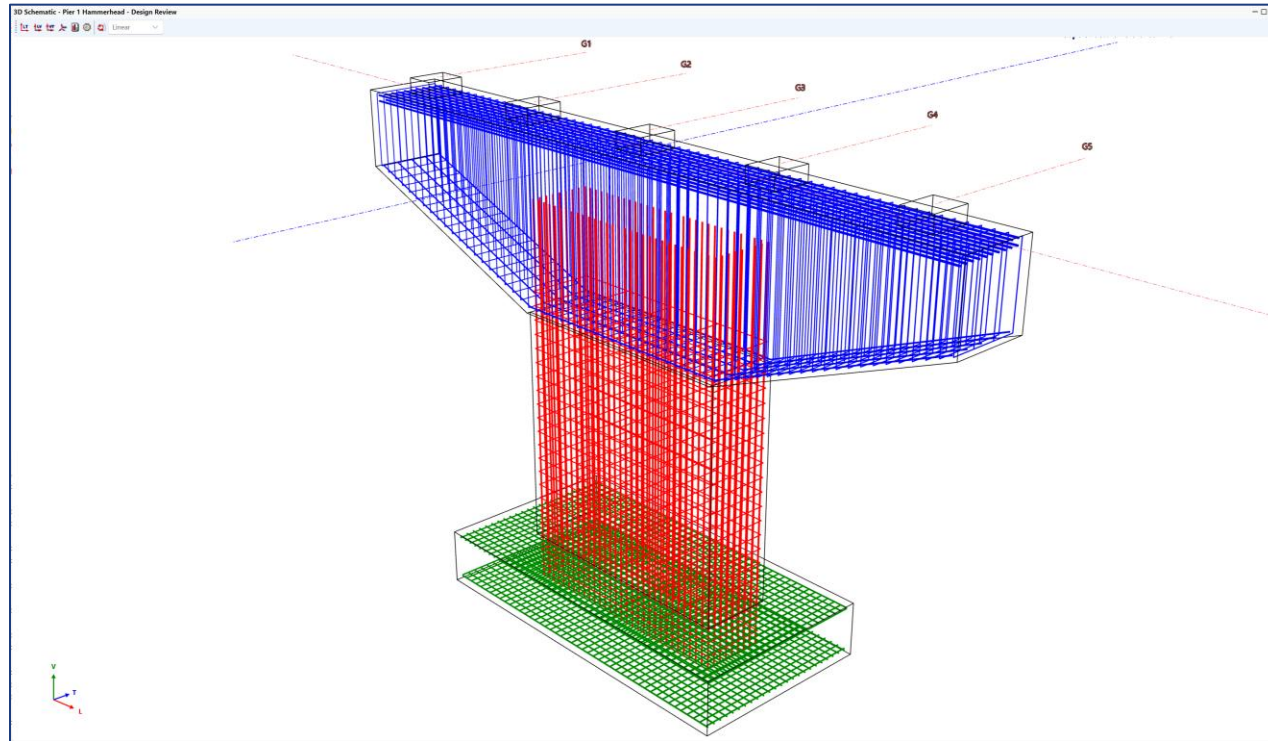
Range	Shear reinforcement definition	Measure from	Direction	Spacing type	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
1	Column 1 Tie Definition	Bottom of column	Up	Actual	0.250	4	6.0000	2.000	2.250
2	Column 1 Tie Definition	Bottom of column	Up	Maximum	2.250		18.0000	9.500	11.750
3	Column 1 Tie Definition	Bottom of column	Up	Actual	11.750	4	6.0000	2.000	13.750



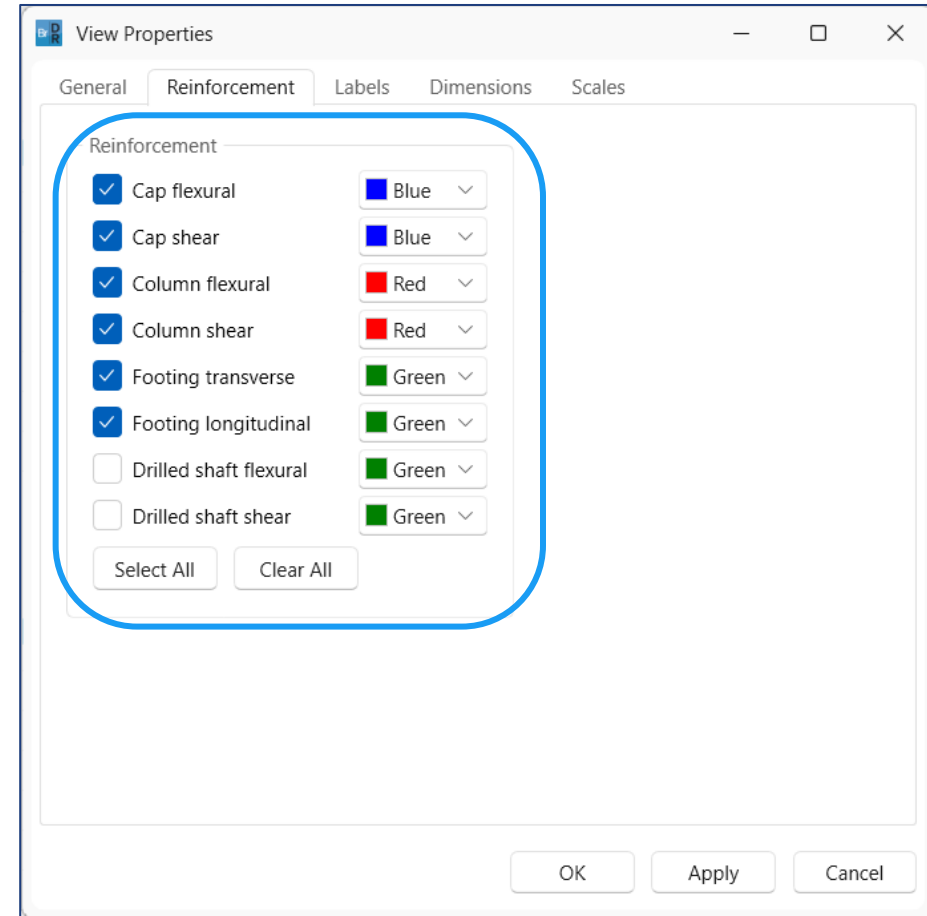
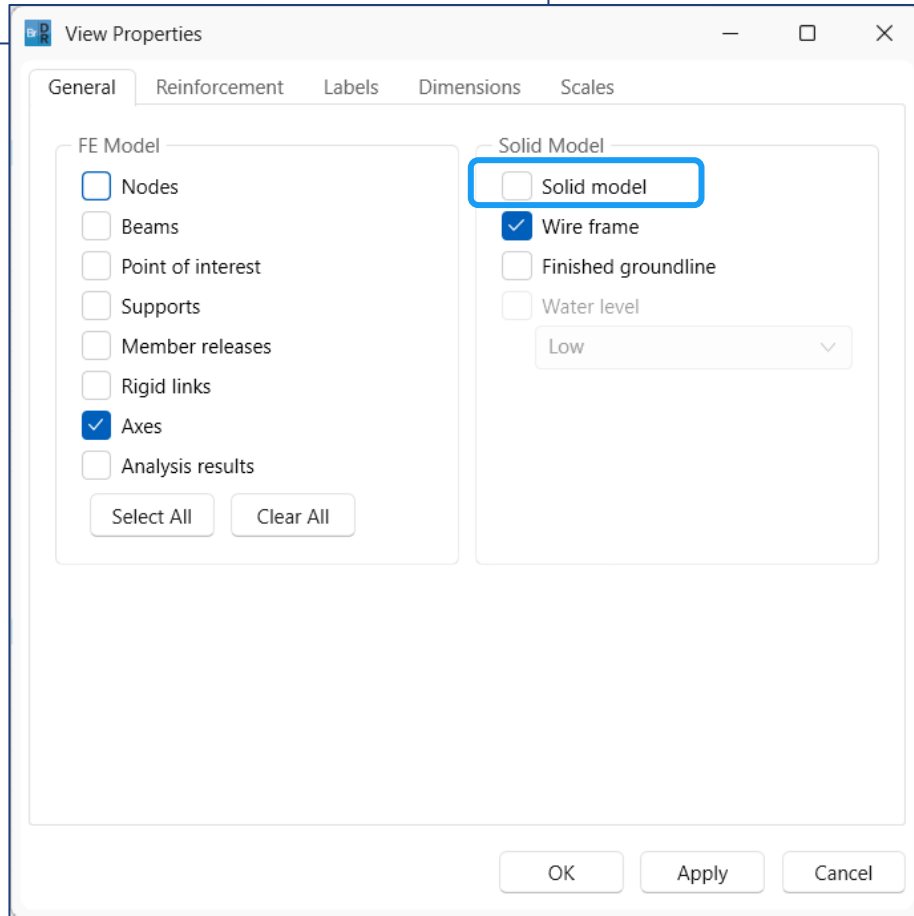
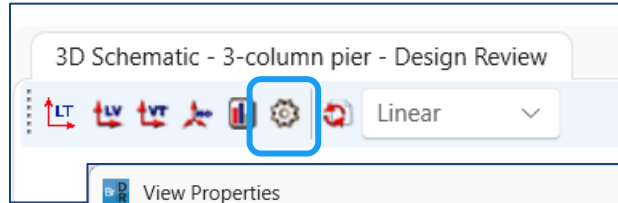
Reinforcement Schematic

- Pier 3D Schematic
- Schematic Settings

Reinforcement Schematic



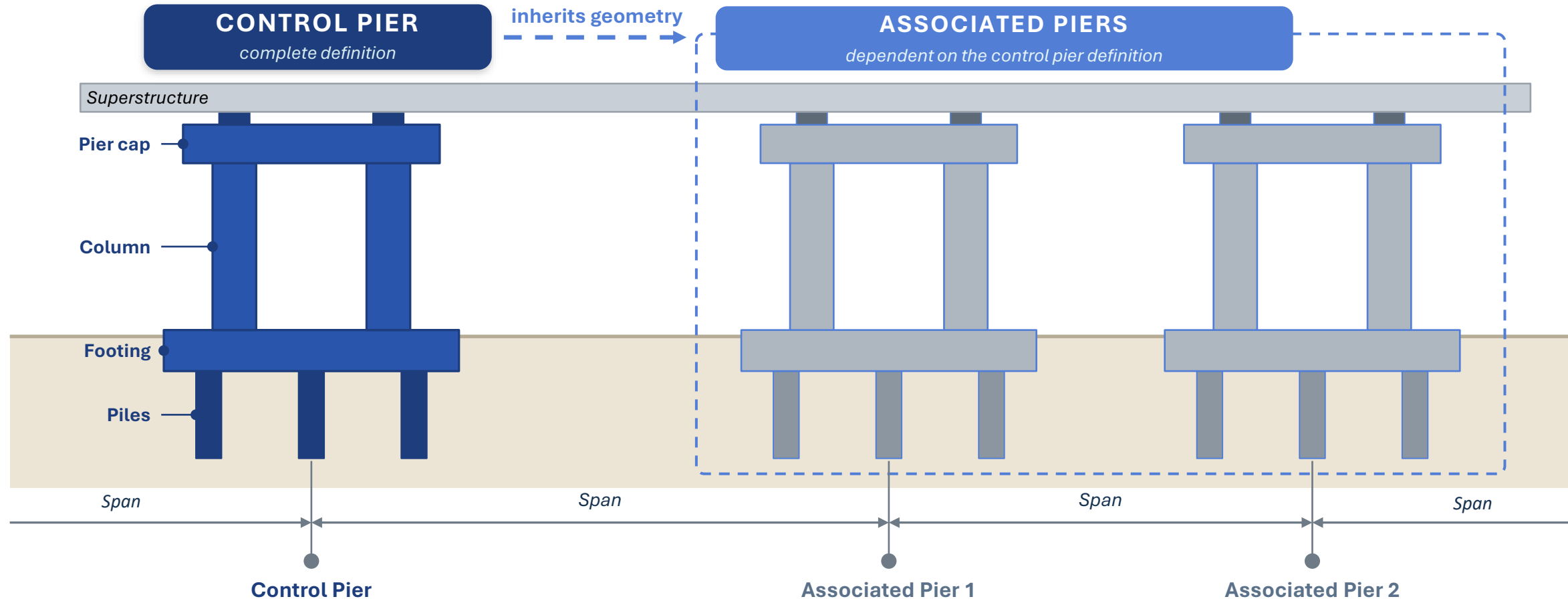
Reinforcement Schematic



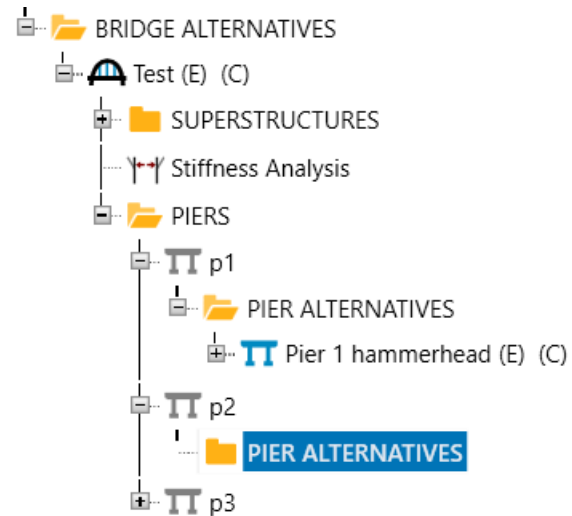
Pier Association

- Association concept
- Dependent data
- Reinforcement association

Pier Association



Pier Association



Pier Alternative - p2 - Pier 2 (assoc Pier 1 hammerhead)

Name: Pier 2 Type: RC SolidShaft Pier

Associate with: p1 - Pier 1 hammerhead

Description Specs Factors Control options Stiffness LRFD reports

Description:

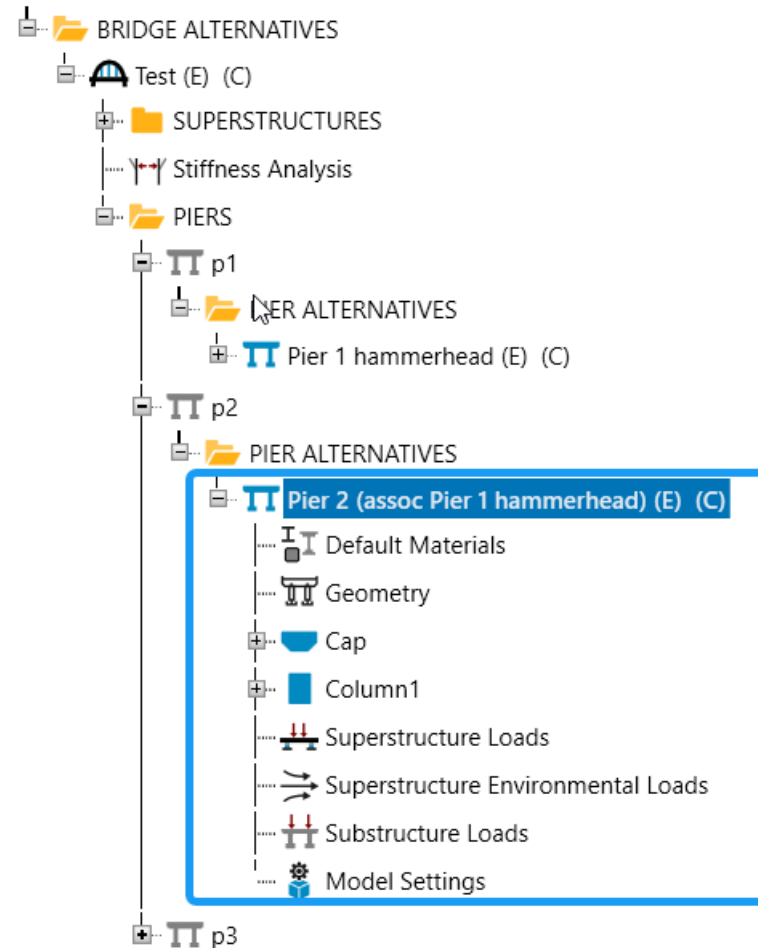
Units: US Customary

Default rating method: LRFR

LRFD substructure design settings

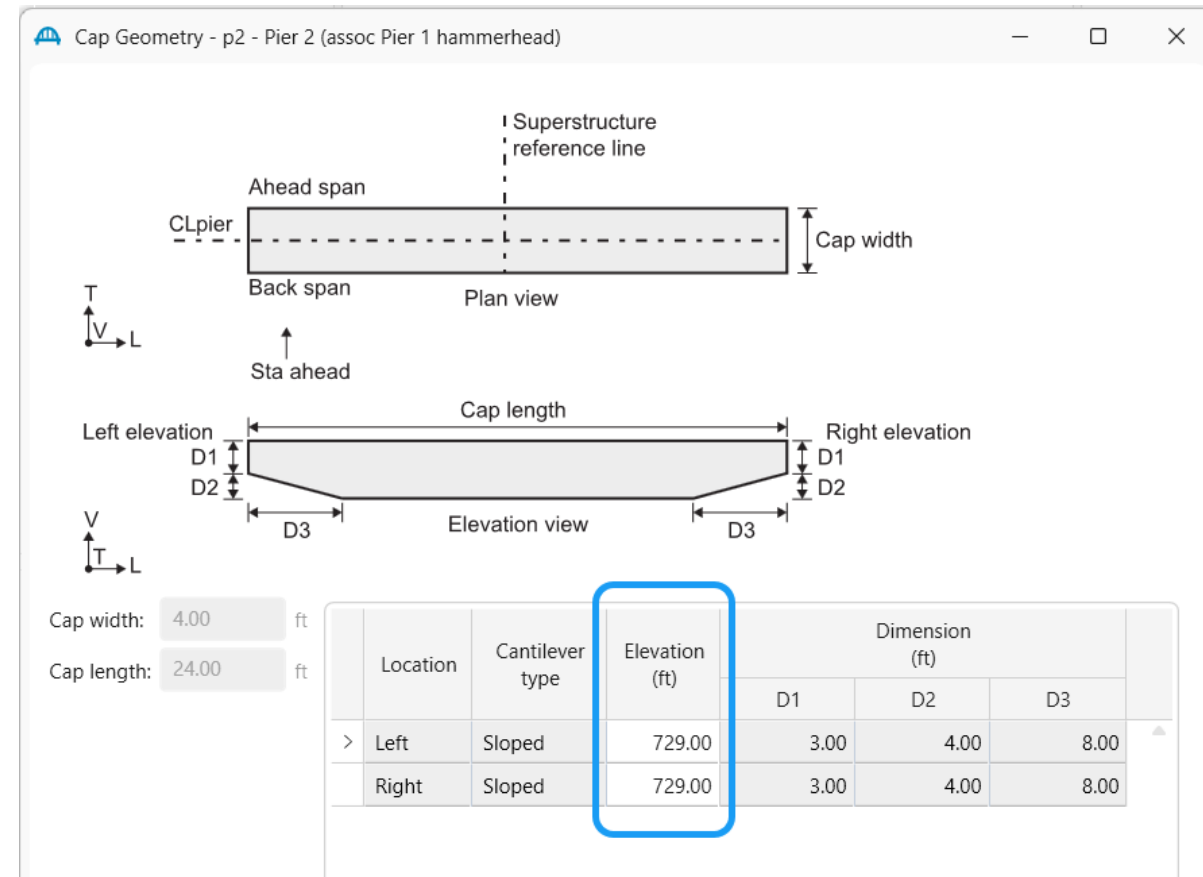
Preliminary mode

Pier Association



Dependent Data

- If a change is made to the gross geometry/reinforcement in the control pier, the change is reflected in the dependent pier
- Only elevation data can be modified in the dependent pier
- Not associated:
 - Loads
 - Deterioration
 - Cap Pedestals



Reinforcement Association

- Un-associate reinforcement in the dependent pier to modify it

Cap Reinforcement - p2 - Pier 2 (assoc Pier 1 hammerhead)

Pier cap length: 24.00 ft

Flexural Left cantilever shear Right cantilever shear

☐ Associate reinforcement with associated pier

Longitudinal skin

Bar size: 4 Bar spacing: 8.000 in Bar material: Grade 60 Stirrup clear cover: 2.0000 in

Primary flexural

Reinforcement input method

☒ Simplified ☐ Advanced ☒ Reinforcement follows cap profile Full length bar edge distance: ft

	Set	Measure from cap	Clear cover (in)	Bar size	Number	Material	Measure from	Start distance (ft)	Straight length (ft)	End distance (ft)	Hook at start	Hook at end
	1	Top	3.000	10	10.000	Grade 60	Full length	0.250	23.500	23.750	☐	☐
>	2	Bottom	3.000	10	10.000	Grade 60	Full length	0.250	23.500	23.750	☐	☐

Pier Cap LRFR Load Rating

- Pier Load Rating
- LRFR Load Factors
- Specification Selection
- LRFR Factors
- Analysis Control Options
- Include in Structure Load Rating
- Analysis Settings
- Analysis Results

Pier Load Rating

- Pier caps only
- Columns and footings are not spec checked in a load rating
- Not supported for integral piers
- LRFR only

Pier Load Rating

AASHTO MBE 6.1.5.2: Members of **substructures need not be routinely checked for load capacity.** *Substructure elements such as pier caps and columns should be checked in situations where the Owner has reason to believe that their capacity may govern the load capacity of the entire bridge.*

Where deemed necessary by the Owner, load rating of substructure elements ... should be done using all permanent loads and loads due to braking and centrifugal forces but neglecting other transient loads such as wind or temperature. The permanent load factors shall be chosen so as to produce the maximum factored force effect.

Pier Load Rating

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Pier Load Rating

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LRFR Load Factors

AASHTOWare Bridge Design and Rating

BRIDGE EXPLORER HELP **LIBRARY**

New Duplicate Open Delete Schematic Close

Manage

- Appurtenances
- Connectors
- Corrugated Metal Panel
- Factors
 - LFR
 - LRFD
 - LRFR**
- LRFD DF Applicability Ranges
- LRFD Substructure Design Settings
- Materials

Library	Name	Description
Standard	2011 (2015 Interim) AASHTO LRF...	AASHTO Manual for Bridge Evaluation, 2nd Edition, includin...
Standard	2011 (2016 Interim) AASHTO LRF...	AASHTO Manual for Bridge Evaluation, 2nd Edition, includin...
Standard	2018 AASHTO LRFR Specifications	AASHTO Manual for Bridge Evaluation, 3rd Edition 2018
Standard	2018 (2020 Interim) AASHTO LRF...	AASHTO Manual for Bridge Evaluation, 3rd Edition, including...
Standard	2018 (2022 Interim) AASHTO LRF...	AASHTO Manual for Bridge Evaluation, 3rd Edition, including...
Standard	2018 (2024 Interim) AASHTO LRF...	AASHTO Manual for Bridge Evaluation, 3rd Edition, including...
Standard	Assumed LRFR Substructure	Includes assumed load factors for substructure load rating

LRFR Load Factors

Factors: LRFR: Assumed LRFR Substructure



Name: Assumed LRFR Substructure

Description:

Includes assumed load factors for substructure load rating

Library



Standard



Agency defined

Routine permit input



Permit weight



Permit weight ratio

Load factors

Legal loads

Permit loads

Concrete

Steel

Wood

Aluminum

Buried structures

Specifications

Bridge type:

Reinforced-Concrete Substructure

Limit state	Dead load				Design load				CE	BR	WA	SH	CR	EH active		EH at-rest		Vehicle			
					Inventory	Operating	Legal load	Permit load						EH active		EH at-rest		Consider			
	DC Max	DC Min	DW Max	DW Min	LL	LL	LL	LL						Max	Min	Max	Min	Inv	Op	Legal	Permit
> STRENGTH I	1.250	0.900	1.500	0.650	1.750	1.350	Table 6A.4...		*	*	1.000	0.500	0.500	1.500	0.900	1.350	0.900	☒	☒	☒	☐
STRENGTH II	1.250	0.900	1.500	0.650	1.750			Table 6A....	**	**	1.000	0.500	0.500	1.500	0.900	1.350	0.900	☐	☐	☐	☒
SERVICE I	1.000	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	☐	☐	☐	☒

* Same as LL for Design/Legal loads

LRFR Specification Selection

Pier Alternative - Pier 2 - 3-column pier

Name: 3-column pier Type: RC Frame Pier

Associate with: -- None --

Description Specs Factors Control options Stiffness LRFD reports

	Analysis method type	Analysis module	Selection type	Spec version	Factors
>	LRFR	AASHTO Substructure LRFR	System Default	MBE 3rd 2024i, LRFD 10th	Assumed LRFR Substructure

LRFR Factors

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)} \quad (6A.4.2.1-1)$$

For the strength limit states:

$$C = \phi_c \phi_s \phi_n R_n \quad (6A.4.2.1-2)$$

- LRFR system factors must be entered by the user since the MBE does not specify these factors

The screenshot shows the 'Pier Alternative - Pier 2 - 3-column pier' window in the ProMiles software. The 'Factors' tab is selected. The 'LRFR' section is expanded, showing a 'Condition factor' dropdown set to 'Good or Satisfactory' and an unchecked checkbox for 'Field measured section properties'. A blue box highlights the 'System factors' section, which contains two input fields: 'Flexure and axial:' and 'Shear:'. The 'Name' field is set to '3-column pier' and the 'Type' is 'RC Frame Pier'.

Analysis Control Options

Pier Alternative - Pier 2 - 3-column pier

Name: 3-column pier Type: RC Frame Pier

Associate with: -- None --

Description Specs Factors **Control options** Stiffness LRFD reports

LRFD

Points of interest

- ☒ Generate at tenth points except supports
- ☐ Generate at support points
- ☒ Generate at support face & critical shear points
- ☐ Generate at section change points
- ☒ Generate at user-defined points
- ☒ Generate at beam reaction points

Shear computation method

☐ Ignore

☒ General procedure

☐ General procedure - Appendix B5

☐ Simplified procedure

☐ Consider inclined flexural forces

☐ Allow negative epsilon in general shear method

LRFR

Points of interest

- ☒ Generate at tenth points except supports
- ☐ Generate at support points
- ☒ Generate at support face & critical shear points
- ☐ Generate at section change points
- ☒ Generate at user-defined points
- ☒ Generate at beam reaction points

Shear computation method

☐ Ignore

☒ General procedure

☐ General procedure - Appendix B5

☐ Simplified procedure

☐ Ignore design & legal load shear

☐ Ignore permit load shear

☐ Ignore tension in long. reinf. due to shear

☐ Consider permit load tensile steel stress

☐ Consider inclined flexural forces

☐ Allow negative epsilon in general shear method

Include in Structure Load Rating

Pier

Pier name: Pier 1

Description Stream flow

Pier skew angle

☒ Input skew angle Skew angle: 0.00 Degrees Description:

☐ Input bearing angle

Finished groundline elevation: ft

Soil density: kcf

☒ Superstructure defined in BrDR

☒ Include in structure load rating

Superstructure longitudinal direction

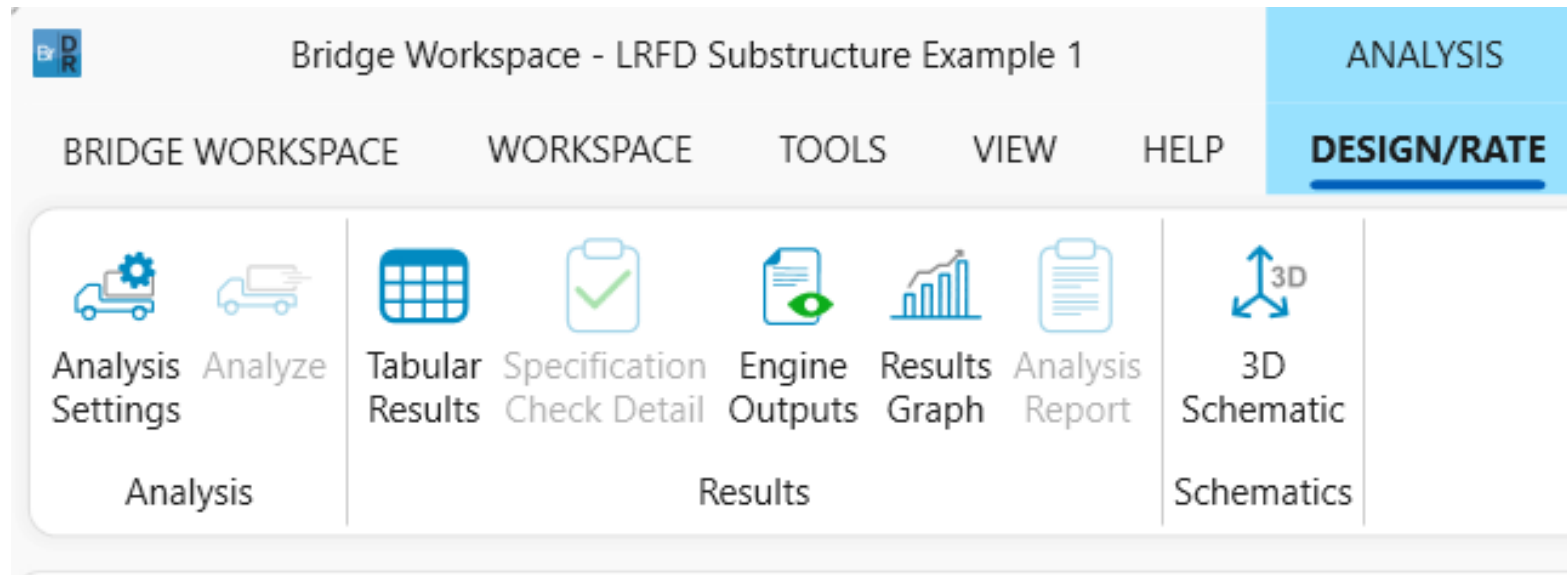
☐ Consider as fixed

☒ Consider as expansion

Pier location relative to bridge alternative

Station: 120.00 ft Offset: -0.00 ft

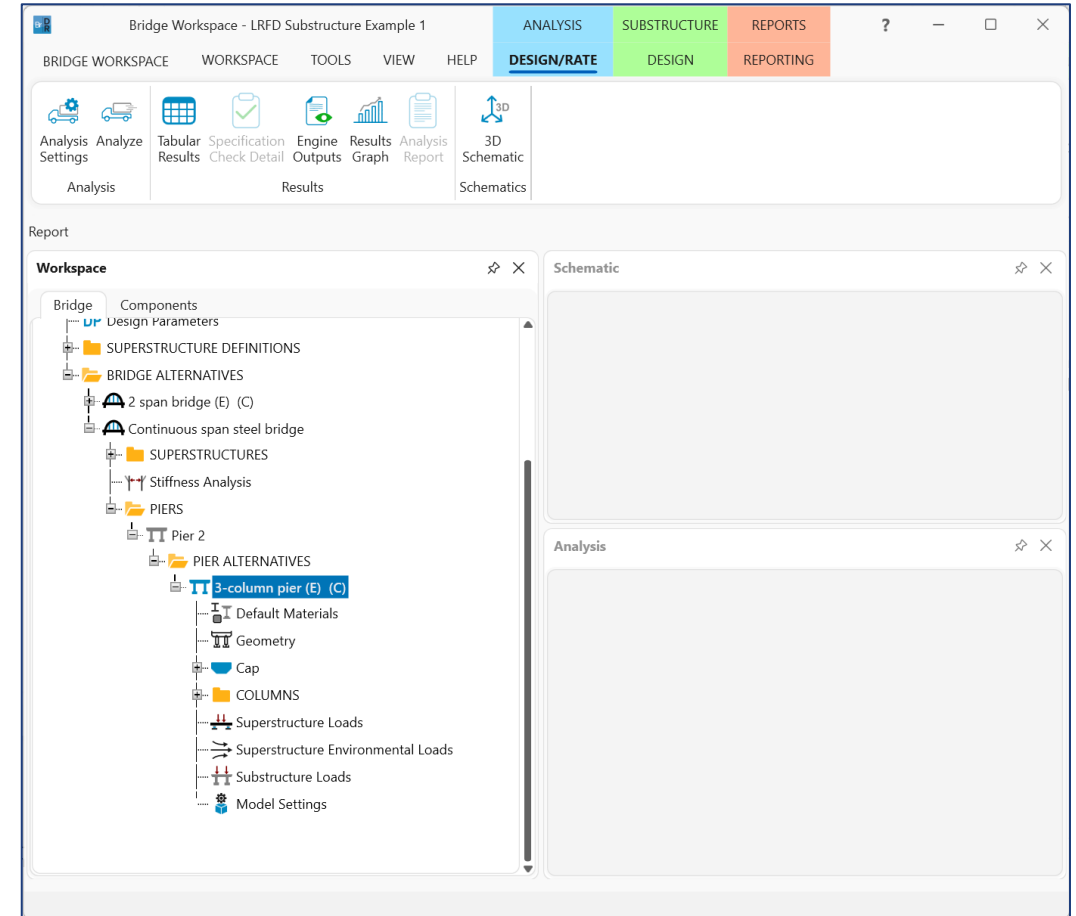
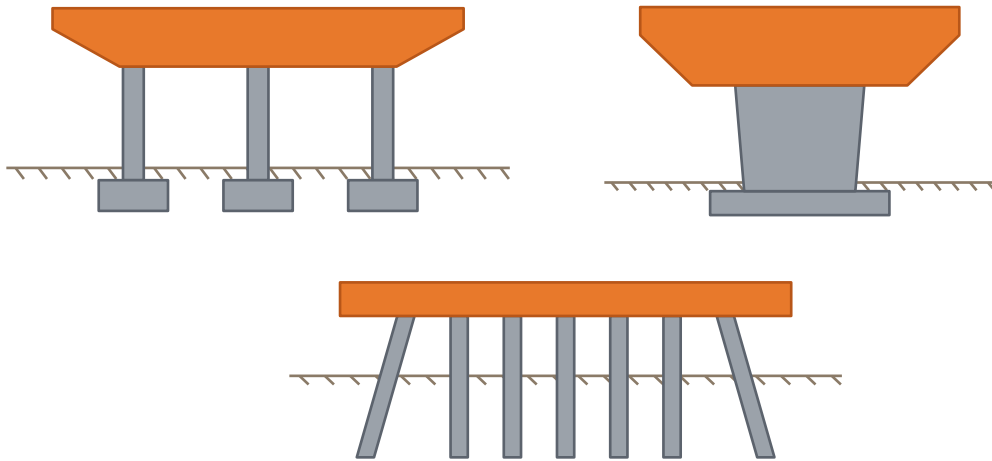
Analysis Design/Rate ribbon



Analysis Settings

ANALYSIS: DESIGN/RATE

Define analysis settings, vehicles, and substructure loading options in the *Analysis Settings* window.



Analysis Settings

The screenshot displays the 'Analysis Settings' window with the following components:

- Design review / Rating:** Radio buttons for 'Design review' and 'Rating' (selected).
- Rating method:** A dropdown menu set to 'LRFR'.
- Analysis type:** A dropdown menu set to 'Line Girder'.
- Lane / Impact loading type:** A dropdown menu set to 'As Requested'.
- Apply preference setting:** A dropdown menu set to 'None'.
- Buttons:** 'Refresh', 'Temporary vehicles', and 'Advanced' (highlighted with a blue box).
- Vehicle selection:** A list of vehicle types including EV2, EV3, H 15-44, H 20-44, HL-93 (SI), HL-93 (US), HS 15-44, HS 20 (SI), HS 20-44, Lane-Type Legal Load, and LRFD Fatigue Truck (SI).
- Vehicle summary:** A tree view showing 'Rating vehicles' with sub-items like 'Design load rating', 'Inventory', 'Operating', 'Fatigue', 'Legal load rating', 'Routine', 'Specialized haul', and 'Permit load rating'.
- Vehicle Properties:** A dialog box with tabs for 'Superstructure analysis' and 'Substructure analysis'. The 'Transverse loading' section includes:
 - 'Vehicle increment in lane:' set to 2.000 ft.
 - 'Lane increment:' set to 4.000 ft.
 - A checked checkbox for 'Move vehicle left to right across travelway'.
 - An unchecked checkbox for 'Move vehicle right to left across travelway'.

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Tabular Results

Print

Report type:

Rating Summary

Lane/Impact loading type

☒ As requested
 ☐ Detailed

Display format

Single rating level per row

Rating display type

Live load type

Action

Critical

Live load	Live load type	Rating method	Rating level	Load rating (Ton)	Safe posting load (Ton)	Rating factor	Component	Location (ft)	Limit state	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	29.28		0.813	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested
HL-93 (US)	Truck + Lane	LRFR	Operating	34.05		0.946	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Inventory	31.97		0.888	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Operating	37.46		1.041	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested
HL-93 (US)	90%(Truck Pair + Lane)	LRFR	Inventory	26.19		0.728	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested
HL-93 (US)	90%(Truck Pair + Lane)	LRFR	Operating	30.17		0.838	Cap	39.000	STRENGTH-I - Concrete Shear Eval	As Requested	As Requested

AASHTO LRFR Engine Version 7.8.0.3001

Analysis preference setting: None

Analysis time: 8/11/2026 3:23:22 PM

Close

Spec Check Details

Specification Checks for 3-column pier - 22 of 816

Properties  Generate

Articles: All articles 

Format: Bullet list 

Report

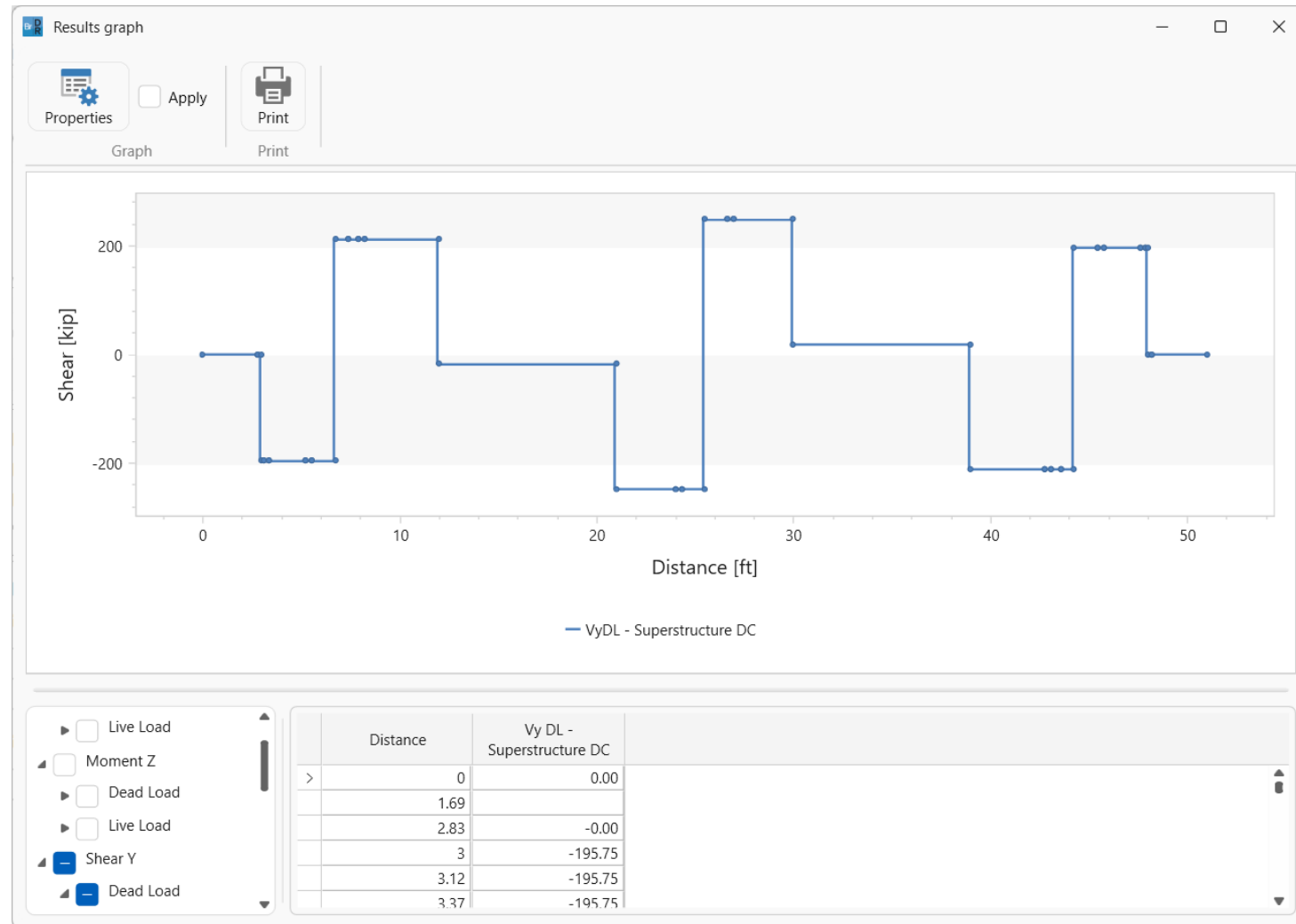
Specification filter

Pier Component

- Cap
 - 0.00 ft.
 - 1.69 ft.
 - 3.00 ft.
 - 3.38 ft.
 - 5.06 ft.
 - 5.56 ft.
 - 5.57 ft.
 - 7.93 ft.

Specification reference	Limit State	Flex. Sense	Pass/Fail
 5.4.2.1 Compressive Strength		N/A	Passed
 5.4.2.5 Poisson's Ratio		N/A	General Comp.
 5.4.2.6 Modulus of Rupture		N/A	General Comp.
 5.4.2.8 Concrete Density Modification Factor		N/A	General Comp.
 5.5.4.2 Strength Limit State - Resistance Factors		N/A	General Comp.
 5.6.2.2 Rectangular Stress Distribution		N/A	General Comp.
 5.6.3.2 Flexural Resistance (Reinforced Concrete)		N/A	Passed
 5.6.3.3 Minimum Reinforcement		N/A	Passed

Results Graph



Analysis Report

Bridge Workspace - LRFD Substructure Example 1

BRIDGE WORKSPACE WORKSPACE TOOLS VIEW HELP

ANALYSIS DESIGN/RATE SUBSTRUCTURE DESIGN

Analysis Analyze Tabular Specification Engine Results Analysis 3D
Settings Results Check Detail Outputs Graph Report Schematic

Analysis Report - New Analysis Report

Report

New Open Save Save as

Model Loads Reactions Displacements Forces Concurrent Forces Rating results

☒ Include in report

Cap rating

☒ Overall rating summary
☐ Detailed rating summary
☒ Material properties
☒ Geometry
☒ Reinforcement
☒ Deterioration

Select all Clear all

New Analysis Report

← Back Forward → Print

Bridge ID :LRFD Substructure Example 1
Bridge : LRFD Substructure Example 1
Pier : Pier 2
User : bridge

SNBI Bridge Number :LRFD_EX1_sub
Bridge Alt : Continuous span steel bridge
Pier Alt. : 3-column pier
Date : Wednesday, August 12, 2026 08:41:37

LRFR Overall Rating Summary

Pier Cap

Live Load	Rating Level	Rating Factor	Controls	Capacity (Ton)	Cap Region	Location (ft)	Percent	Impact	Lane
HL-93 (US) - 90% (Truck Pair + Lane)	Inventory	0.728	STRENGTH-I - Concrete Shear Eval	51.55	Bay 2	13.50	72.0	As Requested	As Requested
HL-93 (US) - 90% (Truck Pair + Lane)	Operating	0.838	STRENGTH-I - Concrete Shear Eval	66.83	Bay 2	13.50	72.0	As Requested	As Requested

Pier Cap Rating Model Information

Cap Material Properties

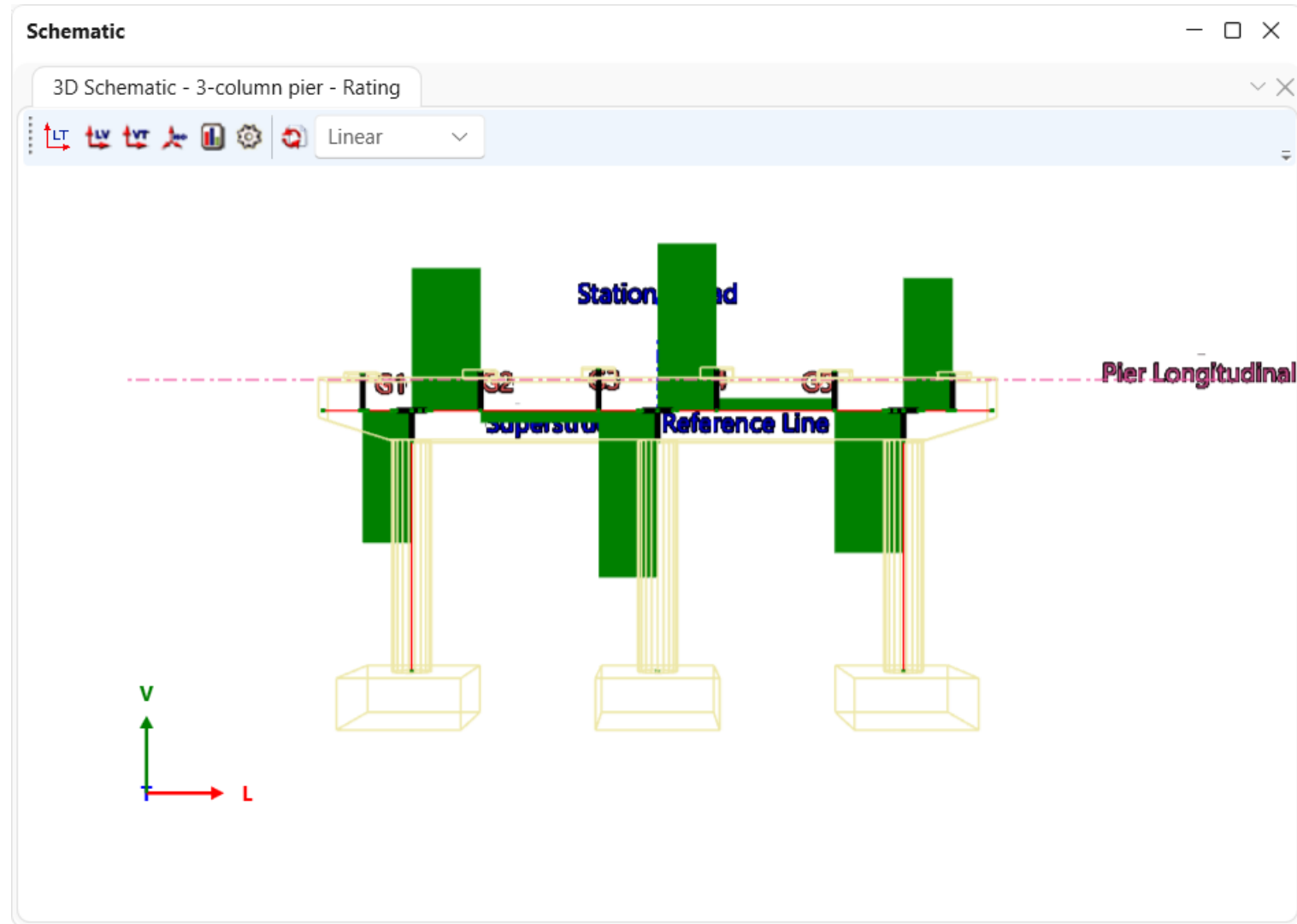
Concrete

Exposure Factor: 1.0

Name	f _c (ksi)	Density for DL (kcf)	E (ksi)
Class A (US)	4.000	0.150	3644.149

Reinforcement Steel

3D Schematic Results





Questions?
Thank you!

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