

# Applying parametric variation for deck width and girder spacing to bridge object with skewed abutments

Program: CSiBridge  
Version: 18.0.1 Build 1206  
Date: 11/25/2015  
Author: ok

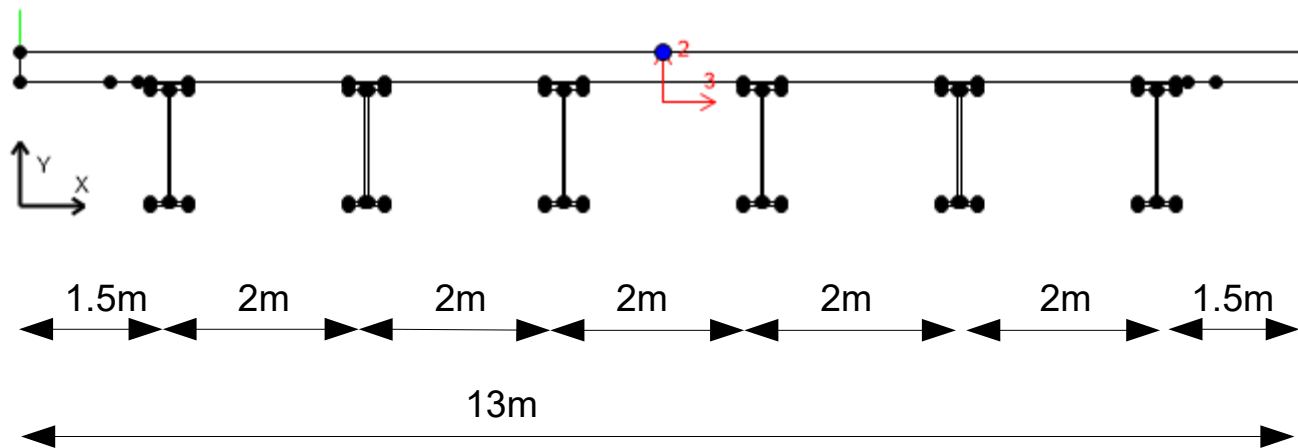
Model ID: 581.1  
Model version: run1

# Purpose

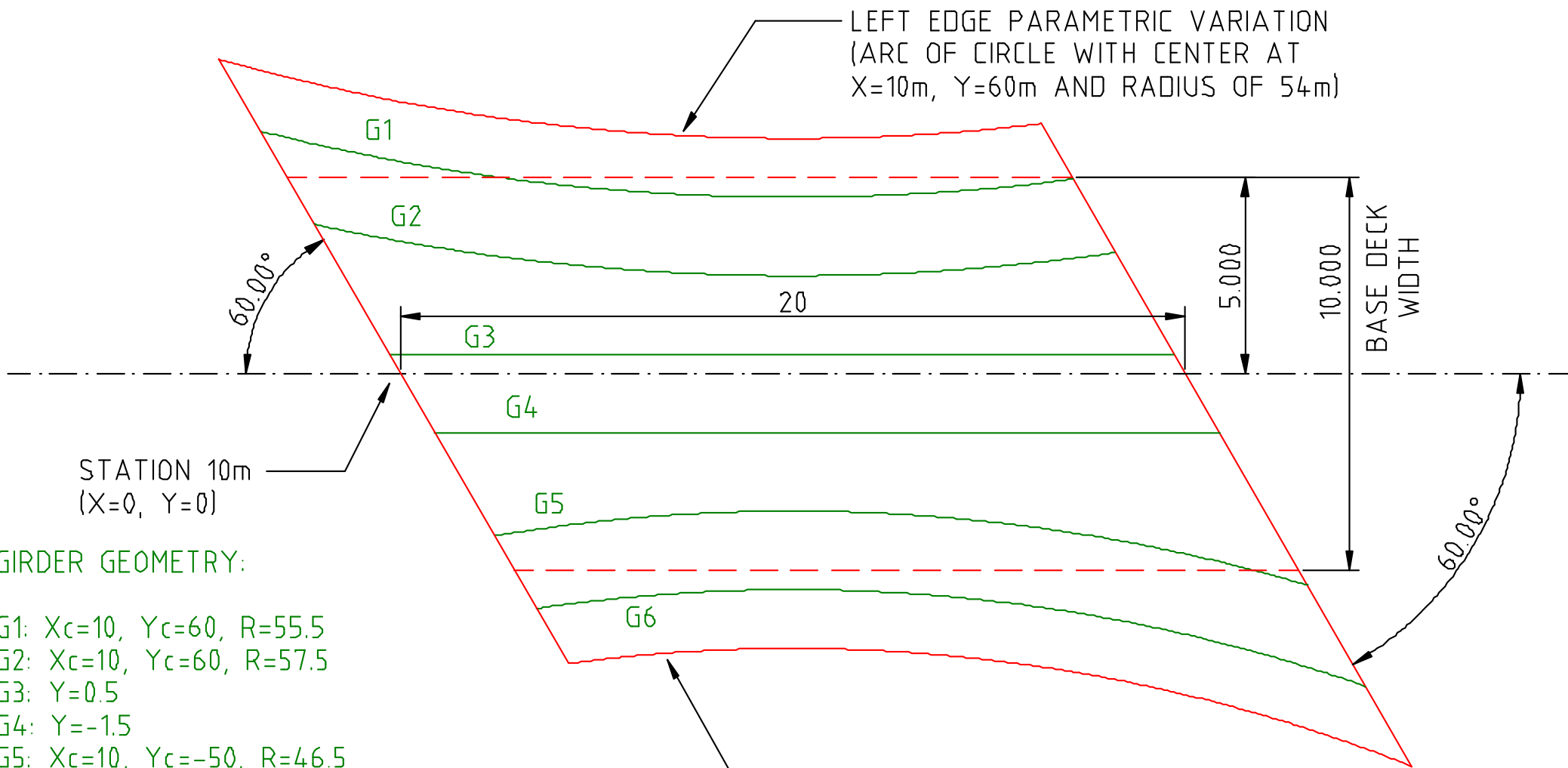
- Develop CSiBridge model that will illustrate how to apply parameteric variation to deck width and girder spacing to bridge object with skewed abutments

# Model Description

- The model geometry was created in CAD (see the next page) the goal is to replicate it exactly in CSiBridge.



Base Deck Dimensions (Before Applying the Parametric Variation)



LEFT EDGE PARAMETRIC VARIATION  
 (ARC OF CIRCLE WITH CENTER AT  
 $X=10\text{m}$ ,  $Y=60\text{m}$  AND RADIUS OF  $54\text{m}$ )

STATION  $10\text{m}$   
 $(X=0, Y=0)$

BASE DECK  
 WIDTH  
 $10.000$

GIRDER GEOMETRY:

- G1:  $X_c=10, Y_c=60, R=55.5$
- G2:  $X_c=10, Y_c=60, R=57.5$
- G3:  $Y=0.5$
- G4:  $Y=-1.5$
- G5:  $X_c=10, Y_c=-50, R=46.5$
- G6:  $X_c=10, Y_c=-50, R=44.5$

RIGHT EDGE PARAMETRIC VARIATION  
 (ARC OF CIRCLE WITH CENTER AT  
 $X=10\text{m}$ ,  $Y=-50\text{m}$  AND RADIUS OF  $43\text{m}$ )

$X_c$  ... ARC X CENTER  
 $Y_c$  ... ARC Y CENTER  
 $R$  ... ARC RADIUS

# Coordinates of various points used to determine the parametric variations

Station	Geometry Control Point	Distances Measured in CAD				Distances Measured in CAD						
		Layout Line to Left Deck Edge a	Layout Line to Right Deck Edge b	Layout Line to G1 c	Layout Line to G6 d	Left Deck Edge - G1 e	G1-G2 f	G2-G3 g	G3-G4 h	G4-G5 i	G5-G6 j	G6 - Right Deck Edge k
5.376	Start of arc	8.019630	-9.565370	6.46301	-7.97371	1.55662	2.07065	3.89236	2.00000	4.36148	2.11223	1.59166
6.000		7.846380	-9.342900	6.29478	-7.75961	1.55159	2.06440	3.73038	2.00000	4.15758	2.10203	1.58328
8.000		7.350210	-8.708350	5.81282	-7.14851	1.53739	2.04671	3.26611	2.00000	3.57506	2.07345	1.55984
10.000		6.934000	-8.178950	5.40833	-6.63815	1.52567	2.03209	2.87624	2.00000	3.08800	2.05015	1.54080
12.000		6.595880	-7.750740	5.07960	-6.22501	1.51628	2.02036	2.55924	2.00000	2.69334	2.03167	1.52573
14.000		6.334370	-7.420660	4.82528	-5.90635	1.50909	2.01138	2.31390	2.00000	2.38872	2.01763	1.51431
16.000		6.148350	-7.186450	4.64433	-5.68014	1.50402	2.00503	2.13930	2.00000	2.17236	2.00778	1.50631
18.000		6.037050	-7.046540	4.53604	-5.54497	1.50100	2.00125	2.03479	2.00000	2.04303	2.00194	1.50157
20.000	Midpoint of arc	6.000000	-7.000000	4.50000	-5.50000	1.50000	2.00000	2.00000	2.00000	2.00000	2.00000	1.50000
22.000		6.037050	-7.046540	4.53604	-5.54497	1.50100	2.00125	2.03479	2.00000	2.04303	2.00194	1.50157
24.000		6.148350	-7.186450	4.64433	-5.68014	1.50402	2.00503	2.13930	2.00000	2.17236	2.00778	1.50631
26.000		6.334370	-7.420660	4.82528	-5.90635	1.50909	2.01138	2.31390	2.00000	2.38872	2.01763	1.51431
28.000		6.595880	-7.750740	5.07960	-6.22501	1.51628	2.02036	2.55924	2.00000	2.69334	2.03167	1.52573
30.000		6.934000	-8.178950	5.40833	-6.63950	1.52567	2.03209	2.87624	2.00000	3.08800	2.05150	1.54080
32.000		7.350210	-8.708350	5.81282	-7.14851	1.53739	2.04671	3.26611	2.00000	3.57506	2.07345	1.55984
34.000		7.846380	-9.342900	6.29478	-7.75961	1.55159	2.06440	3.73038	2.00000	4.15758	2.10203	1.58328
35.772	End of arc	8.354530	-9.996820	6.78812	-8.38865	1.56641	2.08282	4.20529	2.00000	4.75638	2.13227	1.60817

X coordinate	Station	Geometry Control Point	Calculated Parametric Variations									
			Deck width	Offset	LD-G1	G1-G2	G2-G3	G3-G4	G4-G5	G5-G6	G6-RD	
			a - b - 13	(c+d)/2	e - 1.5	f - 2	g - 2	h - 2	i - 2	j - 2	k - 1.5	
-4.630	5.376	Start of arc	4.58500	-0.755350	0.05662	0.07065	1.89236	0.00000	2.36148	0.11223	0.09166	
-4.000	6.000		4.18928	-0.732415	0.05159	0.06440	1.73038	0.00000	2.15758	0.10203	0.08328	
-2.000	8.000		3.05856	-0.667845	0.03739	0.04671	1.26611	0.00000	1.57506	0.07345	0.05984	
0.000	10.000		2.11295	-0.614910	0.02567	0.03209	0.87624	0.00000	1.08800	0.05015	0.04080	
2.000	12.000		1.34662	-0.572705	0.01628	0.02036	0.55924	0.00000	0.69334	0.03167	0.02573	
4.000	14.000		0.75503	-0.540535	0.00909	0.01138	0.31390	0.00000	0.38872	0.01763	0.01431	
6.000	16.000		0.33480	-0.517905	0.00402	0.00503	0.13930	0.00000	0.17236	0.00778	0.00631	
8.000	18.000		0.08359	-0.504465	0.00100	0.00125	0.03479	0.00000	0.04303	0.00194	0.00157	
10.000	20.000	Midpoint of arc	0.00000	-0.500000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
12.000	22.000		0.08359	-0.504465	0.00100	0.00125	0.03479	0.00000	0.04303	0.00194	0.00157	
14.000	24.000		0.33480	-0.517905	0.00402	0.00503	0.13930	0.00000	0.17236	0.00778	0.00631	
16.000	26.000		0.75503	-0.540535	0.00909	0.01138	0.31390	0.00000	0.38872	0.01763	0.01431	
18.000	28.000		1.34662	-0.572705	0.01628	0.02036	0.55924	0.00000	0.69334	0.03167	0.02573	
20.000	30.000		2.11295	-0.615585	0.02567	0.03209	0.87624	0.00000	1.08800	0.05150	0.04080	
22.000	32.000		3.05856	-0.667845	0.03739	0.04671	1.26611	0.00000	1.57506	0.07345	0.05984	
24.000	34.000		4.18928	-0.732415	0.05159	0.06440	1.73038	0.00000	2.15758	0.10203	0.08328	
25.772	35.772	End of arc	5.35135	-0.800265	0.06641	0.08282	2.20529	0.00000	2.75638	0.13227	0.10817	

# Modeling Details



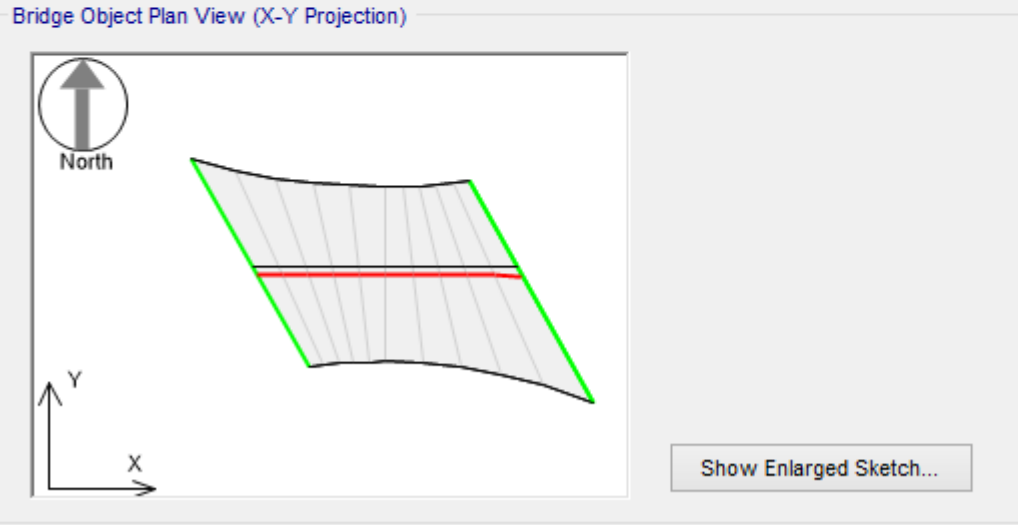
## Bridge Object Data

<b>Bridge Object Name</b> <input type="text" value="BOBJ1"/>	<b>Layout Line Name</b> <input type="text" value="BLL1"/>	<b>Coordinate System</b> <input type="text" value="GLOBAL"/>	<b>Units</b> <input type="text" value="KN, m, C"/>
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**Define Bridge Spans**

Span Label	Start Station m	Length m	End Station m	Start Support	End Support	
<input type="text" value="Span 1"/>	<input type="text" value="10."/>	<input type="text" value="20."/>	<input type="text" value="30."/>	<input type="text" value="BABT1"/>	<input type="text" value="BABT1"/>	<input checked="" type="radio"/> By Station <input type="radio"/> By Length
Span 1	10.	20.	30.	BABT1	BABT1	

Note: 1. Bridge object location is based on bridge section insertion point following specified layout line.



- Modify/Show Assignments**
- Spans
  - User Discretization Points
  - Abutments
  - Bents
  - In-Span Hinges (Expansion Jts)
  - In-Span Cross Diaphragms
  - Superelevation
  - Prestress Tendons
  - Girder Rebar
  - Staged Construction Groups
  - Point Load Assigns
  - Line Load Assigns
- 

Lock to Prevent Updating the Linked Model

# Variation Definition

Variation Name

Deck Width Linear

Units

KN, m, C

## Variation Definition

Point ID	Segment Type and Point Type Segment Is From Point(n - 1) to Point(n)	Distance m	Dim. Change m	Slope m / m
1		-4.63	7.585	
1	Start of Variation	-4.63	7.585	
2	Linear	-4.	7.1893	
3	Linear	-2.	6.0586	
4	Linear	0.	5.113	
5	Linear	2.	4.3466	
6	Linear	4.	3.755	
7	Linear	6.	3.3348	
8	Linear	8.	3.0836	
9	Linear	10.	3.	

Quick Start...

Insert Above

Insert Below

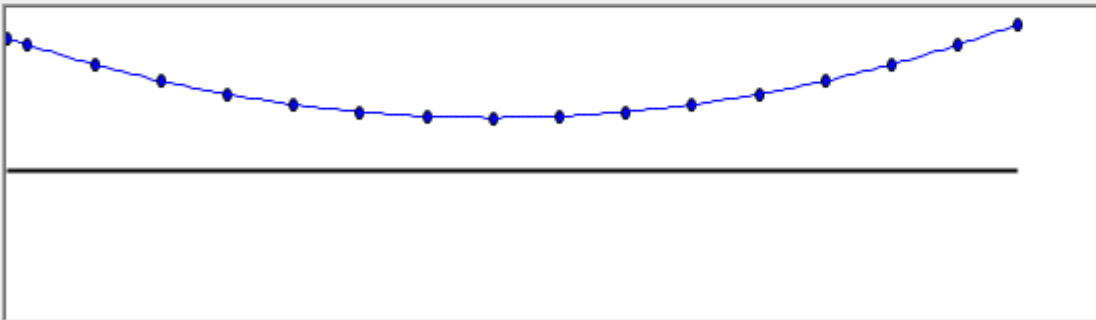
Modify

Delete

Delete All

## Variation Sketch

Use Equal Horizontal And Vertical Scales In Sketch



Distance

Dim. Change

Slope

## Dimension Change Sign

Switch Sign of All Dim. Change

OK

Cancel

# Variation Definition

Variation Name

Offset Linear

Units

KN, m, C

## Variation Definition

Point ID	Segment Type and Point Type Segment Is From Point(n - 1) to Point(n)	Distance m	Dim. Change m	Slope m / m
1		-4.63	-0.7554	
1	Start of Variation	-4.63	-0.7554	
2	Linear	-4.	-0.7324	
3	Linear	-2.	-0.6678	
4	Linear	0.	-0.6149	
5	Linear	2.	-0.5727	
6	Linear	4.	-0.5405	
7	Linear	6.	-0.5179	
8	Linear	8.	-0.5045	
9	Linear	10.	-0.5	

Quick Start...

Insert Above

Insert Below

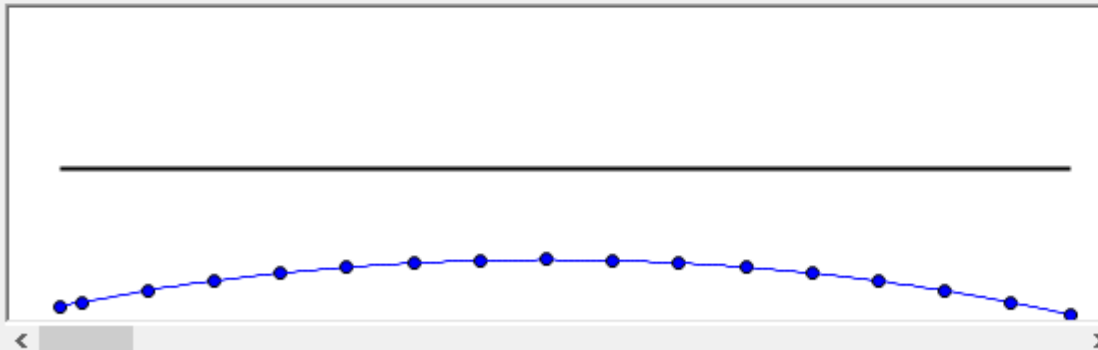
Modify

Delete

Delete All

## Variation Sketch

Use Equal Horizontal And Vertical Scales In Sketch



Distance

Dim. Change

Slope

## Dimension Change Sign

Switch Sign of All Dim. Change

OK

Cancel

### Bridge Section Variation Definition

**Bridge Object Name**

**Span Label**

**Base Bridge Section Property**

**Bridge Section Variation Is Defined By:**

**User Definition**

**Reference to Another Span**

**Display Section**

**User Defined Variation For Steel I Girder**

Distance Measured from Start of Span  Distance Measured from Start Abutment

Parameter	Variation
<b>General Data</b>	
Total Width	Deck Width Linear
<b>Girder Spacing Definition</b>	
Girder Space S1	G1-G2 Linear
Girder Space S2	G2-G3 Linear
Girder Space S3	G3-G4 Linear
Girder Space S4	G4-G5 Linear
Girder Space S5	G5-G6 Linear
<b>Slab Thickness</b>	
Top Slab Thickness (t1)	Constant
Concrete Haunch + Steel Flange Thickness (t2)	Constant
<b>Fillet Horizontal Dimension Data</b>	
f1 Horizontal Dimension	Constant
f2 Horizontal Dimension	Constant
<b>Left Overhang Data</b>	

### Bridge Section Variation Definition

**Bridge Object Name**

**Span Label**

**Base Bridge Section Property**

**Bridge Section Variation Is Defined By:**

**User Definition**

**Reference to Another Span**

**Display Section**

**User Defined Variation For Steel I Girder**

Distance Measured from Start of Span  Distance Measured from Start Abutment

Parameter	Variation
Left Overhang Length (L1)	LD-G1 Linear
Left Overhang Distance to Fillet (L3)	Constant
Left Overhang Outer Thickness (t5)	Constant
<b>Right Overhang Data</b>	
Right Overhang Length (L2)	G6-RD Linear
Right Overhang Distance to Fillet (L4)	Constant
Right Overhang Outer Thickness (t6)	Constant
<b>Live Load Curb Locations</b>	
Distance To Inside Edge of Left Live Load Curb	Constant
Distance To Inside Edge of Right Live Load Curb	Constant
Distance To Centerline of Median Live Load Curb	Constant
Width of Median Live Load Curb	Constant
<b>Insertion Point Location</b>	
Offset X From Reference Point To Insertion Point	Offset Linear
Offset Y From Reference Point To Insertion Point	Constant

# Final Generated Geometry

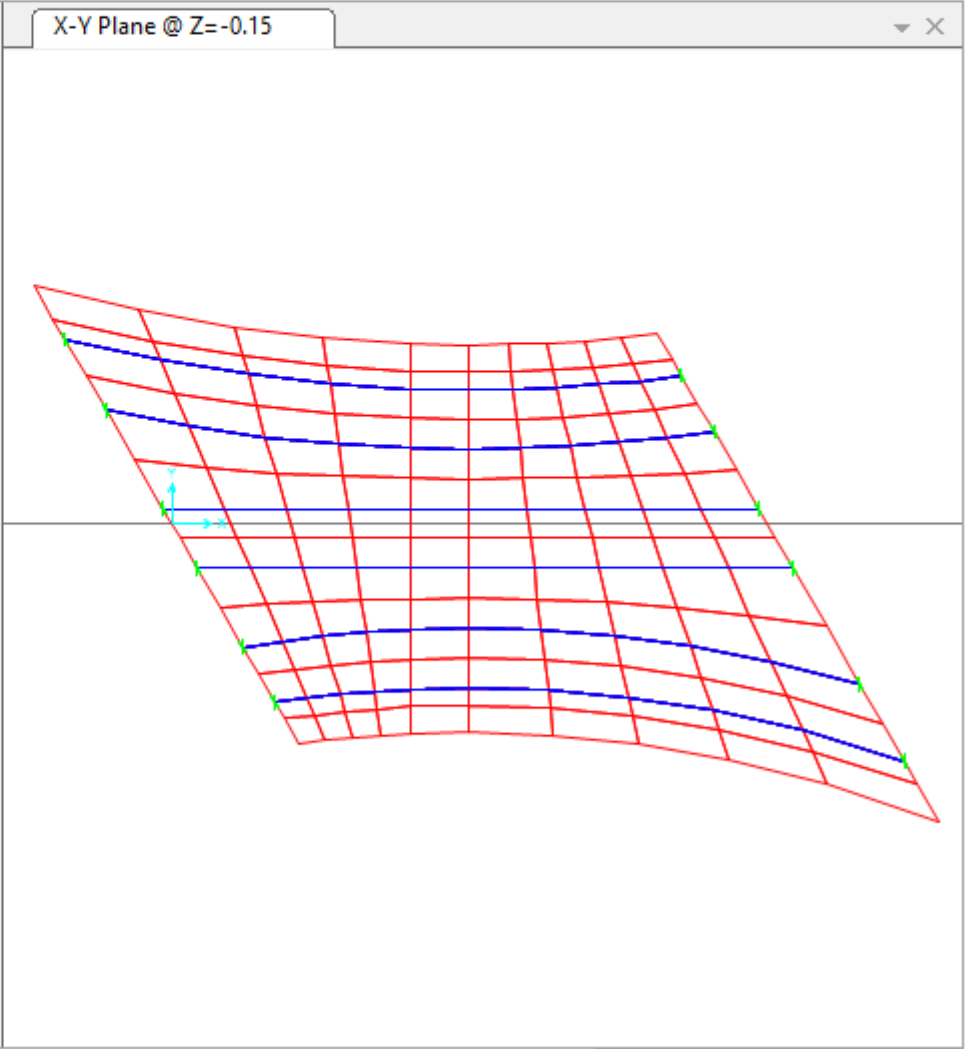
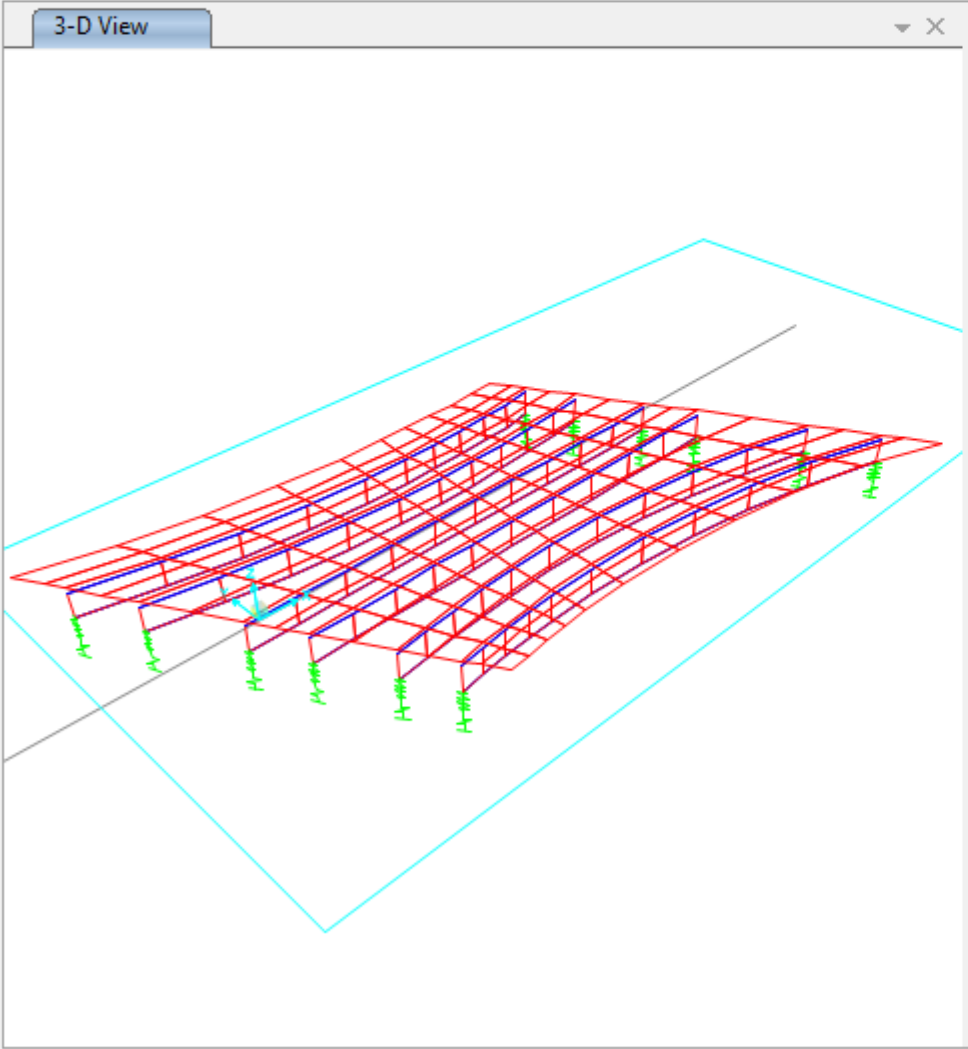
File Home Layout Components Loads Bridge Analysis Design/Rating Advanced

Bridge Wizard Wizard

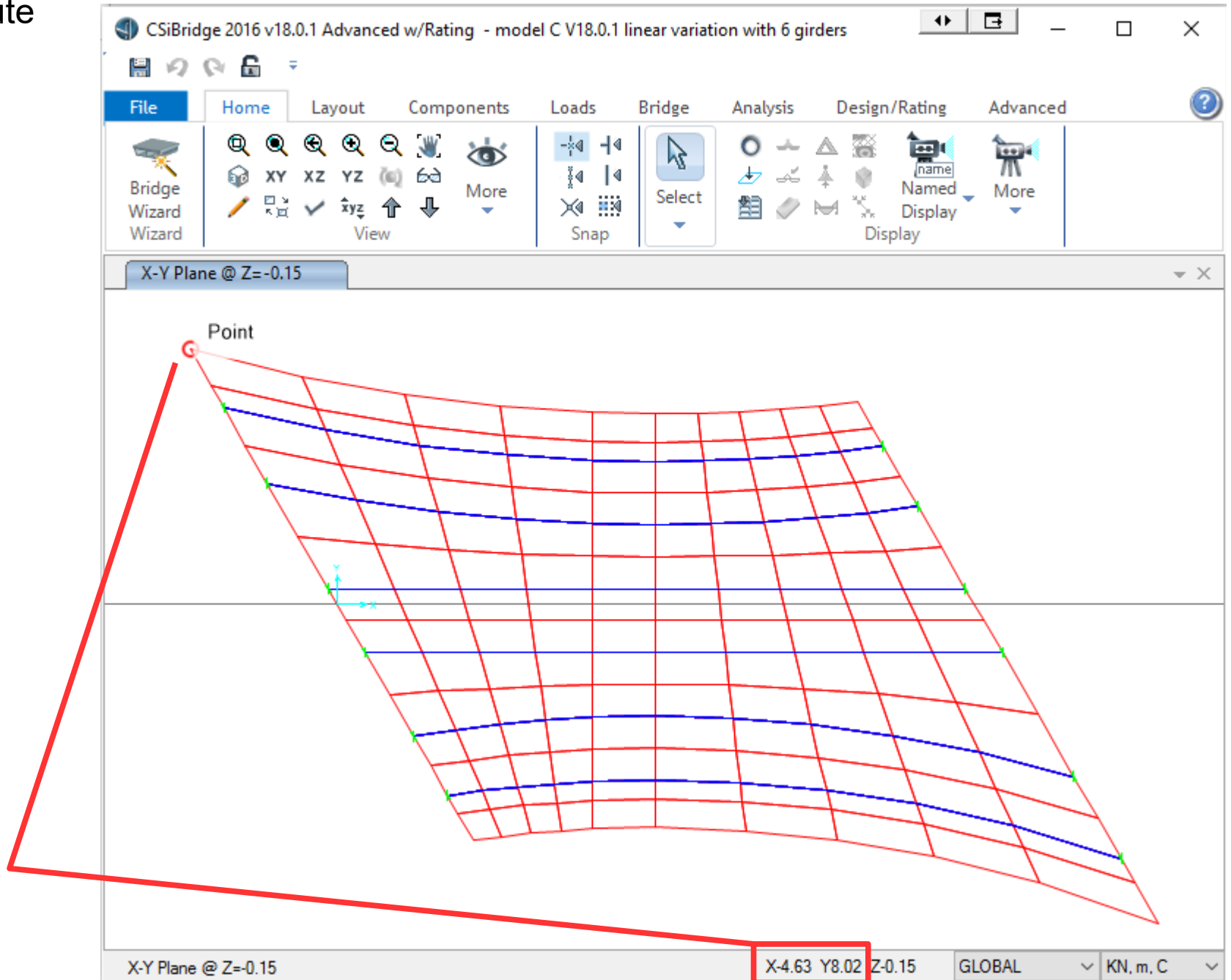
View: XY XZ YZ XYZ ↑ ↓ More

Snap: ALL PS CLR Select Deselect More

Display: Named Display More

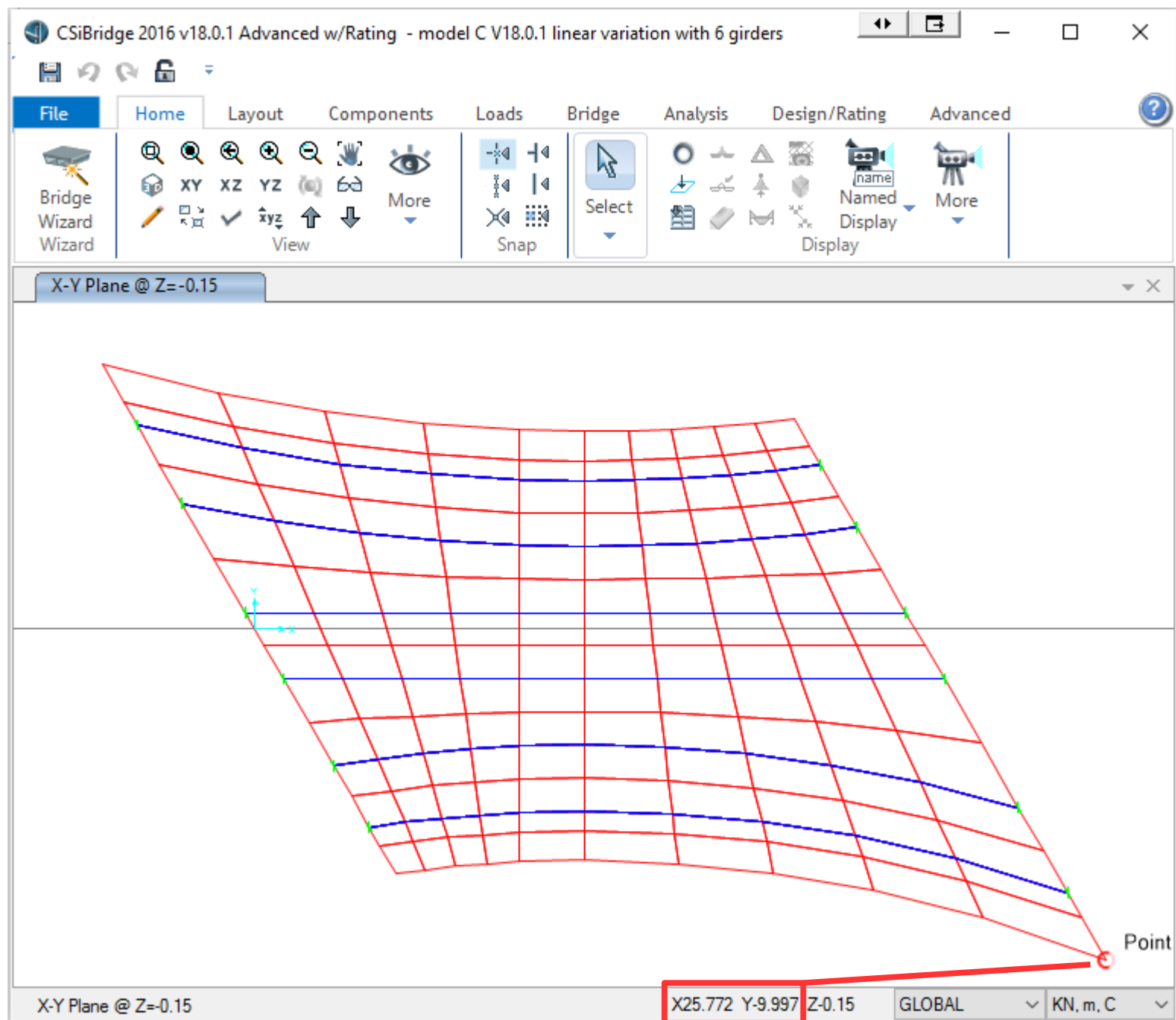


Coordinates of the point in the upper left acute corner exactly match those previously tabulated

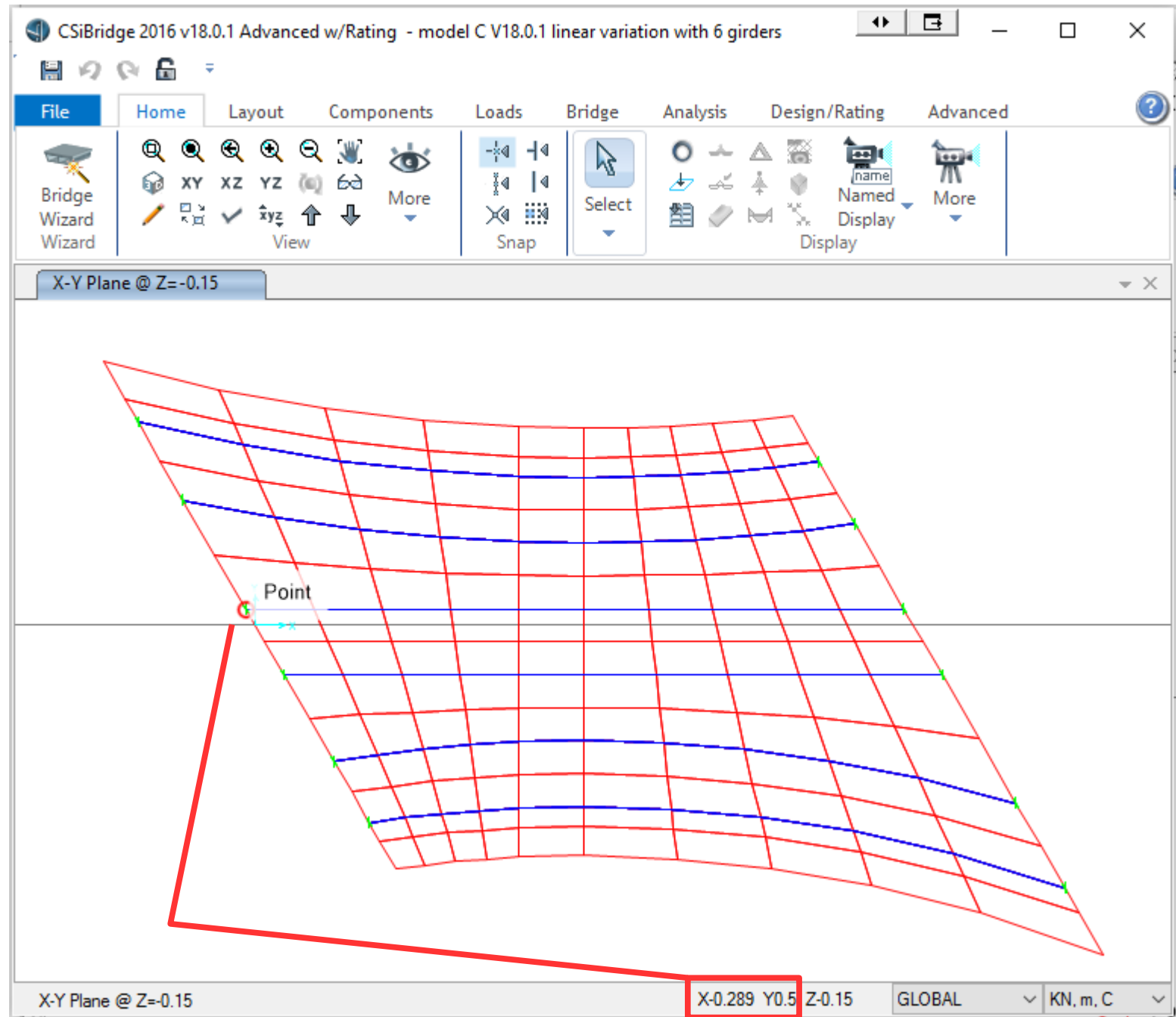




Coordinates of the point in the upper left acute corner exactly match those previously tabulated



Y coordinate is as expected



Y coordinate is as expected

