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OpenRoads
CONNECT Edition

ORD WORKFLOW

Title	Terrain Boundary Editing
Revision	Initial Release
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Overview	

This document provides guidance on editing terrain boundaries created from a Survey Field Book in OpenRoads Designer.

Terrain Boundary Editing Workflow

Overview:

This document describes a process for editing the edge triangles of a terrain, creating a graphical element of the resultant boundary, and importing the new graphical boundary into the terrain. This workflow can be implemented at any time prior to final delivery, but it is not necessary to create a terrain boundary with each processed topo file. Best practice is to create the boundary when you are nearing completion of the terrain.

Required:

- ORD (.dgn) 3D file with survey field book data and a terrain

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Workflow:

A. Deactivate Survey Processing Rules

1. Prep Data
    i. Modify features that you do not want to be triangulated.

    ii. Set Edge Method to "Max Edge Length" with a reasonable "Length" value to reduce the number of edge triangles that need to be removed. The "Length" value is dependent on the project and personal preference. This can be done through the pop-up display (shown here) or the Properties dialog.
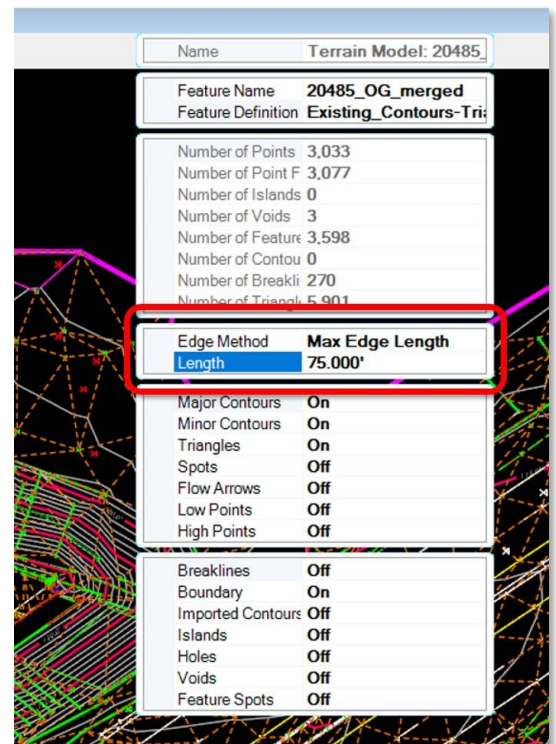
2. In the Survey Tab of the Explorer, go to the Survey Data dropdown and <R> right press on **Default**. Select **Deactivate Survey Processing Rules**.

NOTE: The Terrain cannot be edited when the survey processing rules are activated. When deactivated (locked), edits to the survey field book data will not take effect until the survey processing rules are reactivated. The only changes that should be made during this process are to the edge triangles of the terrain.
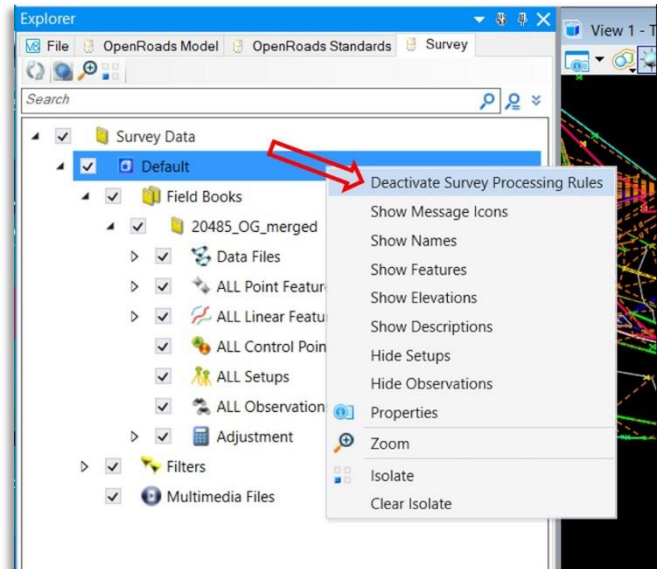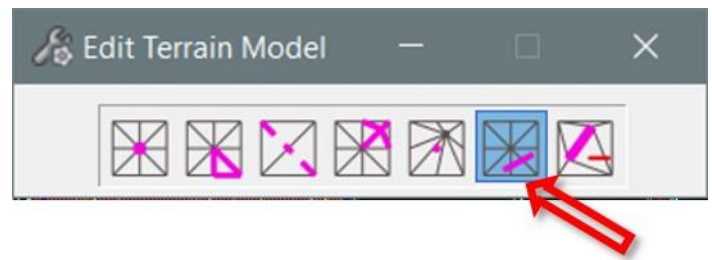
B. Edit Terrain Model Edge Triangles

1. **Survey > Terrain > Edit > Edit Model**.
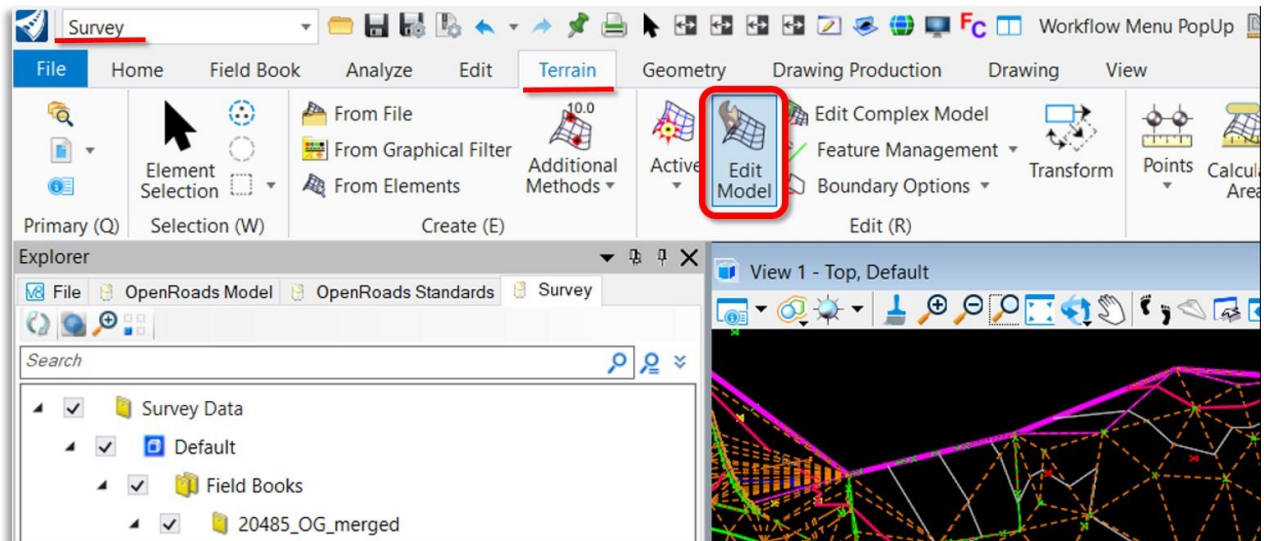
2. In the Edit Terrain Model toolbox, select **Delete Triangle by Line** (second button from the right)

    NOTE: The terrain features must be displayed. If they are not, turn them on now.

3. **<D>** data point on a terrain feature (triangles or contours work best), to select the terrain
4. Follow the prompts to delete edge triangles - **<D>** to start the deletion line and move mouse/line across the triangles to delete (you do not have to hold down the left mouse button) - **<D>** once and release > then move the mouse to drag the deletion line across the edge triangles)
    i. With the tool still active you can move/pan around the edge of the terrain deleting triangles
   ii. If you deactivate the tool, simply reactivate it and continue deleting triangles
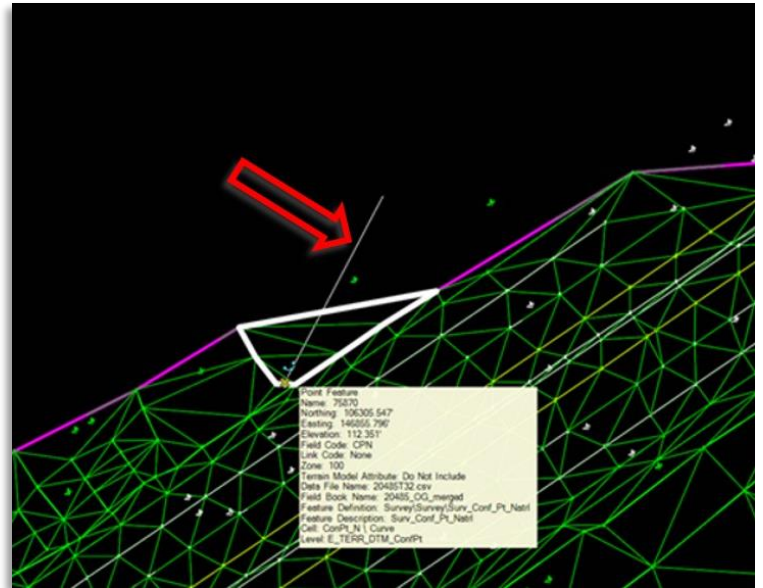
5. When finished deleting edge triangles, <R> to deactivate the edit terrain model tool

C. Create Graphic of Edited Terrain Boundary

1. In the Survey workflow > Terrain tab > Edit group > select the "Boundary Options" dropdown > "Add Boundary"
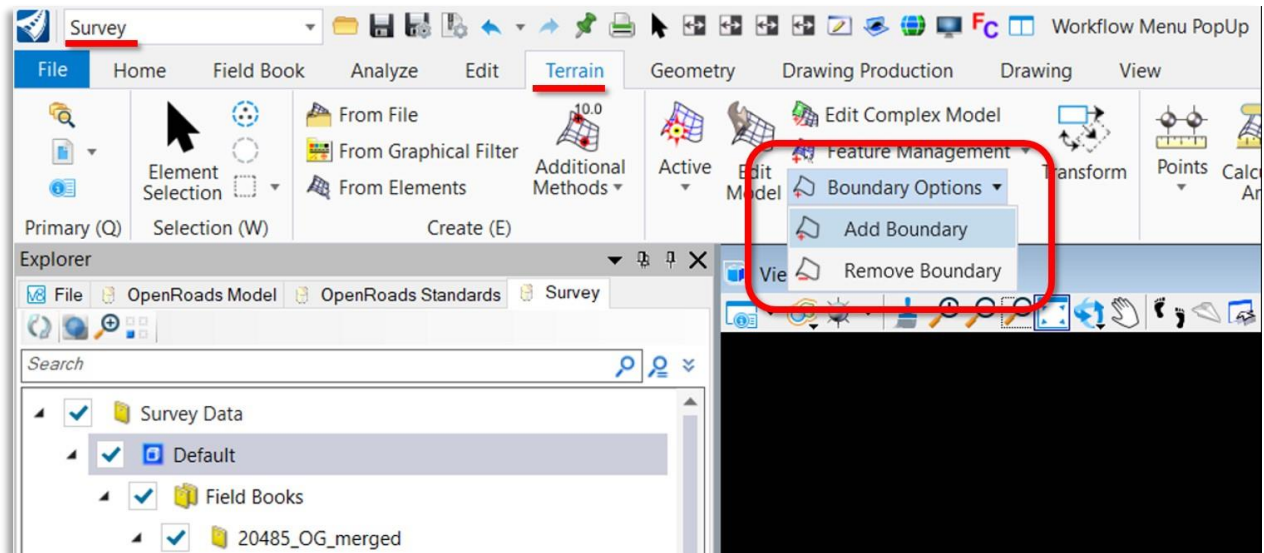

2. Follow the prompts to create a boundary graphic of the edited terrain triangles

   i. **<D>** on a terrain feature to locate the terrain
   ii. Method = **Extract Graphic**
   iii. Feature Definition = **Terr_Bndry_Ext_E**
   iv. **<D>** *or 'Enter'* to accept. Graphical boundary will be created with the standard exterior boundary attributes.
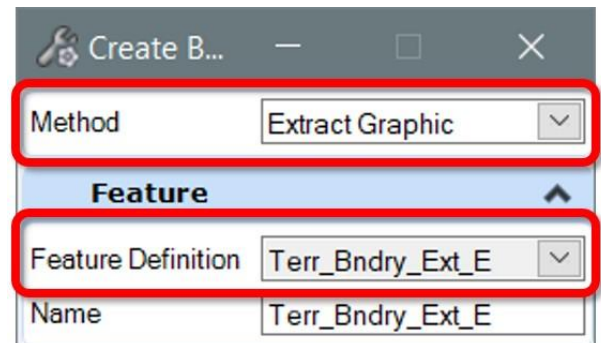
NOTE: A MicroStation graphic is extracted with the Feature Definition assigned. Since we chose Terr_Bndry_Ext_E it is on level E_TERR_BNDRY_ExtLine (see image below). This new graphic will be added to the terrain as a boundary feature; however, it is only a graphic at this point. It is not a feature in the terrain and does not control the triangles yet. If you do not have this line, you cannot proceed. Go back to C.1. and ensure you extract a graphic of the boundary.
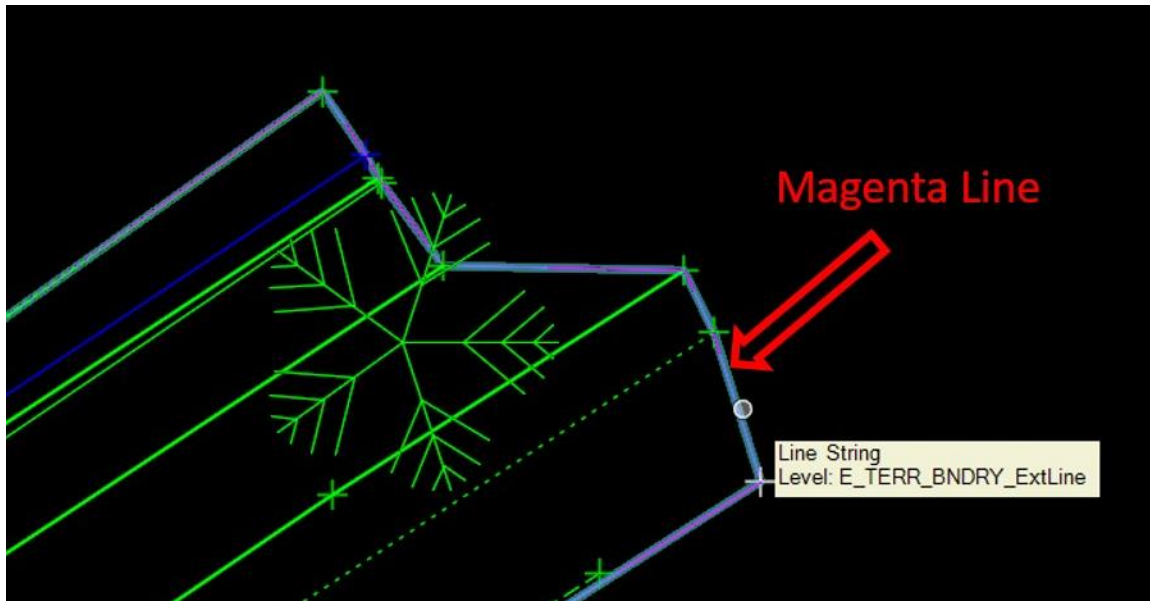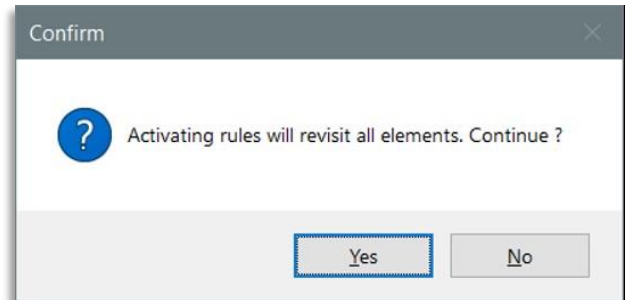

3. In the Explorer, Re-activate Survey Processing Rules by right-pressing on the Default heading in your Survey Data. Select **Activate Survey Processing Rules**.

NOTE: The original triangles will reappear since you have not yet assigned a boundary feature to the terrain.
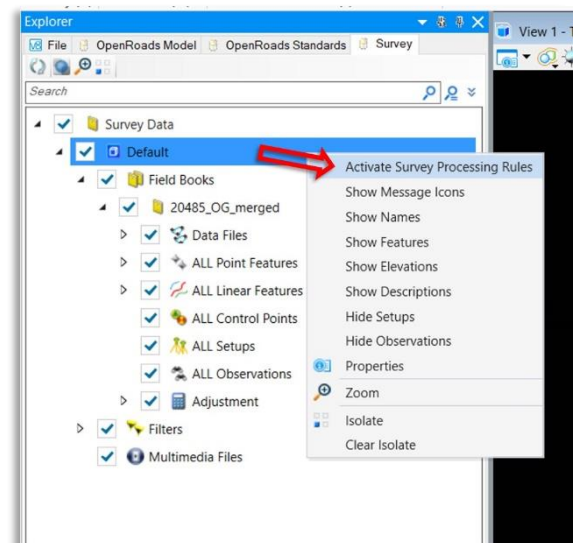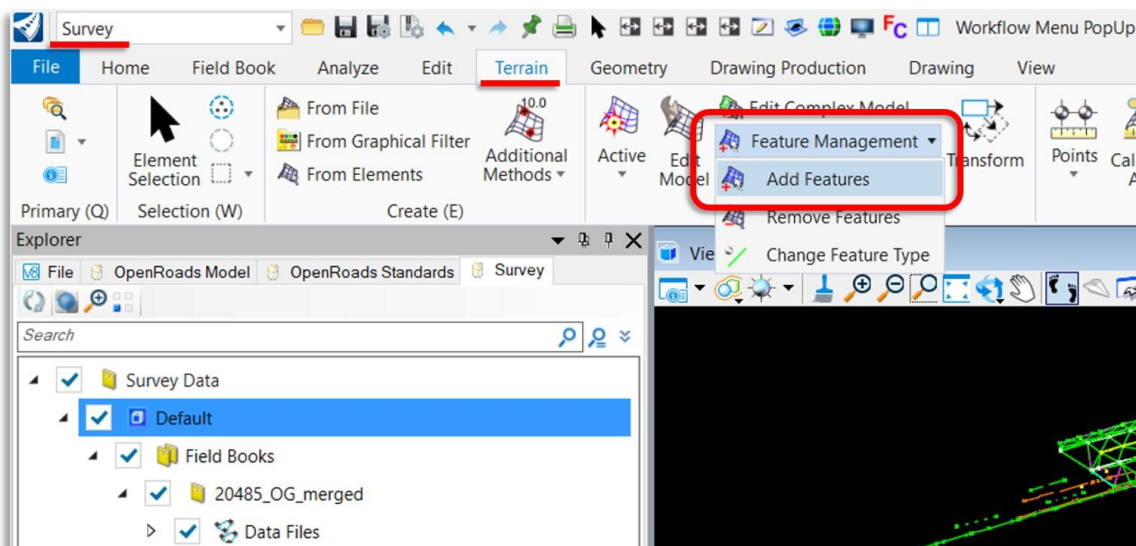
4. Select **Yes** to confirm the "revisit all elements" dialog.

D. Import Graphical Boundary into Terrain

1. **Survey > Terrain > Edit > Feature Management dropdown > Add Features**

NOTE: Feature Management allows the user to select a graphical element to use as a boundary. The Boundary Options dropdown (Add Boundary or Add Ruled Boundary) uses the current terrain triangles perimeter as is and sets that feature (the cyan line) as the terrain boundary.

2. Follow the prompts to add graphical boundary to terrain
    i. **<D>** on a terrain feature to select the terrain
    ii. **<D>** on the graphical boundary created in step C.2.
    iii. **<R>** to reset tool
    iv. Assign Feature Type as **Boundary**
    v. **<D>** to add boundary

NOTE: You should see the edge triangles match with the new graphical boundary added to the terrain. This is a graphical element that is a feature in the terrain and *NOT* in the survey field book. You can still make graphical modifications to the boundary and the triangles will update accordingly.

If you use the Import Features from Current Graphics option to import graphical elements into your survey field book, the graphical boundary element will be added to the survey field book data as a BX (exterior boundary - graphical element) and will function the same as being only in the terrain with relation to edits of the vertices graphically.

CAUTION: If you delete the survey field book BX feature, it will delete the graphical boundary and remove the boundary from the terrain. If you want to delete the BX from the survey field book, but keep a copy of the boundary graphic use the MicroStation Copy tool to make a graphical copy of the boundary, then delete the BX from the survey field book.

E. Adding Survey Data and Modifying Boundary

Often it is necessary to add new data and modify the exterior boundary. Since this is a graphical element the process will use the MicroStation modify tools.

    i.   Remove Boundary from Terrain **- Survey > Terrain > Edit > Feature Management dropdown > Remove Features**
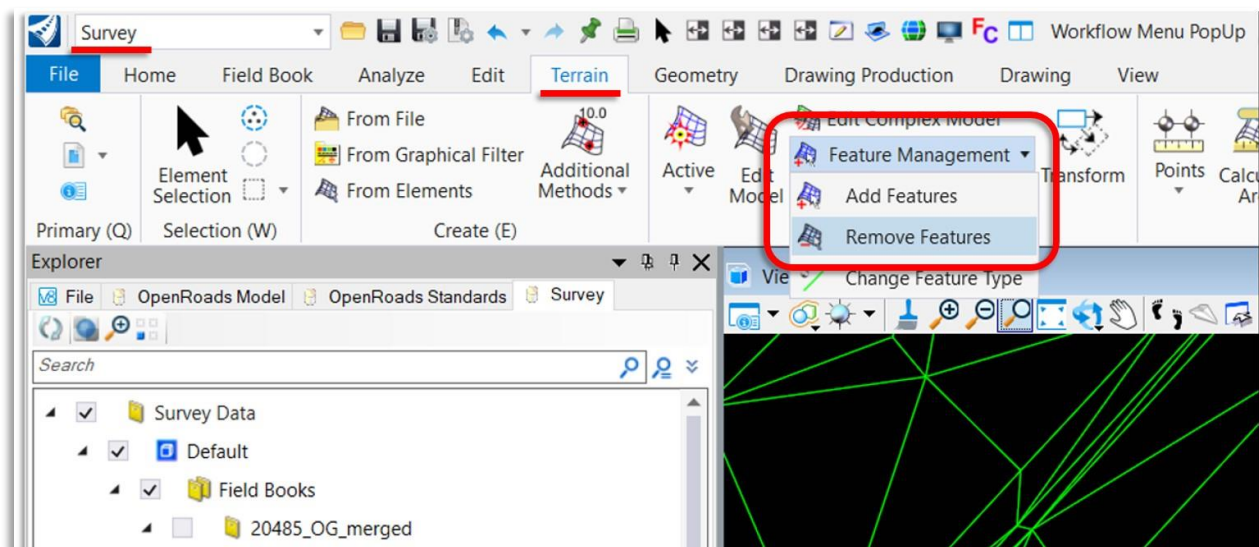

    ii.   Follow the prompts to remove the boundary from the terrain. The triangles will return to their original state.
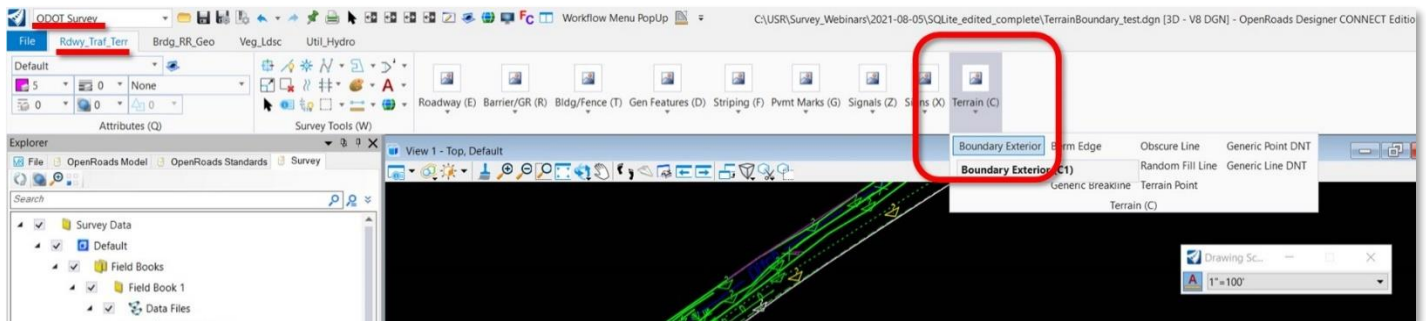
NOTE: The boundary graphic will remain even though the boundary is removed from the terrain.

**CAUTION: If you do not remove the boundary from the terrain and you break the boundary line you will get an error graphic display at the break point saying there is an "Open Terrain Boundary Feature Found" (see image to the right).
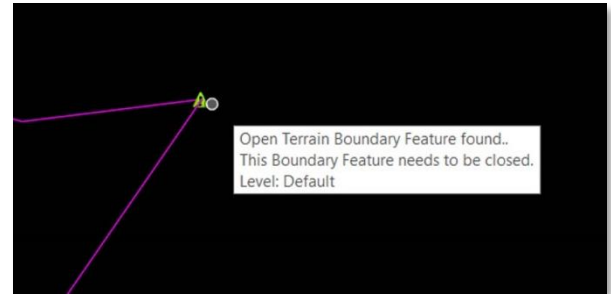

2. Import new survey data into field book (either from the field or point clouds)
   i. Make any edits to the newly added data
3. **ODOT Survey > Rdwy_Traf_Terr > Terrain dropdown > Boundary Exterior** - this sets the correct template for drawing the addition boundary line


4. Manually draw the location of the additional exterior boundary

NOTE: If you have a large amount of survey field book data that you are adding to the existing survey field book and terrain it may be more efficient to extract the boundary graphic of the additional topo data in a separate DGN and field book using steps A-D above. The separate DGN can be referenced to the working merged topo data DGN and the additional boundary graphic can be copied into the working merged topo data DGN. The two graphic boundaries can then be complexed together using MicroStation commands and added to the terrain as a boundary.

5. Break the existing graphical boundary where the two meet using the **Break Element** tool. **Break by Two Points** or **Break by Point** work best.
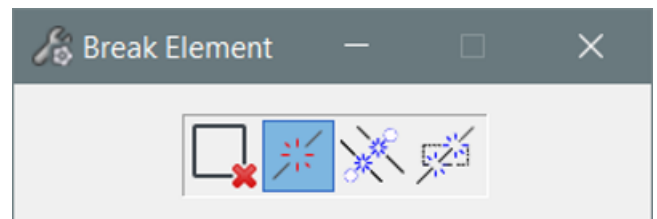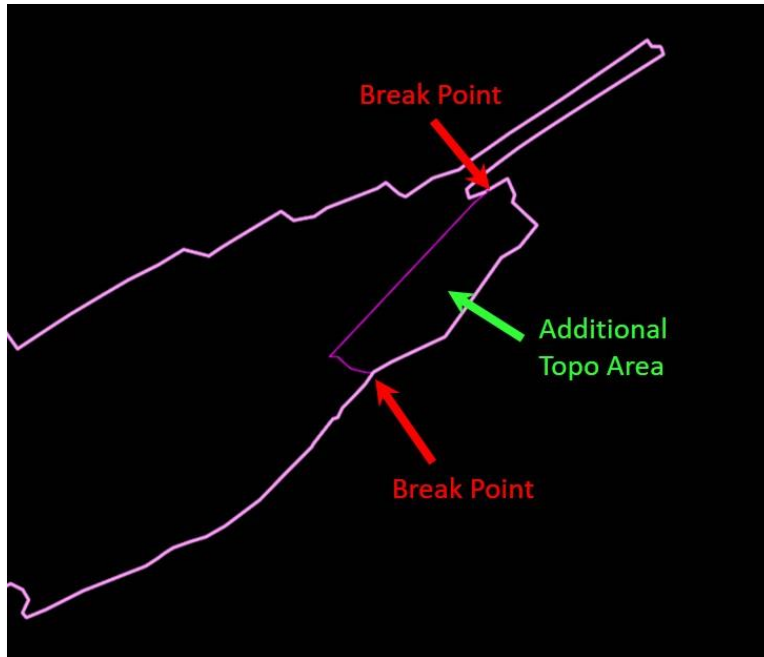
6. **Create a Complex Shape** of the existing graphical boundary and the new additional exterior boundary

7. If not already deleted, delete the remaining portion of the original graphical boundary
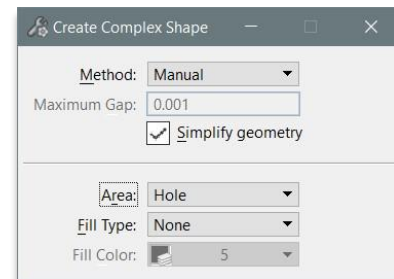
8. Add the new boundary graphic to the terrain, as discussed in **D.1** and **D.2**.

NOTE: If the boundary was added to the survey field book from graphics as a BX, it will be removed from the survey field book when you create the complex shape. It is not necessary to add it back to your survey field book, but if you do want it in your field book right click on the field book name > Import > "Features from Current Graphics." The boundary will be added back to the survey field book.

CAUTION: When you Import Features from Current Graphics it will import all graphical features in your model that are not in your field book and have a template assigned. If there are graphical features that you do not want to import you can **Right-Press on **All Linear Features** > **Add Graphic Linear Feature** and follow the prompts to add only the graphical exterior boundary. You will need to assign the correct field code and terrain model attribute to the feature for the boundary to take effect.

F. Additional Edits to the Terrain Boundary

When a boundary is added to the terrain, the terrain becomes ruled to that boundary and there are now two rules in effect:

- The survey field book processing rules
- The terrain boundary rule

To make edits to the terrain triangles after you have added a boundary, you must deactivate both the Terrain boundary rules and the Survey processing rules. If the terrain boundary rule is not deactivated the triangles will appear to delete using the edit model tools, but will reappear to match the ruled terrain boundary.

1. Remove the boundary from the terrain – **Survey > Terrain > Feature Management dropdown > Remove Features**. Follow the prompts to select the terrain boundary and remove the boundary from the terrain. The graphic of the boundary should remain.
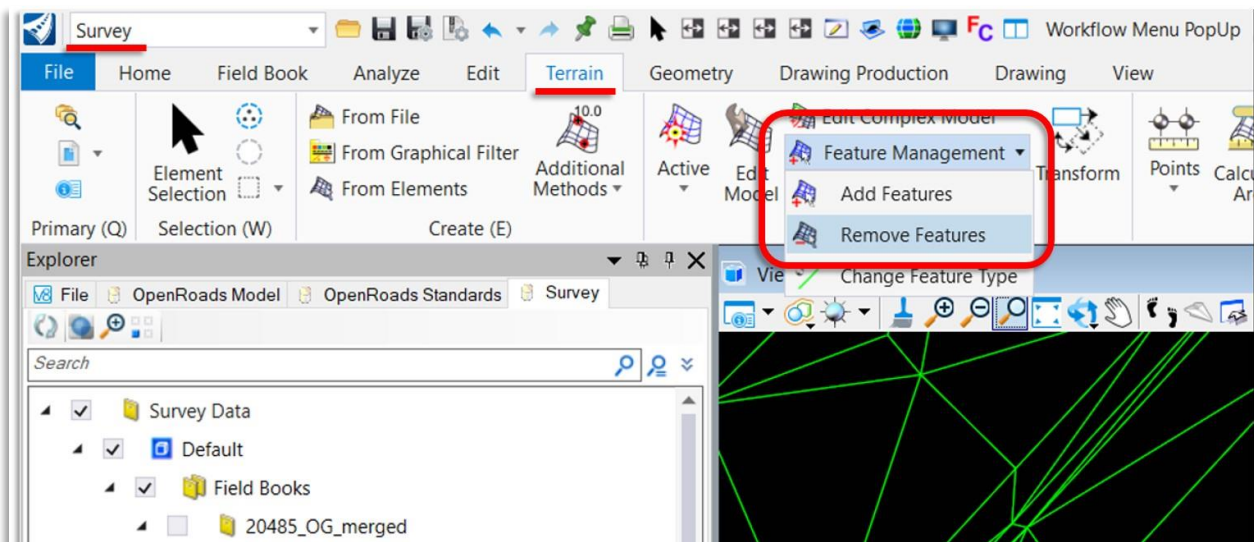
2. **Deactivate the Survey Processing Rules**, as explained in A.2.

3. In the OpenRoads Model Tab of the Explorer dialog, **right-press** on the **Terrain Models** dropdown select **Lock – Deactivate all Rules**.

NOTE: If the terrain model rules are not deactivated, you will not be able to delete edge triangles. This is the second rule that must be turned off.

4. Edit the edge triangles as needed using the method described in Section B.
5. Extract a new graphic of the boundary as described in steps C.1. to 2.
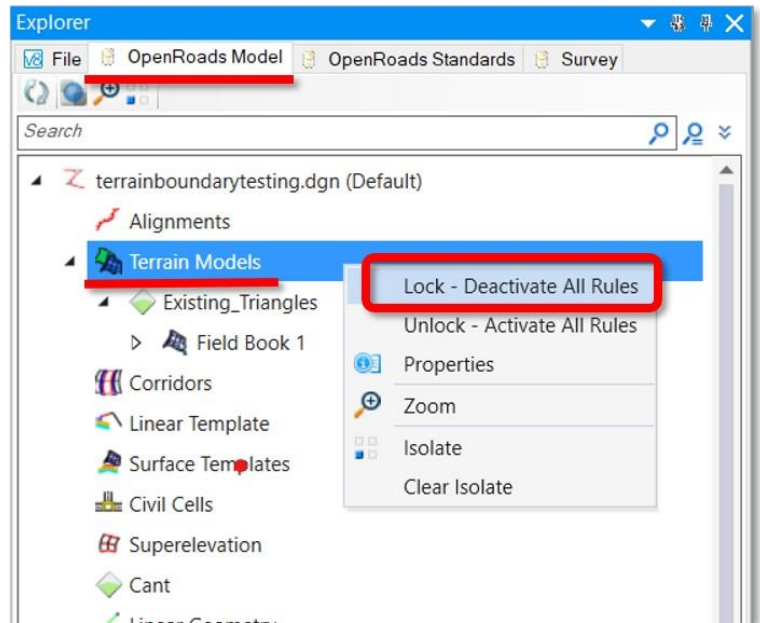
6. Two graphical features on the *E_Terr_BNDRY_ExtLine* level should be visible - the previous graphical boundary from your terrain that you removed and the new graphical boundary that you just created. The two need to be merged (unless you go around the edge of the entire project and edit all of the triangles again). Follow the steps in Section E. 5-7 to create a complex shape of the new boundary.

NOTE: Since there are two graphical features you will need to make four breaks to create the complex shape. When creating the new shape ensure you are selecting the correct boundary lines.
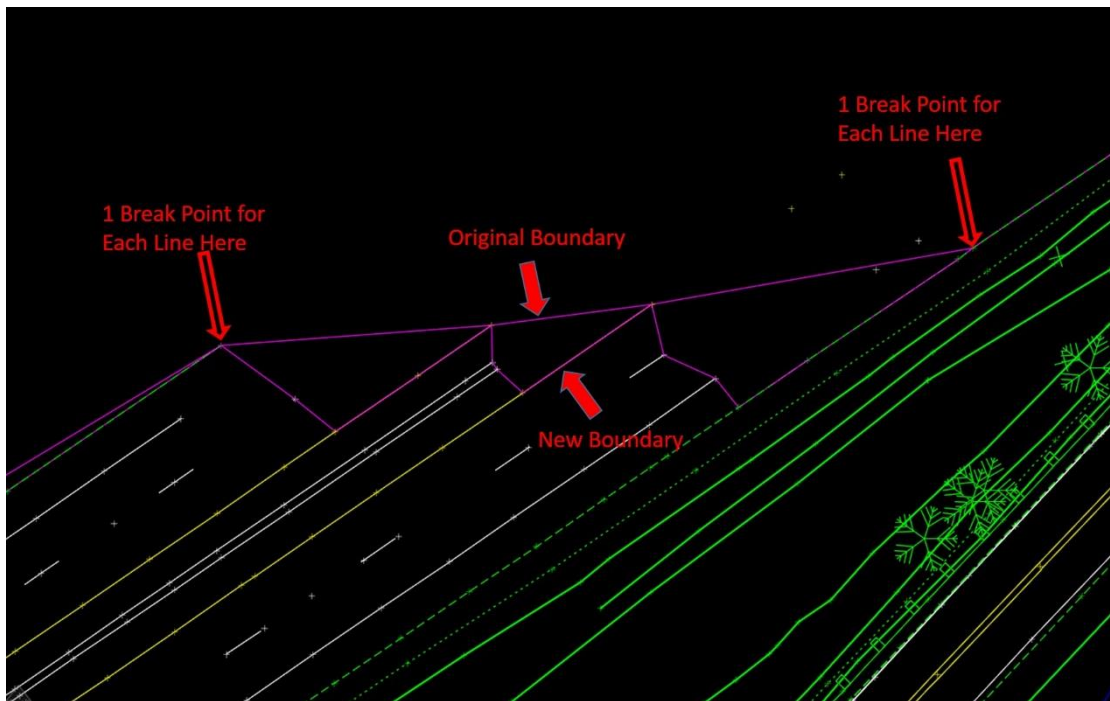
7. Activate the Rules on the Terrain Model – in the **Explorer Dialog > OpenRoads Model tab**, **right-press** on **Terrain Models > Unlock – Activate All Rules**
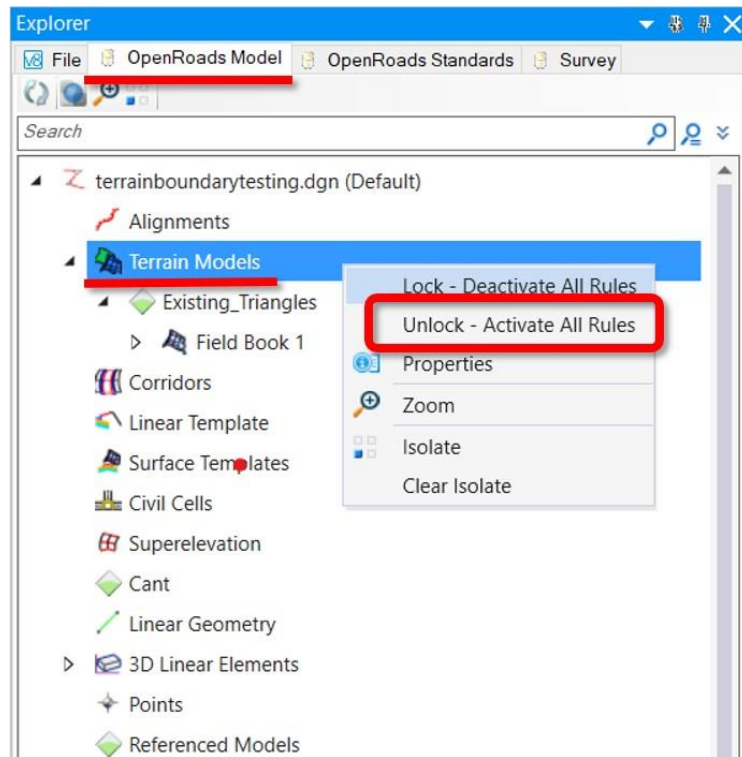
8. In the Explorer, **Activate the Survey Processing Rules** as described in Steps C.3-4
9. Add the updated exterior line to the terrain as a boundary as described in Steps D.1-2. The triangles should match your exterior boundary.