CONNECTICUT DEPARTMENT OF TRANSPORTATION

DIGITAL DESIGN ENVIRONMENT GUIDE

CONNECT EDITION

Volume 2 - Working with Existing Data

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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.

Skills Taught

- Referencing Survey DGN Files
- Attaching Imagery
- Creating Raster Container Files
- Creating an existing Terrain from Lidar
- Re-projecting DGN files

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 – Connecting to GIS Data None
Exercise 7 – Skills Review …\Active_Survey\SV_XX_047_0122_Ellington_NAV83_V29_3.grn …\Active_Survey\SV_XX_047_0122_Ellington_NAV83_V29_4.grn …\Active_Survey\SV_XX_047_0122_Ellington_NAV83_V29_5.grn …\Active_Survey\SV_XX_047_0122_Ellington_NAV83_V29_6.grn …\Active_Survey\SV_XX_047_0122_Ellington_NAV83_V29_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:

3D Design Model	Existing Ground Survey	Existing Survey Feature, Terrain
3D Design Model	Utilities	Borings, Test Pits, Utility as-builts
3D Design Model	Bridge Deck	Existing bridge deck, Terrain
3D Design Model	Hydraulic Data	Hydraulic Section, FEMA floodplain data
2D Design Model	Boundary	ROW, Property Info, Annotation
Drawing Model	Annotation	Existing survey labels, Map Features
Sheet Model	Title Block	Plot border, Ties Boxes and Title Block

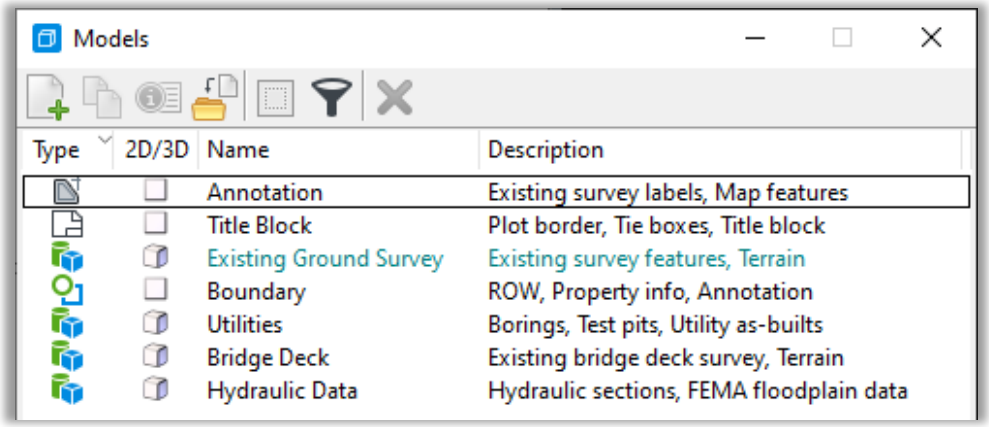

Figure 1 - Existing Survey DGN Models

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

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 OpenBridge CE** or **Compass OpenRoads CE**, for the Available Account select **OVERHEAD** for training proposes. Click on the **Start** button to load the program.

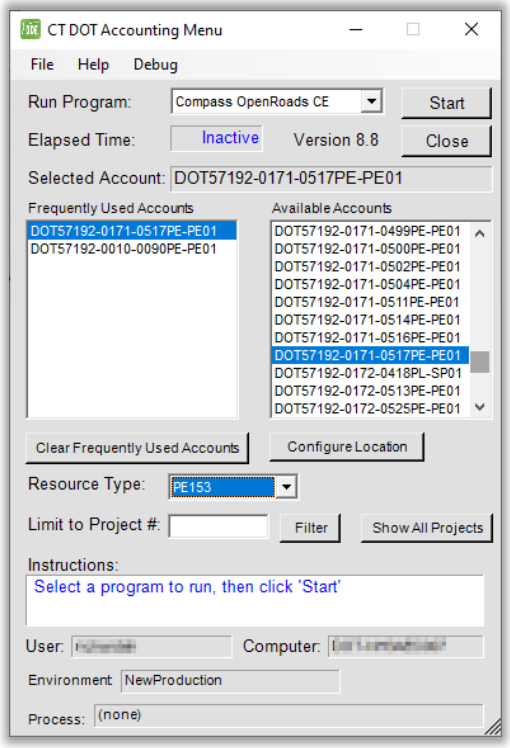

Figure 3 - CTDOT CAD Account Dialog Box

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***).

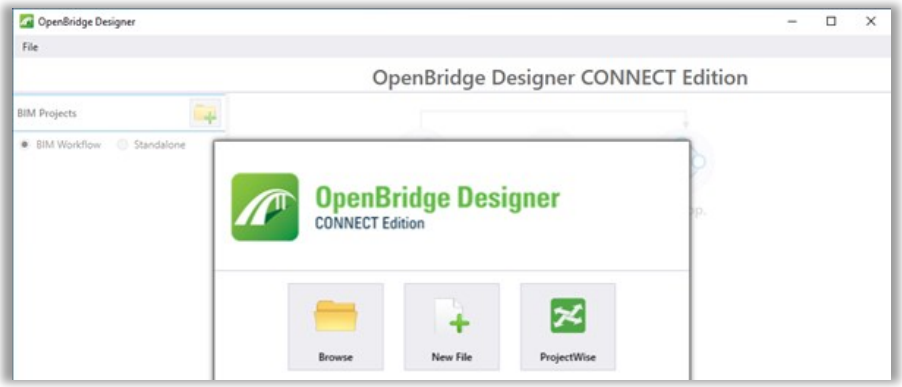

Figure 4 - OpenBridge Designer Open Screen

   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.

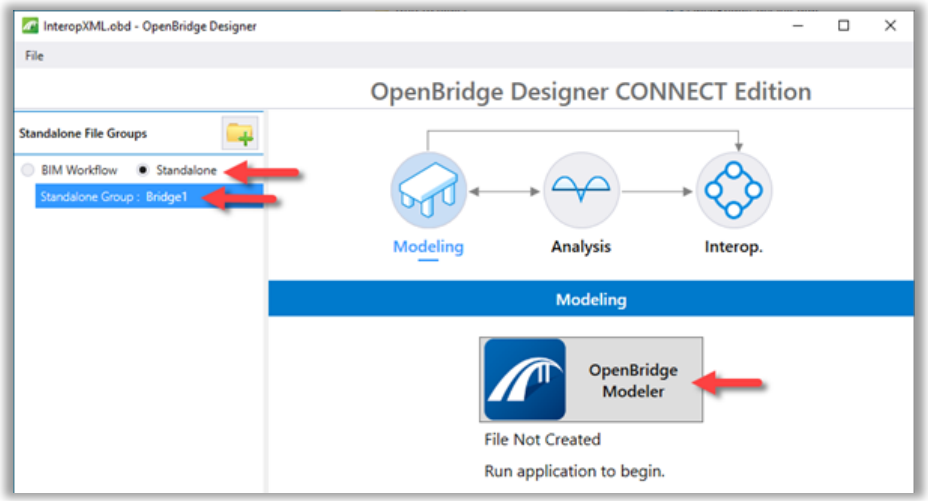

Figure 5 - OpenBridge Designer Open DGN

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.

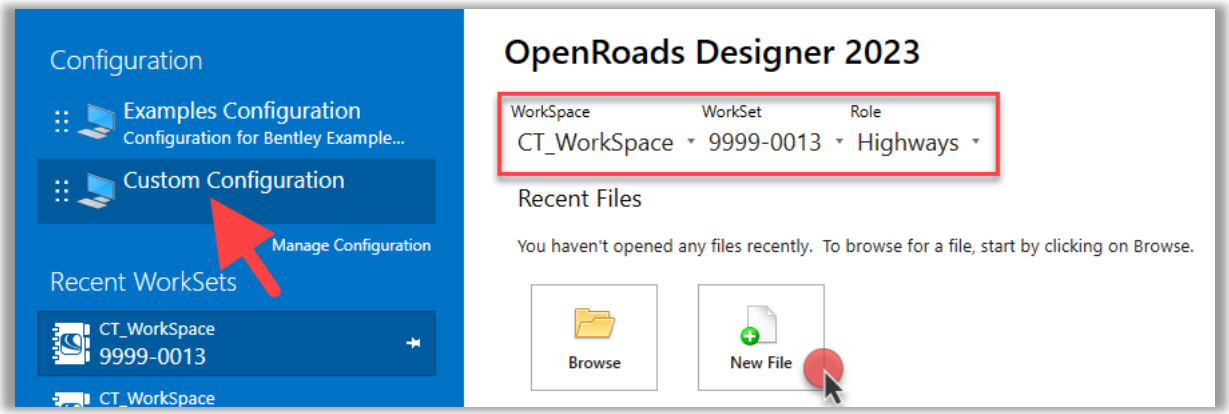

Figure 6 - OpenRoads Start Screen

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

   HW_CB_1234_1234_Westbrook.dgn or ***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.

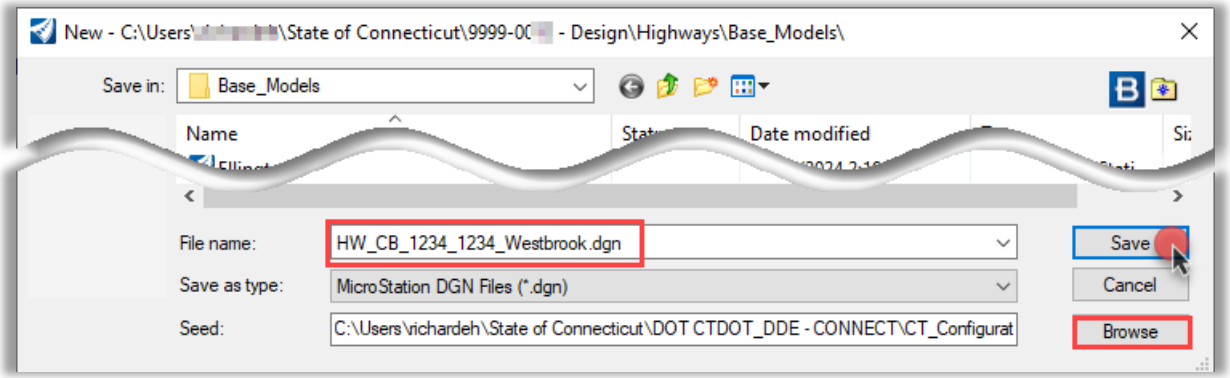

Figure 7 - New File

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.

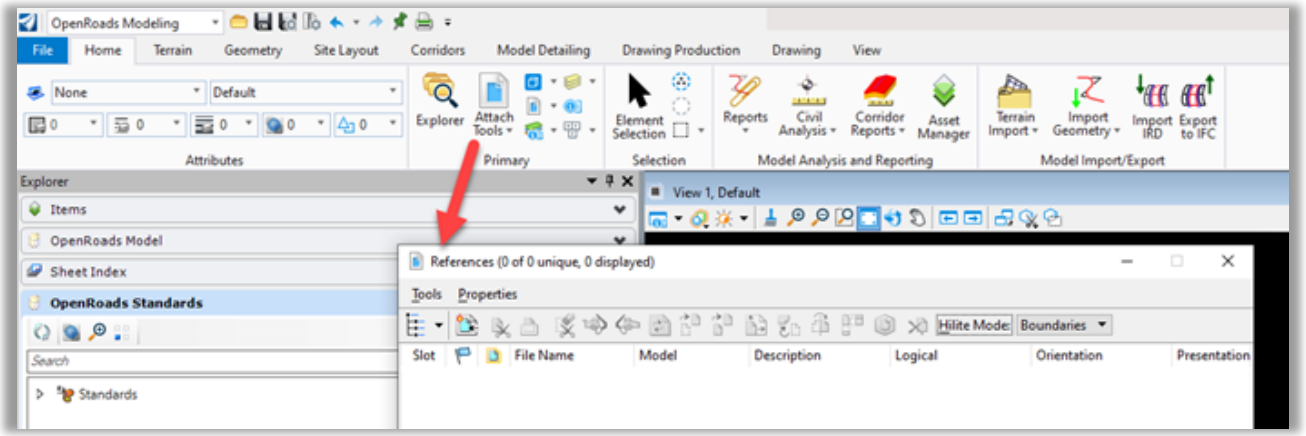

Figure 8 - Attach Reference

1. Select the Reference tool.

   Browse to attach: ***Active_Survey\SV_XX_0154-0128_Westbrook_ORD.dgn***

   On the Reference Attachment Properties select:
   Model: ***Existing Ground Survey***
   Orientation: ***Coincident World***
   Nested Attachments: ***No Nesting***

2. Repeat **Step 2** and reference in the ***Annotation, Bridge Deck and Boundary Models***.

3. Click **Fit View** in the view window.

4. 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.

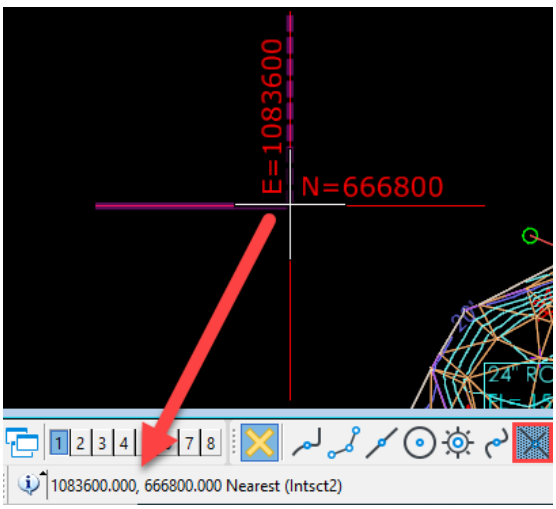

Figure 9 – Check Northing and Easting

5. **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.

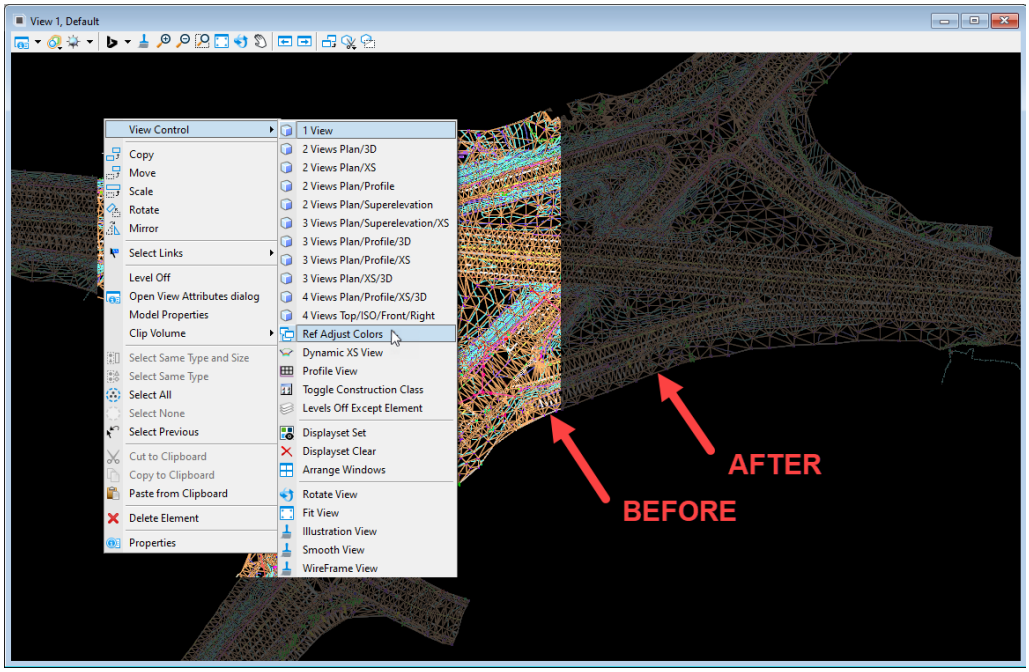

Figure 10 Adjust Reference File Color using Right Click Menu

6. To adjust back open the **References** dialog box, select ***Properties > Adjust Colors...*** and slide ***Value*** and ***Saturation*** to ***100***.

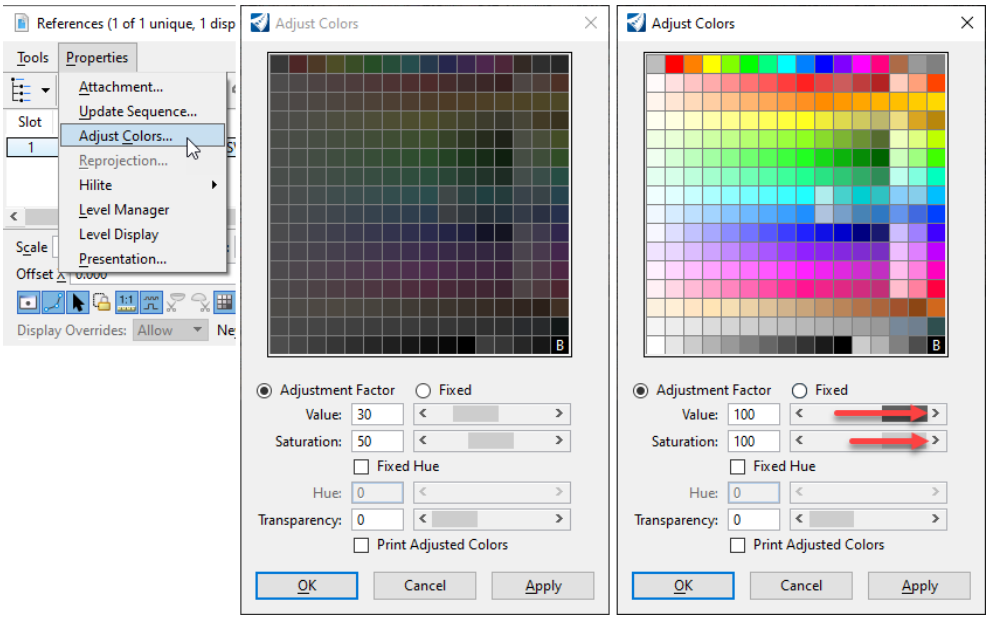

Figure 11 Adjust Reference File Color in Refences Dialog Box

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

1.3 Terrain Models

Terrain models generated by OpenRoads Survey are 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.

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.

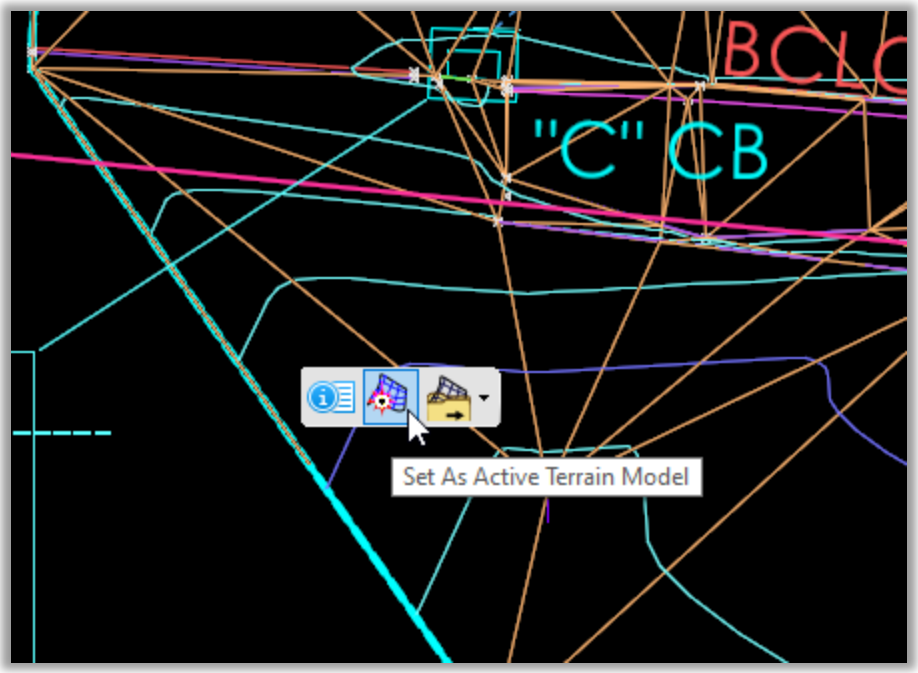

Figure 12 - Set as Active Terrain

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. Leave it so the Contours are on, but the Terrain is off.
4. Review the file and **Save Settings**.

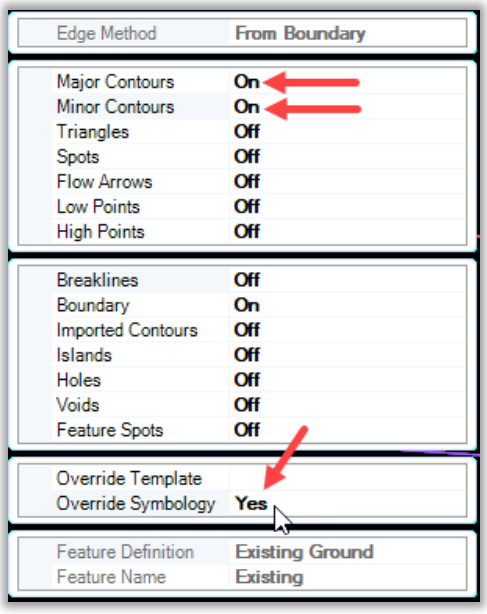

Figure 13 - Override Symbology

1.3.3 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:

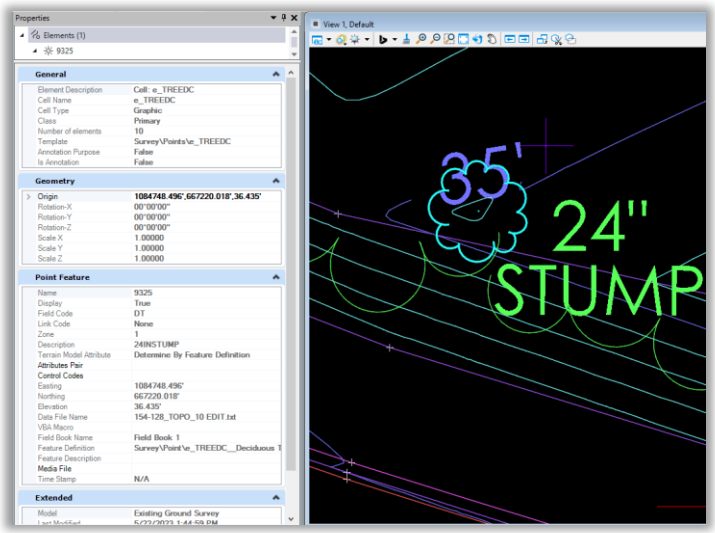

Figure 14 - Point Symbology

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.

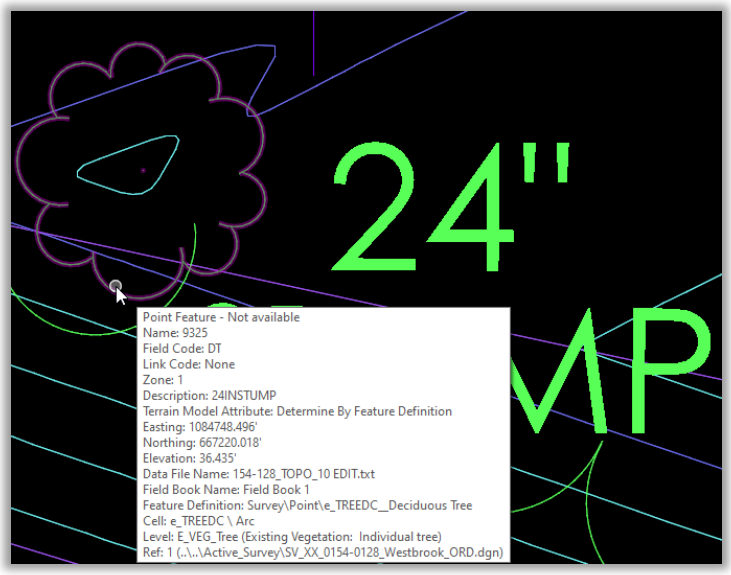

Figure 15 - Point Feature Information

1.3.4 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.

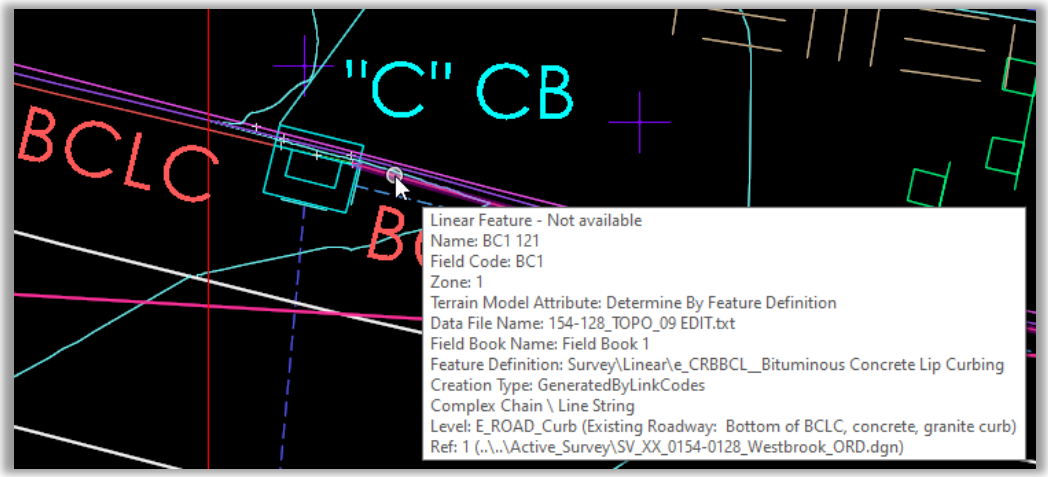

Figure 16 - Linear Feature Information

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

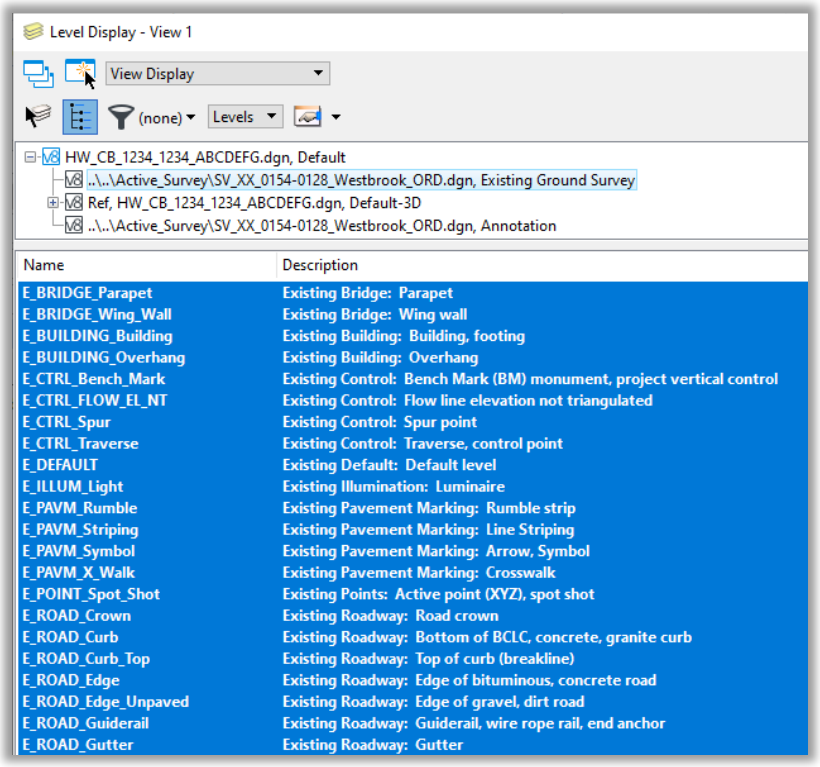

Figure 17 - Survey Feature Levels

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

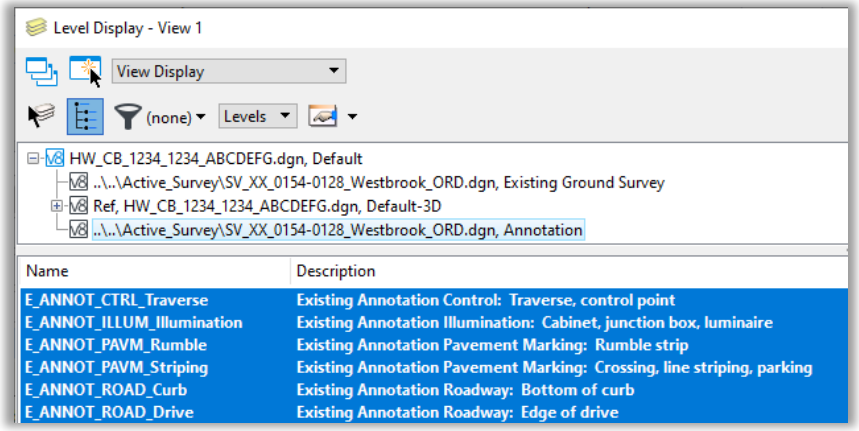

Figure 18 - Survey Annotation Levels

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:
   HW_CB_1234_1234_Branford.dgn or ***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.

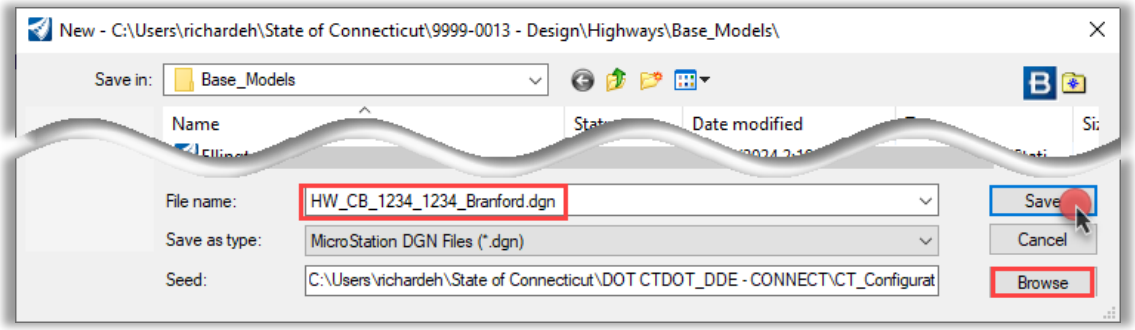

Figure 19- New File

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***

   On the Reference Attachment Properties select:
   Model: ***3D Design***
   Orientation: ***Coincident World***
   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.

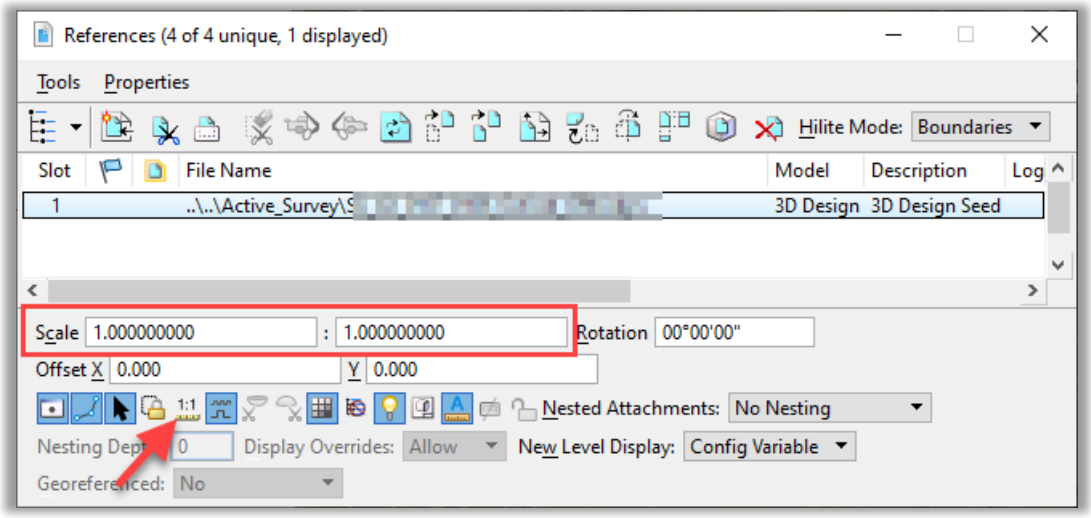

Figure 20 - Reference file Settings

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

   On the Reference Attachment Properties select:
   Model: ***Default***
   Orientation: ***Coincident World***
   Nested Attachments: ***No Nesting***

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 Attachment Properties, set:

Global LineStyle Scale : ***Reference***

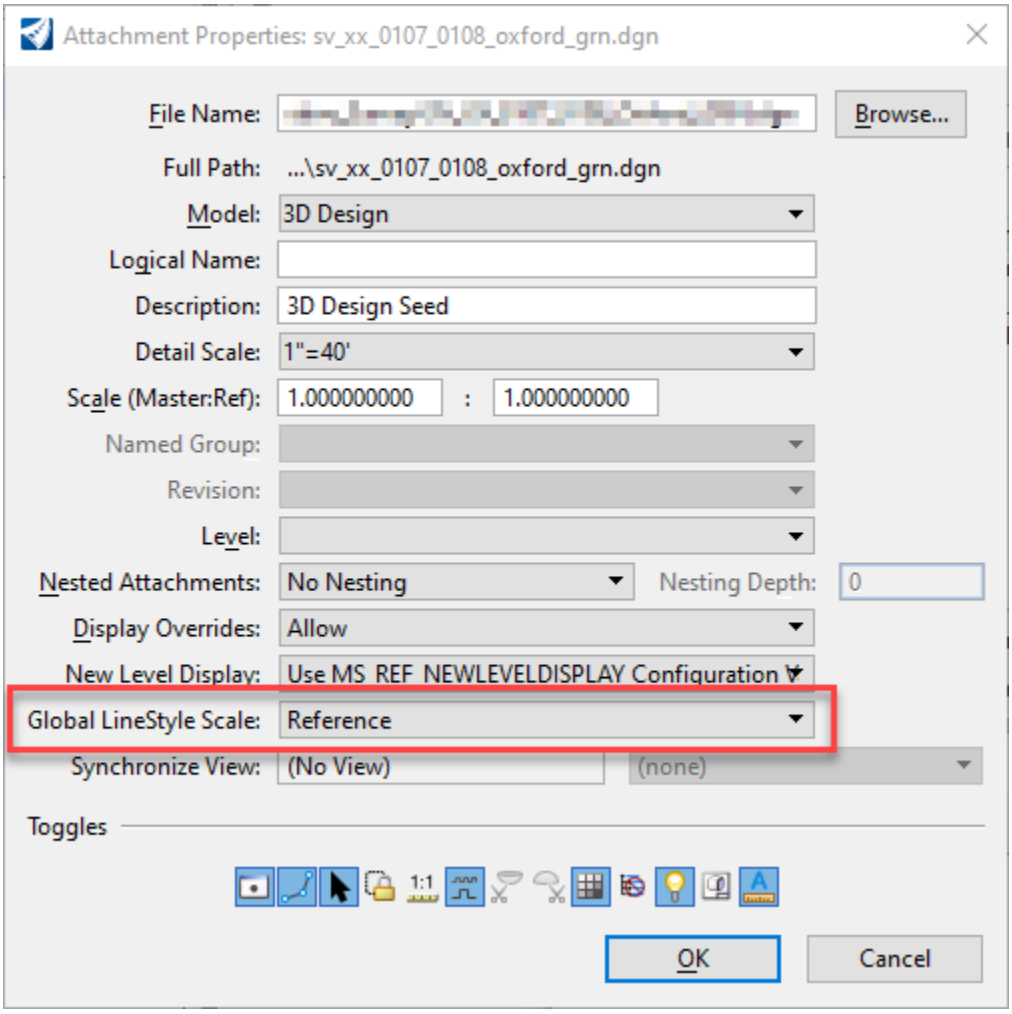

Figure 21 - Set Global LineStyle Scale

Exercise 3 – Working with Datums

3.1 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:
   HW_CB_1234_1234_Oxford.dgn or ***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\|GCS\|2D_ NAD83FT_NAVD88.dgn***
   or
   OBM: ***CT_Configuration\|Organization\|Seed\|GCS\|3D_ NAD83FT_NAVD88.dgn***
3. Follow the prompts to create the file.

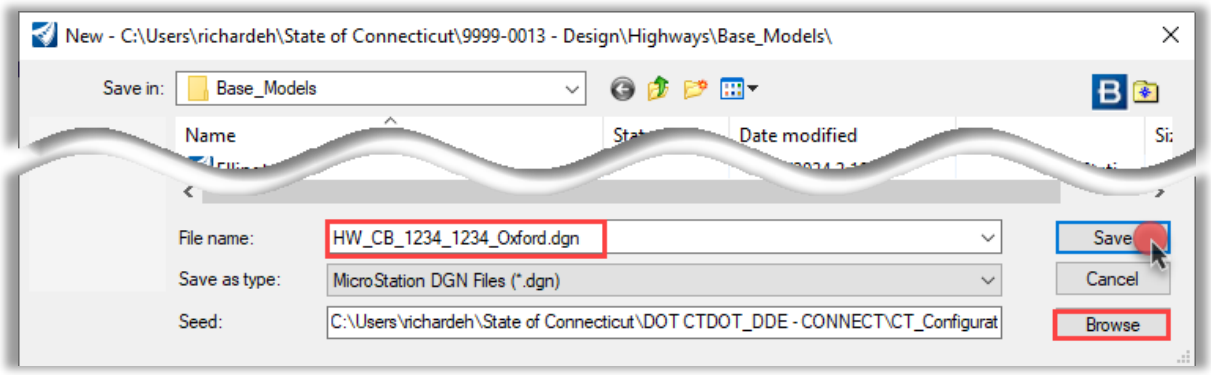

Figure 22 – New File

3.2 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_0107_0108_Oxford _GRN.dgn***

   On the Reference Attachment Properties select
   Model: ***3D Design***
   Orientation: ***Coincident World***
   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.

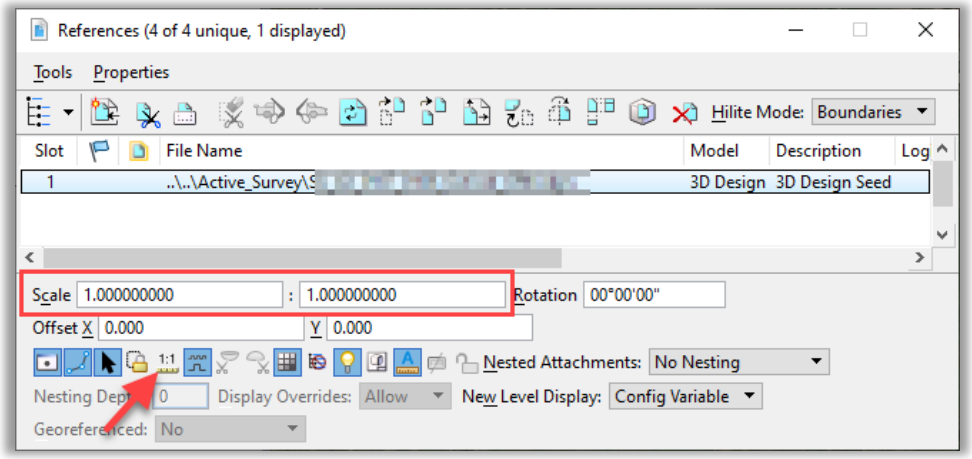

Figure 23 - Reference file Settings

6. Select the Reference tool.
   Browse to attach**: *Active_Survey\ SV_XX_0107_0108_Oxford_ ORD_Terrain.dgn***

   On the Reference Attachment Properties select:
   Model: ***Default***
   Orientation: ***Coincident***
   Nested Attachments: ***No Nesting***

3.3 Geographic Coordinate Systems

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.

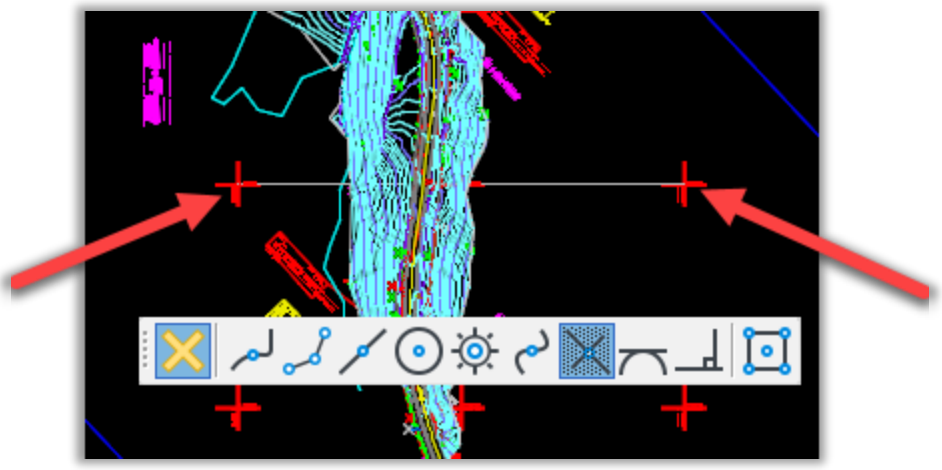

Figure 24 - Place Line from Tic Marks

2. On the **Utilities** tab in in the **Geographic** section select **Coordinate System**.

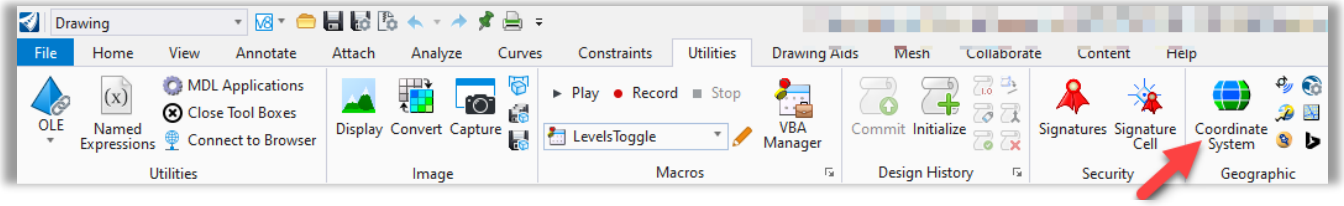

Figure 25 - Coordinate System Tools

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

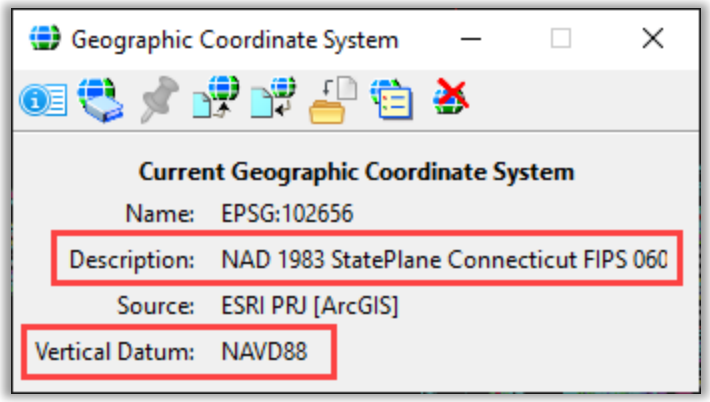

Figure 26 - Coordinate System Settings

4. In the **View** window, zoom into the Survey Title Block and look for the Datum Information to check it against the dialog box. Notice they do not match. There are two tools that can be used to rectify this situation. Users can get the correct Coordinate System by using the **From Library** or **From File** tools.

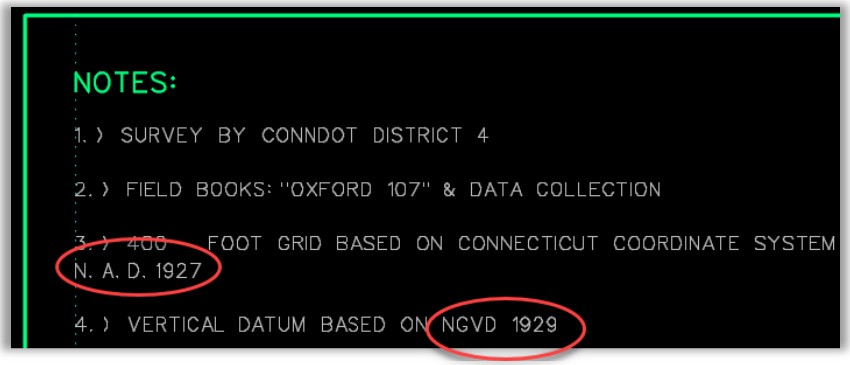

Figure 27 - Survey N.A.D. and NGVD Notes

a. 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**.

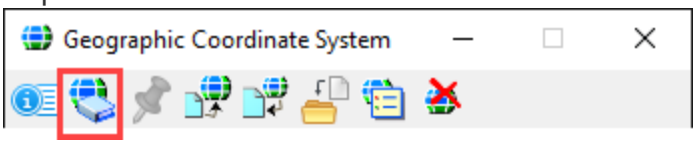

Figure 28 – Select Coordinate System From Library Icon

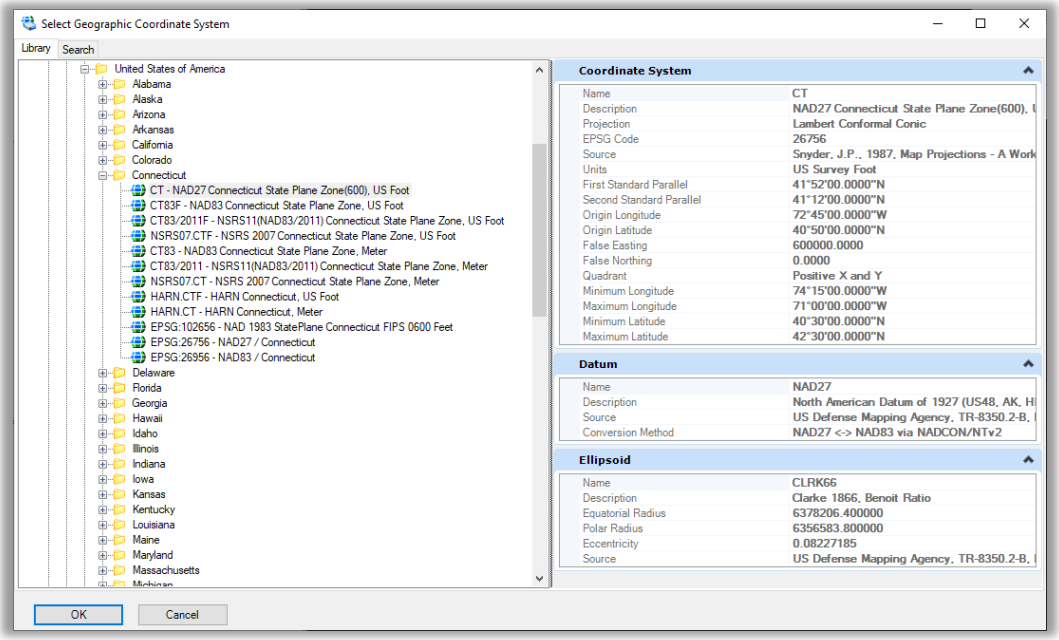

Figure 29 – Select Coordinate System From Library

b. Rather than selecting a GCS from this overwhelming library list, AEC provides seed files in the delivered CONNECT Workspace that can be used as a Geographic Coordinate System Source. 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.

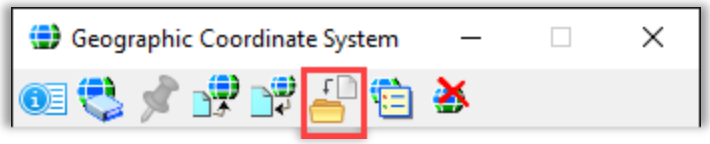

Figure 30 – Select Coordinate System From File icon

Select **From File**, browse to and select **Open**:
CT_Configuration|Organization|Seed|GCS|3D_NAD27FT_NAVD29.dgn

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

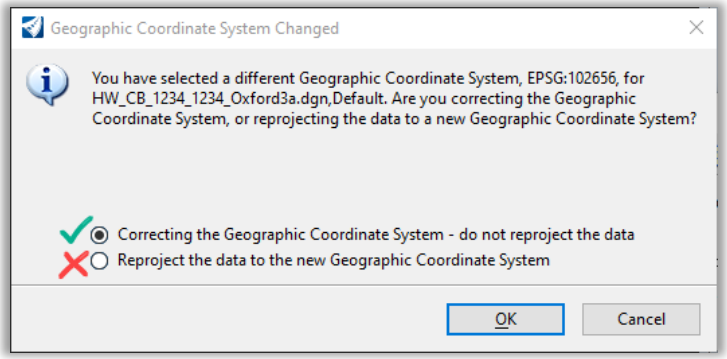

Figure 31 - Geographic Coordinate System Changed Dialog Box

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**.

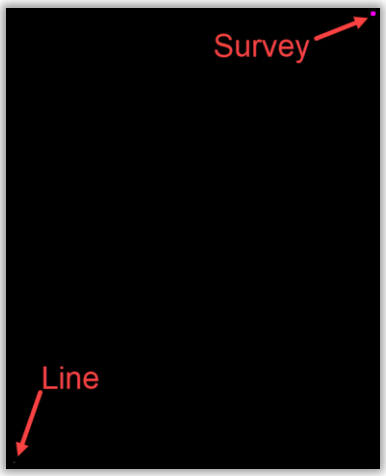

Figure 32 - Reproject the Data to the Geographic Coordinate System

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.

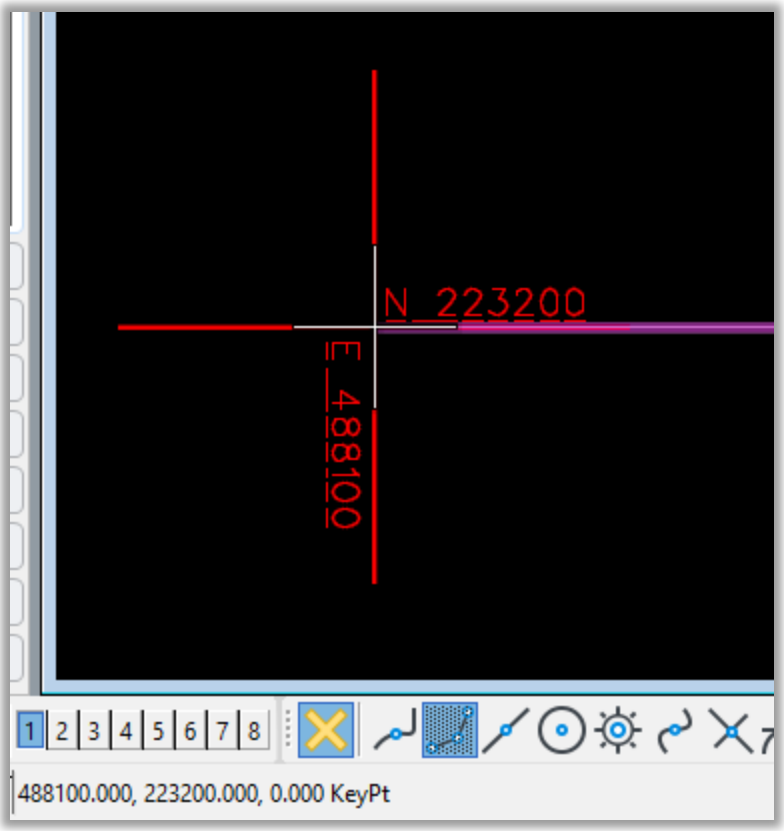

Figure 33 - Coordinates Tic Marks Match

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

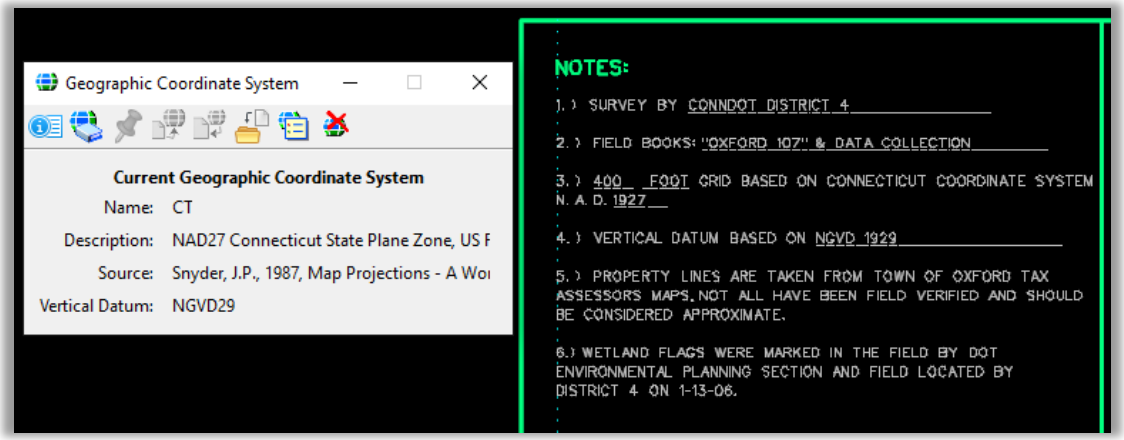

Figure 34 - Coordinate System Check

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.
   HW_CB_1234_1234_Oxford.dgn or ***SB_CB_1234_1234_Oxford.dgn***
2. Open the file for exercise 3, On the View window icon click on **Select Background Map**.

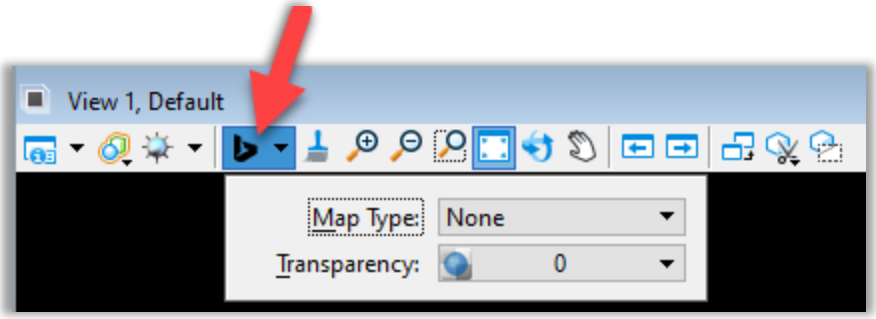

Figure 35 - View Background icon

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

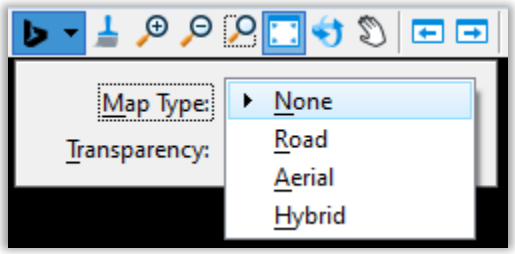

Figure 36 - Background Map Type Pick List

Figure 37 - Background Map Views

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

1. Open the File from Exercise 3.

   HW_CB_1234_1234_Oxford.dgn or ***SB_CB_1234_1234_Oxford.dgn***

2. Open the file for exercise 3, 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.

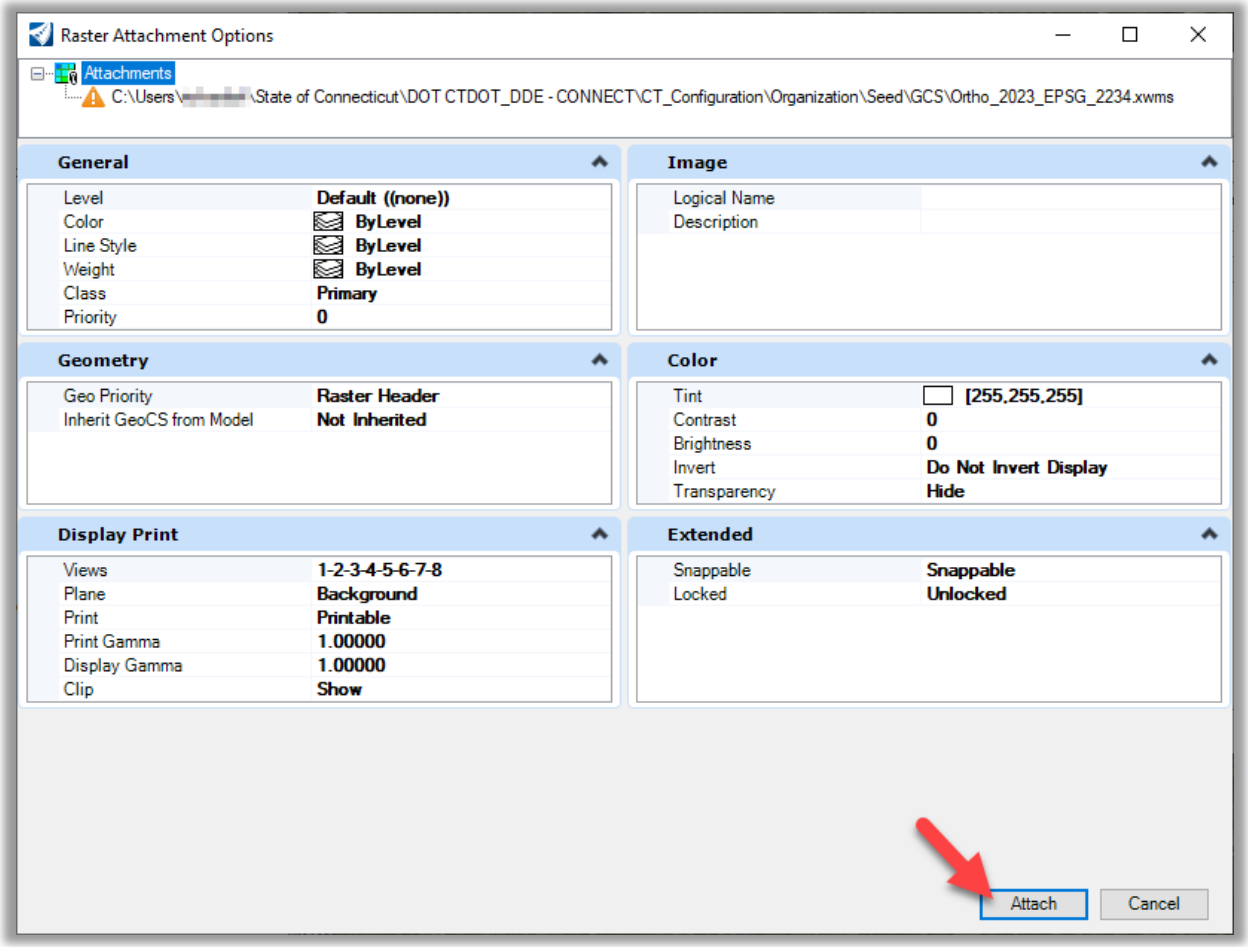

Figure 38 - Attach Raster Options

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:
http://www.cteco.uconn.edu/download.htm

- 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.

   HW_CB_1234_1234 _Oxford_Raster_Container.dgn

   Use the 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.

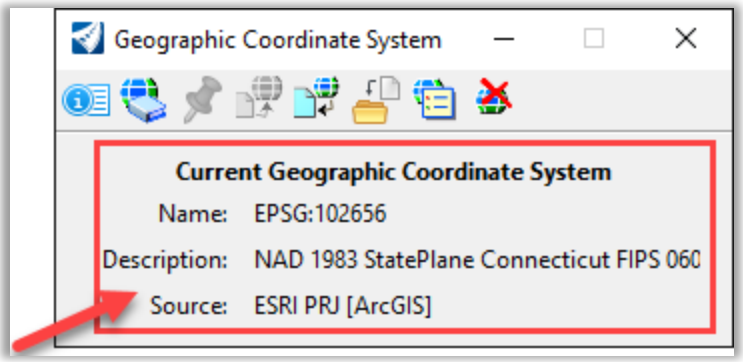

Figure 39 - Coordinate System Settings

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.

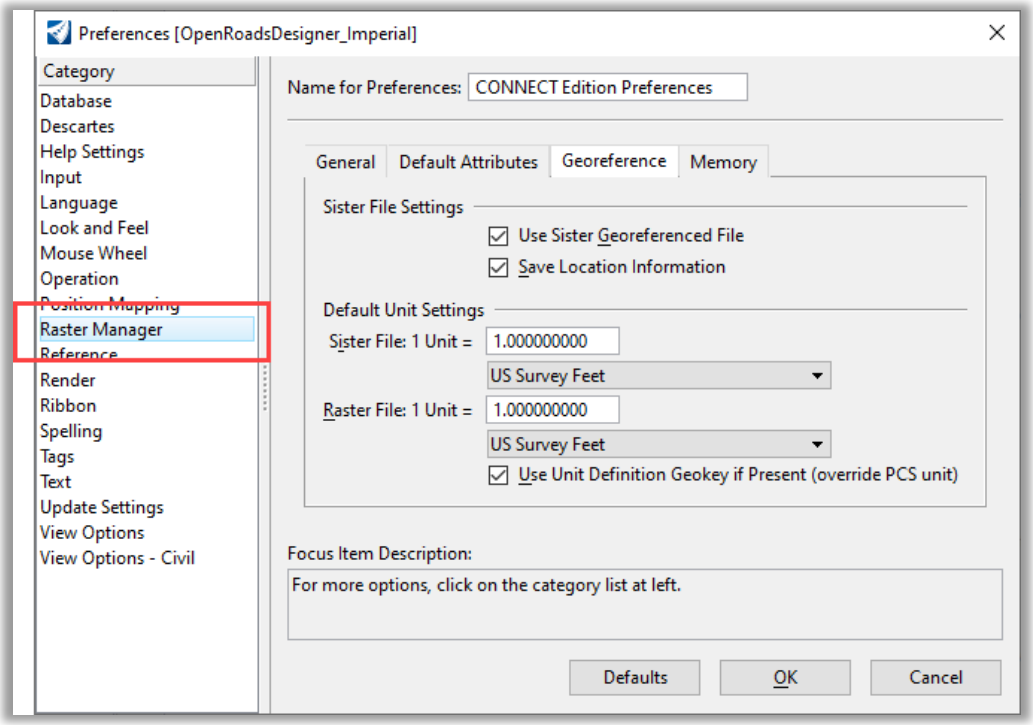

Figure 40- User Preferences Raster Managers Settings

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

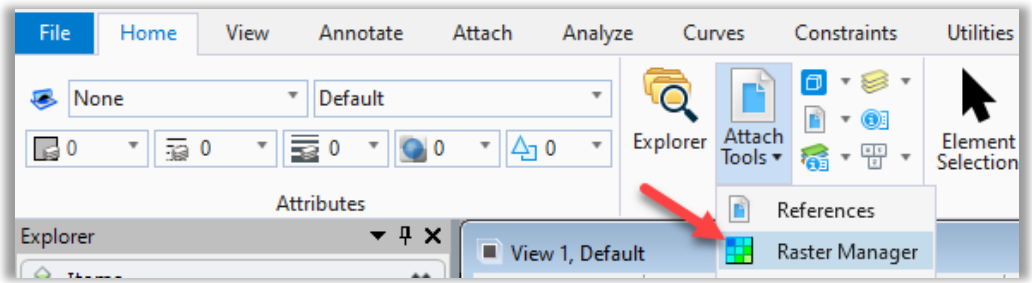

Figure 41 - Raster Manager tool

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

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

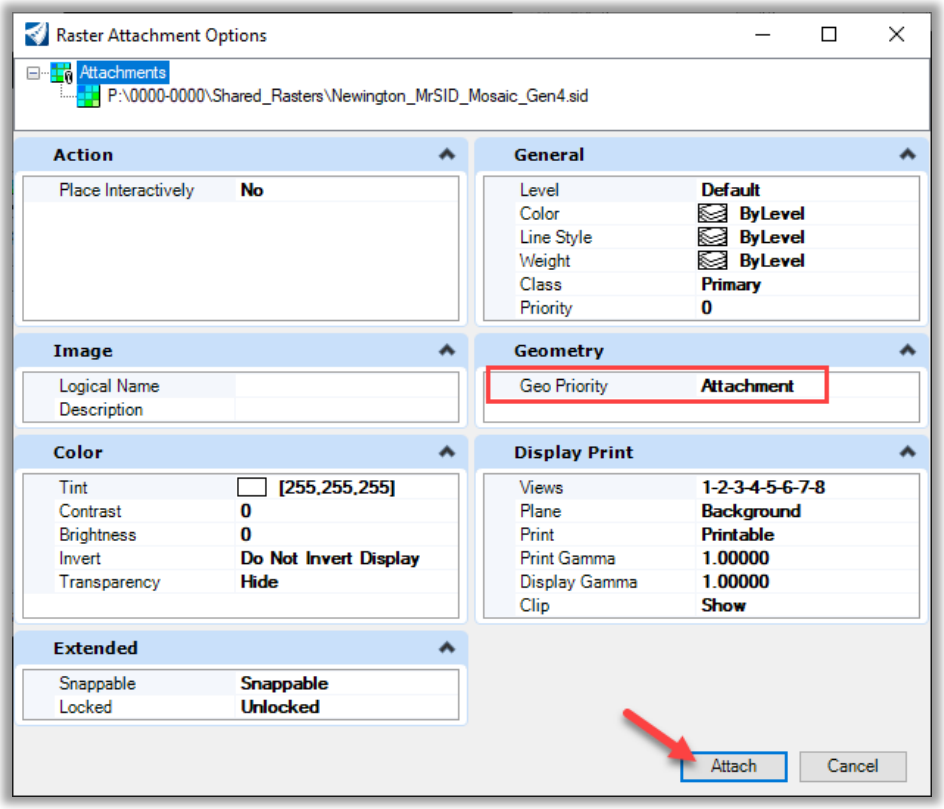

Figure 42 - Raster Manager Attachment Settings

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

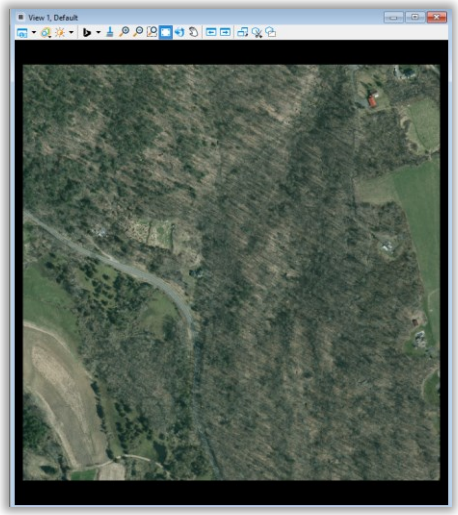

Figure 43 - View of Raster Image

11. Open the File from Exercise 3.
    HW_CB_1234_1234_Oxford.dgn
    or
    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.

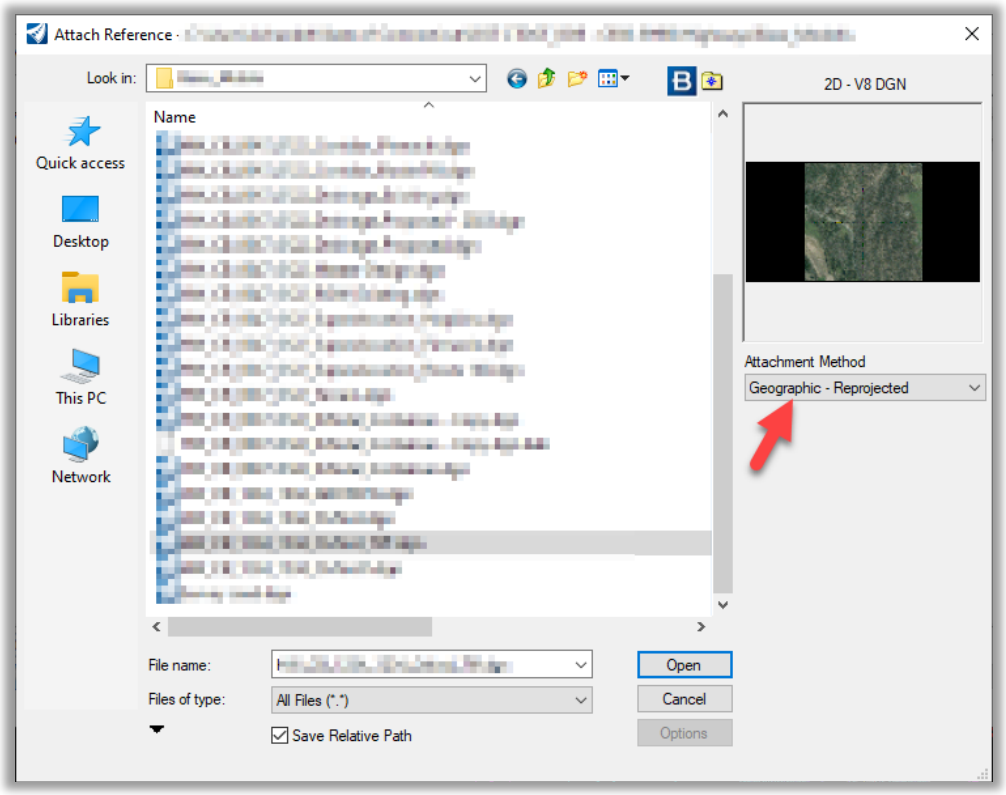

Figure 44 - Reference Geographic Reprojected

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:
http://www.cteco.uconn.edu/download.htm

- 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.

This Module will introduce two ways to import TOPO Data:

- Terrain from LAS 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.

   HW_CB_1234_1234 _Oxford_ TerrainFromLAS.dgn

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

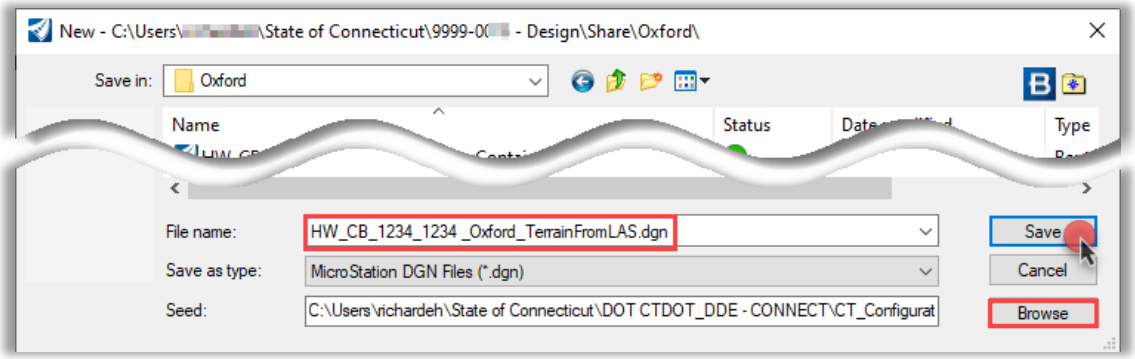

Figure 45 - Create New File

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

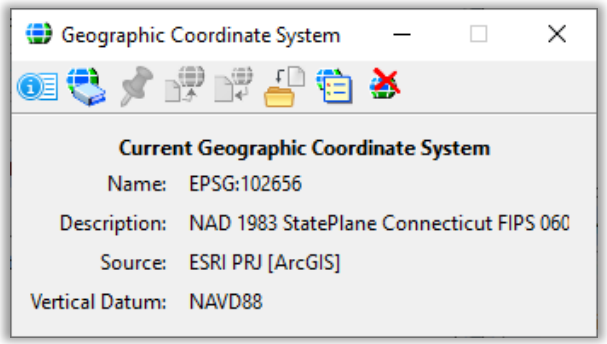

Figure 46 - Coordinate System Settings

3. Under **OpenRoads Modeling** or **Survey**, in the **Terrain** tab select the **From File** icon.

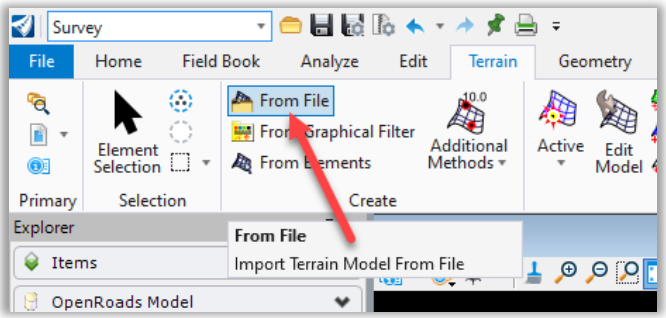

Figure 47 - Import a Terrain Model From File

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.

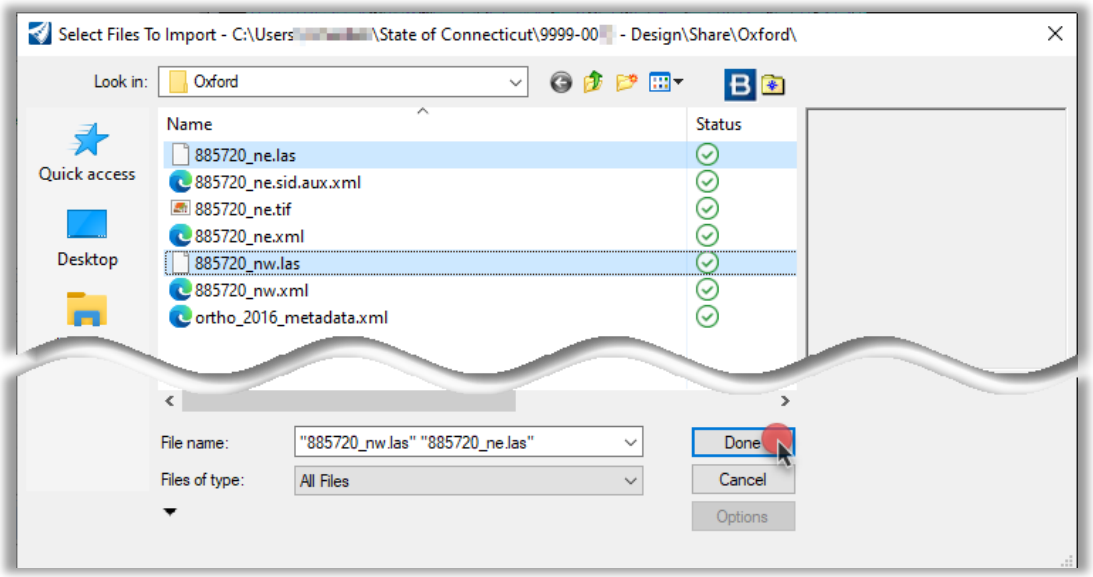

Figure 48 - Select Files to Import Dialog Box

5. 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 Ground**.

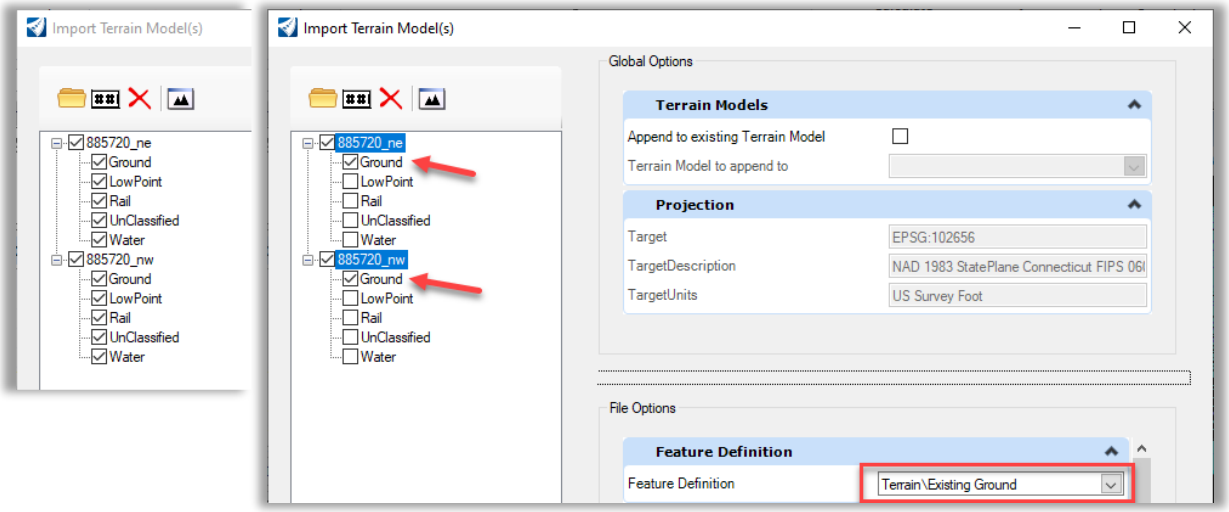

Figure 49 - Terrain Items Selection

6. 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.

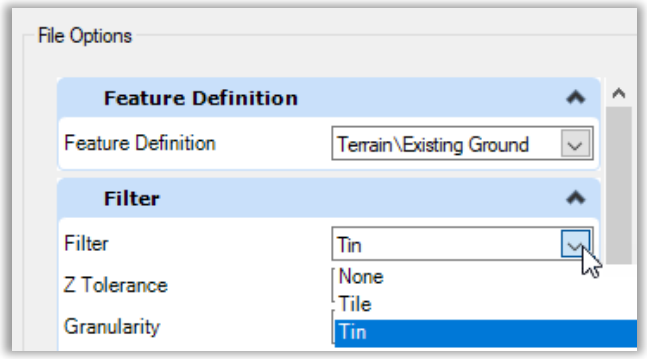

Figure 50 - Three options to Filter the Terrain

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

7. In the filter area select:

   Filter: ***Tin*** Z Tolarence: ***1*** Granularity: ***Coarse***

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

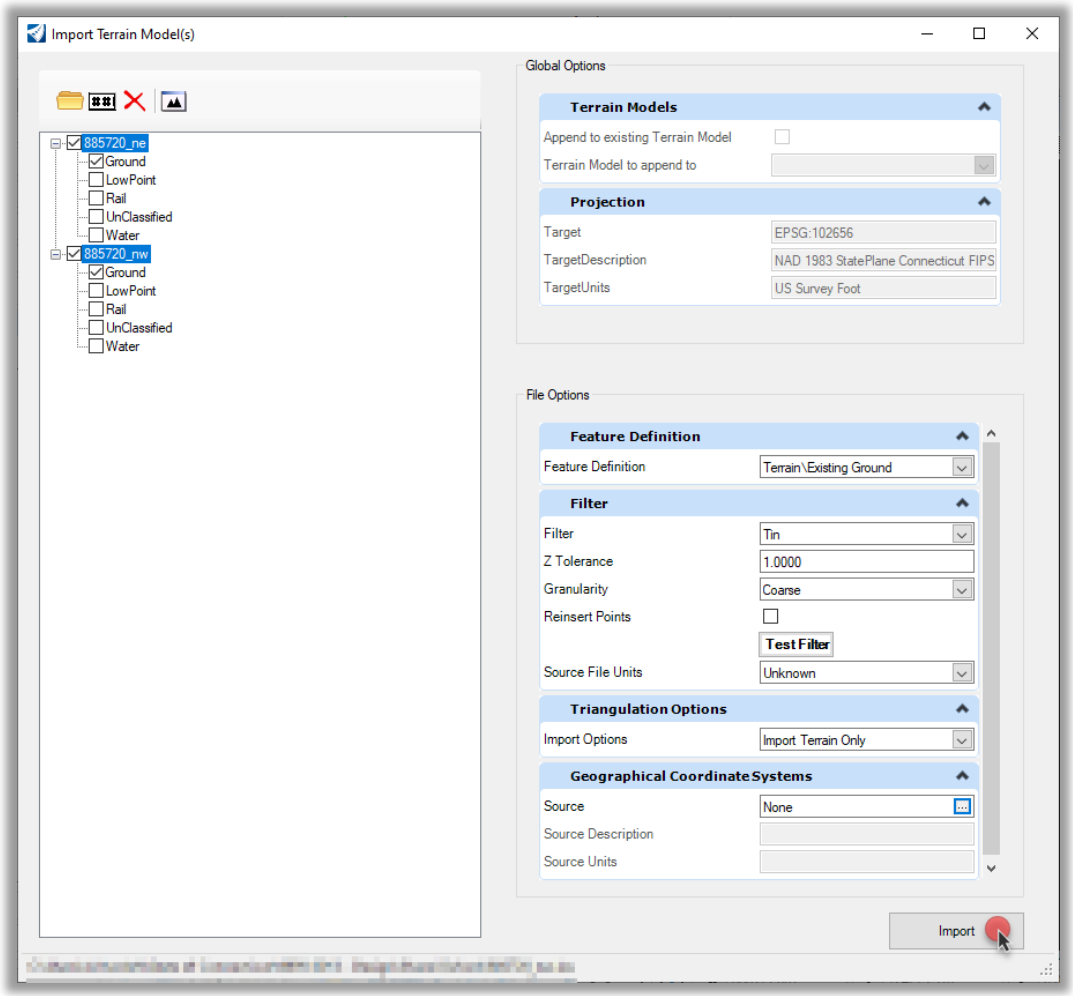

Figure 51 - Import Filter Settings

5.1.2 Graphical Display of Terrains

1. Fit the View. Select **the Element Selection** tool. In the view **left-click** hold, drag a selection from the **top left** to the **bottom right** to encompass both Terrains. Release **Left-click**.]

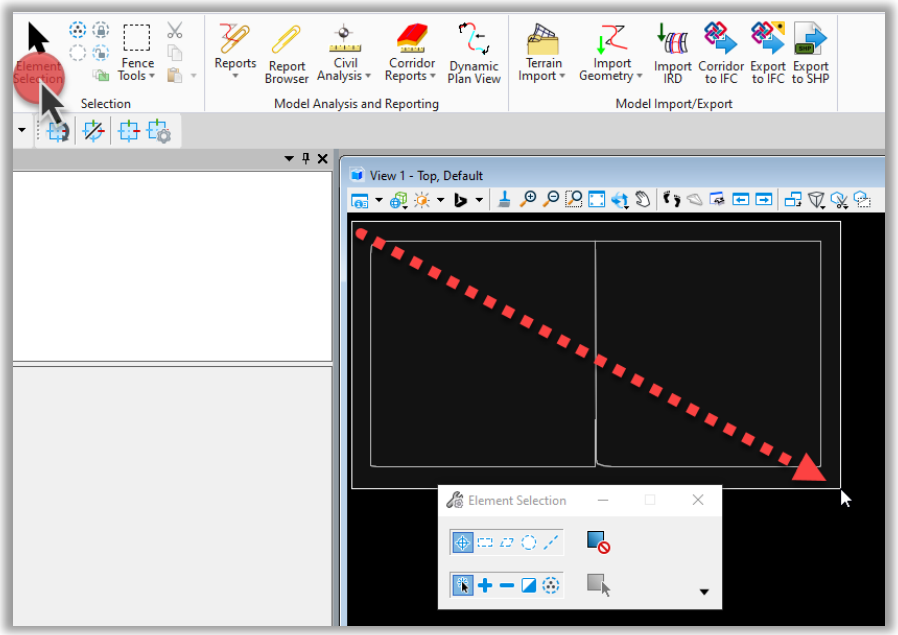

Figure 52 - Terrain Selection

2. In **Properties** turn on the ***Major Contours*** and ***Minor Contours***.

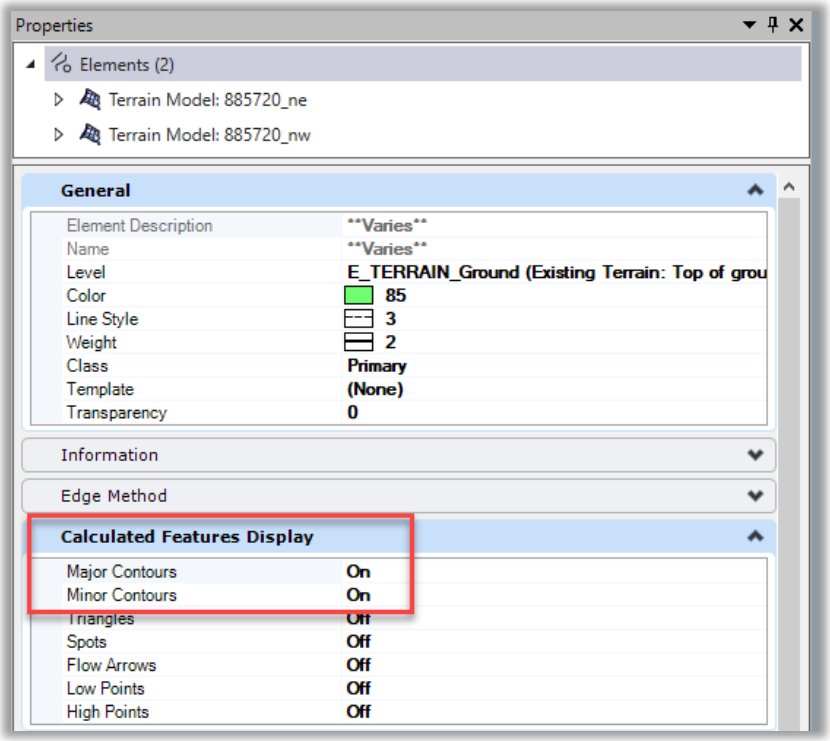

Figure 53 - Terrain Properties

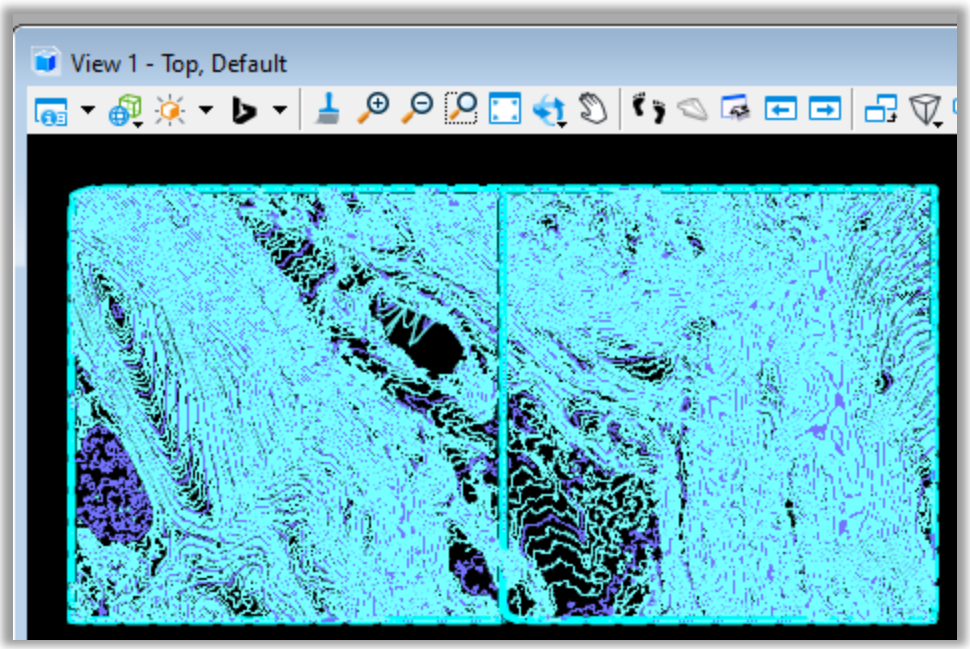

Figure 54 - Contours on in View

5.1.3 Reference the LAS Terrain Model

1. Open the File from Exercise 3.

   HW_CB_1234_1234_Oxford.dgn or ***SB_CB_1234_1234_Oxford.dgn***

   Reference ***HW_CB_1234_1234 _Oxford_ TerrainFromLAS.dgn*** in using **Geograpghic - reprojected**. Notice the reference lines up with the NAD 27 Survey File.

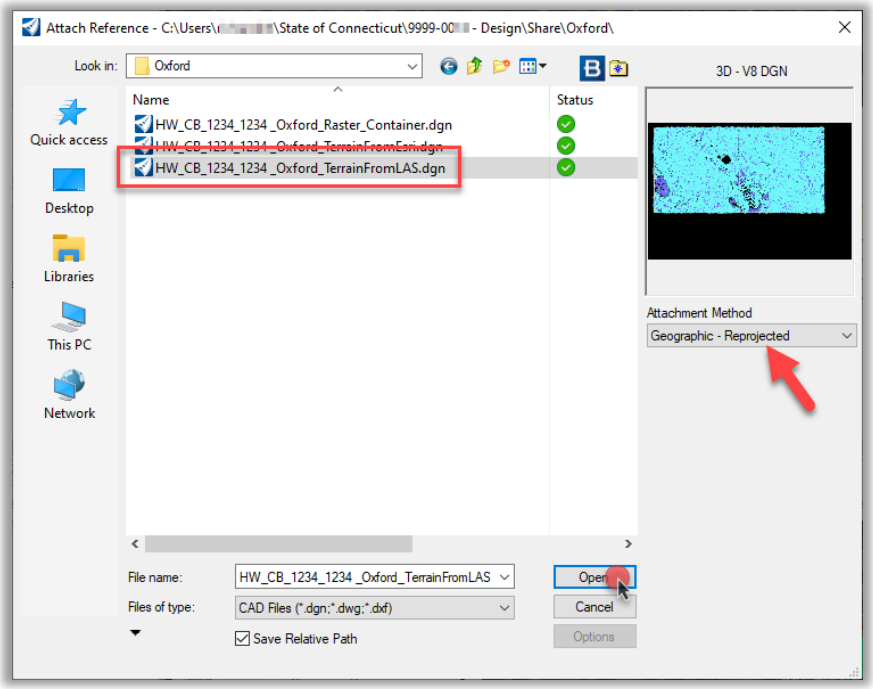

Figure 55 - Attach Reference

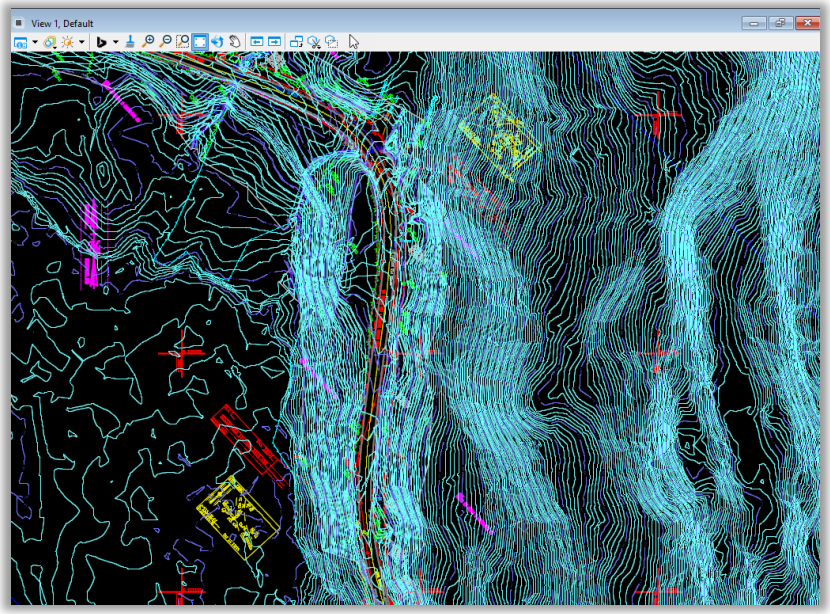

Figure 56 - References in View

2. On the Reference dialog box select ***Properties > Update Sequence***. Use the arrow buttons to move the ***Active Design File*** to the bottom of the list, this will make this file show up on the top in the view. Click **OK**.

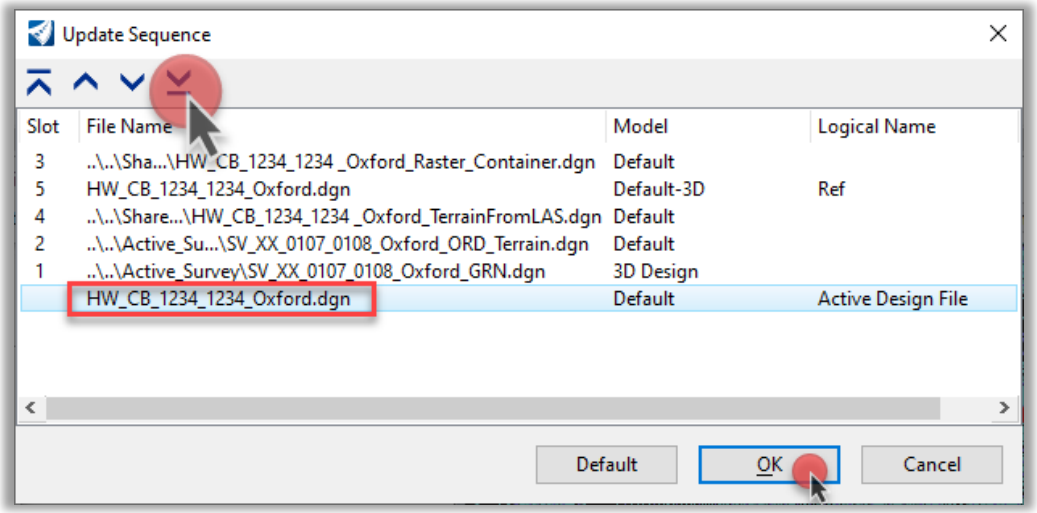

Figure 57 - Update Sequence

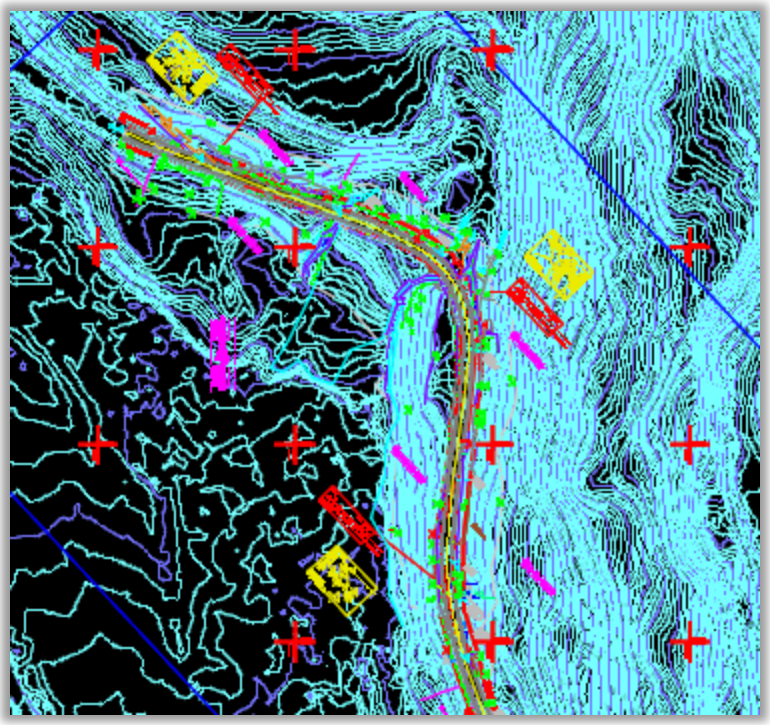

Figure 58 - Updated Sequence in View

3. In Attributes on the Ribbon select the Clipping Boundary Level. In filter enter ***tool,*** select the level ***TOOL_Clipping_Boundary***. Change the Color to ***Yellow*** and Weight to ***10***.

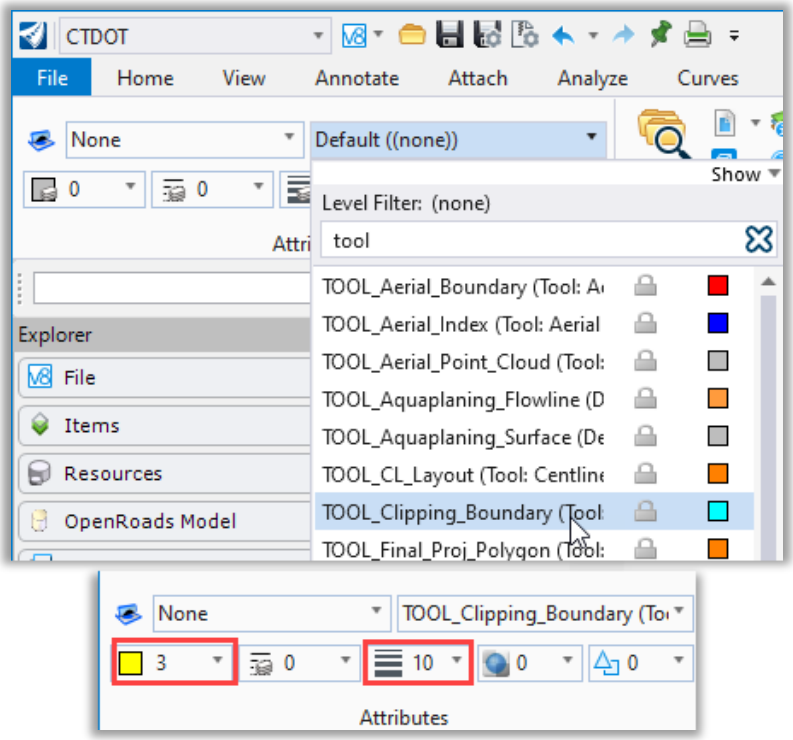

Figure 59 - Set Color and Weight

4. Using the regular MicroStation tool **Place Shape**, place a shape that will be used to clip out the un-needed portions of the terrains.

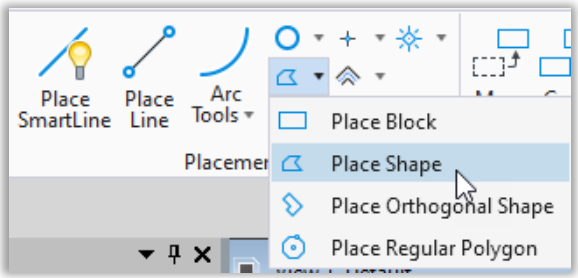

Figure 60 - Place Shape Tool

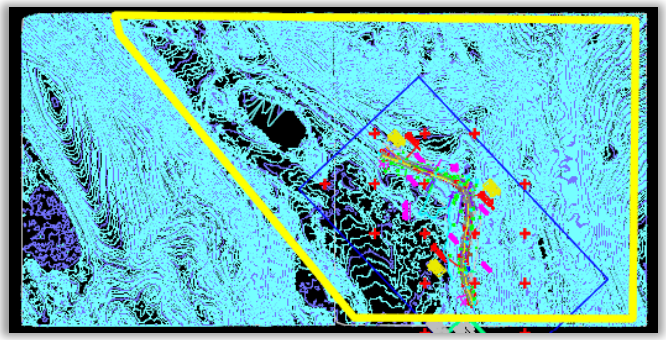

Figure 61 - Place Shape in View

5. In the references dialog box select ***Tools > Clip Boundary***. Change the Method to ***Element*** and in the view select the **Yellow Shape**. The Reference will now be clipped to the Shape.

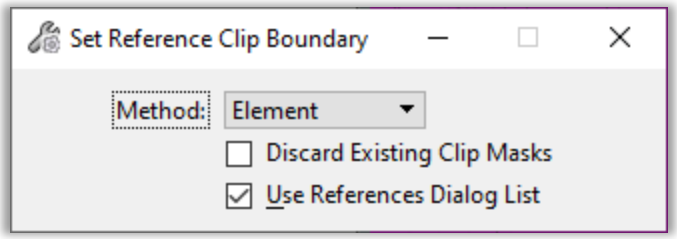

Figure 62 - Set Reference Clip Boundary

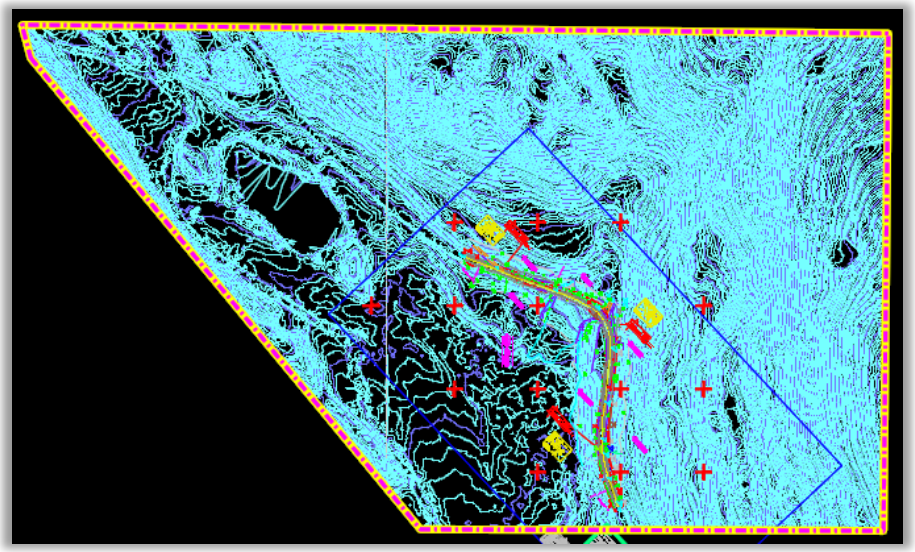

Figure 63 - Reference Clip in View

6. Use the **Element Selection** tool to edit the Boundary: ***drag point handles***, and **add vertices** as needed. Notice the Reference clip auto updates.

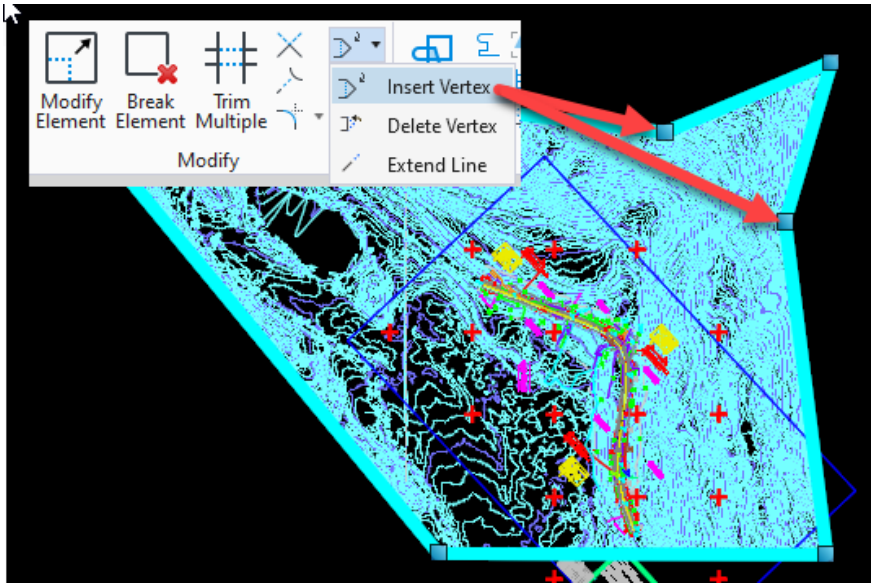

Figure 64 - Add Vertices in View

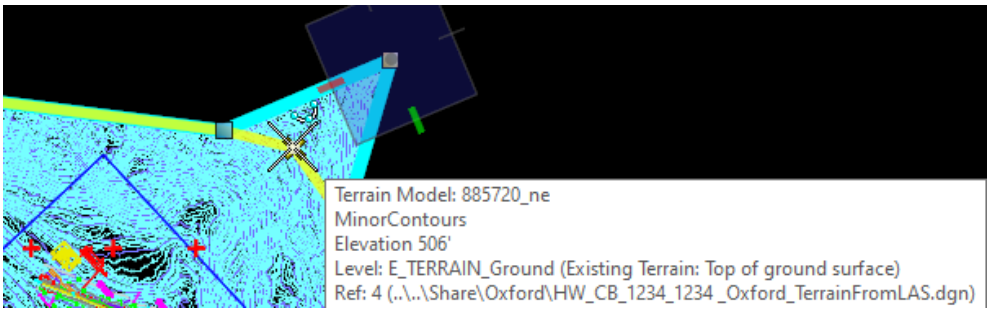

Figure 65 Drag Point Handles

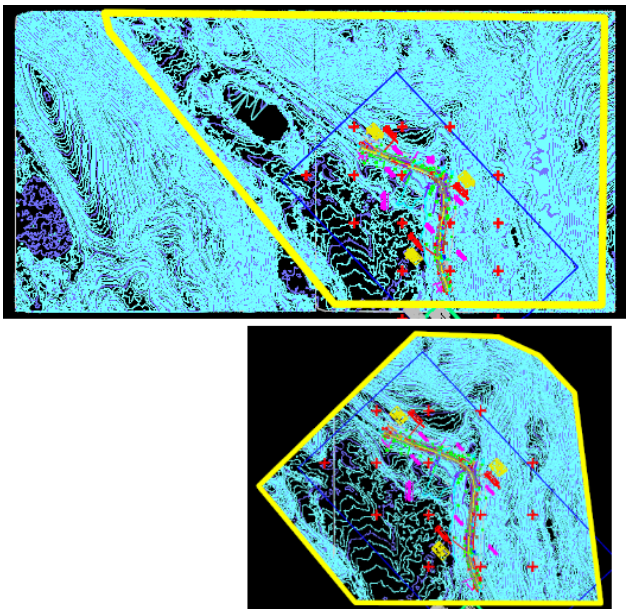

Figure 66 - Compare Clipping Before and After

5.2 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.***

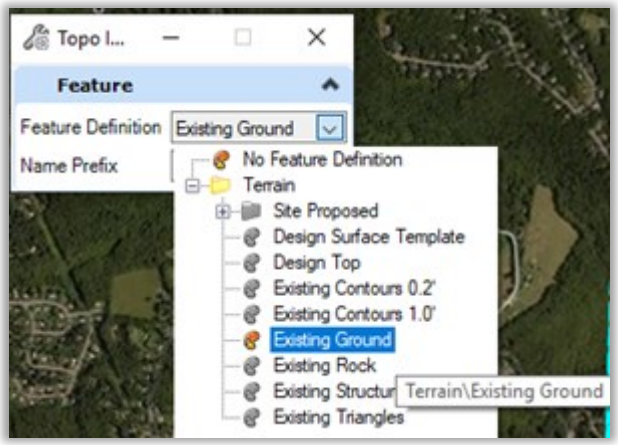

Figure 67 - Set the Existing Ground Feature Definition

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 – 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 .

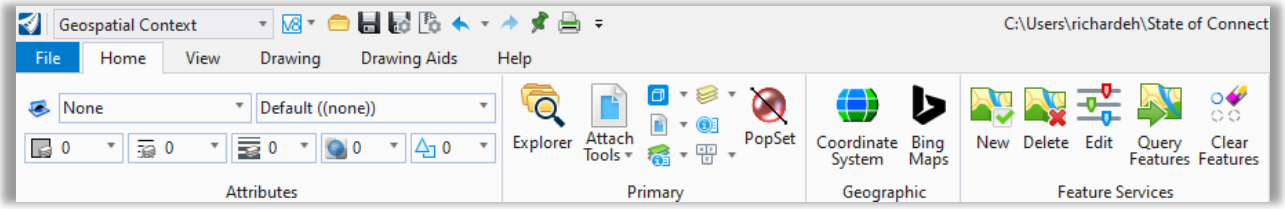

Figure 68 - Geospatial Workflow

6.1 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_CB_1234_1234_AADT.dgn***
2. In the **View** select **Background Map** and choose the Map Type **Road**.
3. Zoom to the Downtown Hartford area.

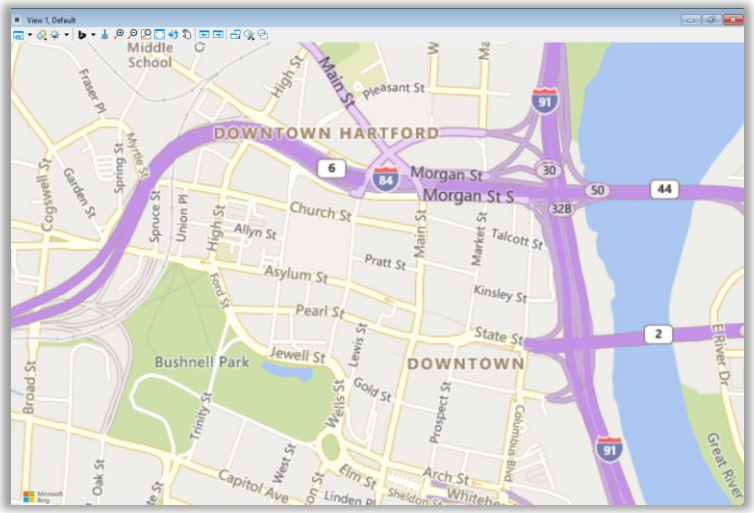

Figure 69 - View Window of Background Map

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**.

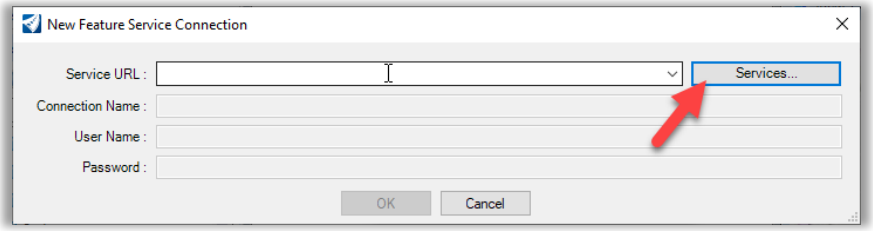

Figure 70 – New Feature Service Connection

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

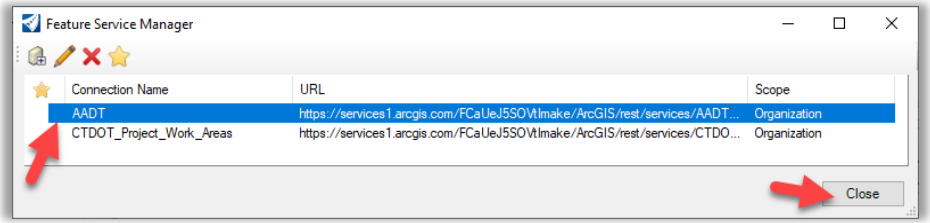

Figure 71 – Feature Service Manager

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

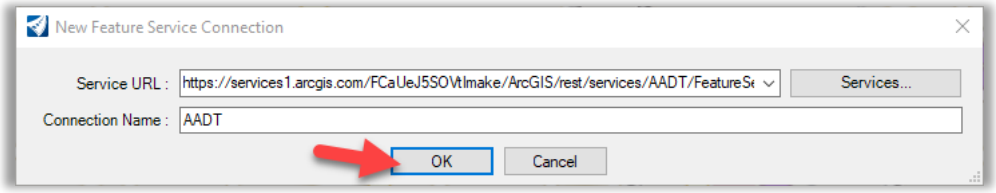

Figure 72 – New Feature Service Connection

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

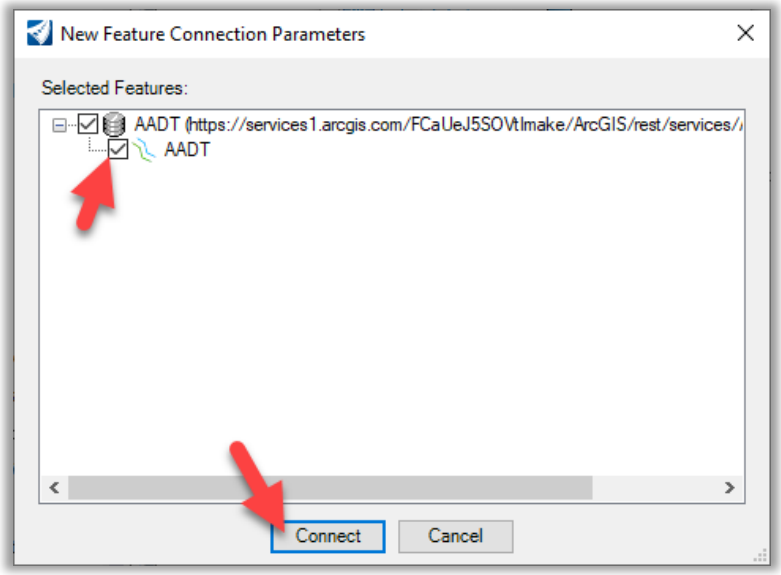

Figure 73 – New Feature Service Connection Parameters

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

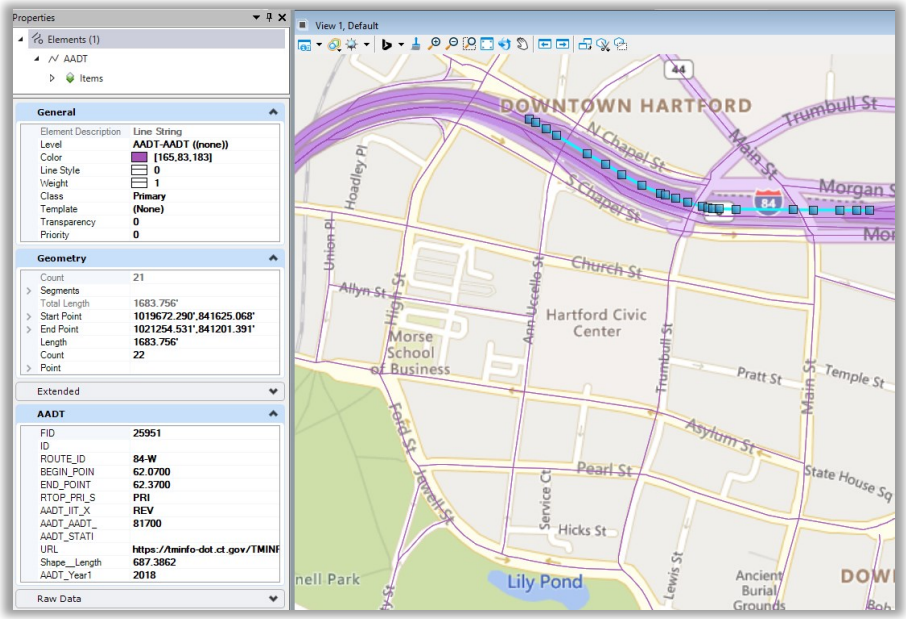

Figure 74 - AADT Properties

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.

6.2 Setting up a new Feature Service

1. Create a new file in the Share folder using NAD 83 / NAVD 88 and name it ***HW_CB_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**

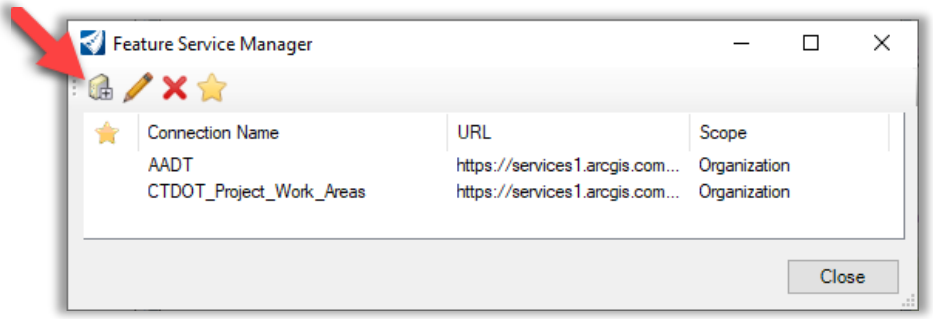

Figure 75 - Feature Service Manager

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
   and click in Connection Name, a name will auto fill, for Scope select WorkSet, click **OK**

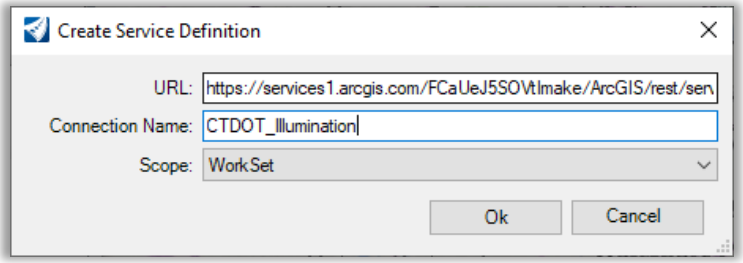

Figure 76 - Create Service Definition

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

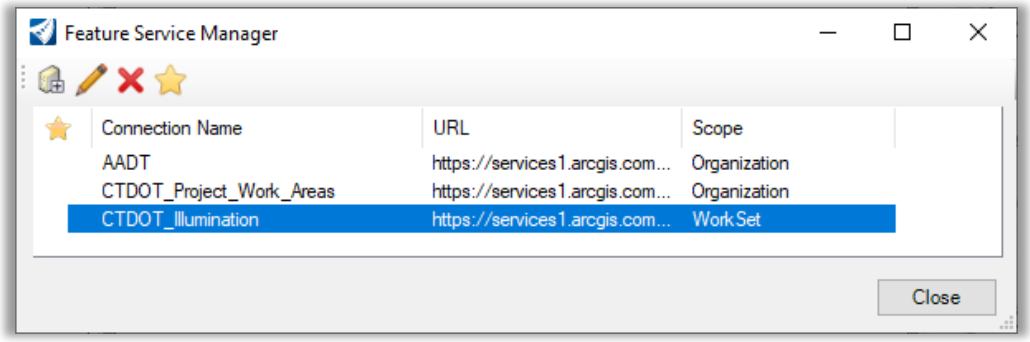

Figure 77 - Feature Service Manager

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

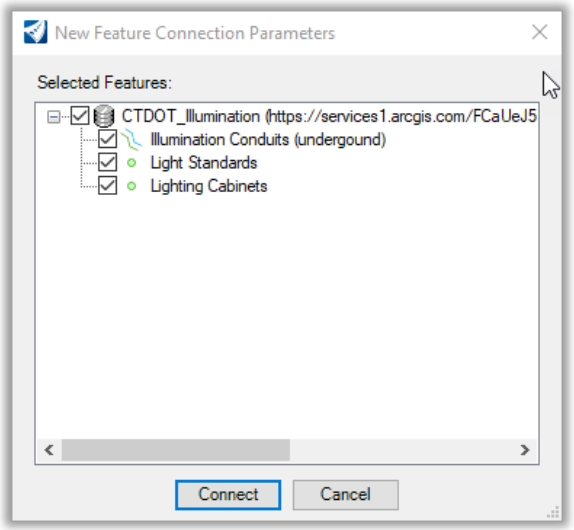

Figure 78 - New Feature Service Connection Parameters

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.

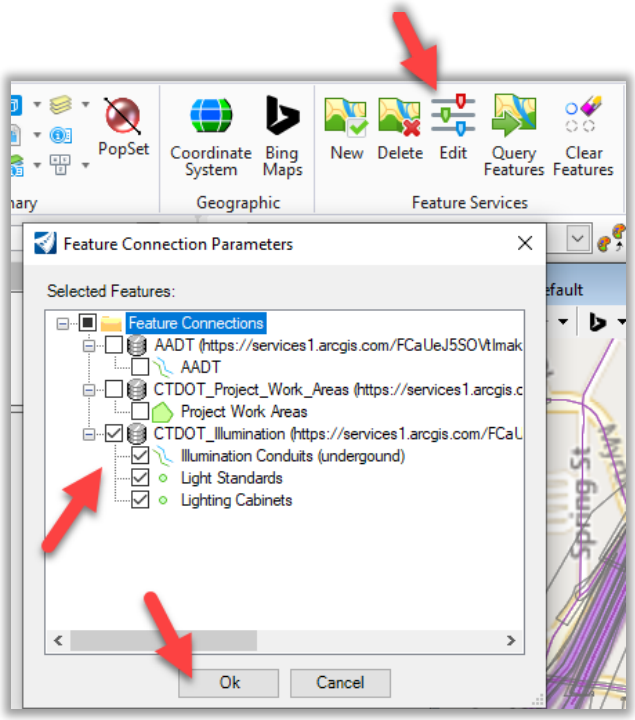

Figure 79 - Edit Feature Service Connection Parameters

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

Exercise 7 – 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_Ellington_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**

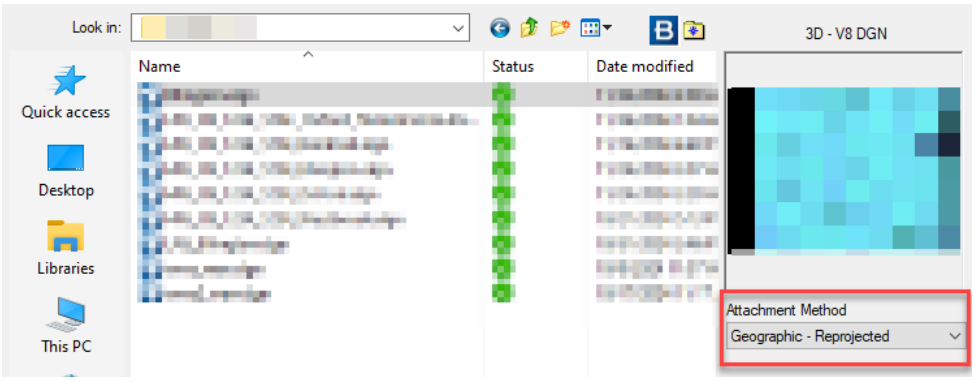

Figure 80 - Reference this file in using Geographic – reprojected

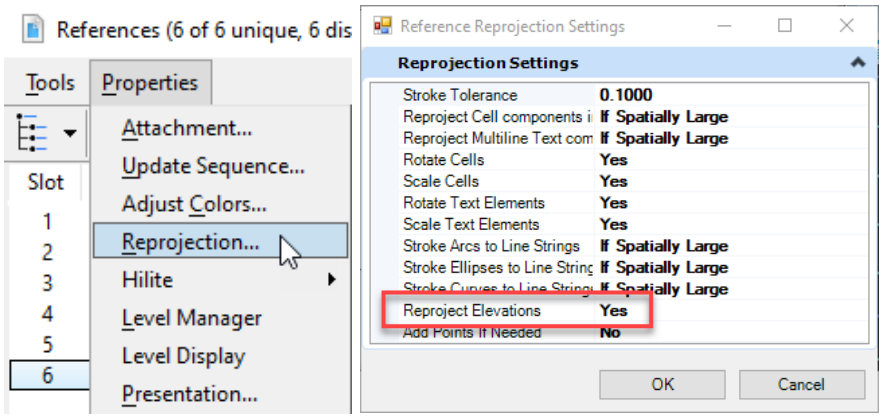

Figure 81 - Reproject Elevations

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**.

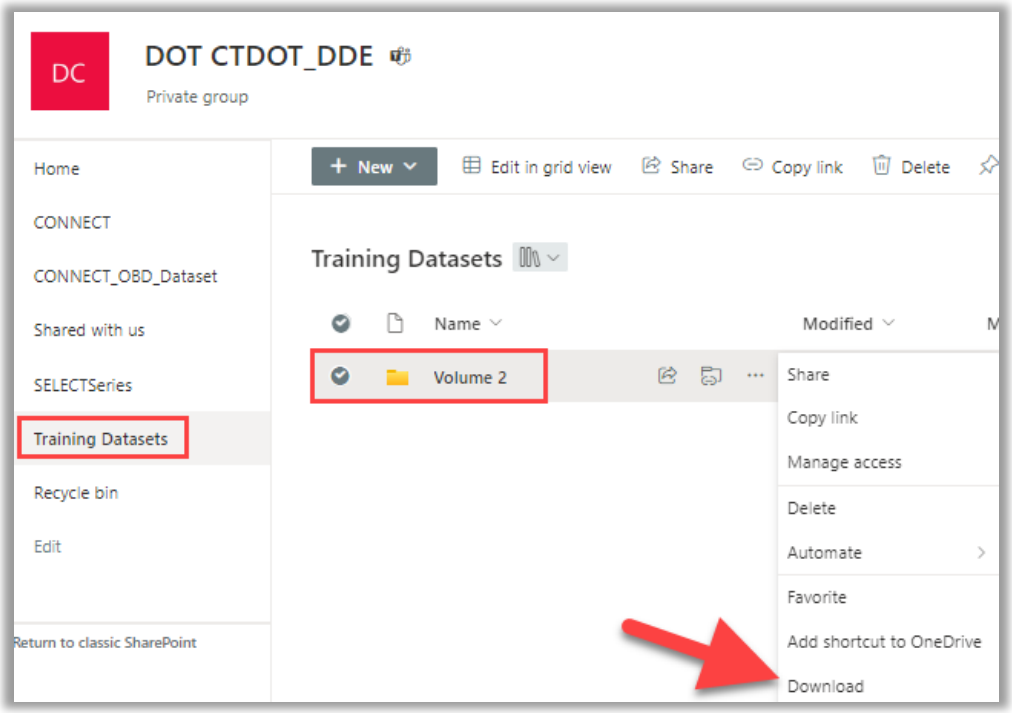

Figure 82 - DDE SharePoint Page - Download Training Dataset

3. **CTDOT employees -** In File Explorer under **This PC** browse to **Downloads** and copy the ***Active_Survey*** 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.

Revisions

10/31/2024

Volume	Section #	Description
2		Complete rewrite Volume 2 - INTRODUCTION TO OPENROADS DESIGNER

12/09/2024

Volume	Section #	Description
2		Exercise 3, added Geographic Coordinate System Changed dialog box options descriptions, Reproject the Data to the Geographic Coordinate System vs Correcting the Geographic Coordinate System – do not reproject the data.