



CONNECT DOCUMENTATION

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OpenRoads Designer

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OpenRoads Drawings

Before You Begin

When a project is created most drawings are created within it. They are “good” at the time of creation but as updates to the seed project are made to enhance and utilize updates to the software, as well as the knowledge of CADD staff a project’s files can become a little outdated if it has been a long time between when it was created and when you are working on it.

Contact the NHDOT CADD Staff to see if your project drawings should be recreated prior to working on them.

General Information

Create OpenRoads Drawings - Video

OpenRoads Designer uses Civil Tools to perform all the roadway design steps. It is also used to create the plan, profile, and cross section drawings from the 2D\3D civil drawings. Linked detail blowups can also be created from the 3D models and displayed on detail sheets. A *Combined.dgn* is created to act as a common reference attach location for the projects Existing Drawings. This *Combined* drawing will contain references to most of the project's OpenRoads existing base drawings needed for design. This drawing will be *Reference Attached* to each design drawing with *Live Nesting* so that all the base drawings will be seen from just one attachment.

Check the seed file before proceeding nh-seedORD-design.dgn..

OpenRoads Designer drawings are seeded with 2 DGN models a 2D **Default**, as well as a 3D **Default-3D**.

It is imperative that the proper DGN model (*Default* model typically) be active when following the documentation. It is also suggested that the recommended drawings be attached to the *Combined.dgn* prior to working in any individual dgn. The *Combined* drawing has been pre-attached to the other design drawings with *Live Nesting*. This would not be possible if the combined drawing had a project number in its name. When attaching files in ORD always attach the **Default** model to the **Default** model, the **Default-3D** model(s) will automatically be attached. In MSC use the File Naming Convention Chart to determine which model to attach. For many drawings you will attach the *Default* model to view the 2D cells and linestyles but some need the *Default-3D* model attached so clipped information is not seen or because Survey or Existing Terrain linear features are only 3D.

If you add a project number to the *Combined* dgn you will need to attach it to your other drawings when you open them. (and remove references to the *Combined*)

Most drawing files are created when the project is created. Contact the CAD/D staff if your project does not contain most of these files. Existing dgns should all be in the Cadd\OpenRoads\ directory, all the other proposed design files can also reside in the



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Cadd\OpenRoads\ directory or sub folders can be created for each design alternative. These sub folders should not be added to Reference file paths so drawings from other folders are not referenced accidentally. The use of the - in the drawing names helps separate the Civil dgn files from native MicroStation files. The project cfg file's Reference file paths can be edited if drawings are stored in subdirectories that need to be referenced by others.

File Naming Convention

File Type	Name Format	Description	Reference Attachments		
			Model to Ref	Reference Description	Logical Name
OPENROADS					
Detail	12345-E-Detail	Contains Linear and Point Features – Linear features are Civil. Point features are Graphical (Microstation Cells)	3D	Linear and Point Features	-e-det
Drainage & Utilities	12345-E-Drainage	Exist. Drainage Detail Extracted from 12345-Survey or 12345-E-MX-Survey-Topo	D-3D	Existing Drainage	-e-drn
Drainage & Utilities	12345-E-Utilities	Utility Features Extracted from 12345-Survey or 12345-E-MX-Survey-Topo	D-3D	Existing Generic Points	-e-gen
Env Features	12345-E-Env	Copied ENV MicroStation lines converted to linear features for Cross Section labels	D-3D	Environmental delineation	-e-env
Row Features	12345-E-ROW-Lines	Copied ERL MicroStation lines converted to linear feature for Cross Section Labeling	D-3D	Existing Right-of-Way	-e-row
Detail	12345-E-FieldCheck	Linear and Point features draped on Existing Terrain. Text should be brought to 12345etxt	D-3D	Field Trip Information	-e-fc
Combined	Combined	Empty drawing containing reference attachments to the Projects Existing drawings. Used to reference all existing drawings with a single attachment – Used in ORD – Live Nest = 1			
Delta Terrain	12345-E-Delta-Terrain	Created to be used as a place holder in the 12345-E-Terrain	3D		
Existing Terrain	12345-E-Terrain	Combined Terrain file from various sources	3D	Exist Terrain	-e-ter



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OPENROADS – SURVEY					
Survey	12345-Survey	For Survey Processing will include Terrain Model	3D	Survey	-sur
Survey	12345-Geom-PP	Plan Prep Alignments	D	Geometry	-gpp
Survey	12345-E-MX-Survey-Topo	For Survey Transfer from MX – Linear and Points are civil features.	D-3D	Linear and Points Features	
Survey	12345-E-MX-Terrain	For Survey Transfer from MX	D-3D	Terrain from MX	
Survey	12345-E-MX-Trav	For Survey Transfer from MX – Traverse points	D-3D	Traverse from MX	
Survey	12345-E-MX-Survey-Linear	For Survey Transfer from MX – used on older projects	D-3D	Linear Detail Features	e-lin
Survey	12345-E-MX-Survey-Points	For Survey Transfer from MX – used on older projects	D-3D	Point Detail Features	e-pts
OPENROADS/PRELIMINARY					
Layout	12345_Layout	Create reference lines for pavement and lane tapers, linked existing ep's, traced drive edges, or any other lines created for point controls	D	Prop Layout	-p-lay
Earthwork	12345-Earthwork	Create closed shapes to clip terrains and apply Surface templates for exist material like Pavement, Muck, Rock, Topsoil, Unsuitable material for Sections and quantities	D	Earthwork Modeling	-ear
Geometry	12345-Geometry	OpenRoads Alignments to show on Plans	D	Geometry	-geo
Corridor	12345-P-Corridor	Corridors, Civil Cells, and possibly Drives. It may be necessary to develop corridors in separate drawings.	D-3D	Prop Corridor	-p-cor
Drainage & Utilities	12345-P-Drainage	Proposed Drainage information	D-3D	Prop Drainage	-p-drn
Drainage & Utilities	12345-P-Utilities	Proposed Utilities Information	D-3D	Prop Utilities	-p-utl



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Drive	12345-P-Drives	Driveway CI, Civil Cells, and corridors – small Side Roads also	D-3D	Prop Driveways	-p-driv
Supers	12345-P-SuperElevations	SuperElevation Sections and Lanes – can create separate for each corridor	--	Prop SuperElevations	-p-sup
Cross Section Detail	12345-XS-Detail	Cross-Section Detail Ticks in Plan View used for annotation cross section drawings. Use a separate drawing for each Alignment	--	XS Detail	-xs-de
ROW Features	12345-P-ROW	Proposed ROW Lines and Labels	D-3D	Prop ROW	-p-row
Proposed Terrain	12345-P-Terrain	Construction Surfaces – Design and Subgrade for Sections and export to LandXML	--	Prop Terrain	-p-ter
Composite Terrain	12345-Composite-Terrain	Composite terrain - Design merged with Existing terrain. Can be used with Proposed Drainage & Utilities drawings.	--		

Create Drawings and Attach References to the Combined Drawing

Files that were recently created from the seed project have predefined logical names attached to the *Default* model so the logical name will be defined when attaching them as a reference file. This can be set under model properties. Open the Combined.dgn and attach all Existing files including the etxt file from the PRJ\ directory. The Combined dgn has already been attached to the other project dgnos with live nesting, so when you open other drawings you should see the existing detail already referenced. If you create a new dgn you will need to attach the Combined with live nesting set to 1. When attaching files always attach them with the **Default** model active and attach the files **Default** model and it will automatically attach the *Default-3D* models. The exception is the Survey.dgn it only has one model so attach its **Default (3D)** model to the **Default** model of the Combined and it will be attached to both.

When working in a dgn, attach only the drawings needed. For example, the Superelevation drawing(s) will only ever need to be attached to the corridor dgn files and the Profile cut sheets drawings. No other drawings need to work with that information so do not attach them to every drawing. XS Detail, XSections, Layout, and the EarthWork are other drawings that only need to be attached for specific purposes to specific drawings.



OpenRoads Designer - Survey

Creating the Survey DGN

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Introduction

This is the first of three sections for processing survey data to create a Survey/Terrain drawing.

The focus of this page is to import the Control Points and to dump the Survey Data files into a new Survey Drawing. Any Rod Height adjustments will trigger OpenRoads to reprocess the data and any edits to the survey data will be lost. Therefore, all Rod Height adjustments must be applied immediately before locking the data down.

File Preparation

Create an *OpenRoads* directory under the Project's *Cadd* folder if one doesn't already exist. Copy files from the folder where Survey stores project data to the Project's *OpenRoads* directory.

Start **OpenRoads Designer**.

Set the Workspace to **NHDOT**.

Select the **WorkSet** for this project. If a WorkSet needs to be created, then provide the project name and number to Bill Caswell to create it.

Create and open a new **12345-Survey.dgn** using the **NH_Survey_Seed_3D.dgn** seed file.

OpenRoads Designer Workflow

Direct your attention to the very top left of the OpenRoads Designer interface. There is a pull-down box to set the OpenRoads *Workflow*. Set this to **Survey** for survey processing.

Underneath the *Workflow/Title Bar* are the Ribbon Tabs. Each Ribbon Tab triggers a different Ribbon. Most of the tools for processing a survey are found on the *Analysis Ribbon*.



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OpenRoads Explorer

Explorer functions as a detail manager of everything OpenRoads. It's the technical liaison or access portal to your drawing, files and specifications. Explorer is located on 5 of 9 Ribbons of the *Survey Workflow* and is integral to Survey processing. The Explorer panel offers 7 tabs, most of the Survey processing may be accessed from the *Analyze* tab.

Control Points

A [video](#) is available to help explain this process.

Control Points will likely be delivered via a text file (.csv format). To load this file, use the OpenRoads Explorer and expand the Survey tab (as shown at left).

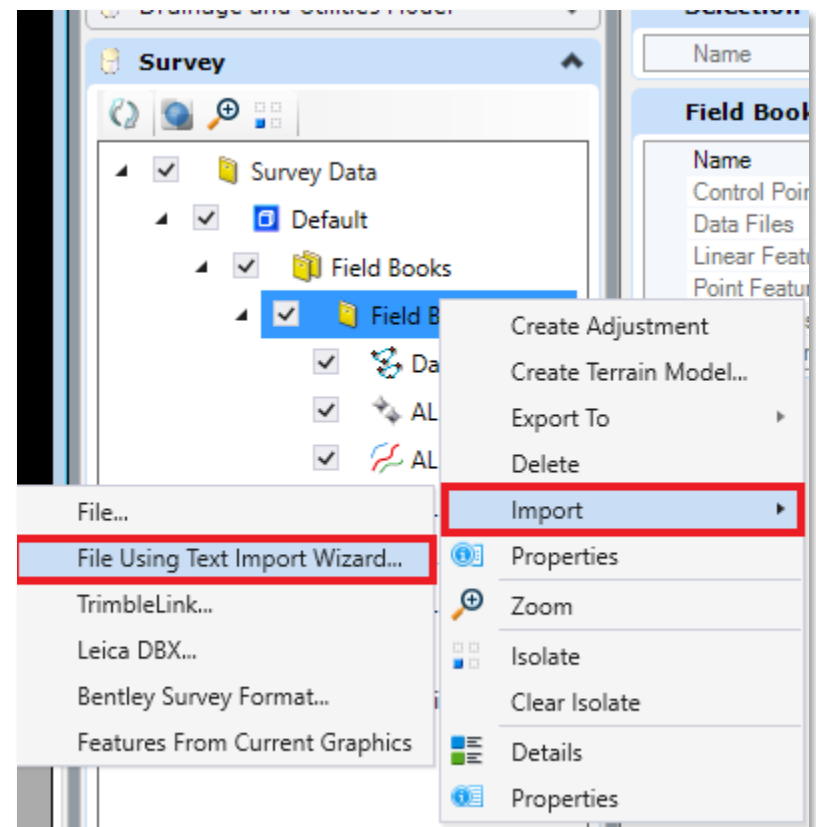
In the main body of the *Survey* tab, expand the *Survey Data > Default > Field Books* folders (as at right).

Right Click the Field Books for a pop-up menu. Select the **New....** Right Click on the newly created field book (probably called *Field Book 1*) and select **Properties**. In the Properties panel, change the *Name* to **12345-Survey**.

If there is a field book already, you can rename it to **12345-Survey**

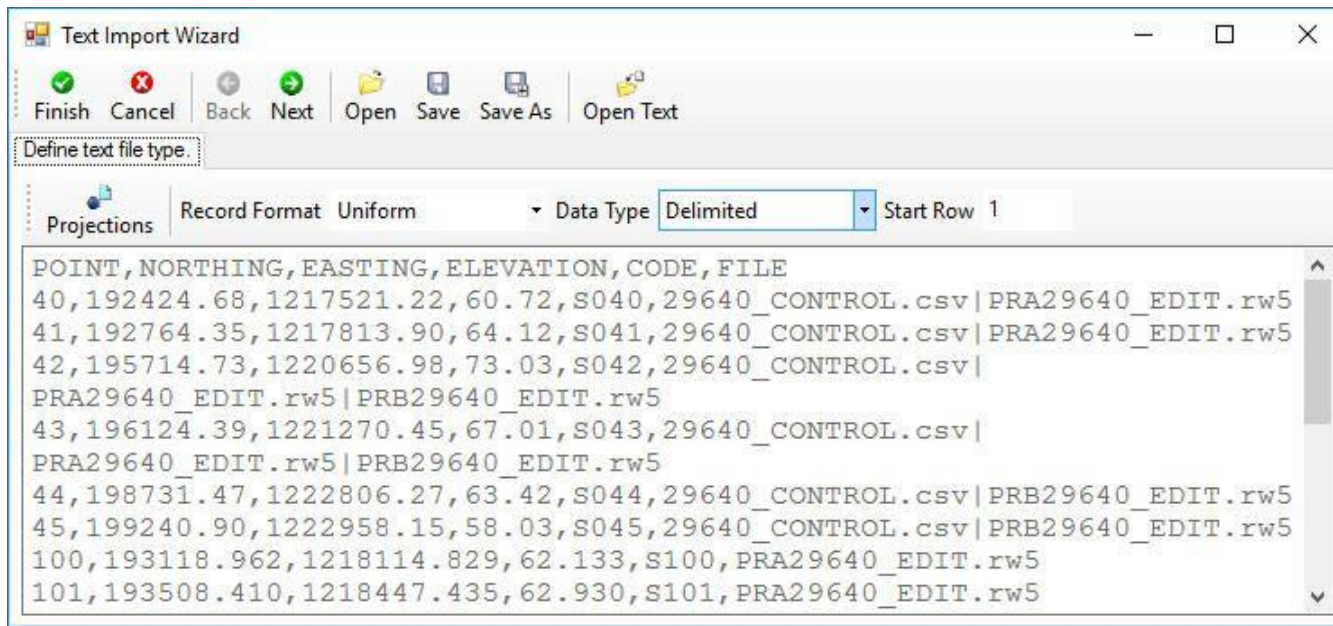
Next, *Right Click* the *12345-Survey* folder for a pop-up menu. Select the **Import > File Using Text Import Wizard...** option.

From the *Select File* panel, navigate and select the text file containing the Control Points (*.csv) and Click **Open**. This results with a *Text Import Wizard* panel. This Wizard's sequence is identified by a progression of tabs and the initial tab is *Define text file type* (example shown below).





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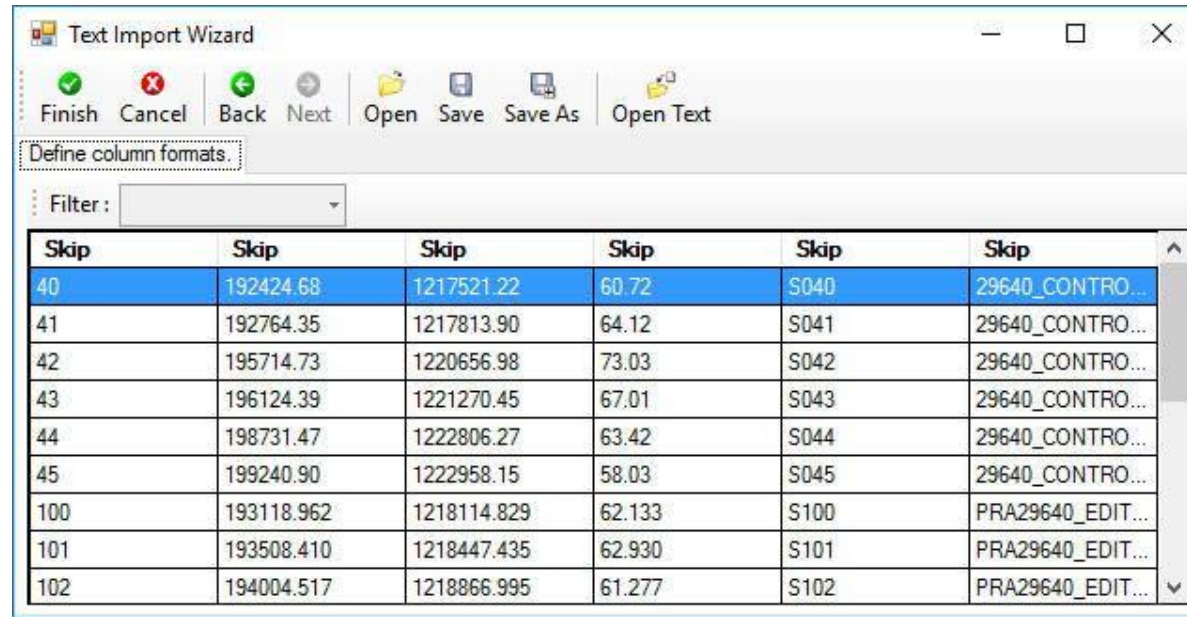
The first row of text in the sample above presents the order of data used in the following lines. This information will be valuable in the near future; however, it does not represent the raw data that is the purpose of this file. Therefore, the initial row of actual data for this example starts on the second row in this case. Change the *Start Row* value to **2**. If all goes well, the first row of displayed text should now be the first row of actual data. Beware of double space data files. Also confirm that the *Data Type* is set to **Delimited**.

Click **Next** to advance to the *Define delimiters for records found* tab. From here check the appropriate *Delimiters* box for this data file. The proper *Delimiter* selection will change the display of data to table format and now separated by columns.

Click **Next** to advance to the *Define column formats* tab (example shown below).



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Notice that all the column headings are default titled as **Skip**. The chore now is to assign the appropriate column headings. Remember that first initial row of text that defined the data file's order, the line(s) that we just directed to ignore. It contained the necessary information for this step (most important, in the proper order). **Left Click** on a column heading to select. **Click** a second time for a pop-up menu with all the possible heading options. Mandatory heading assignments must include:

- Northing
- Easting
- Elevation
- Point Name (shot number)
- Code (traverse point identification)

Change all but the last column heading (for this example) to match the initial row of text from the file. There is no option of *File* for the last column, **Skip** is appropriate in this case.

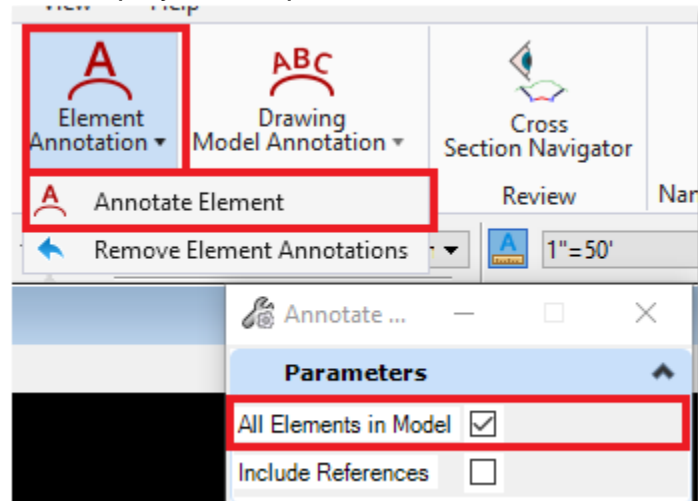
Select **Finish** to import the text file. A prompt will ask to create a tiw file, select **No**.

Click **Fit View** to see the locations. Now is a great time issue the **Save Settings** command.



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To display the point numbers for the traverse points, go to *Drawing Production* tab, *Element Annotation*,



Survey Details

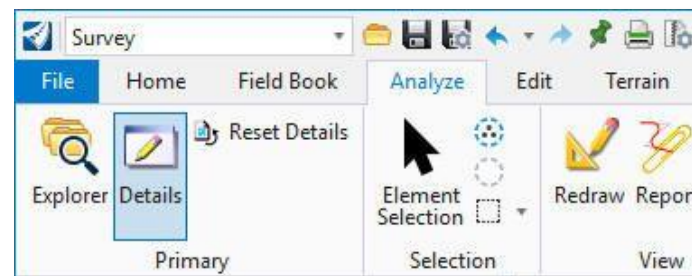
The Survey Details window shows the data associated with the items selected in the Survey tab of OpenRoads Explorer. To open the Survey Details panel, select the Details button found on the Analysis ribbon (one of three possible ribbons).

Expand the *12345-Survey* field book of Explorer to show the categories of available data. The details presented on the Survey Details window will vary depending on what category is selected in the OpenRoads *Project Explorer*.

ALL Point Features will include all the observations in the survey regardless of whether they are Survey Setup Points, Point Features or Linear Features.

ALL Linear Features reports just the Linear Features of the Field Book. Each record represents a single linear feature. The observations have been specifically coded in the field data recorder with *Link Codes* that establish that the feature is a line instead of only a collection of points.

ALL Observations will show all survey shots as lines connecting the Survey Setup to the Target observations.





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Data in the *Survey Details* window can be arranged and sorted by *Right-Clicking* on a column heading and then selecting the desired option from the *Pop-Up* menu. Also, when a single observation is selected the location of that observation is Spot Shadowed in the Graphics Window.

Loading the Data Files

A [video](#) is available to help explain this process.

Before loading any Data Files, check that the Annotation Scale is set to the appropriate scale. Do this from the *Drawing Scales* portion of the *Drawing* ribbon.

Note: Cells cannot be rotated, scaled, or moved until the processing rules have been turned off

From the *Survey* tab of *Explorer*, expand the *Survey Data > Default > Field Books > 12345-Survey* folders. Select the *12345-Survey* folder similar to Control Points section above. (also shown to the right)

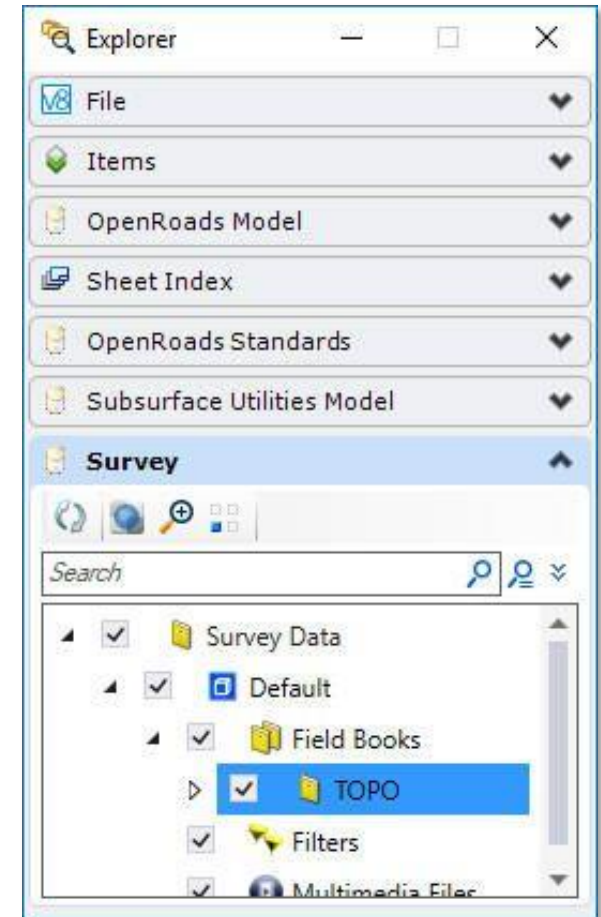
Survey data files have a **.RW5** file extension. To add one to the drawing, from a *Windows File Explorer*, *Left-Click/hold* and drag it over the selected *12345-Survey* folder of *Explorer*. Note that it might be necessary to load the files in a particular order. The Survey Section should supply that information upon delivery.



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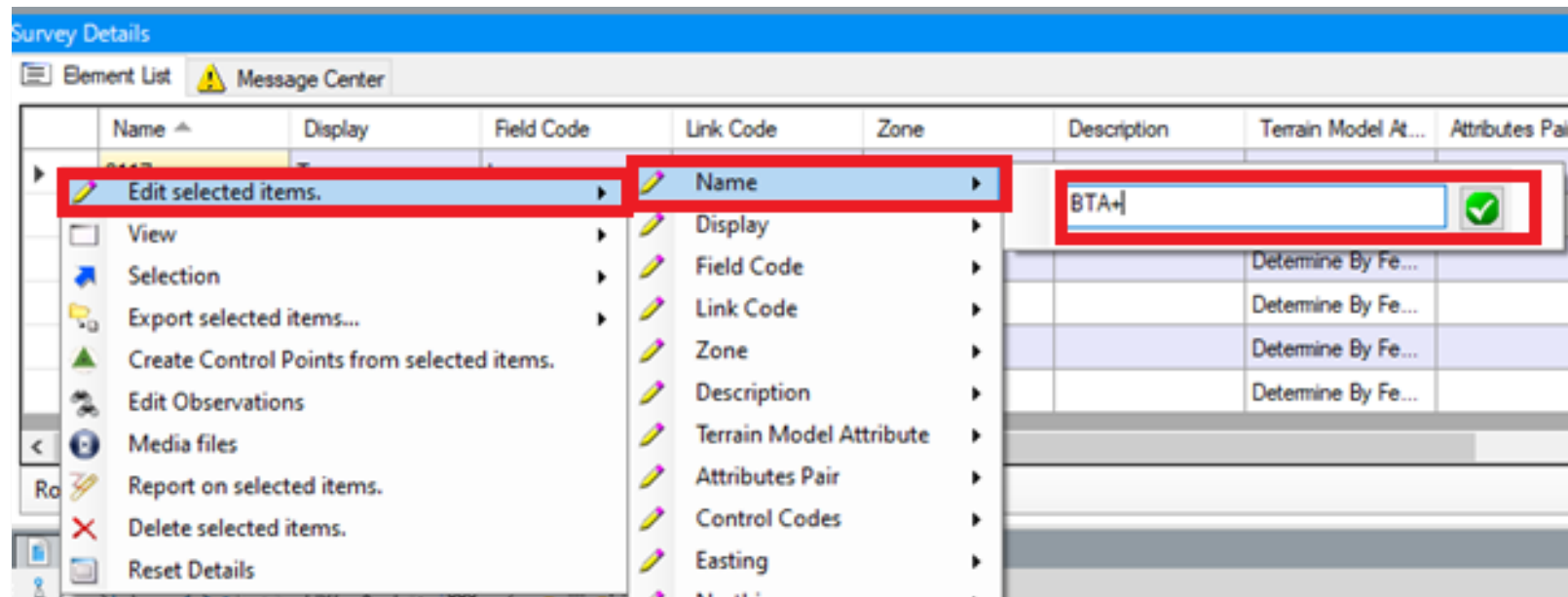
In anticipation that subsequent Survey files may have duplicate observation numbers, it is important to tag the observation numbers of each survey *Data File* with a unique identifier. It is advantageous to avoid any observation from getting re-sequenced. Use the Crew Identification code of the Survey data file name such that points continue to correspond with the field book notes.

To accomplish this, start by selecting All Observations of the 12345-Survey field book from the Survey section of Explorer. Next, open the Survey Details panel to review the output of what is selected in Explorer. The *Survey Details* panel is shown below.





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While working with the *Survey Details* panel, sort the *Name* column to be **Ascending**. Now select every detail observation of this data file. To do this, use the *Selection* column to the left of the first data column (the first data column should be the *Name* column by default). All cells of every observation should highlight when selected as intended (shown above). Be sure that Control Points have not been selected too.

Now, *Right-Click* in the highlighted area of the *Selection* column. Select *Edit Selected Items* > *Name* from the popup menu to get a *Text Input* panel (shown above). Place input focus in this *Text Input* panel and enter the prepending text followed by the Plus (+) sign. The Plus sign will direct the text to prefix the original observation Name (aka the Shot Number). Click the green button of the *Text Input* panel to apply the prepend. Check the edit before moving on.

Click *Fit View* to see the results. Now is a great time issue the **Save Settings** command.

Both the Observation Lines and the Traverse Lines can be toggled OFF from the Display for the *12345-Survey* field book. From the *Survey* tab of *Explorer*, uncheck the boxes **for ALL Observations** and **ALL Setups** to accomplish this.



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Guard Against Re-Processing

All Rod Height adjustments must be applied immediately and the Data Set Locked Down from re-processing. If a Data Set is re-processed, then any general edits made prior will be lost. Therefore, check the following items before Locking Down the Data Set.

Review the data of the ALL Observations folder (of Explorer) using the Survey Details panel. Look for unusually high or low *Rod Heights*. The most common rod heights range from 5' to 8.5'. Acceptable values range from 0' to 25'. This chore is easily accomplished by sorting the *Rod Height* column and checking the extreme values.

Field crews have the ability to include notes or messages in the *Survey* data file. These notes are found in the *Description* column of the *Survey Details* panel while reviewing the *ALL Observations* folder. The easiest message to decipher is an alert of rod height corrections. Simply apply any corrections to the rod height values in the *Rod Height* column for the observation(s) noted. Scan all observations for these notes and repeat.

There is no replacing a visual check of the Terrain's Contours. Despite processing edits have yet to be applied, inspection of the contours will quickly present a bad *Set-Up* or *Rod Height*. Most rod height anomalies are more easily found by reviewing the contours of the terrain model. Contours can be made visible by changing the Feature Definition of the Terrain to *PP_Exist_Contours*. Identify any issues and address immediately.

Locking Down the Data Set

To lock down a Data Set, from the *Survey* tab of *Explorer*, expand the *Survey Data > Default > Field Books > 12345-Survey > Data Files* folders. Under the Data Files folder will be entries for every Data File (.RW5) loaded. Select the Data File to be locked down and then right click it for a pop-up menu. Select **Properties** to get a *Properties* panel. From the *Properties* panel, change *Process Observation Rules* from **True** to **False**.

Repeat for Every Survey Data File

After stabilizing the Data Set by locking it down, drag and drop each additional survey data file onto *Explorer* so it is added to *12345-Survey 1*. Continue to tag the observation numbers of each survey with a unique identifier. Make *Rod Height* adjustments and then Lock the Data Set down. Repeat until done.

For Survey Updates

probably put the new data in a reference then edit any old data that overlaps. Then once the old data is cleaned up, discard the reference file and bring the new data into the survey file and process it as normal.



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Review Survey Data

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This is the second of three sections for processing survey data to create a Terrain drawing.

The focus of this page is to adjust the data to its most accurate representation of the field. This includes and is not limited to closing gaps and overlaps, creating and adjusting offset features as well as addressing crossing features.

Do not proceed with this page if the Survey Data sets have not been locked down yet. Because from this point on, any edits made will be lost if the data is re-processed.

Invalid Feature Codes

In the OpenRoads *Explorer*, expand the *ALL Point Features* folder (as shown at right).

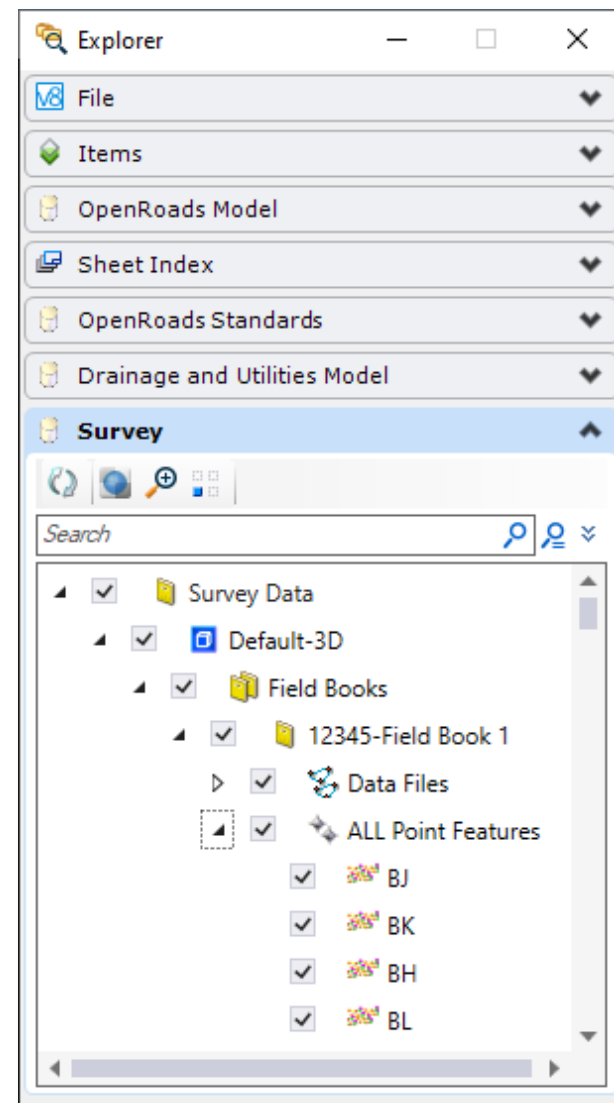
Look for Point Features displayed in **Red**. These are observations in the survey file which are not associated with *Feature Definitions*. The Red entries that represent *Survey Setup Points* are normal and do not need to be addressed. All others should be corrected. Refer to the survey field book notes for shot clarification.

Repeat the process for Linear Features. A [video](#) is available to demonstrate this process.

Linear Features

A [video](#) is available to help explain this process.

Observations need to be reviewed to ensure that they are not only included but grouped with other points of the same string. The inclusion and associating of points to their intended feature is controlled using Link Codes that are assigned in the field data recorder. These codes delineate the beginning and end of linear features as well as the extent(s) of horizontal curvature. There are also various Link Codes available for closing a string to its starting point. All point observations should have the Link Code set to **None**.





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Select the *ALL Point Features* folder from the *OpenRoads Explorer*. Use the *Survey Details* window and sort the *Name* column in Ascending Order. This column shows the order that the observations were taken.

Next, scan the *Feature Name* column for consecutive observations of the same feature code. We assume that all consecutive observations are included in that string unless told otherwise. The corresponding *Link Code* column should define the extent of the feature as well it's curvature. Check the data and add missing Link codes or correct wrong Link codes in the *Link Code* column where necessary. Confirm the feature extents by using the survey field book notes. Also be aware of missing observations. Shot Numbers should be consistent and progressive.

Use	LinkCode	Alpha	Numeric
True	None	None	0
True	Start	BEG	200
True	StartPC	BC	204
True	ArcPC	PC	205
True	NonTanPC	NTC	202
True	ArcSingle	SAP	206
True	ArcToArc	CC	207
True	NonTanPT	NTT	201
True	ArcPT	PT	208
True	ArcToggle	OC*	209
True	End	END	210
True	CloseShape	CLSH	211
True	Close	CLOS	212
True	CircleDiameter	CD*	-1
True	CircleRadius	CR*	-1
True	RectangleWidth	RECT	-1
True	TapeDistance	DIST	-1

Decorations

A [video](#) is available to help explain this process.

Information associated with *Survey Observations* may be toggled on the Display with the use of *Decorations (Analyze ribbon)*. This information includes and is not limited to Point Names, Field Codes (including Start/End point tags) and Point Elevations. Decorations have a Zoom tolerance and they disappear when Zoomed to far out. Control Decorations from the *Analysis ribbon*.



Offset Features

In addition to notes announcing rod height corrections, messages may also describe details to create *Offset Features*. These directions require interpretation to craft a *Control Code* that will generate a new Feature. This entry must be added to the *Control Codes* cell of the first observation of the source feature. A sample message found in the Survey data file might look something like this:

203 CR TC 0.05 0.50

Breaking down this example, the **203** is the signal that an *Offset Feature* is intended. **CR** is the feature label of the *Source Feature*. **TC** is the label of the *Offset Feature* to be created. The next two values are the Offset distances measured from the *Source Feature*. Traditionally, these are written in the order of vertical offset followed by the horizontal offset.



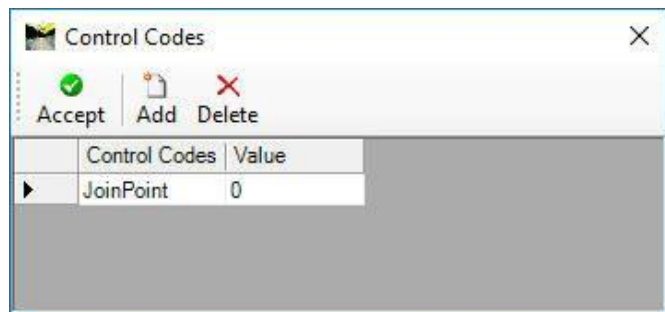
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In the *Survey Details* panel, *Click* twice (not the same as a Double Click) in the first *Control Codes* cell of the *Source Feature*. When done as intended, a button with three dots (...) should appear at the right end of the cell

Click on this button with three dots to get the *Control Codes* panel shown at left.

Name	Display	Field Code	Link Code	Zone	Description	Terrain Model At...	Attributes Pair	Control Codes	Ed
1085	True	L	None	1		Determine By Fe...			100
1086	True	L	End	1		Determine By Fe...			100
▶ 1087	True	SW	Start	5		Determine By Fe...			100
1088	True	SW	End	5	203 SW L 0.00 0...	Determine By Fe...			100

The body of the *Control Codes* panel



(under the menu buttons) is a table for building *Control Code* data. Click the **Add** button to add a default data entry row below the table header.

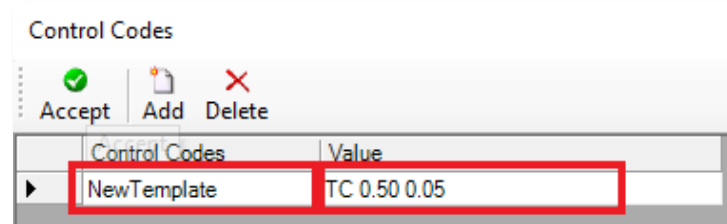
Click on the *Control Codes* cell of the new data entry (currently the default value is *JoinPoint*). From the drop down menu select **New Template**. Next, place input focus in the *Value* cell of the new entry row (to the right of the *New Template Control Code* just set). Use the note from the Survey data file to build the *Control Code Value*, use the following format:

The label of the new Offset Feature; space; the Horizontal Offset; space; the Vertical Offset.

If negative values exist, then it is important to also carry them through. Using the sample note from above it would look like this:

TC 0.50 0.05

When done, a small pencil symbol will appear in the left cell of this new data entry row (left of the cell set to *New Template*). This pencil symbol operates as a button, click it to lock these values. Then Click **Accept** to send the code to the *Control Codes* cell of the *Survey Details* panel. Once again, scan all observations for these notes and repeat.



Control Codes

A [video](#) is available to demonstrate this process.

While on the topic of *Control Codes*, it is possible that existing entries will require corrections or adjustments. This can include direction and magnitude of offsets as well as string label adjustments. Be on the lookout for *Control Codes* that are not set to *New Template*.



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To edit a *Control Code* (similar to the above section, *Offset Features*) click twice in the *Control Codes* cell of the *Survey Details* panel. Once again, do not Double Click. When done as intended, a button with three dots (...) should appear at the right end of the cell. Click on this button with three dots to get a *Control Codes* panel similar to that shown at right:

This time the data entry row is populated with the existing *Control Code Value*. Edit this Value as necessary. After adjusting the Value, click the Pencil Button in the left cell of this data entry row. Then click **Accept** to send the revised Value to the *Control Codes* cell of the *Survey Details* panel.

Continuous Features

A [video](#) is available to demonstrate this process.

The heart of a road survey happens to be the road. These roadway features will yield a smoother and more accurate terrain when like features are joined together. This effort eliminates both overlapping and gapping of continuous features regardless of how many pieces they were surveyed in the field.

First, use the *Element Selection* tool to select a roadway feature. Each string selected of that feature will highlight and display its extent. In the Graphics Window, navigate to each end and evaluate whether or not joining is appropriate.

To join ends, use *Element Selection* again to select the element that contains the end point to move. With AccuSnap toggled ON, grab/hold the *Move* manipulator and drag it to the point that it is being joined too. Release the grab/hold only when AccuSnap engages. Warning, a missed joining will null the edited point's elevation. Check periodically and verify that moved points are not nulled. Move to the next roadway string and repeat.

General Review

Let's take a moment to comment on the software being used. Be aware that OpenRoads is not yet ubiquitous and does not always work as intended. These are the annoyances that have been identified so far:

- Some common *Link Code* sequences freak out associated *Control Code Templates*. Try to either toggle or move *Link Codes* among observations of that feature to properly recognize the *Control Code*. Re-inputting or tweaking the *Control Code* may also scare it straight. Expect much frustration.
- Some features generated by a template from a feature with curvature will double back and cross itself at some observation points. Angles greater than 90 degrees may force the template generated feature to cross its parent feature 4 times and itself once for just one observation. So far eliminating curvature is unfortunately the best solution. Expect much frustration.
- The **CloseShape** *Link Code* should be used in extreme cases only. Because it extrapolates an observation, it is highly vulnerable to compounded errors. It also has no potential of reflecting the accurate elevation of its calculated observation.



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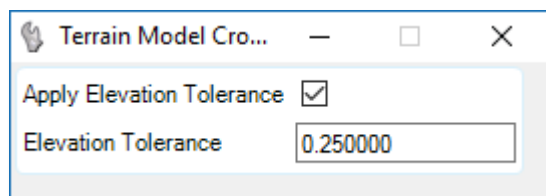
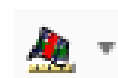
From an editing standpoint, any command that inserts a new point into a line segment that was used to construct the original *CloseShape* feature will likely launch the extrapolated observation to a totally new location. If one does not see the change jump, then one might believe that new resting position is valid. *CloseShape* should only be used for the back side of buildings that are obscured from view and where the generated elevation is not as critical.

Regardless of this instability of OpenRoads, scan the drawing for data collection anomalies. This includes and is not limited to the following:

- Missing information such as Tops of Curb, Tops of Retaining Walls and Tops of Stone Walls: These features should have a corresponding top. If necessary, make up a *Control Code Template* so none of these features goes topless.
- Offset Features projected to the wrong magnitude and/or direction: This could be due to the *Control Code* being mis-entered by the field crew. Or it could be due to the associated Link Code sequence causing interference (just mentioned above).
- Directional Features going the wrong way (such as Hedges, Curbs and Rock Outcroppings): Use the *Transpose Linear Feature* tool from the *Context Sensitive Menu* to flip the feature's direction. [This will also be used for any string that the linestyle is upside down.](#) See Address Crossing Features for more explanation of this command.
- Integrity of Curvature: It is difficult in the field to anticipate how some of the *Link Codes* will react or are influenced by their observation sequence. Look for unexpected bulges in a feature or cords where arcs would likely be. Refer to Aerial imagery to verify feature curvature.
- Crossing Features: The next two sections deal with Crossing Features, however a preemptive attack doesn't hurt.

Report Crossing Features

All field surveys are vulnerable to crossing strings and hopefully the processor (yourself) can prioritize and adjust the features accurately. To generate a crossing features report, from the *Terrain* ribbon select *Reporting > Report Crossing Features*. The stepping arrow allows the toggle of reporting options if *Report Crossing Features* is not the current default.



Before the report can be generated, the panel shown at left will appear however, all required information is addressed by the *Heads-Up* Prompt.

The first prompt asks to Select (a) Terrain Model Element from the active *Graphics Window*. Next, agree to use an **Elevation Tolerance** and finally what the threshold value should be. When an *Elevation Tolerance* is applied, only the features whose elevation difference exceeds the *Elevation Tolerance* value will be reported. Results are presented

in the *Terrain Crossing Features Report* shown below. In addition, red circles appear in the Graphics Window at every intersection identified in the report.



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Intersection Point	Elevation On Feat...	Elevation On Feat...	Elevation Difference	Feature Type 1	Feature Type 2
899179.600, 51109...	920.111	921.005	0.894	Breakline	Breakline
899190.014, 51109...	920.128	919.855	0.273	Breakline	Breakline
899230.716, 51108...	915.566	914.773	0.793	Breakline	Breakline
899232.097, 51108...	915.248	914.660	0.588	Breakline	Breakline

Every record on this report represents a crossing of two Features. A Left-Click on any record will select that crossing and highlight the record in Blue (shown above). Both Elevations of the record also come into focus. Any elevation that is accompanied by a padlock symbol appears to indicate that feature was created by a Control Code template (very little functionality is available for these crossings). Simultaneously in the active Graphics Window, the line segments of both features will highlight in colors strategically synchronized to match the columns in the report.

The **Feature Types Pull-Down** controls which Feature Types are included in the report. All of the Feature Types are reported by default.

The **Zoom To** button will automatically Pan and Zoom the active Graphics Window to the location of the selected Crossing Features.

The **In View** button is a toggle that limits the report to only the Crossing Features that are currently visible in the active Graphics Window. When On, the report is dynamically linked to the view's extents.

The **Export...** button opens the Civil Report Browser of the current report. This browser offers all of the Bentley Reporting functionality.



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Address Crossing Features

Systematically review every *Crossing Feature* and determine an educated solution. Ignore all feature crossings that include Bridge related features, these features are excluded from the generation of the Terrain. A Right-Click on any *Crossing Feature Record* will present a Pop-Up menu with 7 possible options that may be used to address that particular conflict. The 7 options are:

1. Delete Feature 1
2. Delete Feature 2
3. Insert a Point into both Features at a defined Elevation
4. Insert a Point into both Features at an average Elevation
5. Insert point from Feature 1 into Feature 2
6. Insert point from Feature 2 into Feature 1
7. Automatically Fix Elevations

The Automatically Fix Elevations option is intended for non-production projects, please don't use that.

Be aware that some elements do not play well with these commands. For example, feature links that are generated with the **Close Link Code** are likely to fumble.

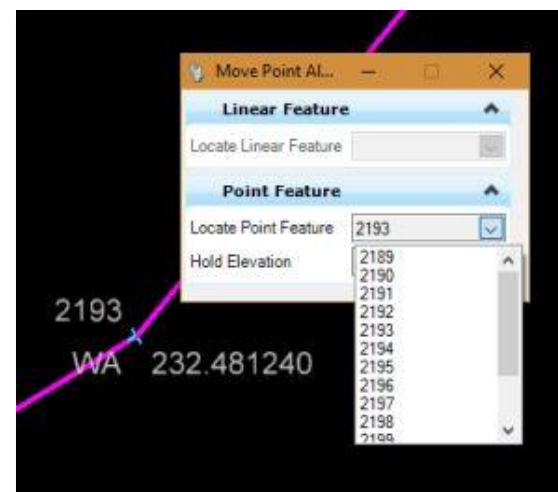
Not all situations are easily addressed by the above options. Additional editing tools are available by using the Element Selection tool on the feature to manipulate. Once the element is selected, hovering the pointer over it to display the *Context Sensitive* menu shown below. More information about the Context Sensitive menu is available in this [video](#).



Some crossing situations may involve two equally legitimate lines that accidentally intersect. In order to salvage both lines, one or part of them simply needs to be nudged a little bit. This is done by either moving the entire feature or just one of its points to a new (and common sense) physical position to eliminate an unintended crossing. Hopefully it is easy to identify which feature is in need of adjustment.

The third button of this menu (shown above with focus) issues the **Move Point Along Linear Element** command. This command allows one to slide a point along the line segment it once defined. The *Elevation* can be locked to its original value or may be linearly interpolated (or extrapolated) from the reference line segment.

The point can be selected from the dropdown menu of the Tool panel or by selecting the point from the active Graphics Window. Fortunately, any point on the drawing may





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have the *Survey Shot Number* shown on the display. Refer to [Decorations](#) for more detail about showing point numbers. If the point is on a selected string, then the *Link Code Manipulator* is added to the standard *Manipulators*.

The last button of this menu that is useful is the **Move Linear Feature** tool (eighth button from the left). Just identify a *Reference Data Point* and then the new location for that point. The whole feature displaces with this point.

Breaking Features apart is best accomplished by adjusting the *Link Codes* of the observations presented in the *Survey Details* window when viewing the *All Point Features* report.

Abandoning observations is best accomplished by deleting observations presented in the *Survey Details* window when viewing the *All Point Features* report. Adjust all the *Link Codes* for those features as necessary.

The best way to **Null** observations and keep their horizontal presence intact is to locate the observations on the *Survey Details* window when viewing the *All Point Features* report. From there, change the *Terrain Model Attribute* property of the point to **Do Not Include**.

Any edit made to a *Crossing Features* will dynamically update the *Terrain Crossing Features Report* and the *Graphics Window*. If the terrain model contours are displayed, they will update as well. Ideally, every feature crossing has a fix.

Final Review

Turn the Contours **ON**. Do a visual scan of the project drawing for contouring anomalies. What we are looking for is not obvious until we see it. Fix anything you find. For examples of manipulating the display of terrains to show contours or triangles, check out this [video](#).

In an effort to avoid repetitive deficiencies of the raw field data. Plan Preparation should communicate to the Chief of Surveys and Mapping any errors and omissions that are found in the field data so that it can be relayed to the Crew Chief of the Survey Crew assigned to the task.



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Creating Complex Terrain for Design Use

This process has two parts, the first will create a delta terrain file, this is a Null place holder terrain for future updates to the terrain model. The second will create a complex terrain, so if there are future updates to the survey, the design teams will not have to reset their active terrain.

Create Delta Terrain

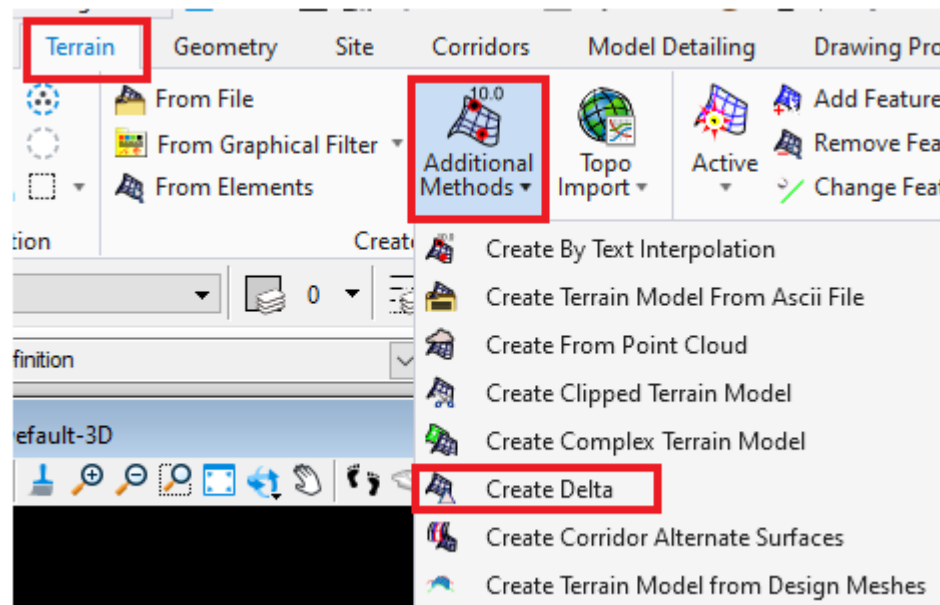
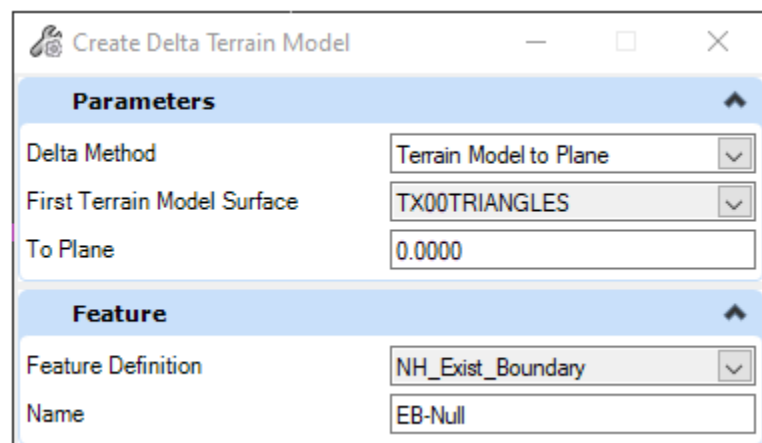
Create and open a new drawing **12345-E-Delta-Terrain.dgn** using the **NH_SeedORD_Design.dgn**. This file should be in the Survey folder. Set the *WorkFlow* to **OpenRoads Modeling**. From the *Home* ribbon, set the *Design File Model* to the *Default-3D* model.

Attach the **12345-survey.dgn** as a reference.

Now under the *Terrain* tab, select drop down *Additional Methods*, **Create Delta**

Once selected, set Delta Method – **Terrain Model to Plane**, To Plane – **0.000**, Feature Definition – **NH_Exist_Boundary**,

Name – **EB-Null** and following the prompts on your screen.



You can now **Save Settings**, then **Save** and exit the Drawing.



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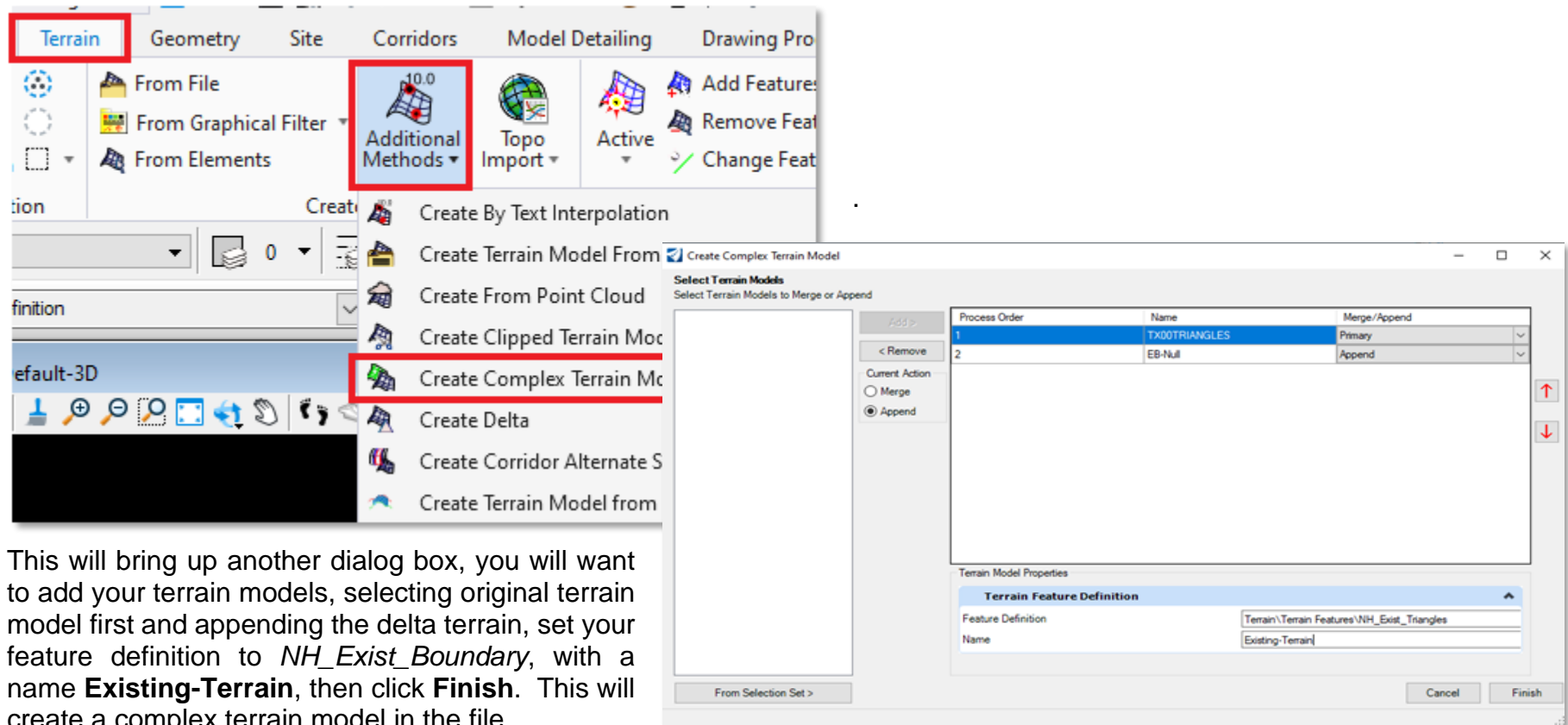
Create Complex Terrain from Delta and Survey

Open the drawing **12345-E-Terrain.dgn**. This file should be in the **Openroads** folder. Set the *WorkFlow* to *OpenRoads Modeling*. From the *Home* ribbon, set the *Design File Model* to the *Default-3D* model.

If a terrain model is already in the file check to see if it is a Complex terrain. Update it with the new survey terrain. If the complex has lidar then set the Survey terrain to *Merge* so it clips out the lidar triangles in the area. If it is not complex delete it.

Attach the **12345-survey.dgn** and **12345-E-Delta-Terrain.dgn** as a reference files.

Under the *Terrain* tab, select drop down *Additional Methods*, **Create Complex Terrain Model**.



This will bring up another dialog box, you will want to add your terrain models, selecting original terrain model first and appending the delta terrain, set your feature definition to *NH_Exist_Boundary*, with a name **Existing-Terrain**, then click **Finish**. This will create a complex terrain model in the file.