AASHTOWare BrDR 7.5.0 Multi-Cell Box Tutorial MCB4 – RC MCB Integral with Pier Example



Topics Covered

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- Comments and Assumptions
- Data Entry
- Structure Typical Section
- Structure Framing Plan Details
- Slab Reinforcement Data Entry
- Vertical Shear Reinforcement Data Entry
- Bridge Alternatives
- Pier Data Entry
- Foundation Alternatives
- Analysis and results

Analysis Methods

Reinforced concrete multi-cell box (MCB) superstructures can be analyzed in the following ways:

- LRFD, LRFR and LFR
- Full box section including each individual webline
- Single webline

Comments and Assumptions

- Based on the year built, 1963, information contained in the design plans, and the AASHTO Manual for Bridge Evaluation:
 - Concrete compressive strength = 3 ksi (fc = 1.2 ksi)
 - \circ Reinforcing steel yield strength = 40 ksi (fs = 20 ksi)
 - Structural Steel Yield Strength = 36 ksi
 - \circ Pile size = 10BP42
- ADTT = 500
- Integral wearing surface = 0.0 in.
- Use approximate longitudinal deck rebar spacing.
- Use the following section to determine pier cap straight flexural reinforcement:



- Web shear reinforcement (S1 S3 bars) are #5 bars.
- Top of footing elevation = 332.96 ft. for all piers.
- Finished ground line elevation = 335.00 ft. for all piers.
- Bottom of footing elevation = 328.71 ft. for all piers
- 30'-0" long piles with 1'-0" embedment
- Assume pile fixity elevation = 318.71 ft.
- Assume pile downdrag force = 0 kip
- Use the maximum shaft height for all piers (27 ft.)
- Soil density = 120 kcf
- Factored bearing resistance of soil = 15 ksf

Data Entry

Br		А	ASHTOWare Bridg	je Design ar	nd Rating	?	-		X
BRIDGE EXPLORER BRID	GE FOLDER	RATE	TOOLS VIE	W					\geq
New Open D Batch ~ Bridge	Find Copy	Paste Copy To~ Manage	Remove Delete	•					2
New (Ctrl+N) Creates a new bridge.		BID	Bridge ID)	Bridge Name			District	2
🖶 📁 All Bridges		20 L	RFD Substructure	Example 1	LRFD Substructure Example 1				\geq
E Zemplates		21 L	RFD Subcharture	Example 2	LRFD Substructure Example 2	\sim	~~~	and .	1

From the **Bridge Explorer**, use the **New** button to create a new bridge and enter the following data.

New Bridge

idge ID: MCB4		NBI s	tructure ID (8): MCB4		Template	letely defined	Bridge Workspace View Use Superstructures Culverts
							Substructures
Description Desc	iption (cont'o	l) Alterr	Global reference point	Traffic	Custom agency fie	elds	
Name:	MCB4				Year built:	1963	
Description:	Integral Box	Beam					
Location:	STA. 907+5				Length:		ft
acility carried (7):	County Rao	ł			Route number:	00404	
eat. intersected (6):	1-55				Mi. post:		
Default units:	US Customa	v	~				
lew Bridge	Jane 1		and and a second se	ه ه	in Jim J		Bridge Workspace View
lew Bridge dge ID: MCB4		NBI s	tructure ID (8): MCB4		Template	letely defined	- Cliverts
lew Bridge dge ID: MCB4		NBI s	tructure ID (8): MCB4		Template	letely defined	- C Bridge Workspace View Superstructures Culverts Substructures
lew Bridge dge ID: MCB4 Description Descri	iption (cont'd	NBI s	tructure ID (8): MCB4	Traffic	☐ Template ✓ Bridge compl Custom agency fie	letely defined	- Cliverts
lew Bridge dge ID: MCB4 Description Description Description Description	iption (cont'e	NBI s	tructure ID (8): MCB4 atives Global reference point	Traffic	Template Bridge compl Custom agency fie	letely defined	- Cliverts Culverts Substructures Substructures
lew Bridge dge ID: MCB4 Description Description Description Irruck PCT: ADT: Directional PCT:	iption (cont'e	NBI s	tructure ID (8): MCB4 hatives Global reference point % %	Traffic	Template Bridge compl Custom agency fie	letely defined	- C Bridge Workspace View Superstructures Culverts Substructures
lew Bridge dge ID: MCB4 Description Desci Iruck PCT: ADT: Directional PCT: Recent ADTT:	iption (cont'e	NBI s	tructure ID (8): MCB4 atives Global reference point % % % Compute	Traffic	Template	letely defined	- C Bridge Workspace View Superstructures Culverts Substructures
lew Bridge dge ID: MCB4 Description Description Description Iruck PCT: ADT: Directional PCT: Recent ADTT: Design ADTT:	iption (cont'a	NBI s	tructure ID (8): MCB4 atives Global reference point % % % Compute	Traffic	Template	letely defined	- C Bridge Workspace View Superstructures Culverts Substructures
lew Bridge idge ID: MCB4 Description Description Description Truck PCT: ADT: Directional PCT: Recent ADTT: Design ADTT: Exp. annual ADTT: gg	iption (cont'd	NBI s NBI s NBI s 0 Alterr 500 500 0	tructure ID (8): MCB4 atives Global reference point % % Compute	Traffic	Template ♥ Bridge compl Custom agency fie	letely defined	- C Bridge Workspace View Superstructures Culverts Substructures
New Bridge idge ID: MCB4 Description Description Description Truck PCT: ADT: Directional PCT: Recent ADTT: Design ADTT: Exp. annual ADTTs: gr Fatigue importance fatigue import	iption (cont'd	NBI s I) Alterr 500 500 0 Main Arter	tructure ID (8): MCB4 aatives Global reference point % % Compute iial, Interstate, Other	Traffic	☐ Template ✓ Bridge compl Custom agency fie	letely defined	
New Bridge idge ID: MCB4 Description Description Description Truck PCT: ADT: Directional PCT: Recent ADTT: Design ADTT: Exp. annual ADTTs. gr Fatigue importance fat	iption (cont'd owth rate: sector:	NBI s I) Alterr 500 500 0 Main Arter Import Import	tructure ID (8): MCB4 atives Global reference point % % % Compute inal, Interstate, Other tance factor override	Traffic	☐ Template ✓ Bridge compl Custom agency fie	letely defined	Bridge Workspace View Superstructures Culverts Substructures
New Bridge idge ID: MCB4 Description Description Description Truck PCT: ADT: Directional PCT: Recent ADTT: Design ADTT: Exp. annual ADTTs, gr Fatigue importance fat (ADTTs,)s:	iption (cont'd owth rate: actor:) Alterr) Alterr 500 500 0 Main Arter Import	tructure ID (8): MCB4 atives Global reference point % % % % Compute ative, Other ance factor override	Traffic	☐ Template ✓ Bridge compl Custom agency fie	letely defined	 − Bridge Workspace View Superstructures Culverts Substructures

Click **OK** to apply the data and close the window.

Now begin adding the **Components** required to build the bridge model. Navigate to the **Components** tab of the **Bridge Workspace (BWS)**.

Bridge Appurtenances – Generic tab

Expand the **Appurtenances** tree and double click on the **Generic** folder (or right click and select **New** or click on the **New** button from the **Manage** group of the **WORKSPACE** ribbon) to define a generic barrier as shown below.

Br	Bridge Worl	kspace - MCB4		ANALY	SIS REPO	RTS	?	_		×	
BRIDGE WORKSF	PACE WORK	ISPACE TOOL	.S VIEW	DESIGN/	RATE REPOR	TING					
A Check Out	Validate Save	Restore Revert	🔀 🎸 Close Export	Refresh	Open New	Copy Past	e Duplicat	e Delete	Schema	tic	
		Bridge				Manag	e				
Workspace		\$ X	Schemati	c	\$	K Repo	ort		×	> ×	
Bridge Compone Compone Participation Participation Bridge Compone Participation Participation Bridge Compone Participation Participa	nponents ents rtenances eneric ediar illing Shap Shap View ector Subs Subs Subs Subs Closs Closs	yze Summary Report Detailed Report eral Preferences e Bridge Workspa	ce ce						×	×	
<u></u>)	
Name: Description:	Railing & F	Post									
	All dimensio	ons are in inch	les								
Distance 1	from edge to Ef	Reference Li	ne	Wie 12	Barrier load:	0.404 — Gener	ic Shape	kip/ft			
			Back Cop	by from lik	Fron	OK	_	Apply		Cance	2



Beam Shapes - Steel I Shape

The **10PB42** Steel Shape for the footing pile is not in the library so it will have to be created. Expand the **Beam Shapes** folder, **Steel Shapes** and double click **Steel Shapes** and enter the following data.

🕰 Steel I Shap	De la construcción de la	– 🗆 X
Name:	10BP42	Rolled shape type
Description:	10BP42	W shape M shape S shape HP shape
Dimension	s Properties	
	Copy to library Copy from library O	K Apply Cancel

Navigate to the **Properties** tab of this window and enter the data as shown below.

ame:	10BF	42		Rolled shape type
escription:	10BF	42		W shape M shape S shape HP shape
Dimension	s I	Properties		
Area:		12.35	in^2	
Nominal lo	ad:	42	lb/ft	
lx:		210.8	in^4	
ly:		71.4	in^4	
Zx:		43.4	in^3	
Zy:		14.2	in^3	
Nominal de	epth:	10	in	

Click **OK** to apply the data and close the window.

LRFD Substructure Design Settings

Define substructure design settings by double clicking LRFD Substructure Design Settings and click Copy from library... button. Select Final Design Setting (US) and click OK.

Library Data: LRFD Substructure Design Settings

-								
	Name			Description	Library	Units	Preliminary	Final
Final D	esign Setting	(SI)	Final	Design Setting (SI)	Standard	SI / Metric	False	True
Final D	esign Setting	(US)	Final I	Design Setting (US)	Standard	US Customary	False	True
Prelimi	nary Design S	Setting (SI)	Prelim	ninary Design Setting (SI) Standard	SI / Metric	True	False
Prelimi	nary Design S	Setting (US)	Prelin	ninary Design Setting (US) Standard	US Customary	True	False
_					الرغي		A	_
LRFD Sub	structure Desig	gn Settings				_ _ Design		
ame:	Final Design	n Setting (US)				Design	eliminary	
escription:	Final Desigr	n Setting (US)				Fir	al	
Limit state	vehicles	Substruc	ture loa	ding				
Ana	lysis method type	Analys modul	is e	Spec version		Factors		
LRFI	c	AASHTO LR	D ~	LRFD 5th 2010i 🗸	2010 AASHTO L	RFD Specifications	~	
Choose ti included	he limit states in the analysis	to be	⊂ D	ynamic load allowance			T	
🗸 Sti	RENGTH-I	Ī		Fatigue and fracture limi	t states: 15	%		
ST	RENGTH-II	- 1		All other limit states:	33	%		
STI	RENGTH-III	- 1						
_								
STI								
STI STI	RENGTH-IV RENGTH-V RVICE-I							
STI	RENGTH-IV RENGTH-V RVICE-I RVICE-II							
STI STI SEI	RENGTH-IV RENGTH-V RVICE-I RVICE-II RVICE-III							

Click **OK** to apply the data and close the window.

Bridge Materials - Concrete

To add a new concrete material, expand the **Materials** folder and double click on **Concrete** in the tree. The window shown below will open. Enter the values shown below. Use the **Compute** button to fill in the lower portion of the window.

🕰 Bridge Mat	terials - Concrete						_		×
Name:	3 ksi								
Description:	Class B cement concrete	2							
Compressive	strength at 28 days (f'c):	3		ksi					
Initial compre	essive strength (f'ci):			ksi					
Composition	of concrete:	Normal	\sim						
Density (for o	dead loads):	0.15		kcf					
Density (for r	modulus of elasticity):	0.145		kcf					
Poisson's rati	io:	0.2							
Coefficient of	f thermal expansion (α):	0.000006		1/F					
Splitting tens	ile strength (fct):			ksi					
LRFD Maxim	um aggregate size:			in					
	Compute								
Std modulus	of elasticity (Ec):	3155.924251		ksi					
LRFD modulu	us of elasticity (Ec):	3625.494616	5	ksi					
Std initial mo	odulus of elasticity:			ksi					
LRFD initial n	nodulus of elasticity:			ksi					
Std modulus	of rupture:	0.410792		ksi					
LRFD modulu	us of rupture:	0.415692		ksi					
Shear factor:		1							
	Copy t	o library	Copy f	rom library	ОК	Ap	oply	Cance	el 🛛

Click **OK** to apply the data and close the window.

Bridge materials – Reinforcing Steel

To add a new reinforcing steel material, double click on **Reinforcing Steel** in the tree and click on **Copy from library...** button. Select the **Grade 40** reinforcing steel and click **OK**. The selected material properties are copied to the **Bridge Materials – Reinforcing Steel** window as shown below.

🕒 Bridge Mat	terials - Reinforc	ing Steel				-		×
Name:	Grade 40							
Description:	40 ksi reinforci	ing steel						
Material prop	perties							
Specified yiel	ld strength (fy):	40.000058	ksi					
Modulus of e	elasticity (Es):	29000.004206	ksi					
Ultimate stre	ngth (Fu):	70.0000102	ksi					
Type Plain Epo: Galv	n xy vanized							
	Copy t	o library Cop	y from library	ОК	Apply		Cance	

Click **OK** to apply the data and close the window.

Bridge Materials – Structural Steel

To add a new structural steel material, double click on **Structural Steel** in the tree and click on **Copy from library**... button. Select the **After 1963** material and click **OK**. The selected material properties are copied to the **Bridge Materials – Structural Steel** window as shown below.

lame:	After 1963					
escription:	Built after 1963 - steel unko					
laterial prop	perties					
pecified mir	nimum yield strength (Fy):	36.000052	ksi			
Specified mir	nimum tensile strength (Fu):		ksi			
Coefficient o	f thermal expansion:	0.0000065	1/F			
Density:		0.49	kcf			
Modulus of e	elasticity (E):	29000.004206	ksi			

Click **OK** to apply the data and close the window.

Navigate back to the **Bridge** tab of the **BWS** tree. The partially expanded tree is shown below.



New Superstructure Definition

Create a new concrete multi-cell box superstructure definition by double clicking the **SUPERSTRUCTURE DEFINITIONS** folder. Select **Concrete multi-cell box superstructure** and click **OK**.

A New Superstructure Definition		\times
Girder system superstructure	Superstructure definition wizard	
Floor system superstructure		
Floor line superstructure		
Truss system superstructure		
Truss line superstructure		
Reinforced concrete slab system superstructure		
Concrete multi-cell box superstructure		
Advanced concrete multi-cell box superstructure		
and the second second second second	and the second second	

Concrete Multi-Cell Box Superstructure Definition

Enter data as shown below. Be sure to leave make the superstructure **Integral with substructure** and that the **Post-tensioned** box is unchecked.

Name: Description:	AS-BUILT Spans 1-4		End projections Left: 6 in Right: 6 in
Default units: Number of spans: Number of cells:	US Customary v 4 4 2	Span lengths Integral piers Enter span lengths along the reference line: Span Length (ft) > 1 57.25 2 80	Average humidity: % Structure type Frame structure simplified definition Integral with substructure Consider substructure skew in FE section properties Not integral with pier
Structure model for Standalone	LLDF computation	3 80 4 57.25	Post-tensioned Analyze webs only
	ected to adjacent structure	and a surface of a	
oncrete Multi-Cell Bo efinition Analysis	x Superstructure Definition Specs Factors En	gine Control options	
oncrete Multi-Cell Bo efinition Analysis Jame:	x Superstructure Definition Specs Factors Eng AS-BUILT Spans 1-4	gine Control options	
oncrete Multi-Cell Bo efinition Analysis Name:	x Superstructure Definition Specs Factors En AS-BUILT Spans 1-4	gine Control options	
oncrete Multi-Cell Bo efinition Analysis Name: Description: Default units:	x Superstructure Definition Specs Factors En AS-BUILT Spans 1-4	gine Control options	- C
oncrete Multi-Cell Bo efinition <u>Analysis</u> Vame: Description: Default units: Number of spans:	x Superstructure Definition Specs Factors En AS-BUILT Spans 1-4 US Customary ~ 4 🗘	gine Control options Span lengths Integral piers Frame connections:	- C
oncrete Multi-Cell Bo efinition Analysis Vame: Description: Default units: Number of spans: Number of cells:	x Superstructure Definition Specs Factors En AS-BUILT Spans 1-4 US Customary ~ 4 4 2	gine Control options Span lengths Integral piers Frame connections: Support Integral 2 3	 End projections Left: 6 in Right: 6 in Average humidity: % Structure type Frame structure simplified definition Integral with substructure Consider substructure skew in FE section properties Not integral with pier

Concrete Multi-Cell Box Superstructure Definition - Control options tab

Navigate to the Control options tab. Uncheck the LRFR Ignore shear checkboxes.



Click **OK** to apply the data and close the window.

Load case Description

Expand the newly created superstructure definition and double click **Load Case Description** and create default load cases. Use the **Add default load case descriptions** button. Load cases are populated as shown below.

L	load case name	Description	Stage		Туре		Time* (days)	
D	C1	DC acting on non-composite section	Non-composite (Stage 1)	\sim	D,DC	~		T
D	C2	DC acting on long-term composite section	Composite (long term) (Stage 2)	\sim	D,DC	~		1
D	W	DW acting on long-term composite section	Composite (long term) (Stage 2)	\sim	D,DW	~		1
SI	IP Forms	Weight due to stay-in-place forms	Non-composite (Stage 1)	\sim	D,DC	\sim		1

Click **OK** to apply the data and close the window.

Structure Cross Sections

Double click the Structure Cross Sections folder and create the following cross section by entering the values shown.



Ove	rall	Cells	Fillets			
Тор	left we	b thickne	ess: 9	in V	/2: 26	ft 🕴
Bott	tom lef	't web thic	kness: 9	in		1
	Cell	S (ft)	Top right web thickness (in)	Bottom right web thickness (in)	Top slab thickness (in)	
>	1	6.6875	9	9	7.5	
	2	6.3125	9	9	7.5	1
	3	6.3125	9	9	7.5	3
	4	6.6875	9	9	7.5	
					And and	a Anna A

Location in cells	Exterior web fillet	Interior web fillet	Horiz (in)	Vert (in)
Тор			6	6
Bottom	\sim	\sim	6	6

With all the data entered click the **Compute properties** button to see the window below then click **OK** to apply this data and close the window.



Schematic – Structure Cross Sections

A schematic can be viewed by right clicking the section just created and selecting **Schematic** (or clicking the **Schematic** button from the **WORKSPACE** ribbon).

Bridge Workspace - MCB4	ANALYSIS	REPORTS	?	- 0	×
Check Out Check In Validate Save & Revert Close Expo Bridge	t Refresh Oper	New Copy F	Paste Duplicate	Delete Sche	matic
Workspace Image: Components Bridge Components Image: Components Image: Components	Schematic	\$ X	Report		× &
Structure Cross Sections Section Section Section Section Section Section Section Superstruct Superstruct Superstruct Superstruct Slab Reinfor Mit, Live Load D Vertical She Vertical She Sechematic Sechema	Analysis				× \$\$



Cross Section Ranges

Assign the cross section to the length of the superstructure by double clicking the **Cross Section Range Properties** in the tree and enter the values shown.

ros	s sections Eff	fective	e supports										
	Start sectio	n	End secti	ion	Depth va	ary	Solid section	Sup nur	port nber	Start distance (ft)	Length (ft)	End distance (ft)	
>	Section 1	\sim	Section 1	\sim	None	\sim		1	\sim	0	54.5	54.5	
	Section 1	\sim	Section 1	\sim	None	\sim	 Image: A set of the set of the	1	\sim	54.5	5.5	60	
	Section 1	\sim	Section 1	~	None	~		2	~	2.75	74.5	77.25	
	Section 1	\sim	Section 1	~	None	~		2	~	77.25	5.5	82.75	
	Section 1	\sim	Section 1	~	None	~		3	\sim	2.75	74.5	77.25	
	Section 1	\sim	Section 1	~	None	\sim		3	\sim	77.25	5.5	82.75	
	Section 1	\sim	Section 1	~	None	\sim		4	\sim	2.75	54.5	57.25	

Click **OK** to apply the data and close the window.

Structure Typical Section

Open the **Structure Typical Section** from the tree and locate the superstructure definition reference line in the center of the structure as shown below.

A Structure Typical Section - Segment 1	¢
Distance from left edge of deck to superstructure definition ref. line Superstructure Definition Reference Line	
Deck Deck (cont'd) Parapet Median Railing Generic Sidewalk Lane position Striped lanes M	Nearing surface
Superstructure definition reference line it. To the Right ofthe left edge of deck.	
Distance from left edge of deck to superstructure definition reference line: 15 ft 15 ft	
and the second of the second s	

oractare specification orginality			
Distance from left edge of deck to			
	perstructure Definition		
	/		
Deck Deck (cont'd) Parapet	Median Railing Ge	neric Sidewalk Lane position Sti	riped lanes Wearing surface
Deck Deck (cont'd) Parapet Sacrificial wear thickness:	Median Railing Ge	neric Sidewalk Lane position Str Structural overlay density:	riped lanes Wearing surface
Deck Deck (cont'd) Parapet Sacrificial wear thickness: Top slab crack control parameter	Median Railing Ge	neric Sidewalk Lane position Str Structural overlay density: Structural overlay thickness:	riped lanes Wearing surface kcf
Deck Deck (cont'd) Parapet Sacrificial wear thickness: Top slab crack control parameter Sustained modular ratio factor:	Median Railing Ge	neric Sidewalk Lane position Sti Structural overlay density: Structural overlay thickness: Bottom slab crack control parameter:	riped lanes Wearing surface kcf in kip/in
Deck Deck (cont'd) Parapet Sacrificial wear thickness: Top slab crack control parameter Sustained modular ratio factor: Top slab exposure factor:	Median Railing Ge	neric Sidewalk Lane position Sti Structural overlay density: Structural overlay thickness: Bottom slab crack control parameter: Bottom slab exposure factor:	riped lanes Wearing surface kcf in kip/in

Navigate to the **Deck (cont'd)** tab and define the sacrificial wearing surface as shown below.

Navigate to the Generic tab and locate the barriers as shown below.



itruc	ture Typical	(A) (B) (B) (B) (B) (B) (B) (B) (B	ture Definition Reference Line			_	
Deck	Deck (c	ont'd) Parapet Median	Railing Generic Side	ewalk Lane position Str	iped lanes Wearing surface		
	Travelway number	Distance from left edge of travelway to superstructure definition reference line at start (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at start (B) (ft)	Distance from left edge of travelway to superstructure definition reference line at end (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at end (B) (ft)		
>	1	-14	14	-14	14		
- LF	RFD fatigue anes availab Override	le to trucks:					
	Overnde		Compute		New Du	iplicate	Delete

In the Lane position tab, use the **Compute** button to create the lane positions.

Click **OK** to apply the data and close the window.

Framing Plan Detail

Double click on **Framing Plan Detail** in the tree and enter the skew at each support in the **Layout** tab. In the case all skews are zero.

umbe	r of spans:	4	
Layo	ut Interi	or diaphragms	
	Support	Skew (degrees)	
>	1	0	A
	2	0	
	3	0	
	4	0	
	5	0	

	agger pe	rpendicular	r diaphragms						
n	Span number	Start distance (ft)	Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)	Diaphragm thickness (in)	Diaphragm Ioad (kip)	
> 1	\sim	0	0	1	0	0	12	12.633	
1	~	20.25	0	1	0	20.25	9	9.475	
1	~	20.25	21	1	21	41.25	9	9.475	
2	~	15.25	0	1	0	15.25	9	9.475	
2	~	15.25	23.75	2	47.5	62.75	9	9.475	
3	~	17.25	0	1	0	17.25	9	9.475	
3	~	17.25	23.75	2	47.5	64.75	9	9.475	
4	~	16	0	1	0	16	9	9.475	
4	· ~	16	21	1	21	37	9	9.475	
4	~	37	20.25	1	20.25	57.25	12	12.633	

Navigate to the Interior diaphragms tab and enter the diaphragm locations as shown below.

Click **OK** to apply the data and close the window.

Schematic - Structure Framing Plan Details

A schematic of the framing plan can be viewed like the typical section.



Slab reinforcement

Double click on the **Slab Reinforcement** node in the **BWS** tree. **Slab Reinforcement** can be located within the structure in several ways for multi-cell boxes. For this example, the reinforcement is defined from the supports and Transverse Reference Lines. The user also has the option to locate rebar about the midspan. Enter **Transverse Reference Lines** as shown below. Each reference line corresponds to a construction joint.

Slab	Reinforceme	ent			- 0		
e:	Multi Cell B	ox					
rans	sverse refere	nce lines	Cells-top slab	Cells-bot	tom slab Overhangs		
_ Ir	anut method						
	Distance	Percen	tage				
_	-	0					
	Reference line	Measured from support	Distance along left edge deck (ft)	Distance along right edge deck (ft)			
	TCJ1	1 ~	41.25	41.25		1	
	TCJ2	2 ~	15.25	15.25			
	ТСЈЗ	2 ~	62.75	62.75			
	TCJ4	3 ~	17.25	17.25			
	TCJ5	3 ~	64.75	64.75			
	TCJ6	4 ~	16	16			
	BCJ1	1 ~	40.25	40.25			
	BCJ2	2 ~	16.25	16.25			
	BCJ3	2 ~	61.75	61.75			
	BCJ4	3 ~	18.25	18.25			
	BCJ5	3 ~	63.75	63.75			
>	BCJ6	4 ~	17	17			
					New Delet	e	
					OK Apply Ca	nce	

The data entry for the top slab is shown below.

CellMaterialReference pointDirectionStart distance (ft)Length distance (ft)Number ofbarsNumber bars for leftBar sizeClear Cover (m)Measured fformBar spacing (m)Bar spacingBar spacingBar coverBar spacingBar spacingBar spacingBar spacingBar spacingMeasured fromBar spacingBa																ngs	Overha	ab	ells-bottom sla	C	Cells-top slab	nes	rse reference li
All Cells Grade 40 Support 1 Right \sim 0 4125 4125 5 2125 $Top of Slab$ \sim 12 12 12 All Cells Grade 40 Support 1 \sim $Right$ \circ 0 2745 2745 66 3 5 2125 $70p$ of Slab \sim 122 12	End fully eveloped	l de	Start fully developed	Side cover (in)	Bar spacing (in)		Measured from	Clear cover (in)	Bar ize	E	Number bars for left web	Number of bars	End distance (ft)	Length (ft)	Start distance (ft)	tion	Direct	e	Reference point		Material		Cell
All Cells \circ Grade 40 \circ Support 1 \circ Right \circ 0 2745 2745 66 3 5 1625 Bettom of Slab \circ 12		Γ		12	12	~	Top of Slab	2.125	~	5	2.5	5	41.25	41.25	0	~	Right	\sim	Support 1	\sim	Grade 40	\sim	All Cells
All Cells Grade 40				12	12	~	Bottom of Slab	1.625	~	5	3	6	274.5	274.5	0	\sim	Right	\sim	Support 1	\sim	Grade 40	\sim	All Cells
All Cells Support 3 Night				12	12	~	Top of Slab	2.125	~	5	2.5	5	62.583334	47.166667	15.416667	\sim	Right	\sim	Support 2	\sim	Grade 40	\sim	All Cells
All Cells · Grade 40 · Support 4 · Infe 4.12 Infe 5.725 5.725 5.725 7.125 Top of Slab · 1.12 <th1.12< th=""> 1.12 <th1.12< th=""><td></td><td></td><td></td><td>12</td><td>12</td><td>\sim</td><td>Top of Slab</td><td>2.125</td><td>~</td><td>5</td><td>2.5</td><td>5</td><td>64.583334</td><td>47.166667</td><td>17.416667</td><td>\sim</td><td>Right</td><td>\sim</td><td>Support 3</td><td>\sim</td><td>Grade 40</td><td>\sim</td><td>All Cells</td></th1.12<></th1.12<>				12	12	\sim	Top of Slab	2.125	~	5	2.5	5	64.583334	47.166667	17.416667	\sim	Right	\sim	Support 3	\sim	Grade 40	\sim	All Cells
All Cells · Grade 40 · Support 2 · Right · 15.833333 30.916667 15.083334 10 · I · I.12 Top of Slab · I.6 I.6 I.1 All Cells · Grade 40 · Support 3 · Right · 17.083333 30.916667 17.083334 10 · I.1 · I.12 Top of Slab · I.6 I.1 All Cells · Grade 40 · Support 4 · Right · · · Support 3 · Right · · · Support 3 · · · · Support 3 ·				12	12	\sim	Top of Slab	2.125	~	5	2.5	5	57.25	41.25	16	\sim	Right	\sim	Support 4	\sim	Grade 40	\sim	All Cells
All Cells ··· Grade 40 ··· Support 3 ··· Initial constraints				6	6	~	Top of Slab	2.125	~	10	5	10	15.083334	30.916667	-15.833333	~	Right	\sim	Support 2	\sim	Grade 40	\sim	All Cells
All Cells ··· Grade 40 ··· Support 4 ··· Instant 15.083333 0.01667 15.83334 10 ··· 2.125 Top of Slab ··· Info Info<				6	6	~	Top of Slab	2.125	~	11	5	10	17.083334	34.166667	-17.083333	\sim	Right	\sim	Support 3	\sim	Grade 40	\sim	All Cells
All Cells ··· Grade 40 ··· Support 1 ··· Right ··· 0 274.5 274.5 4 ··· 1 ··· 1.12 Top of Slab ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 2.125 ··· ··· 5 7.57 <td></td> <td></td> <td></td> <td>6</td> <td>6</td> <td>~</td> <td>Top of Slab</td> <td>2.125</td> <td>~</td> <td>10</td> <td>5</td> <td>10</td> <td>15.833334</td> <td>30.916667</td> <td>-15.083333</td> <td>\sim</td> <td>Right</td> <td>\sim</td> <td>Support 4</td> <td>\sim</td> <td>Grade 40</td> <td>\sim</td> <td>All Cells</td>				6	6	~	Top of Slab	2.125	~	10	5	10	15.833334	30.916667	-15.083333	\sim	Right	\sim	Support 4	\sim	Grade 40	\sim	All Cells
All Cells ··· Grade 40 ··· TCJ1 ··· Right ··· 7.5 7.5 3.75 5 2.5 10 ··· 2.125 Top of Slab ··· 12				2.125	5	\sim	Top of Slab	2.125	~	11	2	4	274.5	274.5	0	\sim	Right	\sim	Support 1	\sim	Grade 40	\sim	All Cells
All Cells v Grade 40 TCJ2 Right -3.75 7.5 3.75 5 2.5 Top of Slab 12 12 All Cells Grade 40 TCJ3 Right -4.25 8.5 4.25 5 2.5 10 2.125 Top of Slab 12 12 11 All Cells Grade 40 TCJ3 Right -4.425 8.5 4.25 5 2.5 10 of Slab 12				12	12	\sim	Top of Slab	2.125	~	10	2.5	5	3.75	7.5	-3.75	\sim	Right	\sim	TCJ1	\sim	Grade 40	\sim	All Cells
All Cells ✓ Grade 40 ✓ TCJ3 ✓ Right -4.25 8.5 4.25 5 2.5 11 ✓ 2.125 Top of Slab ✓ 12 12				12	12	~	Top of Slab	2.125	~	10	2.5	5	3.75	7.5	-3.75	~	Right	\sim	TCJ2	\sim	Grade 40	\sim	All Cells
				12	12	~	Top of Slab	2.125	~	11	2.5	5	4.25	8.5	-4.25	\sim	Right	\sim	тсјз	\sim	Grade 40	\sim	All Cells
All Cells V Grade 40 V ICJ4 V Right V -4.25 8.5 4.25 5 2.5 11 V 2.125 lop of Slab V 12 12				12	12	~	Top of Slab	2.125	~	11	2.5	5	4.25	8.5	-4.25	\sim	Right	\sim	TCJ4	\sim	Grade 40	\sim	All Cells
All Cells V Grade 40 V TCJS V Right -3.75 7.5 3.75 5 2.5 10 V 2.125 Top of Slab V 12 12 12				12	12	~	Top of Slab	2.125	~	10	2.5	5	3.75	7.5	-3.75	\sim	Right	\sim	TCJ5	\sim	Grade 40	\sim	All Cells
All Cells \checkmark Grade 40 \checkmark TC/6 \checkmark Right \checkmark -3.75 7.5 3.75 5 2.5 Top of Slab \checkmark 12 12 12				12	12	~	Top of Slab	2.125	~	10	2.5	5	3.75	7.5	-3.75	~	Right	\sim	TCJ6	\sim	Grade 40	\sim	All Cells

The data entry for the bottom slab is shown below.

ns	verse reference l	ines	Cells-top slab	С	ells-bottom sl	ab	Overha	ngs													
	Cell		Material		Reference point	:e	Direct	ion	Start distance (ft)	Length (ft)	End distance (ft)	Number of bars	Number bars for left web	Bar size	Clear cover (in)	Measured from		Bar spacing (in)	Side cover (in)	Start fully developed	End fully developed
>	All Cells	\sim	Grade 40	\sim	Support 1	\sim	Right	~	0	274.5	274.5	5	2.5	4 ~	1.5	Top of Slab	~	15	12		
	All Cells	\sim	Grade 40	\sim	Support 1	\sim	Right	\sim	0	40.083333	40.083333	6	3	9 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 1	$^{\vee}$	Right	\sim	4.25	31	35.25	6	3	9 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 1	\vee	Right	\sim	40.416667	32.916667	73.333334	6	3	4 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 2	$^{\vee}$	Right	\sim	16.416667	45.166667	61.583334	6	3	10 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 2	\sim	Right	\sim	21.25	35.5	56.75	6	3	10 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 3	$^{\vee}$	Right	\sim	-18.083333	36.166667	18.083334	6	3	4 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 3	\sim	Right	\sim	18.416667	45.166667	63.583334	6	3	10 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 3	$^{\vee}$	Right	\sim	23.25	35.5	58.75	6	3	10 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 4	\sim	Right	\sim	-16.083333	32.916667	16.833334	6	3	4 ~	1.5	Bottom of Slab	~	12	3		
	All Cells	\sim	Grade 40	\sim	Support 4	\sim	Right	\sim	17.166667	40.083333	57.25	6	3	9 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 4	$^{\vee}$	Right	\sim	22	31	53	6	3	9 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	Support 1	\sim	Right	\sim	0	274.5	274.5	4	2	11 ~	1.5	Bottom of Slab	\sim	5	2.125		
	All Cells	\sim	Grade 40	\sim	BCJ1	\sim	Right	\sim	-2	4	2	6	3	4 ~	1.5	Bottom of Slab	\sim	12	3		
	All Cells	\sim	Grade 40	\sim	BCJ2	\sim	Right	\sim	-2	4	2	6	3	4 ~	1.5	Bottom of Slab	~	12	3		
	All Cells	\sim	Grade 40	\sim	BCJ3	\sim	Right	\sim	-2	4	2	6	3	4 ~	1.5	Bottom of Slab	\sim	12	3		
																		N	a	Duplicate	Delete

The data entry for the overhangs is shown below.

ins	Multi Cell Box	e line	s Cells-top s	lab	Cells-botto	m sla	b Over	rhand	as											
	Overhan	9	Material		Reference point	ce	Directio	on	Start distance (ft)	Length (ft)	End distance (ft)	Number of bars	Bar size	Clear cover (in)	Measured from	Bar spacing (in)	Side cover (in)	Start fully developed	End fully developed	
>	Both	\sim	Grade 40	\sim	Support 1	\sim	Right	\sim	0	41.25	41.25	2	5 ~	2.125	Top of Slab 🗸 🗸	9	3			
	Both	\sim	Grade 40	\sim	Support 1	\sim	Right	\sim	0	274.5	274.5	2	5 ~	5.75	Top of Slab 🗸 🗸	15	3			
	Both	\sim	Grade 40	\sim	Support 1	\sim	Right	\sim	41.416667	30.916667	72.333334	3	10 ~	2.125	Top of Slab	8	3			
	Both	\sim	Grade 40	\sim	Support 2	\sim	Right	\sim	15.416667	47.166667	62.583334	2	5 ~	2.125	Top of Slab	9	3			
	Both	\sim	Grade 40	\sim	Support 3	\sim	Right	\sim	-17.083333	34.166667	17.083334	3	11 ~	2.125	Top of Slab V	8	3			
	Both	\sim	Grade 40	\sim	Support 3	\sim	Right	\sim	17.416667	47.166667	64.583334	2	5 ~	2.125	Top of Slab 🗸 🗸	9	3			
	Both	\sim	Grade 40	\sim	Support 4	\sim	Right	\sim	-15.083333	30.916667	15.833334	3	10 ~	2.125	Top of Slab ~	8	3			
	Both	\sim	Grade 40	\sim	Support 4	\sim	Right	\sim	16	41.25	57.25	2	5 ~	2.125	Top of Slab 🗸	9	3			

Click **OK** to apply the data and close the window.

Vertical Shear Reinforcement Definition

Create the following shear stirrups by double clicking the **Vertical Shear Reinforcement Definitions** and entering the data shown.

🕰 Shear	r Reinforcement Definition - Vertical			_		×
Name:	S Bars					
	Material: Bar size: Number of legs: Inclination (alpha): Shear Reinforcement	Grade 40 5 ~ 2 90	Degrees		~	
			Ж Арр	ly (Cance	1

Click **OK** to apply the data and close the window.

hear	Reinforceme	ent Definition - Vert	ical				_		
me:	Z Bars								
			7						
	(]							
				(
			Material:	Grade 40				~	
			Bar size:	6	\sim				
			Number of legs:	1					
			Inclination (alpha):	45	De	grees			
		Vertical Shear Beinforceme	nt						
			11						
				· · · ·	01			C	
					OK		Арріу	Cance	el

Click **OK** to apply the data and close the window.

Web Shear Reinforcement Ranges – WEB1

Open the **WEB1 Shear Reinforcement Ranges** window and select Input Reference Type to **Centerline bearings**. Enter the data for Span 1 and repeat for Spans 2-4.

The stirrup ranges are created as follows.

Start	t Spacing									
	Voids	: Centerline bear	ings		Linked with	n: None		~		
Span Spa	in: 1 v)								
	Name	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars	0.083333	1	0	0	0.083333				h
	S Bars	· 0.083333	1	10	0.8333333	0.9166663				
	S Bars	0.916666	5	12	5	5.916666				
	S Bars	5.916666	5	15	6.25	12.166666				
	S Bars	12.166666	5	18	7.5	19.666666				
	S Bars	19.666666	1	18	1.5	21.166666				
	S Bars	21.166666	6	18	9	30.166666				
	S Bars	30.166666	5	15	6.25	36.416666				
	S Bars	36.416666	5	12	5	41.416666				
	Z Bars	40.75	2	6	1	41.75				
	Z Bars	40.75	1	0	0	40.75				
	S Bars	41.416667	7	10	5.8333333	47.2500003				
	S Bars	47.25	12	8	8	55.25				,
	Copy	Stirrup wizard				New	Duplic	cate	Delete	
							OK	Apply	Canc	el

Web	Shear Reinf	orceme	ent Ranges - W	VEB1					_		×
Start Distan	t reference	g					Nees				
0	Voids	O G	enterline bear	ings		Linked witi	n: None		<u> </u>		
Span	in: 2	~									_
	Nam	ie	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars	\sim	2	1	0	0	2				
	S Bars	~	2	9	6	4.5	6.5				
	S Bars	~	6.5	8	8	5.3333333	11.8333333				
	S Bars	~	11.833333	6	10	5	16.833333				
	Z Bars	~	14.75	1	0	0	14.75				
	Z Bars	~	14.75	2	6	1	15.75				
	S Bars	~	16.833333	9	12	9	25.833333				
	S Bars	~	25.833333	18	18	27	52.833333				
	S Bars	~	52.833333	7	12	7	59.833333				
	S Bars	~	59.833333	8	10	6.6666667	66.4999997				
	Z Bars	~	62.25	2	6	1	63.25				
	Z Bars	~	62.25	1	0	0	62.25				
	S Bars	~	66.5	12	8	8	74.5				
	S Bars	~	74.5	7	6	3.5	78				,
	Сору	Stirr	rup wizard				Nev	v Duplic	ate	Delete)
								ОК	Apply	Cance	el

Web	Shear Reinforcen	nent Ranges - V	VEB1					_		×
Start	t Spacing									
	t reference type	Centerline bear	ings		Linked with	h: None		~		
Span Spa	in: 3 v									
	Name	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars 🗸 🗸	2	1	0	0	2				
	S Bars 🗸 🗸	2	7	6	3.5	5.5				
	S Bars 🗸 🗸	5.5	12	8	8	13.5				
	S Bars 🗸 🗸	13.5	8	10	6.6666667	20.1666667				
	Z Bars 🗸 🗸	16.75	2	6	1	17.75				
	Z Bars 🗸 🗸	16.75	1	0	0	16.75				
	S Bars 🗸 🗸	20.166667	7	12	7	27.166667				
	S Bars V	27.166667	8	18	12	39.166667				
	S Bars V	39.166667	1	18	1.5	40.666667				
	S Bars V	40.666667	9	18	13.5	54.166667				
	S Bars 🗸 🗸	54.166667	9	12	9	63.166667				
	S Bars V	63.166667	6	10	5	68.166667				
	Z Bars 🗸 🗸	64.25	2	6	1	65.25				
	Z Bars 🗸 🗸	64.25	1	0	0	64.25				
	S Bars V	68.166667	8	8	5.3333333	73.5000003				
	S Bars ~	73.5	9	6	4.5	78				
	Copy St	irrup wizard				Nev	v Duplica	te	Delete	
							ОК А	pply	Canc	al

Web	Shear Reinfo	rceme	ent Ranges - V	/EB1					-		Х
Star	t Spacing										
Distar	it reference ty Voids	→ /pe ○ C	enterline bear	ings		Linked with	None		~		
Span Spa	n ranges an: 4 ~										
T	Name		Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars	\sim	2	1	0	0	2				÷
	S Bars	\sim	2	12	8	8	10				
	S Bars	\sim	10	7	10	5.8333333	15.8333333				
	Z Bars	\sim	15.5	1	0	0	15.5				
	Z Bars	\sim	15.5	2	6	1	16.5				
	S Bars	\sim	15.833333	5	12	5	20.833333				
	S Bars	\sim	20.833333	5	15	6.25	27.083333				
	S Bars	\sim	27.083333	12	18	18	45.083333				
	S Bars	\sim	45.083333	5	15	6.25	51.333333				
	S Bars	\sim	51.333333	5	12	5	56.333333				
	S Bars	\sim	56.333333	1	10	0.8333333	57.1666663				
	Сору	Stirr	rup wizard				Nev	v Duplica	te	Delete	
								ОК А	pply	Canc	el

Click **OK** to apply the data and close the window.

Web Shear Reinforcement Ranges – WEB2

Double click on the Shear Reinforcement Ranges for WEB2 and enter the following data for Spans 1-4.

Start	t Spacin	g 🖌									
istar	ice										
nput	t reference	type				Linked with	None		\sim		
	Voids	00	enterline bear	ings		Linked with	. Hone		·		
Span	ranges										
Spa	an: 1										
	Nam	ne	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars	\sim	0	1	9	0.75	0.75				5
	S Bars	~	0	1	0	0	0				
	S Bars	\sim	0.75	7	10	5.8333333	6.5833333				
	S Bars	\sim	6.583333	5	12	5	11.583333				
	S Bars	\sim	11.583333	12	18	18	29.583333				
	S Bars	\sim	29.583333	2	15	2.5	32.083333				
	S Bars	\sim	32.083333	7	12	7	39.083333				
	S Bars	\sim	39.083333	6	9	4.5	43.583333				
	Z Bars	\sim	40.75	1	0	0	40.75				
	Z Bars	\sim	40.75	2	6	1	41.75				
	S Bars	\sim	43.583333	10	8	6.6666667	50.2499997				
	S Bars	\sim	50.25	10	6	5	55.25				
	Сору	Stirr	rup wizard				Ne	w Duplica	ite	Delete]

Veb	Shear Reinforce	ment Ranges - V	VEB2					_		×
Start	t Spacing									
	t reference type Voids	Centerline bear	ings		Linked with	n: None	~			
Span	in: 2 🗸									
	Name	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars	× 2	1	0	0	2				
	S Bars	× 2	20	6	10	12				
	S Bars	/ 12	10	8	6.6666667	18.6666667				
	Z Bars	/ 14.75	2	6	1	15.75				
	Z Bars	/ 14.75	1	0	0	14.75				
	S Bars	18.666667	5	10	4.1666667	22.8333337				
	S Bars	22.833334	9	12	9	31.833334				
	S Bars	31.833334	4	15	5	36.833334				
	S Bars	36.833334	5	18	7.5	44.333334				
	S Bars	44.333334	4	15	5	49.333334				
	S Bars	49.333334	5	12	5	54.333334				
	S Bars	54.333334	6	10	5	59.333334				
	S Bars	59.333334	13	8	8.6666667	68.000007				
	Z Bars	62.25	1	0	0	62.25				
	Z Bars	62.25	2	6	1	63.25				
	S Bars	68	20	6	10	78			-	
	Copy	tirrup wizard				Nev	v Duplicate		elete)
							OK Apply		Cance	1

Neb	Shear Reinforcer	nent Ranges - V	VEB2					_		×
Start	t Spacing									
)istan Input	t reference type Voids	Centerline bear	ings		Linked wit	n: None	~			
Span Spa	an: 3 v									
	Name	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
>	S Bars 🗸 🗸	2	1	0	0	2				
	S Bars ~	2	20	6	10	12				
	S Bars V	12	13	8	8.6666667	20.6666667				
	Z Bars ~	16.75	2	6	1	17.75				
	Z Bars ~	16.75	1	0	0	16.75				
	S Bars ~	20.666667	6	10	5	25.666667				
	S Bars ~	25.666667	5	12	5	30.666667				
	S Bars V	30.666667	4	15	5	35.666667				
	S Bars V	35.666667	5	18	7.5	43.166667				
	S Bars ~	43.166667	4	15	5	48.166667				
	S Bars ~	48.166667	9	12	9	57.166667				
	S Bars ~	57.166667	5	10	4.1666667	61.3333337				
	S Bars 🗸 🗸	61.333333	10	8	6.6666667	67.9999997				
	Z Bars 🗸 🗸	64.25	2	6	1	65.25				
	Z Bars 🗸 🗸	64.25	1	0	0	64.25				
	S Bars ~	68	20	6	10	78				
	Copy St	irrup wizard				Nev	v Duplicate)elete)
							OK Apply	y	Cance	

Start Span ranges Span: 4 Start Number of Spacing Linked with: None	
→ I → Distance Input reference type Voids O Centerline bearings Span ranges Span: 4 Start Number of Spacing End	
Span ranges Span: 4 Start Number of Spacing Length End	
Start Number of Spacing Length End	
Name distance spaces (in) (ft) distance distance (ft)	
> S Bars ~ 2 10 6 5 7	-
S Bars ~ 2 1 0 0 2	
S Bars \checkmark 7 10 8 6.6666667 13.6666667	
S Bars \checkmark 13.666667 6 9 4.5 18.166667	
Z Bars \checkmark 15.5 1 0 1 15.5	
Z Bars \checkmark 15.5 2 6 1 16.5	
S Bars \checkmark 18.166667 7 12 7 25.166667	
S Bars \checkmark 25.166667 2 15 2.5 27.666667	
S Bars \checkmark 27.666667 12 18 18 45.666667	
S Bars V 45.666667 5 12 5 50.666667	
S Bars \checkmark 50.666667 7 10 5.833333 56.5000003	
S Bars V 56.5 1 9 0.75 57.25	

Once the shear reinforcement for **WEB1** and **WEB2** are entered, **WEB3** though **WEB5** can be linked to them since **WEB5** is identical to **WEB1** and **WEB3** and **WEB4** are identical to **WEB2**.

To link **WEB3** with **WEB2**, open the **Web Shear Reinforcement Ranges** window and select **WEB2** from the dropdown menu. The ranges will then populate the window. Click **OK** to accept and close. Repeat this process for the remaining webs.







Bridge Alternatives

Bridge alternative

Double click the **BRIDGE ALTERNATIVES** folder and enter in the information shown below.

Alternative name: AS-BUILT Description Substructures Description:	- 🗆 ×
Description Substructures Description:	
Description: Horizontal curvature Reference line length: 274.5 Start bearing End bearing Starting station: ft Bearing: N 90^ 0' 0.00" E	
Horizontal curvature Global positioning Reference line length: 274.5 ft Start bearing End bearing Distance: 0 ft Starting station: ft Offset: 0 ft Bearing: N 90^ 0' 0.00" E Ft Elevation: ft	
Reference line length: 274.5 ft Distance: 0 ft Start bearing End bearing Offset: 0 ft Starting station: ft Elevation: ft Bearing: N 90^ 0' 0.00" E Elevation: ft	
Start bearing End bearing Offset: 0 ft Starting station: ft Elevation: ft Bearing: N 90^ 0' 0.00" E ft	:
Starting station: ft Elevation: ft Bearing: N 90^ 0' 0.00" E Ft	:
Bearing: N 90^ 0' 0.00" E	:
- Drides alignment	
Start tangent Start tangent length:	ft
O Curved Curve length:	ft
Tangent, curved, tangent Radius:	ft
Tangent, curved Direction: Left	~
Curved, tangent End tangent length:	ft
Superstructure wizard Culvert wizard	
OK Apply	Cancel

rna	ative name: AS	-BUILT			
esc	ription Sub	structures			
	Substructure unit name	Station (ft)	Offset (ft)	Unit type	
>	Abut 1	0	0	Abutment	\sim
	Bent 2	57.25	0	Pier	\sim
	Bent 3	137.25	0	Pier	\sim
	Bent 4	217.25	0	Pier	\sim
	Abut 5	274.5	0	Abutment	\sim

In the **Substructures** tab, define substructure locations as shown below.

Click **OK** to apply the data and close the window.

Superstructures

Double click on the **SUPERSTRUCTURES** folder and enter the name **AS-BUILT**. Move to the **Substructures** tab and assign substructures at each support.

m , s	Supe	erstructure						
Sup	erst	ructure nar	ne: AS-E	BUILT				1
	Desc	ription	Alternativ	/es	Vehicle path Engine		Substructures	1
	Sele	ect the subs	tructure s	uppo	rts:			
	Support S		Substrue suppo	cture ort				
			Abut 1	\sim				
		2	Bent 2	\sim				4
		3	Bent 3	\sim				
		4	Bent 4	\sim				
		5	Abut 5	\sim				- 4
		بالبياس						

Click **OK** to apply the data and close the window.

Superstructure Alternative

Double click on the **SUPERSTRUCTURE ALTERNATIVES** folder. Enter the name **AS-BUILT** and select **AS-BUILT Spans 1-4** from the dropdown box.

A :	Superstr	ucture Alternati	ve							_		×
Alte	rnative	name:	AS-B	UILT]			
Des	cription	:										
Sup	erstruct	ure definition:	AS-BU	IILT Sp	ans 1-4			~				
Sup	erstruct	ure type:	Mult	Cell B	DX							
Nur	mber of	cells:	4									
	Span	Length (ft)										
	1		57.25									
	2		80									
	3		80									
	4		57.25									
							OK	(A	pply	Cano	el

Click **OK** to apply the data and close the window.

Pier Data Entry

Pier

Now open the **Bent 2** Pier window, enter the data for the **finished groundline** and the **soil density**. This example assumes that the finished ground elevation is the same for each pier.

Pier	_		×
er name: Bent 2 Description Stream flow			
Pier skew angle Degrees Input skew angle Skew angle: Input bearing angle			
Finished groundline elevation: 335 ft Superstructure defined in BrDR			
Superstructure longitudinal direction Consider as fixed Consider as expansion Pier location relative to bridge alternative Station: 57.25 ft Offset: 0			
Computed pier location relative to structure Computed pier coordinates			
Station: 57.25 ft X: 57.25 ft Offset: 0 ft Y: 0 ft			
Existing Current Pier alternative name Description			
ОК	Apply	Canc	el:

Click **OK** to apply the data and close the window.

New Pier Alternative

Now create a solid shaft pier alternative. Double click on the **Bent 2 PIER ALTERNATIVE** and select **Solid Shaft Pier** and click **Next**.



Enter the values shown and click **Finish**.

A New Pier Alternative		×
Туре:	RC SolidShaft Pier	
Name:	Bent 2	
Description:		
Units:	US Customary 🗸	
	< Back Finish	Cancel

Pier Alternative – Bent 2

No data needs to be changed on the resulting **Pier Alternative** window so click **OK** to close it.

ne: Bent 2	Тј	vpe: RC SolidShaft Pier		
escription Stiffness Report	ts			
Description:		Units: US Customary	~	
		LRFD substructure design setti	ngs	
	Ψ	Preliminary mode		
		Default design settings:	Preliminary Design Setting (US)	
		Override default		
		Design settings:		
		Final mode		
		Default design settings:	Final Design Setting (US)	
		Override default		
		Design settings:		
		Advanced DLA		

Pier Geometry – Bent 2 – Bent 2

Double click on Geometry under Bent 2 in the tree. Enter the data shown below.



Click **OK** to apply the data and close the window.

Cap Properties – Bent 2 – Bent 2

Open the Cap window and verify the correct cap concrete material is selected.

Des	cription	Additional lo	bads				
Caj	p type: Be	am Shape Ca	p Cap top configuration	on: Sloped	Cap material: 3 ksi	~	
	Pedestals		Exposure factor:				
	Member	CL bearing station (ft)	Angle between CL member and CL support (Degrees)	Bearing seat elevation (ft)			
>	M1	57.25	90	0			

Click **OK** to apply the data and close the window.

Cap Geometry – Bent 2 – Bent 2

Open the Cap Geometry window and enter the following data for the pier cap geometry.



Click **OK** to apply the data and close the window.

Cap Reinforcement – Bent 2 – Bent 2

Open the **Cap Reinforcement** window to enter the flexural and shear reinforcement. A section taken at mid-cap is shown below (Note that the section and elevation view are CADD drawings and were not generated by BrDR).



Pier cap elevations shown below with bent M Bar locations.





Cap Reinforcement – Bent 2 – Bent 2

Based on the section and elevations above, enter the data shown below.

3120.	3 ~ E	Bar spacing:		in	Bar material: Gr	rade 40	~	Stirrup	clear cove	r: 2	in		
nary fle Reinfo	exural prcement input Simplified	method Advanced		Reinforce	ement follows caj	p profile							
Set	Measure from cap	Vertical distance (in)	Bar si:	e Number	Material	Start distance (ft)	Straight length (ft)	End distance (ft)	Hook at start	Hook at end	Developed at start	Developed at end	
1	Тор 🗸	10.83	11	/ 19	Grade 40 🗸 🗸	2.1667	25.66666	27.83336					
2	Тор 🗸	25.5	11	· 4	Grade 40 🗸 🗸	2.1667	25.66666	27.83336					
3	Bottom ~	2.83	11	· 4	Grade 40 🗸 🗸	2.1667	25.66666	27.83336					
4	Bottom ~	2.83	11	· 2	Grade 40 🗸 🗸	2.1667	7.5833	9.75					
5	Bottom ~	41.83	11	· 2	Grade 40 🗸 🗸	13	4	17					
6	Bottom ~	2.83	11	· 2	Grade 40 🗸	20.25	7.5833	27.8333			 Image: A start of the start of		
7	Bottom ~	2.83	11	· 2	Grade 40 🗸	2.1667	5.5833	7.75					
8	Bottom 🗸	41.83	11	· 2	Grade 40 🗸	11	8	19					
9	Bottom ~	2.83	11	2	Grade 40 🗸 🗸	22.25	5.5833	27.8333			\checkmark		
10	Bottom 🗸	2.83	11	2	Grade 40 🗸	2.1667	3.5833	5.75					
11	Bottom ~	41.83	11	2	Grade 40 🗸	9	12	21					
12	Bottom ~	2.83	11	· 2	Grade 40 🗸	24.25	3.5833	27.8333					
13	Bottom 🗸	41.83	11	/ 1	Grade 40 🗸	6	19	25			$\overline{}$		

Navigate to the **Shear** tab. The assumed shear reinforcement spacing is shown below. Enter the data as shown below.

	Bar size	Number of legs	Material	Measure from	Direction	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	5 ~	4	Grade 40 🗸 🗸	Left Edge of Cap $~~ \lor$	Right 🗸	2.8333	13	4.9808	5.3958667	8.2291667
	5 V	4	Grade 40 🗸 🗸	Left Edge of Cap 🗸 🗸	Right 🗸	2.8333	1	0	0	2.8333
	5 ~	4	Grade 40 🗸 🗸	Left Edge of Cap 🗸 🗸	Right \vee	9.1458	1	0	0	9.1458
	5 ~	4	Grade 40 🗸	Left Edge of Cap 🗸 🗸	Right 🗸	9.1458	13	4.9808	5.3958667	14.5416667
	5 ~	4	Grade 40 🗸	Left Edge of Cap 🗸 🗸	Right 🗸	15.4583	1	0	0	15.4583
	5 ~	4	Grade 40 🗸	Left Edge of Cap 🗸 🗸	Right 🗸	15.4583	13	4.9808	5.3958667	20.8541667
	5 ~	4	Grade 40 🗸	Left Edge of Cap 🗸 🗸	Right 🗸	21.7708	1	0	0	21.7708
	5 v	4	Grade 40 🗸	Left Edge of Cap 🗸	Right ∨	21.7708	13	4.9808	5.3958667	27.1666667

Click **OK** to apply the data and close the window.

Column Components – Bent 2 – Bent 2 – Column1

Open the Column1 Components window and select the following concrete material.

6	Nur	Column Compo mber of cross-s	nents - Bent 2 - Bent 2 - Colu ection segments for column:	umn1	1				_		×
		Segment	Material		Segment vary	Cross-section type				ĺ	
	>	1	3 ksi	~	None 🗸	Round	~	^		Segmer Seamer	nt 1 nt 2
		gana, gan			مسرا	an an fra				, sogner	

Click **OK** to apply the data and close the window.

Column Geometry – Column1

Open the Column1 **Geometry** window and enter the following data. The maximum shaft height of 27'-0" is used for all piers.



Click **OK** to apply the data and close the window.

The pier is now sufficiently defined to be considered in the superstructure analysis. The column will be considered fixed at the base of the column. This percent fixity can be adjusted on the **Pier Model Settings** window if desired. The FE model created during the superstructure analysis will include an element modeling the column length and stiffness. For this example, the reinforcement and foundations will be entered.

Generate Pattern Wizard

Open the **Reinforcement Definitions** window to enter the flexural reinforcement pattern. Click the **Generate pattern** button and enter the following input.

🕰 Generate Pattern W	izard							×
Pattern name:	P1		Bundle type	Bar size:	10 ~			
Column segment:	1	~	Single	Material:	Grade 40		~	
Segment cross section:	Rou	Ind	2 Parallel	Clear cover:	3	in		
Top / bottom:	Тор		3 Bar	Number of bars:	30			
Overall trans. width:	66	in						
Overall long. width:	66	in						
							ОК	Cancel

Click **OK** and all rebar locations will be generated.

Column Reinforcement – Bent 2 – Bent 2

Column Reinforcement Bent 2	2 - Bent 2						_		\times
	Name:	P1							
	Bun	dle bars							
++Y	Bar	Bar size	Material	X (in)	Y (in)				
	> 1	10 ~	Grade 40 🗸 🗸	29.365	0				î
+X	2	10 ~	Grade 40 🗸	28.7233043	-6.1053268				L.
	3	10 ~	Grade 40 🗸	26.8262624	-11.9438215				L.
ll	4	10 ~	Grade 40 🗸	23.756784	-17.2603139				L.
↓ Sta Ahead	5	10 ~	Grade 40 🗸	19.6490203	-21.8224478				L.
	6	10 ~	Grade 40 🗸	14.6825	-25.430836				L.
	7	10 ~	Grade 40 🗸	9.074284	-27.9277746				L.
	8	10 ~	Grade 40 🗸	3.0694783	-29.2041355				L.
	9	10 ~	Grade 40 🗸	-3.0694783	-29.2041355				L.
	10	10 ~	Grade 40 🗸	-9.074284	-27.9277746				L.
	11	10 ~	Grade 40 🗸	-14.6825	-25.430836				L
	12	10 ~	Grade 40 🗸	-19.6490203	-21.8224478				L.
	13	10 ~	Grade 40 🗸	-23.756784	-17.2603139				L.
	14	10 ~	Grade 40 🗸	-26.8262624	-11.9438215				L.
	15	10 ~	Grade 40 🗸	-28.7233043	-6.1053268				L.
	16	10 ~	Grade 40 🗸	-29.365	0				L.
	17	10 ~	Grade 40 🗸	-28.7233043	6.1053268				L.
	18	10 ~	Grade 40 🗸	-26.8262624	11.9438215				L.
	19	10 ~	Grade 40 🗸	-23.756784	17.2603139				L.
	20	10 ~	Grade 40 🗸	-19.6490203	21.8224478				L.
	21	10 ~	Grade 40 🗸	-14.6825	25.430836				
	22	10 ~	Grade 40 🗸	-9.074284	27.9277746				
	23	10 ~	Grade 40 🗸	-3.0694783	29.2041355				
	24	10 ~	Grade 40 🗸	3.0694783	29.2041355				
	25	10 ~	Grade 40 🗸	9.074284	27.9277746				
	26	10 ~	Grade 40 🗸	14.6825	25.430836				L.
	27	10 ~	Grade 40 🗸	19.6490203	21.8224478				
	28	10 ~	Grade 40 🗸	23.756784	17.2603139				
	29	10 ~	Grade 40 🗸	26.8262624	11.9438215				-
Generate pattern						New Dupli	icate	Delete	:
						OK An	olv	Cancel	
						App	.,	cance	

Click **OK** to apply the data and close the window.

Column Reinforcement – Column1 – Bent 2 – Bent 2

Open the Column1 Reinforcement window and enter the flexural and shear reinforcement as shown.

lexu	ural	Shear										
	Set	Start distance (ft)	Straight length (ft)	End distance (ft)	Pattern	Hook at start	Hook at end	Developed at start	Developed at end	Follows profile		
I	1	0	27	27	P1 ~							
LOIU	imn Ke	inforceme	nt - Colum	n I - Bent 2	- Bent 2						_	
lex	ural	Shear	nt - Colum	n I - Bent 2	- Bent 2						_	
	ural hear re	Shear einforceme	nt - Colum nt type pirals) Spirals d	esigned a	s ties					_	
Flexi	ural Chear re Tie Bar s	Shear einforceme es S ize Tran numb of le	nt type pirals s. Long per numb gs of le) Spirals d g. g. gs Ma	esigned a	s ties Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)		

Click **OK** to apply the data and close the window.

Foundation Alternatives

New Foundation Alternative Wizard

Open the Foundation Alternatives window, highlight the Pile Footing option, and click Next.



Enter the data shown below and click **Finish**.

A New Foundation Alterna	tive Wizard				>
Туре:	Pile	e Foundation			
Name:	Be	nt 2 Footing			
Description	n:		A		
Units:	US	Customary	~		
Footing wi	dth: 13.	.5 ft	Fo	oting thickness	4.25 ft
Footing ler	ngth: 13.	.5 ft			
Footing ma	aterial: 3 ks	si	\sim		
Piles					
Pile material:	Steel Pile	~			
Pile type:	Rolled H SI	hape \vee			
Pile pattern:	4 🗘 A	cross	Pile edge distance:	1.5	ft
	4 🗘 D	Down	Steel shape:	10BP42	~
Pile embedment depth:	1	ft	Steel material:	After 1963	~
Bottom of pile elevation:	299.71	ft	Factored comp. resistance:	111	kip
Point of fixity elevation:	318.71	ft	Factored tension resistance:	44	kip
			< Back Fi	inish C	ancel Help

Foundation Properties – Bent 2 – Bent 2 – Column1

Click the **Soil** tab and enter the Factored bearing resistance.

A Four	dation Properties-Bent 2-Bent 2-Colu	mn1					-	×
Name:	Bent 2 Footing		Foundation type:	Pile Foundation				
Desc	ription Additional Loads Soil	Piles						
Su	Soil Rock							
Fact	ored bearing resistance: 15	ksf						
1. J	فيتحسو والاسترال		مىرى خىرى	ر المراجع المراجع	المساور أتحر	and the second		

Navigate to the **Piles** tab and enter the following data.

ne:	Bent 2	Footing				Fo	oundat	ion type:	Pile Fou	undation									
esci	ription	Addi	tional L	oads Soil	Piles														
Pile	layout	wizard		Pile type:			Rolle	d H Shape											
				Pile embe	dment de	pth:	1	ft											
				Point of fi	xity elevat	ion:	318.	71 ft											
		Lo	cal								Ba	tter	Bottom		Pile	Downdrag	Factored	Factored	
	Pile name	L (ff)	T (ft)	Shape	Ma	iteria	I	Strong	g axis tion	Ax	is	Vertical to 1 horizontal	elevation (ft)	Resistance Type	head fixity (%)	force (kip)	comp. resistance (kip)	tension resistance (kip)	
>	Pile1	-5.25	-5.25	10BP42 ~	After 19	63	~	Transvers	e v	-L	\sim	6	299.71	Bearing 🗸	100	0	111	44	
	Pile2	-1.75	-5.25	10BP42 ~	After 19	63	~	Transvers	e v	None	\sim		299.71	Bearing \vee	100	0	111	44	
	Pile3	1.75	-5.25	10BP42 ~	After 19	63	~	Transvers	e v	None	\sim		299.71	Bearing \vee	100	0	111	44	1
	Pile4	5.25	-5.25	10BP42 ~	After 19	63	\sim	Transvers	e v	+L	\sim	6	299.71	Bearing \vee	100	0	111	44	1
	Pile5	-5.25	-1.75	10BP42 ~	After 19	63	~	Transvers	e ~	-L	\sim	6	299.71	Bearing \vee	100	0	111	44	1
	Pile6	-1.75	-1.75	10BP42 ~	After 19	63	\sim	Transvers	e v	None	\sim		299.71	Bearing 🗸	100	0	111	44	1
	Pile7	1.75	-1.75	10BP42 ~	After 19	63	\sim	Transvers	e v	None	\sim		299.71	Bearing 🗸	100	0	111	44	1
	Pile8	5.25	-1.75	10BP42 ~	After 19	63	~	Transvers	e ~	+L	\sim	6	299.71	Bearing 🗸	100	0	111	44	
	Pile9	-5.25	1.75	10BP42 ~	After 19	63	~	Transvers	e ~	-L	\sim	6	299.71	Bearing \sim	100	0	111	44	
	Pile10	-1.75	1.75	10BP42 ~	After 19	63	~	Transvers	e ~	None	\sim		299.71	Bearing \vee	100	0	111	44	
	Pile11	1.75	1.75	10BP42 ~	After 19	63	~	Transvers	e ~	None	\sim		299.71	Bearing \vee	100	0	111	44	
	Pile12	5.25	1.75	10BP42 ~	After 19	63	~	Transvers	e ~	+L	\sim	6	299.71	Bearing \sim	100	0	111	44	
	Pile13	-5.25	5.25	10BP42 ~	After 19	63	~	Transvers	e v	-L	\sim	6	299.71	Bearing \vee	100	0	111	44	
	Pile14	-1.75	5.25	10BP42 ~	After 19	63	~	Transvers	e v	None	\sim		299.71	Bearing \vee	100	0	111	44	
	Pile15	1.75	5.25	10BP42 ~	After 19	63	~	Transvers	e v	None	\sim		299.71	Bearing \vee	100	0	111	44	
	Pile16	5.25	5.25	10BP42 ~	After 19	63	~	Transvers	e ~	+L	\sim	6	299.71	Bearing 🗸	100	0	111	44	
																New	Duplicat	te De	lete

Click **OK** to apply the data and close the window.

Foundation geometry – Bent 2 Footing

Open the Foundations Alternatives Geometry. Verify the dimensions.



Click **OK** to apply the data and close the window.

Foundation Reinforcement – Bent 2 – Bent 2 – Column1 – Bent 2 Footing

Open the Foundation Alternatives **Reinforcement** window and enter the data as shown below.

ection of topmost re	ebar:	Longit	tudina 🗸	Top bar clear cover:	4	in	End cover:	2	in		
rection of bottommo	st rebar:	Longit	tudinal 🗸	Bottom bar clear cov	er: 14	in	Material:	Grade 4	0	\sim	
Top longitudinal rei	nforceme	ent			Top transvers	e reir	forcement				
Bar size:	5	~	Number:	14	Bar size:		5	~ N	lumber:	14	
Fully develope	d I reinforc	ement			Bottom tranv	velope erse r	ed reinforcemer	nt			
Bar size:	9	\sim	Number:	27	Bar size:		9	~ N	lumber:	27	
Hooked					Hooked						
Fully develope	d				Fully dev	/elop	ed				

Click **OK** to apply the data and close the window.

The input for Bent 2 is complete.

3D Schematic – Pier Alternative

With pier alternative – **Bent 2** selected, click on the **3D Schematic** button from the **SUBSTRUCTURE DESIGN** ribbon (or right click and select **3D Schematic**)



Br	E	ridge Workspa	ce - MC	B4		ANALYSIS	SUBSTRUCT	URE	REPORTS		?	_		×
BRIDGE WO	ORKSPACE	WORKSPA	CE	tools v	/IEW C	DESIGN/RATE	DESIGN		REPORTING			_		
		2 -		æ	Ţ			5	× 2		30			
Preliminary ~	Generate Model	Load Combinations	Load Palette	Analyze Substructure	Specifica e Checl	ation Tabular k Results	Specification Check Detail	Engine Output	e Results S ts Graph P	oil Iot	3D Schemati	۰		
		Analy	/sis				Re	sults						



Copy pier alternative

Bent 4 is identical to **Bent 2**. Therefore, a copy of **Bent 2** can be created for **Bent 4**. Right click on the **Bent 2** Pier Alternative and select **Copy**.

Workspace	× &
Bridge Components	
MCB4 MCB4 Components Diaphragm Definitions Lateral Bracing Definitions MFF LRFD Multiple Presence Facto Componental Conditions P Design Parameters D Design Parameters Componental Conditions P Design Parameters Componental Conditions P Design Parameters P Design Parame	rs NS
 Expand Branch Collapse Branch 	
🗁 Open	IVES
🗇 Сору	
💥 Delete 🗤	
🦻 Generate Model	
Je 3D Schematic	
C Validate	
View Detailed Papert	
General Preferences	
Close Bridge Workspace	1

Expand **Bent 4**, right click on the **Pier Alternative** and select **Paste**. Change the name from **Bent 2** to **Bent 4**. The input for **Bent 4** is now complete.



Follow the same procedure for **Bent 3**. However, additional input will need to be modified as shown below.

Pile Layout

ne:	Bent 3	Footing			Fo	undat	tion type: Pile	e Fou	ndation								
esci	ription	Addit	tional L	oads Soil	Piles												
Pile	layout v	vizard		Pile type:		Rolle	ed H Shape										
				Pile ember	dment depth:	1	ft										
				Point of fix	ity elevation:	318.	71 ft										
		Loc	al							Ba	tter			Pile		Factored	Factored
	Pile	Coord	inates	Shape	Materia	I	Strong ax	is			Vertical to	Bottom elevation	Resistance	head	Downdrag force	comp.	tension
	name	L (ft)	T (ft)				direction		Axe	5	1 horizontal	(ft)	type	(%)	(kip)	(kip)	(kip)
>	Pile1	-7	-5.25	10BP42 🗸	After 1963	\sim	Transverse	\sim	-L	\sim	6	299.71	Bearing 🗸	100	0	111	44
	Pile2	-3.5	-5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile3	0	-5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile4	3.5	-5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing $$	100	0	111	44
	Pile5	7	-5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	+L	\sim	6	299.71	Bearing $$	100	0	111	44
	Pile6	-7	-1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	-L	\sim	6	299.71	Bearing \sim	100	0	111	44
	Pile7	-3.5	-1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile8	0	-1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile9	3.5	-1.75	10BP42 ~	After 1963	~	Transverse	\sim	-L+T	\sim	6	299.71	Bearing \sim	100	0	111	44
	Pile10	7	-1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	+L	\sim	6	299.71	Bearing \sim	100	0	111	44
	Pile11	-7	1.75	10BP42 ~	After 1963	~	Transverse	\sim	-L	\sim	6	299.71	Bearing $$	100	0	111	44
	Pile12	-3.5	1.75	10BP42 ~	After 1963	~	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile13	0	1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \sim	100	0	111	44
	Pile14	3.5	1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \vee	100	0	111	44
	Pile15	7	1.75	10BP42 ~	After 1963	\sim	Transverse	\sim	+L	\sim	6	299.71	Bearing \vee	100	0	111	44
	Pile16	-7	5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	-L	\sim	6	299.71	Bearing \vee	100	0	111	44
	Pile17	-3.5	5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \vee	100	0	111	44
	Pile18	0	5.25	10BP42 ~	After 1963	\sim	Transverse	\sim	None	\sim		299.71	Bearing \vee	100	0	111	44
	Pile19	3.5	5.25	10BP42 ~	After 1963	~	Transverse	\sim	None	\sim		299.71	Bearing \vee	100	0	111	44
	Pile20	7	5.25	10BP42 ~	After 1963	~	Transverse	\sim	+L	\sim	6	299.71	Bearing \sim	100	0	111	44
															New	Duplicat	te Dele

Foundation Properties – Bent 3 - Bent 3 – Column1

Click **OK** to apply the data and close the window.

Foundation Geometry – Bent 3 Footing

Open the Foundation Geometry window and enter the data as shown below.



Click **OK** to apply the data and close the window.

Foundation Reinforcement – Bent 3 – Bent 3 – Column1 – Bent 3 Footing

Open the **Foundation Reinforcement** window and enter data as shown below.

	ebar:	Longit	udina 🗸	Top bar clear cover:	4	in	End cover:	2	i	n	
rection of bottomm	ost rebar:	Longit	udinal 🗸	Bottom bar clear cover	: 14	in	Material:	Grade	40	~	
Top longitudinal re	inforceme	ent			Top transverse	rein	forcement				
Bar size:	5	~	Number:	14	Bar size:		5	\sim	Number	: 17	
Fully develope	ed al reinforc	ement			Fully devel	lope se re	einforcemen	ıt			
Bar size:	10		Number:	27	Bar size:	sen	10	~	Number	: 34	
Hooked					Hooked						
Fully develope	ed				Fully devel	lope	d				

Click **OK** to apply the data and close the window.

Analysis and Results

The structure is ready for analysis. Note that a design review of substructures for integral box girders cannot be performed at this time.

LRFR Analysis

To perform an LRFR analysis of the superstructure – **AS-BUILT Spans 1-4**, click on the **Analysis Settings** button from the **Analysis** group of the **DESIGN/RATE** ribbon.



Click on the **Open template** button in the **Analysis Settings** window and select the **LRFR Design Load Rating** and click **Open**.

۵	A Open Template					×
	Templates	Description	Analysis	Owner	Public / Private	
	HL 93 Design Review	HL 93 Design Review	LRFD		Public	
	HS 20 LFR Rating	HS 20 LFR Rating	LFR		Public	
	> LRFR Design Load Rating	LRFR Design Load Rating	LRFR		Public	
Τ	LRFR Legal Load Rating	LRFR Legal Load Rating	LRFR		Public	
	Delete			(Open C	ancel

Analysis Settings			-	
Design review O Rating	Rating method:	LRFR	~	
halysis type: Line Girder V				
ne / Impact loading type: As Requested	Apply preference	setting: None	~	
Vehicles Output Engine Description				
Vehicle selection	Vehicle	summary	Advanced	
 ⇒ Standard = EV2 = EV3 = H 15-44 = H 20-44 = H 1-93 (SI) = H I-93 (SI) = N I-100 (SI)	Add to >> Remove from <<	HRR ☐ -Design load rating ☐ -Inventory ↓ -HL-93 (US) ☐ Operating ↓ -HL-93 (US) ☐ Fatigue ↓ -LRP Fatigue Truck (I ☐ -Legal load rating ↓ -Routine — Specialized hauling — Permit load rating	15)	

The Analysis Settings window is updated as shown below.

Click **OK** to apply the settings and close the window.

To run the analysis, with the superstructure – **AS-BUILT Spans 1-4** selected, click on the Analyze button from the **Analysis** group of the **DESIGN/RATE** ribbon.



Tabular Results

Once the analysis is complete, results can be viewed by clicking on the **Tabular Results** button from the **Results** group of the **DESIGN/RATE** ribbon.

Bridge V	Workspace - MCB4		ANALYSIS	REPORTS	?	_	\times
BRIDGE WORKSPACE W	VORKSPACE TOOLS	VIEW	DESIGN/RATE	REPORTING			
a 🖙 🗉		~ ×	2 🖪				
Analysis Analyze Analysis	Tabular Specification	Engine Resu	Its Save				
Settings Events	Results Check Detail C	outputs Grap	on Results				
Analysis	Res	sults					

Superstructure LRFR ratings for full box unit are shown below.

🕰 Anal	lysis Resi	ults - AS-BUILT Spans 1-4										- C	ı x
Print	t												
Report ty	/pe:	⊂ La	ne/Impact loadin	a type	Displa	y Format							
Rating Results Summary V					ad Singl	Single rating level per row							
			- As requested										
Live	e Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Element Name	Limit State	Impact	Lane	
HL	93 (US)	Truck + Lane	LRFR	Inventory	73.71	2.048	234.42	4 - (30.0)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-	93 (US)	Truck + Lane	LRFR	Operating	95.55	2.654	234.42	4 - (30.0)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-	93 (US)	90%(Truck Pair + Lane)	LRFR	Inventory	77.53	2.154	215.09	3 - (97.3)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-	93 (US)	90%(Truck Pair + Lane)	LRFR	Operating	100.50	2.792	215.09	3 - (97.3)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-	93 (US)	Tandem + Lane	LRFR	Inventory	76.02	2.112	234.42	4 - (30.0)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-	93 (US)	Tandem + Lane	LRFR	Operating	98.54	2.737	234.42	4 - (30.0)	AS-BUILTSpans1-4	STRENGTH-I Concrete Flexure	As Requested	As Requested	
AASHTO	LRFR En	gine Version 7.5.0.3001											
Analysis	preferen	ce setting: None											

LFR Analysis Results

The user also has the option to analyze individual web lines. LFR ratings for **Web 1** using the **HS 20 LFR Rating** template are shown below.

🕰 Analy	/sis Res	ults - WEB1									_		×
Print Print													
Report type: Display Format													
Rating Re	esults S	ummary	× 0	As requested □ Detailed Single rating level per row ∨									
As requested Detailed													
Live L	Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lar	ne	
HS 20	0-44	Axle Load	LFR	Inventory	76.21	2.117	267.82	4 - (88.3)	Design Shear - Concrete	As Requested	As Requ	uested	-
HS 20	0-44	Axle Load	LFR	Operating	126.77	3.521	267.82	4 - (88.3)	Design Shear - Concrete	As Requested	As Requ	uested	1
HS 20	0-44	Lane	LFR	Inventory	101.75	2.826	144.15	3 - (8.6)	Design Shear - Concrete	As Requested	As Requ	uested]
HS 20	0-44	Lane	LFR	Operating	167.10	4.642	144.15	3 - (8.6)	Design Shear - Concrete	As Requested	As Requ	uested	
AASHTO L	FR Eng	gine Versior	7.5.0.3001										
Analysis preference setting: None													
												Clo	se