VDOT GeoTechnical Training

Training Manual

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CIVIL ENGINEERING SIGN-UP SHEET

Date: _____

Course: _____

Location: _____

Instructor: _____

Attendee: _____

Company: _____

Address: _____

_____

_____

Phone: _____

Fax: _____

Email: _____

Name as you would like for it to appear on training certificate:

_____

Please FAX this sign-up sheet to:

FAX: (305) 948-6290

Bentley / GEOPAK
1190 N.E. 163rd Street
North Miami Beach, Florida 33162
Attn: Roy Balta

Thank you !

BENTLEY

Course Evaluation

Course Name: Course Dates:

Course Location: Instructor Name:

Student Information

- What is your primary job responsibility?

  _____

- How much experience did you have with GEOPAK prior to attending this course?

  __ Zero __ 1-6 months __ 7-12 months __ 1+ years

- When will you be able to apply what you have learned?

  __ Never __ in 1-6 months __ in 7-12 months __ in 1+ years

- Were you fluent in MicroStation before this course? __ Yes __ No

---

Course Content

1 = Strongly Disagree 2 = Disagree 3 = Agree 4 = Strongly Agree

- Do you feel that you can successfully apply what you have learned? 1 2 3 4

  Comments _____

  _____

- Will the course materials serve as a good reference in the future? 1 2 3 4
- Were the class materials clear and easy to understand? 1 2 3 4
- Were the exercises clear and easy to understand? 1 2 3 4
- Was the material organized in a way in which promoted comprehension? 1 2 3 4
- Was there sufficient time allotted for exercises? 1 2 3 4
- Was the length of the course sufficient? 1 2 3 4

  Comments _____

  _____

- Which sections of the course were MOST valuable to you?

  _____

  _____

- Which sections of the course were LEAST valuable to you?

  _____

  _____

- Overall, did this course meet your expectations? 1 2 3 4

  What expectations did you have that were not met?

  _____

  _____

(OVER PLEASE)

Instructor

- Was the instructor well prepared? __ Yes __ No
- Was the instructor organized? __ Yes __ No
- Did the instructor explain concepts clearly? __ Yes __ No
- Did the instructor explain concepts completely? __ Yes __ No
- Did the instructor clearly state the objectives of the course? __ Yes __ No
- Did the instructor fully cover the objectives of the course? __ Yes __ No
- Did the instructor have a sound and thorough knowledge of the courseware? __ Yes __ No
- Did the instructor have a sound and thorough knowledge of the exercises? __ Yes __ No
- Did the instructor answer questions completely? __ Yes __ No
- Would you take another class from this instructor? __ Yes __ No

What is your overall rating of this instructor?

Excellent Good Average Below Average Poor

Additional Instructor Comments:

_____

_____

General Feedback

- Your training experience with GEOPAK is important to us. Please feel free to offer additional comments, recommendations or suggestions on any aspect of this course.

_____

_____

_____

_____

How would you rate your overall GEOPAK training experience?

Excellent Good Average Below Average Poor

Please return to your instruction or FAX this evaluation form to:

FAX: (305) 948-6290

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1190 N.E. 163rd Street
North Miami Beach, Florida 33162
Attn: Roy Balta

Thank you !

VDOT GeoTechnical Training

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1 Introduction to GEOPAK

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.tin	A binary file containing triangular surfaces also known as the digital terrain model (DTM).
fname.mdb	MicroSoft ACCESS database containing all the information regarding borehole data. This file is created from the gINT database.
fname.gtp	Preference file for visualization settings of borehole information.

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.

To close a dialog box, the following options are available:

- click the X in the upper right corner of the dialog box.
- select the File > Exit option.
- click Cancel on the dialog box.

Exiting the MicroStation file automatically closes all GEOPAK dialog boxes.

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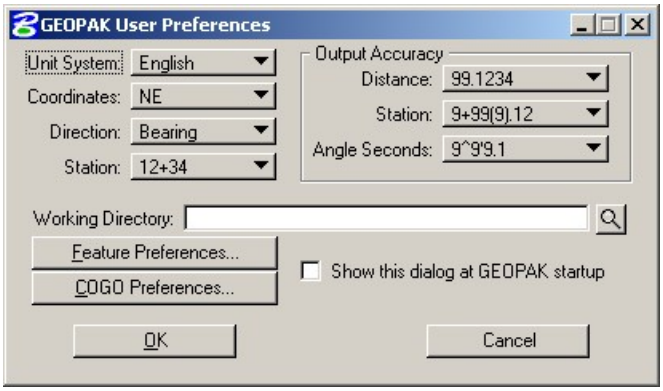
There is a custom tool bar for the VDOT Geotechnical department. This tool bar is comprised of the basic GEOPAK applications that are need to complete a soils project.

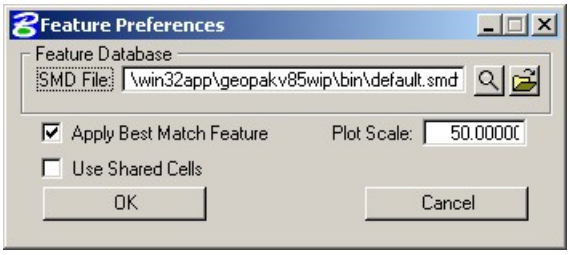
USER PREFERENCES

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 box can be accessed from Applications > GEOPAK Road > User Preferences.



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.

Clicking Feature Preferences opens the Feature Preferences dialog box.



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.

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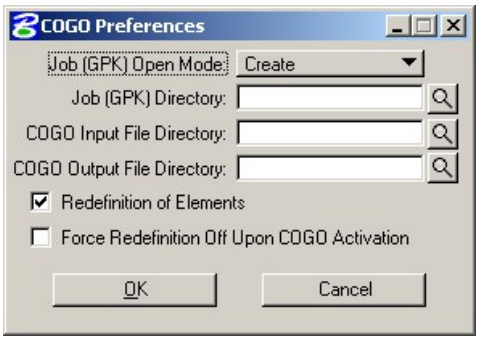
Clicking COGO Preferences opens the COGO Preferences dialog box.

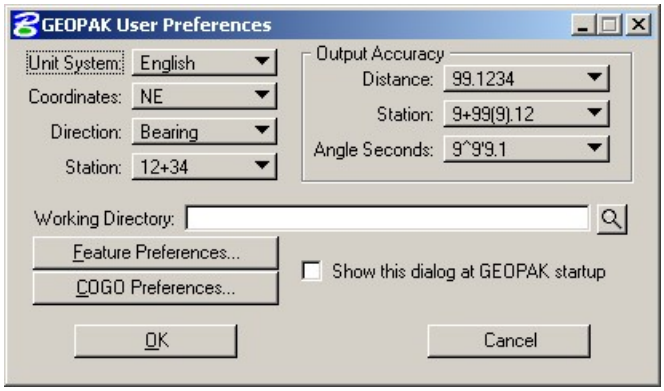


The Job Directory field specifies the location of the GPK file. Since multiple people can read and write the GPK file simultaneously, it is possible to have this file on a server or in a shared folder. If any of the above directory fields are blank, they will default to the Working Directory set in the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

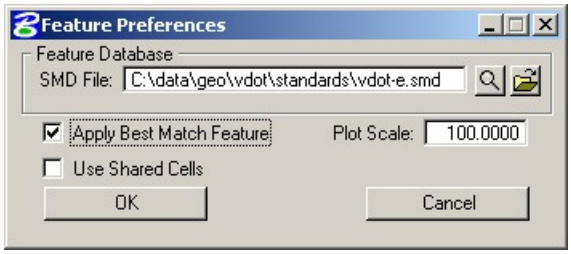
The Plan & Profile Sheet Compatibility option menu can be set to Classic, GEOPAK 2001+ or GEOPAK 2001+ with Raster Manager. Classic enables the original GEOPAK Plan & Profile clip sheet tool, whereas the 2001+ option utilizes a new tool for Plan and Profile sheet generation.

Define Preferences

1. Open the MicroStation file *C:\data\geo\vdot\geotech\d17682des.dgn.*
2. Select the User Preferences tool *(Applications > GEOPAK Road > User Preferences).*



3. Click **Feature Preferences.**



4. Set the **Plot Scale** to **100.**
5. Toggle on **Apply Best Match Feature**.

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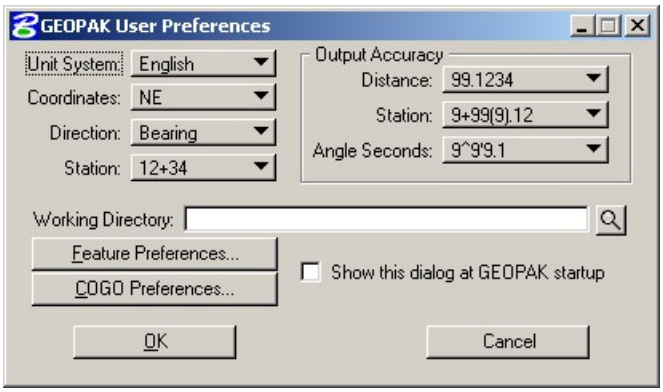
6. Click **OK**.



8. Click **OK**.
9. Exit MicroStation.

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2 Project Manager

INTRODUCTION

Objectives	Learn how to access Project Manager. Learn how to set up a project using Project Manager.
Road Tool Frame	

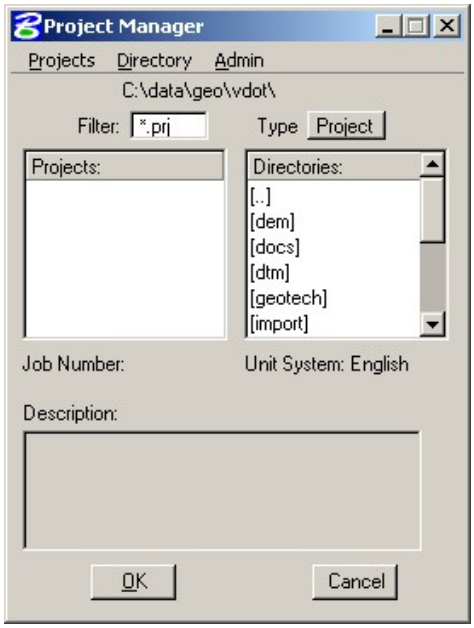
Project Manager is a GEOPAK tool that associates a project with its respective coordinate geometry job number, users, working directories and project files. Project Manager provides the user with an easy workflow system that keeps records of processes run throughout the design of a project.

ACCESSING PROJECT MANAGER

To access Project Manager, select Applications > GEOPAK Road > Project Manager or click the Project Manager tool.

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 OK and Cancel. To exit Project Manager, click Cancel. To continue in the Project Manager process, click OK.



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.

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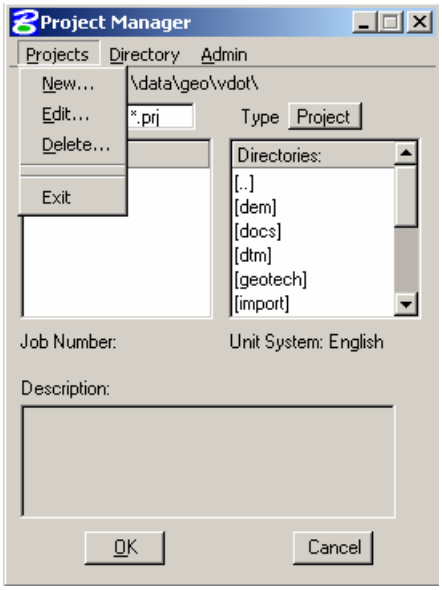
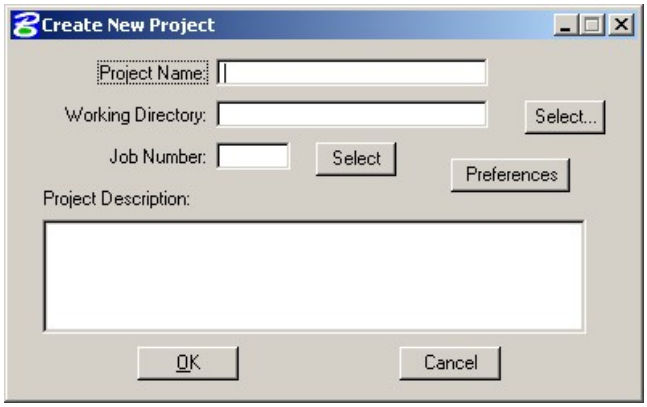
PROJECT TOOLS

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



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. When the New menu option is selected, the following Create New Project dialog box opens.



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, Select 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 Select may be clicked and the appropriate COGO job number selected.

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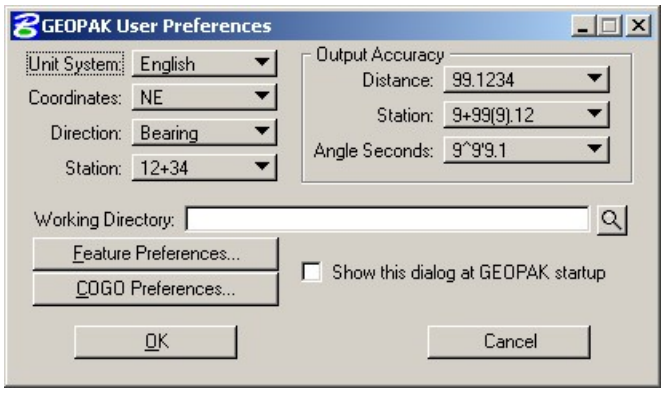
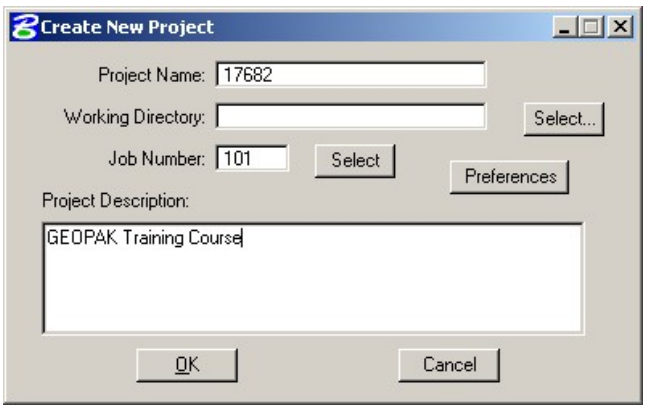
Next, click Preferences, invoking the Project Preferences dialog box.



The user may click on COGO Preferences, then 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 box or added later by accessing it from the Edit menu.



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

The Delete option on the pull down menu 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 option on the pull down menu closes the Project Manager and writes the settings to a resource file.

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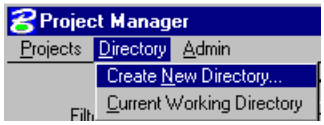
DIRECTORY TOOLS

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



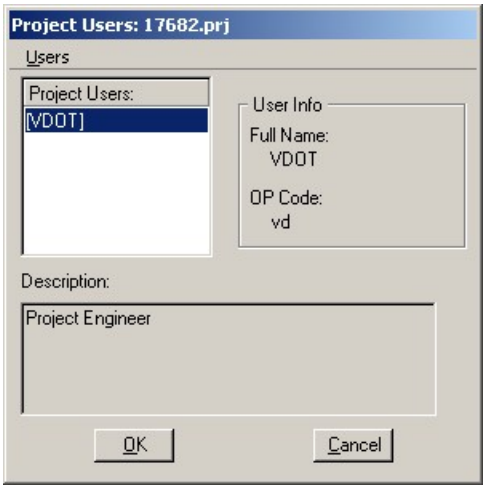
The Create New Directory option creates a new directory on your computer within the current directory. If the Current Working Directory option is chosen, the directory path in Project Manager is changed to that directory.

ADMINISTRATION TOOLS

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

PROJECT USERS DIALOG BOX

Once a project is highlighted and **OK** is clicked, the Project Users dialog box appears.



This dialog box 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 box. 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.

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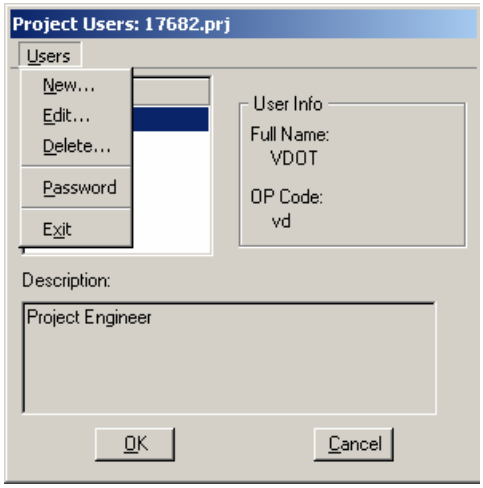
Four tools are supported on the Project Users pulldown as depicted in the exploded view below.



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 box and returns back to the Project Manager dialog box.

ROAD PROJECT DIALOG BOX

After a minimum of one user has been defined, click OK in the lower left corner of the Project Users dialog box or double click on a Project User opens the Road dialog box as depicted.

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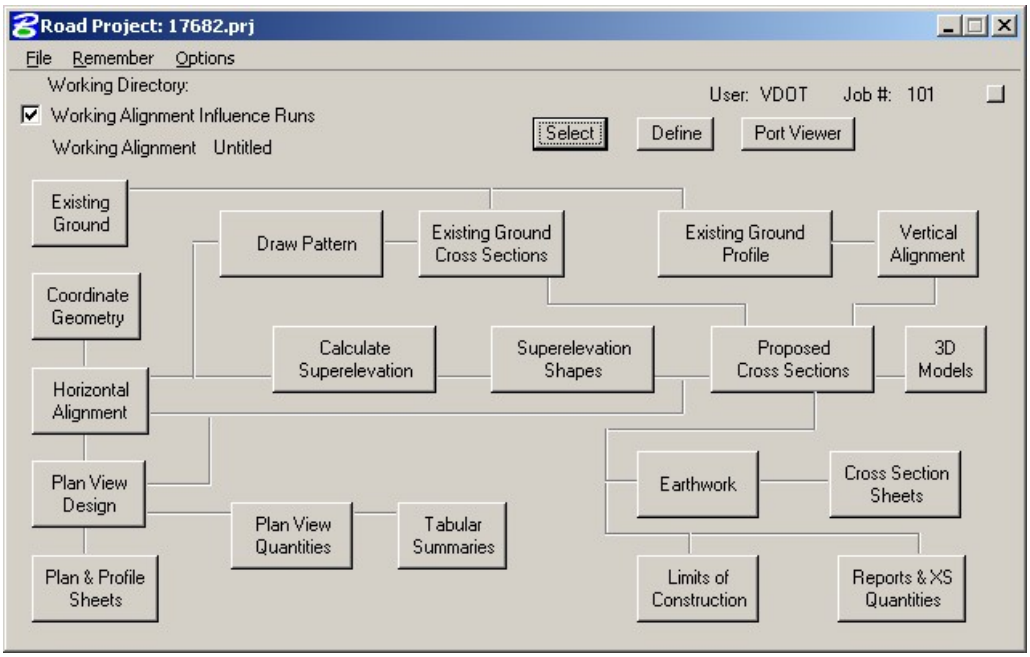
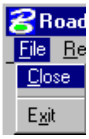


The top of the dialog box displays the Working Directory, Working Alignment (if defined), User and GEOPAK Job Number. In addition, a toggle for Working Alignment Influence Runs is also supported. The bottom portion of the dialog box displays the various processes supported during the design process. The small square in the upper right corner will condense the dialog box 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 box. 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, User, or Road in subsequent sessions. For example, if all three toggles are activated, and the Project Manager is completely closed (all dialog boxes), the invocation of the Project Manager immediately invokes the Road Project dialog box (flow chart) and utilizes the project name, user name, etc., which were active when the Remember toggles were selected.

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If only the **Project** and **User** toggles are activated, the user is returned to the Project dialog box in later sessions. If only the **Project** toggle is activated, the user is returned to the Project Users dialog box 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. Once the tool is closed, the Road Project flow chart will be brought to the top of the view window.

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 box. 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 box:

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

The Port Viewer (covered in detail in Chapter 13) 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. The applicable views for design display include:

- Plan view layout
- Profile
- Cross sections

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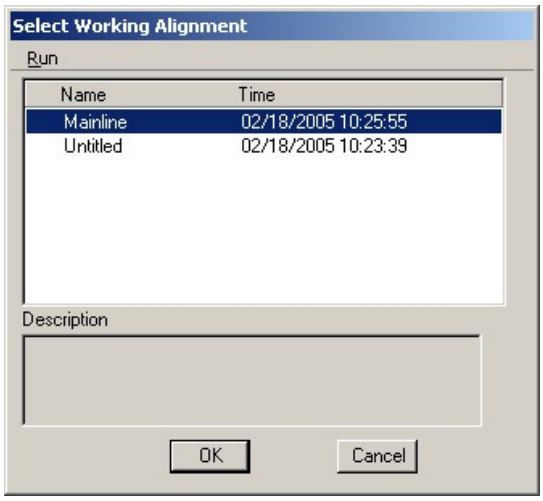
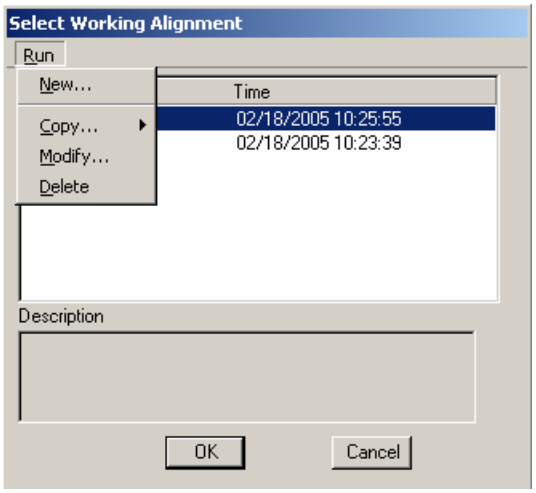
SELECT OPTION



When Select is clicked, the Select Working Alignment dialog box 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 box 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 box. Double clicking on the Name also selects a previous working alignment for subsequent processing. Clicking Cancel closes the Select Run dialog box without any File selection. Several Run options are supported as depicted in the exploded view below.



These are 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.

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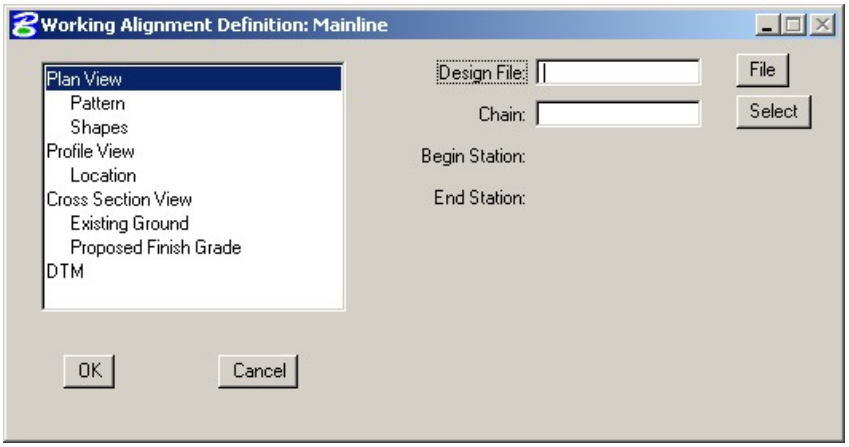
DEFINE OPTION

Once a Run has been selected, clicking **Define** invokes the dialog box depicted below.

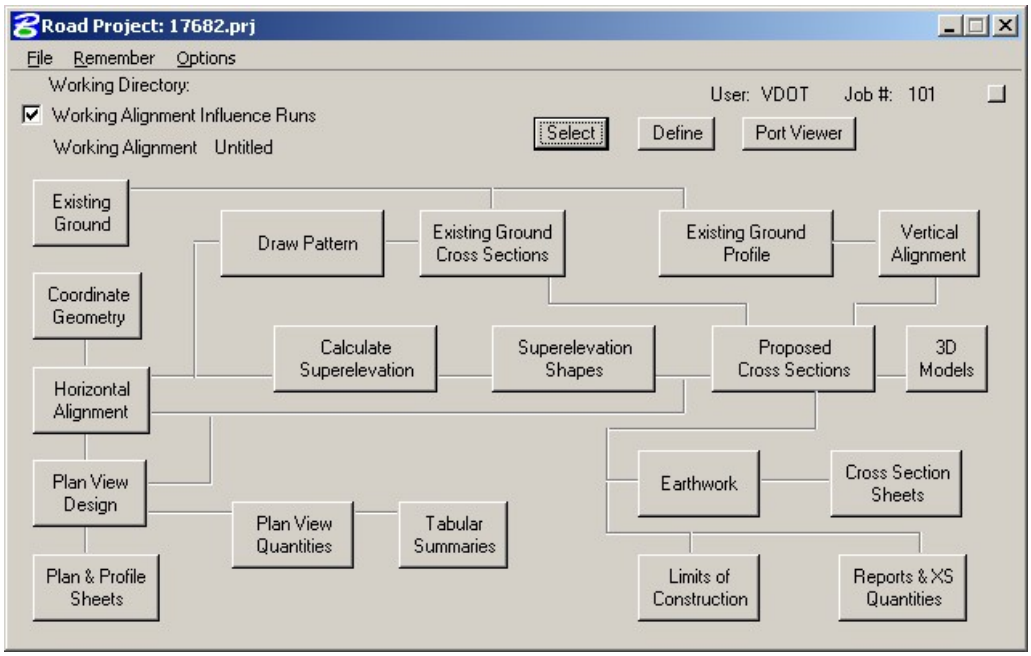


The information that can be associated with a working alignment is listed in the left portion of the dialog box. As each option is chosen, the right side of the dialog box will change to reflect the information needed as can be seen in the dialog box to the right after Profile View was selected.

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 box. For a more complete explanation of each option shown, please see the GEOPAK Manual or On-Line Help.

PROJECT MANAGER PROCESS



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The primary Project Manager dialog box 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 box. 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 box 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 boxes invocation from the Road menu. However, some of the procedures invoke the Select Run dialog box prior to invoking the actual dialog box. The Select Run dialog box enables the user to set up different options to use in alternative design choices or different typicals.

ONLINE HELP

More information can be found under Applications > GEOPAK Road > Help > Project Manager.

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LAB EXERCISE: PROJECT MANAGER

Creating a Project

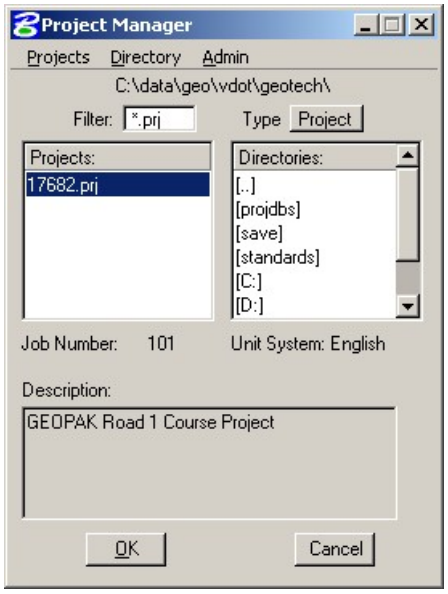
1. Open the MicroStation file *C:\data\geo\VDOT\geotech\d17682dtm.dgn*.
2. Select the Project Manager tool *(VDOT Geotechnical Tools).*

3. In the Directories list box (right side of the Project Manager dialog box), ensure that the project directory is set to *C:\data\geo\VDOT\geotech.*

Note You can navigate quickly to your current working directory by using the pulldown Directory > Current Working Directory.

4. Select the project by clicking on name of the project in the dialog box.

   The project is highlighted as shown in the dialog box with all pertinent information displayed.



5. Click **OK**.

   This opens the Project Users dialog box.

6. Select Users > New to create a new user.
7. Complete the New User dialog box with the name and operator code as shown.

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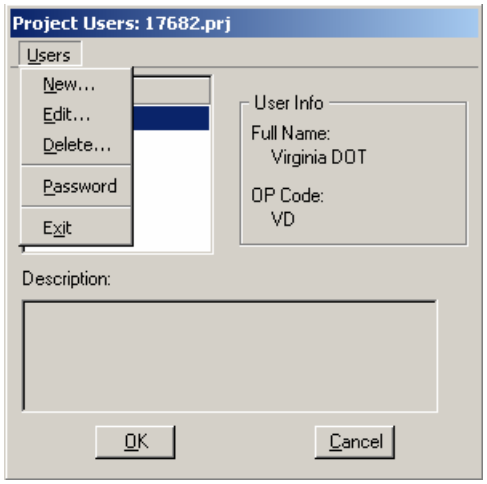

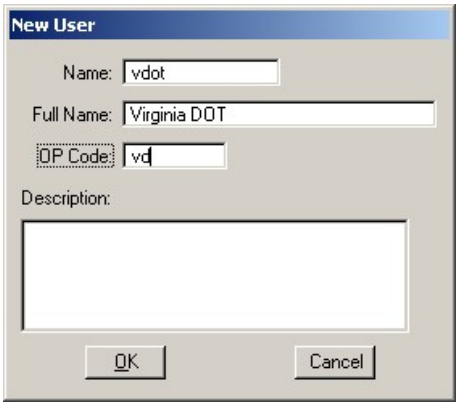

8. Click **OK**. When prompted to define a password for this user, click **No**.
9. Double click the user.

Note To create a project, contact the AES Help Desk.

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3 Coordinate Geometry

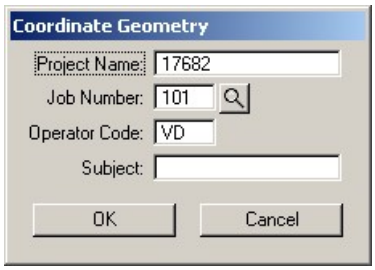
INTRODUCTION

Objectives	Learn to set up and access the coordinate geometry database file. Become proficient in using GEOPAK Coordinate Geometry.
Tool	
Menu Bar Application	GEOPAK Road > Geometry > Coordinate Geometry

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 box appears.



The fields in the Start-Up dialog box are detailed below.

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.

Clicking **OK** opens the main coordinate geometry dialog box.

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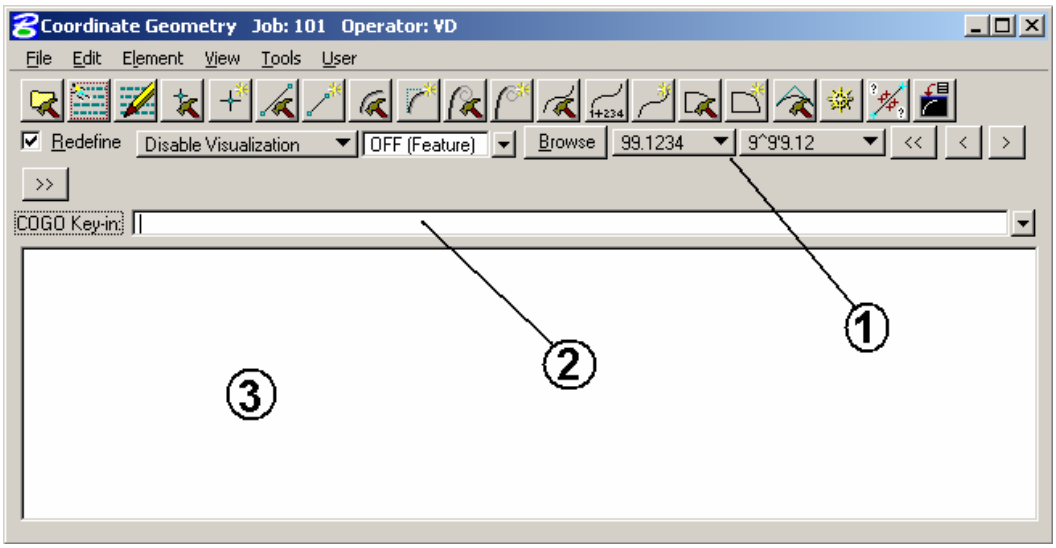
COORDINATE GEOMETRY



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

- Tool Bar (1) consisting of drop down options and icons. The display of specific icons is customizable.
- COGO Key-in (2) this field enables manual entry of COGO commands. The drop down button allows for a history of commands to be reviewed.
- Output Display Window (3) shows the results generated by the commands.

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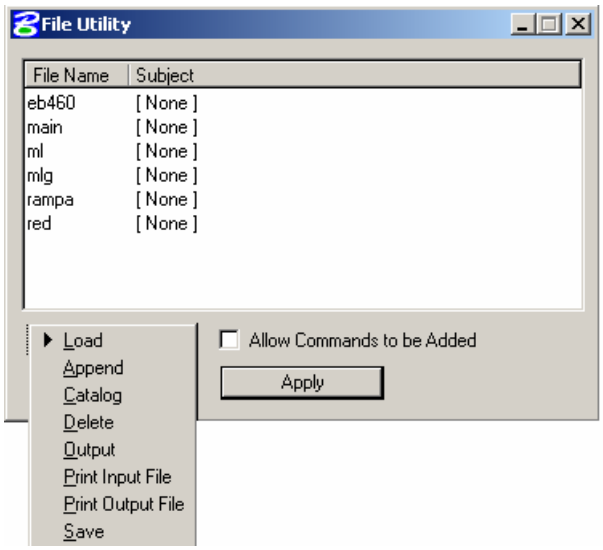
FILE COMMANDS



The File commands (as displayed in the exploded view above) are detailed in the table below.

Append	This command is for *input files* 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. *Highlight* 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.
Load	When selected, a menu appears listing all saved input files. *Highlight* a file, then click the OK button. The input lines from the highlighted file are now displayed in the display window for viewing, editing, or processing.
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	Sends your output/input file to the printer.
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.
Save	Saves the current audit trail to a file. (Fname999.ioc, where 999 is the current job number and oc is the operator code.).
Export	Exports GEOPAK points, chains and profiles into formats for use in various data collectors.
Import	Imports horizontal and vertical alignments and points from RDS and SDMS format into the GEOPAK .gpk file.
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.

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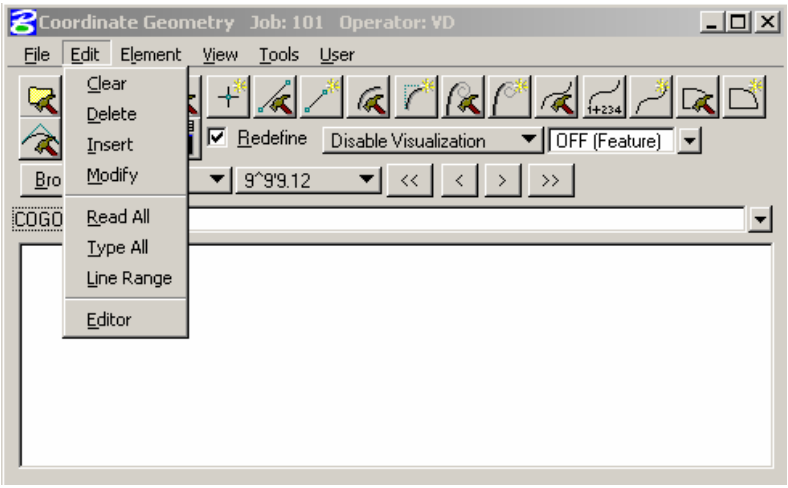
EDIT COMMANDS



The Edit commands (as displayed in the exploded view above) are detailed in the table below.

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.
Editor	Opens the GEOPAK COGO Command Editor, which enables the user to edit the current input file.
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 the specified lines in the audit trail. This may be done for the entire file (All) or by specifying a range of line numbers (Line Range).
Type All	Displays the content of the audit trail, (All) or a portion of the audit trail by specifying a range of line numbers (Line Range).
Line Range	Allows you to specify a beginning line number and ending line number. This range of lines can then be either “read” into COGO or just typed/listed in the display window.

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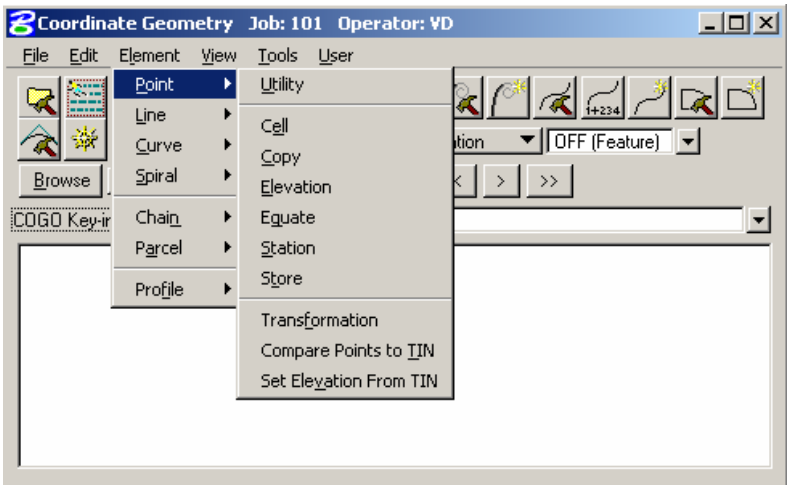
ELEMENT COMMANDS

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.

Cell	Assigns a cell name to a previously stored point. This point and associated cell can then be plotted later through D&C Manager.
Copy	Copies points or a point range to a new point number or range within the same GEOPAK database file
Delete	Deletes a point number (or range of numbers) from the 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
List/Print	Input a range of point numbers. List displays the point numbers (but no associated data) currently stored in the .gpk file within the specified range. Print displays point number, x, y, z coordinates, station value and other stored information in the display output window for the requested points.
Station	Adds a station to a previously stored point.

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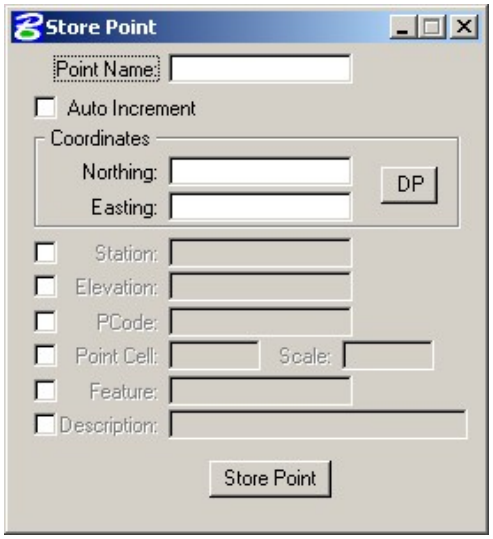
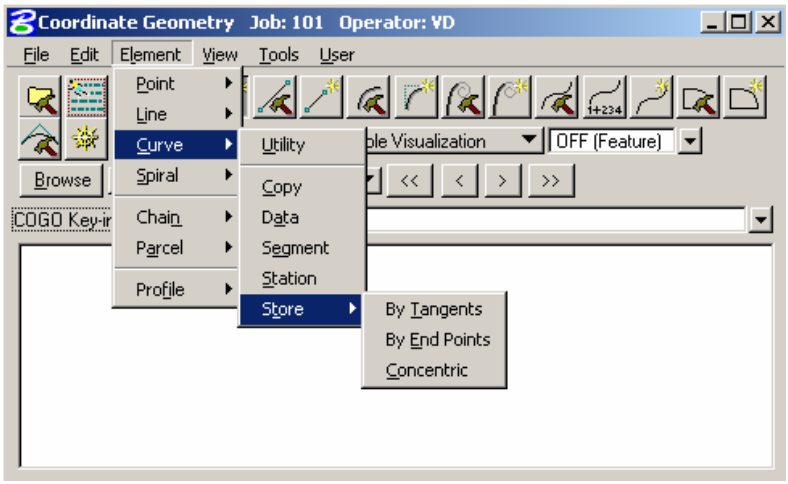
Store	Stores a point by key-in coordinates or by selecting a location graphically. A station, elevation, point code, cell, feature, or description can be optionally stored with the point.	

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



The Curve commands (as displayed above) are detailed in the table below.

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.
Delete	Deletes selected curve from the database file.
List/Print	List displays only the curve names currently stored in the .gpk file. Print displays the curve data of the selected curve.

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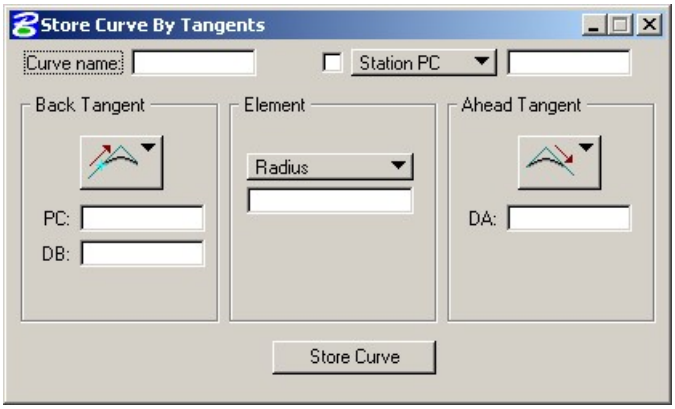
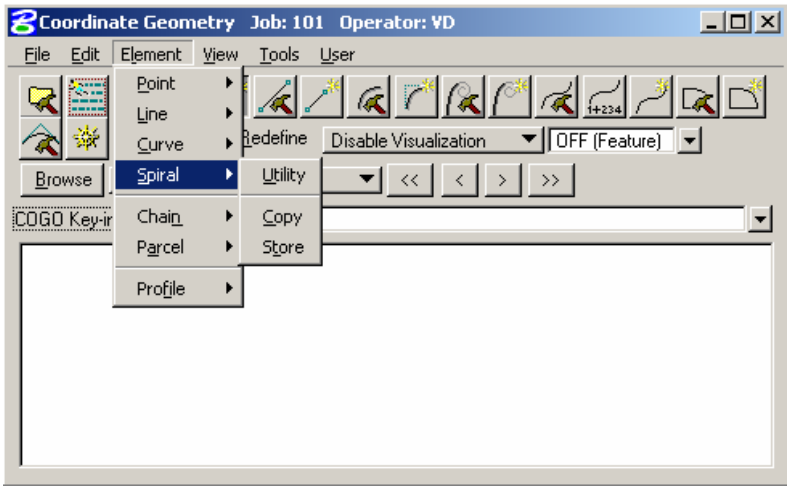
Segment	Defines new curves by dividing a stored curve into segments.
Station	By identifying a curve and a control point on the curve (PC, PI, or PT), a station value may be assigned.
Store	Provides various options for defining and storing lines and curves such as Store Curve from Tangents as shown below.



Transpose	Reverses a previously stored curves direction.

ELEMENT > SPIRAL



The Spiral commands (as displayed in the exploded view above) are detailed in the table below.

Copy	Copies a specified spiral to another spiral name.
Delete	Deletes the selected spiral from the database file.
List/Print	Displays all spiral data for the selected curve. List displays only the spiral names currently stored in the .gpk file. Print displays the spiral data of the selected spiral.
Store	Provides various options for defining and storing spirals.

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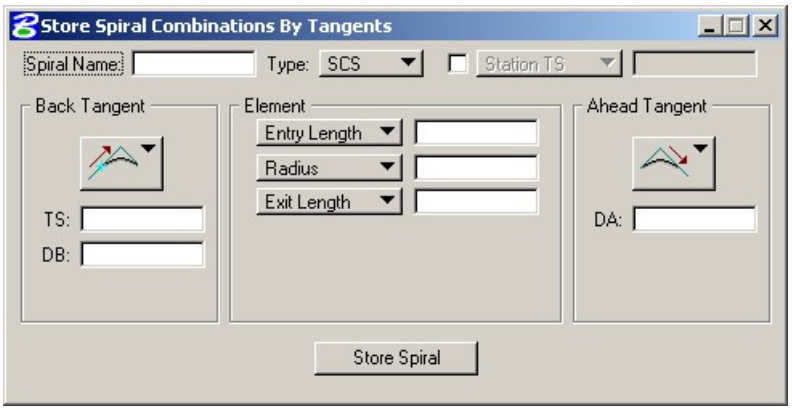
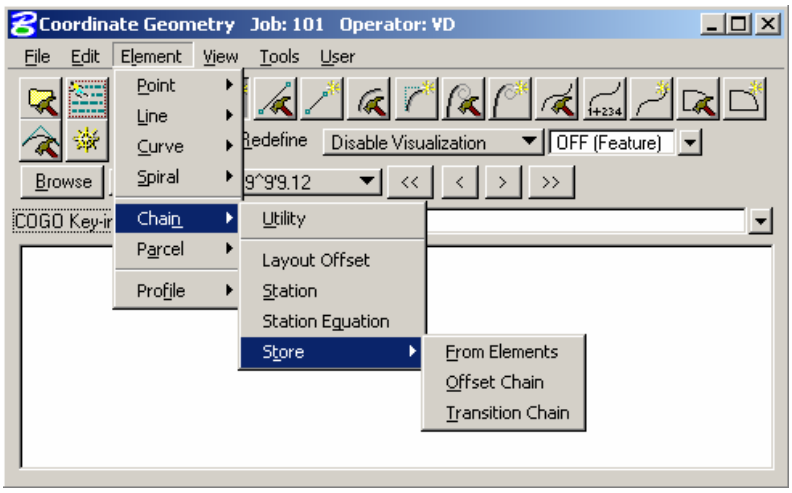


ELEMENT > CHAIN



The Chain (GEOPAK alignment) commands (as displayed in the exploded view above) are detailed in the table below.

Area	Calculates the area of a closed chain
Delete	Deletes selected chains from .gpk database file.
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.
Describe / List / Print	Displays chain information. Print displays the name of each chain element. Describe displays the alignment data of each element in the selected chain.
Stationing	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, From Offset Chain and Transition Chain. (Chain name can be between 1-9 alphanumeric characters)

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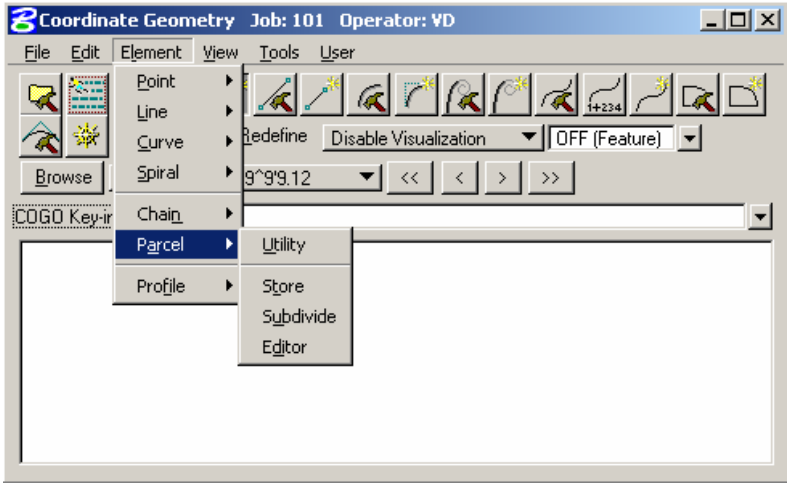
ELEMENT > PARCEL



The Parcel commands (as displayed in the exploded view above) are detailed in the table below.

Delete	Deletes selected parcels from the database file.
Describe / List / Print	Displays parcel information. Describe displays the elements of composition, the area of tract stored, taken and remaining and a point, bearing, distance description of the specified tract. Print displays the elements of composition, the area of tract stored, taken and remaining.
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 dialog boxes.

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 *Legal Description Editor* for the ability to create detailed and customizable legal descriptions.

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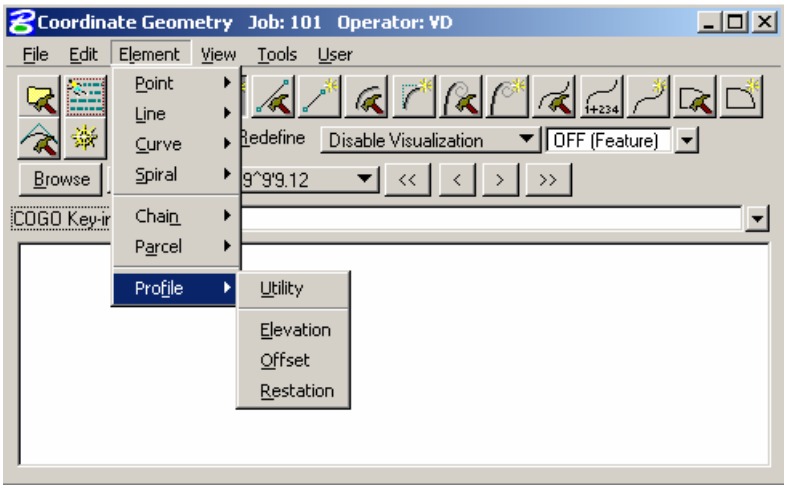
ELEMENT > PROFILE



The Profile commands (as displayed in the exploded view above) are detailed in the table below.

Note Note additional commands are supported as keyin only commands.

Delete	Deletes selected profiles from the database file.
Elevation	Provides three options for reporting elevations along a selected profile, Station, Even Station, Incremental Stations.
List/Print	Displays profile information. Print displays the data of the selected profile from the database file.
Offset	Stores a new profile within a specified Station Range at a defined vertical offset from the original profile.
Restation	Provides a method for restationing an existing profile

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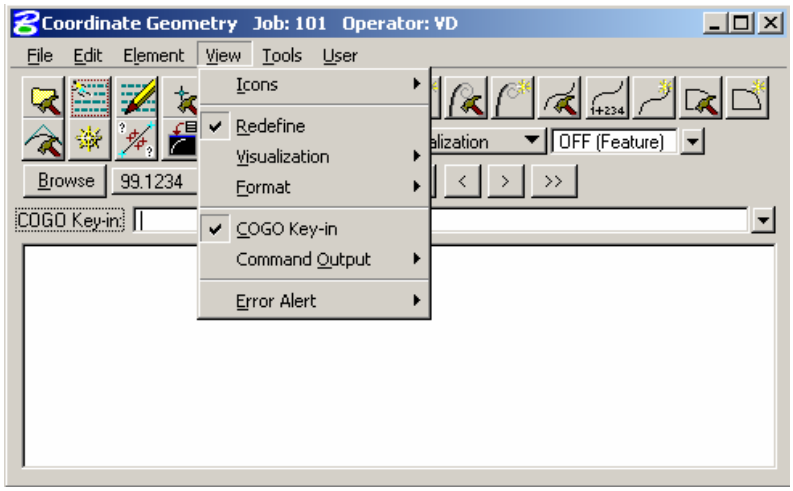
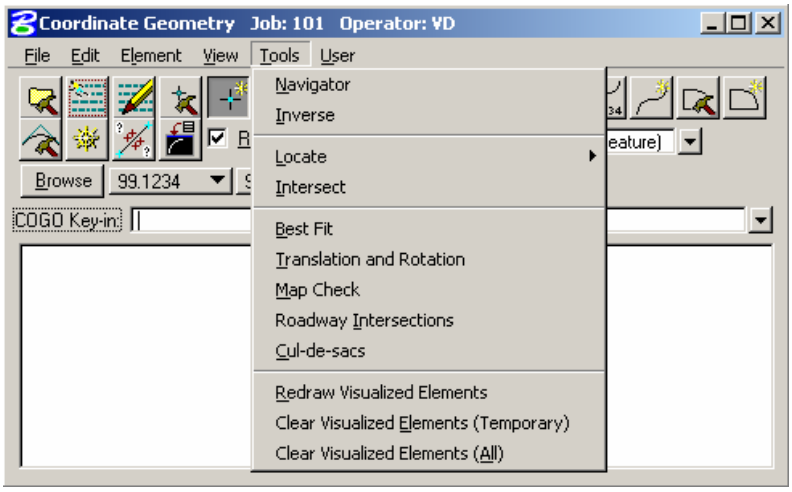
VIEW COMMANDS



The View commands (as displayed in the exploded view above) are detailed in the table below.

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 box.
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 *beep* and/or restore a minimized COGO dialog box when an error occurs.

TOOLS COMMANDS



The Tools commands are detailed in the table below.

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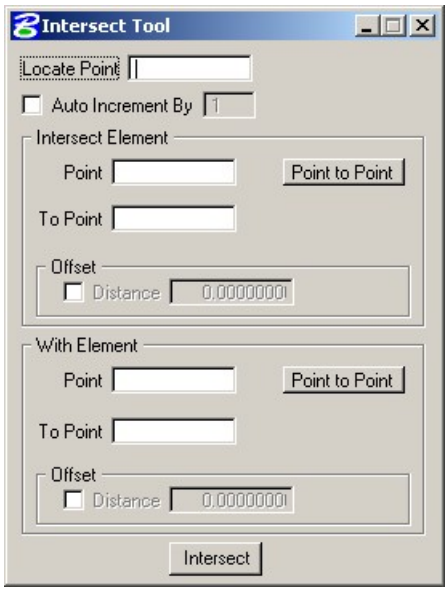
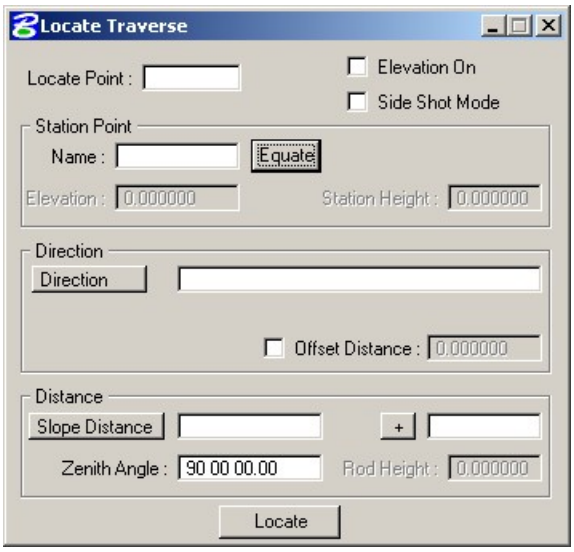
Intersect	Stores a point at the intersection of any two COGO elements.



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 box below.



Superelevation	Calculates the superelevation transitions for a given chain and design speed by the Classic Methods delivered prior to GEOPAK 2000.
Inverse	Calculates the distance and direction between points.
Navigator	Invokes the COGO Navigator. See Section 4.4.
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	Calculates data for the intersection of two COGO elements, usually chains.

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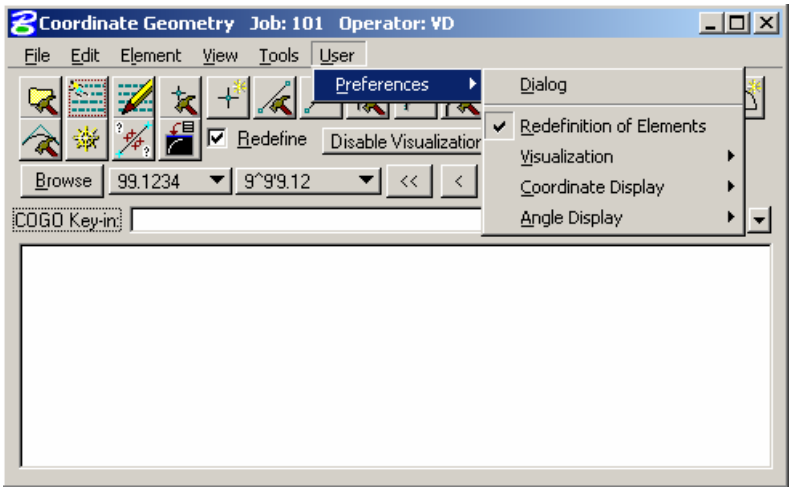
Intersections	
Cul-de-sacs	Calculates data for a cul-de-sac.
Redraw Visualized Elements	Re-syncs the visualized COGO elements in the MicroStation file with the coordinate geometry data.
Clear Visualized Elements (Temporary)	Removes all temporary visualized elements from the view.
Clear Visualized Elements (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.

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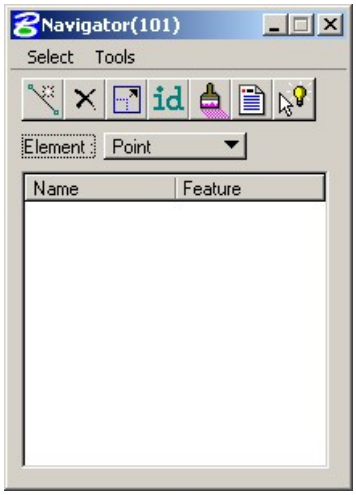
COGO NAVIGATOR

Feature / Function	View, edit and display COGO elements.
Tools	
COGO Menu Bar	Tools > 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 tool.



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.

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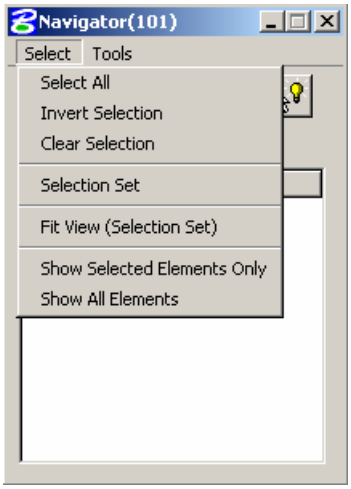
NAVIGATOR > SELECT TOOLS

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



The Select tools are detailed in the table 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.

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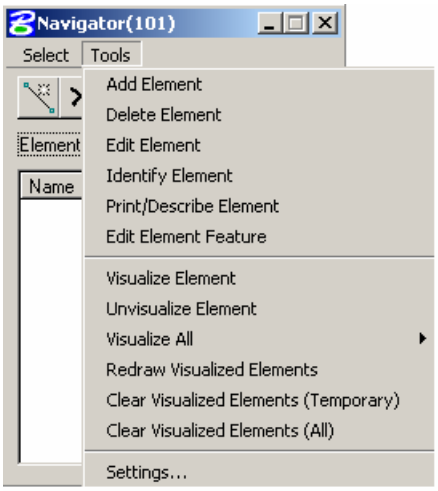
NAVIGATOR > TOOLS

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 box is invoked.
Delete Element	Deletes the highlighted element.
Edit Element	Invokes the appropriate Store Element dialog box, 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 Elements	Re-syncs the coordinate geometry data with the data displayed in the 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.

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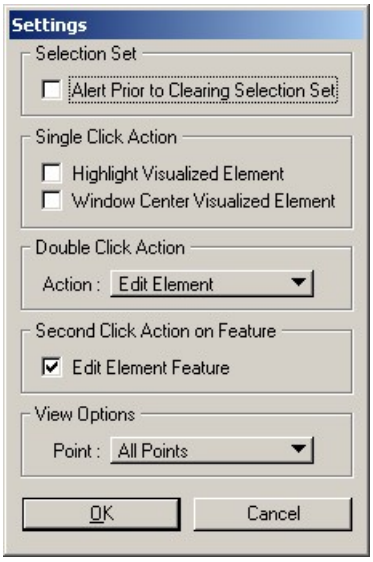
Settings	Enables the user to define certain actions and behaviors of the Navigator.



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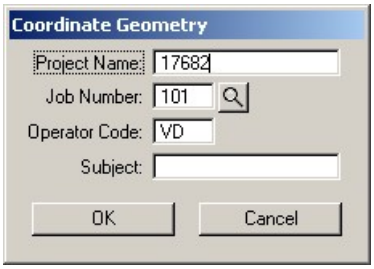
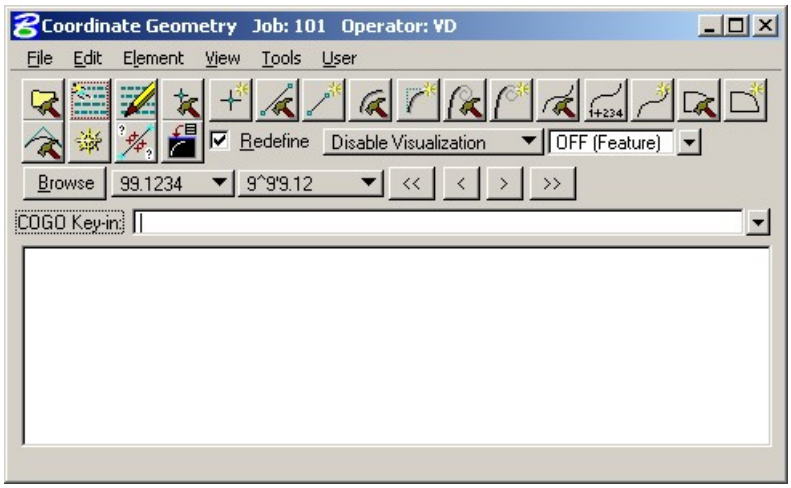
LAB EXERCISE: COORDINATE GEOMETRY

Accessing COGO

1. Open the MicroStation file *c:\data\geo\VDOT\geotech\d17682des.dgn*.
2. Select the **Coordinate Geometry** tool *(VDOT Geotechnical Tools).*



3. Click **OK**.



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

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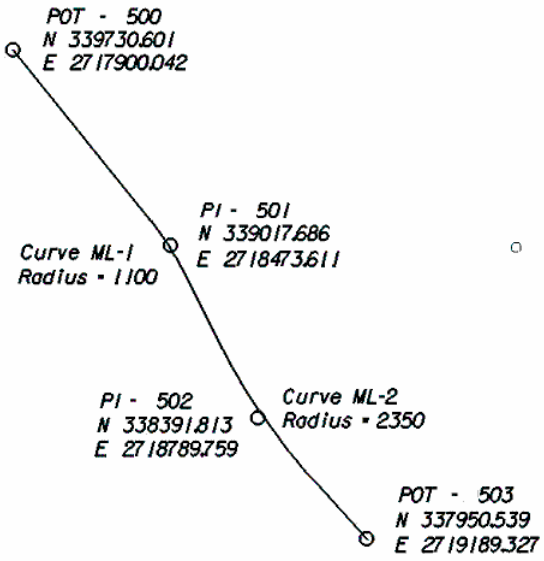
STORE GEOMETRY

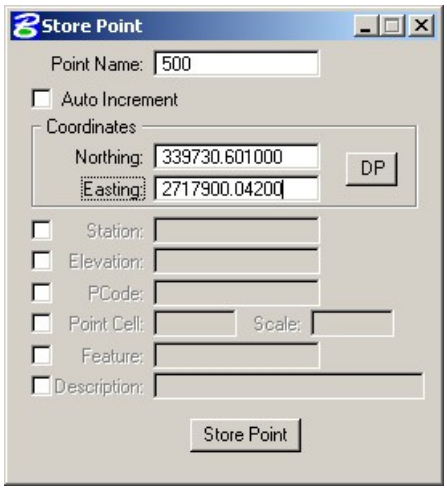
Our course project has 4 alignments. We'll store two of them using Coordinate Geometry. The first alignment will be called **MAINLINE** and is shown below:



Store Points

1. Select the visualization option **Permanent Visualization** on the main COGO dialog box.
2. Select the Store Point tool (COGO: **Element > Point > Store)** or by clicking **Store Point**.

3. To store point 500, manually enter the point number and coordinates as indicated in the dialog box below.



4. Activate the **Auto Increment** toggle.

   This automatically increments the point number by 1 for subsequent Store Point commands.

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5. Click **Apply** to store the point into the COGO database.
6. Continue storing points **501**-**503** by utilizing the coordinates shown on the alignment diagram.

Note The following point naming conventions should be followed.

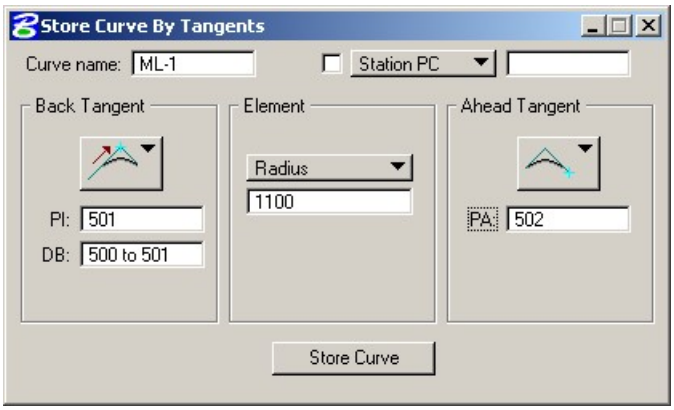
GROUP	POINTS SHOULD BEGIN WITH
Design	D (e.g. D501, D502, etc.).
Hydraulic	H (e.g. H501, H502, etc.)
Survey	S (e.g. S501, S502, etc.)
Traffic	T (e.g. T501, T502, etc.)
Right of Way	R (e.g. R501, R502, etc.)
Environmental	E (e.g. E501, E502, etc.)
Utilities	U (e.g. U501, U502, etc.)

STORE CURVES

1. Select the Store Curve from Tangents tool *(COGO: Elements > Curve > Store > From* Tangents) or by clicking Store Curve.

2. To store **Curve ML-1**, complete the dialog box as shown below and click **Store**.

Note Clicking the "picture" buttons allows you to select from multiple methods of defining the Back and Ahead Tangents



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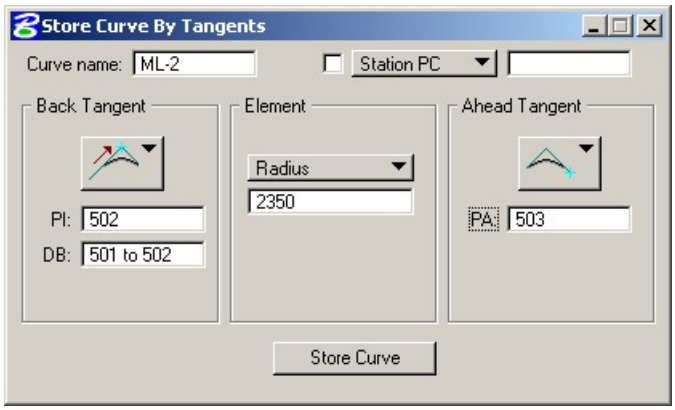
3. To store **Curve ML-2**, complete the dialog box as shown below and click **Store**.



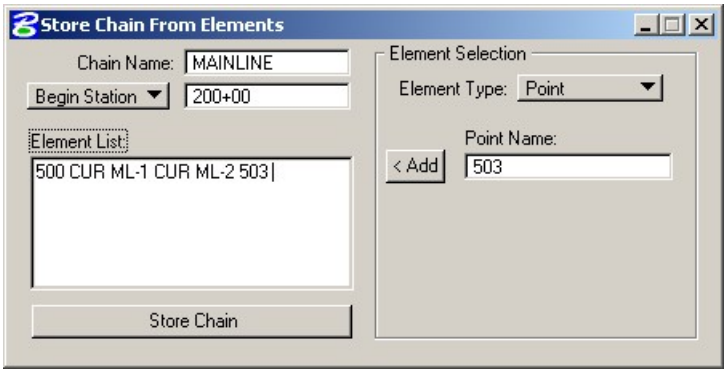
Note Visualized points may be selected to complete any field that requires defined points or directions.

4. Close the Store Curve from Tangents dialog box.

Store Chain

1. Select the **Store Chain** tool *(COGO: Element > Chain > Store > From Elements)* or by clicking Store Chain.

2. Fill in the dialog box as shown below.



Note You can enter the elements manually or select the visualized elements graphically in order to fill in the dialog box.

3. Click **Apply**.

   The chain **MAINLINE** is visualized in the design file.

4. Close the Store Chain dialog box.

Describe Chain

From the COGO dialog window, let's preview the geometry of the chain we just stored.

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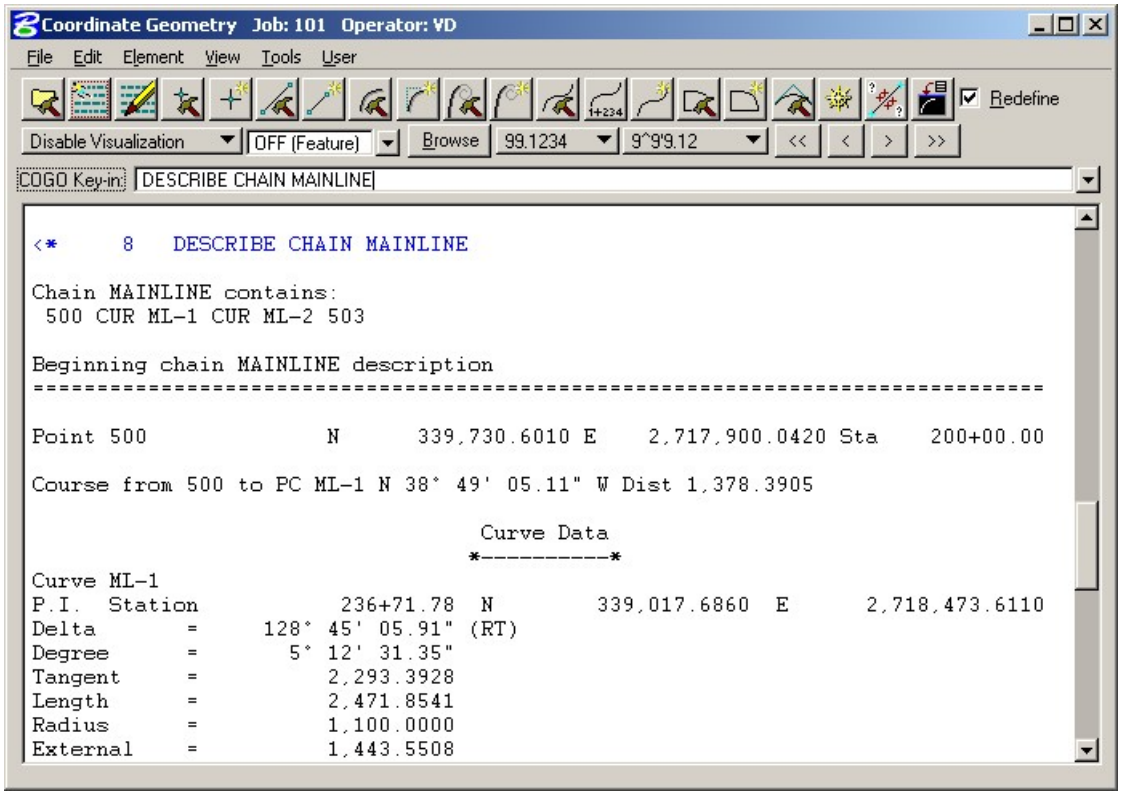
1. Select the COGO **Navigator** tool .

2. or use the **Tools > Navigator** option on the COGO menu bar to access the COGO Navigator dialog box.
3. Set the **Element** to Chain.
4. Highlight MAINLINE.
5. Click “printer”.

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



6. Select **File > Utility** from the COGO menu bar.

   This tool saves an input trail of your commands.

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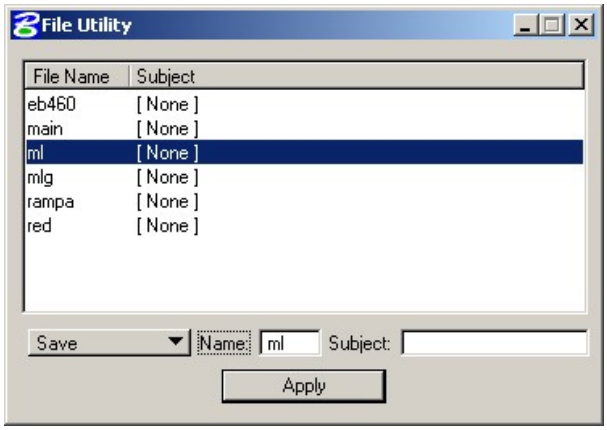
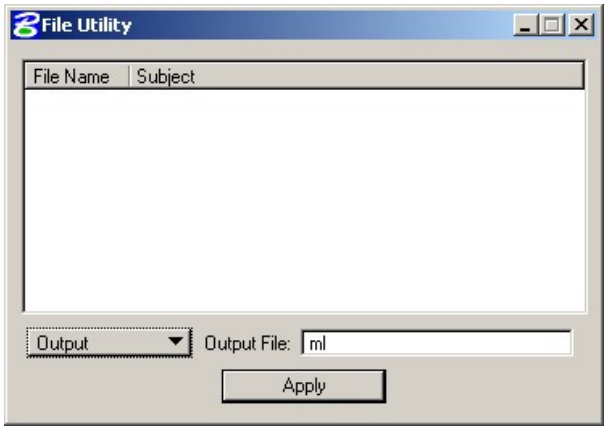
7. Fill out the dialog box as shown below and click **OK**.

   The saved file is *ML101.ivd*.



8. Select **File > Output** from the COGO menu bar.
9. This tool saves an output file with the actual results of the computations.
10. Fill out the dialog box as shown below and click **OK**.

    The saved file will be called 'ML101.ovd'.



11. From the Edit pulldown, select **Edit > Clear** to 'clear' out all the commands that we just previously typed in.

    This will not remove the stored data from COGO.

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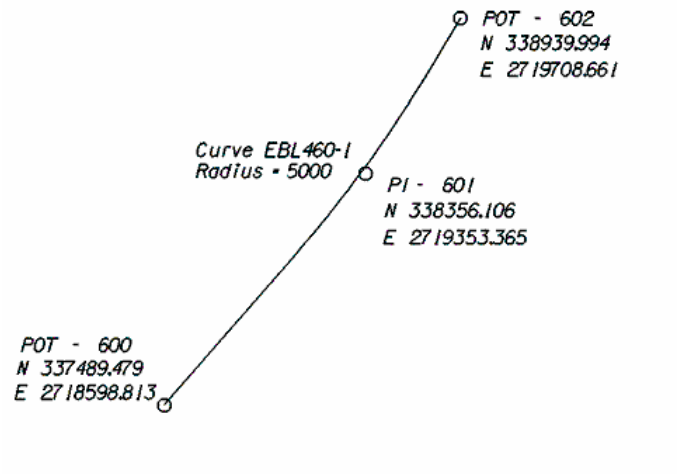
Store Another Alignment

Using the same general steps we learned in storing the previous alignment, use the diagram below to store another chain '**EBL460**'. The beginning station of the chain will be **107+00**.



1. Save an input trail of your commands.
2. Exit COGO.
3. Exit MicroStation.

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4 Digital Terrain Modeling

INTRODUCTION

Objectives	Learn how to display and analyze DTMs for use in roadway design.
Tool	
Menu Bar Application	GEOPAK Road > DTM Tools

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 ground points and vertices along longitudinal features to create planar surfaces. The result of triangulation is the creation of triangles connecting these points. These triangles are included in the GEOPAK TIN file from which existing ground profiles and existing ground cross sections can be generated.

ACCESSING

Clicking GEOPAK Road > DTM Tools invokes the tool frame shown to the right. All of the DTM tools can be accessed from the tool frame or from the DTM menu that can be accessed from the top/left tool on the tool frame.

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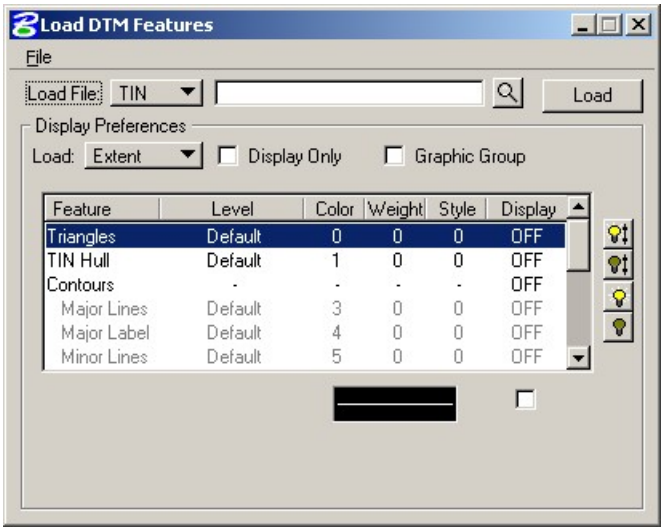
LOAD DTM FEATURES

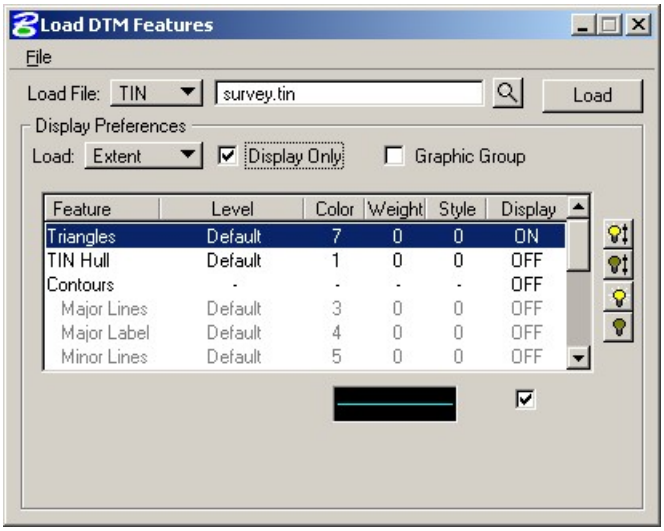
Tool	
Menu Bar	**Load > DTM Feature**

Load is the process by which we can visualize the DTM data, TIN model, lattice model, and contours. By selecting the Load DTM Feature tool, the following dialog box appears.



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 selected view.

Activating the Display Only toggle enables the user to view the elements without writing them to the MicroStation file (temporary display). Conversely, deactivating the toggle writes the DTM features to the MicroStation design file at the defined symbology. These elements can be placed as a graphic group when Display Only is deactivated.



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	Activates the display of all Features.
	Turns off the Display of all Features.
	Turns on only the selected Feature. This can also be accomplished by activating the toggle (below the list box) or double-clicking on an item that is turned off within the list box.
	Will turn off only the selected item. This can also be accomplished by activating the toggle (below the list box) or double-clicking on an item that is turned on within the list box.

ANALYSIS TOOLS

Tools	
Menu Bar	**Analysis > Height** **Analysis > Profile** **Analysis > Volumes** **Analysis > Elevation Differences** **Analysis > Slope Area** **Analysis > Themes** **Analysis > Drainage Tools** **Analysis > Visibility** **Analysis > Trace Slope Path** **Analysis > DTM Camera** **Analysis > Trench Volumes**

The Analysis tools allow the user to visually analyze the digital terrain model utilizing numerous tools as a profile analysis, thematic analysis, drainage flow patterns, and visual portions on the model from any given location.

Height	To determine the height and other associated data dynamically based on user-defined data points within the model.
Profile	View a profile based on a user defined MicroStation element.
Volumes	To compute the volume between two TIN models, the volume between a TIN model and a plane, or the cut and fill totals between two TIN models while applying a shrinkage/swell factors.
Elevation Differences	Will display the elevation difference, or the amount of cut and fill between two TIN models, or a TIN model and a plane of constant elevation.
Slope Area	The Slope Area tool displays the horizontal area and actual slope area (area following the terrain of the Model).
Themes	Displays the digital terrain model based on different user definable themes such as elevation ranges, slope percentage, slope degree, or aspect.
Drainage	Displays and analyzes drainage patterns within a TIN model. Tools include delineating watersheds, drawing flow arrows, determining upstream and downstream traces, finding high and low points, and ridge and sump lines.
Visibility	Based on a user-defined point of origin, GEOPAK visually displays which triangles can and cannot be seen, or what is visible between two points.
Trace Slope Path	Traces a path along a TIN file using a user specified slope and method.

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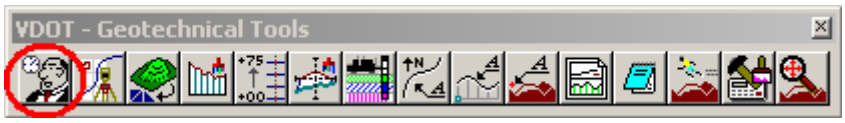
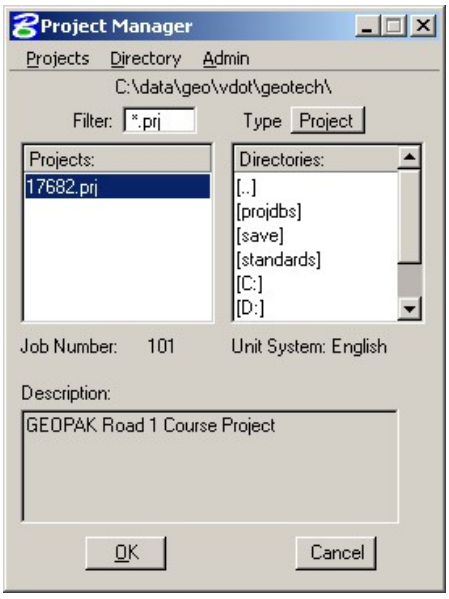
LAB EXERCISE: DIGITAL TERRAIN MODELING

Accessing DTM Tool

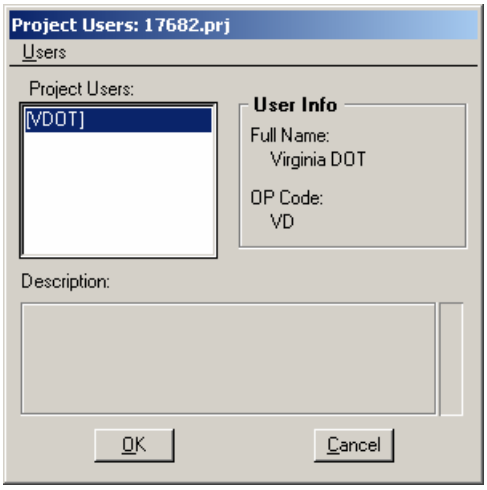
1. Open the MicroStation file *c:\data\geo\VDOT\geotech\d17682dtm.dgn.*
2. Select **Project Manager** from the (*VDOT Geotechnical Tools*).



3. Select the project **17682** from the list and select OK.



4. Select the user **VDOT** form the list and select OK.



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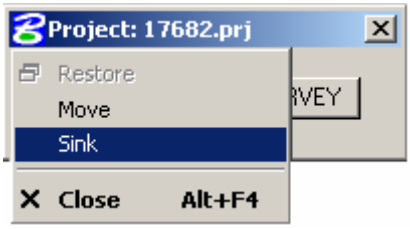
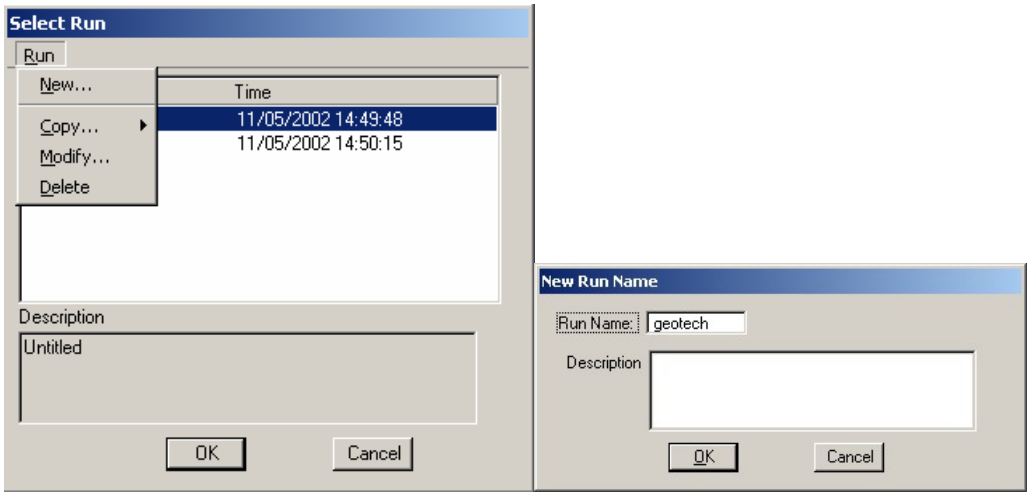
5. By clicking on the Bentley "B" in the upper left of the dialog, select the option from the pulldown for **SINK.**



6. Select the **DTM** tool. (*VDOT Geotechnical Tools tool frame).*

7. Select **Run** > **New**.



8. Enter the **Run Name** of geotech.
9. Click **OK**.

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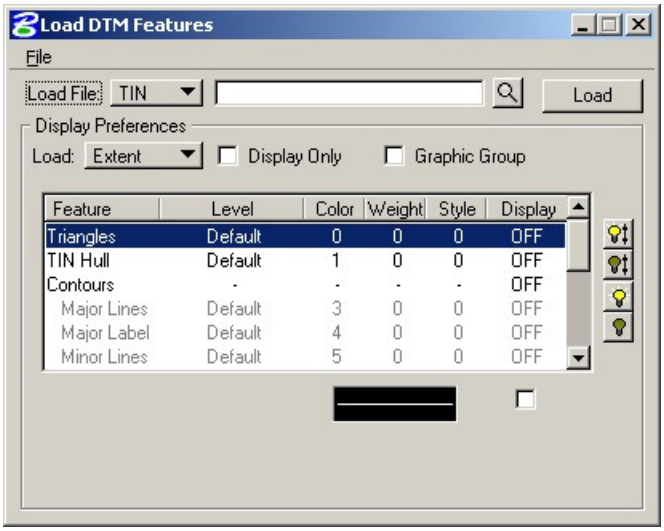
Load DTM Features

1. Select the **Load DTM Features** tool.



2. Change the **Load File** option to **TIN**.
3. Select the TIN file *survey.tin* by clicking **Files**.
4. Enable the toggles for **Graphic Group** but leave the **Display Only** disabled.
5. Select the **Triangles** Feature by highlighting in the list box.

   Notice that initially the display is set to OFF. You can control the display of an item three ways:

   Use the “lightbulb” tools to the right of the dialog box.

   Double-click on an item.

   Use the “display” toggle in the lower right corner of the dialog box.

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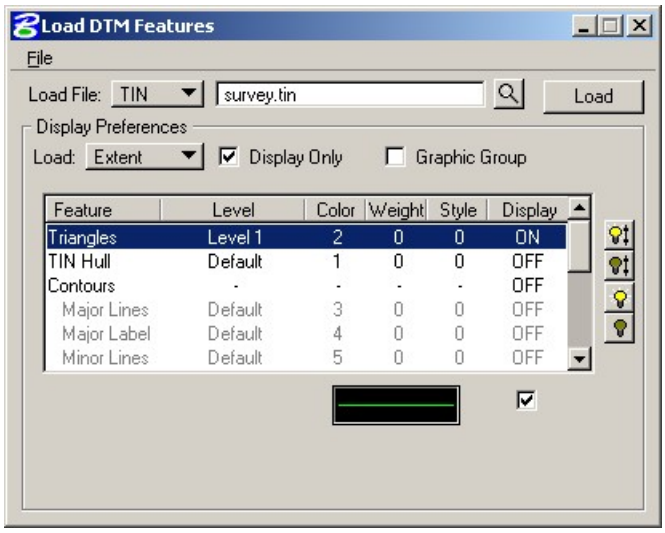
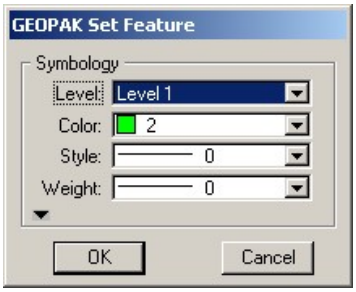
6. Set the Triangles **Display** to ON.



7. Set the display symbology for the Triangles as indicated below:



8. Select the **Tin Hull** (the boundary of the surface model) feature. Activate the Display of the feature and set the symbology as follows; Level = 30, Color = 0, Weight = 0, Style = 0.
9. Click **Load** and review the results.
10. When complete, toggle OFF the triangles and tin hull.

Displaying Contours

1. Select the **Contours** feature. Activate the **Display** Feature.
2. Verify that **On** is set in the Display field.
3. Complete the bottom of the dialog box as indicated below. To complete the Minimum and Maximum Z, Click the **Read** button, which will review the active TIN file and determine these values.
4. Enable the **Display Only** toggle since we only want to "preview" our contours but not actually write them to the design file.

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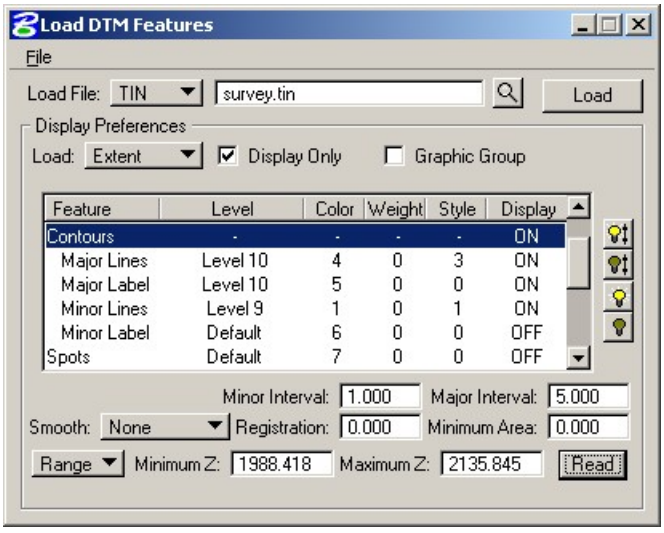

5. Activate the Display of the Contour **Lines** and **Labels** and set the symbology as indicated below:

	Level	**Color**	**Weight**	**Style**	**Font**	**TH / TW**	**Distance**
Major Lines	10	4	3	0			
Major Labels	10	5	3	0	0	TH=3, TW=3	200
Minor Lines	9	1	1	0			

Note The contour symbology standards should be the same as Survey's and are documented in CAICE_2000.doc.

6. Click **Load** to initiate the process.
7. Close the Load DTM Features dialog box and Save Settings.

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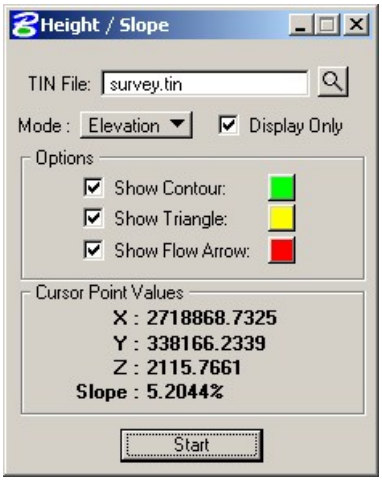
ANALYSIS TOOLS

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

Height Tool

1. Select the Height tool.



2. Activate the **Show Contour** and **Show Flow Arrow** toggles.

   The color may be altered to your choice of colors from the active color table on the Height dialog box. The weight of the contour line and arrow are controlled by the active MicroStation settings.

3. Click **Dynamic** and move your cursor over the model.

   Values for xyz and the slope on the model at the cursor point are displayed.

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

5. Close the Height dialog box.

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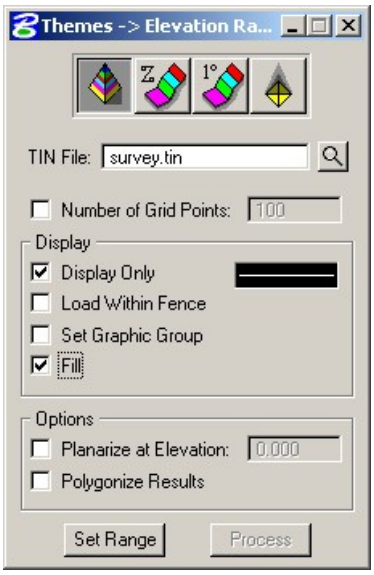
THEMES TOOL

1. Select the Themes tool. *(DTM: Analysis > Themes).*

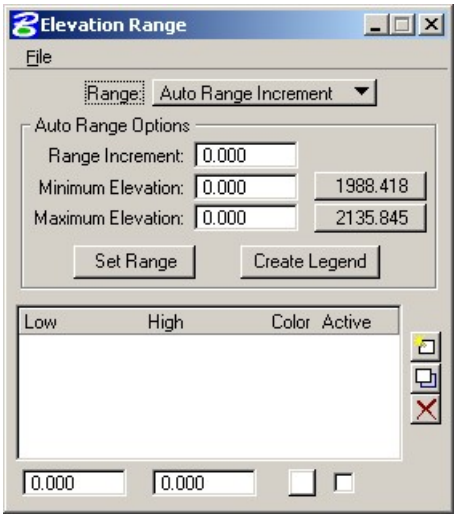


2. Ensure that all graphic elements are Fit in View number 1.

   We will determine the Elevation Range first for the **TIN File** 'SURVEY.TIN'. (This is the first tool on the dialog box).

3. Activate the **Display Only** toggle and the **Fill** toggle.

4. Click **Set Range**.



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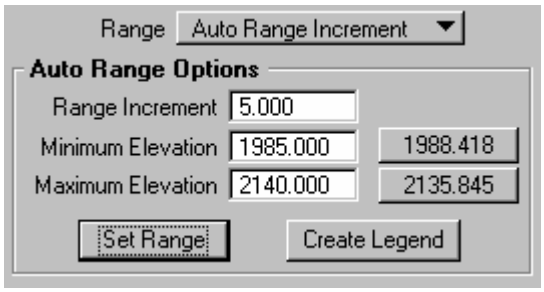
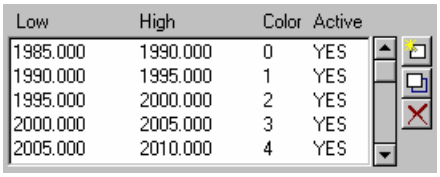
As shown on the right of the **Minimum** and **Maximum** Elevation Fields, the values for the active TIN elevations are listed. By clicking these buttons individually, the elevation fields will automatically be populated.

5. Set the Range option to **Auto Range Increment**.
6. Set the Auto Range Options as shown below:



7. Click **Set Range** to populate the list box on the bottom portion of the dialog box.

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



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

8. Close the Elevation Range dialog box (select the X in the upper right hand corner of the dialog box).
9. Click **Process** to initiate the display of the Elevation Ranges for the surface model.
10. Close the Themes dialog box and Save Settings.

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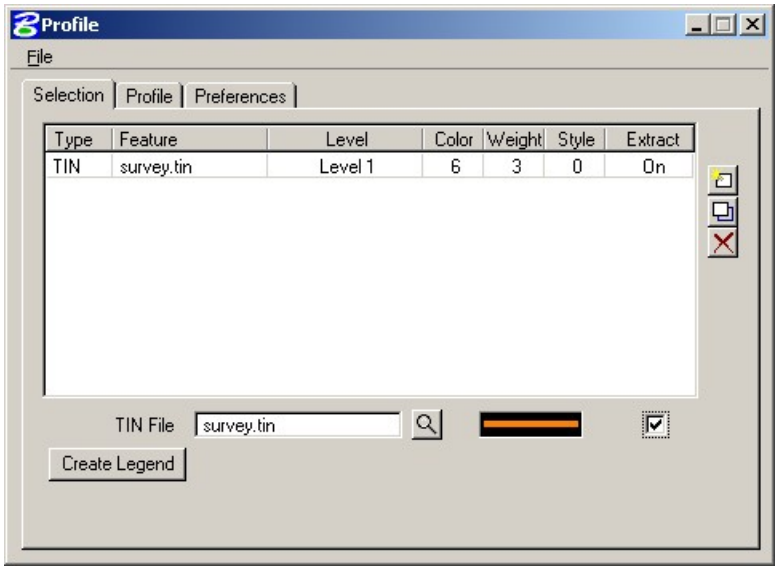
Profile Tool

1. Select the Profile tool from the Analysis tool box to invoke the following dialog box.



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

2. Click **Files** and select *survey.tin*.
3. Double-click on the symbology box (field to the right of the **Files** push button) to set the symbology representing the ground surface profile.

   You may choose any symbology you wish.

4. Click **OK**.
5. Click **Add** (top tool next to the list box) to add the feature to the collection box.
6. Select the **Profile** Tab.

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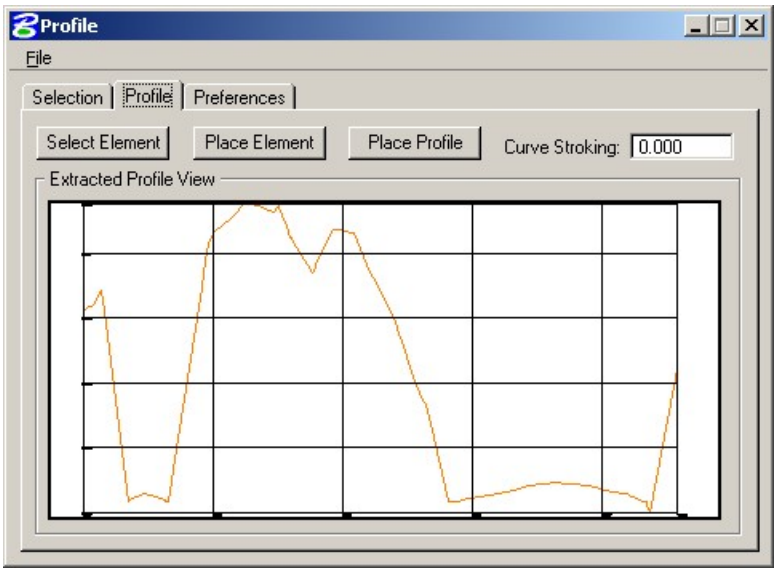
7. Click **Place Element** to cut your actual profile at any desired area by just placing two data points (i.e. a line) or a series of data points (i.e. a line-string) across your surface model at any location.



8. You can use the **Preferences** tab to set up a grid for your profile if desired.
9. Close the Profile dialog box and remove the DTM Tools tool frame.
10. Exit MicroStation.

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5 Existing Ground Profiles

INTRODUCTION

Objectives	Learn to draw and store existing ground profiles extracted from a surface model.
Tools	
Menu Bar Application	GEOPAK Road > Plan Preparation > Draw Profile

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.

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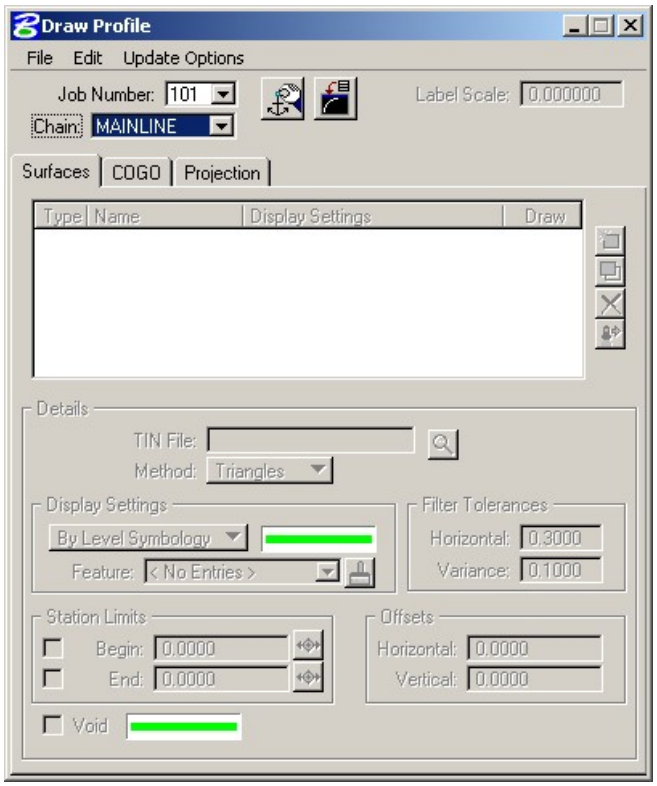
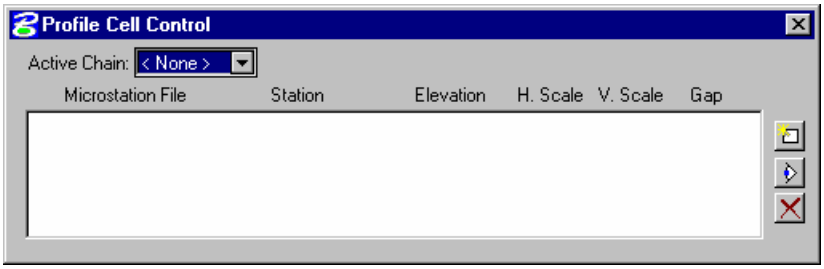
INVOKING THE DRAW PROFILE TOOL

The generation of profiles must be invoked from within the 2D MicroStation design file wherein the profile is to be drawn. When the tool is selected, the dialog box depicted below opens.



The initial entries that are required are the Job Number and Chain name. Once selected, click the Dialog Profile Cell Control tool(to the right of the Job Number field). This will invoke the Profile Cell Control window shown below.



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

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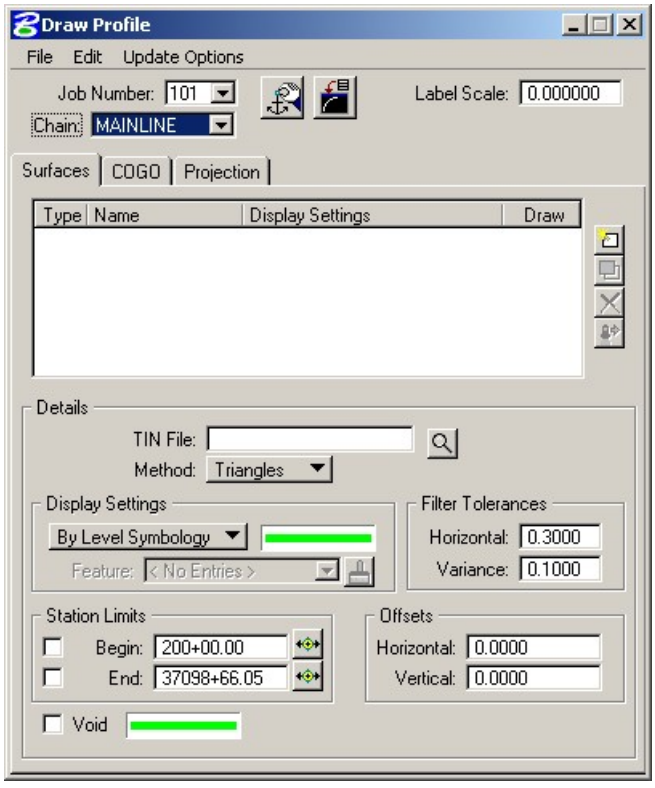
option is selected, the previous active option is de-activated. The four options are detailed in the table below.

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 Draw is clicked.

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, the dialog box 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

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using the Update Profile tool. Refer to the Update Options section to review those options. Any profile may optionally be stored to the GPK file if desired.

DISPLAY SETTINGS

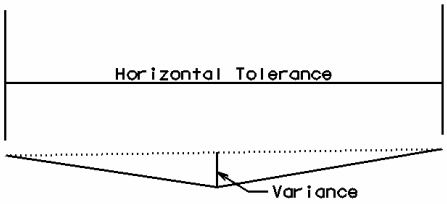
The Display Settings group box specifies the element symbology of the cross section elements being generated. The symbology may be specified using Level Symbology or a feature selected from a D&C Manager database.

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 tool, 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.

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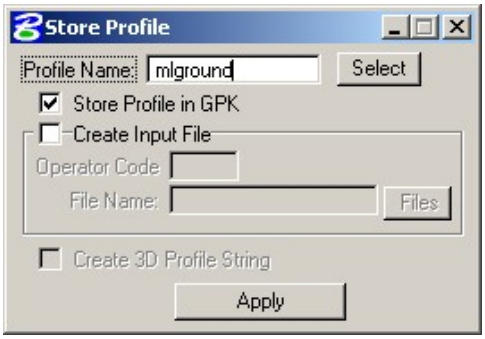
STORE PROFILE TO COGO

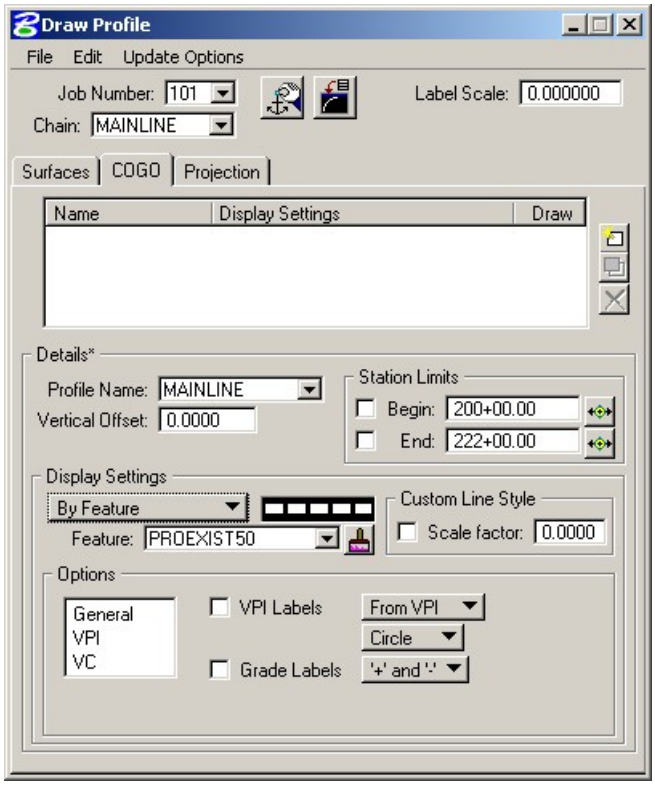
When the profile is drawn, it may also be stored in COGO by pressing this button, which opens the dialog box depicted below left.



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.

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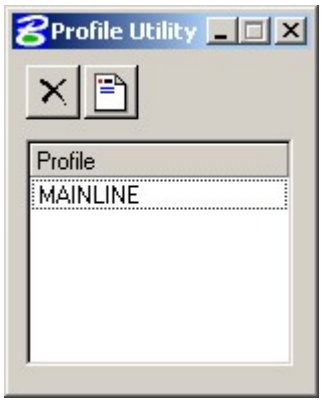
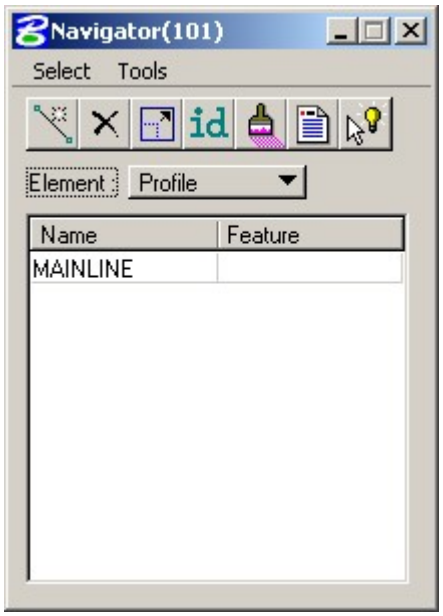
PROFILE REPORT

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 > Output command and supply a filename of 1-5 characters. Then use the File > 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 tool from the COGO dialog box. Change the Element to Profile then highlight the desired profile(s). Once selected, click the printer tool on the Navigator to process the profile(s).



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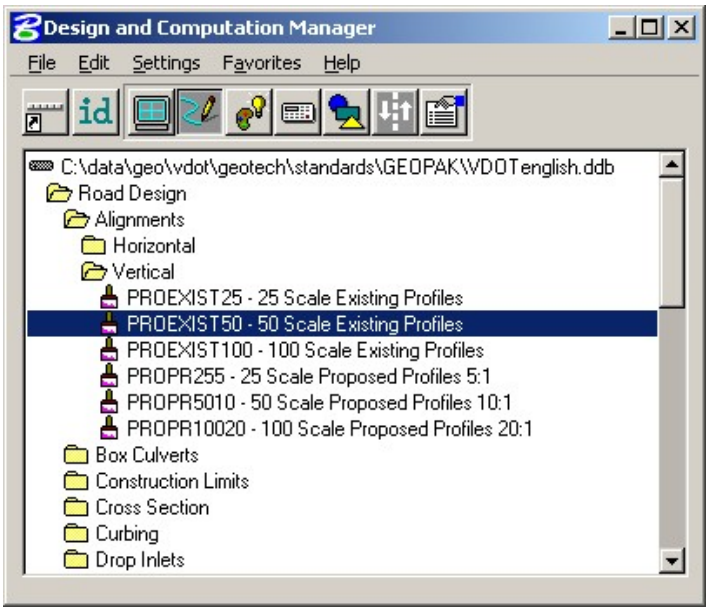
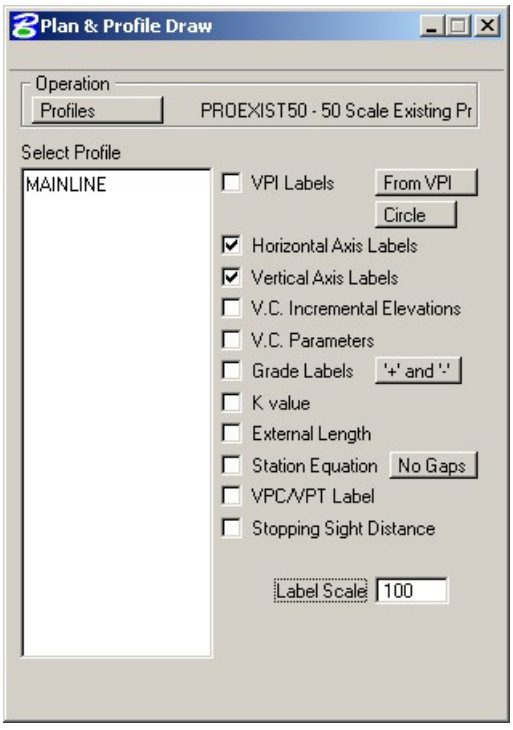
DRAWING PROFILES WITH D&C MANAGER

As with other COGO elements, Design and Computation Manager will be utilized to draw any type of profile into a MicroStation file: existing roadway, proposed roadway, utility, special ditch, etc. To get started, open D&C Manager then navigate to the desired item for plotting of the profile. Upon selecting an item, click on the **Draw Plan & Profile** button on the supplemental D&C dialog box.



The next dialog box that appears is the GEOPAK Draw Plan & Profile window, as depicted below.



If it is not already selected, change the Operation to Profiles. Displayed in the window is a list of profiles currently stored in the GPK file. Along the right side of the window are labeling options for the profile that is to be plotted. Configure these as desired before selecting a profile to plot.

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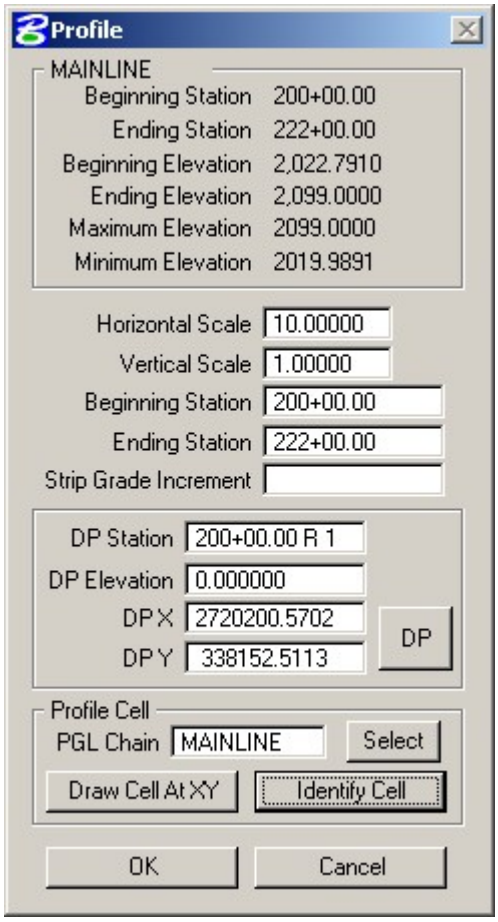
- VPI Labels – Labels the station and elevation of the VPI – typically turned off for plotting of existing profiles.
- Horizontal Axis – Places stations along the bottom of the profile.
- Vertical Axis – Places elevations along the left side of the profile.
- VC Parameters – Labels the length of the vertical curve if applicable.
- VPC/VPT Labels – Annotates the station and elevation of a vertical curves control points.
- Stopping Sight Distance – Places text for crest vertical curves representing the curves stopping sight distance as defined by AASHTO.

After selecting a profile to plot, the dialog box below opens. Since a profile does not have XY coordinates, the user must specify a location in the MicroStation file to place the profile and a scale at which to plot the profile. When using a ratio other than 1:1, the horizontal dimensions of the profile remain true and the vertical is exaggerated.

The location can be selected by clicking on the DP button then specifying a location in the file by issuing a data point in the view. The coordinates can also be keyed in to the dialog box. A Profile Cell can be drawn into the file to represent the location of the data point and associated information. This cell can be used in any other GEOPAK tool that needs to know the location of the profile. A PGL Chain must be selected before drawing the profile cell. This chain will be the chain that the profile is stationed along.

If a value is specified for the Strip Grade Increment, elevations will be calculated at the desired interval along the profile and placed just above the Horizontal Axis Labels (stations).

Click OK to draw the profile.



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LAB EXERCISE: EXISTING GROUND PROFILES

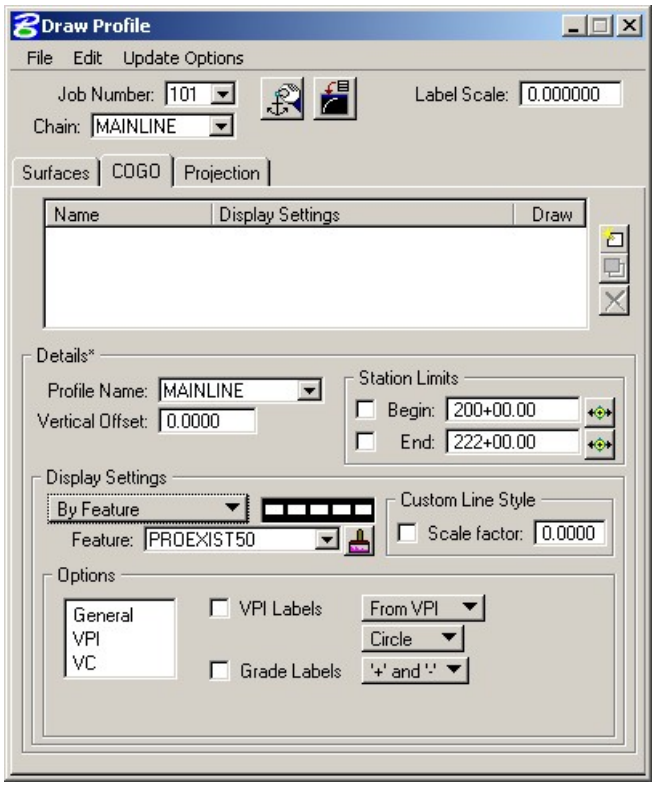
In this exercise, existing ground profiles will be drawn representing the centerline of chain **MAINLINE**.

Draw Existing Ground Centerline Profile

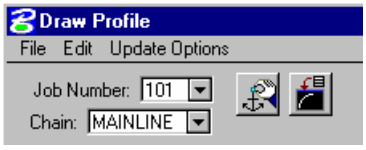
1. Open the MicroStation file *c:\data\geo\VDOT\geotech\d17682prof.dgn.*

   The file *d17682des.dgn* should be attached as a reference.

2. Select the Draw Profile tool *(VDOT Geotechnical Tools).*



3. Set the **Job Number** to 101
4. Select chain **MAINLINE**.
5. Click **Dialog Profile Cell Control** (to the right of Job Number).



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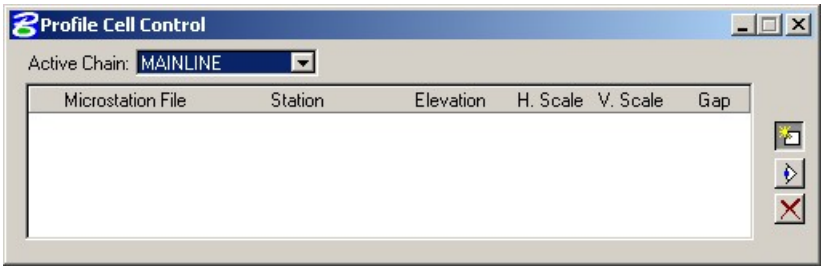
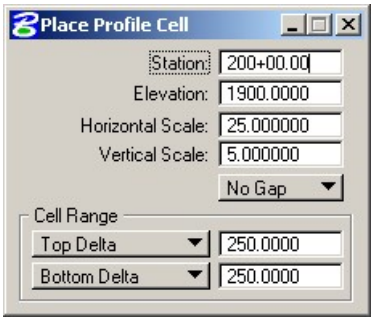
5. Set the **Active Chain** to MAINLINE.



6. Click **Place Profile Cell** on the right side of the dialog box.



7. Fill the dialog box out as shown above and then DP somewhere to the right of the plan view reference file in order to place the profile cell into the design file.
8. Fit the view contents.
9. Close the **Profile Cell Control** dialog box.

Defining the Surfaces Tab Information

1. In the **Details** group, click **Files**, then select *survey.tin*.

   This is the **TIN File** used to cut the profile.

2. 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.

3. Use **By Feature** mode in the **Display Settings** group.
4. Click the Paintbrush and select the item shown below.

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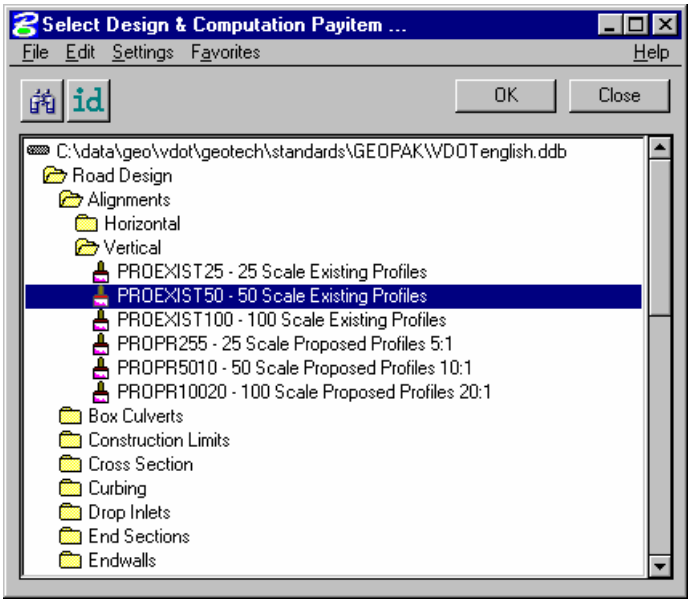
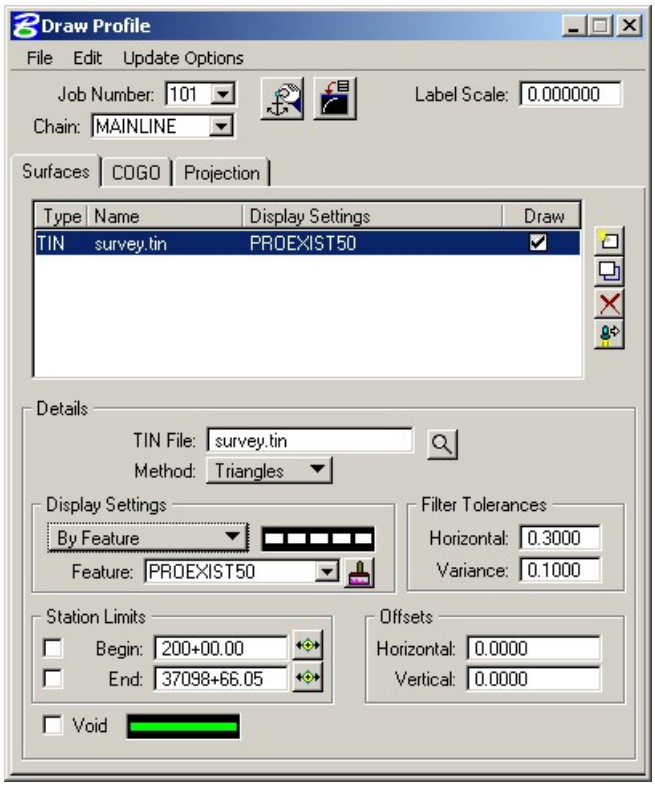


4. Click **OK**.
5. Click **Add Surface Settings** to add the profile to the list box as well as draw the profile into the MicroStation file.



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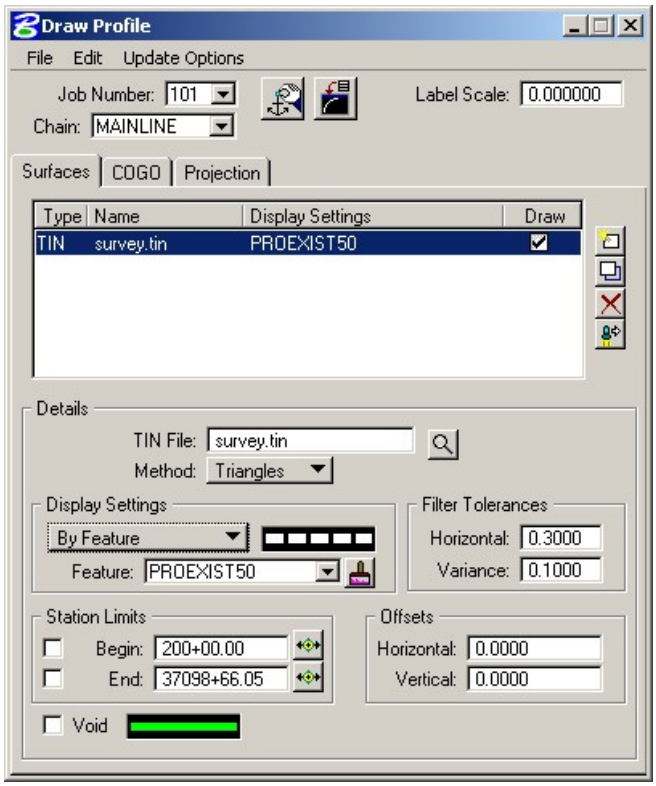
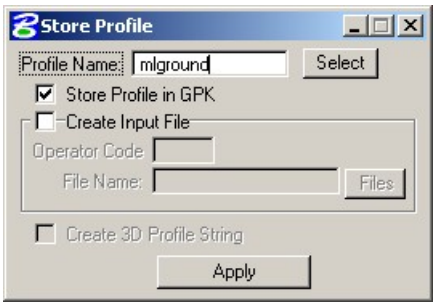
Store Profiles into COGO Database

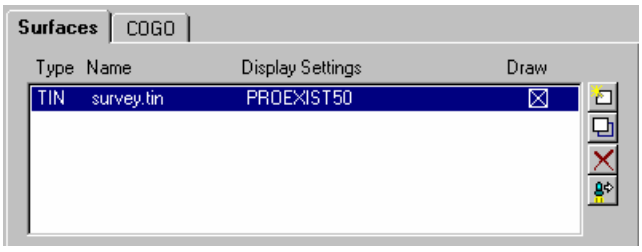
1. Click the Store Surface in COGO.





2. Fill out the dialog box as shown above and click **Apply**.
3. Close the **Store Profile** dialog box.
4. Click **Remove Surface**.

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



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Review Profiles in COGO

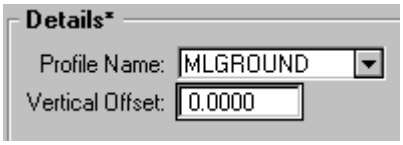
1. Access the coordinate geometry tool. (Press the **Coordinate Geometry** button on the workflow dialog box). Press **OK** to accept your project name, etc. This will open the Coordinate Geometry dialog box.
2. Select **Element > Profile > List/Print** from the COGO menu bar to invoke the List/Print dialog box.

3. Select the profile **'MLGROUND'** and press **Print**.
4. Review the profile information in the COGO output display window.
5. Close the Coordinate Geometry dialog box (use X in upper right corner of the dialog box). When prompted to save the COGO session select NO.

Drawing & Labeling the Existing Centerline Profile

Next, we are drawing and labeling the existing profile utilizing the Draw Profile tool's **COGO** tab.

1. Click the **COGO** tab and set the **Label Scale** to 50 in the upper right hand corner.
2. Select Profile Name **MLGROUND** from the drop down list in the Details area.



3. Under **Display Settings,** set the option to **By Feature**.
4. Select the feature shown below.

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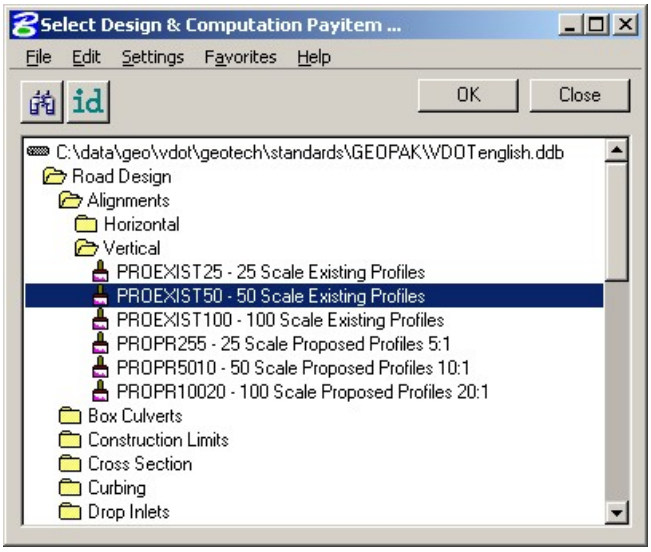
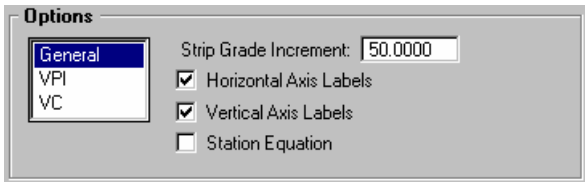


5. Click **OK**.
6. Click **General** in the **Options** area and set the **Strip Grade Increment** to 50.

   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 Profiles dialog box.

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6 Existing Ground Cross Sections

INTRODUCTION

Objectives	To generate existing ground cross sections based on a horizontal alignment and the surface model beneath the alignment, and to review the sections utilizing the Cross Section Navigator tool.
Tools	
Menu Bar Application	GEOPAK Road > Cross Sections > Draw Pattern by Station Range GEOPAK Road > Cross Sections > Ground Cross Sections from DTM GEOPAK Road > Cross Sections > Navigator

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

Tools	
Menu Bar Application	GEOPAK Road > Cross Sections > Draw Patterns By Station Range

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.

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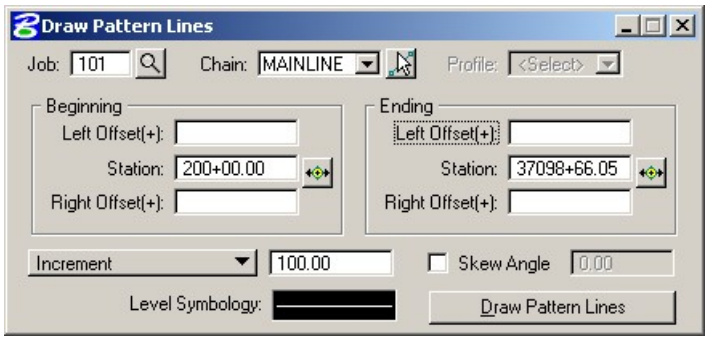
From the Project Manager you will select Draw Pattern, and create or select an existing run. When completed, the following Draw Pattern Lines dialog box appears.



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 box.
- 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 box. 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 box to lengthen, shorten, delete, copy, move, etc.

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

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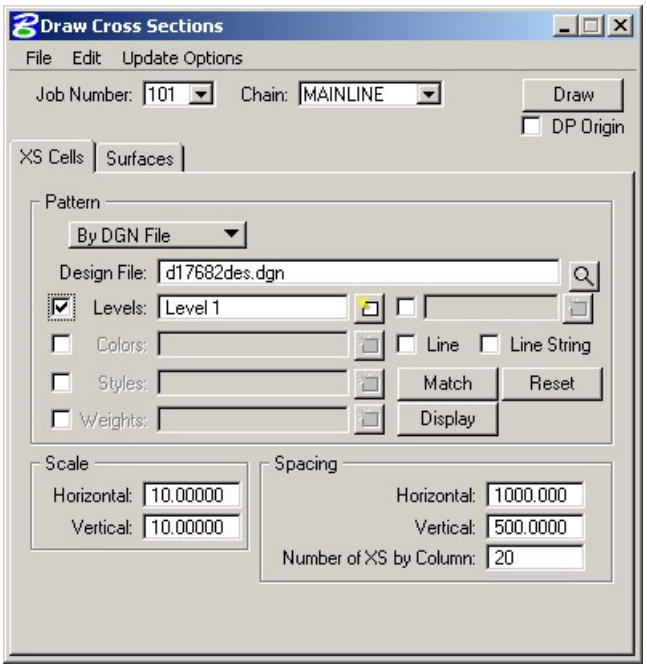
GENERATING CROSS SECTIONS

Tools	
Menu Bar Application	GEOPAK Road > Cross Sections > Draw Cross Sections from Surfaces

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 box unghosts as depicted below.



The rest of the dialog box consists of a menu bar with three listings:

File	Standard file utilities to load, or save settings, plus a dialog box 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.
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 the Draw button is clicked.

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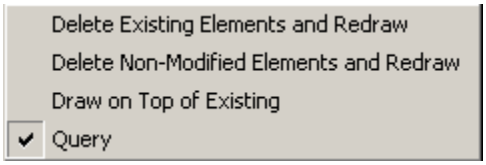

Two tabs on the dialog box support the input data required to draw cross sections:

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 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.

On the Surfaces tab, the (Filter Tolerances group box has two fields: Horizontal and Variance. Both Horizontal and Variance filter tolerances are considered together for each pair of cross section 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.

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CROSS SECTION NAVIGATOR

Tools	
Menu Bar Application	GEOPAK Road > Cross Sections > Navigator

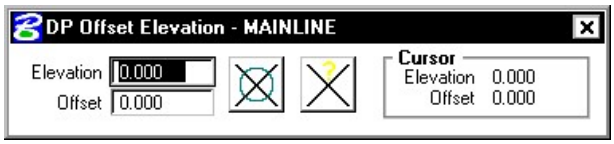
The Cross Section Navigator tool is used to view and traverse between cross sections. It can also be used to draw cross section information.

When the Navigator is invoked, the following dialog box appears.

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 Open View Control Dialog Box 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.

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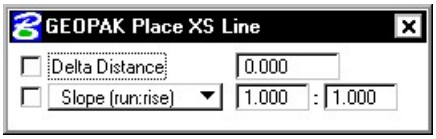


SUMMARY - BASIC STEPS TO CREATING EXISTING GROUND CROSS SECTIONS FROM A DTM

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).

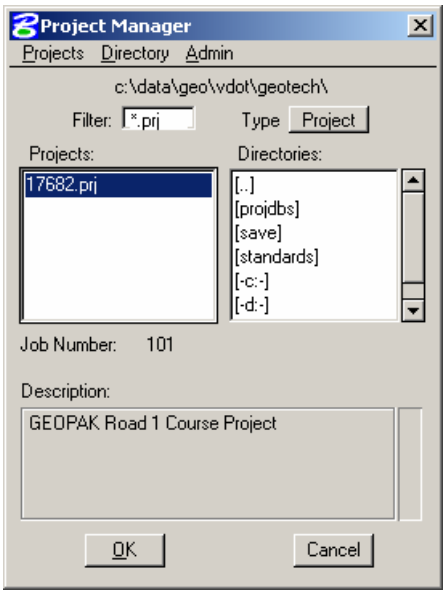
LAB EXERCISE: EXISTING GROUND CROSS SECTIONS

Draw Patterns

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

1. Open the MicroStation file *c:\data\geo\VDOT\geotech\d17682work.dgn.*
2. Select **Project Manager** from the (*VDOT Geotechnical Tools*).

3. Select the project **17682** from the list and select OK.



4. Select the user **VDOT** form the list and select OK.

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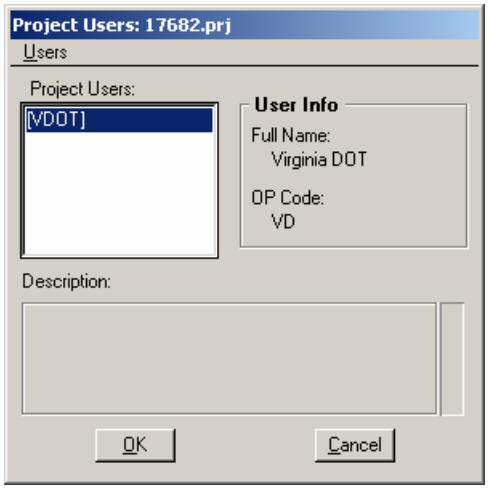
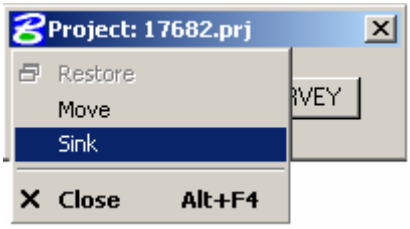
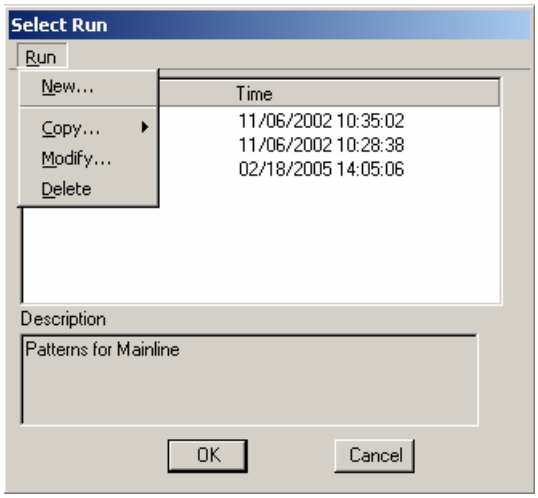


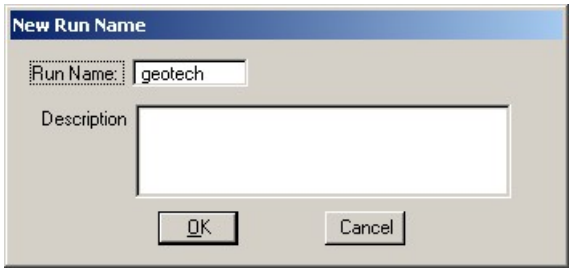
5. By clicking on the Bentley "B" in the upper left of the dialog, select the option from the pulldown for **SINK.**



6. Select the **Draw Pattern** tool *(VDOT Geotechnical Tools).*

7. Create a new **RUN** as shown below





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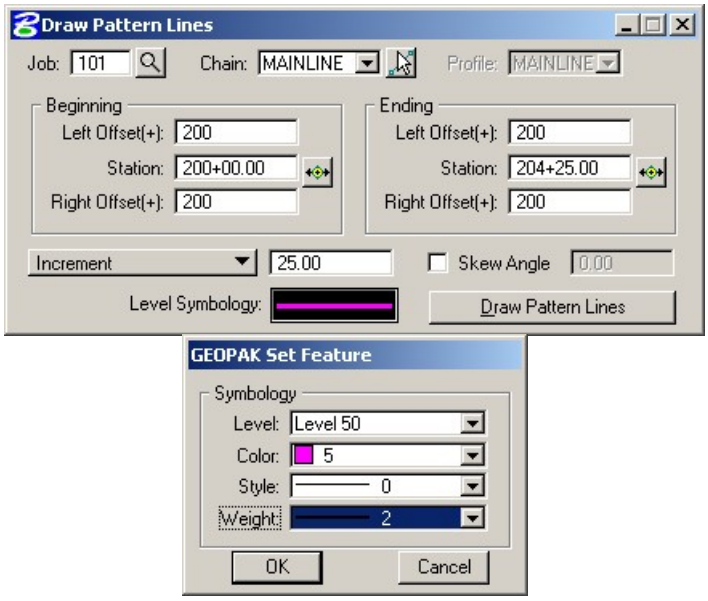
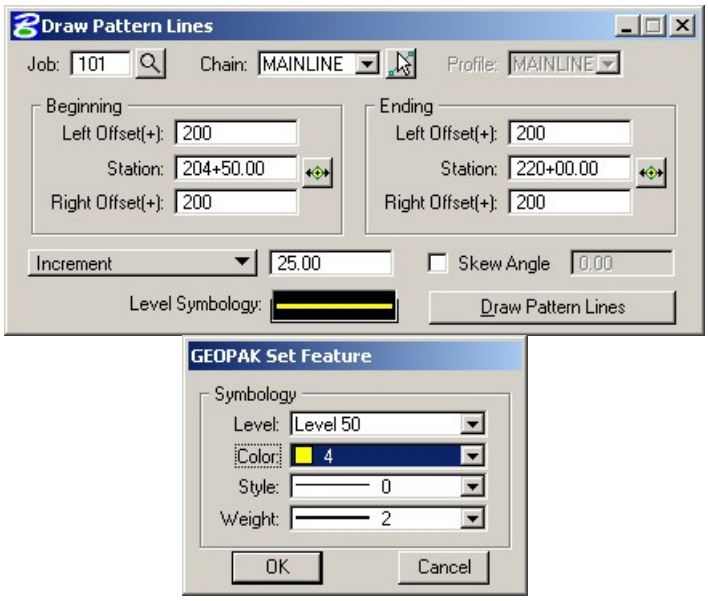
8. Populate the following dialog box as depicted below.



9. Click **Draw Pattern Lines**.

   This initiates the plotting of the patterns into the design file.

10. Change the station range and color as depicted below.



11. Click **Draw Pattern Lines.**

    This initiates the plotting of the additional patterns into the design file.

    In order to place additional pattern lines at particular stations and skew angles, we can adjust the dialog settings once more.

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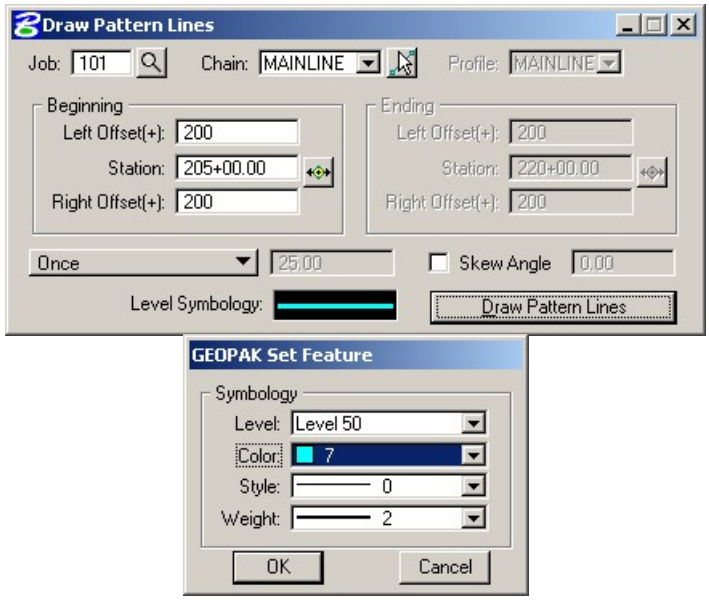
12. Make the changes shown below and click **Draw Pattern Lines**.

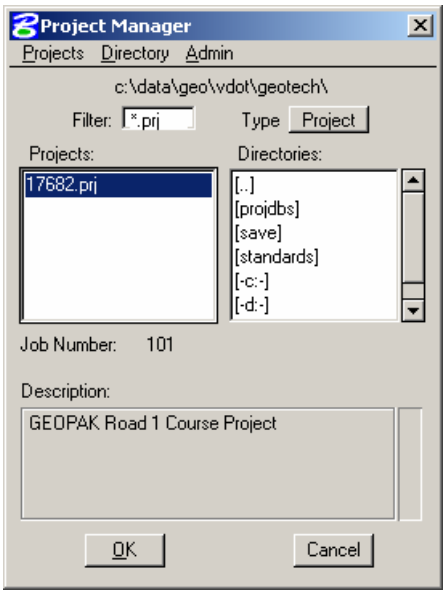


13. Review the pattern lines.
14. Exit the Draw Pattern dialog box and Save Settings.

Generate Existing Ground Cross Sections

1. Open the MicroStation file *c:\data\geo\vdot\geotech\geo_d17682xsmainline.dgn.*
2. Select **Project Manager** from the (*VDOT Geotechnical Tools*).

3. Select the project **17682** from the list and select OK.



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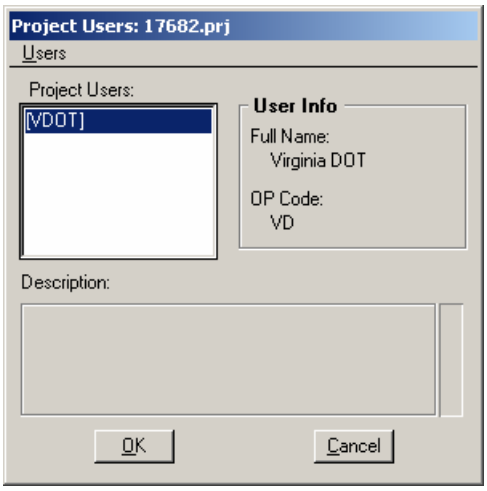
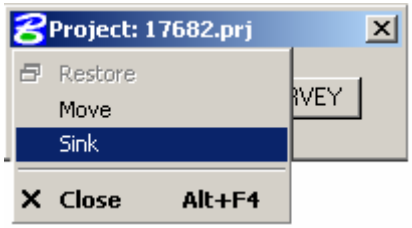
4. Select the user **VDOT** form the list and select OK.

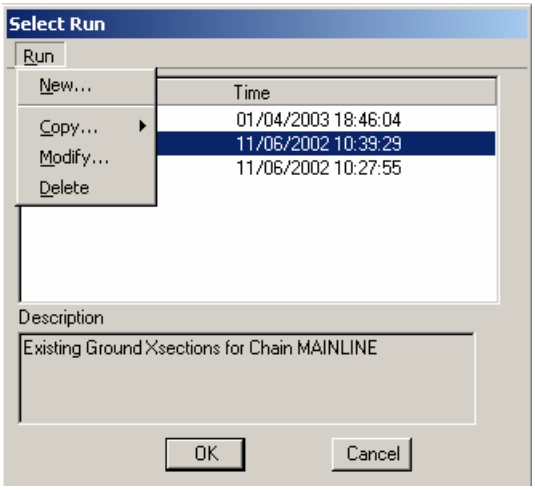


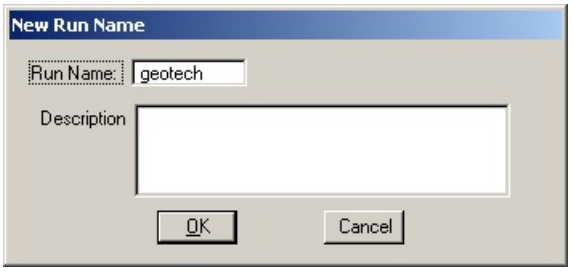
5. By clicking on the Bentley "B" in the upper left of the dialog, select the option from the pulldown for **SINK.**



6. Select the **Existing Ground Cross Sections** tool *(VDOT Geotechnical Tools).*

Create a new **RUN** as shown below





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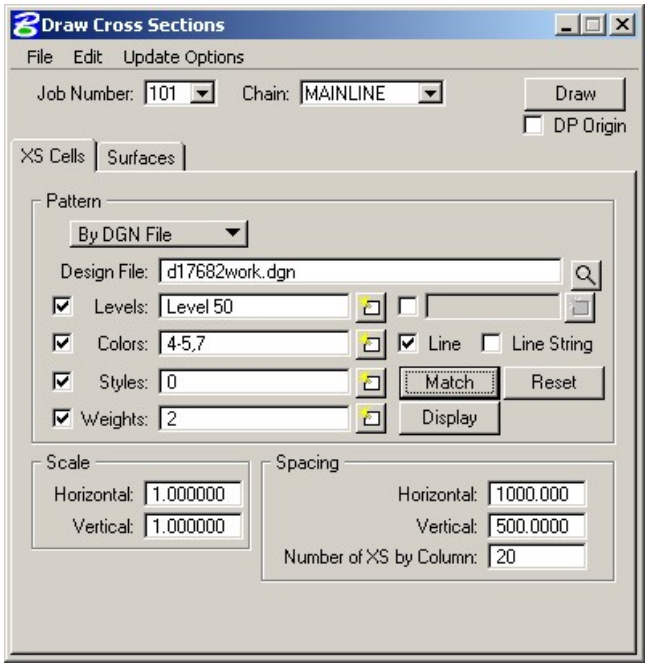
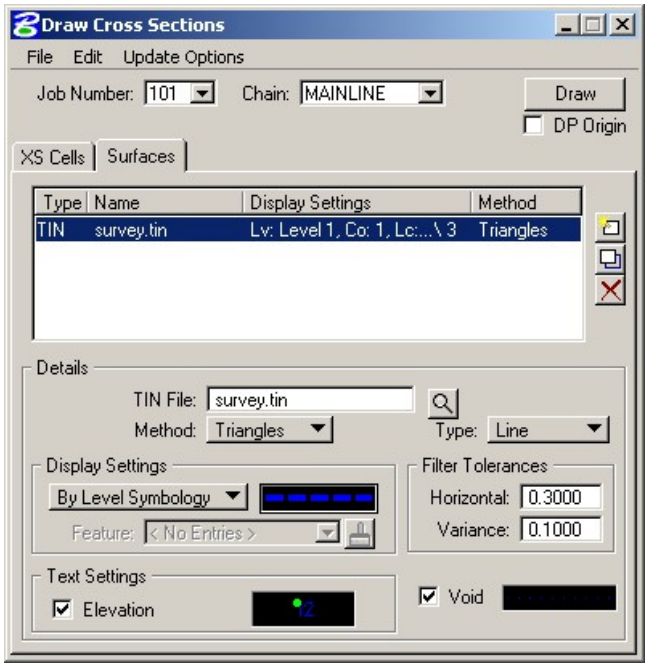
7. Populate the dialog boxes as shown beow.

Note The Display Settings for the existing ground line are set to level 1, color 1, weight 5, style 2.





8. Click **Draw** to initiate the routine.
5. Exit the dialog box and Save Settings.

Review Cross Sections

1. Select the **Cross Section Navigator** tool *(VDOT Geotechnical Tools).*

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

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7 GeoTechnical Tools

INTRODUCTION

Objectives	Learn how to Process GeoTechnical Data
Tool	
Menu Bar Application	GEOPAK Road > Utilities > GeoTechnical

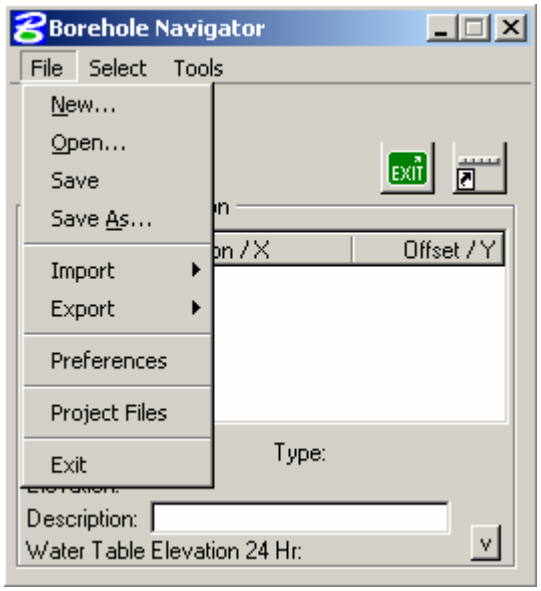
GEOPAK GeoTechnical toolset supports a wide variety of tools for the input, storage, review and editing of soils boring data. Subsurface TINs of the various materials can be created, for subsequent drawing onto cross sections or profiles. The actual borings may be drawn in plan view, placed on cross sections, profiles or drawn into 3D as soils columns

The GeoTechnical application is accessed from the VDOT Geotechnical Tools tool bar.

ACCESSING PREFERENCES

Clicking GEOPAK Road > Utilities > GeoTechnical invokes the Borehole Navigator tool shown to the right.

The Preferences are accessed from the File pulldown in the upper left portion of the dialog.



The GeoTechnical Preferences control the graphic display of the borehole data in plan, 3D, cross section, and profile views. The settings may be saved (*.gtp) to serve as a standard setup for subsequent projects.

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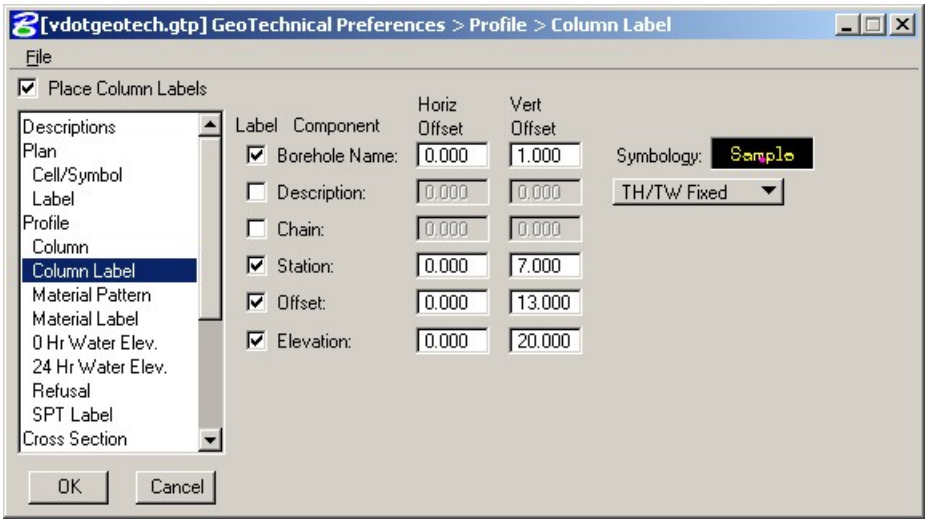
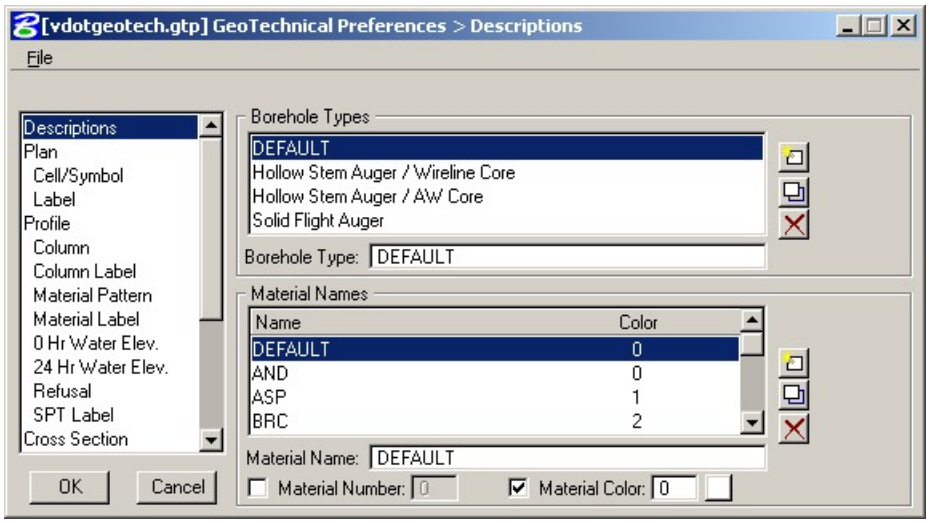
In larger organizations, the GeoTechnical Preference file may be set up and administered by a single person or group of people such as a CAD support group in the same manner as the existing Design & Computation Manager databases.

As each option is selected, the right side of the GeoTechnical Preferences dialog changes to reflect the selection.



When the Descriptions option is selected, the dialog dynamically changes to reflect the selection.



Two group boxes are supported within the Descriptions option: Borehole Types and Material Names. GEOPAK supports an unlimited number of Borehole Types. When the fifth entry is added, scroll bars are automatically displayed for ease of viewing. Three action buttons are supported, as detailed in the table below.

Add	Populate the edit field at the bottom of the group box, then click Add.
Modify	Highlight the line to be modified and GEOPAK populates the edit field. Change the edit field, then click Modify.
Delete	Highlight the line, then click Delete. An Alert message prompts the user for deletion. Clicking OK deletes the Borehole Type, clicking Cancel closes the

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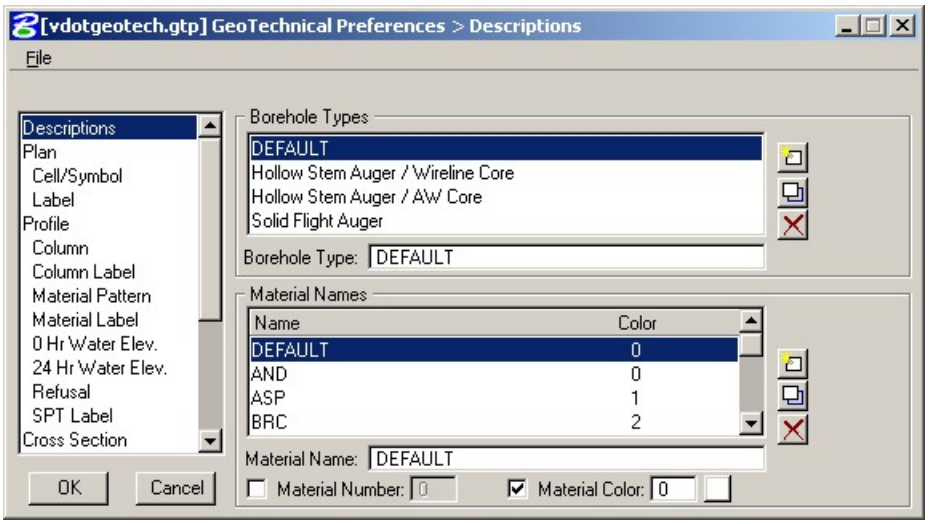
Alert message, but does not delete the type.

GEOPAK supports an unlimited number of Material Names / Numbers. When the fifth entry is added, scroll bars are automatically displayed for ease of viewing. To utilize a Material Number, activate the toggle to the left of Material Number. An optional Material Color can be utilized by activating the toggle to the left of Material Color and then selecting the desired color. The color is displayed in the list box. If the Material Color is not activated when a Material is added, N/A is displayed in the list box. The color is utilized when drawing the soil strata when visualized as a column in 3D and when the fill option (rather than material pattern) is utilized when drawing boreholes on cross sections and profiles.

The Borehole Types stored within the Descriptions Preferences are reflected throughout the GeoTechnical tools and can only be added within the Description Preferences. In the graphic below, four Borehole Types are stored:

- DEFAULT
- Hollow Stem Auger / Wireline Core
- Solid Flight Auger
- Hollow Stem Auger / AW Core



Selecting the Add Borehole tool, from the Borehole Navigator will display the Types as they are stored in the preferences. These are accessed by selecting the pull down next to the Type field. The DEFAULT type is where boreholes that do not have a matching “type” are plotted to. There should be a Borehole Type in the preferences for every borehole type you may encounter. If not, they will be plotted with “default” symbology.

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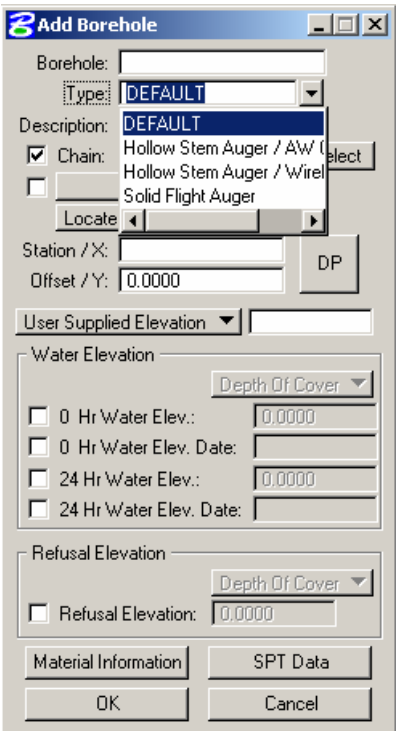
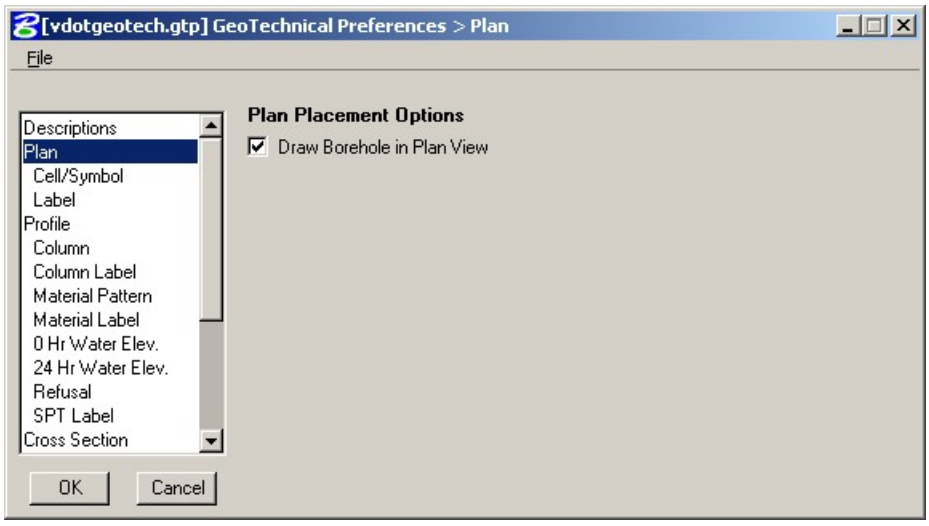


There are three3 basic sections within the preferences other than Descriptions. These are Plan, Profile, and Cross Sections. The preferences for each of these provide a means by which every aspect of the material plotting can be controlled and set to the desired symbology.

PLAN PREFERENCES

The Plan options define the placement of borings onto plan view drawings. When the Plan option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



Only one option is supported on the Plan dialog, Draw Borehole in Plan View. When activated, all plan related options in the list box are unghosted, so the user can set up all preferences required to draw soils borings in the plan view. When not active, borings cannot be drawn in plan view.

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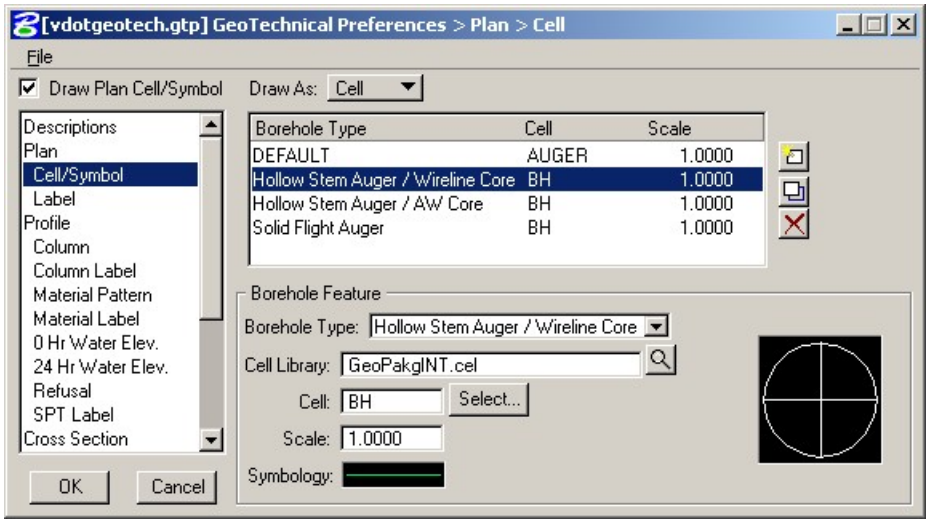
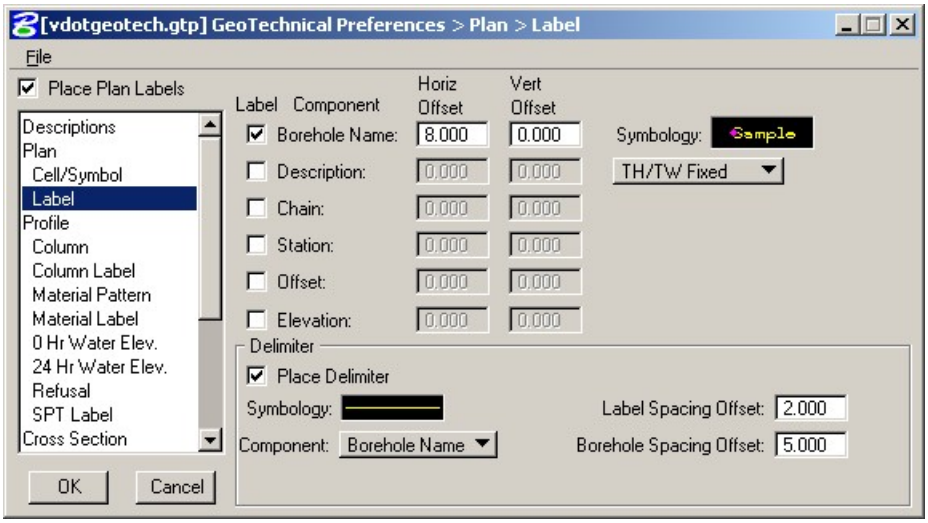
In order to select the Cell / Symbol option, the Draw Borehole in Plan View toggle in the Plan option must be activated. When selected, the dialog depicted below opens. This dialog reflects the Symbol option for drawing.



In order to select the Label option, the Draw Borehole in Plan View toggle in the Plan option must be activated. When selected, the dialog depicted below opens.



In order to place labels and unghost the dialog, the Place Plan Labels toggle in the upper left corner must be activated. The dialog is divided into two sections: label parameters and the Delimiter group box. Six Components can be labeled for each boring. To place a label, activate the toggle to the left of the Component. In the sample above, three Components will be labeled: Borehole Name, Station, and Offset. When all offsets are set to zero, the Borehole Label Origin is located at the origin of the borehole cell or symbol.

PROFILE PREFERENCES

The Profiles options define the placement of borings onto profile drawings. When the Profiles option is selected, the dialog dynamically changes to reflect the selection.

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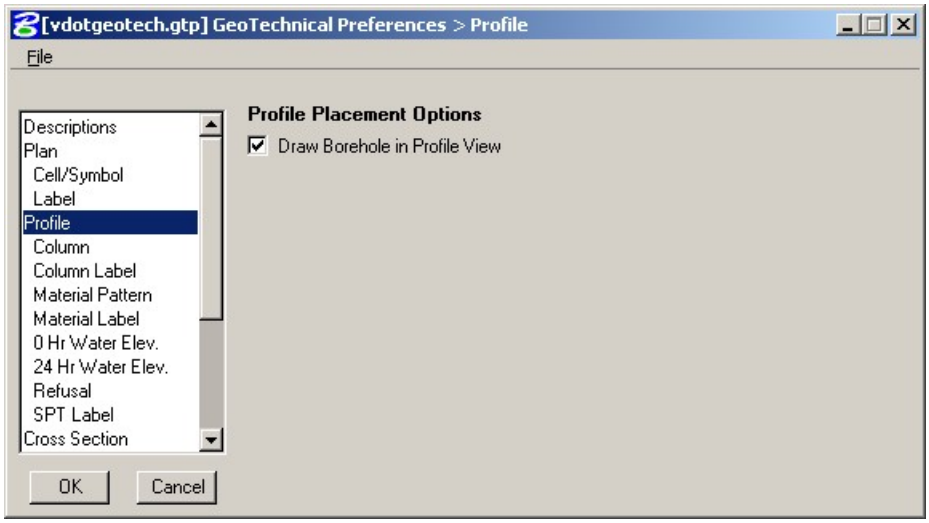
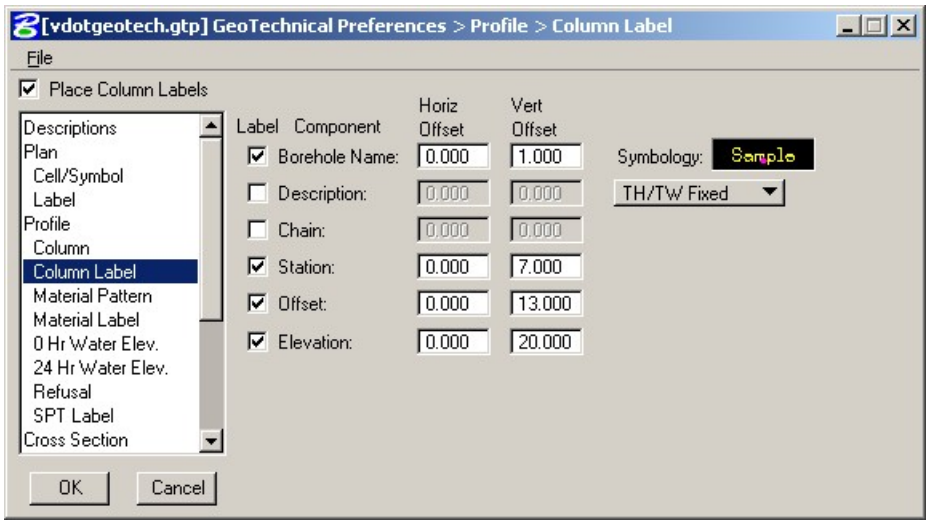


When the Column Label option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



Six Components can be labeled for each boring. To place a label, activate the toggle to the left of the Component. In the dialog above, four Components will be labeled: Borehole Name, Station, Offset, and Elevation.

SUMMARY: STEPS TO DEFINE A BOREHOLE LABEL IN PROFILE VIEW

1. Activate the toggle of the desired Component to label about the borehole column in profile view.
2. Define the horizontal and vertical offsets.

Define the label symbology which controls the text level, color, weight, size, justification and font for all active components. The label is drawn as a graphic group for ease in manipulation in the plan view file.

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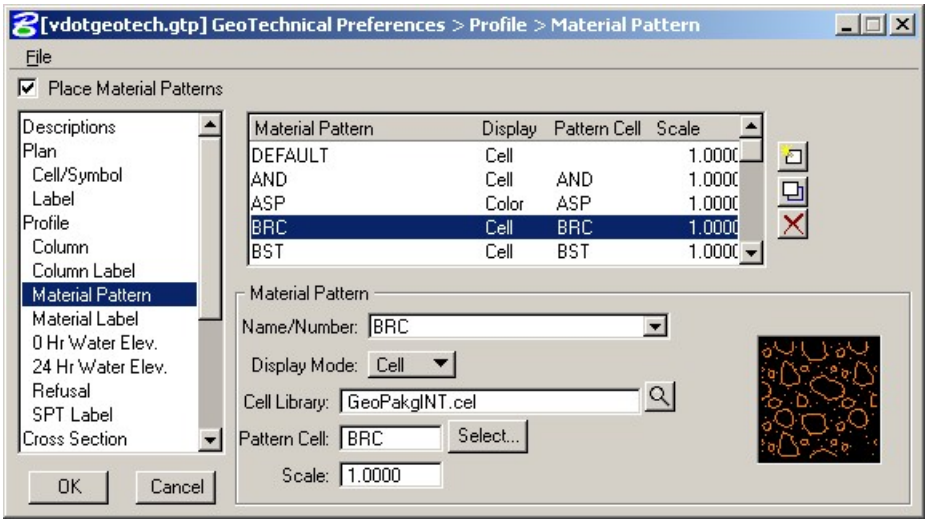
The individual material types may be represented with pattern cells when the columns are drawn into profile view. In order to draw the patterns, the Place Material Patterns toggle in the upper left corner must be active.

When the Material Pattern option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



When using the cell option, manually enter the desired Cell Library or select via the File button.

> ***Note*** If the library is stored on a central server and mounted by the users with various drive designations, do not include the path and drive. Simply include the cell library within the users' MS_CELLLIST.

Select the desired cell by clicking Select and highlighting the cell. The cell is displayed in the box to the right. If the cell is manually entered and cannot be found in the cell library, a message is displayed in the cell display box indicating the cell is not found. Include the Scale used at creation, as the scale of the profile is utilized for plotting scale at time of drawing. The element symbology at time of cell creation is utilized.

Selection of the cell library should automatically attach this cell library to the active design file so that the Pattern Cells may be displayed in the preview box when selected from the cell library or the List Box.

The Cell Library field supports the MicroStation Cell Configuration Variable whereby the user could express the cell Library List such as:

- MS_CELLLIST = $c:\geotechnical\test.cel
- MS_CELLLIST > $c:\geotechnical\spec.cel

The Material Label parameters define the material label location and the symbology of the label. When the Material Label option is selected, the dialog dynamically changes to reflect the selection, as depicted below.

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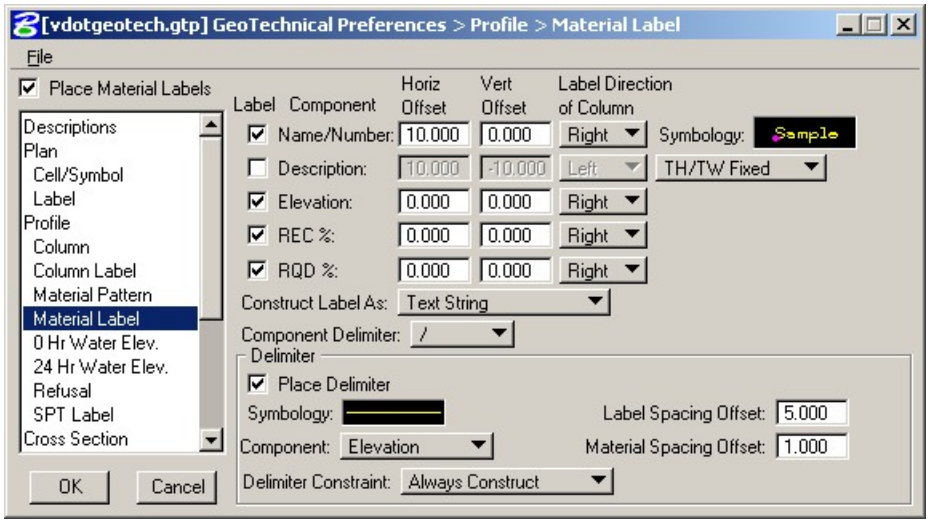
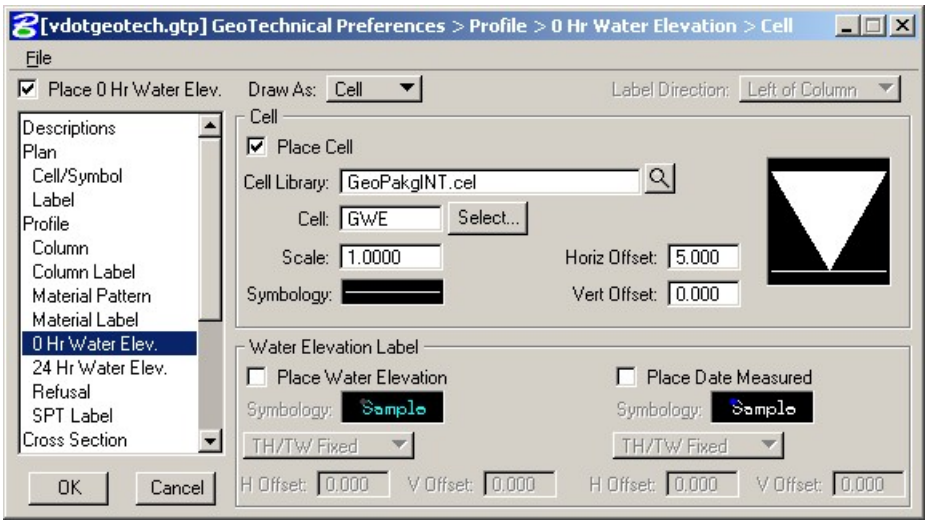


In order to place material labels, the Place Material Labels toggle in the upper left corner must be active. The dialog is divided into two sections: label parameters and the Delimiter group box. Five Components can be labeled for each material. To place a label, activate the toggle to the left of the Component.

SUMMARY: STEPS TO DEFINE A BOREHOLE LABEL IN PROFILE VIEW:

1. Activate the toggle of the desired Component to label about the borehole column in Profile view.
2. Define the Horizontal and Vertical Offsets and Direction to left or right of the column.
3. Define the Construct Label As: option.
4. Define the Label Symbology controls the text level, color, weight, size, justification, and font for all active components. The label is drawn as a graphic group for ease in manipulation in the profile design file.

The 0 Hr. / 24 Hr. Water Elevation Label includes text for the Water Elevation and/or a cell or symbol representation. When the O Hr. Water Elev. option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



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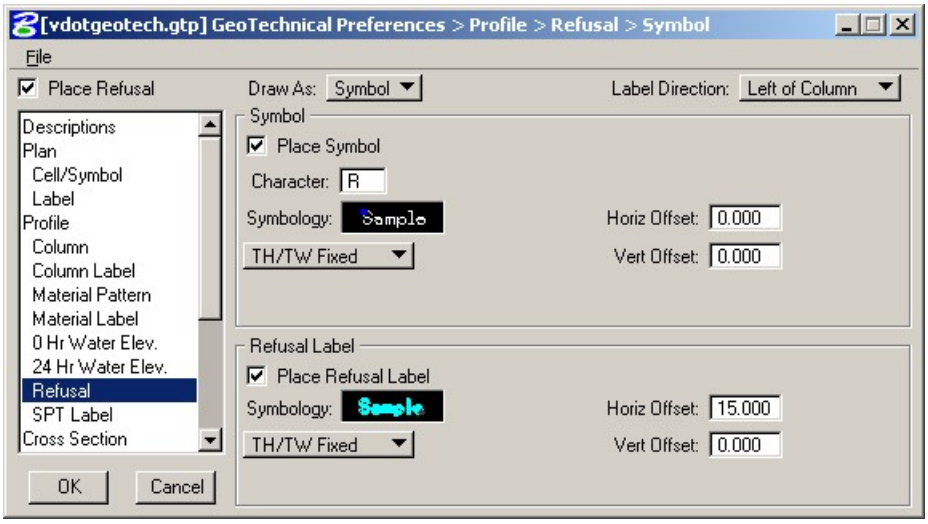
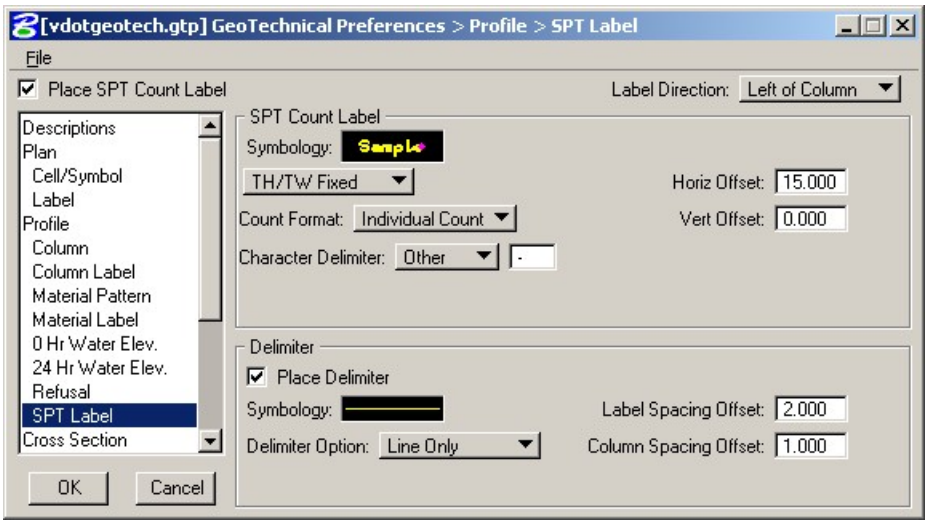
Refusal includes text for the Refusal and/or a cell or symbol representation. When the Refusal option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



The SPT Count Label includes text and delimiter options. When the STP Label option is selected, the dialog dynamically changes to reflect the selection, as depicted below.



CROSS SECTION PREFERENCES

The Cross Section options define the placement of borings onto cross section drawings. When the Cross Section option is selected, the dialog dynamically changes to reflect the selection, as depicted below.

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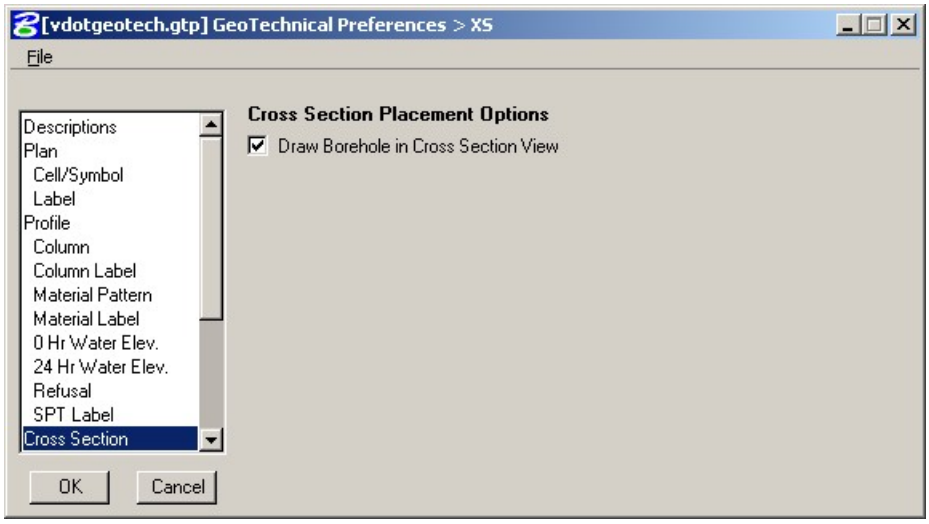

Only one option is supported on the Cross Section dialog, Draw Borehole in Cross Section View. When activated, all cross section related options in the list box are unghosted, so the user can set up all preferences required to draw soils borings in the cross section view. When not active, borings cannot be drawn in cross section view.

The Cross Section preferences are identical to the Profile preferences because the bore hole information to be displayed is identical.

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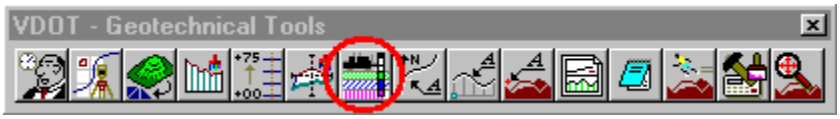
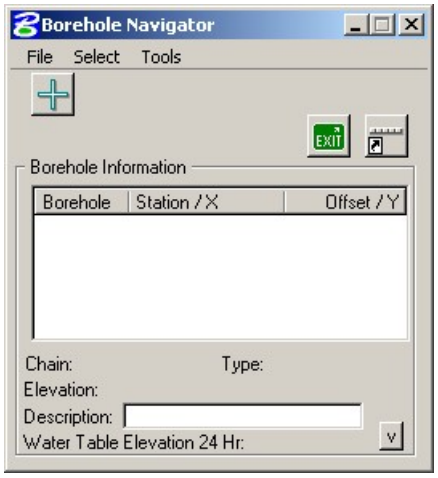
LAB EXERCISE: GEOTECHNICAL TOOLS

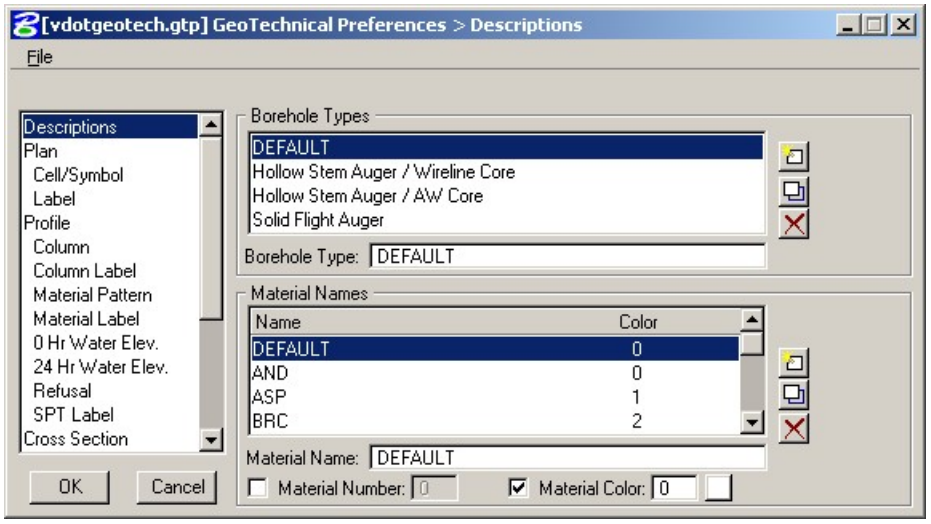
Reviewing the GeoTechnical Preferences

1. Open the MicroStation file *c:\data\geo\VDOT\geotech\d17682work.dgn.*
2. Select the **GeoTechnical** tool *(VDOT Geotechnical Tools).*





3. Select **File > Preferences** from the Borehole Navigator.



4. On the preference dialog, select **File > Open** and set the preference file to *C:\data\geo\vdot\geotech\standards\geopak\vdotgeotech.gtp.*
5. Review each preference settings for Plan, Profile and Cross Sections.
6. Close the Preferences dialog box.

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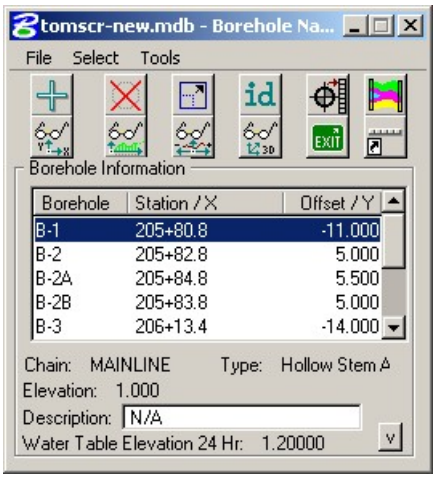
Accessing the GeoTechnical Database

The MicroSoft Access Database **(MDB)** contains all of the soil boring information for a given project. This file is created with a conversion program that converts from the **gINT** software into the database for **GEOPAK** to read.

1. From **Borehole Navigator,** select **File > Open** to access the database.
2. Select the file **tomscr.mdb**.

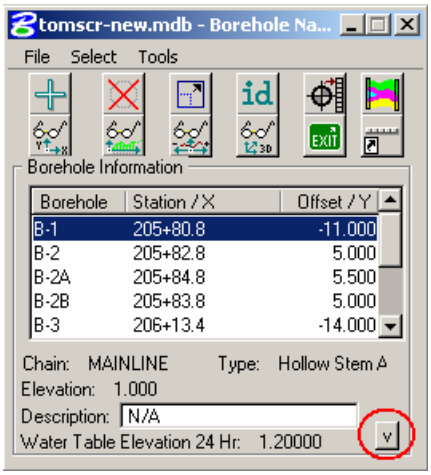
   The file selector should default with a MDB filter.

   This will populate the Borehole Navigator with the soil boring data as shown below. Notice that once the database is open with Borehole Navigator, two rows of tools become available along the upper portion of the dialog.



3. Click **Expand** on the lower right corner of the dialog.

   This will expand the dialog to a allow viewing of the materials for each station.



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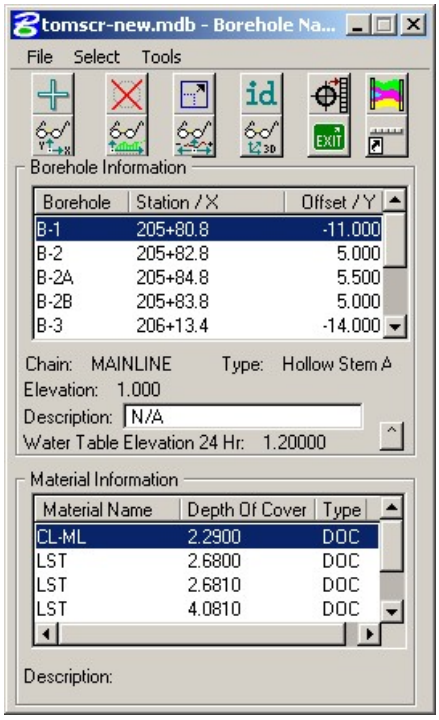
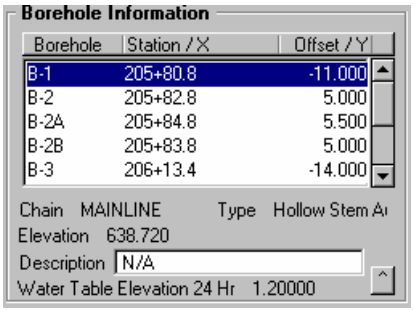


4. As each station is selected in the upper window of the dialog the material list will change in the lower window of the dialog.

5. Navigate through each station.

   Below the **Borehole Information** window you will see various pieces of data pertaining to each boring. The alignment **(CHAIN)** where the boring was referenced, the **Type** of boring, the **Ground Elevation**, a **Description** and the **Water Table Elevation**.



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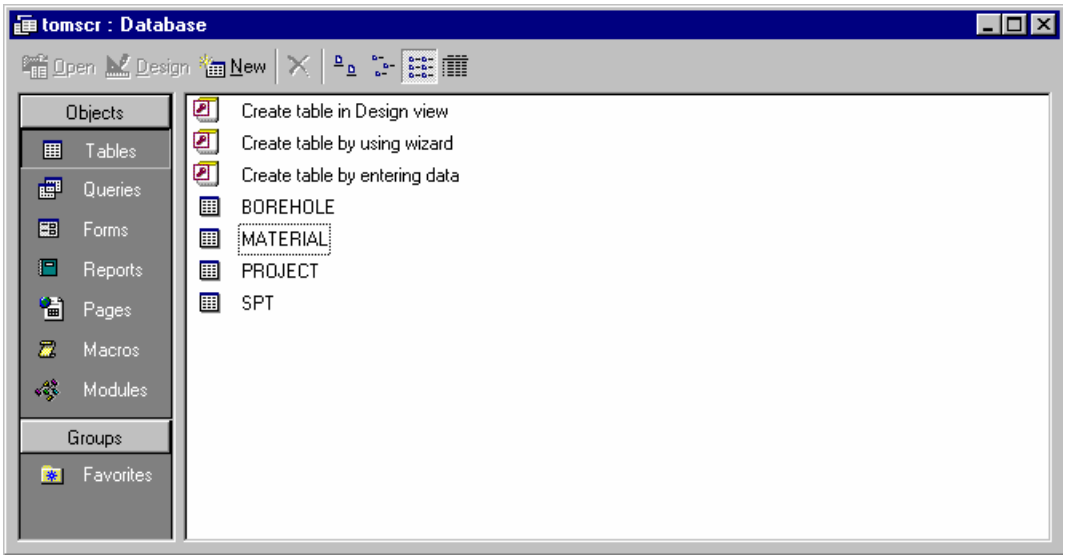
Review of Database Structure (MDB)

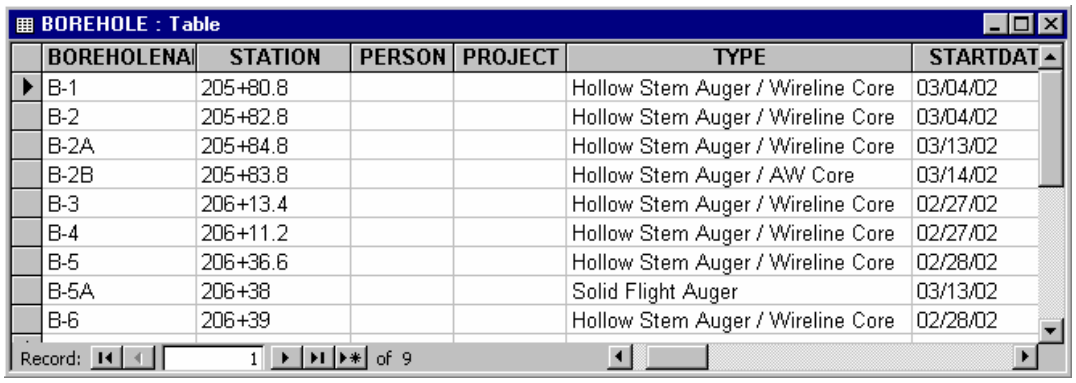
1. Open the database by double clicking on the file **tomscr.mdb** through Windows Explorer.

   You should see several tables with various portions of the boring data stored in each.



2. Double click on the table for **Borehole.**

   This opens the table showing Borehole Name, Boring Type, Station, Elevation. The stations here must correspond to the stationing of the chain that is stored in the coordinate geometry database.



3. Close the Borehole table.

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4. Double click on the **Material Table**.

   This is where all of the material information is stored including material type, depth of cover, and REC and RQD.

MATERIAL : Table

BOREHOLENA	MATERIALNAM	FORM	TYPEOFELEV	DI	T	DEPTHOFCOV	SL
B-1	CL-ML		DOC			2.29	
B-1	LST		DOC			2.68	
B-1	LST		DOC			2.681	
B-1	LST		DOC			4.081	
B-1	LST		DOC			4.631	
B-1	LST		DOC			6.16	
B-2	FL		DOC			0.5	
B-2	LST		DOC			0.501	
B-2	LST		DOC			1.661	
B-2	LST		DOC			2.501	
B-2	CL-ML		DOC			3.001	
B-2	CL-ML		DOC			4.75	
B-2A	CL-ML		DOC			1.8	
B-2A	LST		DOC			2.1	
B-2A	LST		DOC			2.101	
B-2A	LST		DOC			2.28	

Record: 1 of 46

5. Close the material table.
6. Double click on the **Project Table**.

   The information in this table is specific to GEOPAK. This is where the Job Number for the coordinate geometry database is located. This number will correspond to the database provided by the central office design department.

PROJECT : Table

JOBNUMBER	TINFILENAME
101	survey.tin

Record: 1 of 1

7. Close the Project table.
8. Double click on the **SPT Table**.

   All of the blow counts and penetration information for each borehole is stored here.

SPT : Table

BOREHOLENA	DEPTHOFCOV	TYPEOFELEV	TOTALCOUNT	COUNT1	COUNT2	COUNT3
B-1	1.5	0	7	3	3	4
B-2A	1.5	0	28	WT	6	22
B-3	1.5	0	8	2	4	4
B-3	3	0		WH	WH	WH
B-4	1.5	0	11	4	5	6
B-4	3	0	9	7	7	2
B-5	1.5	0	7	3	3	4
B-5A	3	0		WH	WH	WH
B-6	1.5	0	7	2	4	3

Record: 1 of 10

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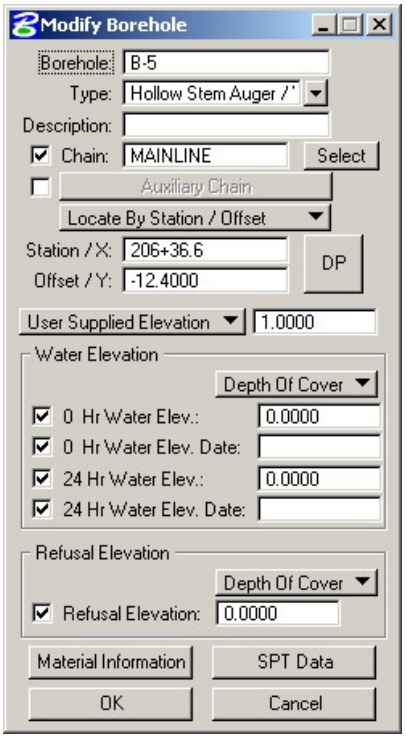
Add / Modify Borehole

To add a borehole manually, you can select the **Add Borehole** tool. You can also double click on and existing borehole to make modifications.

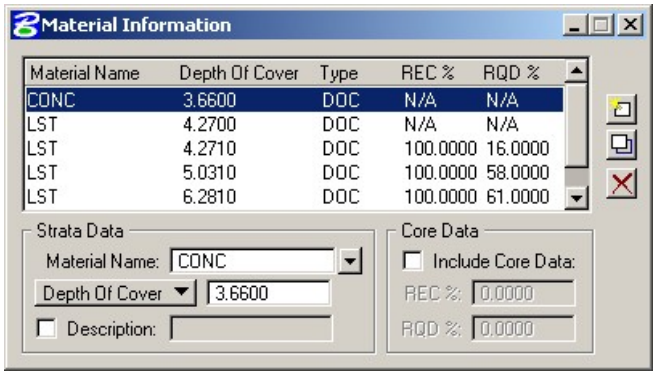
1. Double click on borehole **B-5** in the **Borehole Navigator.**

   The **Borehole Modify** dialog opens with the existing data for editing.



2. Double click **Material Information** in the lower left of the dialog.

   The dialog displays material information related to borehole B-5.



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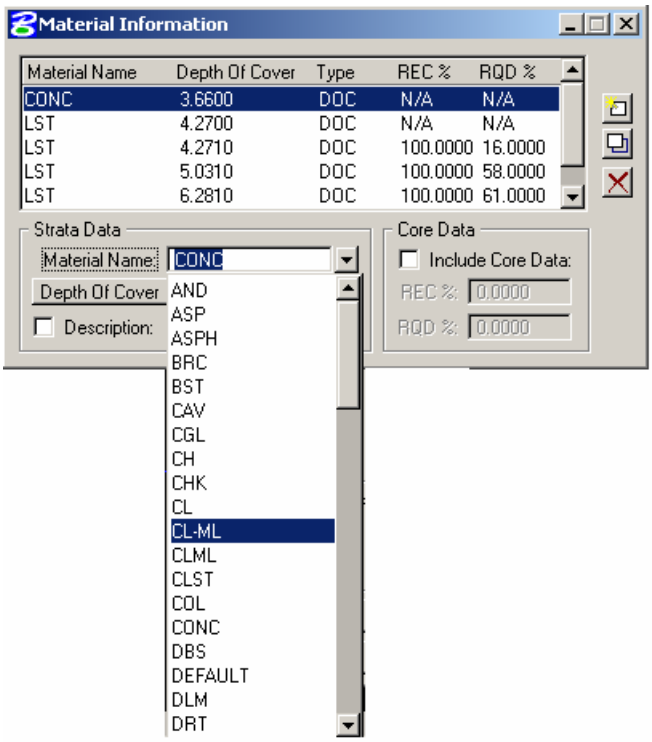
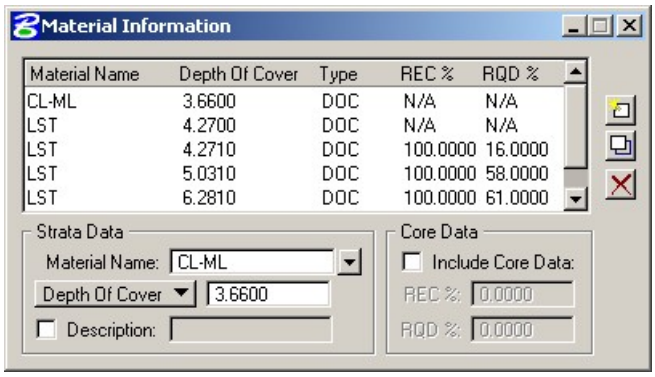
3. Let's modify the **Material Name** for the exiting **CONC** by selecting **CL-ML** from pulldown list of materials.



4. Click the **Modify** icon on the right of the dialog and see the change take place in the display window.



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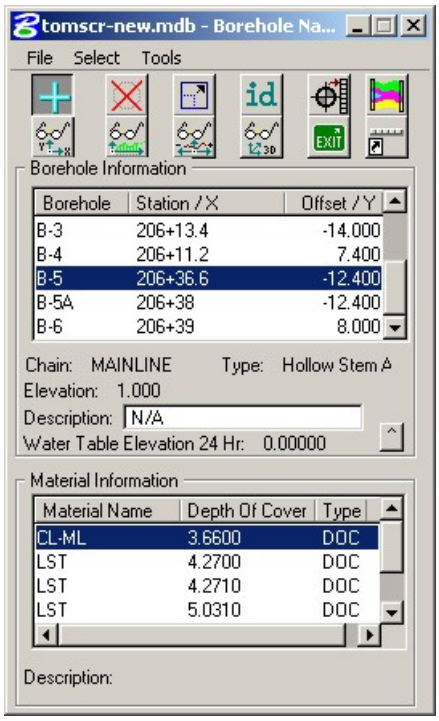
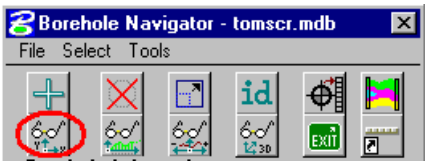
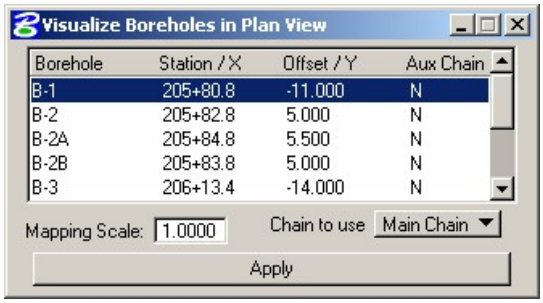
5. The last thing to do is close the **Material Information** dialog and then click **OK** on the lower left of the **Modify Borehole** dialog. You should now see the change in the **Borehole Navigator.**



PLOTTING BOREHOLES IN PLAN

1. From the **Borehole Navigator** select the tool to **Visualize Boreholes in Plan View.**





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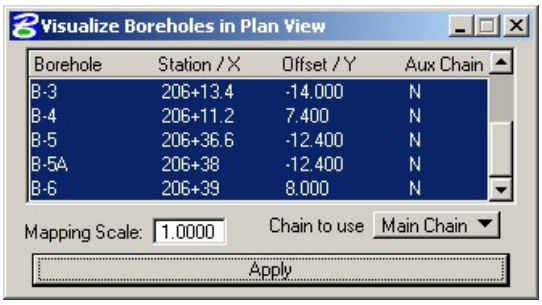
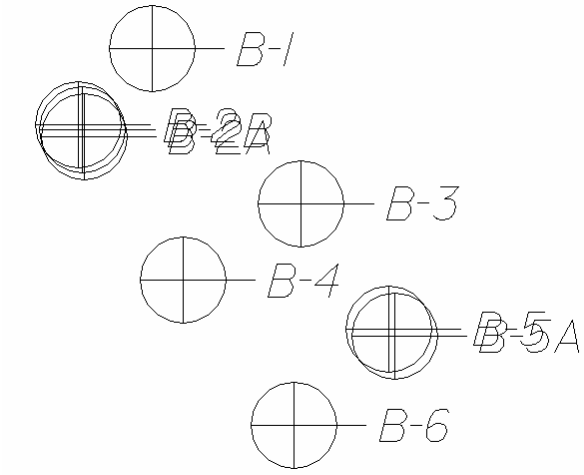
2. Highlight **All** of the boreholes in the dialog by holding down the left mouse button on the first borehole and dragging to the bottom of the list while still holding the button down. This list should now look like the one in the dialog below.



3. Click **Apply**.

   The boreholes should now be visualized in the **Plan** portion of the file. Below is a sample.

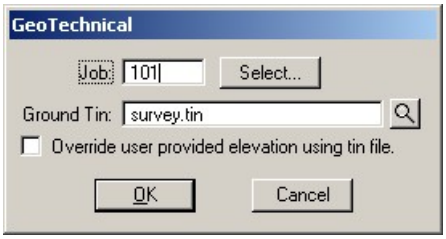


4. Close the dialog for visualizing boreholes in plan view.

PLOTTING BOREHOLES IN PROFILE

Before plotting the Boreholes into the profile view we are going to allow our TIN file to control the elevations.

1. Select **File > Project Files.**



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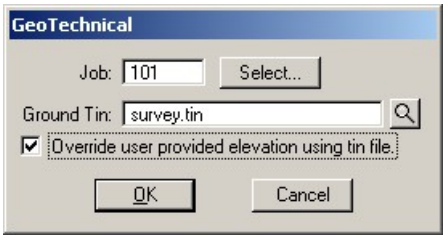
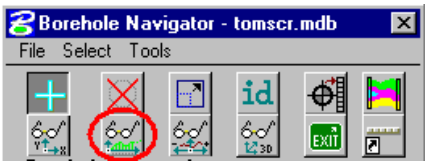
2. Toggle on the option to override user provided elevations.

   This will let the application reference the TIN file for ground elevations.

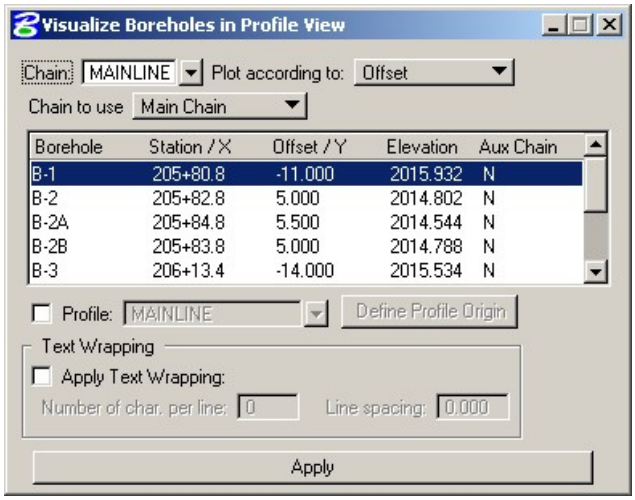


3. Now select the tool to **Visualize Boreholes in Profile View** from the **Borehole Navigator.**



4. Change the chain name to **MAINLINE.**

   The dialog populates with all of our borings.



   The toggle on the upper right side of the dialog dictates how the borings are to be plotted on the profile. These are self explanatory.

5. For our exercise, we will select the **Stack** option.

   Under the display window is an option to identify the profile on which we wish to visualize the boreholes.

6. Using the pulldown, select the profile for **MAINLINE**.

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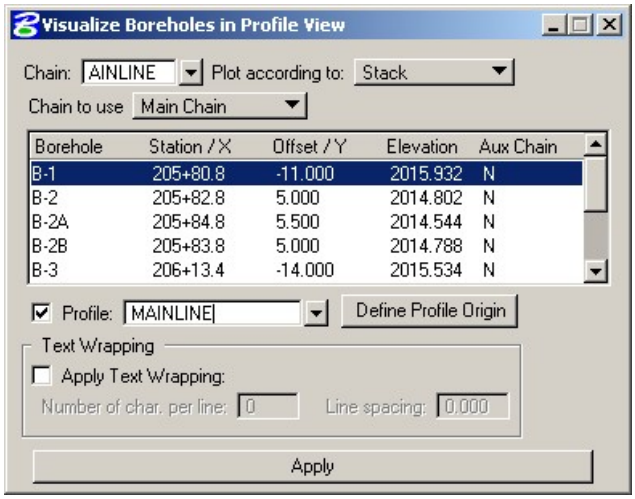
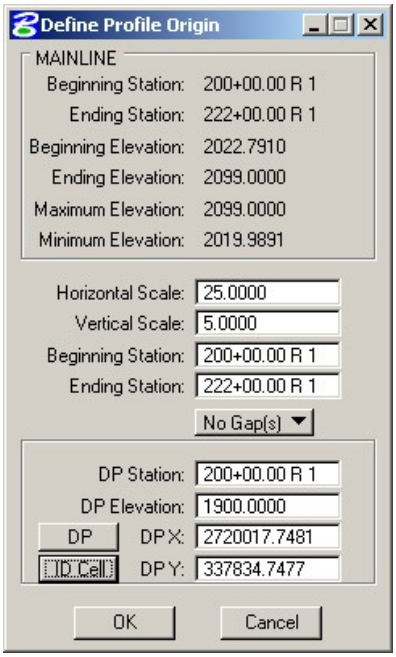


The last thing we need to do is identify in the MicroStation file, where the profile has been drawn. This is accomplished very easily with the Define Profile Origin option.

7. Click **Define Profile Origin**.



In order to populate all of the fields in the dialog, we simply need to identify the **cell** that is referenced to the profile in the drawing.

8. Click **ID CELL** and then select the cell in the drawing.

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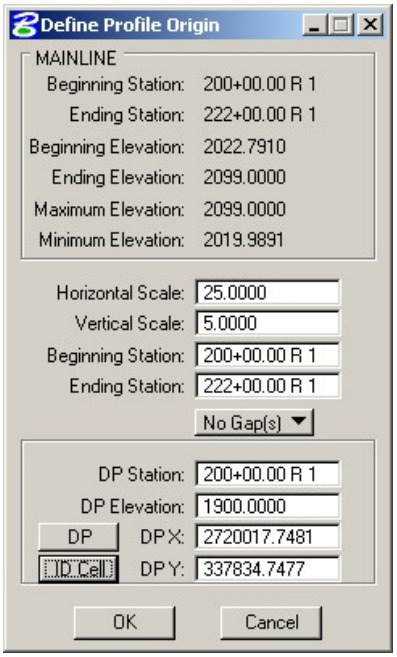
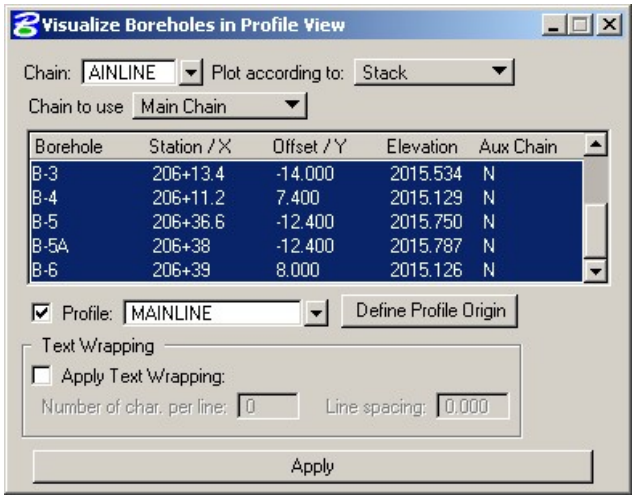


9. Click **OK**.

10. Highlight all of the borings in the window of the **Visualize Boreholes in Profile View** dialog, just as we did in the Plan View dialog and select **Apply**.



11. All of the boreholes should now be visualized on the profile.

Note In the case of boreholes that are separated by very small distances, some manual adjustments may be necessary in order to view them properly.

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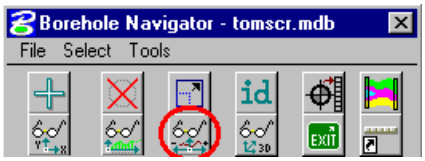
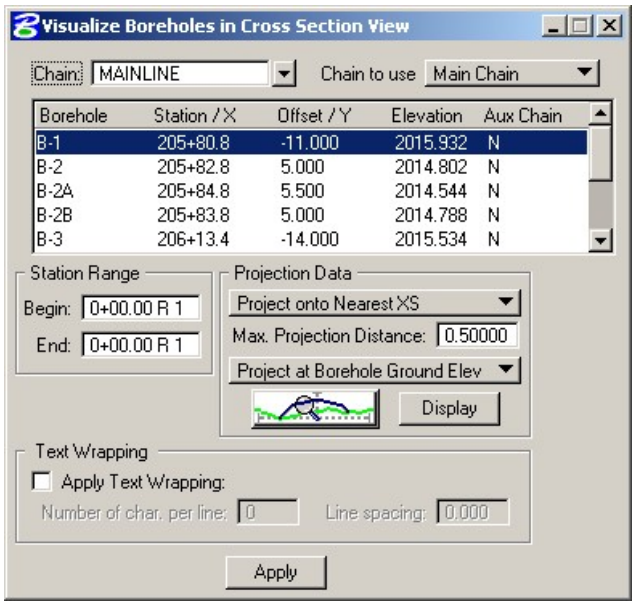
PLOTTING BOREHOLES IN CROSS SECTION

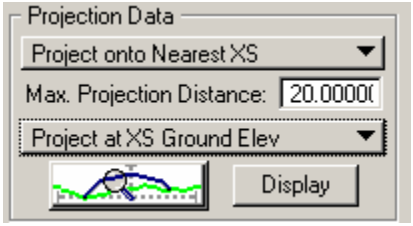
1. Open the MicroStation file *c:\data\geo\VDOT\geotech\geo_d17682xsmainline.dgn.*
2. Select the Visualize Boreholes in Cross Section View tool.



3. Set the CHAIN name in the upper portion of the dialog to populate the display window with our borehole data.



4. All of the setup on this dialog is performed from the Projection Data area.



5. Set the Projection Data to the following settings :

   Project onto Nearest XS

   Max. Projection Distance = 20

   Project at XS Ground Elevation

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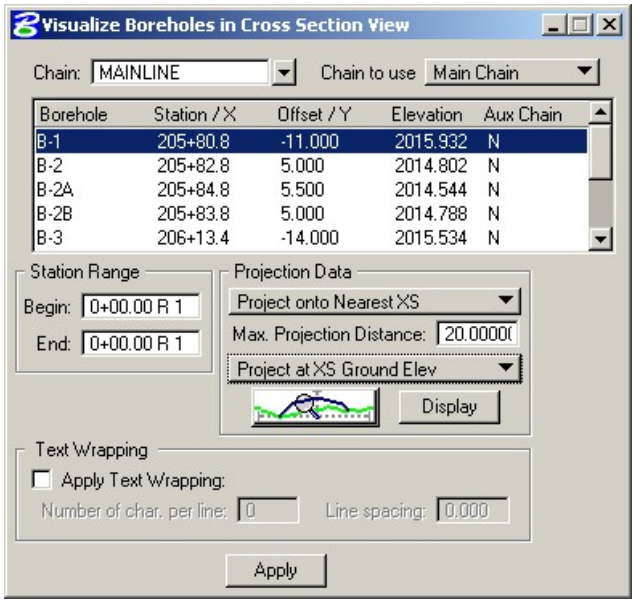
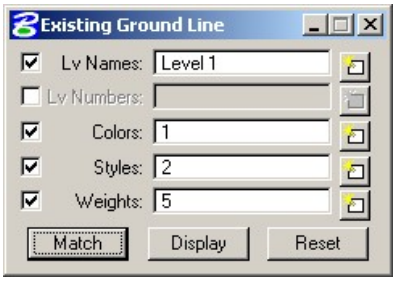


The final setup step is to define the symbology for the existing ground in the drawing.

6. Zoom into a cross section so as to be able to identify the ground line easily.
7. Click **Define Existing Ground icon**.
8. In the following dialog click Reset.

   This will clear out any erroneous values.
9. Toggle on all of the symbology toggles.
10. Click **Match** and data point on the line in the drawing representing the existing ground.
11. Close the dialog when finished.



12. Click **Apply**.

Note In the case of boreholes that are separated by very small distances, some manual adjustments may be necessary in order to view them properly.

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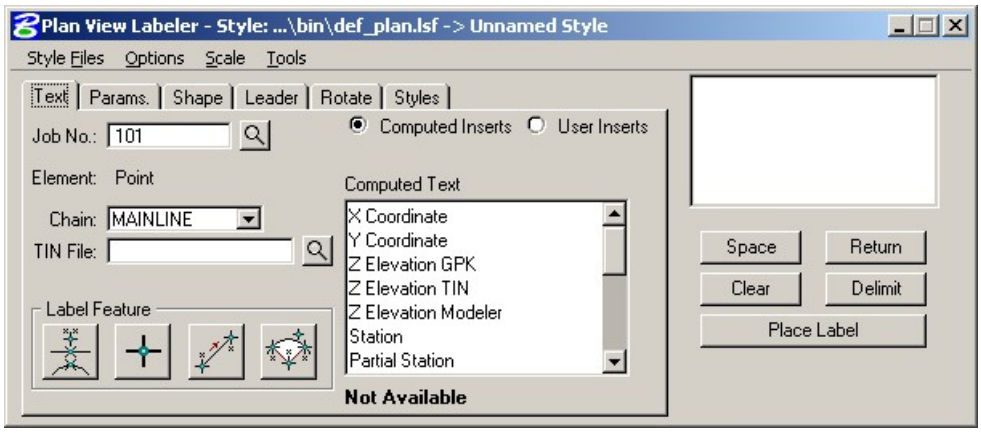
8 Labeling

INTRODUCTION

Objectives	Learn how to label plan information with Plan View Labeler. Familiarize the user with the Cross Section Labeler.
Tools	
Menu Bar Application	GEOPAK Road > Plans Preparation > Plan View Labeling GEOPAK Road > Plans Preparation > Profile Labeling GEOPAK Road > Cross Sections > Labeling

PLAN VIEW LABELING

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. When the Plan View Labeling tool is selected, the dialog box depicted below is displayed.



The label to be placed is displayed in the box on the right side of the dialog box 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.

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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.

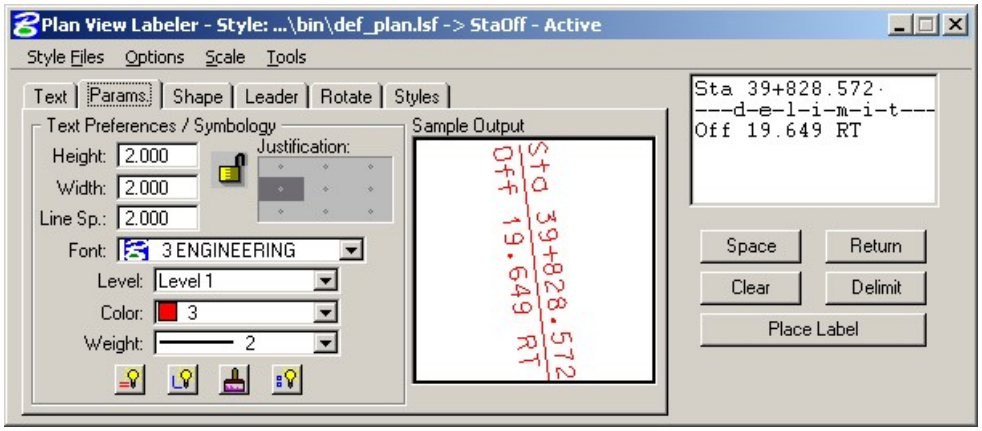
The Computed Inserts are items that GEOPAK has the ability to calculate for the chosen item. The list of Computed Inserts changes with the type of element that is chosen. If a line is chosen, the list of Computed Inserts will show inserts of bearing, and length. If a curve is chosen the list of Computed 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.

There are several methods allowing the user to choose the element to use for calculations in the label.

Select GEOPAK or MicroStation Element	The tool to allows the user to identify either for labeling.
Data Point Location	Selects a location in the design file that may or may not be associated with an element.
2 GPK Point Line	Selecting lines or points that have been visualized via COGO.
3 GPK Point Arc	Selection of visualized arcs and points

PARAMS.



The Parameters tab enables the user set up the text size and symbology for the label.

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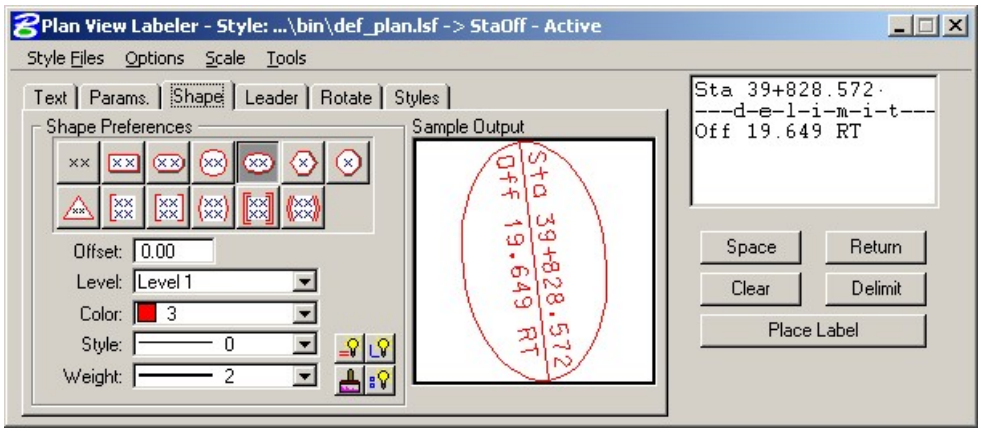
By Current sets the symbology to the current MicroStation settings. By Element allows the user to set the symbology by choosing a MicroStation element. Set All sets the symbology for all elements in the label (text, delimiters, leader lines, etc.).

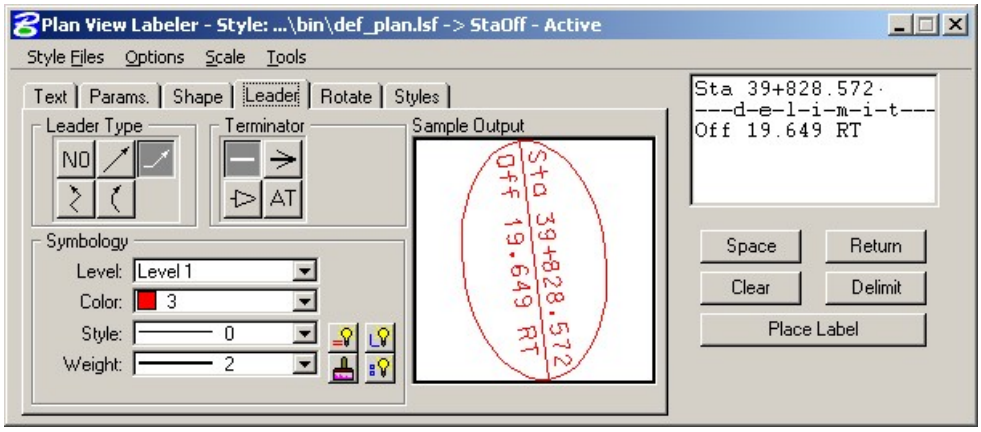
By Current	GEOPAK determines the active MicroStation symbology (level, weight, color and style) and populates the dialog.
By Element	GEOPAK prompts to select a previously drawn MicroStation element, and populates the dialog with its element symbology.
D & C Symbology	Clicking invokes the Design and Computation Manager, wherein the desired item may be selected. By double clicking on an Item, the associated element symbology within the Design and Computation Manager is applied to the Labeling dialog.
Set All	GEOPAK reads the current settings (level, weight, color and style) within the dialog, and populates the Parameter, Shape and Leader dialogs.

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.

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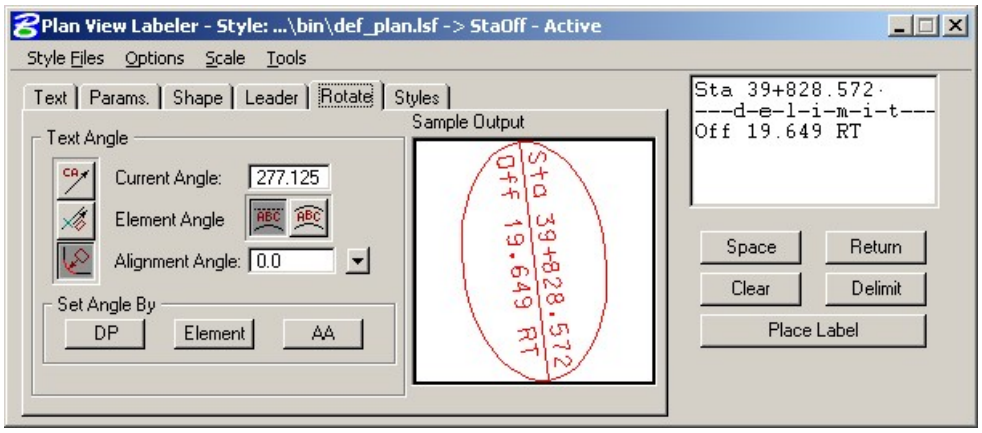
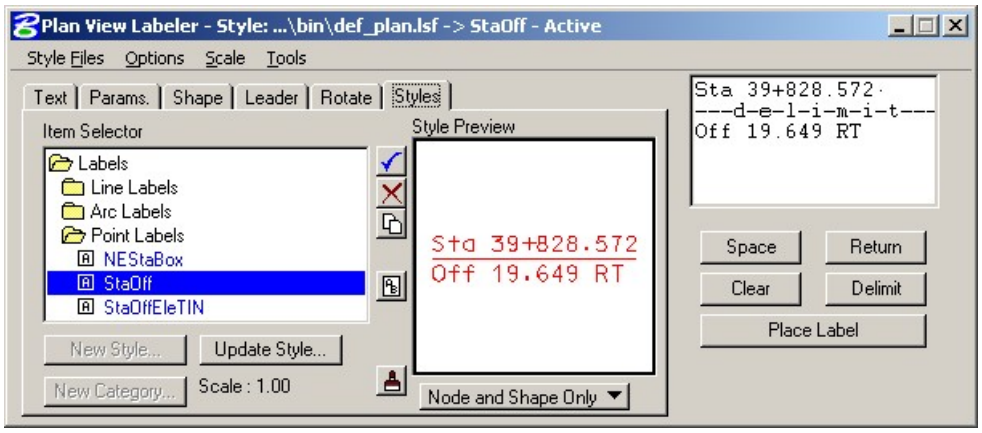
ROTATE



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.

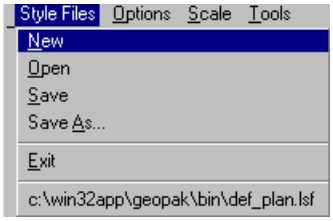
STYLES



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.



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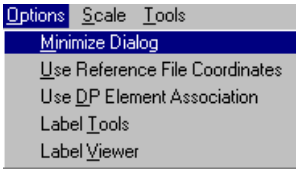
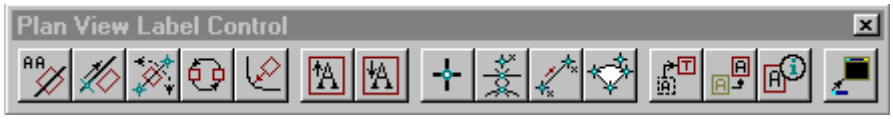
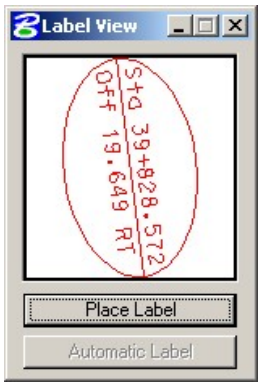
In the Options menu, Minimize Dialog Box will minimize the dialog box when Place Label is chosen. The Use Reference File Coordinates option uses the coordinates from the master plan view file when placing a label in a plan sheet.



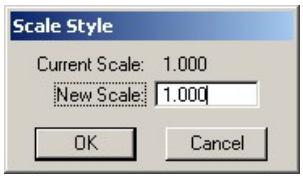
Options > Label Tools invokes the tool frame shown below which enables the user to modify GEOPAK labels.



Options > Label Viewer brings up a dialog box that allows a user to view and place a label.



The Scale > Scale Style menu allows the user to choose a plan scale. All labels will be adjusted according to the plan scale. The user simply keys in a scale, and chooses a Labeling Style. The corresponding label will be placed at the correct size for the scale that was chosen.



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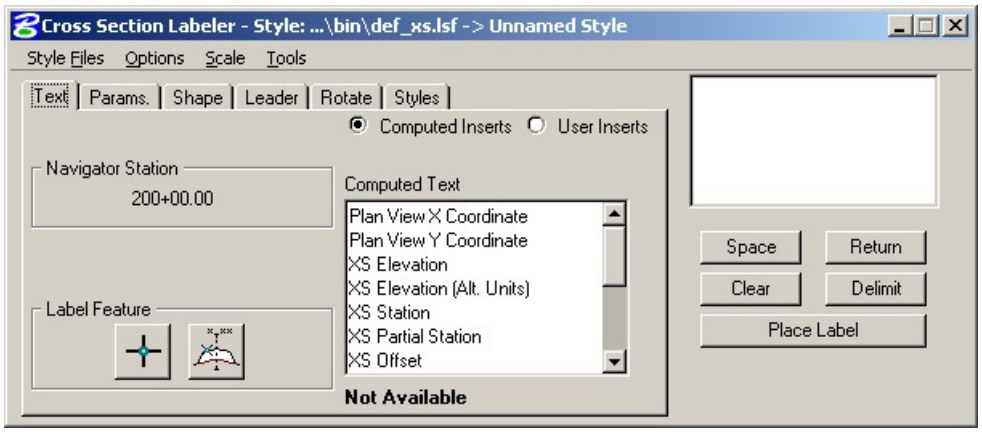
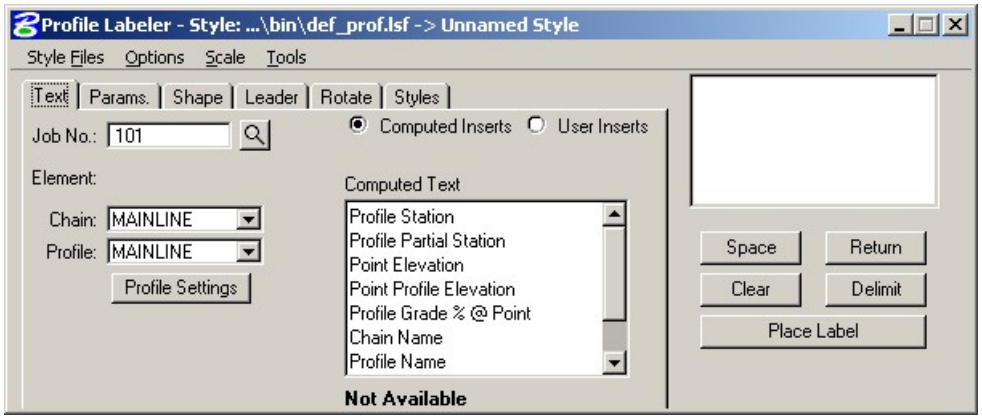
CROSS SECTION LABELING

The Cross Section Labeling dialog box differs from the Plan View Labeling dialog box 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.



PROFILE LABELING

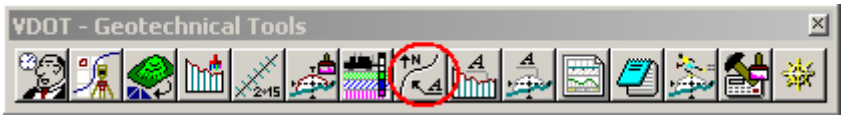
The Profile Labeling dialog box differs from the Plan View Labeling dialog box only on the text tab. The Chain and Profile must be defined, in addition to profile settings. The Computed and User Inserts contain values and phrases related to profiles.



LAB EXERCISE: LABELING

Accessing the Labeler

1. Open the MicroStation file *c:\data\geo\vdot\geotech\d17682des.dgn.*
2. Select the **Plan View Labeler** tool *(VDOT Geotechnical Tools).*



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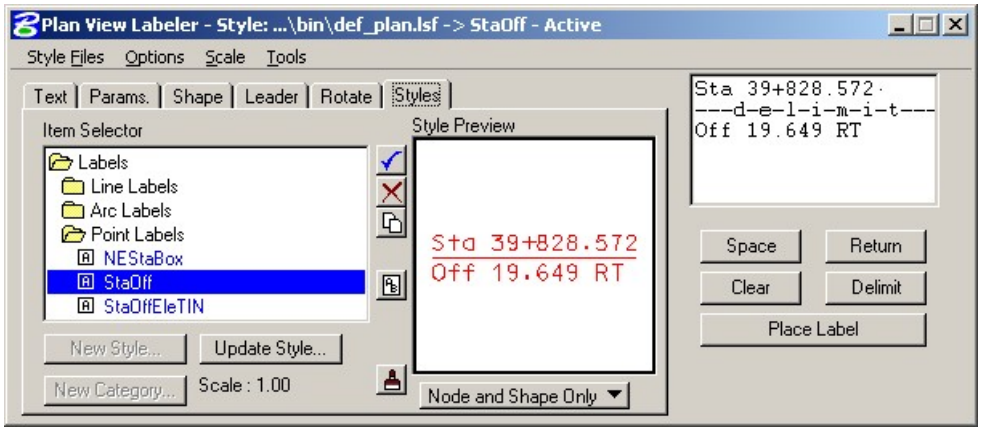
Using Predefined Label Styles

1. Select the Styles tab.
2. Traverse with the Item Selector box to locate the following style: **Labels > Point Labels > StaOff**. Next, double click the **StaOff** style.



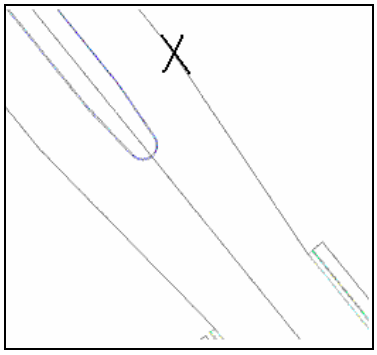
3. Move back to the Text tab and complete as defined below:

Job No.	101
Chain	MAINLINE
TIN File	SURVEY.TIN

Label Pavement Transitions

In the following steps, we will use the **Plan View Labeler** to label the beginning and ending points for pavement transitions.

1. Use the MicroStation pulldown **Utilities > Saved Views** to access the saved view "**TRAN1**".
2. To create a label, click **DP** and then identify the location as shown by the "X" in the following image. The labeler automatically calculates the information.



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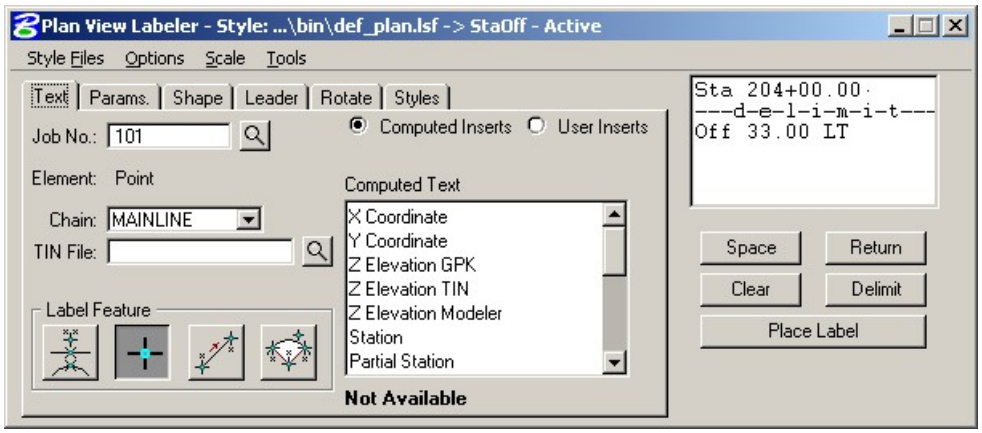
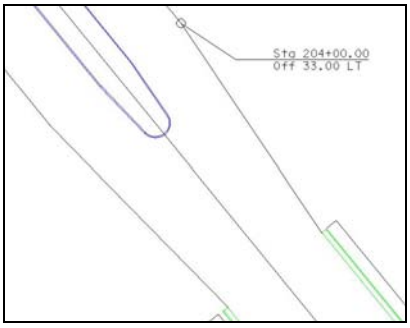


3. Use the **Params.**, **Shape**, **Leader** and **Rotation** tabs to experiment with different labeling styles.
4. To place the label, return to the **Text** tab and click **Place Label**.
5. The label is now attached to your cursor (without the leader for the delimiter).
6. Data point at the location you wish the text to be located.
7. A second data point will define the side of the label from which the leader line will be drawn from the delimiter line to the computed location.



8. Repeat Steps 2-7 to label other points of the transition area.
9. Exit MicroStation.

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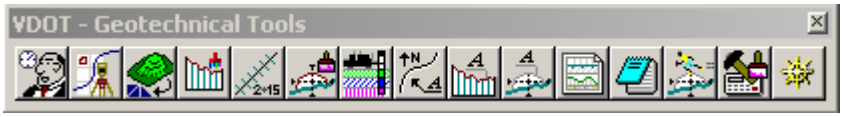
9 Plan and Profile Sheets

OVERVIEW OF FEATURES

Feature / Function	Drawing of plan or plan / profile sheets.
Tool	
Menu Application	GEOPAK Road > Plans Preparation > Plan and Profile Sheets

Plan Sheet Layout supports any combination of Ports on a sheet for maximum flexibility.

Plan Sheet Layout 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.

Plan Sheet Layout 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.

Plan Sheet Layout 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 are all supported in Plan Sheet Layout.

Plan Sheet Layout 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 Plan Sheet Layout, 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

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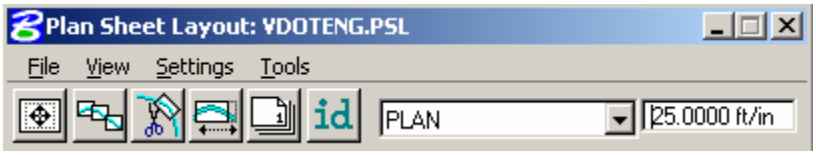
(Sheet Clip Mode) tool. This approach allows the power and flexibility of the Draw Tabular Annotation application to be used with sheets.

INVOKING PLAN SHEET LAYOUT

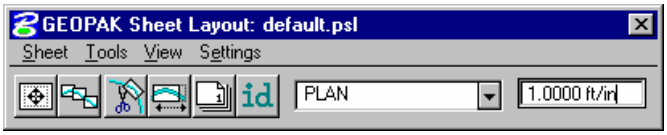


The dialog box is comprised of the title bar which displays the current Sheet Library, the main menu bar, short-cut tools, and the Sheet Name Selector and Plot Scale fields.

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.

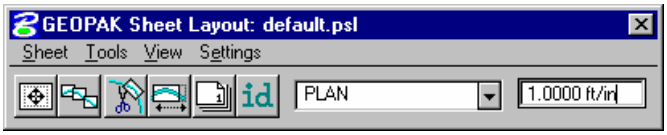
SHEET LIBRARY



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:

- Sheet
- Tools
- View
- Settings

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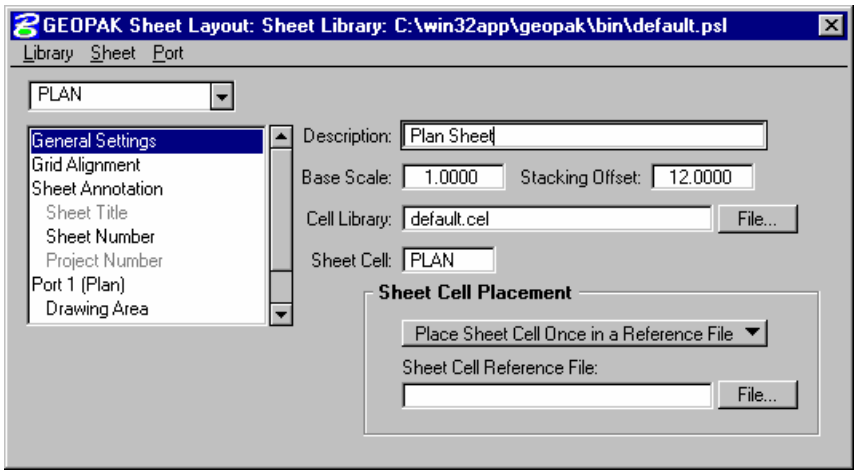
SHEET MENU OPTIONS

Five tools are supported in the Sheet pulldown and are detailed in the sub-sections below.

- Library
- Composition
- Layout
- Clip
- Exit

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."



Composition

This menu item opens the Sheet Composition dialog box, wherein drawing area, overlapping options and other project specific variables are defined. One sample dialog box is depicted below.

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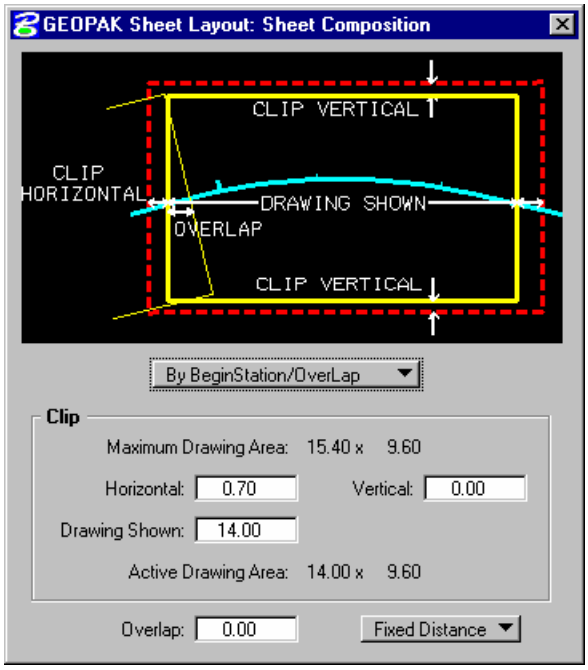
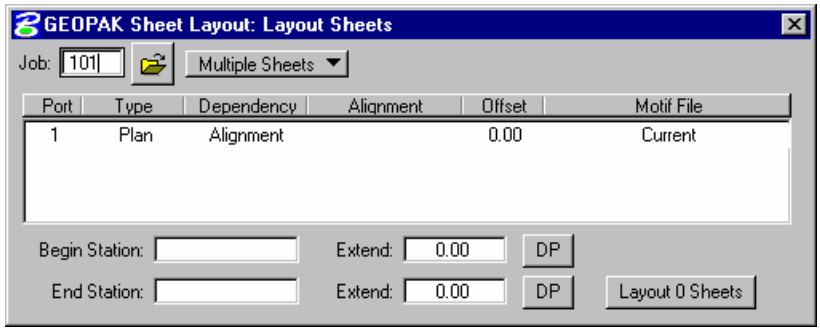


Layout

The Layout dialog box 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.

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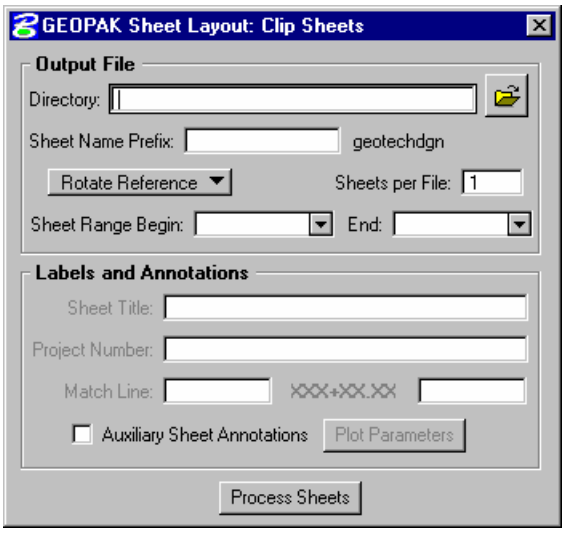
Clip

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 box is utilized to complete these tasks, as detailed below.



Exit

Exits the Plan and Profile Sheets application, but does not close the MicroStation file.

TOOLS OPTIONS

Four tools are supported in the Tools pulldown and are detailed in the sub-sections below.

- Modify
- Sheet Number Manager
- Draw Tabular Annotation (Sheet Clip Mode)
- Identify 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 box, which is illustrated below.

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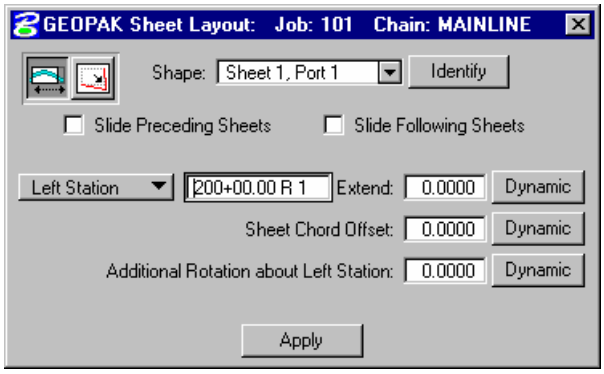
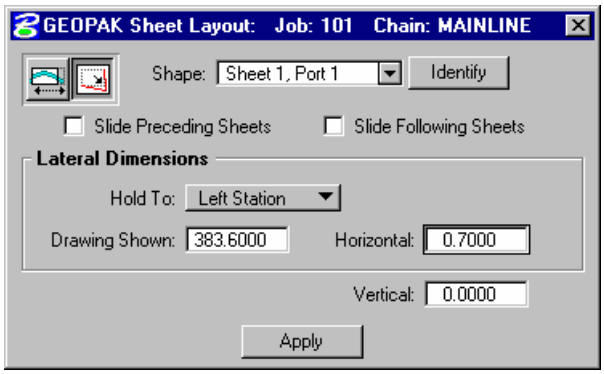


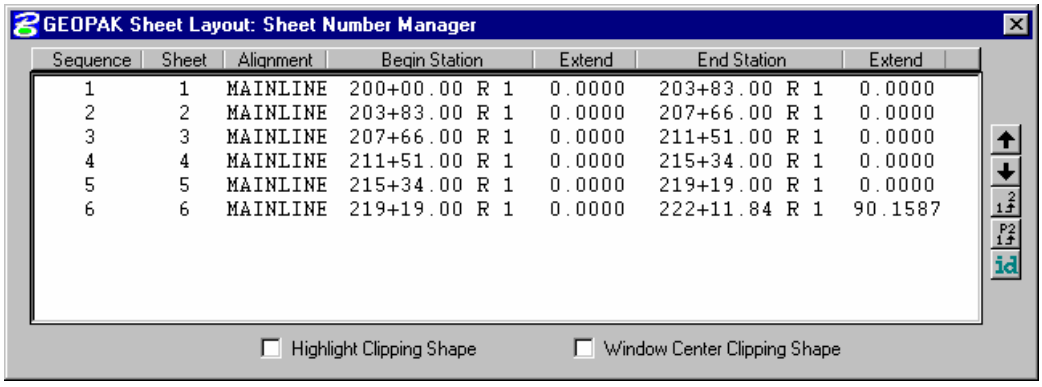
The two tools in the upper left corner are utilized to Slide sheets (along the alignment, rotating, offsetting) and Modify Drawing Area. The Slide options are illustrated above, while the graphic below depicts the Modifying Drawing area.



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 proceeding 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 tool down in the grouping to the right of the list box).

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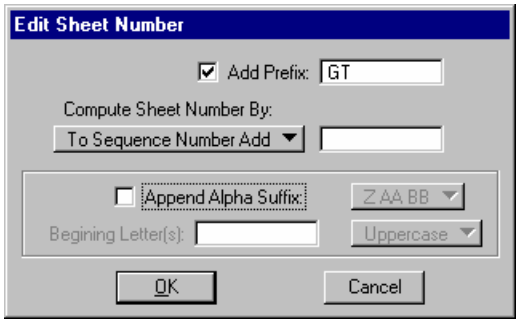


Another option is changing the order the sheets are drawn.

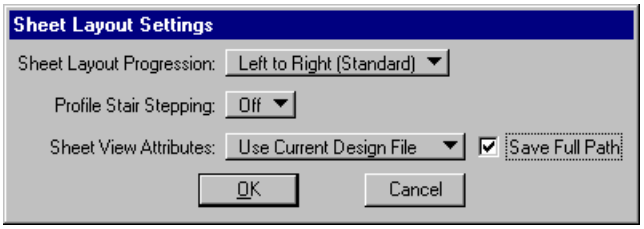
VIEW MENU OPTIONS

Three tools are supported in the View pulldown and are detailed in the table below.

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

One tool is supported in the Sheet pulldown and is detailed in the table below.

Sheet Layout Settings	When the Sheet Layout Settings tool is selected, the dialog box depicted below opens. Three settings are supported within the dialog box 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

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On

- Sheet View Attributes:

  Use Current Design File

  Customize With Motif File

DIALOG BOX TOOLS

Six short-cut tools are supported for ease of use. These tools correspond to tools located within the menu bar pulldowns and are detailed in the table below.

Sheet Composition (Sheet > Composition).

Layout Sheets (Sheet > Layout).

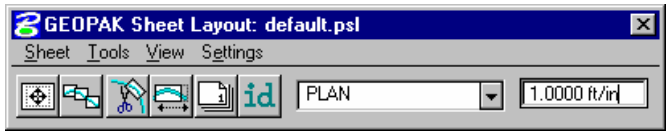
Clip Sheets (Sheet > Clip).

Modify Sheets (Tools > 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 box:

- 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.

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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

PORT INFORMATION

Before laying out sheets, each Port must have its Port Information filled out. The Port Information Dialog boxes are opened by double-clicking the corresponding row in the Layout Dialog box.

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 box 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. This toggle is only for the design file that contains the clipping shapes.

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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

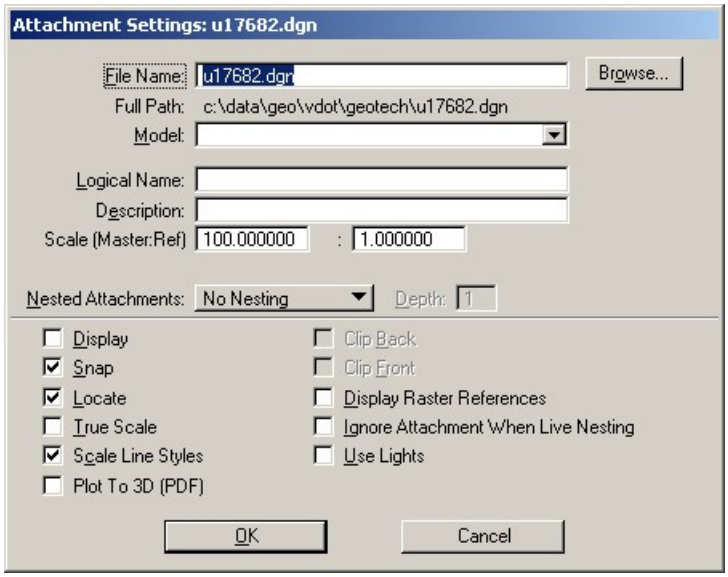
The user can control reference file attachment without the use of Motif Files by selecting the Use Current option for Sheet View Attributes. When this option is used, the Current dgn file (in which clipping shapes have been laid out) is used like a Motif file in that it's reference file attachment information 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.

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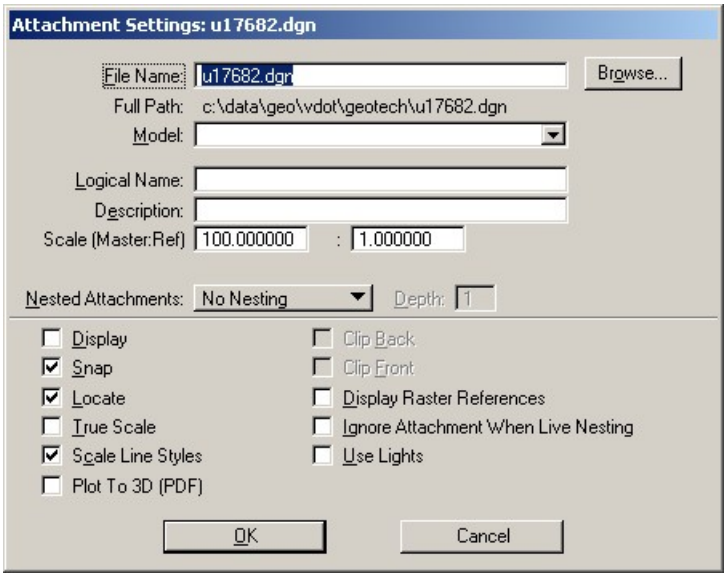
The question arises as to how the various reference file settings are to be controlled for each Port. This is done by using another design file to serve as a pattern for the reference file attachment information. For every Port, there would be a motif file specified by its file name. The Ports on each 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 box depicted below opens.

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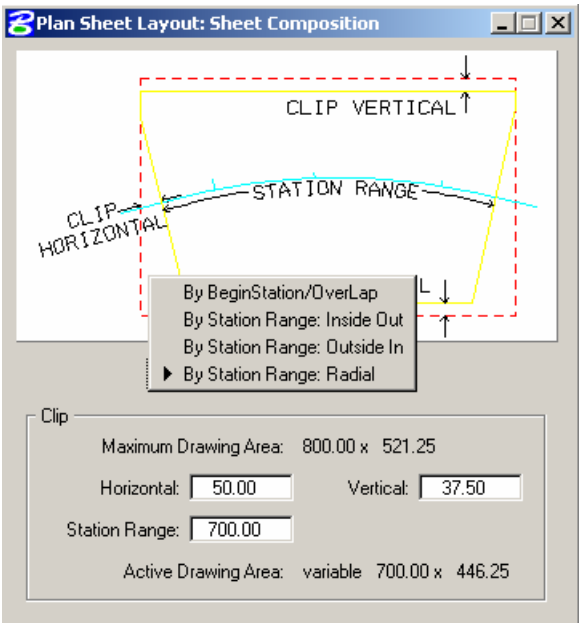

The graphic illustrates the various values required in the dialog box. Directly below, four options are supported, as illustrated in the exploded view above:

- 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:

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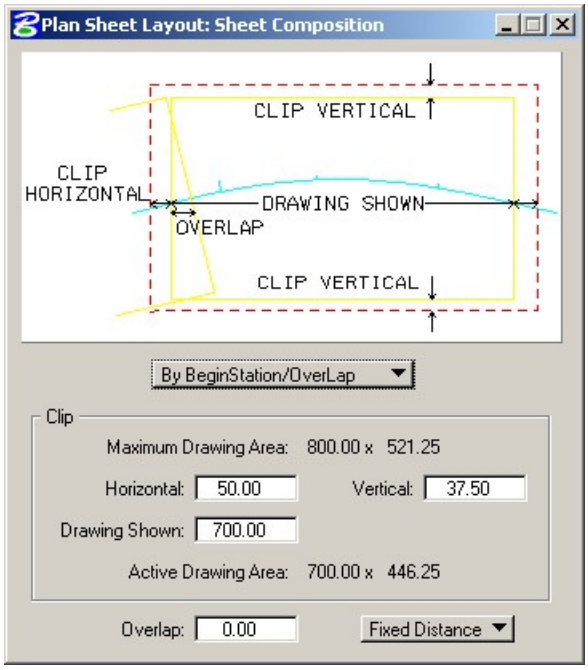
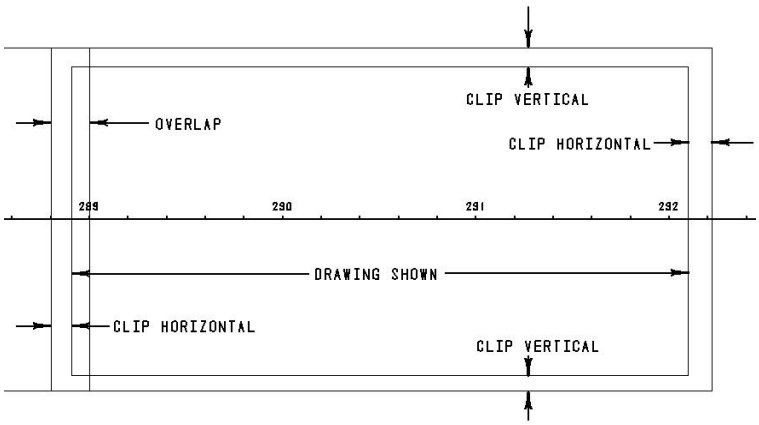


Before these options are reviewed, a discussion of the **Active Drawing Area**, located within the **Clip** group box, is warranted. Several dimensions are found within the **Clip** group box. These include:

- 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 box, in our example, 385 x 240. Then the Clip **Vertical** is subtracted twice, once for the top and once for the bottom. In this case,

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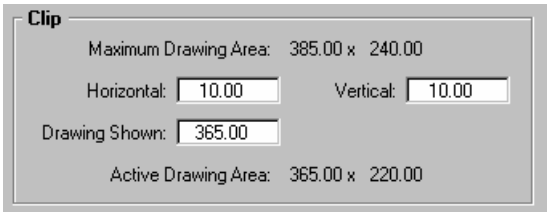
240 - 10 - 10 = 220

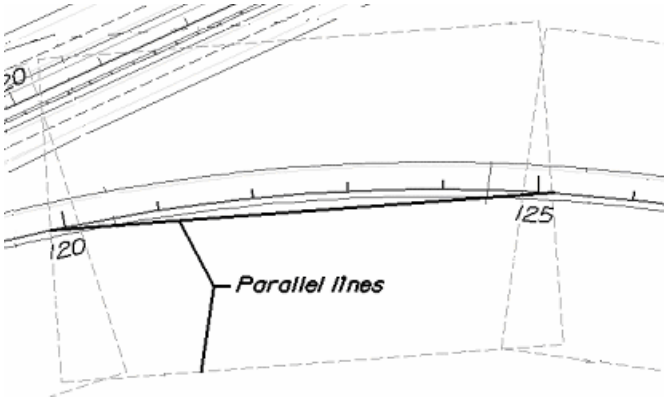
which is shown in the Active Drawing Area. The same method is utilized for the Horizontal computations. The horizontal clip is subtracted twice, once for the right side and once for the left side. In this case,

385 - 10 - 10 = 365.00

which is shown in the Drawing Shown and the Active Drawing Area.



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.

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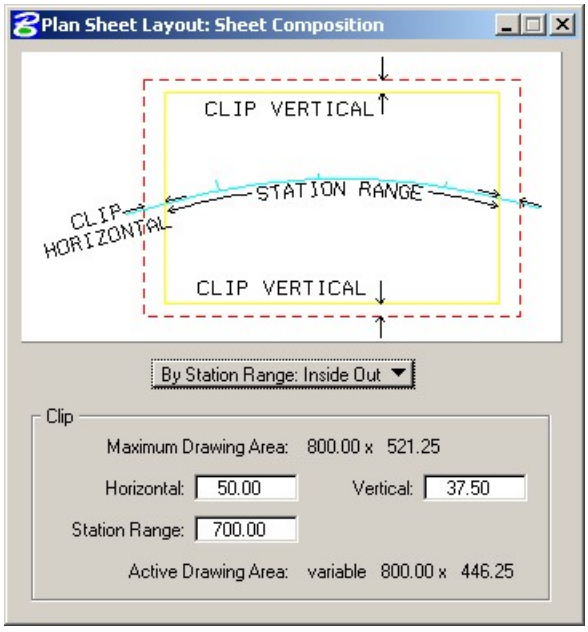
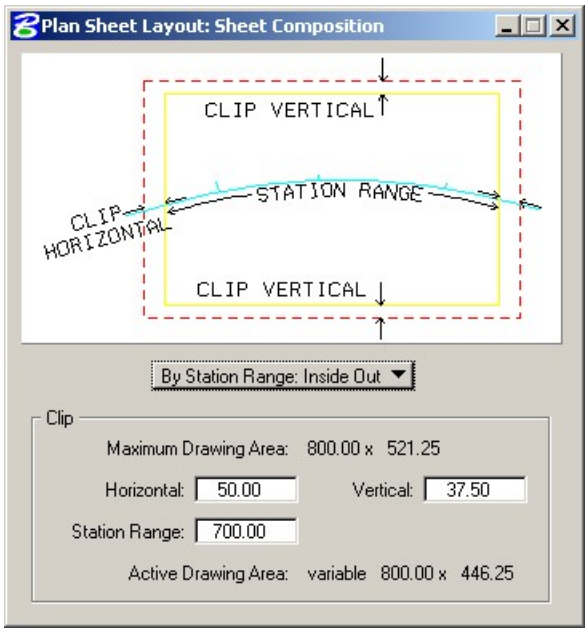


Now the Active Drawing Area is not constant, but displays Variable in the output field.

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.



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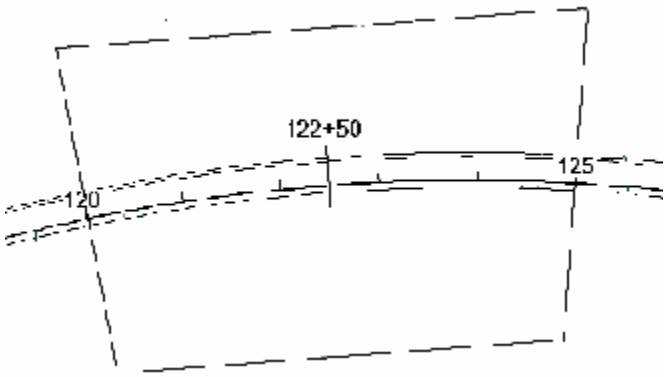


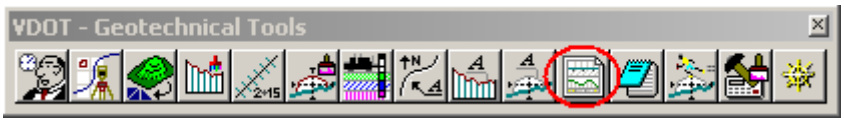
Since the clip area covers a constant station range, the length of the clipping shape will vary depending on the curvature of the alignment.

Note	Note: Any time sheets are deleted from the file using MicroStation commands, the file must be comclicked before laying out the sheets again.

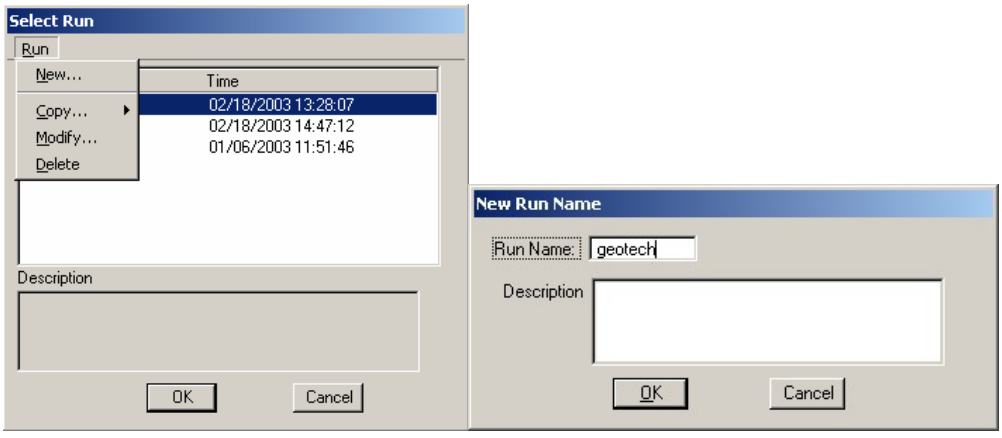
LAB EXERCISE: PLAN AND PROFILE SHEETS

Plan Sheet Layout Process

1. Open the MicroStation file ***c:\data\geo\VDOT\geotech\d17682work.dgn***.
2. Select the **Plan & Profile Sheets** tool *(VDOT Geotechnical Tools).*



1. Create a new **RUN** as shown below.



This will invoke the Sheet Layout tool

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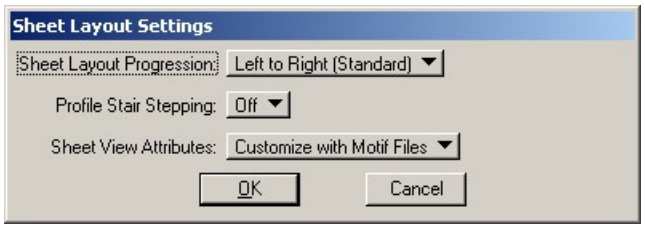
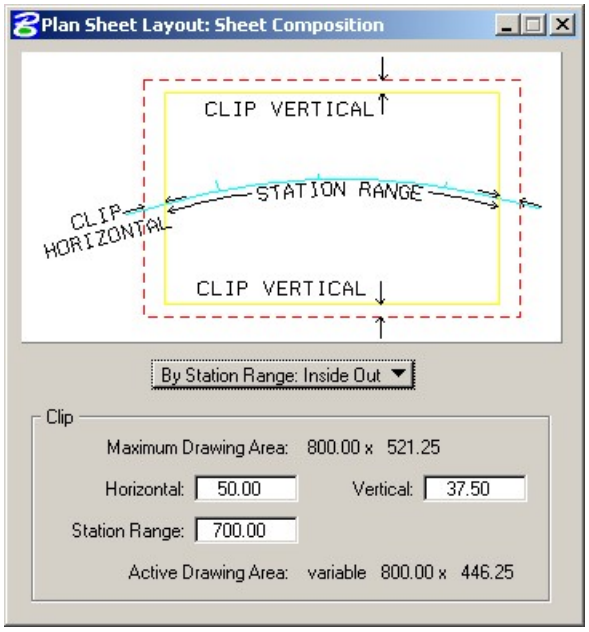
3. Select **Settings > Sheet Layout**.
4. Set **Sheet View Attributes** to Customize with Motif Files.
5. Click **OK**.



6. On the **GEOPAK Sheet Layout** dialog box, select **PLAN** from the sheet list.
7. Set the scale to **25.0000 ft/in**.

8. Click **Sheet Composition**.
9. Populate the **Sheet Composition** dialog box as below.



Note Note: The Vertical setting will trim off the top and bottom of the clipping shape so that plan data will not be placed inside the title blocks on the sheet.

10. Close the Sheet Composition dialog box.

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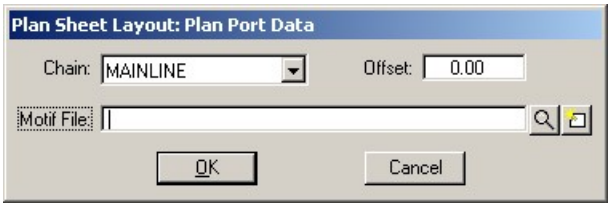
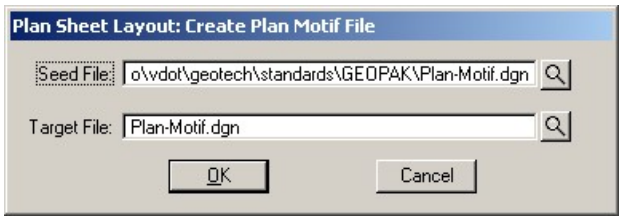
Layout Sheets

1. Click **Layout Sheets**.
2. Click **OK** on the information modal.
3. Click **Open GEOPAK Job** then select job number **101**.
4. Double click on **Port 1**.
5. Set the **Chain** to **Mainline**.
6. Click **Create Motif File**.



7. Populate the **Create Plan Motif File** dialog box as below.

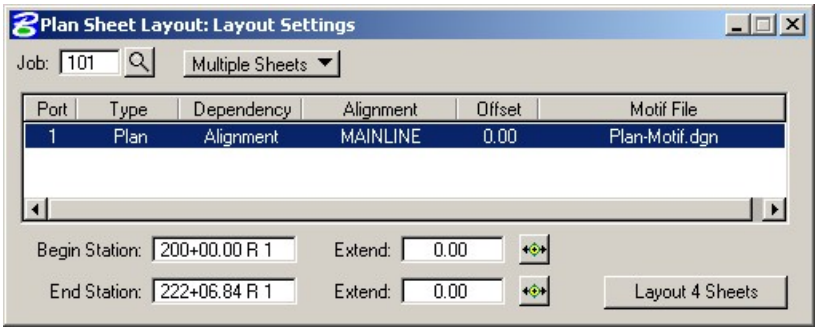


Note Note: The Seed File can be selected by clicking Select Seed Motif File then selecting Plan-Motif.dgn. The Target File name should be entered manually.

8. Click **OK** on the Create Plan Motif File dialog box.

   A file named *Plan-Motif.dgn* should be created in the working directory.

9. Click **OK** on the Plan Port Data dialog box.



10. In the Layout Sheets dialog box, set the **Extend** value for the **Begin Station** to **–200.00**.

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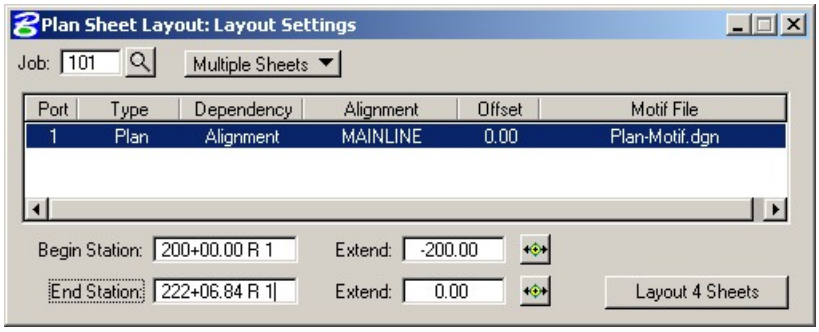
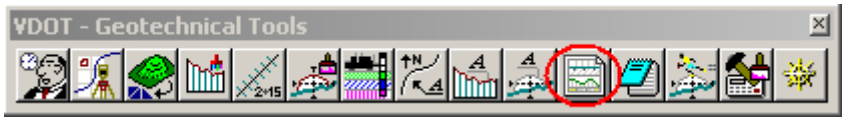
This forces the first sheet to end at **Station 205+00.00**.



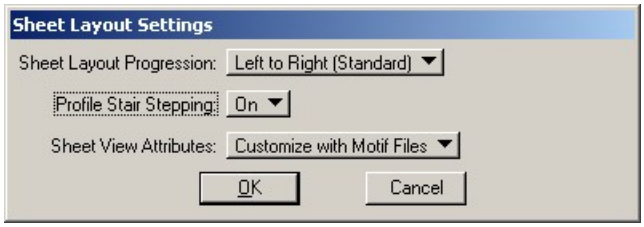
11. Click **Layout 4 Sheets** to draw the clipping shapes into the design file.
12. 4 clipping shapes should be placed for the **Plan** port.
13. Close the **Layout Sheets** dialog box.
14. Exit the Plan and Profile Sheet dialog box and save your run.
15. Review the results.

Profile Sheet Layout Process

1. Select the **Plan & Profile Sheets** tool *(VDOT Geotechnical Tools).*



2. Select **Settings > Sheet Layout**.
3. Change **Profile Stair Stepping** to On.
4. Set the **Sheet View Attributes** to Customize with Motif Files.
5. Click **OK**.



6. On the **GEOPAK Sheet Layout** dialog box, select **PROFILE** from the sheet list.

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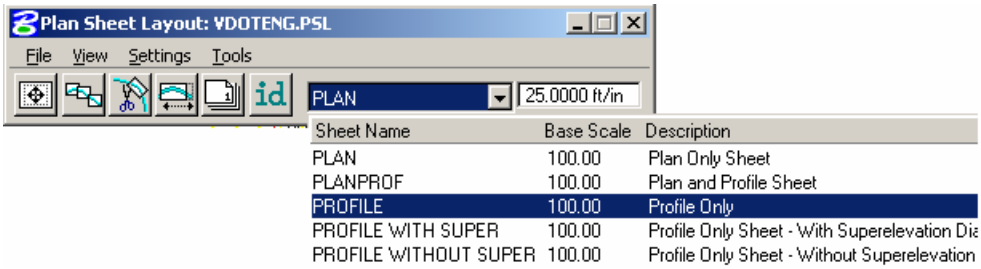
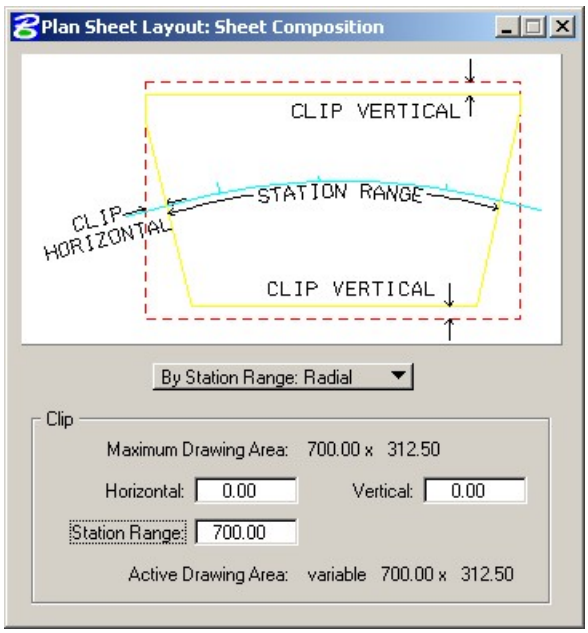
7. Set the scale to **25.0000 ft/in**.



8. Click **Sheet Composition**.
9. Populate the **Sheet Composition** dialog box as below.



10. Close the **Sheet Composition** dialog box.

Layout Sheets

1. Click **Layout Sheets**.
2. Click **Open GEOPAK Job** then select job number **101**.
3. Double click **Port 1**.
4. Set the **Profile** to **Mainline** by selecting it from the option list.

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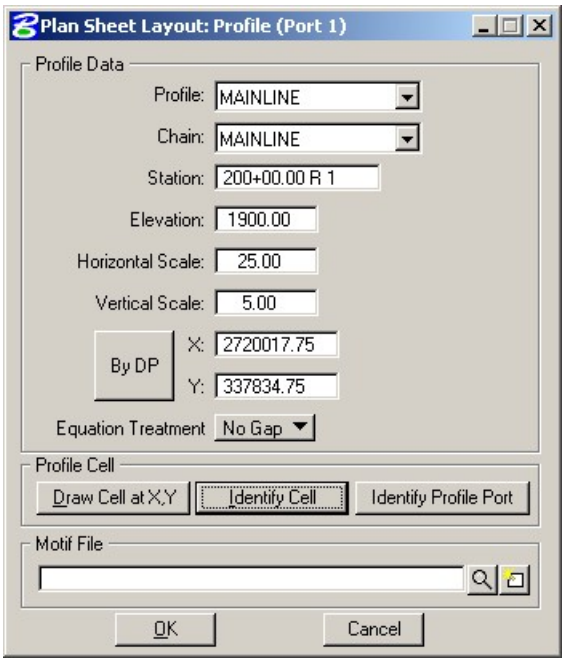
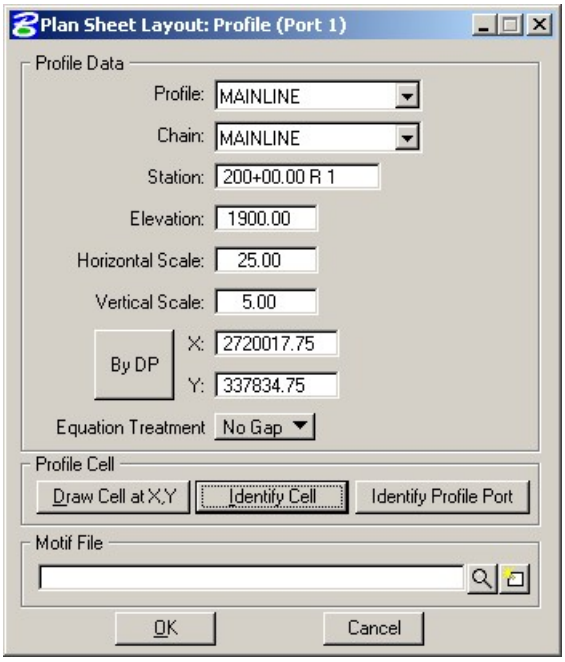
5. Populate the remaining fields on the **Profile (Port 1)** dialog box by clicking **Identify Cell** then graphically identifying the profile cell.



Note Note: The X and Y coordinates may be different than what is shown in the dialog box. They should match the insertion points of your profile cell.

6. Click **Create Motif File**.



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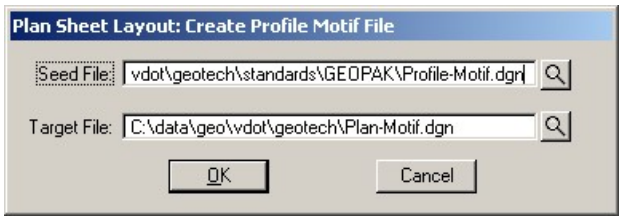
7. Populate the **Create Profile Motif File** dialog box as below.

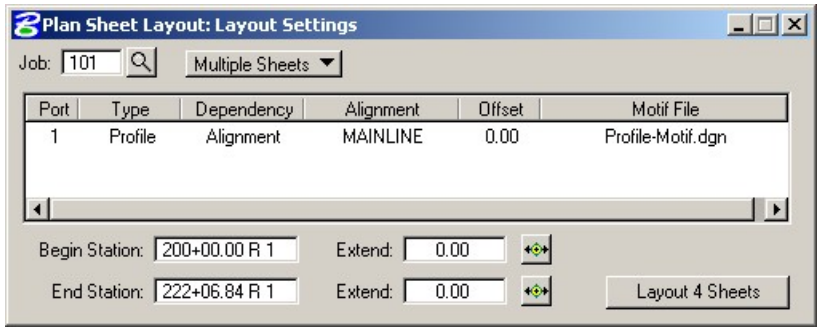


Note Note: The Seed File can be selected by clicking the Select Seed Motif File tool then selecting Profile-Motif.dgn. The Target File name should be entered manually.

8. Click **OK** on the **Create Profile Motif File** dialog box.

   A file named **Profile-Motif.dgn** should be created in the working directory.

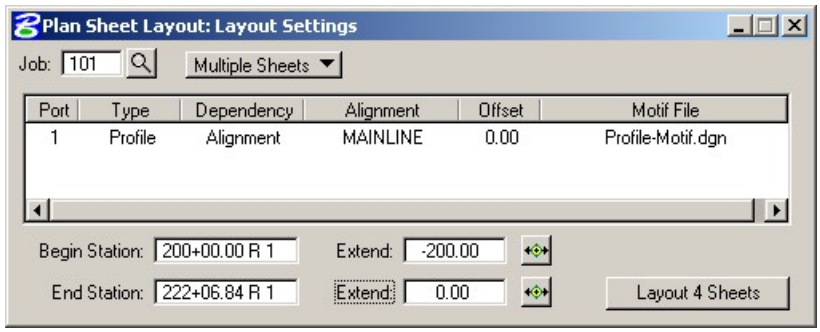
9. Click **OK** on the **Profile (Port 1)** dialog box.



10. In the **Layout Sheets** dialog box, set the **Extend** value for the **Begin Station** to **–200.00**.

    This will force the first sheet to end at **Station 205+00.00**.

11. Click **Layout 4 Sheets** to draw the clipping shapes into the design file.



12. Four clipping shapes should be placed for the Profile.
13. Close the **Layout Sheets** dialog box.
14. Exit the Plan and Profile Sheet dialog box.
15. Review the results.

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Motif File Setup

In the following steps we will set up the **Motif Files** created in the previous section so that the **Plan** view file will be displayed in the **Plan Port** and the **Profile** view file will be displayed in the **Profile and Tabular Data Ports**.

1. Open *Plan-Motif.dgn*.
2. Attach *d17682des.dgn* as a reference file.

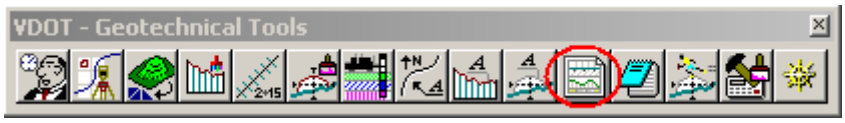
   Fit View and **Save Settings** if necessary.
3. Open *Profile-Motif.dgn*.
4. Attach *d17682prof.dgn* as a reference file.
5. Turn off levels **30 and 63** in the reference file.

   Fit View and **Save Settings** if necessary.
6. Open **d17682work.dgn**.

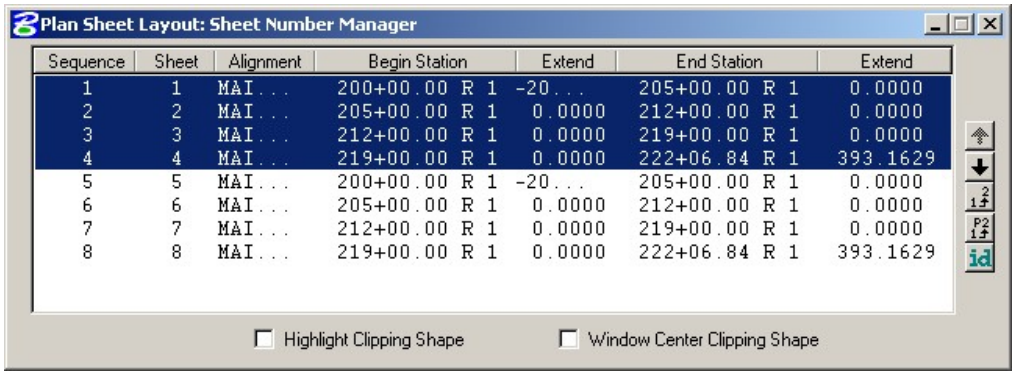
Note Note: Any design file that needs to be clipped to the sheets should be attached to the Motif Files (e.g. Survey, Utilities, Contours, etc.).

RENUMBER SHEETS

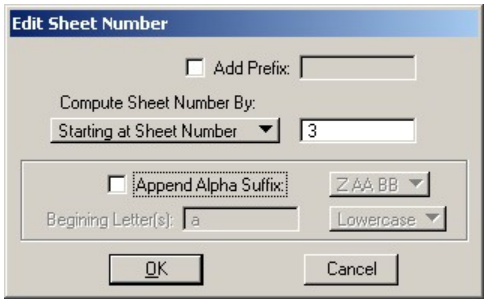
1. Click the **Plan & Profile Sheets** button from the **VDOT – Geotechnical Tool Box**



2. Press the **Sheet Number Manager** icon.
3. Select Sequence Numbers **1 through 4** then press the **Edit Sheet Number** button.



4. Populate the **Edit Sheet Number** dialog box as below then push **OK**.



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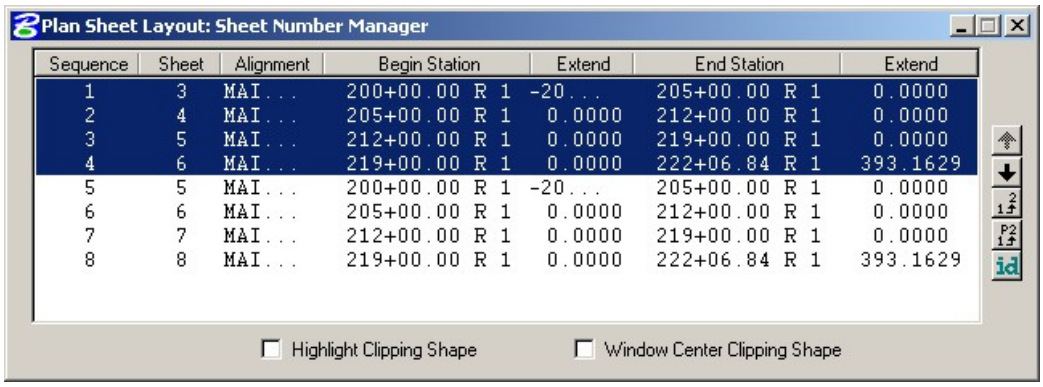
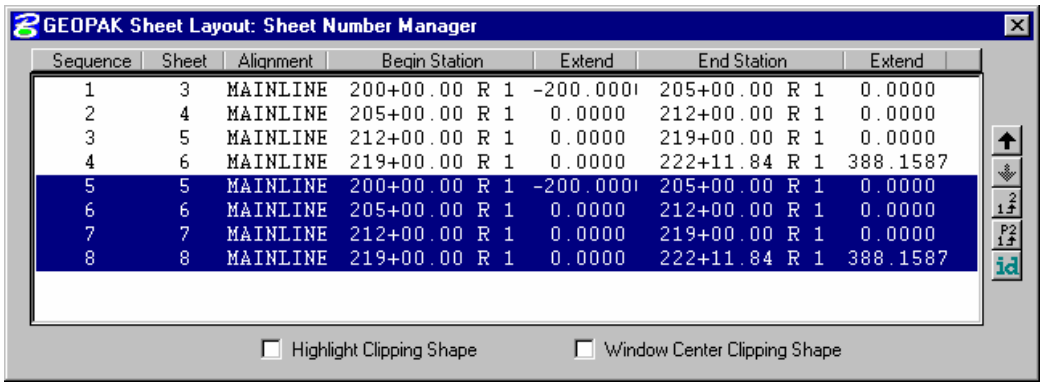
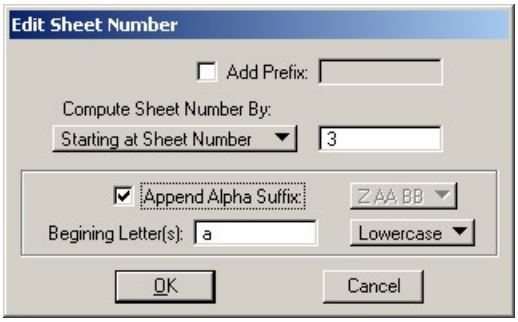
5. The **Sheet Number Manager** dialog box should appear as below.



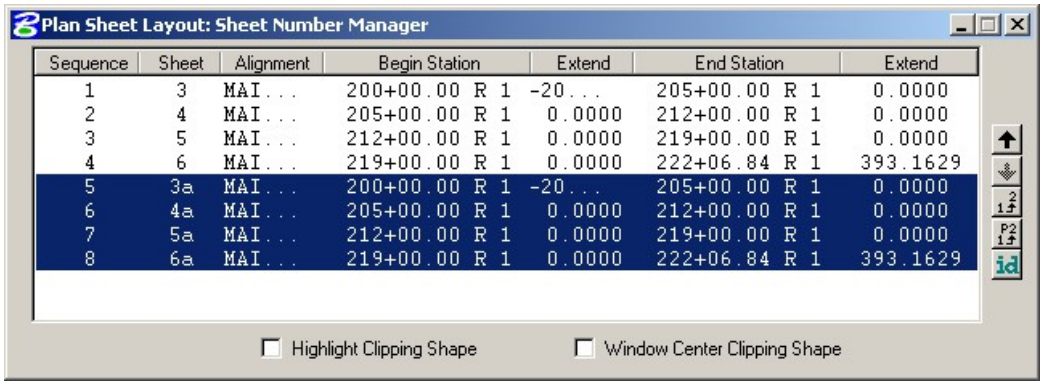
6. Select Sequence Numbers **5 through 8** then press the **Edit Sheet Number** button.



7. Populate the **Edit Sheet Number** dialog box as below then push **OK**.



8. The **Sheet Number Manager** dialog box should appear as below.



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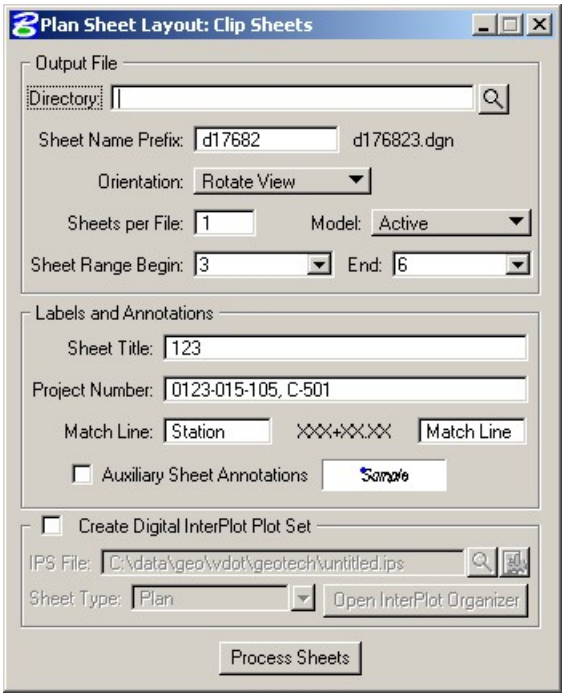
9. Dismiss the **Sheet Number Manager** dialog box by pressing the **X** in the upper right hand corner. Press **Yes** when prompted to **Save Settings**.

Clip Plan Sheets

1. Click **Clip Sheets**.
2. Make sure the sheet is set to PLAN in the dialog below.

3. Populate the **Clip Sheets** dialog box as below.



Note The Sheet Title field will be used to place the Route Number.

4. Click **Process Sheets** to create the plan sheets.
5. Close the **Clip Sheets** dialog box.

Clip Profile Sheets

The following steps should be done in design file *d17682work.dgn*.

1. Change the sheet setting to **PROFILE** in the dialog below.

2. Click **Clip Sheets**.

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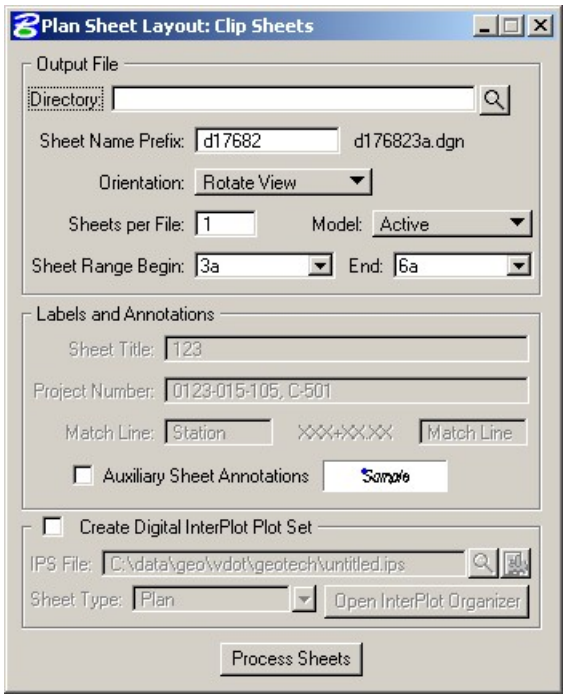
3. Populate the **Clip Sheets** dialog box as below.



Note The Sheet Title field will be used to place the Route Number.

4. Click **Process Sheets** to create the profile sheets.
5. Close the **Clip Sheets** dialog box.
6. Exit the Plan and Profile Sheet dialog box.
7. Save your run.
8. Open any of the newly created **Profile Sheet** files to see the resulting sheets.
9. Exit MicroStation.

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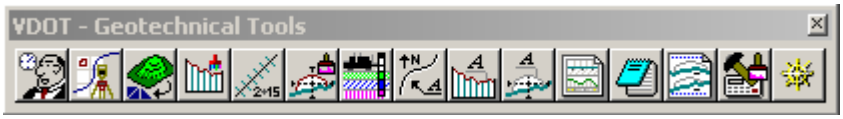
10 Cross Section Sheets

INTRODUCTION

Objectives	Learn the procedures for laying out cross section sheets.
Tool	
Menu Bar Application	None, except batch processing of an input file.

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."

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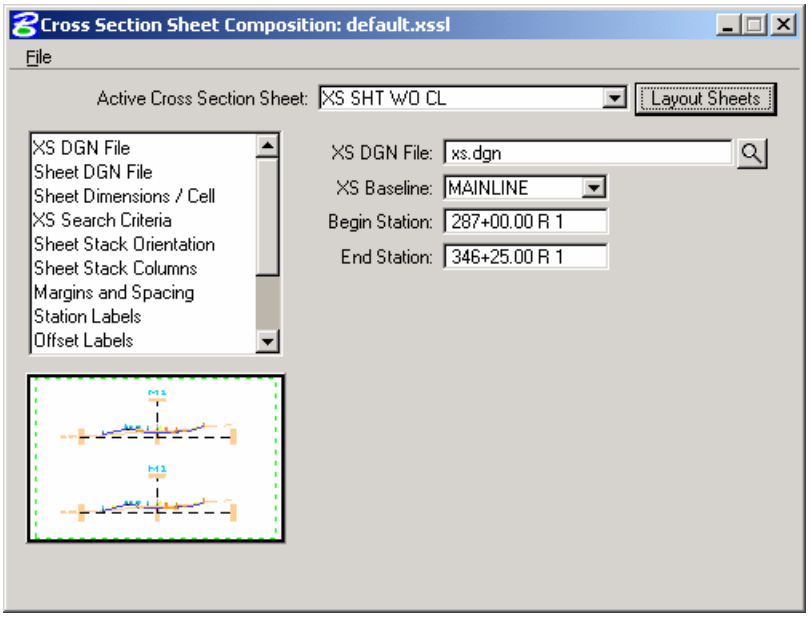
ACCESSING THE CROSS SECTION SHEET LAYOUT TOOL

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 the VDOT custom menu bar.



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.
Copy	Copy a Sheet in a Sheet Library.
Update	Update a Sheet in a Sheet Library.

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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.

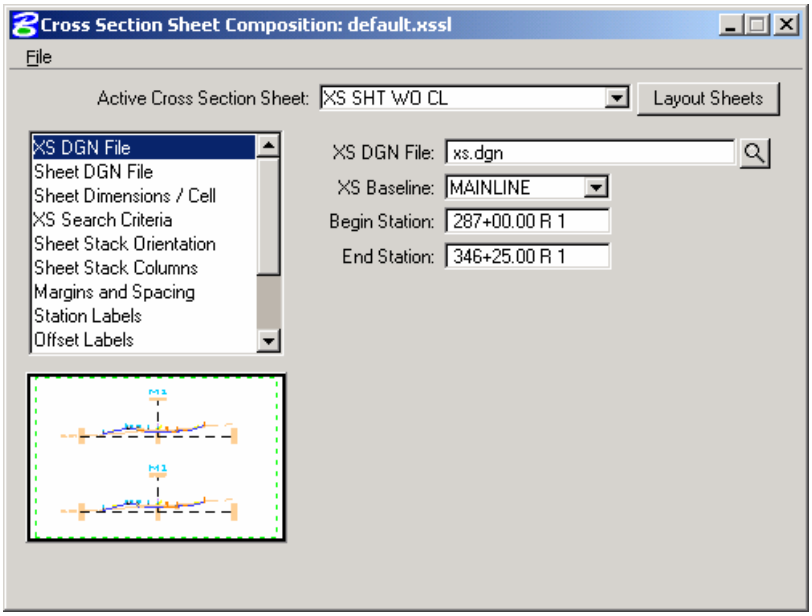
FILE > EXIT

Exit the Cross Section Sheet Composition application.

CROSS SECTION SHEETS DIALOG

The left side of the dialog contains the list of parameters required to compute earthwork. When each parameter is selected, the dialog changes as do the key-in fields to reflect the selected parameter.

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.

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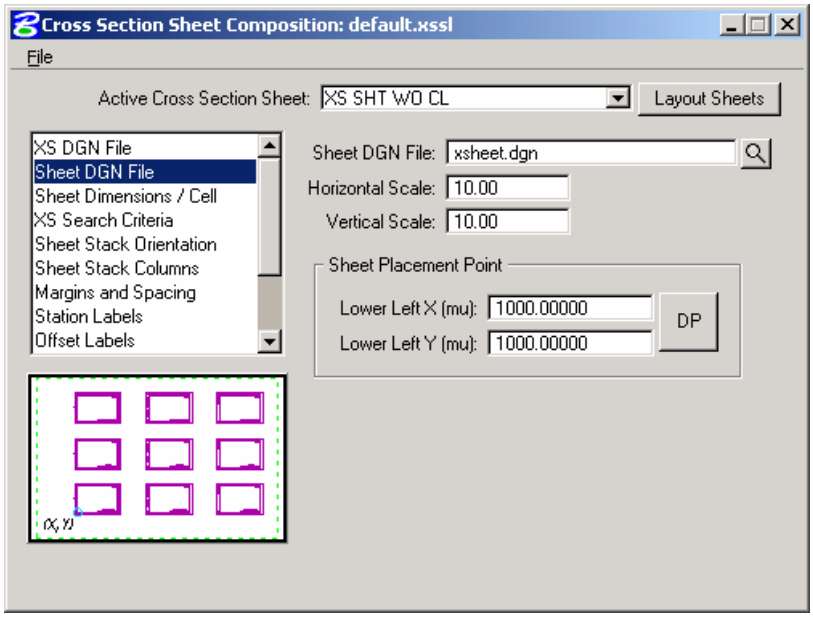
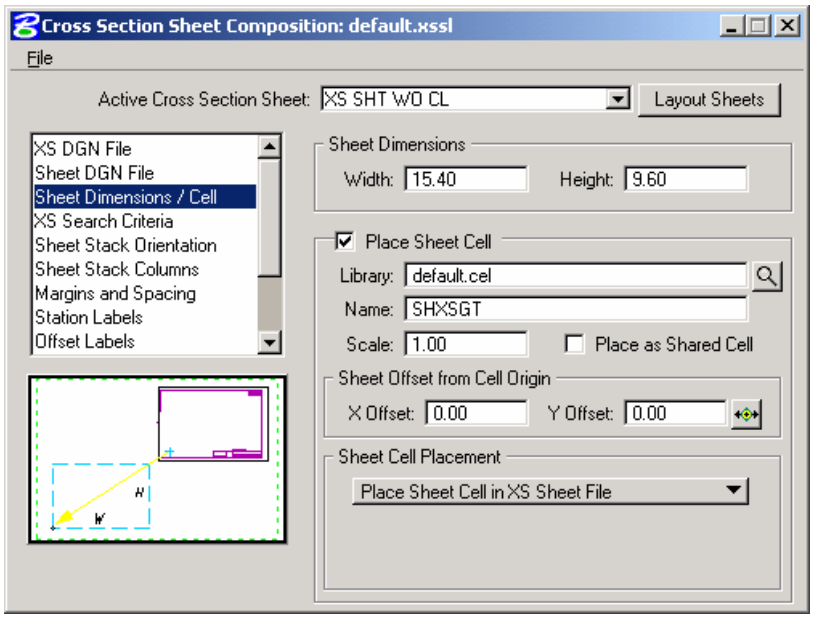


Sheet Dimensions/Cell – Sheet Dimensions defines the Sheet Height and Sheet Width to be used for the cross section sheet. When Place Sheet Cell is toggled on, the application will place a sheet border cell from the specified cell library. A scale can be applied and the sheet cells can be placed as Shared 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 the Lower and Upper Range Limit values to extend beyond the cell limits.

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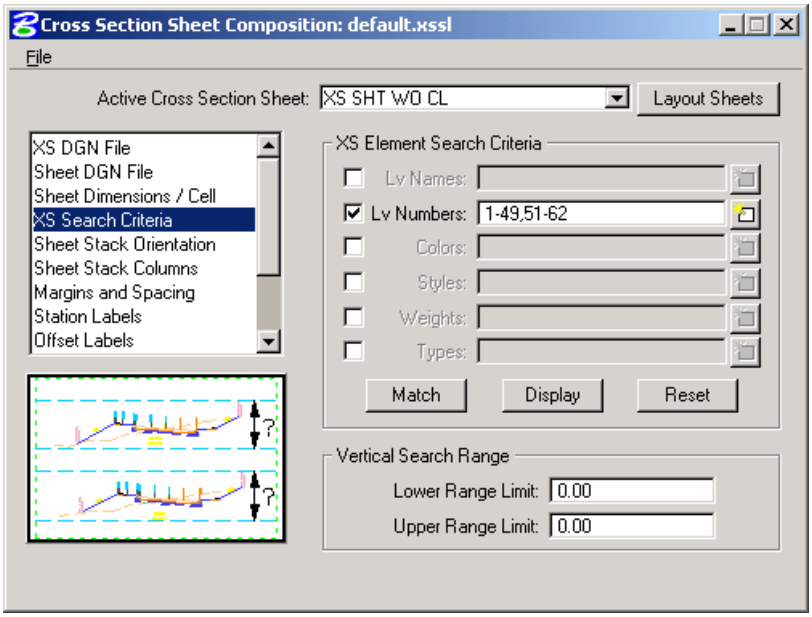
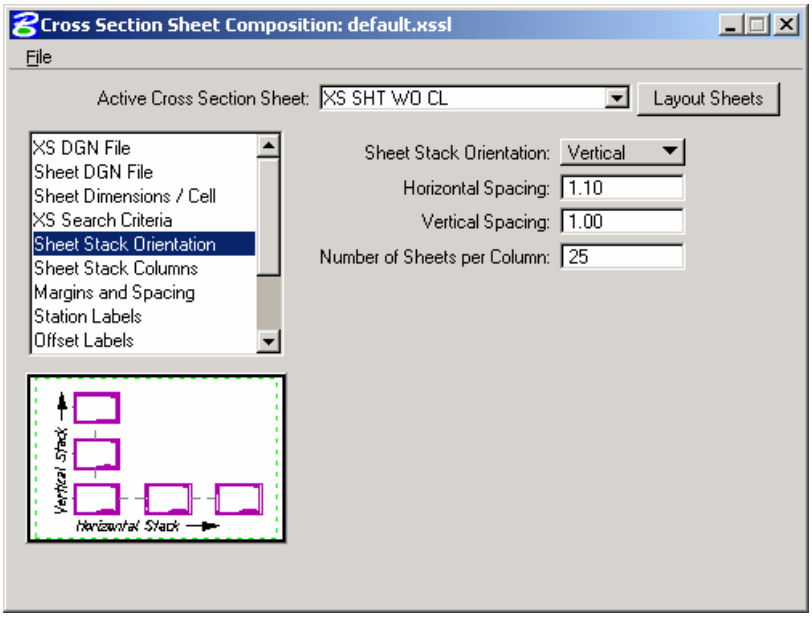


Sheet Stack Orientation – Determines whether you want the sheets to be stacked vertically or horizontally. Also allows you to set the maximum number of sheets you want placed per column in the file as well as the Horizontal and Vertical spacing between sheets.



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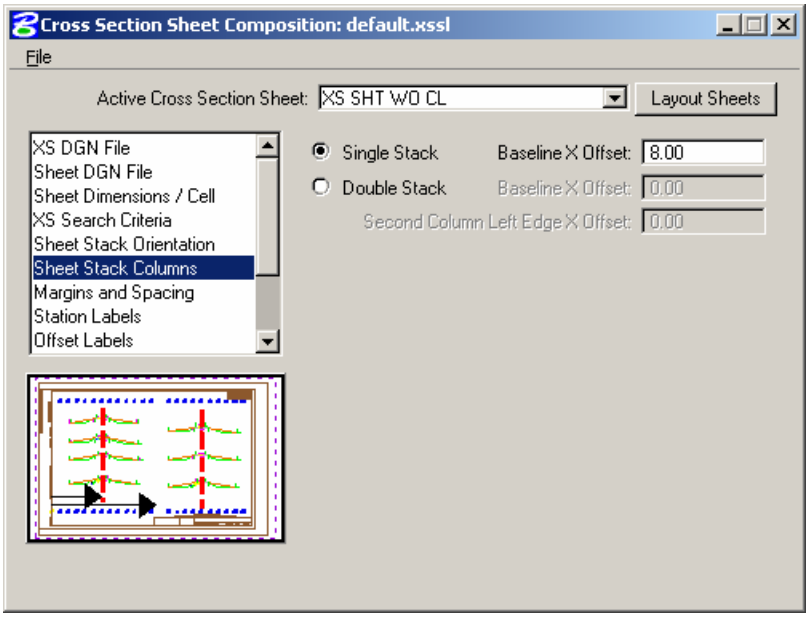
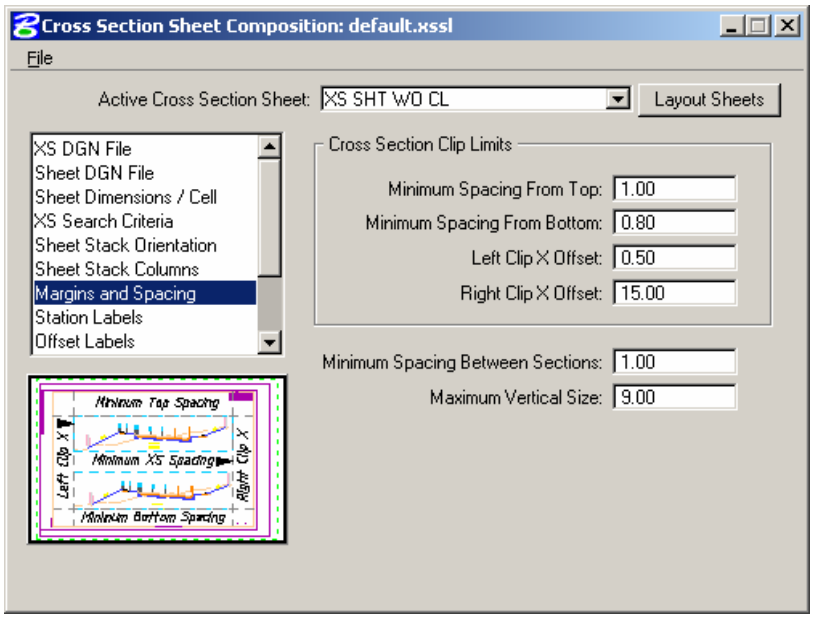
Sheet Stack Columns – Determines whether you want a single stack or a double stack of cross sections per sheet. Baseline X Offset defines the distance from the left-hand edge of the sheet to the zero offset position (i.e. baseline) of the cross sections. If you select Double Stack, you can give an offset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



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.



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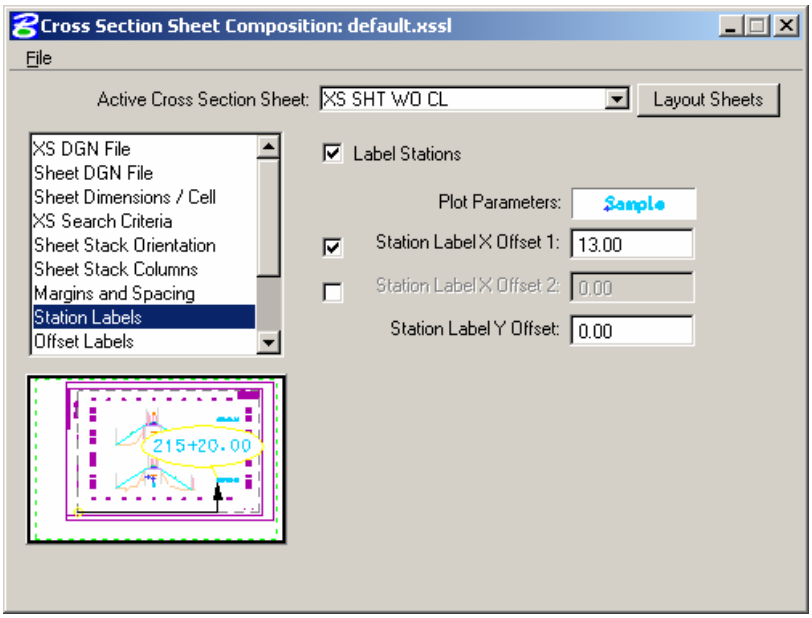
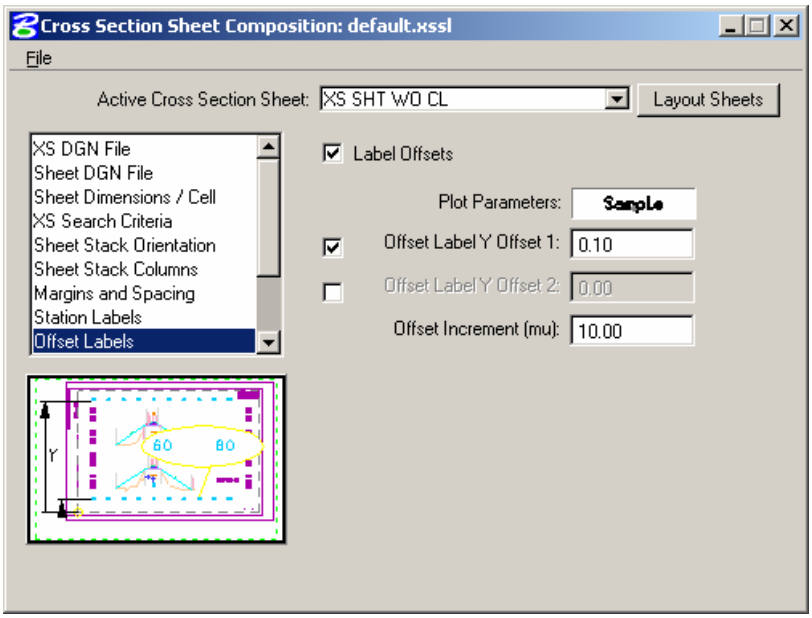
Station Labels – Allows you to define the station label locations and plot parameters.



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



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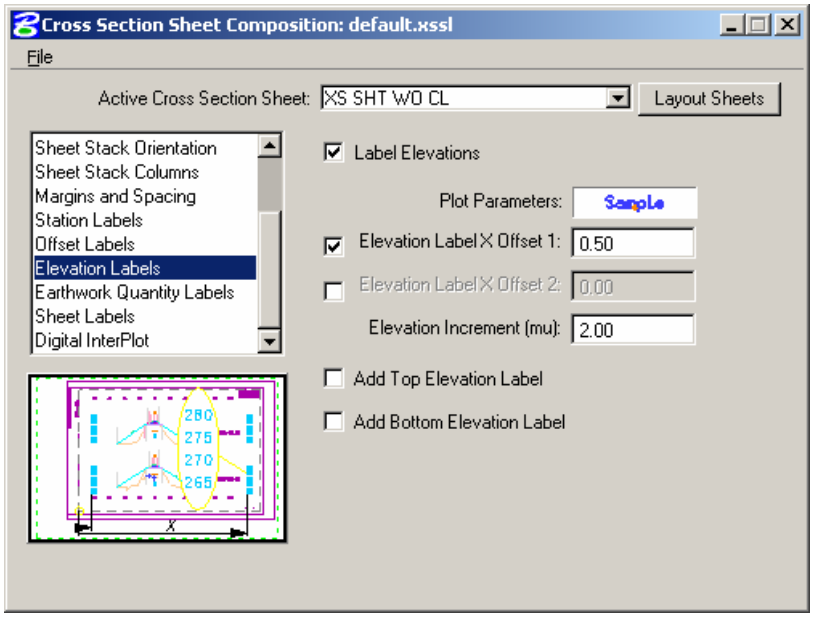
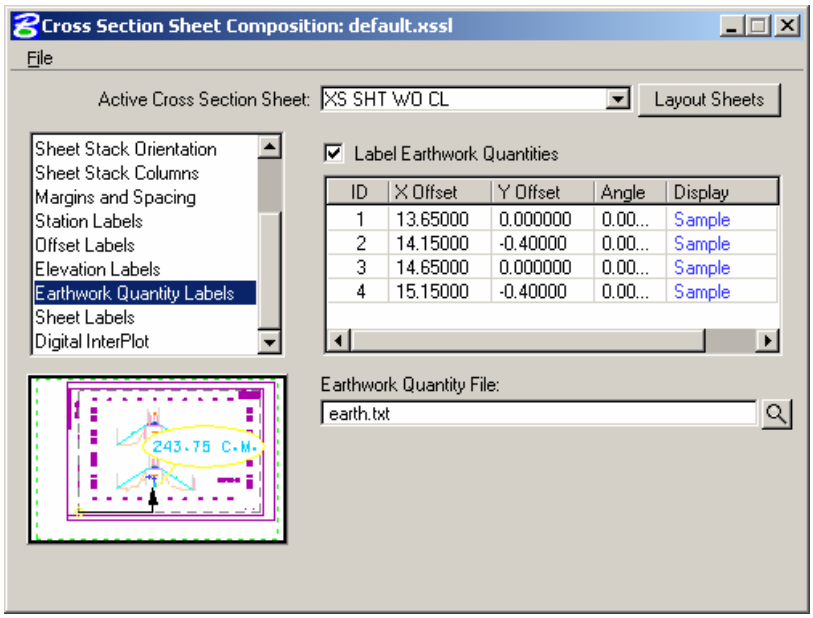
Elevation Labels – Allows you to control the elevation label locations, increment and plot parameters. Add Top Elevation Label - Activating this toggle adds another elevation label above the current labels placed within the elevation labels parameters. If two sets of elevations labels are placed (one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



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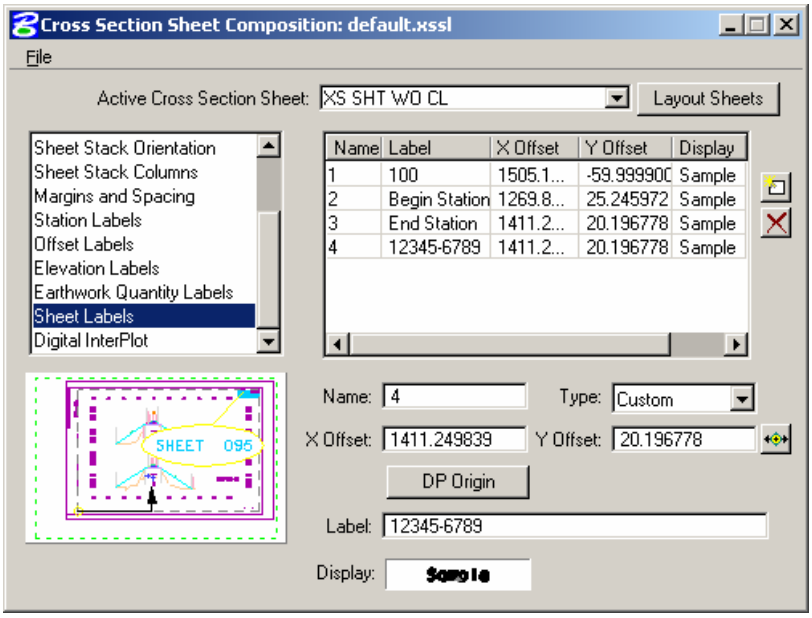
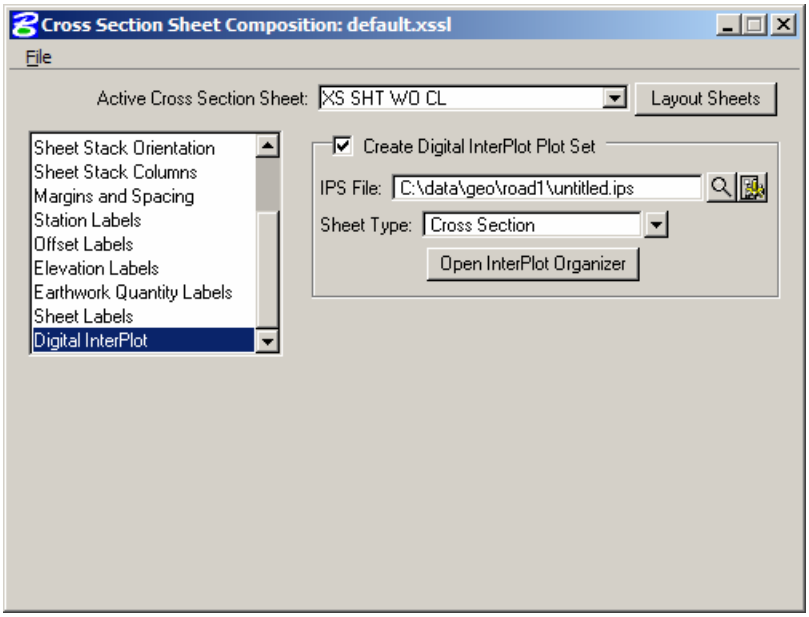
Sheet Labels – Allows the placement of numerous labels. There are three sets of labels that can be placed where the labels change from sheet to sheet. These labels include Sheet Number, Begin Station, and End Station. Any number of custom labels can also be placed. These labels would be something that 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 it's on 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.



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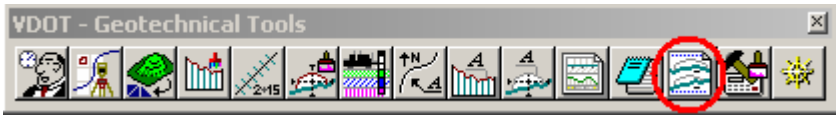
GENERATING SHEETS

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.

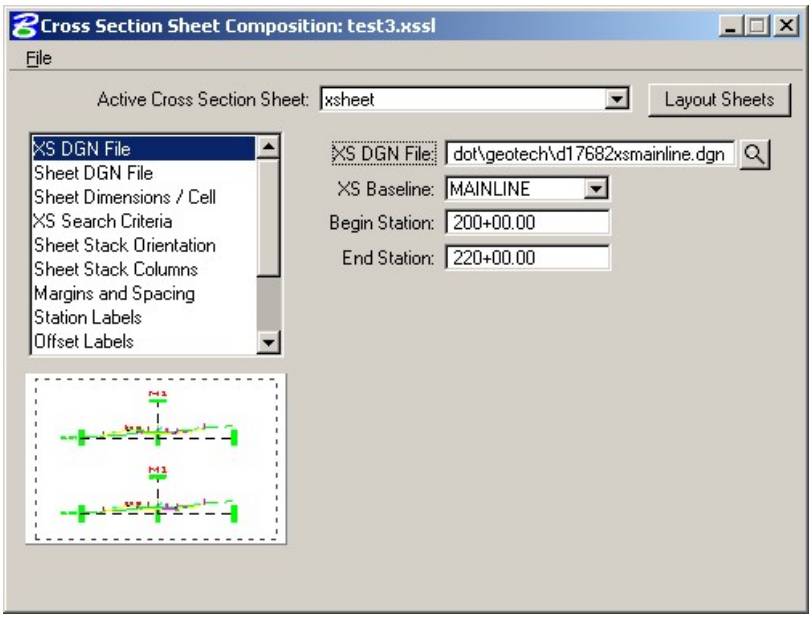
LAB EXERCISE: CROSS SECTION SHEETS

Cross Section Sheet Composition

1. Open the MicroStation file *c:\data\geo\vdot\geotech\d17682xsheet.dgn*.
2. Select the **Cross Section Sheet Composition** tool.



3. Select **File > Sheet Library > Attach** and select the file in: *c:\data\geo\vdot\geotech\standards\GEOPAK\test3.xssl*
4. Specify the file where the cross-sections reside.



5. For the **Sheet DGN File** option, specify the file where the sheets will be located.

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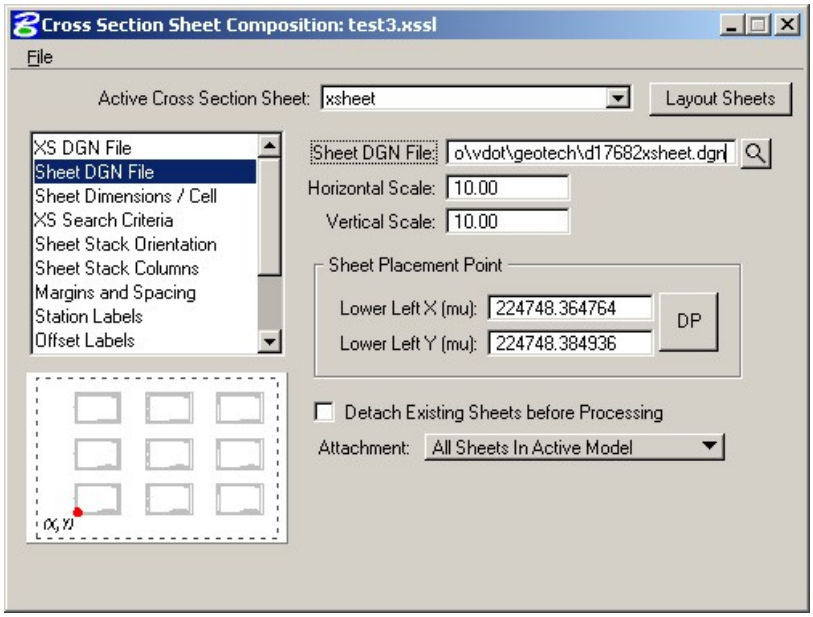
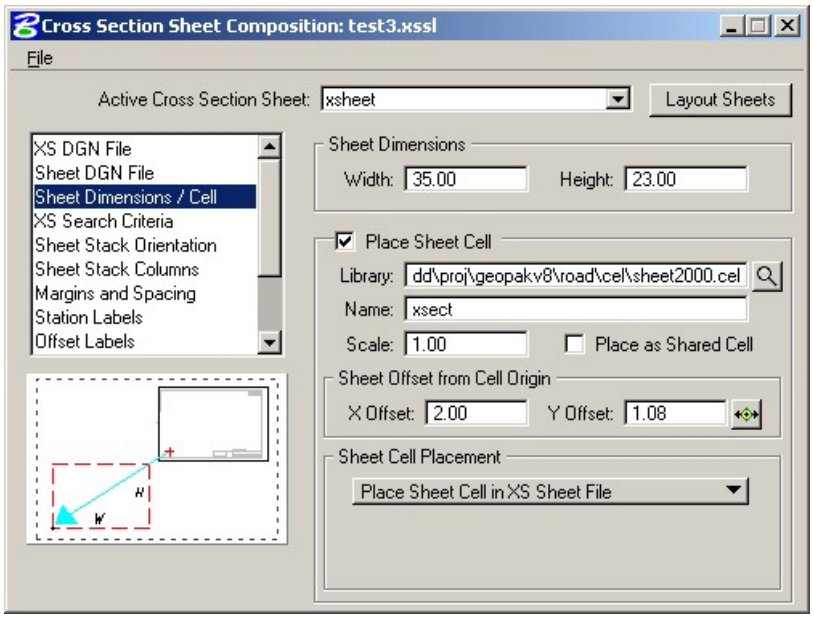


7. Next, verify the cell library according to the following dialog.



8. Once these options have been verified select the **layout Sheet** button in the upper right of the dialog to perform the sheet layout process.

9. Review the cross section sheets.

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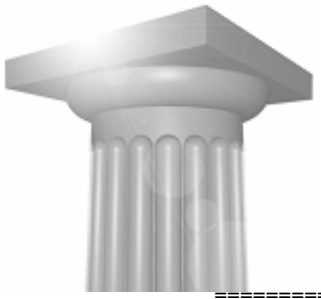


gINT Information

==========

VDOT GINT DATA INPUT TEMPLATES, LIBRARY FILES

AND MICROSTATION MACROS

*** USE WITH GINT VERSION 5 ONLY ***

==========

1.0 CONTENTS

This gINT package contains 9 files:

README.DOC	- this help file
VTRC5.GLB	- VDOT gINT library
VTRC1.GDT	- VDOT gINT data entry template for SPT borehole logs
SOIL.GDT	- VDOT gINT data entry template for soil surveys
CPTU.GDT	- VDOT gINT data entry template for CPT logs
SPT_CPT.GDT	- VDOT gINT combined data template for SPT and CPT logs
BOREHOLE.GCX	- File for converting SPT logs to GEOPAK input format
SOIL_SURVEY.GCX	- File for converting soil survey logs to GEOPAK input format
SAMPLE.MDB	- GEOPAK data file template.

2.0 INSTALLATION:

1. Make sure that gINT software is not running during the installation.
2. The installer places files automatically in the following folders:
3. VTRC5.GLB C:\Program Files\gintw
4. GDT, GCX, MDB files C:\Program Files\gintw\datatmpl
5. After running the installer, start **gINT** and click on **File -> System Properties -> File Location Defaults**.
6. Enable the **VTRC5.GLB** library (specify path). When enabled, this library will print a vertical string at the bottom left of a log output in the following format:

7. report_name:project_name:gINT_version:VDOT_gINT_library_version:current_date
8. Go to **File -> System Properties -> DXF Files** and check the following settings:

   Arial -> Ht Fac 1 = 0.7 Wid Fac 1 = 0.7

   Solid Fills Output as Solids (checked)

   Point Entities Output as Points

   Multiple Page Output to Separate Files (checked)
9. Go to **File -> System Properties -> General** and check the following settings:
10. Unspecified Line Thickness = 0.007

    Unspecified Point Thickness = 0.007
11. Default Print Management Option = Print as data sets are completed
12. Update your gINT program through the gINT Software website.
13. DO NOT merge with your current library file. Use this library separately.

3.0 DATA ENTRY TEMPLATES

When using **VTRC1.GDT** and **SOIL.GDT** templates, place "BOH" (without quotation marks) in the stratum description field and enter bottom depth same as top depth to automatically display "Bottom of Hole" in the output log. Make sure that the first stratum starts at 0 depth when using the SOIL.GDT template.

CPTU.GDT template should be used with an electronic data file from a CPT rig.

Contact VDOT Materials for assistance with the input file preparation.

SPT_CPT.GDT template should not be used for the initial data entry. It is designed for merging databases already constructed with **VTRC1.GDT** (SPT data) and **CPTU.GDT** (CPT data) templates. Merging is done using **File -> Import/Export -> Import from Database** menu items. The resulting database allows for a combined SPT and CPT output.

4.0 OUTPUT REPORTS

The following output reports are available:

LOGS:

SPT_LOG	- SPT Borehole Log (VTRC1.GDT structure)
SPT_LOG_COMP	- Composite SPT Borehole Log (VTRC1.GDT structure)
CPT_LOG	- CPT Log (CPTU.GDT structure)
CPT_LOG_COMP	- Composite CPT Log (CPTU.GDT structure)

Individual SPT log depth per page is set to 40 ft or 12 m by default.

You can override it at input using the “Depth_Log_Page” column within “Borehole”.

Another way is to set the first stratum depth to 0.001, instead of 0. This will force 40 ft or 12 m per page.

Composite SPT logs are always set to 40 ft or 12 m.

CPT logs are set to 100 ft per page.

FENCES:

SPT_FENCE1	- SPT Fence Diagram (VTRC1.GDT structure)
SPT_FENCE2	- SPT Fence Diagram (VTRC1.GDT structure)
CPT_FENCE	- CPT Fence Diagram (CPTU.GDT structure)
SPT_CPT_FENCE1	- Combined SPT and CPT Fence (SPT_CPT.GDT structure)
SPT_CPT_FENCE2	- Combined SPT and CPT Fence (SPT_CPT.GDT structure)

GRFC TABLES:

SOIL_SURVEY	- Soil Survey Report (SOIL.GDT structure)

Note various run-time user inputs when generating reports.

Most of these inputs are self explanatory.

Here are some additional details:

SPT_LOG and SPT_LOG_COMP reports:

GW_strata_legend	- Enter “y” to place water symbols within the strata legend column, instead of at the depth/elevation line (default).
DE_SCALE	- Enter “y” to create “Depth Scale” and “Elevation Scale” column headings, instead of “Depth” and “Elevation” (default titles).
in_line_spt	- Enter “y” to plot the blow counts in one horizontal line, instead of stepwise (default).

SPT_FENCE_1 AND SPT_FENCE_2 REPORTS:

N	- Enter “y” to plot N-values instead of individual blows.
draw_site_map	- Enter “y” to plot a borehole layout.
fence_location	- Heading (description) displayed at the top.

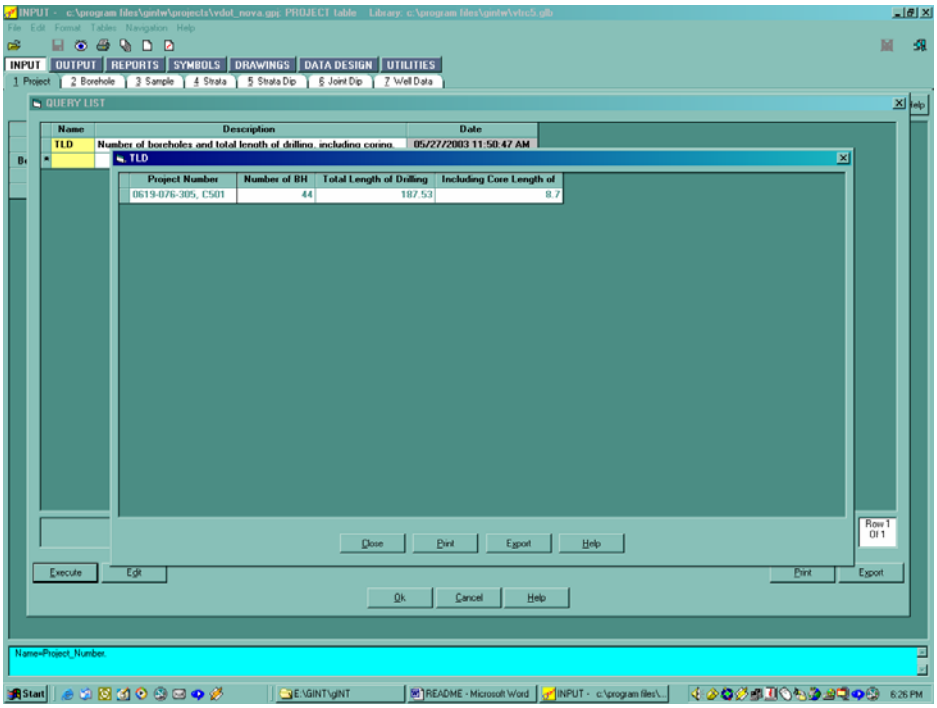
SPT_CPT_FENCE1 AND SPT_CPT_FENCE2 REPORTS:

North_East	- Enter “y” to show Northing and Easting on the x-axis, instead of Station and Offset.

5.0 QUERIES

One query is currently available on projects compiled with the **VTRC1.GDT** data input template. It allows an automatic calculation of the total length of drilling, and the total length of coring for the entire project. To access this query, click on **File -> Queries…** while in the Input mode. A Query List table will be displayed showing the TLD query. Click on the **Execute** button in the lower left to run this query.

An example of a query output appears as follows:



6.0 MICROSTATION MACROS

Macro files are installed automatically in default directories, as follows:

autogeo.ba	C:\Program Files\Bentley\Workspace\standards\macros
comp.ba	C:\Program Files\Bentley\Workspace\standards\macros
fence.ba	C:\Program Files\Bentley\Workspace\standards\macros
cptcomp.ba	C:\Program Files\Bentley\Workspace\standards\macros
font.rsc	C:\Program Files\Bentley\Workspace\system\symb
color.tbl	C:\Program Files\Bentley\Workspace\system\data
printer2.plt	C:\Program Files\Bentley\Workspace\standards\plotdrv
USTN.M01	C:\Program Files\Bentley\Workspace\interfaces\MicroStation\materials
USTN.r01	C:\Program Files\Bentley\Workspace\interfaces\MicroStation\materials
stmaterials.upf	C:\Program Files\Bentley\Workspace\system\data
stmaterials.ucf	C:\Program Files\Bentley\Workspace\users
materials.cel	C:\gINT_materials
materials.cdx	C:\gINT_materials
install fonts.doc	C: \gINT_materials
BRSEED.DGN	C:\gINT_materials
MBRSEED.DGN	C:\gINT_materials

You may have several previous (old) macro files, which should be deleted (if present).

They include:

Comp.BAS	CPTtext.BA
Fence.BAS	
Dxftext.BAS	Dxftext,BA
DxftextM.BAS	DxftextM.BAS
Stick.BA	Stick.BAS
StickM.BAS	StickM.BA

If these files are present, they may recompile and overwrite the new files.

To run the latest macros simply type:

Macro comp	(to process composite log)
Macro fence	(to process fence diagram)
Macro cptcomp	(to process CPT log)

AUTOGEO.BA
This is an Auto-conversion macro file.
To run, simply type: Macro autogeo

NOTES:

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1. To ensure proper operation you must first open a seed file, then import a DXF gINT file into it, then run a MACRO.
2. At the bottom of each composite log there is a field labeled "REMARKS:". This field is bordered to the right by the Page Number block. It is essential that the text following the word "REMARKS:" does not exceed a total length of 93 characters.
3. Make sure that "PRINTER2.PLT" driver is selected when plotting your output from MicroStation.
4. 'Normal' plot scales may not work properly. There are 2 ways to compensate for this. The first is to enter new plot scale factors.
5. These are:

   English Sheets: 0.8967

   Metric Sheets: 0.9444

This is based on the use of proper seed files

(MBRSEED.DGN for metric and BRSEED.DGN for English units).

The second method is to simply input the dimension (only ONE), and the rest will be filled in. There have been some problems with sheets rotating, so we may have to hard key in 34.9, (for the first dimension), or just live with trimming the sheets. If anyone has a better way, please pass it along to Keith Weakley.

!!! The latest suggestion, which needs to verified in the "field", is that we can use 0.906 as a plot scale for both Metric and English.

For questions regarding the MicroStation Macro installation and operation, contact Keith Weakley at the Staunton District Structure & Bridge Office – (540) 332-9109.
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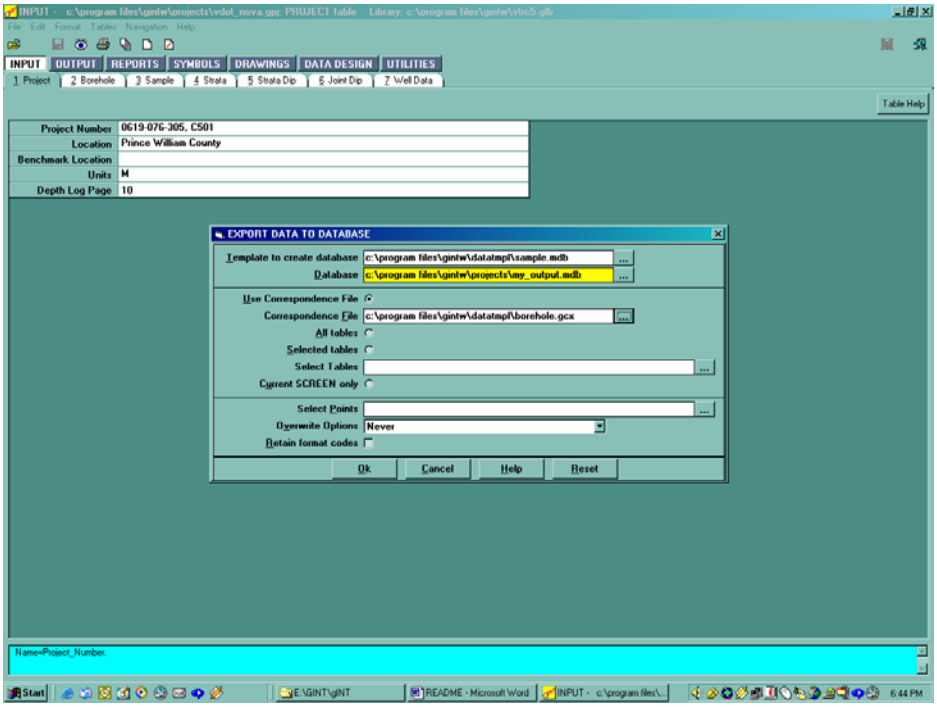
7.0 GEOPAK

gINT projects compiled with **VTRC1.GDT** and **SOIL.GDT** data input templates can be converted for access by GEOPAK. Make sure that your gINT program is updated to version **5.1.068** or higher. The conversion process works as follows:

For projects compiled using the **VTRC1.GDT** template:

- Open your gINT project file.
- Click on **File -> Import/Export -> Export to Database…**
- Select **SAMPLE.MDB** (select MDB file type first) as "Template to create database".
- Assign a name to the yellow "Database" field. This will be the name of the converted file.
- Check the "**Use Correspondence File**" box.
- Select "**borehole.gcx**" as the "Correspondence File".
- Click on the "**OK**" button below.
- A file will be created in the MDB format. Use it as your input to GEOPAK.

An example of a conversion process appears as follows:



For projects compiled using the **SOIL.GDT** template the process is essentially the same, except that you select "**soil_survey.gcx**" as the "Correspondence File".

Note that several new fields have been added for GEOPAK compatibility with gINT. They include JOBNUMBER, CHAINNAME, and AUGER_REFUSAL_DEPTH. These fields are for GEOPAK use only. Also, for proper GEOPAK conversion, make sure that your "**Offset**" is entered as a numeric value only. For example, enter **–12** as a 12 ft left offset and **15** as a 15 ft right offset (negative=left, positive=right of centerline).

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