GEOPAK – Digital Terrain Model Analysis

General

The purpose of this document is to provide guidance in analyzing a Digital Terrain Model (DTM) using the most common and useful DTM tool, the Height & Slope tool. A DTM is also referred to as a surface or terrain model. The DTM Tool - Height & Slope allows the designer to identify an elevation or slope at any point within the boundary of a terrain model. This workflow is typically utilized in evaluating elevations and slopes of existing terrain models submitted as part of the survey deliverables to engineers in the form of either a DGN, TIN or XML file but can also be applied to proposed terrain models created during the design process.

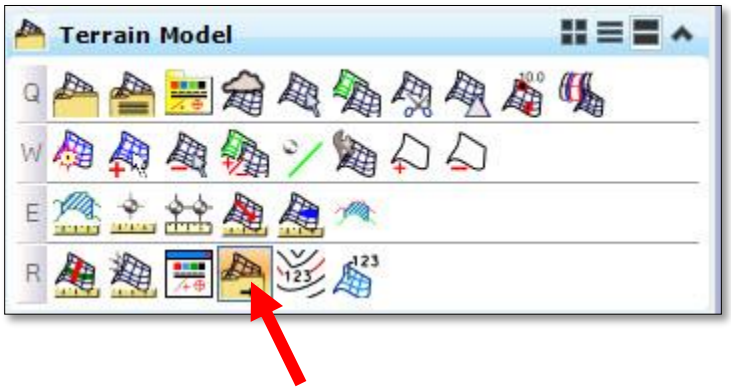
DTM Tools require a Triangulated Irregular Network (TIN) surface which can be exported from the existing terrain model if it was not provided in the survey deliverables. Please refer to Workflow – Existing Ground Terrain Model Creation.pdf for further information regarding terrain models and their uses.

Exporting a TIN File from the Terrain Model

1. If a TIN file was not provided in the survey deliverables, open the survey triangle file (S-XXXXXX_ExTriangle_20YY-MM-DD.dgn) or the (S_XXXXXX_ExTerrain_20YY-MM-DD.dgn) provided for the desired project.

   NOTE: If only a LandXML file of the existing terrain model is available, create a 3D terrain model DGN file using the **Workflow – Existing Ground Terrain Model Creation** before proceeding to step 2.

2. Select the **Export to File** tool from the Terrain Model civil tools.



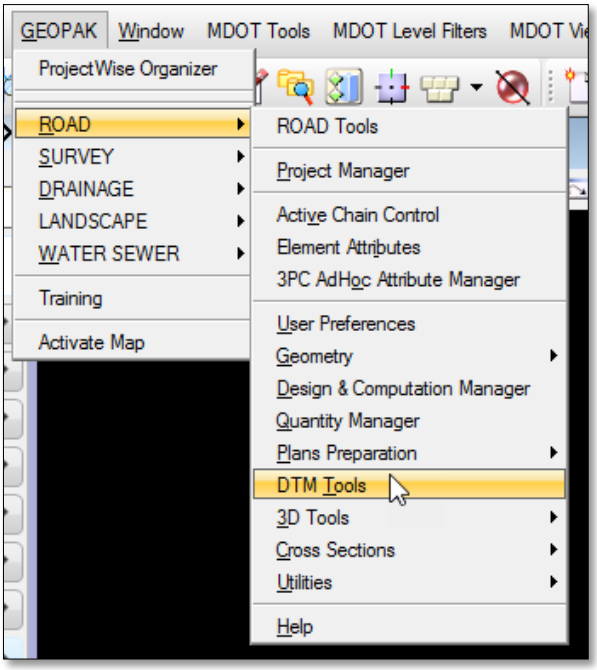
3. Select the terrain to be exported, then set the export format to GEOPAK TIN (.tin).

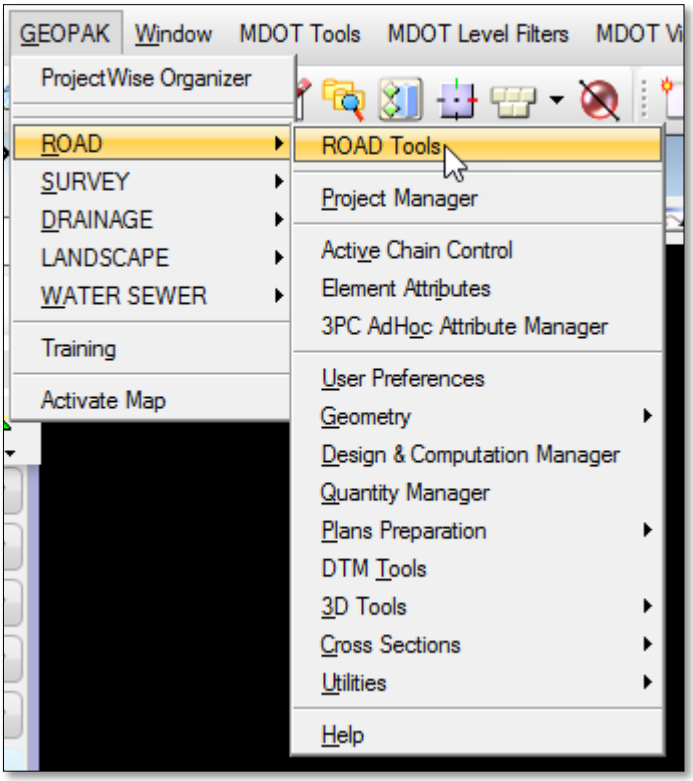
4. Save the TIN file in the folder containing the project design DGN files. Use the format (MDOT job number) Ex_20YY_MM_DD.TIN for the file name.

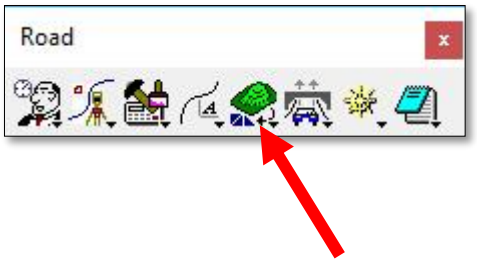
   NOTE: The date should match the date of the survey source data not the date the TIN file was created.

Accessing DTM Tools

1. The DTM Tool bar can be accessed through the GEOPAK Menu (GEOPAK→ROAD→DTM Tools) or the GEOPAK Road Tools and select **DTM: DTM Tools**.







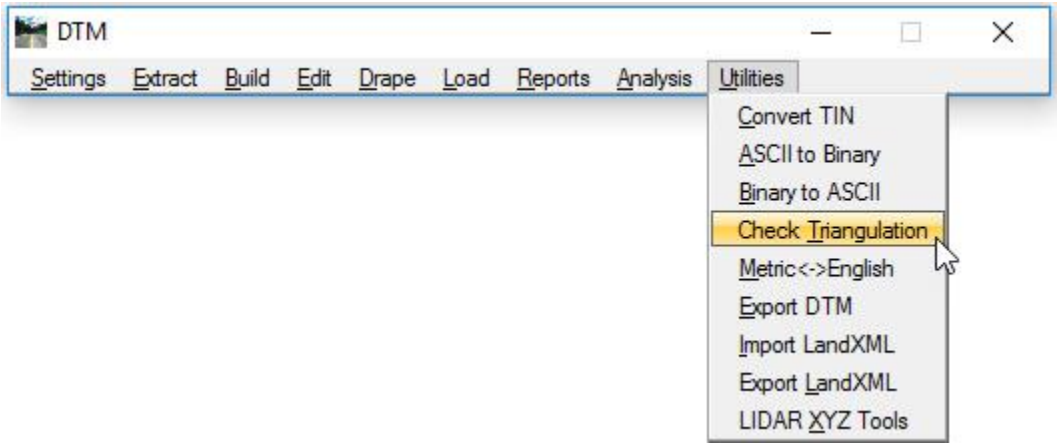
DTM Utilities: Check Triangulation

Before using the TIN for analysis purposes, it is recommended to verify the validity of the TIN file by utilizing the **Check Triangulation** tool. This tool verifies that there are no problems or errors in the triangulation of TIN file but will not reveal spikes, holes or missing\incorrect data.

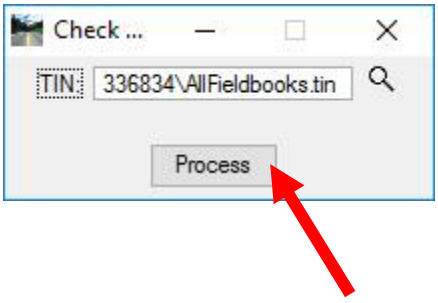
1. Access the DTM Tools as noted in the previous section **Accessing DTM Tools**

2. Select the **DTM Menu** icon to access the secondary DTM toolbar with pull down names instead of icons.

3. In the DTM Menu, select **Utilities→Check Triangulation**

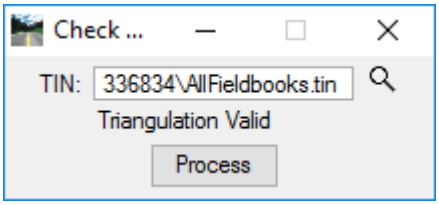


4. In the **Check Triangulation** dialog select the desired TIN file to validate and click the **Process** button.



5. After selecting **Process**, a message will appear in the dialog stating whether the triangulation was valid or invalid.

6. Close the dialog box.

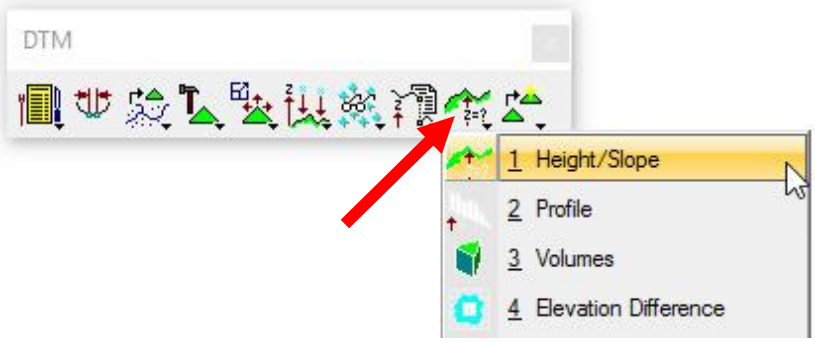


DTM Analysis: Height & Slope

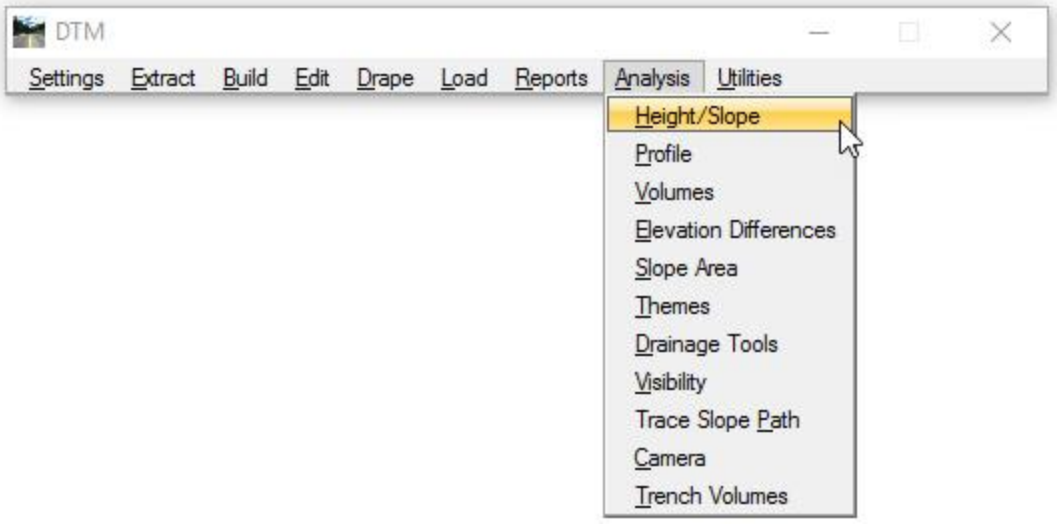
1. In any project file, access the DTM tools.

2. The DTM Height/Slope tool can be accessed either through the DTM tool box or the DTM Menu.

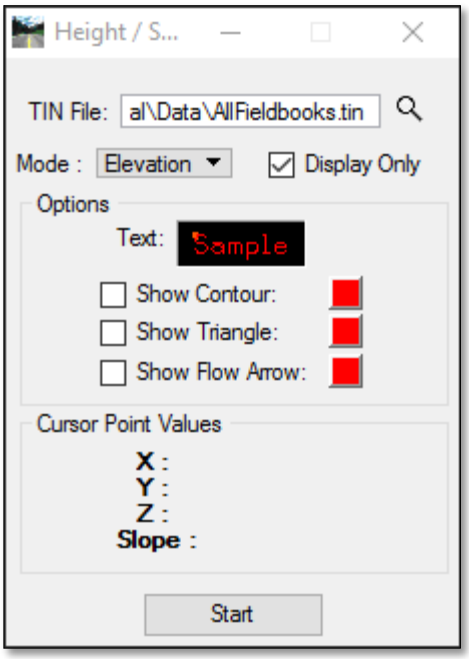
   a. **DTM Tool Box:** Click and hold on the following icon, then select **1 Height/Slope.**



   b. **DTM Menu:** Select the **DTM Menu** Icon, then **Analysis→Height/Slope.**



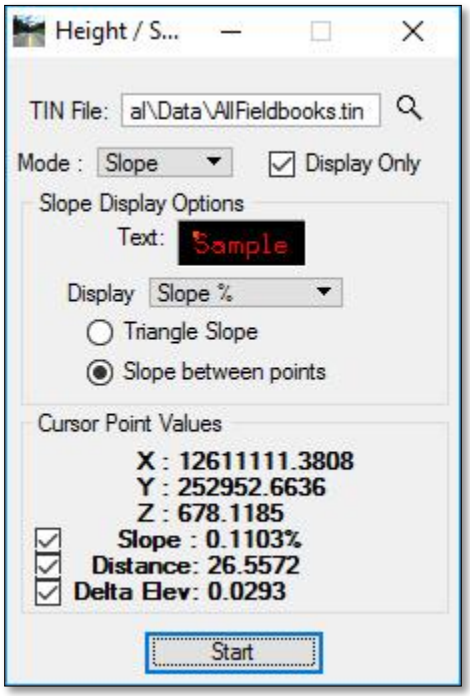
3. The tool default is **Elevation** mode.



   - **TIN File:** Select the TIN file using the magnifying glass icon
   - **Mode:** Change between Elevation or Slope, remain in **Elevation** mode.
   - **Display Only:** When checked, the data will only remain visible until the view is changed. Uncheck to write data into the design file.
   - **Text:** Shows a sample of the text style that will be placed when the tool is used, double click on **Sample** to adjust the text properties. The text is non-annotative.
   - **Show Contour**: Displays a representative contour line
   - **Show Triangle**: Displays a representative triangle
   - **Show Flow Arrow**: Displays a representative flow arrow
   - **Cursor Point Values**: Identifies the point elevation & slope at the selected location.

4. Select **Start** to activate the tool and begin analyzing the TIN in **Elevation** Mode.

5. Change the mode to **Slope to** analyze slopes within the boundary of the Tin file selected.



   - **Display:** Dropdown selection that lets the user display the slope in different formats (Slope %, Slope rise/run, etc)
   - **Triangle Slope:** When selected, the tool will display the slope of a selected triangle in the terrain.
   - **Slope Between Points:** When selected, allows the user to determine the slope between any two points within the terrain boundary.
   - **Cursor Point Values:** Identifies the values at the selected location – unchecked items will not be displayed.

6. Select Start to activate the tool and begin analyzing the TIN in **Slope** Mode.

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.