

# OpenRoads Designer (ORD) Survey Processing Guidelines

## Contents

Introduction to OpenRoads Survey .....	2
Create a Survey Project .....	2
Ribbon and Workflows .....	6
Setting the Geographic Coordinate System .....	6
Setting the Drawing Scale .....	9
Create Field Book and Import Survey Data .....	9
Importing Multiple Survey Data Files - Drag and Drop Process .....	12
Displaying the Background Map.....	13
Reviewing and Editing Survey Data .....	14
Creating and Editing Terrain Model.....	22
Review and Editing Crossing Features .....	25
Annotate Notes .....	27
Finalizing OpenRoads Survey File .....	28
Converting OpenRoads Designer to InRoads and MicroStation .....	29

This document was developed as part of the continuing effort to provide guidance within the South Dakota Department of Transportation in fulfilling its mission to efficiently provide a safe and effective public transportation system through our core values of high ethical standards, stewardship, transparent public service, safety, teamwork, and innovation. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

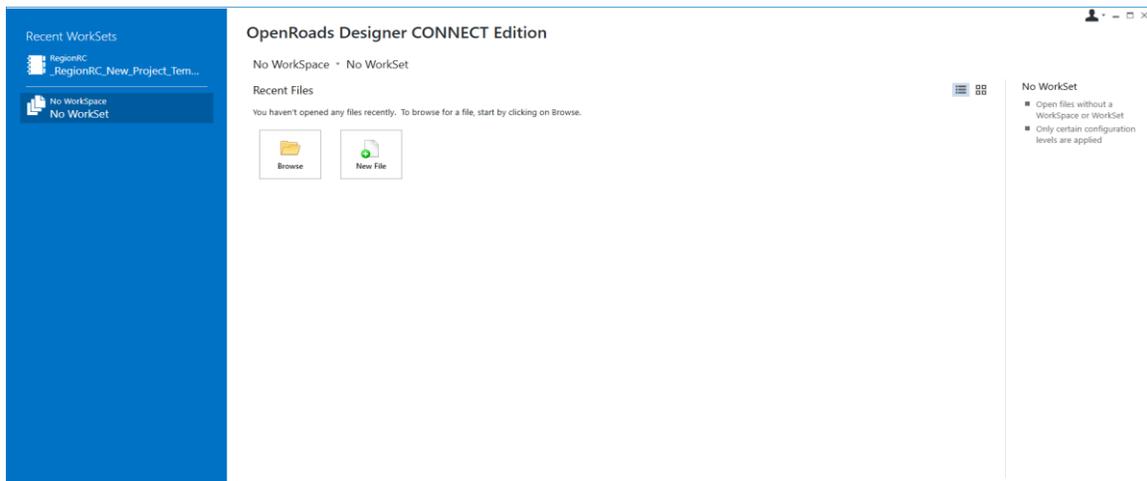
Your comments, suggestions, and ideas for improvements to this document are welcomed.

## Introduction to OpenRoads Survey

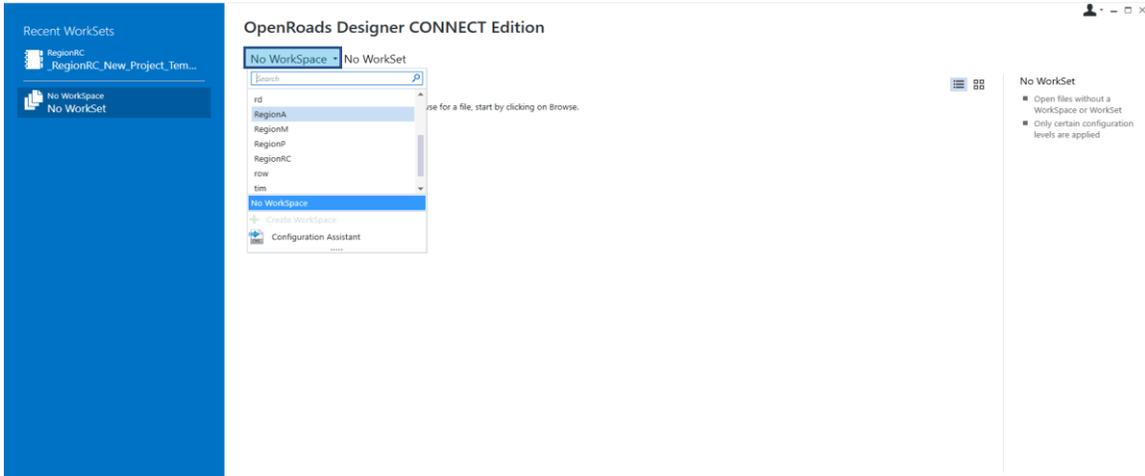
OpenRoads Survey provides surveyors with effective tools to import, review and edit survey data collected in the field in a CAD environment. These guidelines have been developed as part of the SDDOT statewide implementation of OpenRoads Designer (ORD). The intent of this document is to provide guidelines and standards for processing survey data in ORD. Updates to this document will be made periodically when minor revisions, additional information, and/or enhancements are needed.

### Create a Survey Project

- 1) Launch **OpenRoads Designer** from the desktop...

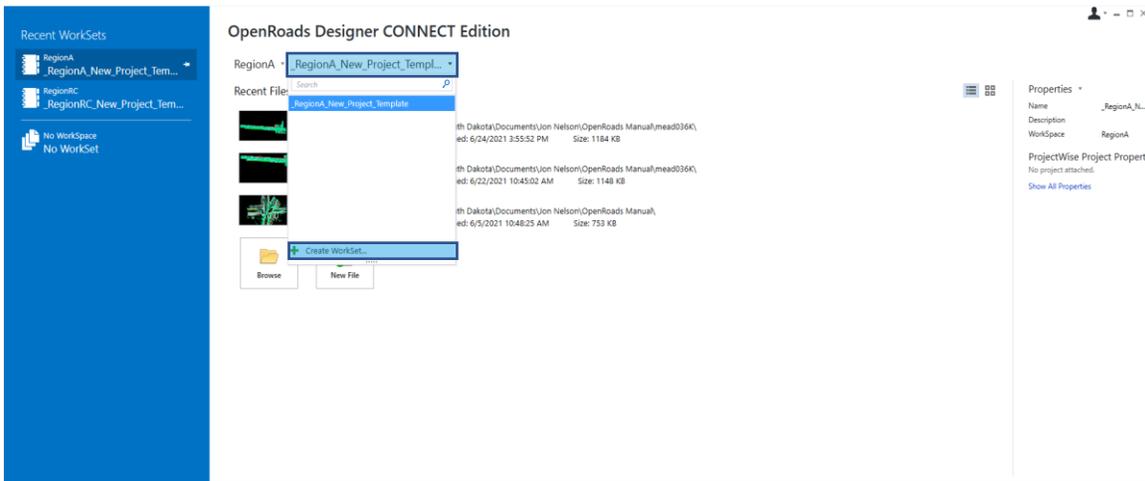


- 2) From the **WorkSpace** drop-down menu select the appropriate Region (**RegionA**, **RegionM**, **RegionP** or **RegionRC**).



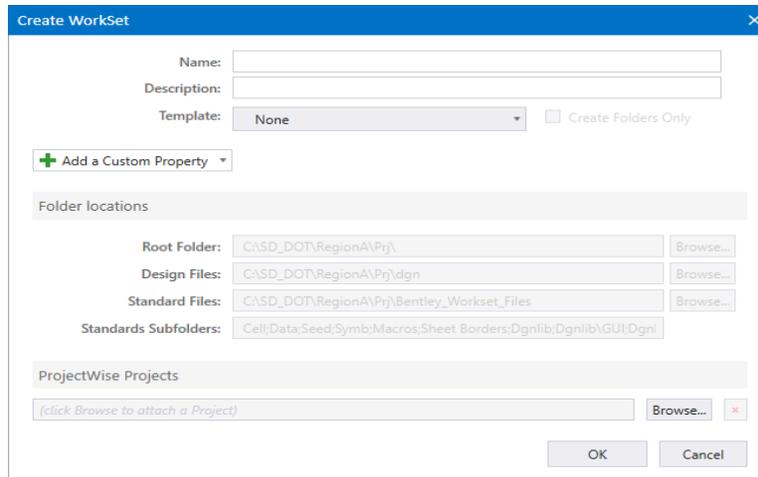
The WorkSpace is a set of files and configuration variables that define the SDDOT settings. Selecting the appropriate Region WorkSpace is important.

3) From the **WorkSet** drop-down menu select **Create Workset...**



The WorkSet sets specific standards, creates subfolders and points to the appropriate project folder within the appropriate Region folder on the U: drive (U:\regionX\prj\cntyPCN#). When a design file (dgn) is created or opened it is associated to the WorkSet that is chosen. Selecting or creating the appropriate WorkSet is important.

The **Create WorkSet** dialog box will appear...



- 4) In the **Name:** field type in the appropriate project folder name (**cntyPCN#**). This will create the project folder on the U: drive (U:\regionX\prj\cntyPCN#) along with the desired subfolders where the new survey file will reside.
- 5) From the **Template:** drop-down menu select the appropriate region template (**\_regionX\_New\_Project\_Template**)

Note: If the project folder already exists on the U: drive prior to creating a new **WorkSet** select **None** from the **Template:** drop-down menu.

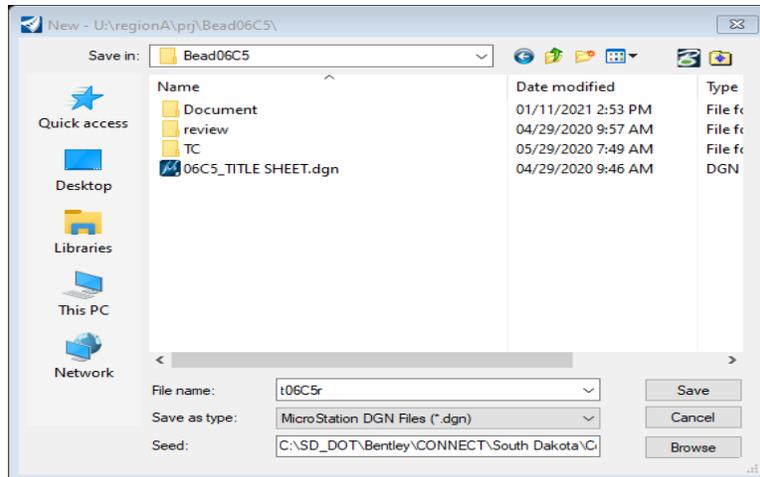
- 6) Select the **OK** button located at the bottom of the dialog box.

A new project folder along with subfolders will be created within the appropriate region folder on the U: drive (U:\regionX\prj\cntyPCN#).

Note: If the project folder already exists on the U: drive prior to creating a new **WorkSet** and **None** was selected in step 5 above the subfolders will be created within the existing project folder.

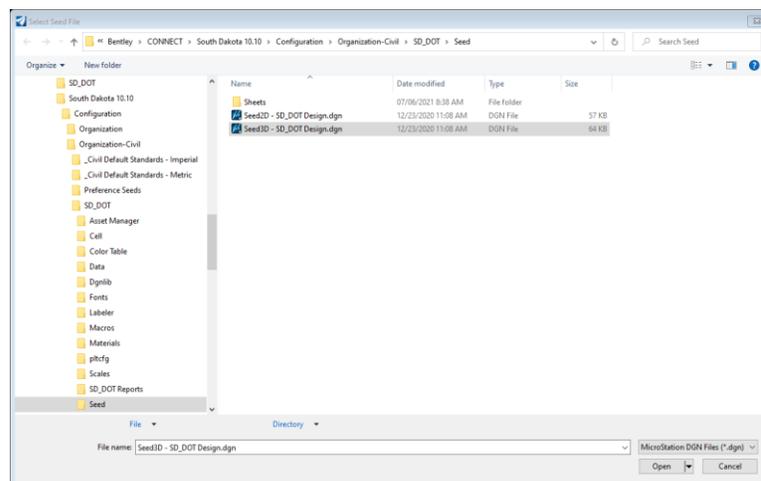
- 7) Create a 3D Survey dgn file by selecting the **New File** button .

The **New** dialog box will appear...



- 8) Navigate to the **dgn** folder within the appropriate project folder within the appropriate region folder on the U: drive (U:\regionX\prj\cntyPCN#\dgn) where the new survey file will reside.
  - a) In the **File name:** field at the bottom of the dialog box type in the appropriate survey file name (**PCN#\_T**)
  - b) Ensure the **Save as type:** is set to **Micro Station DGN files (\*.dgn)**
  - c) Ensure the **Seed:** field is set to utilize the 3D seed file by selecting the **Browse** button located in the bottom right of the dialog box

The **Select Seed File** dialog box will appear...



- d) highlight the **Seed3D – SD\_DOT Design.dgn** file.
- e) Select the **Open** button located in the bottom right of the dialog box

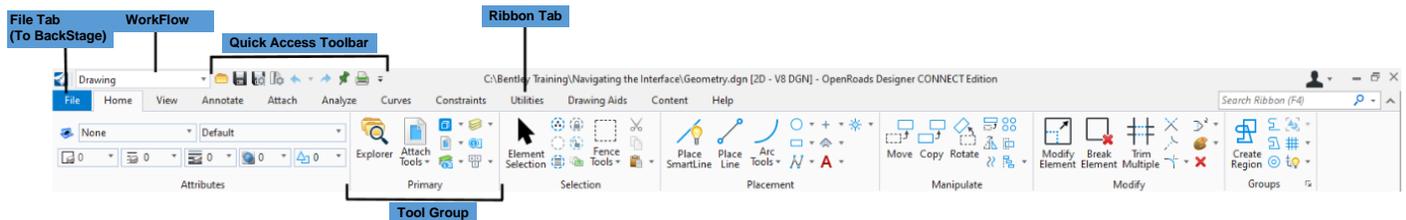
## --Important--

The naming convention for the survey file should follow the SDDOT standard for naming a survey CAD file outlined in **Topography Data Furnished (.dgn file)** [Chapter 6](#) of the SDDOT Survey Manual.

- 9) Select the **Save** button located in the bottom right of the dialog box. The new survey dgn file will be created and opened.

## Ribbon and Workflows

The main section of the interface is the **Ribbon** located along the top of the software and is the primary access to the **Ribbon Tabs** and **Tool Groups**.

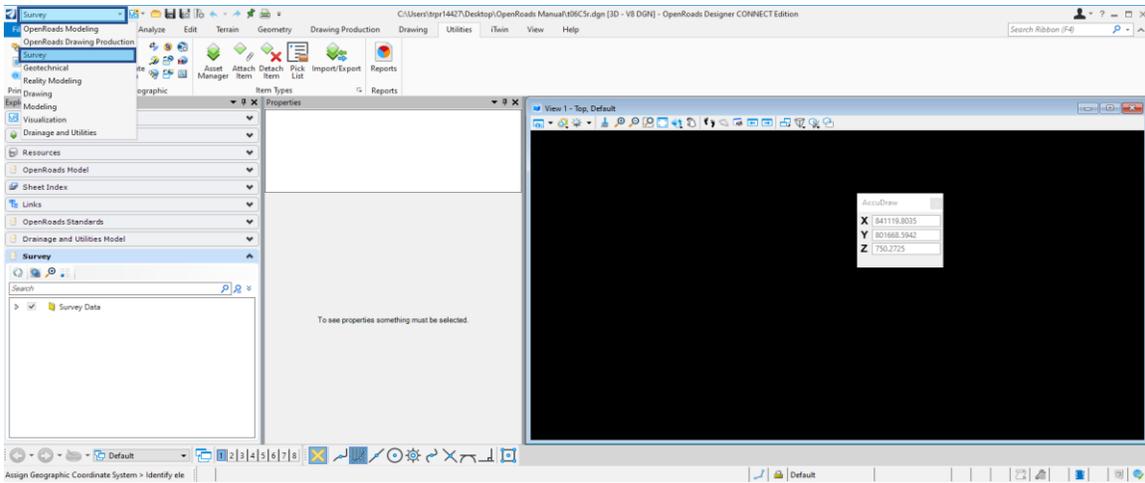


Review each area of the **Ribbon** by selecting each **Tab**. The **Ribbon** functions in a similar manner to the **Ribbon** found in Trimble Business Center and many Microsoft Office products. The **Ribbon Tabs** and **Tool Groups** are dependent on the workflow selected. For example, selecting the **OpenRoads Modeling** workflow will present a new set of **Ribbon Tabs** and **Tool Groups**.

The **Survey** Ribbon Tabs and Tool Groups can be accessed by selecting **Survey** from the **Workflow** drop-down located in the upper left corner of the software. The **Ribbon** will now show the **Ribbon Tabs** and **Tool Groups** associated with the **Survey** workflow.

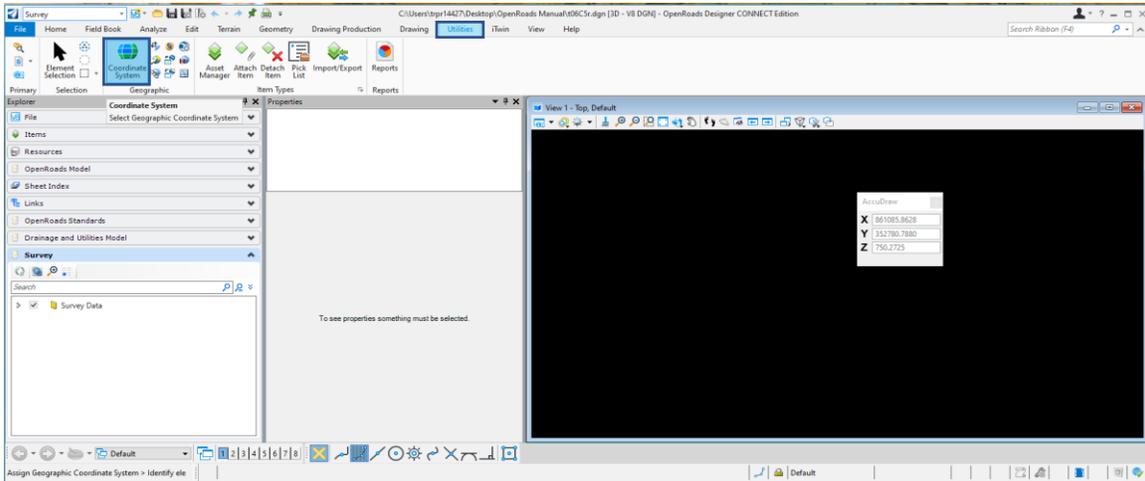
## Setting the Geographic Coordinate System

- 1) Select the **Survey** workflow from the **Workflow** drop-down located in the upper left corner of the software.

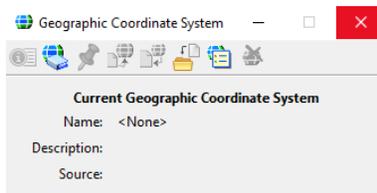


2) Select the **Utilities** tab located along the top row of tabs.

3) Select the **Coordinate System** tool  located within the Geographic tool group.

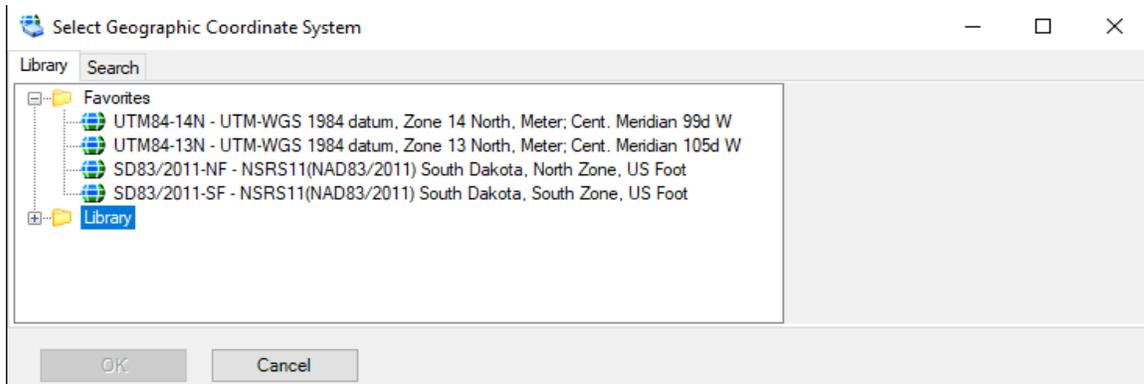


The **Geographic Coordinate System** dialog box will appear...

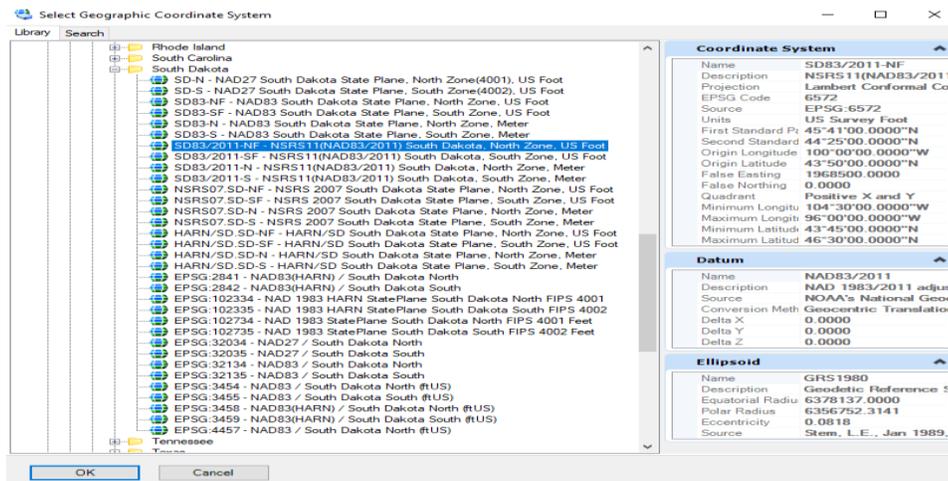


4) Select the **From Library** tool .

The **Select Geographical Coordinate System** dialog box will appear...



- 5) Select the **+** icon next to the **Library** folder and navigate to the following folder... **Projected (northing, easting, ...) > North America > United States of America > South Dakota**



- 6) Select the coordinate system used for the field survey and select the **OK** button located in the bottom left of the dialog box.

The Geographic Coordinate System is now attached.

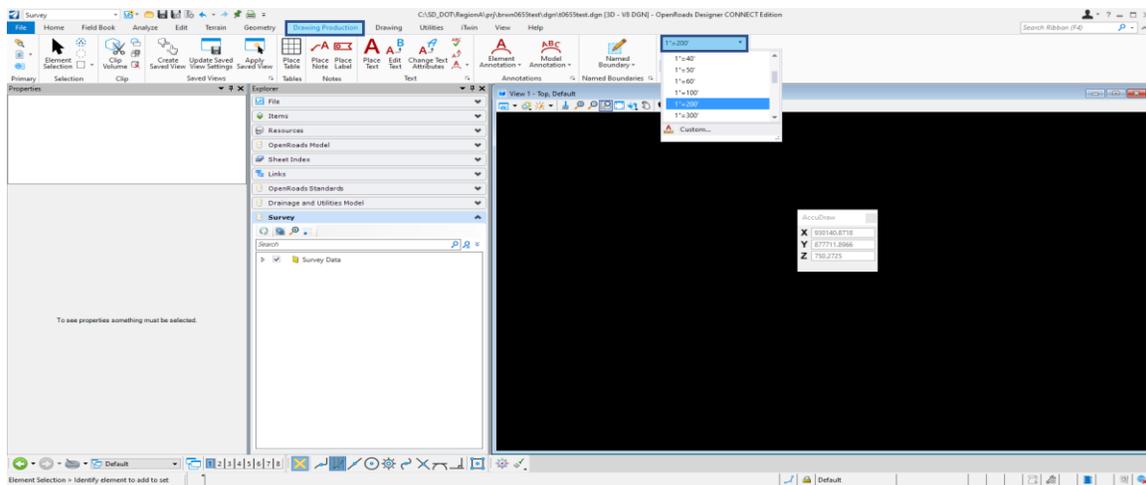
**--Important--**

Select the same coordinate system used to setup the job file in the data collector.

7) Close the dialog by selecting the “X” located in the top right of the dialog box.

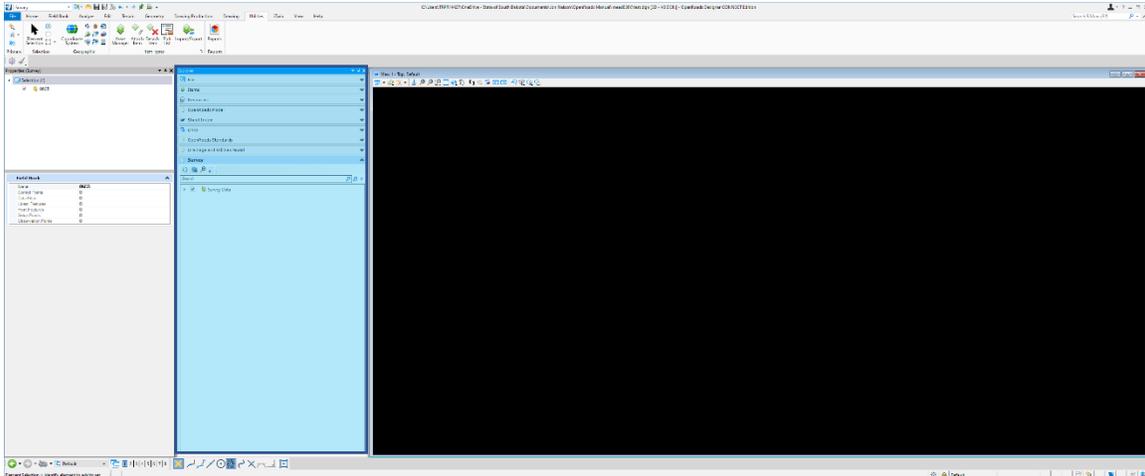
## Setting the Drawing Scale

- 1) Select the **Drawing Production** tab located along the top row of tabs.
- 2) Within the **Drawing Scales** tool group set the **Annotation Scale** drop-down to the appropriate scale for the survey file.
  - a) Rural – set Annotation Scale to **1” = 200’**
  - b) Suburban – set Annotation Scale to **1” = 100’**
  - c) Urban – set Annotation Scale to **1” = 40’**

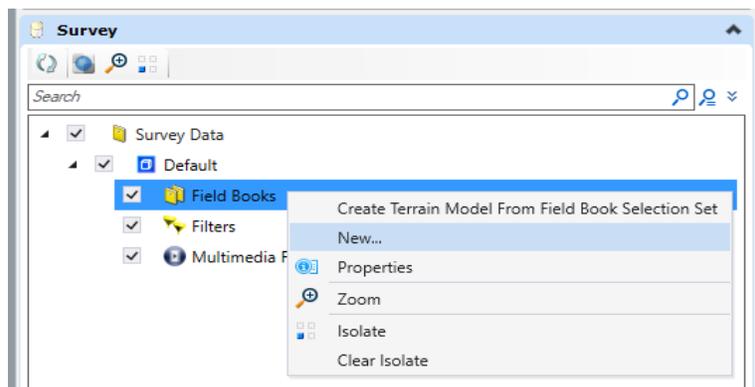


## Create Field Book and Import Survey Data

- 1) From the **Explorer Tab** expand the **Survey Pane** if not already expanded

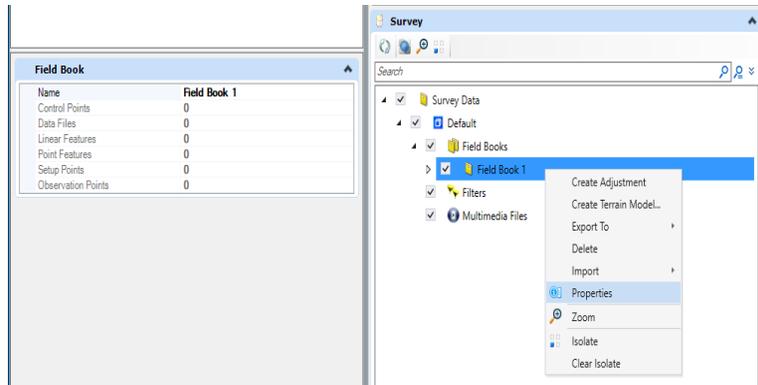


- 2) Select the **drop-down arrow** next to **Survey Data**
- 3) Select the **drop-down arrow** next to **Default** to expand the tree to display the default survey data folders.
- 4) Right click on **Field Books** and select **New...**



A drop-down arrow will appear next to the **Field Books** folder indicating a new field book has been created.

- 5) Expand the **Field Books** folder by selecting the **drop-down arrow** next to the folder to view the newly created field book named **Field Book 1**.
- 6) Right click on **Field Book 1** and select **Properties**



**Field Book 1** properties will appear in the **Properties Tab** next to the **Explorer Tab**

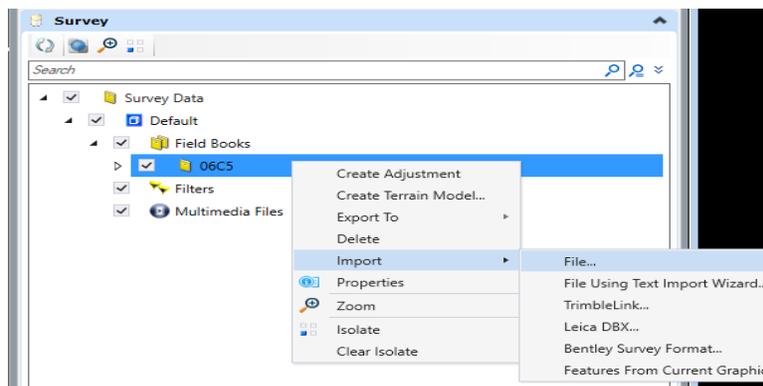
- 7) In the **Name** field type in the appropriate project field book name (**PCN#**) and select the **enter key** on the keyboard.



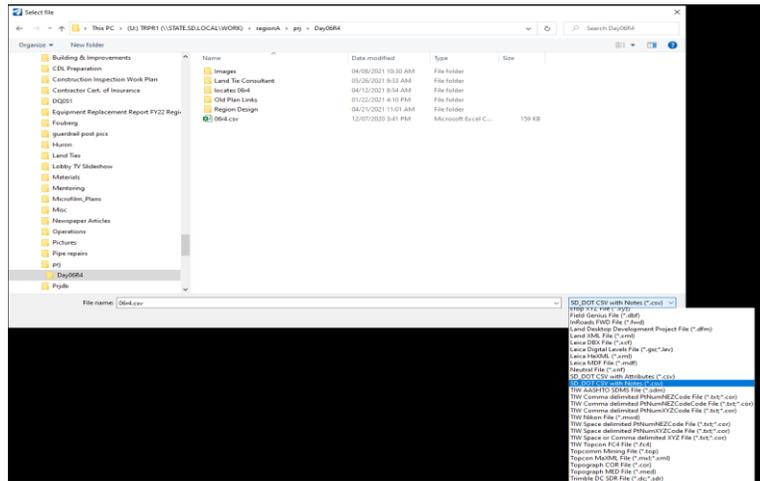
**--Important--**

The naming convention for the field book should follow the SDDOT standard for naming field books outlined in **Field book Data Furnished Chapter 6** of the SDDOT Survey Manual.

- 8) Right click on the newly created project field book in the **Survey Pane** and select **Import > File...** from the drop-down menu



The **Select file** dialog box will appear...



- 9) From the **File type** drop-down menu select **SD\_DOT CSV with Notes(\*.csv)**
- 10) Navigate to the location of the **.csv file** containing the field survey.
- 11) Double click on the **.csv file** to import the field survey data into the projects field book.

Repeat steps 8 through 11 until all **.csv files** have been imported

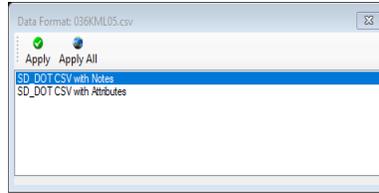
- 12) Select the **Fit view** tool  within the **View Control** toolbar located at the top of the CAD drawing space to graphically display the field survey data.

## Importing Multiple Survey Data Files - Drag and Drop Process

To import multiple .csv files into the project field book use the drag and drop process. After the project field book has been created in steps 1-7 above

- 1) Open windows explorer and navigate to the location of the **.csv files** containing the field survey.
- 2) Select all the **.csv files** to be imported and drag-and-drop them onto the newly created project field book folder inside the Survey panel.

The **Data Format** dialog box will appear...



- 3) Select **SD\_DOT CSV with Notes** and select the Apply button

The **import window** will reappear for each **.csv file** that was dragged-and-dropped into the field book folder. Simply select the **Apply** button for each file or select the **Apply All** button to import all the **.csv files** at once.

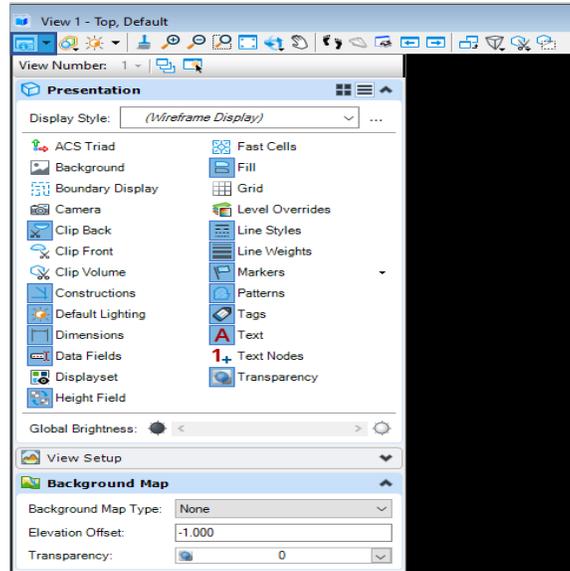
- 4) Select the **Fit view** tool  within the **View Control** toolbar located at the top of the CAD drawing space to graphically display the field survey data.

## Displaying the Background Map

One feature of OpenRoads Designer that is useful when processing survey data is the background map feature. This feature is a good check to insure the correct Geographical Coordinate System was set.

- 1) Select the **drop-down arrow** next to the **View Attributes** tool  within the **View Control** toolbar located at the top of the CAD drawing space

The **View Attributes** pane will appear...



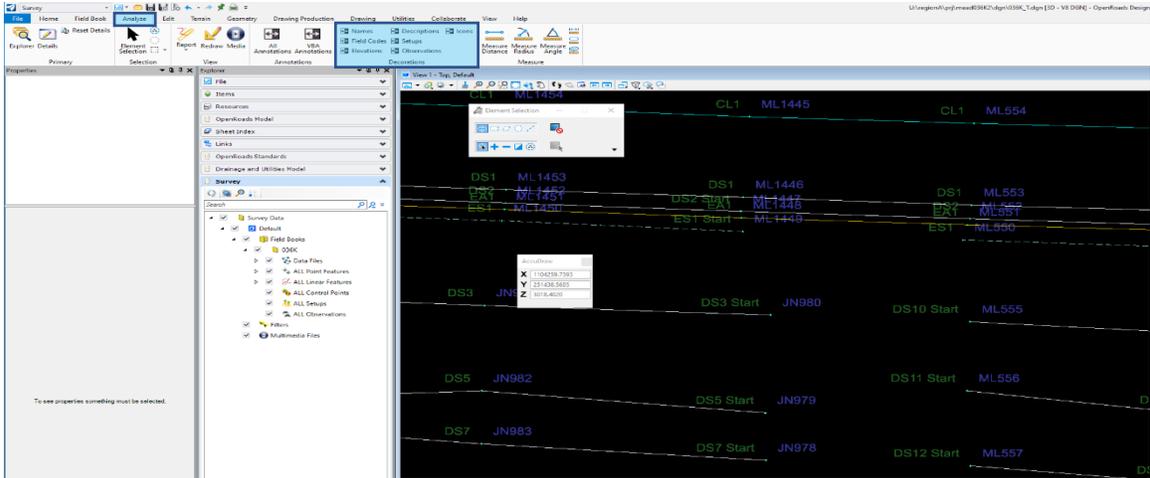
## 2) Set the **Background Map Type:** to **Aerial**

The aerial image will display in the CAD drawing space. Setting the **Background Map Type:** back to **None** will turn off the background map.

## Reviewing and Editing Survey Data

**Point numbers, Field Codes, Elevations** and **Descriptions** known as decorations in ORD can be turned on and off by using the **Decorations** tool group located under the **Analyze** tab.

- 1) Select the **Analyze** tab located along the top row of tabs.
- 2) Within the **Decorations** tool group select the **Names** decoration and the **Field Code** decoration to display the point names and field codes in the CAD drawing space.



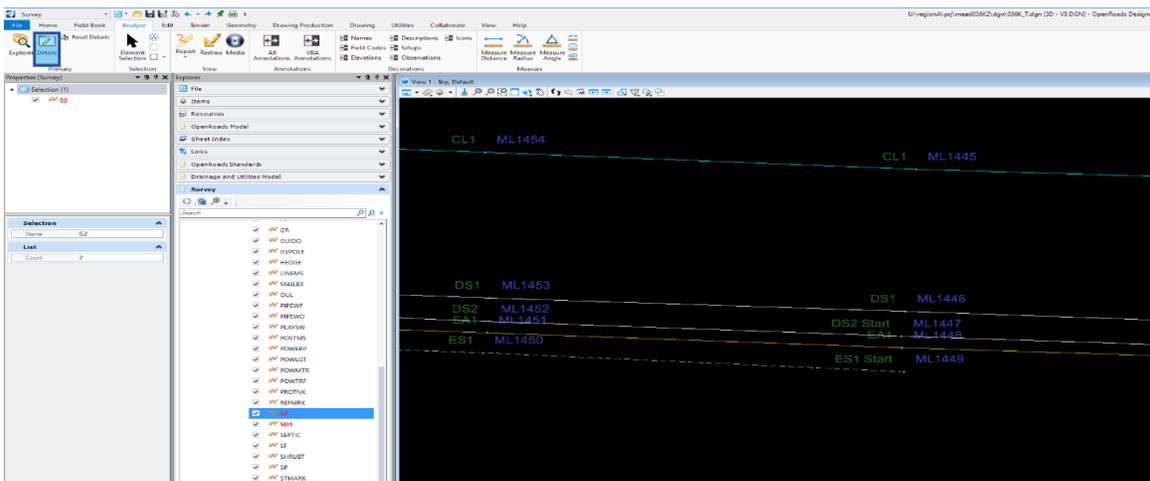
Coding errors can be searched for and edited

- 1) From the **Explorer** Tab expand the **Survey** Pane if not already expanded
- 2) Expand the following folder within the **Survey** Pane by selecting the **drop-down arrow** next to each of the following folders

**Survey Data>Default>Field Books>(PCN#)>ALL Point Features**

- 3) All incorrect field codes within the field book will display in red

- 4) Select the red code errors and then select the **Details** tool  located within the **Primary** tool group



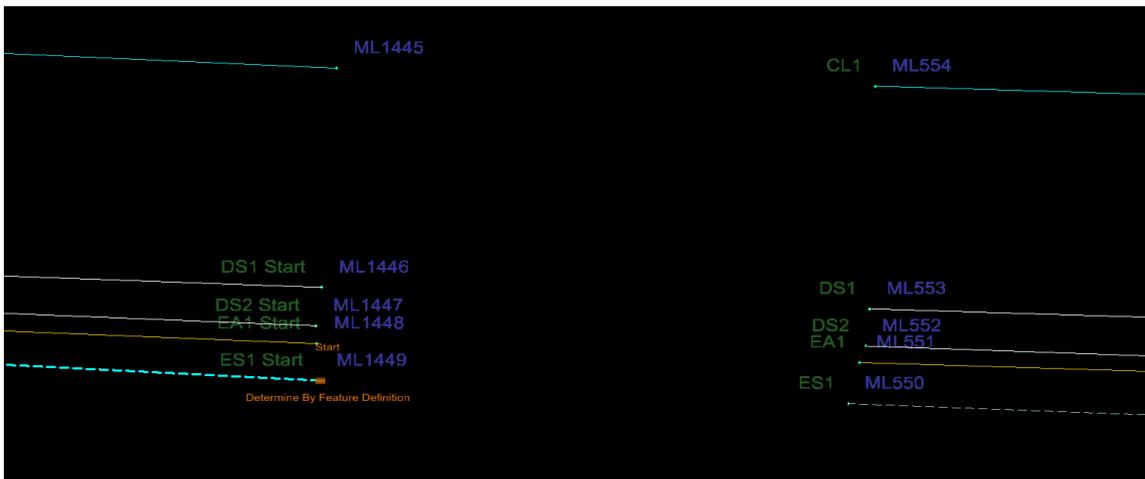
- 5) The **Survey Details** dialog box will appear showing the field code errors

Name	Display	Field Code	Link Code	Zone	Description	Terrain Model At...	Attributes Pair	Control Codes	Easting	Northing	Elevation	Data File Name
JN750	True	S2	None	1		Determine By Fe...			1103884.5860ft	251474.7870ft	2864.2280ft	036KJN01.csv
JN762	True	S2	None	1		Determine By Fe...			1103824.6380ft	251477.5210ft	2864.9440ft	036KJN01.csv

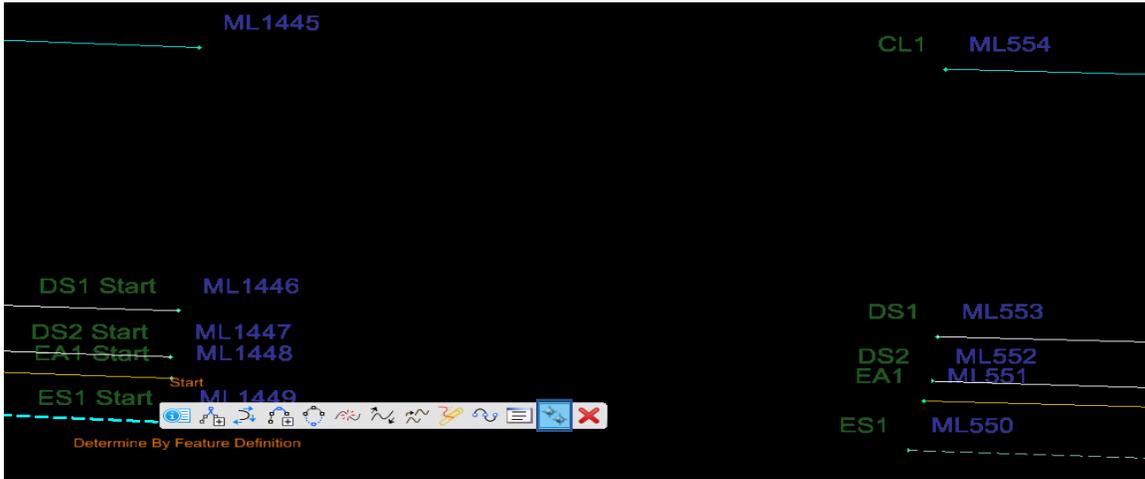
- 6) Click in the first column with the arrowhead to zoom to the point in the CAD drawing space
- 7) Click in the **Field Code** column and fix the field code errors selecting the tab key on the keyboard after each correction
- 8) Close out of the Survey Details dialog box by selecting the X in the upper right of the dialog box
- 9) Repeat steps 4 through 8 for each incorrect field code shown in the **All Point Features** list within the Survey pane

**Join Point** (or **JPT**) is a control code that connects a feature line from the point the control code is associated with to a point number specified following the **Join Point** control code.

- 1) Select one of the feature lines within the CAD drawing space to highlight the feature line.



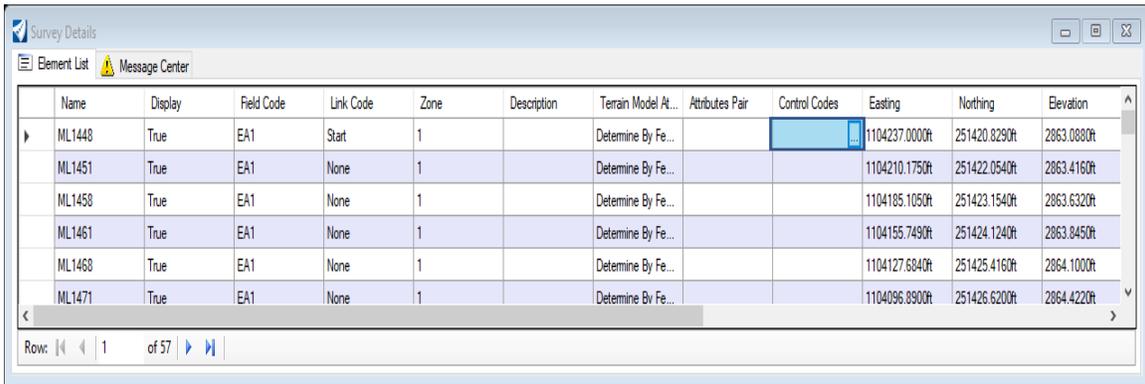
2) Hover over the selected feature line to display the **Civil Context Menu**



3) Select the **Edit Point Features** tool



The **Survey Details** dialog box will appear....

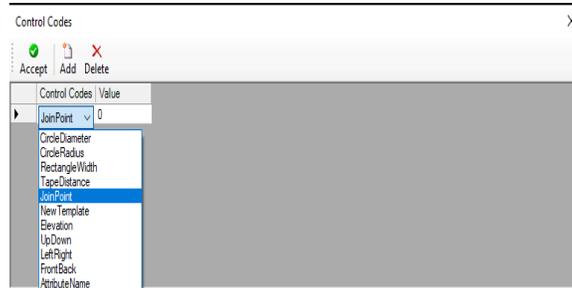


4) Click in the Control Codes field of the point to be edited to display the Control Code ellipsis.

5) Select the **ellipsis** to display the **Control Codes** dialog box



- 6) Select the **Add** icon  located at the top of the Control Codes dialog box
- 7) From the **Control Codes** drop-down menu select the **JoinPoint** Control Code

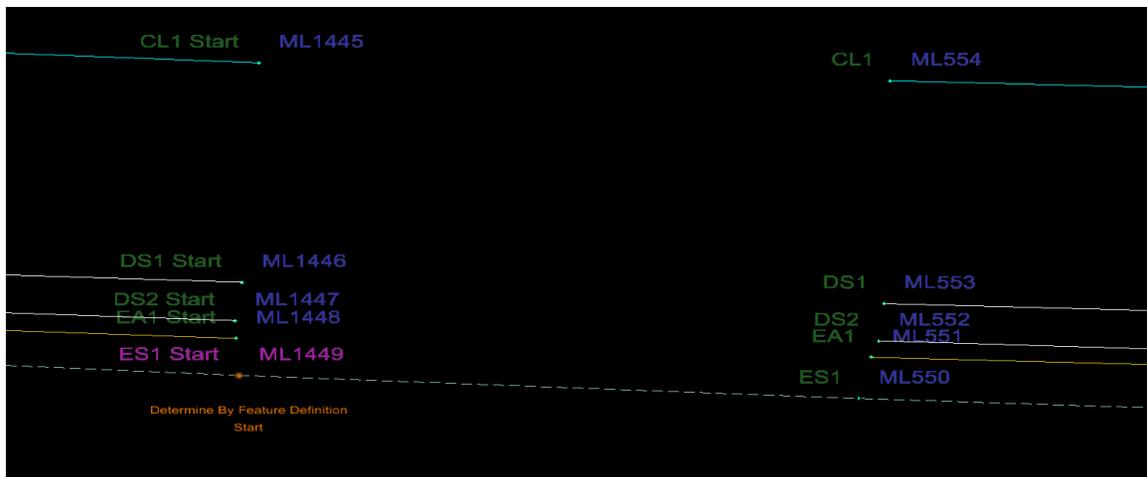


- 8) In the **Value** field type in the point number to join to and select the tab key on the keyboard to accept the point number

**--Important--**

Ensure the tab key is selected after entering the point number in the **Value** field. This will ensure the cursor is cleared from the Value field allowing the point number to be saved.

- 9) Select the **Accept** icon  located at the top of the Control Codes dialog box to complete the command and update the graphics within the CAD drawing space.

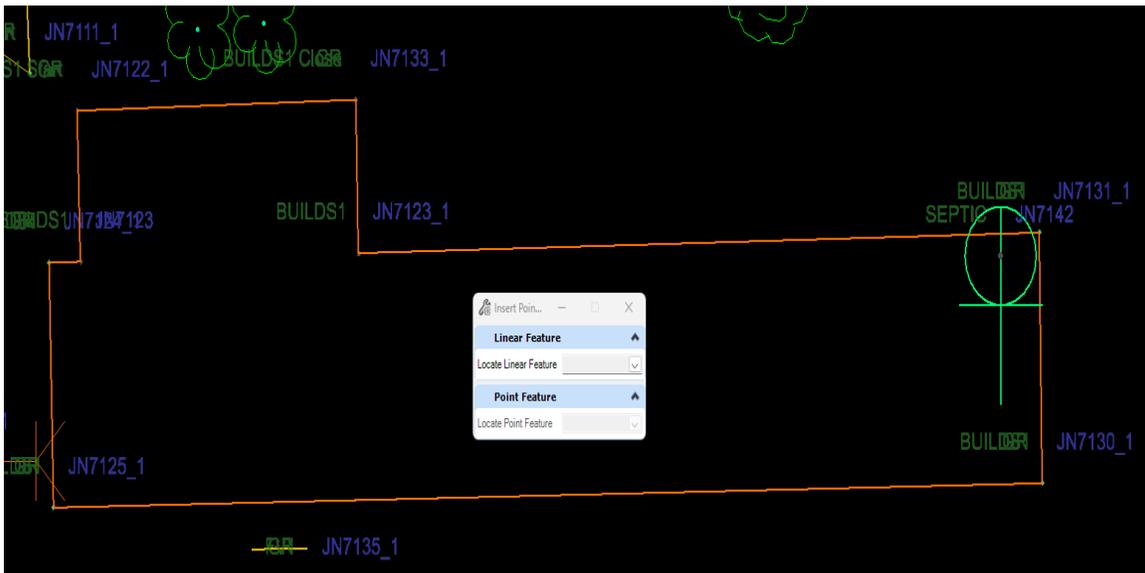


- 10) Repeat steps 3 through 9 until all lines have been joined.





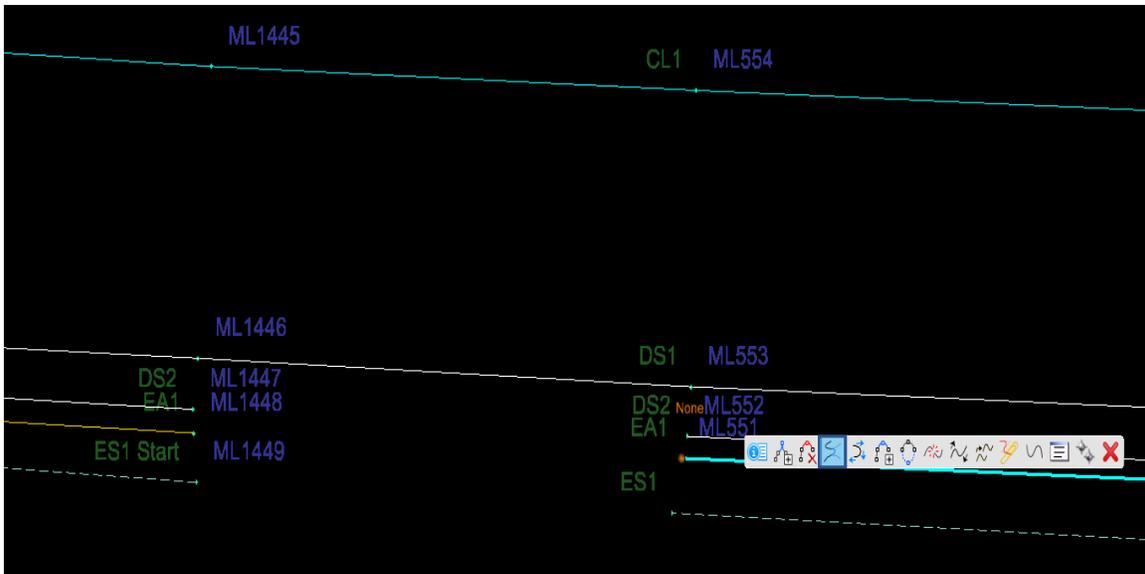
- 4) Left click to accept the proposed change to the linear feature and add the selected point.



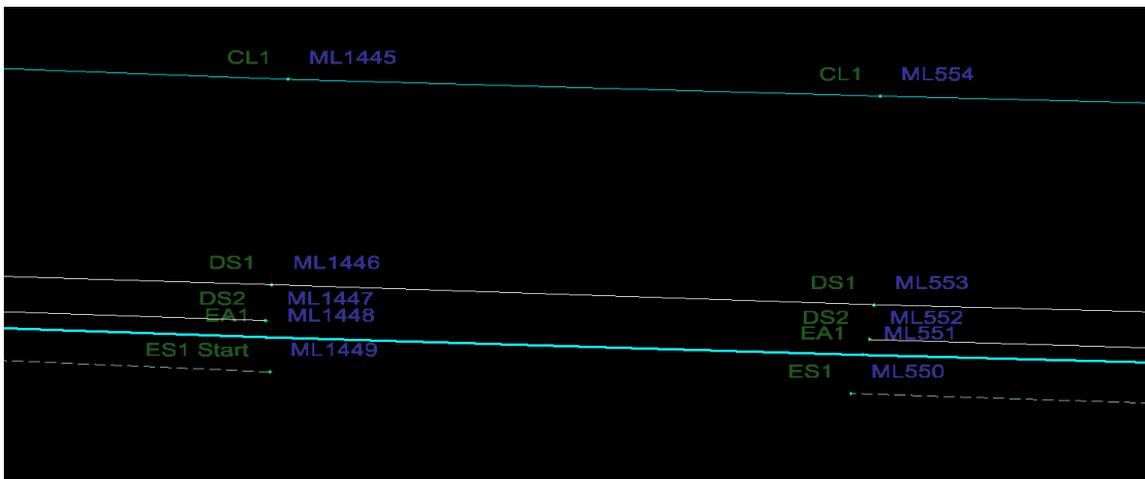
- 5) Repeat steps 1 through 4 until all points have been added.

**Join Linear Features** is a tool found within the **Civil Context Menu** that enables two linear features (line segments) to be joined together into one continuous linear feature (line segment). To be able to use the **Join Linear Features** tool the two linear features (line segments) will first need to be converted to **Point List Linear Features** and then joined together using the **Join Linear Features** tool.





- 4) Select the second linear feature (line segment) to be joined and left click to accept



The two linear features (line segments) are now joined together

- 5) Repeat steps 1 through 4 until all lines have been joined.

### Creating and Editing Terrain Model

Before creating the terrain model, it is best to **Compress** the dgn file to reduce the size of the file and remove unused element types from the dgn.

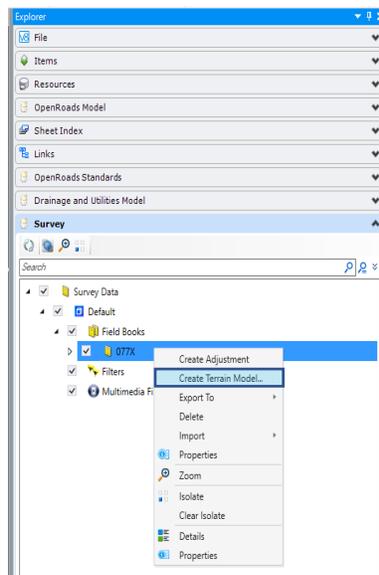
- 1) Select the **File** tab located along the top row of tabs to access the BackStage
- 2) Select **Tools** from the list along the left side of the BackStage to display the Tools options.
- 3) Select **Compress File** from the Tools option list to compress the dgn file.

Note: This process may take several minutes to complete.

Once the **Compress File** process is complete the message **File Compressed** will display in the **Message Center** at the bottom of the software.

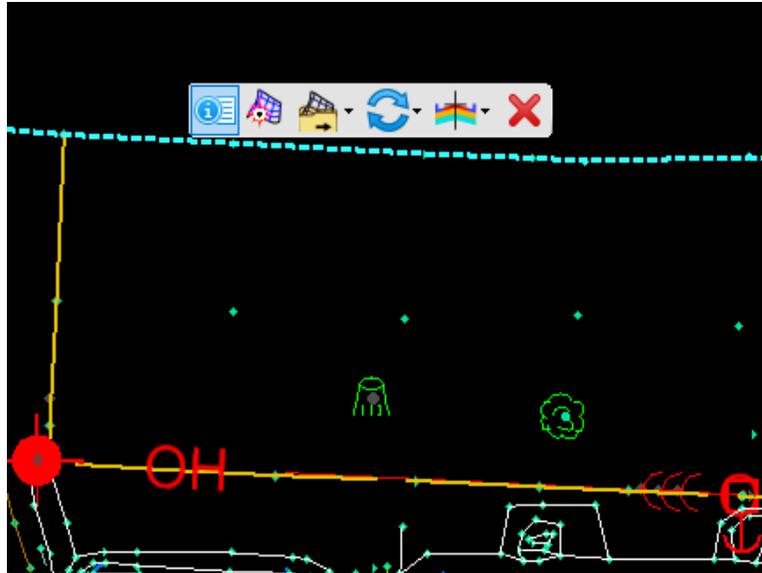
After compressing the dgn file the Terrain Model can now be created.

- 1) From the **Explorer Tab** expand the **Survey Pane** if not already expanded
- 2) Right click on the project field book in the **Survey Pane** and select **Create Terrain Model...** from the drop-down menu to create the terrain model.



The triangles can be turned on and off in the Terrain Model Properties tab by selecting

the terrain model's edge with the **Select Element**  tool. Hover over the selected terrain model's edge to display the **Civil Context Menu**.



Select the **Properties**  tool within the **Civil Context Menu** to display the **Terrain Model Properties** dialog box...

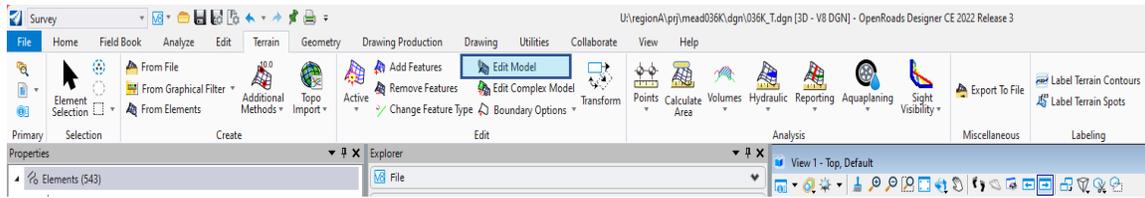
Name		Terrain Model: 036K
Number of Points		6,471
Number of Point Featu		418
Number of Islands		0
Number of Voids		1
Number of Features		1,021
Number of Contours		0
Number of Breaklines		348
Number of Triangles		12,649
Edge Method		Max Edge Length
Length		120.0000ft
Major Contours		Off
Minor Contours		Off
Triangles		Off
Spots		Off
Flow Arrows		Off
Low Points		Off
High Points		Off
Breaklines		Off
Boundary		Off
Imported Contours		Off
Islands		Off
Holes		Off
Voids		Off
Feature Spots		Off
Feature Definition		Existing
Feature Name		036K

The triangles display can be turned on or off by double clicking on the **Triangles** setting.

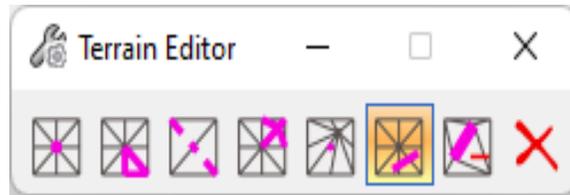
The terrain model triangles and boundary can be edited, modified and adjusted by using the **Terrain Editor** tools.

1) Select the **Terrain** tab located along the top row of tabs.

2) Within the **Edit** tool group select the **Edit Model** tool 



The **Terrain Editor** dialog box will appear...



3) Select the terrain model's edge and use the **Terrain Editor** tools to edit the terrain model's boundary and triangles:

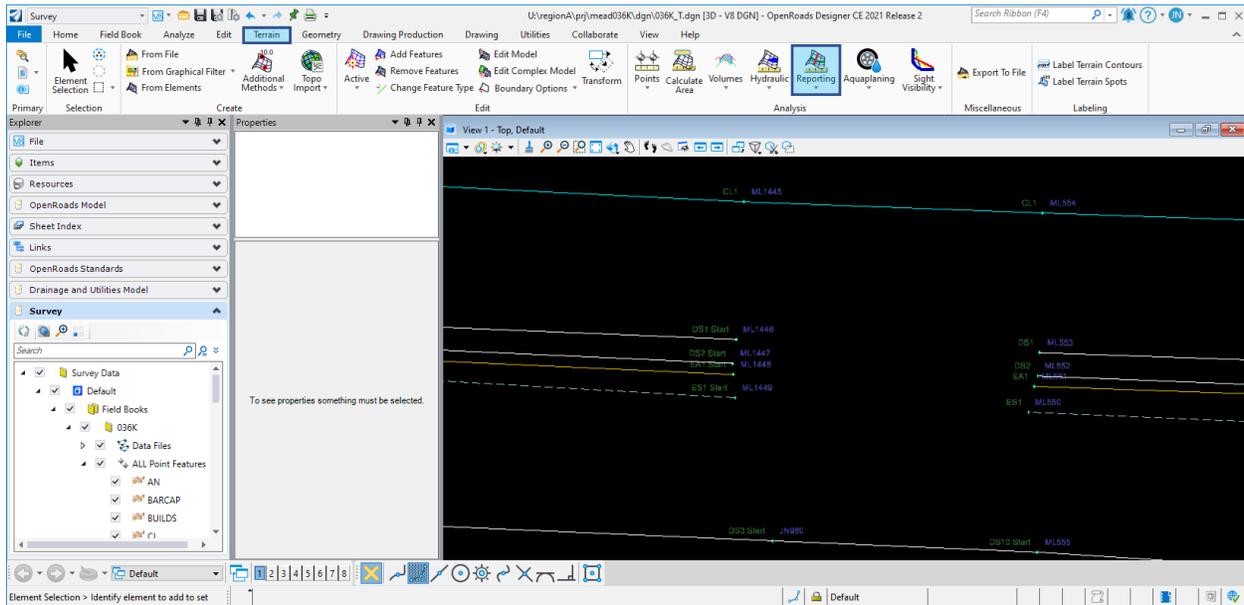
- Delete Vertex** use to delete an existing vertex of the terrain model's boundary
- Delete Triangle** use to delete an existing triangle
- Swap Line** use to swap direction of triangle
- Insert Vertex** use to insert a single vertex of the terrain model's boundary
- Move Vertex** use to move an existing vertex of the terrain model's boundary to a new location
- Delete Triangles By Line** use to delete triangles using a line
- Delete Feature** use to delete a feature from the terrain model
- Delete Edit** use to undo terrain model edits

### Review and Editing Crossing Features

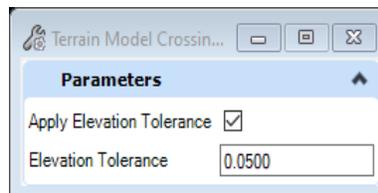
**Report Crossing Features** is a tool found in the Reporting drop-down menu within the Analysis tool group under the Terrain tab. The **Report Crossing Features** tool provides a list of all crossing features (line segments) within the survey. Using the report zoom to the crossing point of the features (line segments) and edit the feature lines (line segments).

1) Select the **Terrain** tab located along the top row of tabs.

2) Select **Report Crossing Features** from the **Reporting** tool  drop-down menu located in the Analysis tool group.



The **Terrain Model Crossing Features** dialog box will appear...



- 3) Ensure the **Apply Elevation Tolerance** is checked
- 4) Enter in a tolerance value into the **Elevation Tolerance** field and select the enter key on your keyboard
- 5) Select the terrain model's edge and right click through the on-screen heads-up prompts attached to the cursor to display the **Terrain Crossing Features Report**.

Intersection Point	Elevation On Featur...	Elevation On Featur...	Elevation Difference	Feature Type 1	Feature Type 2
1104255.814, 25147...	2859.442	2859.238	0.204	Breakline	Breakline
1104993.360, 25148...	2853.843	2853.518	0.325	Breakline	Breakline
1105012.931, 25148...	2852.151	2852.328	0.177	Breakline	Breakline
1105025.510, 25147...	2854.221	2854.454	0.233	Breakline	Breakline
1105173.999, 25147...	2853.653	2853.900	0.247	Breakline	Breakline
1105194.171, 25142...	2855.149	2854.872	0.277	Breakline	Breakline
1105308.772, 25134...	2853.595	2853.873	0.367	Breakline	Breakline
1105313.902, 25133...	2853.584	2853.458	0.126	Breakline	Breakline
1105321.048, 25144...	2853.549	2852.303	1.246	Breakline	Breakline
1105336.297, 25143...	2850.966	2850.799	0.167	Breakline	Breakline
1105345.463, 25142...	2851.214	2849.894	1.320	Breakline	Breakline
1105346.114, 25142...	2851.096	2849.830	1.265	Breakline	Breakline
1105349.430, 25143...	2851.145	2851.580	0.535	Breakline	Breakline
1105353.952, 25143...	2852.719	2852.211	0.508	Breakline	Breakline
1105442.672, 25146...	2853.128	2853.008	0.118	Breakline	Breakline
1105463.285, 25132...	2852.799	2852.949	0.159	Breakline	Breakline

- 6) Highlight one of the intersection points within the report dialog box and select the **Zoom To** button at the top of the report box to zoom to the intersection of the crossing feature lines (line segments).
- 7) Edit the feature lines (line segments) as needed to fix the crossing feature line.
- 8) Repeat steps 6 and 7 until all crossing feature line issues have been resolved.

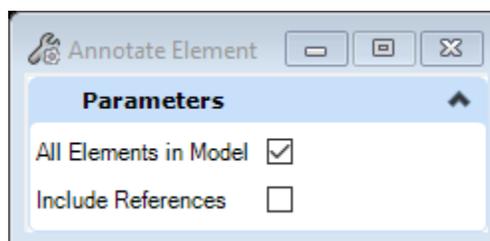
### Annotate Notes

- 1) Select the **Drawing Production** tab located along the top row of tabs.

- 2) Within the **Annotations** tool group select the **Element Annotation** tool



The **Annotate Elements** dialog box will appear...



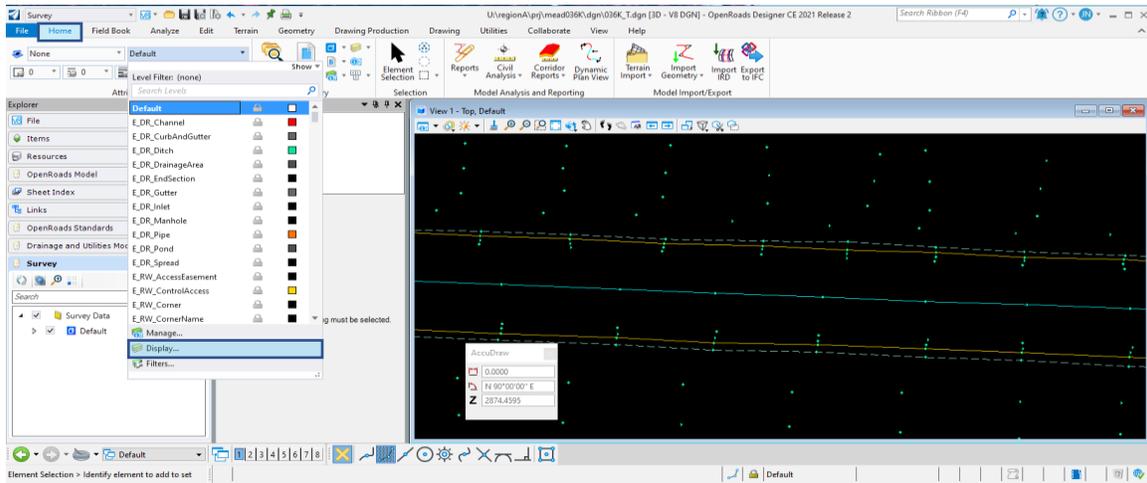
- 3) Check the box next to **All Elements in Model**
- 4) Move cursor into CAD drawing space and left click to annotate all elements in model

Note: this process may take 30 minutes or longer to complete depending on the file size.

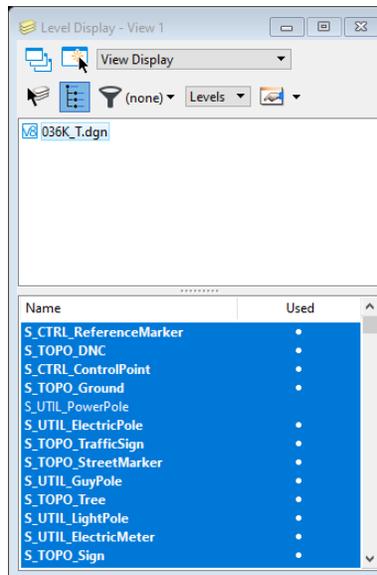
Once the Annotate Elements process is complete the field notes will display in the CAD drawing space.

## Finalizing OpenRoads Survey File

- 1) Select the **Home** tab located along the top row of tabs.
- 2) Within the **Attributes** tool group expand the levels and select **Display...**



The **Level Display** dialog box will appear...



- 3) Turn off the following levels by selecting the white dot in the **Used** column

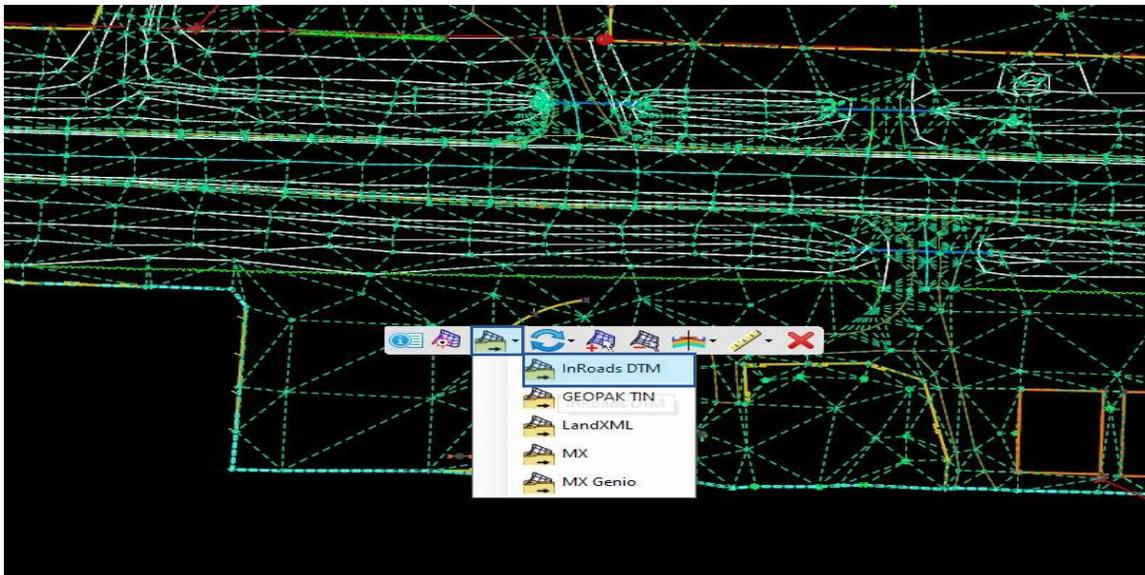
- a. **E\_TERRAIN\_Triangles**
  - b. **E\_TERRAIN\_Boundary**
  - c. **S\_TOPO\_Discon**
- 4) Close the **Level Display** dialog box by selecting the “**X**” in the top right corner of the dialog box
  - 5) Select the **File** tab located along the top row of tabs to access the **BackStage** and select **Save Settings** to save the levels displayed within the CAD drawing space.

## Converting OpenRoads Designer to InRoads and MicroStation

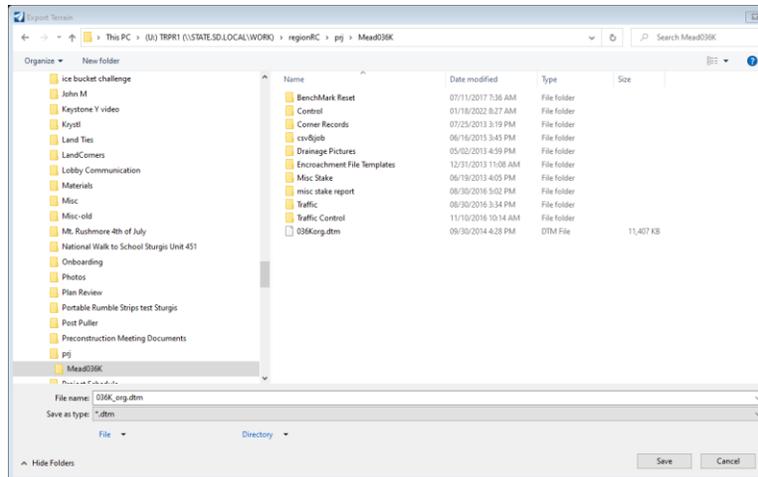
After importing, editing, and processing all field book data and all modifications have been made to the Terrain model. The OpenRoads Designer file can now be converted to be used for design in MicroStation SS4 and InRoads SS2.

Note: Before converting the OpenRoads Designer file check to ensure the correct **Annotation Scale** was set in the [Setting the Drawing Scale](#) section of this manual.

- 1) Hover over an element of the terrain model to display the **Civil Context Menu**
- 2) From the **Export Terrain Model** tool drop-down select **InRoads DTM**



The Export Terrain dialog box will appear...



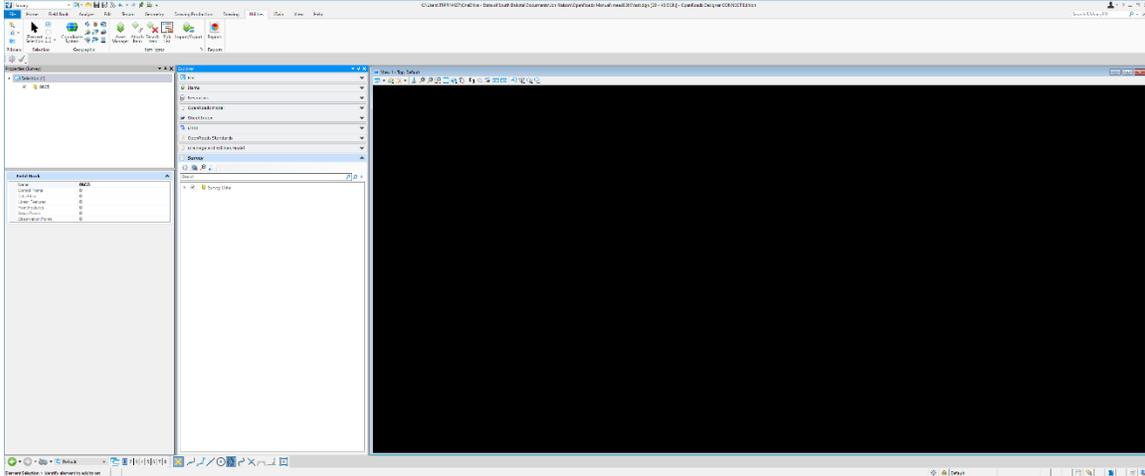
- 3) Navigate to the appropriate project folder within the appropriate region folder on the U: drive (U:\regionX\prj\cnty**PCN#**) where the InRoads surface model file will reside.
- 4) In the **File name:** field at the bottom of the dialog box type in the appropriate surface model name (**PCN#\_org**).

Note: Use the under bar ( \_ ) in the file name between **PCN#** and **org** to signify the file was created in OpenRoads Designer.

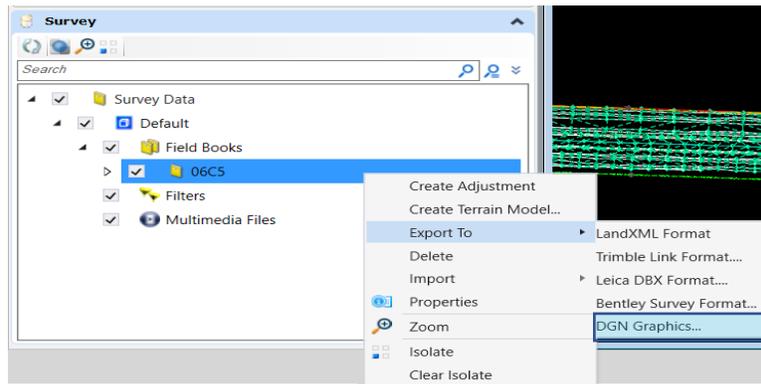
**--Important--**

The naming convention for the surface model should follow the SDDOT standard for naming the surface model file outlined in **Surface Data Furnished (.dtm file)** [Chapter 6](#) of the SDDOT Survey Manual.

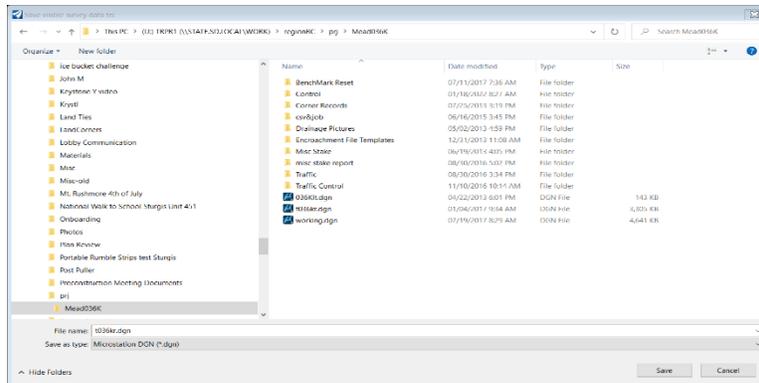
- 5) Select the **Save** button located in the bottom right of the dialog box to save the exported DTM.
- 6) From the **Explorer Tab** expand the **Survey Pane** if not already expanded



- 7) Select the **drop-down arrow** next to **Survey Data**
- 8) Select the **drop-down arrow** next to **Default** to expand the tree to see the default survey data folders.
- 9) Select the **drop-down arrow** next to the **Field Books** folder to expand the tree to see the project field book.
- 10) **Uncheck** and **recheck** the box next to the project field book (**PCN#**) to ensure all survey data is visible.
- 11) **Right click** on the project field book (**PCN#**) and select **Export To > DGN Graphics...** from the drop-down menu



The **Save visible survey data** dialog box will appear...



12) Navigate to the appropriate project folder within the appropriate region folder on the U: drive (U:\regionX\prj\cntyPCN#) where the MicroStation DGN Graphics file will reside.

13) In the **File name:** field at the bottom of the dialog box type in the appropriate MicroStation DGN Graphics file name (**tPCN#\_\*.dgn**).

— signifies the file was created in OpenRoads Designer

\* represents one of the three design file scales and is always lowercase:

r = Rural Scale (Insure Annotation Scale is set to 1" = 200')

s = Suburban Scale (Insure Annotation Scale is set to 1" = 100')

u = Urban Scale (Insure Annotation Scale is set to 1" = 40')

Note: replace the \* shown in the MicroStation DGN Graphics file name with one of the three design file scales letter (**r**, **s**, or **u**)

### --Important--

The naming convention for the DGN Graphics file should follow the SDDOT standard for naming the DGN Graphics file outlined in **Topography Data Furnished (.dgn file)** [Chapter 6](#) of the SDDOT Survey Manual.

14) Select the **Save** button located in the bottom right of the dialog box.

The newly created MicroStation SS4 file (**tPCN#\_\*.dgn**) will automatically open in OpenRoads Designer. This may take several minutes to completely load.

15) Close the newly created MicroStation SS4 file (**tPCN#\_\*.dgn**) by selecting **Close** within the **File** tab along the top row of tabs to exist out of the newly created MicroStation SS4 file (**tPCN#\_\*.dgn**).

The exported MicroStation DGN Graphics file can be viewed by referencing into a MicroStation SS4 file or older MicroStation versions. The **Converting ORD to InRoads and MicroStation** process should be followed each time the OpenRoads CAD file is updated and an older version of MicroStation is needed for design.