



GEOPAK V8i SELECTseries 1, Road 1



Ohio Department of Transportation
October, 2012

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1 Getting Started

1.1 Course Prerequisites

This class is intended for ODOT personnel involved in the production of roadway construction plans. It is recommended that students have knowledge of the following:

- Familiarity with ODOT design policies, procedures and CADD Standards
- Plan preparation experience
- A working knowledge of Windows XP
- A working knowledge of MicroStation V8i SELECTseries 1

1.2 Course Schedule/Conduct

During this training class we will develop an ODOT project using ground survey provided by one of ODOT's District Offices. The project scope calls for partial relocation of State Route 185 by inserting a new spiral-curve-spiral to flatten out the existing curve.

Day 1	CPD Credit*
01 Getting Started	2.0 hours
02 Digital Terrain Models	1.0 hours
03 Coordinate Geometry	4.0 hours
Day 2	CPD Credit*
03 Coordinate Geometry	4.0 hours
04 Project Manager	1.0 Hours
05 Design and Computation Manager	3.0 hours
Day 3	CPD Credit*
06 Drafting Tools	2.0 hours
07 Existing Ground Profiles	2.0 hours
08 Proposed Vertical Alignments	2.5 hours
Day 4	CPD Credit*
09 Plan and Profile Sheets	3.0 hours
10 Plan View Labeling	1.0 hours

* Please note that final determination on what qualifies for CPD credit ultimately lies between the license holder and the State Board for Professional Engineers and Surveyors.



Web Browsing: Please limit web browsing to break times and lunch.



Email: Please limit email usage to break times and lunch.



Cell Phones: Please set cell phones to vibrate and take calls only at break times and lunch. Please refrain from texting during the class



Start Time: 7:30 AM

End Time: 3:30 PM



Breaks: 15 Minutes per half day



Lunch: 45 Minutes

1.3 GEOPAK Support

The **Office of CADD and Mapping Services** has been designated to provide GEOPAK Support and training for ODOT personnel. The Office is also responsible for establishing, maintaining and distributing all ODOT CADD Standards.

The **Office of CADD and Mapping Services** maintains a MicroStation/GEOPAK support website on the ODOT website:

<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/default.aspx>

This training guide is available on-line in Adobe Acrobat format at the following URL:

<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/GPKManual.aspx>

The Design Resource Reference Center is a centralized reference center to help locate online or printed material. Additionally, several mailing lists are available to keep you informed about updates to ODOT standards. A CADD Standards mailing list is also available. Visit the Design Resource Reference Center at the following URL:

<http://www.dot.state.oh.us/drrc/Pages/default.aspx>

The Bentley community offers another great way to get support with MicroStation and GEOPAK problems. For more information, see the following URL:

<http://communities.bentley.com/>

1.4 ODOT CADD Standards for MicroStation and GEOPAK

ODOT CADD Standards for MicroStation and GEOPAK are maintained and distributed by the **Office of CADD and Mapping Services**. The ODOT CADD Engineering Standards manual for MicroStation and GEOPAK is available in Adobe Acrobat format at the following URL:

<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/CADDManual.aspx>

Each ODOT District, and Central Office, maintains a copy of the ODOT CADD standards on a network drive, usually the “i” drive, in the “ODOTstd\V8istd” subdirectory.

1.4.1 Standard Directory Structure

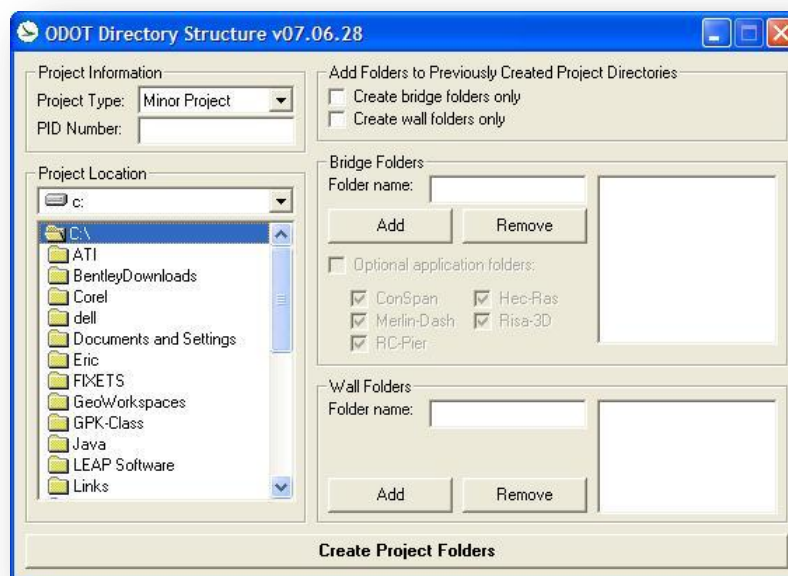
The ODOT CADD Engineering Standards Manual, Section 301, defines the standard project directory structure to be used on all ODOT projects. This training class will use the directory structure for a Minor Project. See the ODOT CADD Engineering Standards Manual for more information on directory structures.

A Visual Basic program is available to assist the project manager with the task of setting up the standard project directory structure. ODOT personnel can access the program from the following directory:

i:\ODOTstd\V8istd\vba\ODOT_Directory.exe

The application can also be accessed by selecting **ODOT > File Management > New Project Directory** from the MicroStation pull-down menu.

When the program is accessed, the dialog shown below is opened.



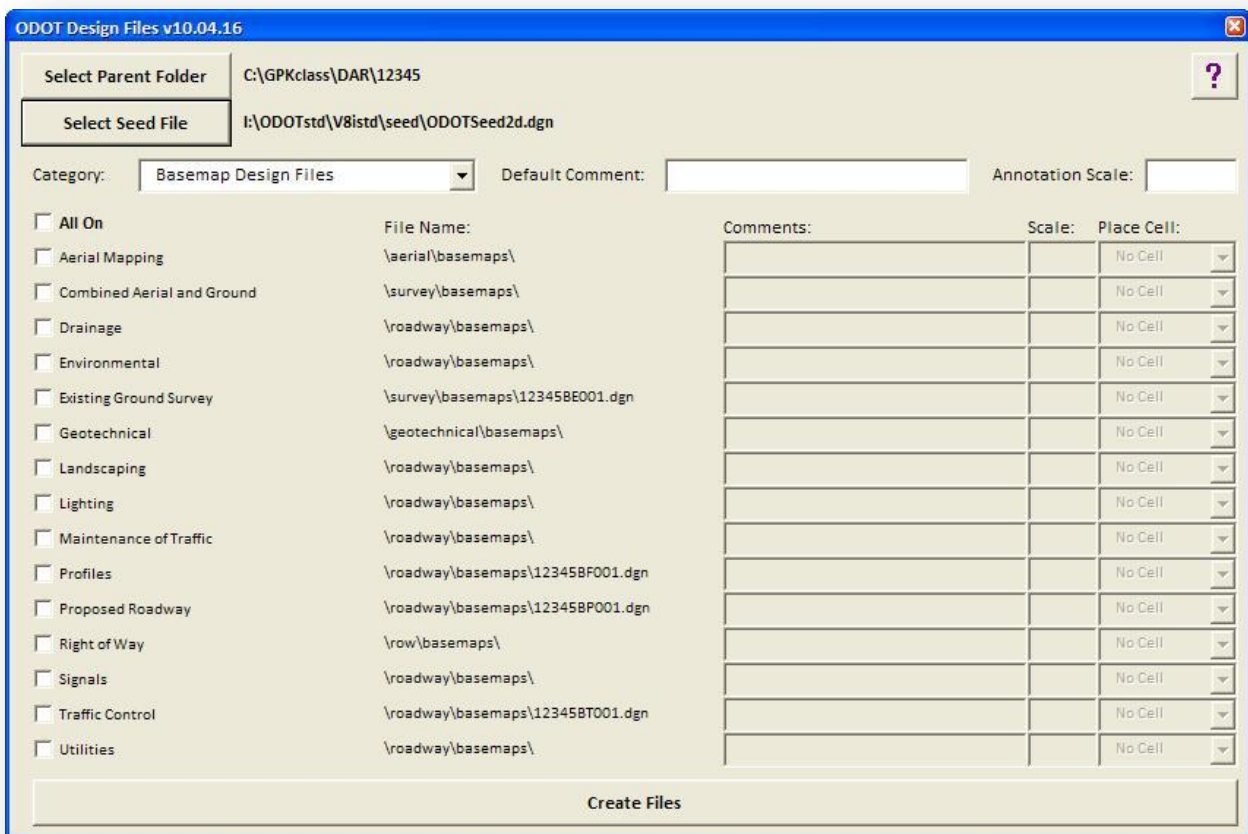
Documentation for the program is available on the ODOT CADD Support website.

1.4.2 Standard MicroStation Design File Names

The [ODOT CADD Engineering Standards Manual](#), Section 303, defines the standard MicroStation DGN file names to be used on all ODOT projects. See the [ODOT CADD Engineering Standards Manual](#) for more information.

A program is available to assist the project manager with the task of creating design files following the standard naming convention and the standard directory structure. The application can be accessed by selecting **ODOT > File Management > New Design File** from the MicroStation pull-down menu.

When the application is opened, the dialog shown below is opened.



Note: This application has been rewritten for MicroStation V8i as a MicroStation Visual Basic Application. As such, the application runs directly in MicroStation V8i. Previous versions of the application were written as a stand-alone Visual Basic 6 executable and required the user to close MicroStation in order for the application to create new the new design files. This version no longer requires the user to close MicroStation, although GEOPAK will be deactivated.

Documentation for the program is available on the ODOT CADD Support website, or by selecting the Help icon located at the upper right of the dialog.

Exercise 1A, Directory Structure

In this exercise, students will create a standard project directory and the basemap design files to be used through the training class.

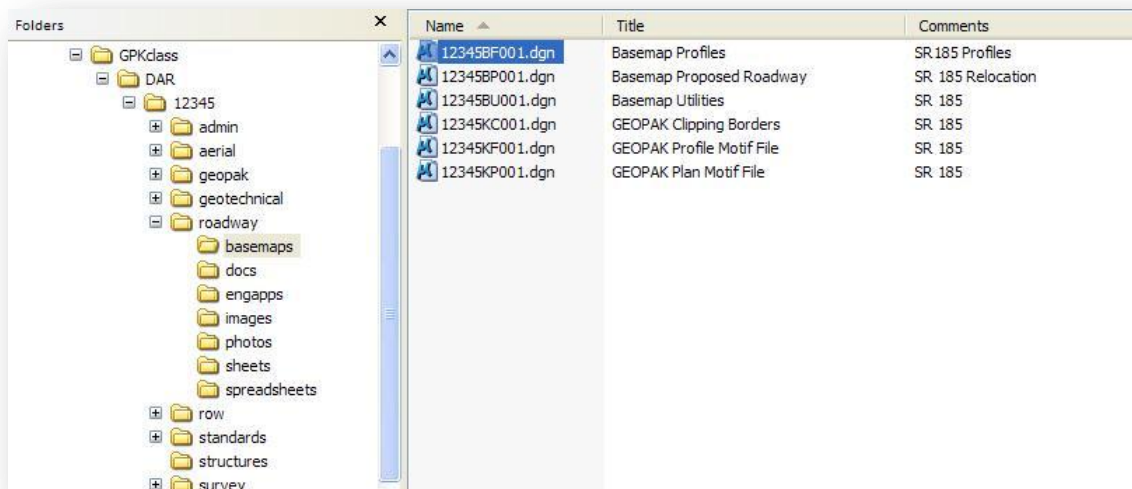
1. Create the following subdirectory for Darke County to house the project files:

c:\GPKclass\ DAR\

2. Use the ODOT Standard Directory application, **ODOT_Directory.exe**, to create a **Minor Project Directory Structure** for the files.
 - Use the C:\GPKclass\ DAR folder as the parent folder for the new project
 - Assign a PID number of 12345 for the project directory.
3. Use the **ODOT_Files** visual basic application to create the proposed basemap design files for the project:
 - Proposed Roadway Basemap
 - Proposed Profile Basemap
 - Set the Annotation Scale to 20 for these new files

After creating the file, answer the following questions:

- A. What is the name of the proposed roadway basemap design file?
 - B. What is the name of the proposed profile design file?
 - C. What folder are these files created in?
4. Configure Windows Explorer to display the file properties (Title and Comments) as shown in the example below. See the [ODOT CADD Engineering Standards Manual](#), Section 304.6 Viewing Supplemental Descriptions.



1.5 GEOPAK File Types

Typically ODOT design personnel will be provided with survey data from either ground survey or aerial mapping. In either case, you can expect to receive the following files:

Description	Extension
A MicroStation design file containing the project mapping. This may be 2D or 3D depending on the survey data. Typically the file will be mapped using State Plane Coordinates converted to ground. Occasionally, the data will be mapped using an assumed coordinate system.	.dgn
A Digital Terrain Model representing the existing ground elevations.	.tin
If the survey data was collected via ground survey, a GEOPAK Coordinate Geometry (COGO) database containing the survey data will be provided. If the survey data was generated by the Office of Aerial Engineering, a COGO database is not typically provided.	.gpk

The GPK file and the DTM file should be named according to the standards defined in the [ODOT CADD Engineering Standards Manual](#), Section 305 and 306.

Exercise 1B, Training Files

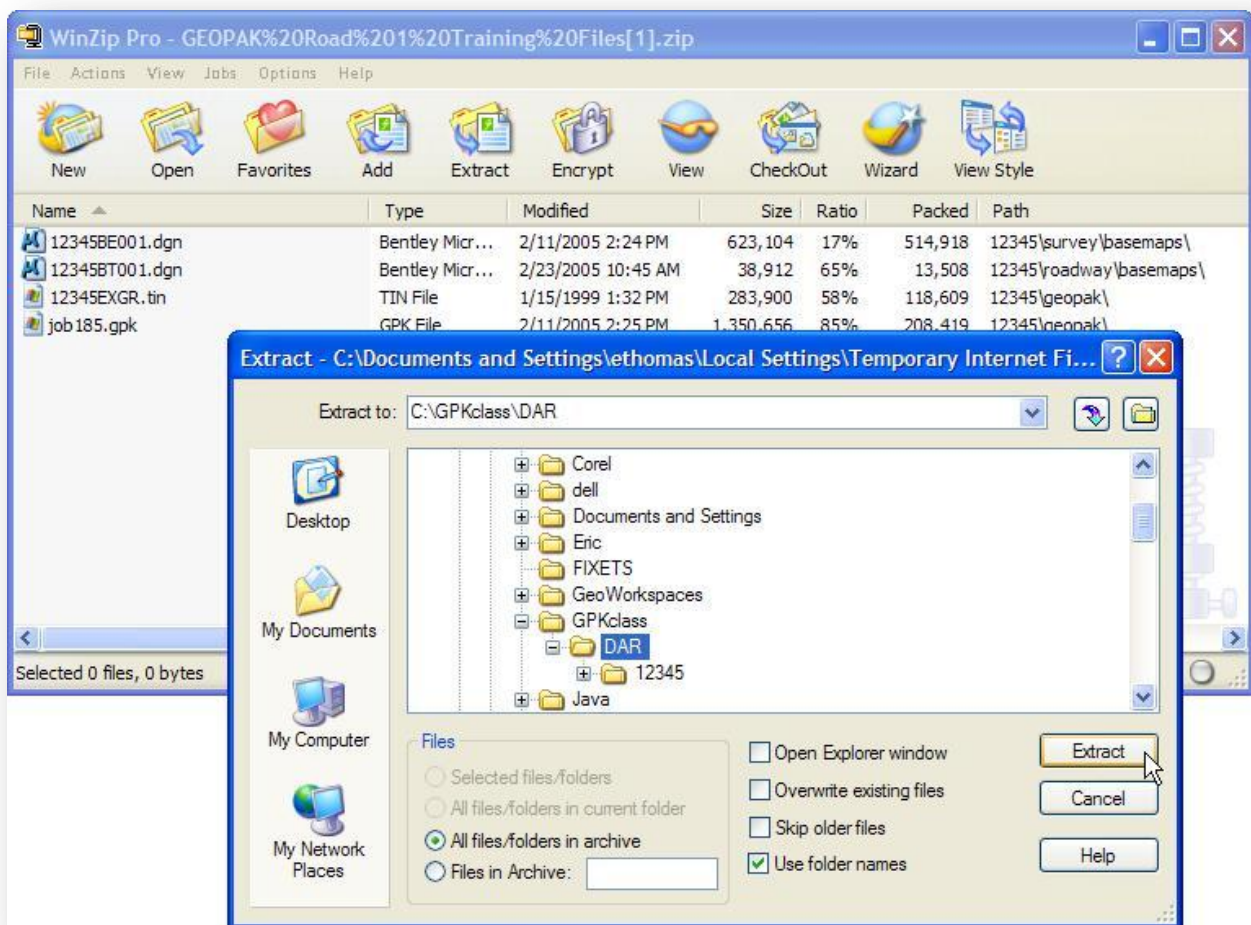
In the exercise, students will add the training files to the project directory structure that was created in Exercise 1A. The training data can be accessed on the ODOT website at the following location:

<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/GPKManual.aspx>

The following files are included in the zip file:

- job185.gpk - Coordinate Geometry database containing the survey data.
- 12345BE001.dgn - 2D MicroStation v8 design file containing the mapping of the survey data for the project.
- 12345EXGR.tin - Digital Terrain Model representing the existing ground.

Unzip the project files to the c:\GPKclass\ DAR\ directory. Be sure to toggle on the **Use Folder Names** option as shown below.



1.6 Working with Existing Ground Survey and Aerial Mapping

1.6.1 Model Annotation Scale

Existing ground information is typically provided by either ground survey or aerial mapping. In either case, the display of the custom line styles, text, and cells is mapped for a specific plotting scale, usually 20 or 50 scale. This presents a problem if the final plans will include sheets at different plotting scales. For example, the text, cells, and line styles referenced into a 10-scale detail sheet from a survey basemap that was mapped for a 20-scale drawing will appear two times too big on the plotted sheets.

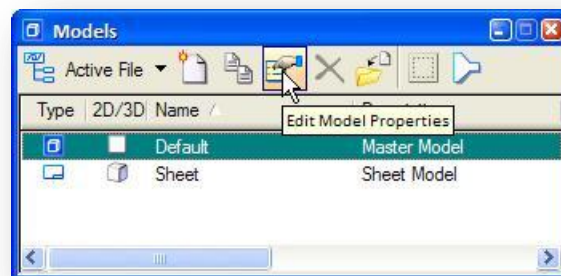
With MicroStation V8i, the **Model Annotation Scale** can be used to control the display size of text, cells, and custom line styles in the active design file and also in any reference attachments. This will allow the designer to control the display size of these features for any intended plotting scale.

Important! In order for the Model Annotation Scale to set the display size for the text, cells, and line styles, these features must be plotted in the basemap design file using a scale of 1. This is a change in procedure from past practices. As stated previously, cells, text, and line styles were typically plotted in the basemap at a specific scale, usually 20 or 50.

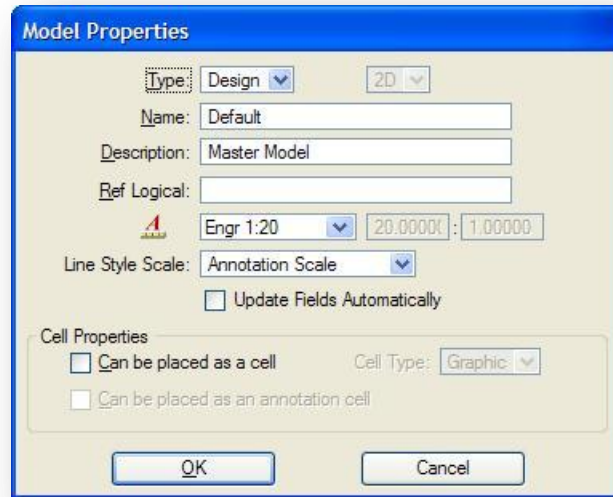
MicroStation V8 introduced the concept of Models and the Model Annotation Scale. To review:

- A V8 design file can have multiple independent drawing areas called a Model
- Each model can be 2D or 3D
- Three types of models are available: Design, Drawing, and Sheet Models
- According to ODOT CADD Standards:
 - Design Models are used to draw the mapping for your project
 - Sheet Models are used to draw plan sheets
 - Drawing models are not used for ODOT projects

To set the Model Annotation Scale, select **File > Models** from the MicroStation pull-down menu to access the *Models* dialog shown below.



Select **Edit Model Properties** as shown above to access the *Model Properties* dialog shown on the following page.



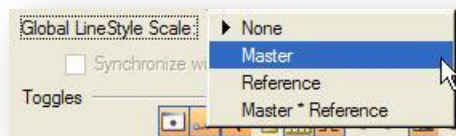
In the example above, the **Annotation Scale** is set to a value of **Engr 1:20**. The **Line Style Scale** is set to match the **Annotation Scale**.

Changing the **Annotation Scale** value will cause the display of the text, cells, and custom line styles to change according to the value selected. This will affect elements drawn in the active file as well as referenced graphics depending on the settings when the references were attached as described in the following section.

1.6.2 Model Annotation Scale and Reference Attachments

When a basemap design file is attached as a reference, the designer can determine whether the text, cells, and line styles are displayed at the scale set in the original design file, or whether the master file will control the scaling.

On the *Reference File Settings* dialog box, the **Global LineStyle Scale** option is used to set which file controls the line style display scale.



- If the survey data was mapped with a scale of 1, set this option to **Master** to allow the **Annotation Scale** of the master design file to control the display scale for text, cells, and line styles on both the active file and all reference attachments.
- If the survey data was mapped for a specific scale, such as 20, set the option to **Reference** to match the annotation scale value set in the original reference file, or to **None** to disallow scaling of the display of the line styles, cells, and text.

1.6.3 Editing Pre-V8i data for use with the Model Annotation Scale

Design files created in previous versions of MicroStation have typically been mapped for a specific scale. To use the **Model Annotation Scale** to control the display size of the text, cells, and line styles, with these files, the data must be edited so that these features are all placed at a scale of 1 in the basemap design file. The data can be remapped at a scale of 1 as described below:

Case 1 – GEOPAK Survey Basemaps:

If you have ground survey processed through GEOPAK Survey, the survey points and lines are included in the GPK file for the project. The data can be re-visualized at a scale of 1 with COGO Visualization commands as described below:

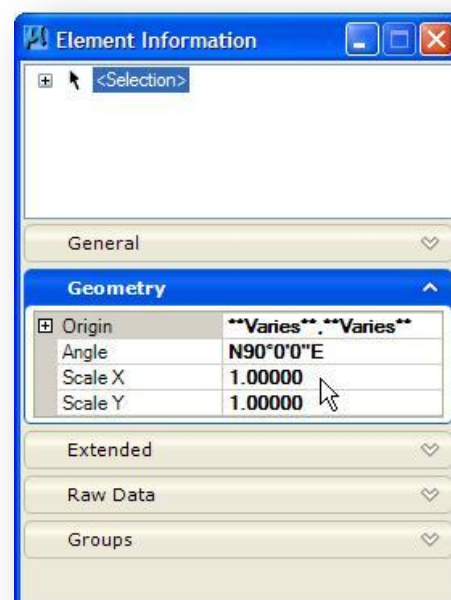
- Visualize the Survey data from the GPK file. See section 3.5 of this guide for more information on visualizing data contained in the GPK file.
- After visualizing the data, use the MicroStation **Element Selection** tool to select all the elements in the file
- Key in the MicroStation command “`annotation scale add`”. This will add the annotation scale to the selected text, cells, and line styles. These elements will now respond to changes in the **Model Annotation Scale**.

Case 2 – Aerial Mapping Basemaps:

If you have ground survey from aerial mapping that is not included in a GEOPAK GPK file, MicroStation commands can be used to change the cell scale, and the custom line style scale to a scale of 1. An overview of the commands is provided below:

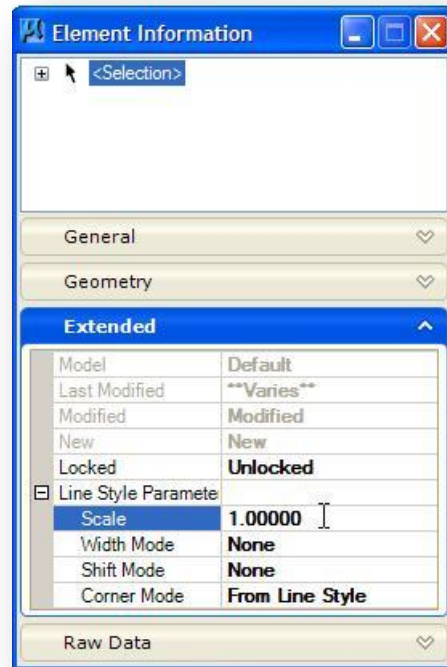
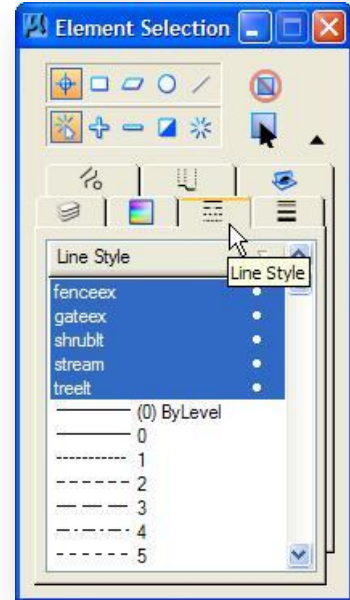
To rescale the cells:

- Use the MicroStation **Element Selection** tool to select all the cells in the file
- Use the **Element Information** tool to change the scale of the selected cells to 1 as shown in the example at right.
- Key in the MicroStation command “`annotation scale add`”.



To rescale the custom line styles:

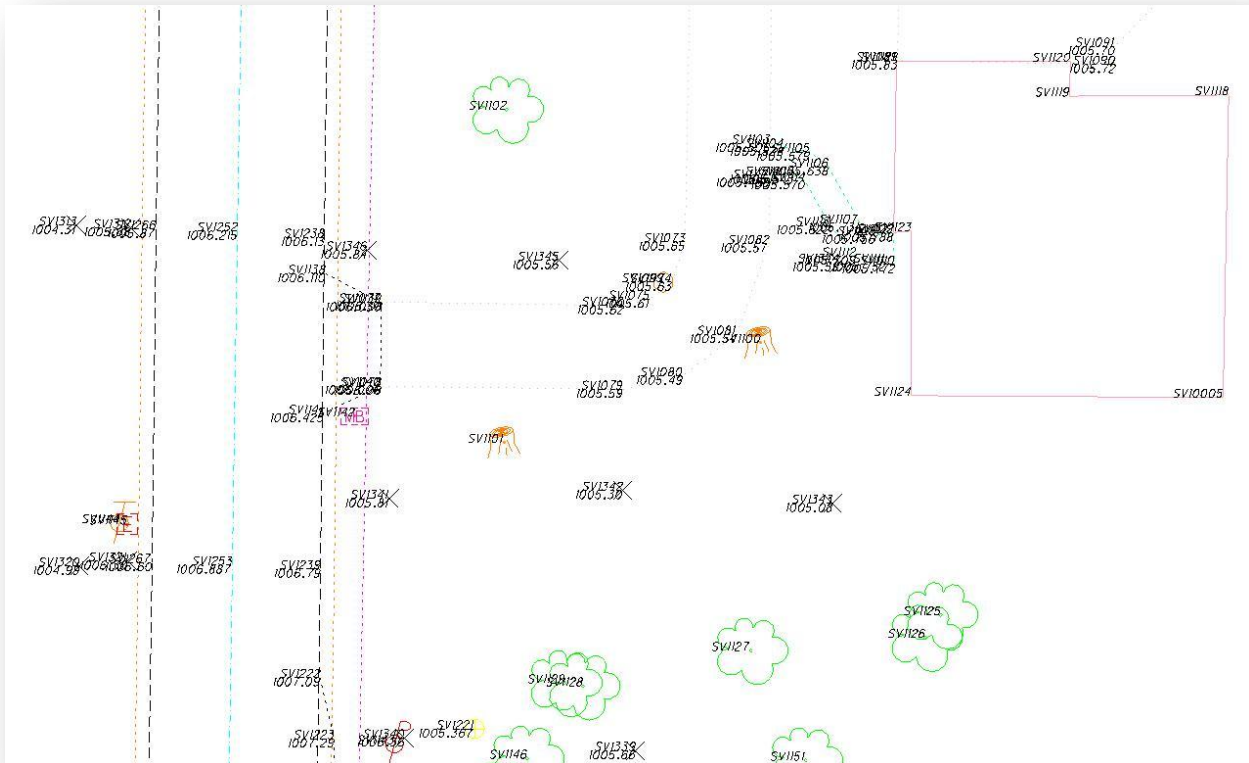
- Use the MicroStation **Element Selection** tool to select all the custom line styles in the file as shown at right. Tip: toggle the selection item to line styles and then drag through all the line styles in the list. The line styles that are in use in the design file will remain selected as shown at right
- Use the Element Information tool to change the line style scale of the selected elements to 1 as shown in the example below.
- Key in the MicroStation command “`annotationscale add`”.



Additional details about the use of models for ODOT projects can be found in the [ODOT CADD Engineering Standards Manual](#).

1.6.4 Survey Data Levels

Ground survey information mapped through GEOPAK Survey may contain several types of supplemental annotation that is not intended to be shown on the construction plans. In the example below, the survey point name and the elevation is plotted in the design file.



This supplemental information is plotted on several levels that are not intended to be shown in the final plans. The table below documents the survey levels that the user may elect to toggle on/off.

Level	Feature	Description
SV_X_Break_Line	Break Lines	Breaks in topography
SV_X_Center_of_Pavt	Center of Pavement	The pavement crown as shot in the field.
SV_X_Random_Point	Random Elevation Shot	Cell placed at the location of a random elevation shot
SV_X_Shot_Marker	Shot Marker	Cell placed at the location of a survey shot along a survey chain
SV_X_Text_Comment	Comment Text	Text comments keyed in the data collector by the surveyor
SV_X_Text_Description	Description Text	Supplemental description information
SV_X_Text_Elevation	Elevation Text	Text representing the elevation of the point
SV_X_Text_Name	Point Name Text	Text representing the name of the point

Exercise 1C, Survey Data

The Survey Data in the file 12345BE001.dgn has been mapped using GEOPAK Survey with a scale of 1 for the display of the line styles, cells, and text. In this exercise, we'll use the model annotation scale to set the display of these features.

- ✓ Open the following design file:

c:\GPKclass\ DAR\12345\survey\basemaps\12345BE001.dgn

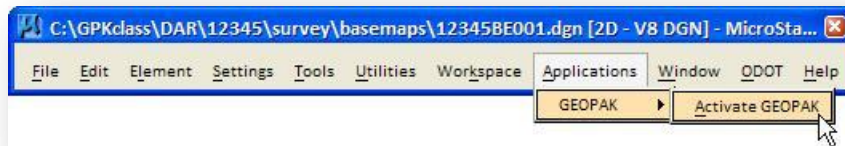
- ✓ Set the **Model Annotation Scale** to a value of 10. Observe the behavior of the text, line styles, and cells
- ✓ Select the MicroStation **Save Settings** command
- ✓ Open the following design file:

c:\GPKclass\ DAR\12345\roadway\basemaps\12345BP001.dgn

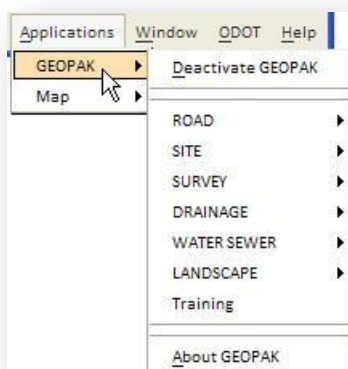
- ✓ Attach the survey design file, 12345BE001.dgn, as a reference attachment
- ✓ Set the **Model Annotation Scale** to a value of 20. Note that the display of the text, line styles, and cells is independent of the value set in the original design file.
- ✓ Turn off levels for the supplemental survey information that you do not wish to display
- ✓ Select the MicroStation **Save Settings** command

1.7 Activating GEOPAK

GEOPAK can be activated by selecting **Applications > GEOPAK> Activate GEOPAK** from the MicroStation pull-down menu as shown below.

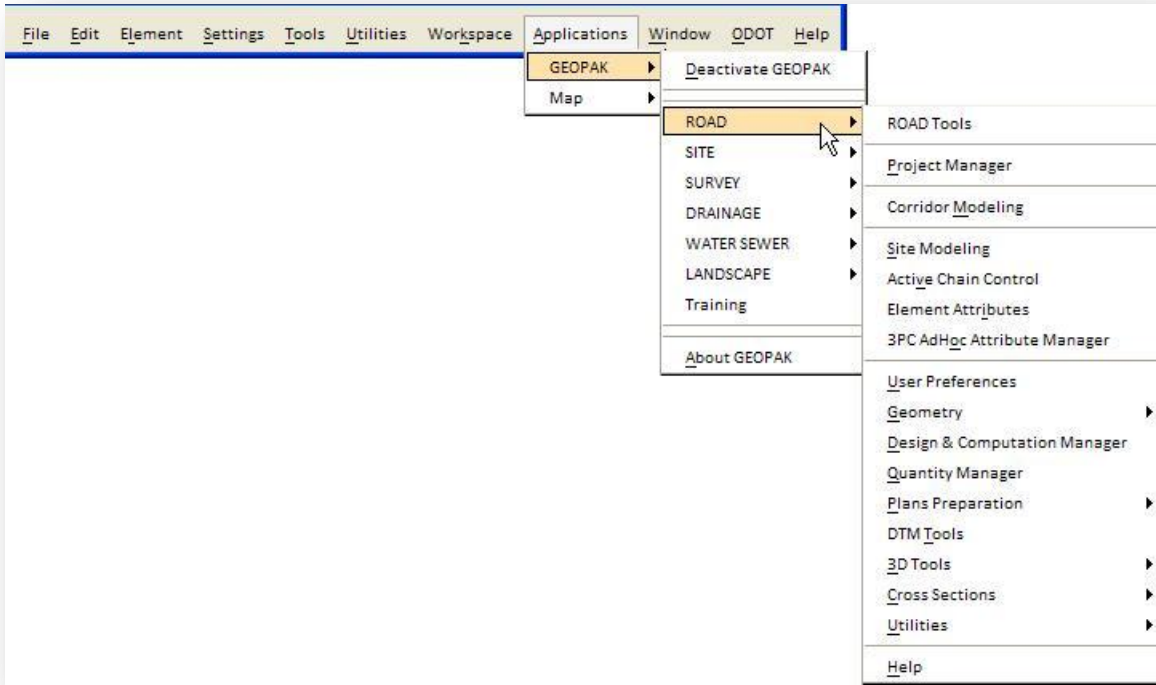


After activating GEOPAK, the **Applications** pull down menu shows an entry for each GEOPAK product that has been activated, as shown below.



1.8 Accessing GEOPAK Road Functions

There are several ways to access the individual functions in GEOPAK Road. Individual functions can be accessed from the **Applications** pull down menu, as shown below.



The *GEOPAK Road Tools* palette can also be used to access the GEOPAK Road functions. Select **Applications > ROAD > Road Tools**. The tool palette shown below is opened. Each icon on the *Road Tools* palette is a tool box that can be opened to become a separate tool box.



See the GEOPAK online help under **Command Reference > GEOPAK Road Tools** for a complete list of all the functions available in each tool box.

The GEOPAK tools are also available from the MicroStation *Tasks* dialog by selecting **GEOPAK Suite** as shown below.



Note: The **Roundabouts** and the **Civil Geometry** tools have not been incorporated into the ODOT workflow and will not be covered in this training class.

The **Data Acquisition** tools are new for the V8i release. These tools are used for processing Survey data and will not be covered in this class.

Throughout the training guide we will make use of many of the functions contained in these tool boxes. This guide will typically demonstrate selecting the tools from the *Road Tools* palette.

1.9 GEOPAK User Preferences

GEOPAK provides numerous system parameters to allow the user to easily set or change the number of decimal places for output files, station formatting, coordinate format, English or Metric units, etc. These parameters are called the GEOPAK User Preferences. These parameters are primarily associated with the Coordinate Geometry functions, but also affect many other GEOPAK functions.

The user preferences can be set for the current session, or saved as part of a specific project configuration as detailed in Chapter 4 of this guide. To access the settings for the current session, select **Applications > ROAD > User Preferences** to access the *GEOPAK User Preferences* dialog box shown below.



Once these preferences have been set, they are stored in a MicroStation resource file. Every time GEOPAK is started, the settings of this dialog box are retained from the last design session.

The options on the *GEOPAK User Preferences* dialog are explained below:

Unit System (English, Metric)

This option determines whether GEOPAK operates according to the English or Metric system of measurement. The Unit parameter affects every GEOPAK component.

Coordinate (NE, XY)

Sets either NE (Northing/Easting) or XY coordinate values in Coordinate Geometry and in the GEOPAK labeling tools.

Direction (Bearing, Azimuth)

Sets the direction format for the line direction in Coordinate Geometry, Labeling, and components within the Design and Computation Manager.

Station Format (1+234, 12+34, 1234)

Sets the format for station variables in Coordinate Geometry, Labeling, and components within the Design and Computation Manager

Output Accuracy:

Distance (0 to 6 decimal places)

Station (0 to 6 decimal places)

Angle Seconds (0 to 6 decimal places)

These options are used to sets the number of decimal places for Coordinate Geometry, Labeling, and components within the Design and Computation Manager.

TIP: Decimal Precision

Setting the number of decimal places for the **Distance Decimal**, **Station Decimal**, and **Angle Seconds Decimal** options only affects the rounding of the screen output. Internally, GEOPAK computes all values using double precision floating point computations.

Working Directory

The **Working Directory** is the most important parameter on the GEOPAK *User Preferences* dialog. Simply stated, the **Working Directory** is used to assign the default directory where GEOPAK will look for files when opening a file, as well as the default directory where GEOPAK will store files when a file is saved. The working directory can be assigned in one of two ways:

Leave the Working Directory field blank

By leaving the **Working Directory** field blank, GEOPAK will search the same directory as the design file that you currently have open for all files accessed during the current design session. This method is preferred when all of the files for the project are located in the same directory as the design file. It should be noted that placing the GPK file in the same folder as the design files does not comply with ODOT CADD Standards for directory structures.

Specifying a specific directory

This is the preferred method for ODOT projects. When using this method, you are telling GEOPAK to search a specific directory for all of the files associated with the project. For example, keying in c:\GPKclass\12345\geopak will tell GEOPAK to look in this directory for all files accessed during the design session. This method is preferred when the GEOPAK related files are stored in a separate directory from the MicroStation design files.

Pressing the **Select** button invokes the *Select Directory* dialog, wherein the desired **Working Directory** may be selected.

1.9.1 Feature Preferences...

The **Features Preferences...** push button invokes the *Feature Preferences* dialog shown below.



The values assigned in the *Feature Preferences* dialog are used when visualizing COGO elements and mapping survey data with assigned feature codes as described below.

Feature Database

The symbology for the elements drawn from survey data is determined by the feature code of each element. These feature codes are stored in a database, the Survey Manager Database (.SMD file), that can be assigned by the user. The following ODOT Standard feature database is automatically assigned:

I:\ODOTstd\V8istd\geopak\survey\ODOT.smd

When survey data is mapped to the DGN file, GEOPAK searches the SMD file for a matching feature name. If a match is found, then the symbology for that feature is used. If a match is not found and there is a feature named "default" in the .SMD file, then the "default" feature symbology is used. If the feature is not found in the .SMD file and no "default" feature is defined in the .SMD file, the current MicroStation symbology is used.

Apply Best Match Feature

When the **Apply Best Match Feature** toggle is active, the best match feature from the feature survey preference database is utilized. This option allows placement of one feature in the database per item and locates derivatives of that feature in the field. For example, assume that feature EP is the Edge of Pavement, but in the field 3 different EP's need to be located. The different EP chains can be located as EP1, EP2 and EP3. During the mapping process, these features are matched to the Edge of Pavement feature EP in the database. Therefore, the user does not have to define multiple EP features in the database.

Plot Scale

This parameter is used to set the scale for elements mapped by GEOPAK Survey, or elements drawn by COGO Visualization. When visualizing Survey Data, the **Plot Scale** should normally be set to a value of 1 for ODOT projects.

Use Shared Cells

If **Use Shared Cells** toggle is off, cells are placed as unshared cells. If **Use Shared Cells** toggle is on, cells are placed as shared cells. **Note:** For ODOT projects, this option should always be toggled off.

Point Label Redraw

Two options are provided to control how the labels are redrawn if COGO or Survey information is redrawn.

Redraw according to SMD

The label is drawn with parameters defined within the specified survey database when the map is drawn or redrawn.

Position relative to symbol

The user can move the point name, elevation, etc using MicroStation tools and if the data is remapped the labels retain their same position relative to the point symbol at the new mapped position.

OK

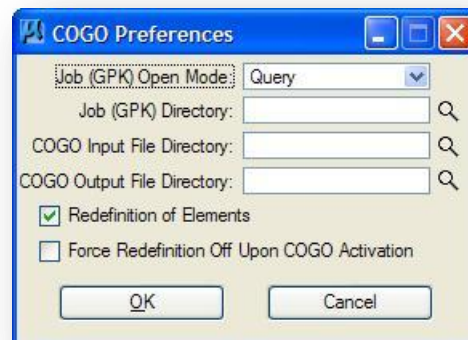
Closes the *Feature Preferences* dialog, and sets all Visualization and Mapping Parameters based on the current dialog settings.

Cancel

Closes the *Feature Preferences* dialog, without changing any dialog settings.

1.9.2 COGO Preferences...

Pressing the **COGO Preferences...** button invokes the *COGO Preferences* dialog shown below.



The *COGO Preferences* dialog has the following options:

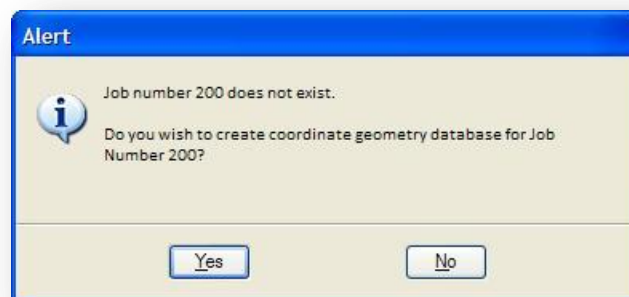
Job (GPK) Open Mode

When the user accesses the GEOPAK Coordinate Geometry (COGO) functions, the software will automatically open the COGO database specified by the user by looking in the **Working Directory** for the database. If no data base is found matching the **Job Number** specified by the user, GEOPAK will respond in one of three ways as described below:

- **Create** – When this option is selected, GEOPAK will automatically create a new coordinate geometry database if the Job number does not already exist in the current Working Directory.

- **No Create** - The software will not create a new database and the COGO dialog box will not be opened.
- **Query** - With this mode, the user is queried when a job number is requested that does not correspond with a job**.gpk file in the Working Directory. Once queried, the designer may proceed with the database creation or cancel it.

If no GPK file is found in the **Working Directory** when the user attempts to open the COGO database, and the **Job (GPK) Open Mode** is set to **Query**, the *Alert* dialog shown below appears. We recommend leaving this option set to **Query**.



Job (GPK) Directory

COGO Input File Directory

COGO Output File Directory

These three options can be used to specify the directory location for the COGO database, COGO input files and COGO output files. If all three fields are left blank, the software will use the directory location specified by the **Working Directory**.

Redefinition of Elements

The Redefine function will allow users to overwrite COGO elements. Checking this toggle on will force the Redefine function on when COGO is activated. Note: Redefine can be turned on/off directly from the COGO dialog box once COGO has been activated. See Chapter 4, Coordinate Geometry for more information on the Redefine function.

Force Redefinition Off Upon COGO Activation

If the Redefine function was left on the last time a user exited COGO, checking this toggle on will force the Redefine function off. We recommend checking this option on.

Show this dialog at GEOPAK startup

Checking on the **Show this dialog at GEOPAK startup** option will force the *User Preferences* dialog to automatically open when GEOPAK is activated.

Tip:

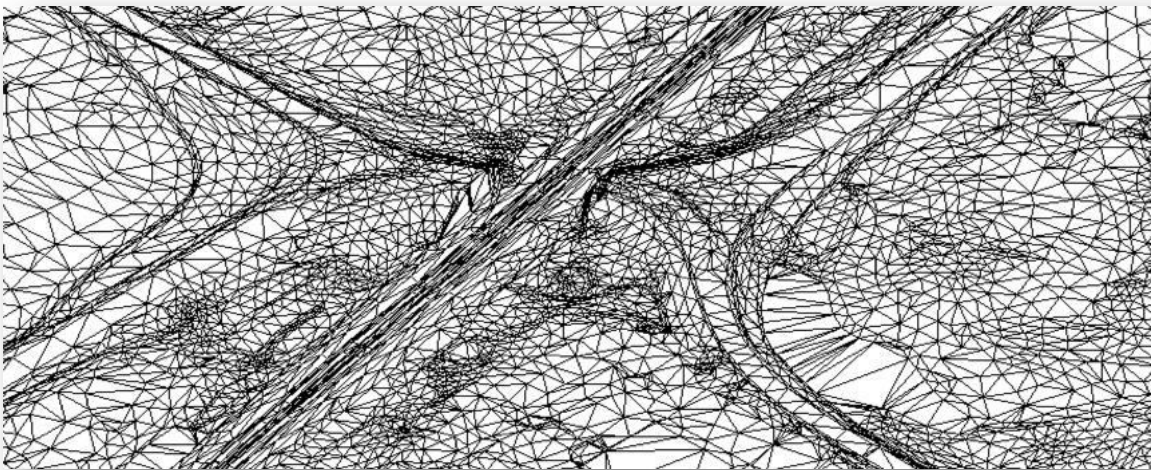
If you are not using Project Manager (see Chapter 4) be sure to review the Working Directory every time you start GEOPAK to ensure that it is set correctly for your project. Toggle on **Show this dialog at GEOPAK startup** to help you to remember to set the Working Directory.

2 Digital Terrain Models

2.1 What is a Digital Terrain Model?

A Digital Terrain Model (DTM) represents the topography of a project in a three dimensional (3D) file.

Triangulation is a mathematical process applied to stored point elevations to produce the DTM. The triangulated model is stored in a binary file as a triangulated topological network. GEOPAK DTM files are named with a .tin extension. An isometric view of a DTM that has been plotted, using triangles, in a MicroStation design file is shown below.



GEOPAK provides the capabilities to generate a DTM from a wide range of data sources including MicroStation elements, survey data, GEOPAK cross sections, or ASCII files with X,Y,Z coordinates. For most design projects, an existing ground DTM will be provided from ODOT's Survey personnel or the Office of Aerial Engineering.

The DTM is used by GEOPAK to extract existing ground profiles and cross sections, display contours, display drainage flow patterns, etc... We will concentrate on the most commonly used DTM functions during this training class.

2.2 DTM Feature and File Types

DTM models can be generated from several feature types. The following features are the most commonly used feature types:

- **Spots** are points that have no relationship to any other point. Random survey shots in open terrain would be an example of spot elevations.
- **Breaks** are used to designate linear features such as edges of pavement, ditch bottoms, ridges, etc.
- **Void** areas are closed shapes to designate areas of missing data or obscure areas. No point or break data located within the void area is utilized and no triangles are created inside the void areas. A building is an example of a void area.
- **Boundary** is used to constrain the external boundary of the triangulated model. No triangles are created outside the boundary polygon. In addition, any point data outside the boundary polygon is ignored. A boundary polygon must start and finish with the same point.

Less commonly used feature types that are supported by GEOPAK are listed below:

- **Contours** are a special feature intended for use when importing contour lines from a MicroStation design file in order to generate a TIN file.
- **Island** is used to place data within a void, i.e., islands in the middle of rivers, lakes, etc.
- Triangles previously plotted in a 3D MicroStation design file can be extracted using the **Graphic Triangles** option to generate a GEOPAK TIN model. This option is useful for generating a GEOPAK TIN model from 3D triangles that were plotted utilizing another software package.
- The **Drape Void** element utilizes the X,Y coordinates of the void area and the elevation is determined by draping the void area onto the TIN model, thereby obtaining its elevation from the model. It is then inserted into the model.

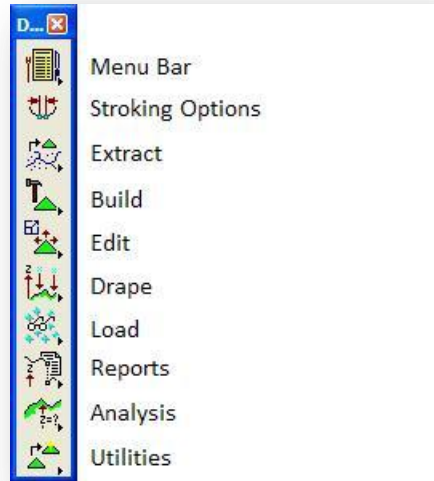
Triangle models generated by GEOPAK Survey typically consist of **Spots**, **Breaks**, and **Voids**.

Before GEOPAK can triangulate the DTM, the information for the feature types listed above must be stored in a DTM input file. This file has a .DAT file extension. The DTM data input file can be stored as an ASCII or Binary file.

GEOPAK uses the DTM Input file as input for the triangulation process. The resulting triangulated DTM file is given a .TIN file extension.

2.3 The DTM Tool Frame

GEOPAK DTM functions are accessed from either the GEOPAK *DTM* tool frame or the DTM menu bar. The tool frame can be invoked by selecting **Applications > Road > DTM Tools** or from the *GEOPAK Road Tools* tool frame as shown below.



If you prefer to use the *DTM Menu Bar* instead of the *DTM* tool frame, select the **Menu Bar** icon from the *DTM* tool frame. The *DTM Menu Bar* is shown below.



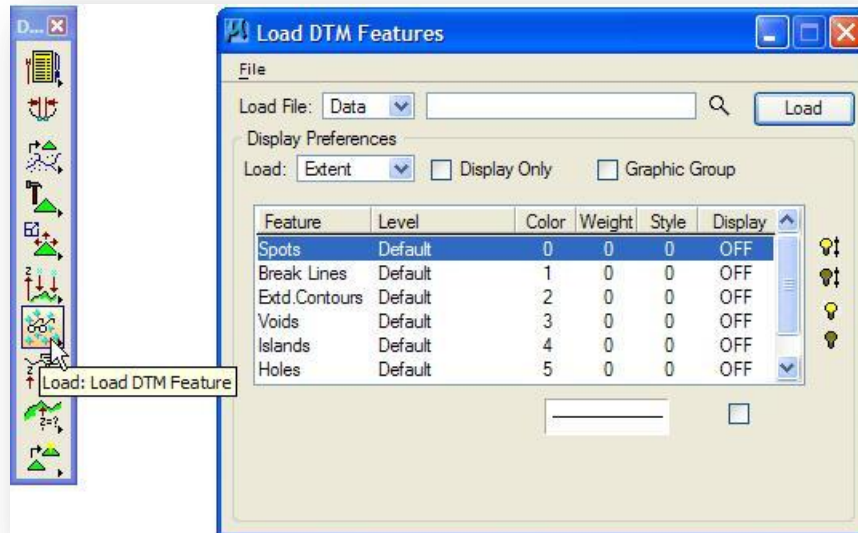
We will use the *DTM* tool frame throughout this training guide.

This training guide will cover the tools most commonly used in roadway design to display and analyze DTM information provided by ground survey or Aerial mapping.

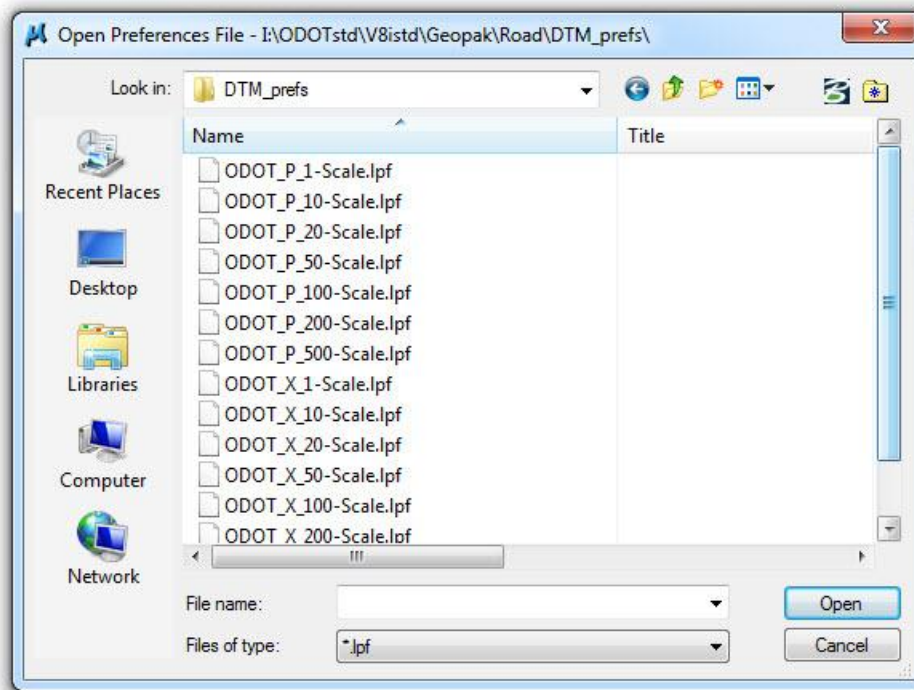
See the GEOPAK on-line documentation for more information on the DTM tools.

2.4 Load DTM Features

GEOPAK supports a wide variety of options to draw and display DTM Features. Select **Load DTM Feature** to access the *Load DTM Features* dialog shown below.



The symbology settings for each Feature can be uniquely defined. These settings can be saved in a preference file for later recall. Several preference files have been configured to set the element symbology according to ODOT CADD Standards. To access the preference files, select **File > Open...** from the *Load DTM Features* dialog.



For ODOT employees, these files are maintained on the “i” drive at the following location:

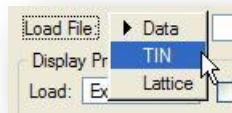
i:\ODOTstd\V8istd\geopak\road\DTM_prefs

The following preference files are available:

File Name	Description
ODOT_P_1-Scale.lpf	Proposed DTM Features, 1-Scale text size
ODOT_P_10-Scale.lpf	Proposed DTM Features, 10-Scale text size
ODOT_P_20-Scale.lpf	Proposed DTM Features, 20-Scale text size
ODOT_P_50-Scale.lpf	Proposed DTM Features, 50-Scale text size
ODOT_P_100-Scale.lpf	Proposed DTM Features, 100-Scale text size
ODOT_P_200-Scale.lpf	Proposed DTM Features, 200-Scale text size
ODOT_P_500-Scale.lpf	Proposed DTM Features, 500-Scale text size
ODOT_X_1-Scale.lpf	Existing DTM Features, 1-Scale text size
ODOT_X_10-Scale.lpf	Existing DTM Features, 10-Scale text size
ODOT_X_20-Scale.lpf	Existing DTM Features, 20-Scale text size
ODOT_X_50-Scale.lpf	Existing DTM Features, 50-Scale text size
ODOT_X_100-Scale.lpf	Existing DTM Features, 100-Scale text size
ODOT_X_200-Scale.lpf	Existing DTM Features, 200-Scale text size
ODOT_X_500-Scale.lpf	Existing DTM Features, 500-Scale text size

Each file is configured for a specific text size that is used with the Contour and Spot feature types.

Information can be loaded from three different **Load File** types as shown below.



Select **TIN** to load information from a GEOPAK TIN file.

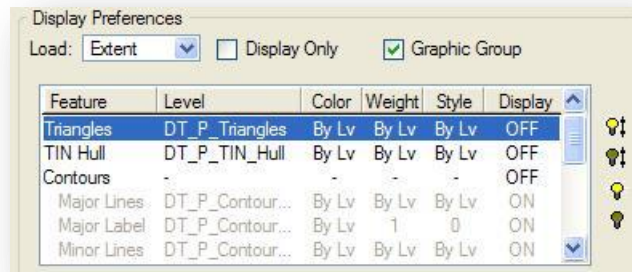
The TIN file is selected by use of the **Select File** icon as shown below.



The **Load** button is used to initiate the drawing or displaying of DTM Features in the active MicroStation design file.

Display Preferences

The Display Preferences portion of the dialog box is used to set the symbology and display status for each feature type.



Load

Three options are available:

- **Extent** - The features for the full extent of the model are drawn.
- **For Fence** - The features within a fence area are drawn.
- **View** - This option draws only features within the current view window.

Display Only

When this toggle is activated, elements are not drawn into the MicroStation file and disappear when an update view command is issued. When toggled off, elements are drawn into the file at the specified element symbology.

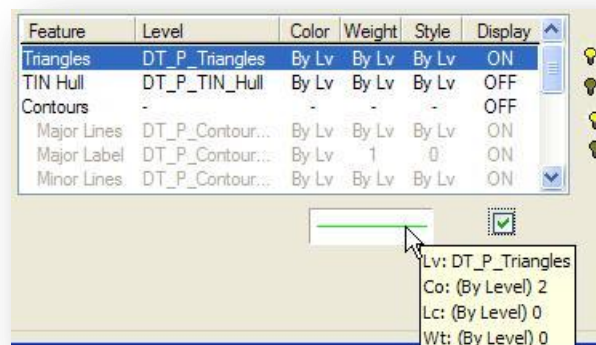
Graphic Group

When activated, all elements placed within a single processing (each pressing of the **Load** button) are placed as a graphic group for easy manipulation and / or deletion.

By default, each **Feature** type is toggled off. The light bulb icons to the right of the dialog can be used to toggle on/off the display for all features, or selected features.

DTM Feature Symbology List Box

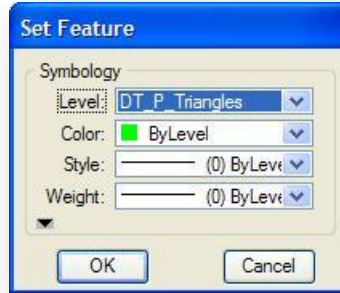
For each **Feature**, there are element symbology options and a **Display** mode on/off toggle.



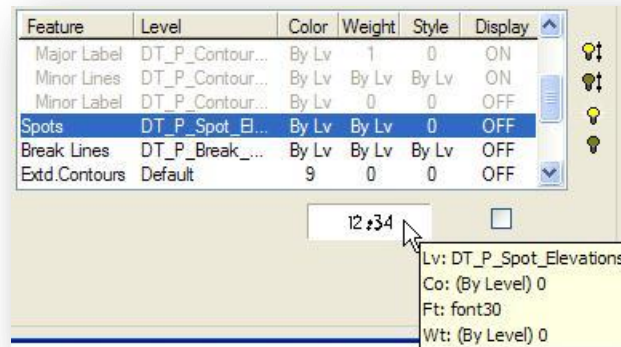
Floating your cursor over the symbology box will reveal the current settings for the selected **Feature** as shown above.

As each **Feature** is highlighted, its element symbology is displayed directly below the list box in the symbology box. The toggle to the right of the element symbology indicates whether the display is on (toggle is on) or off (not toggled).

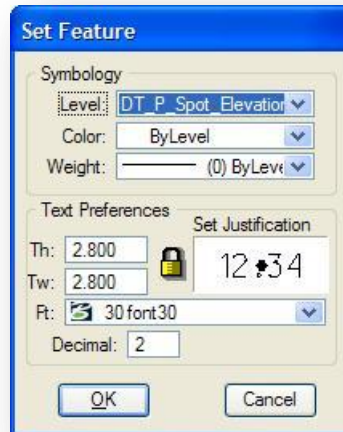
The symbology for the selected item can be changed by double-clicking the symbology box to access the *GEOPAK Set Feature* dialog shown below.



If the selected feature requires text (i.e., **Spots**) the dialog dynamically changes as shown below when the feature is highlighted.

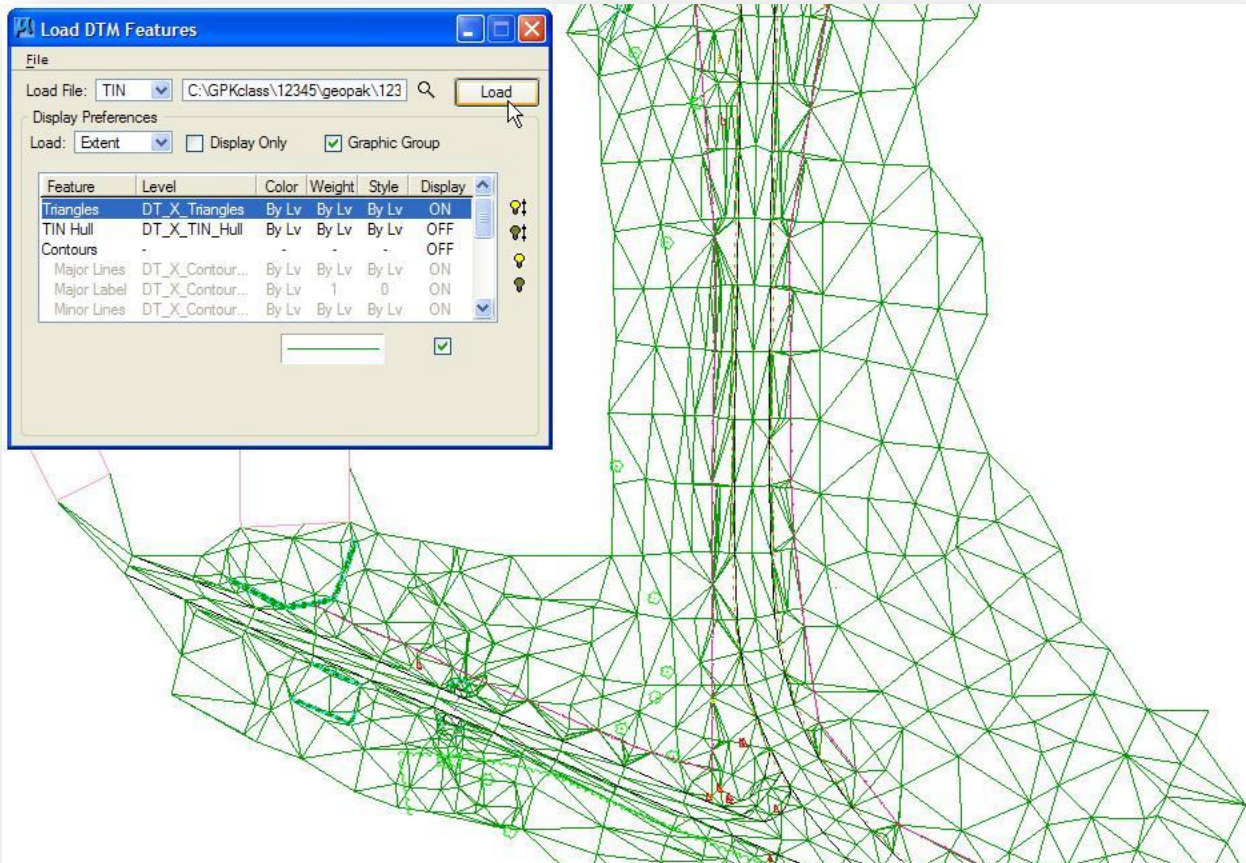


Text parameters may be defined or modified by double clicking on the symbology box.



2.4.1 Plotting Triangles

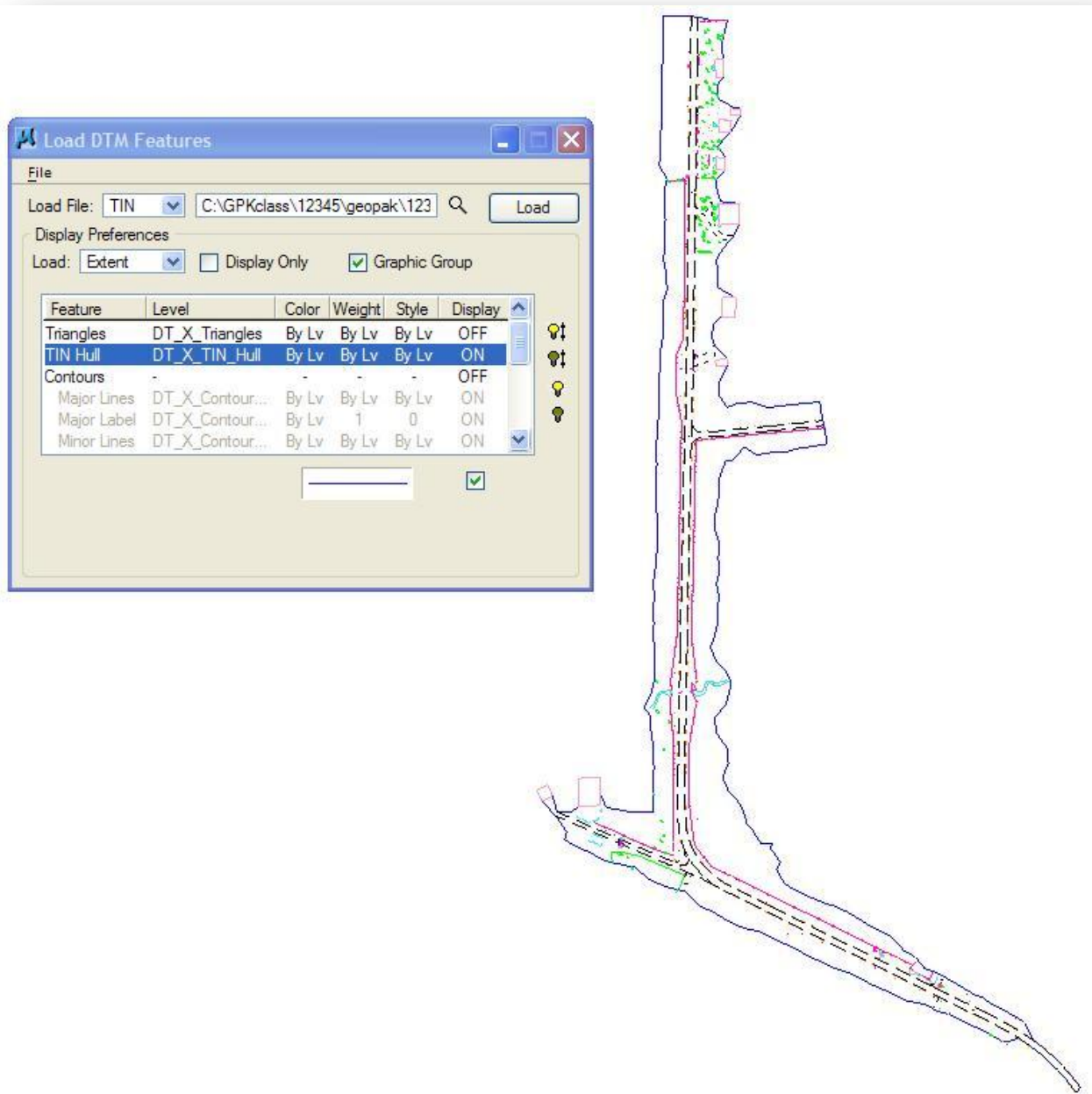
The triangles for the selected TIN file can be plotted as shown below.



The triangles are plotted as a single Mesh element which can easily be deleted as a single element.

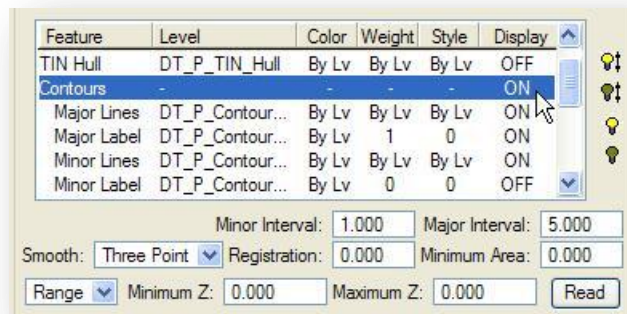
2.4.2 Plotting the Tin Hull

The Tin Hull option is used to plot the external boundary of the triangle model. This option is useful to view the extents of the surveyed data without plotting the individual triangles. An example is shown below.



2.4.3 Plotting Contours

Contours require additional parameters as shown below.



Minor Interval

Major Interval

Major contour intervals should be even increments of minor contour intervals. For example, a minor contour interval of 2 and a major contour interval of 10 would be reasonable values. Every fifth contour element would reflect the level, symbology and text attributes defined for major contours. Conversely, a minor contour interval of 2 and a major contour interval of 5 would not be reasonable since 5 is not an even increment of 2.

Smooth Contours

Three options are available to smooth the contour display:

- **None**
When **None** is used, no smoothing of contours is done.
- **Three Point**
The Three Point Smoothing algorithm replaces each contour vertex with a curve that is tangent to the preceding and following contour segments. The curve starts and finishes at tangent points that are equal distances on both sides of the contour vertex. The distance is hard coded to one third of the minimum of the length of the preceding or following contour segment. Three curve points are then calculated between the two tangent points.
- **B Spline**
The B Spline smoothing places a smoothing cubic B-spline through the contour vertices. To achieve the smoothing effect, five additional vertices are calculated on the B-Spline between the vertices of the unsmoothed contour. Note the B-Spline produces the best-looking contours; however, the B-Spline is also the slowest method.

Registration

Contour placement is dictated by the major and minor interval. The placement can be offset by the value typed into the **Registration** field. The elevations at which contours are drawn is equal to the Minor Interval plus the Registration value. For example, a Minor Contour Interval of 10 and a Registration value of 0.5 will result in contours drawn at elevations 10.5, 20.5, 30.5, etc.

Range or Single

When Range is selected, contours may be placed for a specific **Minimum Z** and **Maximum Z** elevation range as shown below. The **Read** button is used to set the **Minimum Z** and **Maximum Z** values based on the elevation range of the current TIN file.



The **Single** option is used to plot a single contour line at the specified elevation.



There are four sub-items to set the contour symbology:

Major Lines

The **Major Lines** item is used to set the element symbology for the major contour lines.

Major Labels

The **Major Labels** item is used to set the text symbology for the elevation labels placed along the major contour lines. The **Distance Between Labels** can be set using the key-in field.

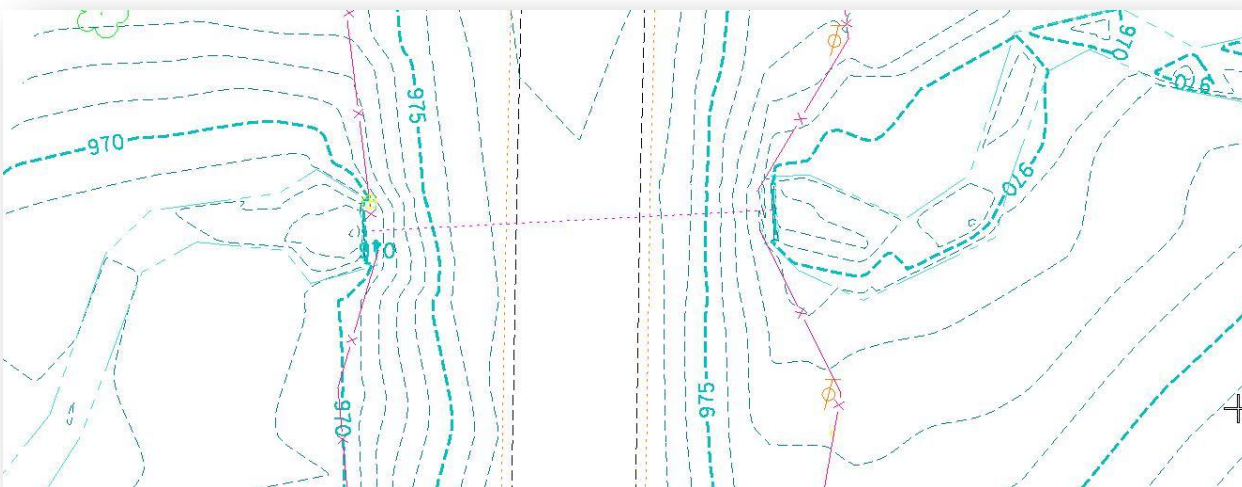
Minor Lines

The **Minor Lines** item is used to set the element symbology for the minor contour lines.

Minor Labels

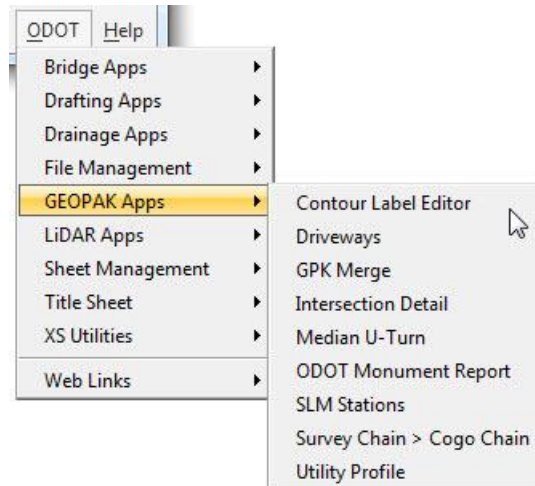
Minor Labels are typically not shown on ODOT plans.

When the **Load** button is selected, the contours are drawn into the active design file. An example of the plotted contours is shown below.

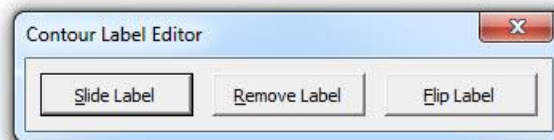


2.4.4 Contour Label Editor

Contour labels can be edited using the Contour Label Editor VBA application. The application can be accessed from the ODOT pull-down menu as shown below:



When accessed, the dialog shown below is opened.



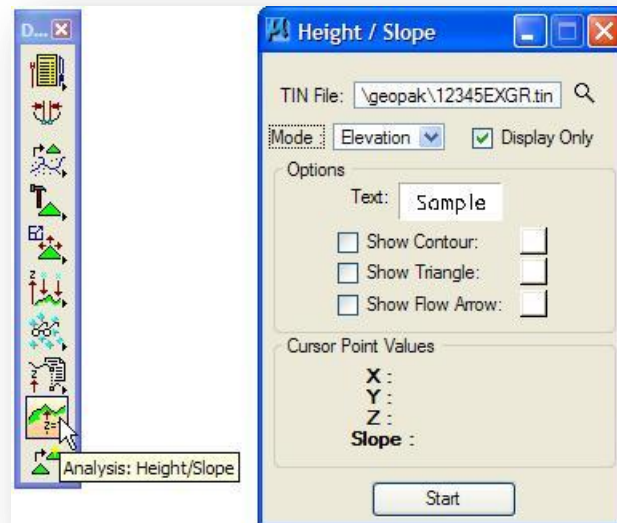
The application has the following three editing options:

- Slide Label
- Remove Label
- Flip Label

2.5 Height / Slope Tool

The **Height / Slope** tool is used to query the selected TIN file for the plan view coordinates, elevation, and slope at an identified location on the TIN model.

From the *DTM* tool frame, select the **Height/Slope** icon to access the *Height / Slope* dialog shown below.



To determine the Elevation or Slope:

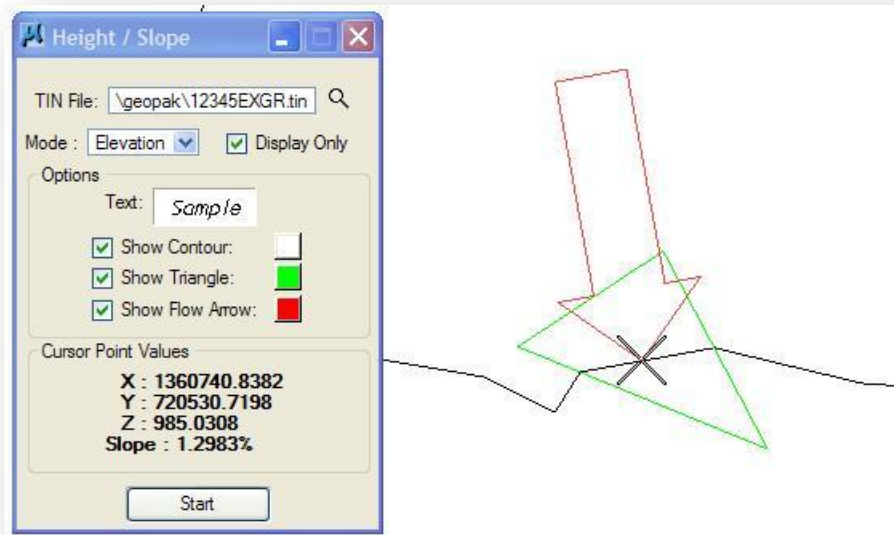
- ✓ Key-in the name of the **TIN File**, or use the **Select File** icon to the right of the key-in field.
- ✓ Select the **Mode**, either **Elevation** or **Slope**. If the **Mode** is **Elevation**, turn on the desired Show features. If the **Mode** is **Slope**, set the Display Options.
- ✓ Turn on **Display Only** if you do not want the data drawn into the MicroStation file.
- ✓ Click **Start**. Move the cursor over any location within the boundary of the triangulated model. The plan view coordinates, elevation, and slope of the triangulated model are dynamically displayed in the **Cursor Point Values** portion of the dialog. If the cursor position is outside the limits of the triangulated model, only the **X** and **Y** coordinates of the cursor location are displayed.
- ✓ Issue a Data Point to place the text in the design file. If **Display Only** is toggled off, the slope or elevation text will be written to the file. The text font and size is based on the active MicroStation settings and the active **Model Annotation Scale**.

Tip:

The number of decimal places shown in the **Cursor Point Values** portion of the dialog is based on the GEOPAK User Preferences.

Display options for Elevation Mode

When **Elevation** is selected, the dialog appears as shown below.



Three options are available in Elevation mode:

Show Contour - displays a contour of the same elevation as the selected point.

Show Triangle - identifies the triangle wherein the point is located.

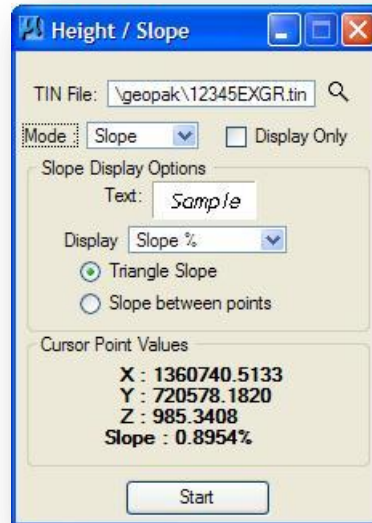
Show Flow Arrow - displays an arrow to indicate direction of flow from the selected point.

To utilize any option, simply activate the toggle to the left of the option, and then select the desired color. The Contour, Triangle, and Flow arrow are dynamically displayed as shown in the example above.

When a data point is issued, the elevation is placed in the design file along with the contour, triangle, and flow arrow options if they are toggled on. If **Display Only** is toggled on, the elements are not written to the file and will be erased from the screen when an update view command is issued.

Display options for Slope Mode

When **Slope** is selected, the **Options** portion of the dialog changes as shown below.

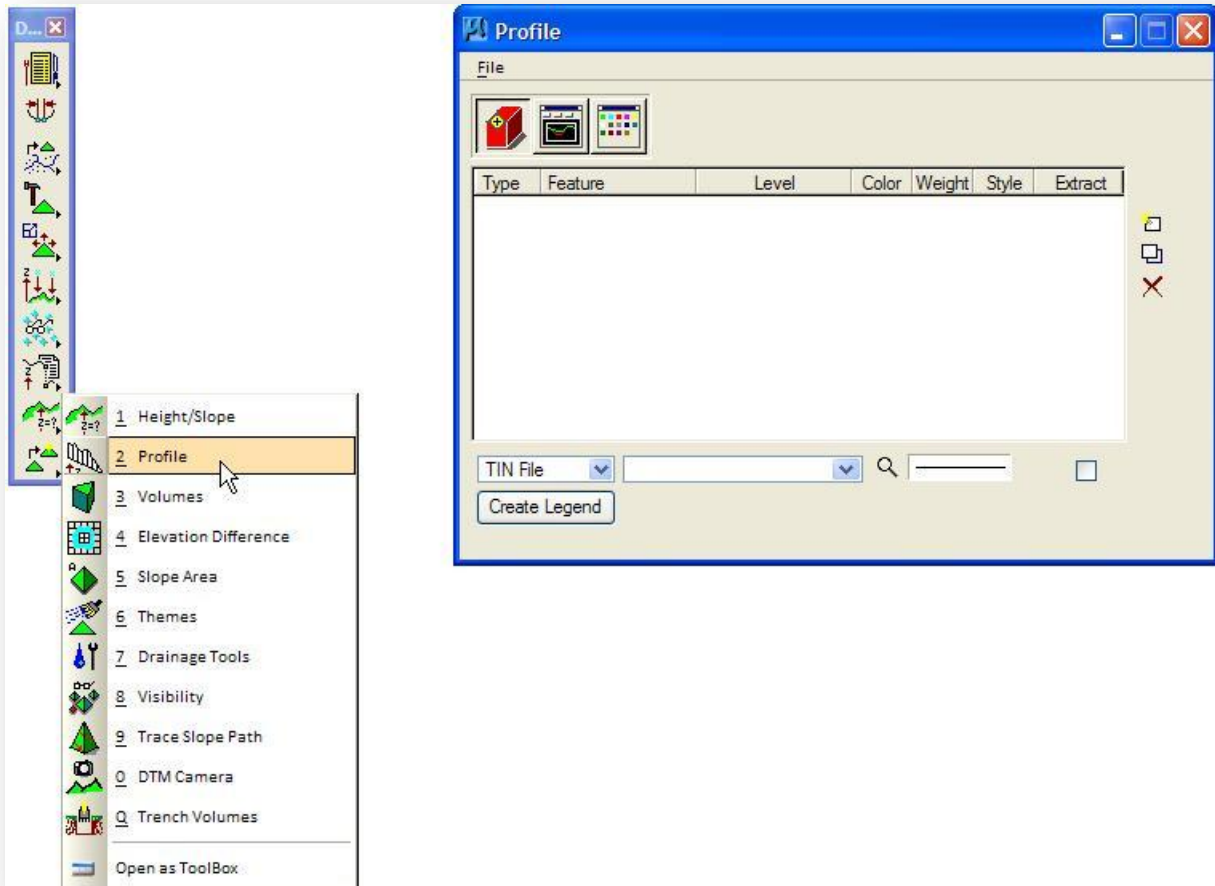


Slopes can be displayed in a variety of formats, such as rise:run, run:rise, percent, and unit/unit. The slope can be specified as the triangle slope at the point of the cursors or between points.

When a data point is issued, the slope value is plotted in the design file. If **Display Only** is toggled on, the elements are not written to the file and will be erased from the screen when an update view command is issued.

2.6 Profile Tool

The **Profile** tool is used to extract a profile from the TIN model along a user defined line or line string. To access the **Profile** tool, select the **Profile** icon from the *DTM* tool frame as shown below.



The main dialog has three tabs:

Object Selection

Used to select the TIN file and set the symbology for the profile.

Create Profile

Used to define the location to extract the profile, and preview the results.

Profile Preferences

Used to set the grid scales, text parameters, elevation, and station ranges for the profile.

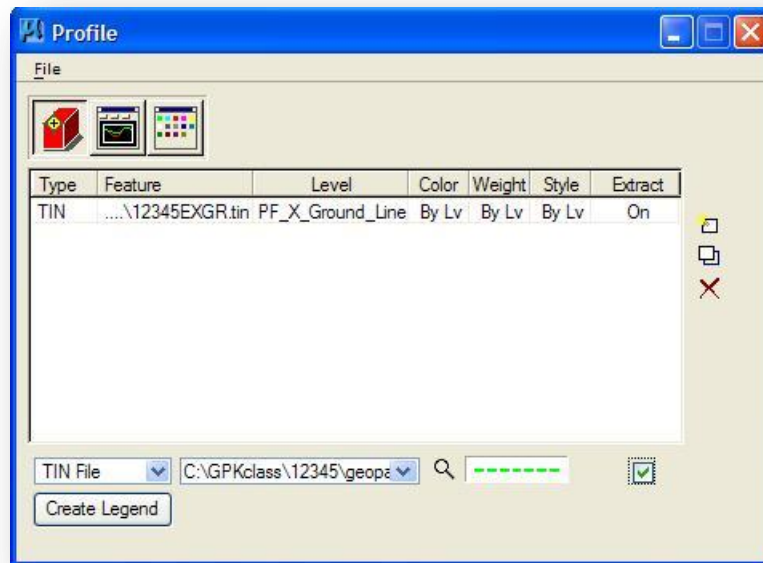
To extract a profile, take the following steps:

- ✓ Identify the TIN file(s) and set symbology for the profile line(s).
- ✓ Select or draw the element whose X,Y values are utilized to generate a profile along the TIN Model. This is accomplished via the **Profile** tab.
- ✓ Set the element symbology and text parameters for the grid. In addition, Minimum and Maximum Stations and Elevations may also be set. This is accomplished via the **Preferences** tab.
- ✓ Generate the profile and view it in the Profile window. Optionally, draw the profile into the MicroStation file. These activities are accomplished via the **Profile** tab.
- ✓ (Optional) Create a Legend or store the profile into COGO via the **Selection** tab.

The **Selection**, **Profile**, and **Preferences** tabs are discussed in more detail on the following pages.

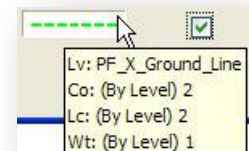
2.6.1 Object Selection Tab

The selection tab, shown below, is used to select the TIN File(s) to use for profile extraction and to set the symbology for the profile line(s).

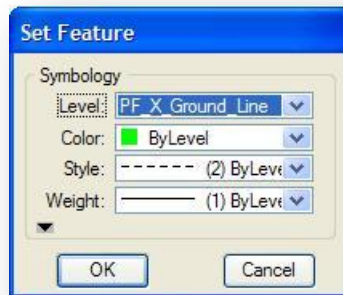


The triangulated model is specified in the **TIN File** key-in field or by using the **Select Files** icon immediately to the right of the key-in field.

The **Symbology** box, immediately to the right of the **Select Files** icon, is used to set the element symbology for the profile lines. Floating your cursor over the symbology box will reveal the current settings as shown at right.



The symbology for the profile line is set by double-clicking the element symbology box to access the *GEOPAK Set Feature* dialog, shown below.



Once you have selected the TIN File, and set the symbology for the profile line, you must add the TIN file name to the list of files to be processed. The three icons to the right of the dialog are used to accomplish this task. Each icon is described below.

 **Add List Item**

Press the **Add** button to add the TIN file to the list of files to process.

 **Modify List Item**

To modify a line that has previously been added to the list box, highlight the line to be modified, change the desired field(s) then press the **Modify** button.

 **Delete List Item**

To delete a line, simply highlight the line then press the **Delete** button.

Create Legend

Once the desired TIN model(s) have been added to the list box, a legend can be created. This is accomplished by clicking **Create Legend** in the lower left corner of the dialog, opening the *Legend Definition* dialog shown below.



Specify the **Title** of the legend along with the **Text** and **Border** parameters. After the symbology is set, click **Place Legend**, which attaches the legend to the cursor. A data point places the legend in the design file.

After a profile has been extracted using the **Create Profile** tab, select the TIN file in the list box to reveal three additional icons, displayed directly below the edit buttons, on the right side of the Selection tab dialog.

 **Show Extracted Points**

When pressed, small circles are displayed in the plan view wherever profile points are extracted. This option is only visible after a profile has been extracted and the line is highlighted in the list box.

 **Export to ASCII File**

Highlight one line within the list box, and then press this button to export the profile based on the highlighted TIN to the user specified File. When pressed, the ASCII File for Exported Profile dialog opens, wherein the file name may be specified. Note the profile element must be selected (or placed) prior to exporting to ASCII. One sample fragment from an ASCII export is illustrated below.

```
0.000 870.553
53.542 870.814
84.516 870.184
158.611 868.678
211.744 868.913
```

The format for the file is Station Elevation.

 **Store to GPK**

This option is only visible after a profile has been extracted and the line is highlighted in the list box. Highlight one line within the list box, then click to create an input file of the profile, based on the highlighted TIN. When pressed, the COGO Input File for Exported Profile dialog opens, wherein the file name may be specified. Note the profile element must be selected (or placed) prior to exporting to ASCII. One sample fragment is illustrated below.

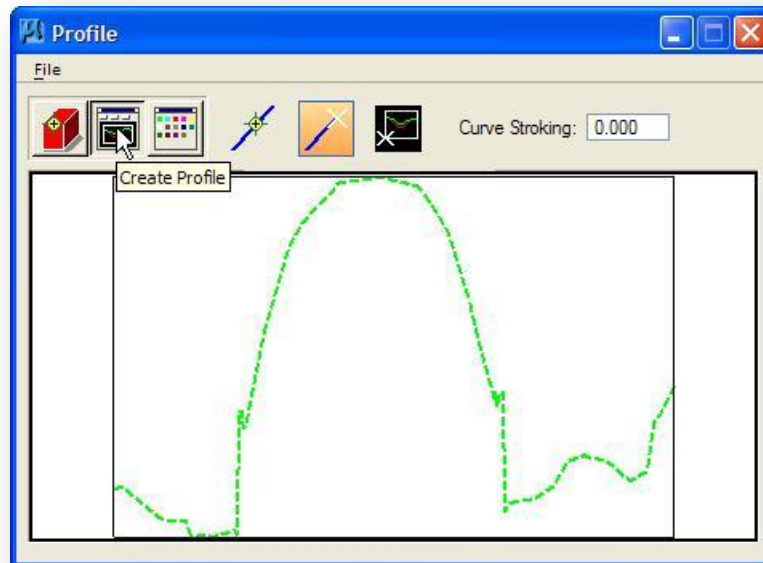
```
STORE PROFILE ????
VPI 1 S 0+00.00 E 870.553
VPI 2 S 0+53.54 E 870.814
VPI 3 S 0+84.52 E 870.184
VPI 4 S 1+58.61 E 868.678
END PROFILE
```

Note the ???? must be replaced with a valid profile name before the file is imported into COGO.

 **Place Extracted Line in 3D**

When pressed, GEOPAK draws a line string denoting the location of the generated profile. This option is only visible in a 3D file after a profile has been extracted and the line is highlighted in the list box.

2.6.2 Create Profile Tab



Three action buttons are available on this tab:

Select Element

Identify a previously drawn MicroStation element, i.e., line, curve, line string, etc., to extract a profile along the element. Once identified, the **Place Profile** button is enabled.

Place Element

Allows the user to identify the profile location by placing a temporary line or line string in the Design File to be used in lieu of selecting a graphic element for which the profile will be extracted.

Place Profile

To place the profile into the MicroStation file, simply press the Place Profile button and select a data point in a blank area of the file. The profile is drawn as depicted below utilizing symbology in the **Preferences** tab.

Curve Stroking

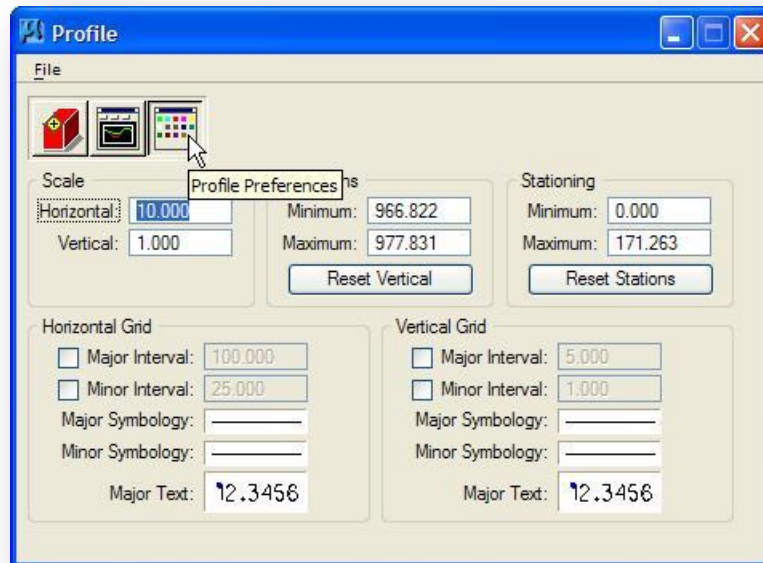
This option is utilized to add interpolated shots along curves, if required.

Extracted Profile View

Once the line has been selected or placed, the profile is fitted within the view window as shown above. Note that all displayed element symbology is defined within the **Preferences** tab.

2.6.3 Profile Preferences Tab

The Preferences tab consists of a variety of element and text parameters discussed below.



Scale

Specify the **Horizontal** and **Vertical** scale utilized to draw the profile. Note the horizontal is drawn to true measurements, while the vertical is distorted.

Elevations

When the **Reset Vertical** button is pressed, the **Minimum** and **Maximum** values from the TIN file are populated in the appropriate fields. The user may choose to round the values in order to draw a complete grid.

Stationing

The profile is stationed from 0.00. Pressing the **Reset Stations** button sets the fields to the beginning and end of the profile element. Once again, to draw a complete grid, the user may round off the values in the fields.

Horizontal Grid, Vertical Grid

These options are used to specify element and text symbology for the horizontal and vertical grid lines. The information is utilized within the Profiles tab and also when drawing the profile into the MicroStation file.

Major Interval is the distance between the major grid lines, while the **Minor Interval** is the number of lines between each major grid. GEOPAK supports unique symbology for both major and minor intervals. The levels SH_Major_Grid_Line and SH_Minor_Grid_Line should be used for **Major Symbology** and **Minor Symbology** values as shown above. Double-click the symbology boxes to set the values.

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3 Coordinate Geometry

3.1 Introduction

The most important component of any GEOPAK design project is the Coordinate Geometry (COGO) database. The database is used to store geometric elements such as points, lines, curves, spirals, chains, parcels and profiles. Survey information, processed through GEOPAK Survey, is also stored in the COGO database. This database is used by various GEOPAK processes for a variety of tasks.

The database is recognized by its file name, job***.gpk, where *** is a one to three alphanumeric character job number.

The following element types are stored in the GEOPAK COGO database:

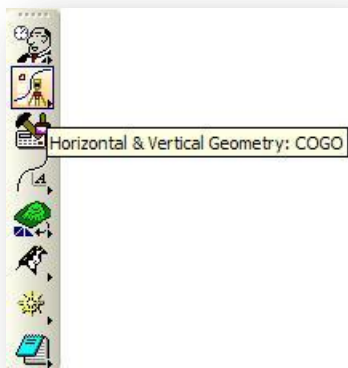
- Points
- Lines
- Curves
- Spirals
- Chains
- Profiles
- Parcels
- Survey chains

This database file is initially created by the Survey personnel for each GEOPAK project. You will normally be provided with a GPK file with your ground survey data. In the event that you do not receive a GPK file with your survey data, a new GPK file must be created for each project. Two element types are stored by GEOPAK Survey: Points and Survey Chains.

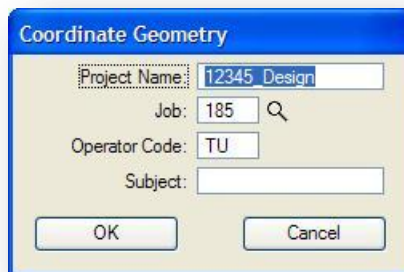
- Survey points represent individual survey shots, such as a telephone pole or an elevation shot that are not connected to another point. Each survey point is assigned a COGO point number and stored in the GPK file.
- Survey chains are comprised of a set of survey points connected together to represent a linear feature such as an edge of pavement or a drainage pipe.

An unlimited number of Points, Curves, Lines, Spirals, Chains, Profiles, Parcels, or Survey Chains can be stored in the GPK file.

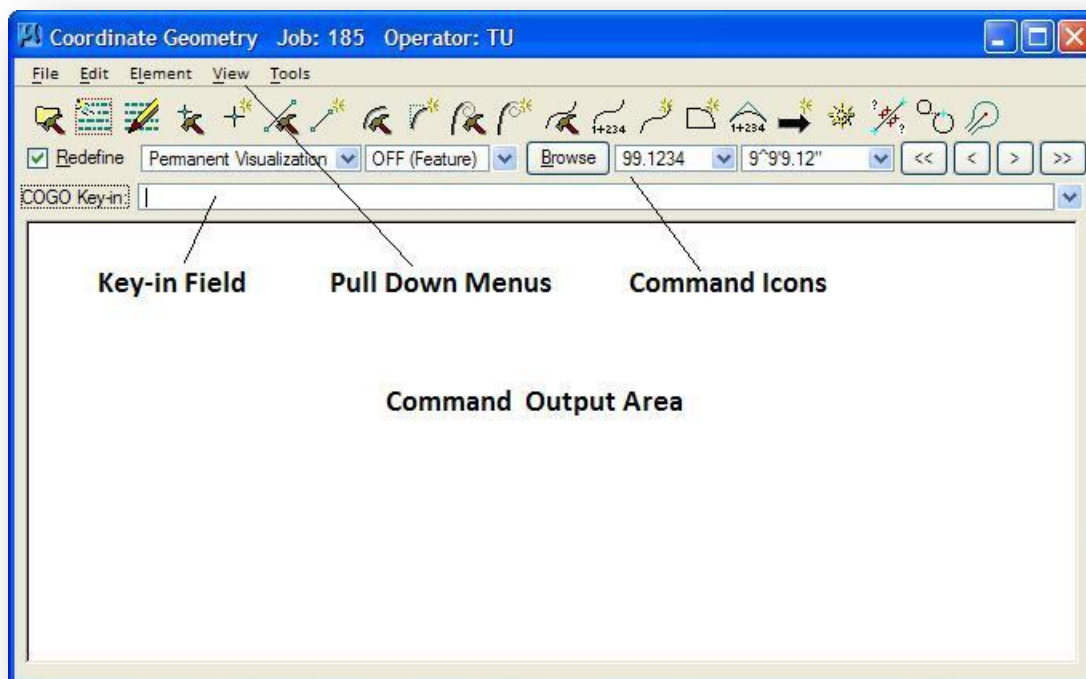
To access the GEOPAK Coordinate Geometry functions, select COGO from the *Road Tools* palette as shown below.



You can also access COGO from the main MicroStation Applications pull down menu by selecting **Applications > Road > Geometry > Coordinate Geometry**.



When COGO is initiated, the *Coordinate Geometry* dialog below will appear:



The window consists of a pull-down menu, icons, a COGO key-in combo box, and a Command Output window. It is resizable by dragging any side or corner. In addition, the entire dialog is completely customizable, for ease of use.

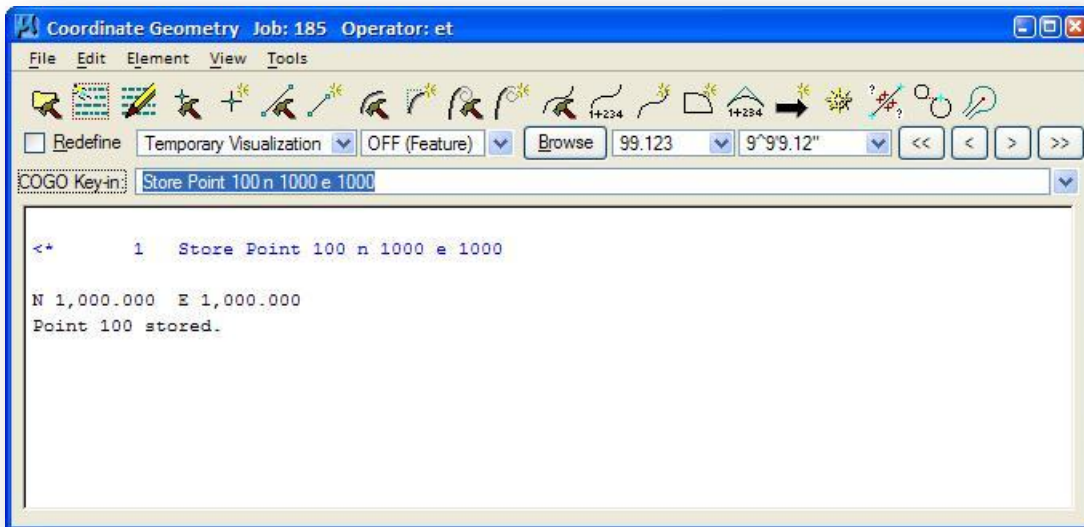
The individual COGO functions can be accessed in a variety of ways as summarized below:

- The pull down menu bar provides a quick and easy method to access various COGO commands via dialogs.
- Commands can be keyed in manually via the COGO Key-in field.
- Commands can be accessed directly via the Command Icons. The icons displayed on the main COGO dialog box can be customized by the user to allow direct access to the most commonly used functions.

Once a command has been executed, the output field is where the results of each command are displayed.

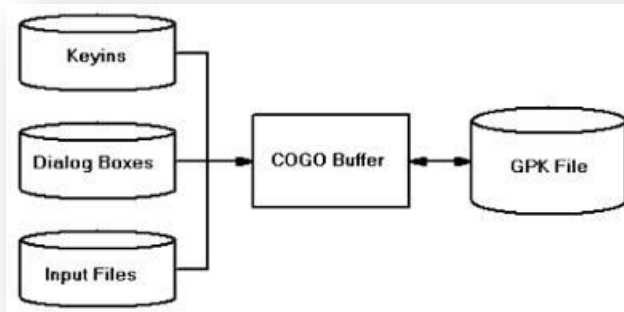
A listing of the previously used commands is available via the drop down menu just to the right of the Key-in field.

An example of a command to store a COGO point, and the resulting output is shown below.



3.2 COGO Processing

When a coordinate geometry command is generated, whether it is via a dialog box or a command line, the command is added to a buffer in memory. The buffer provides an “audit trail” list of all coordinate geometry commands that you have processed during the current session.



When each command is processed, the results are displayed in the coordinate geometry output window.

The audit trail of coordinate geometry commands contained in the memory buffer can be optionally saved into an **Input File**. These input files can be later retrieved and loaded into the buffer whereupon the COGO commands can be edited and reprocessed. See Section 3.12 for more information on saving input and output files.

It is important to note that all COGO elements are immediately stored in the GPK file. It is not necessary to manually “save” the contents of the GPK file before exiting COGO. When exiting COGO, the user is prompted as to whether or not the input file should be saved.



A **Yes** response to this prompt merely saves the input file, as the COGO Elements that were generated as a result of the commands are already stored within the database. A **No** response will exit the coordinate geometry session without saving the contents of the buffer into an Input File.

3.3 COGO Element Naming Conventions

As elements are stored in the GPK file, each element is given a unique name. COGO element names have specific rules that must be followed:

Point names can be alphanumeric, but not numeric-alpha. For example, R2 is supported, however, R2D2 is not. If the point is all numeric, there is a maximum of 8 characters. If it is alpha-numeric, there is a maximum of 15 characters. No special characters (such as hyphen, percent, slash, etc.) are supported.

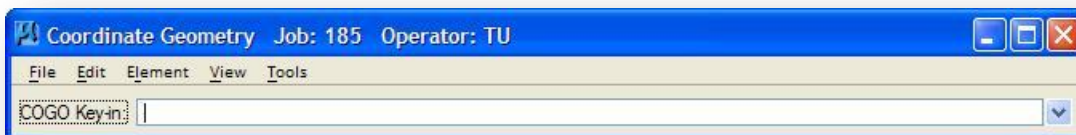
Curves, Spirals, Lines, Chains, Parcels, Profiles, and Survey Chains can have alphanumeric names with a maximum of 15 characters. Underbars and hyphens are supported, but no other special characters.

The ODOT CADD Engineering Standards Manual Section 306 establishes guidelines for standard COGO Element names. The manual is available at the following URL:

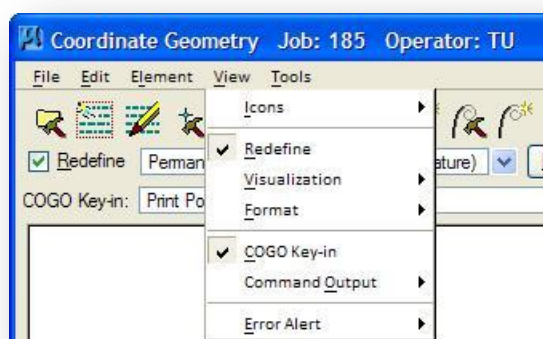
<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/CADDManual.aspx>

3.4 Customizing the COGO Dialog

The COGO dialog can be customized in a variety of ways to facilitate the needs of the individual user. This enables the user to select which icons (if any) are displayed on the screen, display the COGO key-in command line, etc. For example, the COGO dialog could be configured to only display the Key-in field with the pull down menu as shown below:



The customization is easily accomplished via the **View** pull down commands, as shown below.



Icons

Select the icons to be displayed at the top of the COGO dialog. These can be selected by group, (i.e., file, edit, element, etc.) or individually.

Redefine

Displays the define / redefine toggle.

Visualization

Options determine whether COGO commands are temporarily visualized, permanently written into the file, or not displayed. In addition, the feature database file, which controls the visualization symbologies, is specified.

Format

Options for a variety of user parameters are supported, i.e., number of decimal places, station format, etc.

COGO Key-in

Displays the COGO Key-in combo box.

Command Output

Options include text coloring, navigation buttons, and file utilities such as saving and clearing of the output window content.

Error Alert

Audio and visual options when GEOPAK encounters a syntax or operator error.

Within the Icon, Visualize, and Format pull-downs, several common procedures are supported. These are detailed below.

Attach This Group

Attaches all checked items (settings or icons) in the group to the COGO dialog. If a group is attached, an individual item can be added to the COGO display by simply toggling on that item.

Detach This Group

Detaches all checked items (settings or icons) in the group from the COGO dialog. If a group is detached, toggling on an individual item in a group does not add that item to the COGO dialog. The group must be attached before an item is shown in the dialog.

Check All Items

Selection of this pull-down is used to toggle on all items in this group, regardless of their current status. If the group is already attached, the checked items are dynamically added.

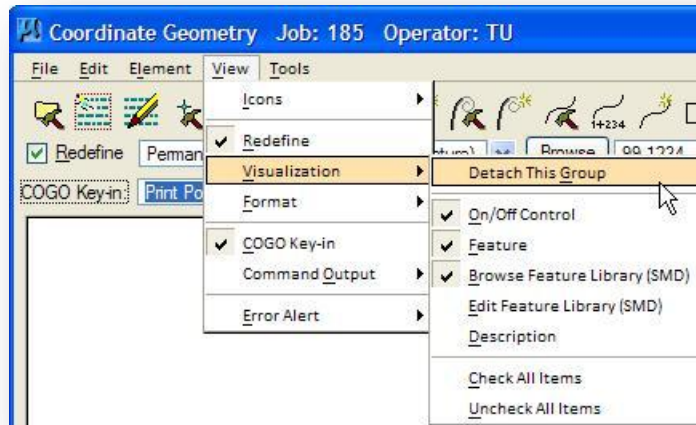
Uncheck All Items

Selection of this pull-down un-toggles all items in this group, regardless of their current status. If the group is already attached, the unchecked items are dynamically removed.

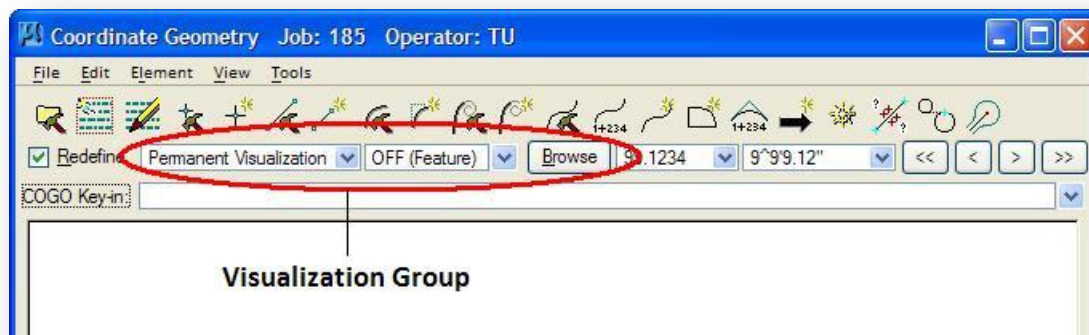
3.5 Visualizing COGO Elements

The visualization tools within GEOPAK are used to display COGO elements as they are stored, or elements that have been previously stored can be redisplayed. These visualization graphics are drawn using features from the currently selected Survey Manager Database (SMD) file. The SMD file is specified by use of the GEOPAK User Preferences dialog box.

The visualization group can be customized, attached or detached by selecting **View > Visualization** from the *Coordinate Geometry* dialog as shown below.



In the example above, **On/Off Control**, **Feature**, and **Browse Feature Library (SMD)** are toggled on. Each option is displayed on the main COGO dialog as shown below.



Visualization On/Off Control

The **Visualization On/Off** Control will allow you to select how COGO elements are placed in the design file. Three options are available as detailed below.

Disable Visualization

When a COGO element is stored, no visualization graphics will be displayed in the design file.

Temporary Visualization

When a COGO element is stored, visualization graphics will be drawn in the design file for the element. These graphics are temporary graphics and will be removed from the file upon exiting COGO.

Permanent Visualization

Elements drawn with **Permanent** visualization are written to the design file and will remain in place upon exiting COGO.

Use **Permanent** mode if you are drawing the survey data in a new design file or adding additional existing features to the GPK file.

Use **Temporary** mode if you are drawing proposed information. This information will be plotted to the design file permanently by use of the D&C Manager, covered in section 5 of the training guide.

Tip:

Regardless of the type of visualization (Temporary or Permanent), GEOPAK can visualize to a level that is not active, in which case the visualized element does not appear. Therefore, verify that levels being visualized are active, as GEOPAK does not activate them automatically.

Feature

In this key-in combo box, located to the right of the **Visualization On/Off Control**, the active feature is displayed. The feature name may be typed in or selected using the **Browse** button. Once a feature has been selected, a history list of the session is created on the pull down, enabling the user to reselect previously utilized features. Two default options are displayed within the **Feature** field: **Off** and **Delete**, which correspond to command line options from prior versions of GEOPAK.

When the **Off** option is set, any element subsequently stored does not have a Feature attached. This is also a useful setting when modifying points which were assigned several different features. For example, several points need to have their coordinates modified, but some are trees, others are power poles, some are light poles. Rather than changing each feature as you are editing, simply set the **Feature** to **Off**. The original stored **Feature** is maintained while you edit the required data. The **Delete Feature** deletes any feature on subsequent commands, or does not attach features to newly stored elements.

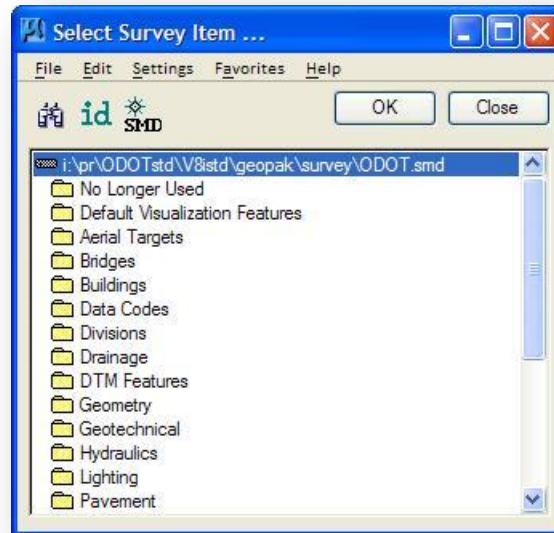
Drawing Elements with the default feature (Feature OFF)

In the event that no feature is selected (Feature Off), GEOPAK will draw Temporary and Permanent visualization graphics using default features for each element type (points, curves, spirals, chains and parcels). The default features have been defined as follows in ODOT.smd:

COGO Feature	Level	Weight	Color	Line Code	Cell
Points	GK_Visualization	1	3	NA	X
Curves	GK_Visualization	1	6	0	NA
Spirals	GK_Visualization	1	1	0	NA
Chains	GK_Visualization	1	3	0	NA
Parcels	GK_Visualization	1	2	0	NA
Easement	GK_Visualization	1	18	0	NA
Taking	GK_Visualization	1	21	0	NA
Lines	GK_Visualization	1	7	0	NA
Survey Feature	Default	2	3	NA	NA

Drawing Elements by Selecting an active Feature

If you wish to store COGO elements with a feature from the Survey Manager Database file (SMD), The **Feature** field can be used to key in the name for the active feature, or the **Browse** button can be used to select a feature from the current SMD file. Selecting the **Browse** button will access the *Select Survey Item...* dialog shown below.



Select the item from the SMD file that you wish to designate as the active feature. The COGO dialog will reflect the selection as shown below.



The active feature has been set to **T** for a Tree. All COGO Graphics will be plotted using this feature until it is changed or turned off.

Since the features used for Visualization are taken from the Survey Manager Database file (SMD), only features corresponding to existing topographical information are available. Proposed items are not available in the SMD file.

3.6 Redefine

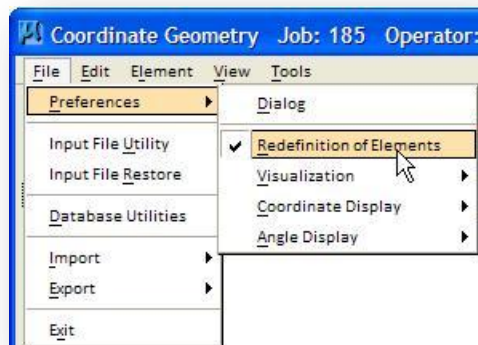
As elements are stored in COGO, each element is given a unique name. If an element is stored with a name that already exists in the GPK file, the user must instruct the software whether to overwrite the previous definition of the element or not. This is accomplished with the **Redefine** option.

When the **Redefine** option is toggled on, an element stored with the same name as a previously stored element will overwrite the previous definition. You are not prompted whether you would like to redefine the element.

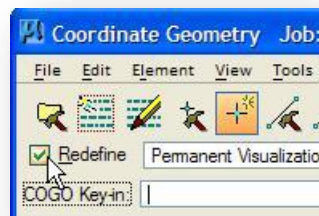
If **Redefine** is not toggled on, any attempt to overwrite previously stored data will not be processed and a "Data Already Exists" message is displayed. The new definition of the element is not stored in the database.

The Redefine option can be turned on/off in one of two ways:

- From the COGO dialog, select **File > Preferences > Redefinition of Elements** to toggle the current value off or on



- Select **View > Redefine** to display the **Redefine** toggle on the face of the COGO dialog. The status can be toggled on/off using the check box.

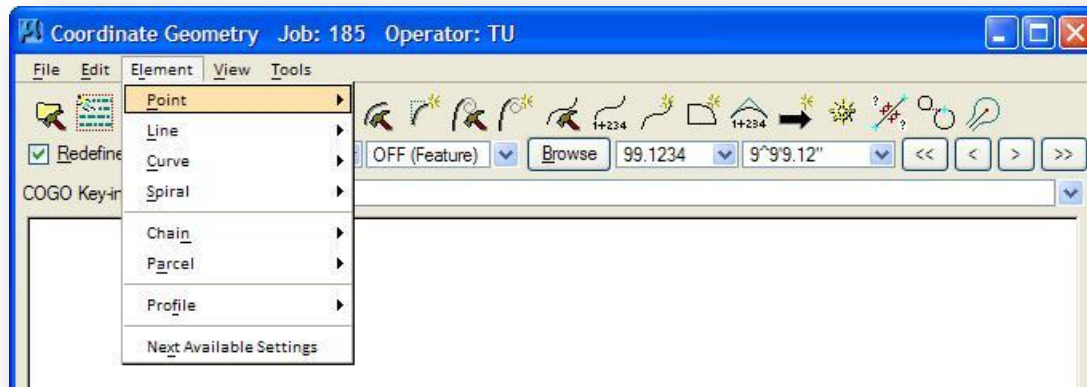


Tip:

It is good practice to leave the Redefine option toggled off until it is specifically needed. If Redefine is left toggled on, and COGO element stored with the same name as a previously stored element will overwrite the previous definition of the element. There is no "undo" in COGO.

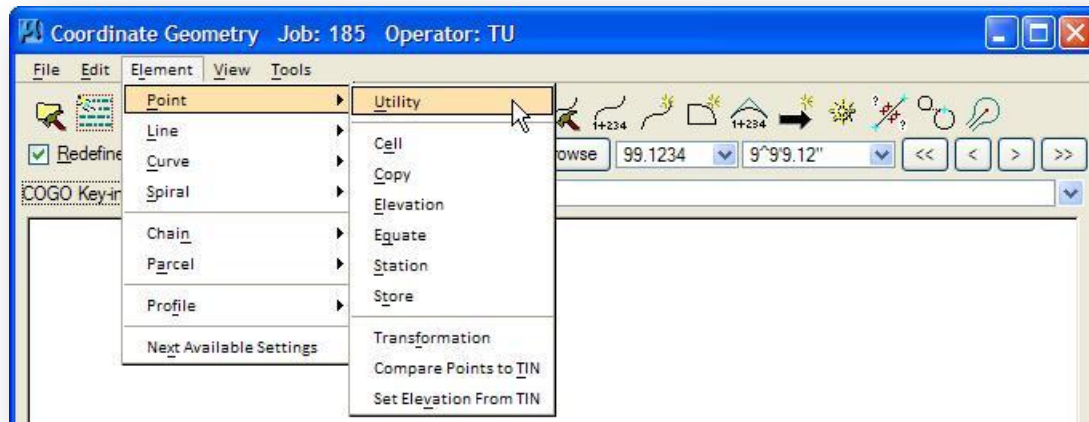
3.7 The COGO Element Menu

The **Element** commands are the foundation for GEOPAK Coordinate Geometry. These commands are used to store, modify, and view reports on the various elements stored in the database.



This section will provide a summary listing of the commands used to store COGO elements. Documentation for the individual commands can be found in the GEOPAK online help.

3.7.1 Element Menu: Point Commands



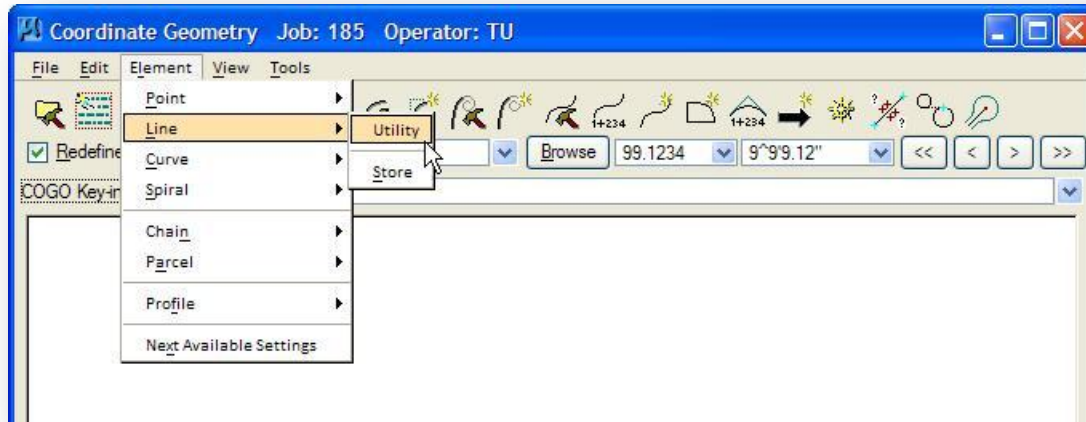
The most basic command in GEOPAK coordinate geometry is the storing of points. Numerous formats and various types of data (i.e., coordinates, stationing, elevations, cells) can be combined to provide the designer with maximum flexibility. The required information to store a point is an alphanumeric point number and N/E or X/Y coordinates. If the coordinates must be computed at a distance and direction from another point, then a locate command rather than a store command will be used. Once a point has been stored, it can be recalled to view the coordinates, printed in an output file, or used to compute other points.

There are two types of point elements, COGO points and Survey points. COGO points are generated via the GEOPAK Coordinate Geometry point options. Survey points are stored by GEOPAK Survey when the survey data is processed.

The following commands are available from the Points menu:

Utility	Displays a list of all stored points, has options for deleting, printing, or visualizing points
Cell	Associates a cell to a previously defined point
Copy	Copies points or a point range to a new point number or range within the same GPK file
Elevation	Adds an elevation to a previously defined point
Equate	Stores a new point with the same values as a previously defined point
Station	Stores the specified station to a previously defined point
Store	Stores a point in the GPK file
Transform	Routines to transform a set of points into a new coordinate system
Compare Points to TIN	This reporting tool compares the elevation to selected COGO points to the TIN elevation of the same X, Y coordinates
Set Elevation from TIN	The Set Point Elevation by TIN Surface tool adds or updates an elevation to a previously defined point, based on a TIN model

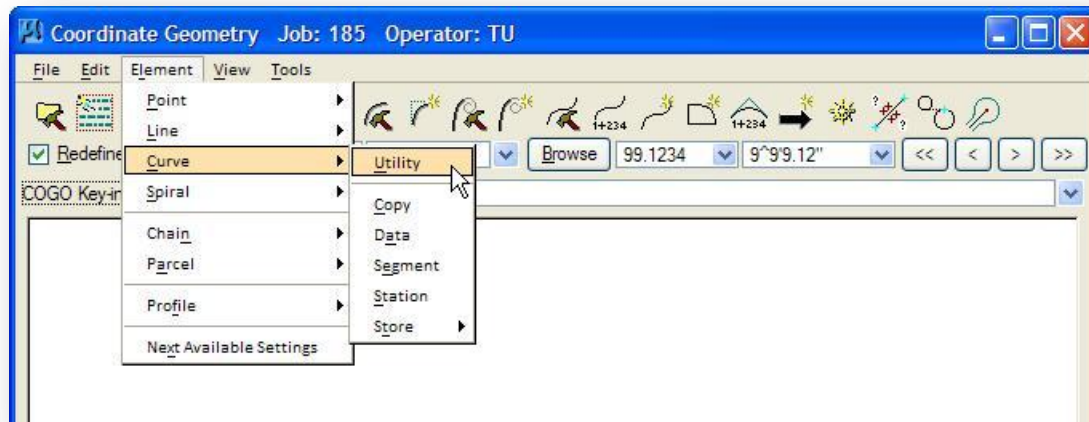
3.7.2 Element Menu: Line Commands



The following tools are available for Lines:

Utility	Display, Transpose, Delete, Print, or Visualize previously stored lines
Cell	Stores a line based on one point and a direction, or two points

3.7.3 Element Menu: Curve Commands



A Curve is defined in GEOPAK as a segment of a circular arc in the horizontal plane. Curves can be defined by arc definition (central angle which subtends a 100 ft. arc) or chord definition (central angle which subtends a 100 ft. chord). Alphanumeric names up to 15 characters can be assigned to each curve. Delta angles greater than 180 degrees are supported in GEOPAK.

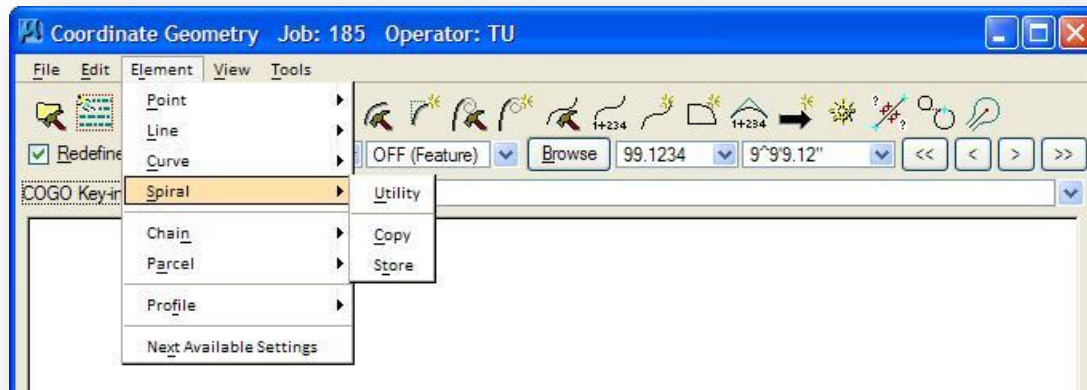
The following curve commands are supported via the Curve menu:

Utility	Display, Transpose, Delete, Print, or Visualize previously stored curves
Copy	Copies a specified curve to another curve name
Data	Calculates the geometric parameters of a curve between two given points
Segment	Defines new curves by dividing a stored curve into segments
Station	Defined the stationing for the selected curve element
Store By Tangents	Defines and stores a circular curve using optional directions and curvatures
Store By End Points	Defines and stores a circular curve from the PC and PT
Store Concentric	Defines and stores a new curve as an offset from a previously defined curve

Additionally, the following key-in only commands are documented in the GEOPAK on-line help:

Station on Curve	Re-stations a Point by projecting the point radial to the curve
Store Curve Thru	Stores a circular curve passing through three previously stored points
Store Curve as Circle	Store a circular curve by use of the center or radius point and the radius distance
Locate Tangent to Curve	Store a new point on a curve at the point of tangency of a line

3.7.4 Element Menu: Spiral Commands



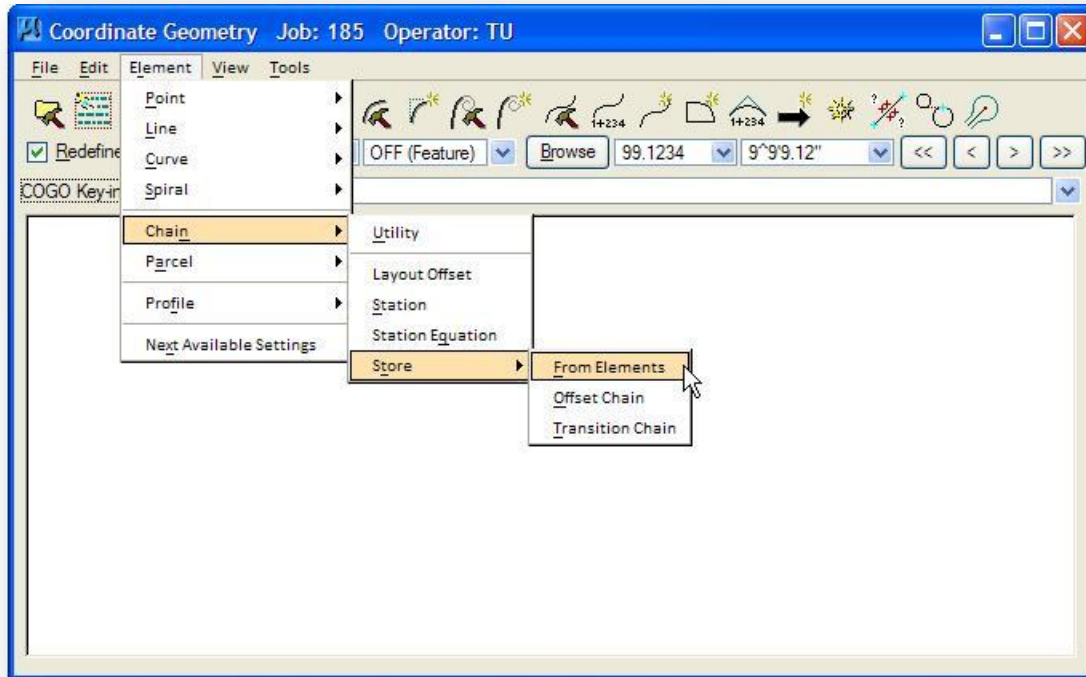
Spirals are transitional curves which provide a gradual change in curvature between a tangent and most circular curves or between circular curves of substantially different radii. The transition curve length provides a natural path for drivers and a convenient location for superelevation runoff. The Euler or clothoid spiral is used in GEOPAK. The following Spiral commands are supported via the pull down menu:

Utility	Display, Transpose, Delete, Print, or Visualize previously stored spirals
Copy	Copies a specified spiral to another spiral name
Store	Stores three geometric elements: back spiral, circular curve and ahead spiral

Additionally, the following key-in only commands are documented in the GEOPAK on-line help:

Store Spiral-Type 1	Stores spirals from a tangent to a circular curve
Store Spiral-Type 2	Stores spirals from a circular curve to a tangent
Store Spiral-Type 3	Stores spirals from a flatter curve to sharper curve
Store Spiral-Type 4	Stores spirals from a sharper curve to flatter curve
Spiral Data	Calculate the geometric parameters of a spiral
Offset From Spiral	Calculate and display the radial offset distance from a spiral to a point(s)

3.7.5 Element Menu: Chain Commands



GEOPAK **Chain** Commands create and store horizontal alignments composed of stored points, curves, spirals, SCS curves, shifts and other chains. Each new element is connected or linked to the previous one, forming an ordered succession of links to be stored in the database. The following Chain commands are supported via the pull down menu:

Utility	Display chains, Compute Area, Describe, Delete, Print, and Visualize chains
Layout Offset	Compute station, offset, distance and direction between two chains or a chain and a point(s)
Station	Re-stations the chain starting from the specified element
Station Equation	Store a station equation on the chain
Store From Elements	Store a new chain by linking elements
Store Offset Chain	Compute and store a chain parallel to a stored chain
Store Transition Chain	Store a chain comprised of a series of station/offset values from a stored chain

3.7.6 Stations and Station Equations

In GEOPAK COGO, the station values are stored with the individual COGO elements. The Chain is merely a list of COGO elements (points, curves, and spirals) that are connected to define the chain.

When storing a chain, the **Store Chain from Elements** dialog provides three options to assigning the stationing to the elements that make up the chain:

Begin at 0.00

The **Begin at 0.00** option ignores stationing values previously assigned with the individual elements and assigns station 0+00 to the beginning of the chain. Every element in the chain is redefined with a new station value relative to the beginning station of 0+00.

Begin Station

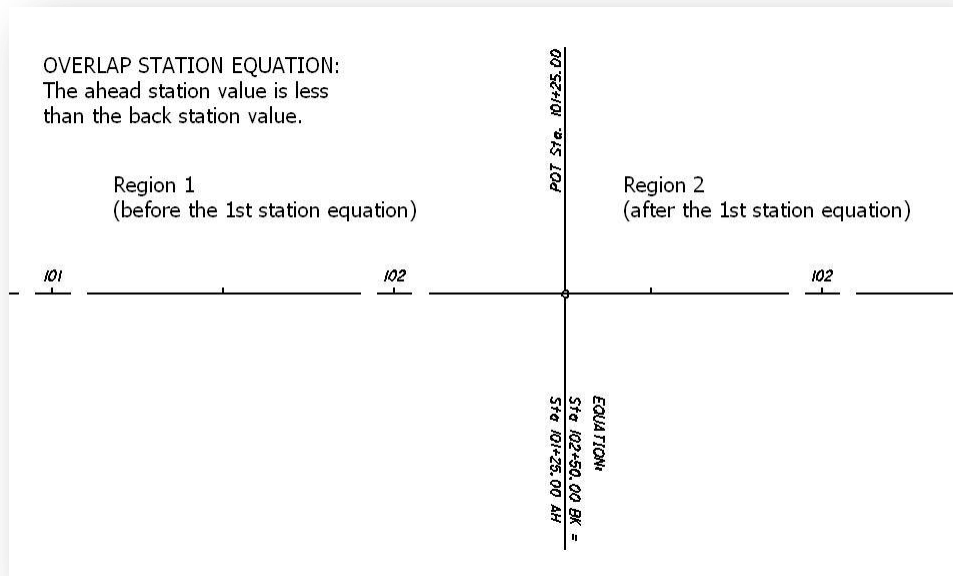
The **Begin Station** option is used to key in a specific beginning station for the chain. This option ignores stationing values previously assigned with the individual elements and assigns the station keyed in by the user to the beginning of the chain. Every element in the chain is redefined with a new station value relative to the beginning station.

As Is

The **As Is** option preserves the station of each individual element. Care must be exercised when utilizing this option, as any inconsistencies in stationing from one element to the next will result in the addition of a station equation. **This option is not recommended.**

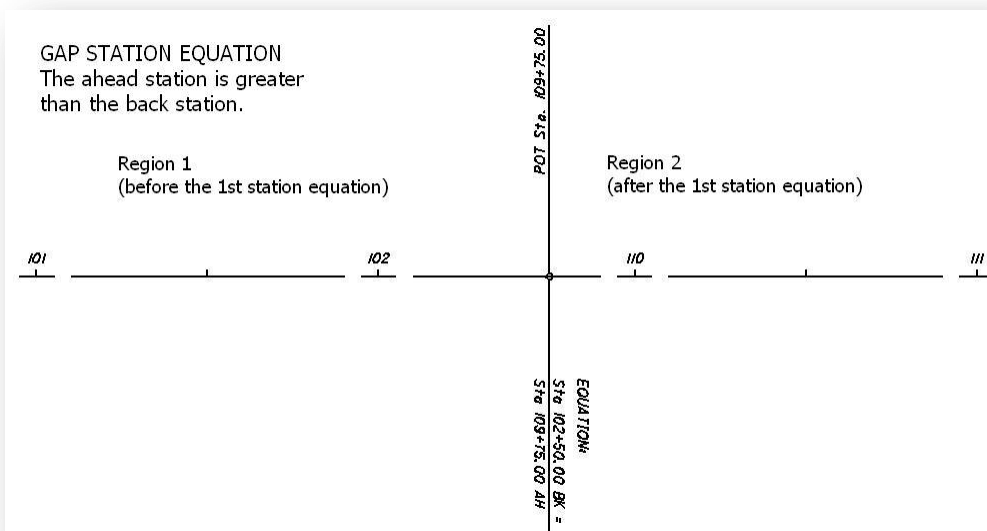
Station equations can be stored at any point on a GEOPAK chain with the exception that equations are not permitted within the limits of a spiral. There are two types of equations as shown on the following page:

Overlap Station Equations



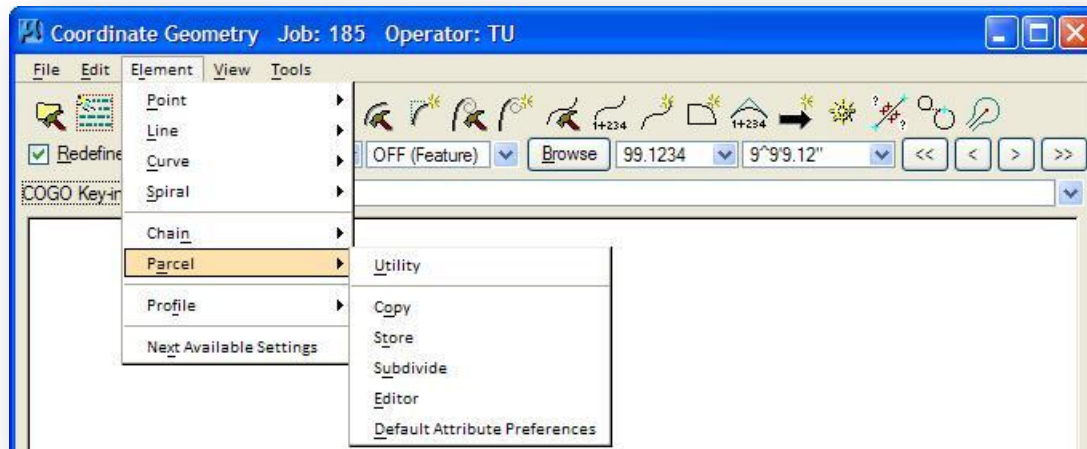
Overlap station equations present the possibility of the same station occurring more than once on the chain. In the example below, station 102+00 occurs before the station equation and after the equation. In order to differentiate between the two stations, GEOPAK treats each portion of the chain as a “region”. Station 102+00 before the equation is designated as “102+00 R 1”. Station 102+00 after the station equations is designated as “102+00 R 2”.

Gap Station Equations



It is not necessary to specify the region number with Gap station equations.

3.7.7 Element Menu: Parcel Commands



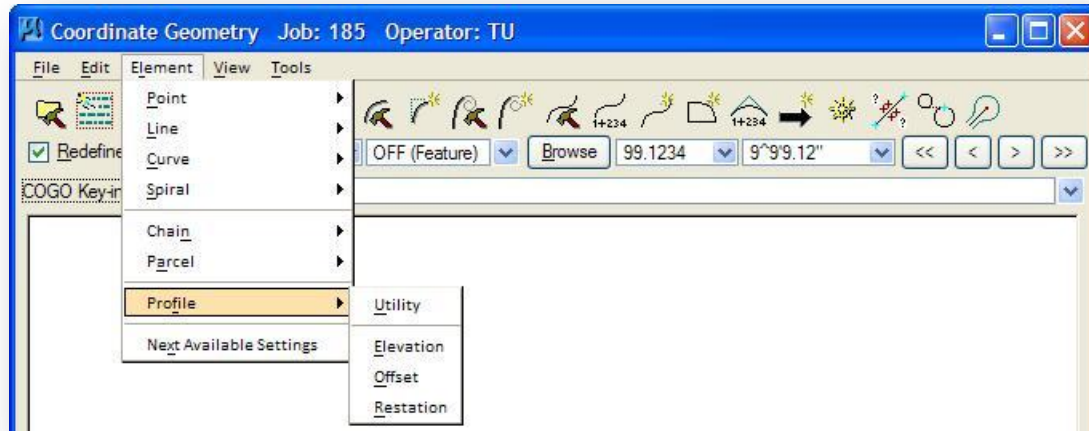
The GEOPAK parcels component can store property lines, taking lines, easement lines and building outlines. Property lines define the border of public or private property. Taking lines are typically proposed right-of-way lines associated with the new or expanded roadway project. Easements are used to supplement the right-of-way requirements for use on lands outside the roadway right-of-way for temporary construction purposes, permanent drainage and/or utility maintenance.

Areas are calculated for closed parcels. These areas include the parcel area, the area taken from the parcel subsequent to the definition of a taking line, the area remaining in the parcel subsequent to the definition of a taking line, and easement areas. For an open parcel, areas are not calculated but the elements of the open parcel are stored.

Optionally, the user can substitute user defined phrases for the default wording in the legal description.

The Parcel commands are not covered in this training class.

3.7.8 Element Menu: Profile Commands



Profile Commands are components of GEOPAK which are used to store vertical alignments and to define a series of grade lines, each of which intersects at a Vertical Point of Intersection (VPI), with or without parabolic vertical curves. All distances along vertical curves are measured horizontally so that the length of a vertical curve is expressed as its horizontal projection. A vertical curve is said to be symmetrical when the tangents are equal in length and asymmetrical when these tangents are unequal.

Utility	Display, print, and delete previously stored profiles
Elevation	Compute elevations along a profile
Offset	Generate and store a new profile at a vertical offset from a previously stored profile
Restation	Create a profile from a previously stored profile using the station defined by the user

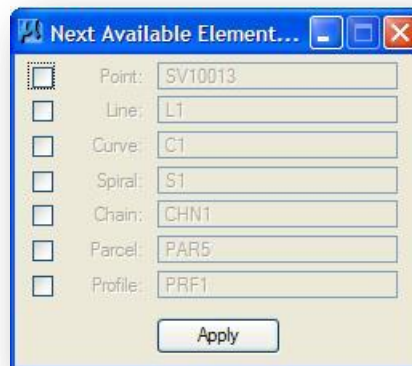
Storing proposed profiles is best accomplished via the Vertical Alignment Generator. See Chapter 8 for information on the Vertical Alignment Generator.

3.7.9 Element Menu: Next Available Settings



When any tool requiring an element name is opened, the next available element name is used as the default. However, the user has the option to change to any supported element name.

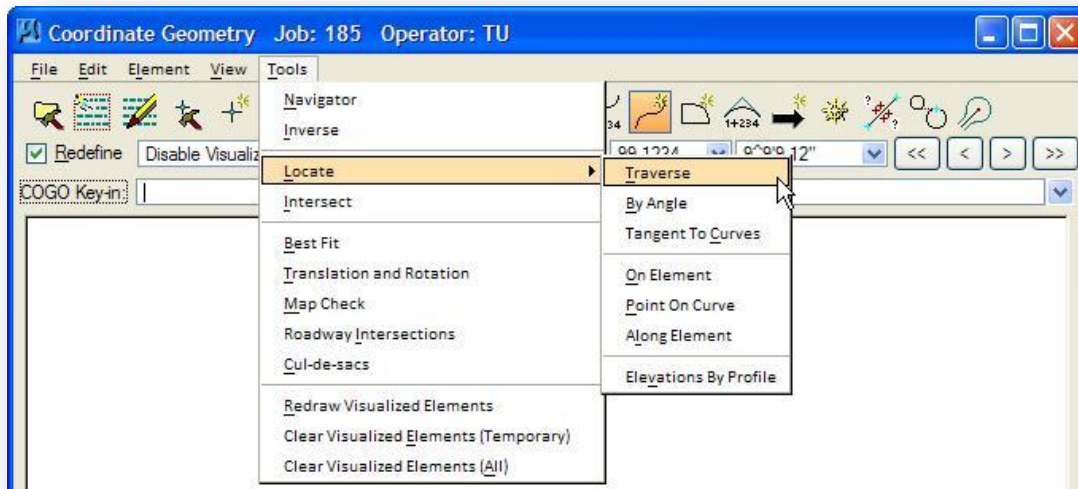
The user may set the next available element name by toggling on the element in the Next Available Settings, then entering the appropriate value.



If GEOPAK encounters a name already in use, the next available feature skips over the already used name and does not overwrite current data regardless of the current setting of the Redefine toggle. For example, if the next available point name is 6, and points 8, 9, and 10 are already used, GEOPAK utilizes 6 and 7, then skips to point 11 with no message given.

3.8 The COGO Tools Menu

The tools menu provides a variety of useful functions. Each function is briefly summarized below. A detailed description of each command is available via the GEOPAK on-line help. Select **Applications > Road > Help** to access the on-line help. From the help dialog, select **Command Reference > Geometry > Coordinate Geometry > Command Reference > Tools** to view detailed information on the commands listed below.



Navigator

The **Navigator** is used to assist viewing, storing, manipulating, and editing coordinate geometry elements. See Section 3.9 for more information on use of the **Navigator** tool.

Inverse

The **Inverse** command computes and displays the distance and direction between each pair of specified points.

Locate

Locate Commands enable the user to locate and store point(s) by reading and processing from previously stored points, geometry and/or stationing. The following commands are available:

Traverse	Locate a new point at a direction and distance from another point
By Angle	Locate a point at an angle from a line formed between two points
Tangent to Curves	Locate and store two points at the tangent between two arcs
On Element	Store a new point on a previously stored curve, spiral or chain
Point on Curve	Store a new point on a curve from a point on the curve
Along Element	Store new points along a line, curve or chain
Elevations by Profile	Assign elevations to point(s) based on a specified chain and profile

Intersect

The Intersect commands enable the user to locate and store point(s) by reading and processing from previously stored points, curves, lines, spirals and chains, all from one dialog. The following intersections are supported:

Line-Line Intersection	Line-Arc Intersection	Line-Curve Intersection
Line-Spiral Intersection	Arc-Arc Intersection	Arc-Spiral Intersection
Curve-Curve Intersection	Curve-Spiral Intersection	Line-Chain Intersection
Curve-Chain Intersection	Spiral-Chain Intersection	Chain-Chain Intersection

Best Fit

Based on a series of points, error estimates, and optional offsets, GEOPAK computes the best fit alignment utilizing a least squares methodology.

Translation and Rotation

Translate and rotate coordinates within a coordinate geometry database.

Map Check

The Map Check / Store Parcel tool enables the user to store or edit parcels (based on directions, distances, and curve data), and compute closure. Parcels can be loaded from the coordinate geometry database or manually typed in. Once a parcel is complete, pressing the Store Parcel stores or updates the parcel in the database.

Roadway Intersections

Based on user-supplied data, the Intersection tool draws a wide variety of roadway or right-of-way intersections and stores the geometry data within the coordinate geometry database.

Cul-De-Sacs

The Cul-de-sac tool enables the user to store a variety of cul-de-sacs based on user-defined inputs.

Redraw Visualized Elements

When selected, all visualized elements are redrawn. If the location of an element in the design file does not correspond to its coordinates in the database, the element is redrawn utilizing the database information.

Clear Visualized Elements (Temporary)

When selected, all temporary visualized elements are deleted. Please note that elements are not deleted from the database.

Clear Visualized Elements (All)

When selected all temporary and permanent visualized elements are deleted. Please note that the elements are not deleted from the database.

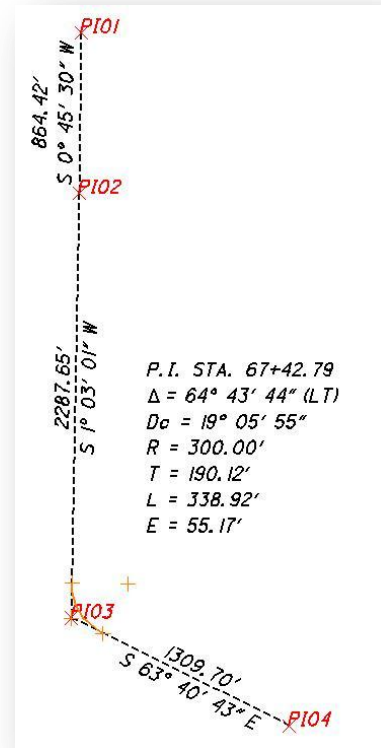
Exercise 3A – Existing State Route 185

The approximate centerline for the existing S.R. 185 has been provided from the Survey department. Using the data provided below, store a chain named CLXS185.

- ✓ Store point PI01 first, using these coordinates:
N 723481.9012 E 1360611.9275
- ✓ Store points PI02-PI04 using the **Locate > Traverse** command with the bearings and distances listed at right.
- ✓ Store a curve named XS18503 using point PI02 as the backsite, point PI03 as the point of intersection and point PI04 as the ahead point. Use a radius of 300' to store the curve.
- ✓ Store a chain named CLXS185 using points PI01, PI02, PI04 and curve XS18503. Assign a beginning station of 35+90.72 when you store the chain.

After you have stored the chain, use the **Describe Chain** command to review chain CLXS185 and answer the following questions:

1. What is the station at point PI02? _____
2. What is the station at point PI04? _____



Exercise 3B – Existing Jameson Road

The survey department has also provided a tangent line down the center of Jameson Rd. Store a chain named CLXJAME using the information provided below.

- ✓ Store points PI05 and PI06 with the following coordinates:

Point Name	Northing	Easting
PI05	720,519.84	1,360,097.80
PI06	720,330.15	1,360,542.17

- ✓ Store chain CLXJAME using points PI05 and PI06. Set 10+00 as the beginning station.

After storing the chain, answer the following questions:

1. What is the bearing and distance from point PI05 to PI06?

Bearing: _____ Distance: _____

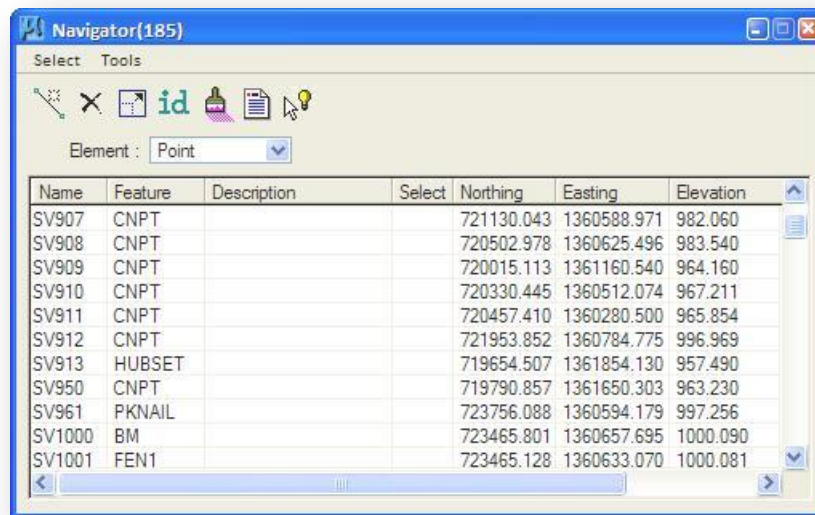
2. What is the station at point PI06? _____

3.9 The COGO Navigator

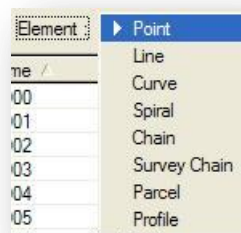
One of the most useful tools in the GEOPAK Coordinate Geometry software is the COGO Navigator. This one tool can be used for a variety of functions as summarized below:

- Store new COGO elements.
- Review/modify previously stored COGO elements.
- Delete COGO elements.
- Visualize individual or all COGO elements.
- Describe COGO elements.
- Select groups of elements, based on user defined search criteria, for further manipulation.

The *Navigator* dialog, shown below, is accessed by selecting **Tools > Navigator** from the *GEOPAK Coordinate Geometry* dialog box.



In order to use the navigator, the type of element to be reviewed edited or manipulated must be selected. The **Element** option button is used to select the element type as shown below.



As each element type is selected, the list box displays all specified elements within the current coordinate geometry database. For example, if Point is selected, all of the COGO points stored in the GPK file are displayed in the list box as shown above.

Just above the **Element** option button, a row of command icons is available for basic element storing and manipulation.

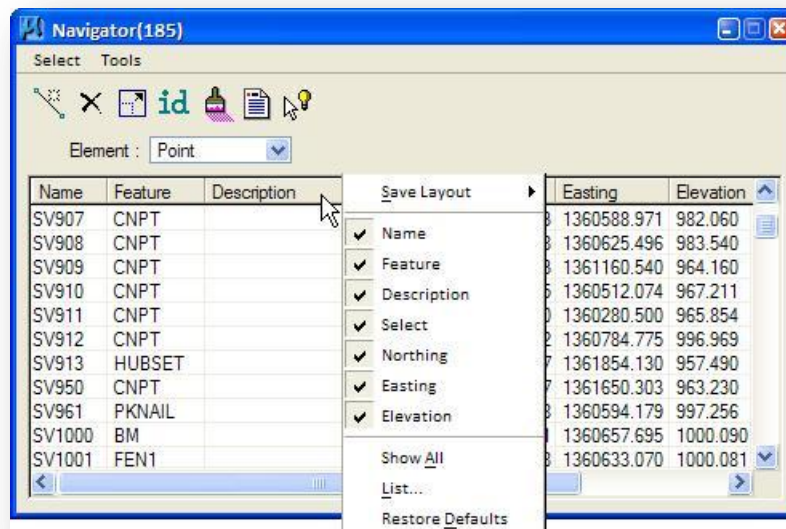


From left to right, the icons represent the following commands:

- Add Element
- Delete Element
- Edit Element
- Identify Element
- Visualize Element
- Print/Describe Element
- Create a selection set

Each of these commands work in conjunction with the currently selected element type.

The *Navigator* dialog is resizable and the columns can be customized by right-clicking on the column heading to access the menu shown below.

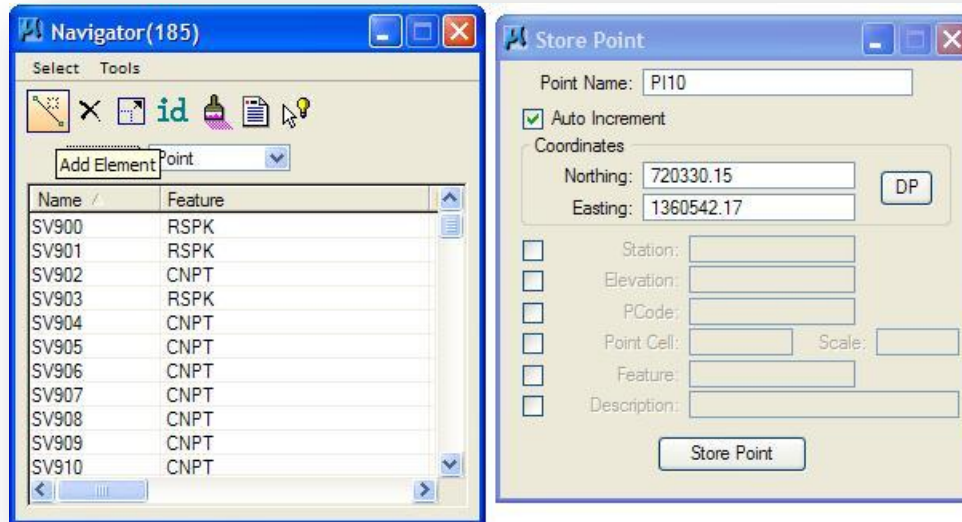


Up to four different dialog configurations can be stored for each Element type by use of the **Save Layout** option. Once a custom layout has been saved, it is available for recall on the menu.

The **Restore Defaults** command is used to restore the Navigator dialog to its default display configuration.

3.9.1 Add Element

With the **Element** option toggled to **Point**, selecting the **Add Element** button opens the *Store Point* dialog box as shown below.

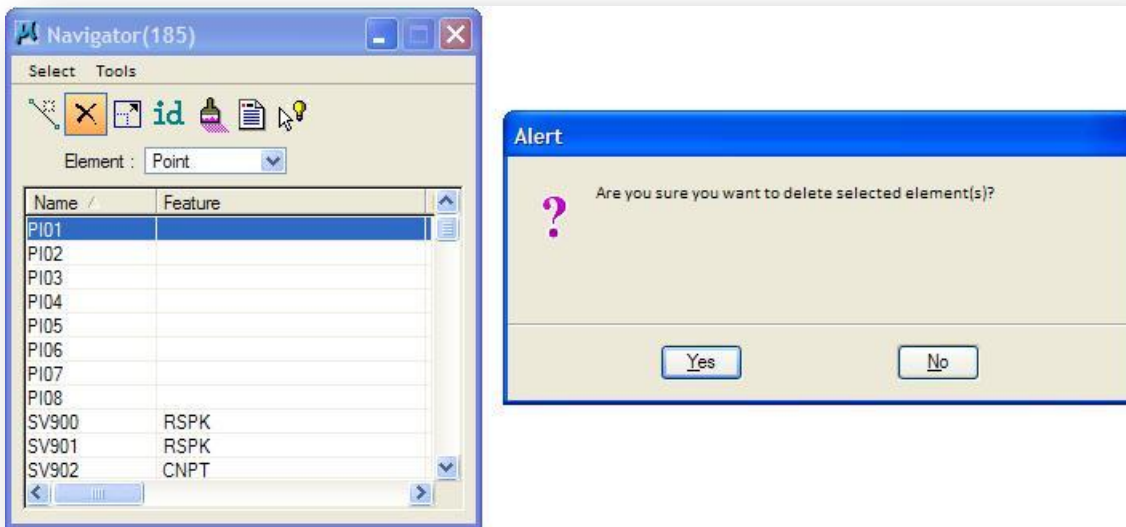


For each Element type, selecting the **Add Element** icon activates the following COGO Dialog boxes:

Point	<i>Store Points</i>
Line	<i>Store Line</i>
Curve	<i>Store Curve from Tangents</i>
Spiral	<i>Store Spiral from Tangents</i>
Chain	<i>Store Chain from Elements</i>
Survey Chain	This option is not available unless GEOPAK Survey is installed.
Parcel	<i>Store Parcel</i>
Profile	Invokes Vertical Alignment generator

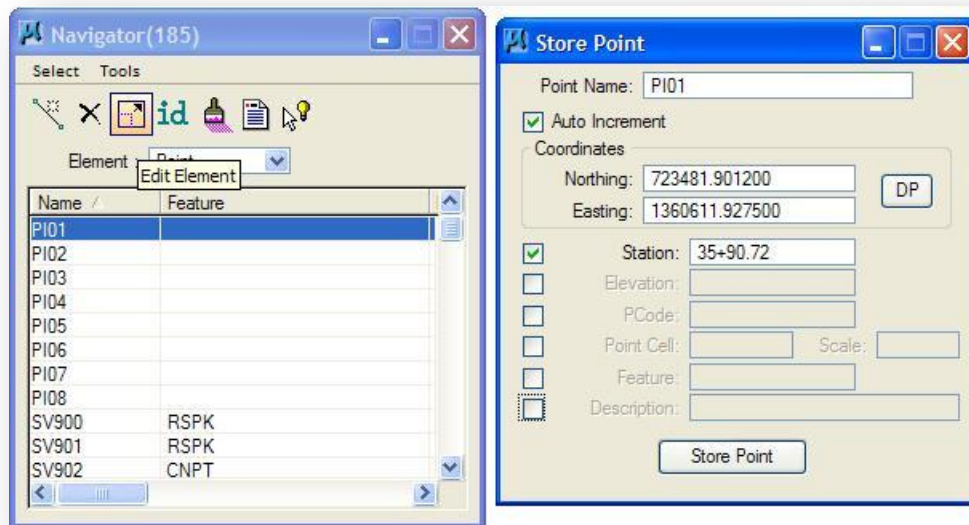
3.9.2 Delete Element

The **Delete Element** icon is used to delete the select COGO element. In the example below, the curve E185 is selected and will be deleted by executing the **Delete** icon. The software will prompt the user before executing the command, as shown below, depending on the status of the **Redefine** toggle.



3.9.3 Edit Element

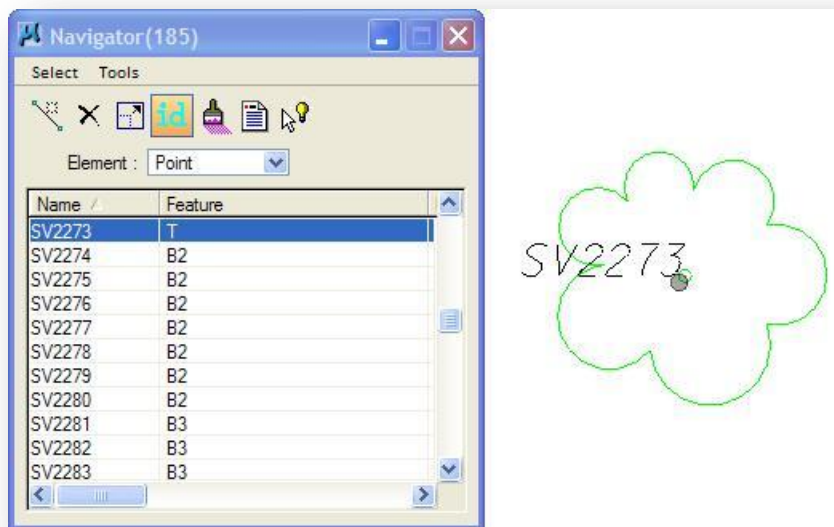
The **Edit Element** icon will invoke the appropriate *Store Element* dialog (based on the **Element** option) and populate the dialog with associated data for the selected element. In the example below, point PI05 has been selected in the *Navigator* dialog. Selecting the **Edit Element** icon invokes the *Store Point* dialog box, with the values for point PI05 in the dialog box. After making the desired edits within the *Store Point* dialog, selecting **Store Point** will re-store point PI05 with the new values, depending on the status of the **Redefine** toggle.



3.9.4 Identify Element

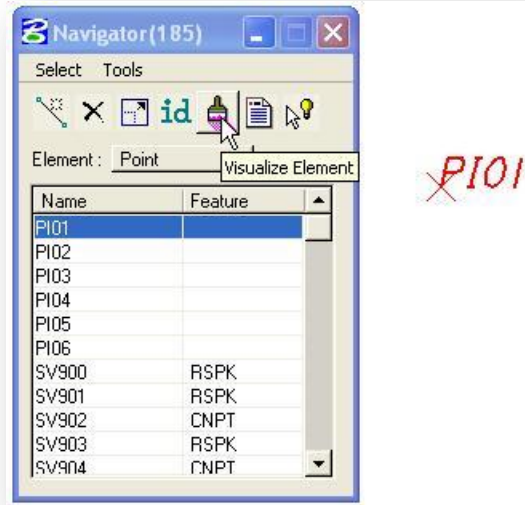
The **Identify Element** (ID) icon is used to select a COGO element in the *Navigator* dialog box by identifying the visualization graphics in a MicroStation design file.

First, press the **Identify Element** button, then identify AND accept the COGO element to be identified. GEOPAK changes (if necessary) to the **Element** type of the selected element. For example, if the Element type is set to **Chain**, and a point is identified, GEOPAK changes the type to **Point**. GEOPAK identifies the selected point and highlights it in the **Name / Feature** display as shown in the example below. If the selected element is not a GEOPAK COGO element, the message “Not a GEOPAK COGO Element” is displayed on the lower left of the MicroStation window.



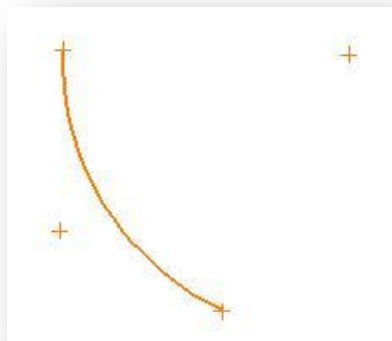
3.9.5 Visualize Element

The **Visualize Element** tool is utilized to visualize any COGO element. First, either temporary or permanent visualization must be active (see page 3-9 for information on the visualization mode).

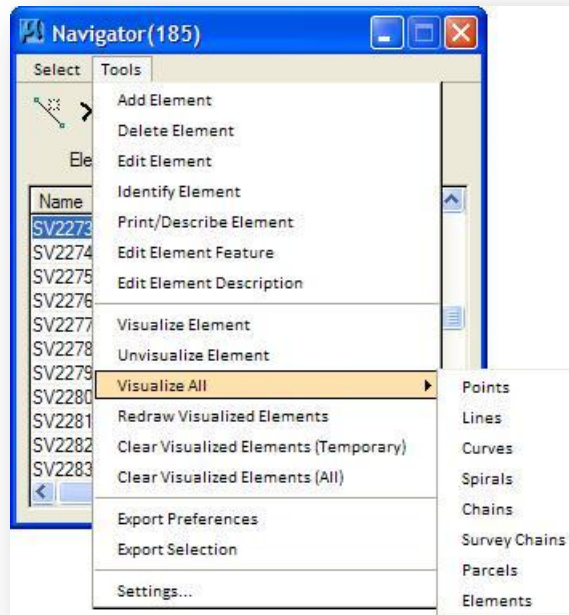


In the example above, point PI01 is currently selected in the *Navigator* dialog box. Selecting **Visualize Element** will draw the selected COGO element into the MicroStation design file. Since point PI01 was not stored with any **Feature**, the default visualization is used for the graphics as shown above. If the elements were previously visualized, a second set of elements is not drawn. Rather, the previously placed graphics are updated to reflect the current information in the database.

Visualization graphics for **Curves** and **Spirals** include symbols placed at the control point locations as shown in the example below. The control point graphics can be utilized by GEOPAK dialog boxes by selecting the elements.



Additional visualization commands are available within the *Navigator* dialog via the **Tools** pull down menu, as shown below.



In order to use the visualization tools, either the Permanent or Temporary visualization must be active. These tools are summarized below:

Visualize Element

When selected, the highlighted elements are visualized, based on the associated **Features**. If no features are associated with the elements, the default features are utilized.

Unvisualize Element

When selected, the visualization graphics for the highlighted element(s) is deleted. Note that the element is not deleted from the database, just the visualization graphics.

Visualize All: Points, Lines, Curves, Spirals, Chains, Survey Chains, Parcels, Elements

Select the desired **Visualize** option from the option pull down menu.

Redraw Visualized Elements

When selected, all visualized elements are redrawn. If the location of a visualized element in the design file does not correspond to its coordinates in the database, the element is redrawn using the database information.

Clear Visualized Elements (Temporary)

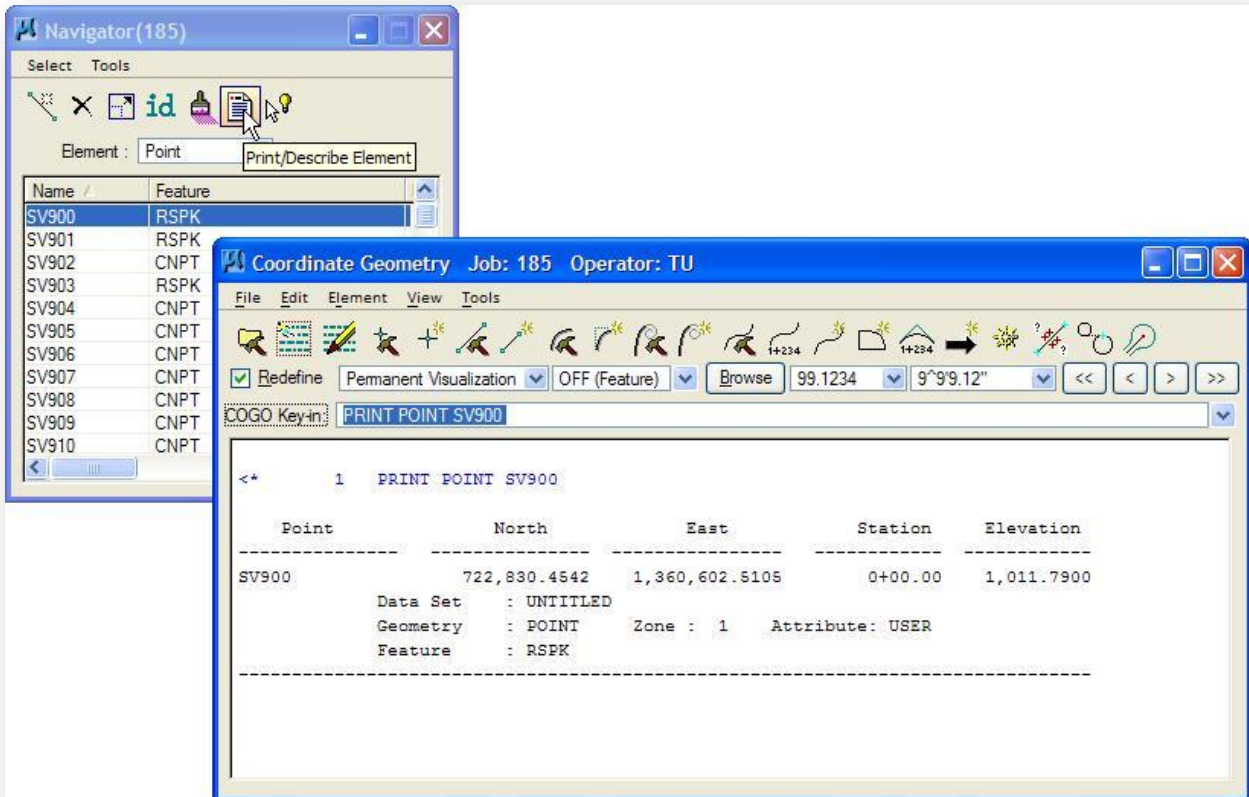
When selected, all temporary visualized elements are deleted. Note that the elements are not deleted from the database.

Clear Visualized Elements (All)

When selected all temporary and permanent visualized elements are deleted. Note that the elements are not deleted from the database.

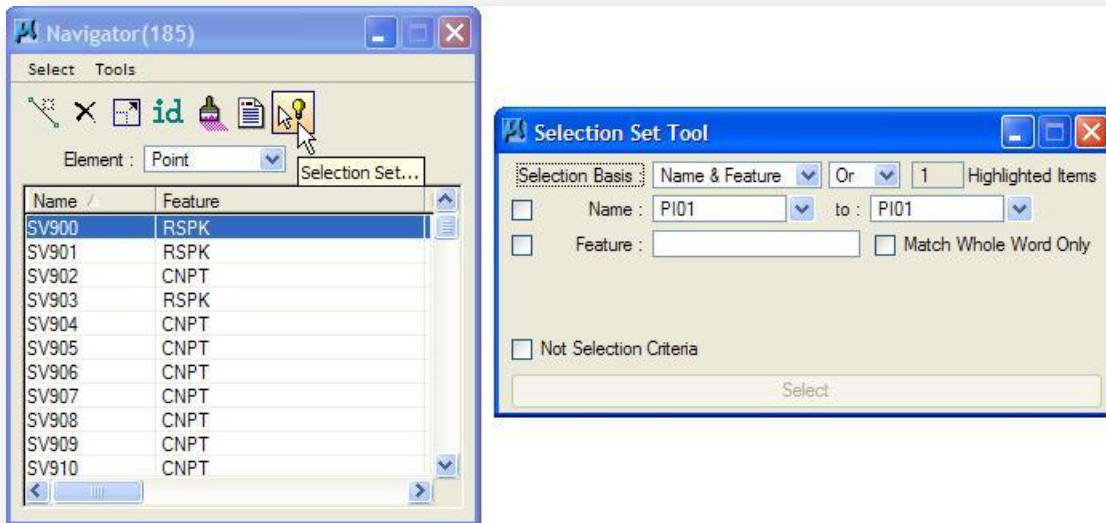
3.9.6 Print/Describe

The **Print/Describe** element tool invokes a print point, print curve, describe chain, describe parcel or print profile command, based on the current element type. Simply highlight the desired element within the feature / list box, and then press the button. The appropriate print / describe command is issued. The results of the command are displayed in the main COGO dialog box, as shown below



3.9.7 Selection Tool

The last icon on the Navigator dialog is used to access the **Selection Set** tool. The selection tool is used to select COGO elements based on a user definable search criteria. The *Selection Set Tool* dialog box is shown at right below.



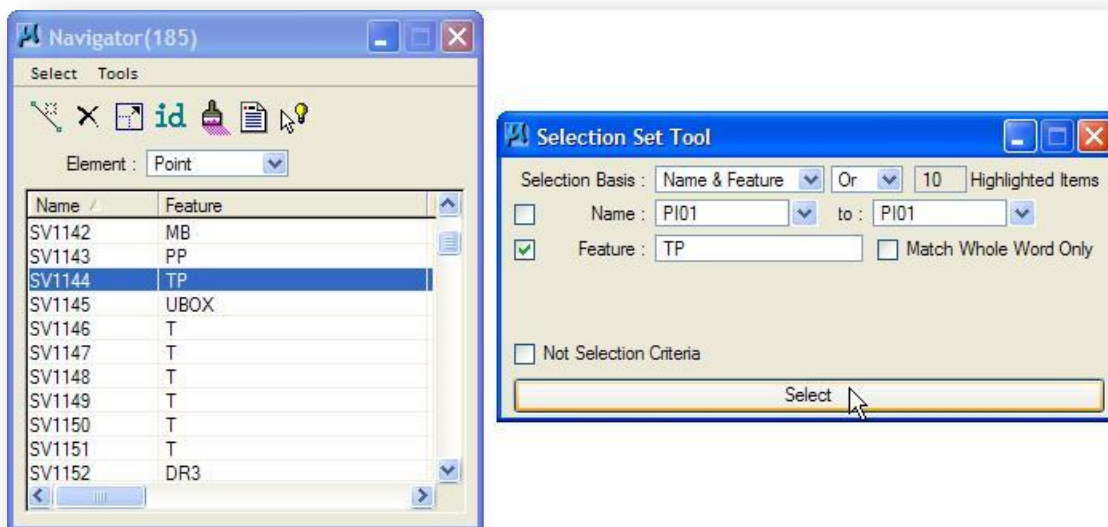
Several options are supported for the **Selection Basis**. As each option is selected, the dialog dynamically changes to reflect the current selection. These options include:

- Name & Feature
- Area Limits
- Elevation Range
- Linear Limits
- Membership
- Survey Attributes

See the GEOPAK on-line documentation for detailed information on each option. For the purpose of this training guide we will illustrate using the *Selection Set Tool* dialog for a few common tasks.

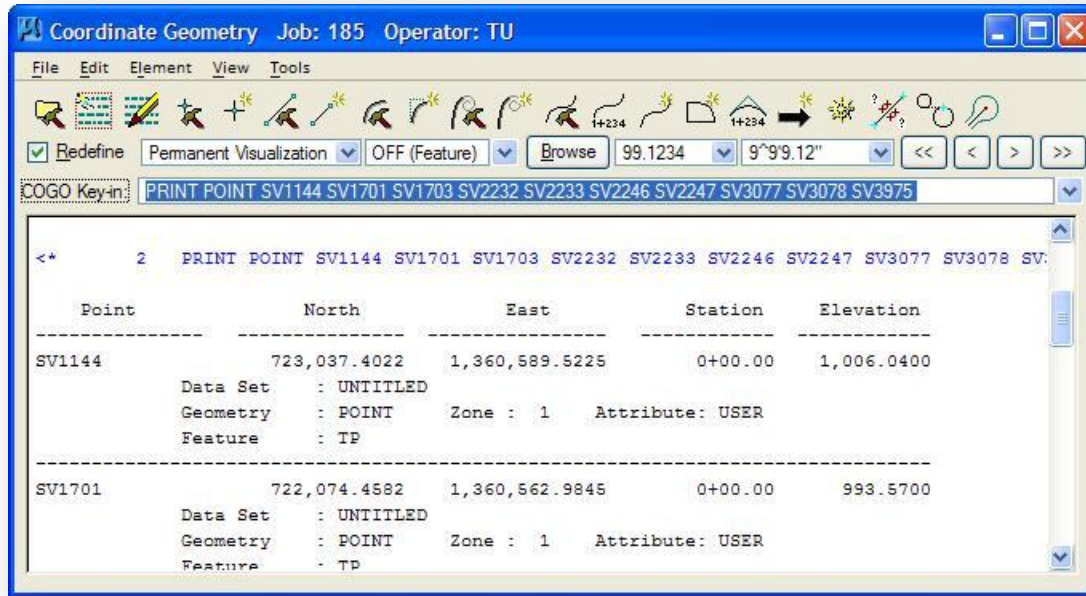
Example 1: Find the station and offset for all the existing telephone poles. Get the coordinates for each telephone pole.

- ✓ From the *Navigator* dialog, select **Select > Clear Selection** to clear any elements that may be currently selected in the Navigator.
- ✓ Open the *Select Set Tool* dialog. The upper right portion of the dialog should read **0 Highlighted Items**.
- ✓ Toggle the **Element** option to **Point** in the *Navigator* dialog
- ✓ Toggle the **Selection Basis** option to **Name & Feature**
- ✓ Toggle the **Feature** option on
- ✓ Key-in the name of the Telephone Pole feature, TP.
- ✓ Pick the **Select** button.

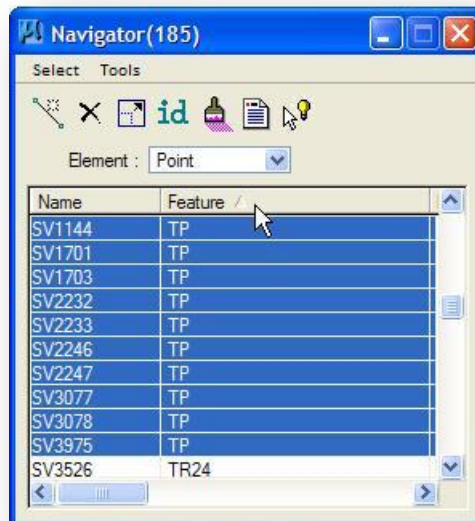


To satisfy the selection criteria above, a Point must be currently selected, **Or** it must have the **Feature TP** assigned. 10 telephone poles are found in the GPK file as shown in the upper right portion of the dialog above. These points are also highlighted in the *Navigator* dialog as show at left above.

To get the coordinates for the highlighted items, select the **Print/Describe Element** icon from the *Navigator* dialog. The results of the Print/Describe command are displayed in the *Coordinate Geometry* dialog as shown on the following page.



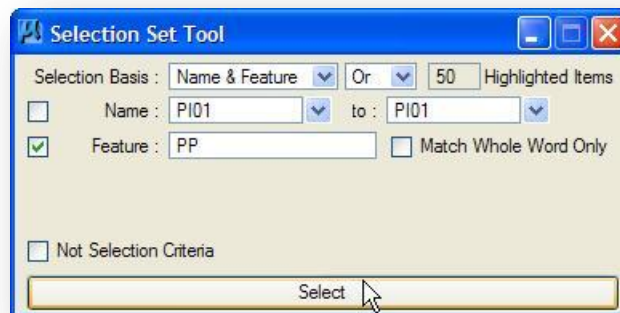
This could have also been accomplished without the use of the Selection tool. You can sort the elements in the COGO Navigator dialog by selecting the column header. In the example below, the points are sorted by the Feature name. All the TP points are grouped together and can be easily selected.



Example 2: Let's expand the selection set to include power poles along with the telephone poles that are already selected. Once we have selected all the telephone and power poles, let's get the station and offset for each pole, but only the ones between station 50+00 and 60+00 along existing State Route 185 within 50' left and right of the centerline.

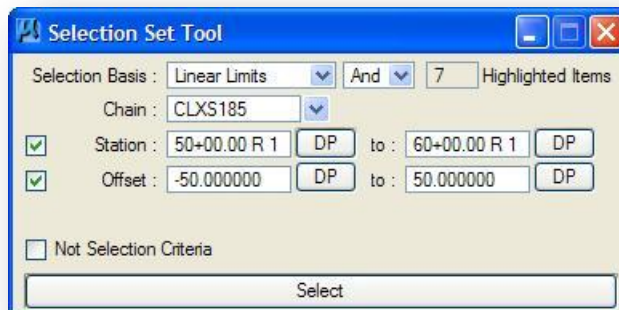
- ✓ Make sure the **Selection Basis** criteria is toggled to **Or** as shown below
- ✓ Type in a **Feature** name of PP for power poles
- ✓ Pick the **Select** button

Using the selection criteria above, a point must have the **Feature PP Or** it must have been one of the **10 Highlighted Items** that were found in Example 1. Our selection set now includes 50 points that have the **Feature TP** assigned, **Or** the **Feature PP**.



Now let's refine our search to find the telephone poles and power poles between station 50+00 and 60+00, within 100' of the centerline.

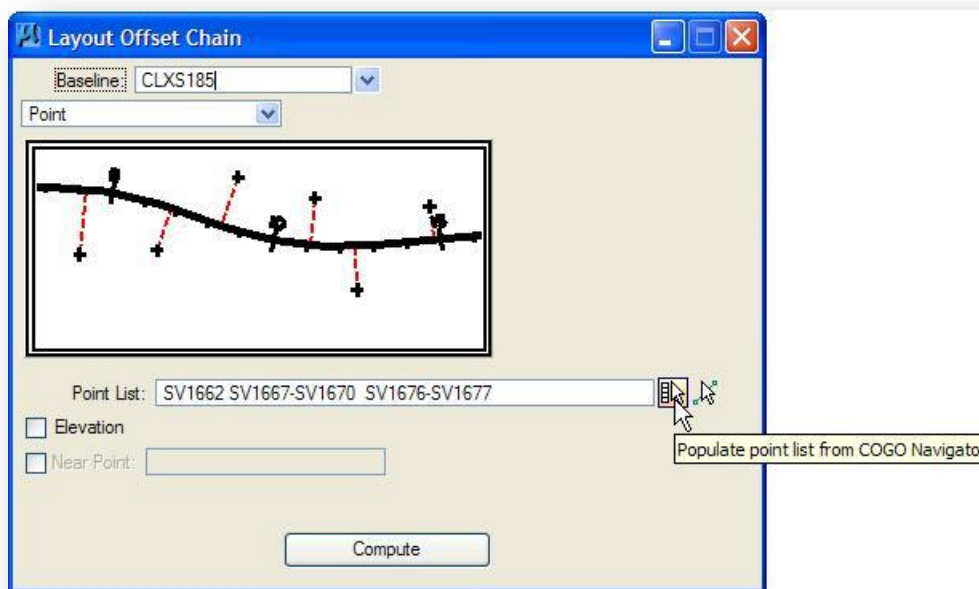
- ✓ Toggle the **Selection Basis** option to **Linear Limits**
- ✓ Change the **Selection Basis** criteria to **and**
- ✓ Select the **Chain CLES185**
- ✓ Toggle on the **Station** option. Key-in the station range for the search as shown below.
- ✓ Toggle on the **Offset** option. Key-in offsets of -50 and 50 as shown below.
- ✓ Pick the **Select** button



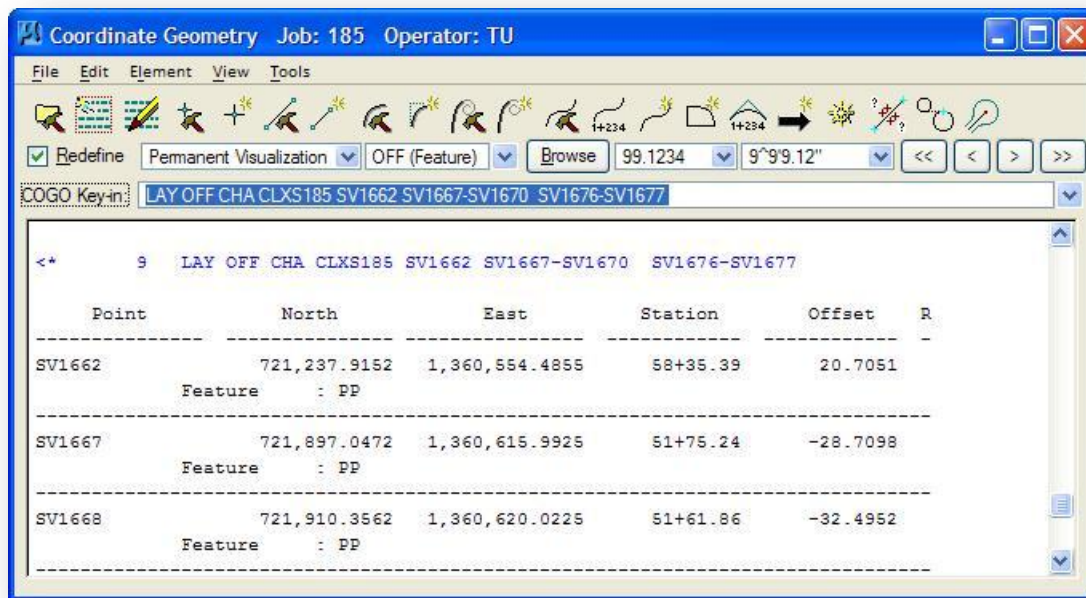
Using the selection criteria shown above, a point must be one of the 50 previously highlighted items **And** it must meet the **Linear Limits** defined above. There are 7 telephone poles or power poles between station 50+00 and 60+00, and within 50' left and right of the centerline of existing State Route 185.

The last step is to get the station and offset of these 7 points. To accomplish that task, use the **Layout Offset** tool.

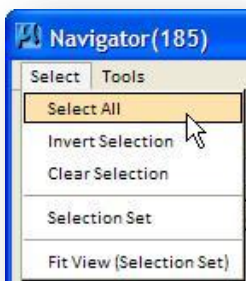
- ✓ From the *Coordinate Geometry* dialog, select **Element > Chain > Layout Offset**
- ✓ Select the **Baseline** CLEXS185
- ✓ Toggle the mode to **Point**
- ✓ To populate the **Point List** field, select the **Populate point list from COGO Navigator** icon
- ✓ Select the **Compute** button.



The results are displayed in the *Coordinate Geometry* dialog as shown below.



The **Select** pull down menu is used in conjunction with the Selection Set tool. The dialog has the following functions as shown below.



Select All

Highlights all elements within the **Name / Feature** list box

Invert Selection

Reverses the highlighting

Clear Selection

Removes highlighting from those elements in the **Name / Feature** list that were previously highlighted.

Fit View (Selection Set)

First, highlight the desired elements in the **Name / Feature** list box. When this tool is selected, the screen is fitted to display only the selected elements.

3.9.8 Navigator Settings

The navigator includes several tool settings for user flexibility. Select **Tools > Settings** from the *Navigator* dialog to access the dialog below.

Alert Prior to Clearing Selection Set

When activated and the user selects a command which requires a new selection set, an Alert message is displayed on the screen.

Mouse Click Actions

If the **Single Click Highlight Visualized Element** is active, a single click on any element within the **Name / Feature** list box highlights the visualized element in the MicroStation design file.

When the **Single Click Window Center Visualized Element** option is active, a single click on any element in the **Name / Feature** list box window centers the element in the MicroStation view.

When **Single Click Enables List Cell Edition** is active the various fields in the Navigator list box may be edited. When toggled off, no editing within the Navigator list box is supported.

Double Click Action

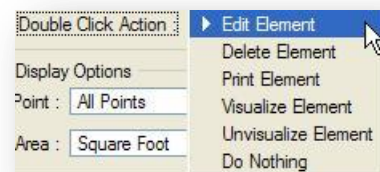
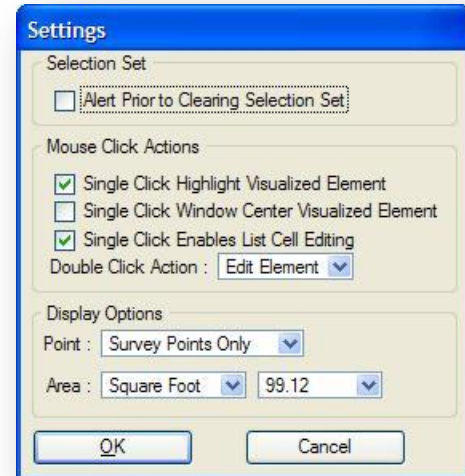
As a shortcut to many of the frequently used element commands, this option enables the user to select one of the commands as shown at right. When an element in the **Name / Feature** list box is double clicked, the selected command in the tool settings is invoked. For example, if the **Print Element** command is selected in the tool settings, then when any element in the **Name / Feature** list box is double clicked, the print element command is invoked. If the **Do Nothing** option is selected, a double click does not invoke a command.

Display Options

If the current GPK file has both Survey points and COGO points, the View options support viewing all points (both survey and COGO), COGO only, or Survey Only.

Area

Options for Square Foot and Acre are supported, which are used in various parcel tools. A setting for number of decimal places for area computations is also supported.



Exercise 3C – Proposed State Route 185

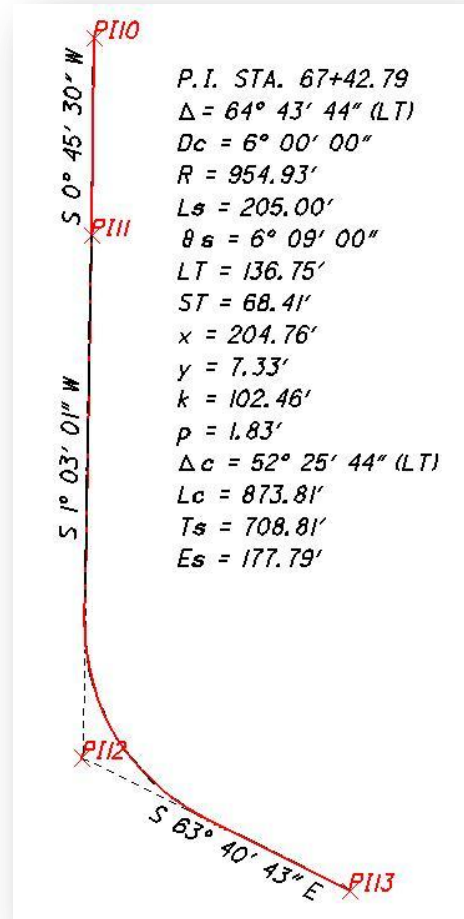
Store a centerline chain proposed S.R. 185 using the information provided below.

- ✓ Use the **Equate Point** or **Copy Point** command to store points PI10-PI13 at the same location as points PI01-PI04.
- ✓ Store a Spiral-Curve-Spiral combination using the curve data shown at right.
- ✓ Using ODOT’s Recommended GEOPAK Naming Standards, what should you name the curve and spirals for this alignment?

Curve Name _____
 Back Spiral Name _____
 Ahead Spiral Name _____

- ✓ Store a chain for the proposed centerline of State Route 185 using 35+90.72 as the beginning station. Using ODOT’s Recommended GEOPAK Naming Standards, what should you name the proposed chain?

Chain Name _____



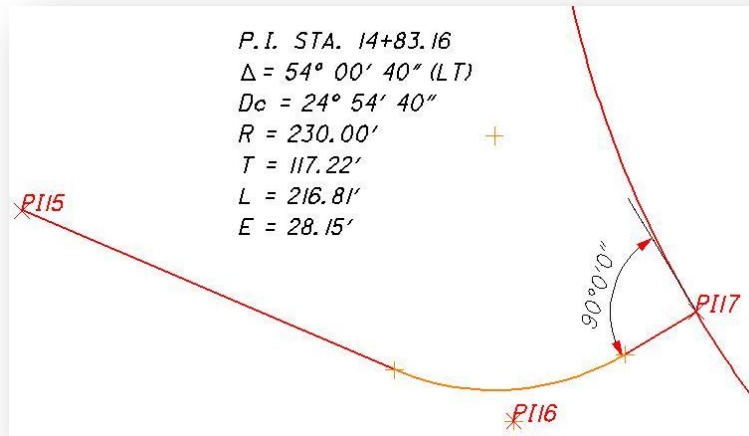
After storing the chain for proposed State Route 185, answer the following questions:

1. What is the station at the ST of proposed State Route 185? _____
 2. What is the station on the existing centerline of State Route 185 at the location of the ST of proposed State Route 185? _____ (Hint: use “Layout Offset Chain Chain”)
- ✓ Using the stations from questions 1 and 2, store a station equation on the proposed centerline. The Back station will be the station on proposed State Route 185 at the ST location. The Ahead station is the station where the ST of the proposed centerline chain meets the existing chain CLXS185. What should you name the point that is stored at the Station Equation?

Tip: Make sure the redefine toggle is on before you initiate the station equation command.

Exercise 3D – Proposed Jameson Road

Store a chain for the proposed relocation of Jameson Road using the information shown in the figure below.



- ✓ Store points PI15 and PI16 at the same location as points PI05 and PI06.
- ✓ Store point PI17 such that the line defined by points PI16 and PI17 is perpendicular to proposed State Route 185. **Hint:** Point PI17 will intersect proposed S.R. 185 within the limits of the curve. In order to be perpendicular to a curve, the line defined by point PI16 and point PI17 must pass through the center (CC) of the curve.
- ✓ Store a curve using the radius shown in the curve data above. Following the ODOT GEOPAK Guidelines, what should you name the curve? _____
- ✓ Store a chain for proposed Jameson Road using 10+00 as the beginning station. Following the ODOT GEOPAK Guidelines, what should you name the chain? _____

After storing the chain for proposed Jameson Road, answer the following questions:

What is the station on proposed S.R. 185 at the intersection with proposed Jameson Road ?

What is the station on proposed Jameson Road at the intersection with S.R. 185 ?

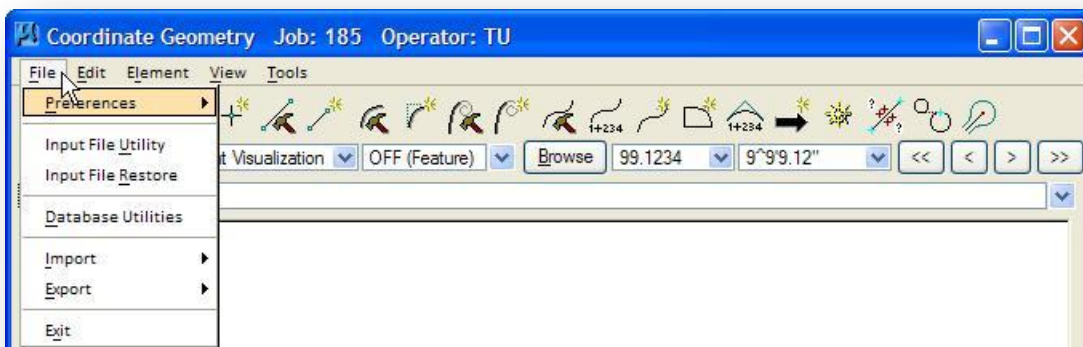
3.10 The COGO File Menu

When a coordinate geometry command is generated via dialog or command line, the command is added to a buffer in memory. The buffer provides an audit trail of all coordinate geometry commands that you have processed during the current session. This audit trail is created whether the COGO operations are generated via key-ins, dialog boxes or stored MicroStation graphics.

The audit trail of coordinate geometry commands contained in the memory buffer can be optionally saved into an **Input File**. These input files can be later retrieved and loaded into the buffer whereupon the COGO commands can be edited and reprocessed. The adjusted buffer contents can be re-saved into the original Input File or saved into another Input File.

To facilitate saving and retrieval of this audit trail, GEOPAK provides numerous commands within the coordinate geometry software. Saving, appending, loading, cataloging, and deleting audit trail input files, in addition to printing input and output file commands, assist the user in productively utilizing the coordinate geometry throughout the a project. These file commands are selected via the **File** menu and the **Edit** menu.

In this section, we will summarize the available commands. See the GEOPAK online help for complete documentation of these commands.



Input File Utility

Includes options to load, save, delete, and print input and output files.

Input File Restore

Loads input files created via the Store Graphics dialog.

Database Utilities

Two utilities are available for database maintenance.

Validate

Looks for problems and errors in the GPK database and reports the findings. This command does not attempt to clean or compress the database.

Clean and Compress

This command scans the current GPK file and removes any corrupt element(s). As part of the rebuilding process it also compresses the GPK file. The results of the rebuilding are saved in a log file in the same directory as the GPK file.

Import

The Import options listed below are available:

- Merge GPK File
- ASCII Points
- SDMS Alignments and Points
- LAND XML 1.0 Geometry
- RDS
- VDOT PLT

Export

The Export options listed below are available:

- ASCII Points
- SDMS Points
- SDMS Alignments
- LandXML 1.0 Geometry
- Alignments and Profiles

Exit

Exits coordinate geometry session

3.11 The COGO Edit Menu

Whereas the **File** commands control the file management of input and output files, the **Edit** pull down controls the content of the COGO command buffer. Numerous **Edit** commands within the coordinate geometry session facilitate basic modification, addition and deletion of lines within the active input file. From within the Coordinate Geometry window, these **Edit** commands are selected via the **Edit** pull down as shown below.



A detailed description of each command is available via the GEOPAK on-line help. Select **Applications > Road > Help** to access the on-line help. Each item is summarized below.

From the help dialog, select **Command Reference > Geometry > Coordinate Geometry> Command Reference > Edit > Edit Commands** to view detailed information on the commands listed below.

Clear	Removes the current list of COGO statements from the buffer
Delete	Deletes the specified line or range of lines
Insert	Inserts the specified line at the specified location
Modify	Replaces a specified text string with a redefined text string
Read All	Processes all lines in the current input file
Type All	Displays all lines in the current input file
Line Range	Reads or processes the specified line range
Editor	Invokes the GEOPAK text editor populated with the current input file

3.12 Working with COGO Input and Output Files

COGO input and output file names can be user-defined, but must be within the software parameters as detailed below. For the example, assume the job number is 185, and the operator code is “tu”.

File Type	Naming Convention	Example
Database	job***.gpk	job185.gpk
Input	name***.iOC	align185.itu
Output	name***.oOC	temp185.otu
Auto generated input	j***oOC.inp	j185otu.inp
Journal	jou***.iOC	jou185.itu

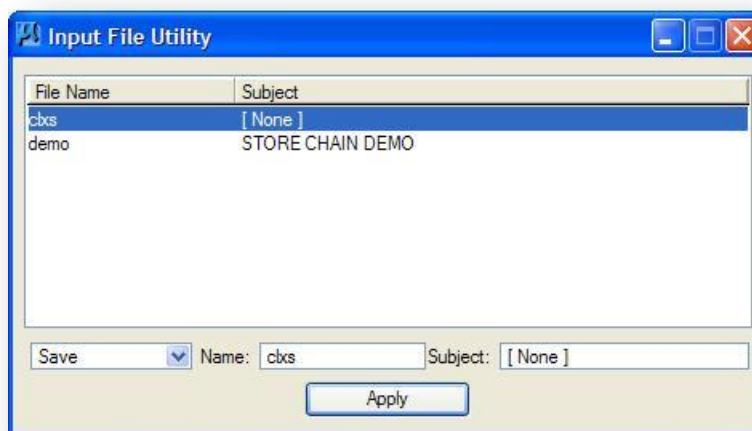
Input files contain a list of the commands that have been processed during a COGO session. The input file can be later retrieved and loaded into memory whereupon the COGO commands can be edited and reprocessed if desired.

Output files contain the list of commands that were processed during the COGO session as well as the results of the command.

The **Journal Files** are used to recover a coordinate geometry session that is abnormally terminated.

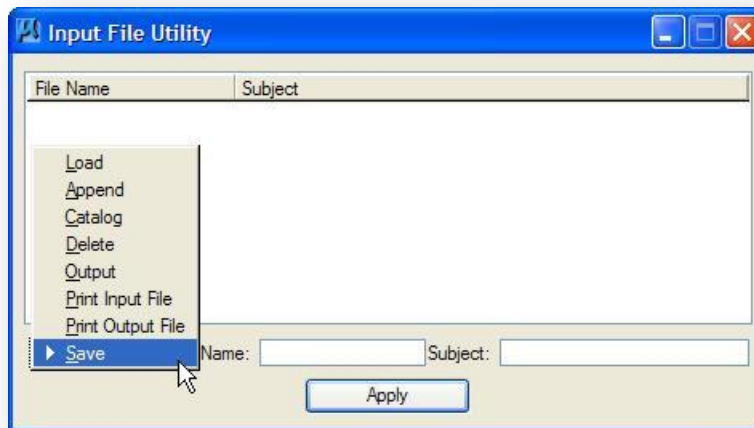
During some of the procedures in GEOPAK, the software automatically generates an input file. The **Store Graphics** command is one example. In these cases GEOPAK names the created file j***oOC.inp where *** is the job number and OC is the operator code.

This naming convention is enforced to allow the software to sort input and output files by type, operator code, and job number. When the Input File Utility dialog is accessed, by selecting **File > Input File Utility**, the name of previously stored files is shown in the dialog. Only the files that match the current operator code and job number are shown in the list box. An example is shown below.



The **Input File Utility** commands are used to save both COGO input and output files.

From the COGO dialog, select **File > Input File Utility** to access the dialog below.

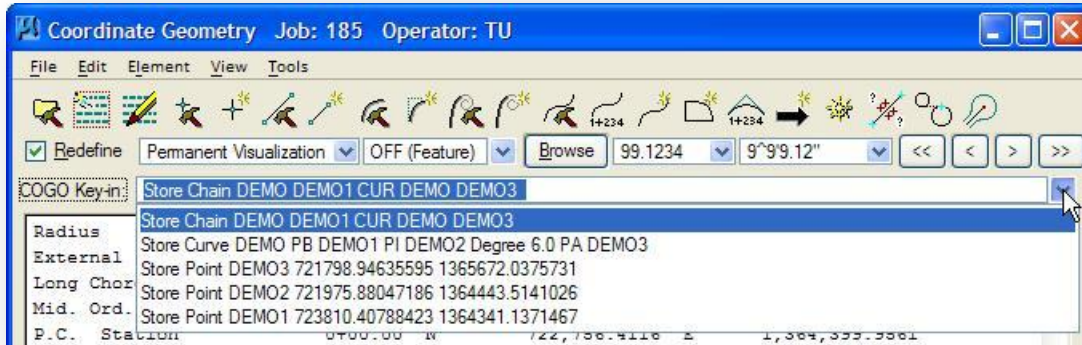


The dialog has the following functions:

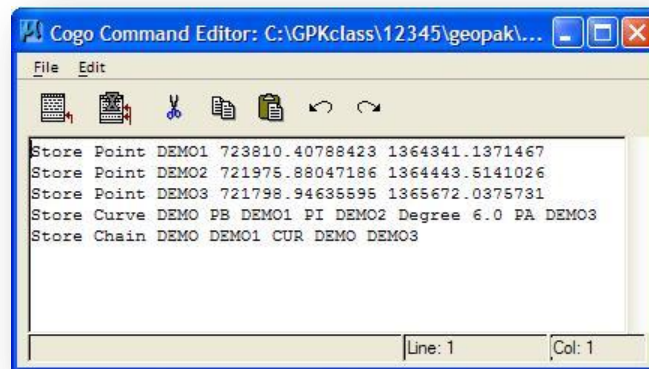
Load	Clears the COGO memory buffer and then loads (into memory) the current contents of a previously stored input file. Once loaded, the COGO commands entered in the input file can be processed (read), edited, modified or deleted
Append	Appends the specified input file to the current input file
Catalog	Displays a listing of all input files for the current operator within the specified project
Delete	Deletes the selected input file
Output	Save the COGO output in an ASCII output file in a format suitable for reviewing, editing or printing to a printer
Print Input File	Prints the selected input file to the Windows printer
Print Output File	Prints the selected output file to the Windows printer
Save	Saves an Input file containing the commands that have been processed during the current COGO session

3.12.1 Saving an Input File

As commands are processed, the list of commands is available from the **COGO Key-in** field as shown in the example below.

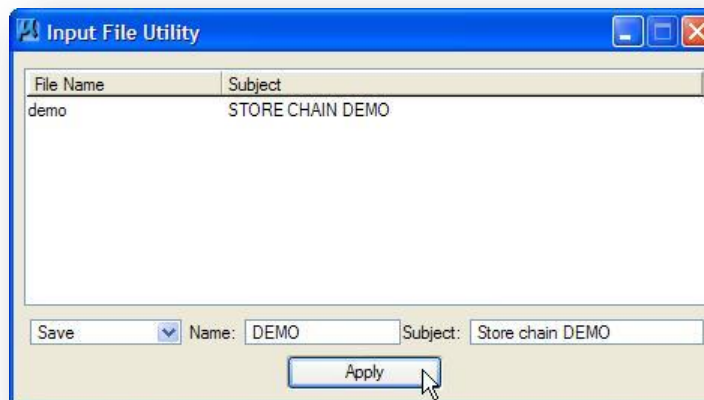


Commands can be selected from the list, edited directly in the **COGO Key-in** field, and reprocessed. The commands can also be edited and reprocessed in an editor by selecting **Edit > Editor**.



To save an input file, take the following steps:

- ✓ Select **File > Input file Utility**, and then select the **Save** option as shown below
- ✓ Type in the **Name** and an optional **Subject** line for the input file



The file is saved in the current Working Directory. The actual file name is modified to comply with the naming convention detailed previously in this section. The resulting file name is **demo185.itu**. The content of the file is shown below.

```
Copyright: (c) 2008 Bentley Systems, Incorporated. All rights reserved.
Project: 12345_Design
Subject: STORE_CHAIN DEMO
Job No. 185 Operator: TU
Date: Thursday December 11, 2008 2:47 pm

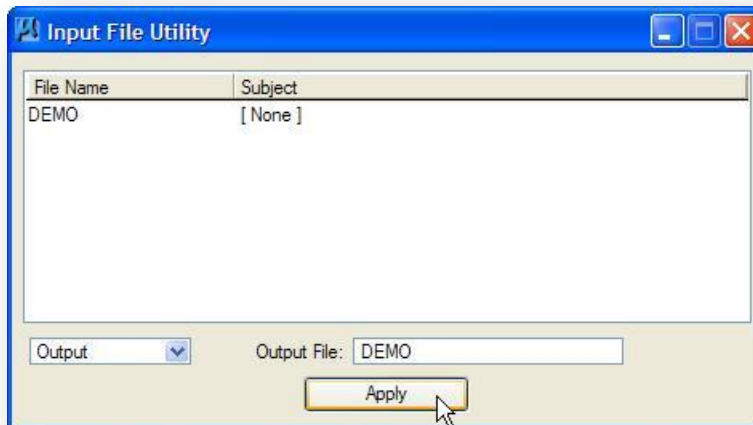
SYSTEM FIX 4 ASEC 2 BEAR PRI 0 RED NE STA 2 FILE: 'DEMO'

* 1 STORE POINT DEMO1 723810.40788423 1364341.1371467
* 2 STORE POINT DEMO2 721975.88047186 1364443.5141026
* 3 STORE POINT DEMO3 721798.94635595 1365672.0375731
* 4 STORE CURVE DEMO PB DEMO1 PI DEMO2 DEGREE 6.0 PA DEMO3
* 5 STORE CHAIN DEMO DEMO1 CUR DEMO DEMO3
* 6 END
```

3.12.2 Saving an Output File

Output files are saved via the Input File Utility dialog. Take the following steps to save an output file.

- ✓ Select **File > Input file Utility**, and then select the **Output** option as shown below
- ✓ Type in the **Name** for the file



The file is saved in the current Working Directory. The actual file name is modified to comply with the naming convention detailed previously in this section. The resulting file name is **demo185.otu**. The content of the file is shown below.

Copyright: (c) 2008 Bentley Systems, Incorporated. All rights reserved.
 Project: 12345_Design
 Subject:
 Job No. 185 Operator: TU
 Date: Thursday December 11, 2008 2:56 pm

SYSTEM FIX 4 ASEC 2 BEAR PRI 0 RED NE STA 2 FILE: 'DEMO'

* 1 Store Point DEMO1 723810.40788423 1364341.1371467

N 723,810.4079 E 1,364,341.1371
 Point DEMO1 redefined.

* 2 Store Point DEMO2 721975.88047186 1364443.5141026

N 721,975.8805 E 1,364,443.5141
 Point DEMO2 redefined.

* 3 Store Point DEMO3 721798.94635595 1365672.0375731

N 721,798.9464 E 1,365,672.0376
 Point DEMO3 redefined.

* 4 Store Curve DEMO PB DEMO1 PI DEMO2 Degree 6.0 PA DEMO3

Curve Data

Curve DEMO

P.I. Station 7+81.75 N 721,975.8805 E 1,364,443.5141

Delta = 78° 36' 37.44" (LT)

Degree = 6° 00' 00.00"

Tangent = 781.7456

Length = 1,310.1734

Radius = 954.9297

External = 279.1760

Long Chord = 1,209.8025

Mid. Ord. = 216.0216

P.C. Station 0+00.00 N 722,756.4116 E 1,364,399.9561

P.T. Station 13+10.17 N 721,864.4419 E 1,365,217.2761

C.C. N 722,809.6193 E 1,365,353.4022

Back = S 3° 11' 38.81" E

Ahead = S 81° 48' 16.25" E

Chord Bear = S 42° 29' 57.53" E

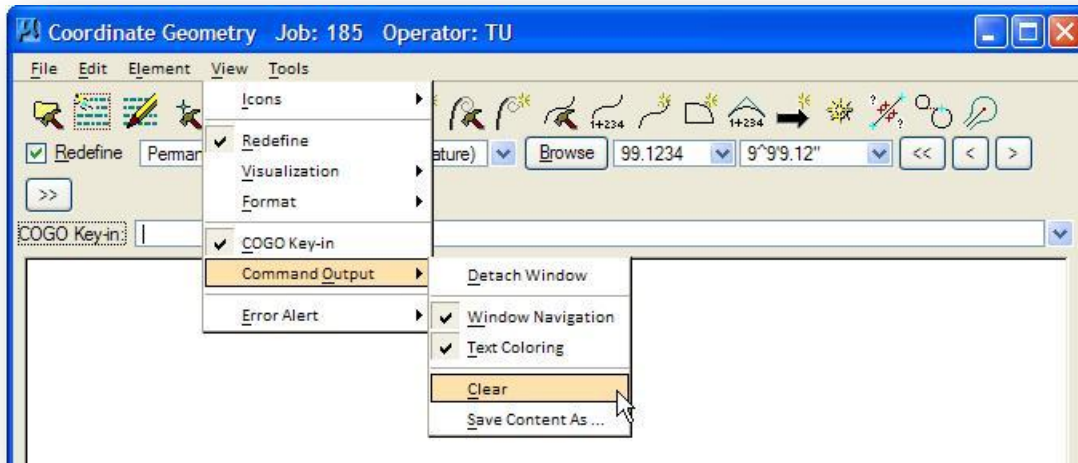
Curve DEMO redefined

* 5 Store Chain DEMO DEMO1 CUR DEMO DEMO3

3.12.3 View > Command Output > Save Content As

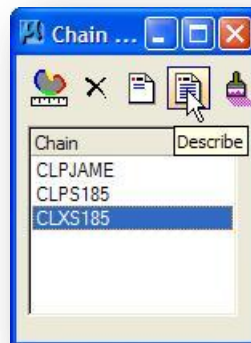
Output files are useful for saving a report containing specific information such as a Describe Alignment command, however keep in mind that the output file will contain the output for all the commands that have been run in the current COGO session. There is another way to save a report containing only the desired contents.

The View pull down menu contains commands to clear the COGO window, and to save the contents of the COGO window as an ASCII file. The **Clear** and **Save Content As...** commands are shown below.



Take the following steps to save an ASCII file with the results of a Describe Alignment command.

- ✓ Select **View > Command Output > Clear** to clear the contents of the COGO window
- ✓ Open the *Chain Utility* dialog by selecting **Element > Chain Utility**
- ✓ Select the desired chain name from the list, and then select the **Describe** icon



- ✓ Save the results of the Describe Chain command by selecting **View > Command Output > Save Content As...** to save the file. The contents of the file are shown below.

```
<* 5 Describe Chain CLXS185
```

```
Chain CLXS185 contains:
```

```
PI101 PI102 CUR XS185103 PI104
```

```
Beginning chain CLXS185 description
```

```
=====
```

```
Point PI101   N   723,481.9012 E 1,360,611.9275 Sta  35+90.72
```

```
Course from PI101 to PI102 S 0° 45' 30.00" W Dist 864.4200
```

```
Point PI102   N   722,617.5569 E 1,360,600.4869 Sta  44+55.14
```

```
Course from PI102 to PC XS185103 S 1° 03' 01.00" W Dist 2,097.5253
```

```
Curve Data
```

```
*-----*
```

```
Curve XS185103
```

```
P.I. Station  67+42.79 N   720,330.2912 E  1,360,558.5548
```

```
Delta = 64° 43' 44.00" (LT)
```

```
Degree = 19° 05' 54.94"
```

```
Tangent = 190.1247
```

```
Length = 338.9197
```

```
Radius = 300.0000
```

```
External = 55.1724
```

```
Long Chord = 321.1816
```

```
Mid. Ord. = 46.6019
```

```
P.C. Station  65+52.67 N   720,520.3841 E  1,360,562.0397
```

```
P.T. Station  68+91.58 N   720,245.9888 E  1,360,728.9676
```

```
C.C.          N   720,514.8851 E  1,360,861.9893
```

```
Back = S 1° 03' 01.00" W
```

```
Ahead = S 63° 40' 43.00" E
```

```
Chord Bear = S 31° 18' 51.00" E
```

```
Course from PT XS185103 to PI104 S 63° 40' 43.00" E Dist 1,119.5753
```

```
Point PI104   N   719,749.5626 E 1,361,732.4663 Sta  80+11.16
```

```
=====
```

```
Ending chain CLXS185 description
```

Note that the Describe Chain command in the sample file above was the fifth command processed during the COGO session. There are two **Clear** commands in the GEOPAK COGO pull-down menus. The commands differ as follows:

Edit > Clear

Issuing this command does not clear the COGO window. This command clears the COGO memory buffer. All commands previously processed are discarded and cannot be recovered unless they were saved in an Input File before issuing the **Edit > Clear** command. The next command that is entered will be command number one.

View > Command Output > Clear

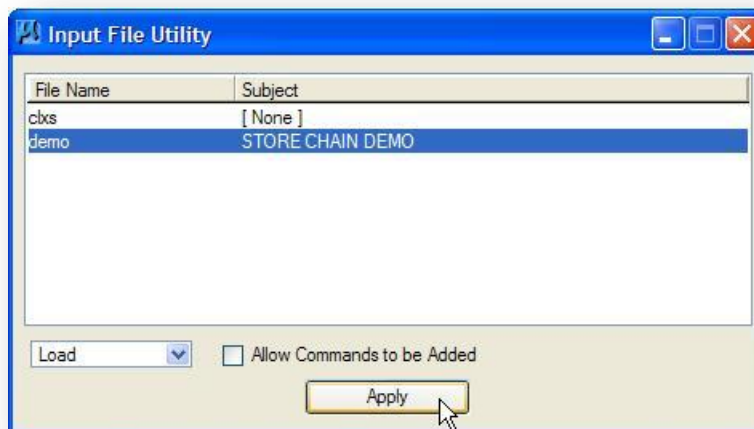
This command clears the output window, but does not clean the COGO memory buffer.

3.12.4 Loading, Editing, and Reprocessing an Input File

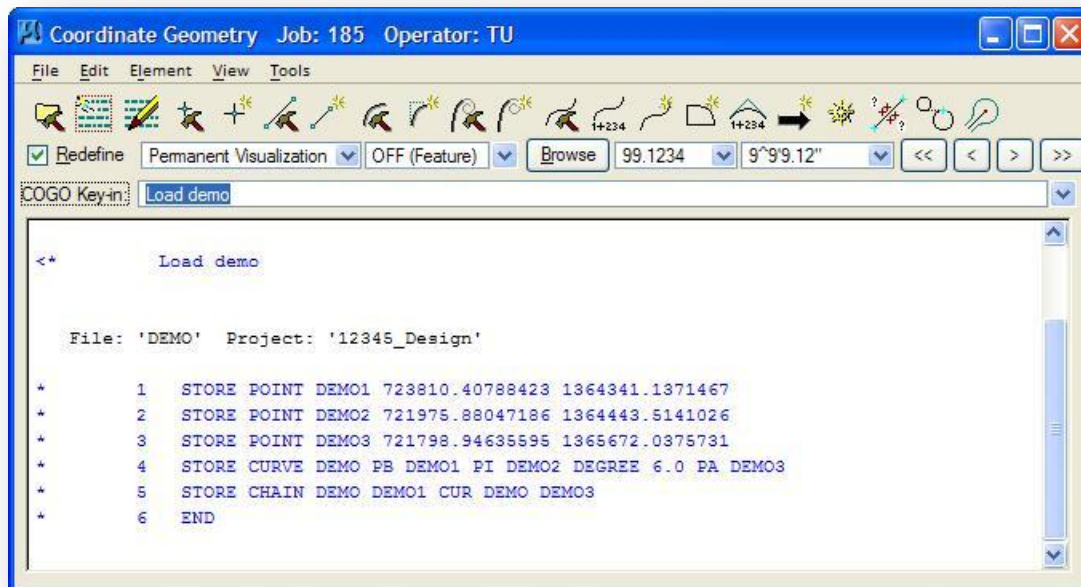
COGO Input files are ASCII files that can be edited using any ASCII text editor. The contents of an input file can be reloaded and edited directly in GEOPAK before reprocessing.

To load a previously saved input file, take the following steps:

- ✓ Select **File > Input file Utility**, and then select the **Load** option as shown below
- ✓ Select the file and press **Apply**

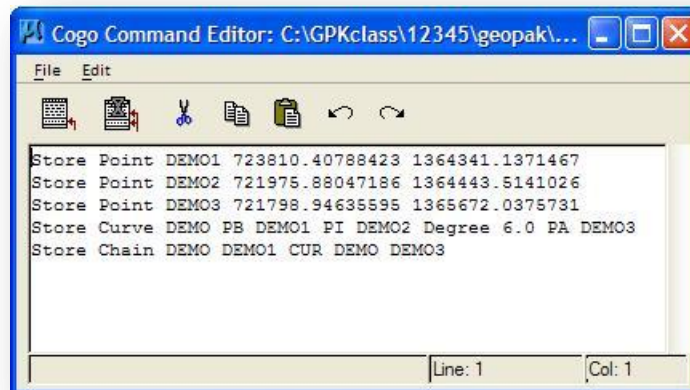


The contents of the file are loaded into memory. The first 10 lines of the file are displayed in the COGO window.



After loading the input file into memory, the command lines can be edited before processing as follows:

- ✓ Select **Edit > Editor** to open the *Cogo Command Line Editor* shown below



The contents of the file can be edited and reprocessed from this editor. Most of the functions in the editor are familiar text editing options. The dialog two specialized functions detailed below.

The leftmost icon is **Restore**. When pressed, all information from the editor is placed in the COGO buffer and displayed in the Command Output window; however, none of the lines are processed.

The second icon, **Restore / Read**, places the information in the COGO buffer AND processes all lines.

When exiting the editor, the user is returned to GEOPAK, however any changes made within the editor are lost if a **File > Save** or **Restore / Process** command was not completed prior to exiting.

Input files can also be reprocessed after loaded by selecting **Edit > Read All** from the main COGO dialog.

3.12.5 Make Input File

Input files can be generated from COGO elements stored in the GPK file at any time by use of the Make Input File key-in command. The format of the command is as follows:

MAKE INPUT FILE file-name element-list

where:

file-name Name of the input file where GEOPAK commands are written.
element-list List of GEOPAK elements for which input file commands are to be created. The format for the element-list must include at least one of the following:

CHAIN name
CURVE name
PARCEL name
 point number or range of point numbers
PROFILE
LINE name
SURVEY CHAIN name (Survey Chains)
SPIRAL name
ALL

The element names may include wild card characters. Selection of a chain implies the inclusion of the store chain command but also implies the inclusion of additional store commands for each individual component element (e.g., point, curve, or spiral comprising the chain).

The Make Input File command is typically used to:

- Reconstruct lost or disorganized input files or
- Transfer elements to different job numbers.

Example:

Make Input File CLXS185.itu chain CLXS185

The contents of the input file are shown below.

```
$ Job Name: 185
$
$ -- COGO CHAIN COMMANDS -- generated by pattern: CLXS185
$
$ Chain CLXS185
STO POI PI101 N 723481.9012000000 E 1360611.9275000000 STA 3590.7200000000 DESCRIPTION "PR SR185 PI 1"
STO POI PI102 N 722617.5569117873 E 1360600.4868778947 STA 4455.1400000001 DESCRIPTION "PR SR185 PI 2"
STO POI PI104 N 719749.5626393603 E 1361732.4663295001 STA 8011.1601781014 DESCRIPTION "PR SR185 PI 4"
STO CUR XS185103 PC N 720520.3840512725 E 1360562.0397041284 DB 181.0502777778 D 19.0985931710 DEL -
64.7288888889 STA PC 6552.6652542104
STO CHA CLXS185 PI101 PI102 CUR XS185103 PI104 AS IS
$
```

Exercise 3E – COGO Input and Output Files

- ✓ Store an input file named TRAIN containing the COGO commands that you used during the lab.

What is the full name of the resulting file? _____

By default, where will the file be stored? _____

- ✓ Store an output file named OUT containing the output for all of the COGO commands that you have run during the lab exercises.

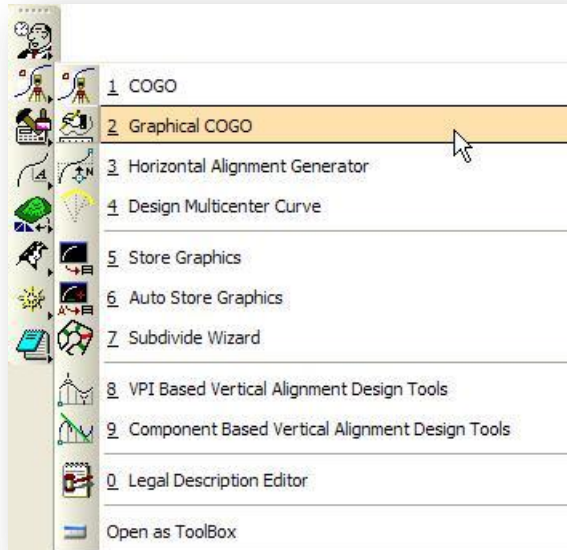
What is the full name of the resulting file? _____

By default, where will this file be stored? _____

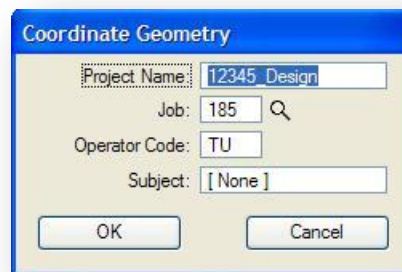
- ✓ Describe the proposed S.R. 185 chain. Store an output file containing only the results of the Describe command.

3.13 Graphical COGO

GEOPAK provides a set of Graphical COGO commands to store coordinate geometry elements, points, lines, curves, spirals, chains, and parcels, using a MicroStation “point and click” interface while maintaining full double precision. Elements placed using Graphical COGO commands are stored in the coordinate geometry database (GPK file). The Graphical COGO tools can be accessed from the GEOPAK *Road Tools* palette as shown below.



Elements created with Graphical COGO commands are stored in the GEOPAK coordinate geometry database. A coordinate geometry session must be open whenever the Graphical COGO tools are invoked. If COGO is not active, you will be prompted to open a GPK file as shown below.



Enter the **Job Number** and the **Operator Code**. The **Project Name** and **Subject** are optional. Select **OK** to access the Graphical COGO tool frame shown below.



Each icon in the tool frame is a tool box that one can be "torn off" to become a separate "tool box." The individual tool boxes can be docked and resized. There are four tool boxes, with the following titles:

- Store Elements
- Modify Elements
- Manipulate Elements
- Groups

Operation of the individual Graphical COGO tools is very thoroughly documented in the GEOPAK online help. Select **Applications > Road > Help** to access the online help. From the online help, select **Bentley GOPEK Road V8i > Command Reference > Geometry > Graphical Coordinate Geometry**. A summary of the available tools is show in the next few pages.

Store Elements

The *Store Elements* tool box contains eleven icons: (from left to right)



- Store a Point
- Store Equally Spaced Points
- Locate Point
- Store Line From Existing Points
- Store Line By Two Points
- Store Tangent Line
- Store Curve by Three Points
- Store Curve by Center
- Store Tangent Curve Constrained
- Store Tangent Curve Unconstrained
- Store Tangent Spiral

Modify Elements

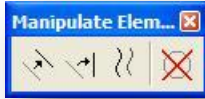
The *Modify Elements* tool box contains nine icons: (from left to right)



- Partial Delete
- Extend Plan View Elements
- Trim Elements
- Intersect Elements
- Extend Element to Intersection
- Extend Elements to Intersection
- Construct Circular Fillet
- Construct Chamfer
- Cut Element

Manipulate Elements

The *Manipulate Elements* tool box contains four icons: (from left to right)



- Move Plan View Element
- Rotate Plan View Element
- Copy Parallel
- Delete Element

Groups

The *Groups* tool box contains two icons: (from left to right)



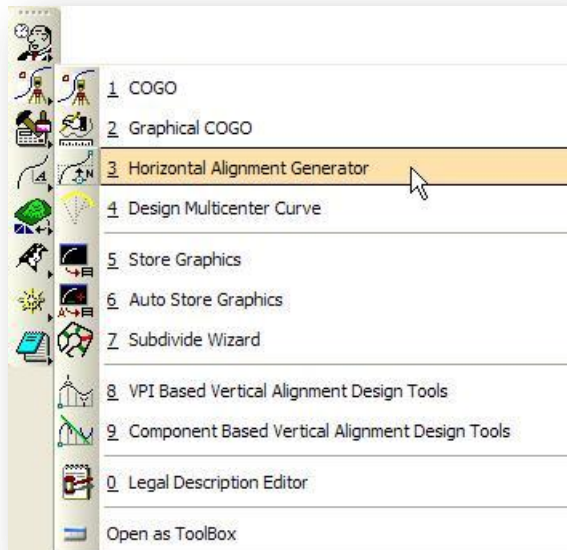
- Store Chain
- Store Parcel

Element Names

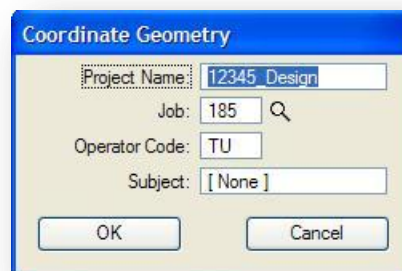
When COGO elements are stored using the Graphical COGO commands, the element name is automatically assigned using the “next available” element name. When any tool requiring an element name is opened, the next available element name becomes the default. However, the user has the option to change to any supported element name.

3.14 Horizontal Alignment Generator

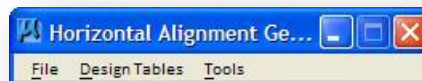
The GEOPAK horizontal alignment generator tools provide the capability to graphically design and modify horizontal alignments in either a MicroStation 2D or 3D file. The tool frame is displayed in response to selecting the **Applications > Road > Geometry > Layout Alignments Horizontal** pull down or from the GEOPAK *Road* tool palette as shown below.



Elements created within the Horizontal Alignment Generator may be stored within a GEOPAK coordinate geometry database. However, a coordinate geometry session must be open whenever the generator is invoked. If COGO is not active you will be prompted to open a GPK file as shown below.



Enter the **Job Number** and the **Operator Code**. The **Project Name** and **Subject** are optional. Select **OK** to access the Horizontal Alignment Generator tool frame shown below.

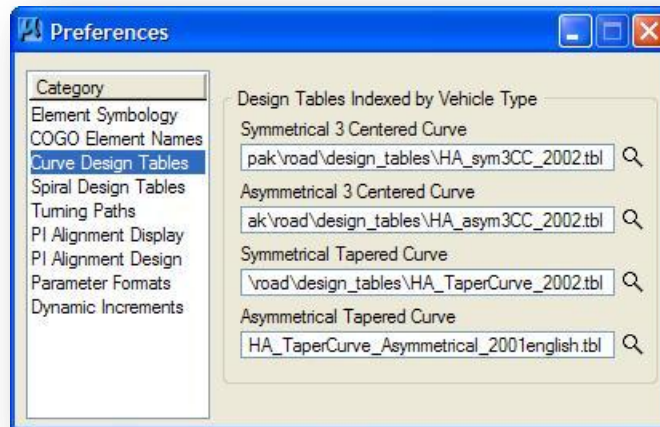


Preferences

Select **File > Preferences** from the *Horizontal Alignment Generator* dialog to access the Preferences dialog. See the GEOPAK On-Line help for detailed information regarding the *Preferences* dialog and its settings. For the purpose of this training guide, we will detail only the dialog options that relate to selecting and using the ODOT Design Tables.

Curve Design Tables

When the **Curve Design Tables** category is selected, the *Preferences* dialog dynamically changes as shown below.



The following **Curve Design Tables** have been configured according to ODOT Standards:

Symmetrical 3 Centered Curve

i:\ODOTstd\V8istd\geopak\road\Design_Tables\HA_Sym3CC_2002.tbl

Asymmetrical 3 Centered Curve

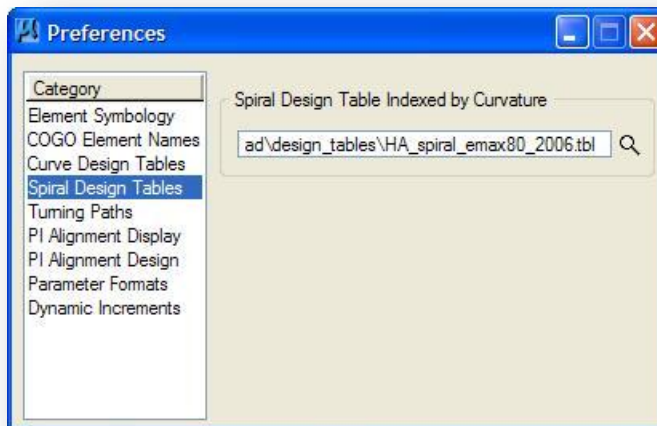
i:\ODOTstd\V8istd\geopak\road\Design_Tables\HA_Asym3CC_2002.tbl

Symmetrical Tapered Curve

i:\ODOTstd\V8istd\geopak\road\Design_Tables\HA_TaperCurve_2002.tbl

Spiral Design Table

When the **Spiral Design Tables** category is selected, the *Preferences* dialog dynamically changes as shown below.



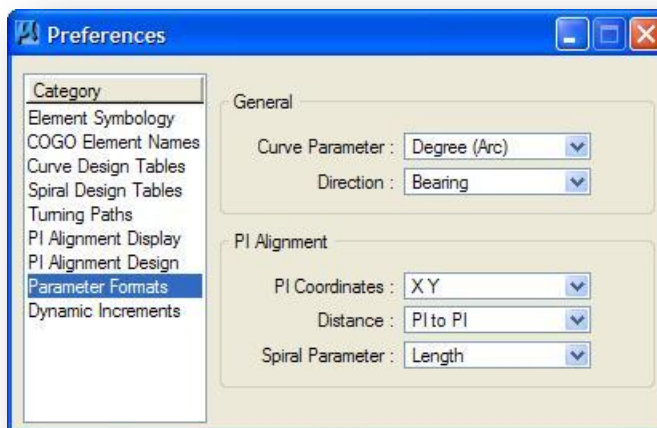
The following **Spiral Design Tables** have been configured according to ODOT Standards:

i:\ODOTstd\V8istd\geopak\road\Design_Tables\HA_spiral_emax60.tbl

i:\ODOTstd\V8istd\geopak\road\Design_Tables\HA_spiral_emax83.tbl

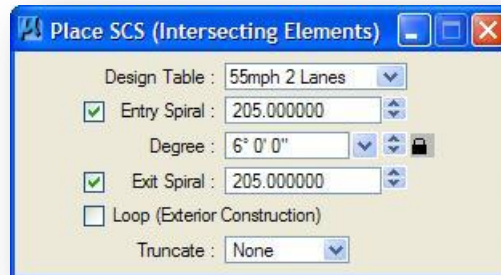
Parameter Formats

When the **Parameter Formats** category is selected, the *Preferences* dialog dynamically changes as shown below.



For ODOT projects utilizing the ODOT Design Tables, set the **Curve Parameter** option to **Degree (arc)** as shown above. The other options can be set as desired by the user and are detailed in the GEOPAK on-line help.

Each design table can be used with its corresponding Horizontal Alignment command to set default values for various parameters within the Horizontal Alignment command. For example, from the *Place SCS* dialog you can select the **Design Table** and the **Degree**. The **Entry Spiral** and **Exit Spiral** values are set according to the values configured in the selected Spiral design table.



Tools

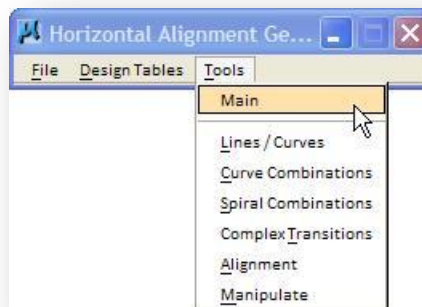
When **Tools > Main** is selected, the tool frame shown below opens.



Each icon in the tool frame is a tool box that can be "torn off" to become a separate "tool box." The individual tool boxes can be docked and resized. There are six tool boxes, with the following titles:

- Lines / Curves
- Curve Combinations
- Spiral Combinations
- Complex Transitions
- Alignment
- Manipulate

Alternately, each of the tool boxes may be opened by selecting them from the **Tools** option on the main menu bar, as shown below.



Operation of the individual Horizontal Alignment Generator tools is very thoroughly documented in the GEOPAK online help. Select **Applications > Road > Help** to access the online help. From the online help, select **Bentley GEOPAK V8i > Command Reference > Geometry > Layout Horizontal Alignments**. A summary of the available tools is shown in the next few pages.

Lines / Curves

The *Lines / Curves* tool box is depicted below and has seven icons (left to right):



- Store a Line By Two Points
- Store a Line Tangent To an Element
- Store a Circular Curve by Three Points
- Store a Circular Curve by Center Point
- Store a Unconstrained Tangent Curve
- Place Simple Curve
- Place Simple Transition Element

Curve Combinations

The Curve Combinations tool box is depicted below and has five icons (left to right):



- Place Turning Path
- Place Compound Curves
- Place Three Centered Curves
- Place Reverse Curves
- Place Taper Curves

Spiral Combinations

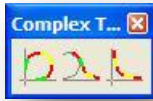
The *Spiral Combinations* tool box is depicted below and has six icons (left to right):



- Place SC Tangent to Line
- Place ST Tangent to Curve
- Place SC Tangent to Curve
- Place SCS (Intersecting Elements)
- Place STS (Disjoint Curves)
- Place SCS (Disjoint Curves)

Complex Transitions

The *Complex Transitions* tool box is depicted below and has three icons (left to right):



- Place Complex Ramp
- Place Ramp Connector
- Place SCSCS Curves

Alignment

The *Alignment* tool box is depicted below and has three icons (left to right):



- Place Dynamic Alignment
- Place PI Alignment
- Store Chain

Manipulate

The *Manipulate* tool box (second column, third row) is depicted below and has four icons (left to right):



- Move a Plan View Element
- Rotate a Plan View Element
- Extend a Plan View Element
- Delete an Element

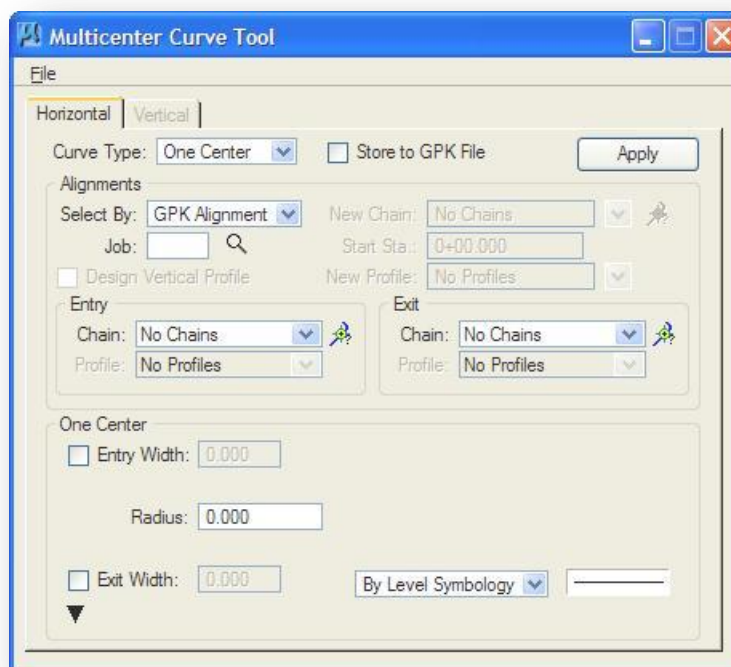
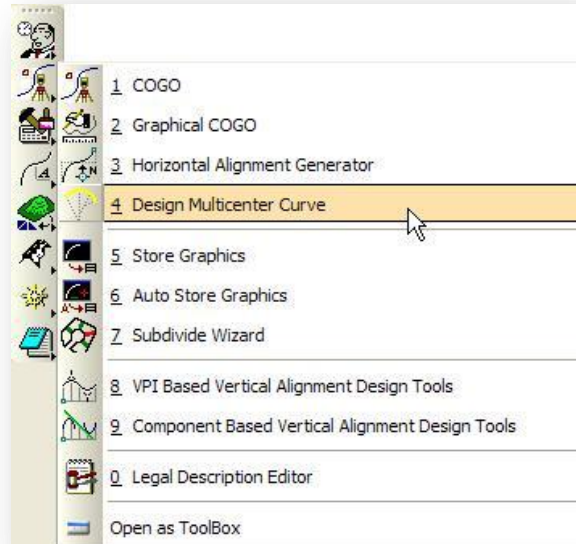
3.15 Multicenter Curve Tool

The Multicenter Curve Tool can be accessed from the *Road Tools* dialog, or by selecting **Applications > GEOPAK > Road > Geometry > Design Multicenter Curve** from the MicroStation pull down menu.

The *Multicenter Curve Tool* dialog, shown below, is opened.

The Multicenter Curve tool is used to store curves for the radius return between two COGO chains. The application can store one, two, and three centered curves. Optionally, the application can be used to design the vertical profile along the radius returns. This can be particularly useful for designing the vertical grade along the radii for import into the GEOPAK Corridor Modeling tool.

See the GEOPAK online help for more information on the operation of this command.

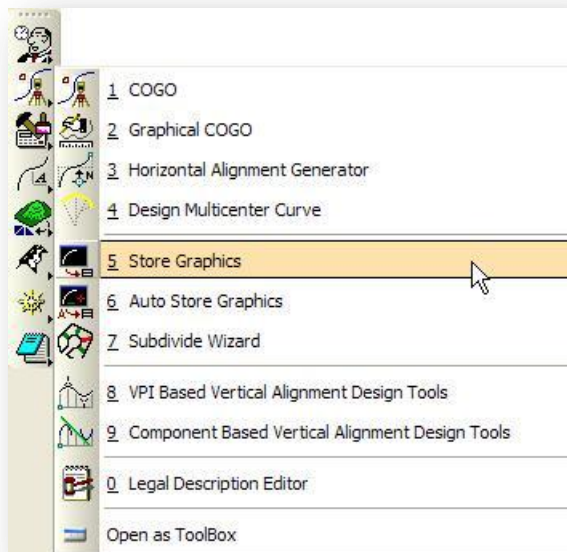


3.16 Store Graphics

The **Store Graphics** tool can be used to store points, curves, chains, and parcels into the coordinate geometry database from graphical elements in a 2D or 3D MicroStation file. When the **Store Graphics** tool is used within a 3D file, only the XY coordinates are used to store the COGO elements and no profile is generated.

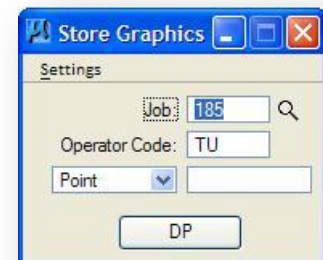
Note: In previous versions of MicroStation the accuracy of the data stored within the GPK file by use of the **Store Graphics** command was based upon the Working Unit resolution of the MicroStation design file. With the release of MicroStation v8 all graphic elements are stored with double precision coordinate values. ODOT has not recommended use of the **Store Graphics** tools with previous versions of MicroStation due to potential errors in the accuracy of design file graphics. Coordinate accuracy should no longer pose a problem with MicroStation v8.

The *Store Graphics* dialog can be accessed by selecting **Applications > Road > Geometry > Store Graphics**, or from the *Road* tool palette as shown below.



The following graphical elements can be stored in the Coordinate Geometry database by use of the *Store Graphics* dialog:

- Point
- Curve
- Chain
- Parcel

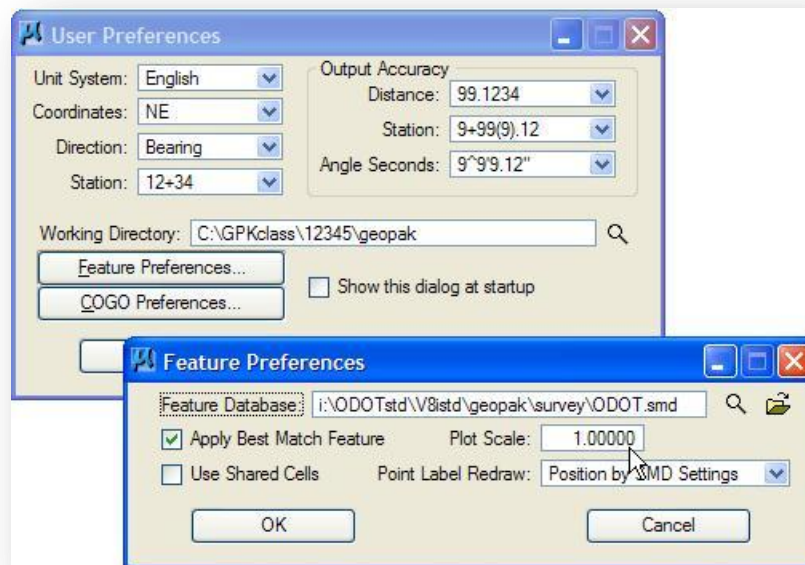


For detailed instructions on use of the *Store Graphics* dialog, see the GEOPAK on-line help

COGO Exercise 3A – Answers

As you store COGO elements in the GPK file, the graphics are drawn utilizing the current visualization settings. Before you begin, set the COGO Visualization settings to display the COGO elements.

- ✓ Make sure the *Feature Preferences* are set to use the ODOT Standard SMD file ODOT.smd.
- ✓ The Plot Scale is used when visualizing the COGO features. Use a plot scale that is large enough to read the point numbers when you are zoomed out.

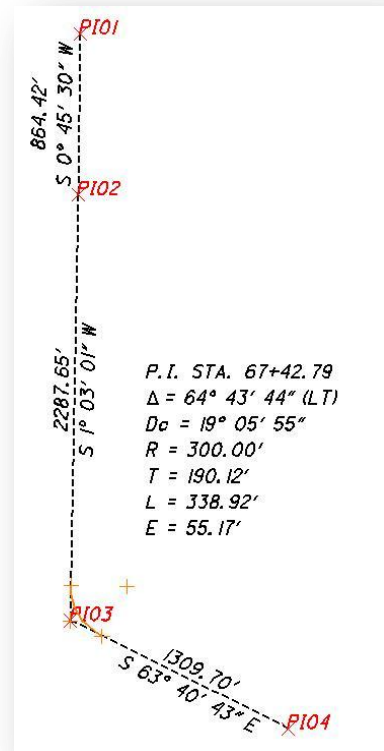
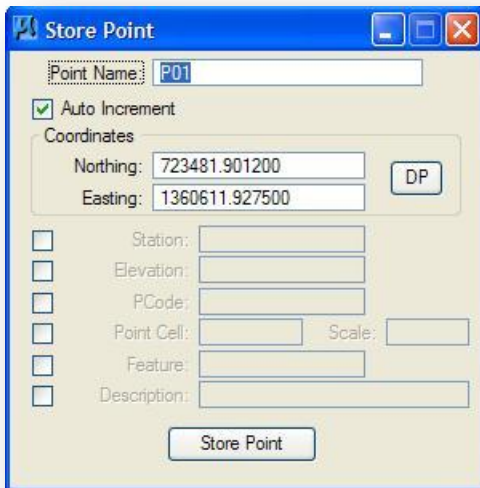


Within the main COGO dialog box, set the visualization mode to **Temporary Visualization** as shown below, or **Permanent Visualization**. In **Temporary Visualization** mode, the visualization graphics will be removed from the design file when you exit COGO.



To store the centerline for Existing State Route 185, first store points PI01-PI04 using the **Store Point** command and the **Locate Traverse** command. Select **Element > Point > Store** from the GEOPAK *Coordinate Geometry* dialog box. The *Store Point* dialog shown below is opened.

- ✓ Key in the Point Number PI01.
- ✓ Key in the **Northing** and **Easting** coordinates shown below for point PI01.
- ✓ Select the **Store Point** button. Point PI01 is now stored in the COGO database and the visualization graphics are displayed at the coordinate location in the MicroStation design file.



To locate points PI02, PI03 and PI04, use the **Locate Traverse** command. To access the *Locate Traverse* dialog shown on the following page, select **Tools > Locate > Traverse** from the GEOPAK *Coordinate Geometry* dialog box.

- ✓ Key in point number PI02 in the **Locate Point** field.
- ✓ Key in point PI01 as the **Station Point Name**.
- ✓ Toggle the **Direction** option to **Bearing**.
- ✓ Key in the bearing between points PI01 and PI02 shown below. Be sure to toggle the directions to the correct values.
- ✓ Set the **Distance** option to **Distance**.
- ✓ Key in the **Distance** value shown above for the existing centerline between points PI01 and PI02.

- ✓ Select **Locate**. Point PI02 is stored at the bearing and distance specified from point PI01.

- ✓ Store point PI03 using point PI02 as the **Station Point** and the bearing and distance shown in the diagram on the previous page.
- ✓ Store point PI04 using point PI03 as the **Station Point** and the bearing and distance shown in the diagram on the previous page.

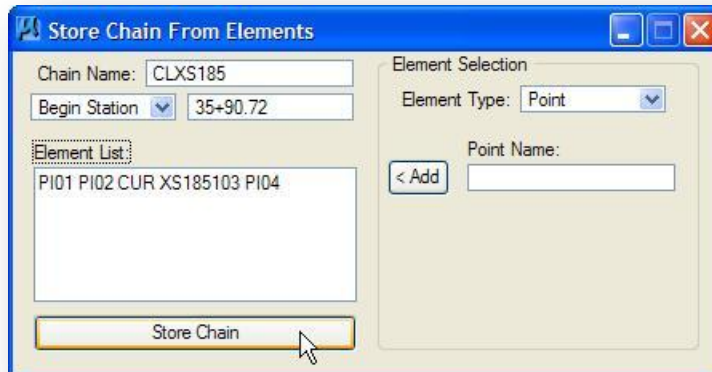
To store a curve for existing SR 185 centerline, select **Element > Curve > Store > By Tangents** from the *GEOPAK Coordinate Geometry* dialog.

- ✓ Key in the Curve Name XS18503.
- ✓ Select the **Back Tangent** and **Ahead Tangent** options as shown above. Point PI02 represents the back tangent point. Point PI03 is stored at the PI of the curve and point PI04 is the ahead tangent.
- ✓ The **Radius** for the curve is 300.

- ✓ Select the **Store Curve** button.

A curve named ES18503 is now stored in the COGO database. The next step is to make a chain from points PI01, PI02, PI04 and curve XS18503.

Use the GEOPAK Store Chain command to store a COGO chain. From the *GEOPAK Coordinate Geometry* dialog, select **Element > Chain > Store > From Elements** to access the dialog shown below.



- ✓ Key in the **Chain Name** CLXS185.
- ✓ Key in the **Begin Station** of 35+90.72.

The **Element List** portion of the dialog box is used to build a list of elements that will make up the chain. If you use the proper syntax, you can key in the list of elements manually. Point numbers can be keyed in directly without any special syntax. Curves must be keyed in as follows:

CUR name

Spirals are keyed in as follows:

SPI name

All elements must be separated by a space in the dialog box.

A second option to build the list of Elements that will be used to make up the chain is to use the **< Add** button with the element selection options. For example, to add point PI01 to the **Element List**, take the following steps:

- ✓ Select the **Element Type: Point** option.
- ✓ Key in **Point Name** PI01.
- ✓ Select the **< Add** button. Point number PI01 is added to the list box. Key in Point Number PI02 and select **< Add** to add point PI02 to the Elements list box.

To add the curve XS18503 to the list box, take the following steps:

- ✓ Select the **Element Type: Curve** option.
- ✓ Pick the curve XS18503 from the list box.
- ✓ Select the **< Add** button. The curve XS18503 is added to the list box.
- ✓ Use the **Element Type: Point** option to add point PI04 to the **Element List**.
- ✓ Select the **Store Chain** button. The new chain is created and stored in the COGO database.

A third option to build the Element List is to select the visualization graphics from the MicroStation design file in the order that you wish the elements to be chained. Take the following steps:

- ✓ Issue a Data Point in the **Element** List box so that the dialog item receives focus and is ready for your input.
- ✓ Select the visualization graphics for point PI01, accept the point by issuing another data point. Point PI01 is added to the **Element** List. Repeat the step for point PI02, curve XS18503, and point PI04.

Select the **Store Chain** button. The new chain is created and stored in the COGO database.

Answers to the Questions:

1. What is the station at point PI02? 44+55.14
2. What is the station at point PI04? 80+11.16

Use the **Describe Chain** command to answer the questions above.

- ✓ From the *Coordinate Geometry* dialog, select **Element > Chain > Utility** to access the dialog show at right.
- ✓ Select **Chain CLXS185** from the list, and then select the **Describe** icon. The results of the **Describe** command are displayed in the *Coordinate Geometry* dialog.



COGO Exercise 3B – Answers

To store the centerline for existing Jameson Road you must first store points $PI05$ and $PI06$ using the **Store Point** command.

From the GEOPAK Coordinate Geometry dialog, select **Element > Point > Store** to access the *Store Point* dialog.

Use the coordinates shown below to store the points:

Point Name	Northing	Easting
$PI05$	720,519.84	1,360,097.80
$PI06$	720,330.15	1,360,542.17

Next, use points $PI05$ and $PI06$ to make a chain for existing Jameson Road. From the GEOPAK *Coordinate Geometry* dialog, select **Element > Chain > Store > From Elements**.

- ✓ Key in the **Chain Name** CLXJAME.
- ✓ Key in the **Begin Station** 10+00.
- ✓ Identify the elements, points $PI05$ and $PI06$, which will make up the chain.
- ✓ Select **Store Chain** to create the chain.

1. What is the bearing and distance from point $PI05$ to $PI06$?

- ✓ Use the **Inverse** command or **Describe Chain** to answer question 1.

Bearing = S 66° 53' 01" E
Distance = 483.164'

2. What is the station at point $PI06$?

- ✓ Use the **Describe Chain** command to answer question 2.

Station = 14+83.164

COGO Exercise 3C - Answers

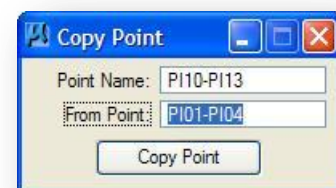
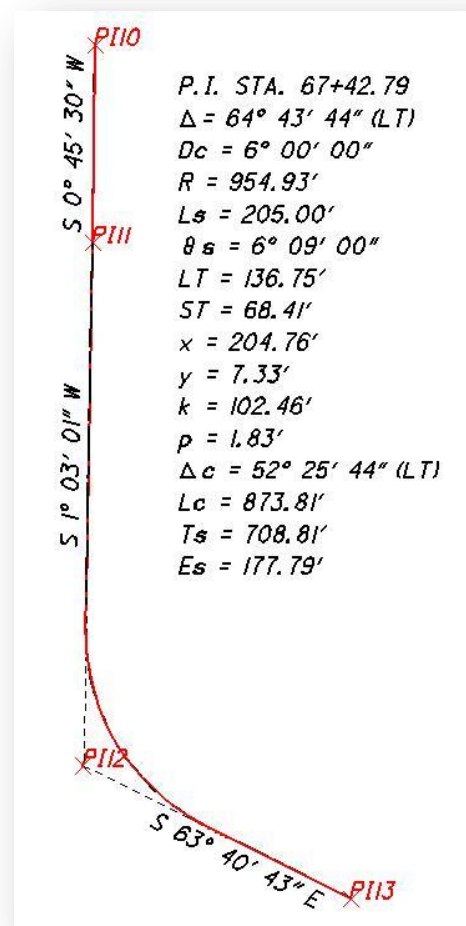
Points PI01, PI02, PI03 and PI04 represent the centerline tangents that were used to store the centerline of existing State Route 185. The same centerline traverse will be used to store the proposed relocation of State Route 185.

Before storing the centerline chain for proposed State Route 185, we recommend that you copy of points PI01, PI02, PI03 and PI04 as new COGO points PI10, PI11, PI12 and PI13 to be used with the new centerline chain. This is necessary because GEOPAK COGO stores the stationing for the chain with the individual COGO elements. If we were to use points PI01-PI04 for the proposed alignment, at first it appears that there will not be any problems because both chains will start at station 35+90.72. However, the proposed relocation of S.R. 185 will result in the stationing at the last point on the chain (point PI04) being different from the existing alignment. Since a COGO point can only have one station value associated with it, the station at point PI04 will be redefined when the proposed chain is stored. This will result in a station equation being inserted into the chain for existing S.R. 185 in order to account for the new station value at point PI04.

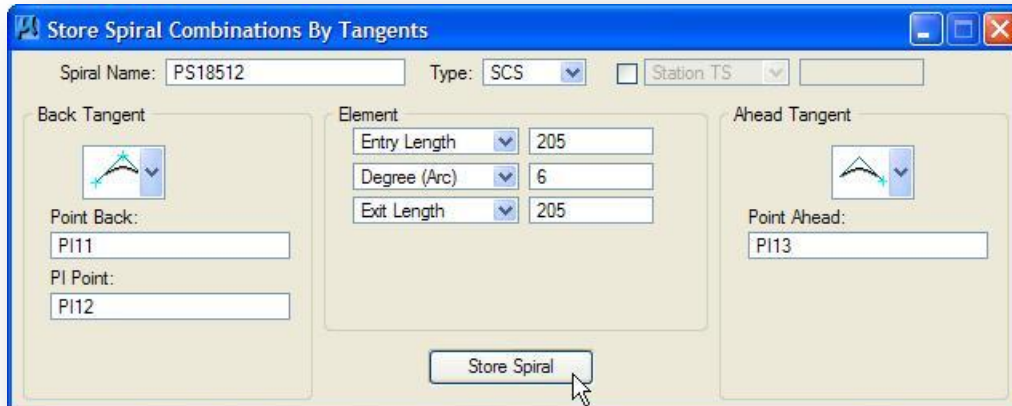
To avoid problems with the stationing on future projects, it is good practice to copy COGO elements to ensure that no elements are shared by multiple COGO chains.

To copy points PI10-PI13 from points PI01-PI04 take the following steps:

- ✓ From the GEOPAK Coordinate Geometry dialog, select **Element > Point > Copy** to access the *Copy Point* dialog.
- ✓ Key in the **Point Name** for the new points to be created.
- ✓ Key in the number of the previously stored points that you wish to copy in the **From Point** field.
- ✓ Select **Copy Point**



Next we will store a spiral-curve-spiral (SCS) combination using points PI11, PI12 and PI13 as the back tangent, point of intersection and ahead tangent reference as shown below.



From the GEOPAK Coordinate Geometry dialog, select **Element > Spiral > Store** to access the dialog shown above.

- ✓ Toggle the Spiral **Type** option to **SCS**.
- ✓ Key in the **Spiral Name**
- ✓ Select the **Back Tangent** and **Ahead Tangent** options as shown above
- ✓ Key in the **Entry Length**, **Degree (Arc)** and the **Exit Length** values as shown above

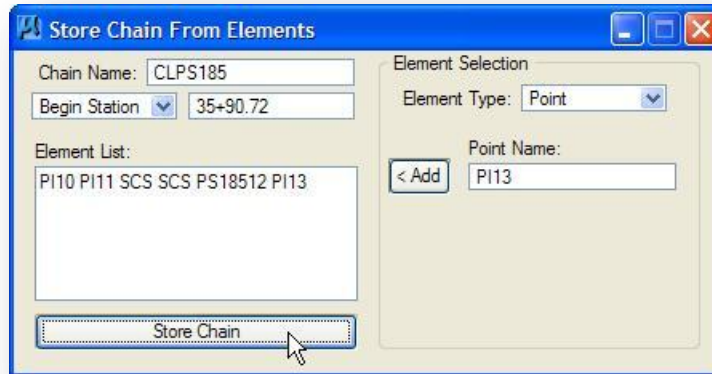
After selecting the **Store Spiral** button, 2 new spirals and a curve are stored in the COGO database. The curve and the two spirals are named as follows:

Entrance Spiral name = "PS18512B" (back spiral)

Curve name = "PS18512"

Exit Spiral name = "PS18512A" (ahead spiral)

The next step is to create a chain from points PI10, PI11, and PI13, spirals PS18512B and PS18512A, and curve PS18512. From the GEOPAK Coordinate Geometry dialog, select **Element > Chain > Store > From Elements** to access the dialog shown below.

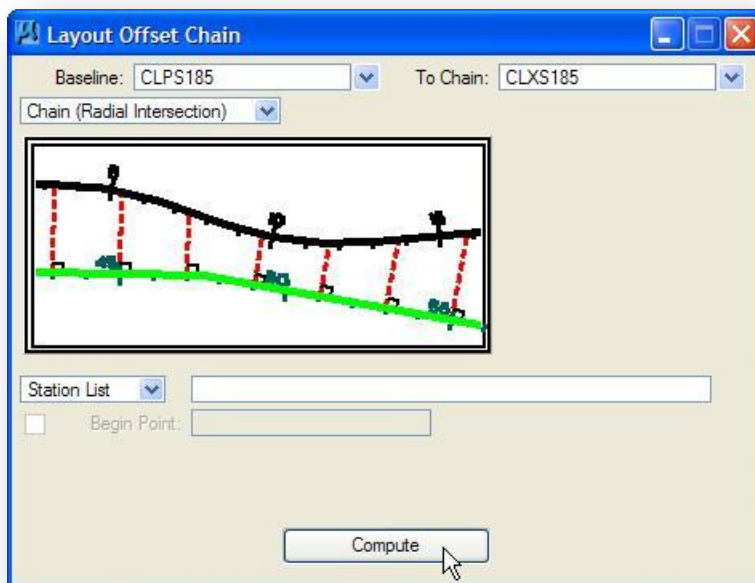


- ✓ Key in the **Chain Name** CLPS185.
- ✓ Key in the **Begin Station** 35+90.72.
- ✓ Compose the list of elements that will make up the new chain.
- ✓ Select **Store Chain**.

Tip:

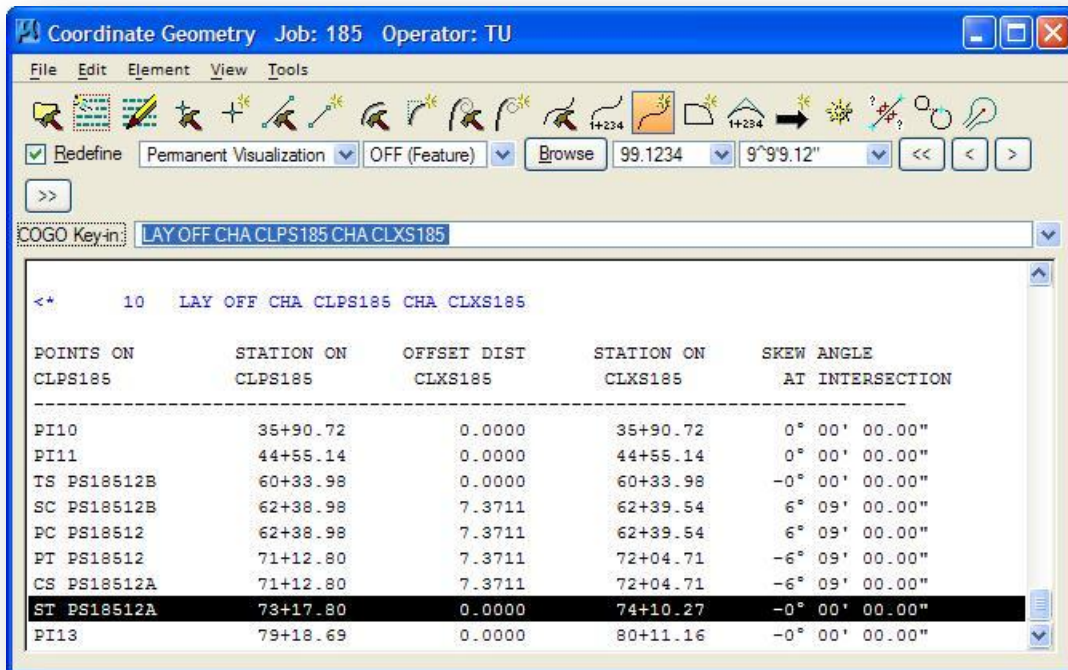
A Spiral-Curve-Spiral combination can be entered as one group in the Element List using the SCS syntax as shown in the dialog above. Using this syntax will identify the SCS as a set and will instruct the **Describe Chain** command to include the Total PI information in the description

Next we will store a station equation on chain CLPS185 at the location where the proposed centerline meets the existing centerline of SR 185 on chain CLXS185.



Proposed State Route 185 will meet Existing State Route 185 at the ST of spiral PS18512A. To store the station equation, we will need the station along chain CLPS185 at the ST of spiral PS18512A, and the corresponding station on chain CLXS185. The **Layout Offset Chain** command can be used to get these stations. From the Coordinate Geometry dialog, select **Element > Chain > Layout Offset** to access the dialog shown at left.

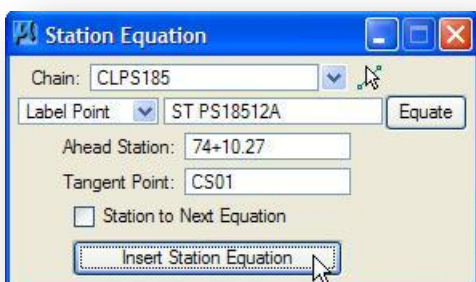
The results of the command are shown on the following page.



From the dialog above, you can see that the station at the ST of spiral PS18512A is 73+17.80. The corresponding station on chain CLXS185 is 74+10.27. We'll use these stations to store the station equation.

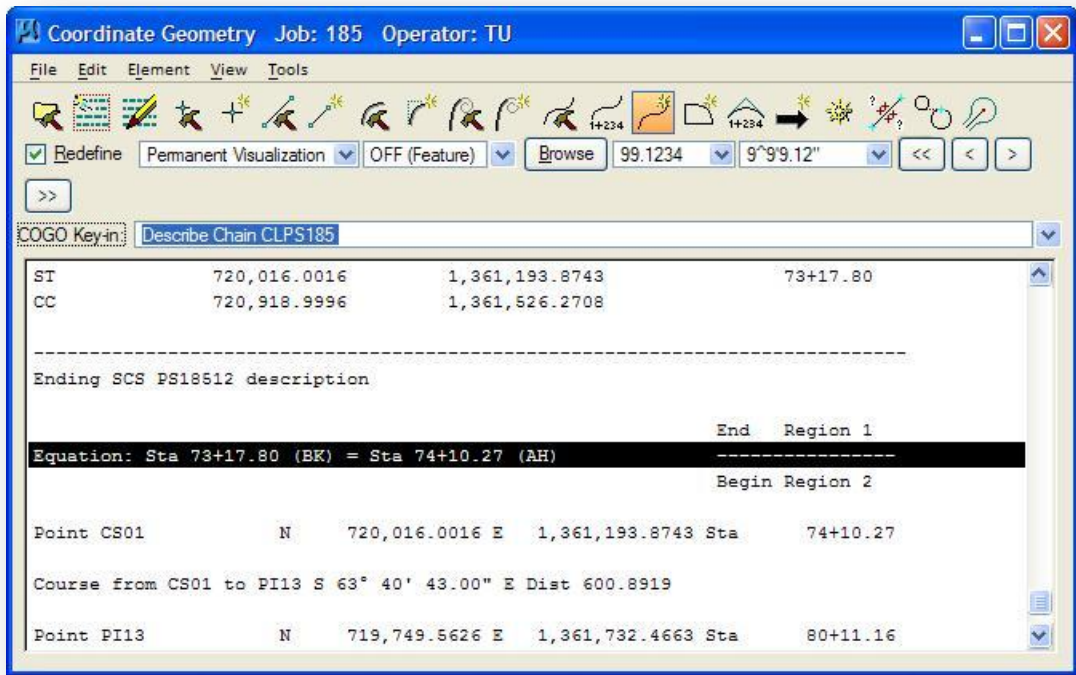
From the Coordinate Geometry dialog, select **Element > Chain > Station Equation** to access the dialog below.

In order to store a station equation on a chain, the **Redefine** option must be toggled on.



- ✓ Select Chain CLPS185 from the list.
- ✓ Select Label Point ST PS18512A
- ✓ Key in a Tangent Point name of CS01
- ✓ Select Insert Station Equation

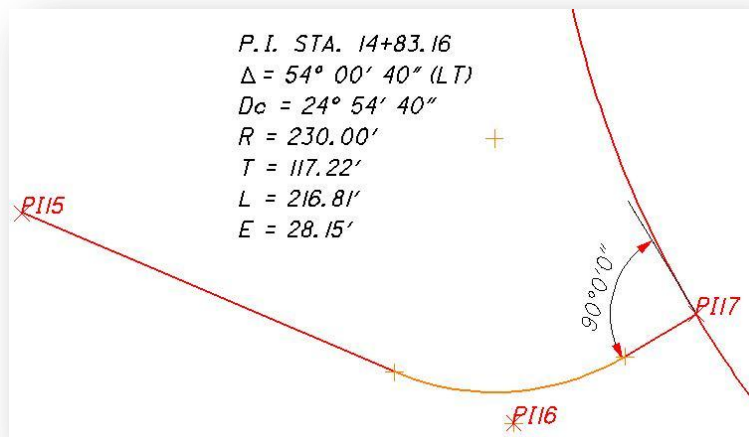
After the station equation has been stored, the **Describe/List/Print Chain** command can be used to review the results of the station equation command as shown below.



COGO Exercise 3D - Answers

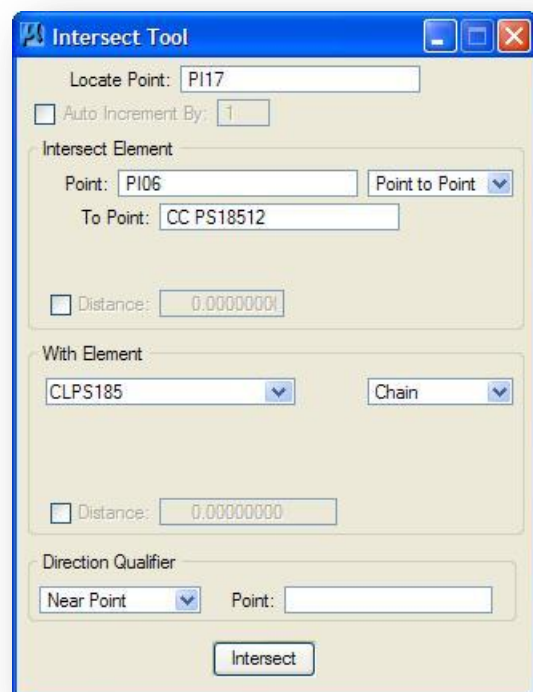
To store a chain for the proposed relocation of Jameson Road, first store new points $PI15$ and $PI16$ at the location of points $PI05$ and $PI06$ using the **Element > Point > Copy** command.

Next we will store a new point $PI17$ at the location where proposed Jameson road will intersect the proposed State Route 185 relocation.

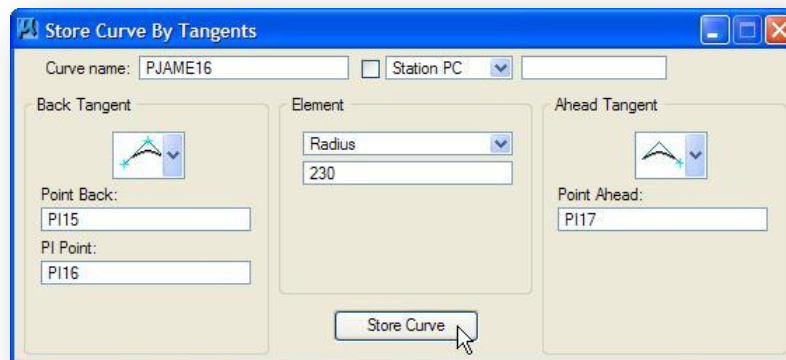


Point $PI17$ should be located so that the tangent line between points $PI16$ and $PI17$ intersects the proposed S.R. 185 chain within the limits of $PS18512$ at a 90° angle. In order for the line formed by points $PI16$ and $PI17$ to be perpendicular to curve $PS18512$, it must pass through the center of curve $PS18512$ (CC $PS18512$). The Intersect tool can be used to locate point $PI17$. **Select Tools > Intersect** to access the dialog shown at right.

- ✓ Key in point number $PI17$ for the new point you wish to store in the **Locate Point** field.
- ✓ Toggle the **Intersect Element** option to **Point to Point** as shown at right.
- ✓ To define the line that will intersect the chain $CLPS185$, key in the point number $PI16$ to use for the start of the line in the **Point** field. The **To Point** field will determine the other end point of the intersection line. Key in **CC $PS18512$** as shown at right.
- ✓ Toggle the **With Element** option to **Chain**. Select Chain $CLPS185$ for the element that will be intersected with the line defined by points $PI17$ and **CC $PS18512$** .
- ✓ Select Intersect to store point $PI17$

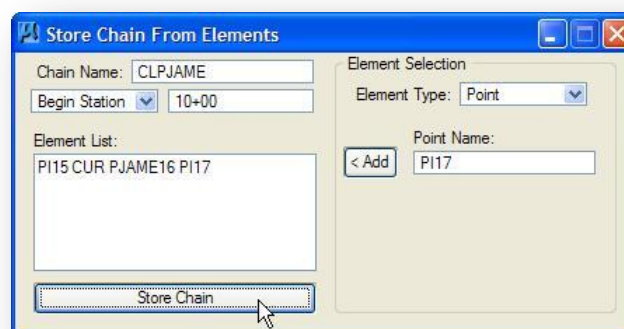


Next we'll use points PI15, PI16 and PI17 to store a curve for the relocation of Jameson Road. From the COGO Navigator dialog, toggle the **Element** option to **Curve**. Select the **Add Element** button to access the *Store Curve by Tangents* dialog as shown below.



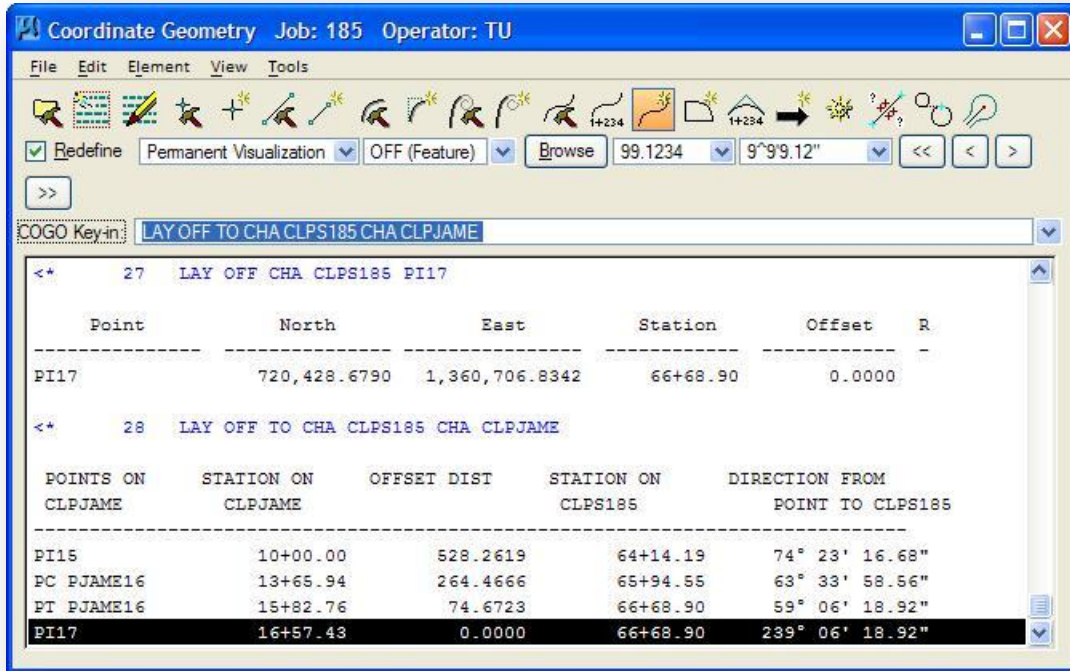
- ✓ Key in the **Curve Name** PJAME16
- ✓ Select the **Back Tangent** and **Ahead Tangent** options as shown using points PI15, PI16 and PI17
- ✓ Key in the **Radius** of 230
- ✓ Select **Store Curve**. The new curve PJAME16 is stored in the COGO database

Next we'll make a chain for proposed Jameson Road using point PI15, curve PJAME16 and point PI17. From the COGO Navigator, toggle the **Element** option to **Chain**. Select the **Add Element** button to access the *Store Chain From Elements* dialog box as shown below



- ✓ Key in the **Chain Name** CLPJAME.
- ✓ Key in the **Begin Station** 10+00
- ✓ Compose the list of elements that will make up the new chain as shown above.
- ✓ Select **Store Chain**.

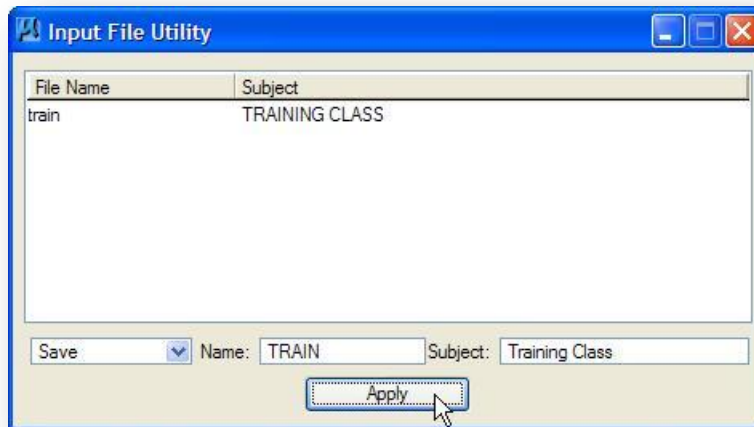
Once you have stored the chain CLPJAME for proposed Jameson Road, you can use the **Layout Offset Chain** command to get the station on chain CLPS185 at the intersection of Jameson Road.



The station on chain CLPJAME with the intersection of the CLPS185 chain also occurs at point PI17 and can also be determined from the command results shown above.

COGO Exercise 3E – Answers

To store an input file, from the GEOPAK *Coordinate Geometry* dialog, select **File > Input File Utility**. The dialog below will appear:



- ✓ Toggle the option to **Save**.
- ✓ Key in train for the name of the input file to save in the **Name** field. The **Subject** is optional.
- ✓ Select **Apply** to save the input file. All of the input commands that you have used during the COGO session are saved in the input file.

By default, the input file will be stored in the Working Directory.

The file will be named train***.ioc, where *** is the Job Number and oc is your Operator Code.

To save an output file, from the GEOPAK *Coordinate Geometry* dialog, select **File > Input File Utility**.

- ✓ Toggle the option to **Output**.
- ✓ Key in the name for the **Output File** you wish to save.
- ✓ Select the **Apply** button. The output from the COGO session is saved to the file.

A list of all the previously stored output files will appear in the dialog under the **File Name** heading.

By default, the output file will be stored in the Working Directory.

The output file will be named test***.ooc, where *** is the Job Number and OC is our Operator Code.

Saving an output file will store all of the output from all of the commands that you ran during the current COGO session. To store an output report of only specific commands, you have two options:

1. Clear the output buffer, issue the desired commands, and they save the output file.

To save an output file containing only the output from the **Describe Chain** command using this method, take the following steps:

- From the GEOPAK Coordinate Geometry dialog, select **Edit > Clear** to clear the COGO buffer

IMPORTANT!!! The **Edit > Clear** command will clear both the input and output commands from the COGO buffer. If you wish to store an input file containing the list of COGO input commands that you ran during the COGO session, be sure to save the input file before issuing the **Clear** command.

- Select **Element > Chain >Utility** to access the *Chain Utility* dialog. Select the chain name from the list, and then select the **Describe** command.
- Select **File > File Utility** to save an output file.

2. Clear the COGO View Window, issue the desired commands, save the text file.

To save an output file containing only the output from the **Describe Chain** command using this method, take the following steps:

- ✓ From the GEOPAK Coordinate Geometry dialog, select **View > Command Output > Clear** to clear the COGO window. The COGO Buffer is not cleared.
- ✓ Select **Element > Chain >Utility** to access the *Chain Utility* dialog. Select the chain name from the list, and then select the **Describe** command.
- ✓ From the GEOPAK Coordinate Geometry dialog, select **View > Command Output > Save Content As...** and enter a name for the file.

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4 Project Manager

4.1 The GEOPAK Project Manager

Each design project will have its own set of alignments, profiles, cross sections, design files, directories, etc. On larger projects, keeping track of all the information associated with your project can be cumbersome. The GEOPAK Project Manager is available to help organize the information associated with each specific design project.

The following information can be stored as part of a GEOPAK project:

- **The settings for the *GEOPAK User Preferences* dialog box.** Opening a specific project will reset the values of the *GEOPAK User Preferences* dialog box to the values stored with the project. This will eliminate the need to reset the *GEOPAK User Preferences* dialog box manually every time you switch to a new project.
- **Design file information.** Project Manager is also used to store the names of the design files associated with a project.
- **Coordinate Geometry information.** Each specific alignment within a given project will have a centerline, existing profile, proposed profile, cross sections, etc. associated with it. This information is also stored in Project Manager.
- **Digital Terrain Model information.** The name of the existing and proposed DTM files can be stored with Project Manager. See Chapter 3 for more information on Digital Terrain Models.

In addition to storing information about your project, the GEOPAK Project Manager provides a flow chart dialog box to help you step through the GEOPAK software functions in a project workflow.

Note:

Use of the GEOPAK Project Manager is optional. Users may elect to access the individual GEOPAK software functions without using the GEOPAK Project Manager by selecting **Applications > Road** from the MicroStation pull down menu.

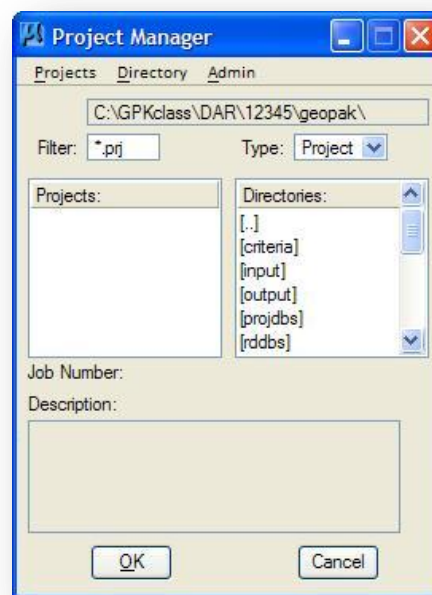
4.1.1 Creating a new GEOPAK Project

There are three steps to create a new GEOPAK Project:

- ✓ Create the project file.
- ✓ Set the project preferences.
- ✓ Create users for the project.

These steps are detailed on the following pages.

To create a new project, select **Applications > ROAD > Project Manager**, or select the Project Manager icon from the GEOPAK Road Tools tool frame to access the *Project Manager* dialog shown below.



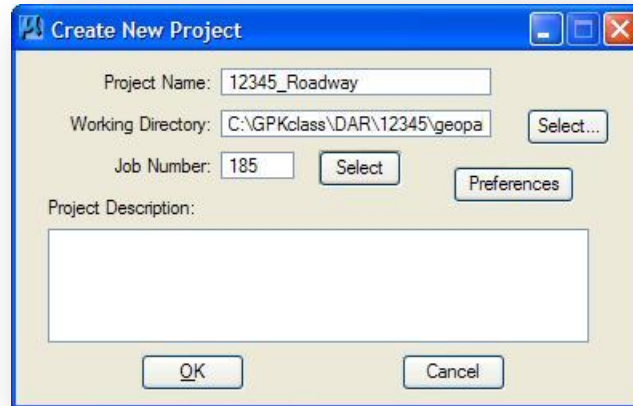
Take the following steps to create a new GEOPAK Project:

- Identify the directory where the new project is to be created. GEOPAK Projects are typically stored in the GEOPAK sub-directory.

Tip: CADD Standards

Information about ODOT's recommended directory structure can be found in the ODOT CADD Engineering Standards Manual:
<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/CADDManual.as>

- Next, select **Projects> New...** from the *Project Manager* dialog box to access the *Create New Project* dialog box.



The *Create New Project* dialog has the following components:

Project Name - The name of the new project you are creating. The project file will be created in the directory that was specified in the *Project Manager* dialog box shown on the previous page. Project files have a .prj file extension. We recommend using the PID Number for the Project Name.

Working Directory - This parameter is used to specify the default directory that GEOPAK will use to open files and to save files. Use the **Select...** button to select an existing directory that will be utilized as the default directory for the project.

Job Number - This is a 1 to 3 digit alpha/numeric designation to be used by GEOPAK to create a Coordinate Geometry (COGO) database for the project. In the example above, using the three characters 185, a Coordinate Geometry data base named job185.gpk will be created in the directory that is specified as the **Working Directory**. The **Select** button is used to select a previously created GPK file for use by this project.

Project Description - The **Project Description** is optional. You may wish to store the following optional information in the **Project Description**:

- County-Route-Section:
- PID Number:
- State Job Number:
- Project Manager:
- Project Designer:
- Project Description:

Preferences - Select this button to access the *GEOPAK User Preferences* dialog shown on the following page.



Notice that the user preferences dialog shown above is the same dialog that is accessed by selecting **Applications > Road > User Preferences**. In this case, the values you enter in the *GEOPAK User Preferences* dialog will be stored as part of the project. When the project is opened, the values associated with the project will override the current GEOPAK User Preferences settings.

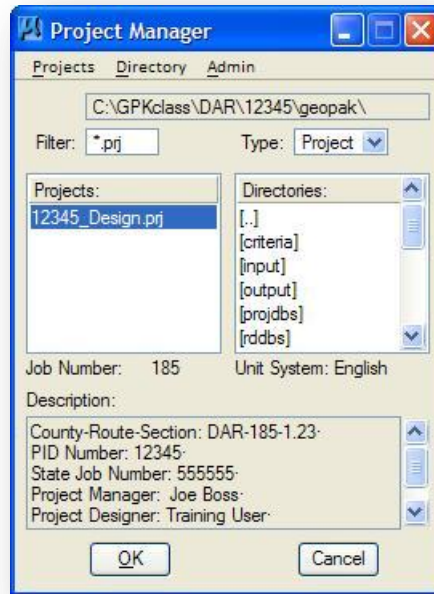
After you have set the **GEOPAK User Preferences**, select **OK** to close the dialog.

Tip: User Preferences

If you select **Applications > Road > User Preferences** to make changes to the current preferences, these changes are not stored as a part of your GEOPAK Project. To change preferences associated with a GEOPAK Project, select **Projects > Edit...** from the *GEOPAK Project Manger* dialog box.

To create the project, select **OK** from the *Create New Project* dialog box. A new file with a .prj extension is created in the directory specified on the *Project Manager* dialog.

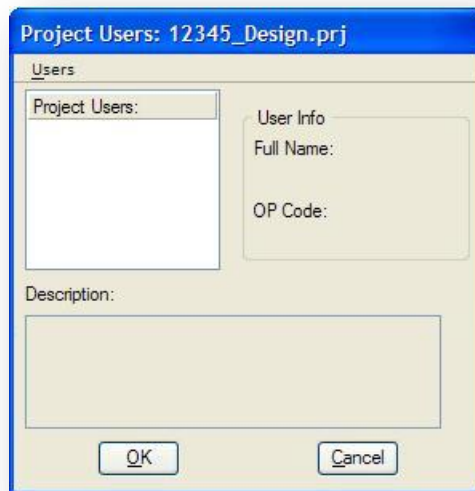
After creating the new GEOPAK Project, the project file is available for selection from the *Project Manager* dialog.



Select the project name, and then select **OK** to open the project (or double click on the project name) to access the *Project Users* dialog.

4.1.2 Project Users

The information stored in Project Manager is saved by each User for the project. New users are created by selecting **Users > New** from the *Project Users* dialog shown below. A minimum of one user must be defined for each project.



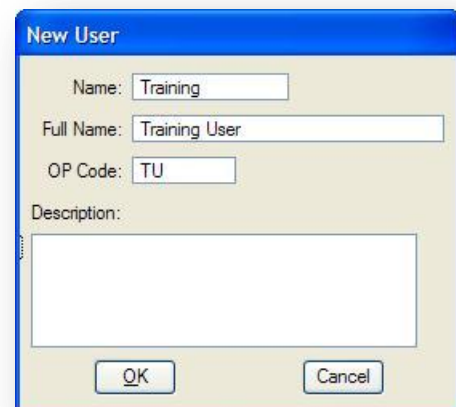
The *New User* dialog is shown at right.

ODOT recommends using the following standard for user information:

- **Name:** The log in name of the user
- **Full Name:** The users full name
- **OP Code:** The initials of the user
- **Description:** Optional

Select **OK** to create the user.

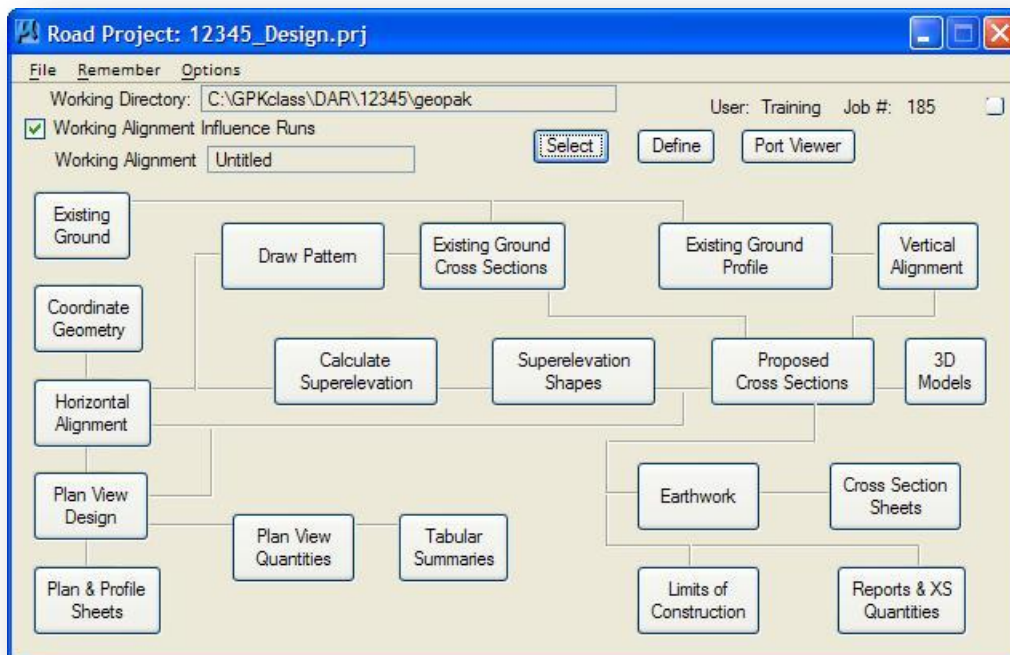
You will be prompted to password protect the user name. Select **Yes** if you wish to password the user name or **No** if you do not want to use a password. ODOT recommends that you do not assign a password for the users on a GEOPAK project.



Once the *Project Users* dialog has been completed, and a minimum of one user has been defined, clicking **OK** (or double clicking on a Project User) closes the *Project Users* dialog and opens the *Road Project* dialog shown below.

4.1.3 The Road Project Dialog

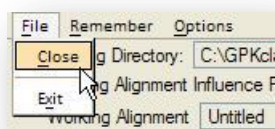
The GEOPAK Project Manager associates a project with its respective job number, user and working directory. When the setup is complete, the *Road Project* dialog appears on the screen.



Each item on the *Road Project* dialog box represents a specific GEOPAK function. The dialog has a few operational functions that are described below:

File

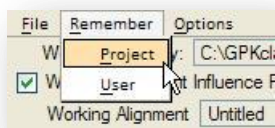
The **File** menu has two options: **Close** and **Exit**.



Select **Close** to close the Road Project dialog box. Select **Exit** to exit from Project Manager.

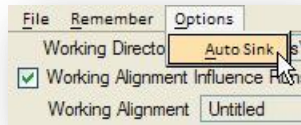
Remember

The options on the **Remember** menu will allow you to select whether GEOPAK will automatically open the last **Project**, or **User** when Project Manager is opened. We recommend leaving these functions toggled off unless you will be working on one project for an extended period of time.

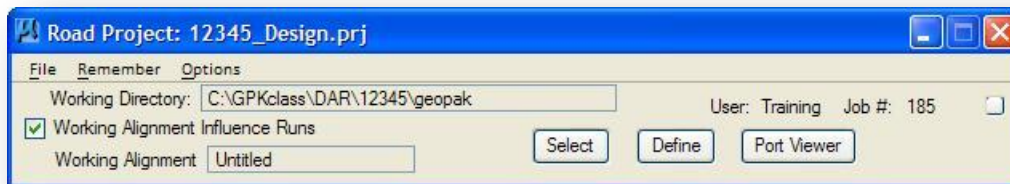


Options

The Options menu will allow you to turn the **Auto Sink** function on or off. With **Auto Sink** turned on, selecting any of the *Road Project* dialog options will automatically sink the *Road Project* dialog behind the MicroStation window. Once the dialog box for the selected function is closed, the *Road Project* dialog will automatically pop back to the top.

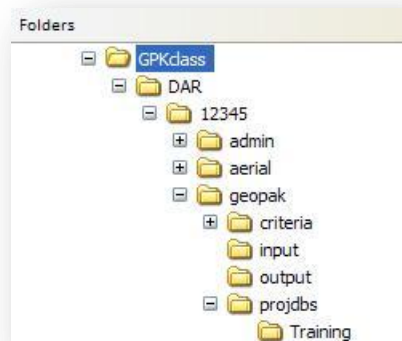


The Road Project dialog can be alternately minimized or maximized by selecting the small button to the right of the dialog. The minimized dialog is shown below.



4.1.4 GEOPAK Project Directory Structure

After you have created a new GEOPAK Project and User, a new sub-directory named *projdbs* is created in the **Working Directory** as shown below. This directory is used to store Project Manager Information for each user. If you create multiple users for a project, a sub directory for each user is created under the *projdbs* directory.

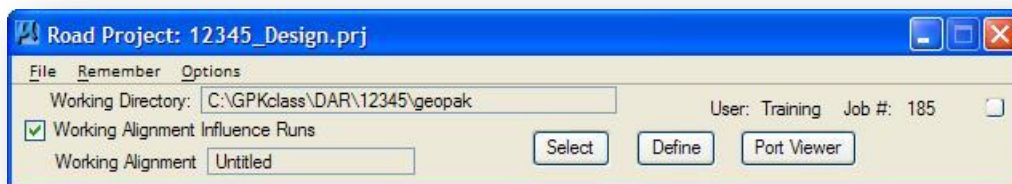


4.1.5 The Working Alignment

Within each GEOPAK project there may be several horizontal alignments, vertical profiles, cross sections, etc., each representing the individual roads of the project. In order to better organize this information, GEOPAK uses the Working Alignment to store information about each roadway within a project. These settings are shared with other dialog boxes within GEOPAK to minimize re-entering the same information in multiple dialog boxes through the project workflow.

An unlimited number of Working Alignment definitions can be created within a GEOPAK project. Each Working Alignment definition will represent a different road alignment within the design project.

The **Working Directory**, **User** and **Job #** are shown across the top of the dialog box as shown below. The currently selected **Working Alignment** is shown on the left.



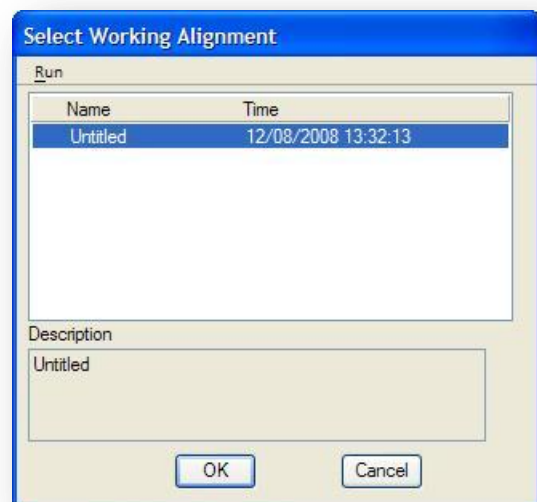
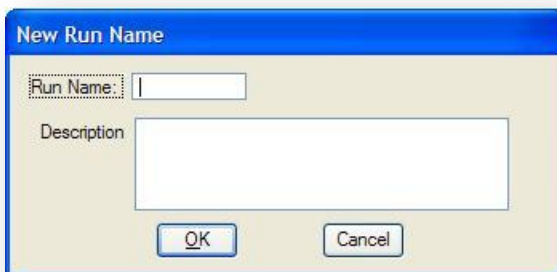
There are two steps to setting up a working alignment

- ✓ Create an alignment “run”
- ✓ Define the conditions for the “run”.

The **Select** button is used to choose an existing working alignment or create a new one. The **Define** button is used to define information about the working alignment. Each process is described in further detail below.

Click the **Select** button to access the *Select Working Alignment* dialog box shown at right. By default there is always a Working Alignment named *Untitled*.

To create a new Working Alignment select **Run > New...** from the *Select Working Alignment* dialog box. The *New Run Name* dialog box shown below appears.



Each Working Alignment is stored as a separate “run” by GEOPAK. Key-in the **Run Name** for the new Working Alignment. ODOT recommends the following standard:

Working Alignments: aa####

Alternatives Alignments: aa####A**

Where:

aa = Road type.
IR = Interstate Route
US = US Route
SR = State Route
RP = Ramp
CR = County Road
TR = Township Road

Note: In cases where the roadway doesn't fall within the Road Type categories above, the name of the street may be used up to the maximum character limit of 8 characters, or 5 characters when alternatives are studied.

= Three digit route number. For example, SR 4 would be 004
= Ramp Number 2S, 3A, etc.

A** = Alternate number. Example: A or A01 for more than one.

The **Description** field is optional. ODOT recommends including the following information as a standard:

Alternate:

Roadway:

Design Speed:

Max. e:

Design Functional Classification:

Description:

Example 1:

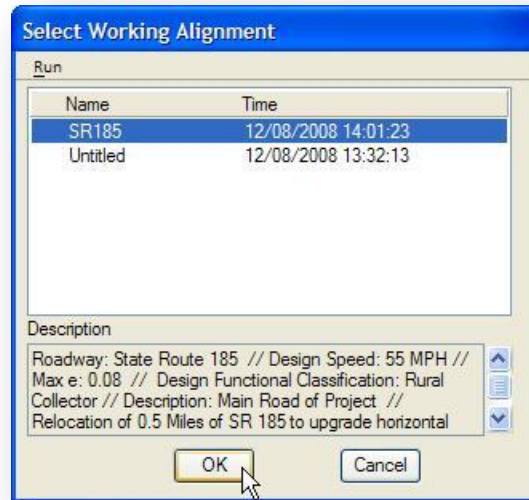
Roadway: State Route 185 // Design Speed: 55 MPH // Max e: 0.08 // Design Functional Classification: Rural Collector // Description: Main Road of Project // Relocation of 0.5 Miles of SR 185 to upgrade horizontal and vertical alignments to meet current roadway design standards.

Example 2:

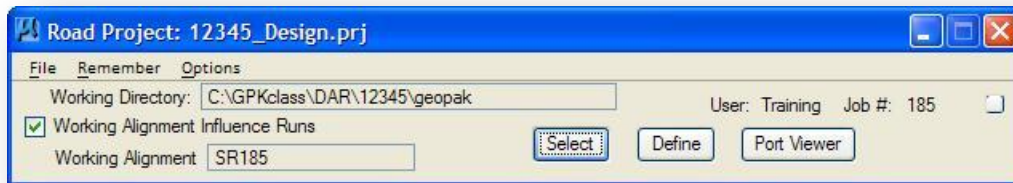
Roadway: County Road 108 // Street Name: Jameson Road // Design Speed: 55 MPH // Max e: 0.06 // Design Functional Classification: Rural Local // Description: Side road of project located at station 66+50. Improvement of CR 108 by reconstruction of vertical and horizontal alignments to improve the intersection with SR 185.

Select the **OK** button to create the new Working Alignment.

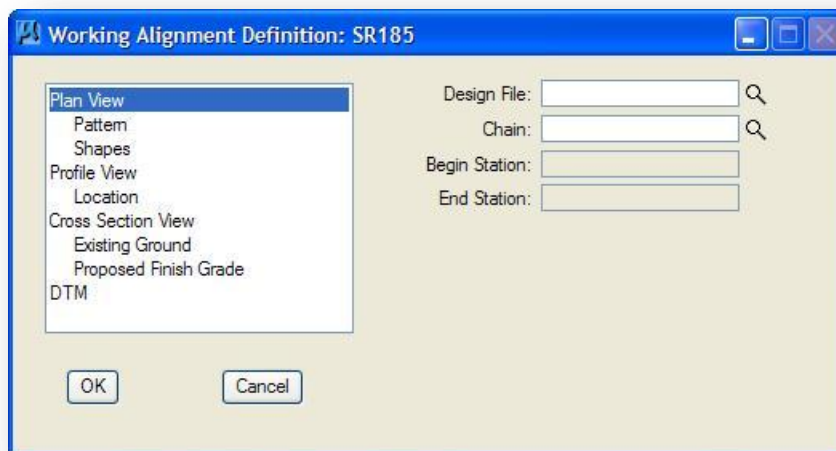
After you have created a new Working Alignment, the name of the alignment is displayed in the *Select Working Alignment* dialog box as shown below.



Select the Working Alignment that you wish to use and click the **OK** button, or double click the name of the Working Alignment. The *Road Project* dialog box is updated to reflect the currently selected Working Alignment as shown below.



From the *Road Project* dialog box, select the **Define** button to access the *Working Alignment Definition* dialog box shown below.



Each item on the left of the *Working Alignment Definition* dialog box represents a different piece of information that can be defined for the alignment. As you work through a GEOPAK project, you will continue to update the *Working Alignment Definition* dialog box as new information is developed.

The first item in the *Working Alignment* dialog is the **Plan View** item. This item is used to store the name of the Design File that contains the proposed graphics for the project, and the name of the **Chain** in the Coordinate Geometry database that is used for the centerline of the road.

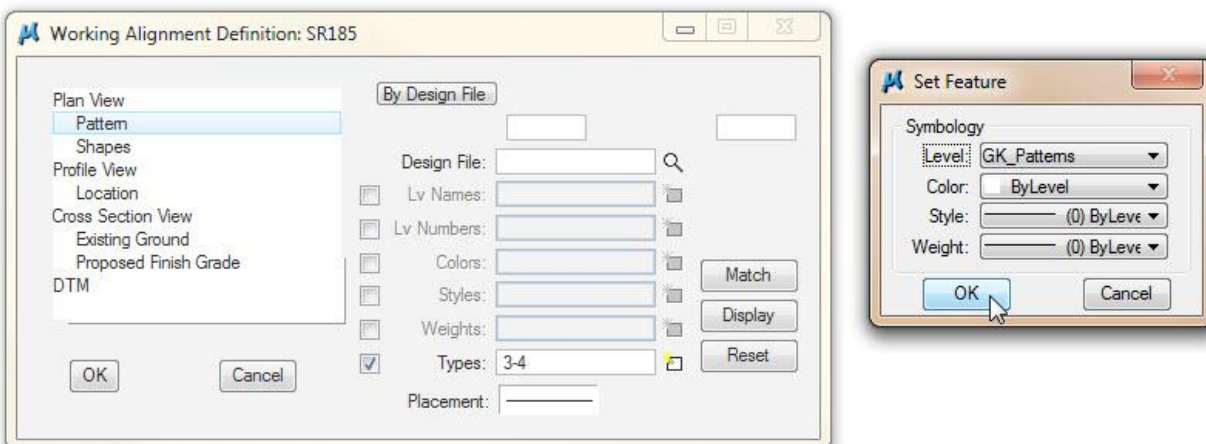
When accessing the various functions of the GEOPAK Road Project dialog box, the settings and parameters of the current Working Alignment run are shared with the dialog boxes for the various functions if the parameters have been specified in the Working Alignment and if the **Working Alignment Influence Runs** toggle is active, as shown above. This eliminates the need to repetitively enter the same data in every dialog box.

4.1.6 Pattern and Cross Section Placement Symbology

After creating the Working Alignment for a specific roadway, it is recommended that you set the default placement symbology for the **Pattern** and the **Cross Section View Existing Ground** items. Both of these options are used in the GEOPAK Road 2 class, not in Road 1, but it is good practice to set these values immediately after creating a new working alignment definition.

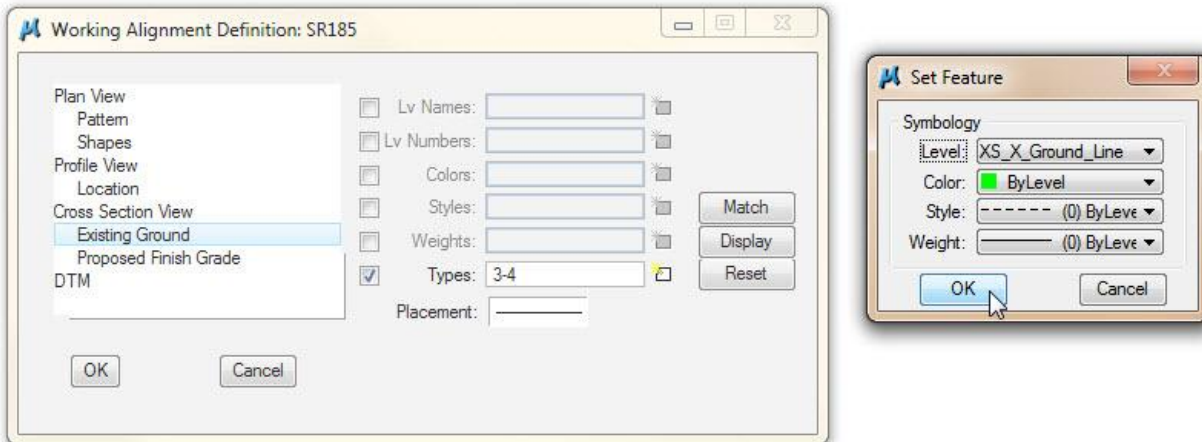
Take the following steps to define the default parameters for pattern line placement:

- Select the **Pattern** item as shown below.
- Select the **By Design File** option.
- Double-click the **Placement** symbology box to access the *Set Feature* dialog shown at right below. Set the **Symbology** as shown. Select **OK**.



Take the following steps to define the default parameters for the Existing Ground line placement:

- Select the **Cross Section View Existing Ground** item as shown below.
- Double-click the **Placement** symbology box to access the *Set Feature* dialog shown at right below. Set the **Symbology** as shown. Select **OK**.



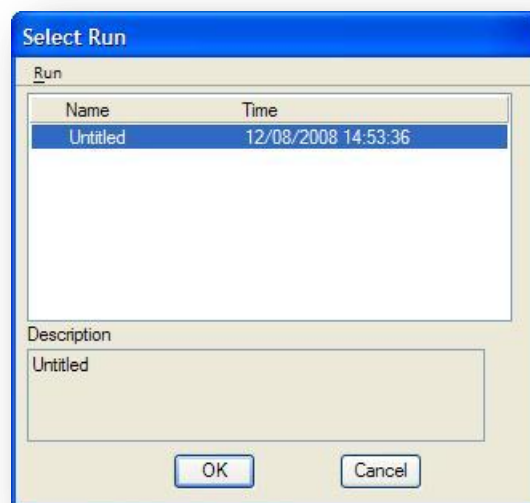
Additional information on the use of these parameters can be found in the GEOPAK Road 2 training guide.

4.1.7 Creating “Runs” in Project Manager

In larger, more complex design projects, the **Project Manager** functions as a data repository and file management tool. In order to accomplish this, the dialog setting for each process is assigned a name and stored as a **Run** for the selected process. This unique name identifies the specific information for the processing. The designer can access previously saved runs to quickly and easily review what data was entered for a specific processing function.

In addition, minor changes can be quickly made by accessing the run, modifying the value or key-in that has changed and rerun the process. The changes can be saved within the **Project Manager**, so, if the alternate did not produce the desired results, it can be discarded.

When the user selects a GEOPAK function with the GEOPAK Project Manager active, the Select run dialog shown below is activated before the function is accessed.



Note: A few processes do not create runs. These include most COGO functions, Plan Production tools, Tabular Summaries, and 3D Models.

If the project is small and only one run of a particular processing is expected, the user can use the default run “Untitled” and continue by clicking **OK**. However, for projects where processing multiple iterations of the same application for separate alignments is expected, (i.e., two different sets of proposed cross sections), it is prudent to assign names and the optional description for easy recognition at a later date.

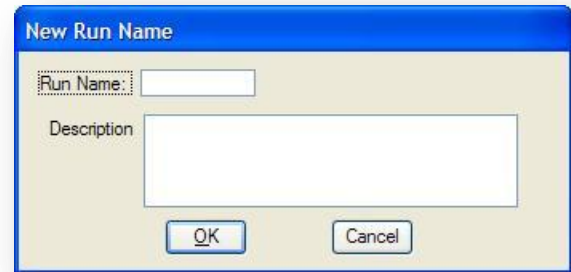
If no options have been previously run, **Untitled** appears in the **Run** list box along with the current time. If prior runs have been processed, they are listed with the last run time. The description of the run file can be seen in the bottom of the dialog when each file is highlighted.

To select a previously defined **Run**, highlight the **Run** from the list, and then click **OK**. Double clicking on the Run file name also selects a previous run for subsequent processing. Clicking **Cancel** closes the *Select Run* dialog.

Several options are supported in the **Run** menu. These include **New**, **Copy**, **Modify**, and **Delete**.

New Run

The **Run Name** is a one to eight character alphanumeric name. The **Description** field is a multi-line field which enables the user to define the contents of the run file. Pressing the **OK** button will automatically close the dialog and return to the *Select Run* dialog where the new **Run** file name is displayed. Clicking **Cancel** closes the dialog without saving the new **Run** Name.

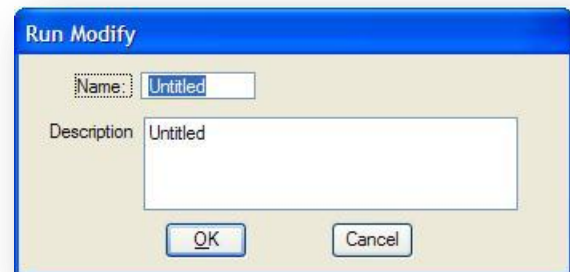


Copy

Several options are supported under the **Copy** menu item. These include: **Project**, **User**, and **Run**. If a **Run** is similar to another **Run**, it is easier to copy the previous run and modify, rather than entering all the information a second time. Similarly, **Projects** and **Users** can also be copied. When the **Copy... > Projects** option is selected, the *Project Selection* dialog opens for identifying the existing project to be copied. Highlight the project to be copied, and then click **OK**. The *Project Users* dialog and *Select Run* dialogs are then displayed for the **User** and **Run** to be identified.

Modify

The **Name** is a one to eight character alphanumeric file name. The **Description** field is a multi-line field which enables the user to define the contents of the run file. If a new description is not keyed in, the description from the original file will be utilized. Clicking **OK** automatically closes the dialog and returns to the *Select Run* dialog. Clicking **Cancel** closes the dialog without modifying any files.



Delete

When the **Run** file to be deleted is highlighted and the **Run > Delete** option is selected, an Alert message box is displayed prompting, "Are you sure? Clicking **Yes** deletes the **Run** and returns to the *Select Run* dialog, while clicking **No** returns to the *Select Run* dialog with no deletion occurring.

Exercise 4

Create a new GEOPAK Project, user, and Working Alignment Definitions for State Route 185 and Jameson Road.

- ✓ Open the file 12345BP001.dgn.
- ✓ Use the GEOPAK Project Manager to create a new project.
 - Which sub-directory should be used to create the project?
 - Using the recommended standard, what should you name the project?
 - Which directory should you assign for the Working Directory?
 - What is the default file extension for the project file?
- ✓ Set the Project Preferences to values that are appropriate for English unit projects.
- ✓ Open the newly created project. Create a new user for the project using your name, full name and operator code. Select the newly created user to access the *Project Manager* dialog box.
- ✓ Create a Working Alignment definition for State Route 185.
 - What should you name the Working Alignment for State Route 185?
- ✓ Define the following information for the State Route 185 Working Alignment:
 - Plan View: Design File (identify the design file with the proposed plan view graphics)
 - Plan View: Chain (identify the proposed centerline)
 - DTM: Existing Ground TIN (identify the TIN file delivered from survey)
 - Pattern: Define the Pattern placement symbology as shown on page 4-12
 - Cross Section View Existing Ground: Define the symbology as shown on page 4-13
- ✓ Create a Working Alignment definition for Jameson Road.
 - What should you name the Working Alignment for Jameson Road?
- ✓ Define the following information for the Jameson Road Working Alignment:
 - Plan View: Design File (identify the design file with the proposed plan view graphics)
 - Plan View: Chain (identify the proposed centerline)
 - DTM: Existing Ground TIN (identify the TIN file delivered from survey)
 - Pattern: Define the Pattern placement symbology as shown on page 4-12
 - Cross Section View Existing Ground: Define the symbology as shown on page 4-13

5 Design & Computation Manager

5.1 Overview

The Design & Computation Manager is used by GEOPAK for several functions. The following operations can be performed with the D&C Manager:

- Set drafting standards for plotting COGO elements into MicroStation
- Set drafting Standards for drawing MicroStation graphics
- Place MicroStation graphic elements as “pay items” that can later be tabulated by GEOPAK
- Identify the GEOPAK pay item attribute for MicroStation elements previously placed with the D&C Manager
- Filter the MicroStation display to show only selected items. For example, display only the proposed drainage items
- Draw pavement markings including various gore treatments
- Draw pavement shapes that can be used to compute pavement quantities






The Design and Computation Manager can be accessed by selecting **Applications > Road > Design & Computation Manager** from the MicroStation menu bar, or from the *Road* tool palette as shown below



The *Design and Computation Manager* consists of two separate dialog boxes, one for settings, as shown on the following page.



The D&C Manager dialog has a row of shortcut buttons across the top of the dialog box. The function of each button is summarized below.

- 
Switching to Toolbox Mode will change the appearance of the D&C Manager dialog box into a slim dialog that can be “docked”. This mode is detailed in section 5.8.
- 
The Identify mode is used to set the D&C Manager item to match an existing MicroStation element previously drawn using the D&C Manager. If no item is found within the specified database, GEOPAK displays the following message in the prompt field: “No matching database item.”
- 
Display mode is used to filter the MicroStation display to show only selected features. See section 5.6.
- 
Design mode is used to plot COGO elements into MicroStation with the desired symbology by use of the Draw Plan and Profile dialog. It can also be used to set drafting standards to be used in conjunction with MicroStation’s element placement commands with the Place Influence option toggled on. See section 5.4 and 5.5 for information on using Design mode.
- 
Set mode is similar to Design mode in that it is used to set the symbology of MicroStation elements. The difference is that Set mode is used to change the symbology of previously stored MicroStation graphic elements



Compute mode is used for tabulating quantities of items that have been placed as a “Pay Item” by use of the Design or Set mode.



The Shape mode uses plan view MicroStation graphics to place shapes required for pavement calculations.



Several options for placing pavement striping and marking are accessed via the Pavement mode. These options are covered in Section 6.7 - Pavement Marking.



The Preferences mode is used to configure the Design and Computation Manager and is not covered by this class.

The use of these functions will become more apparent once you understand the structure and use of the hierarchical database. This is the subject of the next few subsections.

5.2 ODOT Standard D&C Manager Database

The **Office of CADD and Mapping Services** in Central Office is responsible for the development of the ODOT standard GEOPAK Design and Computation Manager Database, ODOT.ddb. The database has been developed to comply with the CADD Standards.

For ODOT personnel, the Design and Computation Manager database is located in the following directory:

i:\ODOTstd\V8istd\geopak\road\ddb

The database can also be downloaded from the ODOT CADD Support website:

<http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/default.aspx>

When the Design & Computation Manager is opened, the default database, ODOT.ddb, is opened as defined in the ODOT configuration.

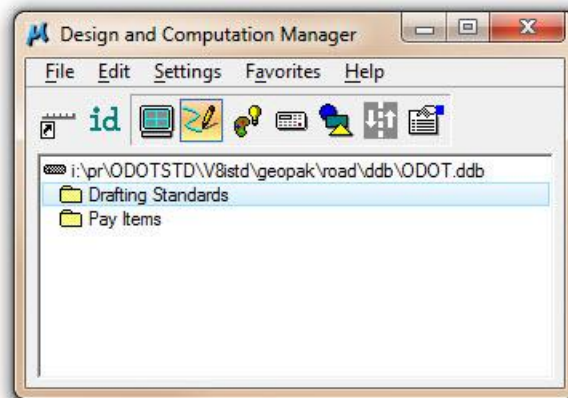
The D&C Manager database is a password protected file and cannot be edited by the designer. Suggestions or requests for enhancements should be forwarded to the **Office of CADD and Mapping Services**.

5.3 D&C Manager Database Structure

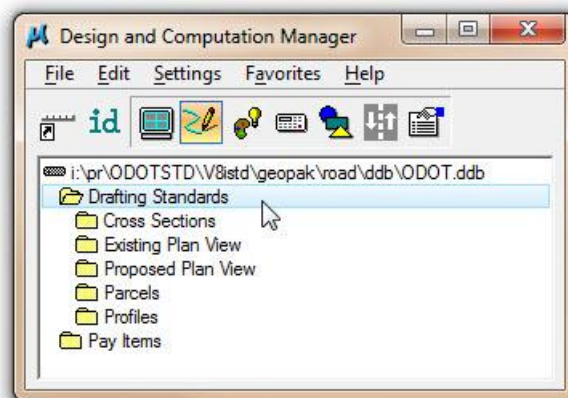
Elements in a MicroStation file representing a roadway project can be classified according to features (e.g., pavement, shoulders, curb and gutters) and/or pay items. The Design and Computation Manager dialog employs a hierarchical database wherein an unlimited number of features and/or pay items can be organized in an unlimited number of categories and subcategories.

5.3.1 Categories

The basic component of the hierarchical tree is the Category. The database ODOT.ddb contains two child categories: **Drafting Standards** and **Pay Items** as shown below.

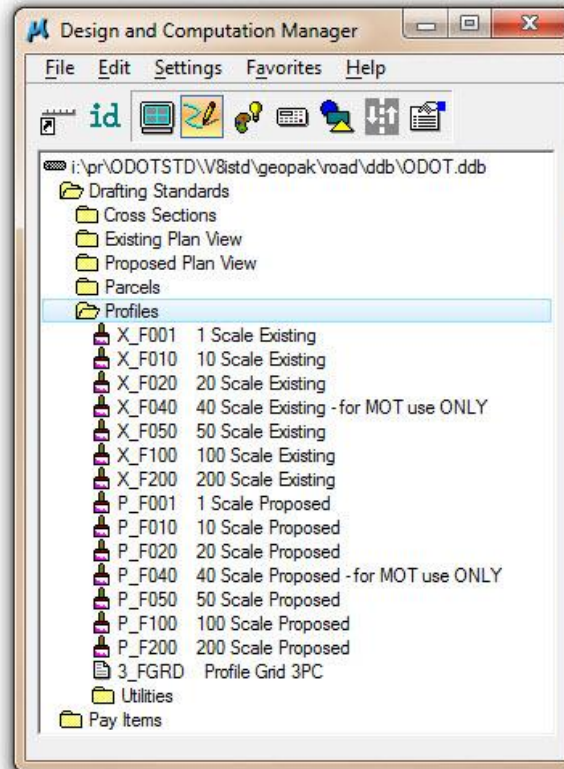


Double-clicking on a category will reveal sub-categories, or items depending on how the database is configured. A double-click on the **Drafting Standards** category will reveal several child categories as shown below.





5.3.2 Items


The other database component is the item. Items contain specific functions related to defining element symbology or placing pay items. A double-click on the **Profiles** category reveals several items as shown below:



There are three types of **Items** in the D&C Manager database, each with a unique icon as summarized below.

 **Report Icon** - These items are used to set drafting standards for MicroStation commands or to draw COGO elements without annotation.

 **Paintbrush Icon** - These items can be used to set drafting standards for MicroStation commands or to draw COGO elements with annotation.

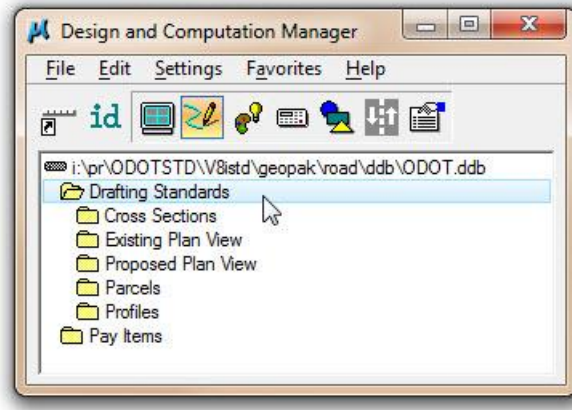
 **Calculator Icon** - These items are used to set drafting standards for MicroStation commands or to draw COGO elements. The resulting graphics are tagged with a pay item attribute that can be used to calculate plan quantities.

Note that each item in ODOT.ddb has an Item ID and a Description as shown above. The ID is a short, cryptic name that is required by the software. The Description is to the right of the item ID.

The use of these items will be detailed in the following sections

5.3.3 ODOT.ddb Categories

The two main categories of the ODOT D&C Manager database are **Drafting Standards** and **Pay Items**. Double-click the **Drafting Standards** category to reveal several child categories as shown at below.



The Drafting Standards categories are summarized below.

Cross Sections - Drafting standards for cross section items can be found in this category. Double click on **Cross Section** in the *Design and Computation Manager* dialog box to bring up a list of items.

Existing Plan View - Drafting standards for existing roadway items can be found in this category. Double click on **Existing Plan View** in the *Design and Computation Manager* dialog box to bring up a list of the child categories.

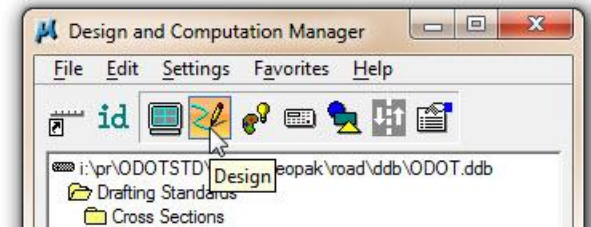
Proposed Plan View - Drafting standards for proposed roadway items can be found in this category. Double click on **Proposed Plan View** in the *Design and Computation Manager* dialog box to bring up a list of the child categories.

Parcels - Drafting standards for existing parcels can be found in this category. Double click on **Parcels** in the D&C Manager dialog box to bring up a list of parcel items.

Profiles - Drafting standards for existing and proposed profiles can be found in this category. Double click on **Profiles** in the D&C Manager dialog box to bring up a list of profile items.

The next few sections will focus on using the Drafting Standards to place elements in MicroStation according to ODOT standards. The Pay Items category has not been developed at this time and will be documented at a later date.

5.4 Design Mode



Design mode is the default mode when the *Design and Computation Manager* dialog is opened, and can be used for the following functions:

- ✓ Set Drafting Standards by use of the Place Influence option for the placement of MicroStation elements using MicroStation commands.
- ✓ Place elements as Pay Items that can be tabulated.
- ✓ Plot COGO elements into the Design file according to the drafting standards set by the D&C items.
- ✓ Run Three Port Criteria (3PC) applications.

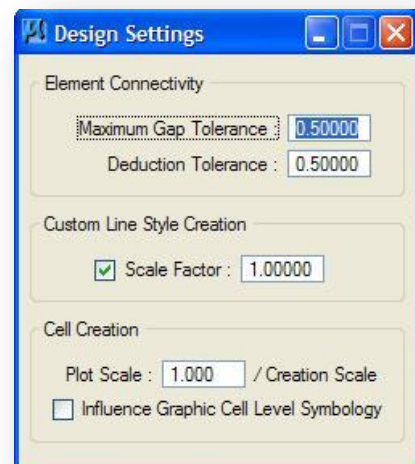
The following sections will detail the procedure to set drafting standards for MicroStation commands and for the plotting of COGO elements. The placement of MicroStation graphics as Pay Items will be documented at a later date.

5.4.1 Design Settings and the Model Annotation Scale

Before you begin placing MicroStation elements in **Design Mode**, it is good practice to check the **Design Settings** to ensure that the **Custom Line Style Creation Scale Factor** and the **Cell Plot Scale** values are set properly.

From the *Design and Computation Manager* dialog, select **Settings > Design** to access the *Design Settings* dialog shown at right.

The following options are available on the *Design Settings* dialog:



Element Connectivity

These options are used when computing pay item quantities.

Maximum Gap Tolerance

If the distance between two specified elements in a MicroStation file is smaller than the **Maximum Gap Tolerance**, the software assumes the two elements intersect and act accordingly. If the distance is larger than the **Maximum Gap Tolerance**, GEOPAK assumes the two elements do not intersect.

Deduction Tolerance

The **Deduction Tolerance** is utilized in the **Compute** mode. For example, if the pay item is specified for a curb line, and for each manhole (drawn in as a cell), there is a deduction of six feet. The origin of the cell does not have to be on the curb line, but must be within the deduction tolerance in order for the cell to be recognized and the deduction to be made.

Custom Line Style Creation

The default custom line style **Scale Factor** used when drawing MicroStation elements is specified here. Note: Some items in ODOT's D&C Manager database, such as a lane line, are configured specifically for a scale factor of one. When these items are placed, the D&C Manager will automatically override the scale factor entered by the user in the *Design Settings* dialog. For ODOT plans, this value should be set to 1.0 to allow the Model Annotation Scale to control the custom line style scale.

Cell Creation

The default scale factor for placing cells is specified here. Note: Some items in ODOT's D&C Manager database, such as a catch basin, are configured specifically for a scale factor of one. When these items are placed, the D&C Manager will automatically override the scale factor entered by the user in the *Design Settings* dialog. For ODOT plans, this value should be set to 1.0 to allow the Model Annotation Scale to control the cell scale.

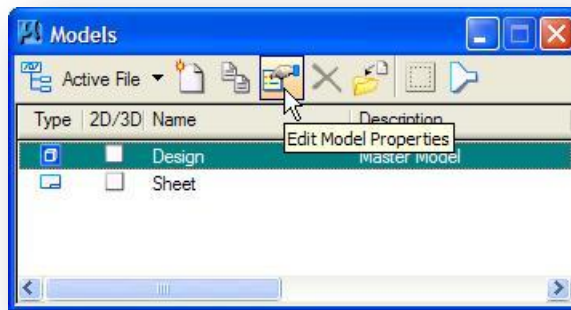
Influence Graphic Cell Level Symbology

When active, the **Influence Graphic Cell Symbology** utilizes the symbology within the Design and Computation Manager, ignoring the element symbology used when the cell was created. The option should always be toggled off for ODOT plans.

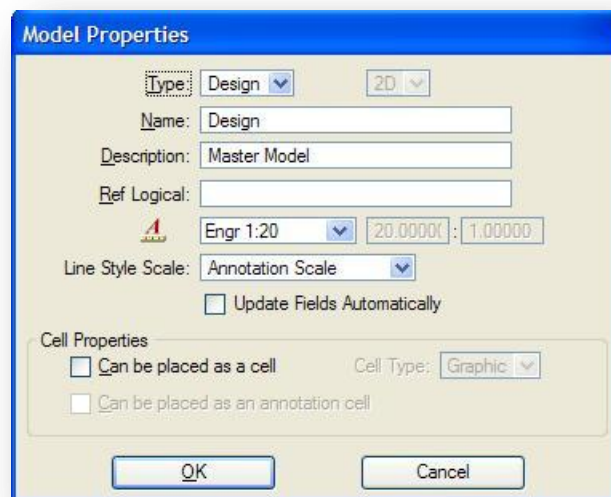
As noted above, the **Custom Line Style Creation Scale Factor** and the **Cell Creation Plot Scale** values should be set to 1.0 for ODOT plans. This will allow the current Model Annotation Scale value to control the size of the cells and the custom line styles.

The annotation scale is set as follows:

From the MicroStation pull-down menu, select **File > Models** to access the *Models* dialog shown below.



From the *Models* dialog, select Edit Model Properties to access the Model Properties dialog shown below.



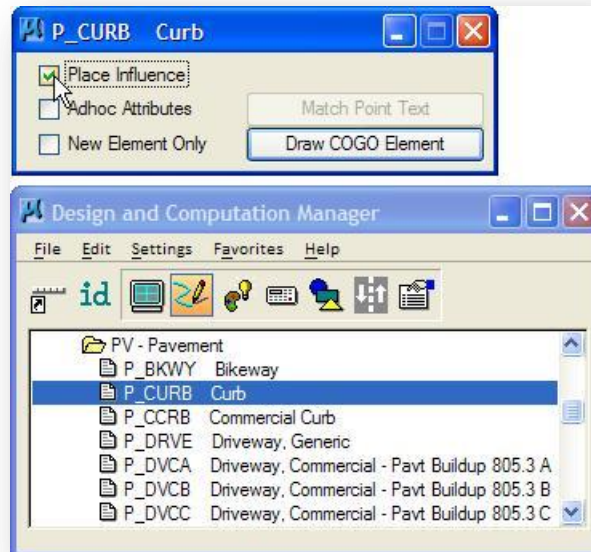
Set the **Annotation Scale** and the **Line Style Scale** as desired. In the example above, the **Annotation Sale** is set to a value of Engr 1:20 for a 20 scale plan, with the **Line Style Scale** value set to match the **Annotation Scale**.

Note: This is a change in procedure from previous releases. See the [ODOT CADD Engineering Standards Manual](#) for more information on the annotation scale.

The ODOT Design & Computation Manager Database for GEOPAK V8i has been specifically modified to accommodate placing cells using the Model Annotation Scale. Previous versions of ODOT.ddb will not allow the cells to be scaled using the Annotation Scale.

5.4.2 Using "Place Influence" With MicroStation Commands

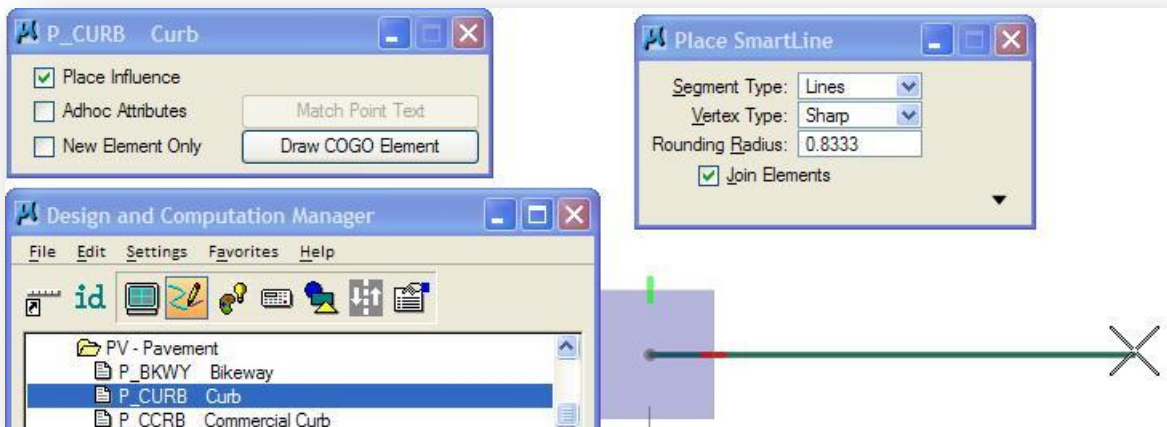
The **Place Influence** toggle is used to temporarily override the currently active MicroStation symbology settings. The **Place Influence** toggle button is located on the D&C Manager Tool Settings dialog as shown below.



By toggling on **Place Influence**, you can use MicroStation commands to place elements utilizing the drafting standards established for the currently selected item in the D&C Manager database.

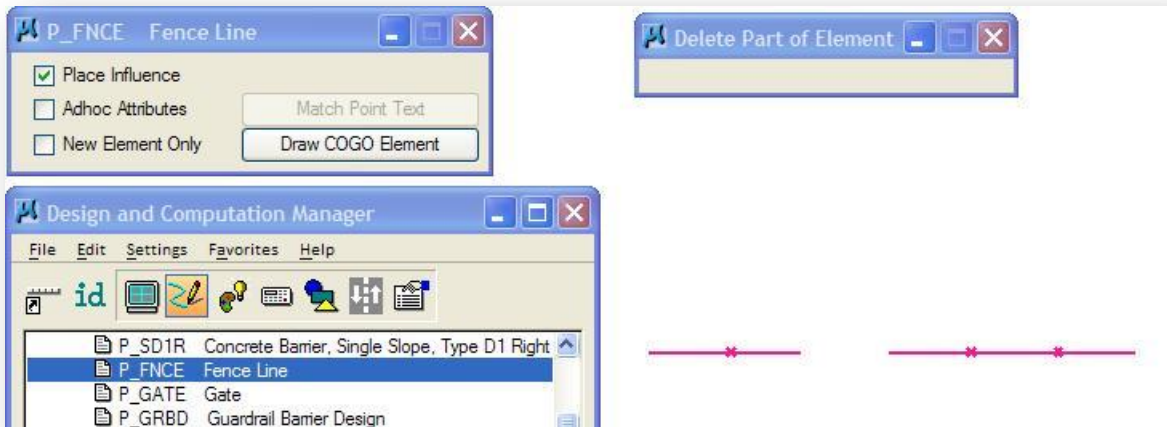
Example 1: Place SmartLine

In the example below, the Proposed Curb item is selected in the D&C Manager Dialog with Place Influence toggled on. The line is placed using the correct symbology for a proposed curb line.

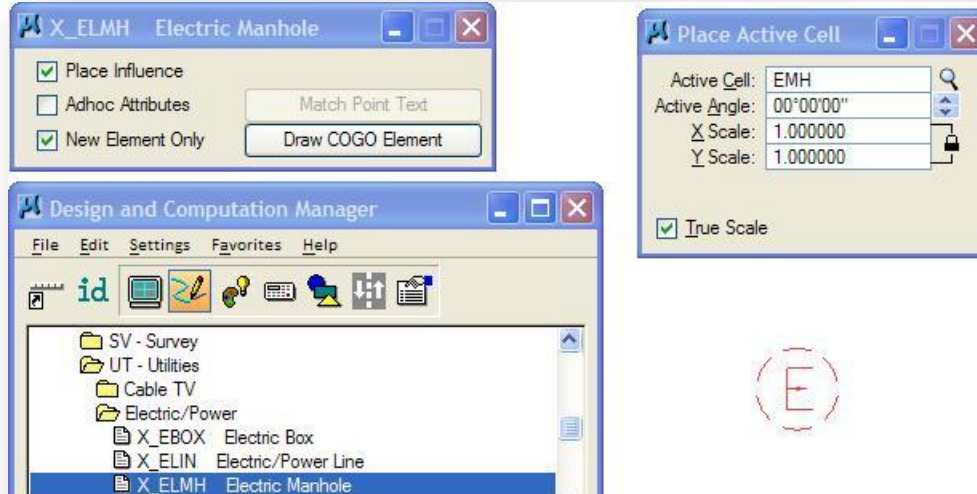


Example 2: Partial Delete

If **Place Influence** is toggled on, it will impact the symbology of elements created using any MicroStation Command, even when using commands that do not normally change element symbology. The Partial Delete command was used in the example below to delete a portion of the proposed curb line that was drawn in example 1. The new elements take on the symbology of the active item in the D&C Manager dialog, in this case a proposed Fence Line, as shown below.

**Example 3: Place Cell**

Some of the items in the D&C Manager Database have been configured to place a cell. In the example below, an existing Electric Manhole is drawn using the Place Cell command.



As the examples above demonstrate, some items in ODOT.ddb have been configured to represent curvilinear features, such as the edge pavement, or a fence line, and others have been configured to represent point features such as a telephone pole or mailbox. Whether placing point features, or curvilinear features using a custom line style, the user must determine how to set the drawing scale for the elements placed.

The cell and custom line styles defined in ODOT's CADD Standards are defined in one of two ways:

- “Physical” items are used to represent the location and size of an item. These items have been drawn at their actual physical dimensions and are placed in the design file at a scale of 1.0.
 - A pavement marking right-turn arrow is an example of a physical cell which is always placed at its actual size.
 - A pavement marking line, such as a lane line, is an example of a physical line style that is always placed using the actual dash and gap dimensions of the line.
- “Cosmetic” cells used to represent the location of an item, but not the actual size. These items are placed in the design file using the active Model Annotation Scale.
 - A Mailbox is an example of a cosmetic cell that is used to designate the location of the item, but not the actual size of the item.
 - A fence line is an example of a cosmetic line style. The location of the “x” on the fence line is used as a symbolic representation of the line type and does not represent specific post spacing for the fence line.

ODOT's CADD standards have been configured to automatically account for these different types of cells and custom line styles. An example of each of these cases follows:

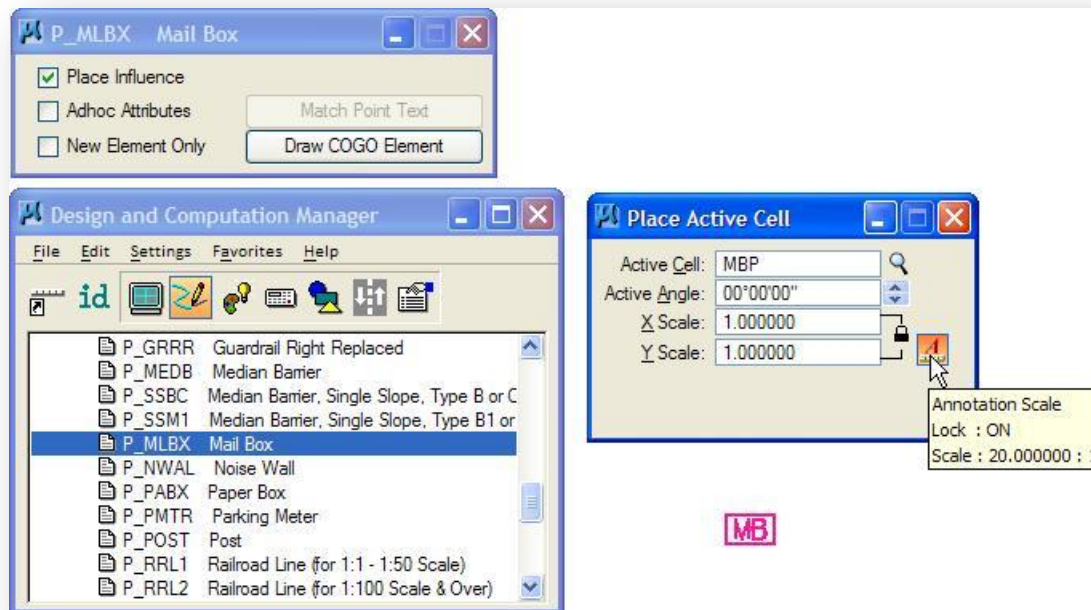
5.4.3 Placing “Cosmetic” cells using the active Model Annotation Scale

For items that are used to represent the location of point features and not the size of the feature, it is necessary to place them using the active Model Annotation Scale. A mail box is an example of an item that is placed representing the location of the feature, but not the size. To place a proposed mail box using **Place Influence**, take the following steps:

- ✓ Check the *Design Settings* dialog to ensure that the **Cell Creation Scale Factor** is set to the value of 1.0.
- ✓ Select the proposed Mail Box item from the database as shown below.
- ✓ Toggle on **Place Influence**.
- ✓ Select the MicroStation **Place Cell** command. The name of the cell associated with the selected item appears in the *Place Active Cell* dialog as shown below.
- ✓ Turn on the Annotation Scale lock
- ✓ Issue a data point to place the cell.

Note that the **X Scale** and **Y Scale** values for the cell are set to a value of 1.0 according to the **Cell Creation Scale Factor** value. The cell is scaled according to the Model Annotation Scale when placed.

If you double click the name of any item in ODOT’s Design and Computation Manager that is used to place a cell, the place cell command will be automatically selected. If **Place Influence** is on, the cell will be floating on your cursor, ready to place in the design file.

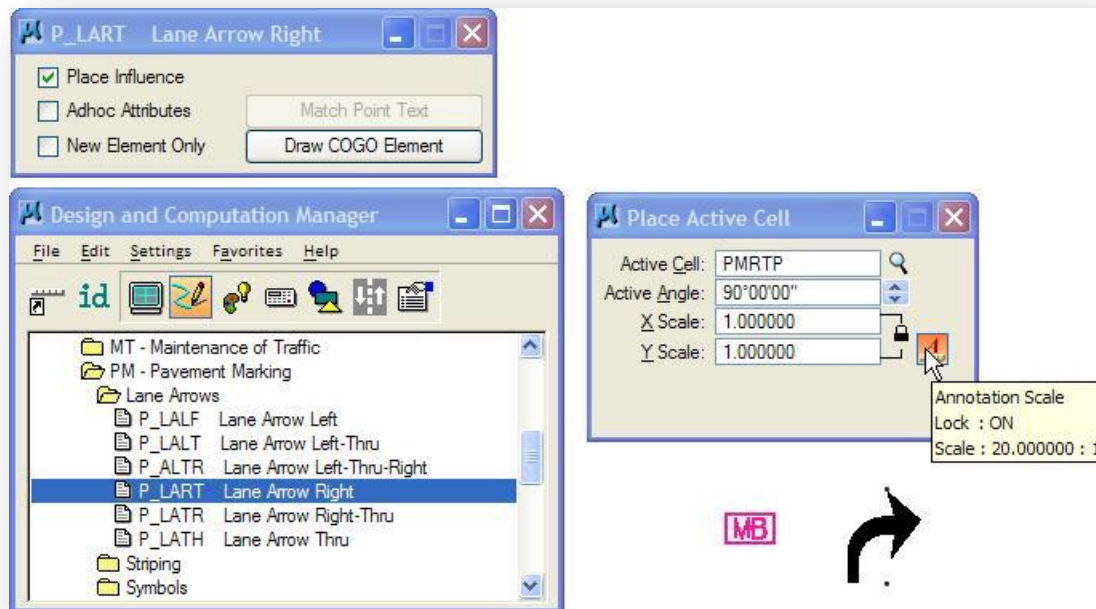


5.4.4 Placing “Physical” Cells Using the Model Annotation Scale

For items that are used to represent the location and the size of a point feature, the cell definition has been configured so that these cells are not scaled by the active Model Annotation Scale.

Pavement marking turn arrows are an example of “physical” cells that are placed using real world dimensions. To place a right-turn arrow, take the following steps:

- ✓ Select the **Lane Arrow Right** item from the D&C Manager
- ✓ Toggle on **Place Influence**.
- ✓ Select the MicroStation **Place Cell** command. The name of the cell associated with the selected item appears in the *Place Active Cell* dialog as shown below.
- ✓ Leave the Annotation Scale lock toggled on. The right-turn arrow cell has been configured to ignore the Annotation Scale value and will be placed at a scale of 1.0
- ✓ Issue a data point to place the cell.

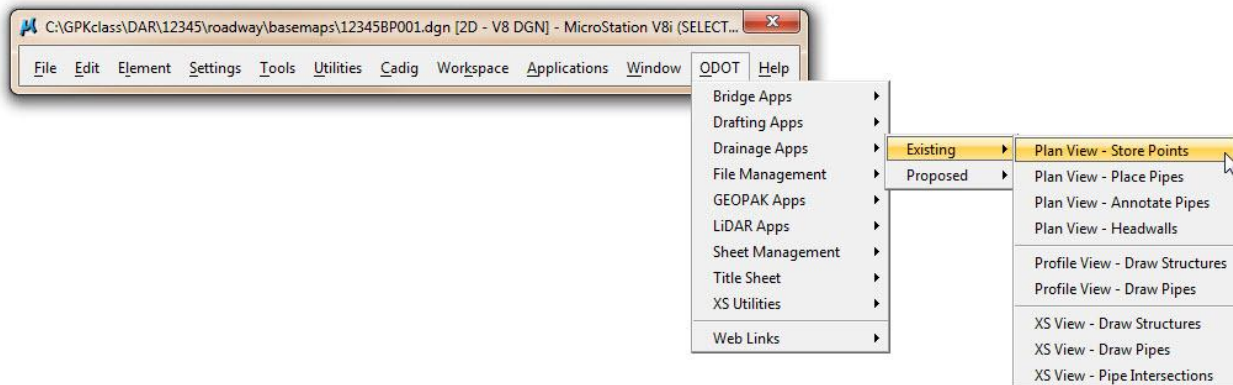


In the example above, the right-turn arrow was placed next to the mailbox cell for comparison.

Note: Changing the active Model Annotation Scale value will result in these cells being redrawn to match the current scale.

5.4.5 Placing Drainage Cells (Catch Basins, Manholes, Inlets, and Headwalls)

Drainage items are also defined as “physical” cells representing the location and size of the item. ODOT has developed several Visual Basic Applications to assist the user when placing existing or proposed catch basins, manholes, inlets, headwalls, and storm sewer lines. Each of these applications is available from the MicroStation pull-down menu in the **ODOT > Drainage Apps** category.



As of January 2011, all DDB items for placing catch basin, man holes, and inlets have been removed from ODOT.ddb. The Visual Basic applications referenced above should be used for placement of these items. See the documentation by selecting the Help icon on the individual applications for more information on the operation of these applications.

5.4.6 Using Place Influence with Curvilinear Features and Custom Line Styles

D&C Manager items that do not represent "point" features are configured to set the active MicroStation symbology for placing curvilinear MicroStation elements. Several of these items have been configured to use custom line styles. The custom line styles are contained in the resource files ODOT_Linestyles.rsc.

Like cells, some custom line styles are intended to be placed as “Physical” features, using real world dimensions, while others are defined as “Cosmetic” features which are placed using the active Model Annotation Scale.

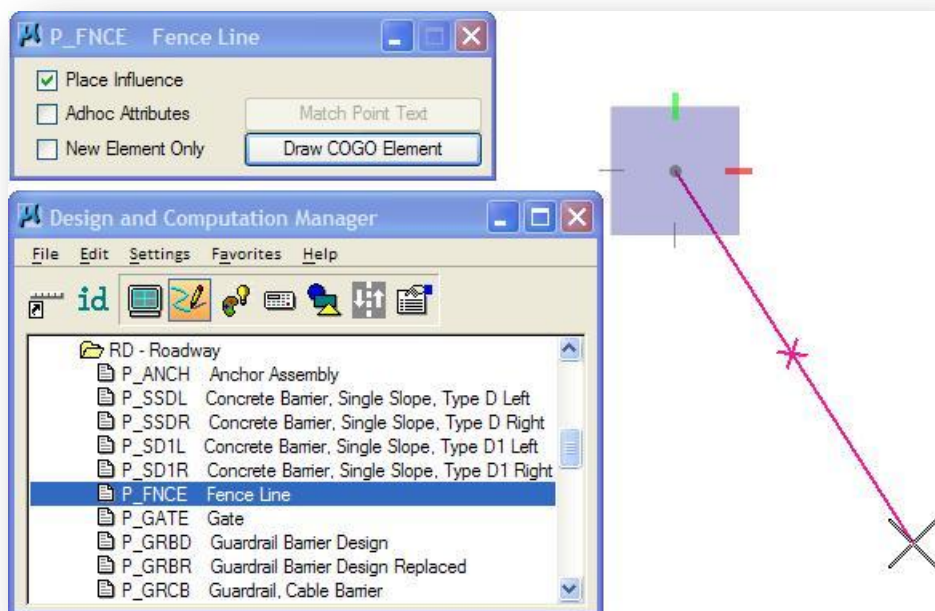
Curvilinear features that should always be placed at a set scale of one, such as a pavement marking lane line, have been configured within the ODOT line style resource file as non-scalable. Other items, such as a fence line will use the active Model Annotation Scale.

5.4.7 Placing “Cosmetic” Line Styles using Place Influence

An example placing a Proposed Fence Line is shown below.

- ✓ Select the **Proposed Fence Line** item as shown below.
- ✓ Toggle on **Place Influence**.
- ✓ Select the MicroStation **Place SmartLine** command or double click on the Existing Fence Line item in the *Design and Computation Manager* dialog. Place a line.

The line will be placed using the level, color, weight and custom line style settings associated with the Fence Line item. The line style scale will be placed with the active Model Annotation Scale.



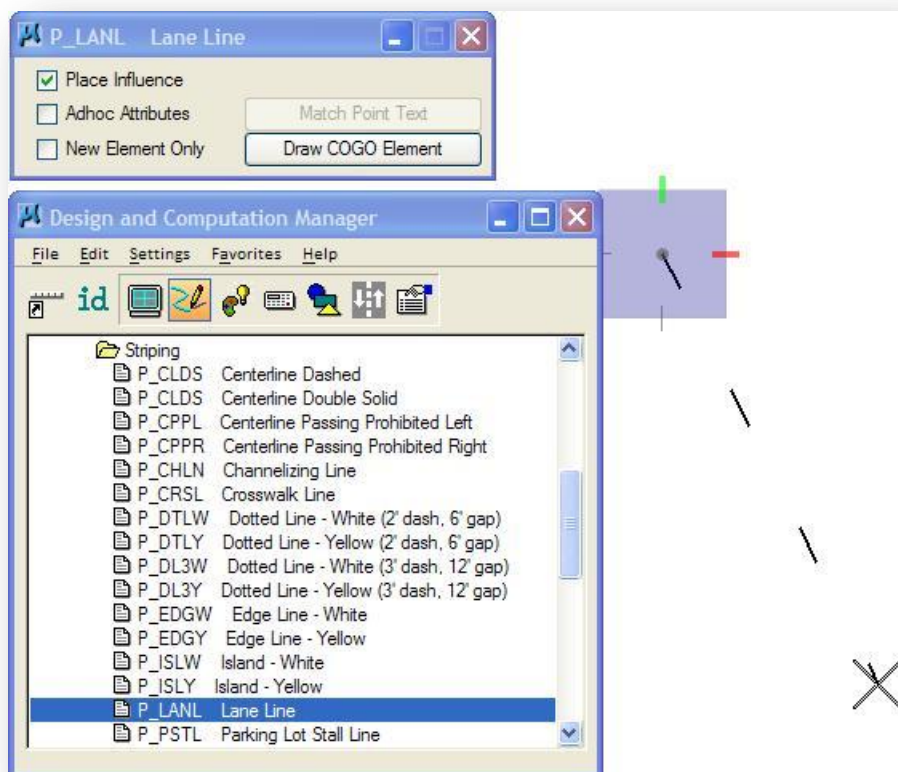
After you have placed the fence line, toggle **Place Influence** off. Notice that the MicroStation symbology settings are returned to the previous values.

5.4.8 Placing “Physical” Line Styles using Place Influence

An example placing a Proposed Lane Line is shown below.


- ✓ Select the **Proposed Lane Line** item as shown below.
- ✓ Toggle on **Place Influence**.
- ✓ Select the MicroStation **Place SmartLine** command or double click on the Existing Fence Line item in the *Design and Computation Manager* dialog. Place a line.


The line will be placed using the level, color, weight and custom line style settings associated with the Lane Line item. The line style scale will be placed at a scale of 1.0 regardless of the current Model Annotation Scale.




5.5 Using Design Mode to Plot COGO Elements

The Design and Computation Manager is also used to plot GEOPAK COGO elements into MicroStation with the proper element symbology. The items in the D&C Manager database are configured in one of three ways as detailed below.

 **Report Icon** - These items are used to set drafting standards for MicroStation commands or to draw COGO elements without annotation.

 **Paintbrush Icon** - These items can be used to set drafting standards for MicroStation commands or to draw COGO elements with annotation.

 **Calculator Icon** - These items are used to set drafting standards for MicroStation commands or to draw COGO elements. The resulting graphics are tagged with a pay item attribute that can be used to calculate plan quantities.

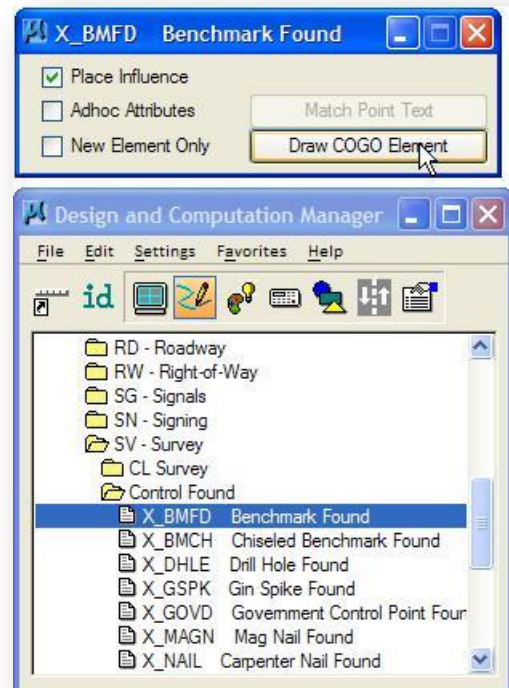
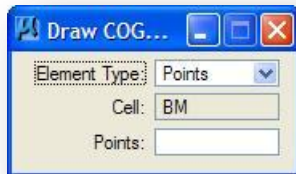
Let's take a look at plotting items from the COGO database using each of the item types listed above.

5.5.1 Plotting COGO Elements Utilizing Report or Calculator Items

The process to plot COGO elements using report or calculator items is identical. The only difference is that calculator items are tagged with a pay item attribute that will allow GEOPAK to tabulate quantities from the graphics.

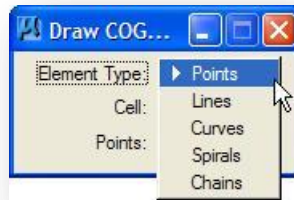
When these items are used to plot COGO elements, no annotation is placed in the design file. For example, the Existing Benchmark Found item can be used to set the active MicroStation cell and symbology according to ODOT Standards by use of the **Place Influence** toggle. If you wish to place the cell for a benchmark at the location of a COGO point, the **Draw COGO Element** option can be used.

Select **Draw COGO Element** to access the *Draw* dialog shown below.

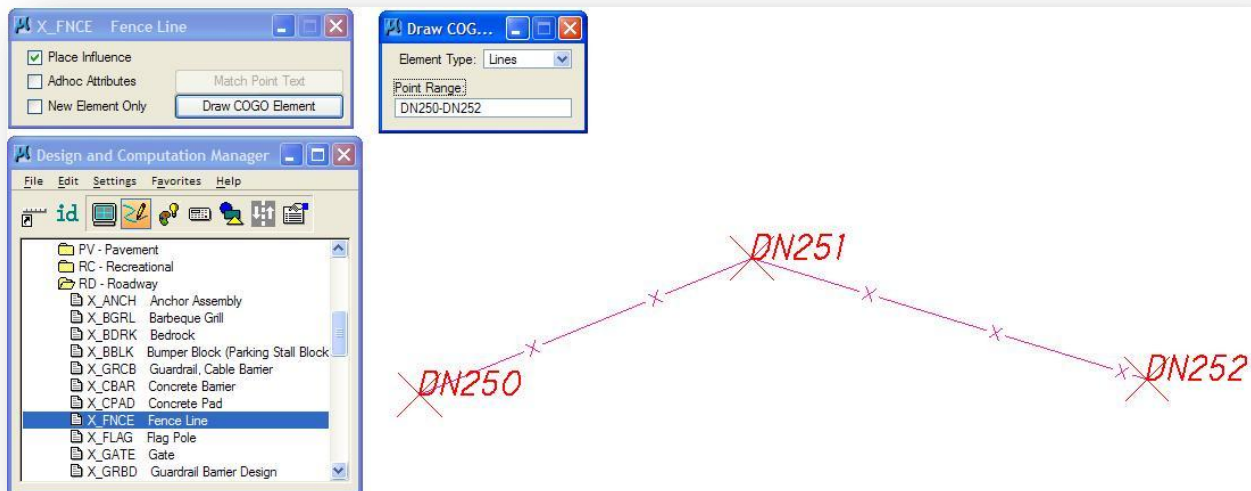


To plot the Benchmark cell in the design file, simply key in the point number and press the enter key. The cell from the selected D&C Manager item will be plotted at the location of the COGO point.

Several other COGO elements can be plotted by use of the *Draw* dialog by selecting the desired COGO element from the **Operation** pull down. The options are shown below.



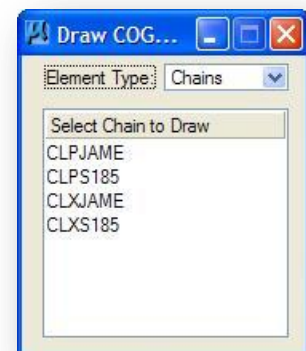
Toggle **Operation** to **Lines**. A line can be drawn through a range of COGO points using the selected D&C Manager symbology. In the example below, a fence line was drawn through points DN250, DN251 and DN252 by keying in the range of points as shown in the dialog below.



When a range of points is keyed in, all of the points are connected in numeric order as shown above. To draw a line through a series of points in nonconsecutive order, the "/" is used to separate the point numbers. For example, to draw the Fence Line from point DN250 to DN252, key-in DN250/DN252.

Toggle the **Operation** option to **Curves**, **Spirals** or **Chains** to plot these items from the COGO database. Once the *Draw* dialog is toggled to one of these options, a listing of the **Curves**, **Spirals**, or **Chains** in the COGO database is included in the dialog. An example of plotting a chain is shown at right.

To plot the chain, simply select its name from the list. Do not double-click the chain name which will result in plotting the chain twice.

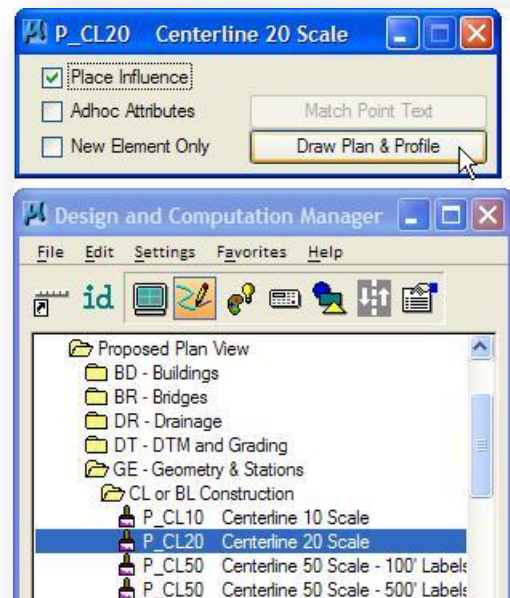
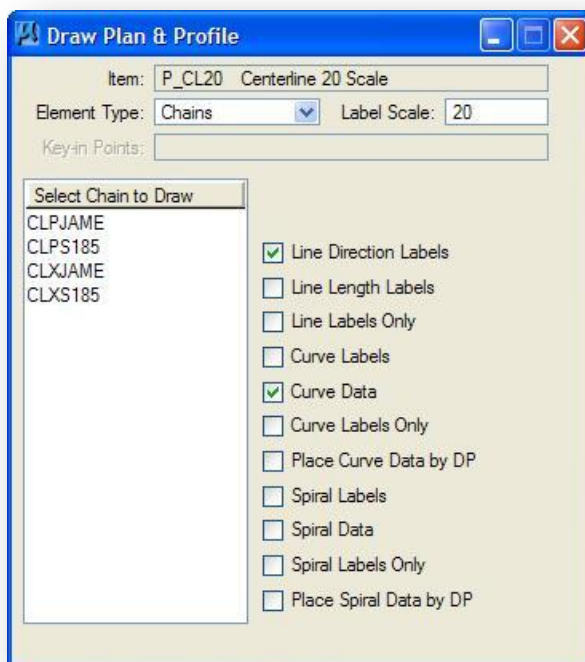


5.5.2 Plotting COGO Elements Using Paintbrush Items

Items in the D&C Manager database with the Paintbrush icon can be used to set symbology for MicroStation commands by use of the **Place Influence** toggle, or to plot COGO elements with annotation. The annotation includes curve data, stationing, bearings, distances, etc... The majority of the items in ODOT.ddb are not configured to plot annotation.

When a paintbrush item is selected, the **Draw Plan & Profile** option is now available as shown at right.

Select **Draw Plan & Profile** to access the dialog shown below.



The top portion of the dialog includes an option button to select the **Element Type** mode. The following Operation options are available:

- Points
- Lines
- Curves
- Spirals
- Chains
- Stationing
- Parcels
- Profiles
- Parallel Chains

A detailed discussion of each of the drawing operations is available in the GEOPAK on-line help.

In the next few sections we will take a look at using the D&C Manager with ODOT.ddb to plot **Chains** and **Stationing**.

5.5.3 Plotting COGO Chains

Several items in ODOT.ddb are configured to plot centerlines and stationing. The Proposed Roadway centerline items are shown in the dialog below.

Additional items for plotting centerlines can be found in the following locations within the DDB file:

Existing Centerlines:

Drafting Standards > Existing Plan View > GE - Geometry and Stations > CL or BL Construction

Drafting Standards > Existing Plan View > RW - Right-of-Way > CL Right-of-Way

Drafting Standards > Existing Plan View > SV - Survey > CL Survey

Proposed Centerlines:

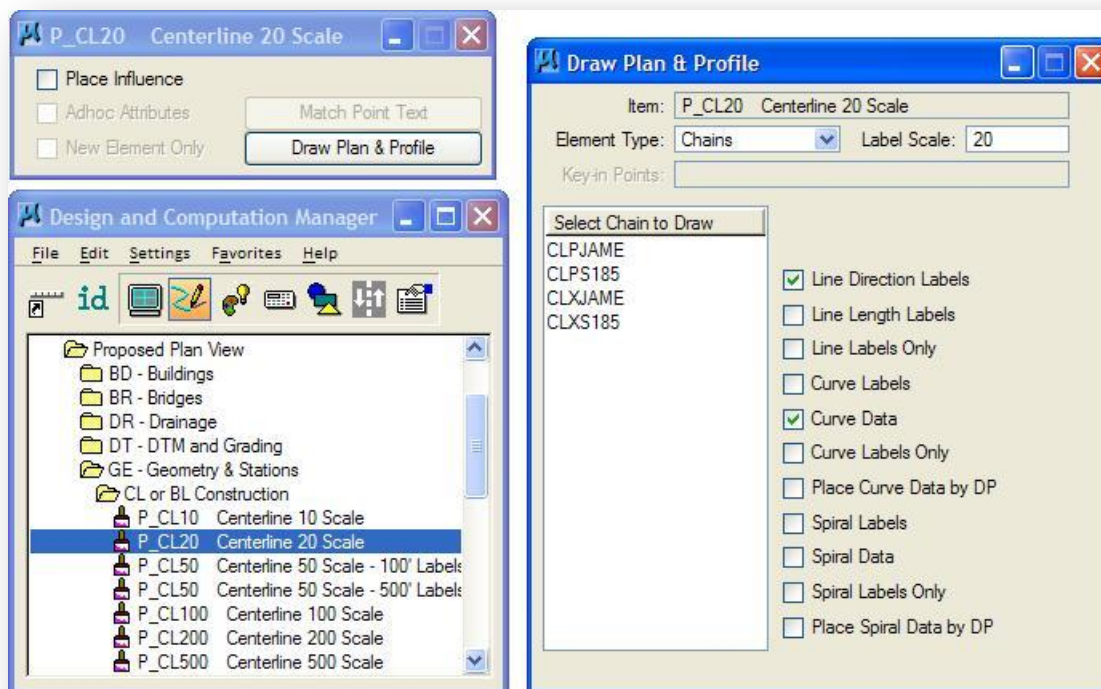
Drafting Standards > Proposed Plan View > GE - Geometry and Stations > CL or BL Construction

Drafting Standards > Proposed Plan View > RW - Right-of-Way > CL Right-of-Way

Drafting Standards > Proposed Plan View > SV - Survey > CL Survey

Drafting Standards > Proposed Plan View > MT - Maintenance of Traffic > Temporary Road CL and Stations

To plot a COGO chain, select the desired Centerline item from ODOT.ddb, then pick the **Draw Plan & Profile** option from the D&C Manager Tools Settings dialog



From the *Plan & Profile Draw* dialog, toggle the **Element Mode** mode to **Chains** as shown above.

The list of available chains in the COGO database is shown in the list box on the left hand side of the *Plan & Profile Draw* dialog.

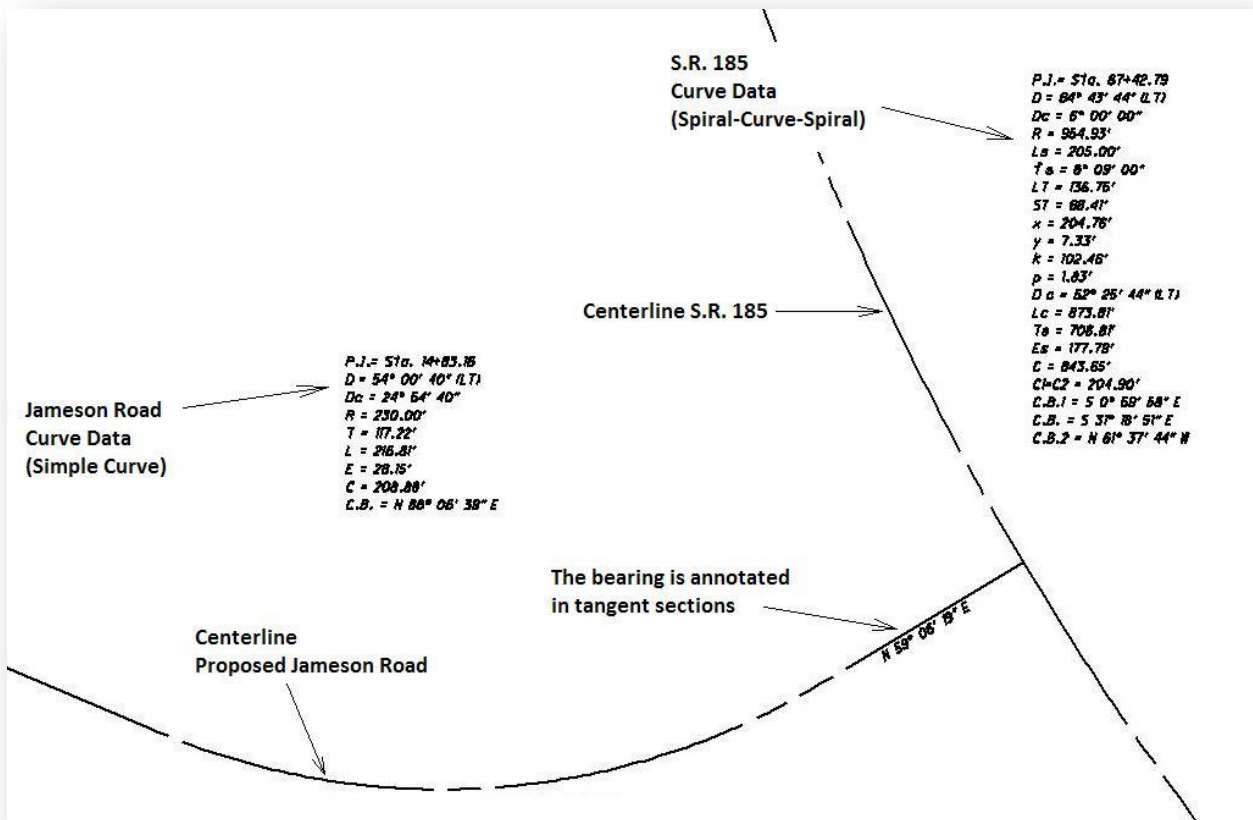
The right side of the *Plan & Profile Draw* dialog contains a list of options for plotting the currently selected item. ODOT.ddb has been configured with the **Line Direction Label** and the **Curve Data** items toggled on. The other options can be toggled on or off as needed. With all options toggled off, only the centerline will be plotted without any labels.

The **Label Scale** is used to specify the plotting scale for the text labels. Note that the label scale must be manually set by the user and is not set by the D&C Manager. The GEOPAK default value is 100.

To plot a COGO chain, simply select the name of the chain from the list box on the left. The chain is plotted with the symbology of the currently selected D&C Manager Item.

Selecting the chain name more than once will result in duplicate graphics being plotted in the MicroStation file.

A sample of the plotted chain and curve data for CLPRS185 and CLPRJAME is shown below.



Each centerline item in ODOT.ddb is configured to place the centerline, curve data, and bearing labels on the levels as shown in the following tables.

Proposed Centerline or Baseline of Construction and Stations

Drafting Standards > Proposed Plan View > GE – Geometry and Stations > CL or BL Construction

Item ID	Description	Line Style	Level
P_CL10	Centerline 10 Scale	cl10	GE_P_CL_10
P_CL20	Centerline 20 Scale	cl20	GE_P_CL_20
P_CL50	Centerline 50 Scale – 100' Label Interval	cl50	GE_P_CL_50
P_CL50	Centerline 50 Scale – 500' Label Interval	cl50	GE_P_CL_50
P_CL100	Centerline 100 Scale	cl100	GE_P_CL_100
P_CL200	Centerline 200 Scale	cl200	GE_P_CL_200
P_CL500	Centerline 500 Scale	cl500	GE_P_CL_500
P_CL1000	Centerline 1000 Scale	cl1000	GE_P_CL_1000
P_CL2000	Centerline 2000 Scale	cl2000	GE_P_CL_2000

Proposed Centerline of Right-of-Way and Stations

Drafting Standards > Proposed Plan View > RW – Right-of-Way > CL Right-of-Way

Item ID	Description	Line Style	Level
P_CLRW20	CL of RW 20 Scale	cl20	RW_P_CL_20
P_CLRW50	CL of RW 50 Scale – 100' Label Interval	cl50	RW_P_CL_50
P_CLRW50	CL of RW 50 Scale – 500' Label Interval	cl50	RW_P_CL_50
P_CLRW100	CL of RW 100 Scale	cl100	RW_P_CL_100
P_CLRW200	CL of RW 200 Scale	cl200	RW_P_CL_200
P_CLRW500	CL of RW 500 Scale	cl500	RW_P_CL_500
P_CLRW1000	CL of RW 1000 Scale	cl1000	RW_P_CL_1000
P_CLRW2000	CL of RW 2000 Scale	cl2000	RW_P_CL_2000

Proposed Centerline of Survey and Stations

Drafting Standards > Proposed Plan View > SV - Survey > CL Survey

Item ID	Description	Line Style	Level
P_CLSV20	CL of Survey 20 Scale	cl20	SV_P_CL_20
P_CLSV50	CL of Survey 50 Scale – 100' Label Interval	cl50	SV_P_CL_50
P_CLSV50	CL of Survey 50 Scale – 500' Label Interval	cl50	SV_P_CL_50
P_CLSV100	CL of Survey 100 Scale	cl100	SV_P_CL_100
P_CLSV200	CL of Survey 200 Scale	cl200	SV_P_CL_200
P_CLSV500	CL of Survey 500 Scale	cl500	SV_P_CL_500
P_CLSV1000	CL of Survey 1000 Scale	cl1000	SV_P_CL_1000
P_CLSV2000	CL of Survey 2000 Scale	cl2000	SV_P_CL_2000

Proposed Temporary Road Centerline and Stations

Drafting Standards > Proposed Plan View > MT - Maintenance of Traffic > Temporary Road CL and Stations

Item ID	Description	Line Style	Level
P_TC20	Temp Road Centerline 20 Scale	cl20	MT_P_CL_20
P_TC30	Temp Road Centerline 30 Scale	cl20	MT_P_CL_30
P_TC40	Temp Road Centerline 40 Scale	cl50	MT_P_CL_40
P_TC50	Temp Road Centerline 50 Scale	cl50	MT_P_CL_50

Existing Centerline or Baseline of Construction and Stations

Drafting Standards > Existing Plan View > GE – Geometry and Stations > CL or BL Construction

Item ID	Description	Line Style	Level
X_CL10	Centerline 10 Scale	cl10	GE_X_CL_10
X_CL20	Centerline 20 Scale	cl20	GE_X_CL_20
X_CL50	Centerline 50 Scale – 100' Label Interval	cl50	GE_X_CL_50
X_CL50	Centerline 50 Scale – 500' Label Interval	cl50	GE_X_CL_50
X_CL100	Centerline 100 Scale	cl100	GE_X_CL_100
X_CL200	Centerline 200 Scale	cl200	GE_X_CL_200
X_CL500	Centerline 500 Scale	cl500	GE_X_CL_500
X_CL1000	Centerline 1000 Scale	cl1000	GE_X_CL_1000

Existing Centerline of Right-of-Way and Stations

Drafting Standards > Existing Plan View > RW – Right-of-Way > CL Right-of-Way

Item ID	Description	Line Style	Level
X_CLRW20	CL of RW 20 Scale	cl20	RW_X_CL_20
X_CLRW50	CL of RW 50 Scale – 100' Label Interval	cl50	RW_X_CL_50
X_CLRW50	CL of RW 50 Scale – 500' Label Interval	cl50	RW_X_CL_50
X_CLRW100	CL of RW 100 Scale	cl100	RW_X_CL_100
X_CLRW200	CL of RW 200 Scale	cl200	RW_X_CL_200
X_CLRW500	CL of RW 500 Scale	cl500	RW_X_CL_500
X_CLRW1000	CL of RW 1000 Scale	cl1000	RW_X_CL_1000
X_CLRW2000	CL of RW 2000 Scale	cl2000	RW_X_CL_2000

Existing Centerline of Survey and Stations

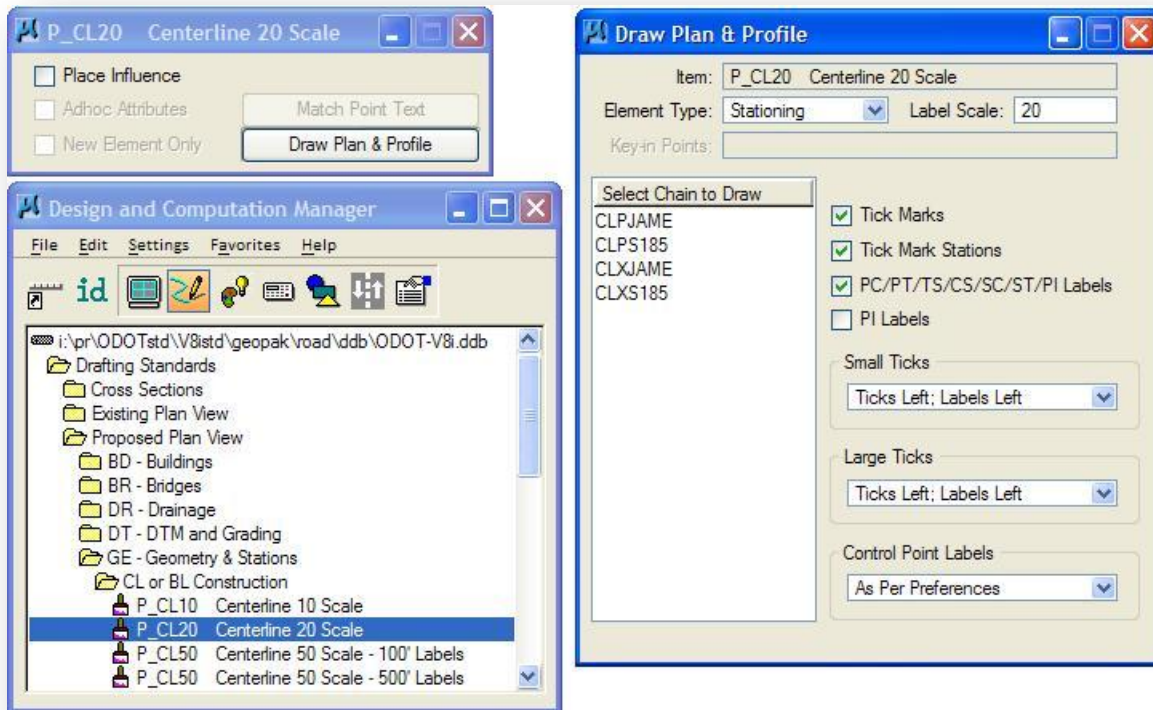
Drafting Standards > Existing Plan View > SV - Survey > CL Survey

Item ID	Description	Line Style	Level
X_CLSV20	CL of Survey 20 Scale	cl20	SV_X_CL_20
X_CLSV50	CL of Survey 50 Scale – 100' Label Interval	cl50	SV_X_CL_50
X_CLSV50	CL of Survey 50 Scale – 500' Label Interval	cl50	SV_X_CL_50
X_CLSV100	CL of Survey 100 Scale	cl100	SV_X_CL_100
X_CLSV200	CL of Survey 200 Scale	cl200	SV_X_CL_200
X_CLSV500	CL of Survey 500 Scale	cl500	SV_X_CL_500
X_CLSV1000	CL of Survey 1000 Scale	cl1000	SV_X_CL_1000
X_CLSV2000	CL of Survey 2000 Scale	cl2000	SV_X_CL_2000

5.5.4 Plotting Stationing

Stationing for COGO chains can also be plotted using the D&C Manager database. Each centerline option in ODOT.ddb is also configured to plot stationing for the alignment.

To plot the stationing for a COGO chain, select the desired Centerline item from ODOT.ddb, then pick the **Draw Plan & Profile** option from the D&C Manager Tools Settings dialog.



From the *Plan & Profile Draw* dialog, toggle the **Operation** mode to **Stationing** as shown at left.

The list of available chains in the COGO database is shown in the list box on the left hand side of the *Plan & Profile Draw* dialog.

The right side of the *Plan & Profile Draw* dialog contains a list of options for plotting the currently selected item. ODOT.ddb has been configured with the **Tick Marks**, **Tick Mark Stations**, and **PC & PT & CS... labels** options toggled on.

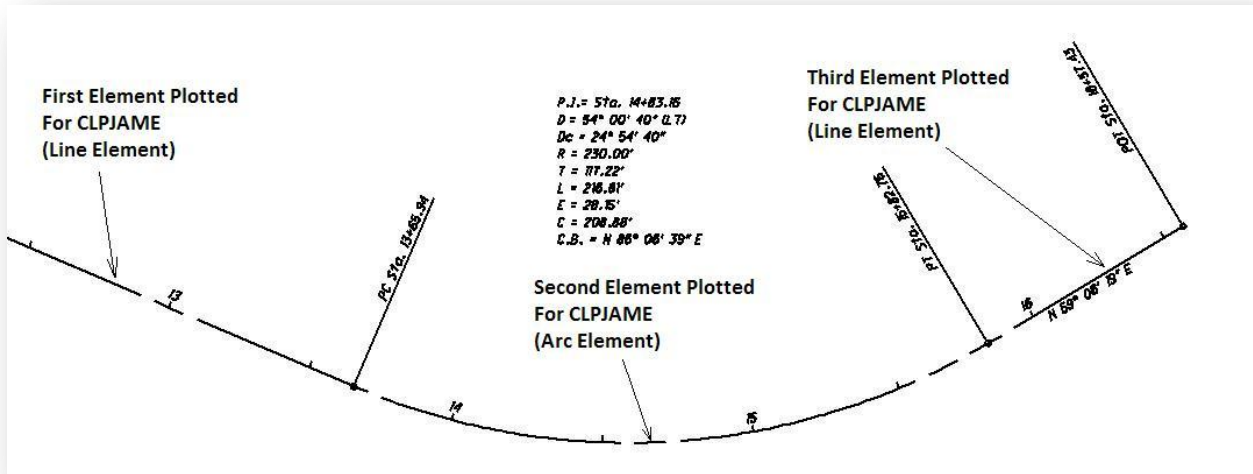
The **Label Scale** is used to specify the plotting scale for the station labels. Note that the label scale must be manually set by the user and is not set by the D&C Manager. The GEOPAK default value is 100.

The options for the placement of **Small Ticks**, **Large Ticks** and **Control Point Labels** should normally be set as shown at left.

To plot the stationing, simply select the name of the chain from the list box on the left. The stationing is plotted with the symbology of the currently selected D&C Manager Item.

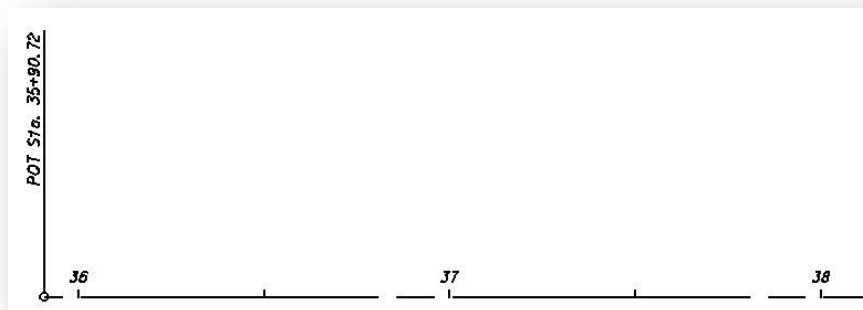
Selecting the chain name more than once will result in duplicate graphics being plotted in the MicroStation file.

An example of the stationing for Jameson Road is shown below.



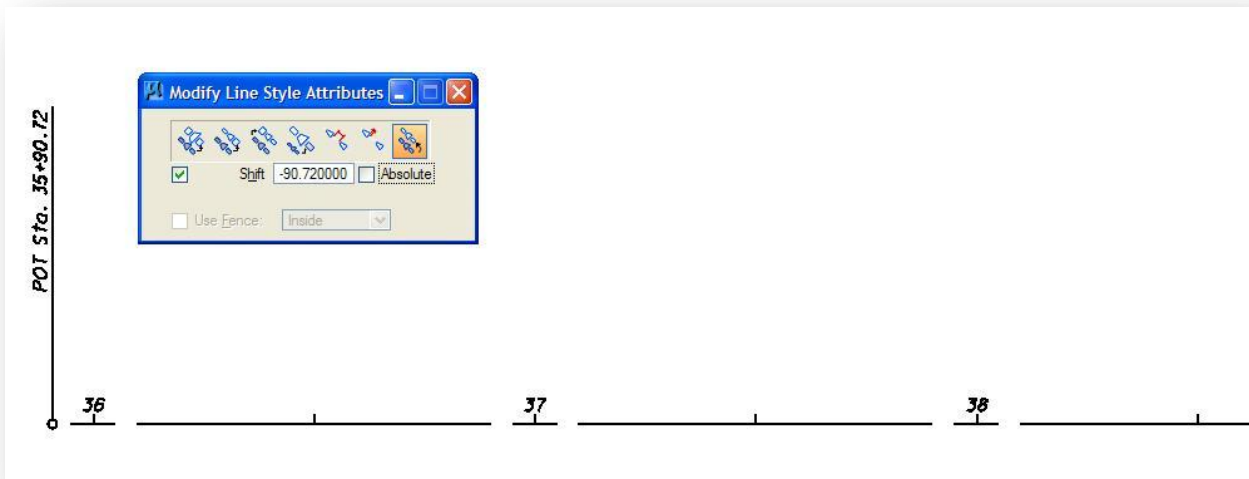
Note: Typically, the stationing will not line up with the short dashes in the centerline as shown above. Many users prefer to have the station ticks line up with the short dashes along the centerline. Several factors contribute to the stationing not lining up with the short dashes as described below:

- The components of the chain are placed as separate MicroStation elements and not as one complex chain. The custom line style cycle is started over for each component of the chain as shown in the example above. Connect all of the components of the centerline as one continuous element using the MicroStation Complex Chain command. Remember that when you create a complex chain the new chain is created using the active MicroStation symbology.
- If your chain begins at an even station, all of the ticks will line up with the short dashes after creating the complex chain.
- If the stationing does not start at an even station, the ticks will not line up with the short dashes as shown in example below:

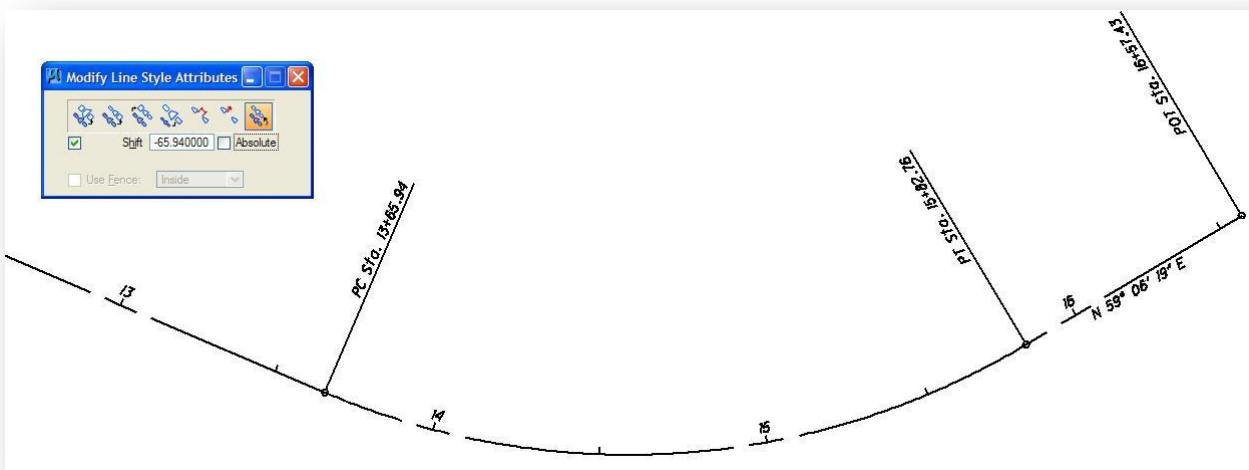


Use the MicroStation **Modify Line Style Attributes** command with the shift option to align the centerline dashes with the station tic marks. The example below shows how to modify the custom line style for the first segment of CLPS185. The shift amount is determined as follows:

Subtract the even station amount from the actual station at the beginning of the line, spiral, or arc segment. Then multiply the answer by -1. In the example below $35+90.72 - 35+00.00 = 90.72$. The line segment is shifted by -90.72 as shown below.



The example below shows how to shift the arc on CLPJAME. $13+65.94 - 13+00.00 = 65.94$. Shift the arc with a value of -64.94.



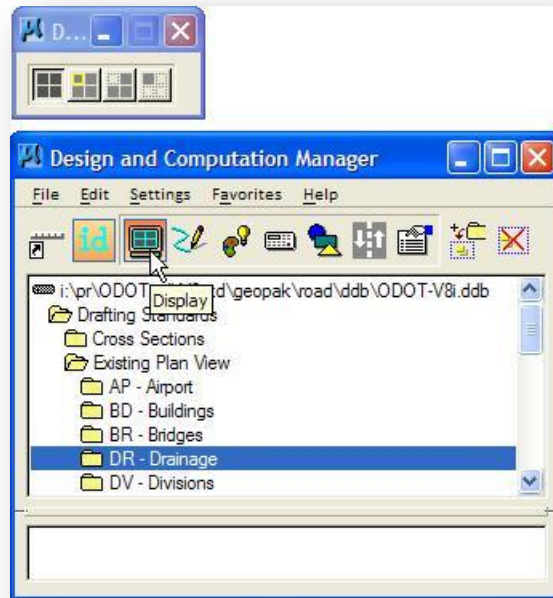
5.6 Identify Item



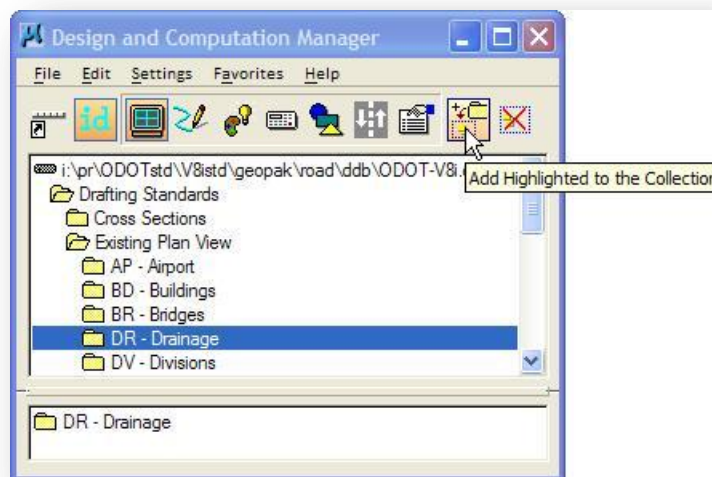
The **Identify Item** tool allows users to navigate the hierarchy by selecting a MicroStation element. After selecting and accepting the element, GEOPAK moves to the item in the hierarchy which corresponds to the selected element. If no matching item is found within the specified database, GEOPAK displays the following message in the prompt field: "No matching database item."

5.7 Display Mode

Display mode allows the designer to filter the display of MicroStation elements in the design file so only specific features are displayed. When **Display** Mode is selected, the *Design and Computation Manager* and the tool settings dialog dynamically change as shown below.



Users can filter the display by Items or by categories. Select the **Add Highlighted to Collection** button to add the currently selected category or item to the Collection box, at the bottom of the dialog, as shown below. Multiple categories and items can be added.



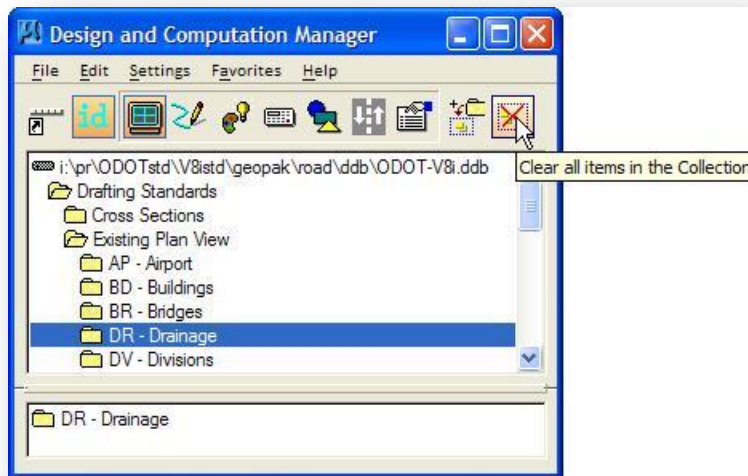
The D&C Manager *Tool Settings* dialog is used to select how GEOPAK will filter the display of elements. Four options are available as shown below.



From left to right, the following options are provided:

- Normal Display
- Highlight Selection
- Hide Selection
- Display Only Selection

To remove an item or category from the collection box, select the **Clear All Items in Collection** icon.



Note: Only items placed using the D&C Manager are recognized by the **Display** Mode. Graphics placed by GEOPAK Survey, COGO Visualization or MicroStation Commands (without using Place Influence) are not recognized by **Display** Mode.

5.8 Set Mode

The **Set** mode is used to change the element symbology of previously drawn MicroStation elements to match the symbology of the current D&C Manager item.



Two methods of setting elements are supported:

- Individual Element Selection
- Complex Chain

The first step for all methods is the selection of the desired item. Navigating through the hierarchy, highlight the desired item. Note the title block of the auxiliary dialog dynamically changes during the navigation process. Once an item is selected, the auxiliary dialog buttons are un-ghosted.

Individual Element Selection

Select the desired item in the D&C Database and then click **Set**. GEOPAK prompts to select the desired MicroStation element. Note the element must be selected AND accepted in order to set the symbology / attribute. Multiple elements may be set to match the D&C Item symbology by use of MicroStation selection sets.

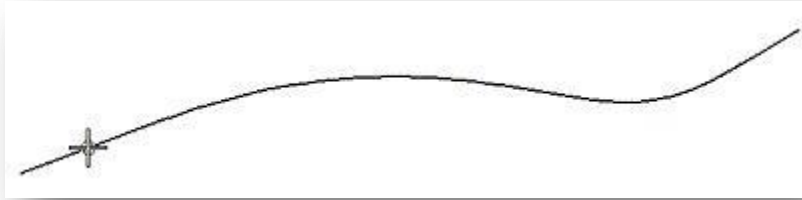
Complex Chain Method

The Complex chain method utilizes the MicroStation automatic complex chain creation command in the background, while setting Element attributes. After selecting the desired item, activate the **Use Complex Chain** toggle, which expands the auxiliary dialog as depicted below.

Note the **Set** button is ghosted, as it is not utilized in this method. The following details the steps for this method:

1. Click **ID Element**

2. Identify and accept a line or arc that constitutes the beginning of the chain.



3. Like the MicroStation Automatic Create Complex Chain, successive connected elements are highlighted one at a time for inclusion or rejection as long as the initial point of each subsequent element is within 0.75 master units (feet or meters) of the end point of the current element. As shown below, after the first element is selected and accepted, the next connected element is highlighted.



If more than a single element is located within tolerance to the next element end point, the message "Fork Accept/Reject" is displayed. A data point accepts the highlighted element. Pressing the reset cursor button rejects the highlighted element and highlights another.

4. Once the end of the chain is reached or the user presses the reset cursor button when no more connecting elements are available, the identification of component chain elements is complete. The highlighting is deactivated and the elements symbology and attributes are now set.

5.9 Favorites

The **Favorites** pull down is a very useful tool that allows the designer to save a list of commonly utilized D&C items for quick access. When selected, two options are available as shown below.



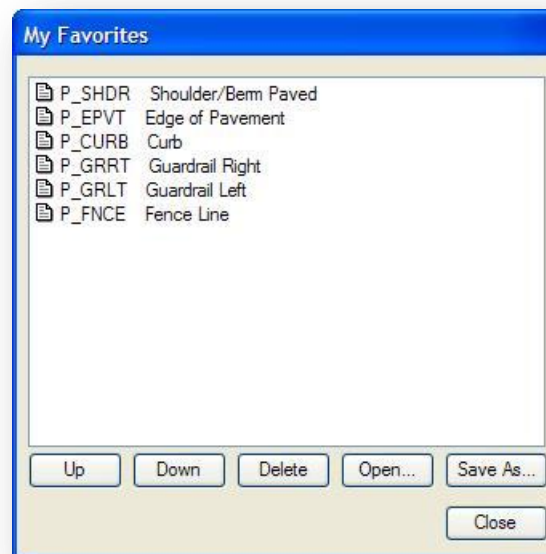
Add to Favorites

To add an item to the Favorites list, take the following steps:

- ✓ Select the item in the *Design and Computation Manager* dialog.
- ✓ Select **Favorites > Add to Favorites**.

The user may select up to twenty items, with each additional item being added at the top of the list. When the twenty first item is selected, the first item is deleted from the list. The dialog width will expand to include all of the selected paths as shown above.

The second tool under the Favorites pull down is **Organize Favorites**, which invokes the *My Favorites* dialog shown below.



The current Favorites are displayed within the list box. The six action buttons at the bottom of the dialog are detailed below.

Up / Down

Favorites can be moved up or down within the list by highlighting the Favorite to be moved, then pressing the **Up** or **Down** button. Each press of the button moves the Favorite one position.

Delete

Highlight the Favorite to be deleted, and then press the **Delete** button to remove it from the list.

Open

Previously saved Favorite lists can be utilized by pressing the **Open** button, which invokes the *File Manager*, wherein the desired listing file may be selected.

Save As...

Favorite lists can be saved for recall in a subsequent session by pressing the **Save As...** button, which invokes the *File Manager*, wherein the current listing file may be named and saved.

Close

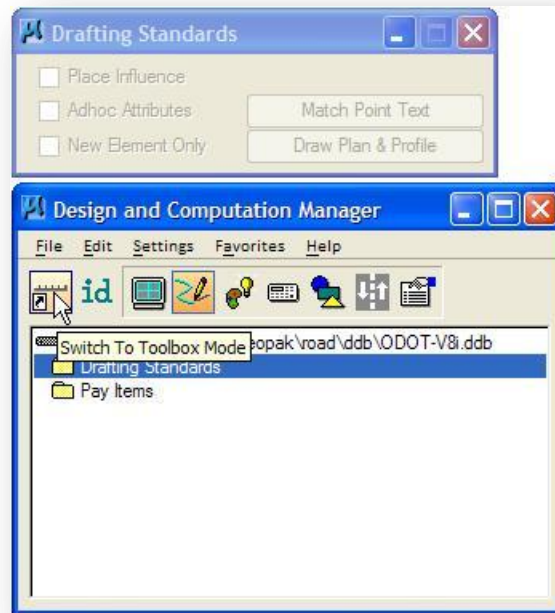
Closes the dialog, returning to the Design and Computation Manager.

5.10 Toolbox Mode

The D&C Manager dialog box can be configured in one of two modes:

- Dialog
- Toolbox

The default mode is dialog, as shown in the graphic below. The menu bar and shortcut buttons are on the top of the dialog, with the list box below.



The second mode is the Toolbox mode, shown below.



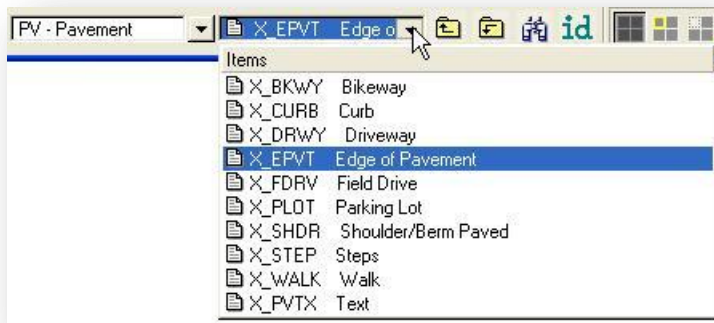
Select the **Switch To Toolbox Mode** icon to change the dialog to toolbox mode. In this mode, the dialog is condensed and is dockable. The icons on the Toolbox mode dialog are detailed below.

Place Influence (Leftmost Toggle)



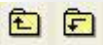
The toggle to the left of the dialog activates the **Place Influence** tool.

Hierarchy

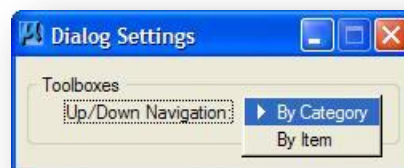


The right field displays the current position within the hierarchy, along with its associated icon. The left field displays its parent. The arrows display the surrounding hierarchy from which categories or items may be selected.

Level Up/Level Down



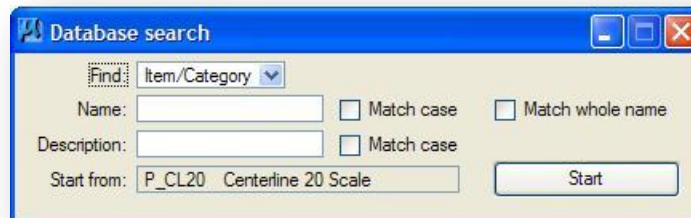
Another method for navigating the hierarchy is the use of the **Level Up** or **Level Down** buttons. One press of the button moves one position. This is utilized in conjunction with the *Design Settings* dialog, invoked by selecting **Settings > Dialog** (when in the dialog mode). The dialog is displayed below.



Two options are supported: **By Category** or **By Item**. When **By Category** is set, pressing the **Level** button moves the current position up or down in the hierarchy by category, ignoring the presence of items. When set to **By Item** and one of the Level buttons is pressed, the current position stays within the current category and moves up or down one item. Note: if the current position is at the bottom position, and the **Level Down** button is pressed, a prompt is displayed. Conversely, if the current position is at the top position, and the **Level Up** button is pressed, a prompt is displayed.

Shortcut button for the Edit > Find tool.

Various searches can be processed throughout the database, utilizing **Item**, **Category**, or **Item / Category** options. The **Name** and/or **Description** fields are specified and **Case Matching** options may be invoked. The search will begin at the highlighted **Item** or **Category** at the time of invocation. When **Start** is clicked, the software scans the database for the specified parameters. If the end of the database is encountered before the specified parameters are met, the software prompts if you want to continue at the beginning of the database. When the specified parameters are found, the correct category and/or item path are listed in the **Starting From:** field.

**Shortcut button for the Identify mode.**

Another tool that enables the user to better navigate the hierarchy is the **Identify** mode. The tool is accessed via the shortcut button at the top of the dialog or from the **Edit** pulldown. When pressed, the user is prompted to select a MicroStation element. After selecting and accepting the element, GEOPAK moves to the item in the hierarchy which corresponds to the selected element. If no item is found within the specified database, GEOPAK displays the following message in the prompt field: "No matching database item."

Shortcut buttons for the Display mode.

The same **Display** tools can be utilized within the Toolbox mode, as well as the dialog mode.

Shortcut button for the Set mode.

This shortcut button is used to access the Set mode.

Shortcut buttons to execute Design, Display, and Set key-in scripts.

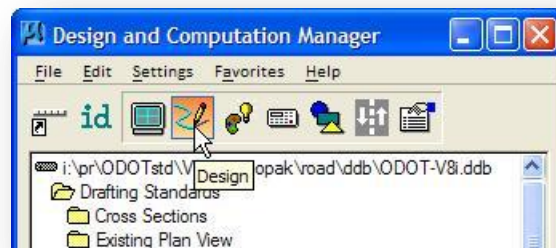
Each item in the DDB file can have a key-in command associated with the item. Separate key-in commands can be assigned for Design, Display, and Set mode. When the user double-clicks an item from the D&C Manager dialog, the associated key-in command is executed.

When in Tool Box mode, there is no way to double-click an item. These three icons are provided to process a key-in command while in tool box mode.

For example, the Proposed Fence Line item has the key-in command “Place SmartLine” assigned for Design mode. Double clicking the Proposed Fence Line item will execute the key-in command. In Tool Box mode, selecting the Proposed Fence Line item and clicking the Design Key-in Icon will execute the “Place SmartLine” key-in command.

**Switch back to dialog mode.**

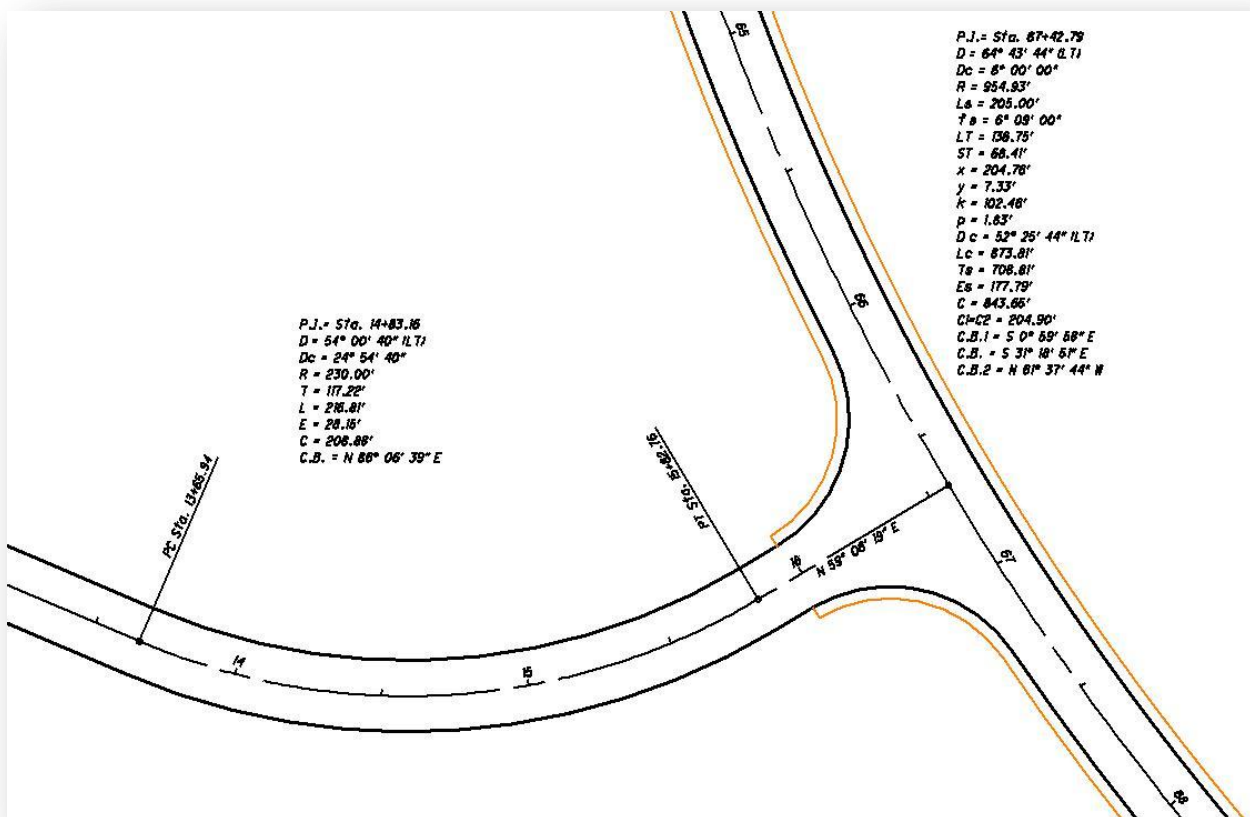
When switching back to dialog mode, only the main D&C Manager dialog is opened. To open the second dialog with the Place Influence toggle, select the Design Mode icon as shown below.



Exercise 5

- Plot the proposed S.R.185 and proposed Jameson Road chains using the correct design and computation manager features for a 20 Scale proposed centerline.
- Plot the stationing for proposed S.R. 185 and proposed Jameson Road for a 1:20 plotting scale.
- Use the MicroStation **Copy Parallel** command with the D&C Manager **Place Influence** option to place a proposed edge of pavement 12' to the left and right of proposed S.R. 185 and proposed Jameson Road.
- Use the MicroStation **Construct Circular Fillet** command with **Place Influence** to place 50' radius returns between proposed S.R. 185 and proposed Jameson Road.
- Use the D&C Manager in conjunction with MicroStation to draw the proposed shoulder for proposed S.R. 185. The shoulder width is 4'. Draw the shoulders around the radius returns as shown below.

The intersection for proposed S.R. 185 and Jameson Road should look as shown below when completed.



6 Drafting Tools

6.1 Overview

GEOPAK provides several tools to assist in the drafting of plan view features. The following tools are the focus of this chapter:

- DP Station Offset
- Draw Cell by Feature
- Draw Cell Group by Feature
- Draw Transition
- Active Chain Control
- Pavement Marking

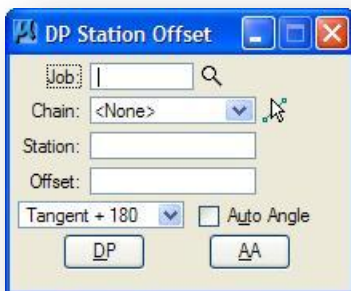
Each of these tools can be used in conjunction with the Design & Computation Manager's Place Influence command to ensure that plan view items are drawn in accordance with ODOT standards.

6.2 DP Station Offset

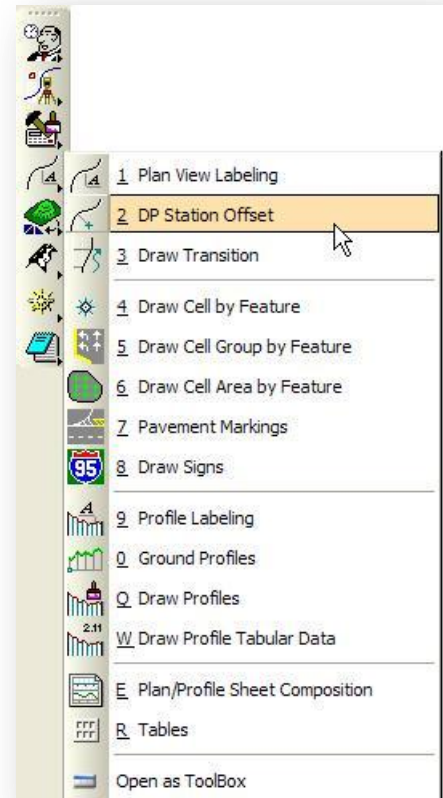
The **DP Station Offset** dialog is used to issue a MicroStation data point in terms of a station and offset relative to a GEOPAK coordinate geometry chain.

The dialog can be invoked by selecting **Applications > Road > Plans Preparation > DP Station/Offset** or from the GEOPAK Road Tools palette as shown at right.

The *DP Station Offset* dialog is shown below.

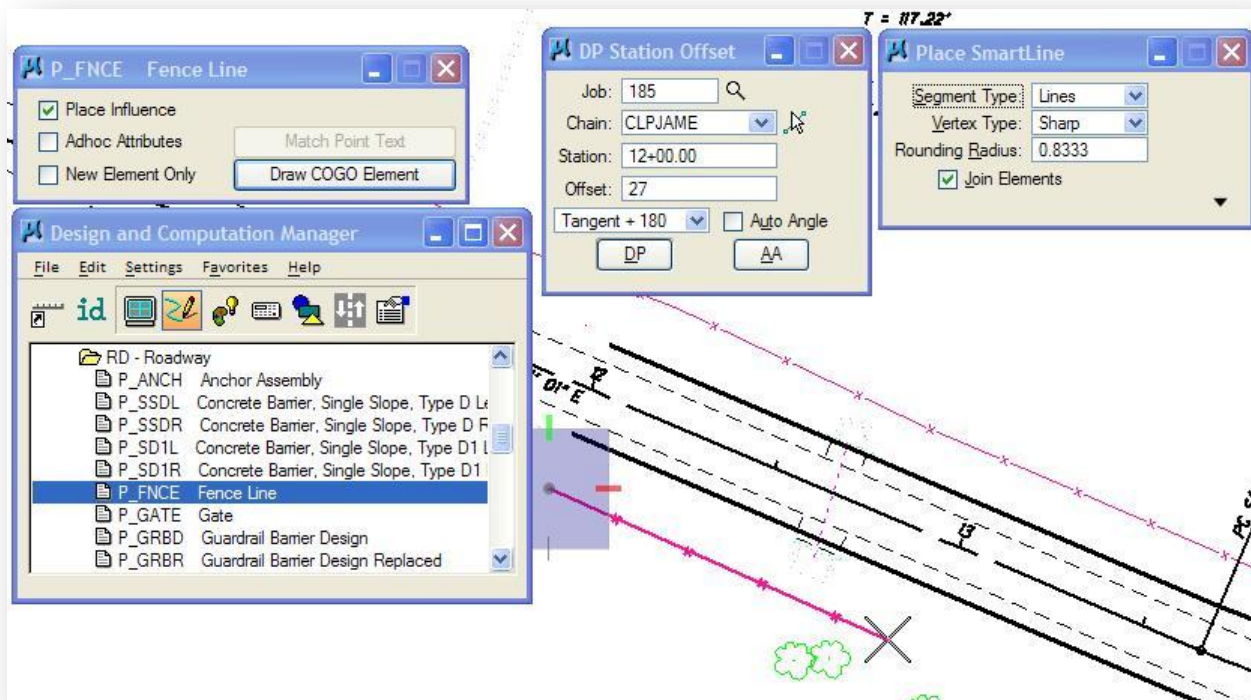


Once invoked, **DP Station Offset** can be used with MicroStation commands to place plan view graphics at a specific station and offset relative to a COGO chain. Let's look at a few examples and applications of this useful tool.



The most obvious use of the *DP Station Offset* dialog is the precision placement of lines, curves, cells, etc. for plan view features which are located by station and offset measurements from a previously stored chain. This could include guard rail, fencing, walls, right of way features, sidewalks and so forth. Let's review the dialog shown on the previous page. To place a proposed fence line, take the following steps:

- ✓ Establish the desired element symbology using the D&C Manager as shown below
- ✓ Next, select the MicroStation Place SmartLine command
- ✓ Fill in the *DP Station Offset* dialog with the desired information for the initial point. This includes the **Job** number, the reference **Chain**, the desired **Station**, and **Offset**. **DP Station Offset** utilizes standard surveying convention for offsets. A positive offset (i.e., 45.6) would be to the right of the chain and a negative offset (i.e., -92) would be to the left according to the direction of stationing. Note: The plus (+) sign is not required, as GEOPAK will assume a positive offset if no sign is given.
- ✓ Select **DP** to send the station and offset to MicroStation. The first endpoint of the SmartLine is drawn from the **Station** and **Offset** values specified.



- ✓ Change the *DP Station Offset* dialog settings to reflect the next endpoint for the fence line. Select **DP** to send the second data point to MicroStation.

If there are station equations in the chain, regions are not required unless the given station exists in more than one region. The syntax for regions is 45+56 R 2 with a minimum of one space between the station and the R and a minimum of one space between the R and the region number.

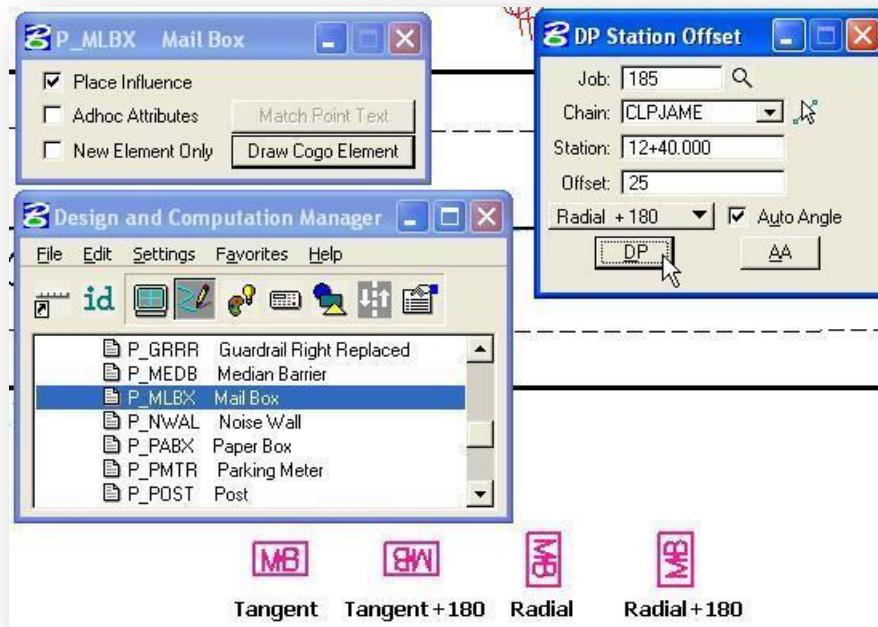
Other uses for **DP Station Offset** include text and cell placement. It might be desirable to draw a cell representing such features as lighting fixtures and drainage structures perpendicular or tangent to the chain. The bottom part of the *DP Station Offset* dialog provides four options to control the orientation of cells as shown in the dialog below.



Options include text or element placement **Tangent** to the chain, **Tangent + 180** degrees, **Radial**, and **Radial + 180 degrees**. All orientations are relative to the direction of stationing. To use these options, select the preferred option (such as **Radial**), then press the **AA** button. GEOPAK will display the **Active Angle** radial to the chain at the designated station in the MicroStation Command Window and set the **Active Angle**.

To place a cell, take the following steps:

- ✓ Set the active cell appropriately, and then choose the **Place Cell** command.
- ✓ Key-in the correct **Station** and **Offset** into the dialog
- ✓ Select the desired rotation option.
- ✓ Press the **AA** button
- ✓ Press the **DP** push button. The cell will be placed in the MicroStation file at the desired location and orientation as shown below

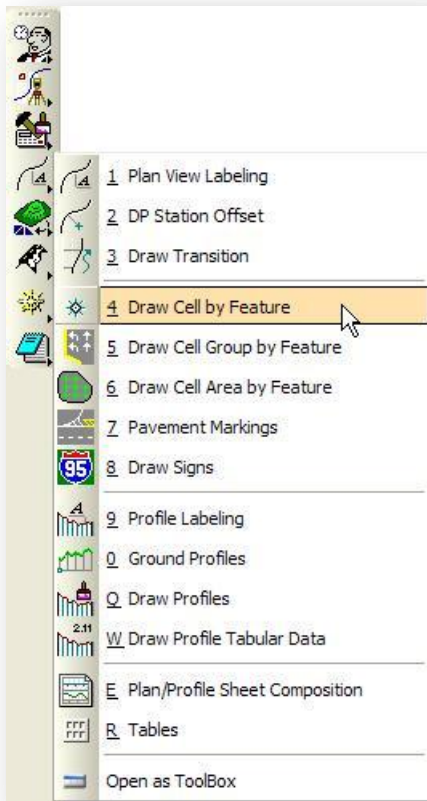


It can be cumbersome to keep selecting the **AA** button to set the **Active Angle** each time a new station and offset value is entered. The **Auto Angle** toggle can be selected to automatically change the active angle automatically every time a new station and offset is keyed in.

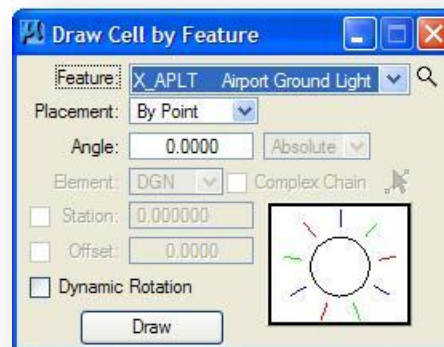
6.3 Draw Cell by Feature

The **Draw Cell by Feature** tool is used to draw cells with a variety of options for all project scenarios. For example, trees can be placed at specific station / offsets, guard rail posts can be evenly spaced along the railing, and all are selected by D&C Manager Feature, rather than searching for cells.

The *Draw Cell by Feature* dialog can be accessed from the GEOPAK Road tool palette as shown below, or by selecting **Applications > Road > Plans Preparation > Draw Cell by Feature** from the MicroStation pull down menu.



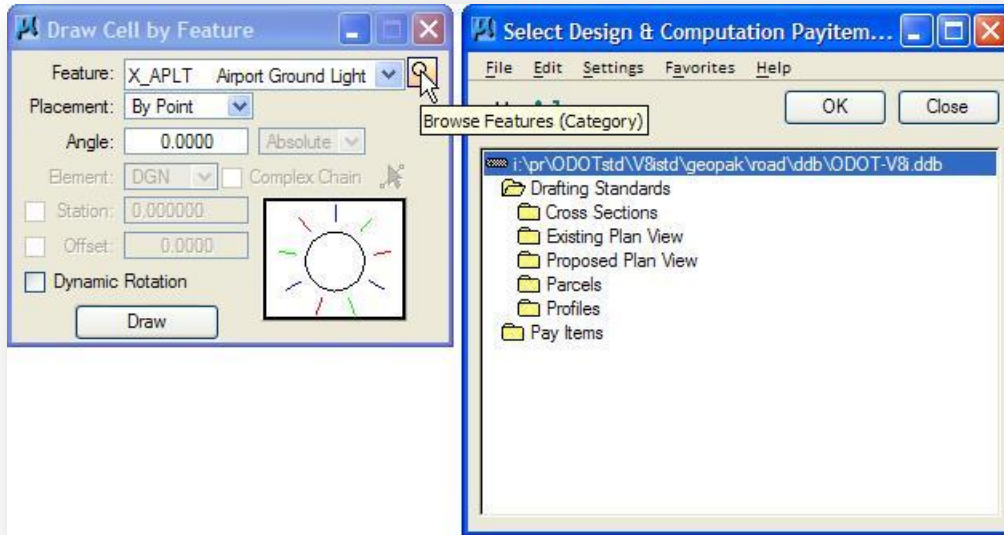
The *Draw Cell by Feature* dialog shown below is opened.



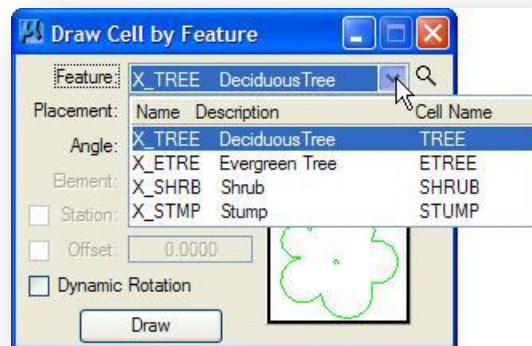
The dialog has the following options:

Feature

This option is used to select the Design and Computation Manager **Feature** which determines the cell to be placed. The items configured to place a cell from the current DDB file are available in the drop down list. If another category or DDB is desired, click the **Browse Features (Category)** button to open the *Select Design and Computation Payitem* dialog shown below



The items within the selected category that have been configured to place cells will become available in the drop down list. In the example below, the Existing Vegetation category was selected. The list is constrained to contain only the cells from that category.



Placement

Cells can be placed along an element, by using the **On Element** option or singly by using the **By Point** option. When **By Point** is selected, the rest of the dialog is ghosted except for **Dynamic Rotation**.

Angle

This key-in field is used to specify the **Angle** of the cell. If set to **Absolute**, the **Angle** is based on 0 degrees as horizontal. If set to **Relative**, the **Angle** is based relative to the selected element or chain.

Element

If the **Placement** option is set to **On Element**, the **Element** option is un-ghosted and has two options:

DGN - Cells are placed relative to a MicroStation element. Click **Identify DGN Element** to identify the element.



Chain – Cells are placed relative to a COGO chain. Select a **Chain** from the list of chains in the current GPK file, or graphically by using the **Identify Chain** button.



Station

When a **Chain** is specified, the station, in conjunction with the offset, is used for determining the placement of the cell. When a **DGN** element is selected, the station represents the distance along the element.

Offset

Offset of the cell, based on the specified chain or from the MicroStation element. It is not necessary to key in negative offsets for elements placed to the left of the reference element. The cell will dynamically move to the left or right side of the reference element depending on the cursor position during placement.

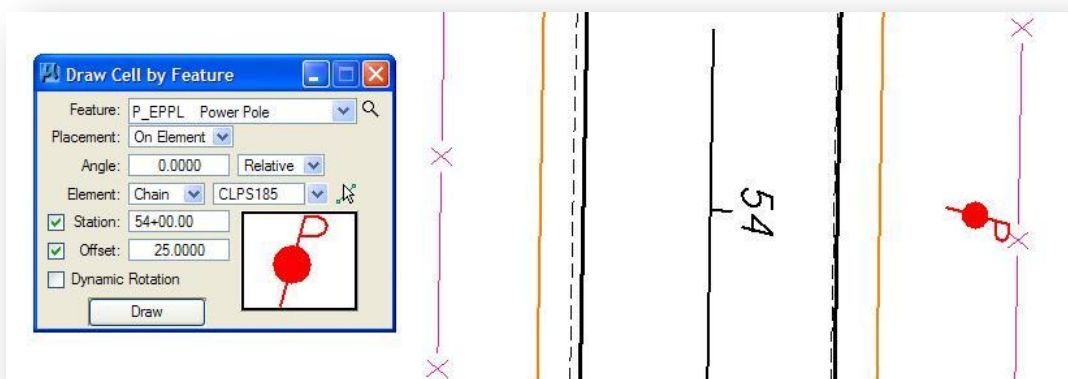
Dynamic Rotation

When toggled on, the cell can be rotated to the desired angle. When toggled off, the **Angle** is entered in the angle field.

Draw

Click the **Draw** button to start cell placement. Depending on the options selected, various prompts are displayed to guide the user in placement.

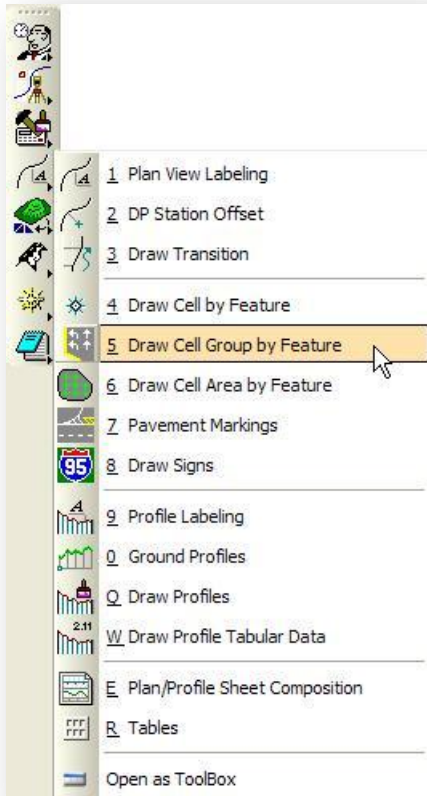
An example of placing a proposed Power Pole is shown below.



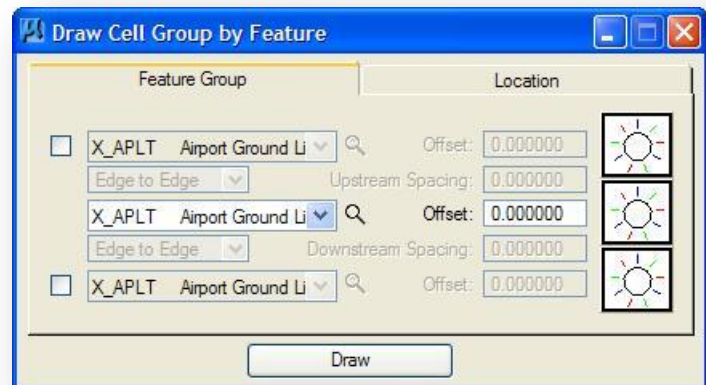
6.4 Draw Cell Group by Feature

The **Draw Cell Group by Feature** tool is used to place groups of cells based on user defined spacing and offsets.

The *Draw Cell Group by Feature* dialog can be accessed from the GEOPAK Road tool palette, as shown below, or by selecting **Applications > Road > Plans Preparation > Draw Cell Group by Feature** from the MicroStation pull down menu.



The *Draw Cell Group by Feature* dialog shown below is opened.

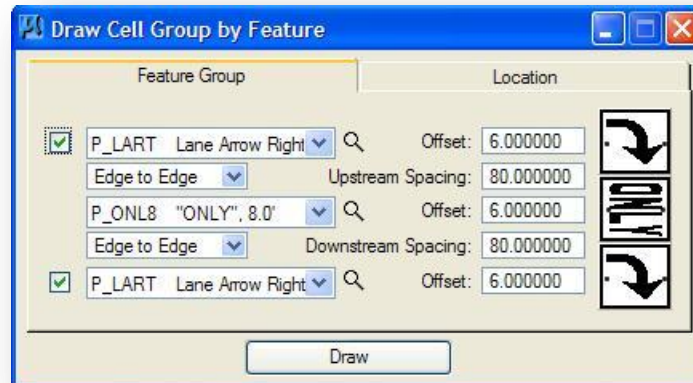


The dialog consists of two tabs:

- **Feature Group** - defines the D&C Manager Features (which in turn dictate the cells) to be used within the group
- **Location** - the placement of the cells based on a graphic element or chain.

Feature Group

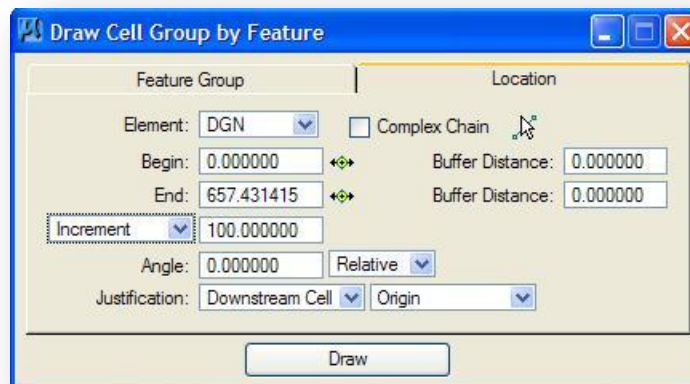
The **Feature Group** tab has the following options:



By default, one cell will be placed using the parameters specified on the **Location** tab. Up to three cells can be placed by clicking on the toggle for the **Upstream** and **Downstream** cells as shown above. The **Offset** and **Spacing** can be specified as show above.

Location Tab

The Location Tab is used to specify where the cell group will be placed in the design file. The group can be placed relative to a design line element or a COGO chain.



Element

The cell group may be placed relative to a **DGN** element or a COGO **Chain**.

DGN - Cells are placed along a MicroStation element. Click **Browse** to identify the element (i.e., lane line in the example of turning arrows). If multiple elements need to be selected, use the **Complex Chain** option.

Chain - Select a chain from the list of chains in the current GPK file.

Begin / End

Used to specify the location where the cells begin and end. If the **Element** is a **Chain**, then the fields are populated with the beginning and ending station of the chain. Cells may be placed along a portion of the element or chain either by changing the entries manually, or by graphical selection via the **DP** buttons.

Buffer Distance

The **Buffer Distance** is intended for the case where the **Begin/End** station is known, but the cells have to be kept a certain distance inside that stationing. For example, if the begin station = 1+50.00 and end station = 7+50.00, the cells are drawn from 1+50 to 7+50. But if buffer distance = 20.00 and 40.00, then the adjusted stations are as follows:

Begin Station = 1+70.00 (1+50.00 + 20.00)

End Station = 7+10.00 (7+50.00 - 40.00)

Spacing

The entire cell group can be repeated and placed multiple times along the selected **Element**. The following options are available:

Increment – Cell groups are placed along the specified **Element** starting from the **Begin** value. For example, if the **Begin** value is 35+90.72, and the **Increment** value is set to 500', then the next cell group will be placed at station 40+90.72.

Even - Cell groups are placed along the specified **Element** starting from the first Even increment past the **Begin** value. For example, if the **Begin** value is 35+90.72, and the **Increment** value is set to 500', then the first cell group will be placed at station 40+00.

Max Spacing - The location of the beginning and ending cell are determined, then a sufficient number of cells are placed in between such that the distance between them is no more than the specified **Max Spacing**.

Once - Only one cell group is placed. Note the **Ending Buffer Distance** and **End** key-in fields are ghosted.

Each Vertex - The origin of the cell is placed at each vertex of the selected element. The key-in field is ghosted for this option.

Each Endpoint - The origin of the cell is placed at the endpoints of the selected element. The key-in field is ghosted for this option.

Angle

Cells can be placed at a specified angle. If set to **Absolute**, the **Angle** is based on 0 degrees as horizontal. If set to **Relative**, the angle is based relative to the selected element or chain.

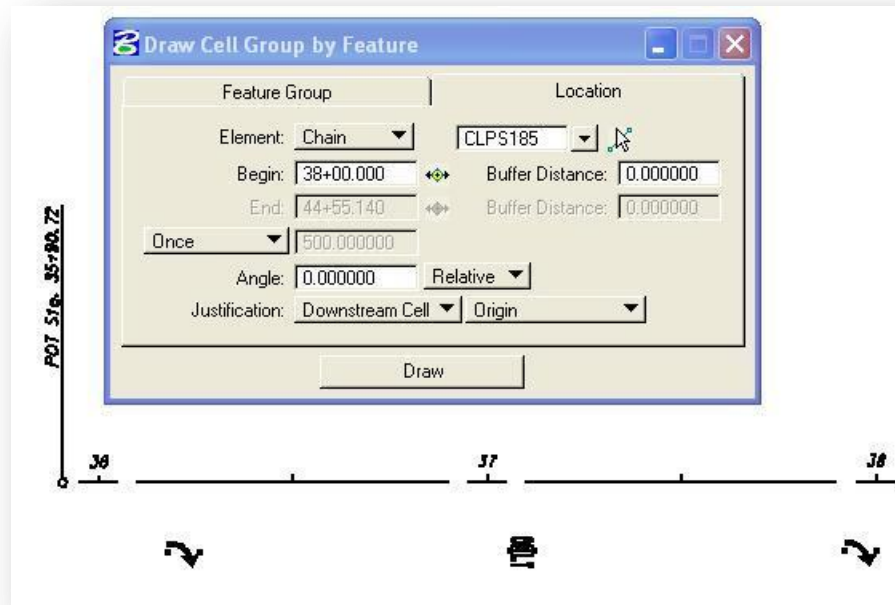
Justification

The justification can be based on the center, upstream or downstream cell. Only those toggled on in the **Feature Group** are available for setting **Justification**.

Draw

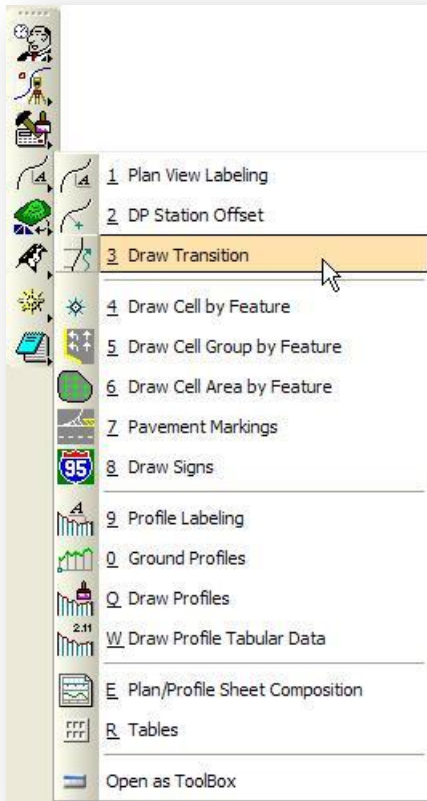
Click to commence cell placement. Depending on the options selected, various prompts are displayed to guide the user in placement.

An example of a cell group is shown below:

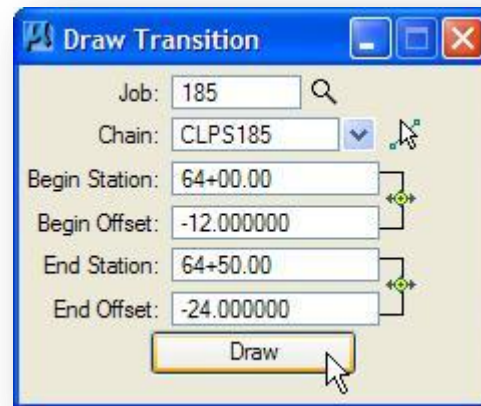


6.5 Draw Transition

The GEOPAK **Draw Transition** tool is used to assist the designer in the drafting of transitions such as those for a turn lane, bypass lane, or acceleration lane. This could be accomplished with the **DP Station Offset** tool in conjunction with the MicroStation Place SmartLine tool. However, the **Draw Transition** tool is especially useful in transition areas that are not in tangent sections of the alignment.



The **Draw Transition** tool is essentially a specialized *DP Station Offset* dialog which allows for two stations and offsets to be input simultaneously. GEOPAK will then draw a transition curve between the two station and offsets using the active symbology. To invoke the *Draw Transition* dialog, select **Applications > Road > Plans Preparation > Draw Transition** or select its icon from the GEOPAK *Road* tool palette as shown at left



Fill in the *Draw Transition* dialog with the information for the transition. This includes the **Job** number, the reference **Chain**, the desired **Beginning Station**, **Beginning Offset**, and **Ending Station** and **Ending Offset**.

Draw Transition utilizes standard surveying convention for offsets. A positive offset (i.e., 45.6) would be to the right, while a negative offset (i.e., -92) would be to the left, of the chain. Orientation is according to the direction of stationing. Note the plus (+) sign is not required as GEOPAK will assume a positive offset if no sign is given.

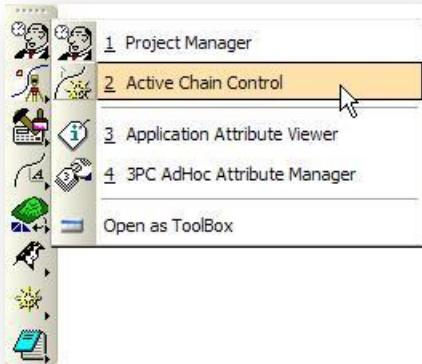
If there are station equations in the chain, regions are not required unless the given station exists in more than one region. The syntax for regions is 45+56 R 2 with a minimum of one space between the station and the R and a minimum of one space between the R and the region number.

Tip:

Draw Transition is not limited to drawing transitioning elements that have a different beginning and ending offset. **Draw Transition** can also be used to quickly draw the Edge of Pavement and Shoulder by using the same value for the beginning and ending offsets.

6.6 Active Chain Control

The **Active Chain Control** enables the user to manage plan, profile, and cross section views simultaneously. It also allows the use of MicroStation tools to place elements in any view (plan, profile, or cross section) in accordance with the **Curvilinear Coordinates** tool.



To access the **Active Chain Control**, select **Applications > Road > Active Chain Control** from the MicroStation pull down menus, or from the *Road* tool palette as shown at left.

The *Active Chain Control* dialog is shown below



First, select the desired **Job** number and **Chain** from the list box at the left end of the *Active Chain Control* dialog. The list of available chains is updated every time a new chain is created or deleted, or if a new GPK file is opened.

The remaining icons on the *Active Chain Control* dialog are documented below.



Graphically select the active Chain.



Opens the *Curvilinear Coordinates* dialog which enables the user to enter precise curvilinear coordinates relative to the active chain. The Curvilinear Coordinates command is described below.



Activates the current profile, which is associated to a Profile Cell. The Profile Cell Status function is described on page 6-14.



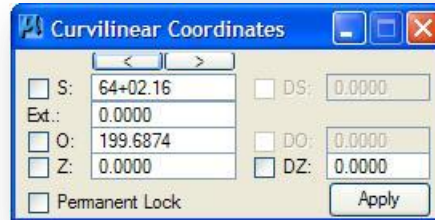
Activates the current Cross Section system. The Cross Section Cell Status command is not covered in this training guide.



View control icons. See page 6-17 for more information.

6.6.1 Curvilinear Coordinates

When the **Curvilinear Coordinates** icon is pressed, the *Curvilinear Coordinates* dialog, as shown below, opens.

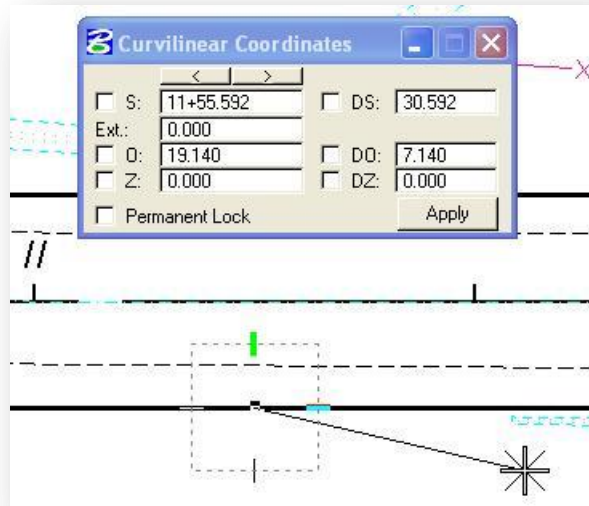


The Curvilinear Coordinates dialog can be used to track the current cursor position relative to the selected COGO Chain, or to enter station, offset, and elevation values that can be Applied to the active MicroStation command.

The fields in the dialog are described in the table below.

<	Select this button to lock the S field at the beginning station on the Chain
>	Select this button to lock the S field to the ending station on the Chain
S	This field reports the Station value of the cursor relative to the selected Chain. As the cursor is moved, the station continuously updated. This field can also be used to enter the station along the active chain. Use the left toggle to lock the value of this field
Ext.	If the cursor is moved before the beginning of the selected chain, or after the end of the selected chain, the distance along an assumed tangent extension of the alignment is reported in this field. A negative value means that the extension is before the beginning of the chain. A positive value means that the extension is after the end of the chain
O	Use this field to track the offset of the cursor or to enter an offset from the active chain. Use the left toggle to lock the value of this field
Z	Use this field to enter an elevation. Use the left toggle to lock the value of this field
DS	Use this field to enter a delta station from the previous data point or tentative point. Use the left toggle to lock the value of this field
DO	Use this field to enter a delta offset from the previous data point or tentative point. Use the left toggle to lock the value of this field
DZ	Use this field to enter a delta elevation from the previous data point or tentative point. Use the left toggle to lock the value of this field
Permanent Lock	When this toggle is checked, coordinates locks remain active, even after a data point is issued
Apply	Select this button to send a data point to the active MicroStation command

The *Curvilinear Coordinates* dialog can be used in conjunction with generic MicroStation commands. For example, select the *Place SmartLine* command. When prompted for the first data point, move the cursor around the screen and note the dynamics within the dialog. Set the station and offset by activating the **S** and **O** toggles, then press the **Apply** button. The first endpoint of the line is placed and moving the cursor displays a line as shown in the graphic below.



Move the cursor to view the dynamics again. The second endpoint can be defined by entering a data point on screen, entering **Station** and **Offset**, entering a **DS** value, or entering a **DO** value.

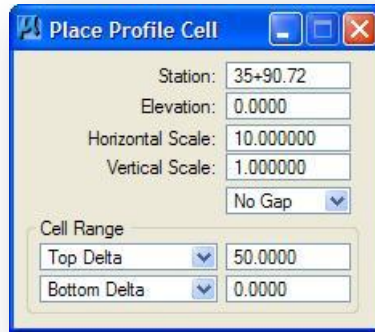
6.6.2 Profile Cell Status



A Profile Cell can be drawn to easily reference the profile in subsequent tasks. Once the cell has been placed, it can be utilized by any process where the profile's **DP Station**, **Elevation**, **X**, **Y**, **Horizontal Scale** or **Vertical Scale** values are needed.

The Profile Cell can be located in the master file or in any of the reference files. When the right mouse button is pressed on the **Profile Cell Status** icon, a pop-up menu appears as shown below.

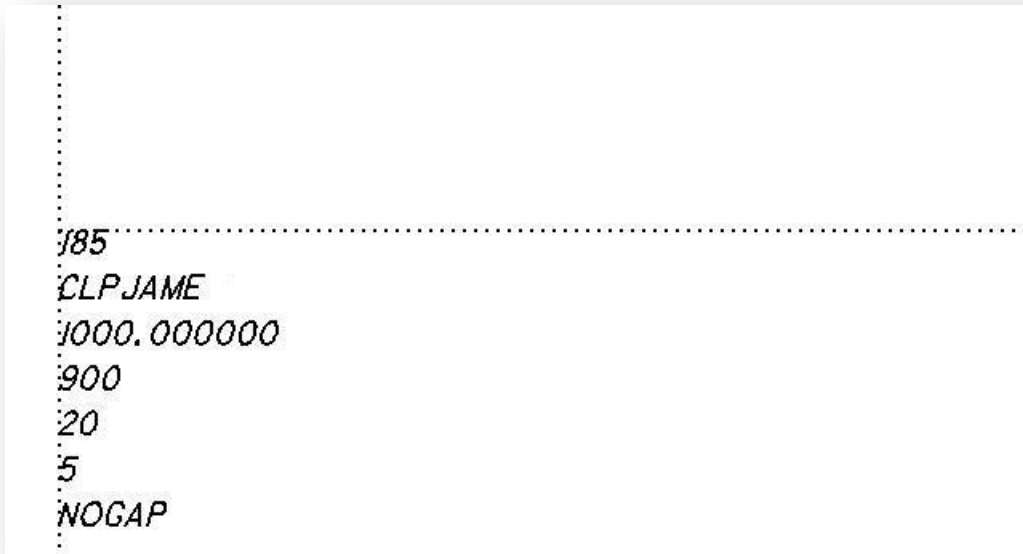


The **Place Profile Cell** option of the pop-up menu allows placement of a profile cell in the active MicroStation design file. **Note:** The profile cell may be placed by many other applications in GEOPAK, i.e., D&C Manager, Vertical Alignment Generator, Project Manager and Plan / Profile Sheets. When selected, the dialog on the following page is displayed.



Station	Use this field to define the Station of the reference data point at the origin of the profile cell
Elevation	Use this field to define the Elevation of the reference data point at the origin of the profile cell. It should be an even value to correspond with the major grid and lower in elevation than the minimum elevation of the profile
Horizontal Scale Vertical Scale	Use these fields to set the scale and subsequently the distortion utilized to draw the profile
Gap / No Gap	Use these fields to set the scale and subsequently the distortion utilized to draw the profile
Cell Range	<p>Use these fields to define the height of the Profile Cell. The option buttons allow selecting the values as shown below</p> <div style="display: flex; justify-content: space-around;">   </div> <p>The Top Delta and Bottom Delta values are given in true length without taking into account horizontal and vertical scales. Care must be given that the Top Delta and Bottom Delta values of the profile cell are set large enough to ensure that all profile elements fall completely within the limits of the profile cell.</p> <p>The Top Elevation and Bottom Elevation values are used to key in elevations corresponding to the top and bottom elevations of the profile cell. Care must be given that the Top Elevation and Bottom Elevation values of the profile cell are set large enough to ensure that all profile elements fall completely within the limits of the profile cell</p>

By default, the profile cell is placed on level "Default", and contains a vertical and horizontal datum, plus a text node containing the information shown below.



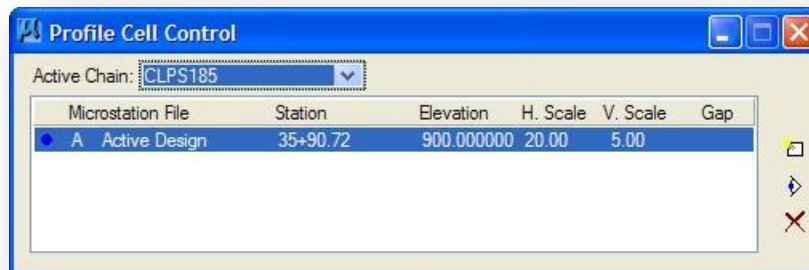
The text size and spacing is controlled by the active MicroStation text attributes.

Profile Cell Control

The *Profile Cell Control* dialog enables the user to place or manipulate profile cells and associated data. When the right mouse button is pressed, a pop-up menu appears as shown below




When the **Profile Cell Control** option is selected, the dialog shown below opens.




The dialog is comprised of two main parts:

Active Chain	Combo box to select the Active Chain
MicroStation File, Station, etc.	This list box gives information about all the Profile Cells that are associated with the Active Chain

Three action icons are located on the right side of the dialog and are detailed below:

 Use this button to place a new Profile Cell. This is the same as the Place Profile Cell command described on page 6-15.

 Use this button to activate the selected Profile Cell.

 Use this button to delete the selected Profile Cell.

For more information on Profiles and Profile Cells, see Chapters 8 and 9.

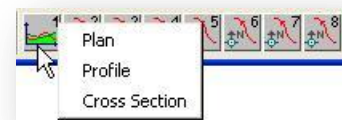
View Control Icons



The right side of the Active Chain Control dialog has eight icons corresponding to the eight MicroStation view windows. These icons are shown below.




Each icon can be used to define the type of view (**Plan**, **Profile**, or **Cross Section**) that is assigned to the associated MicroStation view window (1 through 8). Once the type of view has been assigned, clicking on the view control icon will execute a MicroStation **Fit View** command in the corresponding MicroStation window.

To assign the **Plan**, **Profile**, or **Cross Section** to one of the MicroStation view windows, right click on one of the view icons to open the pop-up menu shown at right.



<p>Plan</p>	<p>Selecting this option will assign the Plan view to the corresponding MicroStation window. After the Plan view has been assigned, the icon will appear as shown in the example for View 1, below</p> 
<p>Profile</p>	<p>Selecting this option will assign the Profile view to the corresponding MicroStation window. After the Profile view has been assigned, the icon will appear as shown in the example for View 2, below</p> 

Cross Section	<p>Selecting this option will assign the Cross Section view to the corresponding MicroStation window. After the Cross Section view has been assigned, the icon will appear as shown in the example for View 3, below</p> 
----------------------	--

After the **Plan**, **Profile**, or **Cross Section** view has been assigned, selecting the icon with the left mouse button will execute a MicroStation Fit View command in the corresponding MicroStation window. The Plan, Profile, or Cross Section is fitted in the corresponding MicroStation window.







After the **Cross Section** view has been assigned, when the right mouse button is pressed on a **Cross Section** view icon, the **Cross Section Navigate** option is added to the pop-up menu as shown at right.



Select **Cross Section Navigate** to open the *XS Navigate* dialog shown below.



The options and icons are detailed below.

	Use this item to select the active cross section view. Only views that have been assigned as Cross Section views on the <i>Active Chain Control</i> dialog are available
	Use this icon to go to the first cross section
	Use this icon to go to the previous cross section
	Use this icon to set the station option in the Curvilinear Coordinates dialog box. After the icon is selected, enter a data point on the screen in the cross section view. The station of the nearest cross section is read into the Curvilinear Coordinates dialog
	Use this icon to go to the next Cross Section
	Use this icon to go to the last Cross Section

Exercise 6

- ✓ Use **DP Station Offset** or the **Curvilinear Coordinates** tool with the **D&C Manager** and MicroStation's **Place SmartLine** command to draw the following pavement tapers for Jameson Road:

Station	Offset Left	Offset Right
12+00	-8.0'	8.0'
12+50	-12.0'	12.0'

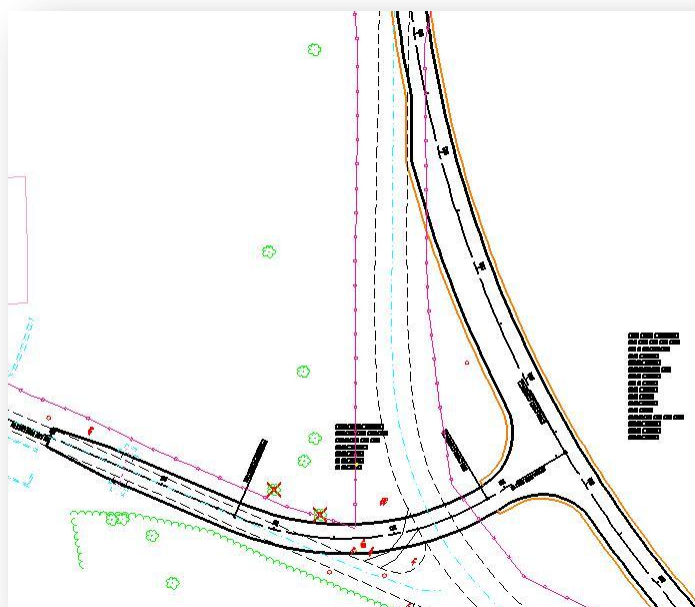
- ✓ Use **Draw Transition** with the D&C Manager to draw a right turn lane at the intersection of S.R. 185 and Jameson Road. The transition for the edge of pavement and shoulder is shown in the table below.

Begin Sta.	End Sta.	EOP Beg. Offset	EOP End Offset	SH Beg. Offset	SH End Offset
63+50	64+00	12'	24'	16'	28'

- ✓ Use the Draw Transition tool to draw 2.5' curve widening for the edge of pavement and shoulder on the inside (left side) of S.R. 185. The transition stations for the curve widening are shown in the table below.

Begin Sta.	End Sta.	EOP Beg. Offset	EOP End Offset	SH Beg. Offset	SH End Offset
60+33.98	62+38.98	-12'	-14.5'	-16'	-20.5'
62+38.98	71+12.80	-14.5'	-14.5'	-20.5'	-20.5'
71+12.80	73+17.80	-14.5'	-12'	-20.5'	-16'

- ✓ Use MicroStation commands with the D&C Manager to revise the edge of pavement and the shoulder as shown in the diagram below.

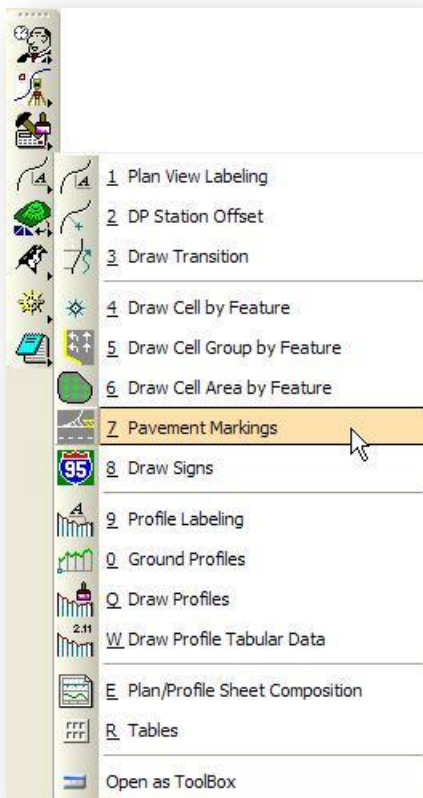


6.7 Pavement Markings Tools

The Pavement Marking tools facilitate the production of traffic control plans. The following options are provided for various pavement marking requirements:

- **Striping** places lines parallel to a specified alignment at a user defined offset.
- **Separation** draws markings between two identified selection sets.
- **Merge and Diverge Chevrons**. Chevrons will not be covered during this training session. For more information on these tools, please see the GEOPAK documentation.

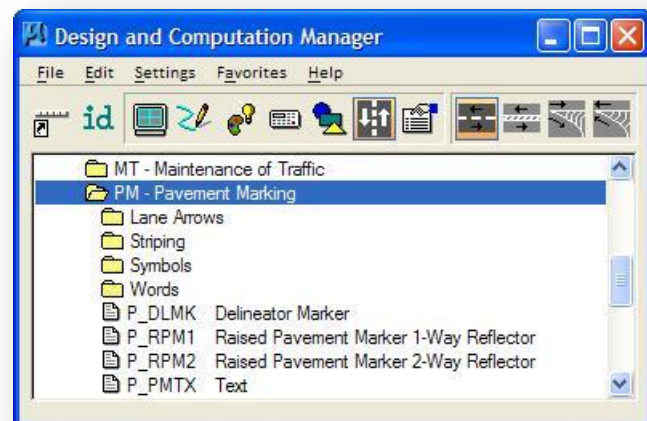
Features such as stop lines, lane arrows, words on pavement (such as ONLY or SCHOOL), etc. can be placed using the **Place Influence** option of the **Design and Computation Manager** in conjunction with the **DP Station Offset** tool, or by use of the GEOPAK **Draw Cell** tool.



The Pavement Markings tools are an option on the GEOPAK Design and Computation Manager. The tools can be accessed as follows:

- Select the **Pavement Markings** icon from the GEOPAK Road Tools palette as shown at left.
- Open the Design and Computation Manager and then select the Pavement Marking mode.

The Design and Computation Manager is opened in Pavement Marking mode as shown below.



Four icons for pavement striping are available as detailed below.



Stripping



Separation



Chevron Diverge



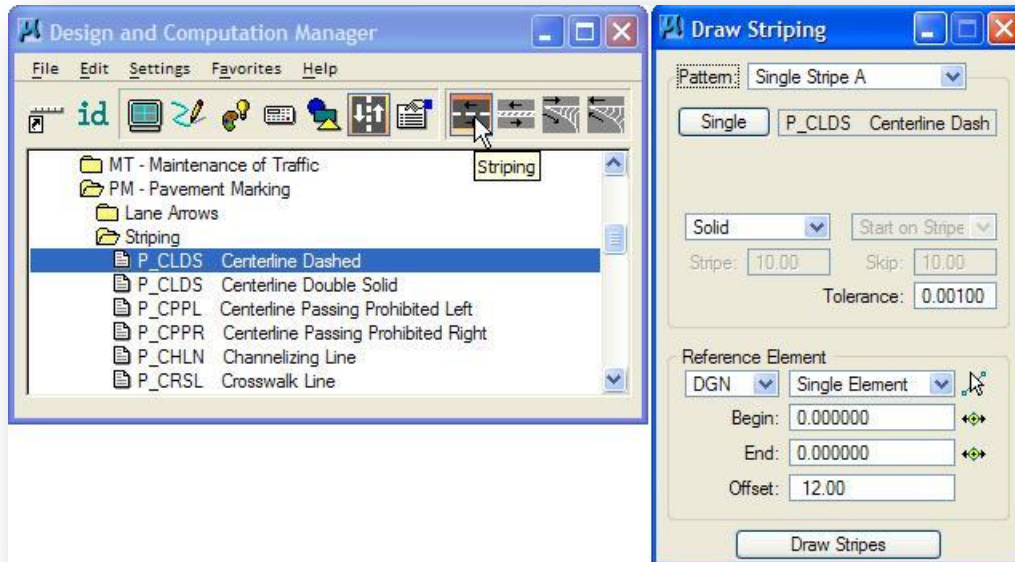
Chevron Merge

A double click onto an Item within the *Design and Computation Manager* dialog will open the striping dialog associated with the depressed push button from the top of the dialog. Alternately, you can single click an item and press the pavement push button.

Note: Pavement Marking Items in ODOT.ddb have been configured to use custom line styles to draw the various striping lines. This training guide will detail the process of placing pavement marking using custom line styles instead of using the **Pavement Marking** tool's **Skip/Stripe** option.

6.7.1 Striping

While the desired Item is highlighted, the selection of the **Striping** option in the upper right portion of the dialog invokes the *Draw Striping* dialog as shown below.

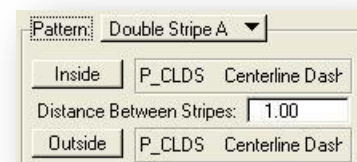


Pattern

In the case of the **Single Stripe** options, two different configurations (**A** and **B**) can be stored, so the user can change the type of striping being placed with a minimum of effort. In the case of the **Double Stripe**, up to four configurations (**A**, **B**, **C**, and **D**) can be stored. These configurations are automatically stored in a resource file. In this manner, they can be accessed in future sessions and the user does not have to re-configure the options.

Single / Inside / Outside

When either **Single Stripe A** or **B** options are selected, the **Single** option is used to specify the current item that will be used to draw the pavement striping. When one of the **Double Stripe** options is selected, **Inside** and **Outside** striping lines can be specified as shown at right.



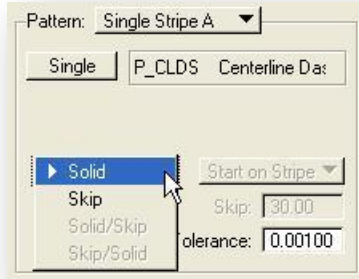
The Item highlighted when the **Striping** option was selected is placed in the Pay Item box by default. Note that this can be changed anytime during the process by clicking **Single**, **Inside**, or **Outside**. The display field immediately displays the currently selected D&C Manager Item.

The **Distance Between Stripes** option is expressed in terms of master units.

Solid, Skip

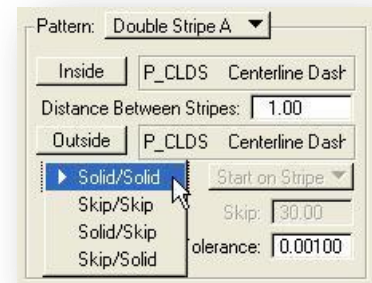
Solid/Solid, Skip/Solid, Solid/Skip, Skip/Skip

GEOPAK provides the option to place solid or dashed lines by use of the **Solid** and **Skip** options as shown below.



Tip:
For ODOT projects, the **Solid** option should always be used since the pavement marking items requiring dashed lines have been configured within ODOT .ddb to use a custom line style to set the dash lengths.

When using the **Double Stripe** options, as shown at right, multiple options are available to control whether the **Inside** or **Outside** lines will be placed as **Skip** or **Solid** lines.

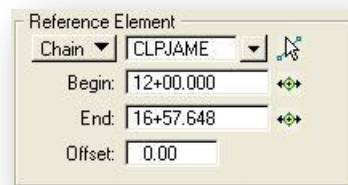
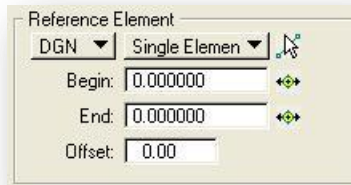


Tolerance

If the length of a segment of pavement marking is less than the **Tolerance**, the line will not be placed. It will only be utilized at the ending point to determine where the final piece of marking is placed.

Reference Element

Options are provided to place pavement markings relative to a MicroStation **DGN** element or a **COGO Chain** as shown below.



DGN

The following options are available to select the **DGN** element:

Single Element - When selected, the user is prompted to select the element.

Selection Set - Create the selection set, then set the toggle to **Selection Set**. Click **ID Element** which computes the stationing for the selection set. If the selected elements are in reference files, this method must be utilized as **Complex Chains** cannot be selected from reference files.

Complex Chain - Select the option, which invokes the MicroStation Create Automatic Complex chain tool to define the elements. The complex chain is created in memory for the purpose of generating the pavement markings.

Begin, End – These values begin at 0.00 and are based on the length of the selected element(s).

Chain

Select the **Chain** from the list or graphically with **Identify Chain**. The **Begin** and **End** station fields are automatically populated with the beginning and ending station on the chain as defaults. The values may be changed manually or graphically by using the buttons to the right of the **Begin** and **End** fields.

Begin identifies the beginning of the striping. Note that **Begin** does not have to be on the element which is used as the basis for the offset, as the software constructs a perpendicular to the element and utilize the projection. By utilizing **Begin** (and **End**), the length of the striping is determined by the designer, not the length of the chain. **Begin** is set by clicking the **DP** icon, then placing a data point at the desired location or by keying in the desired station. The station of the point is displayed to the left of the **DP** icon.

End serves the same function as **Begin**, but at the opposite end. Like **Begin**, it does not have to be located on the element. The **End** is set by clicking the **DP** icon, then placing a data point at the desired location. The station of the point is displayed to the left of the **DP** icon.

Offset

This option is used to specify the **Offset** from the selected elements to the striping. Definition of plus (RT) or minus (LT) is not necessary as the designer graphically indicates the stripe orientation relative to the chain after **Draw Stripes** is clicked.

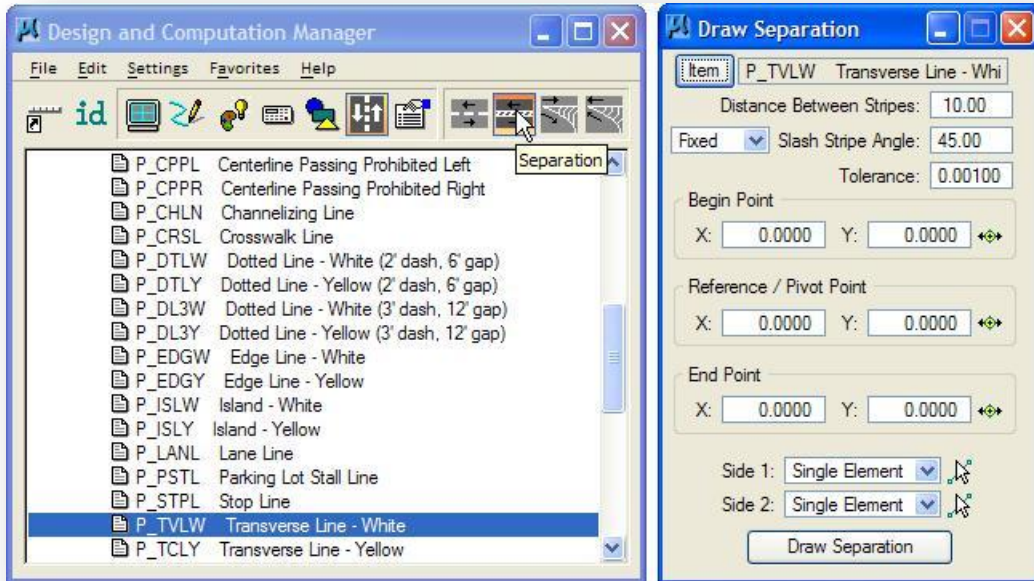
Draw Stripes

Clicking **Draw Stripes** attaches the striping to the cursor at the appropriate offset. By moving the cursor on the screen, the designer can move the striping to the desired side of the chain, and a Data Point places the striping into the MicroStation file. The striping is placed (with each Data Point) in a graphic group for easy deletion, if desired.

6.7.2 Separation

While the **Striping** option draws pavement markings at specified offsets from selected elements or a Chain, the **Separation** option draws pavement markings between two sets of selected elements.

When a Transverse Line item is highlighted in the *Design and Computation Manager* dialog and the **Separation** option is selected, the *Draw Separation* dialog shown below is opened



The Transverse Line is shown in the Pay Item output field in the *Draw Separation* dialog and can be changed at any time by highlighting the desired pavement marking item in the Design and Computation Manger and pressing the **Item** push button.

Distance Between Stripes

This key in field is located below the pavement marking description and is expressed in terms of master units.

Slash Stripe Angle

Angle at which the striping line will be placed measured in degrees. Two **Slash Stripe Angle** options are available: **Fixed** or **Variable** as shown below.



Fixed

If the **Fixed** toggle is selected, the stripes will all be placed parallel to the first stripe (relative to the Reference Point), even in non-tangential areas.

Variable

With the **Variable** option, the angle will be maintained between the stripe and the location side element, even around curves.

Tip:

Use the **Variable** option for most ODOT applications where the transverse lines are in non-tangential areas.

Tolerance

If the length of a segment of pavement marking is less than the **Tolerance**, the line will not be placed. It will only be applied at the ending point to determine where the final piece of marking is placed.

Begin Point

This option identifies the beginning **X** and **Y** coordinates of the striping. Note that **Begin** does not have to be on the element (but inside the striping area) as the software constructs a perpendicular to the element and utilizes the projection. By utilizing **Begin** (and **End**), the length of the striping is determined by the designer, not the length of the chain. **Begin** is set by clicking the **DP** icon, then placing a data point at the desired location. The coordinates of the point are shown to the left of the **DP** button. Note: if the beginning area is in a gore, DO NOT snap to the gore itself, as the point must be inside the striping area.

Reference / Pivot Point

Another point is required by the software in order to place the pavement marking, the **Reference / Pivot Point**. This point is projected onto the **Side 1** element where the first pavement marking line is to be placed. The remaining marking are placed relative to this first stripe.

End Point

The **End Point** serves the same function as **Begin Point**, but at the opposite end.

Side 1, Side 2

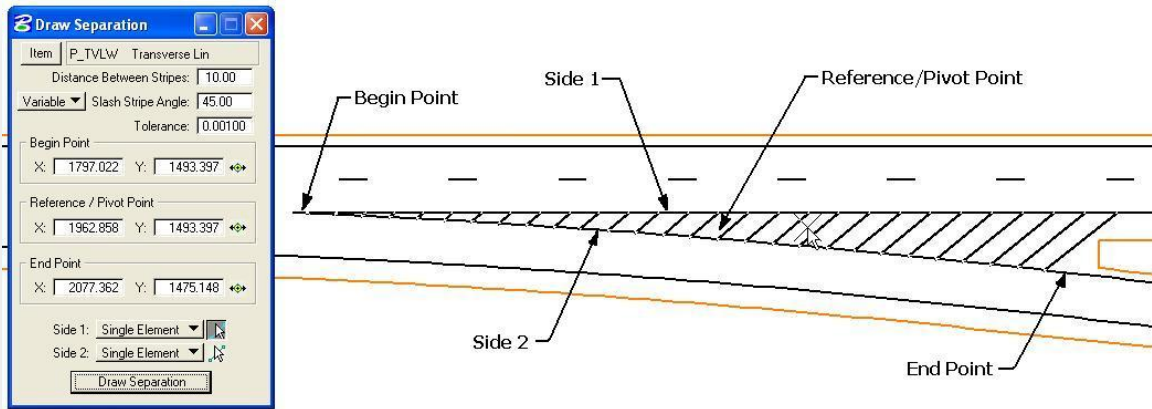
Identify the two edges to generate the marking, **Side 1** and **Side 2**. In order to place the pavement markings correctly, one must understand the difference between **Side 1** and **Side 2**. **Side 2** is used when turning the **Slash Stripe Angle**. The software begins on **Side 2**, and draws the marking at the specified angle until it intersects the **Side 1** element, where the marking stops. It is also desirable to have the total length of the **Side 2** elements longer than the **Side 1** elements, however it is not mandatory. Three methods are supported to define the elements. It is not necessary to use the same method on both sides.

Single Element - When selected, the user is prompted to select the element.

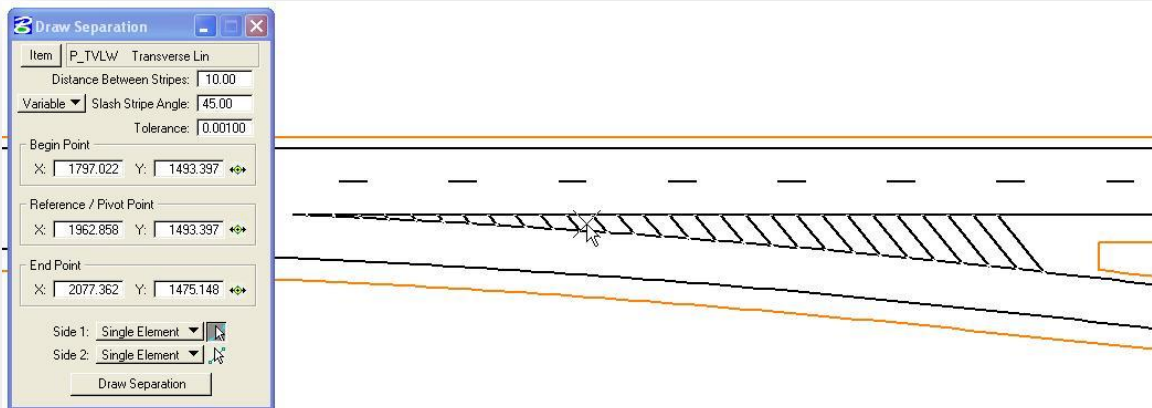
Selection Set - Create the selection set, and then set the toggle to **Selection Set**. Click **Identify DGN Element** to accept the selection set. If the selected elements are in reference files, this method must be utilized as **Complex Chains** cannot be selected from reference files.

Complex Chain - Select the option, which invokes the MicroStation **Create Automatic Complex Chain** tool to define the elements.

An example **Separation** pavement marking is shown below.



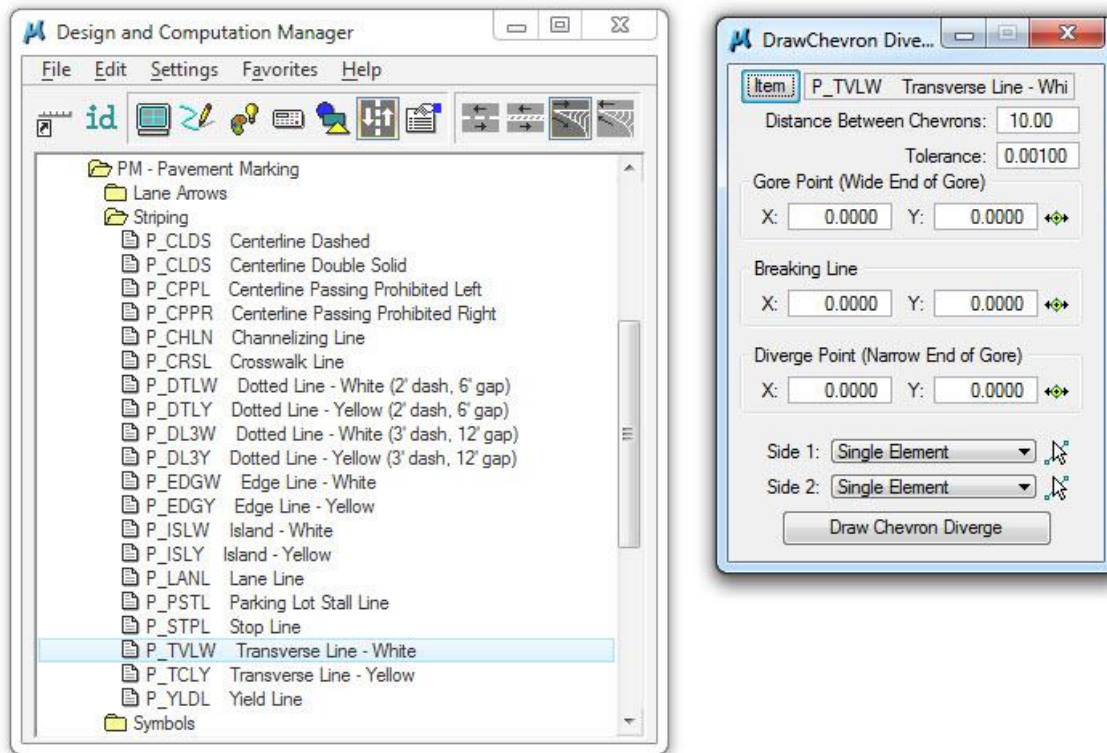
The **Reference/Pivot Point** is used to determine the orientation of the pavement markings. If the cursor is positioned up-station from the **Reference/Pivot Point**, the markings are drawn as shown above. If the cursor is positioned down-station from the **Reference/Pivot Point**, the pavement markings are placed as shown below.



6.7.3 Chevron Diverge

The **Chevron Diverge** option is used to draw pavement markings between two sets of selected elements.

When a Transverse Line item is highlighted in the *Design and Computation Manager* dialog and the **Chevron Diverge** option is selected, the *Draw Chevron Diverge* dialog shown below is opened.



The Transverse Line is shown in the Pay Item output field in the *Draw Chevron Diverge* dialog and can be changed at any time by highlighting the desired pavement marking item in the Design and Computation Manager and pressing the **Item** push button.

Distance Between Chevrons

This key in field is located below the pavement marking description and is expressed in terms of master units.

Tolerance

If the length of a segment of pavement marking is less than the **Tolerance**, the line will not be placed. It will only be applied at the ending point to determine where the final piece of marking is placed.

Gore Point (Wide End of Gore)

Specify the X, Y coordinates for the wide end of the gore area.

Breaking Line

The software utilizes the **Gore Point**, the intersection of the two sides and the **Breaking Line** point to construct an arc which demarcates the breaking in the diverging chevron. The **Breaking Point** must be placed between the two sides utilized to draw the chevron.

Diverge Point (Narrow End of Gore)

Specify the X,Y coordinates at the narrow end of the gore area.

Side 1, Side 2

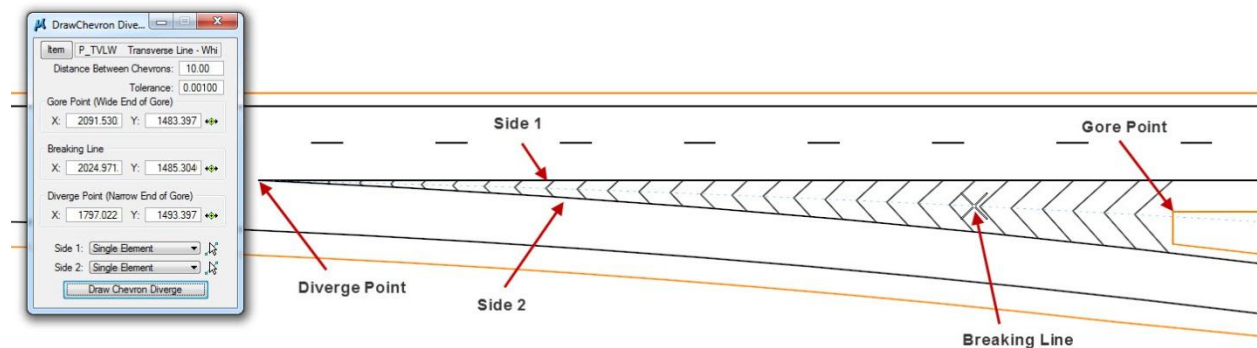
Identify the two edges to generate the marking, **Side 1** and **Side 2**. In order to place the pavement markings correctly, one must understand the difference between **Side 1** and **Side 2**. **Side 2** is used when turning the **Slash Stripe Angle**. The software begins on **Side 2**, and draws the marking at the specified angle until it intersects the **Side 1** element, where the marking stops. It is also desirable to have the total length of the **Side 2** elements longer than the **Side 1** elements, however it is not mandatory. Three methods are supported to define the elements. It is not necessary to use the same method on both sides.

Single Element - When selected, the user is prompted to select the element.

Selection Set - Create the selection set, and then set the toggle to **Selection Set**. Click **Identify DGN Element** to accept the selection set. If the selected elements are in reference files, this method must be utilized as **Complex Chains** cannot be selected from reference files.

Complex Chain - Select the option, which invokes the MicroStation **Create Automatic Complex Chain** tool to define the elements.

An example of the **Chevron Diverge** is show below.



Exercise 6B

- ✓ Place the pavement markings at the locations shown below using the Striping Tool.

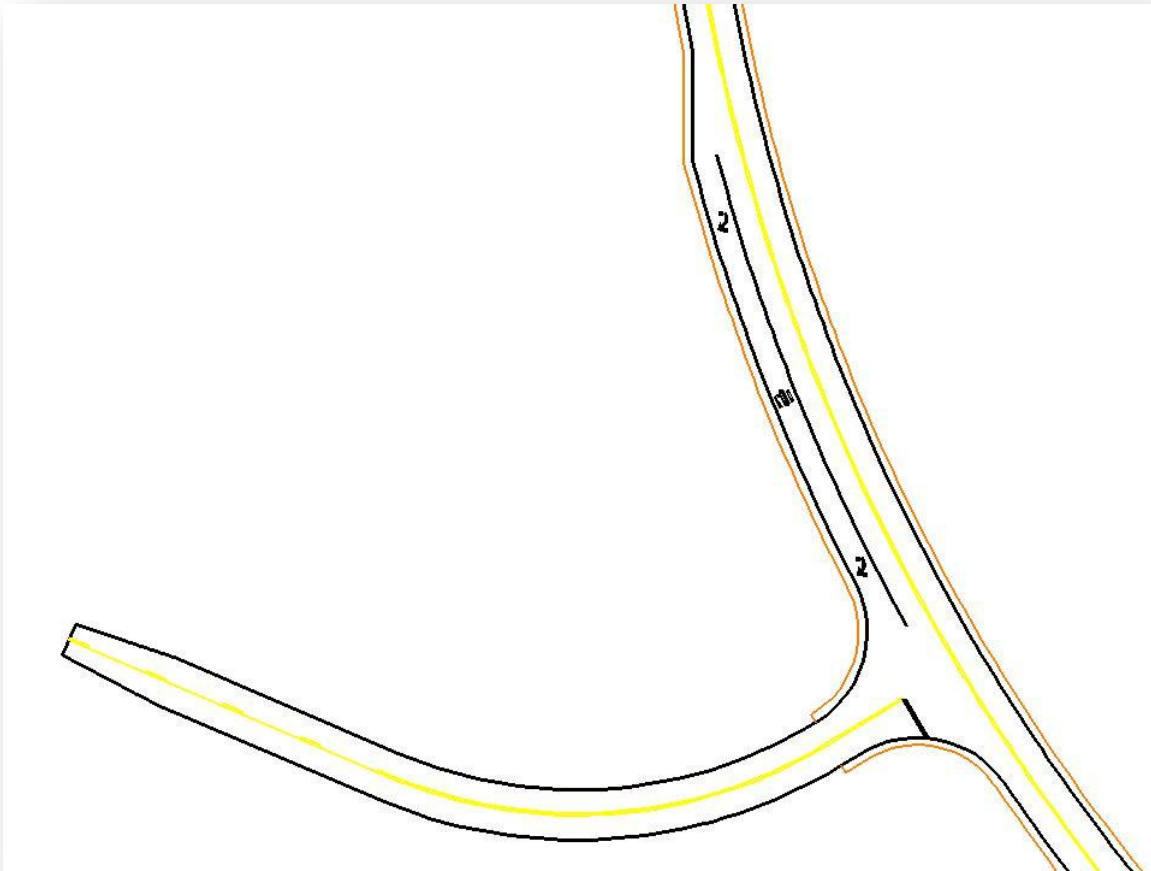
Proposed S.R. 185 Centerline			
Begin Station	End Station	Pavement Marking	Offset
53+00	60+33.98	Centerline Dashed	0
60+33.98	62+38.98	Centerline Passing Prohibited Right	0
62+38.98	71+12.80	Centerline Double Solid	0
71+12.80	74+10.27 R 2	Centerline Passing Prohibited Left	0
74+10.27 R 2	77+50 R 2	Centerline Dashed	0
Proposed S.R. 185 Channelizing Line			
Begin Station	End Station	Pavement Marking	Offset
64+00	66+40	Channelizing Line	12
Proposed Jameson Road Centerline			
Begin Station	End Station	Pavement Marking	Offset
12+00	13+65.94	Centerline Passing Prohibited Right	0
13+65.94	16+27.00	Centerline Double Solid	0

- ✓ Use **Draw Cell Group by Feature** to place the following lane arrows and word “ONLY” on proposed S.R. 185 at the locations shown below.

Station	D&C Feature	Spacing	Offset
66+10	Lane Arrow Right		18
	Word “ONLY”, 8.0'	80' Edge to Edge	18
	Lane Arrow Right	80' Edge to Edge	18

- ✓ Place a Stop Line on proposed Jameson Road at station 16+27. Which GEOPAK tool is best for this application?

The completed pavement markings in the intersection area are shown below.



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7 Existing Ground Profiles

7.1 Overview

Existing ground profiles can be extracted directly from a GEOPAK DTM or from triangles plotted in a 3D MicroStation design file.

This chapter will cover the following profile commands:

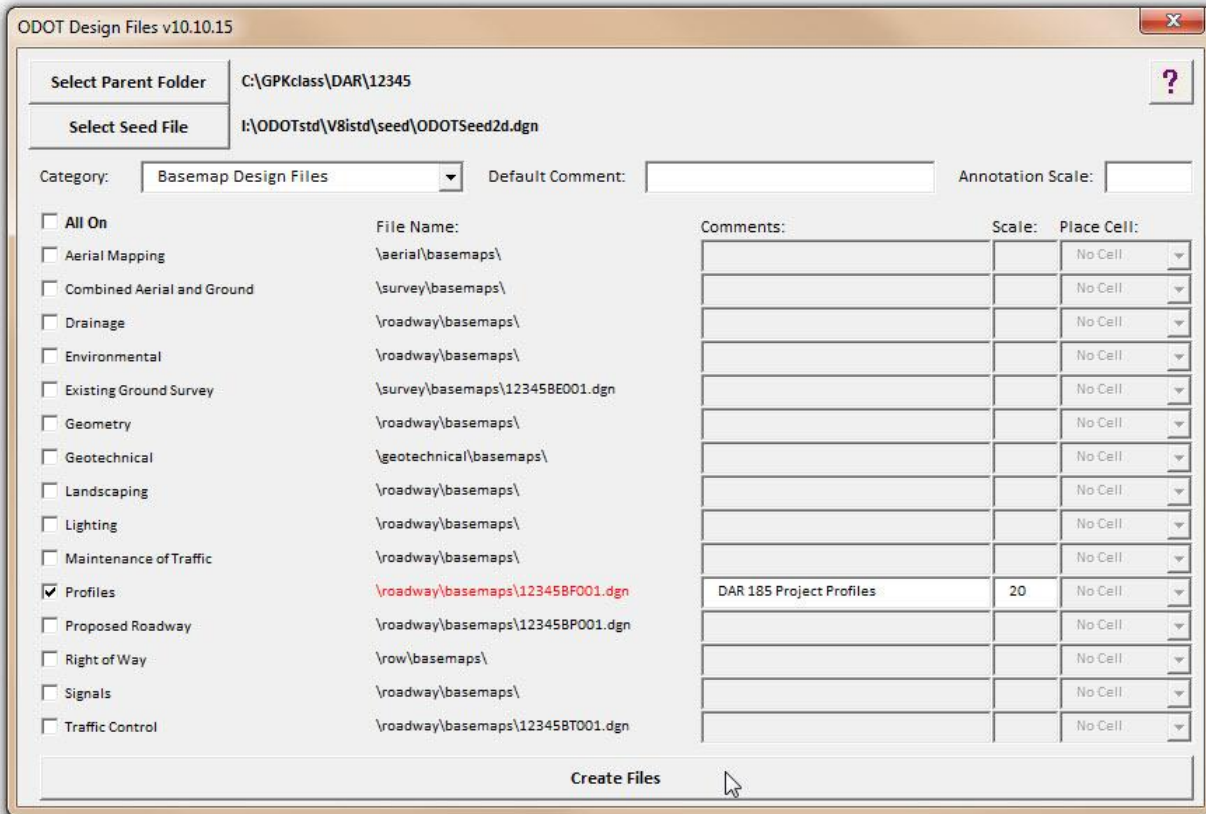
- Creating the Profile Basemap design file
- Extracting ground profiles from DTM files
- Adding profile information to the Working Alignment Definition
- Using the D&C Manager to plot existing ground profiles

GEOPAK provides two tools to extract ground profiles. The *Ground Profiles* dialog, which is accessed through **Project Manager**, is detailed in section 7.3. The *Draw Profiles* dialog is detailed in section 7.6.

7.2 Profile Basemap Design File

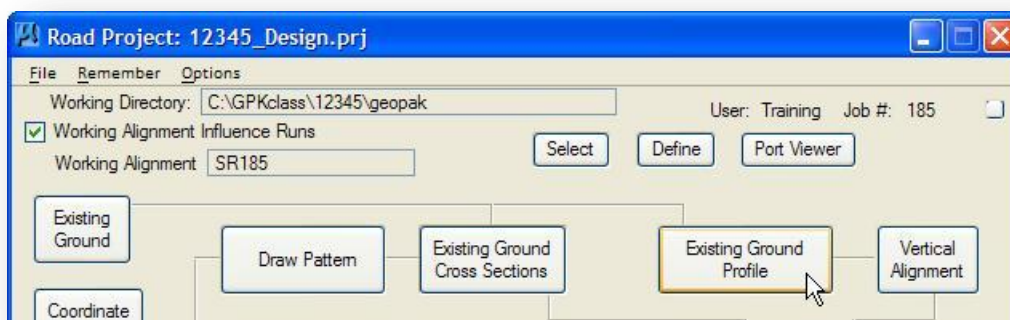
Profiles are drawn in their own basemap design file. It is not necessary to draw the profile for each alignment in a separate design file, all of the profiles for the entire project, both existing and proposed, may be drawn at different locations within in the same design file.

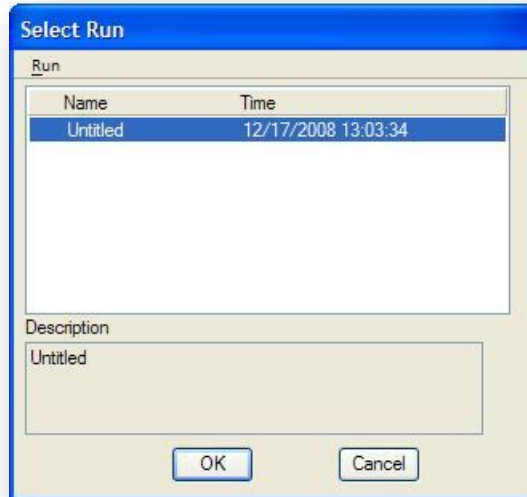
Use the ODOT_Files.mvba application to create the profile basemap. The application is accessed from the MicroStation pull-down menu by selecting **ODOT > File Management > New Design File**. The profile basemap is created as shown in the example on the following page.



7.3 The Ground Profile Dialog

Select **Existing Ground Profile** from the *Road Project* dialog to access the *Create Run* dialog as shown on the following page.

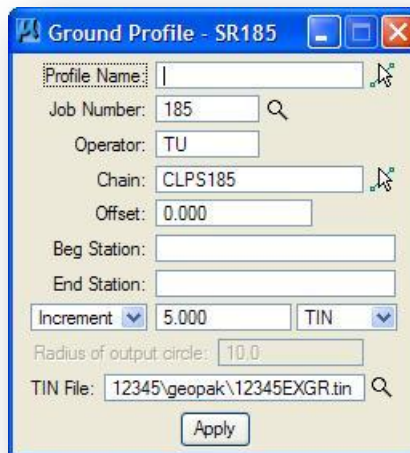




Select **Run > New** to create a new **Run** as shown below. Enter an appropriate **Name** and **Description** for the **Run**.



Open the **Run** to access the *Ground Profile* dialog shown below.



When the *Ground Profile* dialog is opened, information that has been stored in the **Working Alignment Definition** is shared with the *Ground Profile* dialog. The following information is taken from the **Working Alignment Definition**:

- ✓ **Job Number** – The GEOPAK COGO Database Job Number.
- ✓ **Operator** – The user's Operator Code.
- ✓ **Chain** – The name of the COGO Chain to extract the ground profile along.
- ✓ **Tin File** – The name of the GEOPAK DTM file to be used to extract the ground profile.

The remaining items on the *Ground Profile* dialog are explained below:

Profile Name

Use this field to key in the name of the new profile that will be created. The profile will be stored in the COGO data base.

Beg Station

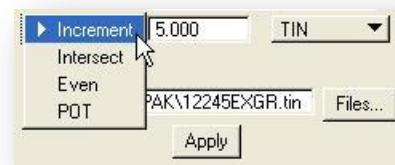
This field identifies the beginning station of the profile. All profile stationing is relative to the baseline defined on the dialog. This setting also serves as the starting point when the designer chooses the **Increment** option, described below.

End Station

This field identifies the ending station of the profile.

Extraction Method

GEOPAK provides four methods to extract existing ground profiles: **Increment**, **Intersect**, **Even** and **POT** as shown at right. The **Intersect** and **Even** options should normally be used by ODOT personnel as described in further detail below.



Intersect

The **Intersect** option is used to extract elevations from triangles plotted in a 3D MicroStation design file or from the selected TIN file. Every location where the selected **Chain** crosses a triangle side will be stored as a VPI for the existing ground profile.

Even

The **Even** method is used to extract elevations from the selected TIN File at the increment keyed in by the user. In the example above, a value of 5.00 master units is keyed in. This means that GEOPAK will extract the elevations for the profile at every station that is divisible by the keyed in value. For example, with a **Beg Station** value of 35+90.72, the first VPI for the existing ground profile is taken at station 35+95. The second VPI will be at station 36+00, the third at 36+05 etc...

Increment

The operation of the **Increment** is identical to the **Even** option with the exception that elevations are extracted incrementally along the chain from the **Beg Station**. With this option set to a value of 5 and a **Beg Station** of 35+90.72, the first VPI will be extracted at station 35+90.72. The second VPI will be at station 35+95.72. The third at 36+00.72... For ODOT projects, we recommend using the **Even** option instead of **Increment**.

POT

The **POT** option will only extract elevations from the DTM at the locations of POT's on the chain. This option is of limited use to ODOT personnel.

Which option should I use, Even or Intersect?

The **Even** option is used to thin out the number of vertices that will be stored in the existing ground profile. On projects where the proposed centerline is on the existing pavement you may choose to use the **Even** option.

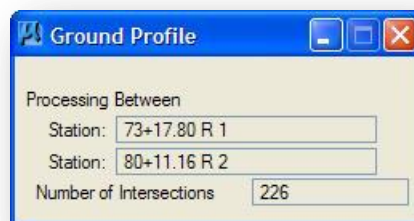
For relocation or new location projects, where the proposed work crosses existing ground, the **Intersect** option is more desirable. Since this option stores a VPI at every location that the chain intersects a triangle side a more accurate profile, with more vertices, will be generated.

Apply

Select **Apply** from the GEOPAK *Ground Profile* dialog box to initiate extraction of the existing ground profile. You are given the option to store the commands necessary to generate the ground profile in a COGO input file. The dialog box shown below will allow you to accept the default name for the input file, or change the name of the input file that will be stored. Select **OK** to initiate extraction of the ground profile



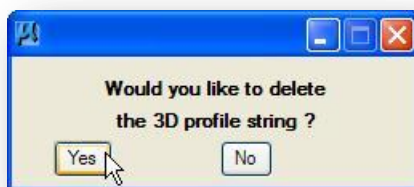
As the ground profile elevations are extracted from the DTM, a dialog box is displayed listing the stations being extracted as shown below:



After GEOPAK has extracted all of the elevations along the chain, the following dialog box is displayed:



Select **Yes** to store the profile in the COGO database (GPK file). After the profile is stored, the following dialog box appears:



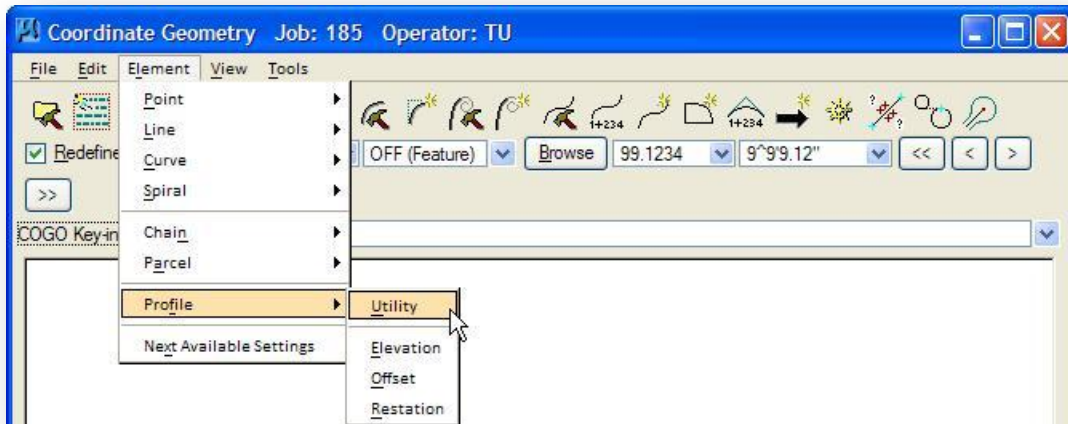
GEOPAK draws some temporary graphics in the active MicroStation design file at the locations where elevations were extracted. These graphics should normally be deleted. Select **Yes** to delete the graphics. **Note:** this message will appear even if you are processing the profile in a 2D design file.

When the *Ground Profile* dialog is closed, select Yes to save the settings of the dialog box in the Project Manager run.



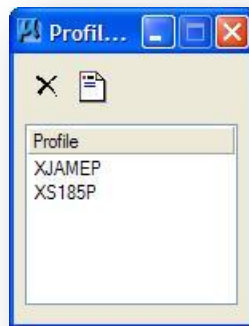
7.4 Reviewing Profile Information with COGO

There are several COGO commands that can be used to review stored profiles as shown below.



7.4.1 Profile Utility

The **Profile Utility** tool displays all stored profiles, and has options for deleting or printing profiles.



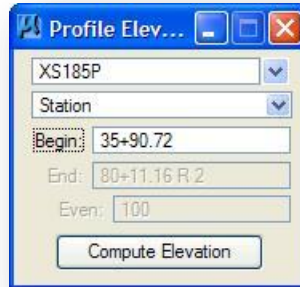
Delete - highlight profile, then click **Delete**.



Print - prints the geometric data for the profile name, including stations, elevations (including the high point), grades and lengths (back, ahead and total) for VPCs, VPIs and VPTs as they relate to each other on the profile. Highlight profile, then click **Print**.

7.4.2 Profile Elevation

The **Profile Elevation** tool is used to compute elevations along a profile based on user-defined parameters.



Elevation Options

Station

Enter a station or series of stations separated by blank spaces.

Even Stations

Reads the **Begin** station, and then determines the next even station (divisible by the **Even Station** value). For example, the beginning station is 125+87 and an **Even** value of 100 is set. The display's first station will then be 126+00, followed by 127+00, 128+00, 129+00, 130+00, etc....

Increment Stations

Reads the **Begin** stationing, then adds the **Incremental** Value with no rounding. For example, the beginning station is 125+87 with an **Incremental** value of 75. The software displays the first station as 125+87, followed by 126+62, 127+37, 128+12, 128+87, 129+62, 130+37, 131+12, 131+87, etc...

When **Compute Elevation** is selected, the results of the command are displayed in the *Coordinate Geometry* dialog as shown below.

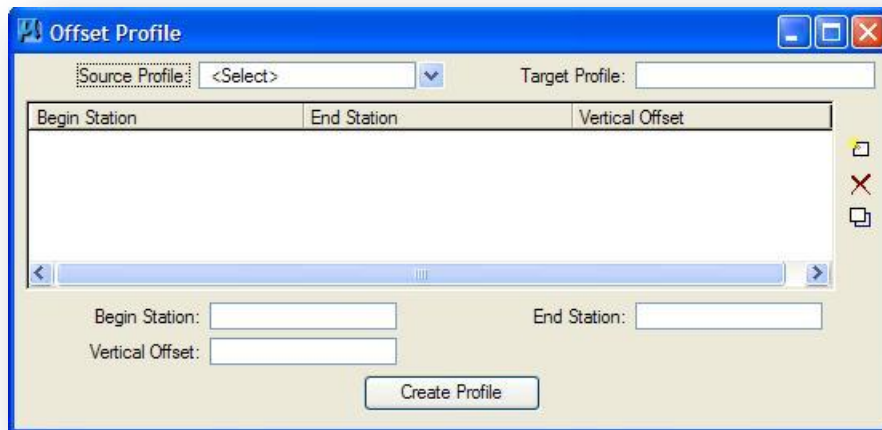


7.4.3 Offset Profile

The **Offset Profile** command generates and stores a new **Target Profile** by shifting a **Source Profile** by the **Vertical Offset** specified by the user.

Vertical offsets can be specified in positive numbers, or negative numbers. By using the value of 0, a profile can be copied with no change in station or elevation values.

Select the **Source** profile and enter a name for the **Target Profile**. Enter the **Begin** and **End Station**, **Vertical Offset**, and then click **Add**. Continue adding lines for various station ranges. When complete, click **Create Profile**.



7.4.4 Restation Profile

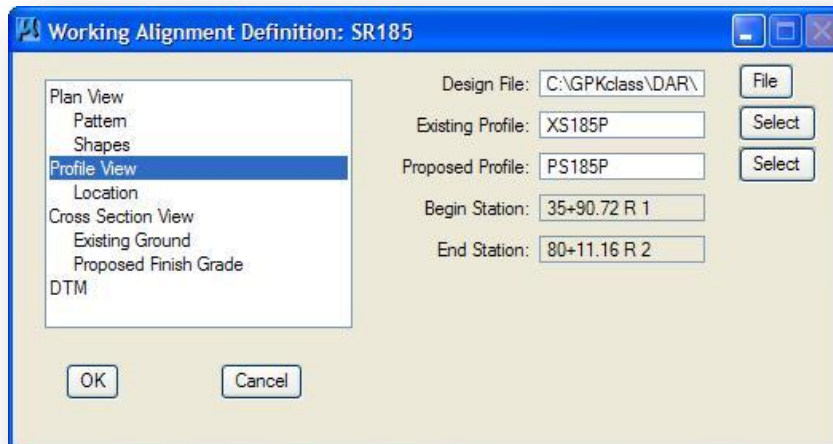
The **Restation Profile** tool creates a new **Target Profile** based on a **Source Profile** and **Chain**, but uses the **Begin Station** specified in the dialog.

Select the **Chain** and **Source Profile** from the lists. Enter the **Target Profile** (use a new profile name so it does not overwrite a current profile). Enter the **Begin Station** and click **Restation Profile**.



7.5 Adding Profile Information To The Working Alignment

After storing a new existing ground profile, be sure to add the information about the profile to the **Working Alignment** definition. Select **Define** from the *Road Project* dialog to access the Working Alignment Definition dialog shown below.

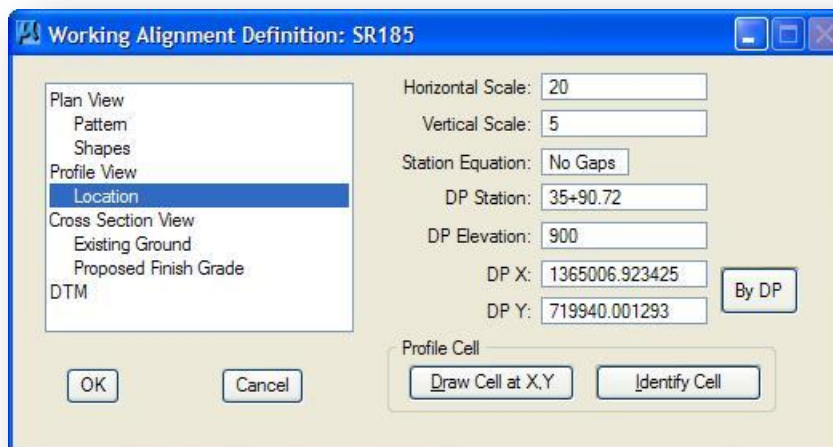


The **Profile View** item is used to identify the existing and proposed profiles for the working alignment.

Use the **Design File** option to identify the MicroStation design file where the profile will be plotted. Use the **File** button to browse the directory structure, or key-in the file name manually.

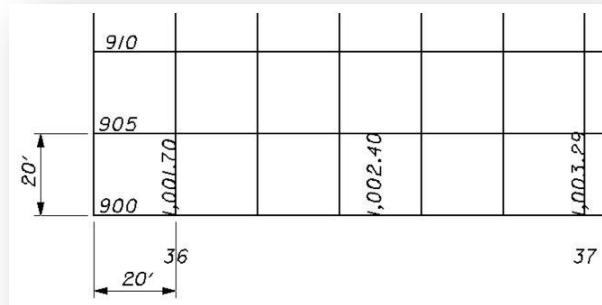
Use the **Select** buttons to browse the GEOPAK COGO data base (GPK file) for the name of the **Existing Profile**. After you select the **Existing Profile**, the station range of the profile is automatically displayed in the dialog box.

The **Location** item, shown below, is used to identify the location where the profile will be plotted in the MicroStation Design File specified by the Plan View item.



Horizontal and Vertical Scales

The combination of vertical and horizontal scales defines the distortion of elevations (vertical scale) on the design profile. Using a **Horizontal Scale** of 20 and **Vertical Scale** of 5, the vertical scale is distorted by the factor ratio between the horizontal and vertical scales. GEOPAK divides the horizontal scale (20) by the vertical scale (5), which produces a distortion factor of 4, i.e. $20/5=4$. The resulting horizontal and vertical scale distortion is depicted in the figure below.

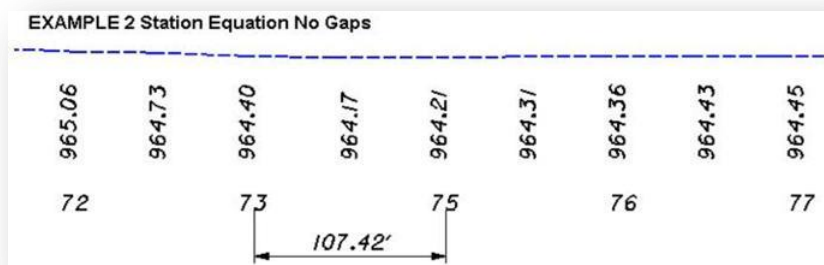
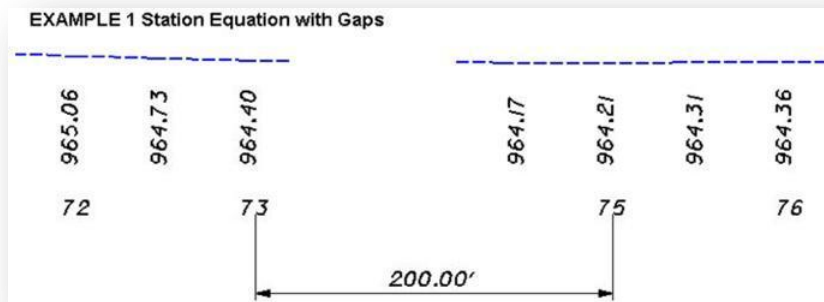


For ODOT plans, the following values should be typically used for the Horizontal and Vertical Scale:

	20 Scale Plan	50 Scale Plan	100 Scale Plan	200 Scale Plan
Horizontal Scale	20	50	100	200
Vertical Scale	5	5	20	40

Station Equation

Use the **Station Equation** item to select whether station equations will be plotted with or without a gap as shown below.



DP Station, DP Elevation

The **DP Station** and **DP Elevation** items are used to define the station and elevation of the location defined by **DPX** and **DPY**, where the profile origin will be placed.

DPX, DPY

The **DPX** and **DPY** items are used to define the location in the MicroStation Design file where the profile origin will be placed. The **BY DP** button can be used to specify the location in the design file that you wish to use at the origin of the profile. Select **BY DP** and then identify the location graphically by identifying a data point in the design file where you wish the profile to be plotted. The coordinates of the specified data point are automatically updated in the Profile dialog box.

Profile Cell

A Profile Cell can be drawn to easily reference the profile in subsequent tasks. Two options are available on the Working Alignment Definition dialog:

Draw Cell at X,Y

Select this option to draw a new Profile Cell in the design file. The **DP Station, Elevation, X, and Y** fields must be populated before the profile cell can be created. A sample profile cell is shown below.



Using ODOT's level library, the cell is drawn on level GK_Cells. The active color, weight, and text parameters are used for the profile cell creation. The **Job Number, Chain, DP Station, DP Elevation, Horizontal Scale, Vertical Scale, and Gap** are all displayed as a part of the profile cell as shown above.

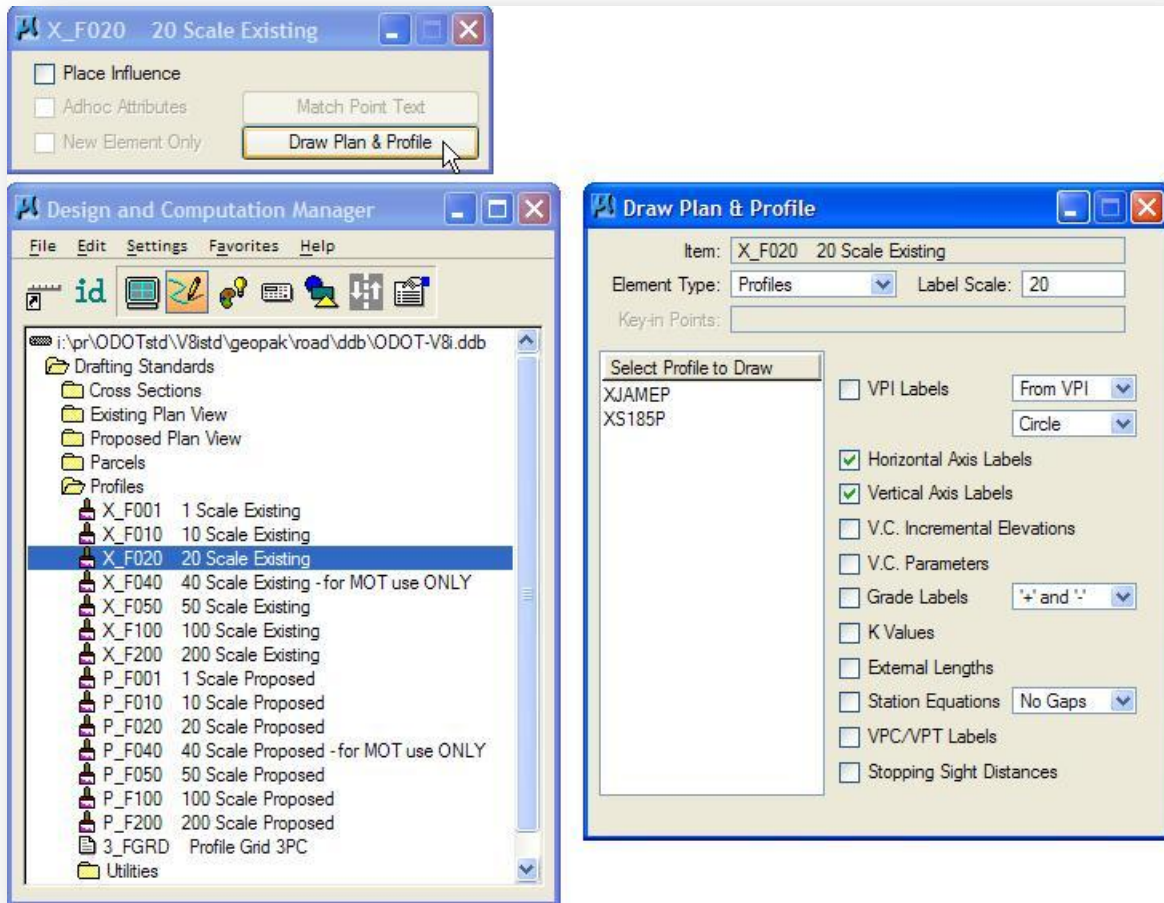
Identify Cell

If a profile cell has been previously placed in the design file the **Identify Cell** option can be used to read the **Job Number, Chain, DP Station, DP Elevation, Horizontal Scale, Vertical Scale, and Gap** parameters from the cell. These values are read into the *Working Alignment Definition* dialog when the cell is selected.

Once a profile cell has been placed, it can be utilized in subsequent processes where the **DP Station, Elevation, X and Y** values are needed. Simply press the **Identify Cell** button, then select and accept the cell which will automatically populate the four fields.

7.6 Plotting Existing Profiles With D&C Manager

There are several items in the ODOT D&C Manager database files for plotting existing ground profiles. To access these items, select **Drafting Standards** and then **Profiles** as shown below.



Several items are configured to plot profiles at a variety of scales as shown above. Select one of the profile items from the D&C Manager list box. The **Draw Plan and Profile** button will now become available. Select **Draw Plan and Profile** to access the *Draw Plan & Profile* dialog box shown at right above.

The top of the dialog box lists the currently selected item and the plotting **Operation** that is to be performed. The **Operation** is automatically toggled to **Profiles** as shown above.

The left portion of the dialog box contains a list box with the names of all of the available profiles in the COGO database (GPK File).

The right side of the dialog box contains several plotting options. Normally you will plot the profile using only the options that have been configured as defaults.

The **Label Scale** is used to set the size of the text labels that will be plotted with the profile. The value of the label scale is not set when an item is selected and must be manually set by the user as shown below.

D&C Item	Label Scale Value
1 Scale Existing	1
10 Scale Existing	10
20 Scale Existing	20
40 Scale Existing	40
50 Scale Existing	50
100 Scale Existing	100
200 Scale Existing	200

To plot a profile, simply select the name of the profile from the **Select Profile** list box on the left of the *Draw Plan & Profil* dialog box. The *Profile* dialog box below is opened after a profile name is selected.

The top portion of the *Profile* dialog box displays information about the selected profile.

The dialog box items described below are set according to the values assigned in the Working Alignment Definition:

- Horizontal Scale
- Vertical Scale
- Reference Station
- Reference Elevation
- DP X
- DP Y

The **Horizontal Scale** and **Vertical Scale** items are used to specify the scale ratio between the horizontal and vertical axis of the profile. Note that the actual horizontal distances of the profile will not be scaled in the MicroStation design file. The distance between station 11+00 and 12+00 will always measure 100' regardless of the **Horizontal Scale** specified. Only the **Vertical Scale** will be distorted.

The **Begin Station** and **Ending Station** items are used to specify the station range that you wish to plot in the MicroStation design file. These items are not automatically set to the limits of the selected profile. Be sure to review the values before plotting the profile.

Strip Grade Increment is used to specify the increment for the existing elevations that will be plotted on the horizontal axis of the profile. If this field is left blank no elevations will be plotted.

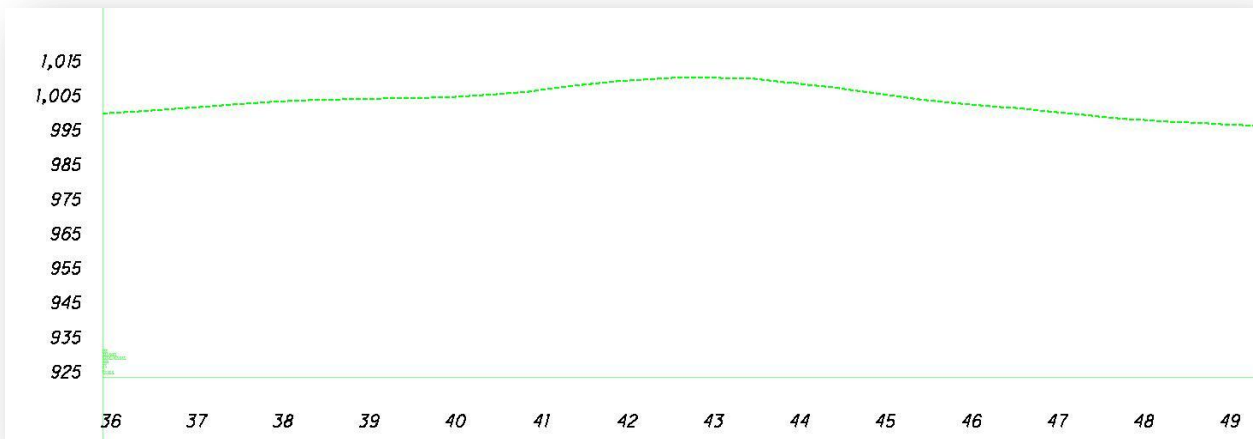
The **X** and **Y** items are used to define the location in the MicroStation Design file where the profile origin will be placed.

The **DP** button can be used to specify the location in the design file that you wish to use as the origin of the profile. Select **DP** and then identify the location graphically by identifying a data point in the design file where you wish the profile to be plotted. The coordinates of the specified data point are automatically updated in the Profile dialog box.

The **Reference Station** and **Reference Elevation** items are used to define the station and elevation of the profile's origin at the location defined by **X** and **Y**.

A Profile Cell can be placed in the design file using the values defined for the **Reference Station**, **Reference Elevation**, **X**, and **Y** fields by using the **Draw Cell at X,Y** button. If a profile cell has been previously placed in the design file, the values for the **Reference Station**, **Reference Elevation**, **X**, and **Y** fields can be read by using the **Identify Cell** button and then selecting and accepting the cell.

Select **OK** to plot the profile. An example of a plotted profile is shown below.

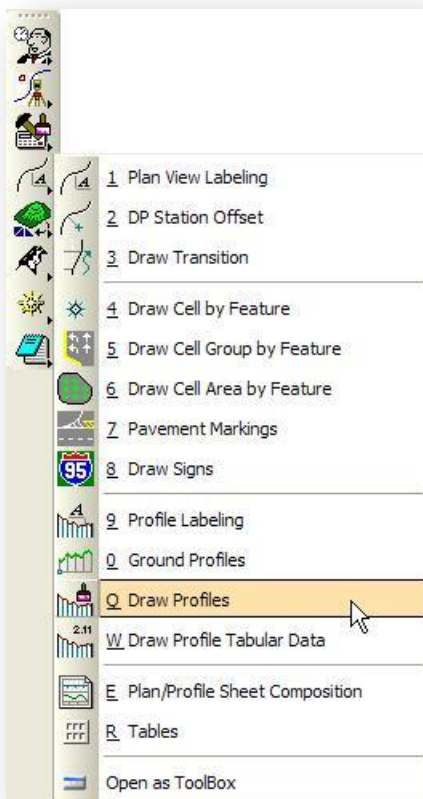


7.7 The Draw Profile Dialog

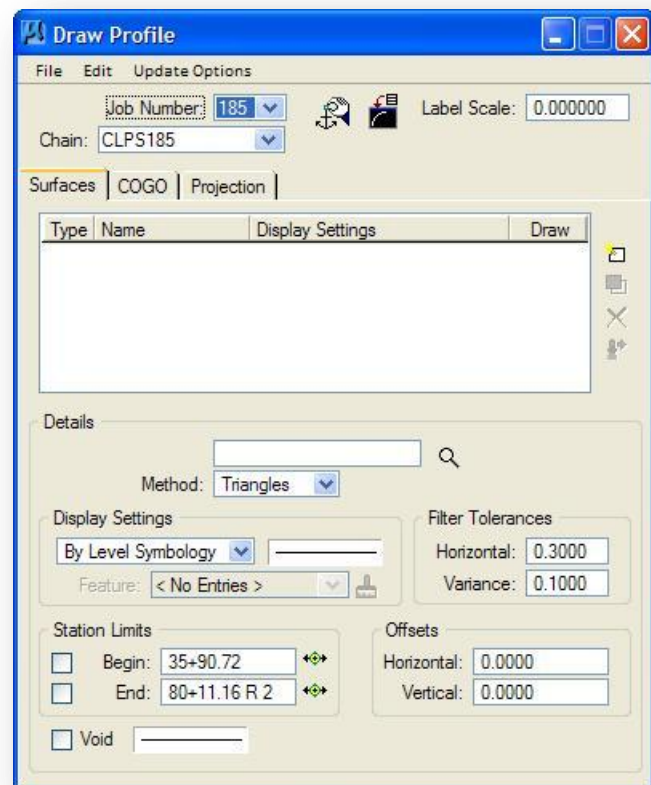
The **Draw Profile** tool enables the user to draw several profiles simultaneously from a variety of data sources.

- The GEOPAK coordinate geometry database where the vertical alignment is stored.
- The GEOPAK binary TIN file.

In addition, if the source data is a TIN file, the resultant profile may be stored within the coordinate geometry database.



Select **Applications > Road > Plans Preparation > Draw Profiles**, or select the **Draw Profiles** icon from the GEOPAK *Road* tool palette to access the *Draw Profile* dialog shown below.



The *Draw Profile* dialog is a powerful tool that allows users to perform the following tasks, all from one dialog:

- Extract profiles from a GEOPAK TIN Model (**Surfaces Tab**)
- Store the Profile in COGO (**Surfaces Tab**)

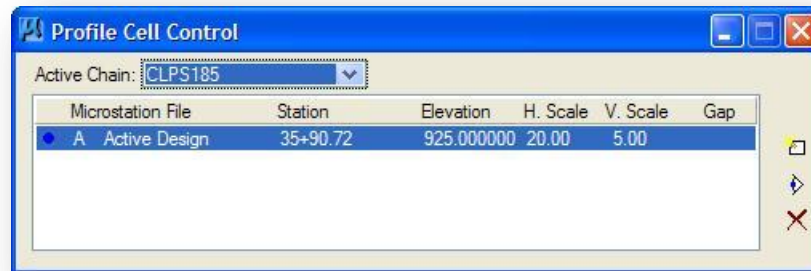
- Draw the profiles using D&C Manager features (**COGO Tab**)
- Project a profile (defined by a COGO Chain, Profile, or a Survey Chain) onto the Profile Cell of another profile (**Project Tab**). For example, this option can be used to draw a drive pipe from the survey data onto the current profile cell.

These functions are detailed on the following pages.

Before a profile can be drawn, it is necessary to place a profile control cell in the design file. Select the **Dialog Profile Cell Control** icon to access the *Profile Cell Control* dialog as shown below.



The dialog is comprised of two main parts:




Active Chain

Combo box to select the Active Chain.

MicroStation File, Station, etc.

This list box gives information about all the Profile Cells that are associated with the Active Chain.

Three action icons are located on the right side of the dialog and are detailed below:

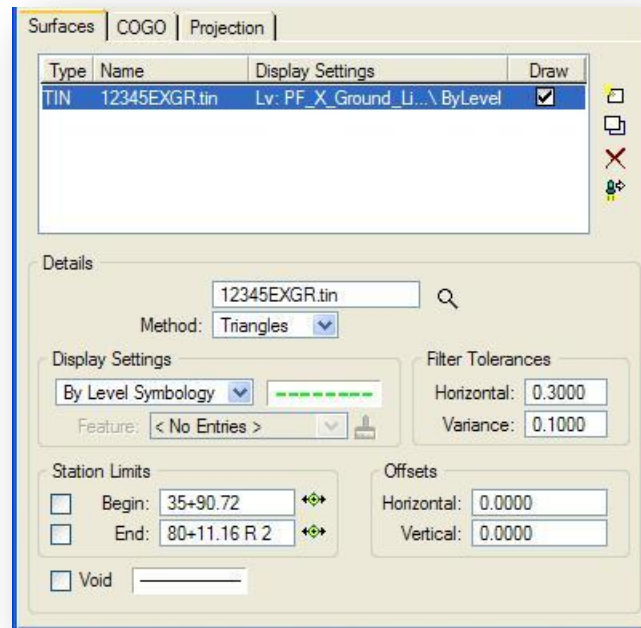
 Use this button to place a new Profile Cell. This is the same as the Place Profile Cell command described on page 6-15.

 Use this button to activate the selected Profile Cell.

 Use this button to delete the selected Profile Cell.

After a profile cell has been placed in the design file for the **Active Chain**, the *Place Profile Cell* dialog will contain the information for the profile cell as shown above.

The Surfaces Tab



The Surfaces tab is used to define the source data for drawing profiles. Multiple surfaces from a variety of sources can be drawn in a single processing. A profile cell must be placed in the active design file for the selected **Chain** before the options on the **Surfaces** tab of the *Draw Profile* dialog become available

The **Details** portion of the dialog has the following options:

TIN File

Identify the TIN model to be used to extract the profile.

Method

The **Method** options are used to determine how the **TIN File** is read to extract profile elevations.

The **Triangles** method is recommended.



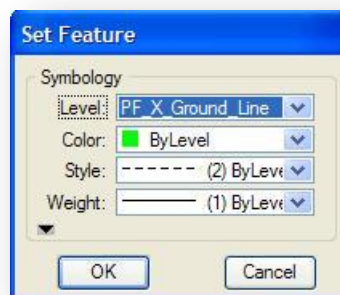
Display Settings

The Display Settings item is used to set the symbology for the profile. Two options are supported.

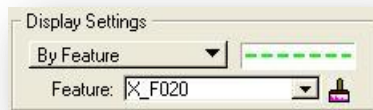
By Level Symbology



Use this option to define the symbology of the profile by selecting the **Level**, **Color**, **Style**, and **Weight**. Double-click the symbology box to access the *GEOPAK Set Feature* dialog shown below.



By Feature



Use this option to define the profile symbology by selecting a feature from the Design and Computation Manager database. The **Browse Feature** icon is used to select the item.

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.

Station Limits

When the **Chain** field at the top of the dialog is populated, its beginning and ending station are displayed in the **Station Limits** group box. The defaults may be utilized if the entire profile is drawn. Manually entering stations or clicking **Set Station** and graphically identifying a location is supported.

Offsets

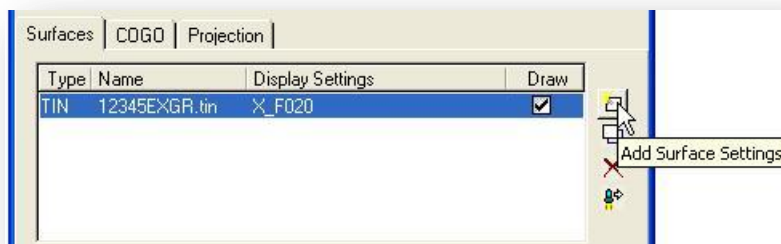
Vertical or **Horizontal** Offsets may be specified in terms of master units (i.e., feet or meters). The **Horizontal** offset is the distance offset from the Chain. Once the horizontal location for the


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.


Void


The **Void** Plot Parameters specify the element symbology of the existing ground lines being generated which are located within a void in the model.

Each surface to be drawn must be added to the list box. This is accomplished via the buttons on the right side of the dialog. When a line is added to the list box, the profile is drawn. To add an item to the list box, simply select the source data type and data, and then populate the **Display Settings**, **Filter Tolerances**, **Station Limits**, and **Offsets**. Then click **Add Surface Settings** as shown below. **Note:** clicking on the draw toggle in the list box deletes or redraws the profile.



 Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, and then click the **Modify Line** icon.

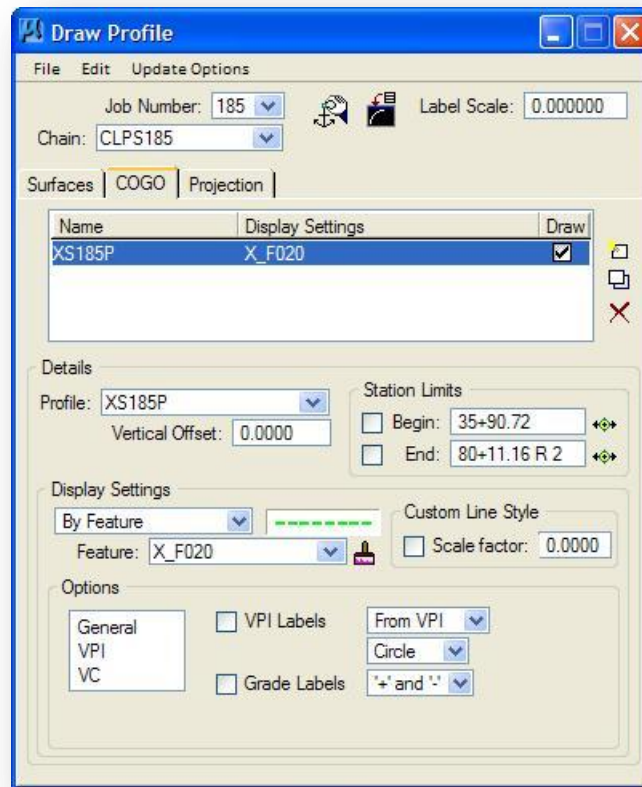
 To delete a line from the list box, simply highlight the line to be deleted and click the **Remove Surface** icon.

 After the profile is drawn, click the **Store Surface in COGO** icon to store the profile in COGO. The *Store Profile* dialog shown below is opened.





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 is invoked while in a 3D file, the user may toggle on the option to create a 3D profile string.


The COGO Tab



Multiple profiles may be drawn from COGO by populating the tab, then using the edit buttons on the right side of the list box.

 To add to the list box, simply select the source data type and data, and then populate the **Details, Display Settings, Filter Tolerances, and Offsets**. Then click the **Add COGO Profile Settings** icon to the right.

 Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, and then click the **Modify COGO Profile Settings** icon.

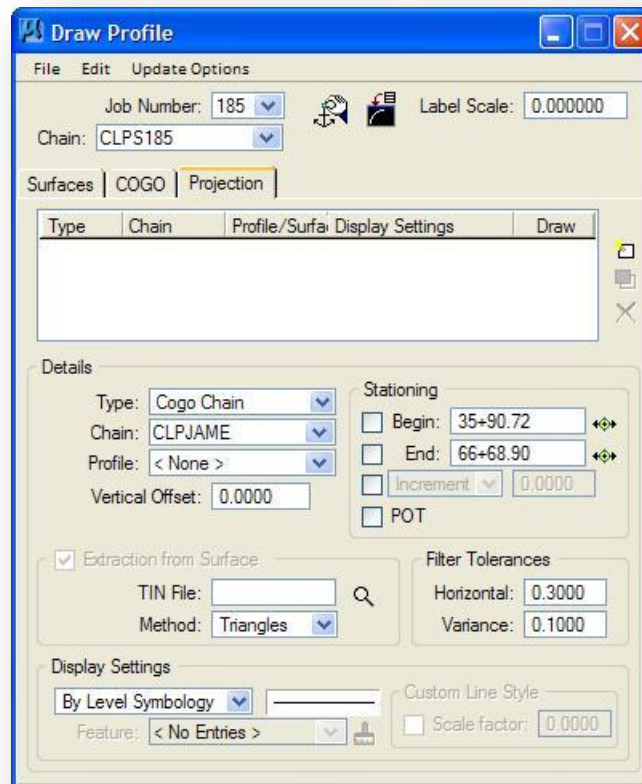
 To delete a line from the list box, simply highlight the line to be deleted and click the **Remove COGO Profile Settings** icon.

Station Limits and **Vertical Offset** are identical to the **Surfaces** tab.


To define the symbology of the profile(s), the user may specify the parameters via the **By Symbology** option, or **By Feature**. When the **By Feature** option is selected, the user must identify an Item from the Design and Computation Manager. Other options which are found on the *Draw Plan and Profile* dialog within Design and Computation Manager are also supported within the *Draw Profile* dialog, i.e., **General Labels, VPI, VPC**, etc. Simply highlight the desired option in the list box, and then set the toggles and fields accordingly.


The Projection Tab


The **Projection** tab can be used when the chain / profile to be drawn is different than the chain / profile used to create the profile cell. When the Projection tab is selected, the dialog dynamically changes, as shown on below.



Each projected profile to be drawn must be added to the list box. This is accomplished via the icons on the right side of the dialog.

 To add to the list box, simply select the **Type**, **Chain**, **Profile**, and **Vertical Offset**, then populate the **Display Settings**, **Filter Tolerances** and **Extraction from TIN**, if desired. Then click the **Add Line** icon to the right.

 Modify a line by highlighting the desired line in the list box, make the desired changes in the fields directly below the list box, and then click the **Modify Line** icon.

 To delete a line from the list box, simply highlight the line to be deleted and click the **Delete Line** icon.

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.

The following fields are defined in the **Details** group box.

Type

A **COGO chain** or **Survey chain** may be selected.

Chain/Survey Chain

After the desired **Type** has been selected, the **Chains** or **Survey Chains** in the currently selected GPK file are listed for selection.

Profile

(COGO Chain option only) Select the **profile** to be used.

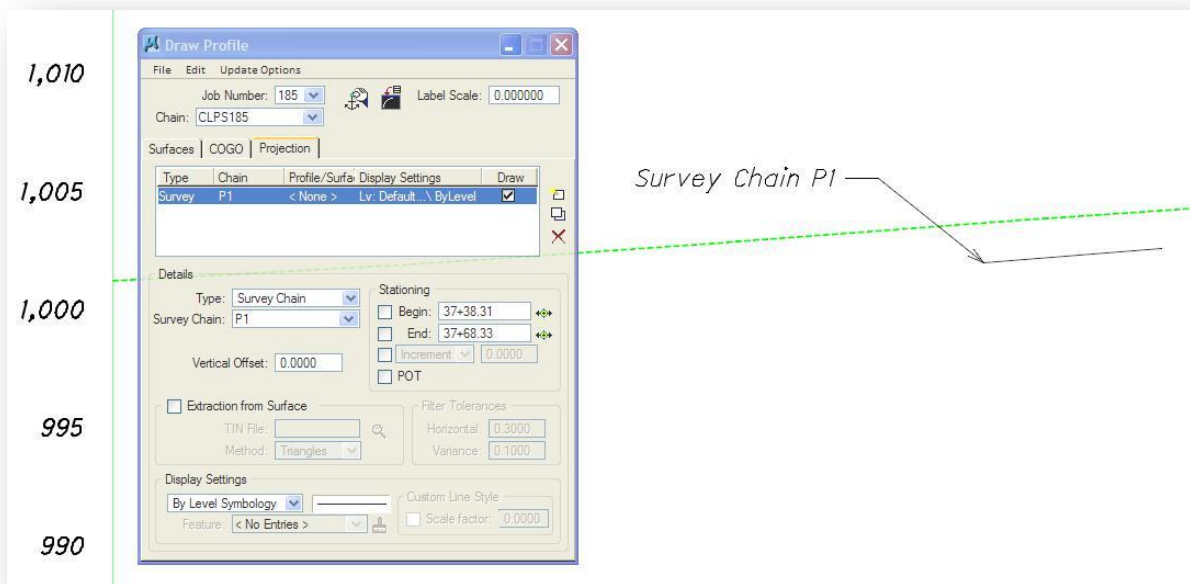
Vertical Offset

Key in the **Vertical Offset** to be applied after the profile is generated from the source data.

Display Settings

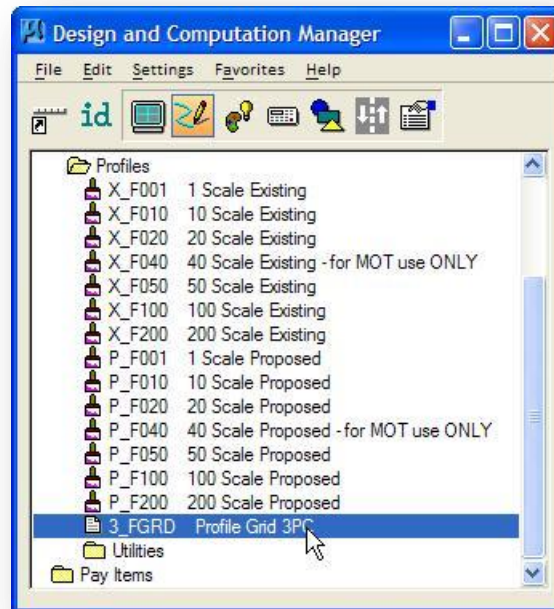
To define the symbology of the projected profile(s), the user may specify the parameters via the **By Symbology** option, or **By FEATURE**. When the **By FEATURE** option is selected, the user must identify an Item from the Design and Computation Manager.

The example below shows the profile of a drive pipe defined by the Survey Chain “P1” projected onto the profile of existing State Route 185.



7.8 Profile Grid

The ODOT Standard D&C Manager Database ODOT.ddb contains an item to plot a profile grid on profiles previously plotted using D&C Manager. This item is configured to run the ODOT Three Port Criteria (3PC) file PROFILE_GRID.3PC when the user double-clicks the item in the D&C Manager dialog.

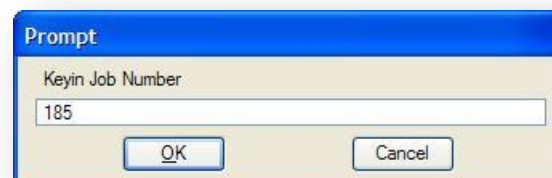


3PC files are normally saved in a standard directory. In order for the D&C Manager to process a 3PC file, we need to tell GEOPAK where to find the files. This is accomplished by the use of a Configuration Variable. This Configuration Variable has already been defined as follows for ODOT personnel:

```
GPK_DC_3PCDIR = i:/ODOTstd/V8istd/geopak/road/ddb/3pc/
```

The Profile Grid 3PC application requires a GEOPAK Profile cell in order to draw the profile grid.

When the user activates the Profile Grid 3PC application by double-clicking on the Profile Grid item in D&C Manager, the following prompt is displayed:



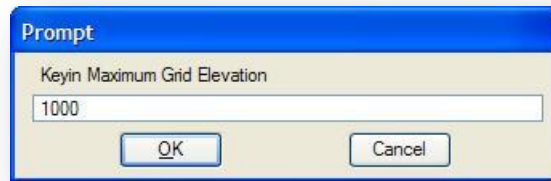
Key in the **Job Number** for the COGO database containing the profile. Select the **OK** button to proceed. Select **Cancel** to exit.

The user is prompted to key in the **Chain Name** that was used to extract the profile as shown below.



Key in the **Chain Name** of the COGO chain that was used to extract the profile. Select the **OK** button to proceed. Select **Cancel** to exit.

The 3PC application will draw the profile grid starting from the reference **DP Elevation** of the profile cell. The upper limit of the profile grid is not read from the profile cell and must be keyed in by the user. The application prompts the user for the **Maximum Grid Elevation** as shown below.



Key in the **Maximum Grid Elevation** (typically this will be a value that is evenly divisible by the vertical scale of the profile). Select the **OK** button to proceed. Select **Cancel** to exit.

Next the user is prompted as to whether or not they want the 3PC application to draw Minor grid lines (Major grid lines are always drawn).



Select **Yes** to draw both the major and minor grid lines. Select **No** to draw the major grid lines only. Select the **OK** button to proceed. Select **Cancel** to exit

The grid lines are drawn using the same symbology as the grid provided on a Standard ODOT plan and profile sheet as detailed below:

	Level	Weight	Color	Style
Major Grid Lines	SH_Major_Grid_Line	1	44	0
Minor Grid Lines	SH_Minor_Grid_Line	0	40	0

The major and minor grid lines are placed as separate graphic groups.

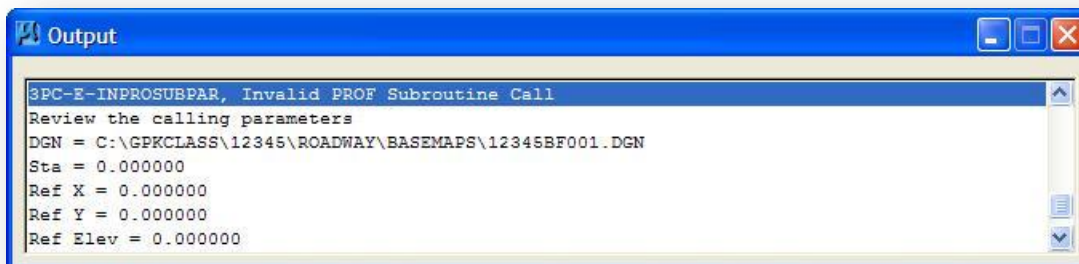
The 3PC application will search the active MicroStation design file for a profile cell matching the **Job Number** and **Chain Name** keyed in by the user. An example of a profile cell is shown below.

```
185  
CLPS185  
3590.720000  
925  
20  
5  
NOGAP
```

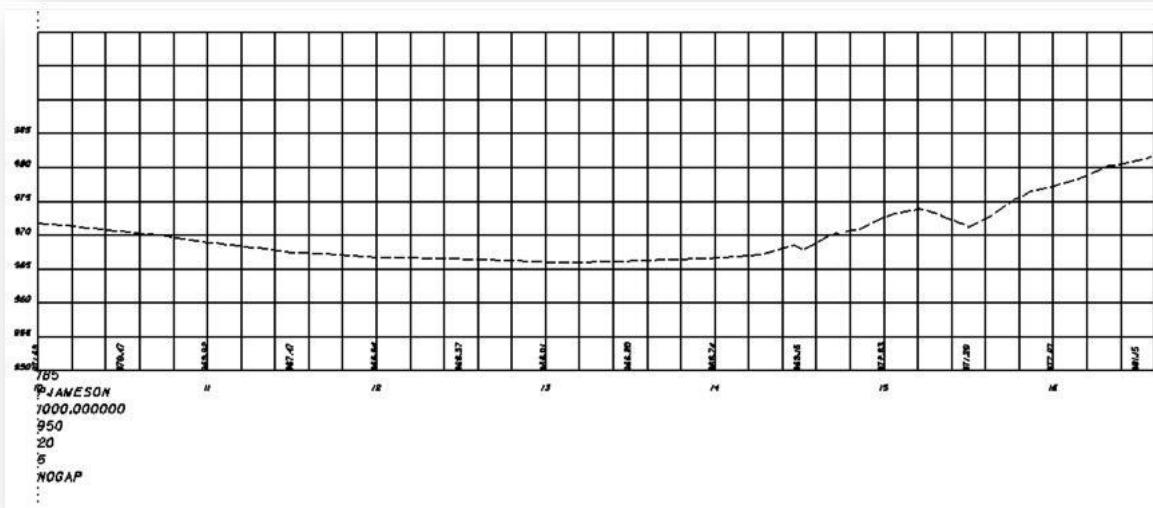
The following information is read from the profile cell when the Profile Grid item is processed:

- DP X, Y Coordinate (read from the Profile Cell origin.)
- DP Reference Station (35+90.72 in the example above.)
- DP Reference Elevation (950 in the example above.)
- Horizontal Scale(20 in the example above.)
- Vertical Scale (5 in the example above.)

If the 3PC Application cannot find a profile cell in the active MicroStation design file matching the **Job Number** and **Chain Name** that was keyed in by the user, the following error message is displayed:



An example of the profile grid, without the minor grid lines is shown below.



The profile grid is optional and is not normally used since the ODOT sheet cells contain a gridded profile area. The application is typically only used in cases where the user wishes to plot a profile, with the grid, for review, during the design process.

Exercise 7

- ✓ Extract an existing ground profile along the proposed S.R. 185 chain.
 - Using the GEOPAK COGO Element Names defined in the ODOT CADD Engineering Standards Manual, what should you name this profile? _____
 - Which method: **Intersect**, **Even** or **Increment** should you use and why?

- ✓ Extract an existing ground profile along proposed Jameson Road.
 - Using the ODOT Guideline for GEOPAK Element Names, what should you name this profile? _____
 - Which method: **Intersect**, **Even** or **Increment** should you use and why?

- ✓ Use the ODOT_Files.exe application to create a new design file to contain the ground profile graphics for S.R. 185.
 - What is the name of the profile design file?
 - Which sub-directory is this file stored in?

The profile for Jameson Road can be plotted in the same design file as the profile for S.R. 185, or a new design file can be created to contain the graphics for the Jameson Road profile.

- If you elect to create a new design file for the Jameson Road ground profile, what is the name of the design file?
- Which sub-directory is this file stored in?

- ✓ Use the D&C Manager to plot the existing profiles for S.R. 185 and Jameson Road at 20 scale. Be sure to place a profile cell for each profile. If you created separate design files, be sure to use the appropriate file for each profile

- ✓ Update the Working Alignment definition for each road to include the existing ground profile information.

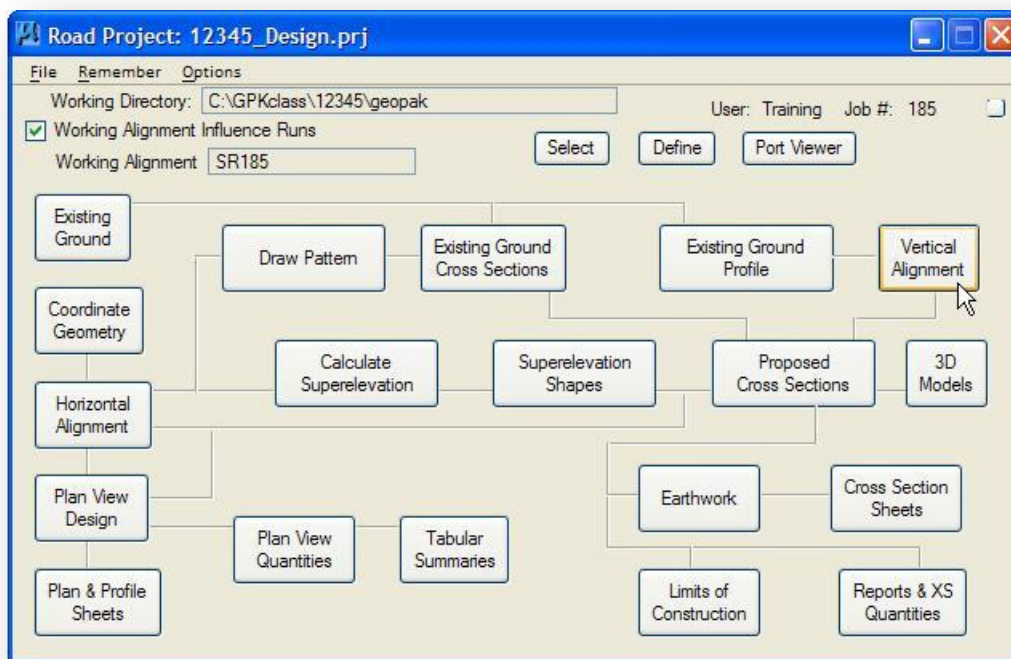
- ✓ Optional: Using the D&C Manager, plot a profile grid for both S.R. 185 and Jameson Road. After plotting the grid, be sure to turn the levels off or delete the grid since it is not needed for the plan and profile sheets.

8 Proposed Vertical Alignments

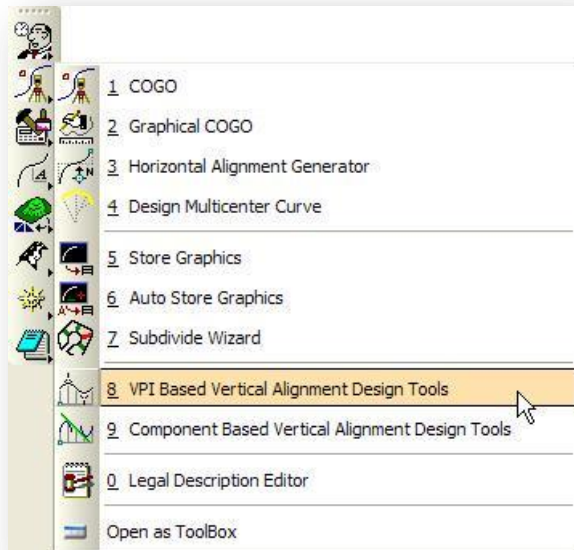
8.1 The Vertical Alignment Generator

The Vertical Alignment Generator is used to graphically create and modify proposed design profiles or existing ground profiles. Profile generation and modification is achieved under the control of an interactive dialog box and dynamic graphical manipulation. The designer can define and manipulate profile geometry by specifying grade, design speed, k-value, elevation, and station values. Alternately, the designer can graphically manipulate these same parameters dynamically.

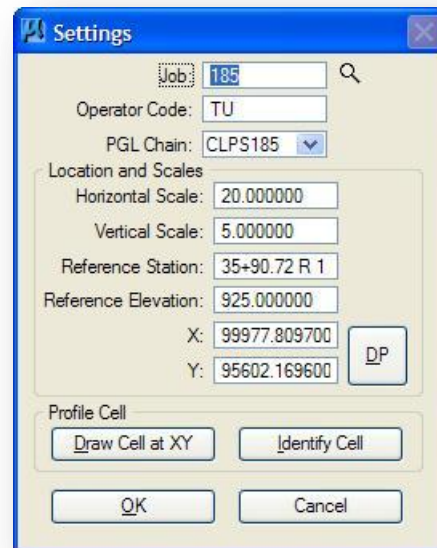
The Vertical Alignment Generator can be accessed by selecting **Vertical Alignment** from the *Road Project* dialog as shown below.



Or by selecting **VPI Based Vertical Alignment Design Tools** from the *GEOPAK Road Tools* palette, as shown below.



When the Vertical Alignment Generator is activated, the *Settings* dialog shown below is opened.



This dialog is used to initialize the design process and define the location in the MicroStation file where the profile is to be designed.

To initialize the profile process, each field on the *Settings* dialog must be defined. If you are using the GEOPAK Project Manager, all of the fields in the *Settings* dialog box will be automatically filled in if you have previously defined the profile information in the Working Alignment definition.

The individual fields on the *Settings* dialog are below.

Job Number

This alphanumeric text string defines the coordinate geometry data base where baseline and profile data are retrieved and stored.

Operator Code

A maximum of two characters, this is the code used to identify the user for a COGO session.

PGL Chain

Identify the name of the horizontal chain that serves as the profile grade line (PGL) and is to be used as a stationing reference.

Horizontal and Vertical Scales

The combination of vertical and horizontal scales defines the distortion of elevations (vertical scale) on the design profile. See section 8.3 on page 8-4 for an explanation on the **Horizontal** and **Vertical Scales**.

Reference Station

In the MicroStation design file, the station that is defined in the **Reference Station** field is assigned the coordinate location specified in the **X** and **Y** fields.

Reference Elevation

In a MicroStation graphical design file, the elevation that is defined in the **Reference Elevation** field is assigned the coordinate location specified in the **X** and **Y** fields.

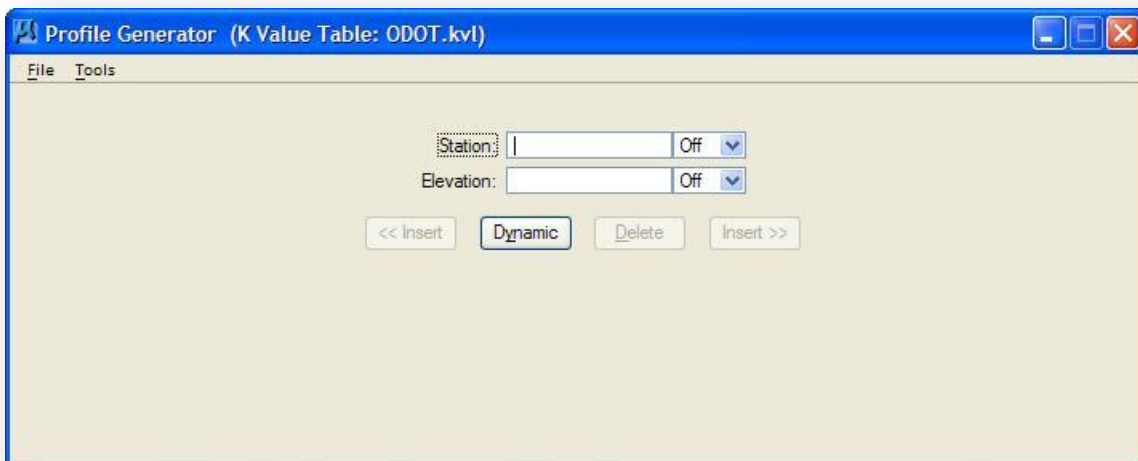
X, Y

These fields correspond to the **Reference Station** and the **Reference Elevation** information defined above. The reference **X** and **Y** coordinate location defines where the profile origin is to be located in the MicroStation file. The actual location of the reference data point is depicted in the **X, Y** fields. These values can be keyed in. However, it is much easier to use the **DP** button. Upon selecting the **DP** button, the user is prompted for a data point. The coordinate values of the selected data point are then depicted in the **X** and **Y** fields. If the proposed profile is being superimposed onto an existing ground profile, the **X** and **Y** location as well as the **Reference Station** and **Reference Elevation** should all correspond to the same parameters and coordinate location used when originally drawing the existing ground profile with the *Plan and Profile* dialog.

Profile Cell

A **Profile Cell** can be placed in the design file at the values defined for the **DP Station**, **Elevation**, **X**, and **Y** fields by using the **Draw Cell at X,Y** button. If a profile cell has been previously placed in the design file, the values for the **DP Station**, **Elevation**, **X**, and **Y** fields can be read by using the **Identify Cell** button and then selecting and accepting the cell.

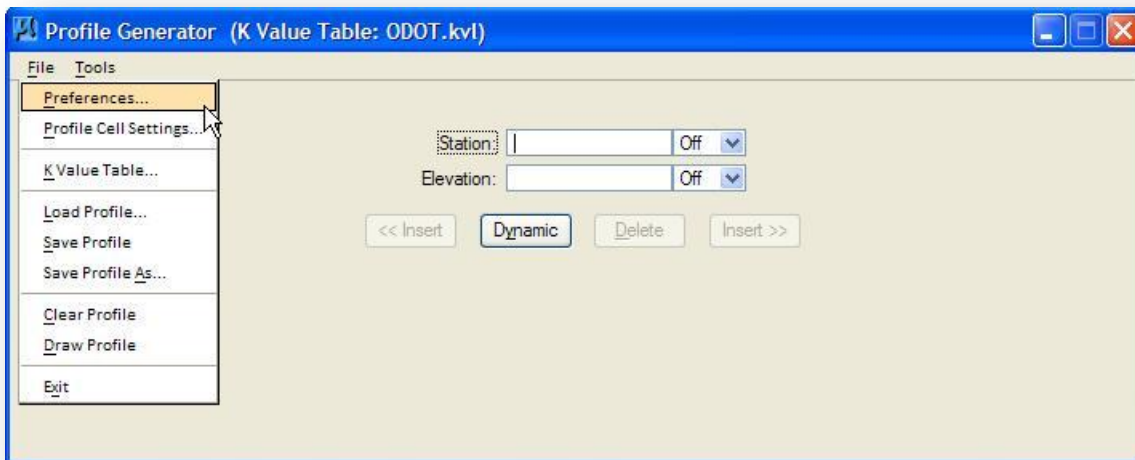
After pressing the **OK** push button on the *Settings* dialog, the *Profile Generator* dialog shown below appears.



The operation of the GEOPAK *Profile Generator* will be discussed in the following sections.

8.2 File Operations

The *Profile Generator* dialog's **File** menu provides the following functions:

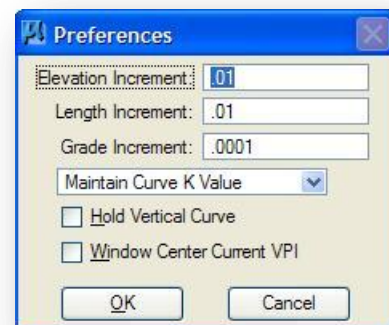


Each option is described below:

8.2.1 Preferences

The *Preferences* dialog box is activated by selecting **File > Preferences** from the *Profile Generator* dialog. In short, this dialog permits the specification of rounding parameters.

The increments defined on this dialog primarily affect the dynamic operations applied during the course of profile design. For example, suppose you dynamically manipulate the VPI. Simultaneous with the movement of your cursor, the back and forward grades are stretching (i.e., rubber banding) while the length of the vertical curve is being continuously adjusted to maintain the selected design speed. At all times and with every slight shift in your cursor, the back and forward grades are rounded to the nearest 0.1 percent, the elevation of the VPI is positioned to the nearest 0.01', the station of the VPI is rounded to the nearest 0.01' and the length of the back grade, the forward grade and the vertical curve is rounded to the nearest 0.1'.



The **Hold Vertical Curve** toggle and the **Maintain VC K Value / Maintain VC Length** option button dictate vertical curve dynamics. If the **Hold Vertical Curve** toggle is active and if the option button is set to **Maintain VC K Value**, then dynamic operations lock the K value. This in essence allows the user to slide the grades along a continuous parabola representing the vertical curve. If the **Hold Vertical Curve** toggle is active and if the option button is set to **Maintain VC Length**, then dynamic operations create a similar effect in that the vertical curve length is held constant.

Window Center Current VPI

If the dialog is adjusted to a current VPI that is outside the view and the **Window Center Current VPI** is active, then the view is automatically adjusted via a Window Center to that VPI.

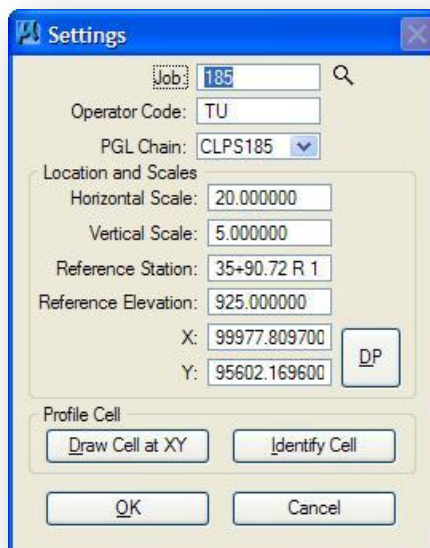
The **Load Profile** function is used to retrieve a profile from the coordinate geometry data base for modification.

Once the design of the profile is complete, the profile can be stored into the coordinate geometry data base with either the **Save** or **Save As...** functions. The **Save** option stores the adjusted profile under the same name at which it was loaded. The **Save As...** function permits the user to store the profile under another name.

8.2.2 Profile Cell Settings


Selecting **File > Settings** from the *Profile Generator* dialog will open the *Settings* dialog shown at right.

This is the same dialog that is opened when the *Profile Generator* dialog is initially activated. This option is provided to allow users to alter these settings without restarting the profile command.



8.2.3 K-Value Table

The *K Values* dialog defines the stopping sight distance K-values for crest and sag conditions at various user specified design speeds. This dialog, shown below, is invoked by selecting **File > K Value Table** from the *Profile Generator* dialog.



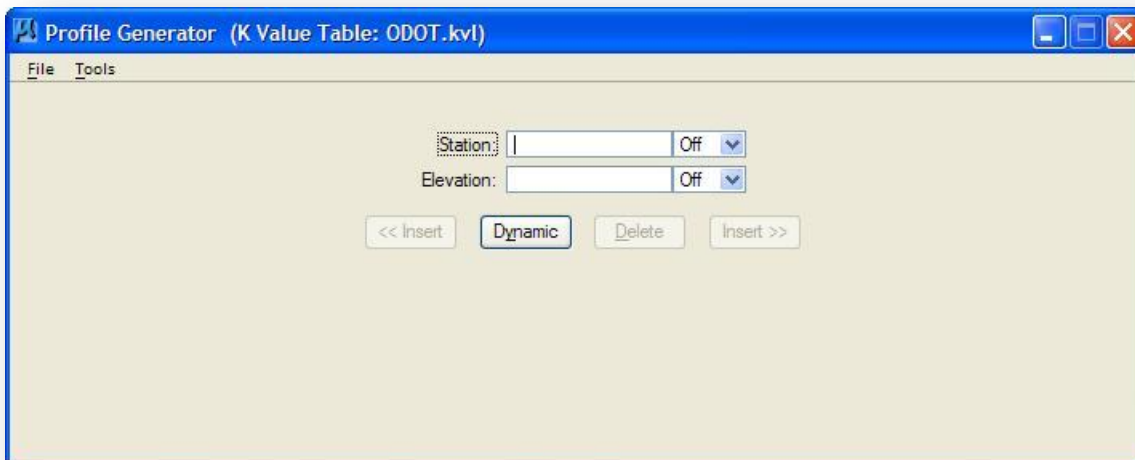
The screenshot shows the 'K Values' dialog box with the following data:

Speed	Sag Minimum	Sag Maximum	Crest Minimum	Crest Maximum
20	17.0	17.0	7.0	7.0
25	26.0	26.0	12.0	12.0
30	37.0	37.0	19.0	19.0
35	49.0	49.0	29.0	29.0
40	64.0	64.0	44.0	44.0
45	79.0	79.0	61.0	61.0
50	96.0	96.0	84.0	84.0
55	115.0	115.0	114.0	114.0
60	136.0	136.0	151.0	151.0
65	157.0	157.0	193.0	193.0
70	181.0	181.0	247.0	247.0

GEOPAK allows the user to save and retrieve customized K Value tables. The following K-Value table is active when using the ODOT configuration:

I:\ODOTstd\V81std\geopak\road\kvalues\ODOT.kvl

The current K Value table name is displayed in the title bar of the *Profile Generator* dialog as shown below.



8.2.4 Load Profile

To load a previously defined profile for editing, select **File > Load Profile** from the *GEOPAK Profile Generator* dialog. The Load Profile dialog is opened as shown below.



Select the profile name and confirm the selection by selecting the **OK** button. GEOPAK will access the previously defined profile, display it on the screen, and adjust the *Profile Generator* dialog to display the parameters for the profile: grades, elevations, stations, lengths of vertical curves, speeds, etc.

The previously defined profile can be either an existing ground profile or a proposed design profile. Typically, an existing ground profile is loaded if there is an error that needs to be corrected, such as a spike. The existing profile can be graphically modified to correct the error and then be saved back into the coordinate geometry data base.

8.2.5 Save Profile, Save Profile As

Once the design of the profile is complete, the profile can be stored into the coordinate geometry data base with either the **Save Profile** or **Save Profile As** functions.

The **Save Profile** option stores the adjusted profile under the same name at which it was loaded.

The **Save Profile As** function permits the user to store the profile under another name.

The **Save Profile As** option (and the **Save Profile** option when storing the profile for the first time) prompts for an **Input File** name, wherein the generated COGO profile commands are written.

8.2.6 Clear Profile

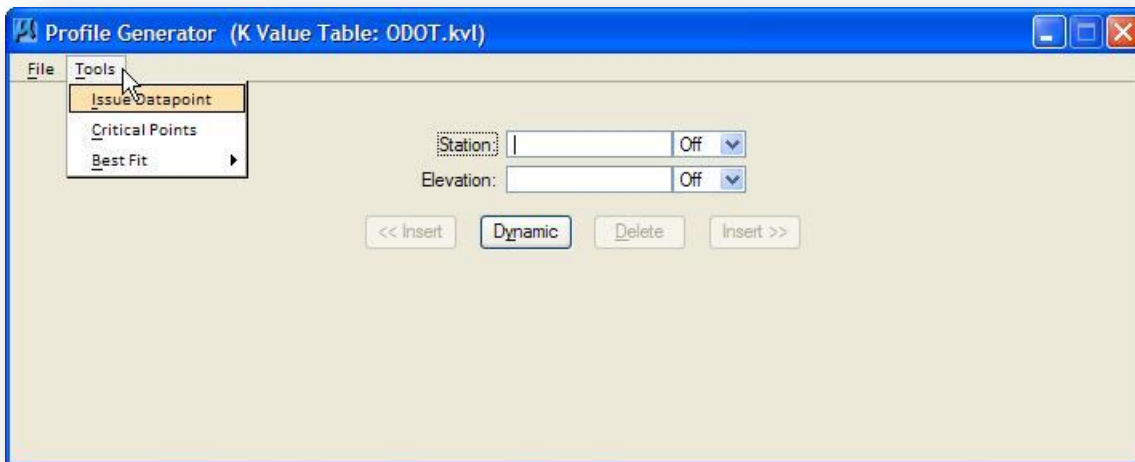
The **Clear** function erases the working profile from the MicroStation graphics and erases all profile information from the *Profile Generator* dialog box. This does not clear the profile from COGO if it has been saved.

8.2.7 Draw Profile

During the profile design process, temporary graphics are displayed representing the profile. The **Draw** function is used to draw the profile graphics permanently into the MicroStation file. The **Design and Computation Manager** should normally be used to plot and annotate profiles.

8.3 The Tools Menu

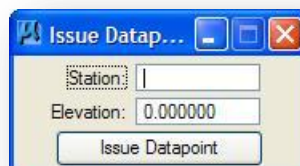
The *Profile Generator* dialog's **Tools** menu provides the following functions:



Each of these functions is described below.

8.3.1 Issue Data Point

From the GEOPAK *Profile Generator* dialog box, select **Tools > Issue Data Point** to access the dialog shown below.

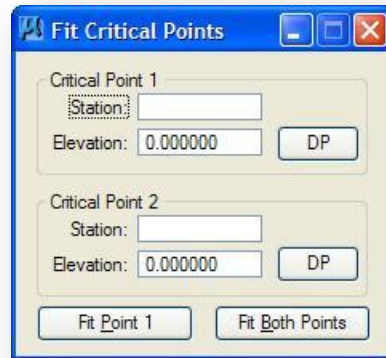


The **Issue Data Point** tool permits the user to type in stations and elevations and issue a MicroStation data point that can be part of a place line, place cell or any other common MicroStation operation. For example, a line endpoint can be placed at a location on the profile corresponding to a specific station and elevation.

8.3.2 Critical Points

Vertical curves can also be defined in terms of one or two critical points. The station and elevations for the critical points can be either typed in or defined via a data point in the MicroStation file. If mathematically solvable, the vertical curve is drawn and the speed option button adjusted to the appropriate design speed.

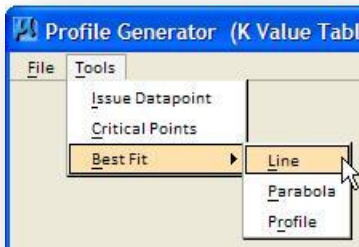
Select **Tools > Critical Points** from the *Profile Generator* dialog to access the *Critical Points* dialog shown below.



The **Station** and **Elevation** for the critical points can be either typed in manually or defined via a data point in the MicroStation file by use of the **DP** buttons. If mathematically possible, the vertical curve will be drawn and the **Speed** option button adjusted to the appropriate design speed.

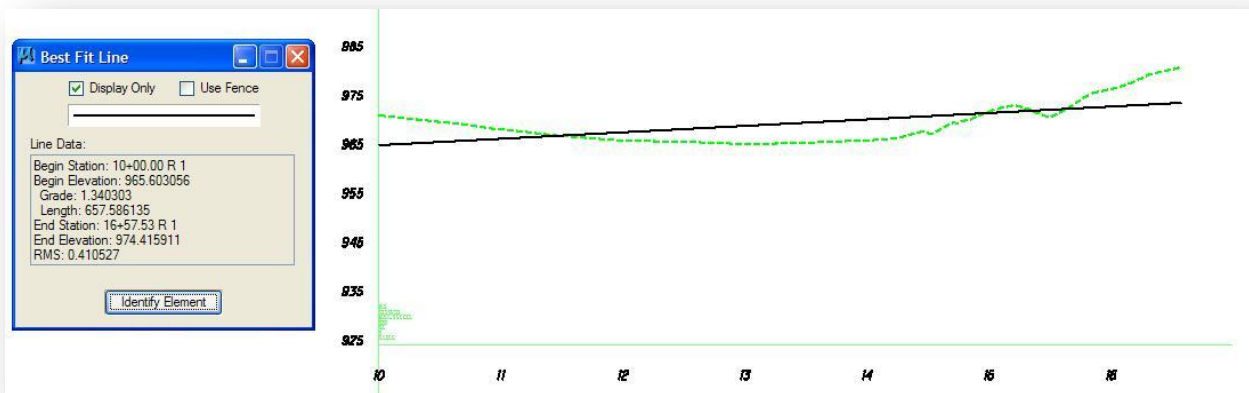
8.3.3 Best Fit

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



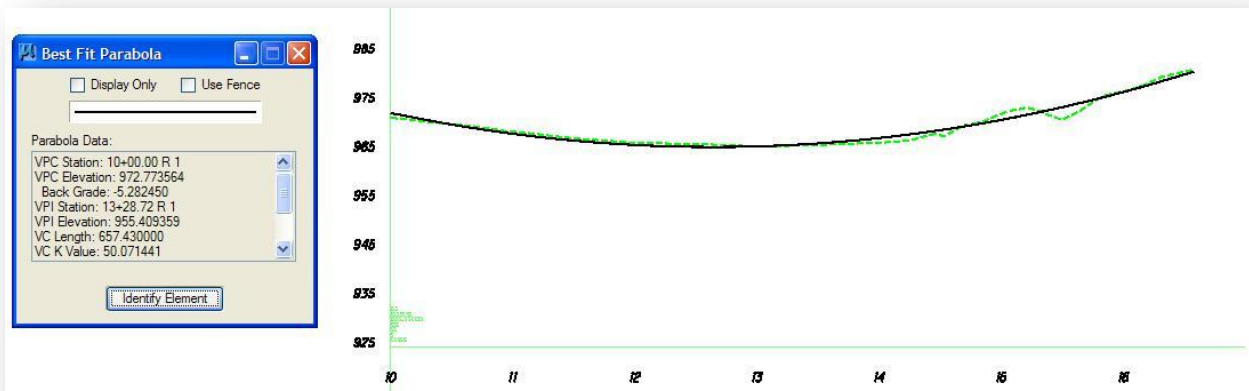
Best Fit Line

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



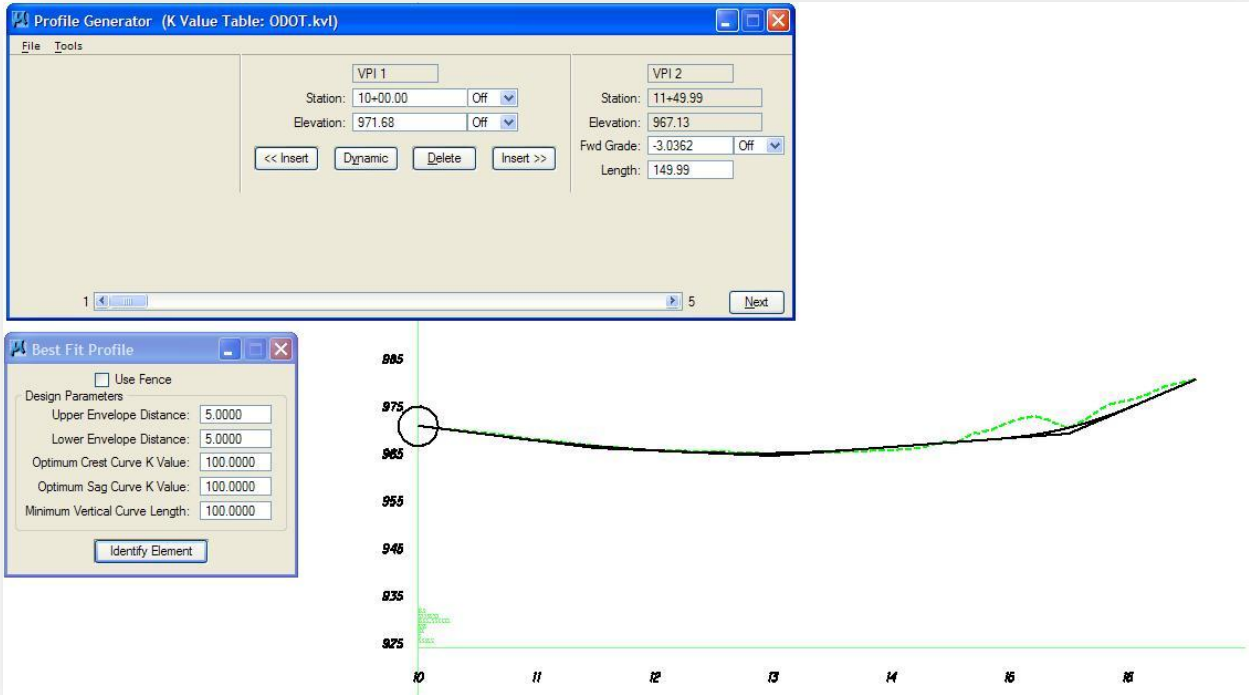
Best Fit Parabola

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



Best Fit Profile

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



When you do a best fit profile there is a unique mathematical solution. You can further restrict or constrain the conditions to find a different solution by using the Envelope Distances. For example, By setting a lower and upper envelope value of 5, the fitted profile is expected to stay within -5 and +5 of the original ground. To create a newly fitted profile that does not cut into ground, use a lower envelope of 0 and upper envelope of any positive number, i.e., 3. The new fitted profile will be between 0 and 3 above the ground (inside of that range).

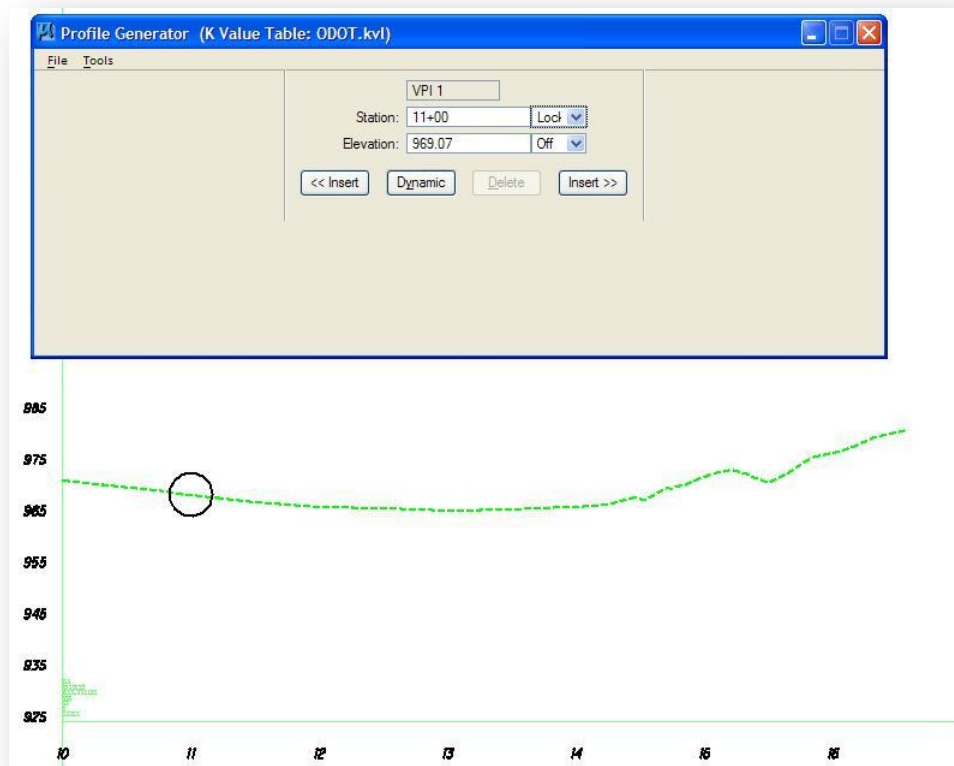
8.4 Storing VPI's

The GEOPAK Vertical Alignment Generator offers a large number of tools for creating a new profile. The creation of a new profile must always begin by placing the first VPI. This step is followed by drawing the first grade. At this point in the process, subsequent VPI's and grades can be specified by precision input or placed dynamically. Vertical curves can be drawn between any successive pairs of back and ahead grades.

The following options are available to define a VPI:

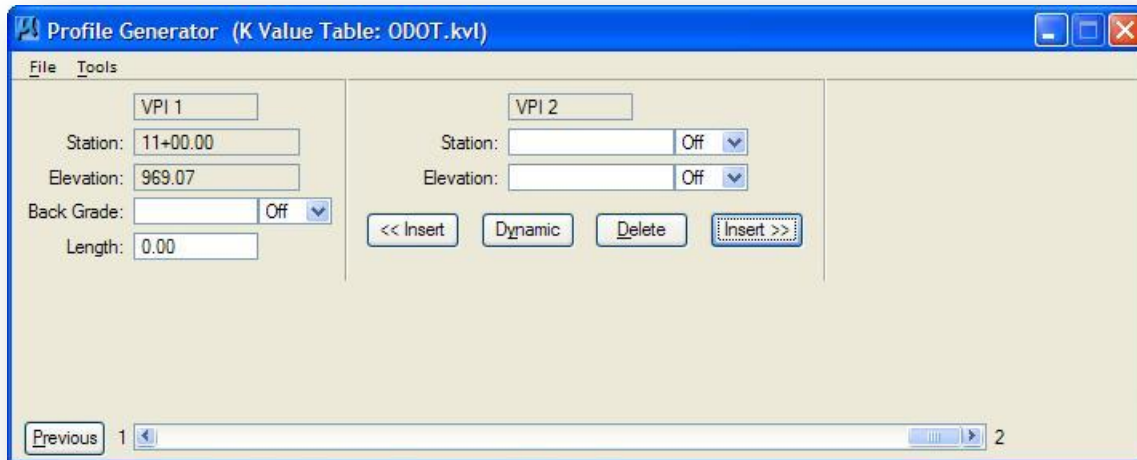
- Precision input: Simply type in the station and elevation of the VPI.
- The VPI can be placed dynamically: Select the **Dynamic** push button. The cursor turns into a circle representing the VPI point. As you move the cursor in the design file, the current station and elevation is continuously updated on the dialog. The VPI will be set upon selection of a Data Point in the design file.

Once the initial VPI is located, the *Profile Generator* dialog appears as shown below.



The **Station** and **Elevation** for the first VPI appear along with two push buttons labeled **Insert Before** and **Insert After**. If you wish to create a VPI before the current the VPI, then select the **Insert Before** push button to the left of the VPI display. Press the **Insert After** push button to the right of the VPI display to create a VPI up station from the current VPI.

After selecting the **Insert After** push button to the right of the VPI display, the dialog appears as shown below.



The **Station** and **Elevation** values for the first VPI now appear on the left of the dialog box. The second VPI is displayed in the center of the dialog box as shown above.

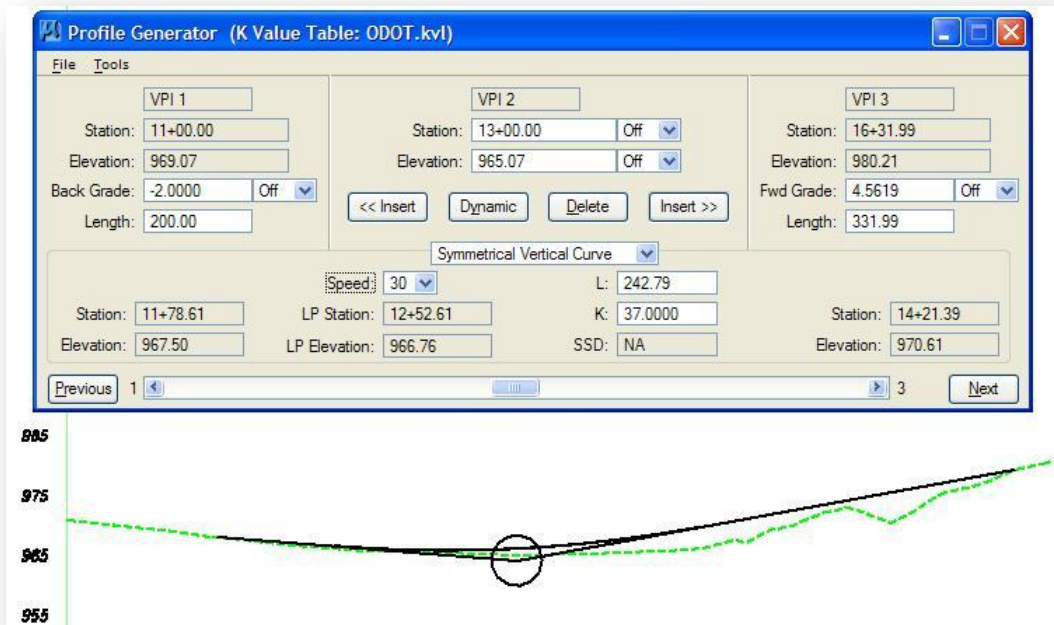
The designer has a wide range of options to choose from in defining the second VPI. The **Back Grade** and **Length** could be defined in relation to the previous VPI or the length and slope of the grade line. Individual station, elevation, grade and length parameters could be defined via precision input, dynamic manipulation or some combination of both. The following will review some of the available options:

- The grade can be defined with precision input by defining any two of the following fields: 1) VPI **Station**, 2) VPI **Elevation**, 3) **Back Grade** and 4) **Length** (length).
- Type in the station for the VPI and select the **Dynamic** push button. The slope of the grade line and the current elevation can be dynamically manipulated with the cursor while the length of the grade and the downstream station will be fixed.
- Type in the elevation for the VPI and select the **Dynamic** push button. The slope of the grade line, the length of the grade line and the current station can be dynamically manipulated along a fixed elevation.
- Type in the slope of the grade line and select the **Dynamic** push button. Cursor manipulations will adjust the length of the grade line along a fixed slope.
- Define the grade completely with dynamics. First, select the **Dynamic** push button. A line appears connecting the current VPI and the cursor. As you move the cursor in the design file, the current VPI **Station** and **Elevation** is continuously updated on the dialog along with the **Back Grade** slope and **Length** (length). The VPI location will be set upon selection of a data point.

The definition of subsequent back and ahead grades is essentially a repetition of the operations described above. You have the option to insert new grade lines from the beginning and the end of the current set of grade lines or a VPI could be inserted between two existing VPI's. Inserting a VPI between existing VPI's will split a grade line into two components.

8.5 Defining Vertical Curves

Given back and ahead grades, vertical curves can be defined by simply setting the **Speed** option button to the desired design speed. For each **Speed** setting, GEOPAK references the K-value table and draws a vertical curve at the maximum K-value settings applicable to the selected speed.



A wide variety of operations are available for dynamically adjusting vertical curves, VPI's and grade lines. Full dynamics can be applied or some appropriate combination of back grade, ahead grade, station and elevation can be "locked."

The locking of profile parameters is controlled by option buttons located adjacent to each parameter field. As can be seen on the dialog above, this option button can be adjusted to three settings: **OFF**, **INC** for increment, and **LCK** for locked. These three settings are defined below:

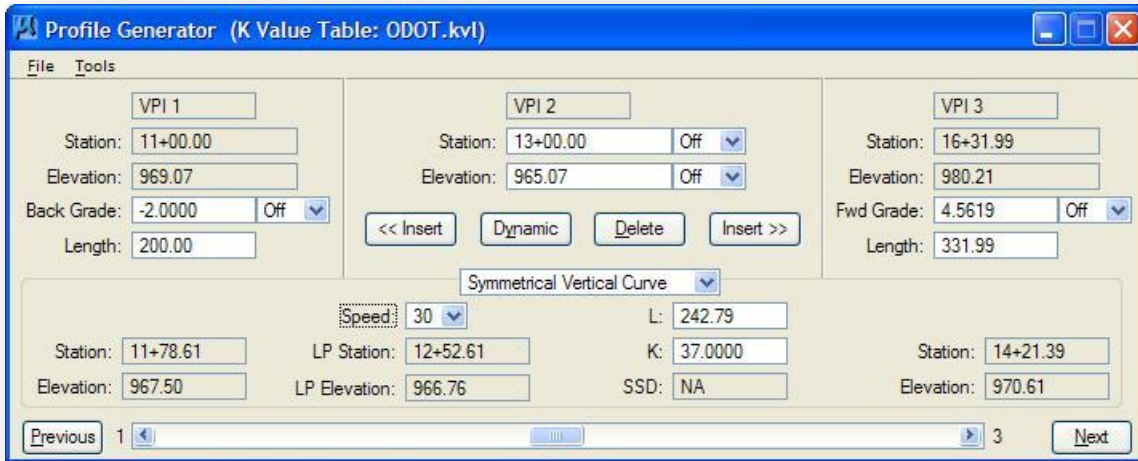
OFF: Full unencumbered dynamics are available. GEOPAK will attempt to round the associated parameter to the increment defined via the Increment dialog but there is no guarantee. If a complicated dynamics operation makes it mathematically impossible to satisfy all increment definitions, some rounding variations could occur. Of course, reasonable rounding variables will mitigate if not eliminate any rounding conflicts.

INC: Ensures that the designated profile parameter will be rounded in accordance with the increment defined on the Vertical Alignment *Preferences* dialog.

LCK: Forces all dynamic operations to maintain the designated profile parameter. This "locked" mode is automatically established when the associated profile parameter is typed in. Only one profile parameter one can be "locked" (**LCK**) at any time.

8.6 Profile Navigation

The GEOPAK Profile Generator provides three options to navigate the VPI's of a profile. The "current" VPI is always displayed in the center of the dialog box.



In the dialog above, VPI 2 is the current VPI. In the MicroStation design file, the location of VPI 2 is designated by a circle at the VPI location.

There are two methods by which the user can move to either the previous VPI (VPI 1) or the next VPI (VPI 3). First, the scroll bar at the bottom of the *Profile Generator* dialog can be used to scroll through the VPI's by selecting the "handle" and sliding it forward or backward.



The second method is to select the **Prev** VPI or the **Next** VPI buttons located on the left and right side of the *Profile Generator* dialog.

8.7 Reviewing Proposed Profiles in COGO

The COGO tools for Profiles are summarized in Chapter 7. The **Print Profile** command, accessed from the *Profile Utility* dialog, includes vertical curve information when a proposed profile is described. An example is shown below.

The screenshot shows the 'Coordinate Geometry' software window with the 'Print Profile PS185P' dialog box open. The dialog box contains a list of profiles: PS185P, XJAMEP, and XS185P. The main window displays the profile data for PS185P.

COGO Key-in: Print Profile PS185P

<* 24 Print Profile PS185P

Beginning profile PS185P description:

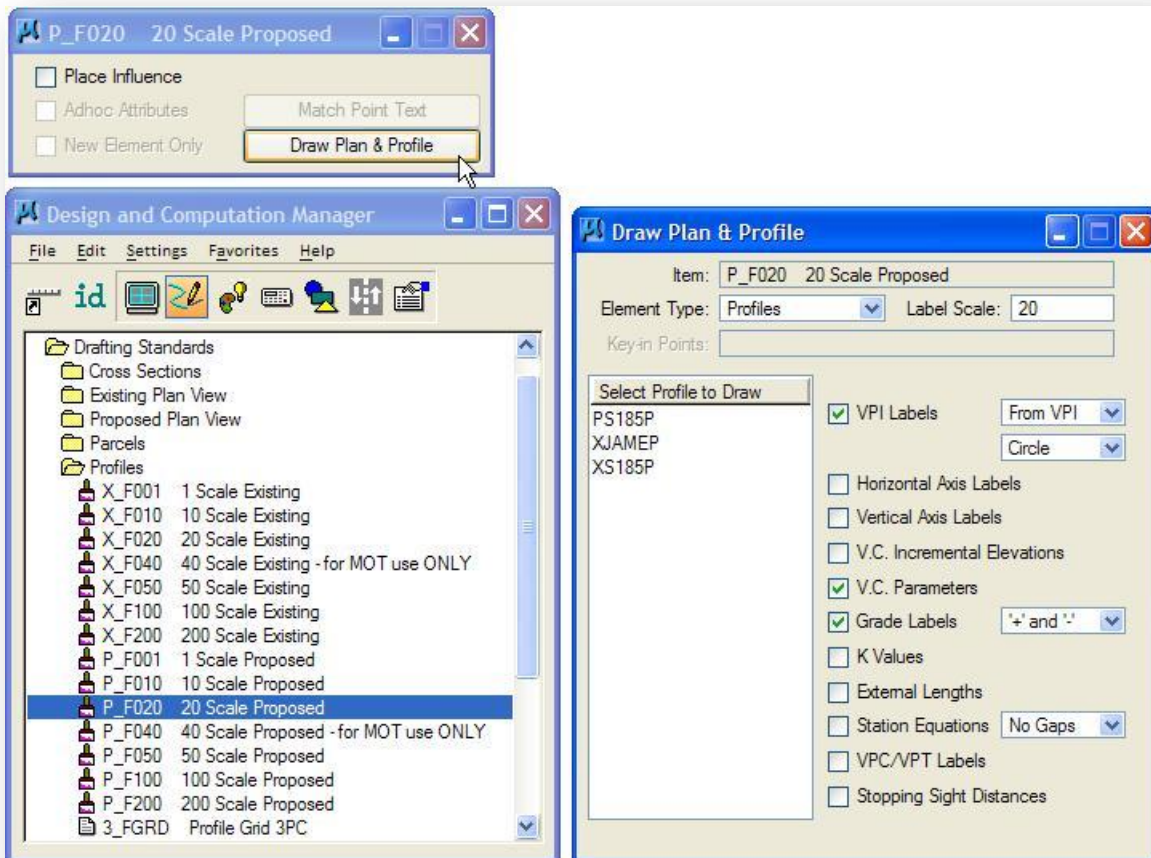
	STATION	ELEV	GRADE	TOTAL L	BACK L
VPI 1	53+00.00	994.9100			
VPC	59+25.00	983.0350	-1.9000	K = 103.5	
VPI 2	60+75.00	980.1850		300.0000	150.0000 150.0000
Low Point	61+21.62	981.1671			
VPT	62+25.00	981.6836	0.9990		
VPC	62+50.00	981.9333	0.9990	K = 159.1	SSD = 586.0
High Point	64+08.97	982.7274			
VPI 3	66+00.00	985.4300		700.0000	350.0000 350.0000
VPT	69+50.00	973.5300	-3.4000		
VPC	69+75.00	972.6800	-3.4000	K = 118.5	
VPI 4	71+50.00	966.7300		350.0000	175.0000 175.0000
				End Region 1	
				Equation: Sta 73+20.24 (BK) = Sta 74+12.82 (AH)	
				Begin Region 2	
VPT	74+17.58	965.9506	-0.4454		
VPI 5	77+50.00	964.4700	-0.4454		

Ending profile PS185P description

8.8 Plotting Proposed Profiles with D&C Manager

There are several items in the ODOT D&C Manager database, ODOT.ddb, for plotting proposed profiles. To access them, select **Drafting Standards > Profiles** as shown at left below.

Select the desired item from the D&C Manager list box. The **Draw Plan and Profile** button will now become available. Select **Draw Plan and Profile** to access the GEOPAK Plan and Profile Draw dialog shown at right below.



The procedure to plot the proposed profile is similar to plotting an existing ground profile as described in Chapter 7 of this guide.

The top of the *Draw Plan & Profile* dialog box lists the currently selected item and the plotting **Operation** that is to be performed. The **Operation** is automatically toggled to **Profiles** as shown above.

The left portion of the dialog box contains a list box with the names of all of the available profiles in the COGO database (GPK File).

The right side of the dialog box contains several plotting options. Normally you will plot the profile using only the options that have been configured as defaults.

The **Label Scale** is used to set the size of the text labels that will be plotted with the profile. The value of the label scale is not set when an item is selected and must be manually set by the user as shown below.

D&C Item	Label Scale Value
1 Scale Proposed	1
10 Scale Proposed	10
20 Scale Proposed	20
40 Scale Proposed	40
50 Scale Proposed	50
100 Scale Proposed	100
200 Scale Proposed	200

To plot a profile, simply select the name of the profile from the **Select Profile** list box on the left of the *GEOPAK Plan & Profile Draw* dialog box. The *Profile* dialog box below is opened after a profile name is selected.

The top portion of the *Profile* dialog box displays information about the selected profile.

The dialog box items described below are set according to the values assigned in the Working Alignment Definition:

- Horizontal Scale
- Vertical Scale
- Reference Station
- Reference Elevation
- X
- Y

The **Horizontal Scale** and **Vertical Scale** items are used to specify the scale ratio between the horizontal and vertical axis of the profile. Note that the actual horizontal distances of the profile will not be scaled in the MicroStation design file. The distance between station 11+00 and 12+00 will always measure 100' regardless of the **Horizontal Scale** specified. Only the **Vertical Scale** will be distorted.

The **Begin Station** and **Ending Station** items are used to specify the station range that you wish to plot in the MicroStation design file. These items are not automatically set to the limits of the selected profile. Be sure to review the values before plotting the profile.

Strip Grade Increment is used to specify the increment for the existing elevations that will be plotted on the horizontal axis of the profile. If this field is left blank no elevations will be plotted.

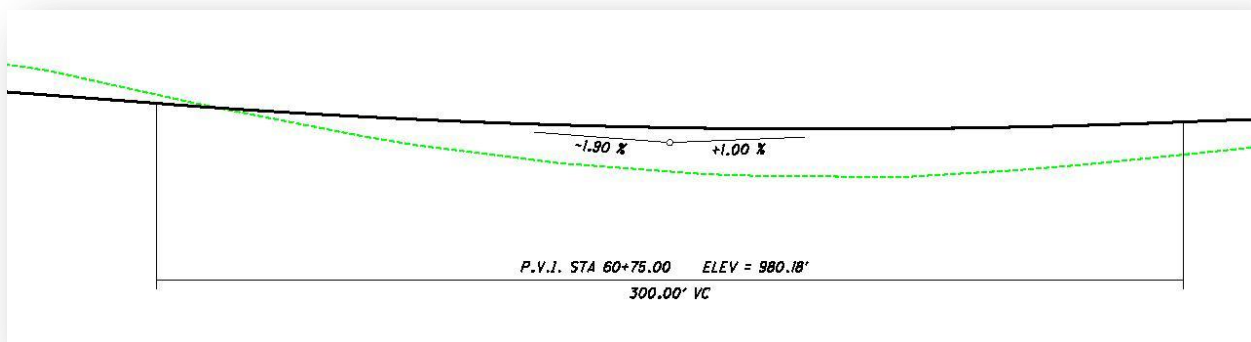
The **X** and **Y** items are used to define the location in the MicroStation Design file where the profile origin will be placed.

The **DP** button can be used to specify the location in the design file that you wish to use as the origin of the profile. Select **DP** and then identify the location graphically by identifying a data point in the design file where you wish the profile to be plotted. The coordinates of the specified data point are automatically updated in the Profile dialog box.

The **Reference Station** and **Reference Elevation** items are used to define the station and elevation of the profile's origin at the location defined by **X** and **Y**.

A Profile Cell can be placed in the design file using the values defined for the **Reference Station**, **Reference Elevation**, **X**, and **Y** fields by using the **Draw Cell at X,Y** button. If a profile cell has been previously placed in the design file, the values for the **Reference Station**, **Reference Elevation**, **X**, and **Y** fields can be read by using the **Identify Cell** button and then selecting and accepting the cell.

Select **OK** to plot the profile. An example of a plotted profile is shown below.

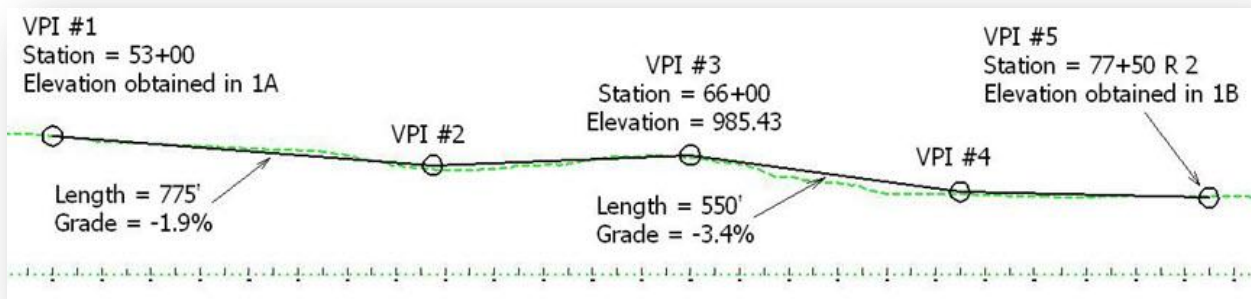


Note: The ODOT Design and Computation Manager database has been configured to yield the best results possible for ODOT construction plans using the available parameters for profile display and annotation. It may be necessary for the designer to edit the labels in order to achieve the desired results. This is especially true if you toggle on other labeling options such as the K-Value or the Stopping Sight Distance as GEOPAK does not offer any capabilities to customize the location of where these values are plotted with relation to the other annotations.

Exercise 8A – S.R. 185 Profile

1. Define and store a proposed profile for S.R. 185 with the following conditions:
 - a. The proposed profile will start at Sta. 53+00 by tying into the existing pavement. What is the existing pavement elevation at Sta. 53+00? _____
 - b. The proposed profile should be tie back into the existing pavement at Sta. 77+50 R 2. What is the elevation of the existing pavement at Sta. 77+50 R 2? _____

Using the elevations obtained above, and the information below, store the proposed profile for S.R. 185.



Hint: When creating Vertical Curves it is a good idea to create all VPI's first then adjust Vertical Curve Lengths.

VPI	Vertical Curve Length
2	350'
3	550'
4	350'

- c. When you have completed the profile, use the **Save Profile As** option to save the profile. Using ODOT's GEOPAK Guidelines, what should you name the profile? _____
 - d. What is the Station and Elevation of the low point on the vertical curve with VPI #2?

Station = _____

Elevation = _____

Hint: Use the COGO profile commands to print the profile information.
 - e. What is the Station and Elevation of the high point on the vertical curve with VPI #3?

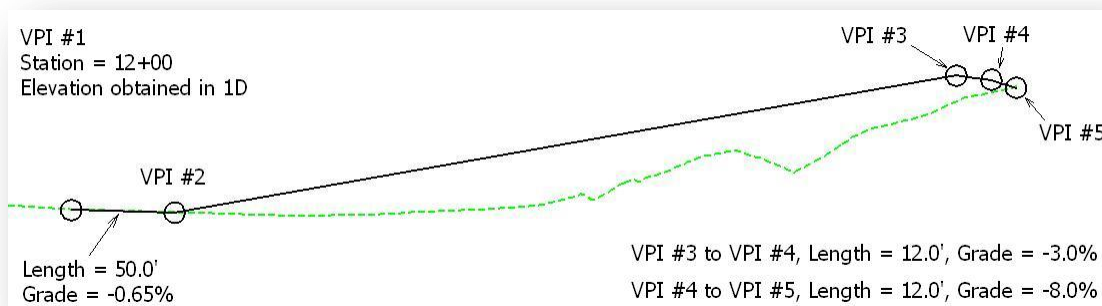
Station = _____

Elevation = _____
2. Update the **Working Alignment Definition** for S.R. 185 to include the name of the proposed vertical alignment.
 3. Plot the proposed profile for S.R. 185 using the **Design and Computation Manager**.

Exercise 8B - Jameson Road Profile (if time permits)

1. Define and store a proposed profile for Jameson Road with the following conditions (set the working alignment to Jameson Road):

- a. What is the Station on the chain CLPS185 at the intersection with chain CPLJAME?
Station = _____
- b. What is the Station on the chain CLPJAME at the intersection with CLPS185?
Station = _____
- c. What is the Elevation on the profile PS185P at the Station from (a)? _____
- d. The proposed profile will start at Sta. 12+00 by tying into the existing pavement. What is the existing elevation at Sta. 12+00 on profile XJAMEP? _____



VPI	Vertical Curve Length
2	100'
3	10'
4	No Curve

- e. When you have completed the profile, use **the Save As...** option to save the profile. Using ODOT's GEOPAK Guidelines, what should you name the profile? _____

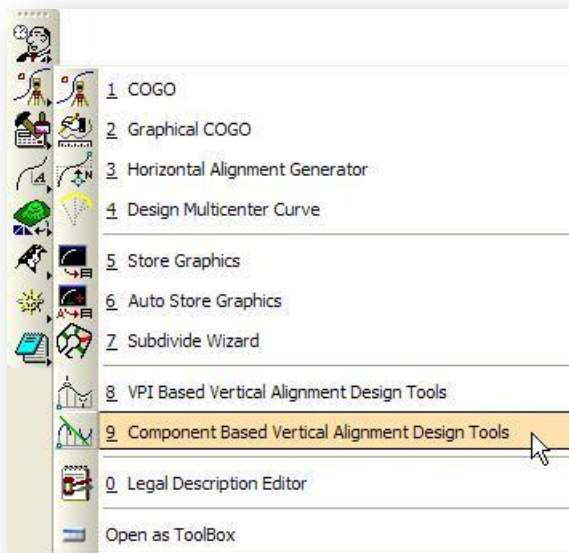
Hints: Start at the intersection of S.R. 185 and Jameson Road and work backwards. With the **Working Alignment** set to Jameson Road, open the **Vertical Alignment Generator** and key-in the data for VPI #5. When this is accomplished, select the **Insert Before** button. The first VPI now becomes VPI 2 and the cursor is now located at VPI 1 (which will end up as VPI#4). Enter the **Length** and **Grade** between VPI #4 and VPI #5 as shown above in the dialog between VPI 1 and VPI 2. After following the preceding step, select the **Insert Before** button. The VPI's will now be renumbered and the current cursor will be VPI 1 which will now be used for VPI#3 shown above. Repeat this procedure until all VPI's are entered. The VPI's should match the graphic above when completed.

2. Update the **Working Alignment Definition** for Jameson Road to include the name of the proposed profile.
3. Plot the proposed profile for Jameson Road using the **Design and Computation Manager**.

8.9 Component Based Vertical Alignment Design Tools

The Component Based Vertical Alignment tools provide the user with tools to place, modify and delete profile components individually. Tools include the placement of tangent lines and a variety of vertical curves. Vertical alignment components interact with each other to automatically trim vertical curves and connect various elements. Additional tools are available to modify copy and rotate components. The user also has the option to store completed profiles in the coordinate geometry database.

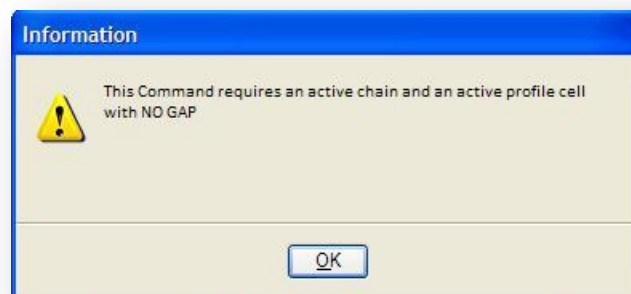
The Component Based Vertical Alignment tools can be accessed by selecting **Applications > Road > Geometry > Layout Profiles (Component Based)** from the MicroStation pull down menu, or from the GEOPAK *Road* tool palette as shown below.



Once selected, the *Component Based Vertical Alignment Design* tool palette, shown below, opens.



This tool requires the **Active Chain Control** command to be opened with an active chain and an active profile defined. See Chapter 6 for information on the Active Chain Control command. If the Active Chain Control command is not open when one of the Component Based Vertical Alignment Design Tools is selected, the following Information dialog will appear.



Operation of the individual Component Vertical Alignment tools is very thoroughly documented in the GEOPAK online help. Select **Applications > Road > Help** to access the online help.

Place Vertical Alignment Lines

The *Place Vertical Alignment Lines* tool palette, the first tool of the *Component Based Vertical Alignment Design Tools* palette, is shown below.



Three commands are available as described below:

Create a Profile Line by Two Points

This tool enables the user to place a profile line by defining two points.

Create a Profile Line Tangent to One Element

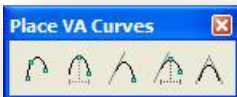
This tool enables the user to place a profile line tangent to one element.

Create a Profile Line Tangent to Two Elements

This tool enables the user to create a profile or Vertical Alignment line tangent to two elements.

Place Vertical Alignment Curves

The *Place Vertical Alignment Curves* tool palette, the second tool of the *Component Based Vertical Alignment Design Tools* palette, is shown below.



Five commands are available as described below:

Place a Vertical Curve by Three Points

This tool enables the user to place a profile curve by three points.

Place a Vertical Curve by High Point

This tool enables the user to place a vertical curve by defining a high point (or in the case of a sag curve, the low point).

Place a Vertical Curve Tangent to One Element and Through One Point

This tool enables the user to place a profile curve tangent to one element (line or curve) and passing through a used-defined point.

Place a Vertical Curve Tangent to One Element Given High Point

This tool enables the user to place a profile curve tangent to one element and pass it through a used-defined high or low point.

Place a Vertical Curve Tangent to Two Elements

This tool enables the user to place a profile curve tangent to two elements.

Manipulate Vertical Alignment Elements

The *Manipulate Vertical Alignment Elements* tool palette, the third tool of the *Component Based Vertical Alignment Design Tools* palette is shown below.



Three commands are available as described below:

Move a Profile View Element

The **Move a Profile View Element** command enables the user to move an element or to make copies. Note the moved or copied element must remain within the confines of the profile cell and its associated delta top and bottom values.

Rotate a Profile View Element

The **Rotate Plan View Element** rotates the selected tangent about a user-defined point. A selection set may also be defined when multiple elements need to be rotated. Note: This command is not supported for vertical curves.

Extend a Profile View Element

The **Extend a Profile View Element** tool can extend or shorten both tangent and vertical curve components.

Profile Tools

The *Profile Tools* palette, the fourth tool of the *Component Based Vertical Alignment Design Tools* palette, is shown below.



Five commands are available as described below:

Store a Vertical Alignment in COGO

This tool enables the user to store graphical profile components into coordinate geometry. This command requires COGO to be active.

Graphical Profile Preferences

This tool enables the user to define the preferences used within the *Component Based Profile Generator*.

Import Vertical Alignment from COGO

This tool enables the user to import a previously stored profile from the coordinate geometry database. This command requires COGO to be active.

Place Profile Cell Anchor

This tool enables the user to place a profile cell which is as a prerequisite to any profile creation using the *Component Profile* tools.

Profile Cell Control

The *Profile Cell Control* dialog enables the user to place or manipulate profile cells and associated data.

9 Plan and Profile Sheets

9.1 Overview

GEOPAK provides the capability to assemble plan and profile sheets from MicroStation design files in which the plan and profile information has been previously placed. Based on user-defined parameters and sheet sizes, the software will place clipping borders into the master design file based on the geometrics of a specified chain and/or profile. The designer has the option to modify the clipping borders by adjusting their size or moving them to a new location. Once the clipping borders are in the desired location, the software will draw the sheets into separate design files by placing sheet border cells and attaching reference files. The designer determines how many sheets are placed into each design file.

There are a few steps that need to be performed before clipping the sheets, as listed below:

- ✓ Prepare plan view graphics for the existing and proposed project information. Multiple specialized basemaps may be used to represent this information according to ODOT standards.
- ✓ Prepare the profile information in a separate profile base map. This will also include a separate row of profile elevations that will be referenced into the completed plan and profile sheets. The profile elevations can be placed using the **GEOPAK Draw Profile Tabular Data** tool.
- ✓ Determine whether to process sheets with the **Use Current Design File** option or the **Customize with Motif Files** option.

If the **Use Current Design File** option is selected:

- Attach all the reference files that will be used on the completed sheets (both plan and profile) to the clipping border design file.

If the **Customize with Motif Files** option is selected:

- Create a new design file to be used as a control file for the plan view reference files. This file, called a “**Motif**” file, will establish all the reference file parameters for the plan view portion of the clipped sheets. Each file that will be shown in the plan “**Port**” should be referenced into the plan view Motif file.
 - Create a new design file to be used as a control file for the profile view reference files. This “**Motif**” file will establish all the reference file parameters for the profile view portion of the clipped sheets. Each file that will be shown in the profile “**Port**” should be referenced into the profile view Motif file.
- ✓ Create a new file to contain the clipping borders.
 - ✓ Run the clip sheets application.

9.2 Sheet Layout Files and Configuration Variables

Many different types of plan and profile sheets can be configured with GEOPAK. Each sheet type is stored in a sheet library. An unlimited number of sheet definitions can be stored within one library. When the user begins the sheet process, the desired sheet layout is selected from the attached library, which loads the associated parameters.

The sheet library has a .psl file extension. ODOT's standard plan and profile sheet library, ODOT.psl, is located in the following directory:

i:\ODOTstd\V8istd\geopak\road\sheet_library\ODOT.psl

By default, GEOPAK will look in the product installation directory for the sheet library. GEOPAK can be configured to look for the sheet library in another directory by use of Configuration Variables. The ODOT Standard configuration has the following variables defined for GEOPAK sheet clipping:

GPK_SHEETCLP_SHEET_LIBRARY_DIR	= \$(V8ISTD)/geopak/road/sheet_library/
GPK_SHEETCLP_SHEET_LIBRARY_NAME	= odot.psl
GPK_SHEETCLP_SHEET_CELL_LIBRARY_DIR	= \$(V8ISTD)/cell/
GPK_SHEETCLP_PLAN_MOTIF_FILE_DIR	= ../roadway/basemaps/
GPK_SHEETCLP_PROFILE_MOTIF_FILE_DIR	= ../roadway/basemaps/
GPK_SHEETCLP_TABULAR_DATA_MOTIF_FILE_DIR	= ../roadway/basemaps/
GPK_SHEETCLP_SHEET_OUTPUT_DIR	= ../roadway/sheets/

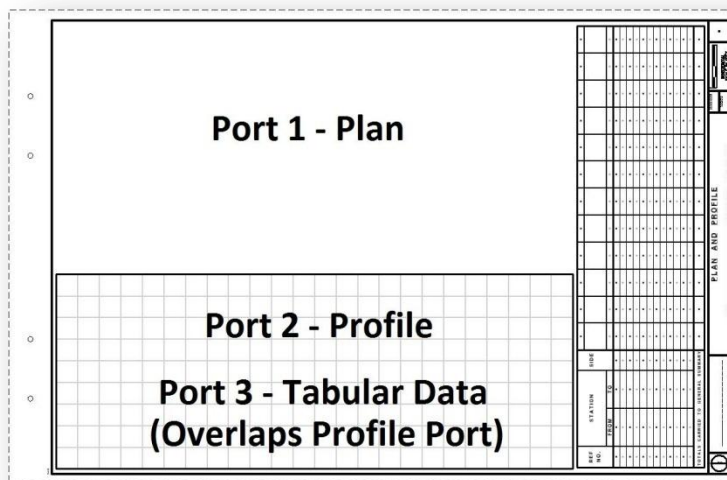
The configuration variables listed above are defined within ODOTV8i.pcf.

9.3 Plan and Profile Sheet “Ports”

Each plan and profile sheet type is made up of one or more “Ports”. A **Port** is defined as follows:

- A **Port** is used to define the clipping areas that are configured for each sheet.
- There are three types of ports that can be included on a sheet:
 - Plan view
 - Profile view
 - Tabular Data (used for profile elevations)
- Each sheet can be comprised of any combination of plan, profile, or tabular data ports.

Let’s take a closer look at the ODOT sheet configuration for a plan and profile sheet as an example of how the ports are used to assemble a completed plan and profile sheet.



The graphic above shows the ports that have been configured for a typical ODOT plan and profile sheet layout item. Each port can have one or more reference file attachments. For example, the plan port might have a reference file attachment to the design file containing the survey data, another reference file attachment to the design file containing the proposed geometry, and another attachment with proposed right-of-way information.

When the plan and profile sheets are clipped, the user must specify which design files will be attached to each port.

GEOPAK provides two options to specify the port attachments; **Use Current Design File** or **Customize with Motif Files**. Each option has pros and cons which are discussed below. This section will focus on defining these options; the dialog to select the processing option is covered later in this chapter.

Use Current Design File

The current design file (the file containing the sheet clipping borders) will be attached to each port on the completed plan and profile sheet. Every reference file that is attached to the current design file is also attached to each port in the completed sheets.

This option is advantageous because it requires less setup and is easier to process, but it has one significant disadvantage as listed below:

- There is no way to individually specify which reference file should be attached to which port. Every reference file attached to the current design file is attached to each port of the completed sheets.

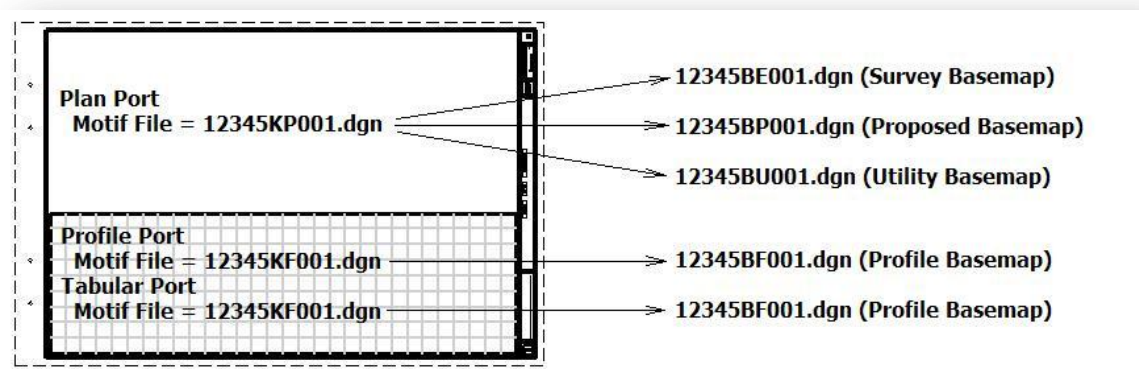
Customize with Motif Files

A **Motif File** is an empty MicroStation design file with reference file attachments. **Motif Files** are used as follows:

- Each **Port** (plan, profile, or tabular) can have one **Motif File** assigned.
- The **Motif File** is used as a template to control the reference file settings for a **Port**. When the sheets are clipped, the reference files that are attached to the **Motif File** are attached to the associated **Port** in the completed sheet.
- The **Motif File** itself is not referenced to the completed plan and profile sheets.
- Graphics placed in the **Motif File** are not used in the completed plan and profile sheets.
- The motif file's reference file settings are used to determine which levels are turned on/off in each of the reference file attachments that make up the completed sheets.

More than one motif file can be used. For example, the user can assign a motif file to control which files are attached in the plan port. A separate motif file can be used to control the reference files for the profile port, and another for the tabular port information.

Although the **Customize with Motif Files** option requires more setup work prior to generating the sheets, this option is advantageous since it gives the user greater control over each file that will be attached as a reference to a port. The diagram below illustrates the use of two motif files to control the reference attachment settings for a plan and profile sheet.

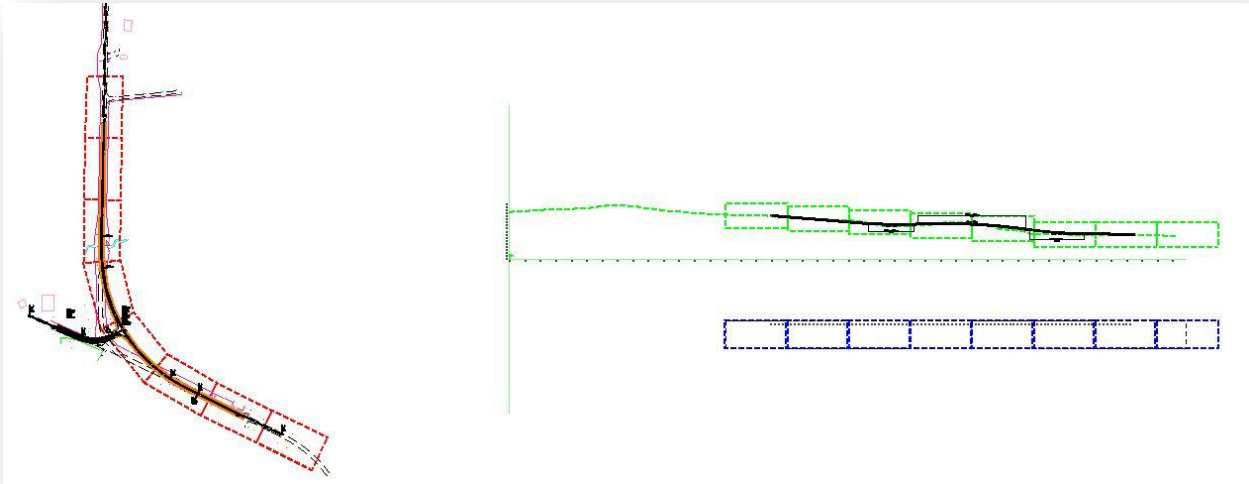


It is up to the user to determine which option will be used.

9.4 Clipping Borders

GEOPAK places clipping borders in a MicroStation design file to designate the clipping range for each plan and profile sheet. Each clipping border corresponds to a port on the completed sheet.

An example of the clipping borders for the plan, profile, and tabular ports is shown below.



For ODOT projects, the clipping borders are normally drawn in a separate design file.

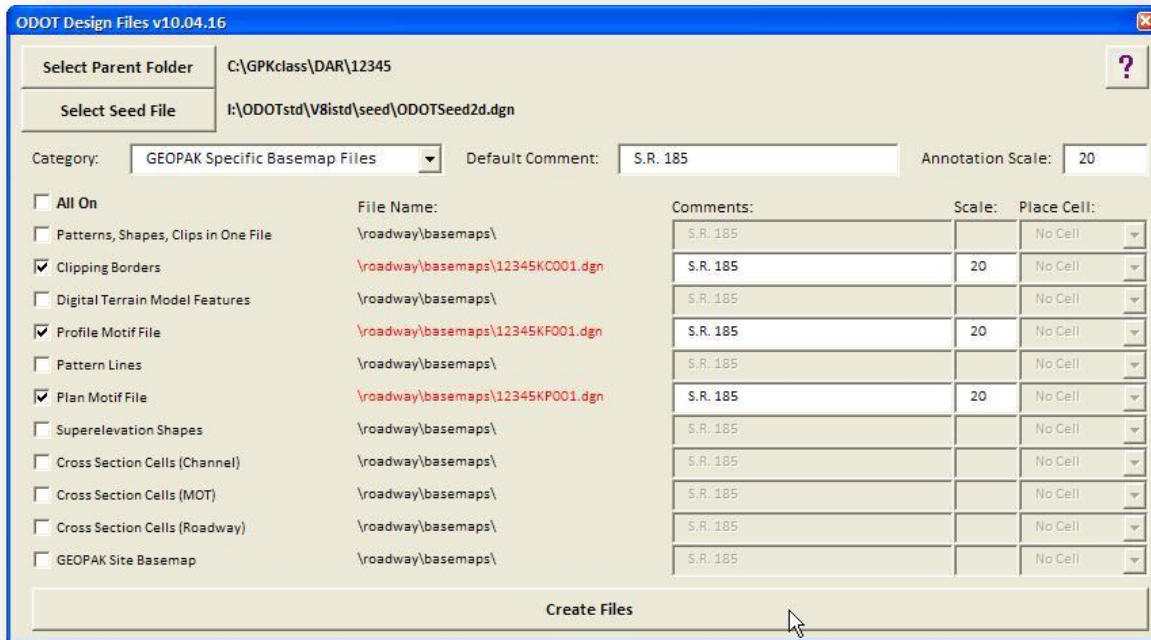
The clipping borders for the plan, profile, and tabular ports are all drawn in the same design file.

The clipping borders are drawn using the following symbology:

Port	Level	Color	Style	Weight
Plan View	GK_Clip_Borders	3	2	1
Profile View	GK_Clip_Borders	2	2	1
Tabular Annotation	GK_Clip_Borders	1	2	1

Regardless of the method used to clip the sheets, **Use Current Design File** or **Customize with Motif Files**, it is necessary to create a design file for the clipping borders. The **ODOT_Files** application can be used to create the clipping border design file. The application is accessed from the MicroStation pull down menu by selecting **ODOT > File Management > New Design File**.

The design file can be created using the application as shown on the following page:

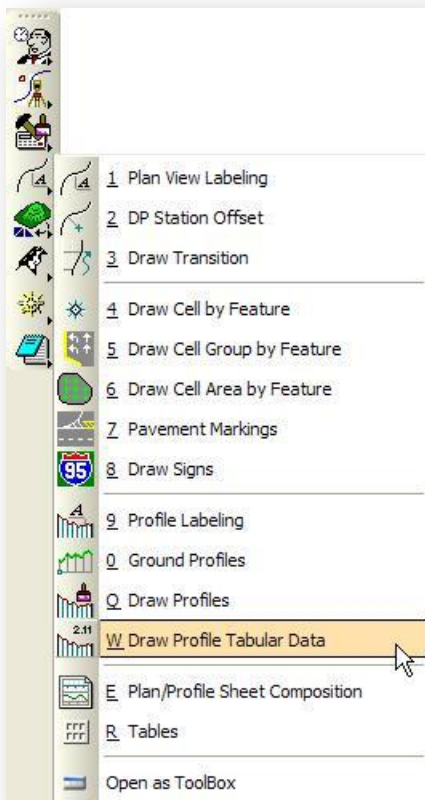


Note: The application requires that GEOPAK is deactivated in order to create the design files. In the example above, three files are created to be used in the sheet clipping process. It is recommended that you create the files all at once in order to avoid repeatedly reactivating GEOPAK.

9.5 Placing Profile Elevations for the Tabular Port

The ODOT plan sheet library, ODOT.psl, has been configured to use a separate reference attachment for the existing and proposed profile elevations that will be displayed in the Tabular Port of the completed plan and profile sheets. By using a reference attachment and the GEOPAK profile cell information, the elevations can be easily updated if the designer makes a change to the profiles.

Before processing the sheets, the user must draw a row of existing elevations, and another row of proposed elevations, in a MicroStation design file that will be referenced into the Tabular Port on the completed sheets. Care must be taken to ensure that the elevations are plotted with the correct horizontal and vertical spacing to fall into the proper location on the completed sheets.

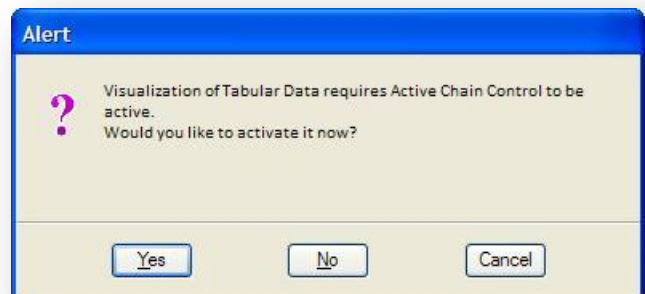


This section will detail the process to place the existing and proposed profile elevations beneath the GEOPAK Profile Cell using the GEOPAK **Draw Profile Tabular Data** tool.

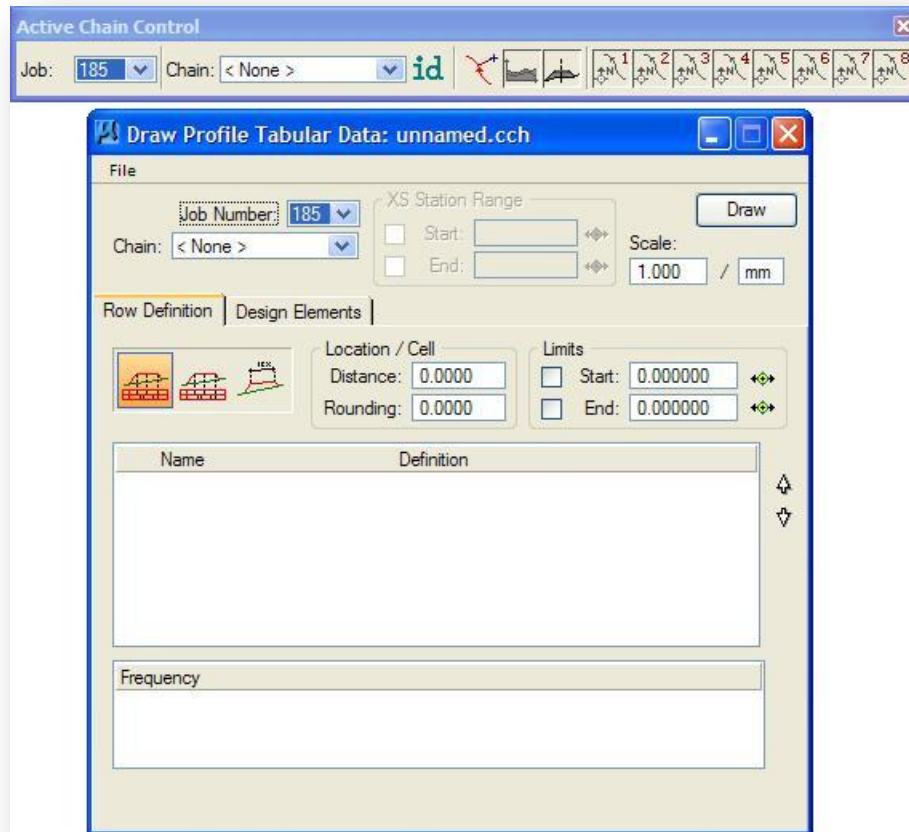
The tabular data is drawn in the active design file. Open the profile design file before accessing the Draw Profile Tabular Data command.

The tool can be accessed by selecting **Applications > Road > Plans Preparation > Draw Profile Tabular Data**, or from the GEOPAK *Road* tool pallet as shown at left.

The **Draw Profile Tabular Data** tool requires **Active Chain Control** to be active. If **Active Chain Control** is not active, you will be prompted to activate it as shown below.

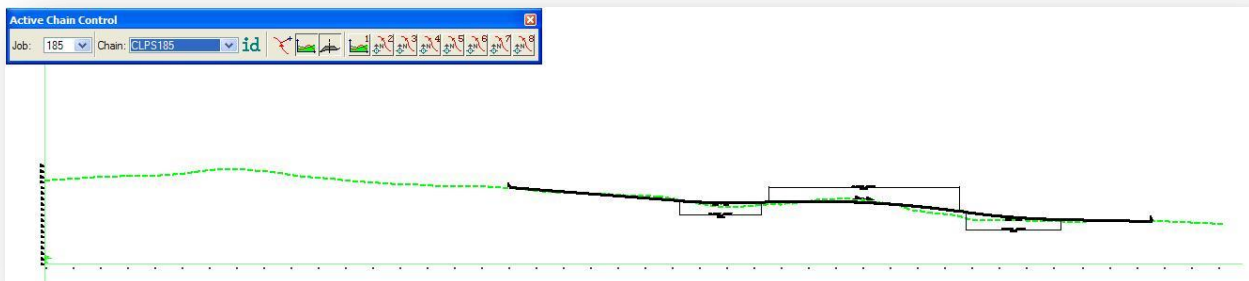


The *Draw Profile Tabular Data* dialog shown on the following page will open, along with the *Active Chain Control* dialog.



The *Active Chain Control* dialog is covered in Chapter 6 of this training guide. To use *Active Chain Control* with the *Draw Profile Tabular Data* tool, take the following steps:

- ✓ Select the **Chain** name that was used to extract the profile that will be used to annotate the Tabular Data
- ✓ Right-Click on the View 1 icon within the *Active Chain Control* Dialog and select Profile option. The profile will automatically be fitted to the view.



The **Draw Profile Tabular Data** tool can be used to place a variety of data, in tabular format, onto profiles according to user-defined parameters. A comprehensive set of preferences enables the user to determine what data is placed, the grid, leader lines, titles, how to handle overlapping text, and where the tabulation is placed in relationship to the profile.

Preference Files

Preferences for the **Draw Profile Tabular Data** tool can be saved in a .cch files for later recall and use. This training guide will detail the process to use the ODOT file profile_elevations.cch file for placing the existing and proposed elevations at an offset to a profile cell to be used for clipping plan and profile sheets. See the GEOPAK online help for details on how to configure the preferences.

From the *Draw Profile Tabular Data* dialog, select **File > Open** to open a preference file. After the ODOT preference file is selected, the *Draw Profile Tabular Data* dialog should appear similar to the example shown above. The ODOT preference file can be accessed from the following location:

i:\ODOTstd\V8istd\geopak\road\cch\profile_elevations.cch

The first entries required in the dialog are at the top of the dialog. These include:



Job Number

Required to identify the coordinate geometry database where the chain for generating the profiles is stored.

Chain

Required to reference an alignment associated with the profile. **Note:** The **Job Number** must be defined in order to populate the **Chain** list.

XS Station Range

This group box is ghosted out, as it is not utilized in the **Draw Profile Tabular Data** tool.

Scale

This option is used to specify the **Scale** used for drawing tabular data. Both Inches and millimeters are supported.

Draw

When the dialog and associated preferences are complete, press the **Draw** button to start processing. Prior to pressing the **Draw** button, all elements (tabular data, grids, etc.) are visualized elements only.

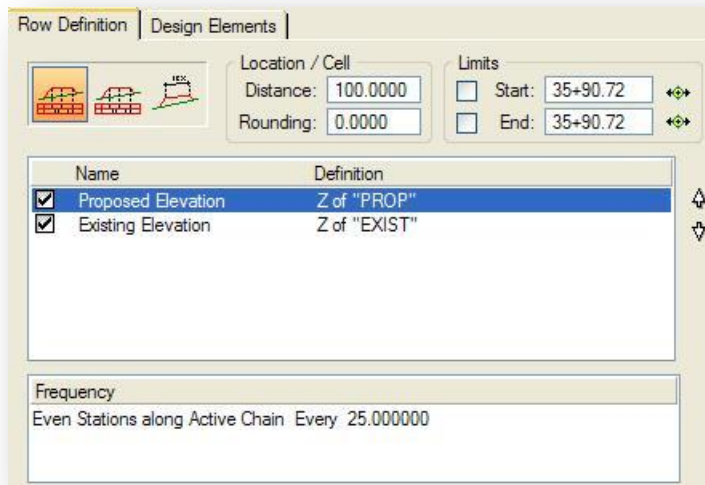
Two tabs on the dialog support the input data required to draw profile tabular data:

- **Row Definition**
- **Design Elements**

Each option is discussed below.

Row Definition

When **the Row Definition** tab is selected, the bottom portion of the dialog dynamically changes as shown below



Three icons are supported for various annotations:



Frame Annotation 1

This option provides a single set of parameters for tabular data. The set-up includes text parameters, what tabular data is to be placed, leader lines, grids, etc. When the button is pressed, all data stored within the Frame Annotation 1 is populated in the dialog.



Frame Annotation 2

Identical in functionality to **Frame Annotation 1**, the second annotation frame is provided to enable the user to have two set-ups within one tabular data preference file. For example, **Frame Annotation 1** may be configured to place profile tabular information below the profile while **Frame Annotation 2** may be configured to place a different set of profile tabular annotation above the profile.



On Surface Annotation

This option places text on the surface rather than in tabular format. For example, labeling pavement slopes would use this format. The option has not been configured to place any graphics using the profile_elevations.cch preference file.

Location/Cell

Location / Cell
 Distance: 100.0000
 Rounding: 0.0000

The **Distance** is measured from the data or profile cell origin vertically to top of the chart. The dialog value is multiplied by the **Scale** for the actual measurement. The **Rounding** relates to the Datum value.

Limits

Limits
 Start: 50+77.640
 End: 80+11.160 F

By default, GEOPAK draws the tabular data the width of the data or profile cell, based on the preferences. Using this group box, the data will be tabulated only within the limits specified.

The rest of the **Row Definition** tab contains a list of profile items that will be annotated. In the example below, two items will be annotated, the **Proposed Elevation** and the **Existing Elevation**. The list box contains the definitions from the current preference file and cannot be added or modified within this dialog. The toggle to the left of the **Name** indicates which Rows are to be used in the current tabular layout.

Name	Definition
<input checked="" type="checkbox"/> Proposed Elevation	Z of "PROP"
<input checked="" type="checkbox"/> Existing Elevation	Z of "EXIST"

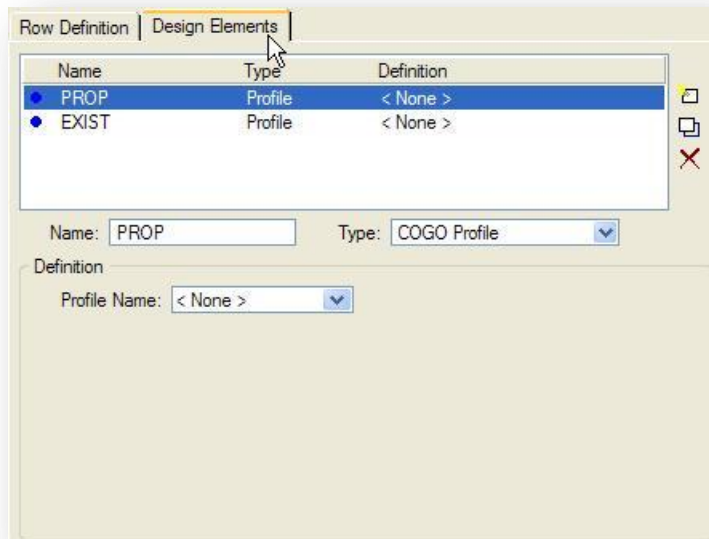
Frequency
 Even Stations along Active Chain Every 25.000000

The only edit buttons (located to the right of the list box) are **Up / Down** arrows to change the order of the rows. To change, simply highlight the row, then press the Up or Down arrow. Each pressing moves the line one position.

The **Frequency** list box displays information for the selected row **Name**. In the example above, the **Proposed Elevation** will be annotated at the frequency indicated in the dialog.

Design Elements

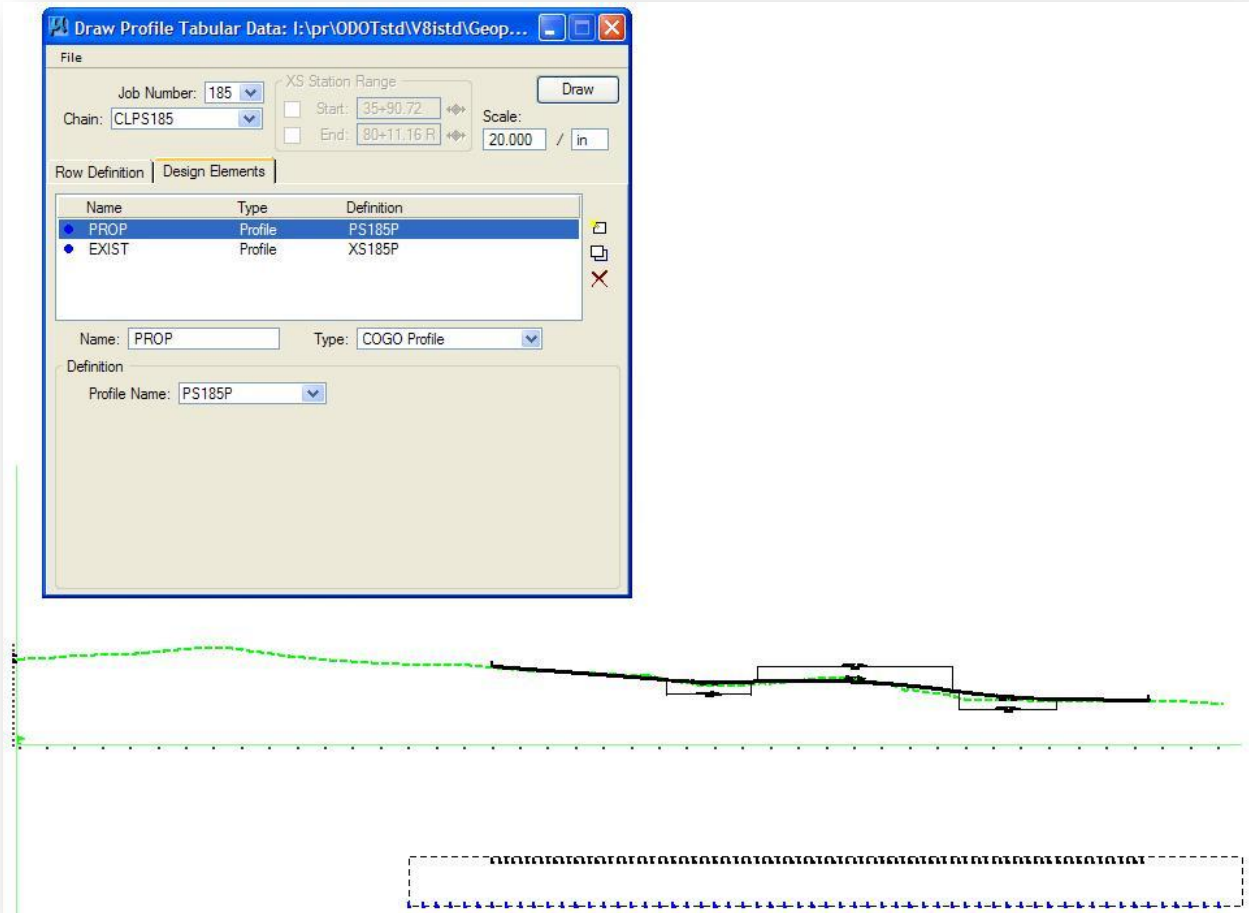
When the **Design Elements** tab is selected, the bottom portion of the dialog dynamically changes as shown below.



The ODOT preference file profile_elevations.cch has two profile variables that must be defined by the user before the elevations can be placed in the design file. To define the variables, take the following steps:

- ✓ Select the variable **Name** from the list box.
- ✓ Select the corresponding profile from the **Definition** drop down list. The list of profile names is taken from the COGO database specified by the **Job Number**.
- ✓ Press the **Modify** Line icon, located to the right of the list box, to add the **Definition** to the list box.

After the **Profile Name** has been defined for each **Name**, the elevations will be dynamically displayed below the profile cell origin as shown in the example below.



Changes to the dialog settings will be dynamically displayed in the design file. For example, changing the **Start** station to 50+00 will cause the dynamics to update the profile elevations to reflect the current station range values. Changing the **Scale** will cause the elevation text size to dynamically update to reflect the current scale value.

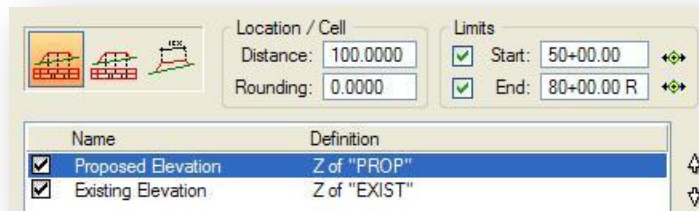
Once you are satisfied with the appearance and location of the profile elevations, select the **Draw** button to write the profile elevations to the design file.

A border is drawn around the elevations as shown above. The border is placed on level Default and will be used to assist the user in defining the origin for the tabular elevations when the sheets are processed. The existing elevation text is placed on level **PF_P_Sta_Elev_Text**. Proposed elevation text is placed on level **PF_P_Sta_Elev_Text**.

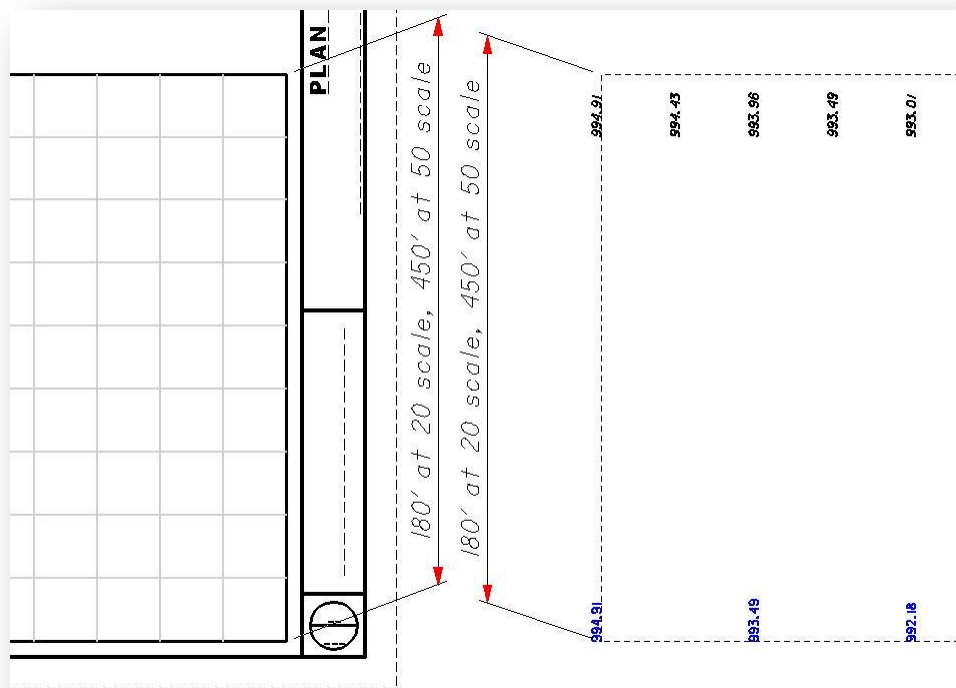
Using Frame Annotation 1 and Frame Annotation 2

The configuration of **Frame Annotation 1** and **Frame Annotation 2** appears to be identical until the profile elevations are placed in the design file. Each annotation option has been configured to place a row of existing profile elevations and a row of proposed profile elevations beneath the profile cell with different spacing as detailed below.

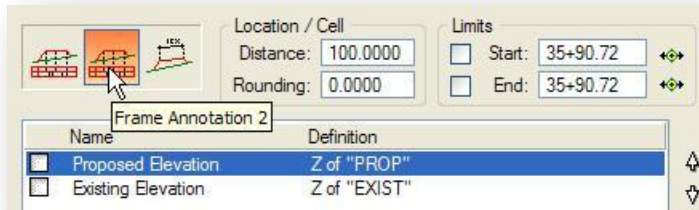
When **Frame Annotation 1** is selected, the **Row Definition** portion of the *Define Profile Tabular Data* dialog appears as shown below.



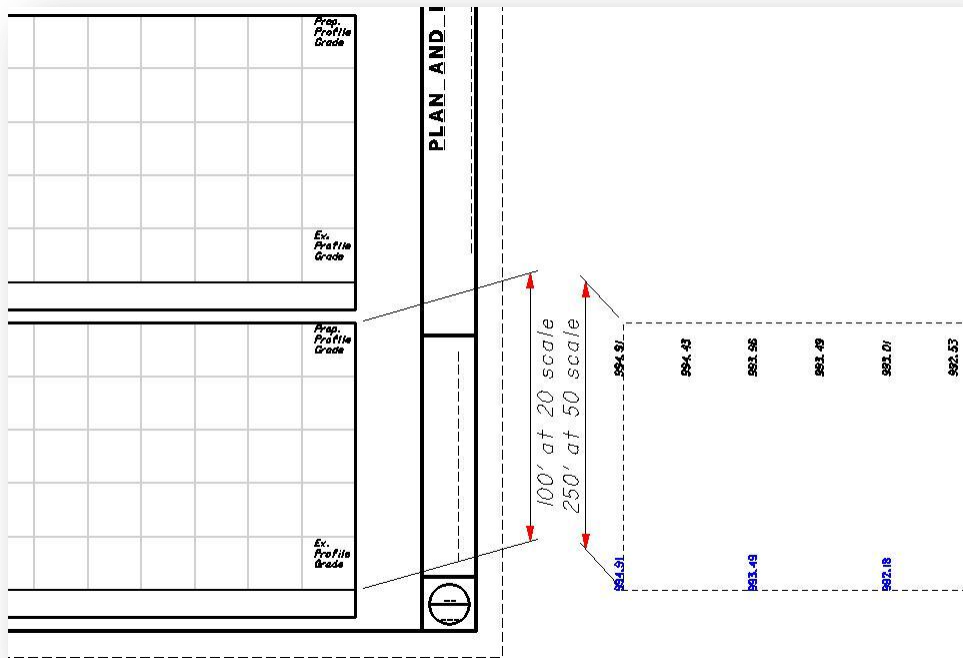
The elevations are placed in the design file with spacing appropriate for use with the ODOT standard plan and profile sheet cells PLPRO1, PLPRS1, or PROF2.



When **Frame Annotation 2** is selected, the **Row Definition** portion of the *Define Profile Tabular Data* dialog appears as shown below.



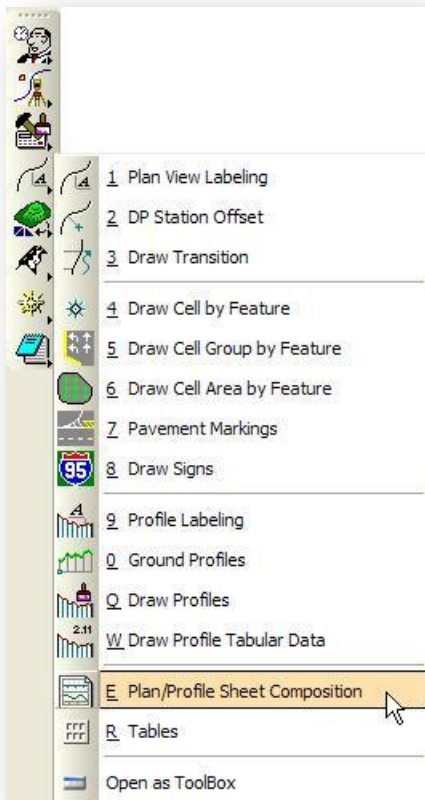
Notice that the **Proposed Elevation** and **Existing Elevation** items for **Frame Annotation 2** are toggled off by default as shown above. Be sure to toggle off the **Proposed Elevation** and **Existing Elevation** for **Frame Annotation 1**, then toggle on the **Proposed Elevation** and **Existing Elevation** for **Frame Annotation 2**. The elevations are placed in the design file with spacing appropriate for use with the ODOT standard plan and profile sheet cell PLPRO3 as shown below



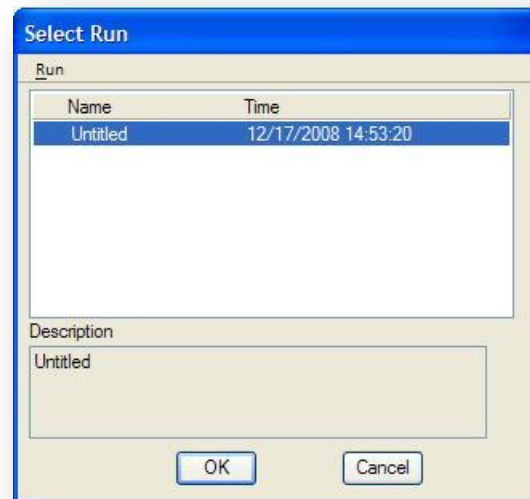
A second preference file, `profile_elevations2.cch`, is available to set the spacing of the profile elevations appropriately for a profile only sheet using the standard sheet cell PROF3.

9.6 The Plan Sheet Layout Dialog

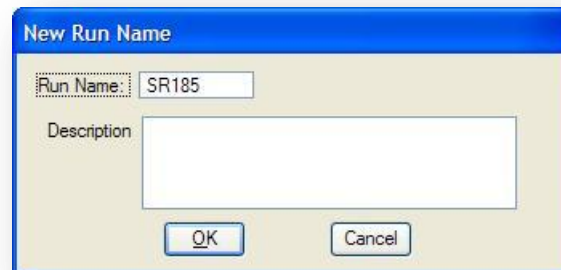
To access the plan and profile sheet function select **Applications > Road > Plans Preparation > Plan/Profile Sheet Composition** from the MicroStation menu bar or select the plan and profile sheet icon from the *Road* tool palette, as shown below. You can also select the **Plan & Profile Sheets** icon from the *Road Project* dialog box.



The *Select Run* dialog shown below will open.



By default, a run named *Untitled* is always created. To create new "run", select **Run > New...** from the *Select Run* dialog box to access the *New Run Name* dialog box shown below.



Key-in the **Run Name** and **Description** for the new run. Select **OK** to create the new run. The new run name will appear in the *Select Run* dialog box.

Select the new run from the list box and then pick **OK** to open the new run. The GEOPAK *Plan Sheet Layout* dialog appears as shown below.



The name of the current sheet library (ODOT.psl) is displayed in the title bar as shown above. A row of icons is available to access the dialog boxes listed below. The corresponding menu access selections are noted in parenthesis.

 **Sheet Composition (Tools > Sheet Composition)**

 **Layout Sheets (Tools > Sheet Layout)**

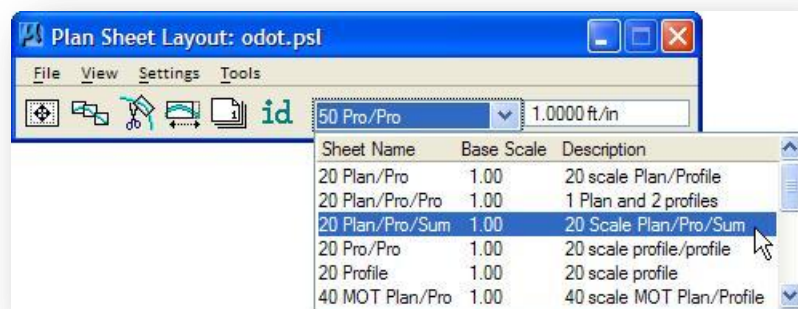
 **Clip Sheets (Tools > Sheet Clip)**

 **Modify Sheets (Tools > Modify)**

 **Sheet Number Manager (Tools > Sheet Number Manager)**

 **ID (Tools > Identify Sheet)**

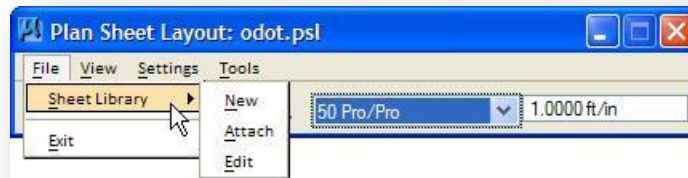
To the right of the icons is the **Sheet Name** list box. This list box contains a list of the sheet types that are configured in the currently selected sheet library. The example below shows a partial listing of the sheet types that are available in ODOT.psl.



The key in field to the right of the dialog is used to specify the scale for the completed sheets.

9.6.1 File Menu

The **File** menu has the following functions:



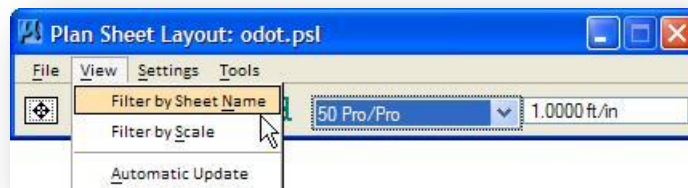
Sheet Library

This menu item contains commands to create, attach, and edit sheet libraries. For a detailed discussion of setting up a sheet library, see the GEOPAK online documentation.

Exit

This menu item exits the GEOPAK *Plan Sheet Layout* dialog

9.6.2 View Menu



After clipping borders have been drawn into the MicroStation file, the **View** menu options can be used to control which sets of clipping borders are displayed on screen. The **View** menu has the following functions:

Filter by Sheet Name

The clipping shapes of the currently selected sheet name are displayed. A MicroStation update view must 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 must be issued if **Automatic Update** is not toggled on. **NOTE: Filter By Sheet Name and Filter By Scale** can be used together.

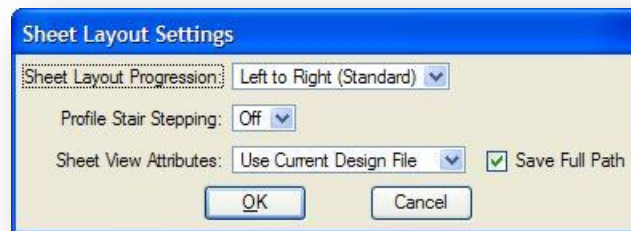
Automatic Update

If this option is toggled on when **Filter By Sheet Name** or **Filter By Scale** is selected, the view is automatically updated.

9.6.3 Settings Menu



When the **Settings > Sheet Layout** option is selected, the *Sheet Layout Settings* dialog shown below opens.



The *Sheet Layout Settings* dialog has the following options:

Sheet Layout Progression

Two options are available: **Left to Right (Standard)** or **Right to Left (Rail)**.

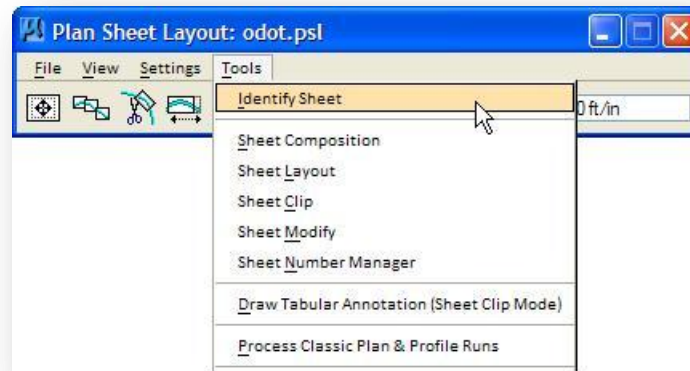
Profile Stair Stepping

Profile stair stepping can be turned either **On** or **Off**.

Sheet View Attributes

Two options are available, **Use Current Design File** and **Customize with Motif Files**.

9.6.4 Tools Menu



The **Tools** menu has the following functions:

Identify Sheet

Select **Identify Sheet**, then select and accept a previously placed clipping shape. GEOPAK determines the settings used to place the original sheet clipping border and automatically populates the dialog settings with the **Sheet Name** and **Scale**. In addition, the **Sheet Name**, **Scale**, **Sheet Number** and **Port** are displayed in the MicroStation prompt field at the bottom of the screen. If the parameters for the selected sheet are not found within the current library, a warning message is displayed indicating the sheet is not found

Sheet Composition

This menu item opens the *Sheet Composition* dialog. See section 9.7.5 for information on this dialog.

Sheet Layout

This menu item opens the *Layout Sheets* dialog. See section 9.7.6 for information on this dialog.

Sheet Clip

This menu item opens the *Clip Sheets* dialog. See section 9.7.7 for information on this dialog.

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 with the tools in the *Modify* dialog, which is detailed in section 9.9.

Sheet Number Manager

The *Sheet Number Manager* dialog is detailed in section 9.10.

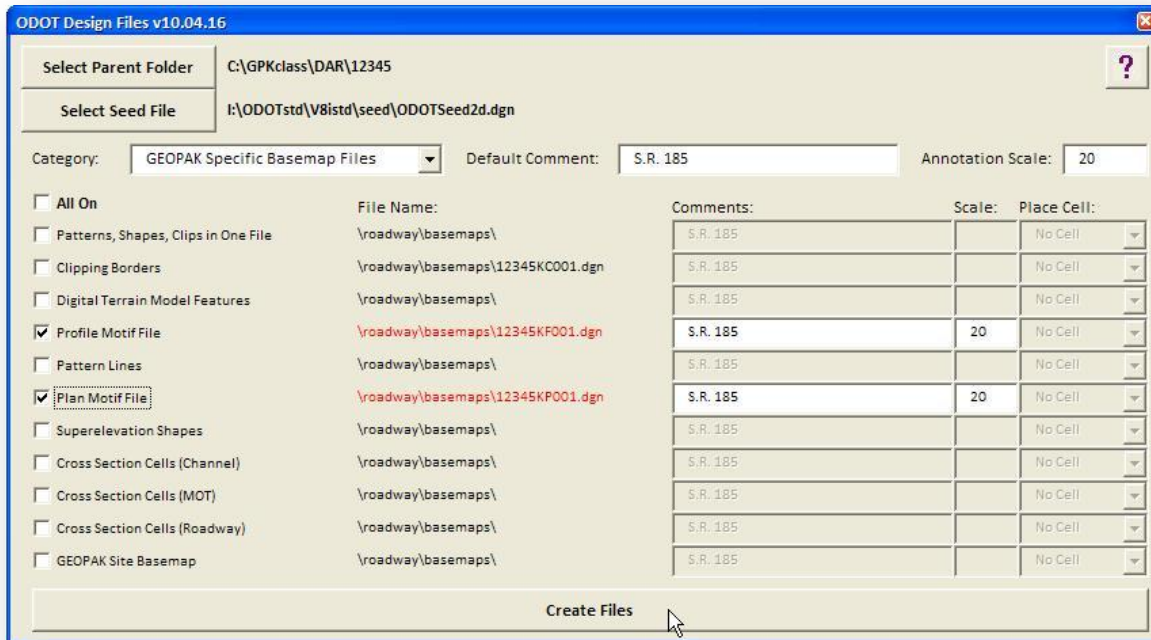
Draw Tabular Annotation (Sheet Clip Mode)

This option is used to draw tabular annotation into clipping shapes which have been previously placed in the DGN file. This option will not be detailed in this training guide.

9.7 Process Sheets: Customize With Motif Files

As stated previously, **Motif Files** are empty MicroStation design files with reference files attached, and are used to designate which reference files will be attached to each **Port** on the completed sheets. Before processing the sheets, the user must create the Motif Files that will be used during the sheet run. The ODOT_Files application can be used to create the Motif Files. The application is accessed from the MicroStation pull-down menu by selection **ODOT > File Management > New Design File**.

The Motif files can be created as shown in the example below:



Toggle the **Category** to **GEOPAK Specific Basemap Files**. Note the folder where the files are created, and the file names.

9.7.1 Configuring the Plan Motif File

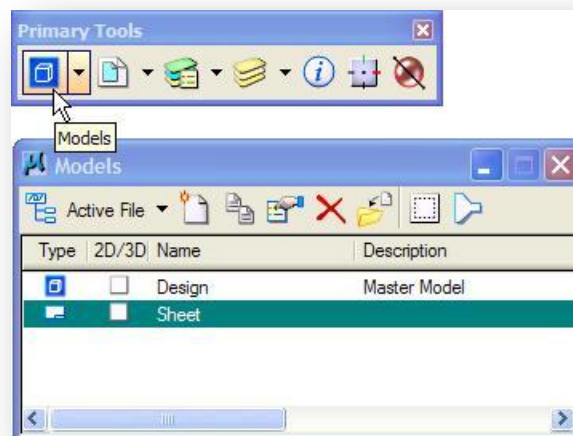
The plan view motif file is used to specify which reference files will be attached to the Plan Port of the completed plan and profile sheets.

Section 303 of the ODOT CADD Engineering Standards Manual specifies that all plan sheets are to be placed in the Sheet Model of the sheet design file. The GEOPAK Clip Sheets application does not give you the opportunity to specify whether the completed sheets will be placed in a Sheet Model or a Design Model in the newly created sheet files.

When using the **Customize with Motif Files** option, the motif file assigned to Port 1 (the plan port in most cases) is used as the seed file for the newly created plan and profile sheet design files. In order to ensure that the completed plan and profile sheets are placed in a Sheet Model, be sure to make all reference attachments in the motif file that is assigned to Port 1 in a Sheet Model.

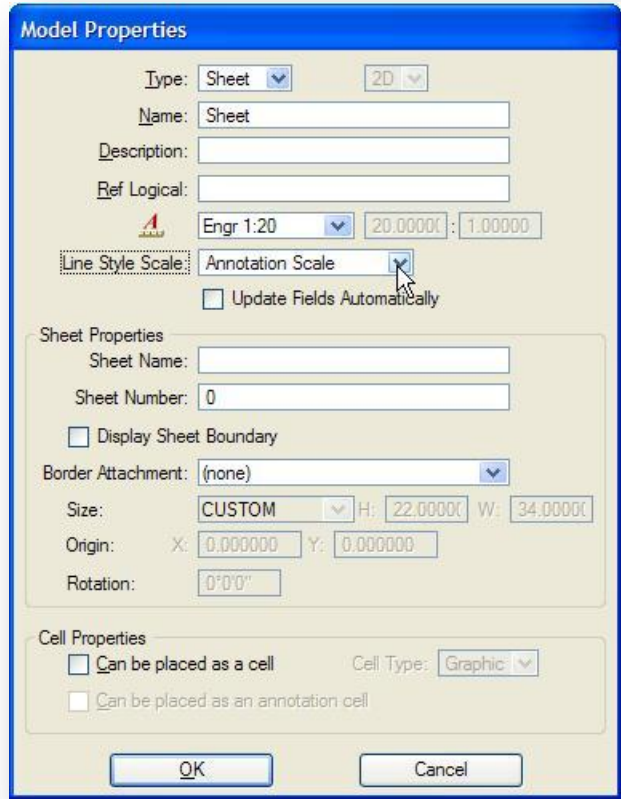
Take the following steps to configure the plan motif file:

- ✓ Open the plan view motif design file.
- ✓ In order for the GEOPAK Clip Sheets application to place the completed plan sheets in a sheet model, select the **Sheet** model as the active model as shown below:



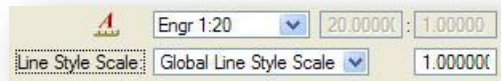
Design files created using ODOT's seed files will contain two models as shown above. To select the active Model within MicroStation, open the Models dialog as shown above and then double click the name of the desired Model.

- ✓ Edit the model properties to set the **Annotation Scale** for the custom line styles. From the *Models* dialog shown above, select **Edit Model Properties** to access the dialog shown below,

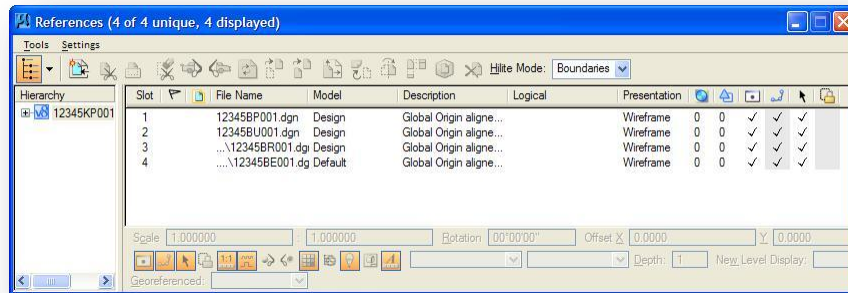


For a typical ODOT design project using MicroStation V8i, the **Line Style Scale** parameter should be set to **Annotation Scale** as shown above.

If the custom line styles have been placed with a specify plotting scale in mind, the option should be set to **Global Line Style Scale** with a value of 1.0 as shown below.

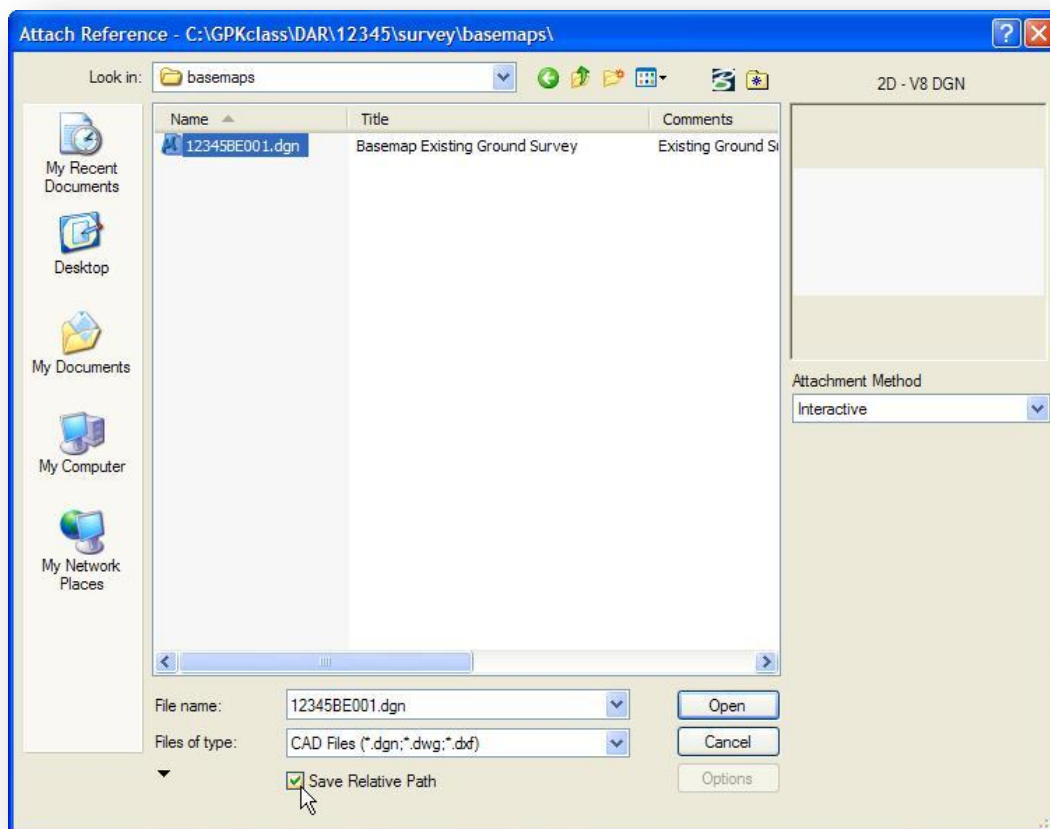


- ✓ Attach the reference files that will be used for the plan port of each sheet. In this example, four references are attached as shown below.



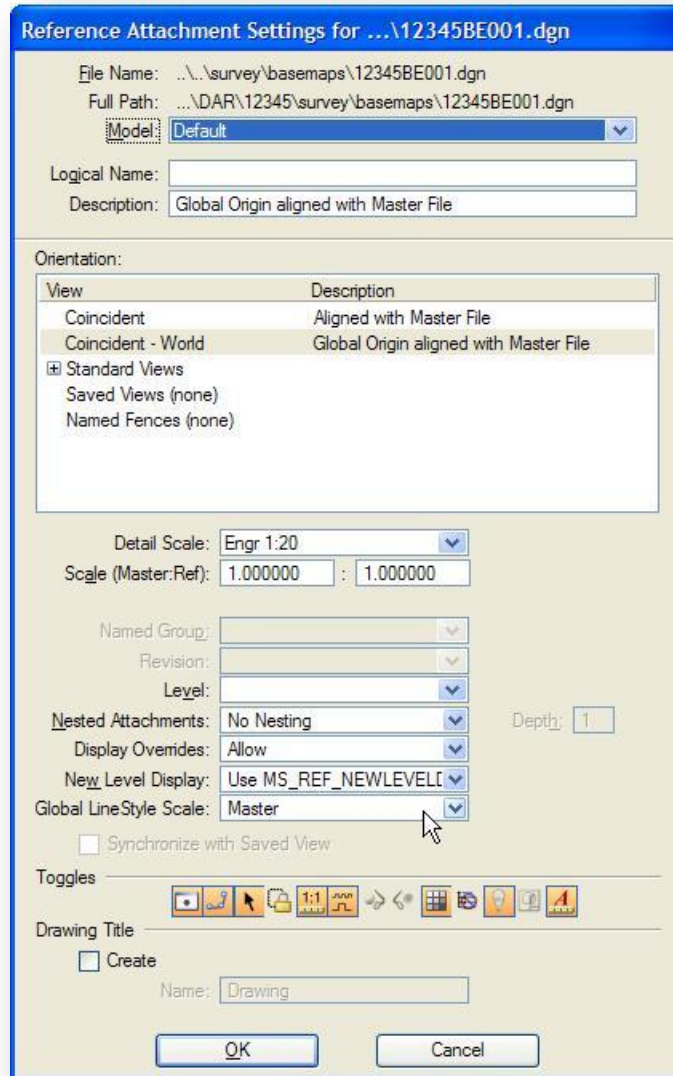
There are numerous parameters to be aware of when attaching references. Two parameters of particular note are mentioned below:

1. Be sure to use the MicroStation option to **Save Relative Path** when attaching all reference files as shown below.



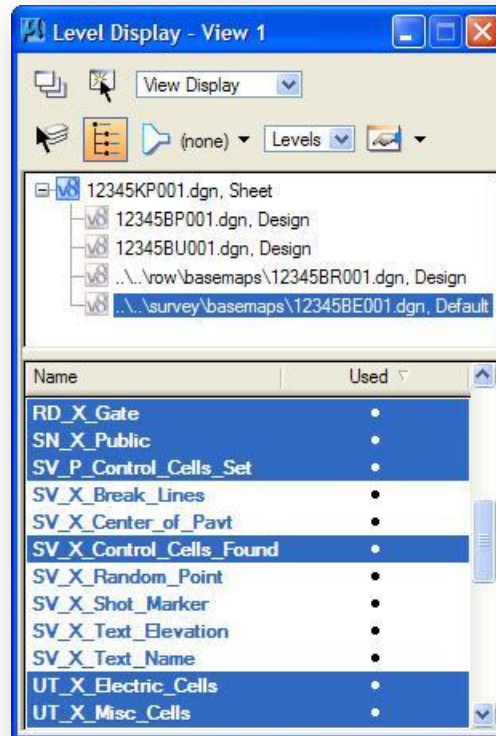
2. On the *Reference Attachment Settings* dialog, shown on the following page, the **Global LineStyle Scale** option is used to set whether the line styles in the reference attachment are scaled using the original value in the reference file, or using the active Model Annotation Scale of the completed sheet file.

Set the **Global LineStyle Scale** option to **Master** as shown on the following page for projects where the survey data was mapped at a scale of 1.0.



- ✓ After the references have been attached, turn on/off the levels that you want turned on/off in the completed sheets for each reference attachment. Use the MicroStation Level Display dialog to accomplish this task.

An example turning on/off the desired levels for the Survey basemap is shown below.

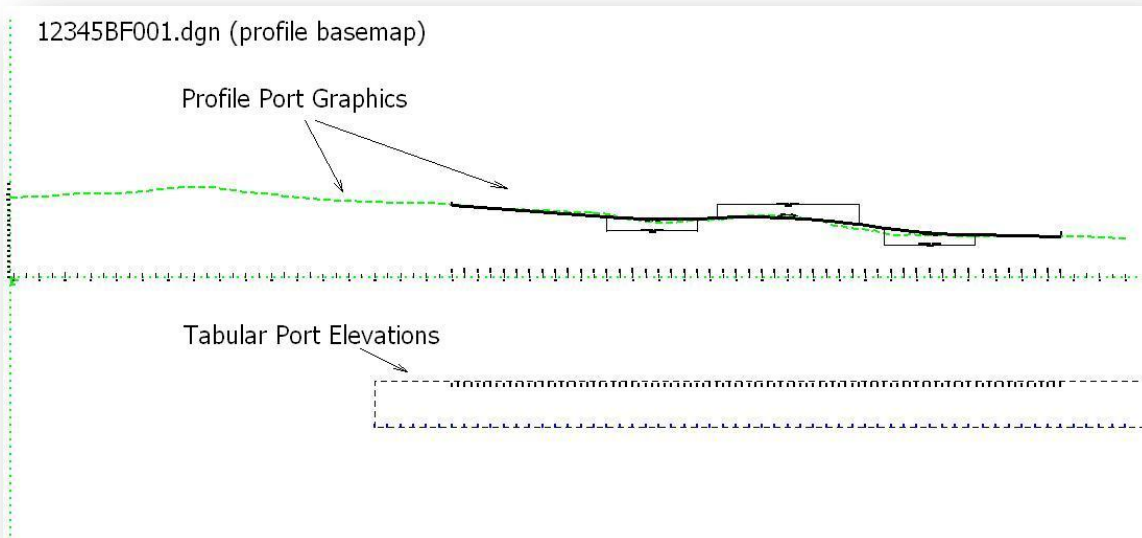


- ✓ From the MicroStation pull-down menu, **Select File > Save Settings.**

The plan motif file is now configured and ready for use.

9.7.2 Configuring the Profile and Tabular Motif File

The profile basemap 12345BF001.dgn contains the graphics for both the profile port and the tabular port as shown below.



Since all the graphics for the profile and tabular port are contained in one design file, the profile motif file is used to specify which reference files will be attached to both the profile port and the tabular port on the completed plan sheets.

The steps to prepare the profile motif file are similar to the steps to prepare the plan motif file and are briefly summarized below. Take the following steps to configure the profile motif file:

- ✓ Open the profile view motif design file, 12345KF001.dgn.
- ✓ Select the Sheet Model as the active model to attach the references.
- ✓ Attach the reference file that will be used for the profile and tabular port of each sheet. In most cases, the profile design file will be attached once for both the profile and tabular ports.
- ✓ Turn on/off the levels that you want to see in the completed sheets. Use the MicroStation Level Display dialog to accomplish this task.
- ✓ From the MicroStation pull-down menu, **Select File > Save Settings**.

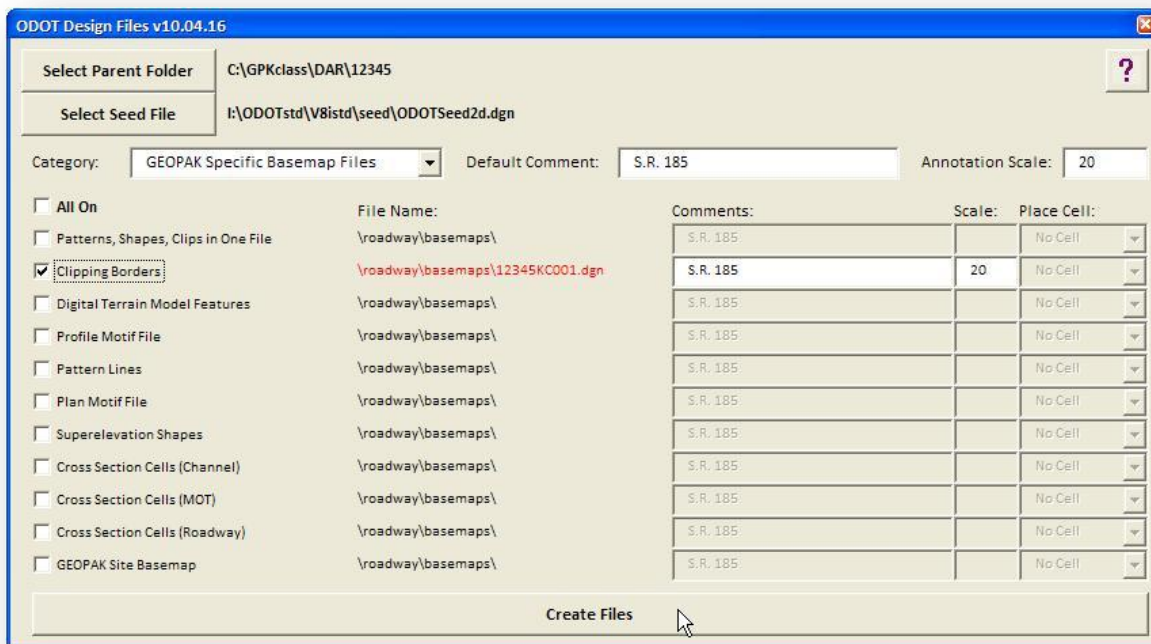
The profile motif file is now configured and ready for use.

9.7.3 Sheet Clipping Borders

GEOPAK places clipping borders in a MicroStation design file to designate the areas that will be clipped into each part of the completed plan and profile sheets. We recommend creating a separate design file to house the clipping borders.

The ODOT_Files application can be used to create the clipping border design file. The application is accessed by selecting **ODOT > File Management > New Design File** from the MicroStation pull-down menu.

The file can be created as shown below:



Note: When using the **Customize with Motif Files** option, the clipping sheet border file is used only to house the clipping borders. It is not necessary to attach any references to the clipping sheet border design file.

9.7.4 Plan Sheet Layout: Settings

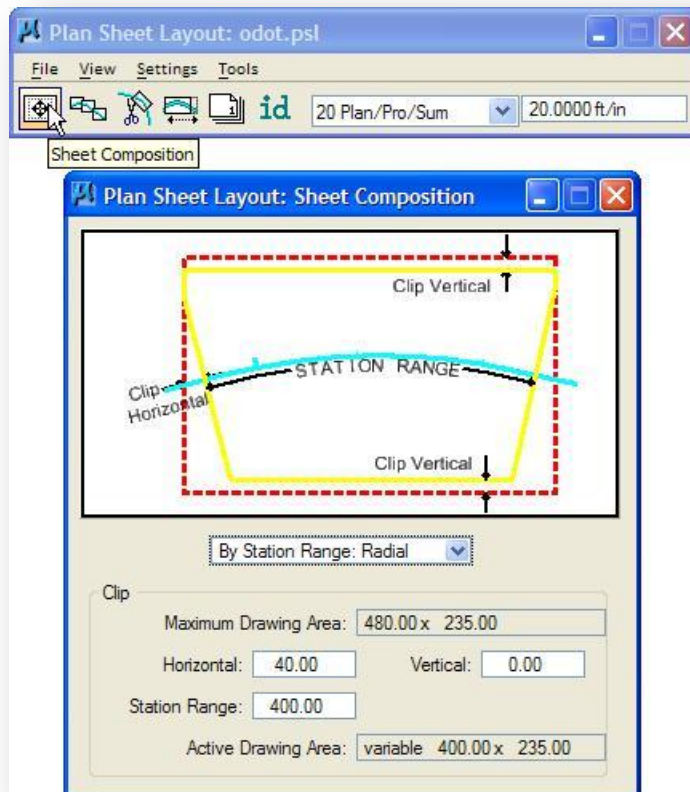
After creating a new sheet Run as detailed in section 9.6, select **Settings > Sheet Layout** from the *Plan Sheet Layout* dialog to access the *Sheet Layout Settings* dialog shown below.



Toggle the **Sheet View Attributes** option to **Customize with Motif Files** as shown above.

9.7.5 Plan Sheet Layout: Sheet Composition

Select the **Sheet Composition** icon to access the *Plan Sheet Layout: Sheet Composition* dialog shown below.



This dialog is used to configure how the clipping borders will be placed for the plan view. Four options are available in the center of the dialog to select how the sheets will be clipped. Each of these options is detailed in the GEOPAK on-line help. The ODOT sheet library has been configured to work specifically with the **By Station Range: Radial** method as shown at left.

We will limit our discussion to the **By Station Range: Radial** option and how to generate sheets in accordance with ODOT Standards using this option.

By Station Range: Radial

The **By Station Range: Radial** option will allow the user to specify how many feet will be placed on each sheet. This interval is entered in the **Station Range** field.

Station Range

The Station Range key-in is used to specify the horizontal length of plan and profile to be placed on each sheet.

IMPORTANT! The ODOT configured sheet library has been configured to work with the Station Range lengths listed in the table below.

Sheet Name	Scale	Description	Station Range				Sheet Cell
			20 Scale	30 Scale*	40 Scale*	50 Scale	
20 Plan/Pro	20	Plan and profile - no summary	500	-NA-	-NA-	-NA-	PLPRO1
20 Plan/Pro/Pro	20	Plan and two profiles	500	-NA-	-NA-	-NA-	PLPRO3
20 Plan/Pro/Sum	20	Plan, profile, summary	400	-NA-	-NA-	-NA-	PLPRS1
20 Pro/Pro	20	Two profile views on one sheet	500	-NA-	-NA-	-NA-	PROF2
20 Profile	20	Profile view only	500	-NA-	-NA-	-NA-	PROF3
40 MOT Plan/Pro	40	40 Scale MOT plan and profile	-NA-	-NA-	1000	-NA-	PLPRO1
40 MOT Plan/Pro/Sum	40	40 Scale MOT plan, profile, sum	-NA-	-NA-	800	-NA-	PLPRS1
50 Plan/Pro	50	Plan and profile - no summary	-NA-	-NA-	-NA-	1250	PLPRO1
50 Plan/Pro/Pro	50	Plan and two profiles	-NA-	-NA-	-NA-	1250	PLPRO3
50 Plan/Pro/Sum	50	Plan, profile, summary	-NA-	-NA-	-NA-	1000	PLPRS1
50 Pro/Pro	50	Two profile views on one sheet	-NA-	-NA-	-NA-	1250	PROF2
50 Profile	50	Profile view only	-NA-	-NA-	-NA-	1250	PROF3
Plan	Any	Plan view only	500	750	1000	1250	BLKW
Plan/Plan	Any	Two plan views on one sheet	500	-NA-	-NA-	1250	BLKW
Plan/Summary	Any	Plan view with summary	400	-NA-	-NA-	1000	PLPRS3

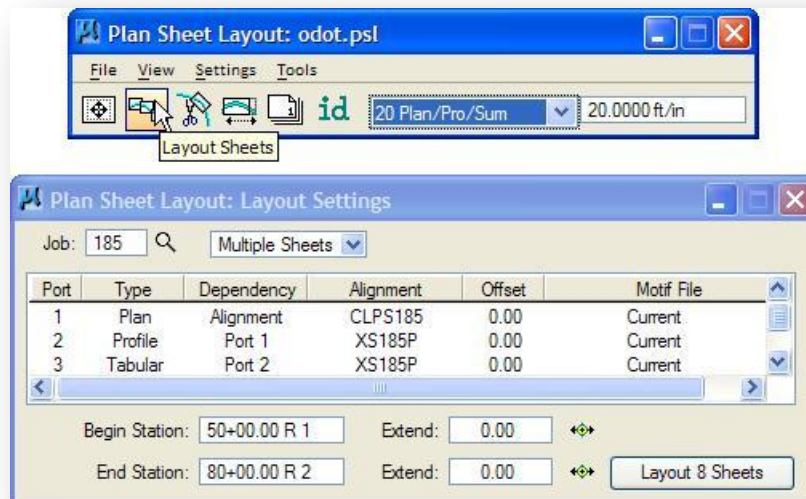
***Important Notes Regarding 30 and 40 Scale Sheets:**

Acceptable scales for Plan and Profile sheets are defined in section 1300 of the Location and Design Manual Volume 3 Highway Plans. The options for 30 and 40 scale sheets are intended for use on Maintenance of Traffic (MOT) plans ONLY. The following guidelines apply:

- 30 scale sheets can be used for MOT plan sheets when a temporary road profile is not shown.
- 20, 40, or 50 scale sheets can be used for MOT plan sheets that include a temporary road profile.
- 30 and 40 scale sheets are never acceptable for use on sheets other than MOT sheets.

9.7.6 Plan Sheet Layout: Layout Sheets

Select the **Layout Sheets** icon to access the *Plan Sheet Layout: Layout Settings* dialog shown below.

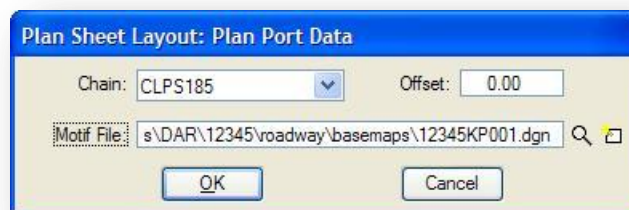


Specify the **Job** number for the GEOPAK COGO Database where the chains and profiles are stored that will be used to lay out the clipping borders.

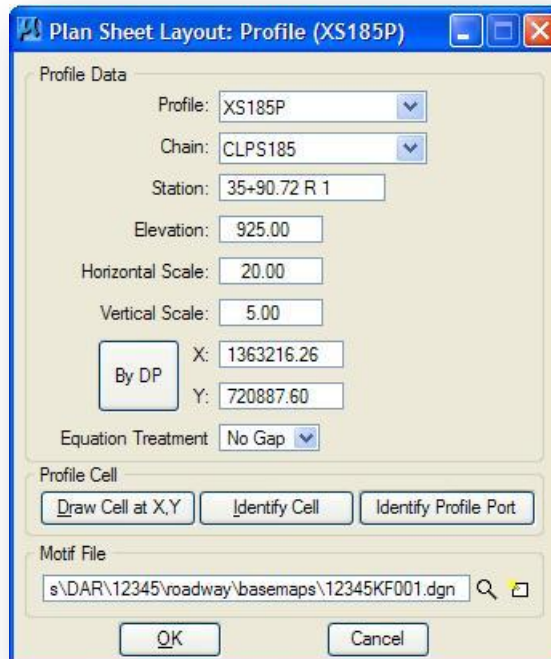
An option button is provided to select whether to process **Multiple Sheets** or a **Single Sheet**.

The center of the dialog lists the ports that have been configured for the selected plan and profile sheet type. Each **Port** must be assigned an **Alignment** and a **Motif File**.

- ✓ Double-click the **Plan** port line in the dialog to access the *Plan Sheet Layout: Plan Port Data* dialog shown below.



- ✓ Select the **Chain** that will be used to layout the plan view clipping shapes. An optional **Offset** can be specified.
- ✓ Select the file you have configured for use as the plan view **Motif File**.
- ✓ Select **OK** to accept the dialog settings.
- ✓ Double-click on the **Profile** port line in the dialog to access the *Plan Sheet Layout: Profile* dialog shown below.



The **Profile Data** portion of the dialog is used to specify the information for the profile origin in the design file. This data is read from the current **Working Alignment**.

- ✓ Select the **Profile** that will be used to layout the profile clipping borders. In many cases, this will be the existing profile.
- ✓ Select the file you have configured for use as the profile view **Motif File**.

The **Profile Cell** portion of the dialog provides the following options:

Draw Cell at X,Y

Use this option to draw a profile cell in the current design file using the current Profile data.

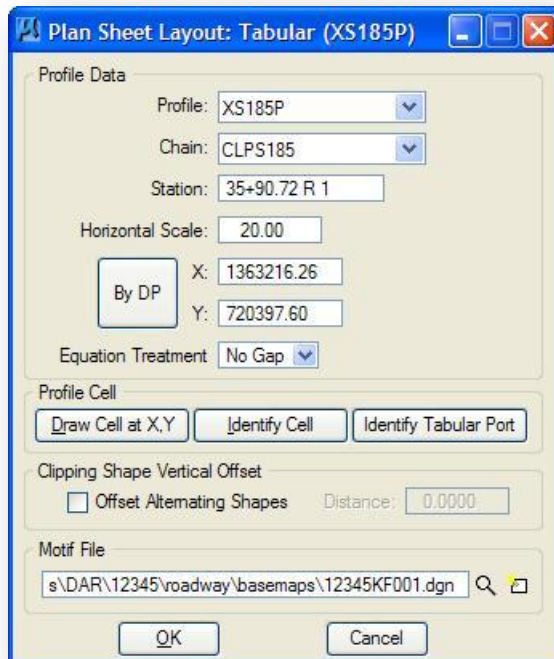
Identify Cell

Use this option to set the Profile Data settings to match the values of a cell previously drawn in the design file.

Identify Profile Port

Use this option to set the Profile Data settings to match the values of a previously drawn profile port clipping shape.

- ✓ Select **OK** to accept the dialog settings.
- ✓ Double-click on the **Tabular** port line in the *Plan Sheet Layout: Layout Settings* dialog to access the *Plan Sheet Layout: Tabular* dialog shown below.



The **Profile Data** is read from the current **Working Alignment**.

- ✓ Select the **Profile** that will be used to layout the profile clipping borders. In many cases, this will be the existing profile.
- ✓ Select the file you have configured for use as the profile view **Motif File**.

The **Profile Cell** portion of the dialog provides the following options:

Draw Cell at X,Y

Use this option to draw a profile cell in the current design file using the current Profile data.

Identify Cell

Use this option to set the **Profile Data** settings to match the values of a cell previously drawn in the design file.

Identify Profile Port

Use this option to set the **Profile Data** settings to match the values of a previously drawn profile port clipping shape.

The **Clipping Shape Vertical Offset** is not used for ODOT plan and profile sheets. See the GEOPAK online documentation for information on this option.

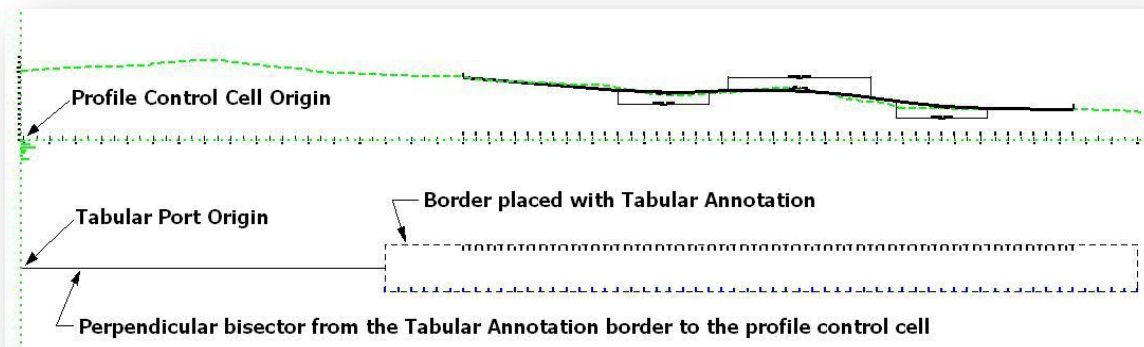
Assigning the Origin for the Tabular Data Port

The origin of the Tabular Data port will need to be assigned based on the location where the tabular data is plotted in the design file relative to the profile cell. As detailed previously, the tabular data is placed below the profile cell when using the ODOT preference file `profile_elevations.cch`. We have elected to place the tabular data that will be used for the tabular port below the profile for the following reasons:

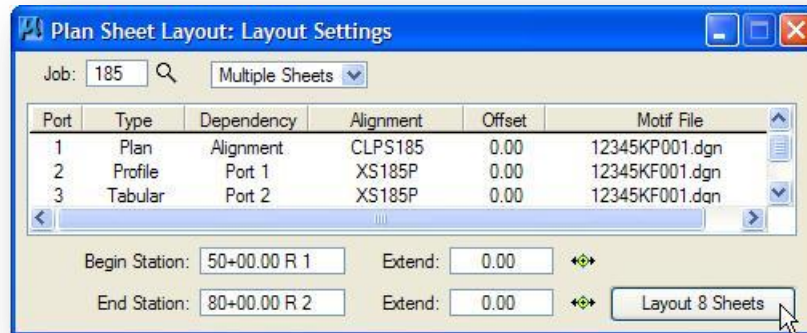
- This is the only way to ensure that the tabular ports will not overlap the profile, the profile cell, or station text. The idea is to have nothing drawn in the tabular ports except the profile elevations.
- Since the profile ports will typically be stair-stepped to follow the profile (unless your profile is very flat) it would be time consuming for the user to move the elevations so that they fall within the limits of the profile ports.

Take the following steps to assign the origin for the tabular port to ensure that it lines up with the plotted tabular annotation:

- ✓ Draw a perpendicular line that bisects the left side of the tabular annotation border to intersect the profile cell as shown below.
- ✓ From the *GEOPAK Sheet Layout: Tabular* dialog, select the **Identify Cell** button and identify the profile cell. This will ensure that the proper values for the **Profile, Chain, Station, Horizontal Scale, and Equation Treatment** are read into the dialog from the identified profile cell.
- ✓ The **X** and **Y** values read from the profile cell in the step above need to be adjusted to correspond to the correct **X** and **Y** origin for the tabular annotation. Select the **By DP** button and snap to the new origin for the tabular port at the intersection of the bisector line drawn in step one and the profile cell, as shown in the example below.



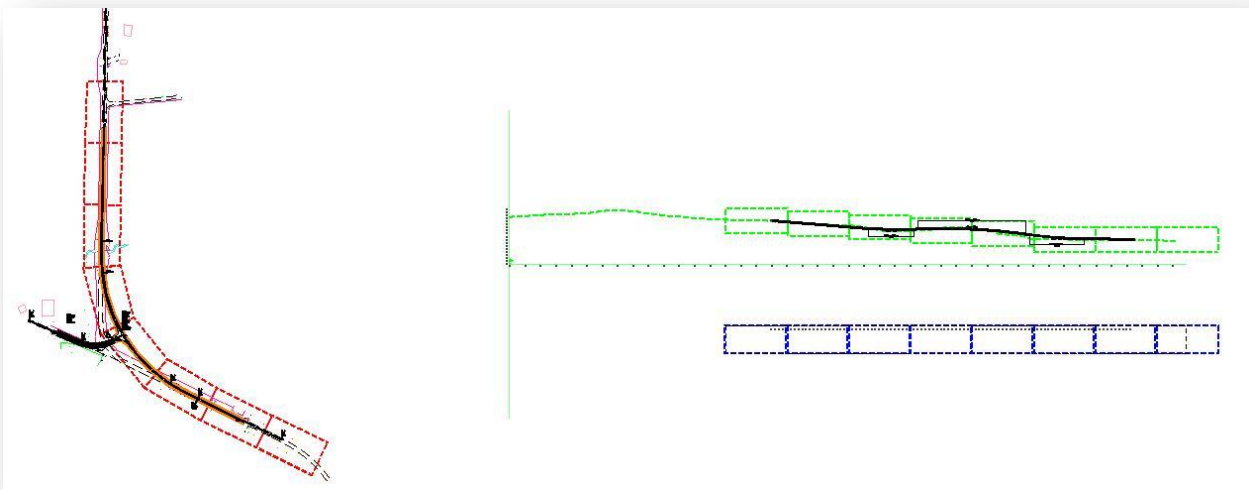
After the plan, profile, and tabular port information has been defined the information will be included in the Layout Sheets dialog as shown below.



After the port data is complete, the user has an option to layout sheet clipping borders for all or part of an alignment or profile. When the alignment or profile is defined within the port data dialogs, the **Begin Station** and **End Station** range is automatically populated. This stationing is used as the default, but can be adjusted by the user as desired. The **Extend** fields can be used to specify a starting and ending station outside the limits of the alignment.

Select the **Layout Sheets** button to initiate placement of the sheet clipping borders. **Note:** the **Layout Sheets** button specifies the approximate number of sheets that will be generated.

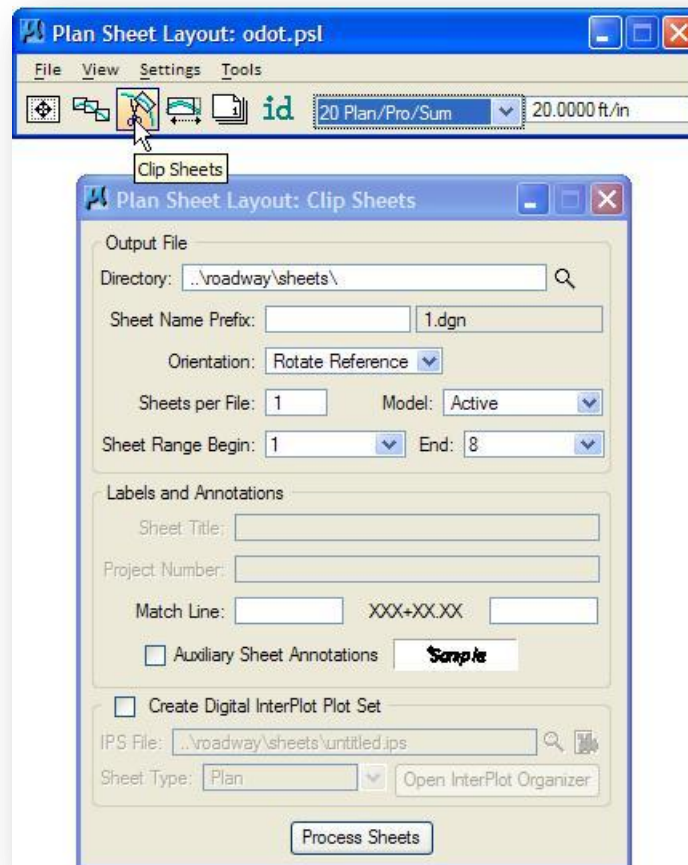
After the **Layout sheet** button is selected, the clipping borders are placed in the active model in the current design file. An example is shown below.



Note: When using the **Customize with Motif Files** option, the clip border design file does not need to have any other elements drawn in the file, or any reference attachments. The example above is shown with the plan and profile basemap design files attached as references for the purpose of showing how the clip borders are aligned in relation to the plan and profile design files

9.7.7 Plan Sheet Layout: Clip Sheets

Select the **Clip Sheets** icon to access the dialog shown below.



The **Directory** specifies the drive and path for the directory where the new design files containing the sheets will be created. The path and name can be input manually or selected via the **Sheet Output Directory** icon.

The **Sheet Name Prefix** identifies the root name for the initial file. Additional files are named by adding the sheet number to the end of the prefix. The default extension is .dgn. In the example above, 12345GP01.dgn would be the name of the initial file. The second file would be 12345GP02.dgn, the third 12345GP03.dgn, etc. **Note:** If the entire file name is given, the default extension is not used.

There are two options for rotating sheets: **Rotate View** and **Rotate Reference**. Each option is described below.

Rotate View

The **Rotate View** option will attach all reference files and then rotate the MicroStation view to conform to the sheet orientation. The reference file attachments are not rotated. In this case, the integrity of the original coordinates and angles of the master and reference files will remain intact. With Rotate View selected, the Sheets per File option is ghosted as only one sheet per file can be placed to maintain coordinate integrity.

Rotate Reference

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 the correct location with respect to the sheet cell. This arrangement allows multiple sheets to be placed in one design file. The user specifies the number of sheets per file via the Sheets per File key-in field.

TIP:

Use the Rotate View option for ODOT projects.

The **Sheet Range** defaults to the entire sheet range, however, the user may generate a partial set by selecting the **Begin** and **End** number of the sheet range from the list.

The **Labels** and **Annotations** group box contains fields for annotating the **Sheet Title**, **Project Number**, and **Match Line**. Each is described below.

Sheet Title

The ODOT standard sheet library, ODOT.psl, has not been configured to allow the placement of a **Sheet Title** on the completed sheets.

Project Number

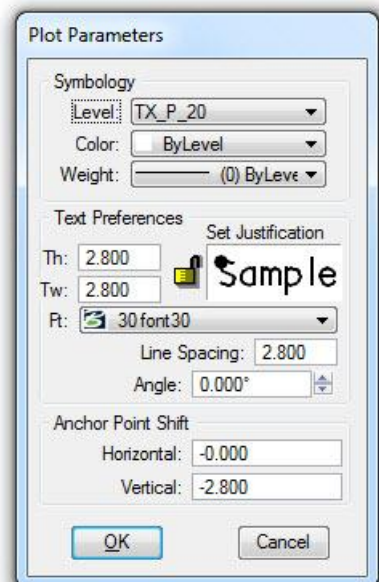
The **Project Number** will be placed in the title block of each sheet as shown in the example at right. Note that the sheet number is automatically placed.

Match Line

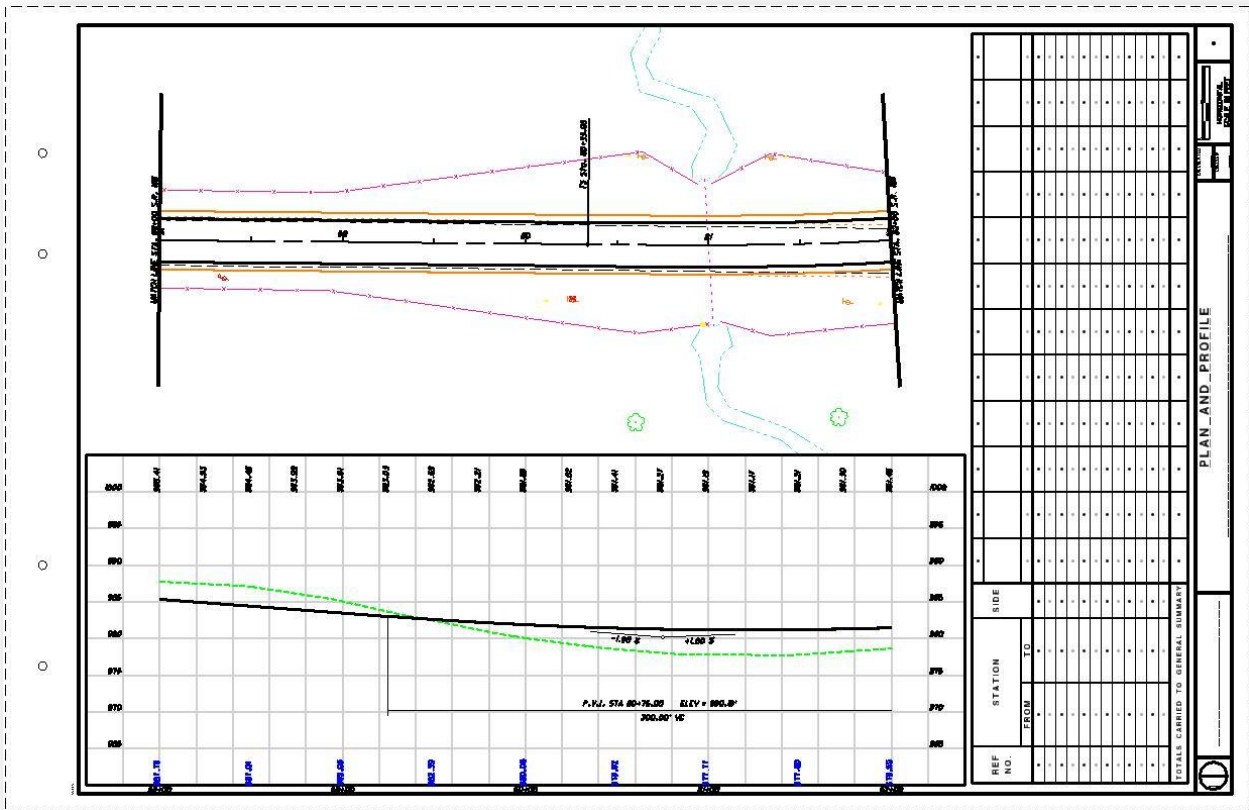
If desired, key in the text that you wish to appear before and after the station number on the match lines.

Auxiliary Sheet Annotations

Toggle on the **Auxiliary Sheet Annotations** option to place a label at the lower left of each sheet. The label contains the sheet number, rotation angle, and the alignment name. The rotation angle can be used to properly orient the north arrow on the sheet. Double-click the symbology box to the right of the toggle to access the *Plot Parameters* dialog at right.



Select **Process Sheets** to initiate creation of the plan and profile sheets. An example of a completed sheet is shown below.



9.8 Processing Sheets: Use Current Design File

The process to clip sheets with the Use Current Design File option is similar to the process using motif files. The biggest difference is that Motif files are not used to specify the reference attachments for the plan, profile, and tabular ports. The references that are attached to the design file containing the clipping borders will be attached to each port in the completed sheets.

The procedure to clip sheets using the Current Design File option is described below.

9.8.1 Configuring the Clipping Border Design File

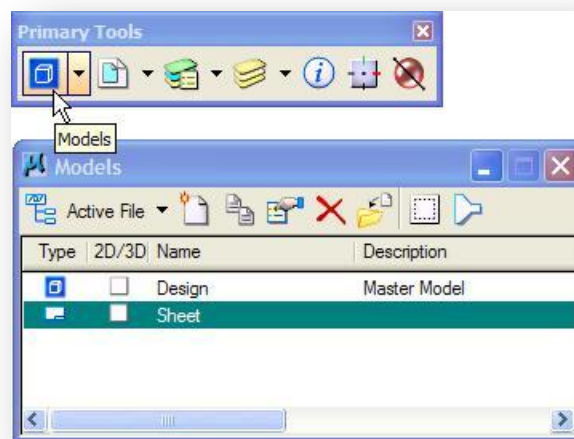
Create a new design file to house the clipping borders as described in section 9.4.

Section 303 of the [ODOT CADD Engineering Standards Manual](#) specifies that all plan sheets are to be placed in the Sheet Model of the sheet design file. The GEOPAK Clip Sheets application does not give you the opportunity to specify whether the completed sheets will be placed in a Sheet Model or a Design Model in the newly created sheet files.

The clipping border design file is used as the seed file for the new sheet design files. Be sure to select the Sheet Model as the active model in the clipping border design file.

Take the following steps to configure the clipping border design file:

- ✓ Open the clipping border design file.
- ✓ In order for the GEOPAK Clip Sheets application to place the completed plan sheets in a sheet model, select the **Sheet** model as the active model as shown below:



Design files created using ODOT's seed files will contain two models as shown above. To select the active Model within MicroStation, open the Models dialog as shown above and then double click the name of the desired Model.

- ✓ Edit the model properties to set the **Annotation Scale** for the custom line styles. From the *Models* dialog shown above, select **Edit Model Properties** to access the dialog shown below,

The screenshot shows the 'Model Properties' dialog box with the following settings:

- Type: Sheet (dropdown), 2D (dropdown)
- Name: Sheet (text field)
- Description: (empty text field)
- Ref Logical: (empty text field)
- Engr 1:20 (dropdown), 20.0000 (text field), 1.00000 (text field)
- Line Style Scale: Annotation Scale (dropdown)
- Update Fields Automatically
- Sheet Properties:
 - Sheet Name: (empty text field)
 - Sheet Number: 0 (text field)
 - Display Sheet Boundary
 - Border Attachment: (none) (dropdown)
 - Size: CUSTOM (dropdown), H: 22.0000 (text field), W: 34.0000 (text field)
 - Origin: X: 0.00000 (text field), Y: 0.00000 (text field)
 - Rotation: 0°0'0" (text field)
- Cell Properties:
 - Can be placed as a cell
 - Cell Type: Graphic (dropdown)
 - Can be placed as an annotation cell

Buttons: OK, Cancel

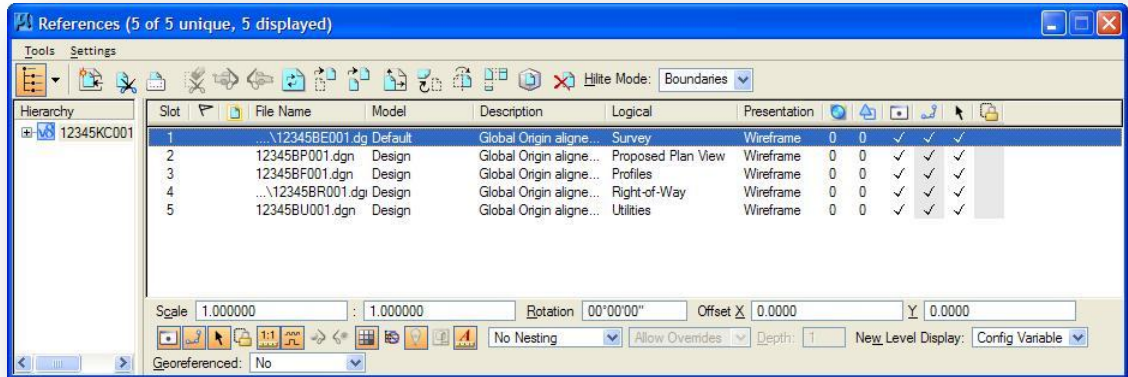
For a typical ODOT design project using MicroStation V8i, the **Line Style Scale** parameter should be set to **Annotation Scale** as shown above.

If the custom line styles have been placed with a specific plotting scale in mind, the option should be set to **Global Line Style Scale** with a value of 1.0 as shown below.

This close-up shows the 'Line Style Scale' section of the dialog box with the following settings:

- Engr 1:20 (dropdown), 20.0000 (text field), 1.00000 (text field)
- Line Style Scale: Global Line Style Scale (dropdown)
- 1.00000 (text field)

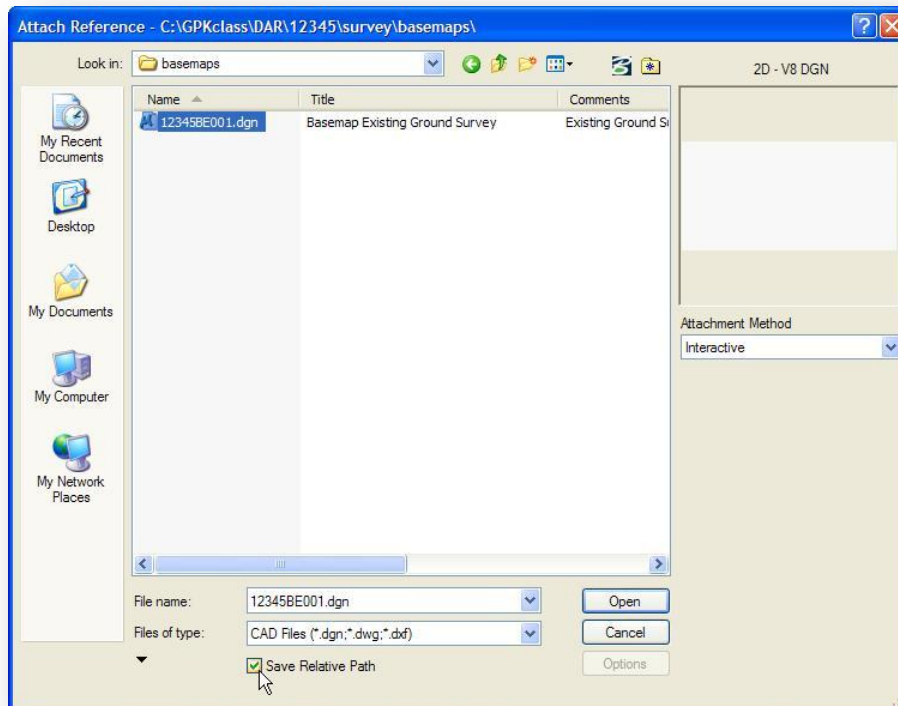
- ✓ Attach the references to the clipping border design file. In the example below, 5 references are attached.



Note that attachments for both the plan and profile view are made to the clipping border design file.

There are numerous parameters to be aware of when attaching references. Two parameters of particular note are mentioned below:

1. Be sure to use the MicroStation option to **Save Relative Path** when attaching all reference files as shown below.



2. On the *Reference Attachment Settings* dialog, the **Global LineStyle Scale** option is used to set whether the line styles in the reference attachment are scale using the original value in the reference file, or using the active Model Annotation Scale of the completed sheet file.

Set the **Global LineStyle Scale** option to **Master** as shown on the following page for projects where the survey data was mapped at a scale of 1.0.

Reference Attachment Settings for ...\12345BE001.dgn

File Name: ...\\survey\basemaps\12345BE001.dgn
Full Path: ...\\DAR\12345\survey\basemaps\12345BE001.dgn
Model: Default

Logical Name:
Description: Global Origin aligned with Master File

Orientation:

View	Description
Coincident	Aligned with Master File
Coincident - World	Global Origin aligned with Master File
Standard Views	
Saved Views (none)	
Named Fences (none)	

Detail Scale: Engr 1:20
Scale (Master:Ref): 1.000000 : 1.000000

Named Group:
Revision:
Level:
Nesting: No Nesting
Display Overrides: Allow
New Level Display: Use MS_REF_NEWLEVEL
Global LineStyle Scale: Master

Synchronize with Saved View

Depth: 1

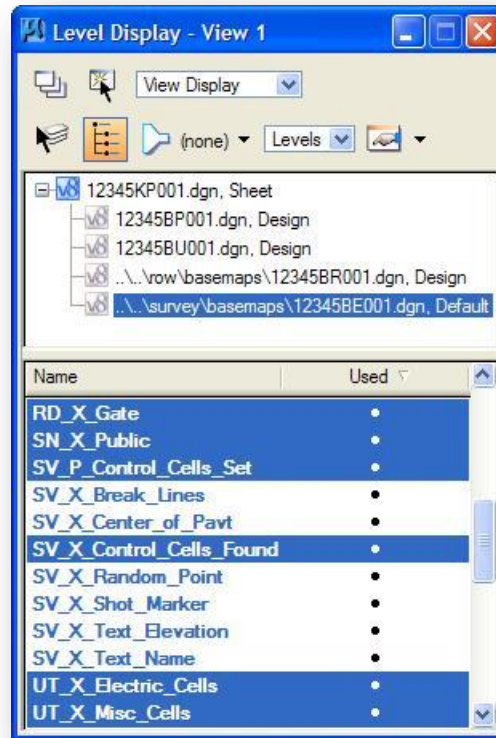
Toggles:

Drawing Title
 Create
Name: Drawing

OK Cancel

- ✓ After the references have been attached, turn on/off the levels that you want turned on/off in the completed sheets for each reference attachment. Use the MicroStation Level Display dialog to accomplish this task.

An example turning on/off the desired levels for the Survey basemap is shown below.



- ✓ From the MicroStation pull-down menu, **Select File > Save Settings.**

The clipping border design file is now configured and ready for use.

9.8.2 Plan Sheet Layout: Sheet Composition

The *Sheet Composition* dialog is not configured any differently when using the **Use Current Design File** option. Complete the *Plan Sheet Layout: Sheet Composition* dialog as described in section 9.7.5.

9.8.3 Plan Sheet Layout: Layout Settings

Complete the *Plan Sheet Layout: Layout Settings* dialog as described in section 9.7.6.

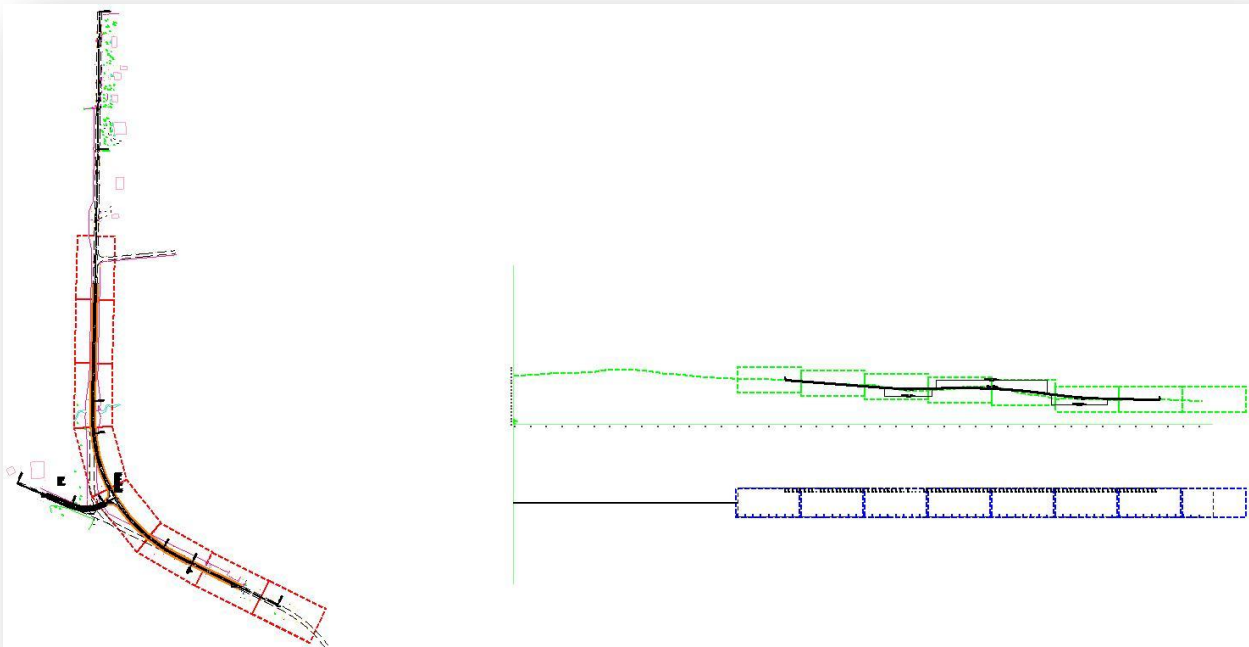
The option to select a Motif File will be unavailable when assigning the Alignment information for the Plan, Profile, and Tabular ports since the current file will be used to determine the reference attachments.

The procedure to assign the origin for the Tabular port is the same as described in section 9.7.6.

When completed, the *Plan Sheet Layout: Layout Settings* dialog will appear similar to the example shown below with the **Current** file assigned as the **Motif File**.



Select the Layout Sheets icon to place the clipping borders in the design file. The borders are placed as shown in the example below.



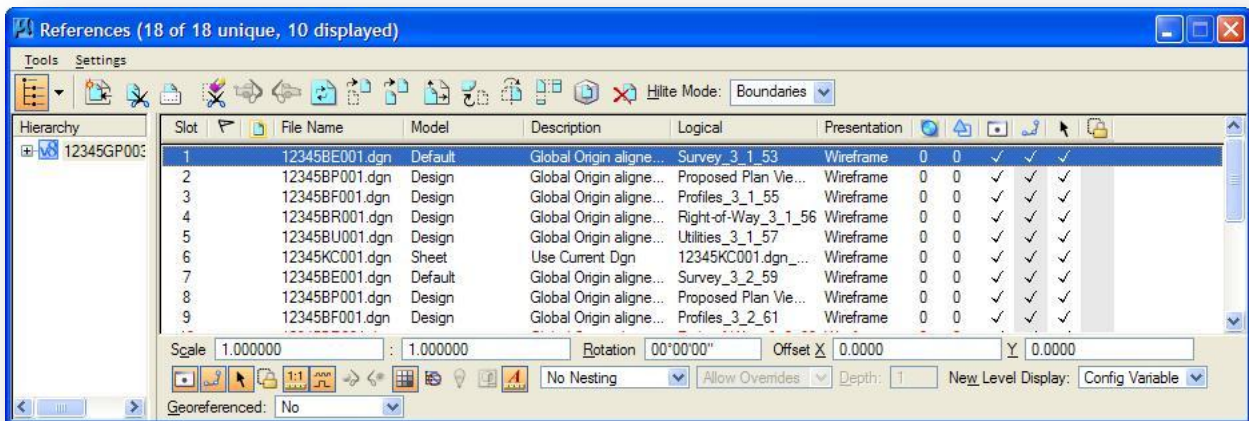
9.8.4 Sheet Layout: Clip Sheets

The *Sheet Composition* dialog is not configured any differently when using the **Use Current Design File** option. Complete the *Plan Sheet Layout: Clip Sheets* dialog as described in section 9.7.7.

Since the **Use Current Design File** option does not allow you to specify which references are attached to each port, users may wish to review the reference attachments and delete any unnecessary attachments.

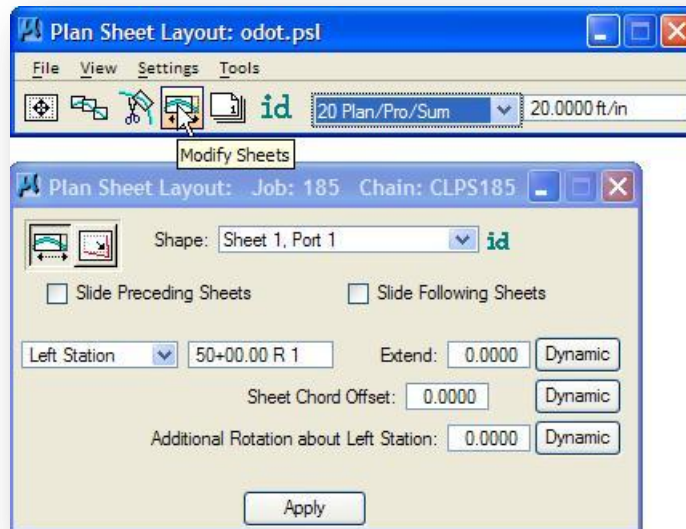
In this example, a total of five references were attached as shown in section 9.8.1. Each of these five attachments is attached to each port of the completed sheet. Additionally, the clipping border design file is also attached to each port. There are a total of 18 reference attachments as shown below.

It is up to the user to determine whether to delete the redundant reference attachments.



9.9 Modify Sheets

After the clipping shapes have been drawn, the user may want to modify or adjust some shapes prior to generating the plan and profile sheet design files. GEOPAK provides tools to modify plan, profile or tabular data clipping shapes. Select **Modify Sheets** to access the *GEOPAK Sheet Layout* dialog shown below.



Although it is possible to modify clipping shapes using the standard MicroStation **Move** and **Modify Element** tools, this is highly inadvisable. In order for sheets to be generated correctly during the clip process, the tools provided by GEOPAK on the *Modify Sheets* dialog must be used for all changes.

Two major modifications are supported and are selected in the upper left corner (via icon):



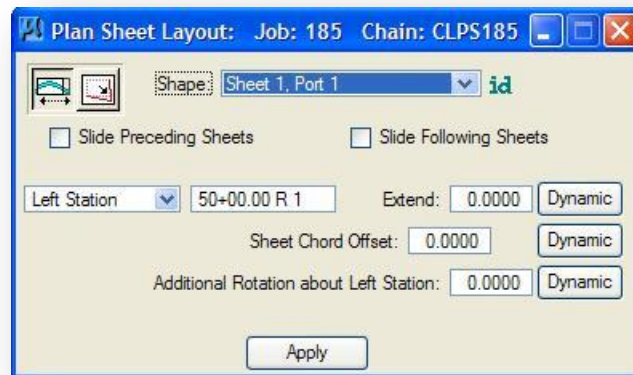
Slide Sheets



Modify Drawing Area

As the modification type is selected, the dialog changes to reflect the selection. The **Slide Sheets** option is shown in the example above. Each option is described on the following pages.

Slide Sheets



First, identify the sheet to be modified by selecting from the list of all clipping borders in the current set. This can also be done graphically by pressing the **id** button, then graphically selecting a clipping shape.

Next, determine whether only one sheet is to be modified or if the modification should be carried over to adjoining sheets. If the sheets preceding the sheet to be modified are also to be moved, then activate the **Slide Preceding Sheets** toggle. If the sheets after the modified sheet are to be moved a corresponding amount as the original shape, activate the **Slide Following Sheets**.

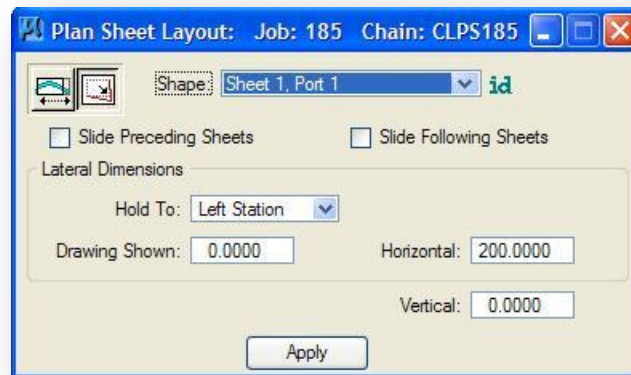
The sheets can be moved dynamically or by value. The **Station** field for a sheet is populated when the sheet is selected. The displayed station is the **Right, Center** or **Left** edge stationing. To move the sheet along the alignment, enter the value (in terms of master units) in the **Extend** field or just enter the new station value. If entering a value in the **Extend** field, a positive number moves in the direction of increased stationing, while a negative number moves in the direction of decreased stationing. To move dynamically, press the **Dynamic** button to the right of **Extend**, which will attach the sheet clipping border to the cursor. Then place a data point to initiate moving the cursor. The **Station** and **Extend** values changing as you move the cursor. Place a final data point to identify the location and slide the selected clipping border.

To move the sheet longitudinally relative to the alignment, without changing the stationing, use the **Sheet Chord Offset**. Once again, the value can be entered or the **Dynamic** button may be utilized. A positive chord offset moves to the right, while a negative value moves to the left (based on increasing stationing). Place a final data point to identify the location and slide the selected clipping border.

The **Rotation** can be entered as an angle or dynamically. **Rotation** always pivots about the left edge of the clipping shape. **Rotation** alone does not cause preceding or following sheets to slide.

Note: Rotating a sheet does not change its station range coverage. Large rotations (such as 90 degrees) will cause the visible coverage of a Plan Port to be different than its station range. This means that an associated Profile Port will not modify itself to cover fewer stations and preceding or following sheets will not slide in response.

Modify Drawing Area

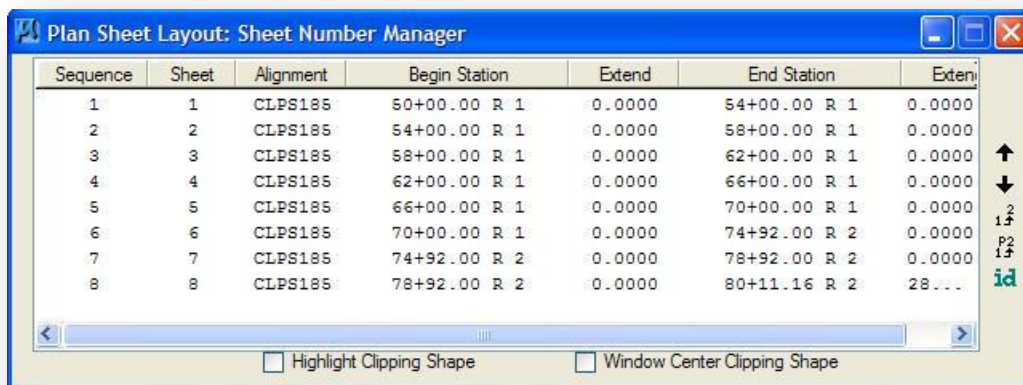


The function of this tool is to change the actual drawing area of the selected sheet. When the sheet is identified, the **Drawing Shown**, **Horizontal** and **Vertical** fields are automatically populated. The user has the option to hold the **Left Station**, **Right Station** or **Center Station**. In order to change the drawing area, only one can be held while the other two are adjusted to the revised drawing parameters. Set the desired values, and then press the **Apply** button to modify the selected sheet.

9.10 Sheet Number Manager



After the clipping shapes have been placed, the user has the option to adjust the sequence of sheets or their numbers. This is accomplished in the **Sheet Number Manager** as shown below.



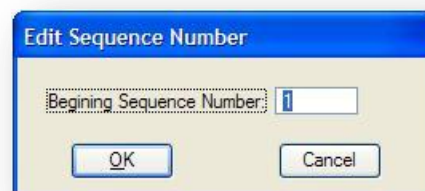
The list box contains the **Sequence** (order the sheets will be drawn) and the **Sheet** number (based on the order the clipping shapes were drawn). The **Begin Station** and **Extension** (if one was used), **End Station** and **Ending Extension** are also displayed.

The toggles on the bottom of the dialog assist the user in locating a particular sheet. Simply activate one or both of the toggles, then highlight a sheet in the list box. The clipping shape associated with the highlighted sheet is either highlighted or centered or both, depending on the setting of the toggles.

By default, the **Sequence** of the sheets matches the **Sheet number**. To change the order, highlight the line to be changed or moved, then use the arrow icons to the right to move the sheet up or down in the sequence.

Edit Sequence

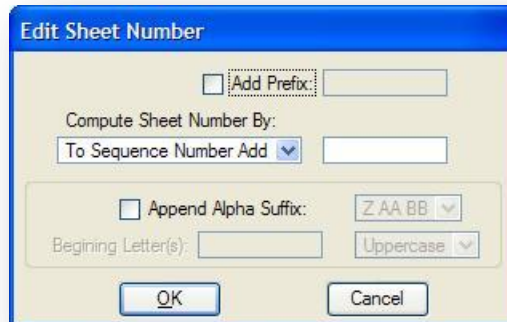
The Edit Sequence tool is useful when they are too many sheets to move with the arrows. Highlight the sheet(s) to be moved, and then press the icon. The dialog shown at right opens. Key in the **Beginning Sequence Number** and select **OK** to apply the changes.





Edit Sheet Number

Sheet Numbers can be changed for any sheet or set of sheets by highlighting the sheets to be changed, then pressing the **Edit Sheet Number** icon, which opens the dialog shown below.



A prefix can be added to the sheet number by activating the toggle and keying in the desired prefix.

Sheet Numbers can be changed by the following options:

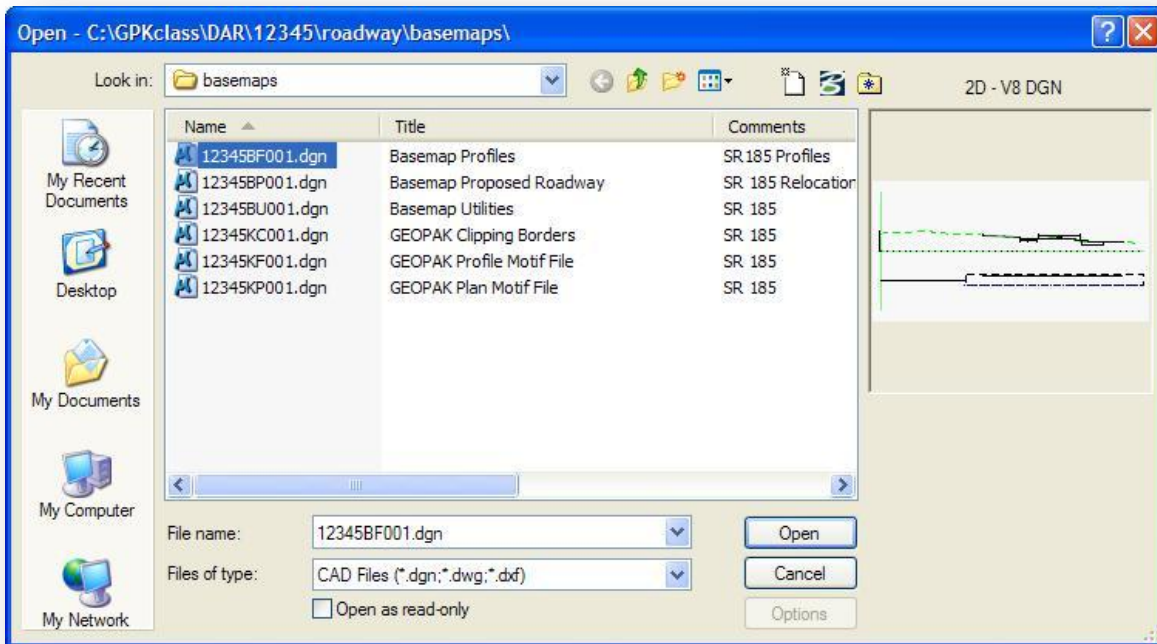
To Sequence Number Add – uses the sequence number plus the added value.

Starting at Sheet Number – starts at the specified number and increments. If the specified number is 101, then sheet 1 would be 101, sheet 2 would be 102, etc.

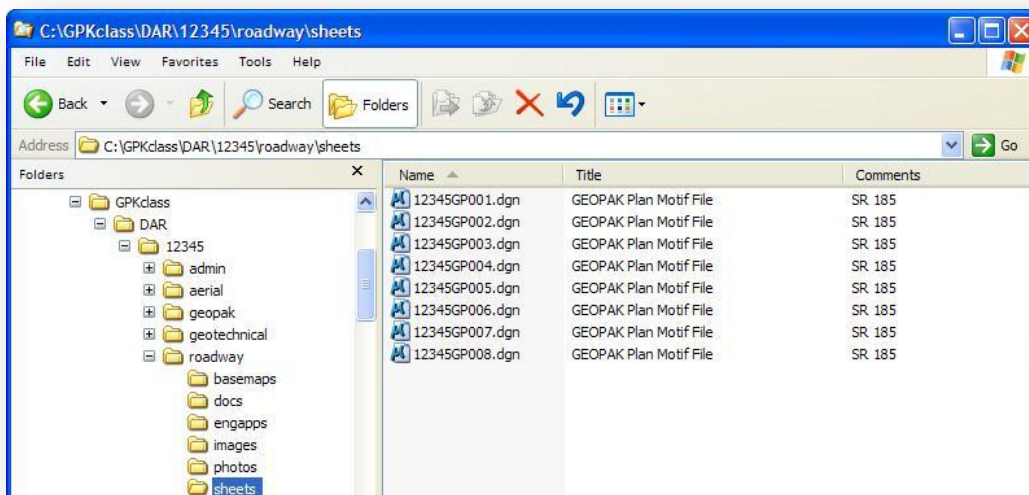
The other options for alphanumeric sheet numbers will not be covered in this training guide.

9.11 Sheet and Motif File Properties

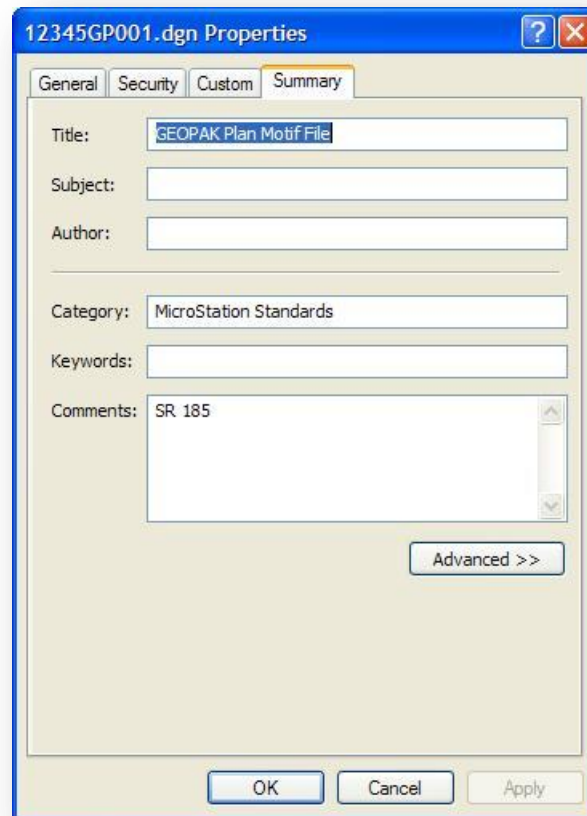
Section 303.4 of the ODOT CADD Engineering Standards Manual details the use the **Title** and **Comments** file properties to assign supplemental description information to MicroStation design files. The supplemental descriptions can be displayed in Windows Explorer or in the MicroStation Manager. An example showing the supplemental descriptions in the MicroStation Manager is shown below.



When the GEOPAK Plan and Profile Sheet Clip application is used to generate plan and profile sheets using the Motif Files option, the completed plan and profile sheet design files will copy the **Title** and **Comments** properties from the Plan Motif File. The example below shows the completed plan and profile sheet design files, and their associated properties, as they appear in Windows Explorer.



It is recommended that you edit the **Title** and **Comment** properties to reflect the correct descriptions for plan and profile sheets. To edit the file properties, right-click on the file name in Windows Explorer and select **Properties**. The *Properties* dialog, shown below, will open. Select the **Summary** tab to edit the **Title** and **Comments** properties.



The **Title** property should be changed to “Roadway Plan and Profile”.

The **Comments** property can be assigned with the station range for each plan and profile sheet.

The completed plan and profile sheets should have the **Title** and **Comments** properties assigned similar to the example shown below.

Name	Title	Comments
12345GP001.dgn	Roadway Plan and Profile	SR 185 Sta 50+00 to 54+00
12345GP002.dgn	Roadway Plan and Profile	SR 185 Sta 54+00 to 58+00
12345GP003.dgn	Roadway Plan and Profile	SR 185 Sta 58+00 to 62+00
12345GP004.dgn	Roadway Plan and Profile	SR 185 Sta 62+00 to 66+00
12345GP005.dgn	Roadway Plan and Profile	SR 185 Sta 66+00 to 70+00
12345GP006.dgn	Roadway Plan and Profile	SR 185 Sta 70+00 to 74+92 R 2
12345GP007.dgn	Roadway Plan and Profile	SR 185 Sta 74+92 R 2 to 78+92 R 2
12345GP008.dgn	Roadway Plan and Profile	SR 185 Sta 78+92 R 2 to 81+00 R 2

Exercise 9

Using this chapter as a guide, clip a set of 20 scale plan and profile sheets for S.R. 185. Take the following steps to create the sheets:

- ✓ Use the **Draw Profile Tabular Data** tool to plot the tabular annotation for the existing and proposed profiles in the profile design file. Which file should you use to draw the Tabular Data?
- ✓ Use the **ODOT_Files** application to create the following design files:
 - Plan view motif file
 - Profile motif file
 - GEOPAK Clipping borders file

What is the name of the plan view motif file?

Which sub-directory is the plan motif file created in?

What is the name of the profile motif file?

Which sub-directory is the profile motif file created in?

What is the name of the design file?

Which sub-directory is the file created in?

- ✓ Open the Plan View Motif file. Which design files should be attached to this file for the plan view portion of the plan and profile sheets?

After attaching the reference files, turn on/off the desired levels in the reference attachments and save settings.

- ✓ Open the profile motif file. Attach the profile design file as a reference file to the profile motif file. Turn on/off the desired levels in the reference attachments and save settings.
- ✓ Open the sheet clipping border design file.
 - Which model in the sheet clipping design file is used to place the clipping borders?
 - Clip the sheets using either 20 Plan/Pro or 20 Plan/Pro/Sum as the sheet type. Be sure to use the Station Range value shown in the table in section 9.7.5 that corresponds to the sheet type you elect to process.
 - Using the ODOT Design File Naming Convention found in the [ODOT CADD Engineering Standards Manual](#), what should you use as the name for the plan and profile sheet files?
 - Which folder should you specify for the completed sheets?

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10 Plan View Labeling

10.1 Overview

GEOPAK provides several labeling tools that can be used to compose and place various labels onto drawings. The following label tools are available:

- Plan View Labeling
- Profile Labeling
- Cross Section Labeling

The operation of each labeler is nearly identical. This training guide will focus on use of the Plan View Labeler. The labeling tools permit the creation of a variety of labels using the following features:

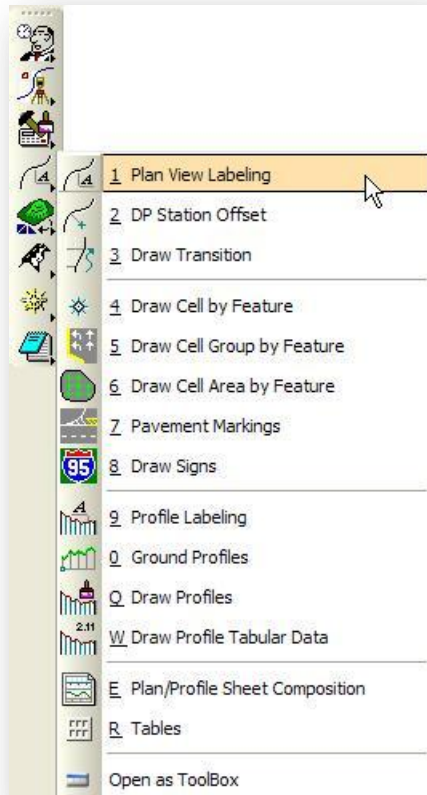
- **Computed Text Inserts** permit standardized computed values to be easily incorporated into labels. These computed values are based on the type of element to be labeled and change as different elements are selected by the user. Types of elements available for computed inserts include points, lines, arcs, complex graphic elements, COGO features, drainage features, etc...
- User **Text Inserts** facilitate the inclusion of user defined text strings in the label. These inserts can be customized to include frequently used labeling terms and be saved and reused.
- Borders can be placed around labels to accommodate different plan label formats.
- Leader lines and line terminators can be used to create the desired label formats.
- Frequently used label formats can be stored as **Label Styles** for subsequent recall. The complete label, including computed text inserts, user inserts, borders, and leaders, are all stored within the style.
- Tools to edit, move, and extract labels are also provided to make manipulation and plan changes easier.

The GEOPAK labeling tools can be accessed from the **Applications** menu as detailed below:

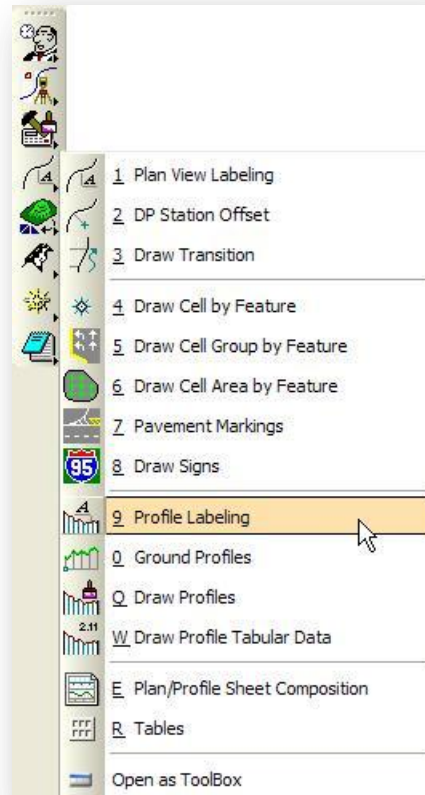
- To access the *GEOPAK - Plan View Labeler* dialog, select **Applications > Road > Plans Preparation Tools > Plan View Labeling**.
- To access the *GEOPAK - Profile View Labeler* dialog, select **Applications > Road > Plans Preparation Tools > Profile View Labeling**.
- To access the *GEOPAK – Cross Section Labeler* dialog, select **Applications > Road > Cross Sections > Cross Section Labeling**.

Each labeler can also be accessed from the GEOPAK Road tool palette. The Plan and Profile labeling options are shown below. The Cross Section Labeling tools is covered in the ODOT GEOPAK Road 2 Training Guide.

Plan View Labeling

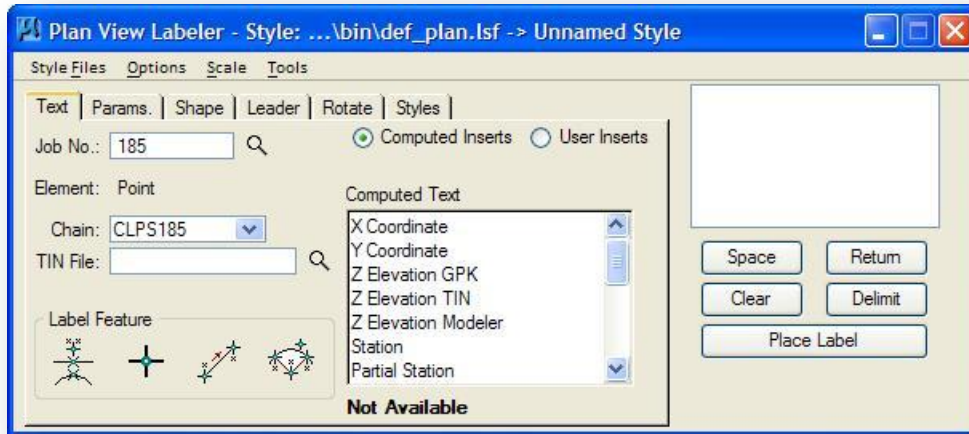


Profile Labeling



10.2 Text Options

The first tab within the *GEOPAK - Plan View Labeler* dialog is the **Text** option, as shown in the graphic below.



Job No.

The coordinate geometry database file (.gpk) used for computed text inserts.

Element (display only)

Whenever one of the **Label Feature** tools is used, the selected element type is displayed in the dialog.

Chain

Select the GEOPAK **Chain** previously stored within the specified coordinate geometry database.

TIN File

Select the GEOPAK TIN file to be used with Computed Text Inserts that are used to label an elevation. In lieu of typing, pressing the **File** button invokes a TIN file dialog where the required file may be selected.

Label Feature

Four options are available to select the type of label to be placed as detailed below:



Select GEOPAK or MS Element

Press this button, and then select the GEOPAK or MicroStation element you wish to label. The labeling options change to reflect values appropriate for the selected element type.



Data Point Location

Press this button, and then issue a data point on the screen. The labeling options change to reflect values appropriate for a data point.



2 GPK Point Line

Press this button, and then select any two visualized COGO points. The labeling options change to reflect values appropriate to labeling a line.



3 GPK Point Arc

Press this button, and then select three visualized COGO points representing the PC, PT and CC of a curve. The labeling options change to reflect values appropriate to labeling an arc.

As you compose the label, the content of the label is displayed in the upper right field of the *Labeler* dialog. You can compose the label by keying in text, or by use of the **Computed Inserts** or the **User Inserts**.

Computed Inserts

One of the most powerful features of the labeling tools is the use of **Computed Inserts**. The **Computed Inserts** are values computed by GEOPAK for various labeling items such as **Station**, **Offset** or **Elevation**. The list of available **Computed Inserts** changes based on the element type being labeled (i.e., point, line, curve, etc.). Once these inserts are added to a label, their values are automatically recomputed during subsequent element identification. Two examples of the available **Computed Inserts** are shown below:

Data Point Location



Select GEOPAK or MS Element (Line)



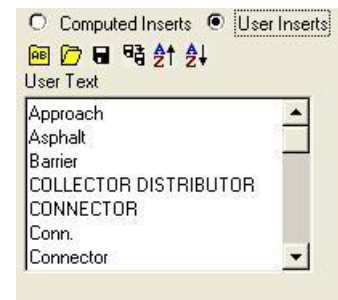
To use a **Computed Insert**, highlight the desired variable and the computed value is displayed below the **Computed Text** list box as shown in the examples above. If the value cannot be computed because of missing information or computing error, the dialog will display "N/A" or "Error". The decimal precision of the inserts can be controlled with the drop down list as shown above. Double clicking the **Computed Insert** adds it to the label at the current cursor position in the label editing field.

User Inserts

A customizable list of **User Inserts** is available to assist the user in building labels containing commonly used words or phrases. These words or phrases can be inserted in the label by selecting them from a list instead of typing them in manually. Commonly used **User Inserts** can be saved in an ASCII text file for future access.

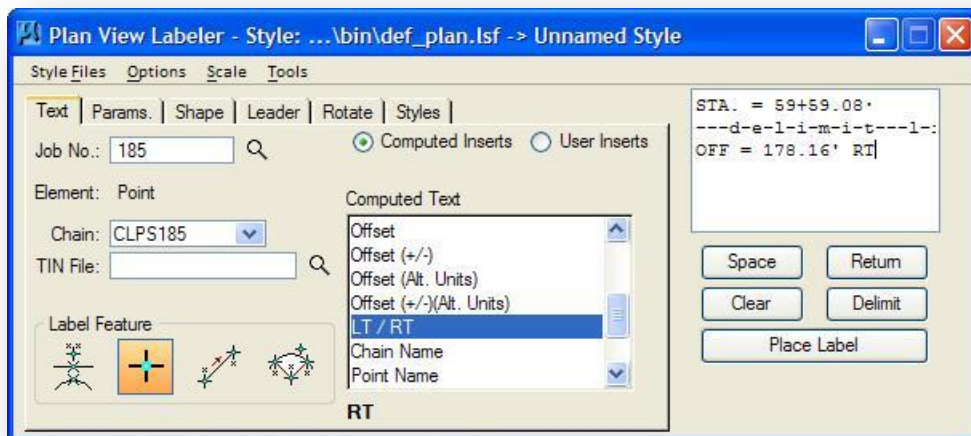
GEOPAK supports an unlimited number of user insert files. Each line of the file is one word or phrase followed by a space. In this way, when two words are placed together by successive data points, a space is placed between them. Several ASCII text insert files are located in the default GEOPAK directory.

When the **User Insert** toggle is active, the icons for file manipulation are displayed as shown at left. The far left icon edits the current text file, while the second icon opens an insert file. The third icon (disk) saves the current file, while the fourth icon is the Save As... option. The last two sort the current insert file in ascending or descending alphabetical order.



10.3 Label Edit Field

The **Label Edit Field**, located to the upper right of the *Labeler* dialog, is used to display the text of the current label. The label can be constructed by manually typing in text into the display or by adding selected **Computed Inserts** or **User Inserts**. An example of a **Data Point Location** station and offset label that was created by a combination of keyed in text and computed inserts is shown in the dialog below.



When subsequent data points are issued the Computed Inserts are automatically updated to reflect the current data point location.

The five buttons under the Label Edit field function as follows:

Space

Press to add a Space within a label. A single space is added with each pressing of the button.

Return

Press to add a Return within a label and move to the next line down.

Clear

Press to clear the entire label from the label display window.

Delimit

Press to place a delimiter between lines.

Place Label

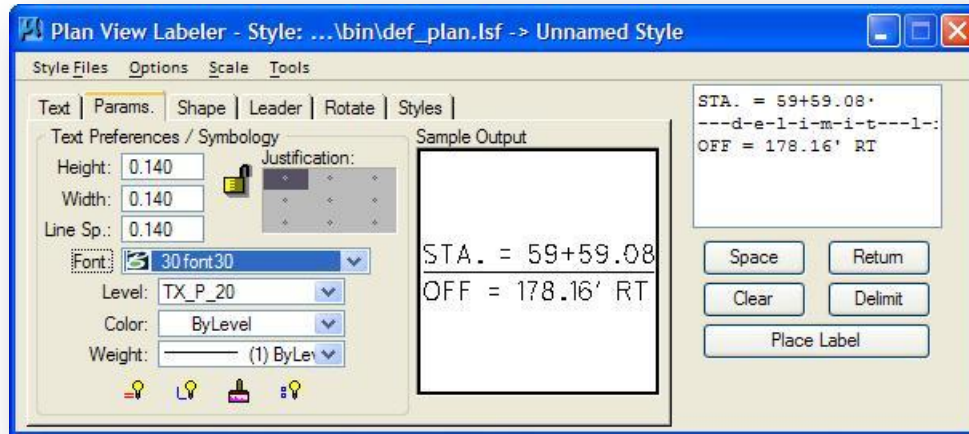
When the label is constructed and ready to place, press this button, then move the cursor for dynamic placement.

Tip:

If the value of a computed text insert is manually edited within the labeler dialogs, it loses the intelligence of a computed label. The computed text insert becomes inserted text and will no longer be computed when subsequent labels are placed.

10.4 Parameters Options

When the **Parameters** tab is selected the dialog changes, as shown below, to control the text parameters of the label.



Text Preferences / Symbology

This portion of the dialog, as shown above, is used to set the text parameters and symbology. Four icons are available at the bottom of the dialog to facilitate setting these parameters:

By Current

After pressing this button, GEOPAK determines the active MicroStation symbology (level, weight, color and style) and populates the dialog.

By Element

After pressing this button, GEOPAK prompts the user to select a previously drawn MicroStation element, and populates the dialog with its element symbology.

By D&C Symbology

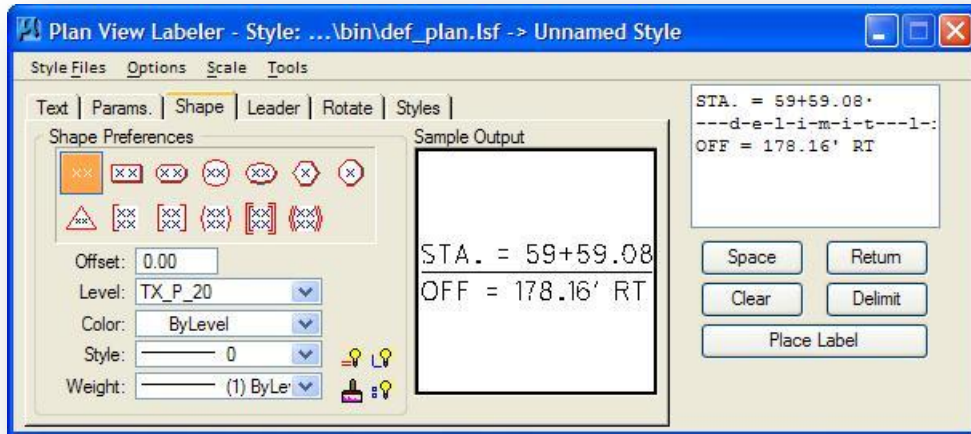
After pressing this button, the user can select a D&C Manager item to set the element symbology.

Set All

GEOPAK reads the current settings (level, weight, color and style) within the dialog, and populates the similar fields in the **Shape** and **Leader** dialog tabs.

10.5 Shape Options

When the **Shape** tab is selected the dialog dynamically changes, as shown below, to set type and symbology of a surrounding shape.



Shape Preferences

Twelve shape selections are available plus a no shape option, as shown above. The shape drawn is proportional to the size of the label. As the label gets larger, the shape is expanded to fit.

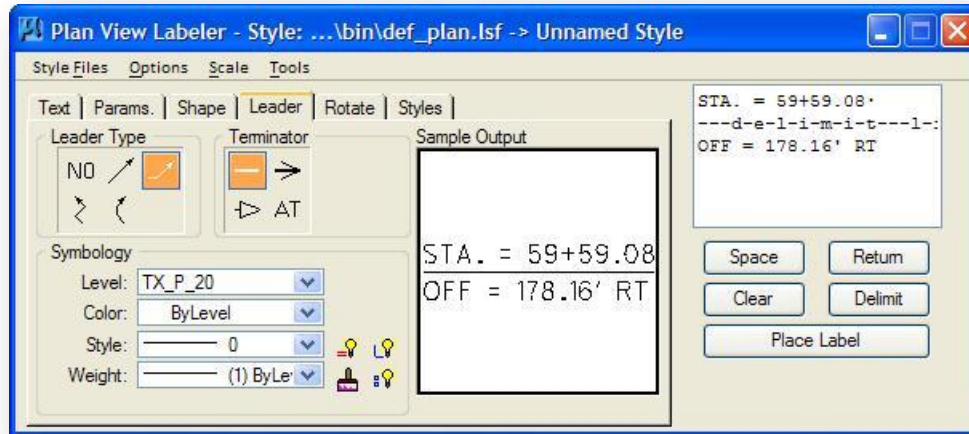
Shape Offset

This key-in field is used to specify the distance from the edge of the text to the shape.

The Level Symbology options are similar to those described for the **Params.** tab.

10.6 Leader Options

When the **Leader** tab is selected the dialog dynamically changes, as shown below, to provide control settings for the type of leader and leader terminator.



Leader Type

Four leader types, plus a no leader option are supported. Depending on the type selected, the user is prompted for data point(s) to provide maximum flexibility over location of the leader. Each shape has several origination points around the circumference to accommodate leaders.

Terminator

Supported options include No terminator, closed arrow, open arrow, and active terminator. To use the active terminator, the MicroStation line terminator must be defined and the cell library containing the terminator must be attached. If a terminator is selected and no cell library is attached, an alert message is displayed.

Symbology

The Level Symbology options are similar to those described for the **Params.** Tab.

10.7 Rotation Options

When the **Rotate** tab is selected, the dialog dynamically changes, as shown below, to set the rotation options for the label. Note that these commands can also be issued from the Label Control tool frame before or during label placement.



Current Angle

This option is used to place a label at the current active angle, or to key in the angle for the label.

Element Angle

This option is used to set the label angle according to the angle along a MS graphic element.

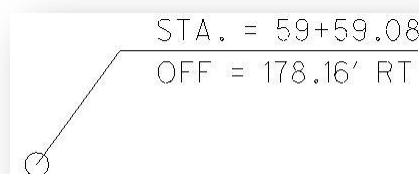
Alignment Angle

This option is used to rotate a label, either before or during placement, at an angle relative to a Chain. First specify the **Job No.** and the **Chain** in the **Text** tab.

Set Angle By

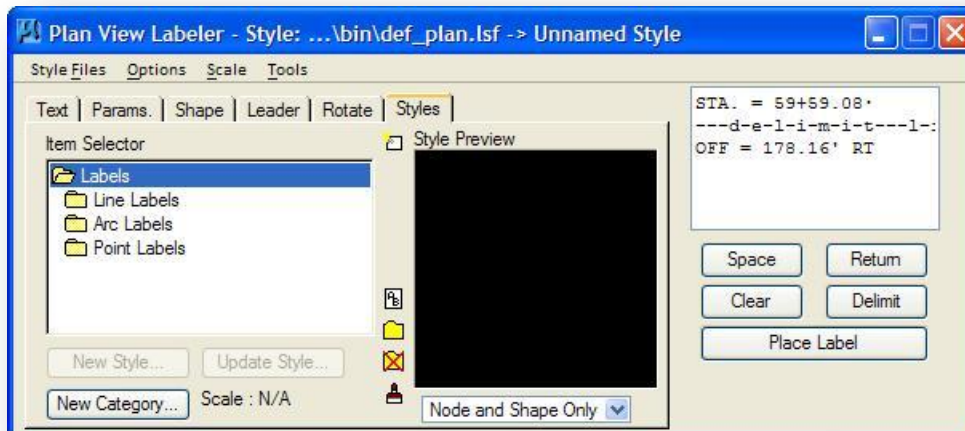
Three options are supported: **DP**, **Element** and **AA** (Active Angle.)

An example of a completed label is shown below.



10.8 Styles Options

When the **Styles** tab is selected the dialog dynamically changes, as shown below, to create, modify, or use a previously defined Label Style.



One of the most useful tools of the labeler is the ability to store and reuse labels. The **Computed Inserts**, **User Inserts**, **Shapes**, **Leaders**, element and **Text** parameters of the label can all be stored under a unique name. This enables the user to create a complete library of labels to use in subsequent sessions. The styles are stored in *.lsf files, with default files for plan label styles (def_plan.lsf) delivered with the GEOPAK software.

New style files can be created, opened, and saved via the **Style Files** pull-down menu in the upper left corner of the main dialog. With each style file, a hierarchy system is employed to easily and quickly organize and subsequently locate the desired label styles. The user has complete control over the naming of categories and labels within each category. Several utilities are supported within the dialog for creating, editing and renaming styles, which are detailed below.

Rename Style / Category

To rename a style or category, simply highlight the item to be renamed, and then press the **Rename Style** button to access the dialog shown below.



Change the name, and then press the **OK** button. The display list dynamically changes to reflect the new name.

Create Style Category

This icon is used to create a new category.

**Delete Style Category**

This icon is used to delete the selected category

**Refresh Style List**

To refresh the style list, simply press the **Refresh** button.

If a **Style Name** is selected in the *Labeler* dialog, the following options are available:

**Select Style Item**

Pressing this button makes the current highlighted style the active style.

**Delete Style Item**

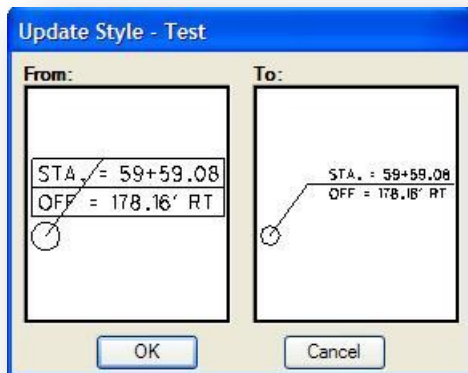
Pressing this button deletes the current highlighted style.

**Copy Style Item**

If two labels are similar, it is more efficient to copy a label style, then modify and save, rather than creating a completely new style. To accomplish this, highlight the style item to be copied, then press the Copy Style Item button, and a copy of the style is created.

Update Style

After modifying a style, the user may want to update the style to include the current modifications. Simply press the **Update Style** button to invoke the dialog shown below. Both **From:** and **To:** labels are shown so the user can easily discern the changes.



Press **OK** to accept the update, while **Cancel** simply closes the dialog with no updating occurring.

Style Preview

This window displays the current style. **Note:** The label is scaled to fit the entire label within the preview window and is not indicative of the scale at the time of placement.

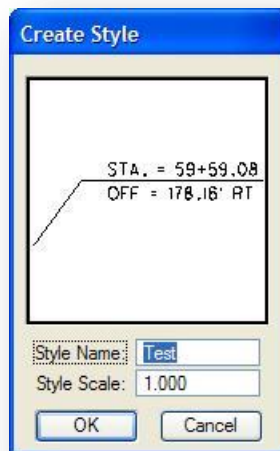
Complete Style / Node and Shape Only



Two options are supported when creating a new style. The entire layout of the label can be retained, or simply the **Node and Shape**, without the leader line options, etc.

New Style...

Select this button to create a new style from the current label. The *Create Style* dialog, shown below, is opened. Key in the new **Style Name** and **Style Scale**.



When complete, press the **OK** button to store the new style, which is added to the **Item Selector** list box. In order to retain the style after closing the labeler, perform a **Style Files > Save** before exiting.

Tip:

Before you can save a label you must first place the label in the design file. The **New Style...** button will remain ghosted until you place the label. To save the label in the style file select the category where the label is to be stored, and press the **New Style...**

10.9 Menu Options

The menu bar options include:

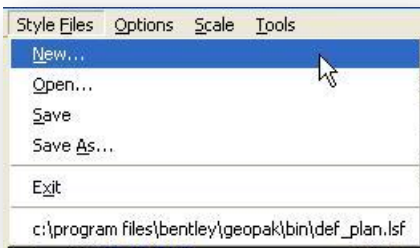
Style Files – File utilities to create, open and save stored Style files containing stored label layouts.

Options – User definable options for tool and dialog control over labeling functions.

Scale – Proportionalizes any label in addition to displaying the current scale.

Tools – Provides access to the **Label Updater**, **Selection Set Labeling**, and **Plan Label Preferences** tools.

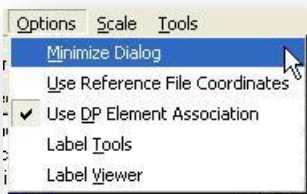
10.9.1 The Style Files Pull-Down Menu



The **Style Files** menu provides options to open, and save Style libraries as shown above. In order to unghost the entire Style Files pull-down menu, you must select the **Styles** tab.

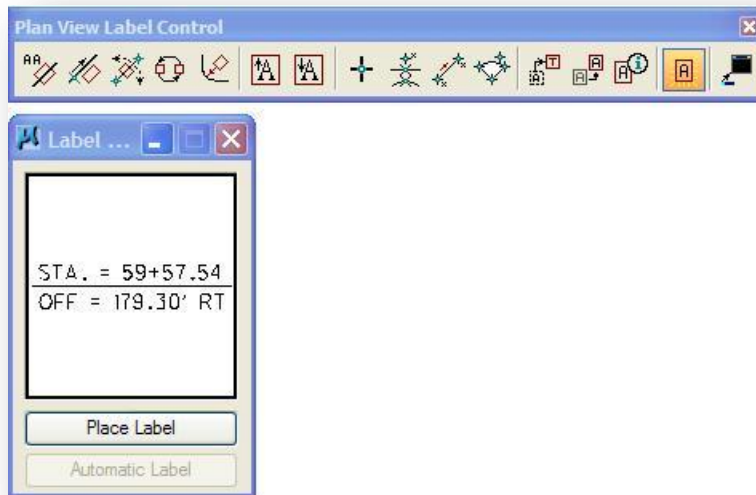
10.9.2 The Options Pull-Down Menu

Five options are supported under the **Options** pull-down as detailed below.



Minimize Dialog

If this option is toggled on, when the **Place Label** button is pressed the main labeling dialog will automatically minimize as shown below. The *Label Viewer* dialog and the *Plan View Label Control* tool palette, also shown below, will automatically open.



Use Reference File Coordinates

When working with elements within a reference file, it is useful to use the reference file coordinates, rather than those of the current active file. Simply activate the toggle and subsequent computed text inserts using reference file elements or data points will reflect the reference file coordinates. If the snap and locate settings in the reference file are active.

Use DP Element Association

This option will enable the association between MS elements and DP (data point) labels that are snapped to the element. If the element is modified, the point labels will move with the element when the **Label Update** feature is used. **Note:** This only applies to elements within the active design file.

Label Tools



The *Plan View Label Control* tool palette contains numerous tools that are useful during the placement of labels. The tools are detailed below.



Rotate Label to Active Angle

This option is used to rotate a label, either before or during placement, to the active angle.



Rotate Label By Element Angle

Utilized to rotate a label to the angle of a MS graphic element. GEOPAK prompts the user to select the element.

**Rotate Label by Two Data Points**

Utilized to rotate a label to an angle between two data points. GEOPAK prompts the user for the two data points.

**Rotate Label 180**

Utilized to rotate a label 180 degrees from the current rotation of the label.

**Rotate Label by Alignment Angle**

Utilized to rotate a label at an angle relative to a Chain. First, in the Text tab of the main dialog, specify the Job No. and the Chain.

**Increase Text Size**

Each press of this button increases the text size of the dynamic label by the scale specified in the dialog.

**Decrease Text Size**

Each press of this button decreases the text size of the dynamic label by the scale specified in the dialog.

**Data Point**

This button is a shortcut for the DP button located on the main dialog.

**Identify Element**

This button is a shortcut for the Identify Element button on the main dialog.

**2 GPK Point Line**

This button is a shortcut for the 2 GPK Point Line button on the main dialog.

**3 GPK Point Arc**

This button is a shortcut for the 3 GPK Point Arc button on the main dialog.

**Edit Label**

After selecting the **Edit Label** tool, GEOPAK prompts for the selection and acceptance of a previously placed label. The label must have originally been placed with the GEOPAK labeler, not simply MicroStation place text or note commands. Once accepted, the GEOPAK labeler dynamically changes to reflect all parameters of the selected label. Make any necessary edits to the label and then select **Place Label** and replace the label.

**Move Label**

Once a label has been placed with any of the GEOPAK labelers, it can be easily moved. Note the data points for any leader lines are not retained and must be placed again.

**Extract Label**

To place several labels similar to a previously placed label, the user does not have to know the style, sizes, etc. GEOPAK loads the style as well as all required element and text parameters.

**Place Label**

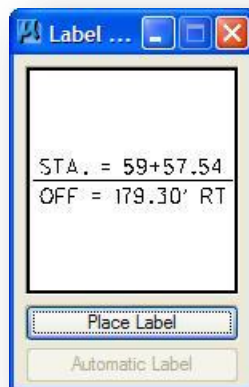
Select this button to initiate label placement.

**Restore Label Dialog**

When the main dialog is minimized, pressing this button restores the main dialog to full size.

Label Viewer

When the **Label Viewer** option is selected, the *Label View* dialog displayed as shown below.



A single label can be placed by pressing the **Place Label** button, and then issuing a data point at the desired location. The **Automatic Label** option is only supported when the sample label includes computed text inserts. When the **Automatic Label** button is pressed and a data point is selected, the placed label includes the updated computed text inserts in the same style as the original label.

10.9.3 The Change Scale... Pull-Down Menu



This menu item allows labels to be scaled from their original creation scale. For example, if a label was created with a text scale of one (TH = 0.14, TW = 0.14) and is to be used on a 20 scale plan sheet, changing the scale from one (1) to 20 would set the size of all the items contained in the label to the correct scale.

10.9.4 The Tools Pull-Down Menu

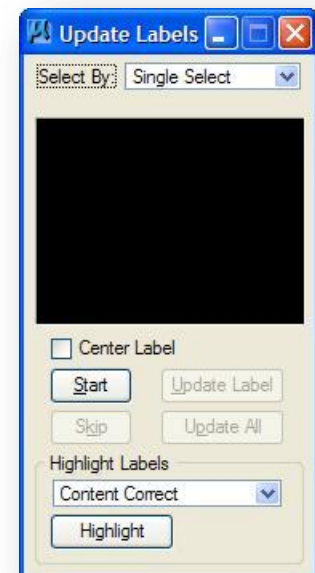
The **Tools** pull-down menu contains the options shown below.



These options are summarized below. See the GEOPAK online help for more information regarding the tools.

Label Updater

The **Label Update** tool is a powerful tool for updating GEOPAK labels. When alignments are modified, TIN files updated, labels moved, etc., GEOPAK "remembers" the computed text information used in the placement of the original label. Therefore, the software can update the label based on updated data. The tool utilizes the dialog shown at right and is invoked by selecting **Tools > Label Updater** from the menu bar in the main Label dialog.



Selection Set Labeling

The **Selection Set Label** tool is a powerful tool for placing or updating labels within a selection set. The workflow is as follows:

- ✓ Select a style from the **Styles** tab.
- ✓ From the labeler menu bar, select **Tools > Selection Set Labeling**.
- ✓ Populate the dialog as desired.
- ✓ Using the Power Selector or MicroStation selection set commands, identify a selection set.
- ✓ Click **Apply** to commence the procedure.



Plan Label Preferences

The *Plan Label Preferences* dialog is used to set default labeling options. To set or activate the Label Preferences, toggle on the **Use Label Preferences** at the top of the dialog.

