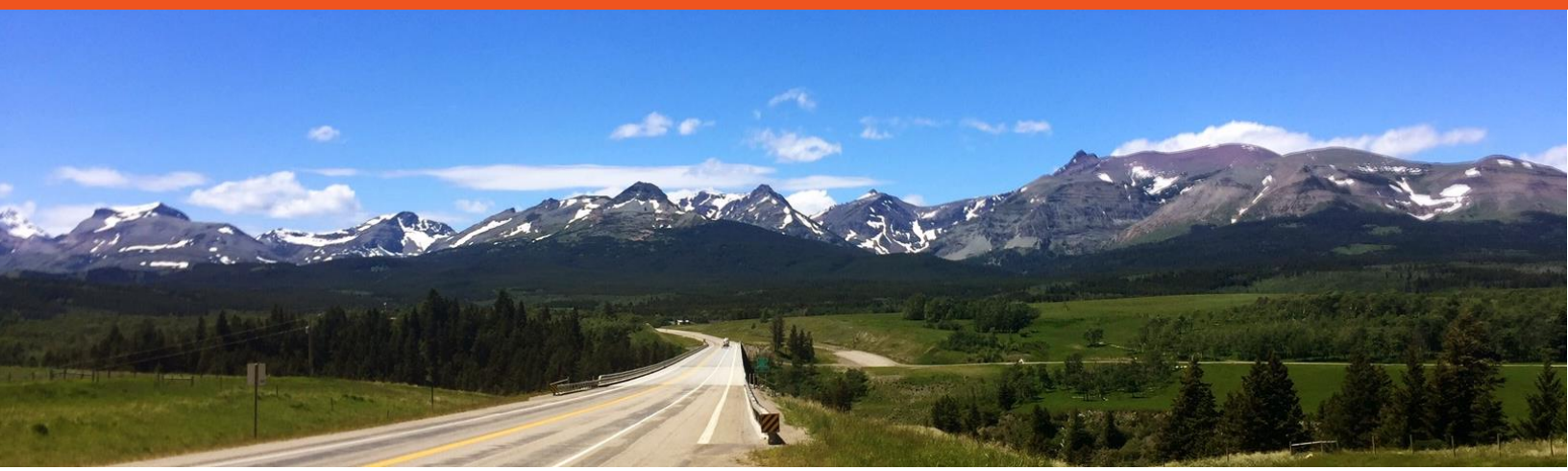

202 – Civil 3D Fundamentals – II

User Guide

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U.S. CAD
ACHIEVE MORE.

Version 1.0
Revision Date: 01/01/2022

Course Description

Course 202 – Civil 3D Fundamentals – II is the second part in the three-part Civil 3D Fundamentals learning path. This course continues developing knowledge of Civil 3D features and functionality. Upon completion, a better understanding of Corridors, Cross Sections, Pipe Networks, Project Explorer, and Volumes and Materials will be achieved.

Civil 3D Fundamentals courses 201, 202 and 203 have been developed to provide the basic functionality of the software to those who have had limited or no exposure to the Autodesk Civil 3D software. These three (3) courses deliver the building blocks to become more knowledgeable and proficient utilizing Civil 3D.

Course Length

8 hours

User Guide Notification Icons

This User Guide contains icons to help alert and assist the user with specific tasks and content. Each icon is identified and described in the table below.

ICON	DESCRIPTION
	The **EXERCISE** icon identifies tasks where users are guided through a hands-on review of the instructional topic using the software.
	The **TIP** icon identifies software best practices and useful tips.
	The **NOTE** icon is used for identifying general information such as: • To provide additional information that is not considered to be a warning or critical. • To provide additional/alternative steps to workflow. • To provide reminders of important information previously covered that may affect specific tasks throughout the workflow process.
	The **CAUTION** icon is used to help identify and warn users of information and or workflow steps that should be followed or executed correctly.

Course Objectives

- How to model Corridors
- How to create Cross Sections
- How to create and edit Pipe Networks
    - Pipe and Structure Catalogs and Parts Lists
    - Applying Pipe and Structure rules to Pipe Networks
    - Profile and Section display options
- Compute Volumes and Materials for a project. Quantity Takeoffs (QTO)
- Understanding and utilizing Project Explorer
- Migrating legacy project data to Autodesk

Topics Covered

- Introduction to Corridors
    - Assemblies and Subassemblies
    - Corridor Frequency of Stationing
    - Corridor Targets and Target Types
    - Understanding and Using Regions
    - Corridor Surfaces
    - Cross Section Editor
- Cross Sections
    - Generating Sample Lines
    - Single/Multiple Cross Sections
    - Section Views
    - Labeling
    - Utilizing the Cross Section Editor
- Pipe Networks
    - Creating Pipe Networks
    - Pipe and Structure Catalogs
    - Pipe and Structure rules
    - Splitting, merging, reconnecting, and renaming Pipe Networks
    - Display options for Pipe Networks
    - Connection and insertion points
    - Generating tables and reports

- Project Explorer
    - Project data navigation, review, and editing
    - Evaluating design criteria
    - Generating tables and reports
- Quantity Takeoff (QTO)
    - Earthwork Volumes
    - Material Volumes
    - Generating reports

Pre-requisites

- A basic understanding of design/drafting procedures and terminology
- A working knowledge of your operating system
- 101 – AutoCAD Fundamentals for Bentley Users
- 201 – Civil 3D Fundamentals – I

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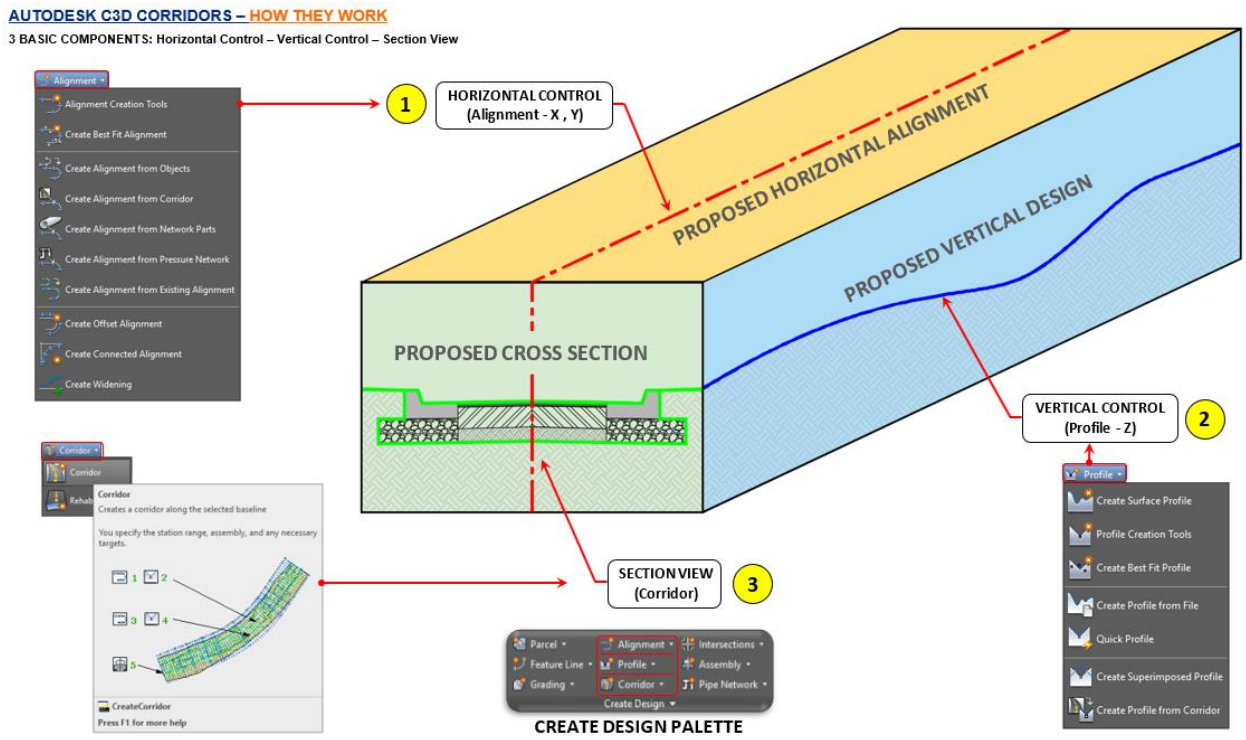
Introduction to Corridors

You can use Autodesk Civil 3D corridor modeling to create flexible and configurable 3D models of corridors, such as roads, highways, ditches, and channels. A corridor model builds on and uses various Autodesk Civil 3D objects and data, including assemblies, subassemblies, surfaces, feature lines, alignments, and profiles. The corridor manages the data, tying various assemblies (applied for different ranges of stations) to the baselines and their finished grade profiles.



Design File Creation and Set-up

Design files are drawing files used for specific design elements related to the project design. Such as, surfaces, alignments, corridors, etc. The following steps will walk us through the creation and set-up of the Corridor Design drawing file which must be done prior to creating corridor assemblies and the corridor itself.

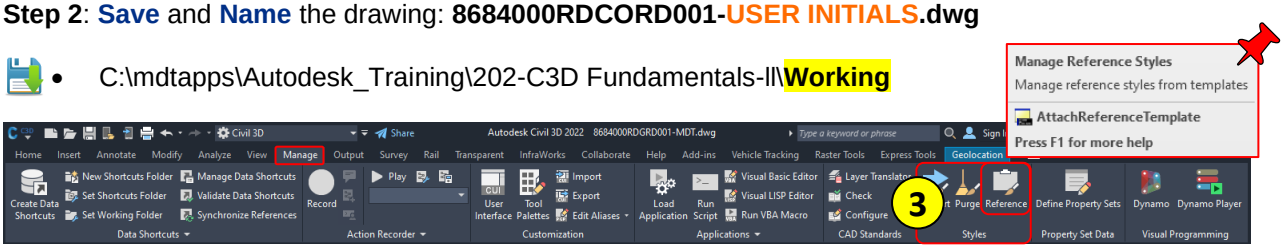
Create a New Drawing

Step 1: From the **Start** tab > **Create** a new drawing using the **Standard**: **design-start.dwt**

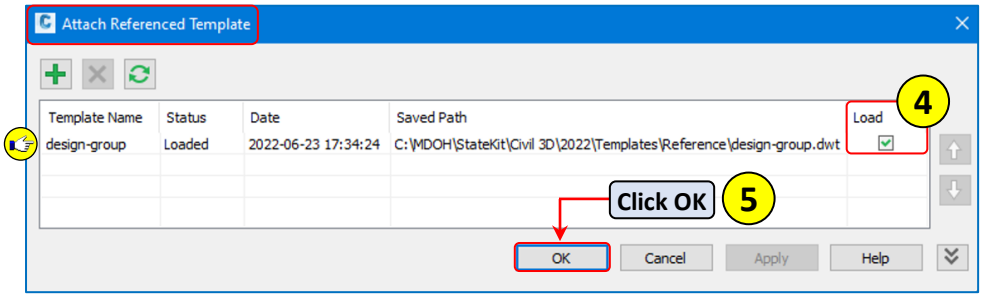
- C:\MDOH\StateKit\Civil 3D\2022\Templates**_Start-Dwg**

Step 2: **Save** and **Name** the drawing: **8684000RDCORD001-USER INITIALS.dwg**

- C:\mdtapps\Autodesk_Training\202-C3D Fundamentals-II**Working**



Step 3: **Navigate** to the **Manage** tab > Styles panel > **Select Reference**

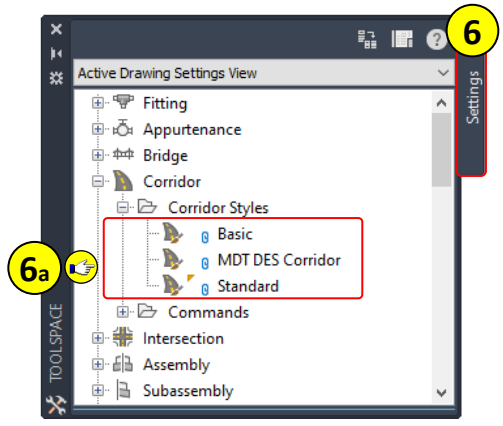


Step 4: **Verify** the attached **design-group** reference template is loaded.

Step 5: **Click OK**.

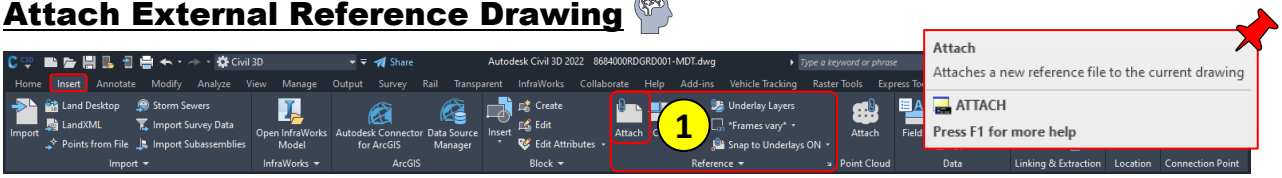
Step 6: **Navigate** to TOOLSPACE > **Settings** tab.

a. **Expand** the **Corridor** object collection > **Expand Corridor Styles**.



	Notice how all styles have a "blue" paperclip icon next to the style name. The paperclip icon signifies those styles are attached and being controlled by a source reference template.

Attach External Reference Drawing

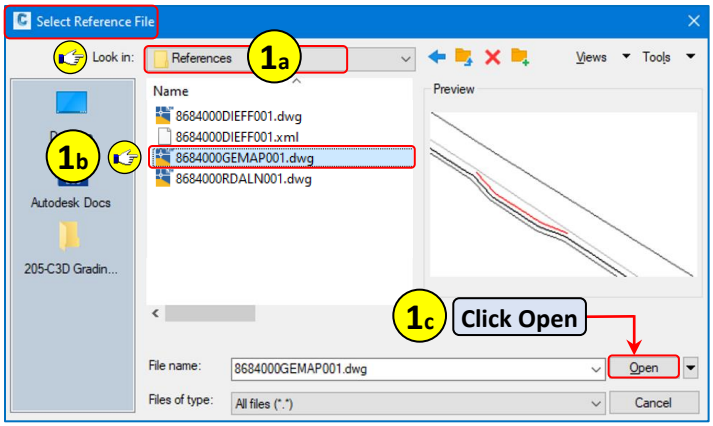


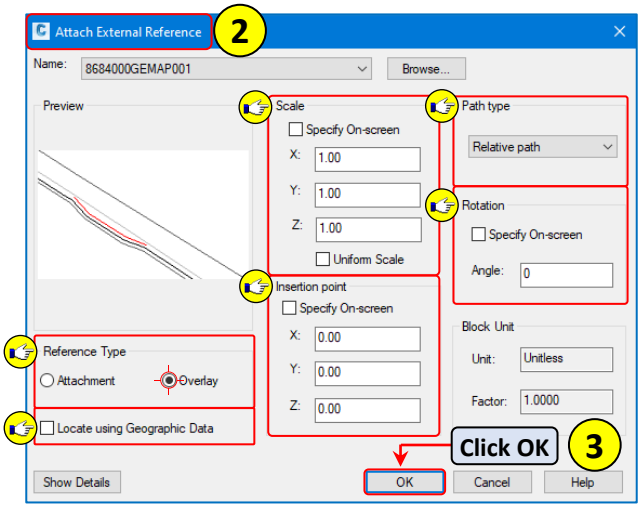
Step 1: **Navigate** to the **Insert** tab > Reference panel > **Select Attach**.

a. **Navigate** to C:\mdtapps\Autodesk_Training\202-C3D Fundamentals-ll **References**

b. **Select** > **8684000GEMAP001.dwg**

c. **Click Open**.





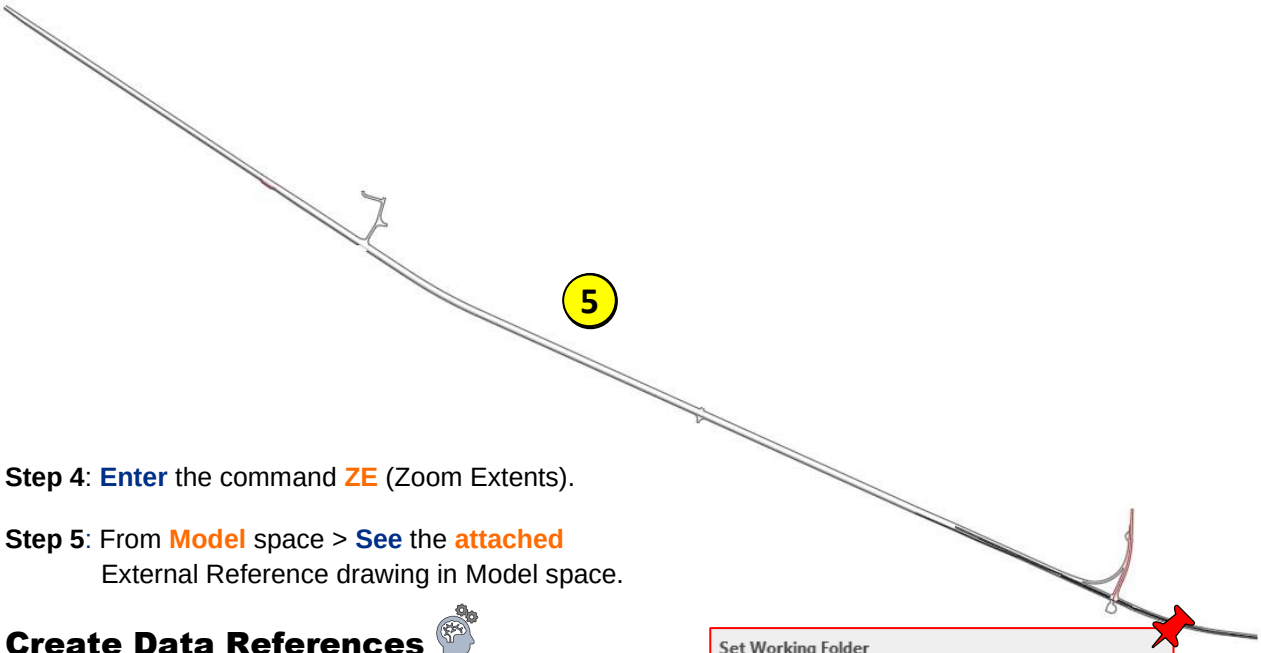
Locate using Geographic Data:

If both the source and consumer drawing contain geographic data, the option is available. Both drawings require a matching **coordinate system** or Geolocation be assigned. If true, the drawing being consumed (referenced) will be inserted spatially correct.

Step 2: From the **Attach External Reference** dialog box**, verify** the following parameters:

- **Reference Type** = Overlay
- **Scale** = Specify On-screen is unchecked
- **Insertion point** = Specify On-screen is unchecked
- **Path type** = Relative path
- **Rotation** = Specify On-screen is unchecked

Step 3: **Click OK**.



Step 4: **Enter** the command **ZE** (Zoom Extents).

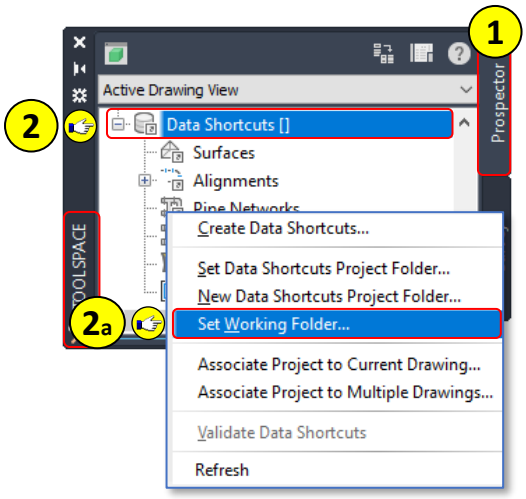
Step 5: From **Model** space > **See** the **attached** External Reference drawing in Model space.

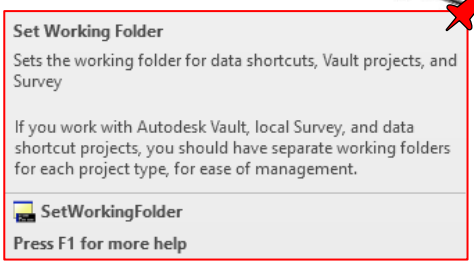
Create Data References

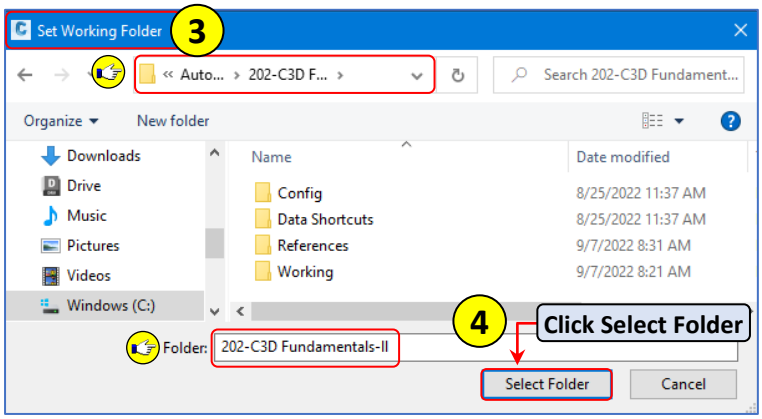
Step 1: **Navigate** to TOOLSPACE > **Prospector** tab.

Step 2: **Right-click** on **Data Shortcuts**.

a. **Select Set Working Folder**…







Step 3: From the **Set Working Folder** dialog box > **Navigate** to:

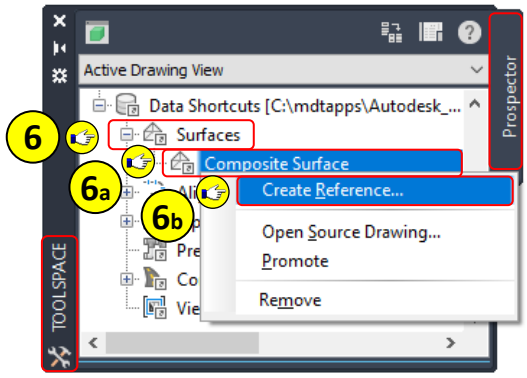
- C:\mdtapps\Autodesk_Training**202-C3D Fundamentals-II**

Step 4: **Click Select Folder**.

Step 5: **Verify** the Data Shortcuts **path** has been correctly set.

Data Shortcuts [C:\mdtapps\Autodesk_Training\202-C3D Fundamentals-II\Data Shortcuts]

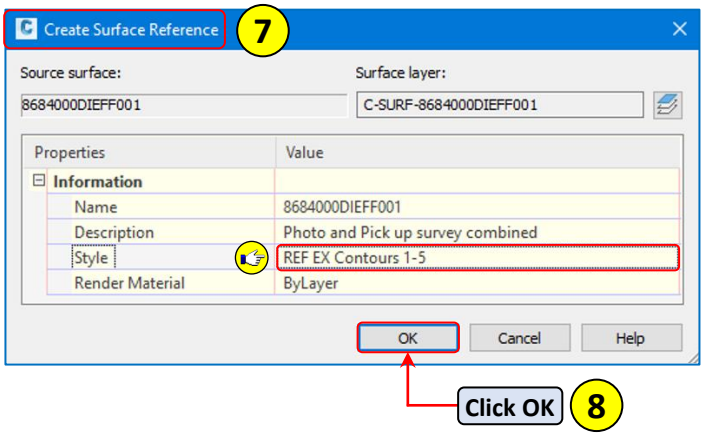
	If there is **NO** Data Shortcuts path visible from the Prospector, the path has been incorrectly set or there is no Data Shortcut Project in the selected directory.

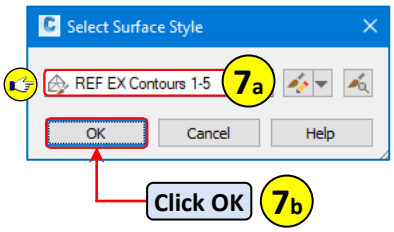


Step 6: From **Toolspace** > Prospector tab > **Data Shortcuts** > **Expand Surfaces**.

a. **Right-click** on **8684000DIEFF001** surface.

b. **Select Create Reference**…





Step 7: From the **Create Surface Reference** dialog box > **Set** the surface style to:

a. **Select REF EX Contours 1-5** surface style.

b. **Click OK**.

Step 8: From the **Create Surface Reference** dialog box > **Click OK**.

Step 9: From **Toolspace** > Prospector tab > **Data Shortcuts** > **Expand Alignments**.

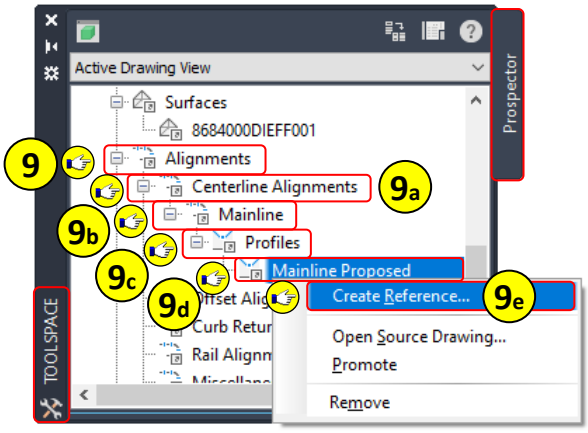
a. **Expand Centerline Alignments**.

b. **Expand Mainline**

c. **Expand Profiles**

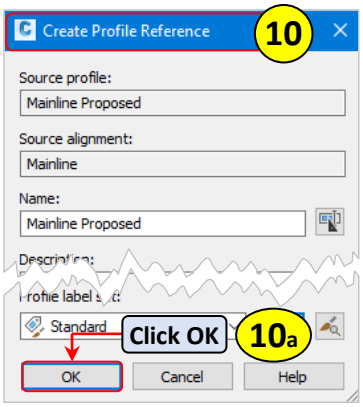
d. **Right-click** on **Mainline Proposed**

e. **Select Create Reference**…

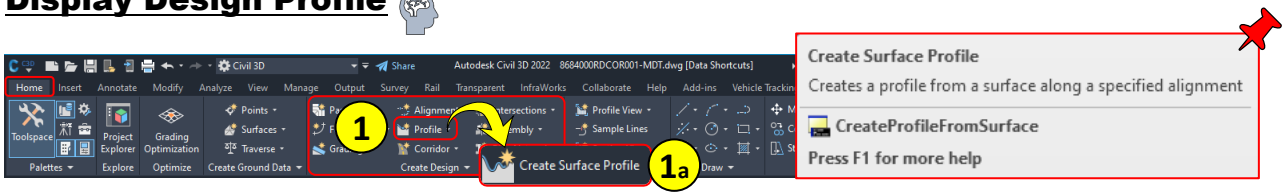


Step 10: From the **Create Profile Reference** dialog box > **Accept** all defaults.

a. **Click OK**.

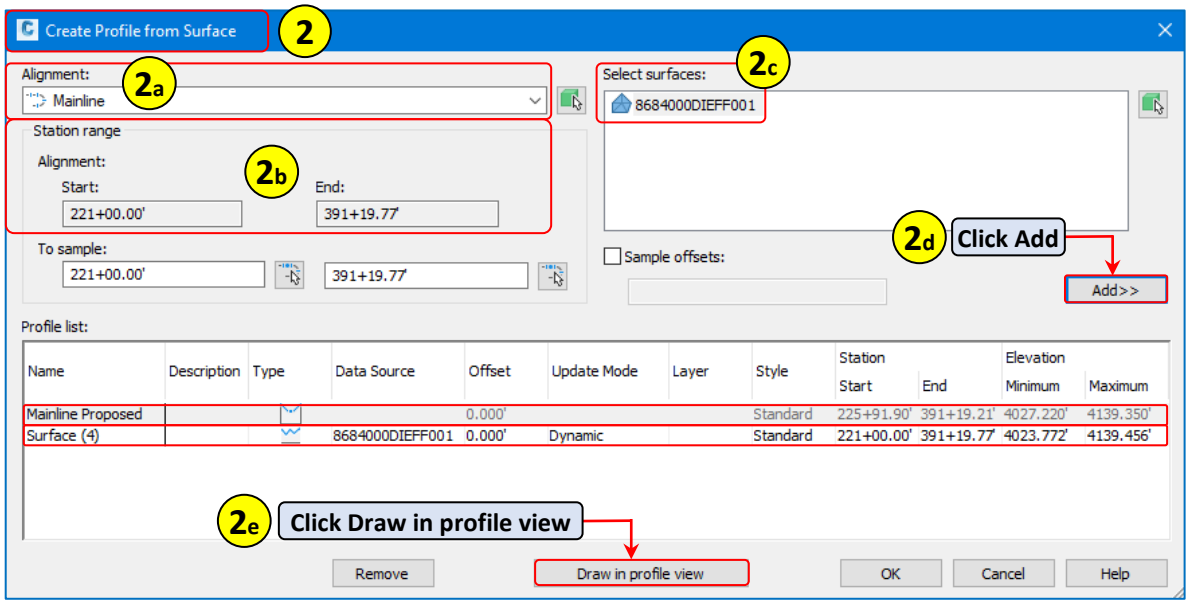


Create Surface Profile and Display Design Profile



Step 1: **Navigate** to the **Home** tab > Create Design panel > **Click Profile** drop-down.

a. From the **Profile** drop-down list > **Select Create Surface Profile**.



Step 2: From the **Create Profile from Surface** dialog box > **verify** and **do** the following:

a. **Alignment** = **Mainline**

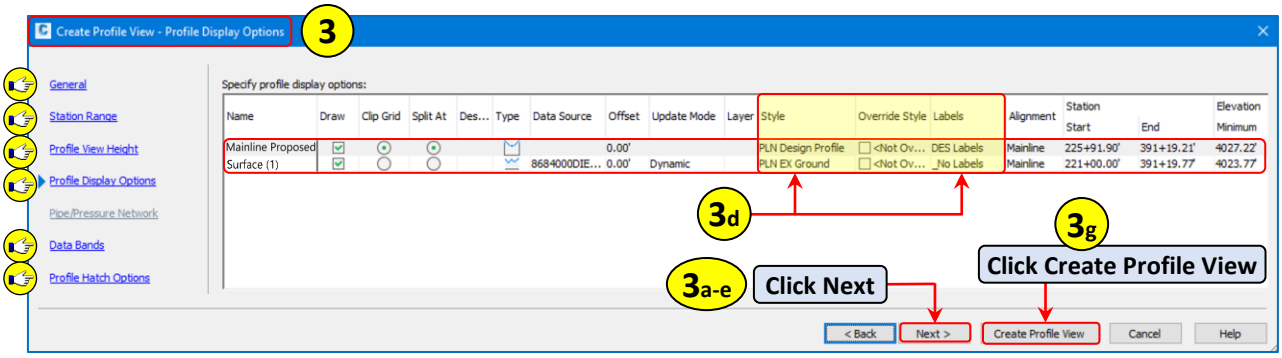
b. **Station Range** = **Default entire range**

c. **Select surfaces** = **8684000DIEFF001**

d. **Click Add>>** (Clicking Add >> will populate the Profile list with the surface profile to be created)

e. **Click Draw in profile view**

	The Profile list contains profiles that can be drawn in a Profile View. The Mainline Proposed profile was previously Data Referenced into the drawing and is ready to be drawn.



Step 3: From the **Create Profile View** Wizard > **Review** each page:

a. From the **General** page > **Accept** defaults by **clicking Next >**.

b. From the **Station Range** page > **Accept** defaults by **clicking Next >**.

c. From the **Profile View Height** page > **Accept** defaults by **clicking Next >**.

d. From the **Profile Display Options** page > **Set** the following parameters:

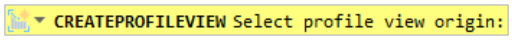
- Mainline Proposed **Style** / **Labels** = **PLN Design Profile** / **Design Labels**
- Surface (1) **Style** / **Labels** = **PLN EX Ground** / **_No Labels**

e. **Click Next >**.

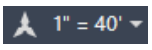
f. From the **Data Bands** page > Select band set > **_No Bands** > **Click Next >**.

g. From the **Profile Hatch Options** page > **Click Create Profile View**.

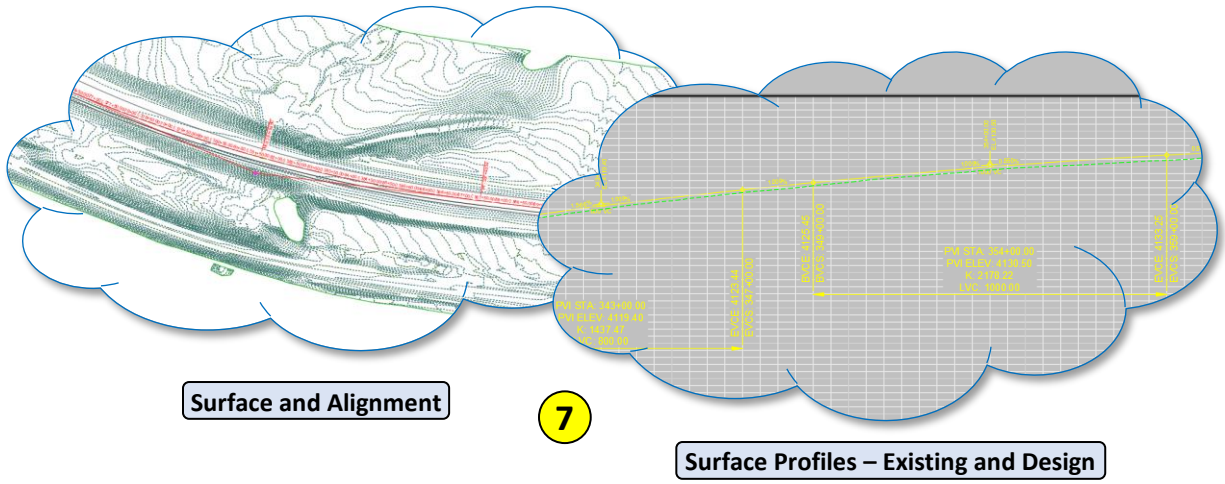
Step 4: From **Model** space when prompted > **Select** profile view origin > **Pick** a **location** in **Model** space to place the profile view.



Step 5: From the **Status Bar** > **Set** the **Annotation Scale** to > **1" = 40'**



Step 6: **Enter** the command **ZE** (Zoom Extents).



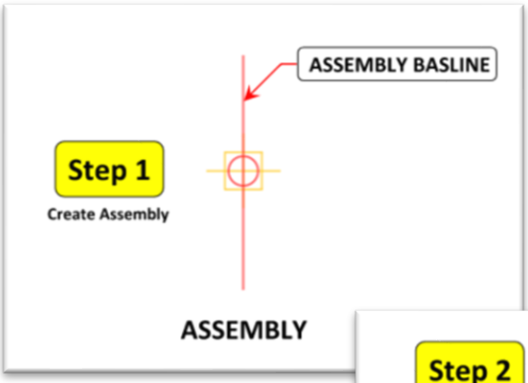
Step 7: From **Model** space > **See** the **referenced C3D** objects.

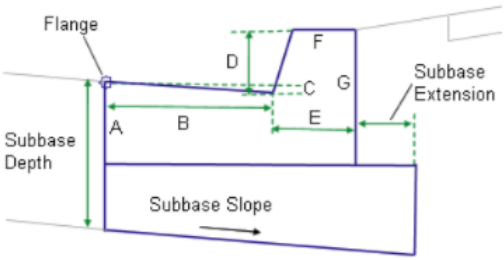
Step 8: **Save** the **drawing** .

Assemblies and Subassemblies

An assembly is an Autodesk Civil 3D drawing object that manages a collection of subassembly objects that are used to form the basic structure of a 3D corridor model. Together, assemblies and subassemblies function as the basic building blocks of a roadway or other alignment-based design. An assembly object must be applied along an alignment to form a corridor. The assembly can reference one or more offsets needed for the corridor design.

The MDT State Kit includes preconstructed assemblies for Rural 2 Lane, Rural 4 Lane, Rural Divided, Urban 2 Lane – Sidewalk, Ramp and Widening. In some cases, there may be the need to create a nonstandard assembly. The MDT State Kit provides subassemblies that can be used to create the desired assembly.



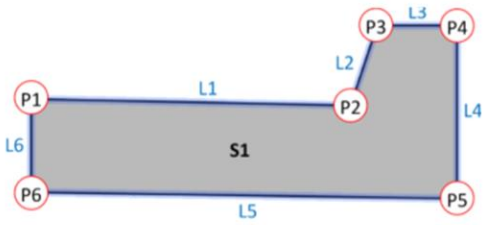


Step 2
Set Parameters

BASIC CURB & GUTTER SUBASSEMBLY with SUBBASE

User defined input parameters control the dimensions of the shape.

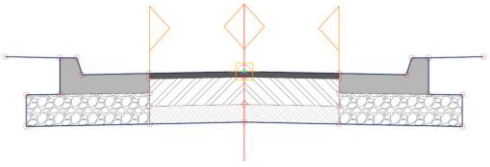
SUBASSEMBLY INPUT PARAMETERS			
Parameter (mm/in)	**Description**	**Type**	**Default**
Dim A	Depth of gutter at flange point	Numeric, Positive (non-zero)	175mm / 7in
Dim B	Width from flange point to gutter flowline		400mm / 16in
Dim C	Depth from the flange point to gutter flowline	Numeric, Positive (non-zero)	25mm / 1in
Dim D	Height of curb from the gutter flowline to Top of Curb	Numeric, Positive (non-zero)	150mm / 6in
Dim E	Width from the gutter flowline to the Back of Curb	Numeric, Positive (non-zero)	200mm / 8in
Dim F	Width of the Top of Curb	Numeric, Positive (non-zero)	150mm / 6in
Dim G	Height of the Back of Curb	Numeric, Positive (non-zero)	325mm / 13in



Step 3
Attach Subassembly

BASIC CURB and GUTTER SUBASSEMBLY

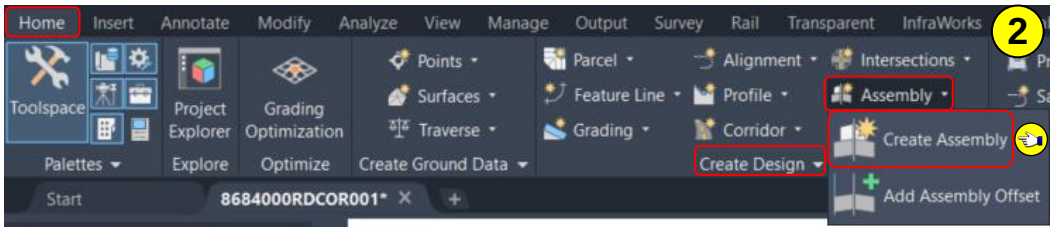
POINT, LINK, and SHAPE CODES		
	Code	**Description**
Points (P) – Vertices of Subassembly (attachment points)		
P1	Flange	Flange point of the gutter
P2	Flowline Gutter	Gutter flowline point
P3	TopCurb	Top of Curb
P4	BackCurb	Back of Curb
Links (L) – Line or curve segments between points		
L1-L3	Top, curb	Finish grade of the curb and gutter
Shape (S) – Two dimensional polygons representing X-section		
S1	Curb	Curb and gutter concrete area



Creating an Assembly

Step 1: **Continue** working with the **8684000RDCOR001-USER INITIALS**.dwg. previously created.

Step 2: **Navigate** to Home tab > **Create Design** panel, **select** **Assembly**, **select** **Create Assembly**.



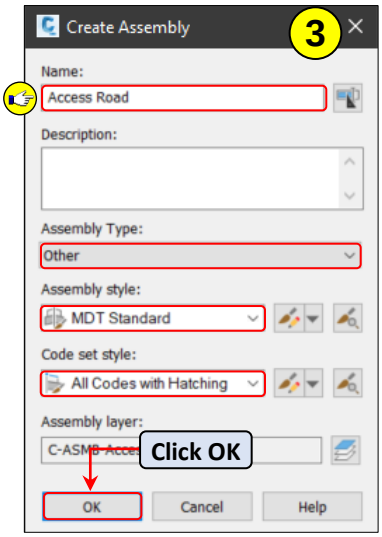
Step 3: **Change** the **parameters** shown below, **click** **OK**.

Name: Access Road

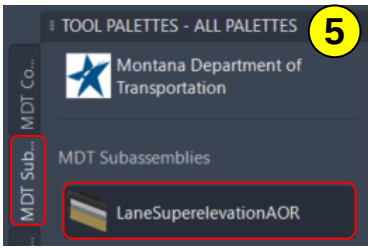
Assembly Type: Other

Assembly Style: MDT Standard

Code set style: All Codes with Hatching

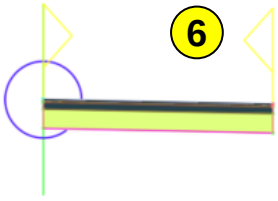


Step 4: **Select** a **point** next to the profile view, when prompted to Specify assembly baseline location.



Step 5: **Navigate** to TOOL PALETTES > **MDT Subassemblies**, **select** **LaneSuperelevationAOR**.

	Assemblies are created at a 1:1 scale. When you select a point on the screen to insert the baseline, Civil 3D will automatically zoom you to its location.

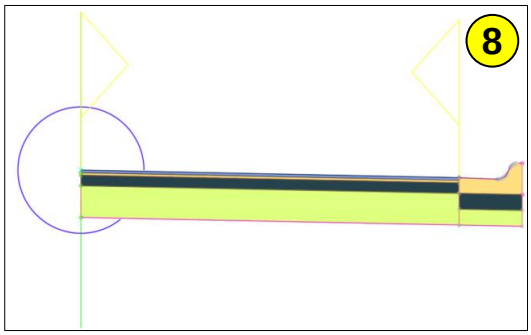


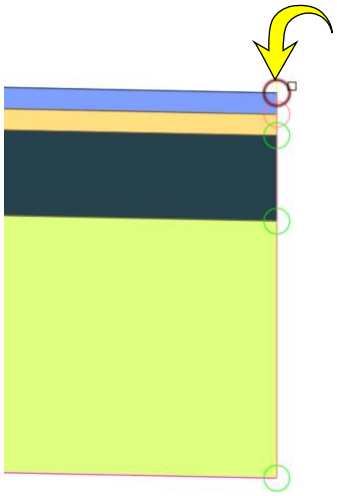
	Prior to placing subassemblies, if needed, certain parameters can be revised and or set using the Properties palette. After placement, parameters can be set at any time through the subassembly properties.

Step 6: **Accept** the **default** properties, **select** the **assembly baseline**, **select** **Esc** to end the command.

Step 7: **Navigate** to TOOL PALETTES > **MDT Subassemblies**, **select** **MDT Curb and Gutter**.

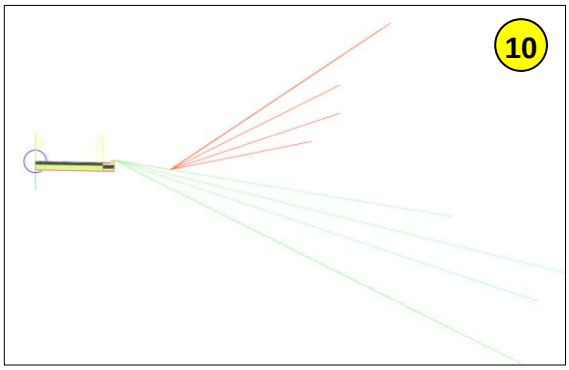
Step 8: **Accept** the **defaults** properties, **select** the upper right point of the **LaneSuperelevationAOR** subassembly, **select** **Esc** to end the command.

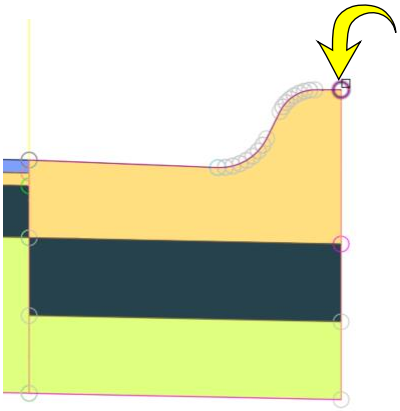




Step 9: **Navigate** to TOOL PALETTES > **MDT Subassemblies**, **select** **MDT Daylight Urban**.

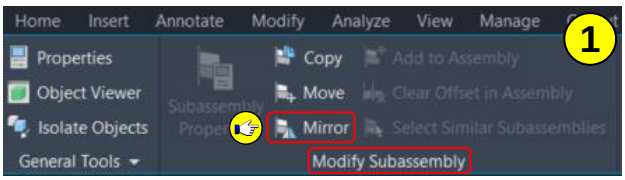
Step 10: **Accept** the **defaults** properties, **select** the back of curb point of the **MDT Curb and Gutter** subassembly, **select** **Esc** to end the command.





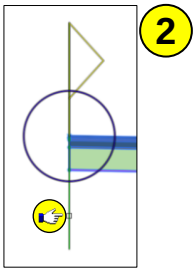
Mirroring Subassemblies

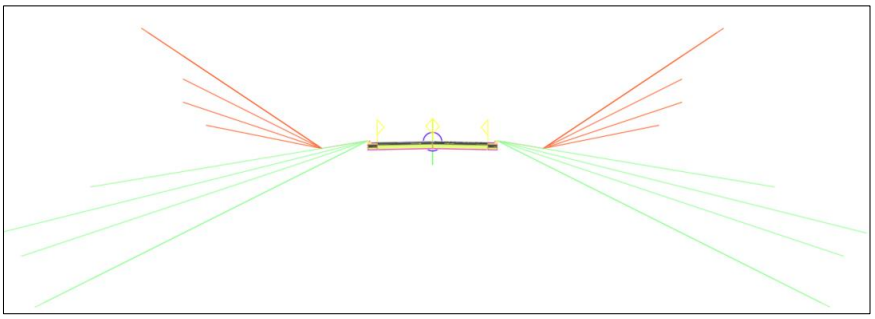
Step 1: **Select** the **LaneSuperelevationAOR**, **MDT Curb and Gutter** and **MDT Daylight Urban** subassemblies, **navigate** to **Modify Subassemblies** panel on the contextual ribbon, **select** **Mirror**.



	AutoCAD commands should not be used on Subassemblies. The Modify Subassembly Move, Mirror and Copy commands must be used. AutoCAD Move and Copy commands should only be used for the Assembly.

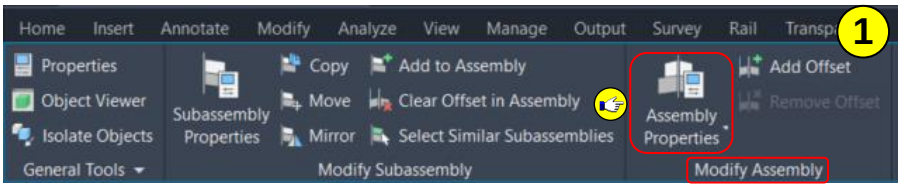
Step 2: **Select** the **assembly base line** > **Press Esc** to end the Mirror command.





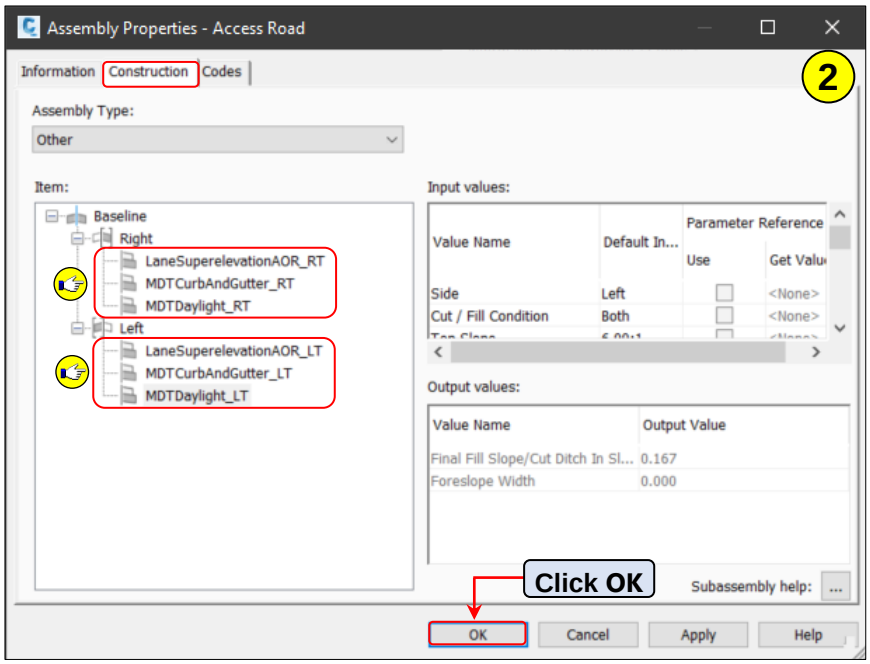
Organizing Subassemblies

Step 1: **Select** the **assembly baseline**, **navigate** to **Modify Assembly** panel, **select Assembly Properties**.



Step 2: **Select Construction** tab in the assembly Properties dialog box, **rename** the **subassemblies** _RT for right side and _LT for left side, **click OK**., **press Esc** to deselect the baseline.

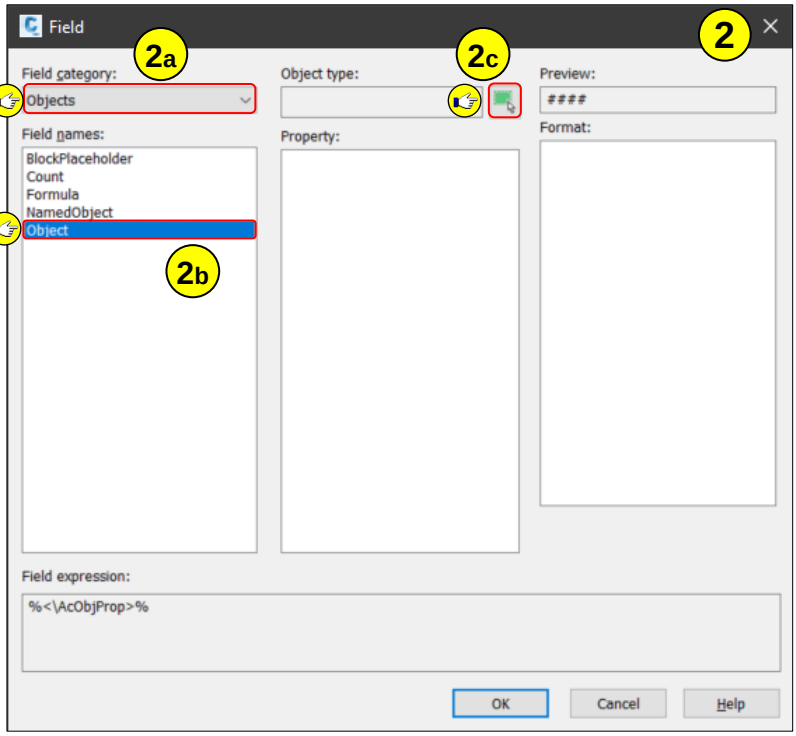
Right	**Left**
LaneSuperelevationAOR_RT	LaneSuperelevationAOR_LT
MDT CurbAndGutter_RT	MDT CurbAndGutter_LT
MDT Daylight_RT	MDT Daylight_LT



Naming an Assembly

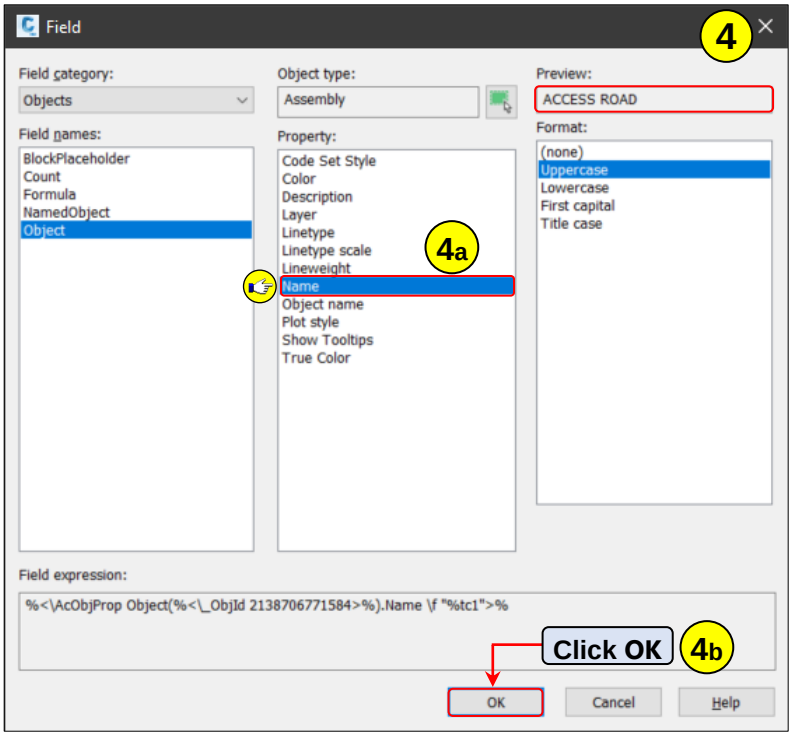
Step 1: **Type** **FIELD** at the command line, select Enter.

Step 2: **Select** **Objects** from the Field category, **select** **Object** from the Field names, **select** the **green box** for the Object Type.



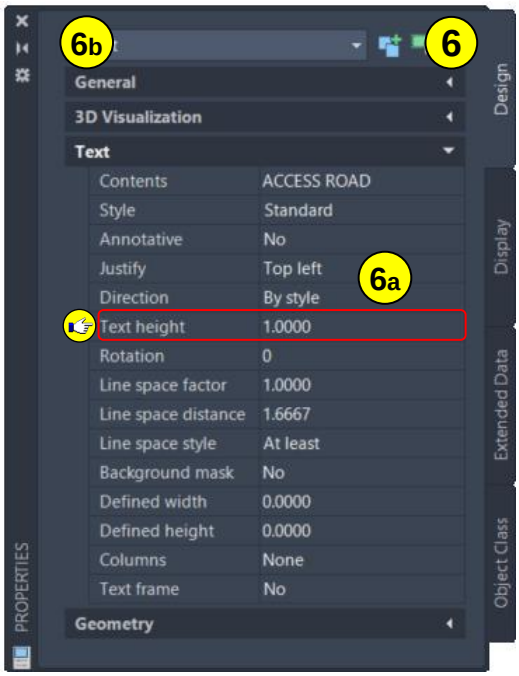
Step 3: **Select** the **assembly baseline** when prompted to Select object.

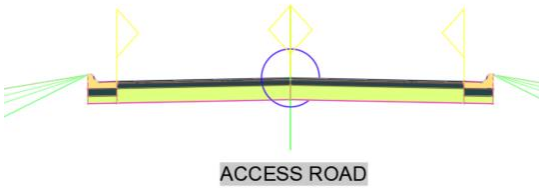
Step 4: **Select** **Name** for the Property, **select** **Uppercase** for the Format, **click** **OK**.



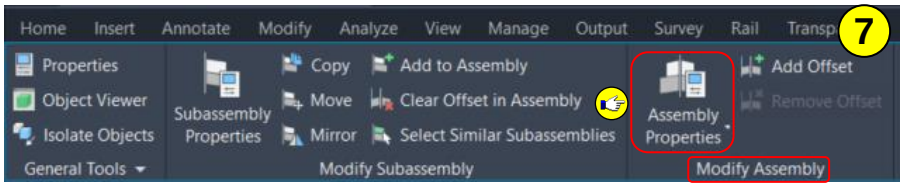
Step 5: **Select** a **point** near the assembly baseline to place the Field in the drawing.

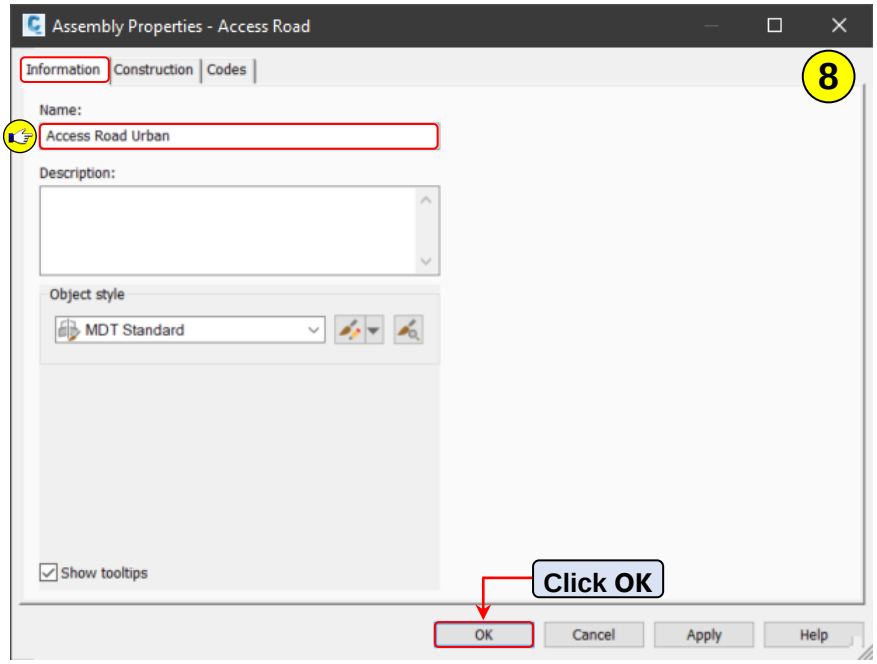
Step 6: **Select** the **Field**, **right click** and **select** **Properties**, **change** the Text height to **1, close** the **properties** palette, **press** **Esc** to deselect the field text.





Step 7: **Select** the **assembly baseline**, **navigate** to **Modify Assembly** panel, **select Assembly Properties**.

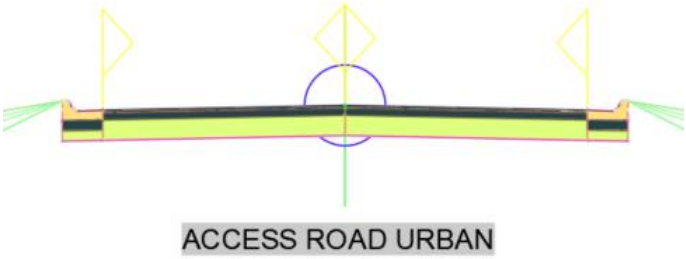




Step 8: Navigate to the **Information** tab, **change** the name to **Access Road Urban**, **click OK**.

Step 9: **Press Esc** to deselect the assembly baseline.

Step 10: Type RE, **select** the **Spacebar** to regenerate the view.

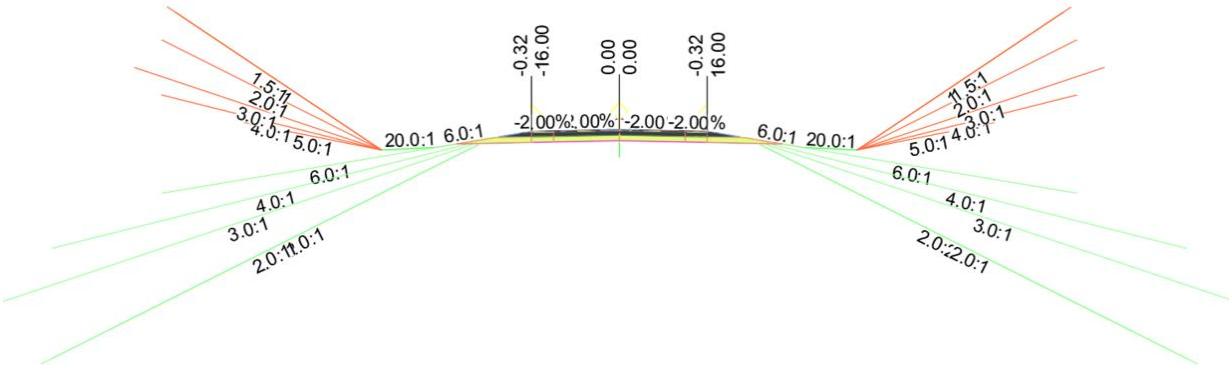


	Fields can be used to add text links to drawing components. If the drawing component updates, the Field will update as well.

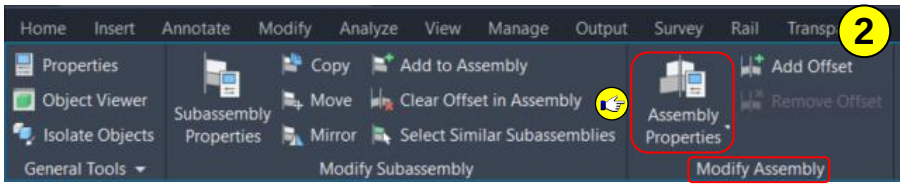
Step 11: **Save** the **drawing** .

Leveraging an MDT Assembly for corridor design

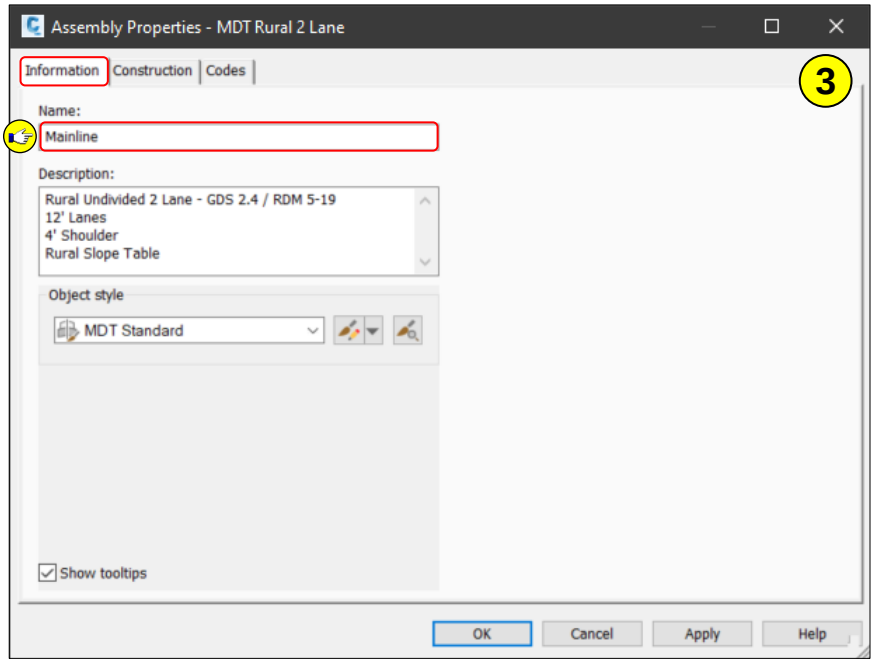
Step 1: **Navigate** to TOOL PALETTES > **MDT Assemblies**, **select** **MDT Rural 2 Lane**, **accept** the **default** properties, **pick** a **point** on the screen to place the assembly, **select** **Esc** to end the command.



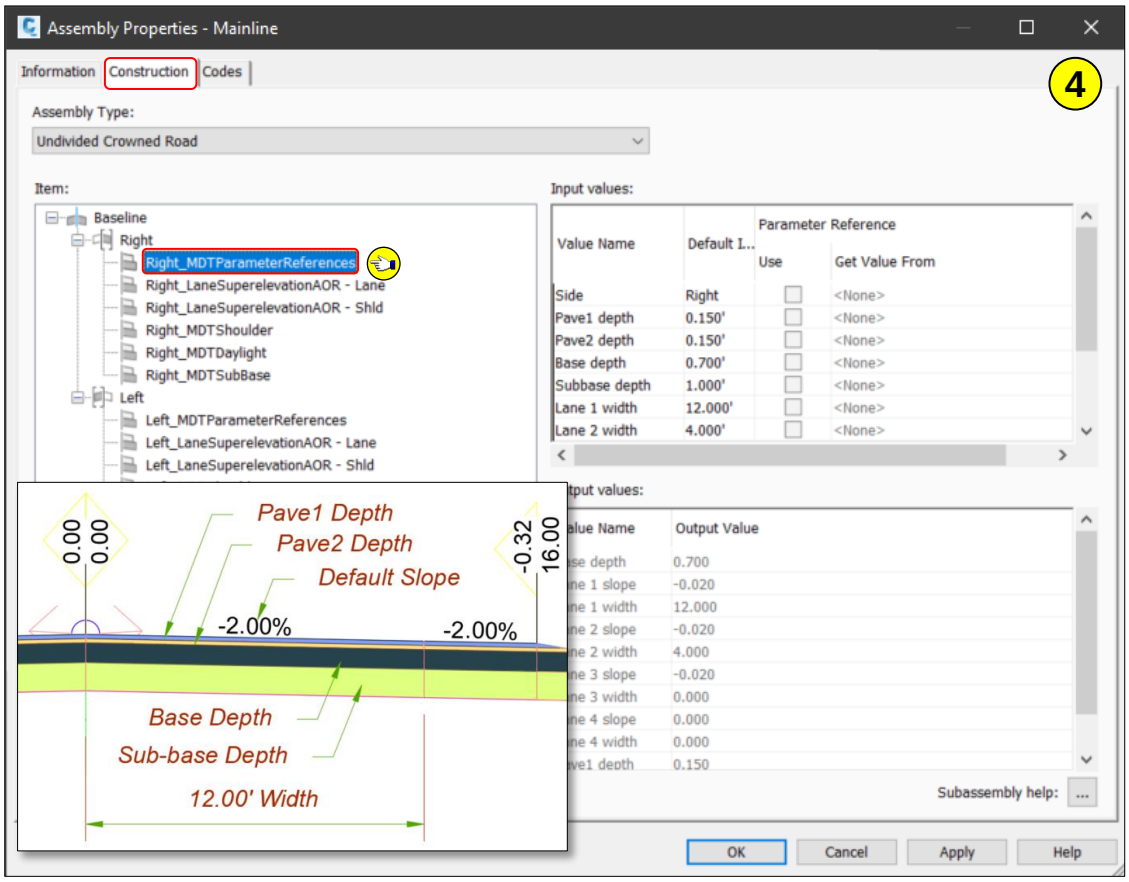
Step 2: **Select** the **assembly baseline**, **navigate** to **Modify Assembly** panel, **select** **Assembly Properties**.



Step 3: On the **Information** tab, **rename** the Assembly to **Mainline**.

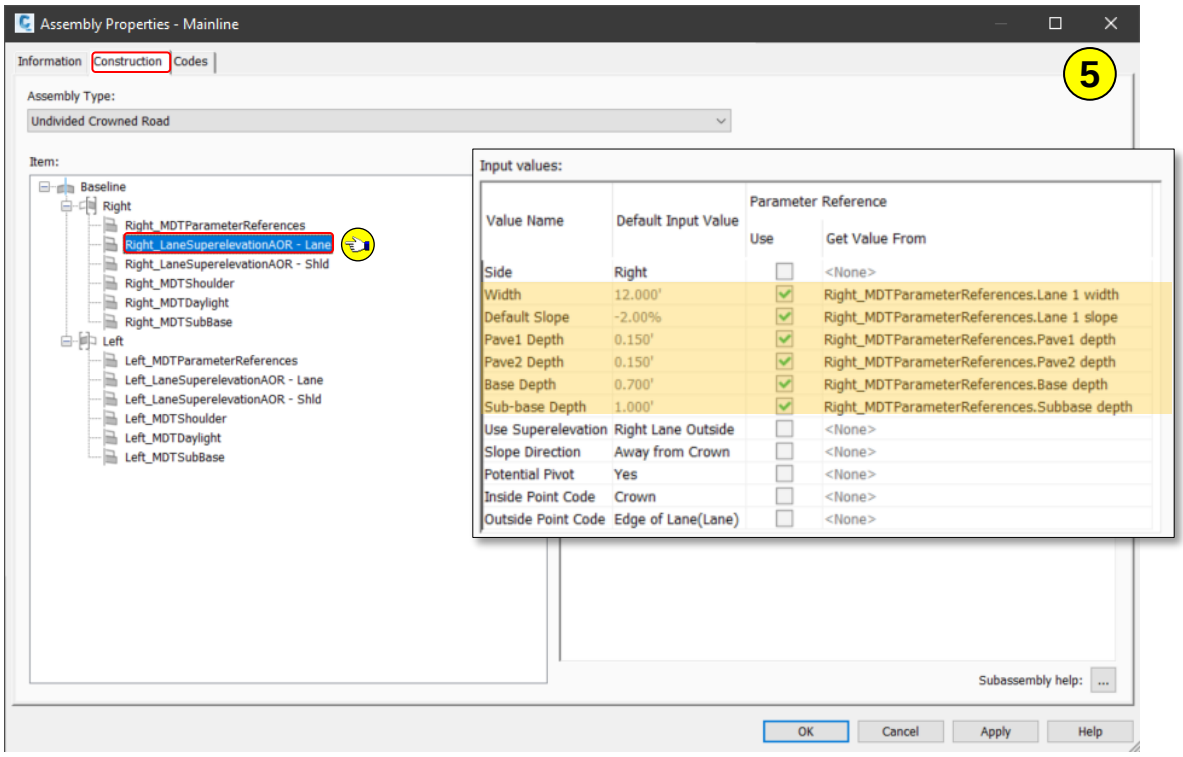


Step 4: Select the **Construction** tab, **select Right_MDTParameterReferences**.



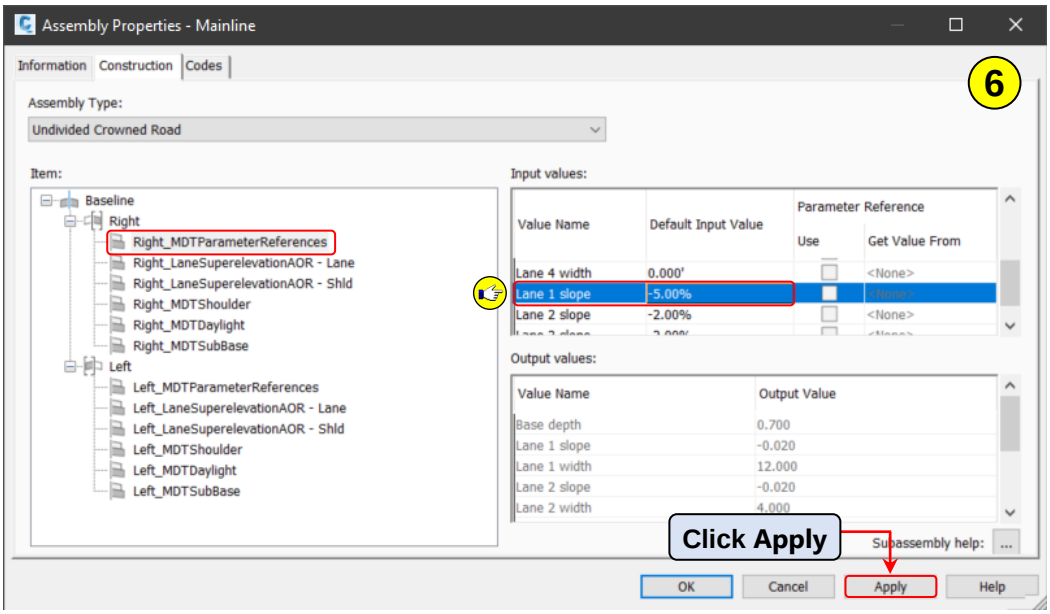
	The MDT Assemblies use a parameter reference subassembly to control the parameters of subassemblies attached to the assembly baseline. To make a parameter change for slope, depth, or width, the value in the parameter references will need to be changed.

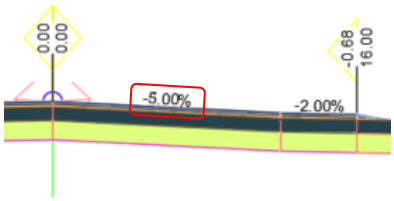
Step 5: **From** the **Construction** tab, **select** **Right_LaneSuperelevationAOR – Lane**.



	Notice the Width, Default Slope, Pave1 Depth, Pave2 Depth, Base Depth and Sub-base Depth "Default Input Values" are not editable and the "Get Value From" is leveraging the Right_MDTParameterRefernces values. To make a value change to the Right_LaneSuperelevationAOR – Lane subassembly the value must be changed at the Parameter Reference level.

Step 6: **From** the **Construction** tab, **select** **Right_MDTParameterReference**, **change** the Lane 1 Slope to **-5.00%**, **click Apply**.

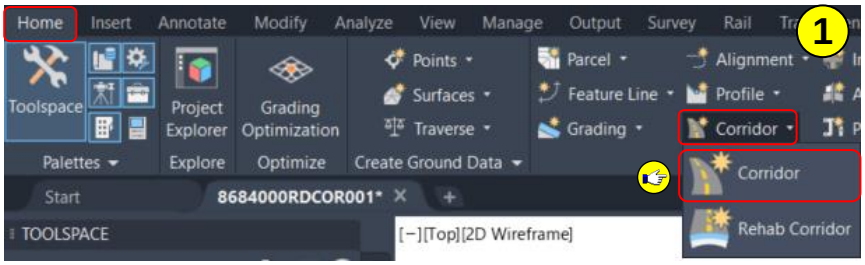




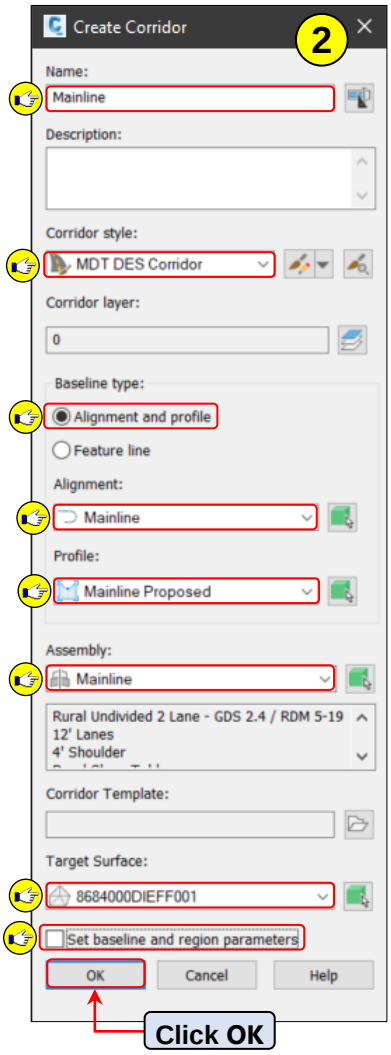
Step 7: **Change** the Lane 1 Slope to back to **-2.00%**, **click OK**, **press Esc** to deselect the baseline.

Create a Corridor

Step 1: **Navigate** to Home tab > Create Design panel > **Corridor**, **select Corridor**.



Step 2: **Change** the following **parameters**, **click OK**.



Name: Mainline

Corridor Style: MDT DES Corridor

Baseline type: Alignment and profile

Alignment: Mainline

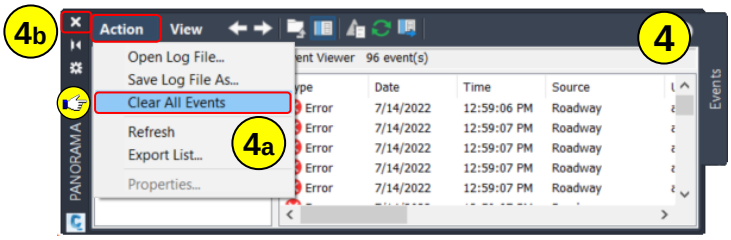
Profile: Mainline Proposed

Assembly: Mainline

Target Surface: 8684000DIEFF001

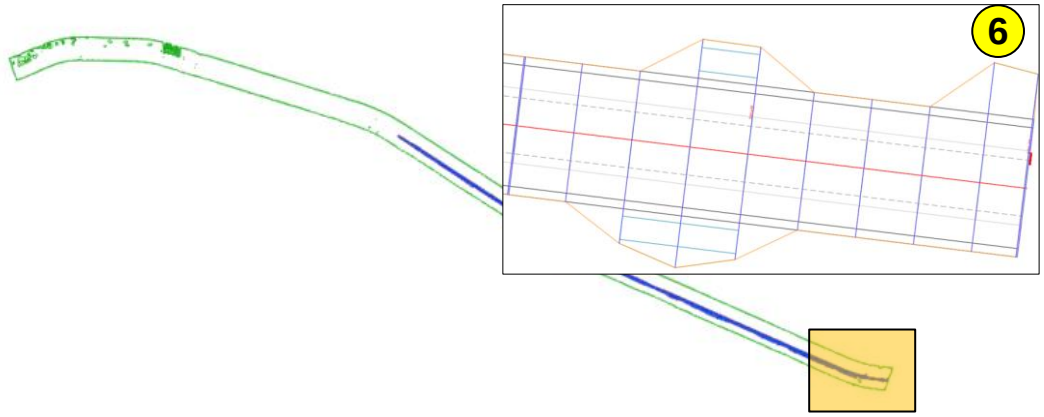
Set baseline and region parameters: Uncheck

Step 4: **Select** **Action**, **select** **Clear All Events**, **close** the **PANORAMA**.



Step 5: **Type** **ZE** + **spacebar** to zoom extents.

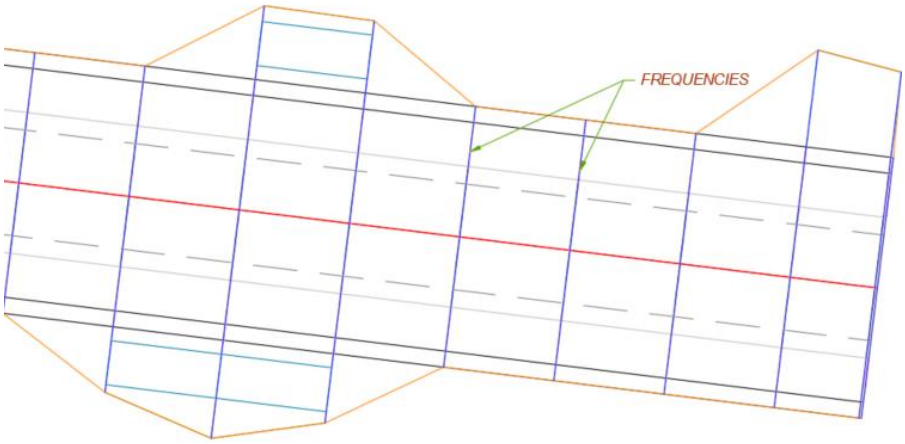
Step 6: **Zoom** to the **southeast** end of the **Corridor**. **See** the corridor.



Corridor Frequency

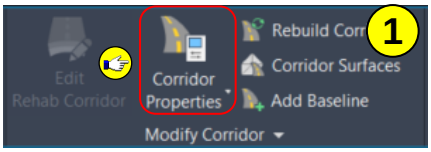
Corridor Frequencies are used to specify an incremental value of where to place an assembly along a corridor. Station frequency can be specified by referencing portions of an alignment and profile geometry in a region. For example, you can specify assembly insertion frequency for the following components of a corridor region:

- **Along Tangents** - Specify the assembly insertion frequency along the tangent portion of an alignment.
- **Along Curves** - Specify the assembly insertion frequency along the curve portion of an alignment.
- **Along Spirals** - Specify the assembly insertion frequency along the spiral portion of an alignment.
- **Along Profile Curves** - Specify the assembly insertion frequency along the curve portion of the profile.
- **At Specific Points** - Specify whether assemblies should be inserted at specific geometry points, including horizontal geometry, superelevation critical, profile geometry, and profile high and low points.
- **Along Offset Targets** - Specify whether assemblies should be inserted based on offset targets.

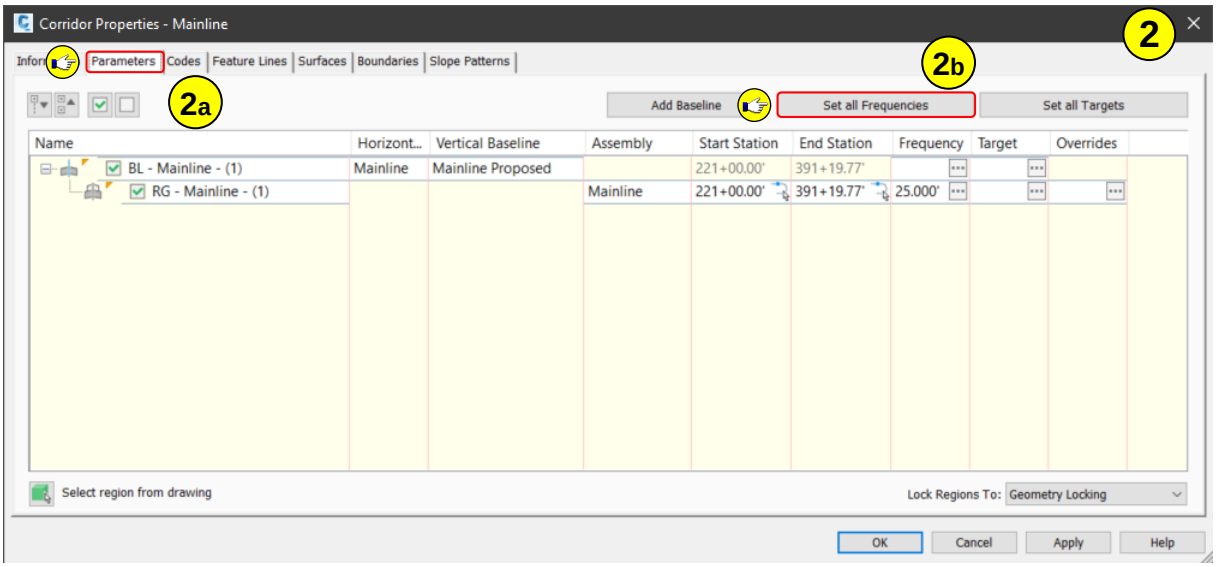


Adjusting Corridor Frequencies

Step 1: **Select** the **Corridor**, **select** **Corridor Properties** on the contextual ribbon.



Step 2: In the Corridor Properties dialog box, **select** the **Parameter** tab, **select** **Set all Frequencies**.



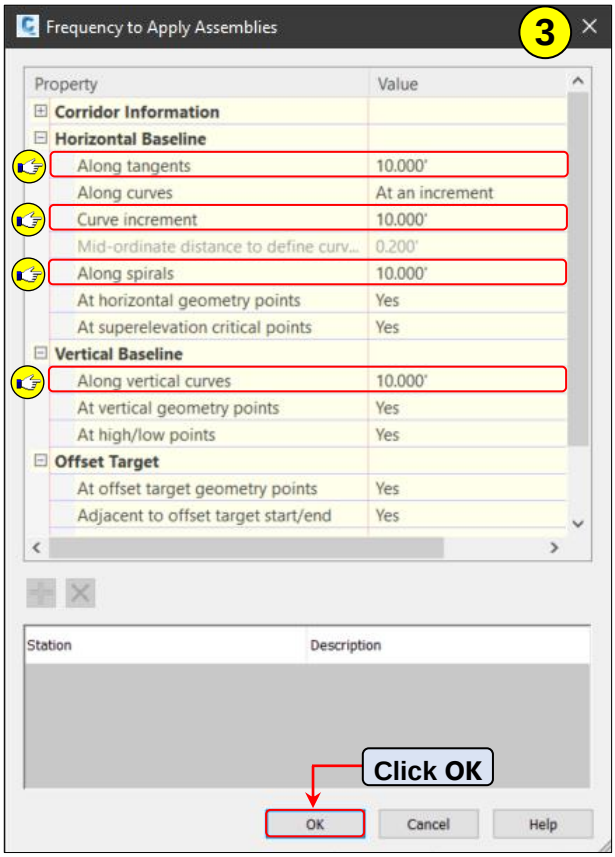
Step 3: **Change** the following **Values** as shown, **click OK**.

Along tangents: 10.000’

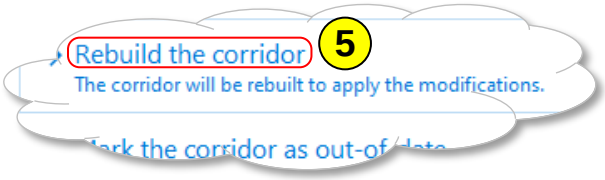
Curve increments: 10.000’

Along spirals: 10.000’

Along vertical curves: 10.000’

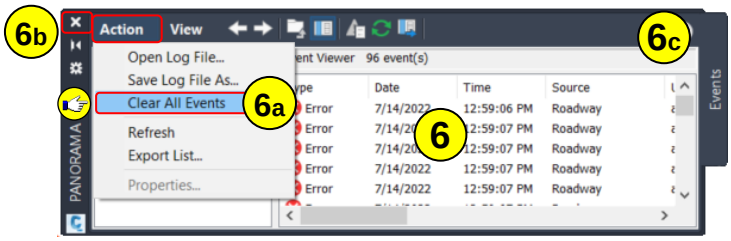


Step 4: **Click OK** on the Corridor Properties dialog box.

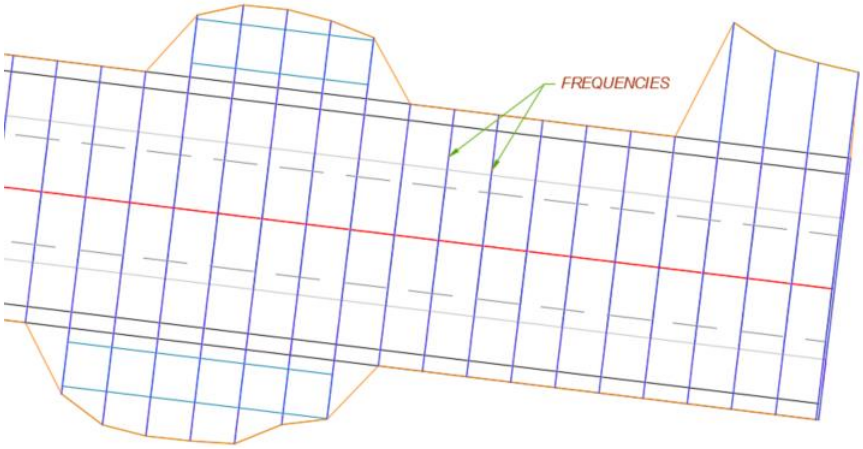


Step 5: **Select Rebuild the Corridor** from the Corridor Properties – Rebuild pop-up window.

Be patient while the corridor updates.



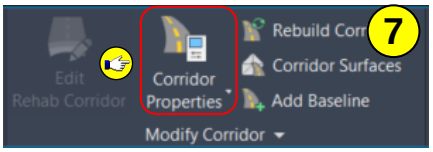
Step 6: **Select Action**, **select Clear All Events**, **close** the **PANORAMA**, **press Esc** to deselect the corridor.



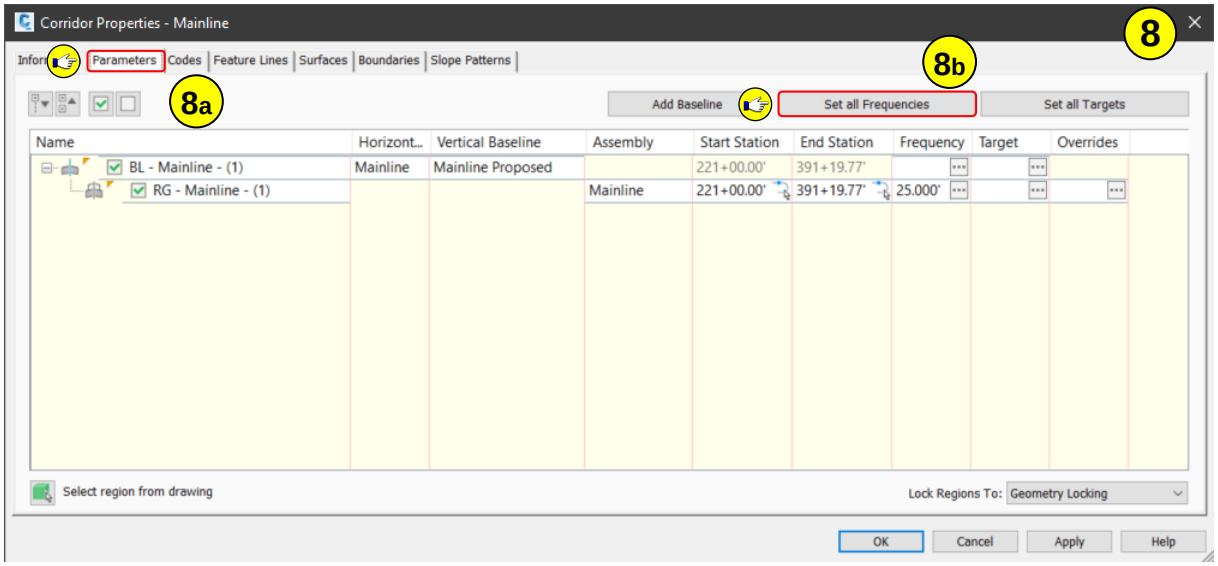
	Notice not only the frequencies intervals increased, by applying additional frequencies, the corridor end conditions have smoother transitions as well.

	By increasing the corridor frequencies, a more accurate depiction of the corridor model is presented. Use caution when increasing frequencies. The smaller the value the slower the corridor rebuild process will be and the drawing performance will decrease. Increasing the corridor frequencies should be applied after the design process and during the calculating volumes and materials process.

Step 7: **Select** the **Corridor**, **select** **Corridor Properties** on the contextual ribbon.



Step 8: In the Corridor Properties dialog box, **select** the **Parameter** tab, **select** **Set all Frequencies**.



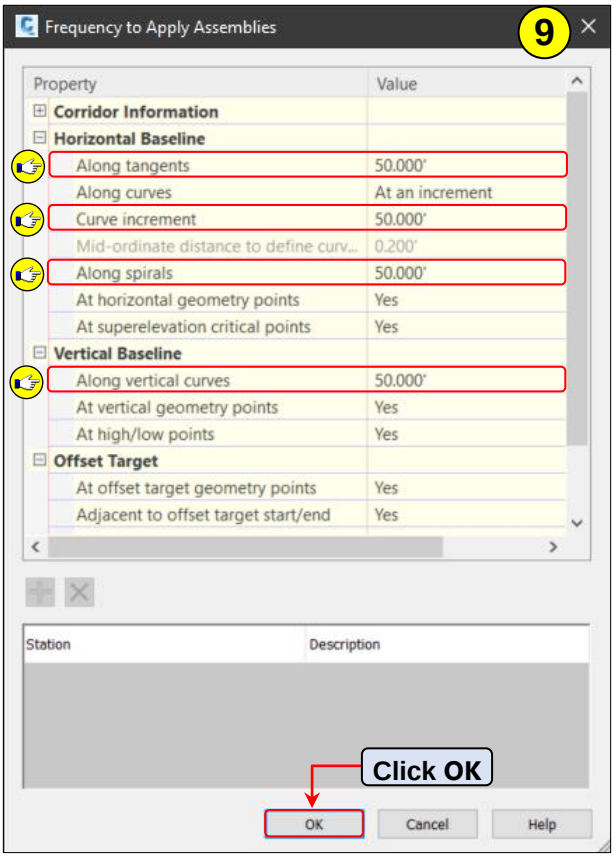
Step 9: **Change** the following **Values** as shown, **click OK**.

Along tangents: 50.000’

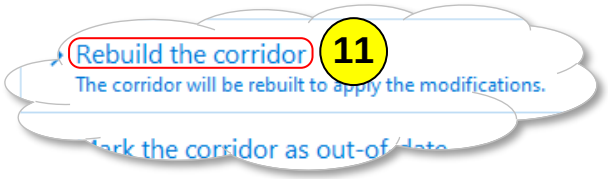
Curve increments: 50.000’

Along spirals: 50.000’

Along vertical curves: 50.000’

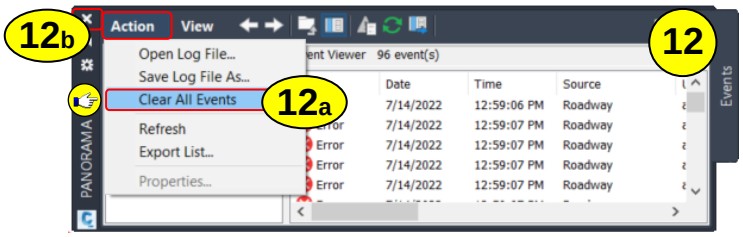


Step 10: **Click OK** on the Corridor Properties dialog box.

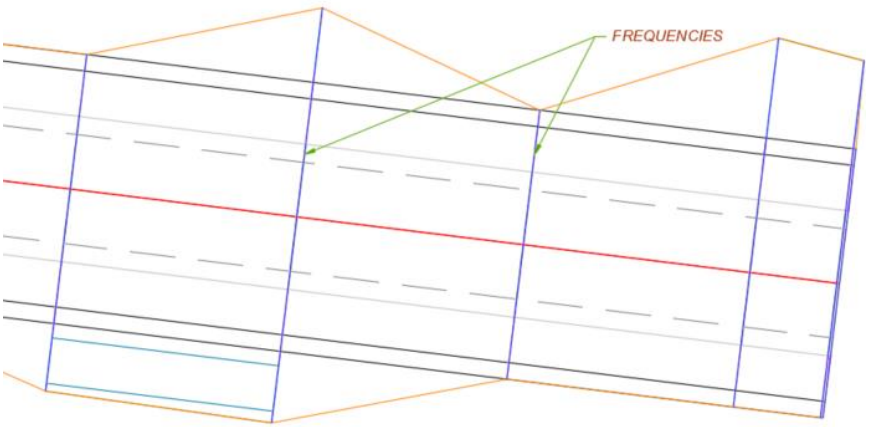


Step 11: **Select Rebuild the Corridor** from the Corridor Properties – Rebuild pop-up window.

Be patient while the corridor updates.



Step 12: **Select Action**, **select Clear All Events**, **close** the **PANORAMA**, , **press Esc** to deselect the corridor.

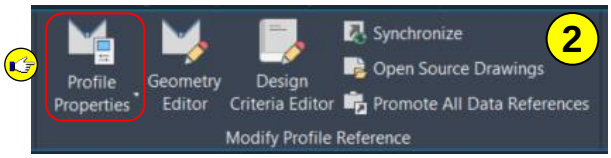


Solving Event Viewer Errors

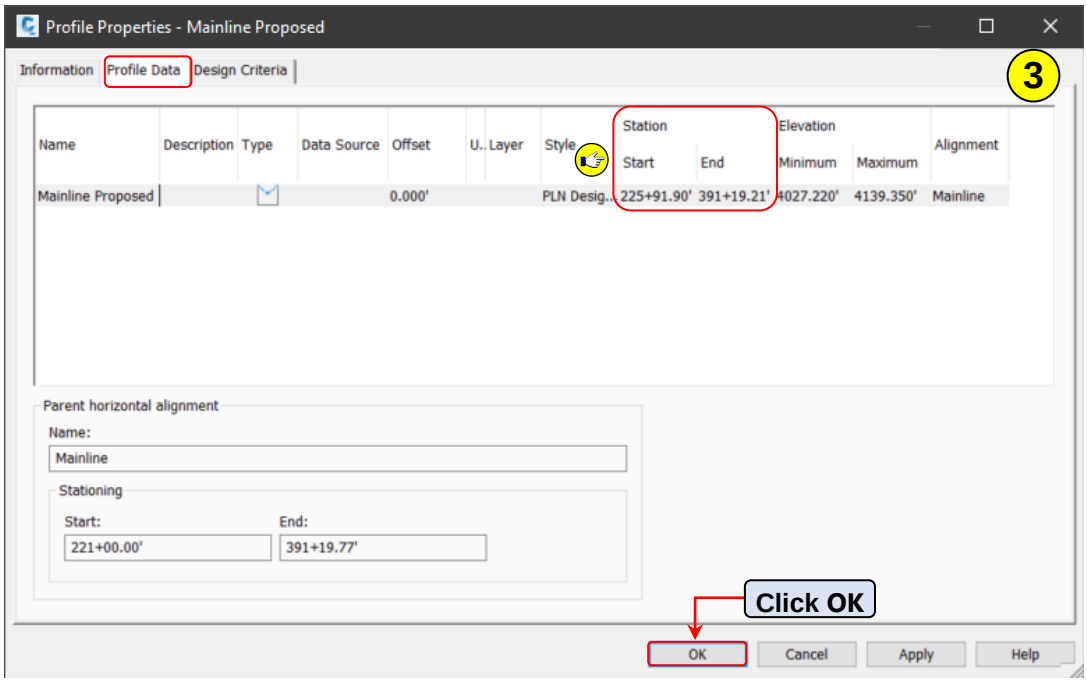
Step 1: **Zoom** to the **Mainline Profile**, notice that the proposed profile doesn't begin at the alignments starting station or extend to the ending station of the alignment.

	A corridor leverages horizontal data from an alignment and vertical data from a profile. When the alignment and profile starting and ending stations do not match, the Event Viewer will populate with errors. To resolve the errors, in this case, the corridor starting and ending stations need to be adjusted to match the profile stationing.

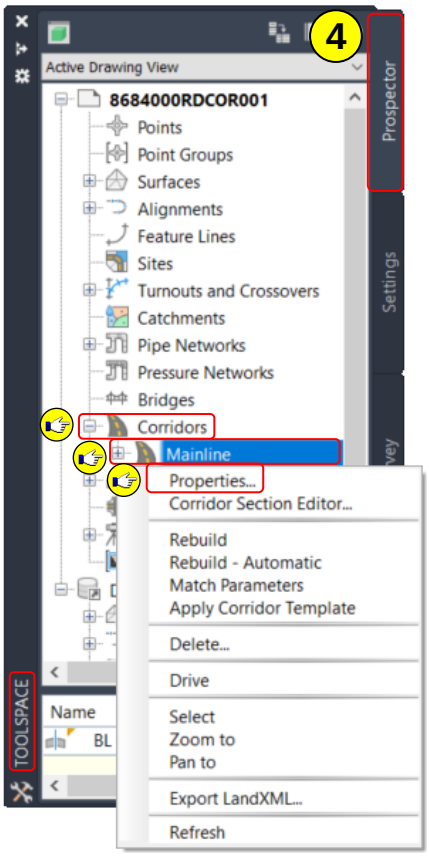
Step 2: **Select** the **Mainline Proposed Profile**, **select Profile Properties** from the contextual ribbon.



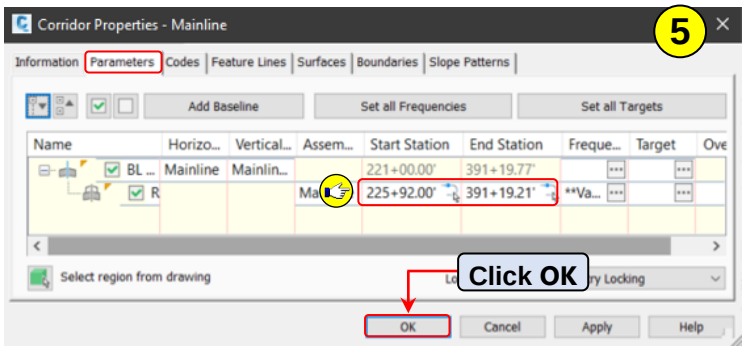
Step 3: On the Profile Properties, **select Profile Data** tab, **note** the **Start** and **End** stations, **click OK**, **press Esc** to deselect the **Mainline Proposed Profile**.

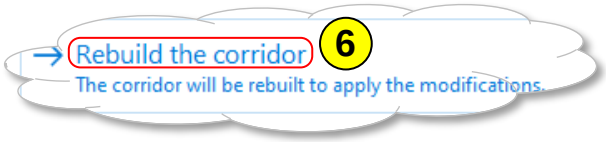


Step 4: **Navigate** to TOOLSPACE > **Prospector** tab, **expand** **Corridors**, **right click** on **Mainline**, **select** **Properties**.



Step 5: In the Corridor Properties dialog box, **select** **Parameters** tab, **change** the Start Station to **225+92.00** and End Station to **391+19.21**, **click** **OK**.





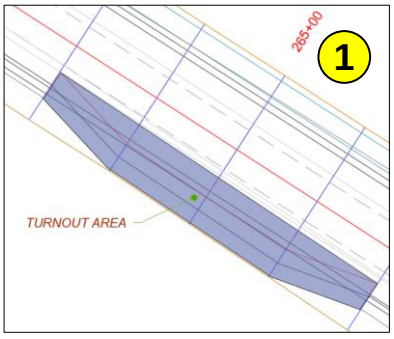
Step 6: **Select** **Rebuild the Corridor** from the Corridor Properties – Rebuild pop-up window.

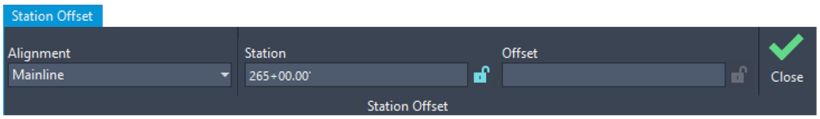
Be patient while the corridor updates.

Corridor Targets and Target Types

Corridor targets can be leveraged to specify horizontal widths adjustments, vertical adjustments from 3D polylines o, feature lines or survey figures and for surface projections. Targets are required when the geometry of one or more of an assembly's subassemblies requires corresponding surface, offset, or elevation targets for defining that geometry. When a corridor contains subassemblies that use targets, the object names of the intended target objects must be mapped from the subassembly definition to the corresponding drawing objects. This task is referred to as setting targets or mapping targets.

Step 1: **Zoom** to **Station 265+00** of the **Mainline** Alignment, **notice** the **turnout area**.

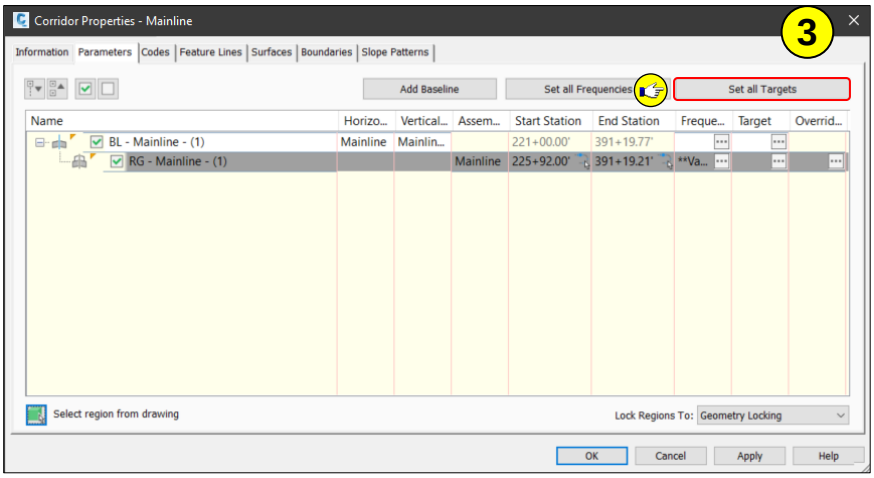




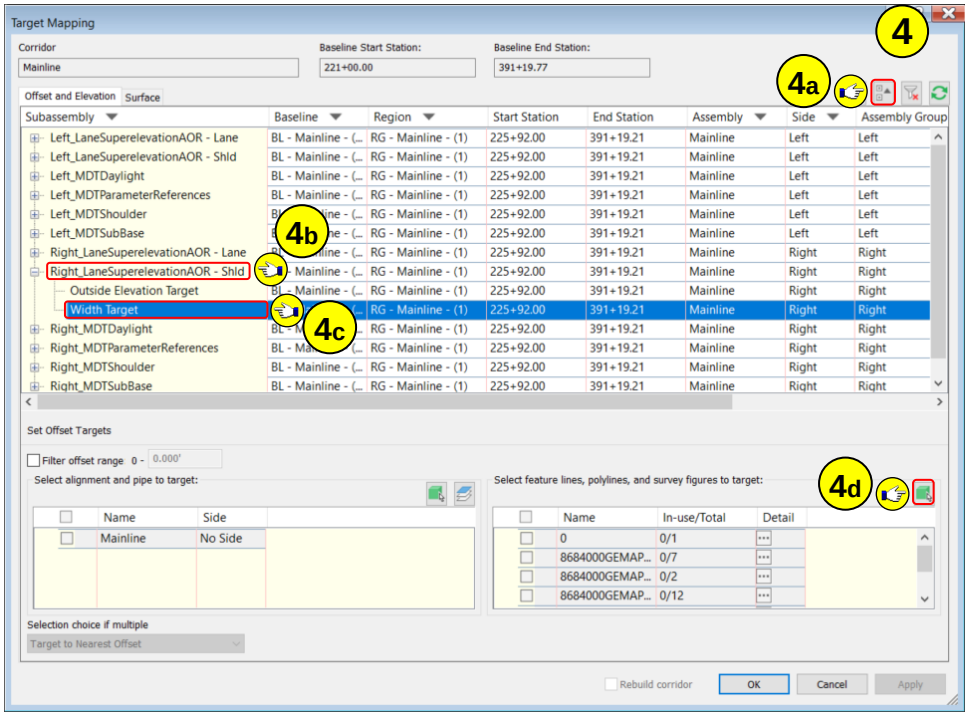
The **Station Offset** Transparent command can be used to easily locate specific stations along an alignment. From the Transparent ribbon tab, **select** **Station Offset** from the Plan panel. When prompted, **select** desired **alignment** from Model space. From the Station Offset contextual tab, **verify** the desired **alignment** is current, **enter** the desired **station**, from Model space, **see** the Cross Hairs locked to the **location**. **Press** **Esc** to end the command.

Step 2: **Select** the Mainline **Corridor**, **right click** and **select** **Corridor Properties**.

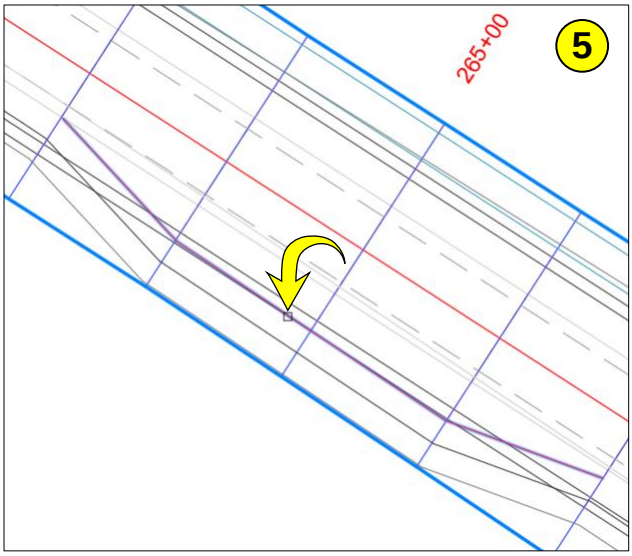
Step 6: In the Corridor Properties dialog box, **select** **Set all Targets**.



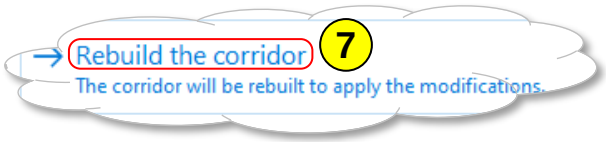
Step 4: In the Target Mapping dialog box, **select** the **Collapse** all button, **expand** **Right_LaneSuperelevationAOR – Shld**, **select** **Width Target**, **select** **pick from screen** button.



Step 5: **Select** the **red line** representing the turnout, **select** **Enter** on the keyboard to return to the Target Mapping dialog box.



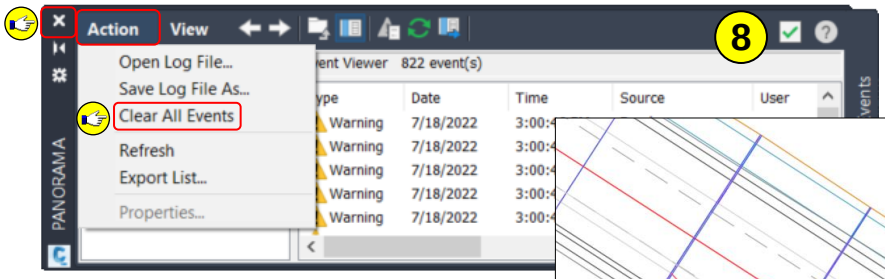
Step 6: **Select** **OK** on the Target Mapping dialog box.



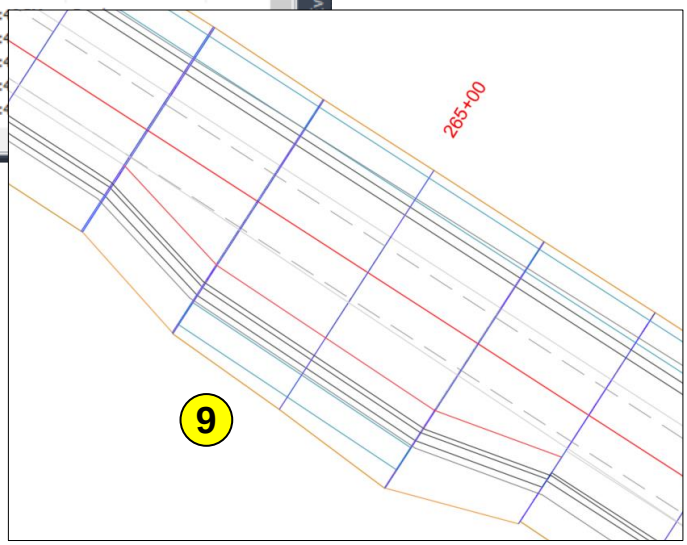
Step 7: **Select** **OK** on the Corridor Properties dialog box, **select** **Rebuild the corridor**.

Be patient while the corridor updates.

Step 8: **Select** **Action**, **select** **Clear All Events** on the Event Viewer, **close** the **Event Viewer**.



Step 9: From **Model** space, **review** the **adjusted** **Turn Out** area of the corridor.

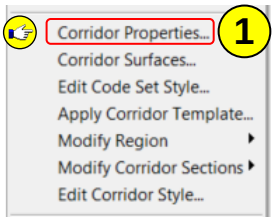


Understanding and Using Regions

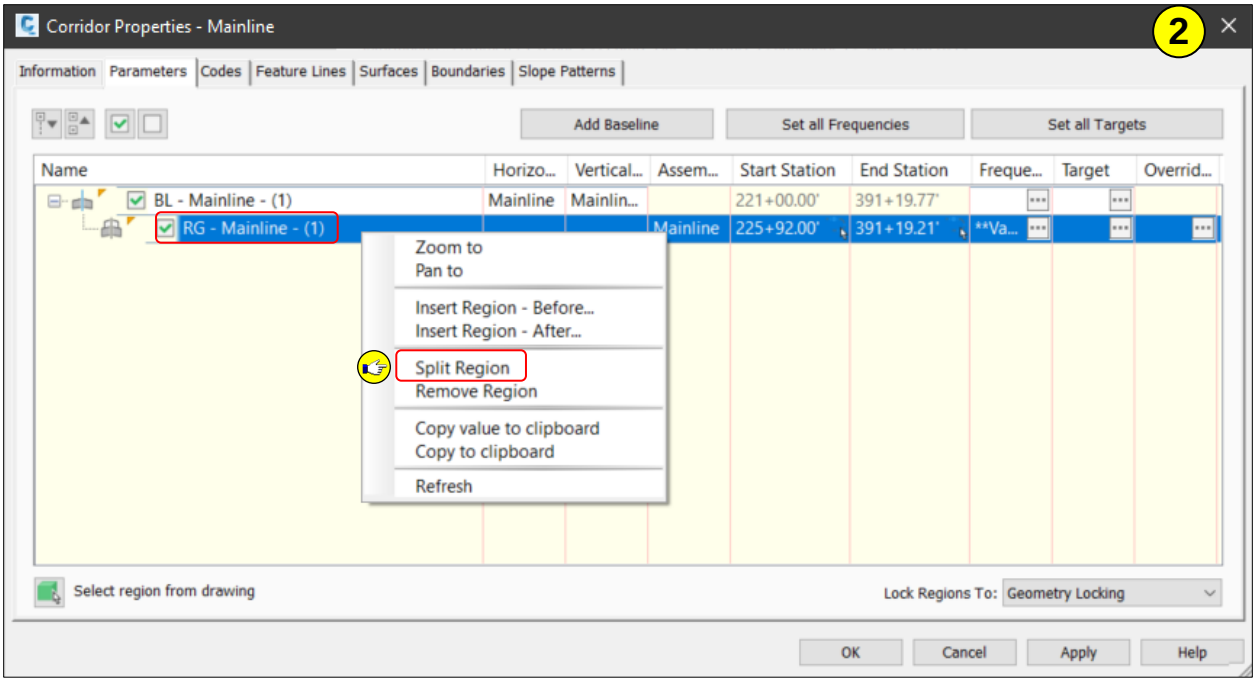
Corridor regions are used to associate assemblies to a specific range of stations along the corridor. Corridor regions can be created to specify different assemblies along the corridor at locations that may not be common to the overall design. For example, a corridor region can be created at an intersecting access road or intersection where the need for an end condition, cut or fill condition, is not needed. Regions can also be leveraged to organize the Corridor. Regions can be created to divide lengthy corridors into more manageable sizes, helping the rebuilding speed. Corridor regions can be turned off when not being focused on and turned back on when needed.

Creating Corridor Regions

Step 1: Select the Mainline **corridor**, **right click** and **select Corridor Properties**.

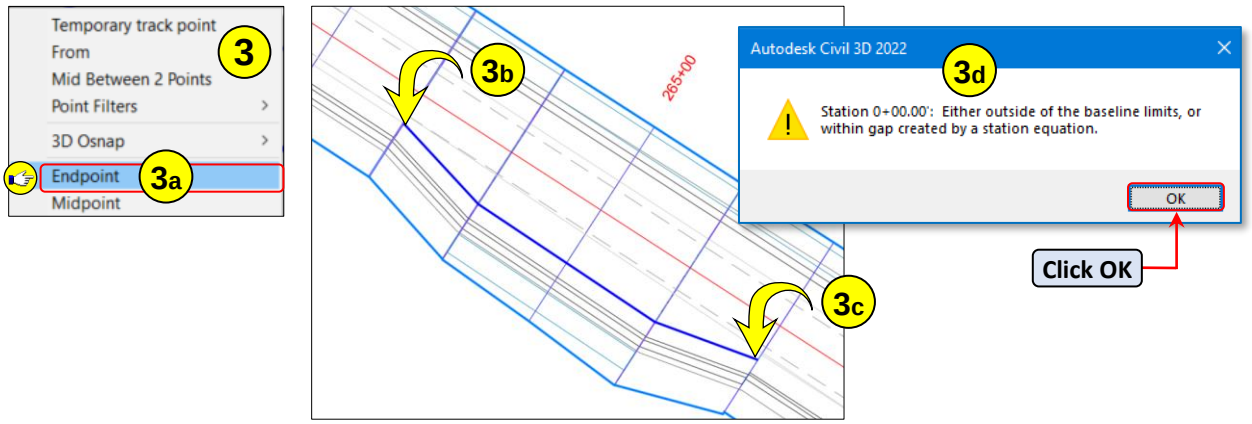


Step 2: Right click on **RG – Mainline (1)**, **select Split Region**.

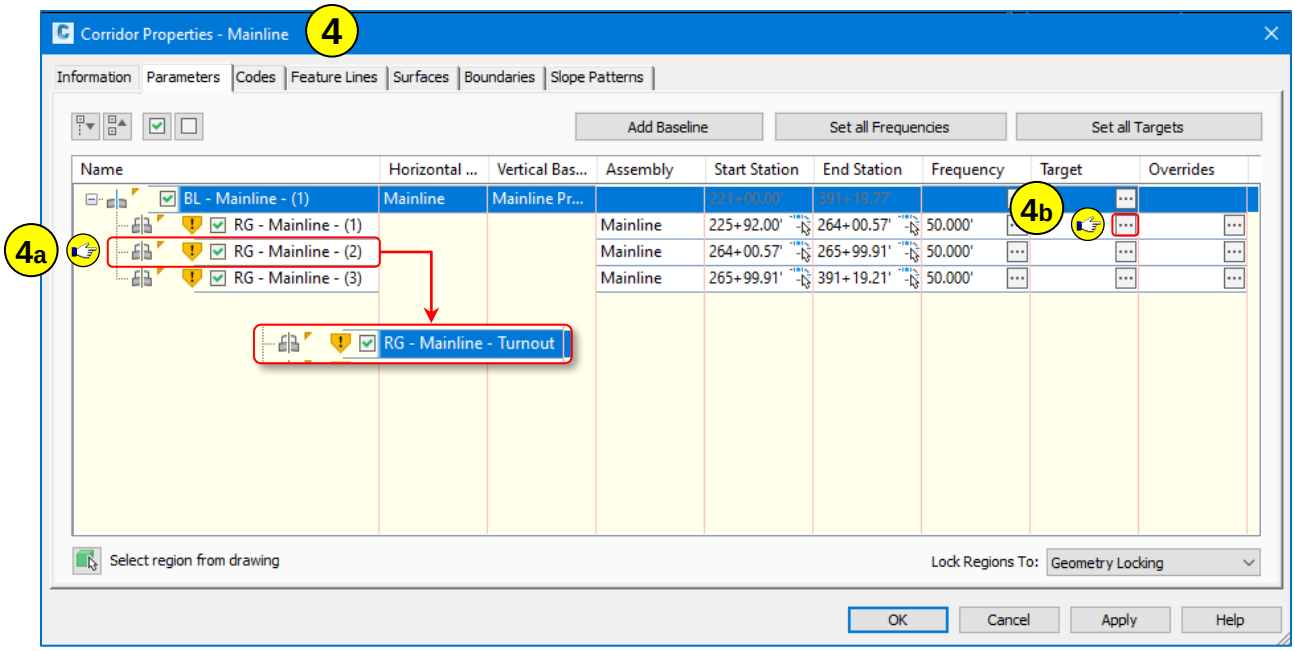


Step 3: **Select** **Shift + right click**, **select** **Endpoint**, **pick** the **northerly endpoint** of the turnout (red Xref target line), **repeat** for the **southerly end**, **select** **Enter** to return to Corridor Properties. If presented with the **Station 0+00.00'** warning pop-up, **click** **OK**.

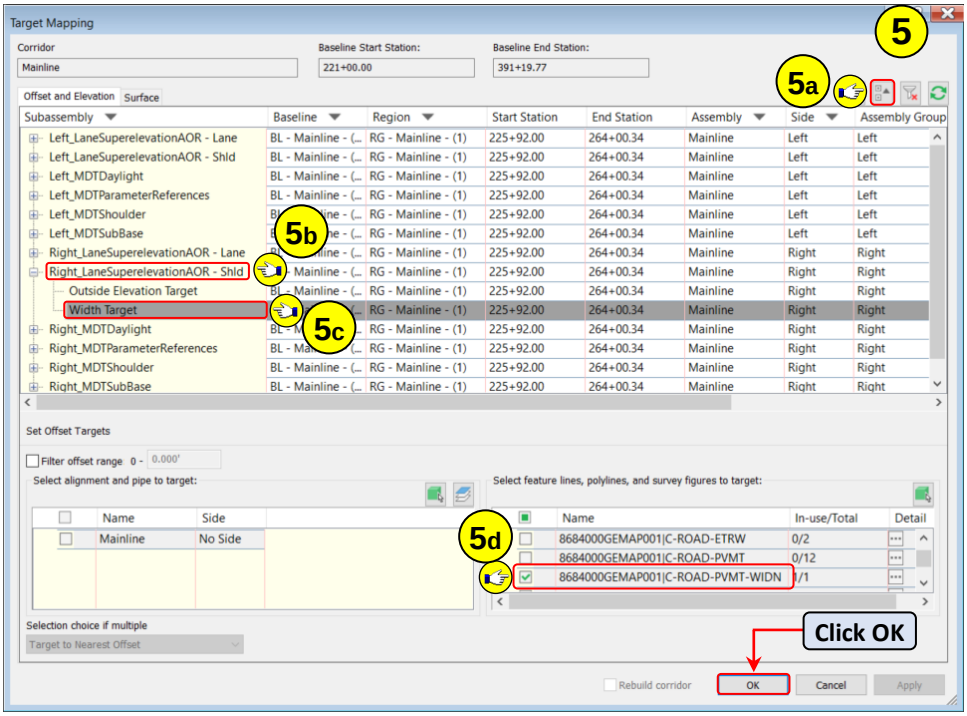
- This warning is common when working with corridors and regions.



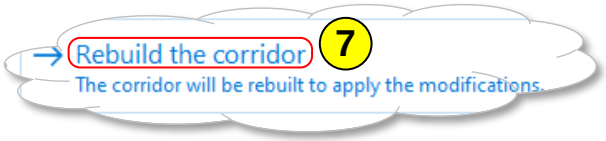
Step 4: **Rename** the RG – Mainline – (2) to **RG – Mainline – Turnout**, **Select** the **Target button** for RG – Mainline – (1).



Step 5: In the Target Mapping dialog box, **select** **Collapse** all button, **expand** **Right_LaneSuperelevationAOR – Shld**, **select** **Width Target**, **uncheck** **8684000GEMAP001|C-ROAD-PVMT-WIDN**, **click** **OK**.



Step 6: **Repeat** for **RG – Mainline – (3)**.



Step 7: From the **Corridor Properties – Mainline** dialog box, **click** **OK**, **select** **Rebuild the corridor**.

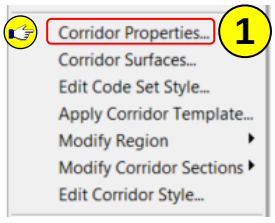
Be patient while the corridor updates.

Corridor Surfaces

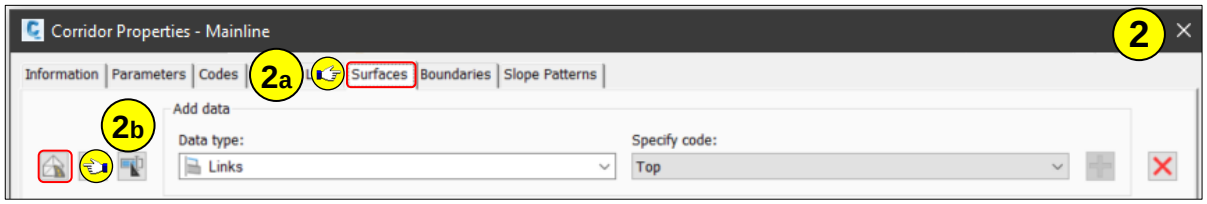
Once a corridor has been created, a corridor surface can be generated. Corridor surfaces are an output of a corridor model, they remain dynamically linked to the corridor. Any changes to the corridor definition are reflected in the surface definitions. The Surfaces tab of the Corridor Properties dialog box is used to create corridor surfaces. Corridor surfaces can be created from corridor links and features lines.

Create a Corridor Surface

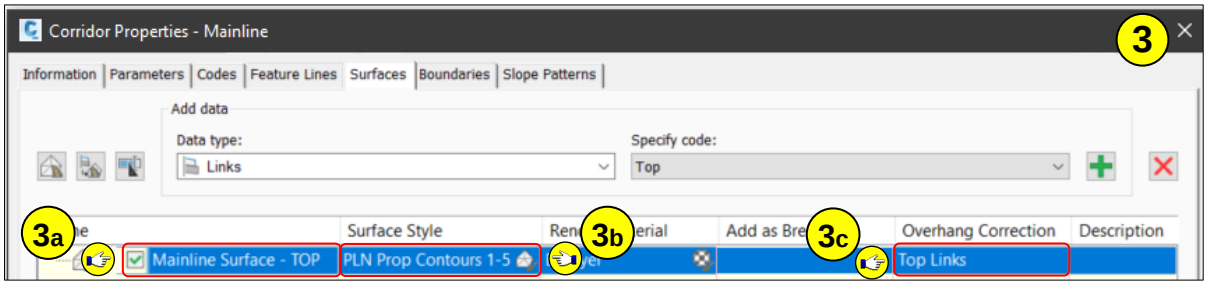
Step 1: **Select** the Mainline **corridor**, **right click** and **select** **Corridor Properties**.



Step 2: **Select** the **Surfaces** tab in the Corridor Properties dialog box, **select** the **Create a corridor surface** button.

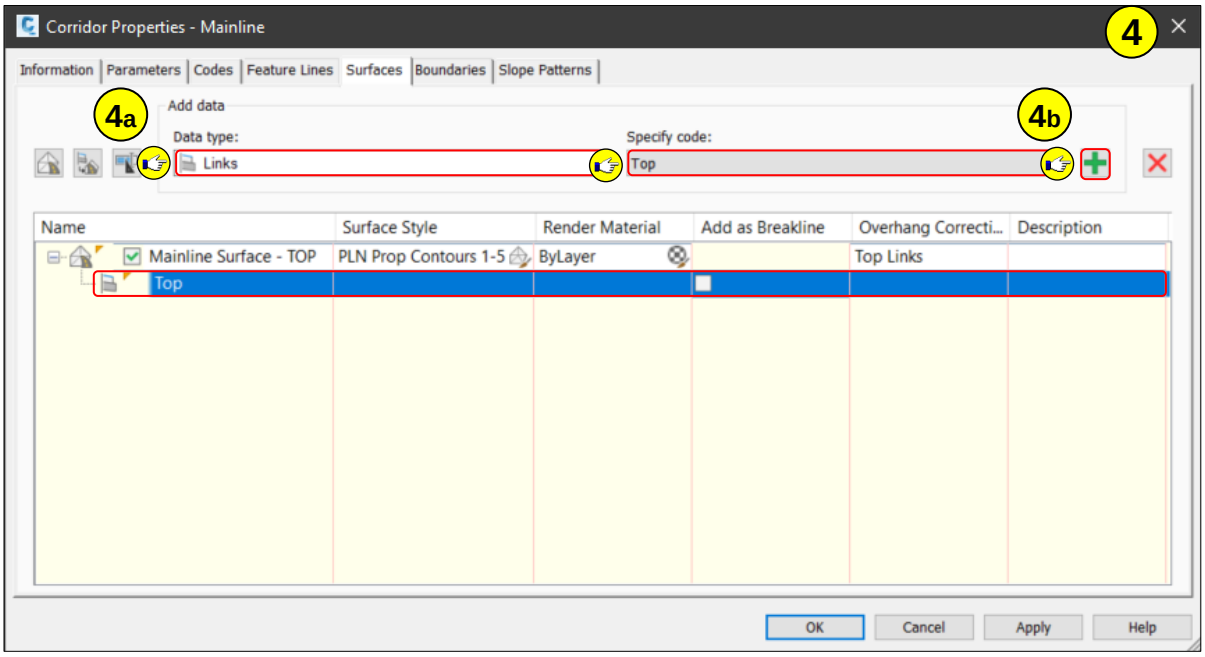


Step 3: **Rename** the surface to **Mainline Surface – TOP**, **change** the Surface Style to **PLN Prop Contours 1-5**, **set** the Overhang Correction to **Top Links**.

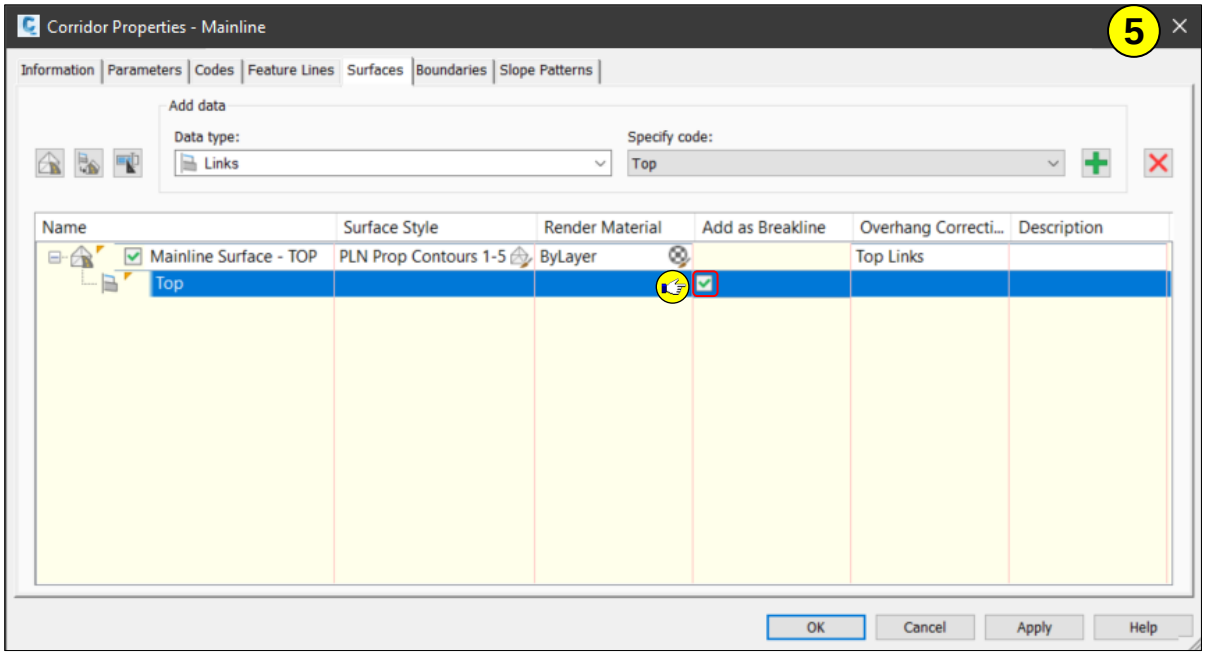


	Overhang Correction forces the corridor surface to use either the Top links or Bottom links of the subassembly(s). In some cases, the corridor surface will use a variation of links to create the surface. By selecting Top links or Bottom links it will ensure the correct links are being leveraged for the desired corridor surface.

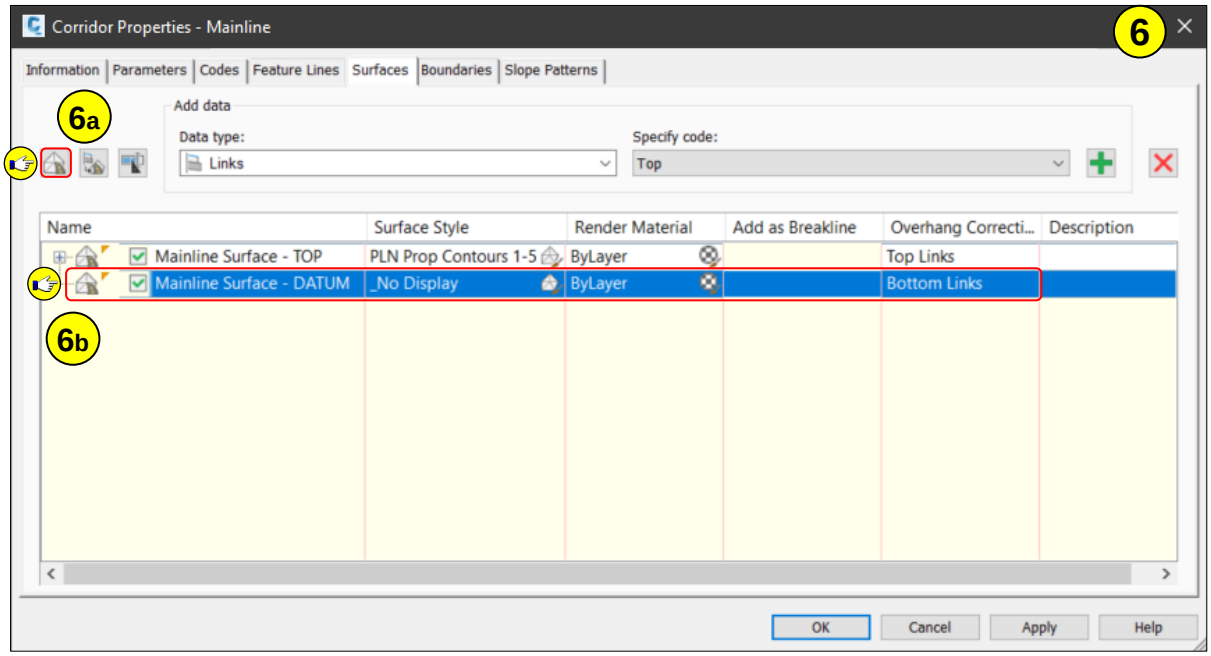
Step 4: **Verify** the Data type is **Links** and Specify code is **Top**, **select green plus** button .

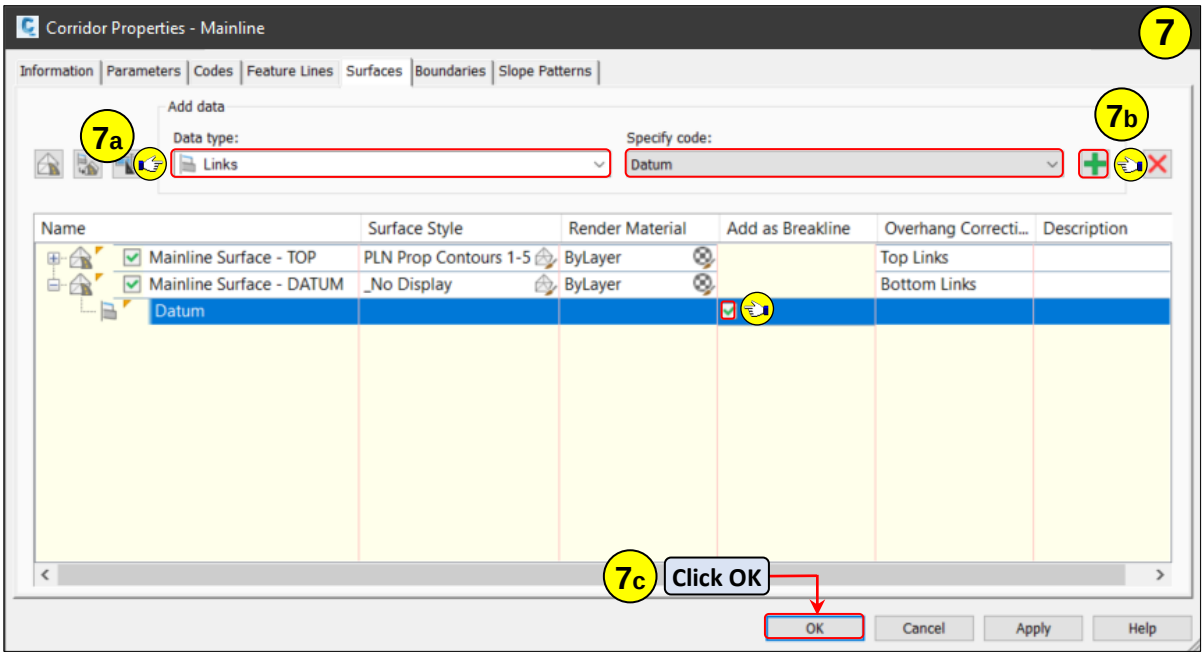


Step 5: **Select** the check box for **Add as Breakline**.

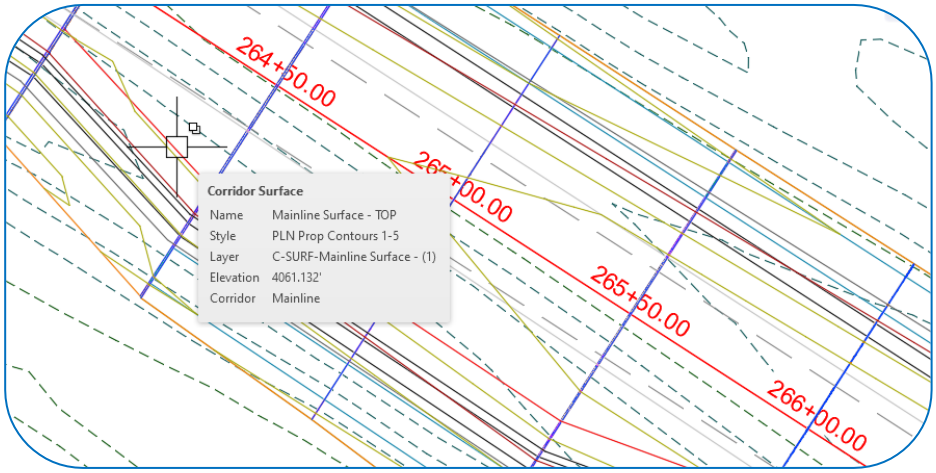


Step 6: **Select** the **Create a corridor surface** button, **rename** the Surface to **Mainline Surface – DATUM**, **change** the Surface Style to **_No Display**, **select** **Bottom Links** for Overhang Correction.





Step 7: **Verify** the Data type is **Links** and Specify code is **Datum**, **select green plus** button, **select** the check box for **Add as Breakline**, **click OK**.

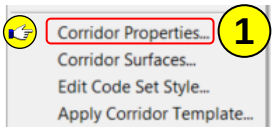


Corridor Boundaries

Corridor surface boundaries are used to prevent triangulation outside the extents of a corridor. Corridor surface boundaries can be created using the following options:

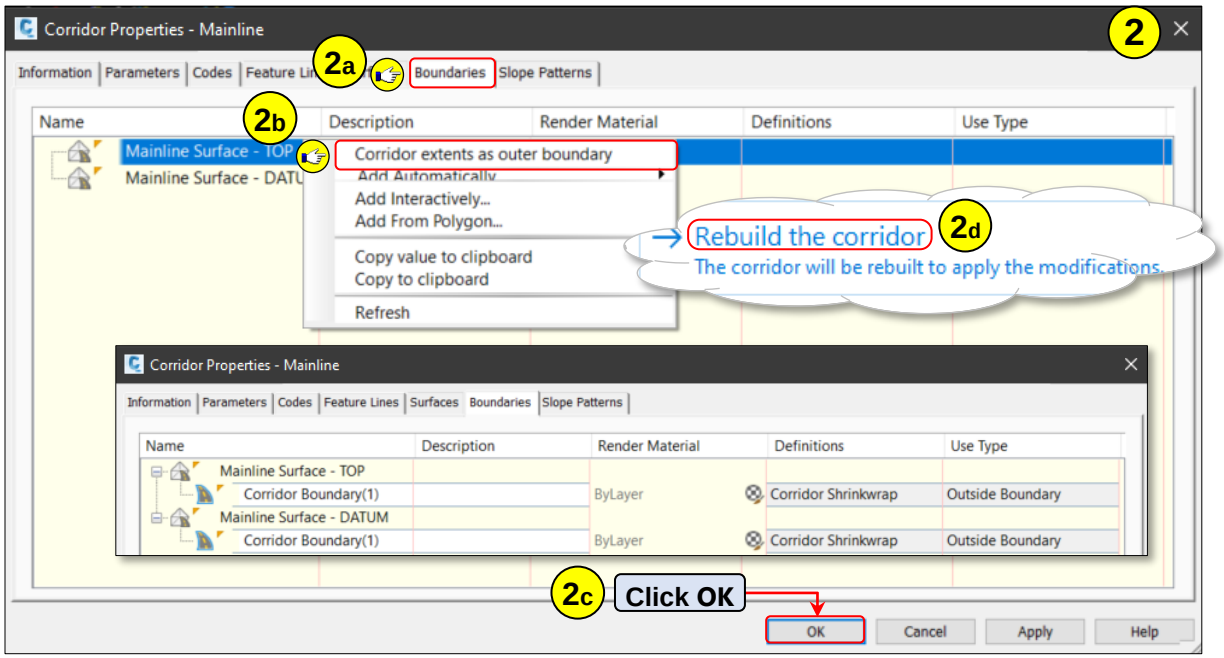
- **Corridor Extents As Outer Boundary** – Trims the triangulation of a surface at the extents of a corridor (Shrink Wrap).
- **Add Automatically** – Based on point codes to which feature lines are assigned. A single baseline must exist for this option.
- **Add interactively** – Allows for feature lines from the corridor to be selected and used as boundary.
- **Add from Polygon** – Uses a closed polyline as the corridor boundary extents.

Create a Corridor Surface Boundary



Step 1: **Select** the Mainline **corridor**, **right click** and **select Corridor Properties**.

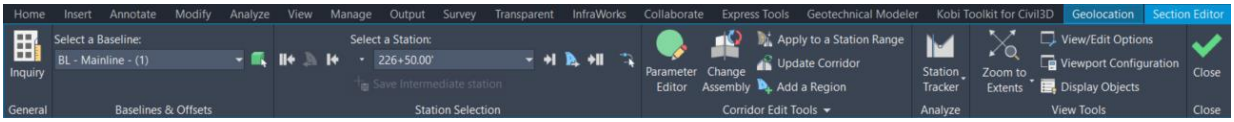
Step 2: **Select** the **Boundaries** tab, **right click** on **Mainline Surface – TOP**, **select Corridor extents as outer boundary**, **repeat** for **Main Surface – DATUM**, **click OK**, **select Rebuild the corridor**.



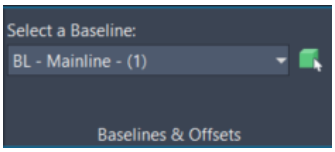
Corridor Section Editor

The Corridor Section Editor can be used to view and modify corridor sections and to visually inspect how assemblies are applied at various stations. The Corridor Section Editor can be leveraged to apply assembly overrides to a corridor section or a range of sections.

Section Editor Overview and User Interface



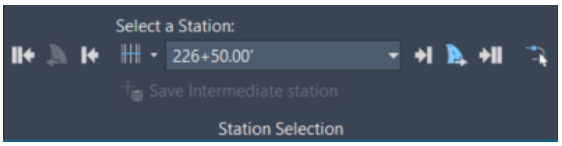
Baseline & Offsets panel:



Select a Baseline – Specify a baseline alignment for a corridor to view and edit sections. Selecting the down arrow allows for selecting available alignments.

- Used to select a baseline from the drawing.

Station Selection panel:



- Display the first or start station on the corridor.

- Steps to previous corridor station.

- Filters the Select a Station list by type of station. All Baseline, Region, Overridden or Non-region.

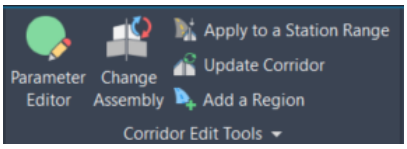
Select a Station – Lists all baseline stations and allows selection of a station to view.

- Steps to the next corridor station.

- Displays the corridor section at the first station of the next region.

- Display the corridor section view at the end station on the corridor.

- Select a station from the drawing or by entering a station value.



Corridor Edit Tools Panel:

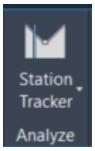
Parameter Editor – Allows for corridor parameter overrides to be applied to a station or range of stations.

Change Assembly – Allows for swamping an assembly at a station or range of stations.

Apply to a Station Range – This tool can be used once the Parameter Editor or Change Assembly tools are applied.

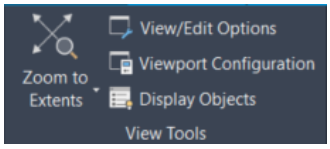
Update Corridor – Used to rebuild/update the corridor.

Add a Region – used to add a region to the corridor.



Analyze panel:

Station Tracker – Used to visually see which station is currently selected. Allows the station tracker to be visible in the current viewport, all viewports or turned off.



View Tools:

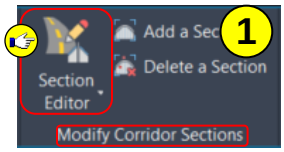
Zoom – Used to Zoom Extents of the assembly, Zoom to a station or offset or assembly.

View/Edit Options – Controls the visibility of the Section Editors objects. Scale, grid, grid text, section slider and code set style.

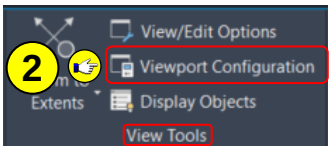
Viewport Configuration – Controls the number of viewports and which views, plan, profile, section or assembly, is displayed in each viewport.

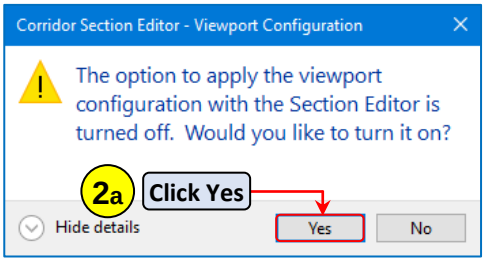
Display Objects - Controls which objects are displayed in the Section Editor.

Using the Corridor Section Editor



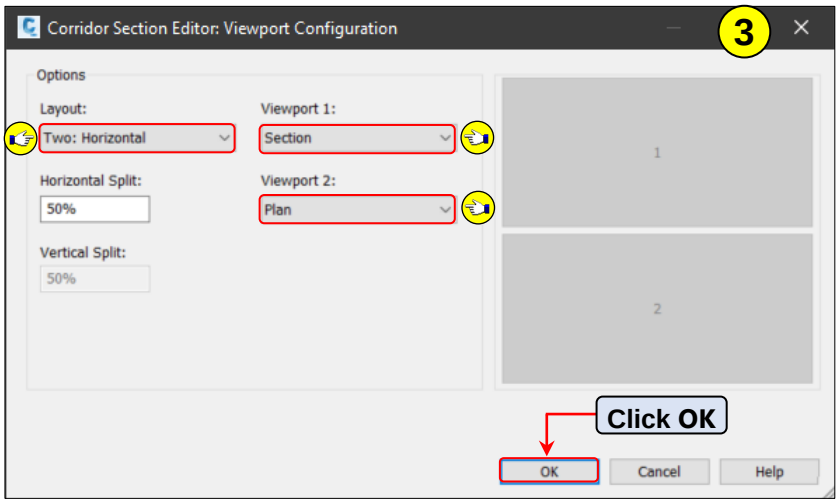
Step 1: **Select** the **Mainline Corridor**, **navigate** to **Modify Corridor Sections** panel on the contextual ribbon, **select** **Section Editor**.



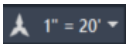


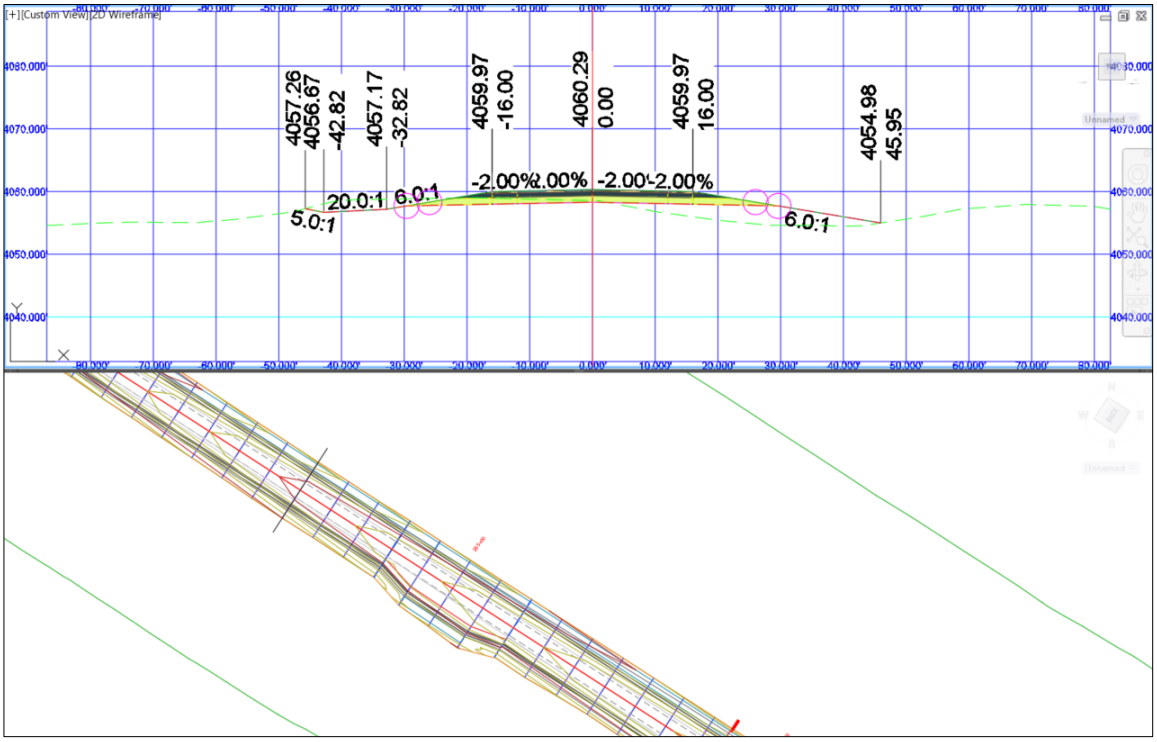
Step 2: In the Section Editor, **navigate** to **View Tools**, **select** **Viewport Configuration**.

a. If the **Corridor Section Editor – Viewport Configuration** warning pop-up appears, **click** **Yes**.

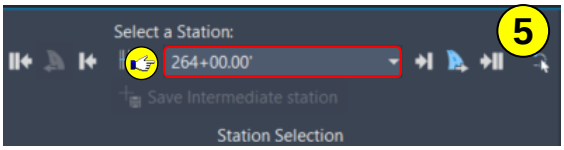


Step 3: **Choose** the following **parameters**, **Click** **OK**.

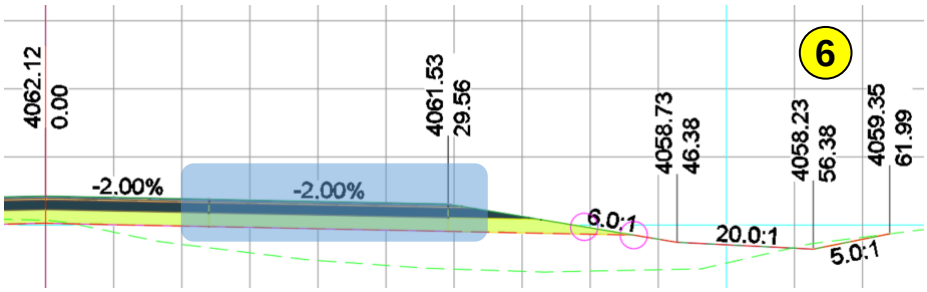
Step 4: **Change** the annotation scale to **1” = 20’**. 



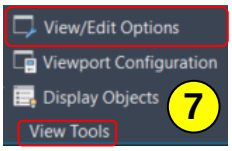
Step 5: **Navigate** to **Station Selection** panel, **select** station **264+00.00’** from the Select a Station tool.

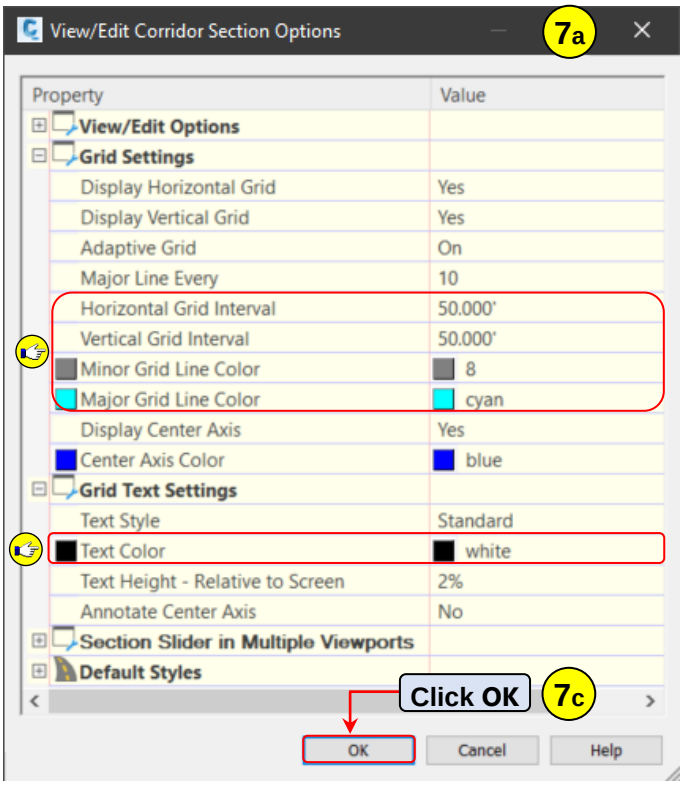


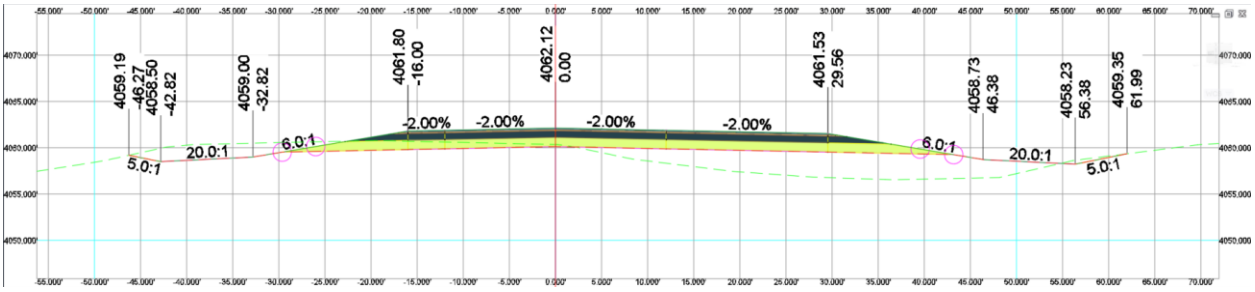
Step 6: **Select** the **Got to Next Station** button, **advance** through the widening area of the corridor. **Notice** the **Right_LaneSuperelevationAOR – Shld** width increases through the turn out.



Step 7: **Navigate** to **View Tools** panel, **select** **View/Edit Options**, **change** the following **settings** in the View/Edit Corridor Section options dialog box, **click** **OK**.







Step 8: **Select** **Close** to close the Section Editor

.

Step 9: **Save** the **drawing**
.

Cross Sections

In Autodesk Civil 3D, section data is defined and displayed using sample lines, sections, and section views, all of which are managed through a collection called a sample line group. An alignment can have more than one sample line group associated with it, each having a unique set of sample lines and sections.

Use sections (also referred to as cross sections) to provide a view of the terrain cut at an angle across a linear feature, such as a proposed road.

Typically, sections are cut across horizontal (plan) alignments at a specified station interval using specified swath widths. These sections are then plotted, individually for a station, or as a group for a range of stations.

Autodesk Civil 3D handles the creation, management, and plotting of sections with the following components:

- **Sections** - Terrain elevations that cut across surfaces, including corridor surfaces, which are associated with a specified sample line group. Elevations are sampled at each of the sample line XY vertices and also at locations where the vertical plane defined by the sample line intersects with surface edges.
- **Section Views** - For each sample line, views displaying some or all of the sections sampled at that sample line. This graphical view has both horizontal limits based on the length of corresponding sample line and vertical values based on the minimum and maximum elevations from the set of sections it is displaying.
- **Section Sheets** -Production-quality section layouts for plotting.

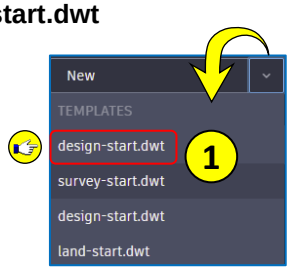
Sample Lines

A Sample Line is a linear plan object representing the direction along which sections are cut for a set of specified surfaces. Sample lines are linear objects that are used to cut sections across an alignment. Sample lines have their own styles and label styles. A set of sample lines makes up a named collection called a sample line group. A sample line group centrally manages the display styles and label styles for several sample lines, sections, section views, and mass haul lines and mass haul views.

Create a Section drawing

Step 1: From the **Start** tab > **Create** a new drawing using the **Standard**: **design-start.dwt**

- C:\MDOH\StateKit\Civil 3D\2022\Templates**_Start-Dwg**



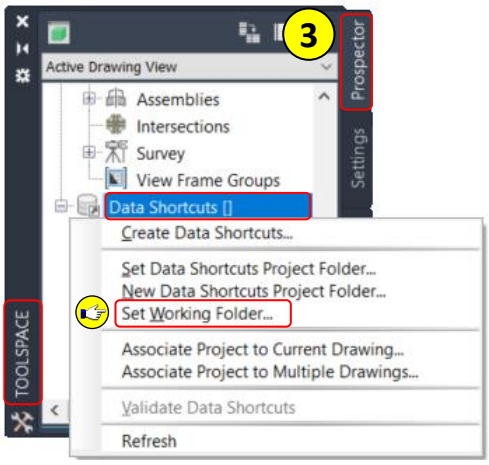
Step 2: **Save** and **Name** the drawing: **8684000RDXS001-USER INITIALS.dwg**

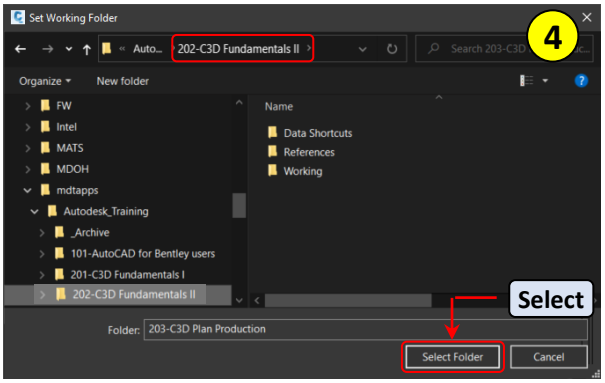
- C:\mdtapps\Autodesk_Training\202-C3D Fundamentals-II**Working**

If the **Working Folder** is still correctly set to **202-C3D Fundamentals II**, **skip** ahead to **Step 6**.

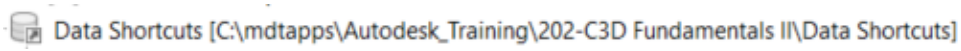
Step 3: **Navigate** to TOOLSPACE > Prospector tab > **Data Shortcuts**, **right click** on **Data Shortcuts**, **select Set Working Folder**.

Step 4: **Browse** to C:\mdtapps\Autodesk_Training**202-C3D Fundamentals II**, **select Folder**.

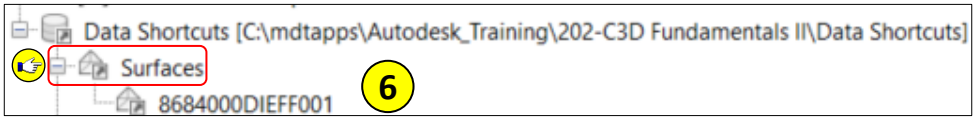




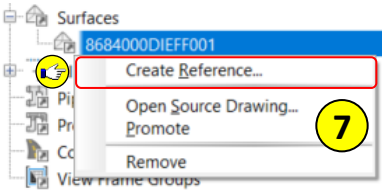
Step 5: **Verify** the Data Shortcuts **path** has been set.



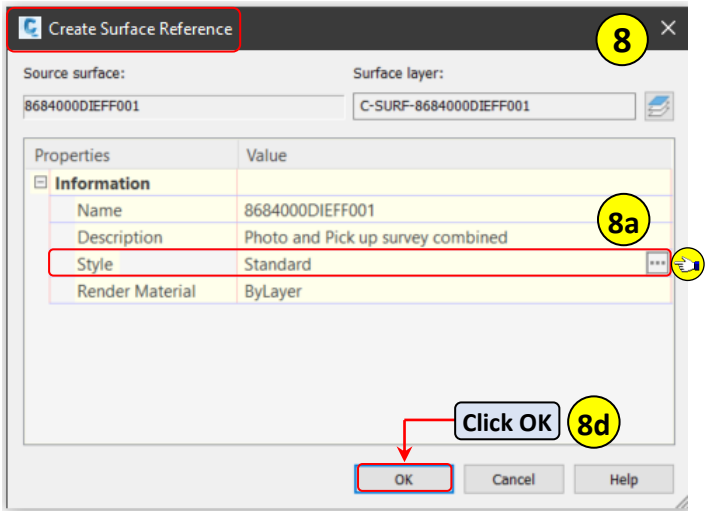
Step 6: **Navigate** to Data Shortcuts > **Surfaces**, **expanded Surfaces**.

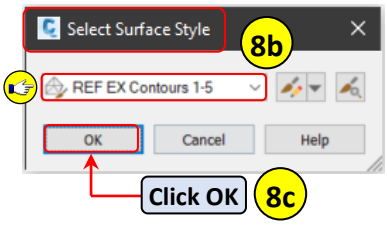


Step 7: **Right click** on **8684000DIEFF001**, **select Create Reference**.



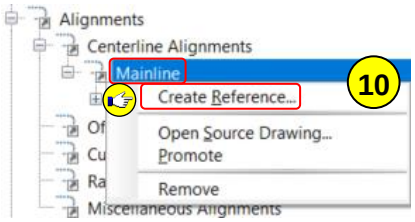
Step 8: In the Create Surface Reference dialog box, **change** the Style to **REF Ex Contours 1-5**, **select OK** in the Select Surface Style dialog box, **select OK** in the Create Surface Reference dialog box.



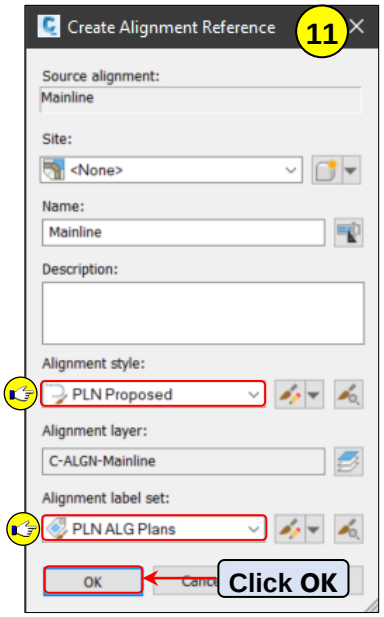


Step 9: **Type** **ZE**, **select** **Enter** on the keyboard to Zoom Extents.

Step 10: **Navigate** to Data Shortcuts > **Alignments**, **expanded** **Alignments, expand** **Centerline Alignments**, **right click** on **Mainline**, **select** **Create Reference**.



Step 11: On the Create Alignment Reference dialog box, **change** the following **parameters**, **click** **OK**.

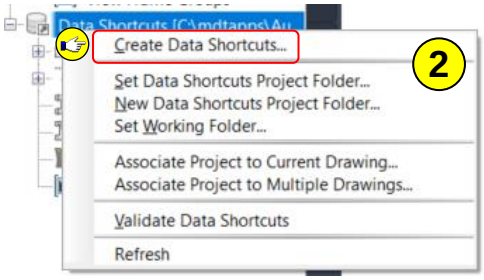


Sharing Data between Drawing Files

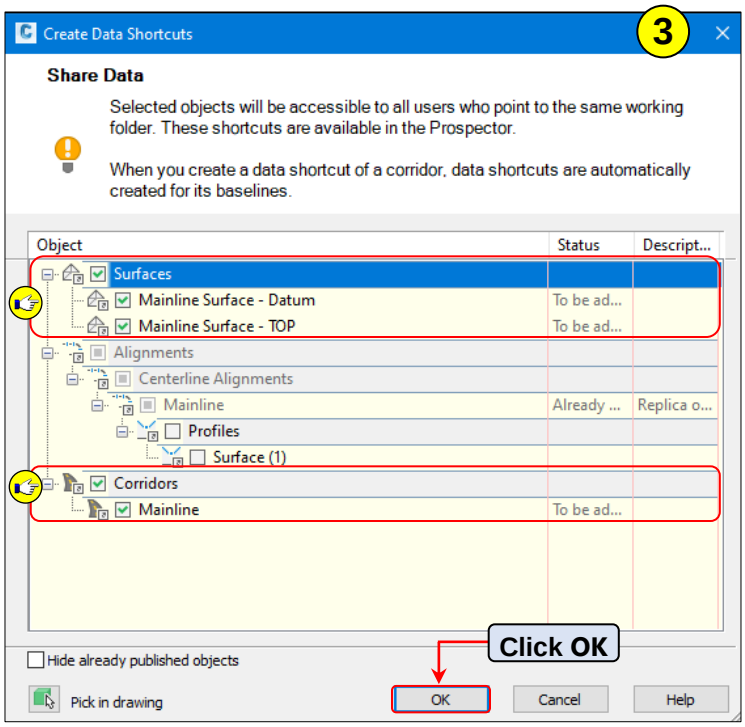
Step 1: **Navigate** to **8684000RDCORR001-USER INITIALS**.dwg drawing tab, **select** the **tab** making it current.

- If the **8684000RDCORR001-USER INITIALS**.dwg was closed previously, **open** the **drawing**.

Step 2: **Navigate** to **Data Shortcuts**, **right click, select** **Create Data Shortcuts**.

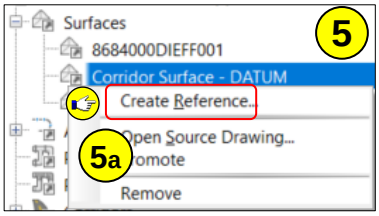


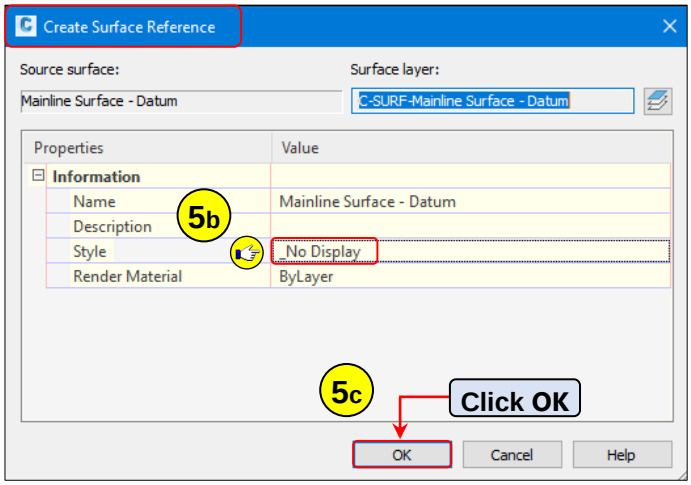
Step 3: **Check** **Surfaces** and **Corridors** boxes from the Create Data Shortcuts dialog box, **click** **OK**.



Step 4: **Navigate** to **8684000RDXS001.dwg** drawing tab, **select** the **tab** making it current.

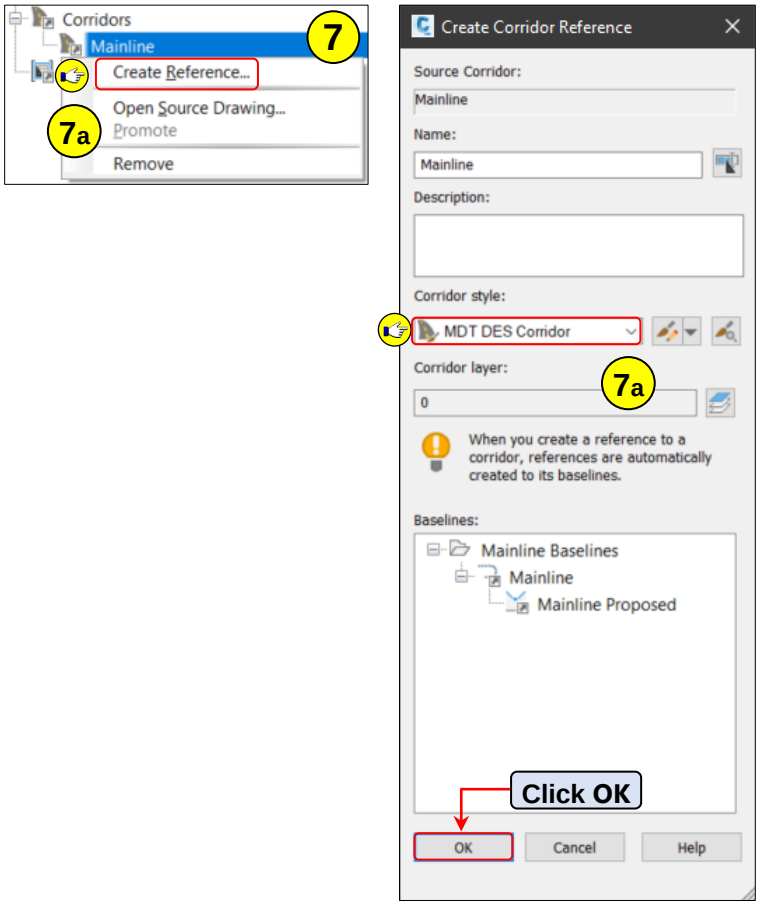
Step 5: **Navigate** to **Data Shortcuts**, **expand** **Surfaces**, **right click** **Corridor Surface – DATUM**, **select** **Create Reference**, **change** the style to **_No Display** in the Create Surface Reference dialog box, **select** **OK**.





Step 6: **Repeat** **Step 5** for **Corridor Surface – TOP**, **change** the style to **PLN Prop Contours 1-5**, **select** **OK**.

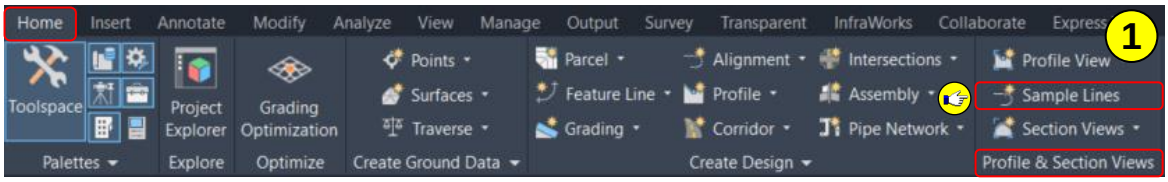
Step 7: **Navigate** to **Data Shortcuts**, **expand** **Corridors**, **right click** **Mainline**, **select** **Create Reference**, **change** the style to **MDT DES Corridor** in the Create Corridor Reference dialog box, **select** **OK**.



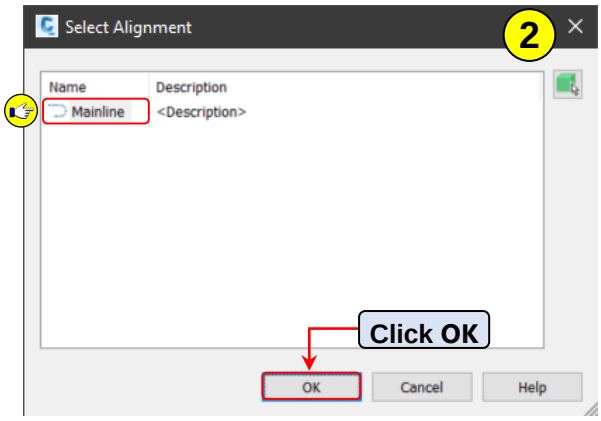
Step 8: **Save** **8684000RDXS001.dwg**.

Generating Sample Lines

Step 1: **Change** the Annotation scale to **1" = 20'**, **navigate** to **Home** tab > Profile & Section Views panel, **select** **Sample Lines**.



Step 2: **Select** **Enter** to select Alignment from list, **select** **Mainline** from the Select Alignment dialog box, **click** **OK**.



Step 3: In the Create Sample Line Group dialog box, **change** the following **parameters**, **click** **OK**.

Name: SLG-Mainline

Sample line style: MDT Sample Line

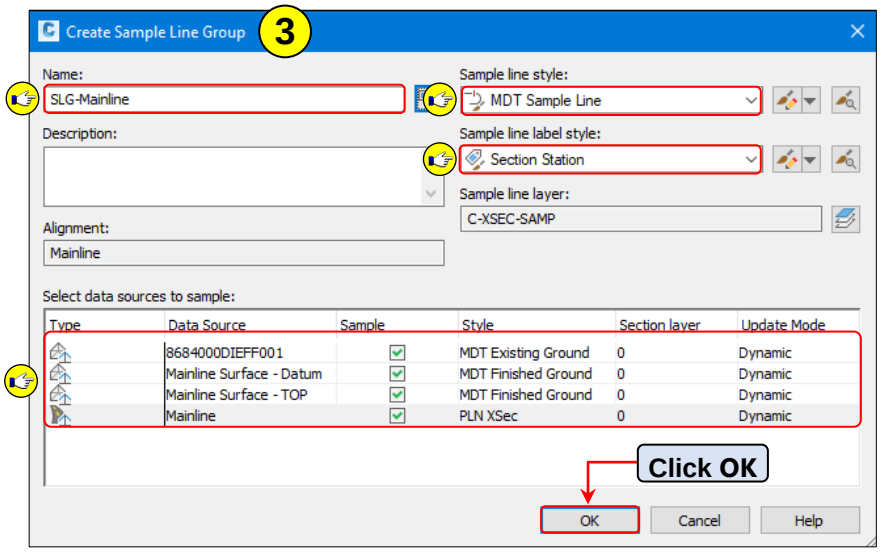
Sample line label style: Section Station

8684000DIEFF001 style: MDT Existing Ground

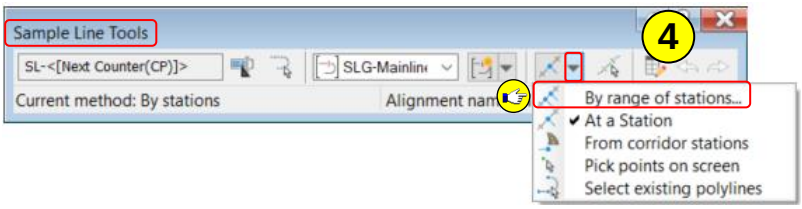
Mainline style: PLN XSec

Mainline Corridor Surface – TOP style: MDT Finished Ground

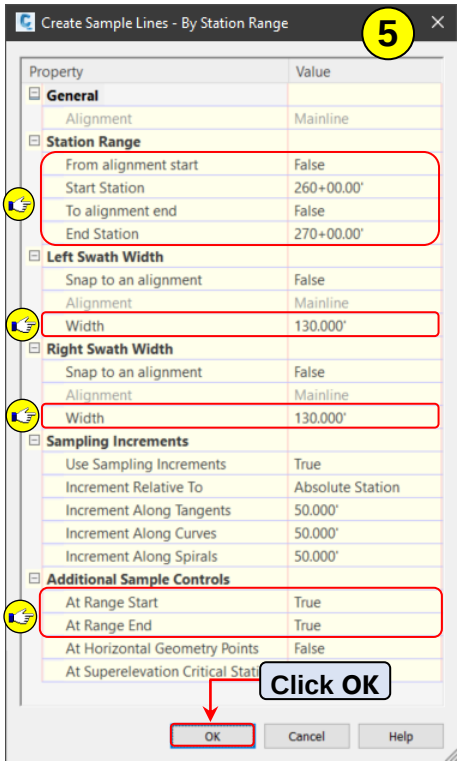
Mainline Corridor Surface – DATUM style: MDT Finished Ground

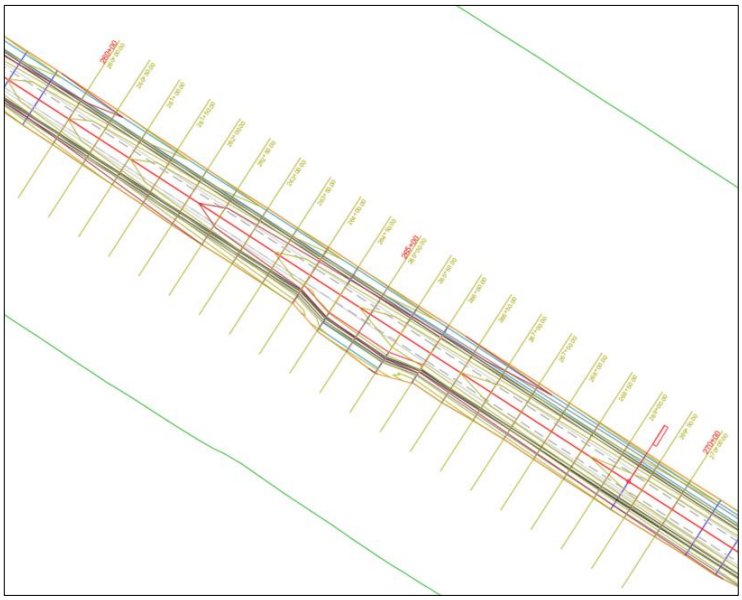


Step 4: On the Sample Line Tools tool bar, **select By range of stations**.



Step 5: In the Create Sample Lines dialog box, **change** the following **parameters**, **click OK**, **select Esc** to end the command.





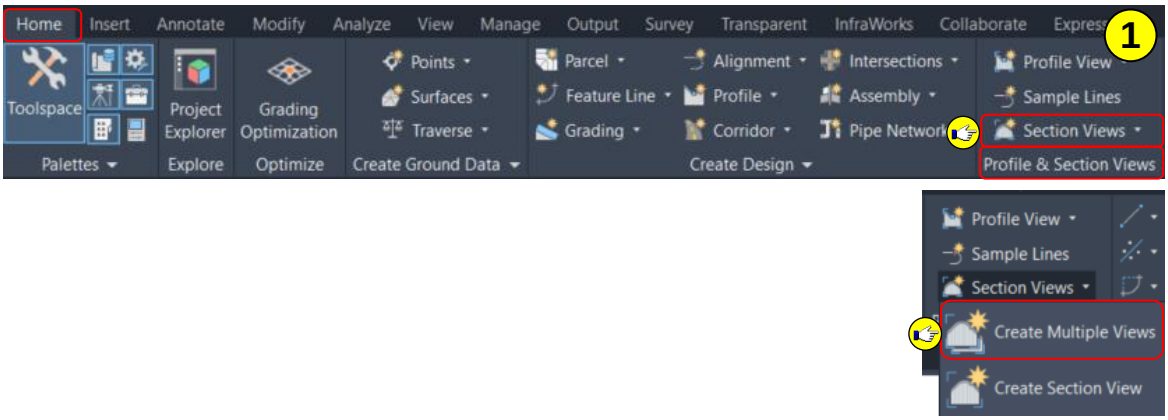
Step 6: **Save 8684000RDXS001.dwg**.

Section Views

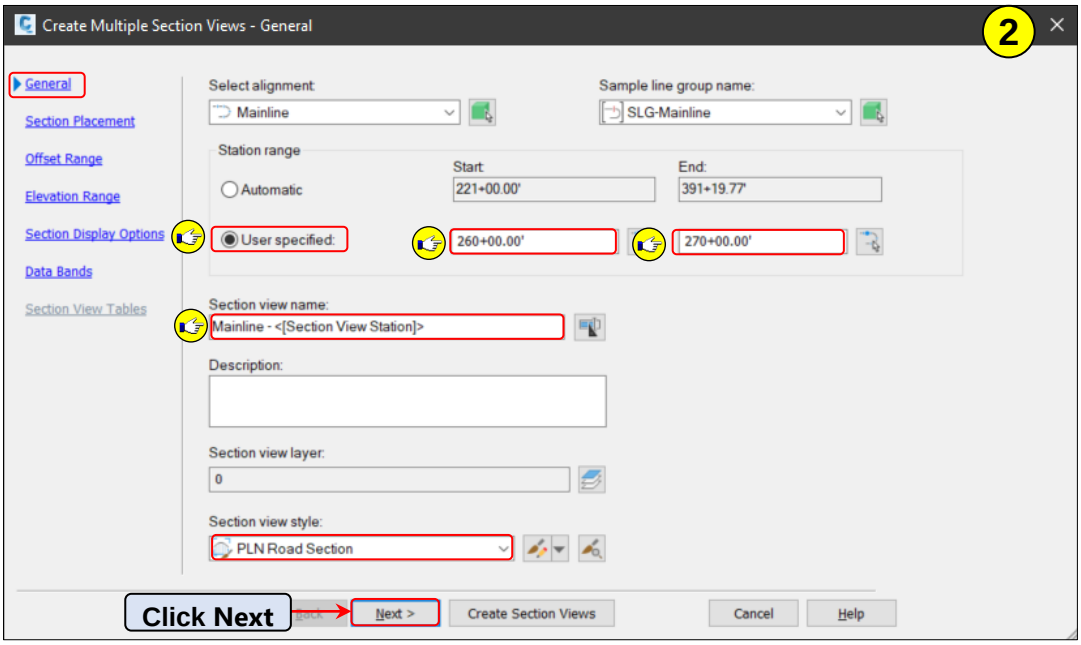
Section views are created from existing sample lines and sections. A section view consists of a grid on which one or more sections are displayed as graphed lines. Multiple section views can be plotted on a sheet that is a specified size and configuration. A section view is very similar to a profile view. It consists of a grid or graph with specific characteristics that are controlled by section view styles. Bands can also be displayed above or below the section view. A section view can display one or more of the available sections at the sample line. Sections can be created as a single section for one sample line or multiple sections from all the sample lines in a sample line group. Objects can be projected in section view including COGO points, AutoCAD points, 3D solids, blocks, multi-view blocks. Crossing objects can be shown in a section view including feature lines, 3D polylines and survey figures. Additionally, pipe network and pressure network structures and pipes can be displayed in section views.

Create Section Views

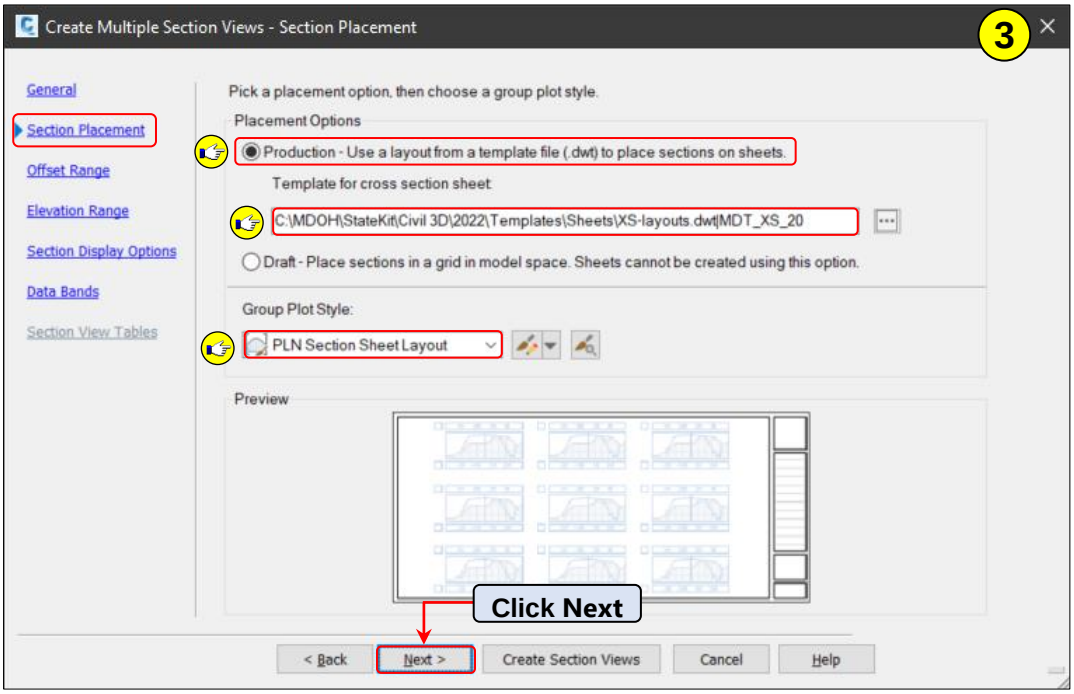
Step 1: **Navigate** to the **Home** tab > Profile & Section Views panel, **select Section Views**, **select Create Multiple Views** from the drop-down list.



Step 2: In the Create Multiple Section Views dialog box, **change** the following **parameters**, **click Next**.

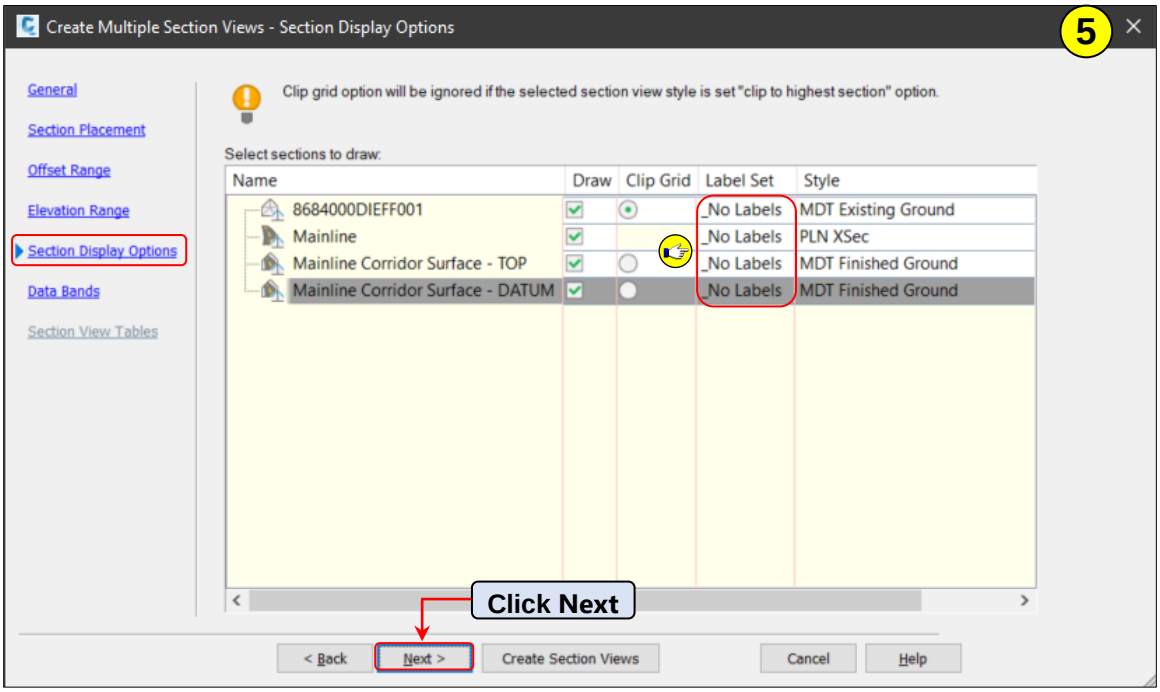


Step 3: On the Section Placement, **verify** the following **parameters**, **click Next**.

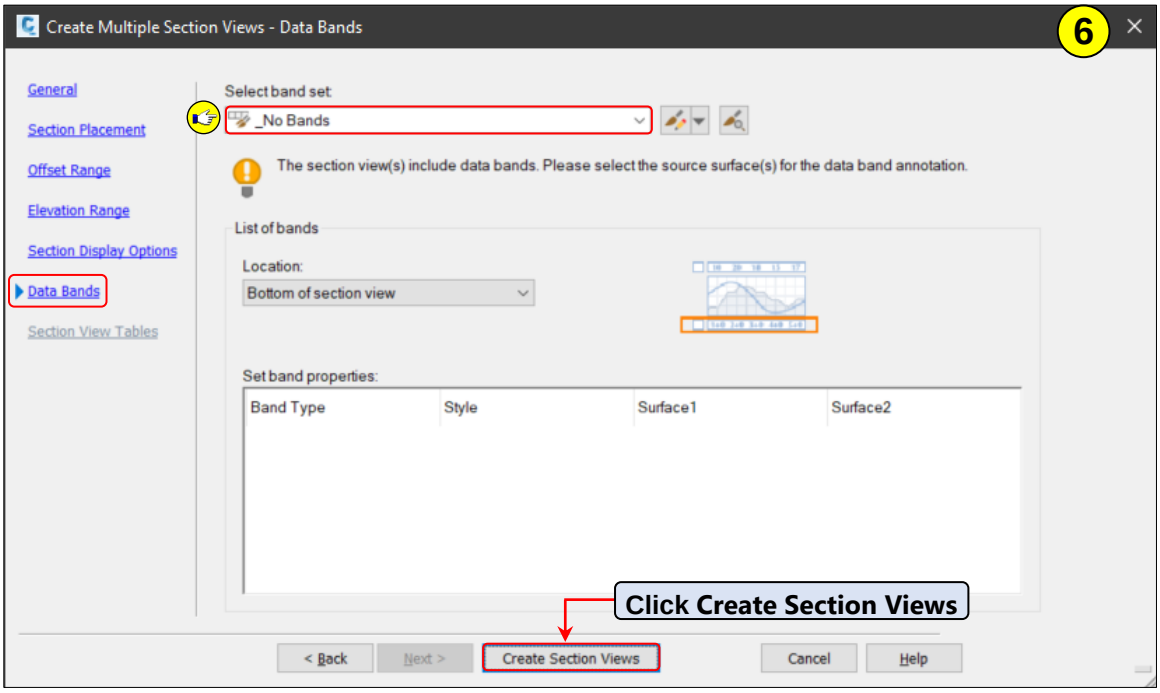


Step 4: **Select Next** for the **Offset Range** and **Elevation Range**.

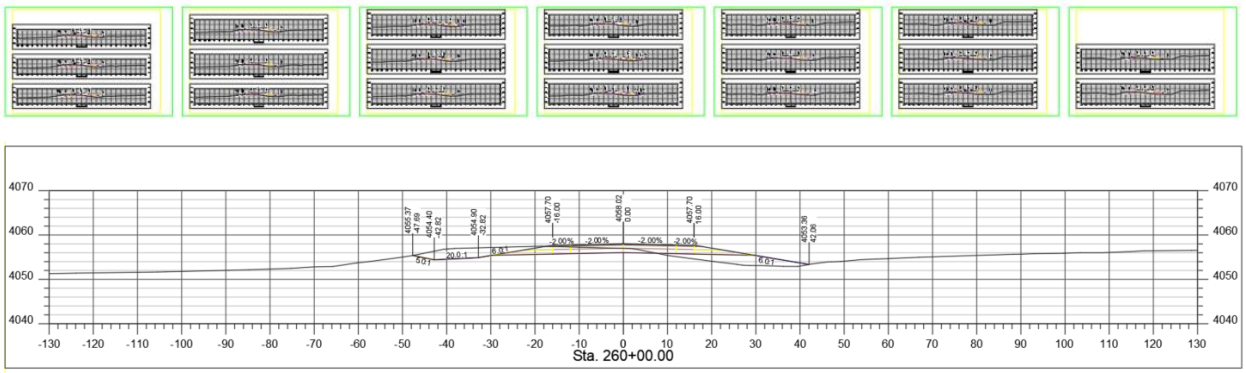
Step 5: On the Section Display options, **change** the following **Label Sets**, **click Next**.



Step 6: On the Data Bands, **select** _No Bands, **click** Create Section Views.



Step 7: When prompted to Identify section view origin, **select** a **point** within the drawing to place the section views.



Section View Labeling

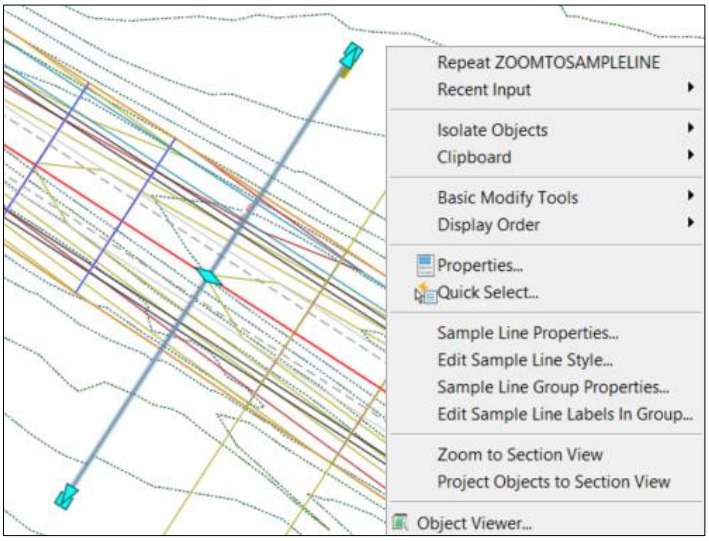
Sections can be automatically labeled when creating them or after. Section labels can include Major and Minor Offsets, grade breaks, segments, and corridor points. A section label set can be created from one or more label styles.

- **Major Offsets** - Offsets, elevations, and instantaneous grades at major increments.
- **Minor Offsets** - Offsets, elevations, and instantaneous grades at minor increments.
- **Segments** - Section segment labels for each segment (line) of a section object. A user-specified weeding factor is supported, thus avoiding close annotation.
- **Grade Breaks** - Grade break labels applied at every grade break point for a section. A user-specified weeding factor is supported, thus avoiding close annotation.
- **Corridor Points** - Corridor point codes using a code set style or a section label set. Corridor points label style can be staggered, so they don't overlap.
- **Label Sets** – A group of section labels used for sections when a section view object is created.

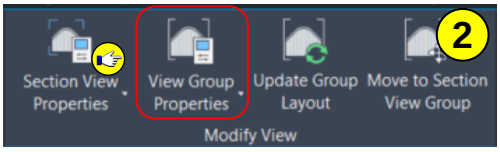
	If a corridor has been sampled in a section view and the PLN XSec style is assigned to the corridor, the MDT State Kit is setup to automatically label it using a code set style.

Create Section View Labels

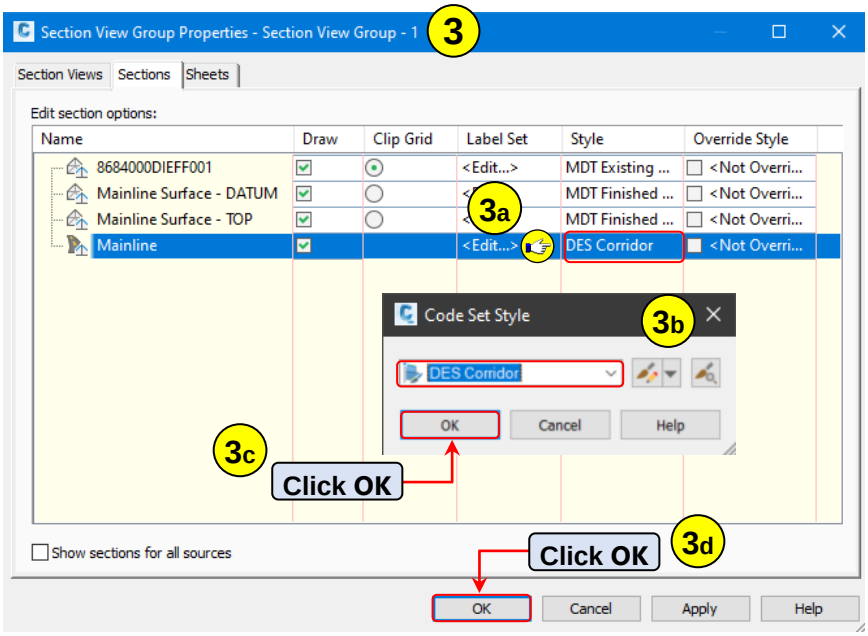
Step 1: Zoom to **Sample Line 260+00.00**, **select** the **sample line**, **right click** and **select Zoom to Section View.**

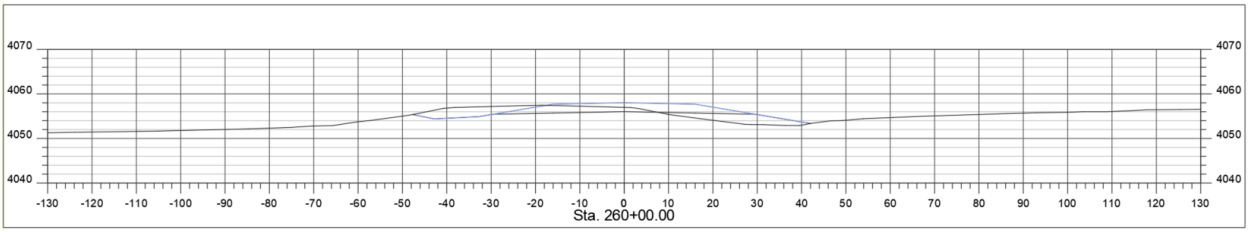


Step 2: Select the **section view**, **select View Group Properties** from the contextual ribbon.

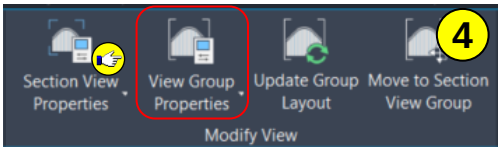


Step 3: **Select** the **Mainline corridor style**, **change** the style to **DES Corridor**, **click OK** to close the Code Set Style dialog box, **click OK** to close the Section View Group properties.

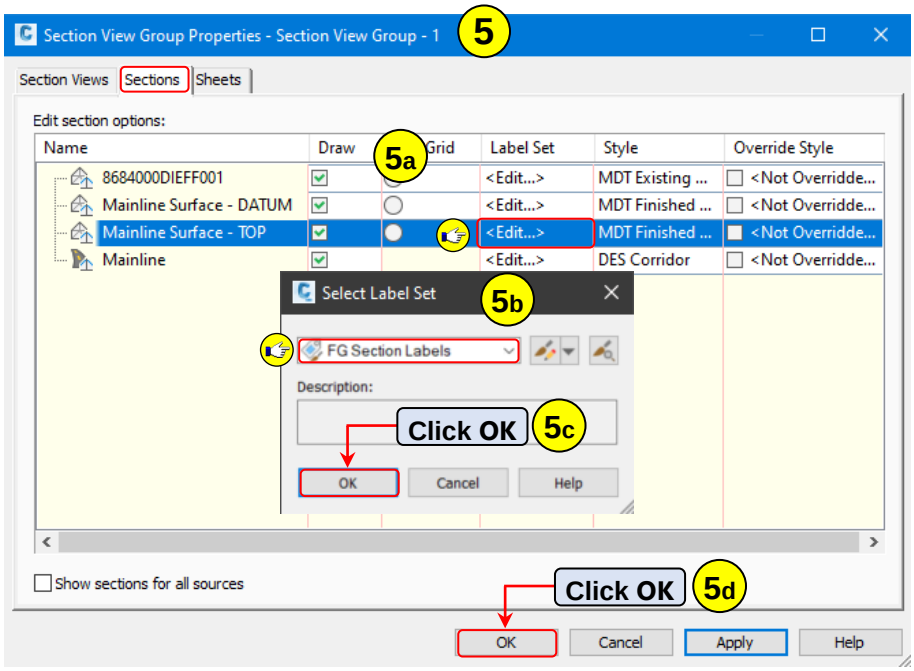


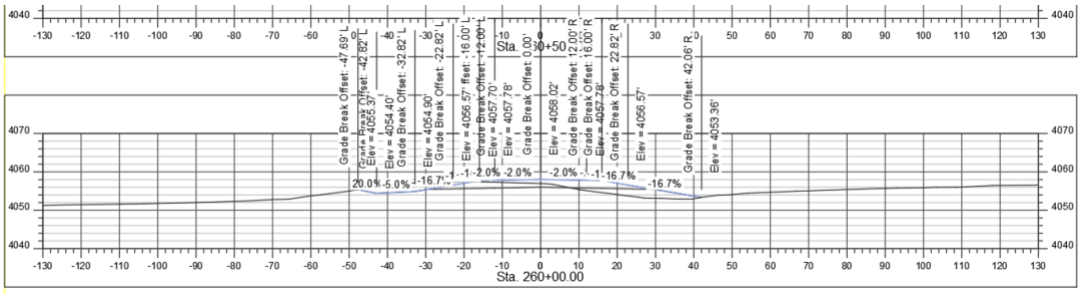


Step 4: **Select** the **section view**, **select View Group Properties** from the contextual ribbon.

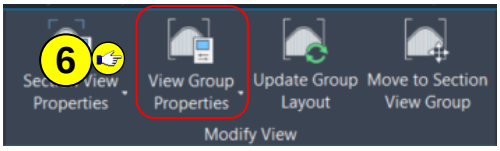


Step 5: **Select** the **Mainline Surface - TOP Label Set**, **change** the Label set to **FG Section Labels**, **click OK** to close the Label set dialog box, **click OK** to close the Section View Group properties.

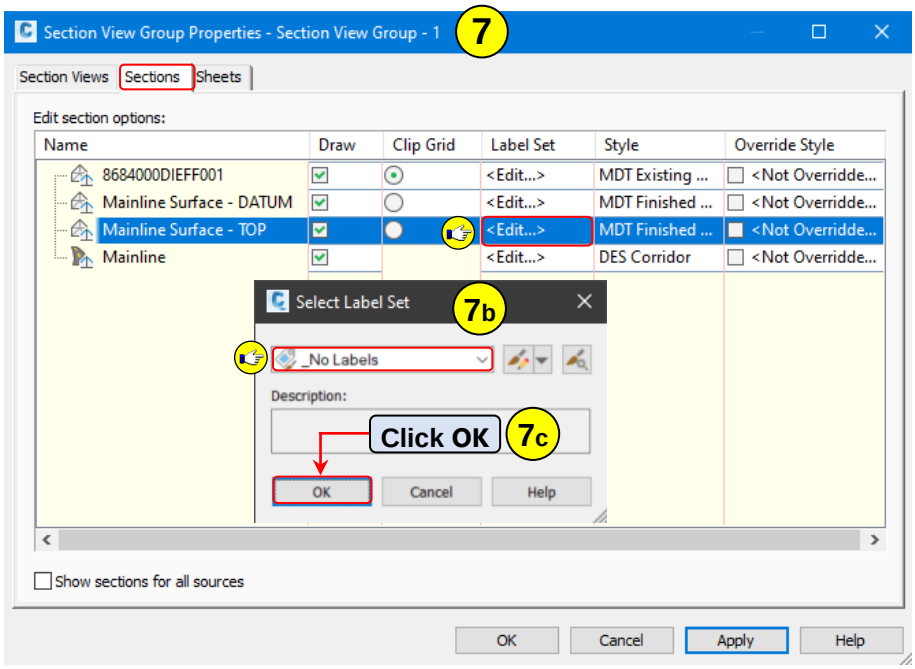




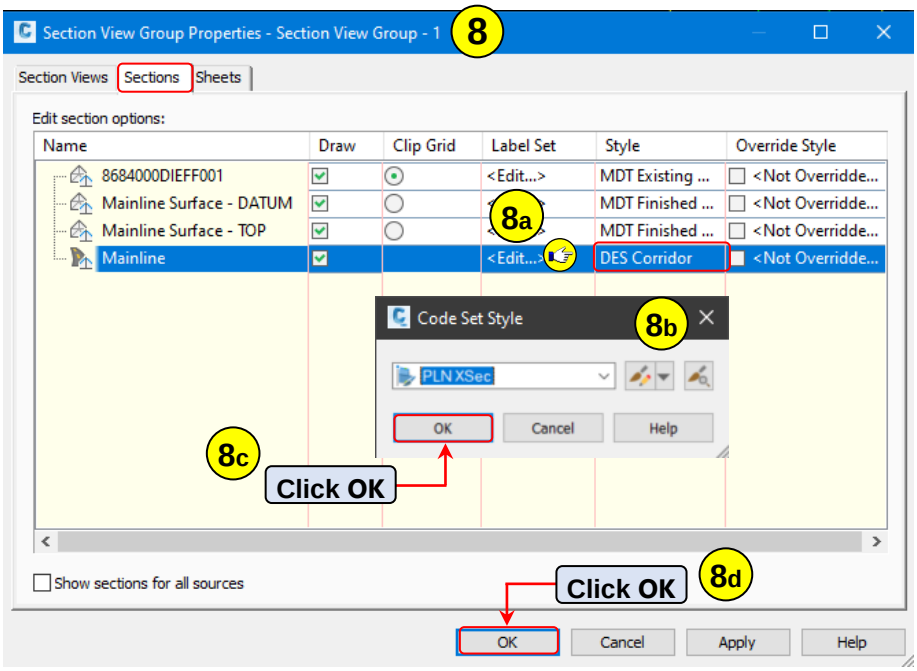
Step 6: **Select** the **section view**, **select** **View Group Properties** from the contextual ribbon.

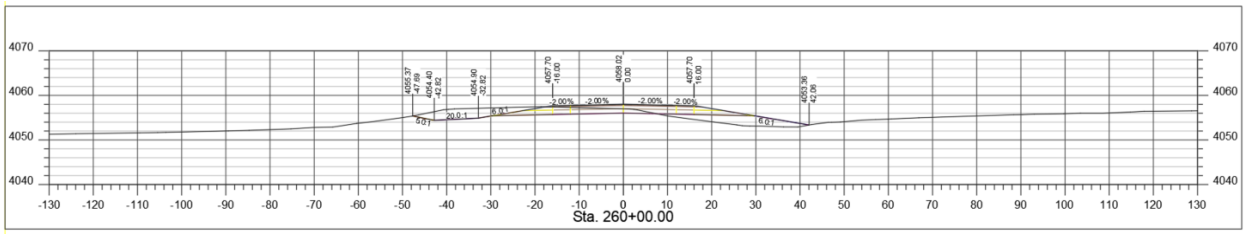


Step 7: **Select** the **Mainline Surface - TOP Label Set**, **change** the Label set to **_No Labels**, **click OK** to close the Label set dialog box.



Step 8: **Select** the **Mainline corridor style**, **change** the style to **PLN XSec**, **click OK** to close the Code Set Style dialog box, **click OK** to close the Section View Group properties.





Step 9: **Press** **Esc** to deselect the Section View, **save** the **drawing**

Earthwork and Materials

Earthwork and material volumes are calculated by comparing two surfaces to each other. Quantities Can be calculated between sample lines derived from regular surface models and from corridor surfaces. User-definable tables specify which materials are defined by which surfaces, and the characteristics of these materials. Finally, average end area analysis is used to tabulate the material quantities along the corridor.

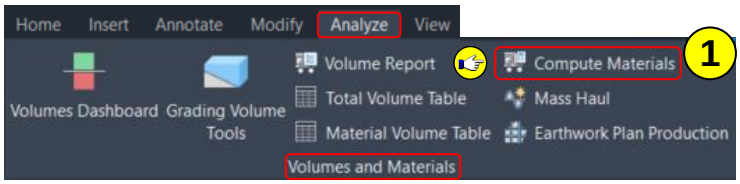
Earthwork Volumes

Calculating earthwork volumes in Civil 3D can be achieved using various methods. They can be calculated using corridors and sample lines, the Volumes Dashboard and by creating a grid or tin volume surface. Grading volume tools can be leveraged for grading as well.

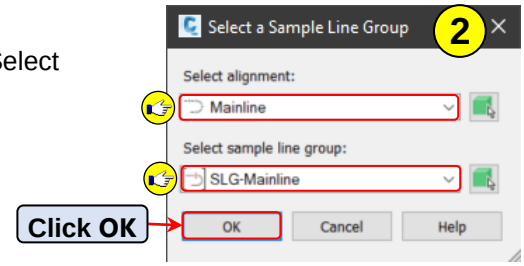
Corridor Surface Volumes

Continue working in the **8684000RDXS001-USER INITIALS.dwg**

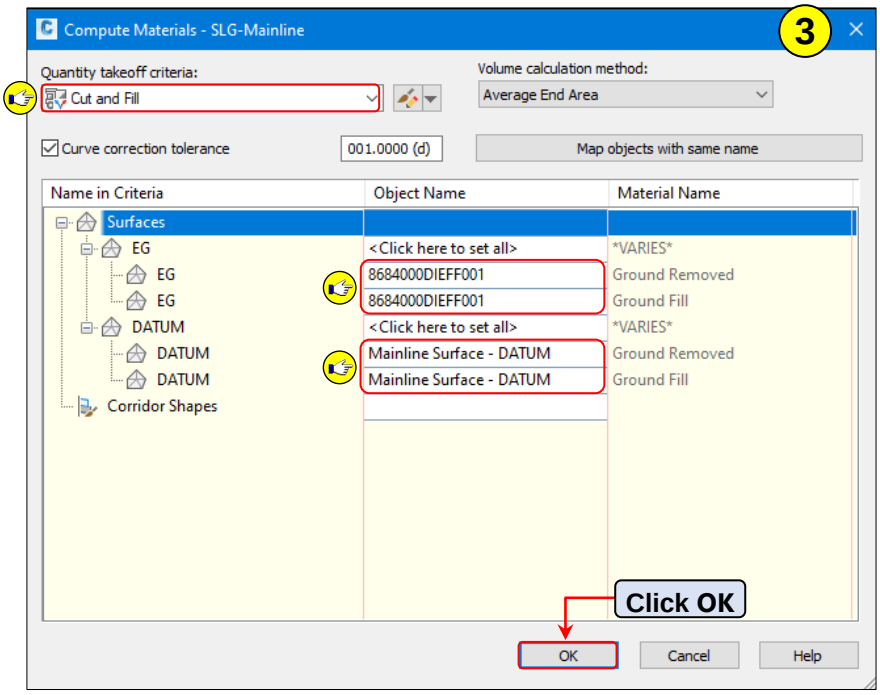
Step 1: **Navigate** to Analyze tab > **Volumes and Materials** panel, **select** **Computer Materials**.



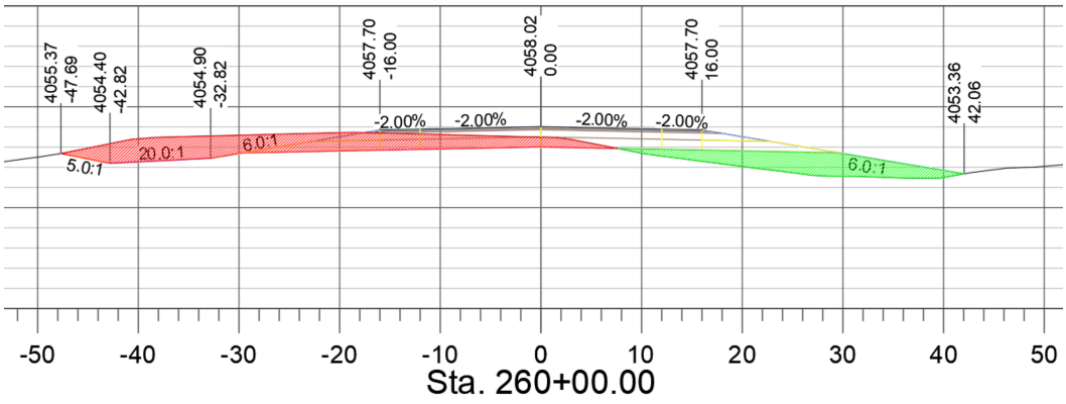
Step 2: **Verify** the **Select alignment** is **Mainline**, **verify** Select sample line group is **SLG – Mainline**. **click** **OK**.



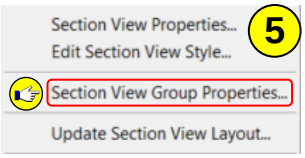
Step 3: In the Compute Materials dialog box, **select Cut and Fill** for the Quantity takeoff criteria, **select 868400DIEFF001** for the EG Surface, **select Corridor Surface – DATUM** for the Datum surface, **click OK**.



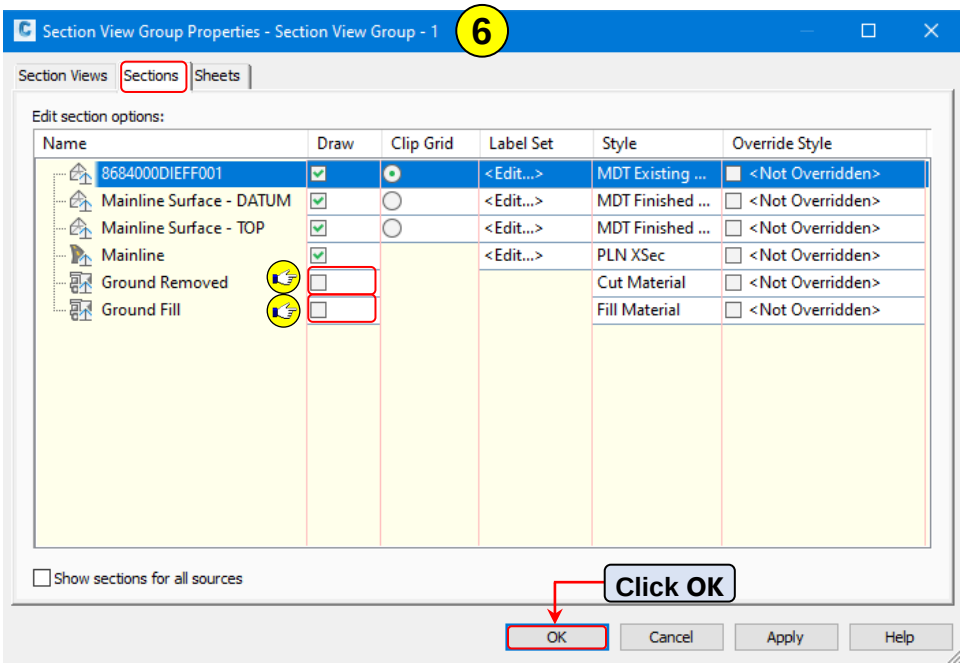
Selecting <Click here to set all> allows for setting the EG and Datum surface for both Ground Removed and Ground Fill.



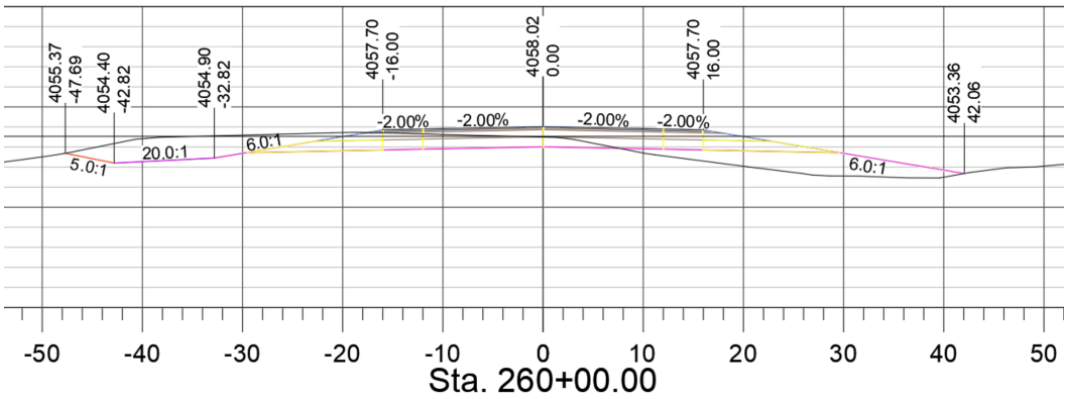
Notice the section views now show the Cut and Fill. This can easily be turned off in the View Group properties.

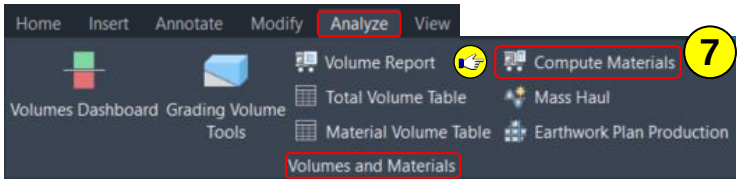


Step 5: **Select** one of the **section views**, **right click** and **select** **Section View Group Properties**.



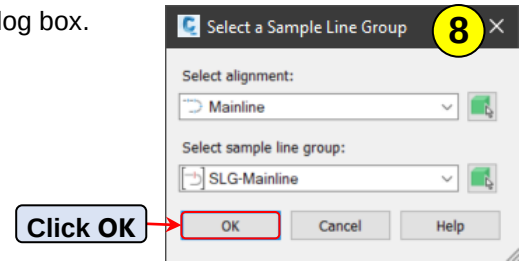
Step 6: In the Section View Group Properties, **select** the **Section** tab, **Uncheck** **Ground Removed** and **Ground Fill**, **click** **OK**, **press** **Esc** to deselect the Section View.

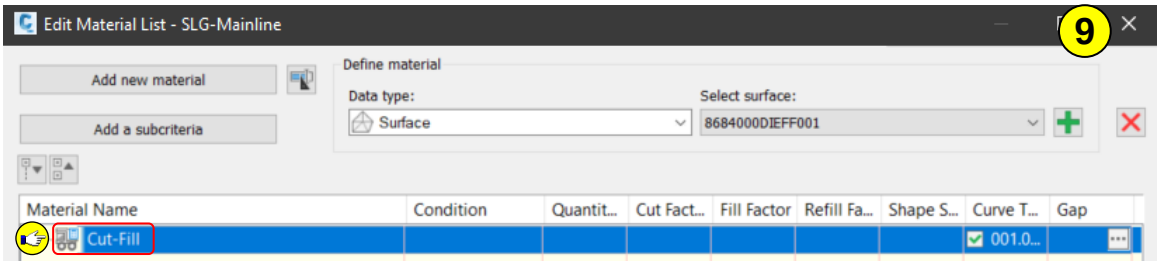




Step 7: **Navigate** to Analyze tab > Volumes and **Materials** panel, **select** **Computer Materials**.

Step 8: **Select** **OK** on the Select a Sample Line Group dialog box.





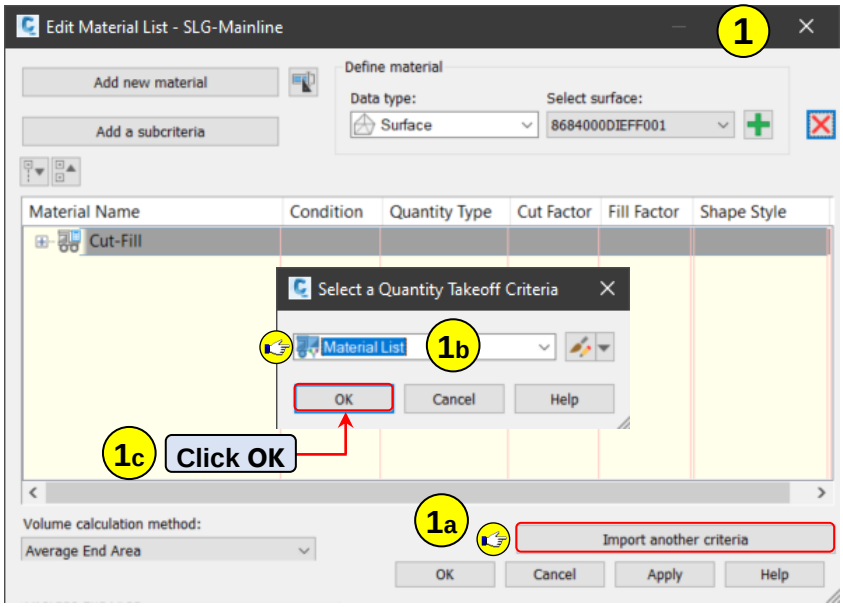
Step 9: In the Edit material List dialog box, **Rename** Materials List (1) to **Cut-Fill**.
Remain in the **Edit Material List – SLG-Mainline** dialog box.

Material Volumes

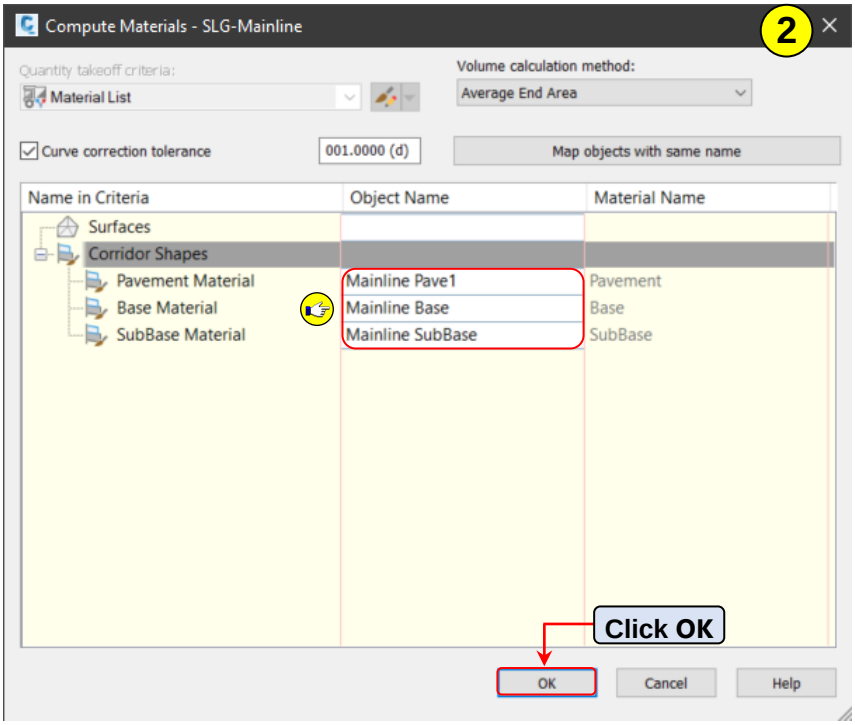
Once a corridor has been sampled, materials can be calculated using the Compute Materials tools. Corridor shapes are leveraged by the tool to compute the materials found within the corridor's assembly. A volume table can be created from the computed materials and displayed. The computed materials can be displayed in cross sections along with a materials table.

Creating a Materials List

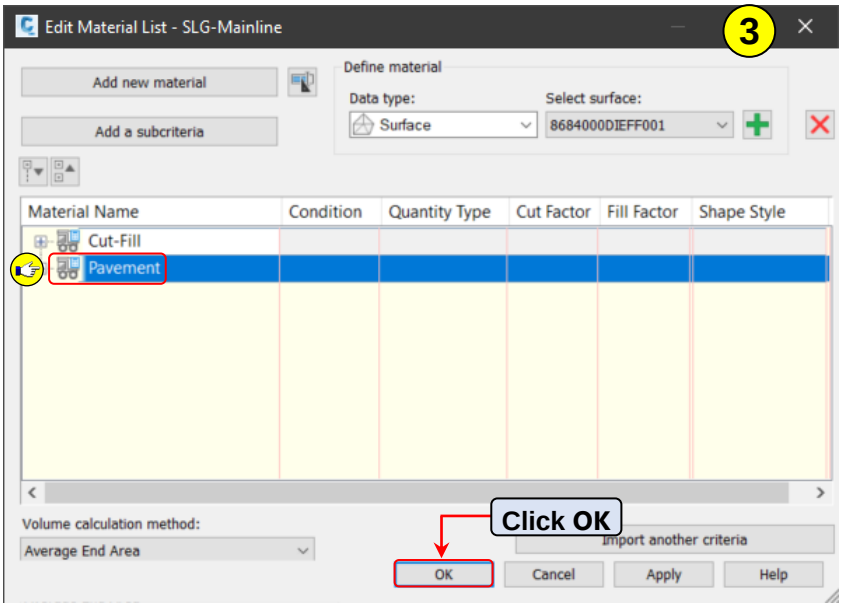
Step 1: In the Edit Materials List dialog box, **select** **Import another criteria**, **select** **Materials List** from the Select a Quantity Takeoff Criteria dialog box, **click** **OK**.

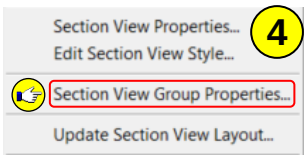


Step 2: In the Compute Materials dialog box, **select Mainline Pave1** for Pavement Material, **select Mainline Base** for the Base Material, **select Mainline SubBase** for the SubBase Material, **click OK**.



Step 3: **Rename** Materials List (2) to **Pavement**, **click OK**.

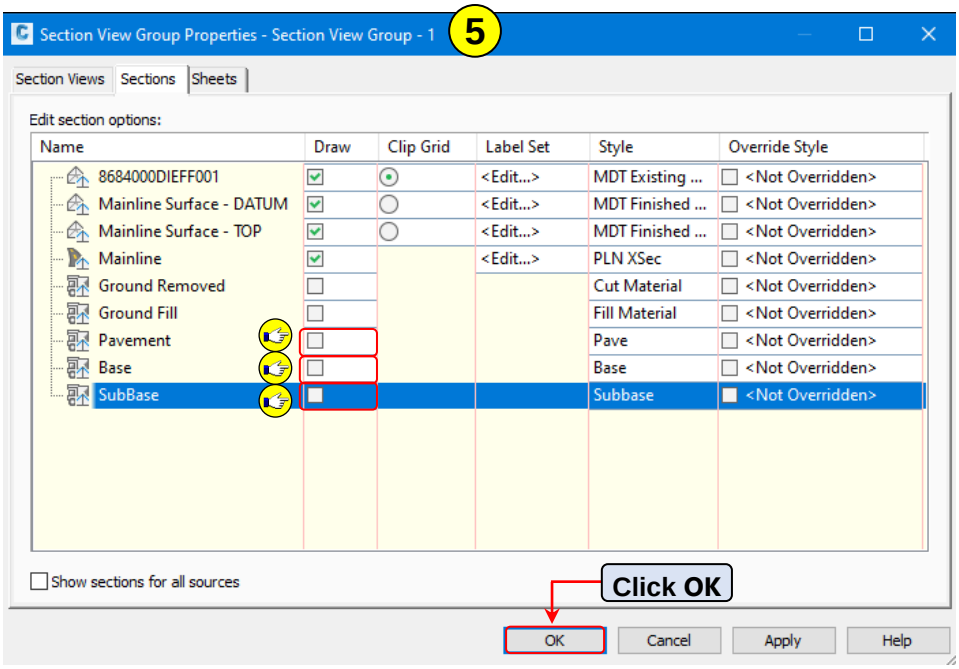




Step 4: **Select** one of the **section views**, **right click** and **select Section View Group Properties**.

	Notice the section views now show the Cut and Fill. This can easily be turned off in the View Group properties.

Step 5: In the Section View Group Properties, **select** the **Sections** tab, **Uncheck Pavement, Base** and **SubBase**, **click OK**.

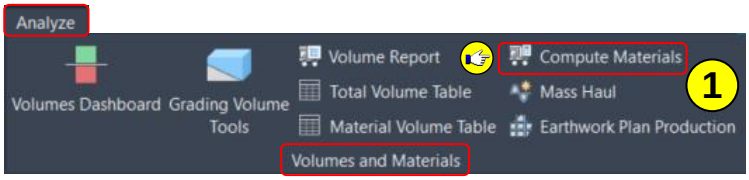


Generating Volume Reports and Table

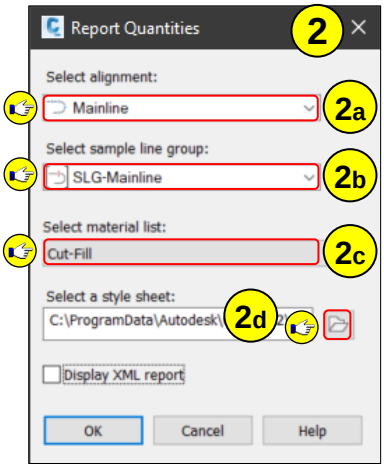
Reporting of the calculated earthwork and materials can be accomplished in Civil 3D using the Volume Report tool. The report can be saved or printed.

Generating Volume Reports

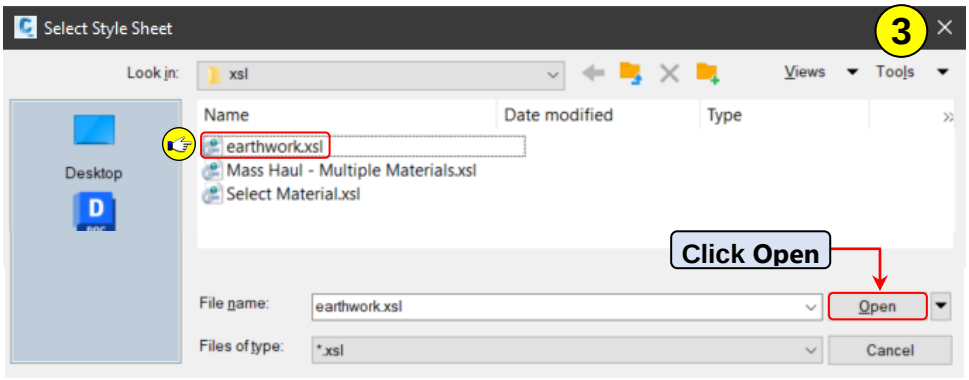
Step 1: **Navigate** to Analyze tab > **Volumes and Materials** panel, **select Volume Report**.



Step 2: In the Report Quantities dialog box, **select Mainline** for the alignment, **select SLG-Mainline** for the sample line group, **select Cut-Fill** for the material list, **select browse** for the style sheet.

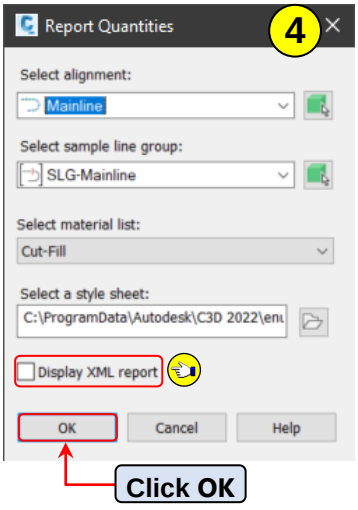


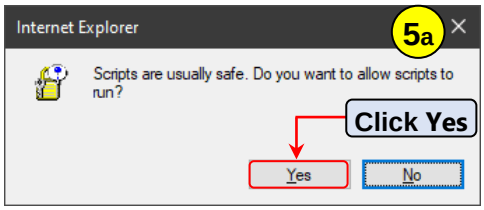
Step 3: In the Select Style Sheet dialog box, **select** **earthwork.xsl**, **click** **Open**.

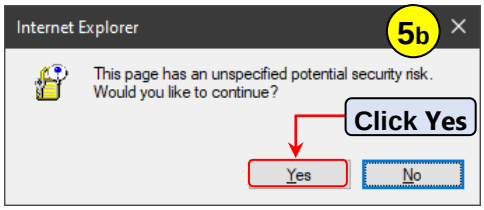


Step 4: In the Report Quantities dialog box, **uncheck** **Display XML report**, **Click** **OK**.

Step 5: **Click** **Yes** on the Internet Explorer dialog box warning about Scripts, **click** **Yes** on the second warning, **close** **Internet Explorer**.







Volume Report

Project: C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Working\8684000RDXS001.dwg
Alignment: Mainline
Sample Line Group: SLG-Mainline
Start Sta: 260+00.000
End Sta: 270+00.000

Station	Cut Area (Sq.ft.)	Cut Volume (Cu.yd.)	Reusable Volume (Cu.yd.)	Fill Area (Sq.ft.)	Fill Volume (Cu.yd.)	Cum. Cut Vol. (Cu.yd.)	Cum. Reusable Vol. (Cu.yd.)	Cum. Fill Vol. (Cu.yd.)	Cum. Net Vol. (Cu.yd.)
260+00.000	83.77	0.00	0.00	46.81	0.00	0.00	0.00	0.00	0.00
260+50.000	75.69	147.65	147.65	59.78	98.69	147.65	147.65	98.69	48.96
261+00.000	68.61	133.61	133.61	61.82	112.59	281.26	281.26	211.28	69.98
261+50.000	61.45	120.42	120.42	67.77	119.99	401.68	401.68	331.27	70.41
262+00.000	55.69	108.46	108.46	76.67	133.73	510.15	510.15	465.00	45.14
262+50.000	48.39	96.37	96.37	79.53	144.63	606.52	606.52	609.63	-3.11
263+00.000	50.00	91.10	91.10	79.47	147.22	697.62	697.62	756.85	-59.23
263+50.000	53.49	95.83	95.83	80.36	147.98	793.45	793.45	904.84	-111.39
264+00.000	53.39	98.97	98.97	76.81	145.52	892.42	892.42	1050.36	-157.94
264+50.000	49.18	94.97	94.97	104.67	168.03	987.39	987.39	1218.39	-231.00
265+00.000	47.24	89.27	89.27	103.36	192.62	1076.66	1076.66	1411.01	-334.35
265+50.000	45.22	85.60	85.60	105.84	193.71	1162.27	1162.27	1604.72	-442.45
266+00.000	45.62	84.10	84.10	74.98	167.43	1246.37	1246.37	1772.15	-525.77
266+50.000	48.09	86.76	86.76	75.42	139.27	1333.14	1333.14	1911.41	-578.28
267+00.000	47.73	88.72	88.72	68.56	133.32	1421.86	1421.86	2044.73	-622.88
267+50.000	48.61	89.20	89.20	67.72	126.19	1511.05	1511.05	2170.92	-659.86
268+00.000	50.98	92.21	92.21	70.69	128.15	1603.27	1603.27	2299.07	-695.80
268+50.000	51.84	95.21	95.21	64.65	125.31	1698.48	1698.48	2424.38	-725.90
269+00.000	48.94	93.32	93.32	68.17	122.98	1791.79	1791.79	2547.36	-755.56
269+50.000	42.65	84.80	84.80	72.41	130.16	1876.59	1876.59	2677.52	-800.92
270+00.000	49.26	85.10	85.10	71.00	132.78	1961.69	1961.69	2810.30	-848.61

Step 6: **Repeat** steps 1-5, **selecting** Pavement for the materials list, **select** Select Materials.xls for the style sheet, **close** Internet Explorer.

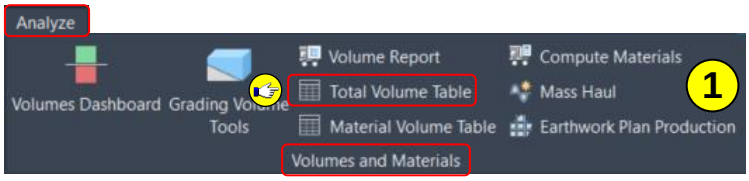
Material Report

Project: C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Working\8684000RDXS001.dwg
Alignment: Mainline
Sample Line Group: SLG-Mainline
Start Sta: 260+00.000
End Sta: 270+00.000

	Area Type	Area Sq.ft.	Inc.Vol. Cu.yd.	Cum.Vol. Cu.yd.
Station: 260+00.000				
	Pavement	4.95	0.00	0.00
	Base	28.60	0.00	0.00
	SubBase	52.45	0.00	0.00
Station: 260+50.000				
	Pavement	4.95	9.17	9.17
	Base	28.60	52.97	52.97
	SubBase	52.45	97.14	97.14
Station: 261+00.000				
	Pavement	4.95	9.17	18.35
	Base	28.60	52.97	105.94
	SubBase	52.45	97.14	194.28

Creating Volume Tables

Step 1: **Navigate** to Analyze tab > Volumes and Materials panel, **select** Total Volume Table.

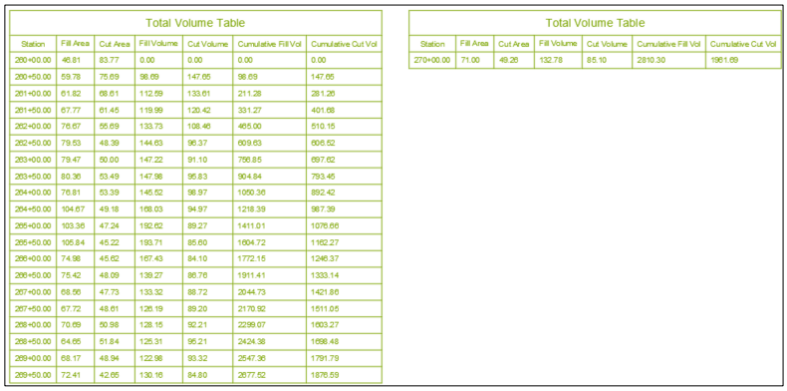


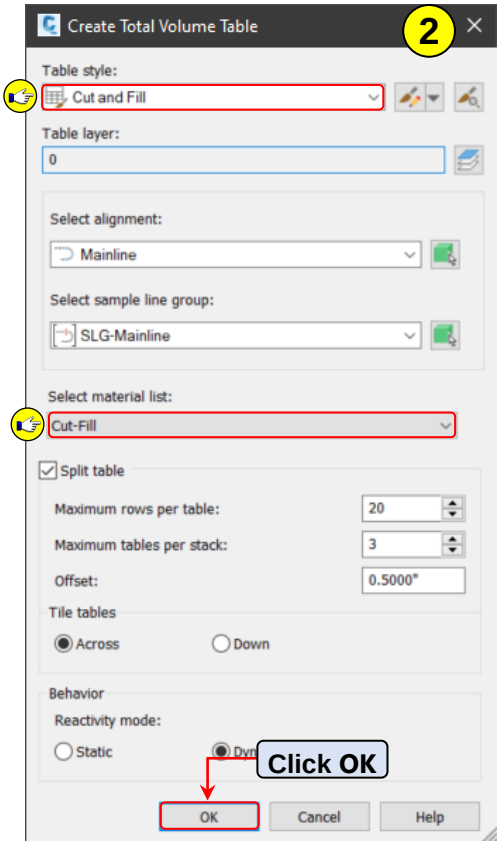
Step 2: In the Create Total Volume Table dialog box, **verify** the following parameters, **click** OK.

Table style: **Cut and Fill**

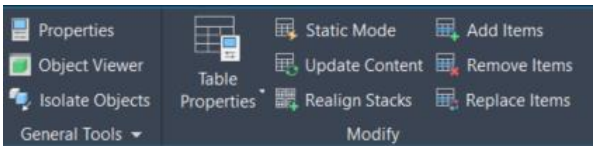
Select material list: **Cut-Fill**

Step 3: **Select** a point within the workspace to place the table.





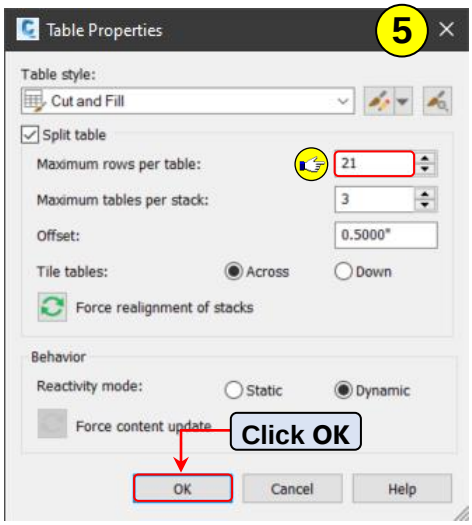
Step 4: **Select** the **Total Volumes Table**, **select** **Table Properties** from the contextual ribbon.



Step 5: In the Table properties dialog box, **change** Maximum rows per table to **21**, **click** **OK**.

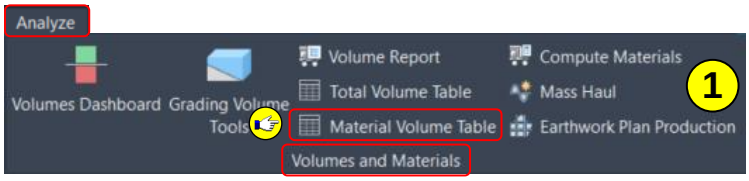
Total Volume Table

Station	Fill Area	Cut Area	Fill Volume	Cut Volume	Cumulative Fill Vol	Cumulative Cut Vol
260+00.00	46.81	83.77	0.00	0.00	0.00	0.00
260+50.00	59.78	75.69	98.69	147.65	98.69	147.65
261+00.00	61.82	68.61	112.59	133.61	211.28	281.26
261+50.00	67.77	61.45	119.99	120.42	331.27	401.68
262+00.00	76.67	55.69	133.73	108.46	465.00	510.15
262+50.00	79.53	48.39	144.63	96.37	609.63	606.52
263+00.00	79.47	50.00	147.22	91.10	756.85	697.62
263+50.00	80.36	53.49	147.98	95.83	904.84	793.45
264+00.00	76.81	53.39	145.52	98.97	1050.36	892.42
264+50.00	104.67	49.18	168.03	94.97	1218.39	987.39
265+00.00	103.36	47.24	192.62	89.27	1411.01	1076.66
265+50.00	105.84	45.22	193.71	85.60	1604.72	1162.27
266+00.00	74.98	45.62	167.43	84.10	1772.15	1246.37
266+50.00	75.42	48.09	139.27	86.76	1911.41	1333.14
267+00.00	68.56	47.73	133.32	88.72	2044.73	1421.86
267+50.00	67.72	48.61	126.19	89.20	2170.92	1511.05
268+00.00	70.69	50.98	128.15	92.21	2299.07	1603.27
268+50.00	64.65	51.84	125.31	95.21	2424.38	1698.48
269+00.00	68.17	48.94	122.98	93.32	2547.36	1791.79
269+50.00	72.41	42.65	130.16	84.80	2677.52	1876.59
270+00.00	71.00	49.26	132.78	85.10	2810.30	1961.69



Creating Material Tables

Step 1: **Navigate** to Analyze tab > **Volumes and Materials** panel, **select** **Material Volume Table**.

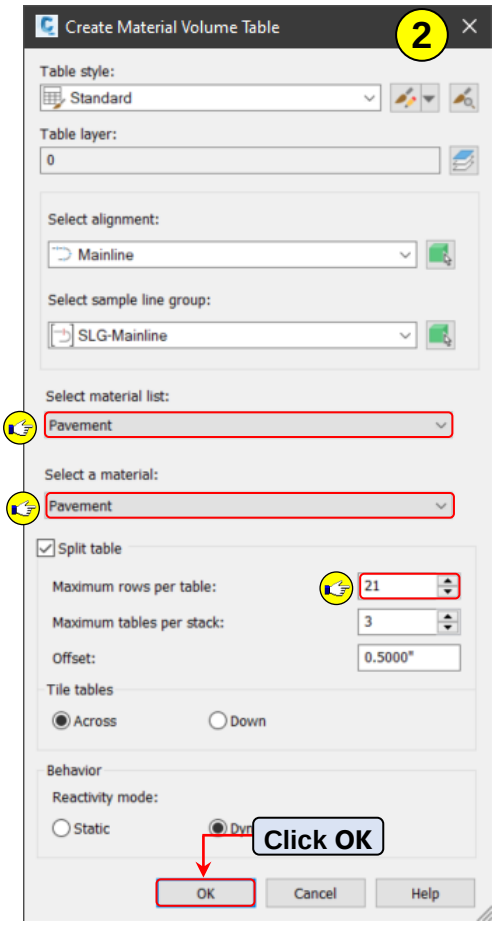


Step 2: In the Create Materials Volume Table dialog box, **verify** the following **parameters**, **Click OK**.

Select material list: **Pavement**

Select a material: **Pavement**

Maximum rows per tale: **21**



Step 3: **Select** a **point** within the workspace to place the table.

Pavement Volume Table			
Station	Area	Volume	Cumulative Volume
260+00.00	4.95	0.00	0.00
260+50.00	4.95	9.17	9.17
261+00.00	4.95	9.17	18.35
261+50.00	4.95	9.17	27.52
262+00.00	4.95	9.17	36.69
262+50.00	4.95	9.17	45.86
263+00.00	4.95	9.17	55.04
263+50.00	4.95	9.17	64.21
264+00.00	4.95	9.17	73.38
264+50.00	6.87	10.94	84.33
265+00.00	6.99	12.83	97.15
265+50.00	7.09	13.03	110.19
266+00.00	4.95	11.15	121.33
266+50.00	4.95	9.17	130.51
267+00.00	4.95	9.17	139.68
267+50.00	4.95	9.17	148.85
268+00.00	4.95	9.17	158.02
268+50.00	4.95	9.17	167.20
269+00.00	4.95	9.17	176.37
269+50.00	4.95	9.17	185.54
270+00.00	4.95	9.17	194.72

Pipe Networks

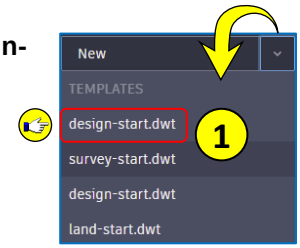
Autodesk Civil 3D Pipe Network tools assist in creating gravity utility systems. A pipe network can contain pipes only, structures only, or, more commonly, both pipes and structures. A part catalog provides access to pipe network items, such as circular, elliptical, or rectangular pipes, manholes, catch basins, and headwalls, and more. A pipe network object manages a collection of pipe objects and structure objects that are associated with each other to represent a pipe system. Typically, the pipes and structures are connected to each other, forming a single pipe run or pipe network. The pipe and structure objects in a pipe network can be associated with a referenced alignment and or a surface, which provide them with station offset and elevation data. Each part in a pipe network can reference any given surface or alignment in the drawing.

Part Catalogs and Part List

The pipe networks feature references a part catalog and a parts list that define the size, shape, and certain behavior of the pipes and structures insert into drawings. The part catalog content is organized into types, subtypes (part shapes), and part families. A parts list contains a set of pipe network parts, pipes and structures, that can be used in a pipe network. A parts list also serves as a way to store defaults, such as styles, render materials and design criteria (rules) to any given part upon creation.

Create a culvert drawing

Step 1: From the **Start** tab > **Create** a new drawing using the **Standard**: **design-start.dwt**



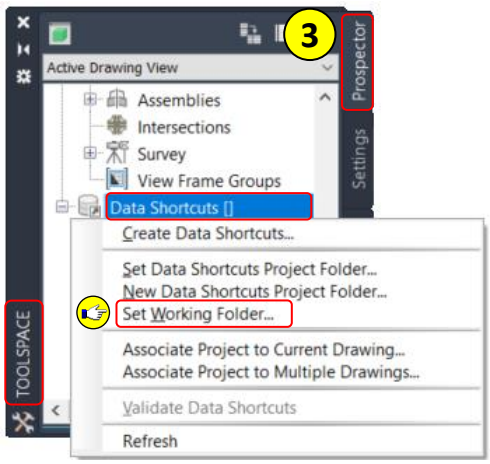
Step 2: **Save** and **Name** the drawing:

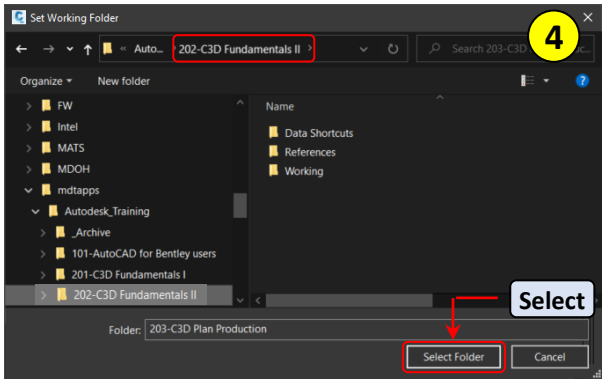
- C:\mdtapps\Autodesk_Training\202-Civil 3D Fundamentals II**Working**
- **8684000RDCULV001-USER INITIALS.dwg**

If the **Working Folder** is still correctly set to **202-C3D Fundamentals II**, **skip** ahead to **Step 6**.

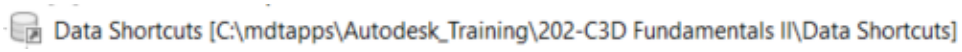
Step 3: Navigate to TOOLSPACE > Prospector tab > **Data Shortcuts**, **right click** on **Data Shortcuts**, **select Set Working Folder**.

Step 4: Browse to C:\mdtapps\Autodesk_Training**202-C3D Fundamentals II**, **select Select Folder**.

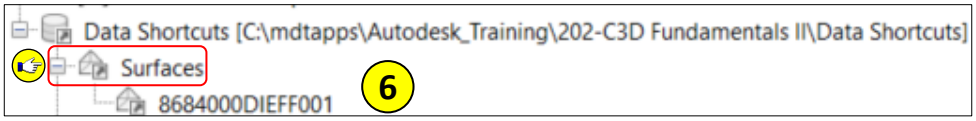




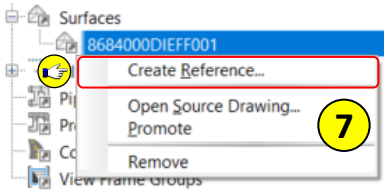
Step 5: **Verify** the Data Shortcuts **path** has been set.



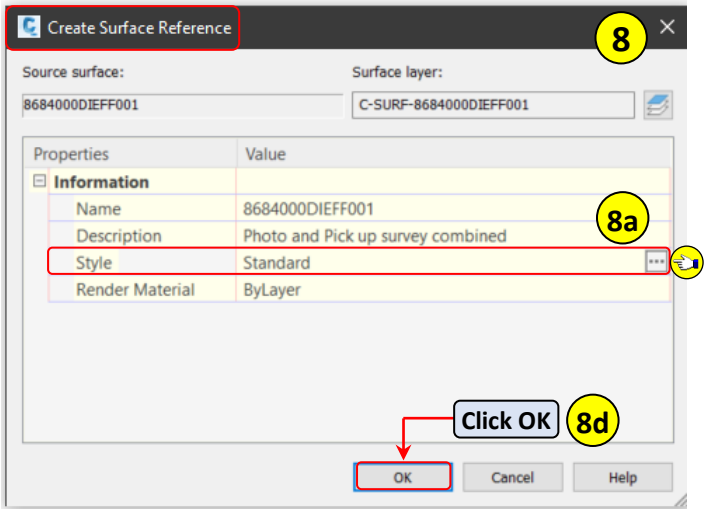
Step 6: **Navigate** to Data Shortcuts > **Surfaces**, **expanded Surfaces**.

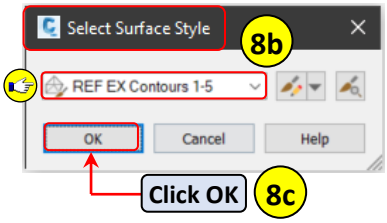


Step 7: **Right click** on **8684000DIEFF001**, **select Create Reference**.



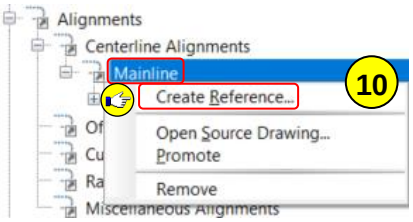
Step 8: In the Create Surface Reference dialog box, **change** the Style to **REF Ex Contours 1-5**, **select OK** in the Select Surface Style dialog box, **select OK** in the Create Surface Reference dialog box.



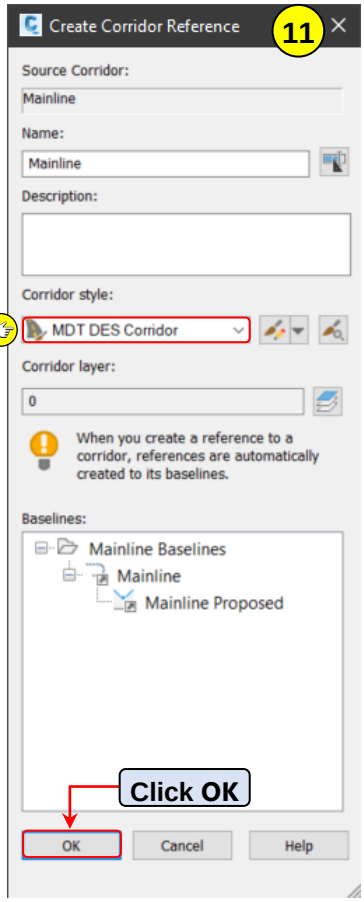


Step 9: **Type ZE**, **select Enter** on the keyboard to Zoom Extents.

Step 10: **Navigate** to Data Shortcuts > **Corridors**, **expanded Corridors, right click** on **Mainline**, **select Create Reference**.



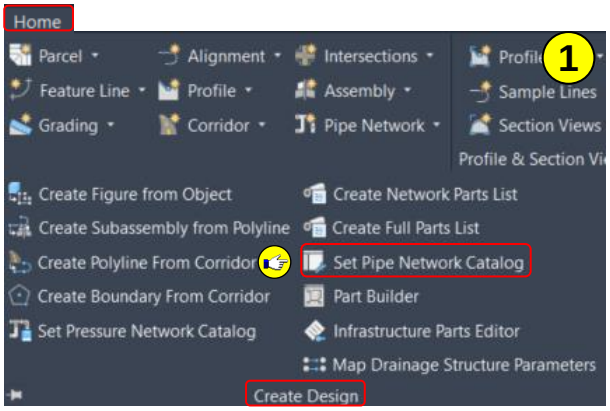
Step 11: In the Create Corridor Reference dialog box, **select MDT DES Corridor** for the Corridor style, **click OK**.



> Corridors are dependent on the alignment and profile it was created with. When a Corridor is data referenced it will bring along the alignment and profile data references as well.

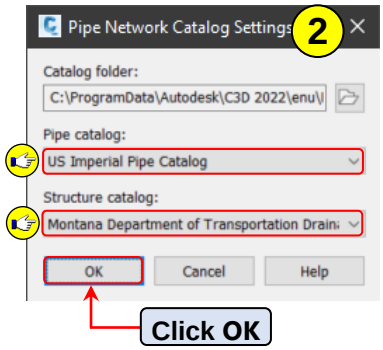
Preparing the drawing for Pipe Network Objects

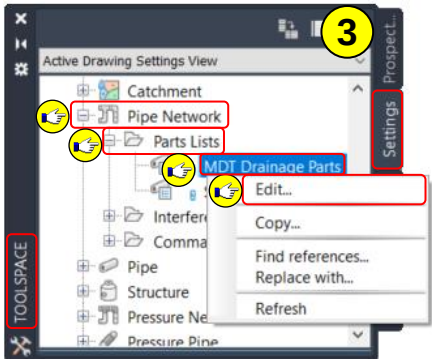
Step 1: **Navigate** to Home tab> **Create Design** panel, **select Create Design** drop down, **select Set Pipe Network Catalog**.



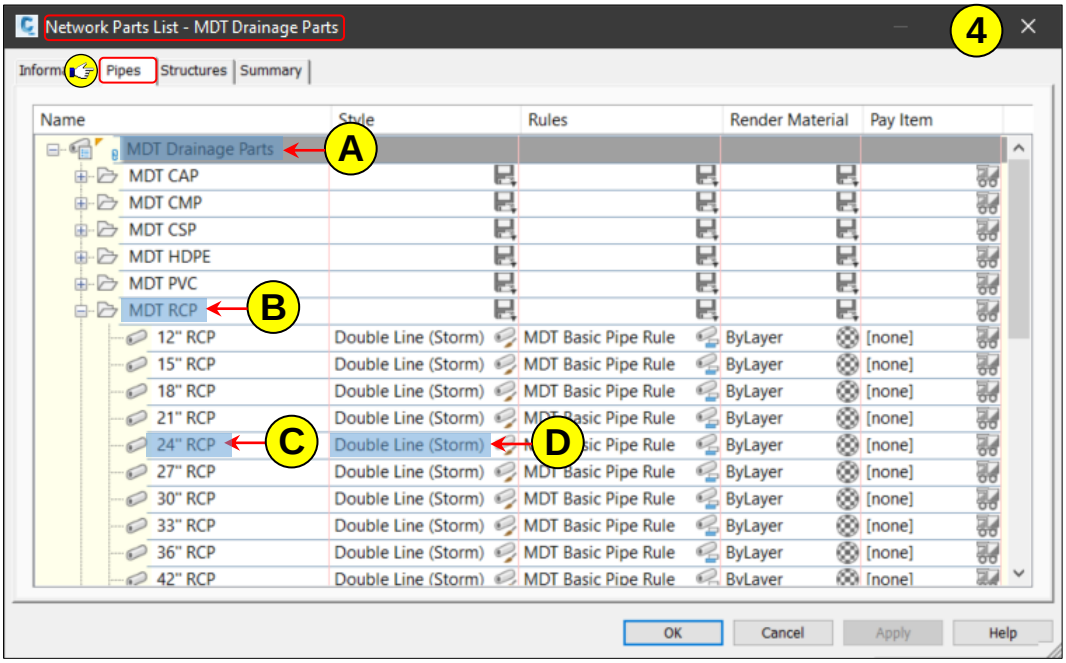
Step 2: **Select US Imperial Pipe Catalog** for Pipe Catalog, **select Montana Department of Transportation Drainage** for Structure Catalog, **click OK**.

Step 3: **Navigate** to TOOLSPACE > **Settings** tab, **expand Pipe Network**, **expand Parts Lists**, **right click** on **MDT Drainage Parts**, **select Edit**.



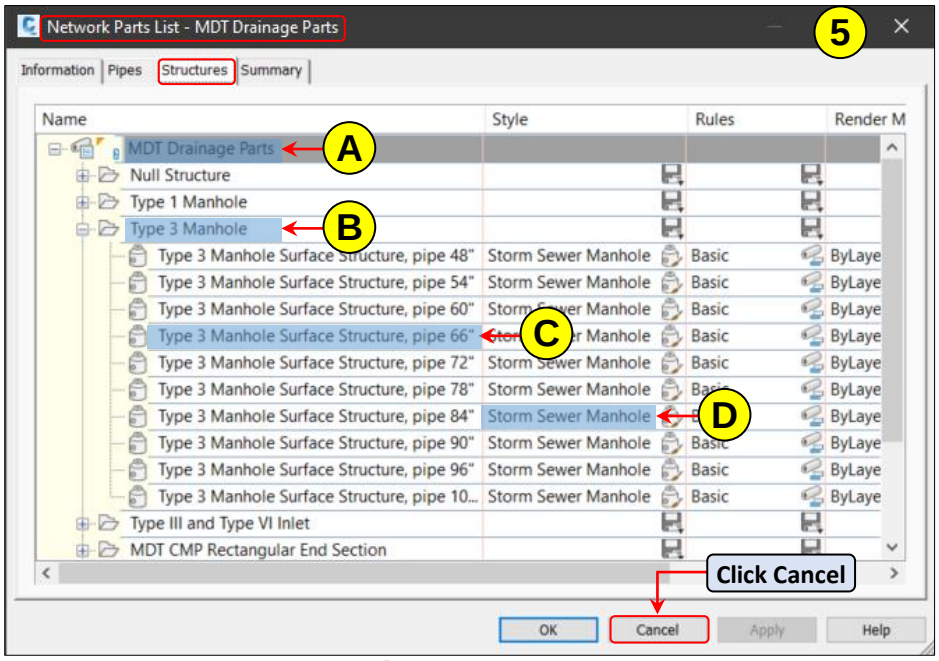


Step 4: In the Network Parts List dialog box, **select Pipes** tab, **expand MDT RCP**.



A - Parts List Name
B - Pipe Material
C - Parts Size
D - Pipe Style

Step 5: **Select Structures** tab, **expand Type 3 Manhole**, **click Cancel**.



A - Parts List Name
B - Structure Type
C - Structure Size
D - Structure Style

Pipe and Structure Rules

Part rules are properties that affect how pipe network parts behave on creation and when you move or edit them. Part rules automatically determine reasonable elevations for parts as they are created. The specific elevation behavior you see is based on choices you make, such as how you define the minimum slope, minimum cover, and desired drop across a structure. Rules also provide automatic validation of your pipe network design, such as checking to see if a structure is too small to accommodate a pipe size, if the length of a pipe is greater than desired, or the maximum cover above a pipe is exceeded. Rules provide an excellent way to give a good starting point for design.

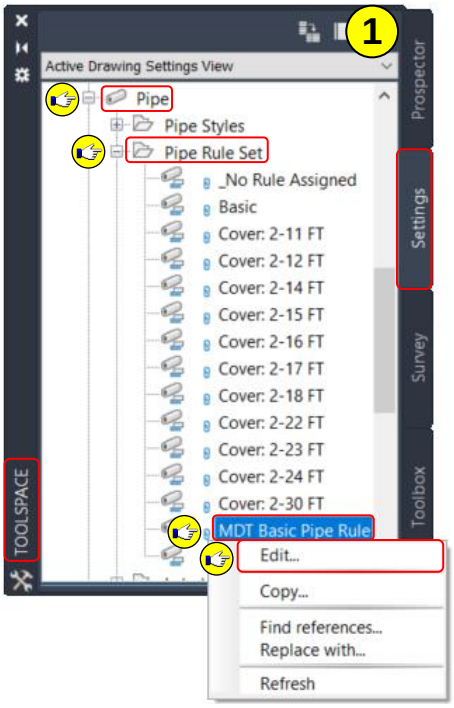
Autodesk Civil 3D pipe network objects use part rules in the following ways:

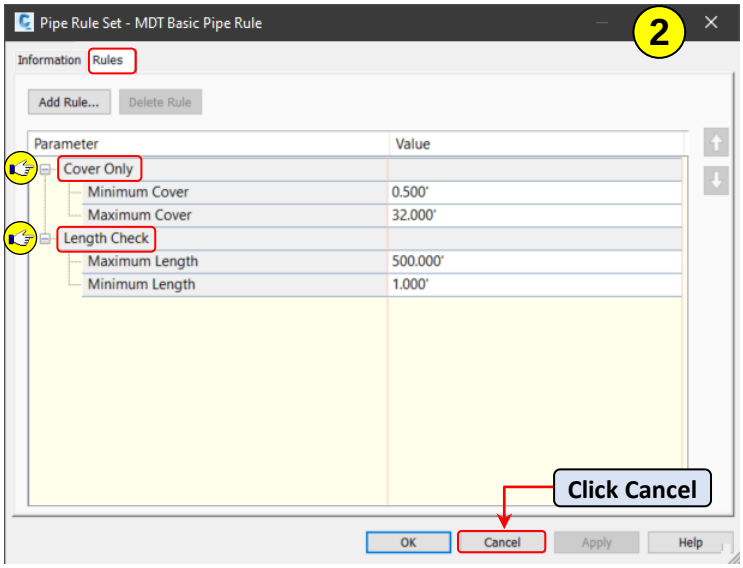
- To determine elevations for pipes and structures when they are created.
- To determine how pipes connect to junction structures.
- To warn that certain criteria is not met while creating or editing pipe networks.

Exploring Pipe Rules

Step 1: **Navigate** to TOOLSPACE > **Settings** tab, **expand Pipe**, **expand Pipe Ruel Set**, **right click** on **MDT Basic Pipe Rule**, **select Edit**.

Step 2: In the Pipe Rule Set dialog box, **select Rules** tab, **expand Cover Only**, **expand Length Check**, **click Cancel**.





Creating Pipe Networks

There are several ways to create pipe networks. Pipe network can be created by using the Network Layout Tools toolbar or from objects including lines, arcs, polylines, both 2D and 3D, feature lines and alignments.

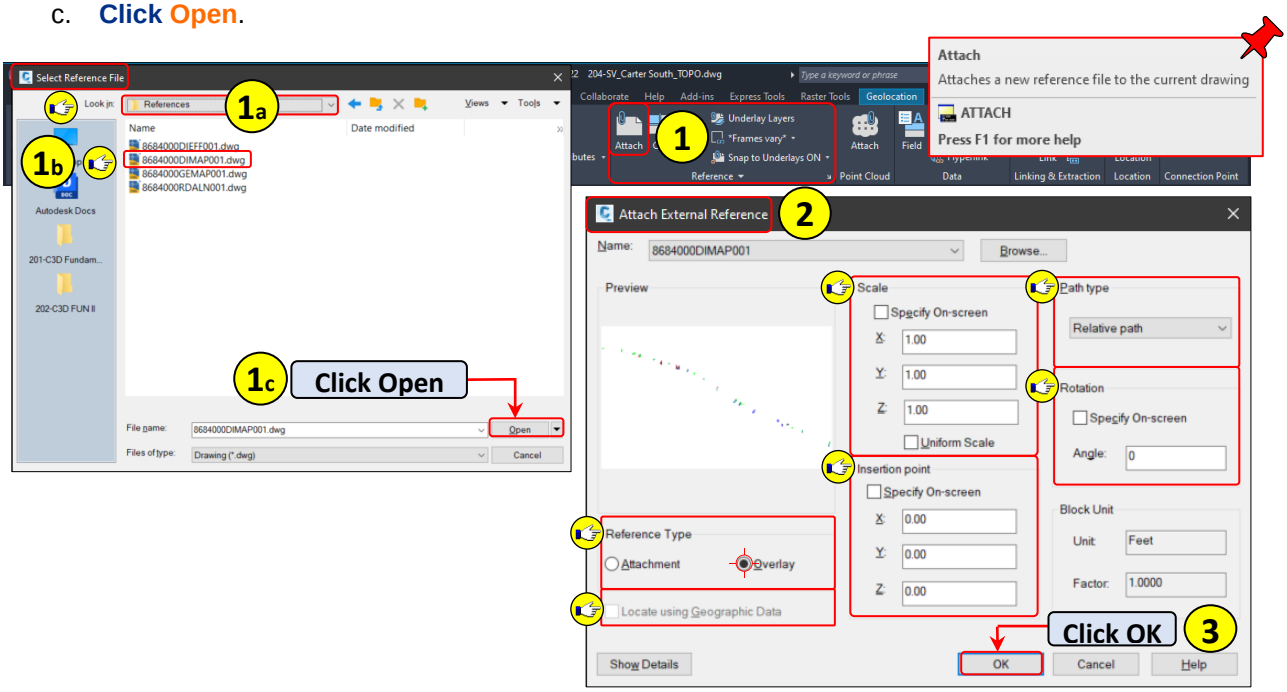
Referencing Existing Culverts

Step 1: **Navigate** to the **Insert** tab > Reference panel > **Select Attach**.

a. **Navigate** to C:\mdtapps\Autodesk_Training\202-Civil 3D Fundamentals II**References**

b. **Select** > **8684000DIMAP001.dwg**

c. **Click Open**.



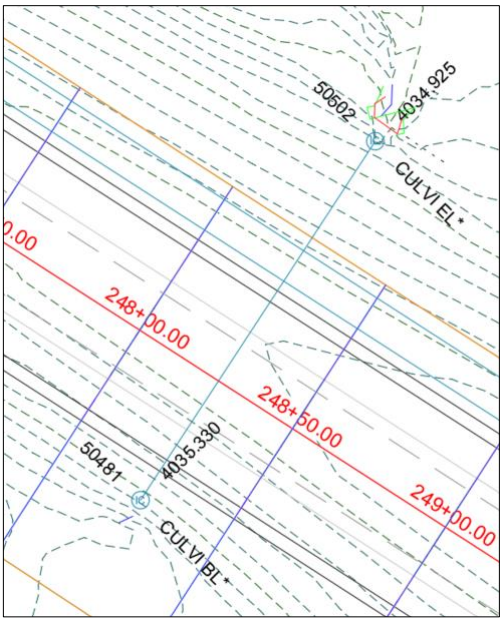
Step 2: From the **Attach External Reference** dialog box**, verify** the following parameters:

- **Reference Type** = Overlay
- **Scale** = Specify On-screen is unchecked
- **Insertion point** = Specify On-screen is unchecked
- **Path type** = Relative path
- **Rotation** = Specify On-screen is unchecked

Step 3: Click OK.

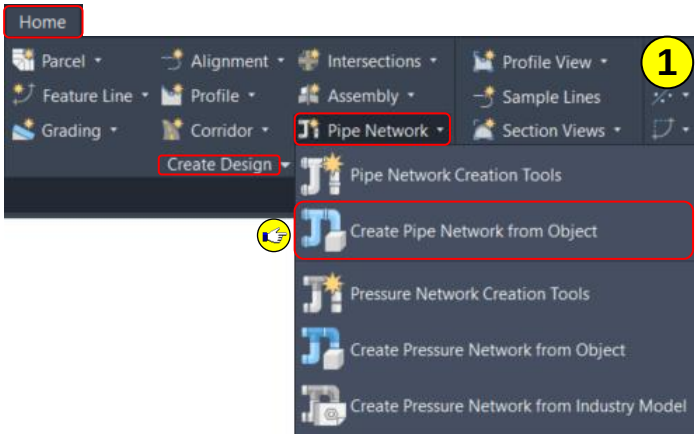
Step 4: **Zoom** to station **248+00.00** of the Mainline alignment.

Step 5: **Save** the **drawing**.



Pipe Network from Object

Step 1: **Navigate** to Home Tab > Create Design panel > **Pipe Network**, **select Create Pipe Network from Object**.



Step 2: **Select Xref** from the command line, **select** the **blue line** representing the existing culvert, **select Enter** to accept the **Northeast** flow direction.

Step 3: **Make** the following **parameter** changes, **click OK**.

Network name: Drainage

Network parts list: MDT Drainage Parts

Pipe to create: 48: RCP

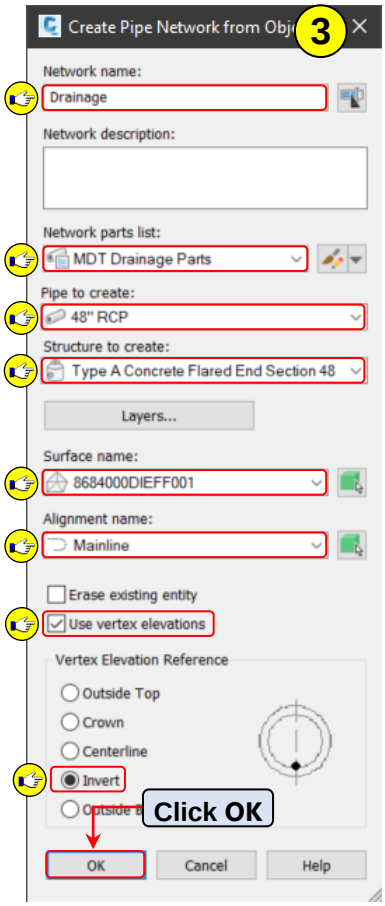
Structure to create: Type A Concrete Flared End Section 48.00 diameter 98.00 L X 94.00 W

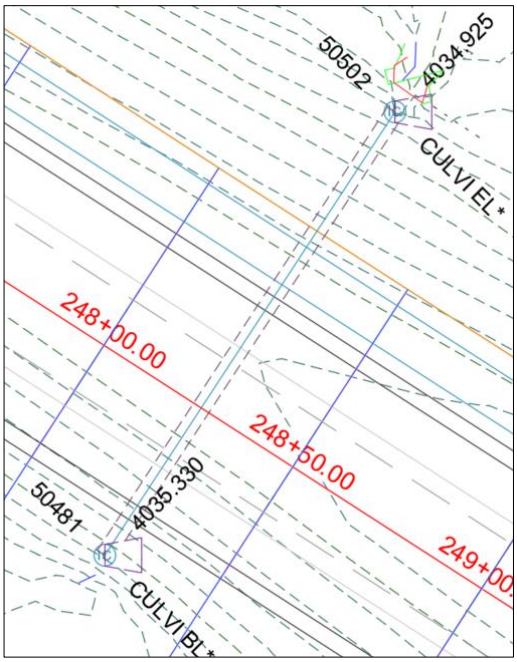
Surface name: 8684000DIEFF001

Alignment name: Mainline

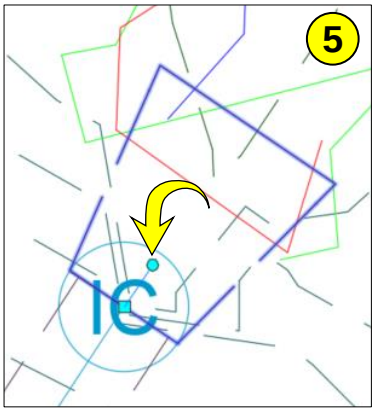
Use vertex elevations: check

Vertex Elevation Reference: Invert

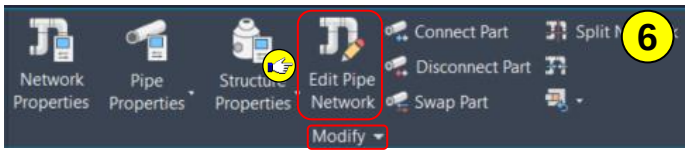




Step 5: **Select** the northerly **flared end section**, **select** the **circle grip**, **rotate** the **flared end section** to align with the culvert.

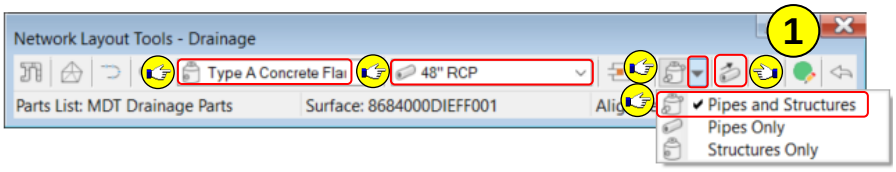


Step 6: **Select** the **culvert pipe**, **navigate** to **Modify** panel, **select** **Edit Pipe Network**.



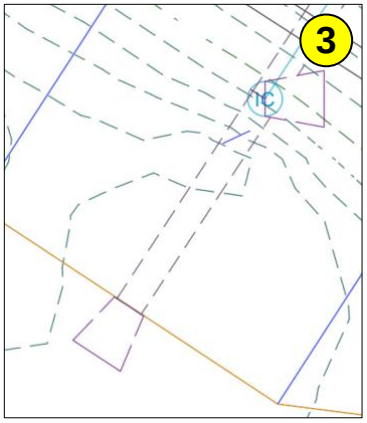
Extending Existing Culverts

Step 1: On the Network Layout Tools tool bar, **select** **Type A Concrete Flared End Section 48.00 diameter 98.00 L X 94.00 W**, **select** **48" RCP**, **select** toggle **upslope**, **select** **Pipes and Structures**.

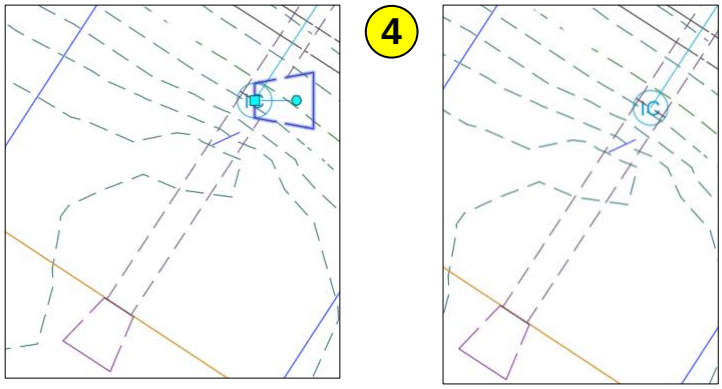


Step 2: **Zoom** to the **southerly end** of the **existing culvert pipe**, **hover** the crosshairs over the **existing culvert pipe**, **select** the existing structure when the connect to structure symbol appears.

Step 3: **Extend** the new pipe to the **edge of the corridor**, **select** a **point** near the corridor limit, **select** **Esc** to end the command.



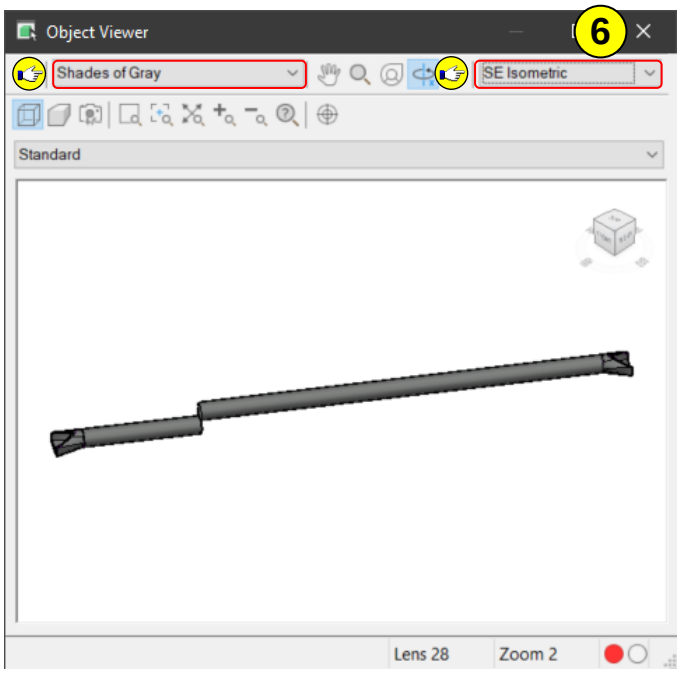
Step 4: **Select** the **existing structure**, **select** **Delete** on the keyboard.



BEFORE AFTER

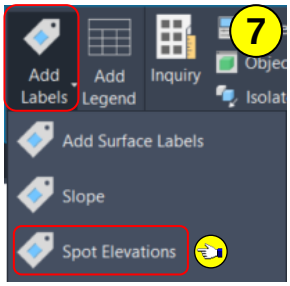
Step 5: **Select** a **structure**, **select** a **pipe**, **right click** and **select** **Select Similar**, **right click** again and select **Object Viewer**.

Step 6: In the Object Viewer application window, **select** **Shades of Gray** for the Visual Style, **select** **SE Isometric** for the View Control, **press** **ESC** when done viewing to close the Object Viewer.

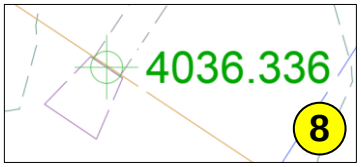


	The new pipe culvert will need to be edited to match the invert of the existing pipe culvert. The invert of the existing pipe culvert is shown on the cogo point. To get the elevation of the surface a surface spot elevation can be added to the drawing.

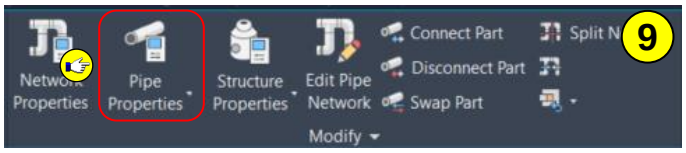
Step 7: **Select** the **8684000DIEFF001 surface**, **navigate** to **Labels & Tables** panel on the contextual ribbon, **select Add Labels**, **select Spot Elevations**.



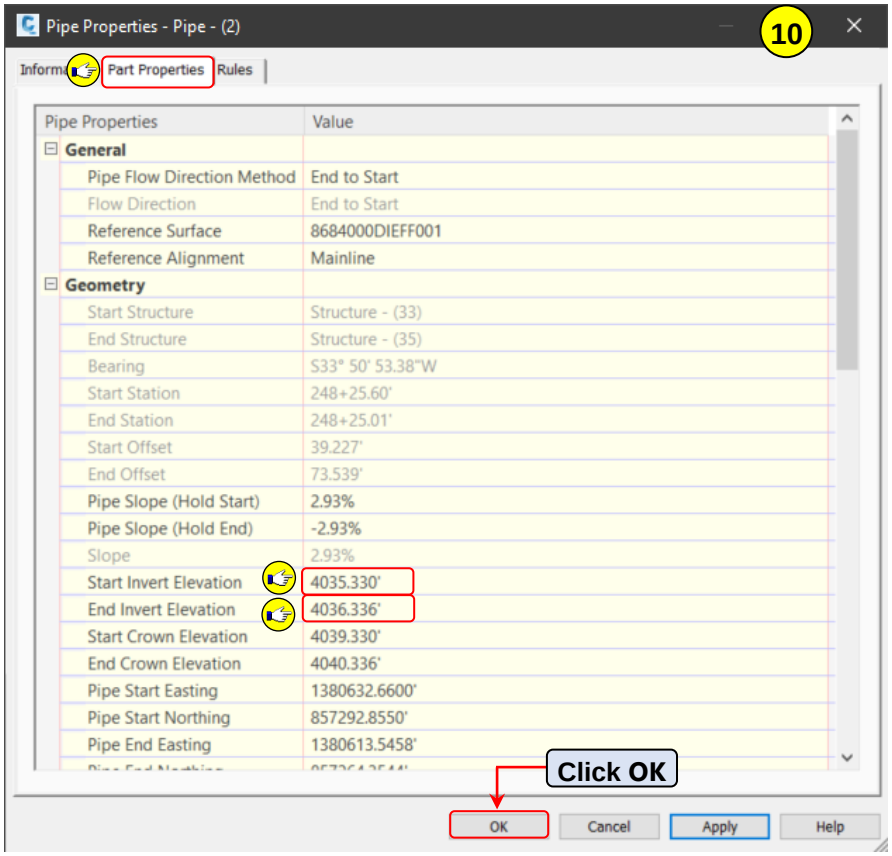
Step 8: **Select** a **point** on the surface near the end of the new pipe culvert.



Step 9: **Select** the **new 48" pipe**, **select Pipe Properties** from the contextual ribbon.

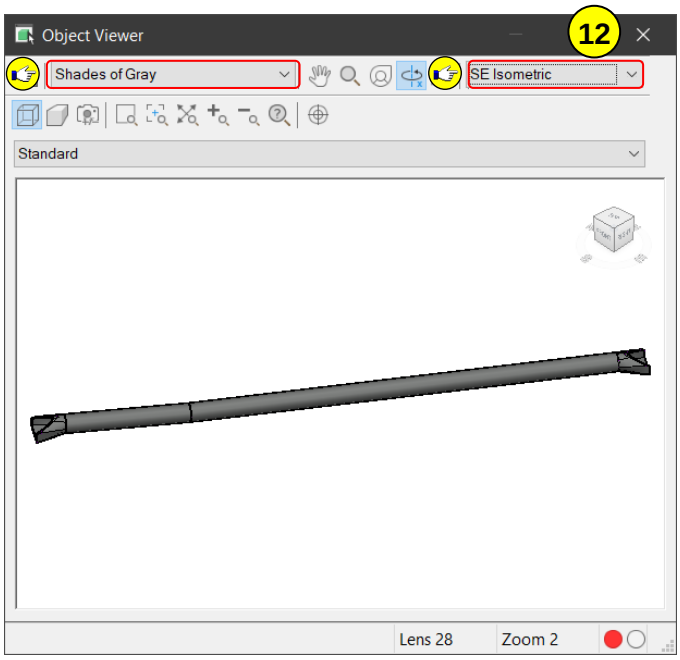


Step 10: In the Pipe Properties dialog box, **select** the **Part Properties** tab, **edit** the Start Invert Elevation to **4035.330**, **edit** the End Invert Elevation to **4036.336**, **click OK**.



Step 11: **Select** a **structure**, **select** a **pipe**, **right click** and **select Select Similar**, **right click** again and select **Object Viewer**.

Step 12: In the Object Viewer application window, **select** **Shades of Gray** for the Visual Style, **select** **SE Isometric** for the View Control, **close** **Object Viewer**.



Step 13: **Save** the **drawing**.

Editing Pipe Networks

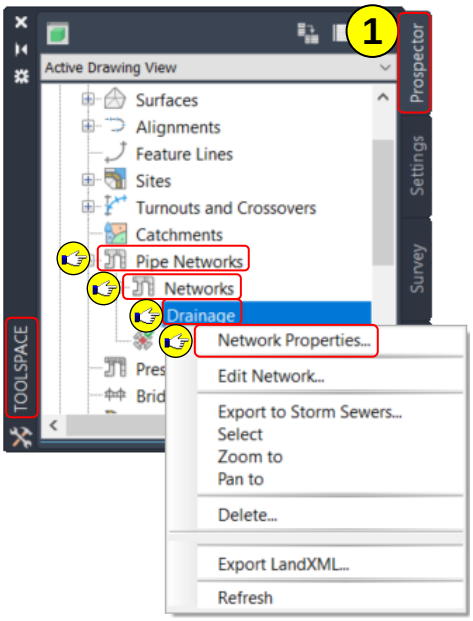
Once a pipe network or networks are created, there are several ways to edit and refine them. The pipe network layout tools, pipe network vista and using grips in both plan and profile views. Individual parts and structures can be edited within their properties dialog box as well.

Splitting Pipe Networks

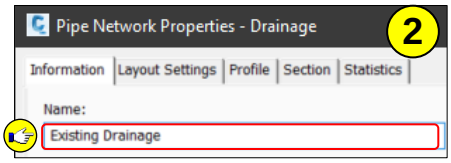
Splitting a pipe network, creating multiple pipe networks from an existing single network, maybe necessary through the design process. Most of the part properties of the selected parts are not modified when splitting a pipe network. Part properties such as the referenced surface, referenced alignment and labeling, remain unchanged when the pipe network is split. The only part property that changes is the pipe network that the parts are associated with.

Creating a Proposed and Existing Network

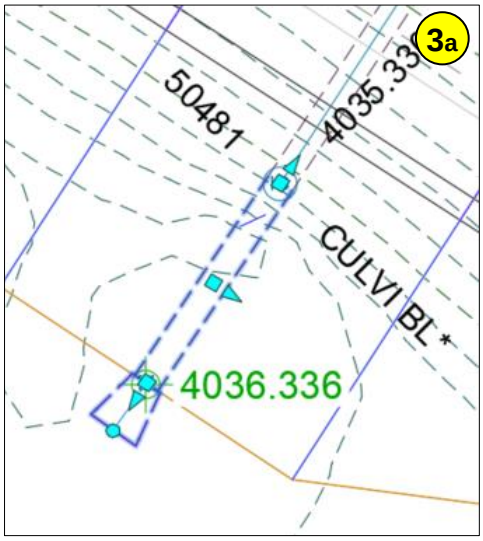
Step 1: **Navigate** to TOOLSPACE > **Prospector** panel, **expand** **Pipe Networks**, **expand** **Networks**, **right click** **Drainage**, **select** **Network Properties**.



Step 2: In the Pipe Network Properties dialog box, **select** **Information** tab, **rename** the network from Drainage to **Existing Drainage**, **select** **OK**.



Step 3: **Select** the **pipe** and **structure** that was created previously, **select** **Split Network** from the contextual ribbon.



Step 4: From the command line, **select** **Create new pipe network**.

```
[Create new pipe network Select a network]
```

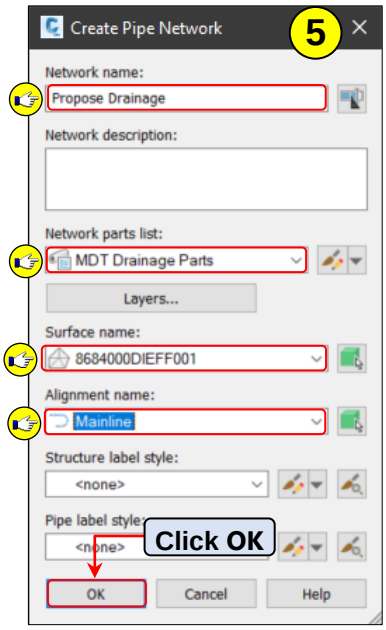
Step 5: In the Create Pipe Network dialog box, **change** the following **parameters**, **select OK**.

Network Name: Proposed Drainage

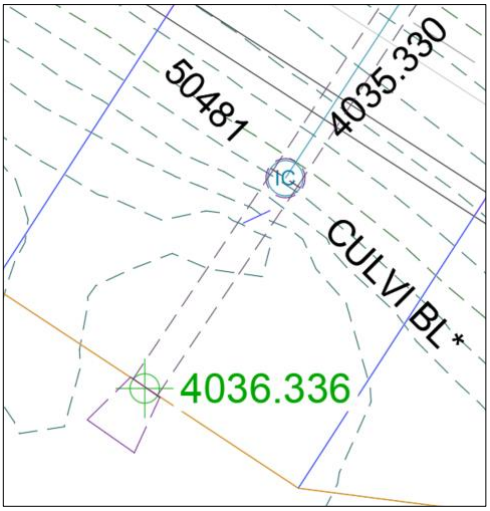
Network parts list: MDT Drainage Parts

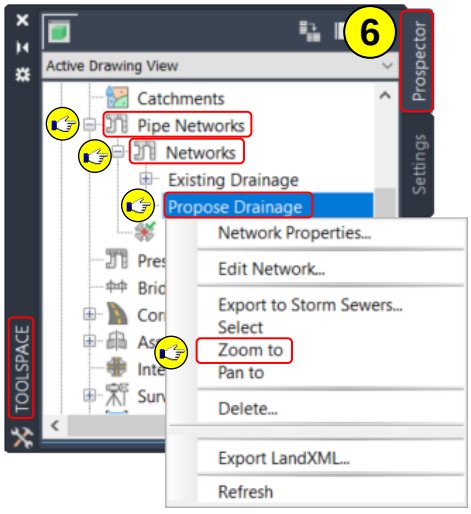
Surface name: 8684000DIEFF001

Alignment name: Mainline



Step 6: **Navigate** to TOOLSPACE > **Prospector** panel, **expand Pipe Networks**, **expand Networks**, **right click Proposed Drainage**, **select Zoom to**.



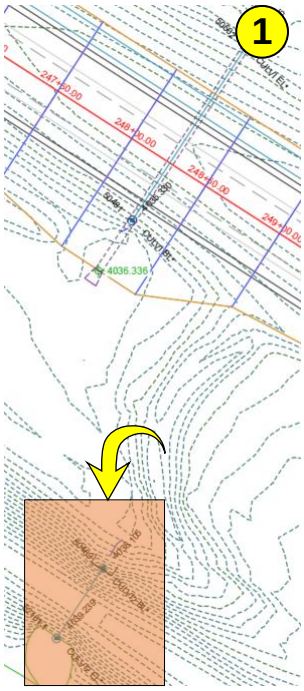


Merging Pipe Networks

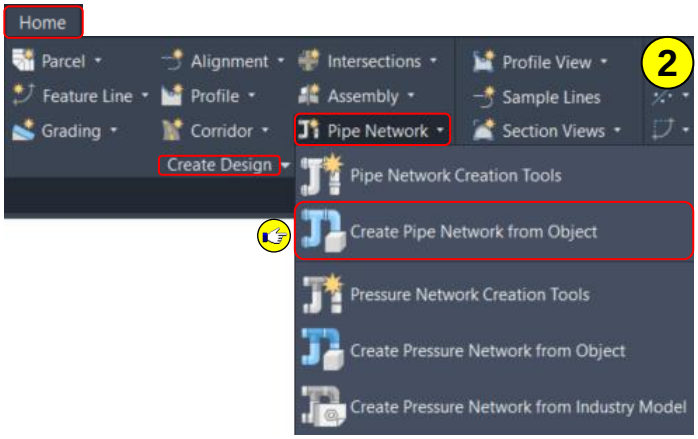
Merging pipe networks, the opposite of splitting them, takes multiple pipe networks and creates a single pipe network from the pipes and structures. When using an analysis tool like Autodesk Storm and Sanitary Analysis (SSA) it may be necessary to merge existing and proposed pipe networks into a single network to perform the analysis.

Creating a single Pipe Network from multiple

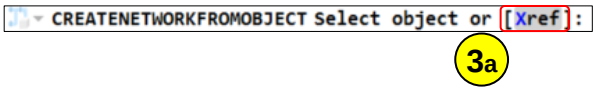
Step 1: **Zoom** to the **existing surveyed culvert** located southerly of the pipe culvert that was created in the previous steps.

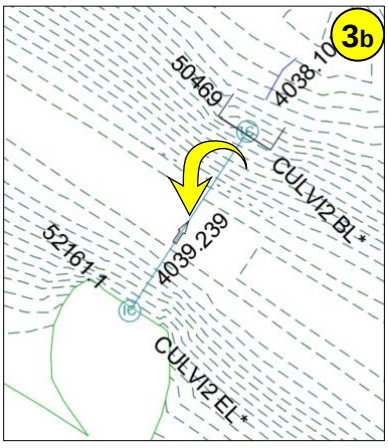


Step 2: **Navigate** to Home Tab > Create Design panel > **Pipe Network**, **select** **Create Pipe Network from Object**.

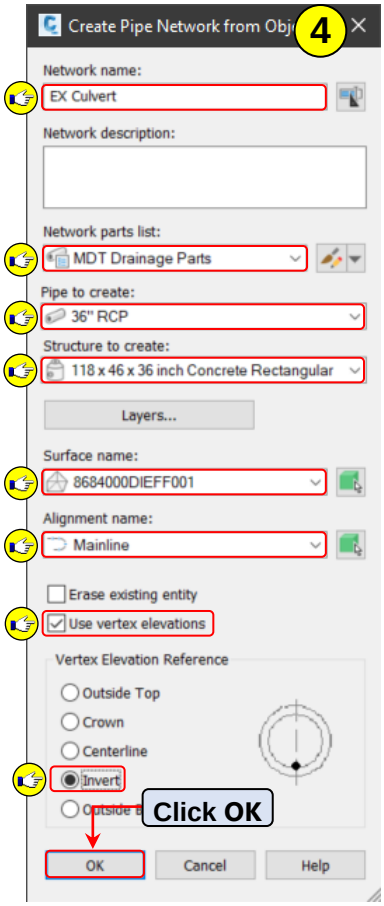


Step 3: **Select** **Xref** from the command line, **select** the **blue line** representing the existing culvert, **select** **Enter** to accept the **Northeast** flow direction.





Step 4: **Make** the following **parameter** changes, **click OK**.



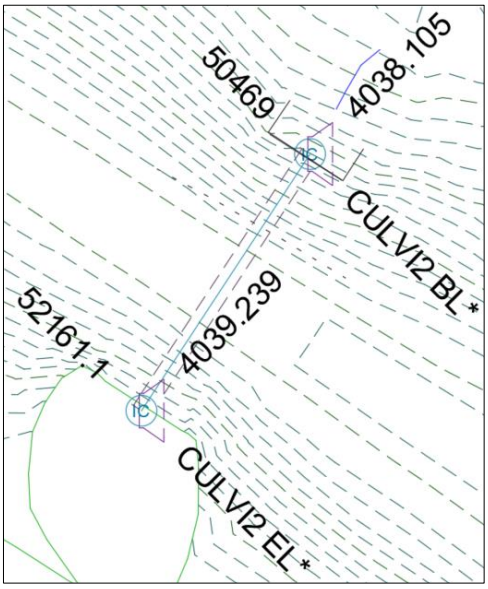
Structure to create: 118 x 46 x 36 inch Concrete Rectangular Box Culvert Headwall

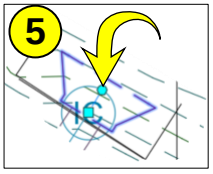
Surface name: 8684000DIEFF001

Alignment name: Mainline

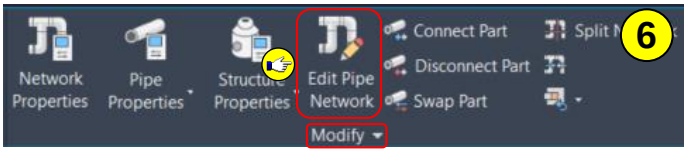
Use vertex elevations: check

Vertex Elevation Reference: Invert



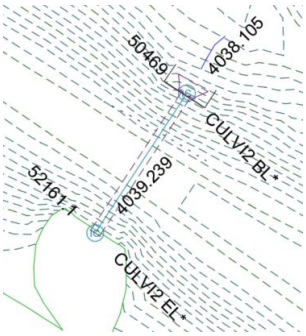


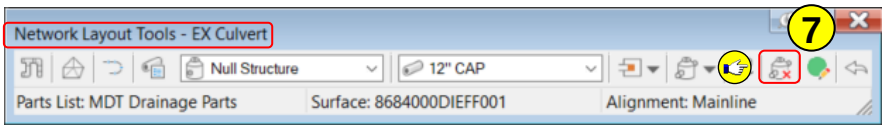
Step 5: **Select** the **northerly headwall**, **rotate** the **headwall** using the grip to align with the culvert.



Step 6: With the **headwall** still selected, **navigate** to the **Modify** panel, **select Edit Pipe Network**.

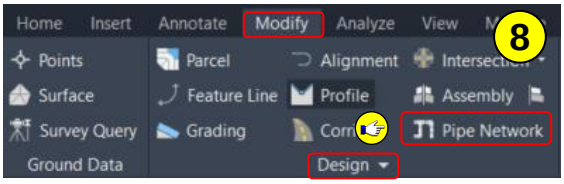
Step 7: On the Network Layout Tools, **select** the **Delete Pipe Network Object** tool, **select** the **southerly headwall**, **press Enter** to complete the command.

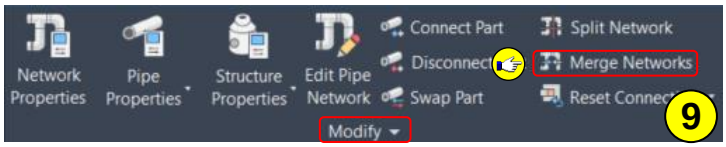




Step 8: **Navigate** to the Modify tab > **Design** panel, **select** **Pipe Network**.

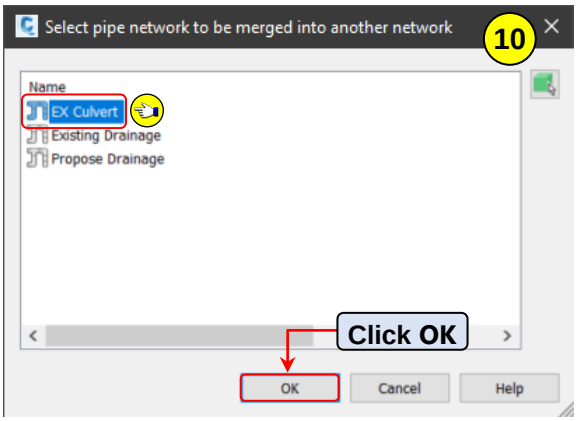
Step 9: **Navigate** to the **Modify** panel, **select** **Merge Networks**.

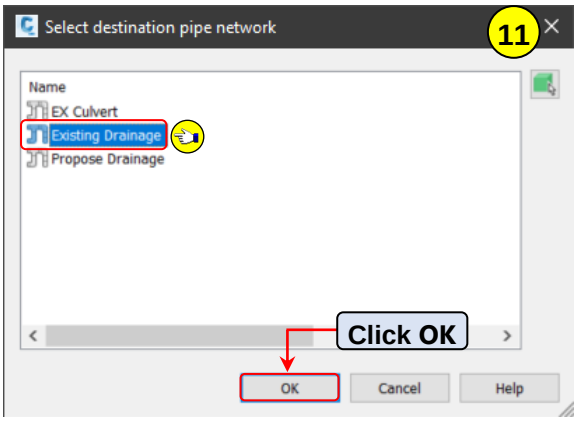




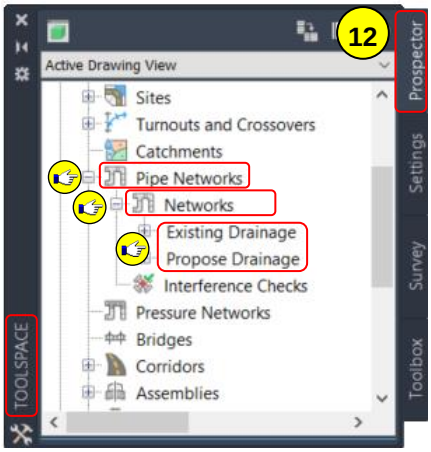
Step 10: In the Select pipe network to be merged into another network dialog box, **select** **EX Culvert**, **click** **OK**.

Step 11: In the Select destination pipe network, **select** **Existing Drainage**, **click** **OK**.





Step 12: **Navigate** to TOOLSPACE > **Prospector** tab, **expand** **Pipe Networks**, **expand** **Networks**, **verify** only **Existing Drainage** and **Proposed Drainage** are listed.

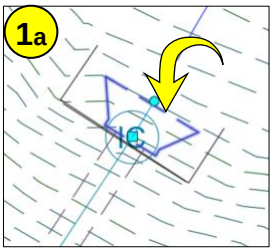


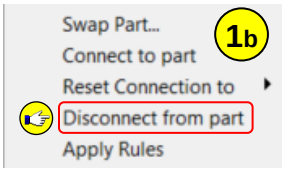
Disconnecting and Reconnecting Pipe Networks

Disconnecting and reconnecting pipe network parts is a simple task in Civil 3D. When disconnecting a part, the disconnected part can then be moved in the drawing without moving parts that were attached to it. Even though a part may be disconnected from the other parts in the same pipe network, the disconnected part still belongs to the same pipe network. Once disconnected a part can be easily reconnected using the right-click menu.

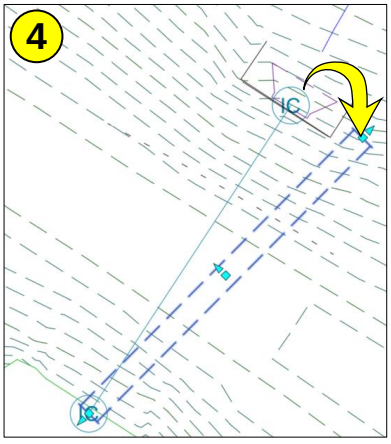
How to Disconnect and Reconnect Networks

Step 1: **Select** the **headwall**, **right click** and **select** **Disconnect from part**, **select** the **culvert pipe** when prompt to Select Connect Part.

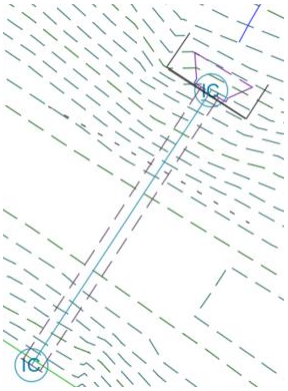


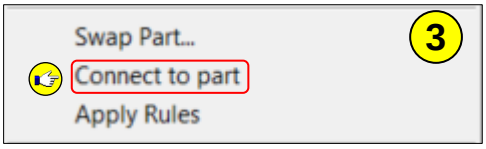


Step 2: **Select** the **culvert pipe**, **move** the **culvert pipe** away from the headwall using the square grip.



Step 3: With the culvert pipe still selected, **right click** and **select Connect to part**, **select** the **headwall** when prompt to Select Network Structure. The culvert pipe is reconnected to the headwall.



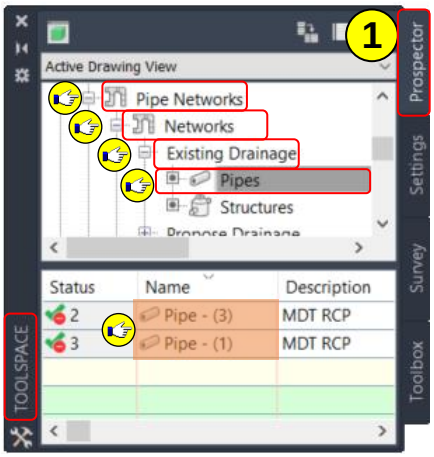


Renaming Pipe Networks

Using the Rename Parts command allows for rename one, all, or a sequence of connected parts within a pipe network. Using this command, a name template can be applied to the new part names as well.

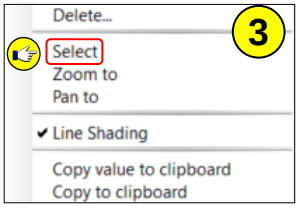
Editing network parts names

Step 1: **Navigate** to TOOLSPACE > **Prospector** tab, **expand Pipe Networks**, **expand Networks, expand Existing Drainage**, **select Pipes**. Notice the list of pipes and names at the bottom of the TOOLSPACE.

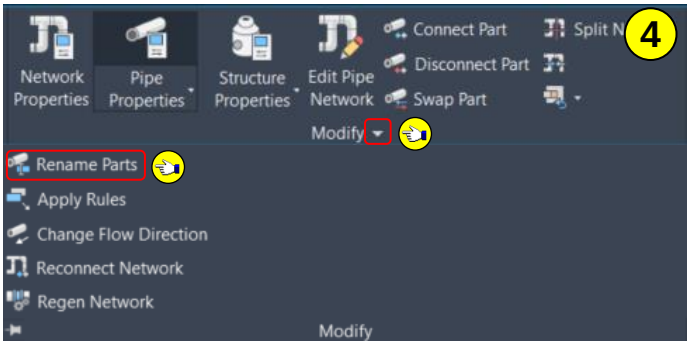


Step 2: **Select** both pipes by holding the Ctrl button while selecting.

Step 3: **Right click** on the **selected pipes** and **select Select**.



Step 4: **Navigate** to the **Modify** panel on the Pipe Network: Existing Drainage contextual ribbon, **select** the **arrow** next to Modify, **select Rename Parts**.



Step 5: On the Rename Pipe Network Parts dialog box, **make** the following **parameter changes**, **click OK**.

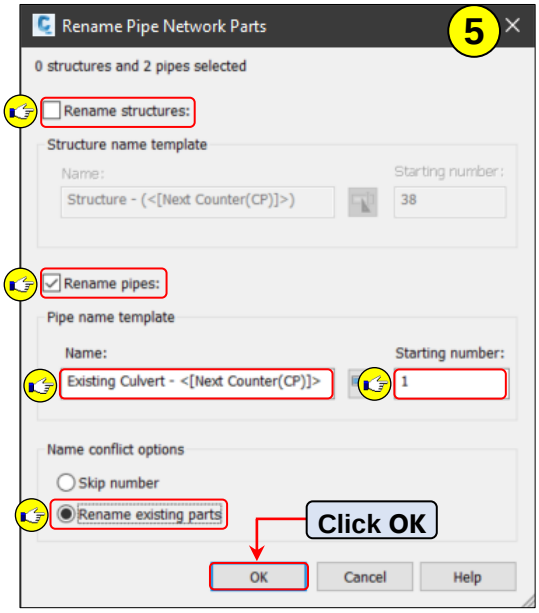
Rename structures: Uncheck

Rename pipe: Check

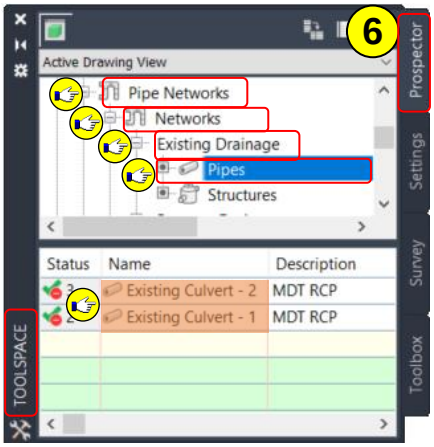
Name: Existing Culvert - <[Next Counter(CP)]>

Starting number: 1

Name conflict options: Rename existing parts



Step 6: **Navigate** to TOOLSPACE > **Prospector** tab, **expand Pipe Networks**, **expand Networks**, **expand Existing Drainage**, **select Pipes**. Notice the list of pipes and names at the bottom of the TOOLSPACE have been updated.



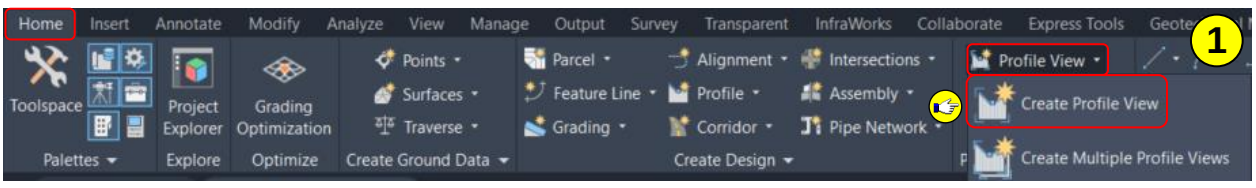
Step 7: **Press Esc** to deselect any network objects and to clear the command line.

Display Pipe Networks

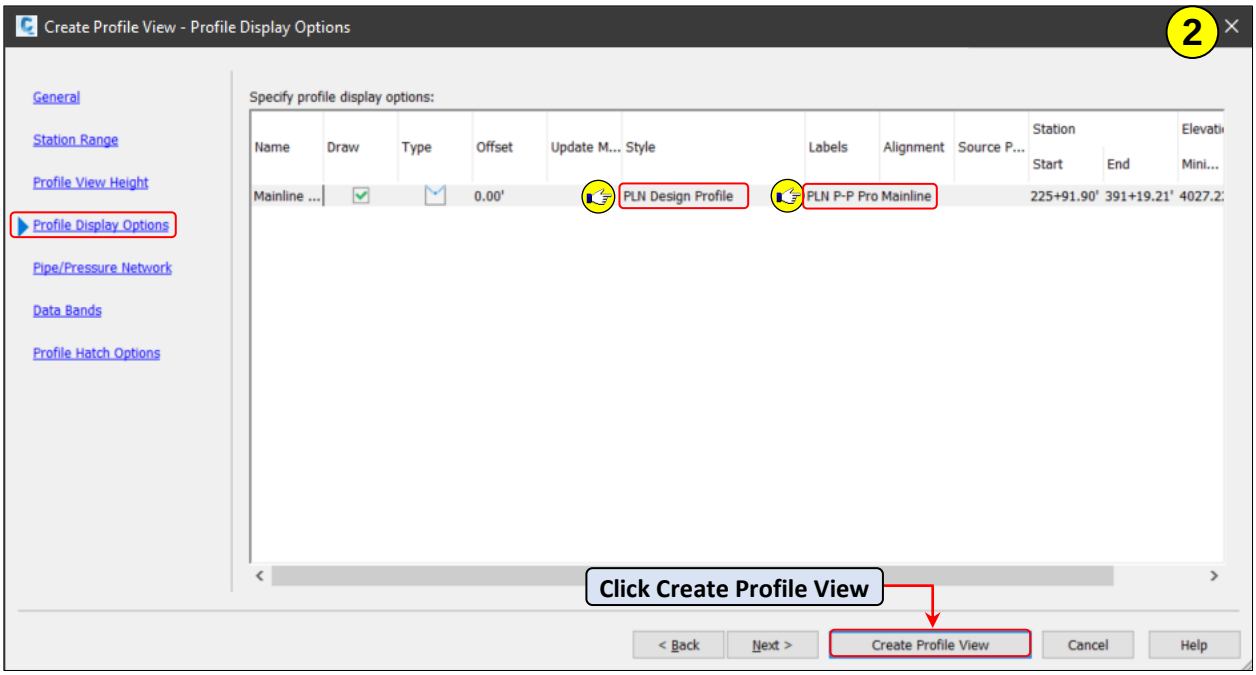
Pipe network parts, or entire pipe networks, can be displayed in profile views and section views. Making changes to the pipe network in plan view, such as moving, swapping, deleting, or resizing parts, those changes are reflected when the parts are dynamically displayed in profile view and section view.

Drawing Network Parts in Profile views

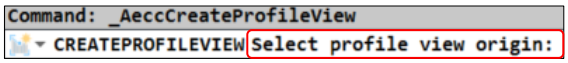
Step 1: **Navigate** to Home tab > **Profile & Section Views** panel, **select Profile View**, **select Create Profile View**.

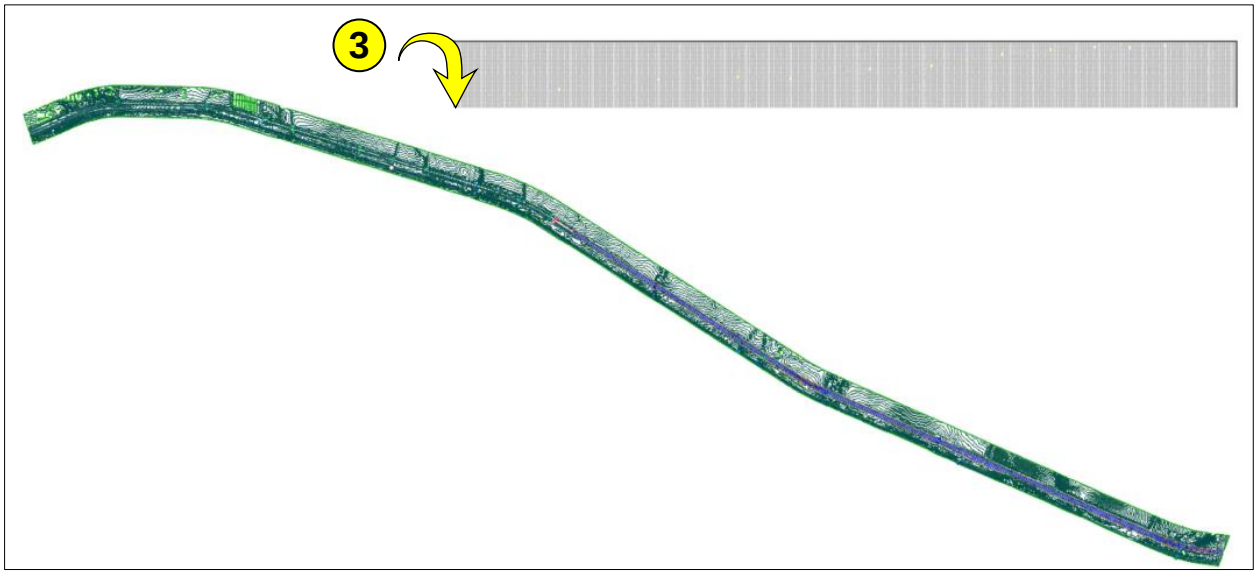


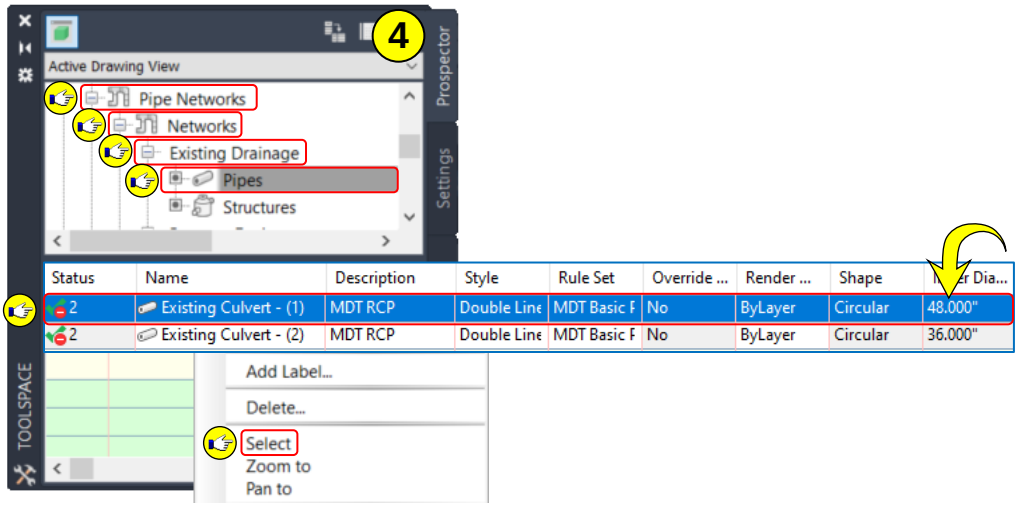
Step 2: On the Create profile View wizard, **accept** the **defaults** for General, Station Range and Profile View Height, **select** **Profile Display Options** link, **change** the **Style** to **PLN Design Profile**, **change** the **Labels** to **PLN P-P-Mainline**, **click** **Create Profile View**.



Step 3: **Select** a **point** on the screen to **place** the **Profile View** when prompted.



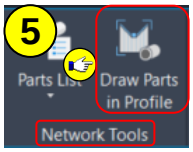




Step 4: **Navigate** to TOOLSPACE > **Prospector** tab, **expand Pipe Networks**, **expand Networks, expand Existing Drainage**, **select Pipes, right click** on **Existing Culvert – (1)** from the list view, **select Select**.

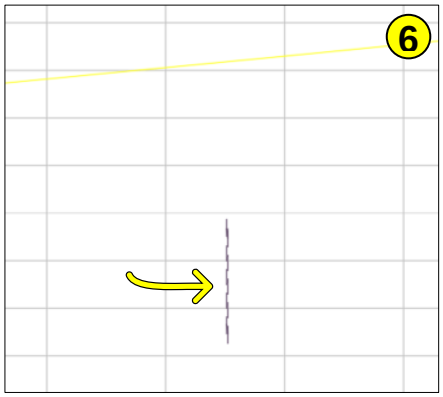
- The naming of the pipes could be different than what is shown here. **Verify** the selected pipe is the **48”pipe** crossing the roadway, and not the 36” pipe.

Step 5: Navigate to Network Tools panel on the contextual ribbon, **select** Draw **Parts in Profile**.



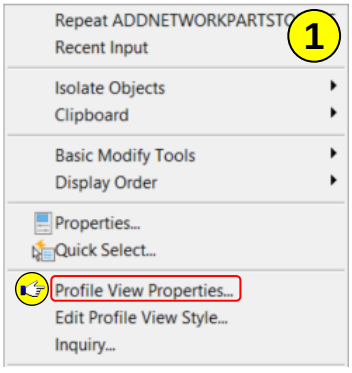
Step 6: **Select** the **Mainline Profile View** when prompted, **press Esc** to end the command.

	The pipe is drawn in the profile view utilizing the pipe style. A style override is needed to properly display the pipe in the profile view.

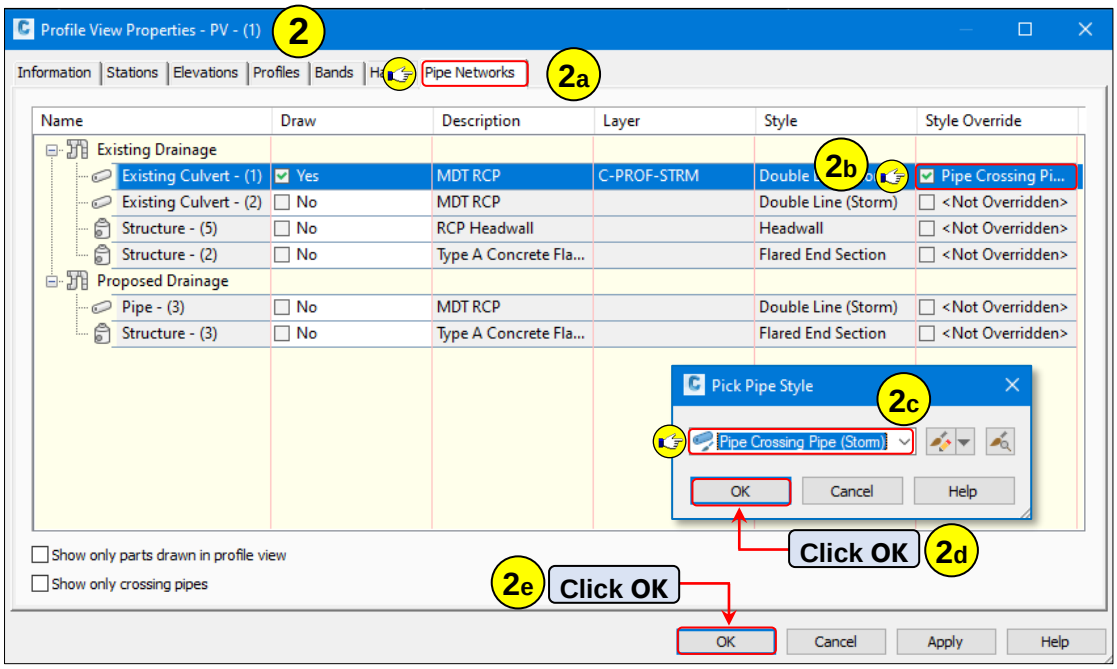


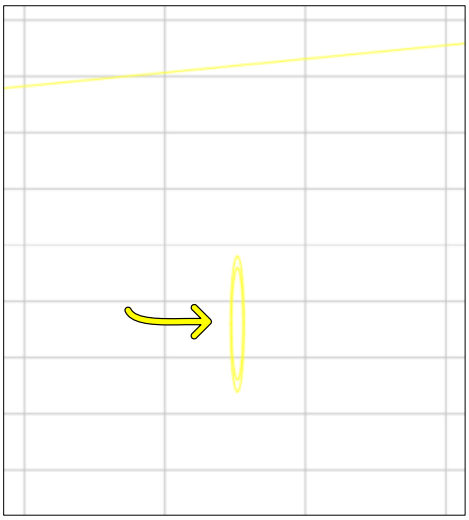
Editing Network Parts Profile View Display

Step 1: **Select** the Mainline Profile View, **right click** and **select Profile View Properties**.



Step 2: On the Profile View Properties dialog box, **select Pipe Network** tab, **select Style Override** for Existing Culvert – 1, **select Pipe Crossing Pipe (Storm)** from the Pick Pipe Style dialog box, **click OK** on the Pick Pipe Style, **click OK** on the Profile View Properties dialog box.

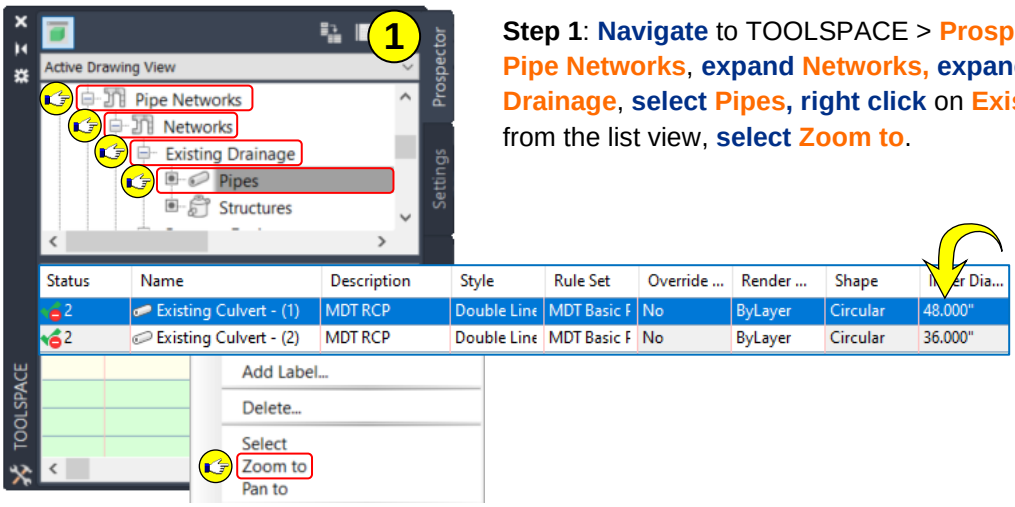


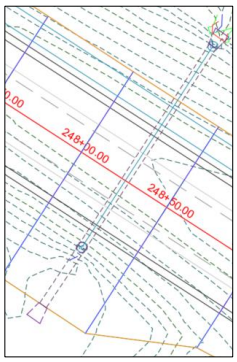


Generating Labels, Tables and Reports

Like most Civil 3D objects, pipe networks can be dynamically labeled. Labels can be added to pipe network parts either when created or after being created. Labels can be added to single parts and multiple parts in plan, profile, and section views. Tables can also be created for pipe network parts. Pipe tables can include data such as pipe shape, size, length, slope, start and end stations, or almost any pipe property. The Civil 3D Reports Manager can be leveraged to generate reports for pipes, pipes and structures, structures, and structures in a CSV format. The Report settings can be customized to generate the preferred report format and data.

Labeling Pipe Network Parts



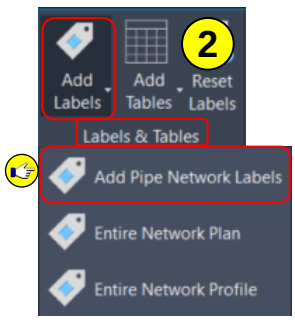


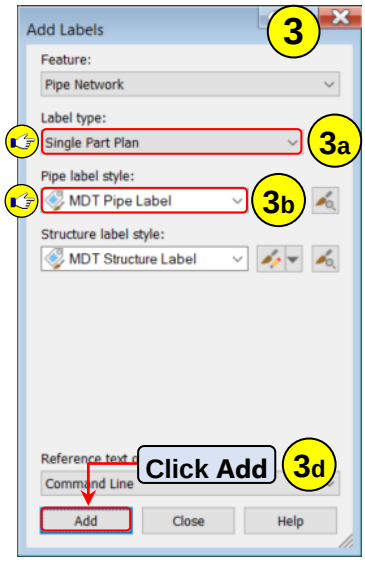
Step 1: **Navigate** to TOOLSPACE > **Prospector** tab, **expand** **Pipe Networks**, **expand** **Networks**, **expand** **Existing Drainage**, **select** **Pipes**, **right click** on **Existing Culvert – (1)** from the list view, **select** **Zoom to**.

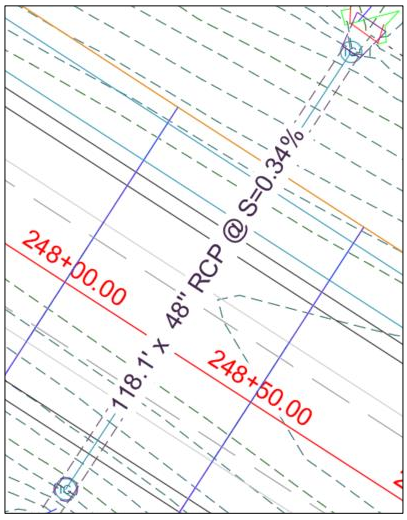
- The naming of the pipes could be different than what is shown here. **Verify** the selected pipe is the **48”pipe** crossing the roadway, and not the 36” pipe.

Step 2: **Select** **Existing Culvert – (1)**, **navigate** to **Labels & Tables** panel, **select** **Add Network Labels**.

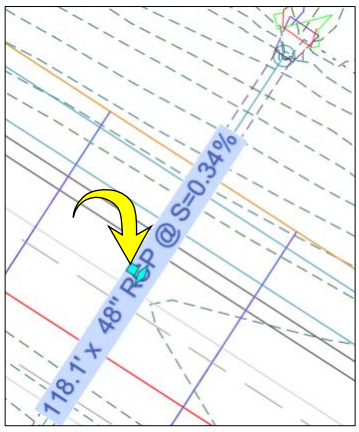
Step 3: On the Add Labels dialog box, **select** **Single Part Plan** for the Label type, **select** **MDT Pipe Label** for the Pipe label style, **click** **Add**.

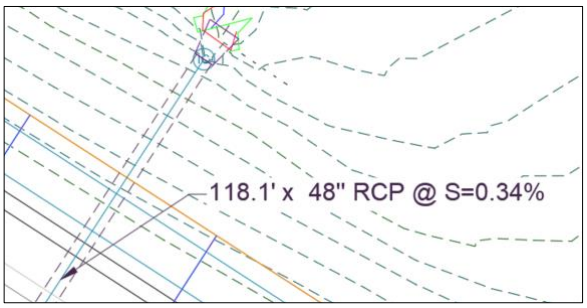




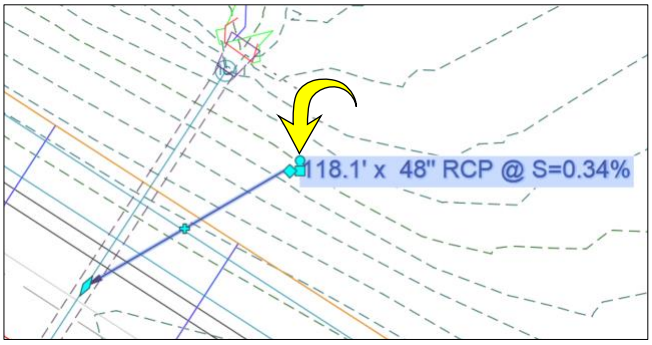


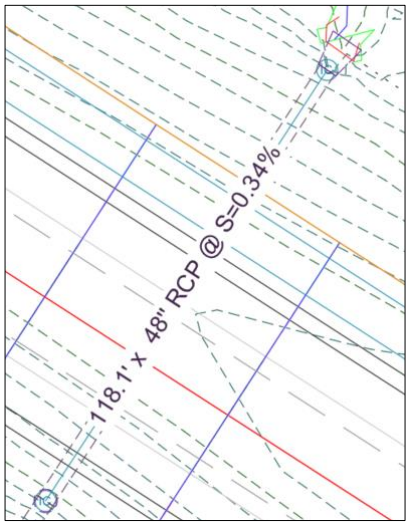
Step 4: **Press** **Esc** to deselect all objects, **select** the **pipe label**, **drag** the pipe label using the **square** grip.



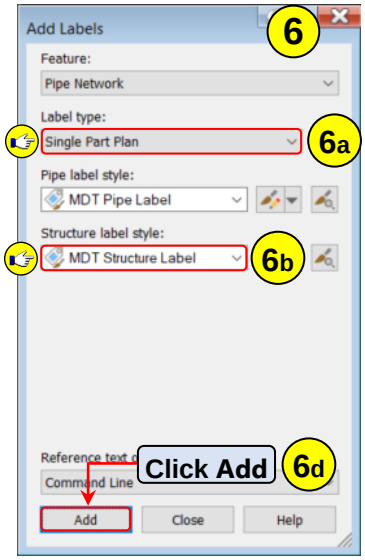


Step 5: **Click** the **circle grip** to reset the label position, **press** **Esc** to deselect the pipe label.

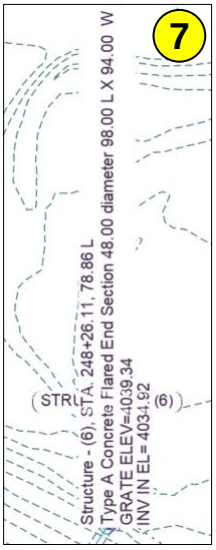




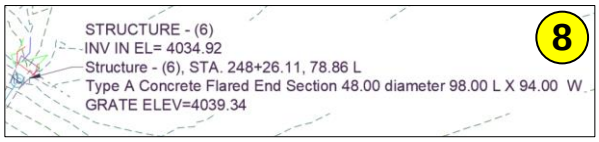
Step 6: On the Add Labels dialog box, **select** **Single Part Plan** for the Label type, **select** **MDT Structure Label** for the Structure label style, **click** **Add**.



Step 7: **Select** the **existing Flared End Section** when prompted to Select structure or pipe.

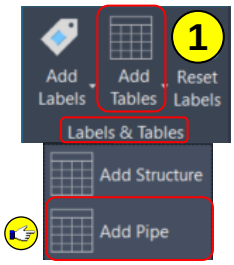


Step 8: **Select** the **structure label**, **drag** the structure label using the **square** grip.



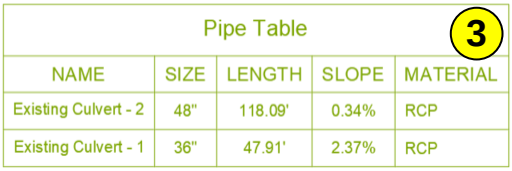
Creating a Pipe Network Table

Step 1: **Select** the 48" **Existing Culvert – (1)** pipe, **navigate** to **Labels & Tables** panel, **select Add Table**, **select Add Pipe**.

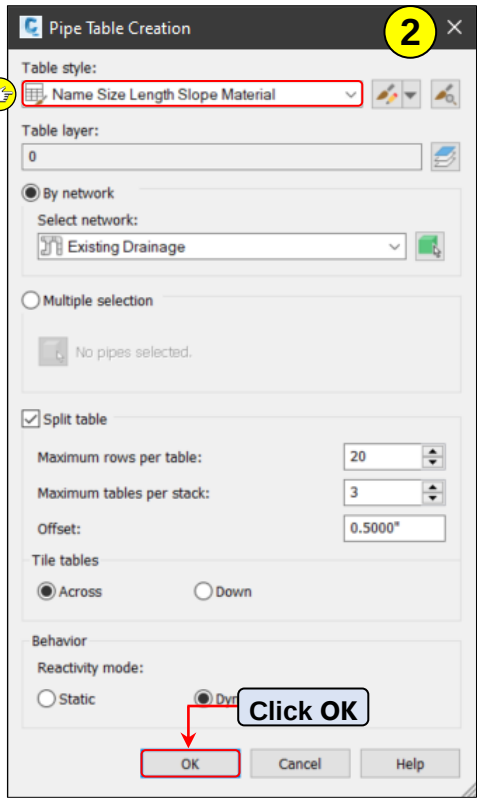


Step 2: On the Pipe table Creation dialog box, **select Name Size Length Slope Material** from the Table style, **click OK**.

Step 3: When prompted to Select upper left corner, **select** a **point** in the drawing to insert the table.



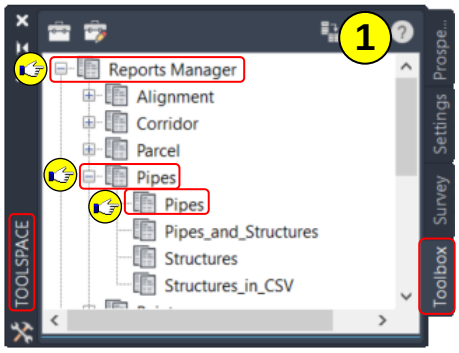
Pipe Table				
NAME	SIZE	LENGTH	SLOPE	MATERIAL
Existing Culvert - 2	48"	118.09'	0.34%	RCP
Existing Culvert - 1	36"	47.91'	2.37%	RCP

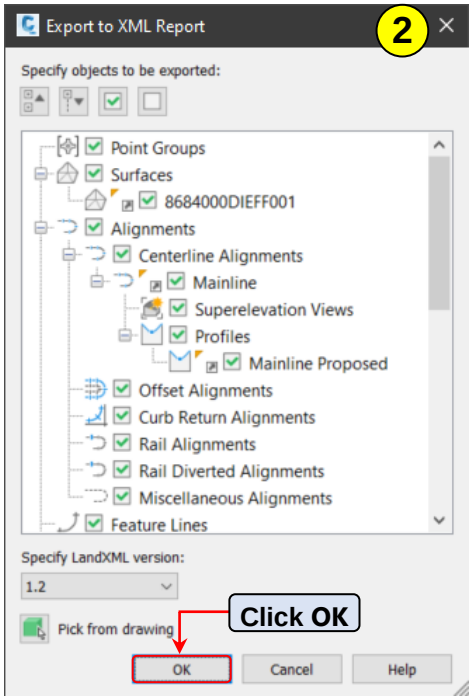


Producing Pipe Network Reports

Step 1: **Navigate** to TOOLSPACE > **Toolbox** tab, **expand** **Reports Manager**, **expand** **Pipes**, **double click** on **Pipes**.

Step 2: On the Export to XML Report dialog box, **click** **OK**.





Step 3: In the Save As dialog box, **browse** to C:\mdtapps\Autodesk_Training**202-C3D Fundamentals II**, **click** **Save**.

Your Company Name

123 Main Street

Suite #321

City, State 01234

Pipes Report **Client:** Client Company
Project Name: C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Working\8684000RDCULV001.dwg **Project Description:**
Report Date: 9/2/2022 2:56:34 PM **Prepared by:** Preparer

Pipe Network: Existing Drainage

Name	Shape	Size (in)	Material	US Node	DS Node	US Invert (ft)	DS Invert (ft)	2D Length (ft) center-to-center edge-to-edge	% Slope
Existing Culvert - 2 (Existing Drainage)	Circular	D:48.00	RCP	Structure - (33) (Existing Drainage)	Structure - (6) (Existing Drainage)	4035.33	4034.92	118.09 118.09	0.34
Existing Culvert - 1 (Existing Drainage)	Circular	D:36.00	RCP	StartNullStruct2	Structure - (37) (Existing Drainage)	4039.24	4038.11	47.91 47.91	2.37

Pipe Network: Propose Drainage

Name	Shape	Size (in)	Material	US Node	DS Node	US Invert (ft)	DS Invert (ft)	2D Length (ft) center-to-center edge-to-edge	% Slope
Pipe - (2) (Propose Drainage)	Circular	D:48.00	RCP	StartNullStruct3	Structure - (35) (Propose Drainage)	4035.33	4036.34	34.32 34.32	-2.93

Step 4: After viewing the report, **close** the **web browser**, **save** and **close** the **drawing**.

Project Explorer

Project Explorer is an all-in-one hub for managing the contents of and extracting information from Civil 3D models. It helps users to review, validate, report, export and edit models. Project Explorer helps users to gain a better understanding of their design, and to control the distribution of geometric information more efficiently. Project Explorer functions as a central hub for managing and easily accessing project data. Here are a few of the ways you can leverage Project Explorer to streamline project workflows.

- Project Explorer allows users to simplify access and navigation to important project data
- Simplify project data navigation, review, and design model editing.
- More easily discover and evaluate design criteria warnings to help meet design standards.
- Efficiently generate custom reports and tables that help meet delivery requirements.

Project Explorer is located on the Home tab of the ribbon >

User Interface (UI) and Navigation

Project Explorer Window

The ***modeless*** live operation of the Project Explorer window allows users to work both in C3D and Project Explorer, moving freely between both. The Project Explorer window displays live geometric project data from the active Civil 3D model. When project data is modified or added to the model, the content displayed in the Project Explorer window will automatically update. To offer greater control over how project data displays in the window, you can customize the window. By selecting an element in the Project Explorer window and pressing the ***CTRL*** button, you can highlight the element in the C3D workspace. To offer greater control over how project data displays in the window, a template-based approach is used to customize the window.

Using dynamic profile and section views in Project Explorer can aid in the design and review process more efficiently. Additionally, support for multiple object editing can help to streamline the process of making multiple design changes in Civil3D.

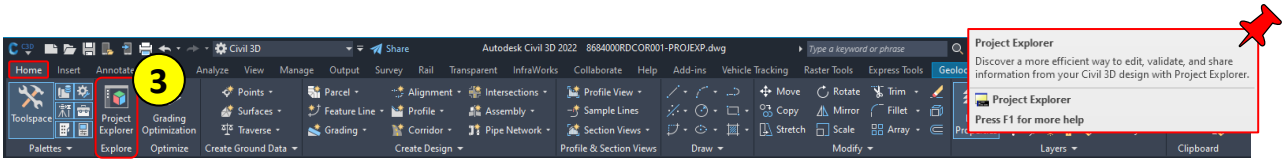
Step 1: Using your preferred method > **Navigate** to and **open** **8684000RDCOR001-PROJEXP.dwg**

- C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II**Working**

Select OK if prompted to use Online Maps.

Step 2: **Save-as** and **Name** the drawing: **8684000RDCOR001-PROJEXP-USER INITIALS.dwg**

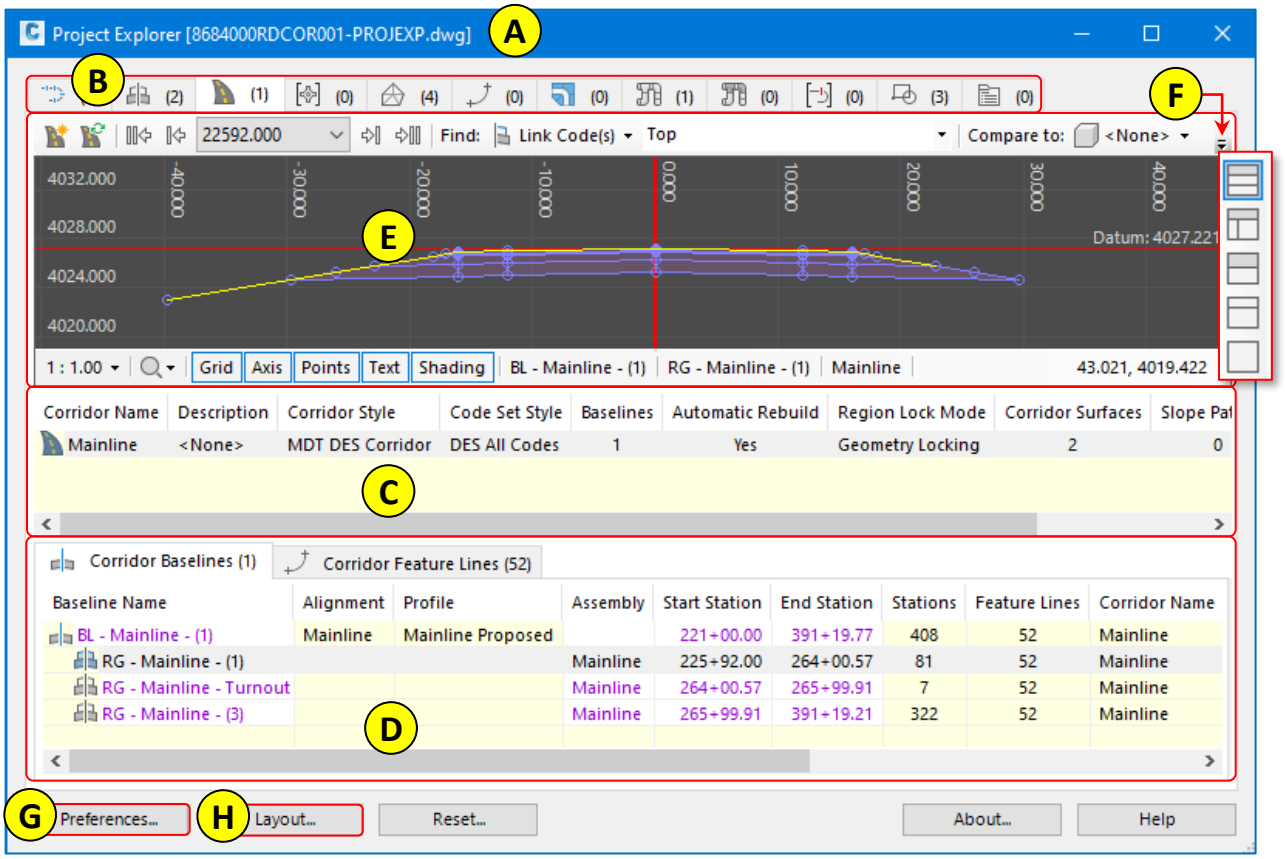
- C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II**Working**



Step 3: **Navigate** to the **Home** tab > **Select** **Project Explorer**.

The Project Explorer window will remain open until closed by the user or C3D is closed.

Before getting started with any model edits, let's first **review** the **Project Explorer** window to become familiar with the User Interface (UI).



Depending on the active object type, the main layout is generally divided into two or three panes.

A. Project Explorer window.
B. Object Category Type tabs.
C. Object List pane.
D. Sub-object Lists pane.
E. Profile or Section View pane.
F. Pane Layouts (used to control layout of individual panes).
G. Preferences (controls color, scaling, fonts, etc).
H. Layout Options (control both data displayed and report layout).

Object Category Type: Number in **( )** (2) indicates number of individual objects in model.

The ***middle*** mouse button can be used for panning and scrolling in the Profile or Section View pane same as in Civil 3D.

Columns can be sorted and repositioned as desired.

- Click-n-Drag on column header to reposition.
- Click on column header to sort data per column data.

Multiple items (rows) can be selected using left-click+Shift or left-click+Ctrl.

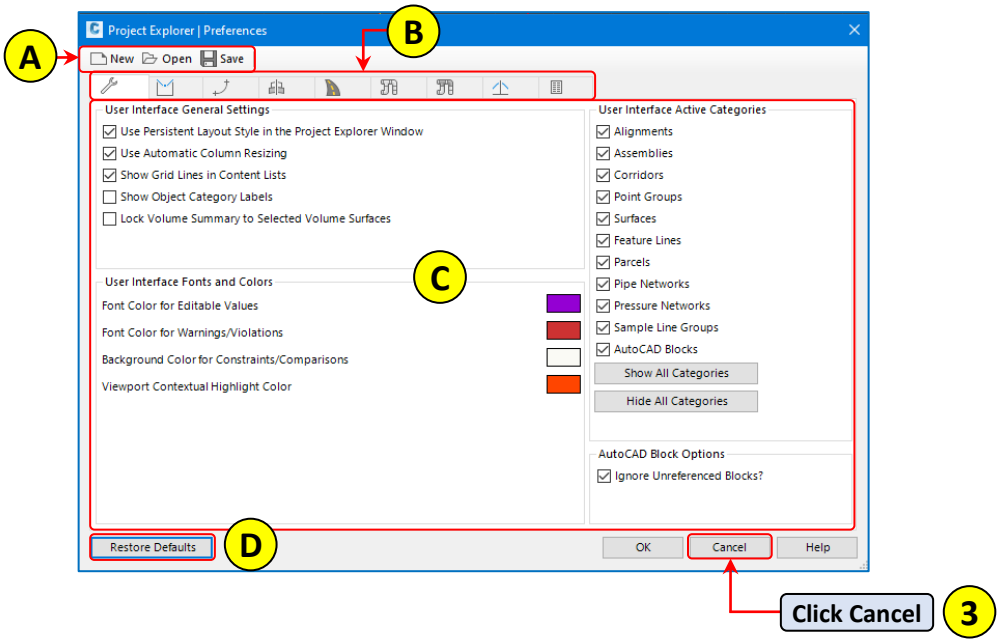
Preferences and Layout Options

The Project Explorer Window and related layout panes are fully customizable. The available customization options are divided into two types, Preferences and Layout Options. Access to the settings and parameters for both are in the lower left corner of the main Project Explorer window.

Step 1: From the **Project Explorer** window > **Select Preferences**…

Step 2: From the Project Explorer **Preferences** dialog box, **review** the available settings.

Parameters in the Preferences dialog box control the graphical display of all user interface items not directly associated with the layout of columns and the generation of reports.



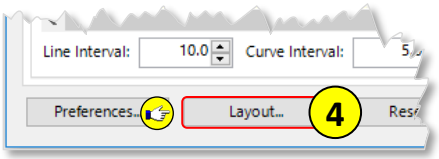
A. Preference controls for creating new, opening exiting, and saving user set preferences.

B. Tabs for General and Object specific preferences.

C. Parameters of current selected tab that can be adjusted.

D. Restore Defaults > resets all parameters to default settings.

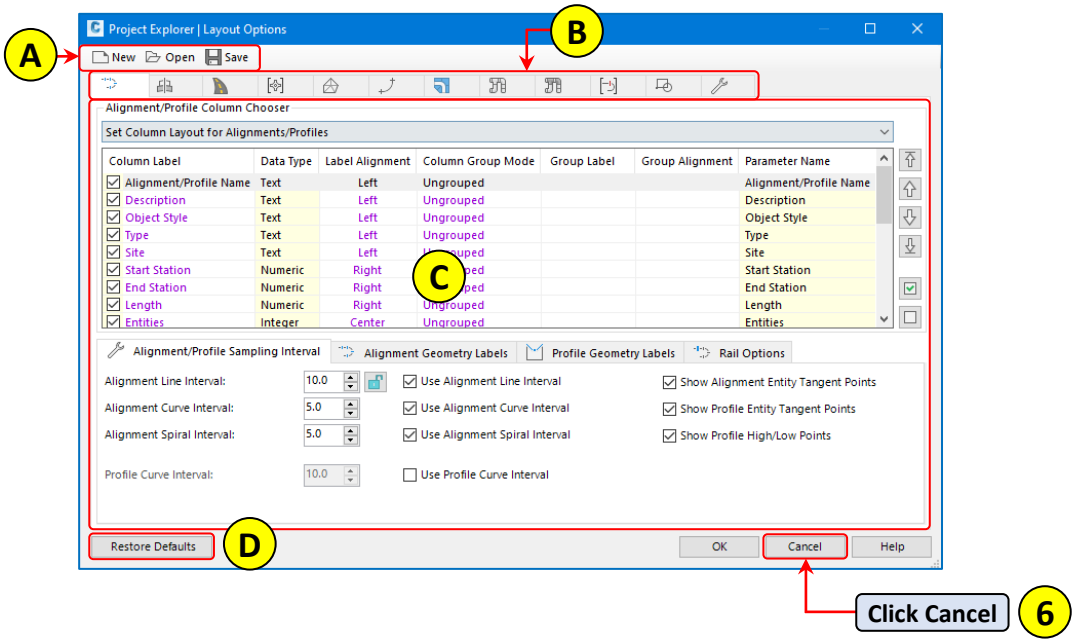
Step 3: **Click Cancel**.



Step 4: From the **Project Explorer** window > **Select Layout**…

Step 5: From the Project Explorer **Layout Options** dialog box, **review** the available settings.

Parameters in the Layout Options dialog box provide control for the Project Explorer window and control for reports. The parameters for the Project Explorer window and reports work independently from the other allowing specific parameters to be set for the working display, and reports. Furthermore, parameters can be set for each type of object.



A. Preference controls for creating new, opening exiting, and saving Layout Styles.

B. Tabs for General and Object specific preferences.

C. Parameters of current selected tab that can be adjusted.

D. Restore Defaults > resets all parameters to default settings.

Step 6: **Click** **Cancel**.

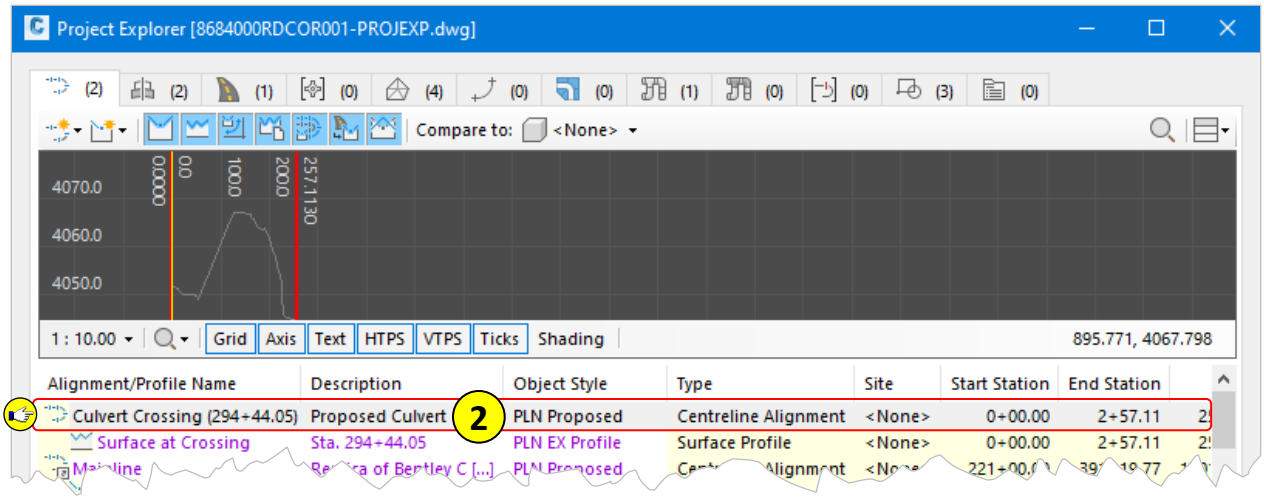
Reviewing and Editing Object Data

Changes and edits to a C3D model can be made directly through the Project Explorer window.

- Values with the text color ***purple*** and white background are editable values.
- Values with the text color ***red*** and shield are flagged as a warning and or in violation.
- **Double-click** on any editable parameter to revise the value.
- **Right-click** a selection of objects will provide access to a limited range of editable parameters.
- Use of the available dedicated tools specific to the object selected, such as edit Pipe Run.

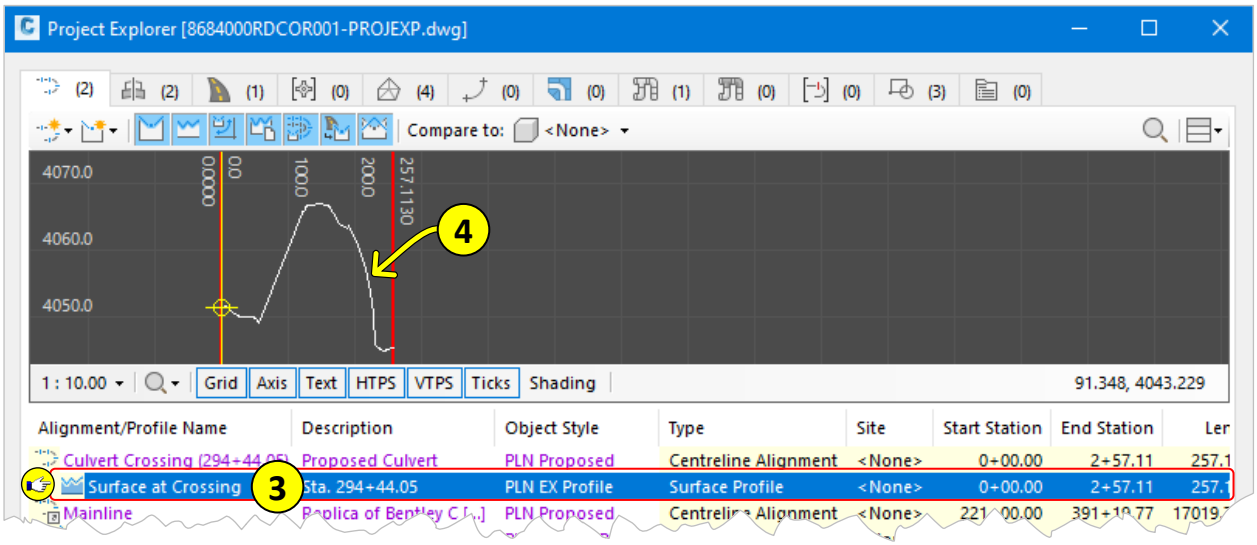
Reviewing Object Data

Step 1: From the **Project Explorer** window > **Select** the **Alignments** object tab.



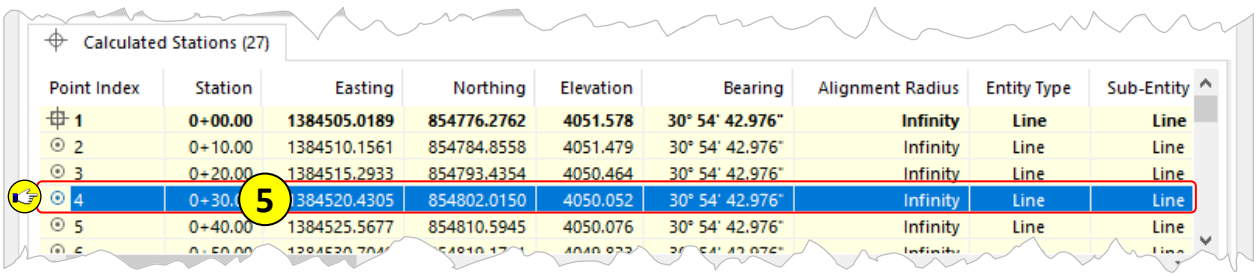
Step 2: From the **Project Explorer** window > Object List pane > **Select** **Culvert Crossing (294+44.05)**.

	Alignment Objects are not displayed in the Profile / Section View pane. Selected Alignment Objects only display the alignment stationing.

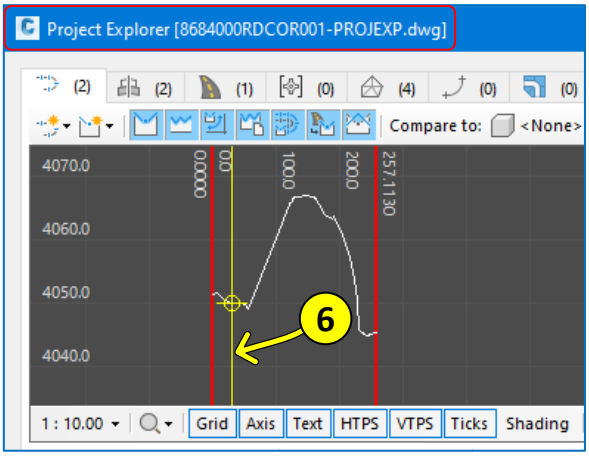


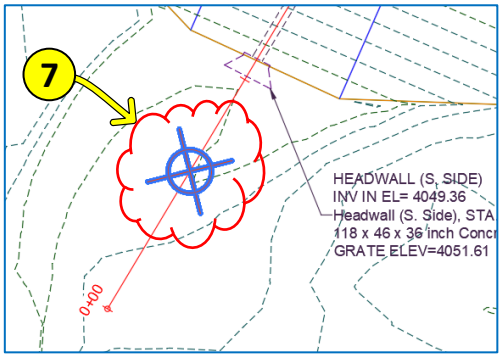
Step 3: From the **Project Explorer** window > Object List pane > **Select** the **Surface at Crossing** profile.

Step 4: From the **Project Explorer** window > Profile View pane > **See** the highlighted **profile**.



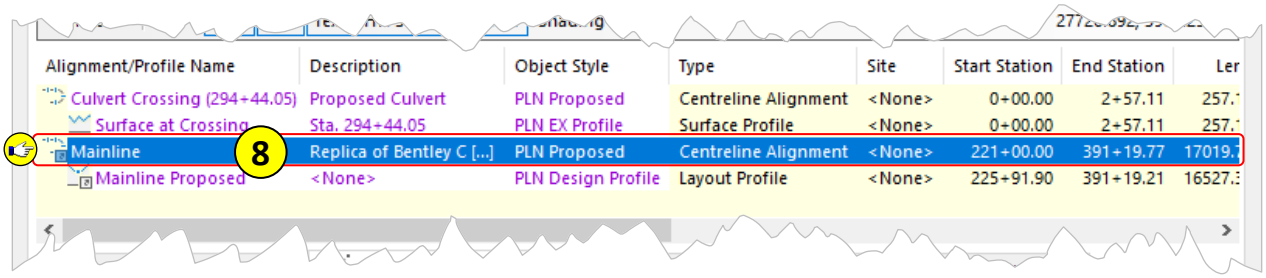
Step 5: From the **Project Explorer** window > Sub-object Lists pane > **Select** any **Calculated Station**.



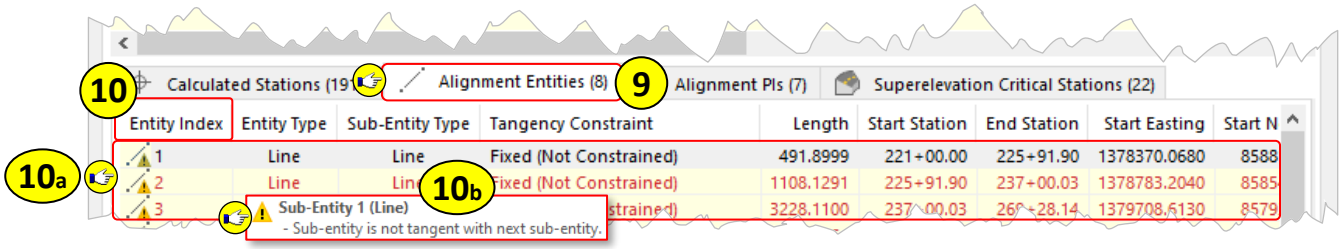


Step 6: From the **Project Explorer** window > Profile View pane > **See** the highlighted **station**.

Step 7: From the **Project Explorer** window > Sub-object Lists pane, with any Calculated Station selected > **Press Ctrl** key > While **pressing** the **Ctrl** key > From Model space > **See** the highlighted **station**.



Step 8: From the **Project Explorer** window > Object List pane > **Select** the **Mainline** alignment.

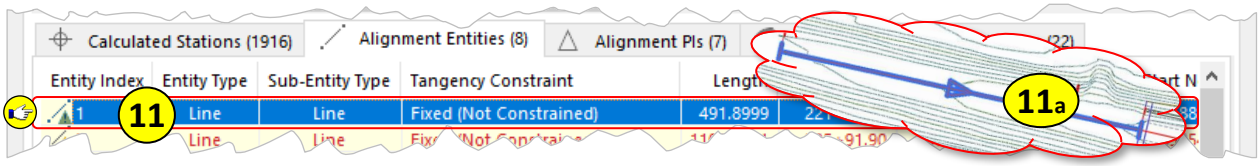


Step 9: From the **Project Explorer** window > Sub-object Lists pane > **Select** the **Alignment Entities** tab.

Step 10: From the **Alignment Entities** tab > **Review** the **Entity Index** column.

a. **Notice** some **Alignment Entities** are displayed in ***red*** with a warning symbol.

b. **Hover** over **Entity 1** > **See** the **Warning Pop-up** > **Sub-Entity 1 (Line)**.

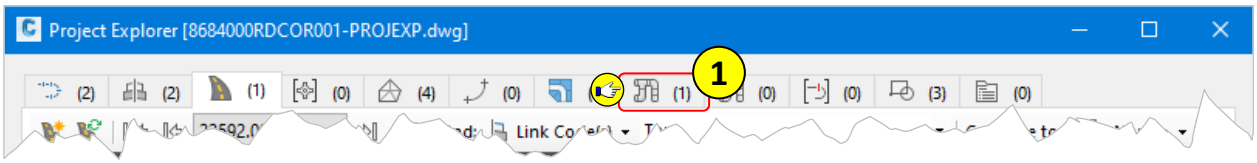


Step 11: From the **Alignment Entities** tab > Sub-object Lists pane > **Select Entity 1** > **Press Ctrl** key.

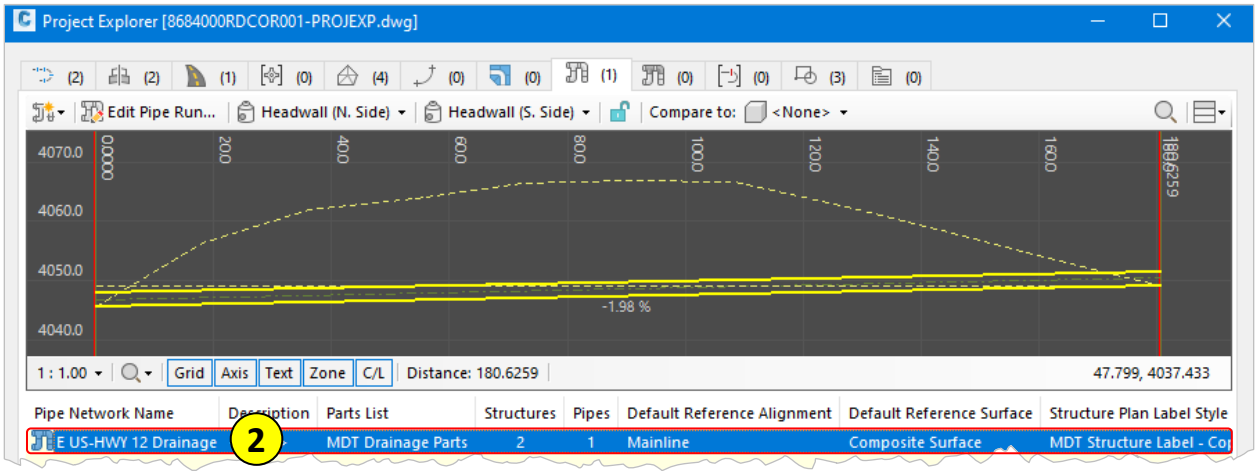
a. While **pressing** the **Ctrl** key > From **Model** space > **See** the highlighted **Alignment Entity**. (The **right-click** menu can be used to Zoom or Pan to the selected entity.)

Editing Object Data

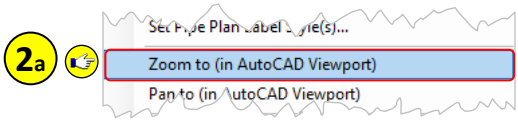
Not only can a C3D object be viewed in Project Explorer, but some parameters can also be edited. The edits in Project Explorer will automatically update the Civil 3D objects in the drawing model.



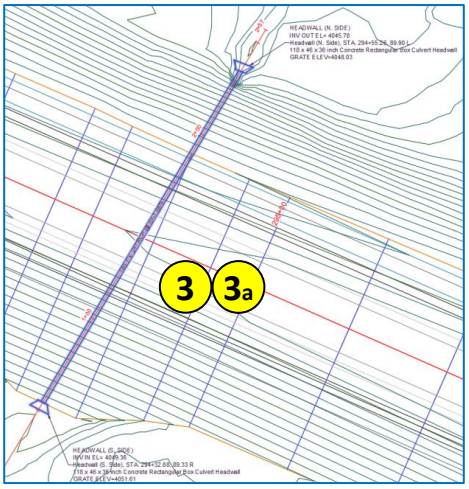
Step 1: From the **Project Explorer** window > **Select** the **Pipe Networks** object tab.



Step 2: From the **Project Explorer** window > Object List pane > **Right-click** on **E US-HWY 12 Drainage**.



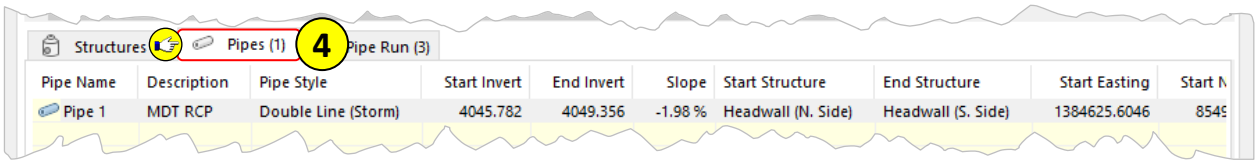
a. **Select Zoom to (AutoCAD Viewport)**.



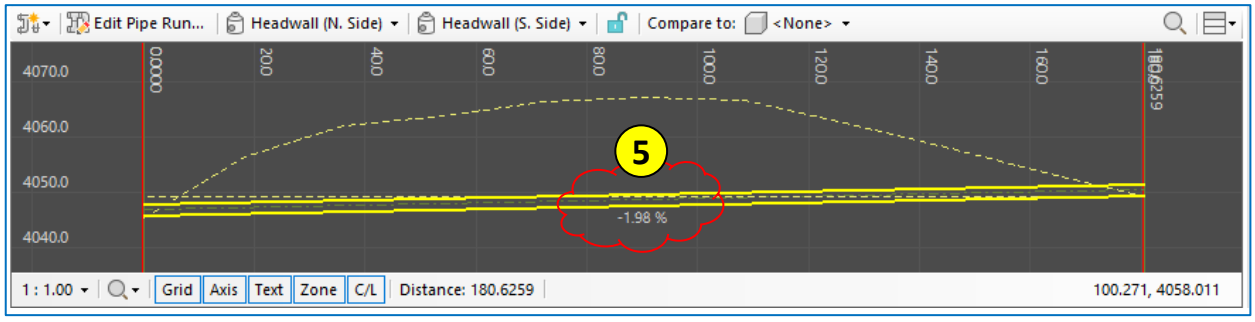
Project Explorer Keyboard Shortcuts	
Z	Zoom to selected object.
P	Pan to selected object.
S	Select the selected object.
C	Clear or de-select current selection.
A (or E)	Open C3D Properties for selected object.
CTRL	Temporarily highlights selected object.
CTRL A	Select all items in list.
CTRL C	Copy selected list items to clipboard.

Step 3: From **Model** space > **See** the **E US-HWY 12 Drainage** pipe network.

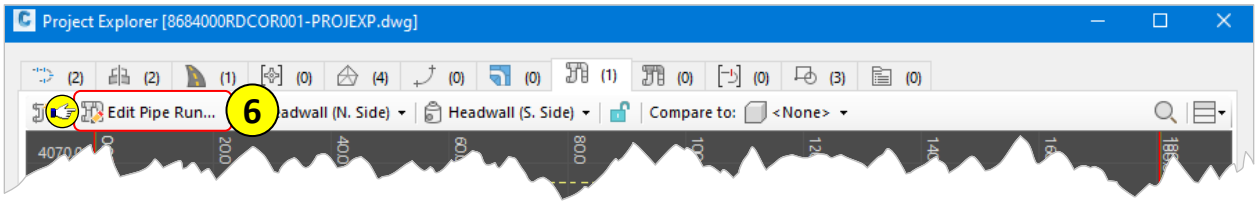
a. With the **Pipe Network** object still selected in the **Object List** pane > **Press** the **Ctrl** key > From **Model** space > **See** the highlighted **Pipe Network** objects.



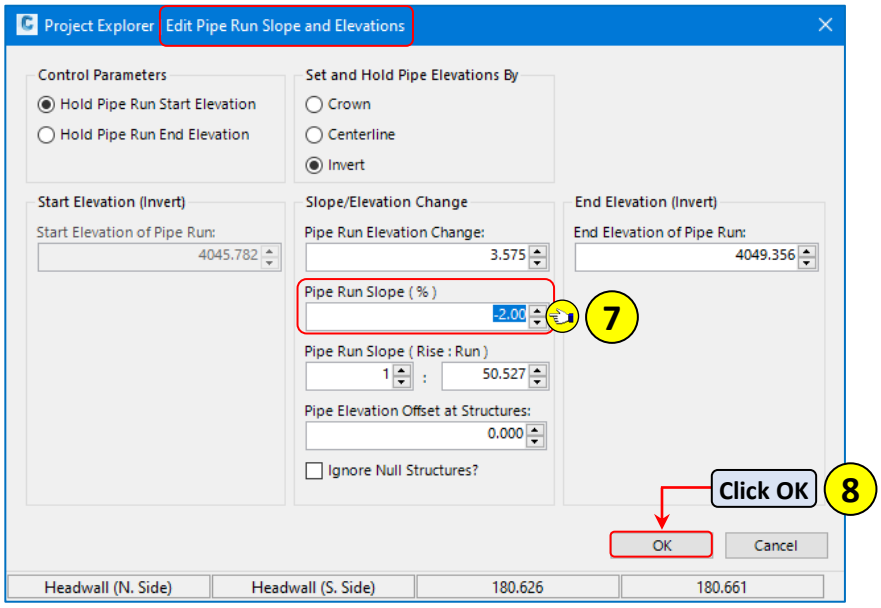
Step 4: From the **Project Explorer** window > Sub-object Lists pane > **Select** the **Pipes** tab.

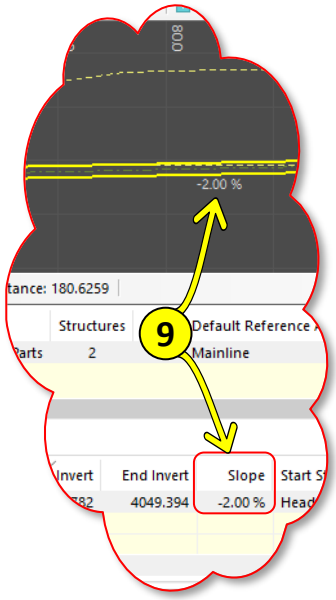


Step 5: From the **Profile View** pane > **See** the **highlighted pipe** and existing **Pipe Run Slope**.



Step 6: Using the available tools above the **Profile View** pane > **Select** **Edit Pipe Run**…





Step 7: From the **Edit Pipe Run Slope and Elevations** dialog box > **Revise** the **Pipe Run Slope** to **-2.00**

Step 8: **Click** **OK**.

Step 9: From the **Project Explorer** window > **Profile View** pane & **Sub-Object Lists** pane > **See** the highlighted pipe and **updated** Pipe Run Slope.

Generating Tables and Reports

Tables and Reports

Project Explorer can quickly generate tables, reports, and spreadsheets from project data. The workflow is fully template driven using Layout Styles, Table Styles, and Report Styles. The Quick Report Window can be used to generate reports and spreadsheets.

Quick vs. Object Sets

It is important to understand the difference between generating a *Quick* report and or table verses generating a report and or table using *Object Sets*.

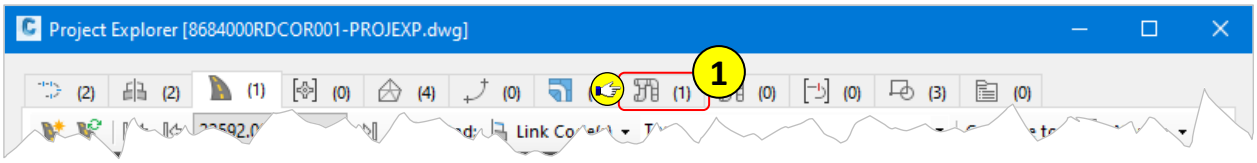
- **Quick** =

  Static operation capturing current state of model object. Not dynamically linked to C3Dobject.

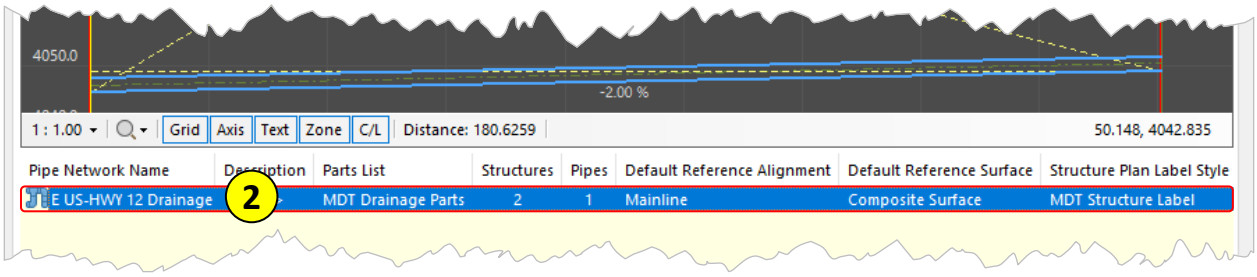
- **Object Sets** =

  Dynamic operation providing real time updates to tables when C3D source object geometry is adjusted. Provides more user control over content, scope, and layout of tables and reports. Tables and reports can be generated quickly using predefined settings from the Object Set. The is no limit to the number of Object Sets that can be saved. Any Object Set created follows the drawing file, so anyone with access to the drawing and Project Explorer can utilize the same Object Set.

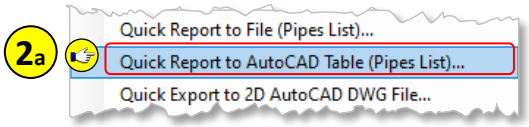
Tables using Quick Report



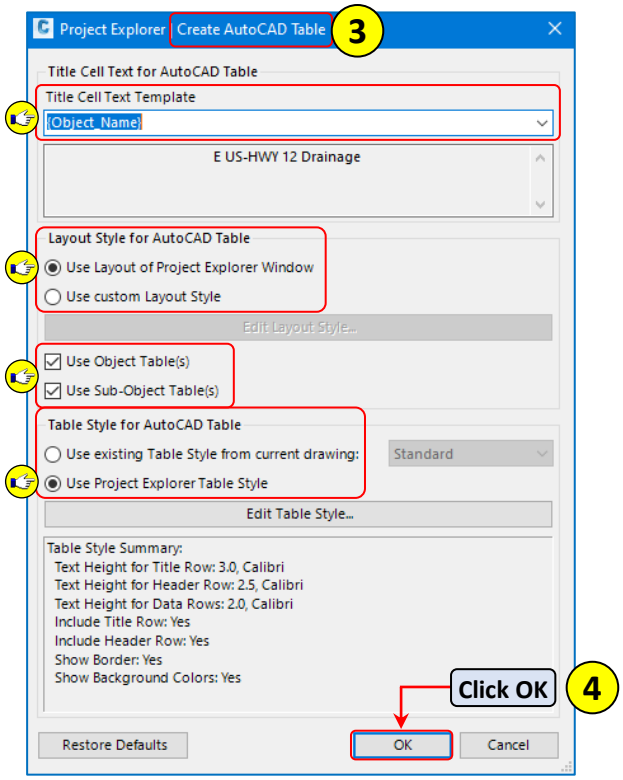
Step 1: From the **Project Explorer** window > **Select** the **Pipe Networks** object tab.



Step 2: From the **Project Explorer** window > Object Lists pane > **Right-click** on **E US-HWY 12 Drainage**.



a. **Select Quick Report to AutoCAD Table (Pipes List)**…



When generating an AutoCAD table, there two key parameters that are needed to define the layout and format of the created table.

Layout Style: Required to define the layout, format, heading name, and what columns and values are visible.

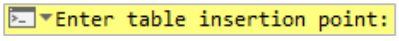
Table Style: Required to define the table border color, font type and size, cell margins and general visual style for table.

Step 3: From the **Create AutoCAD Table** dialog box > **Accept** all default settings:

- **Title Cell Template** = **{Object_Name}**
- **Layout Style for AutoCAD Table** = **Use Layout of Project Explorer Window**.
- **Use Object Table(s)** = **CHECKED**
- **Use Sub-Object Table(s)** = **CHECKED**
- **Table Style for AutoCAD Table** = **Use Project Explorer Table Style**.

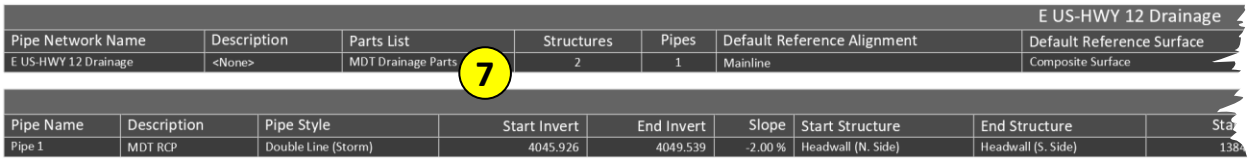
Step 4: **Click OK**

Step 5: When prompted > **Specify** an **insertion** point in **Model** space for the table.



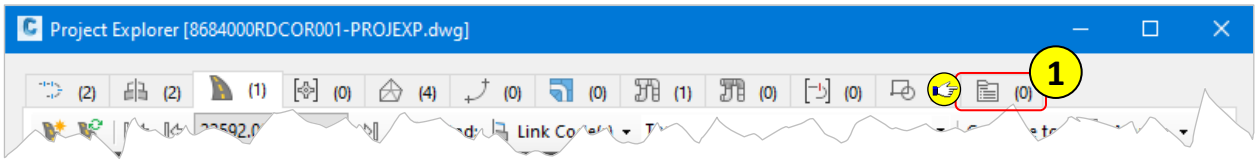
Step 6: **Press ESC** to end the table placement command.

Step 7: From **Model** space > **See** and **review** the **Quick** table.

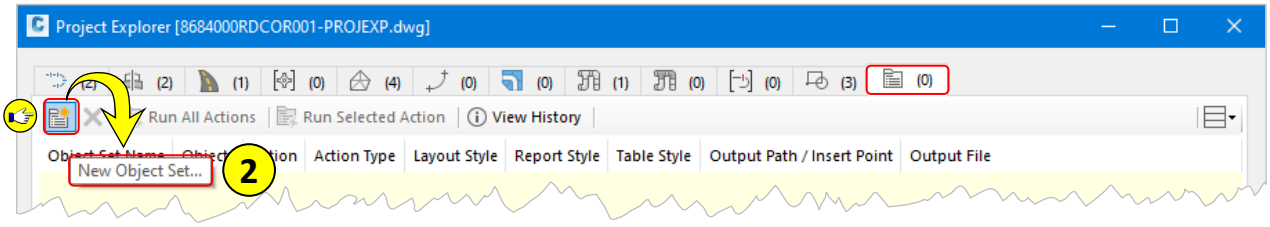


Step 8: **Save** the **drawing** .

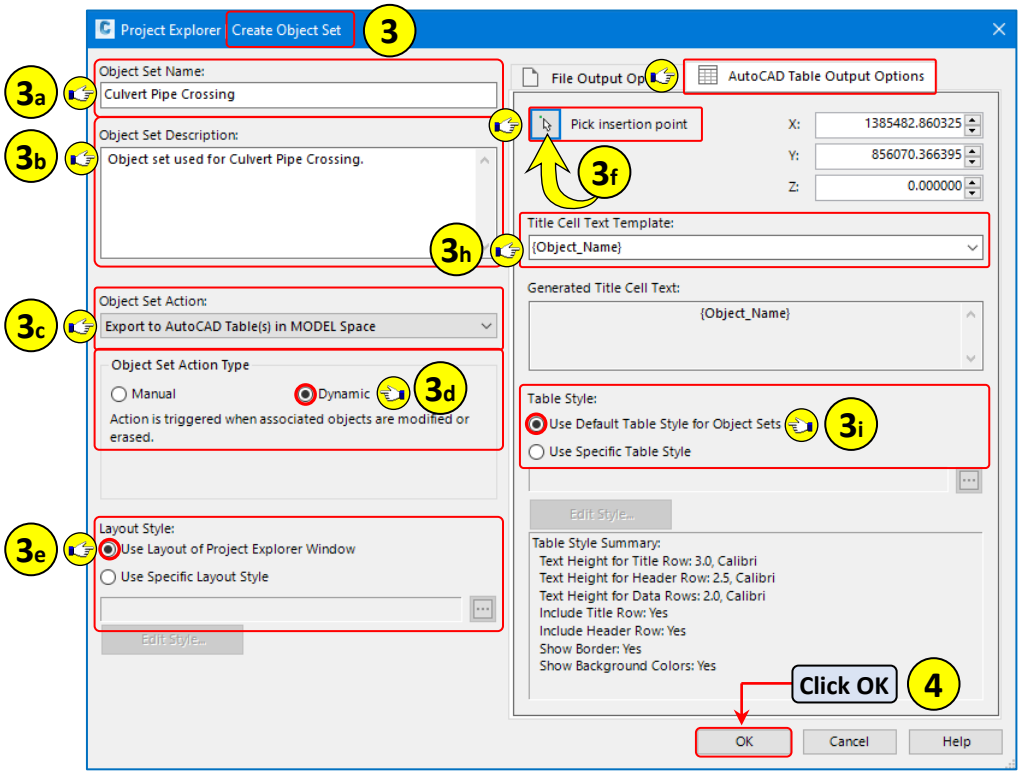
Tables using Object Sets



Step 1: From the **Project Explorer** window > **Select** the **Object Sets** tab.



Step 2: From the **Object Sets** tab > **Create** a new **Object Set** > **Select New Object Set**…



Step 3: From the **Create Object Set** dialog box > **Set** and **verify** the following **parameters**:

a. **Object Set Name** = **Culvert Pipe Crossing**

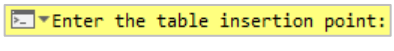
b. **Object Set Description** = **Object set used for Culvert Pipe Crossing**

c. **Object Set Action** = **Export to AutoCAD Table(s) in MODEL Space**

d. **Object Set Action Type** = **Dynamic**

e. **Layout Style** = **Use Layout of Project Explorer Window**

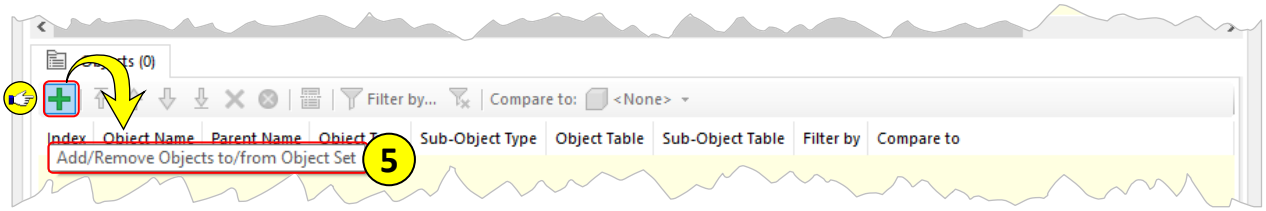
f. From the **AutoCAD Table Output Options** tab > **Select Pick insertion point**

g. When prompted > **Select** an insertion point in **Model** space. 

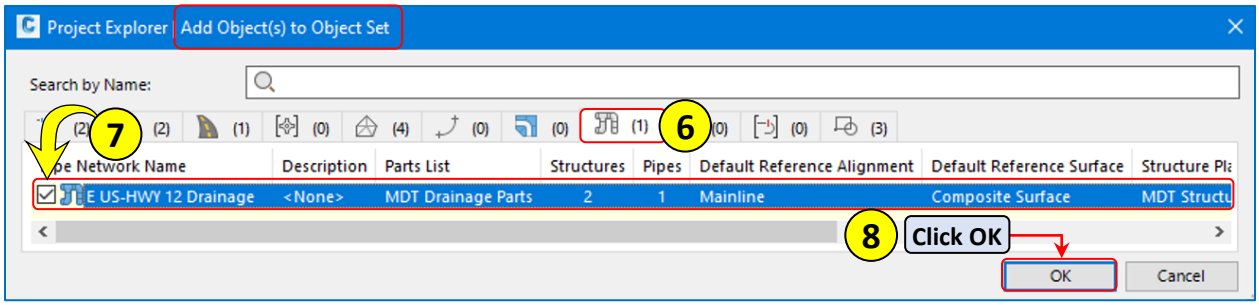
h. **Title Cell Text Template** = **{Object_Name}**

i. **Table Style** = **Use Default Table Style of Objects Sets**

Step 4: **Click OK**.



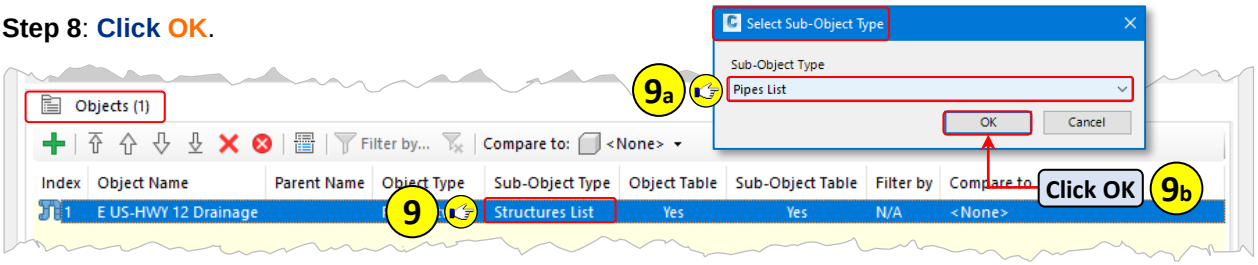
Step 5: From the **Object Sets** tab > **Object Lists** pane > **Select** **Add/Remove Objects to/from Object Set**.



Step 6: From the **Add Object(s) to Object Set** dialog box > **Select** the **Pipe Networks** tab.

Step 7: **Check** ☑ the **E US-HWY 12 Drainage** Pipe Network.

Step 8: **Click OK**.



Step 9: From the **Object Sets** tab > **Object Lists** pane > **Double left-click** on **Structures List**.

a. From the **Select Sub-Object Type** dialog box > **Select Pipes List** from the available types.

b. **Click OK**.

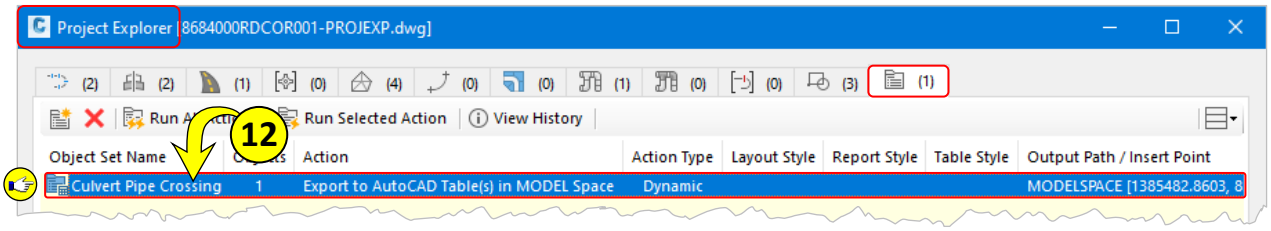
E US-HWY 12 Drainage

Pipe Network Name	Description	Parts List	Structures	Pipes	Default Reference Alignment	Default Reference Surface
E US-HWY 12 Drainage	<None>	MDT Drainage Parts	2	1	Mainline	Composite Surface

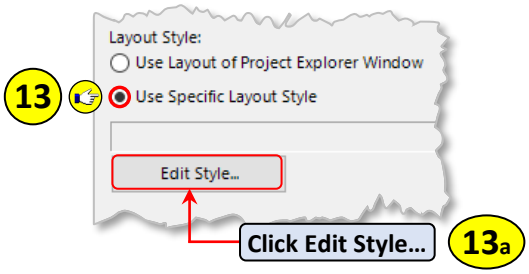
Pipe Name	Description	Pipe Style	Start Invert	End Invert	Slope	Start Structure	End Structure	Start
Pipe 1	MDT RCP	Double Line (Storm)	4045.782	4049.394	-2.00 %	Headwall (N. Side)	Headwall (S. Side)	1384

Step 10: From **Model** space > **See** and **review** the **table** inserted in the drawing.

Step 11: **Save** the **drawing** .

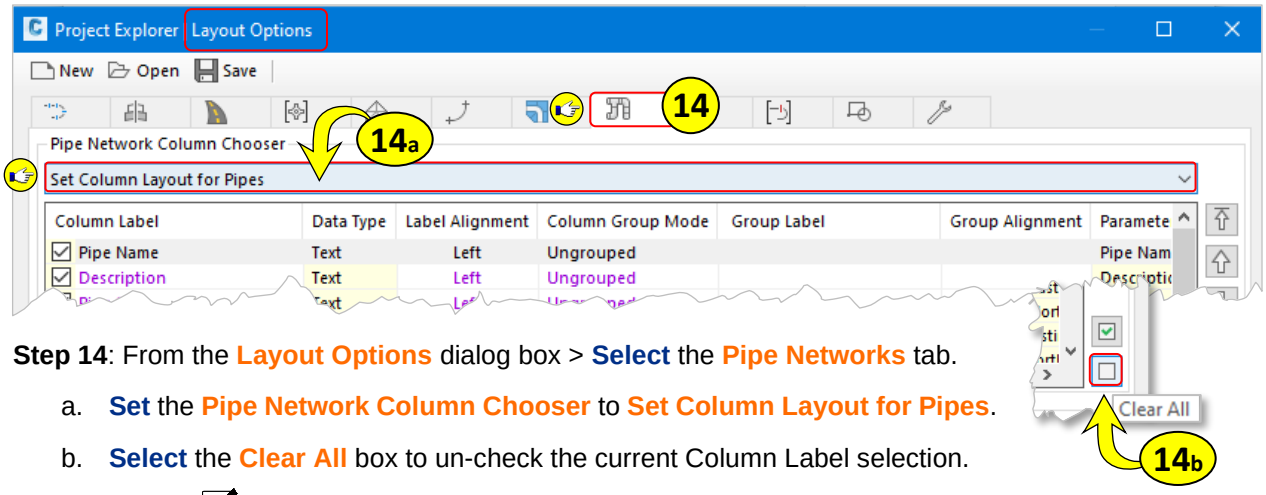


Step 12: From the **Project Explorer** window > Object Sets tab > **Double left-click** on the **Culvert Pipe Crossing** Object Set to open the **Edit Object Set** dialog box.



Step 13: From the **Edit Object Set** dialog box > Layout Style options > **Select Use Specific Layout Style**.

a. **Click Edit Style**…



Step 14: From the **Layout Options** dialog box > **Select** the **Pipe Networks** tab.

a. **Set** the **Pipe Network Column Chooser** to **Set Column Layout for Pipes**.

b. **Select** the **Clear All** box to un-check the current Column Label selection.

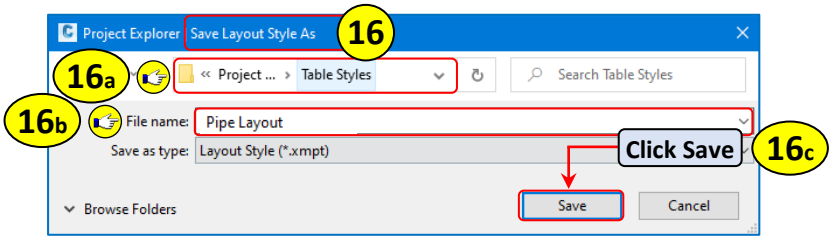
c. **Check** ☑ the following **Column Labels**:

- Pipe Name
- Description
- Part Size Name
- Start Structure
- Start Invert
- 2D Length (Center to Center)
- Slope
- End Structure
- End Invert

	Column Labels can be re-ordered using the hierarchy arrow tools found on the right side of the Layout Options dialog box.

d. **Using** the hierarchy arrow tools > **Reorder** the **Column Labels** to match the list above.

Step 15: Click OK.

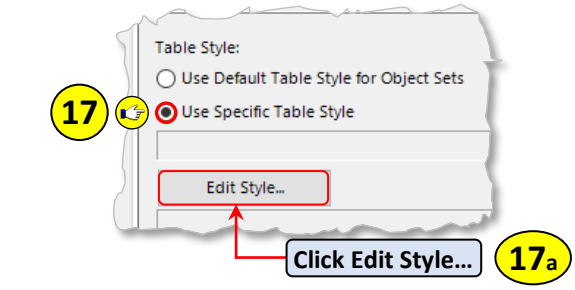


Step 16: When prompted from the **Save Layout Style As** dialog box > **Navigate** to:

a. C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Config\Project Explorer**Layout Styles**

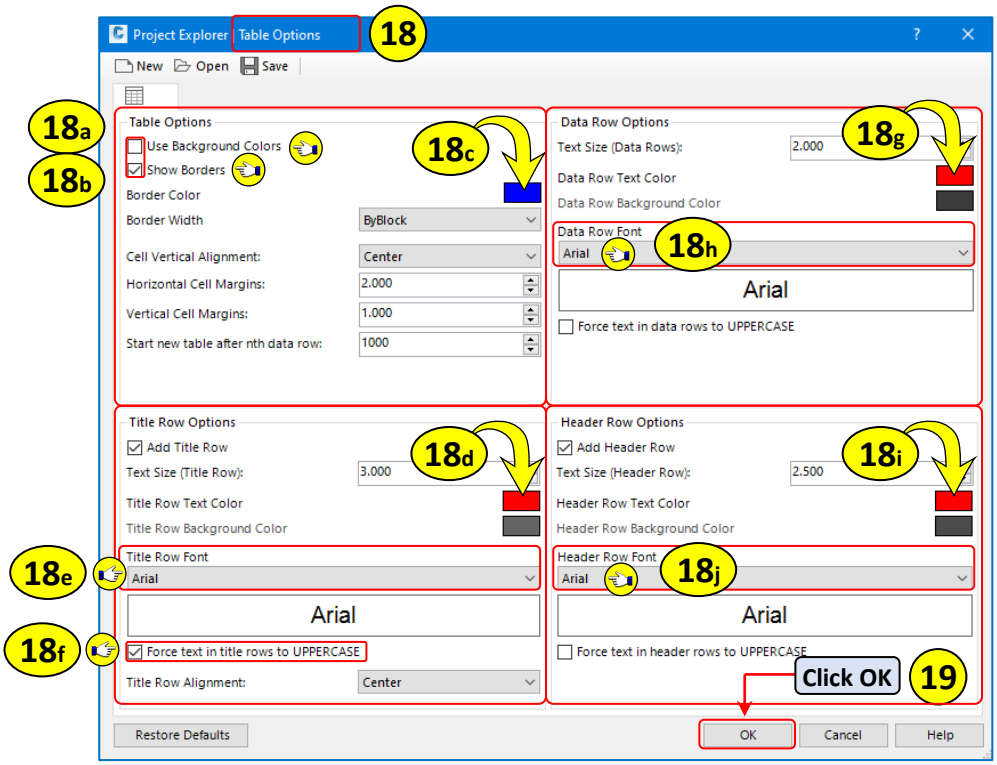
b. **Enter File Name** = **Pipe Layout**

c. **Click Save**.



Step 17: From the **Edit Object Set** dialog box > Table Style options > **Select Use Specific Table Style**.

a. **Click Edit Style**…



Step 18: From the **Table Options** dialog box > **Set** and **verify** the following **parameters**:

Table Options

a. **Use Background Colors** = **Unchecked**

b. **Show Borders** = **Checked**

c. **Border Color** = (EX: **Blue**)

Title Row Options

d. **Title Row Text Color** = (EX: **Red**)

e. **Title Row Font** = **Arial**

f. **Force text in title rows to UPPERCASE** = **Checked**

Data Row Options

g. **Data Row Text Color** = (EX: **Red**)

h. **Data Row Font** = **Arial**

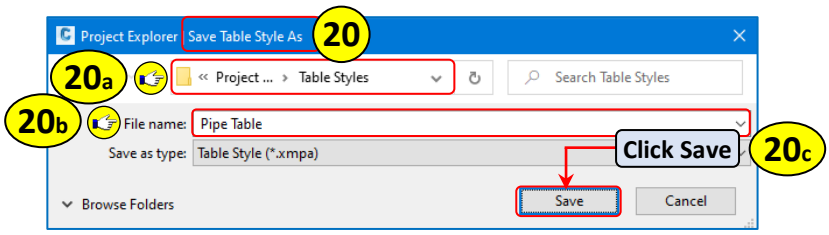
Header Row Options

i. **Header Row Text Color**: (EX: **Red**)

j. **Header Row Font** = **Arial**

*Leave ALL other defaults “As-Is”

Step 19: **Click OK**.

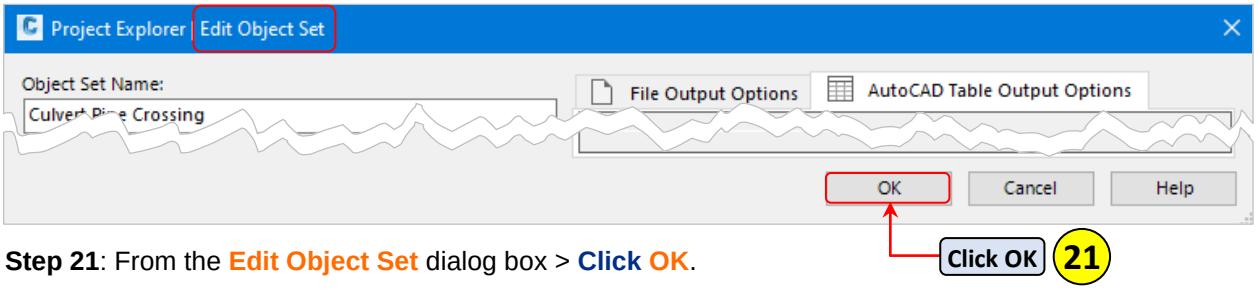


Step 20: When prompted from the **Save Table Style As** dialog box > **Navigate** to:

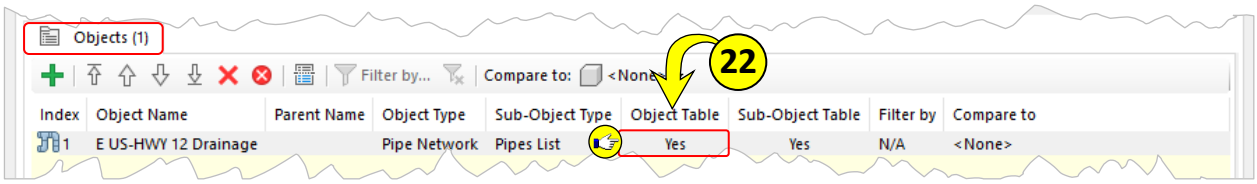
a. C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Config\Project Explorer**Table Styles**

b. **Enter File Name** = **Pipe Table**

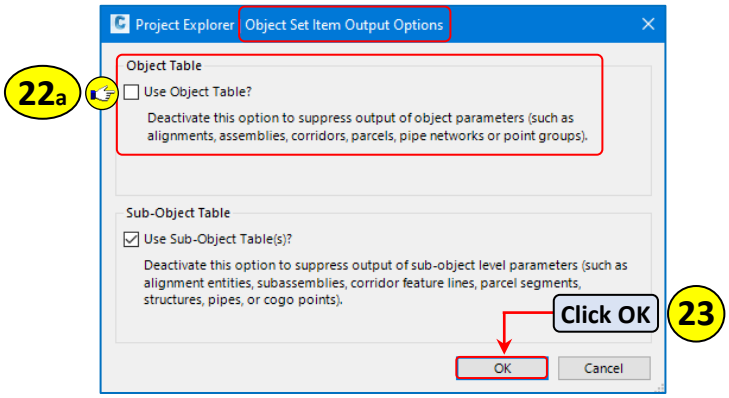
c. **Click Save**.



Step 21: From the **Edit Object Set** dialog box > **Click OK**.



Step 22: From the **Project Explorer** > **Object Sets** tab > **Object Lists** pane > **Double left-click** on **Yes**.



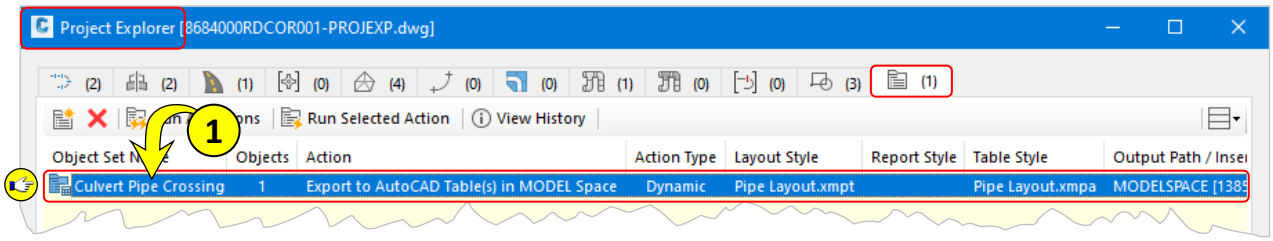
a. From the **Object Set Item Output Options** dialog box > **Uncheck Use Object Table?**

Step 23: Click OK.

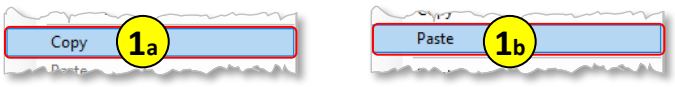
Step 24: From **Model** space > **See** and **review** the **updated table**.

	Project Explorer must be open for table updates to occur.

Reports using Object Sets

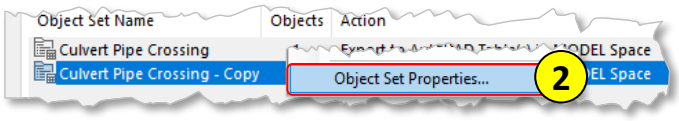


Step 1: From the **Project Explorer** window > Object Sets tab > **Right-click** on the **Culvert Pipe Crossing** Object Set.

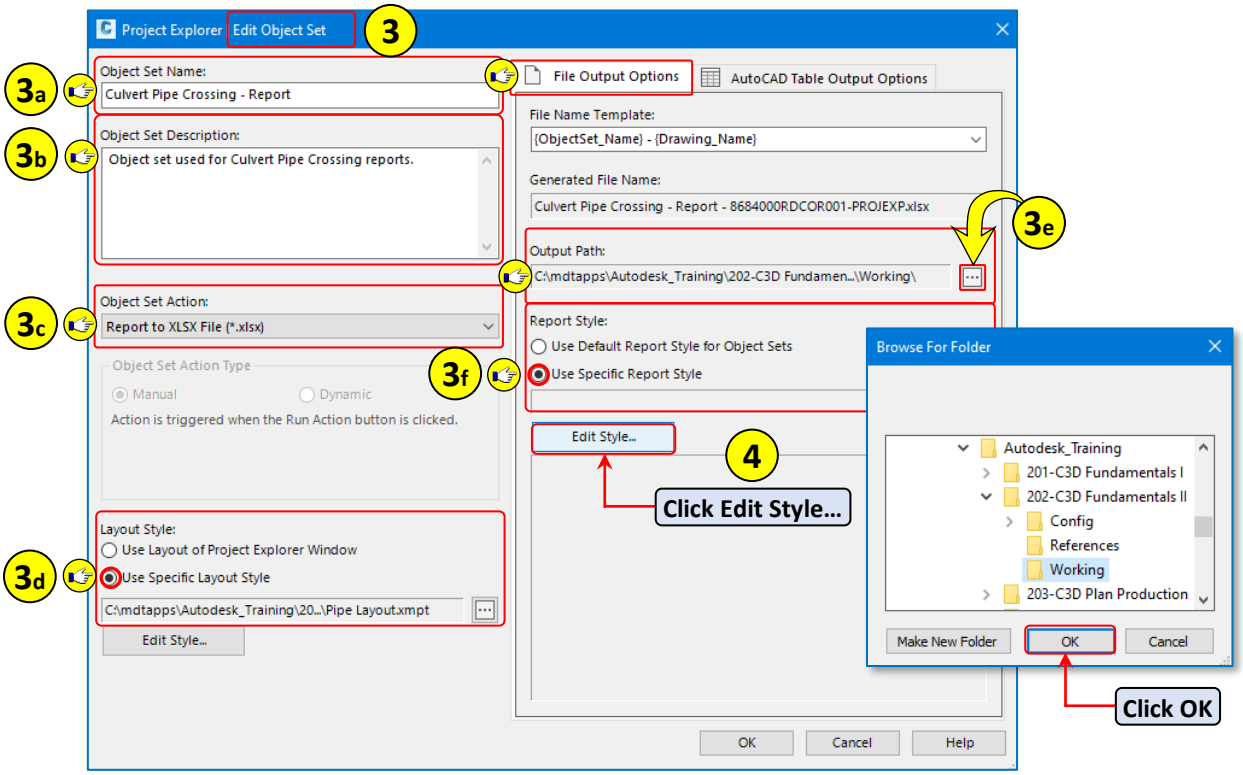


a. From the **pop-up** menu > **Select Copy**.

b. With the **Object Set** still selected > **Right-click** > From the **pop-up** menu > **Select Paste**.



Step 2: **Right-click** on the pasted **Object Set** > From the **pop-up** menu > **Select Object Set Properties**…



Step 3: From the **Create Object Set** dialog box > **Set** and **verify** the following **parameters**:

a. **Object Set Name** = **Culvert Pipe Crossing - Report**

b. **Object Set Description** = **Object set used for Culvert Pipe Crossing reports.**

c. **Object Set Action** = **Report to XLSX (*.xlsx)**

d. **Layout Style** = **Use Specific Layout Style**

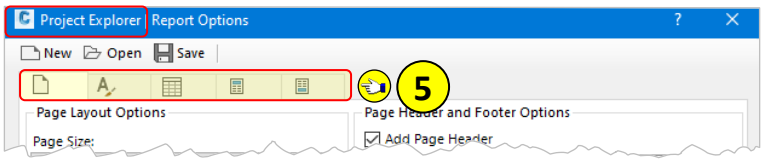
- Pipe Layout.xmpt (*previously created for use with tables*.)

From the **File Output Options** tab:

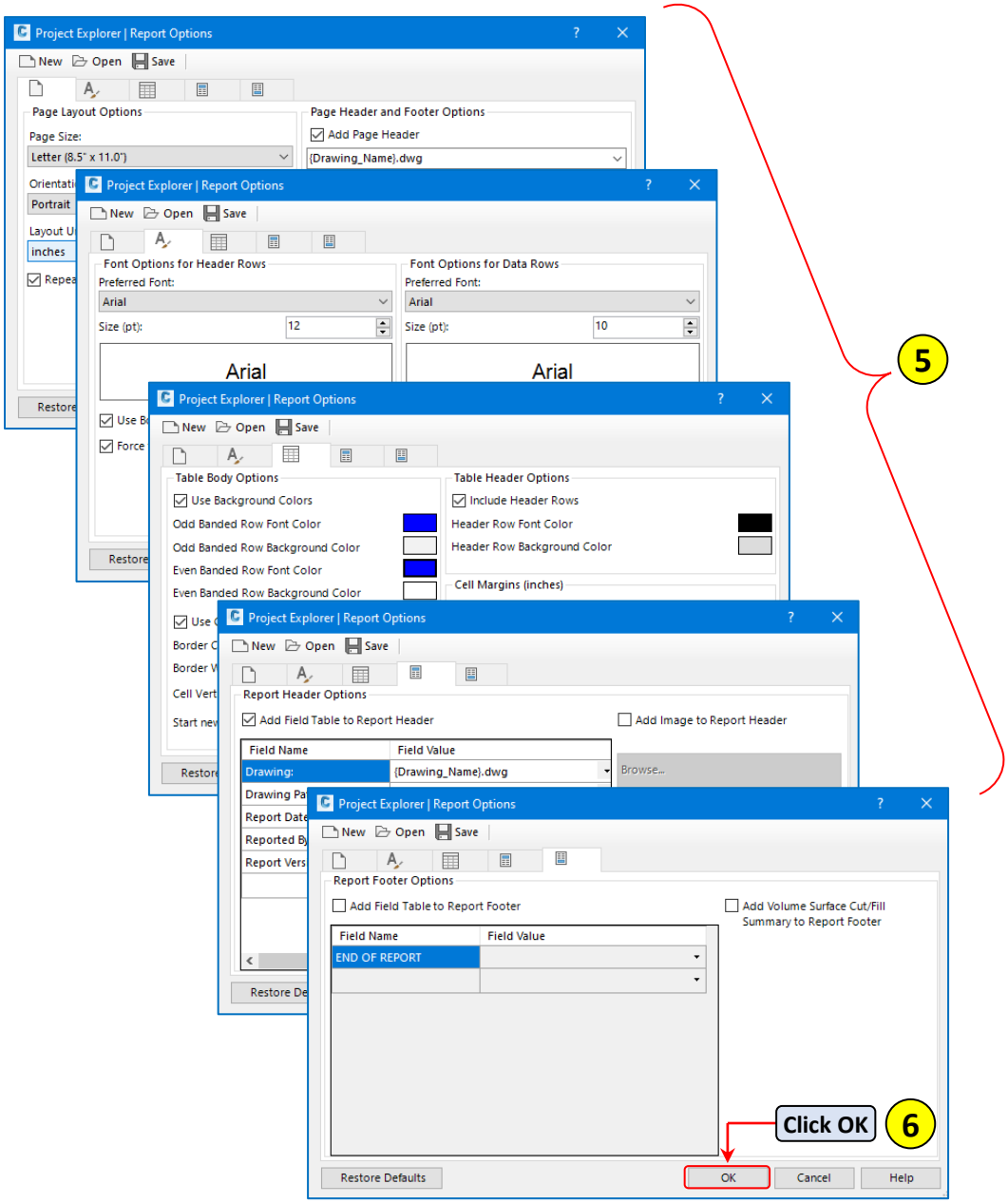
e. **Output Path** = C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II**Working**

f. **Report Style** = **Use Specific Report Style**

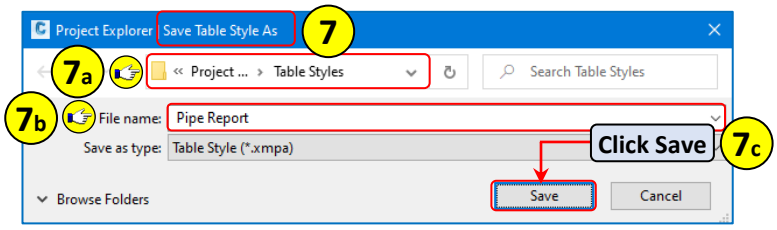
Step 4: **Click Edit Style**…



Step 5: From the **Report Options** dialog box > **Explore** the **options** and **parameters** that can be set and adjusted on each of the available tabs.



Step 6: After **setting** the **options** and **parameters** > **Click OK**.

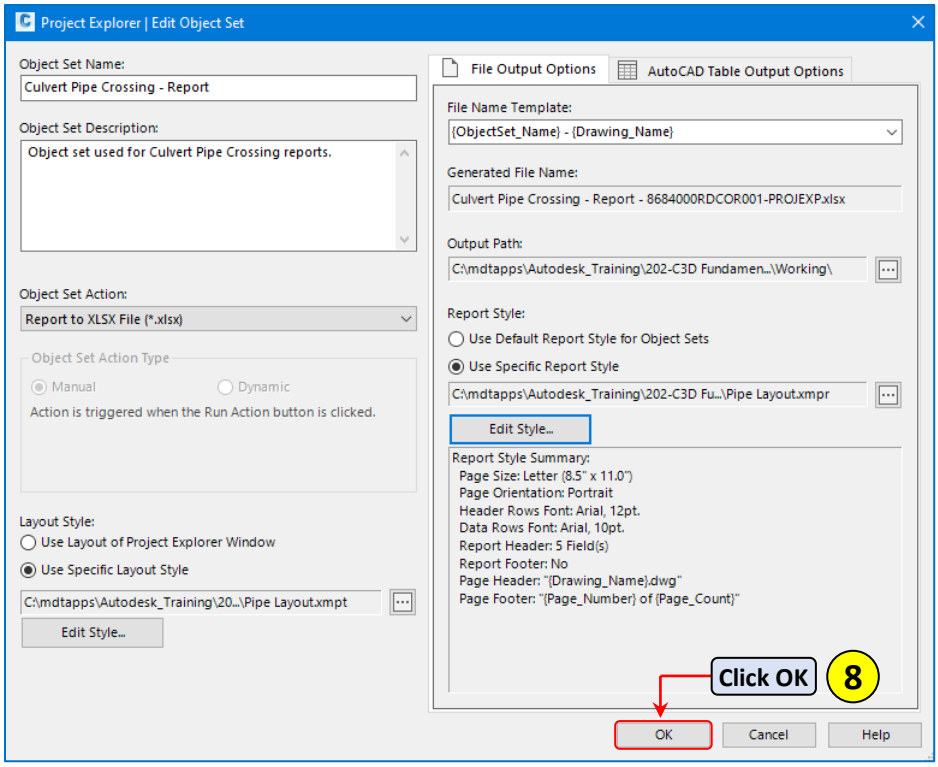


Step 7: When prompted from the **Save Table Style As** dialog box > **Navigate** to:

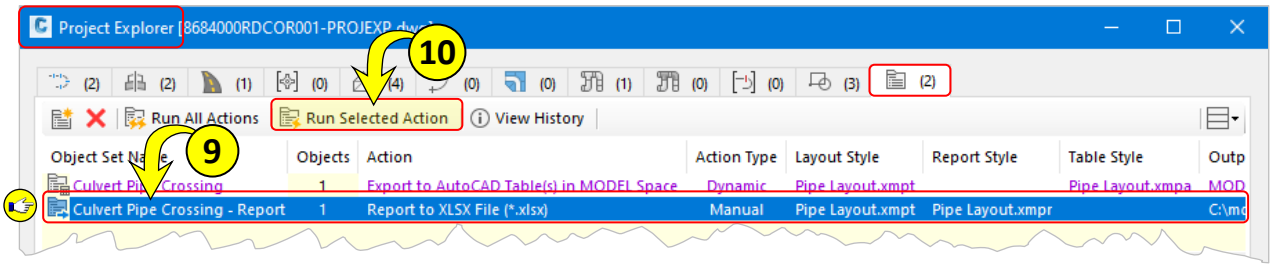
a. C:\mdtapps\Autodesk_Training\202-C3D Fundamentals II\Config\Project Explorer**Report Styles**

b. **Enter File Name** = **Pipe Report**

c. **Click Save**.

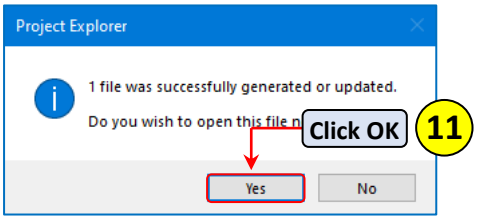


Step 8: From the **Project Explorer** > **Edit Object Set** dialog box > **Click OK**.



Step 9: From the **Project Explorer** window > Object Sets tab > **Select Culvert Pipe Crossing – Report**.

Step 10: From the **Project Explorer** window > **Select Run Selected Action**.



Reports for other Civil 3D objects can be generated following the same steps previously outlined in the **Reports using Object Sets** section.

Step 11: When prompted > **Do you wish to open this file now?** > **Click Yes**.

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PIPE NAME	DESCRIPTION	PART SIZE NAME	START STRUC
Pipe 1	MDT RCP	24" RCP	Headwall (N. Side)

Step 12: The report is generated and opens > **Review** the generated report (EX: .xlsx).

Step 13: **Save** the **drawing** .