



Understanding Design Intent and How it Impacts OpenRoads

Ian Rosam – Director, Product Management, Civil Design

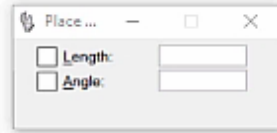
Learning Objectives

This presentation aims to provide you with an understanding:

- of the meaning of ***Design Intent***
- how Civil AccuDraw and MicroStation snaps provides design intent
- how federated models influence design intent

What is Design Intent?

- First lets consider how historically constructions were made



- Consider the impact on

- Time
- Cost
- Confidence

- Where does this occur

- Geometry
- Corridor modelling
 - Template drops
 - Point controls



What is Design Intent?

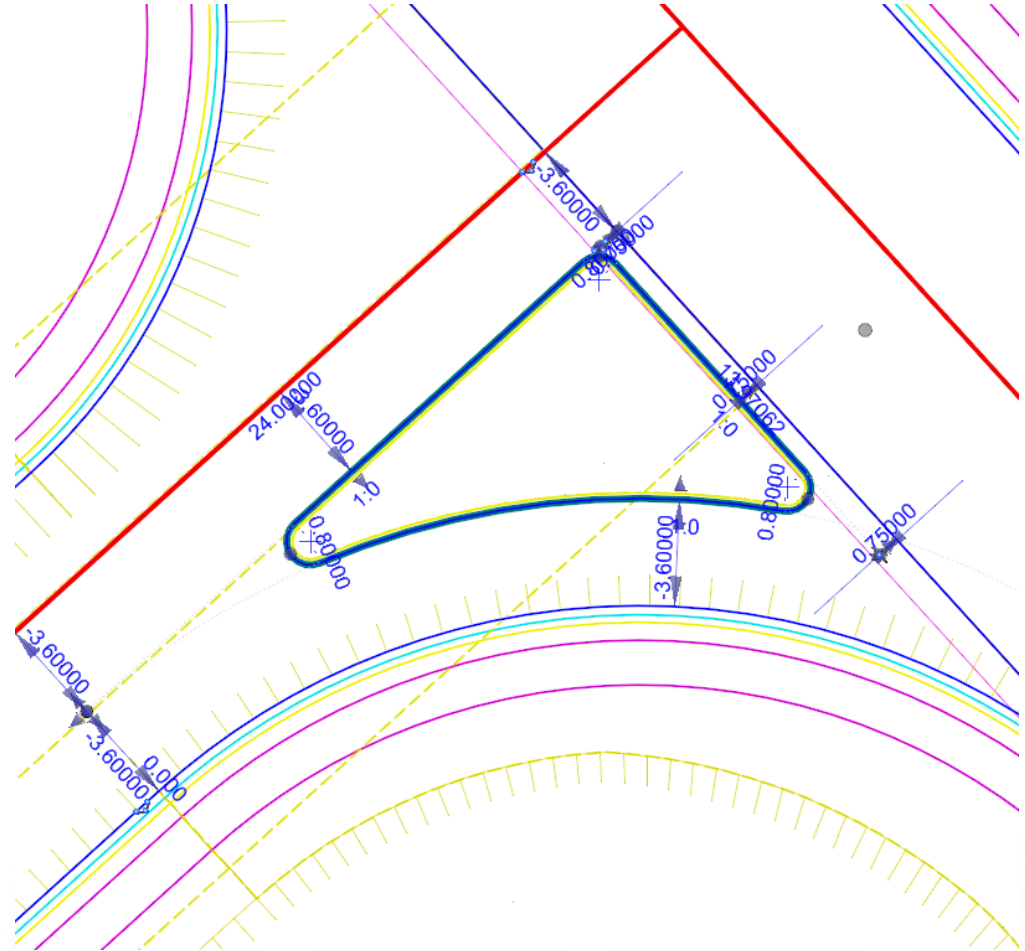
- *Design Intent* is the act of preserving the **rules, relationships** used during the design process in order to maximize the downstream benefits of **automatic updates**.



What are rules and relationships?

- *Method of construction*
 - Line / Arc / Spiral from / to
 - Line / Arc between
 - Offset from
 - Slope from
 - Etc
- *Constraints*
 - Snaps
 - Offsets
 - Accudraw / Civil Accudraw

Button Bar
AccuSnap
Multi-snaps
Nearest
• Keypoint
Midpoint
Center
Origin
Bisector
Intersection
Tangent
Tangent Point
Perp
Perp Point
Parallel
Point Through
Point On
Multi-snap 1
Multi-snap 2
Multi-snap 3



In many cases, there is nothing for you as a user to necessarily think about or consider. You just get the proper rules and relationships as part of the commands you are using.

Automatic Updates

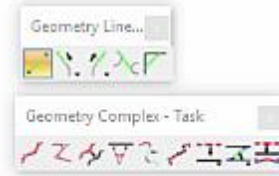
Everyone wants software that will automatically update the design whenever a change is made in order to eliminate errors. However, if not done correctly, what most people don't realize is that automatic updates can generate just as many errors and omissions as it eliminates.

The reason for this is simple – if you are going to update design geometrics correctly, then you must remember the engineering decisions (i.e. the *design intent*) that originally went into the creation of those elements and components. If you don't, then any updates you do will involve assumptions and guessing which will obviously lead to additional errors and omissions.

OpenRoads updates are not based on assumptions – they are based on the fact that we remember the ***design intent***.

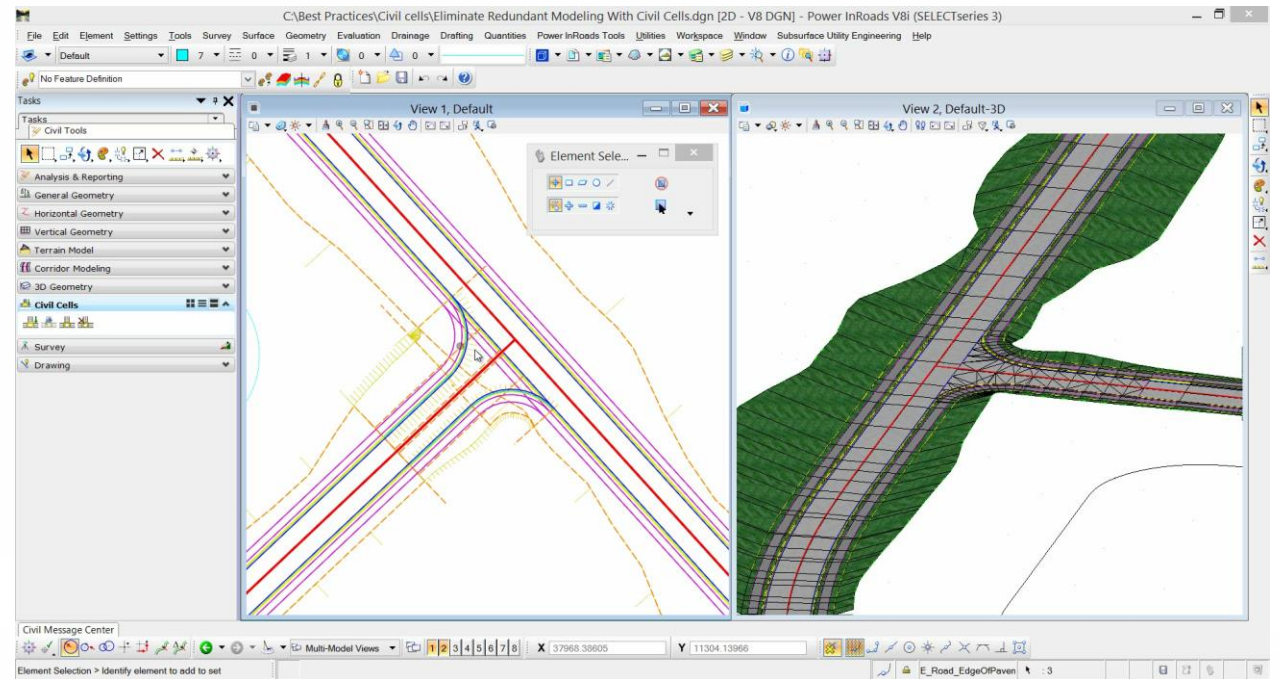
Design intent and the advantages of OpenRoads

- Consider the same end requirement as before



Automatic Updates from rules and relationships?

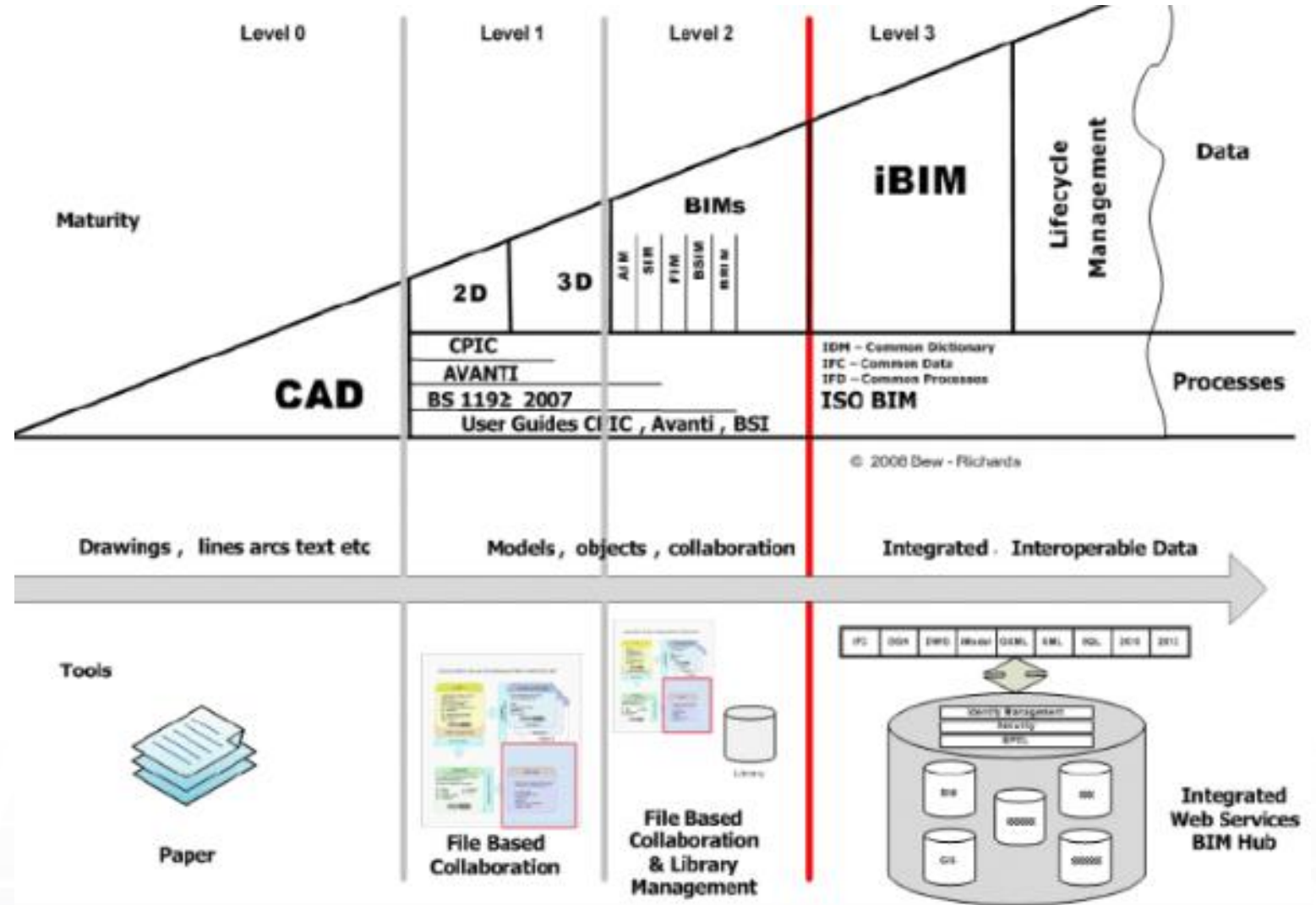
- *Think Cause / Effect or Parent / Child*
 - *Simple -*
 - *Now Scale that up...*
- **Multiple Rule Buckets**
 - Survey
 - Terrain
 - 'Static'
 - 'Dynamic'
 - Geometry
 - Intervals
 - Corridor

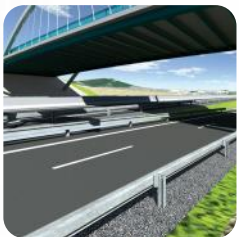
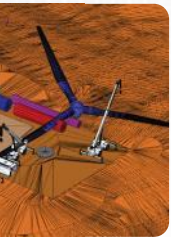


Without Rules there would be no Design Intent
They underpin EVERYTHING in OpenRoads

What are the drivers ?

- Greater efficiency
- Confidence
- Object modelling
- Savings





How to achieve 'design intent'

How to achieve 'design intent'

- *Method of construction*

- Snaps

- Consider propagation

- 'Good snaps' – end point, intersection, perpendicular, tangent, center, mid point (used carefully..)
 - 'Bad snaps' – XY, Nearest

- Controlling Snaps

- Accudraw – provides construction resulting in **XY**
 - Civil Accudraw – provides construction resulting in

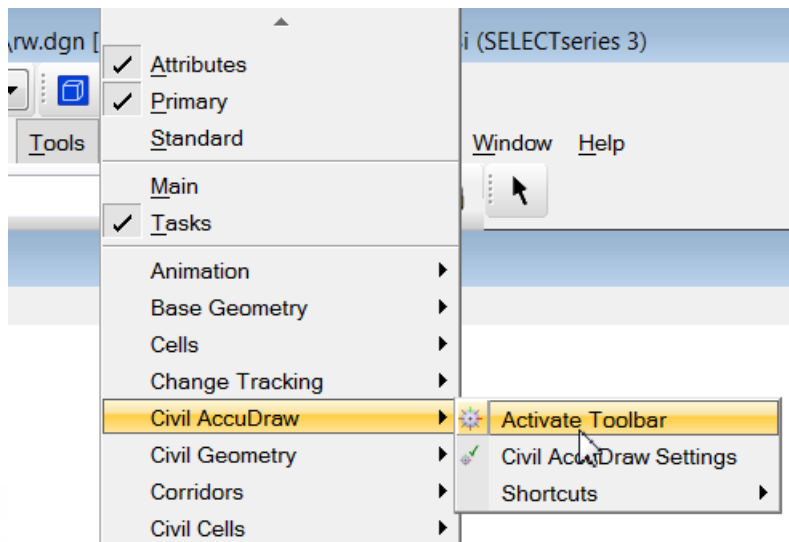


- Button Bar
- AccuSnap
- Multi-snaps
- Nearest
- Keypoint
- Midpoint
- Center
- Origin
- Bisector
- Intersection
- Tangent
- Tangent Point
- Perp
- Perp Point
- Parallel
- Point Through
- Point On
- Multi-snap 1
- Multi-snap 2
- Multi-snap 3

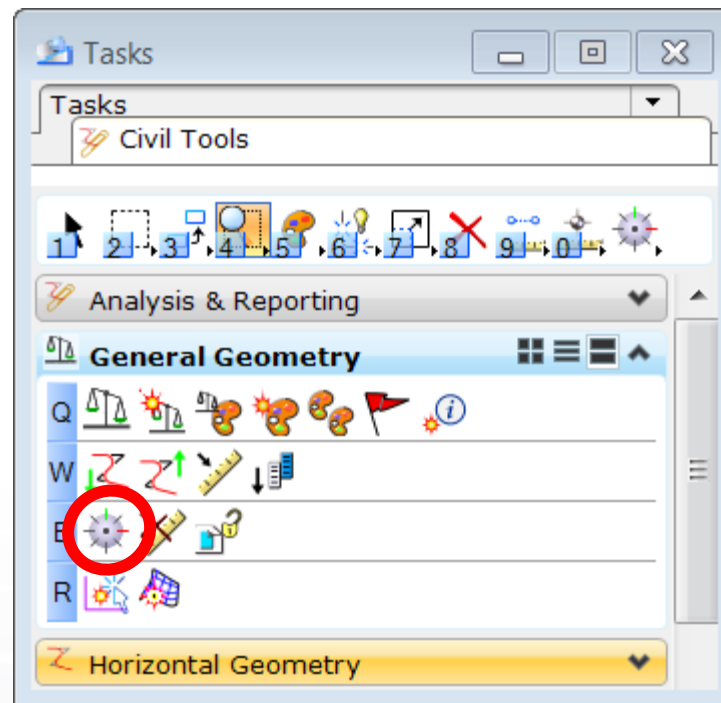
Civil Accudraw

- Activating

Main Tools menu:



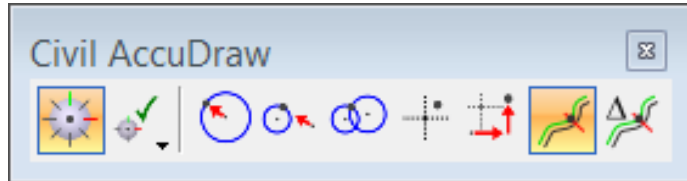
Civil Tools Tasks Navigation:



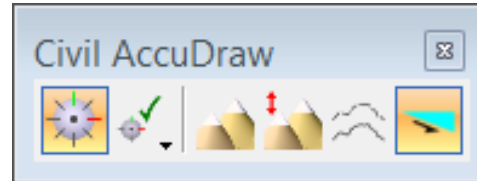
Civil Accudraw

- Modes

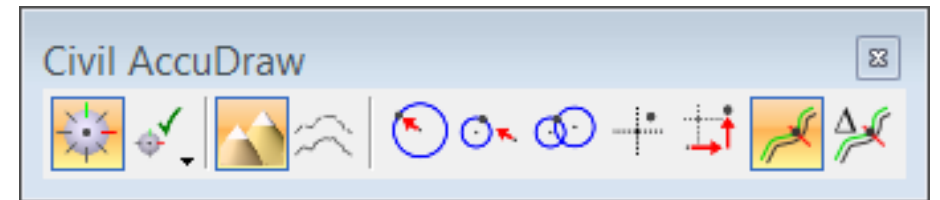
2D Plan



Profile Model View

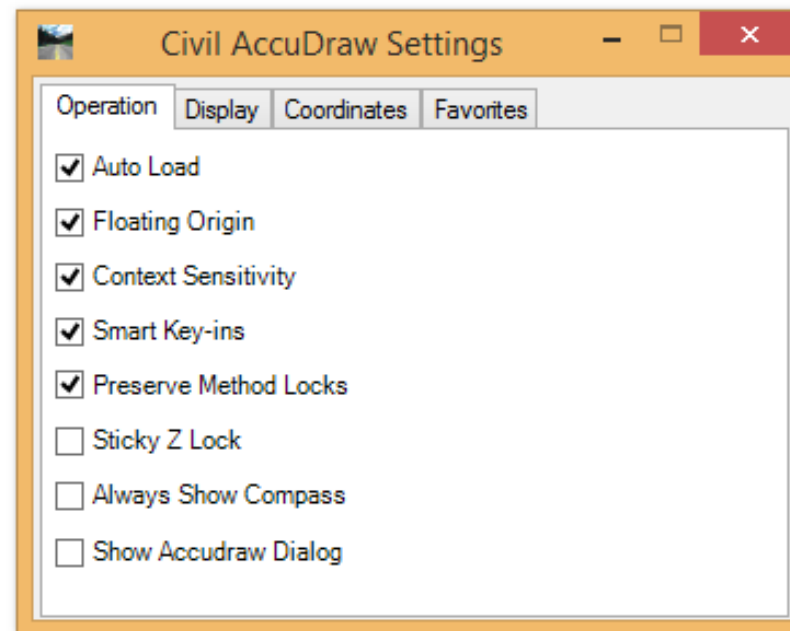
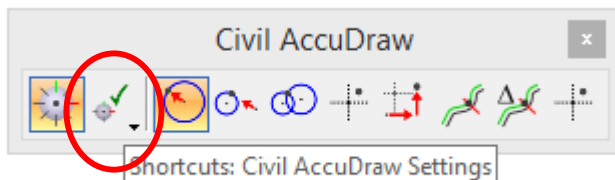


3D Plan



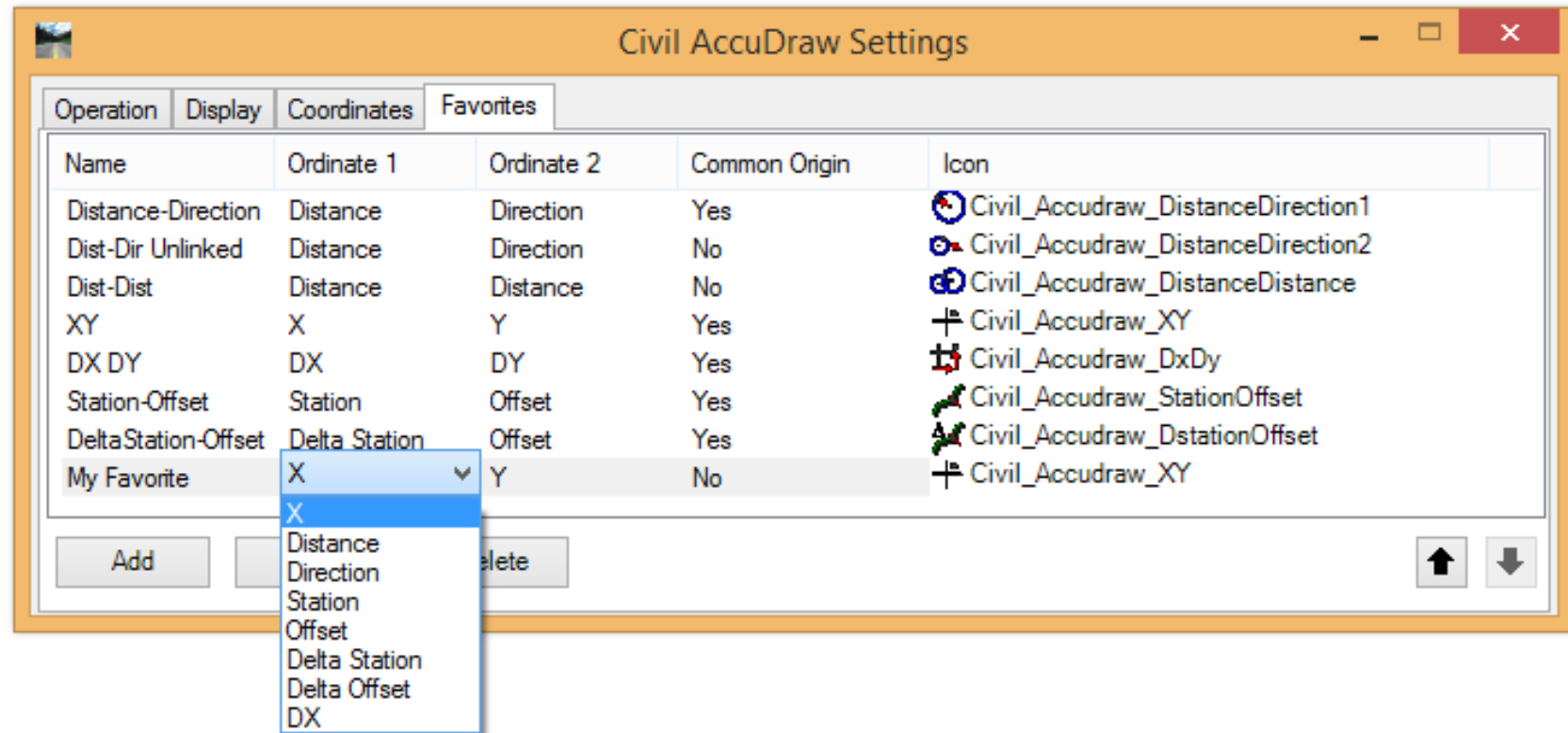
- Settings

Civil AccuDraw toolbar



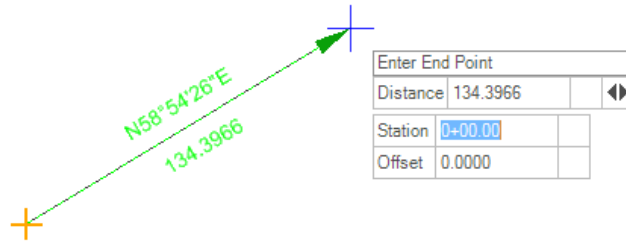
Civil Accudraw

- Common Constructions included
- Favorites supports user-customized methods

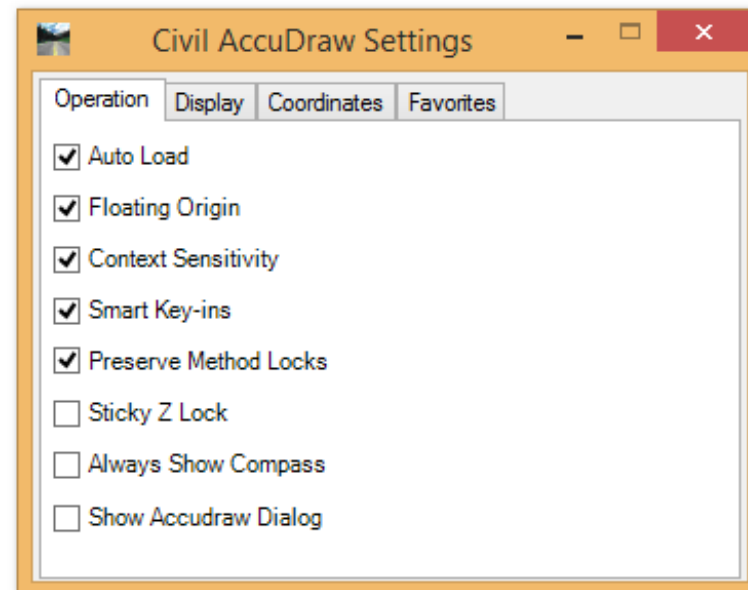


Civil Accudraw - Tips and Tricks

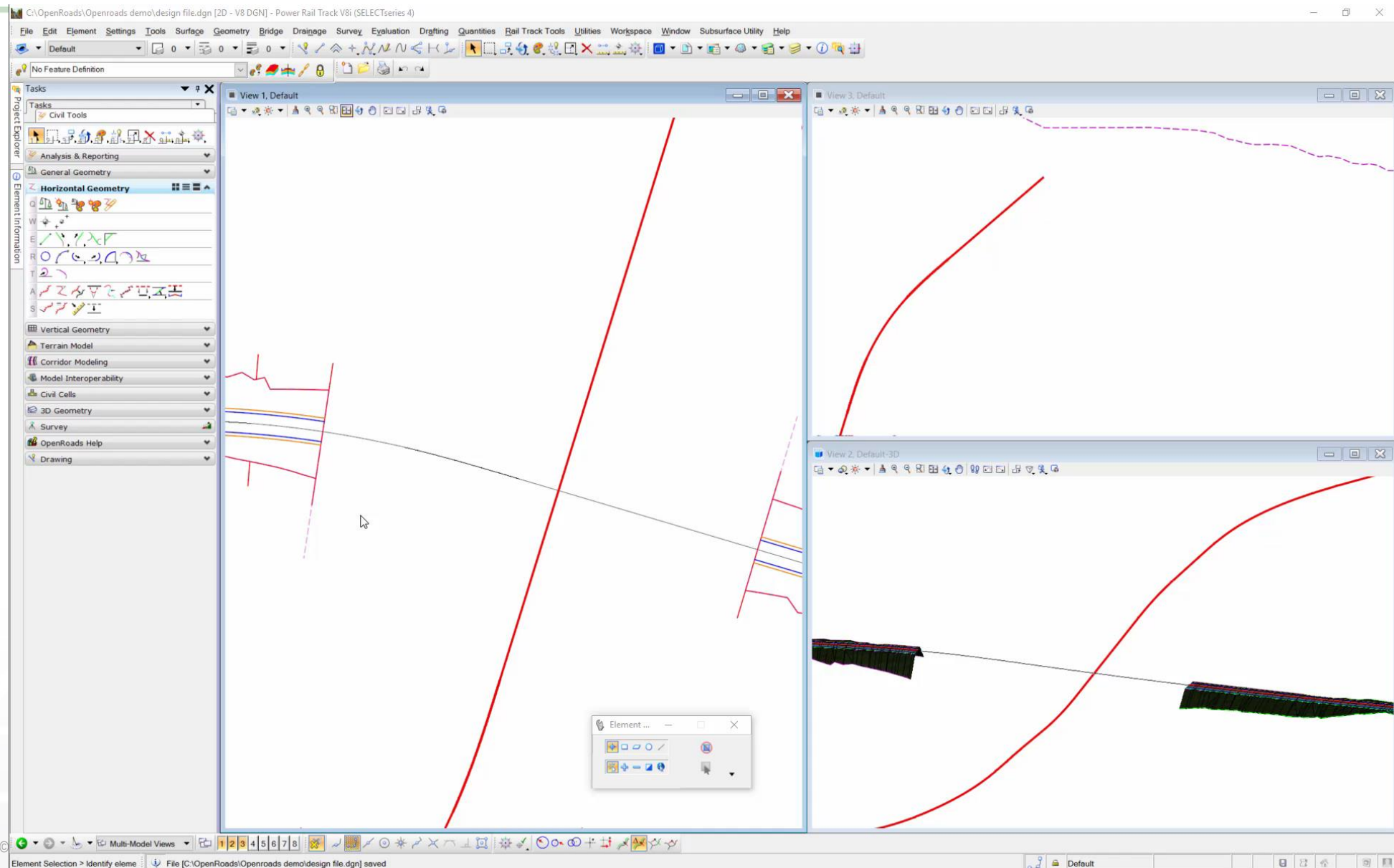
The 'TAB' key moves you from the active cursor input into the Civil Accudraw prompts



Set the origin location using the 'O' key and beware the 'Floating Origin'



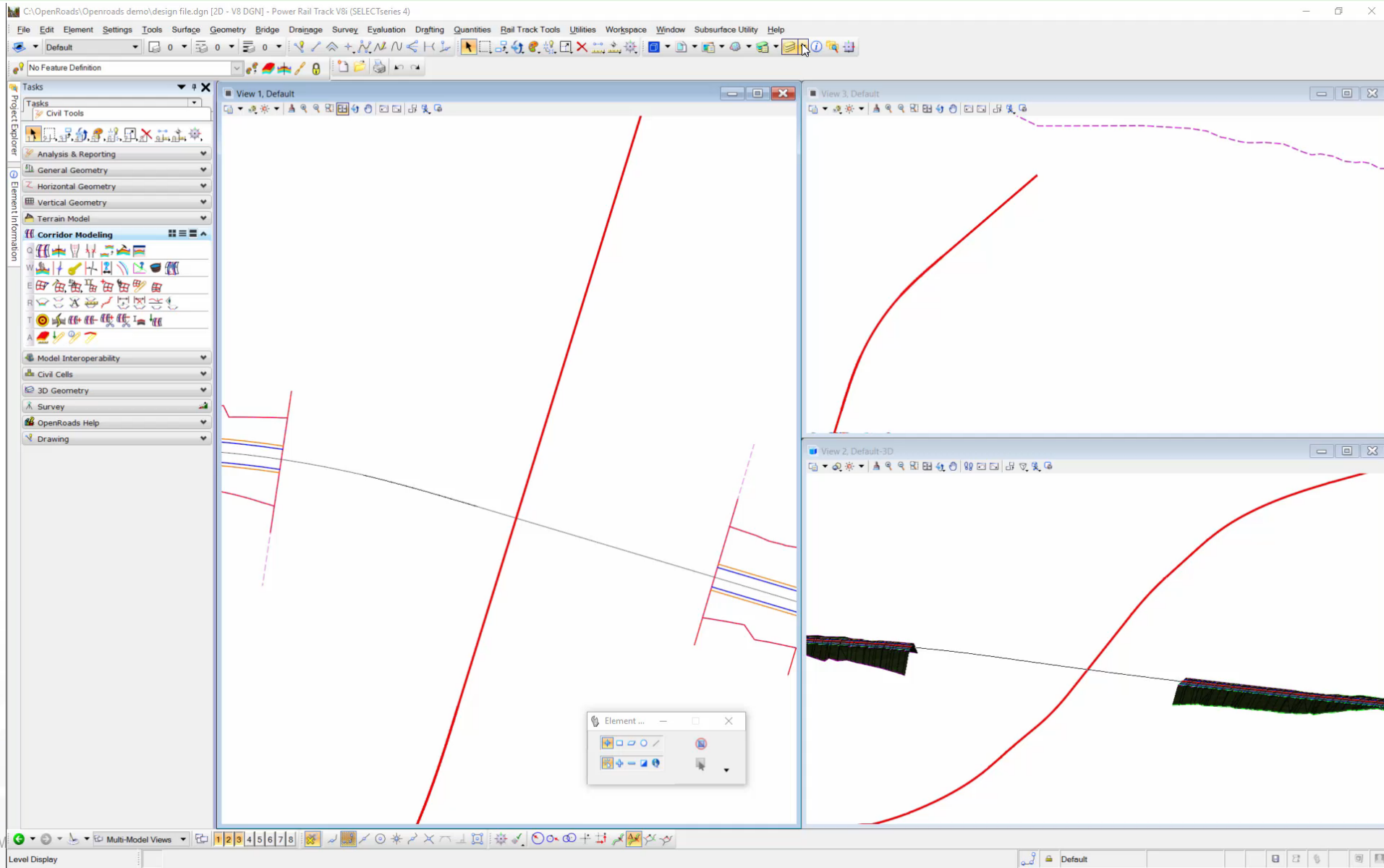
Corridors without Design Intent



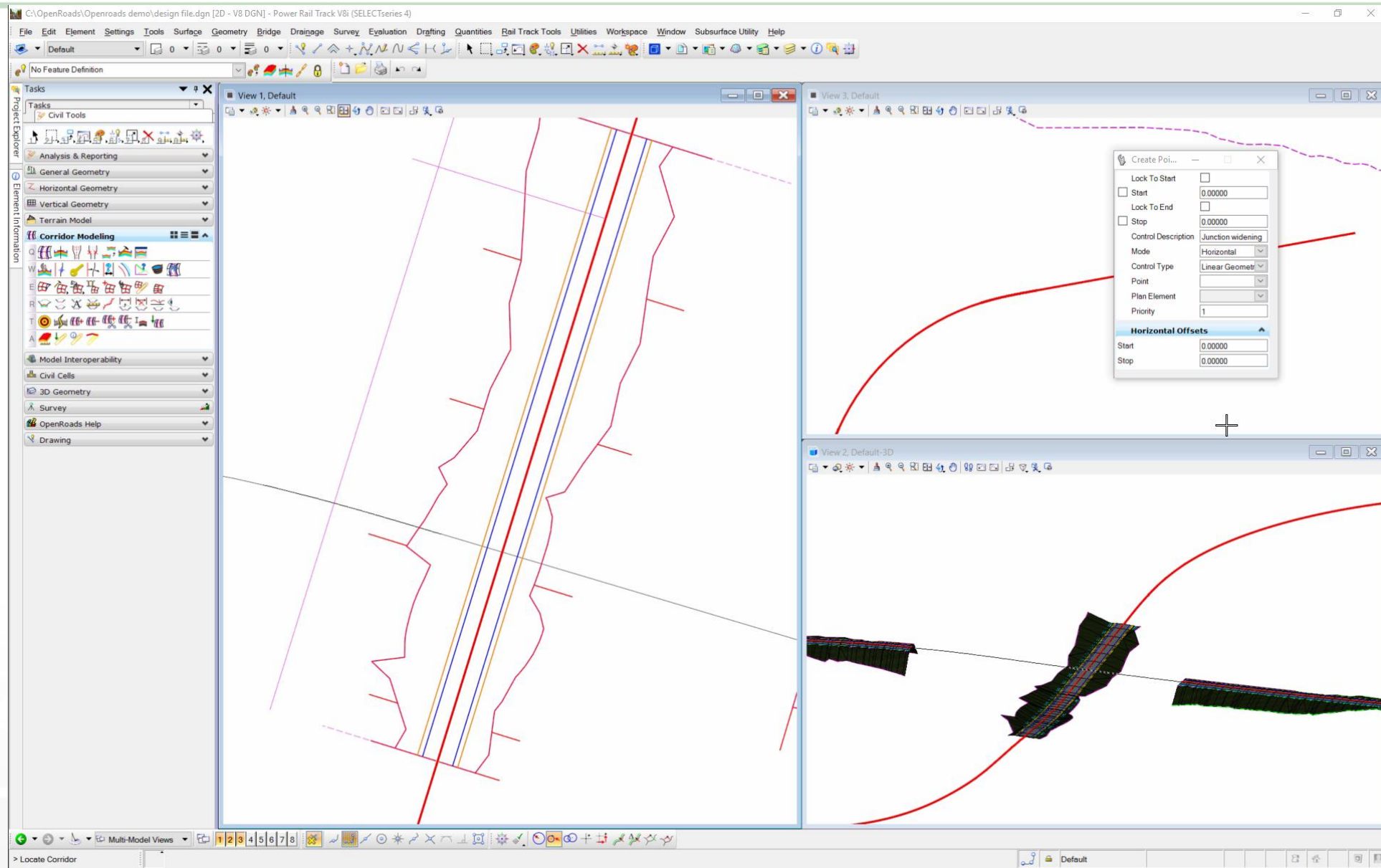
Corridors without Design Intent

- Summary of problems if not properly constrained
 - XY reflects as a Station
 - Locations constrained by Station change as a result of the geometry updating and knock
 - onto locations driven by all corridor objects
 - Manual editing to resolve in the corridor object is time consuming
 - Changes might be small and go un noticed
 - Standards might be compromised that cause an audit failure later

Corridors utilising Design Intent – template drops



Corridors utilising Design Intent – point controls



Best Practice



Create 2D / Planimetric graphics to control the corridor and provide design intent.

Use Civil Accudraw and Graphics to constrain ranges of geometry

Remember 'tentative snap' to aid in locking values in

Add appropriate features that work for you and give the graphical control you need

- Consider using Construction Class in Element Templates
- Place on individual levels for different control – ie.
 - Template Drop
 - Point Controls
 - End Condition Exceptions
 - etc

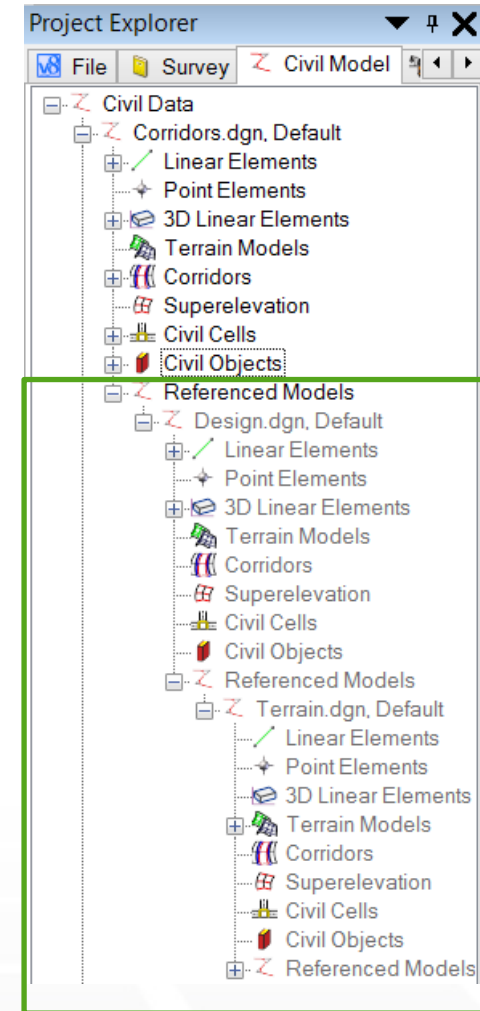
Understanding The Civil Model

Project Explorer > Civil Model

Provides the container for the Civil Model

- Linear Elements
- Point Elements
- 3D Linear
- Terrain Models
- Corridors
- Superelevation
- Civil Objects
- Civil Cells
- Reference Models

Read Only
Access to
reference files



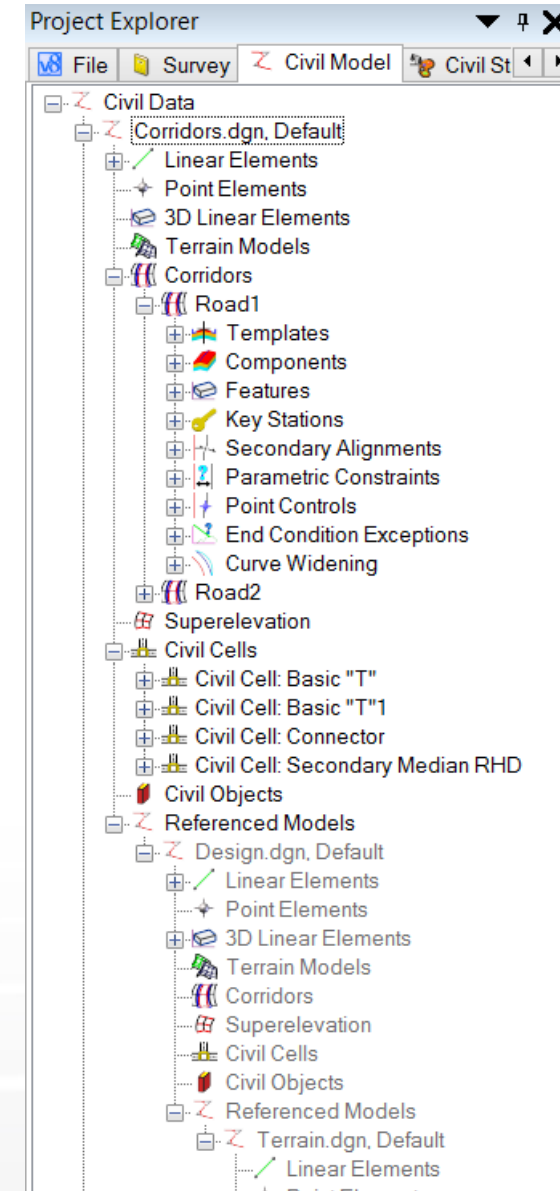
Understanding The Geometry Model

Project Explorer > Civil Model

Special containers for the Civil Model

- Linear Elements
- Point Elements
- 3D Linear
- Terrain Models
- **Corridors**
- Superelevation
- **Civil Objects**
- **Civil Cells**
- Reference Models

Container content not visible at the top level of the Civil Data Model

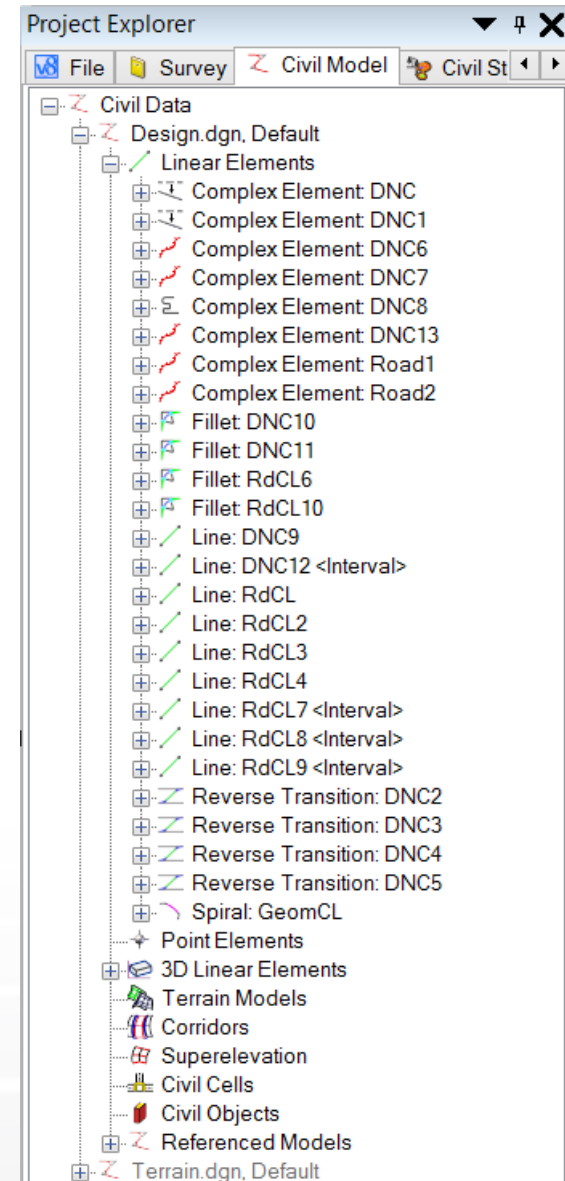


Understanding The Geometry Model

- Linear Elements

Is the 'Geometry bucket'

- Only Featurised (named) elements are visible
- Icons indicate the creation rule

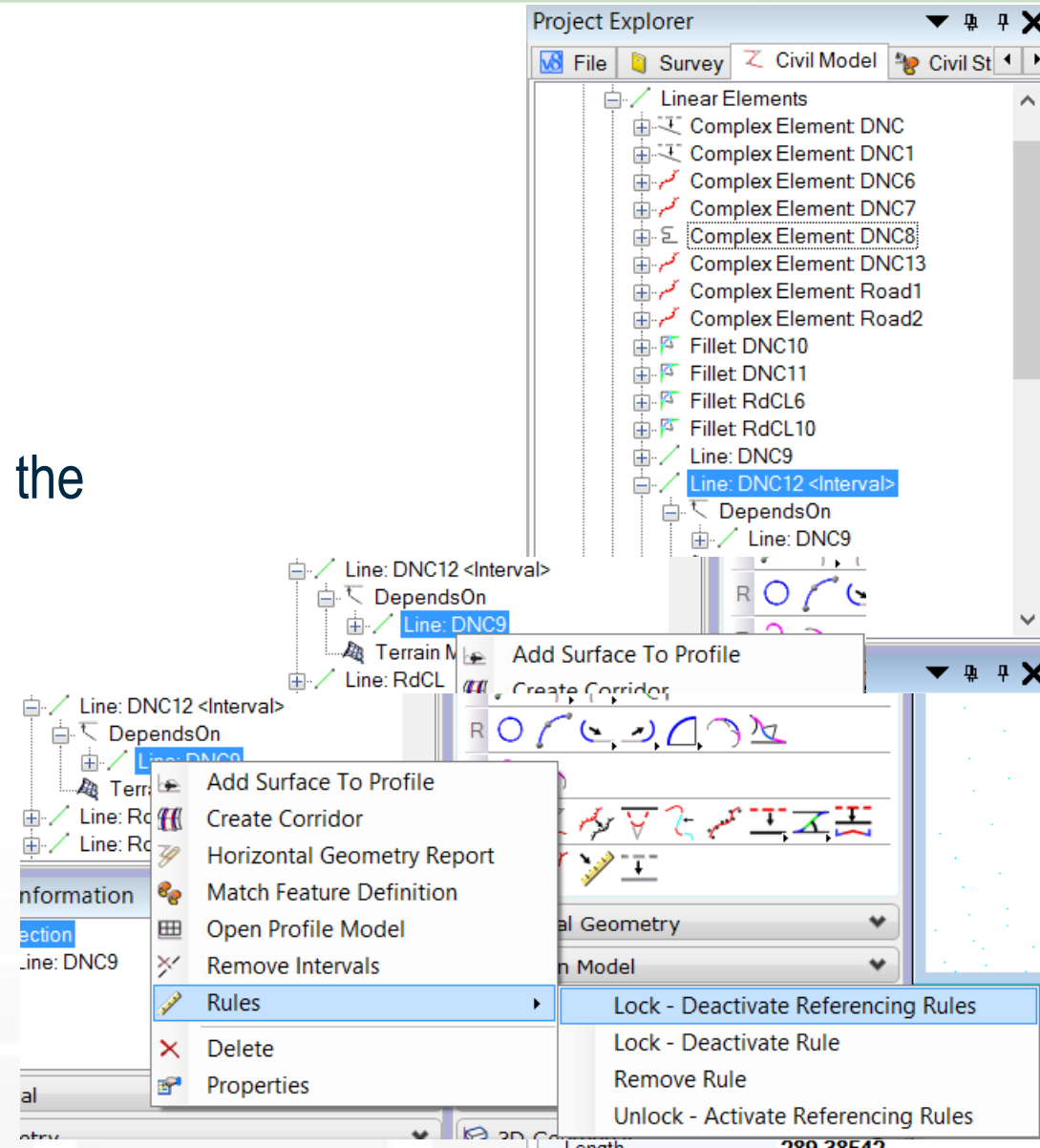


Understanding The Geometry Model

- 'Intervals'

Indicate a rule resulting in modification

- Trim / Extend
- Gaps
- Creates New named Element with rule to the parent
- Intervals can be removed
- Rules can be controlled



Managing Rules

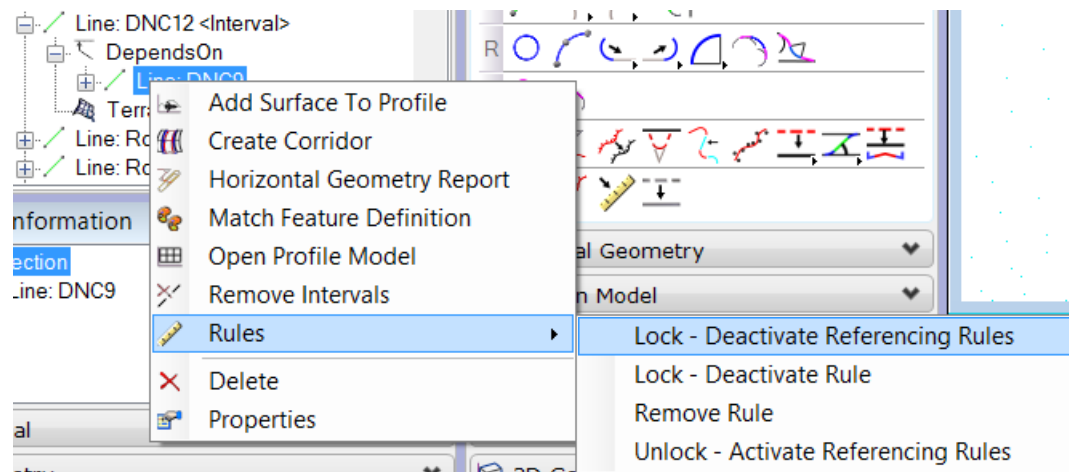


- Rules

- 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

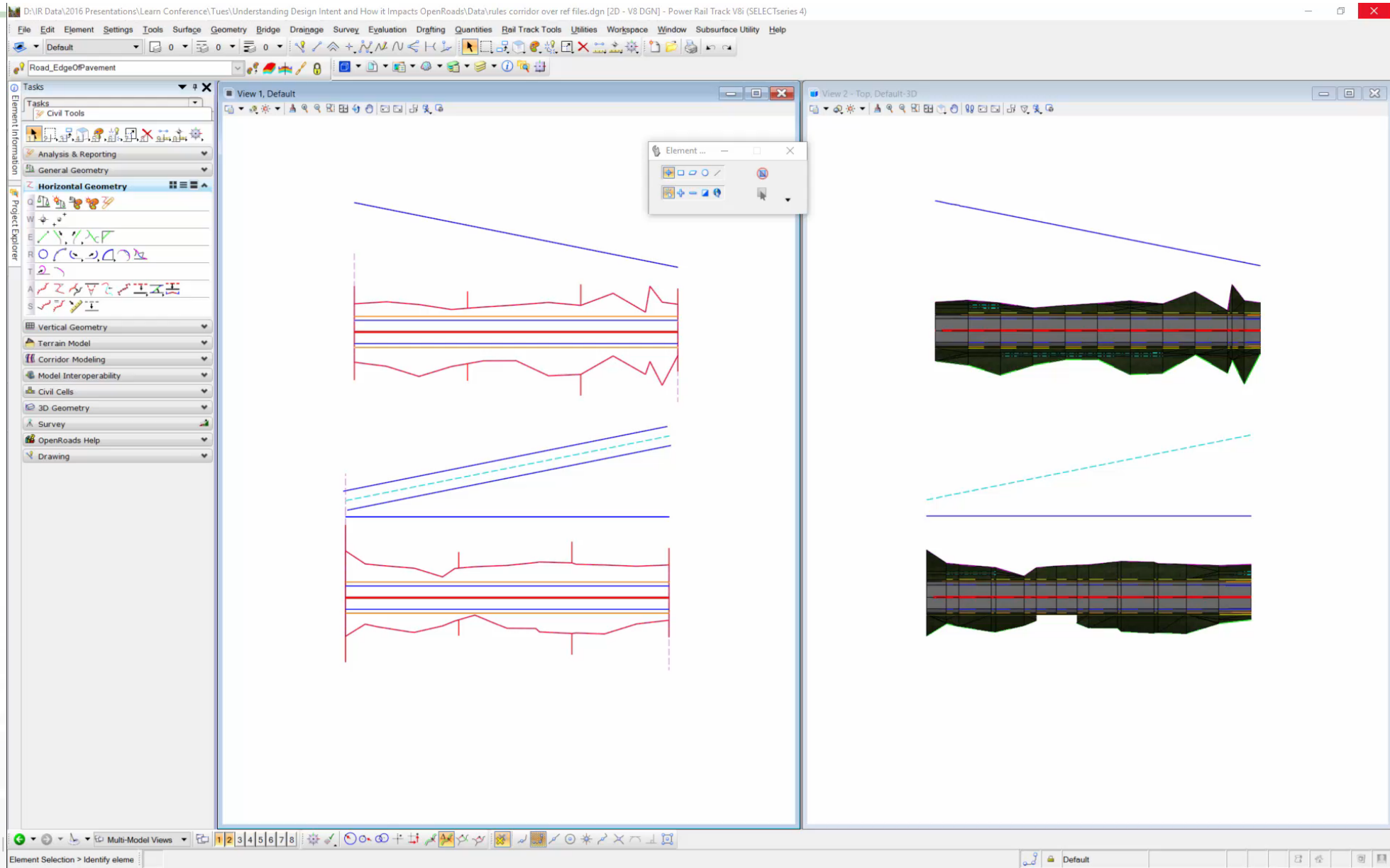


Template N...	Interval	Description	Start Station	End Station
Templates\...	5.00	Lock - Deactivate Rule	32.612	1036.400
Templates\...	10.00000		1036.400	1091.200
Templates\...	5.00000		1091.200	1359.497

Row: 1 of 3

Close

Managing Rules

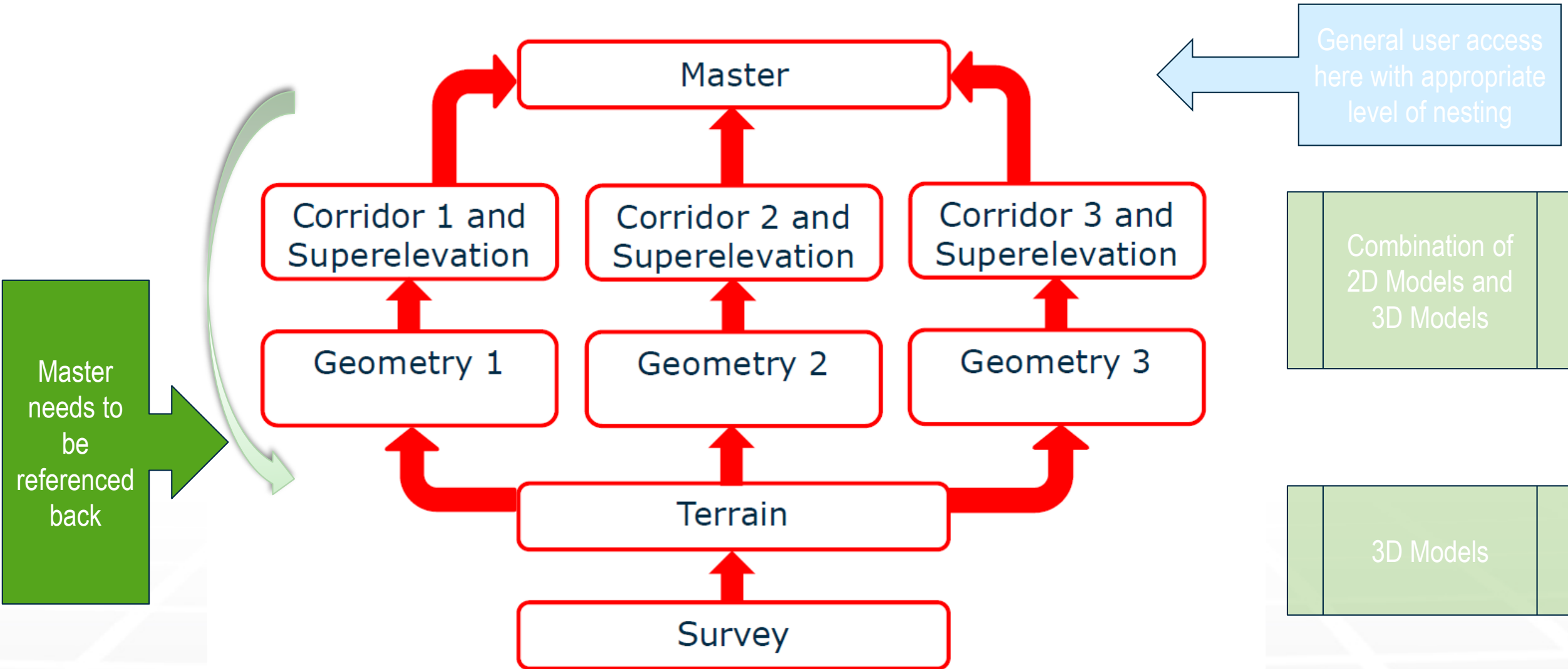


Reference Files and Rules

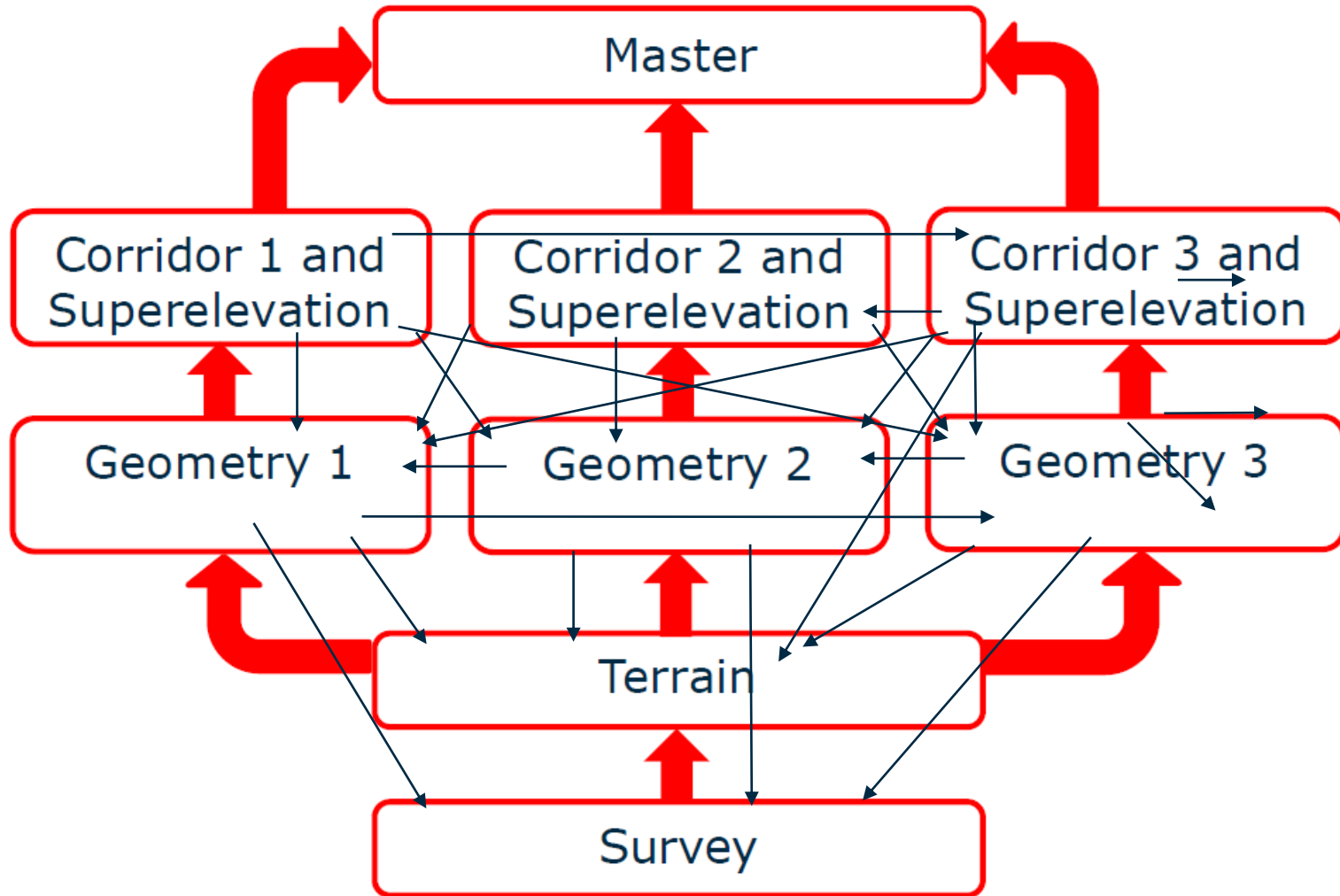
- Rules and Snaps support reference files creating a link to the **element id**
 - Changing out for a different drawing is ‘drawing production thinking’
 - Element id is unique may not work if the element has been modified.
- Updates occur on opening and rule propagation occurs

For rules to work an organised file structure is required

Sample Reference File Organization...



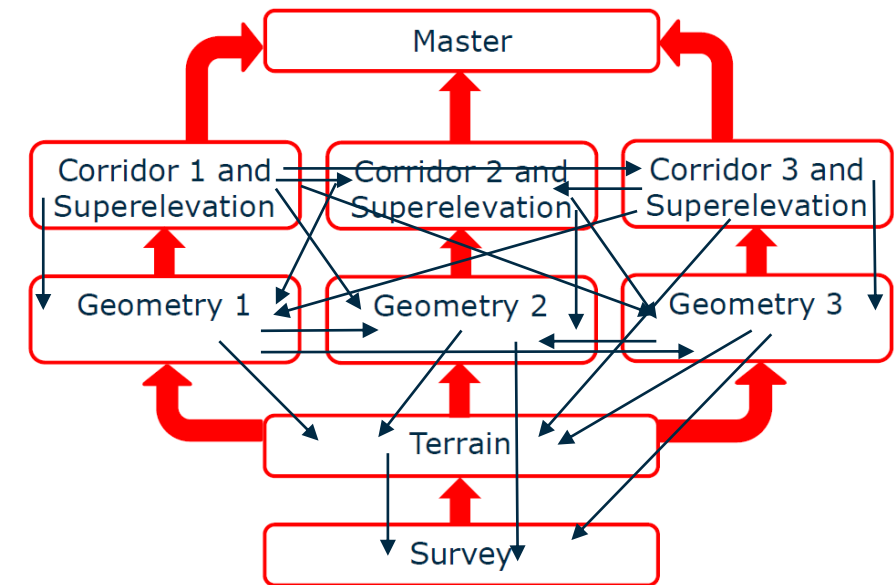
Sample Reference File Organization... In Reality



Reference Files and Rules in OpenRoads

Reference Files and Rules

- Rules and Snaps support reference files creating a link to the **element id**
 - Changing out for a different drawing is ‘drawing production thinking’
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For rules to work an organised file structure is required

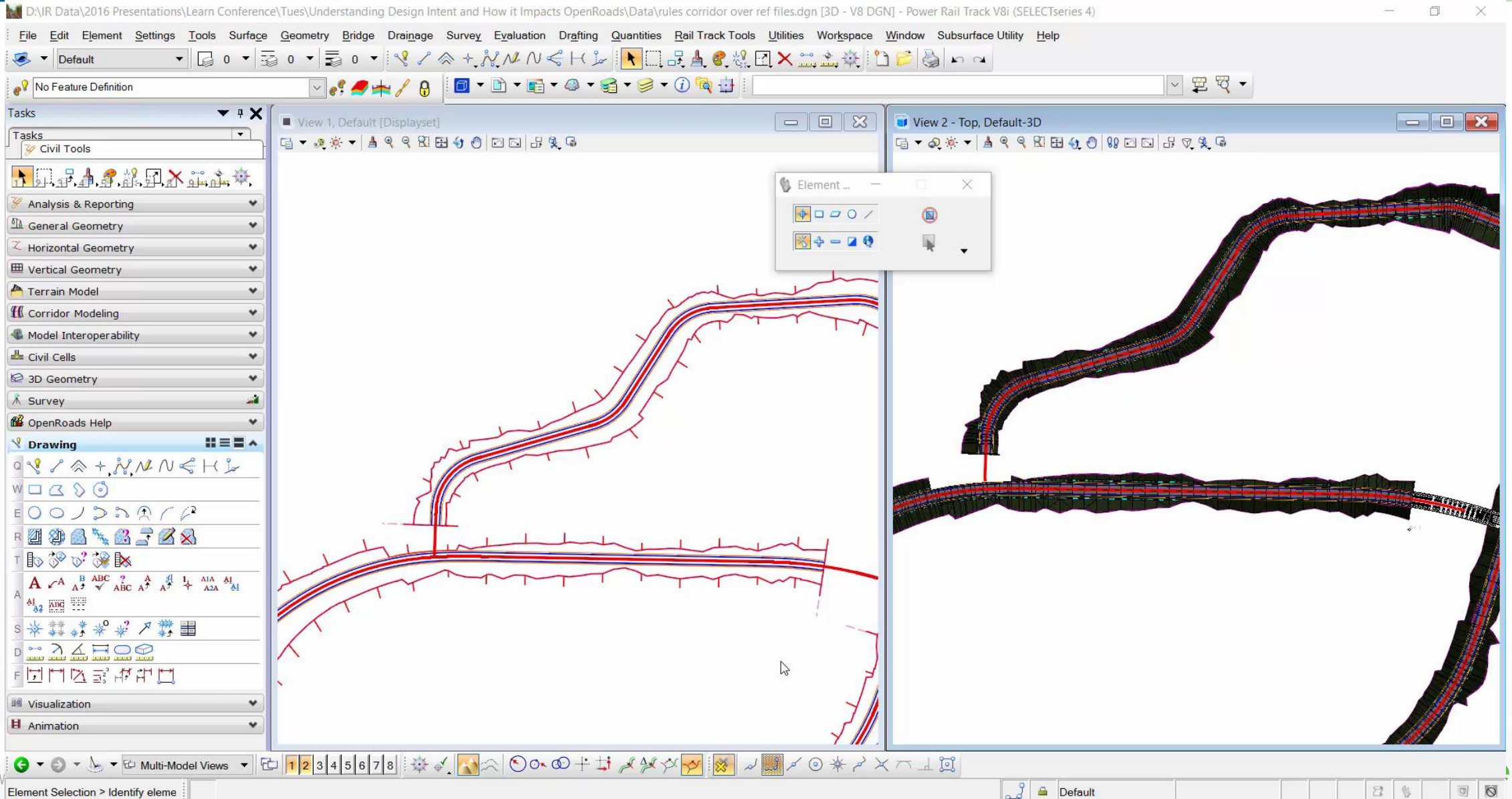
Reference Files and Rules in OpenRoads - Detatching

The screenshot displays the Bentley OpenRoads software interface. The main window shows a 2D/3D view of a rail track corridor. The 'References' dialog box is open, showing a table of references. The table has columns for Slot, File Name, Model, Description, Logical, and Orientation. Two references are listed: Slot 1, 'rules geom over ref files.dgn', Model 'Default', Description 'Global Origin align...', Logical, and Orientation 'Coincident - World'; and Slot 2, 'rules corridor over ref files.dgn', Model 'Default-3D', Logical 'Ref', and Orientation.

Slot	File Name	Model	Description	Logical	Orientation
1	rules geom over ref files.dgn	Default	Global Origin align...		Coincident - World
2	rules corridor over ref files.dgn	Default-3D		Ref	

Scale: 1.000000 : 1.000000 Rotation: 00°00'00" Offset X: 0.00000 Y: 0.00000
Nested Attachments: Live Nesting Display Overrides: Allow Nesting Dep: []
New Level Display: Config Variable Georeferenced: No

What happens when elements are **modified** in Reference Files



What happens when Reference Files are **not found**

The screenshot displays the Bentley MicroStation software interface. A file selection dialog box is open, showing the contents of the 'Data' folder. The dialog box title is 'Open - D:\IR Data\2016 Presentations\Learn Conference\Tues\Understanding Design Intent and How it Impacts OpenRoads\Data\'. The 'Look in:' field is set to 'Data'. The file list is as follows:

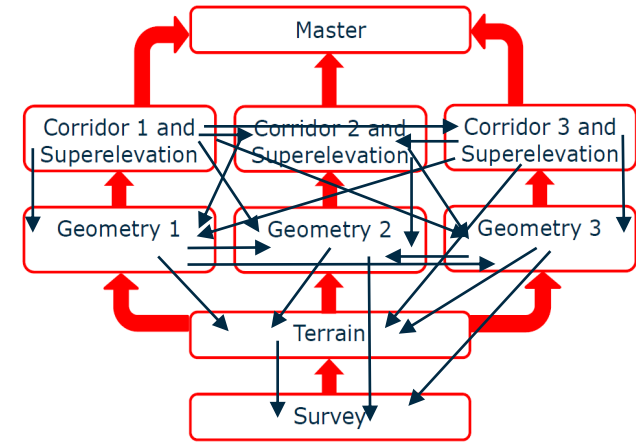
Name	Date modified	Type	Size
Corridor replace	24/05/2016 01:58	File folder	
empty.dgn	24/05/2016 02:18	Bentley MicroStati...	
ConcBridge.dgn	29/07/2015 14:05	Bentley MicroStati...	
corridor Design intent.dgn	13/05/2016 14:45	Bentley MicroStati...	
Gantry.dgn	12/10/2015 17:46	Bentley MicroStati...	
rules corridor over ref files.dgn	24/05/2016 02:29	Bentley MicroStati...	
rules corridor.dgn	14/05/2016 12:16	Bentley MicroStati...	
rules geom over ref files.dgn	24/05/2016 02:20	Bentley MicroStati...	
rules geom.dgn	24/05/2016 02:03	Bentley MicroStati...	
rules WIP.dgn	14/05/2016 10:52	Bentley MicroStati...	
rules.dgn	13/05/2016 15:12	Bentley MicroStati...	
terrain.dgn	13/05/2016 12:17	Bentley MicroStati...	

The file 'rules geom over ref files.dgn' is selected. The 'Files of type' dropdown is set to 'CAD Files (*.dgn;*.dwg;*.dxf)'. The 'File name' field contains 'rules geom over ref files.dgn'. The 'Open' button is visible. The background shows the software interface with a drawing area containing a red line representing a track profile.

Best Practice



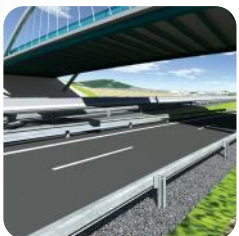
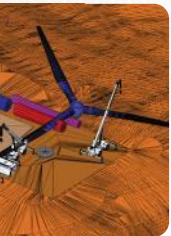
Plan project the structure to avoid **'reference file hell'**



Be mindful of down stream referencing and avoid dropping geometry / recomplexing as it will break the rules over reference file

Understanding Design Intent and How it Impacts OpenRoads

- Rules and relationships are more than a simple offset or snap.
- OpenRoads functionality captures the engineer's "*design intent*" in order to allow for **dynamic** and **intelligent updating** through the entire lifecycle of the project.



Revisit of Learning Objectives

Learning Objectives

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