AASHTOWare BrR 6.8

Truss Tutorial T1 – Truss Floorbeam Stringer Example



Typical Section



Elevation



Plan View





Force

1 Lane DF = (31.25 + 25.25)/35 = 1.61 wheels

Multi Lane DF = (31.25 + 25.25 + 19.25 + 13.25)/35 = 2.54 wheels

Deflection

1 Lane DF = 2 wheels/2 trusses = 1.0 wheels

Multi Lane DF = 4 wheels/2 trusses = 2.0 wheels



BrR Training

T1 – Truss Floorbeam Stringer Example

This example describes entering a truss-floorbeam-stringer system and performing a rating of the truss.

Topics covered:

- Truss description and analysis
- Truss-floorbeam-stringer system superstructure
- Truss line superstructures

Note: It is assumed that the user is familiar with BrR and its Bridge Workspace. Therefore, this example does not go into great detail explaining the Bridge Workspace and detailed entry into windows not particular to a truss.

Truss Description and Analysis

Trusses are described in BrR by entering a text description of the truss in the BrR Truss Command Language. This command language contains commands to describe the truss geometry, members, loads, etc. The Truss Command Language User Manual can be accessed from the BrR Truss window's help topic.

BrR analyzes and rates trusses using the BrR Truss analysis engine. You cannot currently pick an alternate engine to perform the analysis. The BrR Truss analysis engine analyzes a finite element model of the truss and computes rating factors using the Load Factor method. The truss is analyzed for axial force only, bending due to load eccentricity is not considered.

Truss-Floorbeam-Stringer System Superstructure

From the Bridge Explorer, select File/New/New Bridge to create a new bridge. Enter the following description data:

Truss Example 1	
Bridge ID: Truss Example 1 NBI Structure ID (8): Truss Example 1	Template V Superstructures Bridge Completely Defined Culverts
Description Description (cont'd) Alternatives Global Reference Point Traffic	Custom Agency Fields
Name: Truss Example 1	Year Built: 1930
Description:	-
Location: Hornell Length	: 110.00 ft SR21
Feat. Intersected (6): Mi. Post	
Default Units: US Customary	
AASHTOWare Association	OK Apply Cancel

Close the window by clicking OK. This saves the data to memory and closes the window.



Create the following materials for the bridge:

Name:	Truss Steel	Desc	ription: Built 1	905 to 1936 - steel	unknown	
		Material Prop	erties			
	Specified m	inimum yield strength (Fy) -	= 30.000	ksi		
	Specified mini	mum tensile strength (Fu) -	= 60.000	ksi		
	Coeffic	ient of thermal expansion	= 0.00000650	00 1/F		
		Density	= 0.4900	kcf	₩ s	ave time - copy the
		Modulus of elasticity (E)	= 29000.00	ksi	⁴ 1905	5 to 1936' steel from the
					Libra	ry and just change its
					name	!
	Copy To Lib	rary Copy from Libra	ary	ОК Арр	ly Ca	ncel
ridge Mate	Copy To Lib rials - Structural Steel	rary Copy from Libra				
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36	rary Copy from Libra Desc	ription: AASH	DK App TO M270 Grade 36	ly Ca	
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36	rary Copy from Libra Desc Material Prope	ription: AASH	DK App TO M270 Grade 36	ly Ca	
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified m	rary Copy from Libra Desc Material Prope nimum yield strength (Fy) =	ription: AASH erties = 36.000	DK App TO M270 Grade 38	ly Ca	
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified m Specified mini	rary Copy from Libra Desc Material Prope nimum yield strength (Fy) = num tensile strength (Fu) =	ription: AASH erties = 36.000 = 58.000	DK App TO M270 Grade 38 ksi ksi	ly Ca	
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope nimum yield strength (Fy) = num tensile strength (Fu) = ent of thermal expansion =	ription: AASH erties = 36.000 = 58.000	DK App TO M270 Grade 38 ksi ksi 1/F	ly Ca	
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope nimum yield strength (Fy) = mum tensile strength (Fu) = ent of thermal expansion = Density =	ription: AASH erties = 36.000 = 58.000 = 0.000006500 = 0.4900	DK App TO M270 Grade 38 ksi ksi D0 1/F kcf		
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope nimum yield strength (Fy) = mum tensile strength (Fu) = ient of thermal expansion = Density = Modulus of elasticity (E) =	ary (ription: AASH erties = 36.000 = 0.000006500 = 0.4900 = 29000.00	DK App TO M270 Grade 38 ksi ksi D0 1/F kcf ksi		ncel
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope inimum yield strength (Fy) = mum tensile strength (Fu) = ient of thermal expansion = Density = Modulus of elasticity (E) =	ary (ription: AASH erties = 36.000 = 0.000006500 = 0.4900 = 29000.00	DK App TO M270 Grade 38 ksi ksi D0 1/F kcf ksi	W Ca	ncel
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope inimum yield strength (Fy) = mum tensile strength (Fu) = ient of thermal expansion = Density = Modulus of elasticity (E) =	ription: AASH erties = 36.000 = 0.000006500 = 0.4900 = 29000.00	DK App TO M270 Grade 38 ksi ksi D0 1/F kcf ksi	₩ Ca Ca	ncel The second
ridge Mate Name:	Copy To Lib rials - Structural Steel Grade 36 Specified mini Coeffic	rary Copy from Libra Desc Material Prope inimum yield strength (Fy) = mum tensile strength (Fu) = ient of thermal expansion = Density = Modulus of elasticity (E) =	ary (ription: AASH erties = 36.000 = 0.000006500 = 0.4900 = 29000.00	DK App TO M270 Grade 38 ksi ksi D0 1/F kcf ksi	₩ Ca Ca	ncel

Name:	Class A (US)	Des	oription:	Class A cer	nent co	oncrete				
	Compressive strength at 28	l days (f'c) =	4.000		si					
	Initial compressive stre	ength (f'ci) =		ŀ	ksi					l
	Coefficient of thermal	expansion =	0.0000	060000 1	1/F					
	Density (for d	ead loads) =	0.150	ŀ	kef					L
	Density (for modulus of	elasticity) =	0.145	ŀ	kef		(H)		
	Std Modulus of ela	sticity (Eic) =	3644.15	5	ksi		Ę	Save t	ime - copy thi	S
	LRFD Modulus of ela	sticity (Eic) =	3644.18	5	<si< td=""><td></td><td>con</td><td>ncrete f</td><td>rom the Libra</td><td>ry</td></si<>		con	ncrete f	rom the Libra	ry
	Std Initial modulus o	f elasticity =		ŀ	ksi					Г
	LRFD Initial modulus o	f elasticity =			<si< td=""><td></td><td></td><td></td><td></td><td></td></si<>					
	Pois	son's ratio =	0.200							
	Composition of	concrete =	Normal		•					
	Modulus	of rupture =	0.480	ŀ	<si< td=""><td></td><td></td><td></td><td></td><td></td></si<>					
	Sh	ear factor =	1.000							
	Splitting tensile stre	ngth (fct) =		I	ksi					

Now we need to add steel shapes to our bridge. Open the Steel I Shape window and use the Copy from Library button to copy the W12x79 to our bridge.

a	Steel I Shape	•		- • •	
	Name:	W 12x79	Rolled shape type W Shape	M Shape	
	Description:	W 12x79 Imported from AISC Tables (1994)	🔘 S Shape	O HP Shape	
	Dimensions	Properties			
		0.7350 in 0.4700 in 12.0800	in	Use t Library b	the Copy from putton!
		Copy To Library Copy from Library OK	Apply	Cancel	

Follow the same procedure to copy the following steel shapes to our bridge:



The following 2 channel shapes are not in the Standard Library and must be entered manually:



🚇 Steel Channel				- • •
Name: C15	x45			Channel type American Standard
Description: From	NY			 Miscellaneous
Dimensions Prope	rties			
	Area =	13.220	in^2	
	Nominal load =	45.000	lb/ft	
	Max. flange fastener =		in	
	lx =	373.900	in^4	
	ly =	10.300	in^4	
	Corry To Library Corry	u from Libror		Apply Concel
		y from Librar		Appiy Lancel



🗛 Steel Chann	iel					
Name:	C 15x55				- Channel type () Americar	n Standard
Description:	from NY				Miscellar	neous
Dimensions	Properties					
	Area =	16.160	in^2			
	Nominal load =	55.000	lb/ft			
	Max. flange fastener =		in			
	lx =	429.000	in^4			
	ly =	12.100	in^4			
	Copy To Library Copy	y from Libra	ary	ОК	Apply	Cancel

Enter the following Generic appurtenance to model the curb on our structure.



The Bridge Workspace now appears as follows:



We are now ready to create our truss-floorbeam-stringer superstructure definition. Double click on "SUPERSTRUCTURE DEFINITIONS".



E	11	C . 11		· · ·		1	11		1. C
Hnter	The	TOU	$n_{0}w_{1}n_{0}$	intorm	ation to	describe	THE CI	mercriictiire	definition
LINUI	unc	TOD	lowing.	morm	auon to	ucscribe	une si	upersu ucture	ucinnuon.

a	Truss Floorbeam String	jer Floor System Superstructure Def	ïnition	
	Definition Analysis Eng	gine		
	Name:	Truss (TFS)		
	Description:			
				\Im
L				Be sure to select the Main
L				member configuration as
L				"Through". This specifies that live
L				load is applied to the bottom chord
L				of the truss.
L				
L				-
L	Default Units:	US Customary	Main Member Span	Deck type:
L	Number of m	hain members: 2	Lengths Along the Reference Line:	Concrete Deck 💌
L	Main member hurr	nber of spans:	Span Length (ft)	
L	Main member c	onfiguration: Through 💌	1 110.00	Member Alt. Types
L	Numbe	r of stringers: 7		V Steel
	Stringers frame into	o floorbeam: 👿		
	Number of :	stringer units: 6	,	Timber
				OK Apply Cancel
1				

Stringer Units are the portions of the structure where the stringers are to be analyzed as structurally continuous units. In this structure, the stringers are simple spans and there are 6 stringer units.



Use the 'Add Default Load Descriptions' button to create the following load cases:

Load Case Descrip	otion					
Load Case Name	Description	Stage	Τ	Туре		Time* (Days)
DC1	DC acting on non-composite section	Non-composite (Stage 1)	-	D,DC	-	
DC2	DC acting on long-term composite section	Composite (long term) (Stage 2)	• 1	D,DC	-	
DW	DW acting on long-term composite section	Composite (long term) (Stage 2)	• 1	D,DW	-	
SIP Forms	Weight due to stay-in-place forms	Non-composite (Stage 1)	-	D,DC	-	
Prestressed membe	rs only					

Enter the truss spacing and stringer spacing as follows:

🕰 Structure Framing Plan Details			- • ×			
Number of main member spans = 1 Number of main members = 2 Number of stringers = 7						
Layout Diaphragms						
Main Member Support Skew Support Skew (Degrees) 1 0.0000	Member Spacing Orientation Perpendicular to member Along support	Stringer Spacing				
2 0.0000 Ma	ain Member Spacing Truss Bay Start of End of Member 1 35.00 0.00	Stringer (ft) Bay Start of End of Stringer Stringer Stringer 1 5.00 5.00 2 5.00 5.00 3 5.00 5.00 4 5.00 5.00 5 5.00 5.00 6 5.00 5.00				
			Cancel			

This structure does not have diaphragms or lateral bracing on the truss members so no data is entered on the Diaphragms tab.

If we look at the schematic for the framing plan we see that not much is drawn. This is due to the fact that we have not created our floorbeams yet nor specified where the stringers are.

🕰 Schematics: Framing Plan View	- • •
Truss Example 1 Truss Example 1 - Truss (TFS) 07/15/16	
Trues 1	1
Trues 2	

Enter the following data on the Structure Typical Section to locate the truss and stringers with respect to the left edge of the deck.

A Structure Typical Section	
Left edge of deck to first main member	
Deck (Cont'd) Parapet Median Railing Generic Sidewalk Lane Position Striped Lanes	Wearing Surface
Superstructure definition reference line is within the bridge deck.	
Distance from left edge of deck to superstructure definition reference line = Start End 16.50 ft 16.50 ft	
Distance from right edge of deck to superstructure definition reference line = 16.50 ft 16.50 ft	
Left edge of deck to first main member = -1.00 ft -1.00 ft	
Left edge of deck to first stringer = 1.50 ft 1.50 ft	Enter a negative distance to
	indicate that the truss is to the left of
	the edge of deck.

Enter the remaining structure typical section data as shown below:

A Structure Typical Section
Distance from left edge of deck to superstructure definition ref. line Superstructure definition ref. line Left edge of deck to first stringer Superstructure Definition Reference Line Deck Deck (Cont'd) Parapet Median Railing Generic Sidewalk Lane Position Striped Lanes Wearing Surface Deck Control Deck concrete: Class A (US) Total deck thickness: 10.0000 in Deck crack control parameter: kip/in Sustained modular ratio factor:
OK Apply Cancel

🗛 s	Structure Typical Section							×								
				Ba	ck			Fro	G	ìene	eric Shape					
D)eck	Deck (Cont'd)	Pa	rapet M	edia	n Railing	(Generic	Sidev	valk	Lane Position	Striped Lanes	Wearing S	urface		
		Name		Load Ca	se	Measure	То	Edge Dist. M Fr	of Dec easure rom	k ed	Distance At Start (ft)	Distance At End (ft)	Front Face Orientation			
	Curb		-	DC2	•	Back	•	Left Ed	ge	•	0.00	0.00	Right 💌]		
	Curb		•	DC2	•	Back	•	Right Ed	dge	•	0.00	0.00	Left 💌]		
												New	Dup K	licate Apply	Delete	el

🕰 Structure Typ	vical Section			- • •
Deck Deck	(A) Travelway 1 (Cont'd) Parapet Median F	Alling Generic Sidewalk	efinition Reference Line	Vearing 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	-15.75	15.75	-15.75	15.75
LRFD Fatig Lanes ava	ue ailable to trucks: Truck fraction:	Compute	New OK	Duplicate Delete

The Structure Typical Section now appears as follows:



Open the Floorbeam Member Locations window and use the 'Floorbeam LocationWizard' button to specify where the floorbeams are located.

Floorbeam M	lember Location	ns			
Floorbeam Name	Reference Distance (ft)	Offset (ft)	Location (ft)	Skew (Degrees)	
Floorbeam Location Wizard				New	Duplicate Delete
				OK	Apply Cancel

Floorbeam Location Wizard							
F	^p refix for system to	use when na	aming generated	floorbeams : Fl	loorbeam		
			Floorbeam S	pacing			
	Start Distance (ft)	Number of Spaces	Spacing (ft)	End Distance (ft)			
	0.00	1	0.00	0.00			
	0.00	6	18.33	110.00			
				New	Duplicate Delete		
					OK Cancel		

The following floorbeam member locations are created using the wizard.

Floorbeam Name	Reference Distance (ft)	Offset (ft)	Location (ft)	Skew (Degrees)	
Floorbeam1	0.00	0.00	0.00	0.0000	
Floorbeam2	0.00	18.33	18.33	0.0000	
Floorbeam3	18.33	18.33	36.67	0.0000	
Floorbeam4	36.67	18.33	55.00	0.0000	
Floorbeam5	55.00	18.33	73.33	0.0000	
Floorbeam6	73.33	18.33	91.67	0.0000	
Floorbeam7	91.67	18.33	110.00	0.0000	
Floorbeam Location Wizard]			New	Duplicate Delete

Enter the following data to describe the Stringer Group Definition. A stringer group definition contains data regarding a portion of the structure where the stringers are structurally continuous. The stringers in this structure all have the same span data. They are simple spans and are supported by 2 floorbeams. You can create one stringer group definition to contain this geometry data and then later apply this stringer group definition to all 6 stringer units in your structure.

🕰 Stringer Group Definition Geometry		• 💌
Name: Stringer Unit	Description:	
Stringer Span Lengths Diaphragms Number of floorbeams that support this stringer gr All floorbeams are perpendicular to the structure of Floorbeam Spacings Select the floorbeam spacings which can be used to define the stringer span lengths in this stringer group definition: Possible Floorbeam Spacing (ft)	Description: 2	
		Cancel

Describing a Floorbeam Definition:

Create a new floorbeam definition and describe it as follows. This floorbeam definition will be used for all of the floorbeams in the structure.

New Floorbeam Definition	X
Material Type:	Girder Type:
Steel	Built-up Detailed Steel Truss Plate Rolled
	OK Cancel

Floorbeam Definition		
Name: Floorbeam Def		
Description Specs Factors En	gine Control Options	
Description:		Material Type: Steel Floorbeam Type: Rolled Default Units: U.S. Customaru
Floorbeam property input method Schedule-based Cross-section based	Additional self load =	kin/ft
Default rating method: LFD	Additional self load =	%
IIIII Main Floorbeam Span		Floorbeam Length Between Main Members Span Length (ft) 1 35.00
		OK Apply Cancel

Describe the floorbeam profile as follows. The floorbeam is non-composite so we do not have to enter any data on the Deck Profile window.

Floorbeam Profile						X
ype: Rolled Shape						
Shape Top Cover	Plate Bottom Cover	Plate				
Shape	Start Distance (ff)	Length (ft) (ft) (ft)	e Material			
W 33x221	▼ 0.00	35.00 35.00) Grade 36 🛛 🔻			
						_
			New	Duplicate	Delete	
			ОК	Apply	Cance	el

Describing a Stringer Definition:

Create a new stringer definition and describe it as follows.

New Stringer Definition	•
Material Type:	Girder Type:
Steel	Built-up Plate Rolled
	OK Cancel

A Stringer Definition		
Name: Interior Stringer		
Description Specs Factors Engir	ne Control Options	
Description:		A Material Type: Steel
		Stringer Type: Rolled
		▼ Default Units: US Customary ▼
Stringer property input method Schedule-based	Self Load	
Cross-section based	Additional self load =	kip/ft
	Additional self load =	%
Stringer Span Lengths		
 Associate with stringer group of 	definition: Stringer Unit	•
 Enter stringer span lengths 	Stringer Span Length	hs Default rating method:
Number of spans: 1	Span Length Cantilever	r LFD 🔻
	(ft) Span	End Bearing Locations
	1 18.33	Left: in
$\widehat{\varphi}$		Right: in
Save time – associate the		
stringer span lengths with the		
stringer group definition!		
		OK Apply Cancel

Describe the stringer profile as follows. The stringer is non-composite so we do not have to enter any data on the Deck Profile window.

🕰 Stringe	er Profile							×
Type: R	olled Shape							
Shape	Top Cover Plate	Bottom Cove	r Plate					
	Shape	Start Distance (ft)	Length (ft)	End Distance (ft)	Material			
W 21	x57	• 0.00	18.33	18.33	Grade 36	-		
1					New	Duplicate	Delete	
					ОК	Apply	Cance	el

Create a stringer definition to be used for the exterior stringers in the same manner.

Name: Exterior	Stringer	na Cantral Ontiona			
Description:	pecs raciois Engli		≜ N ÷	Material Type: Stringer Type: Default Units:	Steel Rolled
Stringer pro	perty input method nedule-based	Self Load			
🔘 Cro	ss-section based	Additional self load =	kip/ft		
Stringer Sp. Stringer Sp. St	an Lengths ate with stringer group stringer span lengths ber of spans: 1 ociate the	definition: Stringer Unit Stringer Span Length Span Length Cantilever (ft) Span 1 18.33	+s Fr	Del End Bear Left: Right:	fault rating method: _FD ting Locations in in
nger span length nger group defir	is with the				
		-			

Stringer Profile							- 0	×
Type: Rolled Shape								
Shape Top Cover Plate	Bottom Cover	Plate						
Shape	Start Distance (ft)	Length (ft)	End Distance (ft)	Material				
W 16x57	• 0.00	18.33	18.33	Grade 36	-			
1								_
				New		uplicate	Delete	
				ОК		Apply	Cance	el

The Bridge Workspace tree now appears as follows:



Open the 'Truss 1' window and change the name of the truss to 'North Truss'. Enter the text description shown on the next pages.

🗛 Truss			- • •
Name: North Truss	Link with:	None	•
Description Gusset Plates Specs Factors			
Truss "North Truss" Unit Force kips Length ft Properties in DefaultSysUnitType US DefaultStructSteel "Truss Steel" DefaultEndConnection Bolted MaterialType Steel = "Truss Steel" Steel = "Truss Steel" Steel = "Grade 36" MemberCrossSection ChannelBox = Section1 Channels "C 15x55" Outward 13.0 Lacing Top NonDetailed = Section2			
Ln 1		Verifu	
)K Apply	Cancel

The 'Verify' button will read your text description of the truss and verify the syntax of the commands you have input.

The following is a copy of the truss definition described using the BrR Truss Command Language. A description of the command language and its syntax is available by opening the BrR help for the Truss window.

Some of the commands are described in detail below. The name of the command is shown in bold text.

Command	Comments
Truss "North Truss"	
Unit	
Force kips	
Length ft	
Properties in	
DefaultSysUnitType US	
DefaultStructSteel "Truss Steel"	The steel material 'Truss Steel' from the BrR BWS
	will be used as the default steel material if you do
	not enter a steel material in later commands. The
	double quotations around "Truss Steel" indicate that
	Truss Steel is defined in the BrR BWS.
DefaultEndConnection	Used to determine the effective length factor K
Bolted	
MaterialType	Wherever 'Steel' appears in later commands, the
Steel = "Truss Steel"	properties from the 'Truss Steel' in the BWS will be
Steel2 = "Grade 36"	used.
	This command is a shortcut way to specify a steel
	material. This is useful for some of the steel
	materials in the BrR Library whose names are
	lengthy.
MemberCrossSection	
ChannelBox = Section1	
Channels "C 15x55" Outward 13.0	
Lacing Top	
	13



Rolled = Section6	
Beam "W 12x65"	
	25
PanelPoint	
L0 Lower 0.0000.0.0	
L1 Lower 18 3333 0.0	
L2 Lower 36 6667 0.0	
L3 Lower 55 0000 0.0	
14 Lower 73 3333 0.0	
L5 Lower 91 6667 0.0	
L6 Lower 110 0000 0.0	
111 Upper 18 3333 12 0	
U2 Upper 36 6667 13 0	
U3 Upper 55 0000 14 0	
14 Upper 73 3333 13 0	
U5 Upper 91 6667 12.0	
Member	Members are identified by the papel points that they
LOL1 L0 L1 Section1	connect and cross sections are assigned to the
L1L2 L1 L2 Section1	members in this command.
L2L3 L2 L3 Section2	
L3L4 L3 L4 Section2	
L4L5 L4 L5 Section2	
L5L6 L5 L6 Section2	
L0U1 L0 U1 Section4	
U1U2 U1 U2 Section5	
U2U3 U2 U3 Section5	
U3U4 U3 U4 Section5	
U4U5 U4 U5 Section5	
U4U5 U4 U5 Section5 U5L6 U5 L6 Section4	
U4U5U4U5Section5U5L6U5L6Section4L1U1L1U1Section3	
U4U5U4U5Section5U5L6U5L6Section4L1U1L1U1Section3U1L2U1L2Section6	
U4U5U4U5Section5U5L6U5L6Section4L1U1L1U1Section3U1L2U1L2Section6L2U2L2U2Section3	
U4U5U4U5Section5U5L6U5L6Section4L1U1L1U1Section3U1L2U1L2Section6L2U2L2U2Section3L2U3L2U3Section6	

U3L4 U3 L4 Section6	
L4U4 L4 U4 Section3	
L4U5 L4 U5 Section6	
L5U5 L5 U5 Section3	
Support	
L0 Pinned	
L6 Roller	
LLDistribution	Lane distribution factors
OneLane 0.805 0.5	
MultiLane 1.27 1.0	

A schematic of the truss is available by selecting the 'View schematic' toolbar button when the truss is highlighted in the Bridge Workspace tree.



We can now finish describing the floor system (floorbeams and stringers) for this structure. If the floorbeams and stringers are described, BrR will be able to compute the dead load of the floor system and apply it to the truss during the truss analysis.

When we first open this Floor System Geometry window, we know the total number of stringer members in this structure is 42 since there are 6 stringer units and each unit contains 7 stringers. We don't know where the stringer members are located along the length of the structure nor do we know how long each stringer is. The stringer members in the structure are all located at the beginning of the structure and do not have any length to them until a stringer group definition is assigned to the stringer units. The stringer group definition defines the stringer span lengths. Assigning stringer group definitions to the stringer units also locates the stringer members along the length of the structure. Click F1 while this window is open to view examples illustrating how to assign stringer group definitions to stringer units.

A Floor System Geometry Include floorbeams in unit references Distance to Stringer Unit Referenced from Stringer Group Stringer Group Include in Unit Left End of Superstructure Definition Mirror Group Definition Definition Analysis Number or End of Previous Unit Workpoint (ft) Stringer Unit Left end of structure 0.00 None Unit 1 Ŧ Ŧ Stringer Unit End of Previous Unit 0.00 None Unit 2 Ŧ Ŧ Unit 3 Stringer Unit End of Previous Unit 0.00 None Ŧ Ŧ Stringer Unit End of Previous Unit 0.00 None Unit 4 Ŧ Stringer Unit Unit 5 End of Previous Unit Ŧ 0.00 None Ŧ Unit 6 Stringer Unit End of Previous Unit Ŧ 0.00 None Ŧ 0K Apply. Cancel

Click on STRINGER UNIT LAYOUT then click on the following button



Use the Stringer Member Alternative wizard to create Stringer Member Alternatives.

Strin	ger Unit I	Layout Wizard				×
v	Velcom	e to the Stri	nger Unit Lay	out Wizard		
Т	his wizard	helps you create	e Stringer Membe	Alternatives quickly using Stringer	Group Definition Templates.	
S	tringer Gro Stringer I	oup Definition Te Members. These	mplates let you a templates can b	sign Stringer Definitions and Stringe stored and re-used.	er Live Load Distribution factors	ł
s	elect the	Stringer Group D	efinition to which	his template applies: Stringer Unit	•	
			Enter a name	or the new template: Template		
T	his Stringe tringer Un	er Group Definition it locations in the	on has been appli Floor System Ge	d to the following metry window:		
			,			
	Stringer Unit	Stringer Group Definition	Mirrored Status	Â		
	Unit 1	Stringer Unit	None			
	Unit 2	Stringer Unit	None	E		
	Unit 3	Stringer Unit	None			
	Unit 4	Stringer Unit	None			
	Unit 5	Stringer Unit	None			
	Unit 6	Stringer Unit	None	*		
			< Back	Next >	Cancel He	lp

Stringer Unit Layout Wizard

Stringer Definitions

This screen allows you to create Stringer Member Alternatives and assign Stringer Definitions to these Alternatives for all Stringer Members using the Stringer Group Definition picked on Page 1. After the Stringer Member Alternatives are created at the end of this wizard, you can change the Stringer Definitions assigned to the Stringer Member Alternatives by visiting the individual Stringer Member Alternative windows. Changing Stringer Definitions in the Stringer Member Alternative window will not make corresponding changes in this template.

This wizard will generate names for the Stringer Member Alternatives for you or you can enter them yourself in the table below.

Prefix to use when generating stringer member alternatives' names: Stringer % Alt

Generate Stringer Member Alternative Names

X

Stringer Member*	Existing Stringer Member Alternative Name	Existing Stringer Definition	Current Stringer Member Alternative Name	Current Stringer Definition	^
Stringer 1	Stringer 1 Alt	Exterior Stringer 🔹	Stringer 1 Alt	Exterior Stringer 🔹	Ξ
Stringer 2	Stringer 2 Alt	Interior Stringer 🔹	Stringer 2 Alt	Interior Stringer 🛛 👻	
Stringer 3	Stringer 3 Alt	Interior Stringer 🔹	Stringer 3 Alt	Interior Stringer 🛛 👻	
Stringer 4	Stringer 4 Alt	Interior Stringer 🔹	Stringer 4 Alt	Interior Stringer 🛛 👻	
Stringer 5	Stringer 5 Alt	Interior Stringer 🔹	Stringer 5 Alt	Interior Stringer 🛛 👻	-
Children C	1 - -				

*Stringer members in this table are listed from left to right in the structure typical section.

< Back	Next >	Cance	el	Help

Select each stringer and use the Compute from Typical Section button to compute the stringer live load distribution factors.

tringer Unit Layou	t Wizard				— ×
Live Load Distrib This screen allow generated by this	oution Factors vs you to assign Li s wizard.	ve Load Distribut	tion Factors to the	e Stringer Member	Alternatives that will be
Stringer: Stringer	1	- Ap	ply		
Standard	oution factors to be	e used to comput	e effects of permi	t loads with routin	e traffic
Lanes		Distribution (Whee	Factor els)		Compute from Typical Section
Loaded	Shear	Shear at Supports	Moment	Deflection	
1 Lane	0.909	0.750	0.909	0.222	
Multi-Lane	0.909	0.750	0.909	0.444	
Allow distrib	oution factors to be	e used to comput	e effects of permi Apply	t loads with routin	e traffic
Start Distar (ft)	ice Length (ft)	End Distar (ft)	Distribution	ution Factor anes)	
			1 Lane	Multi-Lane	
			<u> </u>	lew Dup	Dicate Delete

Stringer Unit Layout Wizard	— ×
Completing the Stringer Unit Layout Wizard	
You have successfully completed the Stringer Unit Layout Wizard.	
You have created a Stringer Group Definition Template named: Template	
This template will be applied to the Stringer Members in the following Stringer Units:	
Stringer Stringer Group Unit Definition Mirrored Status	
Unit 1 Stringer Unit None	
Unit 2 Stringer Unit None	
Unit 3 Stringer Unit None	
Unit 4 Stringer Unit None	
Unit 5 Stringer Unit None 👻	
To close this wizard, save this template and create Stringer Member Alternatives with these ter click Finish. To close this wizard and save this template without creating Stringer Member Alternatives with properties, click Finish Later. To close this wizard without saving this template or creating Stringer Member Alternatives, click	nplate properties, these template k Cancel.
< Back Finish Later Finish Cano	cel Help

Now use the Floorbeam Member Alternative Wizard to create floorbeam member alternatives.

Floorbeam Member Alternative Wizard														
	Prefix to use when generating floorbeam member Floorbeam % Alt Generate Floorbeam Member Alt alternatives' names:													
	Floorbeam Name	Location (ft)	Existing Floorbeam Member Alternative	Existing Floorbear Definition	Current Fl Member Al	oorbeam Iternative	Current Floorbeam Definition	Include in Analysis						
	Floorbeam1	0.000000	Floorbeam 1 Alt	Floorbe 👻	Floorbe	eam 1 Alt	Floorbe 💌							
	Floorbeam2	18.333300	Floorbeam 2 Alt	Floorbe 👻	Floorbe	eam 2 Alt	Floorbe 💌							
	Floorbeam3	36.666600	Floorbeam 3 Alt	Floorbe 👻	Floorbe	eam 3 Alt	Floorbe 💌							
	Floorbeam4	54.999900	Floorbeam 4 Alt	Floorbe 👻	Floorbe	eam 4 Alt	Floorbe 👻							
	Floorbeam5	73.333200	Floorbeam 5 Alt	Floorbe 👻	Floorbe	eam 5 Alt	Floorbe 👻							
	Floorbeam6	91.666500	Floorbeam 6 Alt	Floorbe 👻	Floorbe	eam 6 Alt	Floorbe 👻							
	Floorbeam7	109.999800	Floorbeam 7 Alt	Floorbe 👻	Floorbe	am 7 Alt	Floorbe 👻							
								OK	Cancel					

The Framing Plan Schematic now appears as follows:

🕰 Schematics: Framing Plan Vi	ew				
🖻 🕞 Q, 🕁 🖶 🗟	67% -				
Truss Example 1 Truss Example 1 - Truss (TFS) 07/15/16					
		Truss			
		Truss 2			
Unit 1 (Stringer Unit)	Unit 2 (Stringer Unit)	Unit 3 (Stringer Unit)	Unit 4 (Stringer Unit)	Unit 5 (Stringer Unit)	Unit 6 (Stringer Unit)

The Structure Typical Section appears as follows:



Select the HS 20 vehicle for the analysis.

) Design Review 💿 Rating	Rating Method: Member Alternative
nalysis Type:	
Line Girder 🗾 👻	
ane/Impact Loading Type:	
As Requested 🔹	Apply Preference Setting: None
hicles Output Engine Description	
Traffic Direction: Both directions	Refresh Temporary Vehicles Advanced
/ehicle Selection:	Vehicle Summary:
 Standard Alternate Military Loading 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 LRFD Fatigue Truck (SI) LRFD Fatigue Truck (US) NRL SU4 SU5 SU6 SU7 Type 3 Tune 3-3 	 Rating Vehicles Design Load Rating Design Load Rating Design Load Rating Remove from Analysis C E Design Load Rating Fatigue Legal Load Rating Routine Specialized Hauling Permit Load Rating Inventory HS 20-44 Operating HS 20-44 Operating Permit Inventory Permit Inventory Permit Operating

Select the 'North Truss' in the BWS tree and select the 'Analyze' toolbar button to analyze the truss. An analysis progress dialog will appear with messages related to the analysis. After the analysis you can view the output files by selecting the 'View latest analysis output' toolbar button.

Truss Example 1	• ×
Truss Example 1 AASHT0_Truss_LFD AASHT0_Truss_LFD Dead Load FE Model Report Live Load FE Model Report Truss Member Section Property Report Rating Results Report Log File	

The 'Live Load Analysis Detail' and 'Live Load Analysis Summary' files contain data related to the live loading of the truss influence lines. The 'FE Model for DeadLoad Analysis' report contains the truss finite element model and dead load analysis. The 'Section Property Report' contains data related to the computed and user input truss member section properties. The 'Rating Results' file contains the rating results for the truss. The 'Log file' is the analysis log produced when the analysis is run. This file may contain errors and warnings that should be reviewed.

A portion of the Rating Results output report is shown below.



Overall Load Factor Rating Summary

Live Load	Live Load Type	Inv Element	Inv RF	Inv Capacity (Ton)	Opr Element	Opr RF	Opr Capacity (Ton)	Legal Opr Element	Legal Opr RF	Legal Opr Capacity (Ton)	Permit Inv Element	Permit Inv RF	Permit Inv Capacity (Ton)	Permit Opr Element	Permit Opr RF	Permit Opr Capacity (Ton)	Impact	Lane
HS 20-44 - Lane	Design Lane	U1L2	2.209	79.53	U1L2	3.689	132.81										As Requested	As Requested
HS 20-44 - Lane	Design Lane	U1L2	2.209	79.53	U1L2	3.689	132.81										With Impact	Multi-Lane
HS 20-44 - Truck	Design Truck	U1L2	1.888	67.96	U1L2	3.153	113.50										As Requested	As Requested
HS 20-44 - Truck	Design Truck	U1L2	1.888	67.96	U1L2	3.153	113.50										With Impact	Multi-Lane

Live Load: HS 20-44 - Lane (Design Lane)

Detailed Truss Member Rating Results

	LL Scale Fa	actor = 1.00																
	Adjacent V	ehicle LL Fact	or = 0.00)														
	Inventory:																	
	A1 = 1.30,	A2 = 2.17																
	Operating:																	
	A1 = 1.30,	A2 = 1.30																
l	Note: Ratin	g factor is out	outted as	99.00 wh	en it i	is greate	r than	99										
		-	DL	1	LL F	orce		Cap	acity	Adj Veh	Demand	One	Multi	-		Opr Legal Permit Permi		
	Member	Truss	Force	Comp		Tone		Comp	Tone	Comp	Tone	Lane	Lane	Inv	Opr	Onr	Inv	Onr
		Element	(kip)	(kin)	IF	(kin)	IF	(kin)	(kin)	(kin)	(kin)	LLDF	LLDF	RF	RF	RF	RF	RF
I			· • /	((mp)		((((111)							
	L0L1	Lower-Chord	208.24			67.73	1.21		969.60				1.270	3.086	5.153			
	L1L2	Lower-Chord	208.24			67.73	1.21		969.60				1.270	3.086	5.153			
	L2L3	Lower-Chord	323.55			104.50	1.21		1335.00				1.270	2.617	4.370			
l	L3L4	Lower-Chord	323.55			104.50	1.21		1335.00				1.270	2.617	4.370			
	L4L5	Lower-Chord	209.45			67.73	1.21		1335.00				1.270	4.692	7.836			
	L5L6	Lower-Chord	209.45			67.73	1.21		1335.00				1.270	4.692	7.836			
l	U1U2	Upper-Chord	309.41	-100.18	1 21			1155 29					1 270	2 248	3 754			

Truss Line Superstructures

The Bridge Workspace tree for a truss-floorbeam-stringer line superstructure definition is shown below.



In a truss line superstructure definition, the relationship between the truss and floor system is not defined. Therefore, you must enter the floor system dead loads that act on the truss yourself. These loads are computed as follows:

Deck Dead Load on Truss

Deck DL = 10"/12 * 33.0' * 0.150pcf = 4.125 kip/ft

L0, L6: 18.33'/2 * 4.125 k/ft / 2 trusses = 18.90 kips L1, L2, L3, L4, L5: 18.33' * 4.125 k/ft / 2 trusses = 37.81 kips

Curb Dead Load on Truss

Curb DL = 85 lb/ft

L0, L6: 18.33[']/2 * 0.085 k/ft * 2 curbs / 2 trusses = 0.78 kips L1, L2, L3, L4, L5: 18.33['] * 0.085 k/ft * 2 curbs / 2 trusses = 1.56 kips **Floorbeam Dead Load on Truss** Floorbeam DL = 221 lb/ft*35 ft = 7735 lb L0, L1, L2, L3, L4, L5, L6: 7.735 kips / 2 trusses = 3.87 kips

Stringer Dead Load on Truss

Exterior Stringer DL = 57 lb/ftInterior Stringer DL = 57 lb/ft

L0, L6: 7 stringers * 0.057 kip/ft * 18.33'/2 / 2 trusses = 1.83 kips L1, L2, L3, L4, L5: 7 stringers * 0.057 kip/ft * 18.33' / 2 trusses = 3.66 kips

The truss command language description for the truss line is the same as the description for the truss system with the addition of a command to describe the user computed floor system dead loads. The following is the PanelPointLoad command used to describe the floor system dead load acting on the truss. This command comes after the Support command.

PanelPointLoad L0 DC 0.0 -25.38 L1 DC 0.0 -46.90 L2 DC 0.0 -46.90 L3 DC 0.0 -46.90 L4 DC 0.0 -46.90 L5 DC 0.0 -46.90 L6 DC 0.0 -25.38