I Just Need to Know…
Introducing the OpenRoads Analysis Tools

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Introduction

- Dan Sheldon – Civil Consultant
  - Joined Bentley in August 2019
  - 20+ years of Civil Design
    - Surveying
    - Road Design
    - Cad Management
  - Call Milwaukee WI home

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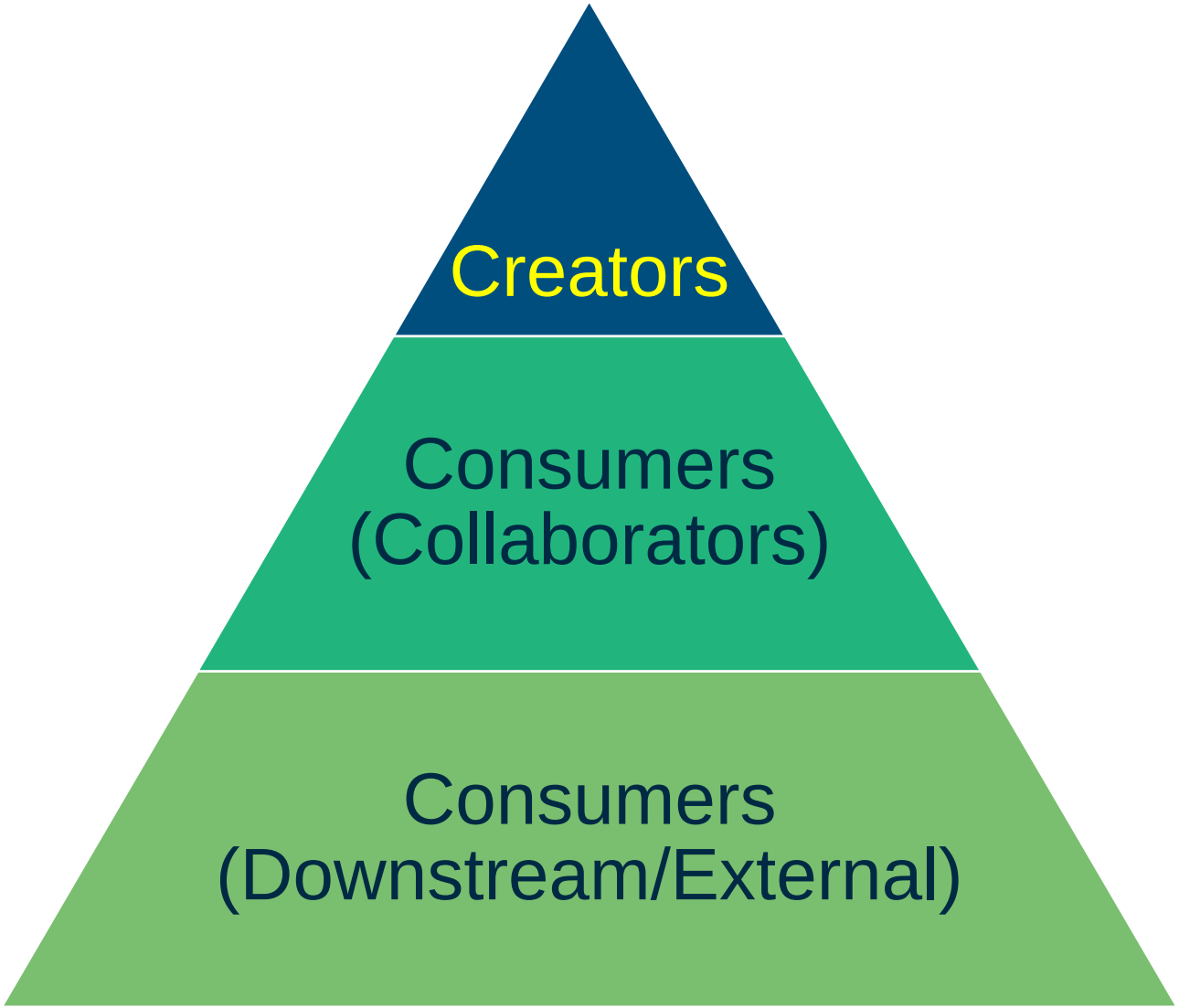
Why is Analysis Important?

- Imagine Elite Race Car Drivers. Now blindfold them.
  - **Quality** is impossible without effective Analysis
  - **Efficiency** is unlikely without continual analysis

Who needs Analysis?

- Software Roles:
  - Creators
  - Consumers
    - Very Broad base – varying needs
    - Managers and Reviewers
    - Quality Teams
    - Other Disciplines
    - *and* Creators



  - Creators need to Analyze to Create with Quality

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Analysis Categories Covered Here:

✓	Feature Attributes	• Properties, Labels • Tables, Reports
✓	Spatial	• Contours, Flowlines • Profiles Cross Sections
✓	Specialty	• Sight Visibility • Aquaplaning
Link	Sheeting & Quantities	• (not covered here, • but we link to detailed content)

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Parts not Covered

This section refers you to resources for

"analysis" capabilities we're NOT covering here

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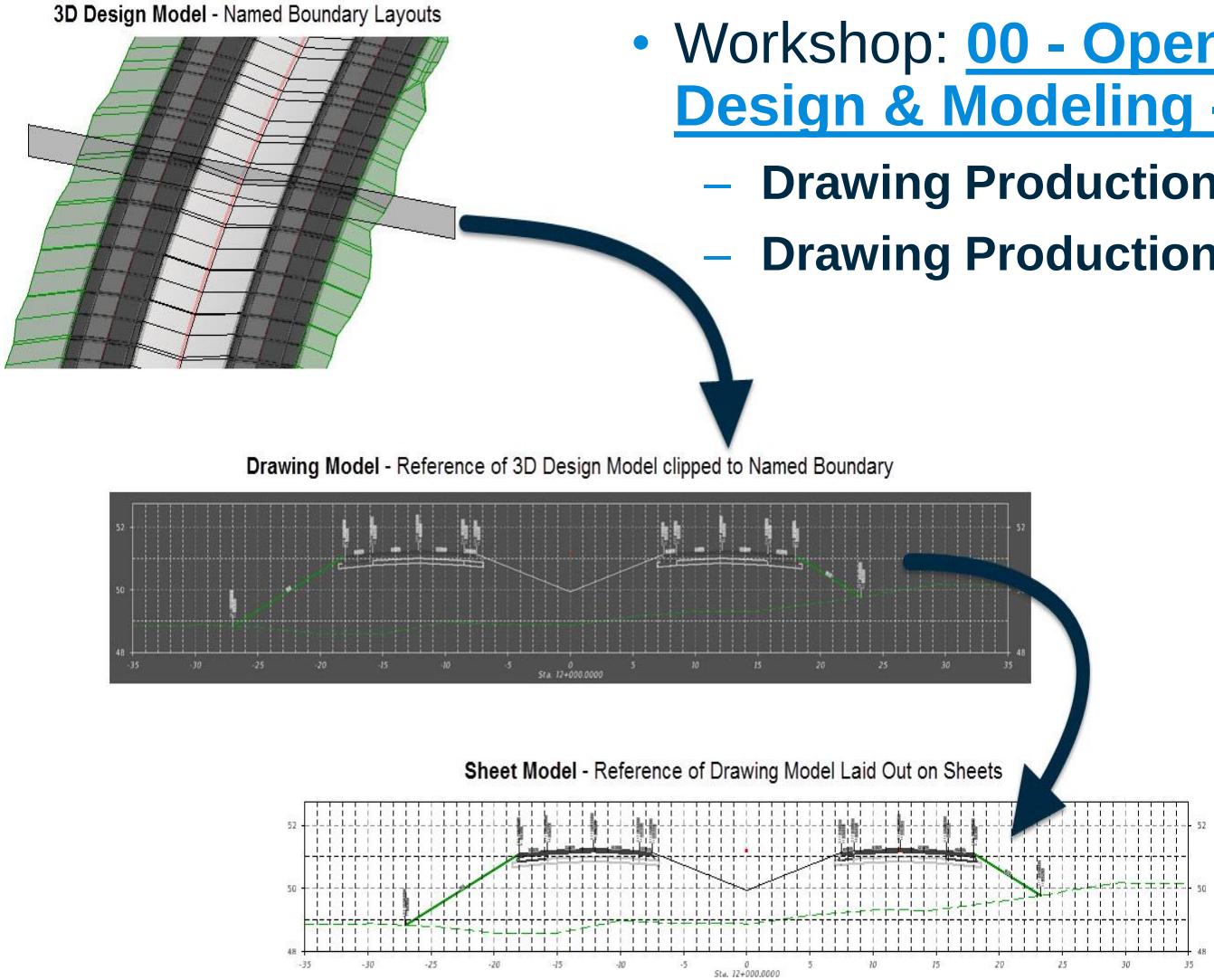
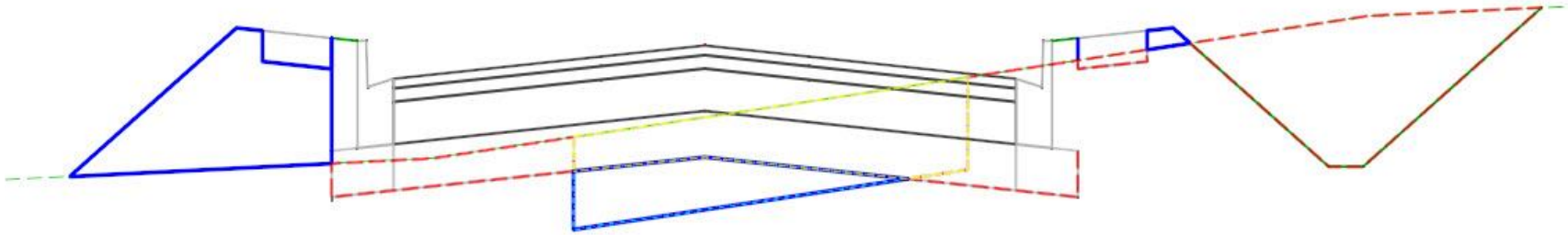
Sheeting and Annotation - Training



- Workshop: [00 - OpenRoads Designer - Roadway Design & Modeling - Fundamentals]
  - **Drawing Production - Creating Plan and Profile Sheets**
  - **Drawing Production - Creating Cross Section Sheets**

Quantities and Earthwork

- Workshop: **00 - OpenRoads Designer - Roadway Design & Modeling – Fundamentals**
  - **Quantities and Earthwork**

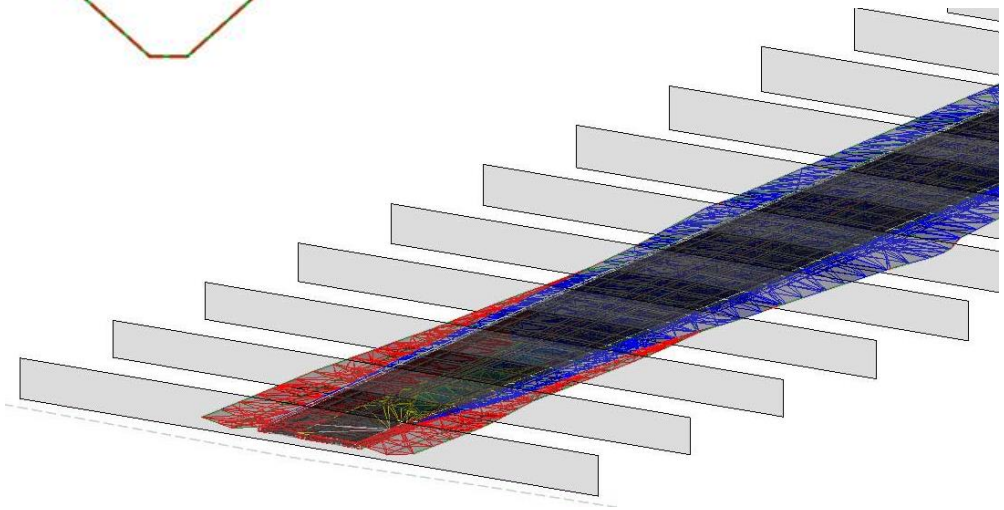


Volumes Report

Report Created: Wednesday, October 3, 2018
Time: 3:23:15 PM

Cross Section Set Name: <None>
Alignment Name:
Input Grid Factor: **Note:** All units in this report are in feet, square feet and cubic feet unless specified otherwise.

Station	Type	Area	Volume	Factor	Adjusted Volume	Included in Mass Ordinate?	Mass Ordinate
0.000							15766.679
	Volumes_Cut:		169553.966	1.000	169553.966	Yes	



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Core Analysis

*What **Everyone** Needs to Know*

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Core Civil Analysis Tools: Available Training

- The Core Analysis tools
  - Required by everybody (consumers, creators, everybody)
- Why not start Training that solves the universal need?
  - **00 - OpenRoads Designer - Roadway Design & Modeling – Fundamentals**
    - QuickStart Navigating the Interface
    - QuickStart for Terrain Display and Analysis (Contours, Elevations, etc.)
    - QuickStart for Geometry - Road
    - Beyond Centerline Geometry
    - Using and Editing Templates
    - QuickStart for Corridor Modeling – Road

You will have permanent, critical skills in a couple of hours

You can bring more resources into your team very quickly *(limited role at first)*

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Platform “Tools”

Built-in General Analysis Capabilities

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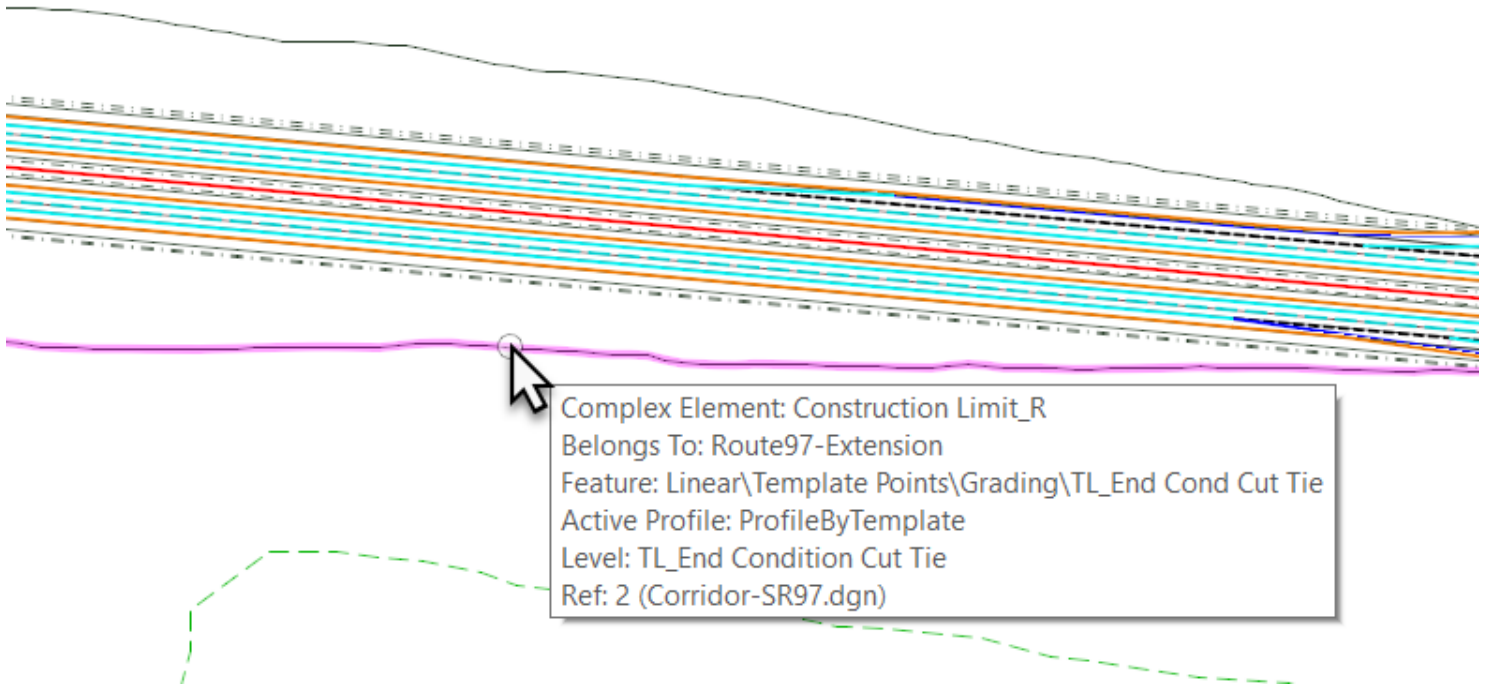
Starting Simple: Hover

- You don’t even have to click to get information



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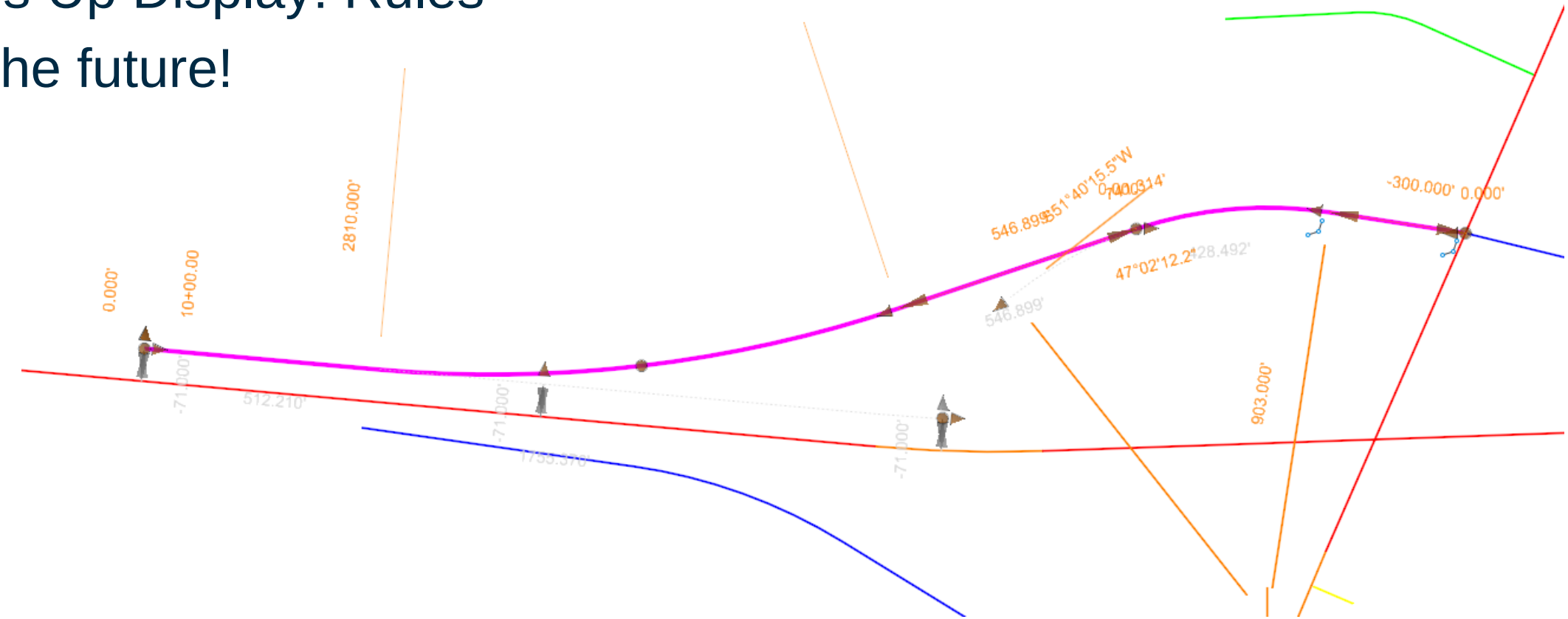
The Power of a Simple Click: Geometry

- Heads Up Display: Rules
- See the future!



[Learn Server Video: Using the HUD to See the Design Intent]

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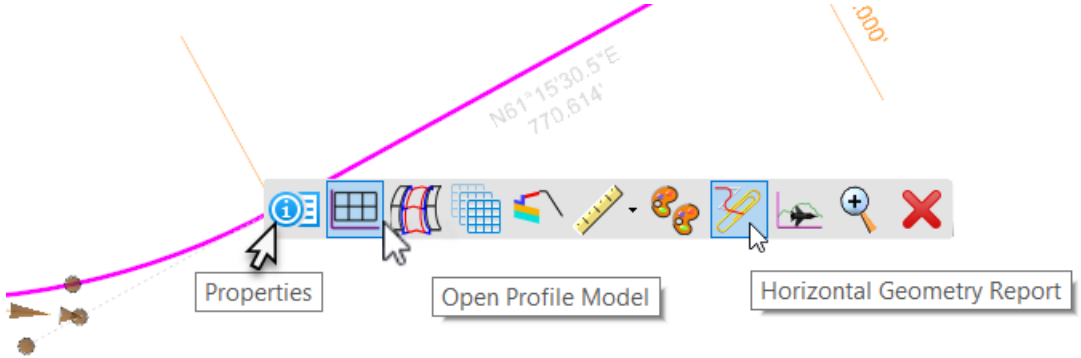
Context Menus include Analysis Tools

Click-and-Hover opens a Context Menu

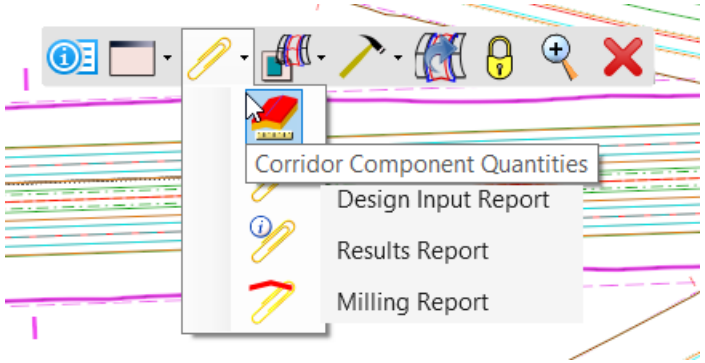
Here, a Geometry Feature shows:

- Properties
- Open Profile Model
- Horizontal Geometry Report



Here, a Corridor shows:

- Properties
- Open Cross Section View
- Corridor Reports



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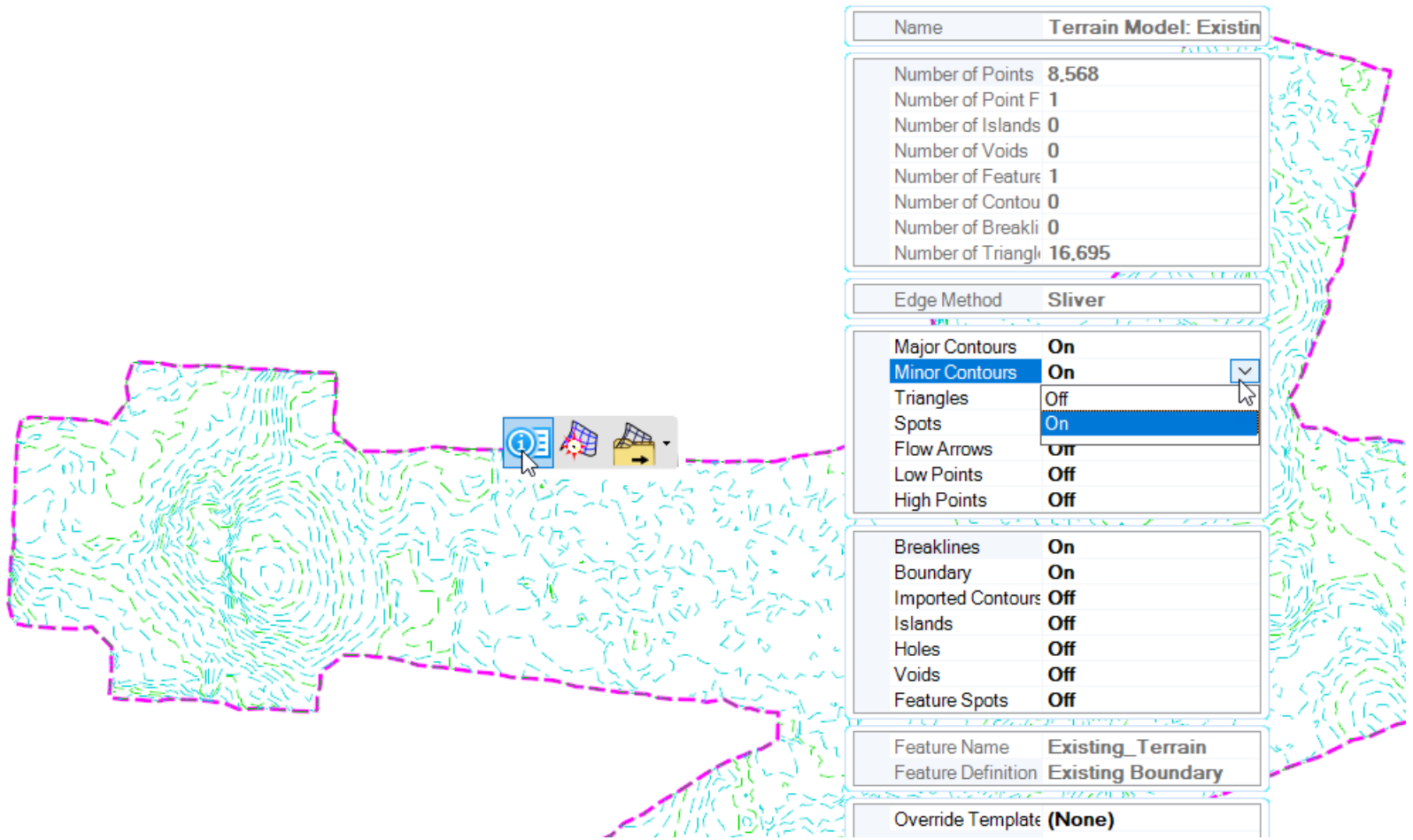
Terrain: Contours, Triangles, etc.

Context Menu > “Quick” Properties

- Contours
- Triangles
- Breaklines
- Flow Arrows
- High & Low Points



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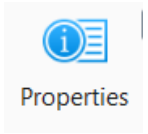
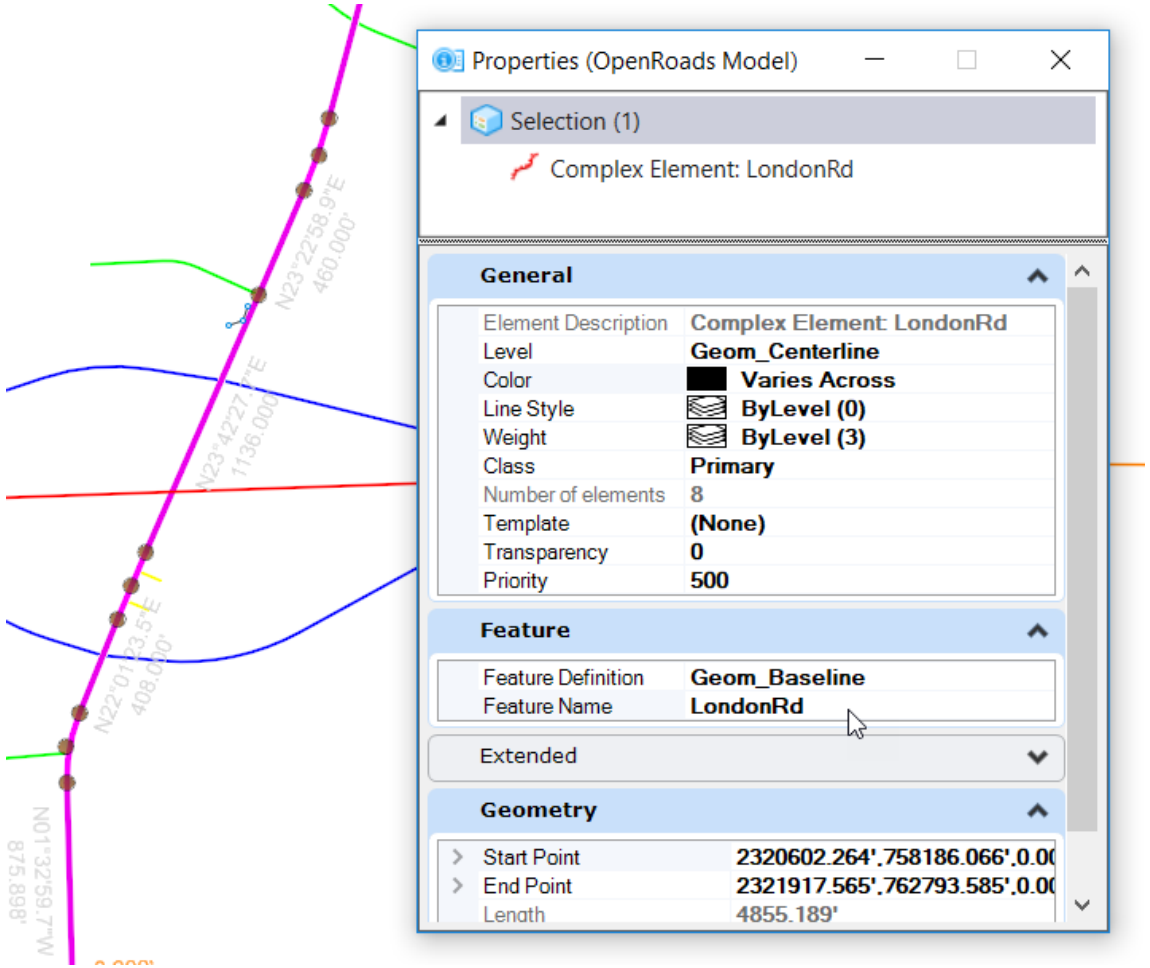


Properties dialog

See an Element's Properties



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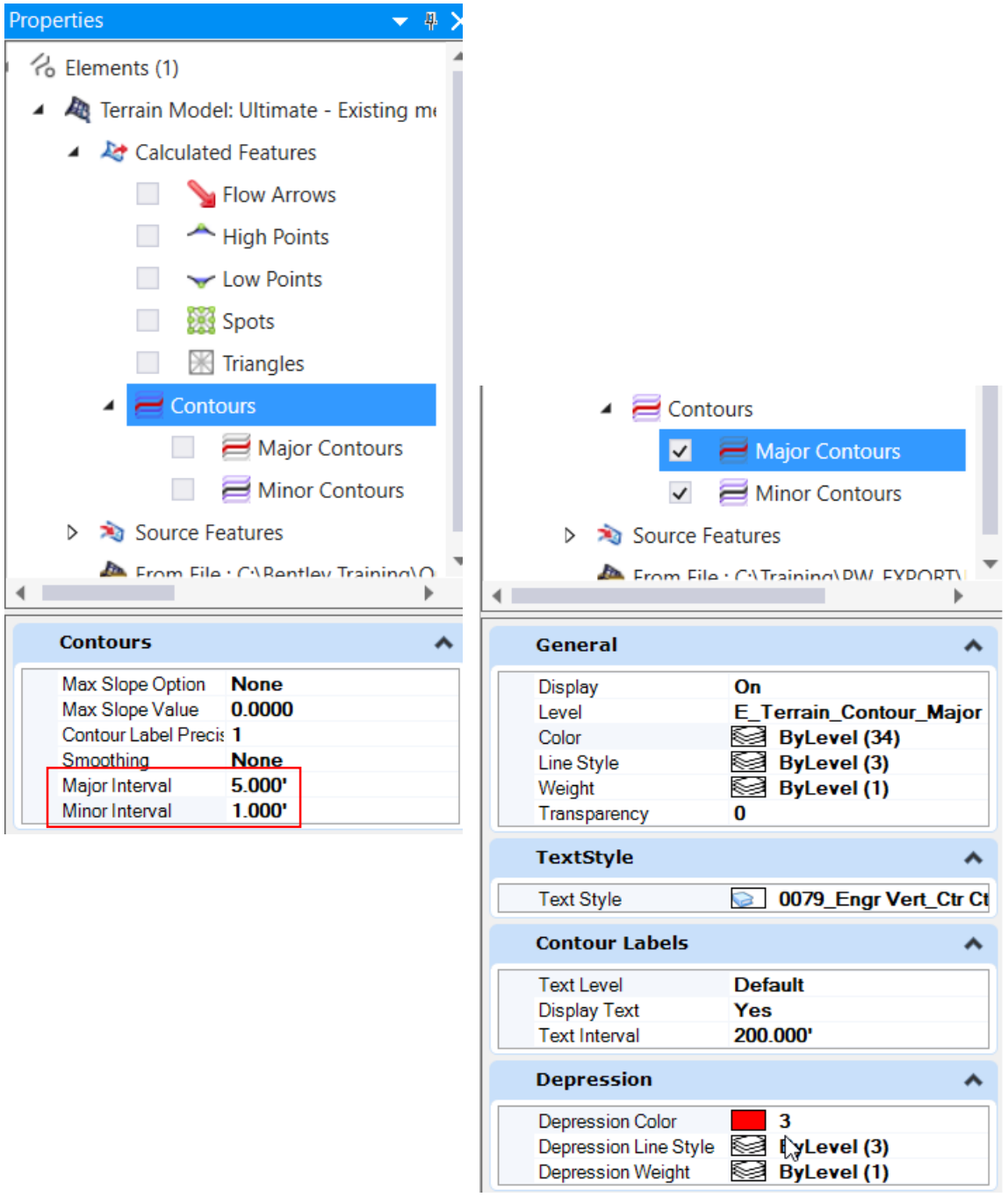
Terrain Display – Properties

Quick Properties + much more

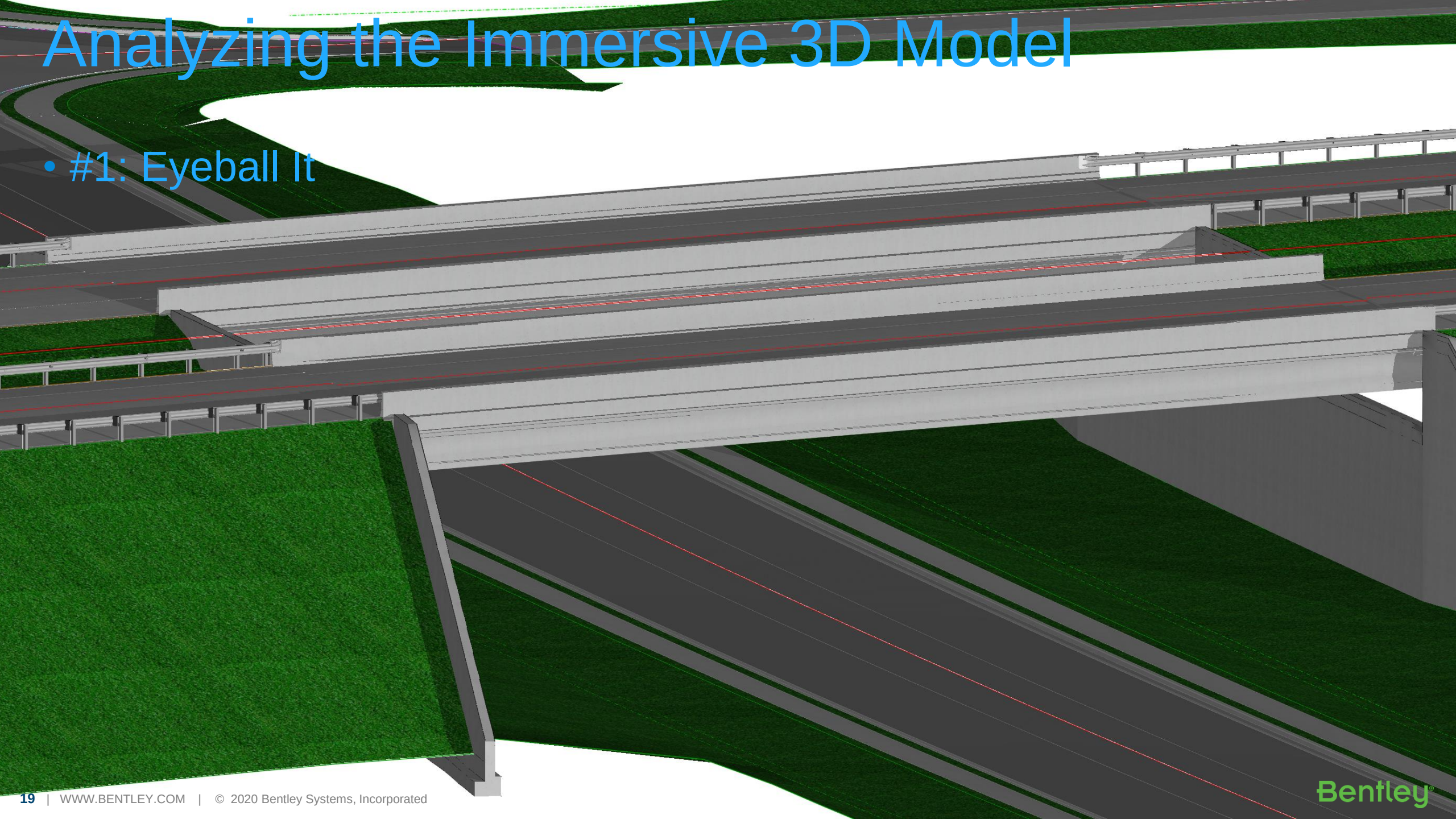
- Set Contour Interval, Labeling
- Depression Contour Symbology

- The Terrain Element is Native to all Bentley Products
  - And so are these capabilities



Analyzing the Immersive 3D Model

- #1: Eyeball It



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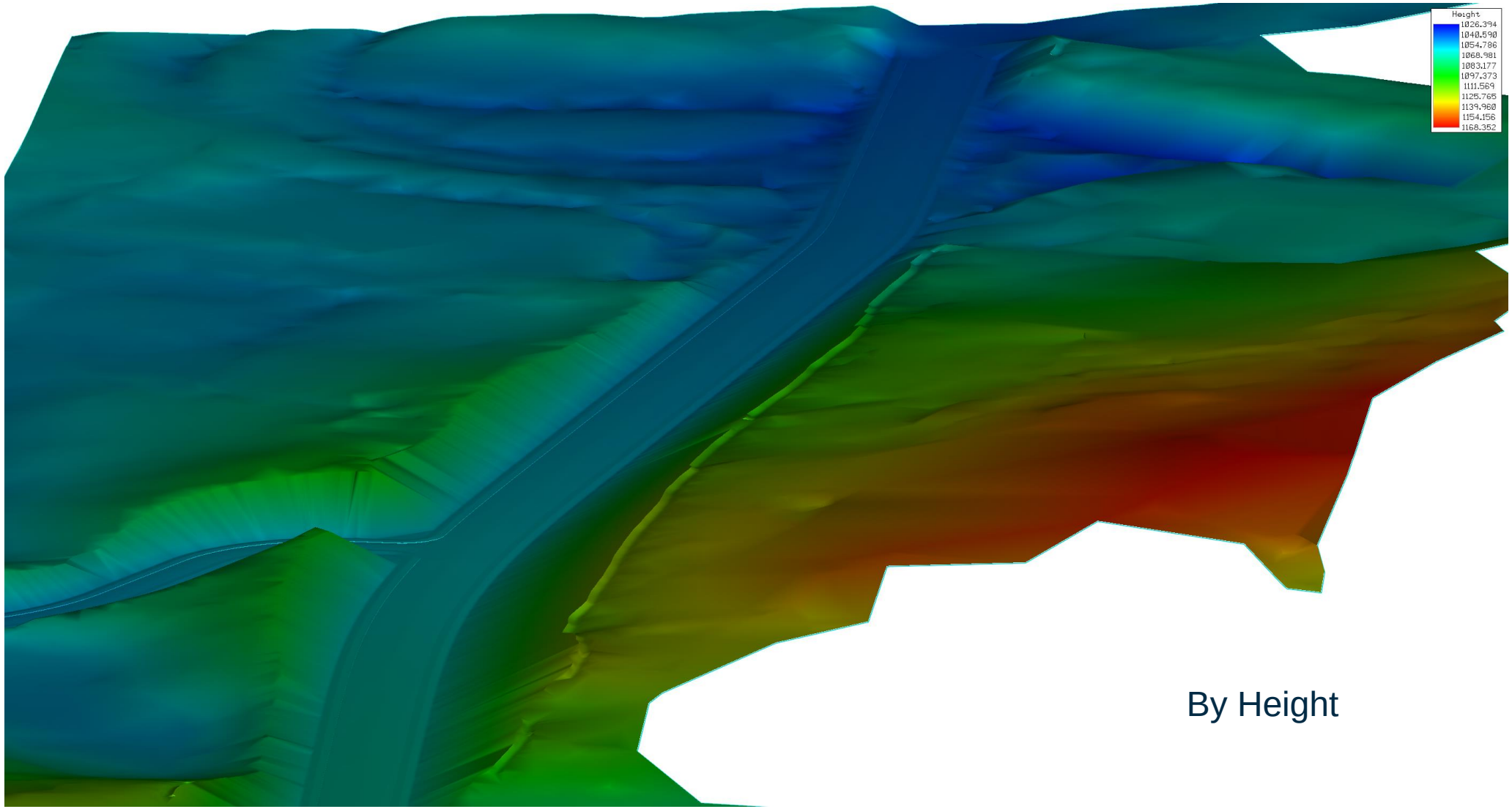
Terrain Thematic Displays: a new way to see clearly



By Height

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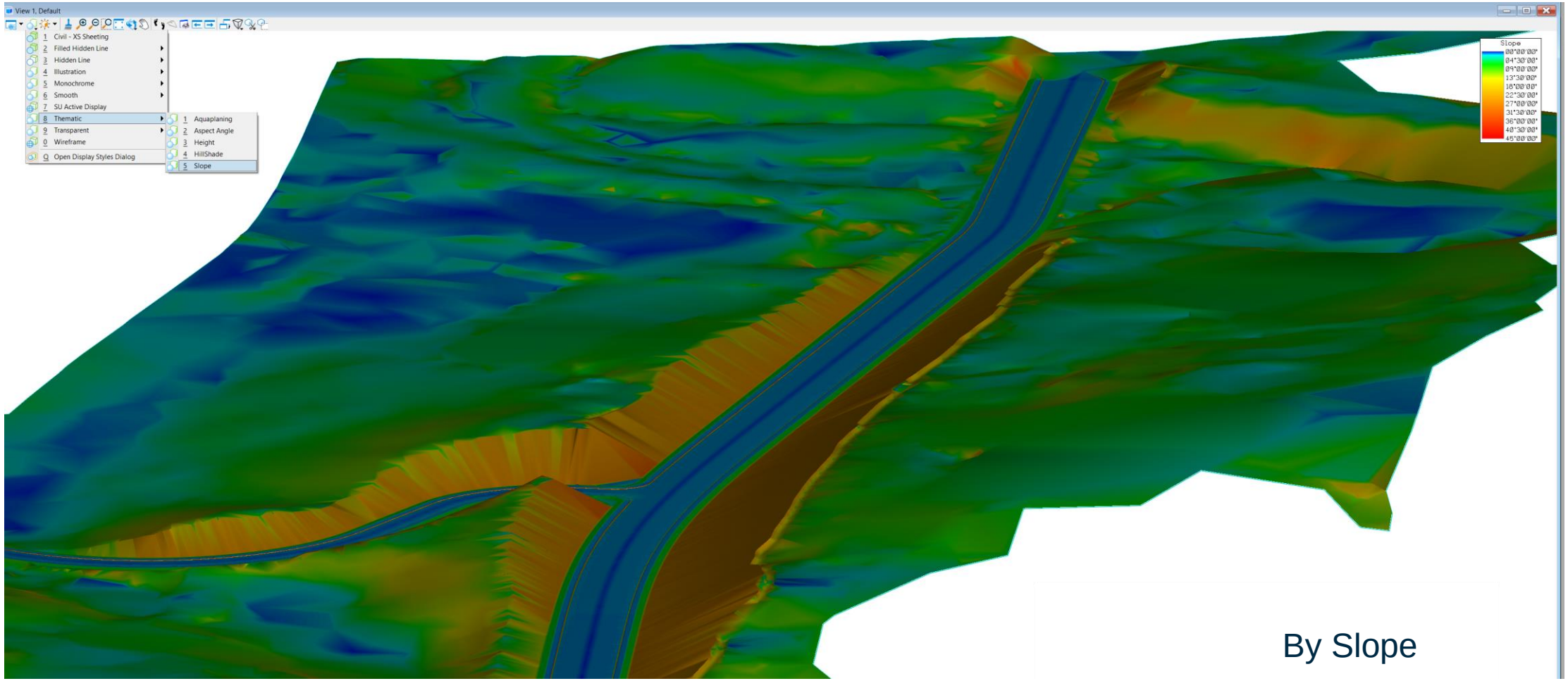
Terrain Thematic Displays: a new way to see clearly



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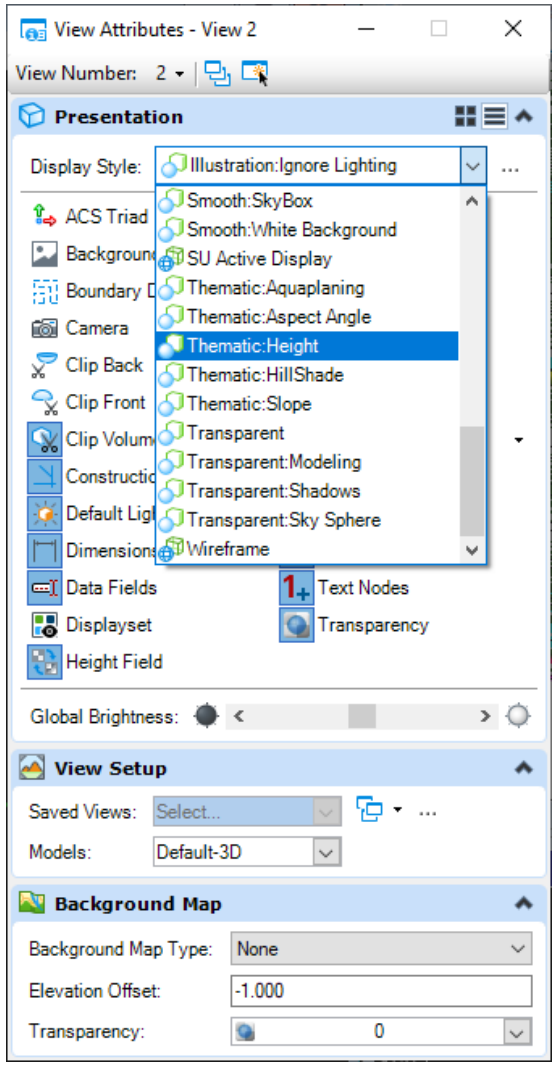
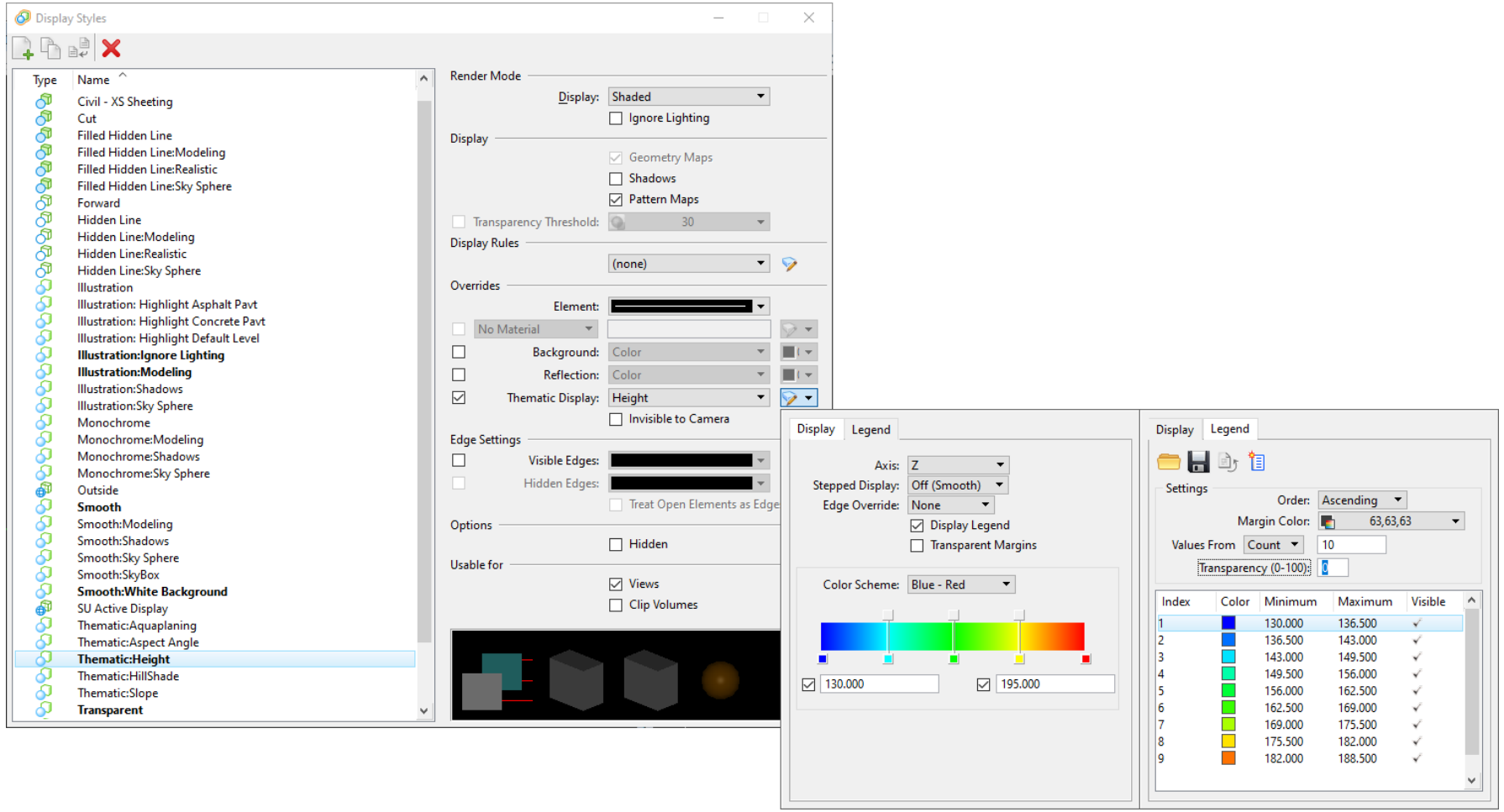
Display Styles





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Explorer: Powerful Multi-Tool

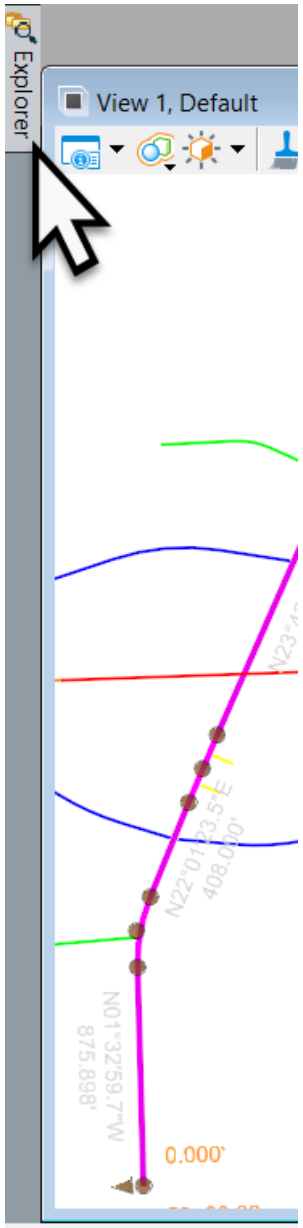
Explore (Analyze)

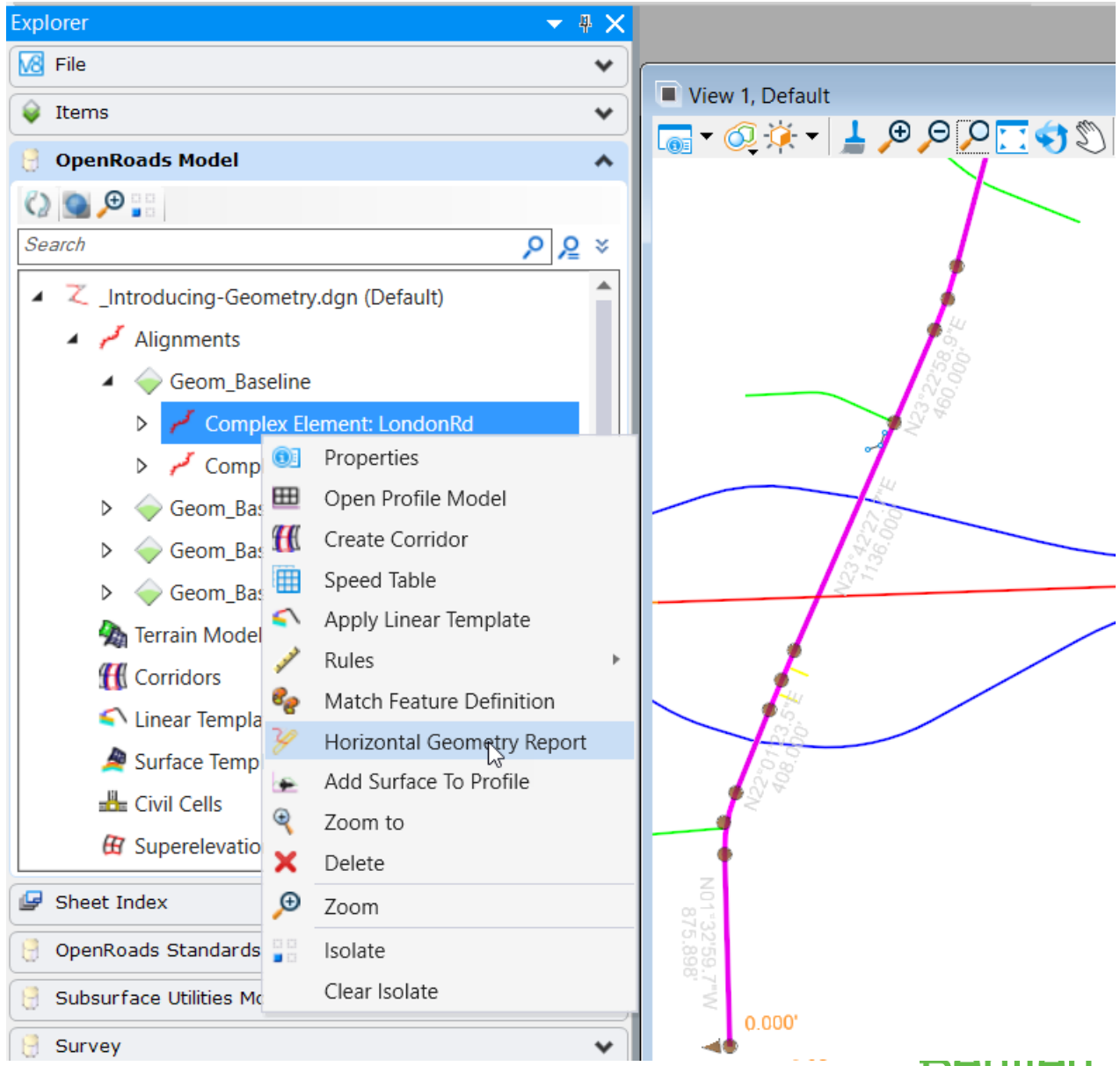
- File Contents
- Features
- Feature Properties
- Dependencies
- Standards

Find (Zoom to)

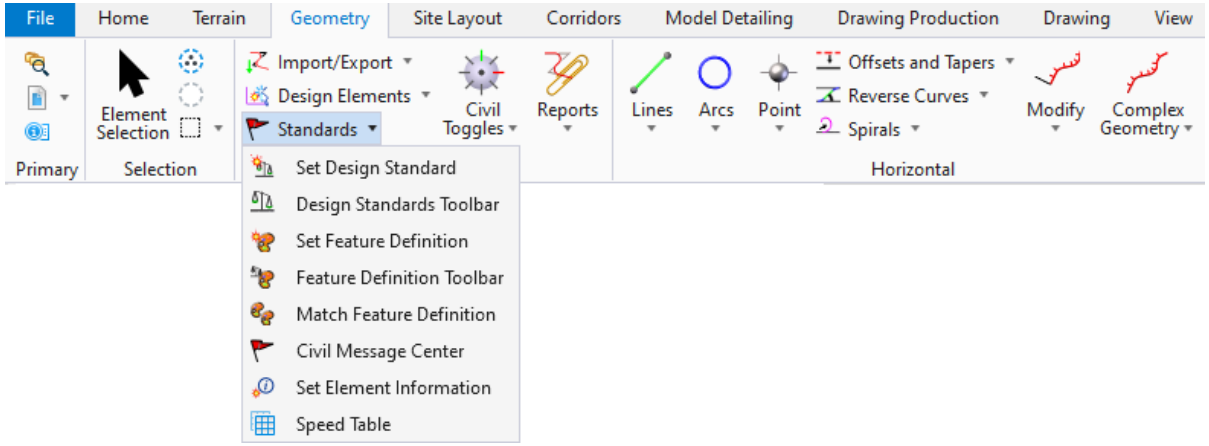
Edit, Delete

Take Actions

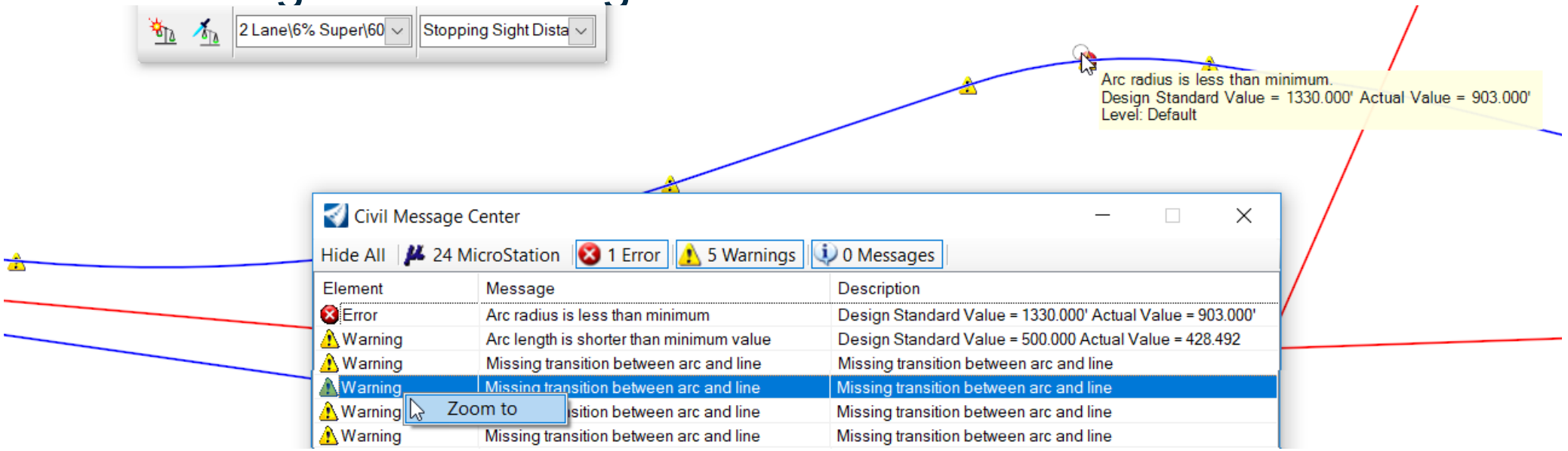




Civil Messages



- Heads Up Glyphs with Messages
- Civil Message Center: List of Errors, Warnings, Messages
  - Toggle the Heads Up Errors, Warnings, Messages
- Civil Message Center: right-click to Zoom To



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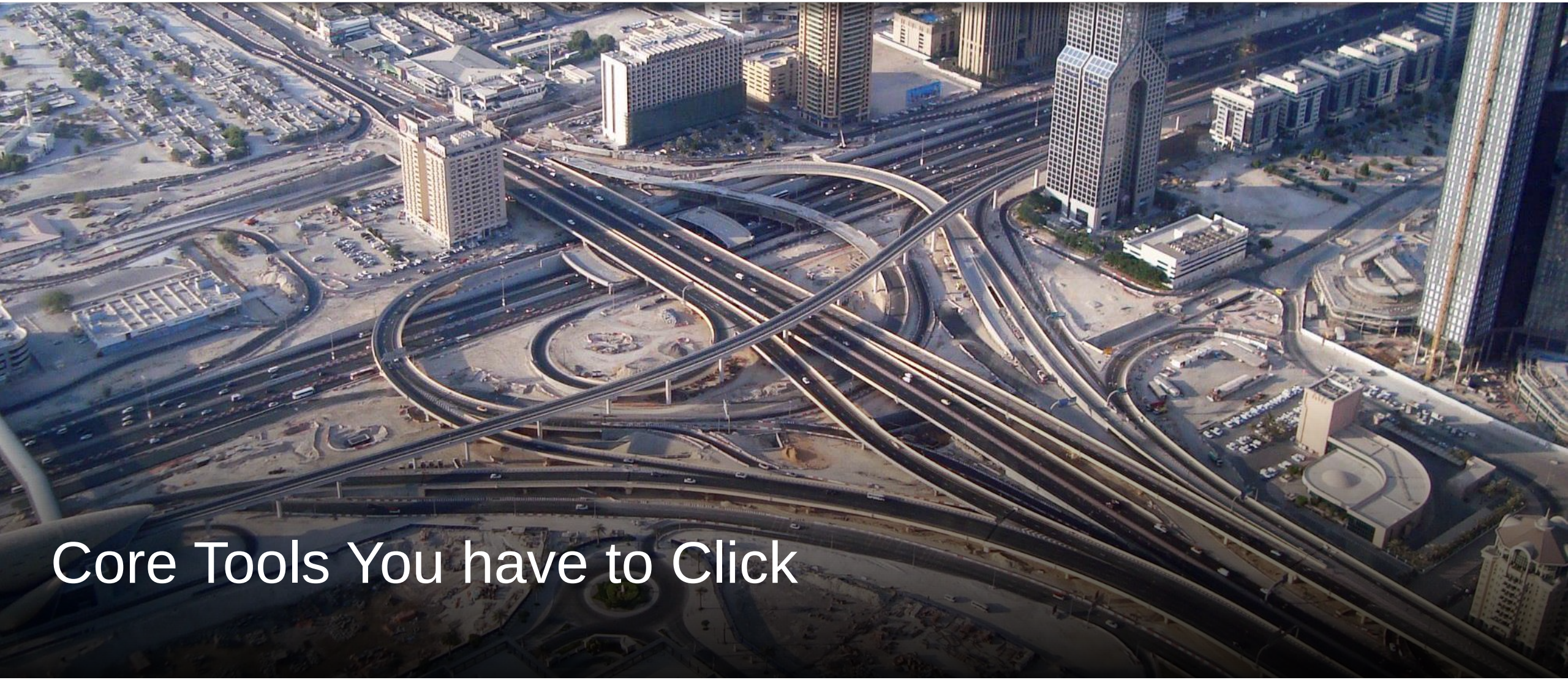

Core Tools You have to Click

Core General Analysis Tools

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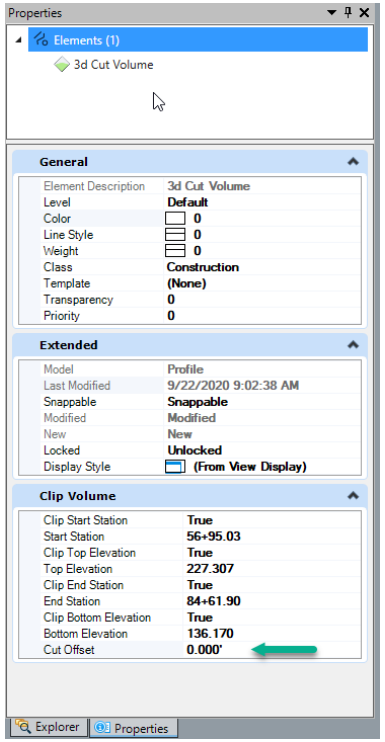
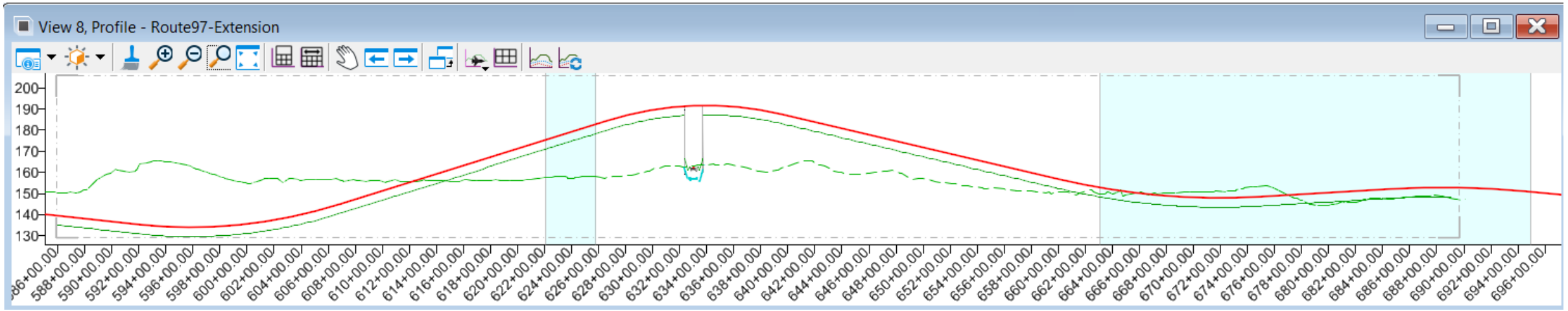
Profile Model

- You can look at a Profile Model of any horizontal element
- A horizontal element “owns” zero or 1 Profile Model
- Profile Models can contain lots of things
- If a Terrain is Active, it shows in the Profile Model Automatically





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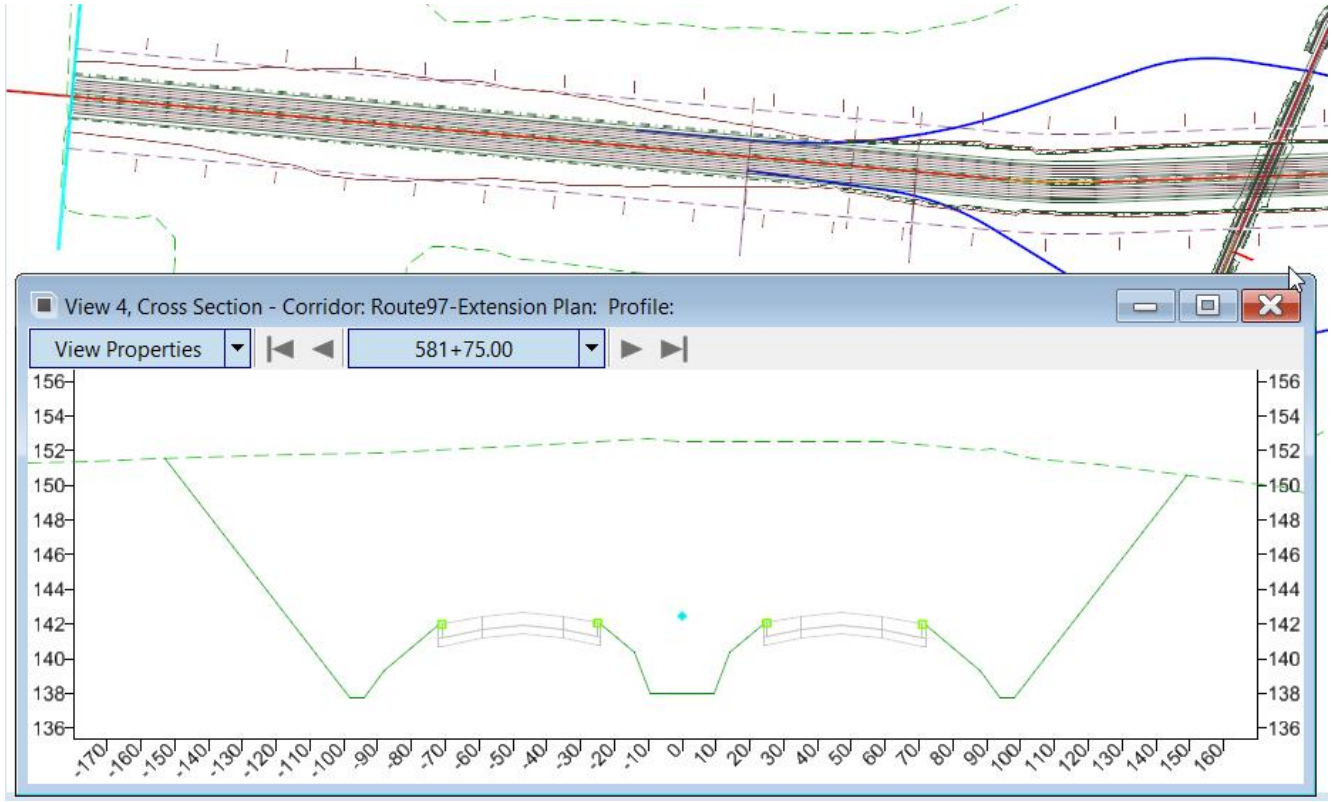
View Cross Section Model

- “Slice through the 3D Model” along an Alignment or Corridor
- If it’s in the 3D Model it’s in the Cross Section
  - Pavement Components
  - Terrain
  - *Any* Component/Volume
  - Utilities
  - Any 3D object



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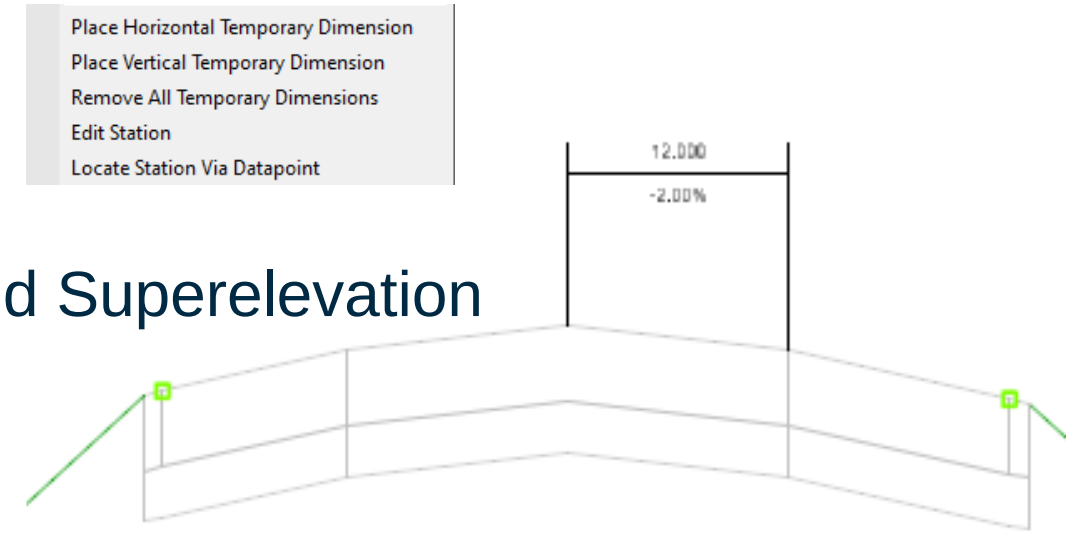
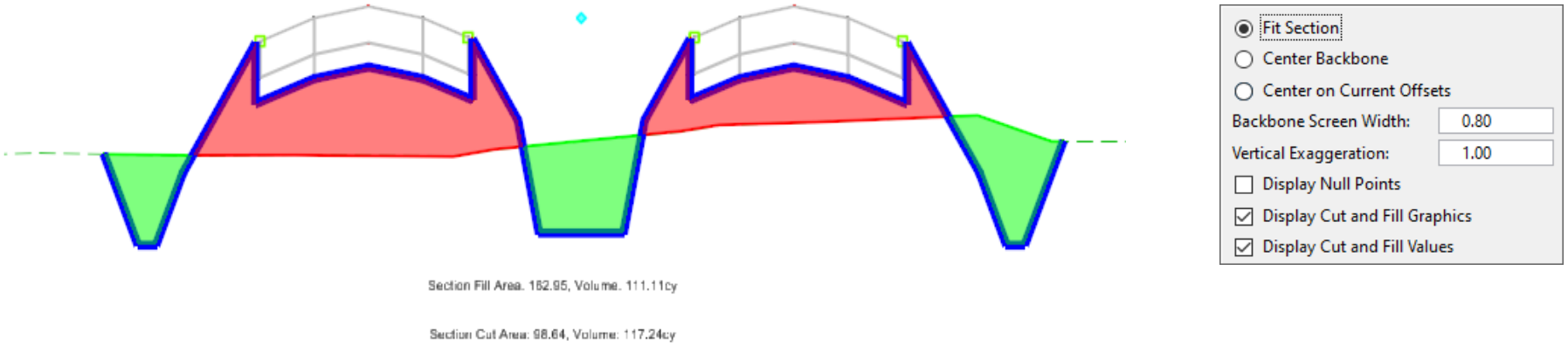
Cross Section View: Dimensions and Cut & Fill Volumes

- Temporary Dimensions:
  - Quick check for slope and width
  - Excellent for checking lane transitions and Superelevation



- Cut and Fill Shapes and Volumes
  - Instant Design Feedback
  - simplified



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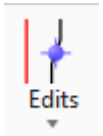
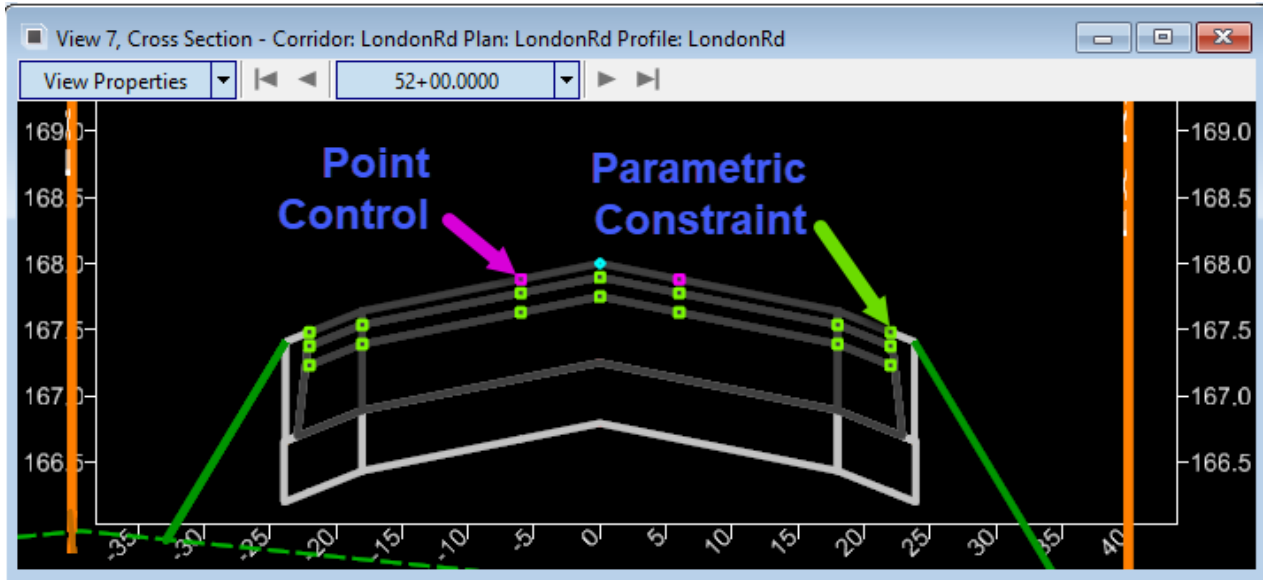
Dynamic Section View

- Parametric Constraints
  - Green Squares show points that are being controlled by a Parametric constraint



- Point Controls
  - Magenta squares show points being controlled by Point controls



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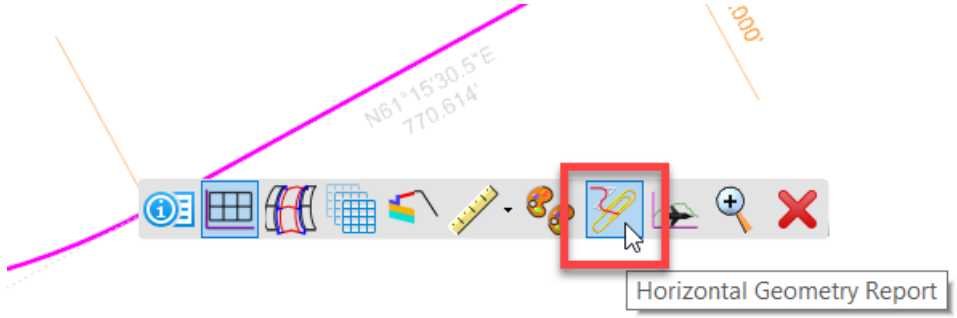
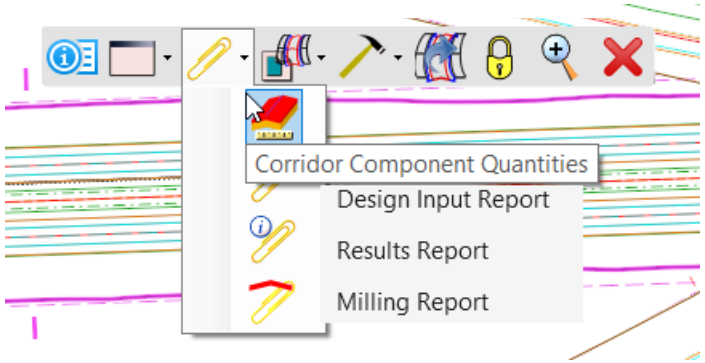
Reports

We’ve shown that Reports can be called from Context Menus

- These are “Quick Reports” with default settings

- Full Reports are in the Ribbons
  - more customizability





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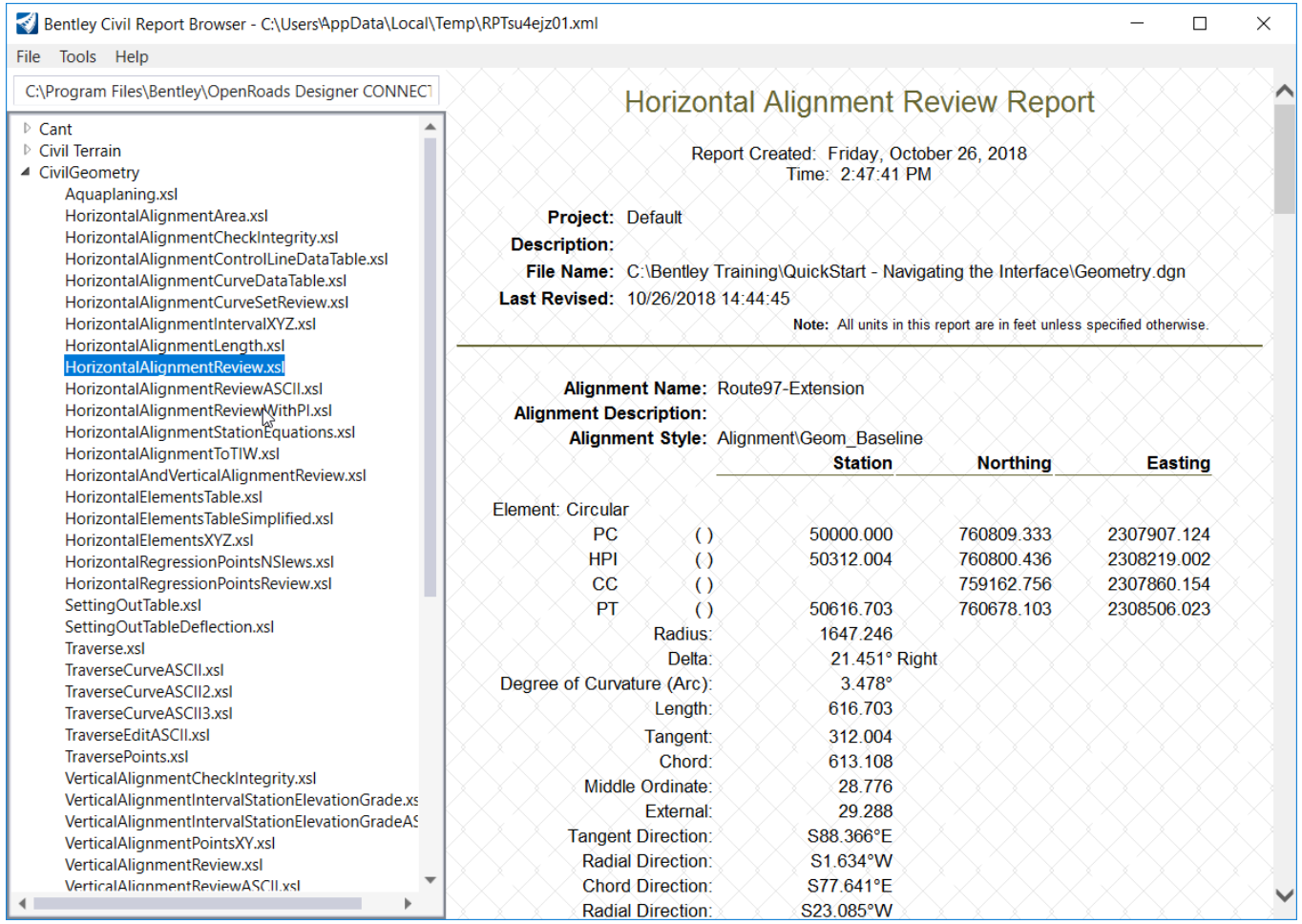
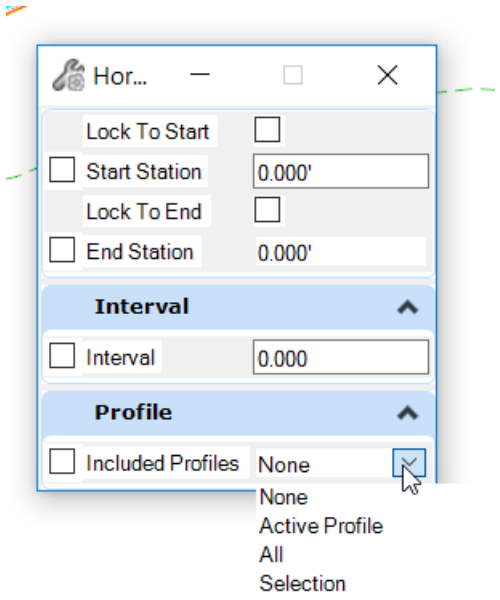
Reports

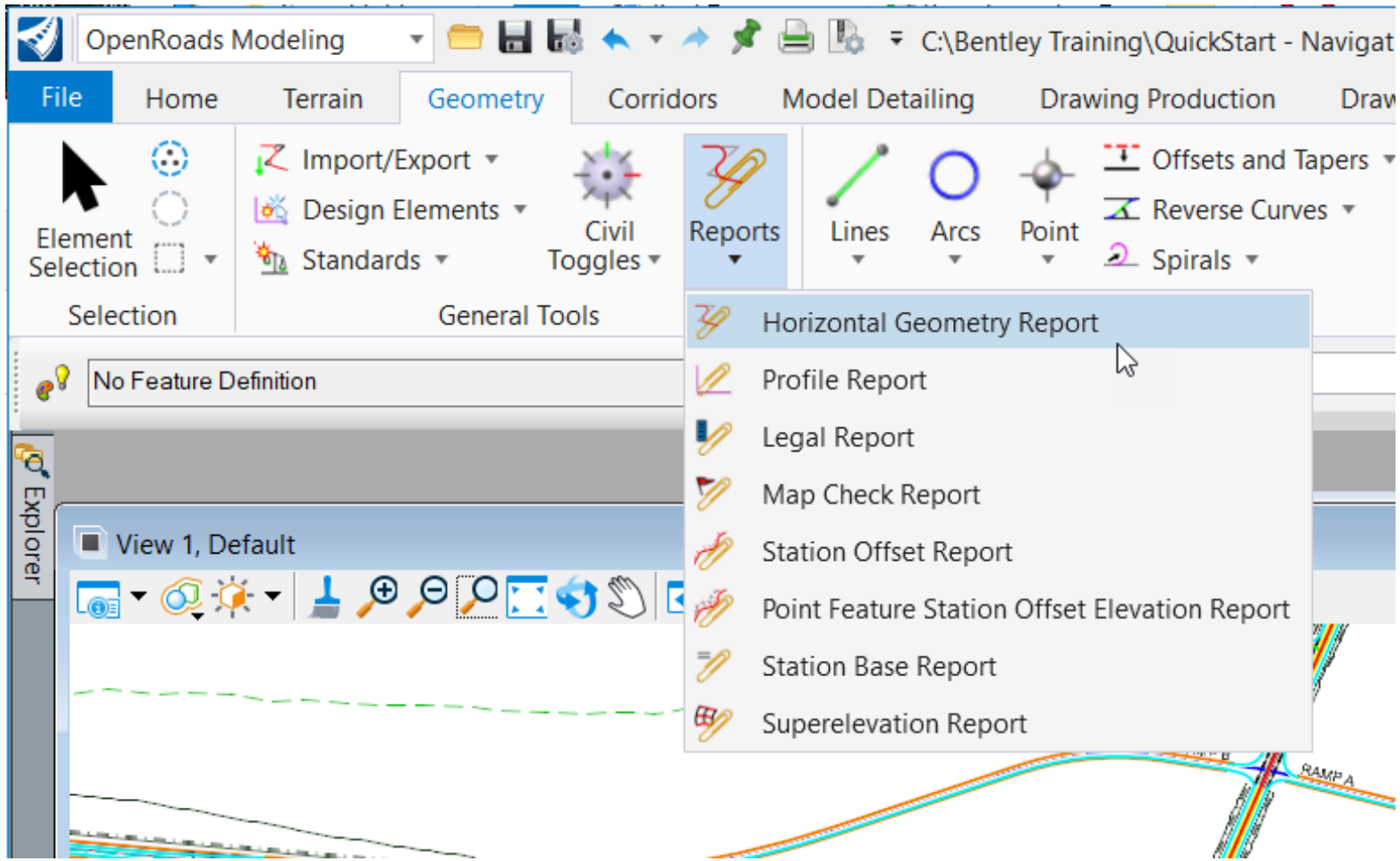
Data → XML Report
Bentley Civil Report Browser allows you to select the Stylesheet and Provide Format Settings



Geometry Reports

- Fully customizable Reports are available from the Ribbon





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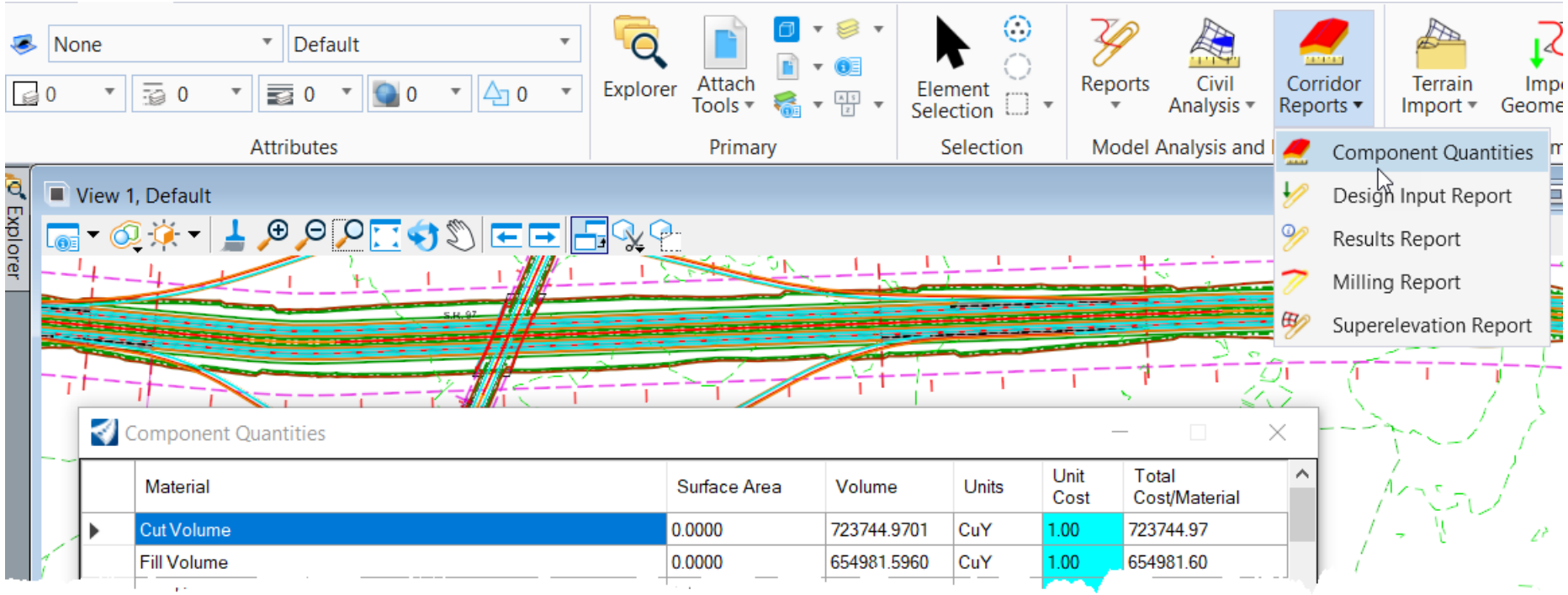
Corridor Reports

- Customizable Reports are available from the Ribbon



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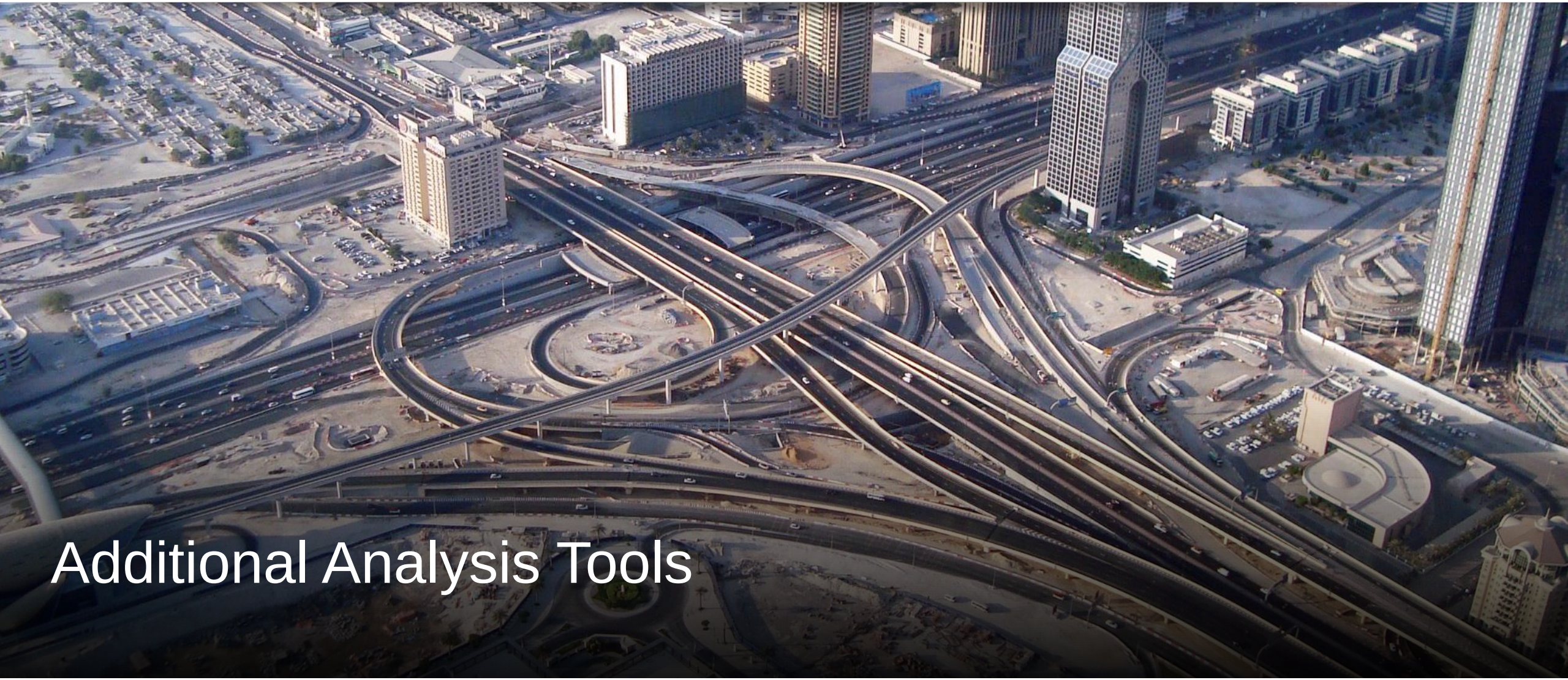

Additional Analysis Tools

“Simple” General Analysis Tools

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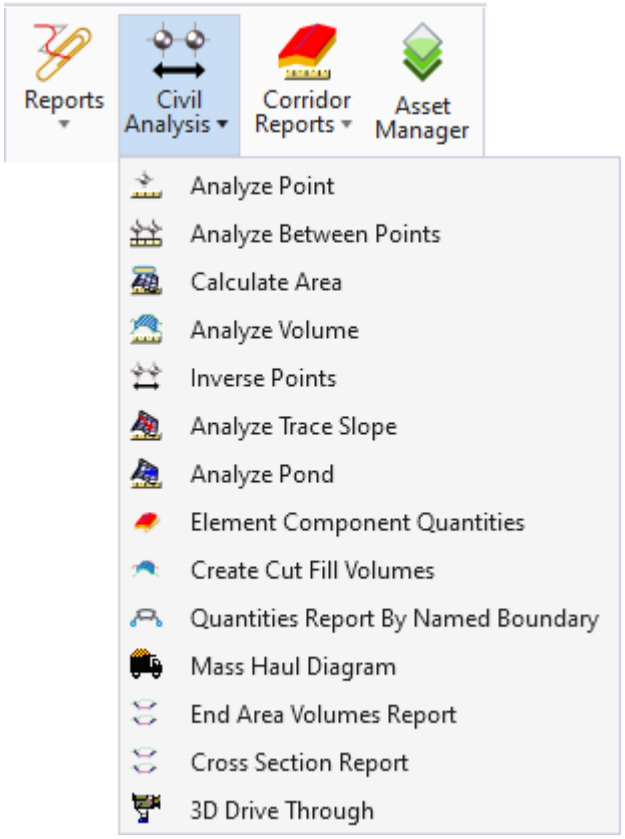
Home Tab – Model Analysis and Reporting – Civil Analysis

We'll hit the tools in a different sequence (other Ribbons)



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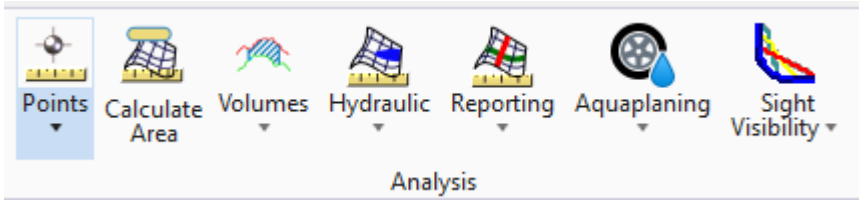
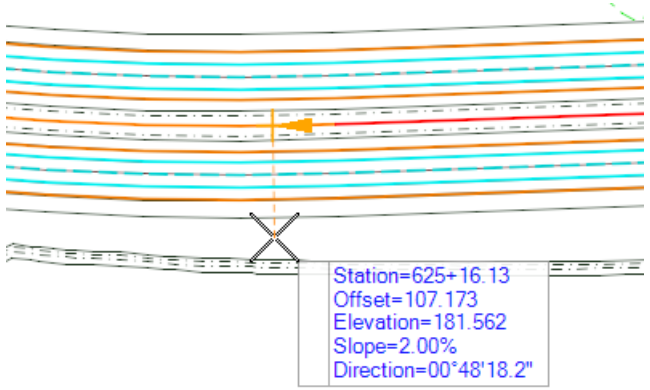
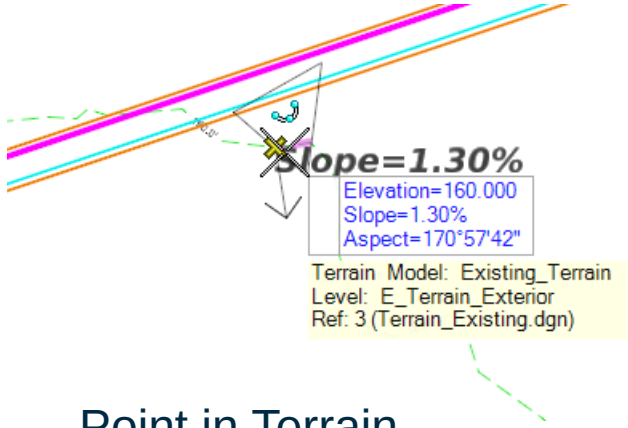
Terrain Tab – Analysis



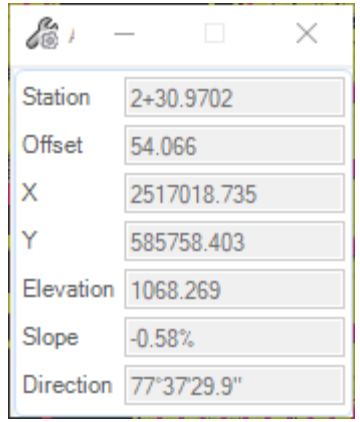
Analyze Point



Point along Geometry



Point in Terrain



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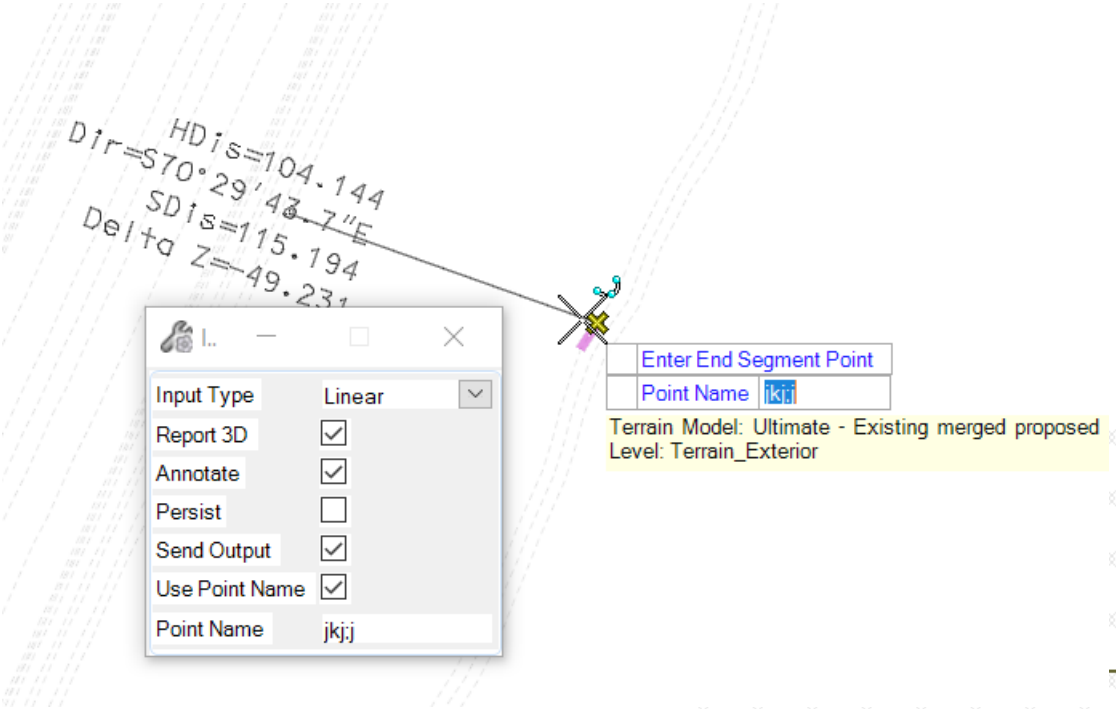
Inverse Points

2D or 3D Model

Linear, Radial, Arc, By Element

Options to

- Annotate
- “Persist”
- Report…



Inverse Report

Report Created: Monday, October 29, 2018
Time: 10:33:40 AM

Current Geographic System:

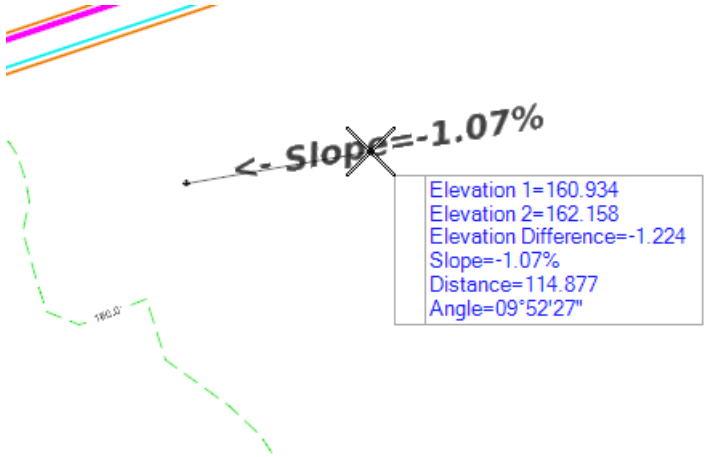
Inverse Elements

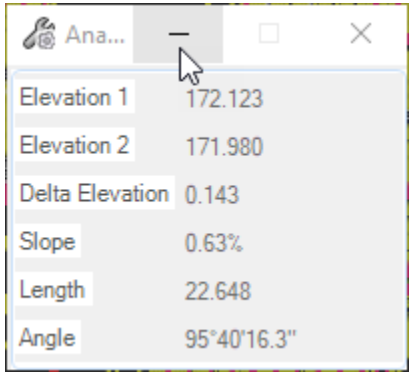
INVERSE LINEAR

Direction	Distance	Northing	Easting	Elevation
S6.663°W	210.476	586959.003	2517492.261	1054.967
		586749.949	2517467.840	0.000
SDIS =	1075.758			
DeltaZ =	1054.967			
N68.329°E	54.661	586749.949	2517467.840	0.000
		586770.134	2517518.637	1105.950
SDIS =	1107.300			
DeltaZ =	-1105.950			

Accumulated Distance = 265.137

Analyze Between Points





Terrain Slope

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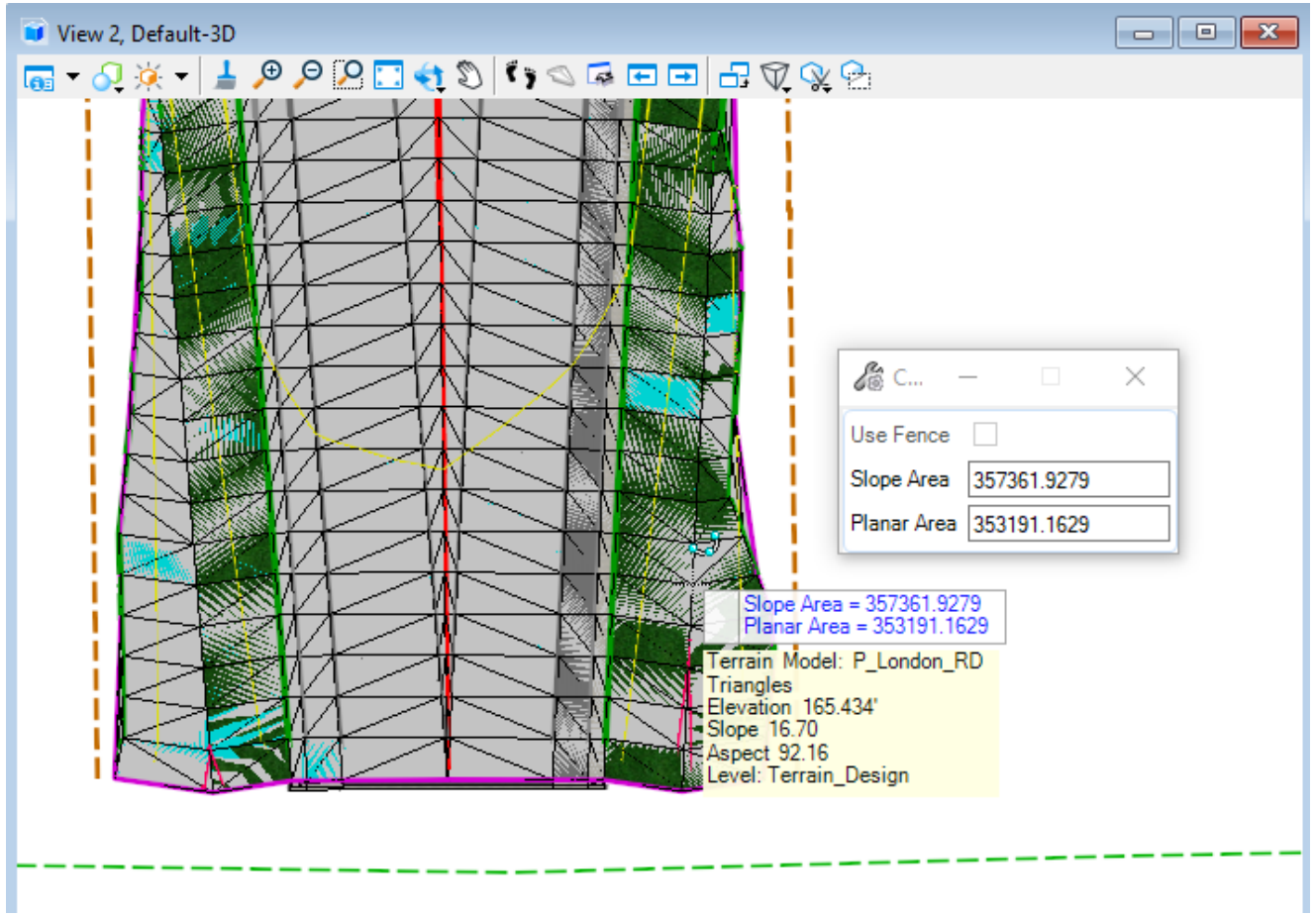
Calculate Area

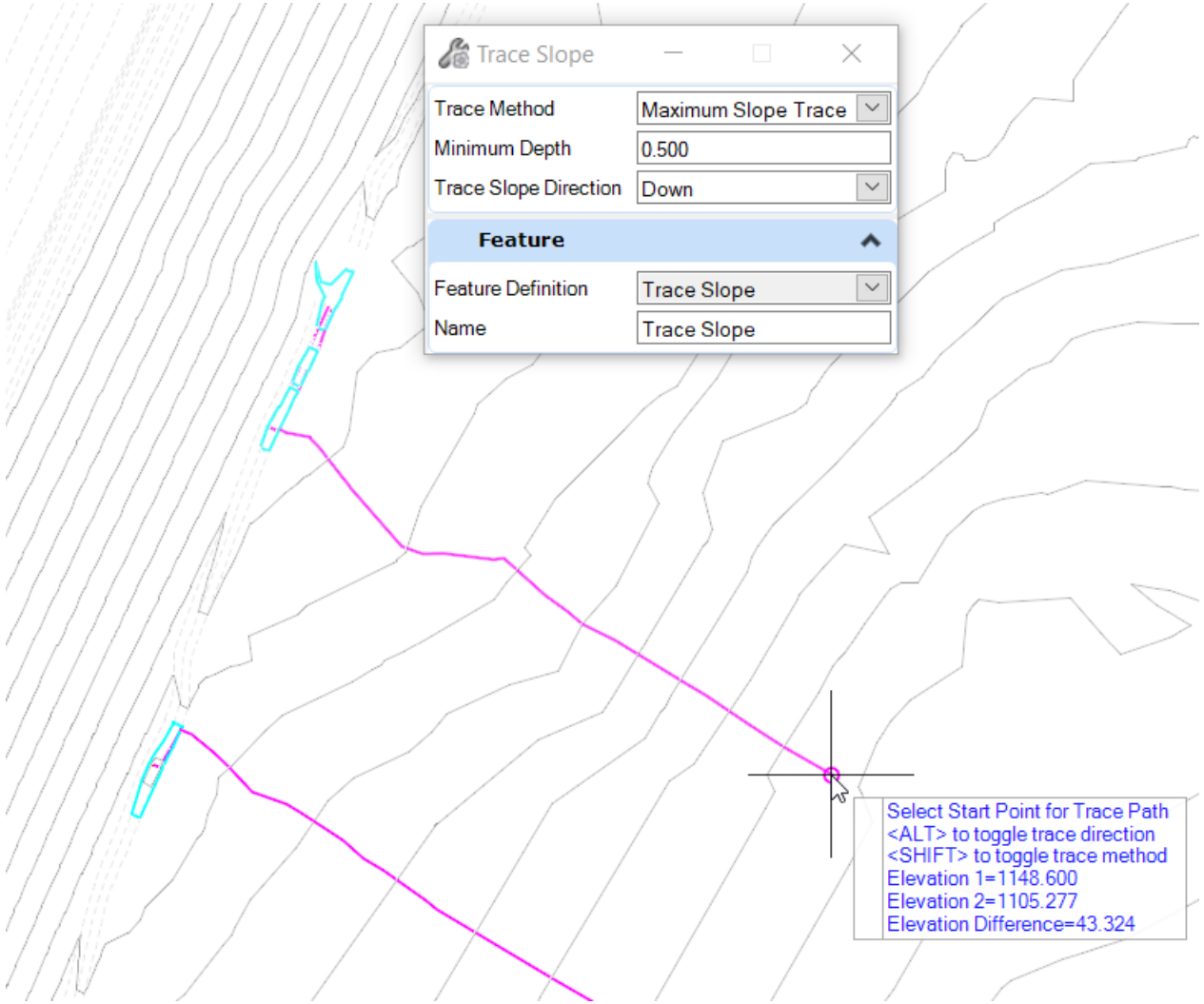
- Allows you to calculate the area of a terrain
  - Can use a Fence
    - Slope Area
    - Planar Area



Analyze Trace Slope

Maximum Slope:

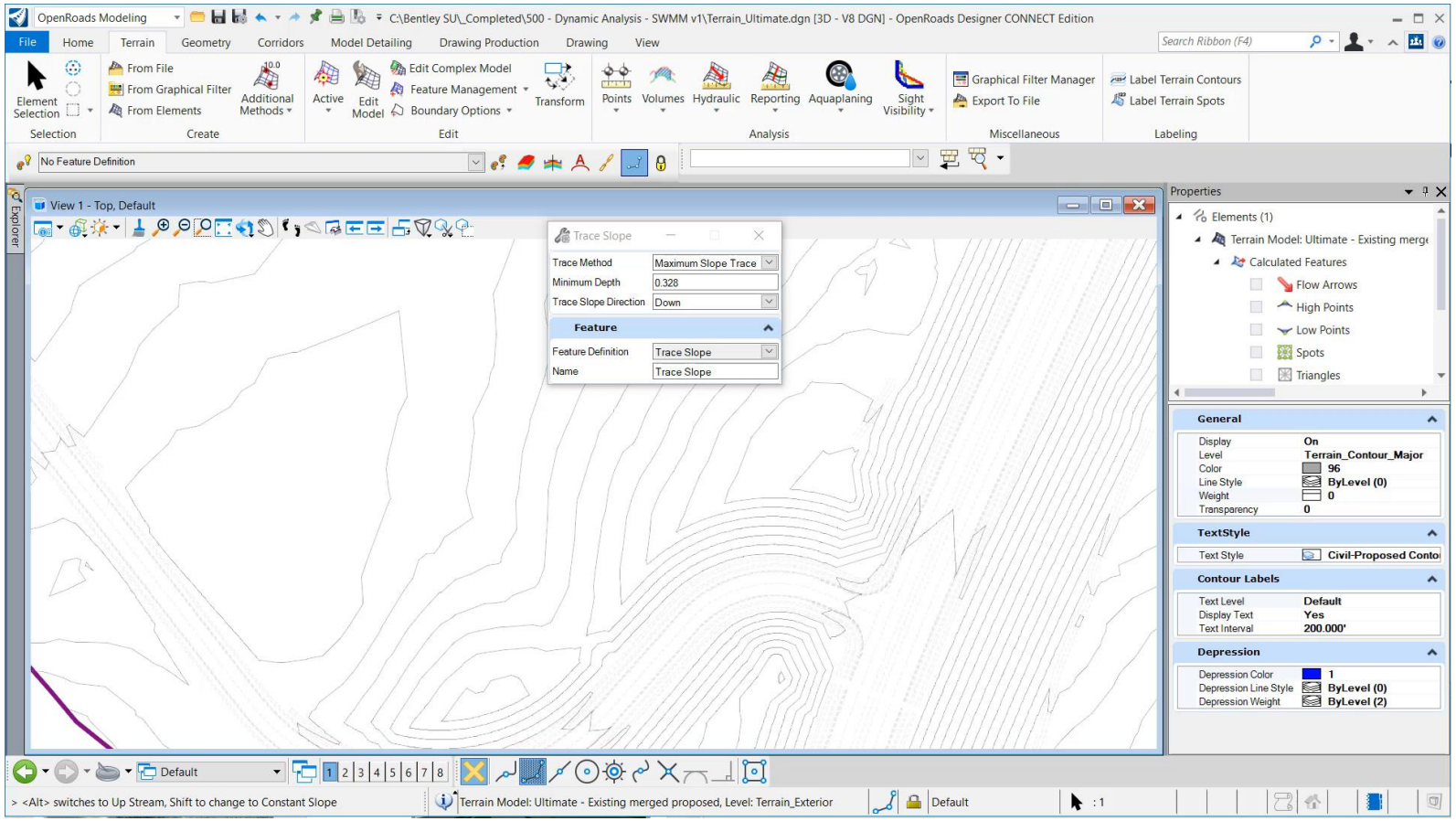
- if you were a raindrop, where would you go?
- InRoads “Trickle”



Analyze Trace Slope (video)

Maximum Slope:

- if you were a raindrop, where would you go?



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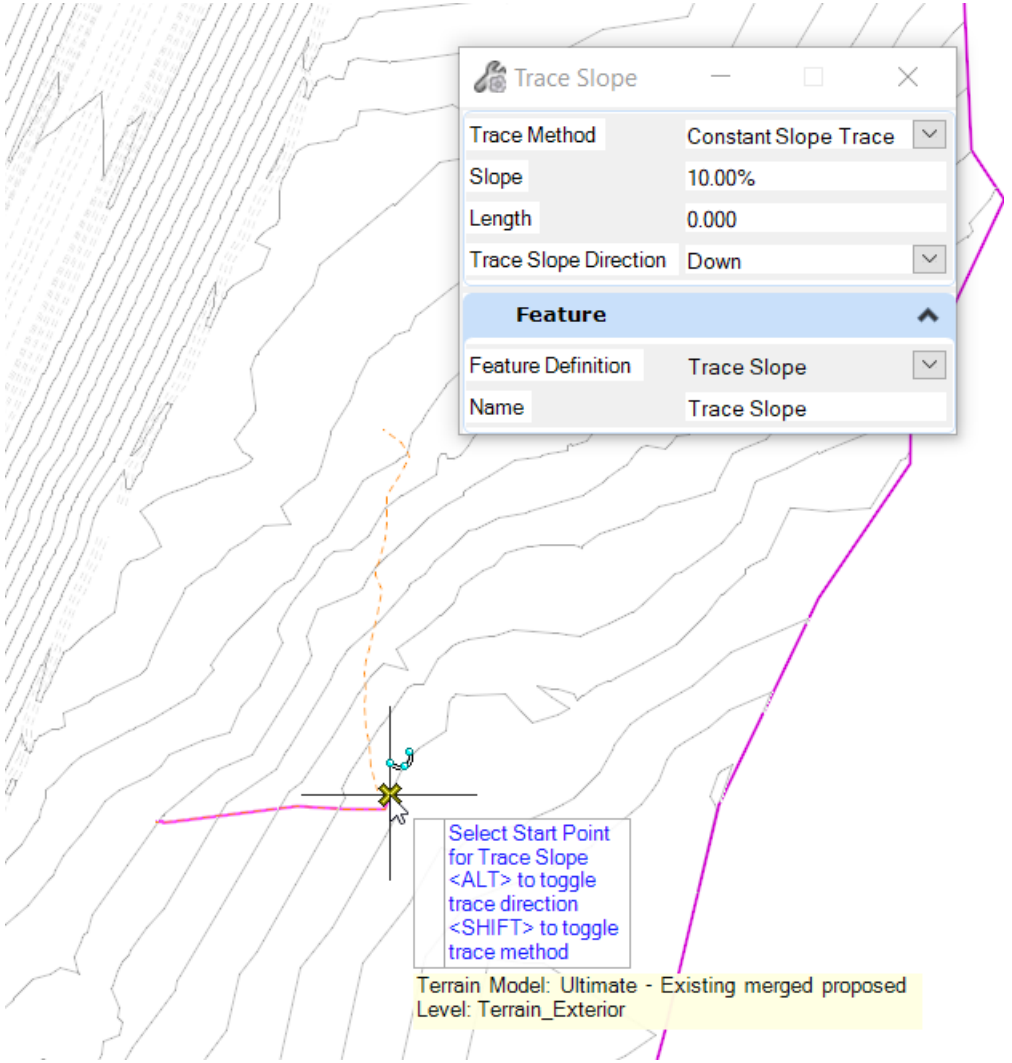
Analyze Trace Slope

Constant Slope:

- draws a constant slope line (for ditches, access roads, etc.)
- If slope is less than the Maximum, then there are 2 paths – you pick



There are two paths down from this high point at 10%

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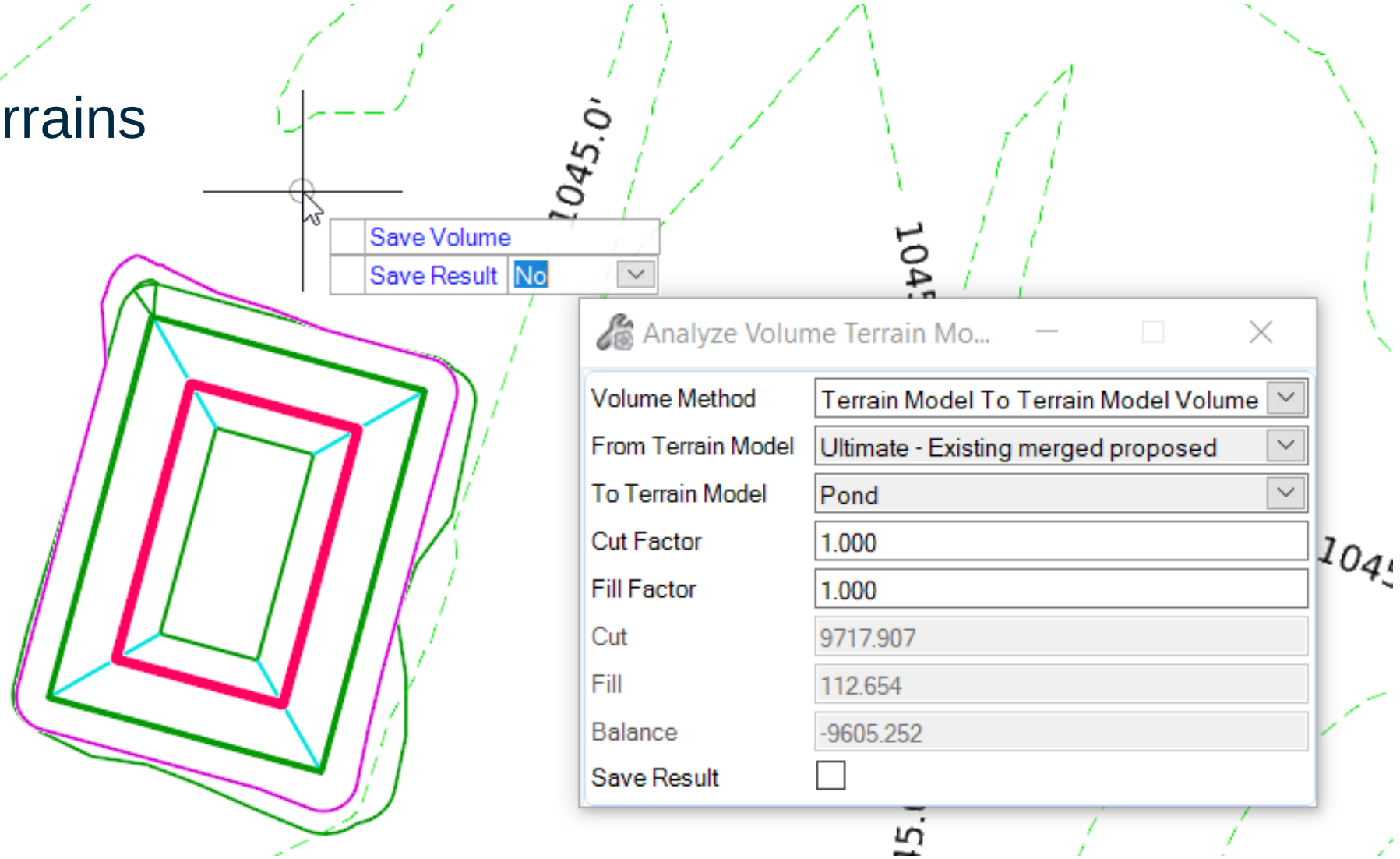
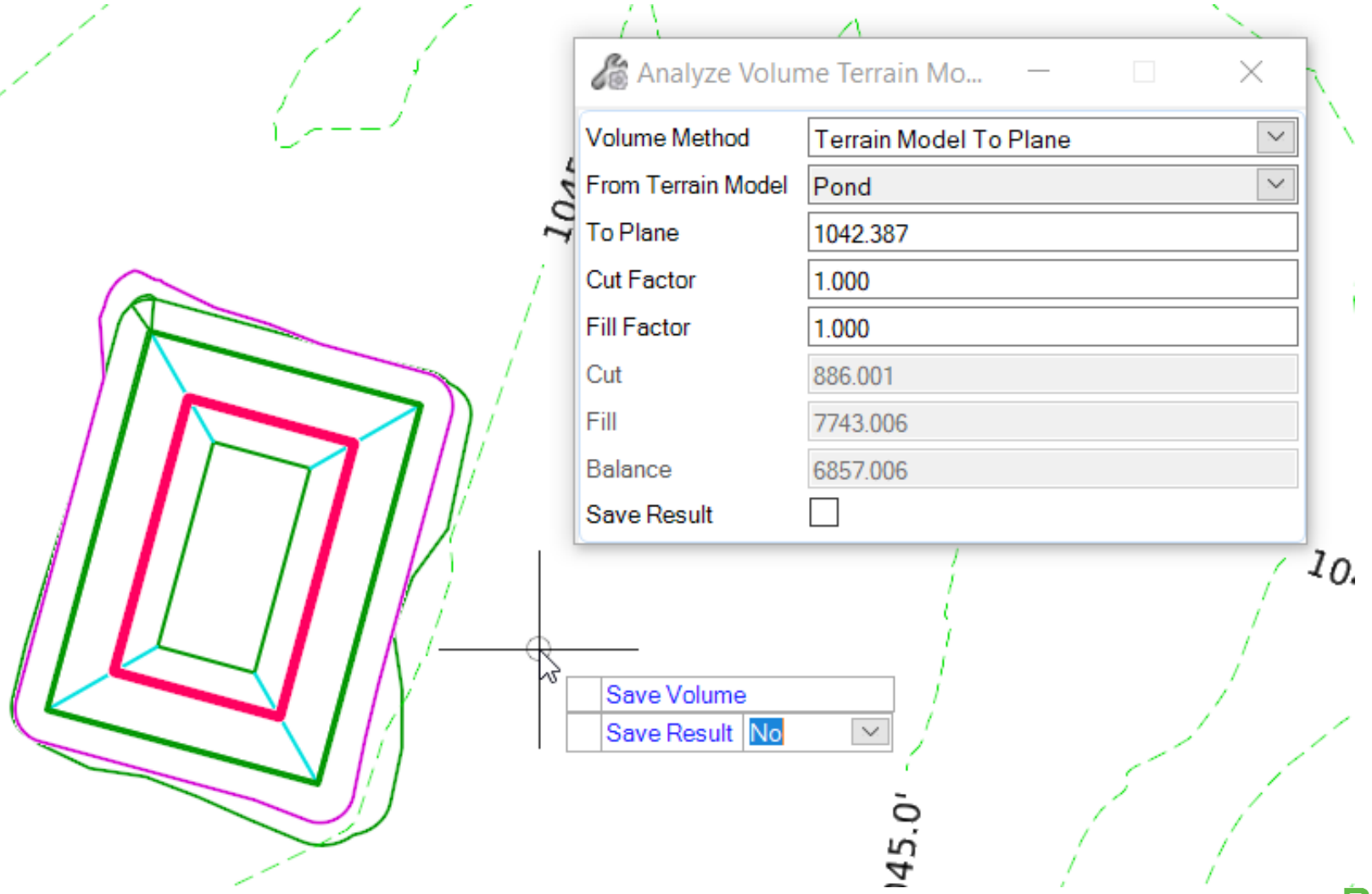
Analyze Volume

- Between Two Terrains



Analyze Volume

- Between Terrain and a Plane



- (for Ponds, use *Analyze Pond*)

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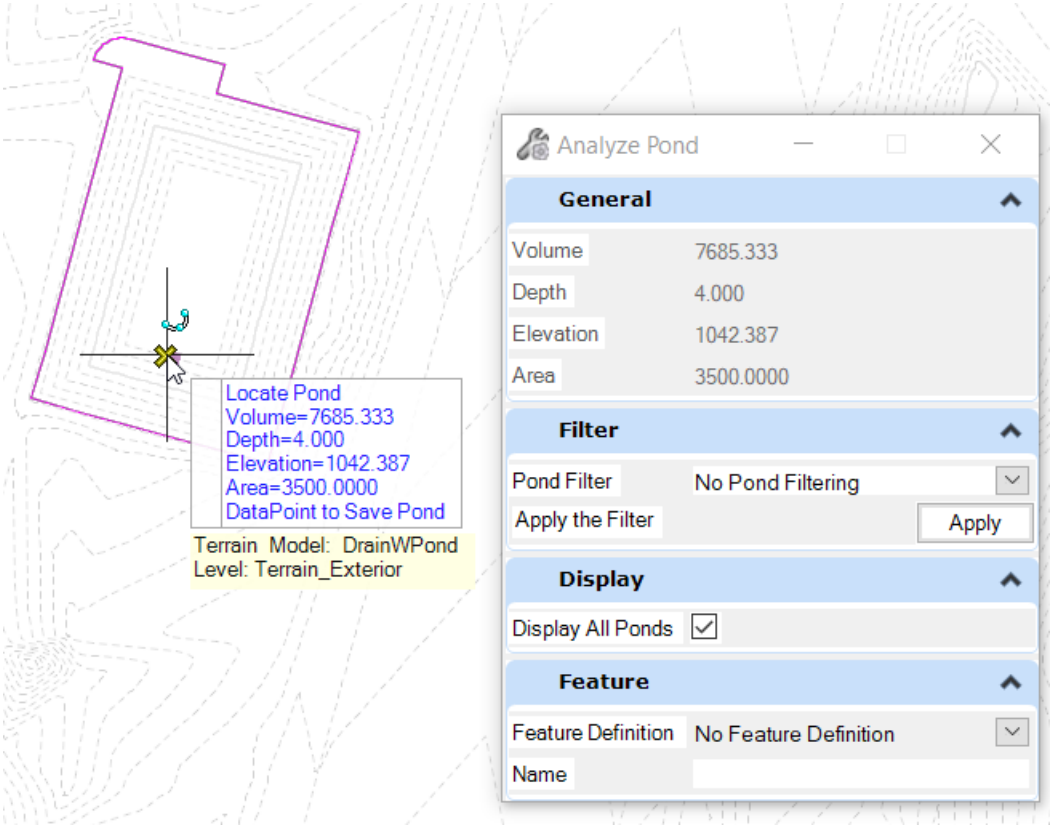
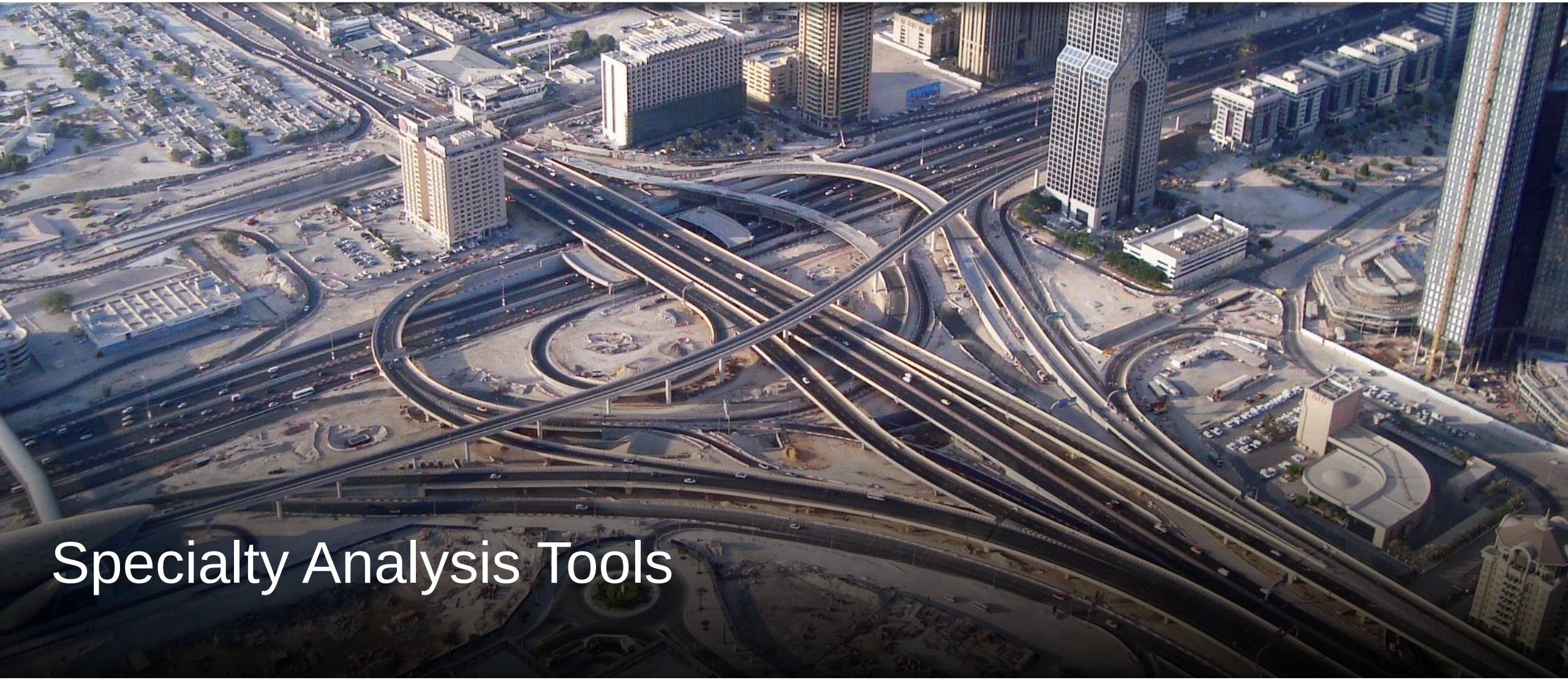
Analyze Pond

Click in a depression to get its

- Volume
- Elevation (top)
- Area (top)
- Depth
- <D> to label it





Specialty Analysis Tools

Really Cool Analysis Tools ("specialized")

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Advancing Infrastructure

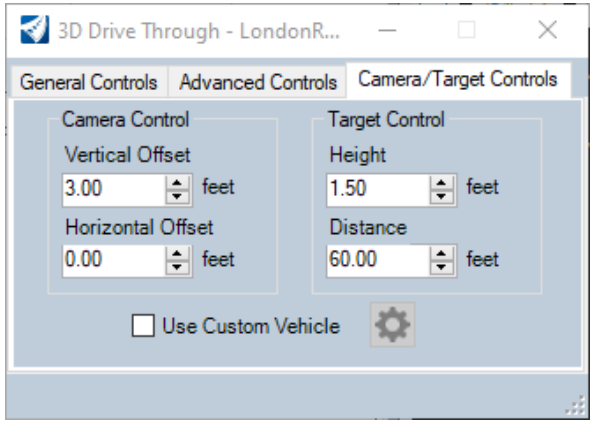
Civil Analysis

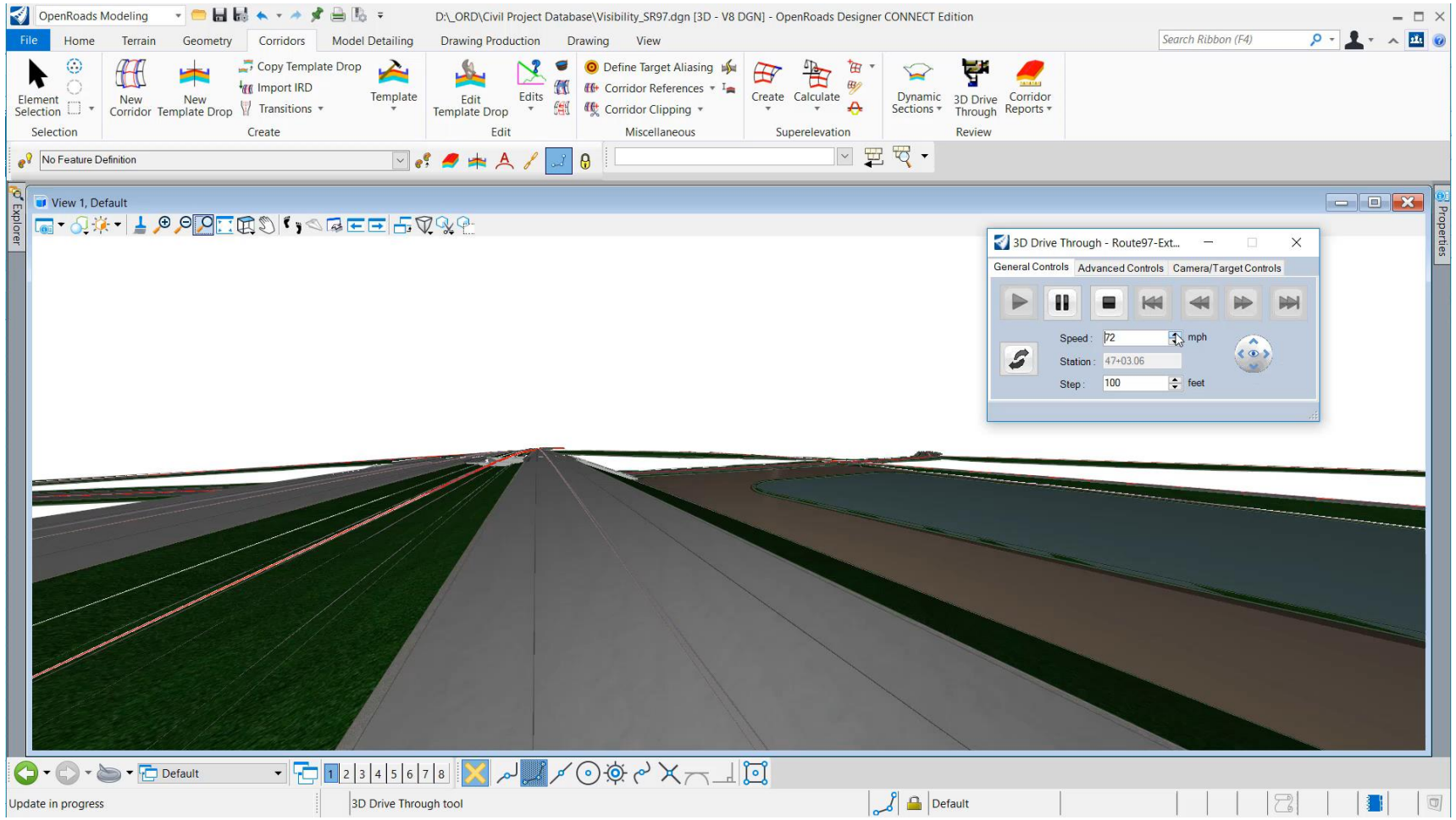
3D Drive Through

This one is pretty easy:
Given

- a 3D line and
- a 3D model,

you can drive through it.





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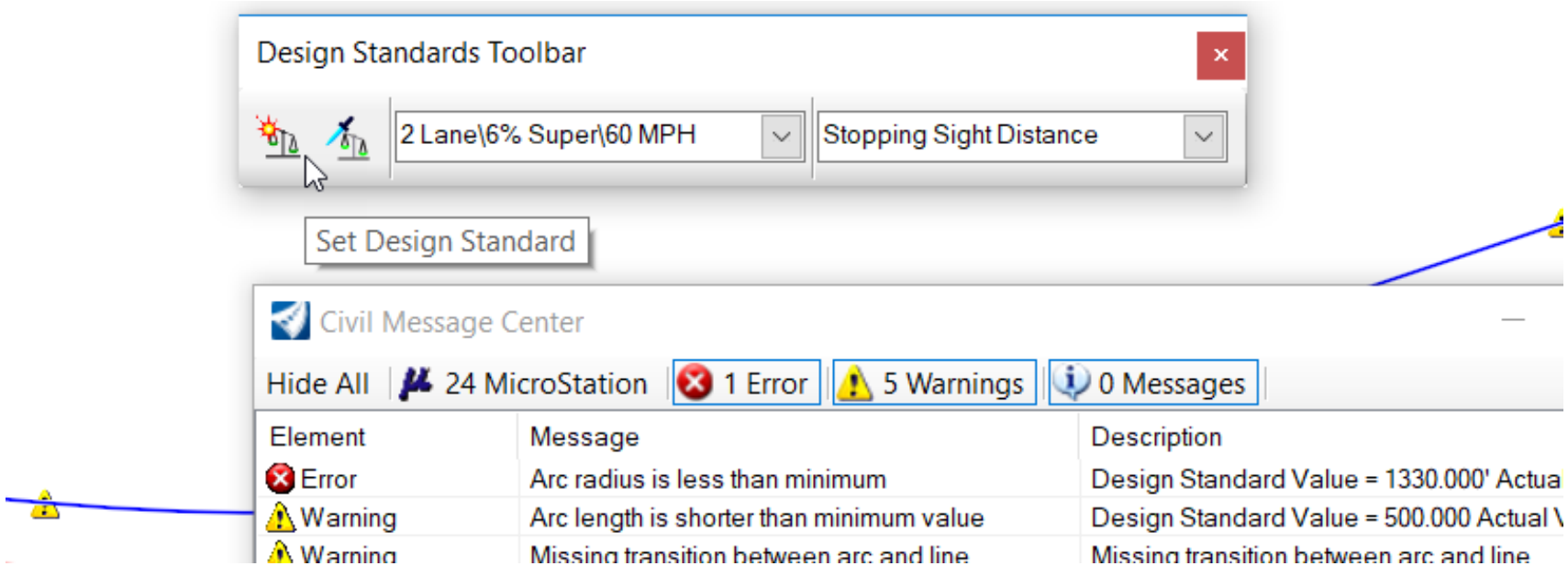
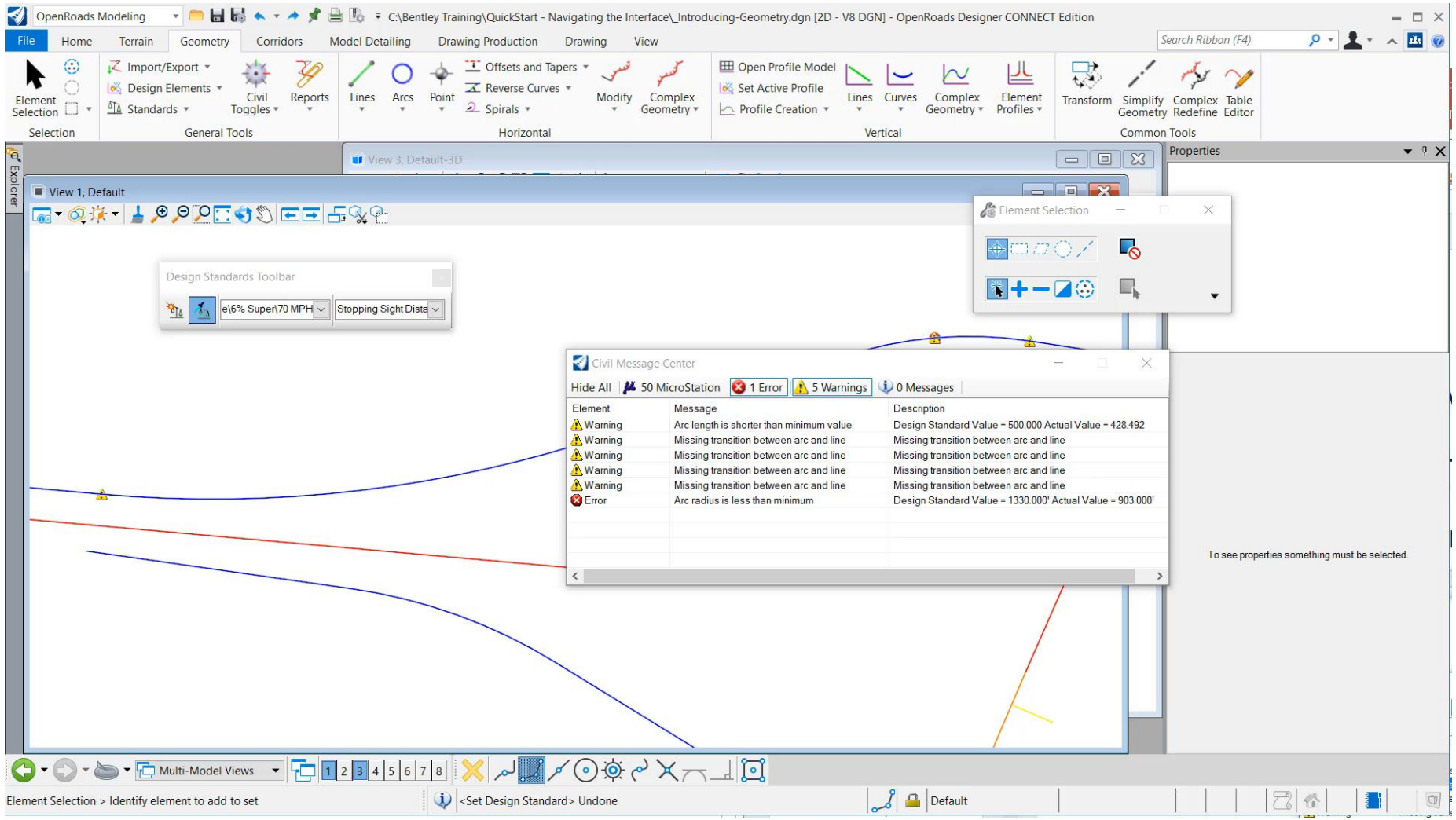
Geometric Design Standards

Civil Message Center analyzes compliance when a Standard has been assigned to Geometry.

- Assigned during layout or at any time



Geometric Design Standards (video)



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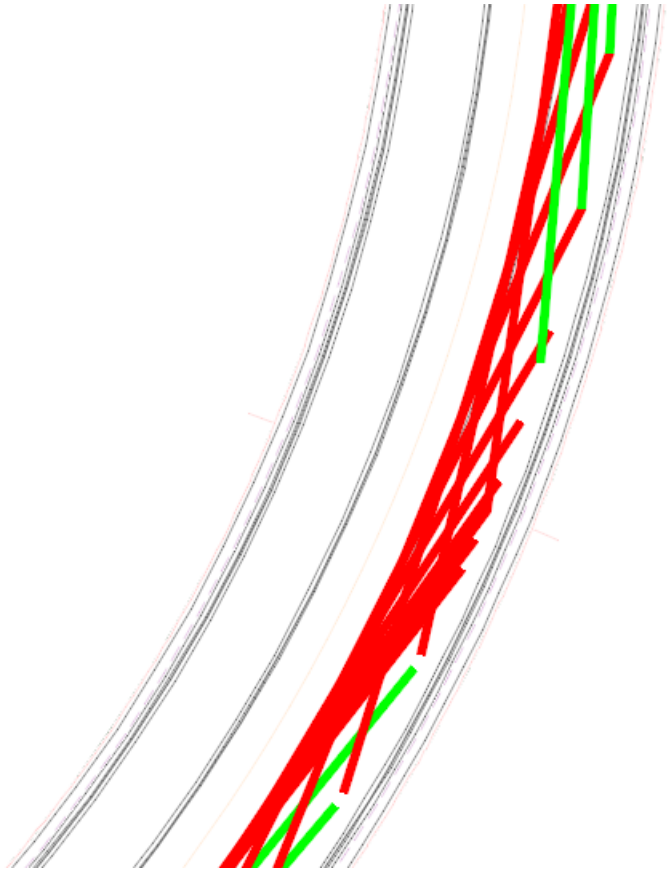
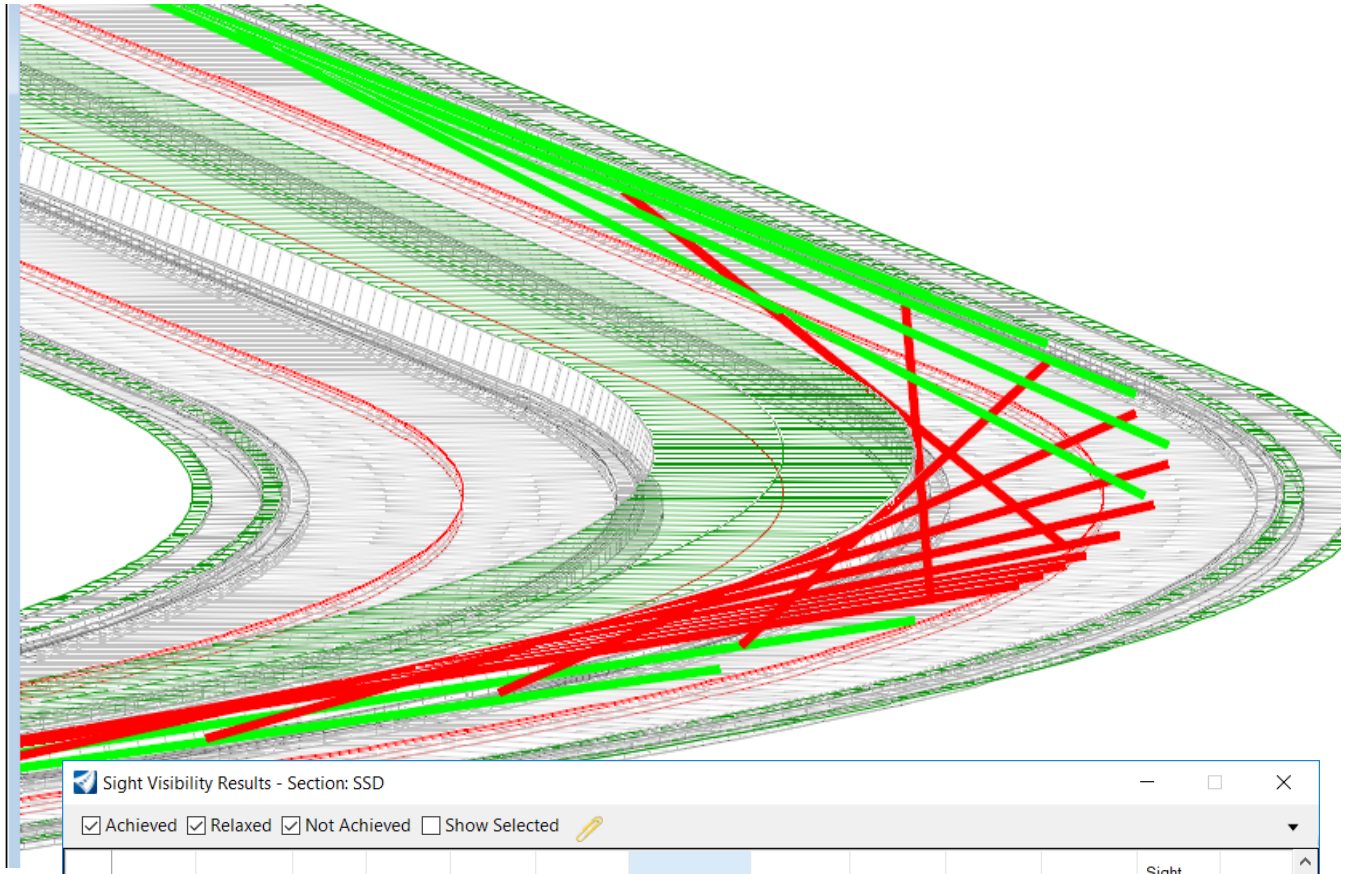
Sight Visibility





Sight Visibility Results - Section: SSD

Achieved | Relaxed | Not Achieved | Show Selected

Eye Position	Object Position	Eye Level	Actual Level	Object Level	Design Speed	Instantaneous Grade	Average Grade	Sight Distance Required	Sight Distance Relaxed	Sight Distance Achieved	Sight Distance Along Sight Line Achieved	Sight Line Status
4+00.0000	7+00.0000	142.135	141.404	141.404	55.000	0.00%	0.00%	495.000	495.000	300.000	311.647	Not Ac...
4+50.0000	7+50.0000	142.263	141.532	141.532	55.000	0.00%	0.00%	495.000	495.000	300.000	311.729	Not Ac...
5+00.0000	8+00.0000	142.391	141.661	141.661	55.000	0.00%	0.00%	495.000	495.000	300.000	311.729	Not Ac...
5+50.0000	8+60.0000	142.520	141.814	141.814	55.000	0.00%	0.00%	495.000	495.000	310.000	319.762	Not Ac...
6+00.0000	9+80.0000	142.648	142.122	142.122	55.000	0.00%	0.00%	495.000	495.000	380.000	387.833	Not Ac...
6+50.0000	11+45.0000	142.776	142.545	142.545	55.000	0.00%	0.00%	495.000	495.000	495.000	501.420	Achiev...
7+00.0000	11+95.0000	142.904	142.673	142.673	55.000	0.00%	0.00%	495.000	495.000	495.000	499.836	Achiev...
7+50.0000	12+45.0000	143.032	142.802	142.802	55.000	0.00%	0.00%	495.000	495.000	495.000	497.744	Achiev...

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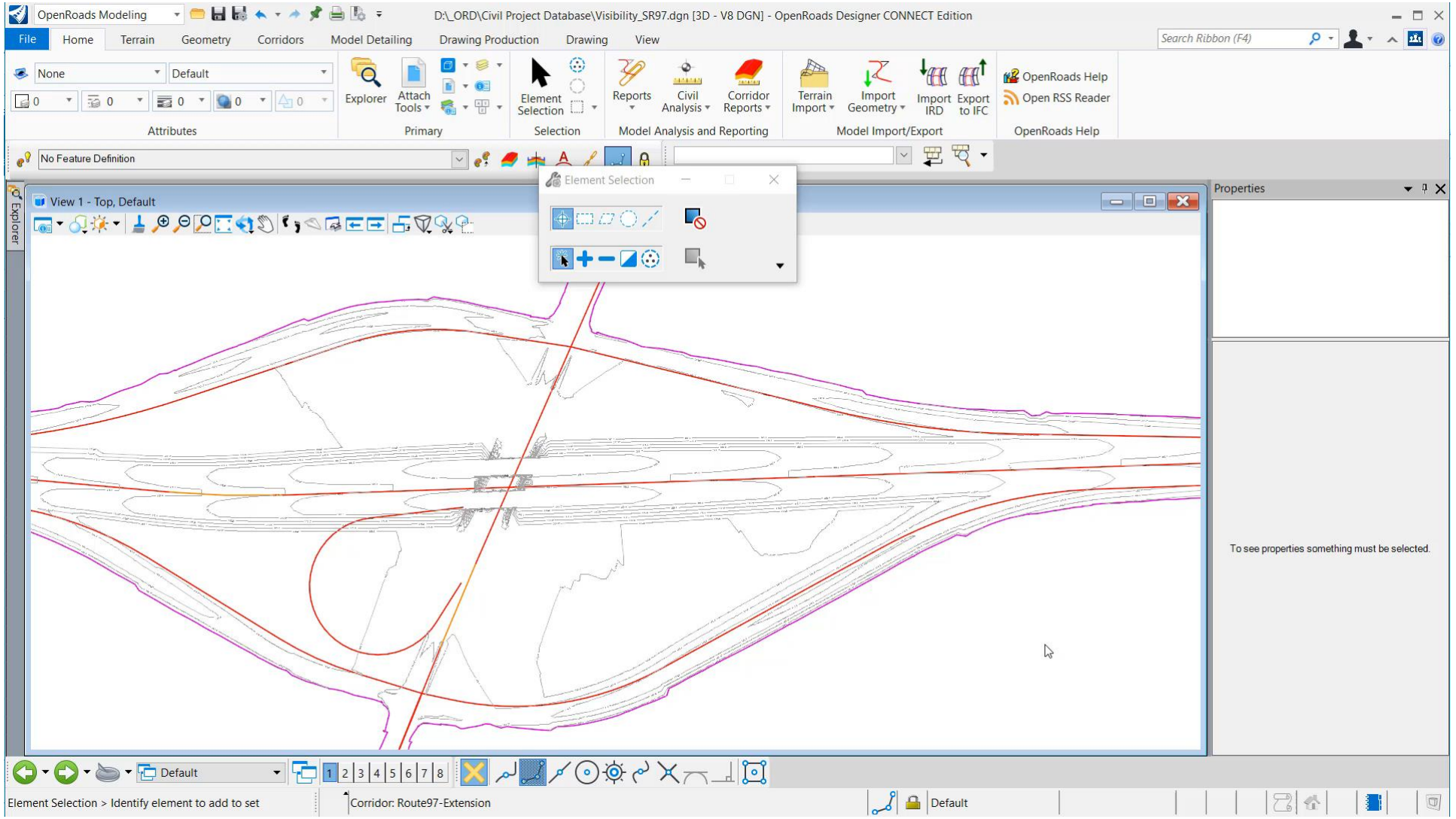
Sight Visibility

- As opposed to 3D Drive Through, this is a “*Quality* Process”: comprehensive, precise checks with clear tabular output.

Sight Visibility (video) - Divided highway overpass



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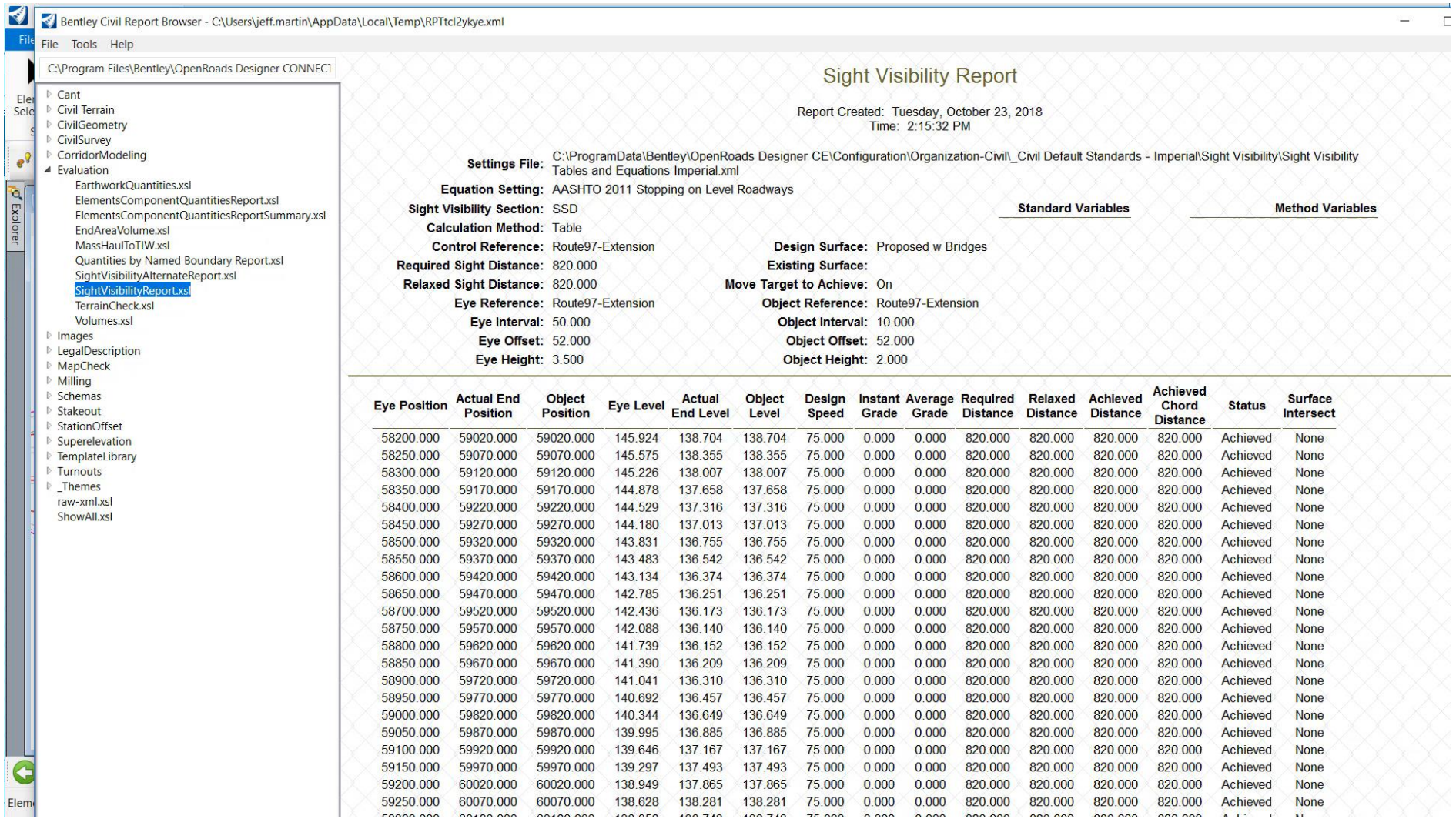
Sight Visibility (video) – paved to barrier



Eye Position	Actual End Position	Object Position	Eye Level	Actual End Level	Object Level	Design Speed	Instant Grade	Average Grade	Required Distance	Relaxed Distance	Achieved Distance	Achieved Chord Distance	Status	Surface Intersect
58200.000	59020.000	59020.000	145.924	138.704	138.704	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58250.000	59070.000	59070.000	145.575	138.355	138.355	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58300.000	59120.000	59120.000	145.226	138.007	138.007	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58350.000	59170.000	59170.000	144.878	137.658	137.658	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58400.000	59220.000	59220.000	144.529	137.316	137.316	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58450.000	59270.000	59270.000	144.180	137.013	137.013	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58500.000	59320.000	59320.000	143.831	136.755	136.755	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58550.000	59370.000	59370.000	143.483	136.542	136.542	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58600.000	59420.000	59420.000	143.134	136.374	136.374	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58650.000	59470.000	59470.000	142.785	136.251	136.251	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58700.000	59520.000	59520.000	142.436	136.173	136.173	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58750.000	59570.000	59570.000	142.088	136.140	136.140	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58800.000	59620.000	59620.000	141.739	136.152	136.152	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58850.000	59670.000	59670.000	141.390	136.209	136.209	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58900.000	59720.000	59720.000	141.041	136.310	136.310	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
58950.000	59770.000	59770.000	140.692	136.457	136.457	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59000.000	59820.000	59820.000	140.344	136.649	136.649	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59050.000	59870.000	59870.000	139.995	136.885	136.885	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59100.000	59920.000	59920.000	139.646	137.167	137.167	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59150.000	59970.000	59970.000	139.297	137.493	137.493	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59200.000	60020.000	60020.000	138.949	137.865	137.865	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None
59250.000	60070.000	60070.000	138.628	138.281	138.281	75.000	0.000	0.000	820.000	820.000	820.000	820.000	Achieved	None

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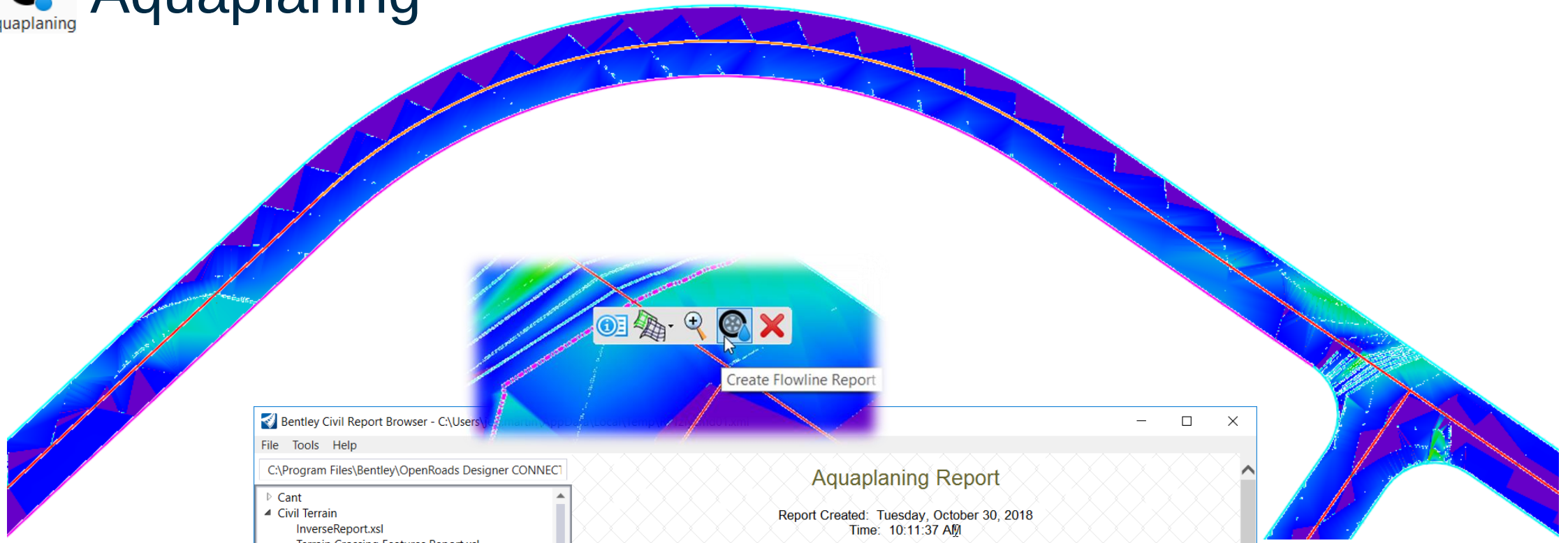
Aquaplaning



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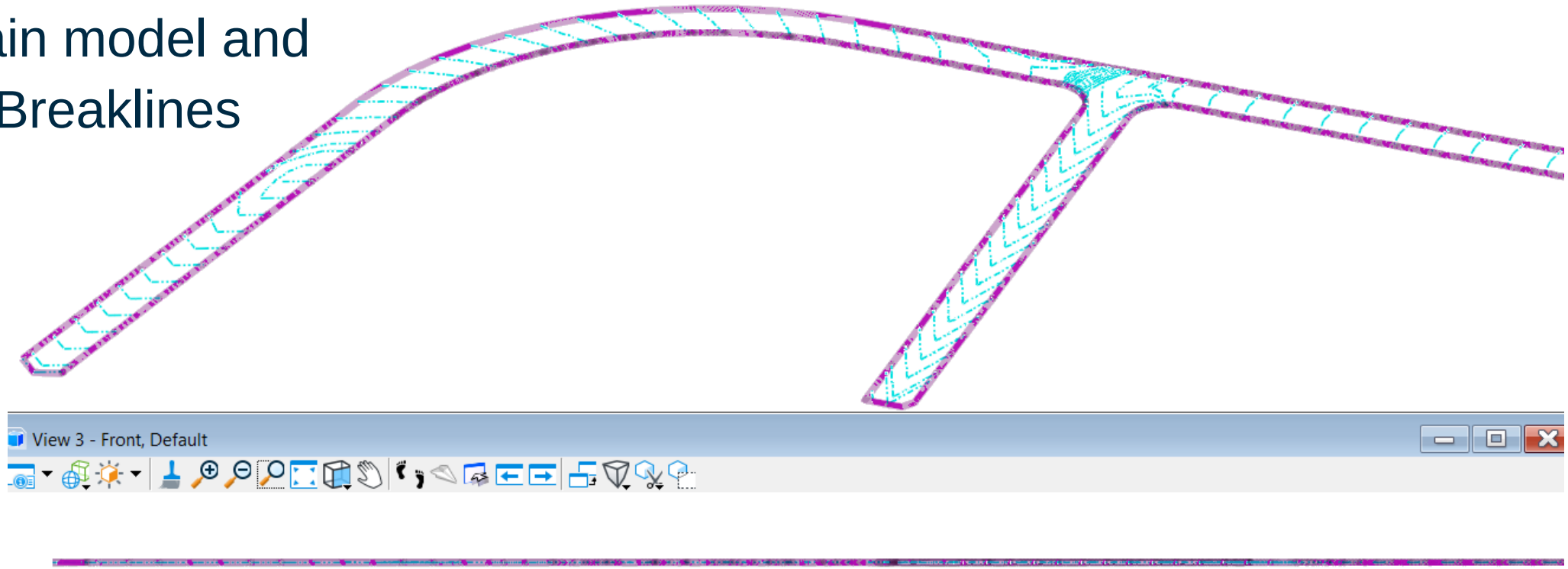
Aquaplaning

The result of an Aquaplaning Analysis is

- a Delta terrain model and
- flow lines = Breaklines

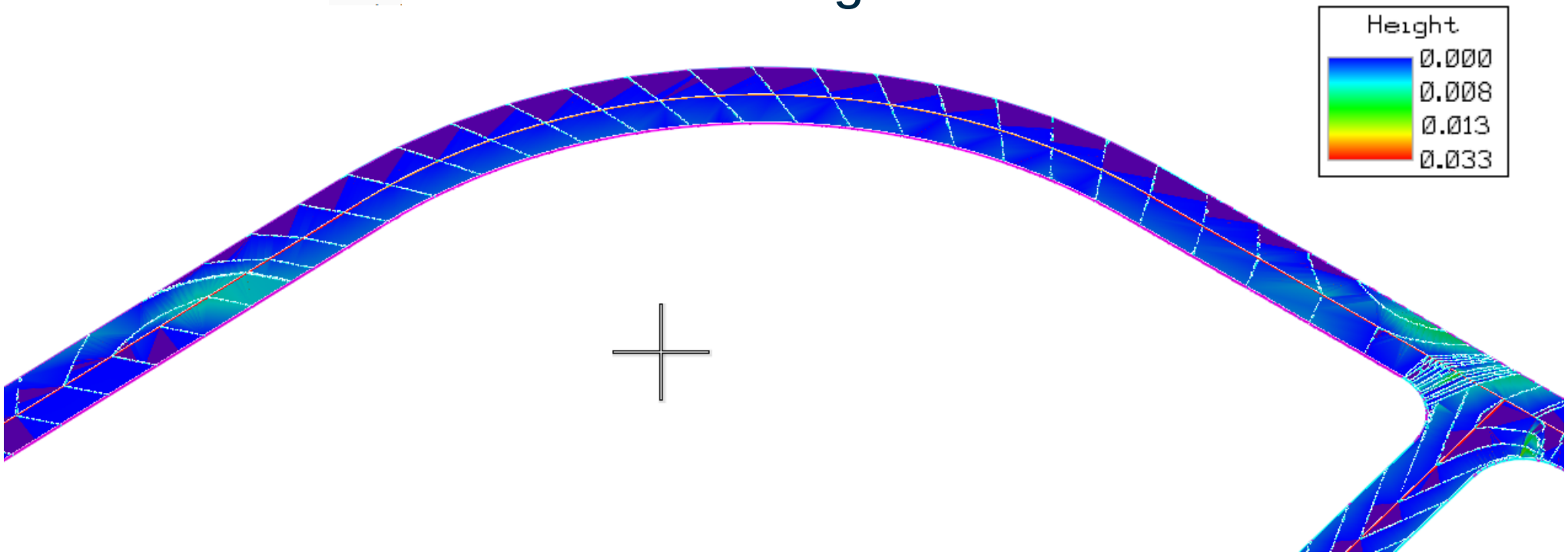


- Elevations < a few mm

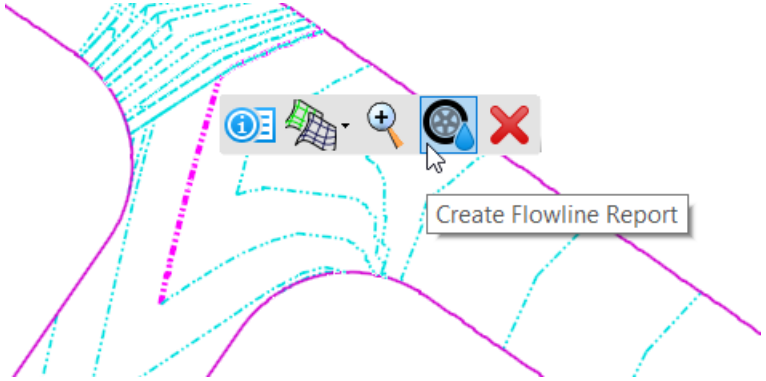
Aquaplaning

The Aquaplaning Feature Definition uses a Thematic Height Display Style to enhance its readability.

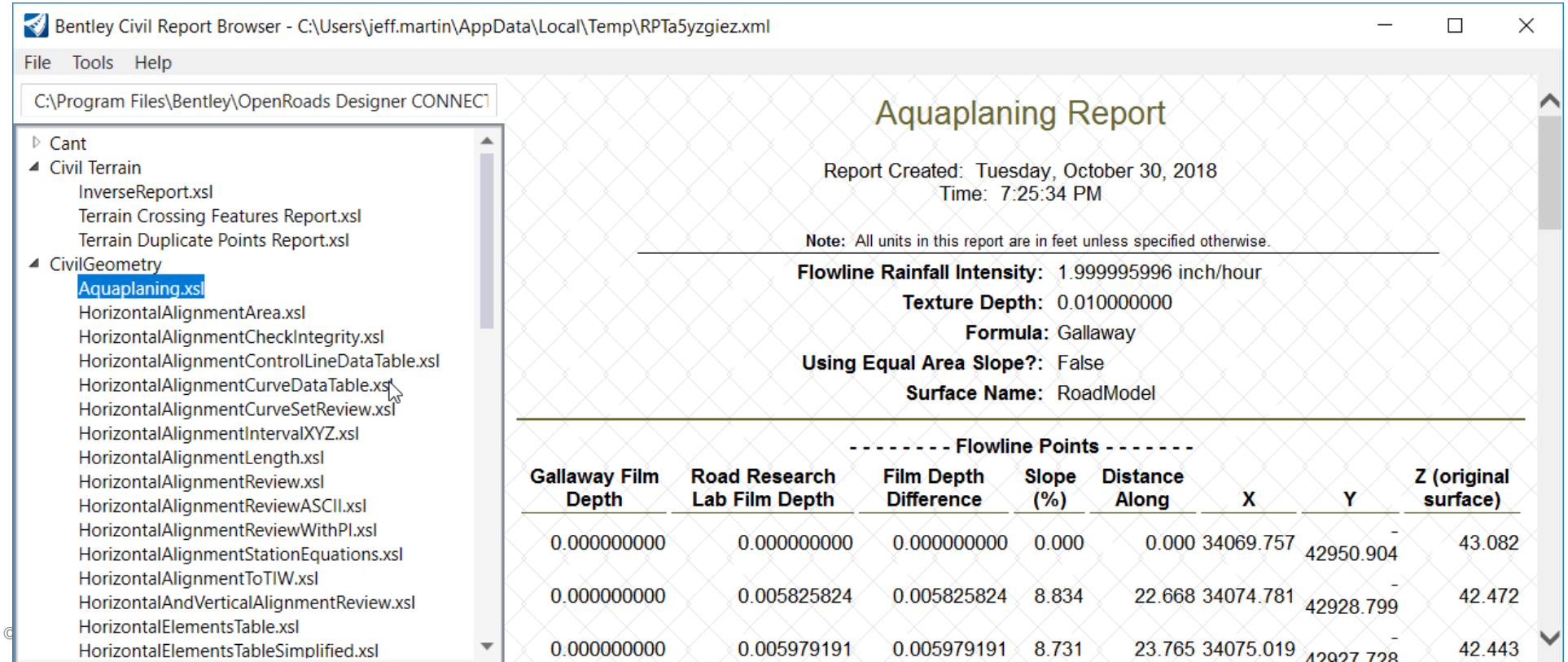
You can Add Flow Lines for areas needing more detail



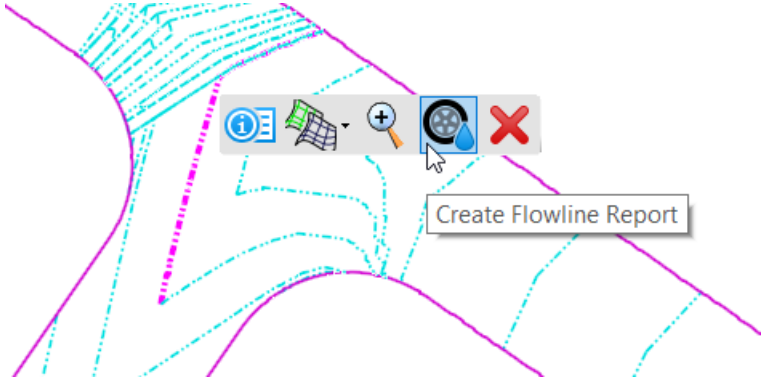
Aquaplaning Report



1. Hover over a Flowline
2. Reset,
3. Left-click to select it
4. Move the mouse along it a little to get the context menu to display
5. Click **Create Flowline Report**



Aquaplaning Report – ANZ Localization



Custom Reports - Stylesheets

File Tools Help

C:\ProgramData\Bentley\OpenRoads Designer CE\Config

- Aquaplaning ANZ
  - Aquaplaning-Austroads-1mm-.xsl
  - Aquaplaning-Austroads-2mm-.xsl
  - Aquaplaning-Austroads-3mm-.xsl
  - Aquaplaning-Austroads-4mm-.xsl
  - Aquaplaning-Austroads-5mm-.xsl
  - Aquaplaning-Austroads-ALL.xsl
  - Aquaplaning.xsl
- Cant
- Civil Terrain
- CivilGeometry
- CivilGeometry ANZ
- CivilSurvey
- CorridorModeling
- CorridorModeling ANZ
- Evaluation
- Images
- LegalDescription
- MapCheck
- Milling
- Schemas
- Stakeout
- StationOffset
- Superelevation
- Superelevation ANZ

AQUAPLANING RISK ANALYSIS REPORT

Report created: 30/6/2018 16:27

FLOW LINE: 1
Rainfall Intensity: 50 mm/hour
Texture Depth: 0.800 mm
Equal Area Slope?: False
Terrain Name: Design-Boundary

Gallaway Film Depth (mm)	Flow Path Slope (%)	Distance on Flow Line (m)	Change in Flow Depth (mm / m)	Easting X	Northing Y	Terrain R.L. Z
0.000	0.00	0.000	0.000	3581.901000	3678.022000	292.951
0.070	3.58	2.449	0.028	3584.089000	3676.921000	292.864
0.339	2.73	3.522	0.251	3585.035000	3676.416000	292.834
0.581	3.37	6.774	0.075	3588.074000	3675.257000	292.725
1.099	2.42	10.278	0.148	3591.453000	3674.332000	292.640

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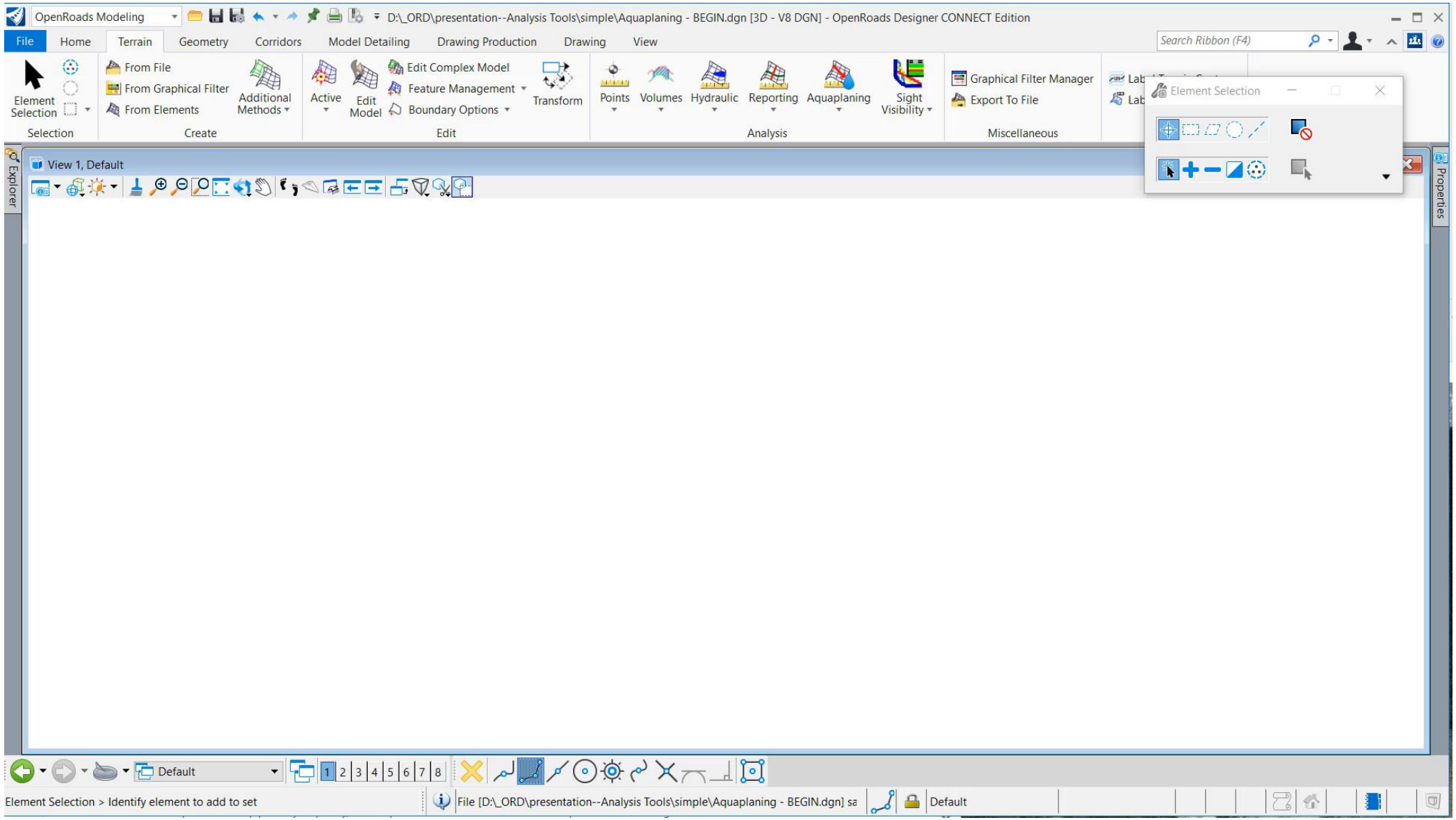
Aquaplaning (video)



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Thanks! Questions?

Remember: anyone can be a proficient OpenRoads Consumer (and ready to learn to Create) in an hour or two.

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