Chapter 13

Original Ground Cross Sections

13.1 Objectives

To generate original ground cross-sections based on a DTM, and to use the **Cross-section Navigator** tools.

13.2 Definitions

Geopak uses topographic elements to generate original cross sections. These include breaklines and spot elevations. GEOPAK can access and read this data from several basic data formats:

- Field Notes
- RDS cross sections
- DTMs based on Photogrammetric Mapping
- DTMs based on survey information

Of these basic formats, MoDOT primarily uses data from DTM's for generating existing ground cross sections.

13.3 Accessing

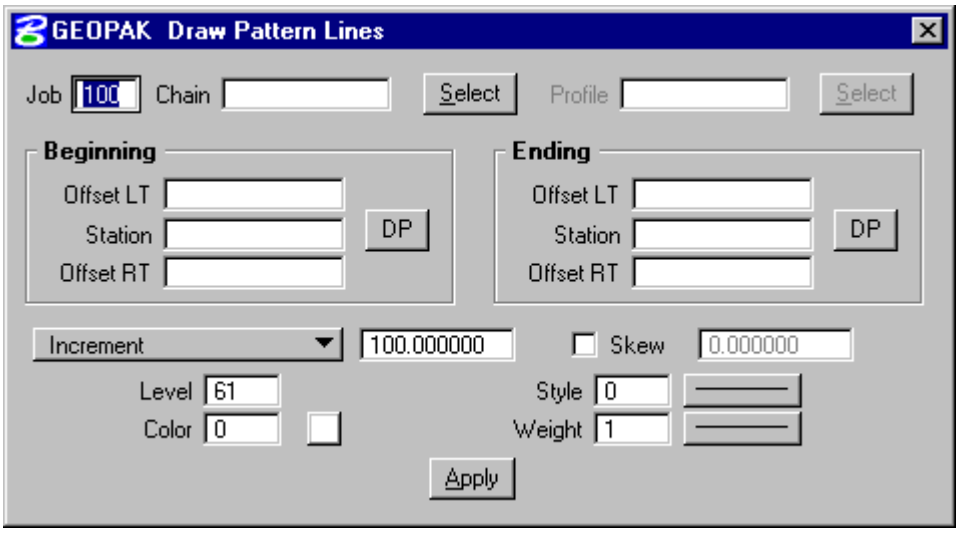
To access the **Draw Pattern Lines** dialog box, go to **Project Manager >> Draw Pattern** or choose the **Draw Pattern** icon.

To access the **Existing Ground Cross Sections** dialog box, go to **Project Manager >> Existing Ground Cross Sections**, or choose the **Existing Ground Cross Sections** icon.

13.4 Pattern Lines

Pattern Lines identify the location of the cross sections. Pattern lines are either a line or a line string drawn into a Microstation drawing. The lines are most commonly drawn using the Microstation Place Line or Place Smartline tools, or by the Geopak **Draw Pattern Line** dialog. The **Draw Pattern Line** dialog allows the user to easily place pattern lines at even intervals, and key alignment locations. The Microstation tools are generally used for specialty sections, such as an existing culvert location, or kinked sections.

From the **Project Manager** select **Draw Pattern**, and choose the run. The following dialog box will appear.



The user selects the **Job Number** and the **Chain** along which to draw the pattern lines. The **Offset LT** and **Offset RT** determine how far from the chain the pattern line is to be drawn, and the **Beginning** and **Ending Stations** determine the station range for which to plot the pattern lines.

Six methods are allowed for drawing the pattern lines.

Increment – starts at the beginning station, and draws a pattern line at the given increment (i.e. for a 100 foot increment on a chain starting at 10+17, pattern lines will be drawn at 10+17, 11+17, 12+17, …)

Even – draws pattern lines at stations divisible by the given value (i.e. for a 100 foot even interval on a chain starting at 10+17, pattern lines will be drawn at 11+00, 12+00, 13+00, …)

Once – draws a pattern line at a given station. (Only the beginning station is active.)

Critical Points - Horizontal – draws a pattern line at each of the critical points (i.e. POT, PC, PT, etc.) within a chain.

Critical Points - Vertical – draws a pattern line at each of the critical points (i.e. VPC, VPT, and high or low point) within a profile.

Superelevation Transitions – draws pattern lines at the beginning and ending of each superelevation shape drawn in the current Microstation file, and any attached reference files. (Locations that are coincident with the horizontal control points are not drawn.)

The cross section **skew** can be set using the **skew** toggle. The pattern line is skewed by the specified angle from the standard pattern line (perpendicular to the baseline). A positive skew

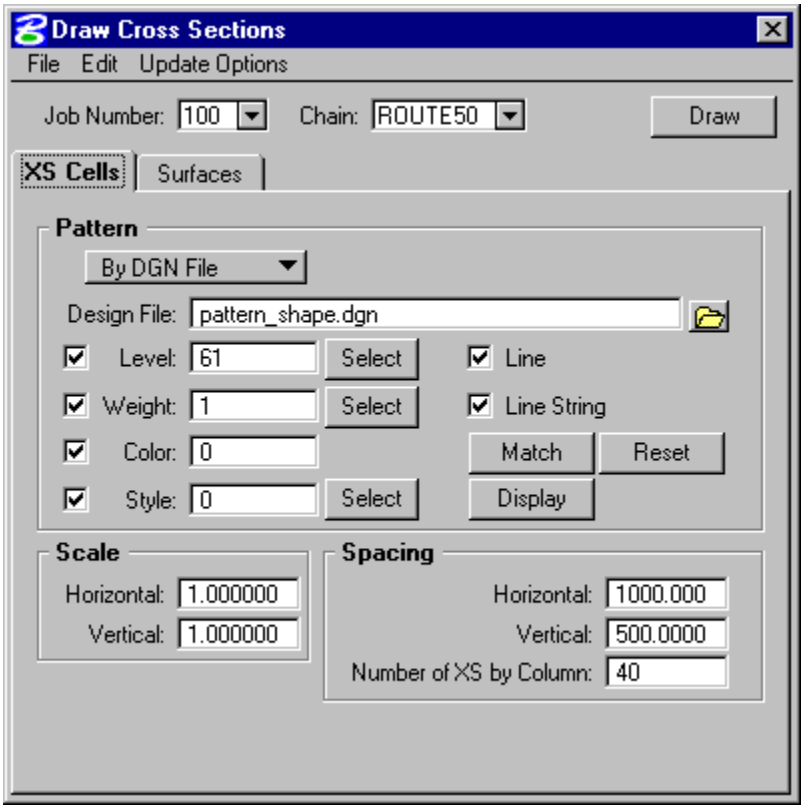
angle will rotate the pattern line clockwise, and a negative skew angle will rotate the pattern line counter-clockwise.

Once all the key-in fields have been completed and the **Apply** button is selected the pattern lines are drawn along the chain into the open Microstation design file (on the specified level, color and style). This is a visual representation of the location of the cross sections to be generated.

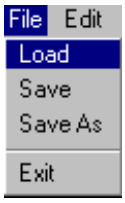
The user can use the Microstation **Place Smartline**, or **Place Line** command to draw additional pattern lines as needed.

13.5 Processing the Existing Ground Sections

Once the pattern lines have been drawn the cross-sections can be processed. To process the cross-sections, go to **Project Manager >> Existing Ground Cross Sections**, or choose the **Existing Ground Cross Sections** icon. After the run is chosen, the dialog box below will appear.

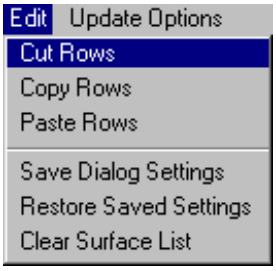


13.5.1 File Menu



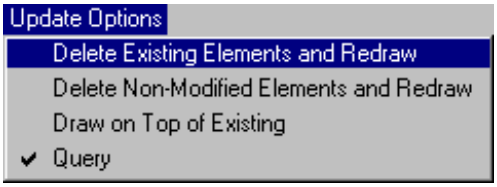
The **File** menu allows the user to save the dialog settings for each chain. The user sets the parameters for each chain, and then selects **File>>Save**. The next time the user accesses this dialog, the current information is completed from the resource files. The user can select **File>>Load** to access the previously saved settings. As the user switches between chains, the dialog settings will change according to how the user saved them. The Project Manager run also performs the same functionality.

13.5.2 Edit Menu



The **Edit** menu allows the user to **Cut**, **Copy**, and **Paste** rows from the **Surfaces** tab. **Save Dialog Settings** will save the information in the dialog box to the resource file. **Restore Saved Settings** will restore the dialog settings from the resource file. (If the resource file is deleted, these settings will be lost and cannot be restored.) The **Clear Surface List** option will clear all surface options from the current list.

13.5.3 Update Options Menu



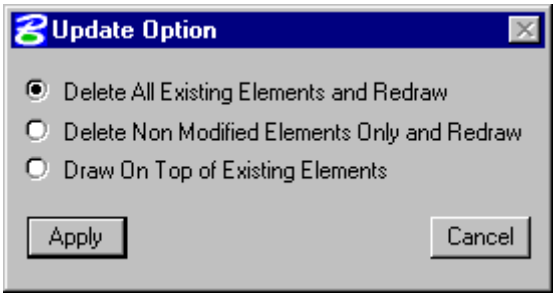
The **Update Options** dialog determines how previously cut original ground section elements will be handled when drawing new original ground section elements on the same cross section cells.

Delete Existing Elements and Redraw – any existing ground lines previously drawn with this tool are deleted and new ground lines are drawn.

Delete Non-Modified Elements and Redraw – only the existing ground lines previously drawn with this tool that have not been modified are deleted and new ground lines are redrawn. Lines that have been modified are left intact.

Draw on Top of Existing – the previously drawn existing ground lines are ignored, and new lines are drawn. This will result in two sets of lines.

Query – brings up the following dialog when the **Draw** button is pressed. The user can choose which option to use.



13.5.4 Job Number

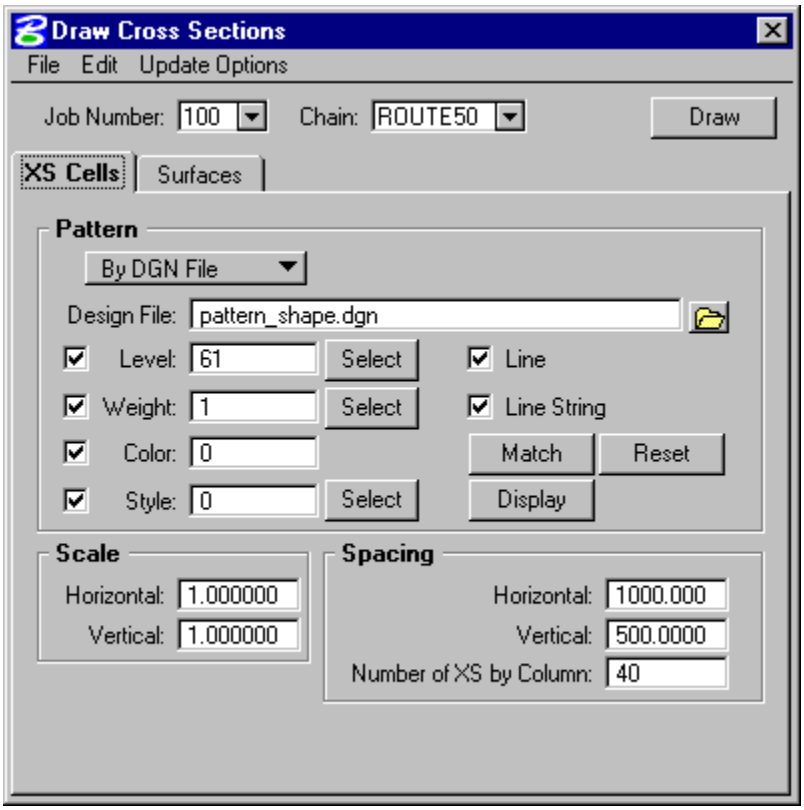
The user must specify the job number that contains the chain on which to base the cross sections. The drop-down arrow will display the .gpk files available in the working directory.

13.5.5 Chain

The user must specify the baseline to be used for the cross sections. The drop-down chain will display the chains available in the specified job number.

13.5.6 XS Cells

The **XS Cells** tab allows the user to determine where each cross section is to be drawn.



Three options are available in the **Pattern** section to determine the location of the cross sections.

By Station – allows the user to specify the **Beginning** and **Ending Stations**, the **Left** and **Right Offsets** and whether the stations should be cut at specified **Even** stations or at a specified **Increment** along the baseline.

By DGN File – uses the pattern lines drawn as discussed in section 13.4. The user needs to specify the Microstation design file in which the pattern lines are drawn, and the symbology of the pattern lines. The **Match** button can be used to select a pattern line with the desired symbology. When accepted, the symbology of the selected element will populate the fields that are turned on. The **Display** button will display all of the elements that match the specified symbology. The **Reset** button will clear all of the symbology fields.

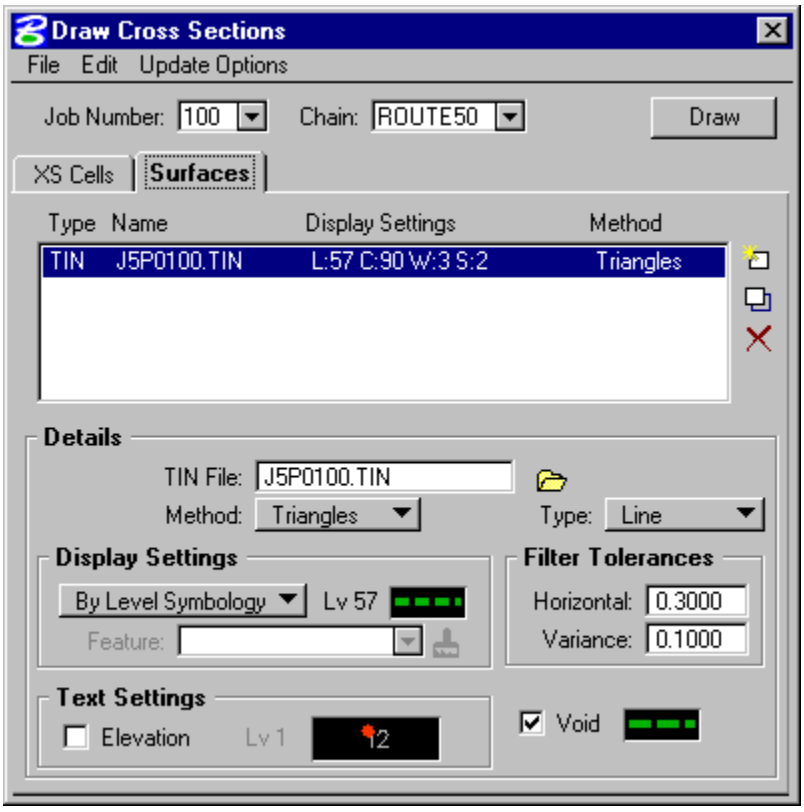
In Existing Only – this option uses the only the cross section cells drawn in the current Microstation Design File.

The **Scale** section can be used to adjust the scale of the cross sections. For MoDOT, the **Horizontal** and **Vertical** scale should always be set to 1.0. MoDOT controls the scaling of the cross sections when the cross section sheets are plotted.

The distance between the cross sections and the maximum number of cross sections in each column can be set using the **Horizontal**, **Vertical**, and **Number of XS by Column** option in the **Spacing** section. It is suggested to leave the **Vertical** and **Number of XS by Column** settings at the default values. The **Horizontal** setting may need to be changed depending on the width of the cross sections. The **Horizontal** setting should be set to a value greater than the total width of the cross section. This will prevent the cross sections from overlapping each other.

13.5.7 Surfaces

The **Surfaces** tab allows the user to specify the surfaces from which to cut the original ground cross sections.



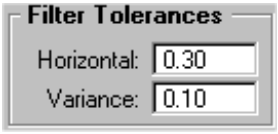
The top portion of the dialog lists the surfaces to be cut, and the symbology to be used when drawing the cross sections for the given surface. The icons on the right allow surfaces to be added, modified, or deleted.

The **Details** portion of the dialog allows the user to specify the TIN file to be used as the cutting surface, select the **Method** of interpolation, and select the **Type** of element to be drawn. When **Breaklines** is selected as the **Method**, the cross section is interpolated between the breaklines, and the triangles are ignored. This is mainly used in a site design application. The method should always be set to **Triangles**, which will include the triangles in the interpolation of the cross section surface. The **Type** allows the cross section to be drawn a **Line**, or a **Line String**.

The **Display Settings** section allows the user to determine how the cross section surface will be drawn. The user can choose **By Level Symbology** or **By Feature**. When using **By Level Symbology**, the user can choose the level, weight, color, and line style for the cross section elements by double clicking on the symbology box next to the **By Level Symbology** / **By Feature** toggle. **By Feature** allows the user to choose an item from the current D&C Manager database. Selecting the paintbrush icon will open the current D&C Manager. The user can select the item to use, which will then be displayed in the **Feature** field. Previously selected items can be viewed by using the pull down in the **Feature** field. Currently, MoDOT does not have any D&C Manager items set up for the cross section view. Therefore, it is suggested to us the **By Level Symbology** option. The **Void** symbology can be set using the **Void** toggle. This will draw any areas that cross a void, or the tin hull using the specified symbology. The following table shows the level symbology currently used in MoDOT.

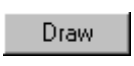
Surface Name	Level	Color	Weight	Line Style
Existing Ground	57	90	3	2
Void Areas	57	40	3	2
Top of Rock	58	8	3	2
Bottom of Rock (for rock seam)	58	9	3	2

The **Filter Tolerances** section allows for the elimination of short segments that may be created but are less than the tolerance distance in length. The default values are good values to be used for these options.



The existing ground elevation at the baseline can be plotted using the **Text Settings** portion of the dialog. To use the text settings option, turn on the **Elevation** toggle. Choosing the symbology box located next to the elevation toggle can set the text symbology.

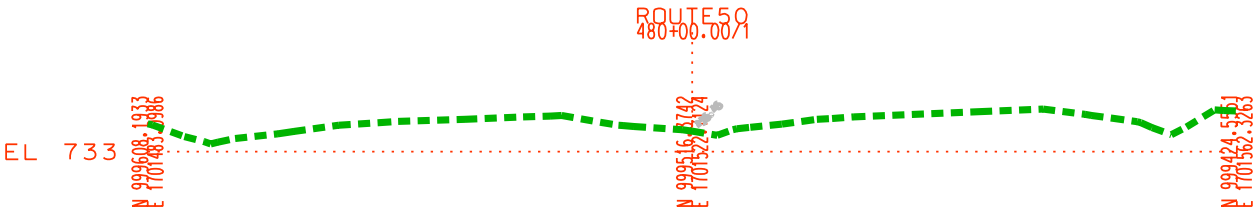
13.5.8 Draw



Once the cross section location is set up, and the surface and surface symbology is determined, the **Draw** button can be used to draw the cross sections into the active Microstation design file.

13.6 Cross Section

The cross sections consist of mostly Microstation elements. These elements can be modified using Microstation tools. New elements can also be added using Microstation or Geopak drawing tools.



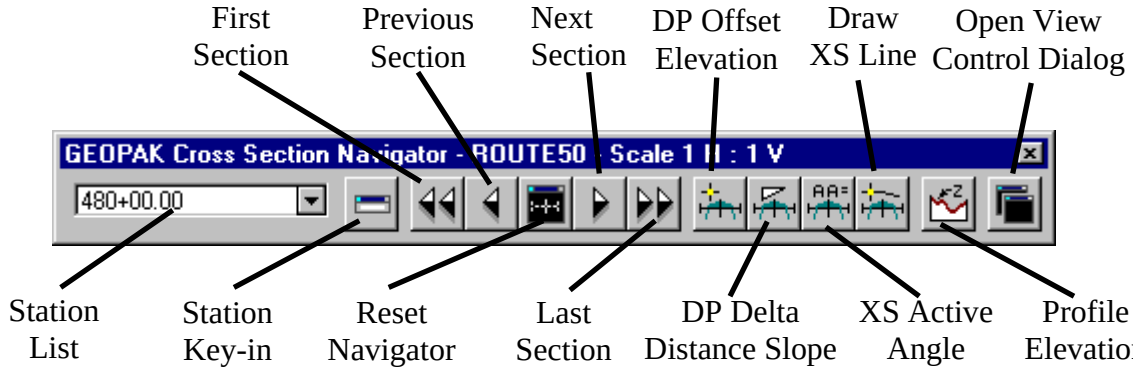
The intelligence of the cross section is built into the cross section cell. This cell is located on level 63. The cell consists of the baseline name, the station and region, the end coordinates for the cross section location, and the coordinates for the location at which the cross section intersects the baseline.

Warning: Do not delete or modify the cross section cells. If the cell is deleted or modified, the intelligence for this cross section will be lost.

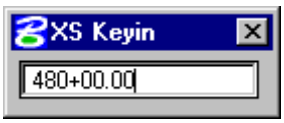
13.7 Cross Section Navigator

The **Cross Section Navigator** is a tool used to view and move between cross-sections. It can also be used to draw cross-section information.

The user can access **Cross Section Navigator** by the **Cross Section Navigator** icon. When the icon is chosen, the following dialog appears.



The user can move through the cross-sections by either choosing the station from the pull-down list, by typing the station value into the **Station Key-in** dialog, or by using the **First Section**, **Previous Section, Next Section,** or **Last Section** icons. The **Reset Navigator** icon will center the first station to the view, and reset the navigator to the first station value. Cross-section elements can be added or modified using Microstation tools, and/or the cross-section drawing tools.

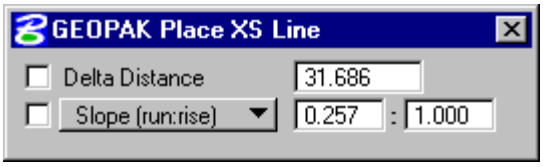


DP Offset Elevation – data points at a given offset/elevation, or find the offset/elevation of the cursor location.

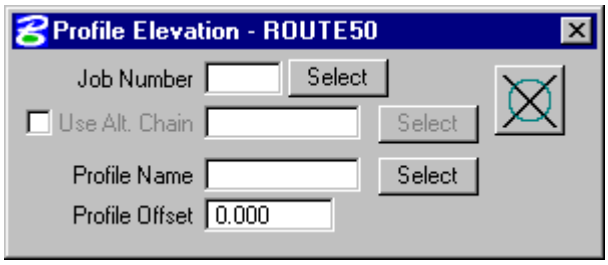
DP Delta Distance Slope – draws a line at a given horizontal distance and slope.

XS Active Angle Tool – sets the active angle to the given value. If a Microstation tool is used with the active angle option, this value will be used.

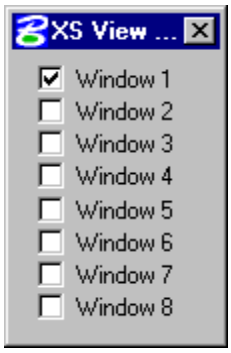
Draw XS Line – draws a cross-section line. An offset or a slope can be specified.



Profile Elevation – issues a data point at the elevation of a specified profile. An alternate chain location can also be specified.



Open View Control Dialog – allows the user to open and navigate through several windows to view different portions of the cross-section at the same time. (I.e. The user can view the whole cross-section in view 1, the left side in view 2, and the right side in view 3.)



13.8 Summary

Basic Steps to Creating Original Ground Cross Sections from a DTM

1. Have an existing triangle file (.tin).
2. Open a 2D Microstation design file for the pattern lines.
3. Draw the pattern lines.
4. Open a 2D Microstation design file for the cross sections.
5. Draw cross sections through GEOPAK.
6. Review and modify (if necessary).