Digital Terrain Modeling

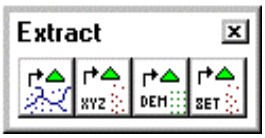
3.1 Accessing DTM Tools

Step 1. Open the MicroStation file **c:\data\geo\vdot\s1373\s1373.dtm**.

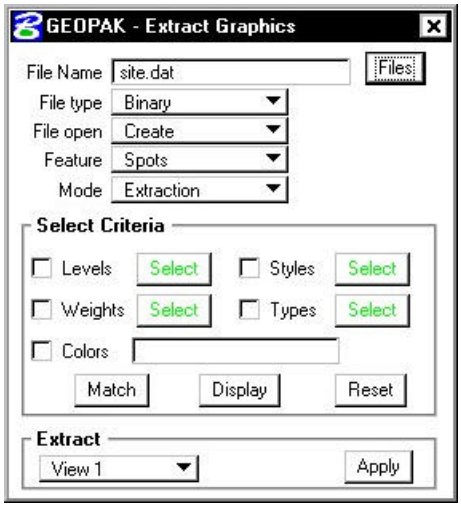
Access **Applications>GEOPAK Road>DTM Tools.**

Step 2. This invokes the DTM Tool Frame.

3.2 Extract Graphic Elements

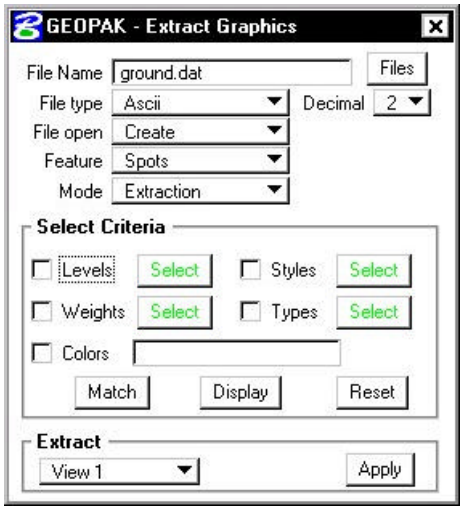


Step 1. Select the **Extract Graphics** icon from the tool frame to invoke the following dialog.

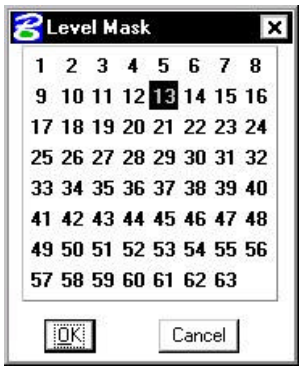


Step 2. To extract the ground spot shots, complete the dialog as indicated below:

File Name	ground.dat
File Type	ASCII
File Open	Create
Feature	Spots
Mode	Extraction



Step 3. Set the appropriate level for the graphical elements that you wish to extract as Spots. Activate the **Level** toggle, and press the **Select** button beside Levels to invoke the Level Mask dialog. Select level **13** and press **OK**.



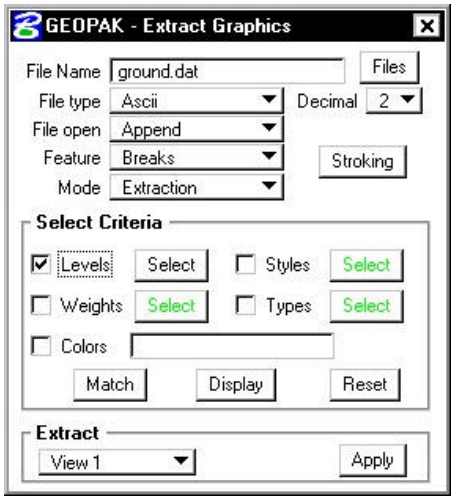
Step 4. Ensure that the entire design file has been fit into View 1.

Step 5. Press **Apply** to initiate the Extraction of the Spots.

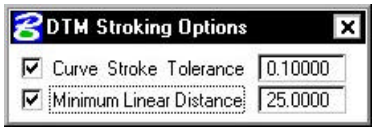
Step 6. Proceed to extract the Breaks as defined below:

File Name	ground.dat
File Type	ASCII

File Open	Append
Feature	Breaks
Mode	Extraction



Notice that when the Feature type is switched to **Breaks**, the **Stroking** button is accessible from the Extract Graphics dialog. Access the Stroking Options dialog by pressing this button and populate the dialog as shown below.



Close the DTM Stroking Options dialog.

Also, we are adding the Break elements to the .dat file; therefore, we are **Appending** rather than **Creating**.

Set the Level for the Breaks to **Level 14**. Be sure to turn off Level 13.

Step 7. Again, ensure that all graphic elements are fit into View 1 and Press **Apply**.

Step 8. Lastly, we will extract the graphical element representing the Obscure area as a Drape Void. This will be to ensure that the elevations at the Void coordinates are included in the surface model and the slopes will be resolved to the Void when triangulation occurs.

File Name	ground.dat
File Type	ASCII
File Open	Append
Feature	Drape Void
Mode	Extraction

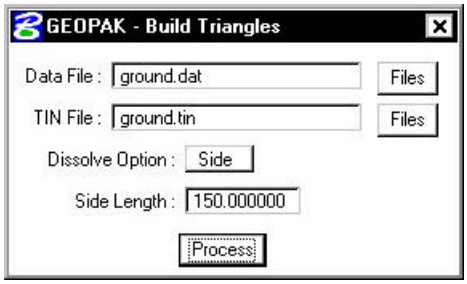
Step 9. Set the Level for the Drape Void to **Level 15**. Be sure to turn off level 14.

Step 10. Ensure that the obscure area is contained within View 1 and press **Apply**.

Step 11. Close the Extract Graphics dialog and Save Settings.

3.3 Build TIN

Step 1. Select the **Build TIN** icon from the tool frame to invoke the following dialog.



Step 2. To Build the **TIN** file, complete the dialog as indicated below:

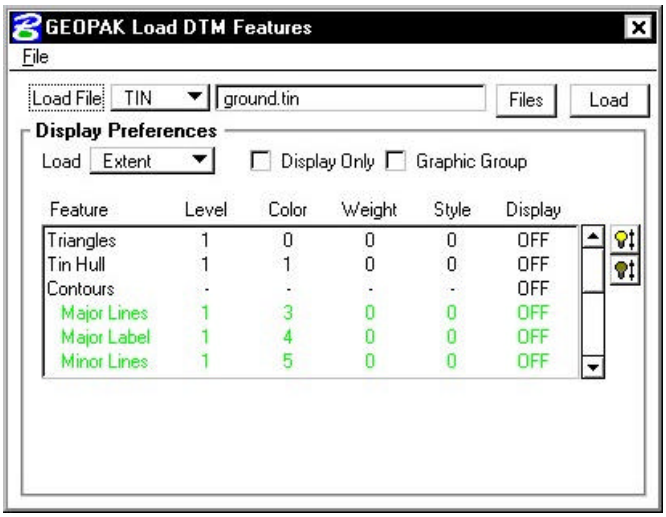
Data File	ground.dat
TIN File	ground.tin
Dissolve Option	Side
Side Length	150

Step 3. Press the **Process** button to initiate the creation of the TIN file.

Step 4. Close the Build Triangles dialog and Save Settings.

3.4 Display DTM Features

Step 1. Select the **Load Features** icon from the tool frame to invoke the following dialog.



Step 2. Change the **Load File** option to **TIN**.

Step 3. Select the TIN file **'ground.tin'** by pressing the **Files** button.

Step 4. Select the **Triangles** Feature by highlighting in the list box. Notice that initially the display is set to OFF. You can control the display of an item three ways:

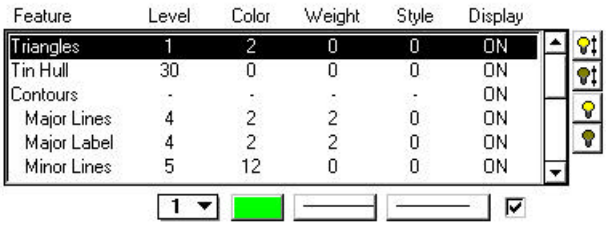
Use the "lightbulb" icons to the right of the dialog

Double-click on an item

Use the "display" toggle in the lower right corner of the dialog

Set the Triangles display to ON.

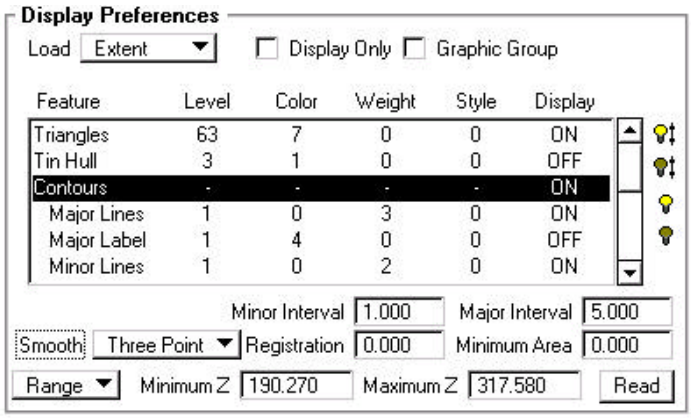
Step 5. Set the display symbology for the Triangles as indicated below:



Step 6. Select the **Tin Hull** (the boundary of the surface model) feature. Activate the Display of the feature and set the symbology as follows; Level = 30, Color = 0, Weight = 0, Style = 0.

Step 7. Select the **Contours** feature. Activate the **Display** Feature. Verify that **On** is set in the Display field.

Step 8. Complete the bottom of the dialog as indicated below. To complete the Minimum and Maximum Z, Press the Read button, which will review the active TIN file and determine these values.



Step 9. Activate the Display of the Contour **Lines** and **Labels** and set the symbology as indicated below:

	Level	**Color**	**Weight**	**Style**	**Font**	**Th / TW**	**Distance**
Major Lines	10	4	3	0			
Major Labels	10	4	3	0	23	TH=6 TW=6	100
Minor Lines	9	7	1	0			

Step 10. Set the Load option to **Extent**, activate the **Graphic Group** toggle and activate the **Display Only** toggle.

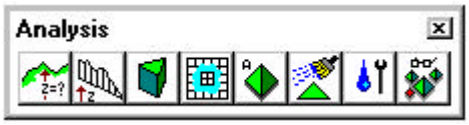
Step 11. Press the **Load** button to initiate the process.

Step 12. Close the Load DTM Features dialog and Save Settings.

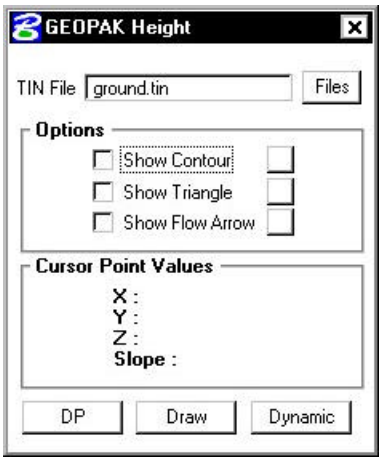
3.5 Analysis Tools

We will review several analysis tools in the following exercises. These include the height, themes, and profiles tools.

3.5.1 Height Tool



Step 1. Select the **Height** icon from the tool frame to invoke the following dialog.

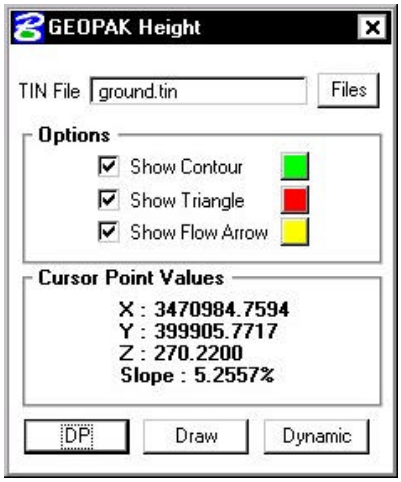


Step 2. Activate the **Show Contour** and **Show Flow Arrow** toggles. The color may be altered to your choice of colors from the active color table on the Height dialog. The weight of the contour line and arrow are controlled by the active MicroStation settings.

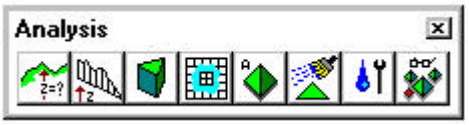
Step 3. Press the **Dynamic** button and scan the surface model with the cursor to display the values for xyz and the slope on the model at the cursor point.

Step 4. The **DP** option can be utilized to review this information at a specific location and the **Draw** option will label the elevation at the selected data point.

Step 5. Close the Height dialog.



3.5.2 Themes Tool

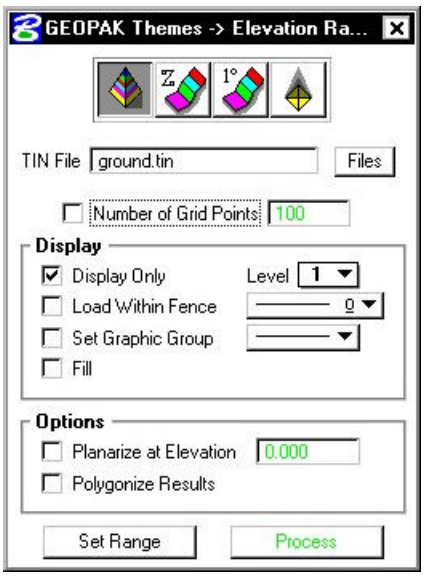


Step 1. Select the **Themes** icon from the Analysis tool box to invoke the dialog depicted below.

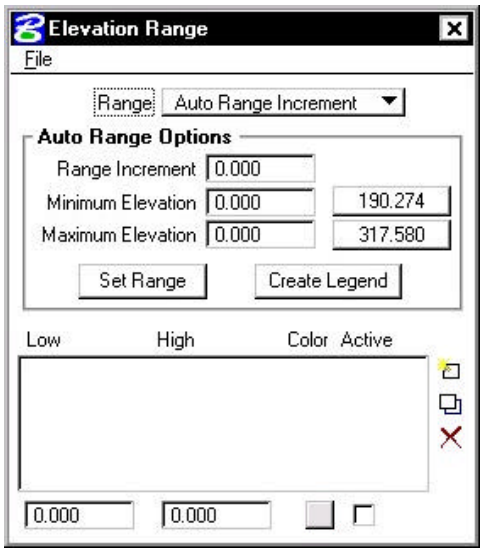
Step 2. Ensure that all graphic elements are Fit in View 1.

Step 3. We will determine the Elevation Range first for the **TIN File** 'ground.tin'. (This is the first icon on the dialog).

Step 4. Activate the **Display Only** toggle and the **Fill** toggle.



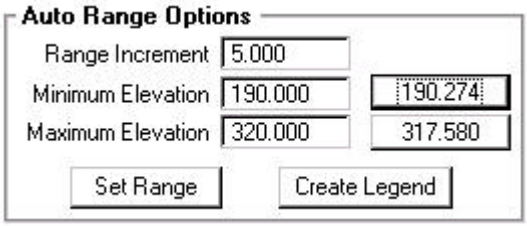
Step 5. Next, press the **Set Range** button to access the following dialog.



As shown on the right of the **Minimum** and **Maximum** Elevation Fields, the values for the active TIN elevations are listed. By pressing these buttons individually, the elevation fields will automatically be populated.

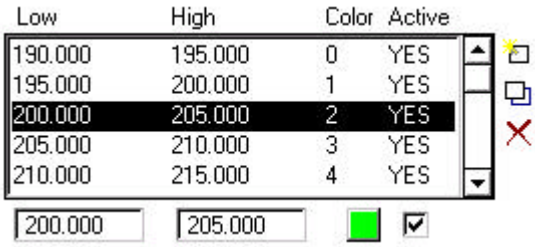
Step 6. Set the Range option to **Auto Range Increment**.

Step 7. Set the Auto Range Options as shown below:



Step 8. Press the **Set Range** button to populate the list box on the bottom portion of the dialog.

Selection of any list of elevations will populate the fields at the bottom.



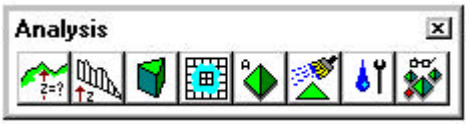
Utilizing the buttons on the right side of the list box will permit additional ranges to be included in the list, modifications to be made to elevation ranges (or the color display of this range), or deleting a particular elevation range.

Step 9. Close the Elevation Range dialog (select the X in the upper right hand corner of the dialog).

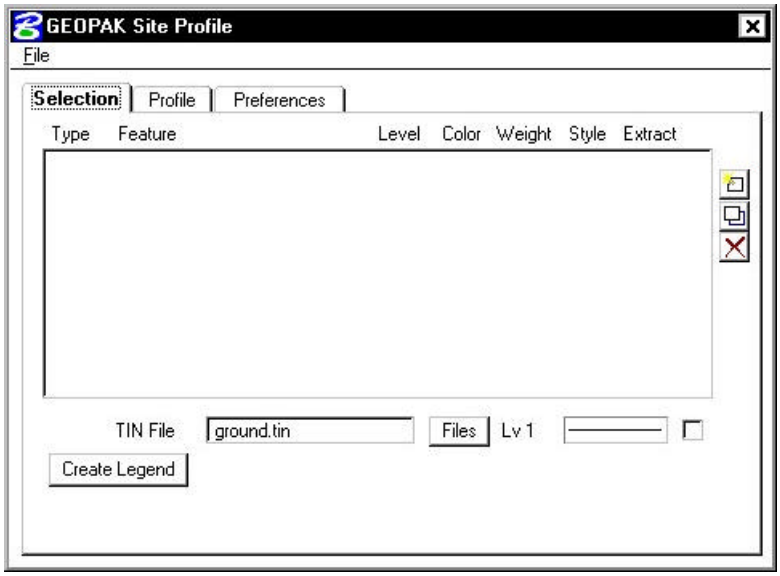
Step 10. Press the **Process** button to initiate the display of the Elevation Ranges for the surface model.

Step 11. Close the Themes dialog and Save Settings.

3.5.3 Profile Tool



Step 1. Select the Profile icon from the Analysis tool palette to invoke the following dialog.

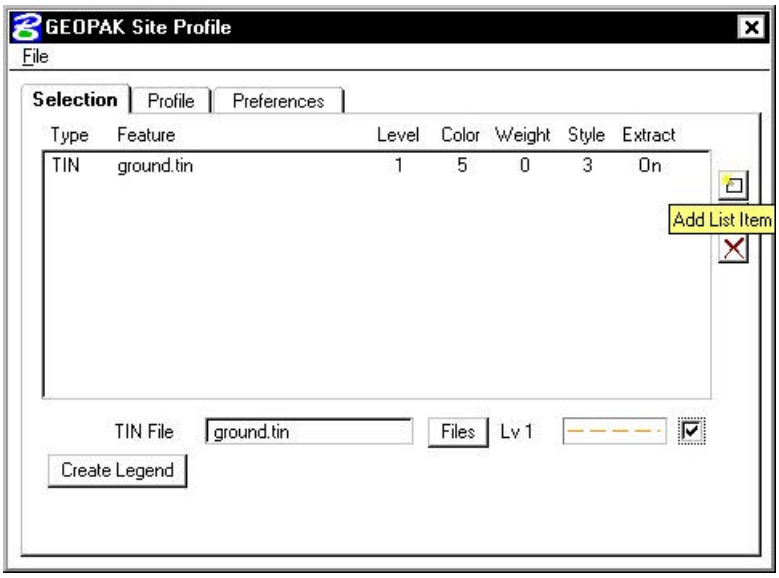


Step 2. Use the **Selection** tab to identify your surface model (TIN File) which you will generate a profile from, and the symbology for your profile.

Step 3. Select the Tin File 'ground.tin' by using the **Files** button.

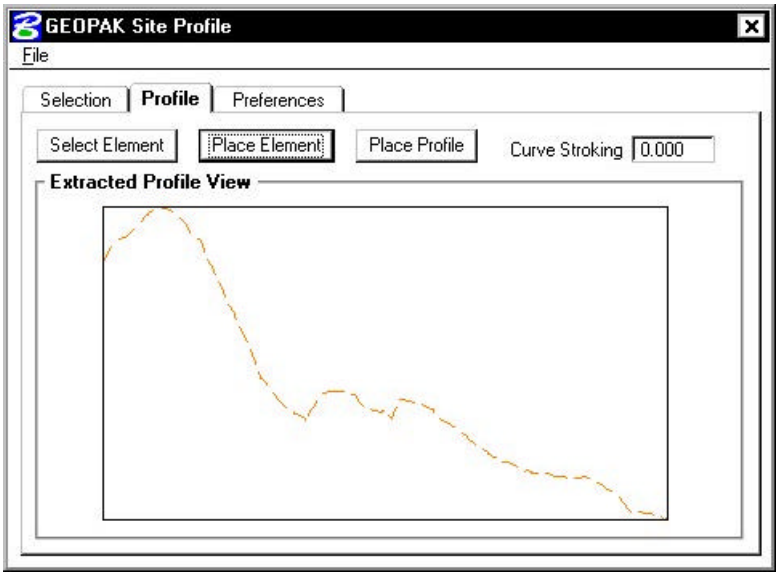
Step 4. Double-click on the symbology box (field to the right of the **Files** push button) to set the symbology representing the ground surface profile. You may choose any symbology you wish. Once the symbology has been set, press OK.

Step 5. Press the **Add** icon (top icon next to the list box) to add the feature to the collection box.



Step 6. Select the **Profile** Tab.

Step 7. Press the **Place Element** button to cut your actual profile at any desired area by just placing two data points (i.e. a line) or a series of data points (i.e. a line-string) across your surface model at any location.



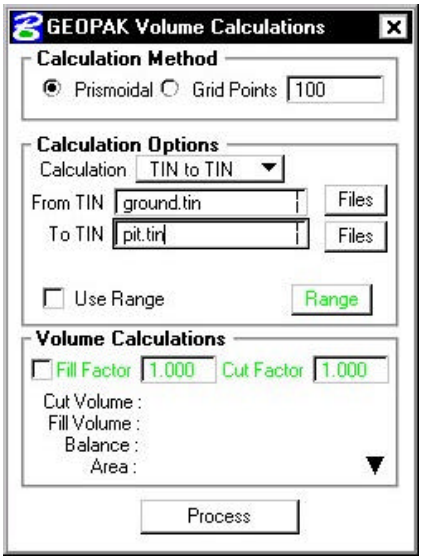
Step 8. You can use the **Preferences** tab to set up a grid for your profile if desired.

Step 9. Close the Profile dialog and remove the DTM Tools tool frame.

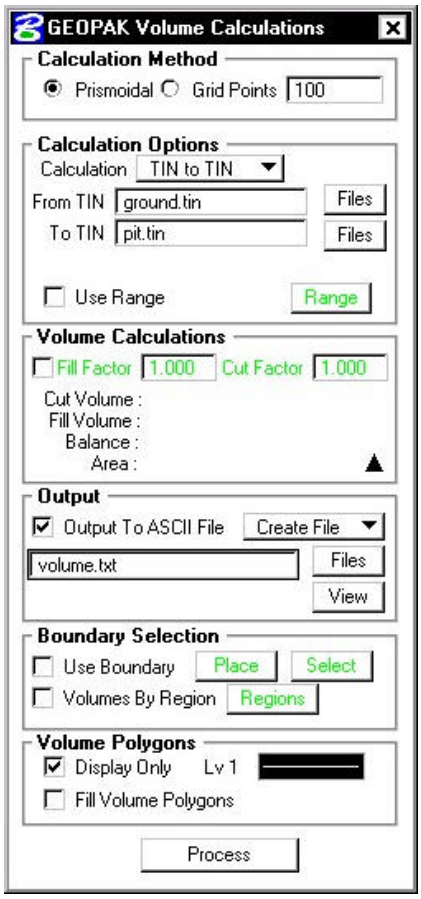
3.6 Prismoidal Volumes

Step 1. From the DTM tool palette select the **Analysis>Volumes** tool.

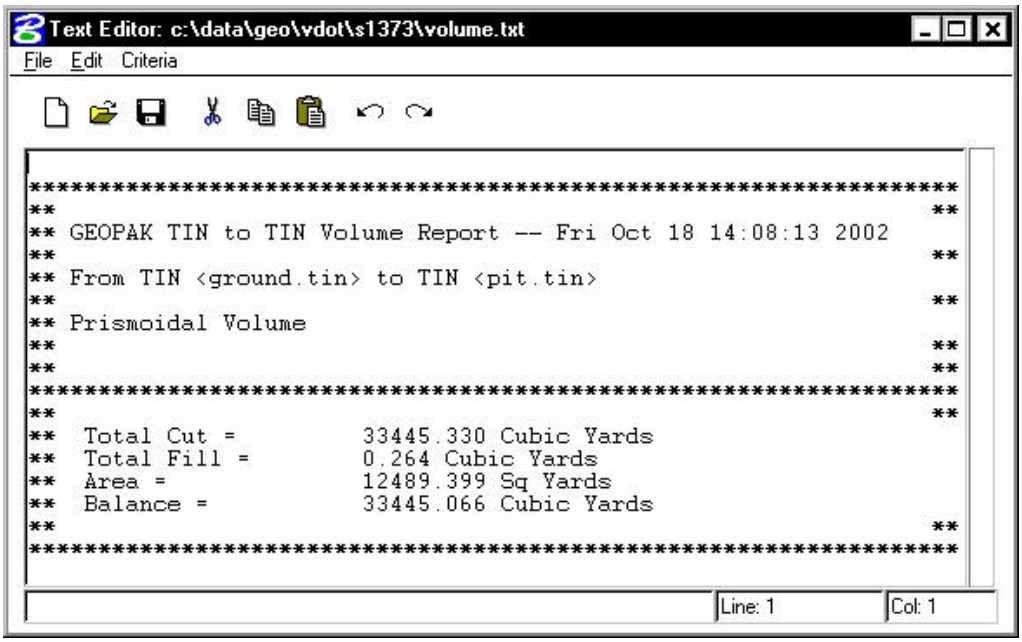
Step 2. Make the settings as shown below and select the **Process** button.



Step 3. Now select the “slam down” button to expand the dialog and fill in as shown below.



Step 4. Select the **Process** button again and then review the file volume.txt to see the final calculations.

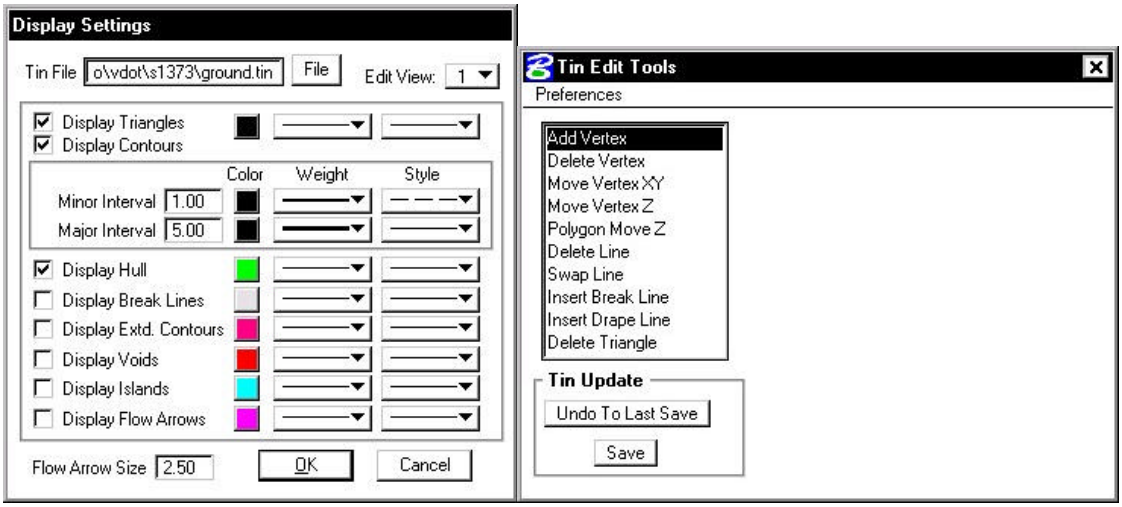


3.7 TIN Editing

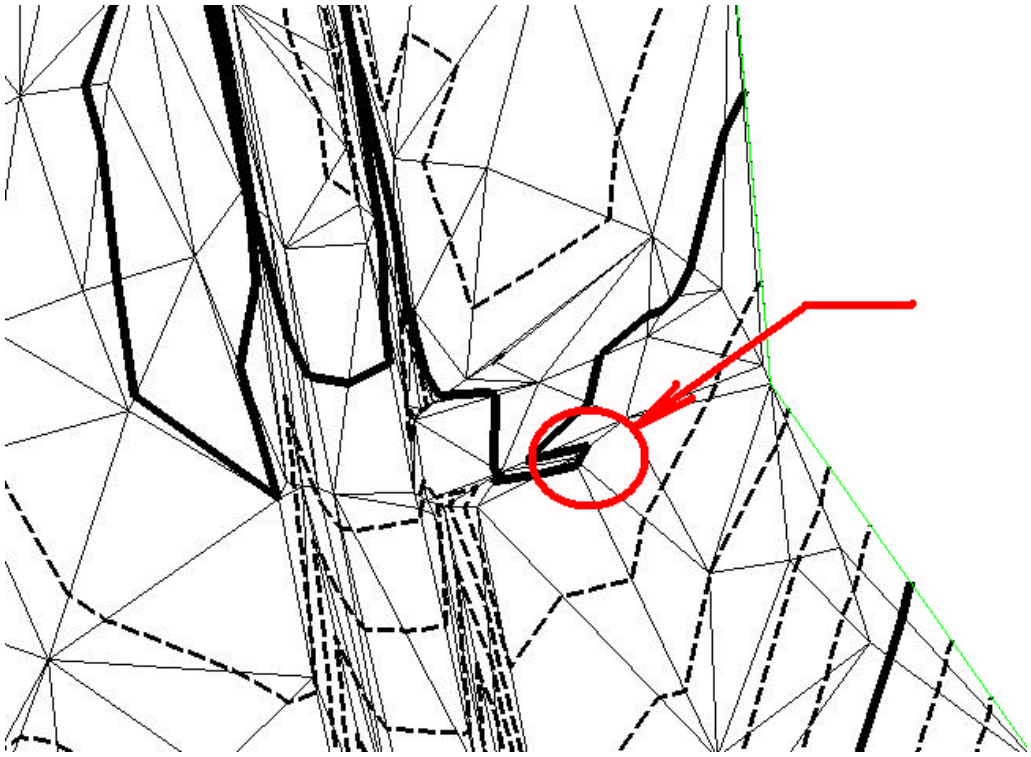
Step 1. Attach the saved MS saved view **Edit.**

Step 2. From the DTM toll palette select the **Edit Tin** icon.

Step 2. This will invoke the 2 dialogs shown below. Make the appropriate settings in the **Display Settings** dialog and select **OK**.

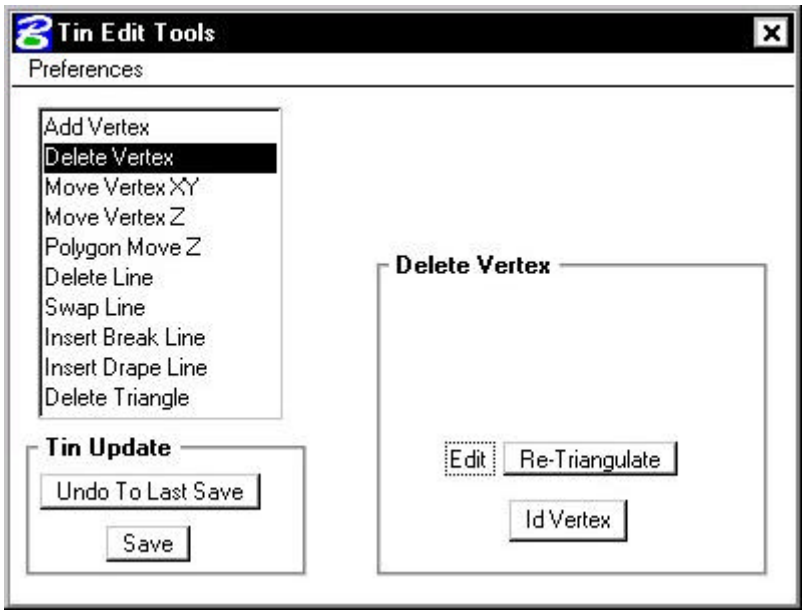


Step 4. The graphic below identifies a bad shot in the tin file that we will edit in order to clean up the tin file.



In order to edit the tin file we need to delete this point and allow the tin to re-triangulate the area that is affected. To do this, select the **Delete Vertex** option from the **Tin Edit Tools** dialog.

Step 5. In the delete vertex dialog make sure the **Edit** toggle is set to **Re-Triangulate**.



Step 6. Select the **Id Vertex** button from the dialog and the Id the vertex on the triangles that you wish to delete.

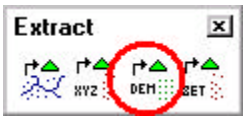
Step 7. Once the Id is made, one more data point to accept the selection will initiate the command.

Digital Elevation Models

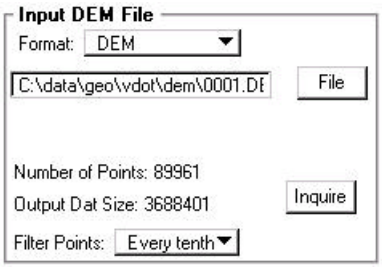
3.8 Importing DEM Files

Step 1. Open the file C:\data\geo\vdot\dem\dem3d.dgn

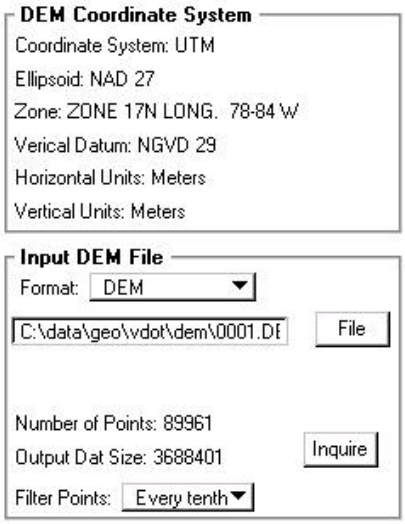
Step 2. Select the icon for importing DEM files.



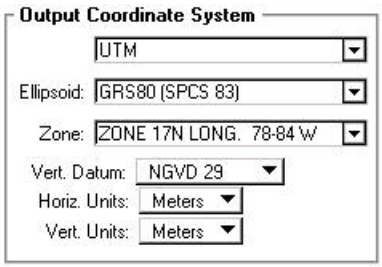
Step 3. Using the **File** button in the **Input DEM File** portion of the dialog, choose the file **C:\data\geo\vdot\dem\0001.DEM**



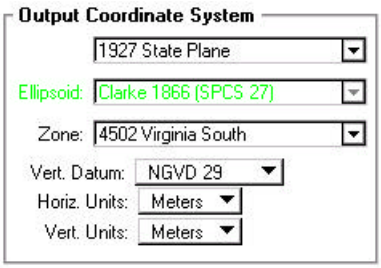
Step 4. Once the file has been loaded select the **Inquire** button to populate the **DEM Coordinate System** portion of the dialog. This process reads the vital information from the DEM file and displays it for review.



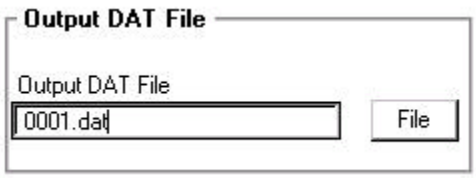
Step 5. Referencing the information in the **DEM Coordinate System** portion of the dialog, make the appropriate settings in the **Output Coordinate System** portion of the dialog.



If it is desirable to convert to State Plane Coordinates then settings make be changed to look something like the dialog below.



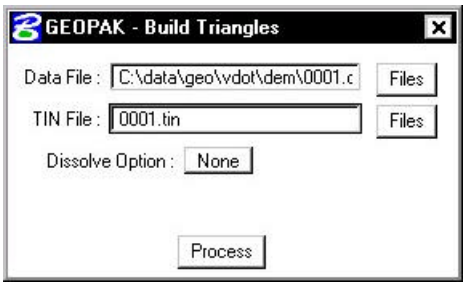
Step 6. The last setting is to assign an output file to write the converted points to. This is done by entering a file name into the field in the **Output DAT File** portion of the dialog.



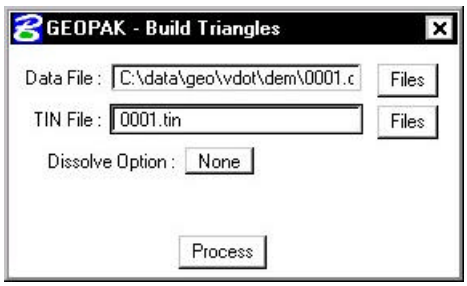
Step 7. Once this is done, select the **Apply** button to convert the DEM file.

Step 8. After the conversion is complete, select the **Build TIN** icon from the **Build** tool bar.

Step 9. Using the **Files** button select the **DAT** file that was created in the previous steps.



Step 10. Now provide the **TIN** file name and select the **Process** button.



Once the TIN has been created any of the query or display tools may be used to review, analyze, or edit the tin file.