

GEOPAK V8i Edition

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Chapter 1 - Geopak – Basic

1.1 - Introduction

GEOPAK V8i Edition, the civil engineering design software in use at Eastern Federal Lands Highway Division (EFLHD), is a comprehensive software package that covers every project phase from conceptualization to final quantities and construction stake-out. The software works within the MicroStation V8i graphic environment providing true interactive design. As with any powerful software, and many complex processes, there are many different ways to accomplish a given task. This guide will outline the necessary procedures to ensure proper adherence to EFLHD standards for project design.

The **BASIC** steps of a GEOPAK design are as follows:

(These steps may be adjusted depending on the type of projects and personal preferences).

Step I- Get the **.TIN** file and **mapping file** from our Survey Branch. The mapping file usually has an extension of “***_map.dgn” (for existing planimetric features).



In order to create Profile, Cross Sections, Earthwork, or 3D models with GEOPAK you must have a Digital Terrain Module (DTM) file that is compatible with GEOPAK Software. The GEOPAK default DTM file is known as the .TIN file. This is an abbreviation for “triangulated irregular network”. The .TIN file is usually made from the field data file by the Survey section. So rather than get into how to make the .TIN file I will simply say, “Get the .TIN file from Survey.”

Currently, it is the responsibility of the Survey Branch to provide the mapping and .TIN file to design. These files will normally located at “**M:\Projects\project directory... \techserv\survey\FinalMapping**” directory at EFLHD.

Step II- Create a horizontal alignment. This can be done several ways, either through Coordinate Geometry or through Interactive Horizontal Design.

Step III- Display and Annotate the horizontal alignment graphically.

Step IV- Generate the existing ground profile.

Step V- Display the “existing ground” profile graphically. This can be done two ways.

Step VI- Create the vertical alignment. This can be done several ways, either through Coordinate Geometry or through Interactive Vertical Design.

Step VII- Display the “design” profile graphically. This can be done two ways.

Step VIII – Design any required/desired widening.

Step IX – Develop Plan and Profile Sheets.

Step X – Generate the superelevation, (the **Shapes**).

Step XI- Draw Pattern lines across the horizontal alignments (for location of cross sections).

Step XII- Generate the existing ground cross sections.

Step XIII- Generate the proposed cross sections.

Step XIV- Develop Cross Section Sheets.

Step XV- Generate the construction limits for the plan view.

Step XVI- Calculate the earthwork.

Step XVII- Generate any miscellaneous staking reports.

Step XVIII- Generate a 3D model.

1.1 - Geopak Files Names

Geopak uses and /or creates files during the design process. Several of the more common files are detailed shown below.

Job###.gpk:

This is Geopak Coordinate Geometry file where all coordinate geometry elements are stored. GPK file is comprised of stored geometric elements such as points, lines, curves, spirals, chains, parcels and profiles. This binary file is created when the user starts a coordinate geometry (COGO) session for the first time. Multiple users can access this file at the same time, and only one file should be created for each project. The “###” is the only variable in this filename. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.



In EFLHD the Job number will be assigned by the CADD Coordinator for all the projects.

(See MicroStation V8i Section 2.2.3 for gpk number naming convention)

Project-name.prj:

It is a binary file resulting from the creation of a new project. It stores information for use by the Geopak Project manager.

The name specified must be a valid Windows file name (i.e., it cannot contain the special characters \ / : * ? " < > |). Although there is no standard naming convention used for .prj files in EFLHD, it's good practice to use a name that relates to the project's route designation because the Project Name specified here is used to access the Project Manager setup for the project in subsequent sessions.

fname###.ioc

ASCII input file for loading data during a COGO session. "###" Represents the job number and "oc" is the operator code (users initials). Filename characters are limited to 5 characters plus the 3 job number character designation as indicated with the example.

fname###.ooc

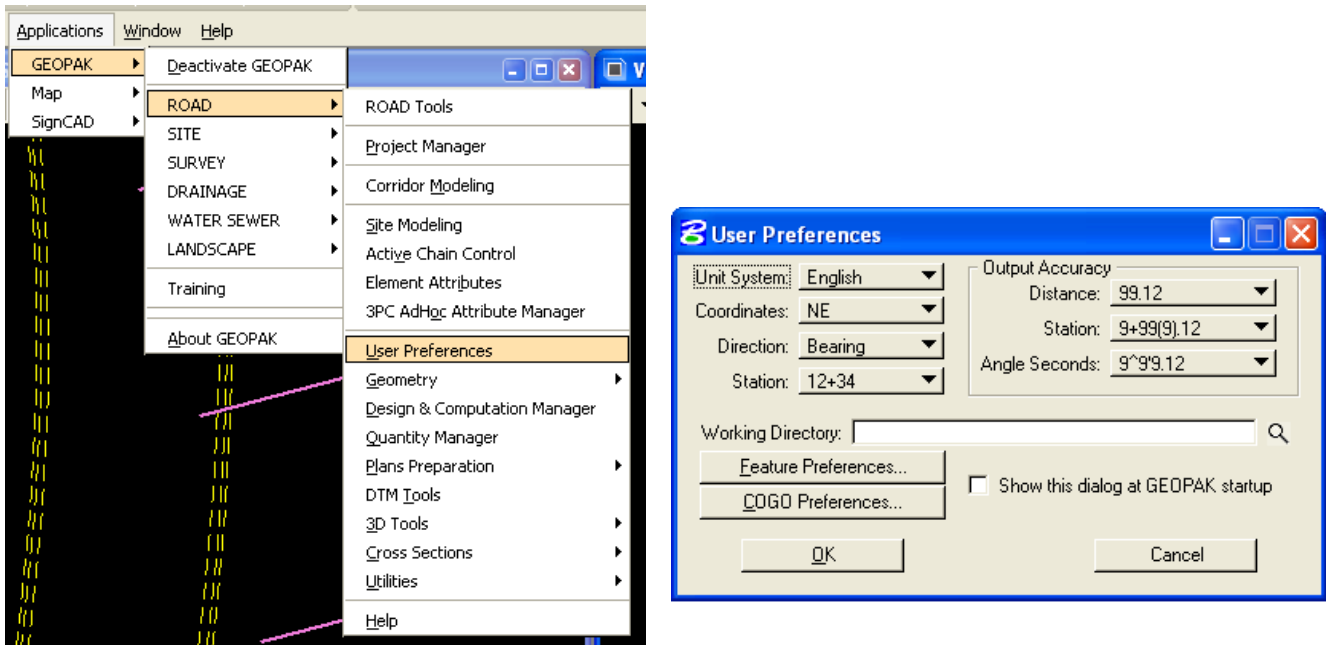
ASCII output file created by GEOPAK during a COGO session. Variables are the same as defined above. Filename characters are limited to 5 characters plus the 3 job number character designation as indicated with the example.

fname.tin

A binary file containing triangular surfaces also known as the digital terrain model (DTM).

1.3 - GEOPAK User Preferences

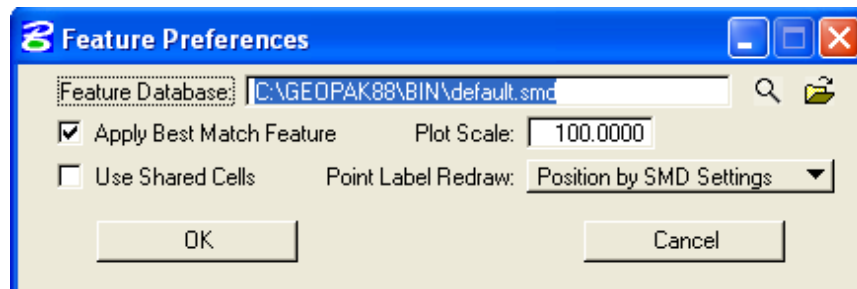
- When a user begins Geopak for the first time or after Geopak has been reloaded, there are certain User Preferences the user needs to set. The User Preferences dialog box can be accessed from **Applications > Geopak > Road > User Preferences**. The following dialog box appears;



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

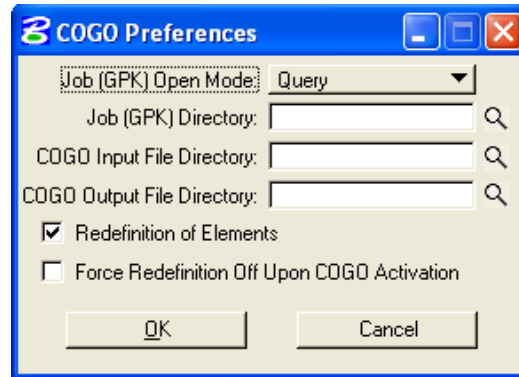
Note - EFLHD designers usually work on more than one project at a time; the field should be left blank ALWAYS as a default preference.

- By clicking the **Feature Preferences** button, the following dialog box is invoked.



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

By pressing the **COGO Preferences** button, the following dialog box is invoked.



The **Job (GPK) Directory** field specifies the location of the **GPK** file. If any of the above directory fields are blank, they will default to the **Working Directory** set in the **GEOPAK User preferences dialog box** (EFLHD's preferred set up-Kept blank as above shown directory).

1.4 - Setting Up Project Manager (Geopak)

1.4.1 - Project Manager Introduction:

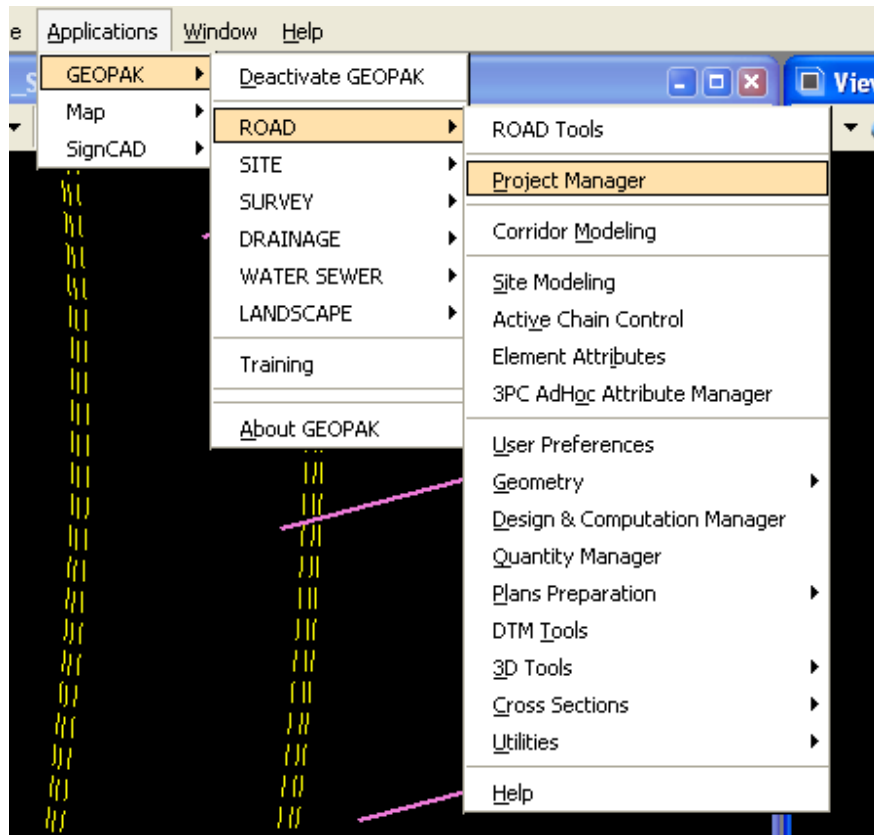
Project Manager is a Geopak tool that associates a project with its respective coordinate geometry job number, users, working directories and project files. Project Manager provides the user with an easy workflow system that keeps records of processes run throughout the design of a project.

You must first setup Project Manager in order to start your project through Geopak. The use of Project Manager is required to create proposed cross-sections through the Typical Section Generator (Using X30 criteria file).



It is required to use the Project Manager for all EFLHD projects working with MicroStation V8i and Geopak X30.

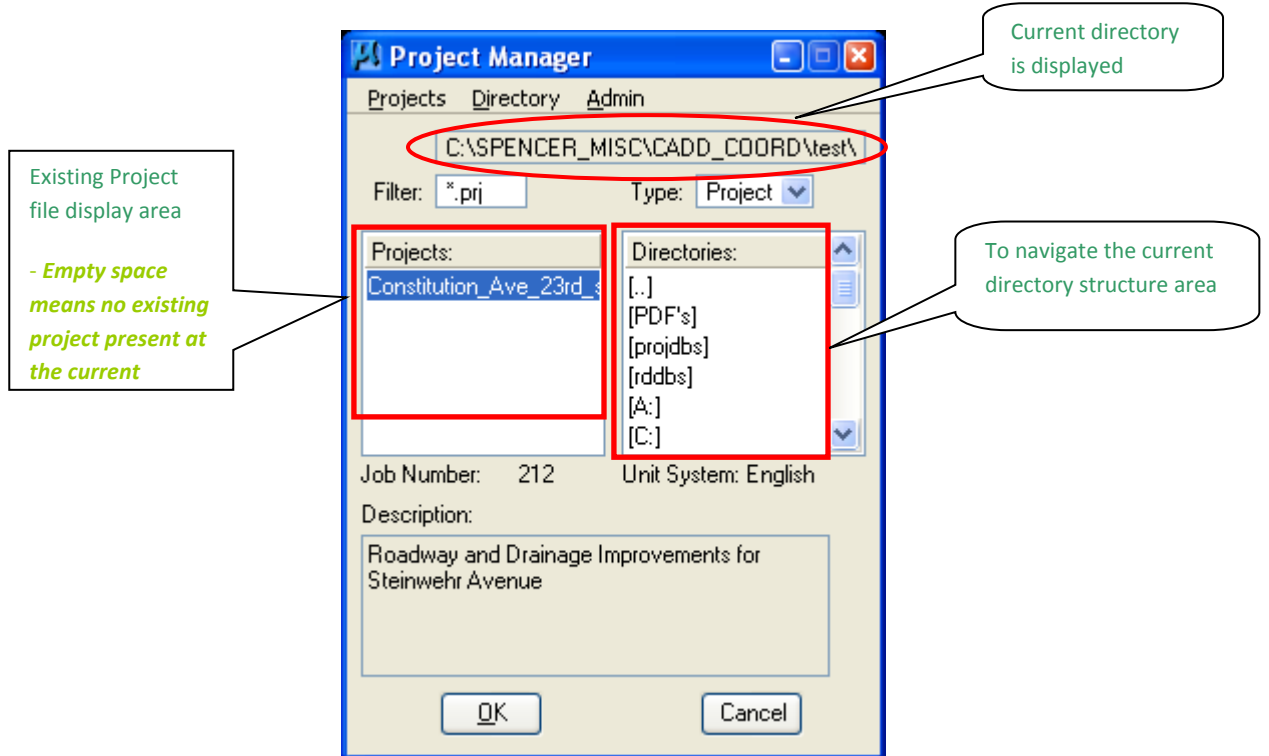
- Open a MicroStation design file. Invoke **Project Manager** by either using the pull-downs **Applications > Geopak > Road > Project Manager**



- Or by using the **Tools icon** shown below:

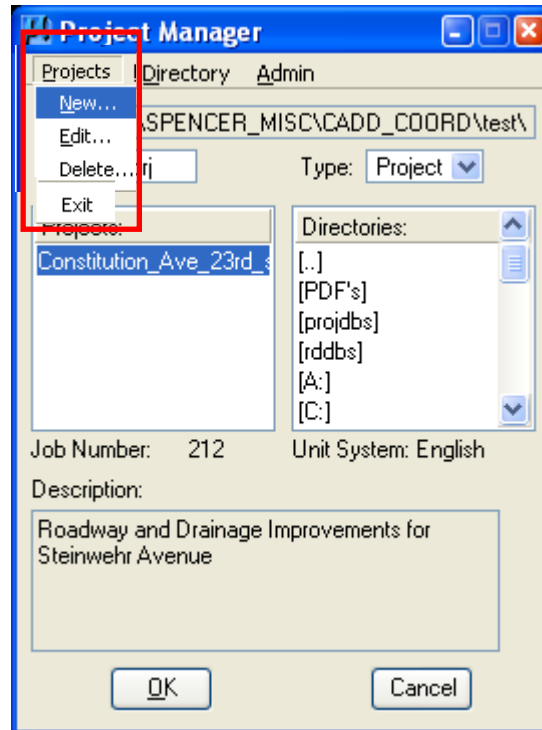


- When **Project Manager** is invoked the dialog appears as shown below. The current directory is displayed at the top of the dialog box. Current project file is displayed under the **Project** area. Project area showing blank mean there is no existing projected at the displayed directory.



Project Tools

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



- The **New** menu option is used to create a new project. The .prj file is stored in the directory shown in the Directory path at the top of the Project Manager Dialog box.
- The **Edit** option on the pull down menu is used to change any settings associated with the currently selected project.
- The **Delete** option on the pull down menu is used to delete any project that has been stored. The user highlights the project in the Projects list box and selects Delete.
- The **Exit** option on the pull down menu closes the Project Manager and writes the settings to a resource file.

Directory Tools

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



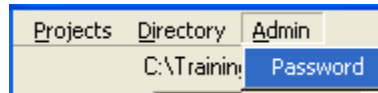
The **Create New Directory** option creates a new directory on your computer within the current directory. If the **Current Working Directory** option is chosen, the directory path in Project Manager is changed to that directory.



Always select the Current Working Directory to access the Road Project.

Administration Tools

- The **Admin** menu option is used to set a password on a project, if desired.

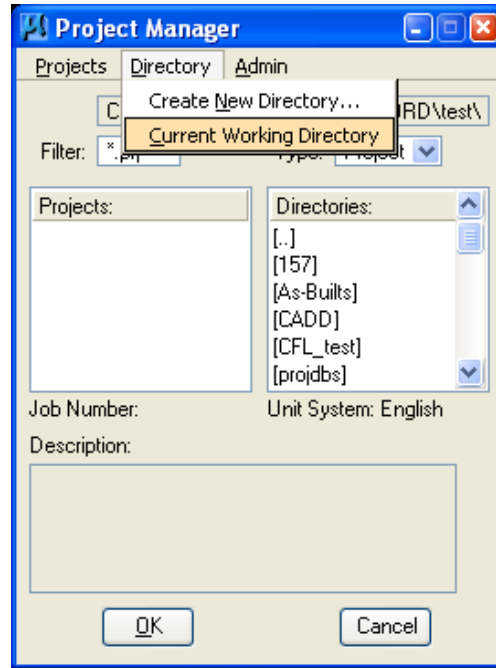


EFLHD does not create Passwords for Project Manager projects.

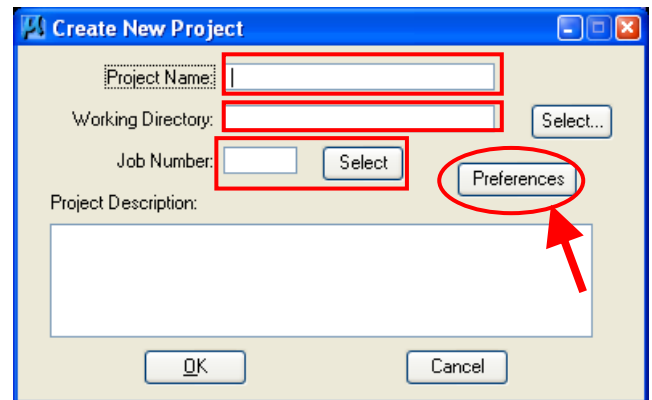
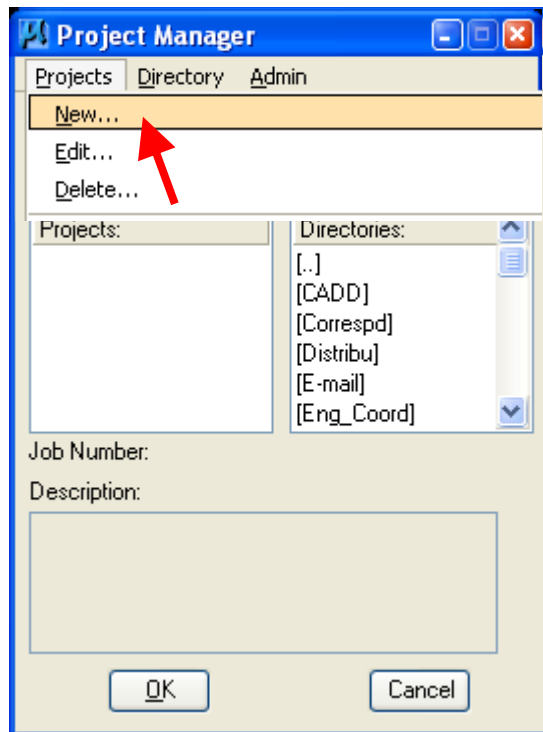
1.4.2 - Create a Project

Step I

- EFLHD suggests to **Create a Project** under your **current working directory**. This is easily done by using the pull-downs on the Project Manager dialog, **Directory > Current Working Directory** as shown below:



- Once the Directory is set, create the **New Project** by using the Project Manager pull-downs, **Projects > New** as shown below:



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

Note - The Working Directory can be left blank if it is desired to have all of the MicroStation and GEOPAK files in a single directory (EFLHD's default preference).

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

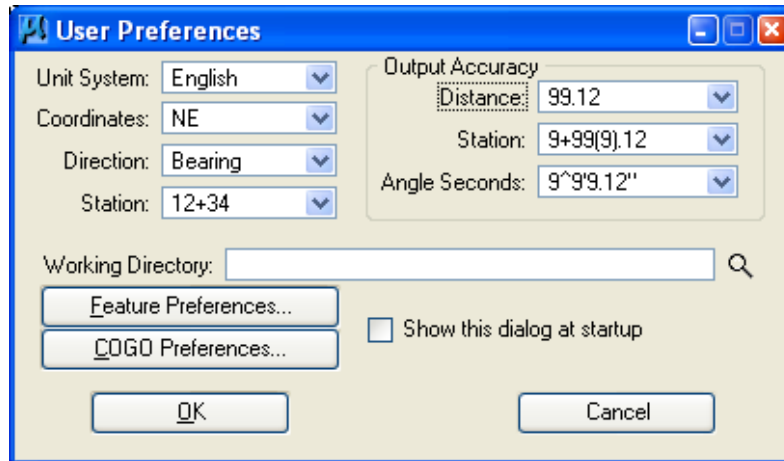
Note - Each project should have one job number.

If the user is creating a new project that does not have an existing .gpk file then the GEOPAK **job number** should be keyed into the **Job Number** field. This is how a new .gpk file is created within Project Manager. If the user is creating a new project that has an existing .gpk file, click on the **Select** button and select the existing .gpk file. If the existing .gpk file isn't visible in the selection window then either the Working Directory is incorrect or the existing .gpk file is not in the Working Directory.

Note - The Project Name specified is combined with a “.prj” extension to create the main Project Manager set-up file in the working directory.

Step II

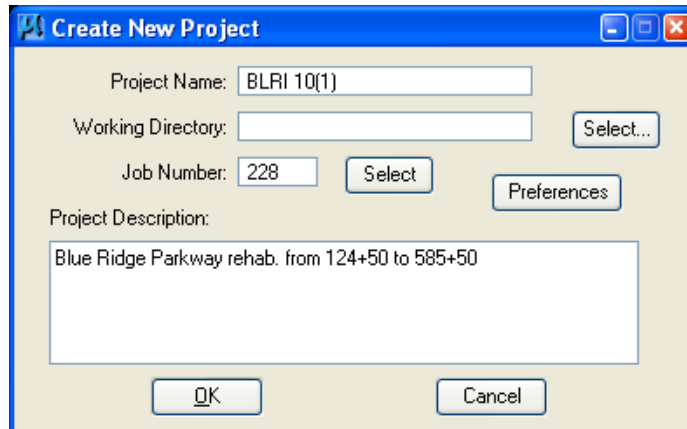
- Select the **Preferences** button from **Create New Project** Menu, the GEOPAK **User Preference** dialog box will appear as shown below:



- Set the desired project related preferences. US Customary Unit specific preferences in EFLHD are shown in the dialog boxes below.
- Keep the **working directory** and all the **COGO preferences'** directory as blank (EFLHD's preferred setting preference).

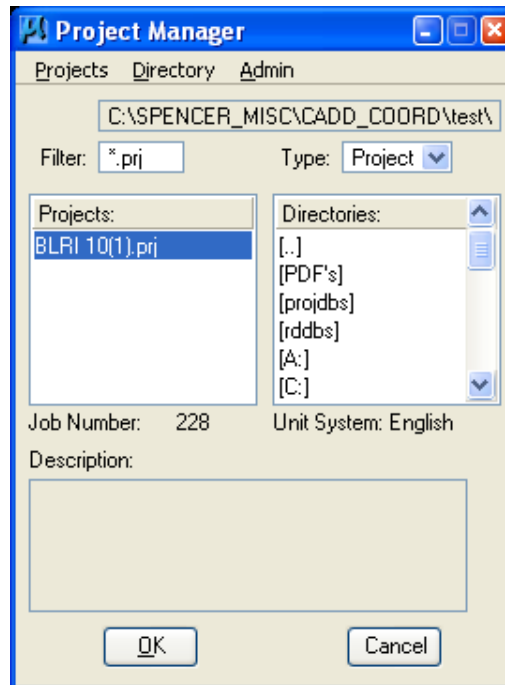
Note - This section is already discussed in Section 1.3 User Preferences.

- Select **OK** to close the Geopak **User Preferences** dialog box and **Create New Project** dialog will come back again.



- Type a short **Project Description** in the “**Create New Project**” dialog box.

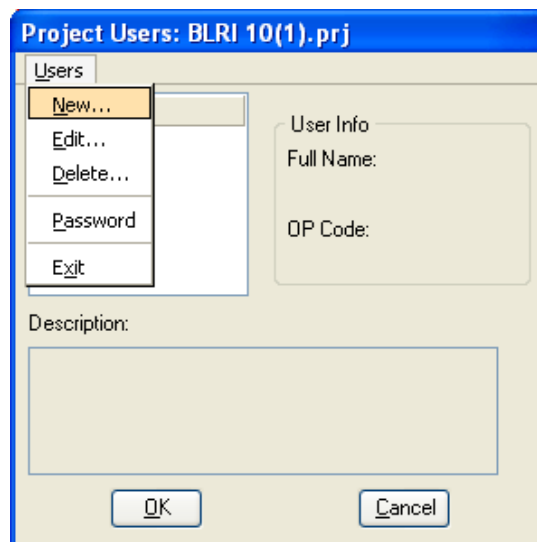
- When **OK** is clicked, the **Project Manager** dialog will appear as shown below, highlight the **.prj** file and click on **OK**:



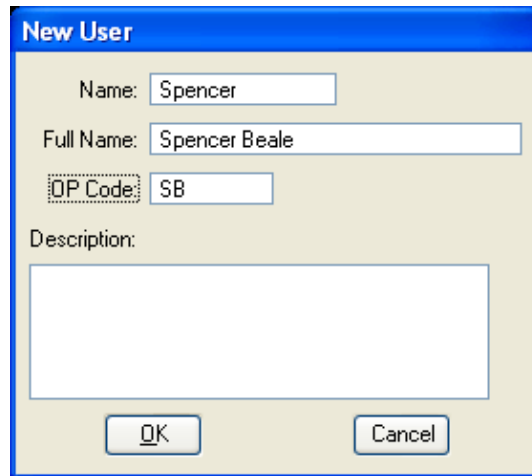
Step III

Create a User

- Once a project is highlighted and **OK** is selected, the **Project Users** dialog appears.
- Select **Users > New** from the pull downs as shown below..



- Complete the **New User** dialog similar to the illustration below and click on **OK**:



New User

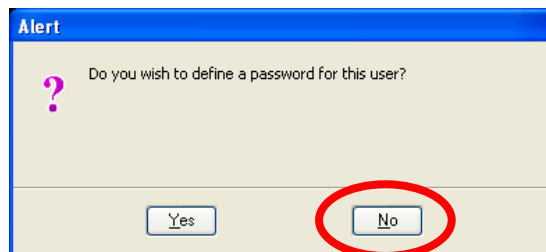
Name:

Full Name:

OP Code:

Description:

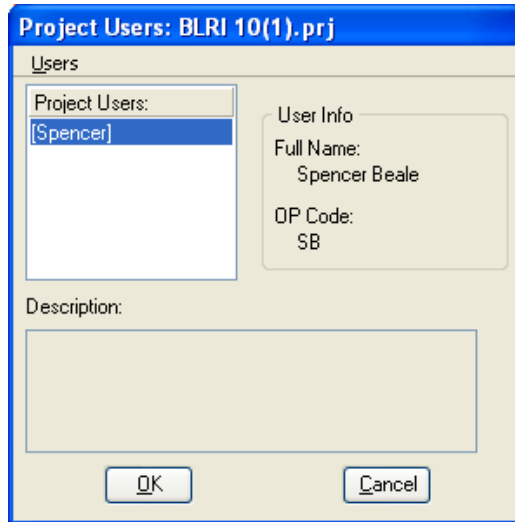
Note – While there may be times when multiple users are required to work on a single project, EFLHD policy is to create and use only one user for one project when and NEVER use passwords in Project Manager.



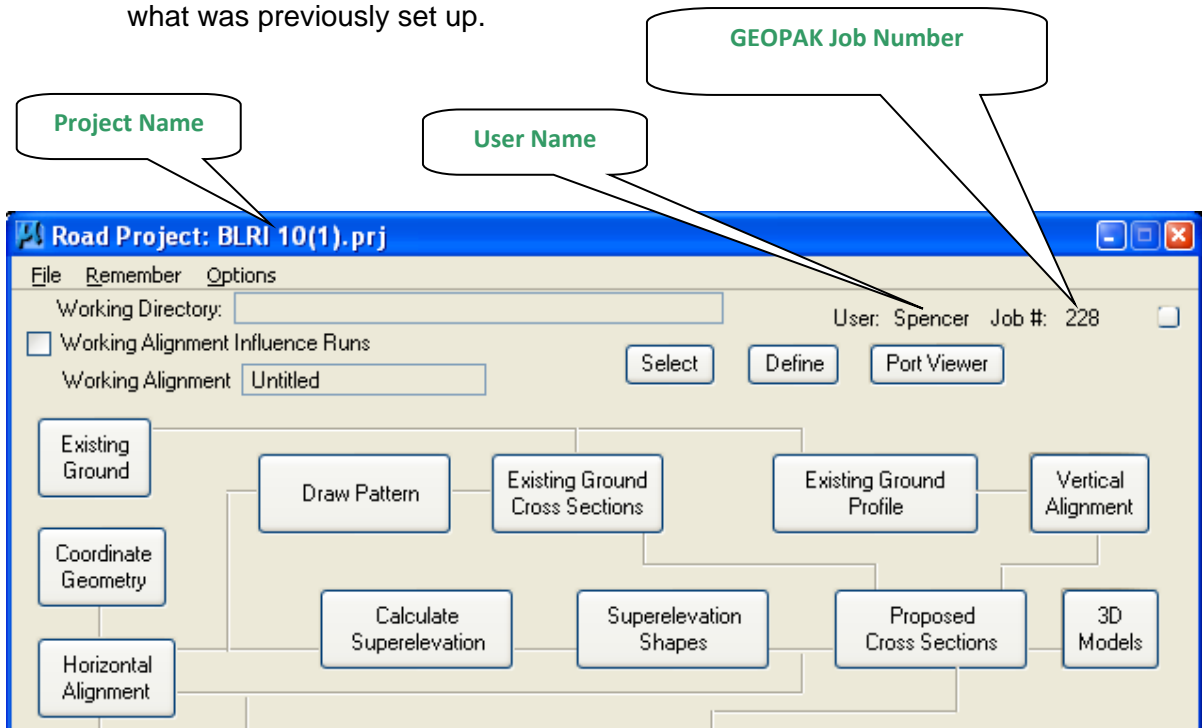
Alert

Do you wish to define a password for this user?

- The **Project Users** dialog will appear similar to the illustration shown below. Highlight the **User** and click on **OK**.

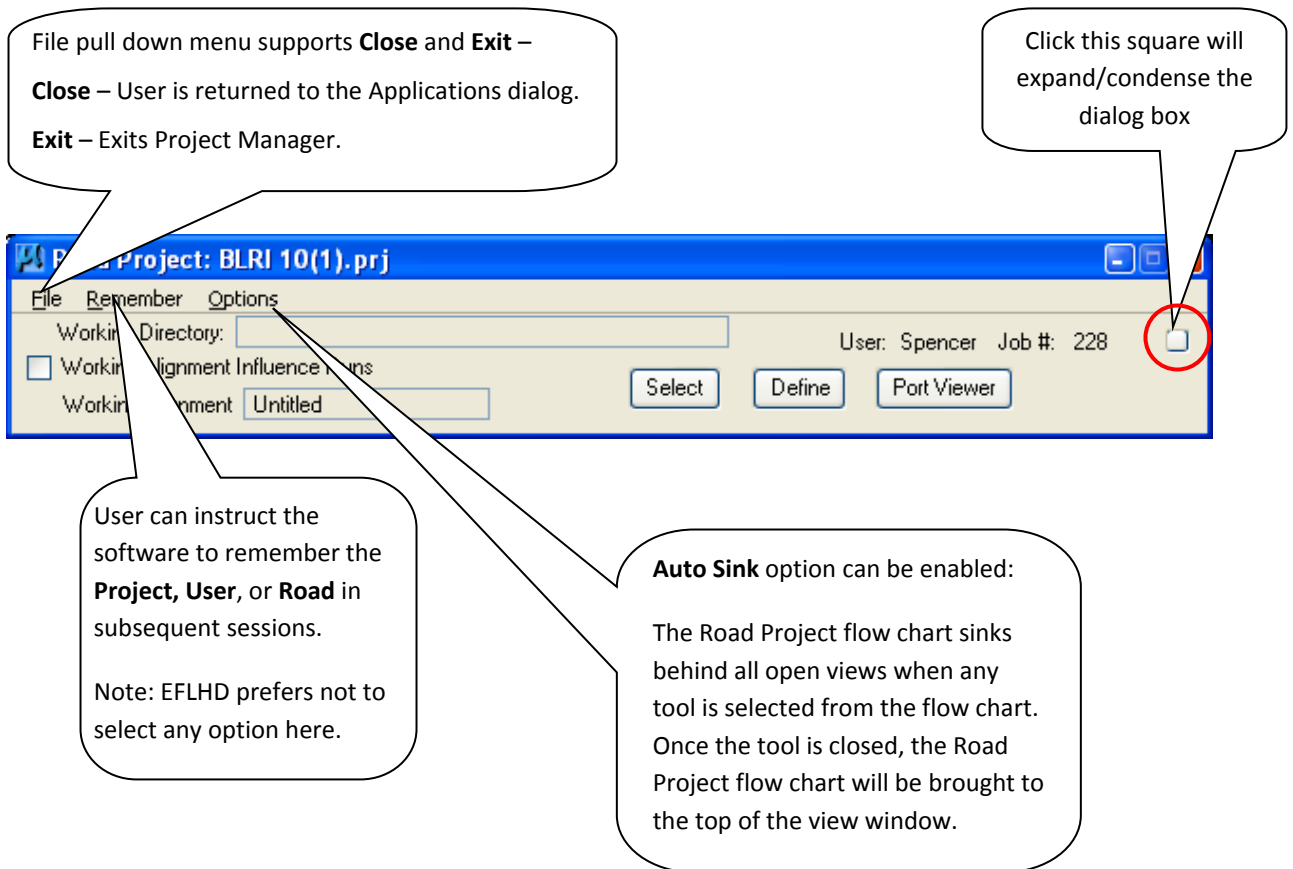


- When **OK** is pressed the Project Manager **Road Project** dialog will appear as shown below. Notice the **Project name**, the **User name** and **Job #** match what was previously set up.



Road Project Dialog

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

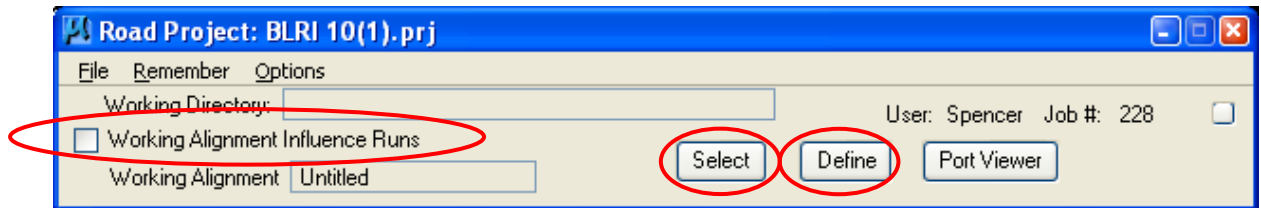


1.4.3 - Create a Working Alignment

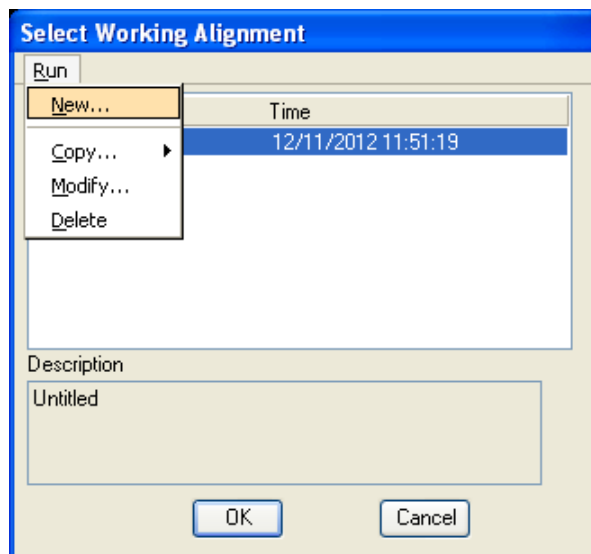
The concept of a working alignment enables the designer to organize a project and to access project information without continually typing in the required information. On a simple project, only one working alignment may be needed. However, on a more complicated project, an unlimited number of working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

- 1) **Select**
- 2) **Define** button
- 3) **Working Alignment Influence Runs** (toggle on left side of dialog box)

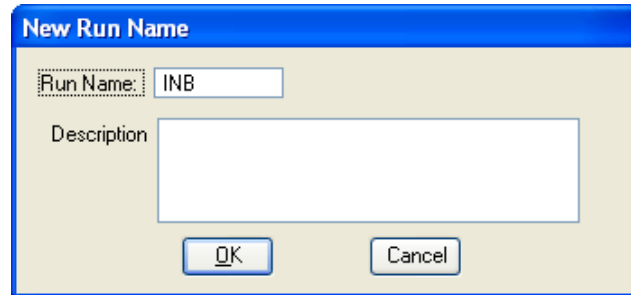
- Click on the **Select** button to create a new **Working Alignment** as shown below:



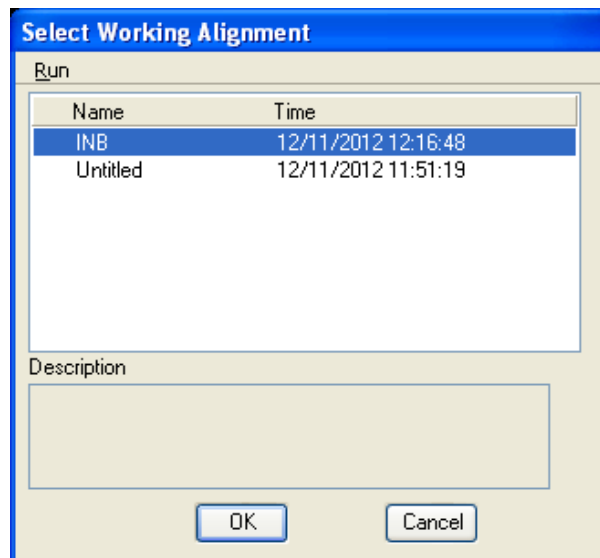
- The **Select Working Alignment** dialog appears. Use the pulldowns and select **Run > New** as shown below. Click on **OK**.



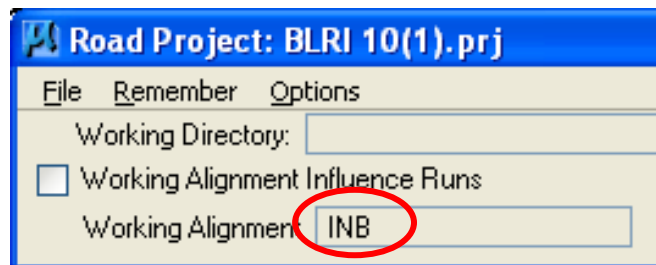
- The **New Run Name** dialog appears. Type in the name of the “Run” to create. The **Description** field is optional. Click on **OK**.



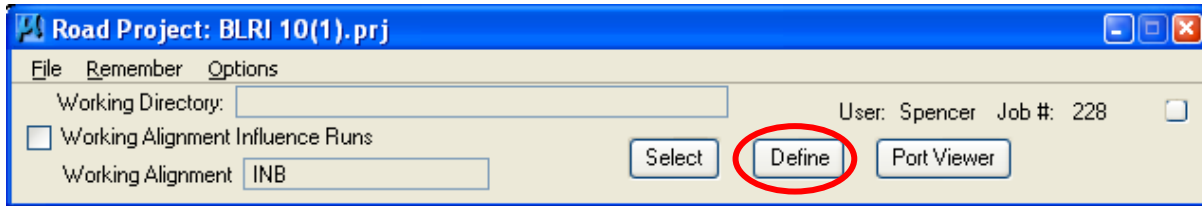
- The **Select Working Alignment** dialog appears. Highlight the desired run (you may eventually have several) and click on **OK**.



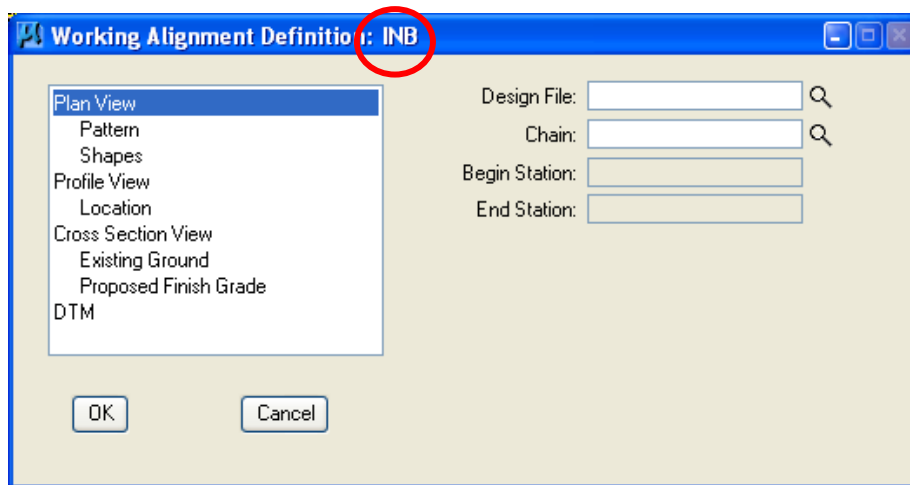
- Notice how the Project Manager (**Road Project**) dialog is now set to use the Working Alignment “**INB**”, as shown below:



- Click on the **Define** button. We are now ready to being “defining” everything about the alignment that we want to use.

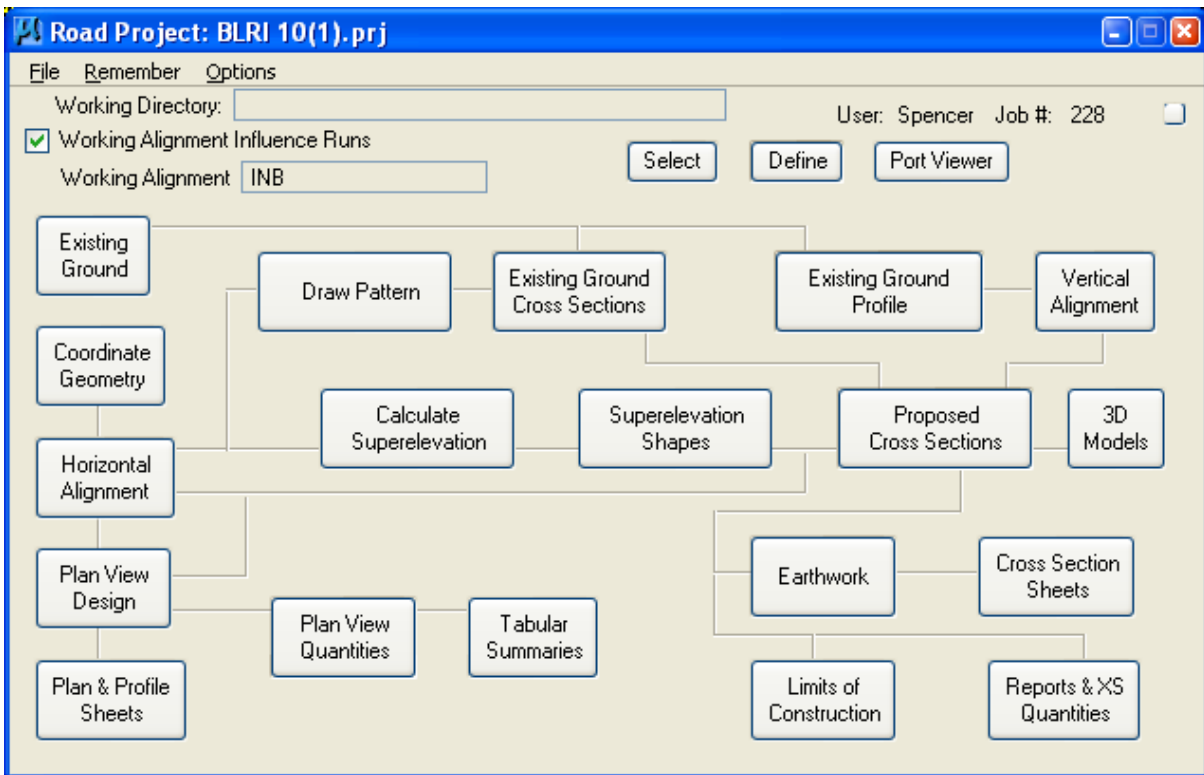


- The **Working Alignment Definitions** dialog appears using the working alignment “INB”.



- Complete each of the required “Sections” of this dialog by clicking on each and completing the fields. Required sections are **Plan View, Pattern, Shapes, Cross-Section View, and Existing Ground**.
- You are now ready to begin the design.

1.4.4 - Project Manager Process



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

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

1.5 – Create the Horizontal Alignment (GEOPAK)

There are many different, and acceptable, methods of creating horizontal geometry using Geopak. Some are described as follow:

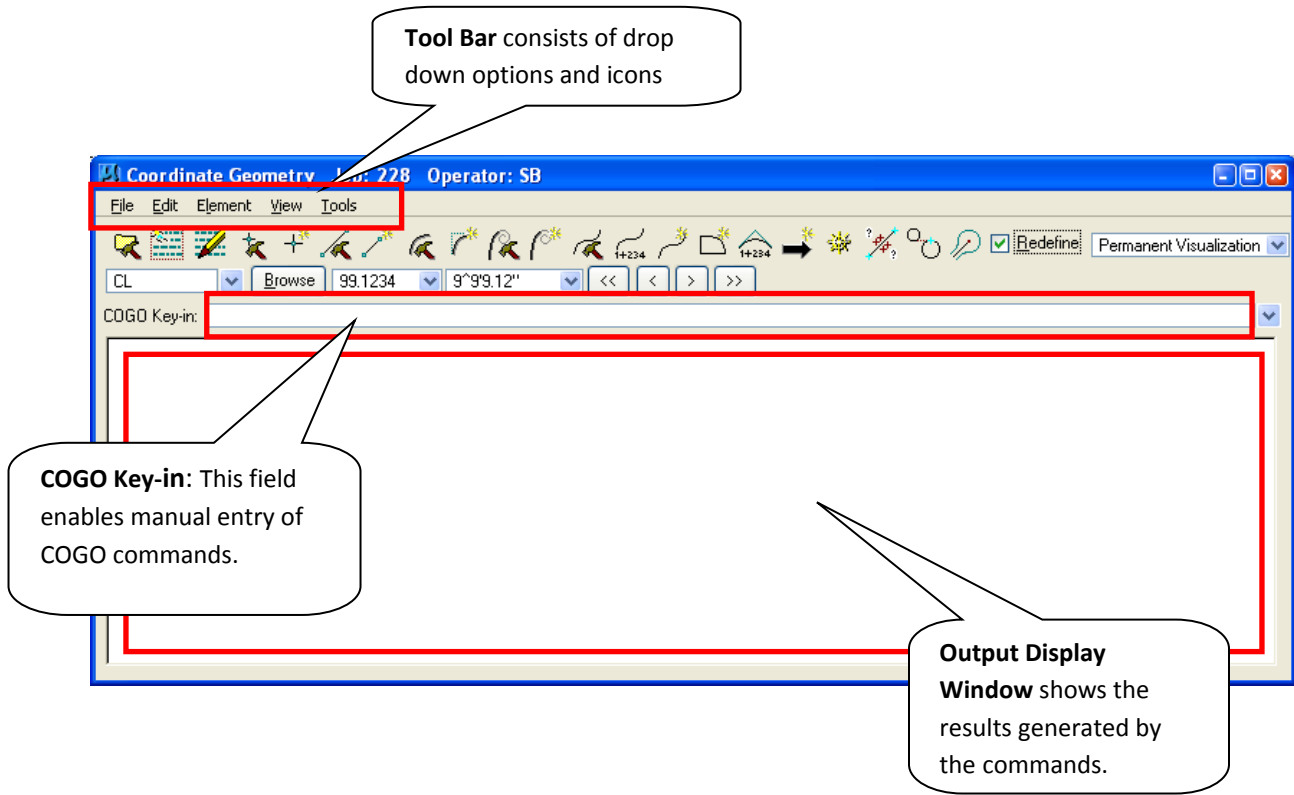
1. Coordinate Geometry (COGO)
2. Graphical COGO/Horizontal Alignment Generator (both are similar)
3. Store Graphics.

Any of these methods are acceptable to EFLHD. Regardless of the method used, the final alignment must be drawn into MicroStation using the **GEOPAK D&C Manager**, with the “**V8_ENGLISH.ddb**” (FLH) file. This will assure that the elements are drawn with the correct symbology, matching the FLH standards.

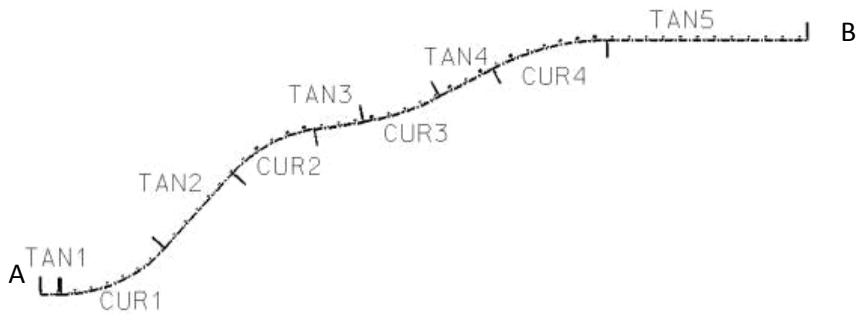
1.5.1 - Coordinate Geometry (COGO):

This method allows the user to have more precise control over tangent bearings, control point coordinates, etc., than with Store Graphics, if done properly. But the disadvantages of these methods are the Commands for the command line and input file methods are difficult to memorize, small adjustments are hard to make, and the process is time consuming.

You can create the horizontal geometry by typing commands in at the COGO command line, by creating an input file with a sequence of COGO commands and loading it into COGO, or by using the dialog box driven Store Curve from Tangents, Locate Traverse, etc., tools that are accessed from the COGO pull down menus to generate the commands. If you use the input file method, remember that the COGO input file name can only be 8 characters long, must have the job number as the last three digits in the name, and the extension has to have an “i”+ the operator code. (i.e. XXXX101.isa), where the i stands for input file.



1.5.1.1 - Steps to follow to create a Chain from Point A to B as shown:



Chain from Point A to Point B

		<u>Y (Northing)</u>	<u>X (Easting)</u>	
TAN1	From Point(5000):	1500.000	1250.000	---Point A
	To Point(5001):	1500.000	1367.957	

CUR1 Radius=818.511

TAN2	From Point(5002):	1770.821	1976.230
	To Point(5003):	2212.417	2373.845

CUR2 Radius=818.511

TAN3	From Point:	2473.161	2854.074	(5004)
	To Point:	2518.881	3142.737	(5005)

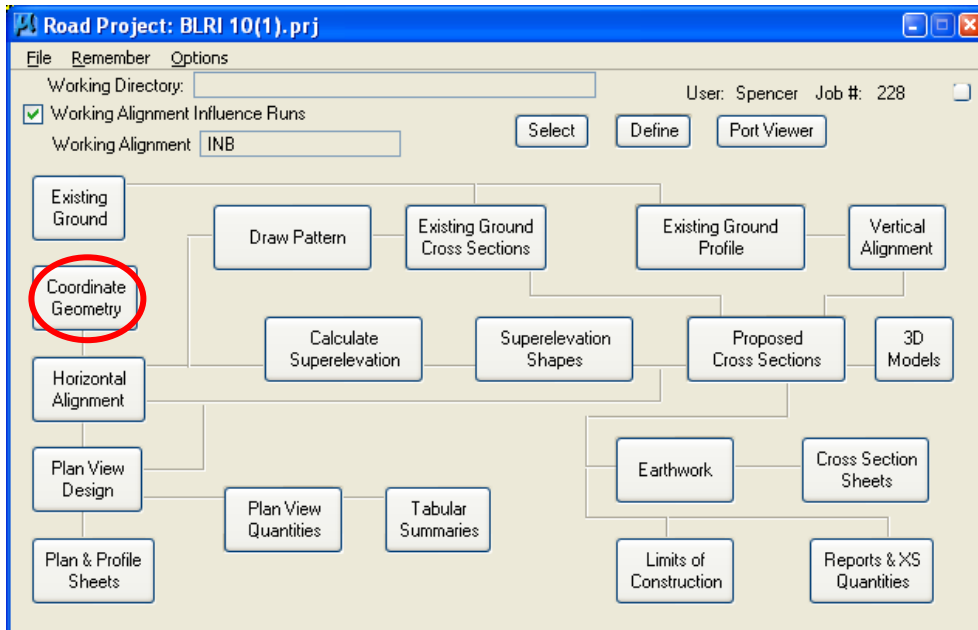
CUR3 Radius=1432.394

TAN4	From Point:	2668.911	3591.129	(5006)
	To Point:	2832.335	3898.485	(5007)

CUR4 Radius=1432.394

TAN5	From Point:	3000.000	4570.953	(5008)
	To Point:	3000.000	5750.000	(5009) ---Point B

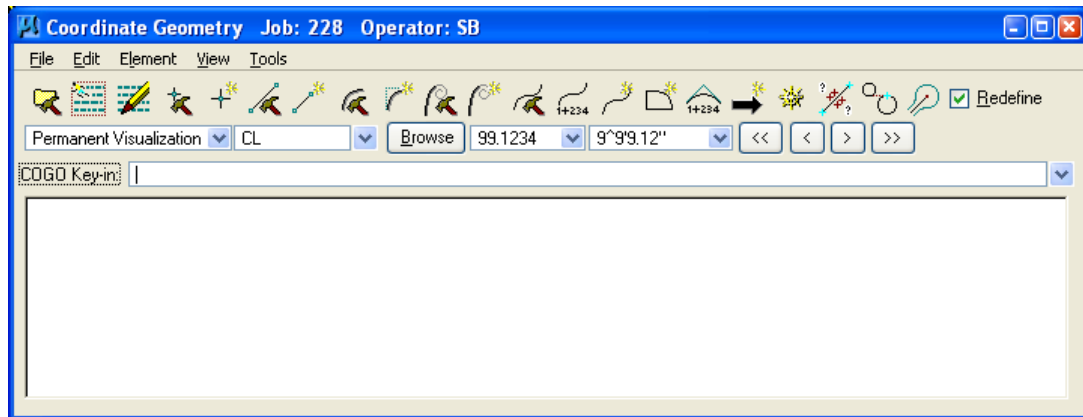
Step 1: Open the **Coordinate Geometry** dialog box by clicking on the **Coordinate Geometry** button on the Project Manager flow chart as shown:



You can also select the Coordinate Geometry button on the GEOPAK main dialog box.



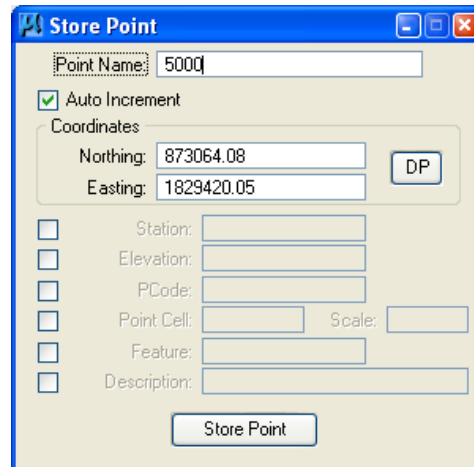
The Geopak Coordinate Geometry dialog box appears as shown below.



Note - If you are using Project Manager, the Coordinate Geometry dialog box will be invoked. Otherwise, the Job Number and Operator code will have to be entered in the COGO Startup dialog box. Project Name and Subject are optional fields. Press the OK button to bring up the Coordinate Geometry window.

Step 2: Store Points

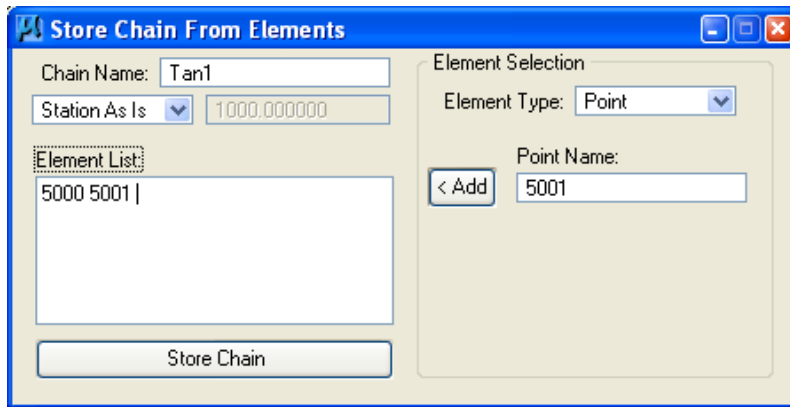
To store a Point, follow **Element > Point > Store** from the **Coordinate Geometry** dialog box.



- Enter Point # (start with 5000)
- Check the *Auto Increment* Box
- Enter the *Northing* and *Easting* or use the **DP** button to data point in your design file for the point data.
- **Store Point**
- Repeat until all *from* and *to* points have been stored. (ex.; You should have 10 points, starting from 5000, 5001.....5009)
- Close the Store Point dialogue box.

Step 3: **Store Chain for Tangent line**

To store a tangent line for a Chain follow **Element > Chain > Store** from the **Coordinate Geometry** dialog box.



- Chain name: Tan# (Starting with *Tan1*)
- Toggle *Begin Station* to ***Station As Is***
- Under Element Type select ***Point***
- Point Name: Type in the points between which the tangent falls. (for example: Tan1 lies between 5000 and 5001, so type 5000 first and hit *Add*, then type 5001 and hit *Add*)
- Store Chain
- Repeat until all tangents have been stored. (In all you should have 5 tangents, starting from Tan1, Tan2.....Tan5)
- Close the Store chain from Elements dialog box.

Step 4: Store a Curve

To store curves follow **Element > Curve > Store > By End Points** from the **Coordinate Geometry** dialog box.

- Name: Cur# (Starting with *CUR1*)
- Enter the PC point# (To-point of back tangent)
- Enter the PT point# (From-point of ahead tangent)
- Change *PI Point to Radius*, and enter the *radius* of the curve from above given data.
- Choose *clockwise or counterclockwise* based on the direction of curve.
- Store Curve
- Repeat until all curves have been stored. (In all you should have 4 curves, starting from CUR1, CUR2.....CUR4)
- Close the Store Curve dialog box.

Step 5: Store Chain for whole Alignment

Select Store Chain again follow **Element > Chain > Store > From Element** from the **Coordinate Geometry** dialog box.

- Chain Name: *RCOGO*
- Change *As Is* to *Begin Station* and enter *10+00*
- Set the Element Type (which is *Point* at present) to *Chain* and add *TAN1*

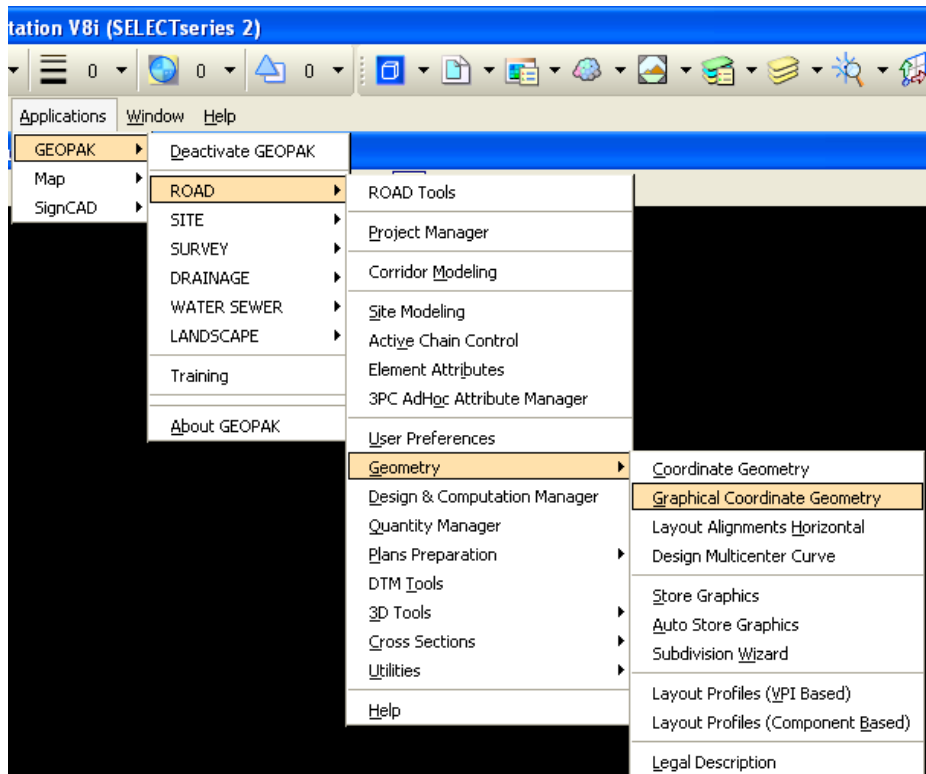
- Now set the Element Type to *Curve* and add *CUR1*
- Continue adding all chains (tangents) and curves in the proper order. (TAN1, CUR1, TAN2, CUR2,TAN5)
- Store Chain
- Close the Store Chain from Elements dialogue box.
- Save this session. Go under **File > File Utility** in the Coordinate Geometry window.
- Select **Save**
- Close the Coordinate Geometry window.

1.5.2 - Graphical COGO/Horizontal Alignment Generator:

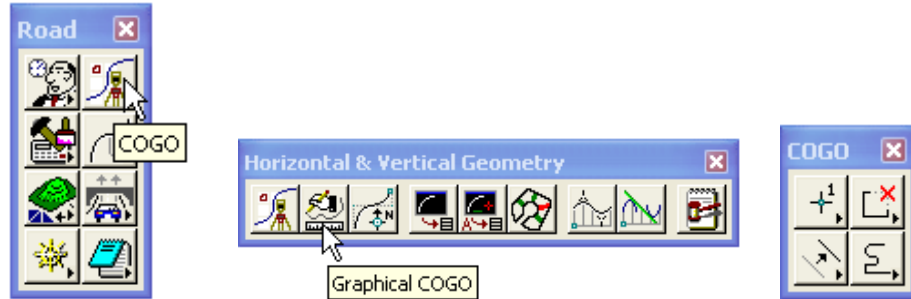
Graphical COGO and the Horizontal Alignment Generator, allow the user to create coordinate geometry elements, much the same as the original COGO tools, but with a much more graphic and user-friendly process.

1.5.2.1 - Graphical COGO:

- Graphical COGO can be accessed by selecting:
Applications > Geopak > Road > Geometry > Graphical Coordinate Geometry,
as shown below.

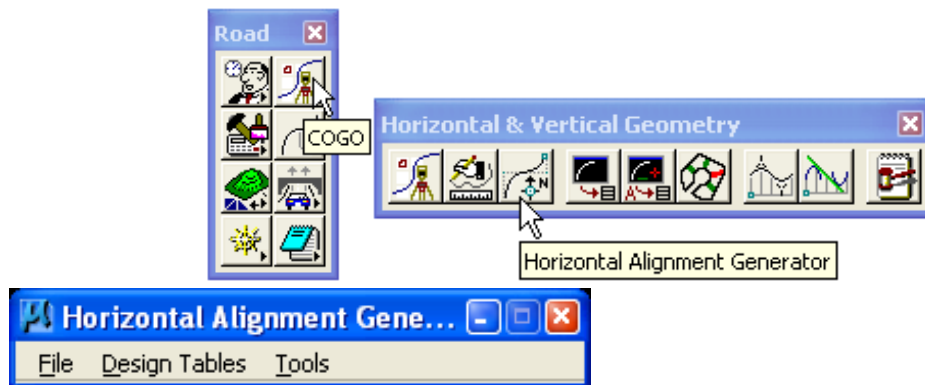


- **Graphical COGO** can also be accessed by selecting the icons from the main **Geopak Road** tool box.



1.5.2.2 - Horizontal Alignment Generator:

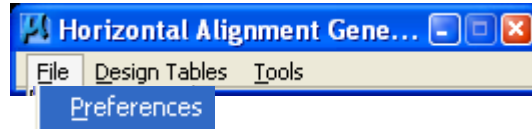
- Horizontal Alignment Generator can be accessed by selecting:
Applications > Geopak > Road > Geometry > Layout Horizontal Alignments, or
- Horizontal Alignment Generator can be accessed by selecting the icons from the main **Geopak Road** tool box.



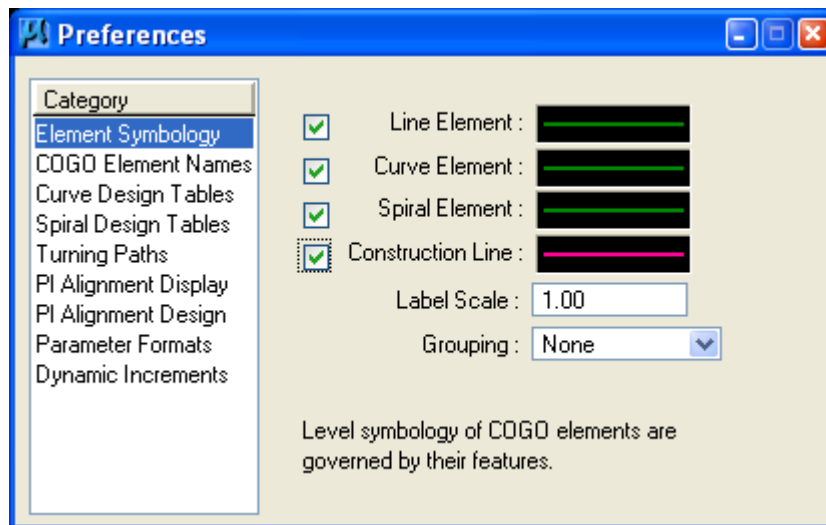
- The **Horizontal Alignment Generator** can also be accessed using **Project Manager** by clicking on the **Horizontal Alignment** button on the flow chart.

Note - The Graphical COGO cannot be accessed directly from Project Manager.

- The File pull-down menu allows the user to set **Preferences** for how newly created elements will be displayed, how to name elements, and which geometry tables to use as a default.



- The **User Preferences** dialog is very useful. It allows the user to preselect the **Element symbologies** for lines curves and spirals, as well as the symbology for the “Modify” tool. This makes it very easy to distinguish the geometric components from each other while laying out the alignment.



1) An important thing to remember is that the components never have to be drawn graphically in order to be manipulated later. COGO has several “**Visualization**” options. It is possible to simply “**Temporarily Visualize**” a component or components for manipulation or for storing the components as a chain. Graphics just make the .dgn file larger and also limit you to the old world of single precision. The Visualization options can be set on the COGO dialog box. EFLHD recommends using “Temporary Visualization” until the Designer is satisfied with the alignments. This way nothing is written to the file before it is desired.

2) These symbologies are used only when the elements are NOT stored directly to the GPK. To store the elements as simple, graphic elements (single precision), the option, “**Save as COGO Elements**” must be checked OFF under the category “**COGO Element Names**”.

3) To specify the color of these elements for storing as COGO elements (double precision)... Modify the **.smd file** via the Geopak User Preferences, (Applications > Geopak > Road > User Preferences).

- In addition you may also set up your own naming convention for storing the geometric components. This is done under the Category “**COGO Element Names**”.

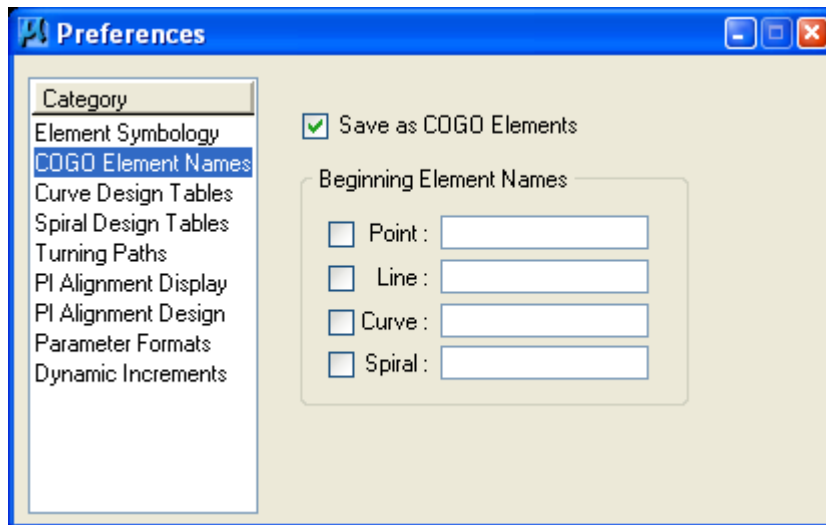
Under the Category **COGO Element Names**, you may setup your own naming convention for **Points, Lines, Curves** and **Spirals**. If the names are left blank, the software will default to the following naming conventions, using the “Next Available” name concept:

Points...(1,2,3...)

Lines... (L1, L2, L3...)

Curves... (C1, C2, C3...)

Spirals... (S1, S2, S3...)



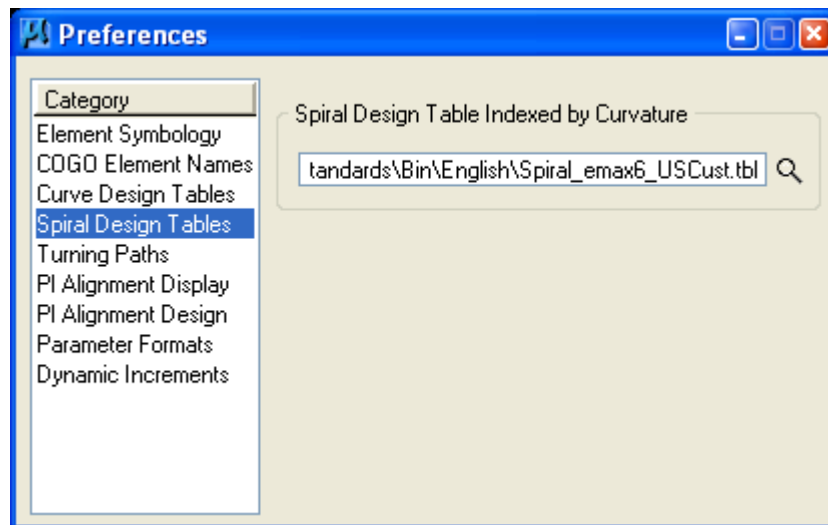
One very important option on this dialog is “**Save as COGO Elements**”, (mentioned earlier). This is what differentiates between whether the components will be stored as graphics (single precision) or as COGO elements (double precision). To save the components directly to the GPK database and as **double precision**, make sure this option is “**checked**”.

Note - The trick here is that the names you key-in will not take effect until this dialog is “dismissed”.

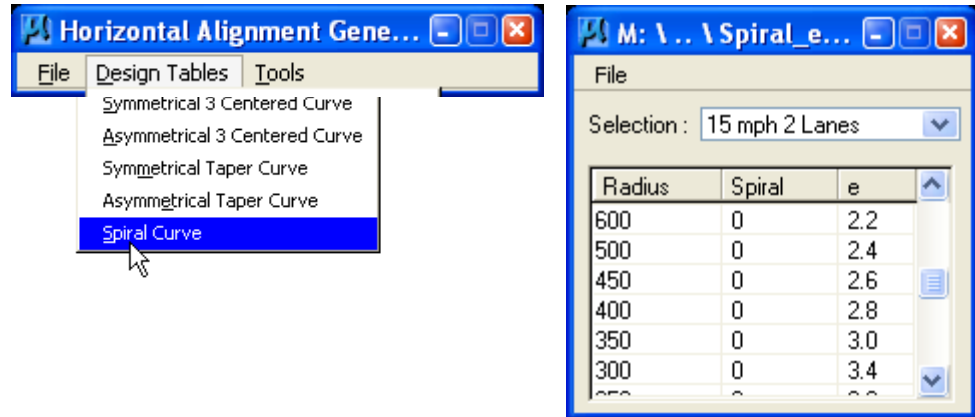
- Currently FLH/EFLHD is using the default Curve Design Tables setup by Bentley (Geopak).
- Under the Category **Spiral Design Tables**, a set of files have been set up to provide the user with an easy way to add spirals (using the AASHTO minimum lengths) to a user defined curve radii or degree. For example, when laying out an alignment with the new Geopak 2001 tools, the user simply keys-in a simple curve radius or degree and the spiral length values are automatically populated by accessing this “table” file.

EFLHD uses the Spiral Design Tables. To access the Spiral Design Tables, path should be set to

“M:\Engineering_Software\Cadd_resource_v8i\X_30\Standards\Bin\english or metric”

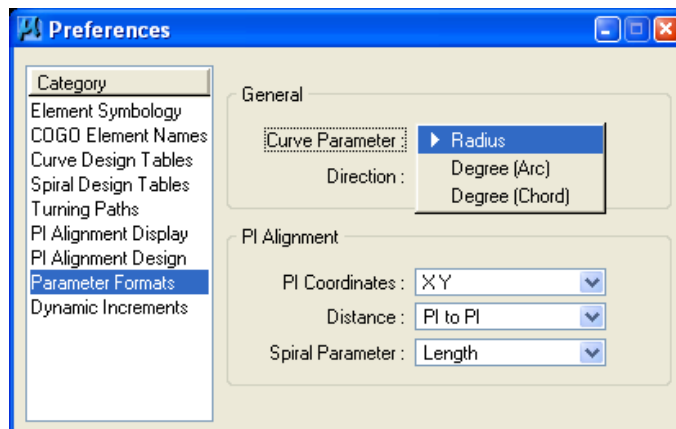


The **Design Tables** menu allows the user to view the settings for the current default design tables. In the **Design Tables** pulldown, the user sets the paths and file names for the tables to be accessed. Once the English or Metric Spiral Curve table is selected, select the design speed and number of lanes. These tables correspond with the AASHTO Green Book.



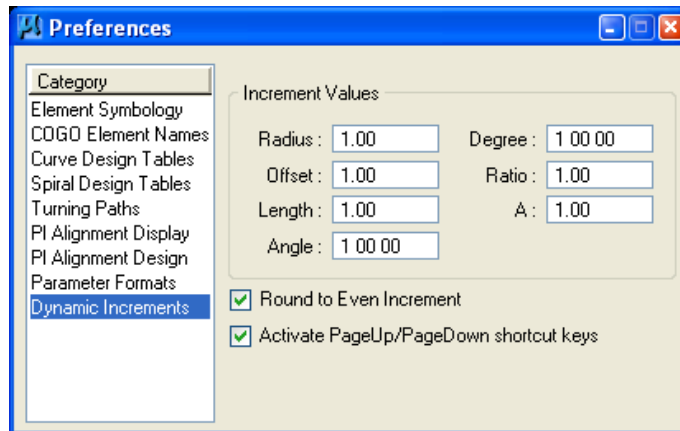
Note - Currently EFLHD uses only the Spiral Curve tables (Metric and English).

- Under the Category **Parameter Formats**, the user selects the curvature type, as shown below.

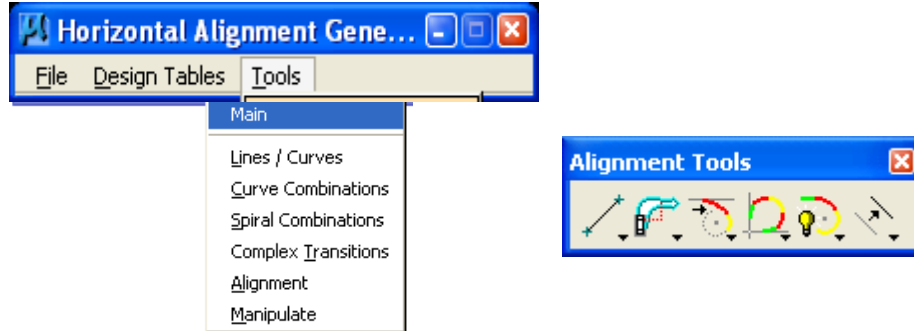


- Under the Category **Dynamic Increments**, the user selects the Increment adjustment Values, as shown below.

If “checked” the option **Activate PageUp/PageDown** shortcut keys will allow the user to increment the elements during design by using the **PageUp** and **PageDown** keys on the keyboard.



- The tools menu activates the COGO tools that will be used to create geometry elements. Selecting **Tools > Main** accesses the following tool frame.



- From the main tool frame, shown above, additional tools may be accessed from each of the six main tool box icons. Each of the tool boxes, as well as the tools from Graphical COGO, may be used together to create any combination of geometry, from the simplest to the most complex.

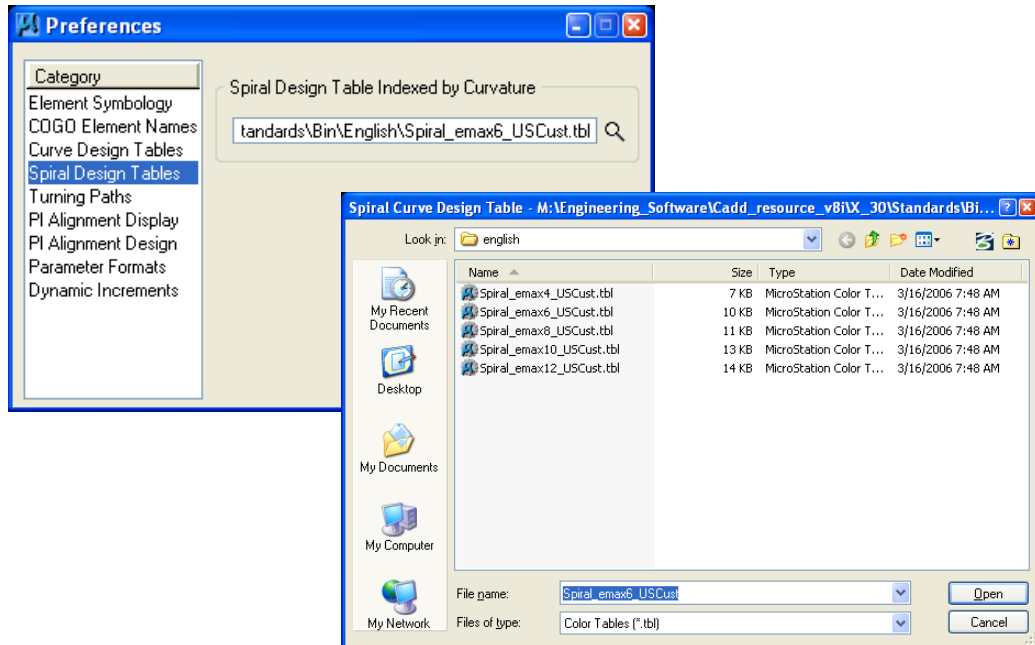
Note - Using these tools to set a horizontal alignment, if done properly, is just as accurate as the traditional command line in COGO. This process is slower than using store graphics.

1.5.2.3 - Examples of using the new Horizontal Alignment Generator...

- First of all COGO must be running for this to work. No need to worry about this though, because the software prompts you for a COGO session if you don't already have one active.
- Check your Horizontal Alignment Generator User Preferences settings as explained earlier to make sure that you have correctly selected all of the desired settings.

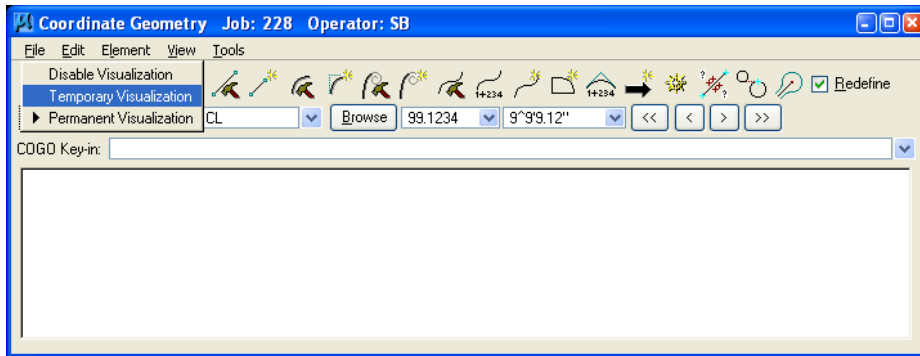
- Check to make sure that your Spiral Design Tables are pathed correctly. These tables aren't actually necessary, but make it much easier when using spirals and making sure that you are using the minimum spiral lengths for the appropriate design speed and curvature. The path (for office workstations) should be set to
M:\Engineering_Software\Cadd_resource_v8i\X_30\Standards\Bin\english.

Browse to this directory and select the appropriate table file.

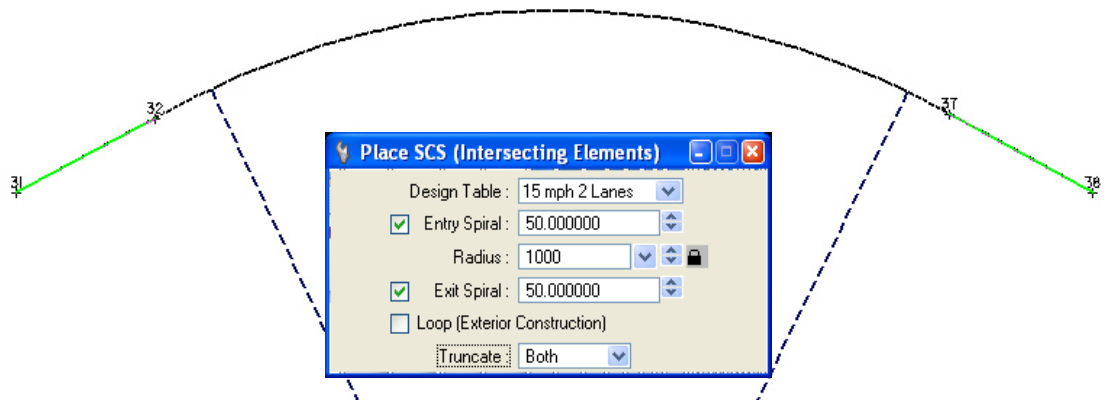
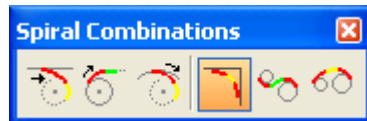


- Select the Main tool box from the Tools pulldown (as shown previously). To place a typical Spiral Curve Spiral (SCS), (most common way):
- Make sure that “Temporary Visualization” (my preference) has been selected in COGO.

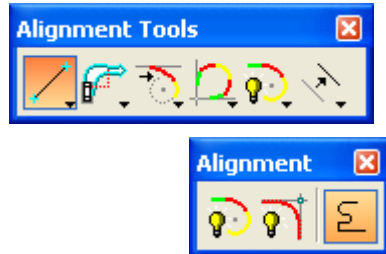
- Create the entry and exit tangents, using the **Store Line by 2 Points** tool.



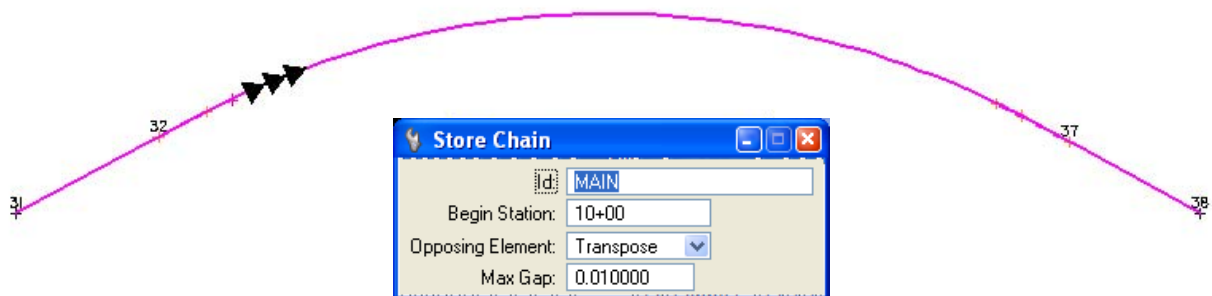
- Select the Place SCS (Intersecting Elements) tool. Identify the tangents, (follow the on screen prompts). Once the second tangent is identified, the 3 elements of the SCS will appear (as keyed-in in the dialog). To “Modify” the length values, you may highlight one of the length fields and use the little arrows for increasing or decreasing the values. Setting the Increment Values was explained earlier (above). The position of the SCS can be easily warped into place. When you are satisfied with the location of the SCS...simply data point the screen. If you had “Save as COGO Elements” toggled ON, those components are now stored in the GPK database.



- Storing these components as a chain is much easier with Geopak V8i. Even though they are not actually drawn graphically... Geopak can see them. To store (for example) these 5 components as a chain, invoke the Geopak Store Chain tool.



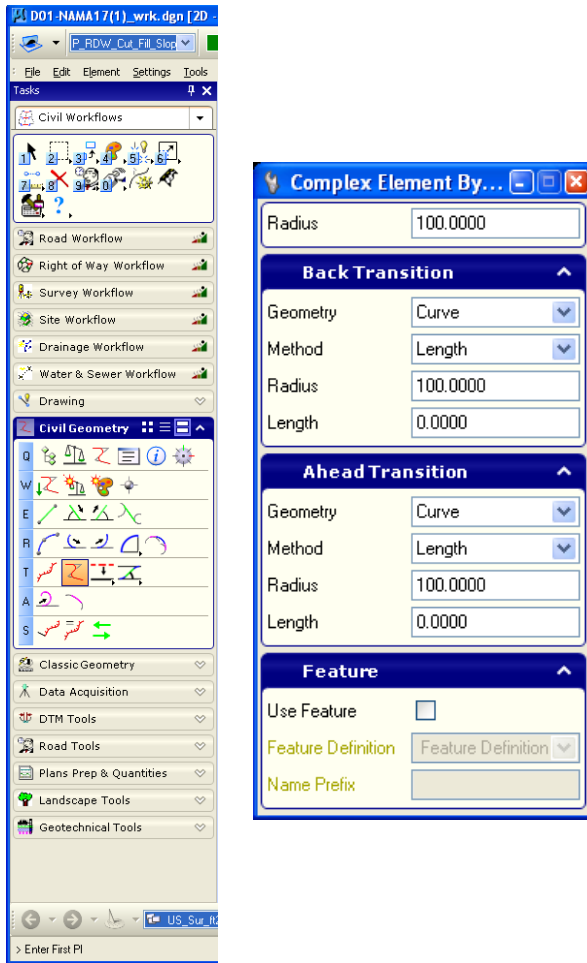
- With Geopak V8i Store Chain there is no need to continuously click until all of the elements are collected. Simply complete the dialog with the Chain Name, Begin Station etc... and data point any component that is visualized and accept it with another data point. All adjacent components will be considered for the chain. You will see several small arrows pointing in a direction. These directional arrows are asking you if this is the direction that you want to store the chain stationing. If this is not the direction, simply click reset and the directional arrows will switch... or as some in the South say...."swap". Once the arrows are pointing the right direction, data point the screen again. The components are now stored as a chain.



- You may have noticed that on the Store Chain dialog there is an "Opposing Element" option. The options are Transpose and Create. These options are given because sometimes the components may not be stored all going in the same direction. When you store the chain at a direction and some of the components were stored in the opposing direction, you have the option to have Geopak Transpose those offending elements or Create new elements instead leaving the original ones alone... I would recommend using Transpose and keep the GPK file smaller and cleaner. The recommended Max Gap setting for a metric design is 0.01 and for English design is 0.03.

Another tool available with Geopak V8i... is the Complex Element By PI, which allows the Designer to place a Dynamic Alignment... This tool allows you to pre-select geometric values and design “on the fly”. Give it a try.

Under the Tasks Bar > Civil Geometry Workflows > Complex By PI.



Enter in the desired geometry and dynamically place tangent / curve combinations.

Change radii, lengths, curve types on the fly while data pointing to graphically create an alignment.

To Modify the Visualized elements:



Visualized elements can be further manipulated using any of the 4 “Manipulate” tools.

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

It is very important to mention that visualized elements cannot be deleted from the GPK file with the normal MicroStation “Delete Element” tool. That tool only deletes elements that are written to the design file. To delete these visualized elements, use the “Delete Element” tool on the “Manipulate” tool box. Of course these elements can also be deleted via COGO key-ins or COGO Navigator.

To View the Output Listing

- There are two ways to do this. After the alignment is stored, activate the **COORDINATE GEOMETRY** dialog box.
- At the top of the COGO dialog box type DES ALI [chain name].
- This produces an output listing.

- At the top of the **COGO** dialog box type DES CHA [chain name].
- ...or... use the COGO pull-downs, **Element > Chain > Describe/List/Print**, select the chain and press Describe.
- This produces the normal GEOPAK output listing.

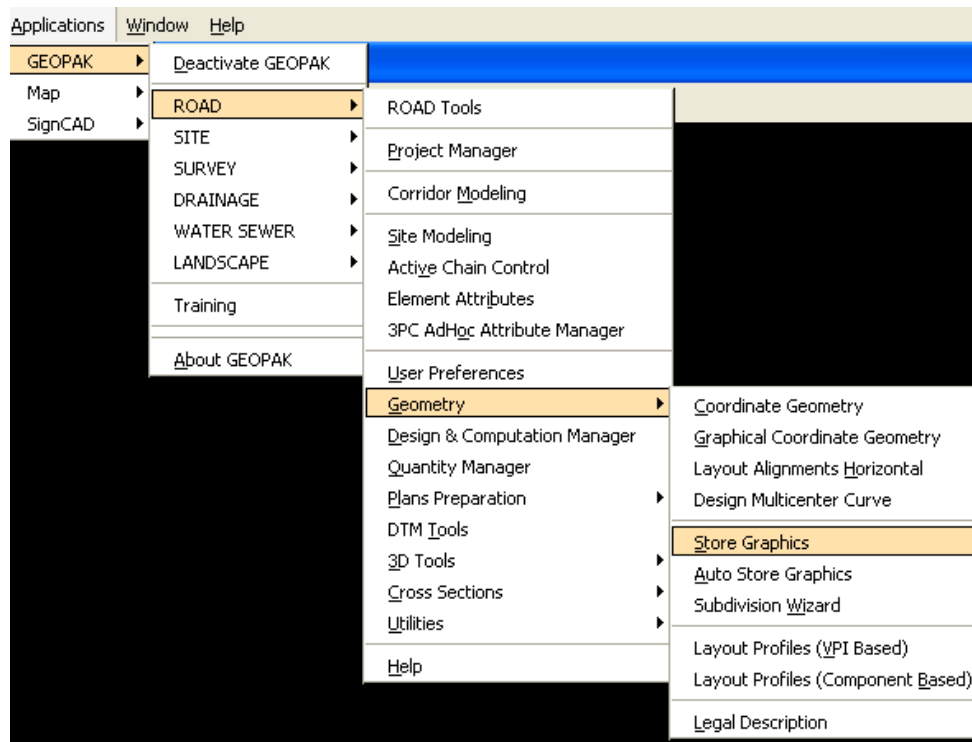
NEXT...To actually print a hard copy of this alignment, at the top of the **COGO** dialog box, type **CLEAR**, press **ENTER**, type DES ALI [chain name], press **ENTER**, or DES CHA [chain name], press **ENTER**, and type **OUT [filename]**, and press **ENTER**. These same commands are also available from the “**Coordinate Geometry**” dialog box “pull downs” located at the top of the dialog box.

To display the alignment graphically, (for Final plans) see Display the Horizontal Alignment.

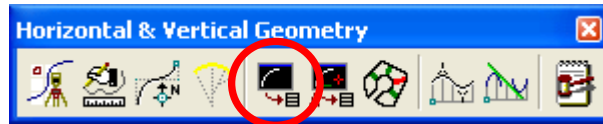
1.5.3 - Store Graphics:

The store Graphics procedure is the simplest and quickest method to create a horizontal alignment. The user can use standard MicroStation draw utilities to layout the alignment then use the Store Graphics tool to store the alignment into COGO. Even though MicroStation measurements are to single precision, GEOPAK stored elements are computed to double precision accuracy. Store Graphics will make slight adjustments to the graphical element locations as required forcing each element in the chain to be exactly tangent to the immediately preceding element and the immediately following element. These adjustments are always minor (e.g. the coordinates of a curve's PC and/or PT may be adjusted a few millimeters to force the curve to match the tangents exactly) but they do occur and the user has no control over them. However, if the graphical elements were drawn correctly then the chain that gets stored into the gpk file is exactly as "accurate" as a chain stored using any of the other methods.

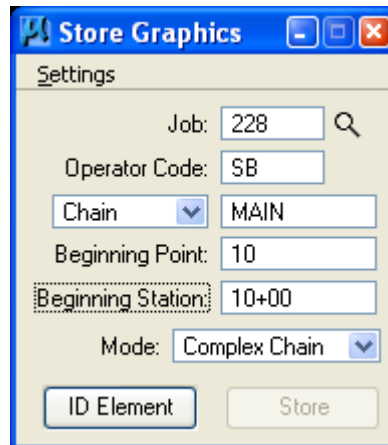
- This command cannot be accessed using Project Manager, but can be accessed the following two ways. From the **GEOPAK** pull down menus select, **Applications > GEOPAK > ROAD > Geometry > Store Graphics**



Or by selecting the icons from the **Geopak Road > Horizontal and Vertical Geometry** tool box as shown below:



- Selecting the **Store Graphics** Icon will invoke the Store Graphics Dialog box. You can store the elements as **Complex Chain**, **Selection Set** or **Single Element**.



Advantages –

Uses simple MicroStation commands to layout alignment, adjustments to alignments are quick, and the only point numbers used are on the alignment (usually just the first and last).

Disadvantages –

1. Not as accurate as COGO. Store Graphics makes minor adjustments to the as-drawn elements in order to get them to tie together mathematically.

2. Cannot draw spirals using MicroStation commands. If spirals are needed, you must use Horizontal Alignment Generator to create that element, and then you may continue using MicroStation commands.

To display the alignment graphically, (for Final plans) see ***Display the Horizontal Alignment Section 1.6.1.***

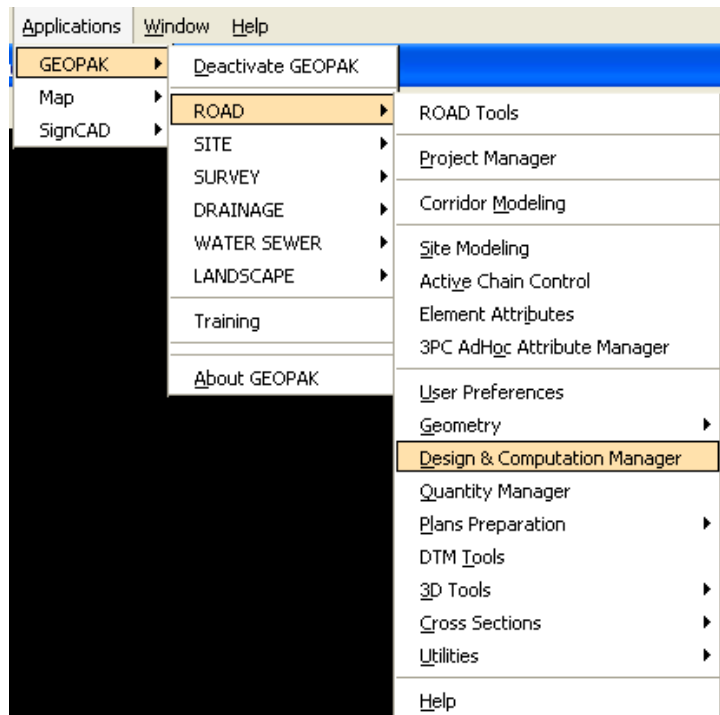
1.6 Display the Horizontal Alignment And Drawing Other Plan Features

1.6.1 - Display the Horizontal Alignment

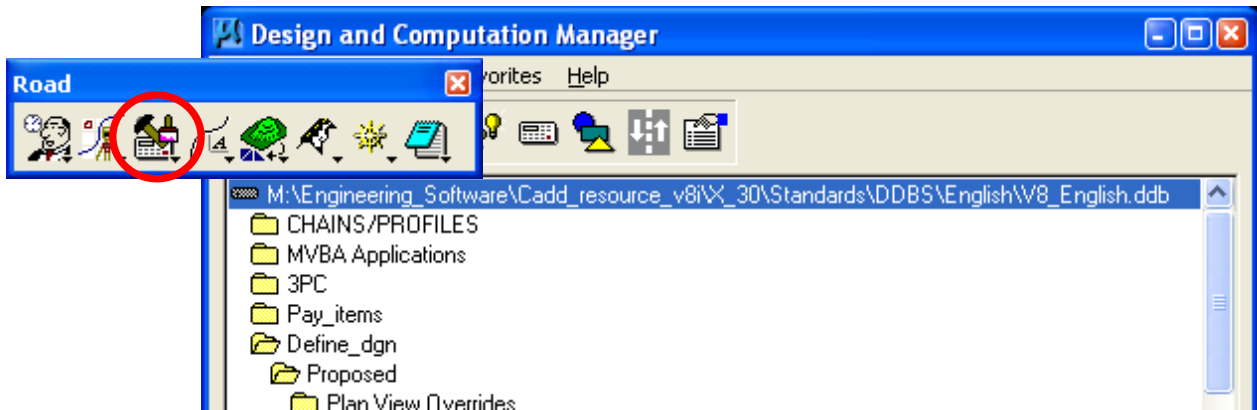
Geopak's ***Design and Computation (D&C) Manager*** is the tool that automates the display the Horizontal Alignment through the use of a hierarchical database, .ddb, containing information about each element of the horizontal alignment display to be placed within a set of plans. The .ddb file in use at EFLHD can be found at:

M:\Engineering_Software\Cadd_Resource_v8iX_30\Standard\DDBS\English\V8_English.ddb

- Access the **D&C Manager** by selecting the MicroStation pull downs: **Applications > Geopak > Road > Design & Computation Manager** as shown below



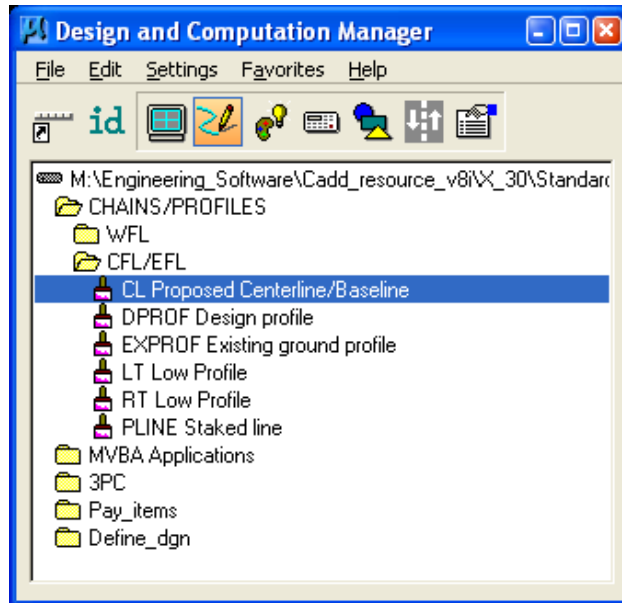
- Or can be access from the **Road Tools** icon as shown below:



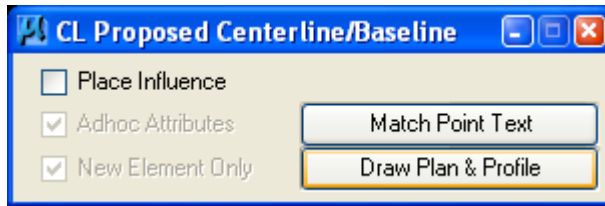
Note - The EFLHD .ddb file is already attached through project configuration setup. If EFLHD's D&C Manager is not attached as shown above, then change it through File > Open > and select the

M:\Engineering_Software\Cadd_resource_v8i\X_30\Standard\DDBS\English\W8_English.ddb

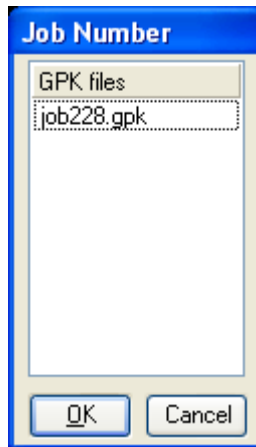
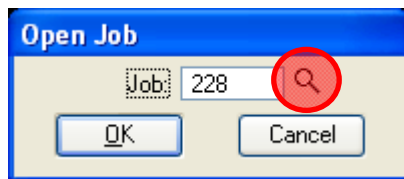
- In the “**Design and Computation Manager**” dialog box, Select **CL Proposed Centerlines/Baseline** as shown below:



- Single click on **Draw Plan & Profile ...** as shown below:



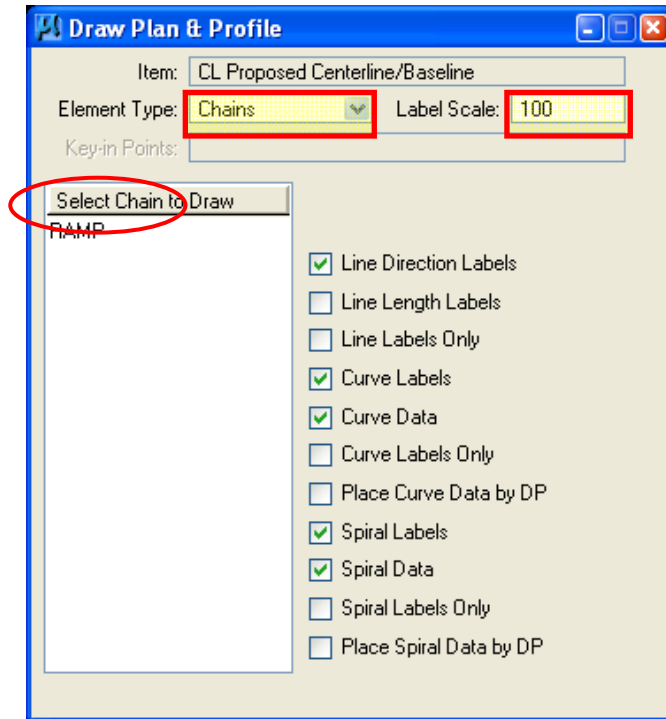
- Key in or Select the Job Number ... as shown below and click on **OK** (in both dialogs):



Note - This step (shown above) will not be necessary if the Project Manage is open.

Display the Chain Information:

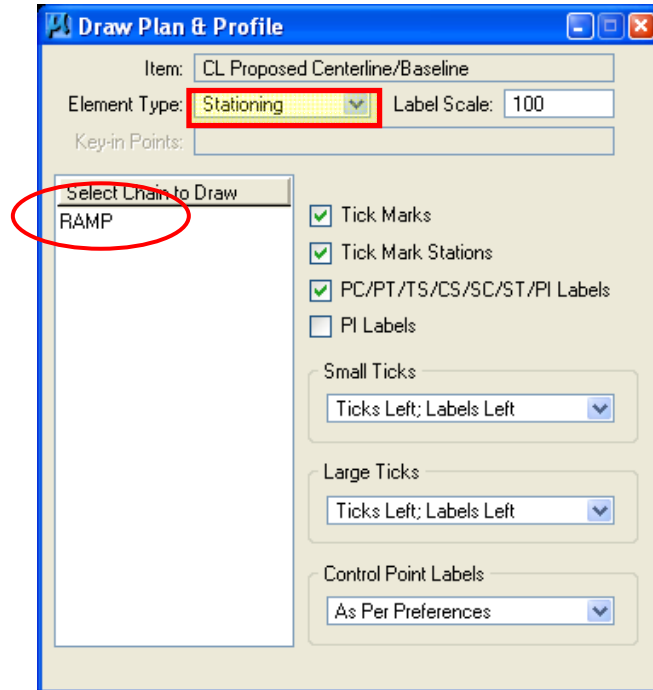
- Toggle “**Element Type**” to **Chains** ... as shown below:



- Set the **Label Scale** as your Plan sheet scale.
- Select the **chain** you want to display with a single click shown inside the circle. Alignment information will display onto MicroStation file.

Annotate the Horizontal Alignment:

- Again toggle “**Element Type**” to **Stationing** ... as shown below:



- Set the **Label Scale** as your Plan sheet scale.
- Select the **chain** you want to display with a single click inside the circle shown above. This will annotate your alignment stationing.

1.6.2 - Draw Widening And Other Plan View Features for X30 Criteria (Geopak)

To develop roadway features representing the proposed roadway to be recognized by **Proposed Cross Section tool** as set in **X30 Criteria files**, two specific GEOPAK tools will be utilized: **D&C Manager** to determine element symbology and **Draw Transition** to place the elements between specific pairs of stations offsets.

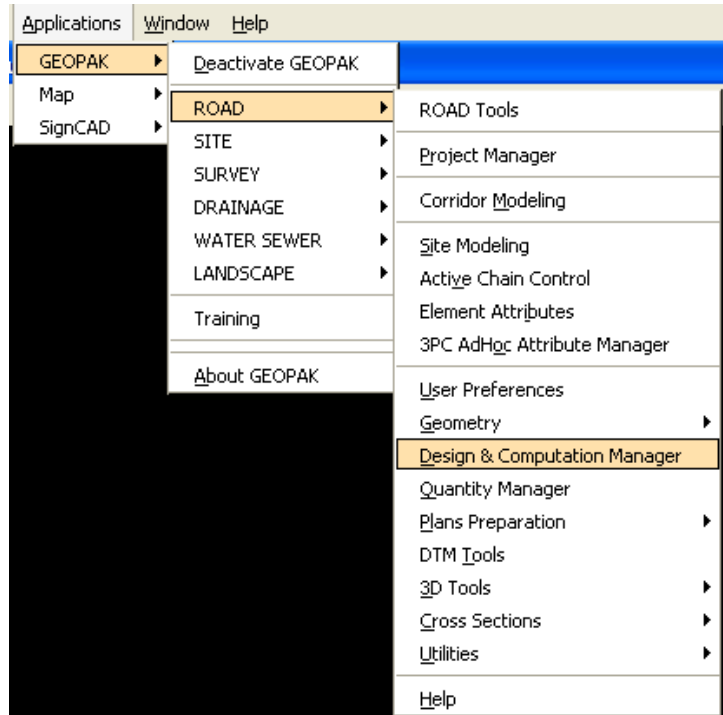
The **D&C Manager** is a tool that allows the user to standardize graphics elements (symbology) for drafting. FLH has developed a database (**V8_ENGLISH.ddb**) for D&C Manager. It is used to draw the elements which have preset standard symbology of the elements according to X30 criteria input file (especially for proposed cross section).

The **Draw Transition** tool draws a line/curve based on a beginning station/offset and an ending station/offset relative to a selected chain. Use of this command includes road widening, edge of the pavement, shoulder, curb & gutter, retaining wall location, guardrail; curve widening, lane transitions and roadway stripping.

Step I

In your “wrk” file;

- Access the **D&C Manager** by selecting the MicroStation pull downs: **Applications > Geopak > Road > Design & Computation Manager** as shown below.

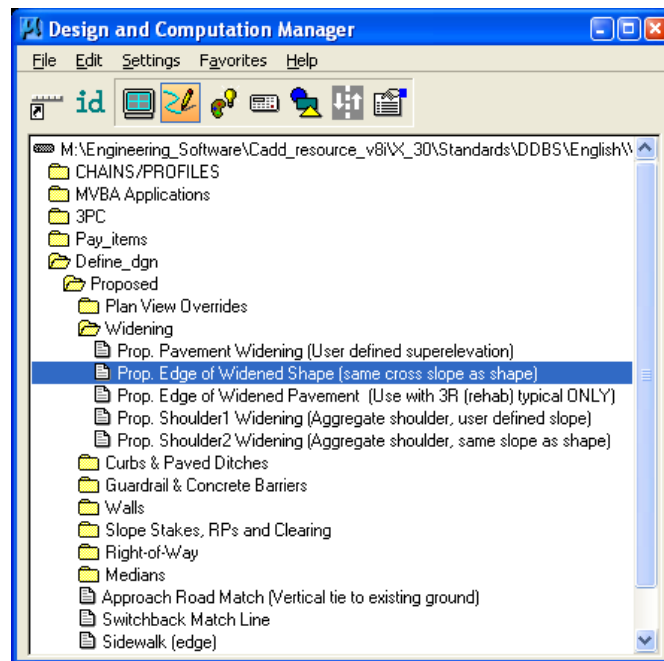


- Or can be access from the Road Tools icon as shown below:

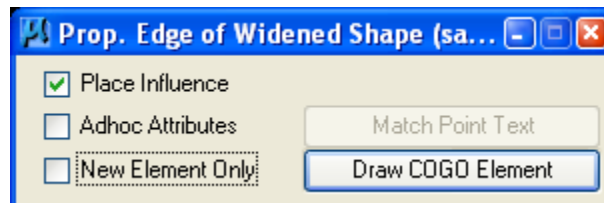


Note : The V8_ENGLISH .ddb file is attached through project configuration setup. If FLH D&C Manager is not attached as shown above, then change it through File > Open> and select the "V8_English.ddb".

- Five Categories are used to group and classify the features and items used in creating construction drawings. **Define_dgn** category is used specially for drawing X30 Criteria elements. This category contains two sub-categories: **Proposed** and **Existing** category. The sub-categories break down each classification into more specific items, such as Widening, Plan View Overrides, etc are the subcategories of **Proposed** category. Within a category, the individual items that are included are designated according to the process that they will be used for. This hierarchical data structure functions much like a directory. Double clicking enables the user to move up or down within the database as shown below.



- In the “**Design and Computation Manager**” dialog box as shown above, Select **Prop. Edge Widened Shape (same cross slope as shape)**. The second dialog box appears as shown below:



- Select **Place Influence** option as shown above.

When the **Place Influence** toggle is activated, elements are drawn using the level, symbology and attributes as defined in the GEOPAK database.

Step II

- To invoke the **Draw Transition** dialog, select **Application > GEOPAK > Road > Plans Preparation > Draw Transition** or select its icon from the GEOPAK Road tool palette as shown below.



- The Draw Transition dialog is shown below.

A screenshot of the 'Draw Transition' dialog box. The dialog has a title bar with a blue background and the text 'Draw Transition'. It contains several input fields: 'Job' with the value '228', 'Chain' with a dropdown menu showing 'RAMP', 'Begin Station' with the value '50+00.00', 'Begin Offset' with the value '10.000000', 'End Station' with the value '67+66.63', and 'End Offset' with the value '10.000000'. There are also two small icons with arrows next to the offset fields. At the bottom of the dialog is a 'Draw' button.

- 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** then click **Draw**. This will draw the elements you have selected in the **D&C Manager**.

To draw another element, select the element in D&C Manager and fill the Draw Transition dialog for Beginning Station, Beginning Offset, and Ending Station and Ending Offset as required for the specific element and then click again **Draw**.



Draw Transition utilizes standard surveying convention for offsets. A positive offset (i.e., 55.0) would be to the right, while a negative offset (i.e., -55.0) would be to the left, of the chain. Orientation is according to the direction of stationing.

1.7 - Create/Draw Existing Ground Profile (Geopak)

There are two methods available for creating and storing an Existing Ground Profile; Traditional Method and a **Draw Profile Tool** Method. Any of these methods are acceptable to EFLHD. Regardless of the method used, the final alignment must be drawn into MicroStation using the “**V8_ENGLISH.ddb**” D&C Manager file. This will assure that the elements are drawn with the correct symbology, matching the FLH standards. **EFLHD’s preferred method i.e. Draw Profile Tool Method is explained in the following section.**

1.7.1 - Draw Profile Tool Method (EFLHD Preferred Method):

The Draw Profile Tool Method allows for not only storing the ground profile into COGO, but also the ability to draw it (graphically) without actually going into the **Design and Computation Manager** directly.

You must have a horizontal alignment (Chain) stored in COGO and a .TIN file.

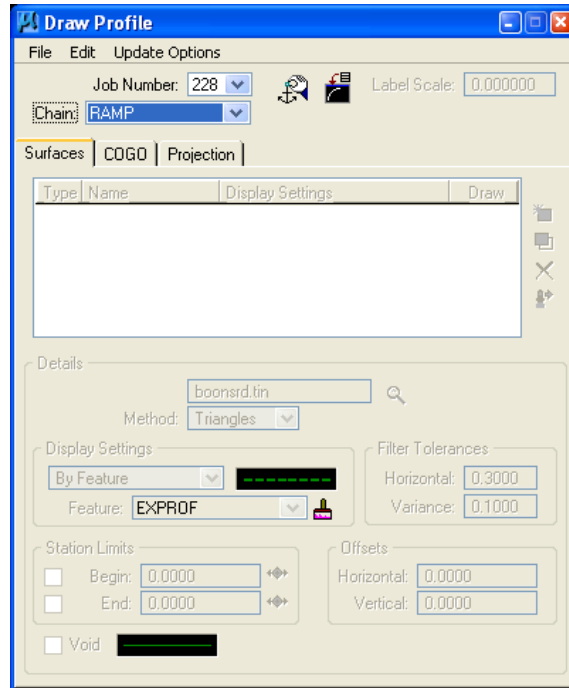
- Create a new DGN file for the **Profiles** using “**Sur_ft2D.dgn**” seed file.
- Rename this file according to the EFLHD Naming Convention (e.g. 01-lop10(2)_pro.dgn).
- Open a MicroStation design file and invoke the Draw Profiles tool via the pulldowns, (as shown below):

Applications > Geopak > Road > Plans Preparation > Draw Profiles

... or use the **Draw Profiles** icon, (as shown below):

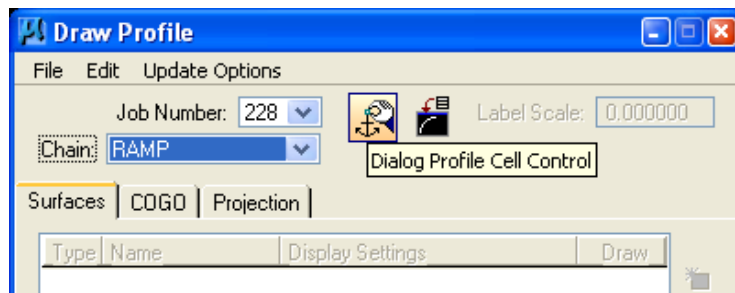


- When the dialog box (below) appears, Select the **Job Number** and **Chain**. You'll notice that unless you already have a profile cell placed in the design file, all fields will be ghosted out except for the 2 icons to the right of the **Job Number** and **Chain** fields. You must place a profile cell before you can create a profile.

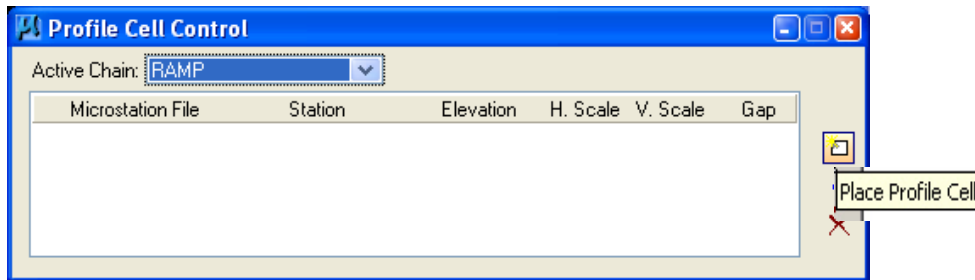


1.7.1.1 - Create Profile Cell

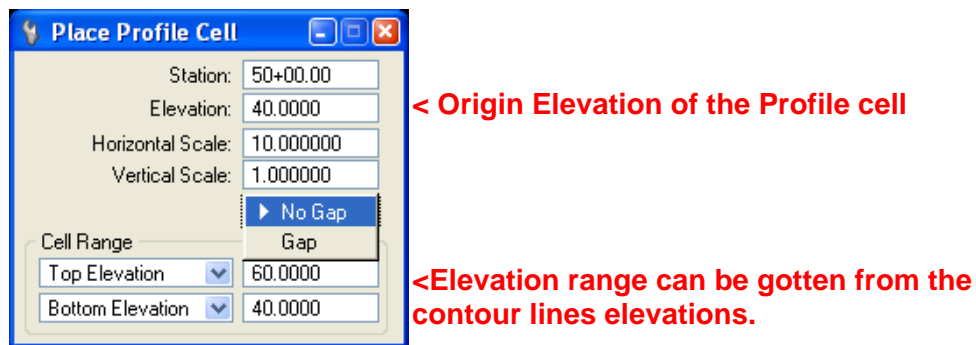
- Click on the **Dialog Profile Cell Control** icon as shown below:



- The **Profile Cell Control** dialog appears as shown below. Click on **Place Profile Cell**:



- The **Place Profile Cell** dialog appears (shown below) along with the Profile Cell attached to your cursor awaiting placement.
- The beginning **Station** should populate automatically. The **Horizontal** and **Vertical** scales are normally set as shown below for 10H and 1V scale with **No Gap**. The **Top Elevation** and **Bottom Elevation** of **Cell Range** are set according to profile minimum or maximum elevation range.



- Once the dialog is completed, data point in your design file somewhere where the profile cell won't interfere with other previously drawn graphics.

```
228
RAMP
5000.000000
40
10
1
NOGAP
```

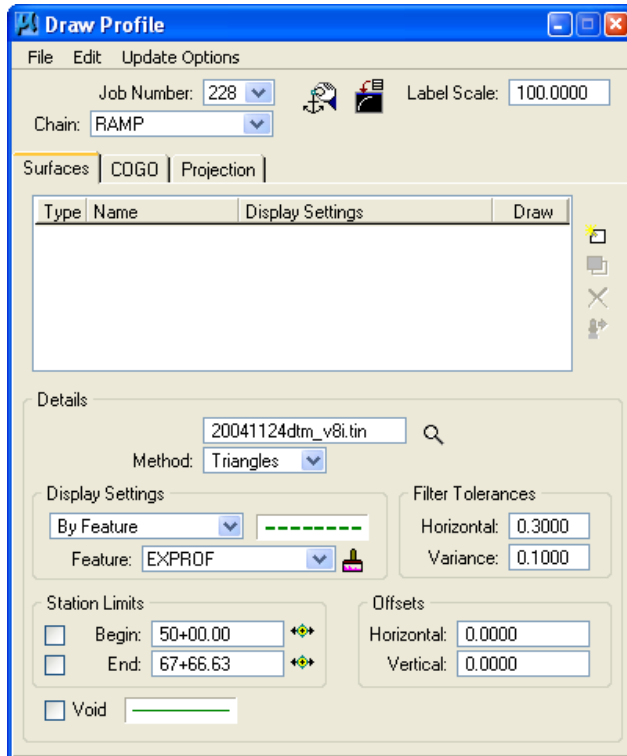
Note - The profile cell origin should look similar to the graphic shown above. The profile cell text parameters are set by the active MicroStation text settings.

- Close the Profile Cell Control dialog box.

1.7.1.2 - The “Surfaces” Tab:

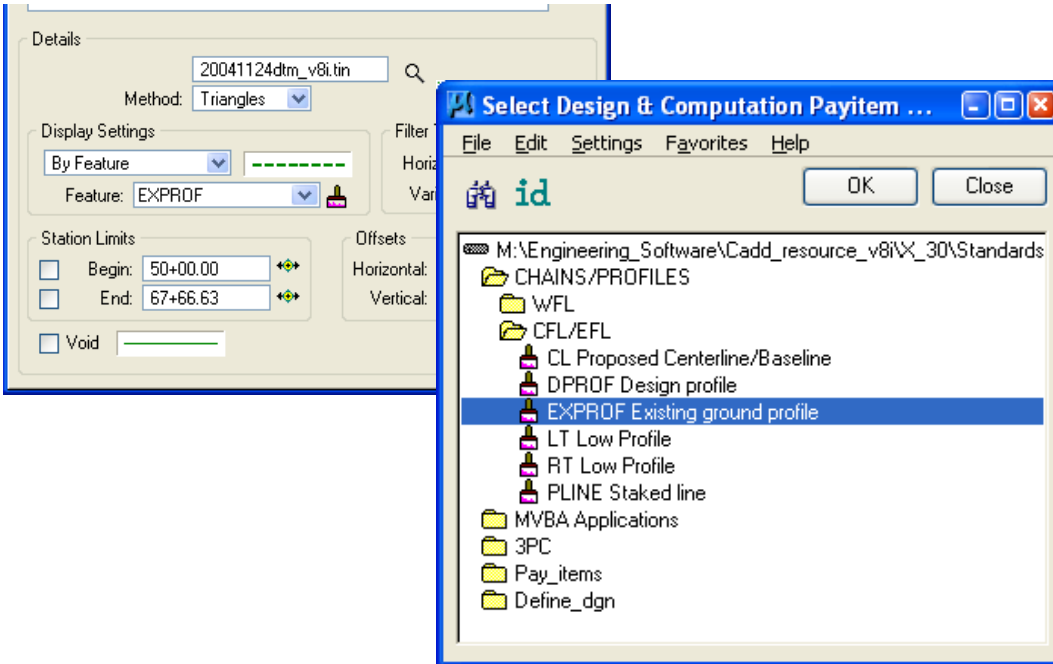
The **Surface** tab defines the surfaces utilized as source data when drawing profiles. Multiple surfaces from a variety of sources can be drawn in a single processing. Each surface to be drawn must be added to the list box.

- Select the **Surface** tab in Draw Profile dialog box after the **Profile Cell** is established, the dialog box dynamically changes as shown below.

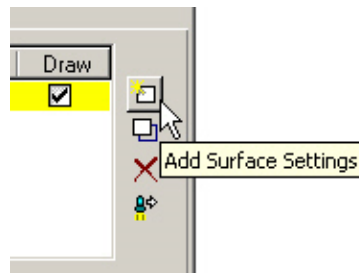


- Select **Label Scale** according to the Plan sheet scale for the texts size (e.g. 100 for 100 scale Plan Sheets).
- On the **Surfaces** tab as shown above, select the folder icon in the Details area, and then select the .TIN file to cut the profile. Set the **Method** to **Triangles** (This instructs the software to compute elevations at each location that the chain intersects a triangle leg from the TIN).

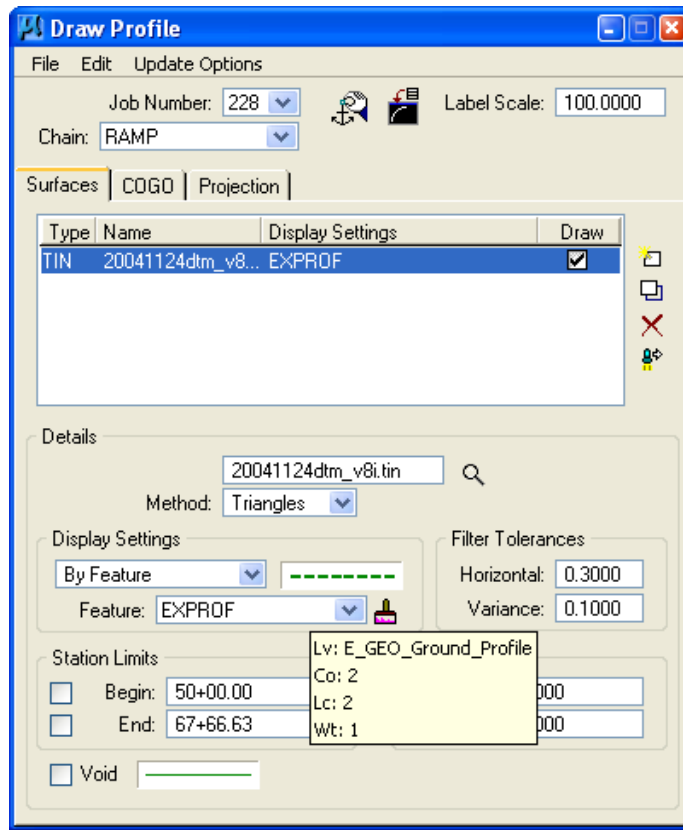
- Use **By Feature** mode in the **Display Setting** area of the dialog box. Click the **paintbrush icon** and select the item “**EXPROF Existing ground Profile**” from the **D&C Manager** .



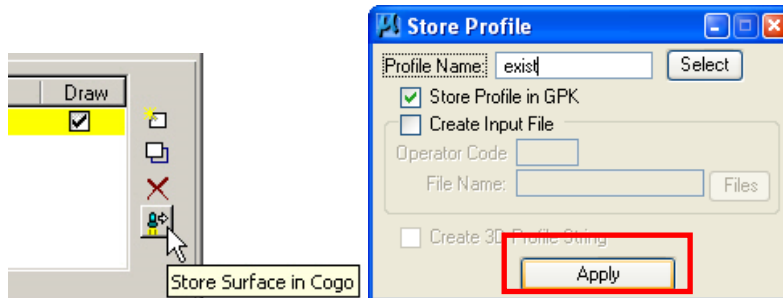
- Press **OK**.
- Click the **Add Surface Settings** icon to add the profile to the list box as well as draw the profile into the MicroStation file.



- The final setting on Draw Profile for Surface tab is as shown below. The recommended Filter Tolerances in EFL should be left at the **default** values of **Horizontal=0.30** and **Variance=0.10**.



Note - Use the following icon as shown below to store an Existing Profile in COGO, though it is not required to display into your MicroStation file in EFLHD.



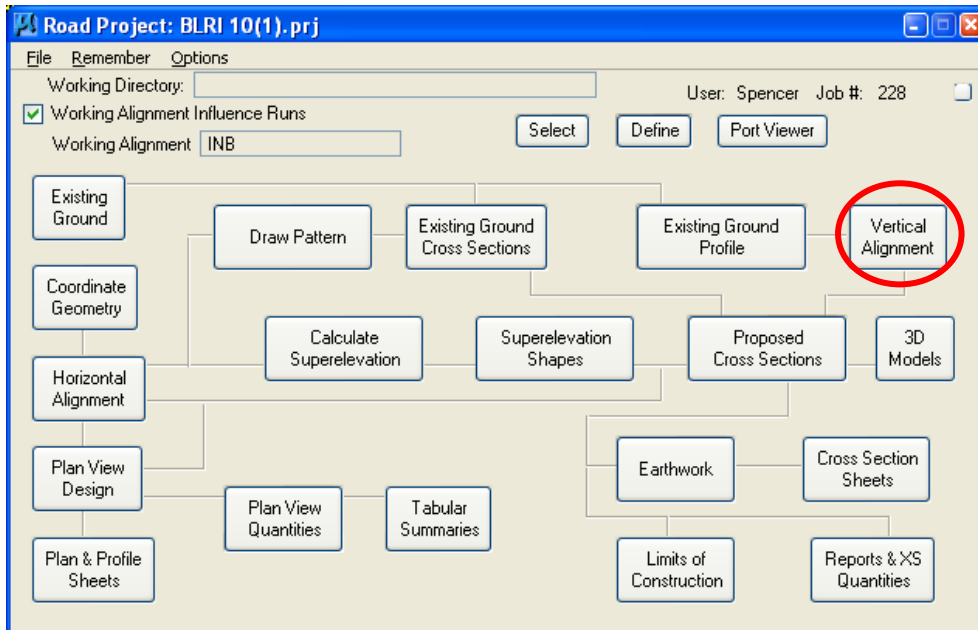
- Software now will display your Existing Profile in your design file.

1.8 - Create Proposed Vertical Alignment (Geopak)

There are two ways to create proposed Vertical Alignment graphically.

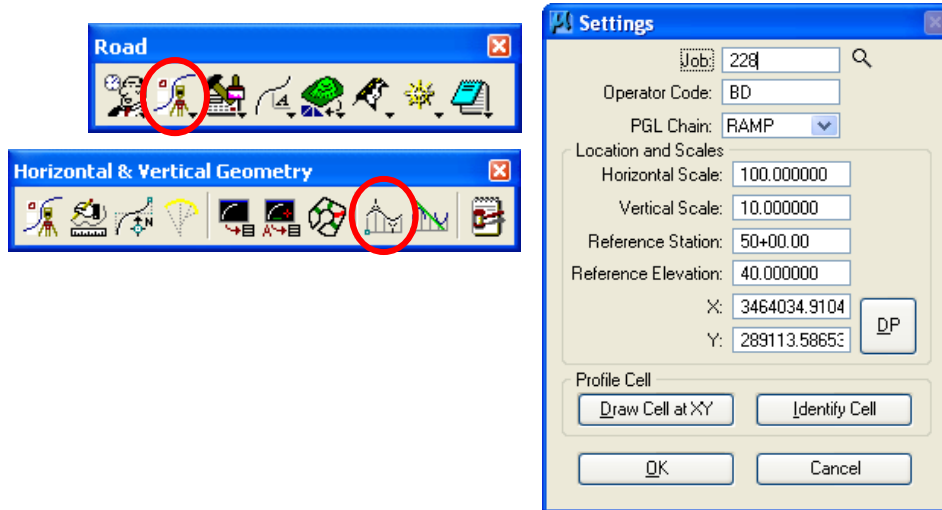
1.8.1 - The “VPI Based” Profile Design Tool:

- Select the **Vertical Alignment** button on the **Project Manager** dialog box as shown below:

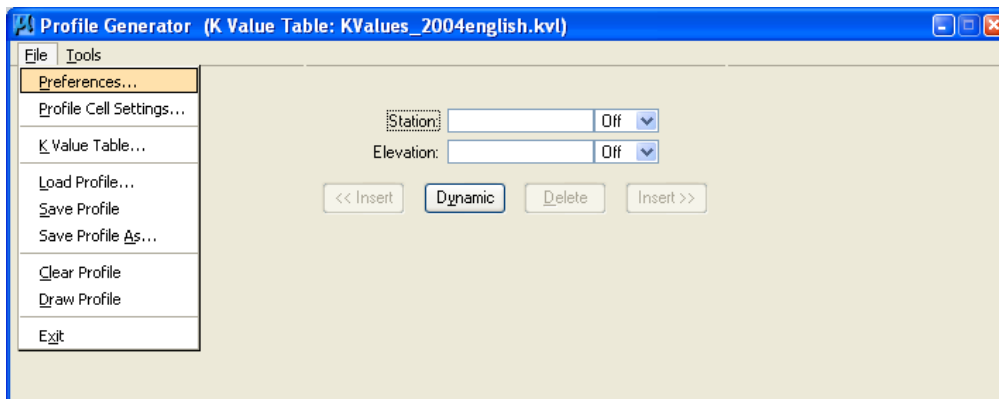


Or

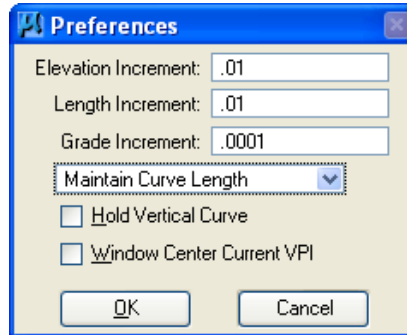
Select **APPLICATIONS > GEOPAK > ROAD > GEOMETRY > LAYOUT PROFILES (VPI Based)** or from the **Road Tools** icon as shown below:



- Most likely... if you're at this point in your design, you have already extracted a ground profile and have it displayed graphically. Click on Identify Cell, data point the cell, click on OK.
- This will invoke the GEOPAK Profile Generator as shown below:



- From the pull down menu, select File > Preferences.... This invokes the Preferences dialog as shown below:

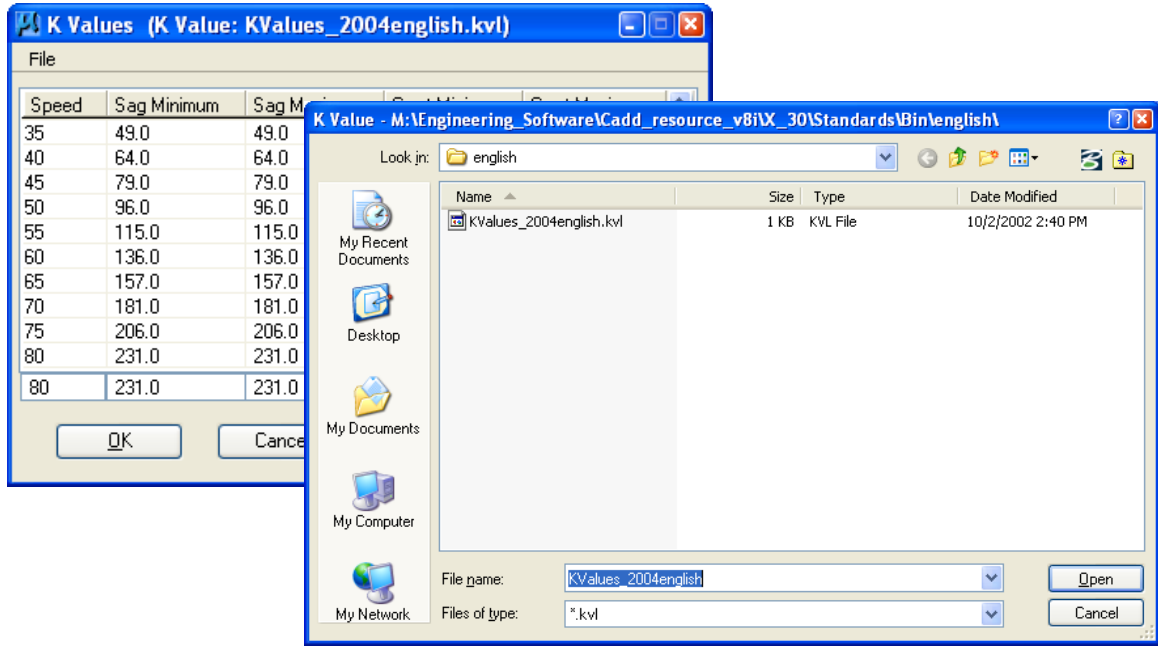


This is where you set the preferences for dynamically laying out the profile. User has the option of selecting **Maintain K Value** or **Maintain Curve Length**. We typically select **Maintain Curve Length**. When finished, click on **OK**.

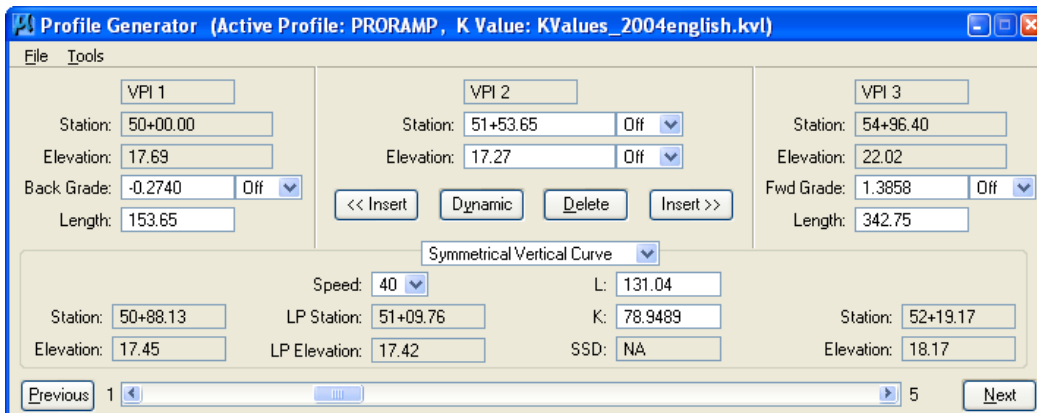
- From the pulldown menu, select **File > K-Values Table**. This invokes the K-Values Table dialog as shown below:

Speed	Sag Minimum	Sag Maximum	Crest Minimum	Crest Maximum
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
75	206.0	206.0	312.0	312.0
80	231.0	231.0	384.0	384.0
80	231.0	231.0	384.0	384.0

- Using the **File** pulldown, select **File > Open** and browse to the folder **M:\Engineering_Software\Cadd_resource_v8i\X_30\Standards\Bin\english** and select the appropriate K-Value table. Press **Open** as shown below. Press **OK** on K Values dialog.



- The **GEOPAK Profile Generator** is shown below (with the K-Value table "Kvalues_2004english.kvl" selected):

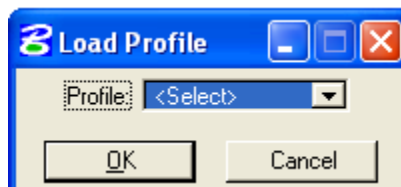
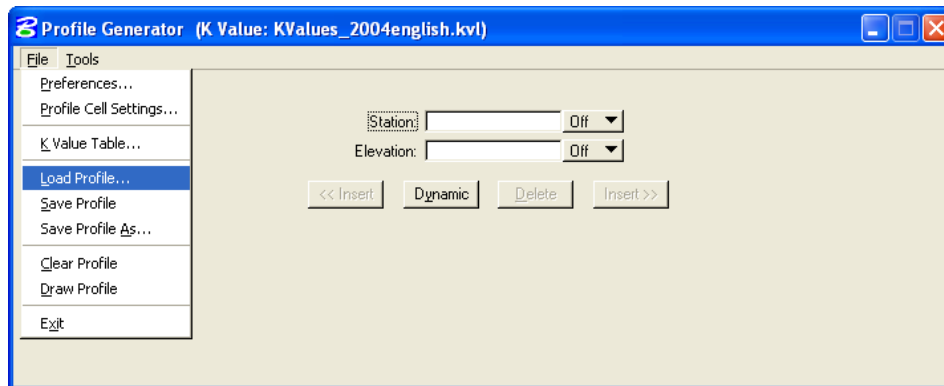


- To begin using the **GEOPAK Profile Generator**, click on **Dynamic** and snap to the beginning of where you want the profile to start. This would usually be exactly at the beginning of the existing ground profile. Accept the snap with a data point of the mouse.

- Pan on ahead, click on **Insert After** and data point the screen where the next VPI should be. I would suggest laying out all the VPIs first, save the file, using the pulldown, **File > Save As** and then go through designing the vertical curves. The vertical curves can be entered by typing in the length in the field, or simply selecting the design speed on the **GEOPAK Profile Generator**.
- When finished, save the file again. The vertical alignment can now be reviewed using **COGO** by using the **COGO** pulldowns **Element > Profile > Print**. Select the Profile and click on **Apply**.

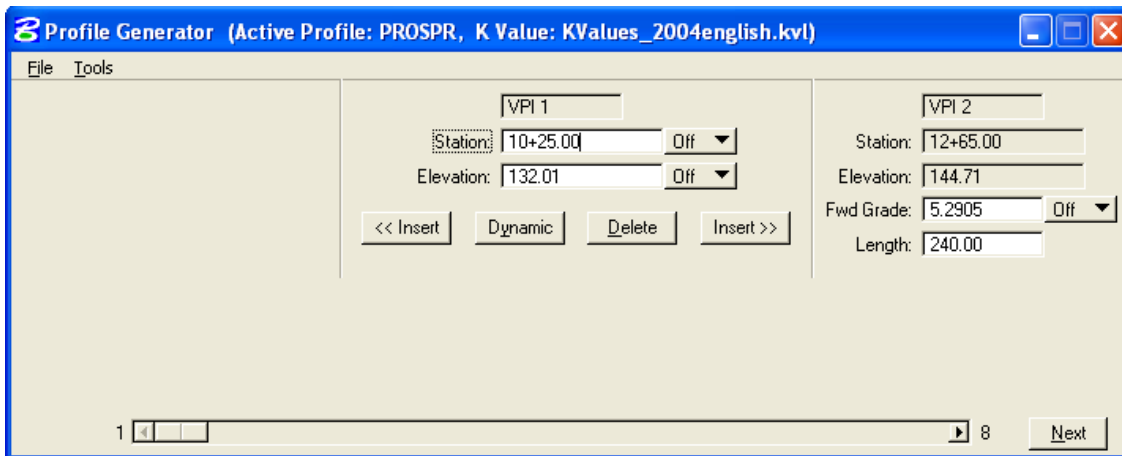
1.8.1.1 - Reload/Modify the Profile:

- Select the **Vertical Alignment** button on the **Project Manager** dialog box (as shown in Section 1.8.1).
- Click on Identify Cell, data point the cell, click on **OK** (as explained in Section 1.8.1).
- This will invoke the **GEOPAK Profile Generator**. Select **File > Load Profile** on Profile Generator dialog box as shown below.



- Click on Select and pick the Profile.

- Click **OK** will load the Profile Generator with profile data for edit as shown below.



- Click on **Next VPI** to move to the VPI to be adjusted or use the horizontal slide bar. When the little reference circle is on the VPI to be adjusted, click on **Dynamic** and slowly move the cursor into the circle. Nothing will happen until the cursor gets close to the reference circle. You may then modify the profile dynamically. When finished modifying, (make sure **Redefinition of Elements** is **On** in the COGO dialog box and save the file again. VPIs can also be **inserted** or **deleted**, dynamically.

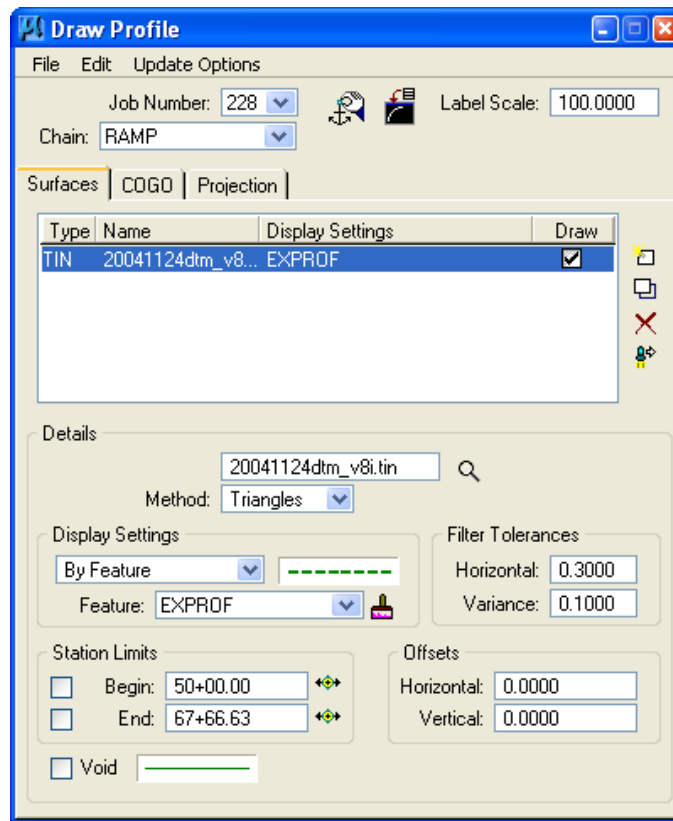
1.8.2 - Display Proposed Profile:

Use the **Draw Profile** Tool setup to display Proposed Profile.

- Open a MicroStation design file and invoke the Draw Profiles tool via the pull-downs, (as shown below):
Applications > Geopak Road > Plans Preparation > Draw Profiles
... or use the Draw Profiles icon, (as shown below):



- Draw Profile dialog box appears as shown below.

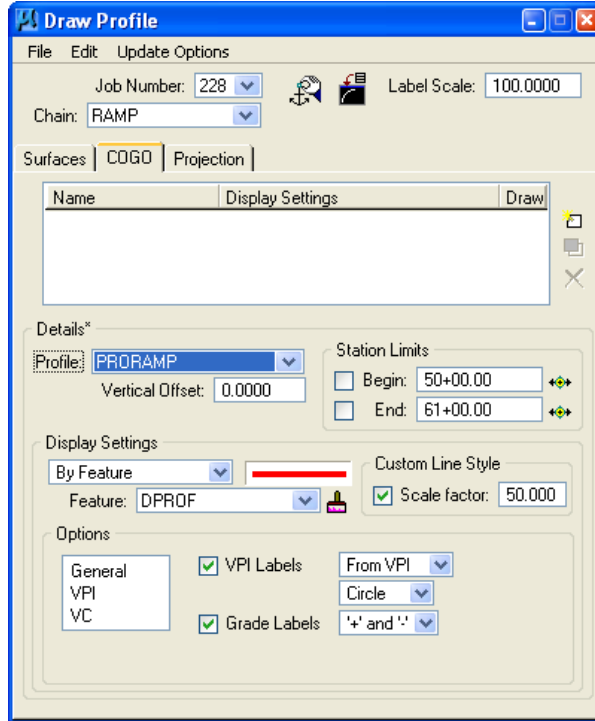


- Select the **COGO** tab.

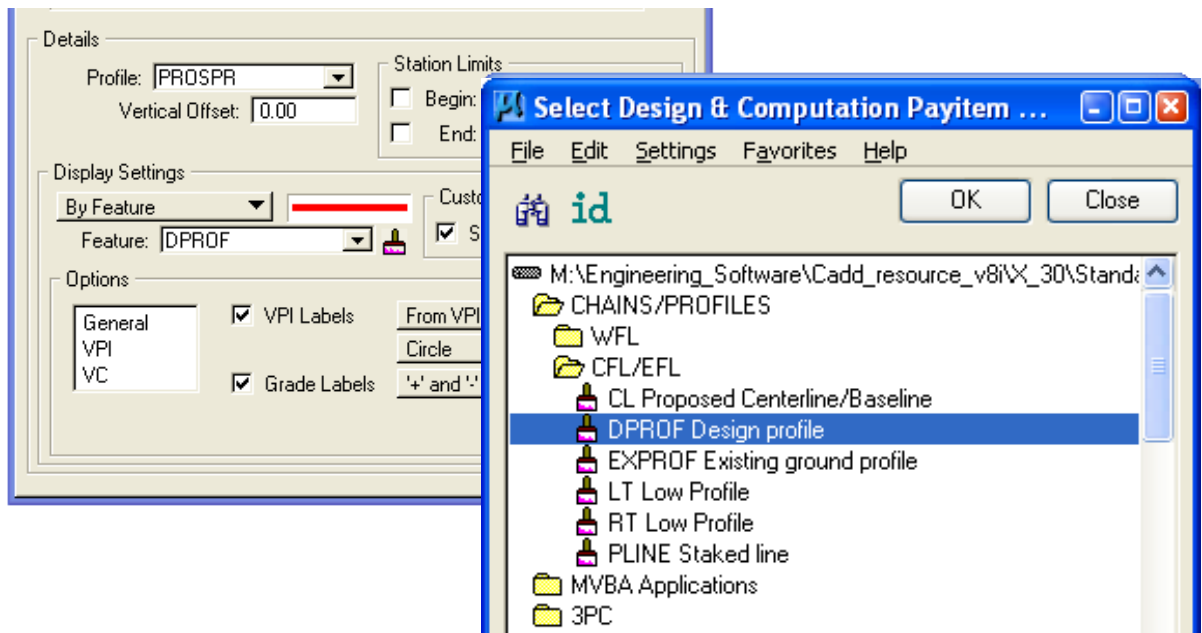
1.8.2.1 - The “COGO” Tab:

*The **COGO tab** is utilized for drawing any profile that has been previously stored into the gpk file. The functionality of the remainder of the dialog is very similar to the **Surfaces tab**.*

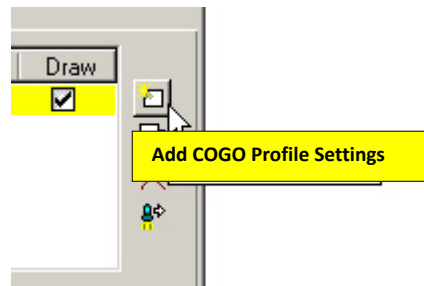
- Select the **COGO** tab in **Draw Profile** dialog box, the dialog box dynamically changes as shown.



- Select the **Profile Name** to be drawn in **Details** section of the icon. Keep the Vertical Offset defaults to a value of 0. Station Limits may also be specified to have the software draw only a portion of the profile.
- Use **By Feature** mode in the Display Setting area of the dialog box. Click the **paintbrush icon** and select the item “**DPROF Design profile**” from the **D&C Manager**.



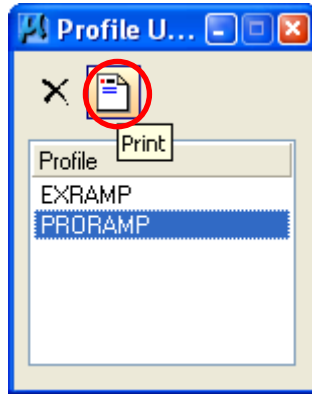
- Press **OK**.
- Click the **Add COGO profile Setting** icon to draw the profile into the MicroStation file as shown below.



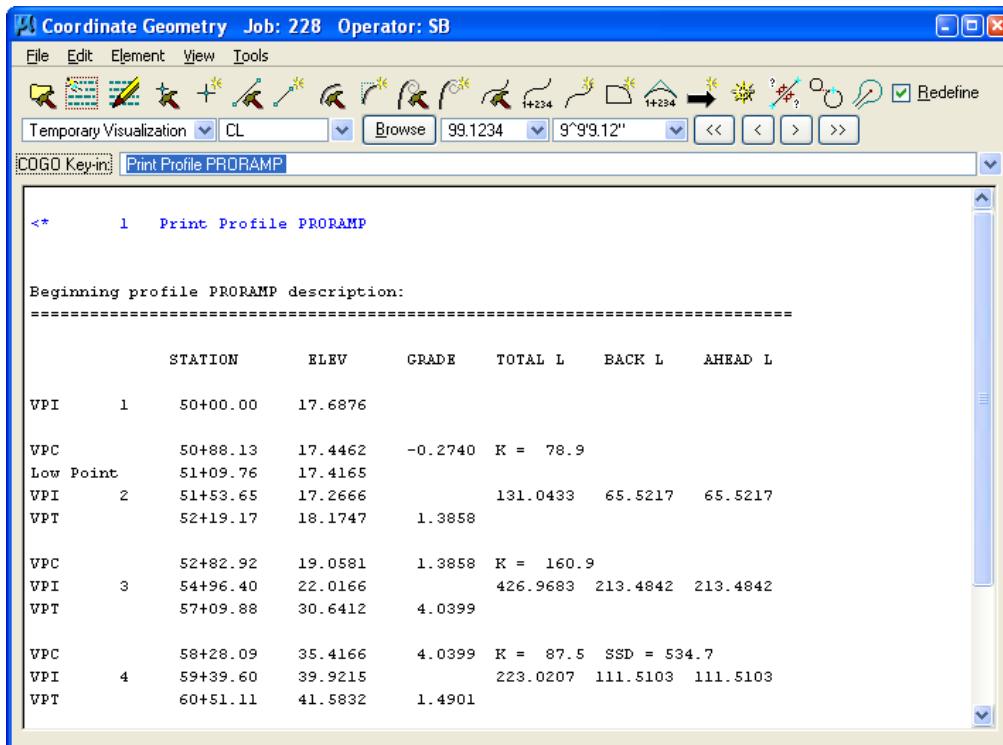
- Software will display your Proposed and Existing Profile in the MicroStation file.

1.8.3 - To print a Vertical Profile Output file:

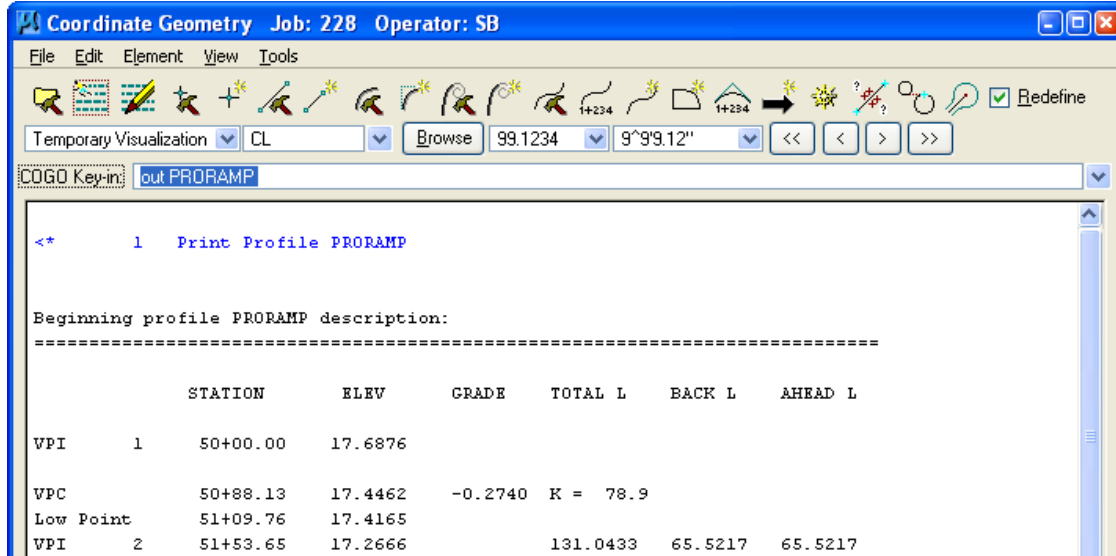
- Open COGO
- Use pull downs, select **Element > Profile > Utility**
- Select Profile (e.g. PROSPR) to be printed as shown below.



- Select **Print icon** as shown above. The Coordinate Geometry dialog box will display the Profile data as shown below.



- Type 'Out PRORAMP (File name, max. 8 character) in COGO Key-in and Enter, as shown below.



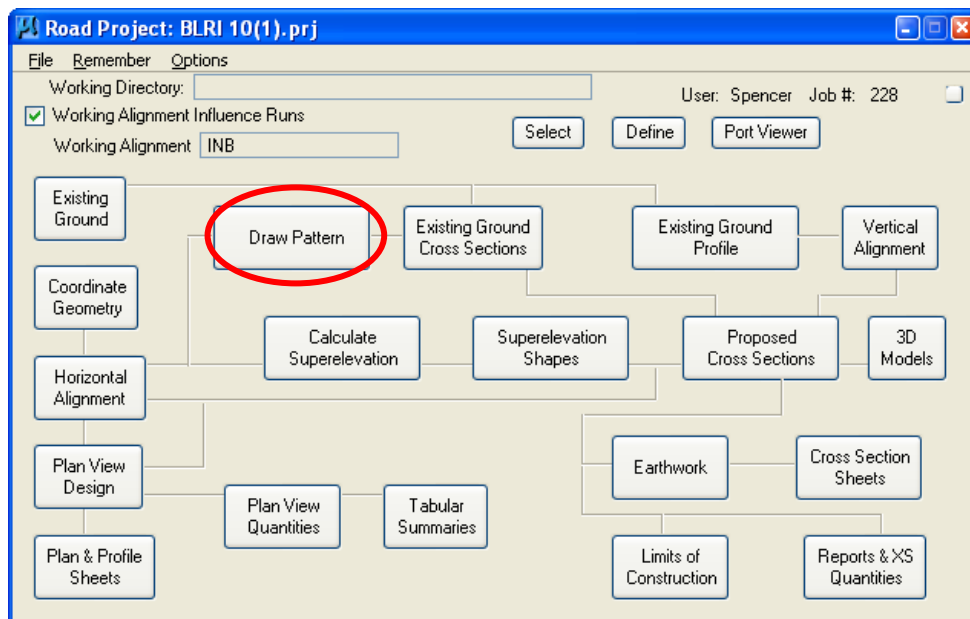
- GEOPAK COGO will create an output file for the proposed data file PRORAMP.osb in working directory. Where **228** is the Job number and **osb** stands for Output for User **SB** for this project.

1.9 - Existing Ground Cross Sections (Geopak)

1.9.1 - Draw Pattern Lines (Geopak)

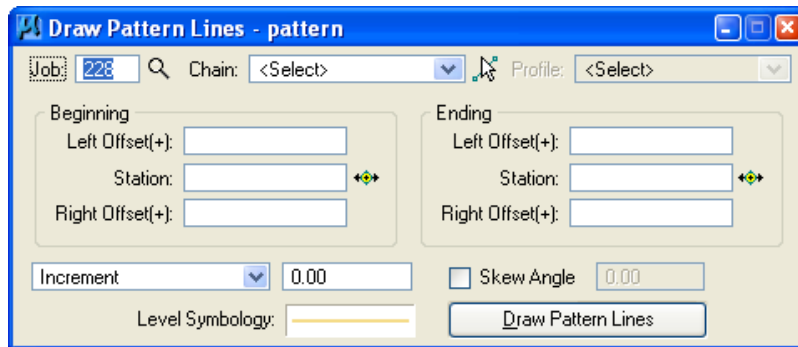
The project designer shall create a design file containing the pattern lines representing the locations of all cross sections in the process of generating the existing and proposed cross sections, earthwork etc. The pattern lines for each alignment, along which original ground cross sections are derived, shall be distinguished by the pattern lines layer name **P_GPK_Pattern_01, P_GPK_Pattern_02 ...**, etc in EFLHD.

- Create a new dgn file (give the name e.g. 01-xxxx_wrk.dgn) and reference your dgn file that contains your chain to this file just to be able to see position of the chain.
- Select the **Draw Pattern** button from the **Project Manager** dialog box as shown below:

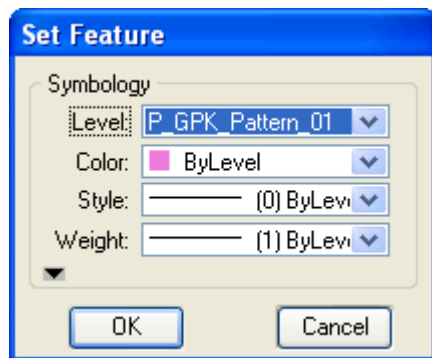


- Create a new run for your patterns or use the default untitled run.

- The **Draw Pattern Lines** dialog appears as shown below:



- This application will simply draw normal MicroStation line elements perpendicular to your chain at user specified **increments**, **station ranges**, and **widths** and at user specified **Level Symbology**. To select the Level Symbology, **double click in the rectangle to the right of Level Symbology** at the bottom of the dialog.
- The **Geopak Set Feature** dialog appears as shown below:



- Complete the **Geopak Set Feature** dialog settings as desired and press **OK**.

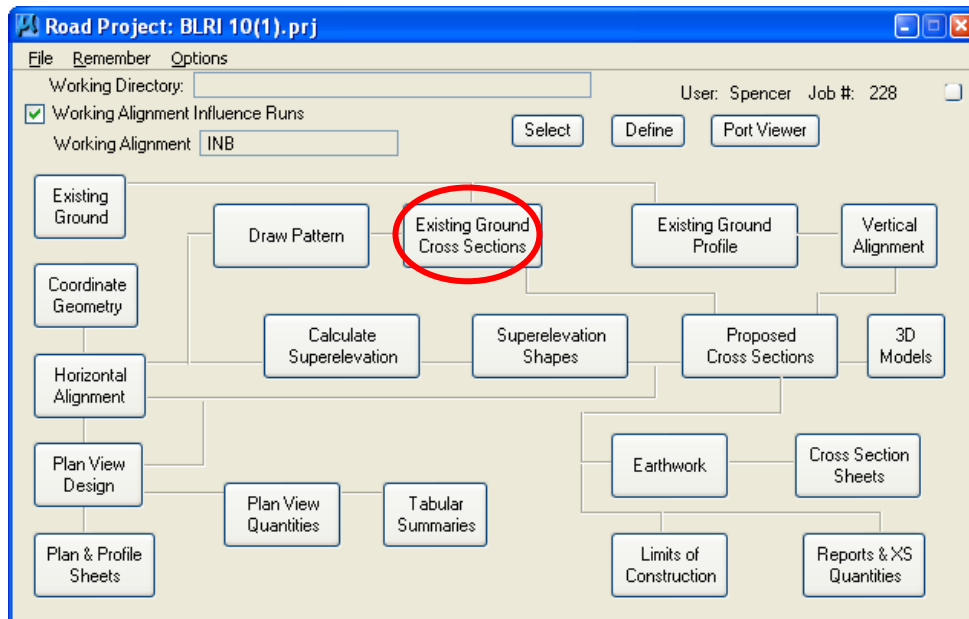
Note – The Color, Style and Weight of the feature settings should be set to ByLevel.

- Complete the **Draw Pattern Lines** dialog settings as desired and press **Draw Pattern Lines**. You should now have a series of lines **perpendicular** to your referenced chain. Later, we will use these lines to generate existing ground cross sections from the “TIN” file.

1.9.2 - Generating the Existing Ground Cross Sections (Geopak)

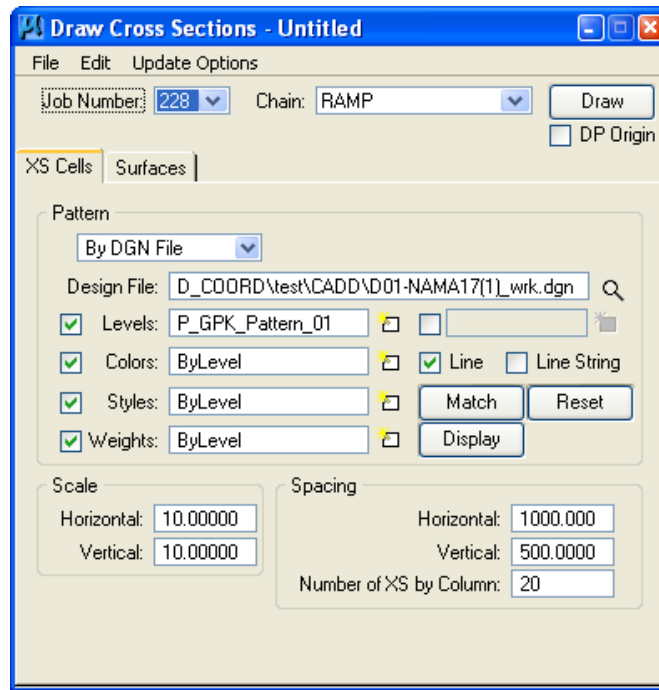
First of all the designer must have the following:

- 1) **A .TIN file.**
 - 2) **A .dgn file containing your “pattern lines”.** (explained in Section 1.9.1)
 - 3) **A horizontal alignment stored in COGO.** (explained in Section 1.5)
 - 4) **A .dgn file to create your “existing ground cross sections”.**
- Create a new dgn file(give the name e.g. 01-xxxx_Dxs.dgn). The **existing ground cross sections** will be drawn in this dgn file.
 - Select the **Existing Ground Cross Sections** button from the **Project Manager** dialog box as shown below:



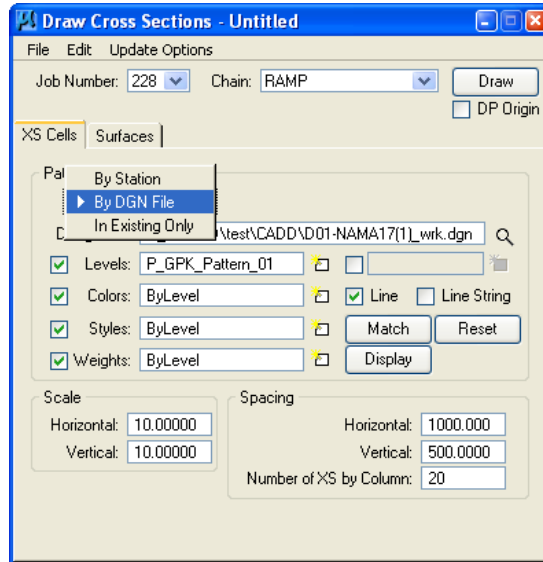
- Create a new run for your existing ground cross sections or use the default untitled run.

- The **Draw Cross Sections** dialog will appear as shown below:

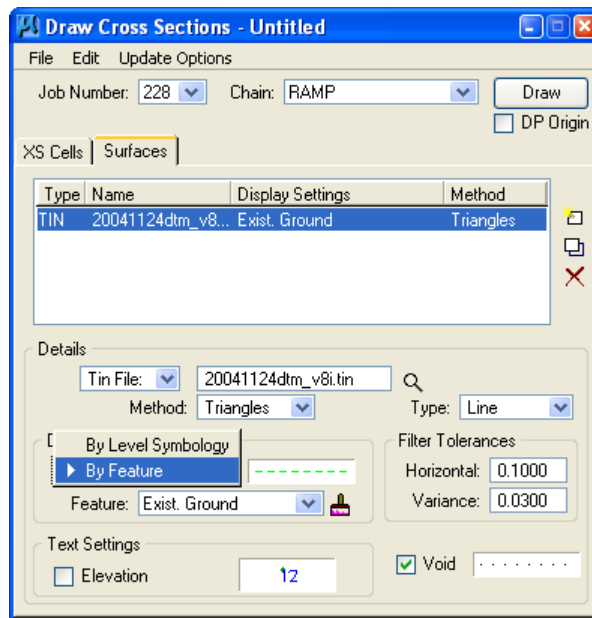


- Select the “**XS Cells**” Tab: Here the designer tells Geopak where to find the information to create the cross section cells and how they are to be laid out.
- Select “**By DGN File**” method for the selection of the **Pattern**. Toggle **on** the desired **element parameter**, (i.e.. Level, Weight...) the press the **Select** button. The **Mask dialog** is displayed, wherein the desired parameter settings may be identified. You may select as few or as many parameters to identify the desired pattern lines or line strings. Or use the match button to select the element parameters.

- Select **Levels** “P_GPK_Pattern_01” (Or select the levels created during the Draw Pattern procedures).



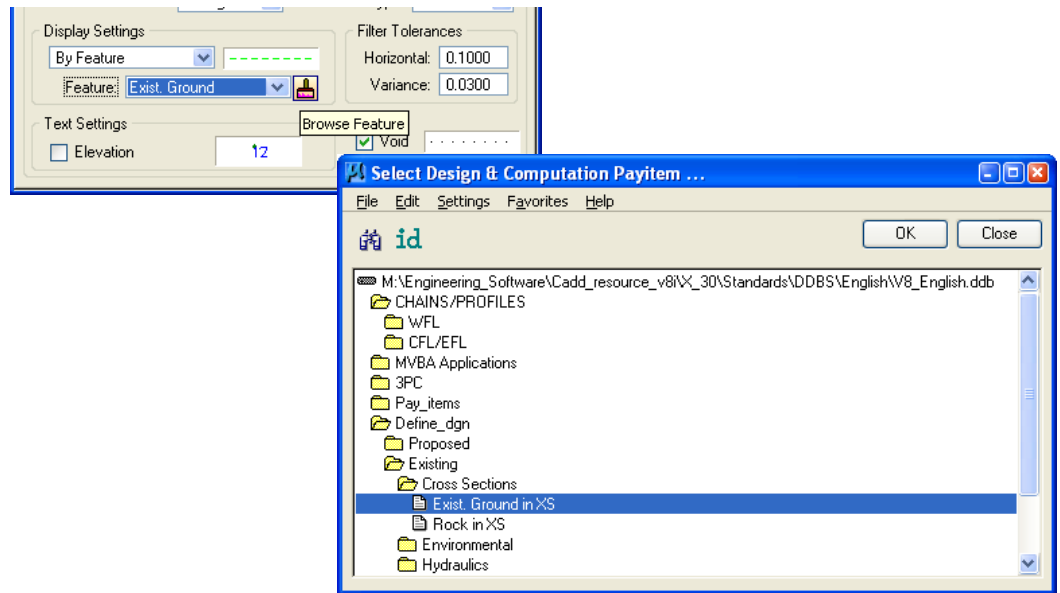
- Select **Scale** to 10 and 10 as a standard practice in **EFLHD**. And keep all the setting for spacing as default as shown above.
- Select the **Surface** tab in **Draw Cross Section** dialog box, the dialog box dynamically changes as shown below (The user creates ground cross sections from a TIN file through this tab).



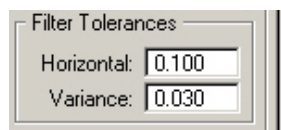
- Select the folder icon in the **Details** area, and then select the .TIN file to draw the cross section. Set the Method to Triangles (This instructs the software to compute elevations at each location that the pattern lines intersect a triangle leg from the TIN) and select **Type** to **Line**.

Note - For several reasons, these elements should be drawn as lines not line strings.

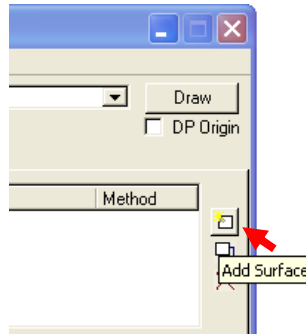
- Use **By Feature** mode in the **Display Setting** area of the dialog box. Click the **paintbrush** icon and select the item “**Exist Ground in XS**” from the **D&C Manager** as shown below.



- Press **OK**.
- Recommended **Filter Tolerances** at EFLHD are shown below:
 - **Metric** tolerances are **.03** and **.009**
 - **US Customary** tolerances are **0.10** and **0.03** (as shown below):



- Click the Add Surface Setting icon to add the surface to the list.
(Delete any incorrect surfaces)



- Click on the **Draw** button located in the upper right corner of the dialog to draw the existing cross section in the design file.

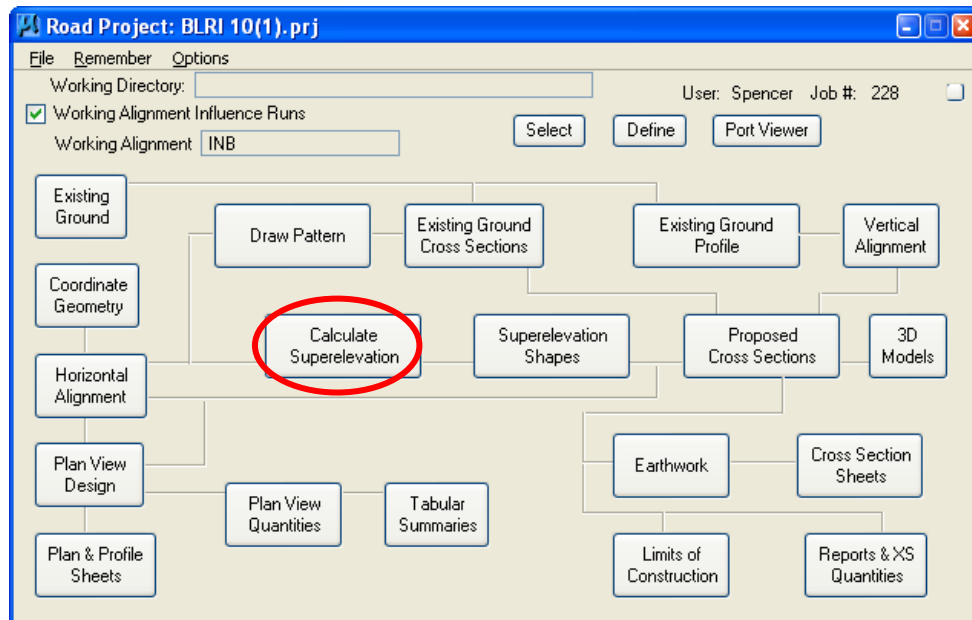
1.10 - Developing the “Superelevation” Shape (Geopak)

A graphical representation of the superelevation transition breaks can be produced in the form of MicroStation complex shapes. These complex shapes are plotted in a design file and read when running Templates to produce the Proposed Cross sections.

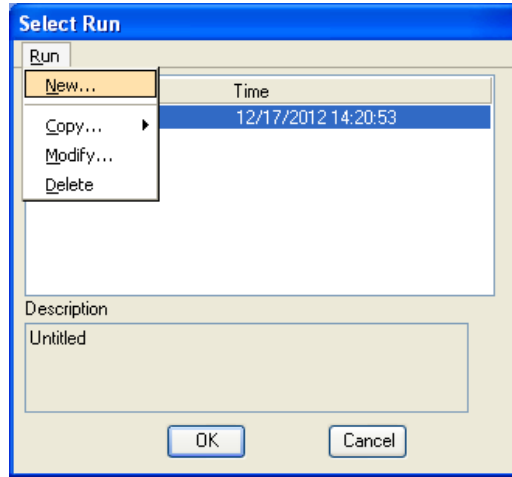
The user fills out several dialog boxes in order to create an ASCII input file. When this input file is executed, the results are graphical elements representing the lane widths and superelevation cross slopes. I would describe these graphical elements as intelligent 2D elements.

The Designer must have a horizontal alignment stored in COGO, a proposed profile stored in COGO, and a dgn file to create a complex Geopak Shape.

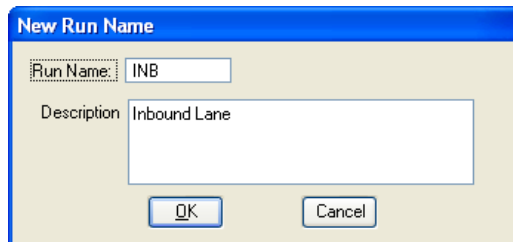
- Open the design file(01-xxxx_wrk.dgn) that you created for Pattern lines (See Section 5.9.1). You will draw **Shapes** for Superelevation in this design file.
- Select the **Calculate Superelevation** button from the **Project Manager** dialog box as shown below:



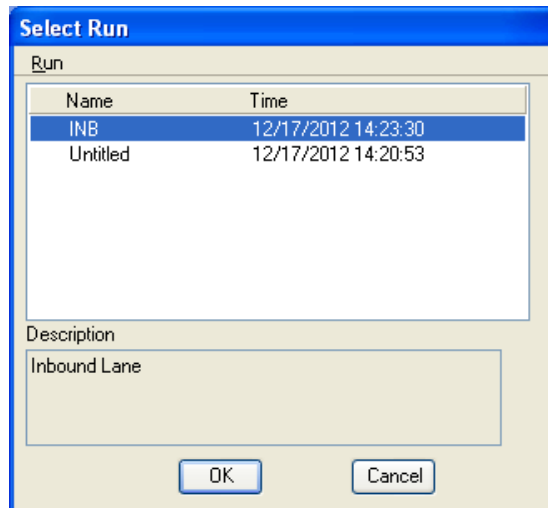
- The **Select Run** dialog appears. Use the pulldowns and select **Run > New** as shown below. Click on **OK**.



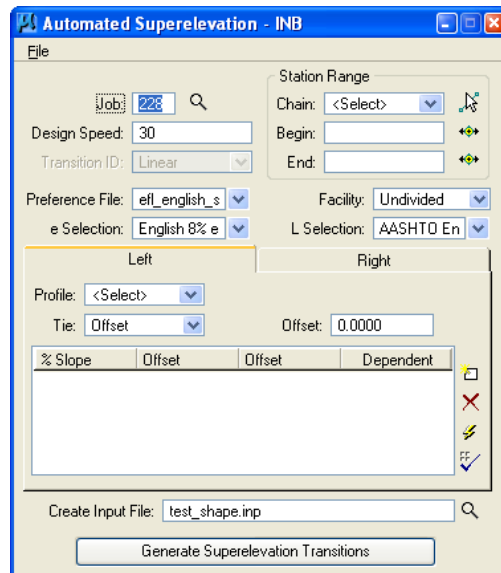
- The **New Run Name** dialog appears. Type in the name of the “Run” to create. The Description field is optional. Click on **OK**.



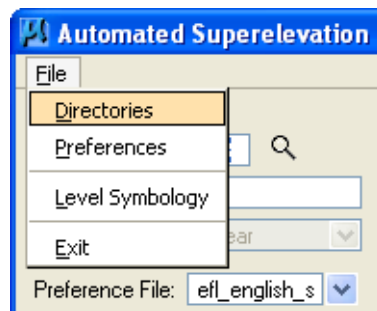
- The **Select Run** dialog appears. Highlight the desired run (you may eventually have several) and click on **OK**.



The **Automated Superelevation** dialog will appear as shown below:

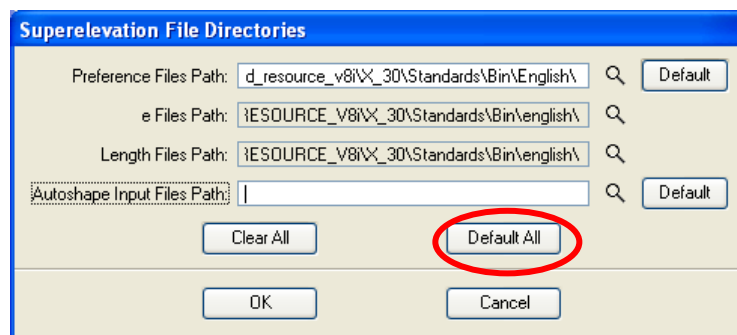


- Set the directory for **Superelevation Preferences** by using the pulldowns **File > Directories** as shown below:

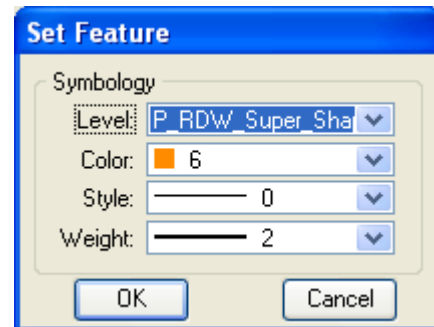
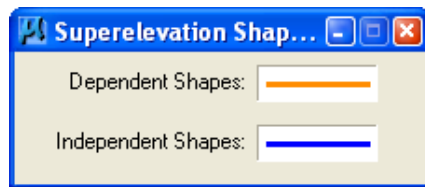
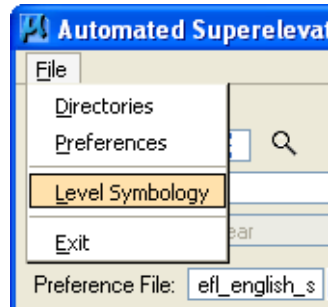


- Click on **Default All** (as shown below) and all directories will be set as shown below. The example below illustrates the English directory paths.

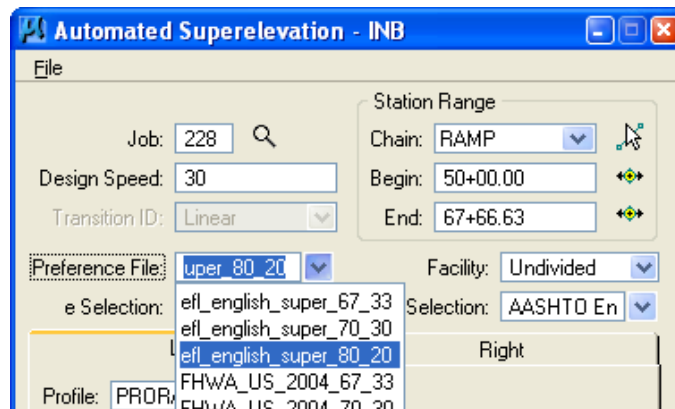
Note - For Metric, the path is
M:\Engineering_Software\Cadd_Resource_V8iX_30\Standards\Bin\Metric.



- Click on **Symbologies** to set the element symbology for the **Auto Shapes**. It is recommended to use **P_RDW_Super_Shapes** for the shapes as shown below.



- The **Superelevation Preferences** (file) can be selected from the **Automated Superelevation** dialog as shown below:

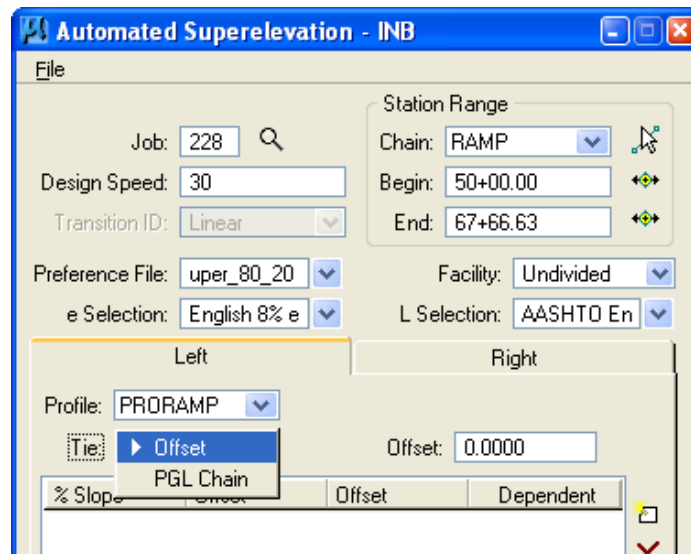


Note - AASHTO 2004 recommended that the proportion of runoff length on the tangent range from 60 to 90 percent for all speeds.

FLH has selected options within the range of AASHTO 2004 recommendation. Typical preference is set 67% and developed three sets of preferences 67-33, 70-30 and 80-20 for transition distribution as shown above.

Explanations of this can be found on page 175 on page 182 in AASHTO 2004.

- The next step is to simply tell Geopak a little more about your design. Complete the top portion of the Automated Superelevation dialog:



- Select the **GP** file
- Identify the **Chain**
- Key-in the **Design Speed**
- Select the Superelevation **Preference file**
- Select the maximum “e” value
- Select from the toggle **Divided** or **Undivided**. We typically design 2 lane roads, so select Undivided.
- The L Selection is made for you. It’s tied to the Superelevation Preference file selection.
- Select the Profile. Click on both the Left and Right Tabs to make sure that the Profile has been selected for both.
- For most cases, set the Tie option to Offset and the Offset data field to 0.00.

- Select **Quick Entry** for your shapes as shown below:



- The **Quick Entry** tool allows the user to enter the data for both the left and right shapes simultaneously... however the **Dependency** must be changed manually if one is desired to be **Independent**.
- Enter the values in the data fields and press **OK**.

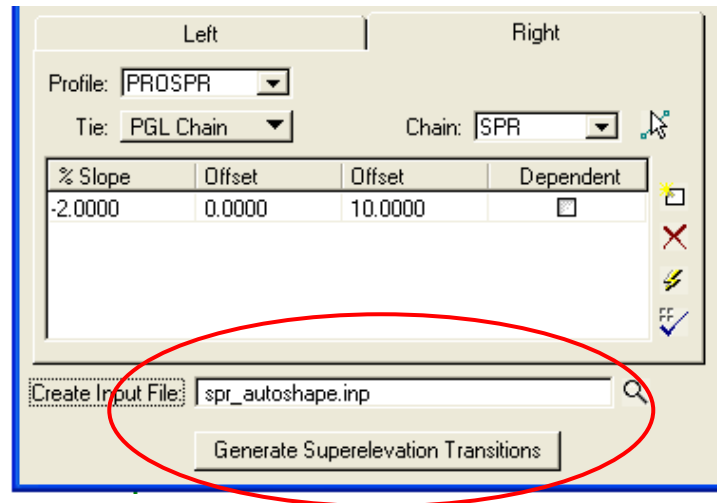
- The result is shown below:

% Slope	Offset	Offset	Dependent
-2.0000	0.0000	-10.0000	<input checked="" type="checkbox"/>

Create Input File: test_shape.inp

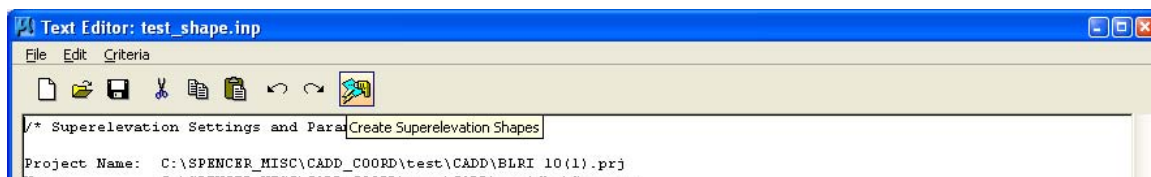
Generate Superelevation Transitions

- As mentioned earlier... as a result of using the **Quick Entry** tool, the **Right** shape will also be set to **Dependent**. To change the right shape to be **Independent**, simply click on the **Right** tab and uncheck the **Dependent** box (as shown below). I normally create one side **Dependent** and the other **Independent** simply so that they are automatically drawn in different colors, (see **Symbology** pull down explained previously). Both sides can actually be **Dependent**, but they both cannot be **Independent**.



Note - Remember, all of this is done to simply create an ASCII input file, (which can be edited).

- Now fill the Input File name and click on **Generate Superelevation Transitions** (This file will be created and placed in your working directory).
- When the input file is created the Geopak Text Editor will automatically pop up as shown below. Click on the icon at the far right (Create Superelevation Shapes) to process the file.**



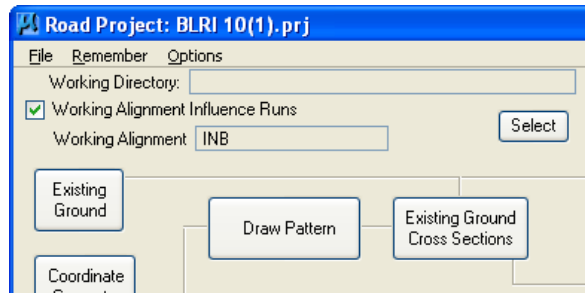
- Once pressed the **“Create Superelevation Shape”**, the superelevation shapes will be drawn into the MicroStation design file.



IMPORTANT: You should always review the input file for how the shapes have been calculated and drawn, before proceeding any farther with your design. You may also edit this file according to your project requirement.

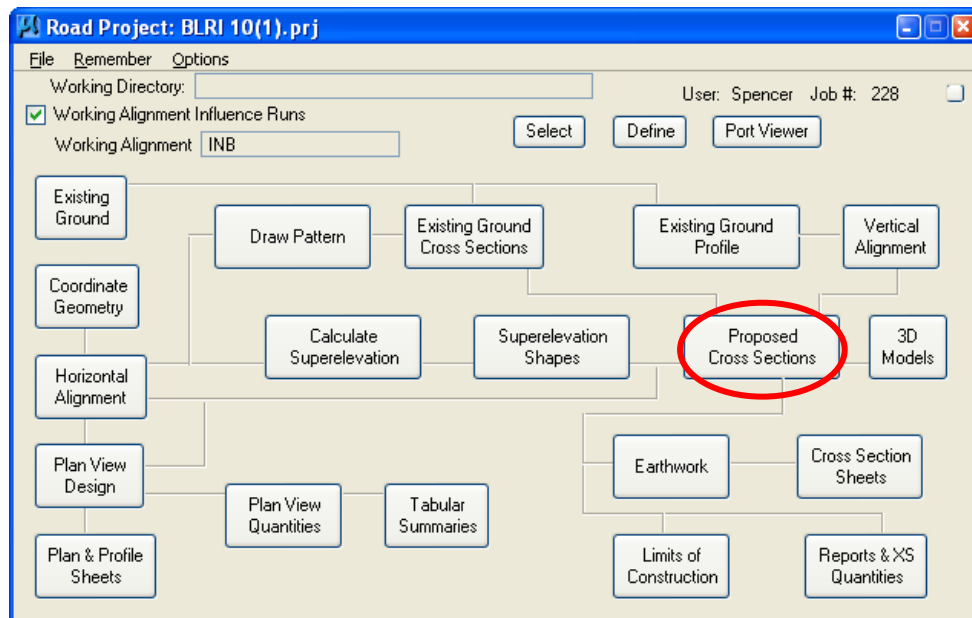
1.11 - Proposed Cross Section (Geopak)

- Open the design file (01-xxxx_Dxs.dgn) which was created for the Existing cross section (Section 5.9.2). The Proposed Cross section will be developed on the top of Existing Cross Section.
- Open Project manager and put a **check mark** in the white box for **Working Alignment Influence Runs** as shown below:

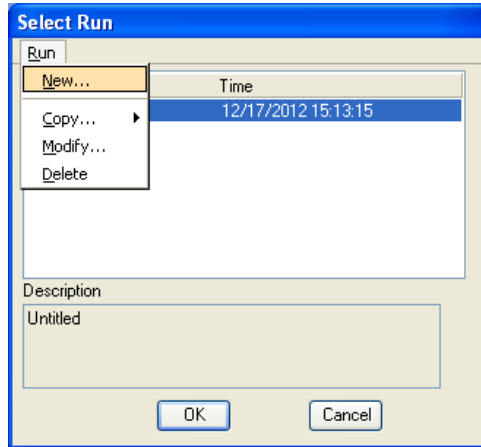


Note - Making sure the working alignment is defined.

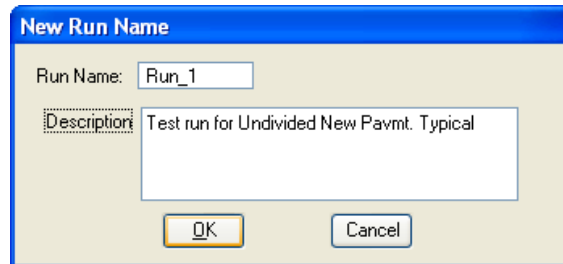
- Select the **Proposed Cross Section** button from the **Project Manager** dialog box as shown below:



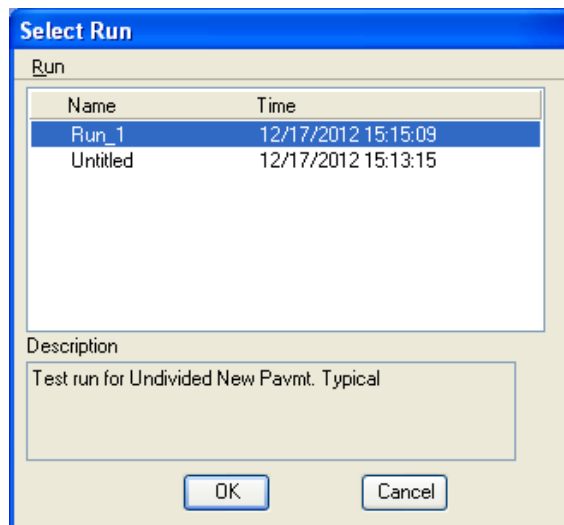
- The **Select Run** dialog appears. Use the pulldowns and select **Run > New** as shown below. Click on **OK**.



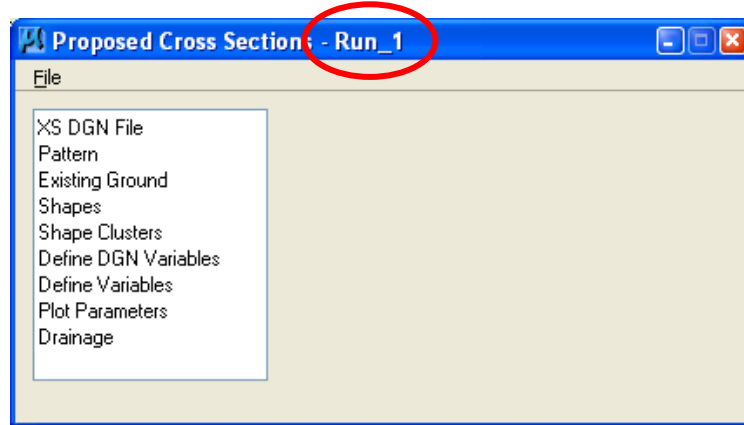
- The **New Run Name** dialog appears. Key in the name of the “Run”. The **Description** field is optional. Click on **OK**.



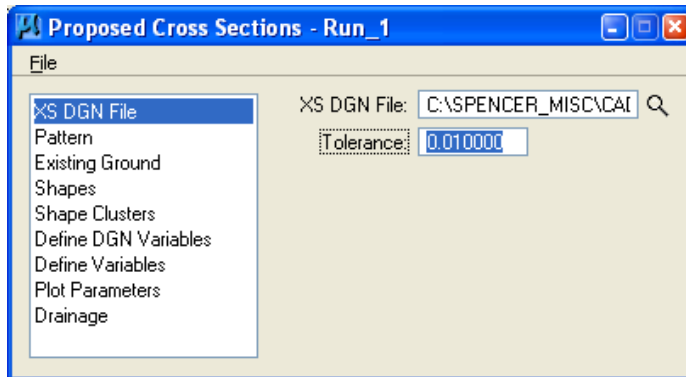
- The **Select Run** dialog appears. **Highlight** the Run and click on **OK** as shown below:



- The **Proposed Cross Sections** dialog appears. Notice that the name of the Run (in this case **Run_1**) also appears at the top of the dialog as shown below:



- Click on **XS DGN File** and browse to the cross section DGN file. Adjust the **Tolerance** setting as described below:

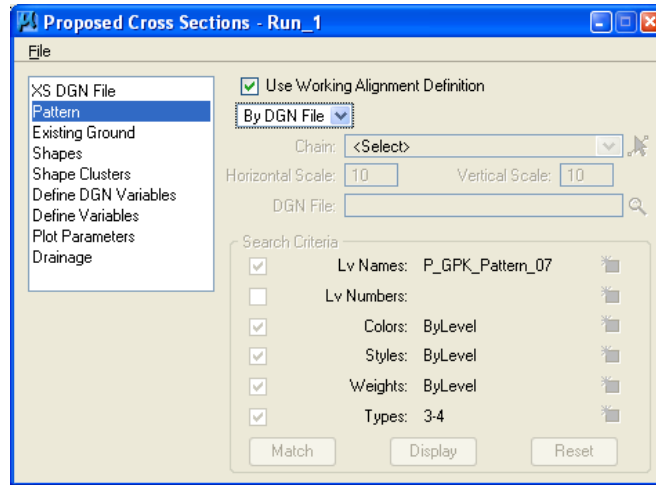


The “Tolerance” setting is very important.

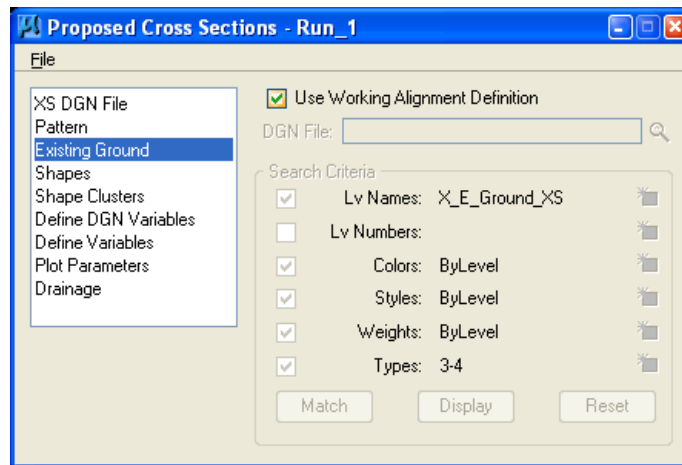
***US Customary projects,
Tolerance = 0.01.***

***Metric projects,
Tolerance = 0.003***

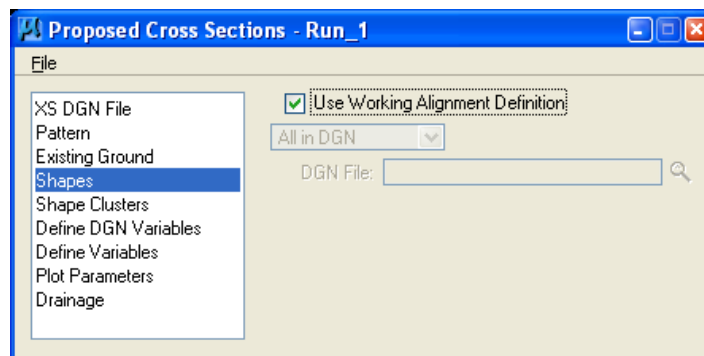
- Click on **Pattern** and put a **check** in the white box for **Use Working Alignment**. Since your pattern lines have been previously defined in your working alignment “INB”, there is no need to identify them again.



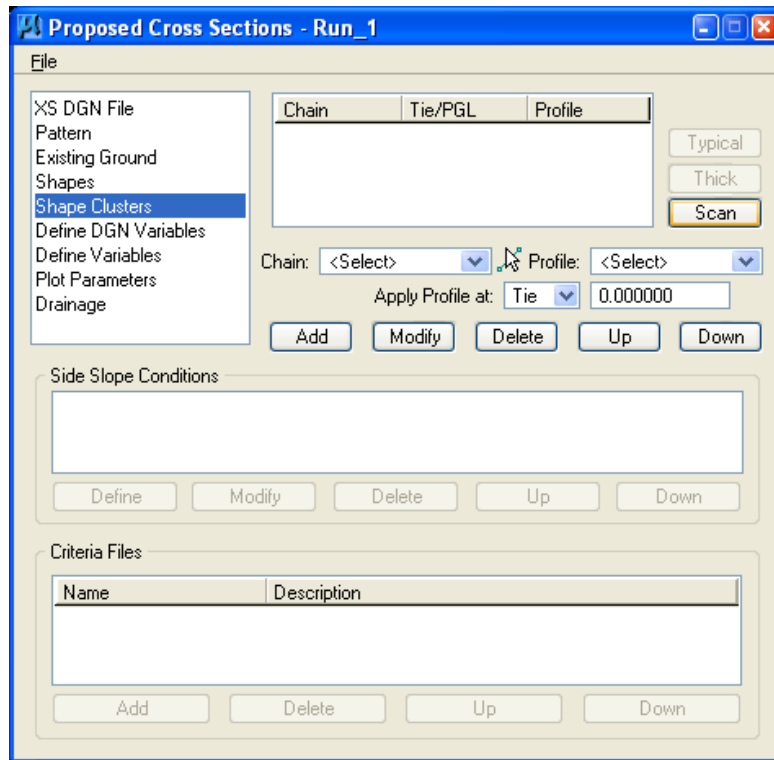
- Click on Existing Ground and put a check in the white box for Use Working Alignment. Since your Existing Ground has been previously defined in your working alignment “spr”, there is no need to identify it again.



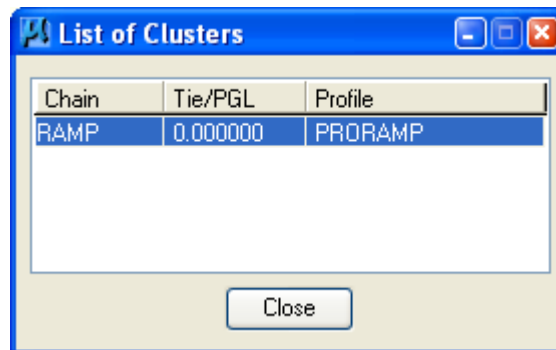
- Click on **Shapes**. This Typical Section **requires superelevation shapes**. Put a **check** in the white box for **Use Working Alignment**.



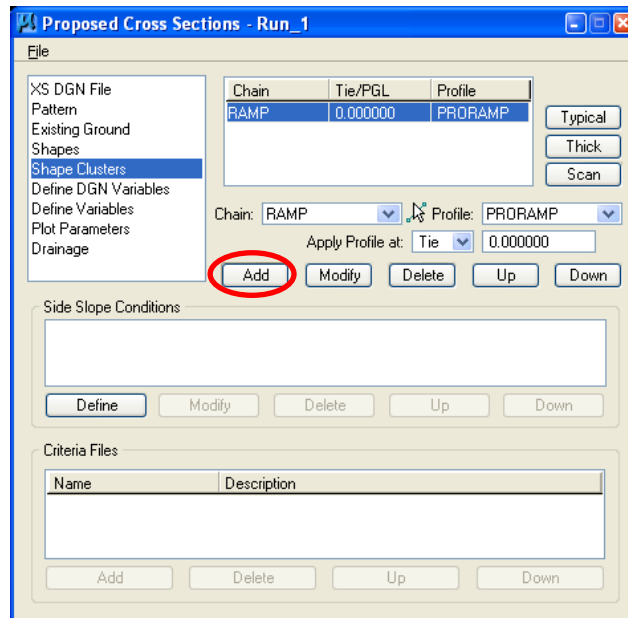
- Click on **Shape Clusters**. Initially the dialog appears as shown below, basically blank with many of the option buttons ghosted out:



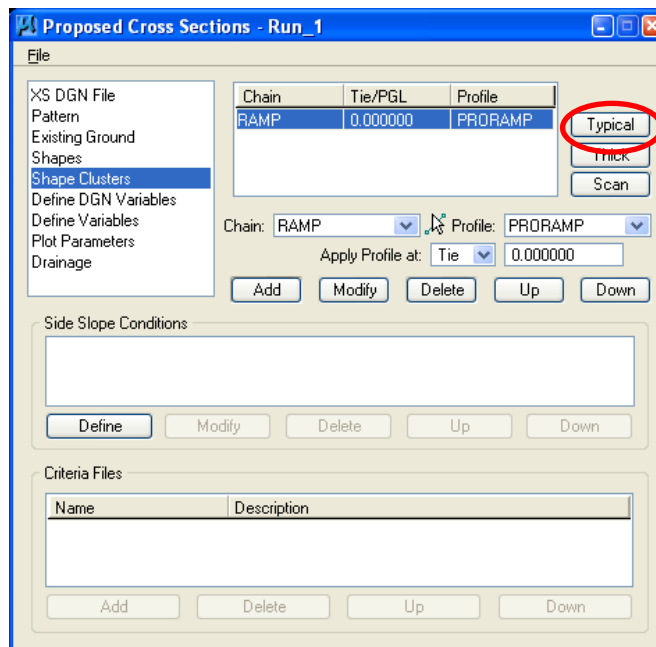
- Click on the **Scan** button and the **List of Clusters** dialog appears as shown below. Highlight the shape cluster:



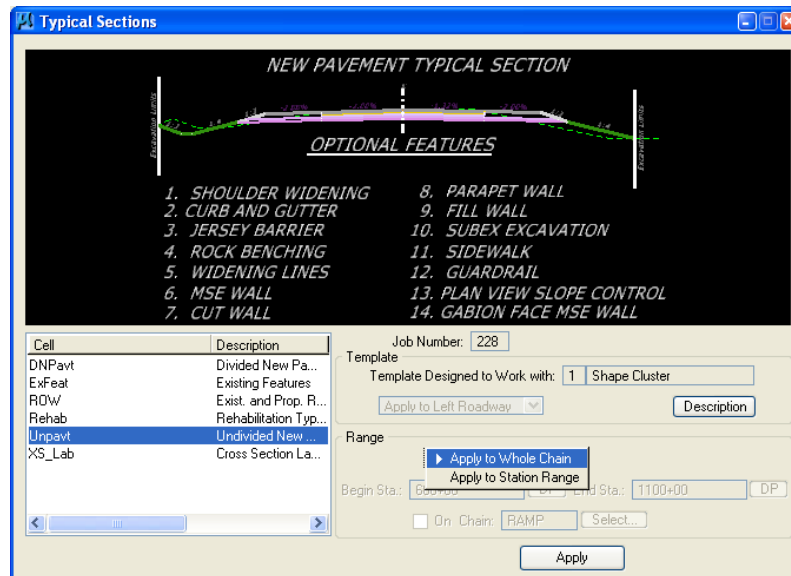
- Click on the **Add** button as shown below:



- When the **Add** button is pressed the shape cluster information gets added to the collection window. **Highlight** the information in the collection window. The **Typical** button becomes unghosted. Click on the **Typical** button as shown below:



- The **Typical Sections** dialog appears as shown below. Select the desired Typical Section.



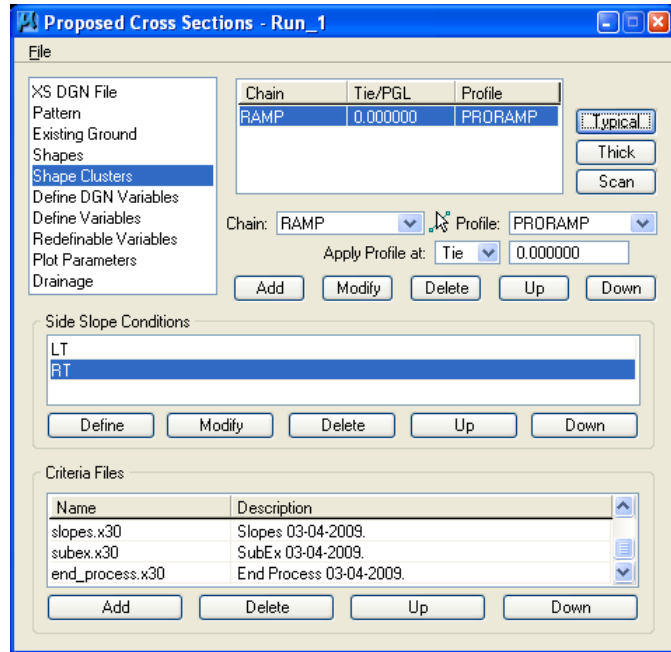
Note - Note the Description button located on the right side of the dialog. When pressed, this invokes a file that provides detailed information on how the typical works including detailed drawings.

- For this example we are using **Undivided New Construction**, so select **UNPAVT**. You may apply this Typical Section to the **Whole Chain** or a **Station Range**. When **Apply to Station Range** is selected, be sure to include the region numbers, as shown below (r 1).

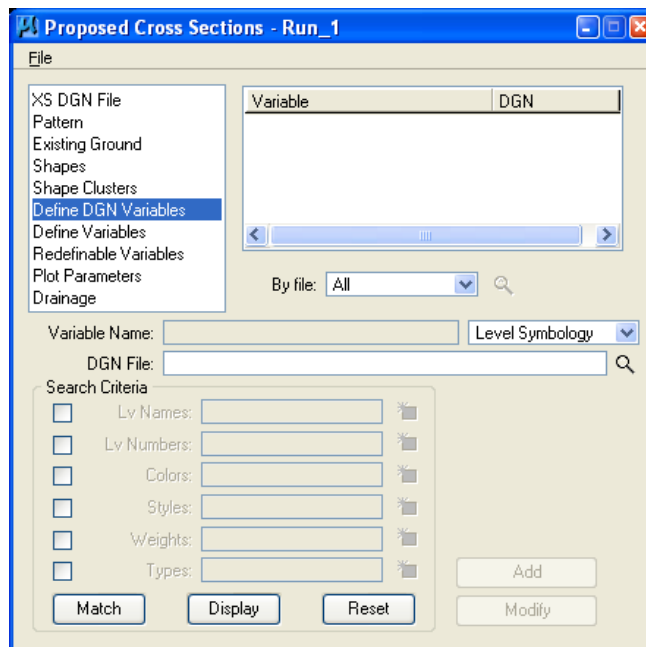
Note - Do not check the white "On" Chain box. Chances are you will never use this option.

- Select **Apply** at the bottom of the dialog. Each Typical Section is associated with different combinations of criteria files.

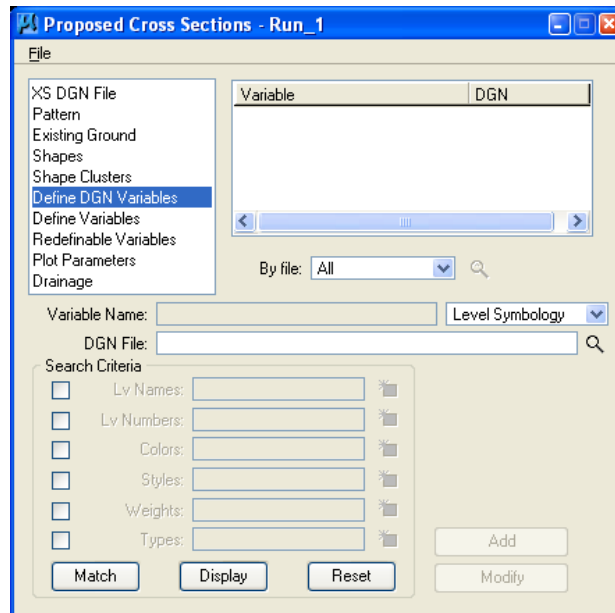
When **Apply** is pressed, the user is basically instructing the software what criteria files to use (and where) and populates the Proposed Cross Sections dialog as shown below:



Click on **Define DGN Variables**. You can ignore this portion of the **Proposed Cross Sections** dialog as it **only applies to the Automated Cross Section Labeling Typical**.

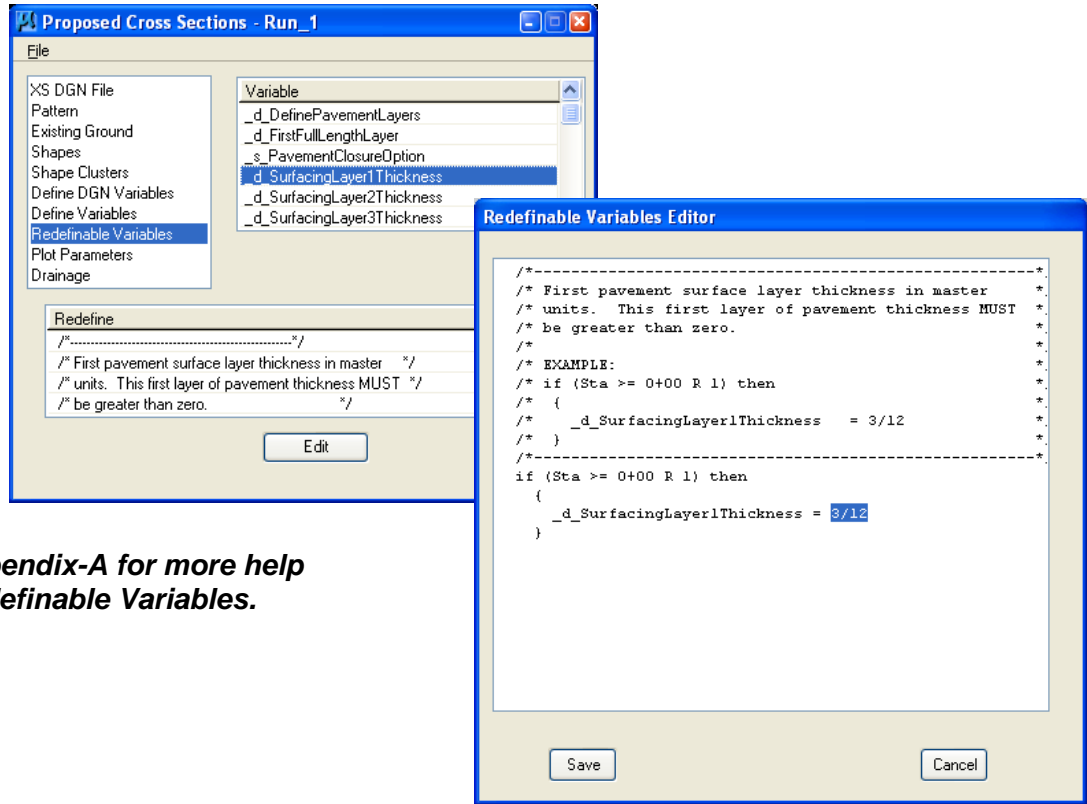


- Click on **Define Variables**. This portion of the dialog is where you specify “Global” variables such as the name of your mapping file where all the existing features are drawn (existing fence, existing edge of pavement.....). You must also specify the names of all other DGN files where the software is supposed to look for plan view elements, such as proposed widening lines, or proposed guardrail.
 - Highlight the Variable, (such as CROSS SECTION DGN), by clicking in the white area.
 - Once highlighted, the default value will populate the Value field.
 - Key-in the Value and press Modify.



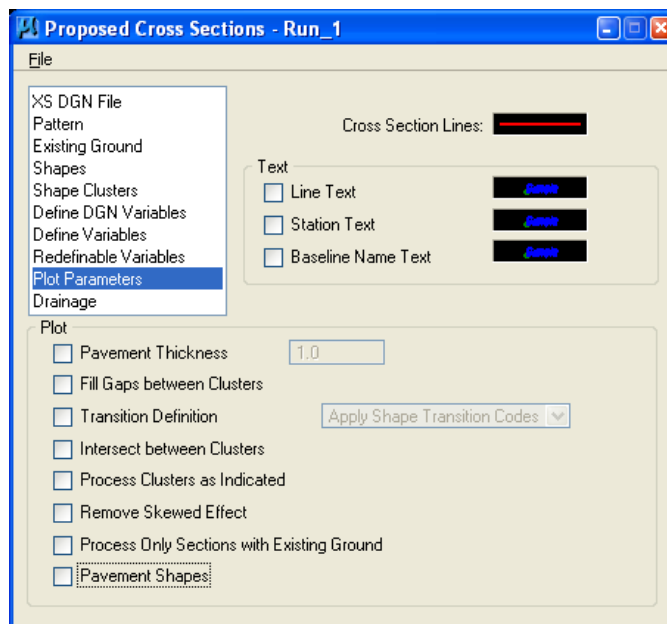
- Click on **Redefinable Variables**. This portion of the dialog is where the user can set **project specific values** for their design.
- In the example below, the 1st **Surfacing Layer** variable (`_d_SurfacingLayer1Thickness`) needed to be modified. The **Variable** was **highlighted** and the **Edit** button was pressed. When **Edit** was pressed the **Redefinable Variables Editor** dialog was invoked. The default value was changed to **3/12 for surface layer thickness**.

- The **Save** button was pressed.

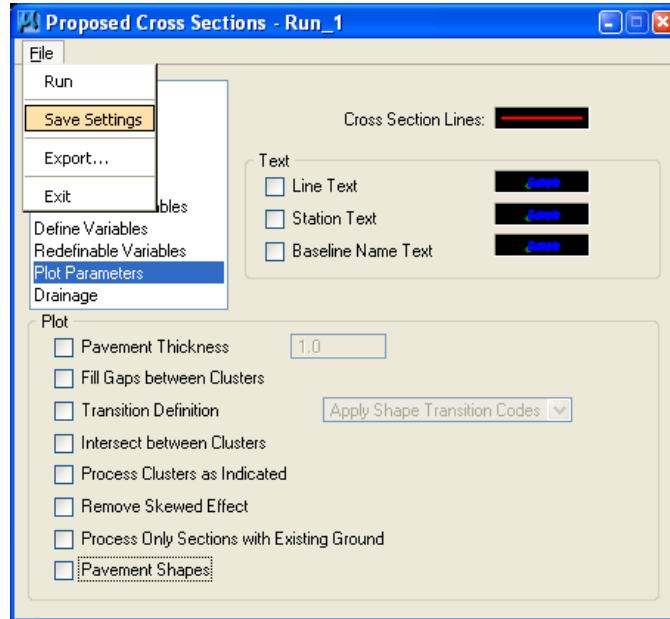


Note - See Appendix-A for more help on Editing Redefinable Variables.

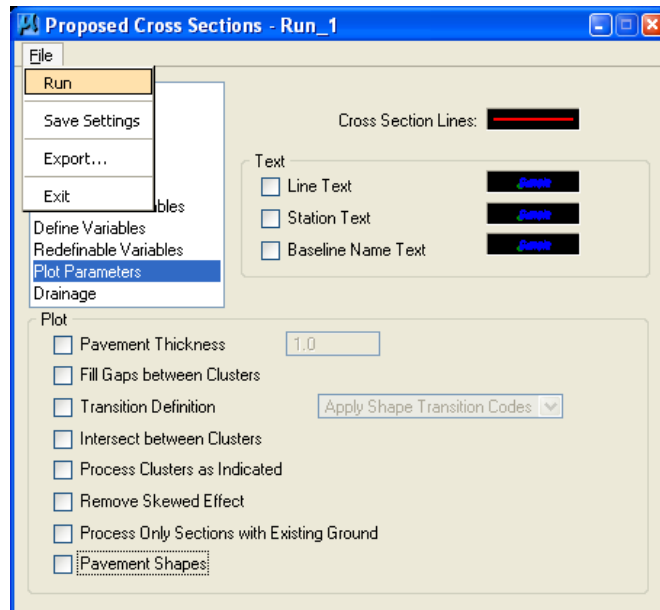
- Click on **Plot Parameters**. Uncheck all Plot options as shown below:



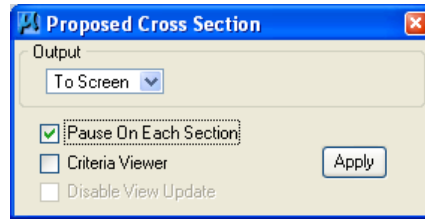
- **Drainage** is not used in Eastern Federal Lands.
- When all modifications are completed, save the Run settings using the pulldown **Files > Save Settings** as shown below:



- To execute the Proposed Cross Section Run, use the pulldown **Files > Run** as shown below:

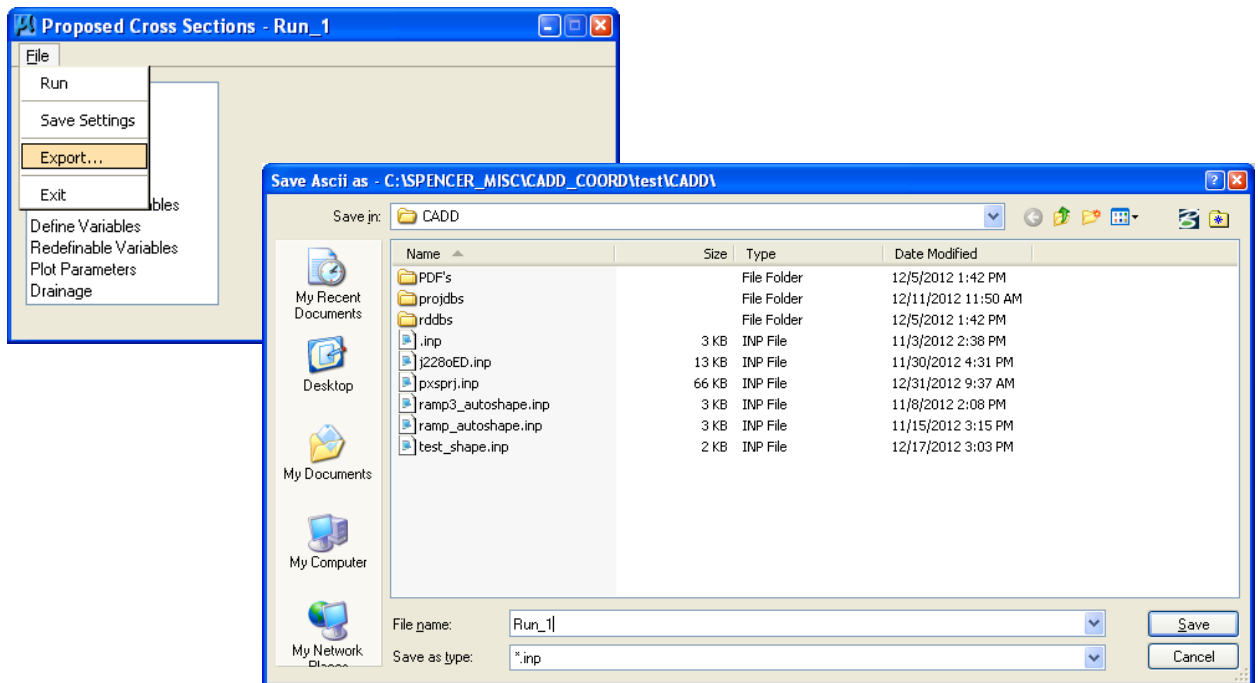


- The dialog below will appear. Set the dialog to **To Screen** or to create a .log file by selecting **To Log File**. Check **Pause On Each Section** and press **Apply**.



- After the first cross section is plotted, you may **uncheck** the **Pause on Each Section** toggle and press **Apply** again to complete the run.

1.11.1 - Save Backup of Proposed Cross Section Run as an ASCII Input File

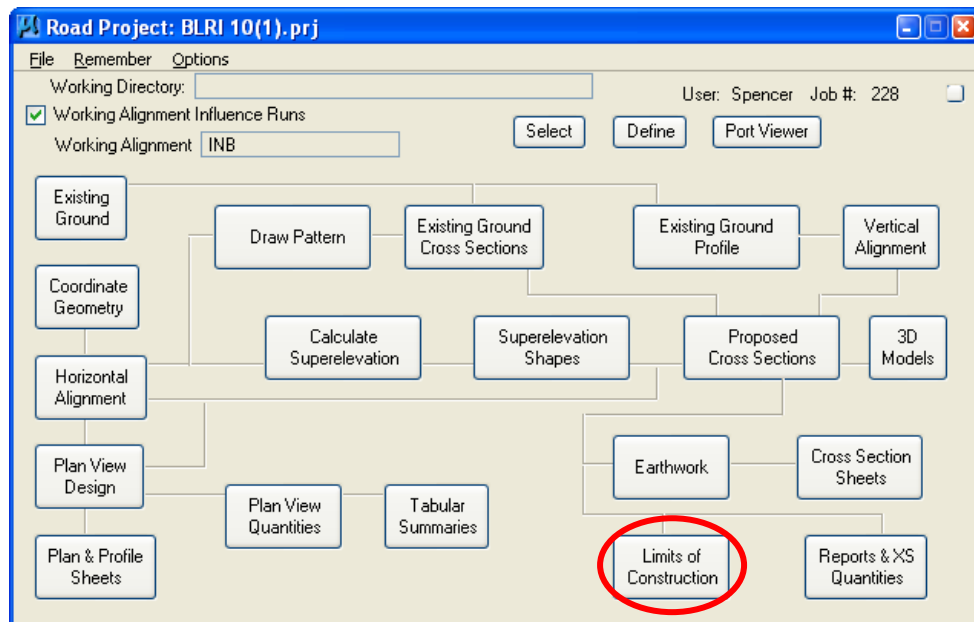


1.12 - Draw Construction Limits (Geopak)

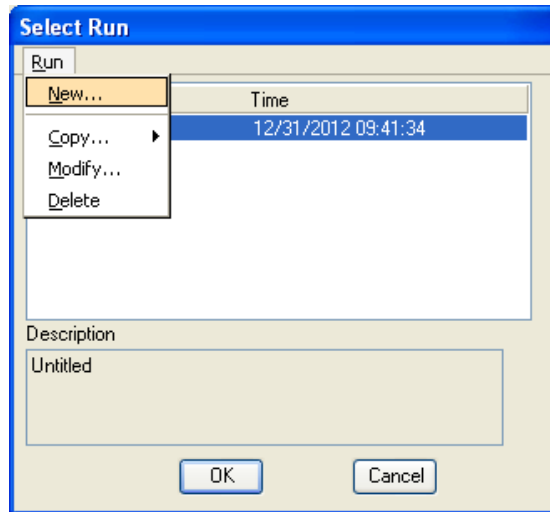
This will draw the graphical elements representing the top of cut and toe of fill on the Plan view.

First of all the designer needs to have a cross section file (e.g. 01-xxxx_Dxs.dgn) containing existing ground and proposed elements, (i.e. top of pavement, ditch, cut and fill slopes etc.) and a design file(e.g. 01-xxxx_des.dgn) for displaying construction limits graphically.

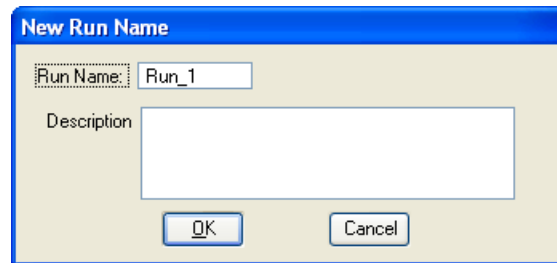
- Open a design file (01-xxxx_Dxs.dgn) containing your Existing and Proposed Cross Sections.
- Open **Project manager** and Select the **Limits of Construction** button from the **Project Manager** dialog box as shown below:



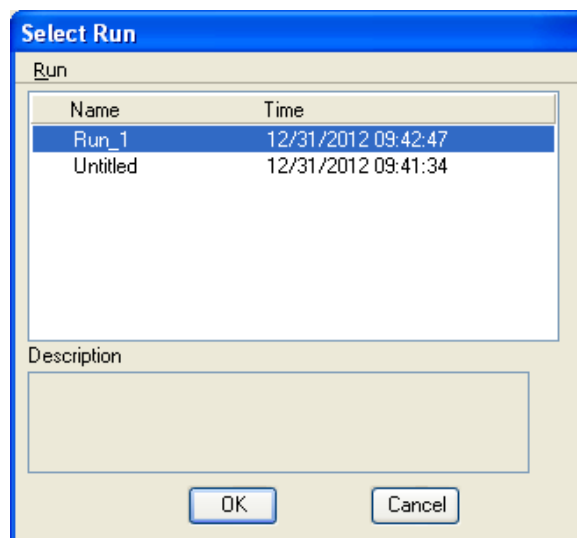
- The **Select Run** dialog appears. Use the pulldowns and select **Run > New** as shown below. Click on **OK**.



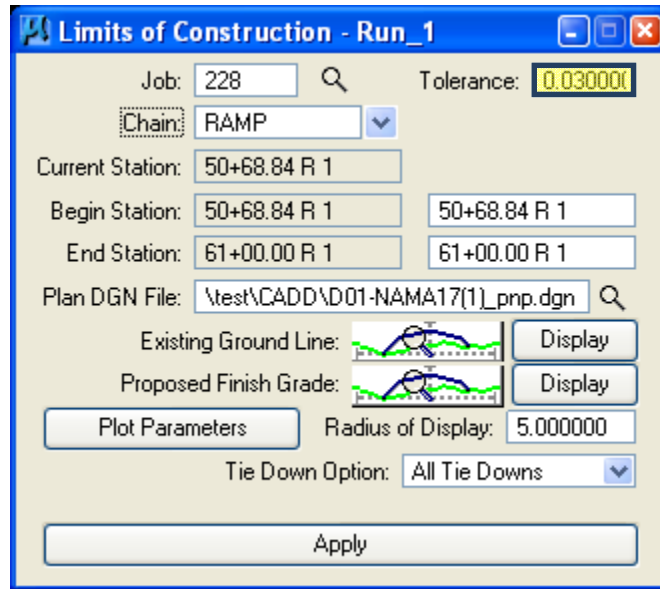
- The **New Run Name** dialog appears. Type in the name of the “Run” to create. The **Description** field is optional. Click on **OK**.



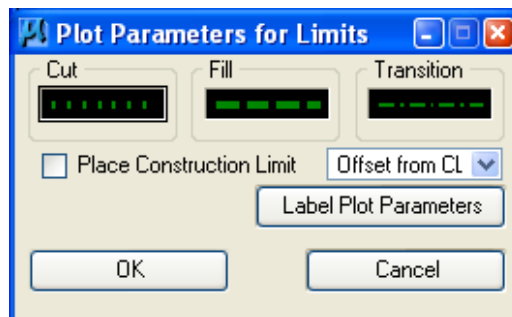
- The **Select Run** dialog appears. Highlight the desired run and click on **OK**.



- The Limit of Construction dialog appears as shown below:



- Key in all appropriate data. The **Plan Dgn** (e.g. 01-xxxx_des.dgn) field is the name of the .DGN file that you want the construction limits elements to be drawn into. Set the **Tolerance** to **0.03**.
- The **Plot Parameters** button, when pushed, brings up the **Plot Parameters for Construction Limits** dialog.



Note - These construction limit lines should match the weights and line styles shown on the “Conventional Symbols and Abbreviations” sheet shown in your plans.

The EFLHD CADD standards call for these lines to be drawn on Level name **P_RDW_Slope_Stake_Limits**.

Cut Line... color 2, weight 3, line style 1,

Fill Line...color 2, weight 3, line style 3

Transition Line...color 2, weight 1, line style 4,

- An option is the “Place Construction Limit” in the Plot Parameters for Construction Limits dialog. When this is toggled on, text may also be drawn in the Plan dgn file (not commonly used in EFLHD).
- When finished keying in your **Plot Parameters for Construction Limits**, press **OK**. After double checking all the fields in the “**Limit of Construction**” dialog press **APPLY**.

If everything was successful, you can open the **Plan Dgn** (e.g. 01-xxxx_des.dgn) file that you selected and see your construction limits.

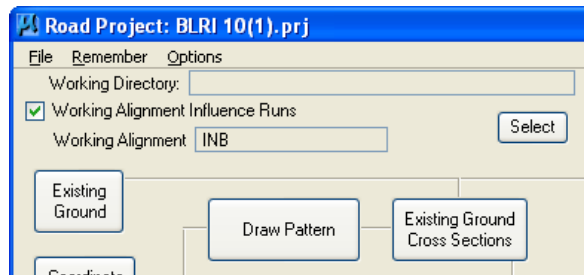
1.13 - Earthwork Quantities (Geopak)

FLH has created a seed earthwork run that is in sync with the .x30 criteria. The actual file is located on the server under

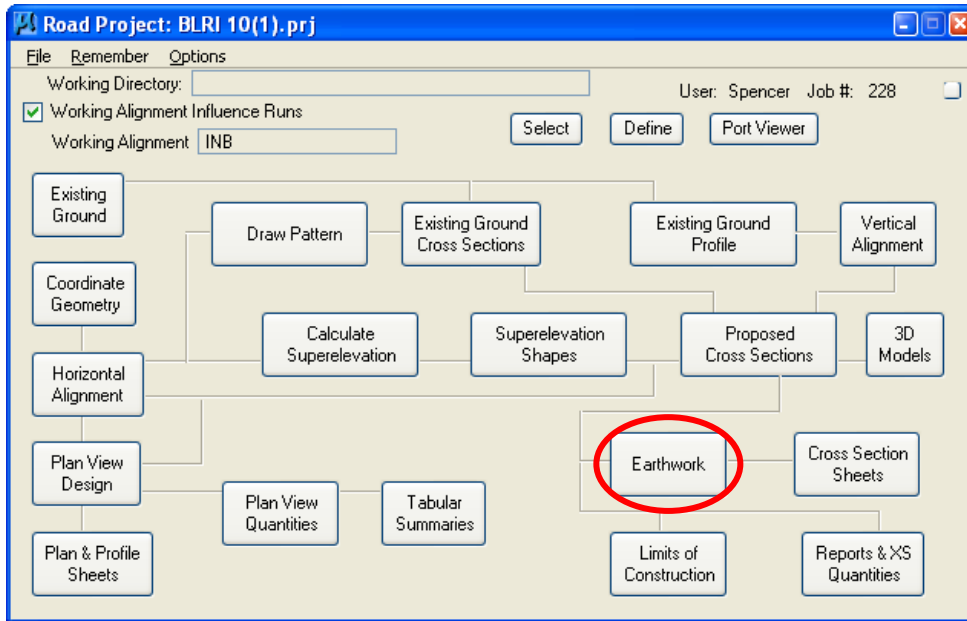
M:\Engineering_Software\Cadd_Resource_V8i\X_30\Standards\Seed_runs\projdbs\user\
The name of the file is FLH.004

Follow the steps below to use the seed earthwork run

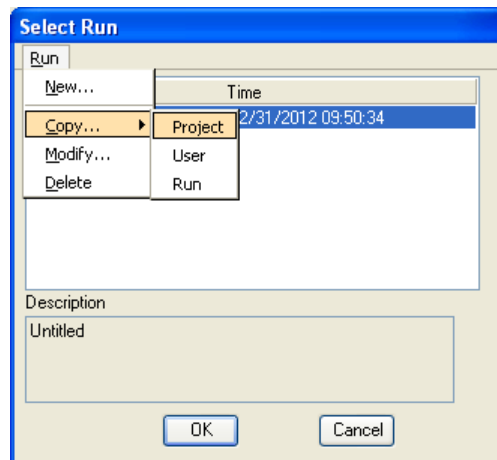
- In Windows Explorer, navigate to M:\Engineering_Software\Cadd_resource_v8i\X_30\Standards. **Copy the Seed_runs folder and its contents to your Desktop.**
- Open a cross section dgn file (01-xxxx_Dxs.dgn) that contains your proposed Cross sections elements.
- Open Project manager and put a **check mark** in the white box for **Working Alignment Influence Runs** as shown below:



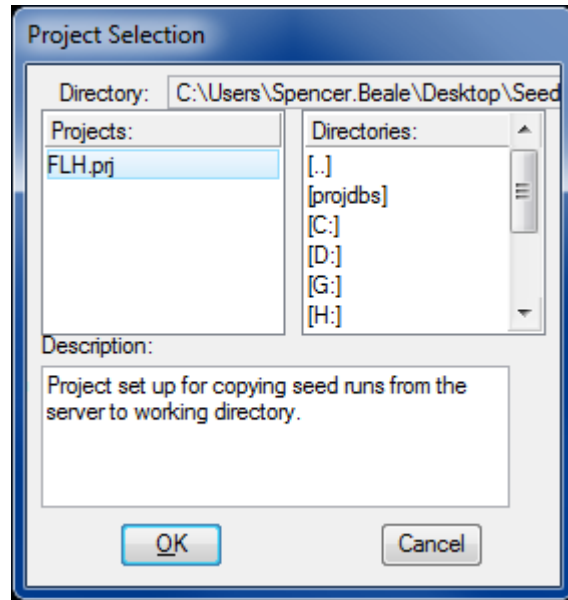
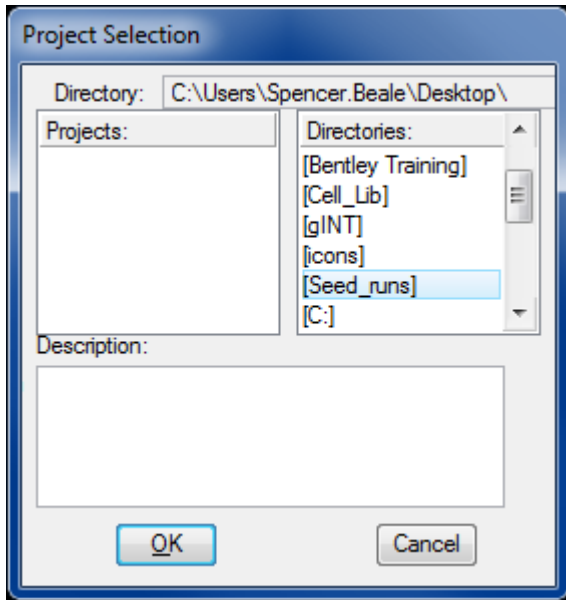
- Select the **Earthwork** button from the **Project Manager** dialog box as shown below:



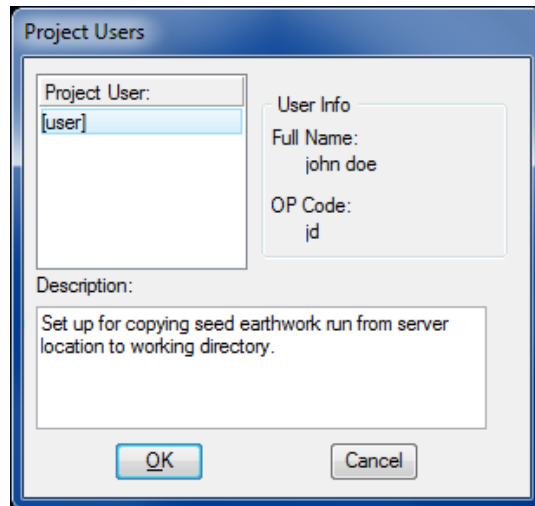
- Select **Run > Copy > Project** from the pulldowns, as shown below:



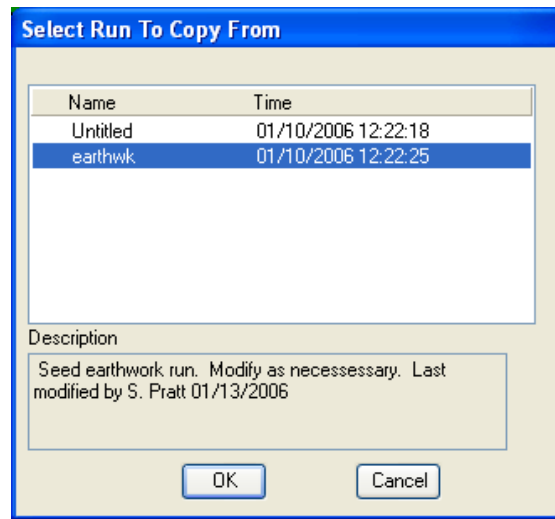
- Using the Browse capabilities of the Directories portion of the dialog, double click your way to the folder **C:\Users\Your.Name\Desktop\Seed_Runs**, as shown below.
Double-Click the FLH.prj to select it.



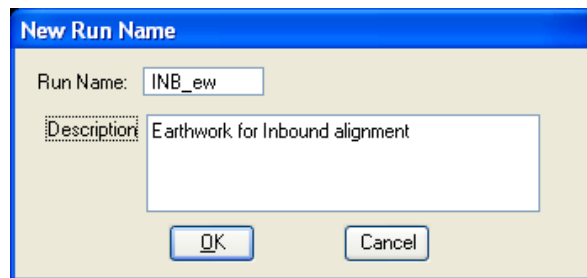
- Select **[user]** and press **OK**, as shown below:



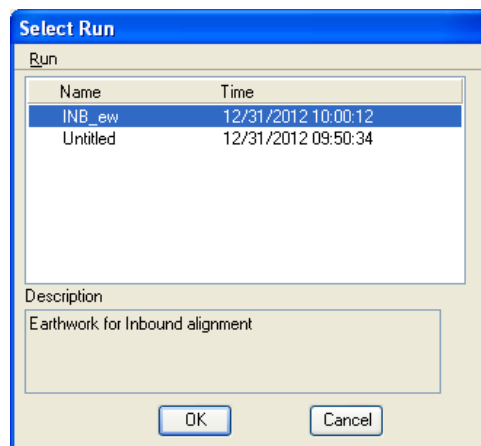
- Select **earthwk** and press **OK**, as shown below:



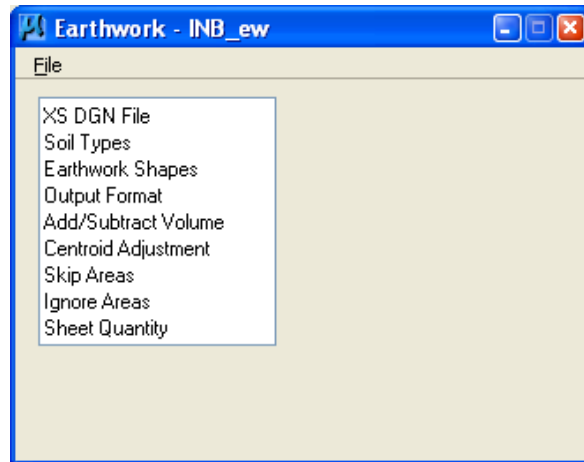
- Type in a **Run Name** that fits your project and an optional Description. Press **OK**, as shown below:



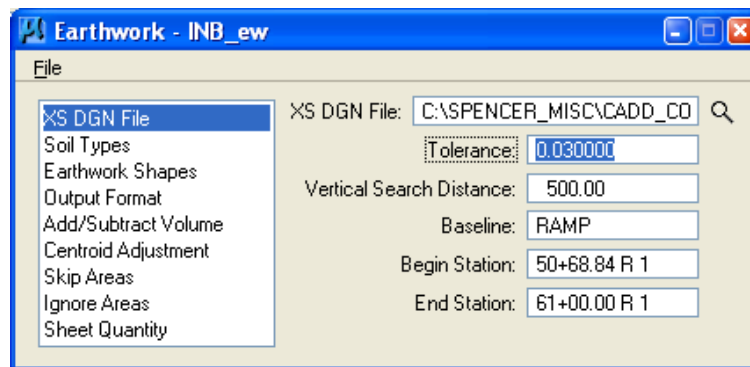
- Select your earthwork run and press **OK**, as shown below. Be patient, as it may take 30 seconds or so to copy the run from the server:



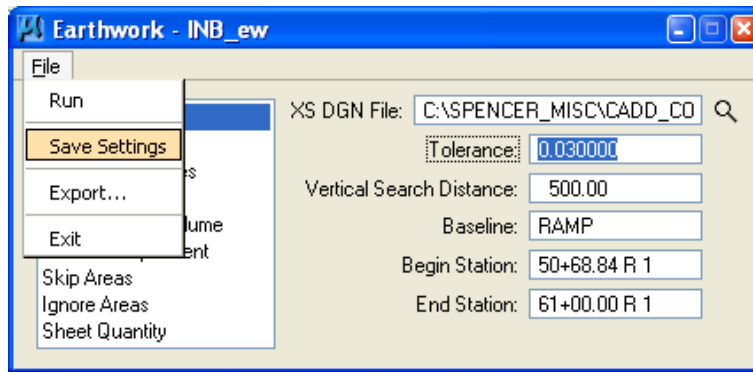
- The Project Manager **Earthwork dialog** will appear, as shown below. Notice the name of the run is shown in the blue title bar:



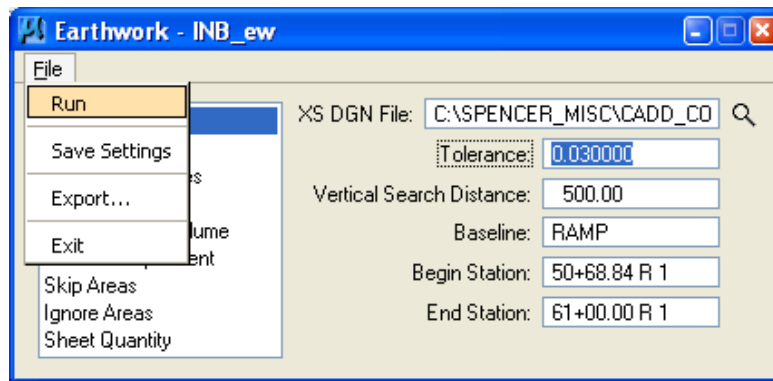
- Click on the **XS DGN File** category on the left side of the dialog and click on the **Select** button to select your cross section file.
- Adjust the **Tolerance** to one of settings shown below.
 - Metric projects should have a Tolerance setting of 0.001
 - US Customary** projects should have a **Tolerance** setting of **0.03**



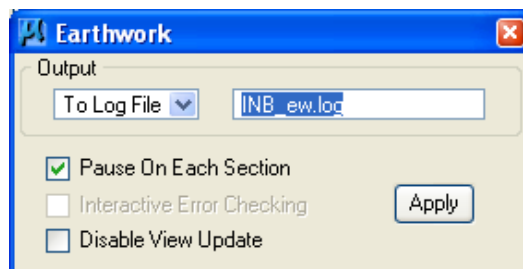
- Selecting the **XS DGN File** and setting the **Tolerance** setting are the only mandatory adjustments that need to be made to this run.
- Other categories (such as Centroid Adj) can be adjusted to suit your project as desired.
- When all adjustments are complete, save the run by using the pulldowns **File > Save Settings**, as shown below:



- To process the earthwork run, select **Run** from the pull-downs **File > Run**, as shown below:



- The Earthwork dialog will appear as shown below. Set the dialog to **To Log File**, type in a name for your earthwork report, toggle **Pause On Each Section** to **ON** (if you want the run to stop on each xs for review) and press **Apply**.



- After checking your first cross section, toggle **Pause On Each Section** to **OFF** and press **Continue** as shown below:

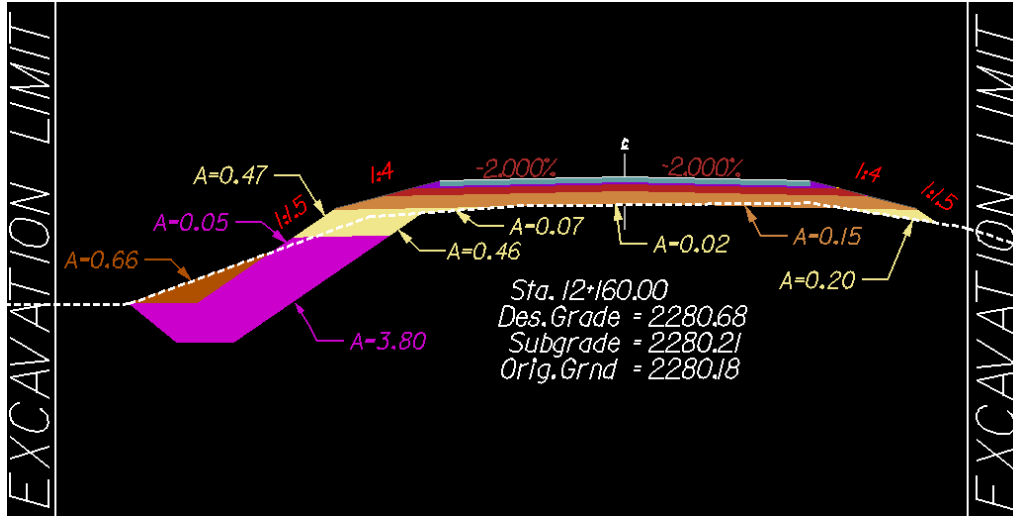
Process Cross Sections Display

Station	Material Name	End Areas (sq. ft.)	Unadjusted Volumes (cu. yd.)	Adjusted Volumes (cu. yd.)	Mul Fac
50+68.84	RDWYEX				
	Common Exc	39.7	0	0	0.90
	Subgrade Exc	2.5	0	0	0.90

Criteria Viewer Disable View Update
 Pause On Each Section Maintain Relative Window

- The earthwork report can be reviewed using any ASCII text editor.

The documentation below is simply for illustration on how Geopak interprets the various elements drawn in a cross section file. The examples below do not reflect the current levels or colors used with V8i.



Below is what the output file would look like.

Station Ordinate	Material Name	End Areas (square yards)	Unadjusted Volumes (cubic yards)	Adjusted Volumes (cubic yards)	Mult Factor	Mass
12+160.00	ITEM_NO._20401__ROADWAY_EXCAVATION					
	Common Exc	0.00	0	0	1.00	
	Subgrade Exc	0.15	4	4	1.00	
	Subsoil Exc	0.00	0	0	1.00	
	Fill	0.00	0	0	1.00	4
	ITEM_NO._20801__STRUCTURE_EXCAVATION					
	Common Exc	0.66	7	7	1.00	
	Subgrade Exc	4.26	43	43	1.00	
	Subsoil Exc	0.00	0	0	1.00	
	Fill	0.00	0	0	1.00	4
	Mass ordinate for ITEM_NO._20801__STRUCTURE_EXCAVATION = 49					
	SUITABLE					
	Common Exc	0.00	0	0	1.00	
	Subgrade Exc	0.00	0	0	1.00	
	Subsoil Exc	0.00	0	0	1.00	
	Fill	1.22	87	87	1.00	-83

ITEM_NO._40101__HOT_ACP					
Common Exc	0.00	0	0	0.00	
Subgrade Exc	0.00	0	0	0.00	
Subsoil Exc	0.00	0	0	0.00	
Fill	0.54	11	0	0.00	-83
ITEM_NO._30201__EMULSIFIED_BASE_GR_D					
Common Exc	0.00	0	0	0.00	
Subgrade Exc	0.00	0	0	0.00	
Subsoil Exc	0.00	0	0	0.00	
Fill	0.43	9	0	0.00	-83
ITEM_NO._30101__AGGREGATE_BASE_GR_D					
Common Exc	0.00	0	0	0.00	
Subgrade Exc	0.00	0	0	0.00	
Subsoil Exc	0.00	0	0	0.00	
Fill	1.10	22	0	0.00	-83
ITEM_NO._20407__SELECT_TOPPING					
Common Exc	0.00	0	0	0.00	
Subgrade Exc	0.00	0	0	0.00	
Subsoil Exc	0.00	0	0	0.00	
Fill	2.33	47	0	0.00	-83
ITEM_NO._25103__KEYED_RIPRAP					
Common Exc	0.00	0	0	0.00	
Subgrade Exc	0.00	0	0	0.00	
Subsoil Exc	0.00	0	0	0.00	
Fill	3.85	39	0	0.00	-83

1.14 - Reports (Geopak)

GEOPAK uses the proposed cross section files to produce staking reports in EFLHD format. The creation of these will be required on all EFLHD projects that have cross sections. These reports include the Subgrade Template Report, the Staking Details Report and the Blue Top Report.

*With the development of FLH standard files and the x30 criteria, Central Federal Lands has developed a Microsoft Visual Basic Application (MVBA) to generate a Subgrade Template Report. This cross section report **replaces** the previously generated FHWA **Slope Stake Report** and the **Red Top Report**.*

GEOPAK progresses from left to right across each cross section while preparing each report. The user will need to provide the level symbology of the existing ground and all the proposed elements to be reported on. These reports will be placed in ASCII files for ease of printing and electronic transfer.

The following sections will describe the processes used to create each of the reports.

1.14.1 - Subgrade Template Report:

The Subgrade Template Report includes the red top (Subgrade) stake locations plus points at all breaks in the roadway prism cross-section (i.e. ditch lines, hinge points, curb lines, sidewalks, benches, walls, etc.), plus the slope stake catch point and the reference hub point.

The Subgrade Template Report MVBA evaluates text elements within GEOPAK cross sections and produces a report based on the text elements found that match the user-specified search criteria.

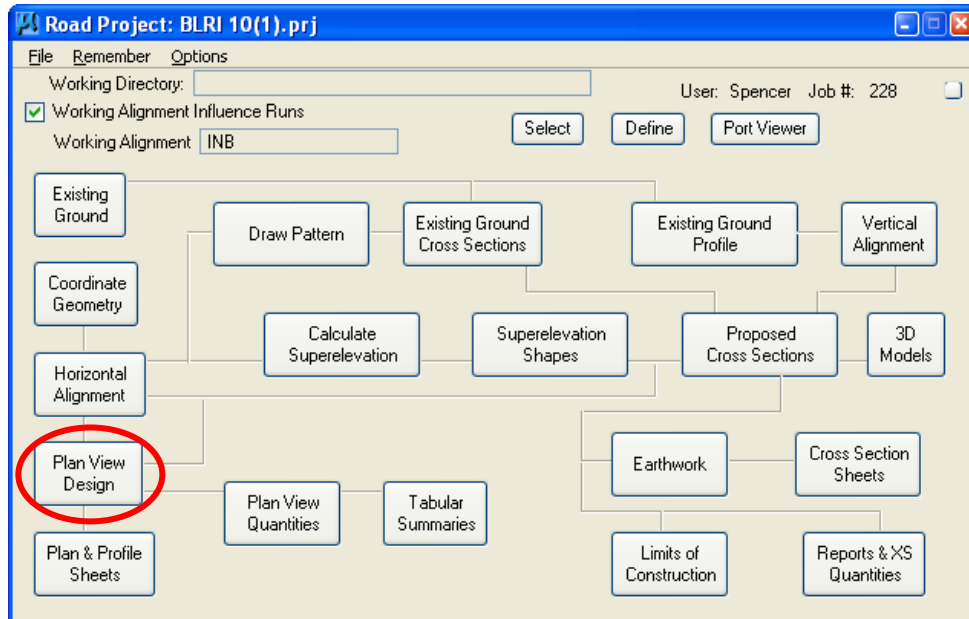
The Subgrade Template Report provides a better format for presenting staking data to contractors, is easier to understand, provides ease for quality control check, and allows for unlimited number of template points.

Subgrade Template Point Identification Sheets were developed to help clarify the information contained in the Subgrade Template Reports. Subgrade Template Point Identification Sheets are used to identify template points along each typical cross section. These Sheets can be access on

“M:\Engineering_Software\Cadd_resource_v8i\Standard_Shts\SG_Template\subgrade_template.dgn” directory.

- Open the cross section dgn file (01-xxxx_Dxs.dgn) that contains your existing and proposed Cross sections.

- Select the **Plan View Design** button from the **Project Manager** dialog box as shown below:

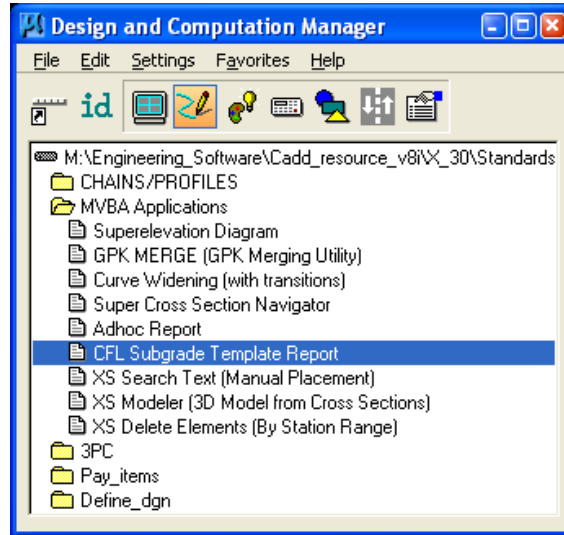


- The following dialog box will appear. Select the **Design and Computation Manager** icon.

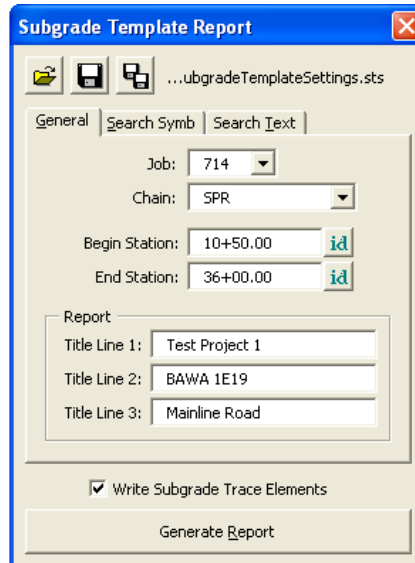


Note - D&C Manager can also be accessed through Applications > GEOPAK > ROAD > Design & Computation Manager or from the Main Geopak Road Tools dialog box. Any method can be used to activate the D&C Manager, but make sure the project manager dialog is activated prior to accessing the Subgrade Template Report MVBA; this will allow the MVBA to access project related settings.

- Select the **CFL Subgrade Template Report** from the **MVBA Applications** category in the V8_English.ddb (D&C Manager) as shown below.

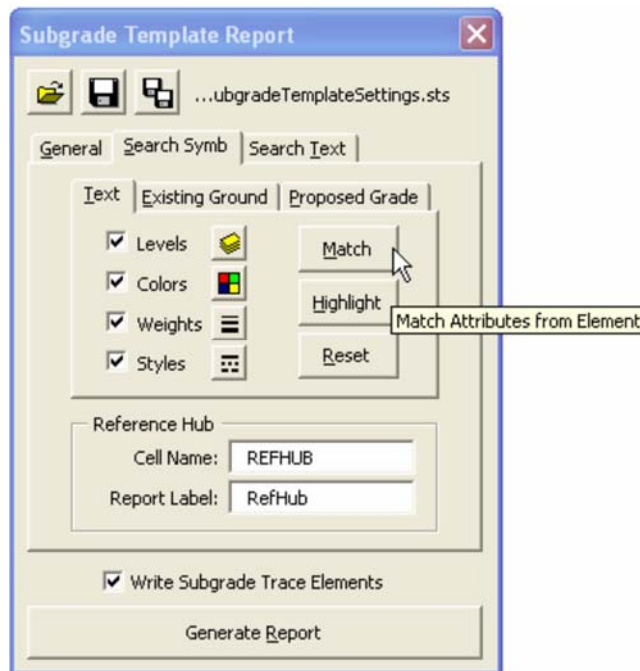


- Double click the **Subgrade Template Report**. The **Subgrade Template Report** dialog box will appear as shown below.



Note:-The Subgrade Template Report MVBA has three tabs which must be filled in prior to generating the Subgrade Template Report. The first tab entitled “General” contains general information including, Job #, Chain, Begin and End Station and the headers for the report.

- Enter the project information as shown above. Toggle on Write Subgrade Trace Elements, while the report is generated, a trace line is drawn to spot check the text points selected for the report. The trace line is drawn to a level named X_P_Subgrade_Trace. The trace line can be visually reviewed to ensure the correct path was used.
- Select “Search Symb” tab. Under this tab, symbologies for Text, Existing Ground, and Proposed Grade needs to be defined. Symbology can be defined by matching or by selecting levels, colors, weights and styles.



Note - When the Subgrade Template Report MVBA is invoked, the VBA loads a default Subgrade Template Settings (.sts) file and automatically places it into the working directory. The default Subgrade Template Settings (.sts) file contains all the settings of the Search symb tab and the Search Text tab according to FLH Template setup. The user can modify the settings as appropriate for their project and save this file or rename the file and save it to the Working Directory.

- Select the “Search Text” tab. Identify all the text to search for in the cross sections that define the path along the subgrade to generate the report. The default Subgrade Template Settings (.sts) file contains the text to generate report for a standard project. Modify, delete or add text values based on the typical section of your project. Use the Subgrade Template Point Identification Sheets as a guide in identifying text points.

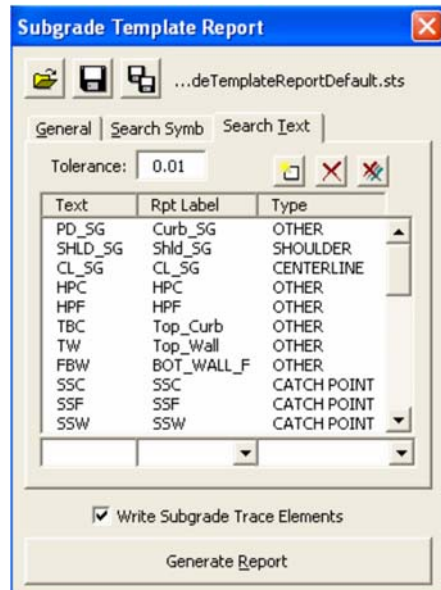
- When the Reference hub cells have been used and found, the report will use “Refhub” to label the point in the report. Any cell with the name “REFHUB” found in the cross section and lying on the existing ground will be listed in thereport.

Reference Hub is not used in any of the EFLHD project for the staking purposes.

- Select the “Search Text” tab. Select the level X_Text_Search, X_Text_Wall_Points and X_Text_Subgrade, associated colors, weights and styles. Use the Match button to select the symbology.
- Select the “Existing Ground” tab. Select the level X_E_Ground_XS, associated color, weight and style. Use the Match button to select the symbology.
- Select the “Proposed Grade” tab. Select the proposed grade symbology from Slope Stake Cut/Fill to Slope Stake Cut/Fill; define the path to search for the text to generate the report. Use match button to select the symbology and use highlight button to view selection. Use the Subgrade Template Point Identification Sheets as a guide to select the path for the report .

Note - Subgrade Template Point Identification Sheets are created with project specific information and included with the project specific Subgrade Template Report. Template points on the Subgrade Template report correlate with the points on the Subgrade Template Point Identification Sheets.

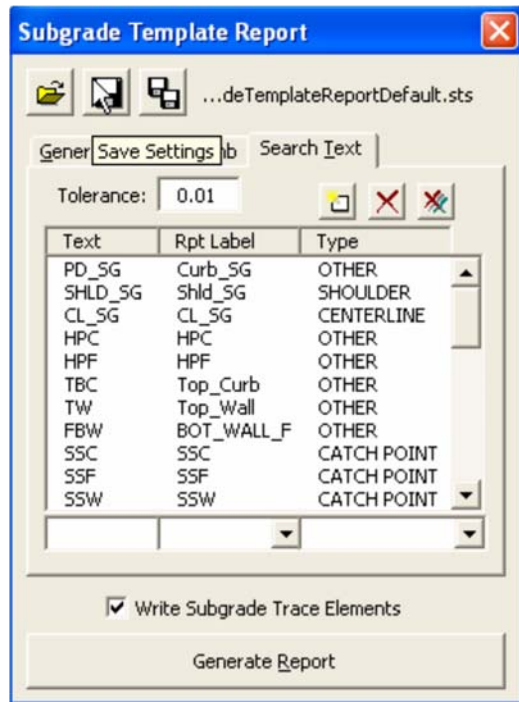
- In the **Search Text** tab:- The “Text” is the text string to search for in the cross section. The “Rpt Label” is the label to use in the report to represent the text string found. The “Type” is the type of point this text string represents which must be centerline, shoulder, catch point or other. Some of the FLH standard search texts are included into the Search Text tab default setup as shown below.



- The user can manipulate the search text list with the help of edit tools as shown above.

Note - Text must be entered as it appears in the cross sections. This MVBA is case sensitive. The tolerance value defines the distance the application will search for text in relationship to a proposed subgrade element vertex. The tolerance value should be around the value as shown for both metric and English projects.

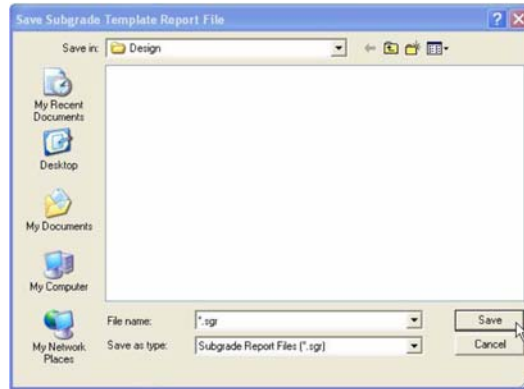
- Once all the settings have been defined, Select the Save Settings Icon to save the project settings. The project modified Subgrade Template Report settings are saved to your working directory as Subgrade Template Settings.sts. Select Save Settings to Another File Icon to save your project settings to a different setting file name.



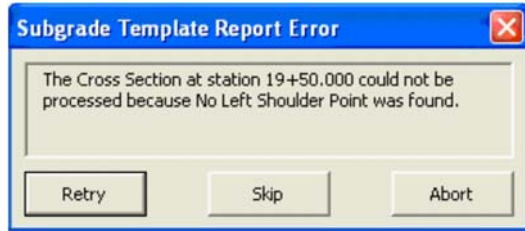
- Select Generate Report to create the report with the defined parameters.



- The following dialog will appear asking to provide the name of the subgrade report file to be created. Provide a name and Select Save.



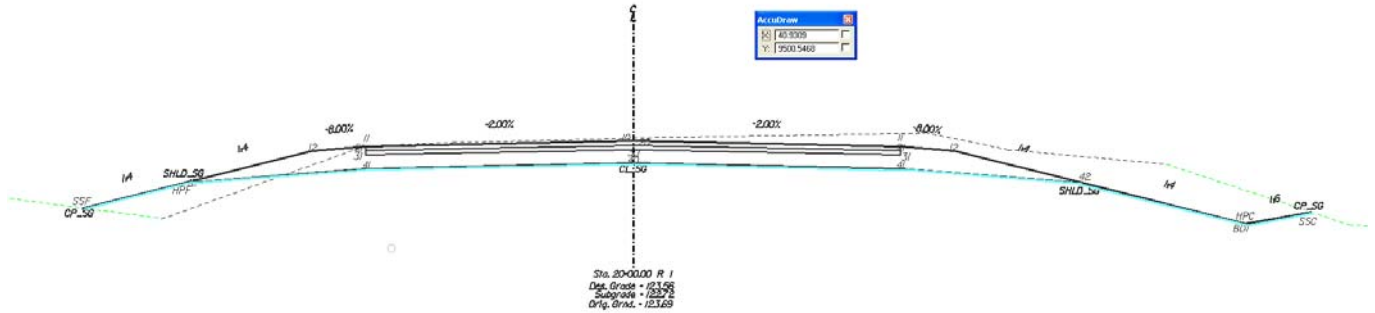
- Occasionally errors are found in the cross sections. These may be caused by incorrect symbology (either in the cross sections or that specified in the dialog) or by search text not specified correctly. When an error occurs on any given cross section the user will be presented with a dialog similar to the following:



- The description of the error in the dialog will indicate the location and type of error that was found.
- When the application has finished processing the final cross section in the specified range a message will be displayed indicating it is done. Select OK.



- Use Cross Section Navigator to view your cross sections with the subgrade traced elements.



- The Subgrade Template Report will produce the following report as shown below. The report will be saved in the location specified and can be viewed and printed using any text editor application. UltraEdit is preferred for viewing and printing the **Subgrade Template Report**.

12/04/2012

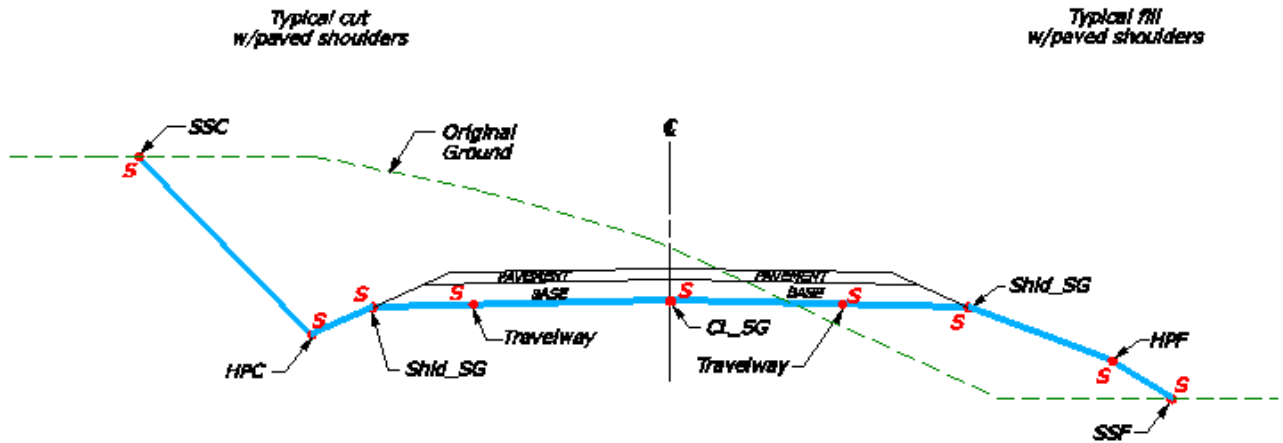
Test Project 1
NAMA 17(1)
Mainline Road

Page# 20

SUBGRADE TEMPLATE REPORT (ft)

Left Side					Right Side					
Station	Cut/Fill	Slope	Distance	Elevation	Super	Super	Elevation	Distance	Slope	Cut/Fill
20+00.00	F 0.94	-1:4.00	20.65	121.03						
			16.90	121.97	-4.450%	-4.450%	121.97	16.90		
							120.47	22.90	-1:4.00	F 1.50
							120.88	25.39	1:6.00	C 0.42
Station	Easting	Northing	Elevation	Offset	Id	Slope	Horiz. Diff.	Vertical Diff.		
20+00.00	1354095.02	498407.91	121.03	-20.65	CP					
						-1:4.00	-3.75	-0.94		
	1354097.90	498405.52	121.97	-16.90	SHLD					
						-0.045	-16.90	-0.75		
	1354110.92	498394.74	122.72	-0.00	CL		0.00	0.00		
						0.045	-16.90	0.75		
	1354123.93	498383.96	121.97	16.90	SHLD					
						-1:4.00	6.00	-1.50		
	1354128.56	498380.13	120.47	22.90	HPC					
						1:6.00	2.49	0.42		
	1354130.47	498378.55	120.88	25.39	CP					

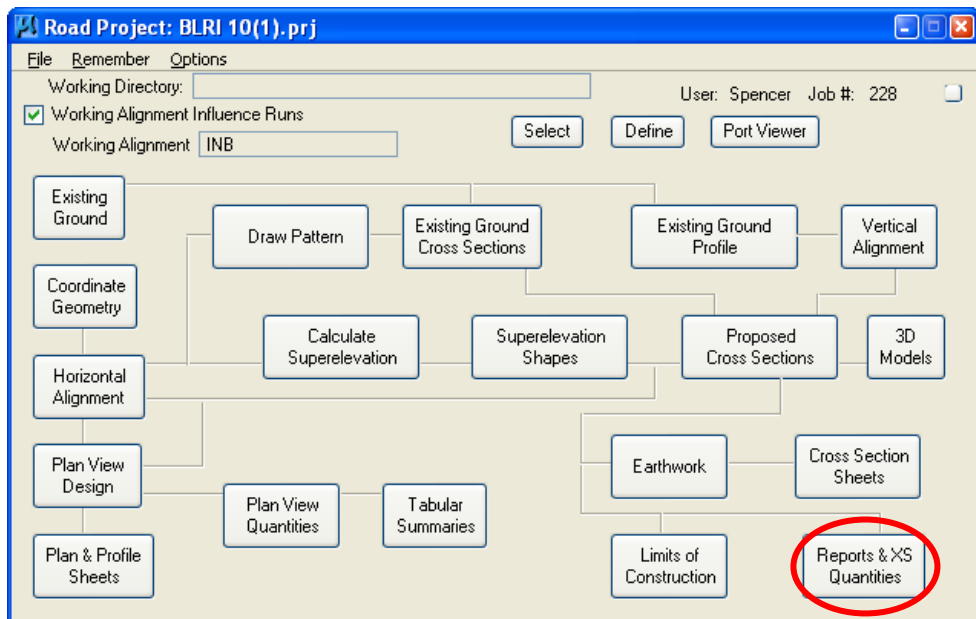
- The **Subgrade Template Reports** generated for construction should be accompanied by the typical **Subgrade Template Point Identification Sheets** for the project. The **Subgrade Template Point Identification Sheet** shown below identifies the template points in the **Subgrade Template Report** along a typical cross section.



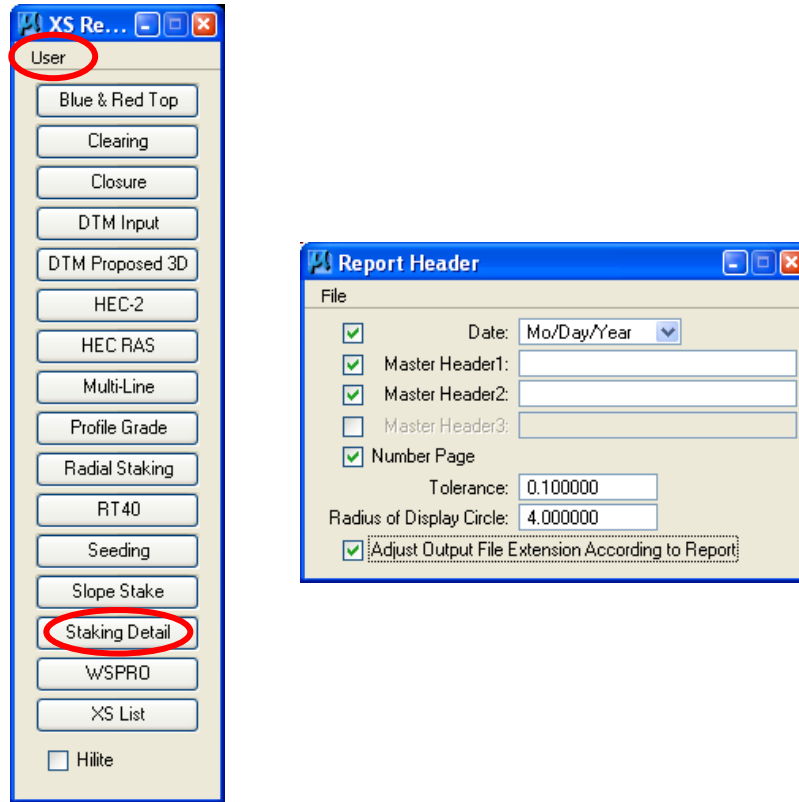
1.14.2 - Staking Detail Report:

The *Staking Detail Report* is used to locate the catch points (tie down point between the proposed finish grade and the existing ground) at each section. Referencing this catch points, the *Staking Report* lists the left and right offset and its corresponding elevation, and the slope of the proposed finish grade. The *Staking Detail Report* are generated from the cross section file by accessing the *XS Report* dialog.

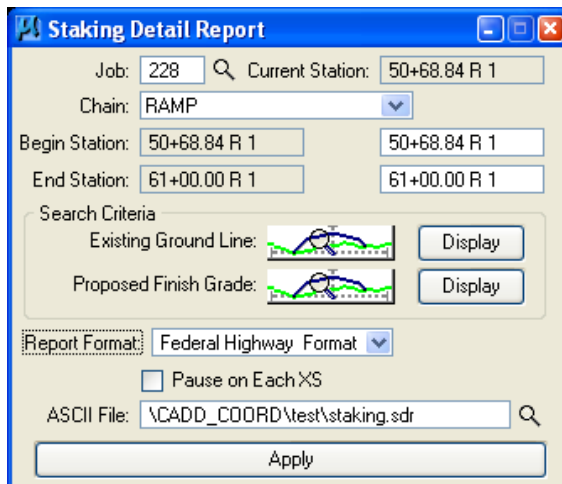
- Open the cross section dgn file (01-xxxx_Dxs.dgn) that contains your existing and proposed Cross sections.
- Select the **Reports & XS Quantities** button from the **Project Manager** dialog box as shown below:




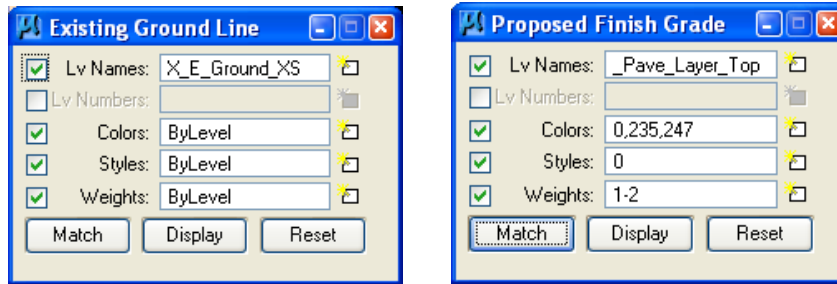
- The **XS Report** dialog will appear as shown below. Click **User** and fill out the **Report Header** Dialog box. This **Report Header** information can be saved by clicking on **File** and selecting the path and file name to be saved.



- Select the **Staking Detail** button from the **XS Report** dialog box. When selected, you will get the following dialog box.



- To set the symbology values for the **Existing Ground Line** and **Proposed Finish Grade**, pick the symbology button  to get the following dialog boxes:



- Set the existing ground line symbology as shown above. Select the top of the pavement layer, ditch slope, cut slope and fill slope for proposed finish grade. The values shown in the Existing Ground Line and Proposed Finish Grade sections will allow GEOPAK to progress through the top of subgrade. This is the path needed to get the correct report.

Note - The values shown in the Proposed Finish Grade are only for a standard ditch or fill section. There will need to be additional symbology added to the Proposed Finish Grade section if retaining walls and other elements are added to the cross sections.

- Once the existing and proposed symbology has been selected, provide a name for the report and select Apply to process the Staking Detail Report.

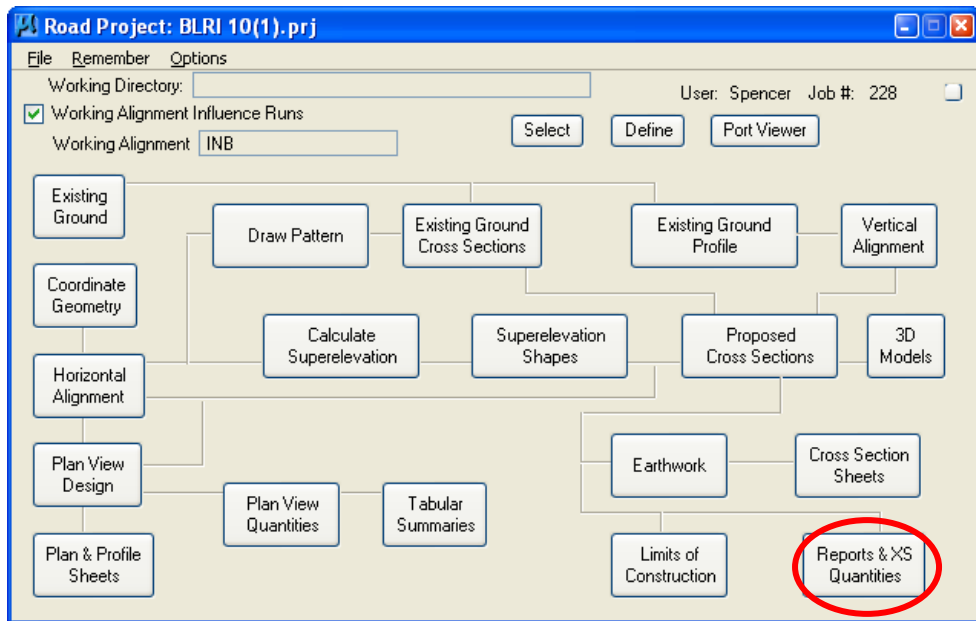
STAKING DETAIL REPORT(Ft)

STATION	Slope	Left Stake		Right Stake				Slope			
		C/F	DIST	ELEV	SUPER	ADJ. SUPER	ELEV.		DIST	C/F	
18+50.00 R 1	6.00:1.	C 0.99	28.81	126.86	-0.020	128.13	-0.020	126.77	28.27	C 0.89	6.00:1.
19+00.00 R 1	6.00:1.	C 0.77	27.55	124.81	-0.020	126.28	-0.020	124.77	25.87	C 0.74	4.00:1.
19+50.00 R 1	6.00:1.	C 0.73	27.29	122.92	-0.020	124.45	-0.020	122.60	25.35	C 0.41	6.00:1.
20+00.00 R 1	4.00:1	F 0.94	20.65	121.03	-0.020	122.72	-0.020	120.88	25.39	C 0.42	6.00:1.
20+50.00 R 1	6.00:1.	C 0.36	25.05	119.27	-0.020	121.17	-0.001	119.84	27.29	C 0.73	6.00:1.
21+00.00 R 1	6.00:1.	C 0.66	26.89	118.12	-0.027	119.79	0.027	117.71	28.62	C 0.27DL	-6.00:1.
21+50.00 R 1	6.00:1.	C 1.91	34.36	118.06	-0.037	118.57	0.037	118.36	17.34	C 0.59DL	-4:1.

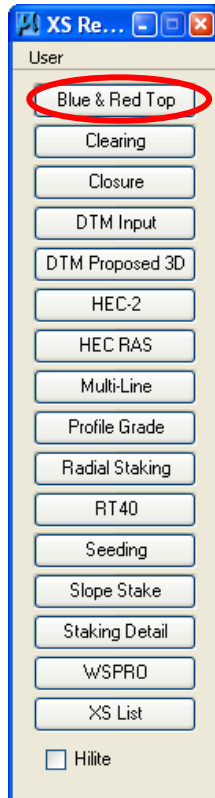
1.14.3 - Blue Tops Reports:

*Blue Tops reports indicate all breakpoints at the top of base course. Based on FLH-defined text strings placed on each cross section, GEOPAK determines the offset and elevation in addition to the slope between each pair of adjoining vertices. There are two reports that are needed; the standard **Blue Top Report** and the **XYZ Blue Top Report** (provides Northing, Easting values, and Elevations). To generate this report, access the MicroStation file containing the cross sections and select the **Blue & Red Top** button from the **XS Report** dialog box.*

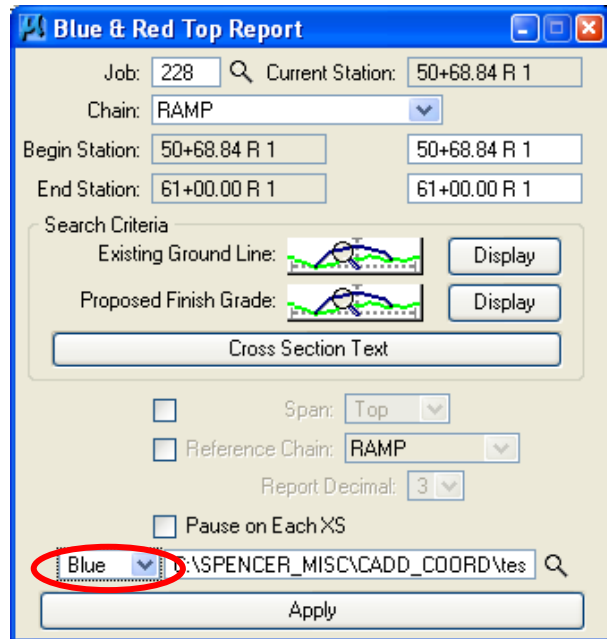
- Open a cross section dgn file (01-xxxx_Dxs.dgn) that contains your existing and proposed Cross sections elements.
- Select the **Reports & XS Quantities** button from the **Project Manager** dialog box as shown below:




- The **XS Report** dialog will appear as shown below. Click **User** and fill out the **Report Header** Dialog box. This **Report Header** information can be saved by clicking on **File** and selecting the path and file name to be saved.

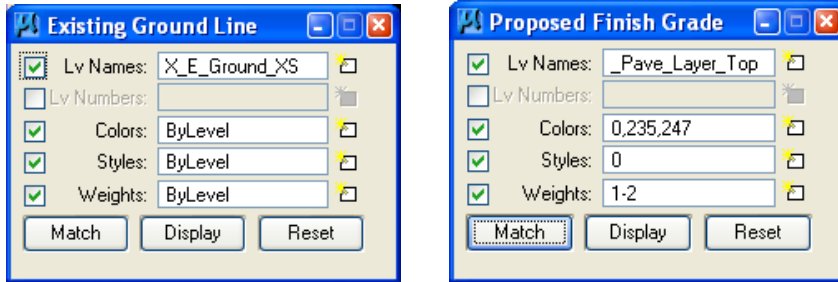


- Select the **Blue & Red Top** button from the **XS Report** dialog box. When selected, you will get the following dialog box.

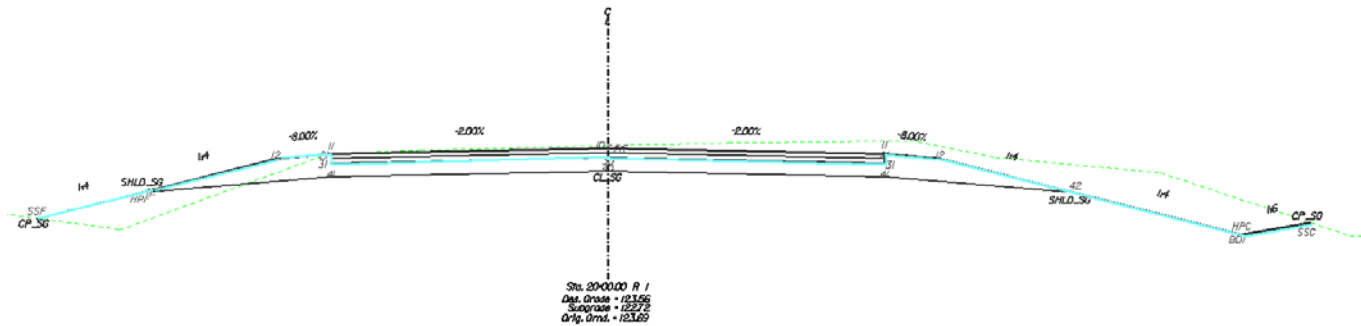


- Toggle the type of report to be generated, (located at the left of the directory path) to **Blue**.
- **Key in the** Job number **and** Chain.
- **If you want notes for the entire chain, highlight the Beg Sta. Field and press delete. The application will automatically set this field to the beginning station of the chain. Repeat this for the End Sta. Field. You may also simply key in a desired station range.**

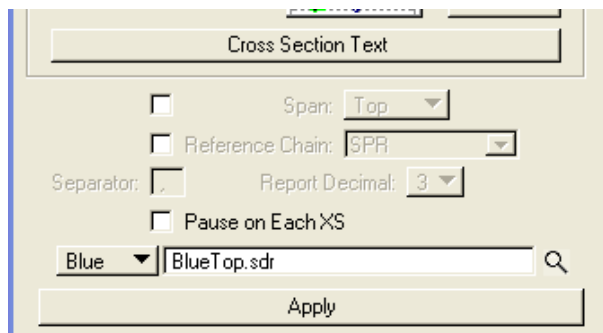
- To set the symbology values for the **Existing Ground Line** and **Proposed Finish Grade**, pick the symbology button  to get the following dialog boxes:



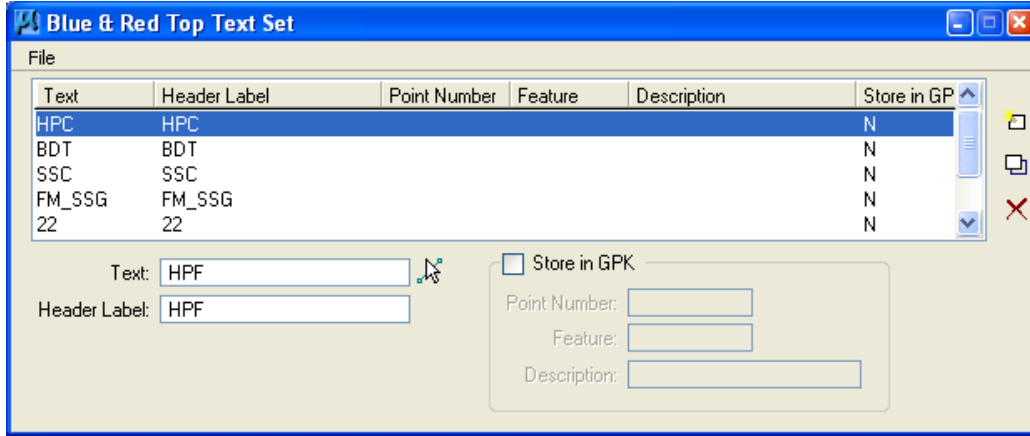
- The values defined in the Existing Ground Line and Proposed Finish Grade sections will allow GEOPAK to progress through the top of base course. You may need to include the top of pavement symbology if the foreslope has the same symbology along the base course as the pavement section. The values shown in the Existing Ground Line and Proposed Finish Grade sections will allow GEOPAK to progress through the top of base course (Aggregate Course) as shown below. This is the path needed to get the correct report.



- Keep the Span and Reference button toggle off as shown below.



- Select the **Text** button to bring up the **Blue and Red Top Text Set** dialog box as shown below:



- Review the cross section to select text at the points that you want reported. For X_30 FHWA criteria, the text placed on your cross sections on a level named **X_Text_Search**. Review your cross sections and key in the text to search for and its description. Press **Add** or **Delete** after each entry. To **Modify** an entry, simply highlight the entry, adjust the values in the white fields and click **Modify**. When finished ... these entry's can be saved for recalling later, by clicking on the **File** pulldown. Select the path and filename to save this information. The text set for your project can be saved as a *.lis file.



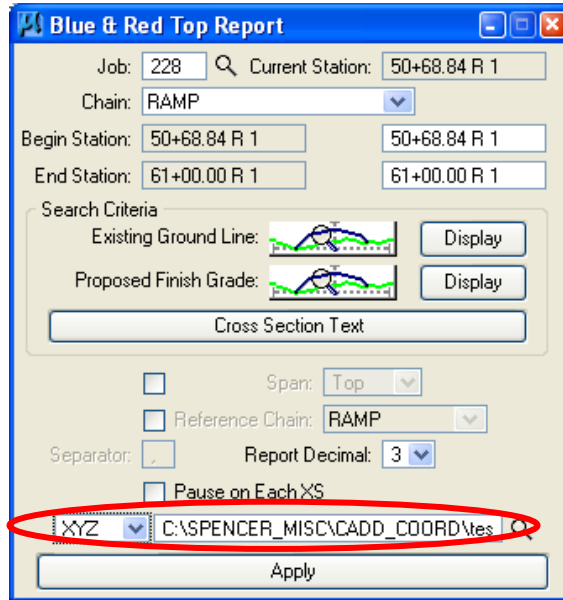
Note - The EFLHD_Default.lis file is located at "M:\Engineering_Software\Cadd_resource_v8i\Standard_Shts\SG_Template\" directory for your project. Open this file through File > Open in Blue & Red Top Text Set dialog and modify according to your project information.

- Prior to running the Blue Top Report, make sure the Blue button is shown in the Blue & Red Top Report dialog box. Select **Apply** to process the report. Report is shown below for one cross section.

BLUE TOPS REPORT(Ft)

STATION	SSF	HPF	SHLD_AB	Travelway	Travelway	CL_AB	Travelway	Travelway	SHLD_AB	HPC
20+00.00R1[Ramp]	121.03	121.97	123.20	123.02	123.36	123.22	123.36	123.02	123.20	120.47
	-20.65	-16.90	-12.00	-10.00	-10.00	0.00	10.00	10.00	12.00	22.90
	-0.94	-0.250	0.087	0.000	0.013	0.013	0.000	0.087	-0.250	0.167

- The XYZ Blue Top Report is the same as the Blue Top Report, just change the button that says **Blue** to **XYZ** as shown below. Provide a new name for the report and select Apply.



XYZ Blue Top Report

Station	X	Y	Z	Offset	ID	SLOPE
20+00.00R1[Ramp]	1354097.900	498405.523	121.970	-16.902	HPF	-0.250
	1354101.676	498402.396	123.195	-12.000	SHLD_AB	0.087
	1354103.216	498401.120	123.022	-10.000	Travelway	0.000
	1354103.216	498401.120	123.355	-10.000	Travelway	0.013
	1354110.917	498394.742	123.222	0.000	CL_AB	0.013
	1354118.619	498388.363	123.355	10.000	Travelway	0.000
	1354118.619	498388.363	123.022	10.000	Travelway	0.087
	1354120.159	498387.088	123.195	12.000	SHLD_AB	-0.250
	1354128.556	498380.134	120.470	22.902	HPC	0.167
	1354130.474	498378.545	120.885	25.392	SSC	