

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 <u>Workflow – Existing Ground</u> <u>Terrain Model Creation.pdf</u> for further information regarding terrain models and their uses.

Exporting a TIN File from the Terrain Model

 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).
- 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.

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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**.





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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**

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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.**

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- 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.

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Cursor Point Values
X : Y : Z : Slope :
Start

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Cursor Point Values
X : 12611111.3808 Y : 252952.6636 Z : 678.1185 Slope : 0.1103% Distance: 26.5572 Delta Elev: 0.0293
Start





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:

<u>MDOT-BridgeDesignSupport@Michigan.gov</u> – For help with bridge design software, cells, levels, and workspace tools.

<u>MDOT-Drainage-Utility@Michigan.gov</u> – For help with GEOPAK Drainage, drainage cells and other subsurface utility modeling tools.

<u>MDOT-CaddSupport@Michigan.gov</u> – For help with cells, levels, line styles, dimensions, and other CADD and workspace tools.

<u>MDOT-RoadwayModelingSupport@Michigan.gov</u> – For help with roadway modeling, modeling templates, civil cells and workspace tools.

<u>MDOT-Survey_Support@Michigan.gov</u> – For help with survey data, workflows and processes.