



Introduction to GEOPAK

OBJECTIVES

The objectives of this chapter are an introduction to GEOPAK, overview of file names, and discussion of User Preferences.

INTRODUCTION

GEOPAK is a comprehensive software package that covers every project phase from conceptualization to final quantities and construction stake-out. The software works within the MicroStation graphic environment providing *true interactive design*. For example, a horizontal alignment can be created graphically, it can be calculated with the coordinate geometry component of GEOPAK or some interactive combination of the two. Dynamic on-screen design provides immediate interpretation of plan view geometrics for making design choices through visualization.

Using GEOPAK will help ensure consistency and accuracy of design work and generate a significant time savings in the overall effort of producing construction plans.

FILE NAMES

GEOPAK uses and/or creates files during the design process. Several of the more common files are detailed in the table below.

job###.gpk	This binary file is created when the user starts a coordinate geometry (COGO) session for the first time or created through Project Manager. The file may be appended to during the design process. All coordinate geometry elements are stored in this file. Multiple users can access this file at the same time, and only one file should be created for each project. The "###" is the only variable in this filename. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.
fname###.ioc Example: align999.ijd	ASCII input file for loading data during a COGO session. "###" represents the job number and "oc" is the operator code (users initials). Filename characters are limited to 5 characters plus the 3 job number character designation as indicated with the example.
fname###.ooc Example: align999.ojd	ASCII output file created by GEOPAK during a COGO session. Variables are the same as defined above. Filename characters are limited to 5 characters plus the 3 job number character designation as indicated with the example.
fname.inp Example: desxs.inp	Any ASCII input file for running GEOPAK processes. Name is user defined with a .INP extension.
fname.dat	A binary file that contains string and point information to be used for digital terrain model construction.

<i>fname.tin</i>	A binary file containing triangular surfaces also known as the digital terrain model (DTM).
<i>Project-name.prj</i>	Binary file resulting from the creation of a new project.

ACCESSING GEOPAK

GEOPAK is started upon entering a MicroStation File. To verify that GEOPAK is active, scan the MicroStation menu bar where the **Applications** menu appears. Simply select **Applications > GEOPAK Road**. When each GEOPAK tool is selected, the corresponding dialog(s) open.

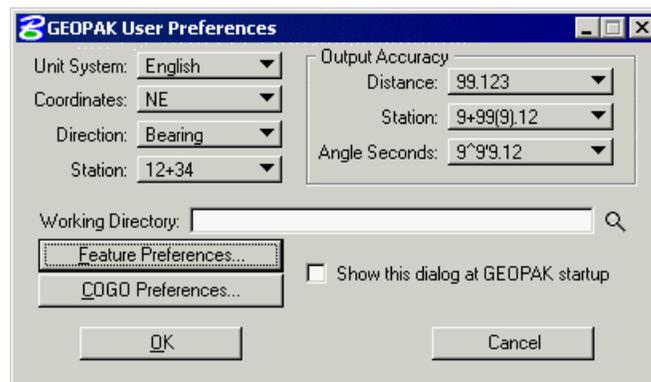
To close a dialog, the following options are available, use the one that appears on the dialog:

- Click the X in the upper right corner of the dialog.
- Select the File > Exit option.
- Or click Cancel on the dialog.

Exiting the MicroStation file automatically closes all GEOPAK dialogs.

USER PREFERENCES

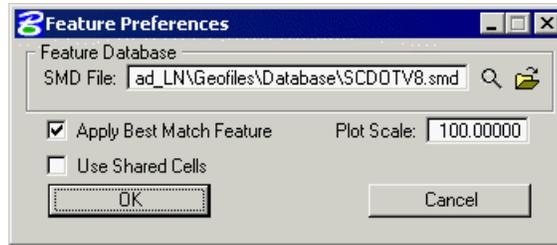
When a user begins GEOPAK for the first time or after GEOPAK has been reloaded, there are certain User Preferences the user needs to set. The User Preferences dialog can be accessed from Applications > GEOPAK Road > User Preferences.



Most of the settings in this dialog can be defined when a project is created within Project Manager (See Chapter 2).

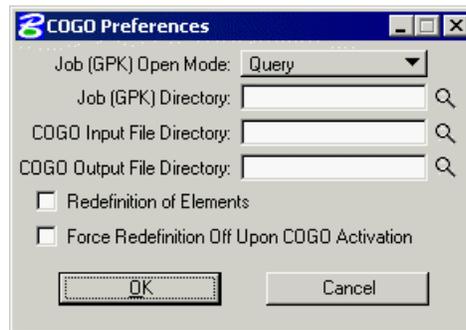
The Working Directory identifies where the data files for a particular project can be found. If a user does not want to work within a specific project, the field may be left blank, and GEOPAK uses the directory wherein the open MicroStation file is located.

By clicking Feature Preferences, the Feature Preferences dialog opens.



This defines the default file utilized for representation of coordinate geometry and survey elements when visualization is utilized during an active coordinate geometry session as well as the scale in which these elements will be displayed.

By clicking COGO Preferences, the COGO Preferences dialog opens.

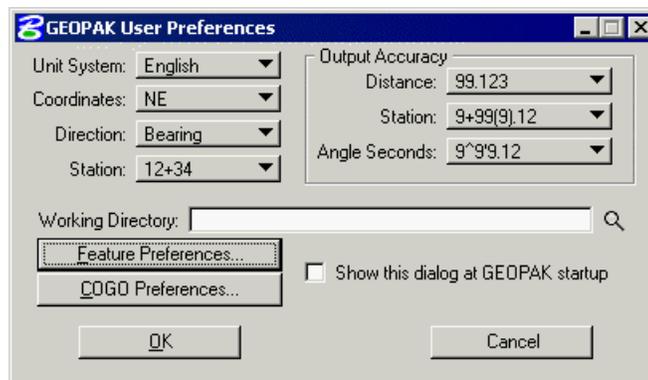


The Job Directory field specifies the location of the GPK file. Since multiple people can read and write the GPK file simultaneously, it is possible to have this file on a server or in a shared folder. If any of the above directory fields are blank, they will default to the Working Directory set in the GEOPAK User preferences dialog.

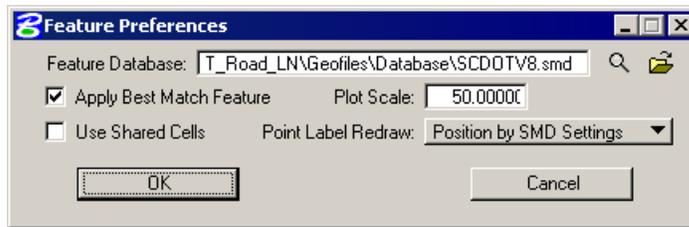
LAB EXERCISE: USER PREFERENCES

Review of Steps to Define Design Preferences

1. Open the MicroStation file *C:\data\geo\S755\S755pp.dgn*.
2. Select the User Preferences tool (*Applications > GEOPAK Road > User Preferences*).



3. Click **Feature Preferences**.



4. Set the **Plot Scale** to 50.
5. Toggle on **Apply Best Match Feature**.
6. Click **OK** to close the Feature Preferences.
7. Click **OK** to close the GEOPAK User Preferences.
8. **Exit** MicroStation.



Processing Survey Data

CHAPTER OBJECTIVES

In this chapter, you will learn about:

- creating a survey dataset
- importing survey data to the GPK file
- visualizing survey data to a DGN file
- creating a DTM from survey data

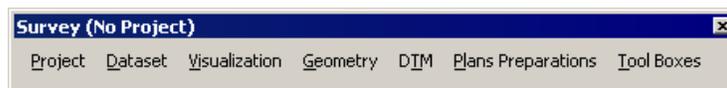
INTRODUCTION

GEOPAK Survey accepts raw survey data (horizontal angles, slope distances, vertical angles, etc.) as well as ASCII data already processed into coordinates and performs the following functions:

- Data Reduction of raw survey data (not needed for ASCII data). This software performs a Network Least Squares Adjustment with the ability to reduce the points to a user defined State Plane Grid. In addition, to network least squares reduction, GEOPAK Survey also supports no adjustment, compass rule and transit rule adjustments.
- Stores the survey points and chains into the GEOPAK Coordinate Geometry database (.GPK file)
- Draws MicroStation graphics of the survey based on the Survey Manager Database (.SMD file) of features. Lines, circular arcs and curve strings are drawn for particular combinations of point and curve geometry features to form the desired geometry of the survey.
- Survey chains can optionally be stored as GEOPAK coordinate geometry chains (alignments).
- Creates a Digital Terrain Model, and optionally the DAT file for GEOPAK (DTM) software. Surveyed chains can be represented as break lines that are adjusted into chord segments around curves. Inclusion of various survey shots into the DTM model can be dictated through specifying which features are to be included/excluded.
- Surveyed chains and points can be interactively edited into the MicroStation file.

ACCESSING

GEOPAK Survey is accessed by selecting **Applications > GEOPAK Survey > Survey** from the MicroStation pull down menu.



Survey has the same set of tools or pull-downs for 2D versus 3D MicroStation design files. GEOPAK monitors the file type and displays an Information dialog if a tool is activated in the wrong environment. When an attempt is made to invoke the 3D Tools icon within a 2D file, the Information dialog is displayed. The tool frame remains and reopens automatically even if you exit MicroStation, then re-enter later.

ASCII SURVEY DATA WORKFLOW

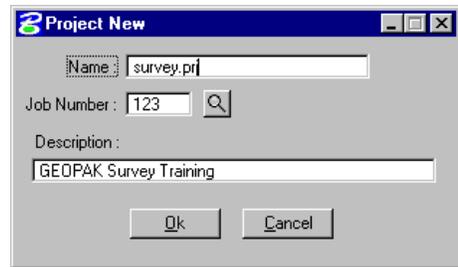
SCDOT users will be processing ASCII survey data files supplied by surveyors in the field. Below is a typical workflow for processing those files.

- Create a new GEOPAK project (.PRJ file) by selecting **Project > New** from the Survey menu.
- Create a new dataset by selecting **Dataset > New** from the Survey menu. This includes simply naming the dataset and selecting the ASCII file(s) to process.
- Set the columns and linking codes, then process the survey data, import the data to the GPK file and visualize it in the drawing with one click.
- Visually review DGN file results.
- Create the DTM by selecting **DTM > Build DTM > From Survey Data** from the Survey menu.
- Close GEOPAK Survey.

CREATING A PROJECT

To create a Project, access the Project pulldown and select New.

This dialog allows the user to provide a logical name for the project in addition to the coordinate geometry database to be used and a verbose description of the project.



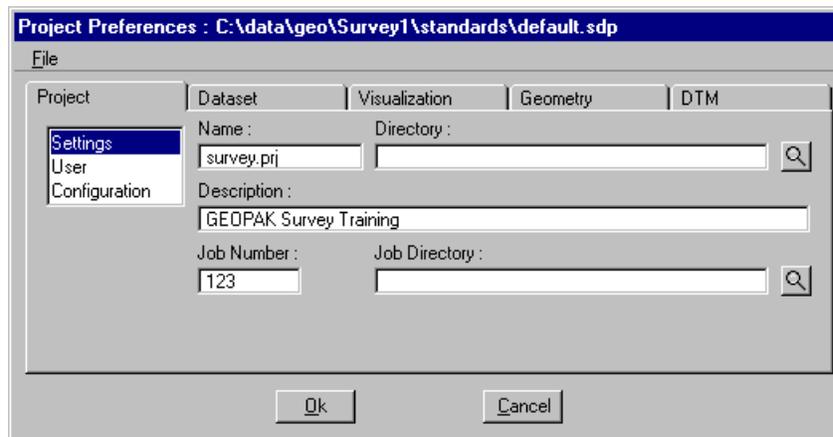
PROJECT PREFERENCES

There are several preference settings that contribute to management of Projects. These are found under the Project > Preferences pulldown as discussed in the previous chapter.

The .prj file is stored in the directory shown in the Directory path at the top of the Project dialog box.

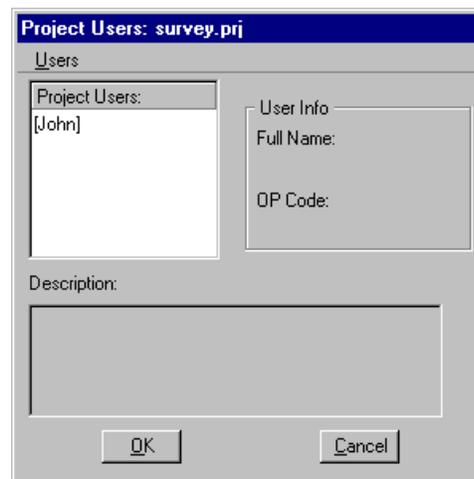
The Project Name can be any number of alphanumeric characters. The Directory specifies the location of the project data files and may be manually entered. In lieu of typing, the Select button may be clicked and the appropriate directory selected.

The next field is for keying in the COGO Job Number or the Select button may be clicked and the appropriate COGO job number selected.



PROJECT USERS DIALOG

Once a project is created the Project Users dialog can be accessed from the Project > Users pulldown and the following dialog opens.



This dialog has three sections: Project Users, User Info and Description. The Project Users list displays a list of users that have been created to work with any project that resides in the current projects home directory. The names shown in Project Users will be the user id's of the people working on that project as specified in the Start Job dialog. Within the User Info group box, the Full Name field further identifies the user, and displays the full name of the user that is currently selected. The OP Code field displays the GEOPAK Operator Code of the currently selected user. The GEOPAK Operator Code is used for all coordinate geometry operations during this session. The Operator Code, along with the Job Number will be utilized whenever an input or output file is created by the software. The Operator Code should be the user's initials. The Description field displays the description of the currently selected user.

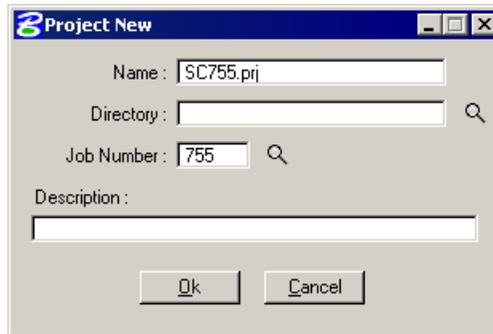
Five tools are supported on the Project Users pulldown.

New	The New pull down menu option creates new users. This option will create users only for the selected project.
Edit	Enables the user to change any of the parameters of the currently selected user. (Note: The User cannot be changed.) This changes the user information for the current project only.
Delete	Deletes the highlighted user.
Password	Creates or modifies a password for the selected user. If the selected user already has a password, the user will be prompted to enter the current password before continuing.
Exit	Closes the User Dialog and returns back to the Project Manager dialog.

LAB EXERCISE: CREATE A GEOPAK SURVEY PROJECT

Survey Project Creation

1. Open MicroStation file *c:\data\geo\SC755\s755pp.dgn*.
2. Select **Applications > GEOPAK Survey > Survey**.
3. Select **Project > New** from the Survey menu.
4. Set the **Name** to SC755 and the **Job Number** to 755.
5. Click **OK** to create the project.



6. Select **Project>Users** from the Survey menu.



7. Select **Users > New** from the Project Users dialog. Populate with your information.



New User

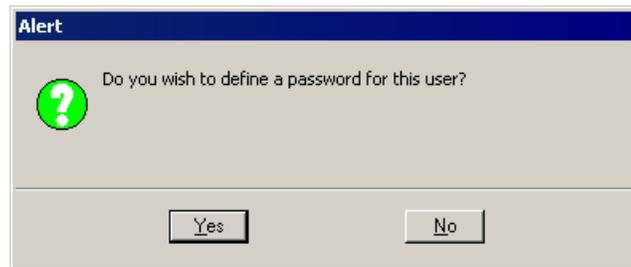
Name:

Full Name:

OP Code:

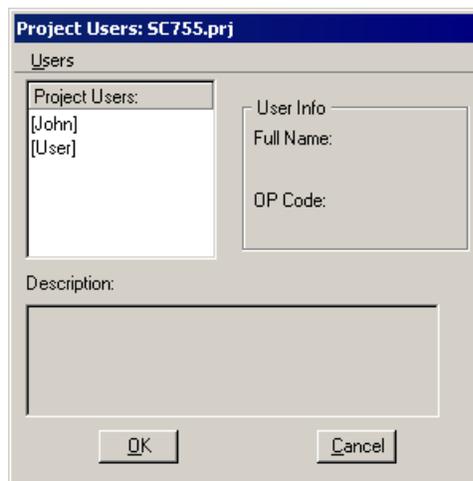
Description:

8. Click **OK** to add yourself as a user on the project.
9. Click **No** when prompted to define a password.



Alert

 Do you wish to define a password for this user?



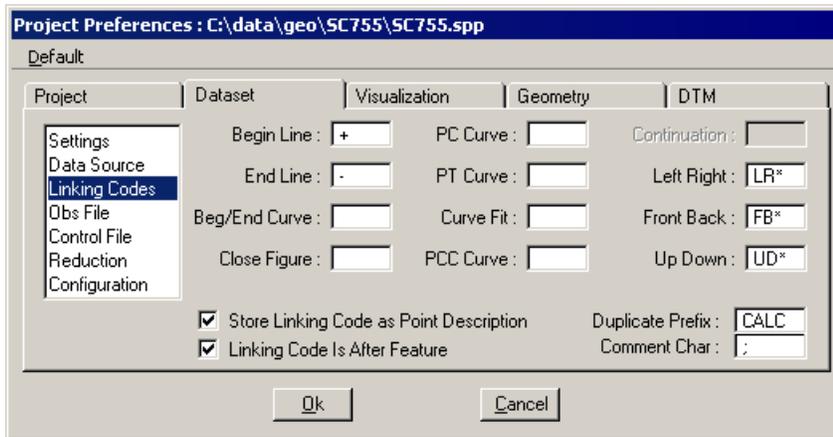
Project Users: SC755.prj

Users

<p>Project Users:</p> <div style="border: 1px solid gray; padding: 2px;"> <p>[John]</p> <p>[User]</p> </div>	<p>User Info</p> <p>Full Name:</p> <p>OP Code:</p>
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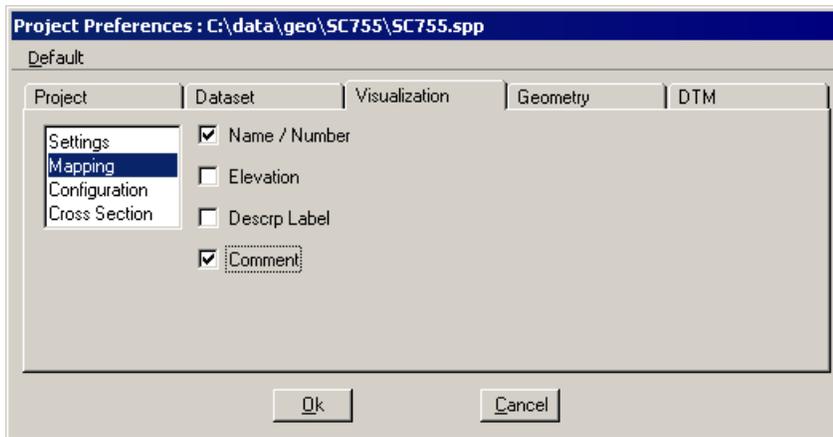
Description:

10. Highlight your name in the list and click **OK** to set yourself as the active user on the project.
11. Select **Project>Preferences** from the Survey menu.
12. Select the **Dataset** tab, then the **Linking Codes** category.
13. Enable the **Linking Code is After Feature** toggle.



14. Select the **Visualization** tab, **Mapping** category.

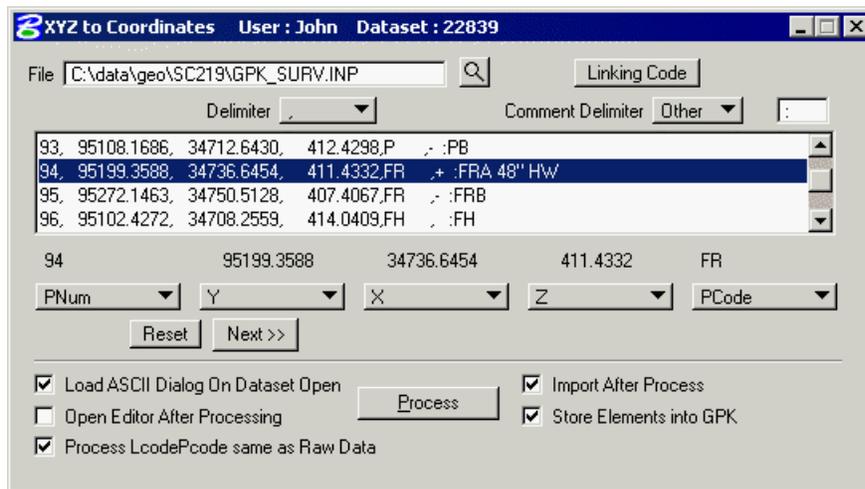
15. Enable the toggles for **Name/Number** and **Comment**.



16. Click **OK** to accept this change.

PROCESSING ASCII XYZ DATA

The GEOPAK Survey Manager supports most any ASCII file containing reduced survey data or even just XYZ data. DTM input files can be derived from a file containing XYZ data with no point codes. Other features include embedded Linking Codes and Feature Codes, linking together shots based upon defined chains, comments and support for the situation where the user does not have a "continuation" linking code for each shot but wants these shots connected. These ASCII files need not conform to any particular structure or format other than a requirement that each point entry be restricted to a single row. The ASCII file should not contain more than one point per row. Similarly, multiple rows should not be required to define a single point code.



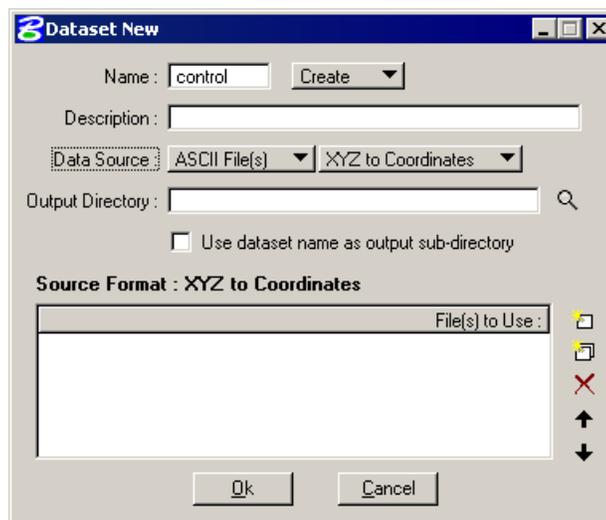
Within the row containing point code data, virtually no restrictions are placed on the arrangement and separation of survey data. Individual data items (point code, x-coordinate, y-coordinate, z-coordinate, point number) can be arranged in either free form or column formats. In addition, extraneous information may be present in the row and ignored by GEOPAK. Data items in the free form format can be separated by spaces, commas, dashes, etc.

LAB EXERCISE: PROCESSING ASCII DATA

Processing ASCII Data – Control Dataset

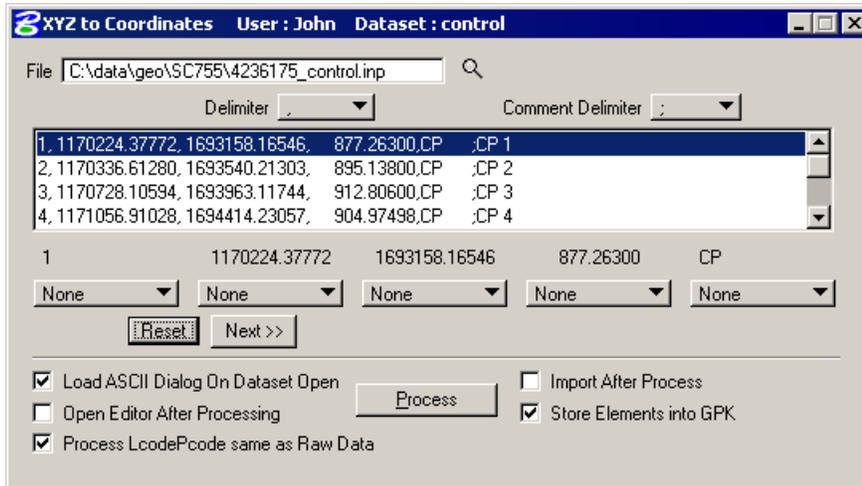
For this Dataset, we will process 3 ASCII files that has already been reduced to coordinates from raw angle/distance data.

1. Select the **Dataset > New** tool from the Survey menu. Key in a name of **control**.

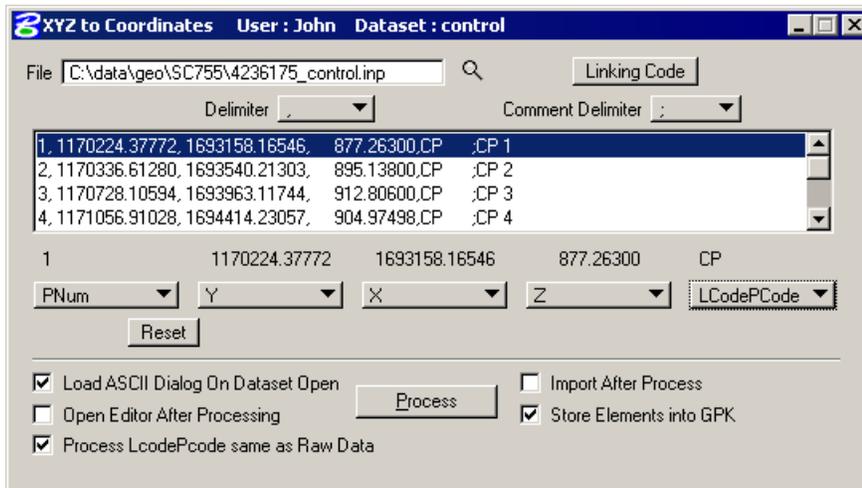


2. Change the **Data Source** to **ASCII Files** and select **XYZ. To Coordinates** as shown above.

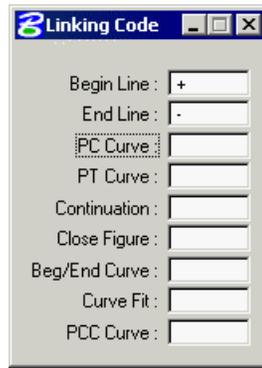
3. Click the **Dataset Add Source File to List** icon and select the ASCII file *C:\Data\Geo\SC755\4236175_control.inp*.
4. Click **OK**.
5. Set the **Delimiter** to **Comma** and the **Comment Delimiter** to **;**.
6. Highlight the first line in the display box.



7. Notice how the combo buttons in the bottom of the window now have a corresponding field shown above it. Set each button for the appropriate value for that column.



8. Click **Linking Code** and set the appropriate linking codes as shown below.

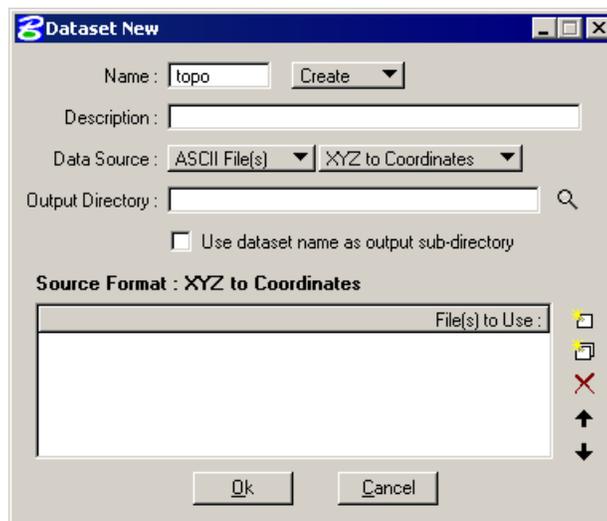


9. Toggle ON **Process LcodePcode same as raw data** in the lower left corner of the dialog.
This will allow the chain name to be selected from the **PCODE** field, but increment the chain names so as not to overwrite a chain with the same name.
10. Enable the **Import after Process** toggle.
This instructs the software to import the points to the GPK file after processing. By default, the points and chains will be visualized in the drawing immediately after importing them to the GPK file.
11. Click **Process** in the dialog. This will process, import and visualize the survey data.
12. **Fit** the MicroStation view to see the resulting graphics.
13. Close the XYZ to Coordinates dialog.



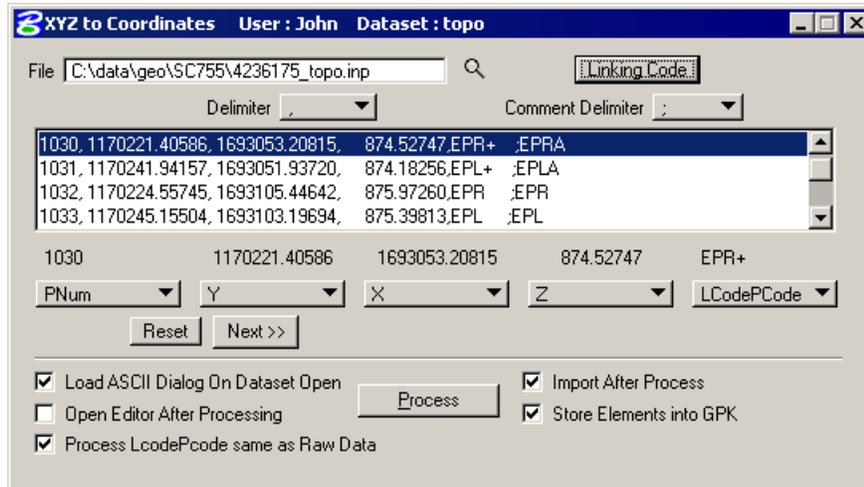
Process ASCII Data – Topo Dataset

1. Select the **Dataset > New** tool. Key in a name of **topo**.

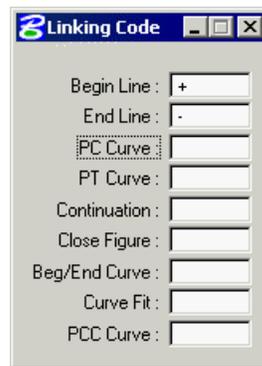


2. Remove the control file from the Files to Use list if present.
3. Click the **Dataset Add Source File to List** icon and select the ASCII file *C:\Data\Geo\SC755\4236175_topo.inp*.
4. Click **OK**.

- Highlight the first line in the display box. Scroll down to select a line with a linking code of + or -.



- The **Linking Code** should still be set from the previous dataset.

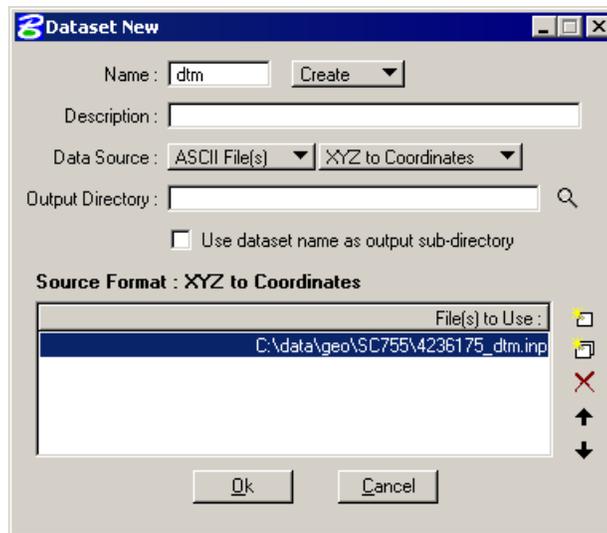


- Click **Process** in the dialog. This will process, import and visualize the survey data.
- Fit** the MicroStation view to see the resulting graphics.
- Close the XYZ to Coordinates dialog.

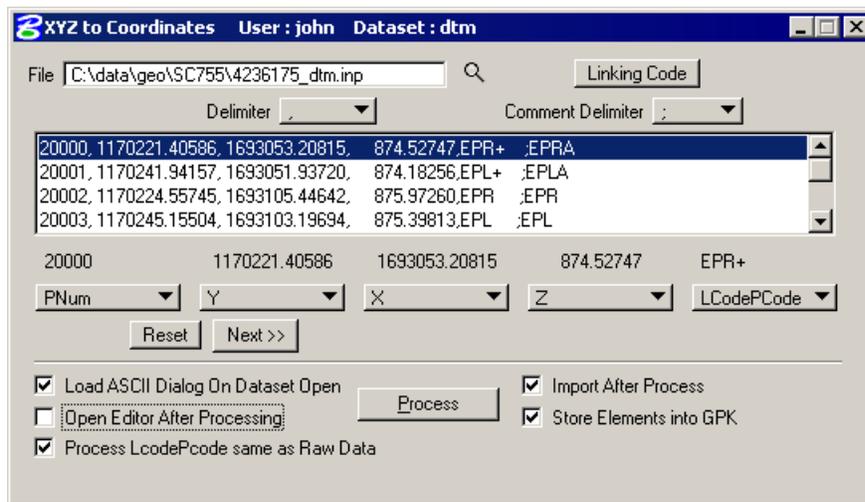


Process ASCII Data – DTM Dataset

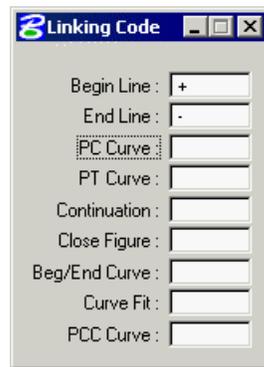
- Select the **Dataset > New** tool. Key in a name of **dtm**.



2. Remove the control file from the Files to Use list if present.
3. Click the **Dataset Add Source File to List** icon and select the ASCII file *C:\Data\Geo\SC755\4236175_dtm.inp*.
4. Click **OK**.
5. Highlight the first line in the display box. Scroll down to select a line with a linking code of + or -.



6. The **Linking Code** should still be set from the previous dataset.



7. Click **Process** in the dialog. This will process, import and visualize the survey data.
8. **Fit** the MicroStation view to see the resulting graphics.
9. Close the XYZ to Coordinates dialog.

DIGITAL TERRAIN MODEL FROM SURVEY

A Digital Terrain Model (DTM) represents the topography of a project in the form of a triangulated network. The DTM can be drawn in a 2D or 3D file, and then rotated to see the existing surface of the project area. Digital Terrain Models can be generated from various sources including MicroStation elements, survey data, photogrammetry data, GEOPAK cross sections, and geometry data.

Triangulation is a mathematical process applied to stored elevations points and stored elevations along DTM break lines to create surfaces. The result of triangulation is the creation of a TIN file from which existing ground profiles and existing ground cross sections can be generated.

ACCESSING

Clicking the Build DTM > From Survey Data from the DTM option on the Main Survey Menu Bar opens the Build GEOPAK DTM dialog. Various DTM tools can be accessed from the tool box for analyzing the DTM. Before using the tools in the tool box, the data must first be triangulated to create a TIN file.

FILE PARAMETERS

Two user-defined stroking values need to be defined before data can be triangulated to create a DTM. Stroking is the process of automatically adding shots to the DTM Input file by interpolating new shots from the linear and curved sections of the data.

Curve Stroke Tolerance	The maximum distance between the arc and the chord used to approximate the arc in the DTM. Stroking only applies to breaks and contours.
<hr/>	
Minimum Linear Distance	If a linear segment is greater than the Minimum Linear Distance, points are interpolated and added to the segment such that the distance between the points is not greater than the Minimum Linear Distance.

Typically the DTM inclusion is determined from the SMD, however in some cases it may be desirable to determine the inclusion from the point/chain DTM attribute field.

Consider a fence feature in the SMD as a “do not include.” Suppose that one particular fence in the dataset was also a top of bank. Chain edit could be used to change the DTM attribute to “include as break” and then the DTM built using the DTM attribute field to determine inclusion.

The data file format is optional for processing Survey data. However, this option can be used to generate an ASCII file with X, Y, Z data along with the feature code.

File Type	Format of the new file. Either format produces the same results. The difference between the two is ASCII files can be viewed and edited with a text editor while Binary files process faster. For ASCII files, the number of decimal places can be chosen.
File Open	Indicates if you are creating a new file or appending data to an existing file.
Create DAT File	Toggled ON if it is desired to create this file.
Write Comments in Data file	Also toggled ON if desired.
DTM Data File	This is the name of the desired ASCII output.

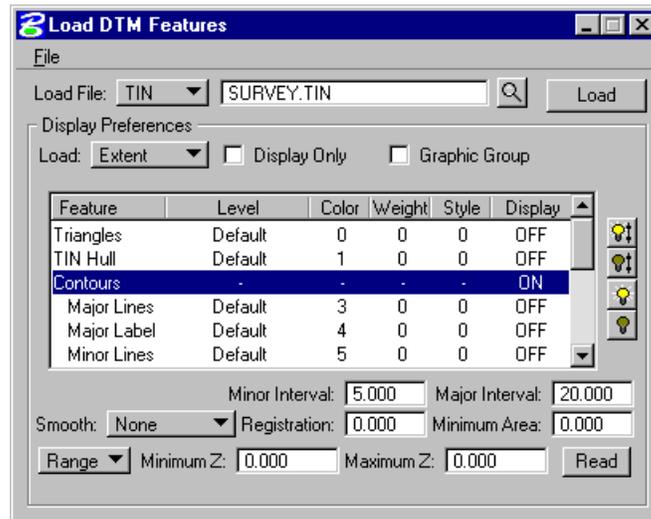
The TIN File parameters allow for the input of a TIN file to be created and also a maximum triangle length applied to the external triangles of the tin.

The file extension **TIN** represents a *triangulated irregular network* and stores the triangulated model in binary format. If the extension is not specified, GEOPAK automatically adds TIN. The file can also be selected via the **Files** button. If the full path is not given, GEOPAK utilizes the working directory.

This dialog also displays the previously discussed **Set Search** button for selecting Datasets to be processed. Once all of the desired Datasets have been selected, click **Process** to create the TIN file.

LOAD DTM FEATURES

Load is the process by which we can visualize the DTM data, TIN model, and contours. Select the Load DTM Features tool from the DTM pulldown on the Main Survey Menu Bar.



The user can choose to load the DTM data (**.dat**), the TIN file (**TIN**), or the Lattice file (**.lat**). Each of these files can be loaded for the model extents, within a fence, or within a window.

Toggle on **Display Only** enables the user to view the elements without writing them to the MicroStation file. Conversely, toggle off writes the viewed elements as MicroStation elements. If **Display Only** is on, updating your active screen clears the display of these elements. When **Display Only** is off, the elements can be placed as a graphic group.

Feature	Level	Color	Weight	Style	Display
Triangles	Level 1	2	0	0	OFF
Tin Hull	Level 1	1	0	0	OFF
Contours	-	-	-	-	ON
Major Lines	Level 1	3	0	0	OFF
Major Label	Level 1	4	0	0	OFF
Minor Lines	Level 1	5	0	0	OFF

The user can set what data to visualize, the symbology, and the contour interval (if **Contours** is turned on).



Turns on all items.



Turns off all items.



Turns on only the selected item. . Can also be done by enabling the toggle or double-clicking on an item that is turned off.



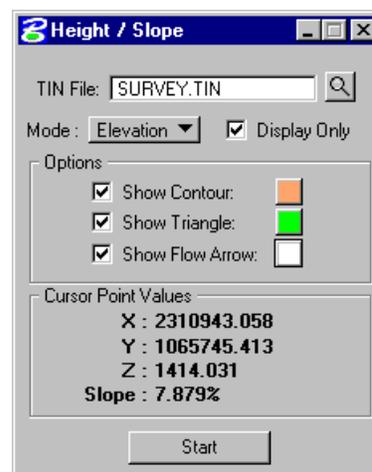
Turns off only the selected item. Can also be done by disabling the toggle or double-clicking on an item that is turned on.

ANALYSIS TOOLS

The **Analysis** tools allow the user to utilize the digital terrain model in many different analyses such as a profile, height, and drainage.

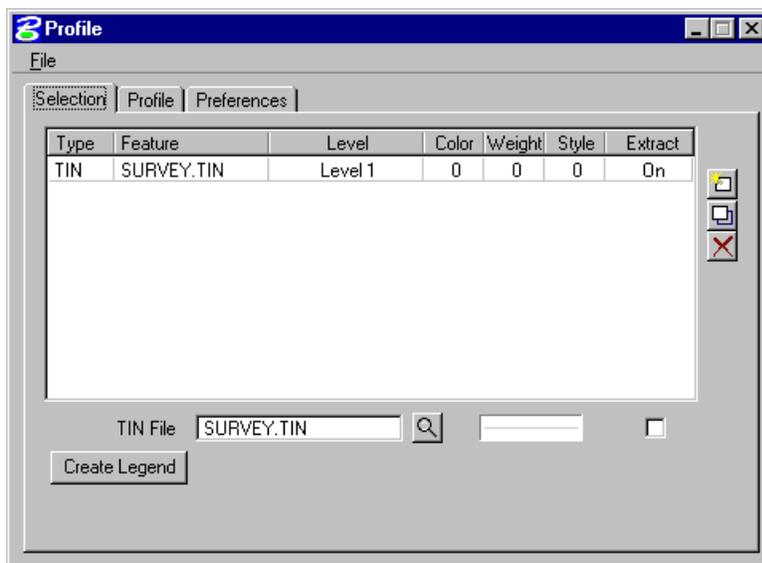
Height

Displays the x, y, and z coordinates and the slope of a given data point. The contour at that elevation, the triangle the point lies within, and the direction of flow can be displayed.



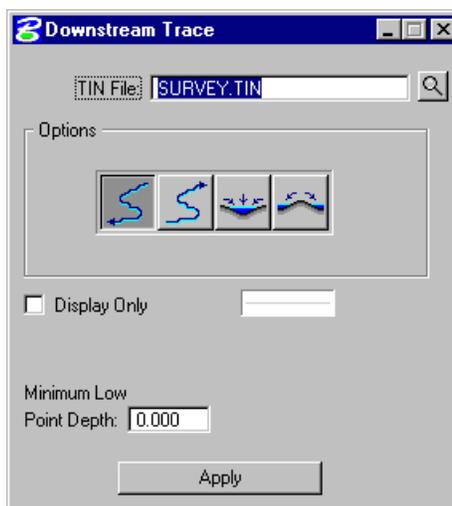
Profile

Displays the profile of the digital terrain model between two points.



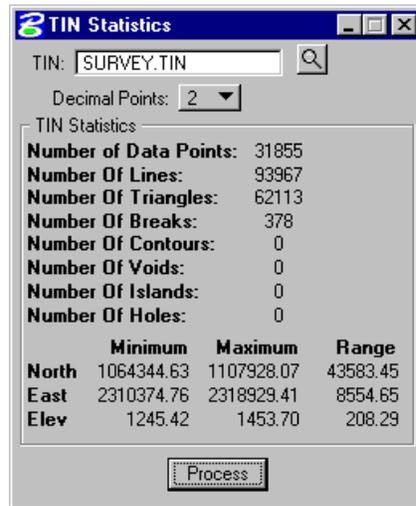
Drainage

Displays and analyzes drainage patterns within a TIN model. Tools include drawing flow arrows, determining upstream and downstream traces, and finding high and low points.



TIN STATISTICS

The TIN statistical data can give the user some information as to the size of tin with regards to number of triangles, points, breaks and other features that may have been written to the file.



For more information on these items, see the *GEOPAK* on-line help.

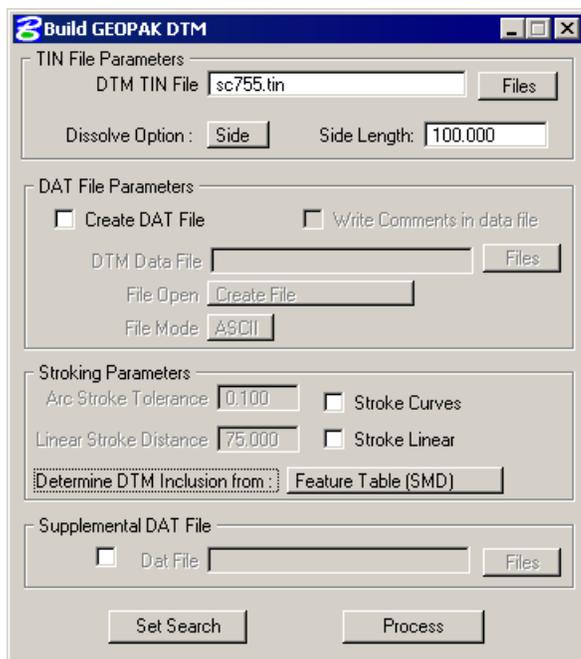
LAB EXERCISE: DIGITAL TERRAIN MODELING

Create DTM

1. Open the MicroStation file *C:\data\geo\SC755\s755pp.dgn*.
2. Select the Project, User, and open the DTM dataset.
3. Select the Build DTM Tool from Survey Data tool (*Survey menu: DTM > Build DTM > From Survey Data*).

This tool creates both the TIN file and the subsequent DAT file (if desired) to be utilized for reviewing and analyzing the DTM surface.

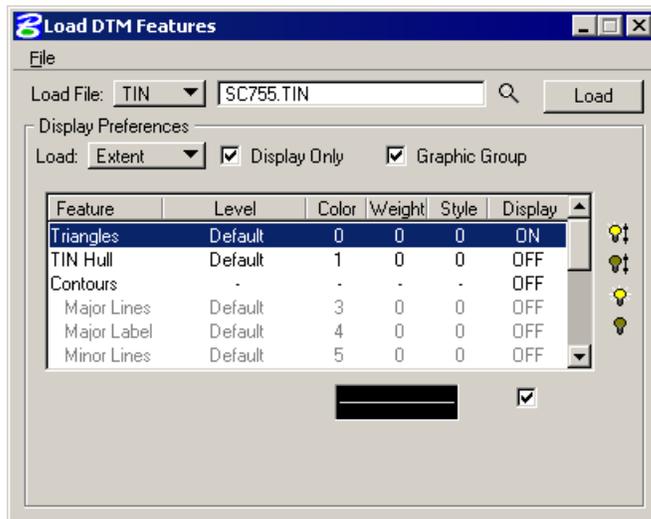
4. Set the desired settings in the Build DTM dialog as shown below.



5. Click **Process**.

 **Load DTM Features**

1. Select the **Load DTM Feature** tool (*Survey menu: DTM > Load DTM Features*).
The tool allows for selection of desired features to display from the TIN file.
2. Set the **Load File** option to **TIN**.
3. Select the TIN file by clicking **Files** and selecting *survey.tin*.
4. Activate the Triangles Displays to **On** by double clicking on the Triangles line.



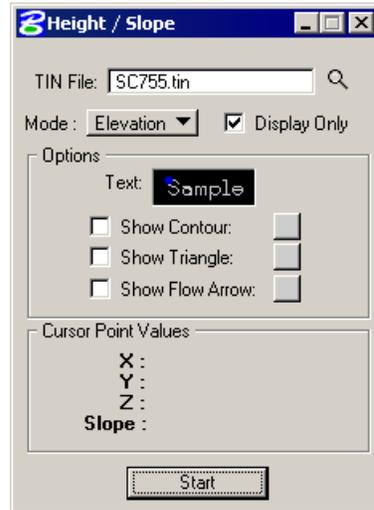
5. Enable the **Display Only** and **Graphic Group** toggles.
6. Click **Load** to draw the triangles into the file.

LAB EXERCISE: ANALYSIS TOOLS

Several analysis tools are utilized in this lab exercise. These include the profile tool, height tool, TIN Statistics, and drainage tools.

Height Tool

1. Select the **Height Query** tool (*Survey menu: DTM > Height Query*).
2. Set the dialog as shown below.

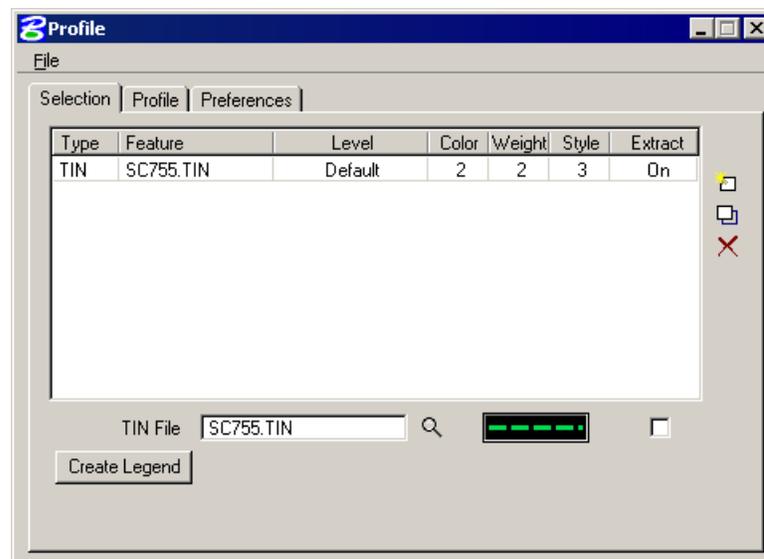


3. Click **Start**.

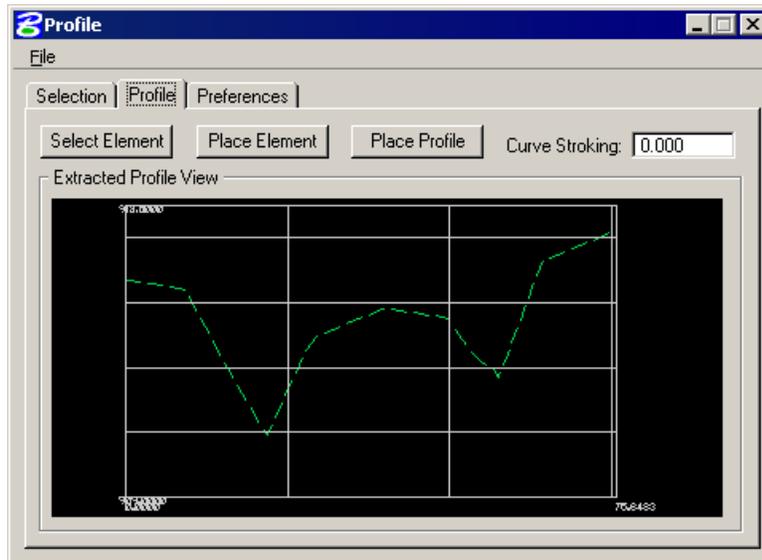
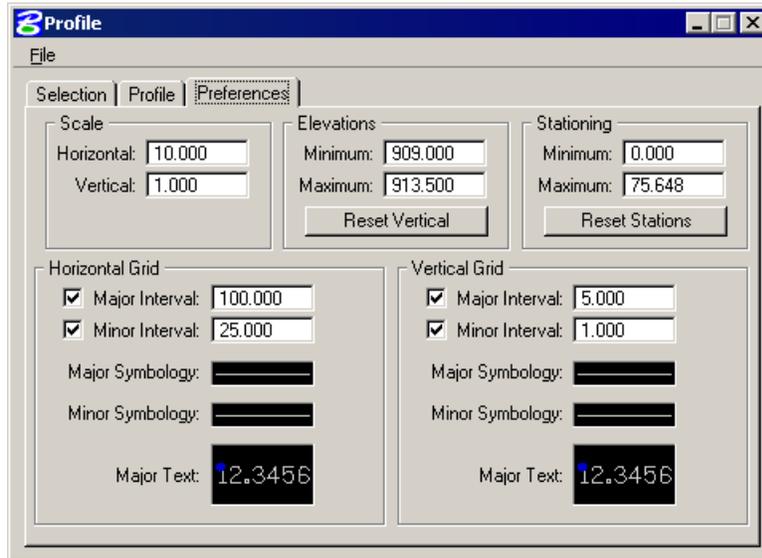
This shows the **Flow Arrow**, **Contour** and **Elevation** in different areas of the DTM.

Profile Tool

1. Select the **View Profiles** tool (*Survey menu: DTM > View Profiles*).
- Use the **Selection** tab to identify your DTM and the symbology for your profile.



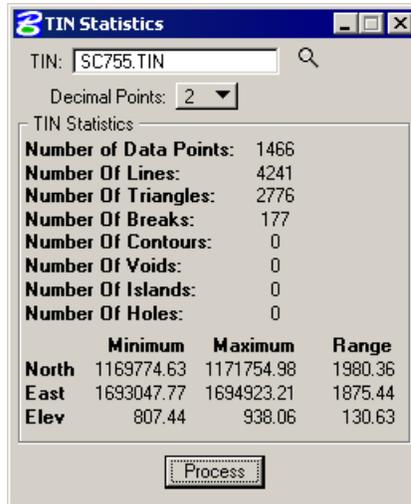
2. Click **Files** and navigate to *SC755.tin*.
3. Double click on the symbology box to set the symbology for the profile.
4. Click **Add** (top icon on right side of list box) to add the features to the list box.
5. Click on the **Profile** tab.
6. Click **Place Element**, then cut your actual profile by placing two data points (i.e. a line) or a series of data points (i.e. a line-string) across your DTM at any location.
7. Use the **Preferences** tab to set a grid for your profile if desired.



8. Return to the **Selection** Tab and notice there are additional icons on the dialog. If selected these will show graphically where each point along the profile was extracted, and/or draw the line that you placed to cut the profile, permanently into the graphic file. You can also create a COGO profile input file, and an optional ASCII file of the profile.

 **TIN Statistics**

1. Select the **TIN Statistics** tool (*Survey menu: DTM > TIN Statistics*).
2. Click **Files** and navigate to *SC755.tin*.
3. Click **Process**.



4. Close the TIN Statistics dialog.
5. Close GEOPAK Survey.



Project Manager

CHAPTER OBJECTIVES

In this chapter, you will learn more about:

- setting up a project using Project Manager.
- how to utilize Project Manager as a workflow guide.
- how to access GEOPAK dialogs from the Project Manager.

INTRODUCTION

Project Manager is a GEOPAK tool that associates a project with its respective coordinate geometry job number, users, working directories and project files. Project Manager provides the user with an easy workflow system that keeps records of processes run throughout the design of a project.

ACCESSING PROJECT MANAGER

To access Project Manager, select Applications > GEOPAK Road > Project Manager or click the Project Manager icon. The adjacent dialog appears.

The current directory is displayed at the top of the dialog box. This may be modified by traversing to a different directory in the Directories list box. Project files (.prj) are displayed in the projects list box.

The remainder of the Project Manager dialog box displays information after a project has been selected from the Projects list box. At the bottom of the dialog box are the OK and Cancel buttons. To exit Project Manager, click the Cancel button. To continue in the Project Manager process, click the OK button.



PROJECT MANAGER MENU BAR

There are three options on the Menu Bar: Projects, Directory and Admin. Each of these choices has tools contained in the pull down.

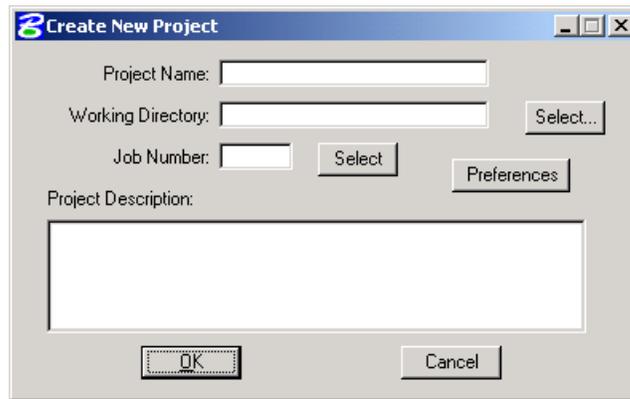
PROJECT TOOLS

There are four options under the Projects pull down, New, Edit, Delete and Exit.



The Windows motif also keeps track of the last few processes that have been executed, which may be recalled as needed by selecting the desired process.

The **New** menu option is used to create a new project. The .prj file is stored in the directory shown in the Directory path at the top of the Project Manager dialog box.

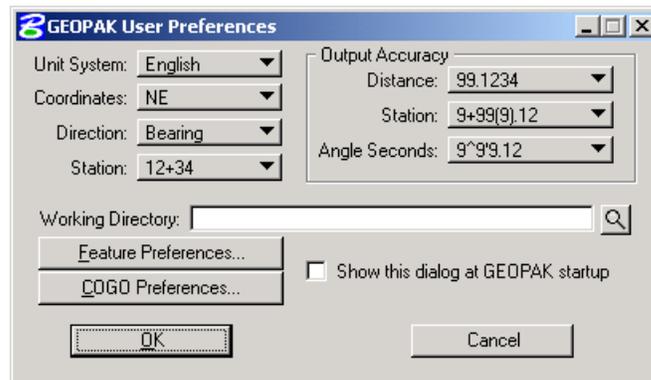


The Project Name can be any number of alphanumeric characters. The Working Directory specifies the location of the project data files and may be manually entered. In lieu of typing, the Select button may be clicked and the appropriate directory selected.

Note The **Working Directory** can be left blank if it is desired to have all of the MicroStation and GEOPAK files in a single directory.

The next field is for keying in the COGO Job Number or the Select button may be clicked and the appropriate COGO job number selected.

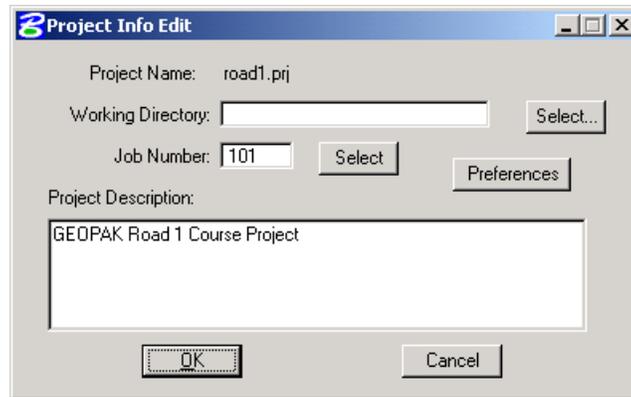
Next, Preferences should be clicked, invoking the Project Preferences dialog.



The user may set the particular parameters for each project as well as the directories for the COGO job number, COGO input files and COGO output files. By setting these parameters for each project, the user can open a design file in one directory and then open another design file in a different directory and still access the correct .GPK file and also save COGO input and output files to the proper directory. The user simply chooses the project and all parameters are automatically set. After all the information is entered, OK is clicked or if the user wishes to abort, Cancel may be clicked.

Note If these fields are left blank, the project working directory is used.

Shown below is a sample project that includes a project description, which may be keyed in at the bottom of the Create New Project dialog.



The Edit menu option is used to change any settings associated with the currently selected project.

The Delete menu option is used to delete any project that has been stored. The user highlights the project in the Projects list box and selects Delete.

The Exit menu option closes the Project Manager and writes the settings to a resource file.

DIRECTORY TOOLS

There are two options under the Directory pull down, Create New Directory and Current Working Directory.

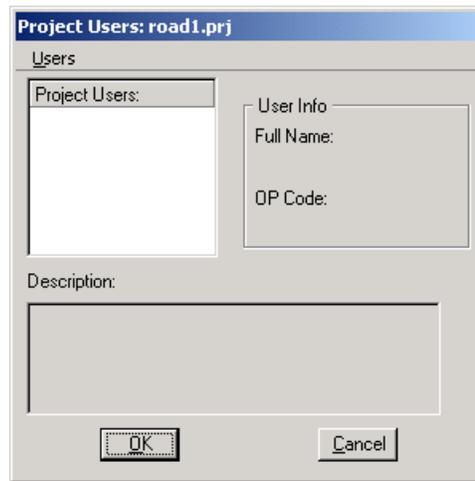
The Create New Directory option creates a new directory on the disk within the current directory. If the Current Working Directory option is chosen, the directory path in Project Manager is changed to that directory.

ADMINISTRATION TOOLS

The Administration menu option is used to set a password on a project, if desired.

PROJECT USERS DIALOG

Once a project is highlighted and OK is selected, the Project Users dialog appears.

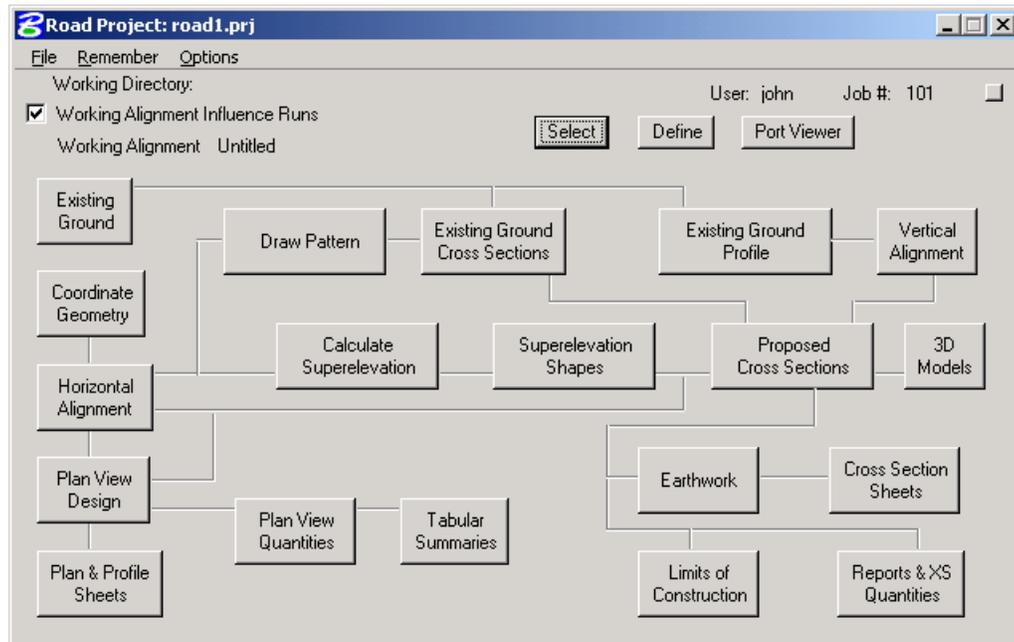


This dialog has three sections: Project Users, User Info and Description. The Project Users list displays a list of users that have been created to work with any project that resides in the current projects home directory. The names shown in Project Users will be the user id's of the people working on that project as specified in the Start Job dialog. Within the User Info group box, the Full Name field further identifies the user, and displays the full name of the user that is currently selected. The OP Code field displays the GEOPAK Operator Code of the currently selected user. The GEOPAK Operator Code is used for all coordinate geometry operations during this session. The Operator Code, along with the Job Number will be utilized whenever a COGO input or output file is created by the software. The Operator Code is typically the user's initials. The Description field displays the description of the currently selected user.

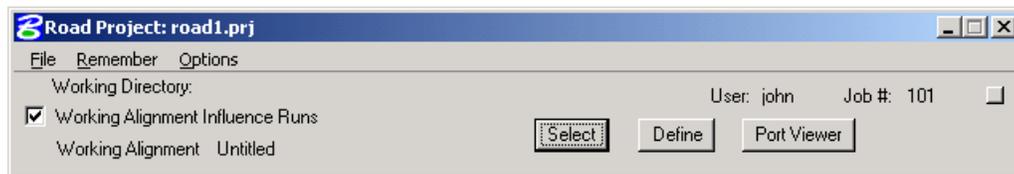
Four tools are supported on the Project Users pulldown: New, Edit, Delete and Exit.

ROAD PROJECT DIALOG

After a minimum of one user has been defined, click OK in the lower left corner of the Project Users Dialog or double click on a Project User, which opens the Project Manager dialog.



The top of the dialog displays the Working Directory, Working Alignment (if defined), User and GEOPAK Job Number. In addition, a toggle for Working Alignment Influence Runs is also supported. The bottom portion of the dialog box displays the various processes supported during the design process. The small square in the upper right corner will condense the dialog as depicted in the graphic below.



ROAD PROJECT DIALOG MENU BAR

There are two pull down menu bar options: File and Remember. When the File option is selected, Close and Exit are supported.

If the Close option is selected, the user is returned to the Applications dialog. If Exit is selected the user is exited from the Project Manager.

When the Remember option is selected, the user can instruct the software to remember the Project or User in subsequent sessions. For example, if both toggles are activated, and the Project Manager is completely closed (all dialogs), the invocation of the Project Manager immediately invokes the Road Project dialog (flow chart) and utilizes the project name, user name, etc., which were active when the Remember toggles were selected.

If only the User toggle is activated, the user is returned to the Project dialog in later sessions. If only the Project toggle is activated, the user is returned to the Project Users dialog in subsequent sessions. This option is particularly useful when numerous users are working on one project.

When the Auto Sink option is enabled, the Road Project flow chart sinks behind all open views when any tool is selected from the flow chart.

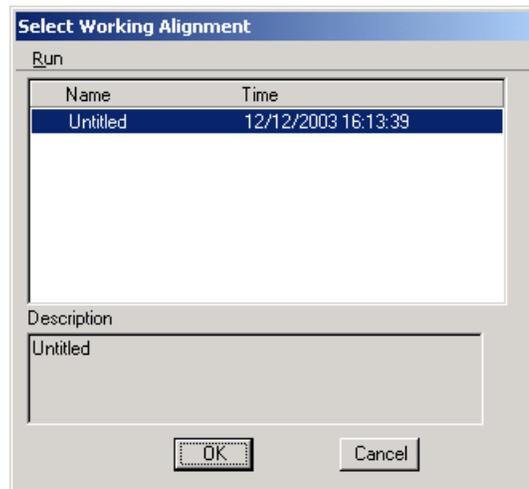
WORKING ALIGNMENT

The concept of a working alignment enables the designer to organize a project and to access project information without continually typing the required information. On a simple project, only one working alignment may be needed. However, on a more complicated project, an unlimited number of working alignments may be defined. With each working alignment, the designer can define associated data, i.e., name of cross section and plan view files, element symbology, etc. The designer can easily change from one working alignment to another by highlighting the desired alignment listed in the Select dialog. Once the working alignment is selected, all previously stored data is utilized in subsequent processing. Three tools relating to working alignments are located at the top of the Road Project dialog:

- Select
- Define
- Working Alignment Influence Runs (toggle on left side of dialog)



SELECT OPTION



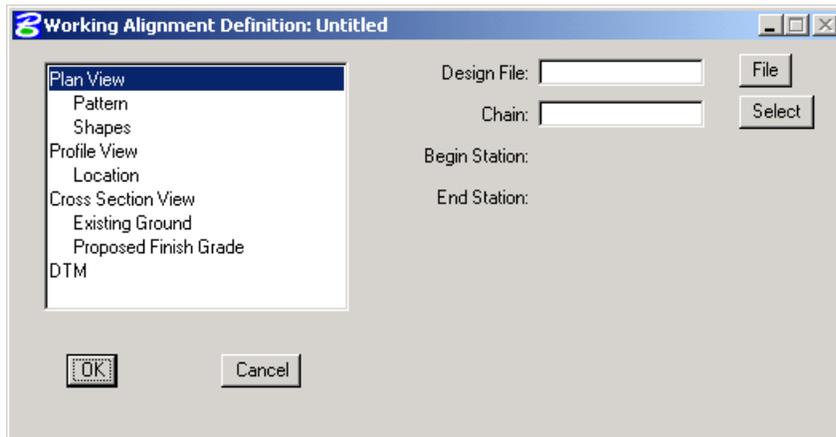
When the Select button is clicked, the Select Working Alignment dialog appears as depicted to the right. If no working alignments have been defined, UNTITLED appears in the Run List box. If working alignments have been defined, they are listed with the last run time. The description of the working alignment can be seen in the bottom of the dialog when each Name is highlighted. To select a previously defined working alignment, highlight the run from the list, then click OK at the bottom of the dialog. Double clicking on the Name also selects a previous working alignment for subsequent

processing. Clicking Cancel closes the Select Run dialog without any File selection. Several Run options are supported as detailed in the table below.

New	Create a new working alignment
Copy	Copy a run from an existing Project, a User in the same project or Run created by the current user.
Modify	Change the name of the existing working alignment.
Delete	Delete an existing working alignment.

DEFINE OPTION

Once a Run has been selected, clicking Define opens the Working Alignment Definition dialog.

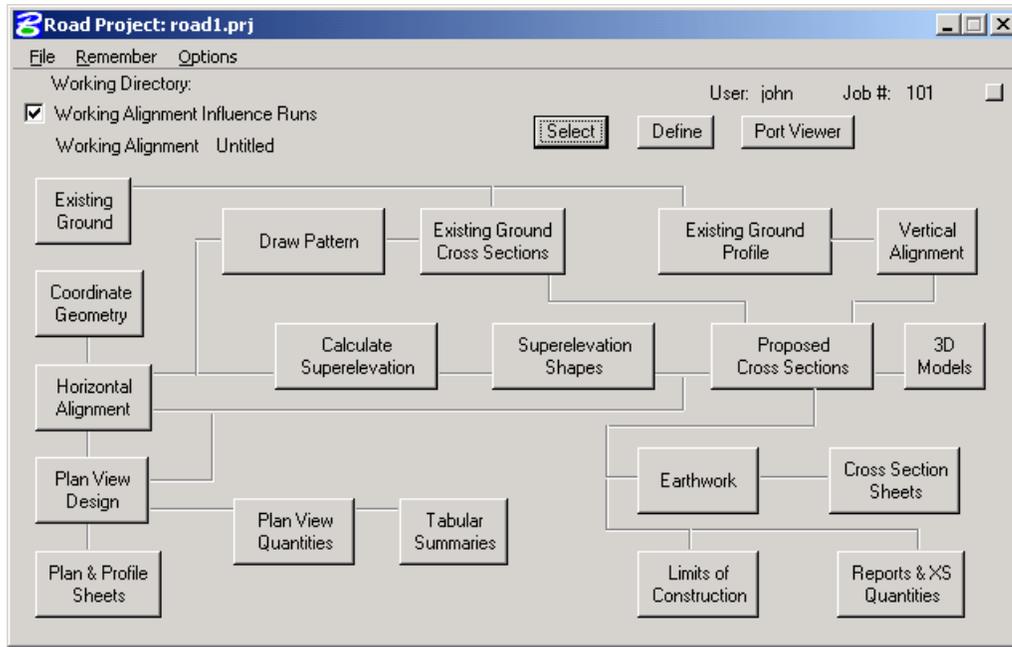


The information that can be associated with a working alignment is listed in the left portion of the dialog box. As each option is chosen, the right side of the dialog box will change to reflect the information needed as can be seen in the dialog box above after Plan View was selected.

All information entered in these fields can be used in subsequent processes run from Project Manager. In the beginning of a project, much of this information will not be known, but as the user goes through the design process, it can be added to the working alignment definitions.

For example, as soon as a chain has been stored in COGO, the user can enter that information in the Plan View fields on the right side of the dialog. For a more complete explanation of each option shown, please see the *On-Line Help*.

PROJECT MANAGER PROCESS



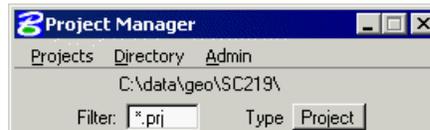
The primary Project Manager dialog is depicted above. The advantage of utilizing the Project Manager rather than selecting functions directly from the Road menu is that pertinent information stored within the Project Manager is automatically displayed within the invoked dialog. Therefore, job numbers, chain names, stationing, file names and data associated with the project do not have to be typed in each time a dialog is utilized. However, if the user chooses to change the fields, they have that option.

Many of the Project Manager processes function identically to their corresponding dialog's invocation from the Road menu. However, some of the procedures invoke the Select Run dialog prior to invoking the actual dialog. The Select Run dialog enables the user to set up different options to use in alternative design choices or different typicals.

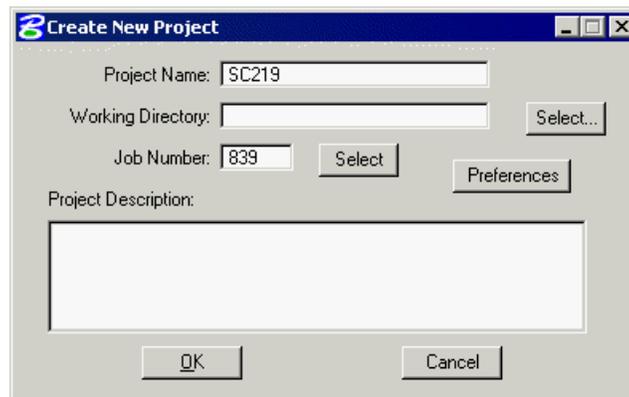
LAB EXERCISE: PROJECT MANAGER

 **Create a GEOPAK Project**

1. Open the MicroStation file *C:\data\geo\SC219\SC219pp.dgn*.
2. Select the Road Tools tool frame (*Applications > GEOPAK Road > GEOPAK Road Tools*).
3. Select the **Project Manager** tool (*Applications > GEOPAK Road > Project Manager*).
4. Ensure that the project directory is set to: *C:\data\geo\SC219*.

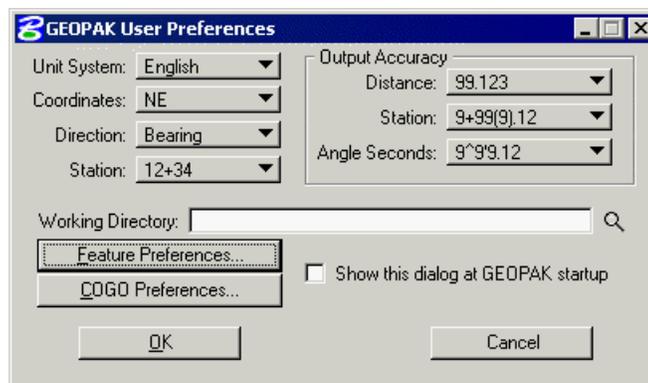


5. Select **Projects > New** and create a new project.



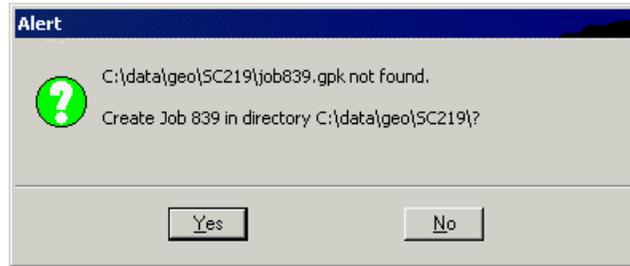
Project name:	SC219
Job Number:	839

6. Click **Preferences**. Ensure the dialog is populated as below.



7. Click **OK**.
After exiting the **Preferences** dialog, you will return to the **Create New Project** dialog.
8. Click **OK**.
9. Click **OK**.

An **Alert** message is displayed stating that Job 839 was not found in the Working Directory you have defined.



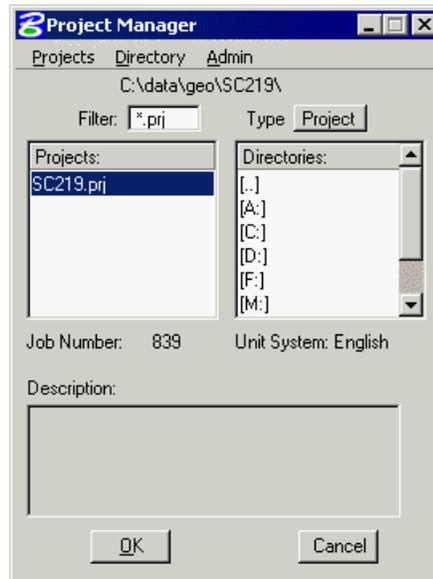
10. Click **Yes** to automatically create this job file.

The main Project Manager dialog is now displayed and the project has been created and ready to be accessed.

 **Create a User**

1. Highlight **SC219.prj**.

To access the project, select the project by single clicking on name of the project in the dialog. The project is highlighted as shown in the dialog with all pertinent information displayed.



2. Click **OK**.
3. Select **Users > New**.



The 'New User' dialog box contains the following fields:

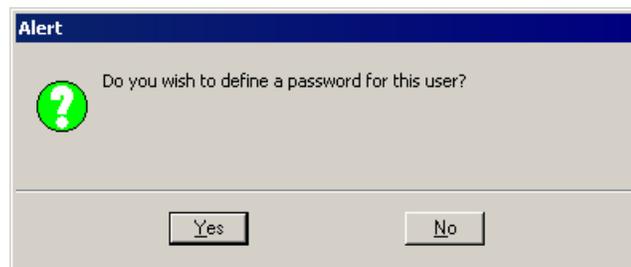
- Name: john
- Full Name: john doe
- OP Code: 36
- Description: Designer

Buttons: OK, Cancel

4. Enter the **New User** information.

Name	john
Full Name	John Doe
OP Code	36
Description	Designer

5. Click **OK**. When prompted to define a password for this user, click **No**.



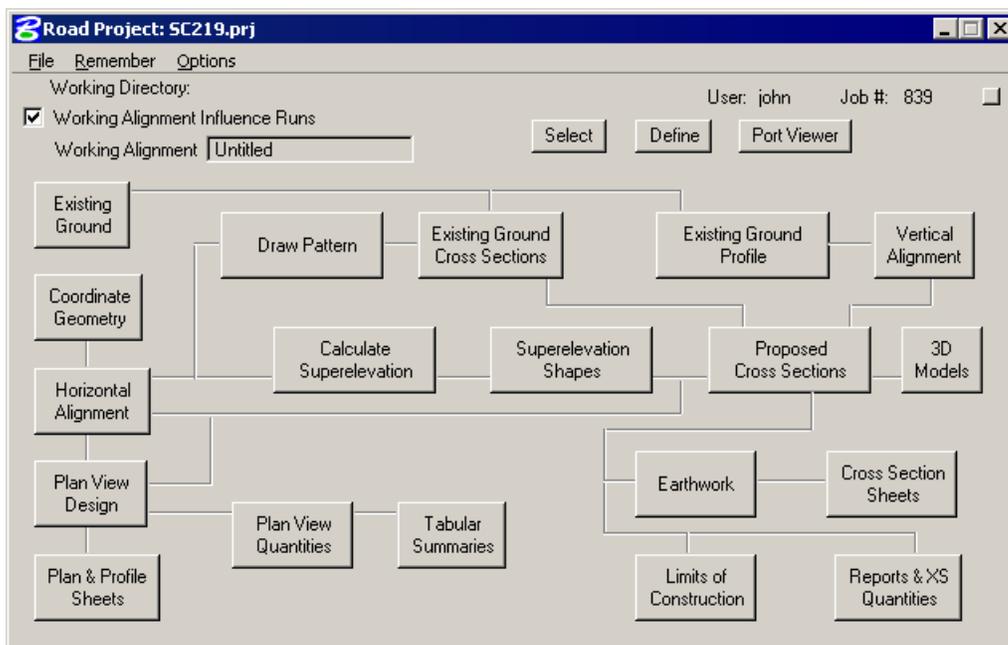
The 'Alert' dialog box contains the following text and buttons:

Do you wish to define a password for this user?

Buttons: Yes, No

6. Double click the user.

You will now see the Main Workflow dialog.



7. Use the **Remember** option to have Project Manager remember our Project and User.
8. Select **Options > Auto Sink** to sink the Road flowchart each time a button is selected.

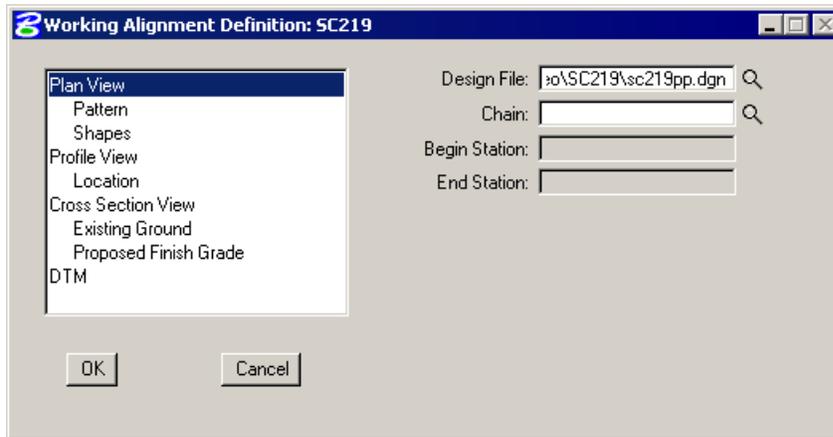


Define Working Alignment

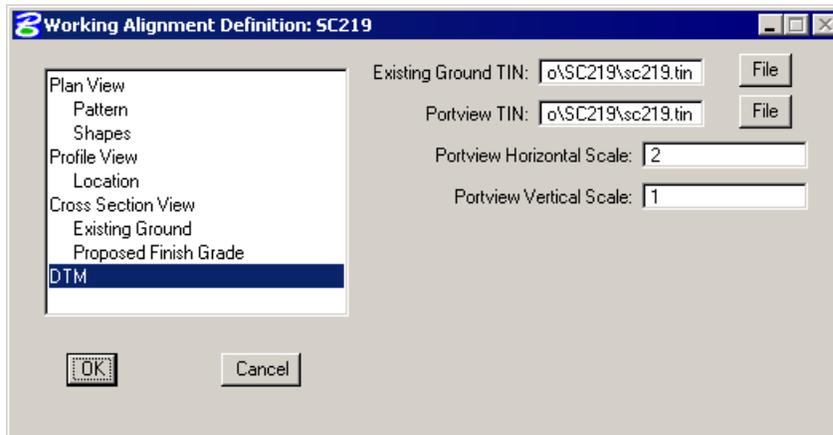
Before leaving this exercise, let's go ahead and begin to set the stage for further design via the Project Manager by defining the Working Alignment. To do this, we'll need to use the Select and Define buttons on the Project Manager Workflow dialog. The Project Manager dialog workflow dialog should still be active.

1. Click **Select**.
2. Select **Run > New**.
3. Enter a **Run Name** of SC219.
4. Enter a **Description** of SC219 Realignment.
5. Click **OK**.

6. Highlight the run then click **OK**.
7. Click **Define** to access the Working Alignment Definition dialog.
8. Highlight **Plan View**.
9. Click **File** then select **sc219pp.dgn**.



10. Highlight **DTM** then complete the DTM definitions as shown below.



11. Click **OK**.

12. **Exit** MicroStation.





Coordinate Geometry

CHAPTER OBJECTIVES

In this chapter, you will learn more about:

- setting up and accessing the coordinate geometry database file.
- becoming proficient in using GEOPAK Coordinate Geometry.

INTRODUCTION

The Coordinate Geometry database file (*.GPK file) is comprised of stored geometric elements such as points, lines, curves, spirals, chains, parcels and profiles. When COGO calculations are completed, the results are stored in the binary database file, which is then utilized throughout the design process with many other applications.

ACCESSING COGO

When Coordinate Geometry is started, the Start-Up Dialog appears.

The dialog box is titled "Coordinate Geometry". It has four input fields: "Project Name:", "Job Number:" (with a magnifying glass icon), "Operator Code:", and "Subject:". At the bottom, there are two buttons: "OK" and "Cancel".

Project Name	Name displayed on reports. This is an optional entry, with a maximum of 60 alphanumeric characters. If Project Manager is active, this field is populated automatically.
Job Number	Identifies coordinate geometry database file and is a required field. The job number is a maximum of three alphanumeric characters. If Project Manager is active, this field populated automatically. This field is required.
Operator Code	Unique 2-character code which enables multiple users access to database file. The user's initials are suggested. Note this field is not required for single user access, but highly recommended. If Project Manager is active, this field is populated automatically.
Subject	Description of coordinate geometry work (could relate to the project) with a maximum of 48 alphanumeric characters. This field is optional.

After the dialog is populated and **OK** is clicked, the main coordinate geometry dialog is invoked.

COORDINATE GEOMETRY DIALOG



The coordinate geometry dialog box is made up of three separate display areas:

- Tool Bar consisting of drop down options and icons. The display of specific icons is customizable.
- COGO Key-in field enables manual entry of COGO commands. The drop down button allows for a history of commands to be reviewed.
- Output Display Window shows the results generated by the commands.

FILE COMMANDS

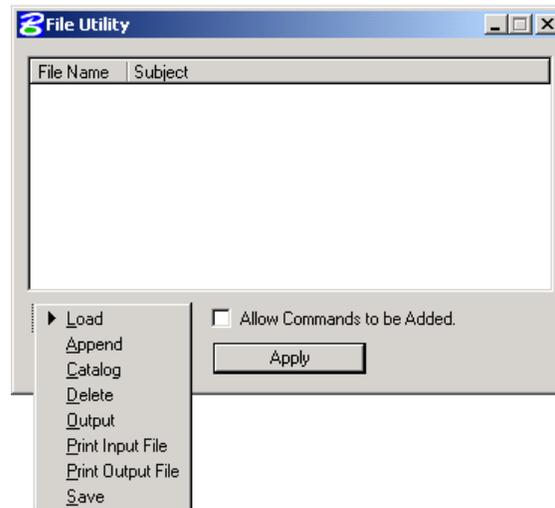


File Utility	This option opens another dialog that contains group of file utilities that will be explained later.
File Restore	Loads an ASCII file of GEOPAK commands into the display window. Note no processing occurs. The file must be named j999ooc.inp , where 999 is the current job number and oc is the operator code.

Import	Imports horizontal and vertical alignments and points from ASCII Points, SDMS Alignments and Points, LandXML 1.0 Geometry, RDS, and VDOT PLT formats into the GEOPAK .gpk file.
Export	Exports ASCII points, SDMS Points, SDMS Alignments, LandXML 1.0 Geometry, and Alignments and Profiles into formats for use in various data collectors.
Exit	Closes the COGO dialog box and ends the coordinate geometry session. A prompt to save the session appears. Yes saves the audit trail, No exits without saving, Cancel returns to the COGO session. Whether you pick Yes or No everything you did is still saved in the .gpk file.

FILE UTILITY

The File Utility option invokes the following dialog.



Load	When selected, a menu appears listing all saved input files. <i>Highlight</i> a file then click OK . The input lines from the highlighted file are now displayed in the display window for viewing, editing, or processing.
Append	This command is for <i>input files</i> only. A new input file is created by copying the contents of an existing input file to the end of the current input file. The Save command must be used in order to store this new file.
Catalog	When selected, a menu appears listing all saved input files (under the current operator code) in the project directory. This is for reference only no action is taken.
Delete	When selected, a menu appears listing all saved input files. <i>Highlight</i> a file then click the OK button to remove this file from your project directory. Although the file is deleted, the elements stored as a result of processing the commands are not deleted.
Output	Writes an ASCII file of the current display for reviewing and / or printing. (Fname999.ooc, where 999 is the current job number and oc is the operator code).
Print Input File	Sends your input file to the printer.
Print Output File	Sends your output file to the printer.
Save	Saves the current audit trail to a file. (Fname999.ioc, where 999 is the current job

number and **oc** is the operator code.).

Allow Commands to be Added When this is toggled on, COGO commands are added to a previously loaded file.

EDIT COMMANDS



Clear Empties the memory of the current audit trail without saving and initializes the line numbers to begin a new sequence of commands. Note this does not clear the display window.

Delete Deletes input commands in the input buffer by line number (or range of line numbers) and re-sequences the line numbers for the remaining commands.

Insert Adds a command line to the current input buffer *before* a specified line number; subsequent command lines shift down and line numbering is automatically re-sequenced.

Modify Changes a fragment in a command line. The modified command line is not processed until a Read command is performed.

Read All Processes all lines in the audit trail.

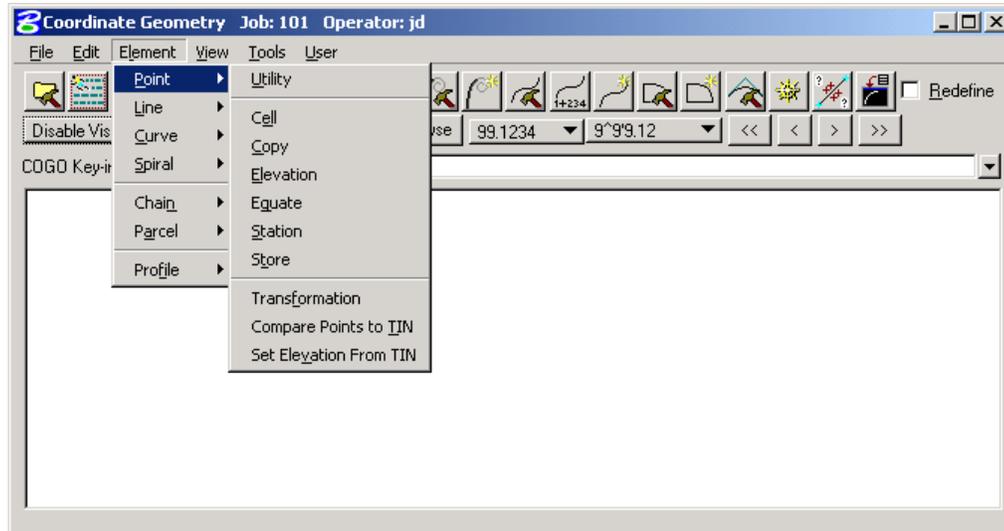
Type All Displays the contents of the audit trail.

Line Range Opens the **Line Range** dialog where a range of lines can be entered that can either be read or displayed.

Editor Opens the **COGO Command Editor**, which enables the user to edit the current input file.

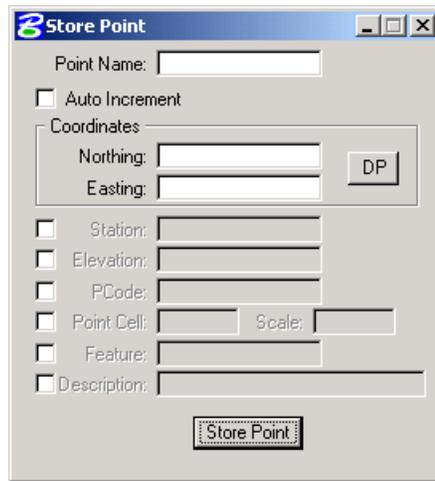
ELEMENT COMMANDS

The mainstay of GEOPAK Coordinate Geometry are the various element commands. Tools are supported for storing, stationing, adding additional data, deleting, etc. GEOPAK supports a wide variety of elements: points, curves, spirals, chains or alignments, parcels, and profiles. Each element is detailed below.

ELEMENT > POINT

One of the most utilized sets of COGO tools are the point commands, as detailed in the table below.

Utility	Opens the Point Utility dialog where the following options are available. Delete - Deletes a point number (or range of numbers) from the database file. Print - Displays the selected point numbers x, y, z coordinates, station value and other stored information in the display output window. Display - Visualizes the selected point numbers currently stored in the GPK file (Temporary Visualization or Permanent Visualization must be turned on).
Cell	Assigns a cell name to a previously stored point.
Copy	Copies points or a point range to a new point number or range within the same GEOPAK database file
Elevation	Assigns an elevation to a previously stored point
Equate	Stores a new point with the same values as a previously stored point
Station	Adds a station to a previously stored point.
Store	Stores a point by key-in coordinates or by selecting a location graphically. A station, elevation, point code, cell, feature, or description can be optionally stored with the point.



Transformation	Performs coordinate transformations based on user-defined control pairings
Compare Points to TIN	Utilizing a set of COGO points (with elevations) compares the COGO elevation to the TIN elevation and completes statistical analysis for "goodness of fit."
Set Elevation from TIN	Utilizing this command, GEOPAK adds or updates an elevation to a previously defined point, based on a TIN model.

ELEMENT > CURVE



-
- Utility** Opens the **Curve Utility** dialog where the following options are available.
 - Reverse** - Reverses a previously stored curves direction.
 - Delete** - Deletes a curve (or range of curves) from the database file.
 - Print** - Displays the selected curves x, y, z coordinates, station value and other stored information in the display output window.
 - Visualize** - Visualizes the selected curves currently stored in the GPK file (Temporary Visualization or Permanent Visualization must be turned on).

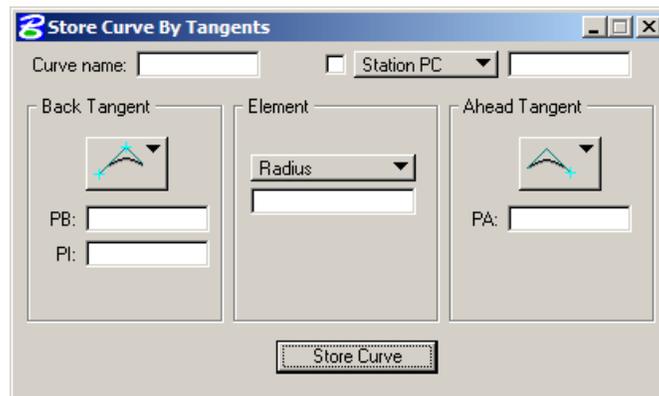
 - Copy** Copies a specified curve to another curve name.

 - Data** Calculates the geometric parameters of a curve, displaying values for Delta, Degree, Tangent, Length and Radius.

 - Segment** Defines new curves by dividing a stored curve into segments.

 - Station** By identifying a curve and a control point on the curve (PC, PI, or PT), a station value may be assigned.

 - Store** Provides various options for defining and storing curves such as **Store Curve By Tangents** as shown below.



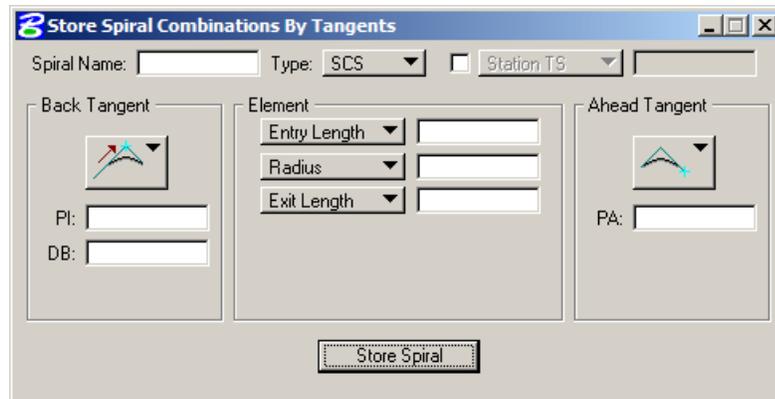
ELEMENT > SPIRAL

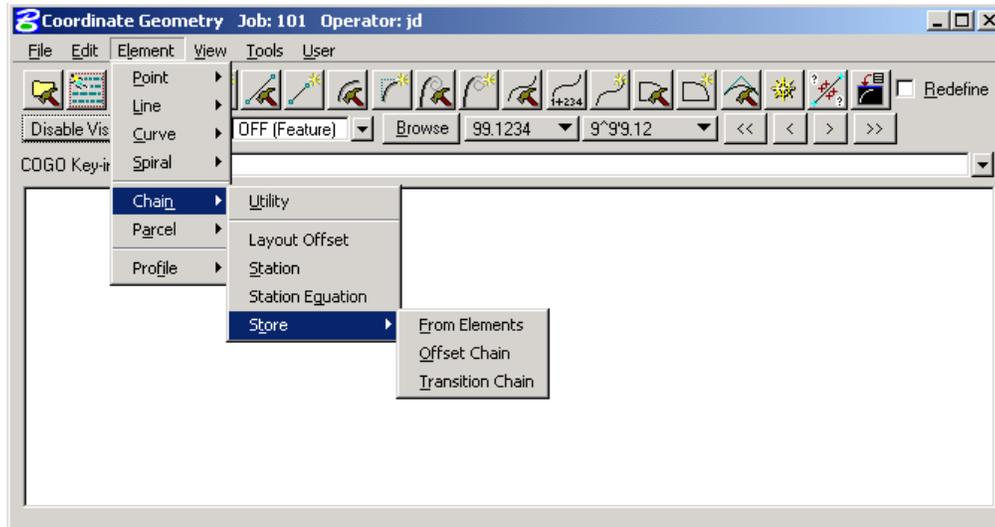


- Utility** Opens the **Spiral Utility** dialog where the following options are available.
 - Delete** - Deletes a spiral (or range of spirals) from the database file.
 - Print** - Displays the selected spirals x, y, z coordinates, station value and other stored information in the display output window.
 - Visualize** - Visualizes the selected spirals currently stored in the GPK file (Temporary Visualization or Permanent Visualization must be turned on).

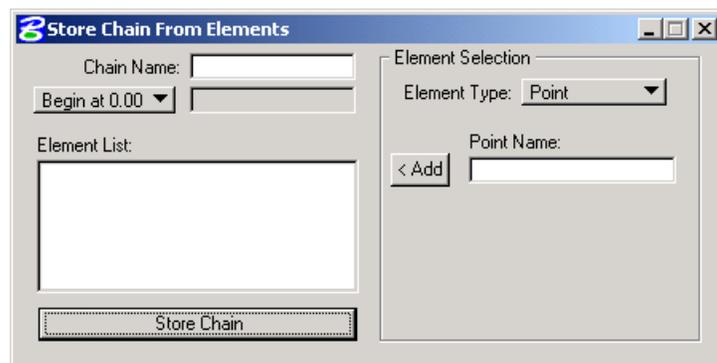
- Copy** Copies a specified spiral to another spiral name.

- Store** Provides various options for defining and storing spirals.



ELEMENT > CHAIN

Utility	Opens the Chain Utility dialog where the following options are available. Area - Calculates the area of a closed chain. Delete - Deletes a chain (or range of chains) from the database file. Print - Displays the name of each element in the selected chains. Describe - Displays the alignment data of each element in the selected chains. Visualize - Visualizes the selected spirals currently stored in the GPK file (Temporary Visualization or Permanent Visualization must be turned on).
Layout Offset	Project points onto a chain or compute offset distance and direction between two chains at each control point or at user defined intervals of a specified station range.
Station	Provides a method for stationing or re-stationing a chain.
Station Equation	Provides a method for applying a station equation to a chain.
Store	Provides three options for storing a chain in the database file, From Elements , Store Offset Chain , and Store Transition Chain . The Store Chain From Elements dialog is shown below. (Chain name can be between 1-9 alphanumeric characters)



ELEMENT > PARCEL



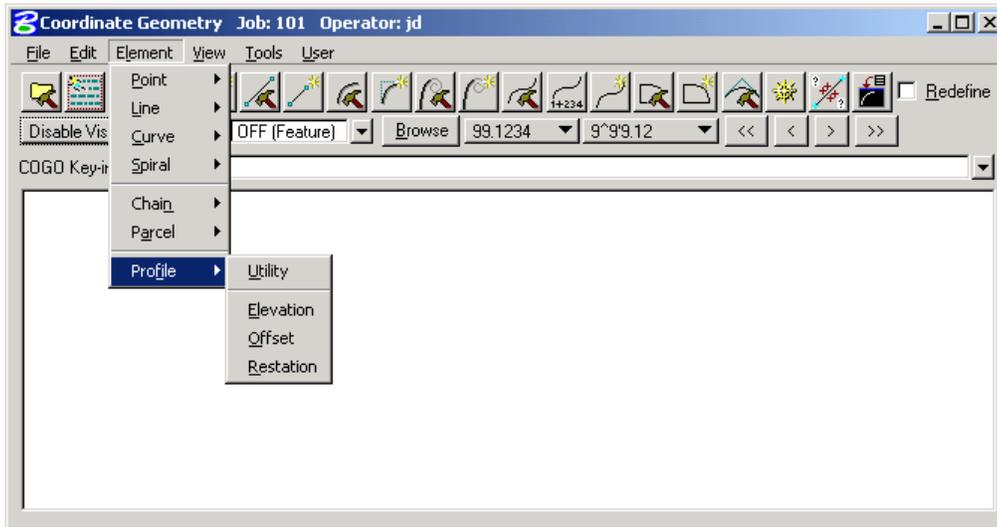
Utility	Opens the Parcel Utility dialog where the following options are available. Delete - Deletes a parcel (or range of parcels) from the database file. Print - Displays the elements of composition, the area of tract stored, taken and remaining. Describe - Displays the elements of composition, the area of tract stored, taken and remaining and a point, bearing, distance description of the specified tract. Visualize - Visualizes the selected parcels currently stored in the GPK file (Temporary Visualization or Permanent Visualization must be turned on).
Store	Stores a parcel by adding points, curves and spirals.
Subdivide	Divides a parcel into individual lots.
Editor	Edits a parcel.

PARCEL COMMANDS (MANUAL ENTRY)

Several parcel commands are supported only by manual entry and have no associated dialogs.

Store Taken	Store the portion of a parcel taken by entering point and curve names in either a clockwise or counterclockwise direction.
Store Easement	Store easements by entering point and curve names in either a clockwise or counterclockwise direction.
Own Parcel	Stores the names of the owners associated with previously stored parcels.
Make Legal	Creates a metes and bounds description and writes it to a user named text file. See also <i>Legal Description Editor</i> for the ability to create detailed and customizable legal descriptions.

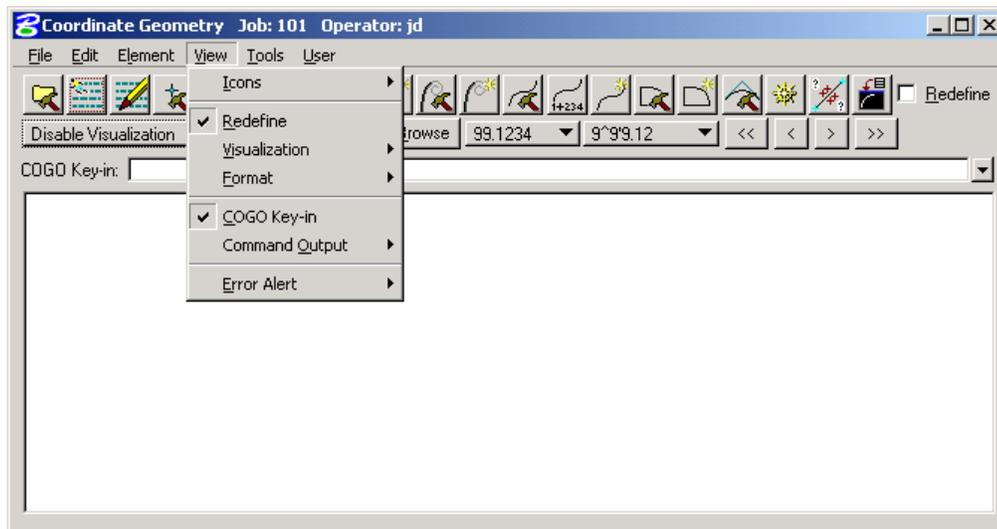
ELEMENT > PROFILE



The Profile commands (as displayed in the exploded view above) are detailed in the table below. Note additional commands are supported as keyin only commands.

Utility	Opens the Profile Utility dialog where the following options are available. Delete - Deletes a profile (or range of profiles) from the database file. Print - Displays the data of the selected profile from the database file.
Elevation	Provides three options for reporting elevations along a selected profile, Station, Even Station, Incremental Stations.
Offset	Stores a new profile within a specified Station Range at a defined vertical offset from the original profile.
Restation	Creates a new profile with different stationing from a previously stored profile.

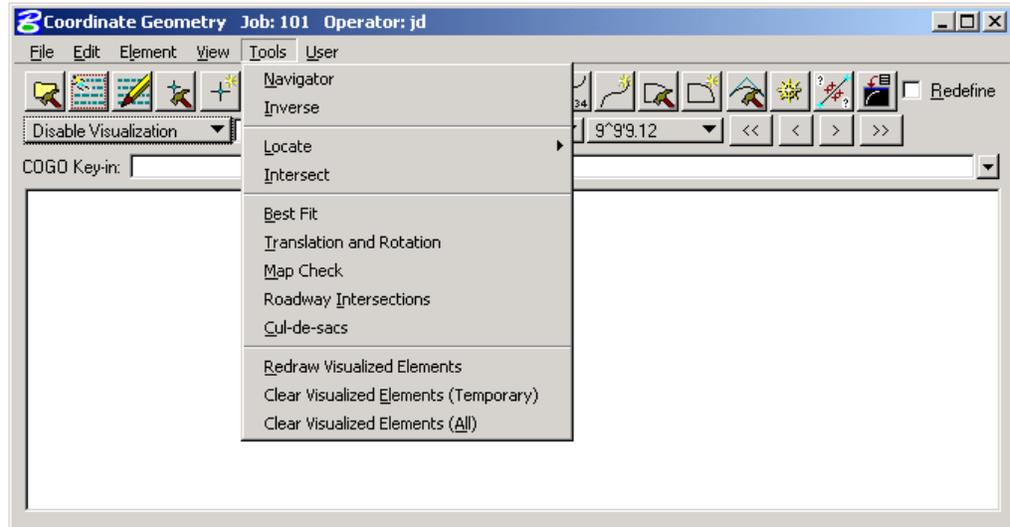
VIEW COMMANDS



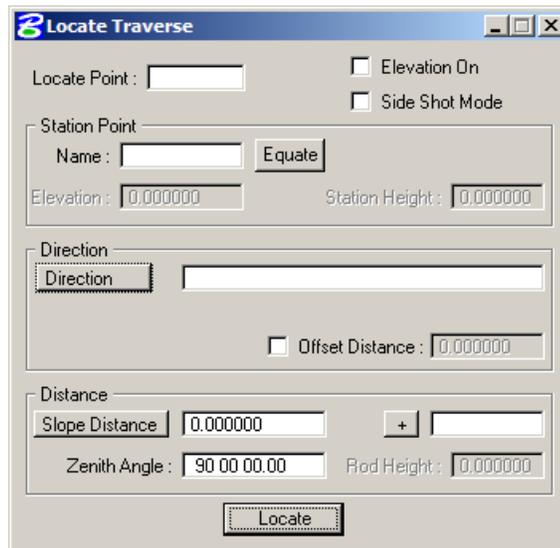
Icons	Enables the user to customize which icons appear in the tool bar.
--------------	---

Redefine	Displays the Redefine box on the tool bar.
Visualization	Displays the visualization items on the tool bar.
Format	Displays the format items (i.e. number of decimals, station format, etc.) on the tool bar.
COGO Key-in	Displays the COGO Key-in box for entering commands in the dialog.
Command Output	Displays the Command Output Window in the dialog box, and controls options for the Command Output Window. The Command output window can also be saved to a text file in lieu of using the File > Output command.
Error Alert	Enables the user to activate a <i>beep</i> and/or restore a minimized COGO dialog when an error occurs.

TOOLS COMMANDS

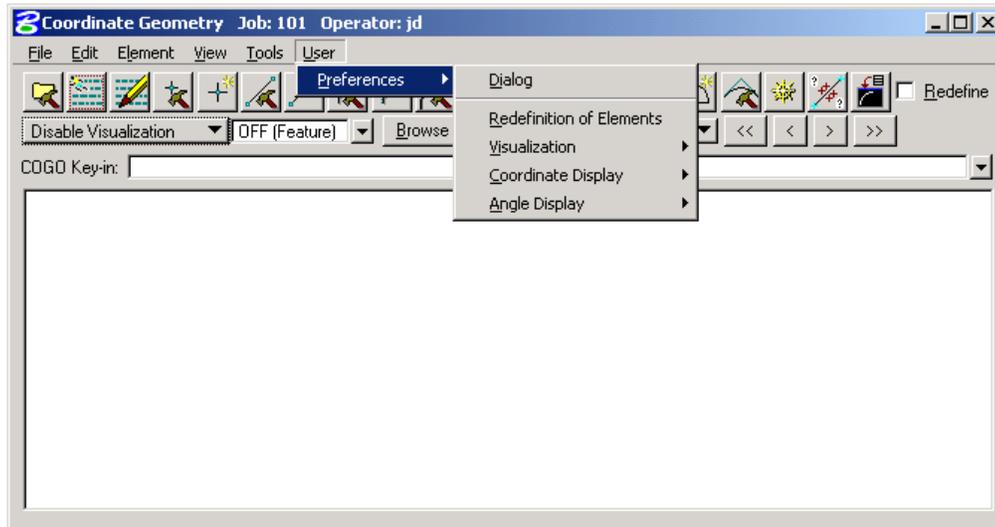


Navigator	Invokes the COGO Navigator.
Inverse	Calculates the distance and direction between points.
Locate	Stores a point or series of points not by specifying coordinates, but based on a previously stored point using several methods. To locate a point by distance and bearing, use the Tools > Locate > Traverse as depicted in the dialog below.



Intersect	Stores a point at the intersection of any two COGO elements.
Best Fit	Calculates a best-fit chain through a set of points.
Translation and Rotation	Moves, rotates, and scales a data set.
Map Check	Edits a parcel.
Roadway Intersections	Calculates data for the intersection of two COGO elements, usually chains.
Cul-de-sacs	Calculates data for a cul-de-sac.
Redraw Visualized Elements	Re-syncs the visualized COGO elements in the MicroStation file with the coordinate geometry data.
Clear Visualized Elements (Temporary)	Removes all temporary visualized elements from the view.
Clear Visualized Elements (All)	Clears all temporary and permanent visualized elements from the MicroStation file.

USER PREFERENCES

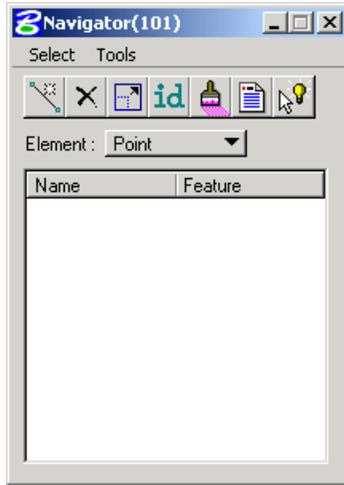


The User Preferences (as displayed in the exploded view above) are detailed in the table below.

Dialog	Allows access to COGO Preferences dialog box.
Redefinition of Elements	Toggles the Redefine option on/off. If Redefine is on, COGO data can be redefined/overwritten.
Visualization	Enables the elements to be displayed in the MicroStation file permanently, temporarily, or not at all.
Coordinate Display	Toggles between displaying NE or XY coordinates.
Angle Display	Toggles between displaying Bearing or Azimuth.

COGO NAVIGATOR

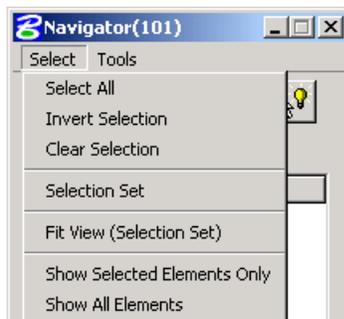
The COGO Navigator is a tool utilized to easily view and edit COGO data. Store, delete, edit, print elements, plus visualization and selection set commands are easily accessible via the Navigator. The Navigator can be accessed by the pull down menu **COGO > Tools > Navigator** or by the Navigator icon. The following dialog opens.



From the Navigator, points, curves, spirals, chains, survey chains, parcels, and profiles (all COGO elements contained in the coordinate geometry database file; *.gpk) can be added, deleted, modified, identified, visualized, printed, or selected.

NAVIGATOR > SELECT TOOLS

A variety of selection tools can be invoked via the Select pulldown, as depicted in the exploded view below.



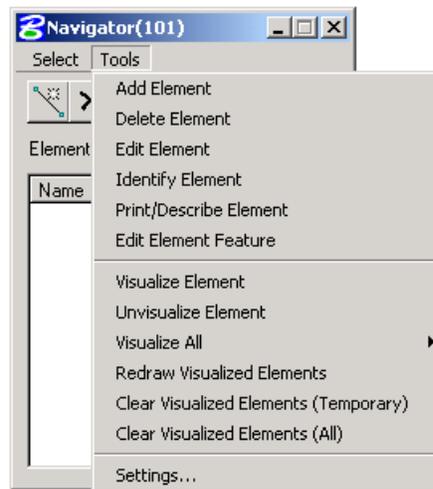
Select All	Selects all data items of a certain type. (i.e. all points)
Invert Selection	Selects all items not previously selected, and unselects all items previously selected.
Clear Selection	Unselects all items.
Selection Set	Allows the user to create a selection set that meets particular criteria. Same as using the Selection Set icon
Fit View (Selection Set)	Fits the selected items to the active MicroStation window.

Show Selected Elements Only Only the items in the selection set are displayed in the MicroStation window.

Show All Elements All items in database file are displayed in the MicroStation window.

NAVIGATOR > TOOLS

A variety of tools can be invoked via the Tools pulldown, as depicted in the exploded view below. Many can also be invoked via the shortcut icons displayed at the top of the Navigator.



Add Element Enables the selected type of element to be stored. When selected, the appropriate Store Element dialog is invoked.



Delete Element Deletes the highlighted of element.



Edit Element Invokes the appropriate Store Element dialog, populated with the associated data of the selected element for editing.



Identify Element When clicked and a COGO element is graphically selected, the element is highlighted in the display field. If the selected element is not the displayed element type (i.e., curve or point), the element type is also changed.



Print/Describe Element Displays the selected element's data.



Edit Element Feature Changes the feature code of the element.



Visualize Element Displays the selected elements according to their feature code or default symbology.



Unvisualize Element Removes display of selected elements.

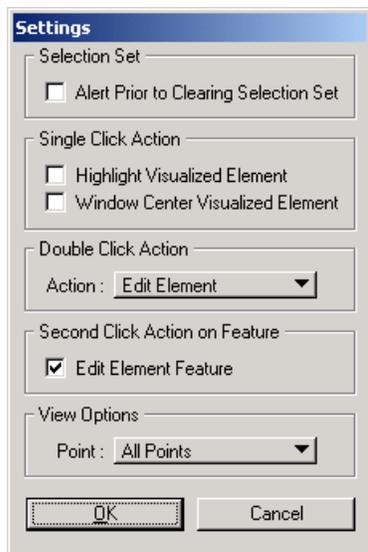


Visualize All Displays all of the elements of a certain type, or all elements.



Redraw Visualized Re-syncs the coordinate geometry data with the data displayed in the

Elements	MicroStation file.
Clear Visualized Elements (Temporary)	Clears only temporary visualized elements from the view.
Clear Visualized Elements (All)	Clears all visualized elements from the MicroStation file.
Settings	Enables the user to define certain actions and behaviors of the Navigator.



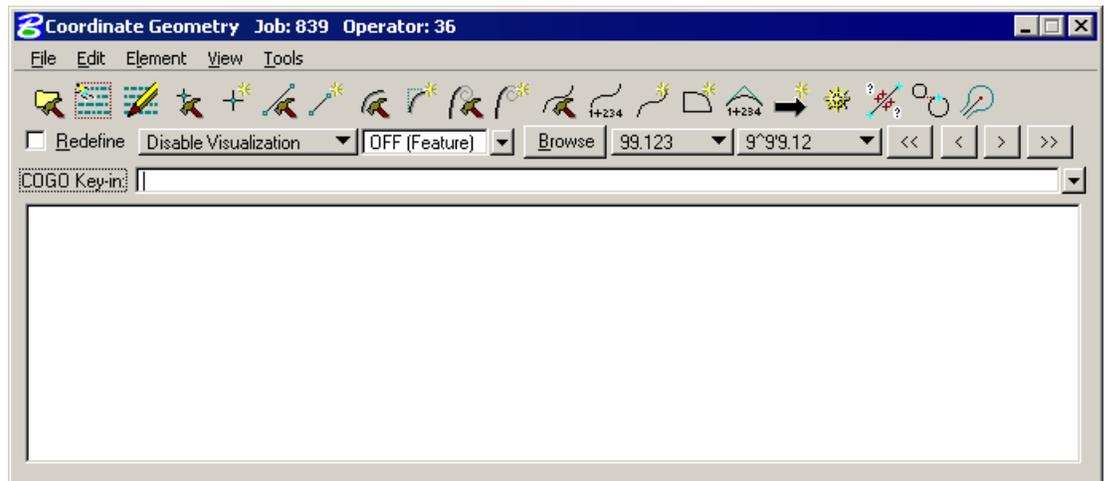
LAB EXERCISE: COORDINATE GEOMETRY **Accessing COGO**

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Access **Project Manager**.

It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.

3. Select the **Coordinate Geometry** tool from the Road Project dialog. The dialog below should appear.

This dialog is completely re-sizable, so you can position it where you’re most comfortable.

 **Import Survey Data to GPK File**

1. Set the visualization choice to **Disable Visualization**.
2. Select **File > Input File Restore** from the Coordinate geometry window.
3. Select **Edit > Read All** to process the file.
4. Open the COGO Navigator to verify the points and survey chains are now stored in the GPK file. (*Tools>Navigator*)

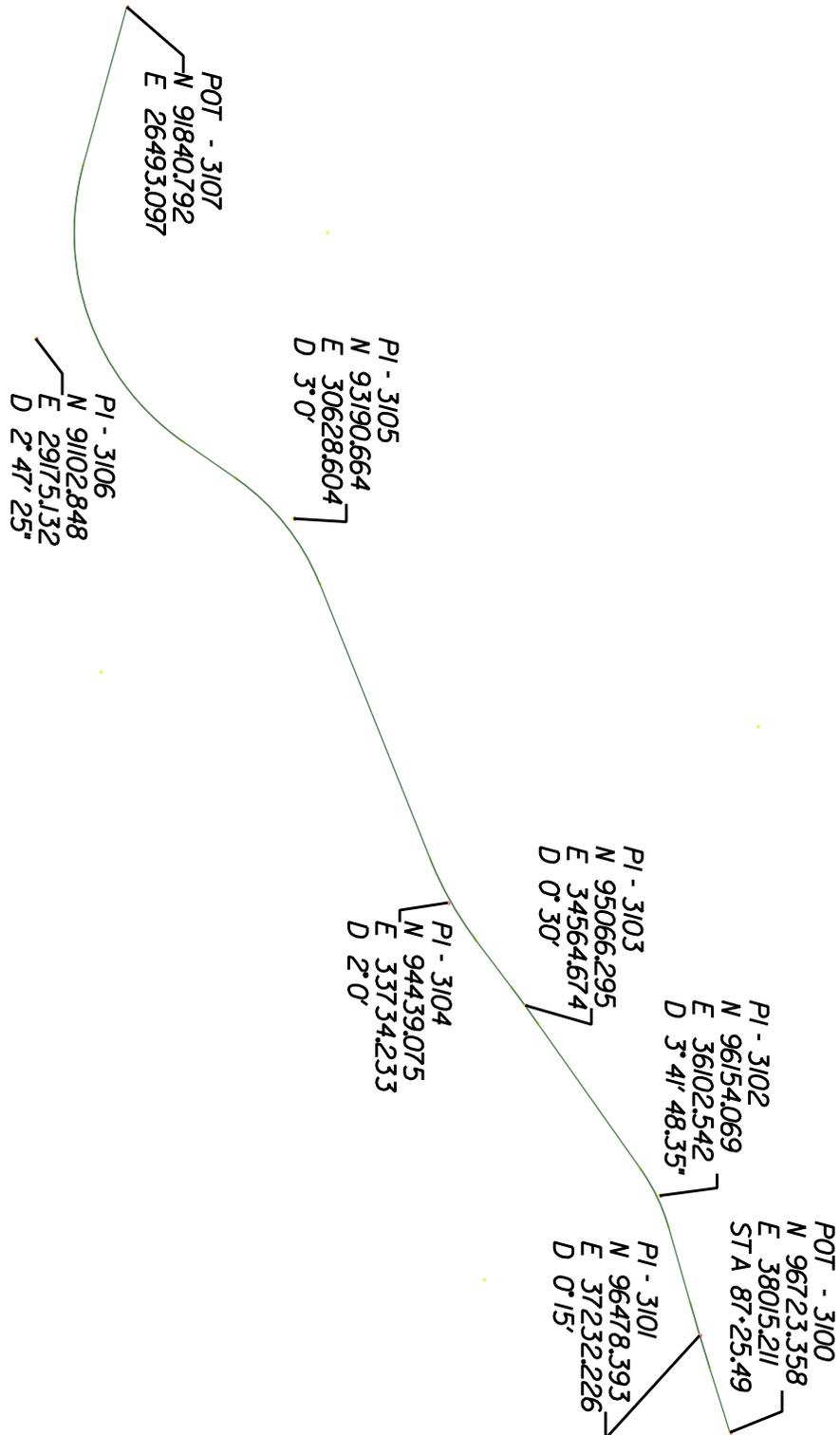
Name	Feature	Description	Select	Northing	Easting	Elevation
1	CP	CP GPS PT# 219A		89076.820	21202.685	555.279
2	CP	CP GPS PT# 219B		90972.306	20274.395	549.539
3	CP	CP GPS PT# 219C		93008.571	30618.049	430.156
4	CP	CP GPS PT# 219D		96769.971	38023.433	434.948
5	CP	CP GPS PT# 219E		97159.297	40729.887	388.348
6	CP	CP		91595.070	20617.710	0.000
7	CP	CP		91815.110	23800.400	0.000
8	CP	CP		91962.520	25301.440	0.000
9	CP	CP		91836.440	26649.320	514.823
10	CP	CP		91560.410	27453.620	515.078
11	CP	CP		91398.080	28455.660	485.198
12	CP	CP		91634.510	29282.270	455.743

5. Select **Edit > Clear** to clear the COGO commands from the input file buffer.
6. Select **View > Command Output > Clear** to empty the output window.

Hint Instead of steps 5 and 6 above, you could close and re-open the COGO dialog for the same end result just as quickly.

 **Store an Alignment**

In the next few steps, we'll use Coordinate Geometry tools to store the alignment displayed below.



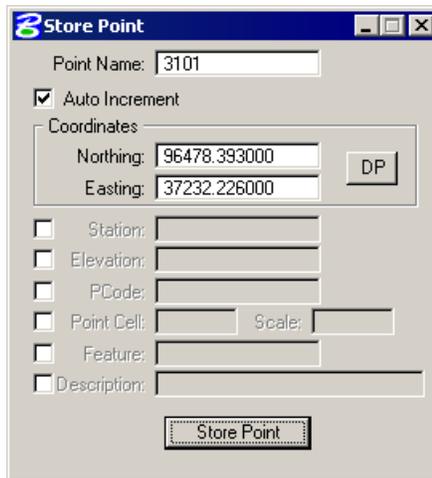
1. Select **Temporary Visualization** on the main COGO dialog.
2. Select the **Store Point** tool (**COGO: Element > Point > Store**).



The screenshot shows the 'Store Point' dialog box with the following fields and values:

- Point Name: 3100
- Auto Increment:
- Coordinates:
 - Northing: 96723.358000
 - Easting: 38015.211000
- Station: []
- Elevation: []
- PCode: []
- Point Cell: [] Scale: []
- Feature: []
- Description: []

3. To store point **3100**, enter the point number and coordinates as indicated in the dialog above.
4. Activate the **Auto Increment** toggle.
This will automatically increment the point number by **1** for subsequent **Store Point** commands.
5. Click **Store Point**.
This stores the point into the COGO database.
6. Store Point **3101** using the coordinates shown below.



The screenshot shows the 'Store Point' dialog box with the following fields and values:

- Point Name: 3101
- Auto Increment:
- Coordinates:
 - Northing: 96478.393000
 - Easting: 37232.226000
- Station: []
- Elevation: []
- PCode: []
- Point Cell: [] Scale: []
- Feature: []
- Description: []

7. Store Point **3102** using the coordinates shown below.

Point Name: 3102

Auto Increment

Coordinates:

Northing: 96154.069000 DP

Easting: 36102.542000

Station: _____

Elevation: _____

PCode: _____

Point Cell: _____ Scale: _____

Feature: _____

Description: _____

Store Point

8. Store Point **3103** using the coordinates shown below.

Point Name: 3103

Auto Increment

Coordinates:

Northing: 95066.295000 DP

Easting: 34564.674000

Station: _____

Elevation: _____

PCode: _____

Point Cell: _____ Scale: _____

Feature: _____

Description: _____

Store Point

9. Store Point **3104** using the coordinates shown below.

Point Name: 3104

Auto Increment

Coordinates:

Northing: 94439.075000 DP

Easting: 33734.233000

Station: _____

Elevation: _____

PCode: _____

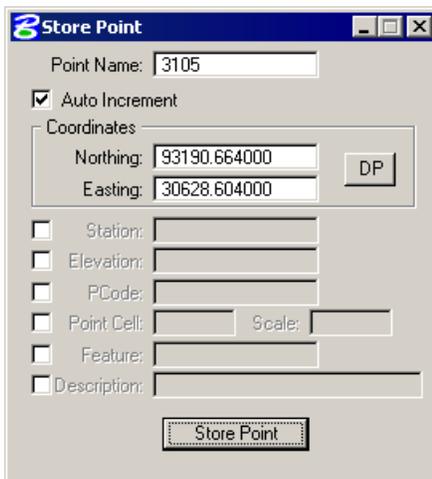
Point Cell: _____ Scale: _____

Feature: _____

Description: _____

Store Point

10. Store Point **3105** using the coordinates shown below.



11. Store Point **3106** using the coordinates shown below.



12. Store Point **3107** using the coordinates shown below.



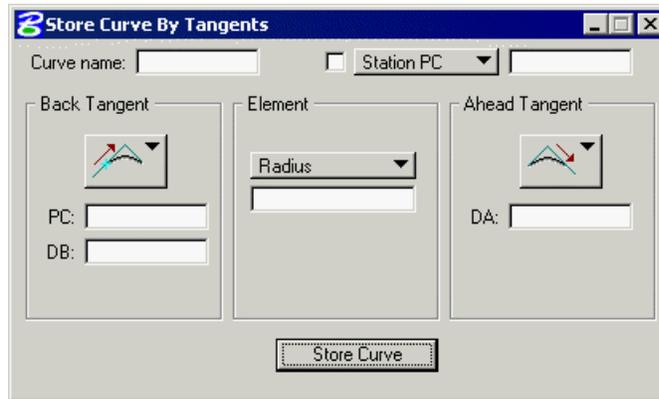
13. Close the **Store Point** dialog.

 **Store Curve Commands**

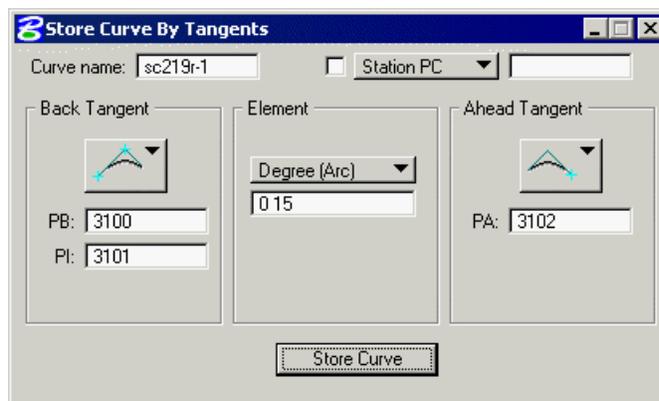
1. Access the **Store Curve By Tangents** dialog by pressing the **Store Curve By Tangents** icon



or by selecting **Element > Curve > Store > By Tangents** from the COGO dialog. The dialog below should appear.



2. To store the curve **SC219R-1**, complete the dialog as shown below.



3. Click **Store Curve** to store curve **SC219R-1** into the COGO database.
4. Store the remaining curves using the information provided on the alignment diagram and the images below..

Note Be careful to name each curve uniquely as the only the Store Point tools increment the element names automatically.

Store Curve By Tangents

Curve name: Station PC

Back Tangent  PB: <input type="text" value="3101"/> PI: <input type="text" value="3102"/>	Element Degree (Arc) <input type="text" value="3 41 48.35"/>	Ahead Tangent  PA: <input type="text" value="3103"/>
--	--	---

Store Curve By Tangents

Curve name: Station PC

Back Tangent  PB: <input type="text" value="3102"/> PI: <input type="text" value="3103"/>	Element Degree (Arc) <input type="text" value="0 30"/>	Ahead Tangent  PA: <input type="text" value="3104"/>
--	--	---

Store Curve By Tangents

Curve name: Station PC

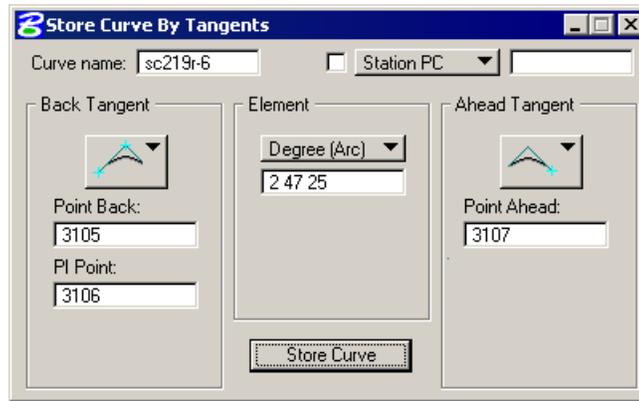
Back Tangent  Point Back: <input type="text" value="3103"/> PI Point: <input type="text" value="3104"/>	Element Degree (Arc) <input type="text" value="2"/>	Ahead Tangent  Point Ahead: <input type="text" value="3105"/>
--	---	--

Store Curve By Tangents

Curve name: Station PC

Back Tangent  Point Back: <input type="text" value="3104"/> PI Point: <input type="text" value="3105"/>	Element Degree (Arc) <input type="text" value="3"/>	Ahead Tangent  Point Ahead: <input type="text" value="3106"/>
--	---	--





- Dismiss the **Store Curve By Tangents** dialog by clicking the **X** in the upper right hand corner.

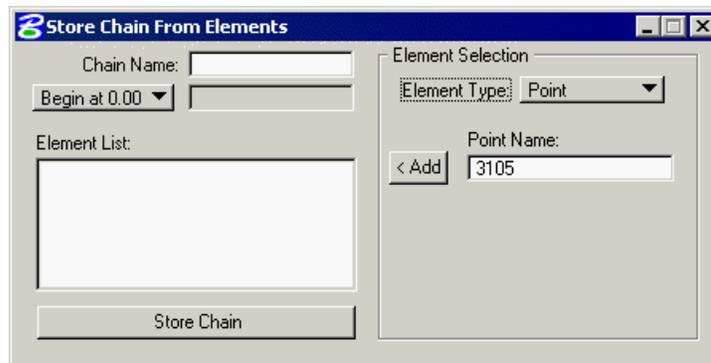
 **Store Chain Command**

Store the centerline chain SC219R according to the diagram on page 4-21.

- Access the **Store Chain From Elements** dialog by pressing the **Store Chain From Elements** icon

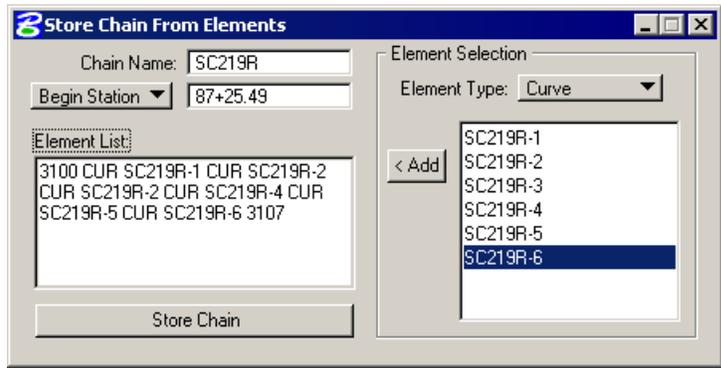


or by selecting **Element > Chain > Store > From Elements**. The dialog below should appear.



- Enter **SC219R** for the **Chain Name**.
- Set the option button to **Begin Station** and enter **87+25.49**.
- Build the list of COGO elements which will become a part of the chain.

You can fill in the elements comprising the chain by keyin or by graphically selecting the visualized elements in the design file. Ensure that the elements are added to the list in the order that you want them to be stored as a chain. The dialog should appear as below.



5. Click **Store Chain** to store chain **SC219R** into the COGO database.
6. Dismiss the **Store Chain From Elements** dialog by clicking the **X** in the upper right hand corner.

 **Describe Chain Command**

From the COGO dialog window, let's preview the chain **SC219R** coordinate geometry.

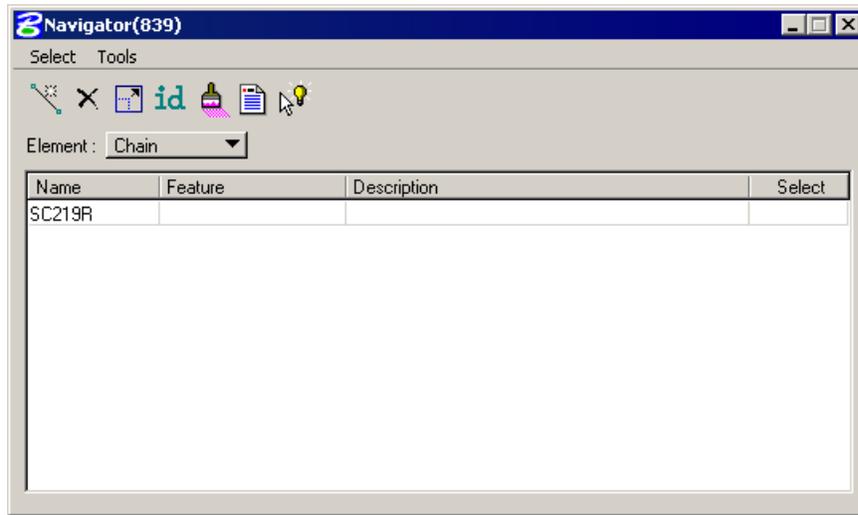
1. Access the **COGO Navigator** dialog by pressing the **Navigator** icon



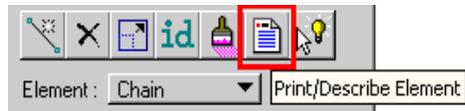
or by selecting **Tools > Navigator**. The dialog below should appear.

Name ▲	Feature	Description	Select	Northing	Easting	Elevation
1	CP	CP GPS PT# 219A		89076.820	21202.685	555.279
2	CP	CP GPS PT# 219B		90972.306	20274.395	549.539
3	CP	CP GPS PT# 219C		93008.571	30618.049	430.156
4	CP	CP GPS PT# 219D		96769.971	38023.433	434.948
5	CP	CP GPS PT# 219E		97159.297	40729.887	388.348
6	CP	CP		91595.070	20617.710	0.000
7	CP	CP		91815.110	23800.400	0.000
8	CP	CP		91962.520	25301.440	0.000
9	CP	CP		91836.440	26649.320	514.823
10	CP	CP		91560.410	27453.620	515.078
11	CP	CP		91398.080	28455.660	485.198
12	CP	CP		91634.510	29282.270	455.743

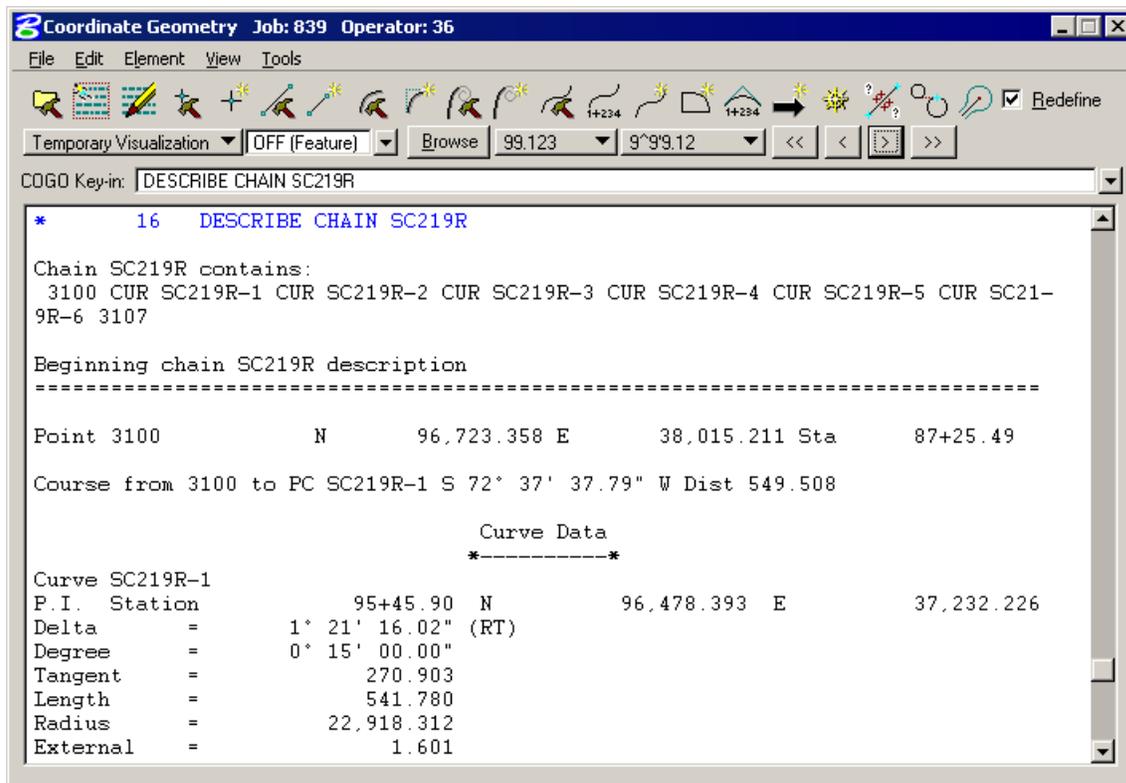
2. Set the **Element** option to **Chain** then highlight the chain **SC219R**.



3. Click the **Print/Describe Element** icon.



The chain geometry will be displayed in the main COGO window as below.



- Dismiss the **Navigator** dialog by clicking the **X** in the upper right hand corner.

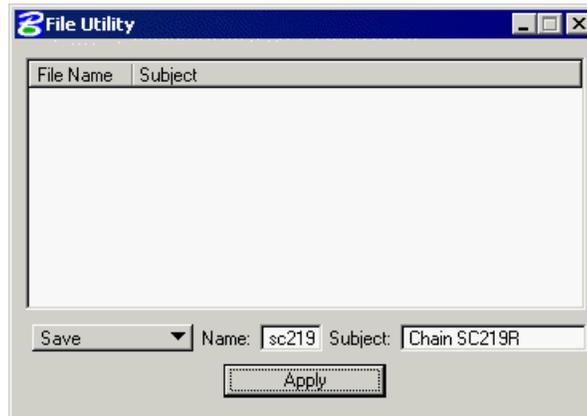
 **Create Input and Output Files**

In the following steps we will save an input trail of our commands and an output file with the computations of chain **SC219R**.

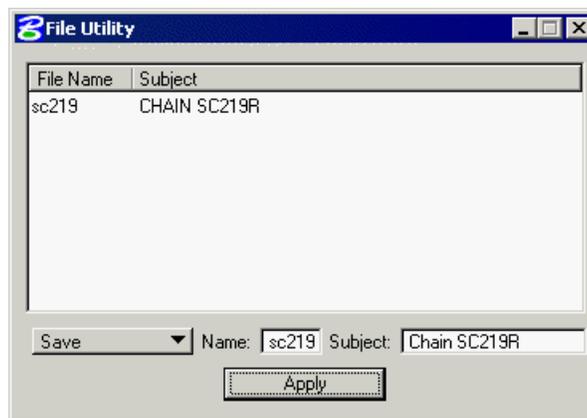
1. Access the **File Utility** dialog by pressing the **File Utility** icon



or by selecting **File > File Utility**. The dialog below should appear.

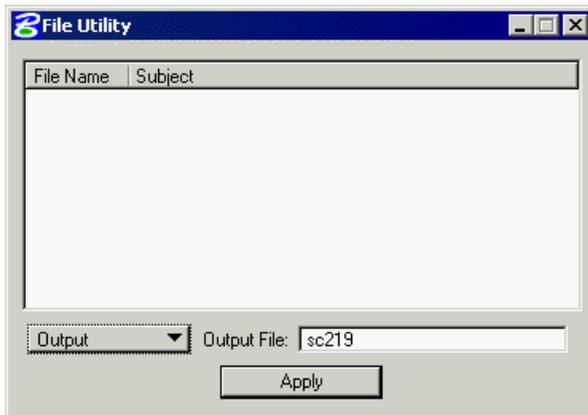


2. On the **File Utility** dialog, set the option button to **Save**.



3. Enter **“SC219”** for the **Name** and **“Chain SC219R”** for the **Subject** then click **Apply**. The saved file will be called **‘SC219839.i36’**

4. To save an output file with the actual results of the computations, set the option button to **Output** on the **File Utility** dialog.

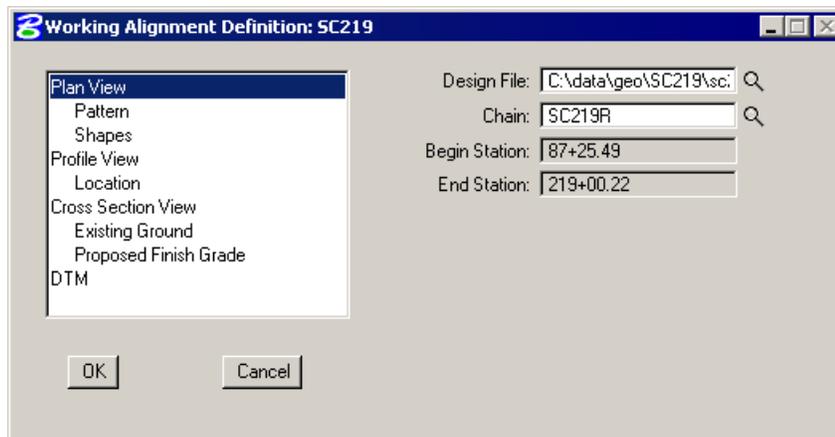


5. **Output File** should be set to **SC219**.
6. Toggle on **“Redefine”** on the main COGO dialog.
7. Click **Apply**. The saved file will be called **‘sc219839.o36’**.
8. Toggle off **“Redefine”** on the main COGO dialog.
9. Dismiss the **File Utility** dialog by clicking the **X** in the upper right hand corner.

Working Alignment

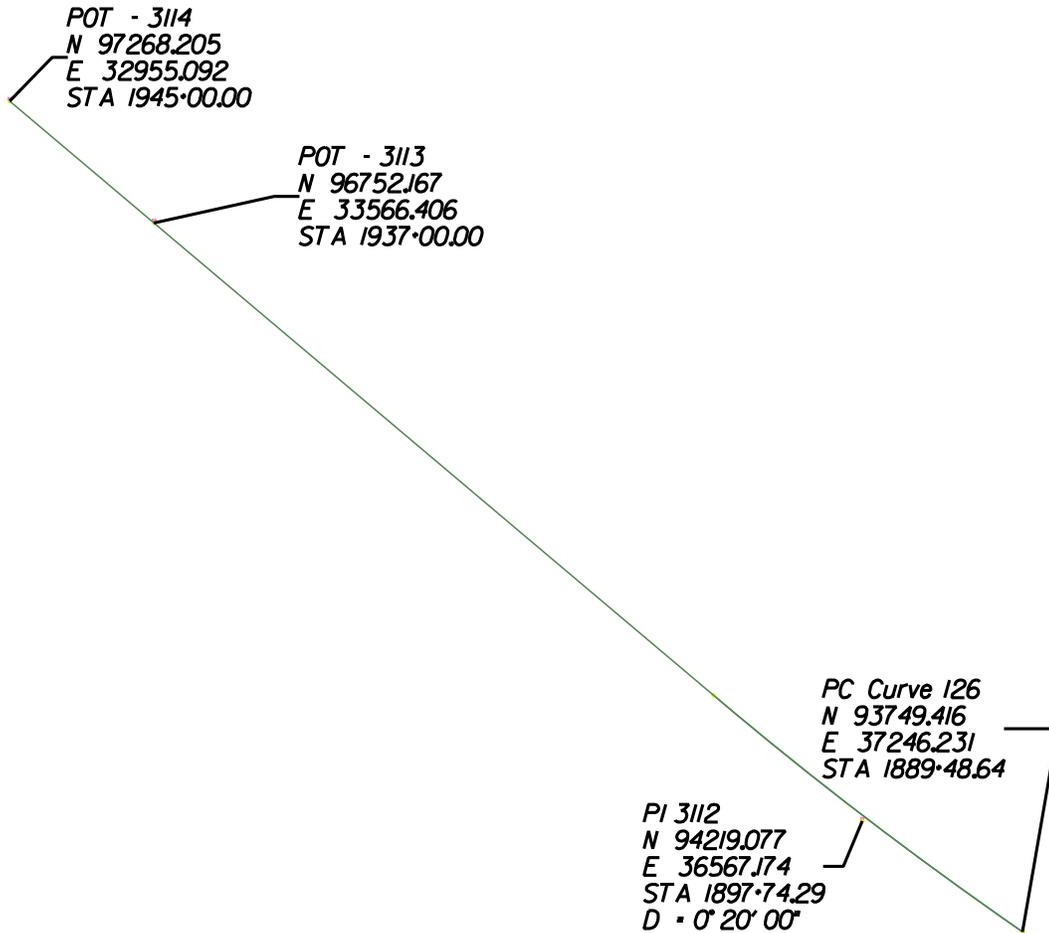
Now that we have our alignment, we have another piece of information for the Working Alignment definition.

1. Access the Project Manager Road workflow dialog.
2. Click **Define**.
3. Highlight **Plan View**.
4. Click **Select** and select chain **SC219**.



5. Click **OK**.

 **Store Chain for Interstate 26**



1. Store points for the control points on the chain above. Begin with point number 3111.
2. Store curve **I26** using the information provided above.
3. Store chain **I26** consisting of the one curve and two points.
4. Save a COGO input file called I26.



Horizontal Alignment Tools

CHAPTER OBJECTIVES

In this chapter, you will learn how to create and store horizontal chains using MicroStation elements.

INTRODUCTION

The Horizontal Layout Tools enable the user to create or modify horizontal geometry (using numerous tools) including placing spirals, curves, tapers, specified bearings and curves, complex ramp loops and connectors, and all to user-defined parameters.

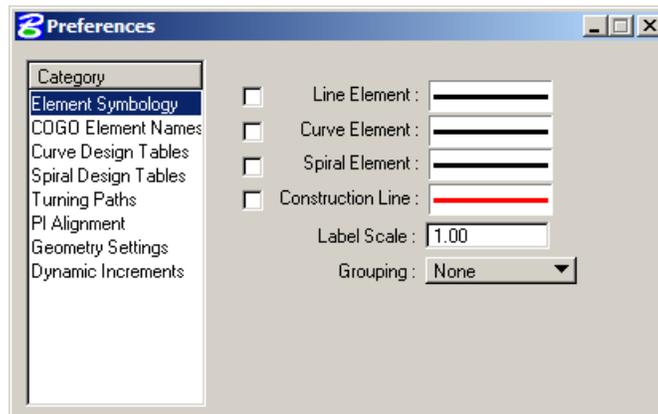
Note A session of COGO must be active.

ACCESSING

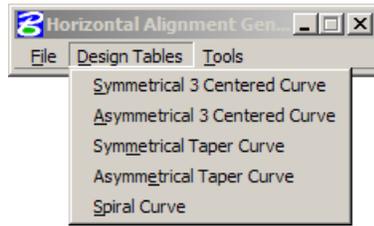
Clicking Horizontal Alignment from the Road Project: Sc219.prj dialog within Project Manager opens the tool frame shown below.



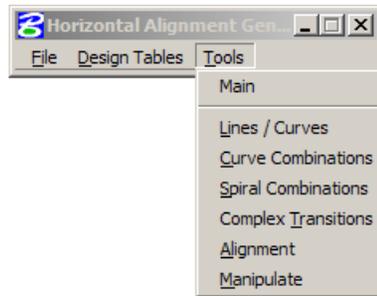
When File > Preferences is selected, the **Preferences** dialog below appears and allows the user to set certain preferences.



The Design Tables option allows the user to set up Design Tables for Symmetrical 3 Centered Curves, Asymmetrical 3 Centered Curves, Symmetrical Taper Curves, Asymmetrical Taper Curves, and Spiral Curves. These files are stores in an ASCII format.



The **Tools** option allows the user to open the **Main** dialog or any of the dialogs needed do store a Horizontal Alignment.



Values within the dialogs dynamically change simultaneously with dynamic graphic modifications.

Note Spiral and compound curve commands do not support dynamic manipulation.

LINES / CURVES TOOLS



The Place **Lines / Curves** Commands are detailed in the table below.

	<p>Store Line By 2 Points</p> <p>The store line by two points command requires two new points and a new line. The command draws the line and the new points.</p>
	<p>Store Tangent Line</p> <p>The Store Tangent Line tool stores a line and its two endpoints in the coordinate geometry database.</p>
	<p>Store Curve By 3 Points</p> <p>The Store Circular Curve by Three Points tool stores a circular curve (using chord definition).</p>
	<p>Store Curve By Center</p> <p>This tool enables the user to store a circular curve by defining the center point, radius, and sweep angle.</p>

**Store Tangent Curve Unconstrained**

The Store an Unconstrained Tangent Curve tool places a curve through a specified point tangent to the specified curve or line.

**Place Simple Curve**

This tool enables the user to store a circular curve. Options include offsets, truncate, and the ability to modify once the first curve is displayed.

**Place Simple Transition**

This tool enables the user to draw a transition element between two arcs. Options for the Transition element include: Tangent, Curve, or Spiral. As the Transition option is changed, the dialog dynamically changes to reflect the selection.

CURVE COMBINATIONS TOOLS

The **Curve Combinations** Commands are detailed in the table below.

**Place Turning Paths**

This tool enables the user to draw turning paths.

**Place Compound Curves**

This tool enables the user to draw a compound curve between two elements.

**Place Three Centered Curves**

This tool enables the user to draw a three-centered curve between two elements. The Design Vehicles group enables the user to select the desired vehicle, based on the data from files stored in the User Preferences.

**Place Taper Curves**

This tool enables the user to draw taper curves between two elements. The Design

**Place Reverse Curves**

This tool enables the user to store reverse curves between two elements. An option is supported for an intermediate user-defined Tangent Length.

SPIRAL COMBINATIONS TOOLS**Place SC Tangent To Line**

This tool enables the user to store a spiral / curve combination tangent to a line.

**Place ST Tangent To Curve**

This tool enables the user to store a spiral / tangent combination tangent to a curve.

**Place SC Tangent To Curve**

This tool enables the user to store a compound spiral / curve combination tangent to a curve.



Place SCS (Intersecting Elements)

This tool enables the user to store a spiral / curve combination tangent to a line. The Design Table enables the user to select the desired Design Speed / Lanes and Degree based on the data from files stored in the User Preferences.



Place STS (Disjoint Curves)

This tool enables the user to store a spiral tangent spiral combination tangent between two elements.



Place SCS (Disjoint Curves)

This tool stores a spiral curve spiral combination between two curves. Note the tool also works with overlapping curves. The Design Table enables the user to select the desired Design Speed / Lanes and Degree or Radius based on the data from files stored in the User Preferences.

COMPLEX TRANSITIONS TOOLS



Place Complex Ramp

This versatile tool enables the user to draw simple to complex ramp geometry.



Place Ramp Connector

This versatile tool enables the user to draw simple to complex ramp connectors, with a variety of options.

ALIGNMENT TOOLS



Place Dynamic Alignment

The first Alignment tool is placing a dynamic alignment. You initially select and accept a beginning element. By moving the cursor, the length of curve and dynamic ahead element change. Continue placing data points to create curves and intermediate tangents. At any time during the process, the Entry Radius may be changed. Any subsequent curves are placed with the revised Radius.



Place PI Alignment

The second Alignment tool is placing a PI based alignment.



Store Chain

The third Alignment tool is storing a chain comprised of graphical elements. This works similar to Automatic Create Complex Chain, while the chains are automatically being stored into the COGO database file.

MANIPULATE TOOLS**Move Plan View Element**

The Move a Plan View Element enables the user to move / translate an element or to make copies.

**Rotate Plan View Element**

The Rotate Plan View Element rotates the selected element about a user-defined point. The Angle may be manually entered and locked, or dynamically changing.

**Extend Plan View Element**

The Extend Plan View Element tool can extend or shorten any element.

**Delete Element**

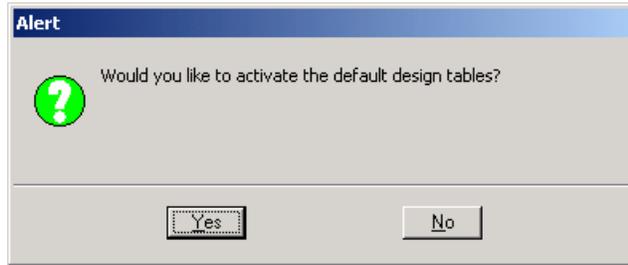
When using the Delete Element tool, no tool settings dialog opens.

Select and accept the element to be deleted. The element is removed from the coordinate geometry database. This tool works with a MicroStation selection set if present. Warning: there is no undo for this command.

LAB EXERCISE: HORIZONTAL ALIGNMENT TOOLS

Accessing Horizontal Alignment Tools

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Access **Project Manager**. It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.
3. Select the **Horizontal Alignment** icon from the Road Project: sc219.prj workflow dialog.
4. Click **YES** when prompted to activate the default design tables.



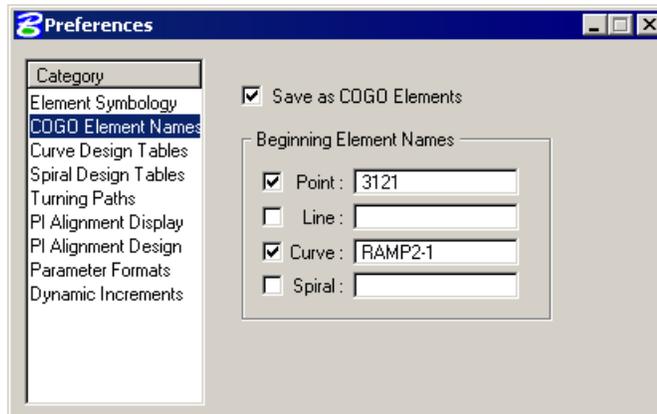
5. COGO should activate and the following dialog should appear



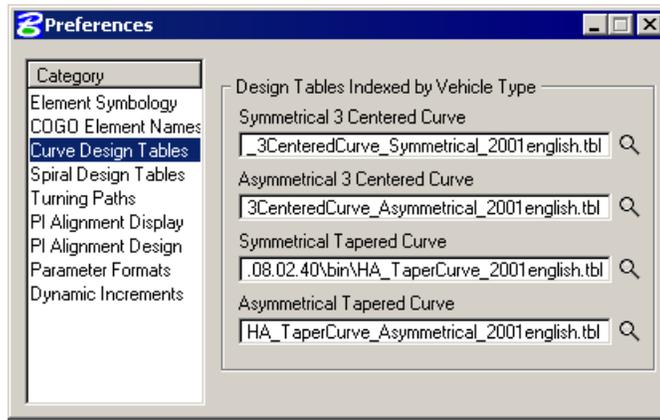
6. Enable **Permanent Visualization**, then you can either move the COGO window out of the way or “sink” it using the Bentley icon.

Setting Preferences

1. Use the **File > Preferences** pulldown to access the Preferences dialog. Select the option for **COGO Element Names** then populate the dialog as shown



2. Select the **Curve Design Tables** option. Using the **Files** button, select the appropriate file for each option. The files are located in the following directory: *c:\program files\bentley\geopak\bin*



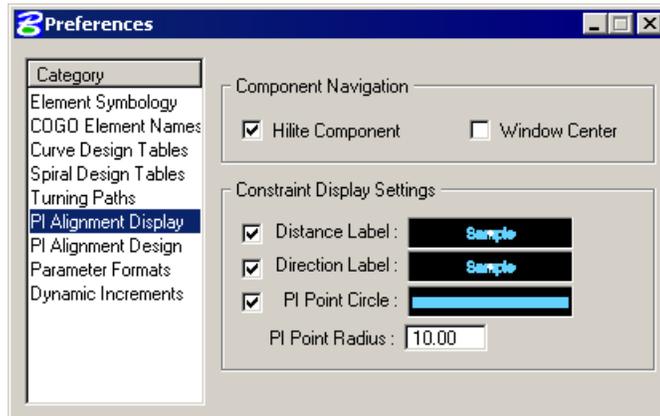
Symmetrical 3 Centered Curve Design Table HA_3CenteredCurve_Symmetrical_2001english.tbl

Asymmetrical 3 Centered Curve Design Table HA_3CenteredCurve_Asymmetrical_2001english.tbl

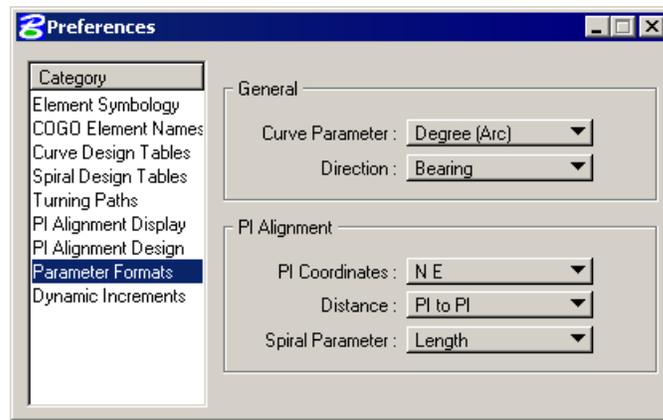
Symmetrical Tapered Curve HA_TaperCurve_2001english.tbl

Asymmetrical Tapered Curve HA_TaperCurve_Asymmetrical_2001english.tbl

3. Set the **PI Alignment Display** category as shown below.



4. Set the **Parameter Formats** category as shown below.



5. Dismiss the **Preferences** dialog by clicking the **X** in the upper right hand corner.



Graphical COGO

CHAPTER OBJECTIVES

In this chapter, you will create and store horizontal chains using Graphical Coordinate Geometry tools.

INTRODUCTION

Graphical Coordinate Geometry is a tool that allows the user the ability to store coordinate geometry elements into the COGO database (GPK file) graphically. Points, curves, lines, spirals, chains, and parcels can be stored, modified, or deleted. The COGO elements can be manipulated by key-in or a click of the mouse and are stored directly into the COGO database.

Note Graphical Coordinate Geometry does not read the exclusive MicroStation graphics.

ACCESSING

Graphical Coordinate Geometry is not accessed from **Project Manager**. It can be invoked by selecting **Applications > GEOPAK ROAD > Geometry > Graphical Coordinate Geometry** or by selecting the **Graphical COGO** icon from the **GEOPAK ROAD** tool frame.



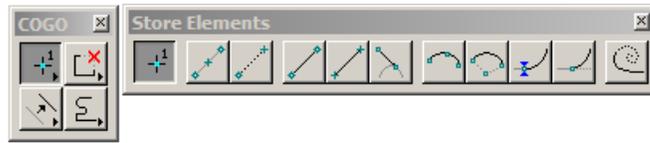
Note A session of COGO must be active.

After Coordinate Geometry is activated and Graphical COGO is selected, the main COGO dialog will appear as below.



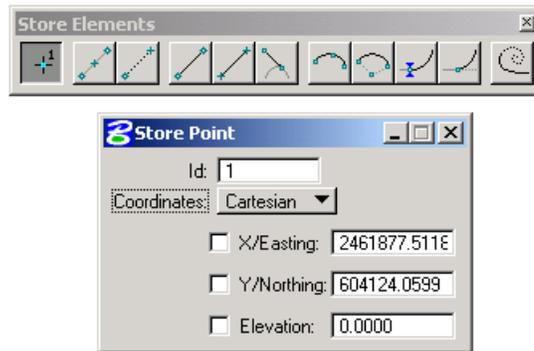
STORE ELEMENTS

The Store Elements tool box contains eleven icons.



As elements are stored, the visualization parameters in the SMD file (as defined in the user parameters) are utilized. This assumes that the temporary or permanent visualization is activated. If no visualization is active, no elements are visualized.

When a Store Element command is selected, the Tool Settings open to allow the user to enter data if necessary as depicted below.

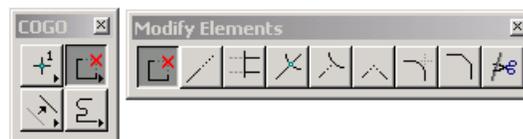


The **Store Elements** commands are detailed in the table below.

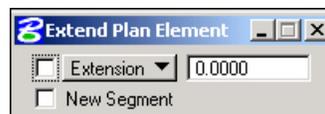
	<p>Store a Point</p> <p>The Store Point tool enables the user to store points utilizing either Cartesian coordinates (x, y, z or N, E, Z) or Curvilinear (station, offset, elevation).</p>
	<p>Store Equally Spaced Points</p> <p>The Store Equally Spaced Points stores a user-defined number of points between two previously defined points or any two data points. A line drawn between the two previously defined points is not necessary.</p>
	<p>Locate Point</p> <p>The Locate Point command stores a point based on the distance and direction from a previously defined visualized point.</p>
	<p>Store Line From Existing Points</p> <p>The Store Line from Existing Points utilizes two previously stored points to store a line.</p>
	<p>Store Line By 2 Points</p> <p>The store line by two points command requires two new points, rather than existing points. The command stores the line and the new points, utilizing the "next" available point and line names.</p>
	<p>Store Tangent Line</p> <p>The Store Line Tangent To Element tool stores a line and its two endpoints in the coordinate geometry database.</p>

	<p>Store Curve By 3 Points</p> <p>The Store Circular Curve by Three Points tool stores a circular curve (using chord definition). The stationing is set to 0+00 at the P.C. The Radius can be manually typed in or defined dynamically.</p>
	<p>Store Curve By Center</p> <p>This tool enables the user to store a circular curve by defining the center point, radius, and sweep angle.</p>
	<p>Store Tangent Curve Constrained</p> <p>The Store a Constrained Tangent Curve tool places a curve tangent to the specified curve or line.</p>
	<p>Store Tangent Curve Unconstrained</p> <p>The Store an Unconstrained Tangent Curve tool places a curve through a specified point tangent to the specified curve or line.</p>
	<p>Store Tangent Spiral</p> <p>The Store Transition Spiral tool quickly places and visually modifies spirals based on an initial line or curve.</p>

MODIFY ELEMENTS



When a Modify command is selected, the Tool Settings dialog opens to allow the user to enter data if necessary as depicted below.



The **Modify Elements** commands are detailed in the table below.

	<p>Partial Delete</p> <p>The Partial Delete tool enables the user to delete part of a COGO line or curve, creating two separate elements.</p>
	<p>Extend Plan View Element</p> <p>The Extend Plan View Element tool can extend or shorten any COGO element.</p>
	<p>Trim Elements</p> <p>The Trim Elements tool trims numerous elements to their intersection with another element.</p>
	<p>Intersect Elements</p> <p>The Compute Intersection of Two Element tool stores a new point by trimming or extending one element to its intersection with another element. Note the two elements remain intact.</p>
	<p>Extend Element to Intersection</p> <p>The Lengthen or Shorten an Element tool works functionally the same as its</p>

	MicroStation counterpart.
	Extend Elements to Intersection The Lengthen or Shorten Both Elements tool works functionally the same as its MicroStation counterpart.
	Construct Circular Fillet The Construct a Fillet Between Two Elements tool works functionally the same as its MicroStation counterpart and stores a circular curve between two elements.
	Construct Chamfer The Construct a Chamfer Between Two Elements tool works functionally the same as its MicroStation counterpart and stores a line between two elements. Both the line and two new endpoints are stored in coordinate geometry.
	Cut Element The Cut Elements into Smaller Elements tool cuts elements into segments.

MANIPULATE ELEMENTS



When a Manipulate command is selected, a sub pallet will appear to allow the user to enter data if necessary as depicted below.



	Move Plan View Element The Move a Plan View Element enables the user to move an element or to make copies.
	Rotate Plan View Element The Rotate Plan View Element rotates the selected element about a user-defined point. The Angle may be manually entered and locked, or dynamically changing.
	Copy Parallel The Copy Parallel tool works functionally the same as its MicroStation counterpart.
	Delete Element When using the Delete Element tool, no tool settings dialog opens. Select and accept the element to be deleted. The element is removed from the coordinate geometry database. This tool works with a MicroStation selection set if present.

Warning There is no undo for this command.

GROUPS



When a Group command is selected, the Tool Settings opens to allow the user to enter data if necessary as depicted below.



The **Groups** Commands are detailed in the table below.



Store Chain

The Store Chain command works in the same manner as the MicroStation Automatic Create Complex Chain with the additional benefit that the chain is automatically stored in the COGO database.



Store Parcel

The Store Parcel tool enables the user to store parcels, takings, easements, and other types of right of way features. It is very similar to the Store Chain tool with many of the same options.

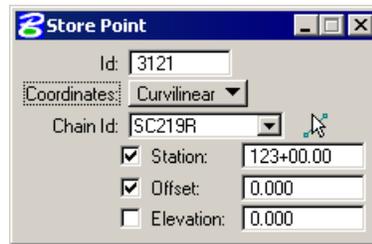
LAB EXERCISE: HORIZONTAL ALIGNMENT AND GRAPHICAL COGO

This exercise will lay out a ramp from chain SC219R to chain I26. The parameters of the ramp are as follows:

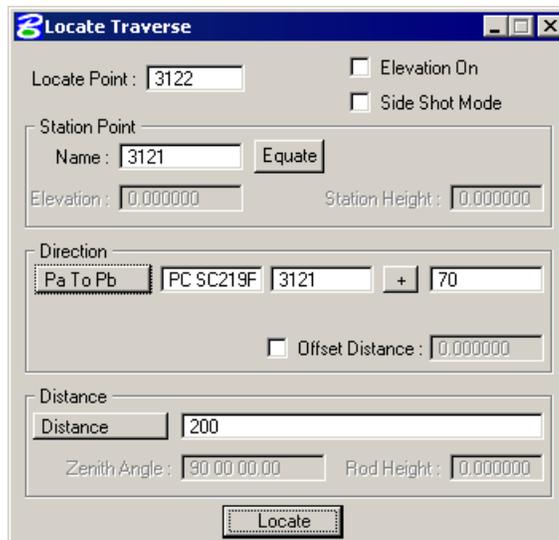
- The chain will start at station 123+00 on SC219R.
- The departure angle from chain SC219R is 70°.
- The initial tangent is to be 125' in length.
- The reverse curves will be 8° and 4° 30' respectively with a 250' tangent between the curves.
- The 4° 30' curve will be tangent to chain I26, 54' offset.

Storing a Ramp

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Open Project Manager.
3. Open the **Horizontal Alignment** and **Graphical COGO** tools.
4. Using Graphical COGO's **Store Point** tool, store a point at station 123+00 on chain SC219R.



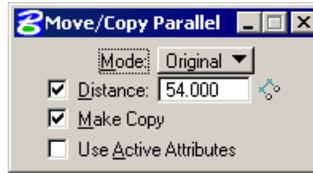
5. Use COGO's **Locate Traverse** tool to locate a point 200' from point 3121 at a 70° angle to chain SC219R.



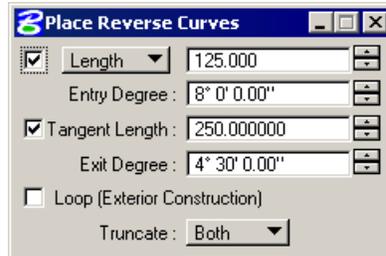
Note The first point above is PC SC219R-3.

6. Store a COGO line from point 3121 to point 3122.
7. Visualize chain I26 using COGO Navigator.

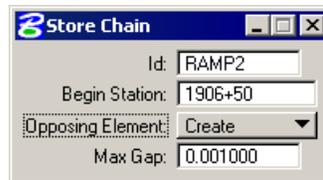
8. Using MicroStation's Copy Parallel command, copy the chain 54' to the west.



9. Drop the complex chain using MicroStation's Drop Element command.
10. Use the **Place Reverse Curve** tool (*Horiz. Alignment Generator: Tools>Curve Combinations*) to place a reverse curve between the initial tangent line and the offset chain I26 using the parameters shown below.



11. Use the **Store Chain** tool from Horizontal Alignment Generator to store the chain RAMP2 beginning at Station 1906+50. Set the chain stationing to run toward chain SC219R.



12. Save the COGO input file with a name of **RAMP2**.
13. Close COGO.



Design and Computation Manager

CHAPTER OBJECTIVES

In this chapter, you will learn more about:

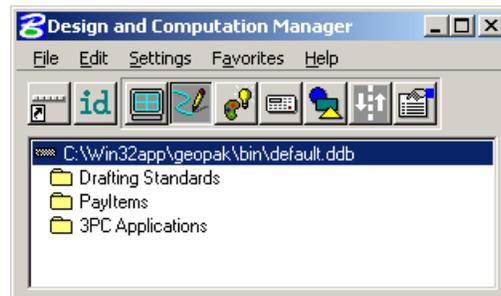
- How to use D&C Manager to plot horizontal alignments into MicroStation.
- Understand the format of the hierarchical database and how to use it.
- Be able to use the D&C Manager in conjunction with other GEOPAK tools & MicroStation to draw and manipulate elements.

INTRODUCTION

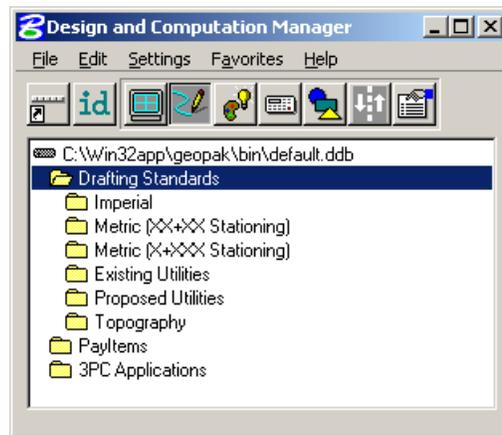
The Design and Computation Manager (D&C Manager) is a tool that allows the user to standardize graphics elements for drafting and pay item quantities.

A hierarchical database is used with the Design and Computation Manager. This database stores information concerning functional classification and display preferences for each feature and item used in a MicroStation file. This file is commonly referred to as the ddb file (*.ddb).

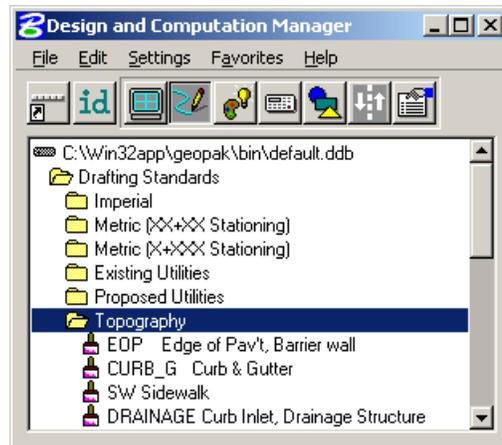
Categories are used to group and classify the features and items used in creating construction drawings. Two common examples of these categories are Pay Items and Drafting Standards as shown in the following diagram.



These three categories each contain sub-categories. The sub-categories break down each classification into more specific items. For example, Drafting Standards may be broken into several additional categories such as Imperial and Metric.



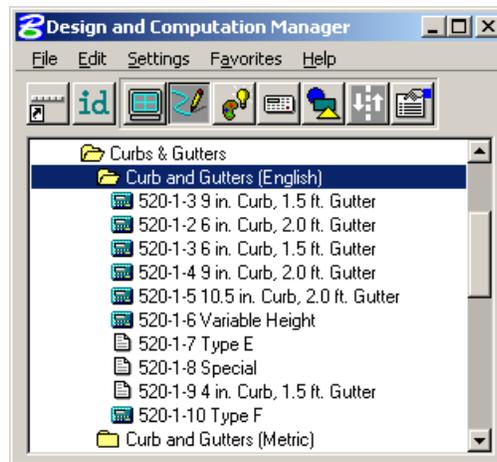
Imperial may be broken into numerous other categories. Within a category (represented by the folder icon), the items that are included are designated according to the process that they will be used for (as a drafting item indicated by a paintbrush shown in the following diagram):



Each entry represents a specific item. The various icons representing the function they will be utilized for can identify items.

- Calculator (quantities calculations)
- Paintbrush (draw design elements)
- Report icon (default, pavement design, pavement markings, etc.)

See report and calculator icons in diagram below:

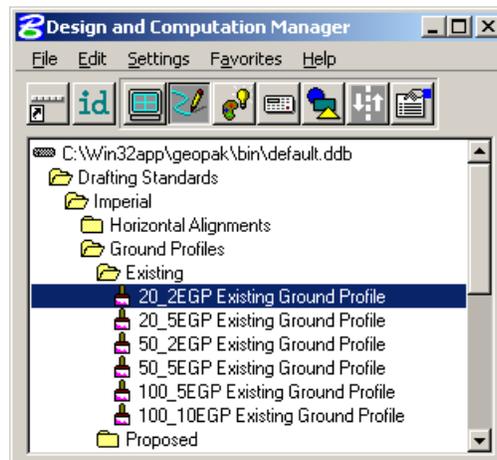


The database may also be password protected if desired. This can be used as a security measure to protect the integrity of the database file and ensure its consistent application on a statewide or company wide basis.

ACCESSING THE DESIGN AND COMPUTATION MANAGER

Design and Computations Manager can be accessed by selecting **Applications > GEOPAK ROAD > Design & Computation Manager**. It can also be invoked from the **GEOPAK ROAD Tools** tool frame and the **Plan View Design** tool box in **Project Manager**.

When the Design and Computation Manager is accessed, two dialogs are displayed.



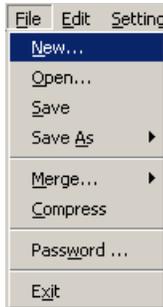
The main D&C Manager dialog is composed of two distinct areas:

- Across the top are icons for the various modes. The D&C Manager may be configured to operate in seven different modes: Display, Design, Set, Compute, Shape, Pavement Marking and Preferences. As various modes are selected, more icons are displayed within this area.
- The Path box displays the name of the attached database file and your current position within the database structure. It lists the categories, sub-categories and items available for selection. This hierarchical data structure functions much like a directory. Double clicking enables the user to move up or down within the database.

A second dialog appears differently depending on the mode of operation. This dialog enables the user to set other options not available on the main dialog.



FILE COMMANDS



For the GEOPAK designer, the only file command options needed are **Open** and **Exit**. The other commands such as **Save**, **Merge**, and **Compress** are used by personnel who maintain the database.

As mentioned previously, the **Password** option may be used to password protect the database so a user would not be able to make changes to it.

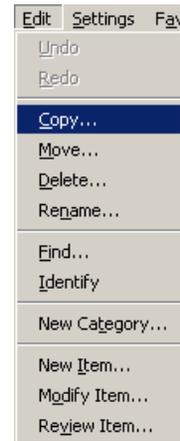
EDIT COMMANDS

As a designer, the most-used Edit commands will be Find, Identify and Review Item.

Find – This tool will search the database (from your current location) for an item or category. If the database is password protected, all other items will be disabled.

Identify – This tool will allow you to select an element in the design file to identify which item it matches in the database.

Review Item – This tool will allow you to review the settings/symbology for a particular item in the database.



SETTINGS

Display Settings - temporarily changes the display of elements on the screen to one common color, then the user may specify additional elements to be viewed in their original colors. This tool enhances visualization when working on a complex project.

Design Settings - sets the *maximum gap* tolerance and *deduction tolerance* used in computations and the drawing scale for placing cells.



FAVORITES

Add to Favorites - saves current D&C Manager path for easy recall in the future.

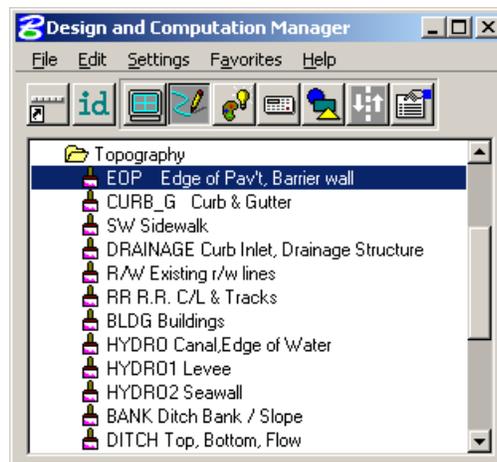
Organize Favorites – allows the organization of previously saved paths.



OPERATIONAL MODE - DESIGN

The Design mode enables the user to draw each roadway element or COGO element (and associated attributes) in the design file based on drafting item parameters.

First, the desired item is highlighted in the main dialog list box, i.e., alignment, edge of pavement, etc.



The Place Influence option sets the level, symbology and attribute tags of elements drawn or copied using MicroStation commands. When the Place Influence toggle is activated, elements are drawn using the level, symbology and attributes as defined in the GEOPAK database. When Place Influence is off, elements are drawn using the active level, symbology and attributes of MicroStation.



The **Draw COGO Element** button is for drawing COGO elements to a design file. A single click to this button prompts the user for a job number then opens a dialog that enables the user to choose a COGO item to draw.



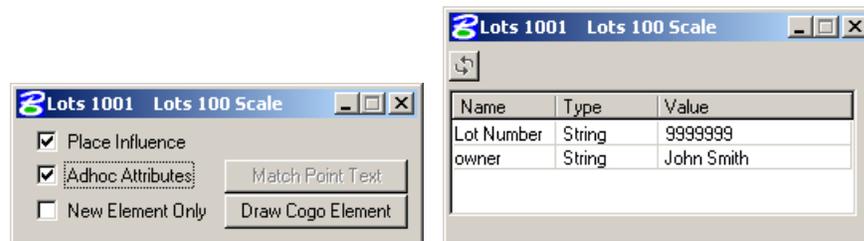
If an alignment, profile or parcel item is chosen, the Draw COGO Element button changes to **Draw Plan and Profile**.



If **Match Point Text** is selected the active MicroStation settings are set to match the drafting preferences symbology for points of the selected item.



Adhoc Attributes is used with **Place Influence** to add Adhoc Attributes to any new element when that element is drawn. A table is displayed when a MicroStation command is selected and the user can modify the value of the Adhoc Attribute prior to placement of the element.



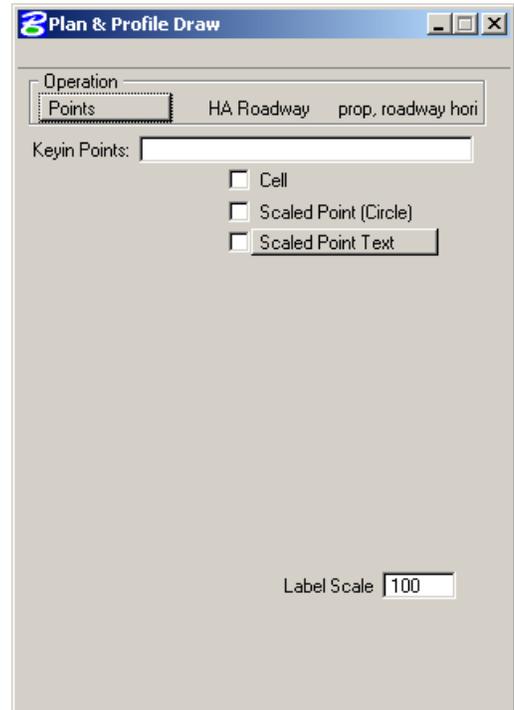
If **New Element Only** is selected and an element is modified or moved, it's symbology is not changed to the selected item.



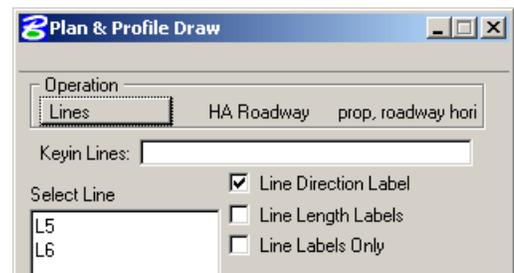
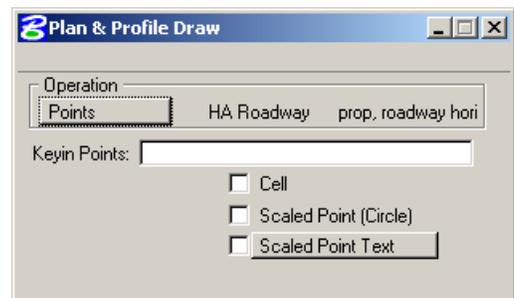
From the secondary dialog that is opened, click the Draw Plan & Profile button to initiate the drawing of COGO elements into the design file. Clicking this button prompts the user for a job number (the coordinate geometry database file wherein the COGO elements are stored), and then opens a dialog that enables the user to choose a COGO item to draw. Do Not activate the Place Influence toggle when using Draw Plan & Profile.

Hint If utilizing the Design & Computation Manager within Project Manager, you are not prompted for a job number since this is associated with the active project.

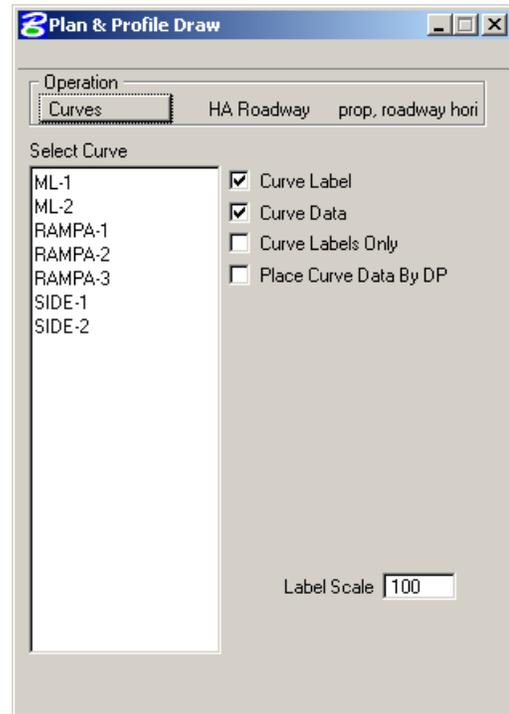
Eight operations may be accessed from the Plan and Profile Draw dialog: Points, Lines, **Curves, Spirals, Chains, Stationing, Parcels, and Profiles**. Each of these operations dynamically changes the dialog to reflect the selection with the various draw and label features used when placing a COGO element in a graphics file.



The **points** and **lines** dialog boxes have a key-in field that allows the user to specify the names of the COGO elements to be drawn. To use the line operation, the user must use point numbers to specify the ends of the line. The points/lines are drawn immediately after you enter their respective names and press the enter key. To draw more than one point or line, place a dash in-between the point numbers. To draw a line without using consecutive point numbers, use a forward slash (i.e. 10/11).



The dialog settings for **curves, spirals, chains, stationing, parcels, and profiles** have a list box that display the names of all curves, spirals and chains stored in the active coordinate geometry database file. Highlighting one of the available elements initiates further commands to draw the element into the design file. Each type of item has a list of parameters that can be optionally plotted.



Hint GEOPAK can draw elements to non-active levels. After elements are drawn, it may be necessary to turn on appropriate levels and fit the elements into the view.

DP STATION/OFFSET

INTRODUCTION

The **DP Station/Offset** tool works in conjunction with MicroStation commands and the D&C Manager. It can be used as the *data point* for any MicroStation command. DP Station/Offset provides precision placement of elements based on a station and offset of a stored chain. Uses for this command include precision placement of elements and window functions.

ACCESSING

The **DP Station/Offset** tool can be accessed by selecting **Applications > GEOPAK ROAD > Plans Preparation > DP Station/Offset**. It can also be invoked from the **GEOPAK ROAD Tools** tool frame and the **Plan View Design** tool box in **Project Manager**.

When the **DP Station/Offset** tool is accessed, the dialog below is displayed.



DRAW TRANSITION

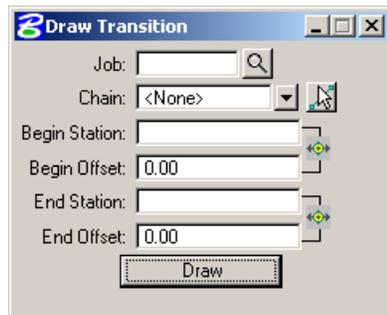
INTRODUCTION

The **Draw Transition** tool draws a line/curve based on a beginning station/offset and an ending station/offset relative to a selected chain. Use of this command includes turn lanes, mailbox widening, curve widening and lane transitions.

ACCESSING

The **Draw Transition** tool can be accessed by selecting **Applications > GEOPAK ROAD > Plans Preparation > Draw Transition**. It can also be invoked from the **GEOPAK ROAD Tools** tool frame and the **Plan View Design** tool box in **Project Manager**.

When the **Draw Transition** tool is accessed, the dialog below is displayed.



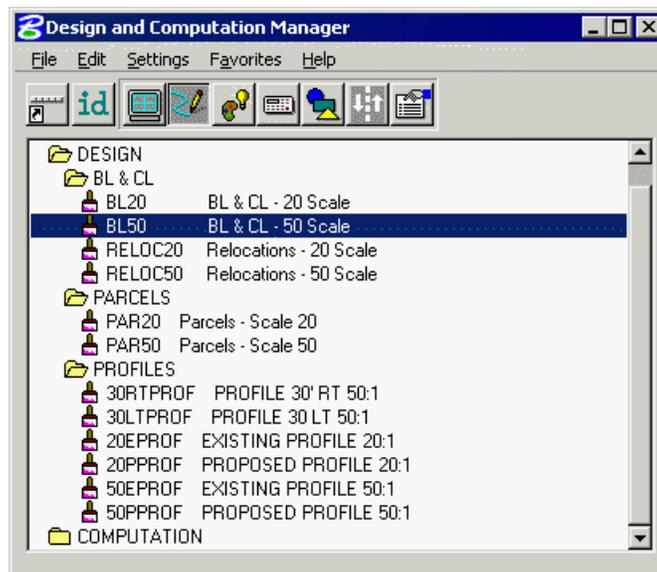
Note Elements placed with **Draw Transition** have MicroStation element type **curve** when the beginning and ending offsets are different and MicroStation element type **line** and/or **arc** when the beginning and ending offsets are the same.

LAB EXERCISE: D&C MANAGER – PLANS PRODUCTION **Accessing Design and Computation Manager**

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Access Project Manager. It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.
3. Select the icon **Plan View Design** button from the Road Project: SC219.prj workflow dialog, which opens the Plan View Design tool box.

 **Drawing Alignments**

1. Select the **Design and Computation Manager** tool (as indicated above) to invoke the Design and Computation Manager shown below. A secondary dialog opens to be used in conjunction with the Design and Computation Manager dialog.

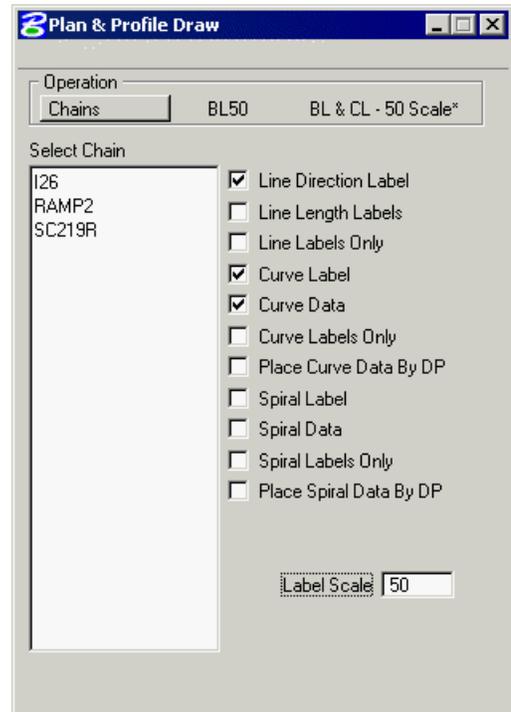


2. Select item **DESIGN > BL & CL > BL50**.

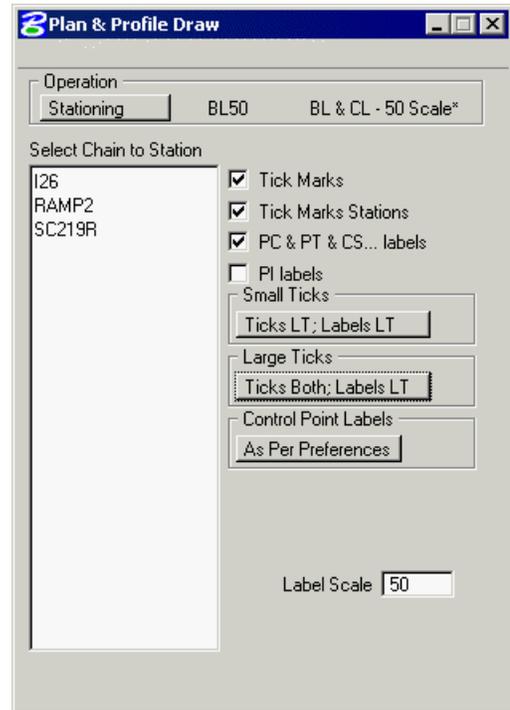
- Next, click **Draw Plan and Profile** from the secondary dialog:



- Select the **Chains** operation. Chain **'SC219R'** should be displayed in the list box as shown. Notice that the options that are to be drawn with the chain are already activated. Set the Label Scale to **50**.
- To draw the chain, select **SC219R** in the list box. **Only click once!!**



- Change the Operation to **Stationing** and annotate the alignment **SC219R** by selecting the chain name in the list box.
- Dismiss the **Plan and Profile** dialog by clicking the **X** in the upper right hand corner.
- Review the results of steps five and six.





Existing Ground Profiles

CHAPTER OBJECTIVES

In this chapter, you will learn to calculate existing ground profiles extracted from a surface model.

INTRODUCTION

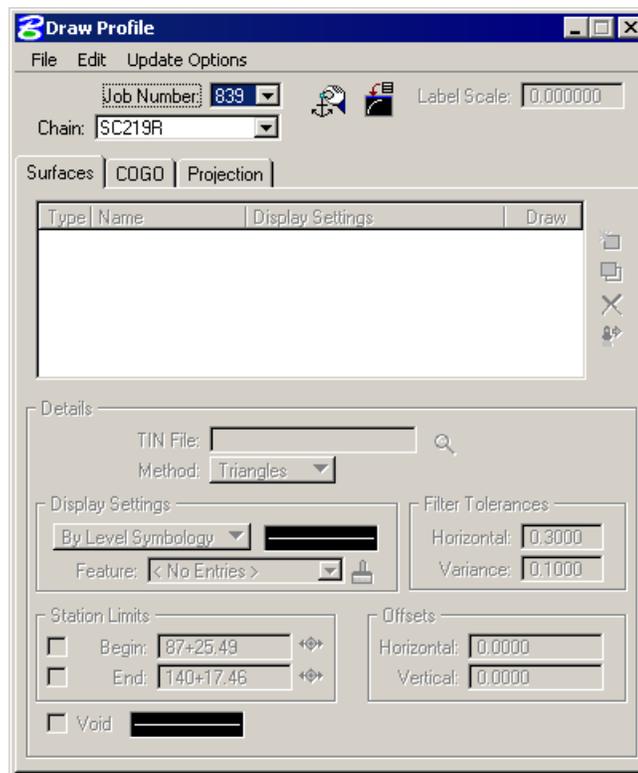
The Draw Profile tool enables the user to draw several profiles from a variety of sources simultaneously.

- GEOPAK coordinate geometry database wherein the vertical alignment is stored.
- GEOPAK binary TIN file, Site Model or Site Object. The Site Model or Object are created utilizing GEOPAK Site Modeler software and are stored within the GEOPAK Site project (gsf) file.

In addition, if the source data is TIN files or site components, the resultant profile may optionally be stored within the coordinate geometry database.

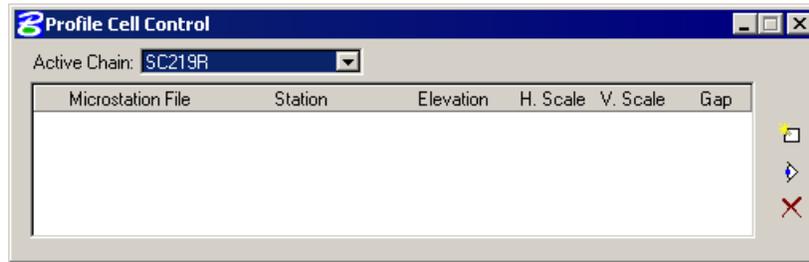
INVOKING THE DRAW PROFILE TOOL

The Draw Profile Tool is not supported by Project Manager. It can be accessed by selecting Applications > GEOPAK ROAD > Plans Preparation > Draw Profiles or from the GEOPAK ROAD Tools tool frame.



The generation of profiles must be invoked from within the 2D MicroStation design file wherein the profile is to be drawn.

The initial entries that are required are the Job Number and Chain name. Once selected, click Dialog Profile Cell Control (to the right of the Job Number field).



Select the Active Chain that the new or existing profile is to be stationed along. If no profile cell exists, click Place Profile Cell along the right side of the window to place a new cell. If multiple profile cells exist, highlight the desired cell and click Activate Profile Cell.

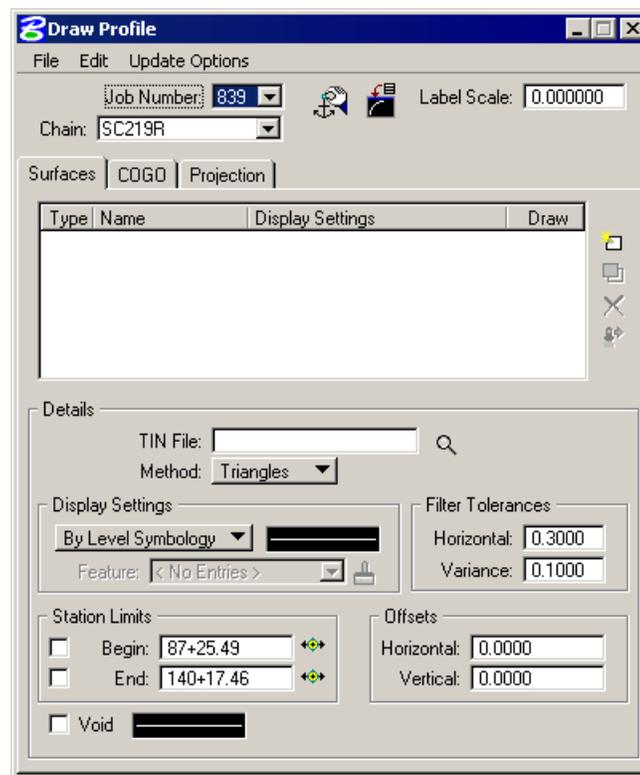
UPDATE OPTIONS

Four update options exist that allow the user the control needed to tell the software what to do if a profile has been previously drawn in the file and needs updated. The options are toggled off / on by each selection of the option by clicking the **Update Options** pulldown. The check to the left of the option indicates the option is active. Only one option may be active at any given time, therefore, if an option is selected, the previous active option is de-activated. The four options are detailed in the table below.

Delete Existing Elements and Redraw	When this option is activated, any profiles previously drawn with this tool are deleted and new ground lines are drawn.
Delete Non-Modified Elements and Redraw	When this option is activated, any profiles previously drawn with this tool and not modified with any MicroStation commands are deleted and new ground lines are drawn.
Draw on Top of Existing	When this option is activated, any previously drawn profiles are ignored and a new set is drawn, resulting in multiple copies of each profile.
Query	When activated, the user is prompted each time the Draw button is pressed.

SURFACES TAB

The Surfaces tab defines the surfaces utilized as source data when drawing profiles. Multiple surfaces from a variety of sources can be drawn in a single processing. When the tab is selected and a profile cell is placed, the dialog dynamically changes as depicted below.



Each surface to be drawn must be added to the list box. This is accomplished via the action / edit buttons on the right side of the dialog box. Each surface draws a cross section line string or lines. When a line is added to the list box, the profile is drawn. Note: clicking on the draw toggle in the list box deletes or redraws the profile.

To add to the list box, simply select the source data and method, Display Settings, Tolerances and Offsets, and then add the profile to the list. Once a profile is drawn, it may be updated at any time by using **Update Profile**. Refer to the **Update Options** section to review those options. Any profile may optionally be stored to the GPK file if desired.

DISPLAY SETTINGS

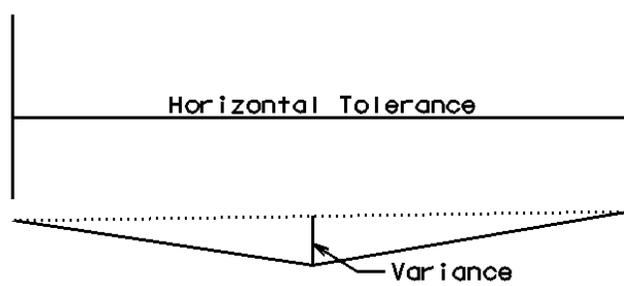
The Display Settings group box specifies the element symbology of the cross section elements being generated. The symbology may be specified using Level Symbology or a feature selected from a D&C Manager database.

To use **By Level Symbology**, set the option to By Level Symbology, then double click on the graphic. This opens the Set Feature dialog box, wherein the symbology can be specified. Click OK when completed.

To use **By Feature**, set the option to By Feature. Next, press the Paintbrush icon, which invokes the current Design and Computation Manager. Select the desired item, and then press the OK button, which closes the Design and Computation Manager, and populates the Draw Profile Display Settings group box.

FILTER TOLERANCES

Both Horizontal and Variance filter tolerances are considered together for each pair of profile segments. The middle point is deleted if both segment lengths are less than the Horizontal filter tolerance while the projected distance between the mid-point and the chord between the two end points is less than the Variance tolerance.



OFFSETS

Vertical or Horizontal Offsets may be specified in terms of master units (i.e., feet or meters). The Horizontal Offset is the distance offset from the Chain. Once the horizontal location for the profile is determined, the data source is utilized to determine the profile. Any Vertical Offset is applied after the profile is generated from the source data.

STORE PROFILE TO COGO



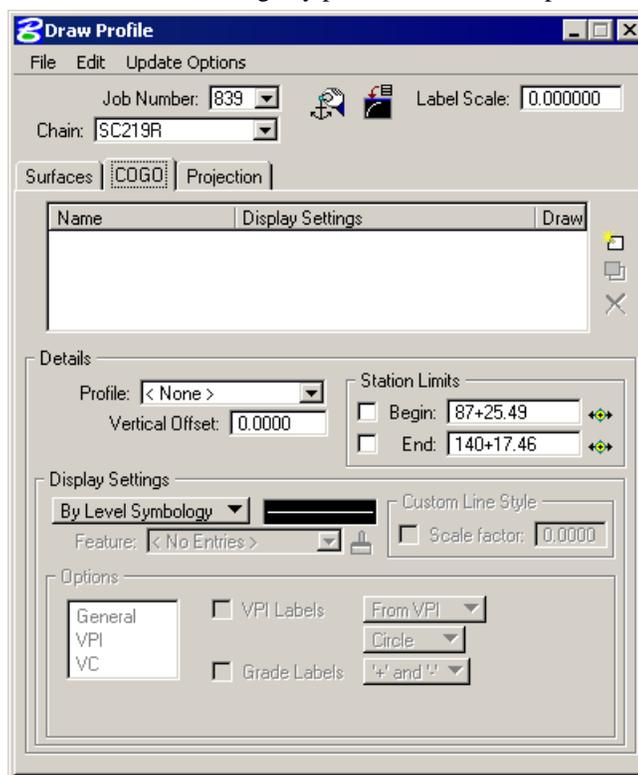
When the profile is drawn, it may also be stored in COGO by pressing this button, which opens the dialog box depicted below left.



The profile may be stored, or just the input file may be created. If an input file is created, the Operator Code and File Name are required. If the dialog box is invoked while in a 3D file, the user may toggle on the option to create a 3D profile string. The 3D profile string consists of the circles denoting every location where the design centerline intersects topographic elements. If the circles are not deleted at this time, they can be deleted at any time with a single application of the MicroStation "Delete Element" command.

COGO TAB

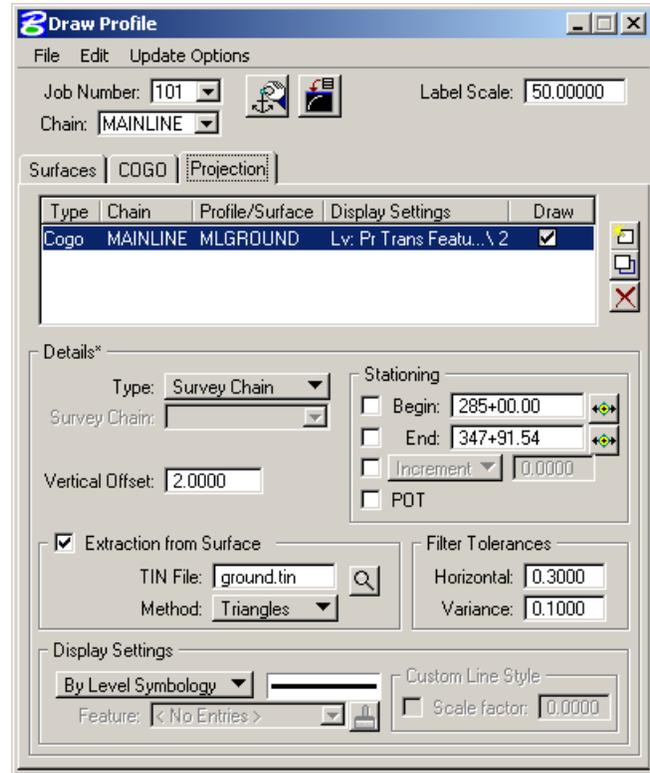
The Cogo Tab is utilized for drawing any profile that has been previously stored into the GPK file.



To draw a profile, first select the Profile Name to be drawn. The Vertical Offset defaults to a value of 0, but can be set to any value. This instructs the software to draw the profile at a distance above or below the elevations in the GPK file. Station Limits may also be specified to have the software draw only a portion of the profile. If the Display Settings are set to By Feature and a feature is selected, the Options area of the dialog box is un-ghosted. This is where various labeling options for the profile can be specified. If a value is given for the Strip Grade Increment, elevations will be placed at that increment along the bottom of the profile.

PROJECTION TAB

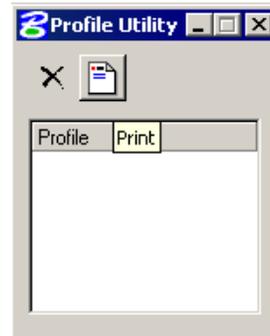
In this option, a new profile is created, extracting the elevations from the specified tin file along the chain selected in the Details section, but projecting the stations onto the chain that controls the profile cell settings.



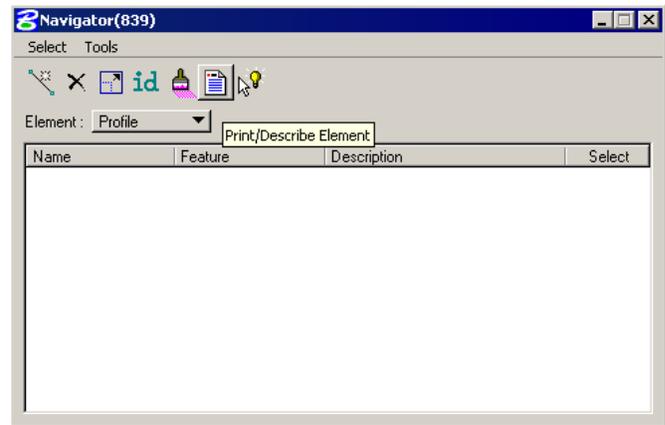
PROFILE REPORT

To review a textual report listing stations and elevations of a ground profile, open the GEOPAK Coordinate Geometry dialog box. A couple of different methods can be used to create this listing for any profile.

By selecting **Element > Profile > Utility** then highlighting a specific profile name and clicking **Print**. The results of this command will be displayed in the Command Output window of the Coordinate Geometry dialog box. To obtain a hardcopy of this information, create an output file using the **File > File Utility > Output** command and supply a filename of 1-5 characters. Then use the **File > File Utility > Print Output File** command to print this to the default system printer.



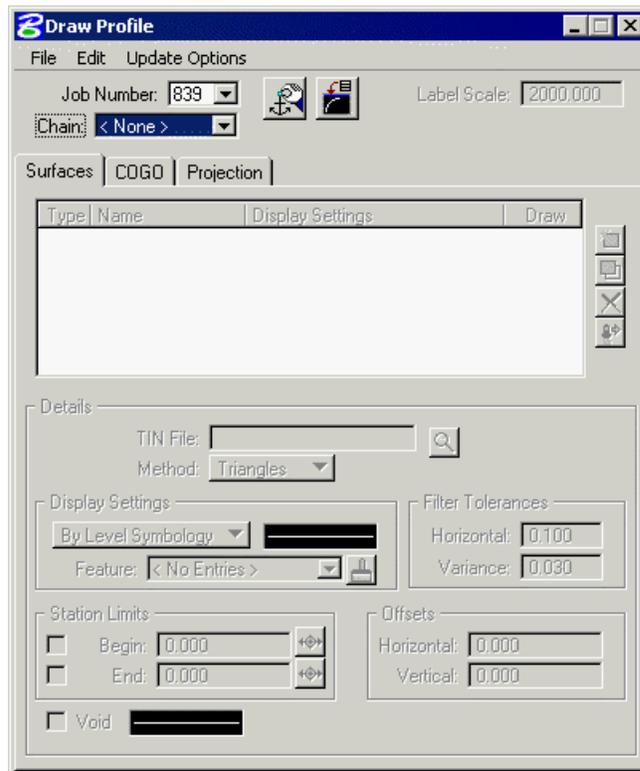
The second method utilizes the COGO Navigator tool to create the **Print Profile** command. The advantage to this method is that multiple profiles can be identified at once and printed to the Command Output window. Start the COGO Navigator by clicking **Tools > Navigator** or selecting the icon from the COGO dialog box. Change the **Element** to **Profile** then highlight the desired profile(s). Once selected, click the **Print/Describe Element** icon on the Navigator to process the profile(s).



LAB EXERCISE: EXISTING GROUND PROFILE

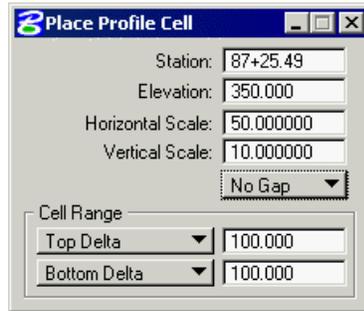
Extract Existing Ground Profile

1. Open the MicroStation file *c:\data\geo\sc219\sc219profile.dgn*.
2. Access Project Manager. It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.
3. Access the **Draw Profile** tool by selecting **Applications>GEOPAK ROAD>Plans Preparation>Draw Profiles** or from the **GEOPAK ROAD Tools** tool frame.



4. Select chain “**SC219R**” from the chain dropdown list.

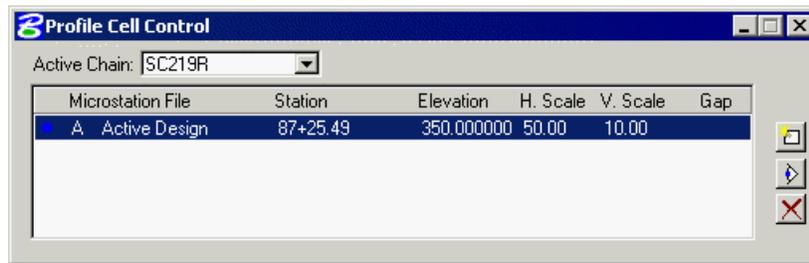
5. Click **Dialog Profile Cell Control** icon (to the right of Job Number).
6. Set the **Active Chain** to **SC219R**.
7. Click **Place Profile Cell** on the right side of the dialog.



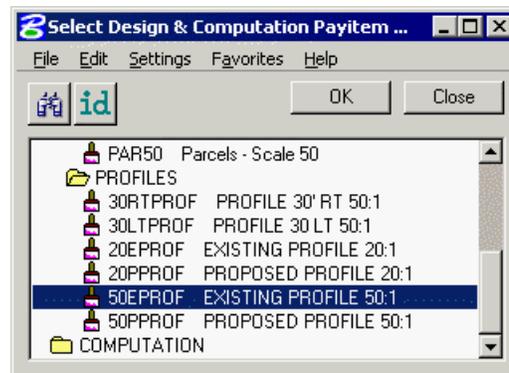
8. Populate the dialog as shown above and snap and accept the lower left corner of the grid.

Hint The coordinates of this location is 10000,10000.

9. Fit the view contents.
10. Close the **Profile Cell Control** dialog.



11. From the Surfaces tab, select the **Browse TIN File** button in the **Details** area, then select the **SC219.TIN** file for the **TIN File** to cut the profile.
12. Set the **Method** to **Triangles**.
This instructs the software to compute elevations at each location that the chain intersects a triangle leg from the TIN.
13. Set the option button to **By Feature** in the **Display Settings** area of the dialog.
14. Click the **Browser Feature (Paintbrush)** icon then navigate to the item shown below.



15. Click **OK**

- Click **Add Surface Settings** to add the profile to the list box as well as draw the profile into the MicroStation file.

Store Profiles into COGO Database

- Click **Store Surface** in COGO.



- Populate the dialog as shown above.
- Click **Apply**.
- Close the **Store Profile** dialog.
- Click **Remove Surface** icon.

Note This erases the profile from the DGN file. We will re-draw the profile shortly.

Review Profiles in COGO

- Select the Coordinate Geometry tool. (Click **Coordinate Geometry** on the workflow dialog box).
- Select **Element > Profile > Utility**.



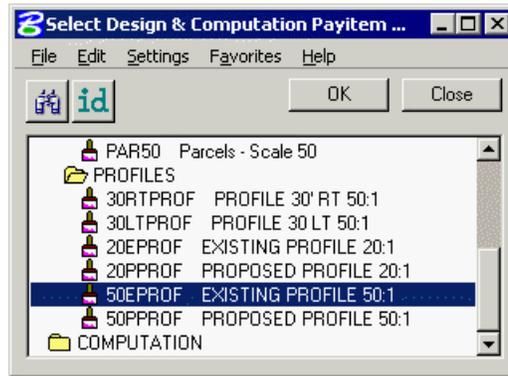
- Select the profile '**SC219REP**'
- Click the **Print** icon.
- Review the profile information in the COGO output display window.
- Close the Coordinate Geometry dialog. When prompted to save the COGO session, select **No**.

 **Drawing and Labeling the Existing Centerline Profile**

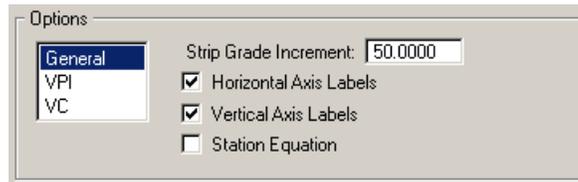
1. Click the **COGO** tab on the Draw Profile dialog then set the **Label Scale** to **50** in the upper right hand corner.



2. Select the **Profile Name** SC219REP in the **Details** section.
3. Set the option to **By Feature** in the **Display Settings** section.
4. Click the **Browser Feature (Paintbrush)** icon then navigate to the item shown below.



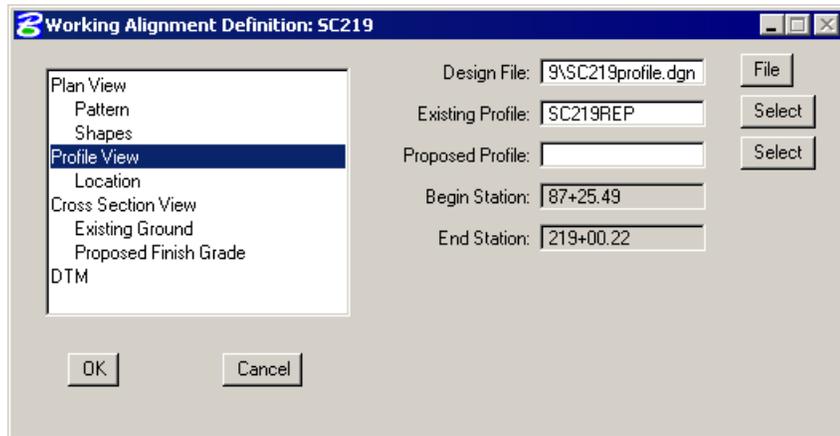
5. Click **OK**.
6. Select **General** in the **Options** area and set the **Strip Grade Increment** to **50**.
This will label the elevations every 50' along the bottom of the profile area.



7. Click **Add COGO Profile Settings** to draw the profile.
This will draw the existing ground profile with the proper symbology in addition to labeling the stations and elevations along the bottom of the profile and the elevations along the left side of the profile.
8. Close the **Draw Profile** dialog.

 **Project Manager Define**

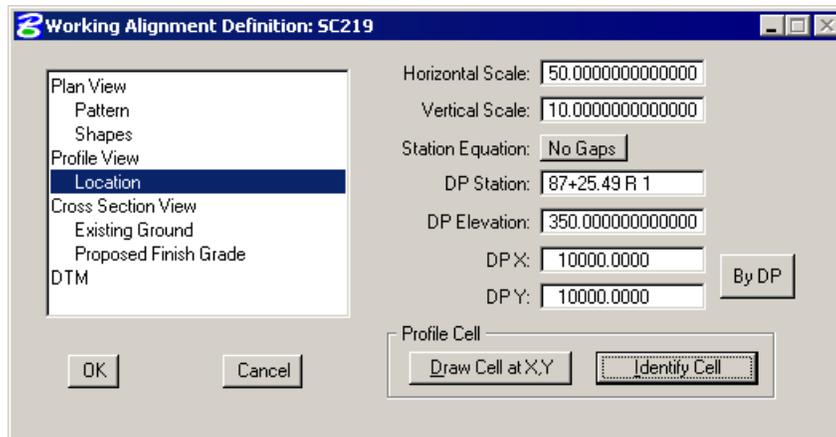
1. From the Workflow dialog of **Project Manager**, click **Define**.
2. Highlight the **Profile View** option and populate the dialog box as depicted below.



Note We have not designed the proposed profile; therefore, we will return to populate this field in a later exercise.

3. Highlight **Location**.
4. To quickly populate this category within working alignment, click **Identify Cell**, then data point on the cell for the centerline profile in the file and accept.

Note Your coordinates may be different than those shown below. That is not a problem



5. Click **OK** to save the updates and close the dialog.
6. **Exit** MicroStation.



Vertical Alignment Generator

CHAPTER OBJECTIVES

In this chapter, you will learn to create and store vertical alignments using the Vertical Alignment Generator.

INTRODUCTION

The Vertical Alignment Generator is a GEOPAK tool that can graphically create and modify proposed design profiles or modify an existing ground profile. These operations may be accomplished through a dialog box and/or by dynamic manipulation of graphic elements.

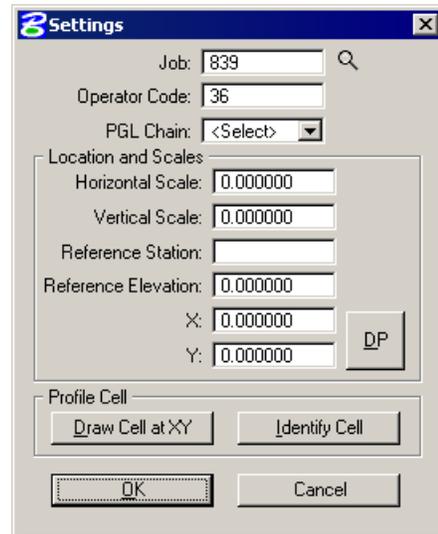
A profile may also be created with Coordinate Geometry (COGO) input (key in commands). In addition, there are VC commands that compute and display vertical geometry and the parameters associated to aid in the development and generation of vertical alignments used in conjunction with Store Profile commands. VC commands define parabolas for various combinations of stations, elevations, grades, slopes and the rate of vertical curvature (K value), and also define the tangents between two parabolas or between a parabola and a point.

ACCESSING

The Vertical Alignment Generator can be accessed by selecting Applications > GEOPAK ROAD > Geometry > Layout Profiles (VPI Based). It can also be invoked from Project Manager by clicking the Vertical Alignment button or by selecting the VPI Based Vertical Alignment Design Tools icon from the GEOPAK ROAD tool frame.

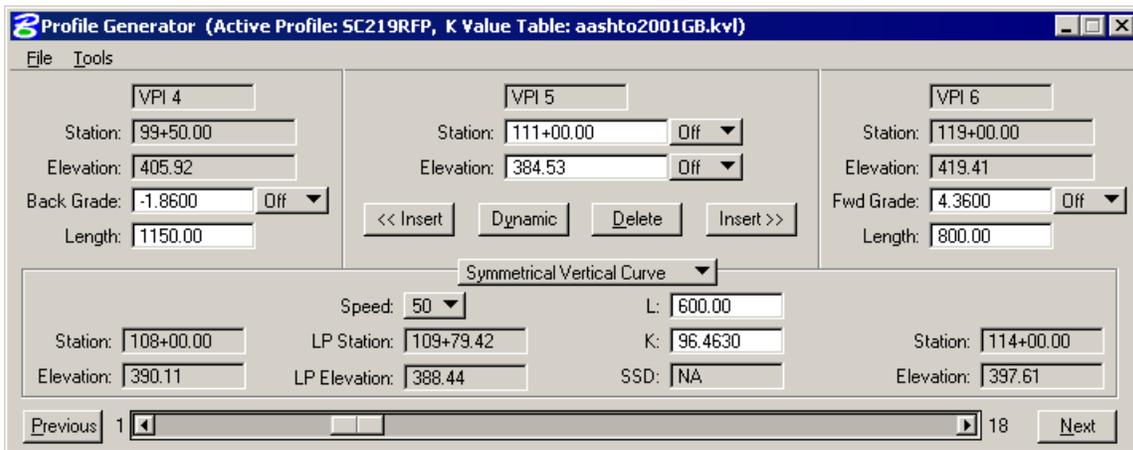
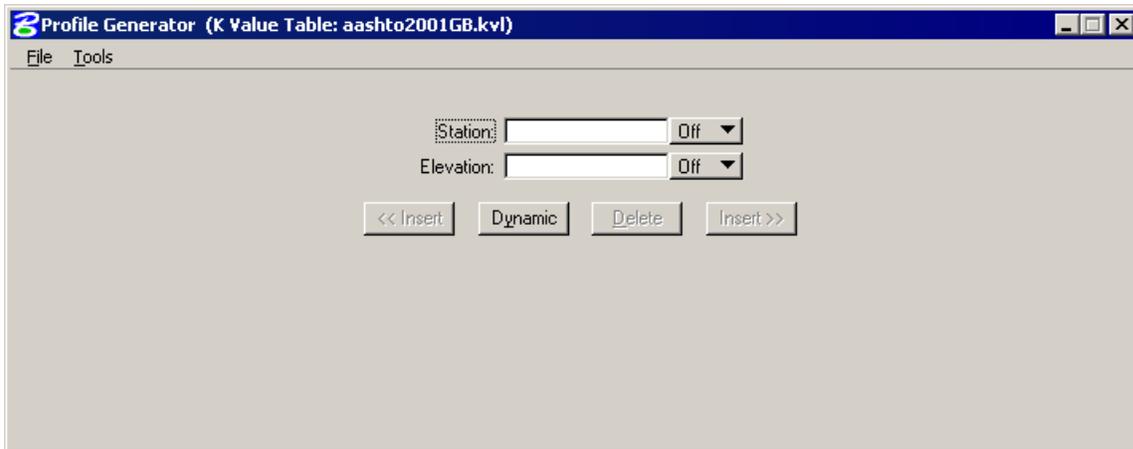
When selecting the Vertical Alignment generator, the first dialog that appears is labeled Settings, as depicted here. The entries in this box set the parameters and define the location within the design file where the profile components are to be displayed. All fields must be completed before the design process can begin. Once OK is clicked, the Vertical Profile Generator dialog box appears.

Note This tool also utilizes the cell that was drawn in the previous exercise by using the **Identify Cell** button.



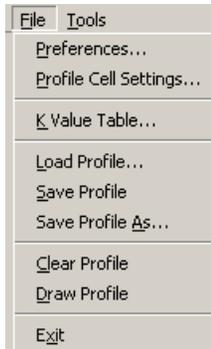
USING THE VERTICAL ALIGNMENT GENERATOR

This tool enables a user to load a previously stored profile or create a new profile. You will notice the dynamic changes in the dialog throughout the vertical alignment design.



Various design parameters must be defined prior to designing a new profile; which are discussed in the options supported under the three menu options; **File**, **Tools**, and **User**.

FILE



Preferences... - sets the rounding parameters for each of the items listed in the dialog box. Also contains a toggle that will force the dialog to window center the view on the current VPI. The **Hold Vertical Curve** toggle and the **Maintain VC K Value /Maintain VC Length** option button dictate vertical curve dynamics. If the **Hold Vertical Curve** toggle is active and if the option button is set to **Maintain VC K Value**, then dynamic operations lock the K value. This in essence allows the user to slide the grades along a continuous parabola representing the vertical curve. If the **Hold Vertical Curve** toggle is active and if the option button is set to **Maintain VC Length**, then dynamic operations create a similar effect in that the vertical curve length is held constant.

Profile Cell Settings... - recalls the **Settings** dialog box that first appeared upon initializing Vertical Layout.

K Value Table... - is a table of stopping sight distance K-values for crest and sag conditions for various design speeds. These values are based on the AASHTO Green Book.

Load Profile... - retrieves a previously stored profile from the coordinate geometry database (.gpk)

Save Profile - stores a new profile or updates (redefines) a previously stored profile under the same name.

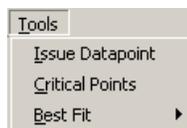
Save Profile As... - is used to store the profile or to save a modified profile under a different name.

Clear Profile - clears the profile display from MicroStation graphics and removes all VPI's from the dialog box.

Draw Profile - write the graphic elements of the profile to the MicroStation file.

Exit - ends the process.

TOOLS



Issue Data Point - Permits the user to type in stations and elevations, issue a data point that can be part of a MicroStation place line, place a cell or perform other generic operations. This is useful in displaying visual references within the profile that need to be considered in design of the vertical profile.

Critical Points - Vertical curves may also be defined by one or two critical points – i.e. the curve will pass through these points. If mathematically solvable, the vertical curve will be drawn and the design speed display adjusted to fit the current parameters.

Best Fit - Three Best Fit tools are supported within the Profile Generator:

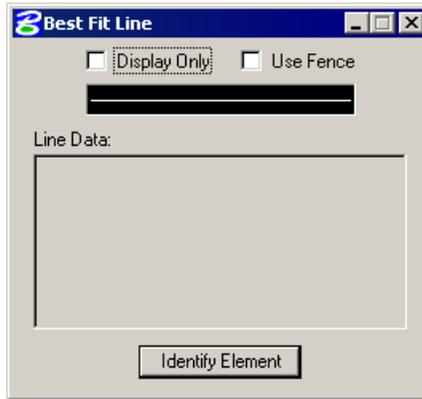
- Best Fit Line
- Best Fit Parabola (Curve)
- Best Fit Profile

BEST FIT TOOLS

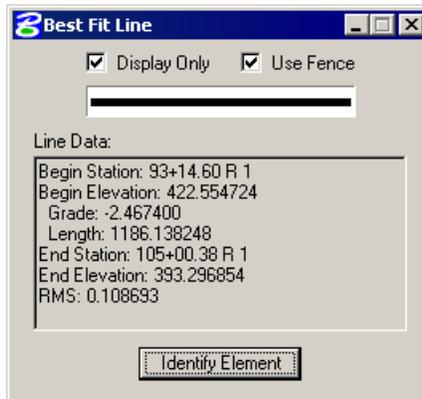
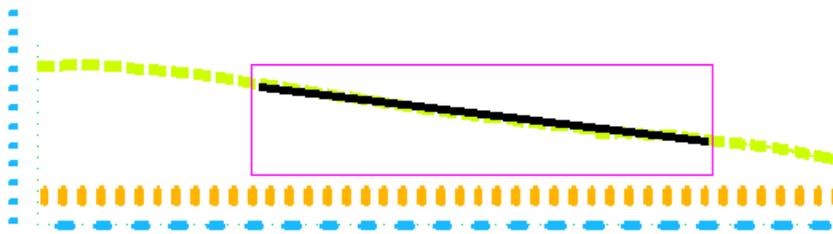
Three best fit tools are available to aid in the generation of a profile that closely matches the existing conditions. Each tool is described in the following sections.

BEST FIT LINE

The Best Fit Line tool fits a line between the candidate elements. The resultant line data is displayed in the dialog and the line is drawn onto the profile cell.

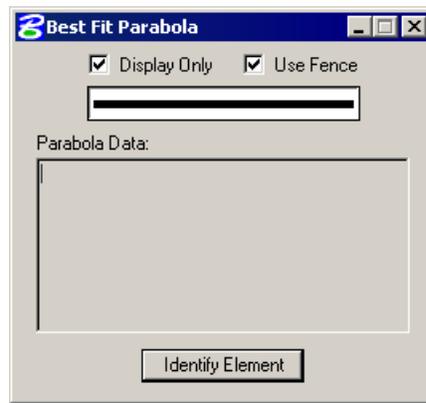


In this example, only the candidate elements within the fence are used for the Best Fit.

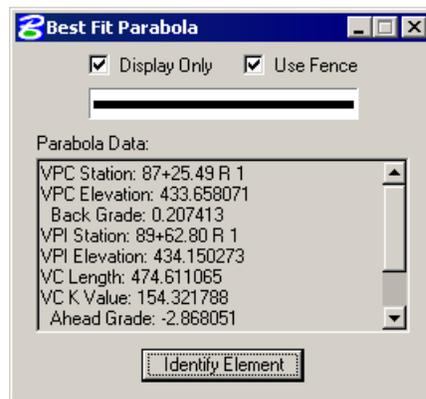
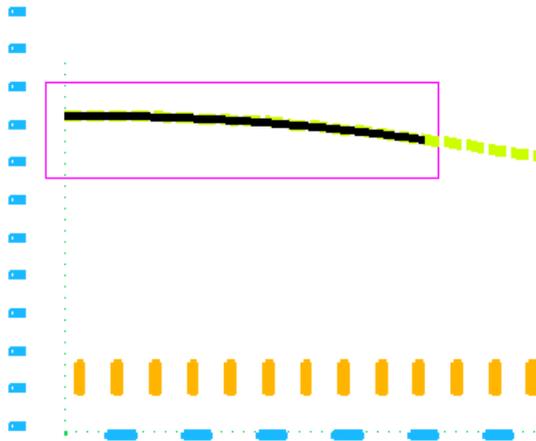


BEST FIT PARABOLA

The Best Fit Parabola tool fits a vertical curve between the candidate elements. The resultant curve data is displayed in the dialog and the curve is drawn onto the profile cell.

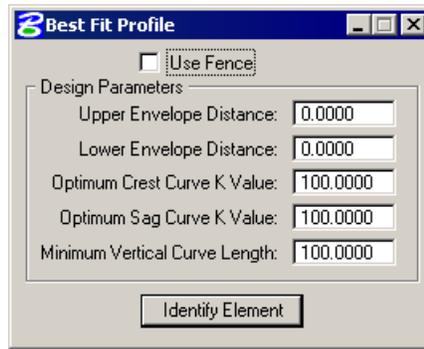


In this example, only the candidate elements within the fence are used for the Best Fit.



BEST FIT PROFILE

The Best Fit Profile tool fits a profile (comprised of tangent lines and vertical curves) between the candidate elements based on the constraints in the Design Parameters. As there is no symbology option, the active symbology is used.



The **Upper and Lower Envelope Distance** values determine an initial desired envelope for the desired profile. Once the tangents are established within the design envelope, the **Crest and Sag K values** and **Minimum Vertical Curve Length** are used as guidelines to establish parabolic vertical curves.

CREATING A NEW PROFILE

Warning The enter/tab key must be used to ensure values are accepted.

A new profile can be created with the following steps:

1. **Place the first VPI using one of the four supported options.**

- Type station and elevation of the VPI into the appropriate fields in the Profile Generator dialog.
- Enter station of VPI as precision input (type in value), and allow the elevation to be defined through dynamic cursor placement on screen.
- Elevation is defined via precision input, and the station is defined through dynamic cursor placement on screen.
- Both values for the VPI can be established dynamically on screen by clicking on the Dynamic button and placing a DP in the view at the desired station and elevation.

2. Define ahead (or back tangent)

Station, elevation, grade and length parameters may be defined via precision input, dynamic manipulation or a combination of both.

3. Define remaining VPI's and Grades

A repetition of Step 2 with an option to insert VPI's between two existing VPI' s.

4. Define Vertical Curves

Simply define the design speed from the Speed option button and GEOPAK will reference the K-value table and draw the vertical curve. If a *curve overlap* occurs, an overlap message will be displayed in the dialog box along with the overlap length. Length of Curve or K-value may also be keyed in.

5. Adjusting Curve Lengths

The vertical curve can be modified by directly keying in either the K-value, curve length or defining the design speed in the dialog box. You will see the values computed automatically adjust to reflect the results of any modifications.

6. Save the Profile.

Select **File > Save Profile As** to name and save the newly created profile. The names of profiles are any 1-9 alphanumeric characters.

PRECISION PLACEMENT OPTIONS

Options available for creating or modifying vertical curves, VPI's and grade lines:



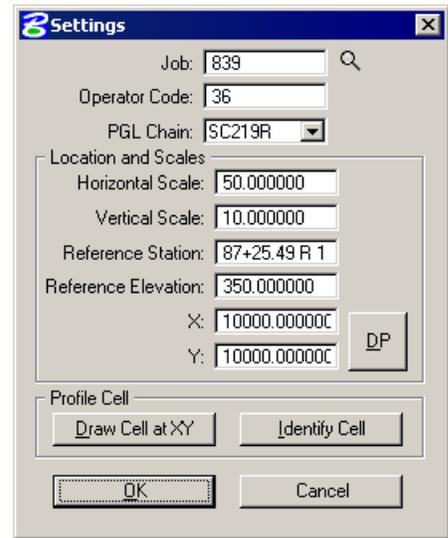
- **OFF** - Values change.
- **INC** (Increment) - Ensures that the designated profile parameter will be adjusted as defined in the Preferences dialog.
- **LCK** (Locked) - Forces selected operations to maintain the designated profile parameters.

LAB EXERCISE: VERTICAL ALIGNMENT GENERATOR



Generate the Proposed Profile

1. Open the MicroStation file
C:\data\geo\sc219\sc219profile.dgn.
2. Access Project Manager.
3. Select the **Vertical Alignment** button from the Road Project: SC219.prx workflow dialog.
4. All of the information in the invoked Settings dialog should be automatically populated based upon the information we provided in the DEFINE dialog in Lab 8.
5. Click **OK**.



6. Provide the initial VPI Station = **87+25.49** and the initial VPI Elevation = **433.87** as shown in the diagram below. Be sure to press Enter after each entry is made.



7. Click the **Insert After** button and complete the VPI Station and Elevation of the subsequent VPIs as detailed in the table below.

VPI	Station	Elevation
2	89+50	435.83
3	95+00	419.69
4	99+50	405.92
5	111+00	384.53
6	119+00	419.41
7	128+50	426.82
8	133+50	435.09
9	146+75	472.75
10	152+50	471.02
11	158+50	446.78
12	169+50	438.56
13	178+00	397.75
14	186+00	441.85
15	197+25	479.8
16	204+25	505.59
17	211+25	521.73
18	219+00	514.57

8. Click the **Prev** button to return to **VPI 2** as shown in the diagram below.
9. Enter a symmetrical vertical curve Length of **400.00**. (The K value and Design Speed are automatically computed.)

The screenshot shows the Profile Generator software interface. The title bar reads "Profile Generator (Active Profile: SC219RFP, K Value Table: aashto2001GB.kvl)". The interface is divided into several sections:

- VPI 1:** Station: 87+25.49, Elevation: 433.87, Back Grade: 0.8730, Length: 224.51.
- VPI 2:** Station: 89+50.00, Elevation: 435.83. Buttons: << Insert, Dynamic, Delete, Insert >>.
- VPI 3:** Station: 95+00.00, Elevation: 419.69, Fwd Grade: -2.9345, Length: 550.00.
- Symmetrical Vertical Curve:** Speed: 50, L: 400.00, HP Station: 88+41.71, HP Elevation: 434.48, K: 105.0542, SSD: 483.38.
- Bottom Section:** Station: 87+50.00, Elevation: 434.08; Station: 91+50.00, Elevation: 429.96. Navigation buttons: Previous, 1, 18, Next.

10. Using the **Next** button to move to each successive VPI, key in the following curve lengths at each VPI.

VPI	Length of Curve
3	200
4	300
5	600
6	500
7	300
8	500
9	700
10	450
11	500
12	700
13	700
14	680
15	500
16	400
17	500

11. Select **File > Save As** to save the profile **SC219RFP**.

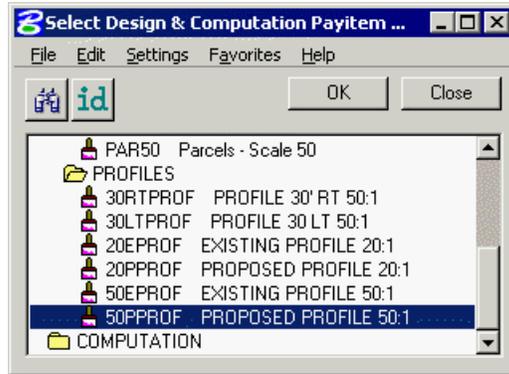


12. Exit the **Profile Generator**.
13. When prompted to save your profile, click **No** since we did that in Step 11.
14. When prompted to save your **Vertical Alignment Settings**, click **Yes**.
15. Open COGO and use the **Element > Profile > Utility** tool to see a listing of information about the profile. Select profile **SC219RFP** then click the **Print** icon to describe the profile. The **Element > Profile > Elevations** tool will provide elevations at any station or increment of stations desired.
16. Exit COGO.

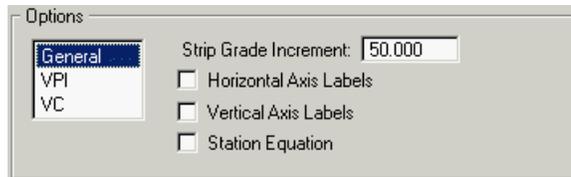
 **Drawing the Proposed Profile**

Next, we are drawing the proposed profile ‘SC219RFP’ utilizing the **Draw Profile** tool on top of the existing ground profile from Exercise 8.

1. Select the **Draw Profile** tool.
2. Select the **COGO** tab.
3. Select the Profile Name **SC219RFP** in the Details section.
4. Set the option button to **By Feature** in the **Display Settings** area of the dialog.
5. Click the **Browser Feature (Paintbrush)** then navigate to the item shown below.



6. Click **OK**.
7. Select **General** in the **Options** area and set the **Strip Grade Increment** to **50**. This will label the elevations every 50’ along the bottom of the profile area.

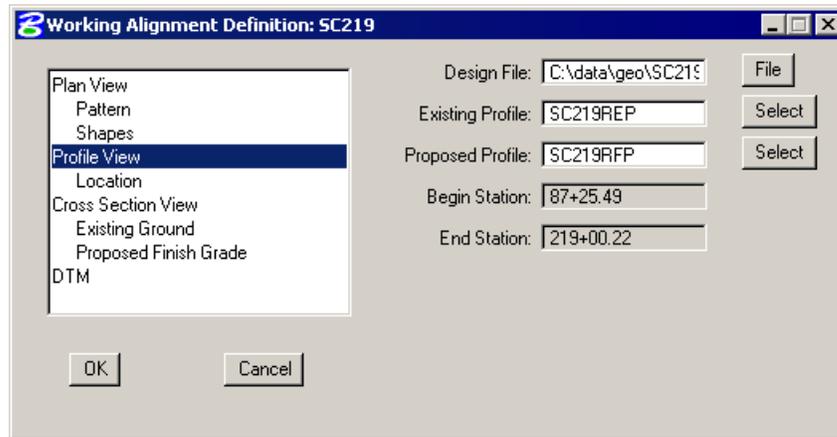


8. Click **Add COGO Profile Settings** icon to draw the profile.
This will draw the proposed profile with the proper symbology in addition to labeling the stations and elevations along the bottom of the profile and the elevations along the left side of the profile.
9. Close the **Draw Profile** dialog.

 **Update Project Manager**

We are completing the Profile View of the Working Alignment Definition in Project Manager.

1. Click the **Define** button from the Workflow dialog of Project Manager,
2. Highlight the **Profile View** option and populate the **Proposed Profile** field as depicted below.



3. Click the **OK** button to save the updates and close the dialog.
4. Exit MicroStation.



Existing Ground Cross Sections

CHAPTER OBJECTIVES

In this chapter, you will learn to:

- generate existing ground cross sections based on a horizontal alignment and the surface model beneath the alignment.
- review the sections utilizing the Cross Section Navigator tool.

INTRODUCTION

The prerequisites to generate existing cross-sections utilizing digital terrain modeling are:

- GEOPAK coordinate geometry database wherein the horizontal alignment is stored.
- GEOPAK binary TIN file, Site Model or Site Object. The Site Model or Object are created utilizing GEOPAK Site Modeler software and are stored within the GEOPAK Site project (gsf) file.
- Pattern lines if pattern by design is to be utilized.

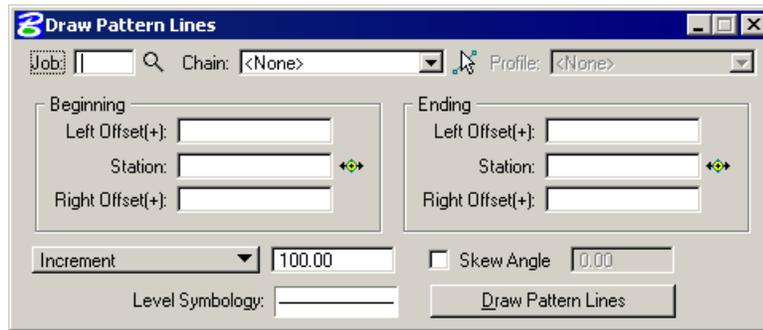
The generation of existing ground cross sections must be invoked from within the 2D MicroStation design file wherein the sections are to be drawn. GEOPAK does not create this MicroStation design file. The user creates the blank design file utilizing the desired seed file, and then GEOPAK draws into it.

PATTERN LINES

Pattern lines are graphical lines and/or line strings in a MicroStation design file that define locations at which the cross sections will be cut.

ACCESSING DRAW PATTERNS

The Draw Pattern tool can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Draw Patterns by Station Range. It can also be invoked from Project Manager by clicking Draw Pattern or by selecting Draw Patterns by Station Range from the GEOPAK ROAD tool frame.



Once all of the fields have been completed, and the application is initiated, graphic lines (on the specified level, color and style) are drawn along the chain. This is a visual representation of the location of the cross sections to be generated.

Six methods are supported for drawing the pattern lines:

- Increment – starts at the beginning station, and draws a pattern line at the given increment.
- Even – draws pattern lines at stations divisible by the given value.
- Once – draws a pattern line at a given station.
- Critical Points Horizontal – draws a pattern line at each of the critical point (i.e. POT, PC, PT, etc.) within a chain.
- Critical Points Vertical – Draws a pattern line at each VPC and VPT in addition to the sag and crest station of vertical curves based on the profile defined in the dialog.
- Superelevation Transitions - The current design file is scanned for Superelevation shapes created with the specified chain. A pattern line is drawn at the beginning and end of each Superelevation shape, ignoring the beginning and ending station fields in the dialog. Note the Superelevation shapes cannot be in a reference file.

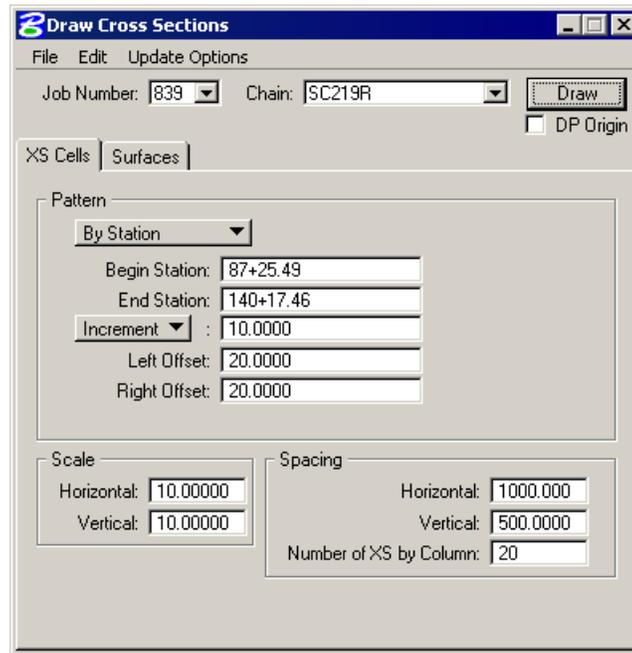
The pattern lines are drawn into the current MicroStation design file. The user can use the MicroStation **Place Smartline** or **Place Line** command to draw additional pattern lines at any user defined location. In addition, MicroStation commands can be utilized to modify pattern lines drawn via the dialog to lengthen, shorten, delete, copy, move, etc.

Note This should be completed before the existing ground cross sections are generated.

GENERATING CROSS SECTIONS

The Draw Cross Sections tool can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Draw Cross Sections from Surfaces. It can also be invoked from Project Manager by clicking Existing Ground Cross Sections or by selecting Draw Cross Sections from Surfaces from the GEOPAK ROAD tool frame.

Once the pattern lines have been drawn, the cross sections can be generated. Note the Job Number must be defined in order to populate the Chain list. Once the Chain is defined, the dialog unghosts.



The dialog contains a menu bar with three listings:

File	Standard file utilities to load, or save settings, plus a dialog exit option.
Edit	Options to Cut, Copy and Paste rows in the surfaces list box. Also, save and restore settings in the RSC file or clear list of all surfaces.
Update Options:	User-defined options on how the software handles the redrawing of cross sections.

Three Update Options are supported, along with a Query option:

Delete Existing Elements and Redraw	When this option is activated, any existing ground lines previously drawn with this tool are deleted and new ground lines are drawn.
Delete Non-modified Elements and Redraw	When this option is activated, any existing ground lines previously drawn with this tool are deleted and new ground lines are drawn.
Draw on Top of Existing	When this option is activated, any previously drawn ground lines are ignored and a new set is drawn, resulting in two sets of ground lines.
Query	When activated, the user is prompted each time Draw is clicked.

Two tabs on the dialog support the input data required to draw cross sections:

- XS Cells** Defines the location of cross sections utilizing either pattern by station or pattern by design. In addition, the scale and spacing are defined on within this tab.
- Surfaces** Define the surfaces utilized for drawing cross sections. Note multiple surfaces may be drawn in a single processing. Source data includes GEOPAK TIN files, Site Models, or Site Objects.

On the **XS Cells** tab, the **Pattern** group box has three choices:

- Pattern by Station** Utilizes Begin and End Station values in addition to an Increment/Even option and Left and Right Offset fields to determine cross section location. This works well when no sections are needed that are at odd stations, skewed or kinked relative to the Chain.
- Pattern by DGN** This method utilizes graphical representation and draws one cross section for each line or line string of the specified parameters. Those parameters include Design File which is the name of the file that contains the lines and line strings in addition to their associated symbology.
- In Existing Only** No user input is required, as this option draws ground lines only for cross section cells which were previously drawn. Therefore, no other pattern requirements are needed.

CROSS SECTION NAVIGATOR

The Cross Section Navigator is NOT accessible from Project Manager but can be invoked by selecting Applications > GEOPAK ROAD > Cross Sections > Navigator or by selecting it from the GEOPAK ROAD tool frame.

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



The user can scan through the cross sections by either choosing the station from the drop down list, or by using the First Section, Previous Section, Next Section, or Last Section icons (arrowheads). The Reset Navigator icon window centers the current station to the view.



The **Profile Elevation** enables the user to define a Profile Name, and optionally, an Alternate Chain and Offset. Once the dialog is populated, pressing the DP button in the upper right hand corner acts as a MicroStation data point in any MicroStation command where a data point is utilized.



The **Open View Control Dialog** enables the user to open several windows to view different portions of the cross section at the same time. The user can view the whole cross section in view 1, the left side in view 2, and the right side in view 3, etc.

Cross section elements can be added or modified using MicroStation tools or GEOPAK cross section drawing tools, as detailed in the table below.

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.



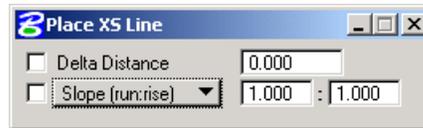
XS Active Angle Tool

Sets the active angle to the given value. If a MicroStation tool is used with the active angle option, this value is used.



Draw XS Line

Draws a cross section line. The length and/or slope can be specified.



SUMMARY - BASIC STEPS TO CREATING EXISTING GROUND CROSS SECTIONS FROM A DTM

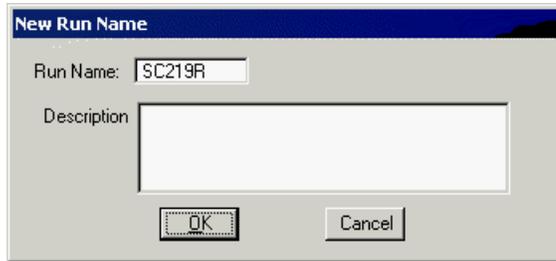
1. Requires a horizontal alignment stored in *.GPK file.
2. Requires an existing triangle file (TIN) from a DTM.
3. Draw pattern lines.
4. Process cross sections using Draw Cross Sections tool.
5. Review and modify (if necessary).

LAB EXERCISE: EXISTING GROUND CROSS SECTIONS

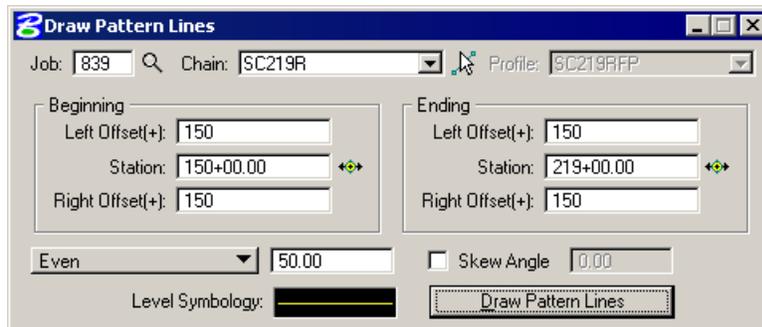
Draw Patterns

The first step in drawing MicroStation lines or line strings is to define the location of the existing ground cross sections.

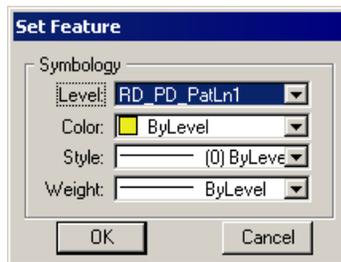
1. Open the MicroStation file *c:\data\geo\sc219\sc219sh.dgn*.
2. Select **Project Manager**.
3. Click **Draw Pattern** from the **Road Project: SC219.prj** workflow dialog.
4. Create a new run called **SC219R**. Open the run.



5. Populate the dialog as depicted below.



6. Double click the **Level Symbology** graphic.



7. Set the **Level** to **RD_PD_PatLn1**, then **Color**, **Style** and **Weight** to **ByLevel**.
8. Click **OK**.
9. Click **Draw Pattern Lines**.

This initiates the plotting of the patterns into the design file. Fit the MicroStation view if necessary to see the patterns.

10. Close the Draw Pattern dialog and Save Settings.

11. Delete the pattern lines on the +50 stations on tangents.

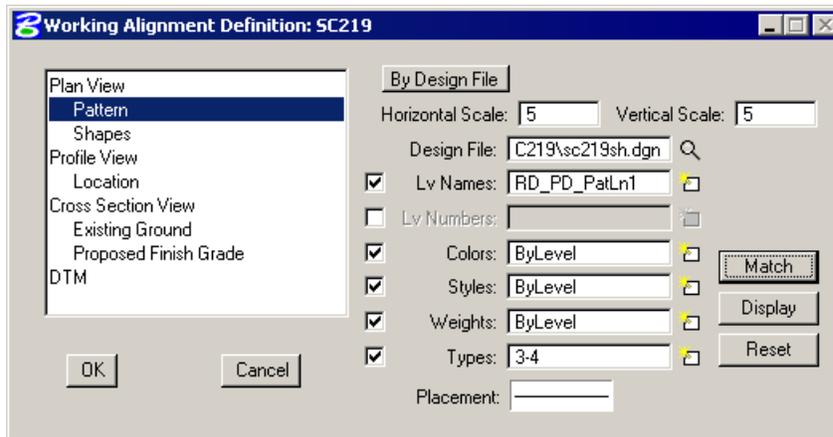
Hint Attach the PP file with only the levels enabled that have the chain and station annotation.

 **Update Project Manager**

We are completing the Pattern section of the Working Alignment Definition in Project Manager.

1. From the Workflow dialog of Project Manager, click **Define**.
2. Highlight **Pattern**.
3. Enter the Pattern information as depicted below.

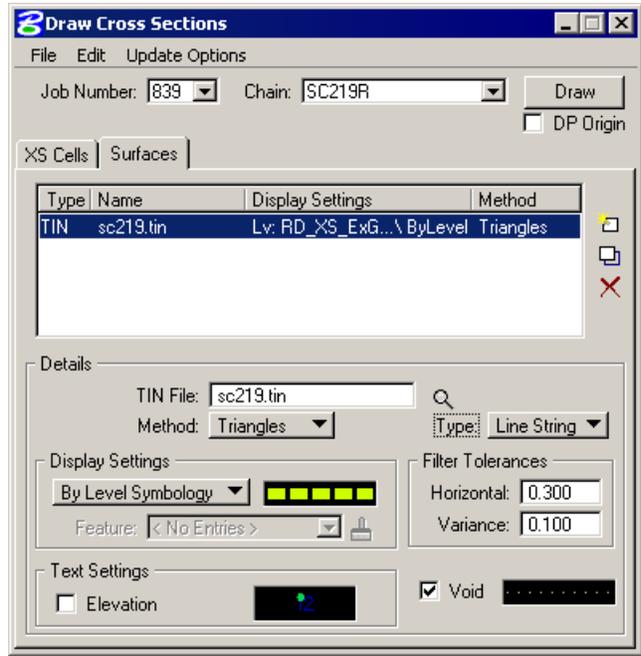
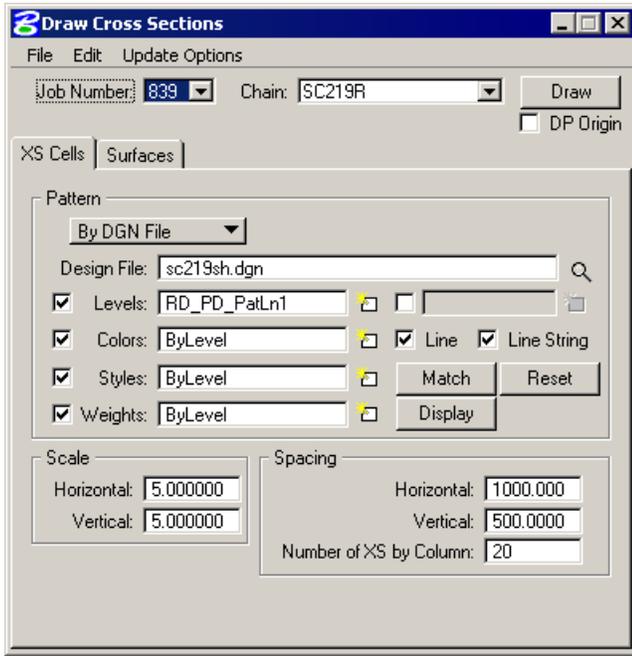
Since we are in the pattern file, you can use **Match** to accomplish this task rather than manually typing in the information.



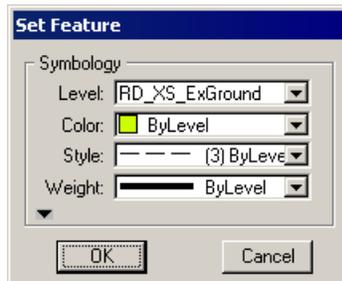
4. Right click the **Placement** graphic and select **By Element**.
5. Identify a pattern line in the drawing and accept. This will set the Placement symbology for any future pattern lines.
6. Click **OK** to save the updates and close the dialog.

 **Generate Existing Ground Cross Sections**

1. Open the MicroStation file *c:\data\geo\sc219\sc219dx.dgn*.
2. Click **Existing Ground Cross Sections** on the **Project Manager** dialog.
3. Create a run called **SC219R**.
4. Populate the dialog as shown below:

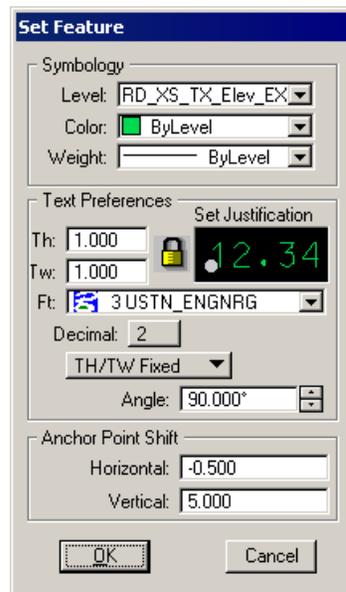


Note Note: The **Display Settings** are set in the **GEOPAK Set Feature** dialog. The dialog is accessed by double clicking on the sample graphics boxes.



Note Do not forget to click the Modify icon to update the preferences

5. Enable the **Elevation** toggle and populate the text parameters as shown.



Note Do not forget to click the Modify icon to update the preferences

6. Generate the existing ground cross-sections by clicking **Draw**.
7. Exit the **Draw Cross Sections** dialog and Save Settings.

Review Cross Sections

1. Select the Cross Section Navigator tool (*Road: Cross Sections > Navigator.*)



2. Browse and check your existing cross sections.
3. **Exit** the XS Navigator dialog when done.

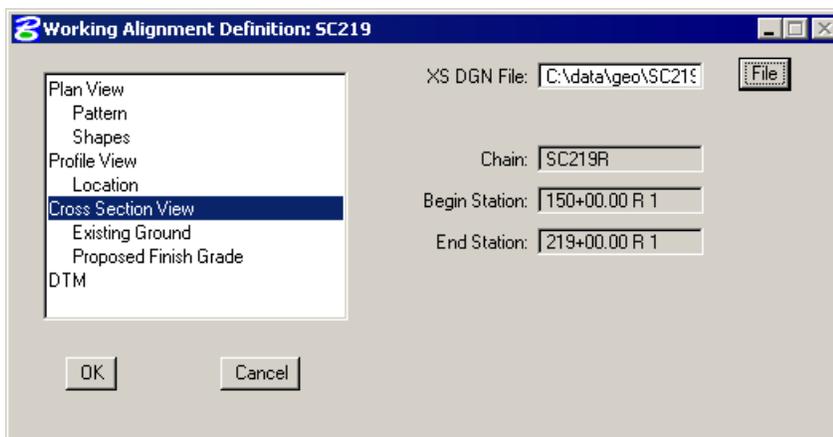
Upon reviewing the sections, it is desirable to “lock” the elements to prevent accidental deletion or modification in later steps.

4. Select **Edit > Select All** from the MicroStation menu bar.
5. Then select **Edit > Lock** to lock the elements.
6. Clear the selection set.

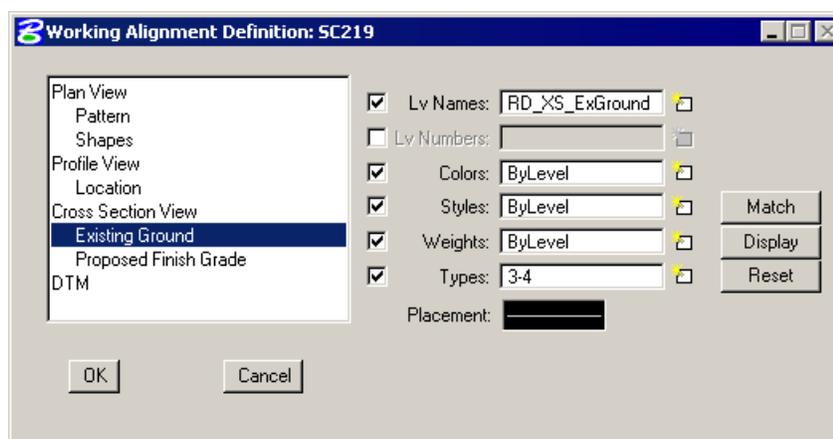
Update Project Manager

We are completing the Pattern, Cross Section and Existing Ground sections of the Working Alignment Definition in Project Manager.

1. Click **Define** from the road flow chart.
2. Highlight **Cross Section View**.



3. Click **File** and select *SC219dx.dgn*.
4. Highlight **Existing Ground** and populate the dialog as depicted below.



Since we are in the cross section file, you can use **Match** to accomplish this task rather than manually typing in the information.

5. Right click the **Placement** graphic.
6. Identify a cross section ground line in the drawing and accept. This will set the Placement symbology for any cross section lines.
7. Click **OK** on the **Working Alignment Definition** dialog to save the updates and close the dialog.
8. Exit MicroStation.



Superelevation

CHAPTER OBJECTIVES

In this chapter, you will learn to use GEOPAK Automated Superelevation dialog and Autoshape Builder to apply superelevation to a roadway.

INTRODUCTION

GEOPAK supports a myriad of options for the definition of pavement on proposed cross sections. They range from a single slope specification emanating from a baseline / profile on each section, to a complicated multiple roadways, each with its own superelevation transitions.

The most basic is the project where no superelevation transitions are required, i.e., the roadway slope for all pavement (if any) can be specified as a single value. In this case, the slope can be defined with the proposed cross section processing and any additional superelevation work is not required. This process will be utilized in Exercise 12 when we have GEOPAK draw the existing shoulder and pavement on the sections – shapeless.

Another option is the definition of superelevation when roadways are constant widths without tapers, i.e., turn lanes, acceleration and deceleration lanes, etc. In these areas, the automated superelevation can be utilized, based on a user-defined design speed and considering the geometry of the specified roadway. After careful review of the data (in ASCII format) and overriding the computed values, GEOPAK draws pavement representations as complex shapes into a MicroStation 2D design file.

A third option is the definition of superelevation when roadways are not constant widths, i.e., gore areas, turn lanes, acceleration and deceleration lanes, etc. In these areas, graphics elements within a MicroStation 2D design file are utilized to create complex shapes which define the superelevation transitions.

A combination of these tools can be combined with a project, or even within a single roadway. The shapeless mode is excellent for rural applications, low volume city streets, frontage roads, etc., while the automated method quickly generates automated shapes for more complex roadways. Any area which cannot be defined via the automated method can be augmented by the graphical method.

ACCESSING AUTOMATED SUPERELEVATION (AUTOSHape INPUT FILE MAKER)

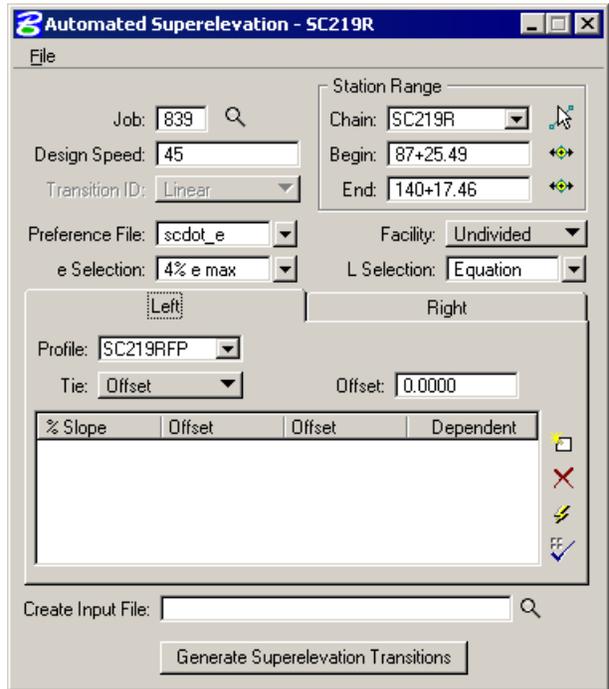
The Automated Superelevation tool can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools. It can also be invoked from Project Manager by clicking the Calculate Superelevation button or by selecting the Automated Superelevation icon from the GEOPAK ROAD tool frame.

The GEOPAK Superelevation package enables the user to create, edit, and run an autoshape input file quickly, basing it on an existing COGO alignment.

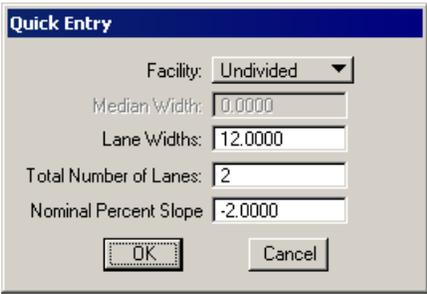
A rich set of preferences is available which gives the user complete control over every aspect of the standardization of the superelevation design process. AASHTO Method V is available as a default, along with the ability to employ user-defined lookup tables both for e (superelevation rate) and for runoff length. User-defined equations may also be entered to compute these values. A thorough set of options is available for resolving the superelevation conflicts of Reverse Curves, Compound Curves, Broken Back Curves, and Short Curves.

GEOPAK calculates superelevation transition locations for any alignment stored into the coordinate geometry database. The main superelevation dialog is simple and straightforward, allowing the user to select which preference file is to be used for the current session, as well as enabling the entry of the typical section lane configuration in the simple engineering terms of Number of Lanes, Lane Widths, Median Width (if any), and Cross Slope. More complex lane configurations may be represented as needed.

Upon computation of the superelevation parameters (cross slopes and stationing), the information is stored in an ASCII file, where the user may review and modify the transitions, if desired. After reviewing the information, the ASCII file is executed from the Autoshape Builder to generate superelevation shapes.



Job	Coordinate geometry database containing the desired chains and profiles.
Chain	GEOPAK baseline chain dictating the horizontal geometry for which superelevation transitions are calculated. This chain is also called the Shape Cluster Baseline in the Auto Shape input file.
Begin Station	When the chain is defined, GEOPAK populates the Begin Station with the default beginning of the chain. To compute superelevation for part of a chain, adjust the station.
End Station	When the chain is defined, GEOPAK populates the End Station with the default beginning of the chain. To compute superelevation for part of a chain, adjust the station.
Design Speed	Design speed that determines what Design Speed is to be used either in the tables or equations for e and length computations.
Preference File e selection L selection	The Preferences File combo box selects which Preference File is to be used for this computation. The various Preferences Files which are available in the combo box are determined by what files have the .sep file extension in the Preference Files Path on the User Directories dialog. When it is set, the available e and length Selection combo boxes are filled in according to the csv file names as specified in the Preferences File. Those combo boxes determine which table within the .csv file will be used for computation.
Facility	Facility determines whether the roadway cross section is to be divided or undivided. This option determines two things. For the dialog box, it determines whether or not the values Profile, Tie (Offset or PGL), and or the Tie or PGL values may be different. If they are different then two shape clusters are to be generated, which usually is required for a median. The state of the Facility option button also determines which Preference is used as found on the Distribution tab of the Preferences dialog.
Left / Right tabs	The area enclosed in the Left / Right tabs are for the determination of values specific to shape clusters. NOTE: The right and left tabs contain data pertaining to each lane within each roadway. If the Facility is undivided, then the left tab is for the left lane(s) while the right tab is for the right lane(s). If the Facility is divided, then the right tab is for the entire right roadway, while the left tab is for the left roadway.
Create Input File	ASCII file wherein GEOPAK creates the autoshape input file. DO NOT include the extension, as GEOPAK adds .inp to the field.
Generate Superelevation Transitions	Commence automatic superelevation calculations
Profile	GEOPAK profile defined as the Shape Cluster Profile in the Auto Shape input file.
Tie	Offset - Horizontal distance from the Profile (PGL) to the Chain. PGL Chain - Chain stored in the gpk file that the shapes will be computed from. This chain does not require a profile be stored with it as the defined profile will be applied to this chain.
Offsets	Offsets define the dimension of the shape (usually a lane) by two offset distances from the baseline. Note that tapers are not supported. Offset distances are negative if measured to the left. . Each lane must have the same offset on the left as the left adjacent lane and must have the same offset

	on the right as the right adjacent lane (no gaps in offsets). Computation may not proceed if this condition is not met.
% Slope	Cross slope of each shape in normal crown in percent format. A negative sign denotes the roadway going downward, while emanating away from the PGL. A Normal Crown section of 2.0% would, therefore, be entered as -2.0. Lane offset values are entered in terms of master units, i.e., feet or meters.
Dependent / Independent	One dependent shape, which is based on the profile, is required for each cluster. Other shapes are drawn not based on the profile, but on adjoining lanes, and are independent. For example, turn lanes are drawn abutting next to the mainline roadway, so they are independent. However, a lane based on the profile for its initial elevation, such as one of the through lanes, is profile dependent.
Edit buttons: Add Delete Modify	Add – populate the fields and click Add. To delete a line, highlight the desired line, then click the Delete. To modify a line, highlight the desired line, click once on the value to be modified. The value will be placed in an edit mode. Change the value then hit enter or tab out of the field.
Quick Entry (second to bottom tool to the right of the list box)	Enables the user to populate the shape cluster list boxes quickly while entering the data using engineering terminology. 
Rectify Lanes (bottom tool to the right of the list box)	If Offset values have been entered that create a gap between lanes, the Rectify Lanes option removes this gap. Click Rectify Lanes and the values will be modified so that any gaps are removed.

Selection of the **Generate Superelevation Transitions** button performs the actual superelevation computations. Three things happen at this point.

- First, the superelevation transitions as computed by GEOPAK are written to the Autoshape Input File specified by the user (in the Create Input File field).
- Second, the log file is written.
- Finally, the Autoshape Input File is loaded into the text editor running within MicroStation. This Autoshape Input File Editor has an icon at the top that allows the Autoshape Input File to be run. Autoshape Input files can also be run from the Autoshape Builder.

```

Text Editor: sc219r_shapes.inp
File Edit Criteria
[* Superlevation Settings and Parameters:
Project Name: C:\data\geo\SC219\SC219.prj
User: C:\data\geo\SC219\projdbs\john
Run Name: SC219R
Unit System is english.
Created input file "sc219r_shapes.inp".
Created activity log file "sc219r_shapes.log".
Created on Fri, Dec 08, 2006 at 12:54.
Using Preference File "scdot_e"
Using e Selection of "6% e max".
Using Length Selection of "Equation"
Using Design Speed of 45.000000.
*/
auto shape
job number = 839

auto shape set
shape cluster baseline = SC219R
shape cluster profile = SC219RFP
shape cluster tie = 0.0000
dependent shape
chain / offset
SC219R -31.5000
SC219R 0.0000
filler line station / slope
87+25.490000 -2.0800
104+36.557143 -2.0800
104+94.200000 -4.4800 /* Curve SC219R-2 */
109+43.300000 -4.4800 /* Curve SC219R-2 */
110+00.942857 -2.0800
Line: 1 Col: 1

```

EXAMPLE - AUTO SHAPE ASCII INPUT FILE

```

/* Superlevation Settings and Parameters:

Project Name: C:\data\geo\SC219\SC219.prj
User: C:\data\geo\SC219\projdbs\john
Run Name: SC219R
Unit System is english.
Created input file "sc219r_shapes.inp".
Created activity log file "sc219r_shapes.log".
Created on Fri, Dec 08, 2006 at 12:54.
Using Preference File "scdot_e"
Using e Selection of "6% e max".
Using Length Selection of "Equation"
Using Design Speed of 45.000000.

*/

auto shape
job number = 839

auto shape set
shape cluster baseline = SC219R
shape cluster profile = SC219RFP
shape cluster tie = 0.0000
dependent shape
chain / offset
SC219R -31.5000
SC219R 0.0000

```

```

filler line station / slope
  87+25.490000      -2.0800
  104+36.557143     -2.0800
  104+94.200000     -4.4800      /* Curve SC219R-2 */
  109+43.300000     -4.4800      /* Curve SC219R-2 */
  110+00.942857     -2.0800
  129+48.300000     -2.0800
  132+11.100000      0.0000
  132+83.400000      3.0100      /* Curve SC219R-4 */
  139+93.300000      3.0100      /* Curve SC219R-4 */
  140+17.457250      2.0043

```

```

auto shape set
shape cluster baseline = SC219R
shape cluster profile  = SC219RFP
shape cluster tie      = 0.0000
dependent shape
chain / offset
  SC219R      0.0000
  SC219R      31.5000
filler line station / slope
  87+25.490000      -2.0800
  101+24.100000     -2.0800
  103+86.600000      0.0000
  104+94.200000      4.4800      /* Curve SC219R-2 */
  109+43.300000      4.4800      /* Curve SC219R-2 */
  110+50.900000      0.0000
  113+13.400000     -2.0800
  132+61.061462     -2.0800
  132+83.400000     -3.0100      /* Curve SC219R-4 */
  139+93.300000     -3.0100      /* Curve SC219R-4 */
  140+15.638538     -2.0800
  140+17.457250     -2.0800

```

```

Plot Parameters
  Dependent Shape
    lvname = Default
    co = 6
    lc = 0
    wt = 2
  Dependent Text
    lvname = Default
    co = 6
  Independent Shape
    lvname = Default
    co = 1
    lc = 0
    wt = 2
  Independent Text
    lvname = Default
    co = 1

```

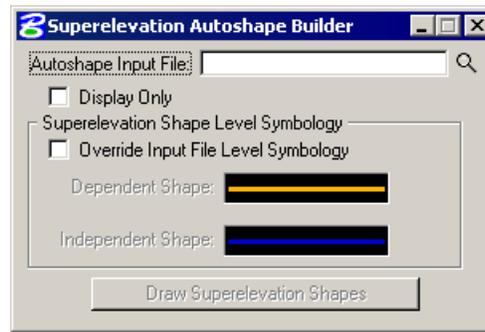
Write shapes into dgn = C:\data\geo\SC219\sc219sh.dgn



DRAW SHAPES INTO PLAN VIEW FILE

The Autoshape Builder is NOT accessible from Project Manager but can be invoked by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools or by selecting it from the GEOPAK ROAD tool frame.

Once the shape input file (fname.inp) has been created and reviewed, the designer can run the input file to place the superelevation shapes into the specified graphics file. To use the interactive method to define roadway superelevation (in a .dgn file) the designer selects the **Autoshape Builder** from the Superelevation Shape Manager Tools tool bar (or alternately from this same tool within the Text Editor as described above).



Autoshape Input File	Name of .inp file (shapes.inp) created by the Automated superelevation generation containing the transitions.
Display Only	Create the shapes in “Display Only” mode. That is, they are not written to the design file and a view Update operation eliminates them, as does zoom in, etc.
Override Input File Level Symbology	This option is used to override the Plot Parameters settings in the Superelevation Shapes input file.

The shapes are placed in a 2D graphics file on level 63 by default. The plot parameters can be modified in the input file with a text editor prior to building the shapes into the graphics file or with the User > Symbologies pull down on the Automated Superelevation dialog.

SUPERELEVATION SHAPE MANAGER TOOLS

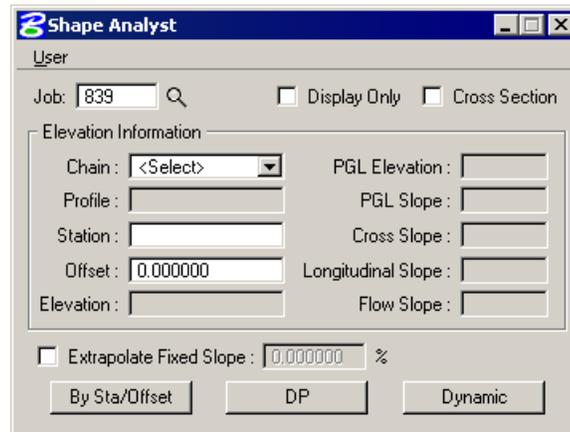
The Superelevation Shape Manager Tools can be invoked by selecting Applications > GEOPAK ROAD > Cross Sections > Superelevation Shape Manager Tools or by selecting it from the GEOPAK ROAD tool frame.

The tools in the Superelevation Shape Manager Tools toolbox are detailed below.

	Automated Superelevation - performs the actual calculations and stores the results in an ASCII file, known as the autoshape input file.
	Autoshape Builder - processes the autoshape input file and draws corresponding complex shapes in the specified 2D design file.
	Shape Maker - graphical method of drawing irregular superelevation shapes. This method is utilized for gore areas, turn lanes, etc.
	Shape Analyst - provides information on any point within a GEOPAK superelevation shape.
	Shape Profiler - provides profile information based on user-define increments intersecting a GEOPAK superelevation shape.
	Shape Editor - dynamically change parameters on a previously created shape. This includes filler line stationing, dynamic moving of shapes, etc.
	Shape Selector - highlights or selects shapes based on a wide range of user queries or filters.
	Shape Properties - provides information on any GEOPAK superelevation shape. In addition, this shape information can be modified on individual shapes or selections of shapes.
	Shape to DTM - provides the option to store a DTM Dat file from the superelevation shapes. In addition, it can plot the calculated elevations into the design file at a user specified interval.

SHAPE ANALYST

The Shape Analyst tool is extremely useful, as it provides information on any point within a GEOPAK superelevation shape.



Before using this tool, the Job Number must be selected. Upon selecting a Job Number, a Chain must be selected that the shapes are defined relative to. If Display Only is enabled, information like elevation and a flow arrow are drawn to the view, but they are not written as elements to the active MicroStation file.

When the Cross Section toggle is not activated and a data point is issued within a shape, the elevation of the data point and a flow arrow are displayed. When the toggle is activated, a dashed line is placed through the data point, radial to the shaped cluster baseline. In addition to the elevation and flow arrow placed at the data point, elevations are displayed where the cross section line intersects any superelevation shape and cross slopes are labeled for each shape.

The By Sta/Offset button causes the current Station / Offset value to be projected back onto the shape cluster baseline and the elevation of the projected point is displayed. This option can be manual entry only and requires no data point on the screen.

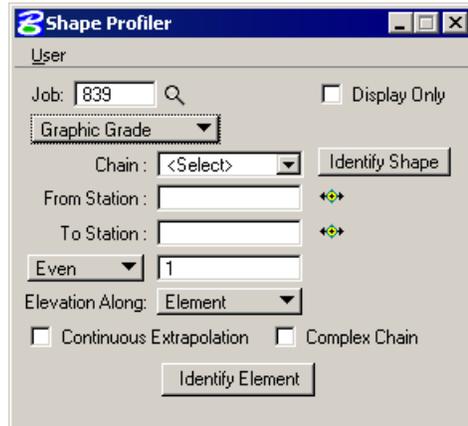
The DP button works within a superelevation shape whose X, Y coordinates are utilized to compute station / offset from the specified shape cluster baseline, which is subsequently utilized in conjunction with the shape to compute the various slopes and elevations. After the DP button is clicked, numerous data points can be placed. It is not necessary to click the DP button again. Each corresponding station / offset is displayed along with the associated output information.

The Dynamic button activates the dynamic mode. As the cursor moves across the screen, any momentary pause places the elevation and flow arrow in the MicroStation file and computes and displays the analysis information.

The Extrapolate Fixed Slope toggle is another option supported in the Shape Analyst tool. The option is utilized when the data point, dynamic point or station / offset is outside of the shape. When the option is not activated, the data point is projected back to the shape's chain. The elevations at the edges of the shape are displayed and the slope of the outside shape is projected to the data point. When the toggle is enabled, the user defined slope is projected from the outer most shape to the data point to determine an elevation.

SHAPE PROFILER

The Shape Profiler tool computes elevations along any GEOPAK Shape or MicroStation element at a user specified interval. The element can be inside or outside of the shapes.



The Job field can be populated by key in or using the Select... button. After selecting a GPK file, click Identify Shape and data point on any shape along the desired Chain. Set the From Station and To Station fields by keying in values or using DP.

Even should be selected when it is desired to have the elevations compute at the even station values. Increment will allow the elevations to be computed starting at the From Station, then adding the increment value to that station. Intersect is used with an element to compute elevations at all locations that the element intersects the shape(s).

The Elevation Along toggle can be set to Shape or Element. When set to Shape, elevations will be computed based on the Even/Increment value along both longitudinal edges of the shape. When set to Element the elevations are computed along the element based on the Even/Increment/Intersect toggle.

Continuous Extrapolation allows the user to identify multiple longitudinal elements outside of the shape area and compute elevations by a user defined Slope and one of three methods: Radial to Baseline, Radial From Element, or Radial to Element.

LAB EXERCISE: SUPERELEVATION **Compute Automated Superelevation**

Since our project consists of a single pavement configuration (4 lane undivided) we'll create a single run to process the automated superelevation data.

1. Open the MicroStation file *c:\data\geo\road1\sc219sh.dgn*.

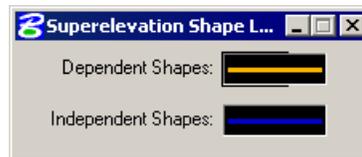
2. Access **Project Manager**.

It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.

3. Click **Calculate Superelevation**.

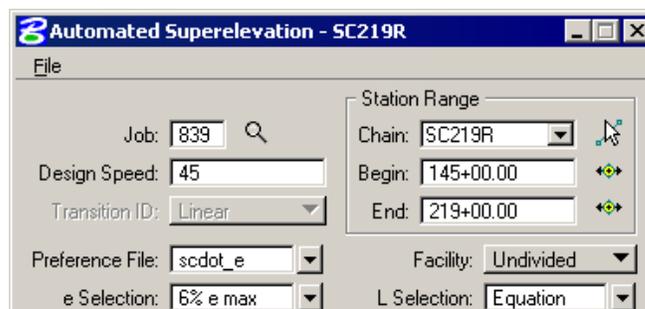
4. Create a new run called **SC219R** and click **OK**.

5. Select **File > Level Symbology**. Set the level for the Dependent and Independent shapes to **RD_PD_SuperShp1**. Close this window.



6. For the upper portion of the dialog, complete as follows:

Job	Automatically set to Job 839 via Project Manager Define Settings
Chain	SC219R
Begin Station	145+00
End Station	219+00
Design Speed	45
Preference File	scdot_e
e Selection	6% e max
Facility	Undivided
L Selection	Equation



7. Set the profile to **SC219RFP**.
All shapes are computed from this profile.
8. Set the **Tie** to Offset and the offset value to **0.0**.
9. Click **Quick Entry** on the lower right side of the Left tab.
10. Populate the resulting dialog as shown.
11. Click **OK**.
12. Review the **Left** and **Right** tabs to ensure they look like the dialog below.

% Slope	Offset	Offset	Dependent
-2.0800	0.0000	-31.5000	<input checked="" type="checkbox"/>

13. Disable the **Dependant** check mark for the shape on the right side.
14. Enter the **Create Input File** as *sc219r_shapes.inp*.
This file stores the computed transitions for this station range.
15. Click **Generate Superelevation Transitions**.
This initiates the calculation of the transitions for the Left and Right roadway.

 **Review Computations and Draw Shapes**

1. Review the computations within the Text Editor dialog.

 The status bar at the bottom shows 'Line: 1' and 'Col: 1'." data-bbox="254 121 763 525"/>

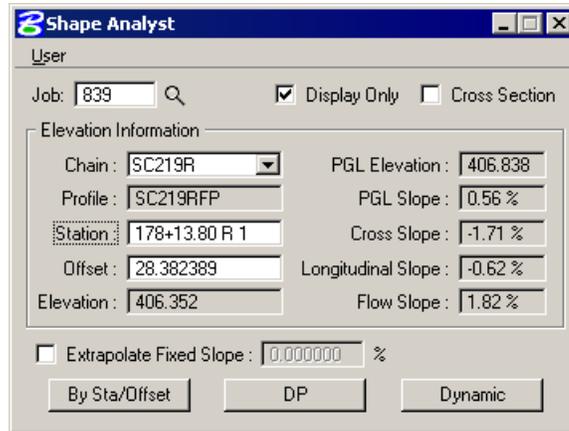
2. Compare the computed stations and slopes with the stations and slopes in the SC219C3.PDF file. Modify the input file as necessary to match the PDF's stations for full super.
3. Save the updates to the input file.
4. Click **Create Superelevation Shapes** within the Text Editor dialog.
This tool draws the shapes into your design file.
3. Close the Text Editor dialog.
4. Close the Automated Superelevation dialog.
5. When prompted to **Save Superelevation settings**, click **Yes**.

 **Shape Manager Tools**

Let's review the graphical shapes before we continue on to proposed cross sections.

1. To access the **Superelevation Shape Manager** tools, select the **Superelevation Shape Manager Tool** application from the Cross Section tool frame, or select **Applications > GEOPAK Road > Cross Sections > Superelevation Shape Manager Tools** from the MicroStation Menu Bar.

2. Select the **Shape Analyst** tool.



3. Enter **Job** 839 and **Chain** SC219R to complete the required definitions.
4. Click **DP** and data point within a graphical shape.
5. Review the information in the dialog.

Your dialog information varies from the dialog above based on the data point selection.

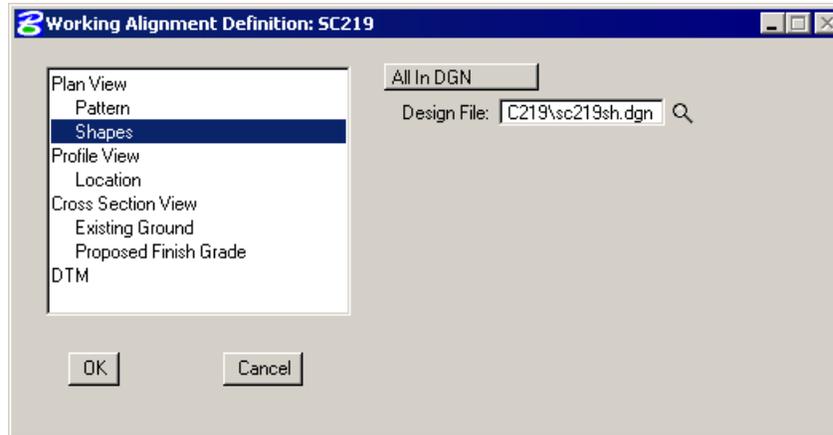
6. Close the **Shape Analyst** dialog.

Note Many user defined preferences are available to display information reflected by the graphical shape. These preferences may be set via the Shape Analyst dialog by selecting User > Preferences.

 **Update Project Manager**

We are completing the Plan View of the Working Alignment Definition in Project Manager.

1. From the Workflow dialog of Project Manager, click the **Define** button.
2. Highlight the **Plan View > Shapes** option and populate the Shapes Design file as shown below:



3. Click **OK** to save the updates and close the dialog.

 **Clean EOP Elements**

1. Attach the file *sc219pp.dgn* as a reference.

Note Use **Coincident World** as the method of attachment.

2. Turn off all levels in the reference except for RD_EX_Road level.
3. Turn off all levels in the active file.
4. Copy the EOP elements to the active file.
5. Turn off the reference file display.
6. Turn on the level containing the pattern lines.
7. Modify the existing EOP lines as necessary such that the pattern line only crosses the EOP twice.





Proposed Cross Sections

CHAPTER OBJECTIVES

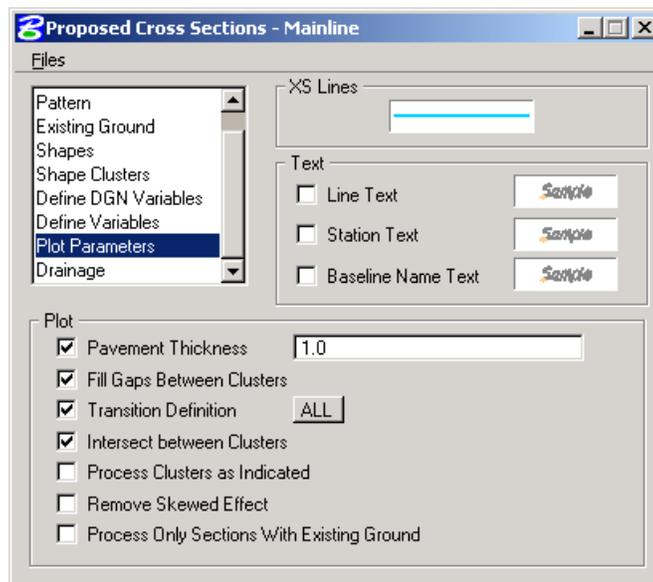
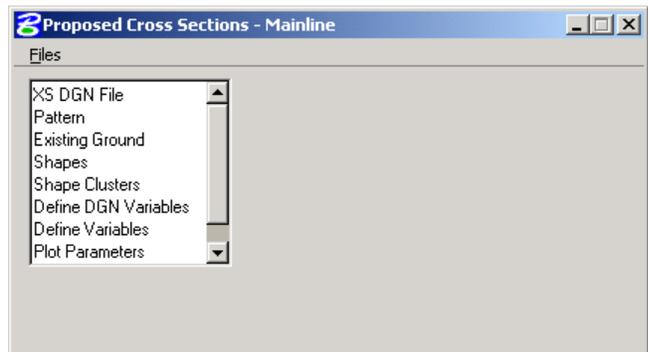
In this chapter, you will use Project Manager to create proposed cross-sections.

INTRODUCTION

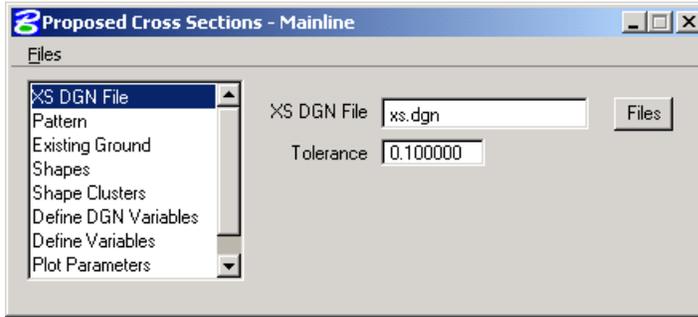
When the Proposed Cross Sections button in the Road Project Manager is clicked, the Select Run dialog is displayed. An existing run may be selected or new run may be started. When complete, click the OK, which closes the Select Run dialog and opens the proposed cross sections dialog.

Note This dialog cannot be accessed outside of the Project Manager.

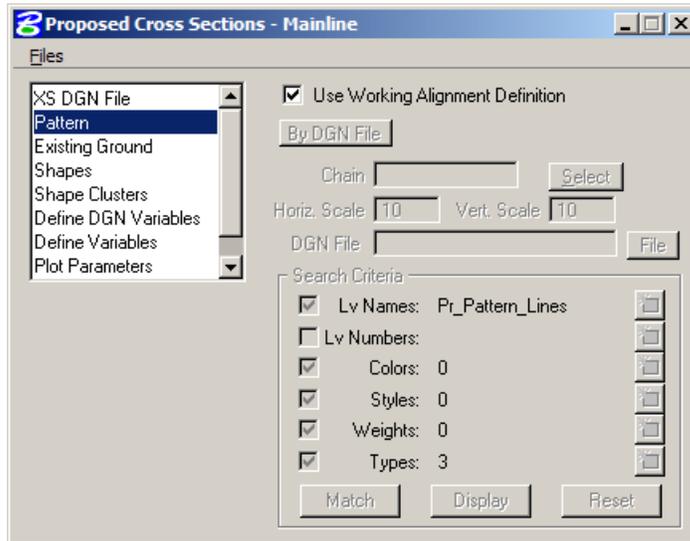
The left side of the dialog contains the list of categories required to process proposed cross sections. When each category is selected, the dialog changes to reflect the requirement of each category. For example, when Plot Parameters is selected, the dialog changes to reflect the various plot parameters and text as depicted on the following diagram.



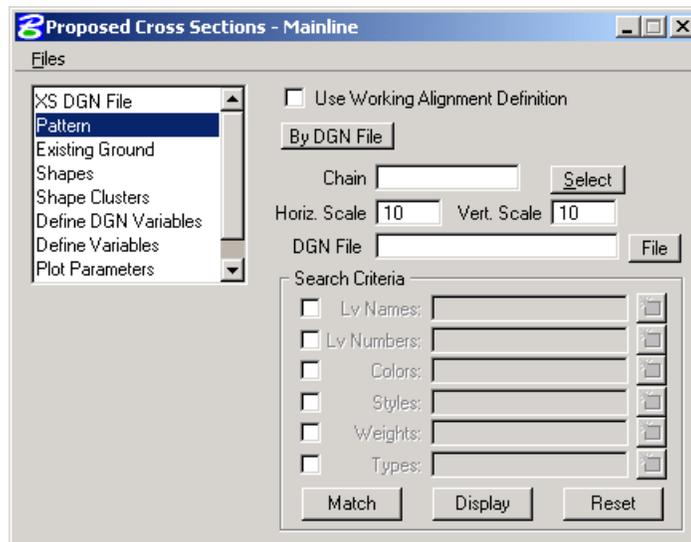
When XS DGN File is selected from the list box, the dialog dynamically changes as depicted below. XS DGN File defines the MicroStation file wherein the original ground cross sections are located as well as the location for the proposed cross sections.



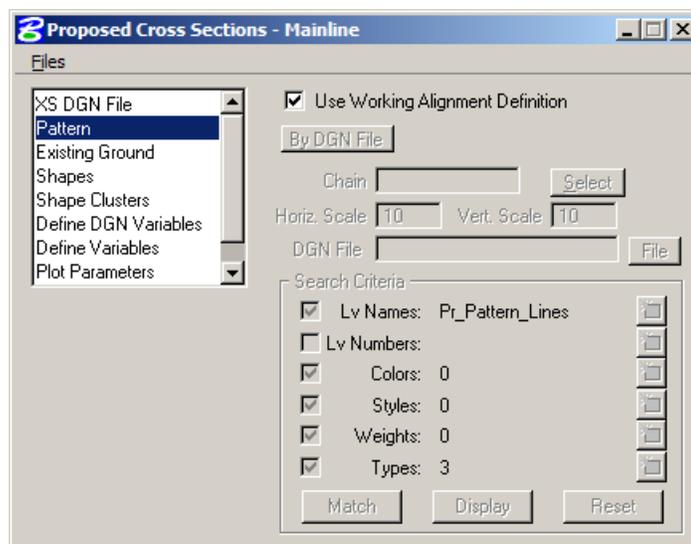
When Pattern is selected, the dialog changes as illustrated below.



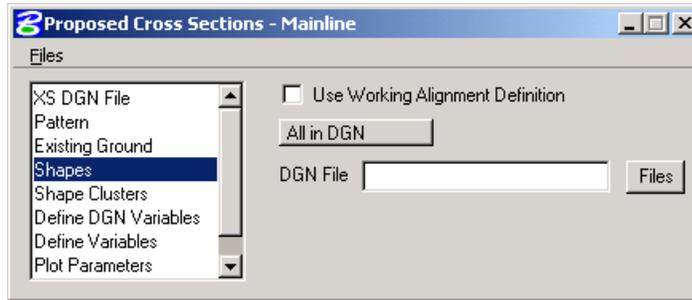
Three dialogs (Pattern, Existing Ground, and Shapes) support a toggle to **Use Working Alignment Definition**. For example, in the Pattern dialog, if the toggle is not active, the user must supply all pattern information.



However, if the toggle is active when one of these three categories is selected, the data information part of the dialog is ghosted and the required information is utilized from the current working alignment definitions. If the toggle is activated, and the required information is not stored within the current working alignment, an Alert message is displayed.



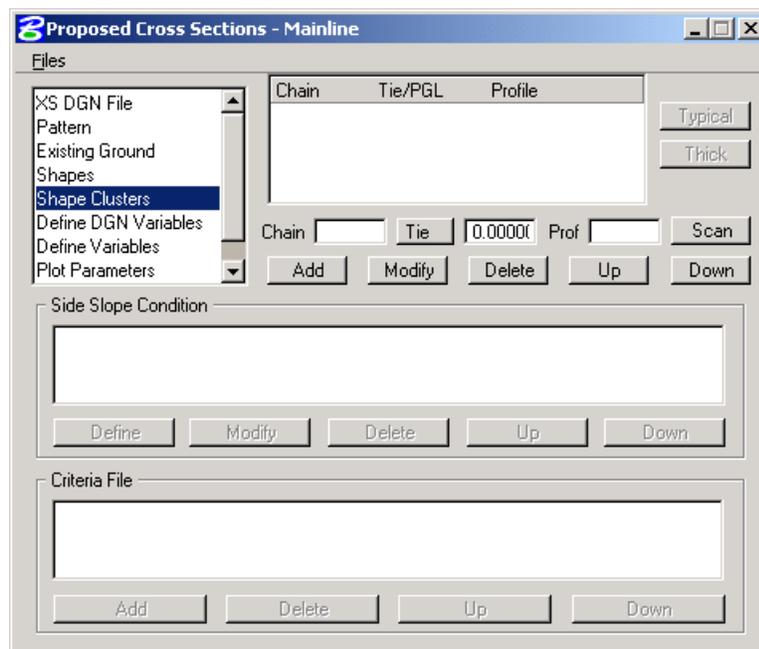
When the Shapes parameter is selected, the dialog is displayed as depicted below.



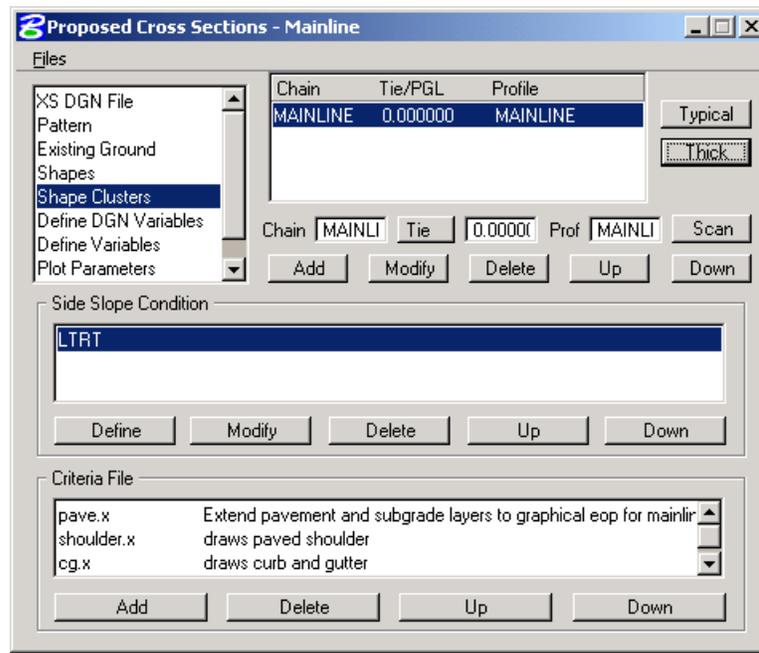
Three Shape definition options are supported:

All in DGN	All shape elements within the specified file are utilized.
By Search Criteria	Only those shapes that match the specified search parameters are utilized.
Shapeless	No shapes are utilized, hence, there is no field for a shapes file name or files button. This option will be used with the first exercise to produce existing shoulders and pavement on the existing cross sections.

When the Shape Clusters parameter is selected, the dialog dynamically changes as depicted below (there should not be any definitions within the dialog upon the initial invoking of this parameter):

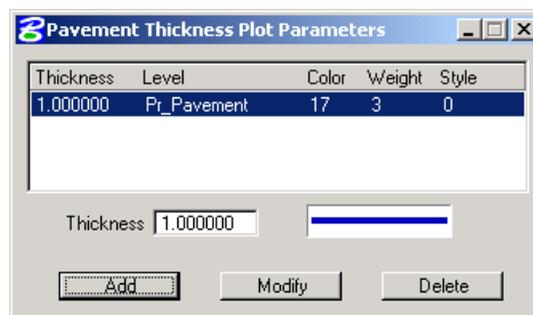


The user may **Add**, **Delete**, or **Modify** any specified shape cluster. When the **Scan** button is clicked, GEOPAK scans the design file and search criteria specified in the Shapes dialog and lists all matching clusters. In the instance of shapeless criteria, the user must define each cluster by utilizing the **Select** button or typing in the **Chain**, **Tie/PGL** and **Profile** associated with this shape; then click the **Add** button.

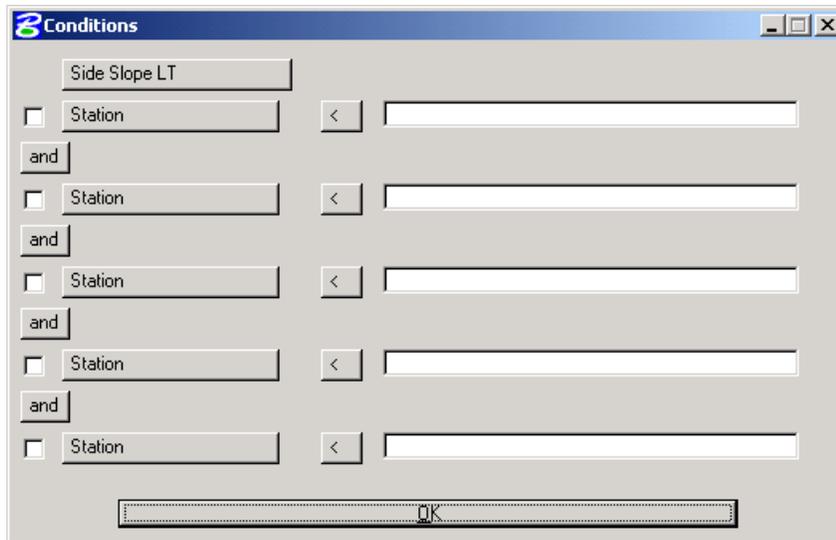


After a cluster has been defined and highlighted, the **Thick** button in the upper right corner is unghosted. This invokes a separate dialog to assign different pavement thicknesses and different symbology to different roadways.

For example, in the dialog below, you can see we've assigned a pavement thickness to the Roadway defined by Chain Mainline. After the information has been defined, simply close the **Pavement Thickness Plot Parameters** dialog, as it does not need to be open in order to process.

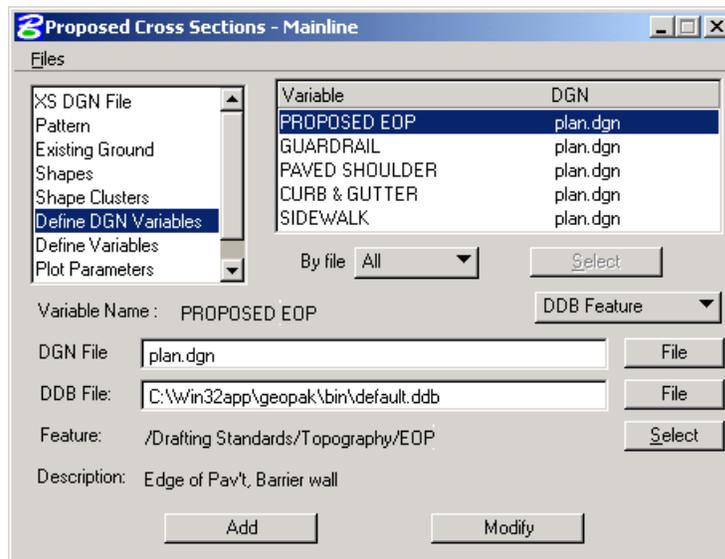


The Side Slope Conditions need to be set up for each shape cluster. To define a side slope condition, highlight the desired shape cluster then click the **Define** button. The dialog below opens.

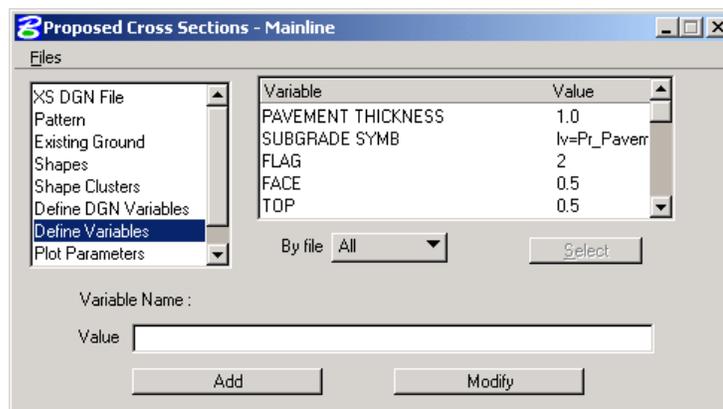


The user can choose **Side Slope LT**, **Side Slope RT**, **Side Slope LT/RT** or **Offset Minus/Plus Side Slope LT/RT**. Certain conditions such as Station > 50+00, or Median Width <= 7.2 can be set up to apply the side slope information if those conditions are met.

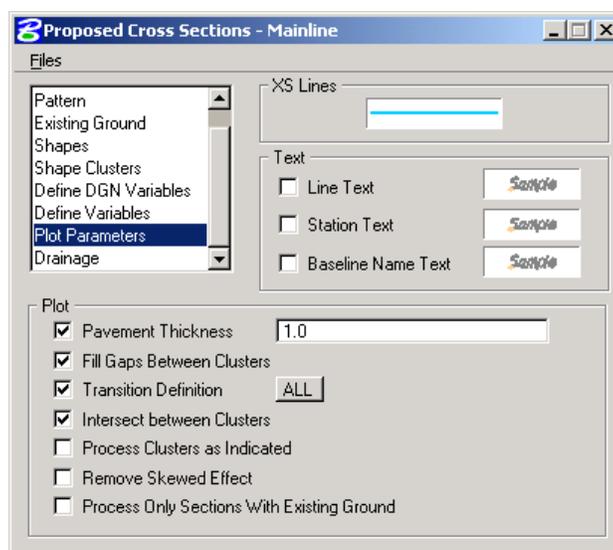
For each Side Slope condition, criteria files are added based upon the type of features to be drawn in the cross sections.



The **Define DGN Variables** option allows the user to define how to locate MicroStation elements used by the criteria files. Define DGN Variables can be determined from the element symbology, or from the symbology and attributes assigned in the D&C Manager database. Variables that are previously defined in the criteria will show up in the list. If the **Select** button is unghosted, variables remain undefined and must be defined before processing the sections. Click **Select** to see a list of undefined variables assign a value, then click **Add**.



Define Variables enable the user to enter job specific values for certain variables. (i.e. pavement thickness, ditch width, backslope, etc.) The user can select the variable from the list, then enter the new value and click the **Modify** button.



Plot Parameters enables the user to determine how the data from the superelevation shapes are going to appear. **XS Lines** determine the symbology of the pavement surface. **Text** plots various pieces of text relating to the cross section. The elevation of the PGL of each shape cluster is automatically plotted. Enable the **Line Text** toggle to define this symbology for the PGL text. The Plot group box enables the user to control different aspects relating to the cross sections and criteria files as detailed below.

Pavement Thickness draws the bottom of shaped pavement for all clusters. If the **Thick** button was utilized in the shape clusters dialog, this should be disabled.

Fill Gaps Between Clusters draws a line between two shape clusters if the criteria does not fill between them.

Transition Definition defines the use of parabolic superelevation transitions.

Intersect Between Clusters extends or trims elements in a median to create a finished, clean appearance.

Process Clusters as Indicated forces the criteria to process the clusters as they are listed in the Shape Clusters dialog. If this option is turned off, the clusters are processed left to right.

Remove Skew Effect forces GEOPAK to correct itself back to the pattern line if a skewed element is encountered in the processing of the criteria files.

Process Only Sections With Existing Ground - If only one group (color) is indicated in the input file for the existing ground in each run, the program loads into memory only the ground lines of the specified color, and processes only those sections. The time reduction may vary depending on the specific conditions of the job and type of machine.

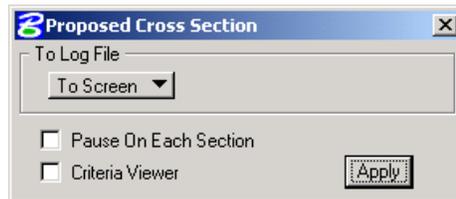
FILES

Under Files, the options are Run, Save Settings, Export... and Exit. To process the cross sections, click the **Run** button, which invokes the Process Cross Section dialog. Save Settings simply saves the current settings to the run. When the **File > Export** option is selected, the user may save the dialog information in an ASCII input file for review or subsequent processing. The **File > Exit** option enables the user to exit the Proposed Cross Sections dialog box. The software also prompts the user with an Alert box if the settings should be saved before exiting. Clicking the **Yes** button saves the current dialog settings, **No** does not save the settings, but both buttons exit to the Project Manager.



PROCESSING

When **File > Run** is chosen, the dialog below appears.



The output can be displayed on the **Screen Only**, or written to a **Log File** and displayed to the screen. The **Pause On Each Section** option enables the user to view each section as it is drawn. **Criteria View** displays each step in the criteria file. This is primarily for debugging purposes.

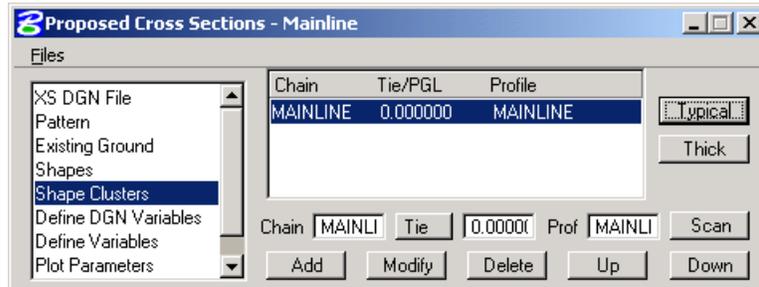
CRITERIA FILES

One of the most powerful and flexible features of GEOPAK is the use of criteria in generating proposed cross sections. Within criteria, design conditions can be evaluated and complicated design decisions executed in response to these design conditions. The flexibility of criteria allows the designer to make the design as basic or as complex as the project requires. Numerous baselines can interrelate as ditches and medians are drawn between roadways and ramps. Sophisticated drainage details can also be drawn with criteria. The list is endless.

Cross section criteria are used to draw cross section features outside of the mosaic of superelevation shapes typically representing pavement. Operationally, the software constructs the cross section features derived from the mosaic of shapes first. Then, the software constructs the remaining portions of the cross section through the application of criteria emanating out from the outer edges of the mosaic of shapes.

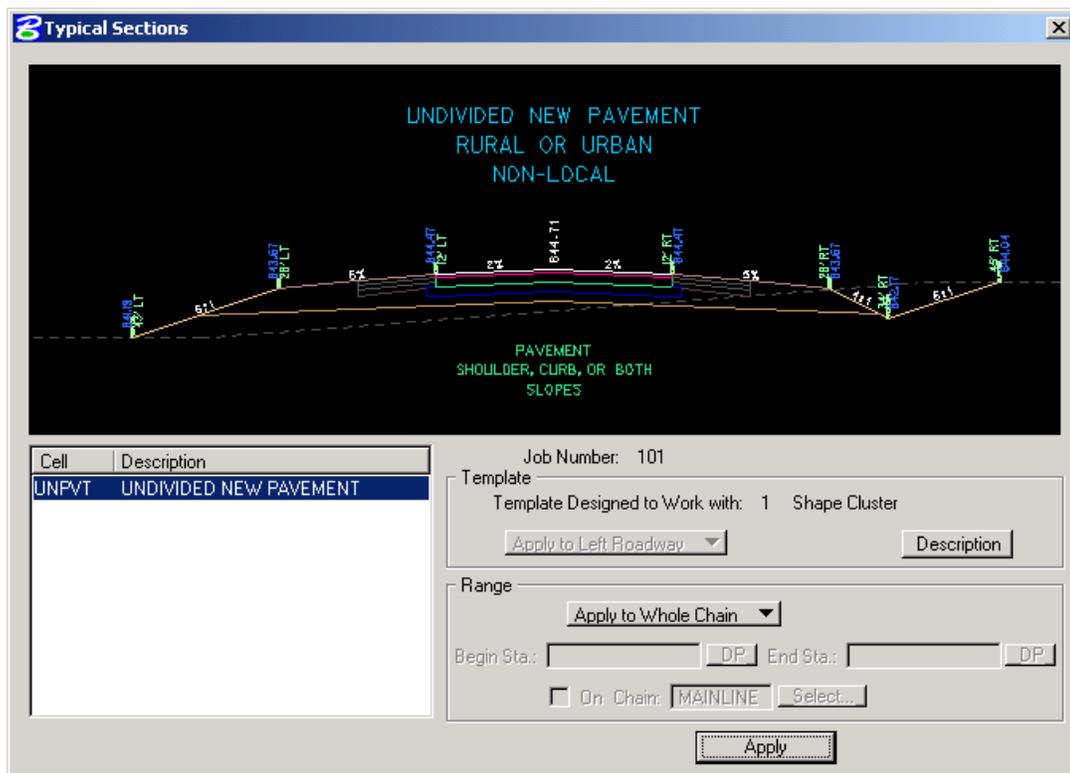
TYPICAL SECTION GENERATOR

Note the button labeled **Typical**.



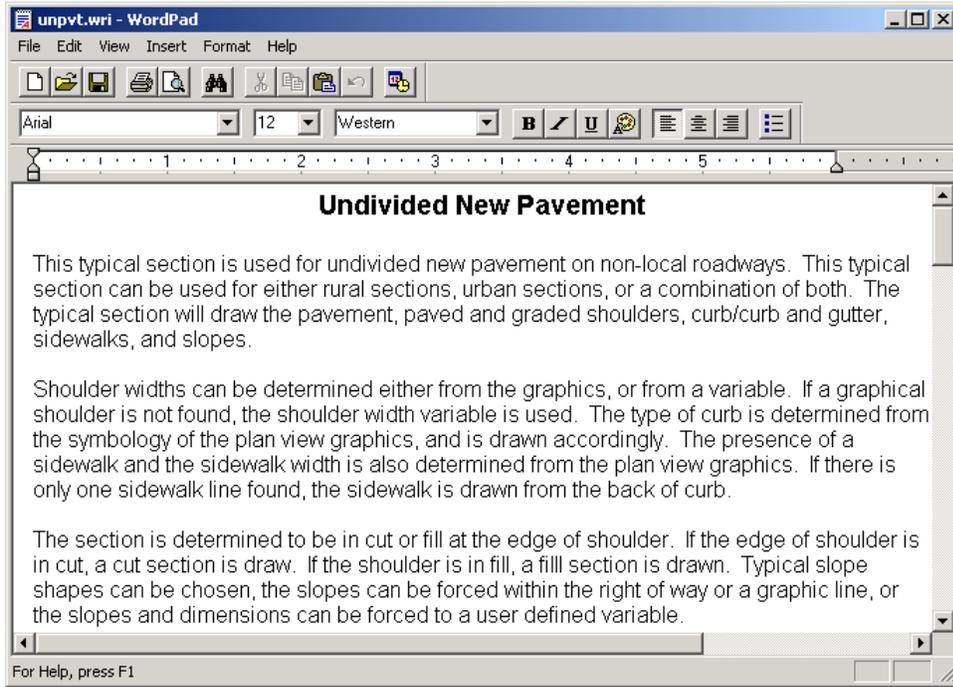
This application enables the designer to apply specific criteria files from a standardized library to specific typical sections, thereby foregoing the need to pick and choose which criteria files they need. They simply select the typical section(s) for their project and the criteria files are retrieved for them automatically from the library.

When the **Typical** button is pressed, the **Typical Section Generator** dialog appears as depicted below.

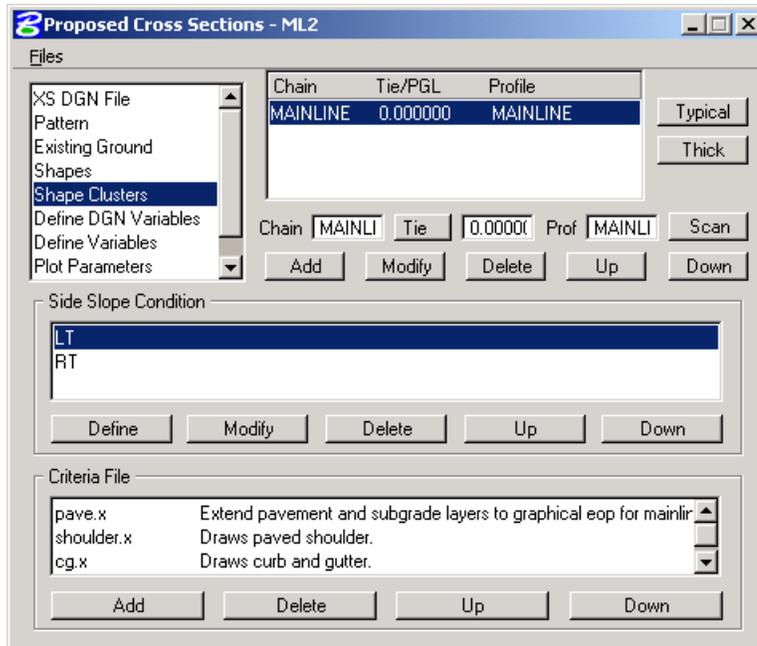


The user must simply select the typical section from the left then click **Apply**. For a divided roadway with a left and right Profile Grade Line, the user would apply the selected typical once to the left roadway and then once again to the right roadway. You can also apply the typical to the entire length of the alignment or only a portion of the alignment by changing the **Apply to Whole Chain** toggle to **Apply to Station Range** and specifying a beginning and ending station for the typical.

Documentation files are available for each typical section that explains what the typical does and identifies variables that need to be set. The files are accessed from within the Typical dialog by pressing the **Description** button. Below is a sample of one of the documentation files.



When the **Apply** button is pressed, the Typical Sections dialog closes, returning the user to the Project Manager - Shape Cluster dialog. GEOPAK has inserted the Side Slope LT and RT and appropriate criteria, as depicted in the dialog below.



LAB EXERCISE: PROPOSED CROSS SECTIONS

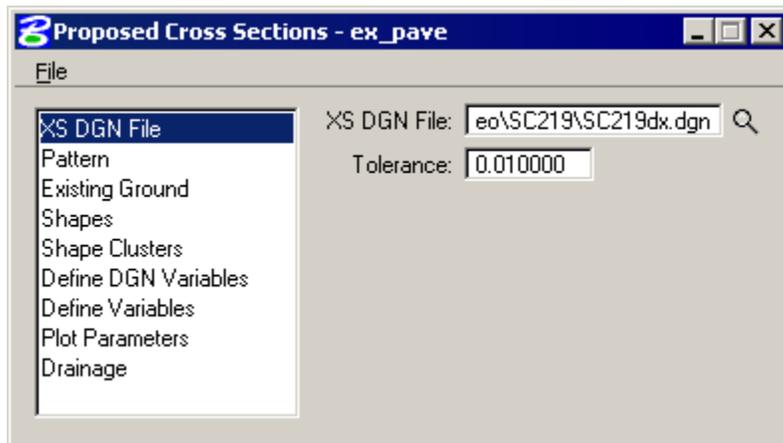
This exercise consists of two distinct steps. This first step will draw existing features on our existing sections. The second step will draw the proposed cross sections.

Drawing Existing Features onto Cross Sections

1. Open the MicroStation file *c:\data\geo\road1\sc219dx.dgn*
2. Invoke **Project Manager**.

It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.

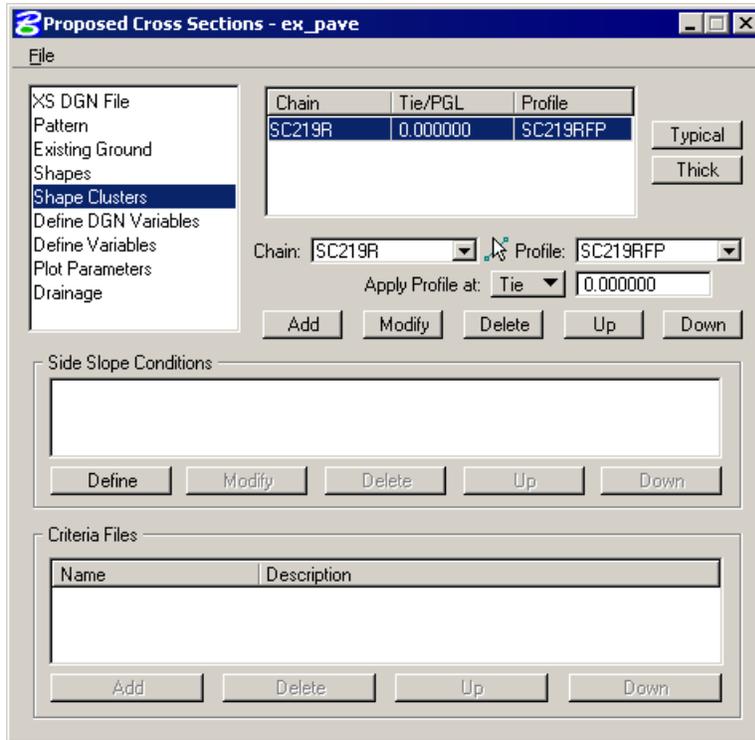
3. Choose Proposed Cross Sections from the Project Manager dialog and create a run called **ex_pave**. Then double-click on **ex_pave**.



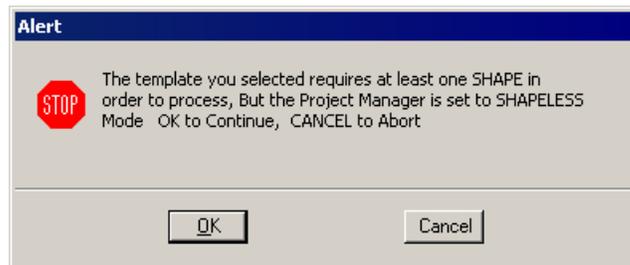
4. Complete the following items in the dialog.

XS DGN File	This filename should be automatically defined as sc219dx.dgn . Set the tolerance to 0.1
Pattern	Use Working Alignment Definition
Existing Ground	Use Working Alignment Definition
Shapes	Set the Shape Option to Shapeless .

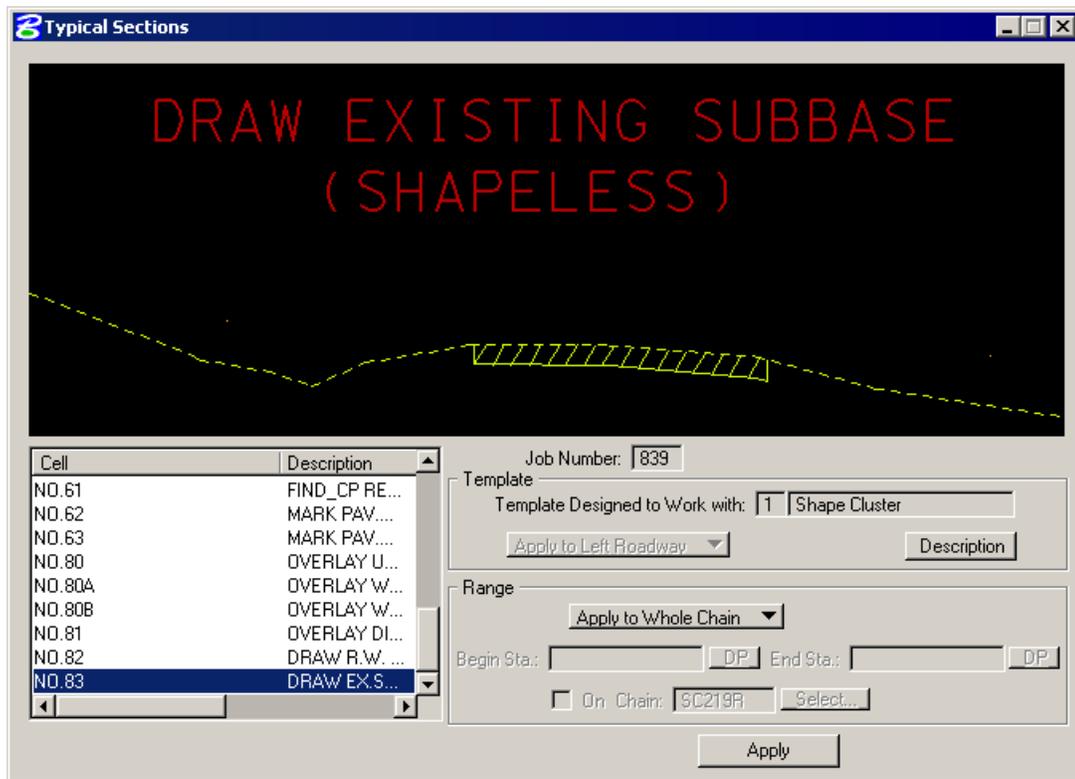
- Next, select the Shape Clusters category to invoke the following dialog.



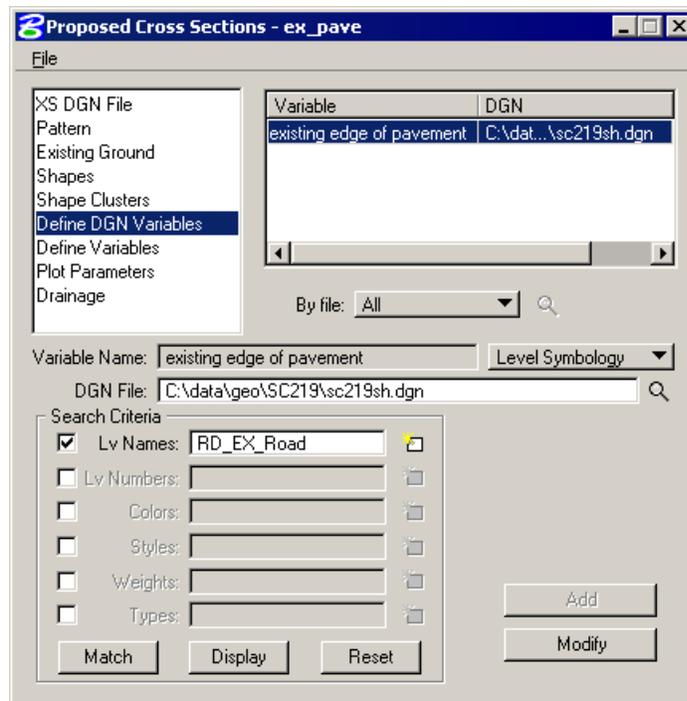
- Define the **Chain**, **Tie** and **Profile** for the shapes.
Select the Chain, Profile and Tie shown above.
- Click **Add** to add the chain, profile and tie to the shape cluster list.
- Click **Typical**. Click **OK** if you are prompted with the following dialog.



- Select the typical **No. 83 – Draw EX. SUBBASE SHAPELESS**.



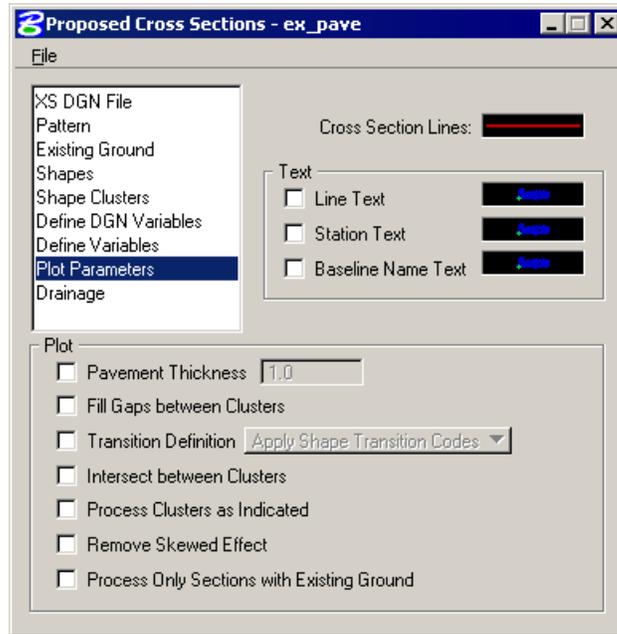
10. Click **Apply** to use this typical for all cross sections.
11. Select the **Define DGN Variables** category from the Proposed Cross Section dialog list box to invoke the following dialog.



Modify the variable *existing edge of pavement* as shown.

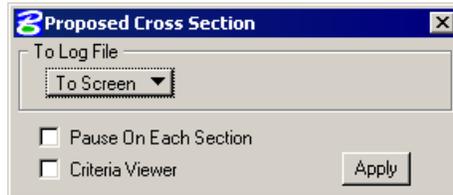
Note This tool scans all of the criteria files for the Define DGN Variables and allows you to define them for each proposed cross section run.

12. Select the **Plot Parameters** category. **DO NOT** change any of the symbology settings for **XS Lines** or **Text**. Toggle **off** all the options in the **Plot** section. The dialog should appear as below.

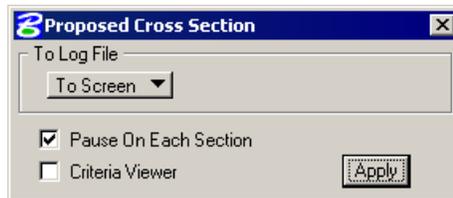


At this point we are ready to process the proposed design sections for the chain **SC219R**.

13. From the Proposed Cross Sections dialog, select **File > Save Settings**, then **File > Run**.
14. The following dialog is invoked. You may define where you want to see the computed cross section information, in an output file or on the screen only.



15. Select **To Screen**. Activate the **Pause on Each Section** toggle to view the first design section once it has been drawn. Click **Apply**.



Note When errors occur, change the **To Screen** to **To Log File** then click **Apply** to generate the log file. Use the GEOPAK Editor to open the log file to determine the problem



The error usually occurs at the end of the file. However, the error may be in the line(s) prior to the error message.

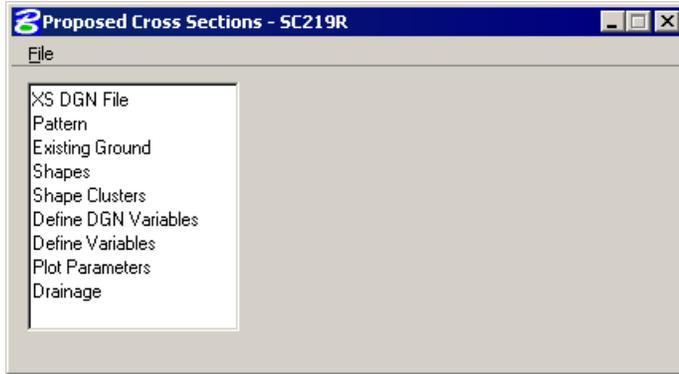
16. When processing is complete, click **Exit** to return to the Process Cross Sections dialog.
17. Dismiss the Proposed Cross Sections dialog by clicking the “**X**” in the upper right of the dialog or by using the **Files > Exit** pulldown.
18. When prompted to **Save Settings**, click **Yes**.
19. Use Cross Section Navigator to review the existing shoulder and base as drawn.
20. Upon reviewing the sections, it is desirable to “lock” the elements to prevent accidental deletion or modification in later steps. Select **Edit > Select All** from the MicroStation menu bar. Then select **Edit > Lock** to lock the elements.



 **Proposed Finished Grade Cross Sections**

In this set of steps, a new run will be created and used to generate the proposed cross sections.

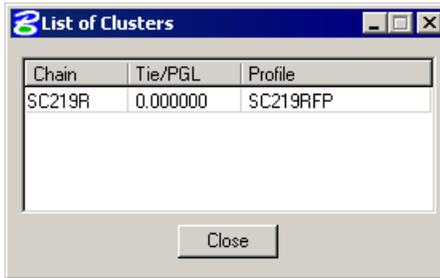
1. Choose **Proposed Cross Sections** from the Project Manager dialog and create a run called **SC219R**. Then double-click on **SC219R** and the following dialog will appear.



2. Complete the following items in the dialog.

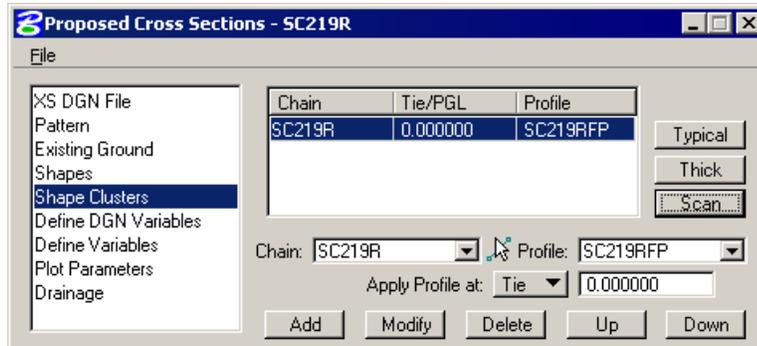
XS DGN File	This filename should be automatically defined as sc219dx.dgn Set the tolerance to 0.01
Pattern	Use Working Alignment Definition
Existing Ground	Use Working Alignment Definition
Shapes	Use Working Alignment Definition

3. Click **Shape Clusters** to define shape clusters, side slope conditions and criteria files.
4. Click the **Scan** button to have the software scan the **sc219dx.dgn** file for all of the shape clusters. The dialog below should appear.

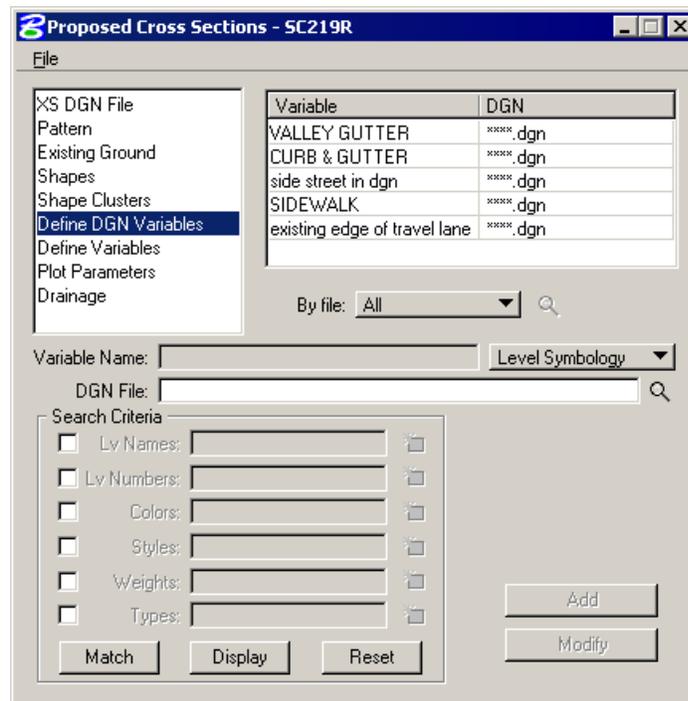


5. Double click the **SC219R** chain then close the **List of Clusters** dialog.

- On the **Proposed Cross Sections** dialog, click **Add** to add the **SC219R** chain to the shape cluster window. The dialog should appear as below.



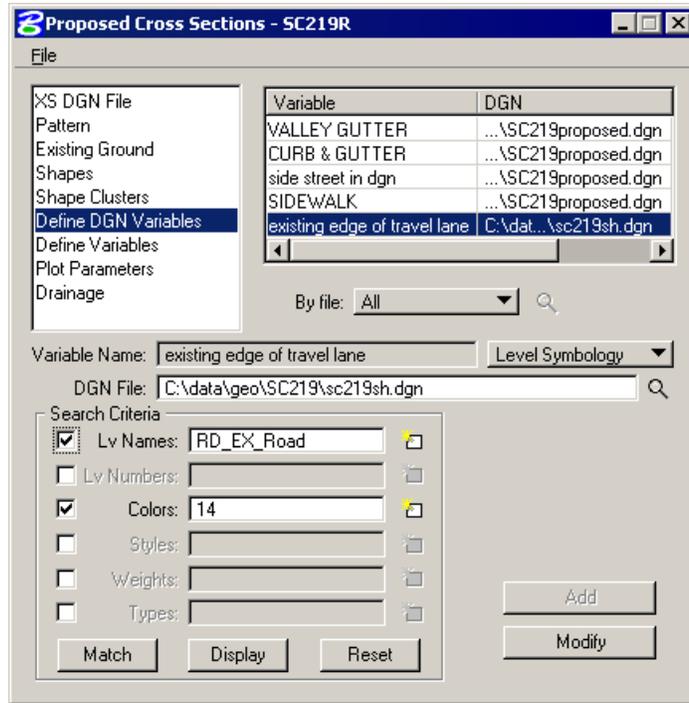
- Select the shape cluster in the list.
- To define the **Side Slope** (areas outside of the pavement limits) conditions simply highlight the shape cluster that was just defined in the list box then click the **Typical** button.
- Select typical **No. 05 – RURAL_URBAN UNDIVIDED**. Click *Apply to use this typical for all sections to be processed.
- Select the **Define DGN Variables** category from the Proposed Cross Section dialog list box to invoke the following dialog.



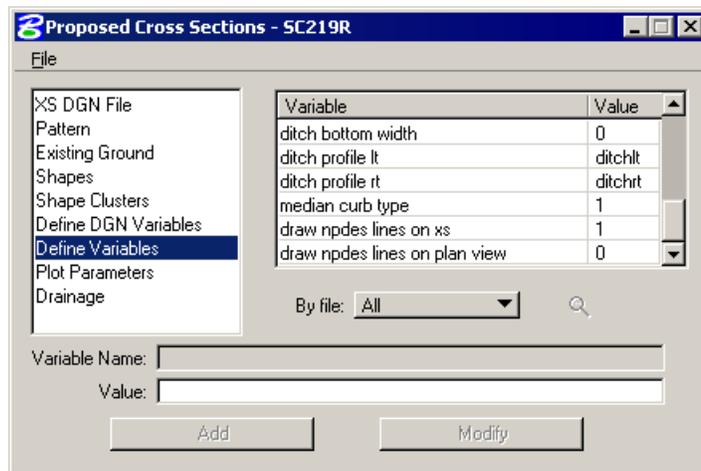
Note This tool scans all of the criteria files for the Define DGN Variables and allows you to define them for each proposed cross section run.

- You should notice that the DGN filename for each variable is set to ******.dgn**. This will need to be modified for all variables in order for the criteria to find these DGN elements during the run. Click the **Select Variable DGN Name** button next to the **DGN File** field. Select *C:\data\geo\SC219\sc219proposed.dgn* then click **Modify**. Use this design file for the first

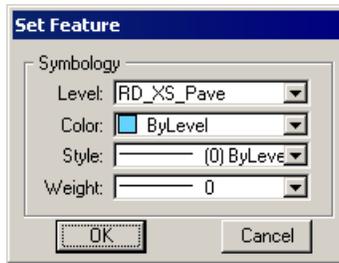
four variables. Fro the last variable, set this to the *C:\data\geo\SC219\sc219sh.dgn file*. After all variables have been modified, the dialog should appear as below.



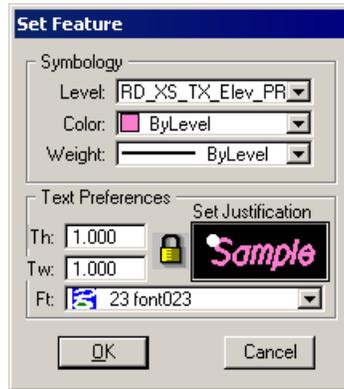
12. Select **Define Variables**. The dialog should appear as below. The variables should be correct.



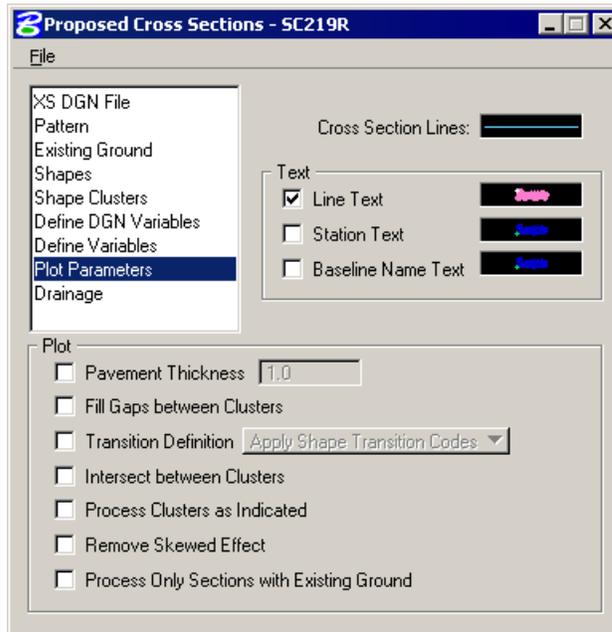
13. Select the **Plot Parameters** category. Double click the sample graphics box next to **Cross Section Lines**. Set the symbology as below then click **OK**.



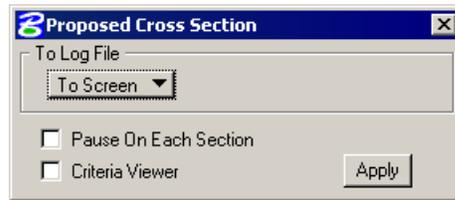
14. Toggle on **Line Text**. Double click the sample graphics box next to **Line Text**. Set the symbology as below then click **OK**.



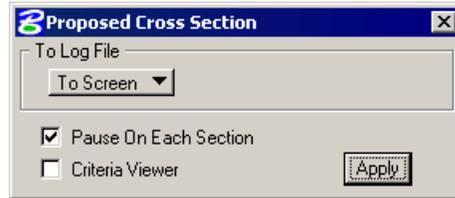
15. Toggle **off** all the options in the **Plot** section. The dialog should now appear as below.



16. From the Proposed Cross Sections dialog, select **File > Save Settings**, then **File > Run**.
17. The following dialog is invoked. You may define where you want to see the computed cross section information, in an output file or on the screen only.



18. Select **To Screen**. Activate the **Pause on Each Section** toggle to view the first design section once it has been drawn. Click **Apply**.



Note When errors occur, change the **To Screen** to **To Log File** then click **Apply** to generate the log file. Use the GEOPAK Editor to open the log file to determine the problem



The error usually occurs at the end of the file. However, the error may be in the line(s) prior to the error message.

19. When processing is complete, click **Exit** to return to the Process Cross Sections dialog.
20. Dismiss the Proposed Cross Sections dialog by clicking the “**X**” in the upper right of the dialog or by using the **Files > Exit** pulldown.
21. When prompted to **Save Settings**, click **Yes**.
22. Use Cross Section Navigator to review the proposed cross sections.

Working Alignment

Now that we have the information for our proposed cross sections, we need to update our **Working Alignment Definition** in Project Manager.

1. From the Workflow dialog of Project Manager, click the **Define** button.
2. Highlight the **Proposed Finish Grade** category.
3. Enable the **Lv Names** toggle, then click **Match** to identify and accept all lines comprising the proposed finished grade. Use the **Display/Undisplay** button to toggle the elements between the highlight color and their original color.
3. Click **OK** to save your changes and exit the dialog.
4. Exit MicroStation.



Port Viewer

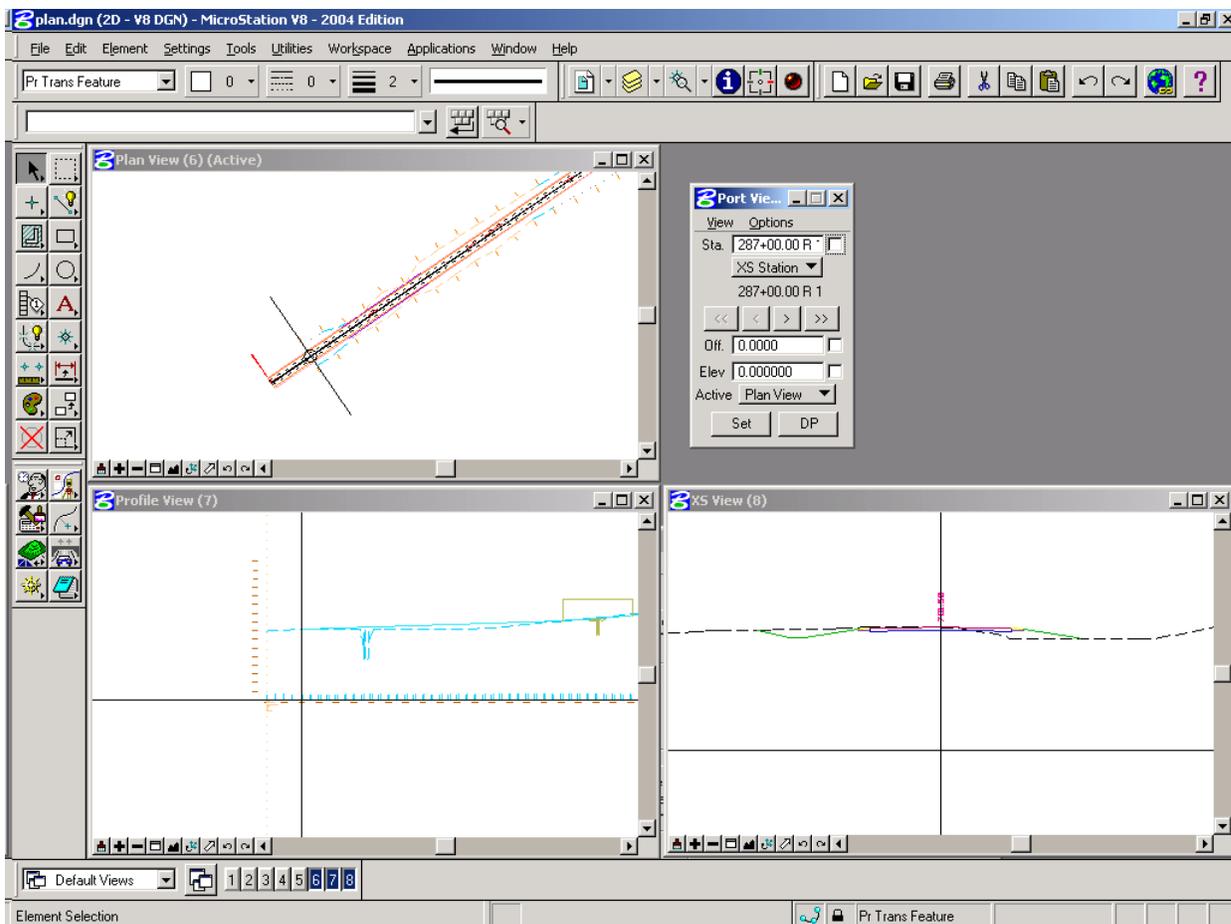
CHAPTER OBJECTIVES

In this chapter, you will learn how to utilize the Port Viewer.

INTRODUCTION

The **Port Viewer** is a tool that enables the user to view and manipulate all three major aspects of a road design simultaneously, even though they are located in different files. The Port Viewer tool is only available while working within the Project Manager application. These applicable views for design display include:

- Plan view layout
- Profile
- Cross sections

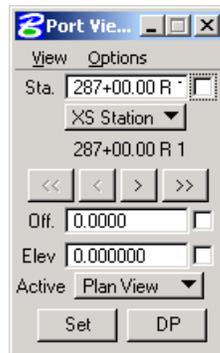


ACCESSING THE PORT VIEWER

Prior to starting the Port Viewer the working alignment must be set up to include the plan view drawing file, centerline chain, profile name and location (optional), cross-section view file(optional), and digital terrain model information(optional)..

To access the Port Viewer tool, click the Port Viewer button on the Project Manager workflow dialog. Note this is the only location from which the Port View can be accessed, as there is no GEOPAK Road tool supported for it.

PORT VIEWER DIALOG SETTINGS



The Port Viewer dialog box allows the user to manipulate the design views in several different ways.

STATION SETTINGS

The user is able to manually enter the chain station that they want to view the plan, profile or cross section design file. The cross hairs in the plan and profile views will move to the active station, and the section view will display the cross-section nearest that station.

TRAVERSE BUTTONS

The “VCR” buttons (forward and backward arrowheads) allow the user to navigate station by station (>,<), or to the beginning or ending station (<<,>>).

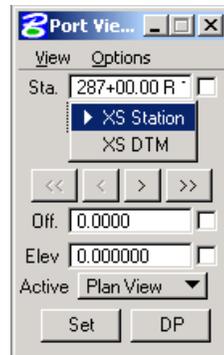
OFFSET CONTROL

The Offset option will control the location of the locator circle in the plan view and the vertical cross hair in the cross-section and profile view.

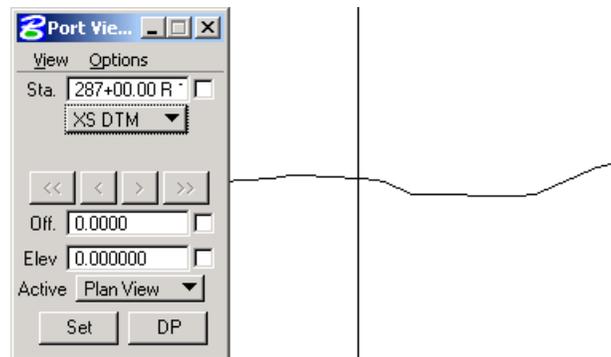
ELEVATION CONTROL

The Elevation option will control the location of the horizontal cross hairs in the profile and cross-section views.

ACTIVE GROUND SETTING



If the TIN file is defined in the **Working Alignment** definition, the DTM view can be substituted for the cross-section view. The DTM view cuts a section on the fly at the location of the cross hairs in the plan view.



ACTIVE VIEW SETTINGS

The **Active** option defines the view that controls the manipulation of the other two views.

SET BUTTON

Once the Active View is selected, the user can click the Set button. This will allow the user to move the cursor to the Active View and move the cross hairs. As the user moves the cursor along the Active View, the other two views will be updated according to the placement of the cursor in the Active View.

DP BUTTON

The DP button enables the user to issue a data point for a MicroStation command. For example, if the user wanted to draw a line at the given station and offset listed in the Port Viewer dialog, they would select the line tool, and click the DP button. This would begin drawing a line at the given station and offset.

PORT VIEWER MENU OPTIONS

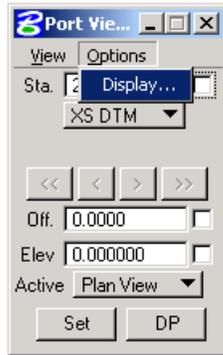
VIEW

The View pulldown from the Port Viewer menu bar allows the user to fit one or all of the views, or to select the Active View.

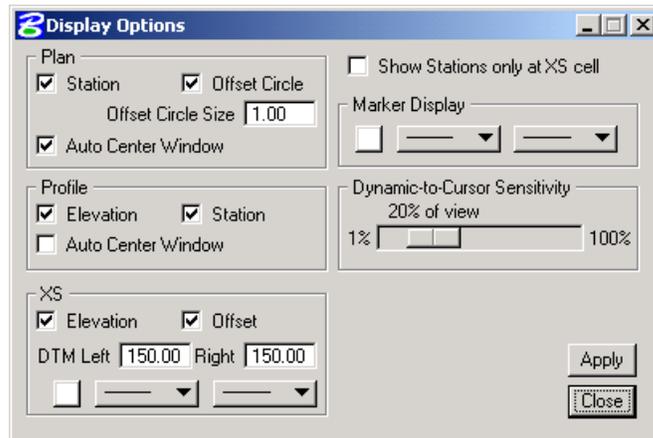
The Fit option will fit the entire horizontal alignment when selecting Plan View, the entire profile when selecting Profile View, or the current cross section when selecting XS View.

The Active option set the active design file to be the one that contains either the Plan, Profile or Cross Section data and reference the others. This is useful if you need to alter a section yet you are in the Plan View. Since the Cross Section file is referenced, you can not modify the section. However if you make the XS View 'active', then the port viewer will open the Cross Section file as defined in the Working Alignment dialog, and reference the Plan and Profile views.

OPTIONS



The **Options** menu controls which cross hairs to display, as well as the symbology of the DTM section view.



Group boxes are supported for Plan, Profile and XS display options.

Three toggles are located in the **Plan** group box: Station, Offset Circle, and Auto Center Window. When the Station toggle is activated, the pattern line is displayed on the screen. When the Offset Circle toggle is activated, a circle of the size specified in the Offset Circle is placed at the Station and Offset specified in the Port Viewer dialog. When the Auto Center Window toggle is activated, the Station and Offset specified in the Port viewer dialog is centered in the Plan window.

The Profile group box has three toggles: Elevation, Station and Auto Center Window. When the Elevation toggle is activated, a horizontal line at the Marker Display element symbology is displayed in the Profile View at the Elevation specified in the Port Viewer. When the Station toggle is activated, a vertical line, also at the Marker Display element symbology, is displayed on the Profile view at the Station specified at the top of the Port Viewer dialog. When the Auto Center Window toggle is

activated, the Station and Elevation specified in the Port viewer dialog is centered in the Profile window.

The XS group box has two toggles: Elevation and Offset. When the Elevation toggle is activated, a horizontal line at the Marker Display element symbology is displayed in the XS View at the Elevation displayed in the Port Viewer. When the Offset toggle is activated, a vertical line, also at the Marker Display element symbology, is displayed in the XS view at the offset specified in the Port Viewer dialog. The XS Group box also contains parameters for the XS DTM Left and Right specified in terms of master units. The XS DTM Left and Right parameters are the horizontal distances from the specified alignment which define the limits of the cross section or DTM display line, similar to a cross section pattern line.

The Dynamic to Cursor Sensitivity determines how close the MicroStation cursor must get to the data point cross hairs (dynamic cursor) before they begin to follow the MicroStation cursor dynamically in the Set mode. This is to prevent the cross hairs from jumping over to the MicroStation cursor until it is within a certain distance from them. This distance is set as a percentage of the diagonal size of a given view. When the dialog settings are complete, clicking the Apply button automatically updates the screen and revises the displays.

The Marker Display group box contains the element symbology of the marker lines.

After the desired settings have been completed, click Apply in the lower right corner to automatically close the dialog and apply all settings.

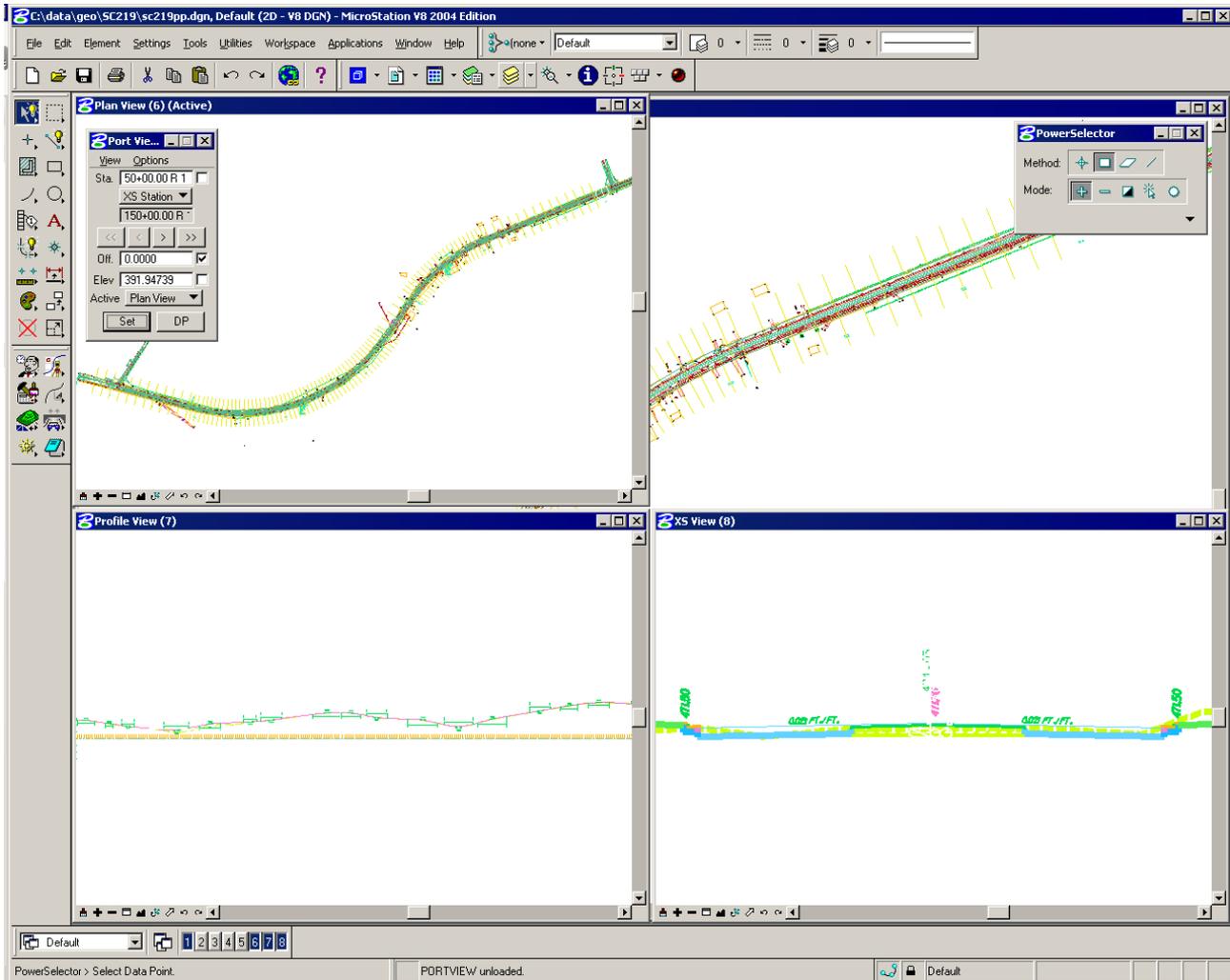
LAB EXERCISE: PORT VIEWER

In this exercise we will use the Port Viewer.

Access Port Viewer

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Click **Select** to make sure you've got **SC219** selected as your **Working Alignment**.

3. Click **Port Viewer**.



4. Use the VCR buttons to scroll through the design, profile, and cross sections.
5. Close the **Port Viewer** dialog.
6. Exit MicroStation.



Earthwork

CHAPTER OBJECTIVES

In this chapter, you will learn:

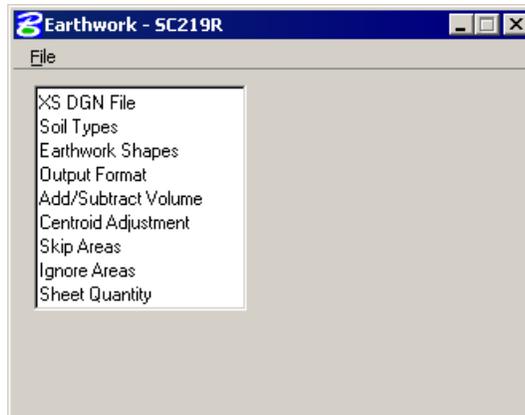
- the procedures for calculating earthwork quantities with GEOPAK.
- how to use Project Manager to set up and process an earthwork run.

INTRODUCTION

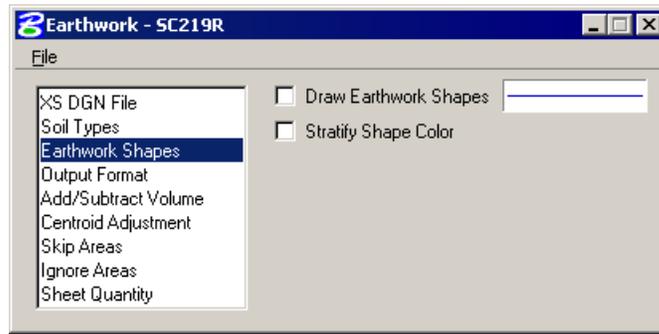
GEOPAK forms graphical earthwork shapes in a (MicroStation) cross section design file to represent the end areas used to calculate volumes by the end-area method. These shapes are created when the designer processes an earthwork run in which the existing ground, finished grade, base, etc. are identified by level, color, weight and type.

ACCESSING

When Earthwork in the Road Project Manager is clicked, the Select Run dialog is displayed. An existing run may be selected or new run may be started. When complete, click **OK**, which closes the Select Run dialog and opens the earthwork dialog.



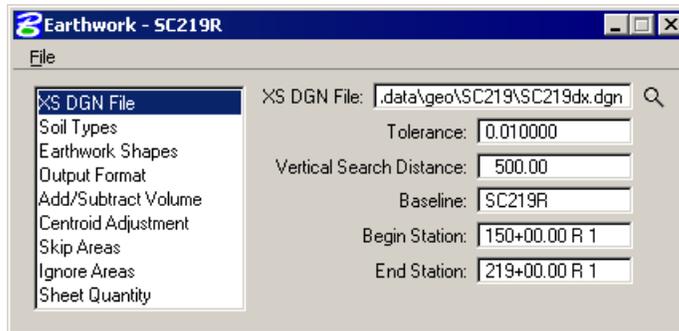
The left side of the dialog contains the list of parameters required to compute earthwork. When each parameter is selected, the dialog changes the key-in fields to reflect the selection. For example, when EW Shapes is selected, the dialog changes as illustrated below.



EARTHWORK DIALOG

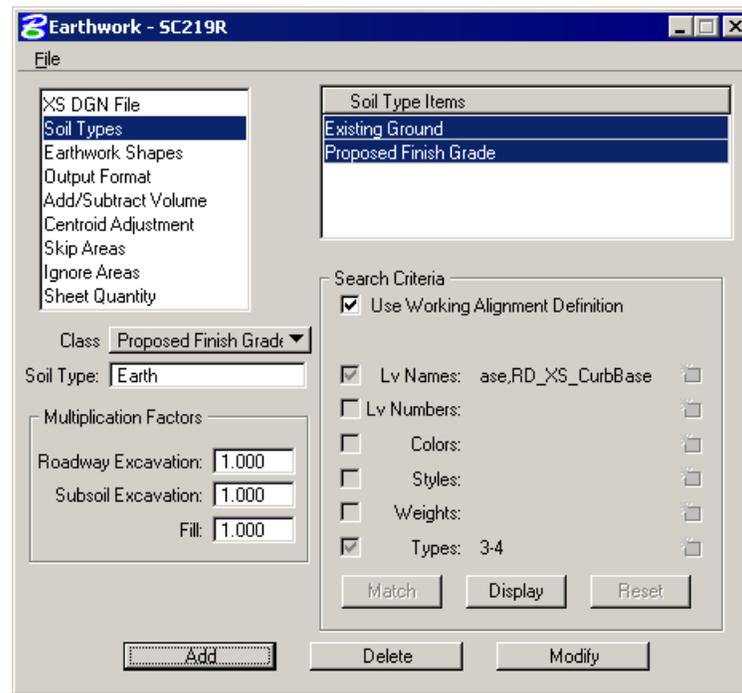
XS DGN FILE

In XS DGN File the user can specify the file name in which to find the cross-sections. Tolerance specifies the maximum distances between two elements (in a cross section) to be considered as adjoining. Vertical Search Distance specifies the distance above and below the cross-section to look for elements pertaining to that cross-section. Baseline specifies the GEOPAK COGO chain the cross-sections are based from. Begin/End Station specifies the beginning and ending stations to perform the earthwork calculations.



SOIL TYPES

The **Soil Types** dialog requires the user to define the symbology and shrinkage/swell factors to be used.



The user must first select the **Class** of the soil type.

Existing Ground	Identifies the surface of the existing ground. This classification is required to calculate earthwork. It also defines the default excavation material.
Proposed Finish Grade	Surface of the proposed roadway. This classification is required to calculate earthwork and defines the default fill material.
Existing Suitable	Material between excavation limits that is to be removed only when it encroaches on the proposed design. For example, if the proposed design is in fill, therefore above the existing suitable, it is not removed.
Existing Unsuitable	Material between excavation limits that is to be removed in all circumstances.
Proposed Undercut	Proposed layers that are not part of the finish grade, i.e. pavement layers, shoulder layers.
Excavation Limit	Pairs of vertical lines drawn in the cross-sections to demarcate the limits of removal for any existing suitable or unsuitable material. Can also be used to isolate where the earthwork computations will take place.

Once the Classification is chosen, a Soil Type, the element symbology of the material, and the shrinkage/swell factors need to be entered. A Classification, except Existing Ground, can be listed multiple times. The Soil Type determines how the cut and fill are calculated. For example, a user creates an earthwork run with a classification of Existing Ground with a soil type of Existing, classification of Proposed Finish Grade with a soil type of Suitable_Grading, and a classification of Proposed Undercut with a soil type of Pavement. The output from the run would look as follows.

Material Name	End Areas	Unadjusted	Adjusted	Mult	Mass
Station		Volumes	Volumes	Factor	Ordinate
	(square	(cubic	(cubic		
	ft)	ft)	ft)		

```

-----
287+00
SUITABLE_GRADING
Excavation      0.00      0          0          1.00
Fill            12.32     336        336        1.00  2887
EXISTING
Excavation      25.88     654        654        1.00
Fill            0.00      0          0          1.00  3541
    
```

In the same example, if both classifications of Existing Ground and Proposed Finish Grade had the soil type of Suitable_Grading, then the output would look as follows.

Material Name	End Areas	Unadjusted	Adjusted	Mult	Mass
Station	(square	Volumes	Volumes	Factor	Ordinate
	ft)	(cubic	(cubic		
	ft)	ft)	ft)		

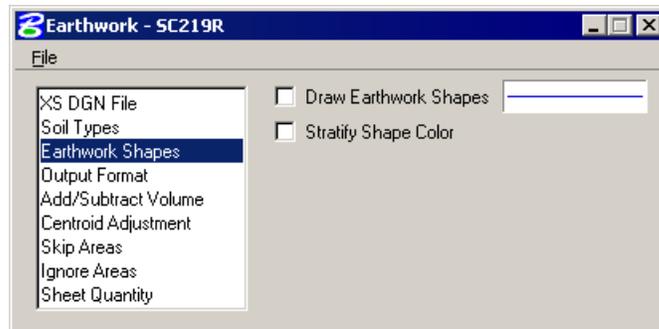
287+00					
SUITABLE_GRADING					
Excavation	25.88	654	654	1.00	
Fill	12.32	336	336	1.00	3541

As can be seen from the above examples, when the soil types for the Existing Ground and Proposed Finish Grade classifications were named differently, both soil types appeared in the output. When the soil types for the Existing Ground and Proposed Finish Grade classifications were named the same, the quantities for each classification were combined into one soil type. By paying close attention to the soil types, the user can specify when material can be re-used and exactly where a specific soil type should be placed.

Once the Classification and Soil Type are chosen, the user can select the Element Symbology to define that particular Soil Type and the Multiplication Factors for the Soil Type. The Match button can be used to select the Element Symbology. Once the Match button is selected, the user can select the elements in the MicroStation view. The symbology of that element will be added to the symbology list used to define the Soil Type.

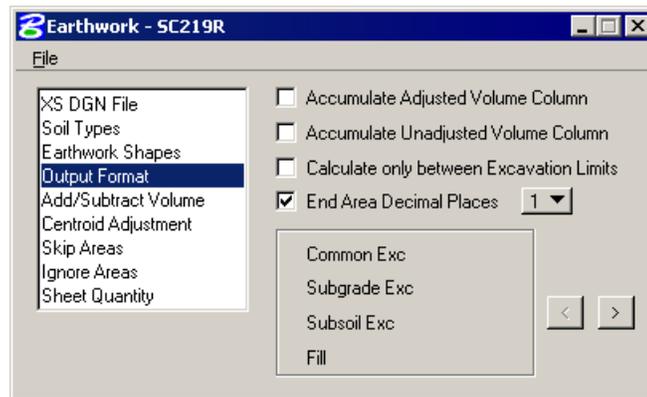
EW SHAPES

EW Shapes enables the earthwork shapes to be drawn and the associated symbology. The colors of the earthwork shapes can be stratified, so that cut and fill or each soil type are different.



OUTPUT FORMAT

Output Format enables the user to specify which items to show in the earthwork report.



An option within the Output Format dialog is **Accumulate Adjusted Volume Column**. When activated, an additional column is added to the earthwork report, where the adjusted volume of each excavation and fill for each material is cumulatively totaled. Note this toggle may be activated simultaneously with the **Accumulate Unadjusted Volume Column**, in which case, two columns are added to the report.

Another option within this dialog is **Calculate Only Between Excavation Limits**. In this case, the use of excavation limits is to demarcate earthwork processing. This is extremely useful in projects where earthwork is staged or separate quantities for each roadway in a multiple alignment is necessary. When the toggle is activated, ALL earthwork calculations are limited to within user-defined excavation limits, not just existing removals.

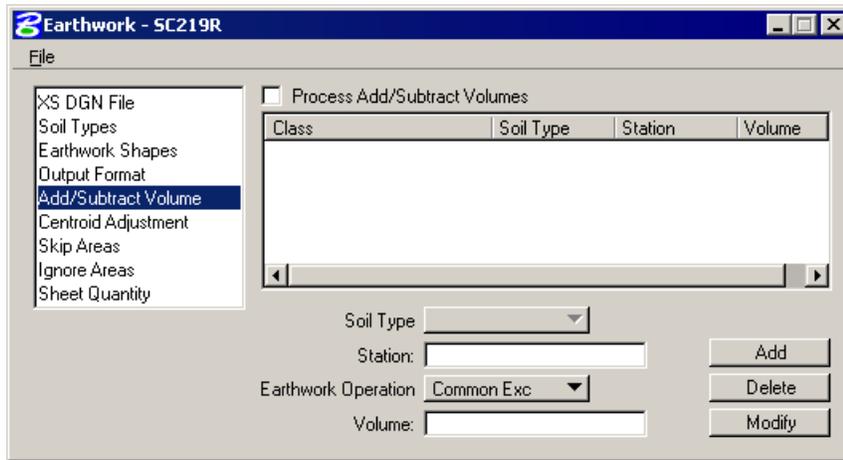
In normal processing, the end areas are rounded to two decimal places. If the user desires a different degree of rounding, the toggle may be activated and the Number of Decimal Places set between 0 and 4.

In the bottom box, any combination of the three classifications of excavation volumes can be formulated. For example, if the user desires to combine all three into an earthwork listing of simply cut and fill, press the < or > arrows until the desired option is displayed. Options include:

- Common Exc, Subgrade Exc, Subsoil Exc, and Fill
- Excavation (Common and Subgrade), Subsoil Exc, and Fill
- Excavation (Common and Subsoil), Subgrade Exc, and Fill
- Excavation (Subgrade and Subsoil), Common Exc, and Fill
- Excavation (all types) and Fill

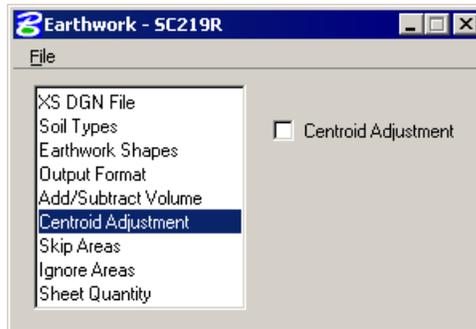
ADD/SUB VOLUMES

Add/Sub Volumes allows the user to enter volumes to be added or subtracted from the total earthwork calculated from the available sections. The user can specify whether to add excavation or fill, the soil type, the station, and the volume to be added.



CENTROID ADJUSTMENT

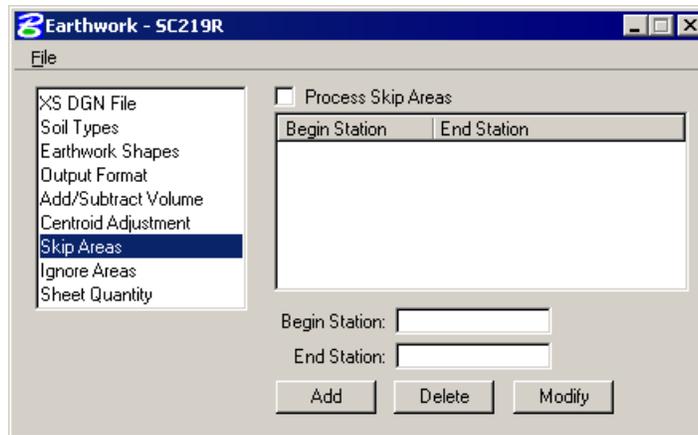
Earthwork volumes are calculated by averaging end areas and then multiplying these averaged areas by the distance between two successive cross sections as measured along the baseline. If the bulk of the cross section areas are located predominantly to either the left or the right of the baseline, as in a detour, an error occurs in the volume calculations for all non-tangential portions of the baseline. This error can be negligible or substantial depending on the degree of baseline curvature as well as the degree to which cross section areas are offset about the baseline. These types of errors can be optionally accounted for via specification of the Centroid Adjustment.



SKIP AREAS

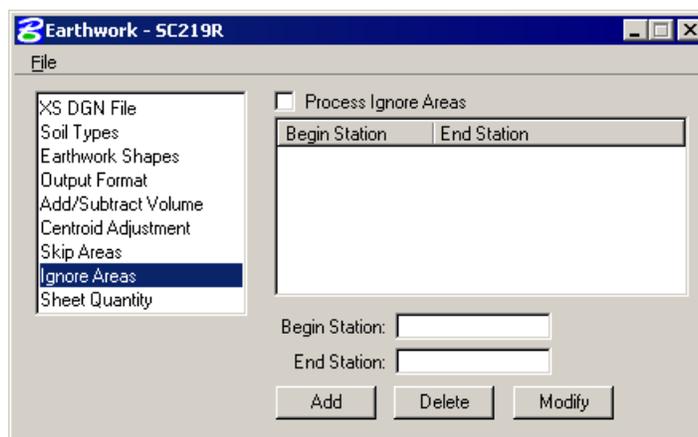
Skip Areas enable the user to specify an area (i.e. bridge exception) in which to not calculate earthwork volumes. End areas continue to be calculated for each cross section, but volume calculations are not performed between user specified station ranges.

To utilize Skip Areas, activate the toggle at the top of the dialog. Next, type in the **Begin Station** and **End Station** of the area to be skipped. If the baseline has station equations, the regions must be included. Then click **Add**. The data is added to the list box. To **Modify** data, highlight the line to be modified, which populates the edit fields. Change the desired value, then click **Modify**. The change is reflected in the list box. To delete a skip area, highlight the line to be deleted, then click **Delete**. The line is deleted from the list box.



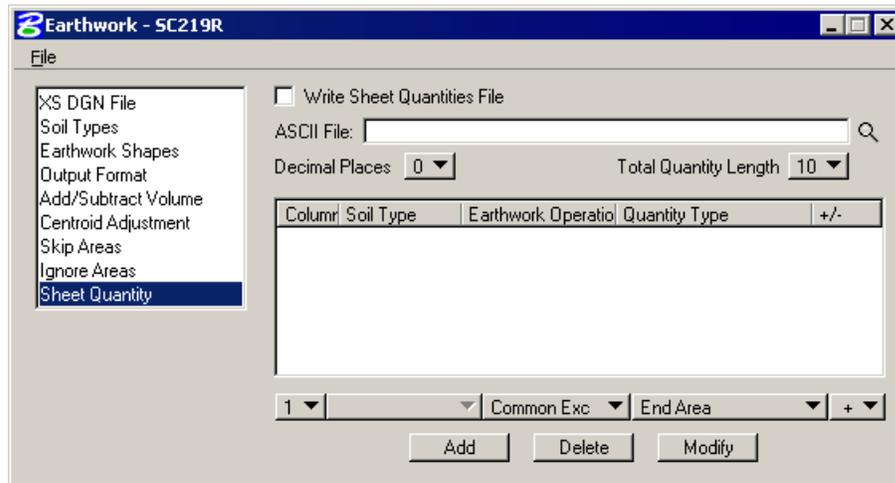
IGNORE AREAS

Ignore Areas enable the user to specify an area in which to ignore ranges of cross sections. To utilize Ignore Areas, activate the toggle at the top of the dialog. Next, type in the **Begin Station** and **End Station** of the area to be skipped. If the baseline has station equations, the regions must be included. Then click **Add**. The data is added to the list box. To **Modify** data, highlight the line to be modified, which populates the edit fields. Change the desired value, then click **Modify**. The change is reflected in the list box. To delete a skip area, highlight the line to be deleted, then click **Delete**. The line is deleted from the list box.



SHEET QUANTITIES

Sheet Quantities allows a user to write an earthwork quantity file to be used when plotting the cross-section sheets.



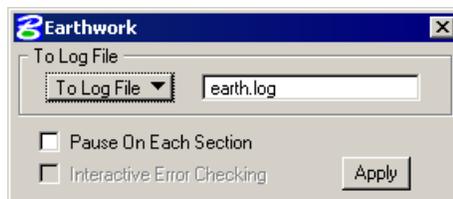
The name of the ASCII file can be chosen or entered. The user then selects the columns in which to place the quantity, the number of decimal places, the total column width, the soil type, the earthwork operation, and the type of quantity.

This information is written to the ASCII file, and can be used to plot the quantities on the cross-section sheets.

From the Files menu, the Run option processes all parameters that have been set in the Earthwork dialog box. The Save Settings option saves all information in the Earthwork dialog. The Export option saves the parameters in the Earthwork dialog box as an ASCII input file. The Exit option exits the Earthwork dialog.

PROCESSING

After all necessary information has been entered, the user has two options. The preferred method of running the earthwork is to select the Run option. The following dialog appears and the user may proceed by entering a log file name, choosing the Pause On Each Section option and then clicking Apply. The second method is to export the information as an ASCII input file, then use the Process Cross Sections tool.

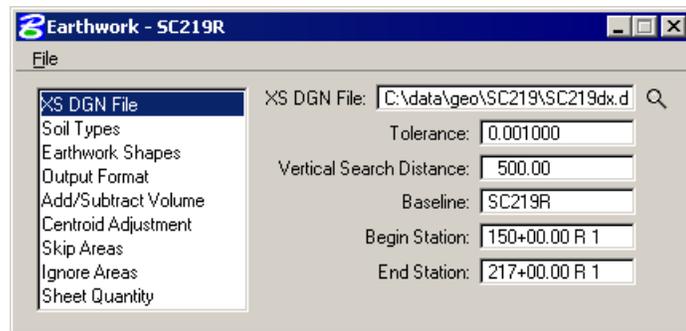
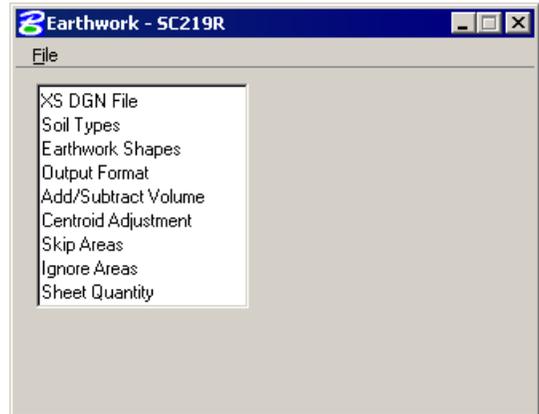


The earthwork quantities are written to the bottom of the log file and can be reviewed in any standard ASCII text editor.

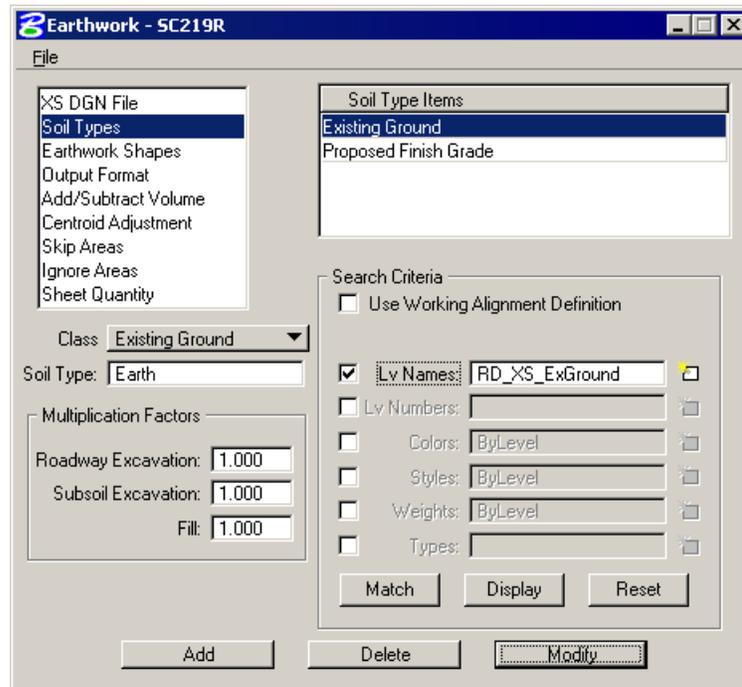
LAB EXERCISE : EARTHWORK

 **Basic Earthwork Computations**

1. Open the MicroStation file
c:\data\geo\sc219\sc219dx.dgn.
2. Access **Project Manager**.
3. Click **Earthwork** from the Project Manager dialog and create a new run named **SC219R**. Open the new run.
4. Populate the **XS DGN File** section of the dialog as shown below. **Be sure to set "Tolerance" to 0.001.**



5. In the **Soil Types** section of the dialog, create the following classifications and soil types utilizing the parameters detailed in the table below.

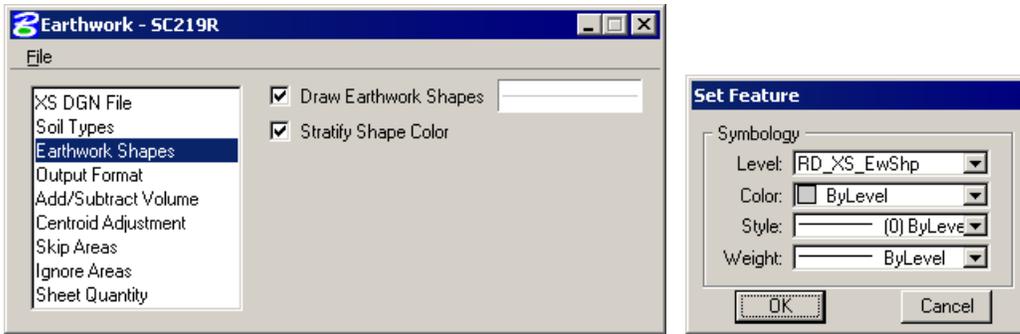


CLASS	SOIL TYPE	SEARCH CRITERIA
Existing Ground	Earth	Lv Names=RD_XS_ExGround
Proposed Finish Grade	Earth	Use Working Alignment Definition

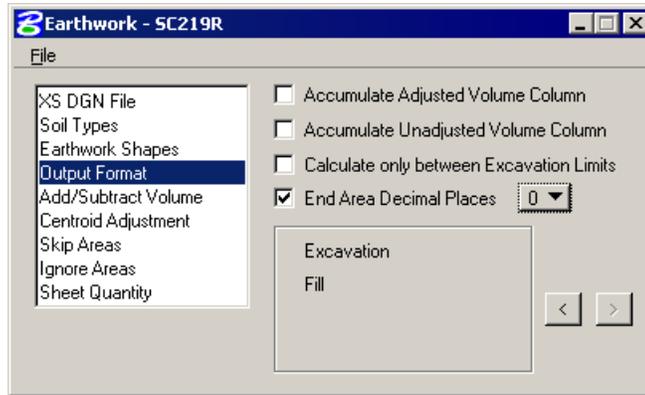
In our case, we are not using the Working Alignment Definition to define the symbology of the Existing Ground. We could manually define the symbologies using the settings in the Search Criteria portion of the dialog. When using these settings, there are also three additional buttons to help you.

Match	Prompts you to identify an element. Once you do, it will fill in the symbology settings with the symbology of the identified element.
Display	Highlights all elements in the design file matching the set symbology.
Reset	Clears all symbology settings.

- In the **EW Shapes** section of the dialog, toggle on **Draw Earthwork Shapes** and **Stratify Shape Color**. Populate the **GEOPAK Set Feature** dialog with the plot parameters as shown below then click **OK**.



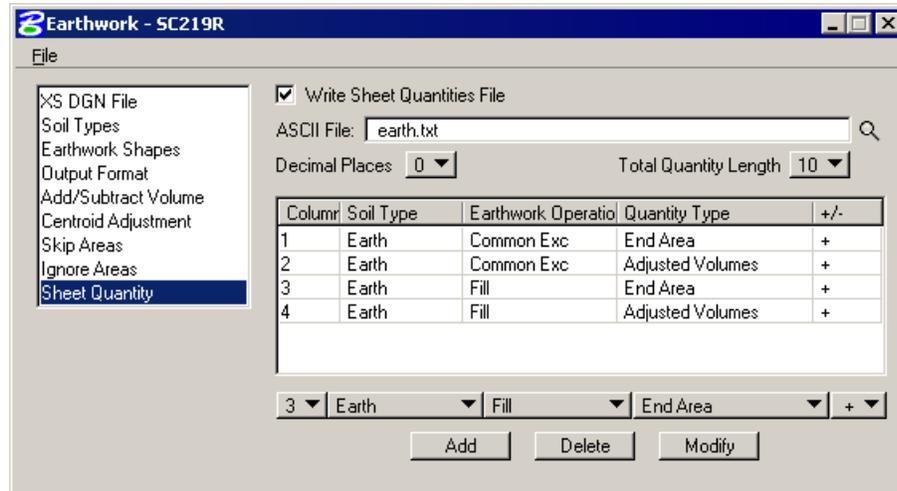
7. Change the **Output Format** as shown below.



Note Use the arrows (< or >) to change the format to **Excavation** and **Fill**.

8. In the **Sheet Quantities** section, toggle on the Write Sheet Quantities File. Name the file **earth.txt**. Add the following columns to the file with Decimal Places = 0 and Total Quantity Length = 10:

COL.	SOIL TYPE	EW OPERATION	QUANTITY TYPE	+/-
1	Earth	Common Exc	End Area	+
2	Earth	Common Exc	Adjusted Volumes	+
3	Earth	Fill	End Area	+
4	Earth	Fill	Adjusted Volumes	+



9. Select **Files > Save Setting** to save your input and then, using the **Files > Run** pulldown, run the earthwork for the proposed cross sections. Place your output into a log file as shown in the dialog below and **Pause on Each Section**.



10. Review the file **earth.log** using the GEOPAK editor.
11. Exit the Earthwork dialog and save your run.
12. Review your cross sections using XS Navigator. Notice that GEOPAK has placed shapes onto your cross sections representative of the calculated earthwork areas. These shape areas can be measured to verify earthwork areas if desired.



Cross Section Sheets

CHAPTER OBJECTIVES

In this chapter, you will learn the procedures for laying out cross section sheets.

INTRODUCTION

The GEOPAK sheet layout component provides an automated tool to draw cross section data in a format suitable for producing hard-copy cross section construction drawings. The input includes specifying sheet layout parameters as well as the graphic design file where the cross sections were originally created by GEOPAK. The output is a MicroStation design file of the cross sections. Each cross section is displayed as a reference file and labels such as baseline, station, offsets and elevation are added. There are several advantages to using sheet input:

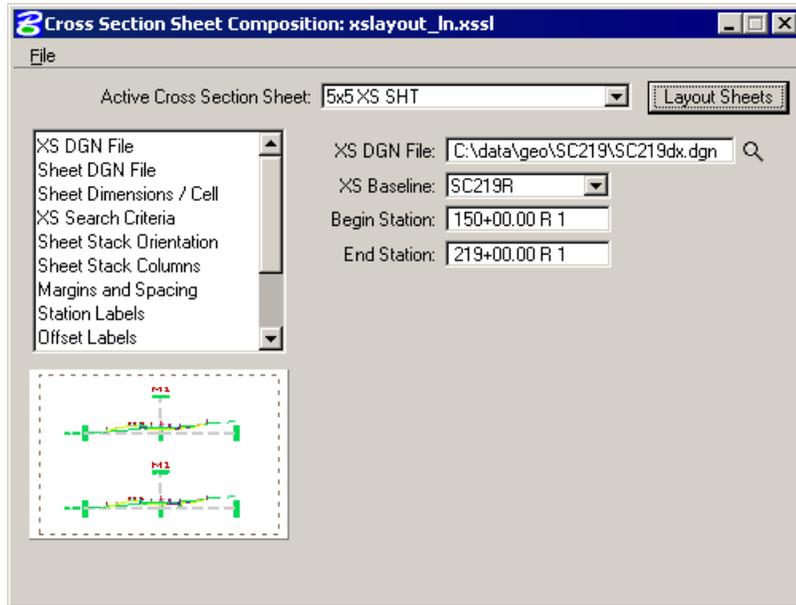
- The cross sections will be sorted in numeric order for the specified baseline.
- The cross sections will be spaced closer together.
- The original cross section file is left intact and any modifications to the cross sections will be automatically displayed in the sheet file due to the use of reference files.
- The cross sections are placed into "sheet format" according to user specified criteria.

The parameters for each sheet are defined in a Sheet Library. In order to lay out sheets, a Sheet Library must be attached to the current session. The name of the currently attached Sheet Library is shown in the title bar. Sheet Libraries have an extension of xssl. An unlimited number of different sheets can be stored within one library. When the user begins the sheet process, he selects the desired sheet layout from the attached library, which loads the associated parameters.

If a different Sheet Library is needed, it can be attached via the menu items File > Sheet Library > Attach. Detailed information on the set-up of the Sheet Library can be found in the online help section entitled "Sheet Library Set-up."

ACCESSING THE CROSS SECTION SHEET LAYOUT TOOL

The Cross Section Sheet tool can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Cross Section Sheet Composition. It can also be invoked from Project Manager by clicking the Cross Section Sheets button or by selecting the Cross Section Sheet Composition icon from the GEOPAK ROAD tool frame.



FILE > SHEET LIBRARY

TOOL	DESCRIPTION
New	Create a new Sheet Library.
Attach	Attach a Sheet Library.
Save	Saves a Sheet Library.
Save As	Save a Sheet Library as a new name.

FILE > SHEET

TOOL	DESCRIPTION
New	Create a new Sheet in a Sheet Library.
Delete	Delete a Sheet in a Sheet Library.
Update	Update a Sheet in a Sheet Library.

FILE > LOAD V7 INPUT FILE

This option gives the user the ability to load an ASCII input file that was created in previous versions of GEOPAK.

FILE > SAVE SETTINGS

Saves all dialog settings in Project Manager.

FILE > LAYOUT SHEETS

Layout cross sections into sheet format.

FILE > EXIT

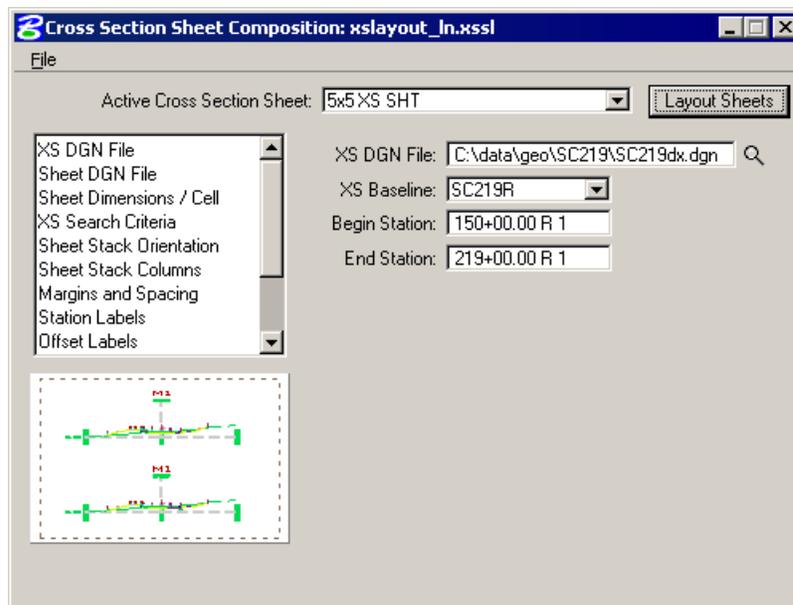
Exit the Cross Section Sheet Composition application.

CROSS SECTION SHEETS DIALOG

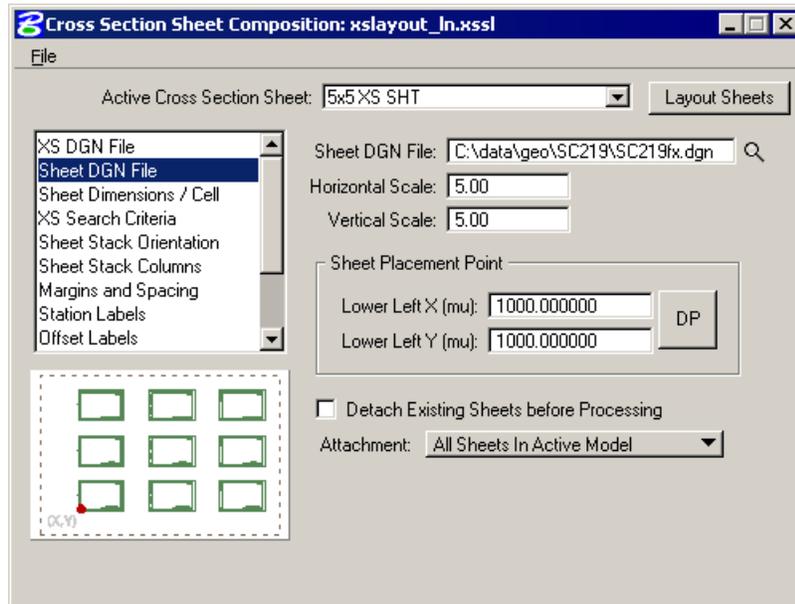
The left side of the dialog contains the list of parameters required to process cross sections into sheets. The slide bar to the right of the list box enables the user to view the entire list. When each parameter is selected, a graphic explanation of the parameter appears in the right side of the dialog, and keyin fields for each variable appear below it.

Active Cross Section Sheet - Settings for a variety of different cross section sheets can be stored in the cross section sheet library as standards. In this way, the same settings can be used for numerous projects by all users in the organization. To begin, the user would select the desired sheet layout from the list. If the cross section sheet library is not attached, it can be attached by selecting File > Sheet Library > Attach. The setting within the attached sheet library determined what selections are displayed in the Active Cross Section Sheet field.

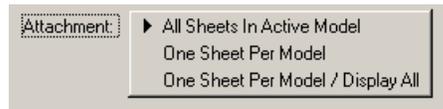
XS DGN File – Tells the software where to locate the cross sections. The chain and stationing will be filled out automatically if defined via the project manager. By default, the software will find all elements within the confines of the cross section cell.



Sheet DGN File - Specifies which file the cross section sheets will be placed in. Also allows you to set the horizontal and vertical scale at which they are to be laid out and the coordinate location in the MicroStation Design file at which the sheets will be placed.



If the **Detach Existing Sheets before Processing** option is toggled on then all elements are removed and reference files are detached before new sheets are processed.



Attachment:

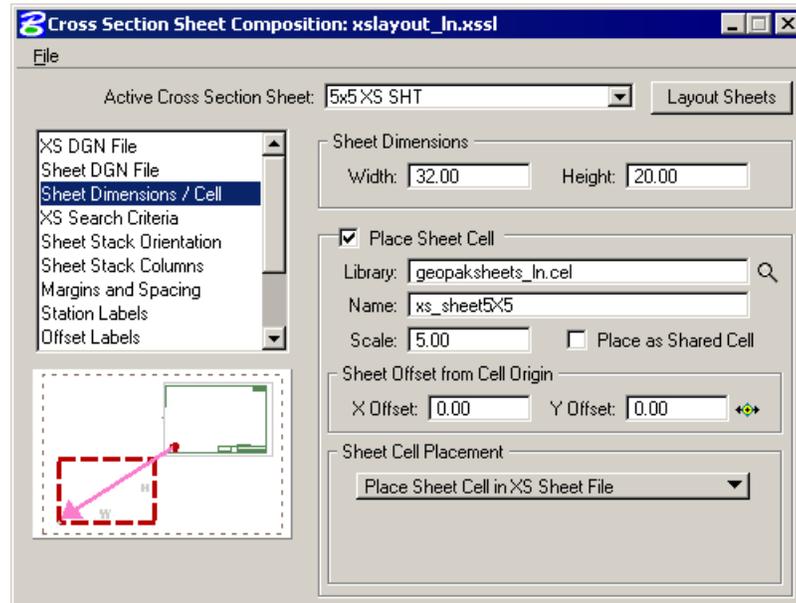
All Sheets In Active Model – All sheets are placed in the Active Model.

One Sheet Per Model – Sheets are placed in separate models and no sheets are placed in the active model.

One Sheet Per Model / Display All – Sheets are placed in separate models and all sheets are attached to the active model as reference files.

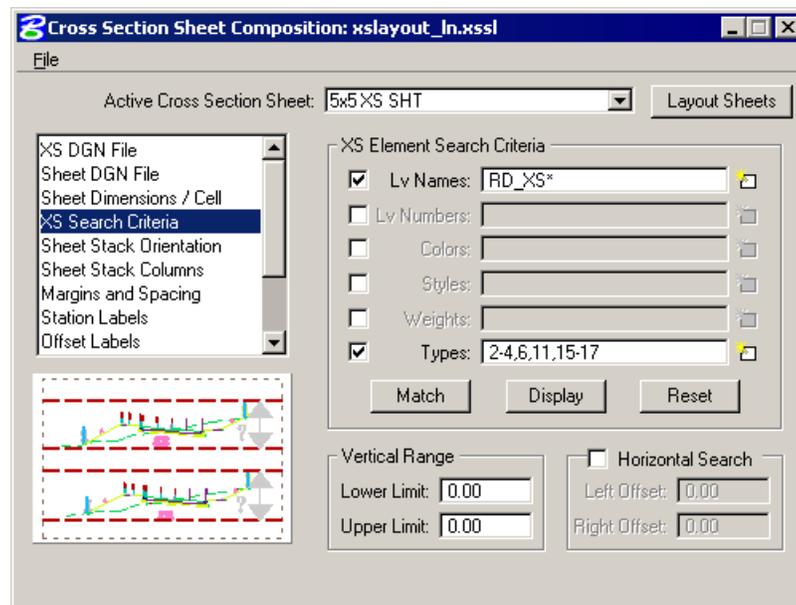
Note Models are named **XS_SHEET_** and the sheet number is added to the name.

Sheet Dimensions/Cell – Sheet Dimensions defines the Sheet Height and Sheet Width to be used for the cross section sheet. When Place Sheet Cell is toggled on, the application will place a sheet border cell from the specified cell library. A scale can be applied and the sheet cells can be placed as Shared Cells. Sheet Offset from Cell Origin is the X and Y offset from the sheet border cell origin.

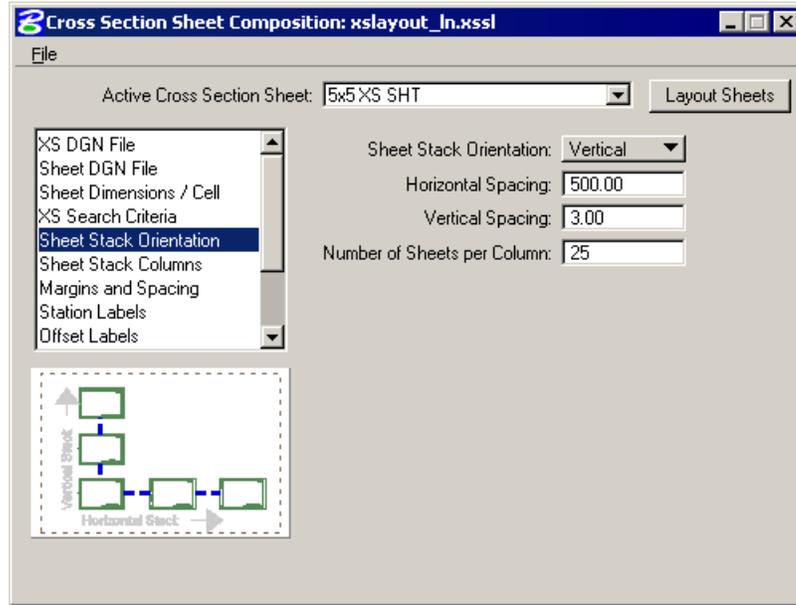


There are two options for **Sheet Cell Placement**. The sheet border cell can be placed in the sheet file with the cross section reference files as shown above. It can also be placed once in a reference file then the sheet cell file is attached to the file that contains the cross section reference files as many times as it is needed.

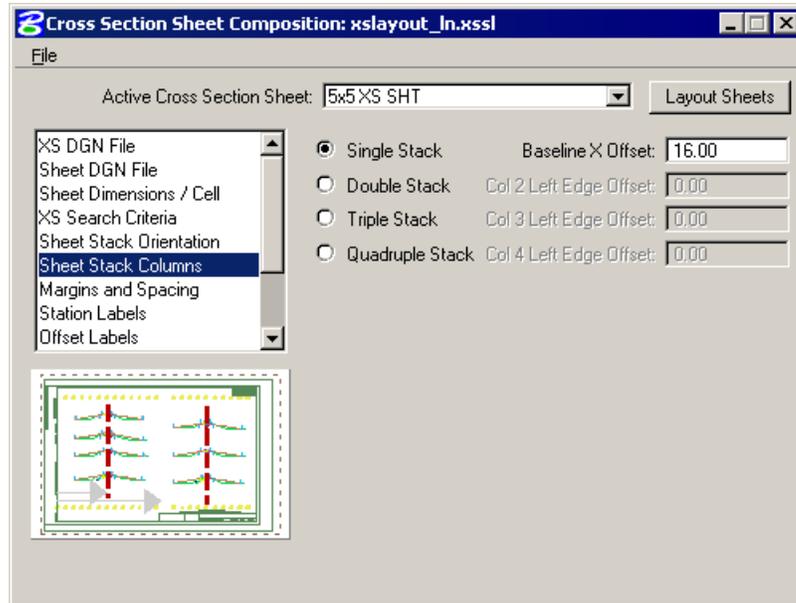
XS Search Criteria – Indicates the search criteria (symbology) for the data to be used as input to the sheet layout software. If you need to look farther than that (i.e. outside of the cell), you can use the Lower and Upper Range Limit values to extend beyond the cell limits. There is also a Horizontal Search to look outside the limits of Sheet Width setting.



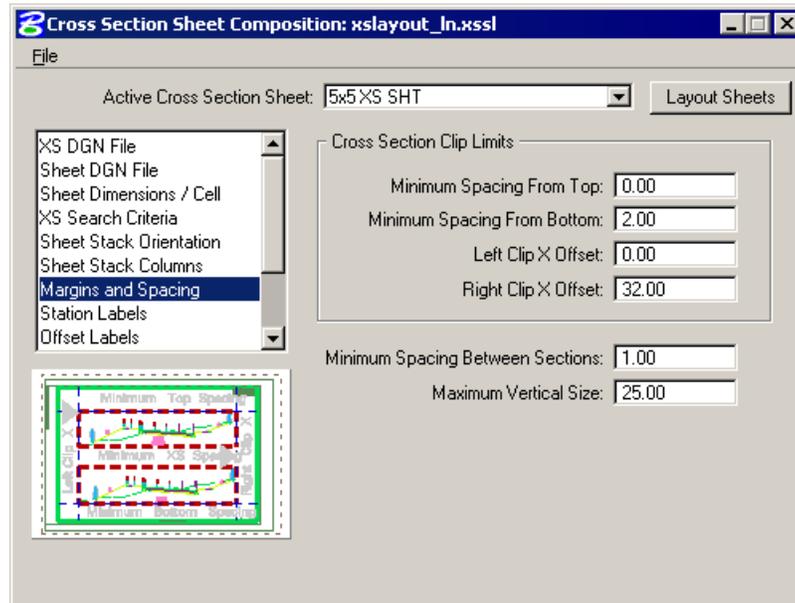
Sheet Stack Orientation – Determines whether you want the sheets to be stacked vertically or horizontally. Also allows you to set the maximum number of sheets you want placed per column in the file as well as the Horizontal and Vertical spacing between sheets.



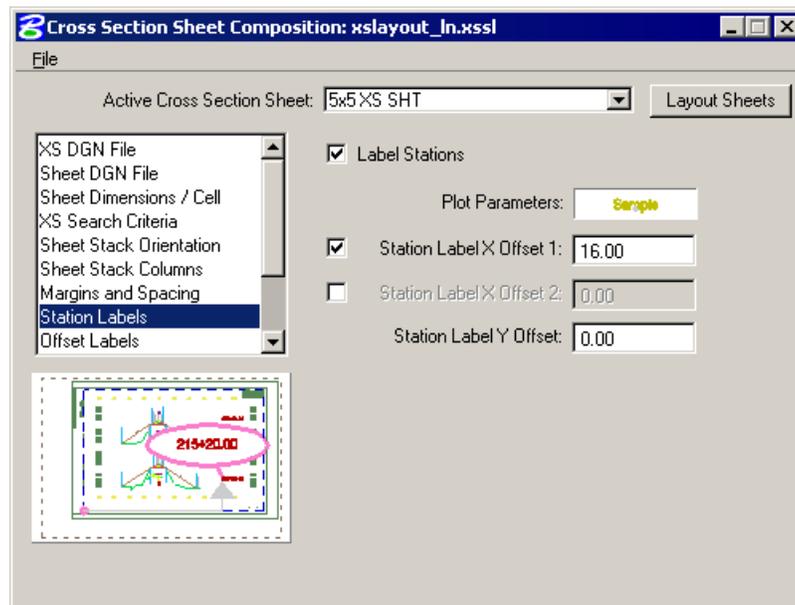
Sheet Stack Columns – Determines whether you want a single stack or a double stack of cross sections per sheet. Baseline X Offset defines the distance from the left-hand edge of the sheet to the zero offset position (i.e. baseline) of the cross sections. If you select Double Stack, you can give an offset value which is the distance of the second stack from the left hand edge of the sheet. There are also options for Triple and Quadruple stacking.



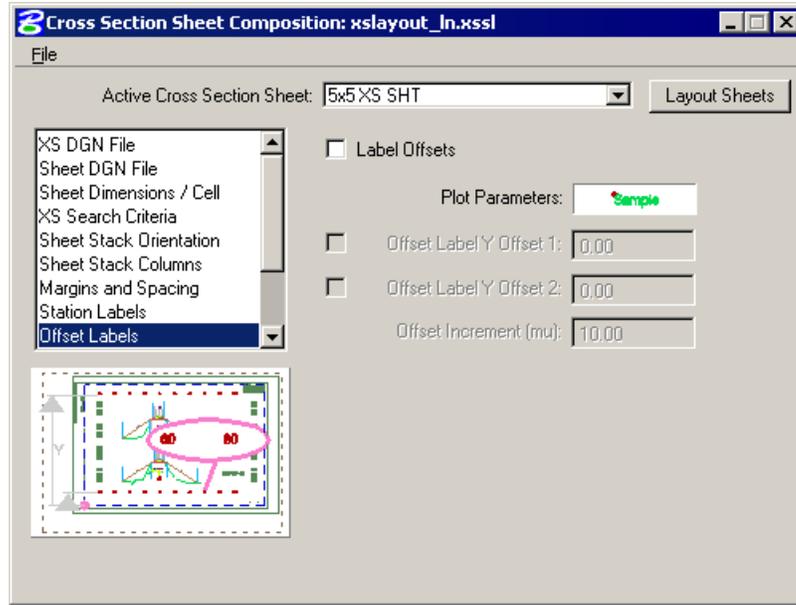
Margins and Spacing – Cross Section Clip Limits defines the clipping limits from the left hand edge of the sheet. To the left of the Left Clip X Offset remains clear space and to the right of the Right Clip X Offset remains clear space. All minimum spacing requirements as well as the maximum allowable vertical size of any cross section is also set here.



Station Labels – Allows you to define the station label locations and plot parameters.

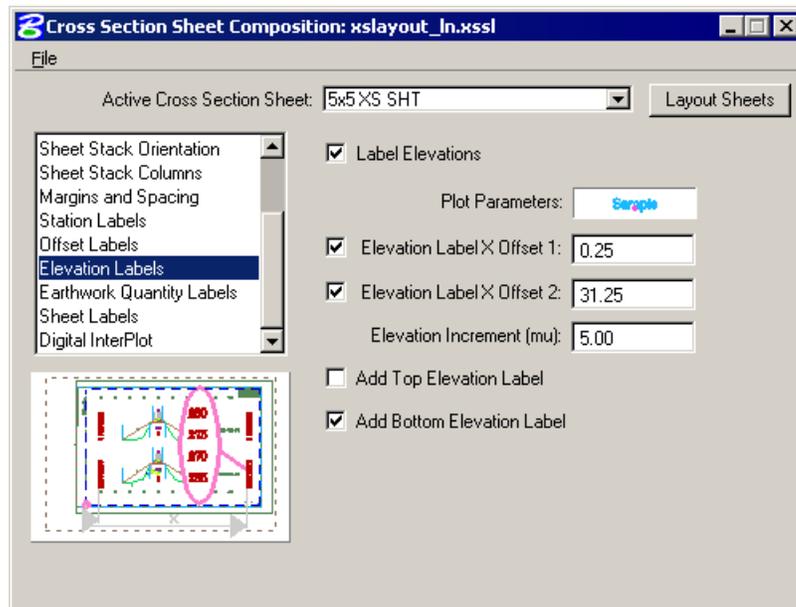


Offset Labels – Allows you to define the offset label positions, increments and plot parameters.

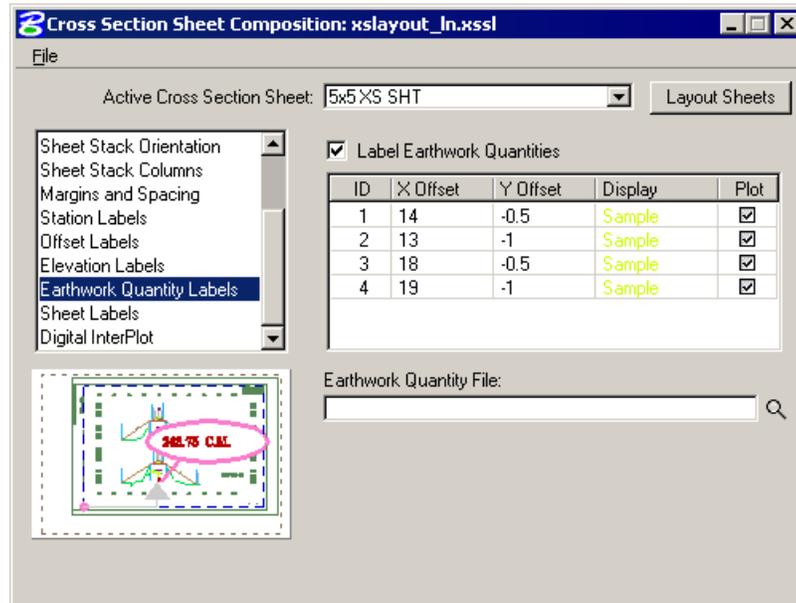


Elevation Labels – Allows you to control the elevation label locations, increment and plot parameters.
 Add Top Elevation Label - Activating this toggle adds another elevation label above the current labels placed within the elevation labels parameters. If two sets of elevations labels are placed (one on each side of the section), the top elevation is added to both.

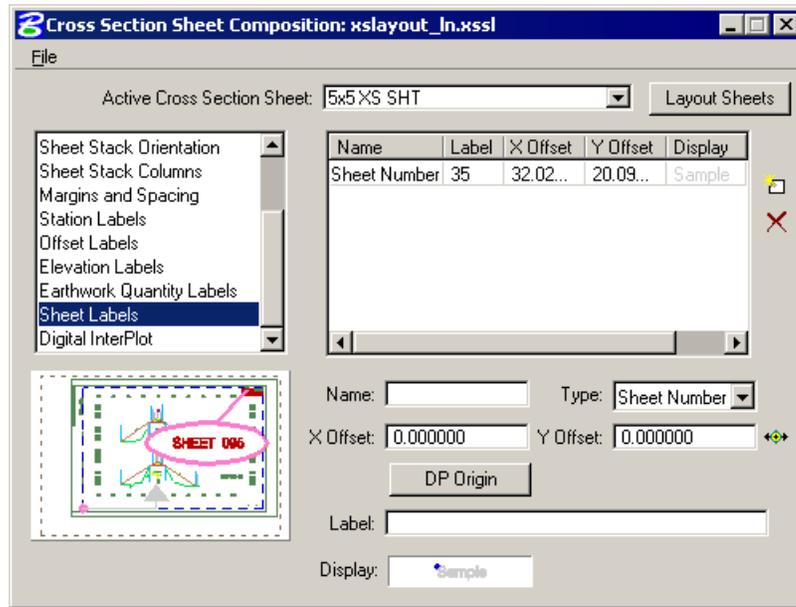
Add Bottom Elevation Label - Activating this toggle adds another elevation label below the single label placed within the elevation labels parameters. If two sets of elevations labels are placed (one on each side of the section), the bottom elevation is added to both.



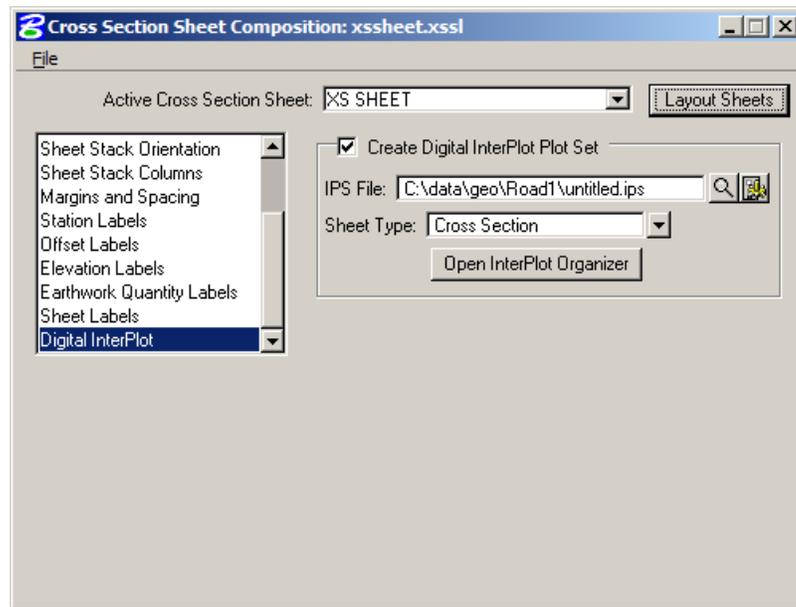
Earthwork Quantity Labels – The user can define the ASCII file that contains the earthwork quantity information, as well as set the symbology and location of the earthwork quantity labels. This will use the information gathered during the earthwork run to place the earthwork quantity labels on the cross section sheets.



Sheet Labels – Allows the placement of numerous labels. There are three sets of labels that can be placed where the labels change from sheet to sheet. These labels include Sheet Number, Begin Station, and End Station. Any number of custom labels can also be placed. These labels would be something that does not change from sheet to sheet such as Project Number, Designer, etc. A list of labels can be created and each label can have its own symbology. Location of the labels is controlled by the DP Origin and DP Label Justification Point buttons. The DP Origin button locates the origin of the sheet cell and the DP Label Justification Point button sets the X and Y Offset from the sheet cell origin for the placement of the label.



Digital InterPlot – Allows the creation of the Digital InterPlot Plot Set during the Layout Sheets process.



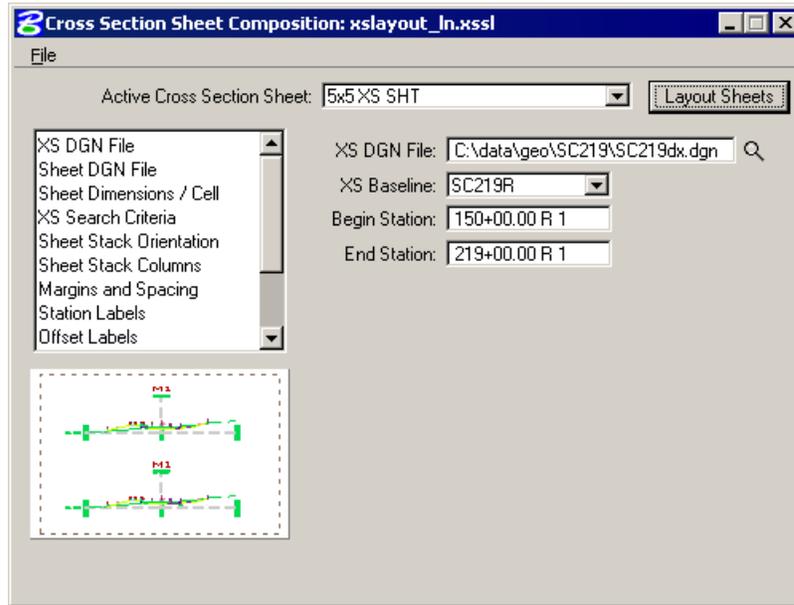
GENERATING SHEETS

From the **Files** menu, the **Layout Sheets** option will process all parameters that have been set in the **Cross Section Sheets** dialog box. There is also a **Layout Sheets** button on the main dialog.

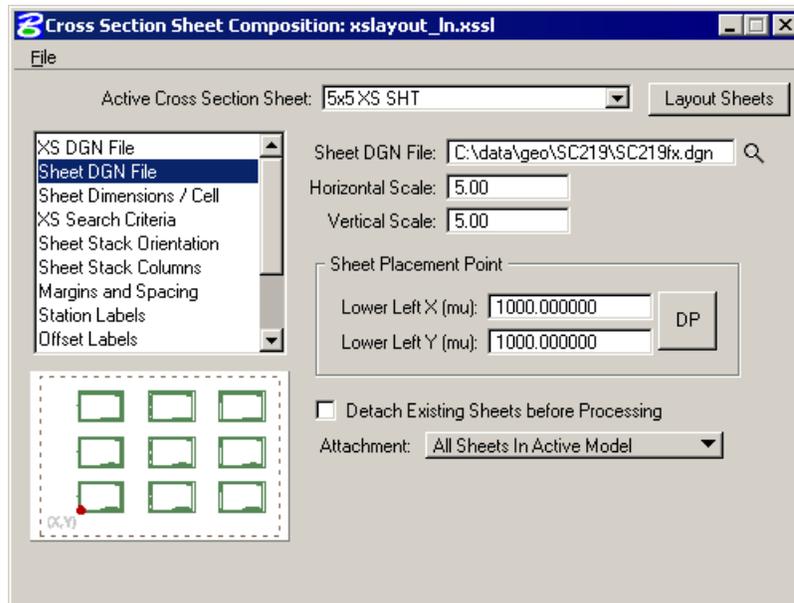
LAB EXERCISE: CROSS SECTION SHEETS LAYOUT

 **Generating Cross Section Sheets**

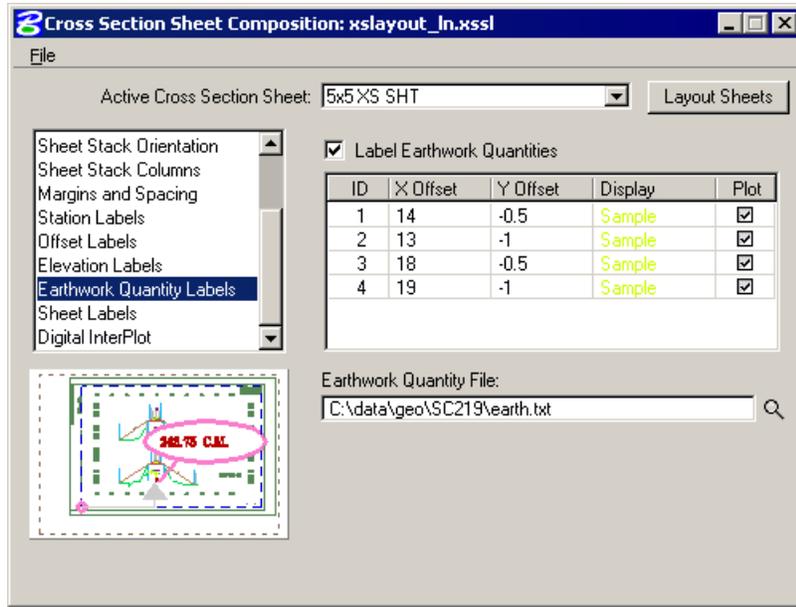
1. Open the MicroStation file *c:\data\geo\sc219dx.dgn*.
2. Access **Project Manager**.
3. Click **Cross Section Sheets** from the Project Manager dialog and create a new run named **SC219R**. Open the new run.



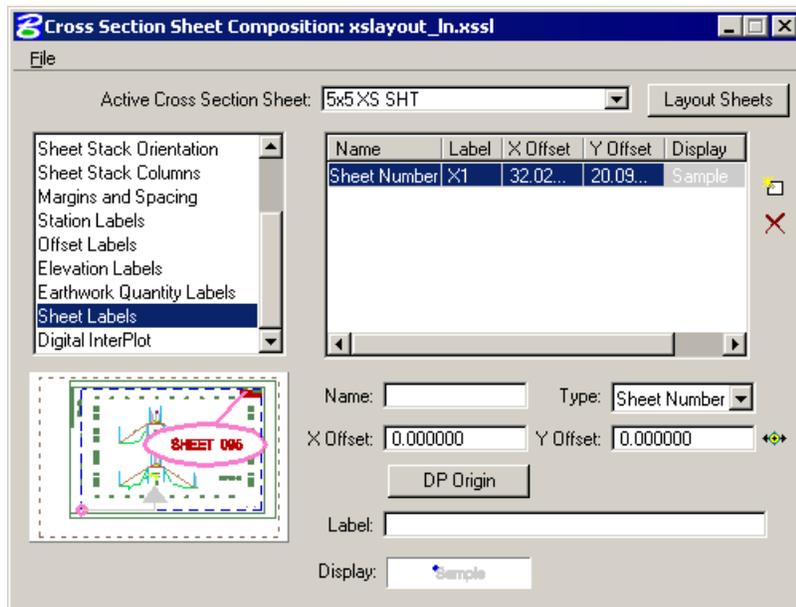
4. Click **Select Sheet DGN File** and select the sheet design file *sc219fx.dgn*.



5. Select **Earthwork Quantity Labels**. Click **Select Earthwork Data File** and select the **earth.txt** file created in the previous chapter.



6. Select **Sheet Labels**. Double click in the **Label** column to make it editable. Enter **X1** for the starting Sheet Number then tab out of the field.



7. Using MicroStation, turn off levels **Default** and **RD_XS_EwShp** then select **File > Save Settings**.
8. Process the cross sections onto the sheets using either the **File > Layout Sheets** pulldown or by clicking the **Layout Sheets** button.
9. Close the **Cross Section Sheet Composition** dialog.
10. When prompted to **Save Settings**, click **Yes**.

When the Cross Section Sheet Layout process is completed, you will be in the sheet file.
Review your work.

11. Exit MicroStation.







XS Reports & Limits of Construction

CHAPTER OBJECTIVE

In this chapter, we will create various cross section reports:

- for plan use (design elements and quantities).
- as input for other programs and/or applications of GEOPAK
- for construction layout

Create and draw construction limits in the plan view file.

INTRODUCTION

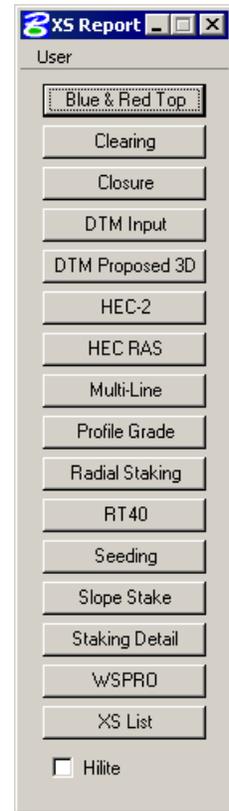
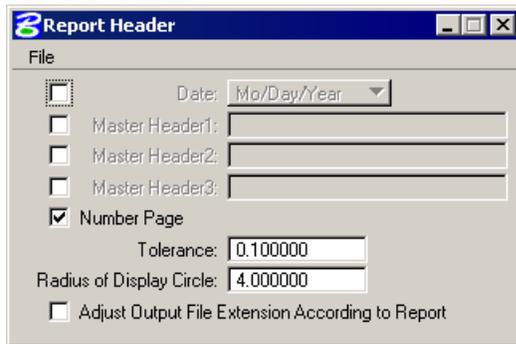
The GEOPAK Cross Section Report Utility can extract up to sixteen different reports from original and design cross-sections. For each report generated, the user must set the parameters of the existing and/or design cross sections. GEOPAK also provides an option to make custom headers for each of the reports via the User pull down menu.

ACCESSING CROSS SECTION REPORTS

The Cross Section Reports dialog can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Reports. It can also be invoked from Project Manager by clicking the Reports & XS Quantities button or by selecting Cross Section Reports from the GEOPAK ROAD tool frame.

CUSTOM HEADER

From the XS Report dialog, select **User > Preferences**. To activate the individual fields simply toggle on the box next to the desired field. Once you have completed the dialog box, the information will be saved as an .hdr file. This allows for the creation of a separate header for each type of report. The tolerance field determines the maximum gap allowed between cross section elements.



BLUE AND RED TOP

Based on the dialog box settings, GEOPAK determines the offset and elevation of a slope and its breakpoints. Blue refers to the top of pavement and Red is the top of subgrade. The user must determine this by indicating text and level, color, weight and style for each surface.

CLEARING

The Clearing Report is useful for obtaining clearing and grubbing quantities. For each station, GEOPAK will list the clearing distance on each side of the chain and the width of any exception. You can obtain the results in the appropriate units. Toggle boxes for Cut Slope Rounding, Additional Clearing in Cut and Fill, and Minimum Clearing Width are provided for increased control over the output.

GEOPAK can also generate quantity sub-totals based on the value specified in Sub Every.

To use the Except Width option, you must have an existing ASCII file that includes the Beginning and Ending Station and Exception Width.

Once everything is set, you can output the information to an ASCII file

CLOSURE

The **Closure Report** provides information on the intersection point between the user defined proposed finish grade and existing ground. In addition to the ASCII report, the designer may instruct GEOPAK to close any gap either by drawing a vertical line between the endpoint of the proposed finish element

and the existing ground or extending the slope of the last proposed element to intersect existing ground. The procedure will not extend existing ground. The **Closure Report** can be accessed within any MicroStation cross section file by selecting Closure from the main XS Reports dialog.

DTM INPUT

This process generates XYZ coordinates from cross section elements and places this information into an ASCII file for use by the DTM portion of GEOPAK. To use this dialog box simply enter the .gpk job number, chain name and station range. GEOPAK will read the cross section elements based on level, weight, color and style.

DTM PROPOSED 3D

This report is similar to DTM Input except that you can set both original and proposed cross sections at the same time. This report also differs in that it makes break lines across the cross sections.

HEC – 2

This process reads cross section elements and formats the information in an ASCII text file suitable for use in the HEC-2 hydraulic program.

HEC RAS

This process reads cross section elements and formats the information in an ASCII text file suitable for use in the HEC RAS hydraulic program.

MULTI-LINE

This report is useful in creating cross-sections for staged construction. Begin by entering the job number, chain name and station limits. Primary cross section element parameters must be completed before secondary element parameters. This is important due to the order in which GEOPAK reads the information. Once all the parameters have been entered, the new cross sections may be drawn to the design file or you may choose the display only option. An ASCII text file will be generated.

PROFILE GRADE

The **Profile Grade Report** is one of the most versatile reports available. It prints existing ground and design grade elevations and low point elevations for each cross section. Additionally, this report has the ability to search either for the low points or any text string that you specify and create horizontal and vertical alignments and store them directly into the .gpk. Horizontal alignments created from this report will have no curves.

RADIAL STAKING

The **Radial Staking Report** is a specialized report created for the U.S. Federal Highway Administration (FHWA).

RT 40

The RT 40 Report produces RDS based RT40 data. To use this dialog box simply fill in the job chain name, stationing range and the parameters of the cross section elements you wish to use.



SEEDING

Other than the usual entries, the user must enter the parameters of the elements to be seeded.

This dialog box includes slope and subtotal options as well as a way to limit the number of segments read (By-Pass Segments). The user may also establish additional seeding specifications (Additional Distance).

Once all of the settings are complete, the report will produce seed or sod quantities written to an ASCII output file for use in plan quantities.

SLOPE STAKE

The Slope Stake Report is a special format report developed for the FHWA. This report generates offsets, elevations and superelevation information for each cross section. To generate this report fill in the usual cross section parameters plus Subgrade and Hub Staking information. When complete, push Apply and the report is written into an ASCII file.

STAKING DETAIL

The Staking Detail Report determines the tie down point between the proposed finished grade and the existing ground. GEOPAK will list the right and left offset, elevation, and slope of the finish grade and superelevation rate for each cross section. To create this report, fill in the project information and desired cross section elements' parameters. Once complete, you have the choice between two formats, a FHWA ASCII report or a Montana DOT report (includes ditch elevations).

WSPRO

This report takes the cross section elements and turns them into an ASCII file for use as input in the WSPRO hydraulic analysis program.

XS LIST

This report creates a listing of elevations and offsets for each cross section element according to user defined parameters. You have the option of creating either an original cross section list or a design cross section list. These reports are very similar to RDS cross section lists.

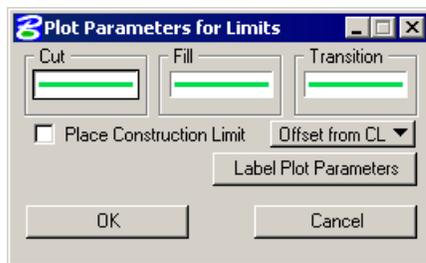
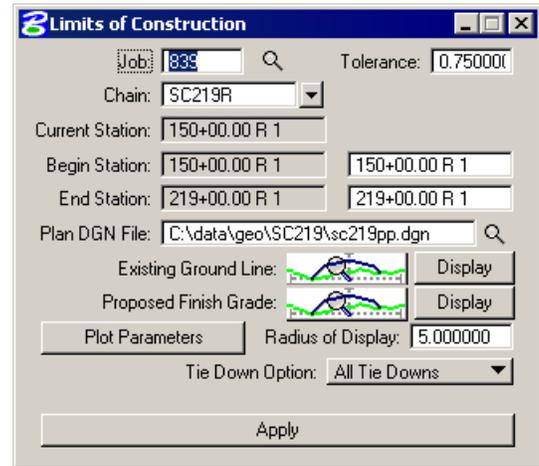
ACCESSING LIMITS OF CONSTRUCTION

The Limits Of Construction dialog can be accessed by selecting Applications > GEOPAK ROAD > Cross Sections > Limits Of Construction. It can also be invoked from Project Manager by clicking the Limits Of Construction button or by selecting the Limits Of Construction from the GEOPAK ROAD tool frame.

When the **Limits of Construction** dialog is invoked, the dialog to the right opens.

The user must specify the Job number, the chain name, and the file containing the plan view information. The **Existing Ground Line** and the **Proposed Finish Grade** sections will be filled by the run if Project Manager is utilized.

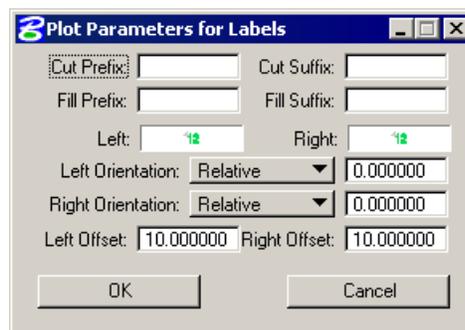
The **Plot Parameters** button opens the dialog below. The symbology for the cut, fill, and transition construction limits can be set in this dialog.



The **Place Construction Limit** toggle allows the user to place various text strings along the construction limits. Clicking the **Label Plot Parameters** button sets the symbology for these text strings.

The **Radius of Display** field is the size of the display circle when GEOPAK is scanning the cross-sections.

The last option in the main **Limits of Construction** dialog is the **Tie Down Option**. There are two Tie Down Options. If the **All Tie Downs** option is set, all tie downs within a section are plotted. (I.e. wide medians, outer roadways, ramps, etc. may have tie downs in between the limits of the main roadway, and the outer roadway or ramp.) If the **Outer Tie Downs** option is selected, then only the outmost tie downs are plotted.

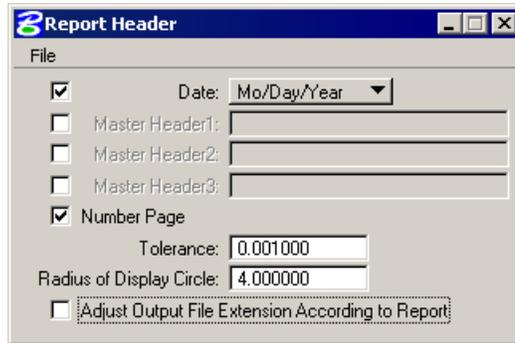


Once Apply is clicked, the limits of construction and the optional text are drawn into the plan view file at the specified symbology.

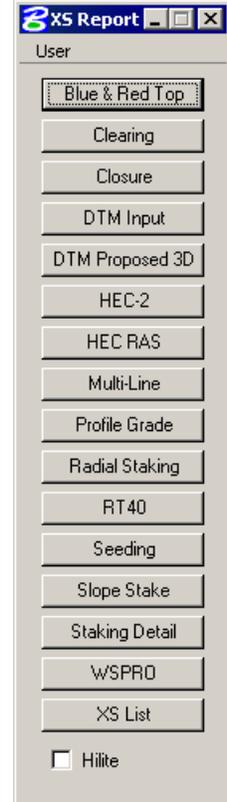
LAB EXERCISE: XS REPORTS & LIMITS OF CONSTRUCTION

Seeding Quantities

1. Open the MicroStation file `c:\data\geo\sc219\sc219dx.dgn`.
2. Access **Project Manager**.
3. Click the **Reports & XS Quantities** button on the main **Project Manager** dialog.
4. From the XS Reports dialog, select User > Preferences.
5. Set the **Tolerance** to **0.001** then close the **Report Header** dialog.

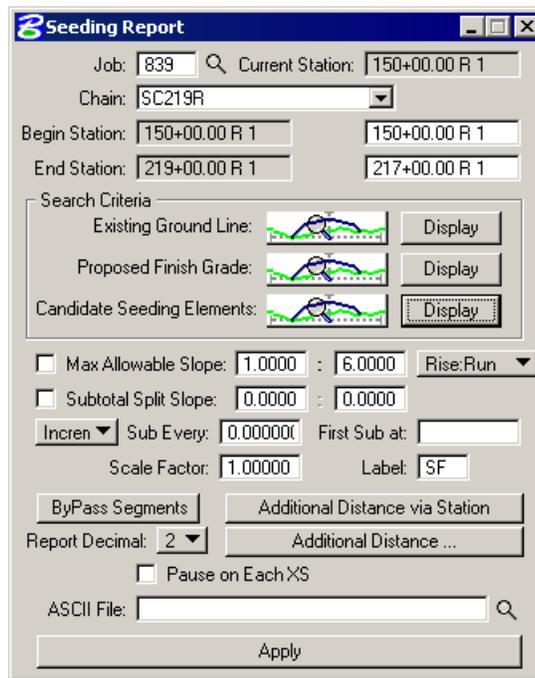


6. From the **XS Reports** dialog, select the **Seeding** report.

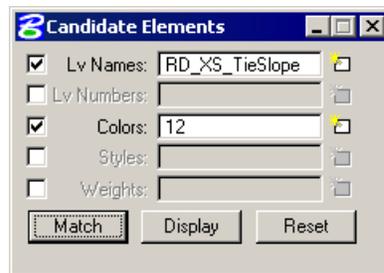


Note Most of the **Seeding Report** dialog will be populated from **Project Manager**.

7. Select **Chain SC219R**.
8. Set the **Ending Station** to 217+00.
9. Click **Candidate Seeding Elements** search criteria.



- Populate the **Candidate Elements** dialog as below then close the dialog.

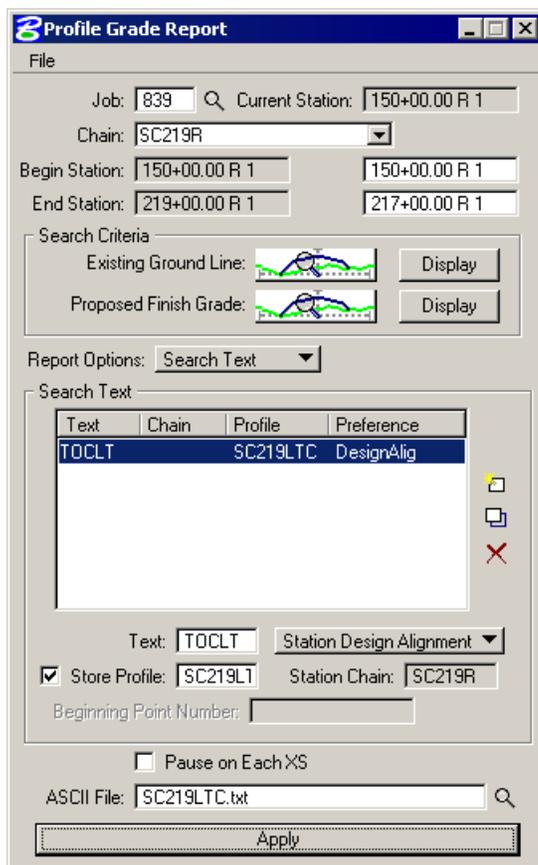


- Set the **ASCII File** name to **seeding.txt**.
- Click **Apply**.
- Using the **GEOPAK Editor**, review the report “**seeding.txt**”.
- Close the **Seeding Report** dialog.
- Close the **XS Report** dialog.

 **Top of Curb Profile**

The following report will read text placed on the cross sections to assist in generation of a top of curb profile.

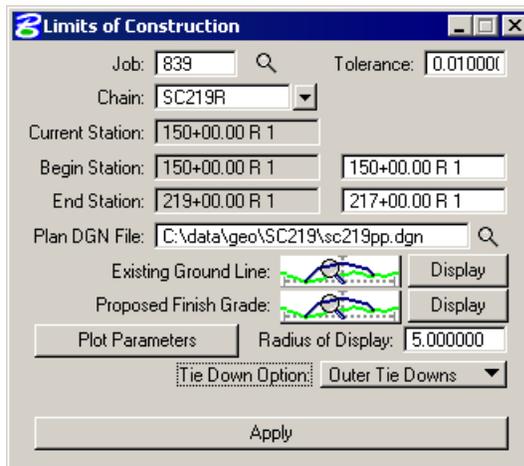
- Select the **Profile Grade** report from the XS Report menu.
- Zoom to a single cross section. Use the **Display** button for the proposed finished grade to check the levels defined for the Proposed Finished Grade. If necessary, add the symbology for the top and front of the curb and top of the pavement.
- Set the **Report Option** to Search text.
- Set the **Search Text** box as shown below.



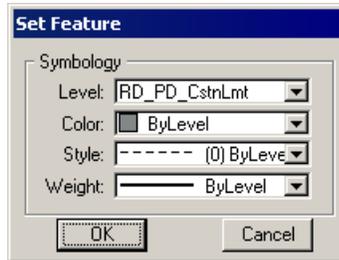
5. Set the **ASCII File** to SC219LTC.txt.
6. Click **Apply** to process profile for the left top of curb.
7. Open the COGO dialog to print the resulting profile information to the COGO window to review.

 **Plan View Limits of Construction**

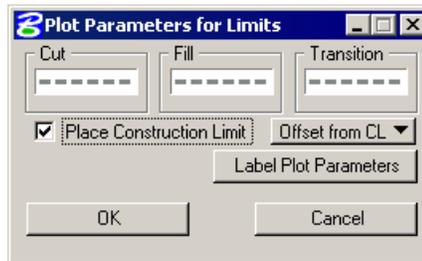
1. Click **Limits Of Construction** from the Project Manager dialog and create a new run named **SC219R**. Open the new run.



2. Zoom to a single cross section. Use the **Display** button for the proposed finished grade to check the levels defined for the Proposed Finished Grade. If necessary, add the symbology for the top and front of the curb and top of the pavement.
3. Click **Plot Parameters**.
4. Double click the **Cut** sample graphics.
5. Populate the **GEOPAK Set Feature** dialog as below then click **OK**.



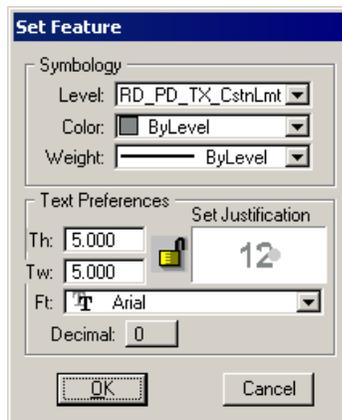
6. Right click the **Cut** sample graphics field and select Copy. Then right click the **Fill** and **Transition** graphics and select Paste.
9. On the Plot Parameters for Construction ... dialog, toggle on **Place Construction Limit** then click **Label Plot Parameters**.



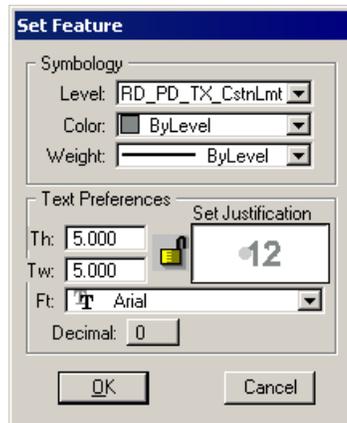
7. Populate the top portion of the **Plot Parameters for Labels** dialog as below.



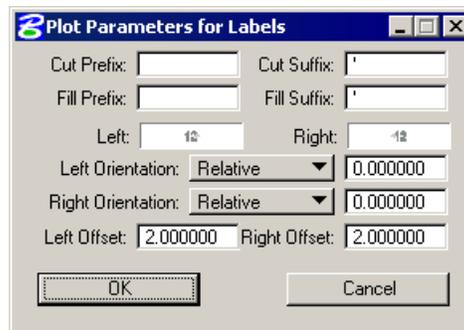
8. Double click the sample graphics box for the **Left** side labels.
9. Populate the **Set Feature** dialog as below then click **OK**.



10. Double click the sample graphics box for the **Right** labels.
11. Populate the **Set Feature** dialog as below then click **OK**.



12. Populate the lower portion of the **Plot Parameters for Labels** dialog as below then click **OK**.



13. Click **OK** on the **Plot Parameters for Construction ...** dialog.
14. On the **Limits of Construction** dialog, set the **Tolerance** to **0.01**
15. Click **Apply**.
16. Close the **Limits of Construction** dialog.
17. When prompted to **Save Settings**, click **Yes**.
18. Review the limits of construction in **c:\data\geo\road1\plan.dgn**.
19. Exit MicroStation.



Labeling

CHAPTER OBJECTIVES

In this chapter we will:

- Learn how to label plan information with Plan View Labeler.
- Familiarize the user with the Cross Section Labeler.

INTRODUCTION

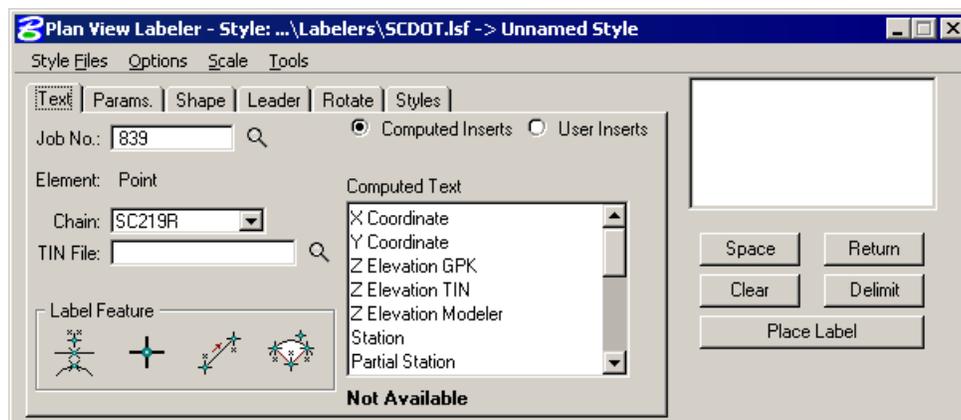
GEOPAK's labeling tools allow a user to place "smart" labels in a MicroStation drawing. These labels have the ability to calculate XYZ coordinates, station, offset, direction, length, radius, degree of curvature, etc. of the associated element.

ACCESSING THE PLAN VIEW LABELER

The Plan View Labeler can be accessed by selecting Applications > GEOPAK ROAD > Plans Preparation > Plan View Labeling. It can also be invoked from Project Manager by clicking the Plan View Design button or by selecting the Plan View Labeling tool from the GEOPAK ROAD tool frame.

PLAN VIEW LABELING

When the Plan View Labeling icon is selected, the dialog depicted below is displayed.



The label to be placed is displayed in the box on the right side of the dialog as shown above. The Space button places a space in the label at the cursor position. The Return button starts a new line of text. The Clear button starts a new label. The Delimit button places a line above or below a line of text. The Place Label button attaches the label to the cursor for placement in the drawing.

The user can select the various tabs to define / modify the label appearance.

TEXT

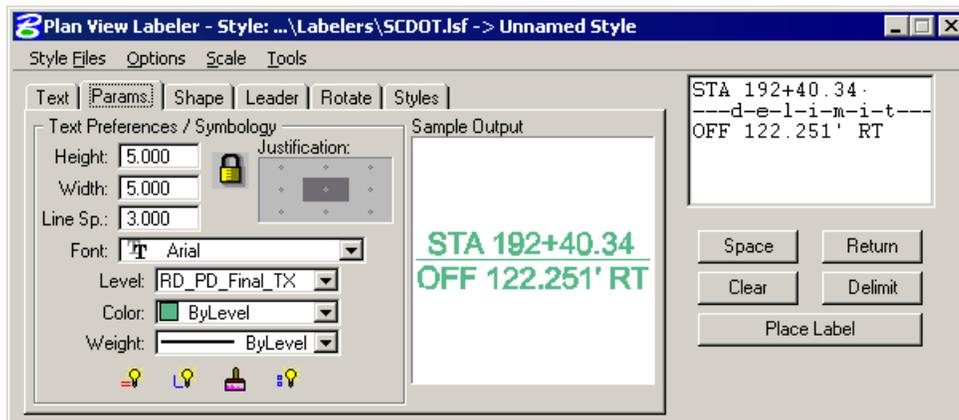
For data to be computed, the job number and the chain need to be selected. If elevations are to be calculated, a TIN file needs to be chosen.

The Computed Inserts are items that Geopak has the ability to calculate for the chosen item. The list of Computed Inserts changes with the type of element that is chosen. If a line is chosen, the list of Computed Inserts will show inserts of bearing, and length. If a curve is chosen the list of Computed Inserts will change to show inserts of radius, curvature, chord length, etc.

The User Inserts are inserts that a user may use on a regular basis. This list can be customized for a specific user's needs.

The Identify Element button allows the user to choose the element to use for calculations in the label. The Data Point button will let the user pick a specific point to calculate the coordinates, station, or offset for.

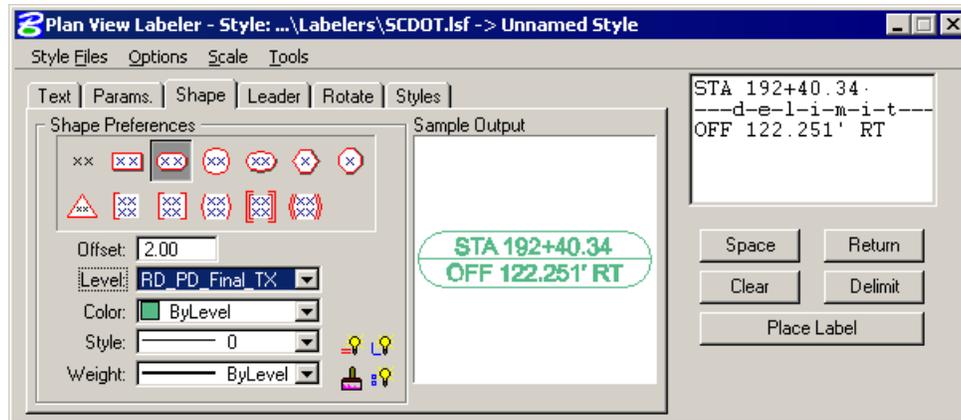
PARAMETERS



The **Parameters** tab enables the user set up the text size and symbology for the label.

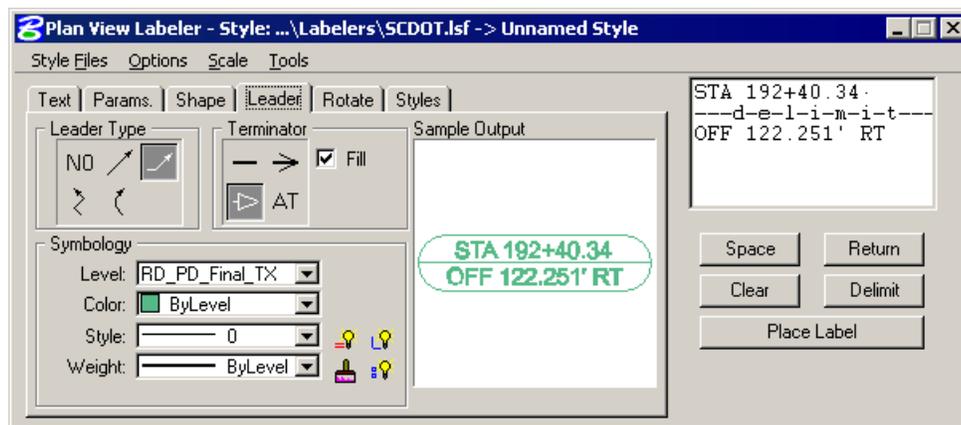
By Current sets the symbology to the current MicroStation settings. **By Element** allows the user to set the symbology by choosing a MicroStation element. **D & C Symbology** allows the user the ability to match symbology of an item in a DDB file. **Set All** sets the symbology for all elements in the label (text, delimiters, leader lines, etc.).

SHAPE



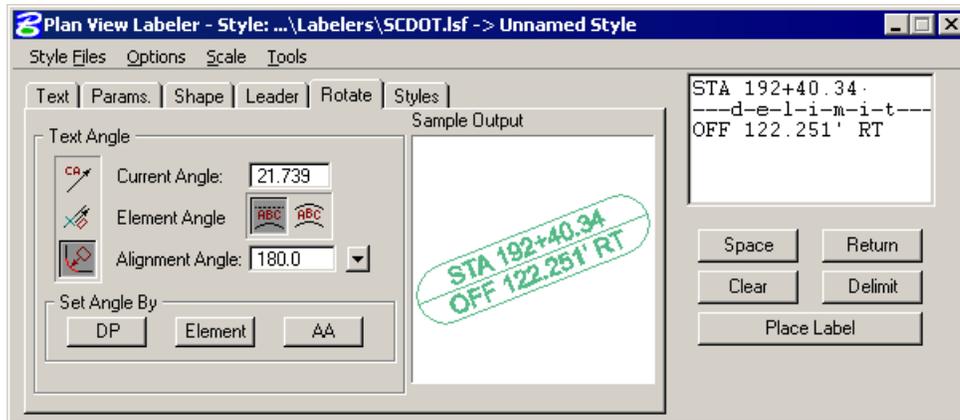
The Shape tab allows the user to place a shape around the label, and set the symbology for the shape.

LEADER



The Leader tab allows the user to attach a leader from the label to the point. Different leader types and terminators can be chosen. The active terminator can also be used.

ROTATE



The **Rotate** tab allows the label to be rotated. The rotation can be determined from the current angle, the angle of the element, or the alignment angle. The angle can also be set by two data points (first data point set the location, next data point sets the angle) or the active angle.

STYLES



The Styles tab allows a user to choose label symbology from a library of pre-defined styles. When the user chooses the style, all symbology, leaders, shapes, etc. is set up for the user.

MENUS

The Style Files menu allows the user to open a new style library. You must be under the **Styles** tab in order to open a style library.

Options > Minimize Dialog minimizes the main dialog (when the Place Label button on the main dialog is pressed) to allow for easier label placement. The Label Viewer can be used in conjunction to still view the sample contained in the Label dialog.

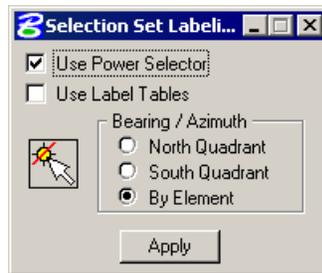
The main labeling window can be maximized by selecting the **Restore Label Dialog** icon within the appropriate View Label Control tool frame or the labeling tool on the main Road, Site, or Drainage tool frame.

Tools > Label Updater - The Label Update tool is a powerful tool for updating GEOPAK labels. When alignments are updated, TIN files modified, labels moved, etc., GEOPAK "remembers" the computed text information utilized in the placement of the original label. Therefore, the software can update the label based on updated data. The tool utilizes the dialog depicted below.



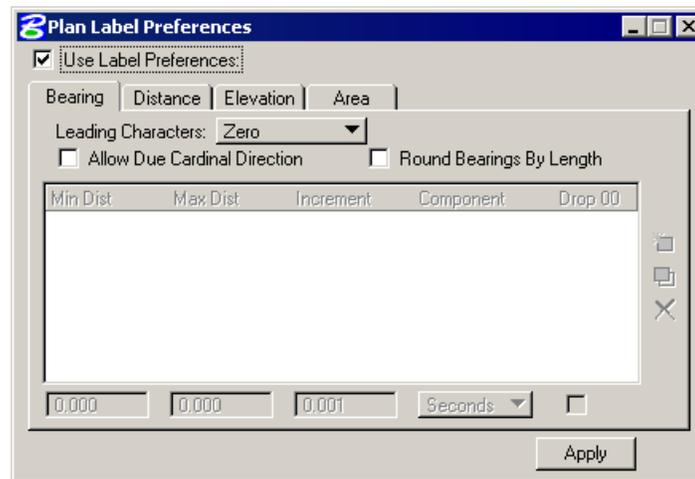
Tools > Selection Set Labeling - The Selection Set Label tool is a powerful tool for placing or updating labels within a selection set.

When the Selection Set Labeling tool is activated from the pulldown menu, the dialog depicted below opens.



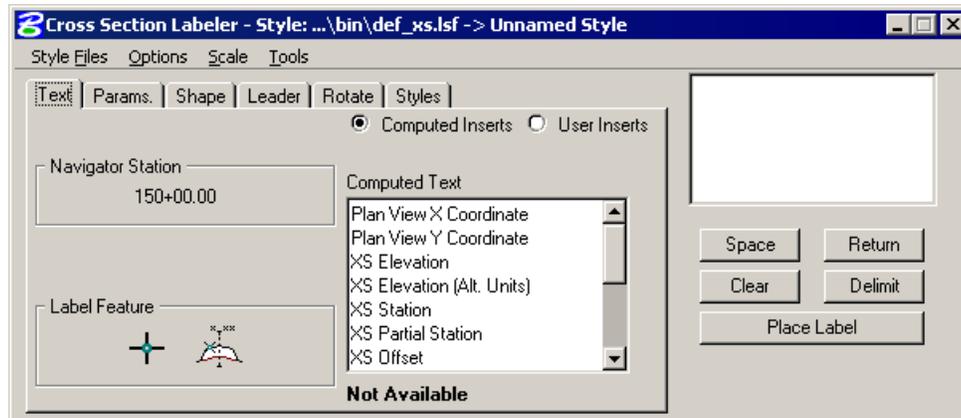
Tools > Plan Label Preferences – Allows for the customization of the plan view labels. Options include Bearing, Distance, Elevation, and Area.

When the Plan Label Preferences tool is activated from the pulldown menu, the dialog depicted below opens.



CROSS SECTION LABELING

The Cross Section Labeling dialog differs from the Plan View Labeling dialog only on the text tab. Cross Section Labeling works with the Cross Section Navigator. The current Cross Section Navigator station is shown on the Text tab. The Computed and User Inserts contain values and phrases related to cross-sections.

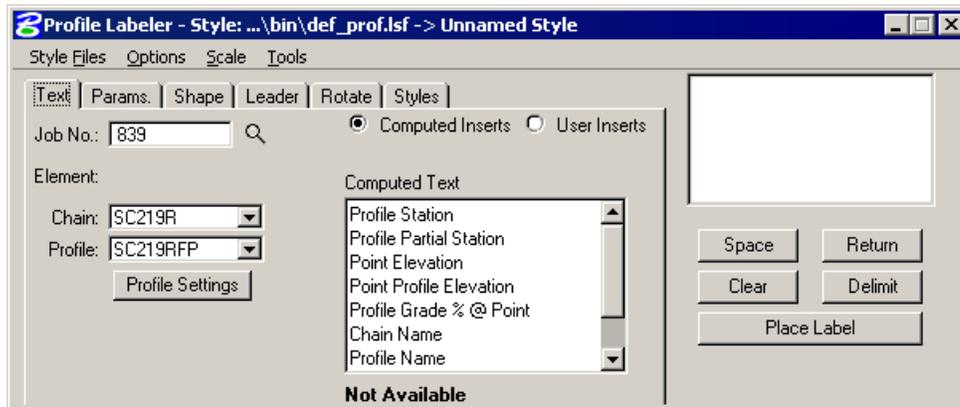


ACCESSING THE CROSS SECTION VIEW LABELER

The **Cross Section View Labeler** can be accessed by selecting **Applications > GEOPAK ROAD > Cross Sections > Cross Section Labeling**. It can also be invoked by selecting the **Cross Section Labeling** icon from the **GEOPAK ROAD** tool frame.

PROFILE LABELING

The **Profile Labeling** dialog differs from the **Plan View Labeling** dialog only on the text tab. The Chain and Profile must be defined, in addition to profile settings. The **Computed** and **User Inserts** contain values and phrases related to profiles.



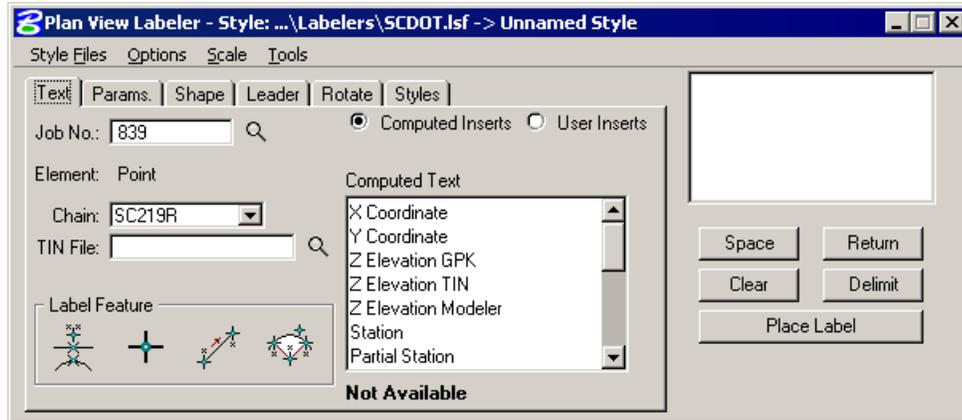
ACCESSING THE PROFILE VIEW LABELER

The Profile View Labeler can be accessed by selecting **Applications > GEOPAK ROAD > Plans Preparation > Profile Labeling**. It can also be invoked by selecting the Profile Labeling icon from the **GEOPAK ROAD** tool frame.

LAB EXERCISE: LABELING

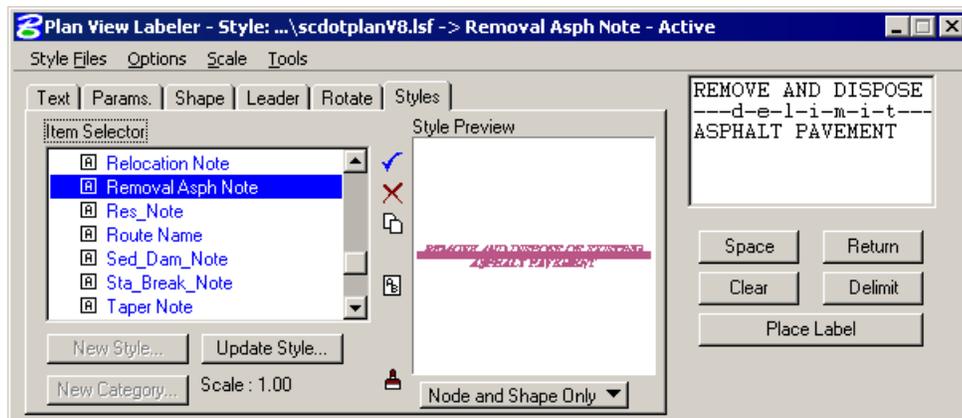
 **Accessing the Labeler**

1. Open the MicroStation file *c:\data\geo\sc219\sc219pp.dgn*.
2. Access **Project Manager**.
3. Click the **Plan View Design** button on the main **Project Manager** dialog.
4. Attach *SC219proposed.dgn* as a reference file.
5. Zoom in to the end of the project
6. From the **Plan View Design** tool bar, click the **Plan View Labeler** tool.



 **Using Predefined Label Styles**

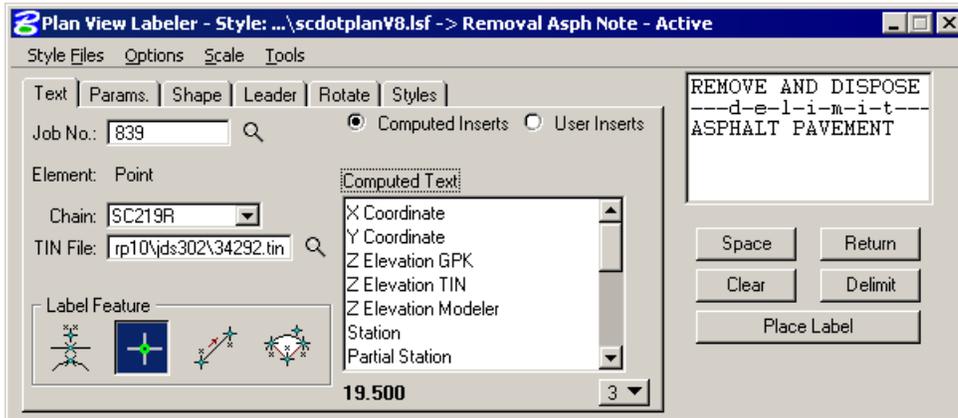
1. Select the **Styles** Tab.
2. Traverse with the Item Selector box to locate the following style: **Labels > Plan_Sht_Label > Removal Asph Note**. Next, double click the **Removal Asph Note** style.



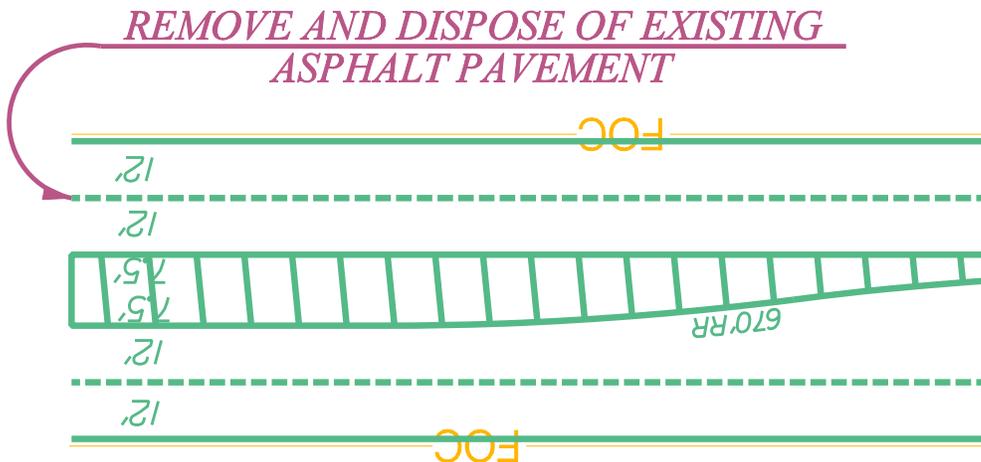
3. Move back to the Text tab and complete as defined below:

Job No.	839
Chain	SC219R
TIN File	SC219.tin

- To begin the process, select the **DP** button and then identify the location that you wish to use to anchor the end of the leader line for the note. The labeler automatically calculates the information.



- Click the **Place Label** button.
- The label is now attached to your cursor (without the leader for the delimiter).
- Data point at the location you wish the text to be located.
- A second data point will define the side of the label, which the leader line will be drawn from the delimiter line to the computed location.





Plan and Profile Sheets

CHAPTER OBJECTIVES

In this chapter you will learn the process for laying out and clipping plan and profiles sheets.

OVERVIEW OF FEATURES

These are the new features that the Plan and Profile Sheets Application provides:

- Supports any combination of Ports on a sheet for maximum flexibility.
- Provides powerful handling of MicroStation reference files. This is accomplished by having other MicroStation files serve as patterns for the reference file attachments. These are called motif files.
- It has the option to automatically make a notch in the clipping shape at layout time to make room on the sheet for a title block. This is done by putting the clipping shape pattern into the sheet cell.
- Extended Stationing is used as a means to allow sheets to be placed partially off of an alignment or even completely off of the alignment.
- It has the ability to place sheets with a Right to Left Station progression, which is opposite of the standard used in roadway design. This was added for users doing rail design.
- A thorough capability is provided to perform sheet numbering. Alphanumeric prefixes and suffixes as well as changing the start number of the sheets and rearranging the ordering.
- It supports Profile Stair Stepping. In situations with steep grades or narrow profile ports, sometimes the profile goes off the top or bottom of the port before it gets to the end of it. To handle this, users would put a break in the profile port and adjust the elevations to bring the coverage up or down to where it needs to be. Within V8, GEOPAK automatically locates these breaks and plots the profile clipping shapes in accordance with that. This adjustment carries through, then, to the sheet design file.
- Profile Gap Equalities -- If a Profile has been plotted with the Gap option turned on, the coverage of the sheet is now adjusted so that subsequent sheets remain aligned with the grid.
- Raster Manager -- Descartes is not supported by the application. Raster Files are now to be referenced via the Raster Manager application available via Bentley Select.
- Tabular Data Application -- Sheet Clip places Clipping Shapes suitable for Tabular Data. However, the actual placement of the tabular values in the dgn file is now done via the Draw Tabular Annotation (Sheet Clip Mode) tool. This approach allows the power and flexibility of the Draw Tabular Annotation application to be used with sheets.
- Digital InterPlot – The Digital InterPlot Plot set can be created during the sheet clipping process.

ACCESSING PLAN & PROFILE SHEET COMPOSITION

The Plan & Profile Sheet Composition tool can be accessed by selecting Applications > GEOPAK ROAD > Plans Preparation > Plan/Profile Sheet Composition. It can also be invoked from Project Manager by clicking the Plan & Profile Sheets button or by selecting the Plan/Profile Sheet Composition icon from the GEOPAK ROAD tool frame.

INVOKING THE MAIN DIALOG

When the Plan/Profile Sheet Composition tool is selected, the Plan Sheet Layout dialog depicted below opens.



The dialog is comprised of the title bar which displays the current Sheet Library, the main menu bar, short-cut icons, and the Sheet Name Selector and Plot Scale fields.

The first time the application is invoked, it opens up a default.psl sheet library located in the \geopak\bin\ folder if the configuration variable isn't defined.

The Plot Scale will be displayed in the proper units depending on how it is set in the User Preferences.

SHEET LIBRARY

The parameters for each sheet are defined in a Sheet Library. In order to lay out or clip sheets, a Sheet Library must be attached to the current session. The name of the currently attached Sheet Library is shown in the title bar. Sheet Libraries have an extension of .PSL. An unlimited number of different sheets can be stored within one library. When the user begins the sheet process, they select the desired sheet layout from the attached library, which loads the associated parameters.

If a different Sheet Library is needed, it can be attached via the menu items Sheet > Library > Attach. It is also possible to review or make changes to the Sheet Library by selecting Sheet > Library > Edit. Detailed information on the set-up of the Sheet Library can be found in the online help section entitled "Sheet Library Set-up."

MAIN MENU BAR OVERVIEW



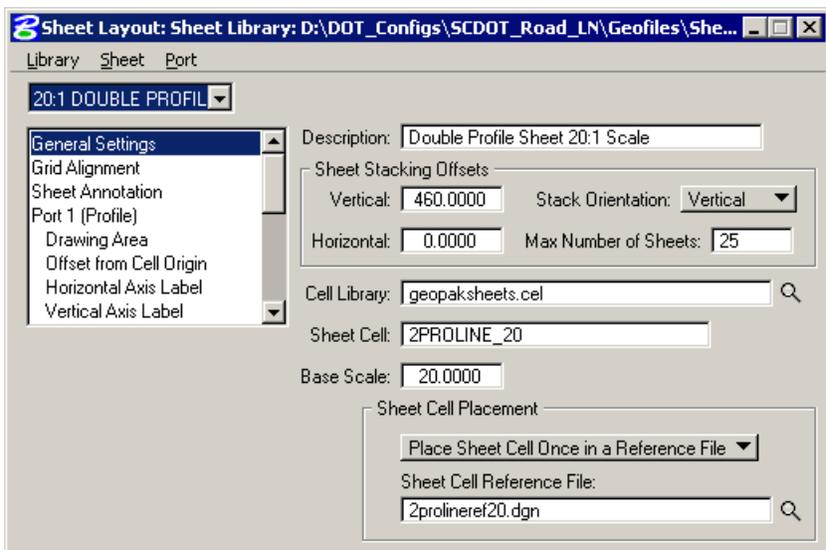
Four options are supported in the main menu bar:

- File
- View
- Settings
- Tools

FILE MENU OPTIONS

Two tools are supported in the **File** pulldown and are detailed in the table below.

Sheet Library The Library file contains the various parameters, cells, and dimensions for creating sheets. In this menu option, a new Library can be created, an existing Library can be edited, or the user can define (Attach) the desired Library. For a detailed discussion of setting up and editing a Library, refer to the online documentation "Sheet Library Set-Up."



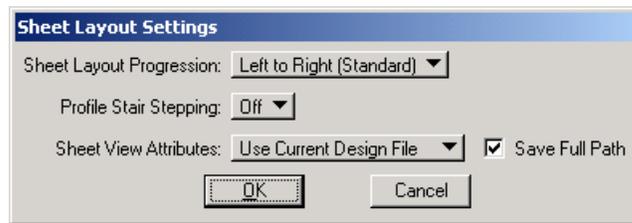
Exit Exits the Plan and Profile Sheets application, but does not close the MicroStation file.

VIEW MENU OPTIONS

Filter by Sheet Name	The clipping shapes of the currently selected sheet name are displayed. A MicroStation update view will need to be issued if “Automatic Update” is not toggled on.
Filter by Scale	The clipping shapes of the currently selected Scale are displayed. A MicroStation update view will need to be issued if “Automatic Update” is not toggled on. NOTE: “Filter By Sheet Name” and “Filter By Scale” can be used together.
Automatic Update	If this is toggled on when “Filter By Sheet Name” or “Filter By Scale” is selected the view is automatically updated.

SETTINGS MENU OPTIONS

Sheet Layout When the **Sheet Layout** tool is selected, the dialog depicted below opens. Three settings are supported within the dialog including **Left to Right** or **Right to Left** layout, **Stair Stepping** for profiles, and **Sheet View Attributes**.



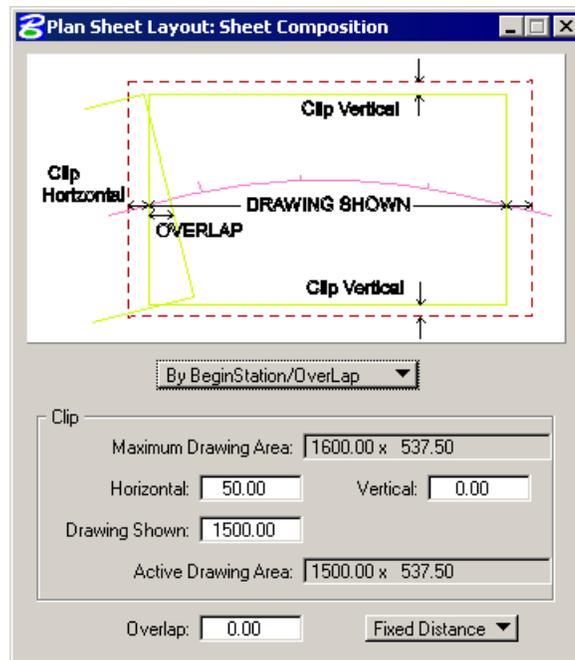
- Sheet Layout Progression:
 - Left To Right (Standard)
 - Right To Left (Rail)
- Profile Stair Stepping:
 - Off
 - On
- Sheet View Attributes:
 - Use Current Design File
 - Customize With Motif File

Note The “Save Full Path” toggle applies to the Current Design file only.

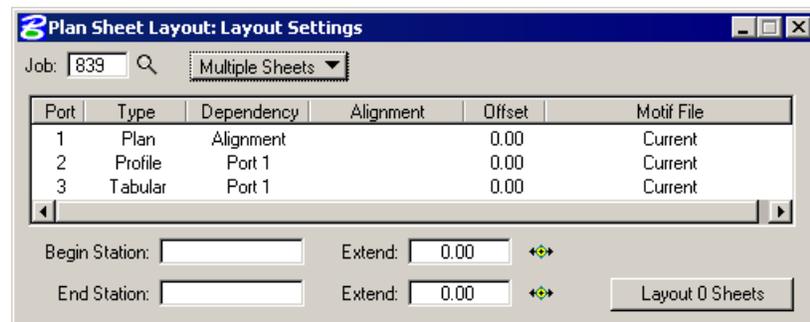
TOOLS MENU OPTIONS

Eight tools are supported in the Tools pulldown and are detailed in the table below.

- Identify Sheet** Select **Identify Sheet**, then select and accept a previously placed clipping shape. GEOPAK determines the settings utilized to place the original sheet and automatically populates the dialog with the **Sheet Name** and **Scale**. In addition, the **Sheet Name**, **Scale**, **Sheet Number**, and **Port** are displayed in the MicroStation prompt field at the bottom of the screen. If the parameters for the selected sheet are not found within the current library, a warning message is displayed indicating the sheet is not found, the name of the current library, and the name of the library used to place the original sheet.
- Sheet Composition** This menu item opens the **Sheet Composition** dialog, wherein drawing area, overlapping options and other project specific variables are defined. One sample dialog is depicted below.



- Sheet Layout** The **Layout Settings** dialog is utilized to define the GEOPAK Job Number, alignments, and /or profiles for the desired sheets.



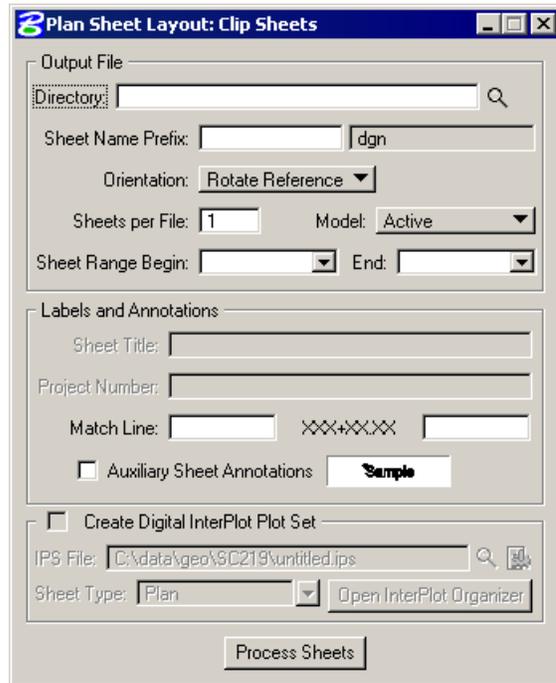
Fields are also supported for stationing, if only part of the chain is being utilized for sheet layout.

Sheet Clip

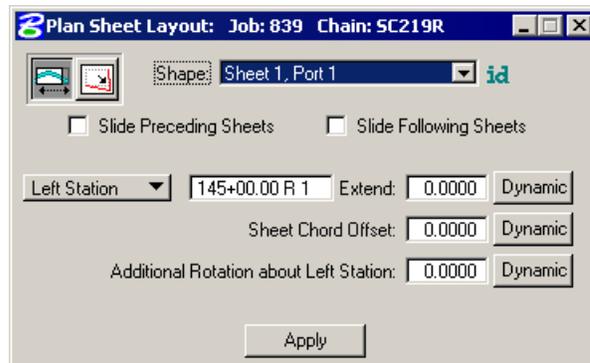
Once the sheets have been laid out and any modifications complete, the sheets are ready to be clipped and drawn for the final production sheets. The Clip dialog is utilized to complete these tasks, as detailed below.

In addition to clipping sheets, attaching reference files, and placing borders, the Clipping dialog also has options for placing a Sheet Title, Project Number, Match Lines, and Auxiliary Sheet Annotations.

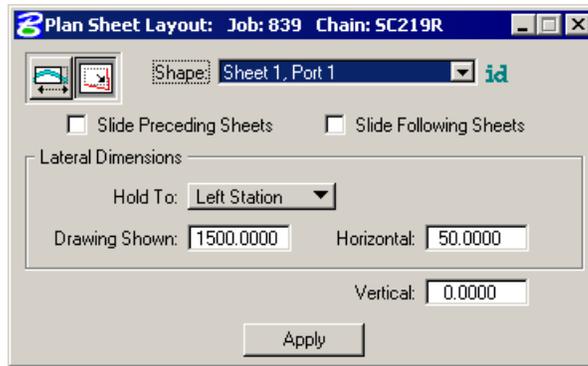
Create Digital InterPlot Plot Set – Allows the creation of the Digital InterPlot Plot Set during the Layout Sheets process.

**Sheet Modify**

After the sheets are laid out, the user may want to adjust individual sheets to conform to the project limits, etc. This can be accomplished utilizing the tools in the Modify dialog, which is illustrated below.



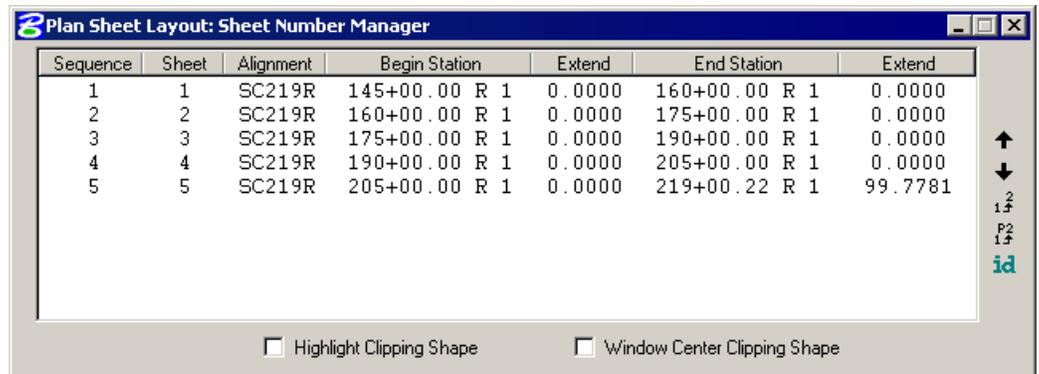
The two icons in the upper left corner are utilized to Slide sheets (along the alignment, rotating, offsetting) and Modify Drawing Area. The Slide options are illustrated above, while the graphic below depicts the Modifying Drawing area.



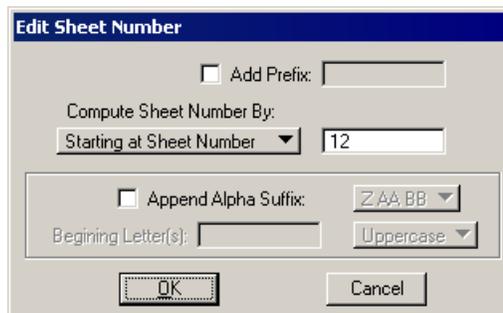
The user can select the sheet to be modified from the pick list or by graphic identification. Sheets can also follow the movement of the selected sheet, i.e., moving one sheet to left moves all preceding or following sheets to the left by the same amount.

Sheet Number Manager

After the sheets are laid out, the Sheet Number Manager can be invoked as depicted below, populated with the current sheets.



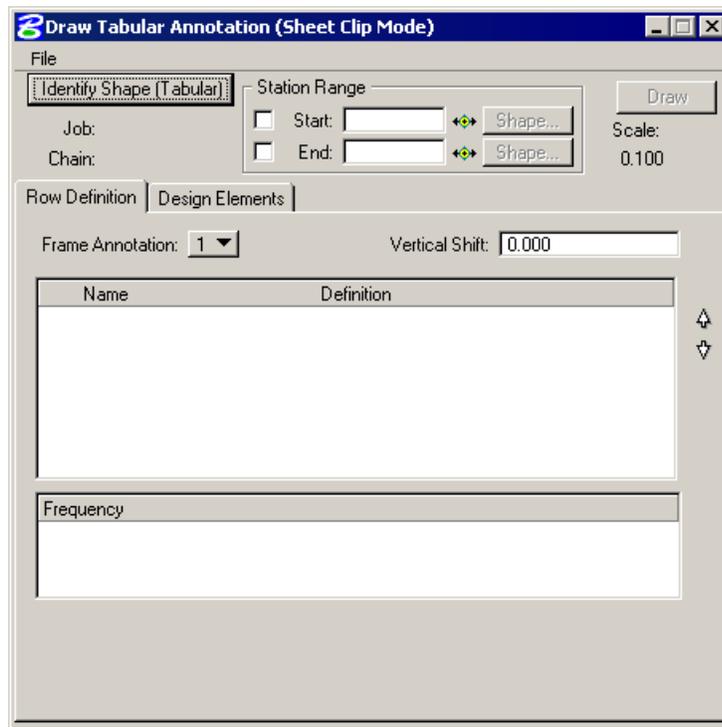
The actual sheet number can be modified, prefix and suffix added, and other labeling options by utilizing the Edit Sheet Number (fourth icon down in the grouping to the right of the list box).



Another option is changing the order the sheets are drawn.

Draw Tabular Annotation (Sheet Clip Mode)

When the Draw Tabular Annotation tool is selected, the Draw Tabular Annotation dialog is opened, as depicted below.



The user can define the tabular data to be included within the plan /profile sheets.

DIALOG ICONS

Six short-cut icons are supported for ease of use. These icons correspond to tools located within the menu bar pulldowns and are detailed in the table below.

-  Sheet Composition (Tools > Sheet Composition).
-  Layout Sheets (Tools > Sheet Layout).
-  Clip Sheets (Tools > Sheet Clip).
-  Modify Sheets (Tools > Sheet Modify).
-  Sheet Number Manager (Tools > Sheet Number Manager).
-  ID button (Tools > Identify Sheet).

SHEET NAME SELECTOR AND PLOT SCALE



Two parameters are global to the entire application and are shown on the main dialog:

- The **Sheet Name Selector** enables the user to select which sheet is to be placed in the next Layout operation. The drop down list displays all sheets in the currently attached Sheet Library.
- The **Plot Scale** text item determines the scale at which sheets will be placed in the layout.dgn.

PRIMARY WORK FLOW

The approach taken by this application is to represent the reference-clipping boundary of each Port on each Sheet. The clipping boundary is represented by MicroStation Shapes, referred to as Clipping Shapes.

For each project, there is one design file which contains all of the Clipping Shapes for a project, for example, layout.dgn. All design elements exist in files referenced to layout.dgn. It is recommended that layout.dgn have only Clipping Shapes in it.

The Primary Work Flow consists of two operations:

- Layout of sheets – places clipping shapes into layout.dgn file.
- Clipping sheets - reads the Clipping Shapes from the Layout dgn and creates new design files which include all required reference files which are clipped at the correct boundaries along with the Sheet Cell and other annotations.

There are two options for Clipping Sheets: Rotate View and Rotate Reference.

When Sheets are clipped using the Rotate View option, the sheet cell and the view are moved and rotated such that they are coordinately correct with the clipping shape of Port One. This arrangement allows only one sheet per design file.

When Sheets are clipped using the Rotate Reference option, the sheet cell and view are not rotated. The reference files are rotated and moved to be in the correct location with respect to the sheet cell. The arrangement allows multiple sheets to be placed in one design file.

PORTS

Each Sheet consists of one or more Ports. A Port can be considered a window into the design. For each sheet that is placed into a layout.dgn, each Port on that sheet is placed as a Clipping Shape.

PORT TYPES

There are three types of Ports: Plan, Profile, and Tabular Data. It should be noted the 2001 plus version of Plan and Profile Sheet Composition does not place tabular data values. The application places Clipping Shapes designed to include Tabular Data. The actual placement of the Tabular Data values is accomplished by the Draw Tabular Annotation (Sheet Clip Mode) tool in coordination with the Plan and Profile Sheet Composition application.

PORT INFORMATION

Before laying out sheets, each Port must have its Port Information filled out. The Port Information Dialogs are opened by double-clicking the corresponding row in the Layout Dialog.



Plan Ports only need the controlling chain, an offset value, and the name of the motif file for the given Port. If the “Use Current Design File” option is selected, Current will be displayed in the dialog instead of a Motif File name.

Motif files are used to determine reference file attachment.

Profile Ports require the name of the controlling profile in addition to all the information found in a profile cell.

Tabular Data Ports require the same kind of information that Profile Ports do, but also may optionally have the ability to stagger the placement of the ports. This staggering allows the Clipping Shapes to be longer without conflicting so that they may accommodate margin labels.

SHEET VIEW ATTRIBUTES

Two options are supported for **Sheet View Attributes**:

Use Current Design File – All reference file attachments, active levels, etc., are based on the current design file. An optional toggle is supported to **Save the Full Path** of reference files.

Customize with Motif Files - A blank file is utilized as a pattern file for the reference file attachments. Also levels can be turned on or off as desired. We call these files motif files.

USE CURRENT DESIGN FILE

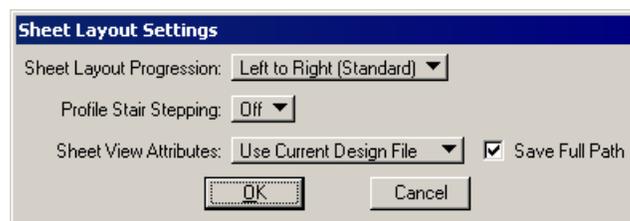
The user can control reference file attachment without the use of Motif Files by selecting the Use Current option for Sheet View Attributes. When this option is used, the Current dgn file (in which clipping shapes have been layed out) is used like a Motif file in that it’s reference file attachment information carries over to each Port during Clipping.

Also the design file containing the clipping shapes will be attached as a reference file for each port to accommodate users that wish to place there clipping shapes in the proposed design file.

The advantage of Use Current Design File is that the user does not need to concern themselves with setting up motif files. What they see in the layout design file is what they will get in clipped sheet files. However, when Use Current Design File is that selected option, it is not possible to have different reference file settings for different Ports on the same sheet. All Ports must have the same attachment information and can’t be customized.

The Save Full Path toggle is used when the sheets will be placed in a different directory than the reference files.

NOTE: If the sheets are to be placed in a different directory, then the reference files must be attached to the current design file with “Save Full Path” toggled on.



CUSTOMIZE WITH MOTIF FILES

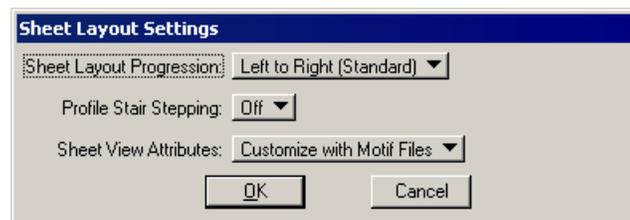
It is sometimes necessary to have two or more Ports on a sheet which have differing reference file attachment settings. This could happen with two Plan Ports which cover the same area but show different aspects of the project. For example, the top Port would show the proposed design and the bottom Port would show traffic control. This could be considered as the two Ports on the same sheet having different themes or different motifs.

The question arises as to how the various reference file settings are to be controlled for each Port. This is done by using another design file to serve as a pattern for the reference file attachment information. For every Port, there would be a motif file specified by its file name. The Ports on each sheet may have the same or different Motif Files.

During a Clip operation, the reference file attachment information is read from the motif file for each Port. When a Port is placed into the final sheet file, all reference files which are attached to the corresponding Motif File are attached to the final sheet design file. All reference level view on/off settings of the motif file are also applied to the reference file attachment in the final sheet design file. Note the clipping shapes are still used to define the Clip Boundary of each reference file associated with that Port.

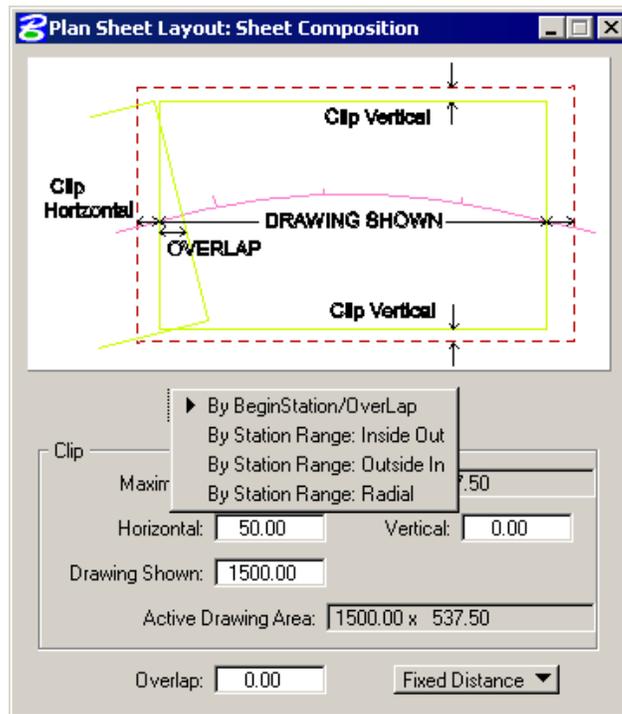
In the example described above of a sheet with Design and Traffic Control, the top Port could have a Motif File named design_motif.dgn. The bottom Port could have a Motif File named Traffic_motif.dgn. At any time before sheets are clipped, the Motif Files (which would normally be blank) must be opened, desired levels should be active, and the reference files attached. The reference file names and their paths used for the motif file must match exactly to the reference files and associated paths in the original file. Therefore, the user will normally set up the motif files on a project by project basis, unless an organization has a standardized set of file naming conventions and level structure utilized on every project, where a single set can be developed for the entire organization.

NOTE: If the sheets are to be placed in a different directory, then the reference files must be attached to the motif file with "Save Full Path" toggled on.



SHEET COMPOSITION

When the Sheet Composition tool is accessed, the dialog depicted below opens.

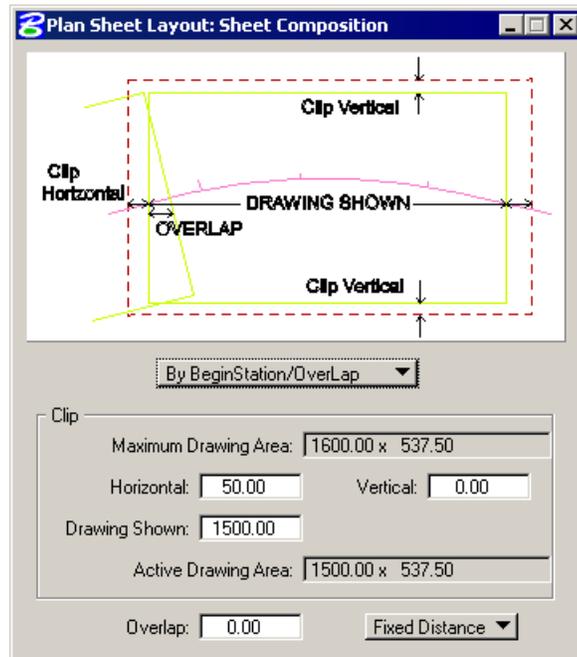


The graphic illustrates the various values required in the dialog. Directly below, four options are supported, as illustrated in the exploded view above:

- By Begin Station/Overlap
- By Station Range: Inside Out
- By Station Range: Outside In
- By Station Range: Radial

BY BEGIN STATION/OVERLAP OPTION

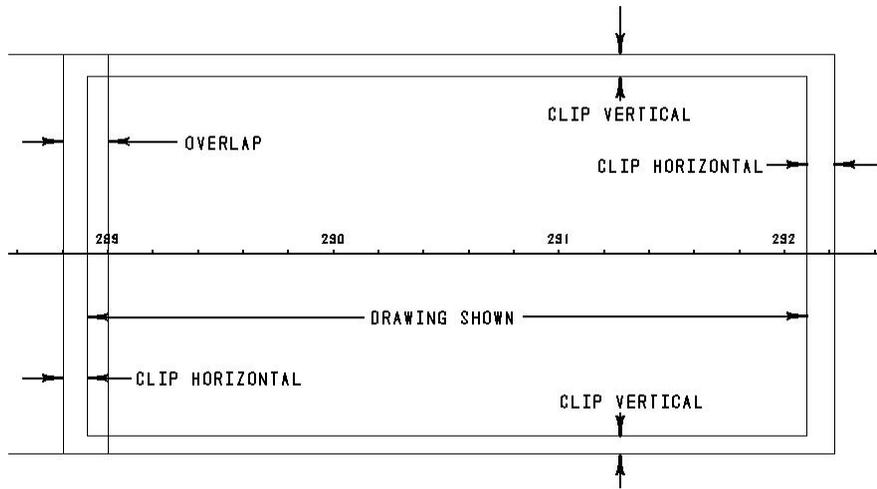
When the **By Begin Station/Overlap** option is selected, the Clip group box containing the Drawing parameters, **Overlap** options and associated fields as depicted in the graphic below:



Before these options are reviewed, a discussion of the **Active Drawing Area**, located within the **Clip** group box, is warranted. Several dimensions are found within the **Clip** group box. These include:

- Maximum Drawing Area (display only)
- Horizontal
- Drawing Shown
- Vertical
- Active Drawing Area (display only, calculated by GEOPAK)

The graphic below illustrates each dimension for the subject sheet. In addition, a portion of the adjoining sheet to the left is shown in order to depict the overlap. Notice that the alignment is also displayed from approximately station 289+00 to 292+00.



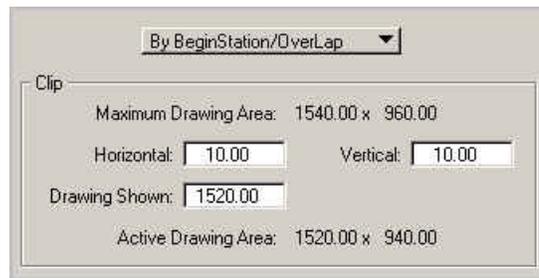
First, GEOPAK utilizes the Maximum Drawing Area based on the Sheet Name and Scale selected in the main Sheet Layout dialog, in our example, 1540 x 960. Then the Clip **Vertical** is subtracted twice, once for the top and once for the bottom. In this case,

$$960 - 10 - 10 = 940$$

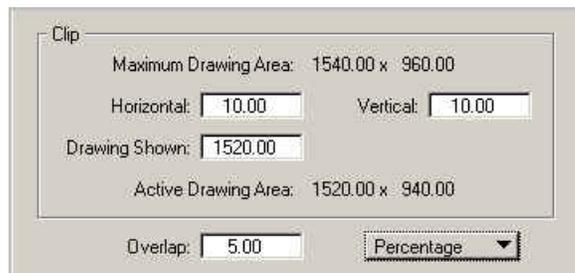
which is shown in the **Active Drawing Area**. The same method is utilized for the Horizontal computations. The horizontal clip is subtracted twice, once for the right side and once for the left side. In this case,

$$1540 - 10 - 10 = 1520$$

which is shown in the **Drawing Shown** and the **Active Drawing Area**.



Once again referring to the graphic above, GEOPAK considers the Overlap shown on the left side between the two adjoining sheets. The **Overlap** toggle has two options as depicted in the exploded view below:



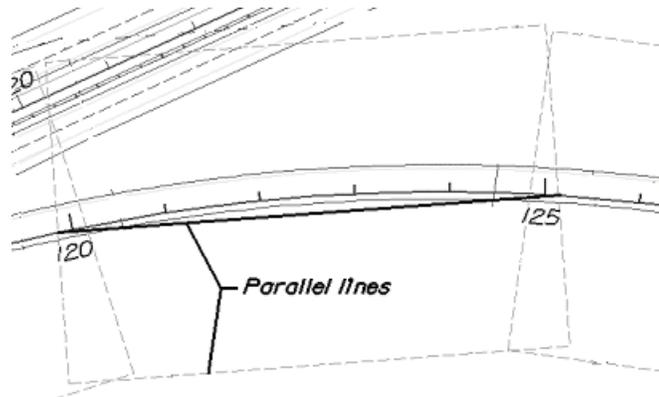
- Percentage
- Fixed Distance

When the **Percent** option is selected, the designer keys in the desired overlap in percent format in the **Overlap** field. Note the percent sign (%) is not required. The Percentage is calculated utilizing the Drawing Shown value. In this example, the 5.26% overlap is 156.75 feet (5.26% of 176.75).

In our Percentage example, the overlap is 5.26%. Therefore, a 20.00 foot overlap in clip areas is present between successive sheets.

If the **Fixed Distance** option is utilized, the Value field is in master units, i.e. feet or meters.

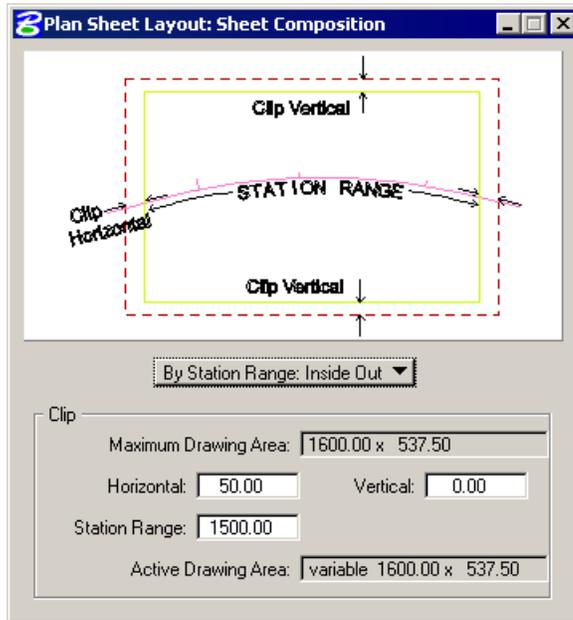
When placing sheets on a curve, the chord of the curve where it intersects the inside border is utilized to orient the sheet as depicted in the graphic below:



Since the **By Begin Station/Overlap** Sheet Composition option uses a chord distance to compute the length of the sheet, in the area of a curve more stationing will be covered. On a Plan/Profile sheet, this means there will be unequal coverage between the Plan and Profile. With this in mind, it is recommended that **By Begin Station/Overlap** Sheet Composition option be used for a Plan only case.

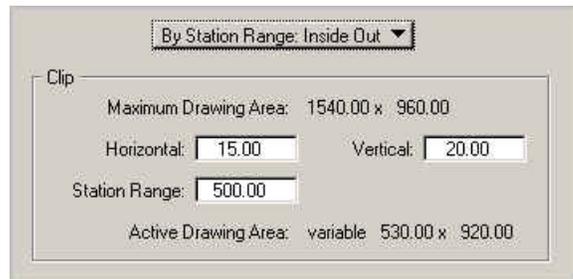
BY STATION RANGE: INSIDE OUT OPTION

The **By Station Range: Inside Out** option orients sheets between a rounded station interval. This interval is entered in the **Station Range** field. When utilizing this option, the Clip group box also has a slightly different look as seen in the graphic depicted below.

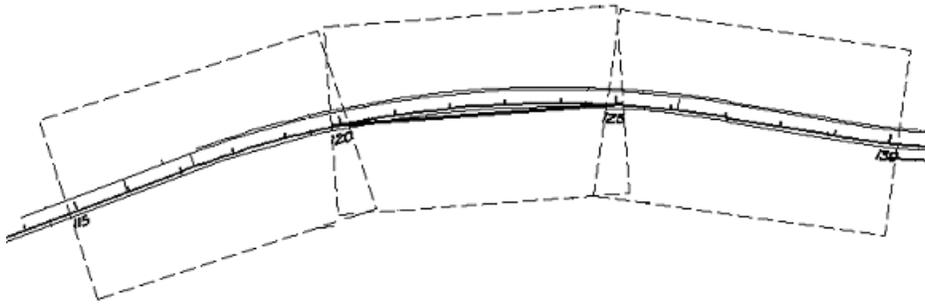


Now the **Active Drawing Area** is not constant, but displays **Variable** in the output field.

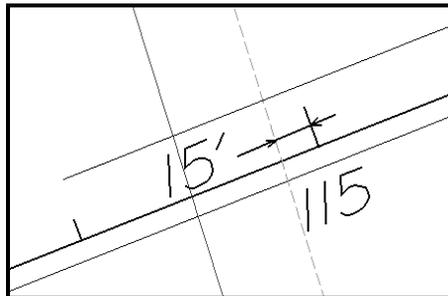
The **Horizontal** keyin has a slightly different meaning which can be best illustrated with an example. Let's use 500 feet for the **Station Range**, and 15 feet **Horizontal**. The dialog is depicted below.



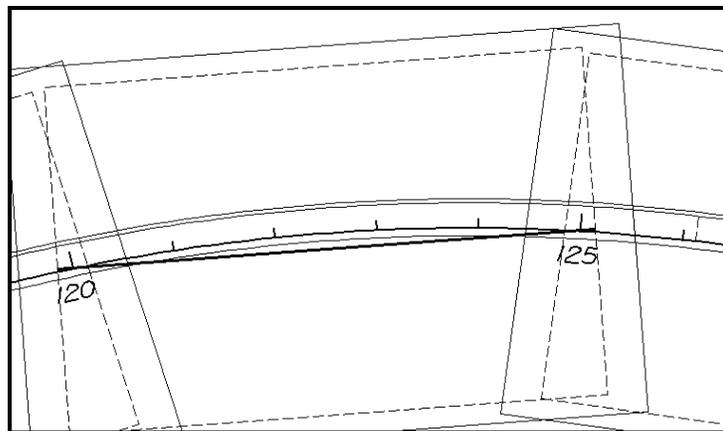
Utilizing the dialog above, the following sheets are generated.



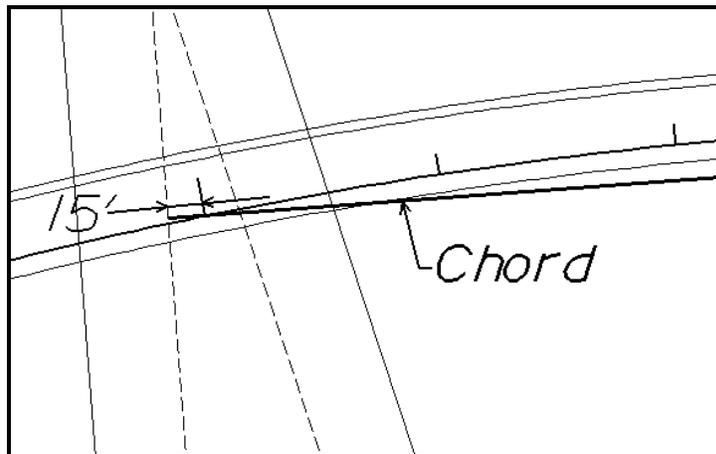
The first step when the sheets are drawn is to determine the stationing for each sheet. Our first sheet will be oriented between stations 115+00 to 120+00. GEOPAK then expands the sheet clip area by the **Horizontal** keyin distance. Looking at a detail of the beginning of the project, the clip area is expanded fifteen feet before station 115+00 as seen in the graphic below. Note the inside border is the dashed line, and station 115+00 and its associated tick mark are shown.



The curve is calculated slightly different. The second sheet in this series is on a curve. The station range is 120+00 to 125+00. A chord is drawn for the curve between stations 120+00 and 125+00 as seen in the graphic below.

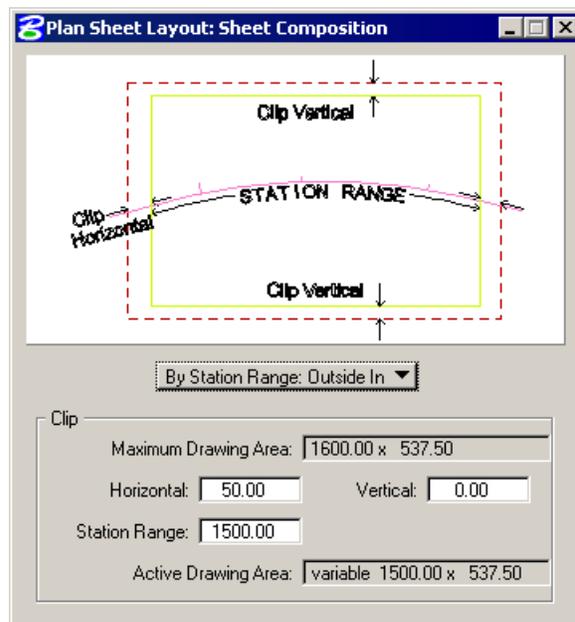


Notice that the inside sheet border is wider than the chord. The software will extend the chord the amount of the Horizontal keyin (in our example, fifteen feet) to establish the vertical edge of the inside border as seen in the detail below.

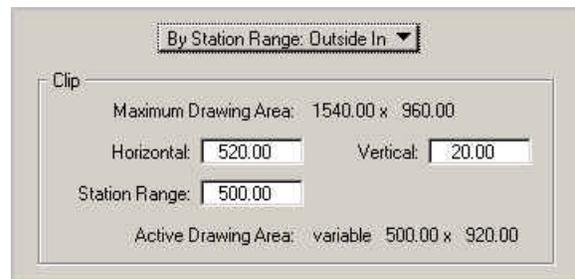


BY STATION RANGE: OUTSIDE IN OPTION

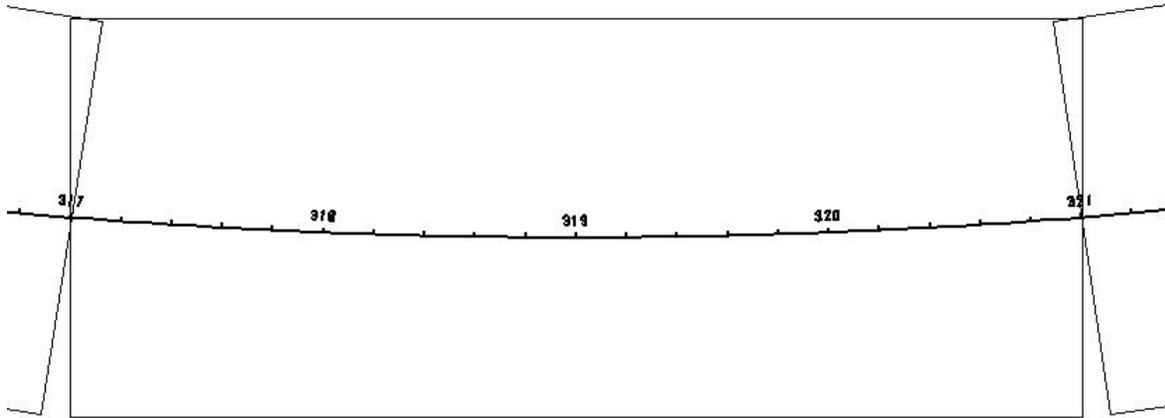
The **By Station Range: Outside In** option orients sheets between a rounded station interval. This interval is entered in the **Station Range** field. When utilizing this option, the Clip group box also has a slightly different look as seen in the graphic depicted below.



The **Outside In** option is slightly different as seen in the dialog below.



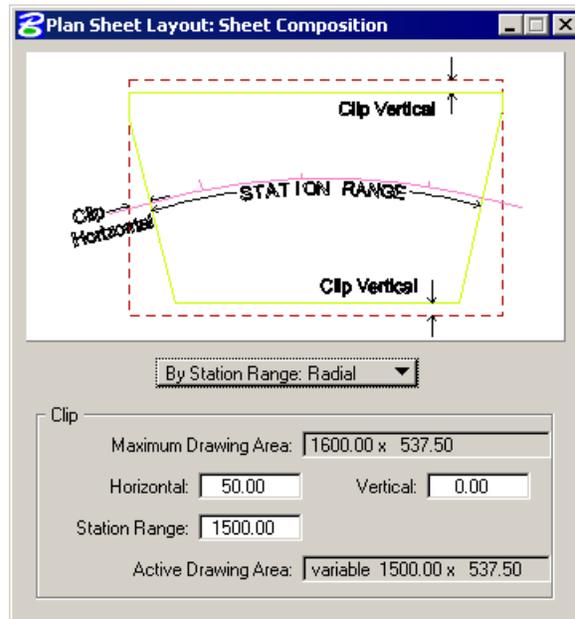
The Clip Area is no longer variable, but a constant based on the **Sheet Size** as well as the **Horizontal** and **Vertical** fields. In our example, the same 500 feet is keyed in. When generating the sheets, GEOPAK determines the center of the sheet, and the corresponding station. In our example the midpoint of the stationing for the sheet from 120+00 to 125+00 is 122+50. This point will be placed at the midpoint of the sheet as depicted in the drawing below:



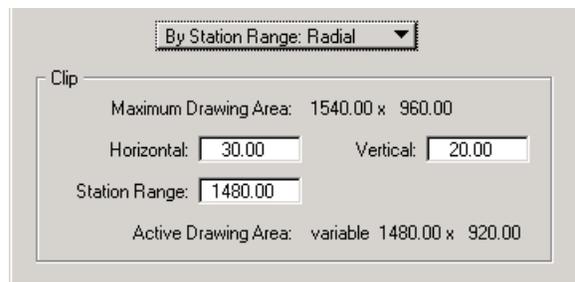
Since the clip area covers a constant station range, the length of the clipping shape will vary depending on the curvature of the alignment.

BY STATION: RADIAL OPTION

The **By Station Range: Radial** option orients sheets between a rounded station interval. This interval is entered in the **Station Range** field.

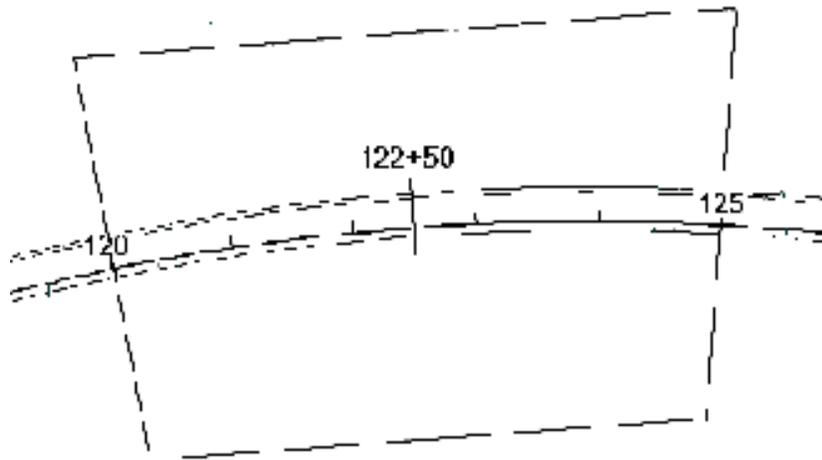


An example best describes how this feature works. In the dialog below, each sheet has a station range of 1480 feet. Based on the station ranges in the bottom of the dialog, the first sheet would encompass station 120+00 to 134+80, while the second sheet would include stations 134+80 to 149+60.



To draw this second sheet, GEOPAK locates the midpoint station 122+50, which in our example is on a curve. Utilizing the chord of curve as the vertical center, GEOPAK draws the top and bottom of the clip regions 460 from the chord, making the clip region 920 feet high. This is computed from the sheet size of 960 minus the vertical keyin of 20 for the top and 20 for the bottom, resulting in a 920 feet height.

In the next step, GEOPAK moves to station 134+80 and draws the clip border radial to the alignment at the specified station until it intersects with the previously computed top and bottom clip regions. The same process is repeated at the other end of the sheet, i.e., 149+60. Therefore, the inside clip region is trapezoidal as depicted in the graphic below.

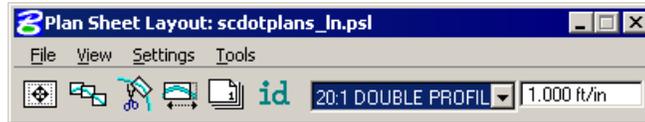


Since the clip area covers a constant station range, the length of the clipping shape will vary depending on the curvature of the alignment.

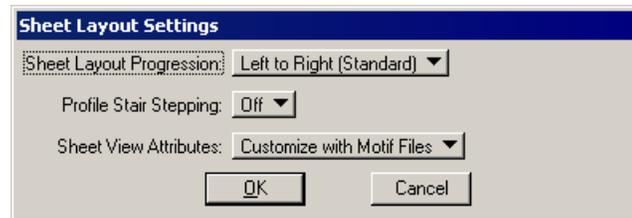
LAB EXERCISE: PLAN AND PROFILE SHEETS

Configure Sheet Settings

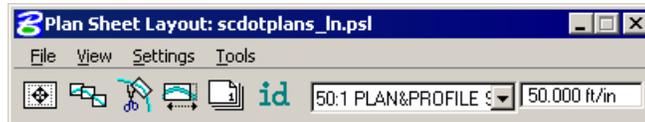
1. Open the MicroStation file *c:\data\geo\sc219pp.dgn*. Attach as a reference *c:\data\geo\sc219\sc219proposed* and *c:\data\geo\sc219\sc219profile.dgn*.
2. Access **Project Manager**.
3. Click the **Plan & Profile Sheets** button from the **Road Project: Road1.prj** workflow dialog.
4. Create a run **SC219R** to set up the plan/profile sheets. The dialog should appear as shown below.



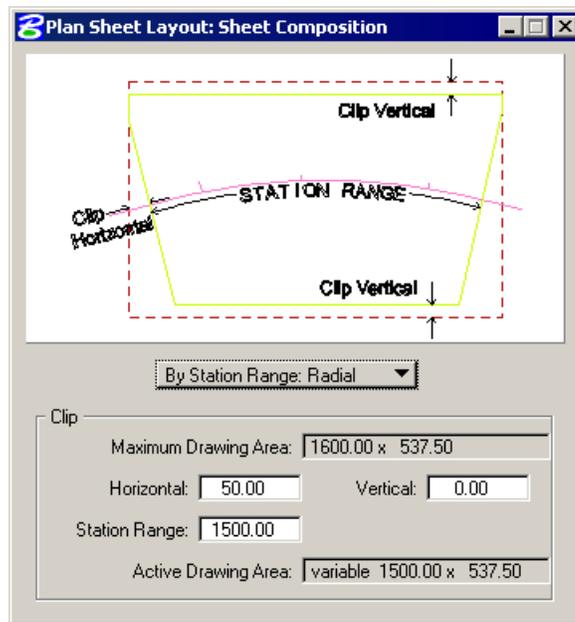
5. Select **Settings > Sheet Layout**.
6. Change **Sheet View Attributes** option to **Customize with Motif Files** then click **OK**.



7. Populate the **GEOPAK Sheet Layout** dialog as below.



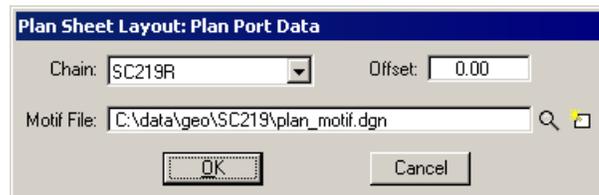
8. Press the **Sheet Composition** icon. Populate the **Sheet Composition** dialog as below.



- Dismiss the **Sheet Composition** dialog by clicking the **X** in the upper right hand corner.

 **Sheet Layout Process**

- Press the **Layout Sheets** icon. The Job Number will be set automatically from Project Manager.
- Double click on **Port 1** to invoke the **Plan Port Data** dialog. Select **SC219R** from the **Chain** dropdown list.
- Click the **Create Motif File** icon. Select *motif_seed.dgn* as the seed file and key in a name of **plan_motif.dgn** as the **Motif File**. Click **OK** to create the new file. The **Plan Port Data** dialog should appear as below. Click **OK**.



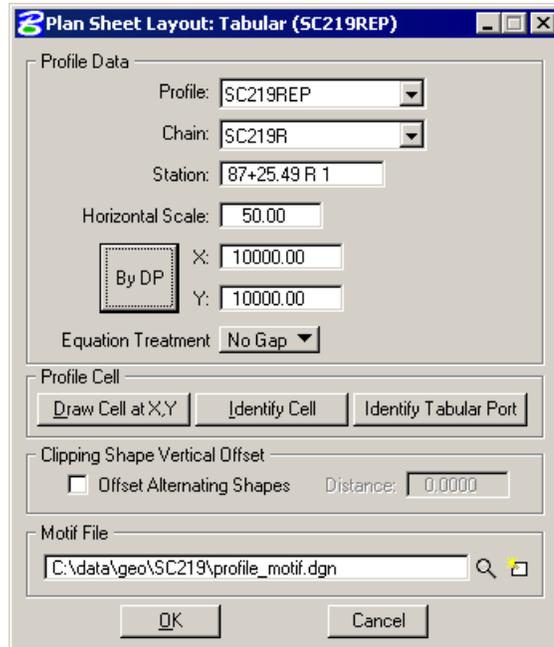
- Double click on **Port 2** to invoke the **Plan Sheet Layout: Profile** dialog. Select Profile **SC219REP** in the pull down box, then populate the **Plan Sheet Layout: Profile** dialog by pressing the **Identify Cell** button then graphically identify the profile cell to populate the dialog.

5. Click the **Create Motif File** icon. Select *motif_seed.dgn* as the seed file and key in a name of **profile_motif.dgn** as the **Motif File**. Click **OK** to create the new file. The **Plan Sheet Layout: Profile** dialog should appear as below. Click **OK**.

Note The X and Y coordinates may be different than what is shown in the dialog. They should match the insertion points of your profile cell.

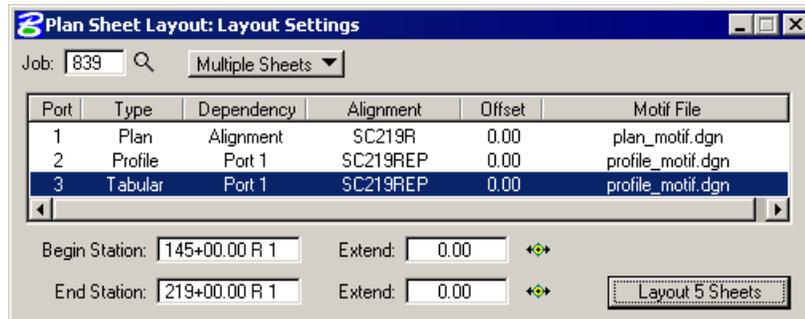
6. Double click on **Port 3** to invoke the **Plan Sheet Layout: Tabular** dialog. Select Profile **SC219REP** in the pull down box, then populate the **Plan Sheet Layout: Tabular** dialog by pressing the **Identify Cell** button then graphically identify the profile cell to populate the

dialog. Select **profile_motif.dgn** as the **Motif File**. The **Plan Sheet Layout: Tabular** dialog should appear as below. Click **OK**.



Note The X and Y coordinates will be different than what is shown in the dialog.

7. Set the **Beginning Station** to 145+00.
8. Click the **Layout 5 Sheets** button to draw the clipping borders into the design file.



Note 5 clipping shapes should be placed for the plan port.

Note 5 clipping shapes should be placed for the profile port.

Note 5 clipping shapes should be placed for the tabular data port.

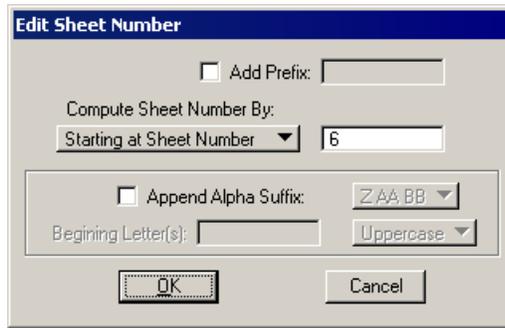
9. Dismiss the **Layout Sheets** dialog by clicking the **X** in the upper right hand corner.

 **Motif File Setup**

1. Open the file *c:\data\geo\sc219\plan_motif.dgn*.
2. Attach the following references: *sc219pp.dgn* and *sc219proposed.dgn*.
3. Turn levels on/off as desired in each view. The levels displayed in each view will appear just like that on the sheets.
4. Open the file *c:\data\geo\sc219\profile_motif.dgn*.
5. Attach the following references: *c219profile.dgn*.
6. Turn levels on/off as desired in each view. The levels displayed in each view will appear just like that on the sheets.
7. Open the file *c:\data\geo\sc219\sc219pp.dgn*.

 **Sheet Number Modification**

1. Click the **Sheet Number Manager** icon.
2. Highlight all of the sheets in the list.
3. Click the **Edit Sheet Number** icon along the right side of the dialog.
4. Let's set the starting sheet number to 6. Click **OK** to renumber the sheets.



Edit Sheet Number

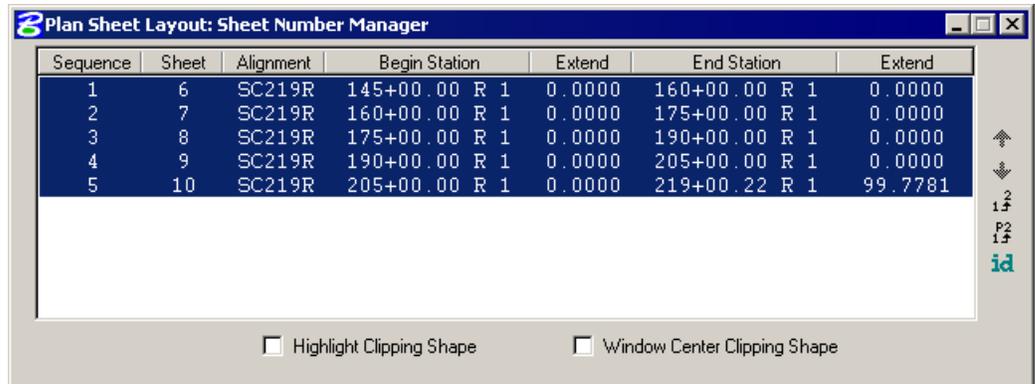
Add Prefix:

Compute Sheet Number By:
Starting at Sheet Number

Append Alpha Suffix:

Beginning Letter(s):

5. The **Plan Sheet Layout: Sheet Number Manager** dialog should appear as shown below.



Sequence	Sheet	Alignment	Begin Station	Extend	End Station	Extend
1	6	SC219R	145+00.00 R 1	0.0000	160+00.00 R 1	0.0000
2	7	SC219R	160+00.00 R 1	0.0000	175+00.00 R 1	0.0000
3	8	SC219R	175+00.00 R 1	0.0000	190+00.00 R 1	0.0000
4	9	SC219R	190+00.00 R 1	0.0000	205+00.00 R 1	0.0000
5	10	SC219R	205+00.00 R 1	0.0000	219+00.22 R 1	99.7781

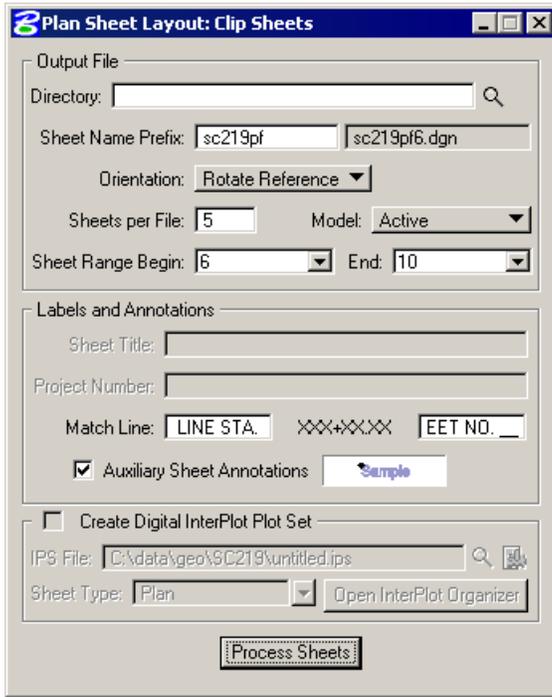
Highlight Clipping Shape Window Center Clipping Shape

Note This tool can also be used to resequence the order of the sheets.

6. Dismiss this dialog. When prompted to save the sheet number changes, click **Yes**.

 **Clip Sheets**

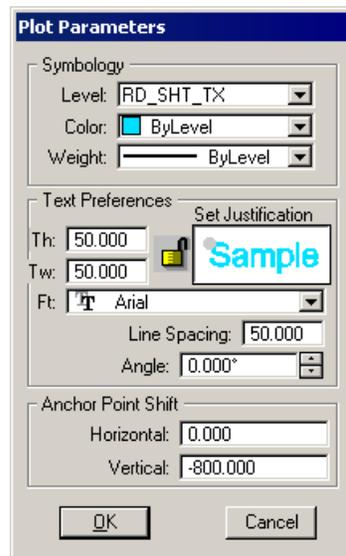
1. Click the **Clip Sheets** icon. Populate the **Clip Sheets** dialog as below.



Note The **Match Line** prefix field has the following text: **MATCH LINE STA**
 Make sure to include a blank space in the prefix field after the "A" in "STA". This will provide a blank space after the "A" and before the computed match line station text.

The **Match Line** suffix field has the following text: **SEE SHEET NO. __**
 Include a blank space before the S in See.

2. Toggle on **Auxiliary Sheet Annotations**.
3. Double click the sample graphics box next to **Auxiliary Sheet Annotations** to invoke the **Plot Parameters** dialog. Populate the dialog as shown below. Click **OK**.



4. Click **Process Sheets** to create the plan and profile sheets.
5. Close the **Clip Sheets** dialog.
6. Close the **Plan Sheet Layout** dialog.
7. When prompted to **Save Settings**, click **Yes**.
8. Open any of the newly created files to see the resulting sheets.
9. Exit MicroStation.





D & C Manager - Quantities

CHAPTER OBJECTIVES

In this chapter, you will learn more about the operational modes of the D&C Manager including calculating automated quantities.

INTRODUCTION

The Design and Computation Manager (D&C Manager) is a tool that enables the user to standardize graphics elements for drafting and pay item quantities. To review how to access the Design and Computation manager, see session 7.

One of the major goals of any design project is the cost-effective development of plans production sheets. This includes construction plans, profile sheets, estimated quantities, and various other sheets needed to actually construct the design. Although generic MicroStation commands can be utilized to produce the required sheets, several GEOPAK tools can be used in conjunction with the Design and Computation Manager and these MicroStation commands to help automate the process.

Other GEOPAK tools are within the Design and Computation Manager and various plan view functions:

- Controlling Various MicroStation Copy Functions utilizing the Place Influence option and the Design mode
- Controlling the MicroStation Display Filters (Display mode)
- Changing the MicroStation symbology via GEOPAK Items (Set mode)
- Identification of plan view areas to incorporate into the automated quantities (Shape mode)
- Plan view quantities (Compute mode)
- Pavement Markings
- Pavement Symbols

ACCESSING THE DESIGN AND COMPUTATION MANAGER

Design and Computations Manager can be accessed by selecting **Applications > GEOPAK ROAD > Design & Computation Manager**. It can also be invoked from the **GEOPAK ROAD Tools** tool frame and the **Plan View Design** tool box in **Project Manager**.

OPERATIONAL MODES

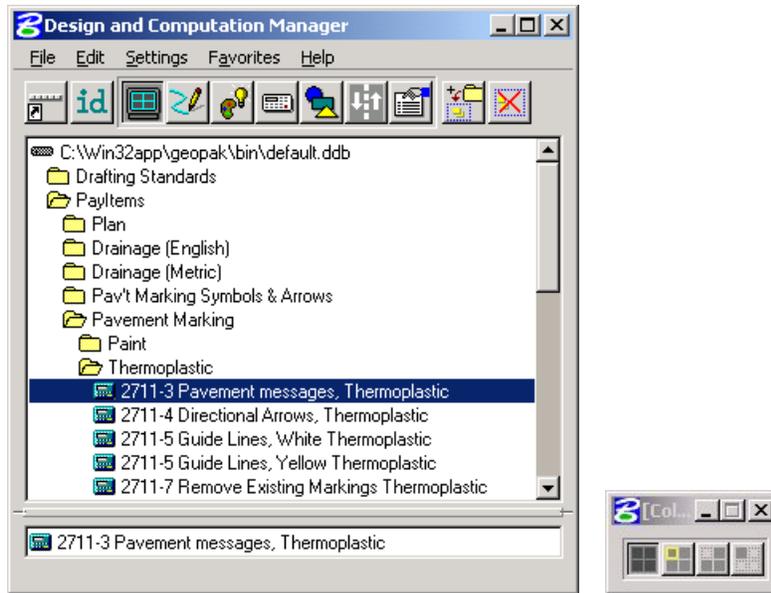
Several operational modes are supported within the Design and Computation Manager. The Design mode was discussed in session 7. In this session, the following modes are reviewed: display, set, shape, compute and pavement markings.



DISPLAY

Display mode is used to enhance on screen visualization by enabling the user to manipulate the display of GEOPAK intelligent elements.

The feature(s) to be visualized are added to the Collection box – the bottom window of the D&C Manager dialog when set to Display or Compute modes. Individual items or entire categories can be placed in the collection by utilizing the **Add to Collection** icon as shown below.



Three display options are supported for the display of the items in the Collection box.

- **Highlight** - changes those items stored in the collection area to the MicroStation highlight color.
- **Not** - simply turns off the display of the collection items leaving everything else on.
- **Only** - will turn off everything but the collection items.

Before utilizing the display filters, visualization is enhanced if all the elements on the screen are gray, or another singular color, rather than the vast conglomeration of color seen on the screen for a typical project. Therefore, to set the color, select **Settings > Display** from the menu bar. The Display Preferences dialog appears.



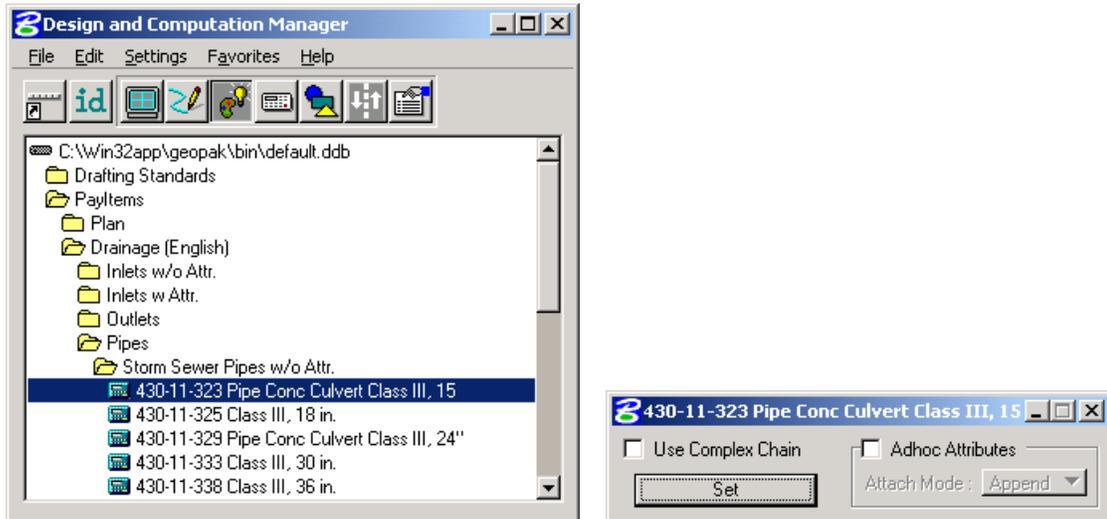
SET

The Set mode allows the user to assign attributes from the ddb database to existing graphical elements in the file. Three methods are available for specifying the graphic elements to be changed: individual element selection, Complex Chain or MicroStation Selection Set.

When changing individual elements, highlight the desired item in the D&C Manager dialog. Click **Set**, then datapoint the element to modify, then datapoint off the element to accept.

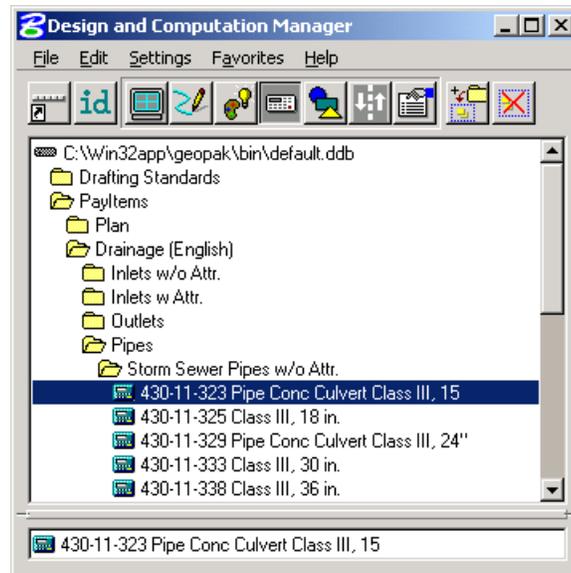
Complex Chain automatically creates a chain from graphic elements and applies the attributes of the highlighted item in the content box.

To modify the symbology of many elements to a single item, create a MicroStation Selection Set of the elements. Next, click **Set** to transfer the attributes of the item selected in the D&C Manager to the items identified in the MicroStation design file.



COMPUTE

An important, yet time-consuming part of any project is the computation of quantities. Through the Compute mode of the Design and Computation Manager, GEOPAK offers tools that make the completion of this task much quicker and easier. In addition, since the software utilizes the plan view construction drawings to compile quantities, discrepancies between the drawings and the tabulated quantities are non-existent. Chosen items within either the *View* or a *Fence* are calculated





Once the MicroStation plan view design file is accessed, the first step is to invoke the Design and Computation Manager and click the shortcut button at the top of the dialog to Compute.

The dialog changes dynamically to reflect the compute operation.

The Design and Computation Manager dialog is resizable. Within the dialog, the sash (long, thin bar between list boxes) enables the user to adjust the partition between the list and collection boxes while the overall dialog size remains constant. Simply place the cursor over the sash and dynamically move.

In addition to dynamically adjusting the main dialog to reflect the compute operation, the auxiliary dialog is invoked as depicted below. Note if the auxiliary dialog was already invoked from another operation, it dynamically changes to reflect the Compute operation.

The next step is the selection of the correct item from the hierarchy. GEOPAK computes quantities only for those hierarchical items that are configured for the computation of quantities.

Two selection methods can be employed. The first method is to select an entire category. GEOPAK computes quantities for every item found in the selected category as well as any child categories. This is accomplished by double clicking through the groups until the desired category is contained in the Content list box. Single click onto the desired category and click the **Add to Collection** button at the top of the dialog.

The second method involves the selection of individual features. This is accomplished by double clicking through the categories until the desired item appears in the hierarchy list box. When seen in the hierarchy list box, a single click onto the desired item and subsequent click of the **Add to Collection** button places the item in the Collection box.

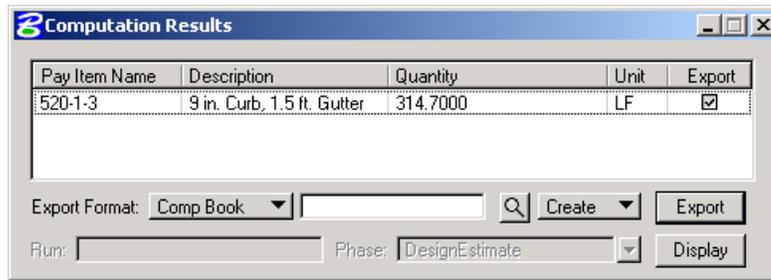
Options that apply to various Output types are detailed in the table below

Note All **Extents** options are sensitive to the Inside, Overlap and Clip modes.

Job Number	GEOPAK Coordinate geometry database (GPK) file wherein the specified chain is stored.
Extents > Active Design File	If the Active Design File toggle is selected, all selected items that are in MicroStation file will be computed.
Extents > View	If the View toggle is selected, only selected items that can be seen in MicroStation view one will be computed. If the view includes area outside of the Range , the Range will override.
Extents > Fence	If the Fence toggle is selected, a fence must be placed, and all specified graphical features which are inside both the fence and the Range will be tabulated.
Extents > Boundary Element	If the Boundary Element toggle is selected, all selected items that are in a selected Boundary Element will be computed.

Extents > Station Range	If the Station Range toggle is selected, all selected items that are within a selected Station Range will be computed.
Extents > Sheet Range	If the Sheet Range toggle is selected, all selected items that are in a selected Plan Sheet Clip Boundary will be computed.
Extents > Selection Set	If the Selection Set toggle is selected, all selected items that are in a MicroStation Selection Set will be computed.
Extents > Boundary Selection Set	If the Boundary Selection Set toggle is selected, all selected items that are in a group of boundary elements within a MicroStation Selection Set will be computed.
Highlight During Computation	When activated, all MicroStation elements utilized in computations are highlighted in the selected color.
Baseline Reference > Chain	Requires a minimum of one chain which must be stored in the specified job number.
Baseline Reference > DGN	The user can graphically select a DGN Element to be used as a Baseline Reference.
Baseline Reference > None	When None is selected, nothing is used as a Baseline Reference.
Identify Chain	The Identify Chain Selector allows the user to graphically select the desired chain.
Range	Left and right offset limits (in master units) from the chain where the quantities will be computed. Any specified item located outside of the limits is not included in the report
Begin/End Station	Station range for computing quantities
Compute Quantities	Commences the computation process.

After the desired quantities have been computed, a second dialog will be displayed containing the computed quantities. The dialog is shown below.



Several output formats are available as described in the table below.

Comp Book	A more detailed report that lists not only quantity summaries, but also geometric properties such as plan view coordinates and station/offsets for located elements. File is in ASCII format.
Item Report	Quantities Summary listing pay items, descriptions, units and total quantities for located elements. File is in ASCII format.
Item Tables	Contains the same information as the Item Report, but formatted in tabular form.
DBMS	Very detailed information including calculated and rounded quantities, geometric properties, pay item numbers, descriptions, station / offset values, etc. The format is the selected database (i.e., Microsoft Access, Oracle, SQL Server, and dbase).
CSV By Item	Quantities Summary listing pay items, descriptions, units and total quantities for located elements. Format is in CSV format.
CSV By Element	A more detailed report that lists not only quantity summaries, but also geometric properties such as plan view coordinates and station/offsets for located elements. Format is in CSV format.
Run	A method of grouping various quantities and / or pay items.
Phase	Quantities can be separated into various phases, as a means to group various pay items. Default phases include: Design, Preliminary, and Final. Note the user can add new phases, but must be aware of naming limitations of downstream applications (i.e., Transport links in Quantities Manager.)

SHAPE

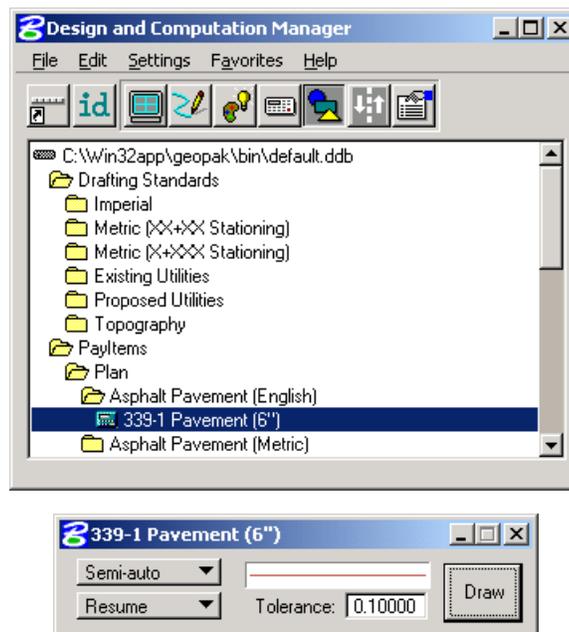
The placement of shapes for area quantities is simple and fast when utilizing the shape mode. In order to place a shape, GEOPAK must identify a closed area. This area can be defined by intersecting elements, which do not have to be clipped or shortened to define the closed area. There are three options for placing shapes depending on the complexity of the plan view and the type of area where quantities are desired:

·**Semi-auto** - utilized when the plan view has more conflicting elements or where the selection of an area produces very small shapes. In this method, the user is prompted when each element is selected to determine the path of the software in producing shapes.

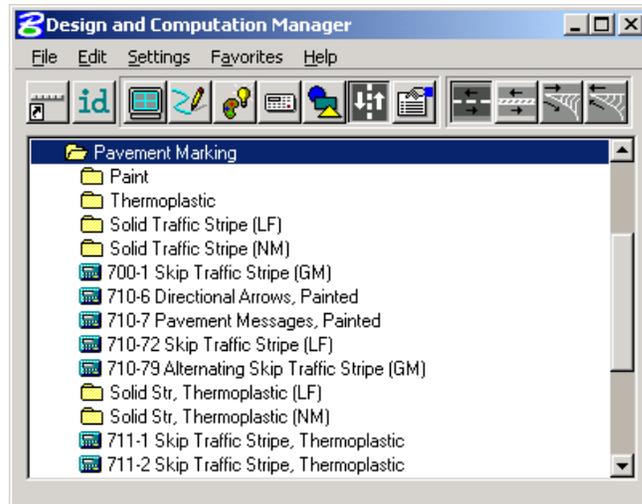
·**Automatic** - best utilized when the elements forming the shape do not conflict with other elements in the view.

·**Exclusive** - This option utilizes the automatic option, but in addition, prompts the user for the identification of an area inside the original shape that is excluded from the area quantity. The Exclude mode is useful for curb and gutter around a traffic island.

Any of the three options may be chosen during the course of shape placement. To change from one option to another, simply adjust the option button on the right side of dialog.



PAVEMENT



The **Pavement** mode allows the user to place pavement marking including striping, and symbols. The various tools are detailed in the table below.

Striping	Places single or double, solid or skip pavement stripes.
	
Separation	Places traffic separation pavement marking.
	
Chevron Diverge	Places pavement chevrons in areas of diverging traffic.
	
Chevron Merge	Places pavement chevrons in areas of merging traffic.
	

SINGLE STRIPING

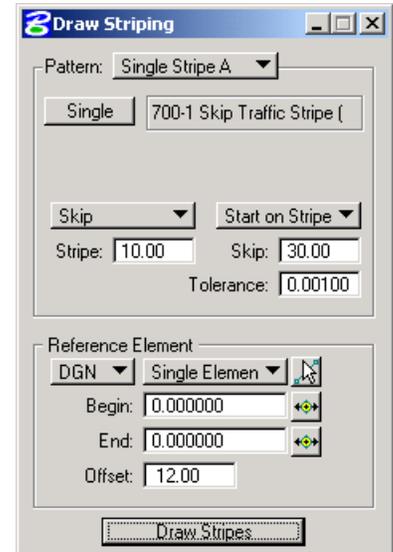
This dialog offers predefined configurations for single stripe and double stripe options to easily control the type of striping being placed.

The pay item reflects the currently selected pay item in the **D&C Manager** dialog; however, it may be changed at any time during the process.

Next, define the start option by selecting **Solid** or **Skip** (or a combination thereof). If Skip is active, the user must define the stripe and skip lengths. If an ending stripe is shorter than the Tolerance value, it will not be drawn.

The lower portion of the dialog box provides tools for identifying the reference element on which the striping will be based. The Reference Element can be defined by DGN Element or a Chain stored in the GPK file.

A Begin and End station range can be defined as well as an offset.

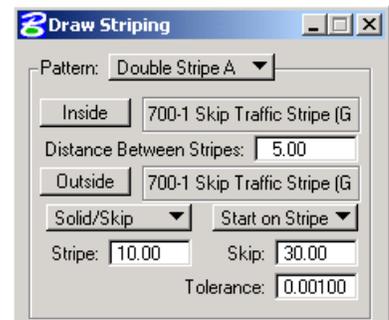


After clicking **Draw Stripes**, the user must enter a data point on either side of the reference element to begin striping. Striping is placed at the indicated offset value; the data point controls whether striping is offset left or right. *Striping is placed as a graphic group.*

DOUBLE STRIPING

The process for Double Striping is the same as Single, except for having two pay item placement options, Inside and Outside and a user definable Distance Between Stripes. The user must select either the Inside or Outside button for the highlighted (D&C Manager) pay item to be displayed in the dialog box. Separate quantities are calculated for each stripe.

The remaining process is the same as described above.



SEPARATION

This option draws pavement markings between two sets of selected elements. Elements may be either GEOPAK or MicroStation generated.

Once a pay item has been selected, the user may set the **Distance Between Stripes** and the **Slash Stripe Angle**. Tolerance functions the same as for striping.

A **Begin Point** and **End Point** should be issued before the **Reference/Pivot Point** is identified. The Reference DP must fall between the beginning and ending DP. It marks the location of the first pavement marking and determines the direction of the slashed stripe. All other markings will be based on the first stripe.

Tools for defining the limits of the pavement markings are located at the bottom of the Separation dialog box. **Side 1** identifies the elements where the striping will terminate. **Side 2** is the set of elements from which the striping begins.

After the **Draw Separation** button is selected, the user must issue a data point in the graphics file for the pavement markings to be displayed.

CHEVRON DIVERGE

Once the pay item and its relative parameters have been defined, there are three points needed to define the chevron: **Gore Point**, **Breaking Line**, and **Diverge Point**.

The **Gore Point** defines the wide end of the gore.

The **Breaking Line** point must fall between the two sides of the gore and sets the location of the point at which the chevron diverts in a different direction.

The **Diverge Point** represents the narrow end of the gore where chevrons are to stop.

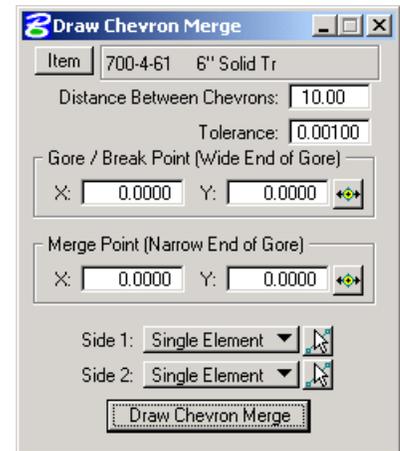
Use the **Side 1** and **Side 2** buttons to identify the sides of the gore. Once the **Draw Chevron Diverge** button is selected, the chevrons are displayed.

CHEVRONS MERGE

This process works basically the same as Chevron Diverge except the two points, **Gore/Break Point** have been combined into one point that serves both functions and should be located near the wide end of the chevron.

The **Merge Point** should be located near the narrow end of the gore. It simultaneously sets the beginning of the pavement markings and the point at which the chevron will break.

The remainder of the process is as described above.

**QUANTITY MANAGER**

Quantity Manager is an application designed to manage design quantities with a direct connection to GEOPAK Design and Computation Manager.

FEATURES

Features include:

- Standalone application for managing design quantities. Neither MicroStation nor GEOPAK is required for utilizing the Quantity Manager
- Intuitive interface to organize quantities by payitems, by stations, by units of measure etc.
- Special treatment for rounding and lump sum items.
- Support CAD file quantities as well as non-graphic quantities.
- Manual input and modifications.
- Interface with estimating systems for payitems and funding sources.
- Custom report capabilities.
- Funding computations.
- Cost estimates.
- Cost comparison.

Several Database Management Systems are supported, including:

Microsoft Access 2000, Oracle, and SQLServer

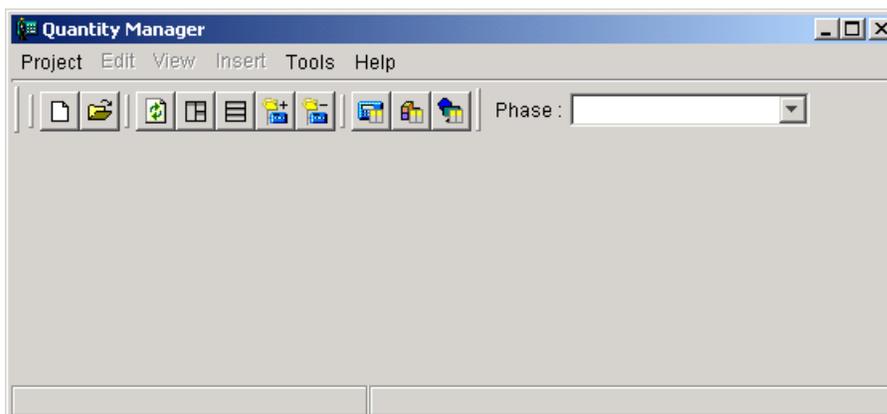


ACCESSING QUANTITY MANAGER

Quantity Manager can be accessed by selecting **Applications > GEOPAK ROAD > Quantity Manager**. It can also be invoked from the **GEOPAK ROAD Tools** tool frame or by double-clicking the icon from the desktop.

INVOKING THE MAIN DIALOG

When the **Quantity Manager** tool is selected, the **Quantity Manager** dialog depicted below opens.



THE QUANTITY MANAGER DATABASE

The quantity manager database consists of multiple relational tables. The information stored in each table is described below.

Tables - Information Stored

Project - General information about the project. Project name, descriptions, spec year etc.

Chain - Information on baselines used for computing stations and offsets of quantities

Phase - A phase is a way to group quantities. A typical usage is to organize different phases of a project (design phase, construction phase), or to break down quantities from different departments or divisions, or for staging quantities. A filter to view quantities by phase is provided.

Pay Item - The basic definition of a payitem – name (or pay item number), description, unit of measure, unit cost etc.

Quantity - The quantity associated with each pay item is the sum of all individual quantities for that payitem. For example, 20 pipes each with length 50' in length will correspond to 20 quantity records, one for each pipe.

Element - For each quantity, there may be one or more associated elements. The element table is only needed when graphic quantities are quantified. For example, a single pipe will have one quantity record (linear feet) and one element record (a line element), however, a pavement area will have one quantity record (square feet or yard), but multiple element records composing the perimeter of that pavement area.

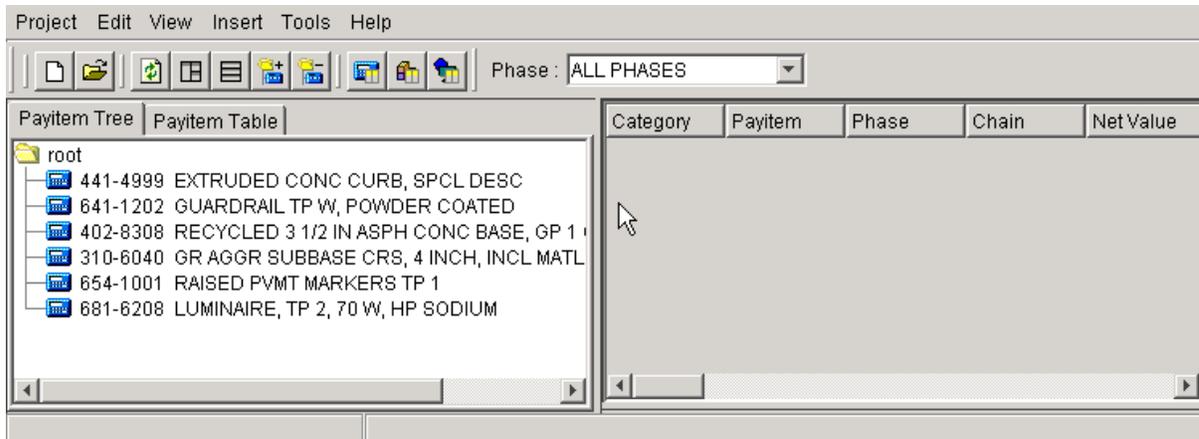
Vertex - For each element, there may be one or more associated vertices. A line element will have two vertices, a line string will have many, and a rectangular shape will have five (1, 2, 3, 4, 1).

Payer - This is a list of payer (funding sources) that will be participating in funding computations.

Funding Rule - This is a list of funding rules. Each funding rule is made up of a list of participating payers, and their corresponding participating percentages. A funding rule may optionally carry a station range, in the event that certain payitems may be funded differently at different stretches of a project.

PULLDOWN MENUS

When a database is opened or created, tools on the menu bar are undimmed, as depicted in the graphic below. Six menus are supported on the menu bar.



PROJECT

New	Creates a new database by opening the Create Database dialog box.
Open	Opens the Connect To Database dialog box, wherein the desired database may be selected, and User Name and Password defined.
Close	Closes the current project (database) but does not exit the Quantity Manager.
New Phase	Used to separate a project into smaller, more manageable groups for large projects. Each sub-group can be reviewed, manipulated, etc., or all groups can be manipulated simultaneously. If desired, only one phase can be used. Click OK to create the New Phase, and open the Phase Property dialog box. Additional phases may be added, phases may be deleted, and the Funding dialog can be opened from the action icons at the bottom of the dialog.
Import	Payitems can be imported into the current category from an aecXML document displayed in the Select Payitems dialog. The Search Mask enables the user to specify the initial part of the Payitem to filter the list.
Export	Two export types are supported in GEOPAK Quantity Manager: ·GEOPAK QM XML – this will export an XML document that conforms to the standard GEOPAK schema. The schema document is supplied with the install and resides in schemas/qm.xsd. ·aecXML which can subsequently be imported into AASHTO's Trns*port software for estimating purposes.
Properties	Opens the Project Properties dialog box, which is also displayed when a project is created.

History List	Lists previously created or opened databases. This short-cut enables users to select databases used in previous sessions.
Exit	Closes the Quantity Manager.

EDIT

Select All	Highlights all payitem entries in the current quantity pane.
Unselect All	Unselects all payitem entries in the current quantity pane.
Delete	Deletes the highlighted item or category from the database. If a category is highlighted, all child categories and payitems are also deleted. An Alert message is displayed prior to any deletions.
Rename	Renames the selected category or payitem. Please note that the highest level category (root) may not be renamed.
Phase	Opens the Phase Properties dialog, where phases can be added, deleted and the Funding dialog invoked.
Funding	Two options are supported: Payer – List of Payers and Description utilized when defining funding rules. Payers can be added, deleted or imported from an aecXML funding source document. Funding Rule – List of funding rules utilized when defining funding splits for quantities. Rules can be added, deleted, or modified from this dialog.

VIEW

Refresh	Updates all displayed fields from the database.
Columns	<p>Three modes are supported:</p> <ul style="list-style-type: none"> ·Payitem Table ·Quantity Table ·Element Table <p>For each mode, a list of fields within the database is displayed. The user may select or unselect which fields are hidden and which are displayed. The options within the columns vary based on the select of the Table type. Any item toggled on is displayed in the table, any item not toggled is hidden.</p>
Expand Category Quantities	This is a check/toggle to specify the content of the quantity pane when a category is selected. If it is checked, the quantity of the selected category will be displayed, along with all quantities in all subcategories. If it is checked off, the quantity pane will only show quantities in the current selected category, one level deep.
Expand Tree	When chosen, all categories, sub-categories, and pay items are expanded in the Payitem Tree (not the Payitem Table). Note the graphic on the left is the default table, where only root is shown, while the graphic on the right is after the tree is fully expanded.
Collapse Tree	When chosen, all categories, sub-categories, and pay items are collapsed in the Payitem Tree (not the Payitem Table), so that only the highest level category in the hierarchy is shown. Note the graphic on the left an expanded tree with several categories, sub-categories and payitems, while the graphic on the right is after the tree is collapsed, and only the Pay Items category is displayed.
Normal	When chosen, changes the database layout to normal view, where the payitem table is on the left, while the quantity and element tables are one above the other on the right side. If the view is already normal, no changes occur.
Tile Horizontally	When chosen, changes the database layout to horizontal view, where the three tables are one above the other. If the view is already horizontal, no changes occur.

INSERT

Category Insert a category from the current selected category. Three modes are supported:

- Above...
- Below....
- Sub-category

New categories can be added anywhere within the database hierarchical structure.

Pay Item Insert a payitem from the current selected category or payitem. Three modes are supported:

- Above...
- Below....
- In Category

New pay items can be added anywhere within the database hierarchical structure. To add a single item above or below a payitem already in the table, select that payitem then use the Above and Below modes. To add an item at the bottom of a category, select the category first, then utilize the In Category mode.

Quantity Insert a quantity to the current selected payitem. Based on the source of the computations, some data may be dimmed and not available for modification. The quantity property dialog is divided into a general tab and a location tab.

TOOLS

Reports Provide tools to define custom report styles and create reports. Two modes are supported:

- Create
- Define Styles

Reports > Create Create a report of the selected payitem(s) of the active phase. The user may choose the desired report style and report document type. Only document type supported currently is PDF (Adobe Portable Document Format).

Once the document is created, the default viewing application will be launched.

Reports > Define Styles Opens the Report Styles dialog, wherein. new report styles may be added, and existing report style may be modified and deleted.

HELP

About GEOPAK Quantity Manager Activates the About GEOPAK Quantity Manager dialog.

Contents Activates the GEOPAK Quantity Manager online help document.

CREATING A QUANTITY MANAGER DATABASE

Quantity Manager databases can be created in two distinct methods:

- Creating a new quantity manager database within Quantity Manager via **Project > New** on the menu bar.
- Creating a new quantity manager database with **Design & Computation Manager**.

DESIGN AND COMPUTATION MANAGER

1. Create the database within **GEOPAK Design and Computation Manager** – Compute mode.
2. Click on the **Quantity Manager** icon on your desktop.
3. Select **Project > Open** and identify the database created in step 1.

ENTERING DATA

Quantities may be added to the Quantity Manager in two basic methods:

- Automatically generating quantities utilizing the GEOPAK Design and Computation Manager.
- Manual entry, i.e., typing the information into the Insert > Quantity tool.

A combination of methods can also be utilized. The user may import the quantities which are represented graphically via the Design and Computation Manager method. Then non-graphic quantities, such as mobilization, earthwork quantities and lump sum items can be added manually.

DESIGN AND COMPUTATION MANAGER

Utilizing the GEOPAK Design and Computation Manager is an efficient method of automatically generating plan-view or graphic quantities. One output of the D&C Manager is the QM database. In this case, the payitems within the D&C Manager, method of computation, computation values, element information (coordinates, curve radius, etc.) and other data are imported into the QM database. For more details on how to capture quantities via D&C Manager, refer to the online help in GEOPAK Road or Site.

Once payitems are entered into the QM database, they can be reviewed, and in some cases modified. Funding splits can be performed. Non-graphic quantities can also be added by the manual entry method.

MANUAL ENTRY

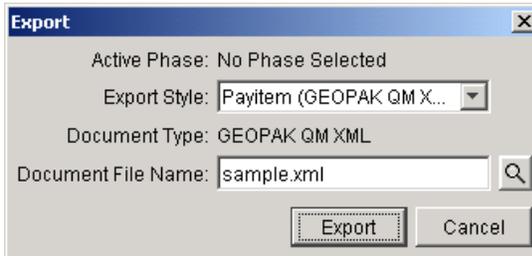
To create a new quantity, select payitem, then invoke **Insert > Quantity** from the pulldown menu or Insert Quantity from the pop up menu.

The image displays two side-by-side screenshots of the 'New Quantity Properties' dialog box for payitem 441-4999. The left window shows the 'General' tab with various input fields and buttons. The right window shows the 'Location' tab with fields for stationing and offsets.

Two tabs are supported. The **General** tab has a variety of different quantity options, as well as descriptions and other general information. The **Location** tab has key-in fields for minimum and maximum station / offset values.

EXPORTING FROM QUANTITY MANAGER DATABASE

Exporting data from Quantity Manager is accomplished by selecting **Project > Export**, opening the dialog box depicted below.



Active Phase	Only a single phase may be exported at one time. If All Phases is selected, the Export button is disabled. Although the Active Phase cannot be changed (display only) in this dialog, a Phase change made in the main dialog automatically changes the Export dialog box.
Export Style	Five export schemas are supported: Payitem (GEOPAK QM XML) is the standard schema used for creating custom reports. The schema is delivered with Quantity Manager under qm/schemas/qm.xsd. Payitem + Funding (GEOPAK QM XML) Payitem + Quantity (GEOPAK QM XML) Payitem + Quantity + Element (GEOPAK QM XML) Payitem + Quantity Sorted (GEOPAK QM XML)
Document Type	Displays the document type to be exported.
Document File Name	Key in the File Name or select via the Browse button.

Note In order to export a Trns*port compatible file, the phases, and funding rules must comply with Trns*port nomenclature.

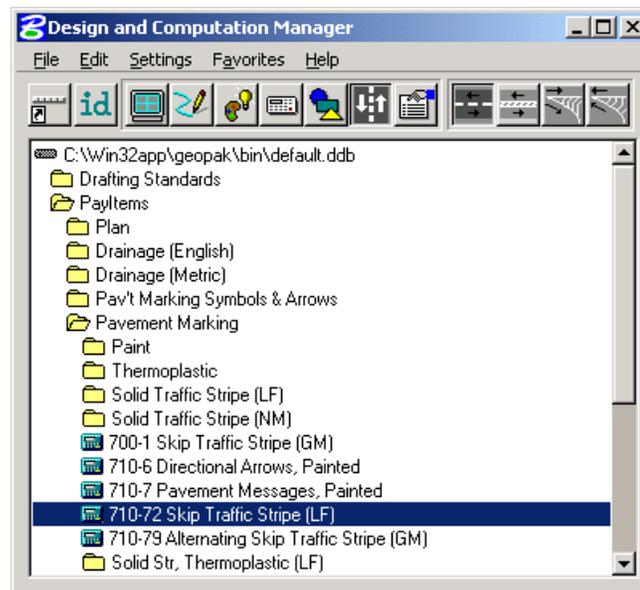
LAB EXERCISE: PLANS PRODUCTION WITH D&C MANAGER **Accessing Plans Production Tools**

1. Open the MicroStation file **c:\data\geo\road1\plan.dgn**.
2. Access **Project Manager**. It should automatically access the Road workflow dialog since we “remembered” the options in Lab 2.
3. Click **Plan View Design**.
This opens the Plan View Design tools tool frame.
4. Open Design and Computation Manager.

 **Pavement Striping - Skip**

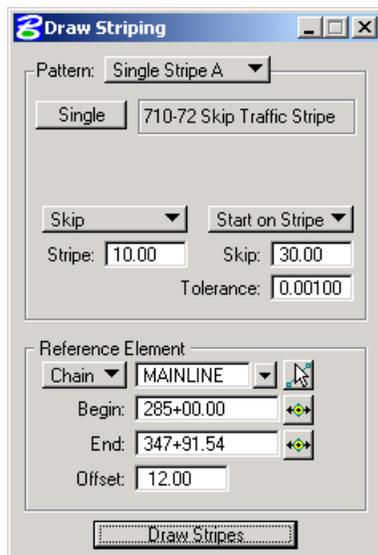
In this section, we are placing pavement striping parallel to the main alignment.

1. Change the Mode to Pavement Marking and select **Pay Items > Pavement Marking > 710-72 Skip Traffic Stripe (LF)**.



2. Select the Striping Operation as shown above to access the Striping dialog.

3. Populate the dialog as shown below.

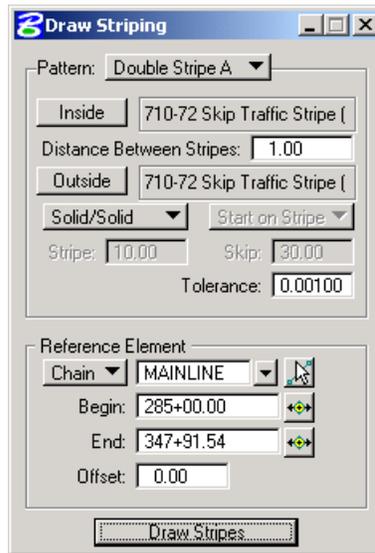


Note Note: Be sure that your graphic group lock is off before the next step.

4. Click **Draw Stripes**. The striping is attached to the cursor. You can move to either side of the baseline and place the striping. Data point on the left side of the alignment.
5. Click **Reset**.
6. Click **Draw Stripes** again to place the striping on the other side of the road.

 **Pavement Striping – Solid**

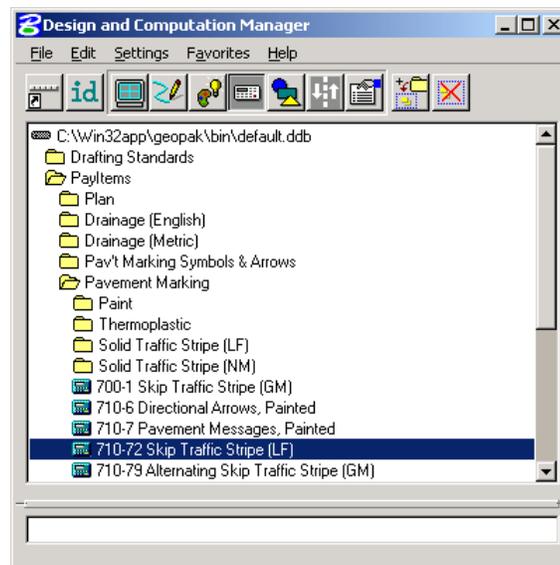
1. Change **Single Stripe A** to **Double Stripe A**.
2. Click the **Inside** and **Outside** buttons to select the current pay item from the ddb file.
3. Set the **Distance Between Stripes** to 1.0.
4. Change the option button to **Solid/Solid** for placing a dual solid line.
5. Set the **Offset** to **0.00**.



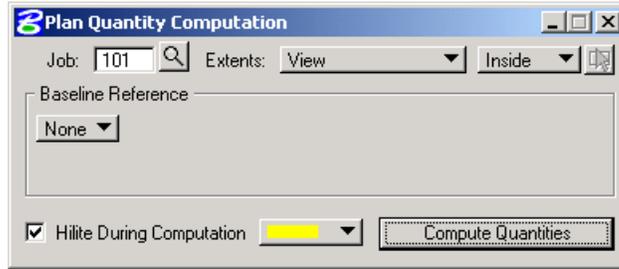
6. Click **Draw Stripes**, then move the cursor to the view and issue a data point then a reset.
7. Close the striping dialog , but leave the main D&C Manager dialog active.

 **Compute Quantities**

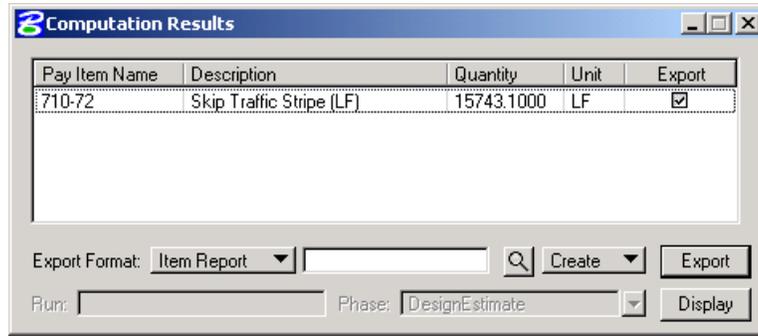
1. Change the current D&C mode to **Compute**.



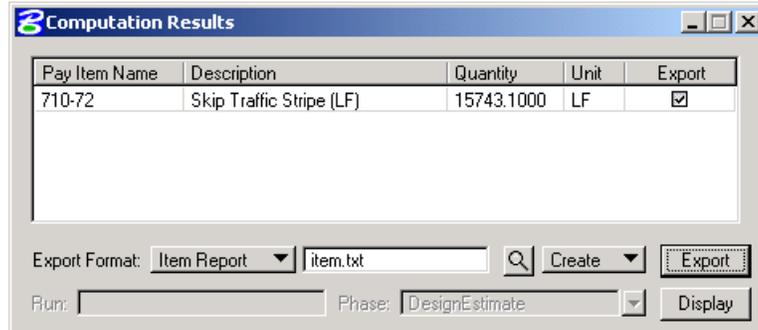
2. Click item **710-72 Skip Traffic Stripe (LF)** to make it the active item for computing quantities.
3. Populate the supplemental dialog as shown below.



4. Since we are doing the quantities based on what is displayed in View 1, be certain to fit all pavement marking in View 1.
5. Click **Compute Quantities**. Update the view so that the elements are no longer highlighted.
6. Review the output.

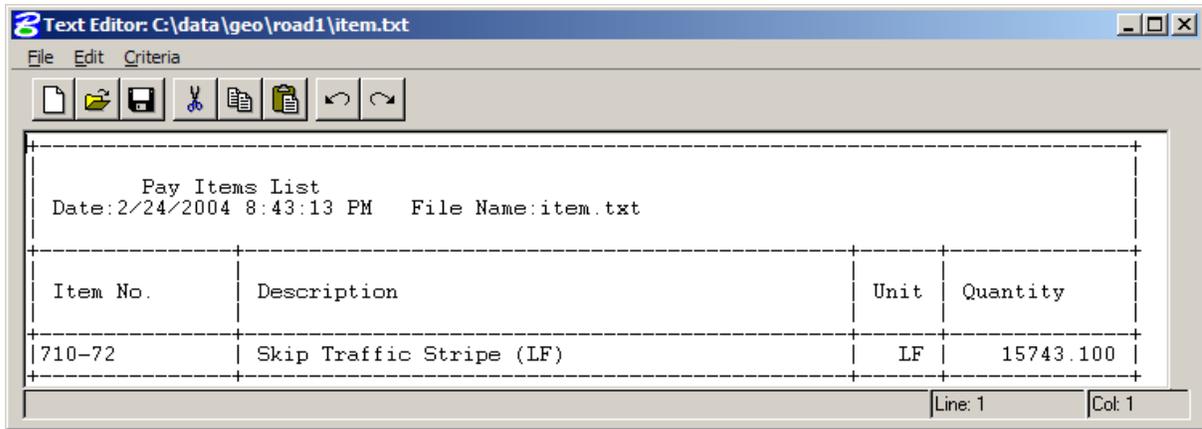


7. Next we will export the quantities to an Item Report. Set the **Export Format** option to **Item Report**. Enter the output file name **item.txt**. The dialog should appear as below.



8. Click **Export**. A file named **item.txt** should be created in the working directory.

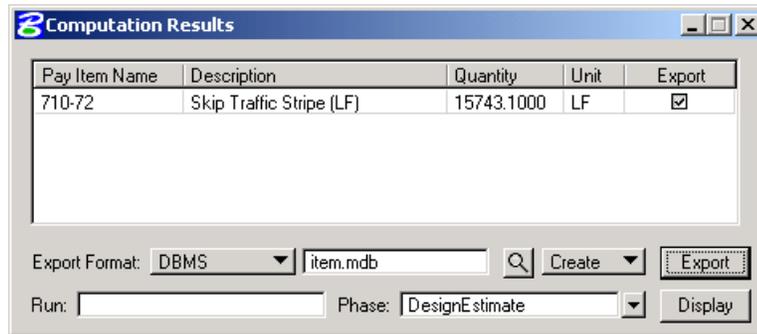
9. Open **item.txt** using the GEOPAK editor. The file should appear as below.



10. Close the GEOPAK editor, but leave the main D&C Manager dialog active.

 **Create Quantities Manager Database**

1. Set the **Export Format** to **DBMS** on the **Computation Results** dialog. The output file name should change to **item.mdb**.



2. Click **Export** . A file named **item.mdb** is created in the working directory.
3. Close all D & C Manager dialogs.
4. Select **Application > GEOPAK ROAD > Quantity Manager**.

