



Harnessing the Power of Civil Geometry

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Bentley[®]
Advancing Infrastructure

Description



Civil Geometry is a comprehensive collection of tools that when combined; empower you to easily define intelligent, updatable, and responsive alignments and other geometry.

Civil Geometry is also the core of Civil Cells.

During this session we will solve common geometry situations and explore how the Feature Definition Toggle Bar settings, Snaps, and Civil AccuDraw affect the geometry.



Communities

Bentley Communities Search

Welcome Products Support About

OpenRoads | OpenSite > OpenRoads | OpenSite Wiki > Geometry CONNECT

- ▼ Road and Site Design - Wikis
 - ▼ OpenRoads Designer
 - > Training
 - > Basic Settings
 - > Terrain Modeling
 - ▼ **Geometry CONNECT**
 - > General Geometry Tools
 - > Horizontal Geometry Tools
 - > Vertical Geometry Tools
 - > Common Geometry Tools
 - Video: Horizontal/Vertical Geometry Creation Example
 - Delete PI in OpenRoads Designer
 - Video: General Geometry Overview
 - How can you delete Geometry from OpenRoads Designer?
 - How to Correct Complex By Elements Message

Horizontal

- [Video: Using the Append Element Command](#)
- [Video: Create and Annotate Horizontal Alignment](#)
- [Video: Spiral Arc Spiral](#)
- [Video: Create Compound Spirals](#)
- [Video: Create Reverse Spirals](#)
- [Video: Introduction to Intervals and Base Elements](#)
- [Video: Rename Linear Geometry Element Description](#)
- [Video: Add Internal Station Equation](#)
- [Video: How To Use The Replace Reference Command For Arc Geometry](#)
- [Video: How to edit spirals within a complex alignment](#)
- [Video: Simple Arc Between Elements Tool in OpenRoads Designer](#)
- [Video: Modify Geometry Points tool](#)
- [Video: Geometry Builder Tool Demonstration](#)
- [Video: Geometry Builder Tool Overview](#)
- [Video: Locate Point by Angle Resection](#)
- [Video: How to add Multiple Station Equations in an Alignment](#)
- [Video: Spiral From Element](#)

Vertical

- [Video: Profile From Surface](#)
- [Video: Profile By Slope From Element](#)
- [Video: Create Vertical Alignment](#)
- [Video: ORD Project Profile to Element](#)
- [Video: Project Profile Range to Element ORD](#)
- [Video: Create 3D Cut](#)
- [Video: Refresh 3D Cut](#)
- [Video: How to draw a vertical profile at constant distance above ground surface.](#)

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Geometry CONNECT

The following resources are provided as a reference by Bentley's Technical Support Group.

[OpenRoads Designer - Geometry Learning Path](#)

Video Clips

General

- [Video: General Geometry Overview](#)
- [Video: Geometry Import Review](#)
- [Video: Civil Accudraw Basic Review](#)
- [Video: Import XML file in OpenRoads Designer](#)
- [Video: Horizontal/Vertical Geometry Creation Example](#)
- [Video: Create a simple Ramp in OpenRoads Designer](#)
- [Video: Attach All Profile Views](#)
- [Video: Transpose Element](#)
- [Video: Export Alignment to IFC format](#)
- [Video: Import Native InRoads ALG into OpenRoads Designer CONNECT Edition](#)
- [Video: How to Drape Points onto a Terrain](#)

Horizontal

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Agenda



Introduction



Getting Started



Common
Questions



Additional
Resources

Introduction



Civil Geometry



Geometric elements with added **intelligence.**



More than just CAD graphics



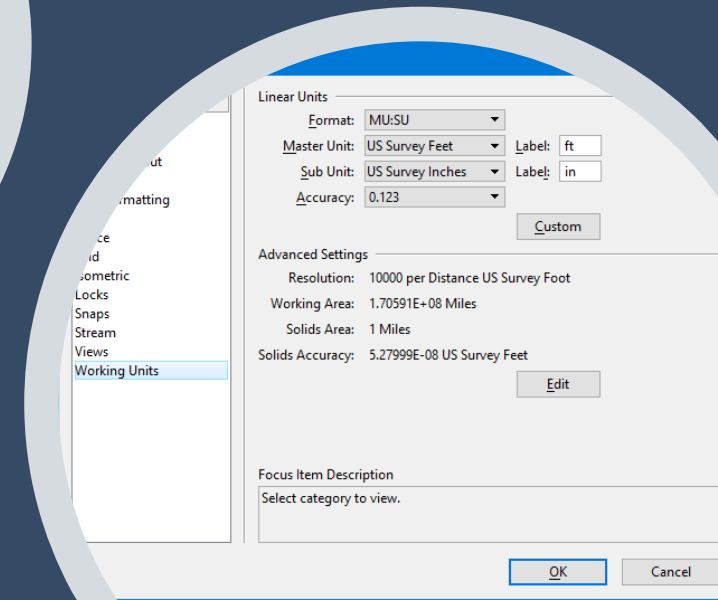
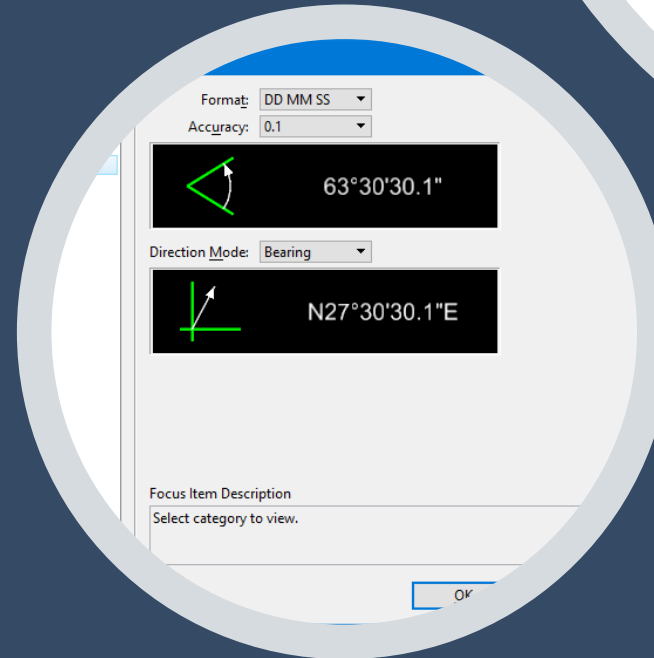
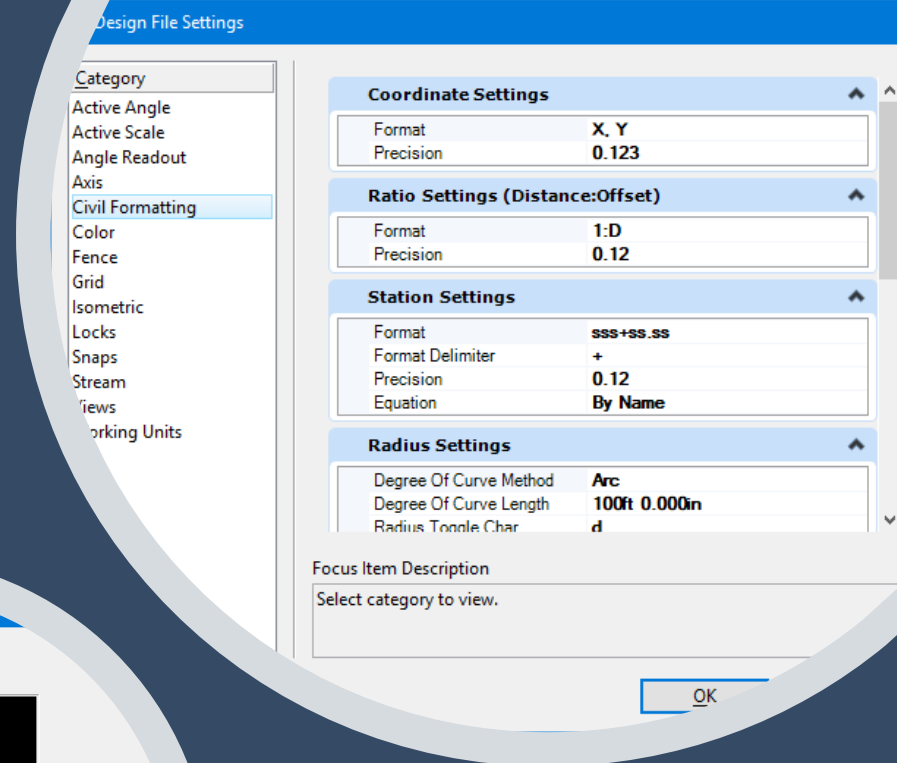
Geometric elements are stored and managed in the DGN file



Supports native civil geometry import : ALG, GPK, and FIL

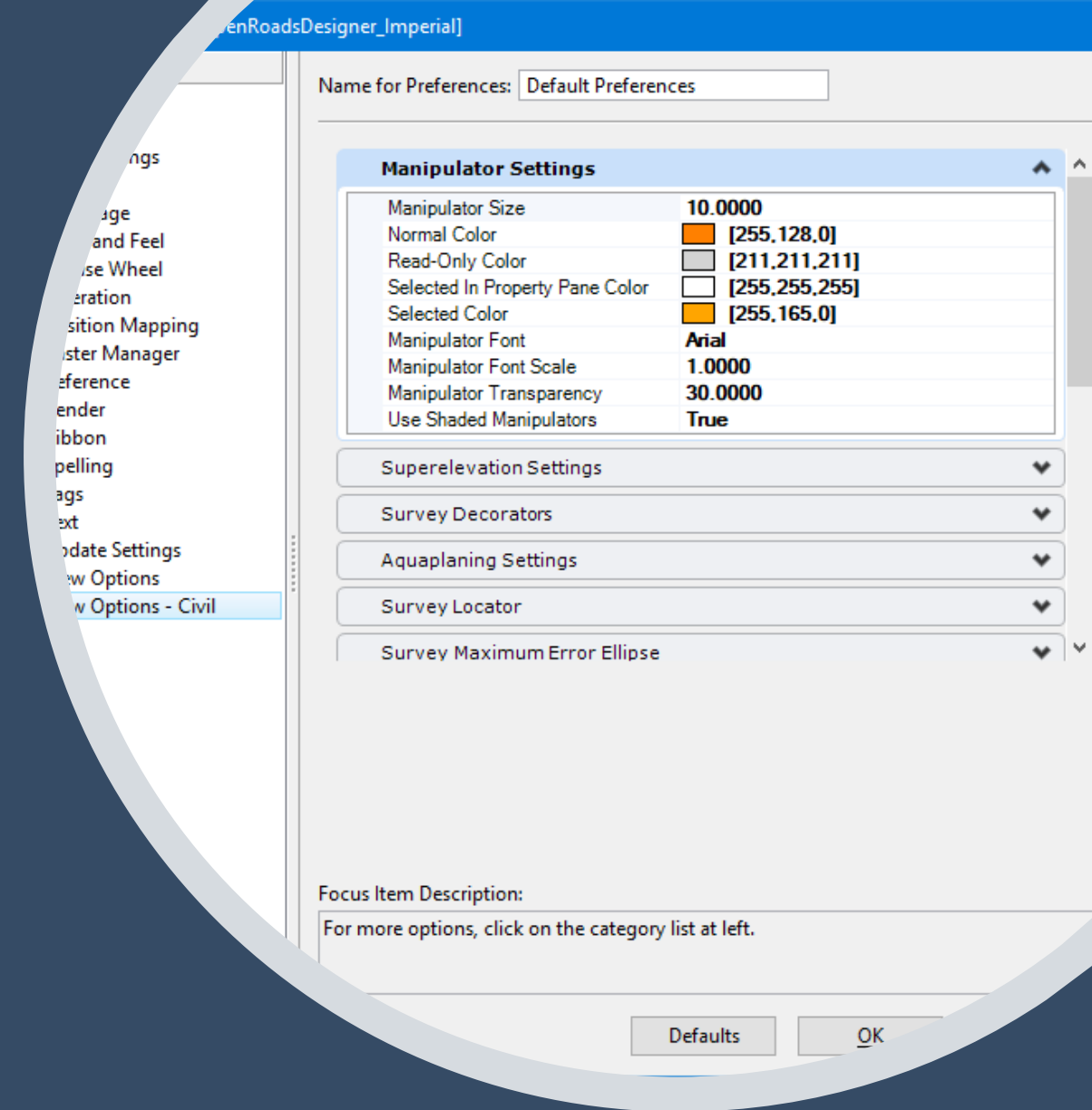
Design File Settings

- Angle Readout
- Civil Formatting
 - Coordinate Settings
 - Ratio Settings (Distance:Offset)
 - Station Settings
 - Radius Settings
 - Profile Settings
- Working Units



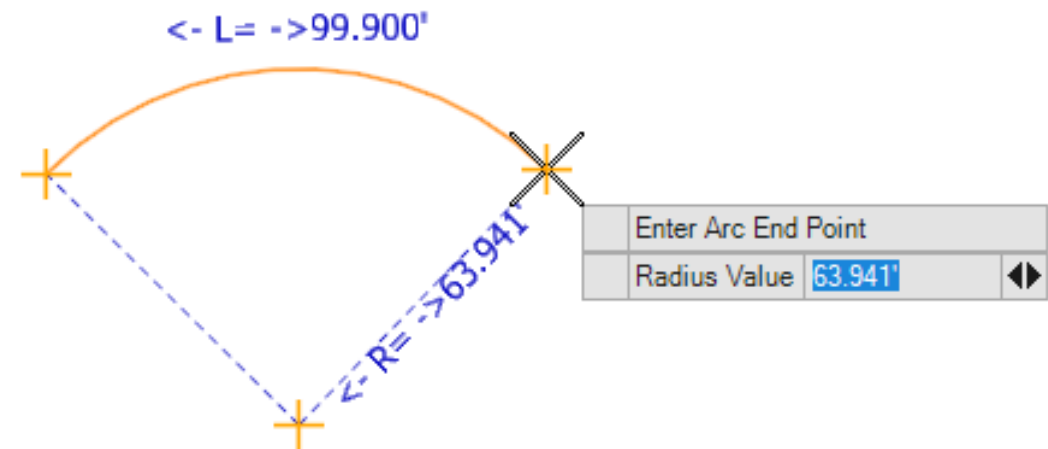
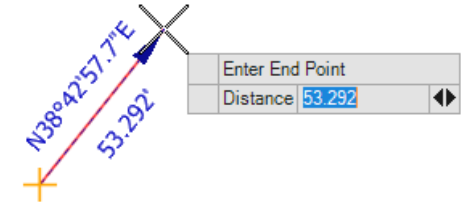
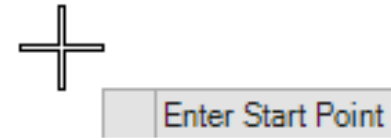
Preferences

- User-Definable
- View Options – Civil
 - Manipulator Settings
 - Superelevation Settings
 - Survey Decorators
 - Aquaplaning Settings
 - Survey Locator
 - Survey Min/Med/Max Ellipses
 - Toggle Commands
 - Drainage and Utilities



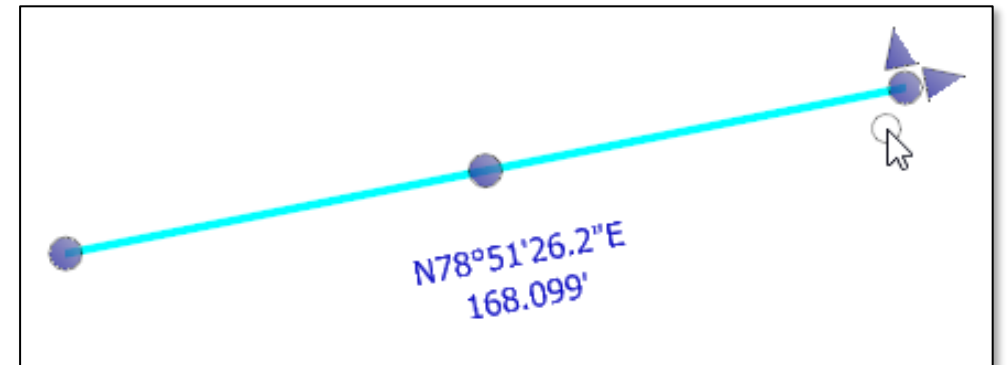
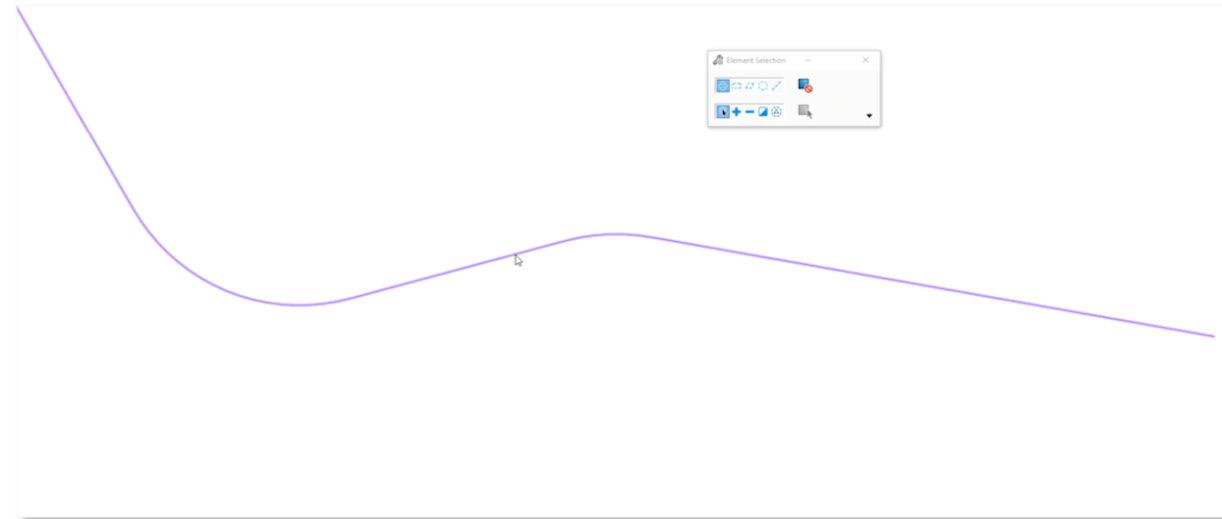
On-Screen Prompts

- All Civil Tools, accept inputs needed to create elements.
- Dynamic Feedback = better design decisions in less time.



Manipulators and Handlers

- Dynamically displayed on selection
- Applies to Civil Geometry elements
 - Text manipulators
 - Drag handles
 - Snap icons
 - Civil AccuDraw constraint





Civil Message Center

- Provides feedback on a variety of issues.
 - Errors in constructions
 - Design Standards
- Types of messages
 - MicroStation
 - Errors
 - Warnings
 - Messages

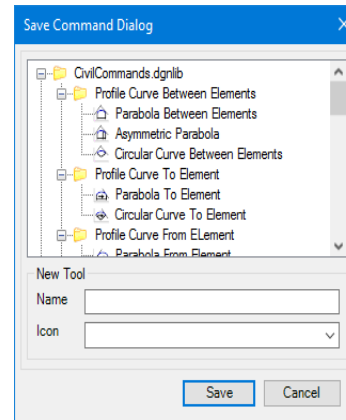
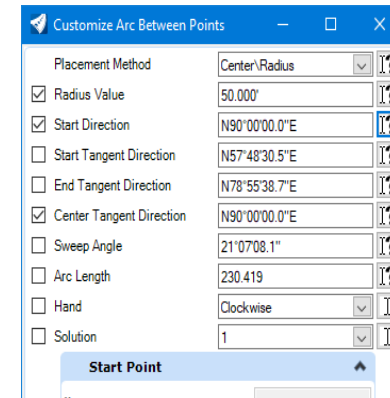
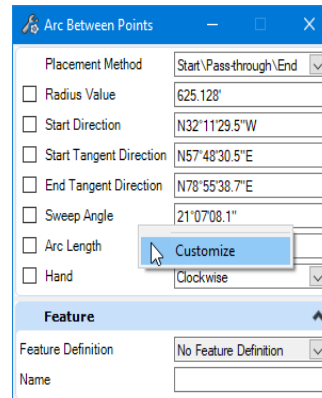
The screenshot shows the 'Civil Message Center' window with a toolbar at the top. The toolbar includes 'Hide All', '10 MicroStation', '0 Errors', '5 Warnings', and '0 Messages'. Below the toolbar is a table with three columns: 'Element', 'Message', and 'Description'. The table contains four rows of warning messages.

Element	Message	Description
Warning	Maximum deflection with no curve exceeded	Design Standard Value = 00°00'00" Actual Value = 05°00'00"
Warning	Maximum deflection with no curve exceeded	Design Standard Value = 00°00'00" Actual Value = 05°00'00"
Warning	Tangent length is longer than maximum value	Design Standard Value = 0.000 Actual Value = 75.000
Warning	Tangent length is longer than maximum value	Design Standard Value = 0.000 Actual Value = 163.000



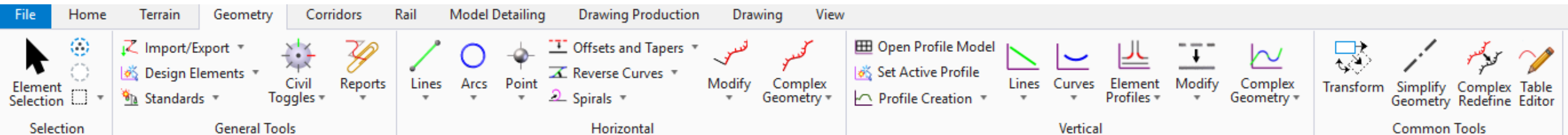
Customizable Dialogs

- Enables control of common tasks/entries
 - Right-click/customize on dialog
 - Save As
 - Define Tool Name + Icon



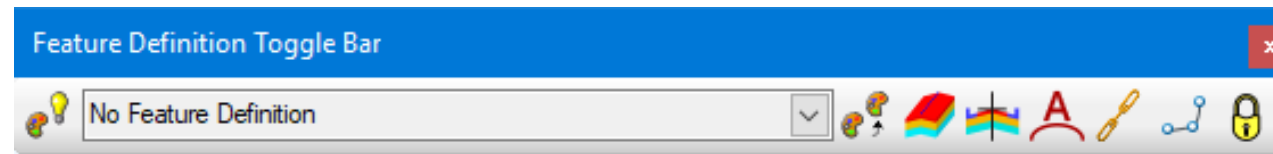
Ribbon Interface

- Modern User Interface
- Workflows deliver sets of Tasks
- Task per Tab
- Task comprised of Groups
- Groups organize Tools/Commands
- Contextual
- Supports Search
- Customizable



Feature Definition Toggle Bar

Used to Activate and deactivate settings that impact a variety of Geometry commands.



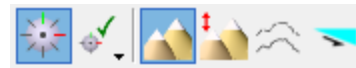
- Override Feature
- Feature Definition drop-down
- Match Feature Definition
- Create 3D Automatically
- Use Feature Definition Template
- Auto Annotate
- Chain Commands
- Persist Snaps and Rule
- Rule Deactivation

Civil AccuDraw

Extending AccuDraw for civil designers this essential tool is used to capture the construction and perform intelligent updates - design intent.



Plan View

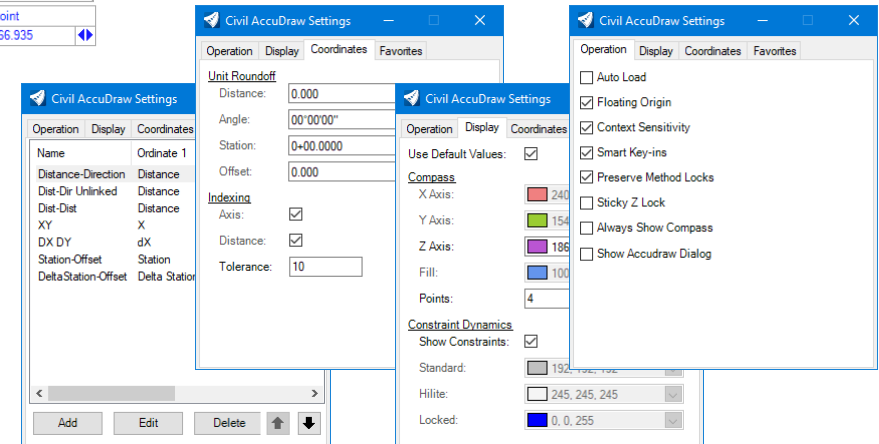
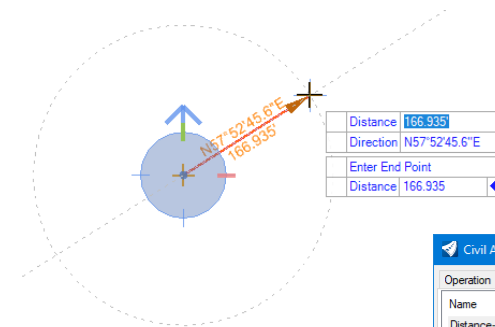


Profile View



3D View

- Context-sensitive Toolbar
 - Plan/Profile/3D
- Compass/North Arrow
- Can be toggled on/off
- Floating dialog or panel
- Customizable Settings



Explorer and Properties Dialogs

Commonly used in combination when working with Civil information.

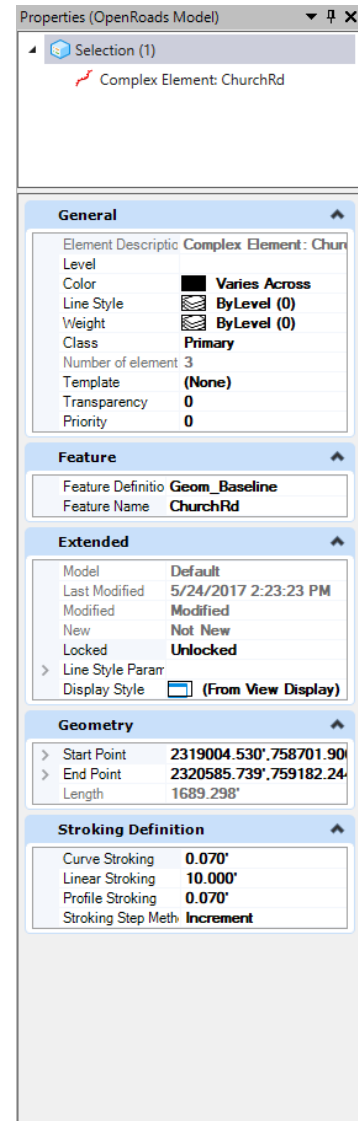
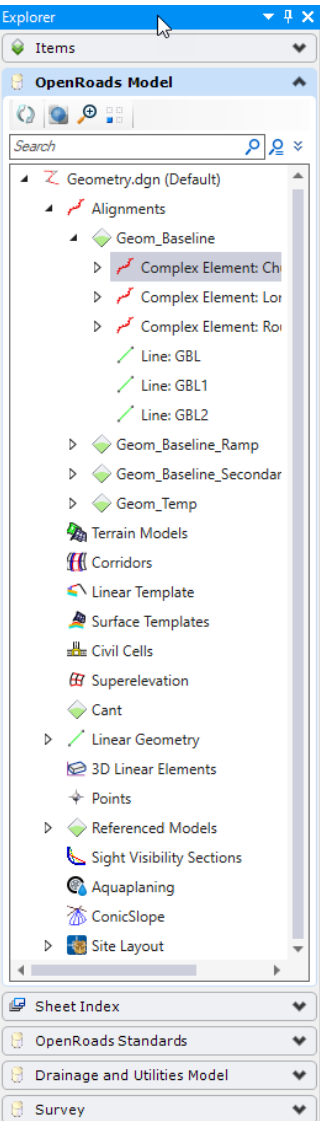
- Explorer

- OpenRoads Model

- Displays all Civil objects in the active and referenced files.
 - Categorized content
 - Right-click menus
 - Zoom To
 - Expand / Collapsible

- Properties

- Review or modify information about an element(s).
 - Works with Civil objects



Understanding The Geometry Model - Rules

- Rules

- Relationship – cause / effect

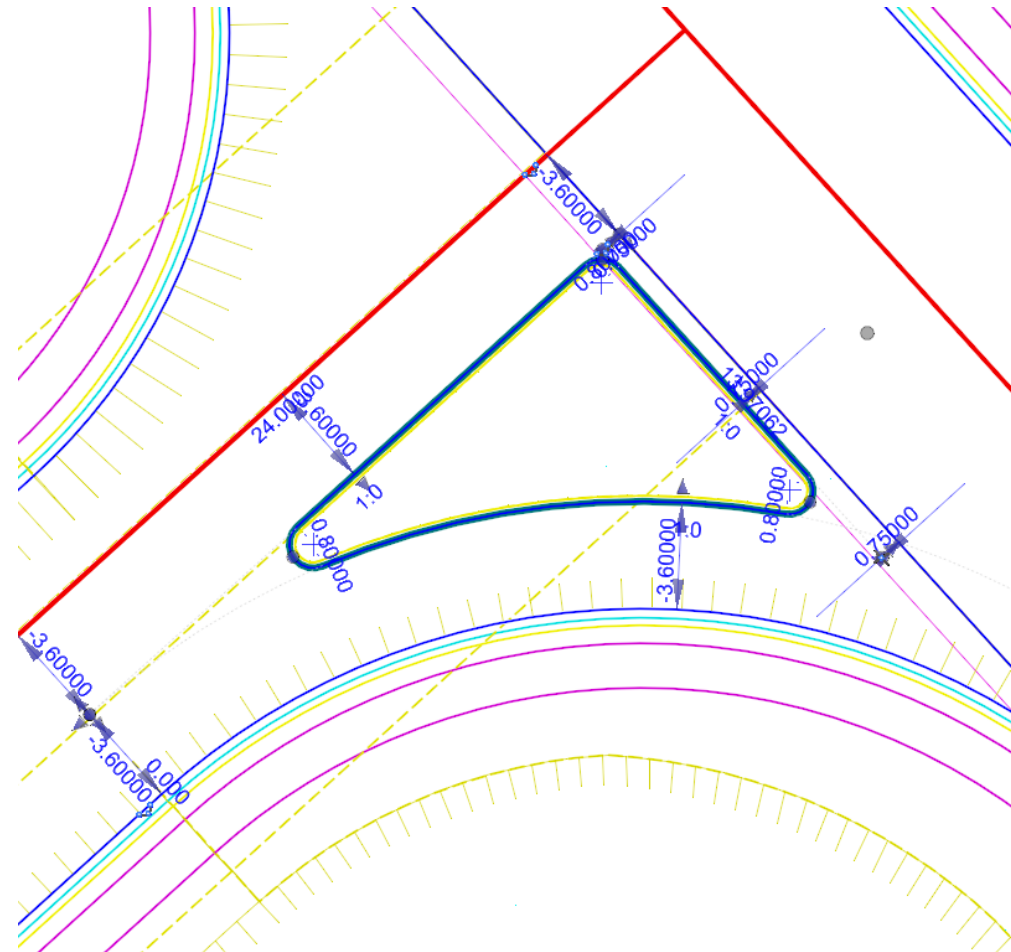
- Line / Arc / Spiral from / to
- Line / Arc between
- Offset from
- Slope from
- Etc

- Includes

- Snaps
- Civil Accudraw

- Multiple Rule Buckets

- Geometry
- Corridor



Rules underpin EVERYTHING in OpenRoads

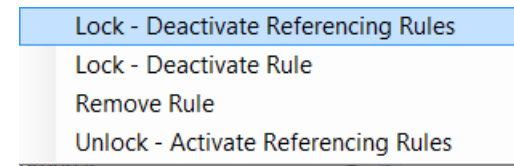
Understanding The Geometry Model - Rules

- Rules

- Rule Management

- Lock / Unlock Rule #
 - Can't edit / delete / no manipulators
 - Lock / Unlock Referencing Rules #
 - Children are locked and don't update
 - Remove Rule

sometimes a toggle or explicit command



Understanding The Geometry Model - Rules

Template N...	Interval	Description	Start Station	End Station
Templates\...	5.00	Lock - Deactivate Rule	32.612	1036.400
Templates\...	10.00000		1036.400	1091.200
Templates\...	5.00000		1091.200	1359.497

Row: 1 of 3

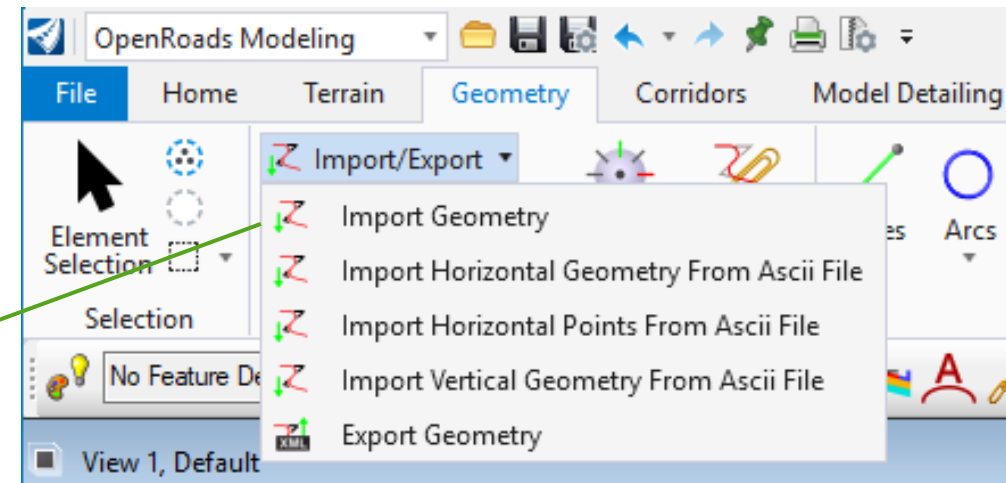
Close



Getting Started – Import / Export Geometry

- Import Geometry – looks to native product formats and third party file types
 - GPK - GEOPAK
 - ALG - InRoads
 - .FIL - MX
 - LandXML
 - ASCii H&V
 - IFC Alignment
 - Genio
 - Import Horizontal Points from Ascii File

All Files (*.*)
Civil Geometry Files (*.xml; *.ifc)
MX Geometry Files (*.fil)
MX Genio Files (*.inp; *.txt)
InRoads Geometry Files (*.alg)
GEOPAK Geometry Files (*.gpk)
All Files (*.*)



File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4)

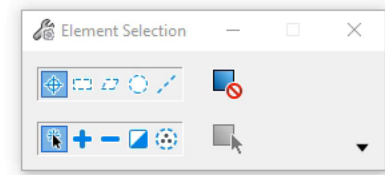
Element Selection Import/Export Design Elements Standards Civil Toggles Reports Lines Arcs Point Offsets and Tapers Reverse Curves Spirals Modify Complex Geometry Open Profile Model Set Active Profile Profile Creation Lines Curves Complex Geometry Element Profiles Simplify Geometry Complex Redefine

Selection General Tools Horizontal Vertical Common Tools

No Feature Definition

View 1 - Top, Default

Element Selection



Element Selection > Identify element to add to set

Default

1 2 3 4 5 6 7 8

Default



- New
- Open
- Save
- Save As
- Save Settings
- Send Mail
- Close
- Tools
- Settings
- Properties
- Print
- Import
- Export
- Publish i-model
- Help
- Exit

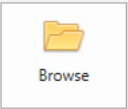
Open

Recent Files for Training-Metric



Geometry_import_3D.dgn
D:\Geometry\
Model: Default ▾

Modified: 12/10/2017 09:55:21 Size: 824 KB



Browse



What we just saw – Import Geometry

- **Always Use 2-D model**
 - Catch it early as it can't be 'unpicked' easily
 - Less clutter and easier selecting
 - Auto-Managed 3-D model space if working in 2-D. No user interaction required for 3-D model creation once profile is assigned to 2-D alignment.
 - Some geometry commands are not supported in 3-D.

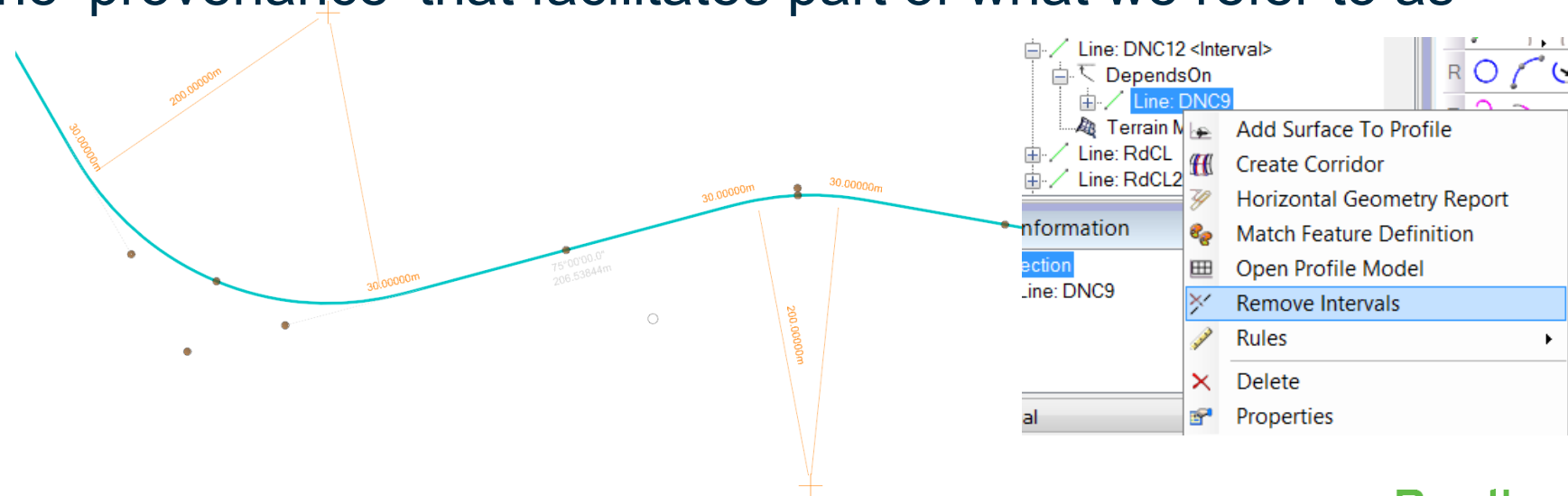


Geometry Intervals - Some common questions

- what are they ?
- what are the benefit?
- how can they be edited?
- how to remove ?

Geometry Intervals - what are they ? What are the benefits

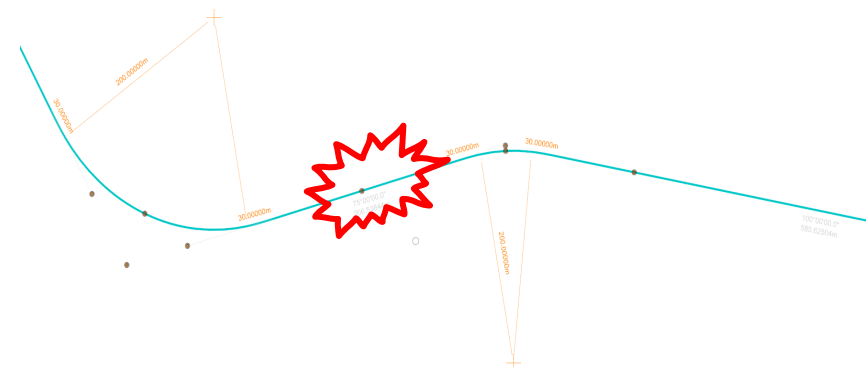
- Intervals are the visible presentation of underlying base geometry
- Intervals have external rules applied to them and so dynamically react to changes
 - Trim / Extend
 - Gaps
- Creates New named Element with rule to the parent with the base (hidden) geometry provides the 'provenance' that facilitates part of what we refer to as 'design intent'



Geometry Intervals - How can they be edited / removed ?

- Interval presentation

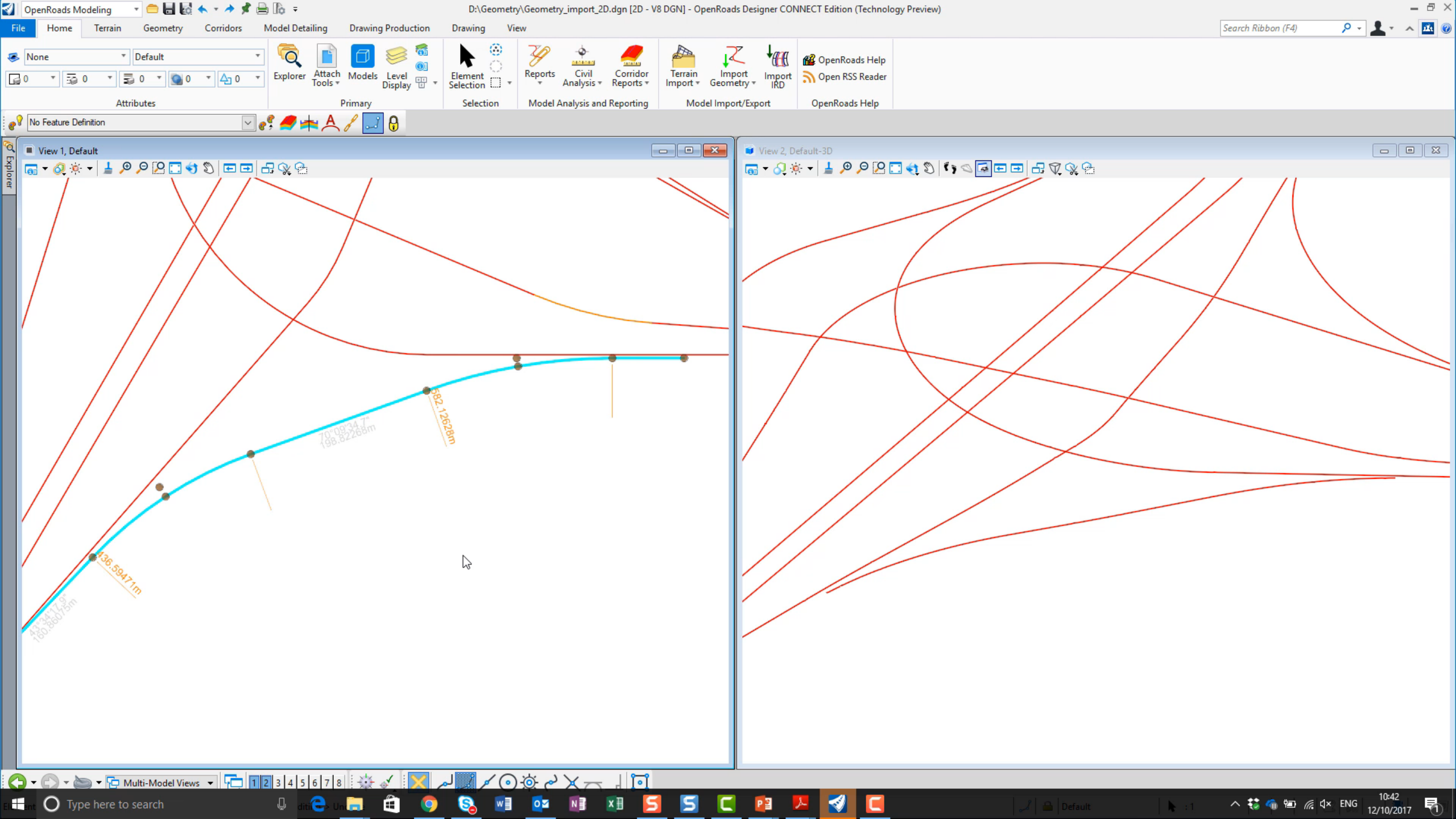
- Intervals are displayed 'dimmed' to help identify intervals



- Simplify Geometry

- Where there is no dependent rule allows the base elements in a complex to be simplified down to the interval
- Works for both horizontal and vertical
- Option to keep base element





File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4)

Element Selection Selection

Import/Export Design Elements Standards

Civil Toggles Reports

Lines Arcs Point

Offsets and Tapers Reverse Curves Spirals

Modify Complex Geometry

Open Profile Model Set Active Profile Profile Creation

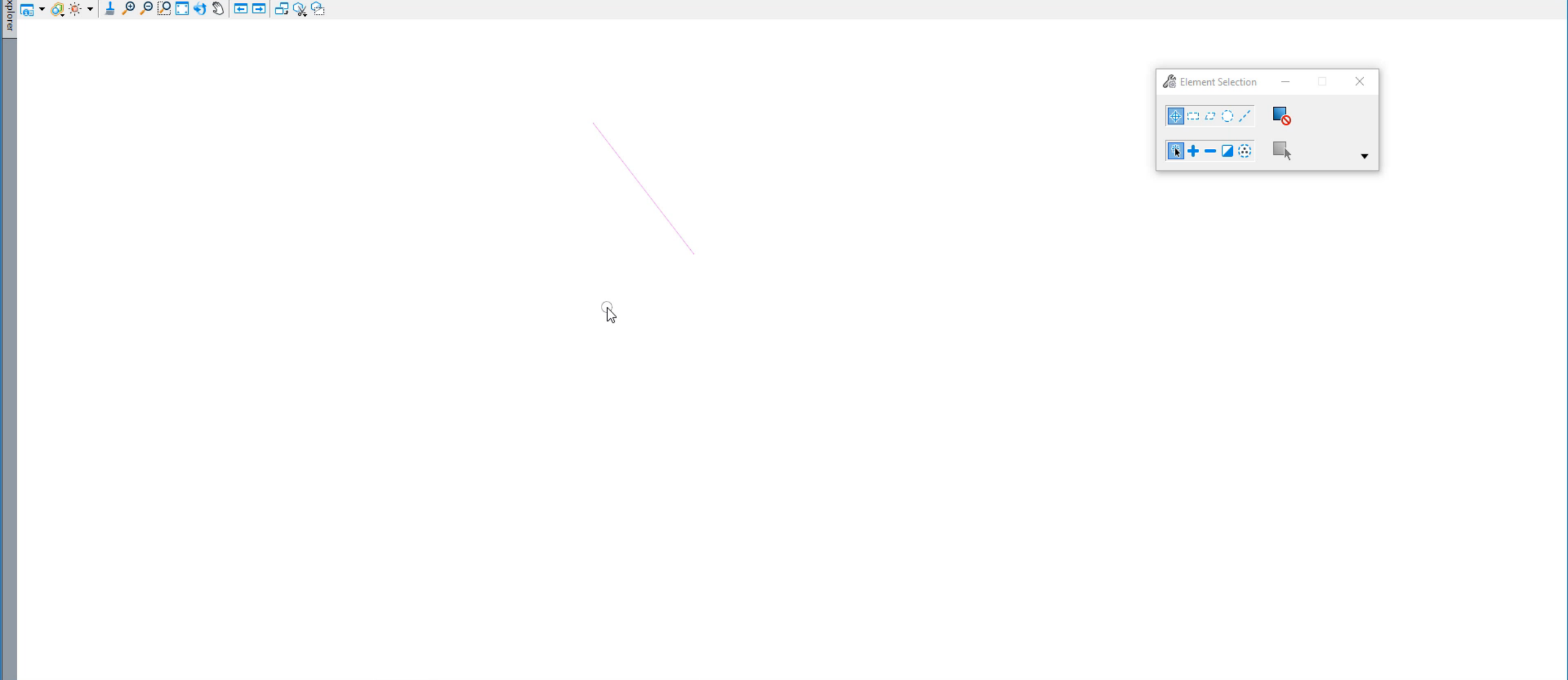
Lines Curves Complex Geometry Element Profiles

Simplify Geometry Complex Redefine

Common Tools

No Feature Definition

View 1, Default

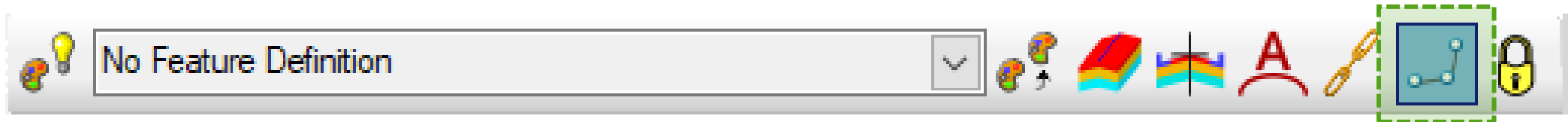


Element Selection

Selection tools: pan, zoom, rotate, move, delete, copy, paste, undo, redo, select all, select none, select by name, select by layer, select by type, select by color, select by size, select by area, select by volume, select by mass, select by weight, select by length, select by width, select by height, select by depth, select by radius, select by diameter, select by circumference, select by area, select by volume, select by mass, select by weight, select by length, select by width, select by height, select by depth, select by radius, select by diameter, select by circumference.

What we just saw – Import Geometry

- Design intent through snaps
- Manipulation of base elements and intervals
- Removal of ‘Snap Rule’ off an element – New in Update 2
- Simplification of geom to ‘visible’ instance – New in Update 2



- Toggle to prevent Snap being preserved as a Rule

File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4)

Element Selection Selection

Import/Export Design Elements Standards Civil Toggles Reports Lines Arcs Point

Offsets and Tapers Reverse Curves Spirals Modify Complex Geometry

Open Profile Model Set Active Profile Profile Creation

Lines Curves Complex Geometry Element Profiles

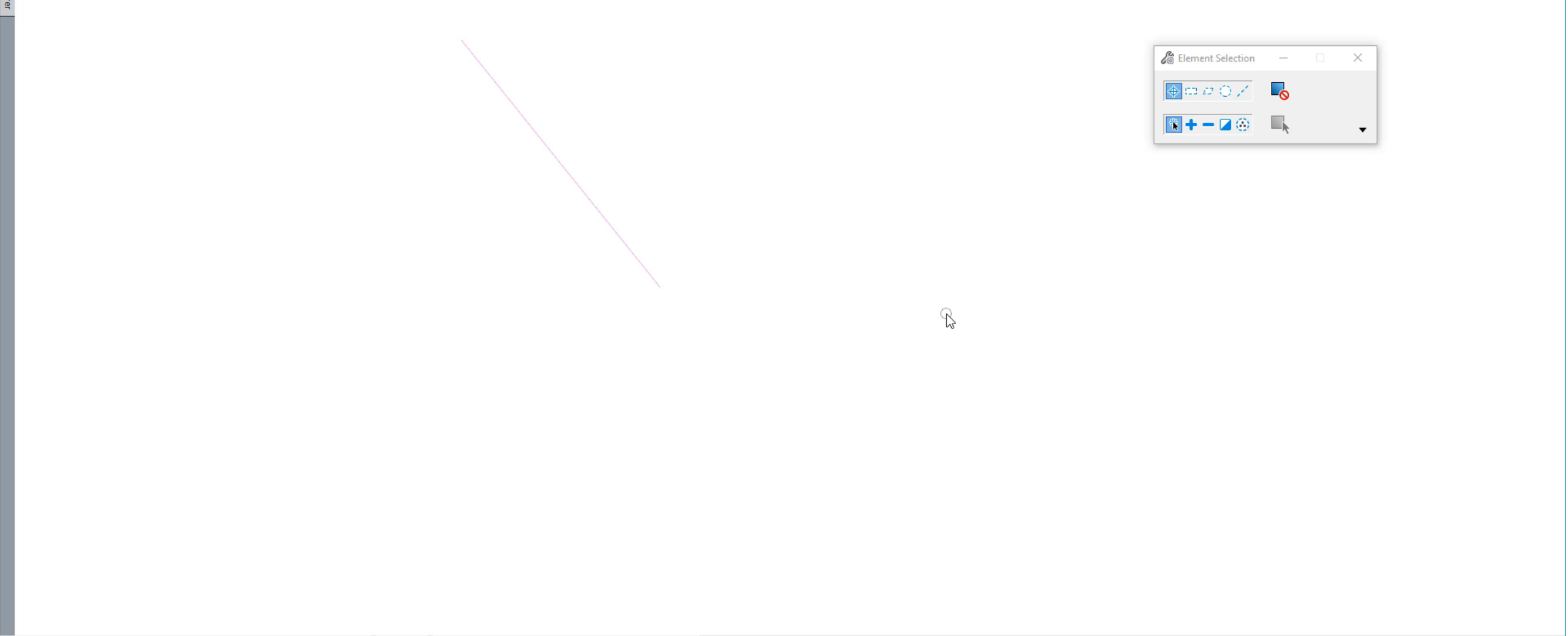
Simplify Geometry Complex Redefine

Horizontal Vertical Common Tools

No Feature Definition

View 1, Default

Explorer



Element Selection

Simple Geometry editing

How To...

- Insert PI
 - Use Insert Vertex to insert PI to horizontal alignment
- Delete PI and Remove Curves
 - Use Delete Vertex to remove PI's which can also remove horizontal curves
- Insert Curves
 - Use Insert Fillet tool if you need to insert a curve or curve combinations between tangents on previously create alignment
- Append Elements
 - If you need to add additional elements to the beginning or end of alignment

File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4)

None Default

Attributes

Explorer

Primary

Selection

Placement

Manipulate

Modify

Measure

Drawing Scales

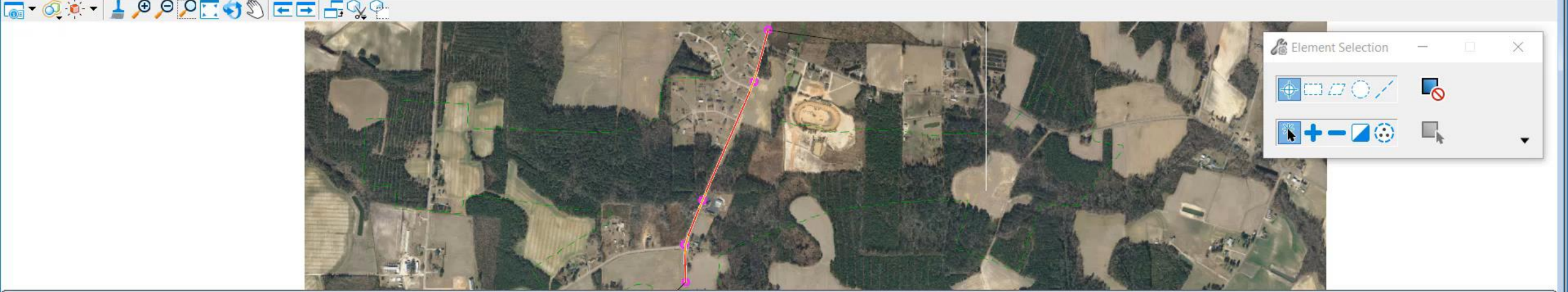
1"=100'

ACS Plane Lock

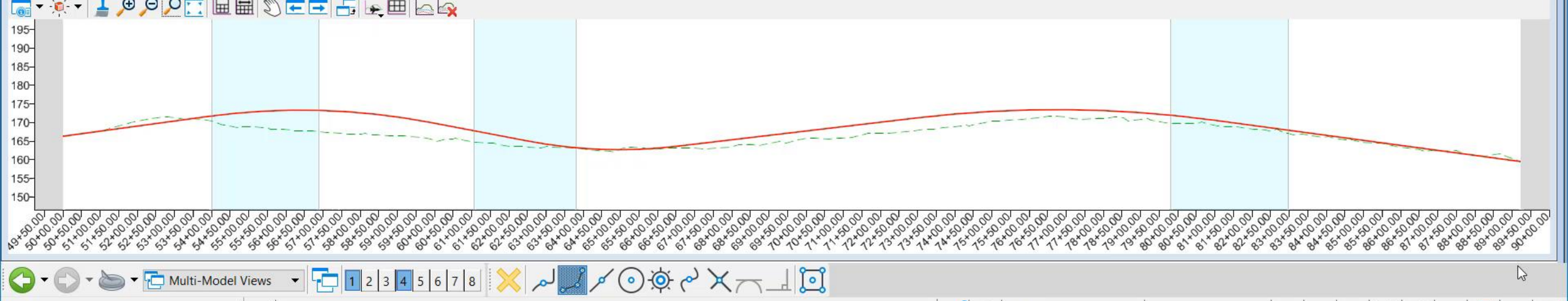
Annotation Scale Lock

No Feature Definition

View 1, Default



View 4, Profile -



File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4) Sign in

Element Selection Import/Export Design Elements Standards Civil Toggles Reports Lines Arcs Point Offsets and Tapers Reverse Curves Spirals Modify Complex Geometry Open Profile Model Set Active Profile Profile Creation Lines Curves Complex Geometry Element Profiles Simplify Geometry Complex Redefine

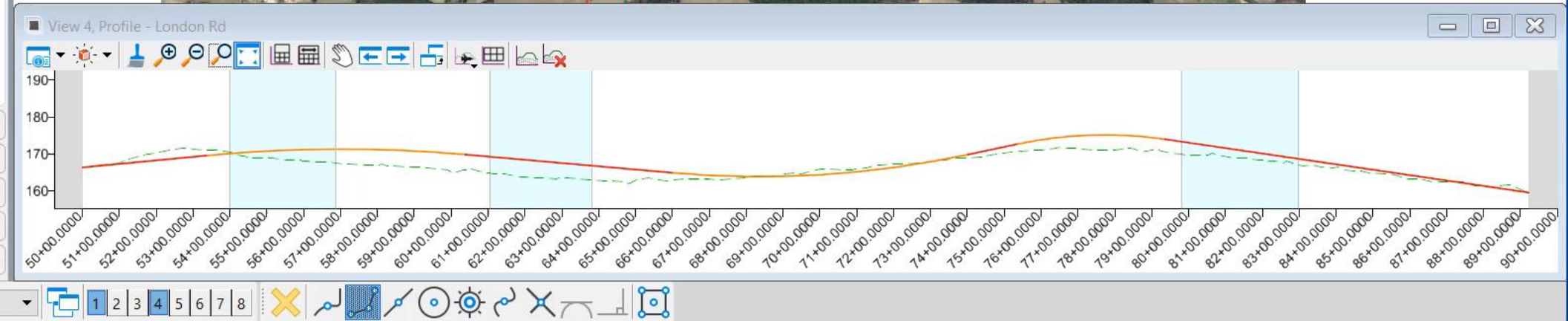
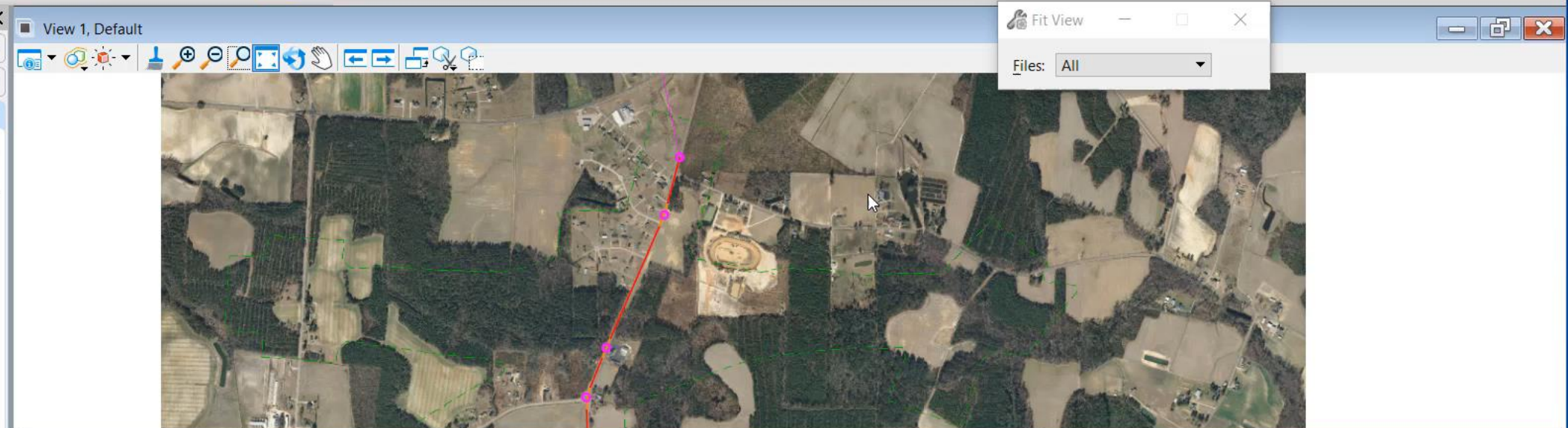
Selection General Tools Horizontal Vertical Common Tools

Geom_Baseline

Explorer

- File
- Items
- OpenRoads Model
 - OpenRoads Model

Search



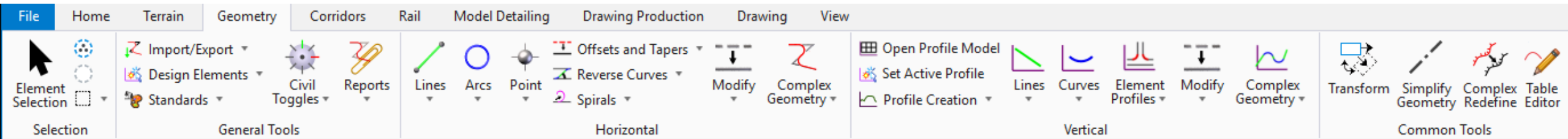
Multi-Model Views 1 2 3 4 5 6 7 8

Fit View > Select view to fit

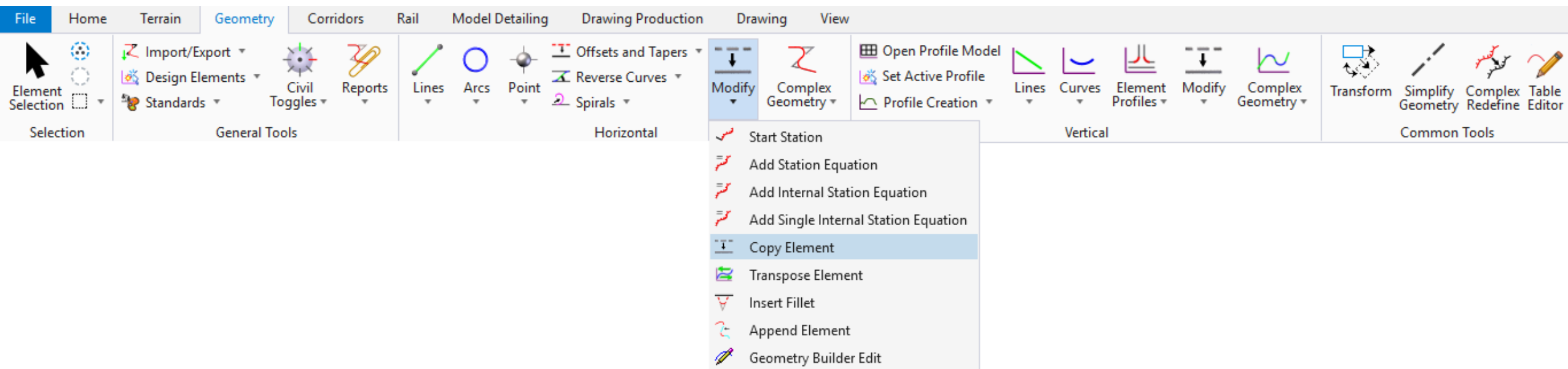
Default

Complex Geometry editing

- New Geometry Paradigm
 - impact of
 - Rules & relationships
 - Reference files
 - MSTN edits vrs Civil Edits



Complex Geometry editing



- Copy

- MSTN Copy vrs Civil Copy

- MSTN – just copies plan graphics
 - Civil Copy preserves civil integrity including vertical if present and gives option of maintaining rules

Complex Geometry Editing Options

- Legacy edits
 - Export to the tools we know, edit, round trip
- Drop – edit rebuild
 - **REMEMBER – Civil Geometry is more than just CAD graphics**
 - In the early stages this can be ok but the project develops this can give rise to rule issue and ‘static’ models due to lost references
- Substitute Geom
 - Allows the corridor to be reassigned to new geom

Complex Geometry Editing Options

- Drop – edit rebuild
 - **REMEMBER – Civil Geometry is more than just CAD graphics**
 - In the early stages this can be ok but the project develops, especially by adding vertical this can give rise to rule issue and ‘static’ models due to lost references
- Substitute Geom
 - Allows the corridor to be reassigned to new geom

File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4)

Element Selection Selection

Import/Export Design Elements Standards General Tools

Civil Toggles Reports Lines Arcs Point Horizontal

Offsets and Tapers Reverse Curves Spirals Modify Complex Geometry

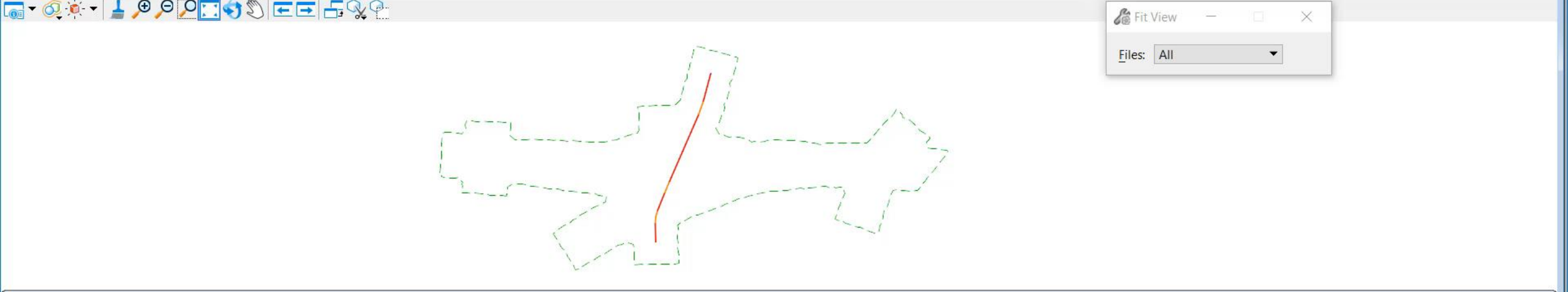
Open Profile Model Set Active Profile Profile Creation Vertical

Lines Curves Complex Geometry Element Profiles

Simplify Geometry Complex Redefine Common Tools

Geom_Baseline

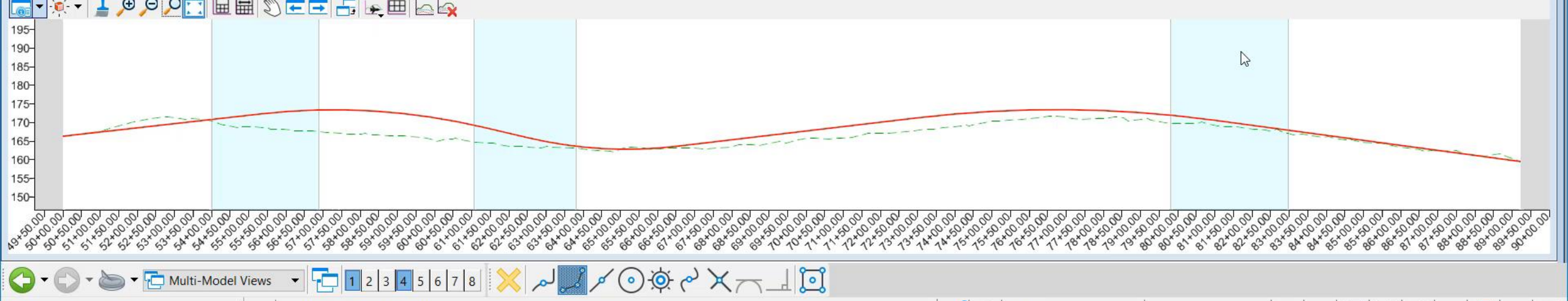
View 1, Default



Fit View

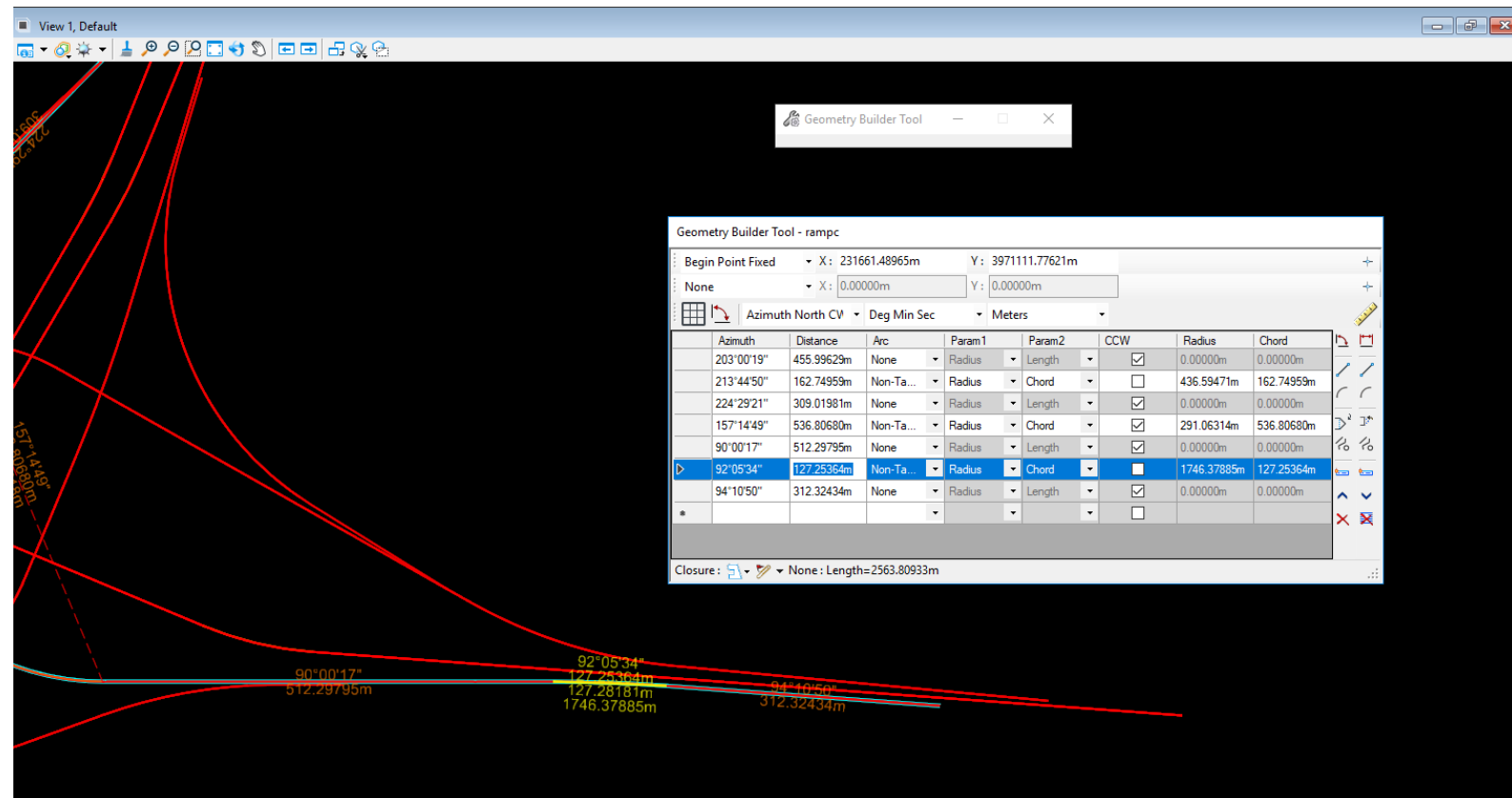
Files: All

View 4, Profile - LondonRd

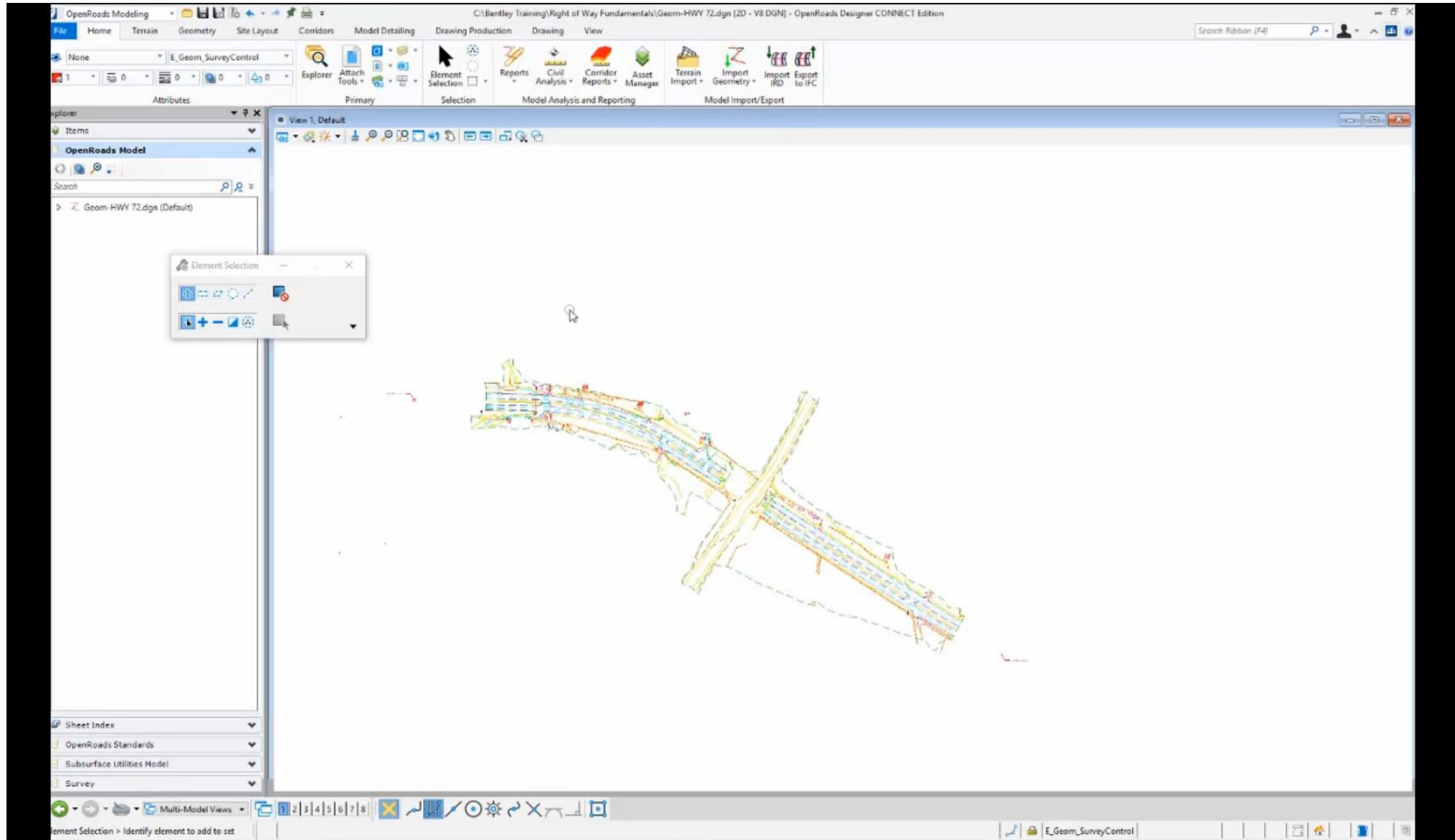


Complex Geometry Editing Options – Geometry Builder

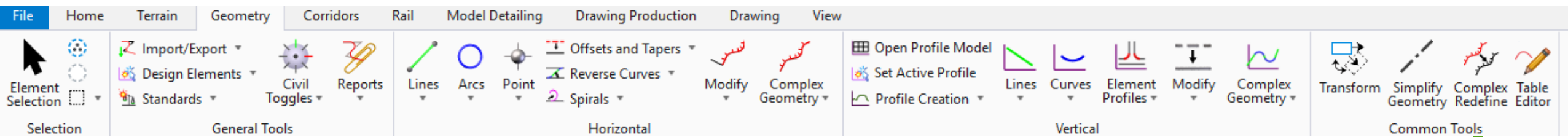
- Provides ‘COGO’ workflows
- Really powerful geometry creation / editing tools
 - Element Highlight
 - Move element up/down
 - Insert element before/after



Complex Geometry Editing Options – Geometry Builder



Complex Geometry editing Options - Complex Redefine



- This is the recommended workflow for complex editing of ‘ruled geometry’
- Non destructive
 - Preserves rules
 - Links maintained for common elements
- Projects vertical (the new horizontal will be different so this is a best first attempt)



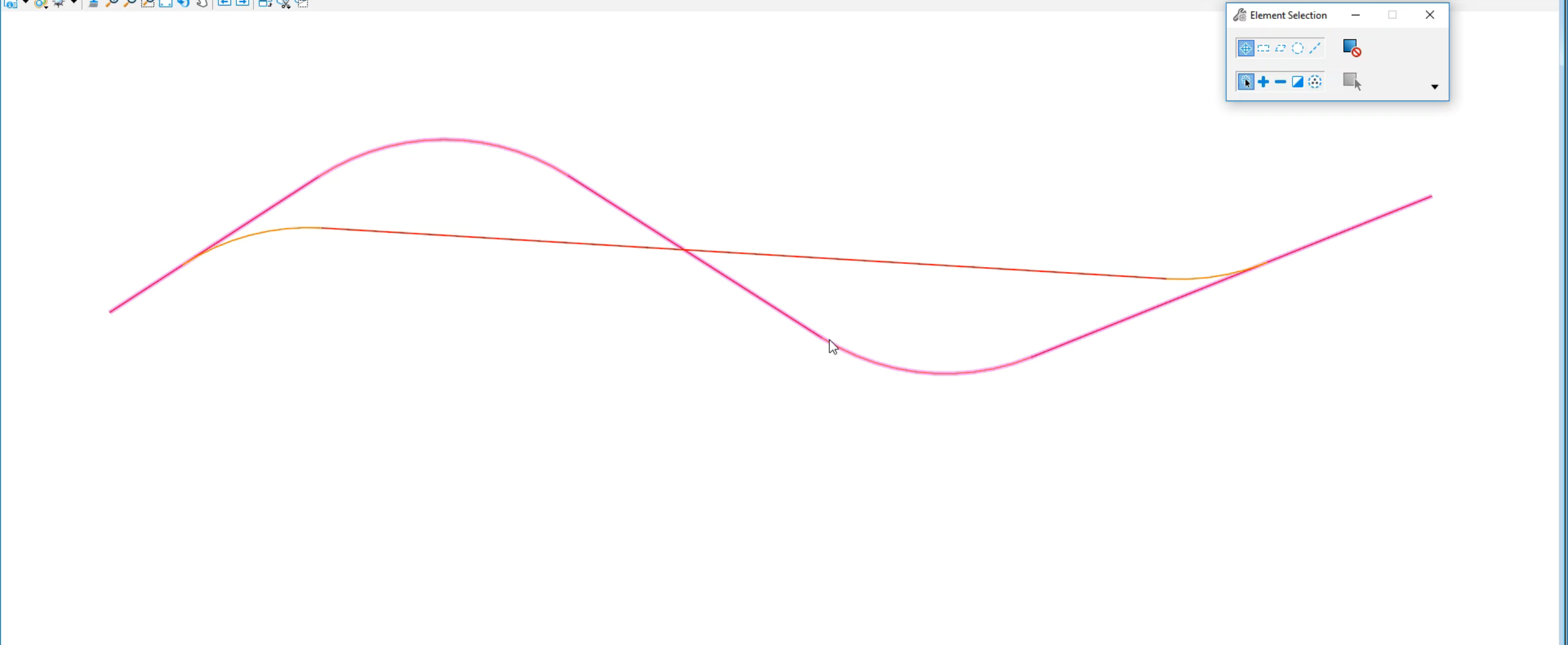
File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Search Ribbon (F4) Sign in

Element Selection Import/Export Design Elements Standards Civil Toggles Reports Lines Arcs Point Offsets and Tapers Reverse Curves Spirals Modify Complex Geometry Open Profile Model Set Active Profile Profile Creation Lines Curves Complex Geometry Element Profiles Simplify Geometry Complex Redefine Common Tools

No Feature Definition

View 1, Default



Element Selection

Selection tools: pan, zoom, rotate, move, delete, copy, paste, undo, redo, select, lasso, window, crosshair, eraser, fill, text, dimension, leader, table, image, link, help, search, settings, close.

Navigation and tool icons: back, forward, home, search, zoom, pan, rotate, move, delete, copy, paste, undo, redo, select, lasso, window, crosshair, eraser, fill, text, dimension, leader, table, image, link, help, search, settings, close.

OpenRoads Modeling | D:\JOE_Conference Archive\2017 Learn\Geometry\corridor.dgn [2D - V8 DGN] - OpenRoads Designer CONNECT Edition

File Home Terrain Geometry Corridors Model Detailing Drawing Production Drawing View

Attributes: None, Default, 0, 0, 0, 0

Primary: Explorer, Attach Tools, Models, Level Display

Selection: Element Selection

Model Analysis and Reporting: Reports, Civil Analysis, Corridor Reports

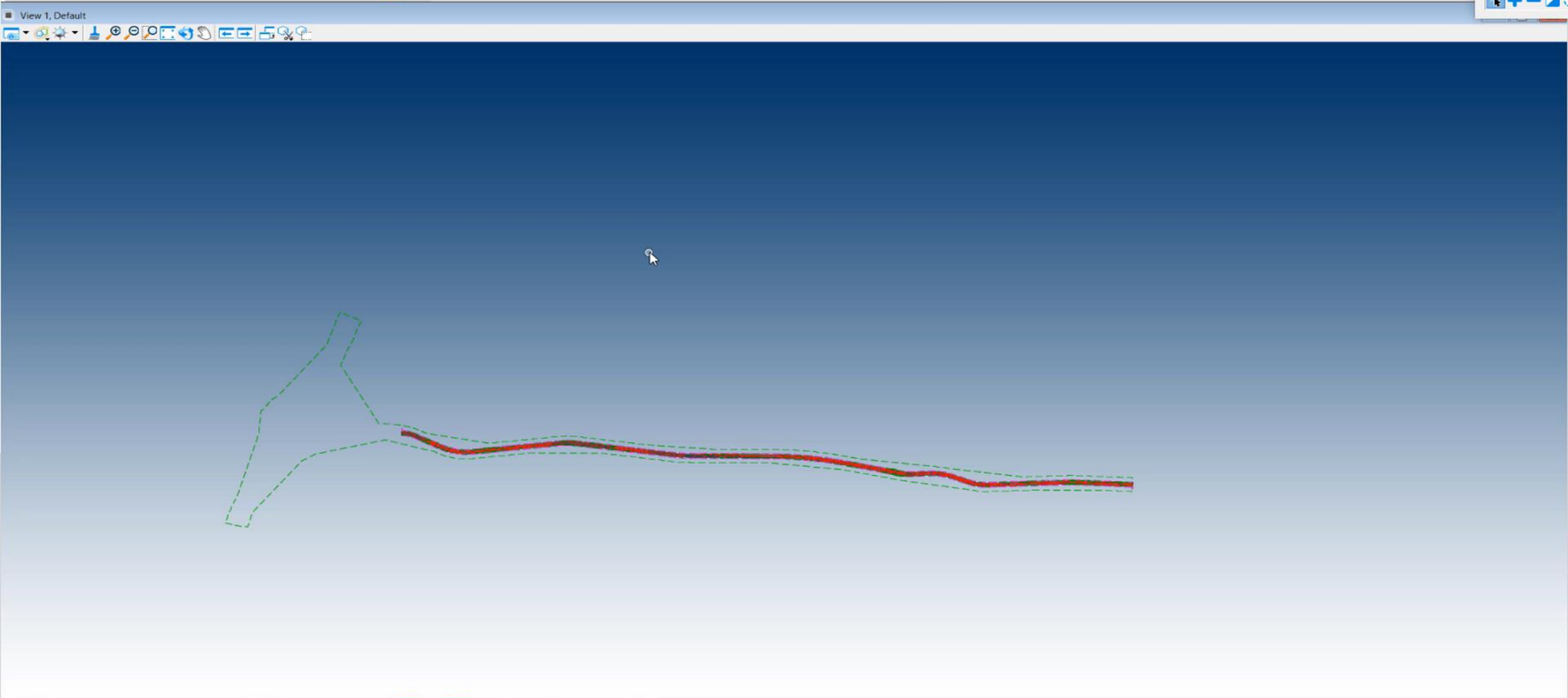
Model Import/Export: Terrain Import, Import Geometry, Import IRD

OpenRoads Help: OpenRoads Help, Open RSS Reader

No Feature Definition

View 1, Default

Element Selection

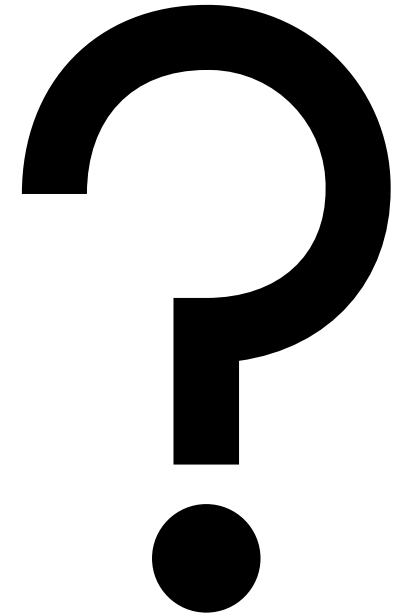


Element Selection > Identify element to a

Default | 1 2 3 4 5 6 7 8 | [Navigation icons]

Default

Some Common Questions



Missing Manipulators

Element Selection >
Disable Handles

- Use Default = Enabled

Zoomed out or
partially off screen

- Adjust your Zoom focus
- Fit element on screen

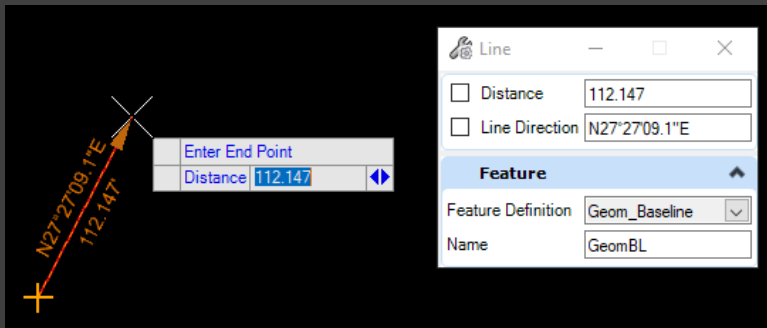
Referenced

- Manipulators used to edit

Missing Civil Rules

- Use Create Civil Rule Feature tool

Prompt VS Dialog



Commands are customizable



Loads last used values (XML)



Locked values can be saved



Prompts can be removed/added



Tip: END key unlocks values in prompt



Tip: Left and Right Arrow keys access other values in prompt



Tip: TAB moves Down through Civil AccuDraw fields in prompt



Best Practice: Use Prompts initially, Dialog for entry correcting

Controlling Geometry Updates



Dynamic Updating
may not always be
desirable

Complex
Geometry
edits
Managing
model updates



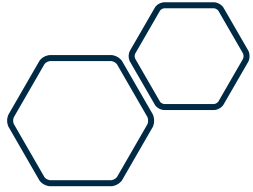
Consider locking
referencing rules
on geometry

Disables
editing
manipulators



Federating files
using referencing

Updates do
not occur until
reference is
opened.



Additional Resources

- <http://Communities.Bentley.com>
- <http://Docs.Bentley.com/LiveContent>
- <http://Learn.Bentley.com>



Communities

Bentley Communities Search

Welcome Products Support About

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Horizontal

- [Video: Using the Append Element Command](#)
- [Video: Create and Annotate Horizontal Alignment](#)
- [Video: Spiral Arc Spiral](#)
- [Video: Create Compound Spirals](#)
- [Video: Create Reverse Spirals](#)
- [Video: Introduction to Intervals and Base Elements](#)
- [Video: Rename Linear Geometry Element Description](#)
- [Video: Add Internal Station Equation](#)
- [Video: How To Use The Replace Reference Command For Arc Geometry](#)
- [Video: How to edit spirals within a complex alignment](#)
- [Video: Simple Arc Between Elements Tool in OpenRoads Designer](#)
- [Video: Modify Geometry Points tool](#)
- [Video: Geometry Builder Tool Demonstration](#)
- [Video: Geometry Builder Tool Overview](#)
- [Video: Locate Point by Angle Resection](#)
- [Video: How to add Multiple Station Equations in an Alignment](#)
- [Video: Spiral From Element](#)

Vertical

- [Video: Profile From Surface](#)
- [Video: Profile By Slope From Element](#)
- [Video: Create Vertical Alignment](#)
- [Video: ORD Project Profile to Element](#)
- [Video: Project Profile Range to Element ORD](#)
- [Video: Create 3D Cut](#)
- [Video: Refresh 3D Cut](#)
- [Video: How to draw a vertical profile at constant distance above ground surface.](#)

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Wiki Forum Blog Files Ideas

Geometry CONNECT

The following resources are provided as a reference by Bentley's Technical Support Group.

[OpenRoads Designer - Geometry Learning Path](#)

Video Clips

General

- [Video: General Geometry Overview](#)
- [Video: Geometry Import Review](#)
- [Video: Civil Accudraw Basic Review](#)
- [Video: Import XML file in OpenRoads Designer](#)
- [Video: Horizontal/Vertical Geometry Creation Example](#)
- [Video: Create a simple Ramp in OpenRoads Designer](#)
- [Video: Attach All Profile Views](#)
- [Video: Transpose Element](#)
- [Video: Export Alignment to IFC format](#)
- [Video: Import Native InRoads ALG into OpenRoads Designer CONNECT Edition](#)
- [Video: How to Drape Points onto a Terrain](#)

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Thank you!

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