

TR20425 - Do You Cross the Bridge or Fade Away?

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About Me

- Used AutoCAD® since release 9
- Teaching since 2000
- Writing courseware since 2007
- Books are sold in 67 different countries



Class summary

This class will help you to explore preliminary bridge design options by using Bridge Design for InfraWorks 360 software to visualize realistic civil structures in the context of the surrounding proposed site. Then Structural Bridge Design software is used to analyze the bridge in the cloud. We run a line girder analysis to verify the structural strength of the bridge girders and ensure they meet design standard requirements. Next, we take the design into Navisworks software to uncover design problems and constructability issues more effectively and plan the construction sequencing. The Autodesk InfraWorks 360 model is taken into AutoCAD Civil 3D software for precise grading. Then we round-trip the model back into Autodesk InfraWorks 360 for better design communication. This session features Autodesk InfraWorks 360, AutoCAD Civil 3D, and Navisworks Manage.




Key learning objectives

At the end of this class, you will be able to:

- Create engineered roads of the proposed design.
- Add bridges to design roads using Bridge Design for InfraWorks 360.
- Verify the structural strength of the bridge girders.
- Incorporate design changes from AutoCAD Civil 3D

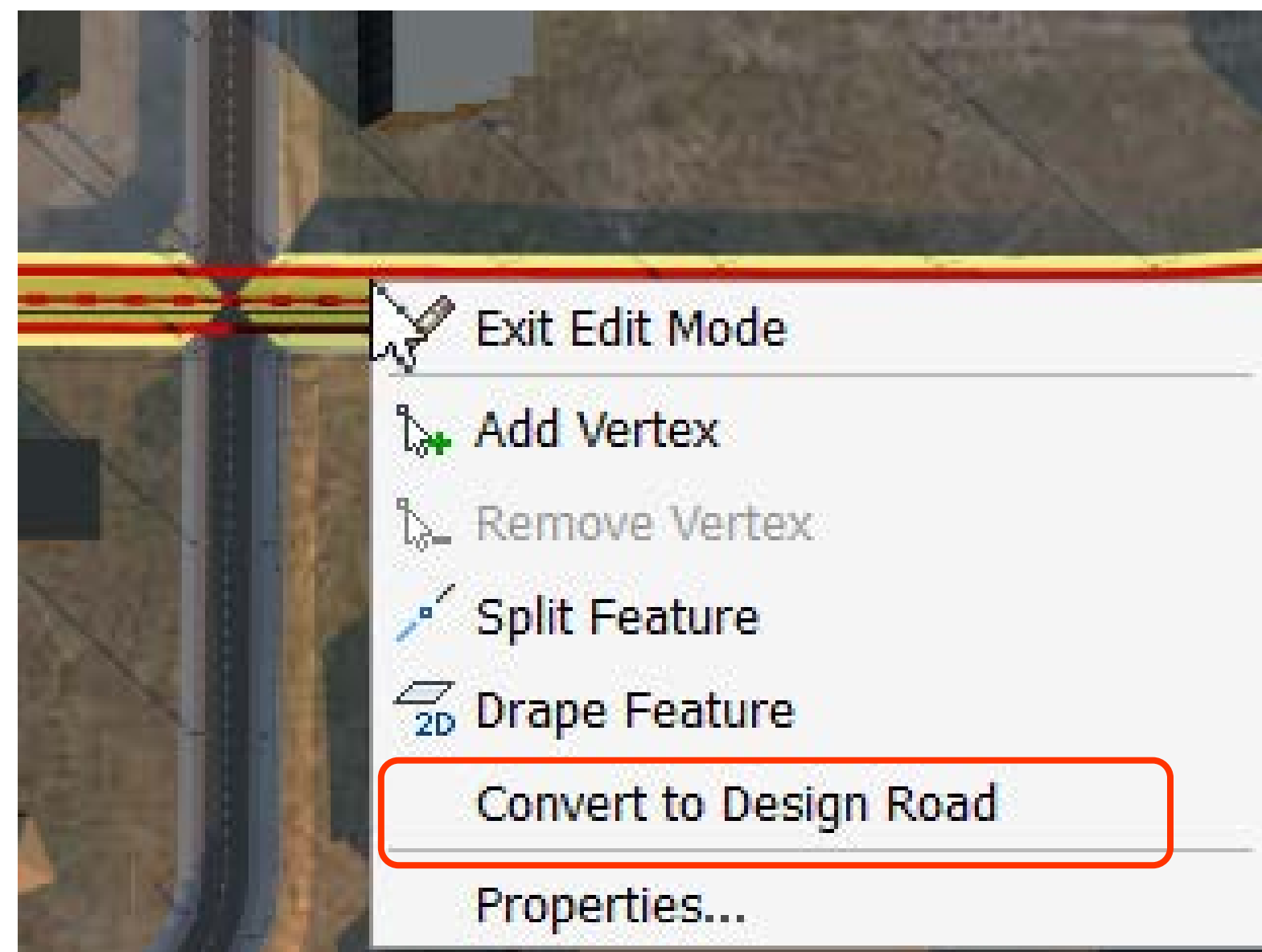
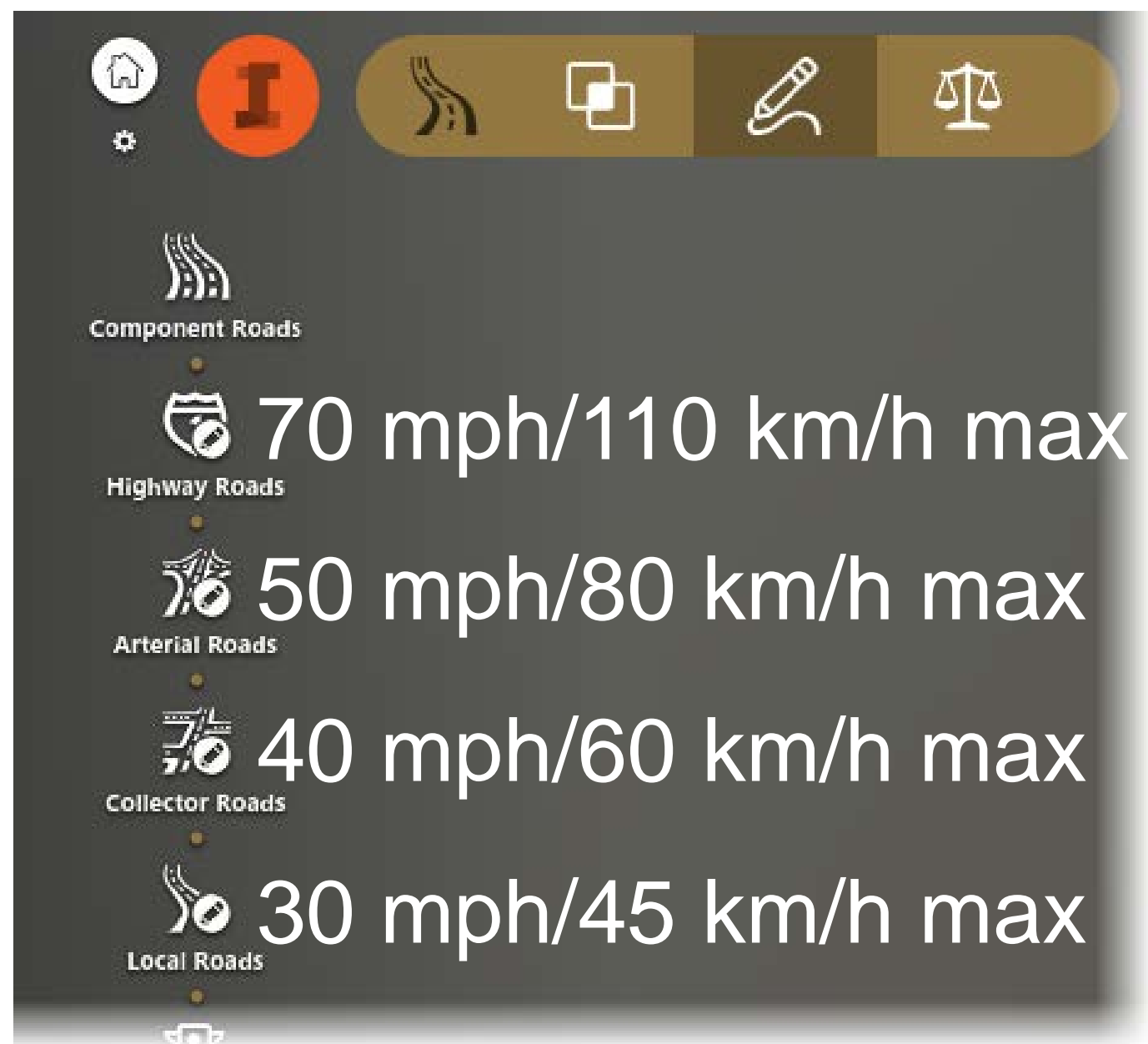


An aerial perspective of a cityscape featuring a multi-lane bridge crossing a wide river. In the background, a large stadium and a dense cluster of skyscrapers are visible under a clear blue sky. The foreground shows landscaped green areas with trees and a small garden bed. The bridge has a rainbow-colored line along its edge, and a red car is visible on it.

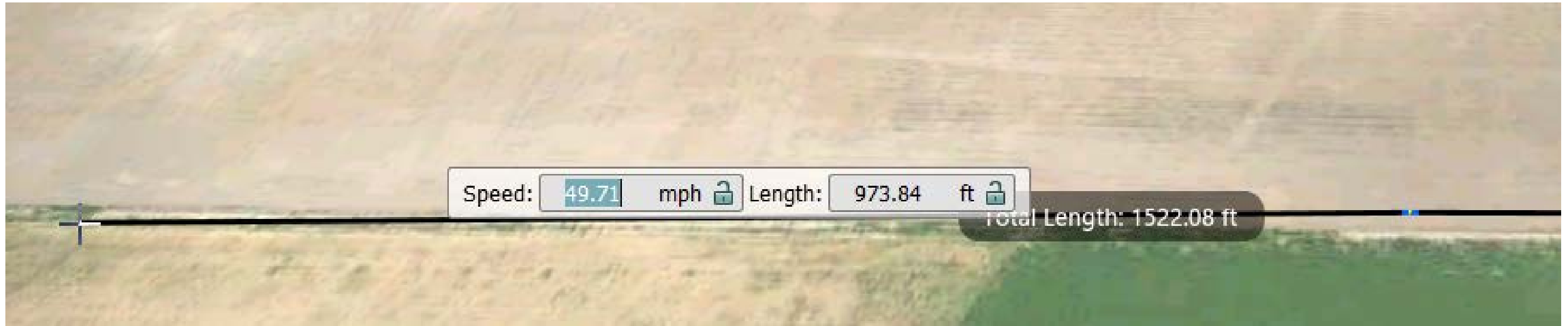
Create Engineered Roads of the Proposed Design

Road Types

In Canvas Tools



Set the design speed and tangent length



Horizontal curves and spirals

Length: 555.34 ft

Spiral

Curve

Tangent

Total Length: 1913.74 ft

Spiral Curve Spiral

Curve Options

- ☐ Curve
- ☒ Spiral Curve Spiral
- Undo
- End Draw

Curve Radius: 231.00 ft

Spiral Length: 110.00 ft

Fly-out Menu

Curve

Curve Options

- ☒ Curve
- ☐ Spiral Curve Spiral
- Undo
- End Draw

Curve Radius: 231.00 ft

Fly-out Menu

See it in Action

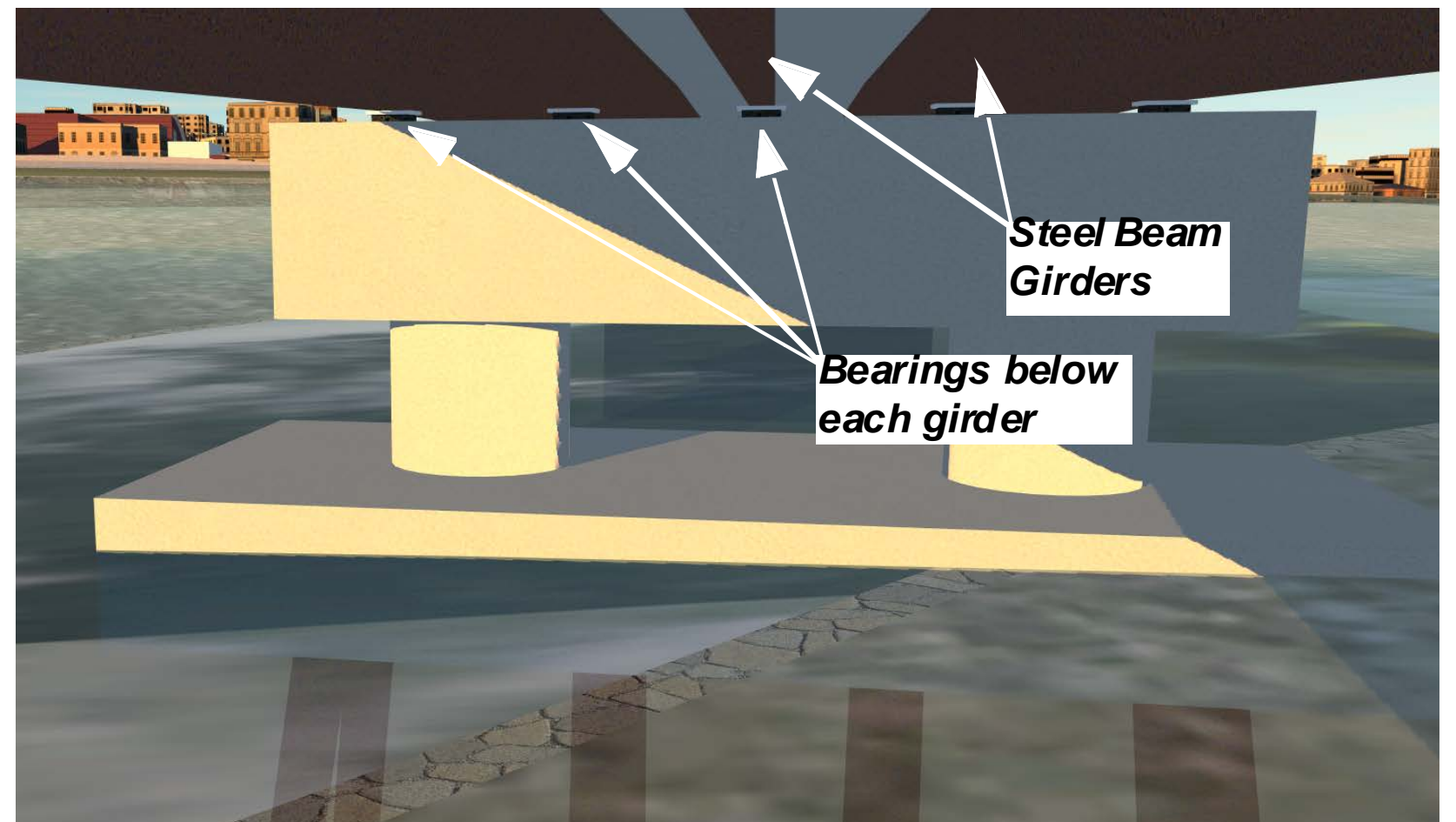
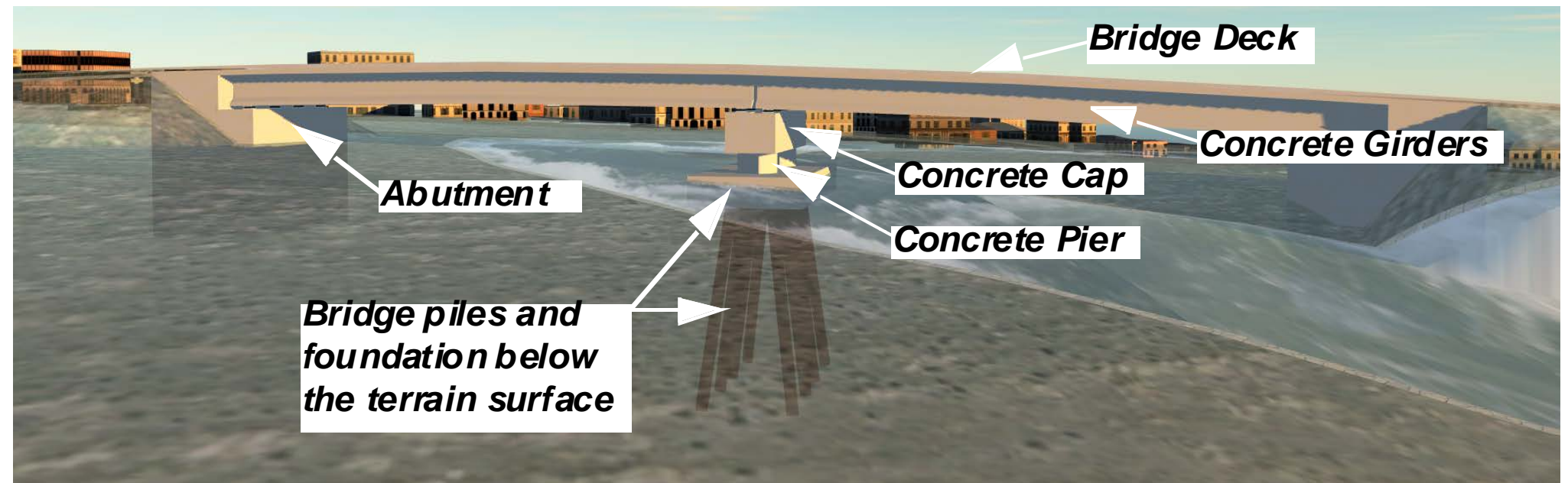


Add Bridges to Design Roads



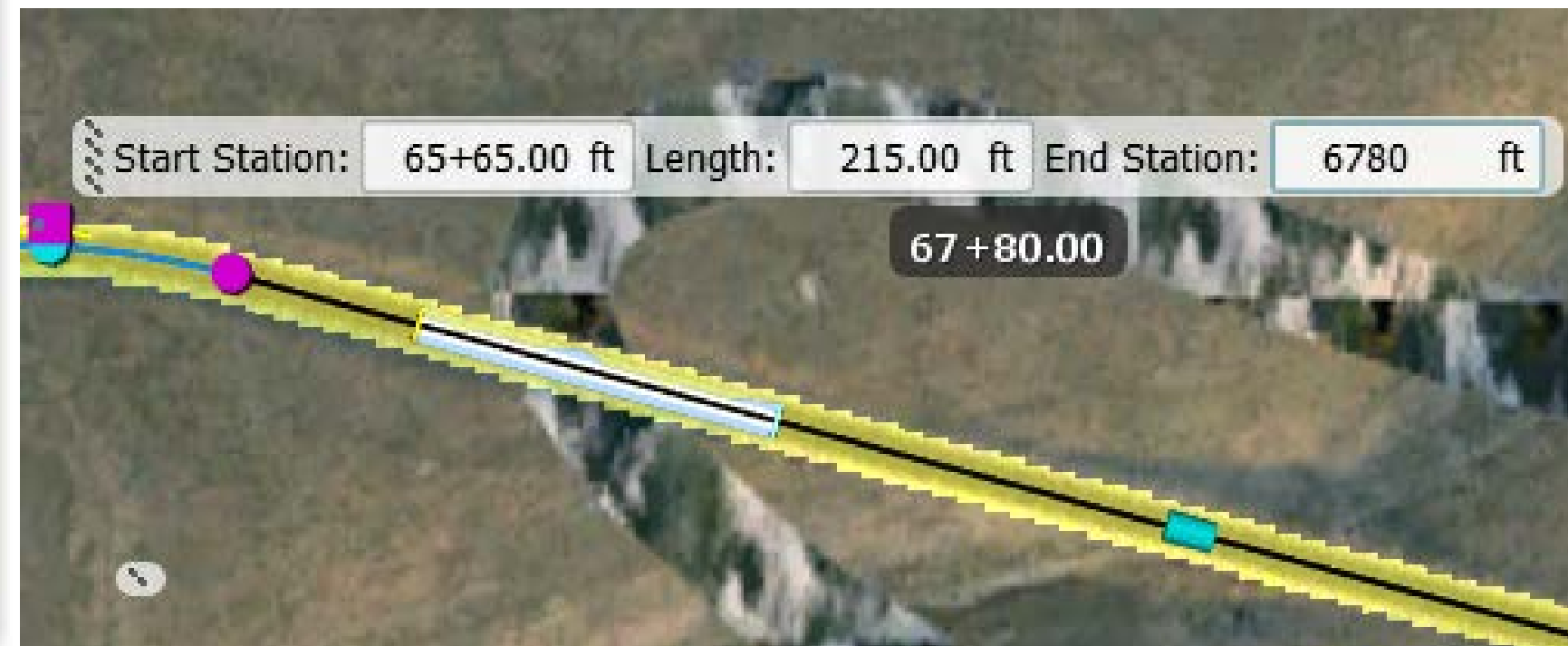
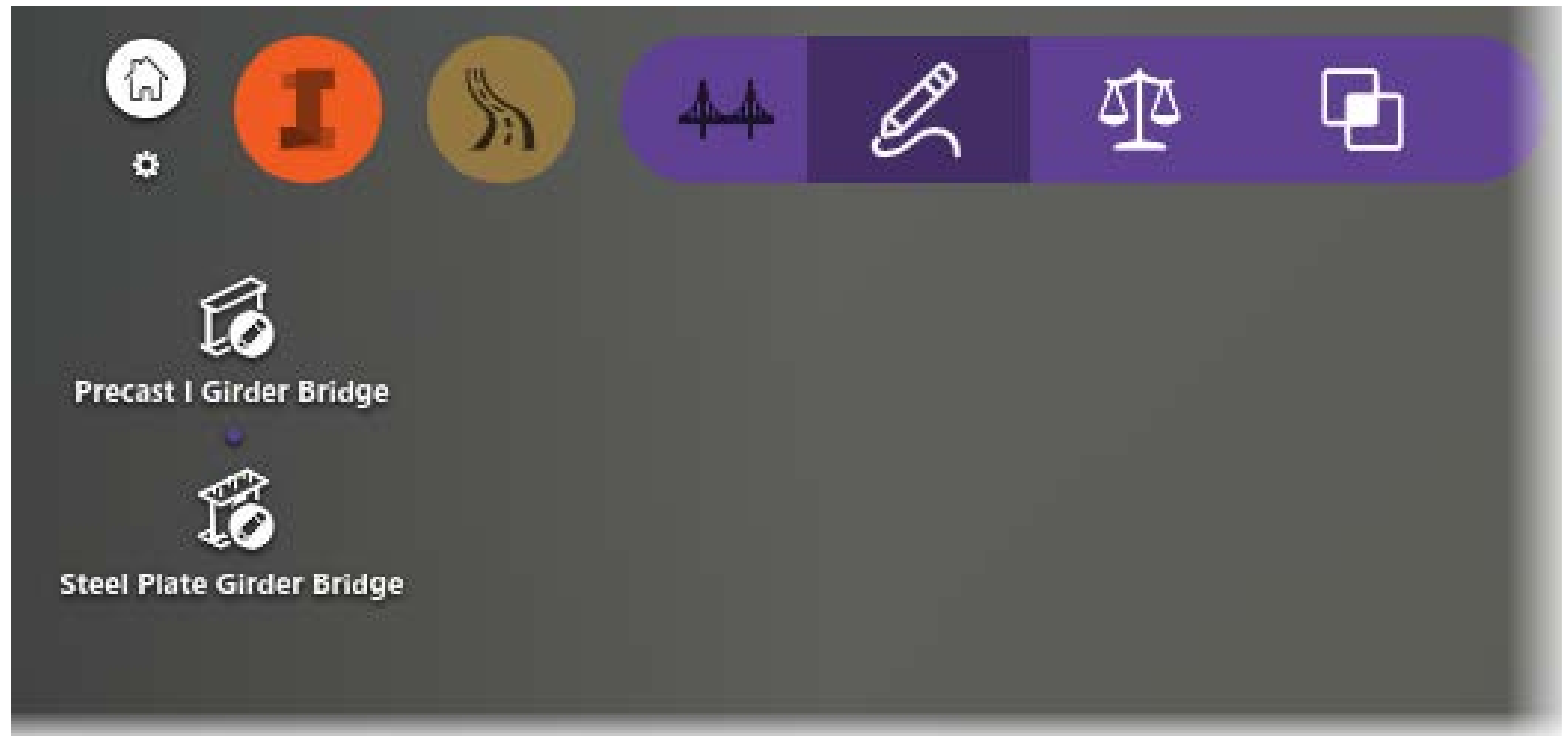
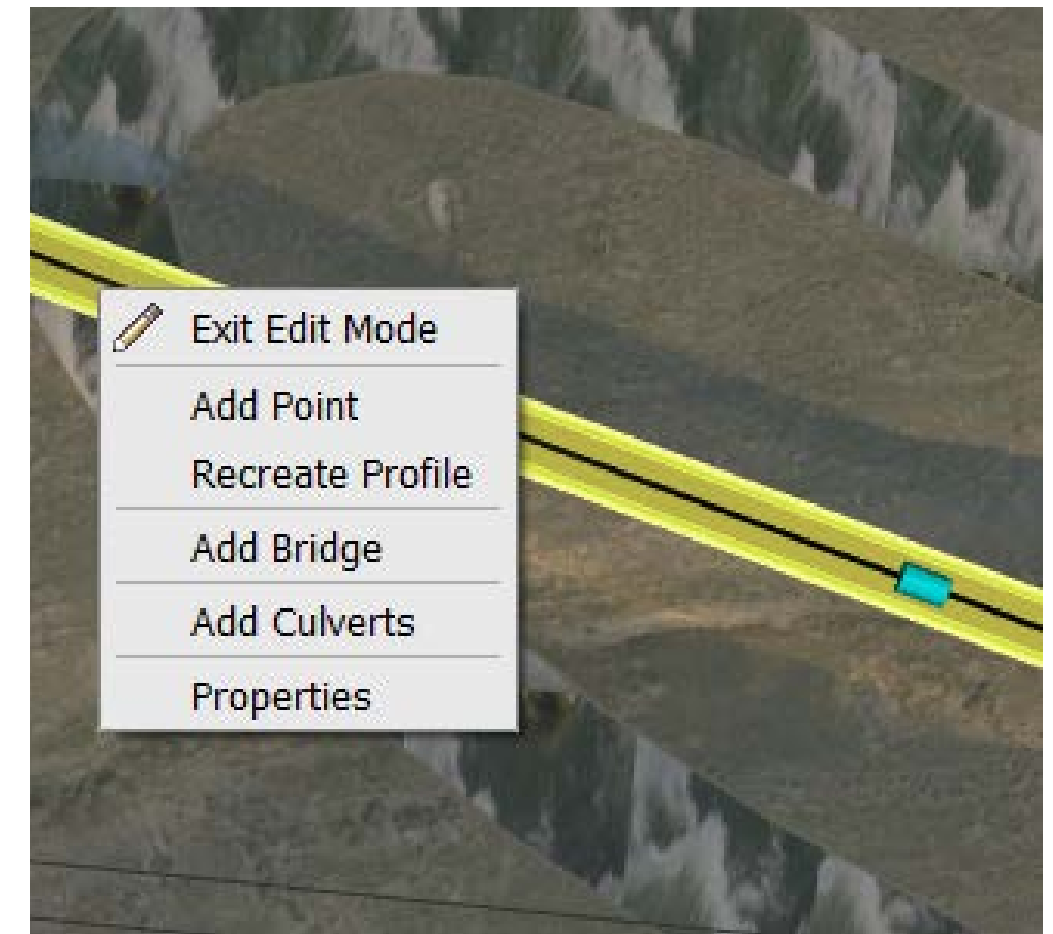
Bridge Components

- Deck
- Girders
- Bearings
- Piers
- Caps
- Piles
- Foundation
- Abutment



Create Bridges

- Select the Design Road and Right-click
- In Canvas Tools
- Set Start and Ending Stations



Modify Bridges - Bridge Asset Card

- Change type
- Set # of piers
- Show clearance envelope

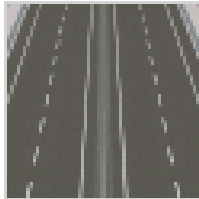
Bridge

Bridge 1

Utah Lake Crossing > Bridge 1

Type

Road style



Bridge type

Precast I

Attributes

Design standard

AASHTO LRFD

Number of piers

255

Geometry

Length

29408.54'

Bearings

Clearance Envelope

Lifespan

Creation date

Termination date

Advanced

Tag

User data

Tooltip

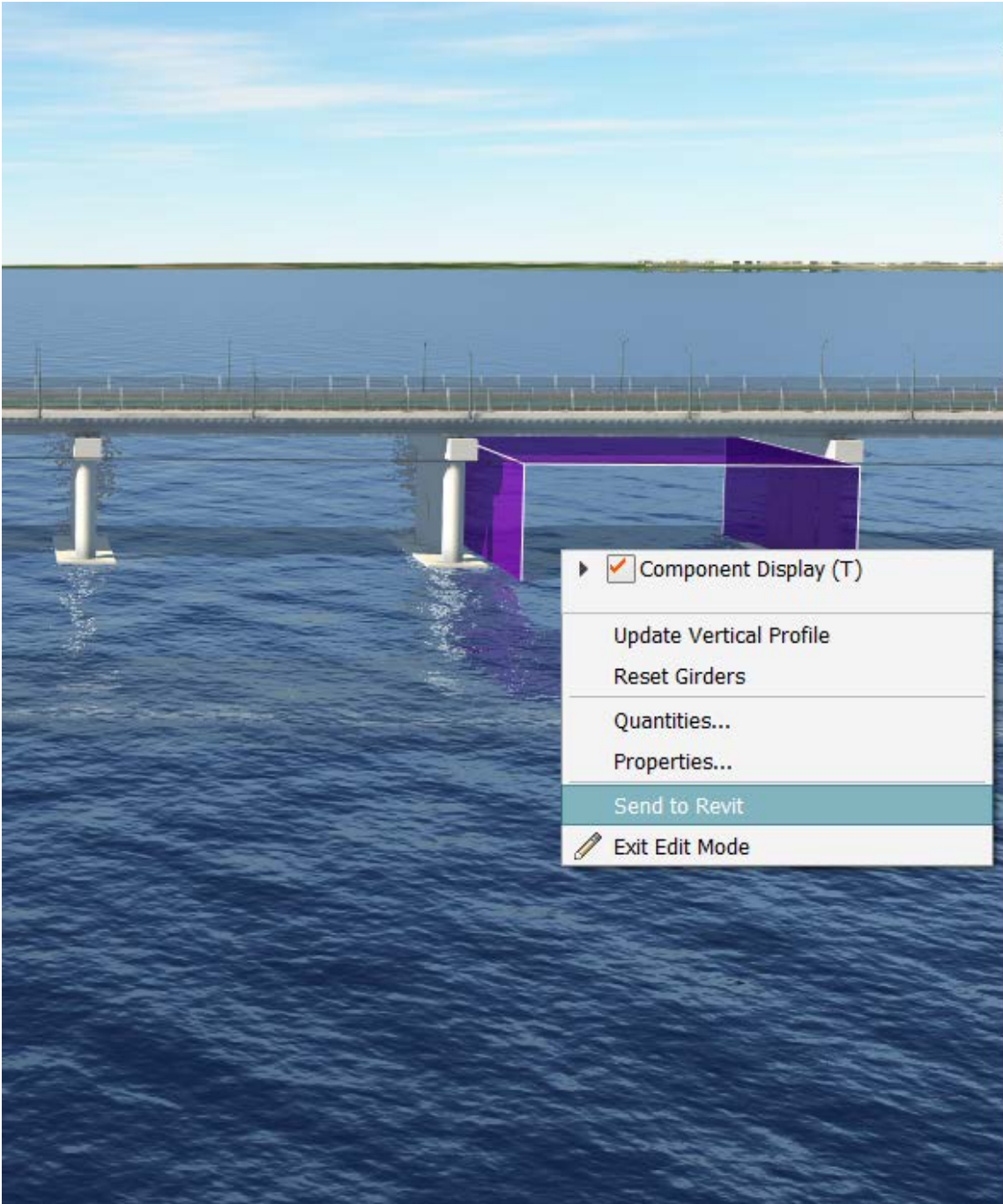
Link

Description

Click to start typing...

Modify Bridges - Bridge Clearance

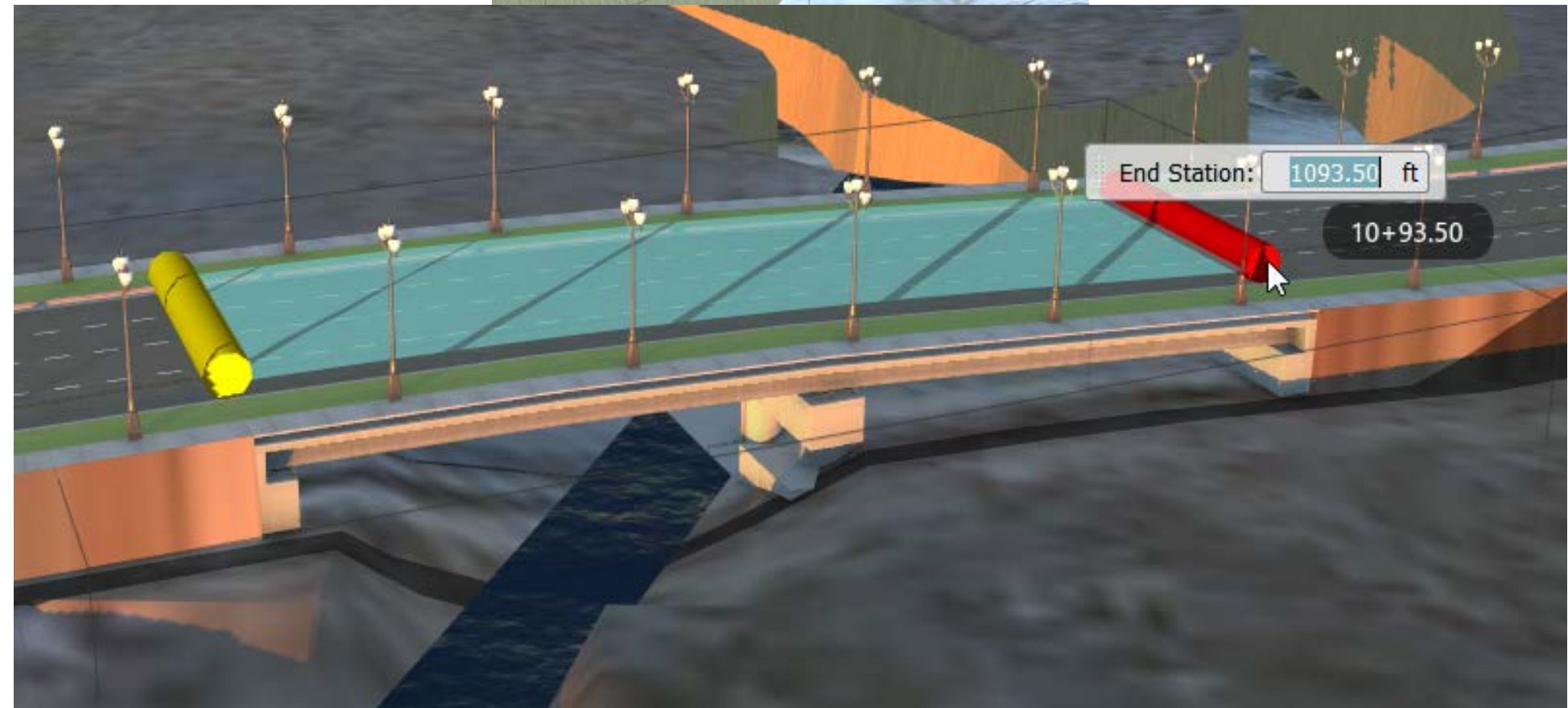
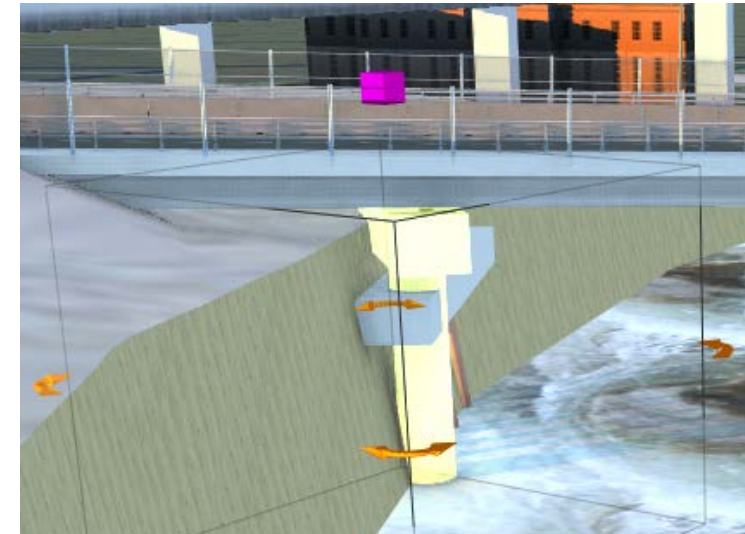
- Show clearance envelope
- Make Adjustments
- Update Vertical Profile



Attributes	
Design standard	AASHTO LRFD
Number of piers	255
Geometry	
Length	29408.54'
Bearings	
Clearance Envelope	
Show envelope	<input checked="" type="checkbox"/>
Start offset	14598.63'
End offset	14695.08'
Height	35.0'
Base elevation	0.0'
Skew	0.0°
Lifespan	
Creation date	
Termination date	
Advanced	
Tag	
User data	
Tooltip	
Link	
Description	
Click to start typing...	

Modify Bridges – Bridge Gizmos

- Using Gizmos
 - Control gizmo
 - Rotate gizmo
 - Start/End gizmos



Modify Bridges – Bridge Stack

Bridge

Bridge 1

Utah Lake Crossing > Bridge 1

Type

Road style

Bridge type

Precast I

Attributes

Design standard

AASHTO LRFD

Number of piers

255

Geometry

Length

29408.54'

Bearings

Clearance Envelope

Show envelope

Start offset

14598.63'

End offset

14695.08'

Height

35.0'

Base elevation

0.0'

Skew

0.0°

Lifespan

Creation date

Termination date

Advanced

Tag

User data

Tooltip

Link

Description

Click to start typing...

Girder Group

Girder group 1

Bridge 1 > Girder group 1

Type

External:

AASHTO Type VI

Internal:

AASHTO Type VI

Attributes

Number of girders

2

Material Properties

Strength (final)

8.0 ksi

Strength (transfer)

6.0 ksi

Tendon strength

270.0 ksi

Initial prestress

75.0 %

Geometry

Nominal length

119.3'

Start station

0+04.31'

End station

3+96.78'

Start gap

0.33'

End gap

0.0'

Start spacing

8.93'

End spacing

8.93'

Lifespan

Creation date

Termination date

Advanced

Tag

User data

Tooltip

Link

Description

Pier

Pier 1

Bridge 1 > Pier 1

Type

Legacy Pier

Attributes

Offset

120.94'

Skew

0.0°

Azimuth

177.34°

Diaphragm width

4.92'

Cap

Offset: Left

0.0'

Offset: Right

0.0'

Depth

8.2'

Height

6.56'

Columns

Width

6.56'

Depth

6.56'

Spacing

19.69'

Round

Lifespan

Creation date

Termination date

Advanced

Tag

User data

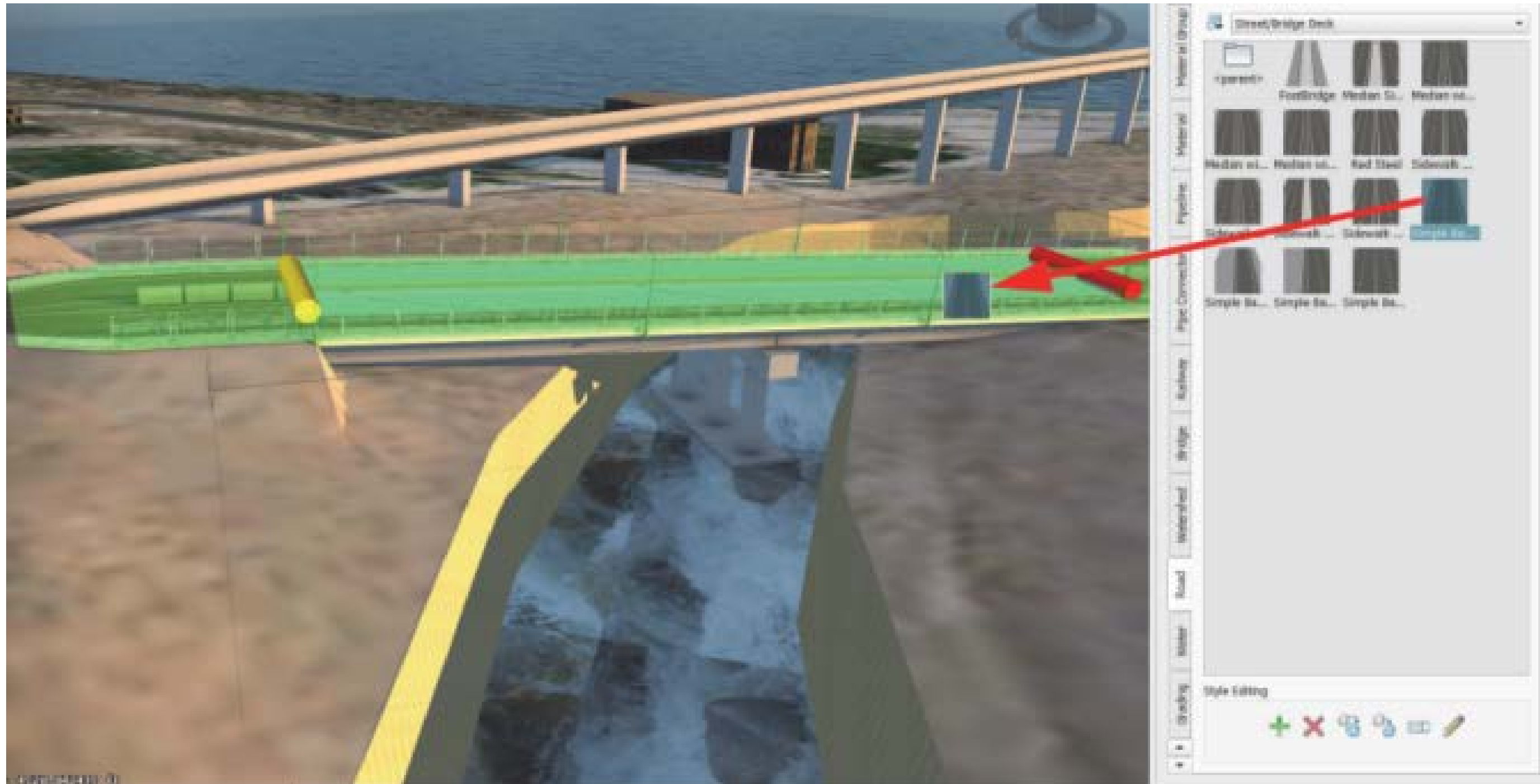
Tooltip

Link

Description

Click to start typing...

Modify Bridges – Style Palette



See it in Action



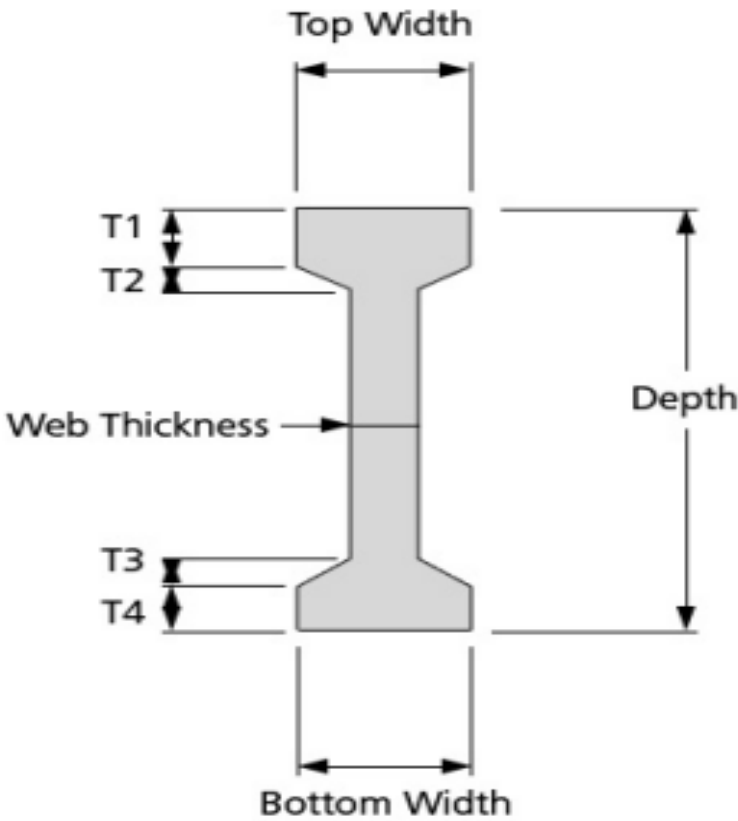
Verify the Structural Strength of the Bridge Girders



Girders

- Girder asset card

Concrete Girder




Girder Group


Girder group 3

Bridge 1 > Girder group 3

Type

External: 

[AASHTO Type VI](#)

Internal: 

[AASHTO Type VI](#)

Attributes

Number of girders: 1

Material Properties

Strength (final)	8.0 ksi
Strength (transfer)	6.0 ksi
Tendon strength	270.0 ksi
Initial prestress	75.0 %

Geometry

Nominal length	114.83'
Start station	7+73.51'
End station	11+50.25'
Start gap	0.0'
End gap	0.0'
Start spacing	8.93'
End spacing	8.93'

Lifespan

Creation date	
Termination date	

Advanced


Tag	
User data	
Tooltip	
Link	
Description	

Girder

Left exterior

Girder group 3 > Left exterior

Type

[AASHTO Type VI](#) 

Attributes

Length	114.83'
Start offset	-26.78'
End offset	-26.78'

Section Dimensions

Top width	3.5'
Bottom width	2.33'
Depth	6.0'
Web thickness	0.67'
T1	0.42'
T2	0.33'
T3	0.83'
T4	0.67'

Lifespan

Creation date	
Termination date	

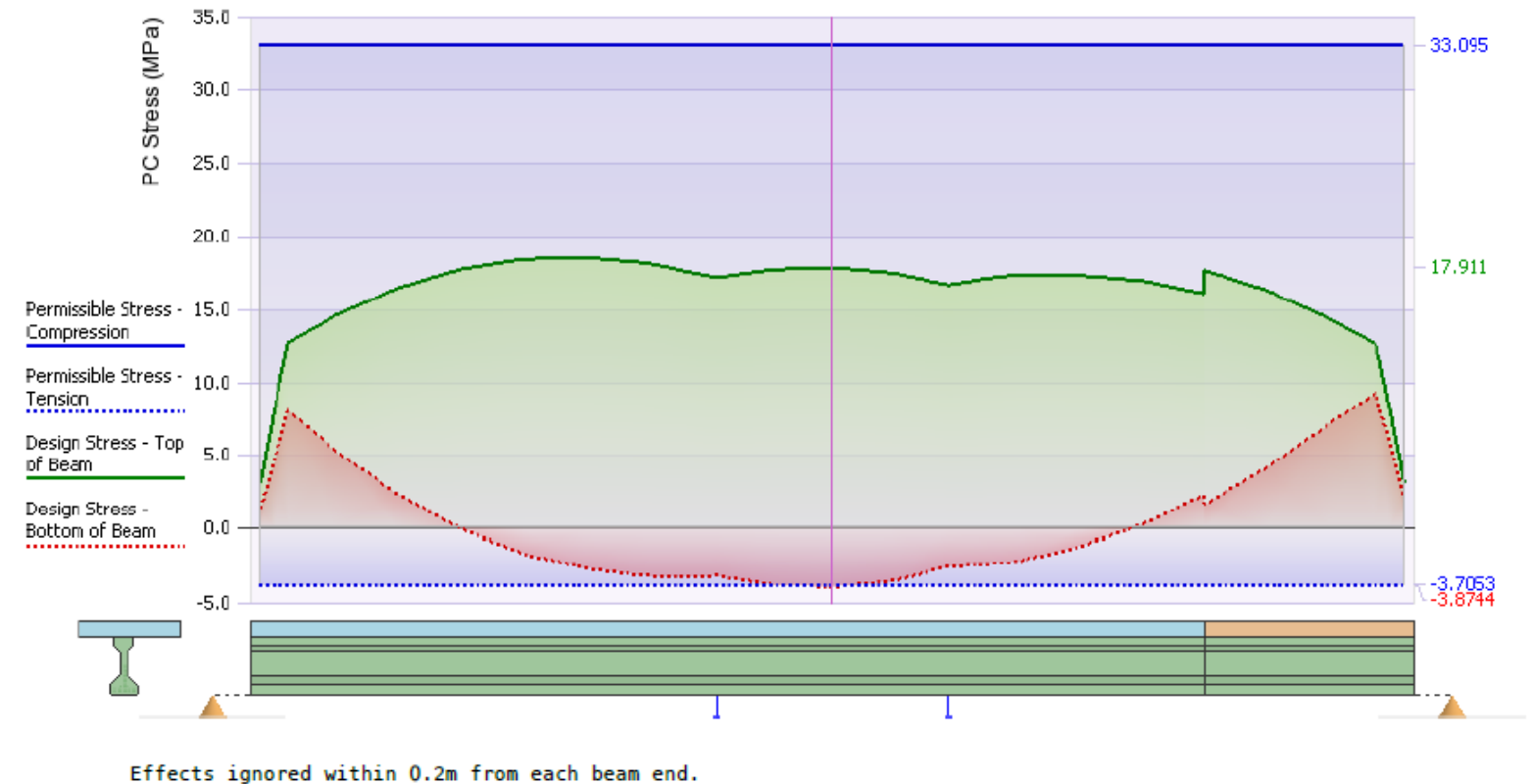
Advanced

Tag	
User data	
Tooltip	
Link	
Description	

Girder Analysis

- Verify structural strength of concrete bridge girders
 - Show results in model
 - Get Full Report (uses cloud credits)

Girder Design Calculations: Live Load Bending



Performance ratio = $-3.87 / -3.71 = 1.05$

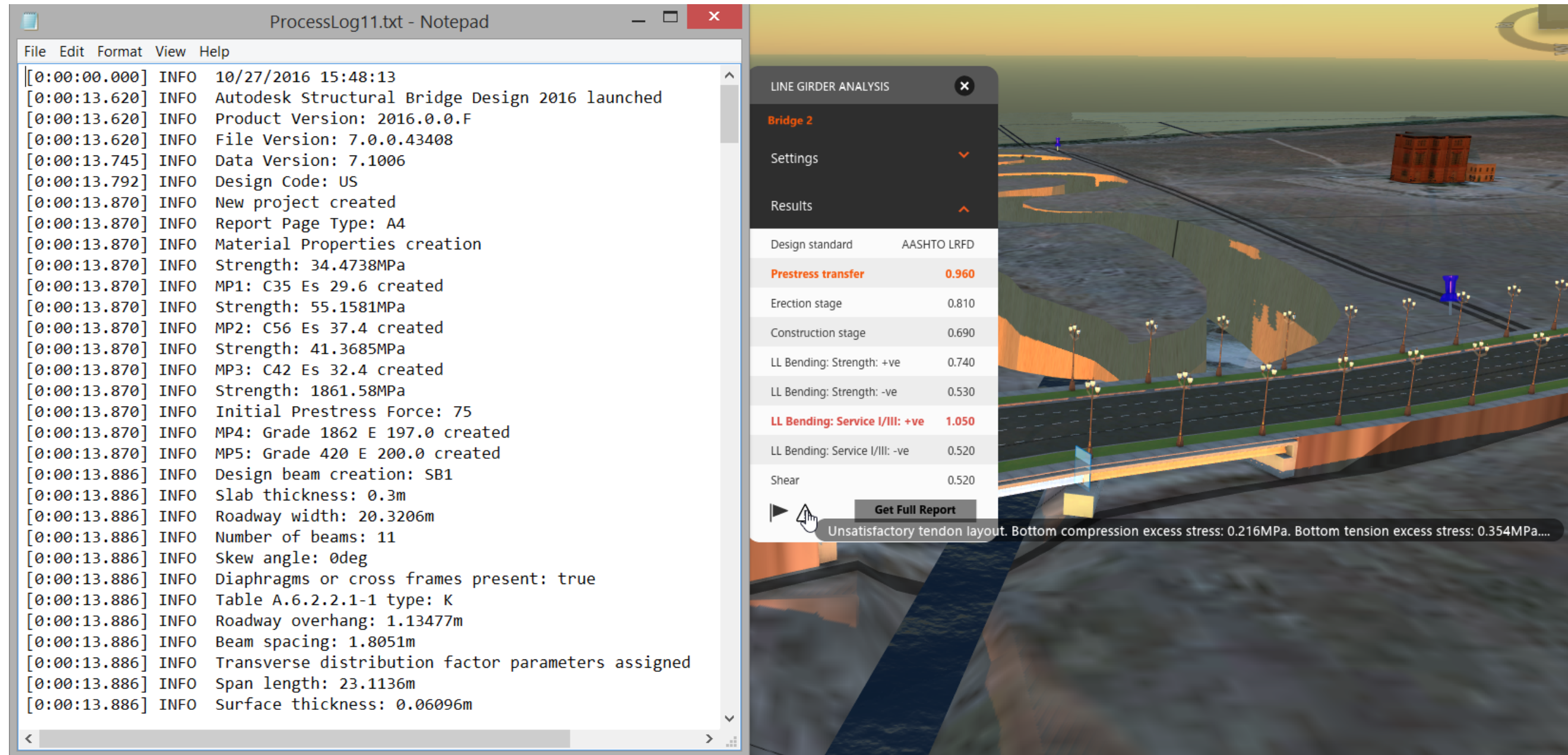
Section details:

Ref 1 "Section 1"
at 0.5 x span = $0.5 \times 23.1136 = 11.5568$ m from left end of beam

Design Code:

AASHTO LRFD Bridge Design Specifications
Sixth Edition with 2013 Interim Revisions

See it in Action



The screenshot displays the Autodesk Structural Bridge Design 2016 interface. On the left, a Notepad window titled 'ProcessLog11.txt' shows a log of project creation steps. On the right, a 3D model of a bridge is shown with a 'LINE GIRDER ANALYSIS' overlay. The analysis results table is as follows:


LINE GIRDER ANALYSIS	
Bridge 2	
Settings	
Results	
Design standard	AASHTO LRFD
Prestress transfer	0.960
Erection stage	0.810
Construction stage	0.690
LL Bending: Strength: +ve	0.740
LL Bending: Strength: -ve	0.530
LL Bending: Service I/III: +ve	1.050
LL Bending: Service I/III: -ve	0.520
Shear	0.520

Below the table, a 'Get Full Report' button is visible. A warning message at the bottom of the analysis overlay states: 'Unsatisfactory tendon layout. Bottom compression excess stress: 0.216MPa. Bottom tension excess stress: 0.354MPa....'

ProcessLog11.txt - Notepad

File Edit Format View Help

[0:00:00.000] INFO 10/27/2016 15:48:13
[0:00:13.620] INFO Autodesk Structural Bridge Design 2016 launched
[0:00:13.620] INFO Product Version: 2016.0.0.F
[0:00:13.620] INFO File Version: 7.0.0.43408
[0:00:13.745] INFO Data Version: 7.1006
[0:00:13.792] INFO Design Code: US
[0:00:13.870] INFO New project created
[0:00:13.870] INFO Report Page Type: A4
[0:00:13.870] INFO Material Properties creation
[0:00:13.870] INFO Strength: 34.4738MPa
[0:00:13.870] INFO MP1: C35 Es 29.6 created
[0:00:13.870] INFO Strength: 55.1581MPa
[0:00:13.870] INFO MP2: C56 Es 37.4 created
[0:00:13.870] INFO Strength: 41.3685MPa
[0:00:13.870] INFO MP3: C42 Es 32.4 created
[0:00:13.870] INFO Strength: 1861.58MPa
[0:00:13.870] INFO Initial Prestress Force: 75
[0:00:13.870] INFO MP4: Grade 1862 E 197.0 created
[0:00:13.870] INFO MP5: Grade 420 E 200.0 created
[0:00:13.886] INFO Design beam creation: SB1
[0:00:13.886] INFO Slab thickness: 0.3m
[0:00:13.886] INFO Roadway width: 20.3206m
[0:00:13.886] INFO Number of beams: 11
[0:00:13.886] INFO Skew angle: 0deg
[0:00:13.886] INFO Diaphragms or cross frames present: true
[0:00:13.886] INFO Table A.6.2.2.1-1 type: K
[0:00:13.886] INFO Roadway overhang: 1.13477m
[0:00:13.886] INFO Beam spacing: 1.8051m
[0:00:13.886] INFO Transverse distribution factor parameters assigned
[0:00:13.886] INFO Span length: 23.1136m
[0:00:13.886] INFO Surface thickness: 0.06096m

A 3D architectural rendering of a city skyline. In the foreground, a multi-lane bridge with a rainbow-colored railing spans a river. A red car is driving on the bridge. The riverbank is landscaped with green grass, trees, and a small pond. In the background, a dense city skyline with various skyscrapers is visible under a clear blue sky. A semi-transparent white banner is overlaid on the middle of the image, containing the text.

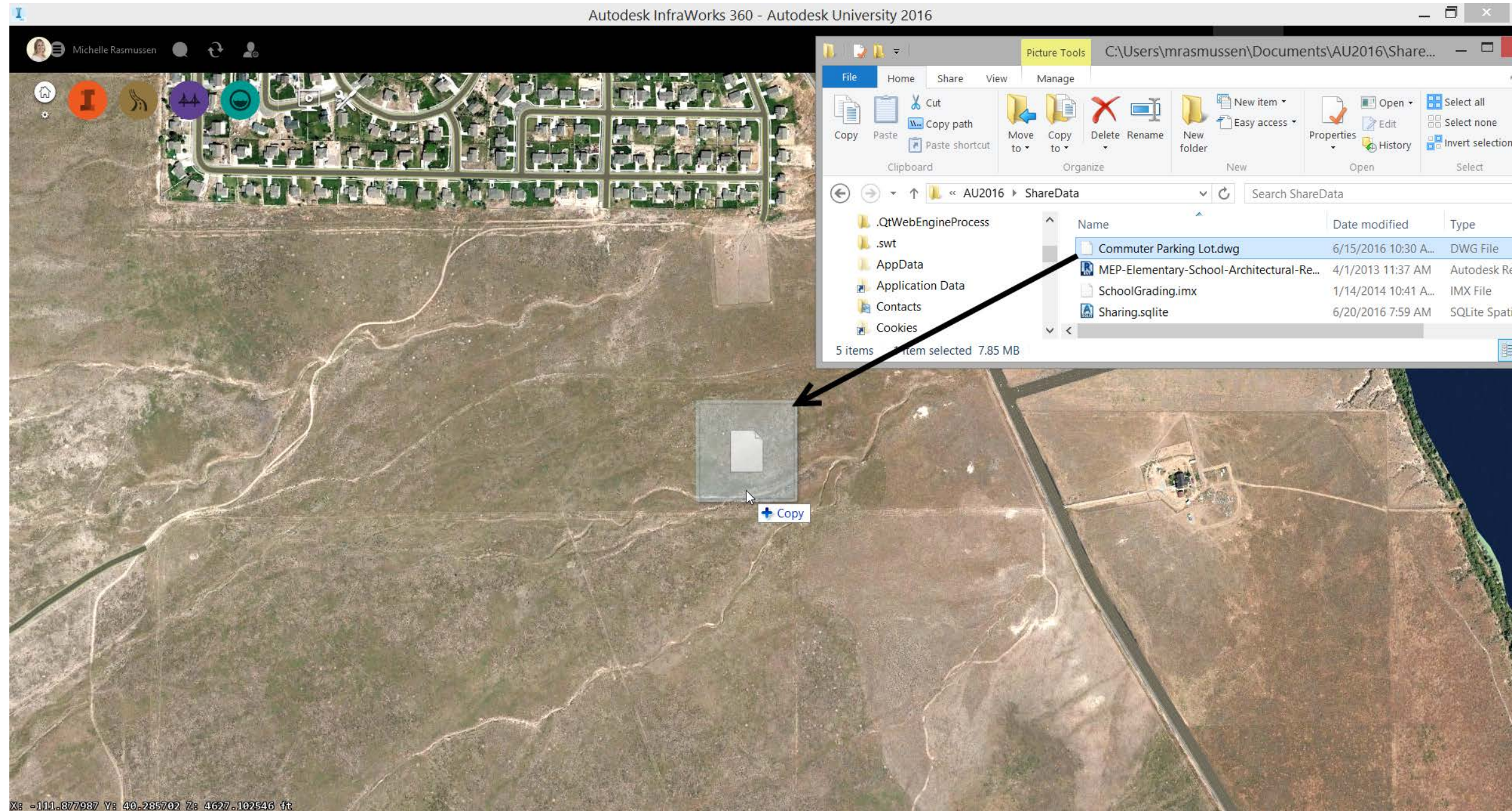
Incorporate design changes from AutoCAD Civil 3D

Overlay or Import

- Import
 - Corridors
 - Surfaces
 - Pipes
 - Pipe Networks
- Overlay
 - Linework



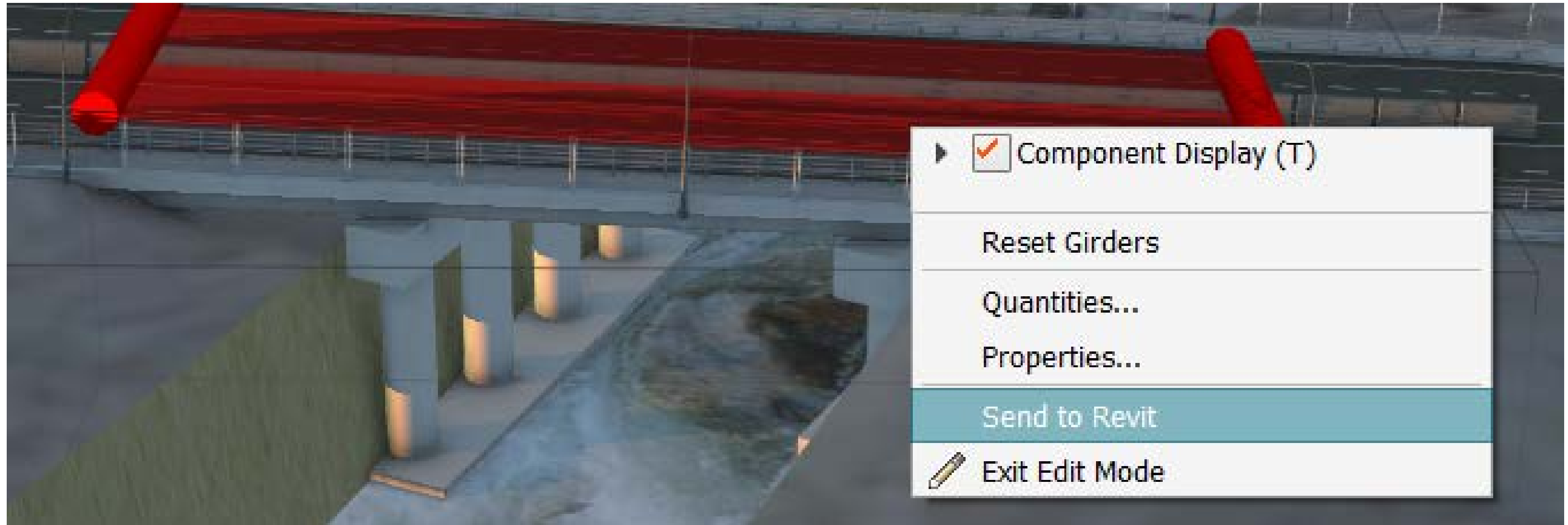
See it in Action



Bonus Material



Take the Bridge into Revit



See it in Action

Take the Design into Navisworks

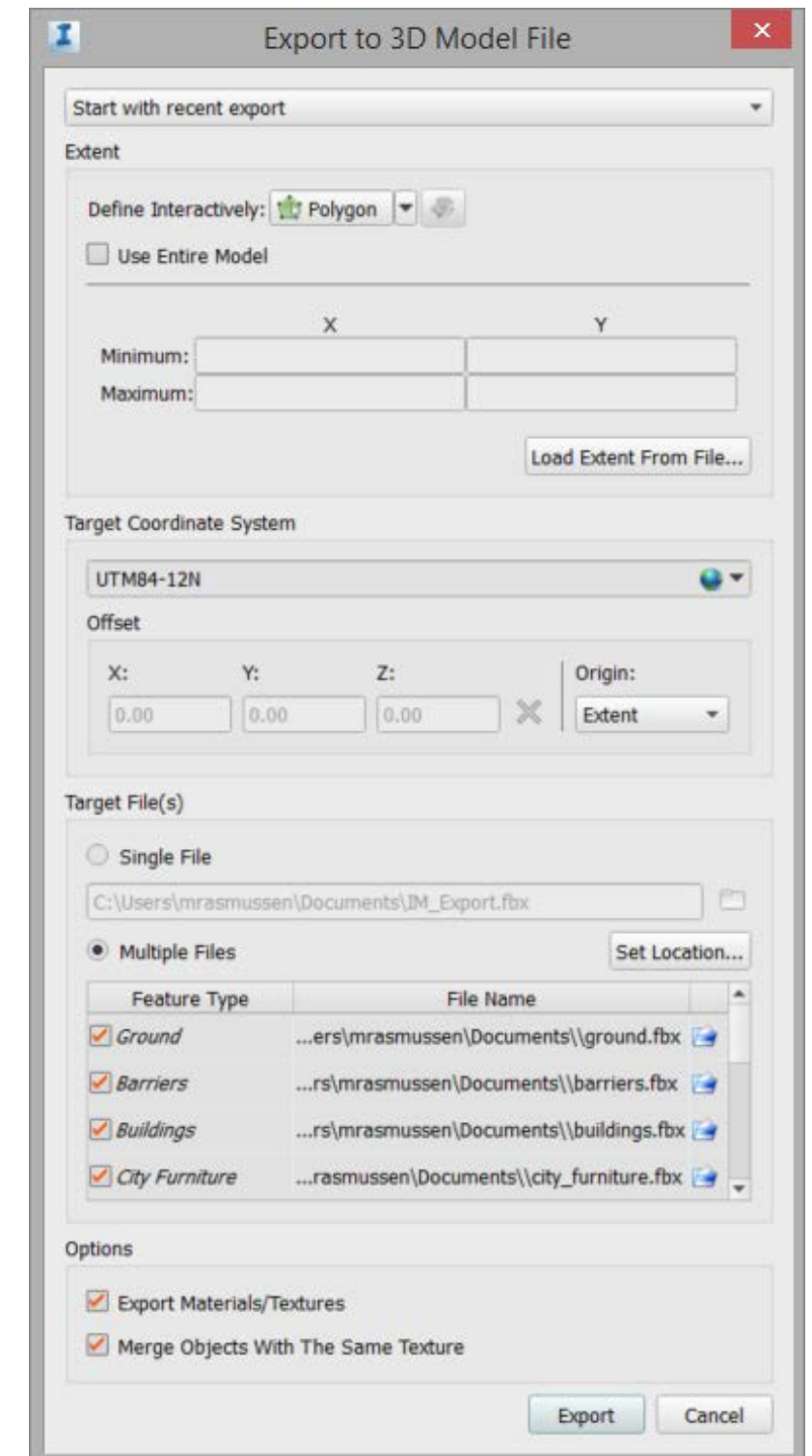
- Two options:
 - First, take it into AutoCAD Civil 3D.
 - Export a 3D Model which you can append to the Navisworks file.

Screencast

Export the Autodesk InfraWorks 360 Model to Navisworks

Export an FBX file

- Define the area to export
- Set the Target Coordinate System
- Determine if you want one file or many
- Click Export.



See it in Action

How did I do?

At the beginning of this class, I said you will be able to do the following:

- Create engineered roads of the proposed design.
- Add bridges to design roads using Bridge Design for InfraWorks 360.
- Verify the structural strength of the bridge girders.
- Incorporate design changes from AutoCAD Civil 3D

Bonus Material:

- Take the Bridge into Revit
- Take the Design into Navisworks

Let Autodesk Know What You Thought

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**



Workout With Me and Pinky & Proppy

- When: Today at 6:00
- Where: Canyon Ranch Spa
- Cost: \$25 which goes to charity
- Party Bus: 9:00 pm
- Cost: \$75



