
Chapter 20

3D Modeling

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20.1 Objectives

- Create 3D cross sections from 2D cross sections
- Interpolate between 3D cross sections to create B-spline surfaces
- Use Drive Through to view the model
- Place pavement markings on the 3D model

20.2 Definitions

Geopak 3D Modeling is a process of deriving three-dimensional cross sections from two-dimensional cross sections and interpolating between the three-dimensional cross sections to create b-spline surfaces that represent the design.

20.3 Prerequisites

Before a 3D model can be extracted from 2D cross sections, there are a few prerequisites that must be met. They are:

- 2D design cross sections
- Plan view graphics
- 3D design file

2D Design Cross Sections

The user should have an existing design file where 2D cross sections are stored. The user will need to know which levels contain the existing ground line and the proposed finished grade.

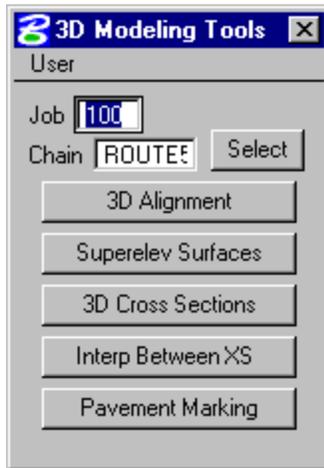
Plan View Graphics

The user must also have another 2D-design file containing plan view graphics. The plan view graphics should include the elements specified in the **Run**. For example, edge of pavement, chains and pavement markings.

3D Design File

A blank 3D-design file must exist to store the 3D cross sections as they are generated. Enter the 3D-design file and attach the 2D-plan file as a reference file. Save the settings of this file with only the Top View displayed.

20.4 3D Modeling Tools



From a 3D-design file, access the 3D modeling tools by selecting **Project Manager >> 3D Models** or by selecting the **3D Models** icon. The dialog box will appear requiring a job number and chain name. This chapter will primarily focus on the **3D Cross Sections**, **Interp Between XS** and **Pavement Markings** tools. Descriptions of the available 3D modeling tools follow:

3D Alignment - will draw elements into a 3D file, at correct coordinates, using the specified alignment and profile.

Superelevation Surfaces - is used to draw Geopak generated 2D shapes into B-spline surfaces, within a 3D model, following user defined plotting parameters.

3D Cross Sections - will reference your 2D cross section file and create a 3D complex chain to represent the 3D cross sections.

Interp Between XS - interpolates between the 3D cross sections to create B-spline surfaces.

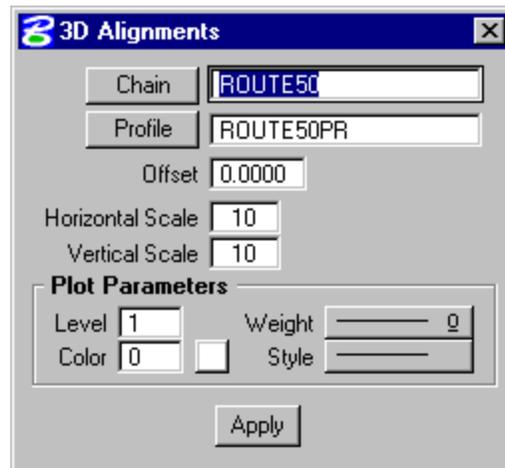
Pavement Markings - will add pavement markings to a 3D model. The pavement-marking tool will scan pavement markings in a 2D file and draw the markings in the 3D file based on user defined parameters.

20.5 3D Modeling Process

1. Plot the 3D alignment, and attach the plan view as a reference file.
2. Geopak will open the 2D cross section file, scan the cross sections and create a complex line-string based on the cross sections.
2. Geopak then returns to the 3D-design file to draw the 3D cross sections.
3. B-spline surfaces must be created using **Interp Between XS**.

20.5.1 3D Alignment

A 3D alignment must be plotted. This 3D alignment is a representation of the combined chain and profile. An offset from the chain can be specified as well as the horizontal and vertical scales, and the symbology of the 2D alignment.



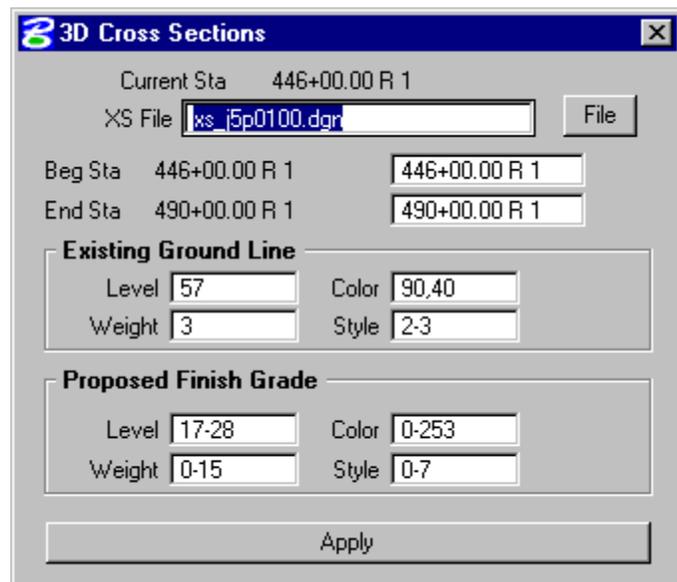
20.5.2 3D Cross Sections

Generate 3D Cross Sections:

- Enter the 2D cross-section file containing design cross-sections; Geopak reads the file to determine the beginning and ending station of the cross-sections. These stations are automatically displayed in the dialog box; however, the user may key in a different range.
- Define the attribute information for Existing Ground Line and Proposed Finished Grade.
- Select **Apply**

Geopak opens the 2D cross-section file and begins creating 3D complex line-strings from each cross-section. Each 2D cross-section will highlight as the line string is formed. This gives the user a brief opportunity to check for errors. When the process is complete, Geopak returns to the 3D file to draw the cross-sections.

A visual inspection of the 3D cross-sections should be performed to verify their integrity. The colors of the 3D-line string should reflect the same colors as shown in the 2D-design cross section. If



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an error has occurred, the user should return to the 2D-design cross section file and fix the appropriate cross section(s) using Geopak and/or Microstation. Repeat the 3D cross-section process for any revised cross-sections and review.

20.5.3 Interpolation Between XS

Two **Methods** exist for interpolating cross-sections:

Longitudinal - is used when a 2D-plan view is referenced to the 3D cross-section file. This is the most common method.

Surfaces - should be selected when your plan view reference file is a 3D file.

Beginning Station and Ending Station - values will automatically be displayed when each of their offsets are defined. Offset information must be entered in order and is controlled by successive activation of the **DP** buttons. The user must define the Beginning Station offsets by first issuing a **DP** for the left and right offset locations. The same process is repeated for the End Station box.

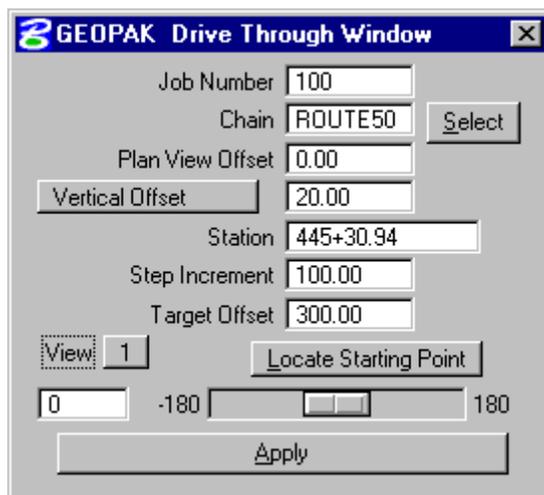
Highlight Applied Breaklines - will highlight the breaklines used in interpolation when toggled on.

Select the **Draw Surfaces** bar at the bottom of the dialog box to begin the interpolation process. The user is encouraged to process a small range of cross sections until the entire project has been done. When Geopak interpolates 3D cross sections, it projects *like color to like color* between cross-sections. All Microstation elements should maintain a consistent color scheme throughout the project. For example, within a 2D file, all ditch slopes should be drawn the same color and roadway lines should also be drawn using one color. If colors do not correspond, you will get a “Color Mismatch” error and the process will terminate. There are two ways to correct this error:

- Check the cross sections for an inconsistent color scheme, correct any errors, then regenerate the necessary cross sections, or
- Activate the **Force Color** toggle; this will allow Geopak to ignore the color of the cross section elements and interpolate using only the specified color.

20.6 GEOPAK Drive Through

GEOPAK Drive Through provides the user realistic visualization of 3D surfaces. Select **Applications >> Geopak Road >> 3D Tools >> Drive Through** or choose the **Drive Through** icon.



The user must enter the **Job Number** and a **Chain** name. The drive through will follow this chain or may be offset from the chain by entering a value in the **Plan View Offset** box.

Two options are available to define the distance the driver is from the roadway vertically:

- **Constant Elevation** will place the driver at a fixed elevation, as defined by the user, throughout the drive through process.
- **Vertical Offset** places the driver at a specified distance above the model, meaning the elevation of the view changes with the elevation of the model.

The **Station** value will automatically display the beginning station of the selected chain, but may be changed by user key-in.

Step Increment defines the distance traveled between each camera view.

Target Offset defines how far down the road the viewer is looking (the focal point).

Pressing the **Locate Starting Point** button will find the first station on the alignment where a 3D graphic element is present. This is a convenient way to locate the start of a model.

View indicates the Microstation view to be processed.

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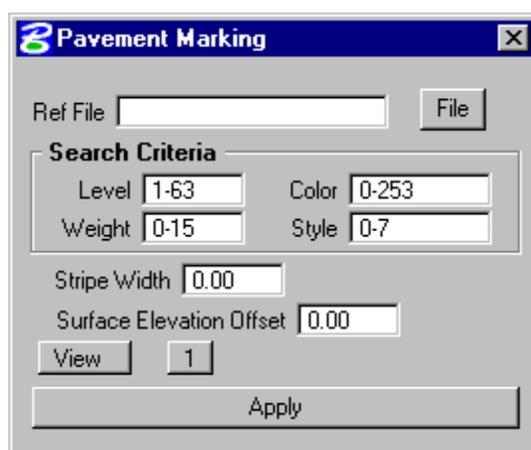
Press the **Apply** bar to activate the first camera view. Once the first view is displayed, the user may *pan* the view by moving the slide bar to the desired angle and pressing the Apply button again.

After viewing the model:

- Restore the view by rotating to the top view.
- Access the **Settings >> View Attributes** dialog box from the Microstation command window and toggle **Camera** off (automatically toggled on during drive through process).

20.7 Pavement Markings

This tool places pavement markings in a 3D file by extracting graphic information from the plan view of a 2D file. (Pavement markings created by *copying parallel* a complex element must be dropped before they can be included in a 3D model.)



Enter the name of the 2D graphics file containing pavement markings.

Provide **Search Criteria** by entering the graphic attributes of the pavement markings.

Stripe Width reflects the actual width of the plan view stripe you want to create.

Surface Elevation Offset is the distance from the B-spline surface the stripe shape is drawn. Special attention needs to be applied to this value. If the distance is too low, the stripe may fade into the roadway; if the distance is too high, the stripe may cast a shadow on the road surface when the model is moved to a visualization software package. It is desirable to place the stripe just above the surface. Begin by using a value of 0.10; if adjustments are necessary, use small increments.

Pavement Markings may be applied to an entire view or a fenced area by selecting the appropriate option. If view is chosen, be sure to *fit the view* before processing.