MDOT - Creating Model Line String and LandXML RID Files

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General Information

This document is intended to provide guidance for creating the model output Reference Information Documents (RID) deliverable for design projects created using the MDOT_02 Workspace. This process is required for any design model data necessary to convey the design intent during construction. The procedure is used to create the files listed below. A working knowledge of CADD, OpenRoads and design modeling are necessary to complete this process.

> RID files produced with this workflow:

- M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn

- M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn (*as necessary*)

- M-XXXXXX_LandXML_PrSurf_20YY-MM-DD.xml

- M-XXXXXX_LandXML_PrSubSurf_20YY-MM-DD.xml (*as necessary*)

- M-XXXXXX_LandXML_PrTriangle_20YY-MM-DD.xml

The following design data is required prior to completing this procedure:

- Completed design model for the proposed project

- The M-XXXXXX_PrCorridor_*Roadway*_20YY-MM-DD.dgn file(s) which is the 2D DGN file(s) containing the proposed 3D line strings to be included in the RID.

NOTES:

- See Chapter 3 of the Design Submittal Requirements for a detailed description of the above files.

- Line strings must not be merged into DGN files when creating terrain models from corridors.

- Only the line strings for the top surface *or* applicable subsurface should be visible or included in the selection set during the LandXML creation procedure.

- Both the LandXML files for the top surface and the proposed triangles come from the same line string data. The only difference between the files is how the surface data is converted to LandXML format and used in downstream processes.

- Terrain models and LandXML files should not cross gaps for structures or breaks in the design. Each portion of the gapped design requires a separate terrain model and LandXML file. Civil cells and connected side roads shorter than 200' should be included with the associated main line roadway.

- It is important to verify that the terrain model created from the line strings contains all the appropriate grade breaks and does not contain spikes.

Part 1: Proposed Terrain Model Creation

Option 1: Element Selection Method

Proposed Top Surface

A. Isolate the applicable top surface features in a M-XXXXXX_PrCorridor_*Roadway*_20YY-MM-DD.dgn file (in the Default 3D View) including any associated civil cells and side roads shorter than 200'. Either by manually turning off all the levels containing XS, RdBase and Bot~ in the name or by using the MDOT Sheet_View_Filters found on the MDOT Tools\Sheet Tools toolbar.
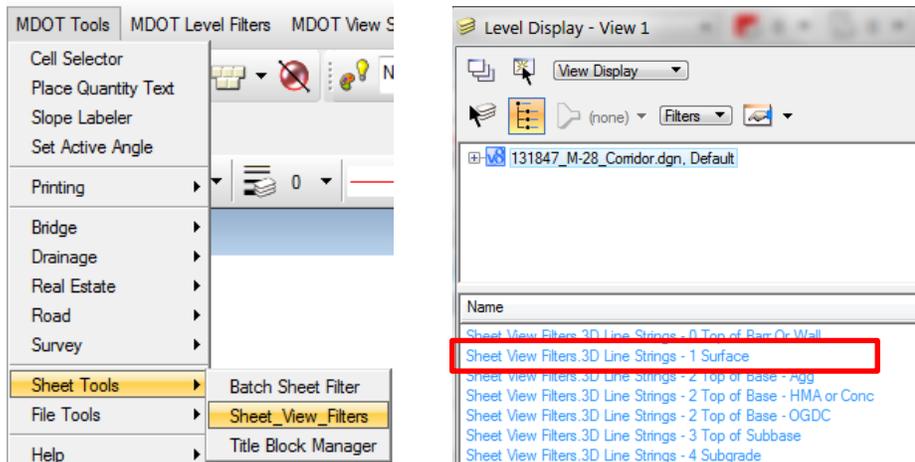
B. Select all the applicable top surface line string features and use the Create Terrain from Element command
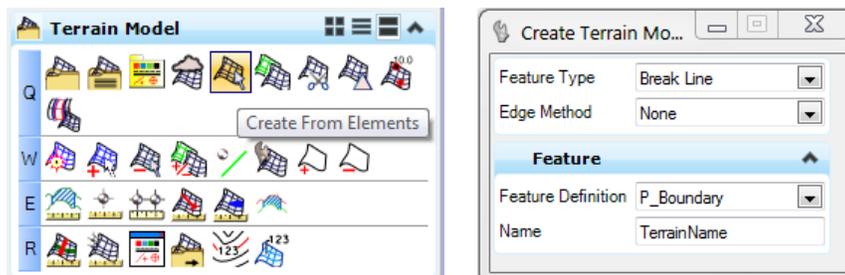
C. Assign the following:

- Feature Type: Break Line

- Edge Method: None

- Feature Definition: P_Boundary (or P_Triangles - from View to see triangles)

- Name: Assign a name for the terrain model that clearly identifies what it represents

D. Left Click through the command to complete the terrain model creation.

E. Cancel out of the command when you see the terrain model created in Project Explorer.

F. Repeat for each corridor model or proceed to **Part 2: LandXML Output.**

Proposed Subsurface

G. Isolate the applicable subsurface features in the M-XXXXXX_PrCorridor_*Roadway*_20YY-MM-DD.dgn file (in the Default 3D View) including any associated civil cells and side roads shorter than 200'. Either by manually turning off all the levels containing XS in the name and any level not representing the bottom features of the proposed grade or by using one the MDOT Sheet_View_Filters found on the MDOT Tools\Sheet Tools toolbar.
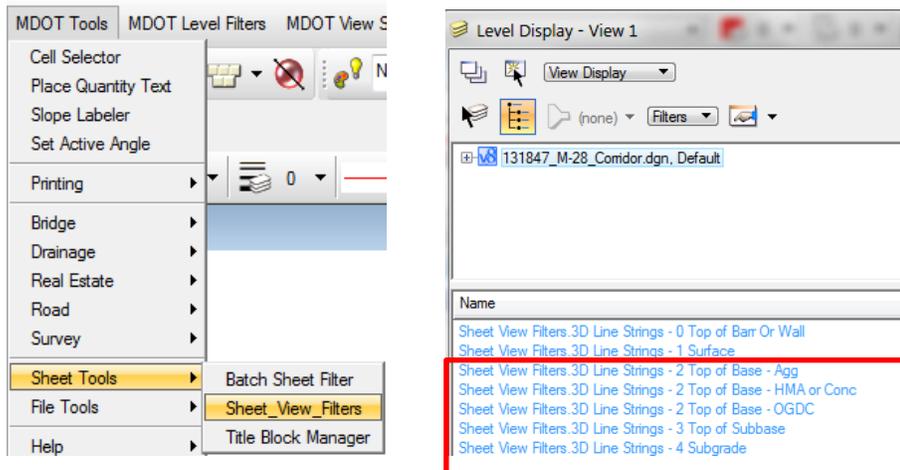
H. Verify that only the bottom most line string features are displayed. Vertical faces will not create an acceptable terrain model. Each X,Y location can only have one associated Z value.

I. Select all the subsurface features and use the Create Terrain from Element command
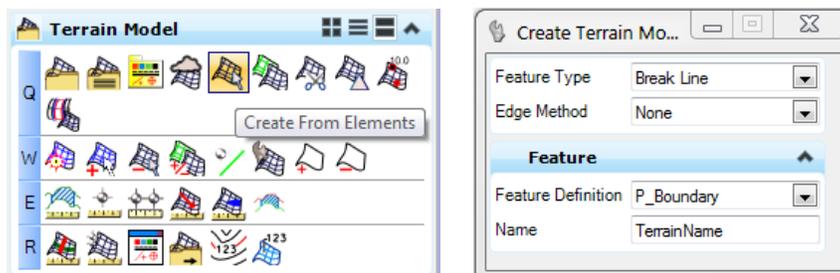
J. Assign the following:

- Feature Type: Break Line

- Edge Method: None

- Feature Definition: P_Boundary (or P_Triangles - from View to see triangles)

- Name: Assign a name for the terrain model that clearly identifies what it represents

K. Left Click through the command to complete the terrain model creation.

L. Cancel out of the command when you see the terrain model created in Project Explorer.

M. Repeat for each corridor model or proceed to **Part 2: LandXML Output.**

Option 2: Terrain from Filter Method

Proposed Top Surface

NOTE: This method is only applicable for line string DGN files containing model data with no gaps.

A. In the M-XXXXXX_PrCorridor_*Roadway*_20YY-MM-DD.dgn select the Create Terrain Model By Graphical Filter tool (in the Default 3D View).
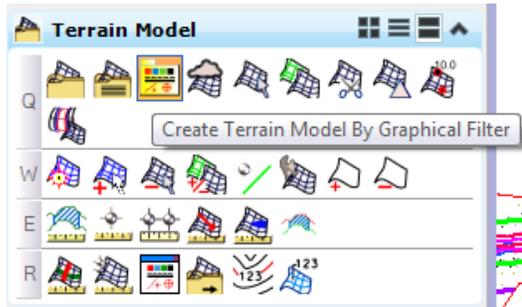
B. Use the "…" button to select the Pr – 1 Top of Surface filter
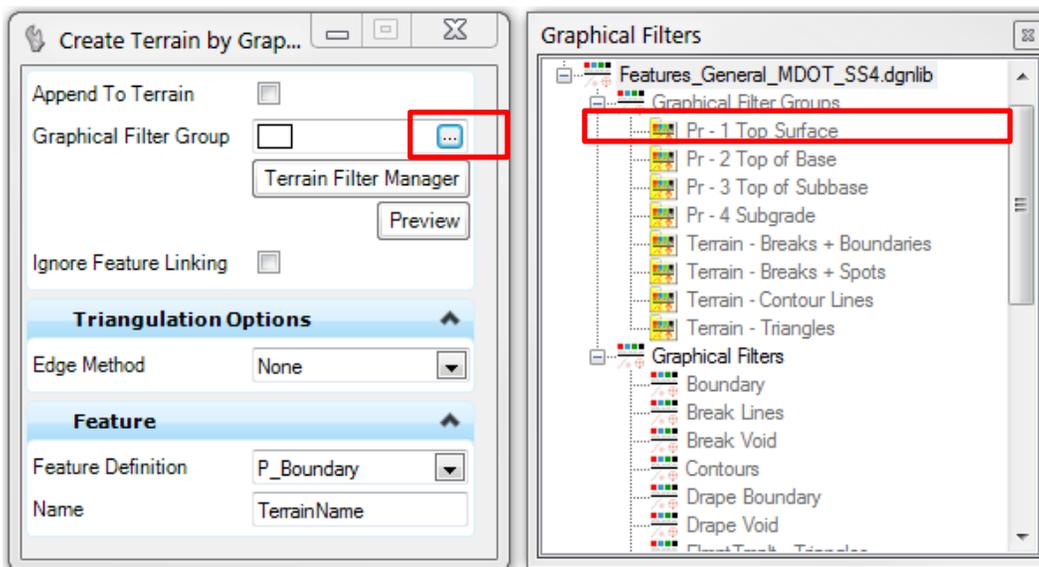
C. Assign the following:

- Edge Method: None

- Feature Definition: P_Boundary (or P_Triangles - from View to see triangles)

- Name: Assign a name for the terrain model that clearly identifies what it represents

D. Left Click through the command to complete the terrain model creation

E. Repeat for each corridor or proceed to **Part 2: LandXML Output.**

NOTE: This option is not recommended for the proposed subsurface terrain creation. See **Option 1: Proposed Subsurface**.

Part 2: LandXML Output

NOTE: LandXML files of triangles and line strings must not cross gaps for structures or areas where proposed surface features are not present in the proposed model DGN files. Create separate LandXML files for each corridor or design model of the proposed project. Civil cells and connected side roads shorter than 200' should be included with the associated main line roadway.

Top Surface Output Data

1. In any M-XXXXXX_PrCorridor_*Roadway*_20YY-MM-DD.dgn file containing a terrain model select Export Terrain Model and select LandXML
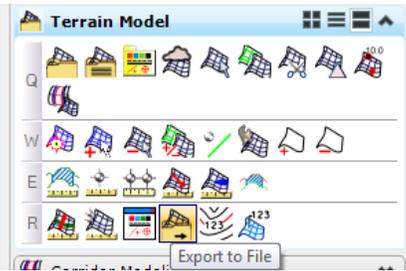
2. Select the top surface terrain model and assign the following:

- Select Terrain: Left Click on the top surface terrain model to select it or use the pull-down menu to select the top surface terrain model

- Export Format: LandXML (.xml)

- Project Name: Output_PrSurf_*Roadway*_20YY-MM-DD

- Project Description: Provide a brief description of the project

- Export Options: Export Features Only
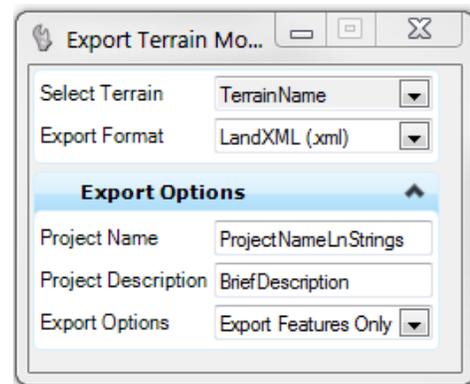
3. Left Click through the prompts to create the Output_PrSurf_*Roadway*_20YY-MM-DD.xml LandXML file.

4. Repeat for all project corridor models.

NOTE: The Roadway specific output LandXML files are not included in the RID submittal files. They are used as a necessary first step in the production of 3D line string and submittal LandXML files to retain some of the design feature intelligence for consumption by downstream users.

SubSurface Output Data

> NOTE: Subsurface LandXML files are only required when the subsurface is not a consistent vertical offset from the proposed top surface such as when the subgrade does not follow the top surface superelevation.

5. Repeat Steps 1 thru 3 selecting the subsurface terrain model and assign the following:

    - Select Terrain: Left Click on the subsurface terrain to select it or use the pull-down menu to select the subsurface terrain model

    - Export Format: LandXML (.xml)

    - Project Name: Output_PrSubSurf_*Roadway*_20YY-MM-DD

    - Project Description: Provide a brief description of the project

    - Export Options: Export Features Only
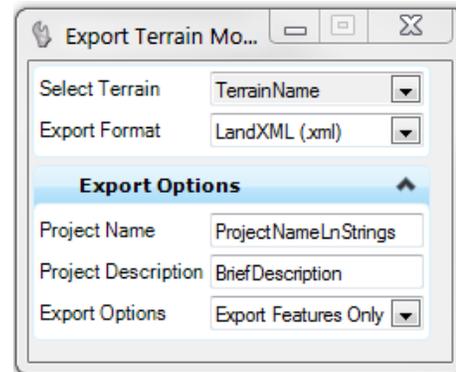
6. Left Click through the prompts to create the Output_PrSubSurf_*Roadway*_20YY-MM-DD.xml LandXML file.

7. Repeat for all project corridor models where subsurface models are required.

> NOTE: The Roadway specific output LandXML files are not included in the RID submittal files. They are used as a necessary first step in the production of 3D line string and submittal LandXML files to retain some of the design feature intelligence for consumption by downstream users.

Part 3: Proposed Line String File Creation

Top Surface DGN file

8. Create the M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn file using the appropriate 3D seed file. *This file is included in the RID submittal*.

9. Import each Output_PrSurf_*Roadway*_20YY-MM-DD.xml LandXML file using the Create from File tool.
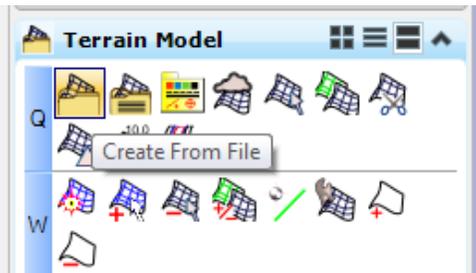
10. Import the features only, do not use an edge method nor append the data together. If a LandXML output file was made correctly, the Geographical Coordinates shown should match the project coordinate system. Review the following dialog:
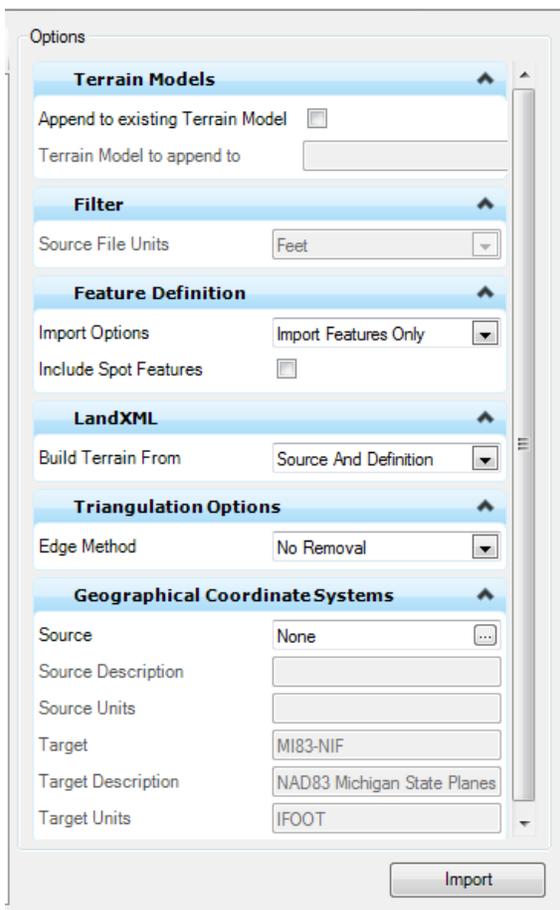
11. Select Import to add the features to the DGN file.

12. Repeat this process for all project LandXML output files representing the proposed top surface of the project.

13. Clean up the line strings removing any tiny segments that overlap other line strings. This is common where civil cells have been used to cut a corridor model.

14. Remove any line strings that overlap. Any location can only have a single line string representing that XYZ location.

15. Verify that all the grade breaks, civil cell break lines and required top surface features are included in the imported data. If features are missing delete the incorrect terrain model data and repeat the process until the imported line strings are correct.

SubSurface DGN file

16. When applicable, create the M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn file using the appropriate 3D seed file. *This file is included in the RID submittal if subsurface data is required*.

17. Import each Output_PrSubSurf_*Roadway*_20YY-MM-DD.xml LandXML file using the Create from File tool.
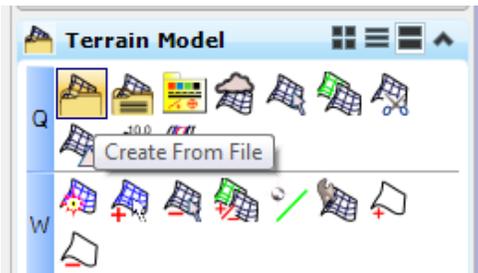
18. Import the features only, do not use an edge method nor append the data together as indicated in Step **10** of **Part 3: Top Surface DGN file.**

19. Repeat Part 3: Steps 11 - 14 for the subsurface data.

20. Verify that all the grade breaks, civil cell break lines and required subsurface features are included in the imported data. If features are missing delete the incorrect terrain model data and repeat the process until the imported line strings are correct.

Part 4: Final Terrain Model Creation

Top Surface Model

21. Create a terrain model from the imported line string data in the M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn file using one of the methods described in **Part 1: Proposed Terrain Model Creation.**

    NOTE: For projects with gaps in the line string data, create the individual terrain models in the line string file as shown below using **Part 1: Option 1: Element Selection Method.** When more than one terrain model exists in the same DGN file it is helpful to name terrain models in such a way as to clearly indicate what they represent.

Gap in the Design

Terrain Model 1   Terrain Model 2
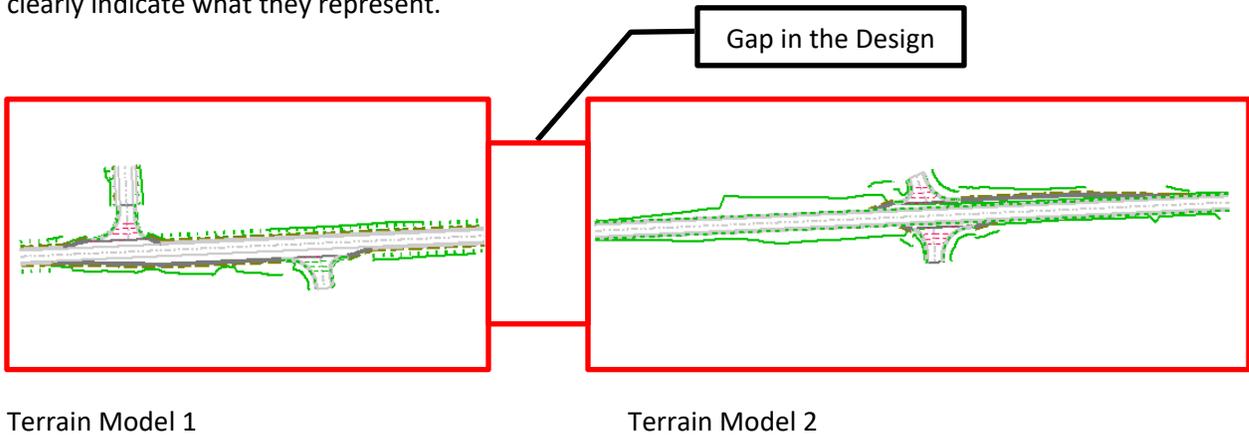
22. Verify each portion of the 3D line string DGN file is represented in a terrain model. 3D line strings are not typically included in more than one terrain model.

23. Verify that there are no spikes or irregularities in the terrain model by viewing the data from multiple directions. This is best done by using the P_Triangle – From View terrain model feature definition instead of the P_Boundary feature definition.

SubSurface Model

24. Create a terrain model from the imported subsurface line string data in the M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn file using the method described in **Part 1: Proposed Terrain Model Creation.**

    NOTE: For projects with gaps in the line string data, create the individual terrain models in the line string file as shown above using **Part 1 Option 1: Element Selection Method.** When more than one terrain model exists in the same DGN file it is helpful to name terrain models in such a way as to clearly indicate what they represent.

25. Verify each portion of the 3D line string DGN file is represented in a terrain model. 3D line strings are not typically included in more than one terrain model.

26. Verify that there are no spikes or irregularities in the terrain models by viewing the data from multiple directions. This is best done by using the P_Triangle – From View terrain model feature definition instead of the P_Boundary feature definition.

Part 5: Terrain Boundary Creation

NOTE: This process is repeated for each terrain model in the M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn and the M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn prior to conversion to LandXML. LandXML files of terrain models created without terrain boundary features are not usable by downstream users.

27. Select any terrain model and select the Lock – Deactivate the Rules from the context sensitive menu


28. Select Edit Terrain Model to clean up any excess exterior triangles
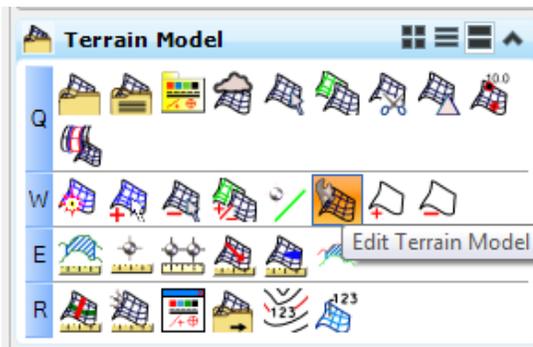
29. Select Delete Triangle By Line
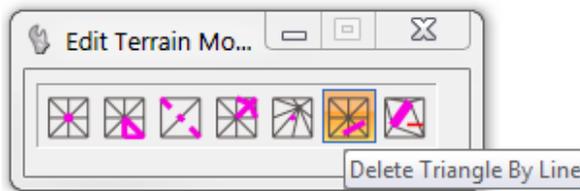
30. Select the terrain model and remove any unnecessary triangles by drawing a line over the areas
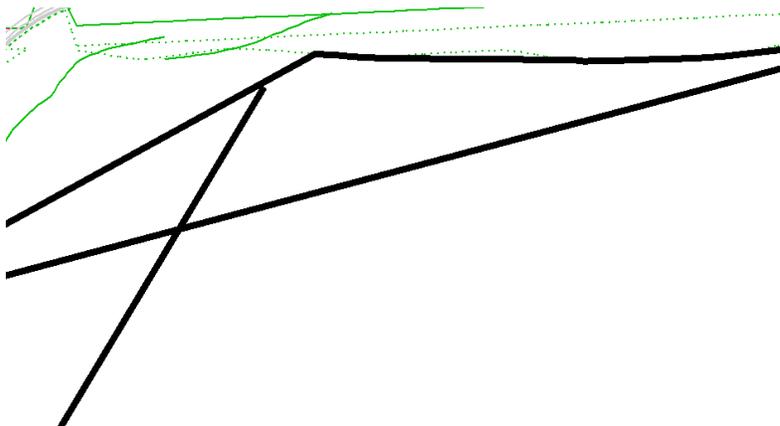
NOTE: It is not recommended to remove interior triangles with this method. Triangle deletion automatically stops when it reaches an included surface feature.

31. Once all the triangle cleanup is complete select Create Terrain Model Boundary
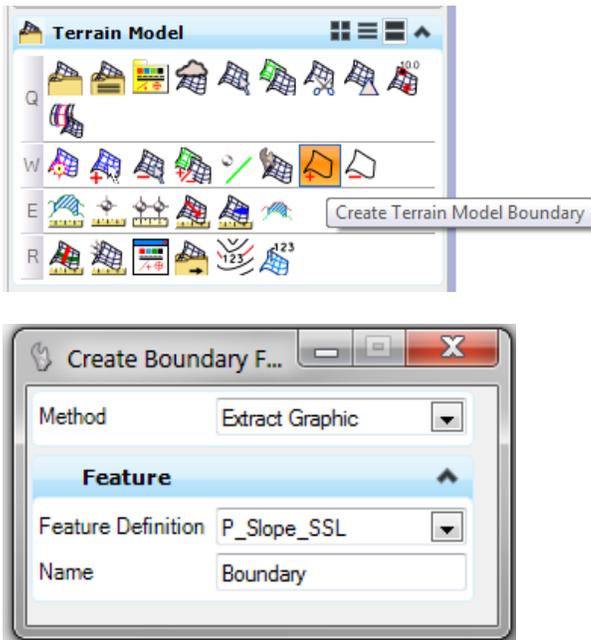
32. Enter the following:

- Method: Extract Graphic

- Feature Definition: P_Slope_SSL (for use a slope stake line or P_Corridor_Bndry_ClipLine~)

- Name: Name the boundary clearly when creating more than one terrain in the same DGN file

33. Select the terrain model and Left Click through the prompts to complete the command

34. Cancel out of the command.

    NOTE: There are three Methods for adding a boundary to the terrain model. They apply as follows:

    - Extract Graphics – Will extract the current limits of the triangulation and produce an editable 3D line String in the DGN file which must be added to the terrain model prior to exporting to LandXML. (Recommended)

    - Add Boundary – Extracts the current limits of the terrain model and adds it to the terrain model as a boundary. This boundary cannot be viewed nor edited.

    - Add Ruled Boundary – Will extract the current limits of the triangulation and create an editable ruled draped boundary to the terrain model based on the current triangulation which must be added to the terrain model prior to exporting to LandXML. Editing or replacing this boundary has proven difficult.

35. Add the new boundary to the terrain model by selecting Add Features
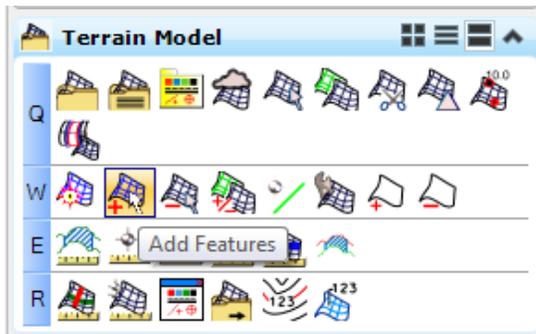
36. Change the feature type to Boundary
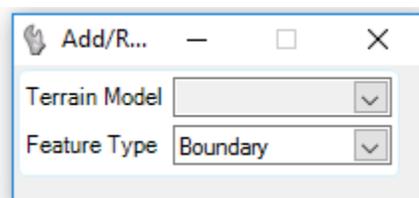
37. Follow the prompts by selecting the terrain model and the extracted boundary feature

38. Cancel out of the command once the boundary is applied to the terrain model. This can be noted by the shape of the terrain model and by viewing the triangles.

39. Verify that there are no spikes or irregularities in the terrain models by viewing the data from multiple directions. This is best done by using the P_Triangle – From View terrain model feature definition instead of the P_Boundary feature definition.

Part 6: Final LandXML File Creation

Files created in this section are included in the RID submittal.

Top Surface LandXML Data

40. Export each top surface terrain model contained in the M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn to LandXML format as shown in **Part 2: Top Surface Output Data.**

    a. Name the LandXML file M-XXXXXX_LandXML_PrSurf_20YY-MM-DD.XML if only one terrain model was created for the project.

    b. Name the LandXML files M-XXXXXX_LandXML_PrSurf*(Descriptor)*_20YY-MM-DD.XML if more than one terrain model was created due to gaps in the design data.

41. Create another LandXML of the same data in triangle format by selecting each top surface terrain model and assigning the following:

    - Select Terrain: Left Click to select it or use the pull-down menu to select the top surface terrain

    - Export Format: LandXML (.xml)

    - Project Name: M-XXXXXX_LandXML_PrTriangle_20YY-MM-DD

    - Project Description: Provide a brief description of the project

    - Export Options: Export Triangles Only
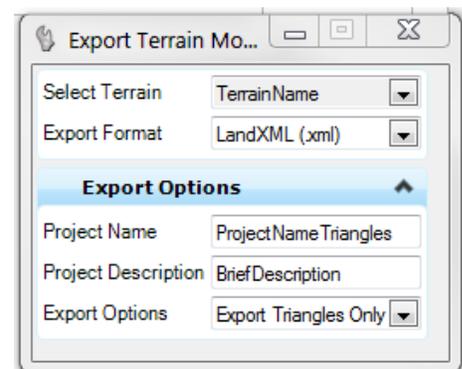
42. Left Click through the prompts to create the M-XXXXXX_LandXML_PrTriangle_20YY-MM-DD.xml LandXML file.

    a. If more than one top surface terrain model is present in the DGN file due to gaps in the design, repeat the process for each terrain model and provide the same descriptor for the region contained in the triangle LandXML file as the corresponding line string LandXML file.

SubSurface LandXML Data

43. Export the subsurface terrain model in the M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn to LandXML format as shown in **Part 3: SubSurface Output Data**.

    a. Name the LandXML file M-XXXXXX_LandXML_PrSubSurf_20YY-MM-DD.XML if only one terrain model was created for the project.

    b. Name the LandXML files M-XXXXXX_LandXML_PrSubSurf*(Descriptor)*_20YY-MM-DD.XML if more than one terrain model was created due to gaps in the design data.

Additional NOTES:

- Terrain models and LandXML files should not cross gaps for structures or breaks in the design. Each portion of the gapped design and subsequent 3D line string data requires a separate terrain model and LandXML file. The file name of the gapped areas shall include a descriptor to indicate the contents.

- All the 3D line sting data for the top surface features should be submitted in a single DGN file named M-XXXXXX_PrLineString_Surf_20YY-MM-DD.dgn.

- All the 3D line sting data for applicable subsurface features should be submitted in a single DGN file named M-XXXXXX_PrLineString_SubSurf_20YY-MM-DD.dgn.

- It is important to verify that the terrain models and LandXML files created from the 3D line strings contains all the appropriate grade breaks and do not contain spikes.

Technical Support

Please email any questions, issues or problems associated with this document to:

MDOT-EngineeringSupportTraining@Michigan.gov

Additional Design Services Help and Support can also be obtained through the following email resources:

MDOT-BridgeDesignSupport@Michigan.gov – For help with bridge design software, cells, levels, and workspace tools.
MDOT-Drainage-Utility@Michigan.gov – For help with GEOPAK Drainage, drainage cells and other subsurface utility modeling tools.
MDOT-CaddSupport@Michigan.gov – For help with cells, levels, line styles, dimensions, and other CADD and workspace tools.
MDOT-RoadwayModelingSupport@Michigan.gov – For help with roadway modeling, modeling templates, civil cells and workspace tools.
MDOT-Survey_Support@Michigan.gov – For help with survey data, workflows and processes.