CONNECTICUT DEPARTMENT OF TRANSPORTATION

DIGITAL DESIGN ENVIRONMENT GUIDE

CONNECT EDITION

Volume 2 - Working with Existing Data

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Table of Contents

VOLUME 2 - Working with Existing Data

Course Overview

This course will cover how to reference older Survey dgn files created in V8i as well as new CONNECT Edition survey files. The course will also teach different techniques to attach Imagery and LiDAR data. The CTDOT's default Geographic Coordinate System (GCS) is NAD 1983 State Plane Connecticut with a North American Vertical Datum of 1988. There are cases in which the Survey was created using different datums, this course will step through the process of reprojecting imported data to line up with other datums.

In this course you will also be displaying and annotating the features of an existing terrain model using the properties and terrain tools. You will learn how to work directly in both a 3D terrain model file, and in a 2D referenced file, to display features using default standards, and how to modify the default parameters to change the display. You will also learn how to display a background map and label elevations.

Skills Taught

- Referencing (older Survey dgn files created in V8i as well as new)
- Understanding Geographic Coordinate Systems
- Creating Raster Container Files
- Attaching Imagery
- Importing LiDAR Data
- Using and creating Terrains
- Re-projecting DGN files
- Connecting to GIS

Exercises and Available Working Files

Exercise 1 – Referencing the Survey File …\Active_Survey\SV_XX_0154-0128_Westbrook_ORD.dgn
Exercise 2 – Referencing Old V8i Files …\Active_Survey\SV_XX_0098_0103_Branford_GRN.dgn …\Active_Survey\SV_XX_0098_0103_Branford_ORD_Terrain.dgn
Exercise 3 – Working with Datums …\Active_Survey\SV_XX_0107_0108_Oxford_GRN.dgn …\Active_Survey\SV_XX_0107_0108_Oxford_ORD_Terrain.dgn
Exercise 4 – Attaching Imagery …\Share\Oxford*.sid
Exercise 5 – Creating a Terrain from LiDAR Data …\Share\Oxford*.las
Exercise 6 – Terrains for Drainage Analysis …\Highways\Base_Maodels\HW_CB_1234_1234_Alignments.dgn …\Highways\Base_Maodels\HW_CB_1234_1234_PerryLane_Corridor.dgn …\Highways\Base_Maodels\HW_CB_1234_1234_PerryLane_Terrain.dgn …\Highways\Base_Maodels\HW_CB_1234_1234_Route188_Corridor.dgn …\Highways\Base_Maodels\HW_CB_1234_1234_Route188_Terrain.dgn …\Highways\Base_Maodels\HW_CB_1234_1234_Super.dgn …\Share\ HW_NC_1234_1234_OxfordDrainage_ComplexTerrain.dgn …\Bridge\Base_Maodels\SB_CB_1234_1234_PerryLane_Terrain.dgn **Completed file is needed for back up** HW_CB_1234_1234_PerryLane_Terrain_Complete.dgn HW_NC_1234_1234_Oxford_TerrainFromLAS_Complete.dgn HW_NC_1234_1234_Oxford_DrainageComplexTerrain_Complete.dgn
Exercise 8 – Skills Review …\Active_Survey\SV_XX_047_0122_Ellington_3.grn …\Active_Survey\SV_XX_047_0122_Ellington_4.grn …\Active_Survey\SV_XX_047_0122_Ellington_5.grn …\Active_Survey\SV_XX_047_0122_Ellington_6.grn …\Active_Survey\SV_XX_047_0122_Ellington_ORD_Terrain.dgn …\Share\Ellington*.sid …\Share\Ellington*.las

Introduction

This volume will focus on the base set up for the civil applications OpenRoads Designer and OpenBridge Modeler. All civil engineers should have a solid knowledge base of Geographic Coordinate Systems and understand the uses of data acquisition for existing conditions. These workflows will not document each tool that is available on the interface. See the online help for commands not detailed in this document.

Survey dgn files that have been through the QC process are available for referencing in the **Active_Survey** folder in each project. Protecting the integrity of the survey information has always been a concern for CTDOT's Survey personnel. Under no circumstances shall design personnel copy the survey files out of the Active_Survey folder into their folder in the effort to edit the survey data contained in the Survey field book/terrain design file(s). The accuracy of the Survey information is the responsibility of the survey offices and therefore the original survey information shall not be edited by design personnel. If changes need to be made to the survey files, these changes shall be coordinated with the originator (Central and District Survey) of the survey data.

Terrain Creation Methods

The three methods used for creating an existing terrain in a Survey design file are as follows:

- Location Survey post-processed field data (only completed by the Survey Unit)
- InRoads DTM Conversion (only completed by the Survey Unit)
- LiDAR Data (can be created by survey or design).
  Design may use extracted LiDAR for use with non-contract files. A use case maybe to determine drainage areas that expand outside of the supplied survey.

Official Survey Deliverables

New Terrain processed with ORD fieldbook

When a new OpenRoads Location Survey is requested, the Survey Unit will use OpenRoads Designer to create a fieldbook and import field data. Survey information processed with the ORD Survey tools are written directly to the DGN file. Both the fieldbook and terrain model are embedded within the ORD design file.

This survey file is in the CTDOT WorkSet Design folder **Active_Survey.** The Survey DGN File will contain several different Models each with distinct information and uses:

2D Design Model	Annotation	Existing survey labels, Map features
2D Design Model	Boundary	ROW, Property Info, Annotation
3D Design Model	Bridge Deck	Existing bridge deck, Terrain
3D Design Model	Existing Ground Survey	Existing Survey Feature, Terrain
3D Design Model	Hydraulic Data	Hydraulic Section, FEMA floodplain data
3D Design Model	Utilities	Borings, Test pits, Utility as-builts

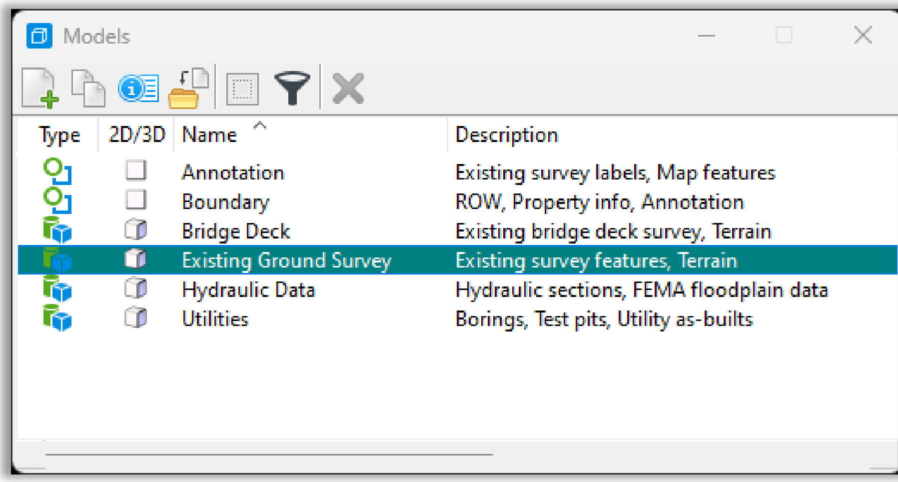

Figure 1 - Existing Survey DGN Models

Geo-Coordination

Having the correct geographic setting on your CAD file provides capabilities such as:

- Applying a background map to the view.
- Referencing other geo-located designs and raster data.
- Displaying geographic latitude and longitude.
- Entering latitude and longitude data.
- Interfacing with a Global Positioning System device to correlate your physical position with the design on a mobile computer.
- Exporting to Google Earth.

For more information on the National Geodetic Survey please visit:
http://www.ngs.noaa.gov/faq.shtml#WhatNAD

Exercise 1 – Referencing the Survey File

This exercise instructs users how to create a base model design file for a project. Base model files will reside within the project folder structure the ***…\Discipline Folder\Base_Models*** folder.

1.1 File Creation

Before attempting to open or create DGN files users should make sure the following is in place:

- The CTDOT CONNECT DDE synced through SharePoint
- The COMPASS (**Training**) Project Synced
- Go to the following files in your student folder and right click on select **Always Keep on this device**

Share\Oxford\885720_ne.las	Share\Ellington\085890_nw.las
Share\Oxford\885720_nw.las	Share\Ellington\085890_ne.sid
Share\Oxford\885720_ne.tif	Share\Ellington\085890_nw.sid
Share\Oxford\885720_ne.sid	Share\Ellington\085895_se.sid

1. Launch the Application. On your desktop double click on the **Accounting Icon**.

Figure 2 - CTDOT CAD Accounting Icon

2. On the CTDOT Accounting Menu there will be several applications to pick. In the ***Run Program*** field select the needed program:
   - **Compass OpenRoads CE** or **Compass OpenBridge CE**
   - for the Available Account select **OVERHEAD** for training proposes.
   - Click on the **Start** button to load the program.

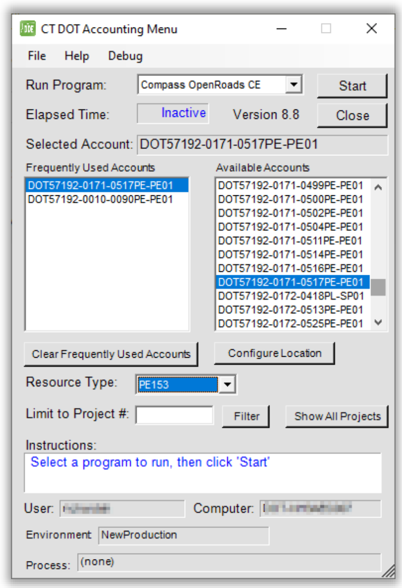

Figure 3 - CTDOT CAD Account

3. After launching the program, a Welcome Screen for ***OpenRoads Designer*** will appear. OpenRoads users will continue to Step 4.

For **OpenBridge Designer** a home dialog box for open. OpenBridge users will need to complete a. and b. below before moving on to Step 3.

a. On the OpenBridge Designer Home dialog box select **New** to create a new OBDX file in your C or D drive. Name the file with your initials and Training. (example: ***ABC_TRAINING.obdx***).

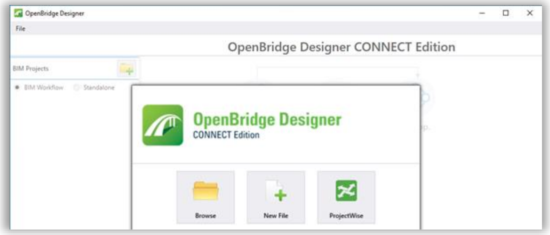

Figure 4 - OpenBridge Designer Open Screen

b. On the left side menu unsure that **Standalone** has been selected (not BIM Workflow). Select or create a New Group to expose the **OpenBridge Modeler icon.** On the left menu make sure you a have the ***Group*** selected **not a DGN file**. After selecting the ***Group*** click on the **OpenBridge Modeler** icon.

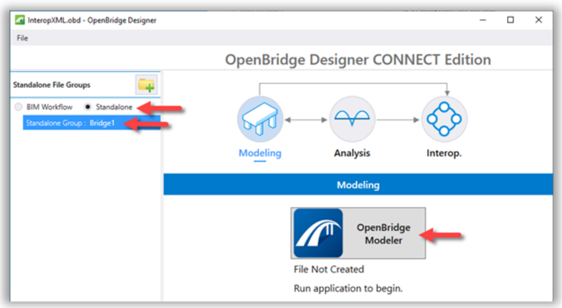

Figure 5 - OpenBridge Designer Open DGN

4. Ensure you are using the **Custom Configuration** and **CT_WorkSpace**, then select the relevant **WorkSet** (Training WorkSets start with 9999_0001, select the # that you were assigned) and **Role**. The example below shows the options available in OpenRoads Designer, OpenBridge, will look similar. The WorkSets listed correspond to project numbers and will be the same for all products.

5. Select the **New File** icon.

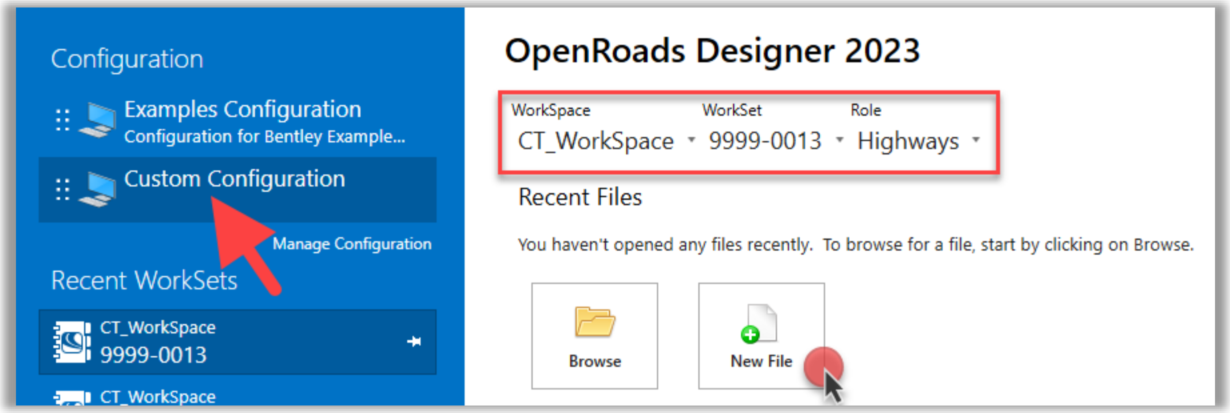

Figure 6 - OpenRoads Start Screen

6. From the New dialog box, ***Save in:*** browse to the ***proper discipline*** folder and enter the File Name:

   ORD – ***...|Highways|Base_Models|HW_CB_1234_1234_Westbrook.dgn***

   or

   OBM – ***...|Bridge|Base_Models|SB_CB_1234_1234_Westbrook.dgn***

7. click the **Browse** button to select the proper seed file. See below for each application's seed file locations.

   ORD – ***CT_Configuration|Organization|Seed|Road|Seed2D - CT RoadDesign.dgn***

   or

   OBM – ***CT_Configuration|Organization|Seed|Bridge|Seed3D - CT BridgeDesign.dgn***

8. Follow the prompts to create the file.

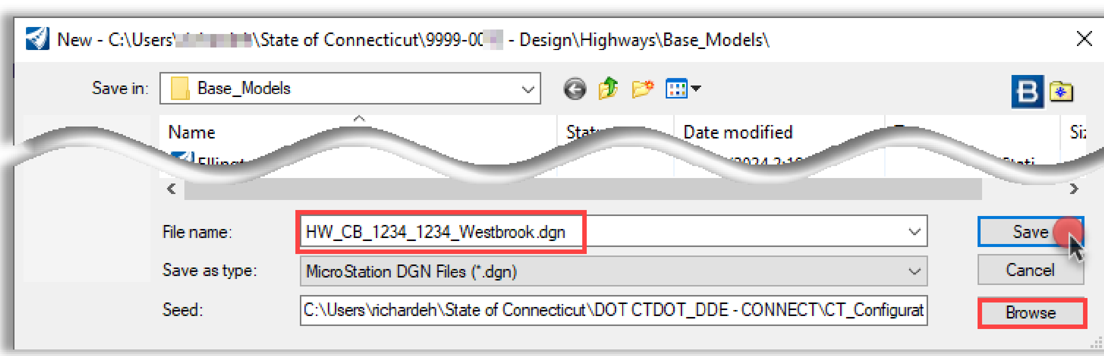

Figure 7 - New File

1.2 Reference Attachments

References are used to display the contents of another DGN file within the current ORD and OBM models. The Home tab in each Workflow contains the reference tools as shown below. This is no different for existing data, terrains and survey topo will be referenced into design models.

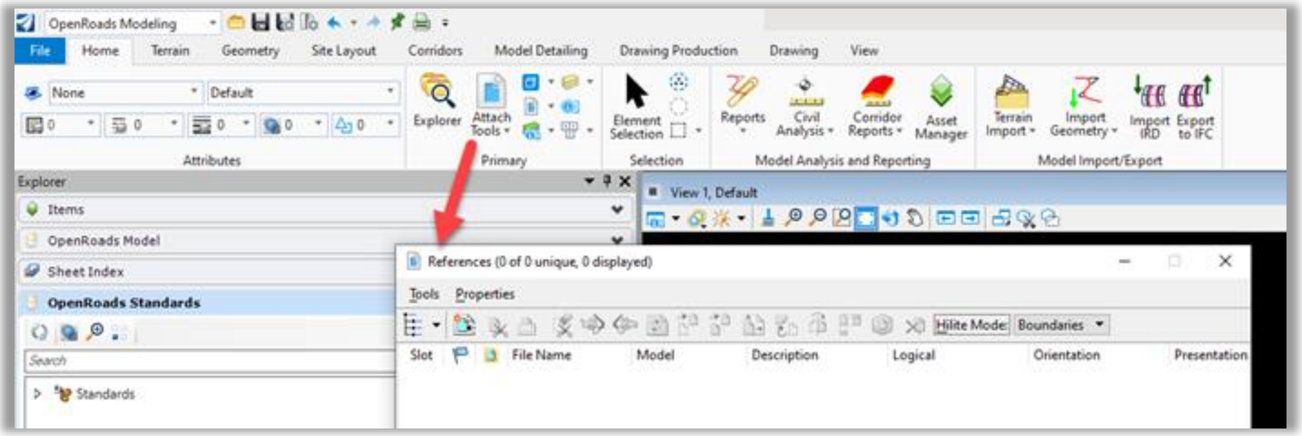

Figure 8 - Attach Reference

1. In the Upper left corner of the application select The **CTDOT** Workflow.

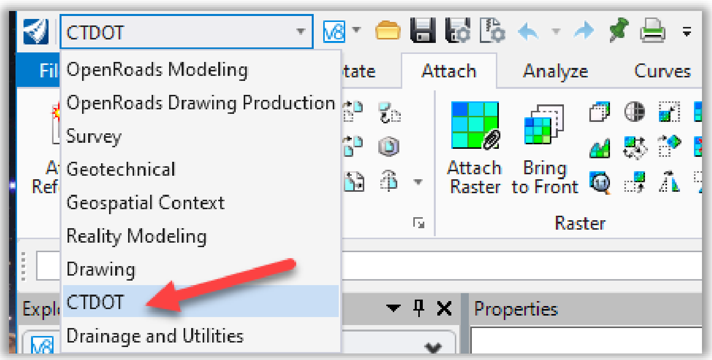

Figure 9 - CTDOT Workflow

2. Select the **Home** tab, in the **Primary** section click on the **Attach Tools** pull down and choose the **References** tool.

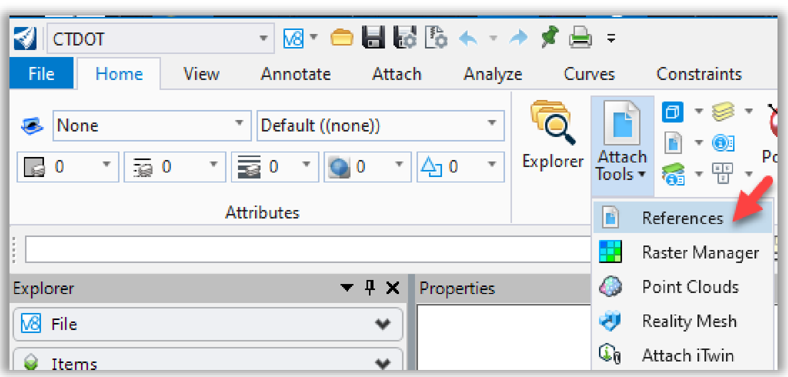

Figure 10 - References Tool

3. On the References dialog box select ***Tools | Attach…***

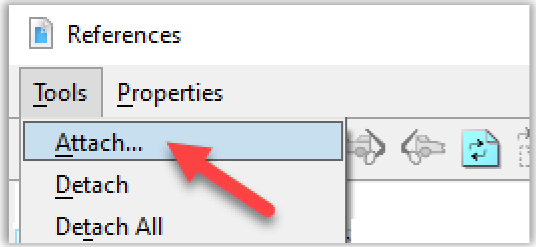

Figure 11 - Attach References Tool

Browse to attach: ***Active_Survey|SV_XX_0154-0128_Westbrook_ORD.dgn.*** Assure the Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

Note: *If the selected file does not belong to the active WorkSet, you will get an alert mentioning the same. Click* ***OK*** *to continue.*

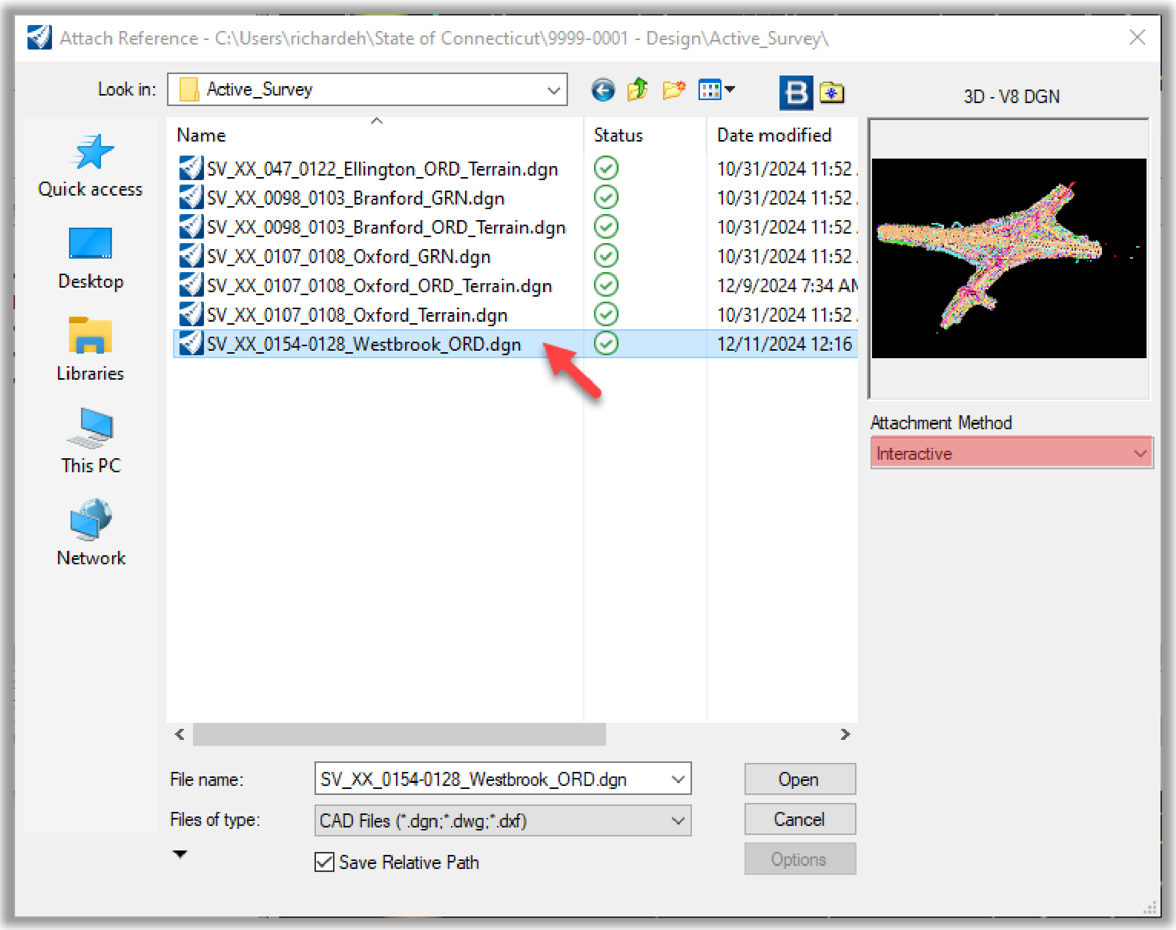

Figure 12 - Attach Reference File

4. On the Reference Attachment Properties select (see page 12 for OpenBridge):

OpenRoads

Model: ***Existing Ground Survey***

Orientation: ***Coincident World***

Detail Scale: ***1" = 40'***

Nested Attachments: ***No Nesting***

Toggle Annotation Scale: ***ON***

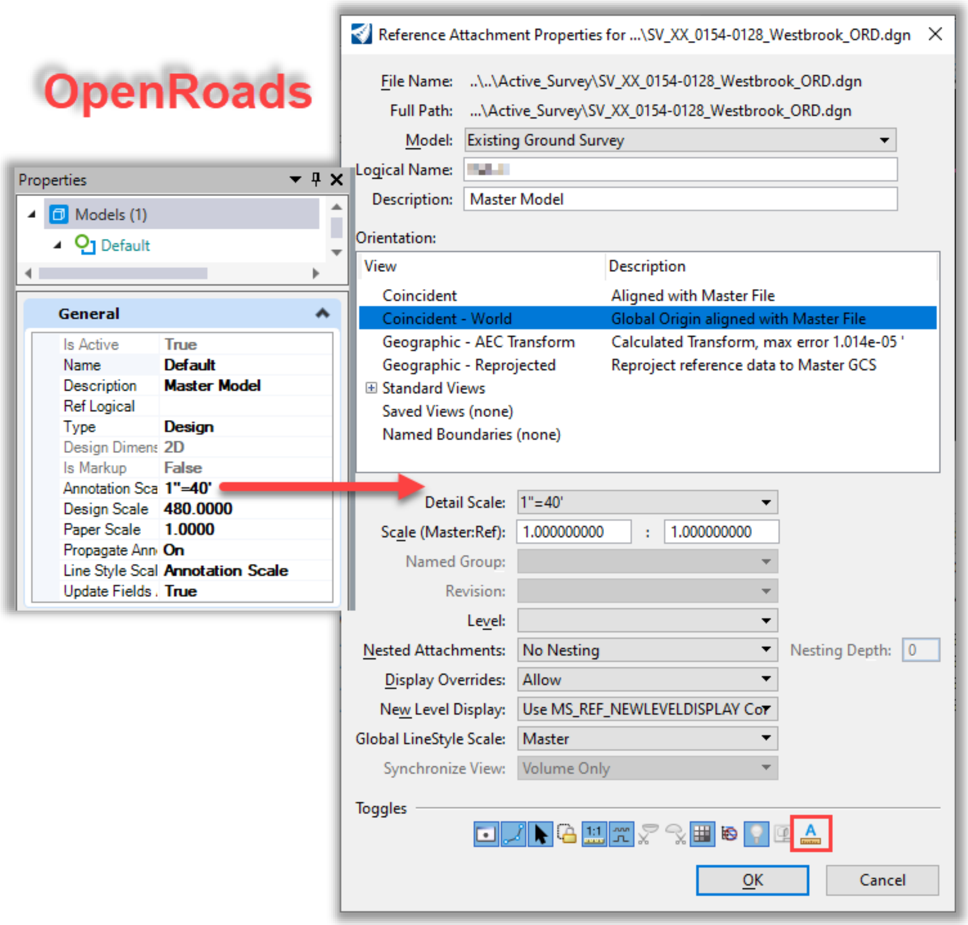

Figure 13 - OpenRoads Reference Settings

OpenBridge

Model: ***Existing Ground Survey***

Orientation: ***Coincident World***

Detail Scale: ***Full Size 1 = 1***

Nested Attachments: ***No Nesting***

Toggle Annotation Scale: ***ON***

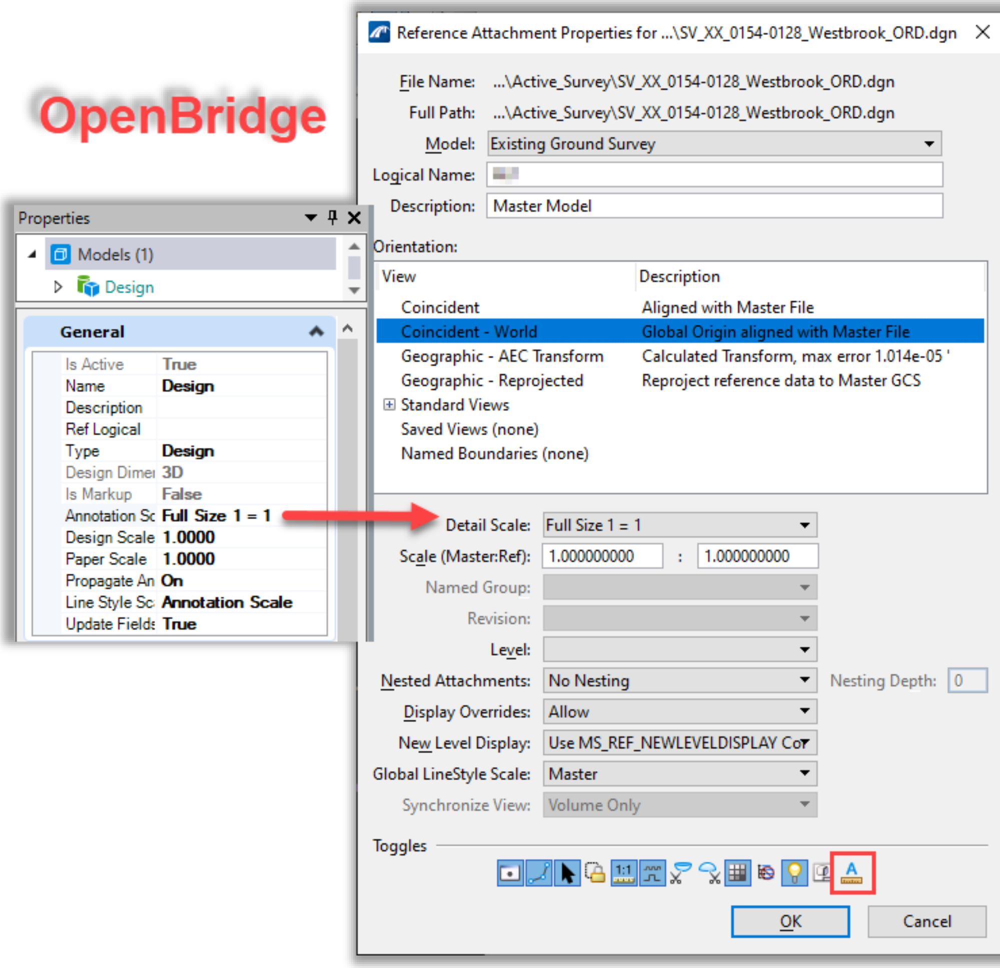

Figure 14 - OpenBridge Reference Settings

Best Practice: Reference Terrain Model to Project File

With terrain model elements stored in 3D design files, they are easily shared and used by many users. The most common workflow for design projects is to simply reference the 3D design file that contains the terrain model to your 2D working or project file. Once the terrain model is attached, the terrain data is accessible by all other commands. As a reference file, the terrain model can be displayed differently each time its referenced allowing contours to be viewed by one reference, while another drawing or user views triangles or contours at a different interval. Because everyone using the terrain model is referencing the same source, any updates to the terrain model are automatically propagated to all users.

5. Repeat **Steps 3 and 4** and reference in the following models:
   - **Annotation**
   - **Bridge Deck**
   - **Boundary Models**
6. Click **Fit View** in the view window.
7. Double-check that the survey ground file came in at the correct location. **Zoom** to a ***coordinate grid cross*** and **Intercept Snap** to it, the **XY-axis** below the view window should display the same numbers as the northing and easting of the coordinate grid cross.

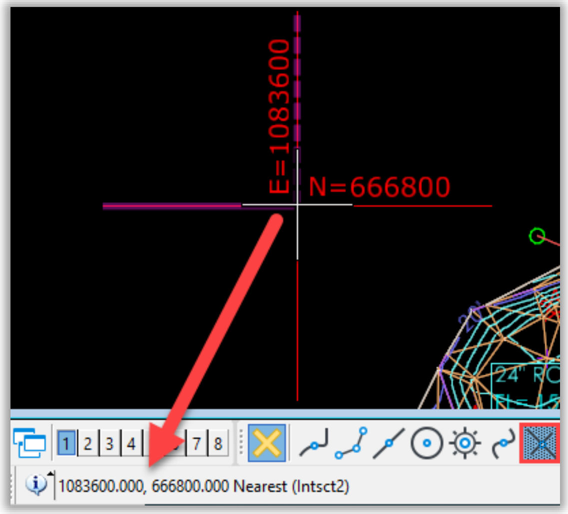

Figure 15 – Check Northing and Easting

8. This next step is for OpenBridge only, to see the Line Styles of lines that use Annotation Scale as well as the Northing and Easting coordinate grid cross, open the **Models** dialog box and in Properties set Annotation Scale to ***1"=40'*** and Line Style Scale to ***Annotation Scale***.

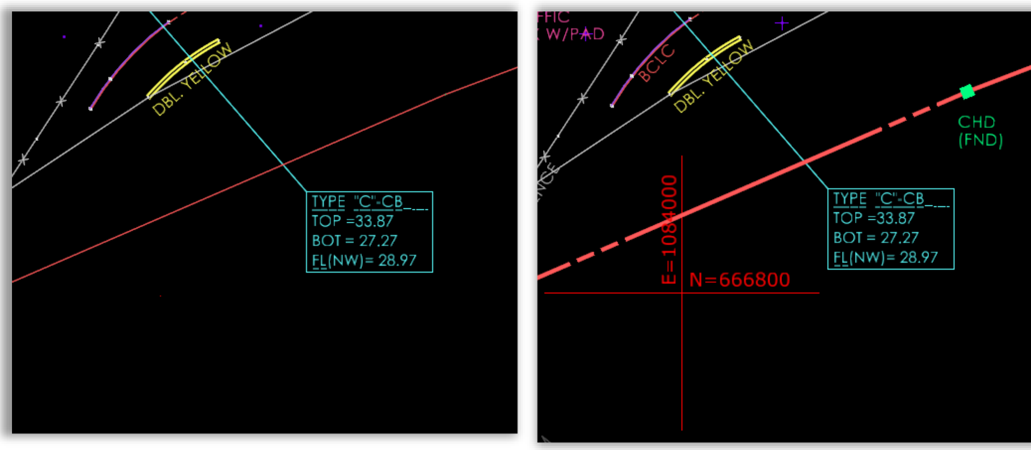

Figure 16 – Annotation Scale

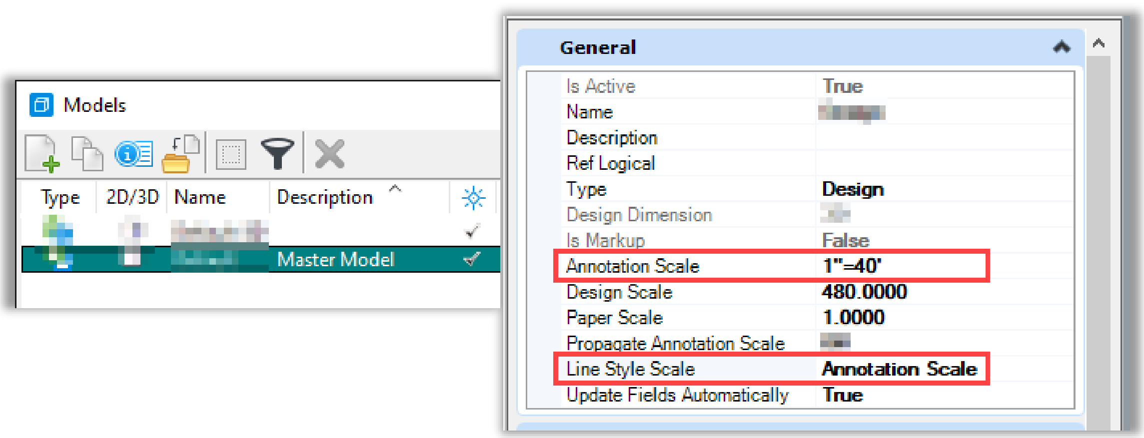

Figure 17 – Model Line Style Scale

9. **Right Click Hold** in the view and select **View Control / Ref Adjust Colors**. This will dither out the references, so your design pops out front.

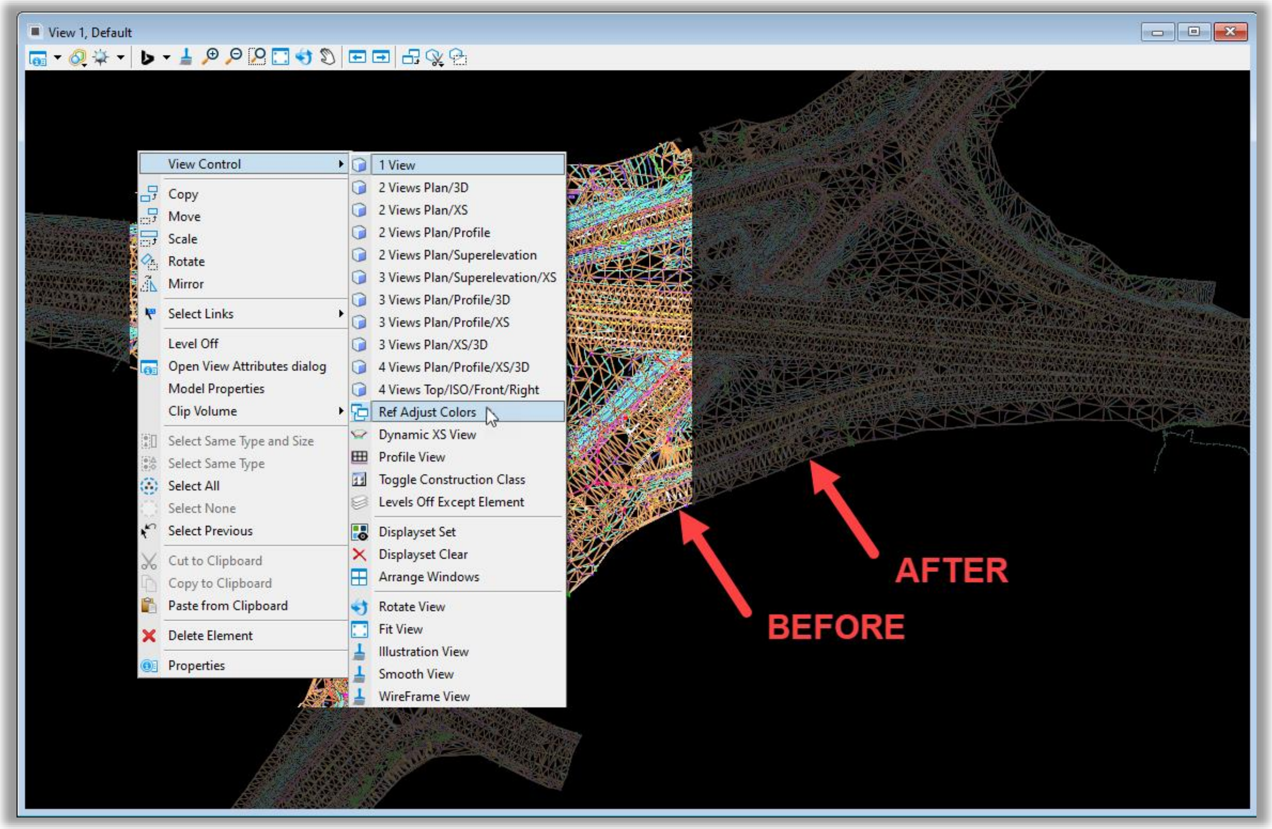

Figure 18 - Adjust Reference File Color using Right Click Menu

10. To adjust back open the **References** dialog box and select ***all the Referenced Models***. In the top menu select ***Properties > Adjust Colors…***

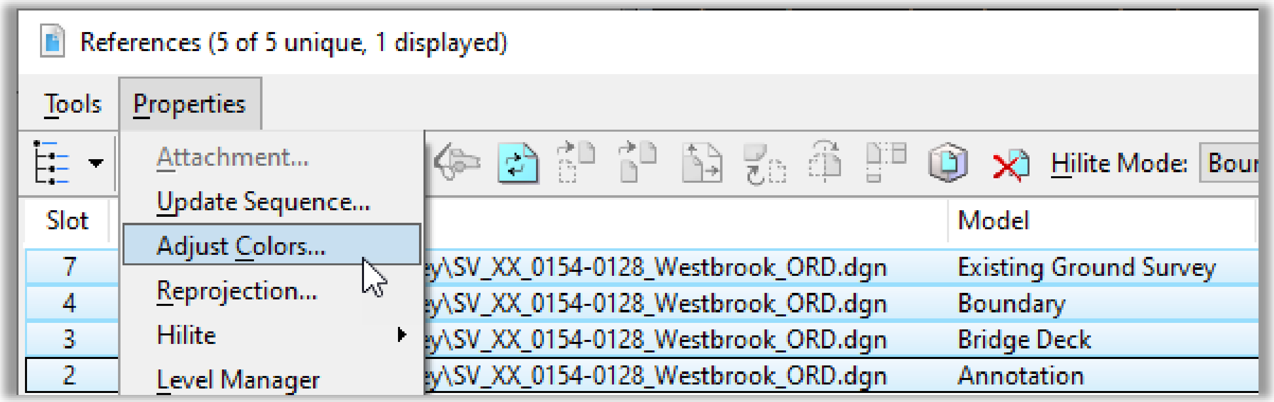

Figure 19- Referenced Models Adjust Colors

11. Slide ***Value*** and ***Saturation*** to ***100***.

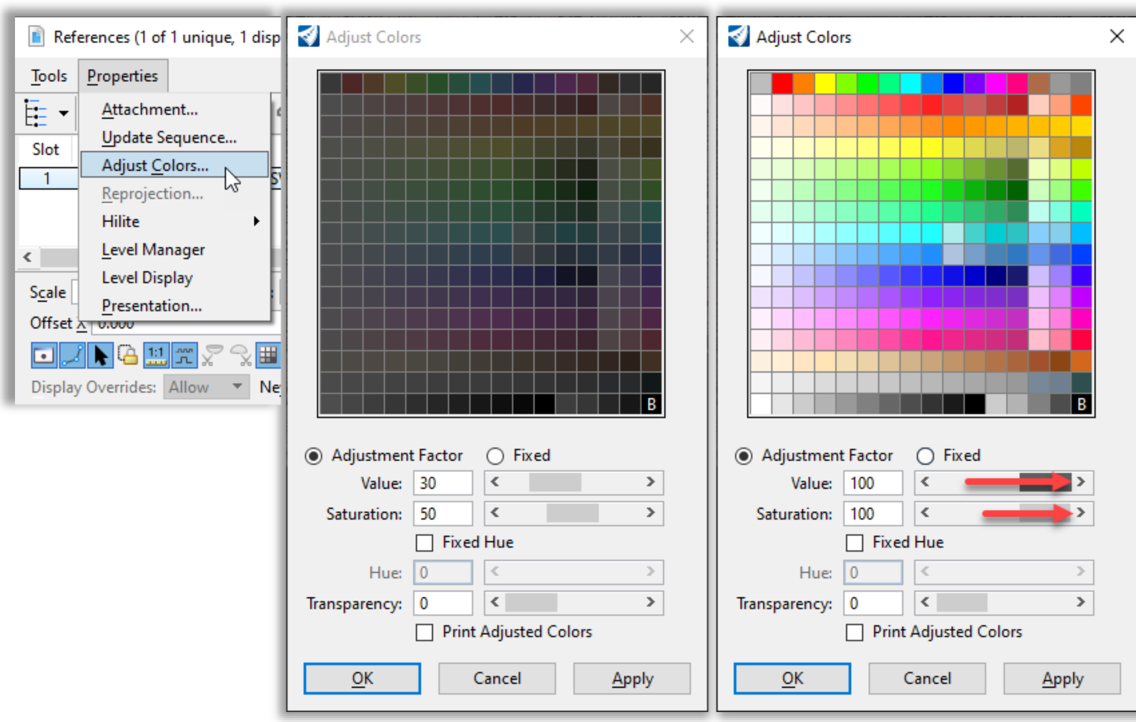

Figure 20 - Adjust Reference File Color in Refences Dialog Box

12. Turn off levels as needed. Review the file and **Save Settings**.

1.3 Terrain Models

The Existing Ground Survey model is a Terrain model generated by OpenRoads Survey and is stored in the design file as a Terrain Model element type. The terrain model can be accessed by design personnel by attaching the survey design file as a reference attachment. This was done in the steps above when the **Existing Ground Survey** model was referenced in.

A terrain model is a set of triangles mathematically computed from point data collected from the surface being modeled. They are typically used to model highly irregular surfaces, like the surface of the earth. A terrain model is created from 3D features such as points, breaklines, and contours. Terrain models are also referred to as digital terrain models (DTMs), triangulated irregular networks (TINs), or triangulated surfaces.

A terrain model is stored as a 3D mesh element in a 3D design (.dgn) file, similar to what used to be stored in an InRoads DTM file. When you select a terrain model in the design file, the Element Selection tool recognizes it as a Terrain Model, and the Properties and Explorer Windows will show it as a Terrain Model Element. The display of a terrain model in the product is controlled by using a Feature Definition and Element Template.

Terrain Models contain two types of features:

- Source Features are created from the source data imported to create the terrain model and include Breaklines, Boundary, Imported Contours, Islands, Holes, Voids, and Feature Spots.
- Calculated Features are derived or calculated from the source features and include Contours, Triangles, Spots, Flow Arrows, Low Points, and High Points.

Terrain Models also contain two types of ‘spot’ points, Feature Spots and Spots.

- Feature Spots are a Source Feature and contain the x,y,z information from imported point data.
- Spots are a Calculated Feature and contain the x,y,z information at all of the triangle vertices in the terrain model.

In an existing terrain model, it is possible and often likely that the Feature Spots and Spots will be the same. In a complexed terrain model where an existing terrain model and a proposed design terrain model have been combined, you will see differences in the points.

1.3.1 Defining the Active Terrain

After attaching the survey design file containing the terrain model element, it is normal practice to set this terrain model as the "Active Terrain". The active terrain model is used to define the existing ground for profiles and cross sections.
When the terrain is activated, the software will automatically create a 3D model in the active design file. This 3D model is attached as a self-reference to the active file.

1. Use the Element Selection tool to select the terrain boundary, Activate the terrain by clicking on the terrain boundary, hover over the boundary and from the pop-up menu select/click the **Set Terrain Active** tool (Hint for this survey select the most western edge of the terrain). The command can also be selected from the Terrain tab ***Active › Set Active***. Select the terrain model when prompted.

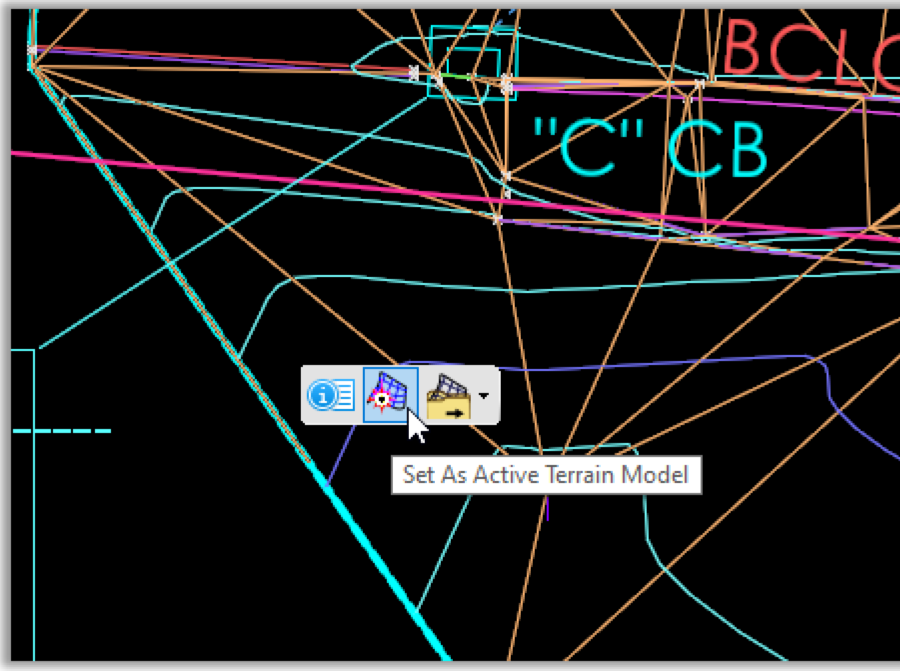

Figure 21 - Set as Active Terrain

2. Open the **Models** dialog box and notice a 3D Model Space has been created.

1.3.2 Terrain Models Display Settings

The display of the terrain model is controlled by the feature definition that is assigned in the design file that contains the terrain element. In the example above, the terrain is displayed using the E_TERR_Ground feature definition.

The terrain display can be defined uniquely for the active file as follows:
The properties dialog appears as a pop-up dialog as shown below. Since the terrain model is contained in a reference attachment, all the fields are ghosted and cannot be edited. The user may wish to override the assigned feature definition to turn on/off contours and triangles or change the contour interval settings. This is accomplished by setting the Override Symbology option to Yes to allow editing the terrain model properties. After setting the Override Symbology setting to Yes, the display of the terrain features can be toggled on/off using the options shown on the right for turning on/off contours, triangles, etc.

1. Use the Element Selection tool to select the ***Existing Ground Survey*** terrain boundary, allow the cursor to rest over the terrain element. The menu shown below appears. Choose **Properties,** and a popup will appear. This can also be seen if the Properties dialog box is docked.
2. Set the override symbology to **Yes**. Then to turn off and on the **Major and Minor contours** and **Triangles**. Watch the view display as each property is selected.
3. Practice with toggling On/Off other terrain features. Leave it so the ***Contours*** are ***on***, but the ***Triangles*** are ***off***.

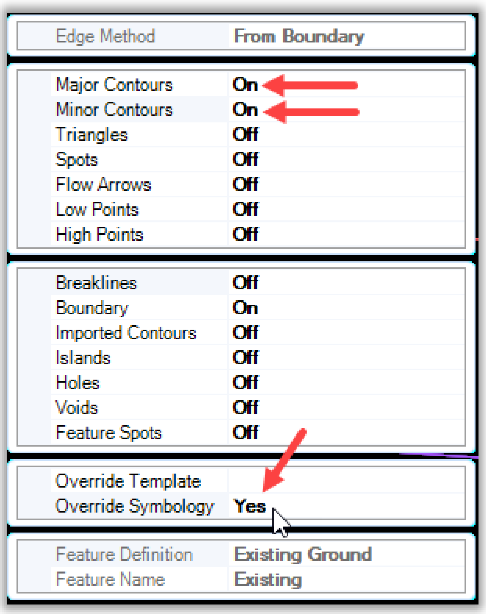

Figure 22 - Override Symbology

5. Change the Major and Minor Contour intervals.

    a. In the top of the Properties Window, expand Terrain Model: ***Existing_Terrain > Calculated Features > Contours***.

    b. In the top of the Properties Window select ***Contours*** to display the Contours information box.

    c. In the Contours section, change the ***Major Interval*** to ***1*** and the ***Minor Interval*** to ***.1***

    d. In the Contours section, change them back to ***Major Interval*** to ***5*** and the ***Minor Interval*** to ***1***.

    Note that the contour display immediately updates as you change the values.

6. Review the file and **Save Settings**.

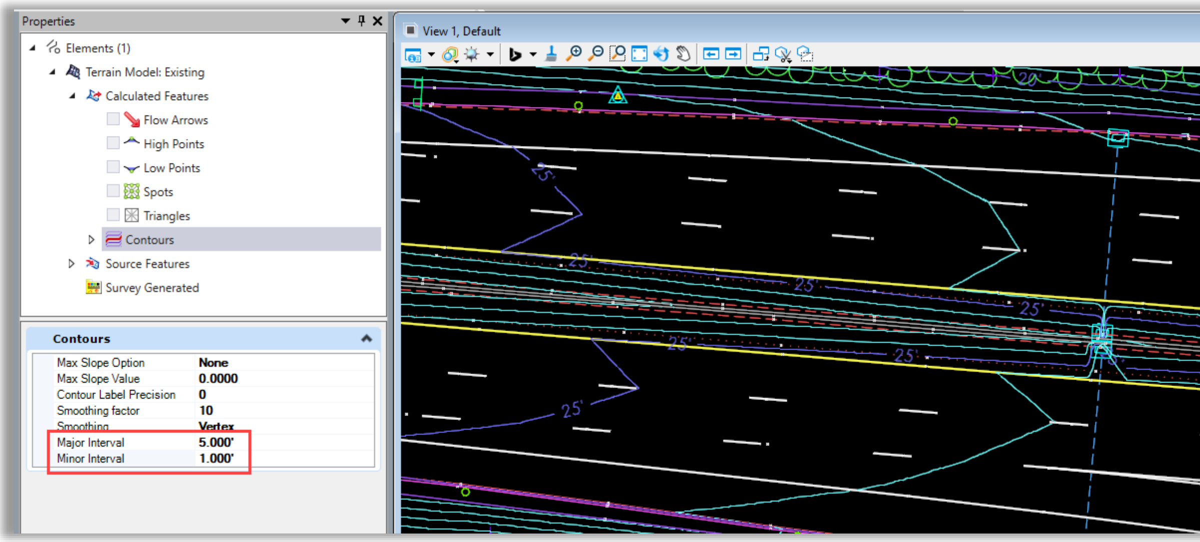

Figure 23

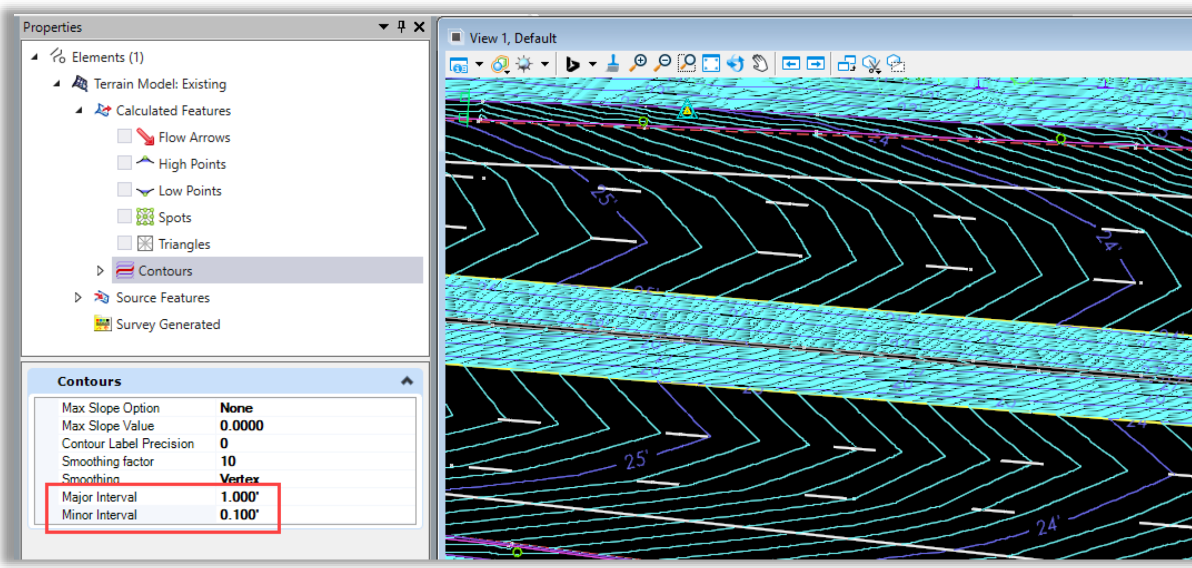

Figure 24

Notes:

- *In this terrain model, as in many terrain models, you will find that all of the different source features may not exist.*
- *In the dialog, you can double-click on a feature name or the On/Off indicator to toggle that feature display on/off.*
- *If you toggle all the feature displays off, the boundary feature will still be displayed. At least one feature has to be displayed in order for the terrain to be selected and the boundary is the default feature that will be displayed if all the features are toggled off.*

1.3.3 Terrain Model Features

Terrain Models contain two types of features.

- **Source Features** are created from the source data imported to create the terrain model and include Breaklines, Boundary, Imported Contours, Islands, Holes, Voids, and Feature Spots.
- **Calculated Features** are derived or calculated from the source features and include Contours, Triangles, Spots, Flow Arrows, Low Points, and High Points.

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In an existing terrain model, it is possible and often likely that the Feature Spots and Spots will be the same. In a complexed terrain model where an existing terrain model and a proposed design terrain model have been combined, you will see differences in the points.

In the following pictures from a complexed terrain model, Feature Spots are displayed on the left and Spots are displayed on the right.

1.3.4 Point Features

When survey files are imported and processed, each field shot is stored as a Point Feature in a Field Book which is embedded in the design file. For example, the field code “DT” is included in the “e_TREEDC__Deciduous Tree” feature definition and is used to designate a Deciduous Tree. When survey data is processed, the tree symbology is generated in the design file view using a CTDOT standard cell element as shown:

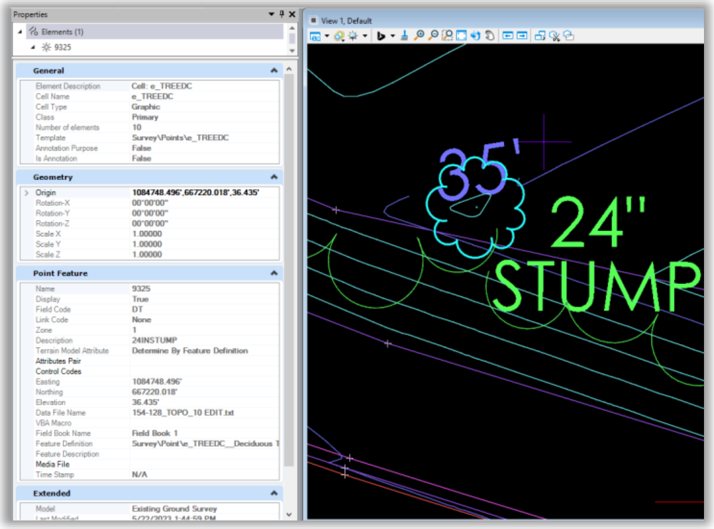

Figure 25 - Point Symbology

The information for an individual point can also be reviewed as follows:

1. From the Home tab, choose the **Element Selection** command.
2. **Float** the cursor over a ***referenced survey point*** and allow the cursor to rest over the element.
3. A pop-up dialog will appear showing the survey information for the Point Feature.

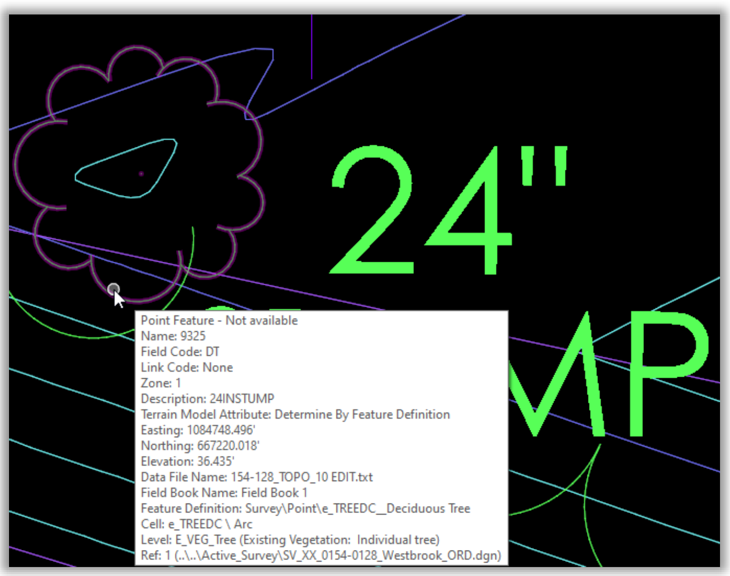

Figure 26 - Point Feature Information

1.3.5 Linear Features

A series of survey points representing curvilinear features can be connected as a Linear Feature. With the Element Selection tool active, float the cursor over the referenced linear feature, and a pop-up menu will open with information about the Linear Feature.

1. From the Home tab, choose the **Element Selection** command.
2. **Float** the cursor over a ***referenced survey line*** and allow the cursor to rest over the element.
3. A pop-up dialog will appear showing the survey information for the Point Feature.

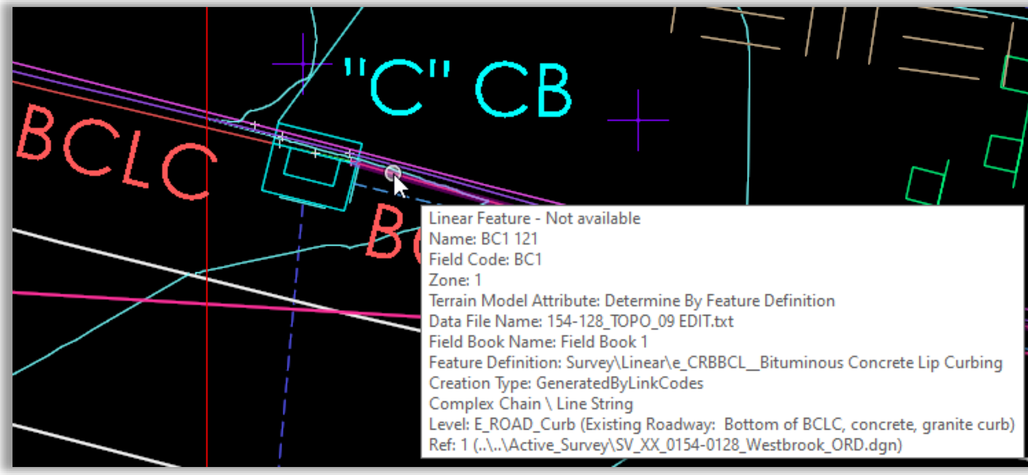

Figure 27 - Linear Feature Information

1.3.6 Override Template

In the previous sections, you have changed the terrain display by manually turning on and off different features and changing parameter values. As just discussed above, a feature definition defines what an item is and points to how it will be displayed. Using a feature definition is a quick way to change the display parameters without having to change each individual setting.

1. Select the **Existing Terrain** to define the display parameters.
2. In the Properties Window select the **Reference** section: for Override Template select ***Terrain > Existing Triangles***.

   Note that the triangles are now displayed and the contours are off.

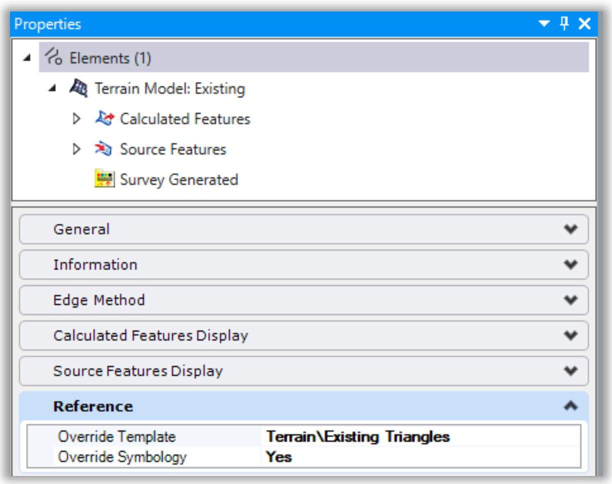

Figure 28

3. Change the Override Template to ***Terrain|Existing Contours Only***.

1.3.7 Change the Text Size

1. Select the **Drawing Production tab** and then in the **Drawing Scales group**, select the drop-down menu and change the drawing scale to **1"=20'** . Note that the text size of the major contour labels decreases.
2. Switch the Drawing Scale back to **1"=40'**.

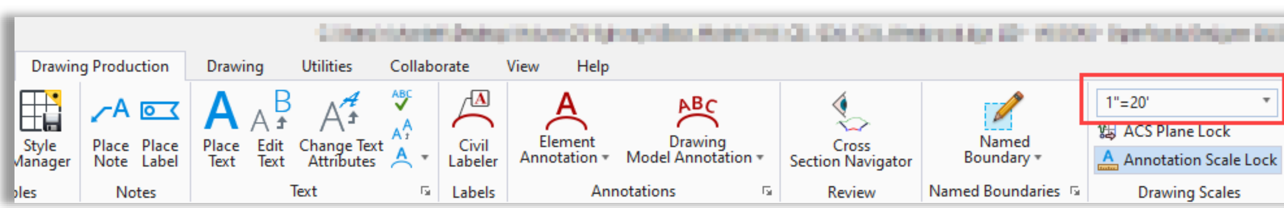

Figure 29

3. Select **Save Settings** from the Quick Access ToolBar.

1.3.8 Setup and review 2D and 3D View and Models

In this section, you will open a new view in the design file to display the 3D model that was automatically created with the Set Active Terrain command. You will also look at the models in the design file and their association to the displayed views.

1. Right-click in **View 1** and hold down the right mouse button to access special view control tools.
2. Select **View Control > 2 Views Plan/3D**.

   Notice the views change, you now have 2 view windows open.

   View 1 on the left is the 2D model view that you started with, and View 2 on the right is the 3D model view that was automatically created when you set the terrain model active.

   Also, observe the existing terrain model boundary is displayed in 2D and 3D. The terrain model triangles are not displayed at this time. Triangles, breaklines, feature spots and contours can be displayed via the terrain model properties as needed.Note: Pressing the F9 key on your keyboard automatically configures the 2 Views Plan/3D view setup for you, 2D on the left and 3D on the right. This will come in handy as you move through the design process.

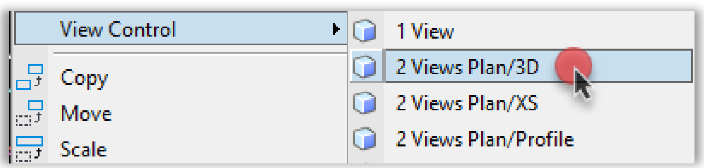

Figure 30

3. From the ribbon menu select **Home > Primary > Models**.

   Review the Models dialog, notice there are 2 models available, Default and Default 3D. Models can be 2D or 3D. It's very important to realize that even though you started with a 2D design file it is possible to have a 3D model also available in the same design file. Recall that setting a terrain model active automatically creates a 3D model for you. The 3D model must be created by the software. Do not create your own model named Default 3D, it will not work properly.

   Also, the 2D and 3D models are directly related to the model views, recall View 1 is named Default and View 2 is named Default 3D.

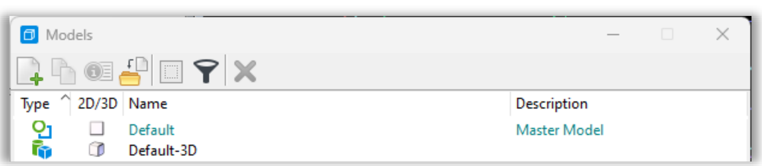

Figure 31

4. **Close** the Models dialog.

1.3.9 Existing Survey Levels

The CTDOT CADD Standards include MicroStation levels that are specific to survey information. These levels are grouped in the level library using the prefix "E_". There are survey levels for features as well as annotation:

1. Make **View 1** active. Open **Level Display** and click on the ***Existing Ground Reference Model***
2. Sort By **Used**, explore and become familiar with the groupings.

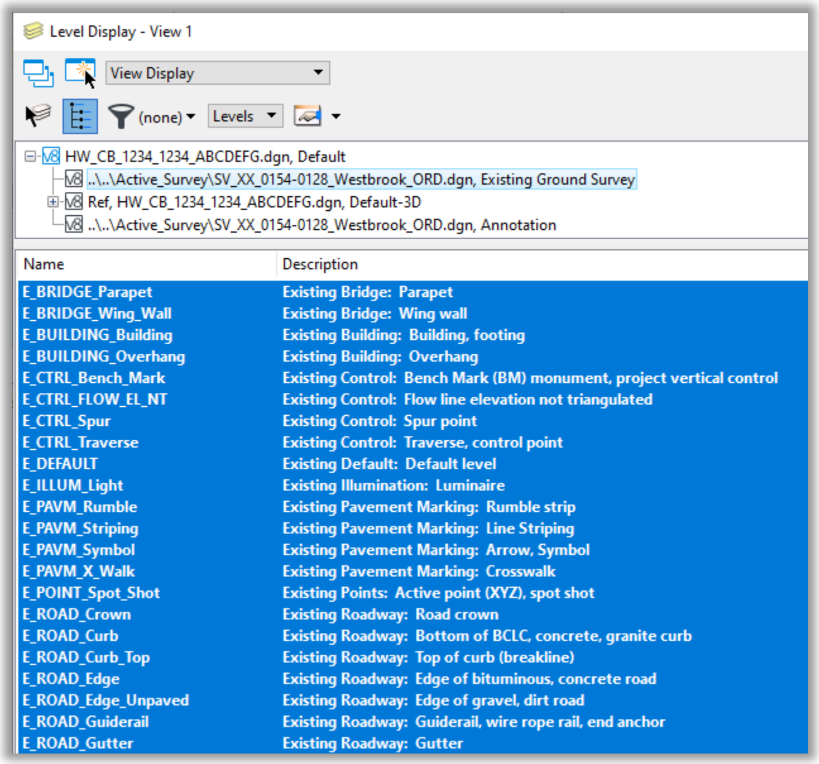

Figure 32 - Survey Feature Levels

3. Click on the ***Annotation Model*** and notice the ***E_Annot*** grouping.

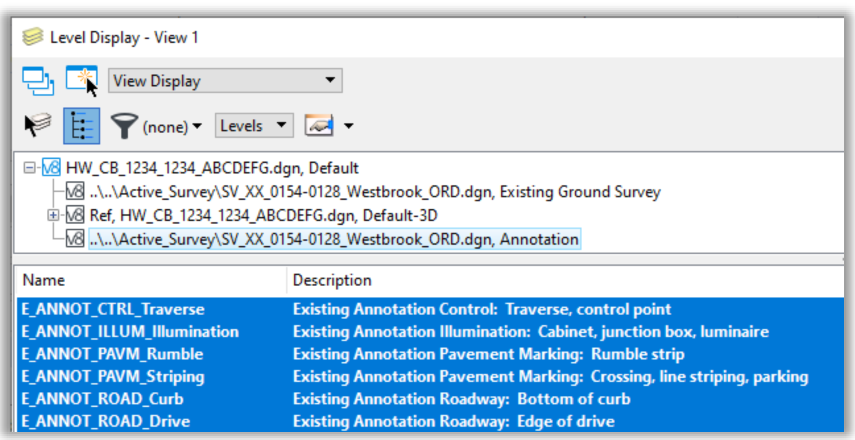

Figure 33 - Survey Annotation Levels

Level display setting (option menu) - Sets the level display for this dialog.

- **View Display —** Changes in the level display affect the chosen view in the active model.
- **Global Display —** Changes in the level display affect all views in all models in the open file.
- **Global Freeze —**Indicates whether the level is frozen. If frozen, elements on the level are not displayed and cannot be printed. If View Display or Global Display is off, or if Global Freeze is on for the level on which the reference is placed, elements in the reference are not displayed.

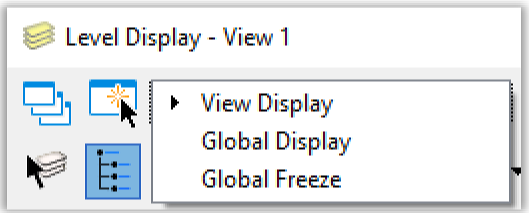

Figure 34 – Level Display Options

Exercise 2 – Referencing Old V8i Files

The Working Units of DGN files changed with CONNECT Edition. There will be times old files created in V8i will need to be reference. This Exercise will detail the procedure to get the files to line up geospatially.

2.1 File Creation

1. Select **New File** to create a new file. From the New dialog box, browse to the ***proper discipline*** folder and enter File Name:.

   ORD - ***…|Highways|Base_Models|HW_CB_1234_1234_Branford.dgn***

   or

   OBM - ***…|Bridge|Base_Models| SB_CB_1234_1234_Branford.dgn***

2. On the New dialog box click the **Browse** button to select the proper seed file. See below for each application's seed file locations.

   ORD - ***CT_Configuration|Organization|Seed|Road|Seed2D - CT RoadDesign.dgn***

   or

   OBM - ***CT_Configuration|Organization|Seed|Bridge|Seed3D - CT BridgeDesign.dgn***

3. Follow the prompts to create the file.

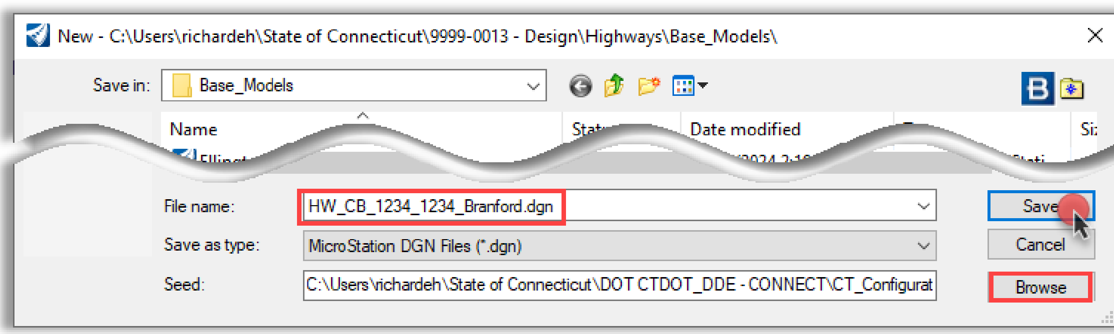

Figure 35- New File

2.2 Reference Attachments

In this portion of the exercise, you will be referencing two files.

- The **Ground** Topo design file previously created using V8i. Sometimes you will have several ground files and on very old files the extensions maybe **.grn**.
- The ORD **Terrain** survey file, this file was created by importing an old V8i InRoads DTM

1. Select the Reference tool.

   Browse to attach: ***Active_Survey|SV_XX_0098_0103_Branford_GRN.dgn***

   Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

   On the Reference Attachment Properties select:
   Model: ***3D Design***
   Orientation: ***Coincident World***
   Open Roads-Detail Scale: ***1"=40'*** OpenBridge-Detail Scale: ***Full Size 1 = 1***
   Nested Attachments: ***No Nesting***
   Toggle Annotation Scale: ***ON***

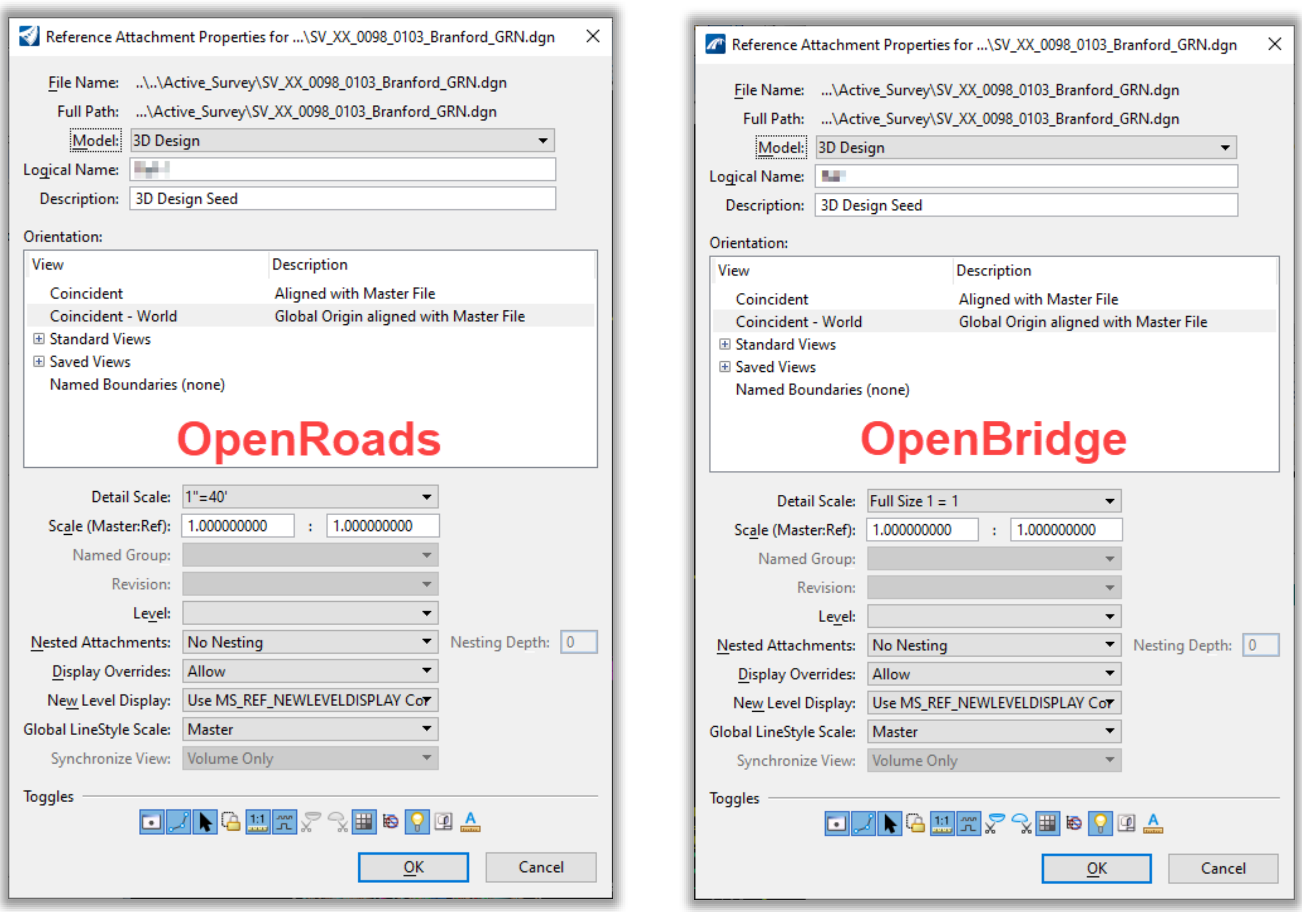

Figure 36 - ORD (left) and OBM (Right) Reference Settings

2. Click **Fit View** in the view window. Double-check that the survey ground file came in at the correct location. **Zoom** to a ***coordinate grid cross*** and **snap** to it, the **XY-axis**,
3. Notice the coordinates do no match up.

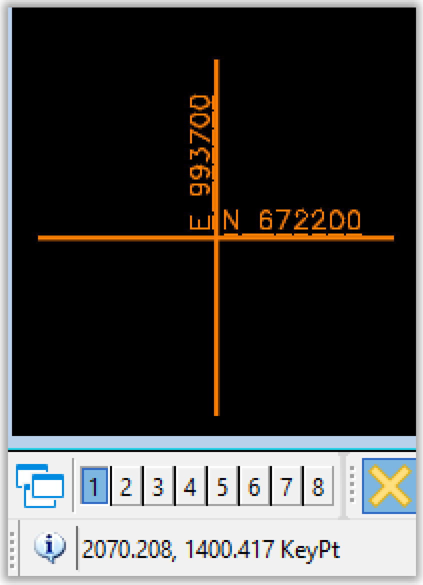

Figure 37 – Coordinates do not match

4. In the References dialog box change ***True Scale to off*** and the scale to ***1 to 1***.
5. **Fit** the view and re-check the coordinates, they should now line up.

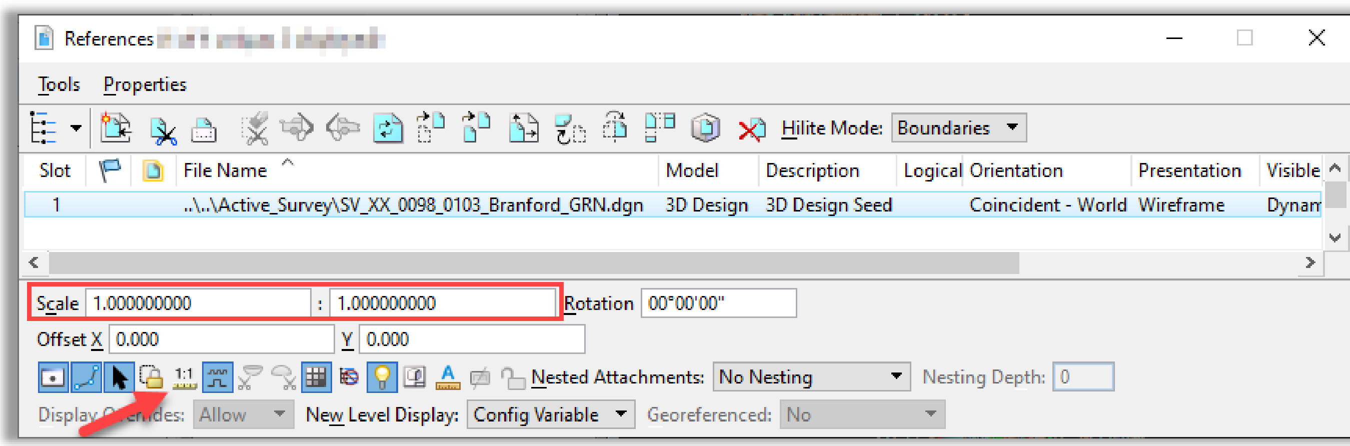

Figure 38 - Reference file Settings

6. Select the Reference tool. Browse to attach:
   Active_Survey| SV_XX_0098_0103_Branford_ORD_Terrain.dgn

   Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

   On the Reference Attachment Properties select:
   Model: ***Default***
   Orientation: ***Coincident World***
   Open Roads-Detail Scale: ***1"=40'*** OpenBridge-Detail Scale: ***Full Size 1 = 1***
   Nested Attachments: ***No Nesting***
   Toggle Annotation Scale: ***ON***

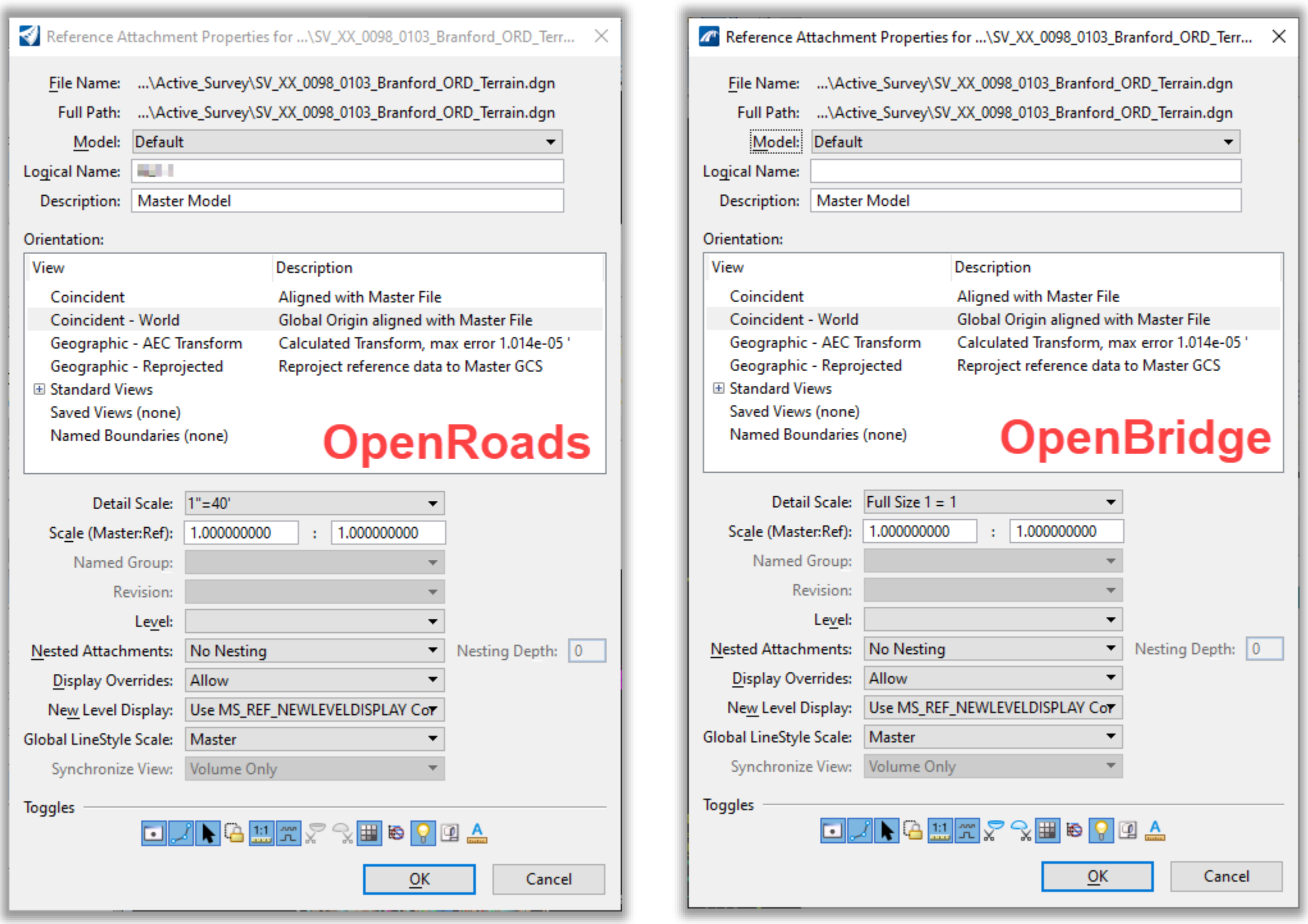

Figure 39 - ORD (left) and OBM (Right) Reference Settings

7. Click **Fit View** in the view window. Double-check that the survey ground file came in at the correct location. **Zoom** to a ***coordinate grid cross*** and **snap** to it, the **XY-axis**, the MicroStation command window should display the same numbers as the northing and easting of the coordinate grid cross.

8. Review the file and **Save Settings**

2.3 Line Style Scale

With some old files the Line Style Scale may not come through the correct size when referencing. The Line Style may come through so small they view as a solid line. This can be adjusted in the Model Properties and/or Attachment Properties. With old files its really just trial and error with the settings as its hard to know what was done in the reference file when it was created years back.

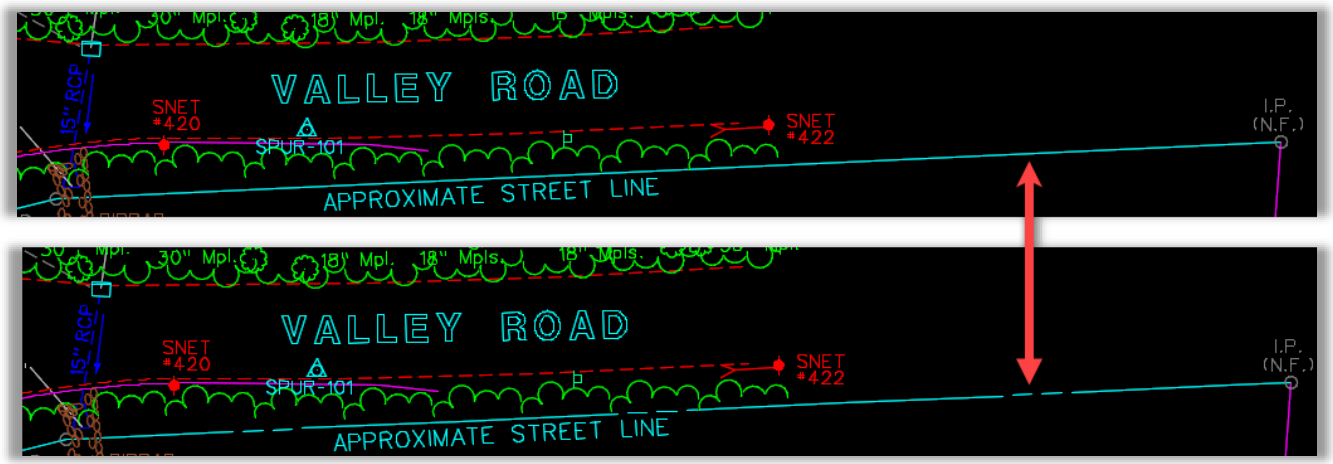

Figure 40 - Wrong Line Style Scale

Open the Models dialog box and in Properties set Annotation Scale to ***1"=40'*** and Line Style Scale to ***Annotation Scale***.

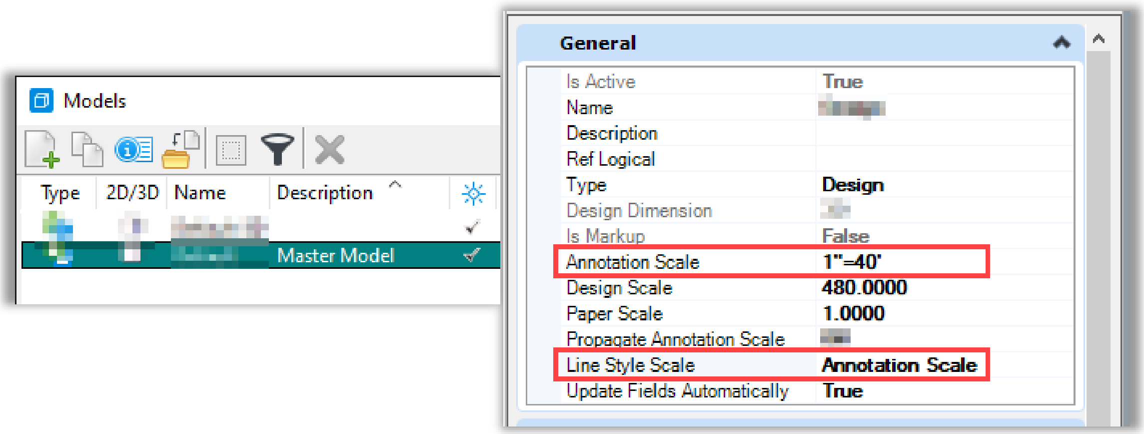

Figure 41 – Model Line Style Scale

In the References dialog box double click on the Reference File with odd looking Line Style and Set:

Global LineStyle Scale: ***Reference***

Click **OK**

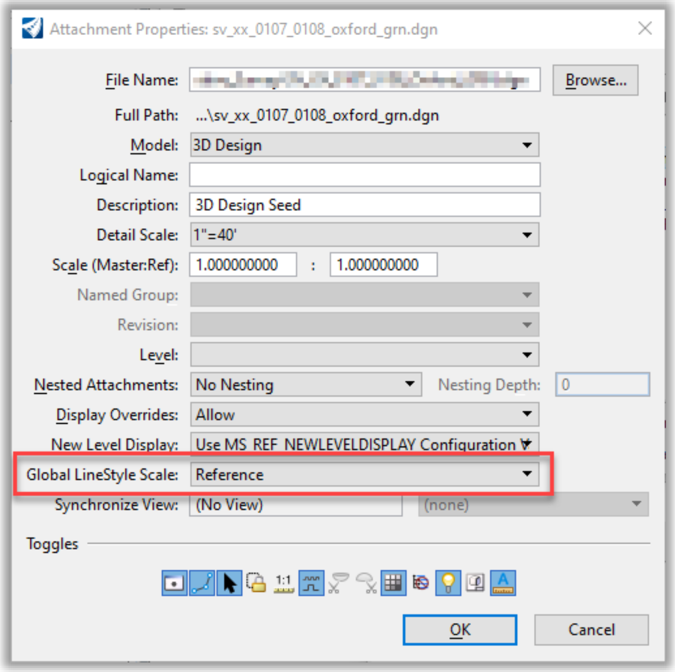

Figure 42 - Set Global LineStyle Scale

In the View Window zoom in and out, if the Line Stye still does not look correct the ***Annotation Scale*** *may need to be* ***on*** *or* ***off*** *depending on the reference file. This can be adjusted after the initial reference is brought in.* After switch between the Annotation Scale settings zoom in and out again to see the results.

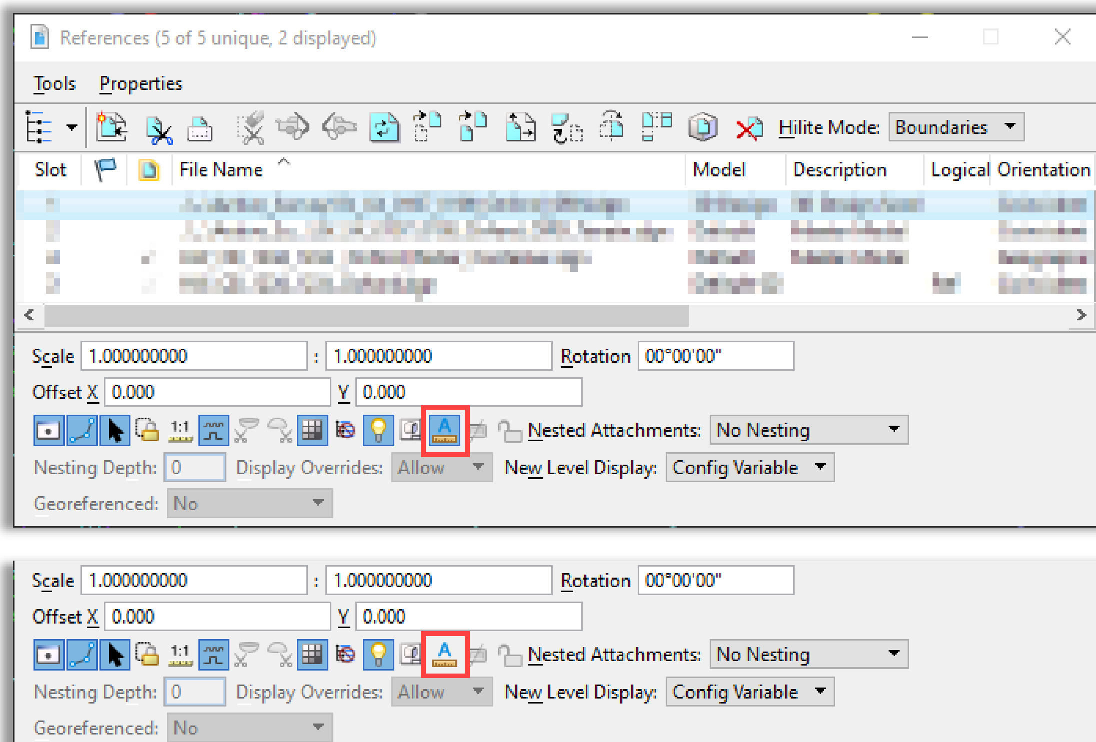

Figure 43 – Annotation Scale Setting on / off

Exercise 3 – Working with Datums

3.1 Review the Surveyed GCS

The Geographic Coordinate System (GCS) lets the software know where the project is located geographically and what coordinate system needs to be defined for the project. The GCS is typically defined in the seed file provided by most agencies or surveyors. In this section, you will learn how to review the Geographic Coordinate System defined for your project.

1. Select the **File > Open** and **Browse**, browse to your project **...\Active_Survey** and select ***SV_XX_0107_0108_Oxford_ORD_Terrain.dgn.*** Click the Open down arrow and select **Open Read-Only**.

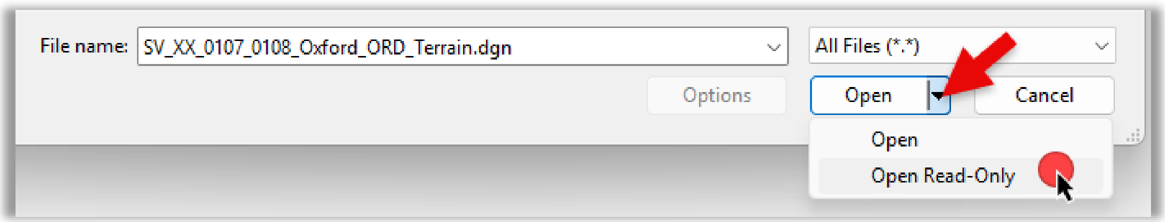

Figure 44 - Open Read-Only

2. In the lower right corner of the screen that there is a Geographic Coordinate System icon with a check mark. This informs the user that a Geographic Coordinate System has been defined in this file.

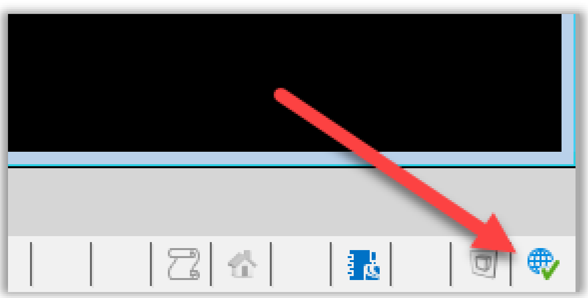

Figure 45 – Design Model has Coordinate System

1. Review the Geographic Coordinate System. Select **Utilities > Geographic > Coordinate System**.

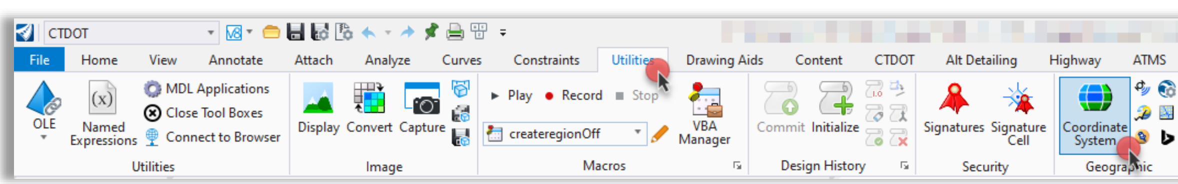

Figure 46 - Coordinate System

2. The following toolbox will appear. As you can see, it displays the current Geographic Coordinate System that has been defined for this file and project.

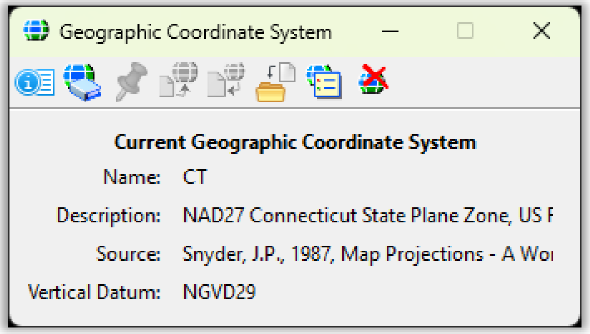

Figure 47 – Active Coordinate System

3. **Close** the Geographic Coordinate System toolbox.

4. Open Read-Only the old V8i dgn ***SV_XX_0107_0108_Oxford_GRN.dgn*** and review the Title Block notes. Make note of the NAD and NAVD year. If there is inconstancy between the **Geographic Coordinate System** set in the terrain file and the **Title Block** text, reach out to Central Survey for clarification.

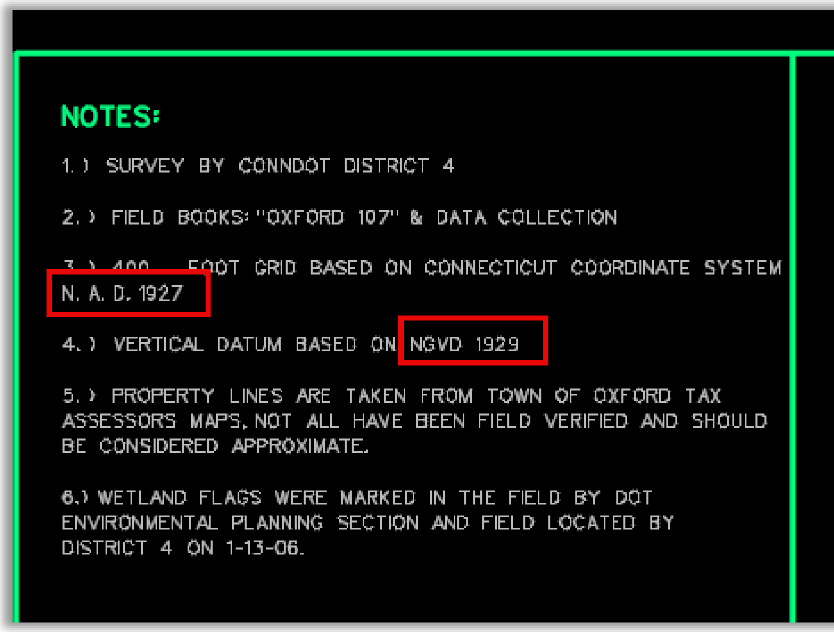

Figure 48 – Survey Title Block

3.2 File Creation

CONNECT Edition design files contain Geo-Coordination features which allow users to specify the position of the design contents on the Earth's surface. Once that position is established, the design can be easily coordinated with other data for which the geographic location is known. The seed files in the Discipline folders have been assigned a default Geographic Coordinate System (GCS) of NAD 1983 State Plane Connecticut with a North American Vertical Datum of 1988 to allow interaction with geospatial applications. This GCS has also been applied to each view as an Auxiliary Coordinate System (ACS). Seed files of different Datums are available in the GCS folder for use with odd cases. Designers should first consult with the Survey Unit to obtain the correct datums (NAD and NAVD). This coordinate information can also be found in the Survey dgn title block notes, users can open the survey files read only to view this information.

1. Select **New File** to create a new file. From the New dialog box, browse to the ***proper discipline*** folder and enter the proper File Name:

   ORD - ***...\Highways\Base_Models\HW_CB_1234_1234_Oxford.dgn***

   or

   OBM - ***...\Bridge\Base_Models\SB_CB_1234_1234_Oxford.dgn***

2. On the New dialog box click the **Browse** button and select the following Seed File:

   ORD - ***CT_Configuration\Organization\Seed\Road\Seed2D - CT RoadDesign.dgn***

   or

   OBM - ***CT_Configuration\Organization\Seed\Bridge\Seed3D - CT BridgeDesign.dgn***

3. Follow the prompts to create the file.

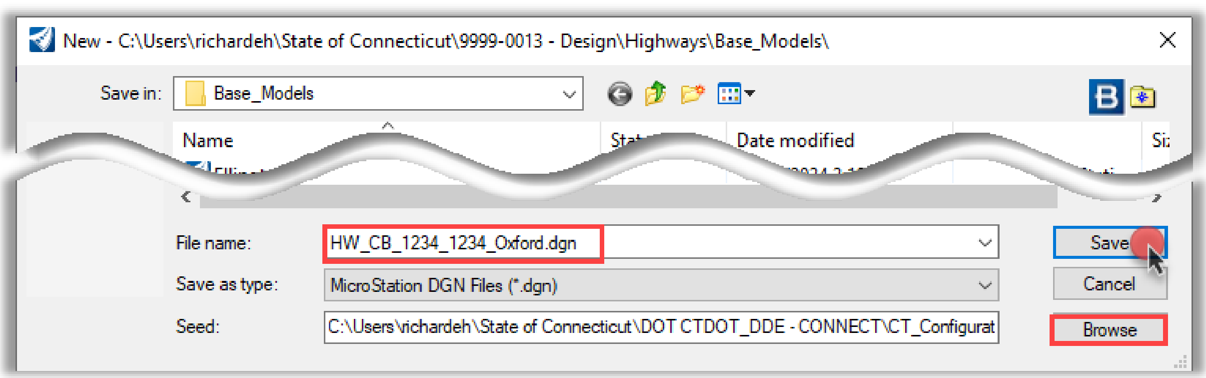

Figure 49 – New File

4. We will now import the GeoSpatial Header for the Survey File. Select **Utilities > Coordinate System**.

3.3 Reference Attachments

In this portion of the exercise, you will be referencing two files:

- The **Ground** Topo design file previously created using V8i. Sometimes you will have several ground files and on very old files the extensions maybe **.grn**.
- The ORD **Terrain** survey file, this file was created by importing an old V8i InRoads DTM

1. Select the Reference tool.

   Browse to attach: ***Active_Survey|SV_XX_0107_0108_Oxford_GRN.dgn***

   Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

   On the Reference Attachment Properties select:
   Model: ***3D Design***
   Orientation: ***Coincident World***
   Open Roads-Detail Scale: ***1"=40'*** OpenBridge-Detail Scale: ***Full Size 1 = 1***
   Nested Attachments: ***No Nesting***

2. Click **Fit View** in the view window. Double-check that the survey ground file came in at the correct location. **Zoom** to a ***coordinate grid cross*** and **snap** to it, the **XY-axis**,
3. Notice the coordinates do no match up.
4. In the References dialog box change ***True Scale to off*** and the scale to ***1 to 1***.
5. **Fit** the view and re-check the coordinates, they should now line up.

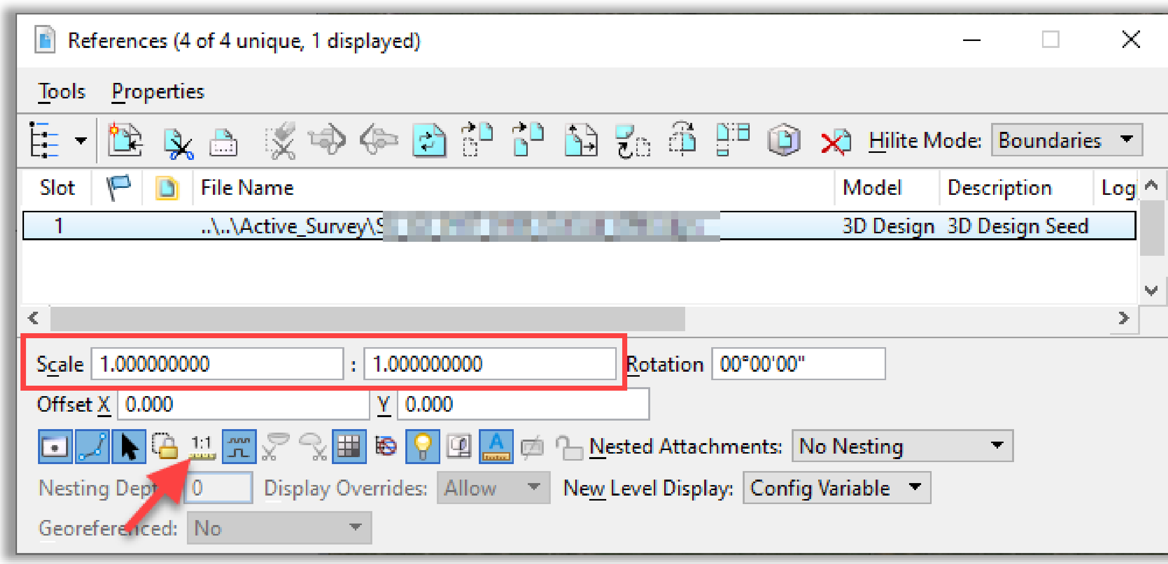

Figure 50 - Reference file Settings

6. Select the Reference tool.

   Browse to attach: ***Active_Survey| SV_XX_0107_0108_Oxford_ORD_Terrain.dgn***

   Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

   On the Reference Attachment Properties select:
   Model: ***Default***
   Orientation: ***Coincident World***
   Open Roads-Detail Scale: ***1"=40'***   OpenBridge-Detail Scale: ***Full Size 1 = 1***
   Nested Attachments: ***No Nesting***

3.4 Update the GCS

Let's explore the Geographic tools available with the OpenX applications

1. Use the **Intersect Snap**, **Place Line** command and place a line from one Northing and Easting Tick Mark to another.

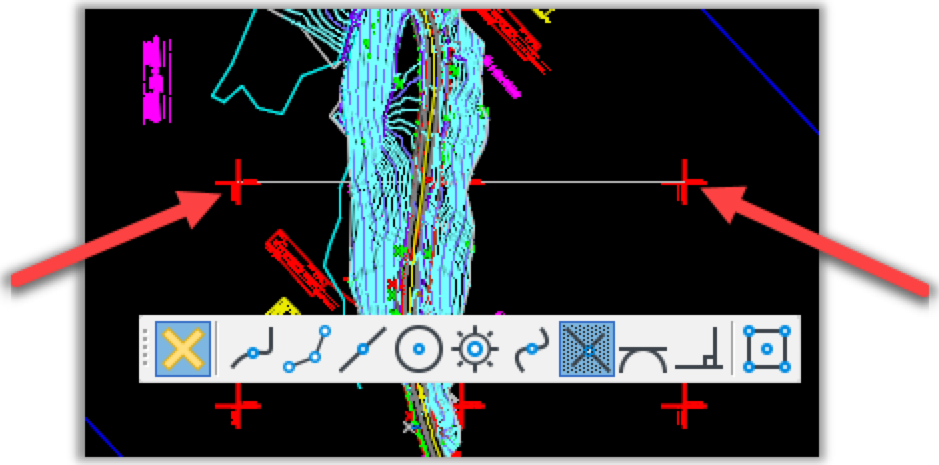

Figure 51 - Place Line from Tic Marks

2. Change the Workflow to **Drawing**, on the **Utilities** tab in in the **Geographic** section select **Coordinate System**.

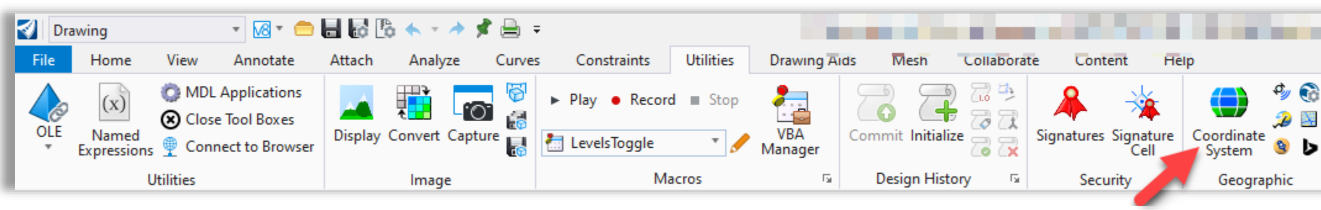

Figure 52 - Coordinate System Tools

3. Notice the Geographic Coordinate System dialog box information, this file uses ***NAD83*** and ***NGVD88***.

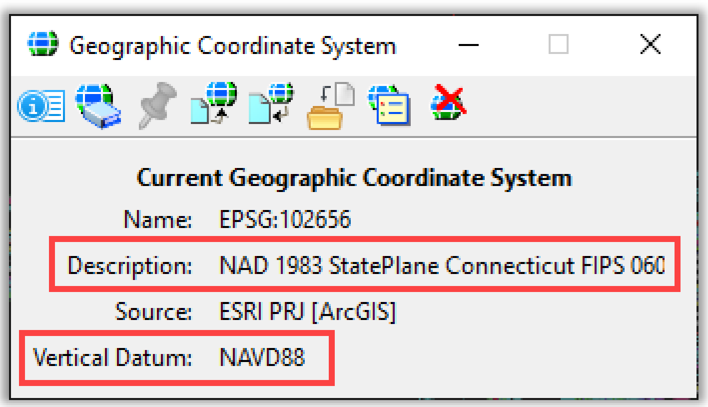

Figure 53 - Coordinate System Settings

4. A library of predefined Geographic Coordinate Systems (GCS) is available in CONNECT. Select the **From Library** icon to see the list of available Datums. Browse to ***Library/Projected (northing, easting, …)/North America/United States of America/Connecticut***, notice the available datums. This method can be confusing as there are a lot of options. Click **Cancel**.

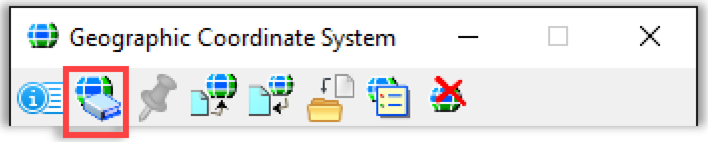

Figure 54 – Select Coordinate System From Library Icon

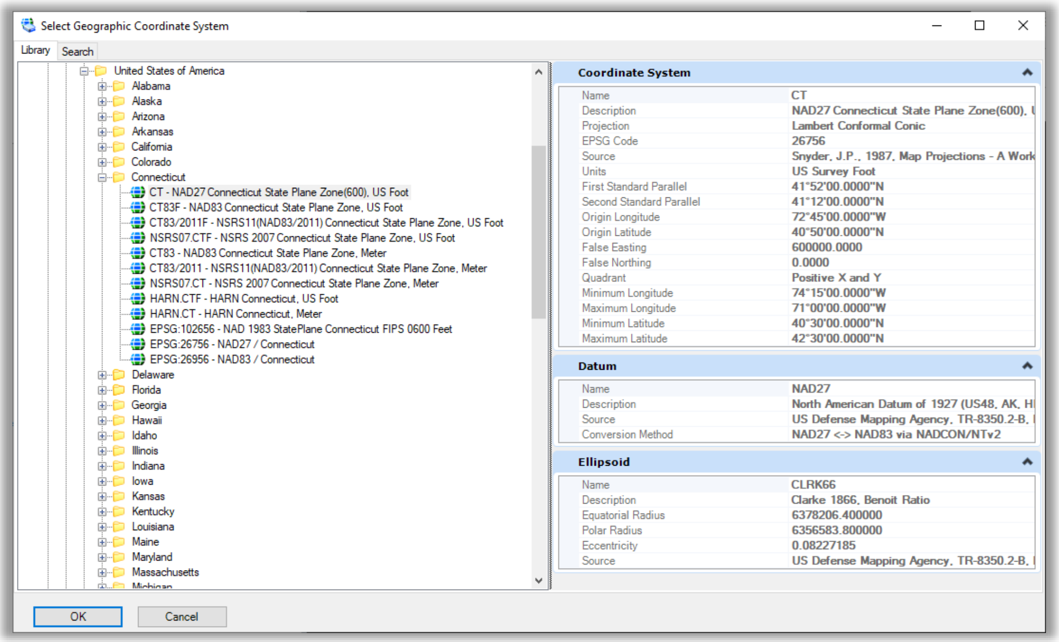

Figure 55 – Select Coordinate System From Library

5. Rather than selecting a GCS from this overwhelming library list, It is advised to use the GCS directly for a survey file. These files can be accessed by selecting the **From File** tool on the Geographic Coordinate System Toolbox. The tool will apply the GCS from the selected source to the active design file.
On the Geographic Coordinate System dialog select ***From File***. Browse to the location of the Survey ***Active_Survey/File SV_XX_0107_0108_Oxford_ORD_Terrain.dgn***.

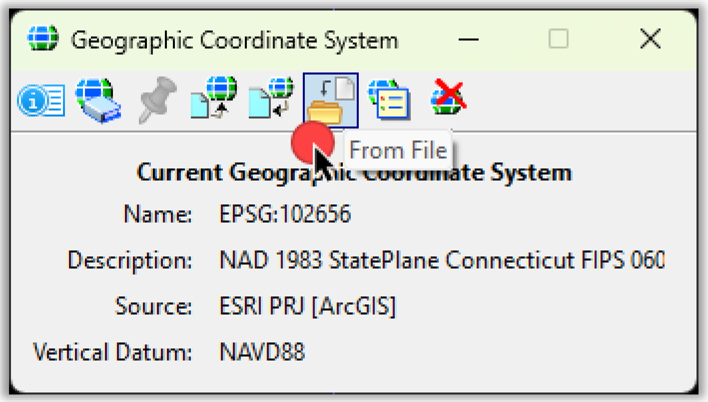

Figure 56 - From File

13. The Geographic Coordinate System Changed dialog box will appear. There are two options.

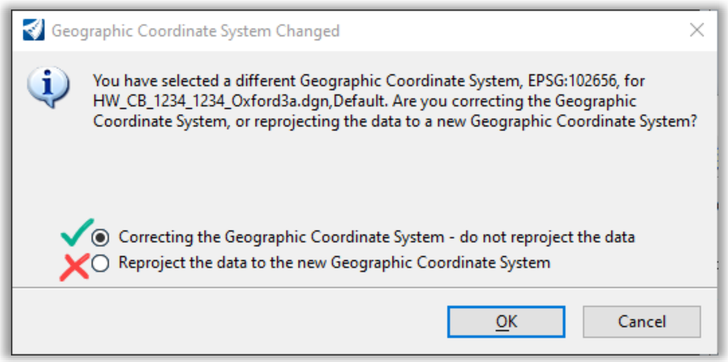

Figure 57 - Geographic Coordinate System Changed Dialog Box

a. First, we will see what ***Reproject the Data to the Geographic Coordinate System*** does to the line placed in step one. Select **Fit View**, this is **not** the desired option as it no longer lines up with the Survey. Select undo to reverse this setting and re-select **Fit View**.

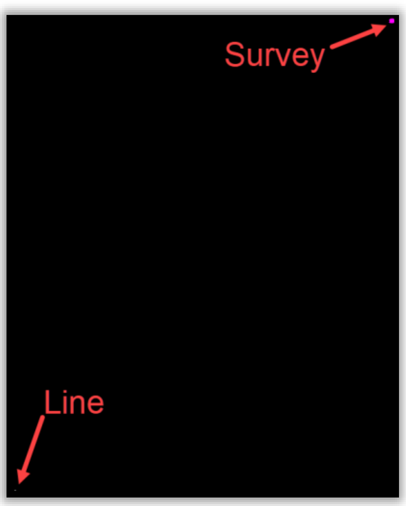

Figure 58 - Reproject the Data to the Geographic Coordinate System

b. Select the **From File** tool again but this time select ***Correcting the Geographic Coordinate System – do not reproject the data***.

Notes:

- Notice the line does not move and the Coordinates still match. Zoom to one of the lines that was placed on the coordinate grid cross and snap to it, compare the graphical text with the XY-axis output. The same northing and easting numbers appear.
- If you have other Models in the file, for example a 3D Model that was created during the Corridor Modeling procedure you will need to repeat step 5b.

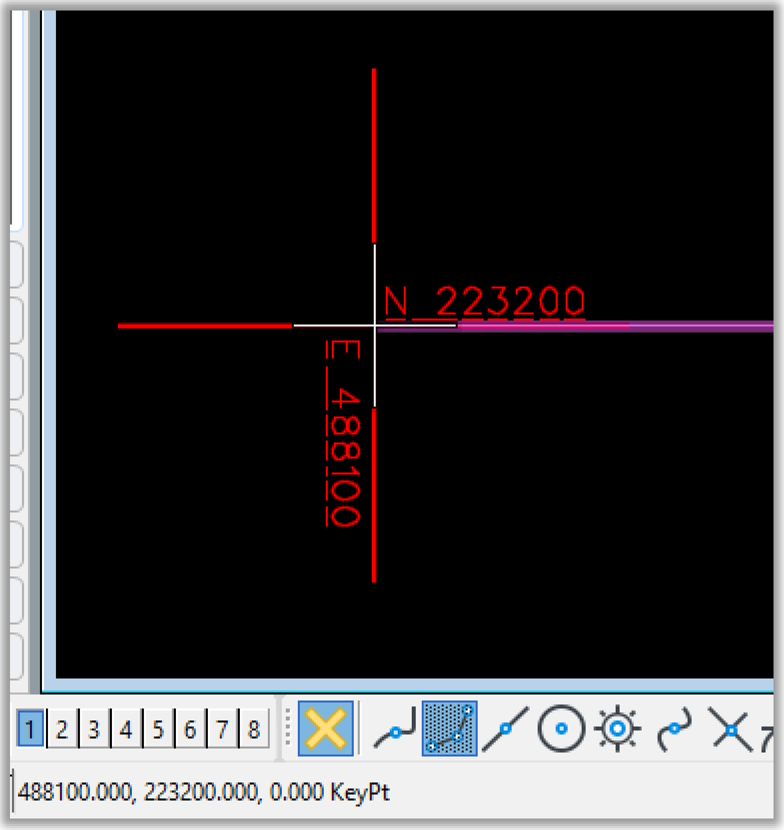

Figure 59 - Coordinates Tic Marks Match

14. Notice the Survey Notes Block and the Datum now match.

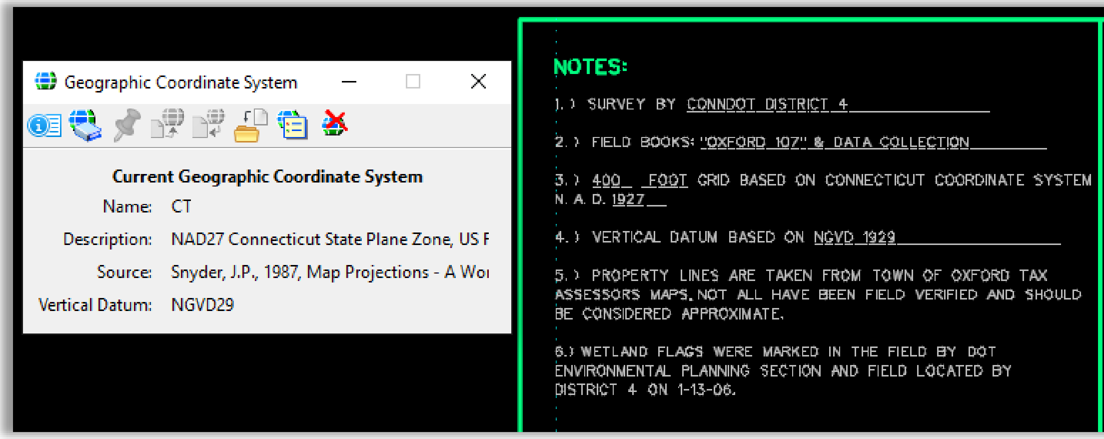

Figure 60 - Coordinate System Check

7. Select **Save Settings**

Exercise 4 – Attaching Imagery

There are two ways to view areal imagery in a DGN file.

1. Through the View as a background map
2. Attaching a raster image

4.1 Select View Background Map

1. Open the file from Exercise 3.

   ORD - *...\Highways\Base_Models\HW_CB_1234_1234_Oxford.dgn*

   or

   OBM - *...\Bridge\Base_Models\ SB_CB_1234_1234_Oxford.dgn*

2. Open the file for exercise 3, On the View window icon click on **Select Background Map**.

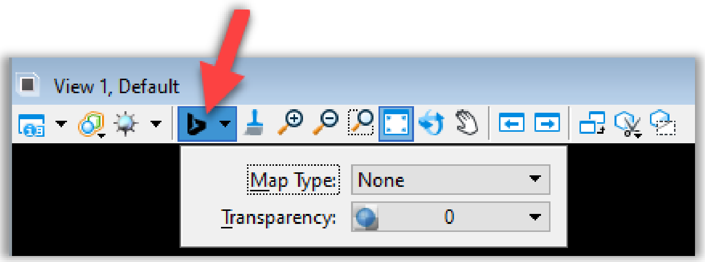

Figure 61 - View Background icon

3. In the **Map Type** pull down select **Background Map Type**. Select **Road**, **Aerial**, or **Hybrid**.

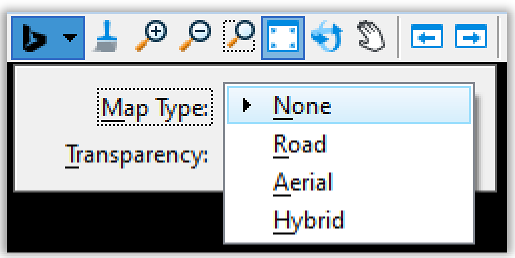

Figure 62 - Background Map Type Pick List

Figure 63 - Background Map Views

4.2 Connecting to Imagery on a Web Map Server (WMS)

1. Open the file from Exercise 3.

   ORD – *...|Highways|Base_Models|HW_CB_1234_1234_Oxford.dgn*

   or

   OBM – *...|Bridge|Base_Models| SB_CB_1234_1234_Oxford.dgn*

2. Turn off the background map.
3. Open the **Raster Manager**, click on ***File > Attach > WMS***
4. Browse to ***CT_Configuration|Organization|Seed|GCS|***
5. Double click on ***Ortho_2023_EPSG_2234.xwms*** to open, select **Attach**

   Note: This will load an image of the entire state. It may take some time for this image to come in to view as it is bringing a large amount of data. The view will be slow to entirely update, because of this attaching individual SID files may be more desirable. There are other xwms files available for use in this folder as well.

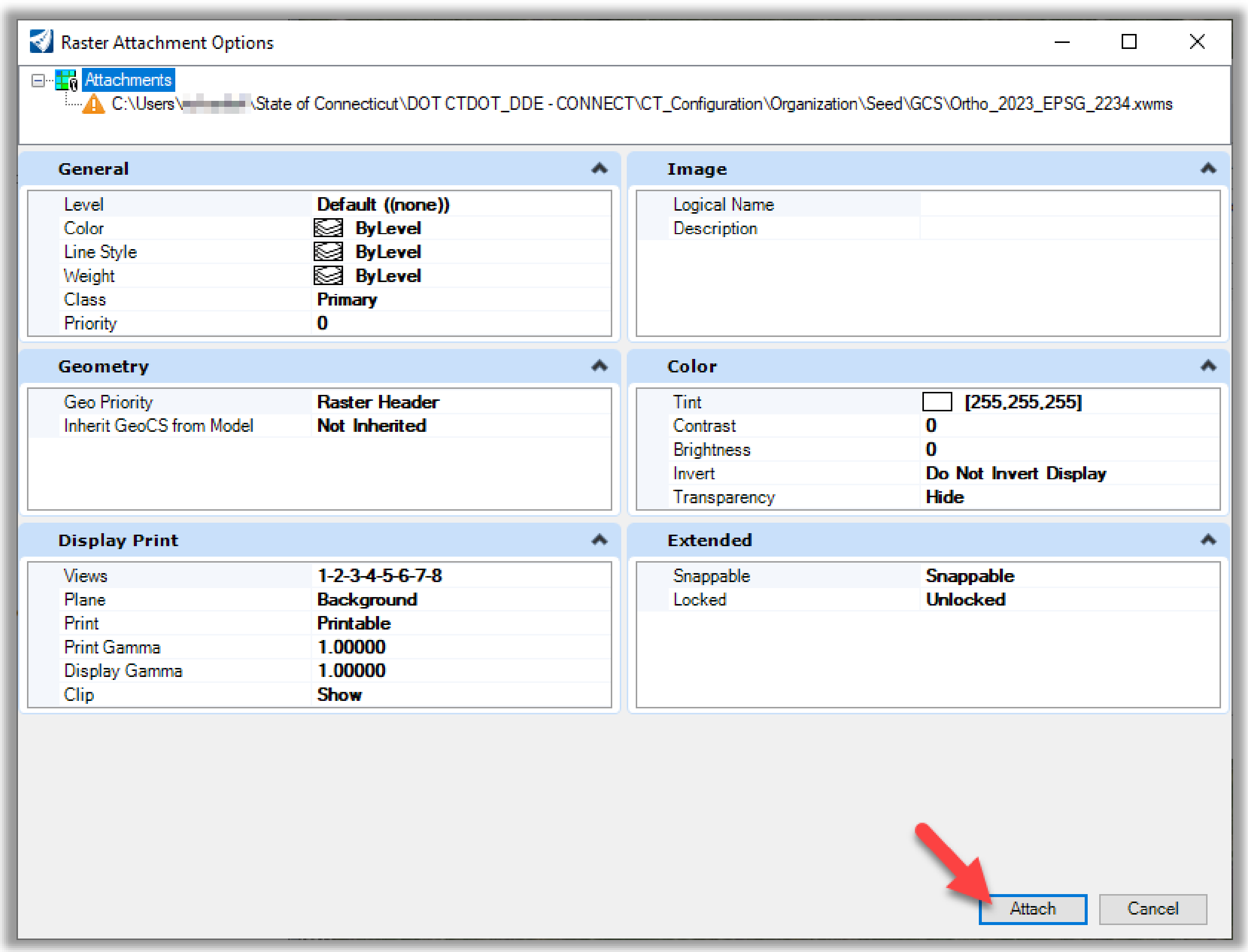

Figure 64 - Attach Raster Options

4.3 Attaching Imagery from Raster Files

A DGN file will be used as a container for the Orthophotography raster attachments. No other items (line work, cells, text, etc…) shall be added to this file accept for the raster attachments. This container DGN file can be referenced into other Design, Drawing, and Sheet Models as needed. Following this simple procedure will be extremely helpful to other units that are referencing your files. There have been several help inquiries on raster referencing through the years going back to V8i and continuing in CONNECT Edition. AEC has found that setting up your raster's in a separate dgn has solved publishing, printing and other downstream issues.

In this exorcise we will be attaching information from UCONN:
[CT Aerial Imagery and Lidar Elevation Download App]

- CONNECT Edition Products are now compatible with 4 band orthoimage (MrSID4).
- UCONN uses NAD 83. The DGN container file will be NAD 83 and will be projected as needed in your files used for design and layout.
- The downloaded data will be in a Zip file and should be extracted to the **Share** folder in your Workset. Typically, there are two types of Images available depending on the year selected on UCONN's site, Tiffs and SIDs. It's important that all the files in the Zip be copied into the Share folder together.

1. In File Explorer browse to your project's Share folder. Click on the Oxford Folder. Notice the Downloaded data from UCONN's site.
2. In CAD create a 2D DGN file using a 2D Seed file and use it as a container for the Orthophotography raster attachments and store it in the ***Share*** folder.

   ORD - ***…|Share|HW_CB_1234_1234_Oxford_Raster_Container.dgn***
   or
   OBM - ***…|Share|SB_CB_1234_1234_Oxford_Raster_Container.dgn***

   Use the **2D** seed file:
   CT_Configuration|Organization|Seed|GSC|2D_NAD83FT_NAVD88.dgn
3. After the file is created check to make sure the CT NAD 83 Geospatial Header is attached.

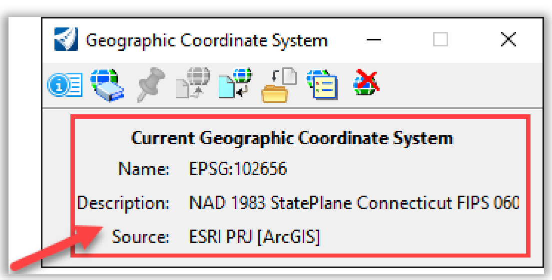

Figure 65 - Coordinate System Settings

4. Now you will need to check your user settings. Select ***File > Settings > User > Preferences***.

5. On the Preferences Dialog box locate and select **Raster Manager** and under Georeference check the following:
   Sister File Settings:
   Use Sister Georeferenced File is toggled ***on***.
   Save Location Information is toggled ***on***.

   Default Unit Settings:
   Sister File: ***1 Unit = 1 US Survey Feet***
   Raster file: ***1 Unit = 1 Us Survey Feet***
   Use Unit Definition Geokey if Present (override PCS unit) is toggle ***on***.

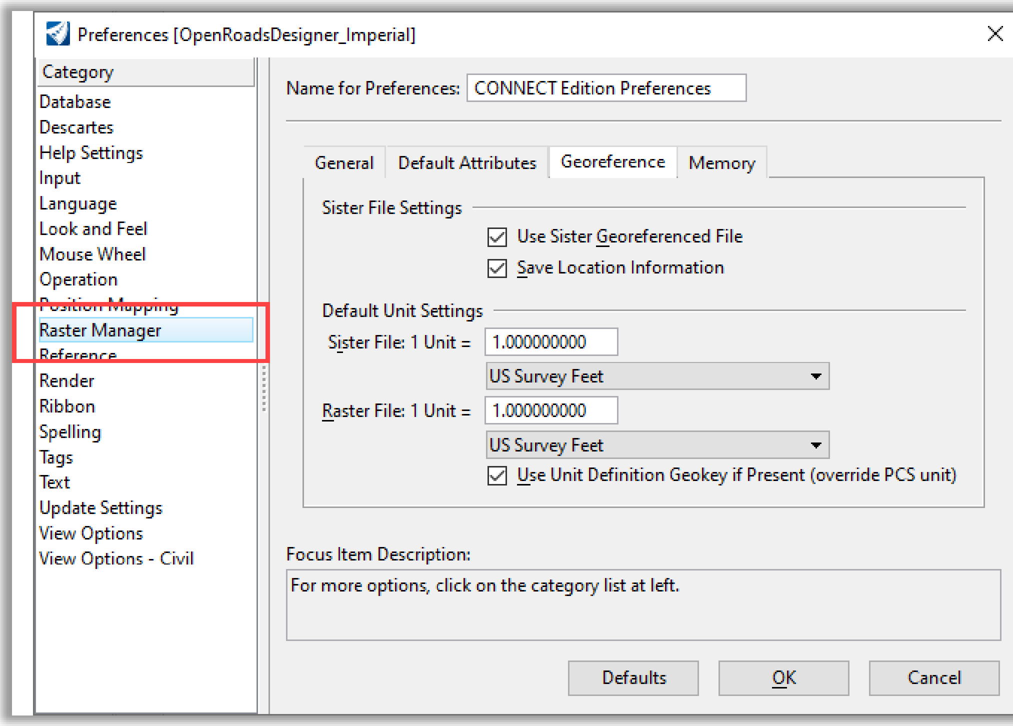

Figure 66- User Preferences Raster Managers Settings

6. Click **OK**.

7. Select the **Home** tab and hold down the **Attach Tools** icon, select **Raster Manager**.

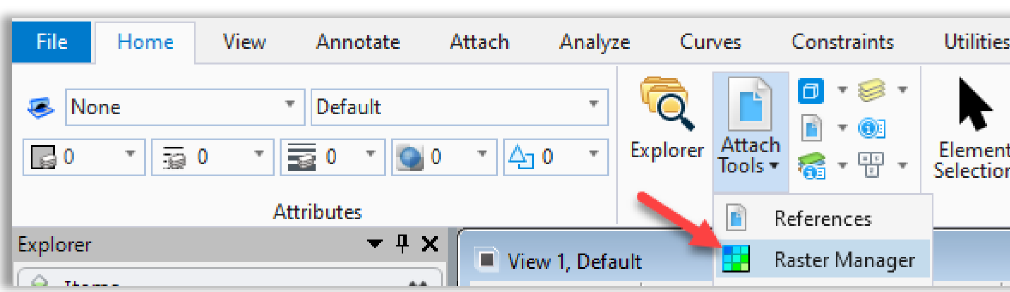

Figure 67 - Raster Manager tool

8. *In the **Raster Manager*** select ***File / Attach / Raster*** and browse to ***Share/Oxford*** attach the .tif or the sid file.

   The main differences between .sid and .tiff files are the size:

   - Compression: .sid files use Multi-resolution Seamless Image Database (MrSID) compression, while .tiff files do not.
   - Portability: .sid files are designed to enable portability of massive bit-mapped (raster) images, while .tiff files do not specifically address portability.

9. On the Raster Attach Options dialog box under Geometry select ***Attachment***. Select the **Attach** button to accept.

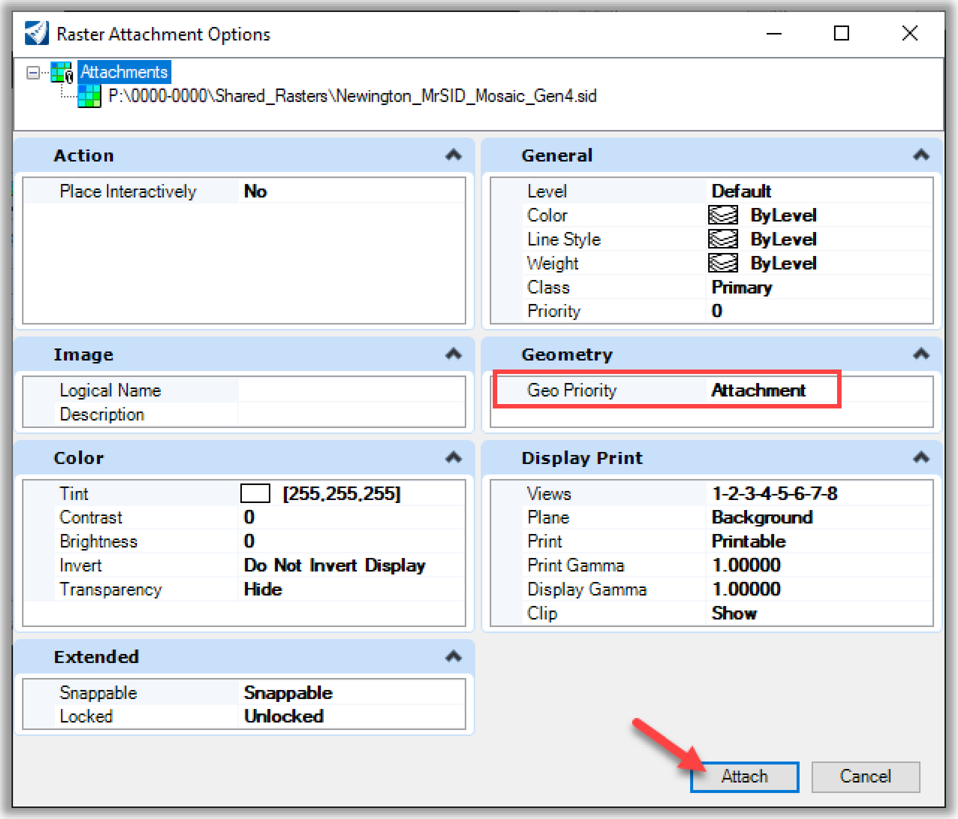

Figure 68 - Raster Manager Attachment Settings

10. Select **Fit**, to bring the photo to the center of the view and **Save Settings**.

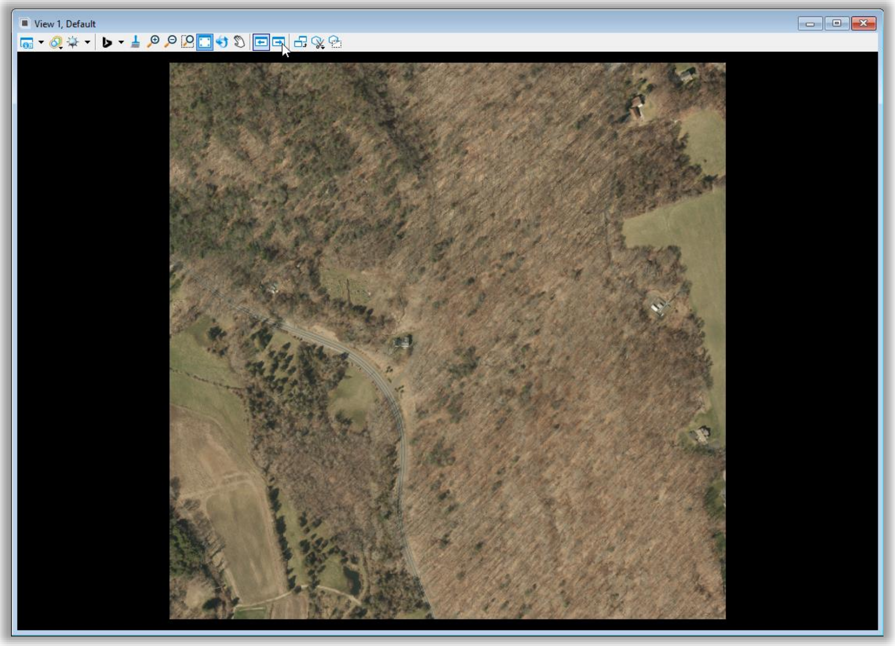

Figure 69 - View of Raster Image

11. If you would like the Raster to use Transparency, select it in the **View Window** and in **Properties** under **General** set the desired ***Transparency*** value.

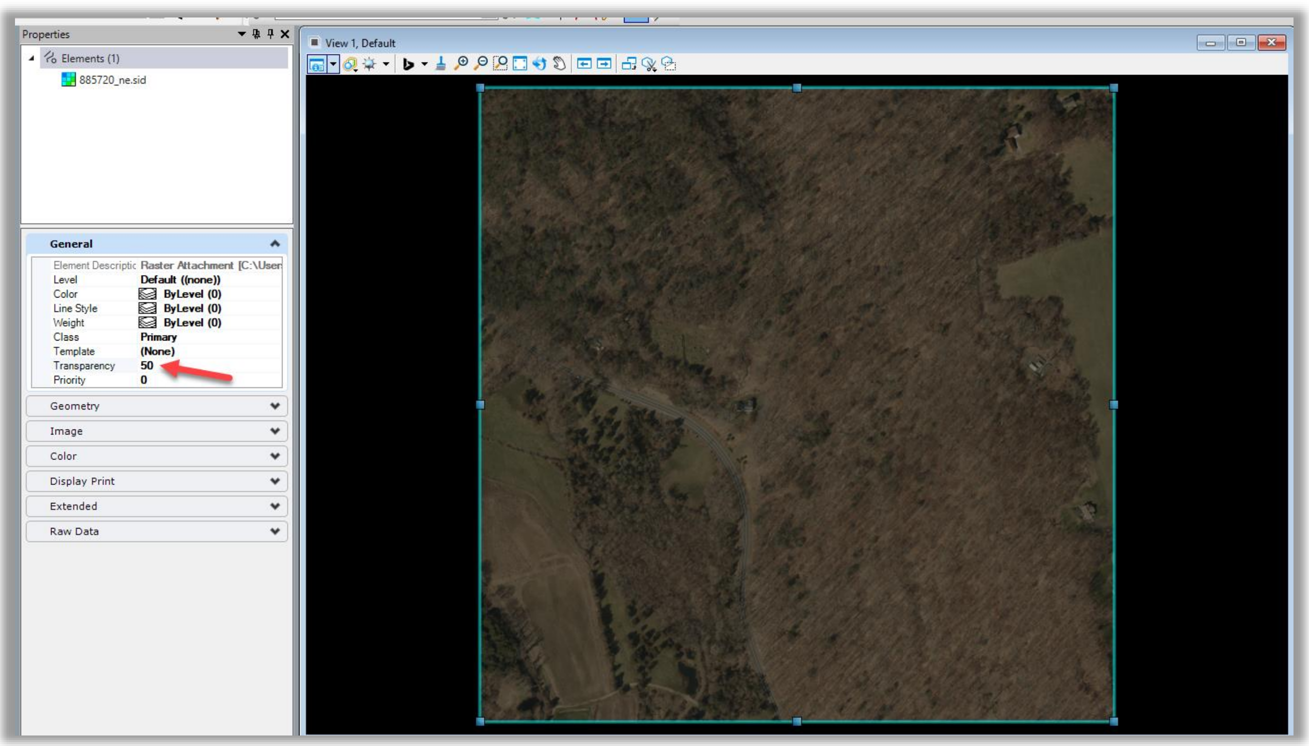

Figure 70 – Set Transparency

11. Open the File from Exercise 3.

    ORD – *...|Highways|Base_Models|HW_CB_1234_1234_Oxford.dgn*

    or

    OBM –*...|Bridge|Base_Models| SB_CB_1234_1234_Oxford.dgn*

12. Turn off the **background map** and the in the Raster Manager turn off the **WMS in View 1**.

13. Reference this file in using **Geograpghic - reprojected**. Notice the reference lines up with the NAD 27 Survey File.

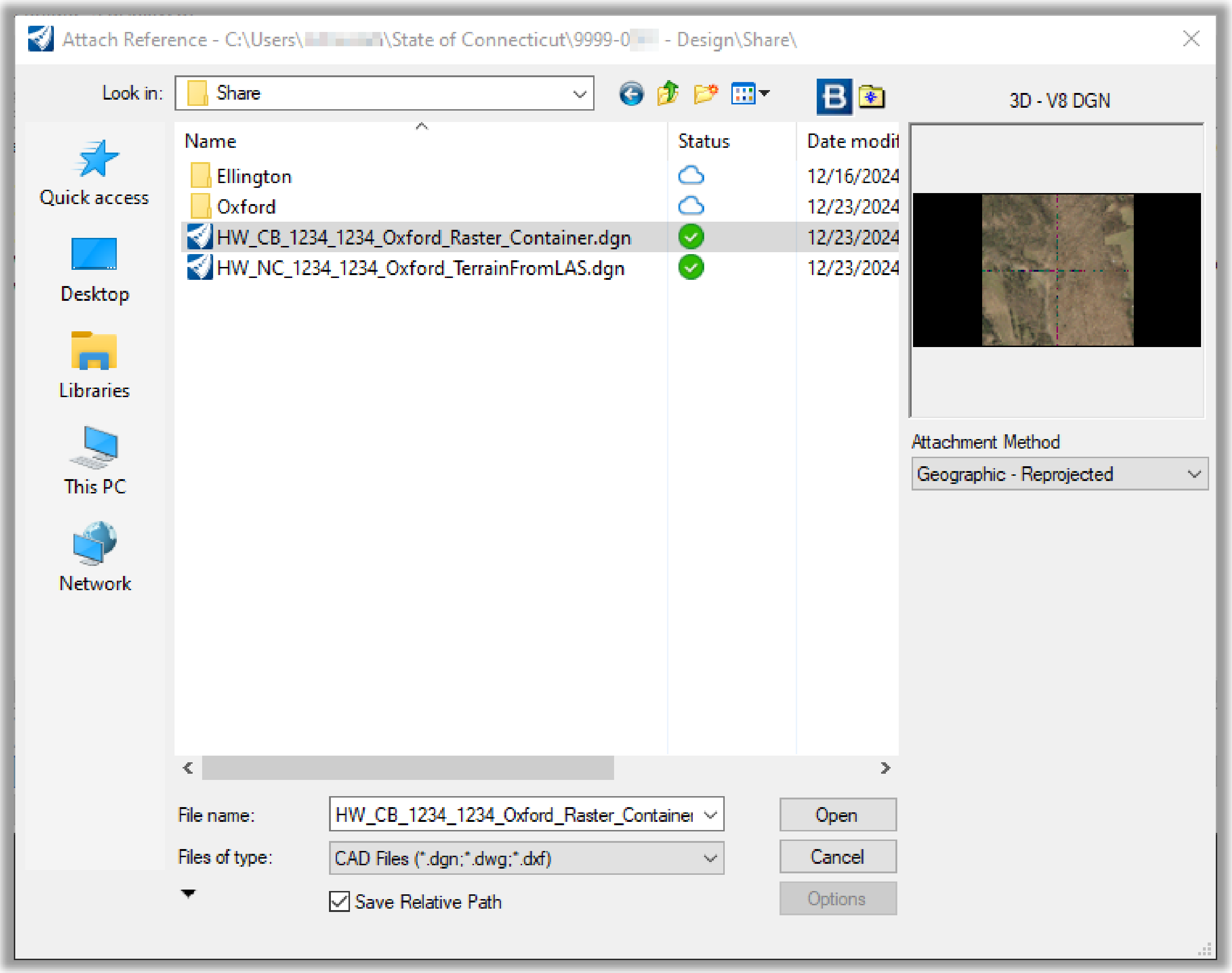

Figure 71 - Reference Geographic Reprojected

Exercise 5 - Creating a Terrain from LiDAR Data

Statewide LiDAR can be found on the UCONN/CT ECO Website. CONNECT Edition Products are now compatible the LAS data.

For information please visit:
CT Aerial Imagery and Lidar Elevation Download App

UCONN uses NAD 83. The DGN container file will be NAD 83 and will be projected as needed in your files used for design and layout.

- The downloaded data will be in a Zip file and should be extracted to the **Share** folder in your Workset.

LiDAR data comes in two main formats: LAS and LAZ. LAS is an uncompressed format ideal for fast processing, while LAZ is a compressed version that saves up to 90% of storage space without losing data accuracy. Here's what you need to know:

- LAS: Faster to process, widely used for active workflows, but requires more storage.
- LAZ: Smaller file size, great for storage and sharing, but slower to process due to decompression.

The most recent available data form UCONN only provided the LAZ format, which is unfortunate for us in the CAD world as this causes us to have to process a few extra steps to get a terrain.

This Module will introduce two ways to import TOPO Data:

- Terrain from LAS File
- Terrain from LAZ File
- Terrain from Esri

5.1 Terrain from LAS File

5.1.1 Import with Filtering

1. In CAD create a 3D DGN file using a **3D** Seed file and use it as a container for the LAS Terrain and store it in the ***Share*** folder.

   ORD - ***…|Share|HW_NC_1234_1234_Oxford_TerrainFromLAS.dgn***
   or
   OBM - ***…|Share|SB_NC_1234_1234_Oxford_TerrainFromLAS.dgn***

   Use the **3D** seed file:
   CT_Configuration|Organization|Seed|GSC|3D_NAD83FT_NAVD88.dgn

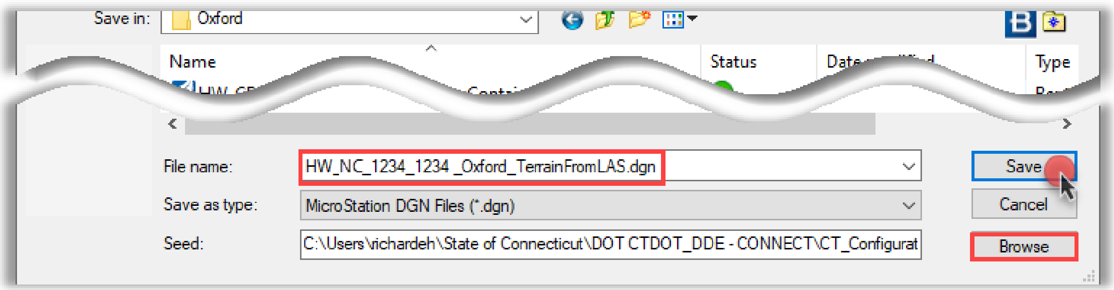

Figure 72 - Create New File

2. Check to make sure the CT NAD 83 / NAVD88 Geospatial Header is attached.

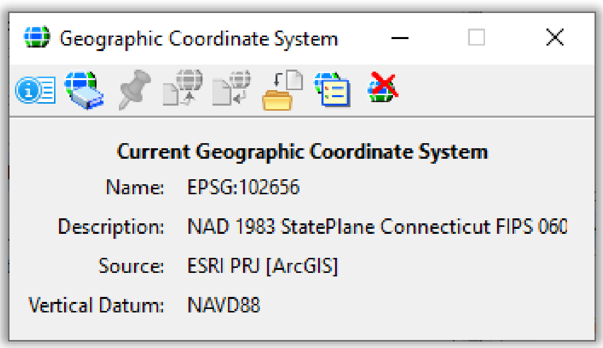

Figure 73 - Coordinate System Settings

3. **ORD –** Select the **OpenRoads Modeling** or **Survey** Workflow, on the **Terrain** tab, **Create** section, select the **From File** icon.

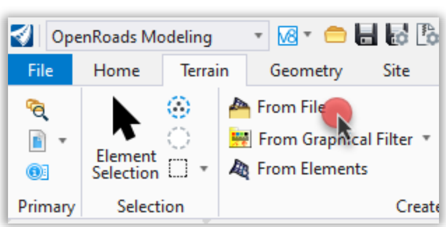

Figure 74 ORD Import a Terrain Model From File

OBM – Select the **OpenBridge Modeler** Workflow, on the **Civil** tab, **Terrain Model** section, select the top left pull down and choose **Create From File**.

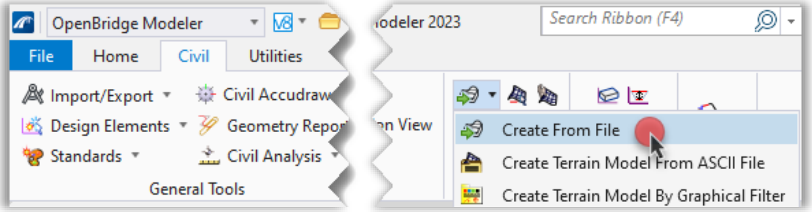

Figure 75 – OBM Import a Terrain Model From File

4. Browse to the downloaded LAS file(s) in ***Share / Oxford***. Select the **LAS file(s)** ***885720_ne*** and ***885720_nw*** and click on the **Done** button.

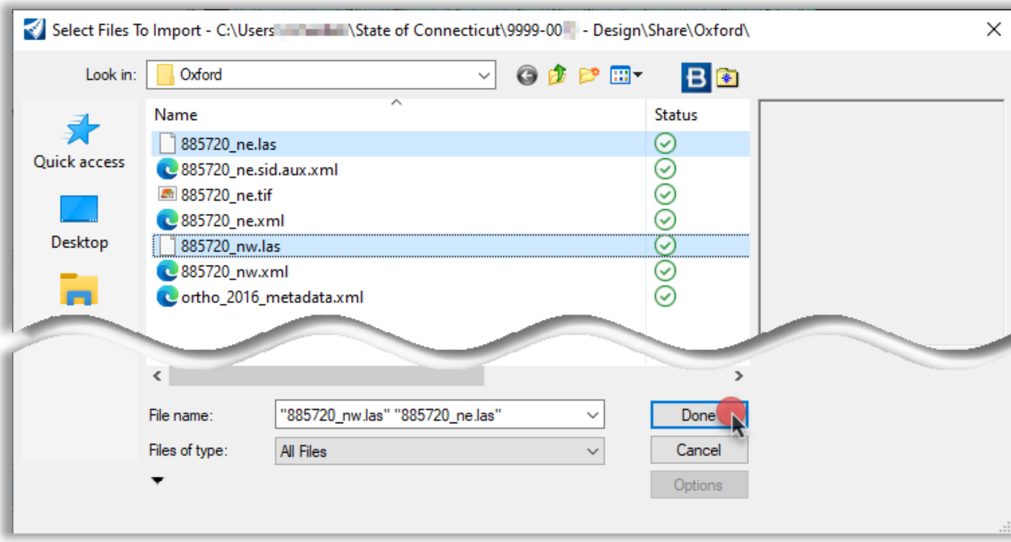

Figure 76 - Select Files to Import Dialog Box

5. In the Import Terrain Model(s) select the following:

   a. On the Import Terrain Model(s) dialog box only leave only **Ground** checked on for both Terrains. In the file Option area select the Feature Definition **Terrain \ Existing Contours Only**.

   b. Under File Options the number of points and size of the file can be reduced by Filtering. Three options are supported: **None**, **Tile**, and **Tin**. From empirical studies, the tiling algorithm is faster and typically produces a 30% to 50% reduction in file size. The TIN algorithm typically produces a 70% to 90% reduction.

   c. In the filter area select: Filter: ***Tin*** Z Tolarence: ***1*** Granularity: ***Coarse***

   d. Select **Import** and **Close** the dialog box.

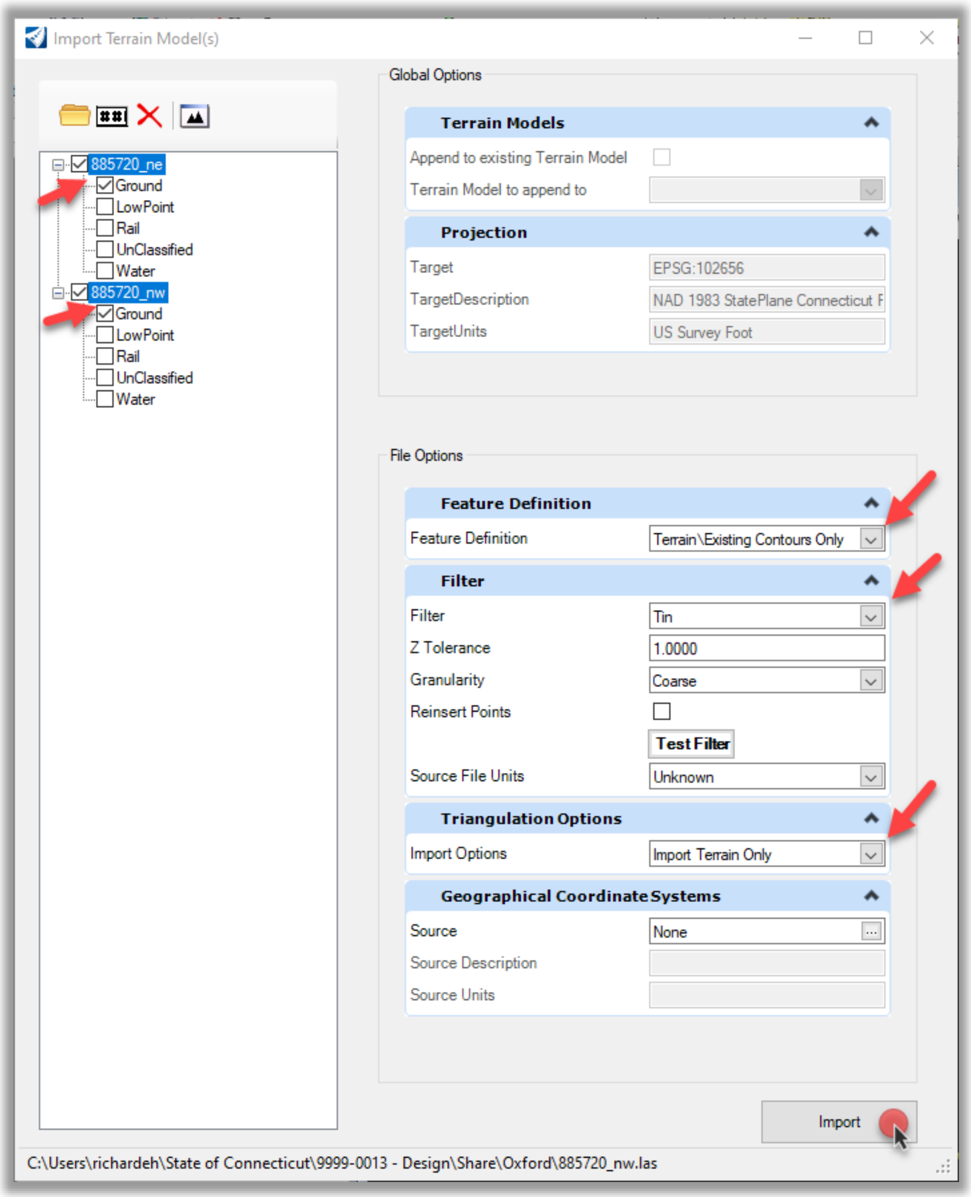

Figure 77 – Import Terrain Selections

None **-** No filter is applied if None is selected. No additional inputs are required.

Tile - The tiling algorithm is a recursive divide and conquer algorithm that divides the data set into tiles. A best fit plane is calculated for each tile and points are removed if they fall within the user set Z tolerance to the plane.

Z Tolerance	The variation in the Z coordinate that the surface is allowed to move during the filtering process. Typically for the first invocation of the filtering function, the Z tolerance should be set from 0.5 to 1.0 for imperial data sets and from 0.25 to 0.5 for metric data sets. Depending on the outcome and desired result, the Z tolerance can be varied up or down.
Minimum Tile Points	A tile will not be subdivided if it has less than this number of points. Typically set this to five.
Max Tile Divisions	Allowable level of recursion allowed and is the number of times the initial tiling set can be subdivided. Typically set this to five.
Start Tile Length	The data set is initially divided into tiles of this size, prior to recursion to the minimum tile points. The setting of this parameter requires some knowledge of the distance between the points, which requires an inspection of the points in MicroStation to determine. Typically set this to 10 times the distance between the points.

Tin **-** The TIN algorithm filters points if they fall within the user set Z tolerance of the triangle planes. The TIN algorithm first tiles the points into tiles with a maximum of 2 million points and then repetitively triangulates each tile filtering out points.

Z Tolerance	The variation in the Z coordinate that the surface is allowed to move during the filtering process. Typically for the first invocation of the filtering function, the Z tolerance should be set from 0.5 to 1.0 for imperial data sets and from 0.25 to 0.5 for metric data sets. Depending on the outcome and desired result, the Z tolerance can be varied up or down.
Granularity	Course - Filters more points with some blurring of ridges and valleys. Fine - Filters fewer points with less blurring of ridges and valleys.
Reinsert Points	After filtering the points a further check is made based on the tolerances

5.1.2 Create Complex Terrain Model

1. In **Explorer** select the ***two Terrains*** and switch the Feature Definitions to ***Existing Ground***. This will set the Terrain to only see the Boundary which will make is easier to see the Complex Terrain we will be creating in the next step.

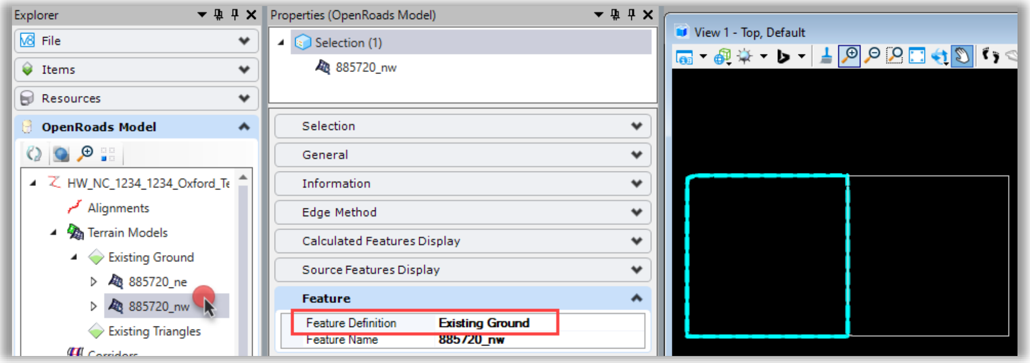

Figure 78 – Updated Terrain Feature Defintion

2. **ORD –** Select the **OpenRoads Modeling** or **Survey** Workflow, in the **Terrain** tab, **Create** section, select the **Additional Methods** pull down and choose **Create Complex Terrain Model**.

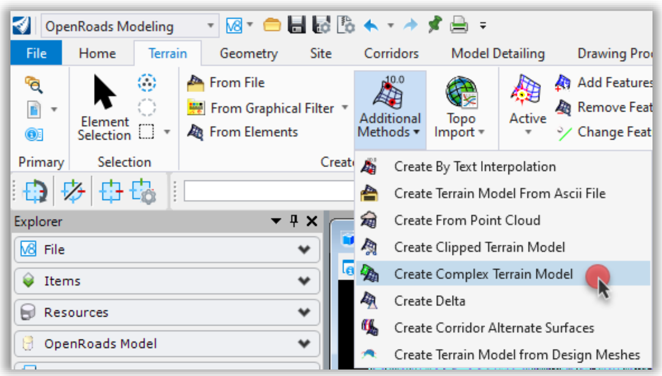

Figure 79 – ORD Create Complex Terrain Model

OBM – Select the **OpenBridge Modeler** Workflow, in the **Civil** tab, **Terrain Model** section, select the top left pull down and choose **Create Complex Terrain Model**.

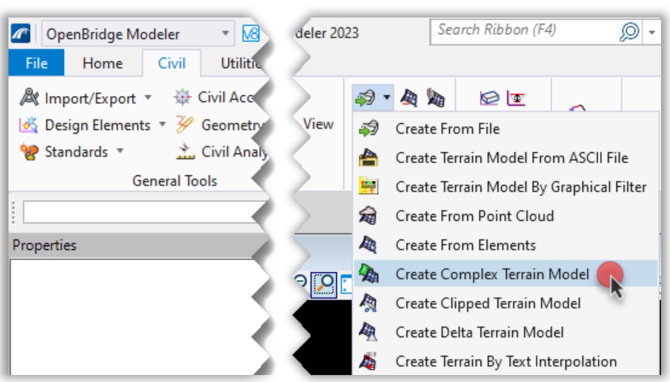

Figure 80 – OBM Create Complex Terrain Model

Select the 885720_ne and click the **Add** button

select the 885720_nw and click the ***Add*** button

Use the following settings:

Current Action: ***Append***

Terrain Feature Definition: ***Terrain > Existing Contours Only***

Name: ***Combined***

Click **Finish** to complete the Complex Terrain.

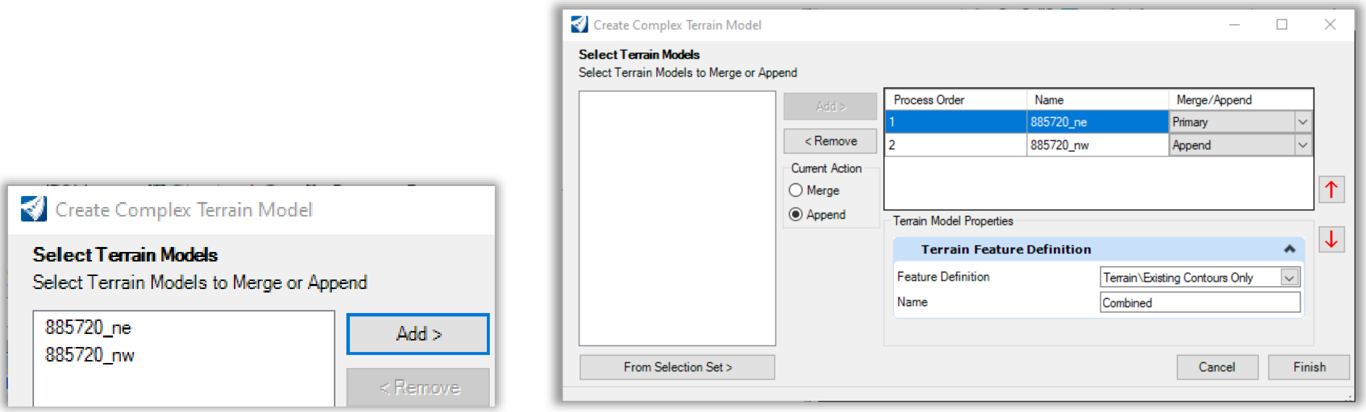

Figure 81 – Create Complex Terrain Model

Current Action Merging or Appending Terrain Models

Both merging and appending combines the data contained in multiple (two or more) models. However, they are not the same process and yield different results.

When appending, the software triangulates the combined data from the two terrain models using all data from both models and ignoring none. The two models may overlap or be adjacent to one another. If there is data in both models in a common area, it is all utilized for triangulation.

When merging, the software triangulates the combined data from the two terrain models in areas where they do not overlap. The two models must overlap at least one point. If there is data in both models in a common area (overlap), the data from the primary model is discarded, and only the data from the merging model is used. Therefore, order is critical.

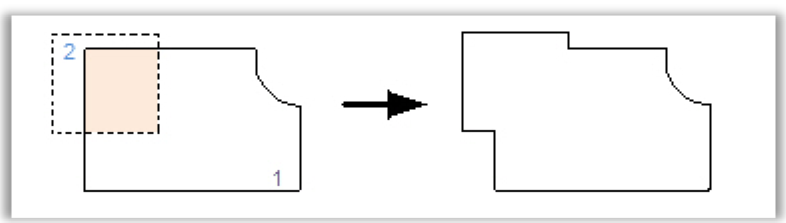

Figure 82 - Merging vs Appending Terrain Models

In the example above, TM1 is the primary model, and TM2 is being merged (lower on the order list). In the shaded area (which both terrain models have in common), the data from

TM2 is utilized, and retriangulated around the common edges. The data within the shaded area from TM1 is discarded. The hull of the new, merged terrain model is shown.

1. In our example the files do not overlap so **Append** is needed. Notice how the contours react to the two different Methods.

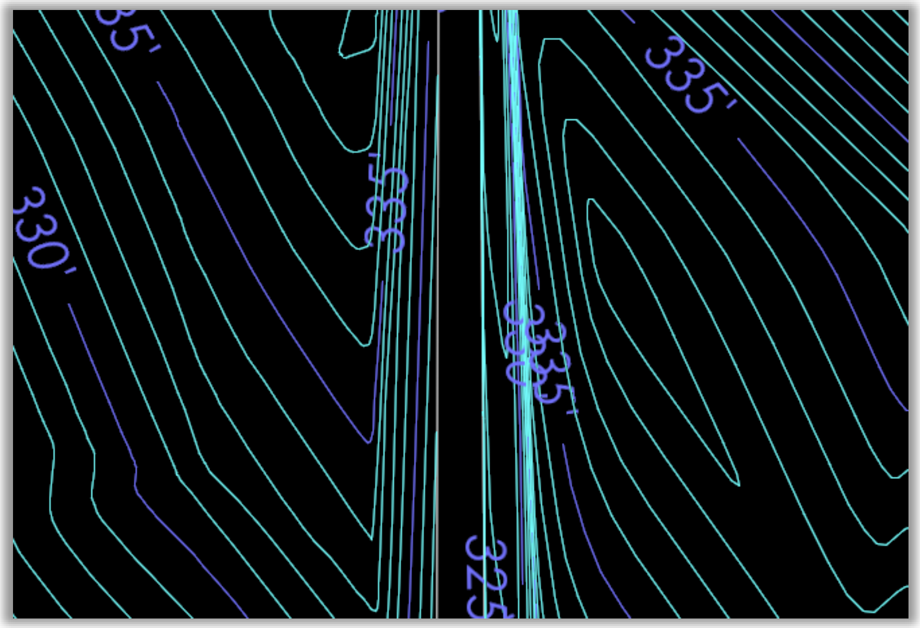

Figure 83 – Contour Display after a Complex Merged Terrain

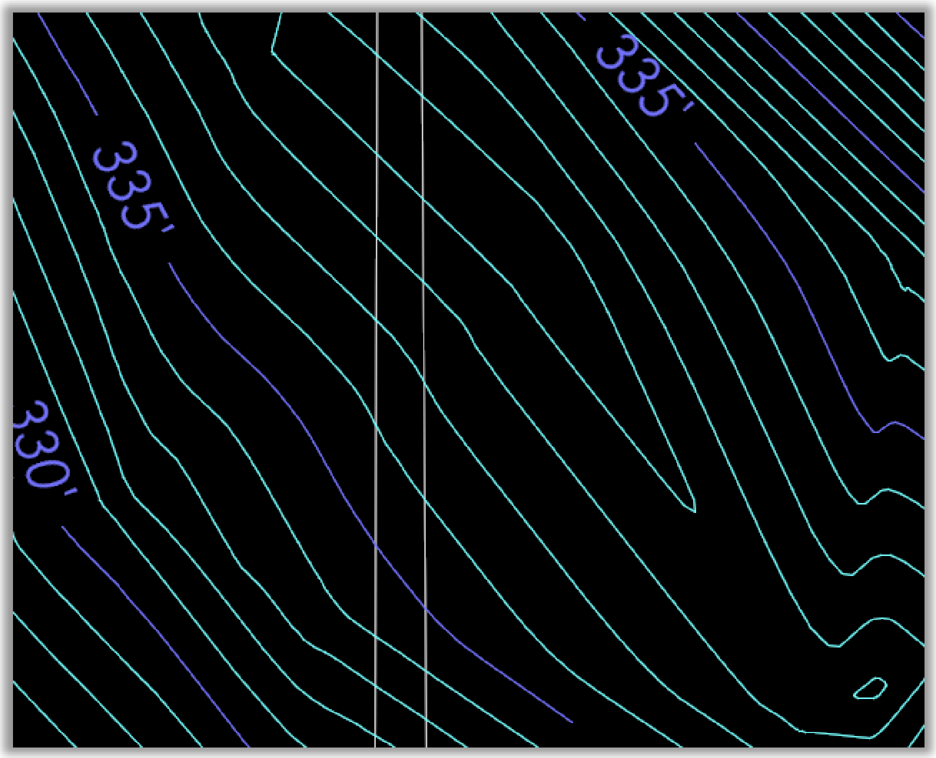

Figure 84 - Contour Display after a Complex Appended Terrain

5.1.3 Create Clipped Terrain Model

1. In Attributes set the following active:
   Level: ***E_TERRAIN_Boundary***
   Color: ***Yellow***
   Line Style: ***3***
   Line Weight: ***10***

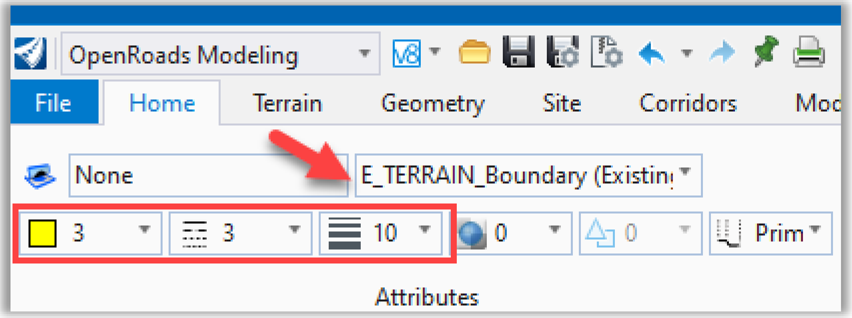

Figure 85 – Set Attributes

2. Using the drawing tool; **Place Shape**, draw a closed polygon around the Terrain you would like to keep.

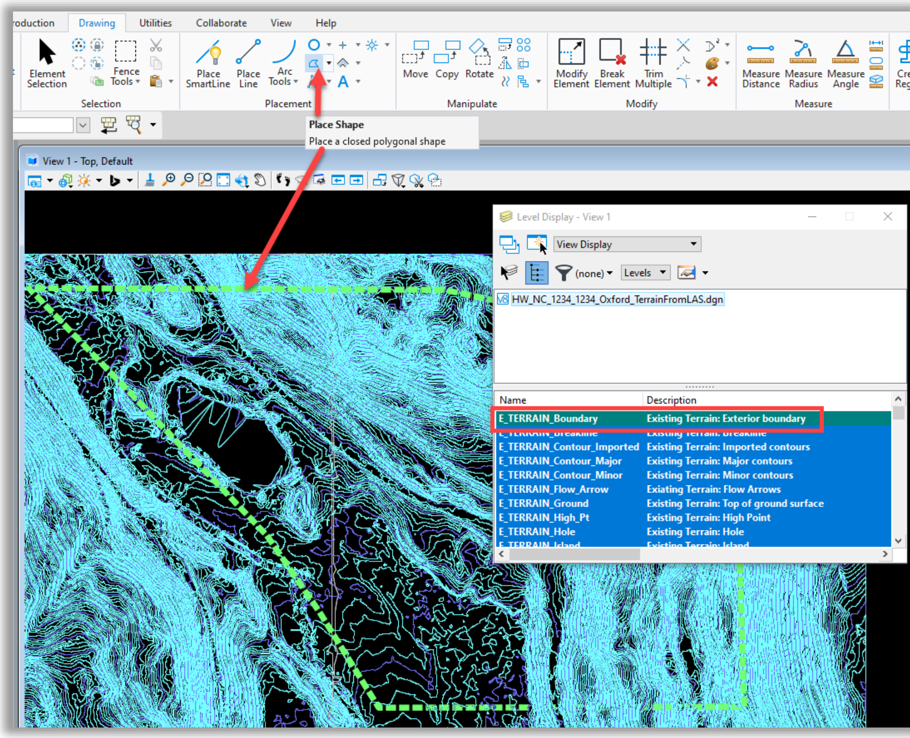

Figure 86 – Set Level Active and Place Shape

3. In **Explorer** select the ***Combined Terrains*** and switch the Feature Definitions back ***Existing Ground***. This will set the Terrain to only see the Boundary which will make is easier to see the Complex Terrain we will be creating in the next step.

4. **ORD –** Select the **OpenRoads Modeling** or **Survey** Workflow, in the Terrain tab , **Create** section, select **Additional Methods** pull down and choose **Create Clipped Terrain Model**.

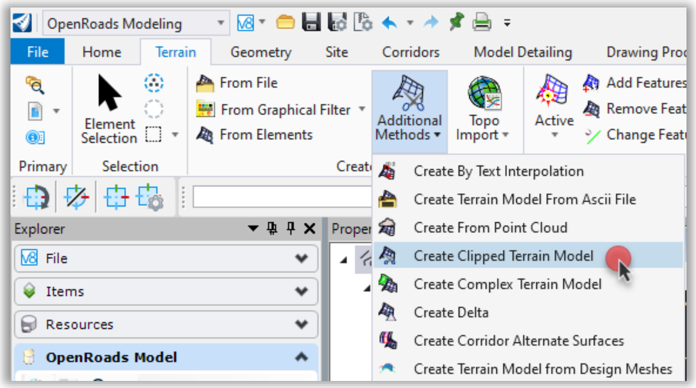

Figure 87 – ORD Create Clipped Terrain Model

OBM – Select the **OpenBridge Modeler** Workflow, in the **Civil** tab, **Terrain Model** section, select the top left pull down and choose **Create Clipped Terrain Model**.

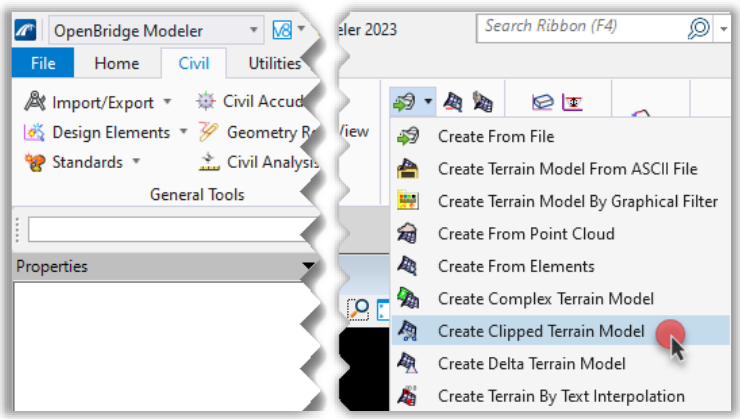

Figure 88 – OBM Create Clipped Terrain Model

2. Set as follows:
   Referenced Terrain Model: ***Combined***
   Clipping Method: ***External***
   No Horizontal or Vertical Offset
   Feature Definition: ***Terrain > Existing Contours Only***
   Name: **Clipped**

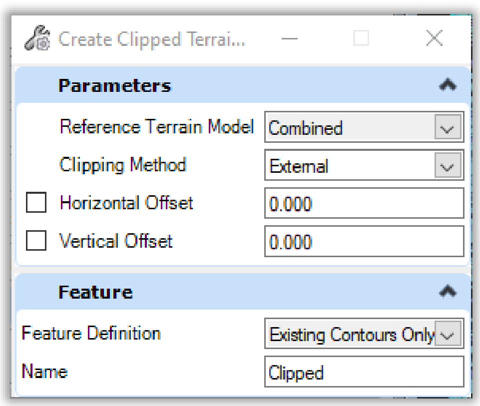

Figure 89 - Create Clipped Terrain Model

3. Follow the prompts; select the Clipping Element and reset (right Click) when done, toggle through the settings and clip the Terrain.

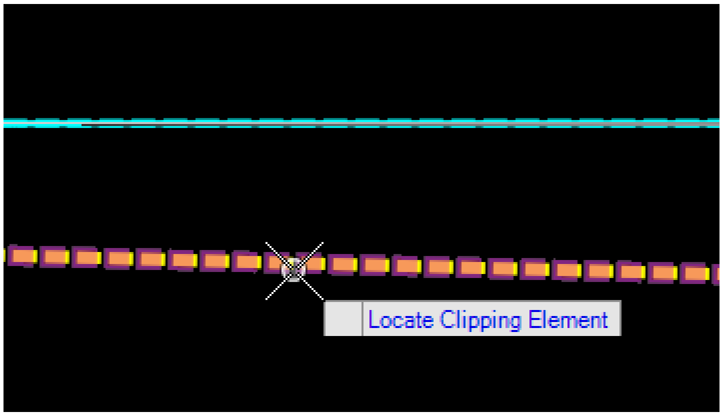

Figure 90 – Locate Clipping Element

4. Select the Clipping Shape and edit the shape as needed.

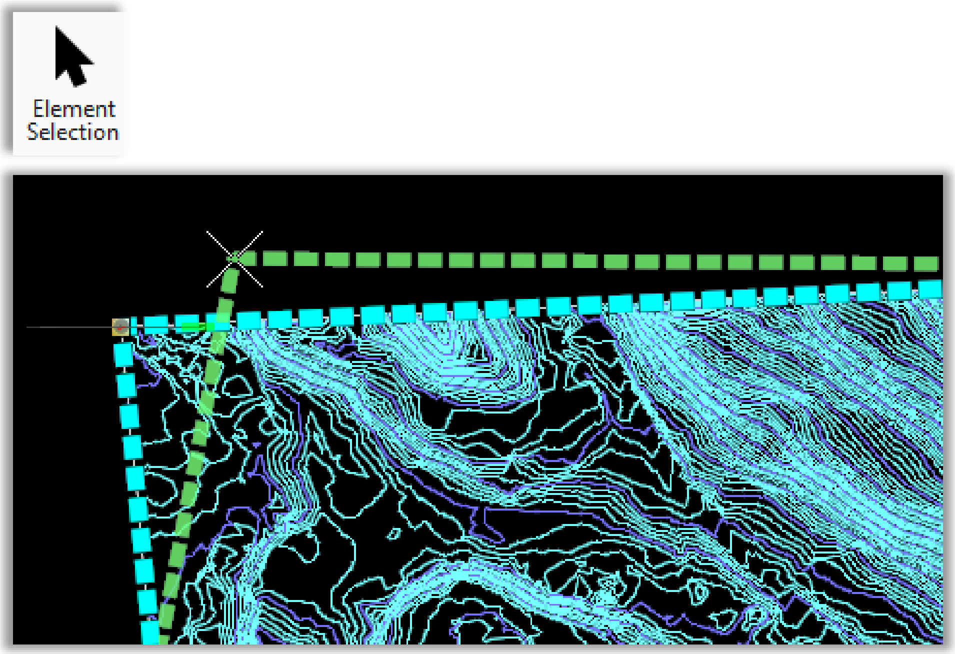

Figure 91 - Move Point on Shape

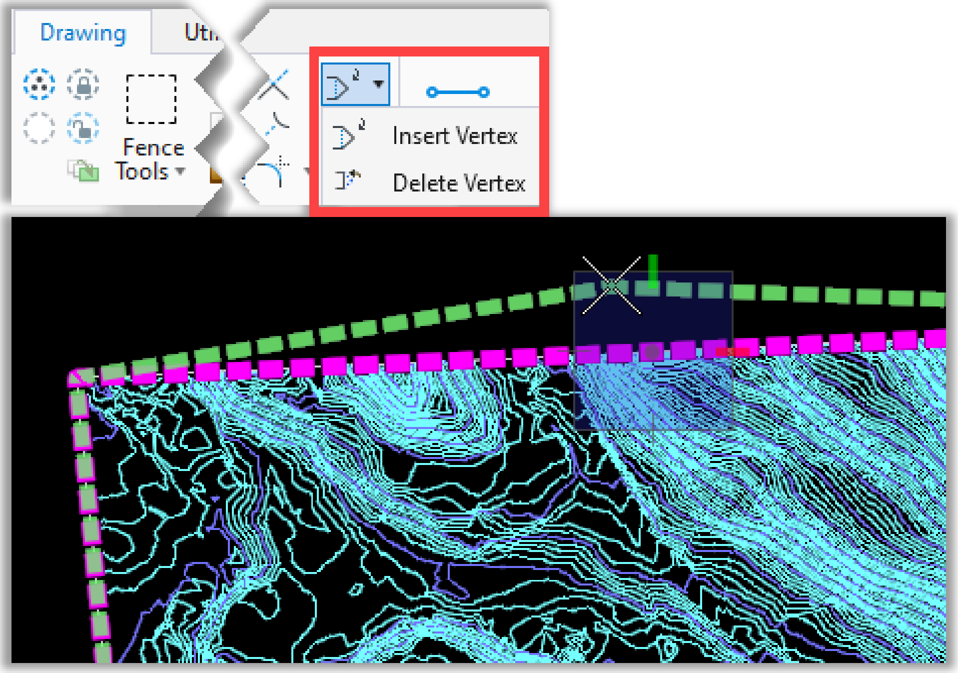

Figure 92 - Insert Point on Shape

5. In Explorer right click on the Clipped terrain and select **Set as Active Terrain**.

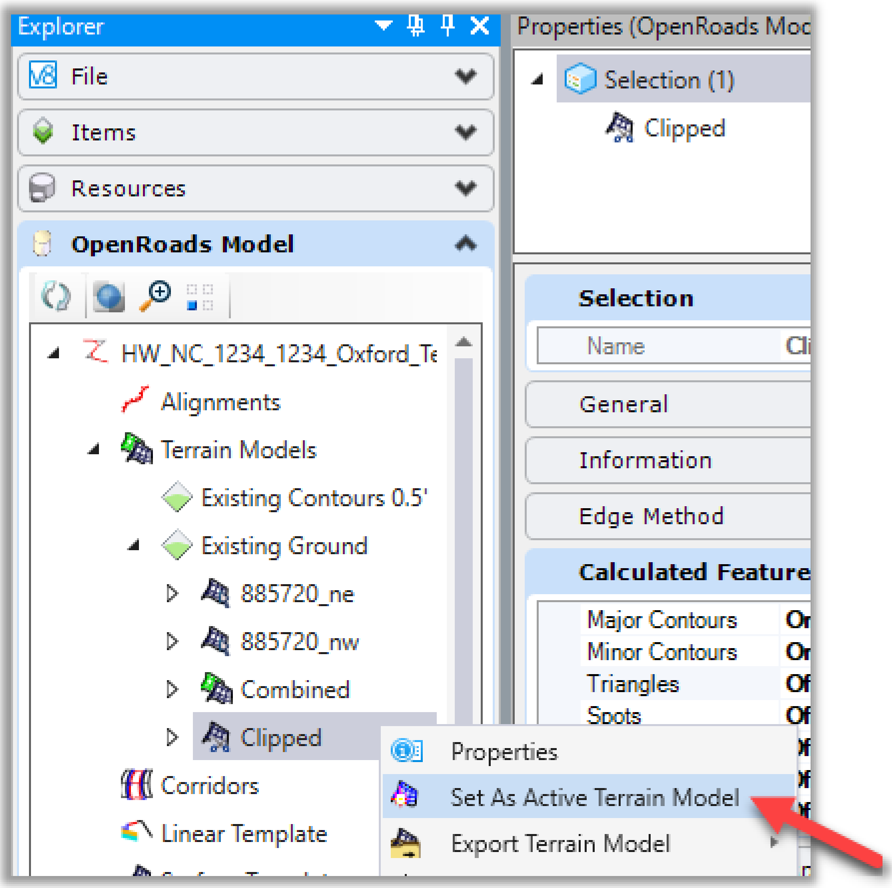

Figure 93 – Set Active Terrain Model

6. If you have any contours outside of the Boundary, switch the Edge Method to ***Sliver***.

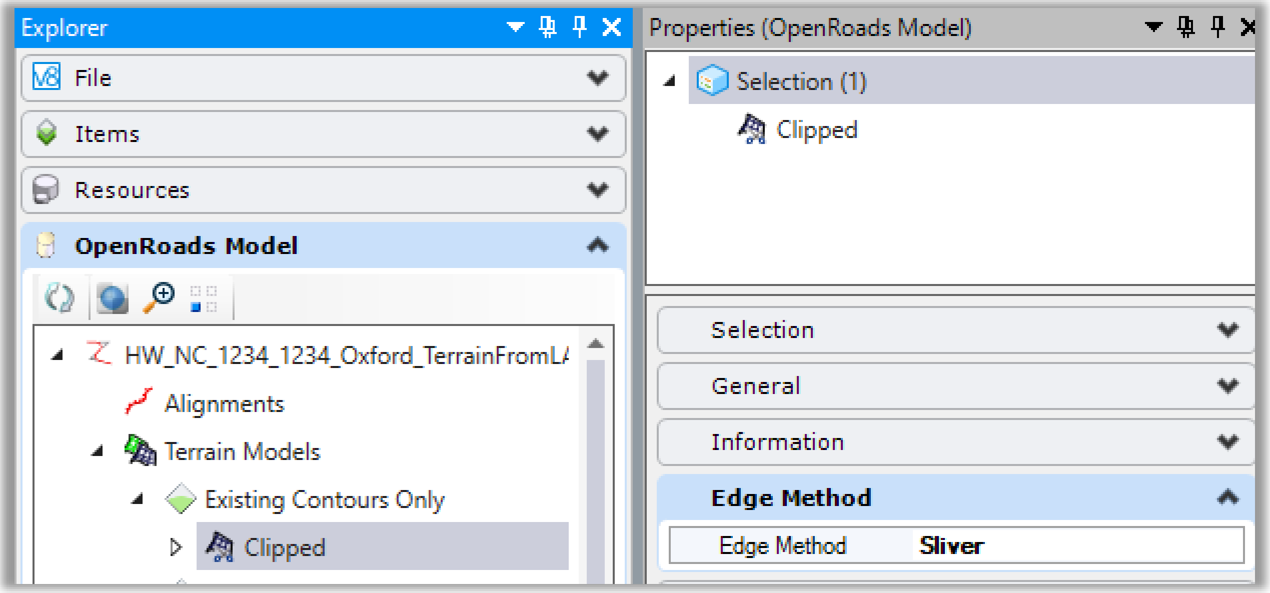

Figure 94 – Edge Method Sliver

7. **Save Settings**.

5.2 Terrain from LAZ

Using a LAZ file will require users to:

Step 1. Create a Point Cloud (POD file) from the LAZ data.

Step 2. Filter the Point Cloud to just display the ground points (other classification such as Vegetation, and unclassified will need to be turned off)

Step 3. Import the Point Cloud into a Terrain

5.2.1 Create a Point Cloud

1. In CAD create a 3D DGN file using a **3D** Seed file and use it as a container for the LAS Terrain and store it in the ***Share*** folder.

   ORD - ***…|Share|HW_NC_1234_1234_Oxford_TerrainFromLAZ.dgn***

   or

   OBM - ***…|Share|SB_NC_1234_1234_Oxford_TerrainFromLAZ.dgn***

   Use the **3D** seed file:

   CT_Configuration|Organization|Seed|GCS|3D_NAD83FT_NAVD88.dgn

2. In **Search** type ***Point Clouds*** and select, this will bring up the Point Clouds dialog box.

3. Select ***File > Attach***

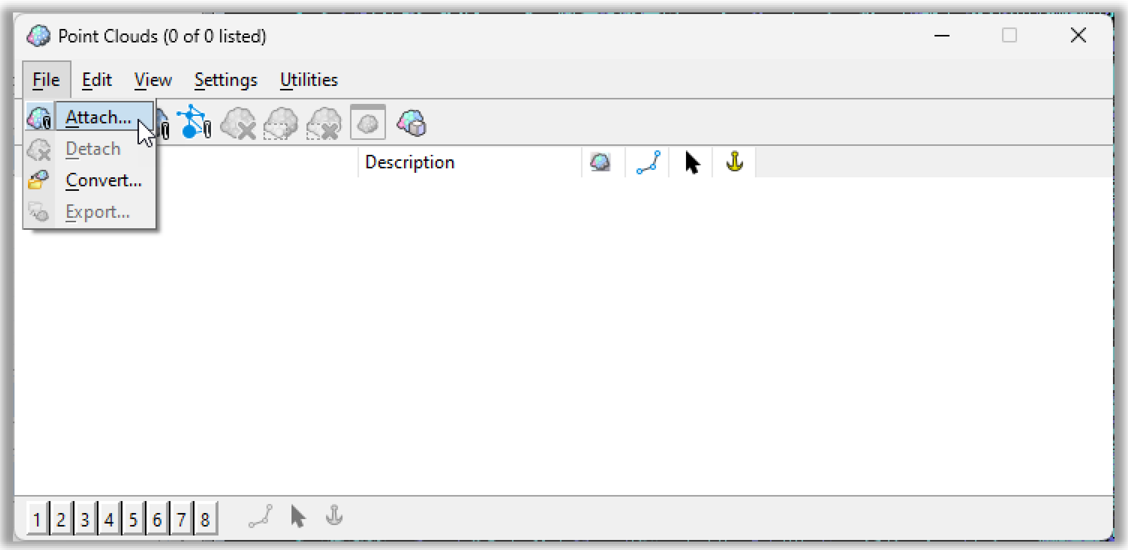

Figure 95 – Attach Point Clouds dialog box

4. In the Open dialog box change the file type to ***LAZ*** and browse to ***Share > Oxford > LAZ > 885720_ne.laz***

5. Click **Open**.

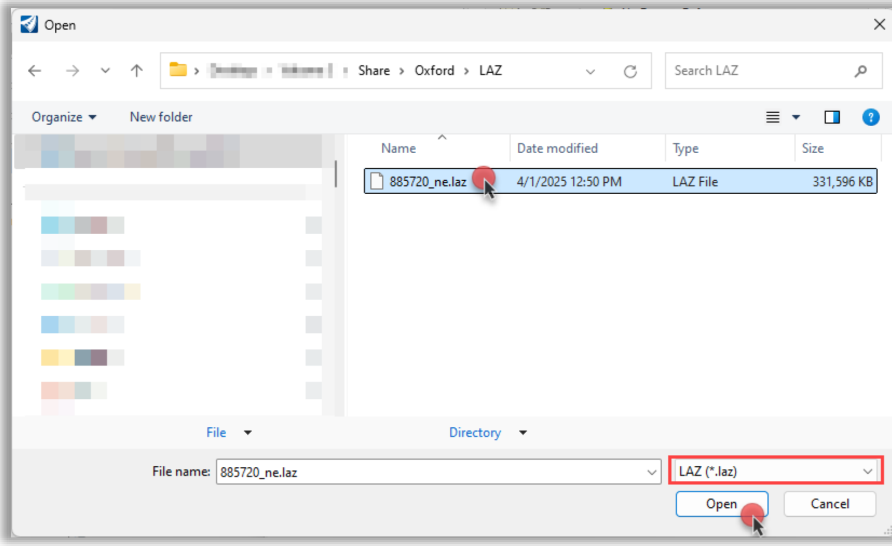

Figure 96 – Open Point Cloud dialog box

6. You will be prompted to create convert the LAZ file. Switch the source Geometry Unit to ***US Survey Feet*** and click **OK**.

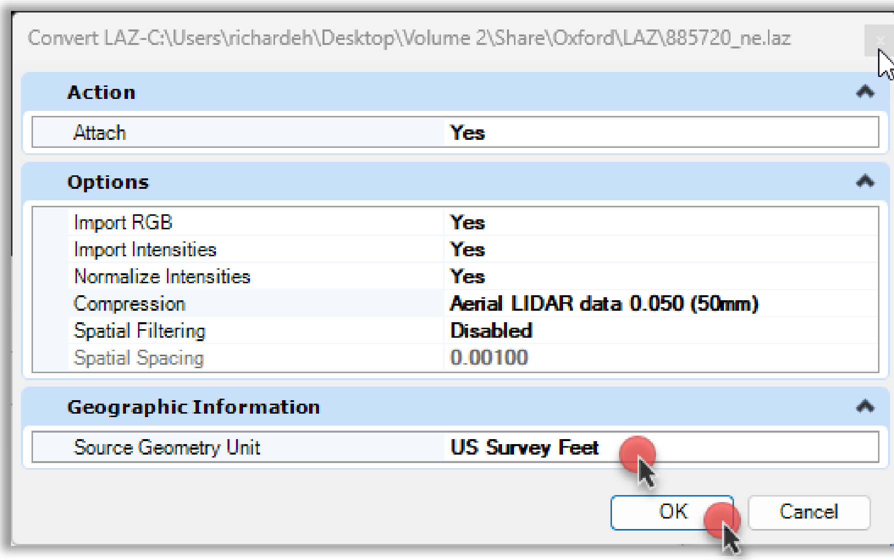

Figure 97 – Convert LAZ dialog box

7. You will be prompted to Save a *pod file. Save it to **Share|Oxford|LAZ**

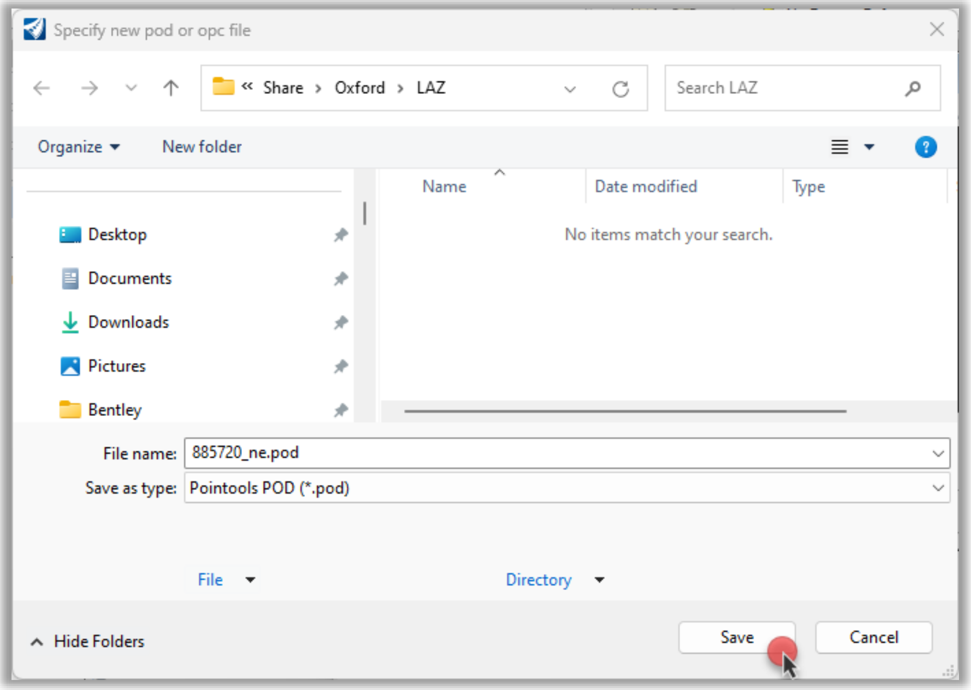

Figure 98 – Save POD file dialog box

3. The file will begin to convert and may take a few minutes. After it is processed the converted data will appear as a POD file and will appear in the Point Clouds dialog box.

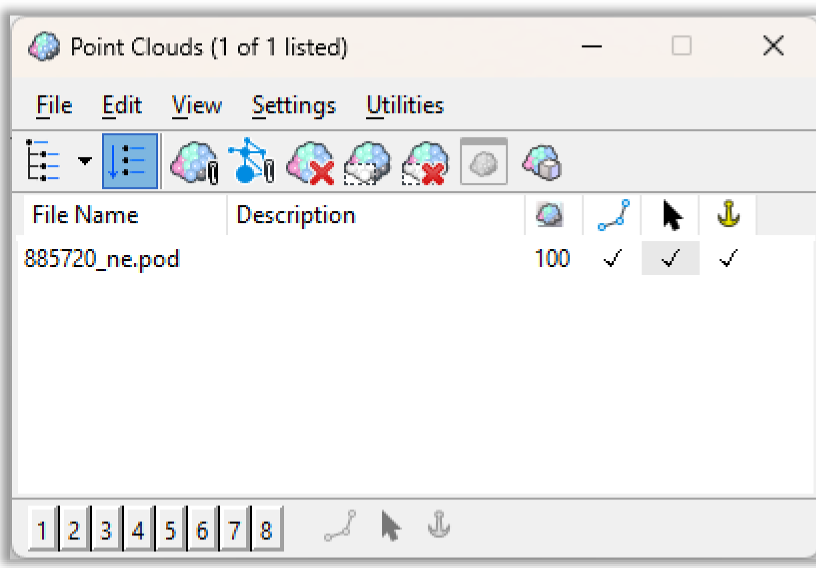

Figure 99 – Point Clouds dialog box

5.2.2 Filter the Point Cloud Classifications

1. **Fit View 1** to view the data. In View 1 Select **View Attributes**, select ***Point Cloud Styles***, for Stye select ***Classification***.
2. Select the **three dots …** on the right of Classification. The Properties dialog box will display a list of Classification, turn off everything except ***Ground***, the view should show only red points.
3. Turn on **the Background Map** to verify it lines up.

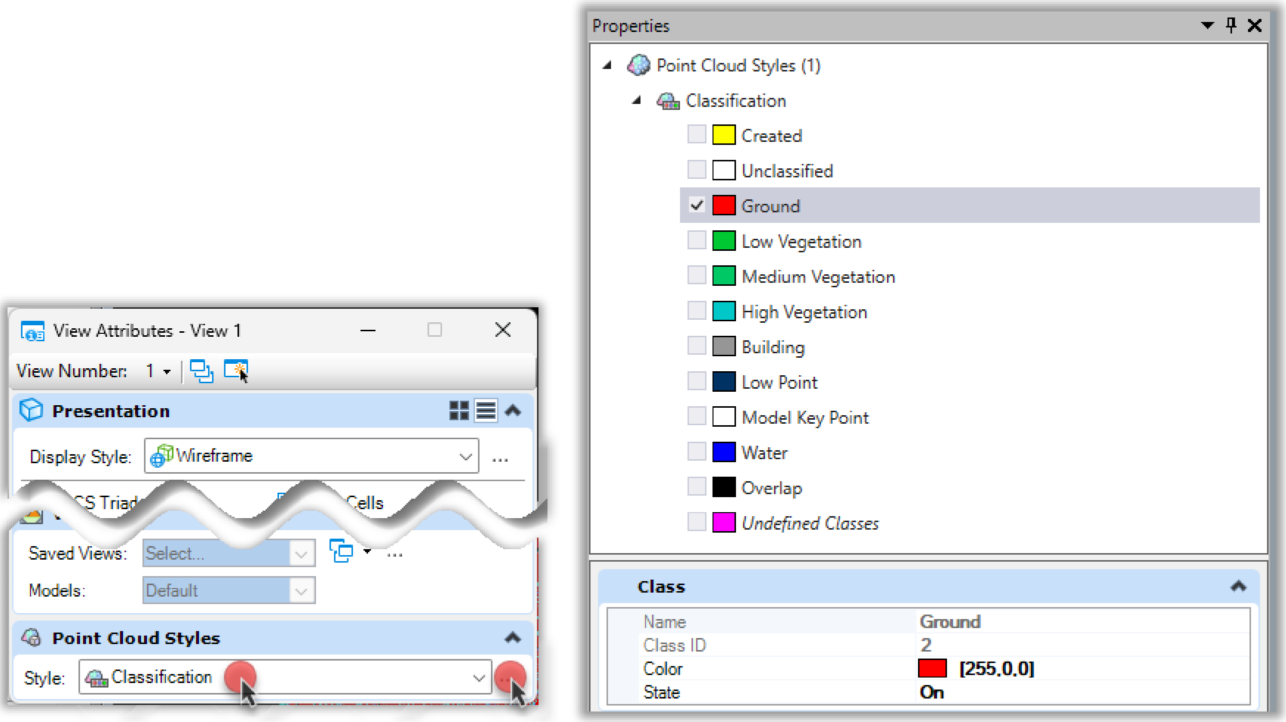

Figure 100 – View Attributes, Classification Properties ON/Off

5.2.3 Import a Point Cloud into a Terrain with Filtering

1. In **Search** type ***Create from Point Cloud*** and select, this will bring up the Create Terrain from Point Cloud dialog box.
2. In the File Options area select the Feature Definition **Terrain \ Existing Contours Only**.
3. Under File Options the number of points and size of the file can be reduced by Filtering.

   In the filter area select: Filter: ***Tin*** Z Tolarence: ***1*** Granularity: ***Coarse***
4. Select **Import** and **Close** the dialog box.
5. Select the **Selection** tool.
6. In the Point Clouds dialog box select **File > Detach**.

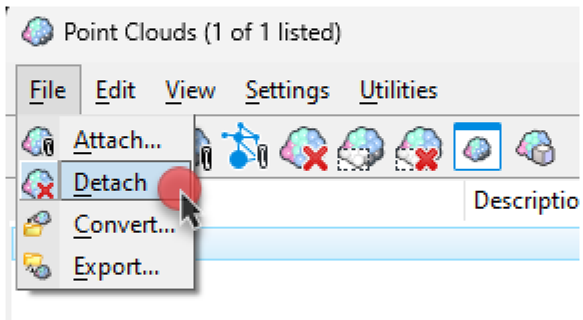

Figure 101 – Detach Point Cloud

7. The same method in 5.1.3 Create Clipped Terrain Model can be used to clip.

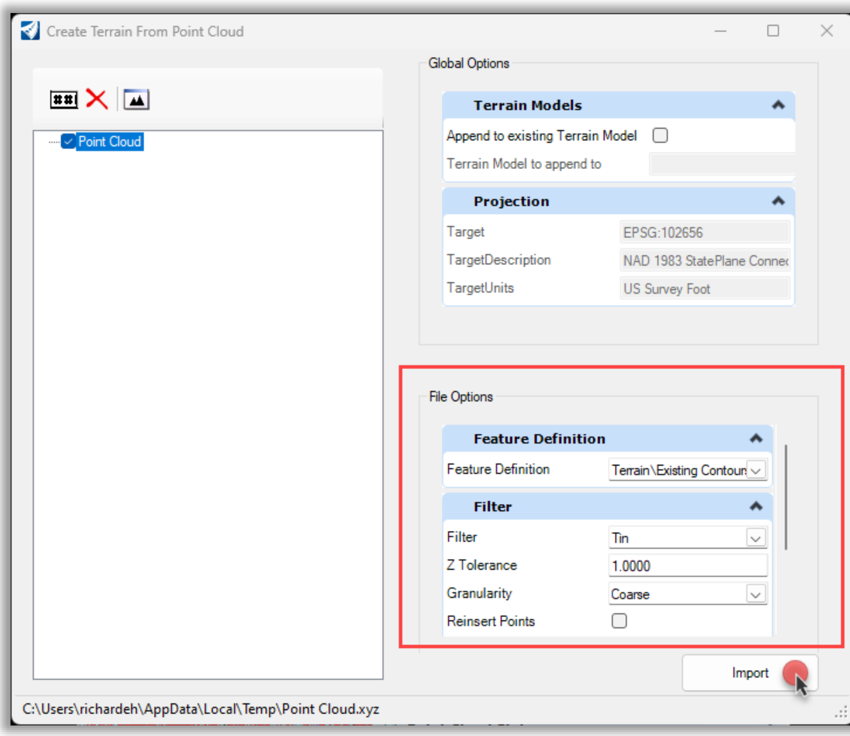

Figure 102 – Create Terrain from Point Cloud dialog box

5.3 Terrain from ESRI

This option is only available to users with a certain ESRI license.

1. In CAD create **Share / Oxford / *HW_CB_1234_1234 _Oxford_TerrainFromEsri.dgn***
2. Turn on the View Background Map. Place a shape around the required LiDAR Data area.
3. In the DGN file's search field type in ***Esri Terrain***, Sign in to **ersi.**
4. A dialog box will appear, select the Feature Definition ***Terrain|Existing Ground.***

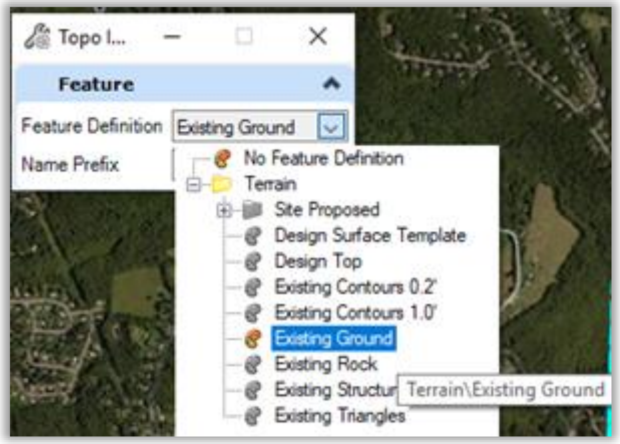

Figure 103 - Set the Existing Ground Feature Definition

6. Follow the prompts and select the shape placed in step 3.
7. Use the Element Selection Tool and select the new Terrain ***outer boundary.***
8. In the **Properties** Box, **Calculated Features Display** turn on the ***Major Contours and Minor Contours.***

Exercise 6 – Terrains for Drainage Analysis

This exercise will cover different techniques when Creating and Managing Multiple Terrain Models that can be used to analyze Drainage Areas. When creating a drainage design the network of inlets, pipes, and contributing overland flow will expand outside of the proposed terrains and go beyond the surveyed area. Because of this you will need to merge multiple terrains.

6.1 Create Terrains from Graphical Filters Tool

To create a Proposed Terrain, we are going to use the Graphical Filter method. The reason for this is that there are many Feature Definitions, Linear Elements, Template Features and Template Meshes stored within the Proposed Design Corridor, and by using Graphical filters we can extract them relatively easily.

Open:

ORD – **…\Design\Highways\Base_Models\HW_CB_1234_1234_PerryLane_Terrain.dgn**

or

OBM – **…\Design\Bridge\Base_Models\SB_CB_1234_1234_PerryLane_Terrain.dgn**

6.1.1 Graphical Filter Manager

1. Reference the Perry Lane Corridor File.
   …Design\Highways\Base_Models\HW_CB_1234_1234_PerryLane_Corridor.dgn

   Note: The opened file will come with the Existing Terrain already referenced and set active.

2. **ORD –** Select the **OpenRoads** Workflow, in the **Terrain** tab, **Create** section, select **From Graphical Filter > Graphical Filter Manager**

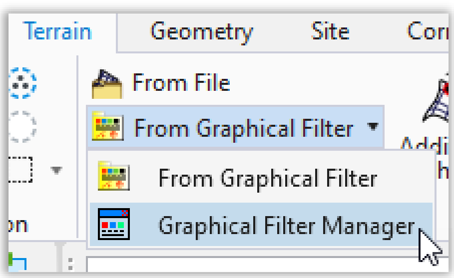

Figure 104 – ORD Graphical Filter Manager Tool

OBM – Select the **OpenBridge Modeler** Workflow, in the **Civil** tab, **Terrain Model** section, select the top left pull down and choose **Create Terrain model by Graphical Filter**, a dialog box will open select the **Terrain Filter Manager button**.

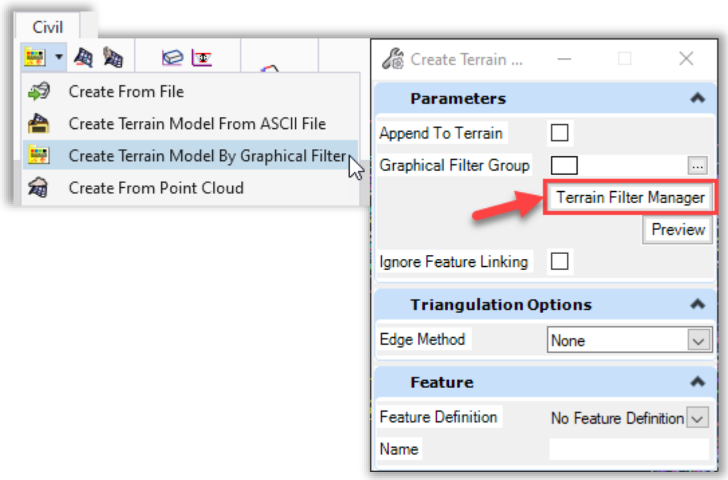

Figure 105- OBM Graphical Filter Manager Tool

The Terrain Filter Manager dialog appears:

- Users can create their own filters by selecting ***Filters*** under the current DGN, ***…_CB_1234_1234_PerryLane_Terrain.dgn***.
- On the left-hand pane under ***CV_Graphical Filters.dgnlib(Default)*** you have a series of predefined Filter groups, that are grayed. These are delivered with the CTDOT Workspace and be be used by copying them to your DGN file.

3. Click on the ***Proposed Finish grade*** Filter Group under ***CV_Graphical_filters.dgnlib*** and view test them against your file.

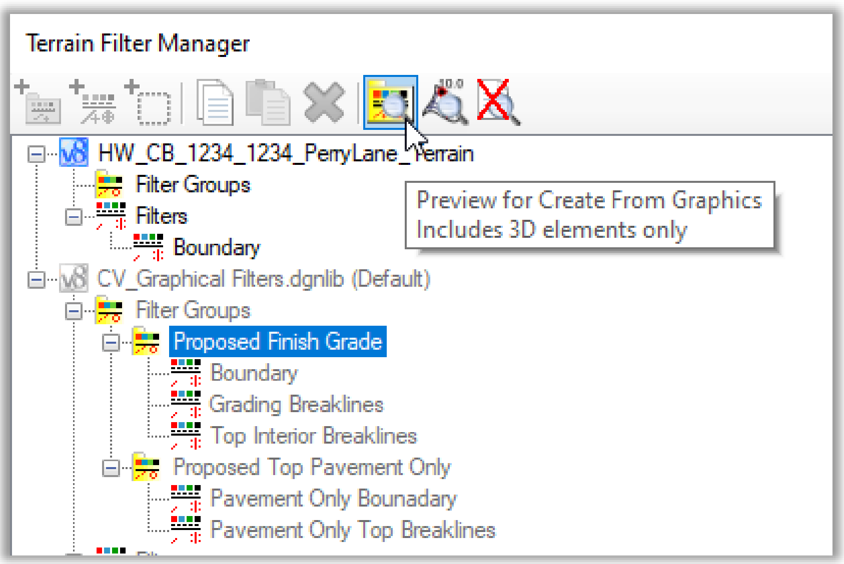

Figure 106

4. Notice everything highlights except for the Seam line.
   Note: *the seams for the side road were created with Geometry Feature Definition* ***Misc Line*** *which is not part of the delivered Filters. The delivered filter includes the Feature Definition* ***Seam Lines,*** *this is the feature Definitions that should be for projects. In this case we wanted to demonstrate how to add your own Feature Definition to a filter, so Misc Line was used.*

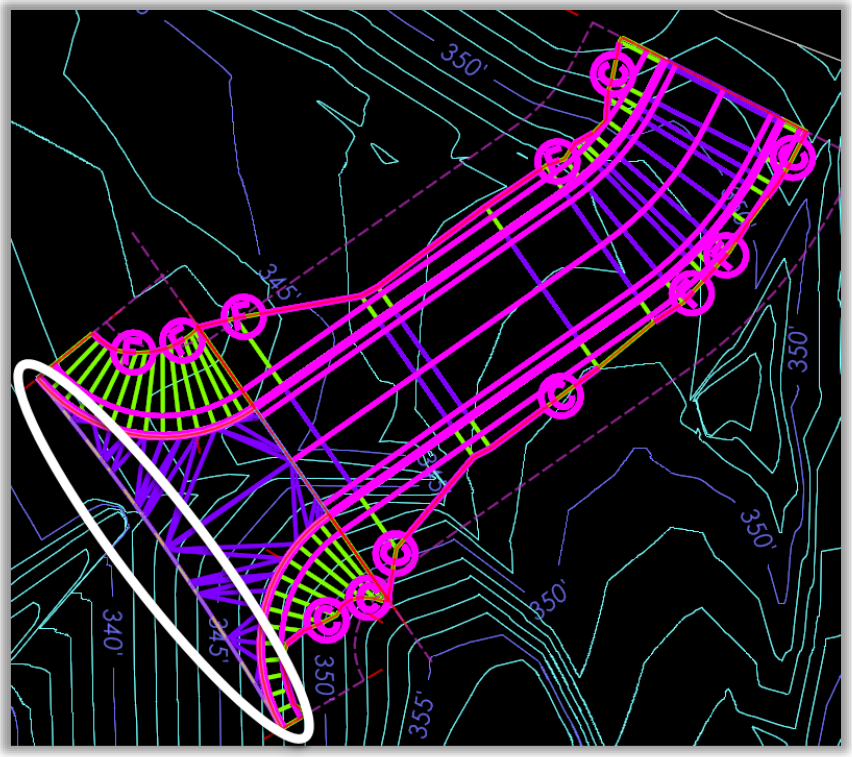

Figure 107

5. Create our own filter, Under HW_CB_1234_1234_PerryLane_Terrain right click on ***Filters*** and select ***Create Filter***.

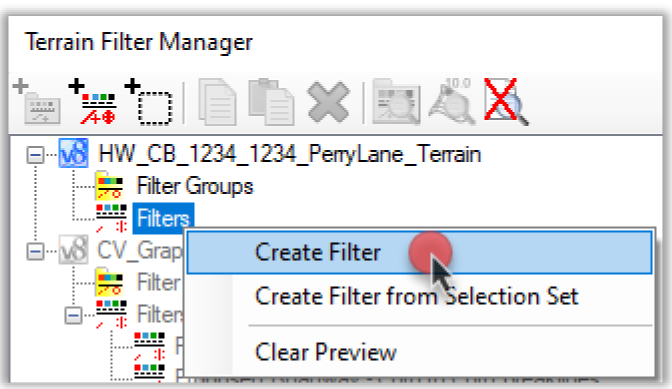

Figure 108

6. Name it ***Seam Lines***.

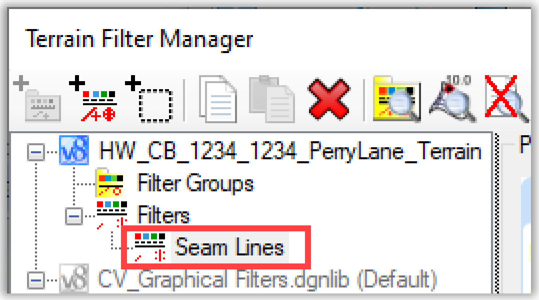

Figure 109

7. Select **Edit Filter**

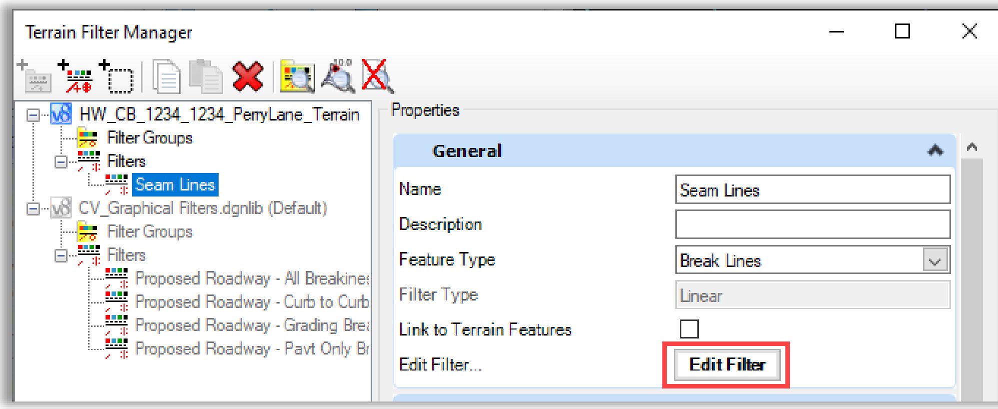

Figure 110

8. On the Edit Filter dialog box select ***Civil Features***, under Features select ***Linear|Roadway Geometry|Misc Line*** and click ***Add***.

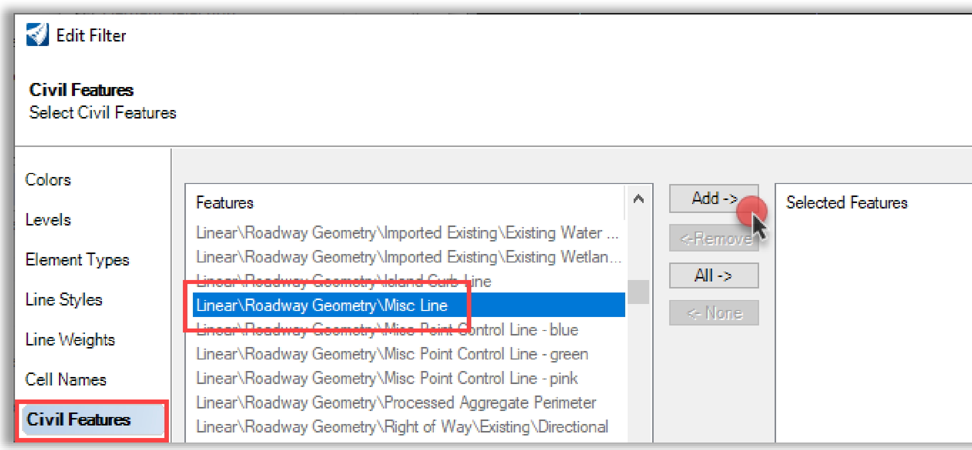

Figure 111

7. Notice the Feature Definition is now in the right-hand column. Click **Finish**.

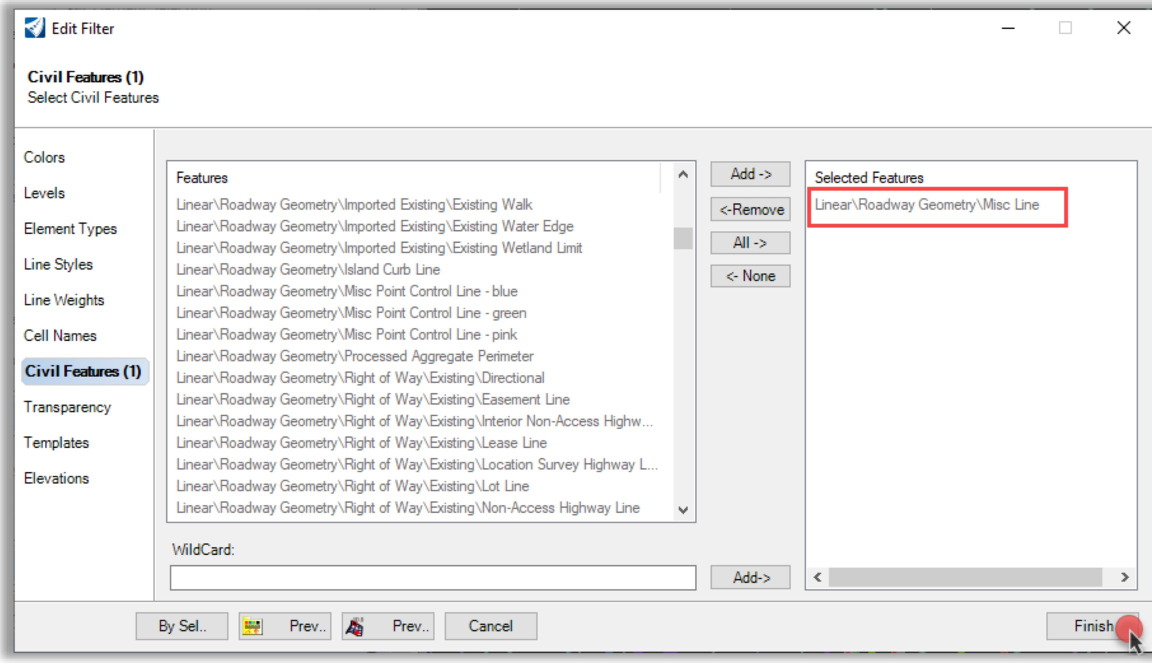

Figure 112

8. With Seam Lines selected, click on ***Link to Terrain Features***.

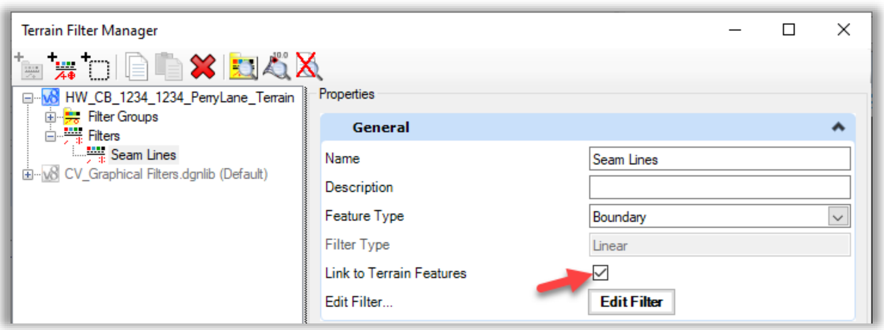

Figure 113 – Link to Terrain Features

9. Right click on the Click on the ***Proposed Finish grade*** Filter Group under ***CV_Graphical_filters.dgnlib*** and select **Copy**.

10. Select Filter Groups folder on top and select **Paste**. This will copy the Filters and the Rilter Groups to your dgn file.

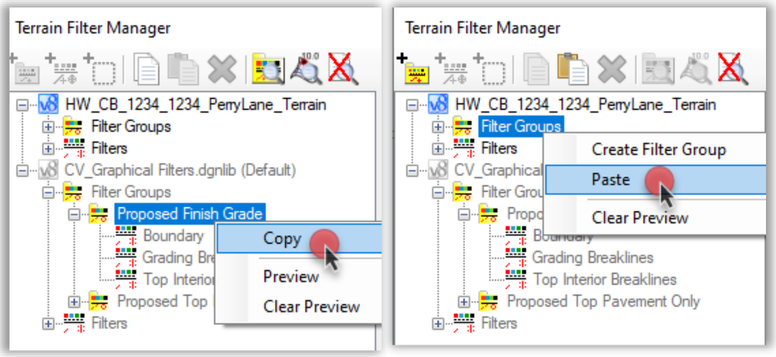

Figure 114 – Copy / Paste Filters

4. Add Seam Lines to the Filter Group, Select ***Copy of Proposed Finished Grade***, on the right pull down Select Filters and check off ***Seam Lines***. A total of 4 should now be selected.

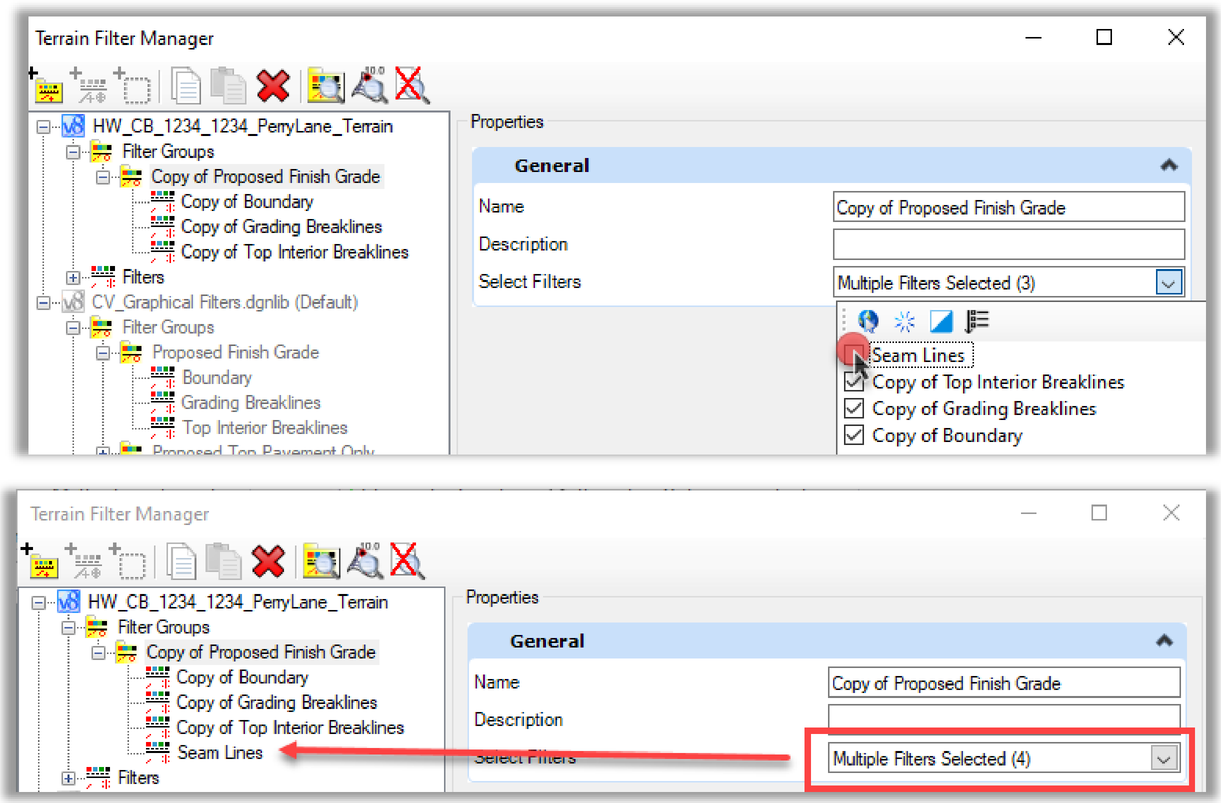

Figure 115 - Edit Filter dialog box Add Filters to a Group

14. On the Terrain Filter Manager dialog select **Finish**.

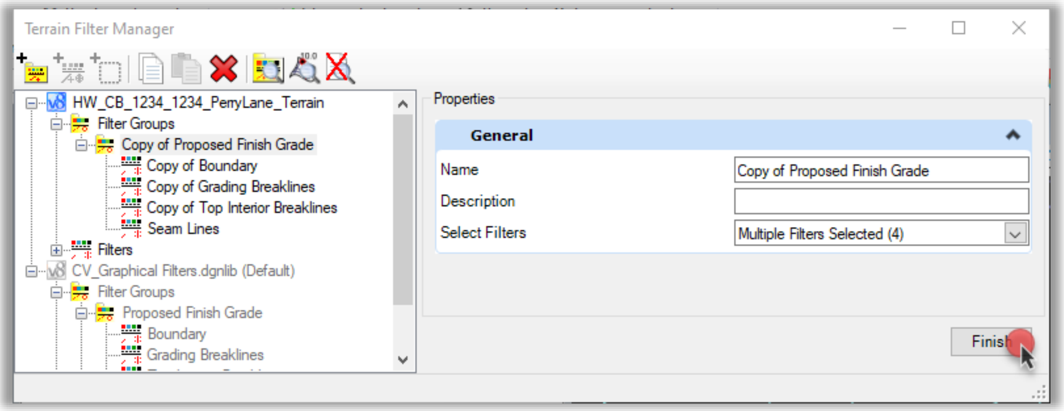

Figure 116 – Finish Edit Filter dialog box Add Filters to a Group

6.1.2 Create Terrain from Graphical Filter

1. Now we will create the terrain

ORD – Select **Terrain > Create > From Graphical Filter > From Graphical Filter**

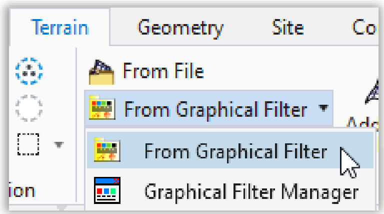

Figure 117 – ORD From Graphical Filter Tool

OBM – Select the **OpenBridge Modeler** Workflow, in the **Civil** tab, **Terrain Model** section, select the top left pull down and choose **Create Terrain model by Graphical Filter**

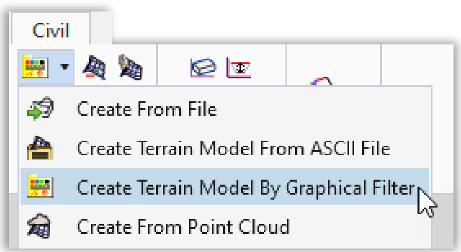

Figure 118 - OBM From Graphical Filter Tool

2. The Create Terrain from Graphical Filter dialog will appear.
   - Feature Definition: ***Terrain|Design Top***
   - Name: ***P_TERR_PerryLane***
   - Append to Terrain: ***OFF***
   - On the Select Filter or Graphical Filter Group: ***Left Click on the ellipses button*** on the Graphical filter dialog box
   - Go to… ***Active DGN > Graphical Filter Groups > Copy of Proposed Finished Grade***
   - Ignore Feature Linking: ***OFF***
   - Set Edge Method: ***Remove Slivers***
   - Select ***Preview*** to see what is being filtered in.

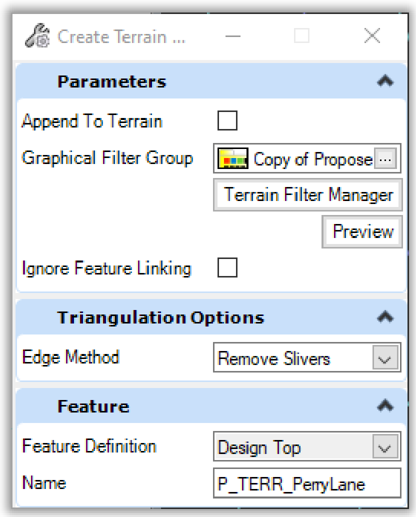

Figure 119 - Create Terrain From Graphical Filter

3. **Data Point** to accept selection.
4. **Left-click** to accept the parameters. Your Proposed Terrain will be created.
5. **Hit <Esc>** to Exit Command.

6. In **Explorer** select **Terrain Models > Design Top**, and Turn on the ***Triangles***. View the terrain that was just created.

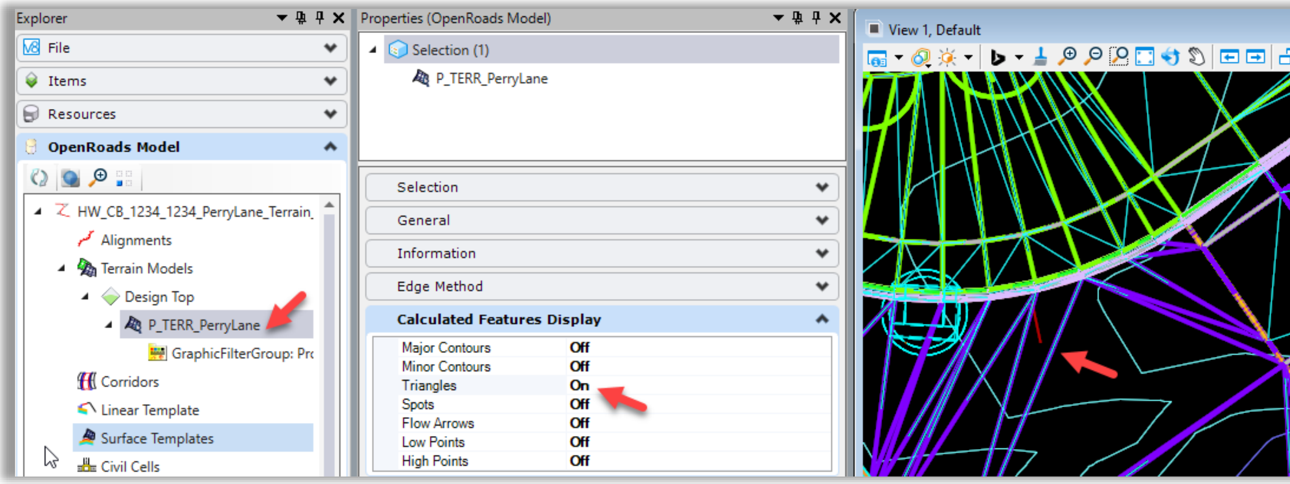

Figure 120

6.2 Create Complex Terrain

In this section you will learn how to create a Complex terrain.

1. Open

ORD File ***...Design|Share|HW_NC_1234_1234_Oxford_DrainageComplexTerrain.dgn***

or

OBM File ***...Design|Share|SB_NC_1234_1234_Oxford_DrainageComplexTerrain.dgn***

2. Select the Reference tool

Browse to attach: ***Active_Survey|SV_XX_0107_0108_Oxford_ORD_Terrain.dgn***

Attachment Method is set to ***Interactive*** and ***Save Relative Path*** is ***on***. Select **Open**.

On the Reference Attachment Properties select:
Model: ***Default***
Orientation: ***Coincident World***
Detail Scale: ***1"=40'***
Nested Attachments: ***No Nesting***

2. Similarly attach:

Highway|HW_CP_1234_1234_Route188_Terrain.dgn
Model: ***3D Design***

Highway|HW_CP_1234_1234_PerryLane_Terrain.dgn or
Bridge|SB_CP_1234_1234_PerryLane_Terrain.dgn
Model: ***3D Design***

2. Select the Reference tool. Browse to attach the file you created in 5.1.1

Share|..._NC_1234_1234 _Oxford_TerrainFromLAS.dgn

Select **Geographic – reprojected** and click **Open**.

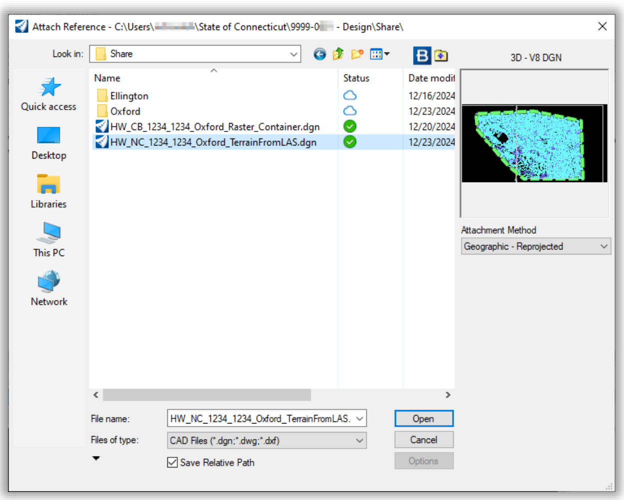

Figure 121 - Attach Reference

3. Notice the reference lines up with the NAD 27 Survey File.

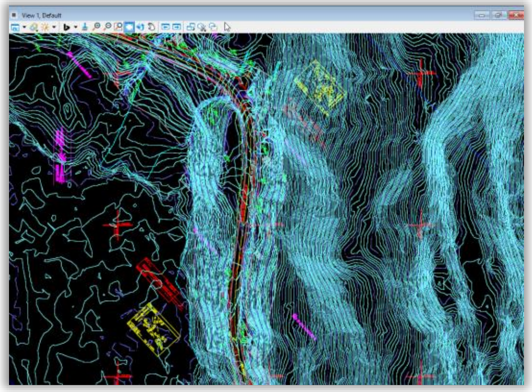

Figure 122 - References in View

3. In the Properties dialog box, override the referenced terrains as follows:

Set Override Symbology : **Yes**

Over Template:

- Clipped: ***Terrain|Existing Ground***
- SV_Surface: ***Terrain|Existing Ground***
- P_TERR_Route188: ***Terrain|Design Top***
- P_TERR_PerryLane: ***Terrain|Design Top***

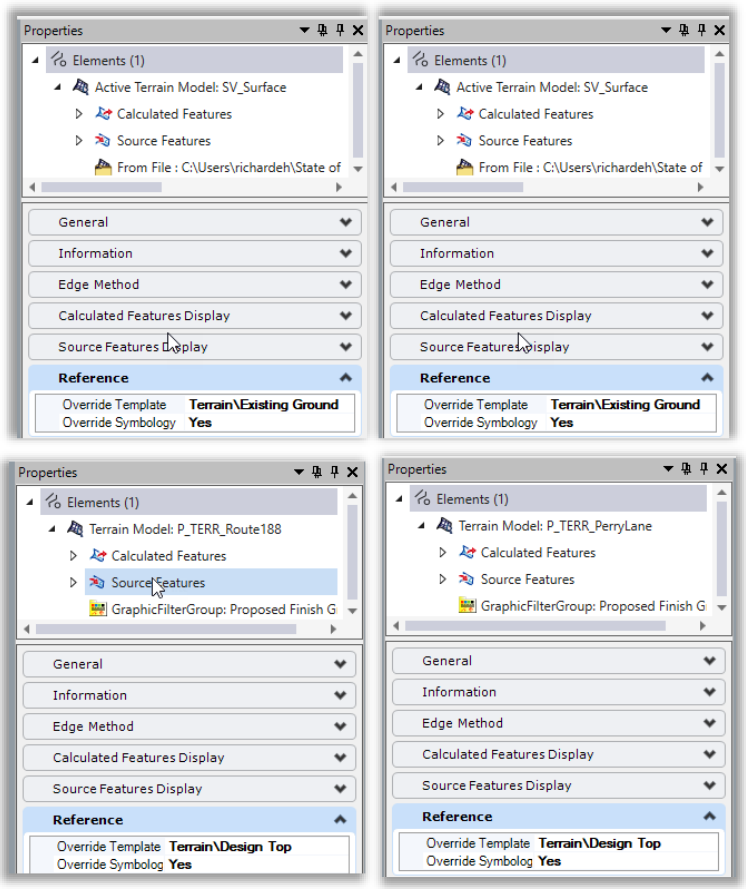

Figure 123 – Terrain Overrides

4. Create a Complex Terrain Model. In Search type in ***Create Complex Terrain Model***, the Create Complex Terrain Model dialog will appear, this tool will read all the terrains attached as highlighted below –

5. Select Current Action: Merge, ***Left-click*** on Terrains in the following order and click **Add**:
   - ***Clipped***
   - ***SV_Surface***
   - ***P_TERR_Route188***
   - ***P_TERR_PerryLane***

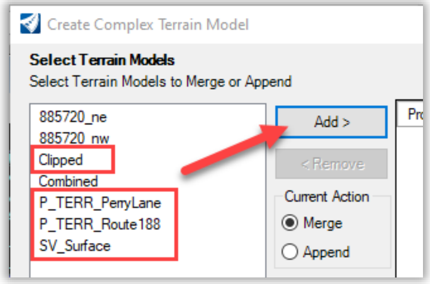

Figure 124 - Add Terrains

10. Set the Terrain Model Properties as shown below
    - Feature Definition: ***Terrain|Existing Contours Only***
    - Name: ***Drainage Terrain***

    Before creating a complex terrain, your dialog box will look same as shown below

11. Left-click on **Finish** button at the end.

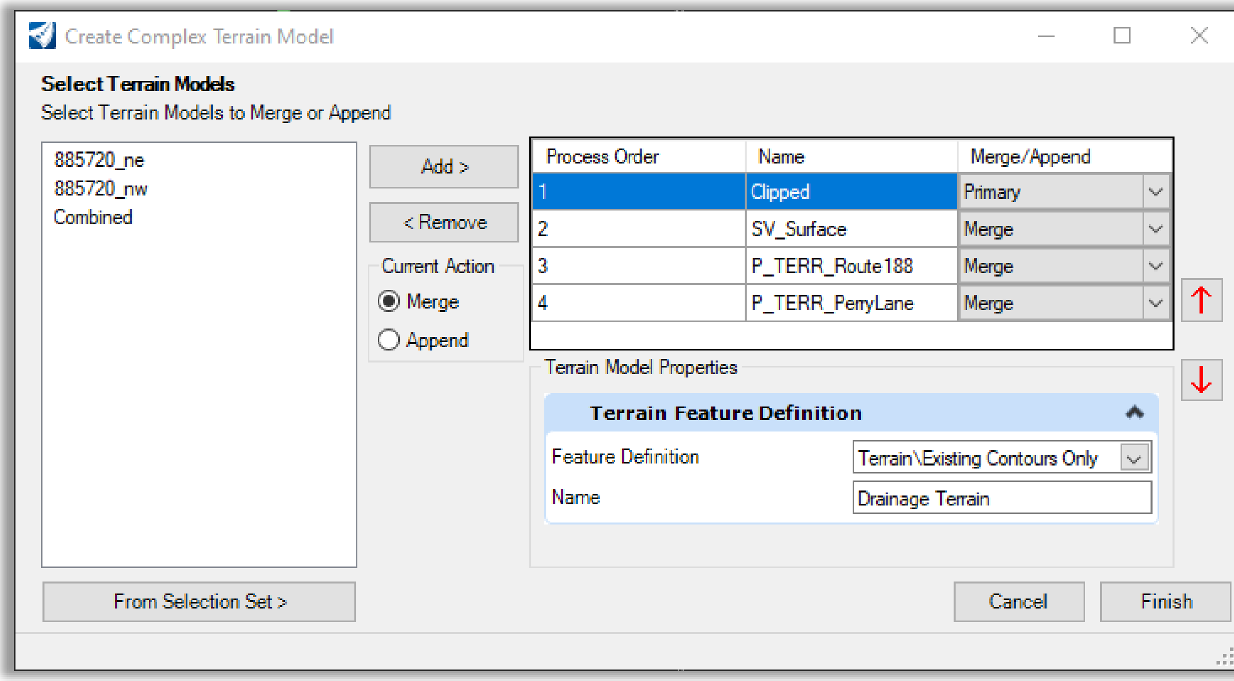

Figure 125 - Create Complex Terrain Model

12. Zoom in to see the Merged Complexed Terrain. Turn off the Reference files to better see the Merged Terrain.

13. This Merged Terrain is now ready to be referenced into your Drainage Working file.

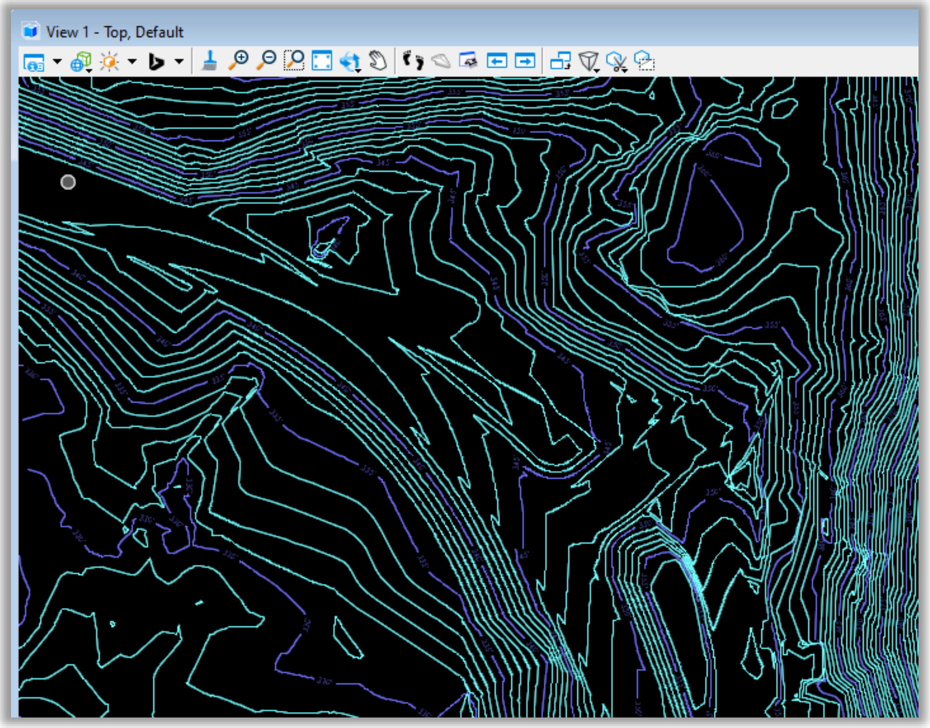

Figure 126 – Merge Terrain

6.3 Label and Analyze Terrain Data

6.3.1 Label Terrain Contours

The display of major and minor contours have an option to label the contour elevations at a specified interval. When you are reviewing an area of a terrain model you may find that there are no contour labels in that specific area. The Label Terrain Contours command will quickly label the displayed contours along a specified line.

1. Zoom into the terrain so the text is readable.
2. On the **Home** tab in the **Attatributes** group select the Element Template, ***Terrain|Label|Existing Contour Elevation***.
    - This will set the Level, Text Style and Dimension Style
    - If you would like to annotate proposed contour, select ***Terrain|Label|Proposed Contour Elevation***

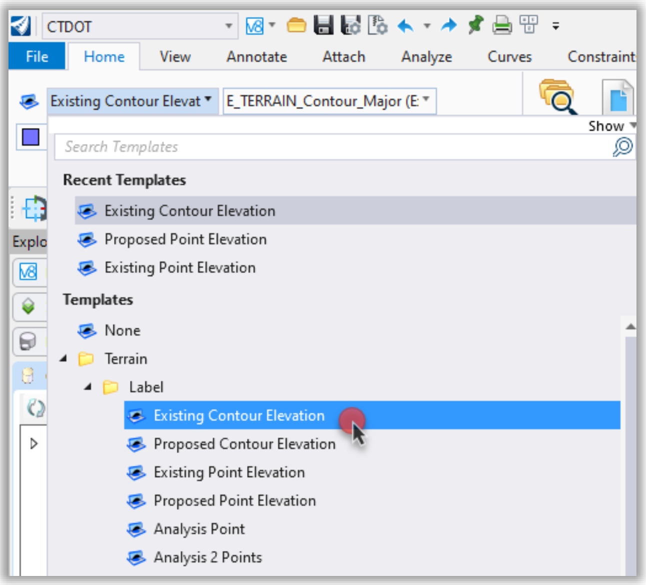

Figure 127 – Select an Element Template

3. Label the terrain contours.

   a. Select **Terrain > Labeling > Label Terrain Contours** from the ribbon menu and set the options in the dialog box as follows:

      - Annotation mode: ***Major Contours Only***
      - Text Alignment: ***Follow Line***
      - Dimension Style: ***CV_Terrain Label Existing Contour Elevation*** (this will be set with what was selected in step 2 above)

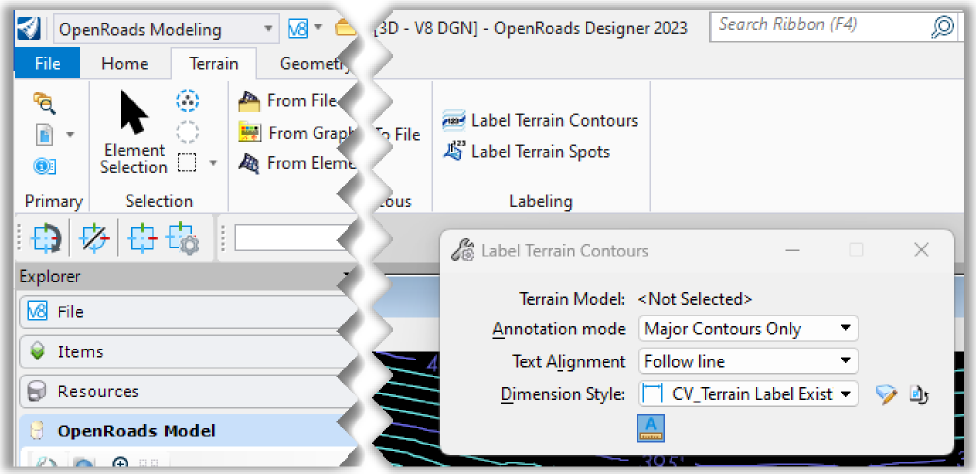

Figure 128 - Label Terrain Contours dialog box

   b. Click on a **contour line** to select the terrain model and follow the prompts (in the prompt field in lower left corner).

      - Select From Point: **Left click at the foot of the hill**
      - Select To Point or Reset to complete: **Move your cursor to the top of the hill and Left click to define the end point**.

   c. **Reset** or Esc to exit the command.

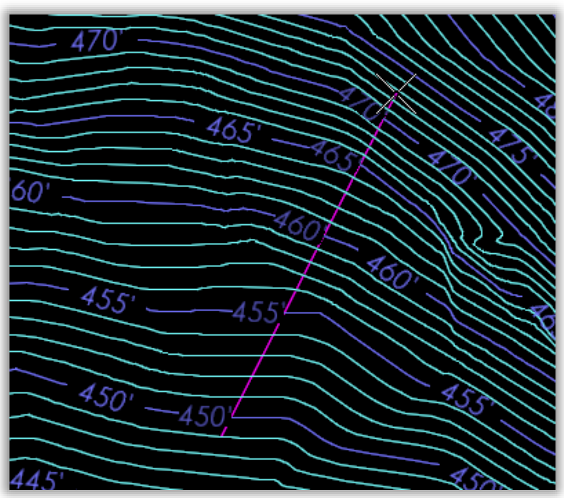

Figure 129 - Label Terrain Contours

Notes:

- *The terrain contours must be displayed in the view for the Label Terrain Contours command to function.*
- *The elevation text is placed as a dimension element and is independent of the terrain display. Changing the terrain display will not alter the graphics placed with this command. To delete the graphics placed, use the Element Selection tool to select the text and then press the delete key.*

6.3.2 Label Terrain Spots

The Label Terrain Spots command will quickly label the elevation of a single point in a terrain model.

1. On the **Home** tab in the **Attatributes** group select the Element Template, ***Terrain|Label|Existing Point Elevation***
    - This will set the Level, Text Style and Dimension Style
    - If you would like to annotate proposed Point, select ***Terrain|Label|Proposed Point Elevation***
2. Select **Terrain > Labeling > Label Terrain Spots** from the ribbon menu.
3. Set the following parameters in the Label Terrain Spots dialog box:
    - Text Style: ***CV_Terrain Label Existing Point Elevation*** (this will be set with what was selected in step 1 above)
    - Dimension Style: **CV_Terrain Label Existing Point Elevation** (this will be set with what was selected in step 1 above)
    - Text Rotation: ***Horizontal***
    - Location: ***Automatic***
    - Horizontal Attachment: ***Auto***

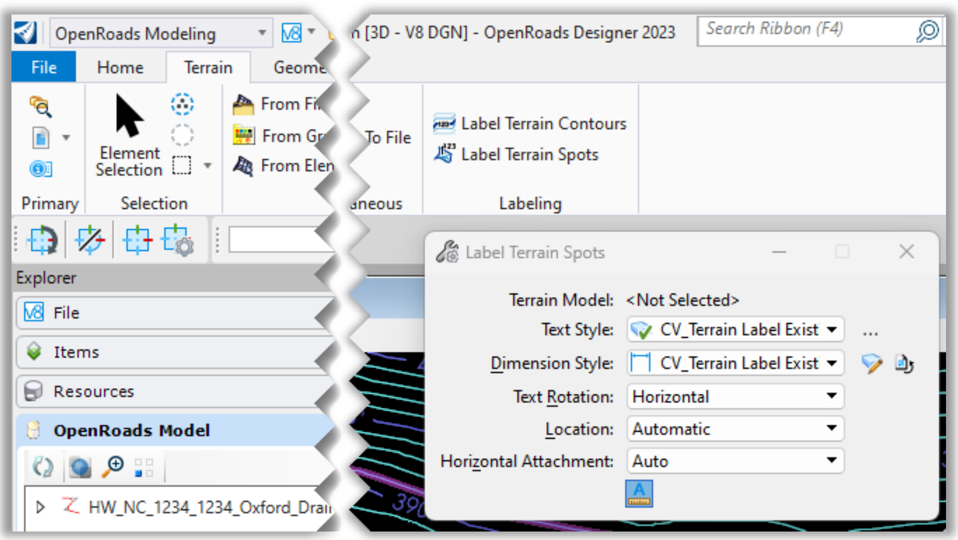

Figure 130 - Label Terrain Spots dialog box

4. At the prompt Identify Terrain Model, click on a **contour line**.

   As you move your cursor in the view a label with the elevation will be dynamically updated.

   - Select Spot: **Click to select a spot to be labeled**.
   - Accept/Reject: Move your cursor and **click to accept** and place the label annotation and leader line.

5. Place several elevation labels.
6. **Reset** or Esc to exit the command.

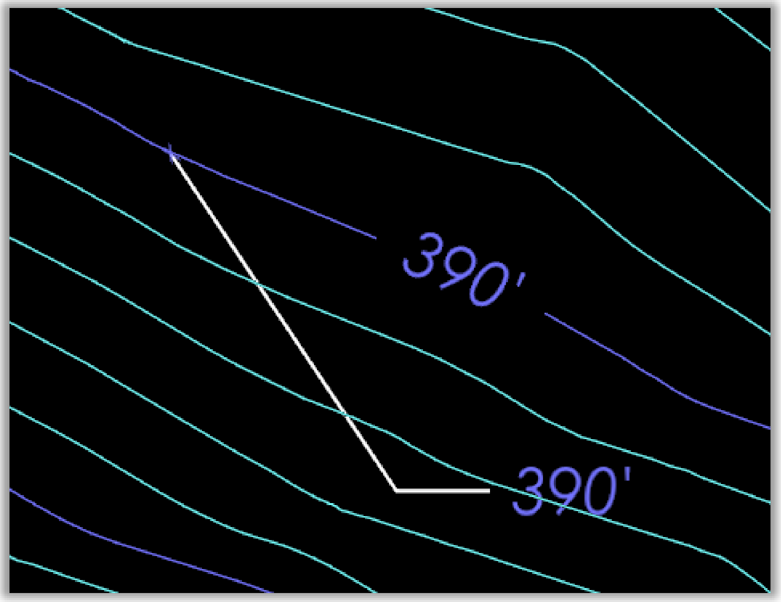

Figure 131- Label Terrain Spots

Notes:

- *The terrain contours or triangles do not have to be displayed for the Label Terrain Spots command to function, but you do have to be able to select the terrain.*
- *The elevation text and leader line is placed as a note element with an associated dimension element and is independent of the terrain display. Changing the terrain display will not alter the graphics placed with this command. To delete the graphics placed, use the Element Selection tool to select the graphics and then press the delete key.*

6.3.3 Analyze Points

When you need detailed information at a specific location on the terrain, the Analyze Point command will quickly provide the elevation, slope and aspect of a single triangle in the terrain model.

1. On the **Home** tab in the **Attatributes** group select the Element Template, ***Terrain|Label|Analysis Point***.
    - This will set the Level, Text Style and Dimension Style
1. Select **Terrain > Analysis > Points > Analyze Point** from the ribbon menu.

    Select Element To Analyze Point: click on a **contour line**
2. Toggle the Display Settings in the Analyze Point dialog to:
    - Display Contours: ***Off***
    - Display Contours in View: ***Off***
    - Display Slope: ***On***
    - Display Triangle: ***Off***

    As you move your cursor in the view, a label with the slope and a directional arrow are dynamically updated and the heads-up display will show the elevation, slope and aspect.
    - Alt to toggle Displayed Info: Click to select the **location for the slope** to be labeled.
3. Toggle the Display Triangle option On and click again to label another location.
4. Label several locations.
5. **Reset** or Esc to exit the command.

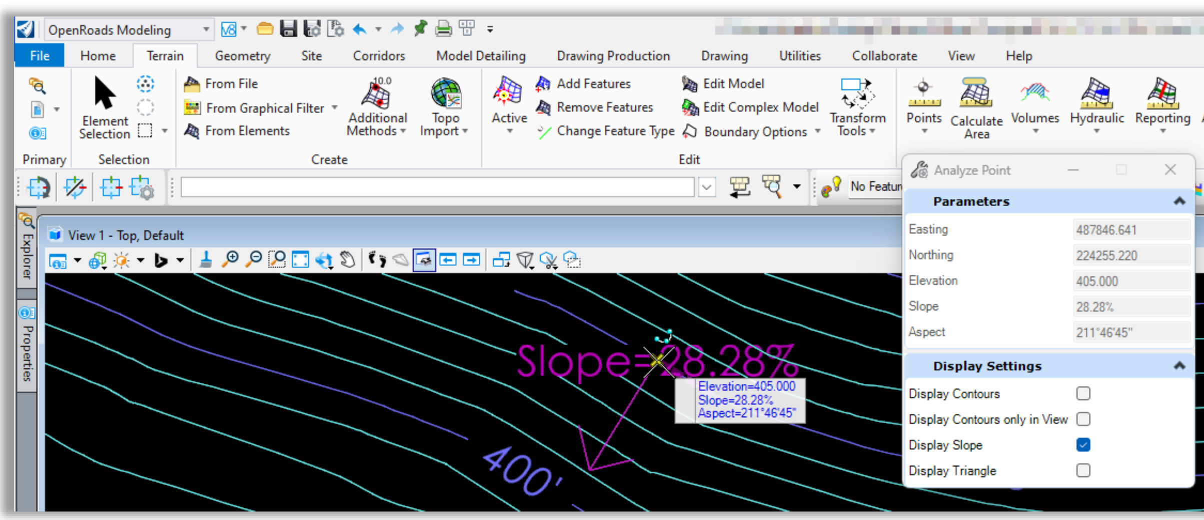

Figure 132 - Analyze Point

Notes:

- *The terrain contours or triangles do not have to be displayed for the Analyze Point command to function, but you do have to be able to select the terrain.*
- *The slope annotation symbology is controlled by the active Text Style. In the Label Terrain Spots activity above, the Label - Center Center text style was selected and that is controlling the display. You can change the active text style in the Label Terrain Spots command, or go to the Drawing Production > Text > Place Text command and select a text style.*
- *The slope text, direction arrow and triangle are multiple types of elements and are independent of the terrain display. Changing the terrain display will not alter the graphics placed with this command. To delete the graphics placed, use the Element Selection tool to select the graphics and then press the delete key.*
- *When the command is active, the ALT key can be used to toggle the Display Settings options on and off.*

6.3.4 Analyze Between Two Points

The Analyze Between Points command will quickly annotate the slope on the terrain between two specified points.

Additionally the heads-up display provides the elevation of the points, elevation difference, slope, distance and angle.

1. On the **Home** tab in the **Attatributes** group select the Element Template, ***Terrain|Label|Analysis 2 Points***.

    - This will set the Level, Text Style and Dimension Style

1. Select **Terrain > Analysis > Points > Analyze Between Points** from the ribbon menu and follow the heads-up prompts.

    - Select Terrain Model element: Click on a **contour line** to identify the terrain model
    - Select Start Point: Click a location in the **terrain** to define the **first point**

      As you move your cursor in the view, a line with the slope and a directional arrow are dynamically updated and the heads-up display will show the elevations, elevation difference, slope, distance and angle.

    - Alt selects a different Terrain: Click a **second location** to define the second point and place the annotation

2. Select another set of points and label the slope.
3. **Reset** or Esc to exit the command.

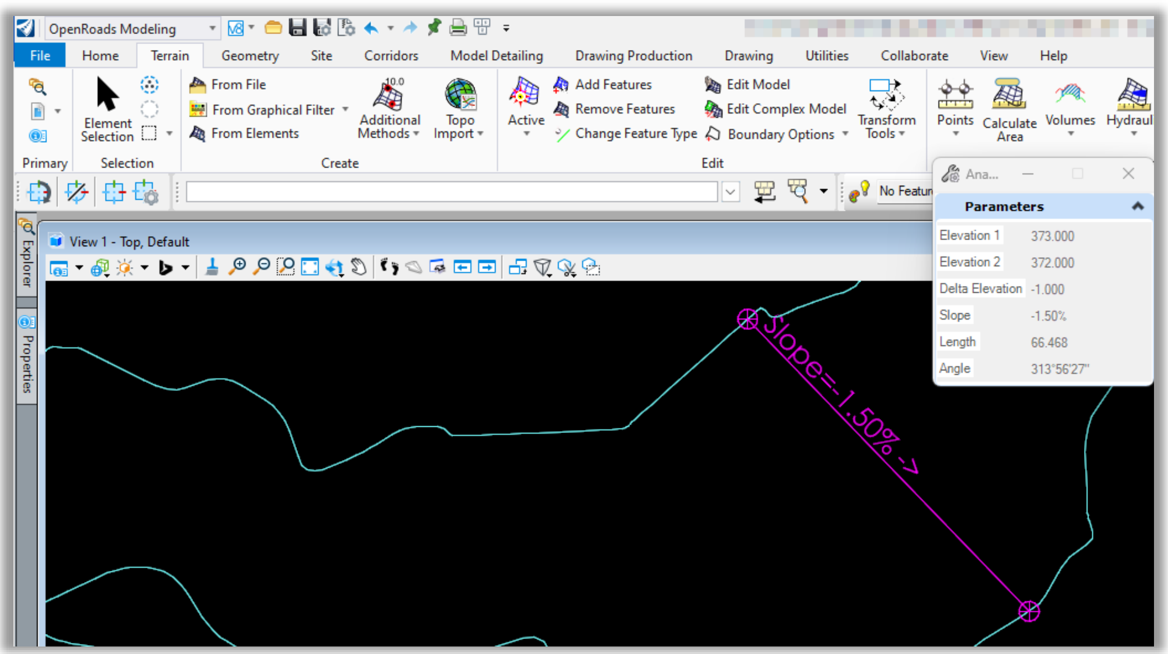

Figure 133 - Analyze Between Points

Notes:

- *The terrain contours or triangles do not have to be displayed for the Analyze Between Points command to function, but you do have to be able to select the terrain.*
- *The slope annotation symbology is controlled by the active Text Style. In the Label Terrain Spots activity above, the Label - Center Center text style was selected and that is controlling the display. You can change the active text style in the Label Terrain Spots command, or go to the Drawing Production > Text > Place Text command and select a text style.*
- *The slope text, direction arrow and line are multiple types of elements and are independent of the terrain display. Changing the terrain display will not alter the graphics placed with this command. To delete the graphics placed, use the Element Selection tool to select the graphics and then press the delete key.*

Exercise 7 – Connecting to GIS Data

You can now display contextual data using the tools available in this workflow You can display data from different standard geospatial web services allowing to see the context of existing assets and data Feature Services Connections.
Connecticut offers the open data that can be connected to, below is the link to the list
https://services1.arcgis.com/FCaUeJ5SOVtImake/ArcGIS/rest/services

In these exercises we will be using **Feature Services** in the **Geospatial Context** workflow .

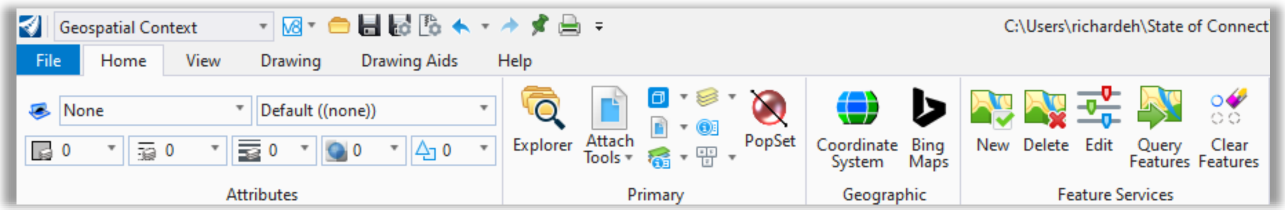

Figure 134 - Geospatial Workflow

7.1 Connecting to a Feature Service

The CTDOT DDE come with the following configured services. In this section you will be walked through the step to connect to them

1. Create a new file in the Share folder using NAD 83 / NAVD 88 and name it ***HW_NC_1234_1234_AADT.dgn*** or ***SB_NC_1234_1234_AADT.dgn***
2. In the **View** select **Background Map** and choose the Map Type **Road**.
3. Zoom to the Downtown Hartford area.

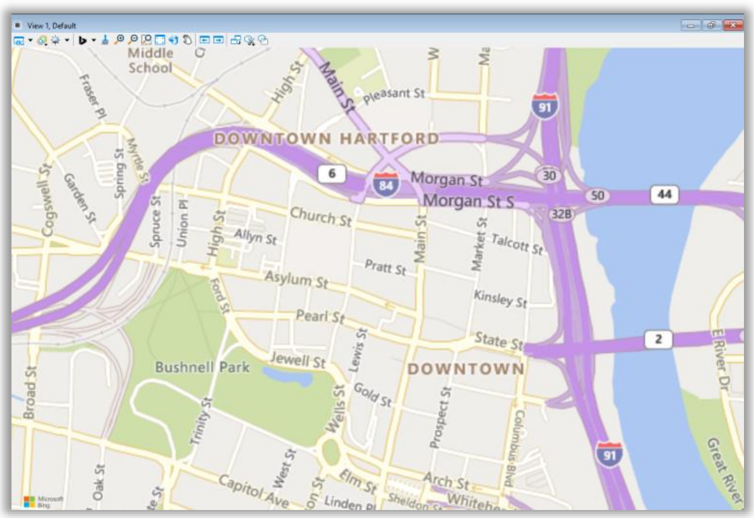

Figure 135 - View Window of Background Map

4. Select **Geospatial Context** from the **Quick Access Toolbar**. In the **Feature Services** section select **NEW**.
5. The New Feature Service Connection dialog box will appear select **Services**.

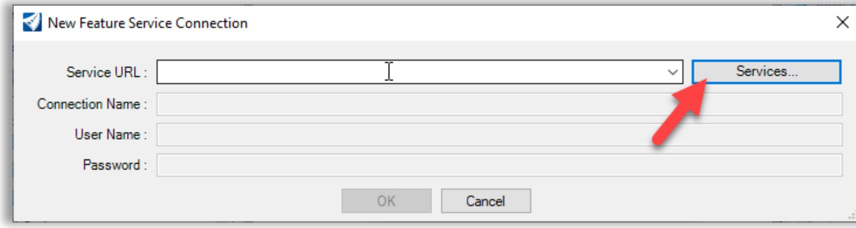

Figure 136 - New Feature Service Connection

6. Select **AADT** and click **Close**.

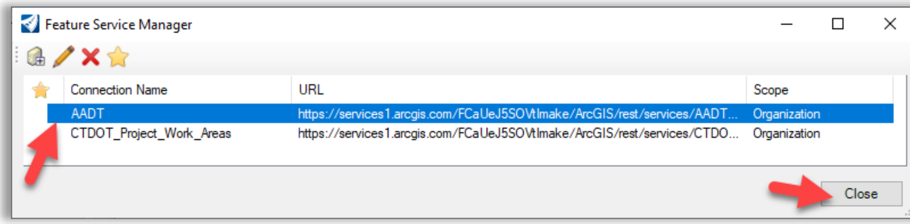

Figure 137 - Feature Service Manager

7. On the New Feature Service Connection click **OK**.

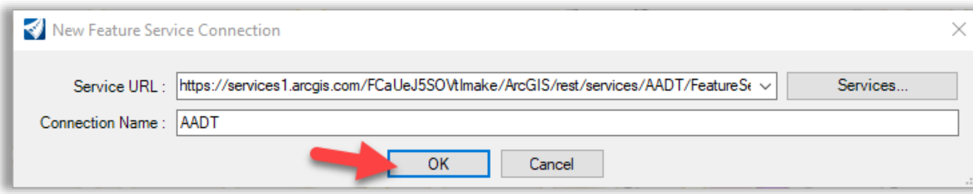

Figure 138 - New Feature Service Connection

8. On the New Feature Parameters, make sure ***AADT*** is checked Select **Connect**.

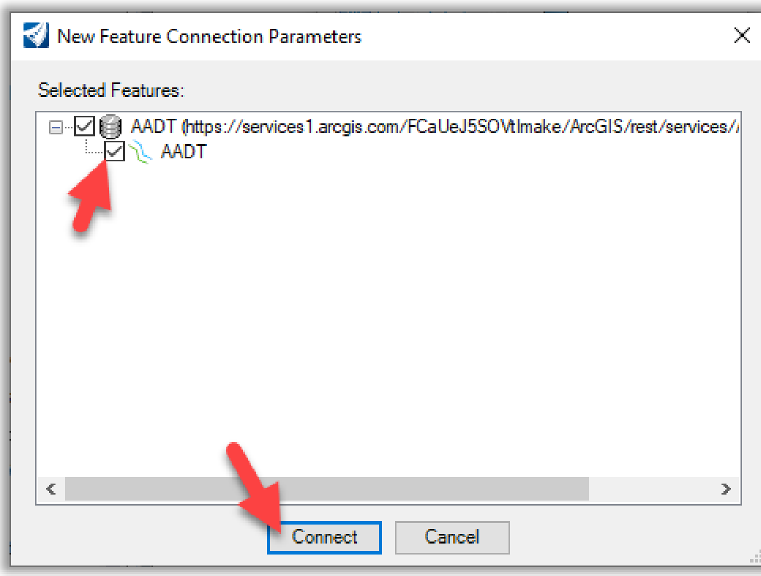

Figure 139 - New Feature Service Connection Parameters

9. In the Feature Services section select **Query Features**
10. It may take a few seconds for the data to load, click on one of the graphics and view the data. You may find it easier to turn off the Background Map.
11. Click on the new **purple lines** and view the data in **Properties**. Notice the **AADT** Item box and review the fields

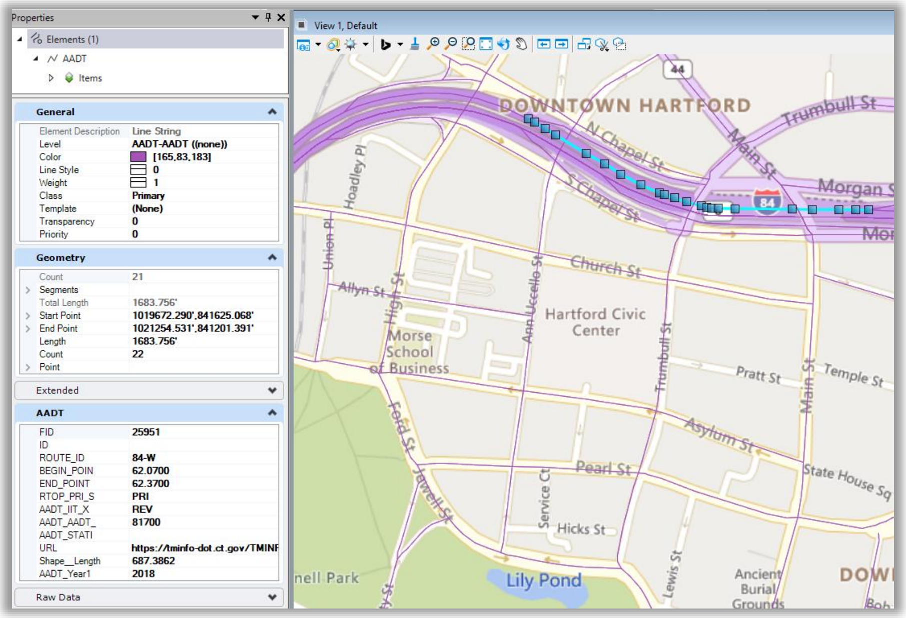

Figure 140 - AADT Properties

12. These query results are a snapshot in time, if some time has passed and you would like to view new results you will need to run the query again in this file.

7.2 Setting up a new Feature Service

1. Create a new file in the Share folder using NAD 83 / NAVD 88 and name it ***HW_NC_1234_1234_Exsiting_Illumination.dgn*** or ***SB_NC_1234_1234_Exsiting_Illumination.dgn***
2. In the **View** select **Background Map** and choose the Map Type **Road**.
3. Zoom to the Downtown Hartford area.
4. In the **Feature Services** section select **New**.
5. The New Feature Service Connection dialog box will appear select **Services**

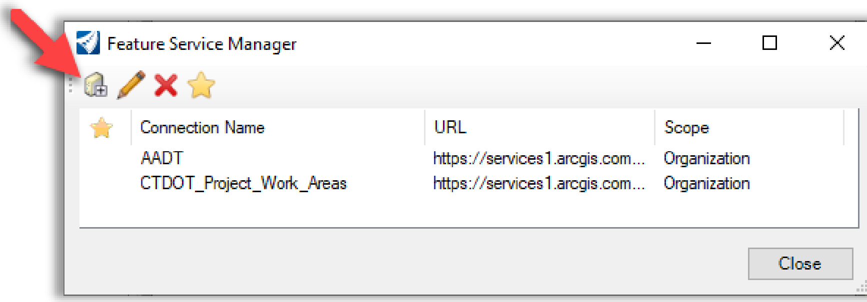

Figure 141 - Feature Service Manager

6. On the Feature Service manager click on **Create Service Definition**
7. On the Create Service Definition paste in: https://services1.arcgis.com/FCaUeJ5SOVtImake/ArcGIS/rest/services/CTDOT_Illumination/FeatureServer
   Click in Connection Name, a name will auto fill, for Scope select WorkSet, click **OK**

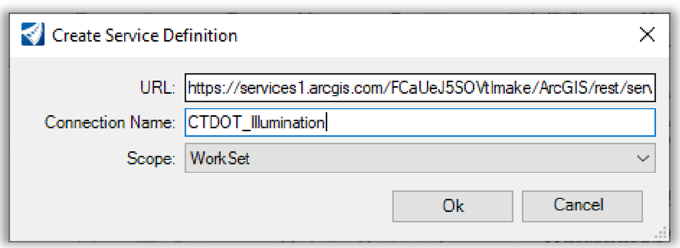

Figure 142 - Create Service Definition

8. Click on the **Connection** name and select **Close**.

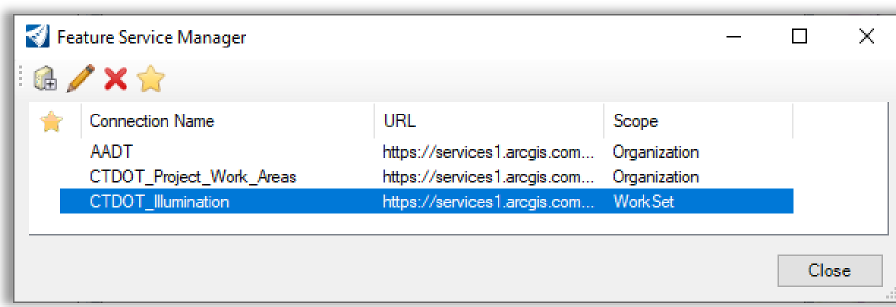

Figure 143 - Feature Service Manager

9. On the New Feature Service Connection click **OK**.
10. On the New Feature Parameters, make sure all options are checked Select **Connect**.

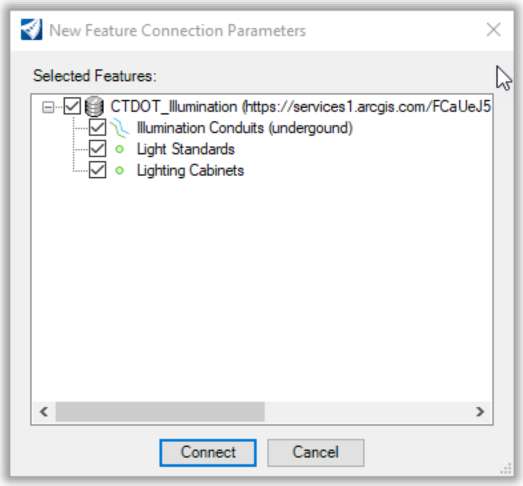

Figure 144 - New Feature Service Connection Parameters

11. In file explorer browse to your workset and notice the file ***\Standards\Data\FeatureServiceServerList.xml*** was created. This is because WorkSet was selected for Scope.
12. Back in the CAD application select **Edit** feature Services. Only have the Illumination options toggled on.

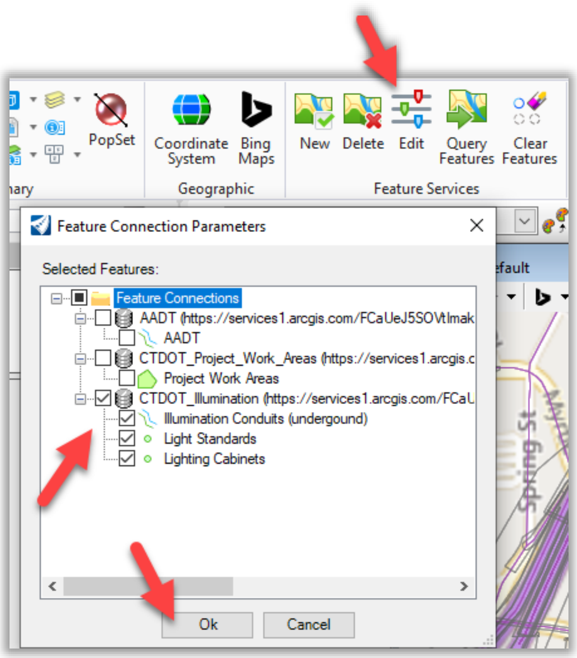

Figure 145 - Edit Feature Service Connection Parameters

13. In the Feature Services section select **Query Features**
14. Click in the view with the new lines and points and review the data in Properties.

Exercise 8 – Skills Review

This section is to be completed independently. Use the previous exercises as a guide.

The following files will be used as the base data:

Survey - These files use a Datum of NAV 1983 & NAVD 1929 and are old V8i files

- Active_Survey\SV_XX_047_0122_Ellington_3.grn
- Active_Survey\SV_XX_047_0122_Ellington_4.grn
- Active_Survey\SV_XX_047_0122_Ellington_5.grn
- Active_Survey\SV_XX_047_0122_Ellington_6.grn
- Active_Survey\SV_XX_047_0122_Ellingtion_ORD_Terrain.dgn

Rasters and LAS Data- These files use a Datum of NAV 1983 & NAVD 1988

- Share\Ellington*.sid
- Share\ Ellington*.las

Create three files:

a. 2D Raster container file
b. 3D LAS container file
c. Design file that Geospatially matches the Survey Data and reference in the Raster and LAS Container Files, Survey Ground Files and Survey Terrain

Discussion:

1. What seed file did you use to create a?
2. What seed file did you use to create b?
3. What seed file did you use to create c?
4. In File c. what steps did you take to line up the References of the old V8i Ground files?
5. In File c. what steps did you take to line up the References of Raster Container?

Answers:

1. What seed file did you use to create a?
   Organization\Seed\GCS\2D_NAD83FT_NAVD88.dgn

2. What seed file did you use to create b?
   Organization\Seed\GCS\3D_NAD83FT_NAVD88.dgn

3. What seed file did you use to create c?
   Organization\Seed\GCS\2D_NAD83FT_NAVD29.dgn

4. In File c. what steps did you take to line up the References of the old V8i Ground files?
   - **Orientation: Coincident World**
   - **In the References dialog box changed True Scale to off and the scale to 1 to 1**

6. In File c. what steps did you take to line up the References of Raster and LAS Containers?
   - **Reference this file in using Geograpghic – reprojected**
   - **Reproject Elevations**

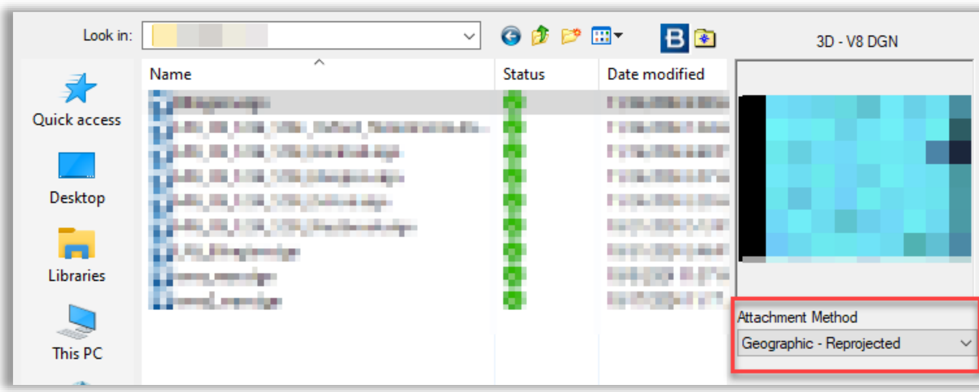

Figure 146 - Reference this file in using Geographic – reprojected

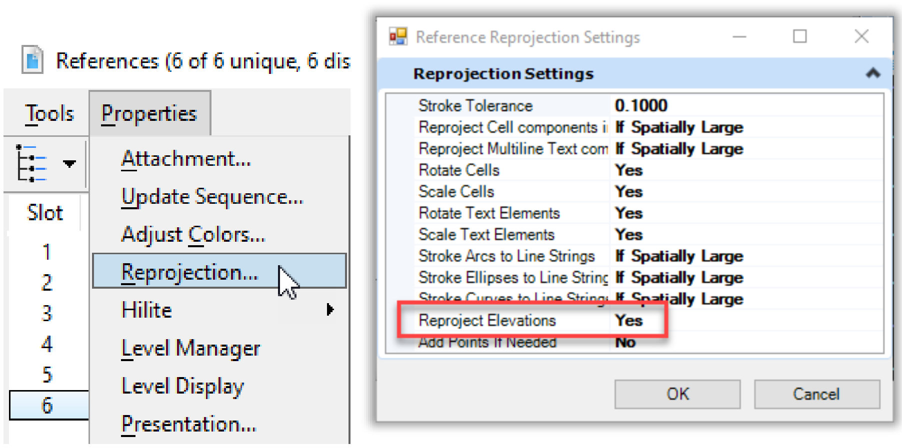

Figure 147 - Reproject Elevations

Dataset Install for Self-Paced Training

The training data set is stored in SharePoint for those doing self-paced training.

1. In **Microsoft Edge** browse to: [DOT CTDOT_DDE - Training Datasets - All Documents]

2. Click on **Training Data Sets** and select **Volume 2**. Click on the three dots **...** and select **Download**.

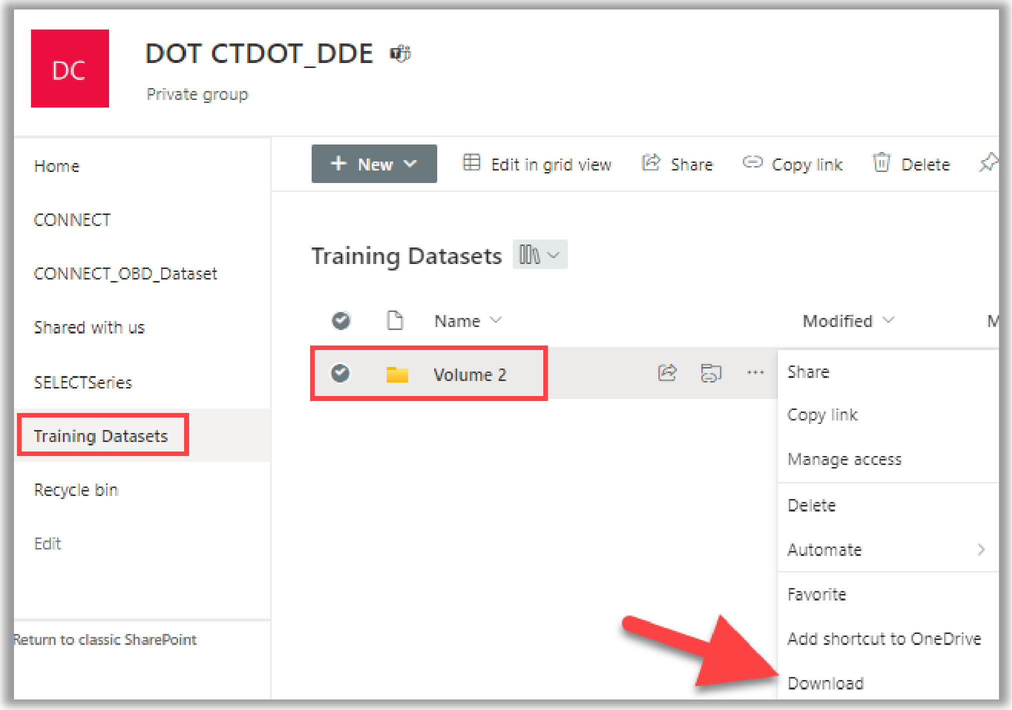

Figure 148 - DDE SharePoint Page - Download Training Dataset

3. **CTDOT employees -** In File Explorer under **This PC** browse to **Downloads** and copy the ***Active_Survey, Highways*** and ***Share*** folders to your Non-Project Work Area.

   C:\Users\yourname\OneDrive - State of Connecticut\CAD_NonProjects\Design

   Consultants or those who would like to work outside of one drive can create a working folder on their computer.

4. When launching the application In CAD Accounting use the ***Non-Projects*** option for Run Program.

Glossary

Reference

Orientation - Sets the view of the model being attached. The list may also include saved views and named boundaries. You can select multiples of a type of orientation to attach. For example, you could attach multiple saved views. Coincident and Coincident World are treated as the same type.

Coincident — Aligns the references with regard to design plane coordinates only.

Coincident World — Aligns the references with the active model with regard to both Global Origin and design plane coordinates.

To Determine the Location of the Global Origin Key in **`ACTIVE ORIGIN $`**

Geographic – AEC Transform — Calculates the linear transform that gives the best approximation to the results of performing the full reprojection algorithm, if the active model and the reference have geographic coordinate systems. The approximation is acceptable for smaller scale data, such as most man-made structures occupying less than a square kilometer.

When the geographic coordinate system is created from placemark monument points, it maintains angles and consistently scales the model relative to the primary placemark monument point and the scale of the data at that point in the coordinate system.

For geographic data, the results are unlikely to be acceptable. To evaluate if this method is an acceptable approximation, the maximum error is displayed in the Description field. It is calculated by applying the exact calculation to each corner of the reference range and comparing that position to the position calculated from the transform. For references covering geographically small areas, the errors are typically small fractions of a meter. The advantage of this georeferencing method is that it gives the same performance as other reference attachments, since reprojection is not necessary.

When two models use the same base geographic coordinate system with the only difference being their local transforms, MicroStation can calculate an exact linear transform between the two models.

Geographic – Reprojected — Reprojects all data in the reference model from the reference model's geographic coordinate system to the active model's geographic coordinate system, if the active model and the reference have geographic coordinate systems. The reprojected data is stored only in memory (since the reference is not changed), so the reprojection calculations happen each time the reference is loaded. This increases the time required to open the active model but is more accurate.

This orientation mathematically recalculates points in the reference model to align with corresponding latitude/longitude points in the active model.

Standard Views — Identifies the views that can be used to display the reference: Top, Front, Right, Isometric, Bottom, Back, Left, or Right Isometric. If the file being attached is 2D, you can choose only the Top view.

Saved Views — Identifies the saved views that are available in the reference.

Named Boundaries — Identifies the named boundaries that are available in the reference. When a 3D model is selected for attachment, you can expand a named boundary and select a standard rotation to apply to the view attachment. For example, if you select a named boundary, then expand it to select the Top view, the extents of the named boundary are used, and the orientation is the top view.

When a named fence is used to attach a reference, all levels are on. If a particular level is desired, then use the named fence as a clip volume for a saved view in the reference, and select the saved view.