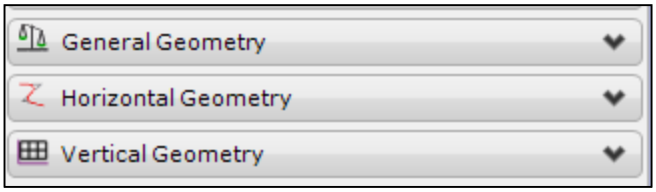
Contents

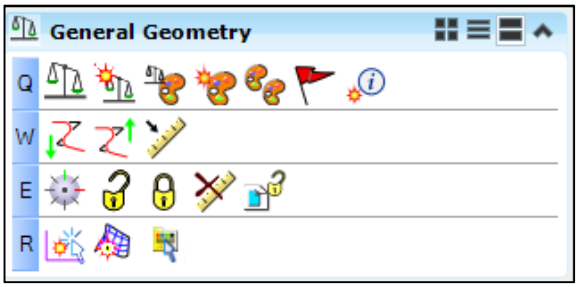
1. Civil Geometry Overview

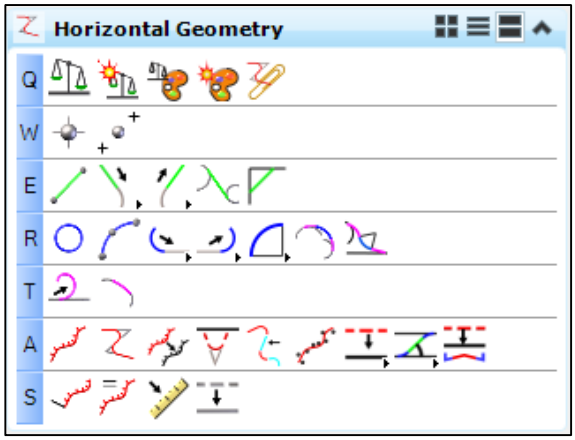
Civil Geometry is a dynamic, rules-based approach to geometry that provides a level of associativity by preserving design intent, snaps and Civil AccuDraw input. The results of the tools are intelligent MicroStation elements which can be dynamically edited and associations between elements are automatically updated.

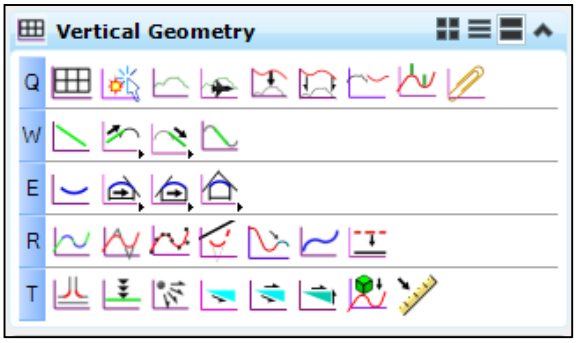
No external geometry file is required. The MicroStation elements serve as the geometry elements with additional intelligence applied to store the rules and associations. Civil geometry must be exported to the native application coordinate geometry (.GPK) to be used in processes within GEOPAK.

OpenRoads Technology Geometry commands are contained in three task lists, **General Geometry**, **Horizontal Geometry**, **& Vertical Geometry.**



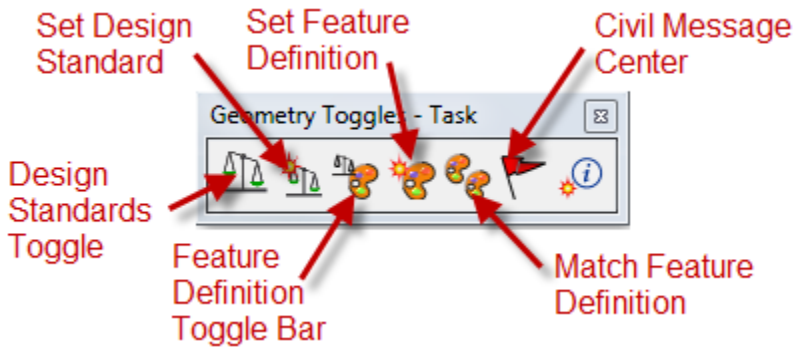






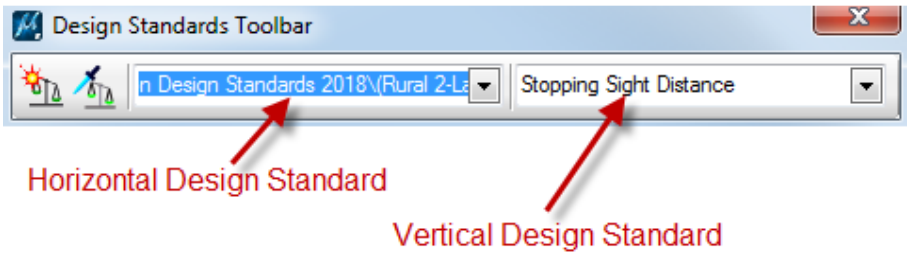
2. General Geometry Tools

A. Geometry Toggles Toolbar



i. Design Standards Toggle

Opens the Design Standards Toolbar

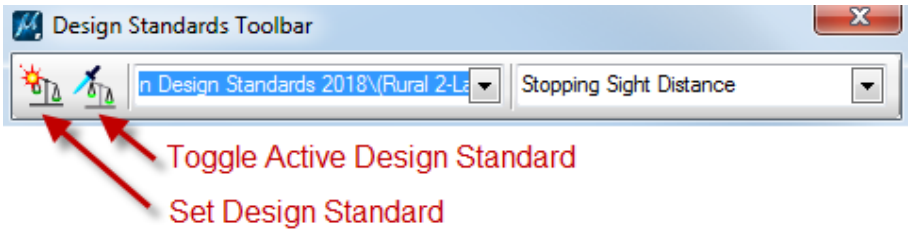


Design Standards are used for alignment checks based on AASHTO Geometric Design Standards. They work at 2 levels:

- Provide min/max values for element creation, e.g. minimum curve radius
- Check complex elements for breaks, overlaps, etc.

When a Design Standard is violated:

- A graphic icon appears over the element that has violated the standard
- An error or warning appears in the Civil Message Center (pg. 6)



ii. Toggle Active Design Standard

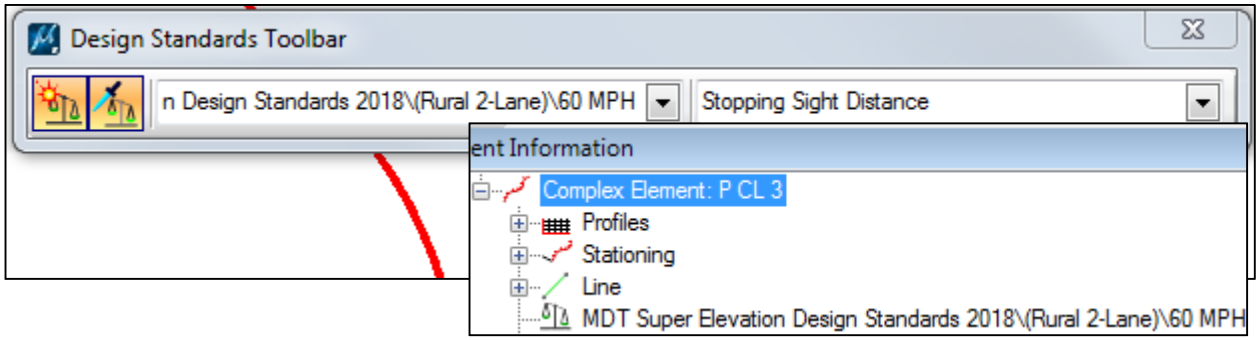
Turns the current Design Standard off and on. When active, all commands will use the values contained in the selected Standard.

- Found on the Design Standards Toolbar

iii. Set Design Standard

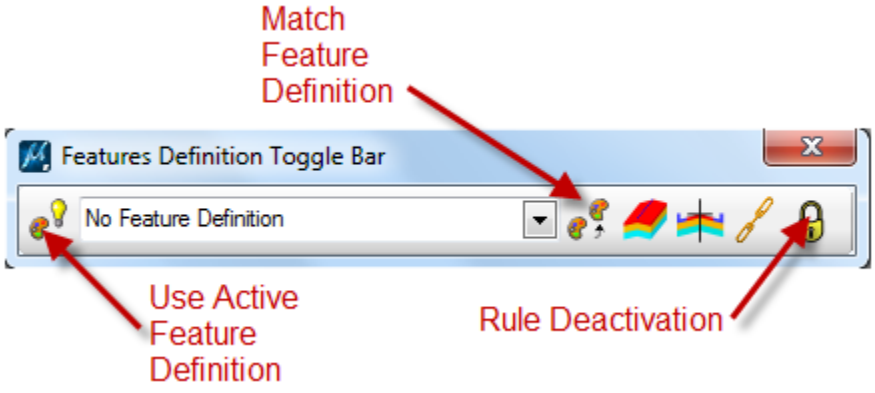
Allows the user to assign a Design Standard to an element.

- Uses the active standard from the Design Standards Toolbar



iv. Features Definition Toggle Bar

Opens the **Features Definition Toggle Bar**



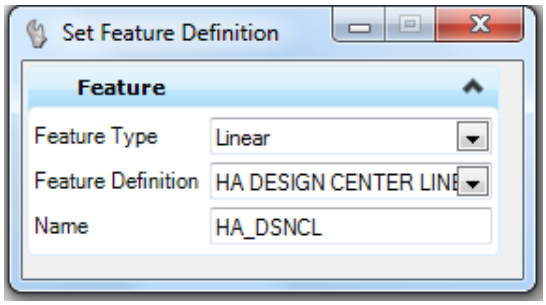
v. Use Active Feature Definition

Forces the active OpenRoads Technology geometry creation tool to use the feature definition defined by this dialog

vi. Set Feature Definition

Assigns a feature definition to a MicroStation Element

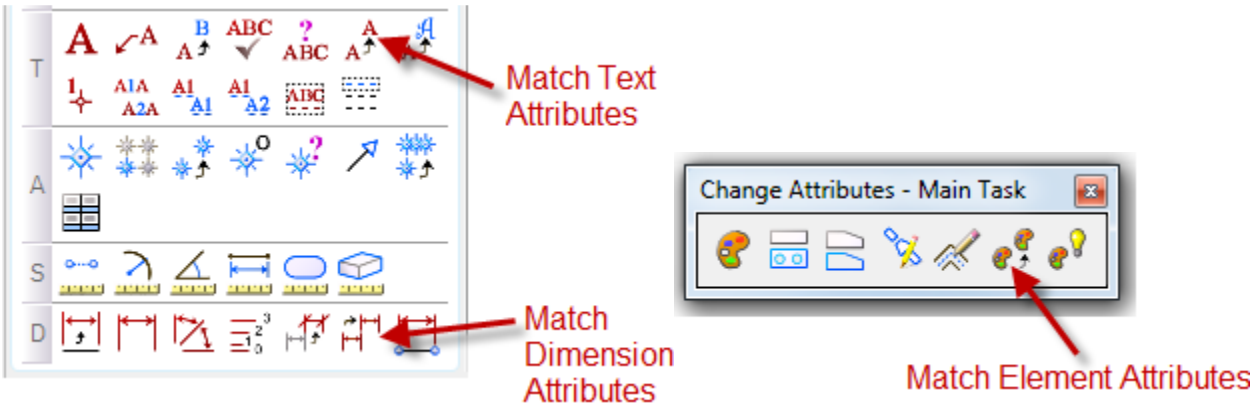
- **Linear or Surface**



vii. Match Feature Definition

Sets the Active Feature Definition from the assigned Feature Definition of a selected element

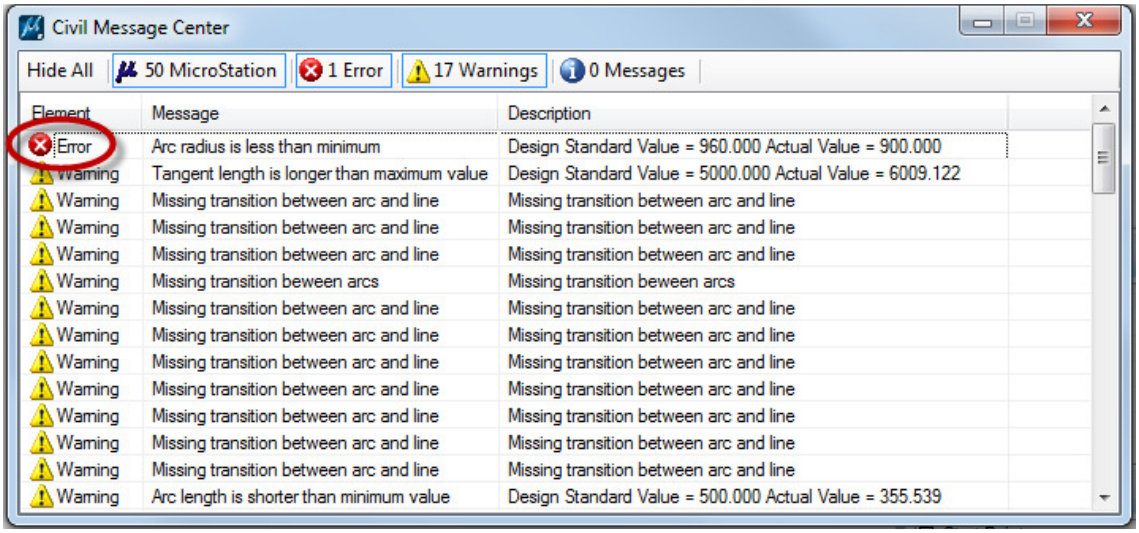
- Works the same way as the MicroStation Match Element Attributes, Match Text Attributes, and Match Dimension Attributes commands



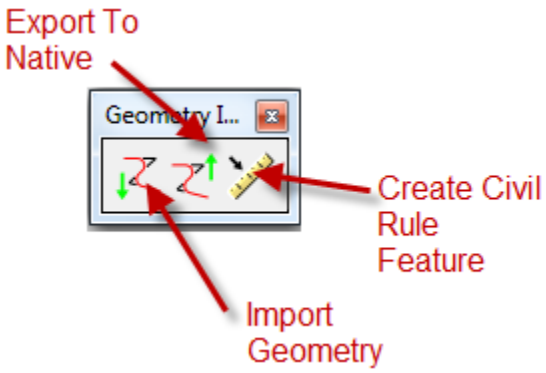
viii. Civil Message Center

Provides feedback on a variety of issues that can affect the design process, such as errors in construction and design standards that have been violated.

- **MicroStation** - duplicates all messages that MicroStation shows in its own message center
- **Errors** - displays severe problems found in the Civil geometry that need attention
- **Warnings** - displays less severe errors that should be investigated
- **Messages** - displays informational messages about the Civil Tools

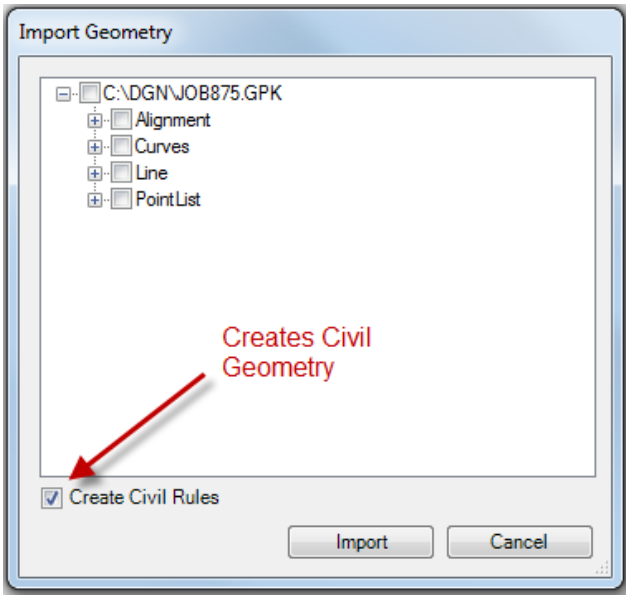


B. Geometry Import/Export Toolbar



i. Import Geometry

Creates civil geometry from a GEOPAK .GPK file

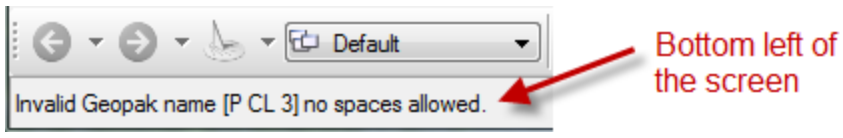


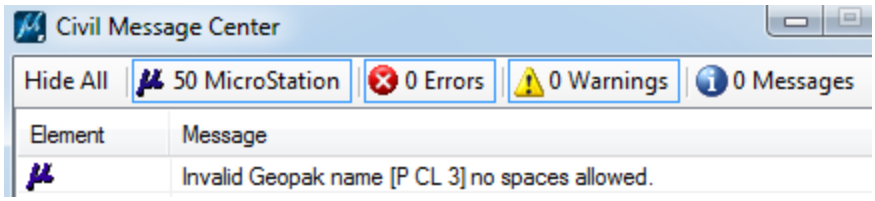
Note: Some imported geometry cannot be ruled. (Vertical and Horizontal)

ii. Export to Native

Sends civil geometry to a GEOPAK .GPK file

- Must follow GEOPAK naming conventions





iii. Create Civil Rule Feature

Applies civil rules to horizontal or vertical MicroStation geometry

- Without civil rules applied, MicroStation geometry cannot be edited using civil tools

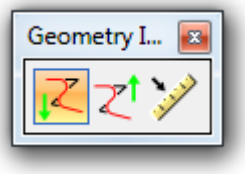
Note: The element must be in a 2D design model to be able to convert it to a Civil Rule Feature.

Exercise 1: Importing Geometry

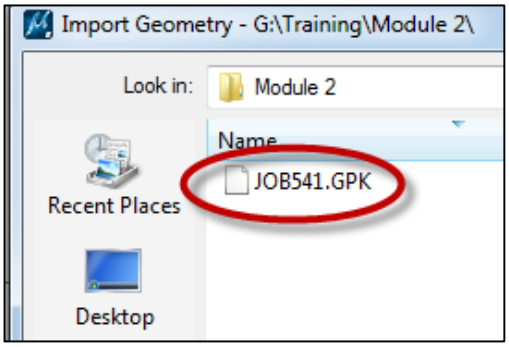
1. ***Open OpenRoads in the Enhanced workspace***

2. ***Open File*** *8541000RDALN001.dgn*

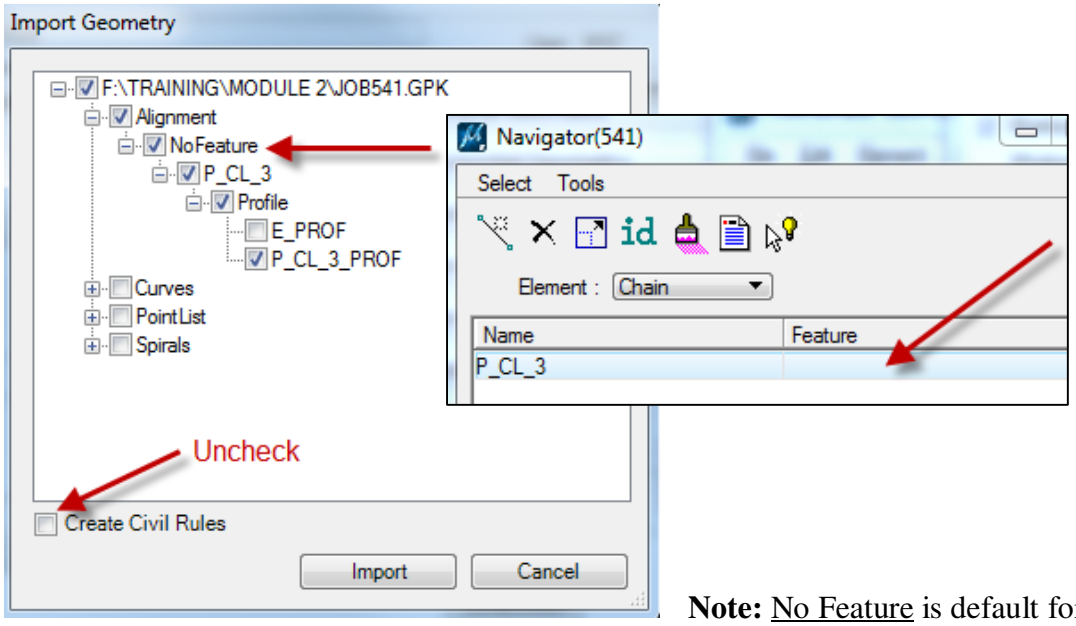
3. ***Select the*** *Import Geometry* ***command to open the file selection dialog box***



4. ***Select*** *JOB541.GPK*

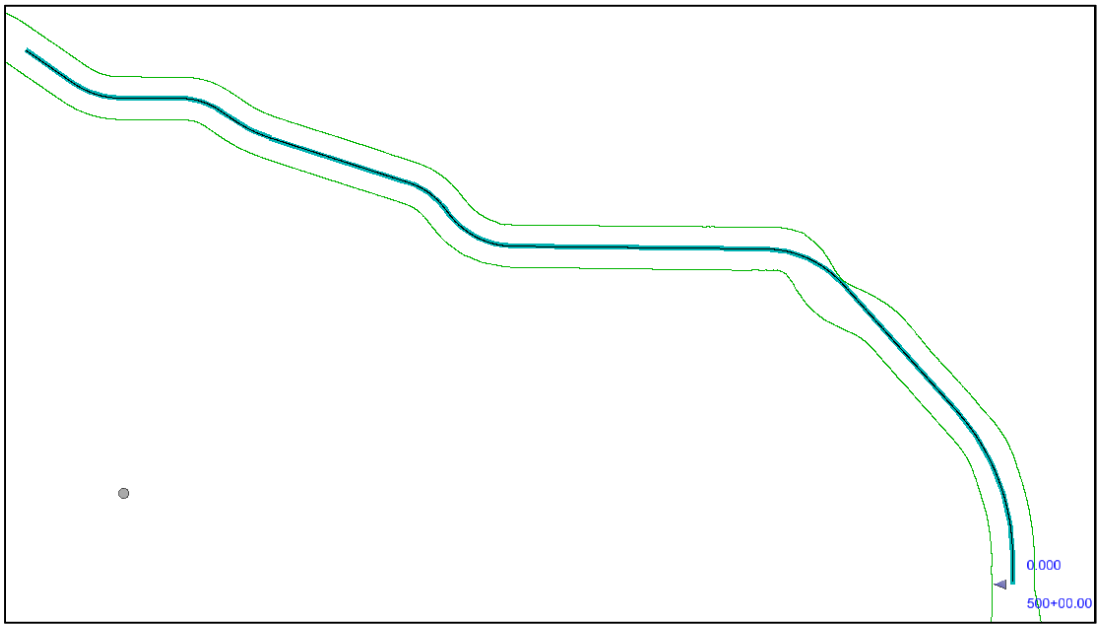


5. ***Select Alignment:*** *P_CL_3* ***with Profile:*** *P_CL_3_PROF*. ***Create without Civil Rules***



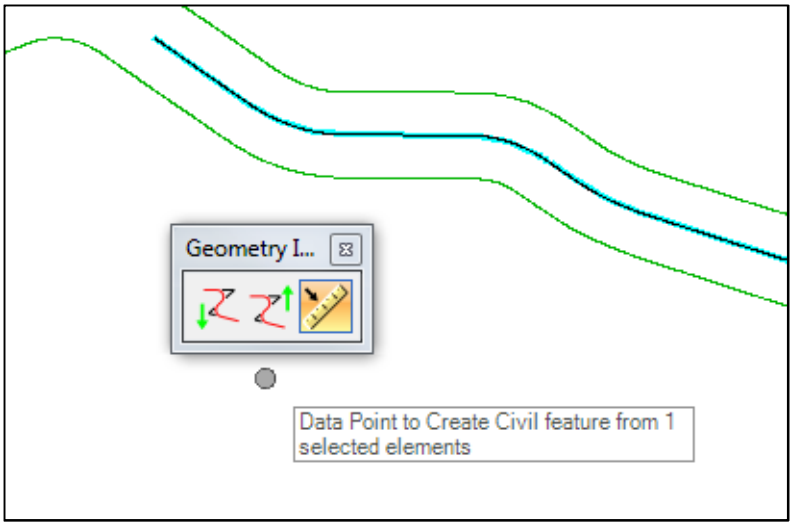
Note: No Feature is default for existing gpk alignments.

6. ***Click*** *Import*

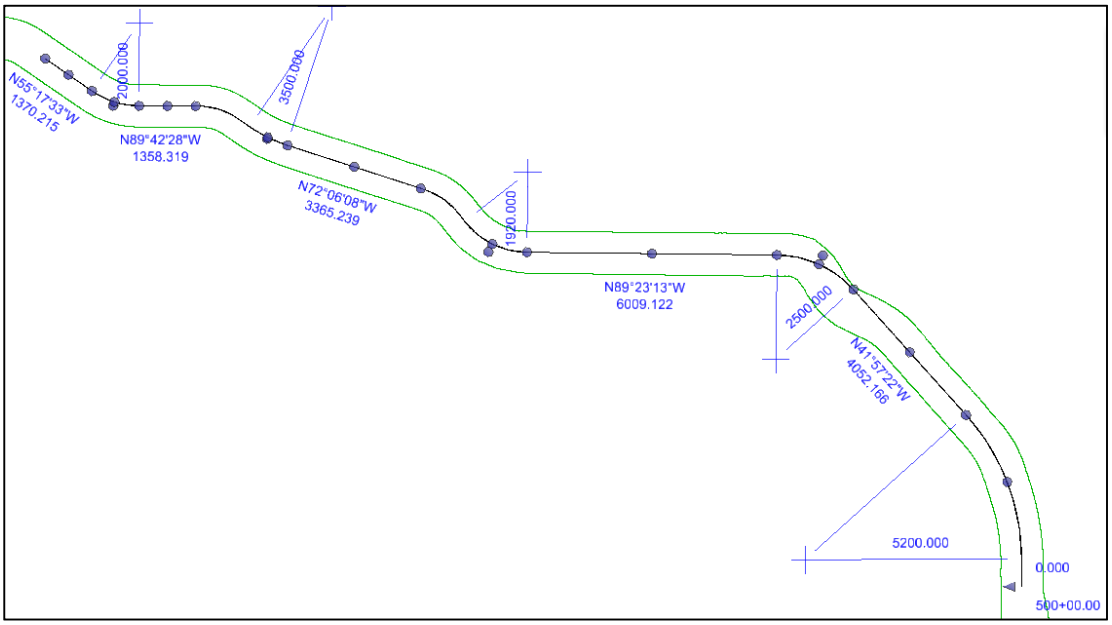


7. ***Select the horizontal alignment***

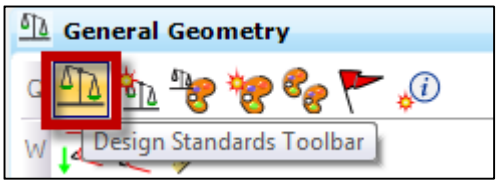
8. ***Click*** *Create Civil Rule Feature* ***to add 'intelligence' to the imported alignment***



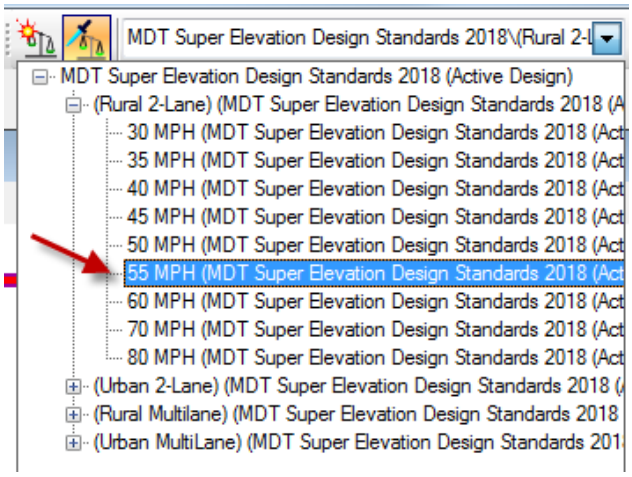
9. Data point to complete



11. Open the Design Standards Toolbar



12. On the Design Standards Toolbar set the Horizontal Design Standard to *Rural 2-Lane 55 MPH (MDT Super Elevation Design Standards 2018 (Active Design))*



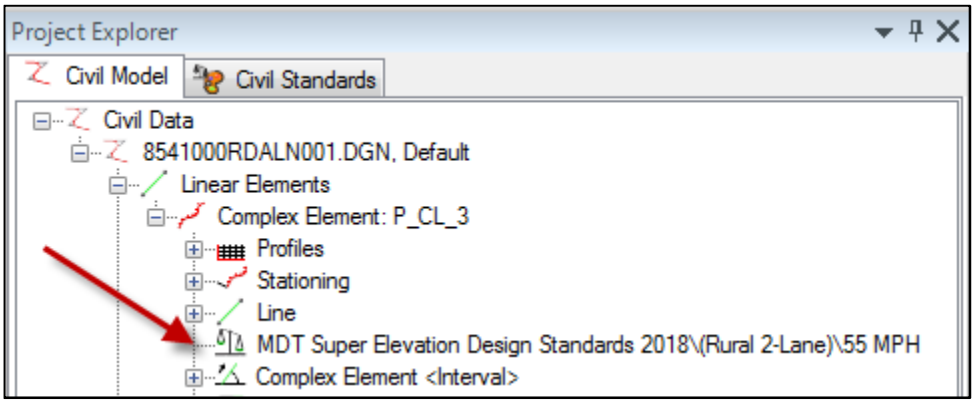
The Vertical Design Standard will default to Stopping Sight Distance

13. Click *Set Design Standard*

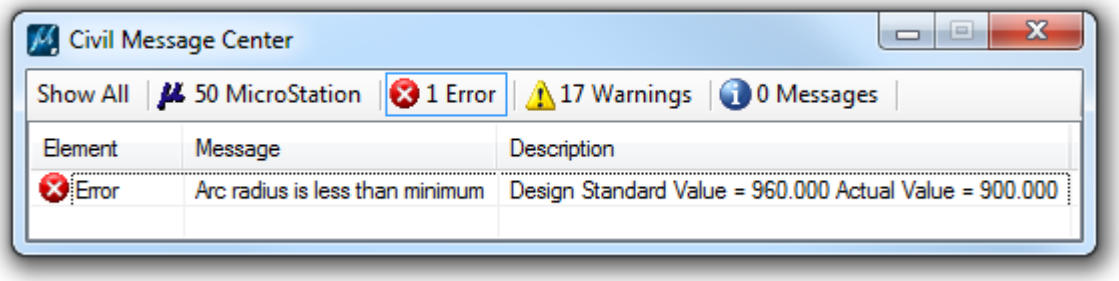
14. Select the alignment: *P_CL_3*

Note: Applying a design standard to the horizontal alignment does <u>not</u> apply it to any profiles associated with the alignment (active or not).

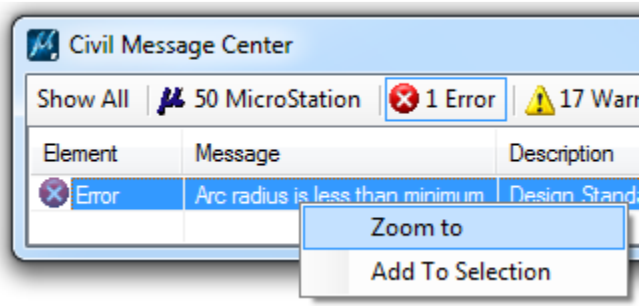
15. Open Project Explorer



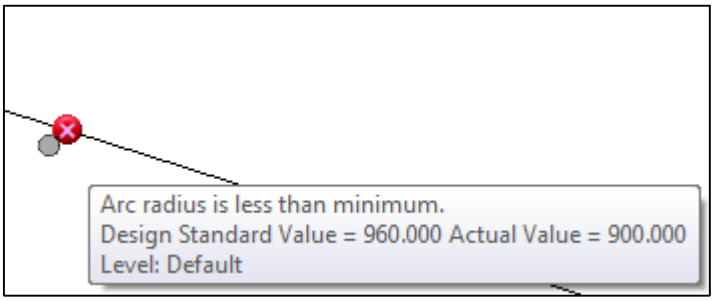
16. Open the Civil Message Center to check for any elements not meeting the design standard



17. Right Click on the error and click *Zoom To.*

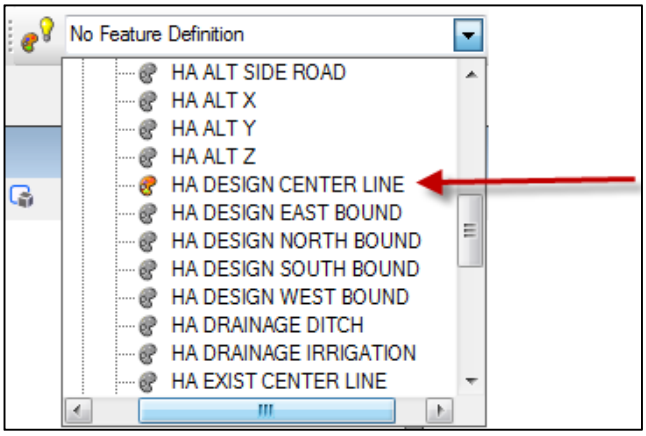


18. Hover the mouse over the warning symbol on the alignment.

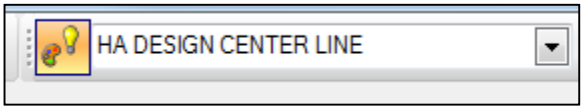


19. Change the curve radius to 960

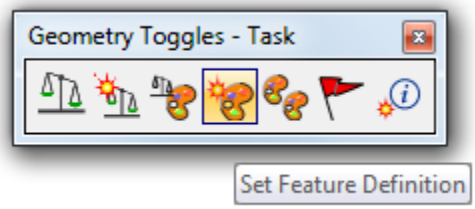
20. On the Feature Definition Toggle Bar set the Feature Definition to: *HA DESIGN CENTER LINE*



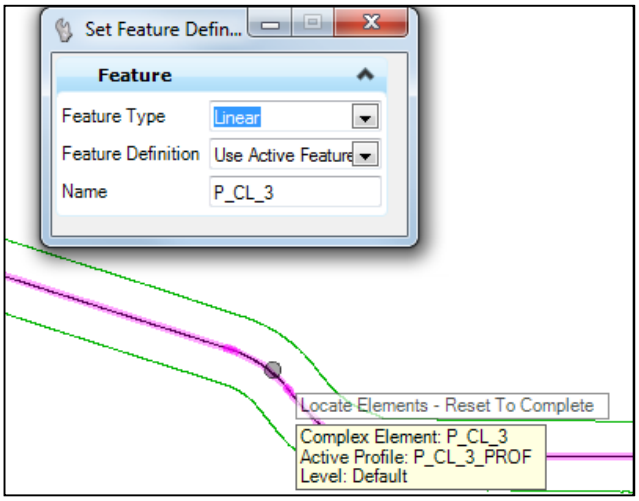
21. Toggle On *Use Active Feature Definition*



22. Click *Set Feature Definition*



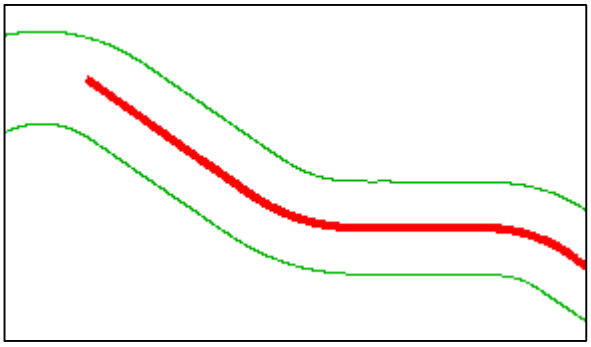
23. Set Feature Type to: *Linear* ***and Feature Definition to:*** *Use Active Feature*



24. **Select alignment: P_CL_3**

25. **Reset to accept**

26. **Click OK**



3. Design Intent

Design Intent builds associations and relationships (rules) between civil elements. The element information (how, where, and creation method) is stored with the element and ensures that the creation rules are maintained throughout design.

One way to facilitate Design Intent is to use MicroStation snaps in conjunction with Civil Geometry tools and Civil AccuDraw. Snapping one element to another creates a rule between the two elements based on the type of snap used.

A. Snaps - Civil geometry points use MicroStation Snap Codes.

i. Intersection Snap
   - Intersected elements can't be separated, the intersection point can be moved

ii. Key Point Snap
   - Elements break

iii. Tangent Point Snap
   - Preceding element can be updated, following element can't

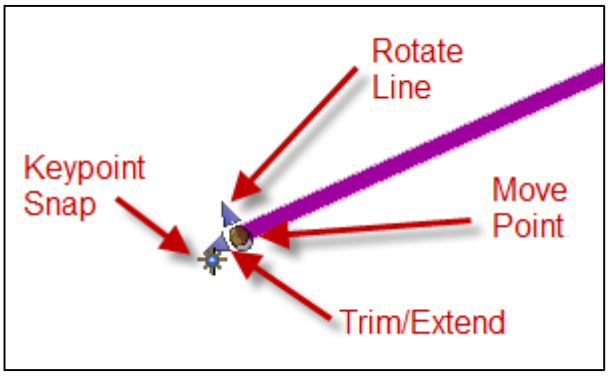
iv. Tangent Snap
   - Preceding and following elements can be updated

Using MicroStation Snaps during element placement creates rules. Using snaps to modify an existing element also creates rules.

B. Manipulators

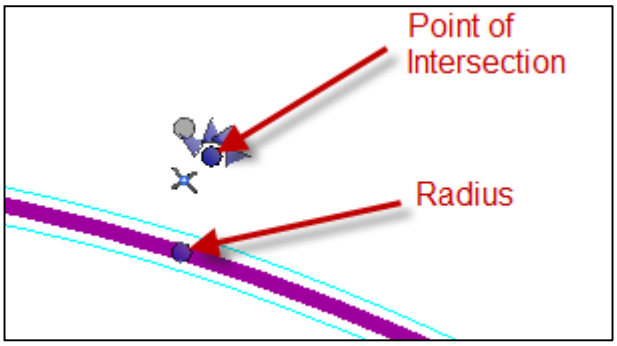
i. Elements can be edited by on-screen graphic **Manipulators** or by adjusting the **Element Properties**.
   - Similar to MicroStation element grips, but smarter

Line Graphic Manipulators



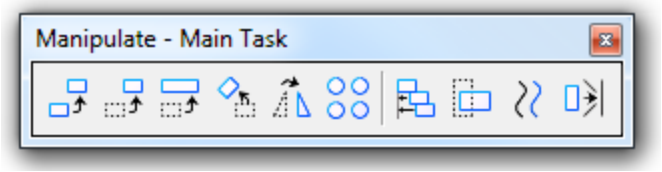
*Using the **Move Point** manipulator breaks the rule

Curve Graphic Manipulators



C. MicroStation Commands

i. MicroStation **Manipulate** commands **do not work** on civil geometry elements.

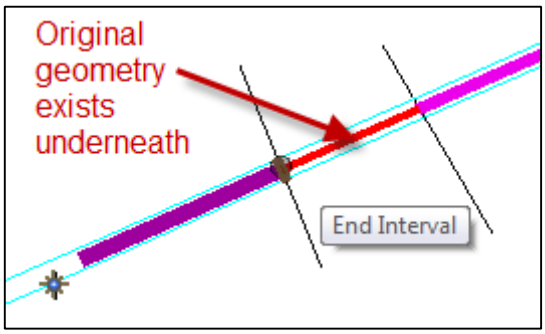


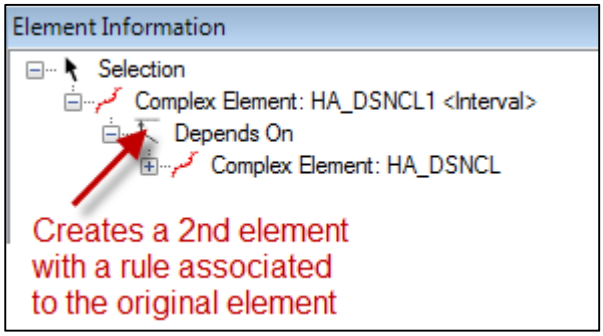
The **Horizontal Geometry** commands have equivalent tools for civil geometry.

ii. MicroStation **Modify** commands have limited ability to effect civil geometry elements

- The **Insert/Remove Vertex** commands work the same

- **Trim**/**Extend**/**Break** commands create *Intervals*





Best Practice is to avoid using MicroStation **Modify** tools if possible.

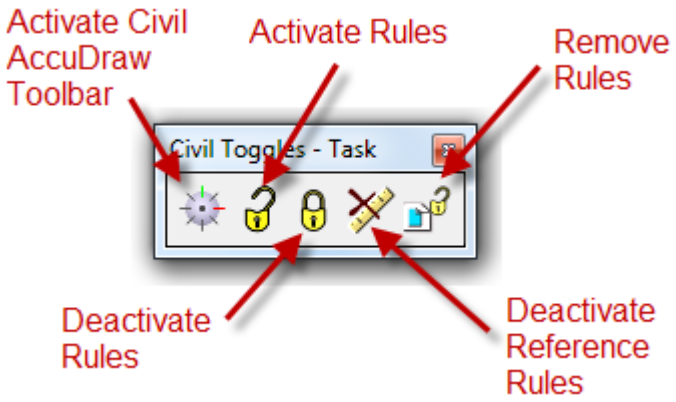
D. Rules

Design Intent employs 'civil rules'. Rules allow elements to remember the creation method while also creating editable horizontal or vertical geometry.

Rules between multiple elements create parent/child relationships. Any manipulation of the parent element affects the child.

Civil geometry elements have a level of intelligence that can save time in the design process. However, for each rule, model processing time increases. Best practice is to disable processing while making changes and enabling processing again after all changes have been made. This will increase the efficiency of the civil tools as well as, decreasing design and processing time.

Geometry Civil Toggles Toolbar



i. Activate Civil AccuDraw Toolbar

Opens the Civil AccuDraw Toolbar based on the active model (plan/profile/3D/cross section)

ii. Activate Rules

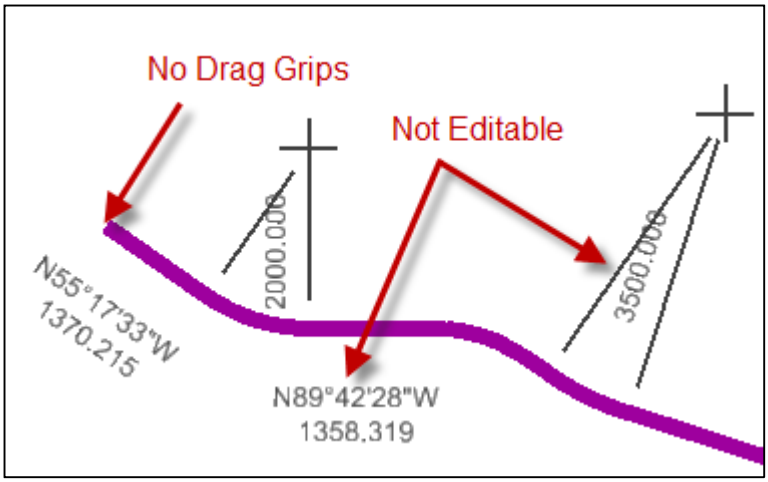
Unlocks the selected element and civil rules that define it.

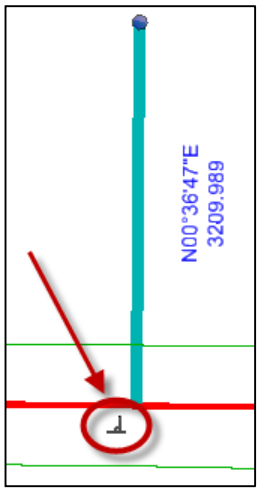
- Default setting for a ruled element
- Element becomes editable
- If changes have been made to a parent element, the civil rule will persist, and the selected element will update.

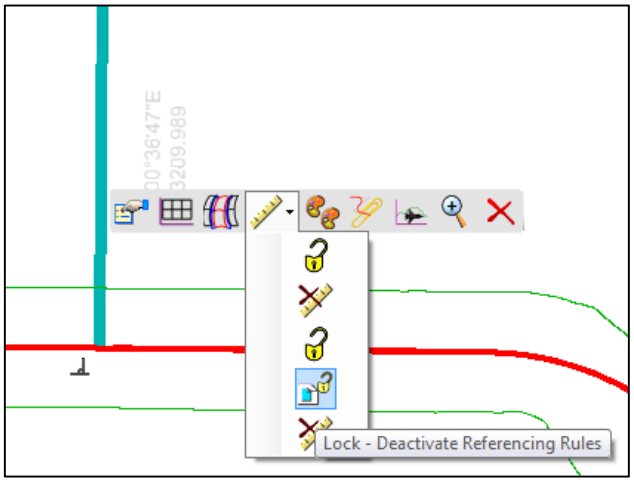
iii. Deactivate Rules

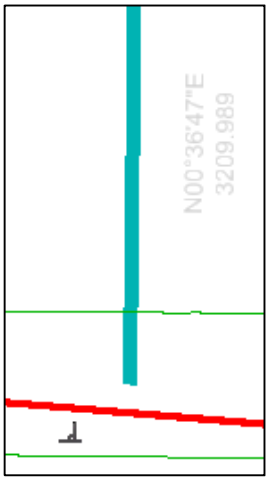
Locks the selected element and the civil rules that define it.

- Element is no longer editable
- Rules still exist









iv. Remove Rules

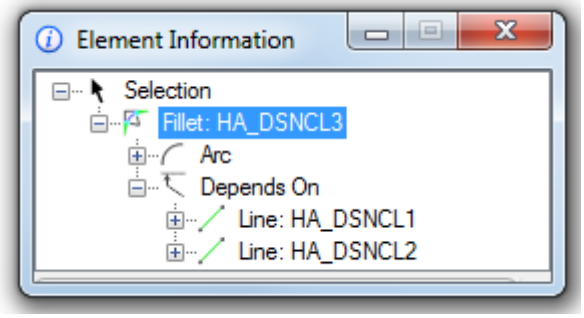
Deletes civil rules from selected elements.

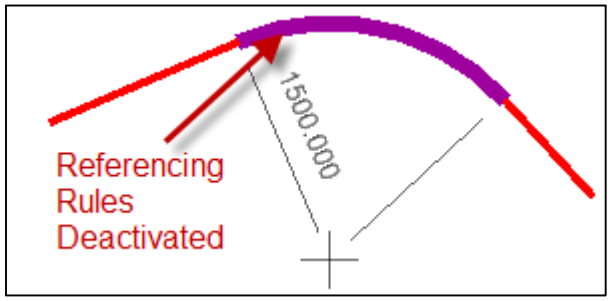
- Once removed, the rule cannot be retrieved.
- Converts the selected element to simple MicroStation geometry
- Undo (Cntl Z) should be used with caution

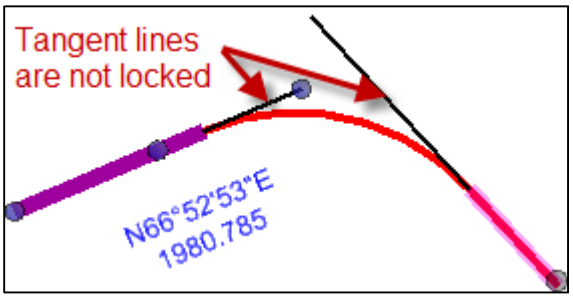
v. Deactivate Reference Rules

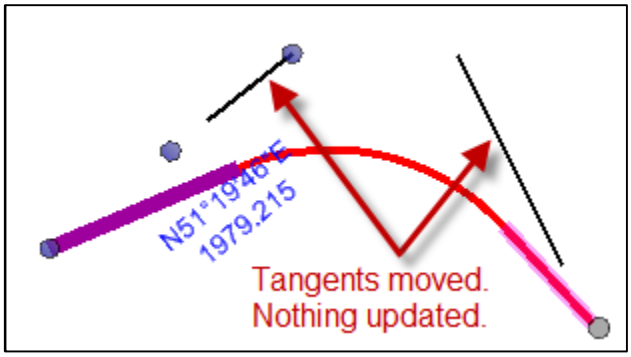
Locks elements upon which the chosen element is dependent (parent elements)

- Element is no longer editable
- No longer updates based on relationships (rules) to other elements. e.g. an arc tangent to two line segments.


Element Information
Selection
Fillet: HA_DSNCL3
Arc
Depends On
Line: HA_DSNCL1
Line: HA_DSNCL2


1500.000
Referencing
Rules
Deactivated


Tangent lines
are not locked
N66°52'53"E
1980.785

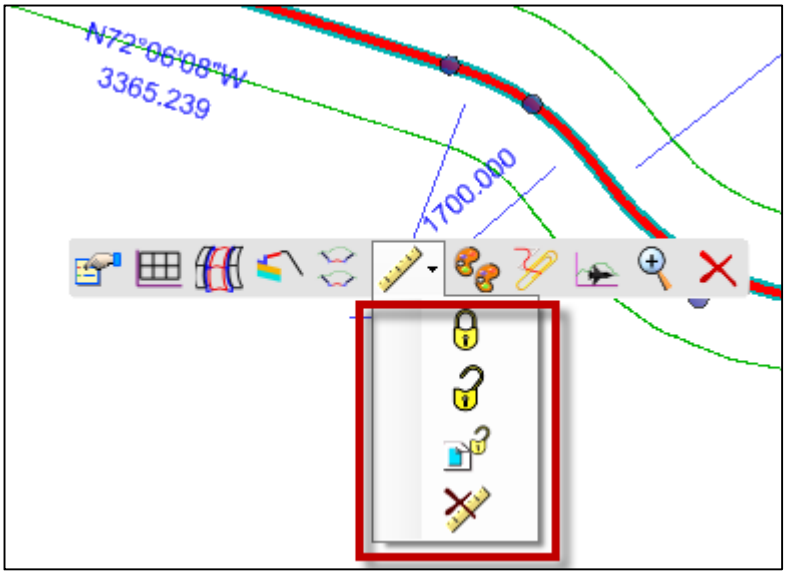

N51°19'46"E
1979.215
Tangents moved.
Nothing updated.

vi. Replace Reference

Reassigns a selected element's parent reference to a different civil geometry element.

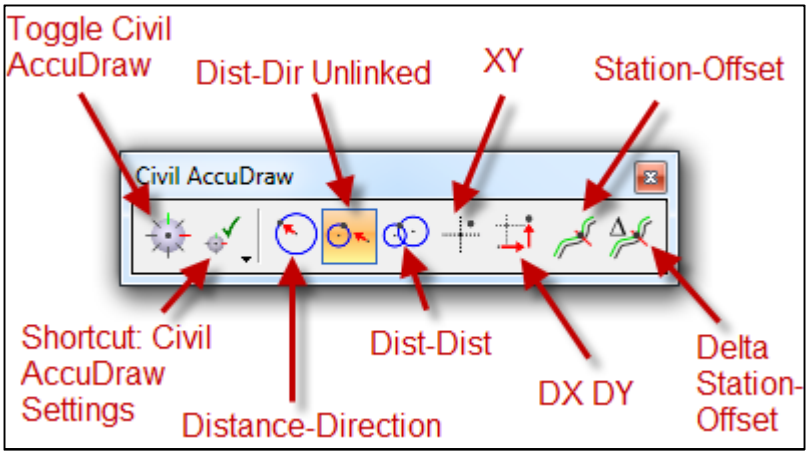
- Updates a previously locked element that references an element in a different file
- Only appears in the context sensitive toolbar when the selected element's rule references another civil geometry element. e.g. an offset rule

Applicable **Rule** commands also appear in the context sensitive toolbar

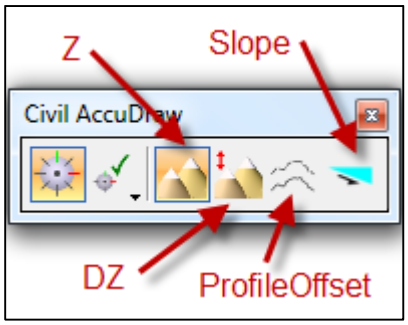


E. Civil AccuDraw

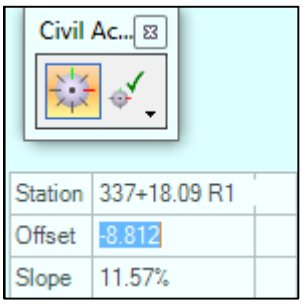
Horizontal Civil AccuDraw Toolbar



Vertical Civil AccuDraw Toolbar

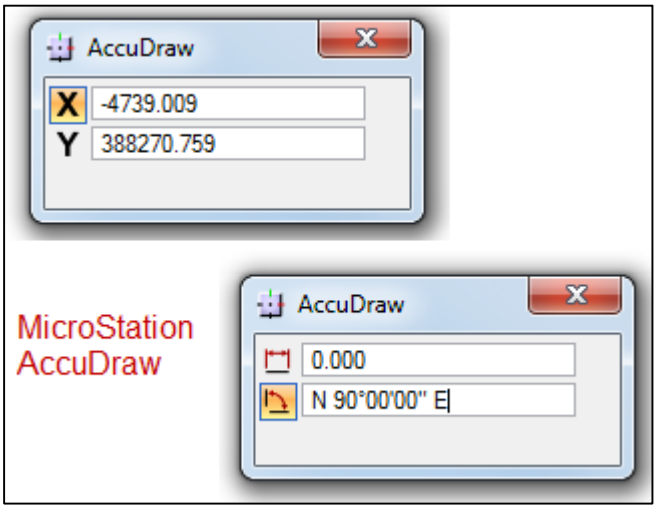


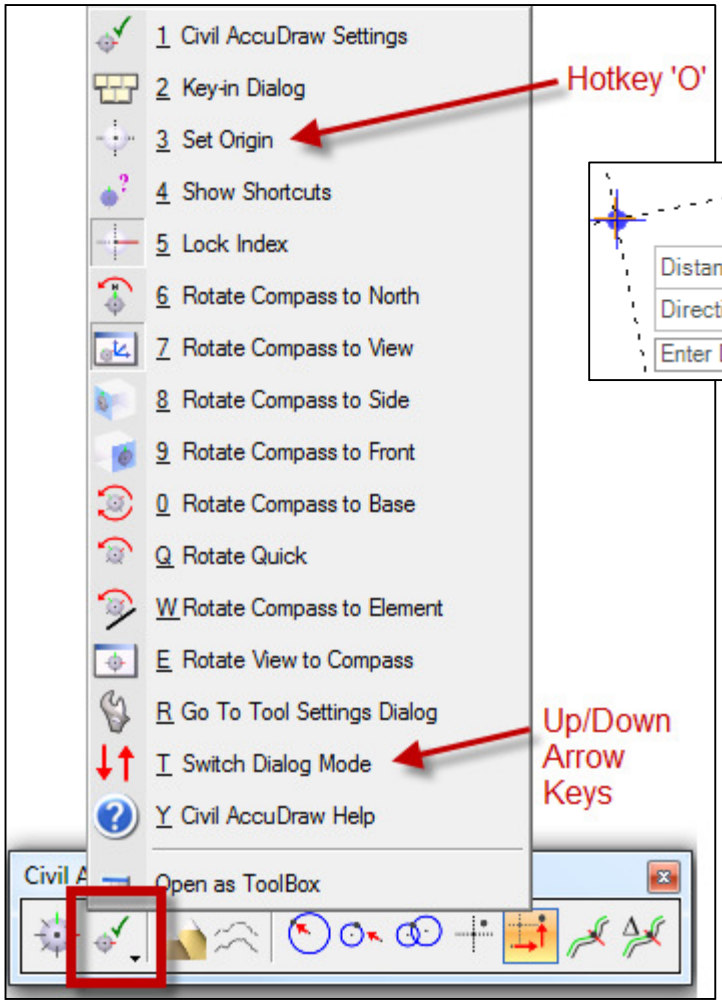
Cross Section Civil AccuDraw Toolbar/Prompt

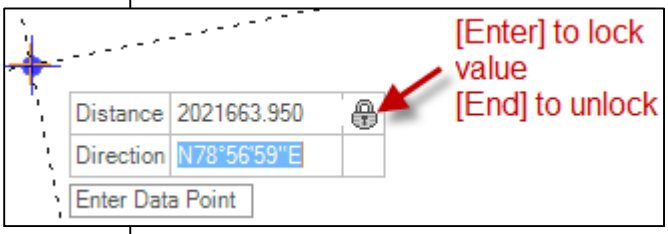


See the OpenRoads Manual for definitions of each AccuDraw command

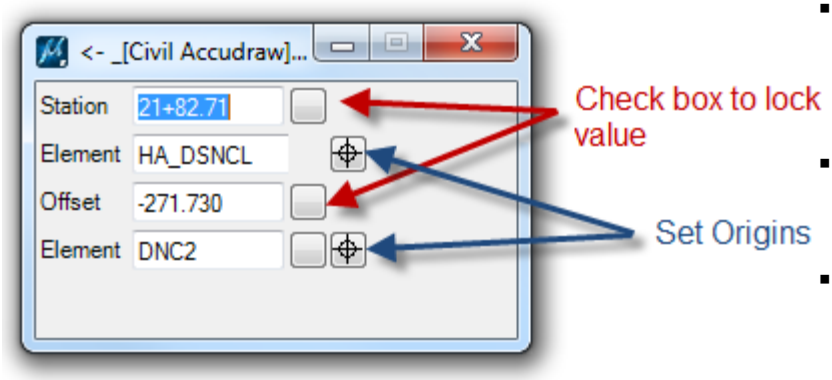
Note: While in the 3D Model, the toolbar displays both the horizontal and vertical tool icons.





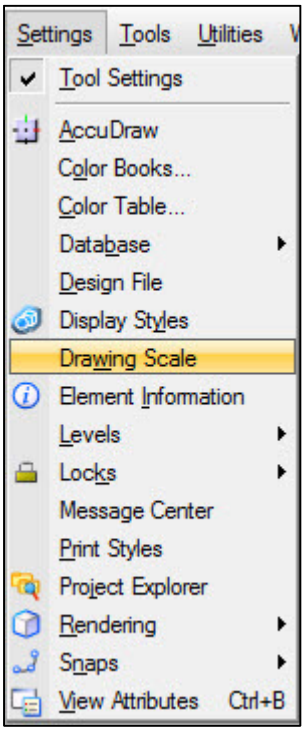


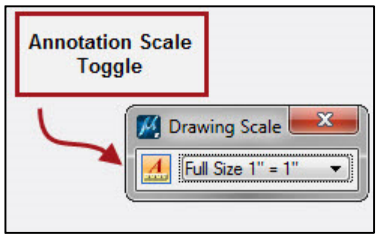
- The cursor prompt will be visible any time a command requiring a point selection is active
- **<Left> (←)** and **<Right> (→)** arrow keys cycle through the input types (toolbar buttons)
- **<Tab>** moves between active input values
- **<Enter>** locks the active value
- **<End>** unlocks the active value
- **<Down> (↓)** arrow opens the Civil AccuDraw dialog box
- **<Up> (↑)** arrow closes the Civil AccuDraw dialog box
- Hotkey '**O**' to select an origin (point or alignment depending on the active setting)



F. Annotation Scale & Drawing Scale

- *Model property* used to scale annotation elements.
- Often referred to as **sheet scale**.
- Works with: text, text fields, notes dimensions, cells, hatches, detailing symbol styles, custom line styles, reference file elements and sheet model boundaries.
    - Does not work with patterns.
- Works on active DGN files as well as referenced DGN files.





NOTE: "**Drawing Scale**" is not an actual scale. "Drawing Scale" is the name of the dialog used to control Annotation Scale settings.

Best Practice is to set Annotation Scale to 1:1 and turn "ON" Annotation Scale Lock ***while placing elements for annotation***. Turn Annotation Scale "OFF" while modeling

To change the annotation designation for already placed elements:

- Select all elements
- **Element Information > Annotation Scale**. Set the Annotation Scale equal to **"True"**.

CAUTION: Docking and/or leaving the Drawing Scale dialog open can cause the DGN file to crash when switching between the Default 2D view, and the Dynamic Views (Profile, Cross Section) view while creating/editing a model. Crashing can occur even if the dialog is not open, but Annotation Scale is left active ("ON"). **Turn Annotation Scale "OFF" (deactivate) and close the Drawing Scale dialog box/toolbar *during model creation and editing.***