Proposed Terrain Creation

Proposed terrains in DGN format are created in both the Design phase (1_Design\Roadway) and the Construction phase (3_Construction\Construction_Engineering or Construction_Survey). Proposed terrains are often exported to surface LandXML format and stored in 1_Design\1_Milestone_Submissions\7_3D_Design, included in Ebids ZIP files, and also delivered as a Construction Survey handoff in 3_Construction\Deliverables.

On the Construction side, civil terrains may be created for quantity calculations with OpenX Designer using a DGN stored in 3_Construction\Construction_Engineering.

Five Methods to Create Terrains

The steps to create a terrain using five different methods are outlined below. Preparation, Analysis, and Editing should be performed when using any method of terrain creation from corridors. Tips and advice for good practices are also included.

Prepare

P1. Create a new file from a 3D seed to hold the terrain. (TERR_XXX-YY_pub)
P2. Attach a reference to the published corridor. (If attaching a CORR_bas_CF, use Live Nesting Depth=1)
P3. Fit the view.
P4. Optional and good practice – attach a reference to the Survey existing terrain and use Set As Active Terrain to create the 3D ***managed*** model. Adjust the level display to not display any levels from the existing terrain. *(The Terrain>Create commands all will create the 3D managed model if it has not already been created.)*

Choose one of the five methods of creating a terrain below.

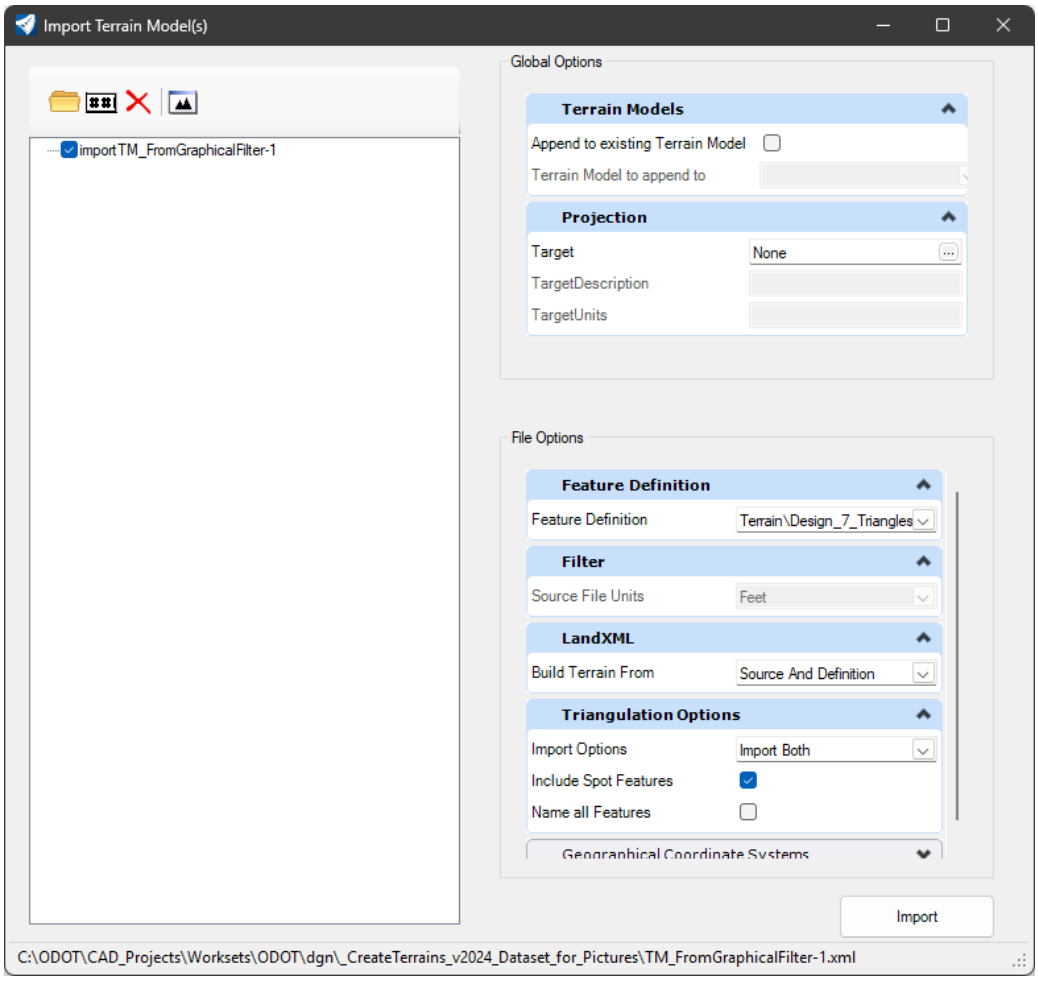
Terrain>Create

From **F**ile

Use [From File] to create DGN terrains from a surface LandXML file. This method is often used by Construction to create DGN terrains for progress quantity calculations. For this one method, it is not necessary to attach a reference to a corridor at all. However, if an original corridor is attached, the imported terrain can be easily and graphically compared to the original.

F1. After selecting [**From File**], navigate to the location of a surface LandXML file, select the file, and click [**Done**] to open the Import Terrain Model(s) dialog.
F2. Optional and good practice – On the Import Terrain Model(s) dialog, use the [**Rename Terrain Model**] button in the upper left corner to prepend the name of the terrain with Import.
F3. In the Import Terrain Model(s) dialog, File Options area - set a **Terrain Feature Definition**.
F4. Optional and good practice – set the LandXML Build Terrain From to **Source and Definition** *(this chooses which paragraphs in the LandXML file to load)* and set the

Triangulation Options to **Import Both** *(this specifies how to address the external triangles of the created Terrain Model)*.



F5. Click the [**Import**] button to create the terrain.

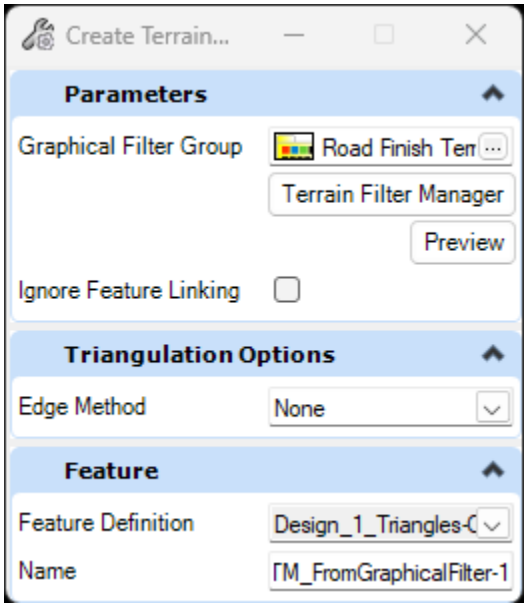
F6. Use the [**X**] in the upper right corner of the Import Terrain Model(s) dialog to close the dialog.

Analyze the results.

From Graphical Filter

Use [From Graphical Filter] to create DGN terrains from a referenced corridor file. One terrain will be constructed from all visible 3D elements in the active DGN and attached references that match the selected graphical filter group.

G1. After selecting [**From Graphical Filter**], select the **Road Finish Terrain** graphical filter group using the ellipsis button, assign a **Terrain Feature Definition**, and **Name** the terrain.



G2. Left click to accept the heads-up prompts. The terrain will be created, and the command will reset for another terrain after accepting "Datapoint to accept selection".

G3. <**Esc**> or choose Element Selection to exit the command.

Analyze the results.

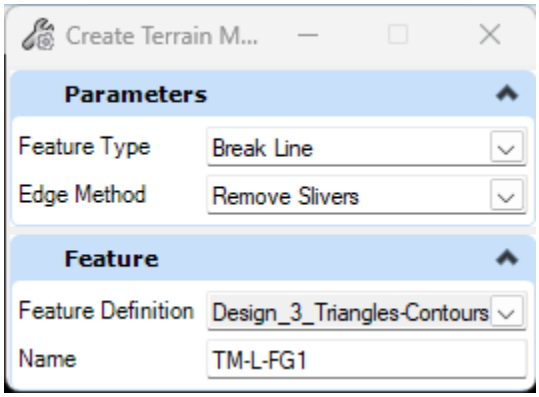
From Elements

E1. Adjust the level display

a. Toggle off all levels coming from the 2D model of the published corridor (Default)

b. Toggle off all levels except those that begin with "P_" coming from the Default-3D model, to display just the finish grade feature definitions.

E2. Select [**From Elements**]. Set the **Feature Type** to Break Line, **Edge Method** to Remove Slivers, set a **Feature Definition**, and **Name** the terrain.



E3. Use the mouse scroll wheel to adjust the view zoom level and select each displayed element, one by one; right click when done to complete the selection set.

Tip! - if elements don't allow you to select them, you may need to <**Esc**> and restart the [**From Elements**] command.

Tip! – it may be easier to pre-select all the elements by dragging a selection box before running the command. When the [**From Elements**] command is run with a selection set already formed, you are immediately invited to Datapoint to accept the selected elements.

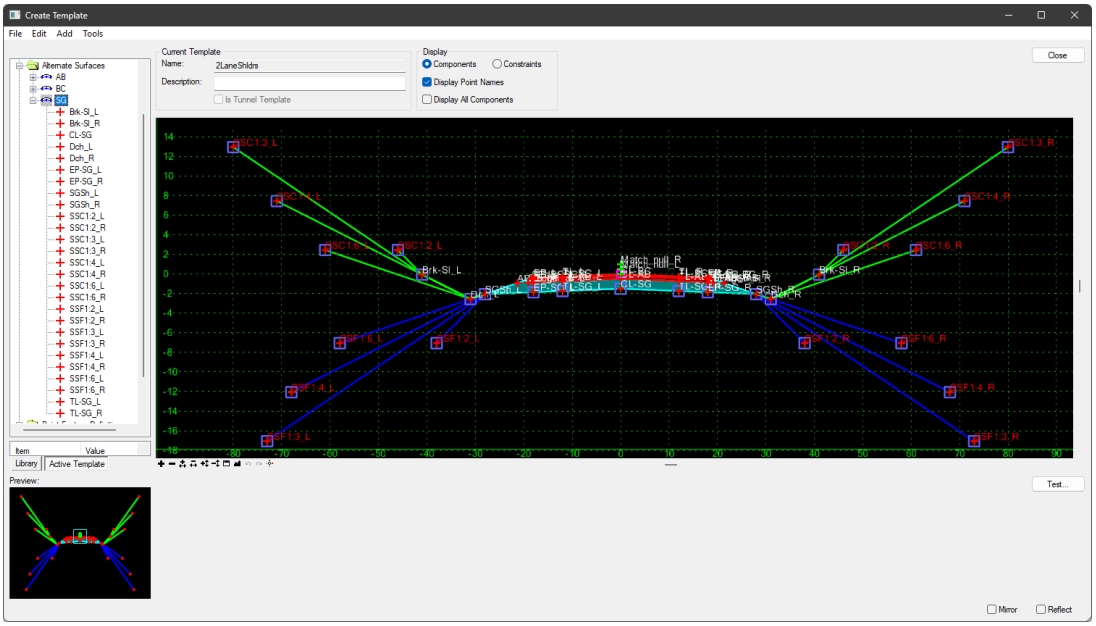
E4. Left click to accept the heads-up prompts. The terrain will be created.

Tip! - The [**From Elements**] command will move right into the Add Feature (Boundary) command – it is recommended to <**Esc**> out.

Analyze the results.

Create Corridor Alternate Surfaces

The multiple alternate surfaces that are defined in the templates used in the corridor may be created with one command – Create Corridor Alternate Surfaces. In ODOT's example corridor templates, the SG alternate surface includes all the points in the end conditions and the points at the bottom of the roadbed components (blue rectangle).



A1. Run Terrain>Create>Additional Methods>**Create Corridor Alternate Surfaces**.

A2. Select the corridor and terrains for all alternate surfaces will be created.

A3. Open the Explorer and expand the OpenRoads Model group. Expand the Terrain Models category and expand the **Not Featurized** terrain feature definition to see the names of the alternate proposed terrains.

A4. Good practice – delete the alternate terrains that do not correspond to the material layer of the DGN file name. For example, if creating SG, delete AB and BC.

A5. Good practice – Select the alternate terrain and assign a terrain feature definition in the Features group of the Properties dialog.

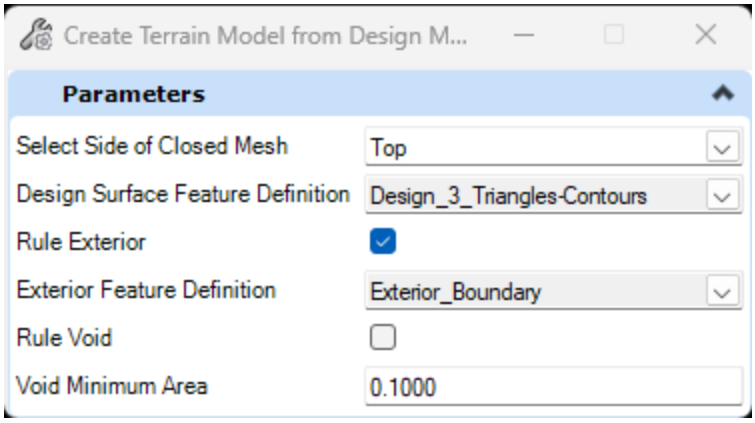
Analyze the results.

Create Terrain Model from Design Meshes

Terrains created from design meshes will not contain break lines as source data. When viewed in OpenRoads Designer, a terrain created from a design mesh will exactly match the

corridor when it is displayed with a terrain feature definition of “Final Top Mesh” or “Final Bottom Mesh”. Both the top and the bottom mesh will create a finish grade terrain and a subgrade terrain that extends out to the template catches.

M1. Run Terrain>Create>Additional Methods>**Create Terrain Model from Design Meshes**
M2. Select **Top** for FG or **Bottom** for SG. Set a Terrain **Feature Definition**.



M3. Optional and good practice – check the box to “Rule Exterior” and set a Linear>Miscellaneous>Exterior_Boundary feature definition. This will create a ruled boundary that can be exported.
M4. Left click to accept the heads-up prompts. The terrain will be created after accepting “Datapoint to accept selection”.

Analyze the results. The terrains are programmatically named TM-1, TM-2, and so on. You may change the Name of the terrain in the Properties.

Analyze the Terrain

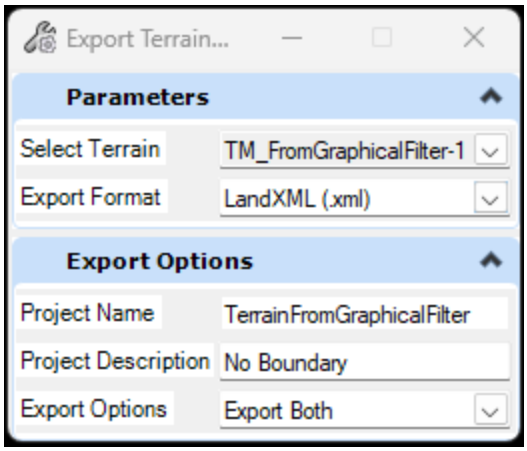
Use both methods listed here to analyze the resulting terrain.

Explorer

In the proposed terrain DGN, open the Explorer and the OpenRoads Model. Expand the Terrain Models category and the terrain feature definitions to see the names of the proposed terrains. Use the Properties dialog and the Feature group to change the name of a proposed terrain, if needed. Use the Level Display dialog to investigate the levels and to change the display of the boundary, triangles, and contours. The boundary of an attached published corridor can be displayed to compare to the boundary of the proposed terrain.

Export To File

1. After selecting [**Export To File**] from the Terrain>Miscellaneous group, select the terrain, select the export format of **LandXML (.xml)**.



2. Good practice – fill in the **Project Name** with specifics about how the terrain was created and use the **Project Description** field to document what is used for a boundary.
3. Optional and good practice – set the Export Options to **Both** to export both **Source** *(perimeter points, boundary (if added), and breaklines with corridor feature names and feature definitions)* and **Definition** *(the Triangulated* Description *Irregular Network – points and faces)* to the LandXML file.
4. Left click to accept the heads-up prompts. Navigate to a folder location and click [Save].
5. <**Esc**> or choose Element Selection to exit the command.
6. Open the LandXML file using Notepad ++ or import the LandXML file to create an "import" terrain to compare with the DGN terrain (be cautious - exports may be done at various stages.

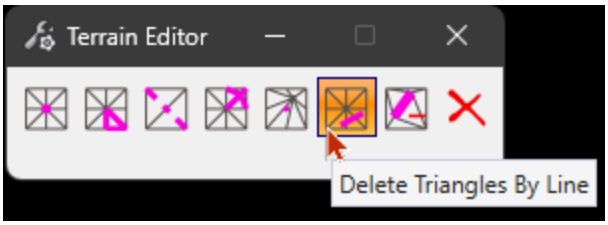
Editing the Terrain

Terrains created from corridors are ruled to the corridor, such that changes to the corridor will affect the terrain the next time the terrain file is edited. The rule to the source data for the terrain (corridor features or geometry features) can make it frustrating when trying to edit terrain boundaries. You may decide to remove the terrain rule (perhaps to save the resulting terrain at a particular phase) but recognize that removing the rule breaks the relationship between the source data and the terrain. It is recommended to add a boundary before exporting to a file. The Edit Terrain tools can be used when the method of creating the terrain provides no initial boundary.

Delete Triangles By Line

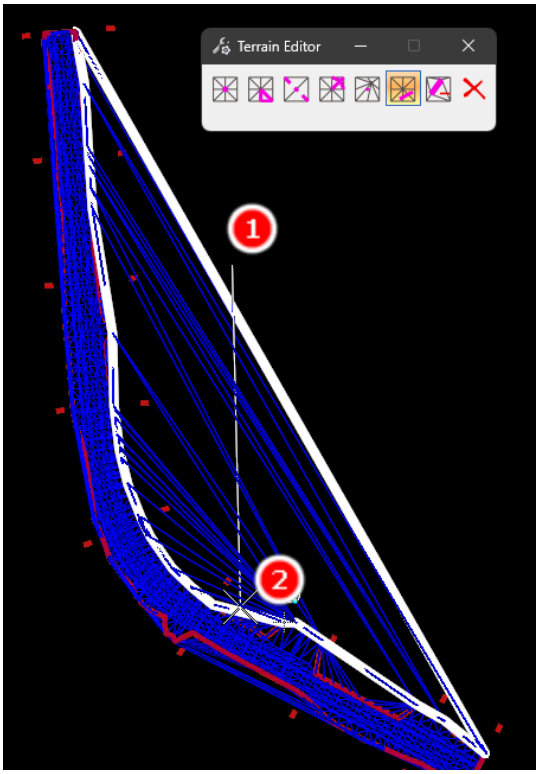
Use the [Delete Triangles By Line] command to modify the perimeter of the triangulation to begin with a graphic that more closely resembles the corridor boundary. The steps below show deleting many exterior triangles from a terrain created from elements with an Edge Method of None.

1. Run Terrain>Edit>**Edit Model**.
2. On the Terrain Editor tool settings dialog, click on the [**Delete Triangles by Line**] button. (this is to cause the perimeter of the terrain to better match the corridor boundary)



Tip! - Toggle on the D_CORR_Boundary level in the CORR_pub, Default model reference attachment.

3. Select the terrain by clicking on terrain graphics.
4. Place two points to draw a line that crosses triangles to be deleted as shown below.

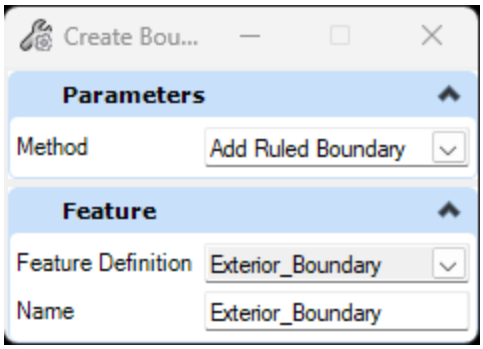


Tip! - Use the mouse scroll wheel to zoom in after placing the first point on the line to more accurately delete triangles outside the red corridor boundary.

Boundary Options>Add Boundary

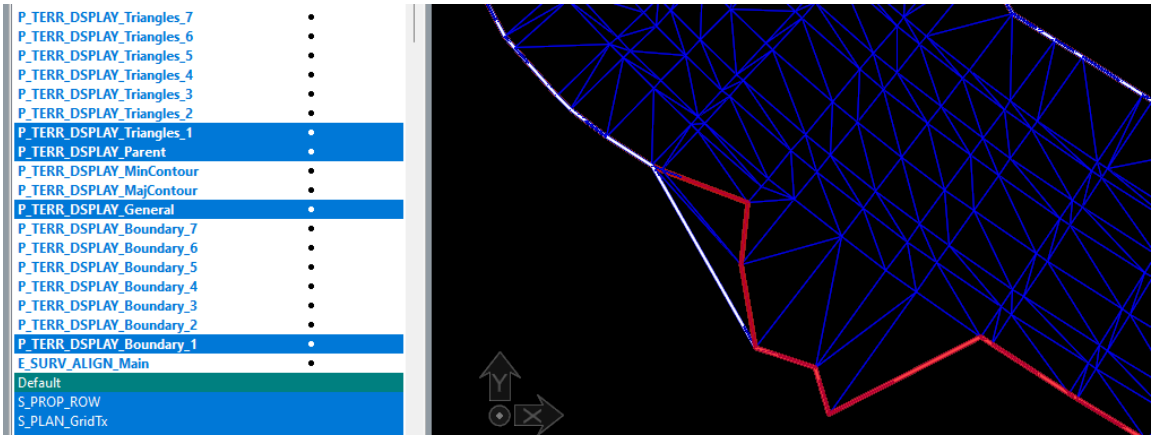
The [Add Boundary] choice of the Boundary Options executes the command: **Create Boundary From Terrain** with 3 methods: Extract Graphic, Add Boundary, or Add Ruled Boundary. Create Boundary From Terrain generates a simple graphical shape element of the terrain perimeter as it currently appears. The method Add Ruled Boundary is recommended.

1. Run Terrain>Edit>Boundary Options>**Add Boundary**.
2. On the Create Boundary From Terrain tool settings dialog, set the Method to **Add Ruled Boundary**, and set the Feature Definition to Linear\Miscellaneous**Exterior_Boundary**.



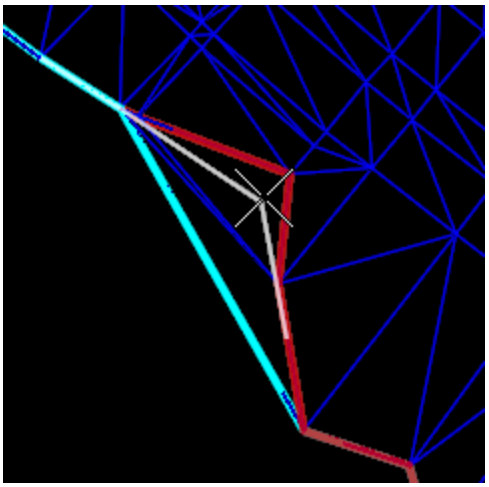
3. Select the terrain by clicking on terrain graphics, then left click to accept the heads-up prompt for the method.

A white-colored graphic shape of the perimeter is added to the file on the P_TERR_DSPLAY_General level. The shape is also added as the terrain boundary and the terrain is ruled to the shape.



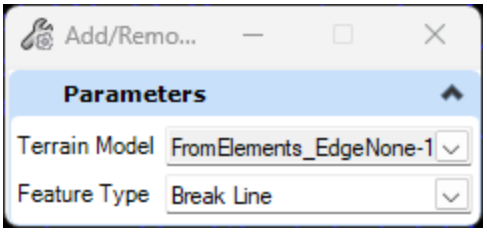
Modify a Ruled Boundary

A terrain boundary added as an actual feature definition, not just a triangulation edge method, is an editable shape. When it is selected, selection handles at each vertex may be moved and a vertex may be inserted and snapped to an outer edge triangle. The image below shows the mouse cursor 'X' on a new vertex of the white-colored ruled boundary during an Insert Vertex command.



Add Features

Use Terrain>Edit>Add Features to add other break lines to strengthen triangulation in areas of transition.



Tip! - Features can also be added that are adjacent to a terrain, just remember to modify the terrain boundary to surround additional features.