
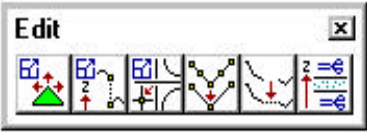
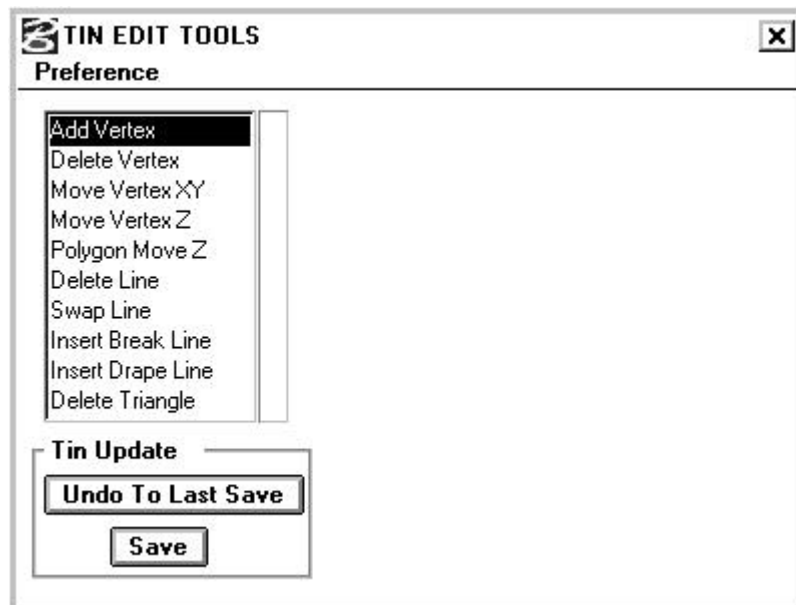


TIN Editing Tools

8.1 Overview

Feature / Function	Dynamically editing of a TIN model.
Tool 	
DTM Menu Bar	Edit > Edit Triangles

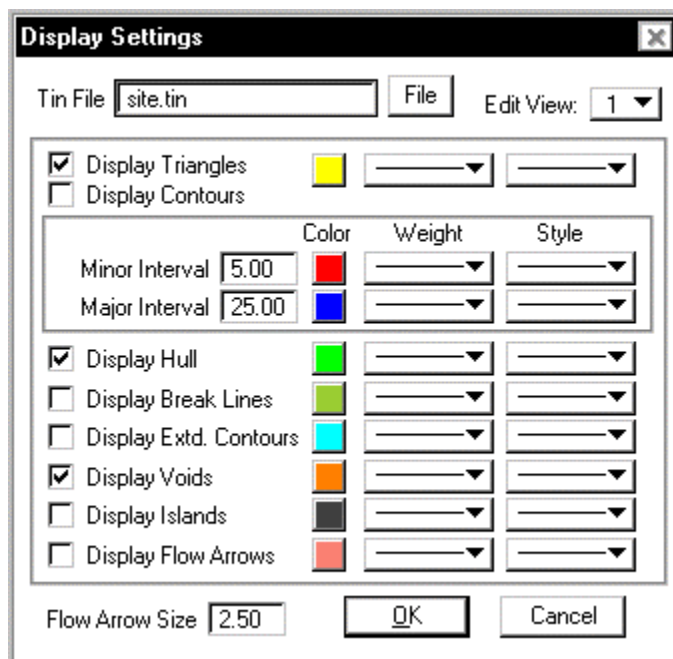
A myriad of tools to interactively edit TIN models are located in the Edit TIN dialog as depicted below. The triangulated model can be dynamically edited in terms of adding, deleting or moving spot elevations. Break lines can be added, draped or deleted. As editing is initiated, resultant triangles, contours, flow arrows, and voids are optionally displayed “on the fly.”



The list box on the left side of the dialog contains the editing tools. As each tool is selected, the right part of the dialog dynamically changes to reflect the current tool. Below the list box, the TIN Update group box has two buttons:

- **Undo To Last Save** - deletes all displayed changes back to the last time the binary TIN file was saved.
- **Save** - the displayed changes are not incorporated into the specified binary TIN file until the **Save** button is selected. This need not be done after each process, but can be accomplished after all the desired changes are made or at any time during the processing. Note if the dialog is closed or the main DTM dialog is closed without saving, the changes will not be reflected in the TIN file.

Before editing can commence, the TIN file to be edited and its display parameters must be defined. This is accomplished by selecting **Preference > Display** from the upper left corner of the dialog, invoking the Display Settings dialog depicted below.

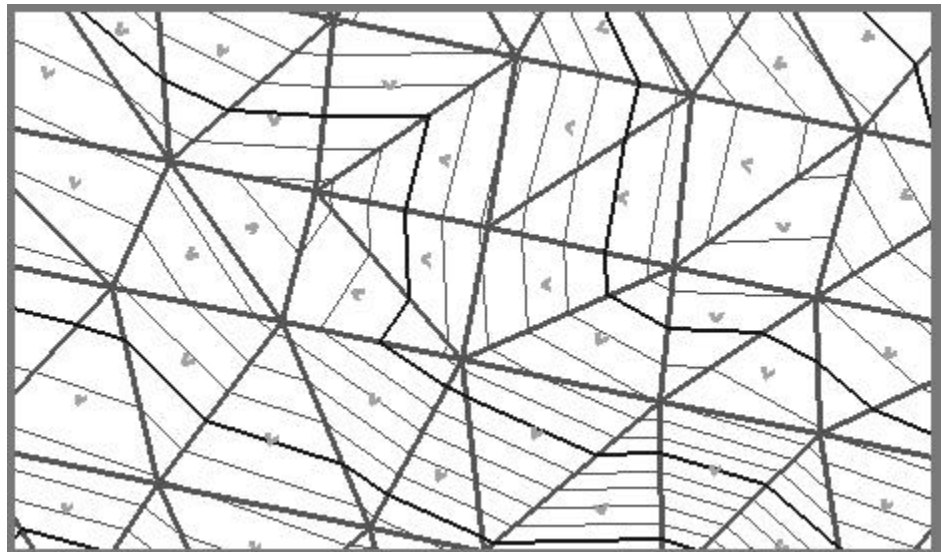


The **TIN File** to be edited can be typed, or pressing the **File** button invokes the File Manager, wherein the desired file may be selected. All displays are placed in the view selected by the **Edit View** mode in the upper right corner. The rest of the dialog contains the various display options and associated element symbology. If a particular feature is desired, simply activate the toggle to the left of the feature. Any number of features may be active simultaneously. After activating a feature, set the element symbology to the right of the feature: **Color**, **Weight**, and **Style**. Note that no level is required as the elements are only displayed, not written in the MicroStation file. When contours are activated, fields are provided for **Major** and **Minor Intervals**, in addition to different element symbologies. **Extd.** (Extracted) **Contours** are contours utilized to create the DTM, usually digitized.

If activated, they are drawn at the same elevation as those used for extraction. Therefore, there is no major or minor intervals. Flow lines are arrows drawn (at the specified **Flow Arrow Size**) within each triangle indicating direction of water flow. When the display settings are complete, pressing the **OK** button automatically closes the dialog and returns to the Tin Edit Tools dialog. In addition, the selected Edit View is updated to display the specified features within the view.

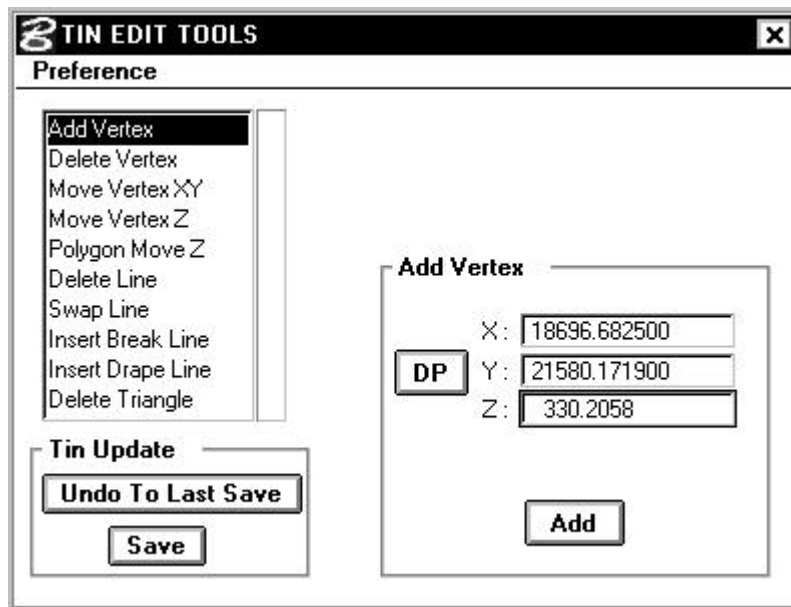
Note if the Edit View is not within the hull of the TIN, no features are displayed. If this occurs, draw the hull via the **Load Hull** tool with Display On deactivated. Adjust the window utilizing MicroStation Fit and View commands to be within the hull.

A small area or large part of the TIN area may be displayed, however, for editing purposes, closer views are desirable. At any time during the edit session, the display parameters may be changed by selecting **Preference > Display**, with the screen updating when the Display Settings dialog is closed. The example below displays triangles, contours, and flow arrows. Utilizing this example, let's review each editing tool.

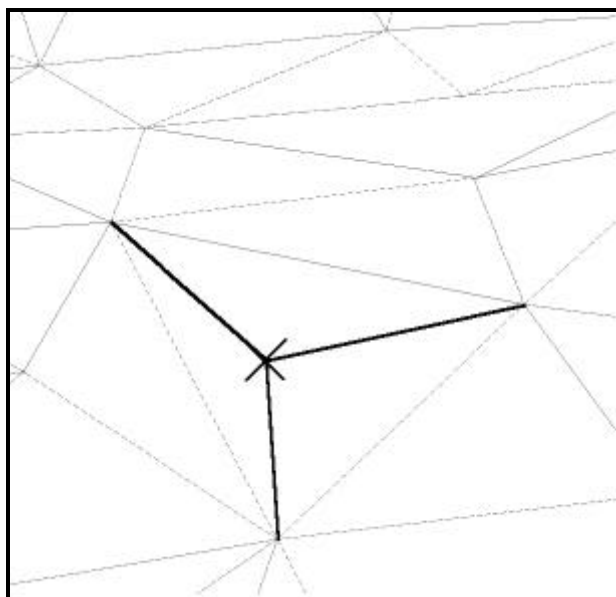


8.2 Add Vertex

The Add Vertex tool is utilized to add additional spot elevations either internal or external to an existing model. When selected, the dialog depicted below is displayed.



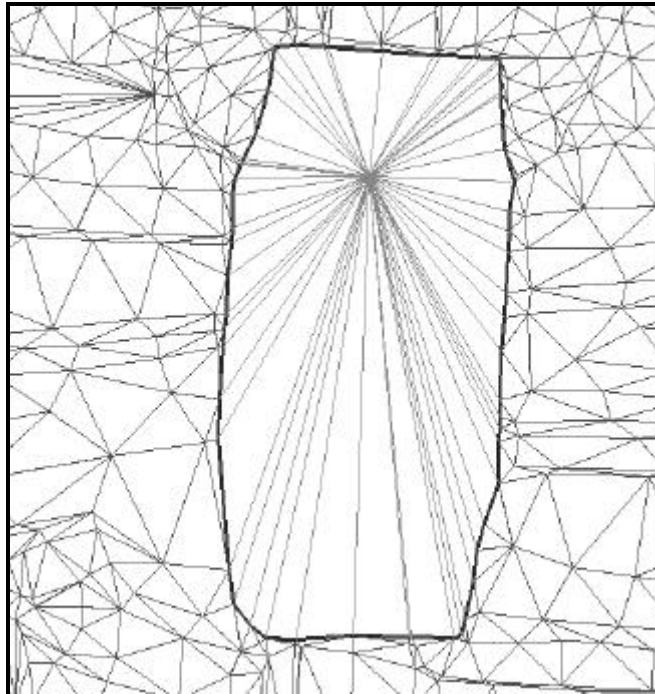
The user has the option of keying in the desired values in the **X**, **Y**, and **Z** fields or interactive editing by pressing the **DP** push button. Once the **DP** button has been pressed, moving the cursor over the screen will display the cursor coordinates in the dialog. The **X** and **Y** values are the true coordinates of the cursor, while the **Z** value is the elevation of the specified TIN at the cursor's X, Y value. GEOPAK will also display the triangles on the fly, i.e. as the cursor is moved, the generated triangles will also move as depicted in the graphic below.



A second data point on the screen will discontinue the dynamics. If desired, the **Z** value in the dialog may be changed to a different

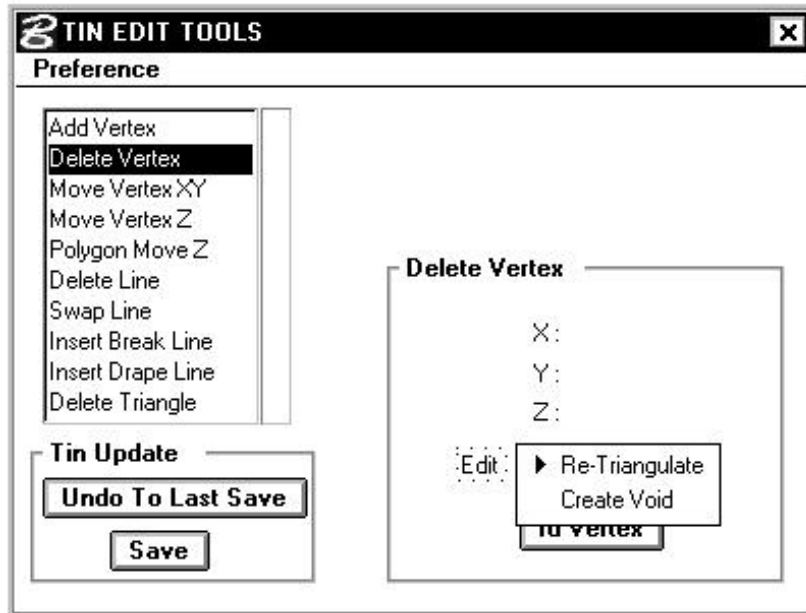
elevation. Pressing the **Add** button temporarily adds the point into the specified TIN file.

Note that a point may be added inside a previously defined Void. In this case, the software will delete the void and draw in triangles, as seen in the graphic below. The void now has a point added in the upper half, with triangles radiating from the added point to the edge of the void.

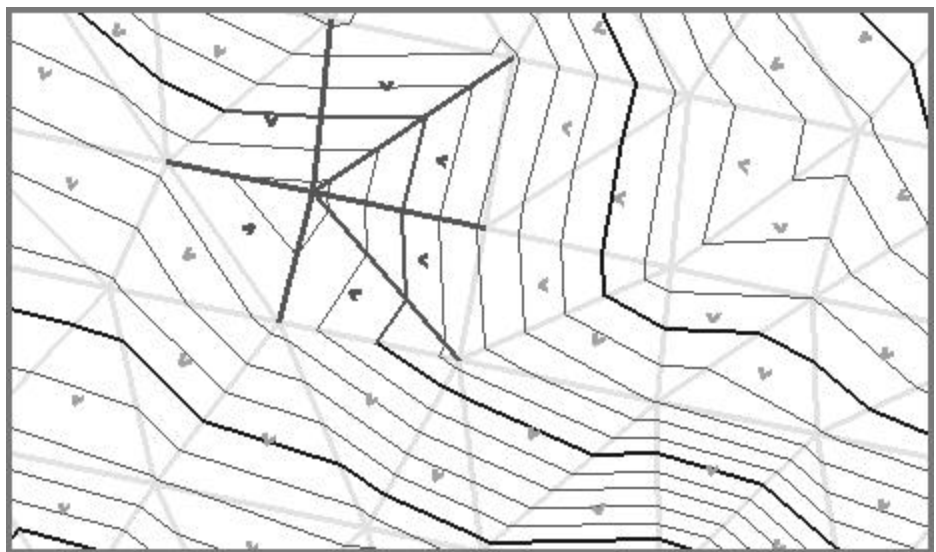


8.3 Delete Vertex

Another option is Delete Vertex. When selected, the dialog dynamically changes as depicted below. Note that two options are supported for editing: **Re-Triangulate** or **Create Void**.



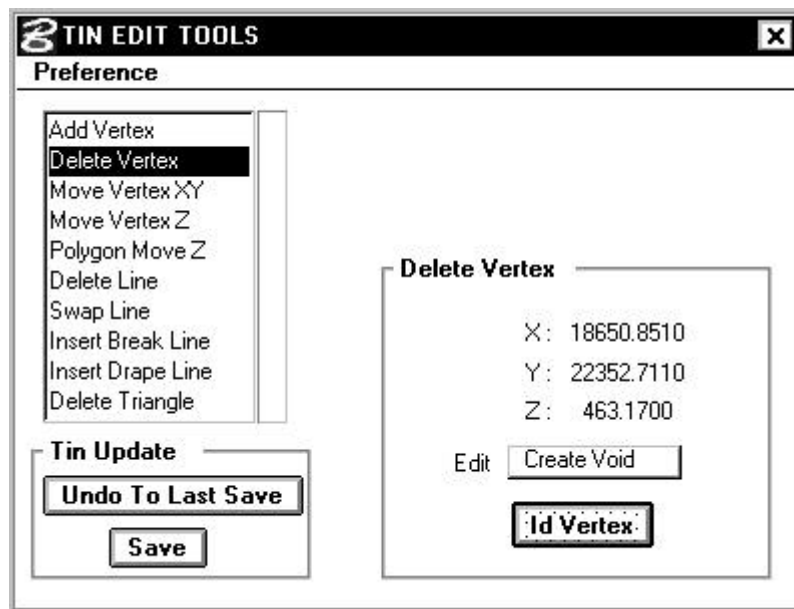
The **Re-Triangulate** option deletes the specified point, then re-triangulates the model without it. As depicted in the graphic below, when the **ID Vertex** button is pressed and the specified point is identified on the screen with a data point, the affected vertex, triangle sides, and all associated display elements (i.e., contours, flow arrows, etc.) are highlighted.



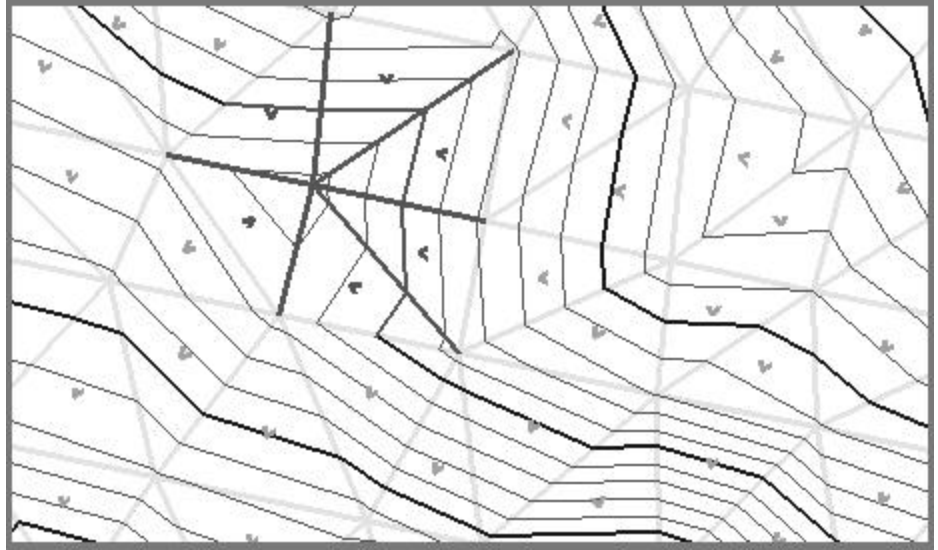
When a second data point is placed anywhere on the screen, the vertex is deleted and all associated elements are dynamically updated as depicted in the graphic below.



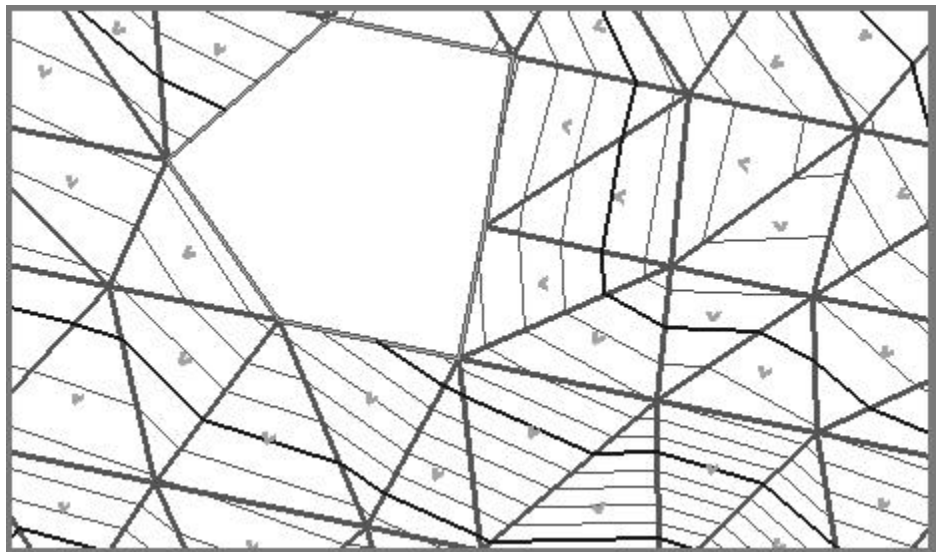
The **Create Void** option identifies the triangle(s) which contains the desired point to be deleted and changes the triangle(s) to a void area. The dialog is depicted below.



The **ID Vertex** button is selected, and the point to be deleted is identified by a data point on the screen. The affected vertex, triangle sides, and display elements are highlighted as depicted in the graphic below, while the **X**, **Y**, and **Z** coordinates of the point are displayed in the dialog.



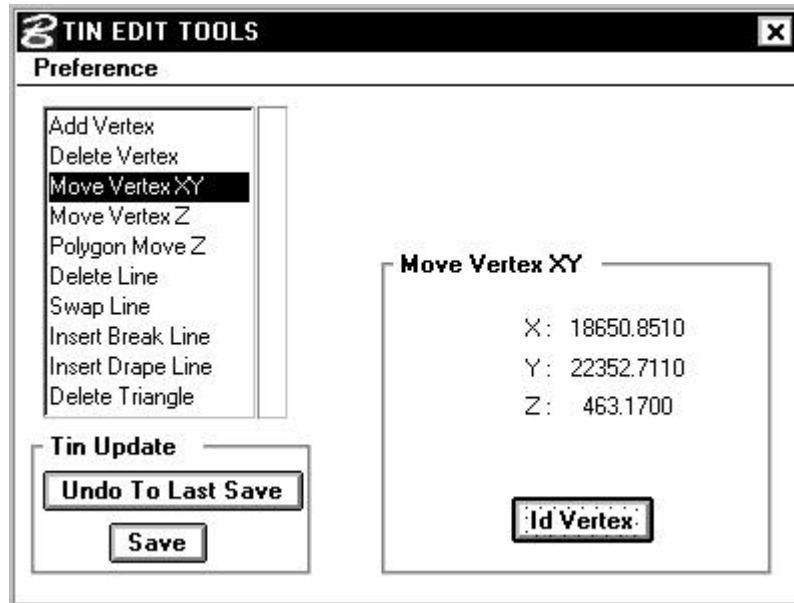
When a second data point is placed anywhere on the screen, the vertex is deleted, a void is created, and all associated elements are dynamically updated as depicted in the graphic below.



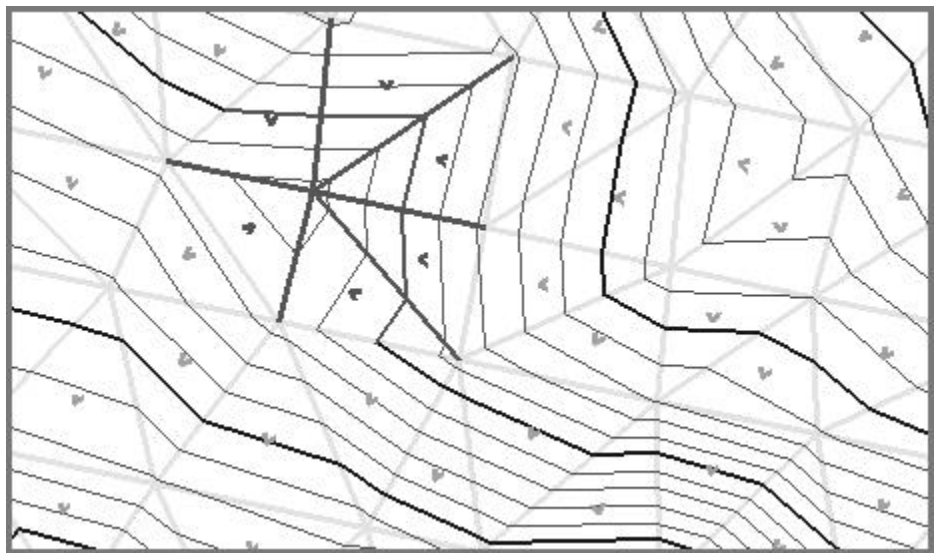
Also note that if the **Utility > Triangle Statistics** command is utilized after the **Save** button is pressed, the Number of Voids has been adjusted to accurately reflect the number of voids in the model.

8.4 Move Vertex XY

Another option is Move Vertex XY. When selected, the dialog dynamically changes as depicted below.

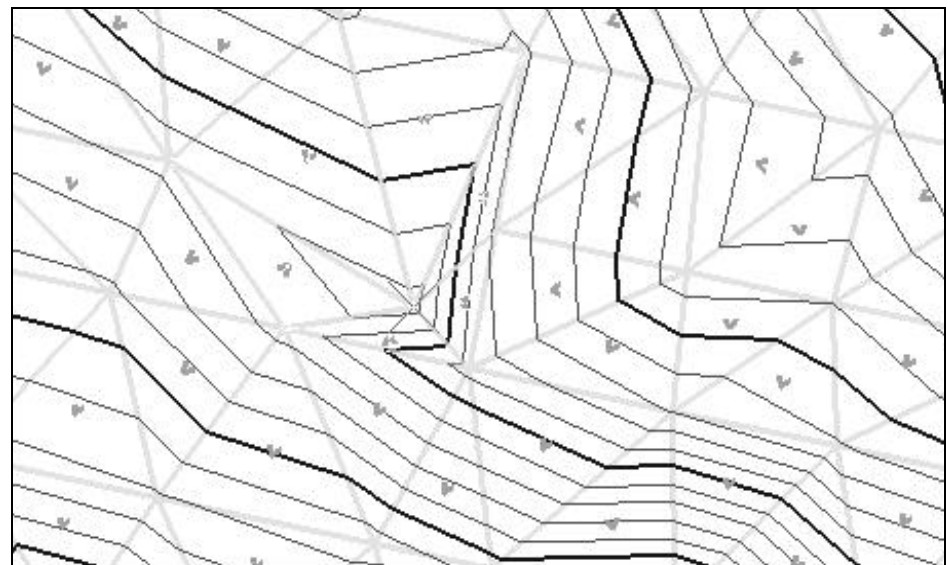
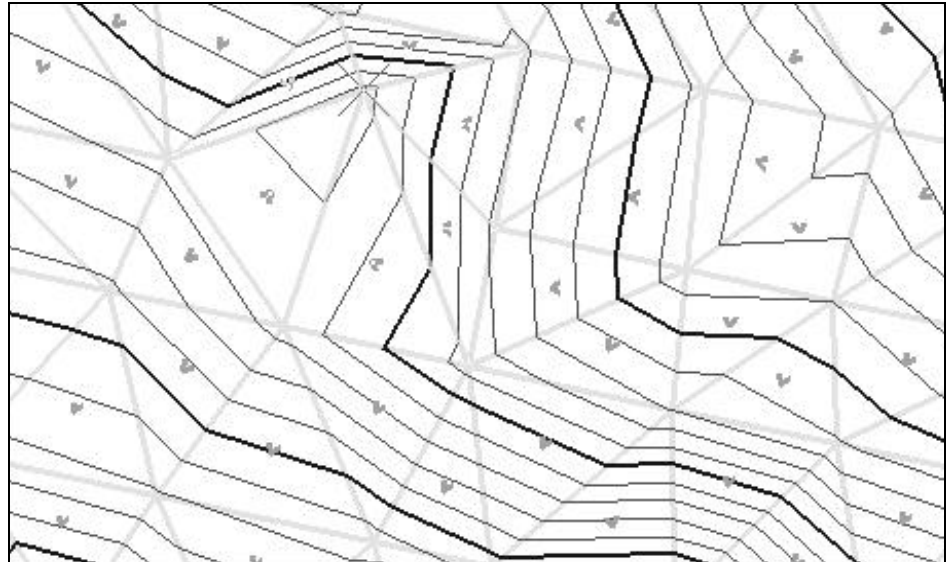


The **ID Vertex** button is selected, and the point to be moved is identified by a data point on the screen. The affected vertex, triangle sides, and display elements are highlighted as depicted in the graphic below, while the **X**, **Y**, and **Z** values of the vertex are displayed in the dialog.



When a second data point is placed anywhere on the screen, the vertex is attached to the cursor. Any movement of the cursor dynamically

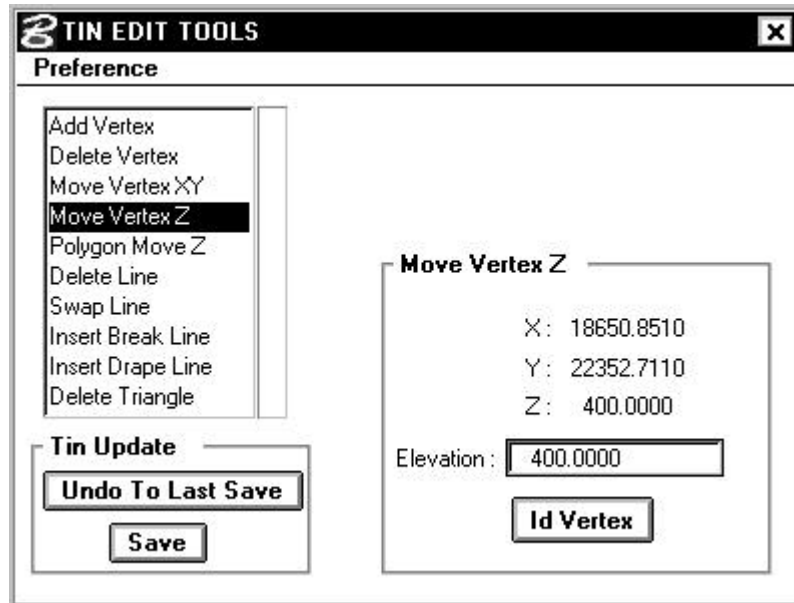
moves all highlighted elements as depicted in two examples below. In addition the **X**, **Y** coordinates on the dialog dynamically change, however the **Z** value remains fixed at the value of the original selected data point.



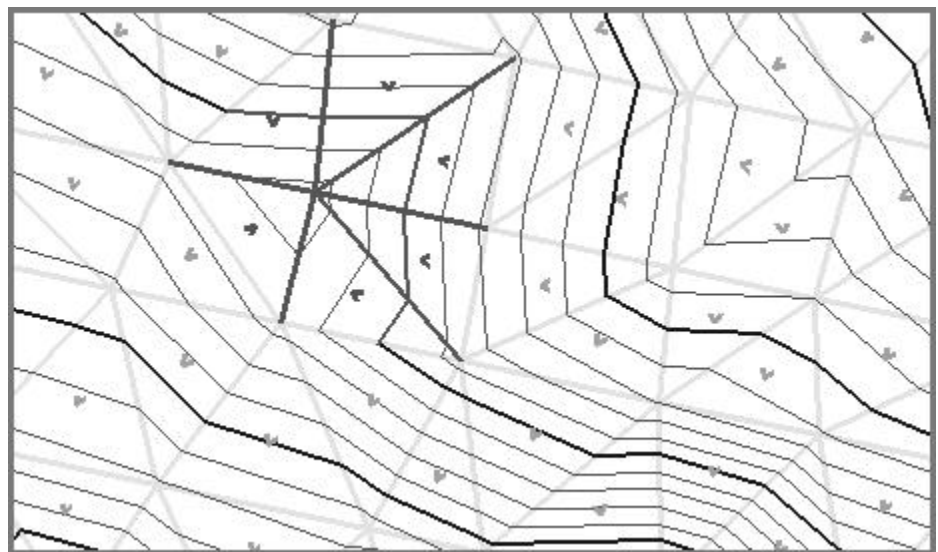
A final data point will discontinue the dynamics, and add the revised vertex into the TIN file.

8.5 Move Vertex Z

Another option is Move Vertex Z. When selected, the dialog dynamically changes as depicted below.

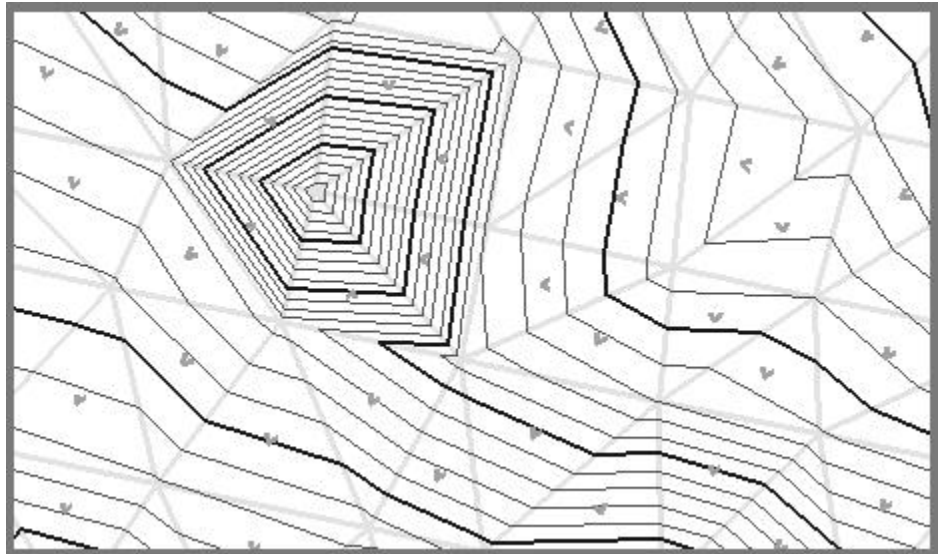


The **ID Vertex** button is selected, and the vertex whose elevation is to be moved is identified by a data point on the screen. The affected vertex, triangle sides, and display elements are highlighted as depicted in the graphic below.



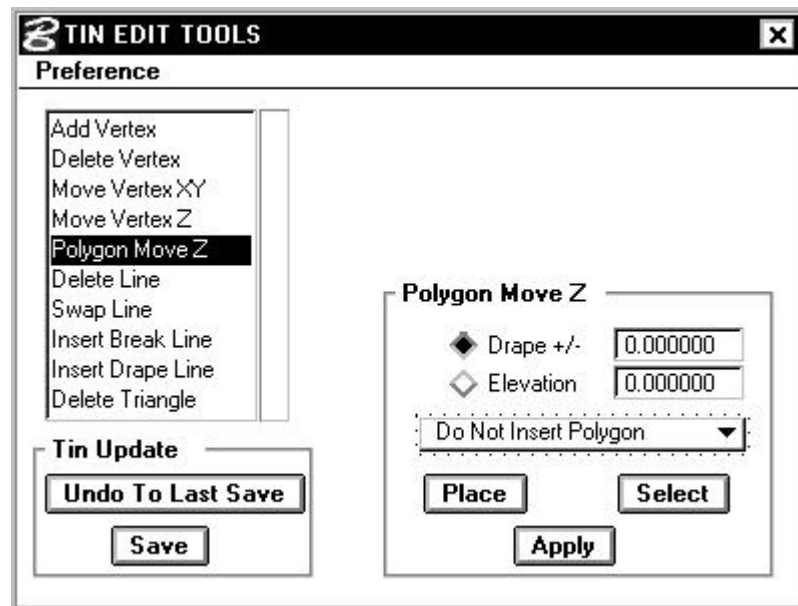
Key in the desired **Elevation**, then place a second data point anywhere on the screen. The vertex is moved to the specified elevation and all

associated elements are dynamically updated on the screen as depicted in the graphic below.



8.6 Move Polygon Z

Another option is Move Polygon Z. In this option, all vertices within the specified polygon will be raised (or lowered), then the entire model is re-triangulated. When selected, the dialog dynamically changes as depicted below.



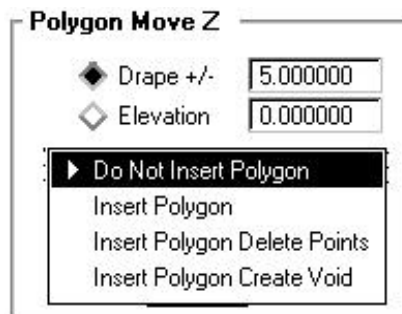
Two options are supported to specify the value of the change in elevation: **Drape** or **Elevation**. In Drape, either positive or negative

values in master units dictates the amount GEOPAK moves the polygon above or below the model. In the other option, **Elevation**, GEOPAK will move the appropriate vertices and optionally, the polygon, to the specified elevation. Note, the toggle next to the desired option must be activated.

If the polygon has been placed prior to processing the Polygon Move Z **Apply** button, then the **Select** option should be utilized. If the **Place** button is pressed, the software prompts for drawing the polygon as part of the Move procedure. To commence the procedure, press the **Apply** button.

Note that the entire polygon must be completely external or completely internal to utilize this process. In addition, due the precision of the LAT/TIN files vs. the precision of the graphics file, utilizing the TIN hull as the polygon is not supported.

Four options are supported for handling the polygon as depicted in the exploded view below.



An example of each option illustrates the difference. All four options will be utilized with the original model and polygon depicted below. Note, the **Drape** value is +5 in all cases.



8.6.1 Do Not Insert Polygon

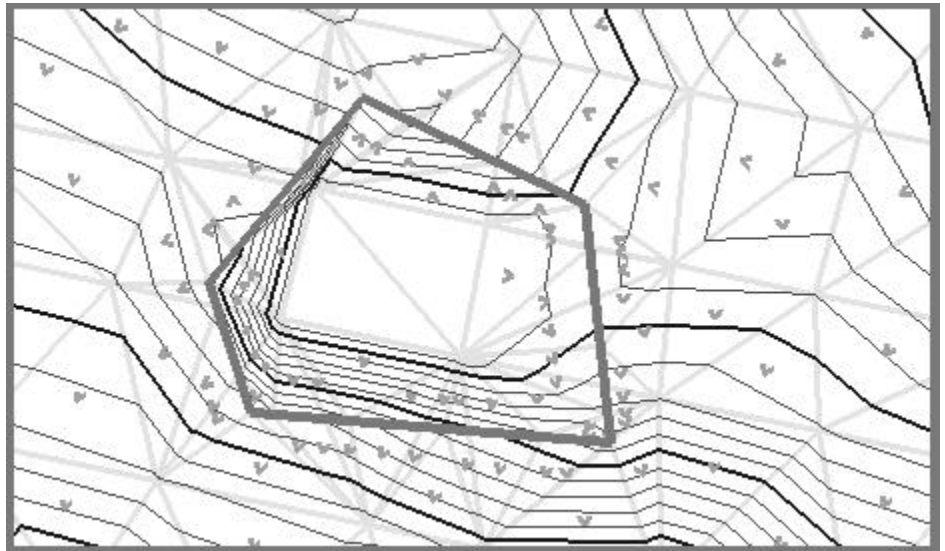
In this option, the elevations of all vertices within the polygon are moved by the amount specified in the Drape or Elevation field, however, the polygon is not utilized for any other purpose, i.e., break line. The resultant model is depicted below. Note that the contour lines have shifted throughout the polygon.



8.6.2 Insert Polygon

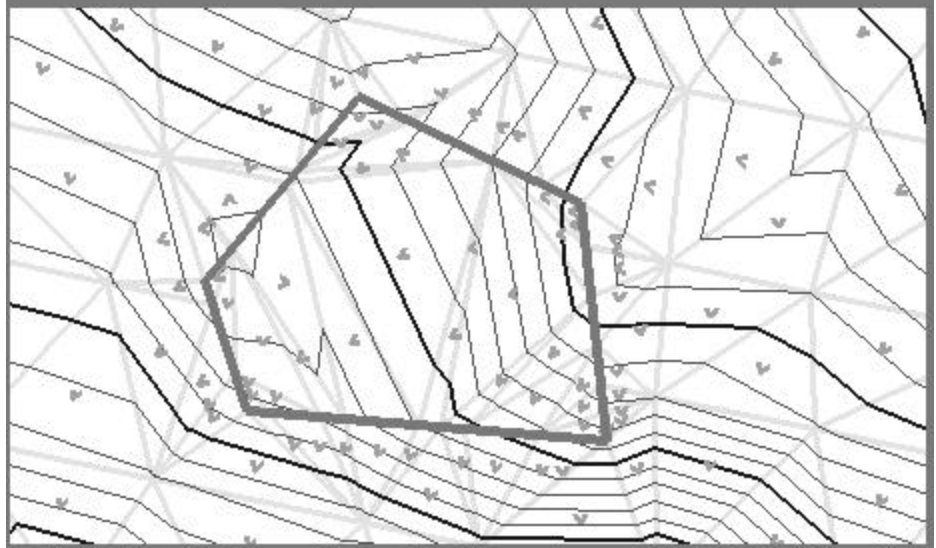
In this option, the elevations of all vertices within the polygon are moved by the amount specified in the **Drape** or **Elevation** field. In addition, the polygon is utilized as a break line. Therefore, care must be taken in the placement of the polygon in respect to its z value(s) for

correct elevation placement. The Drape or Elevation is utilized only for vertices within the polygon. The resultant model is depicted below. Note the change in contours adjacent to the polygon.



8.6.3 Insert Polygon Delete Points

In this option, all vertices within the polygon are deleted and the polygon is utilized as a break line. Therefore, care must be taken in the placement of the polygon in respect to its z value(s) for correct elevation placement. The resultant model is depicted below. Note that all vertices within the polygon are absent, and all triangles internal to the polygon have vertices on the polygon, as it is the closest break line. In addition, the triangles, contours, and flow arrows adjacent to the polygon have changed drastically, based on the elevations of the polygon vertices, therefore the elevations of the break line.



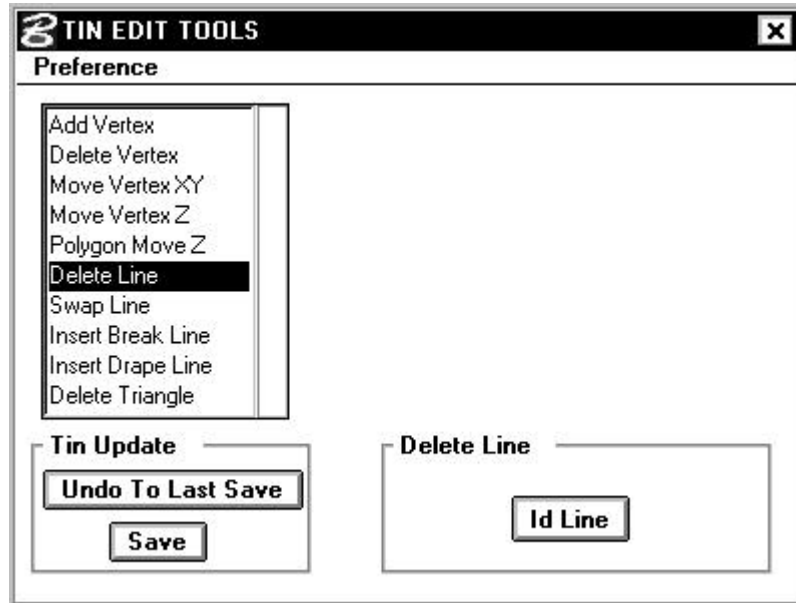
8.6.4 Insert Polygon Create Void

In this option, the elevations of all vertices within the polygon are removed as the polygon is utilized as the hull of a void. In addition, the polygon is utilized as a break line. The resultant model is depicted below. Note the absence of triangles within the polygon, as it is now a void. In addition, the triangles, contours, and flow arrows adjacent to the polygon have changed drastically, based on the elevations of the polygon vertices, therefore the elevations of the break line.

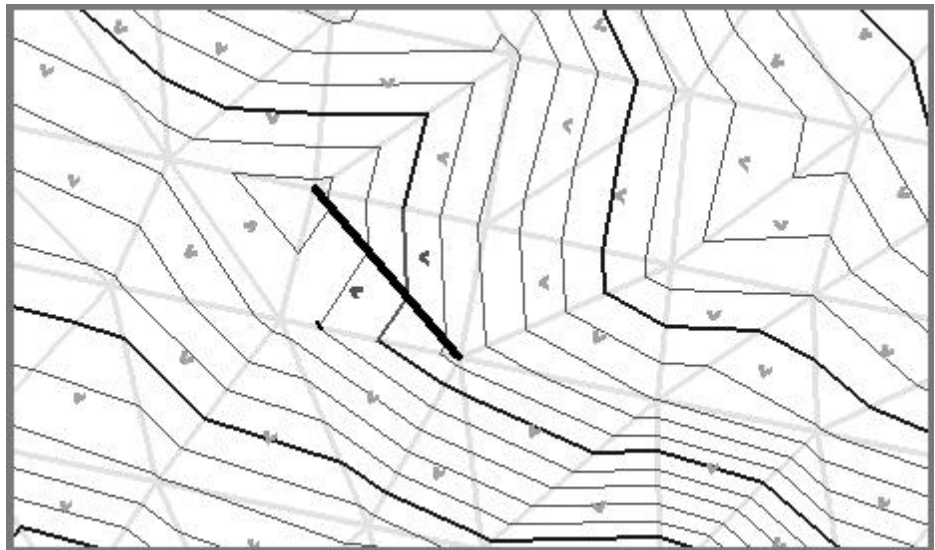


8.6.5 Delete Line

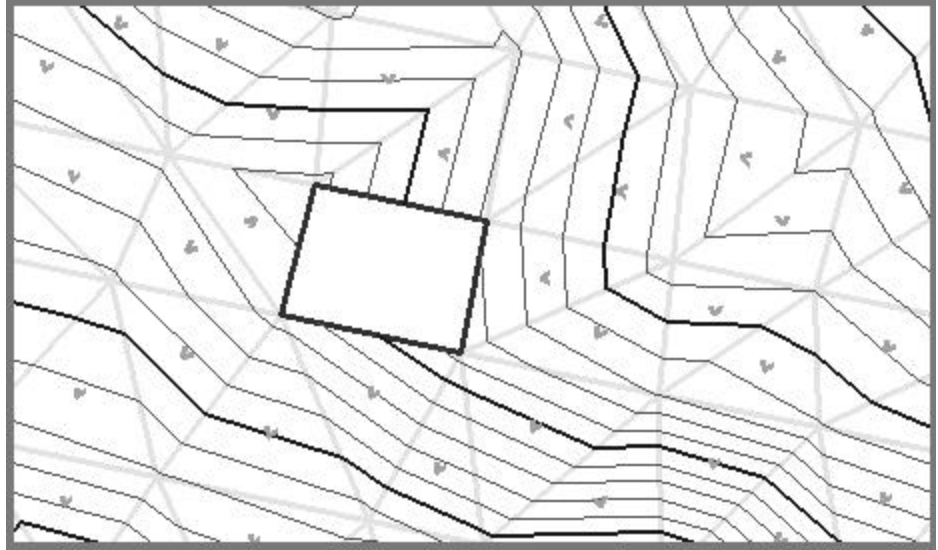
Another option is Delete Line. When selected, the dialog dynamically changes as depicted below.



The procedure is simple, just press the **ID Line** button, then select the triangle side to be deleted. The side and all affected elements highlight as depicted in the graphic below.

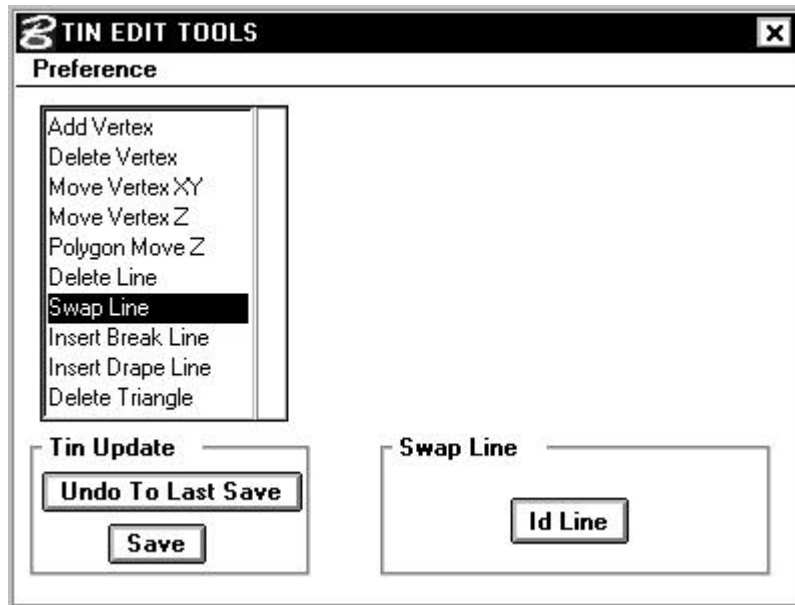


A second data point will delete the line leaving a void in the model. In the graphic below (with the **Display Void** toggle in the Display Parameters activated), the line is deleted and a void is inserted.

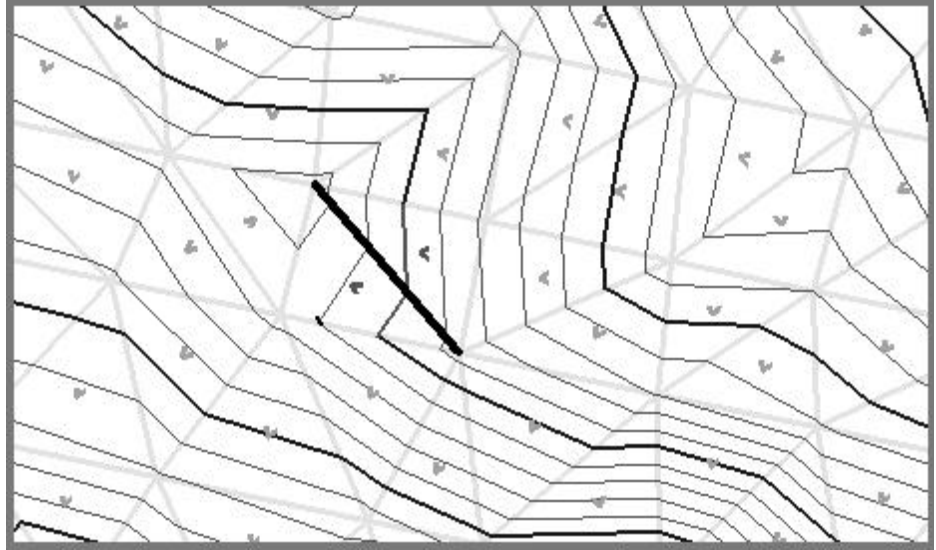


8.6.6 Swap Line

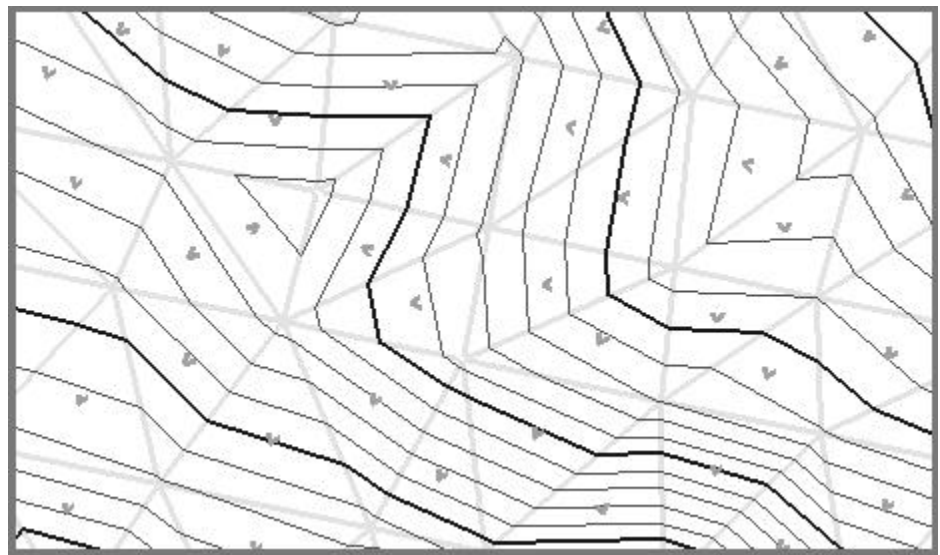
Another option is Swap Line, which changes the common side of two triangles. When selected, the dialog dynamically changes as depicted below.



Simply press the **ID Line** button, then identify the line to be swapped. The line, affected contours, and flow arrows are highlighted as depicted in the graphic below.

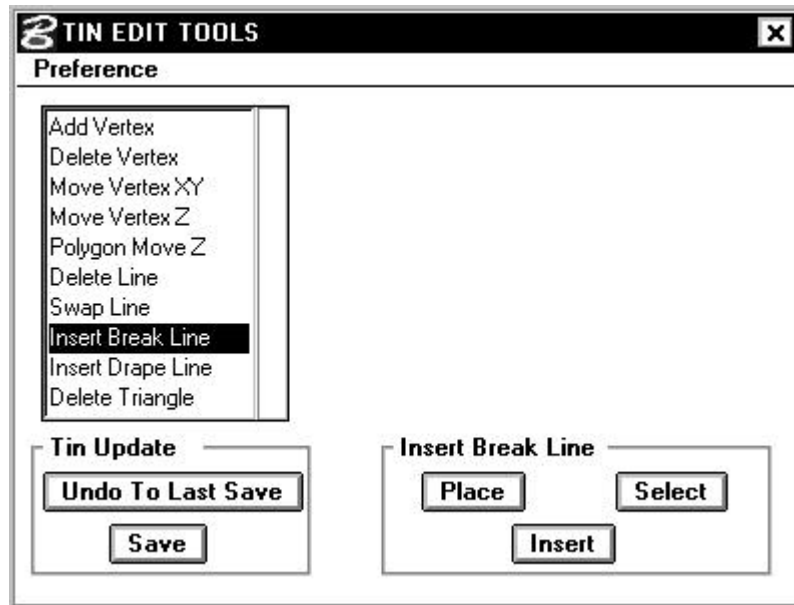


A subsequent data point will complete the procedure, whose results can be seen in the graphic below.



8.7 Insert Break Line

Another useful editing tool is **Insert Break Line**, whose dialog is depicted in the graphic below. In contrast to the **Insert Drape Line**, the **Insert Break Line** utilizes the x, y, and z coordinates from the break line element, so it must be placed at the desired X, Y, and Z location.



Two methods of insertion are supported: **Place** and **Select**. **Select** is utilized if the break line has been previously drawn, while **Place** is used if no prior break line elements have been drawn.

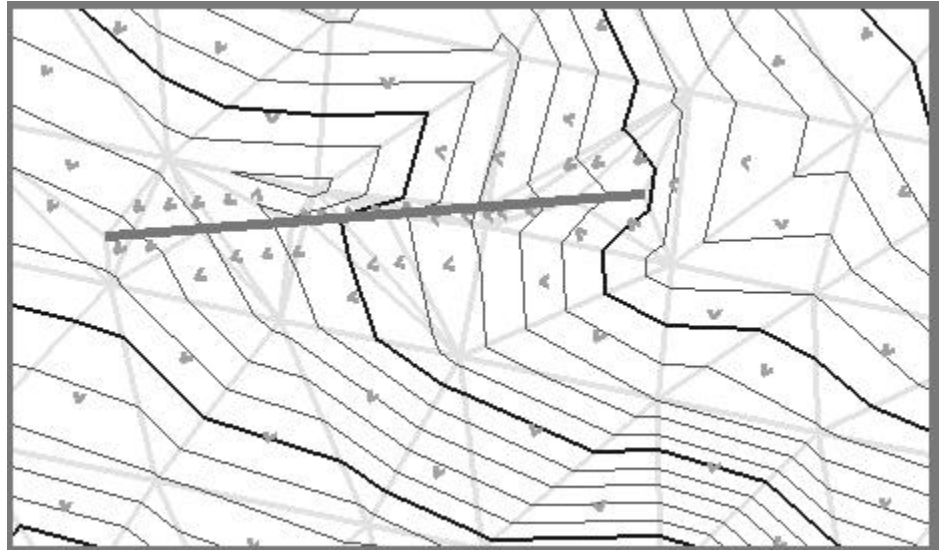
8.7.1 Select Method

If the break line has been drawn into a MicroStation file prior to processing, then utilize the **Select** option. When the **Select** button is pressed, GEOPAK prompts to identify and accept a previously drawn element as depicted in the graphic below.



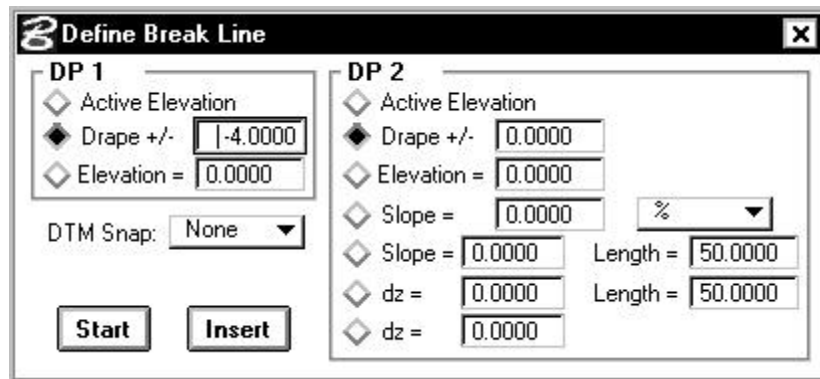
Note there is no dynamic action occurring on the screen. Once the break line has been identified, pressing the **Insert** button commences

the process. The result of inserting a break line (which is depicted on the screen for reference) is illustrated below. Note the additional triangles along the break line and change in flow arrows and contours reflecting the newly inserted break line elevations.



8.7.2 Place Method

If the break line has not been drawn, press the **Place** button, which invokes the dialog depicted below.



The dialog provides a plethora of options to assist the user in the placement of a break line. The first step is the selection of the z value for the first data point. Three options are supported in the upper left corner of the dialog:

- **Active Elevation** - the current elevation of the MicroStation view.

- **Drape** - the elevation difference in master units above (positive) or below (negative) the model at the specified x,y location.
- **Elevation** - the specified elevation or z value in master units.
-

Choose the desired option by activating the appropriate toggle to the left of the option and when required, key in the desired value.

In order to snap to various triangular elements in the model (which are only displayed, hence, cannot be snapped to with generic MicroStation snap locks), three options are supported:

- **Side** - With this option, GEOPAK will snap to the closest side of triangle.
- **Vertex** - GEOPAK will snap to the closest vertex.
- **None** - GEOPAK will not snap to any displayed triangular element.
-

To commence placement, set the desired options, then press the **Start** button and locate the first data point.

Numerous options are supported for the second data point as detailed below:

- **Active Elevation** - The X, Y location is determined by the dynamic movement of the cursor, while the Z coordinate is determined by the active elevation of the MicroStation view. When properly located, pressing a data point will discontinue the dynamics.
- **Drape +/-** - The X, Y location is determined by the dynamic movement of the cursor, while the Z coordinate is determined by the elevation of the model (at the X,Y cursor coordinates) plus or minus the drape value. When properly located, pressing a data point will discontinue the dynamics.
- **Elevation** - The Z coordinate is determined by the typed in value in the dialog, The change in elevation (**Dz**) from one endpoint of the break line to the second endpoint and the **Length** (in master units) are typed into the dialog.
- **Slope** - The **Slope** (specified in terms of percent, foot / foot or meter / meter) is projected to the X, Y location determined by the dynamic movement of the cursor. When properly located, pressing a data point will discontinue the dynamics.
- **Slope and Length** - The **Slope** (specified in terms of percent, foot / foot or meter / meter) is projected by the

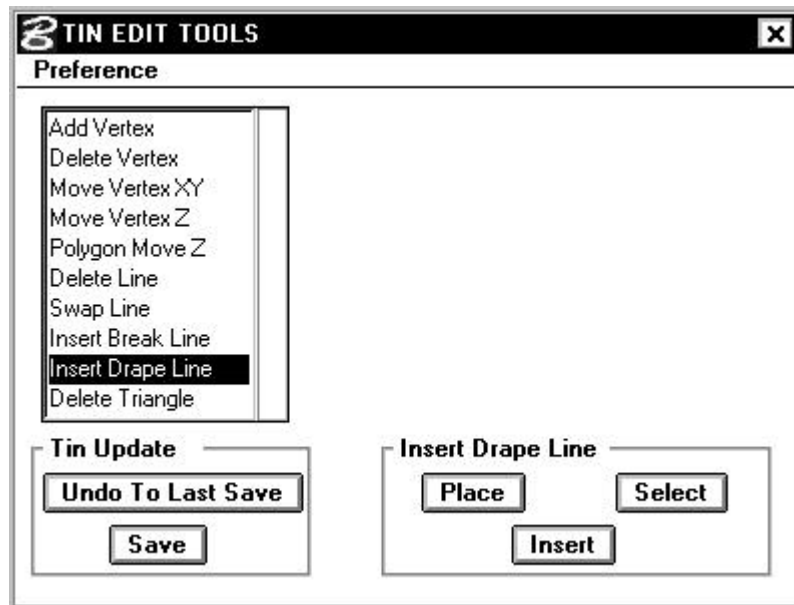
specified **Length**. The dynamic movement of the cursor only controls the direction.

- **Dz** and **Length** - The change in elevation (**Dz**) from one endpoint of the break line to the second endpoint and the **Length** (in master units) are typed into the dialog. The dynamic movement of the cursor only controls the direction.
- **Dz** - The change in elevation (**Dz**) from one endpoint of the break line to the second endpoint is typed into the dialog, while the X, Y location is determined by the dynamic movement of the cursor. When properly located, pressing a data point will discontinue the dynamics.

Pressing the **Insert** will insert the break line, dynamically changing all affected elements.

8.8 Insert Drape Line

The third option, **Insert Drape Line**, will utilize the X, Y coordinates of an element placed in the MicroStation file, however the Z value will be determined from the TIN model. The dialog is depicted below.



If the drape element has been previously drawn into the MicroStation file, then the **Select** option should be utilized. When the **Select** button is pressed, GEOPAK prompts the user to identify and accept the previously drawn element. The **Place** option, when pressed, prompts the user to draw the desired drape line. Note that the Z value of the drape line being drawn is inconsequential, as the Z values are determined from the specified TIN model.

After the drape line has been identified, press the **Insert** button to commence the process. In the graphic depicted below, the drape element is drawn for reference onto the original TIN model.

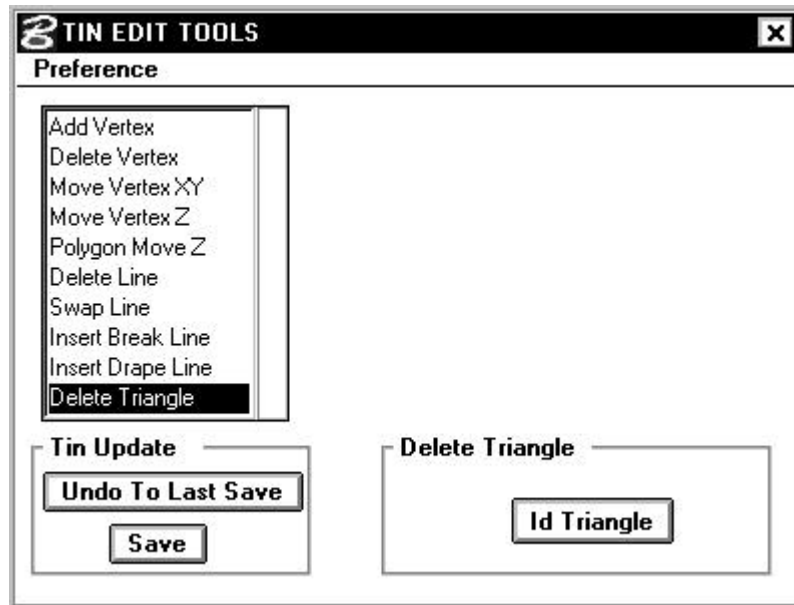


The results of the Insert Drape Line are depicted in the graphic below.

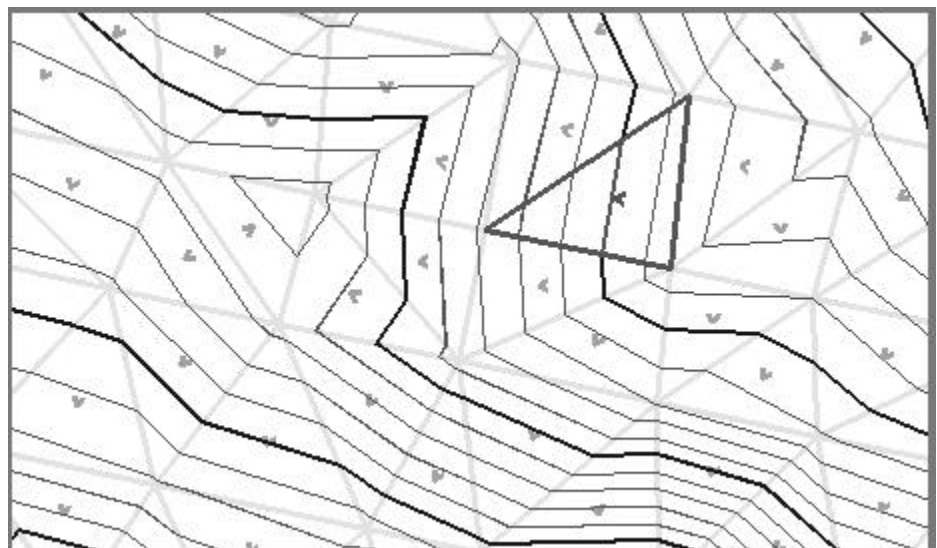


8.9 Delete Triangle

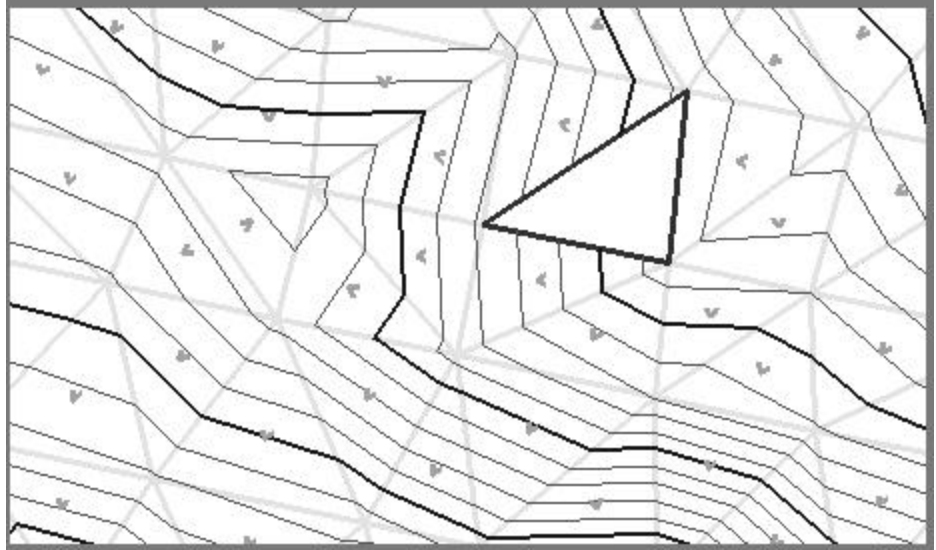
The last editing tool is Delete Triangle. If an external triangle is selected, it will be deleted from the model, and the external hull will be updated accordingly. If an internal triangle is selected, a void will be created in the model. The void will be reflected in subsequent processing of either the **Load > Voids** command or **Utility > Triangle Statistics** command. The dialog is depicted below.



Press the **ID Triangle** button, and identify the desired triangle on the screen, which is highlighted as depicted in the graphic below.



A subsequent data point will delete the triangle and in this case, create a void as the highlighted triangle is internal to the model. The resultant model is depicted below.



Additional adjacent triangles may also be deleted, creating a larger void as depicted in the graphic below.

