EFLHD
Highway Design
CADD Procedures Guide
(CPG)

2011

EFLHD

Highway Design

CADD Procedures Guide

(CPG)

2011

Highway Design
Eastern Federal Land Highway Division
21400 Ridgetop Circle
Sterling, VA 20166

Table of Contents

SECTION 6: GEOPAK- EFLHD Procedures

APPENDIXES

REFERENCES

Bentley Systems, Incorporated.
Central Federal Lands Highway Division
Western Federal Lands Highway Division
EFLHD CADD Manual
MicroStation V8 Training Manual By Peter A. Man
FHWA Project Development and Design Manual (PDDM)
UGS Community (Connect Press)
The Complete Knuckleheads

SECTION 1: Introduction

The Eastern Federal Lands Highway Division (EFLHD) has established CADD standards and procedures for the automation of the development of plans, specifications and estimates (PS&E) Packages.

The primary functions of the EFLHD Highway Design CADD Procedures Guide (CPG) are to:

i)   Provide guidance on CADD methods and policies which are as current as practical.
ii) Assure uniformity of practice for projects designed by or for EFLHD.

This guide does not eliminate the need for other references or training. Portions of the material in this guide may be specifically superseded by subsequent Official Issuances of the EFLHD or FLH (e.g., CADD Manual, PDDM).

Variations from this guide will be necessary for special or unusual conditions, or between the issuances of new or revised source documents and any corresponding updates of the CPG. Consequently, instructions in this document are not intended to preclude the exercise of individual initiative and judgment in reaction to project specific conditions or application of current state of the art practices. Rather, such initiative and judgment is encouraged when it is appropriate and there is a rational basis for deviation. However, it is equally important that there be consistency in the application of this manual. The objective is uniformity of process and presentation.

1.1- Software Package & Trademarks

The EFLHD has adopted **MicroStation** as its standard graphics package. MicroStation is a drafting package developed, marketed and sold by **Bentley Systems Inc**. The EFLHD has also adopted **GEOPAK**, by **Bentley Systems Inc**. as its standard road design system with modifications to meet EFLHD standards. Other trade names computer protocols, and file formats mentioned in this manual are the trademarks of their respective owners. In no event will the appearance of any graphic, description of any graphic, picture, screen display, or any other method of conveying meaning be considered to impair the rights of the respective owners.

The system operates on a Personal Computer (PC) running NT/2000/ Window XP operating system.

Standard File types and extension: There are many types of CADD files in use at EFLHD as shown below.

Extension	Description	Standard CADD Directory/Working Directory
. DGN	MicroStation graphics design file	M:\Projects\.......\..\.......\proj_dev\CADD
. DGNLIB	MicroStation V8 library containing level	M:\Engineering_Software\Cadd_resource_v8\X_30\Standards\Library_Files
. DDB	GEOPAK D&C Manager database file	M:\Engineering_Software\Cadd_resource_v8\X_30\Standards\DDBS
. RSC	MicroStation resource file	M:\Engineering_Software\Cadd_resource_v8\X_30\Standards\Resources
. CEL	MicroStation V8 cell file	M:\Engineering_Software\Cadd_resource_v8\X_30\Standards\Cell_Lib
. X30	GEOPAK criteria(X30) files	M:\Engineering_Software\Cadd_resource_v8\X_30\Typicals
. TIN	GEOPAK digital terrain model	M:\Projects\.......\..\.......\ techserv\survey\FinalMapping
. PSL	GEOPAK plan & profile cut sheet criteria	M:\Engineering_Software\Cadd_resource_v8\Plan&Profile_Shts
. XSSL	GEOPAK cross section cut sheet criteria	M:\Engineering_Software\Cadd_resource_v8\Cross-Sec_Shts
. GPK	GEOPAK COGO file	M:\Projects\.......\..\.......\proj_dev\CADD

1.2- Installation and Configuration

1.2.1-General

This section outlines the setup for a typical installation of MicroStation at EFLHD.

1.2.2- Installation

MicroStation v8 is installed in c:\BentleyV8\ for a typical EFLHD setup.
GEOPAK v8 is installed in c:\Geopak88\ for a typical EFLHD setup.

1.2.3- Configuration Variables and Files

The configuration and associated files for MicroStation and GEOPAK that are used for plan development at EFLHD are typically stored in a directory tree "**M:\Engineering_Software_v8**".

EFLHD_Eng_30.pcf is the Project Configuration File containing the MicroStation and GEOPAK Configuration Variables settings necessary for a EFLHD Roadway project. All of the MicroStation and GEOPAK configuration variables referenced throughout this document are set in this file.

Unit definition is also set **ft, Ft,** and '**as** Survey foot for MicroStation V8/XM through this configuration file.

1.3- Revisions and Updates

CADD Coordinator (Spencer Beale), with input from CADD Manager (Richard McDaniel), IT section and CADD users, will develop and maintain standards and procedures for the EFLHD CADD related activities.

This guide will be revised by the CADD Coordinator as needed to insure that it is up to date with EFLHD standards.

If you have suggestions, which we strongly encourage, please submit them to the CADD Coordinator Highway Design Section.

1.4- The Appendixes

The appendixes at the back of this manual include A&E CADD setup procedures.

SECTION 2- Project Administration

2.1- Project Directory

The sharing of information is a vital part of the success of a EFLHD project. Thus, when a new project begins, a centralized directory structure is needed. Since it is important that data is shared but not corrupted by unauthorized users, the Division has established a standard procedure for directory creation and file naming.

Generally new project directories are requested by the Planning & Programming Branch in conjunction with the request to add the project into the Project Management System (PrMS). If an additional directory is needed, or if the original request has not been made or fulfilled in a timely fashion, Users should contact the PrMS Specialist (Bradley Bookwalter) or the CADD Coordinator (Spencer Beale) by email to make the request. The email request should include the project number, name of the Agency, and the State of the project. The Coordinator will setup the standard root directories on the central CADD server.
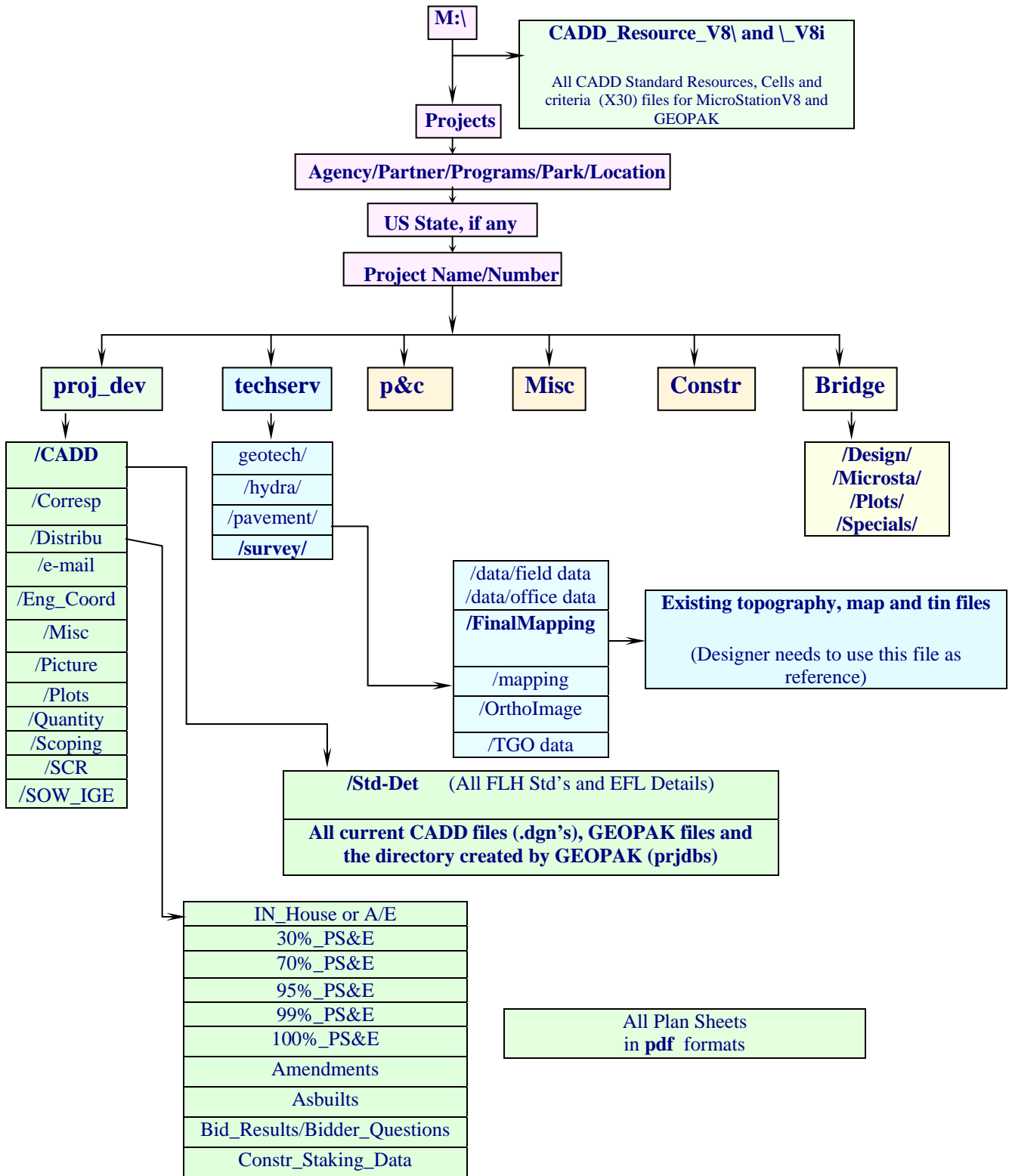
Each directory has the appropriate security access set by section. Thus, Highway Design staff is only allowed write access to the "**proj_dev"** subdirectory. Other directories will be "read only" for Highway Design staff. The Highway Design **CADD Directory Structure** is shown in "**Green**". See directory structure **Section 2.1.1**.

IT Services has optimized levels of security so that project related folders, up to and including the "**proj_dev**" root directories, cannot be deleted or edited. However, any folder can be created by an individual user, past that level. Obviously, users need to follow certain naming conventions of folders in order to effectively communicate with others.

If preferred, after each milestone distribution, create a new subdirectory with the equivalent name (30%, 70%, etc…) under the CADD folder. Create a copy of all files and place them into this new directory as an electronic record. **Current CADD files will always stay in CADD sub-directory of the project directory.** (It is recommended that you manage the old files as design progresses, ex; delete 30% milestone dgn files after 95% PS&E is distributed. Delete 70% dgn files after 100% is distributed . . .)

2.1.1- Directory Structure

The directory structure for all workstations and Personal Computers has been established as shown below.

```
M:\
 │
 ├──────────────────────────────→  CADD_Resource_V8\ and \_V8i
 │                                  All CADD Standard Resources, Cells and
 │                                  criteria (X30) files for MicroStationV8 and
 Projects                           GEOPAK
 │
 Agency/Partner/Programs/Park/Location
 │
 US State, if any
 │
 Project Name/Number
 │
 ├──────────┬──────────┬──────────┬──────────┬──────────┐
proj_dev   techserv    p&c        Misc       Constr     Bridge
```

proj_dev

/CADD
/Corresp
/Distribu
/e-mail
/Eng_Coord
/Misc
/Picture
/Plots
/Quantity
/Scoping
/SCR
/SOW_IGE

techserv

geotech/
/hydra/
/pavement/
/survey/

Bridge

/Design/ /Microsta/ /Plots/ /Specials/

/data/field data /data/office data
/FinalMapping
/mapping
/OrthoImage
/TGO data

Existing topography, map and tin files

(Designer needs to use this file as reference)

/Std-Det   (All FLH Std's and EFL Details)

All current CADD files (.dgn's), GEOPAK files and the directory created by GEOPAK (prjdbs)

IN_House or A/E
30%_PS&E
70%_PS&E
95%_PS&E
99%_PS&E
100%_PS&E
Amendments
Asbuilts
Bid_Results/Bidder_Questions
Constr_Staking_Data

All Plan Sheets in **pdf** formats

2.2- File Naming Conventions and Plan Sheet Organization

There are many types of files in use at EFLHD as discussed in Section-1. Of utmost importance is the naming convention of the MicroStation design files produced throughout a project. The file naming convention is set up to allow anyone to identify the contents of a CADD file without actually opening the file. The following design File Naming Convention is to be implemented on all new projects. This convention is to be used by all EFLHD users and A&E consultants.

Also, shown at the end of this section, is the order of plan sheets for a typical EFLHD project. It is hard to imagine every type of file that may be created in a special case. If a file is not shown, best judgment must be exercised to place the file in an appropriate place within the plan set.

2.2.1- Highway Design- CADD File Naming Conventions

There are two types of design files that are produced in the process of generating construction plan sheets; sheet design files and master design files. Sheet design files represent the finished construction documents for a project, and the master design files will be used as a reference to the sheet design files. Following are examples of two types of files used in developing a set of construction plans.
Sheet Design Files: Title Sheets, Typical section sheets, Plan & profile sheets, Cross section sheets, etc.
Master Design Files: Survey files (contain topography, utility), Master GEOPAK design files (contains proposed alignment, shape, etc.), Sheet border file (contain sheet border, project #, etc.), Hydraulic files (contains all proposed drainage and erosion control items), etc.

Assigning file names to CADD design files is to be done with consistency to make future searches for the files and plan organization a simpler task.

All EFLHD MicroStation design files should be named with the following formats.

XXX-YYYYYYYY_ZZZ.dgn

File type descriptor (See **2.2.1.4**)

Project number descriptor (See **2.2.1.3**)

Section number descriptor (See **2.2.1.1**) - Master Design Files
Sheet number descriptor (See **2.2.1.2**) - Sheet Design File
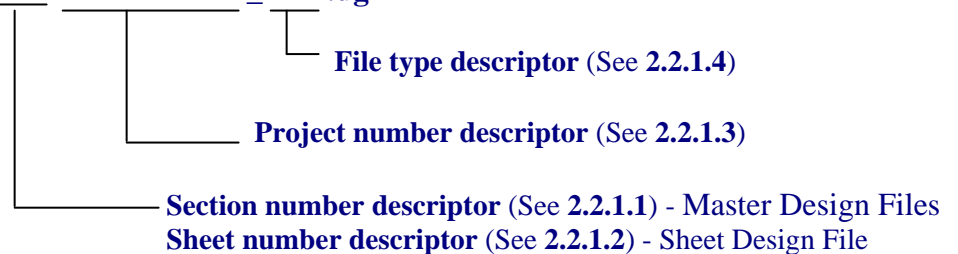
2.2.1.1- For all Master Design Files:

Section Number Descriptor	Departments or Sections
01	Highway design
02	Survey
03	Hydraulics
04	Safety/Environmental
05	Geotechnical
06	Traffic/Pavement
07	Bridge
08	Construction
09	A&E (Consultant)

2.2.1.2- Plan Sheet Organization:

Sheet Number Descriptor	Description
A	Title Sheet, Conventional Plan Symbols and Abbreviations, Location plan, Survey and horizontal alignment information plan
B	Typical Sections
C	Tabulation of quantities and Summaries & Schedules
D	Mainline Plan and Profile Sheets
E-H	Minor Roadways Plan and Profile Sheets and others.
K	Pipe Profiles or Drainage Cross Sections
M	Erosion Control Plan & Narrative, Landscape Plan (last)
N	Temporary Traffic Control Plans
P	Permanent Signing & Striping Plans
R	Bridge Plans
S	Standard Details Sheets and Special Details (Only for Highway design)
T	Mainline Cross Section Sheets
U-Z	Minor Roadways and others Cross Section Sheets

Note:- I, L, O, and Q letter designations are not to be used so as not to cause confusion between these letters and the numbers 0 and 1.

2.2.1.3- Project Number Organization:

	Forest Highway	Park Road	Refuge Road	Other
Project Name	AR PFH 65-3(5)	PRA RICH 300(1),305(1)	RRP-LOP 10(2)	MT OMAD 18(33)
State/Park/Program	Arkansas	Richmond National Park	Lake Ophelia national Wildlife Refuge	Missile Road
Highway Route	65	300, 305	N/A	18
Segment of Route	3	N/A	N/A	N/A
Project Number	5	1	2	33
Project Number Descriptor	**AR653(5)**	**RICH300(1)**	**LOP10(2)**	**OMAD18(33)**

2.2.1.4- Roadway Design File Type Descriptor: File types refer to the designated use.

File Type	File Type descriptor
Sheet Design Files	
Title Sheet	ttl
Symbols and Abbreviations	sym
Vicinity Maps/Location Sheet	loc
Survey & Horizontal Alignment Inf.	sur
Typical Sections	typ
Summary of quantities/Tabulation	qnt
Plans and profiles	Pln(for plan), prf(for profile), p&p(for plan & profile)
Storm drainage plan	dpl
Storm drainage profile	dpr
Box Culvert Plan & Profile	bpp
Drainage cross section	dxs
Utility Plans and profiles	upp
Erosion Control Plan/narrative	e&s
Landscaping Plan	lnd
Temp Traffic control plan	tcp
Permanent Signing & Striping plan	ssp
Bridge Plan	brp
Roadway Cross sections sheets	xss
Master Design Files	
Project Border File	bdr
Master file for design and Alignment	des
Master file for Profile	pro
Super elevations, pattern for x-sections	wrk
GEOPAK Lines not for plan sheets	lin
Area Pattern for new pavement etc.	pat
Master Cross section (mainline)	Dxs
Minor Roadways cross section& others	Exs, Fxs, Gxs, Hxs, etc.
Hydraulic, drainage, sediment & erosion	hyd

Note: The 3-digit file descriptor is given for most of the sheets in a typical plan set and master design files. As it is hard to foresee every type of file that may be included in a plan set, a special case may arise where there is no file descriptor for a file that has been created. In such a case, follow the rest of the naming convention as closely as possible, while generating a unique file descriptor for the new file.

2.2.2- File Naming Conventions of Standards and special Details

- All FLH standards should be downloaded from WFLHD and not renamed.

- All EFLHD Details are copied from EFLHD's Standard directory and also not renamed.

- Standards, Details, and Special Details will be kept in Std-Det directory on the project directory.

Note: *1.A special Detail is a modified standard, detail, or project specific detail and should end with a letter .*
2. The Standard Sheet number should have S prefix on it as shown in Section 2.2.1.2.
3. The sheet numbers of the specials and details are determined after all the standards, details, and special details are assembled.

2.2.3- File Naming Conventions of EFLHD GEOPAK Job number " .gpk" files:

Job###.gpk

This binary file is created when the user starts a coordinate geometry (COGO) session for the first time or is created through the Project Manager. All coordinate geometry elements are stored in this file. Multiple users can access this file at the same time, and only one file should be created for each project. The "###" is the only variable in this filename. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.
When working on EFLHD projects, the .gpk number will be assigned by the Highway Design Manager. The convention will be a standard numeric system, starting at 600 for year 2006 and 700 for year 2007 and so on. The first .gpk file assigned in year 2006 would be job600.gpk, then job601.gpk, etc.
Internally, EFLHD personnel will request a .gpk number from the CADD Coordinator. The CADD Coordinator will then assign a number, from a file on the server, documenting the project information for the assigned number. This document will be the master list of all .gpk files assigned for all projects. The read-only file is located at;
M:\Engineering_Software\cadd_resource_v8\Master_GPK Numbers\MasterGPK-List.xls.

2.2.4- Example:

Suggested Naming Convention for Lake Ophelia National Wildlife Refuge, RRP LOP 10(2)

Sheet Series	Sheet No.	Description	Design File names	Remarks
A	A01	Title Sheet	A01-LOP10(2)_ttl	
	A02	Symbol & Abbreviation Sheets	A02-LOP10(2)_sym	
	A03	Location Map Sheet	A03-LOP10(2)_loc	
	A04	Survey Information Sheet	A04-LOP10(2)_sur	
B			B-LOP10(2)_typ	Typical Sections
	B01	Typical Section Sheet 1	Model name B01	
	B02	Typical Section Sheet 2	Model name B02	
C			C-LOP10(2)_qnt	Quantity Sheets
	C01	Tabulation Of Quantity Sheet	Models name C01	
	C02	Summaries & Schedules 1	Models name C02	
	C03	Summaries & Schedules 2	Models name C03	
	C04	Summaries & Schedules 3 etc.	Models name C04	
D			D-LOP10(2)_pnp	Plan & Profile sheet for Mainline Roadways
	D01	Plan & Profile Sheet 1 of Road 1	Models name D01	
	D02	Plan & Profile Sheet 2 of Road 1	Models name D02	
	D03	Plan & Profile Sheet 3 of Road 1	Models name D03	
	D04	Plan & Profile Sheet 4 of Road 1	Models name D04	
	D05	Plan & Profile Sheet 1 of Driveway	D05-LOP10(2)_p&p	Driveway, Parking lot, culvert, and utilities related to Mainline roadways
	D06	Plan & Profile Sheet 2 of Parking lot	D06-LOP10(2)_p&p	
	D07	Plan &Profile Sheet of Box Culvert	D07-LOP10(2)_p&p	
	D08	Plan & Profile for Utilities	D08-LOP10(2)_p&p	
E-H		Road 2, all minors roads, and other roadways		Follow same as D series Sheets
K	K01	Drainage Cross Sections Road 1	K01-LOP10(2)_dxs	
	K02	Drainage Cross Sections Road 2		
	K03	Drainage Cross Sections others		
M	M01	Erosion Control Narrative	M01-LOP10(2)_e&s	
	M02 to M03	Erosion Control Plan sheet Road 1	MA-LOP10(2)_e&s	Use models M02 & M03
	M04- to M05	Erosion Control Plan sheet Road 2	MB-LOP10(2)_e&s	Use models M04 & M05
N	N01 to N03	Temp. Traffic Control Plan Road 1	NA-LOP10(2)_tcp	Use models N01 N02, & N03
	N04 to N05	Temp. Traffic Control Plan Road 2	NB-LOP10(2)_tcp	Use models N04 & N05
	N6	Temp. Traffic Control Plan others	N06-LOP10(2)_tcp	
P		Permanent Signing & Striping Plan		Follow as N Series sheets
T	T01 to T30	Cross Section Mainline Road 1	T-LOP10(2)_xss	All cross section sheets of Road 1 will be in one design file
U	U01 to U10	Cross Section minors Road 2	U-LOP10(2)_xss	Same as in T Series

2.3- Plan Sheet Organization

Example of Index to Sheets for the above project:

Sheet No.	Description
A01	Title Sheet
A02	Symbol & Abbreviation Sheets
A03	Location Map Sheet
A04	Survey Information Sheet
B01 –B02	Typical Sections
C01	Tabulation Of Quantity
C02 –C04	Summaries & Schedules
D01-D08	Plan & Profile Sheet of Mainline Road, Driveway, Parking Lots.
E01-E06	Plan & Profile Sheets of minor road 2, Driveway, Parking Lot
K01-K03	Drainage Cross Sections
M01- M05	Erosion Control Plan and Narrative
N01-N06	Temp. Traffic Control Plan
R01-R09	Bridge Plans
S01-S19	Standard Details Sheets
T01 to T30	Cross Section Mainline Road 1
U01 to U10	Cross Section minors Road 2

SECTION 3: MicroStation(V8) Basics

3.1- MicroStation Design File Settings

3.1.1- Setting Button Assignments:

By default, the mouse buttons are assigned as shown below.
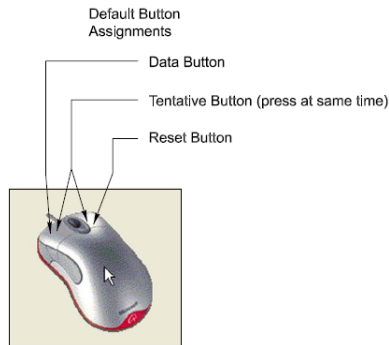
Each of the buttons can be set to something different. For instance, if you wanted to assign your mouse button as shown below follow the instruction ahead.
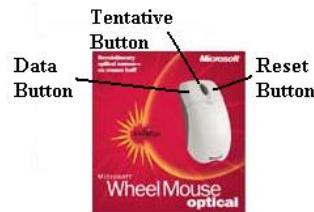
To set up the mouse buttons, go to **Workspace->Button Assignments…..**
In the Button Assignments dialog box under Buttons, choose **Data**. If the assignment under Invoked by is anything other than Left Button then move the mouse into the Button Definition Area and press the **Left** mouse button.   In the Button Assignments dialog box under Buttons, choose **Tentative**.   If the assignment under Invoked by is anything other than Middle Button then move the mouse into the Button Definition Area and press the **Middle** mouse button (the wheel).   In the Button Assignments dialog box under Buttons, choose **Reset**.   If the assignment under Invoked by is anything other than Right Button then move the mouse into the Button Definition Area and press the **Right** mouse button. Finally, press the **OK** button.
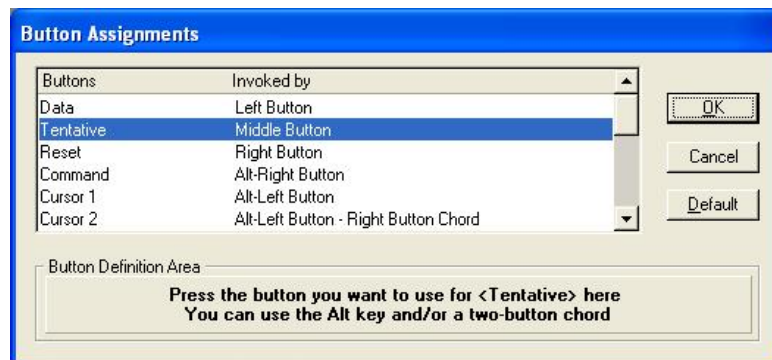
3.1.2- Compress Design File:

From the MicroStation dialog box, choose **File -> Compress -> Design**. This physically removes all logically deleted elements.

3.1.3- Save Settings:

From the MicroStation dialog box, choose **File -> Save Settings**. This save all the design file settings so that when the file is open the next time, all the settings will be restored.

3.2- Level Assignments

3.2.1- Introduction

To maintain uniformity among different drawing files, it is essential that an organized leveling system be used. MicroStation V8 allows levels to be saved on a name basis instead of previous number based system. A design file may contain an unlimited number of levels in which data may be displayed. There are two primary ways in which to assign symbology to each element: first, the color, weight, and line style of the graphic elements are set independently. Second, a new addition introduced in MicroStation V8, is **ByLevel** symbology. With ByLevel symbology each level may have a pre-assigned color, line style, and weight. By selecting the desired level, these attributes are automatically set.

- In MicroStation 2004, levels and the associated ByLevel symbology are stored in a DGN library, and may be attached to any MicroStation file. In order to maintain the X30 criteria and future versions of Geopak criteria files, *FLH_Combined.dgnllib* are controlled FLH wide. EFLHD designers and consultants will not be able to add new levels to the *FLH_Combined.dgnllib* file.

- For EFLHD employees, the standard DGN Library will be automatically attached while opening a design file using the Project Configuration (**EFLHD_Eng_30**).

    Note:- In EFLHD, most elements should be placed with the GEOPAK D&C manager, the .ddb file. This is the best way to insure that elements are placed with the proper symbology, for final output and for use at later stages for GEOPAK criteria files and for computing quantities. See Section 7.3.

- All levels are named and have a default color, line weight, and style.

- Level definitions are stored and managed by "**FLH_Combined.dgnlib**"

- Levels have ByLevel Symbology and Override Symbology settings.

- Users shall not create their own levels for use in any design files submitted or exchange with EFLHD. (*See list of FLH levels in EFLHD CADD Manual*)

- Levels can be managed by Level Manager and Level Display icons as shown below. Go to **Setting>Level>Manager**
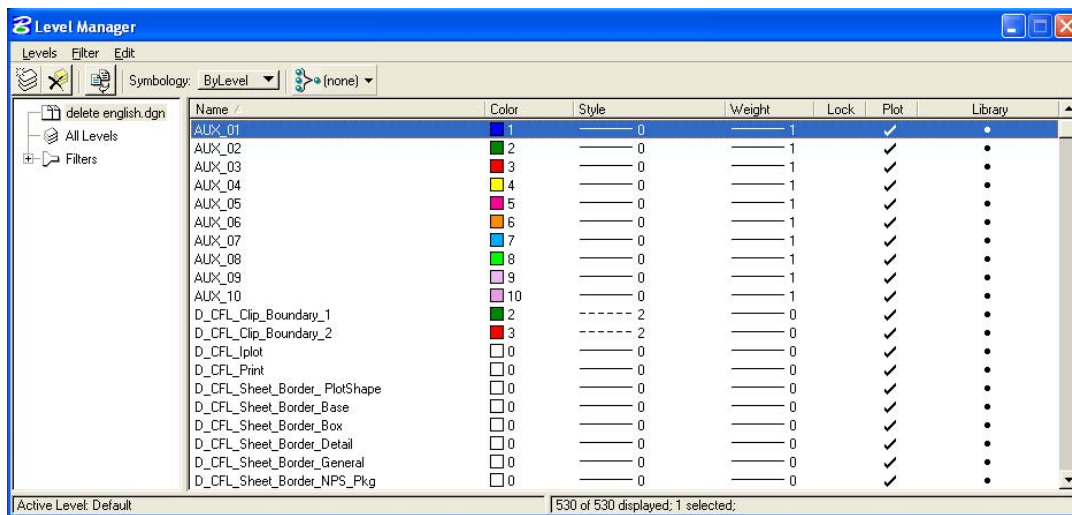
3.3- References

3.3.1- Introduction

External design files can be attached to the current file as a reference. Attached references maintain a dynamic link with the current file, allowing changes in the attached references to be reflected in the current file. Elements in the attached file display as though they are part of the current file. References, however, are a one-way reference in that you cannot edit attached files while you are working in your current design.

A reference file must be a design (dgn) file or DWG (AutoCAD) file that is attached to the design file in which you are currently working. User can also attach the current file to itself. Drawing files in other format e.g. tiff file, pdf file etc can be attached to your design file through Raster Manager.

A design file or dwg(Autocad) file can be attached to the design file through the Reference Manager as shown below.

- Access Reference Manager through **File>Reference**
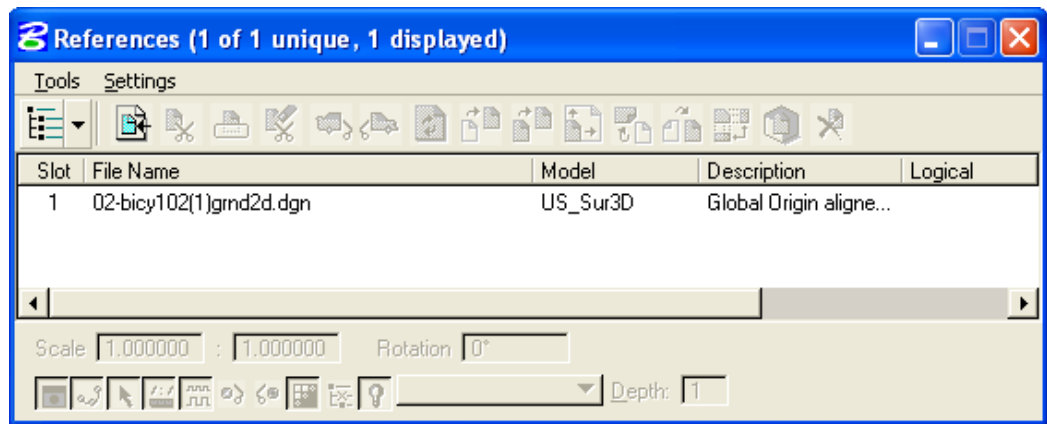
- Once selected **Tools>Attach** to attach design file will activate **Attach Reference** dialog as shown below.
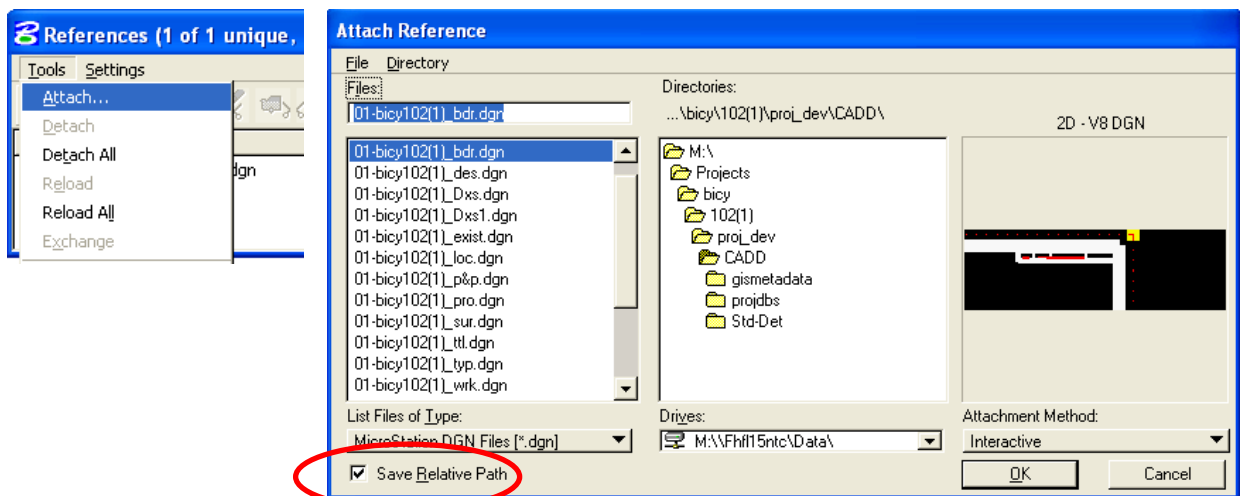
- Enable the check box of Save Relative Path as shown above (recommended to all users).

1. Active directory 2. Relative path directory 3. MS_RFDIR directory 4. full path directory

- Select the design file to be referenced from the Attach Reference dialog and click OK.
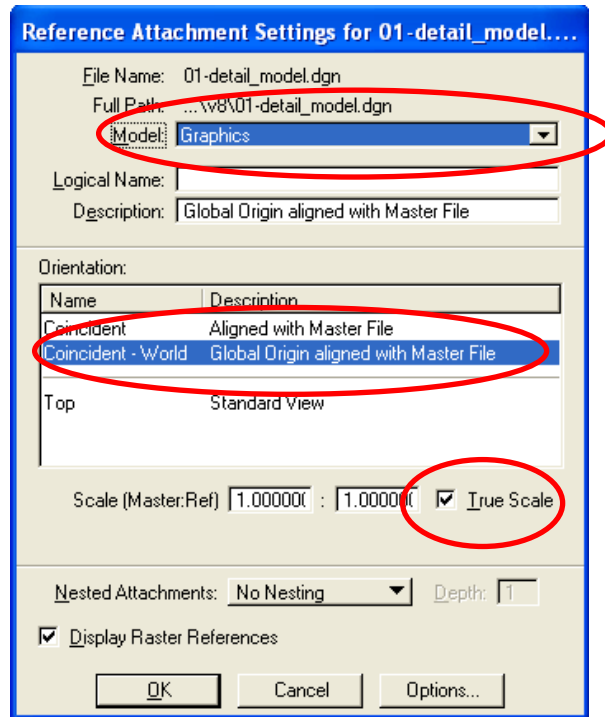
- Select the **Model** you want to reference.
- ALWAYS select **Coincident – World**.
- Select check box for **True Scale**
- Click **OK** to attach the selected model of the design file, the Reference Manager dialog will look as shown below.
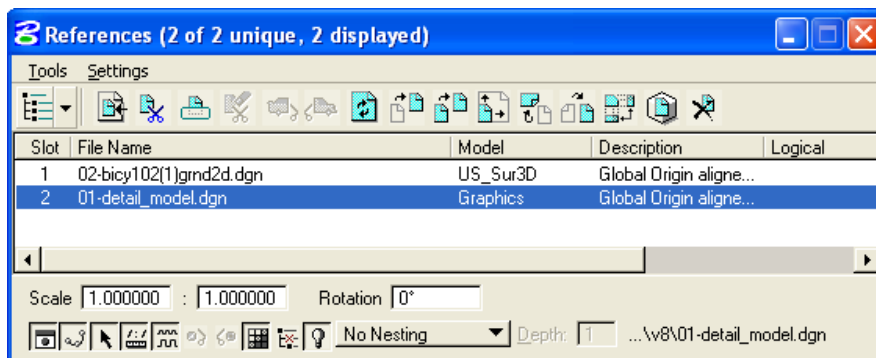
*Note:- **Coincidnte-World** setting adjusts reference files with different Global Origins and is the only attachment method to preserves coordinate system values.*

***True Scale** setting adjusts reference files with different Units of Resolution.*

3.4- Models

3.4.1- Introduction

Bentley has introduced the concept of models with MicroStation V8. Whereas a V7 design file used to be one single design space, a V8 design file is a container of models, each of which behaves much like a separate design file. MicroStation V8 design files can contain more than one "model" -- each model is analogous to an entire V7 design file. In MicroStation V8, models introduce an entirely new approach. When you set up a new DGN file in MicroStation V8, you create at least one model within your new DGN, whether you know it or not. You can create an unlimited number of models in a DGN file. Every model has its own set of eight views.

Design models can be either 2D or 3D. A design model can also be used as a reference or placed as a cell. There are two types of models: design or sheet. By default, the view windows of design models have black backgrounds and those of sheet models have white backgrounds (**EFLHD Highway Section** prefer **Design** model rather than **Sheet** model except quantity sheets).

*Note:- In EFLHD configuration set up, **model** is set to be created ALWAYS 2D for 2D dgn file and 3D for 3D design files(Using default seed file "Sur_ft2D" for 2D dgn files and Sur_ft3D for 3D dgn files)*

.

3.4.2- Models dialog box

MicroStation V8 offers a simple dialog box to manage models. The Models dialog box can be accessed through **File > Models** or by clicking on the Models icon.
The Models dialog box is explained in the graphic below:
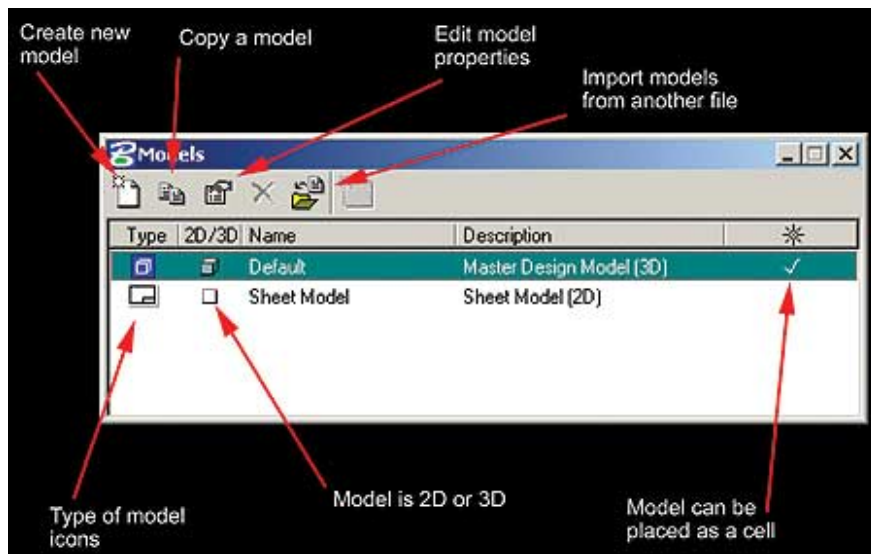
3.4.3- Tips on Models

- To switch between the models, you simply double-click on the model name in the Models dialog box or select a view group associated with the desired model.

- Each model has its own reference attachments. When you attach a reference, one of the new parameters you set is the model to access as part of the reference definition.
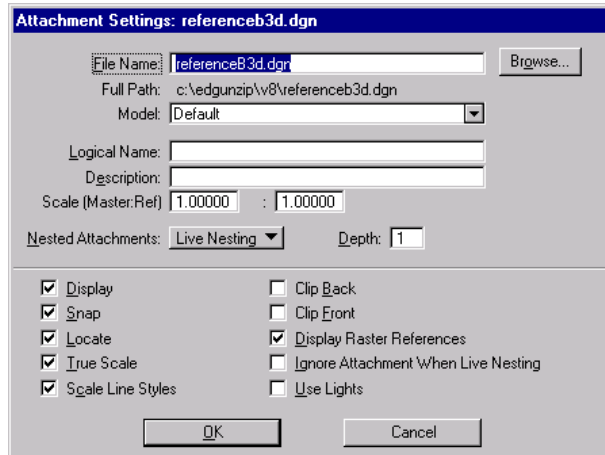
- You can also drag and drop DGN or DWG files from Windows Explorer into the Models dialog box to import the models from the selected files. Similarly you can use drag and drop to drag models from the Models dialog in another open session of MicroStation V8 to the Models list box and drop them in to import the models.

3.4.4- EFLHD Preferences regarding Models

EFLHD prefer to use Models on the following sheets of PS&E Plan set.
- **Typical Sections** (If you have more than one sheet of Typical Sections, use model).
- **Quantity Sheets** (Use EFLHD Quantity sheet with Excel file).
- **Plan sheet, Plan & Profile Sheet, E&S sheets, Stripping Plan sheets** etc., see Plan &Profile Sheet clipping.

3.5- <u>Plotting</u>

3.5.1- Introduction

MicroStation has a built-in printing process. Printing is available by using the MicroStation pulldowns **File>Print**. The **Print** dialog is shown below.
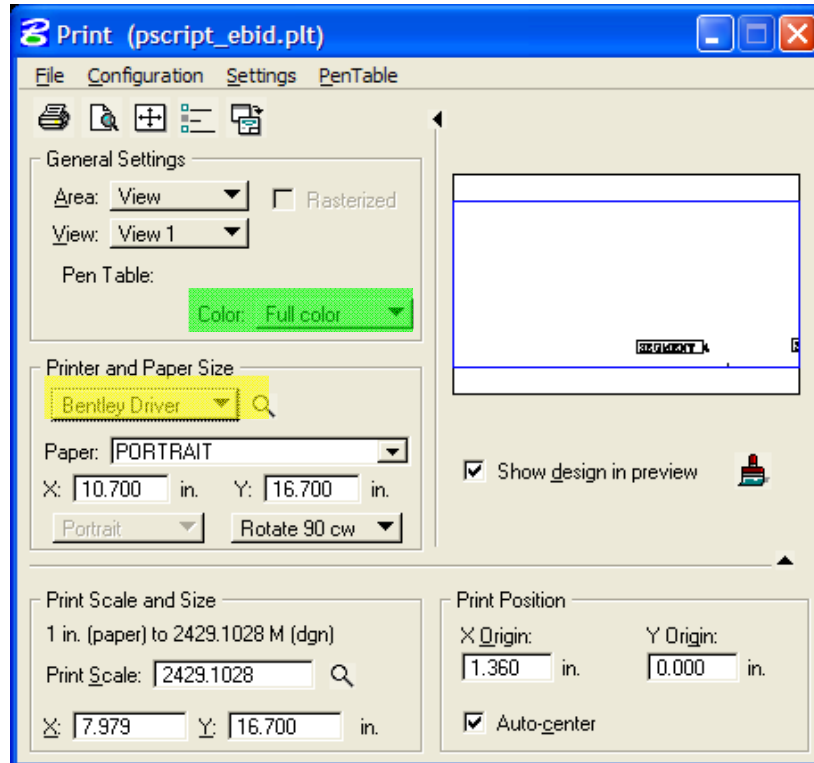
One of the common ways to ensure that a plot will be printed to scale and right format is to:

- Place a fence at the corners of the border of your design file.
- Select the magnifier at **Printer and paper size** on the **Print** dialog box as shown in **yellow** for the list of print drivers. Select the right print driver (EFLHD print driver) as explained in **Section 3.5.2,** next page.
- Select **Color** icon on the **Print** dialog as shown in Green and select either Gray scale (for Cross section and Plan &Profile sheets), full color for colorful sheets or Monochrome for all black sheets for LPT (Bentley) Drivers. For Window drivers, Color icon is set automatic, doesn't need to select.

3.5.2- EFLHD Internal Plotting

At EFLHD there are several plot drivers for both 11x17 and 8 ½ x 11 and for color, and black & white. Listed below are the location and purposes of the plot drivers (**.plt**).

To Print Sheet:

11"x17" / 8½" x11" - BENTLEY driver for black-and-white (b&w) sheets (Metric and English)

Plot driver location: M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\plt_lpt2\e_lpt2.plt

Example: Use this driver for all plan sheets except p&p Sheets and Cross Section Sheets.

11"x17" / 8½" x11" - BENTLEY driver for shaded b&w sheets (Metric and English)

Plot driver location: M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\plt_lpt2\e_lpt2s.plt

Example: Use this driver for P&P Sheets and Cross Section Sheets.

11"x17" / 8½" x11" - WINDOW driver for color, shaded and b&w (Metric and English)

Plot driver location: M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\Window\

HP5500_331-Cave_HD.plt	**-**For printer Room No 331, Highway_Cave.
HP5550_100-Proc_Admin.plt	**-**For printer Room No 100, Admin.
HP5550_140-survey_TS.plt	**-**For printer Room No 140, Survey.
HP5550_320_HD.plt	-For printer Room No 320, Highway Design.
HP5550_340-Bridge2.plt	-For printer Room No 340, Bridge.
HP5550_350-TS.plt	-For printer Room No 350, Technical.
HP5550_220-HD.plt	-For printer Room No 220, Highway Design.

To Create a PDF File:

For 11"x17" / 8½" x11" Black-and-White Sheets (Metric and English)

Plot driver location: M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\PDF\eflhd_bw-pdf.plt

Example: Use this driver for all plan sheets except P&P Sheets and Cross Section Sheets.

For 11"x17" / 8½" x11" Shaded Black-and-White Sheets (Metric and English)

Plot driver location:
M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\PDF\eflhd_shade&color-pdf.plt
M:\Engineering_Software\Cadd_resource_v8\Plotting\Plot_Driver\PDF\pdf_EFLHD_v8.plt (Latest)

Example: Use these driver for p&p Sheets, Cross Section Sheets, and all other sheets.

Pen tables: The appropriate pen table is automatically attached when the user selects the plot driver file.

3.5.3- <u>Batch Printing</u>

Batch printing will allow users to plot files without having to open the file and place a fence around the data to get a plot. Batch printing is a MicroStation utility used to print and re-print sets of drawings. Job sets are created containing the desired drawing files and a set of print specifications are created for each job set. The print specifications are defined containing information such as printer, print area, layout, and display. This chapter will detail each of the necessary settings associated with Batch Printing.

- Select **File>Batch Print** from the main MicroStation pull-down menus as shown below.
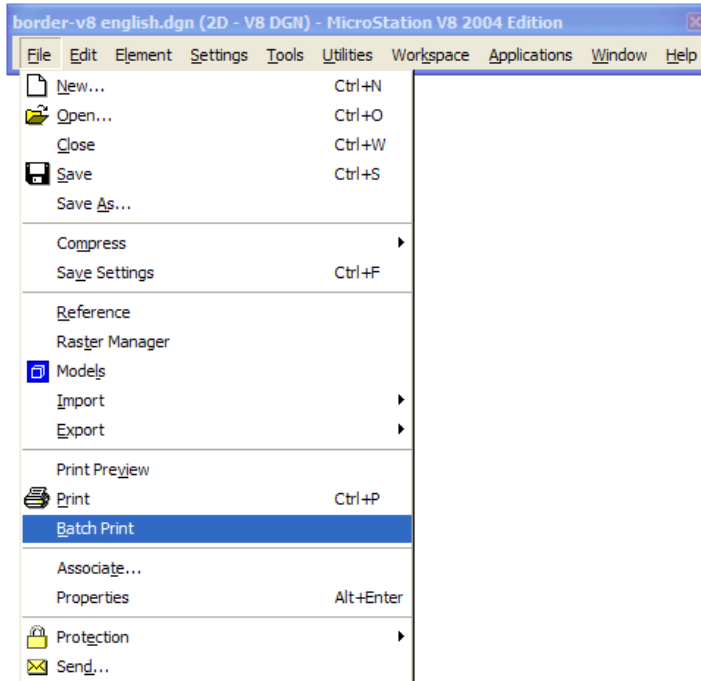
- Once selected the **Batch Print** dialog box is activated. The top bar on this dialog will show the current Job Set. Shown below as [Untitled]. Once a new Job Set is created or an existing Job Set is opened the name will replace [untitled].
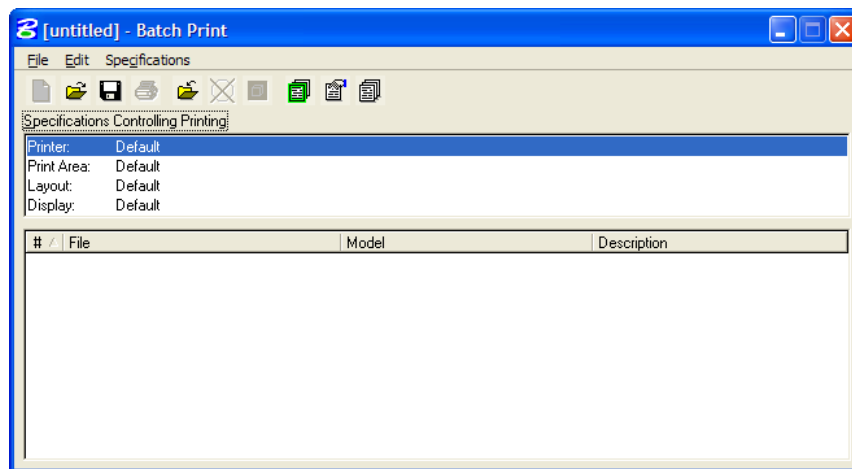
- To open an existing job set select **File>Open** and select the desired job.

    Job Sets are lists of files to be printed, along with the associated print specifications used to print the files such as which printer, what area to print, what scale, which pen table, etc. Each job set created will have the extension, .job.

Step I

- Creating a New Job Set- The user must first select the design files to be added to the Job Set.

  Select **Edit>Add** Files…
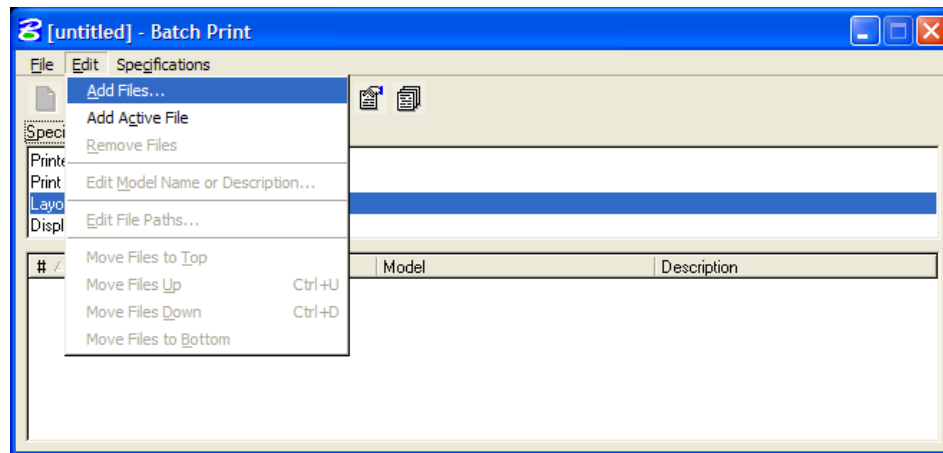
- The user may also alternatively select the Add Design Files icon, as shown below.
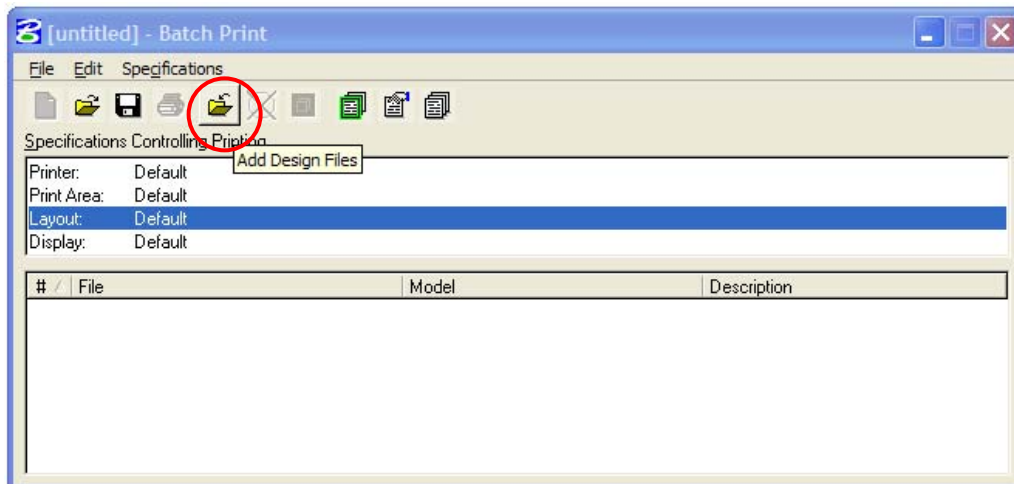
- Once selected the Select Design Files to Add dialog box will activate as shown below.
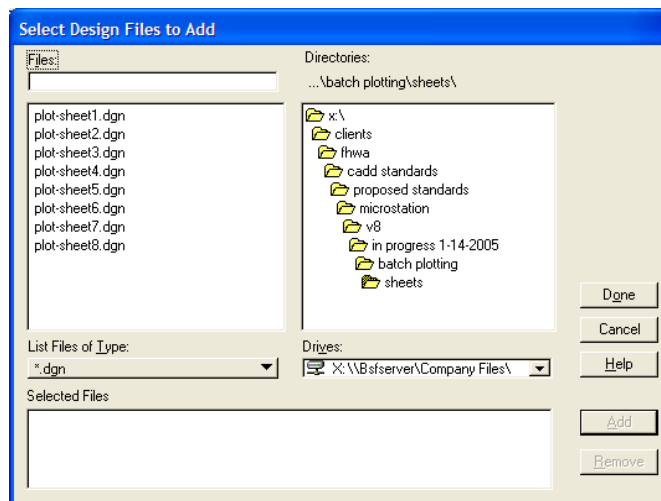
- Select the desired directory from the upper right Directories box. Once you have navigated to the correct directory, select the desired files from the upper left Files box. You may select multiple files by using the control or shift keys while selecting.

- After selecting the desired files, the Add button will be active. Select the Add button and the selected files will be populated in the selected files box at the bottom of the above dialog box.

- Once complete, select the done button. The Batch Print dialog box will display as shown below.
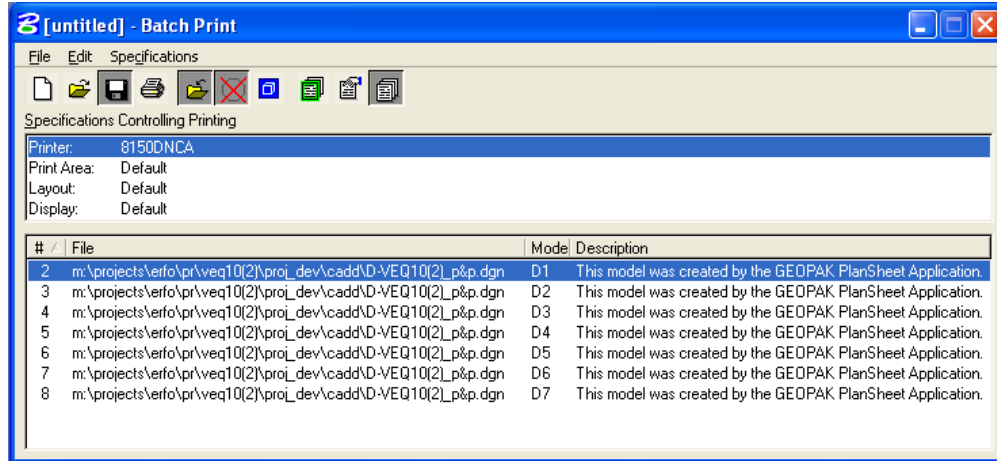
Step II

- Now set the plot specifications (Plot specifications tell MicroStation how to plot the selected files).

- Select **Specifications>Manage**, or select the **Manage Specification** icon, as shown below.
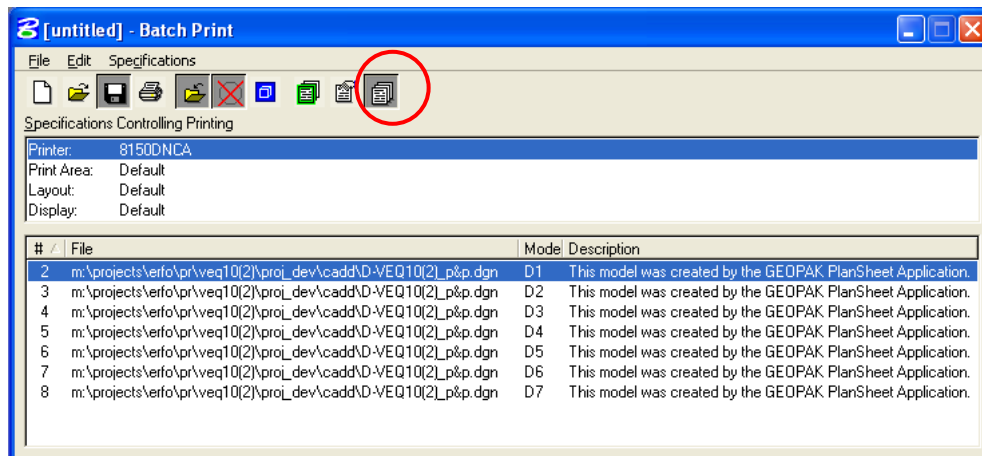
- Once selected the Batch Print **Specification Manager** dialog box will activate.
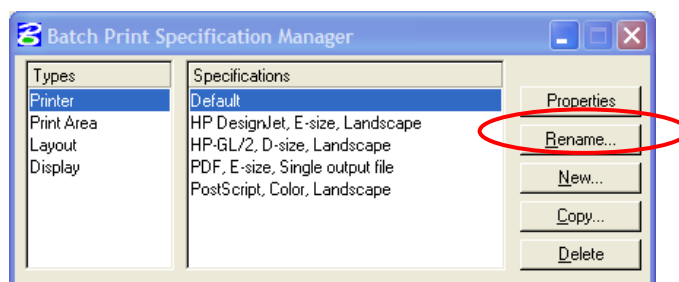
- Select **Printer** Type and highlight **Default** Specification. Begin by renaming the default printer to be a more descriptive name. Select **Rename** from the dialog box shown above, the **Rename Printer Specification** dialog box will activate. Give a descriptive name, shown as 8150DNCA below, and select **OK**.
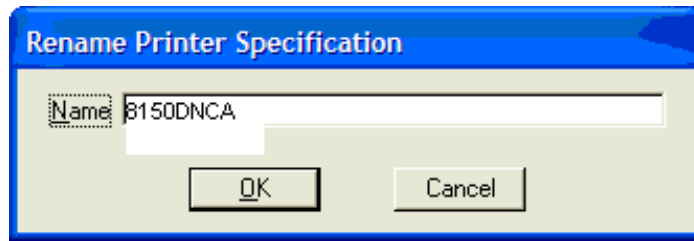
- Once renamed, highlight the printer on the left and the newly renamed **8150DNCA** on the right, and select **Properties**.
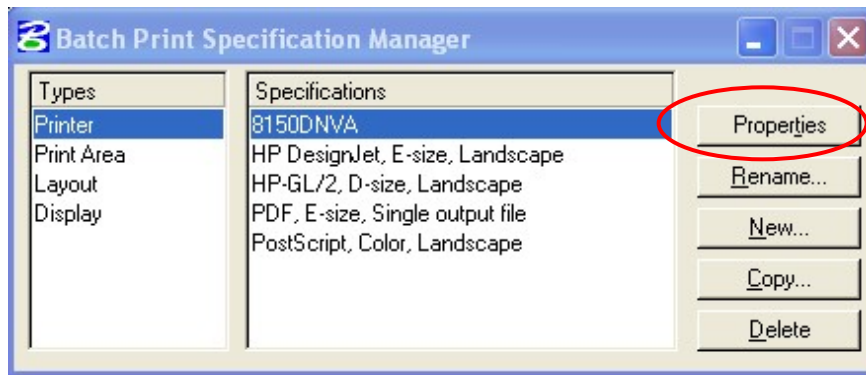
> *Note:-In most cases the EFLHD user will want to select one of the plot driver files found in the M:\Engineering_Software\cadd_resource_v8\Plotting\plotdrv\ directory in order to achieve special plotting effects such as shading contours or p&p sheet grids.*

- Once **Properties** is selected, the following dialog box will activate allowing the user to select the desired printer driver. Click the **Driver** button on the Properties dialog and select the printer driver (see **Section 3.5.2)** and choose **OK**.
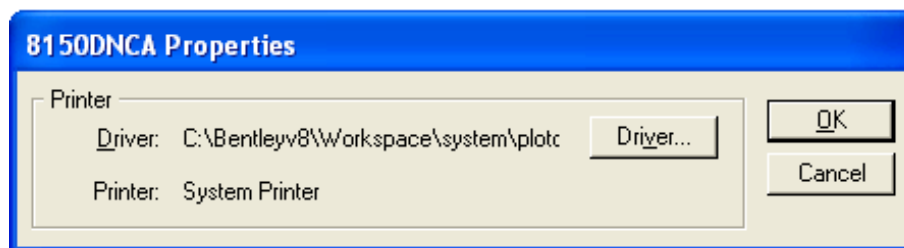
- Select **Print Area** Type and highlight **Default** Specification on the Specification Manager dialog and rename the **Print Area** specification to be more descriptive, shown below as **EFLHD**.
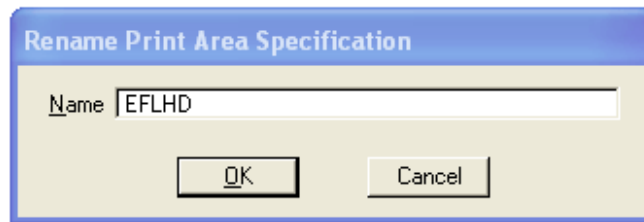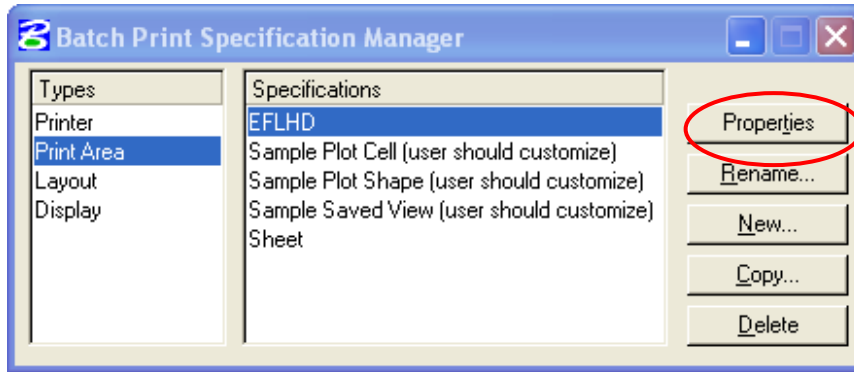
- Select **EFLHD** Specification of **Print Area** and click on **Properties** button. The EFLHD Properties dialog box will appear as shown below.
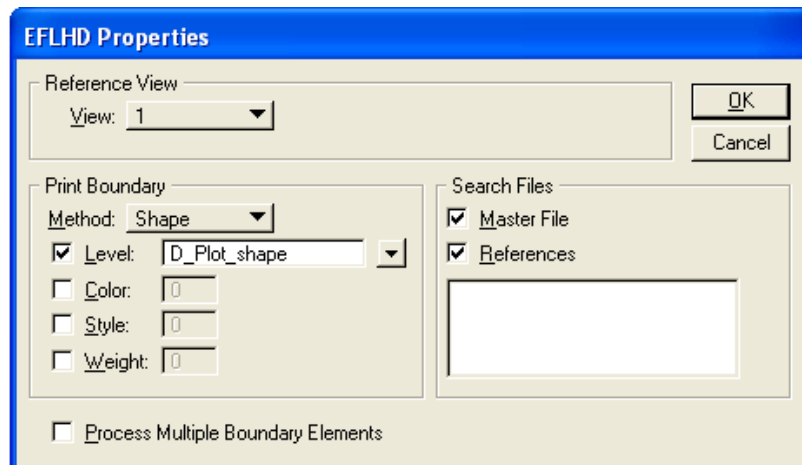
> *Note:- This step will be to set the desired print area. Using the EFLHD standard sheet border cells will ensure that a plot shape will be available to define the area to be plotted for each sheet. Included with each border is a plot shape on level D_Plot_shape that has been created as a construction element so it will not plot unless desired. The print area properties dialog, shown above, allows the user to select the attributes of the plot shape and to look for the plot shape in the master file, reference files, or both. If any of the design files to be plotted has more than one sheet then check the Process Multiple Boundary Elements box at the bottom of the properties dialog*

- Select the attributes of the plot shape as shown above and click <u>O</u>K. When selecting the References check box the box below becomes active to allow the user to select certain reference files by logical or file name. If this box is left empty all of the reference files will be searched.

> *Note:-The level of the plot shape must be typed in. The drop-down box will only include the levels in the master file, as the list could get quite long.*

- From the **Batch Print Specification Manager** dialog box select **Layout**.
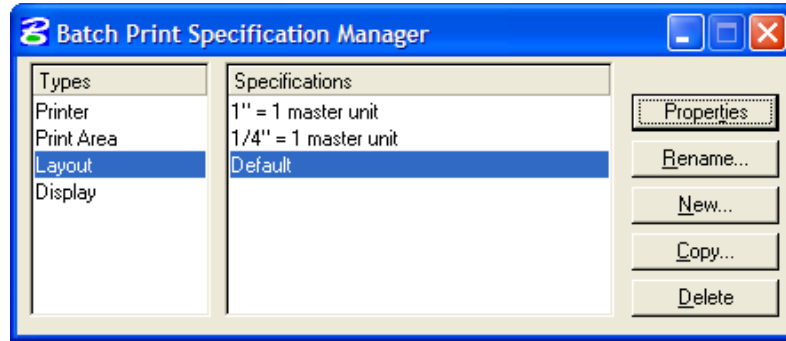
- Select **Default** from the right hand box and then select **Properties**. For layout, the name (default) may be renamed if desired however there may be little need to change these specifications so default may be fine.
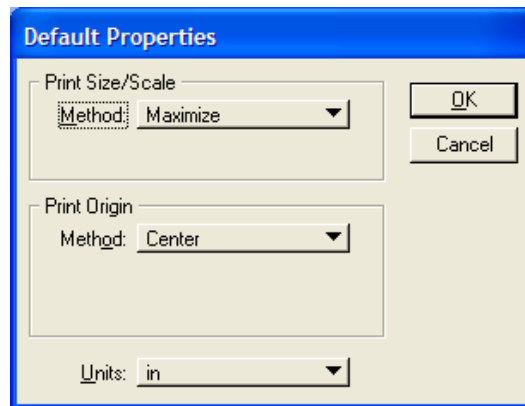
- Select Maximize, Center, and the correct units and select OK.

- From the Batch Print Specification Manager dialog box select Display.
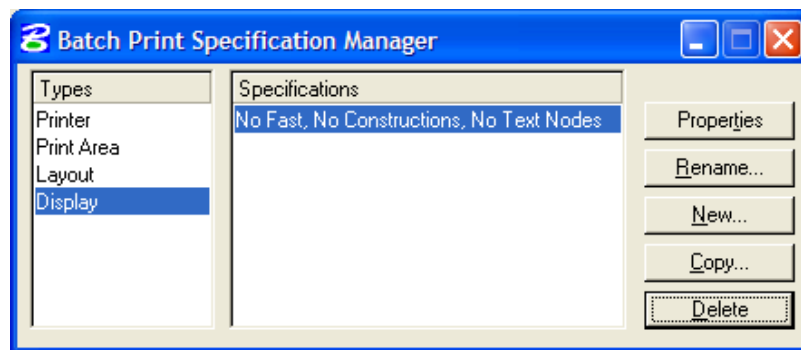
- Select New to create a new set of specifications. Input a new name and click OK.
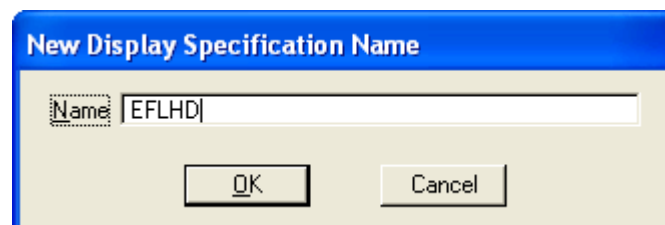
- Select the new name from the right hand box and then select Properties.
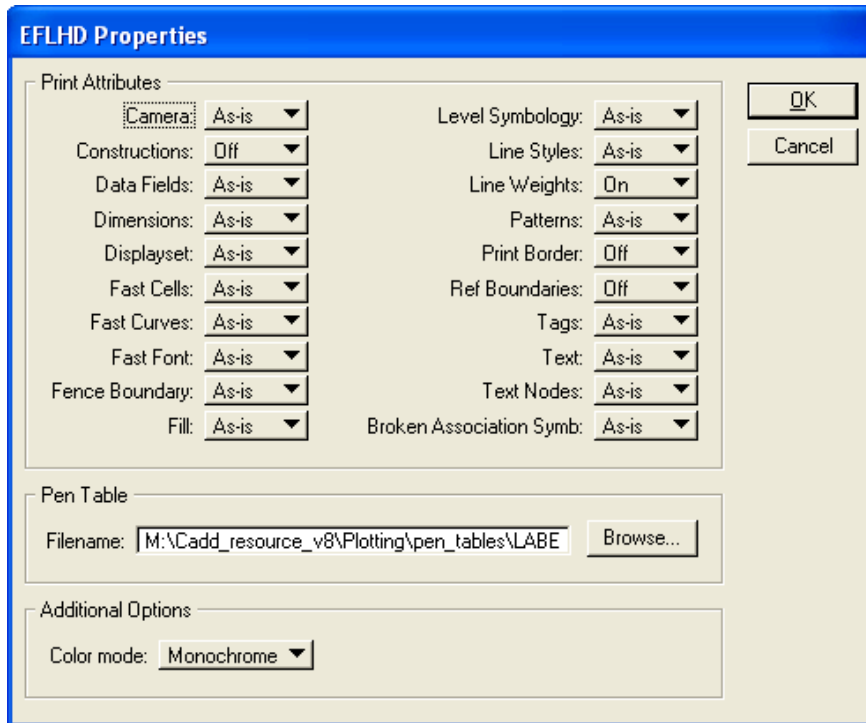
- The display dialog is similar to the view attributes dialog box, but is specific to printing. In MicroStation 2004 Edition you have the ability to plot with attributes different than the current view. From this dialog box you also have the ability to specify a pen table.

- From the example above we have turned Constructions, Print Border, and Ref Boundaries Off. This allows us to use these features during our work but not to plot them.

- Select the desired attributes and select OK.

- Close the Batch Print Specification Manager by selecting the X in the upper right corner.

- Once the files have been added and the specifications set, select **File>Save**. This will save all of the settings in a Job Set file with a .job extension. Job Set files may be stored in any convenient directory. There is no standard or default directory where batch print looks for these files.

Step III – Printing

- If reprinting a previously saved Batch Print Job Set use File>Open in the main Batch Print dialog pull down menus to select the .job file for that Job Set. This will populate the dialog with the files to be printed and the associated print specifications. If continuing directly from Workflow 2 above (Creating a New Job Set) then skip this step.

- From the Batch Print dialog, shown below, select the printer icon.
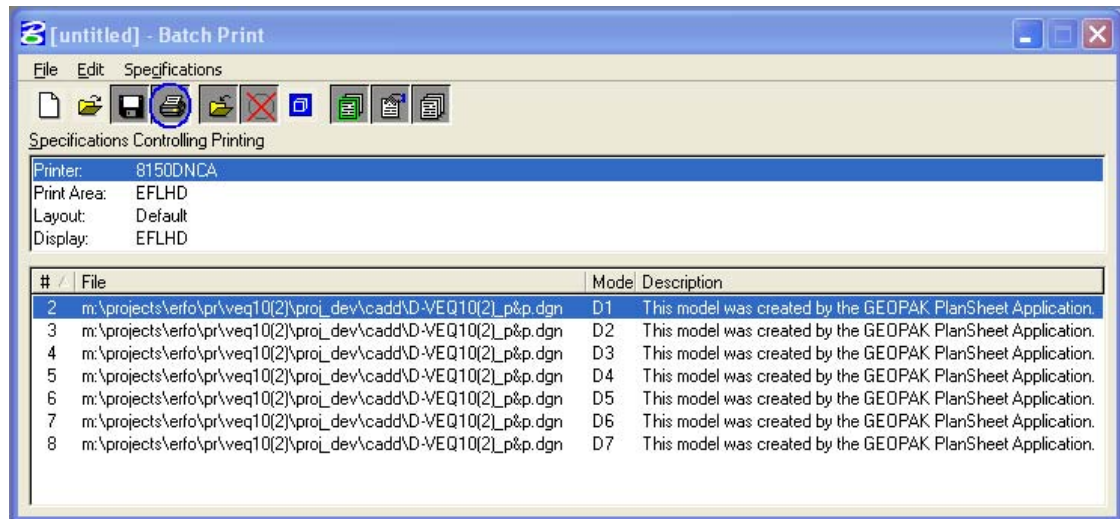
- The Print Batch dialog will activate.
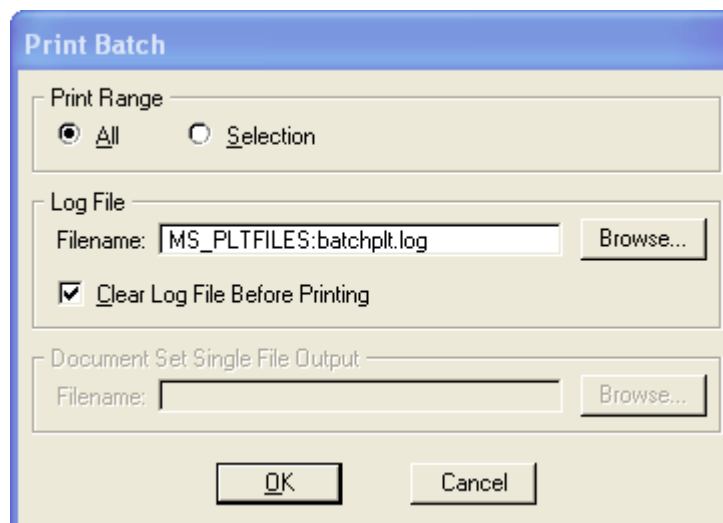
- From this dialog box the user can select a print range, and log file.

- Select OK and the files will be sent to the printer. A status bar will be displayed during the process, as shown below.
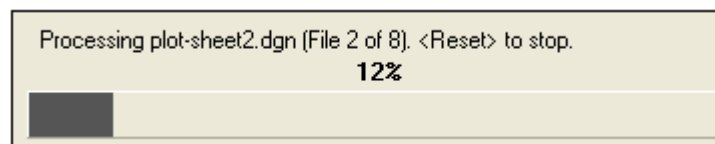
SECTION 4:   MicroStation - EFLHD Standard Procedures

4.1- EFLHD Standard Settings

4.1.1- Open MicroStation File

ALWAYS pick **Project** Configuration of **Workspace** from the "**MicroStation Manager**" dialog box as shown below.
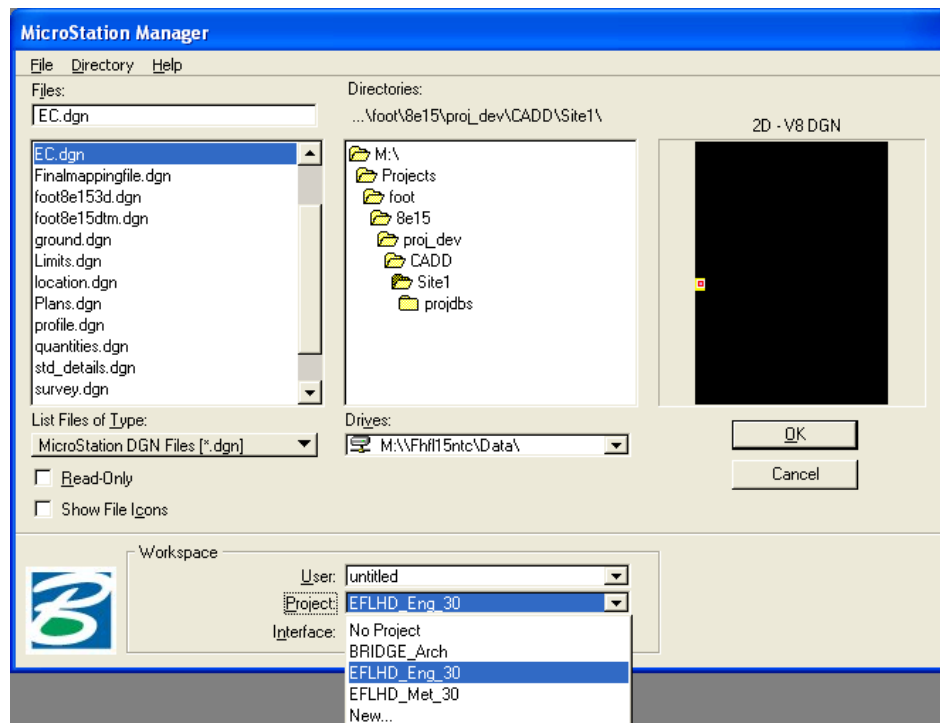
Select "**EFLHD_Eng_30**" for **English** project, "**EFLHD_Met_30**" for **Metric** project of **Highway Design Section**, and "**Bridge_Arch**" for Bridge drawings of **Bridge Section**.

Using the Project Configuration of workspace "**EFLHD_Eng_30**" will give the user access to the **X30** Generation of Standard Files (Level library, line styles, cell library, color table, text styles, ddb files, etc) and also set the MicroStation in **Survey Feet Unit** environment.

*Note:-Unit of Bridge Design files are set as **International Foot** and Highway design files are set for **Survey Foot**.*

4.1.2- Creating a New CADD File

35

All design files must be created from a Seed file. A separate two dimensional seed file has been developed for English and Metric scale design file. These are "**Sur_ft2D.dgn**", and "**Metric_2D.dgn**".

ALWAYS use the seed files from **M:\Engineering_Software\Cadd_resource_v8\X30\Standard\seed** when creating a new file. There is an English one (Sur_ft2D or 3D) and a metric one (Metric_2D or 3D). While in the MicroStation Manager Window (the first screen that pops up when you open MicroStation), make sure that the Project is set to "**EFLHD_Eng_30**" under Workspace. Next, rename the file and save it in your project folder.

> *Note:-These seed files have several operating parameters set specific to that sheets purposes and scale .Some of the parameters are as follows:*
> *a. Working Units: Imperial --- Master Unit- Survey Feet (')*
> *Sub Unit- Survey Inches (")*
> *Resolution- 10000 per Survey Foot*
> *b. Global origin set to lower left (GO=0,0)*
> *See M:\Engineering_Software\Cadd_resource_v8\X30\Standard\seed*
>
> *for available standard EFLHD Seed Files.*

4.1.3- Text Styles settings in use at EFLHD

MicroStation V8/XM gives the user the ability to save the various text settings as a text style. With MicroStation V8/XM text styles the user no longer needs to set text parameters such as text font, height, width, etc. each time text is needed. Each of these settings is saved within a text style.

At EFLHD there is 1 text style for each italics and non-italics for both standard text and title/heading text. This is a total of 4 text styles for English as shown below.
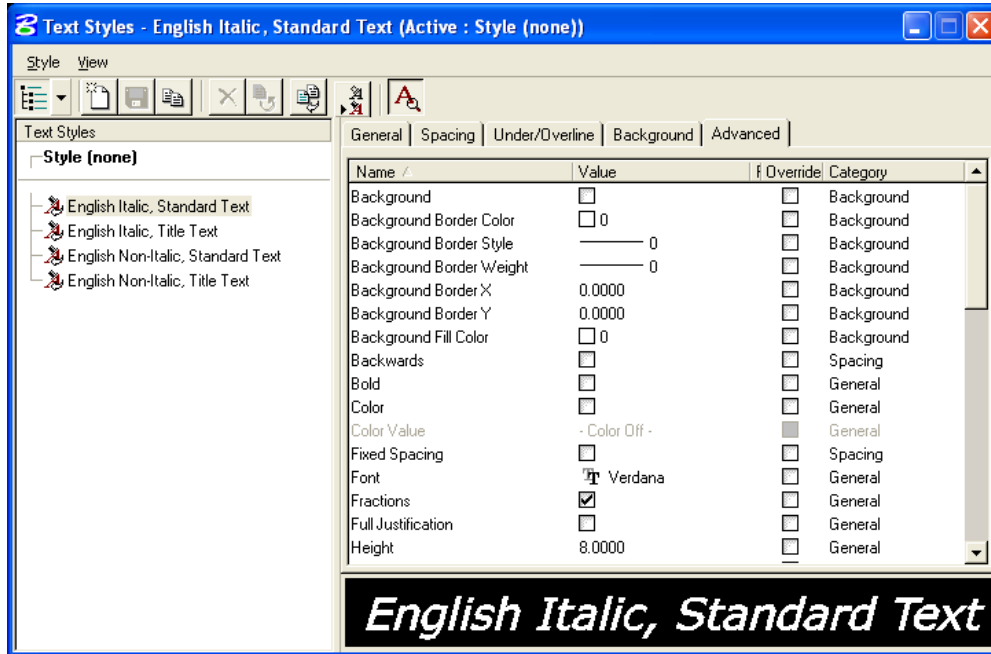
*Note:- Creating a new design file with the seed file and opening the new design file using with project configuration file(**EFLHD_Eng_30**) will give the user access to the EFLHD text styles and dimension styles settings.*

To use EFLHD text styles setting, set and lock the Annotation Scale in Model properties as shown below in different steps.

Set the Annotation Scale

Step 1.   Open **Model** dialog box follow, **File>Models** , then click on the **Edit Model properties** icon as shown below:
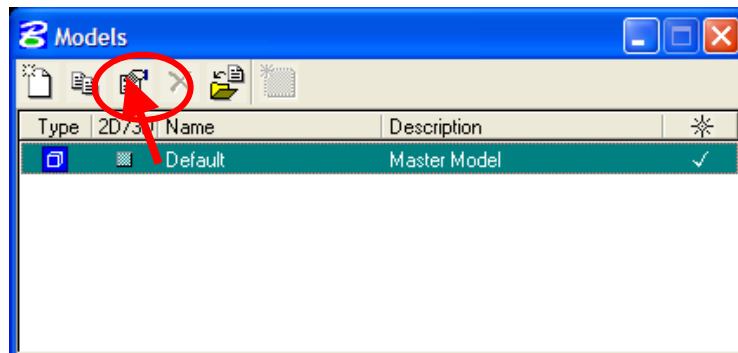
Step 2. Select the annotation scale from the **Model Properties** dialog as shown below.
In the example, the annotation scale has been set to 1"=100'.
Once the model properties have been set, select **OK**.
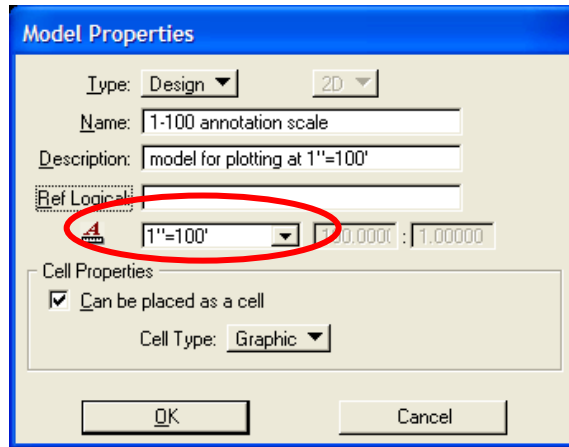
Set the Setting Annotation Lock

Step 3. Annotation Lock can be selected from the main Microstation pull down menus by selecting **Settings>Locks>Annotation Scale**, as shown on the left below, or by using the locks menu on the Microstation status bar, as shown on the right below.
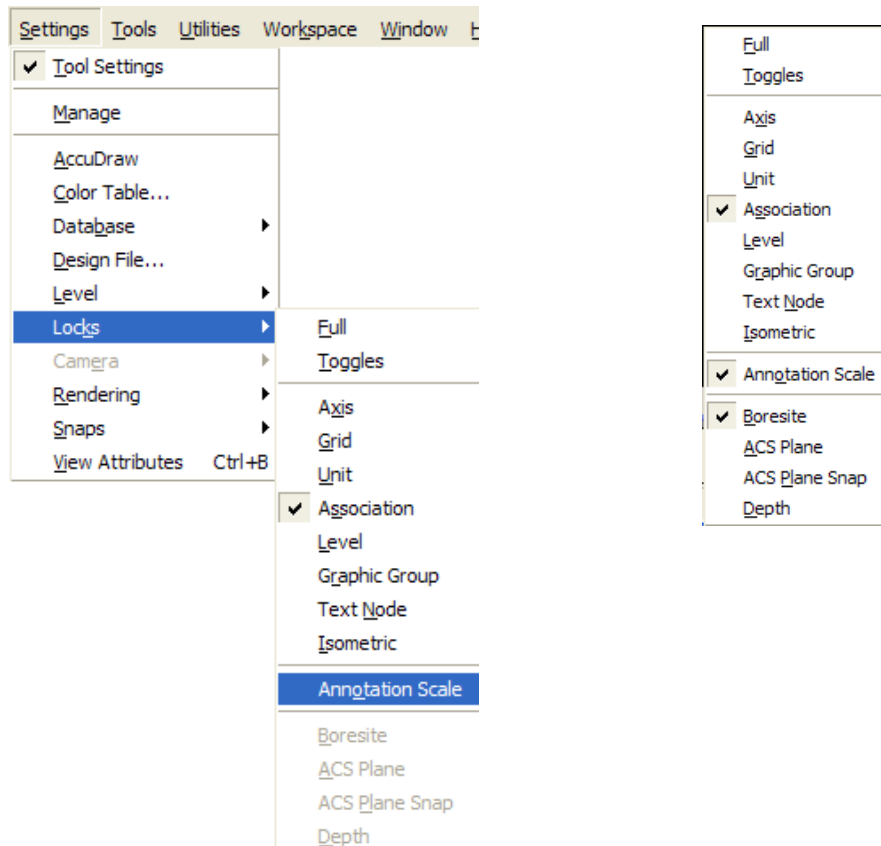
Step 4. With the **Annotation Scale** lock on, text will now be placed at the proper size for the output scale.

Step 5. Select the Place Text tool.
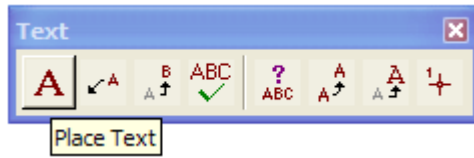
Step 6. From the tool settings window, select the desired text style.
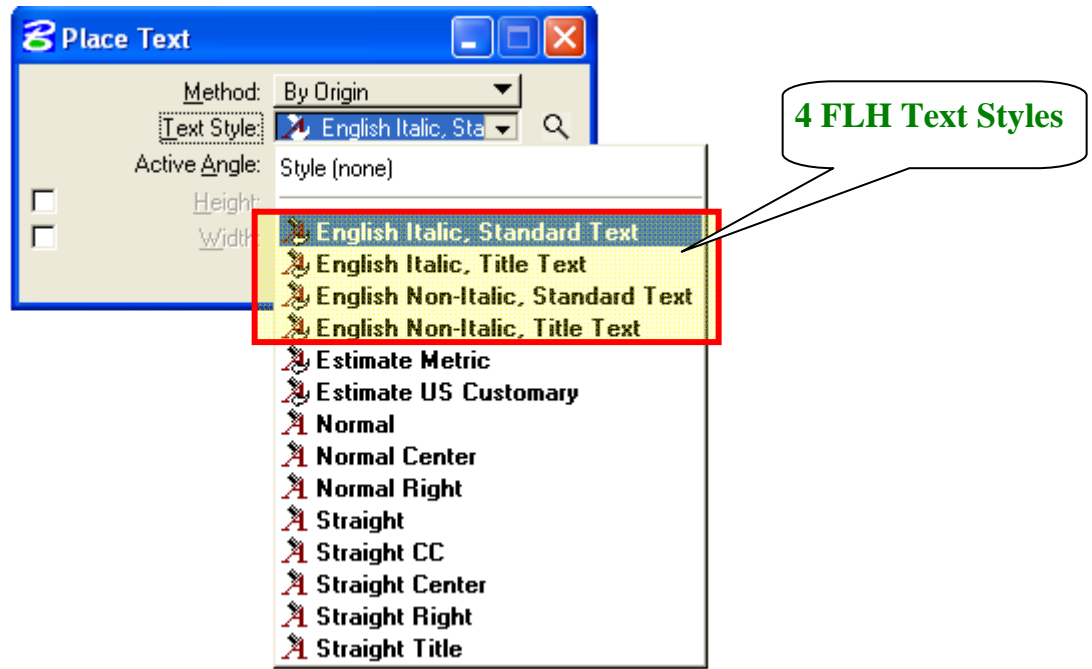
Step 7. By selecting the **English Italics Standard Text**, the proper text size, font, line spacing, etc. will be set automatically.

Step 8. Begin placing text.

4.2- Border Sheet

- Standard Border Sheets have been developed by the EFLHD Highway Design Section and will be used for all EFLHD projects.

- Border design files are kept in the following directory.

    "**M:\Engineering_Software\Cadd_resource_v8\Borders\01-EFLHD_bdr.dgn**".

- English and Metric borders are kept in different models of this border design file.

- Designer needs to copy this file into project working directory.

- Rename this file according to the EFLHD's naming convention [e.g. "**01-lop10(2)_bdr.dgn**" for RRP-LOP 10(2) project].

- Edit all project information of the English and Metric border according to the working project.
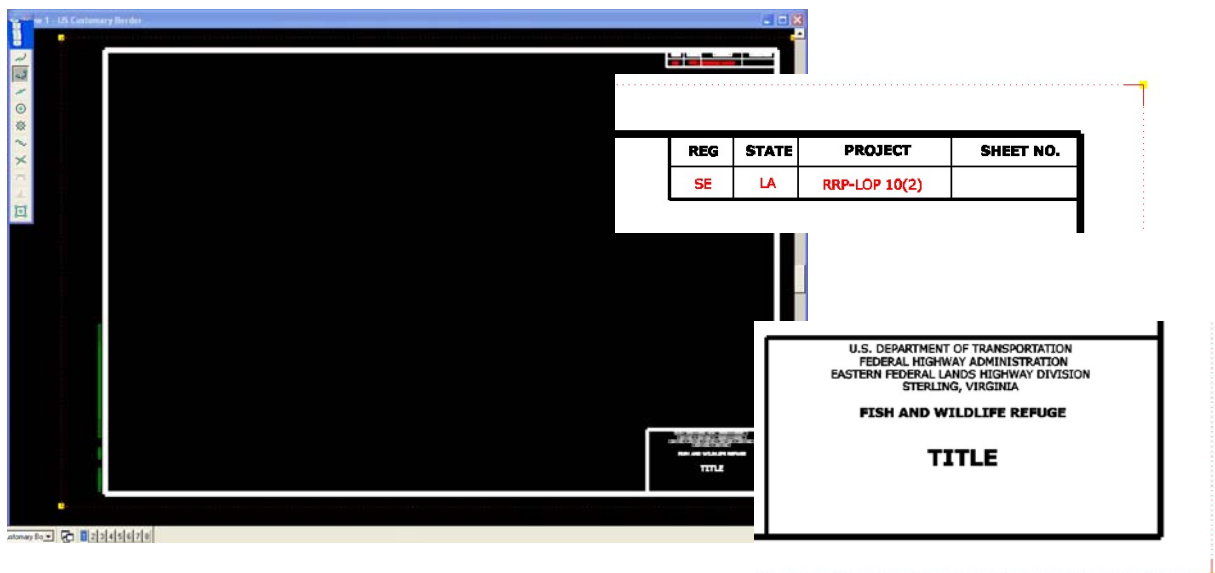
Note: - - Text's font, style, and size will not be changed by the users.
-The English border is drawn for 1"=100' (US Customary)

4.3- <u>Title Sheet</u>

The Title Sheet identifies the set of plans, conveys the general type of improvement planned, and locates the improvement. The Title Sheet includes, at least the major criteria under which the improvement is designed, a sketch showing the location of the proposed project, a State map, a complete index of the sheets in the plan set, and the length of project.

- Standard Title Sheets for each partner agency have been developed and are kept in the following directory.

  "M:\Engineering_Software\Cadd_resource_v8\Standard_Shts\Titles"

- Copy these files into your project working directory.

  Rename the files according to the EFLHD's naming convention [e.g. "A01-lop10(2)_ttl.dgn" for RRP-LOP 10(2) project].

- Replace location map and key map for the required State. Edit all required information according to the project.
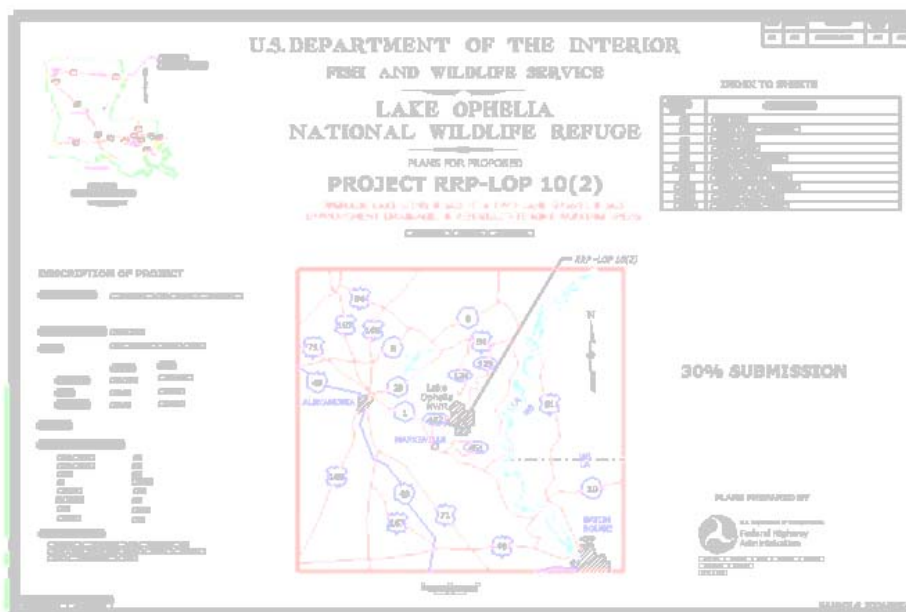
Note:- *- Text's font, style, and size will not be changed by the users.*
- Project border will not be used as reference in the Title design file.

4.4- Symbols and Abbreviations Sheet

The Symbols & Abbreviations Sheet details all of the standard plan symbols and abbreviations currently in use by EFLHD. The symbols and abbreviations should not be changed on a project-to-project basis. When a special symbol is required for a specific project, show it in the space designated for the Project Specific Symbol.

- A standard Symbol and Abbreviation Sheet is developed for EFLHD and will be used for all EFLHD projects. See M:\Engineering_Software\Cadd_resource_v8\

- Copy this file into the project working directory.

- Rename the file according to the EFLHD naming convention [e.g. "A02-lop10(2)_sym.dgn" for RRP-LOP 10(2) project].

- Re-attach project border design sheet file of your working project directory.

SYMBOLS & ABBREVIATIONS
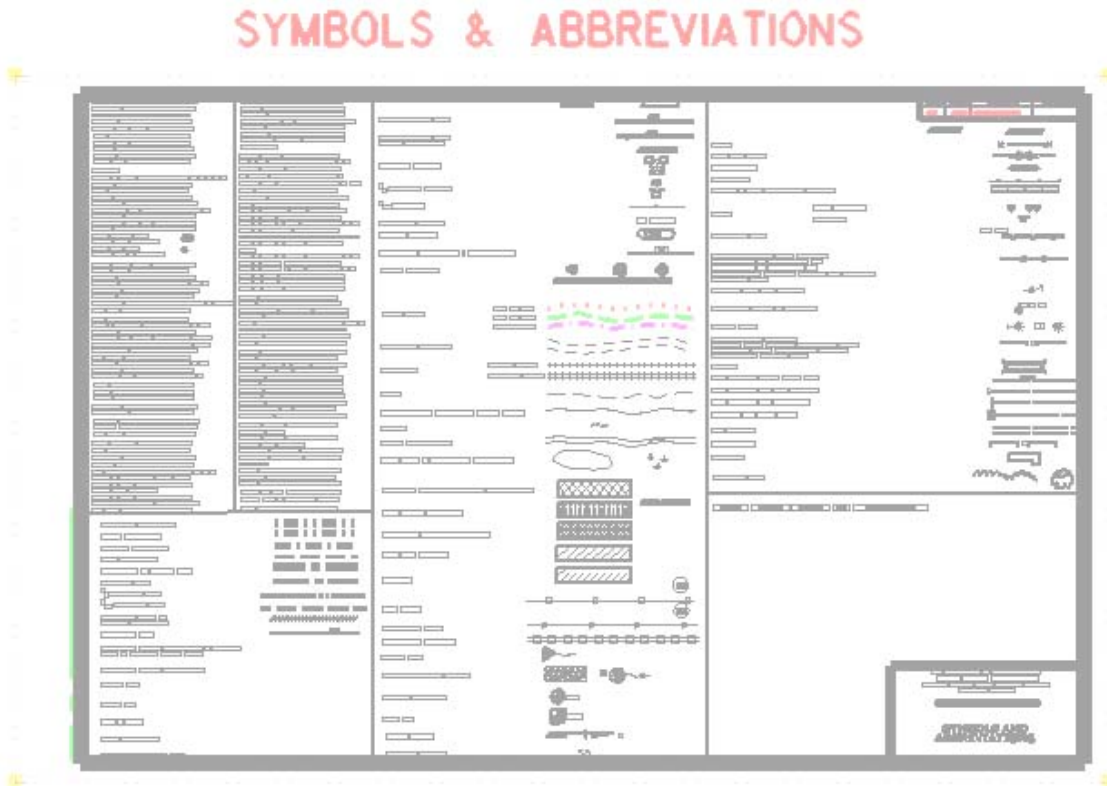
4.5- Location Map Sheet

The Location Map shows the location and limits of the improvement. The location sketch shows physical features that will aid in the identification of the proposed road location, including intersecting and adjacent roads, prominent landmarks, towns, property lines, and a north arrow. A graphic scale is included for the location sketch so the scale will be applicable on reduced size prints.

- Create a new DGN file using "**Sur_ft2D.dgn"** seed file.

- Name this file according to the EFLHD Naming Convention [e.g. "A03-lop10(2)_loc.dgn" for RRP-LOP 10(2) project].

- Attach your project border file using reference default model selection (Note border is drawn for 1"=100' US Customary).

- Use models in the same location map design file, if project have more than one location map sheet.

4.6- Survey Information Sheet

The Survey Information Sheet shows the horizontal and vertical datum notes(State Plane Coordinates; NAD, NAVD, etc; mapping on grid or ground with scale factor; location map showing all primary and secondary control points; sketches of references of project control points including staked centerline points (POT,PC,PT, etc.); subsurface utilities note (SUE Level A,B,C or D); coordinate listing of project control points (NEZ plus type of points); and coordinate listing of proposed alignment or staked centerline data.

- Create a new DGN file using "**Sur_ft2D.dgn"** seed file.

- Name this file according to the EFLHD Naming Convention [e.g. "A04-lop10(2)_sur.dgn" for RRP-LOP 10(2) project].

- Attach your project border file using reference default model selection. Change the scale according to the project requirement (Note border is drawn for 1"=100' US Customary).

- Attach project horizontal alignments, existing features and control points, and the survey information from the survey file.

- Use models in the same survey info design file, if project have more than one survey info sheet.

4.7- <u>Typical Section Sheet</u>

The Typical Section shows the shape of the finished cross-section within the construction limits, and represents the appearance of the completed project. It must be specific enough to describe the proposed work, its location, and material needed.

- Create a new DGN file using "**Sur_ft2D.dgn"** seed file.

- Rename this file according to the EFLHD Naming Convention [e.g. For one sheet typical sections. The file name will be "**B01-lop10(2)_typ.dgn**". Use models if you have more than one sheet. The file name will be "**B-lop10(2)_typ.dgn**". B1, B2 will be the models name for RRP-LOP 10(2) project].

- Attach your project border file . (Attach reference on other models also if you have more than one sheet).

- Use models in the same Typical section sheet design file, if project have more than one typical section sheet.

4.8- Quantity and Summaries Sheet

The Summary of Quantities tabulation combines and summarizes the contract quantities for all pay items. This summary informs prospective bidders where to locate work within the plan sheets, the difference between plan quantities and bid schedule quantities, if any, and expands on contract bid schedule information.

4.8.1- EFLHD Quantity Sheet Information

Standard Quantity Design Sheets are developed by EFLHD to improve efficiency and consistency in the process of generating quantity summaries and schedules sheets for the PS&E Package.

There are two design files and one excel file.

- Border file, 01-**EFLHD_bdr.dgn** (M:\Engineering_Software\Cadd_resource_v8\Borders\01-**EFLHD_bdr.dgn**).
      This file is used for border as referenced to the quantity design sheets in each model.

- Quantity Sheet Design File, **Quantity.dgn**
(M:\Engineering_Software\Cadd_resource_v8\Quantity_Shts**Quantity.dgn**)
(This file has different summaries and Schedules on each model)

- Quantity Spread Sheet, **Quantity.xls**
 (M:\Engineering_Software\Cadd_resource_v8\Quantity_Shts**Quantity.xls**)
 (This file has same summaries and Schedules in each of the sheets)

   Note:- For consultants, these files are available through the CADD_Resources_V8.zip download(See Appendix A).

4.8.2- Summaries & Schedules Sheets

Step I
- Copy these files (explained above in section 4.8.1) into the working directory.
- Rename these files as per EFLHD Naming Convention (*See Section 3 of this guide*).

Step II
- Open Quantity Sheet Design file.

   Note:-This file has the Tabulation of Quantities sheets in the Default Model and all other Summaries and Schedules sheets in different Models of the design file. 01-EFLHD_bdr.dgn border file is already referenced to these models. You can't see the border in any of the models as you have changed the border file name and directory.

- Reattach all border reference files you need to use with your project border file.

- Click model view at the bottom left and select different Summaries and Schedules in your design file. Some are shown as below:
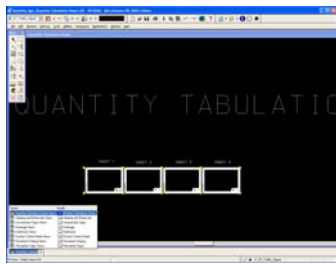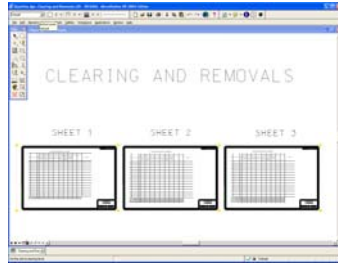
Tabulation of Quantity   **Clearing And Removals**   **Construction Signs**   **Drainage**
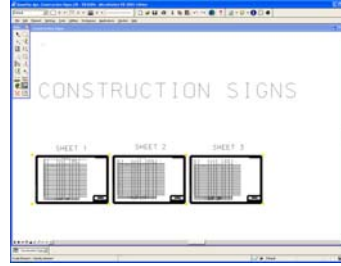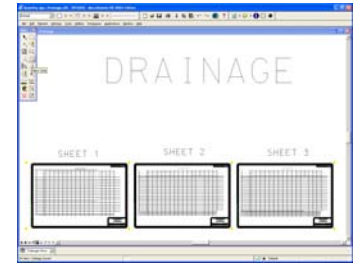
- The Tabulation of Quantity Sheet is in the Quantity Tabulation Sheet Views models and Summaries and Schedules Sheets are in different models of the design sheet.

- Summaries and Schedules are as follow:
  i) Clearing and Removals, ii) Construction Signs, iii) Drainage, iv) Earthwork, v) Erosion Control, v) Pavement Striping, and vi) Permanent Sign Sheets.

- The tables of different sheets of each model are linked with Excel worksheets. The Excel file has the Summaries and Schedules in different worksheets as shown below in red circles:

- The above spreadsheet has seven worksheets and each worksheet has three tables for different Summaries and Schedules (sheet1, sheet2 and sheet3). These sheets have a link connection with the Quantity Sheet design file. Any changes in the spreadsheet will automatically be changed in your Quantity Sheet design file.

- The link in the Quantity Sheet design file with the Excel file will be lost because of a change in directory and files name. To reestablish the link, follow Step III.

Step III

- Open the Quantity Sheet design file. Open Clearing and Removal Models.

- Open **Links menu** through **Edit>Link** as shown below:
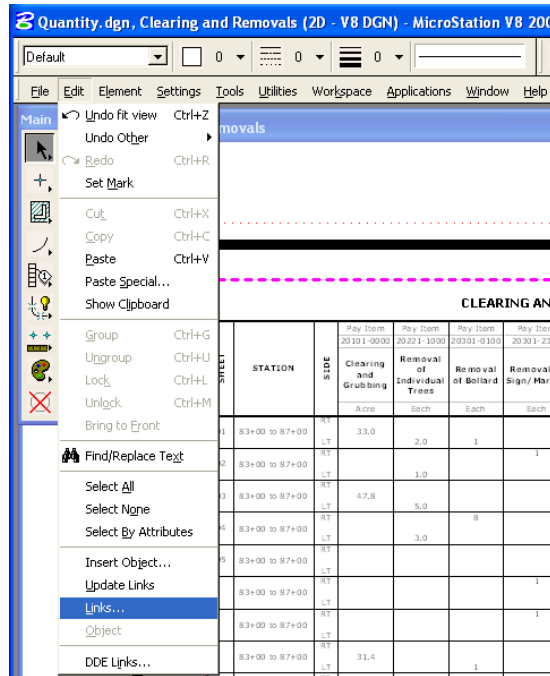
- The Links Menu for Clearing and Removal Models will appear.
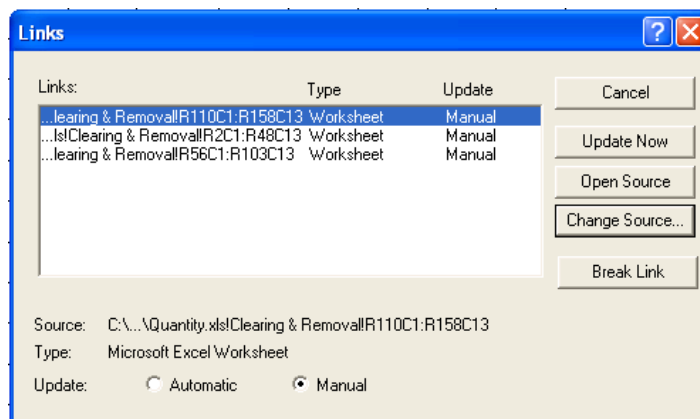
- **Highlight** one line on link menu as shown above and click on **Change Source**. **Change Source** menu will appear.
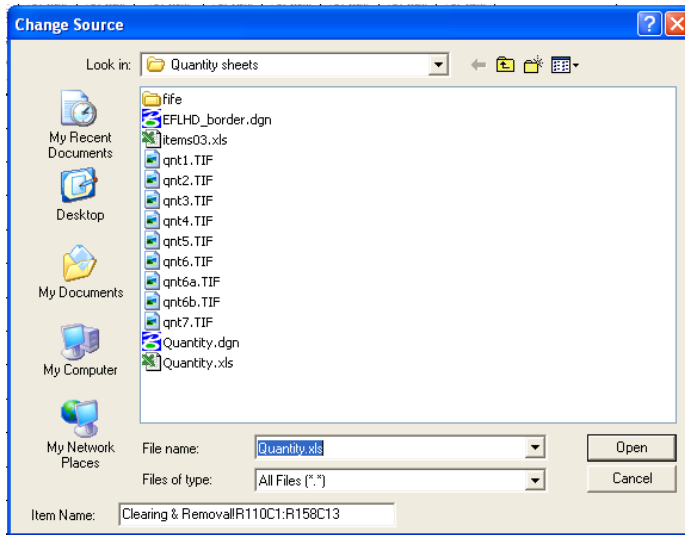
- Select the Quantity excel file from the working directory of the Change Source menu. Select all three lines one by one and change the source of the link by selecting the same Excel file.

- Change the source of all the links in each Model with the same Excel file.

- Open the Excel file and select the working sheets of Summaries and Schedules to use. Edit according to the project information and **save** the Excel spreadsheet file.

- Open the Quantity Sheet design file and select **Edit>Update Links** as shown below. Your design file will be updated according to the Excel Spreadsheet.
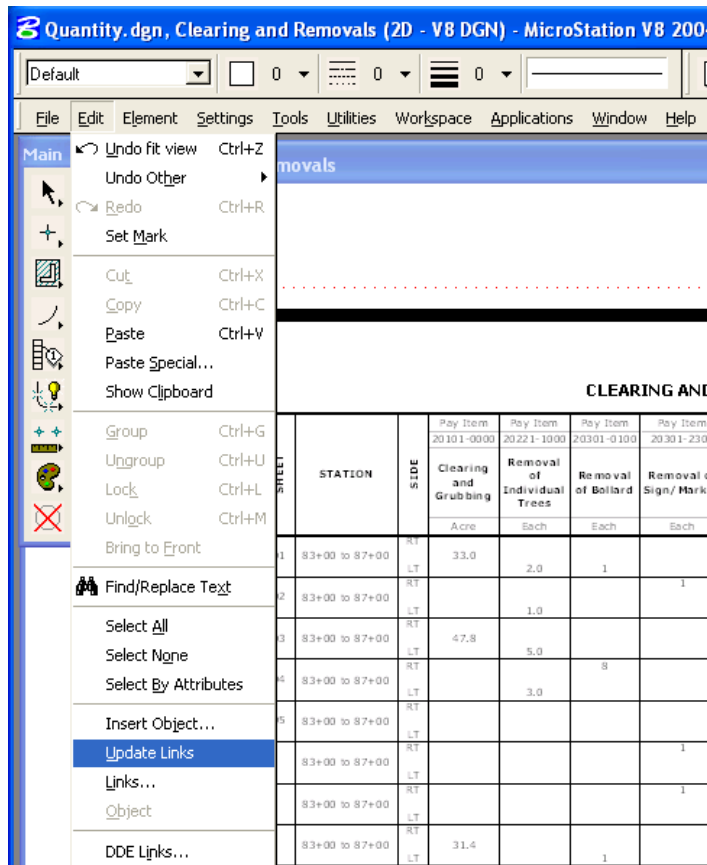
4.8.3- <u>Tabulation of Quantity Sheets</u>

- Use Quantity Sheet files (explained in Section 4.8.1).
- This file has the Tabulation of Quantities sheets in the Quantity Tabulation Sheet Views Model.
- Reattach the border reference file.
- Import Quantities of Engineer's Estimate System (EES) into Tabulation of quantity sheet file.

4.8.3.1- Import Quantities of Engineer's Estimate System into Tabulation of quantity sheet file.

<u>FOR EXPERIENCED USERS</u>(See next page for 1st time users)

Step I:
- Create txt file from your project Engineer's Estimate.
- Open the Engineer's Estimate of your project.
- Create a text file for Quantity tabulation sheet > Go to CADD Files on main menu of EES and click on create files.

Step II:
- Edit the text file with UltraEdit-32 software (Use any column mode text Editor).
- Extra blank columns of the table need to be deleted from the original text file created by EES.
- Open text file with UltraEdit-32. Go to **Column** and select **Column mod,** highlight all columns text that you want to delete and press delete.
- Save the final text file and repeat the same for other text files if it is created by EES.

Step III:
- Import EE's table into the Quantity Tabulation Sheet "dgn" file.
- Open the Quantity Sheet design file (Default model).
- **Select** Change text attributes **or** text attributes in your design file.
- Set the **"change text attributes"** or "**text attributes**" setting as shown below:

<div align="center">

Text Style=Style (none)
Font = 3
Height=7.0
Width= 6.0
Line spacing=6.0
Interchar spacing=0.0
Slant =0.0
Line length = 255
Underline=Disable
Vertical=disable
Line space type=Automatic

</div>

- Select save setting, **File>Save Setting**.
- Import text file by selecting File>**Import>Text**
- Select your text file and click **OK**.
- Place the text on the left portion of your sheet when it appears on your screen.
- Repeat steps to import other text file (if you have) into the dgn file and place the text on the right portion of your sheet when it appears on your screen.

FOR FIRST TIME USERS

Step I: Create txt file from your project Engineer's Estimate   **50**

- Open the Engineer's Estimate for the project
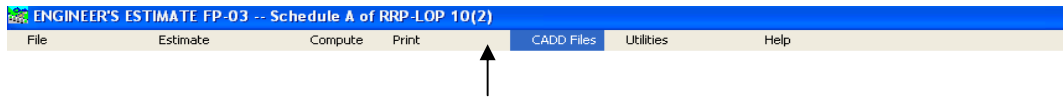
- Click on "CADD Files" on the main menu of the Project EES as shown above.
- The "Edit CADD sheet headings" menu will appear as shown below:
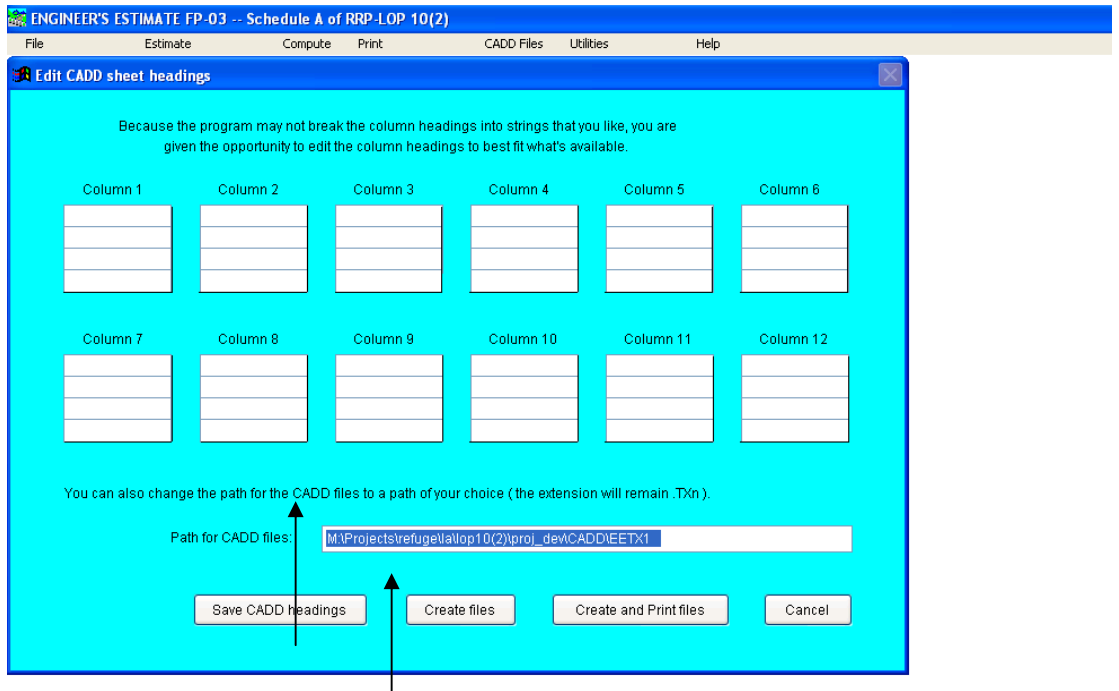
- In "Path for CADD files" type the directory string and file name.

- Click on "**Create files**". It will create text files in the given directory.

    Note:- *It will create one or more files in text format depending on the size of the quantities table in the EE's.*

Step II: Edit the text file with UltraEdit-32 software (Use any column mode text Editor).

- This is how the original EE's table will appear in the dgn file, if import without edit:

- The extra blank columns, shown within the red rectangle needs to be removed before importing into the dgn file.

- Use UltraEdit-32 software to remove the blank columns (Consultant may use any other Text Editor software with column mode edit capability).

- Open text file with UltraEdit-32,the text file will appear as shown below:
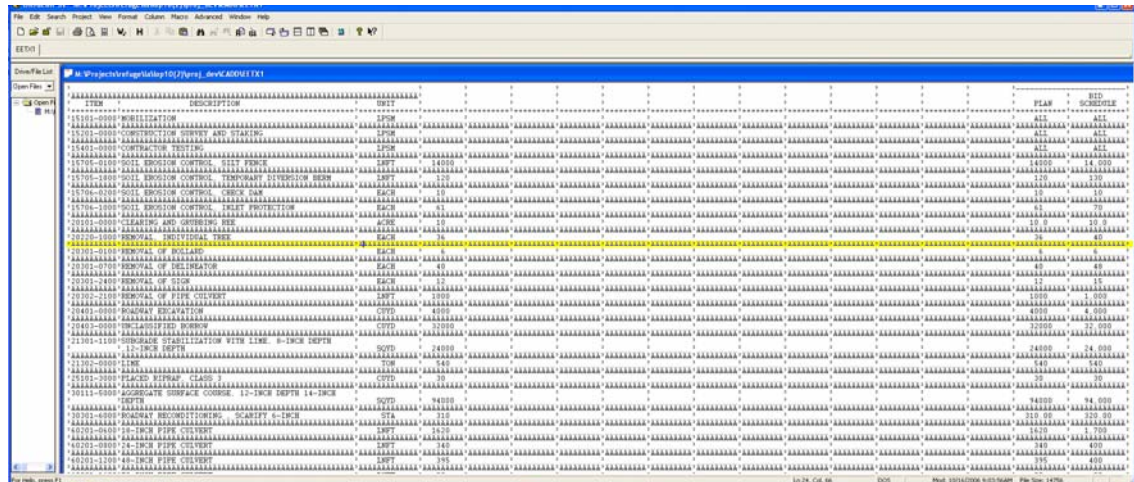
- Select Column >Column mode from the top menu bar as shown below:
-
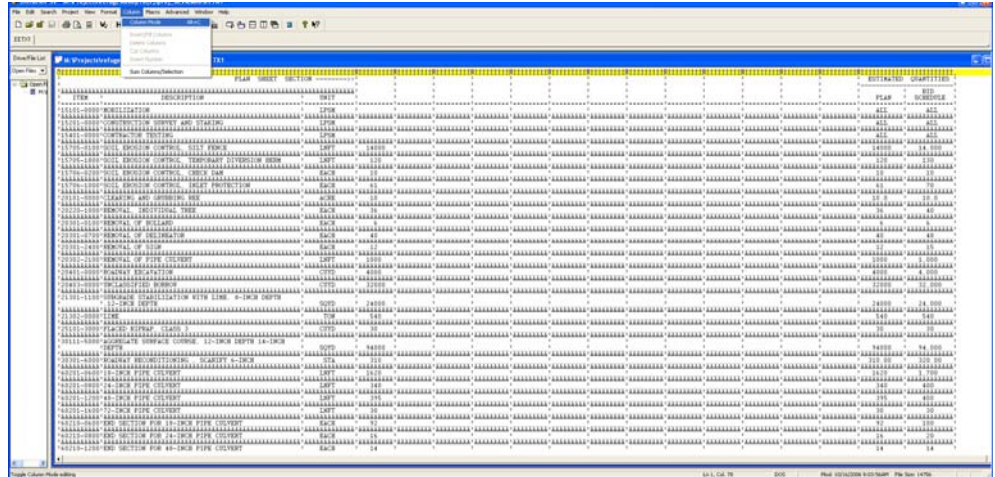
- The highlighted portion shown below is the extra columns you want to remove. Select these columns by clicking at point **1** and drag your cursor to point **2**. Then press delete on your keyboard or select **File>Delete** as shown below:
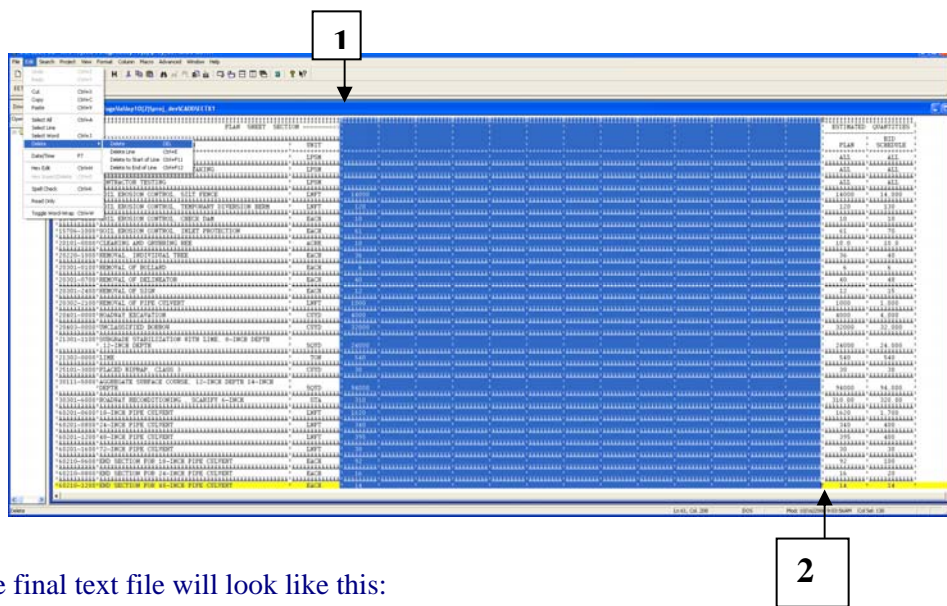
- The final text file will look like this:
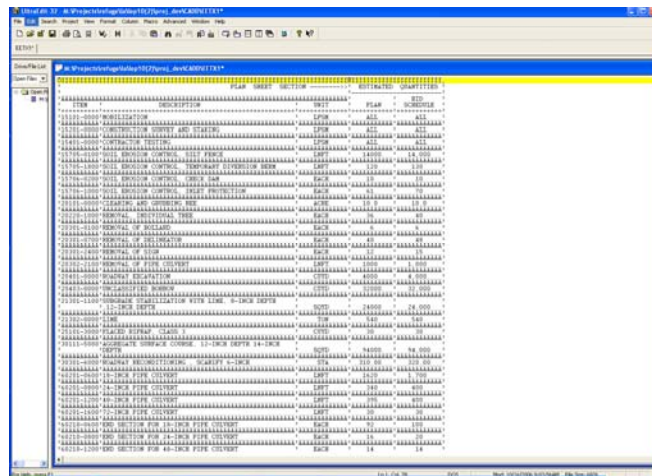
- Save this file and close UltraEdit.
- Repeat the same steps for each text file.

Step III: Import EE's table into Quantity Tabulation Sheet "dgn" file.

- Open Quantity Sheet dgn file (Quantity Tabulation Sheet View model).
- Select the Change text attributes in your design file as shown below:

- Set the change text attributes settings as shown below:

<div align="center">

Text Style=Style(none)

Font = 3

Height=7.0

Width= 6.0

Line spacing=6.0

Interchar spacing=0.0

Slant =0.0

Line length = 255

Underline=Disable

Vertical=disable

Line space type=Automatic

</div>
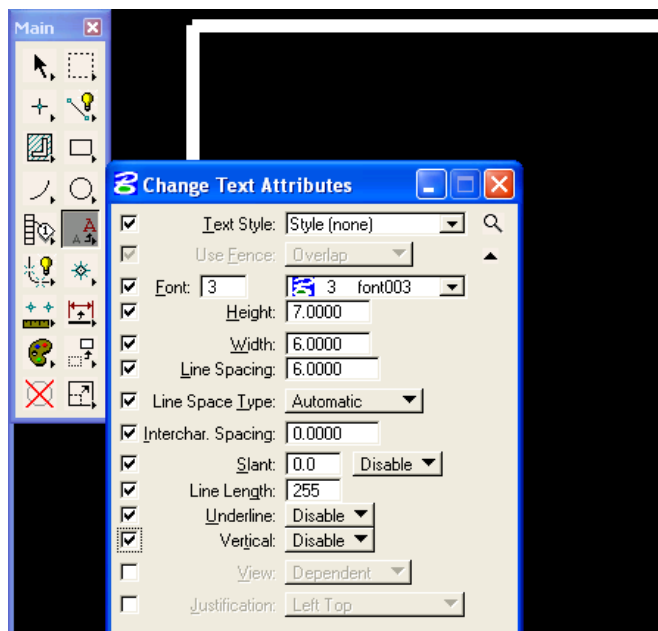
- After the text attributes settings, select save setting, File>Save Setting.
- Import the text file by selecting File>Import>Text, as shown below:
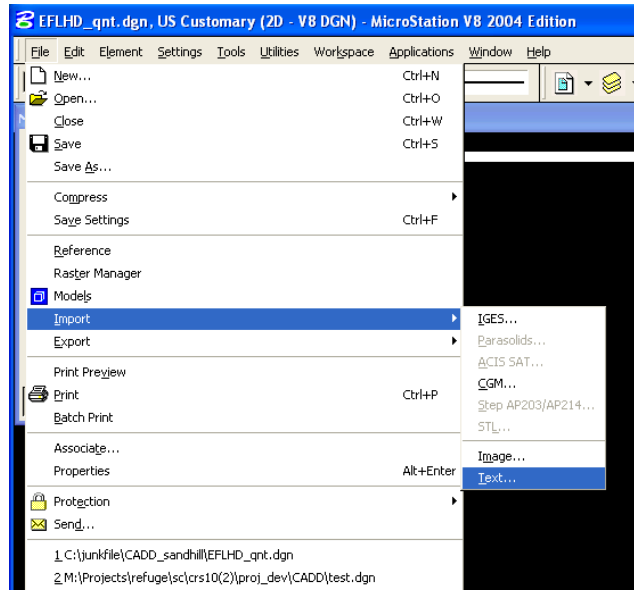
- Select your text file and click OK, as shown below:
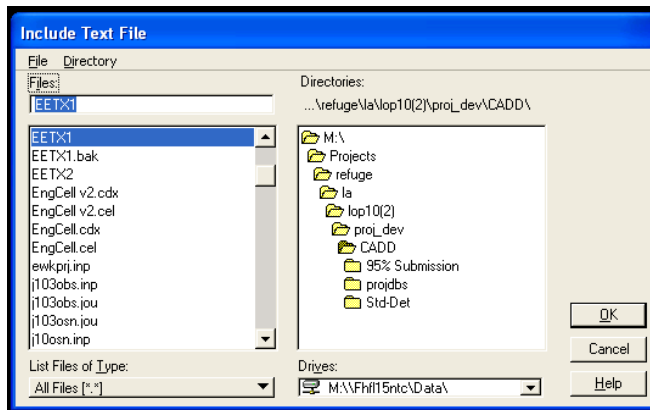
- Place the text on the left side of your sheet as shown below:
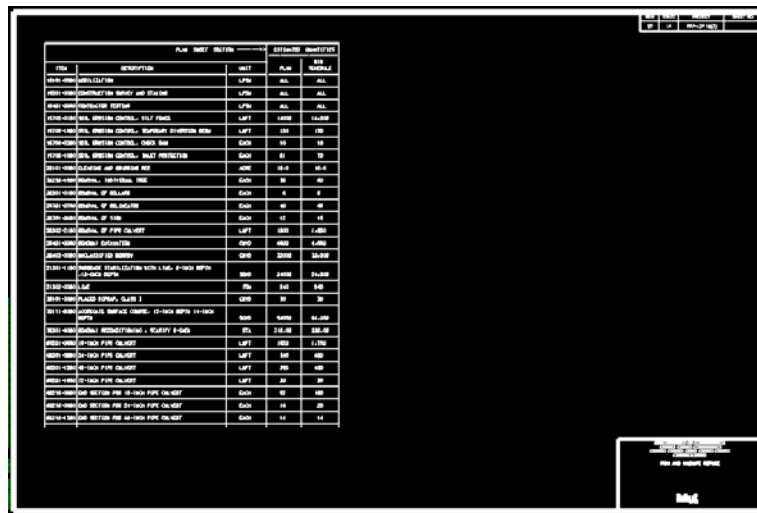
- Repeat the same step to import the second text file into the dgn file. Place the text on the right side of the sheet as shown below:

4.9- Plan and profile Sheets

The designer may incorporate plan and profile sheets, plan sheets, line graphs, or other descriptive sheets that describe the proposed work. When laying out plan and profile sheets, avoid dividing major structures, highway intersections, interchanges, or grade separations between sheets.

See **Section 6** to create **Plan & Profile Sheet Clipping** using Geopak Civil Software.

4.10- Approach Roads and Parking Area

Plans, profiles, and details for approach roads, parking areas, turnouts, and other associated roadways may be placed in a single section or in multiple sections as appropriate. It may be appropriate to include approach road plans with the mainline plan and profile sheets. Use unique stationing for designed approach roads and secondary roads.

4.11- Erosion and Sediment Control

- A standard Erosion and Sediment Control Narrative Sheet is developed for EFLHD and will be used for all EFLHD projects with Erosion and Sediment Control Plans.

- See M:\Engineering_Software\Cadd_resource_v8\Standard_Shts\ESC_Narrative

- Copy this file into the project working directory.

- Rename the file according to the EFLHD naming convention [e.g. "M01-lop10(2)_e&s_nar.dgn" for RRP-LOP 10(2) project].

- Re-attach the project border sheet file from your working project directory.

4.12- Temporary Traffic Control

See **Section 6** to create **Plan & Profile Sheet Clipping** using Geopak Civil Software.

4.13- Permanent Traffic Control

See **Section 6** to create **Plan & Profile Sheet Clipping** using Geopak Civil Software.

4.14- Drainage Details and profile

4.15- FLH Standards and EFLHD Details

4.15.1- Introduction

FLH Standard Drawings are intended to cover various design elements and be applicable nationwide. They have been posted on the Western Federal Lands Highway Division office website for repetitive use in the plans. Each standard drawing is available in both Metric and US Customary units and conforms to the FP-03.

EFLHD Detail Drawings are also created within the Division on a continual basis by the Highway Design office to clarify the work required in the plans.

4.15.2- EFLHD Policy

The following are the EFLHD policies regarding Standard Drawings and EFLHD Detail Drawings:

- All three Divisions have one set of Standard Drawings known as the FLH Standard Drawings. These Standards Drawings are located on the WFLHD website.
  http://www.wfl.fha.dot.gov/design/standard/

- Each Division also has their own set of Detail Drawings.
  EFLHD Detail Drawings are located on the EFLHD website. Details 2011
  EFLHD Detail Drawings are also available in the following directory:
  All V8 Details - M:\Standards\EFLHD_Detail-Drawings\V8\

- Use EFLHD Detail Drawings when there is no available FLH Standard Drawing and/or when the Standard is not appropriate for the project.

- **FLH Standard Drawings and Eastern Federal Lands Detail Drawings may be modified based on individual project requirements. Submit *modified* FLH Standards, EFLHD Details and completely new project specific Details to the HD CADD Coordinator, through your HDM, for review prior to including the drawing(s) in your submittal plans. Describe any and all modifications made to the drawing when submitting to the CADD Coordinator.**

- **When FLH Standard Drawings are modified, renumber as follows:**

    i) Modified Standard Drawings become Project Specific Detail Drawings.

    ii) Change Drawing Numbers by adding alphabetic characters.
    (e.g. Standard Drawing # 635-01 will be renumbered as Project Specific Detail Drawing # 635-01A).

    iii) Replace the word "Standard" with "Detail".

    iv) Replace "Federal Lands Highway Division" with "Eastern Federal Lands Highway Division".

    v) Remove "Standard Approved For Use" and dates. (your changes will not have been approved on the FLH level)

    vi) Change the File Name to match the new Detail number.
    (e.g. A Standard file name st63501.dgn would change to st63501a.dgn).

- **When EFLHD Detail Drawings are modified, renumber as follows:**

    i) Modified EFLHD Detail Drawings become Project Specific Detail Drawings.

    ii) Remove "Detail Approved For Use" and dates. (your changes will not have been approved on the EFL level)

iii) Change Drawing Numbers by adding alphabetic characters.
 (e.g. EFLHD Detail Drawing # E633-02 will be renumbered as Project specific Detail Drawing # E633-02A for the English version).

iv) Change the File Name to match the new Detail number.
(e.g. A EFLHD Detail file name st63302_detail.dgn would change to st63302a_detail.dgn).

- **When adopting a detail from a DOT / another source / or creating a completely NEW detail, number as follows;**

    i) New details are Project Specific Detail Drawings.
    ii) Add an "E" prefix and alphabetic character at the end. (e.g. #E602-A)
    iii) Provide a reference to the source of the adopted detail.
    iv) Provide the original source Detail No.
    v) Review/Revise original source detail's Notes.

- **Always use FLH Standard Drawings and EFLHD Detail Drawings from the original sources/directory as shown above and NOT from old project directories.**

4.15.3- Use FLH Standard Details (V8) copied from WFLHD Website

Step I

- Copy border file "**EFLHD_bdr.dgn**" from "M:\Engineering_Software\Cadd_resource_v8\Borders\ "directory into your project working directory. Change file name as per EFLHD naming Convention (e.g. 01-lop10(2)_bdr.dgn for LOP 10(2) project).

- Open eflhd_border.dgn file and choose Metric and US Customary views from the "View Groups" dialog (Metric and English need both views to use Standard drawings downloaded from WFLHD Website).
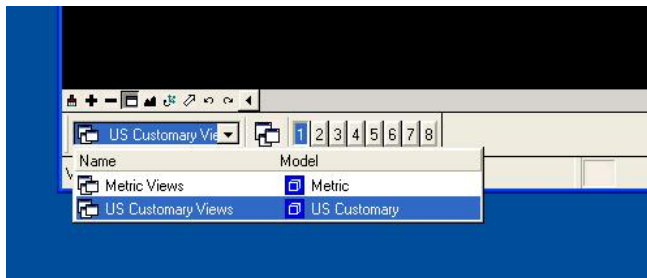
- Edit text for your project information "the top right corner of the border".
(Edit this for both Metric and US Customary views).

Step II

- Copy/Download the Standard drawing from WFLHD Website.
- Choose Metric or US Customary views from the "View Groups" as per your project requirement.
- Turn off the following levels from the active files:
  - D_WFL_Arch
  - D_Trad
  - D_EFL_Handles
  - D_EFL_Border
  - D_EFL_Arch
  - D_CFL_Print
  - D_CFL_Iplot
- Attach your project border from your project directory. Attach Metric or US Customary view as your requirement of your reference file. (Only metric will be used for dual unit)
- Turn off level default and D_EFL_Handles in the border reference file.

Step III
- Make sure to "Save Settings" for your permanent display.

4.15.4- Use EFLHD Details (V8)

Step I

- Copy border file "**EFLHD_bdr.dgn**" from "M:\Engineering_Software\Cadd_resource_v8\Borders\ "directory into your project working directory. Change file name as per EFLHD naming Convention (e.g. 01-lop10(2)_bdr.dgn for LOP 10(2) project).

- Open eflhd_border.dgn file and choose Metric and US Customary views from the "View Groups" dialog (Metric and English both views need both views to use EFLHD Detail drawings).
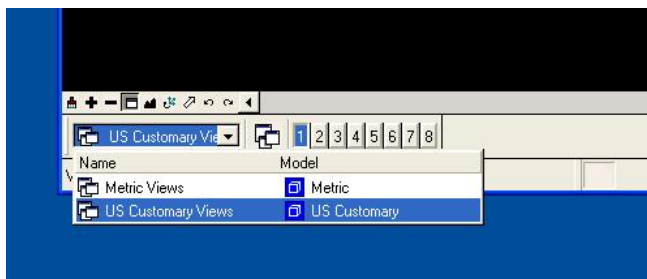
- Edit text for your project information "the top right corner of the border".
  (Edit this for both Metric and US Customary views).

Step II

Copy/Download EFLHD Detail drawing from EFLHD Website.
Or copy from M:\Standards\EFLHD_Detail-Drawings\V8\ directory.

- Choose Metric or US Customary views from the "View Groups"
- Re-attach your project border from your project directory.

Step III

- Make sure to "Save Settings" for your permanent display.

4.16- Cross Section Sheet

See **Section 7** to create **Cross Section Sheets Clipping** using GEOPAK Civil Software.

SECTION 5: Geopak – Basic

5.1- <u>Introduction</u>

GEOPAK 2004 Edition (GEOPAK), the civil engineering design software in use at the Federal Highway Administration's 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 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 preferances).

Step I-   Get the **.TIN** file and **mapping file** from our Survey Branch. The mapping file usually has an extension of "***_map.dgn" (for planimetrics).

Note:-In order to create Profile,Ccross sections,Earthwork, or 3D models with GEOPAK you must have Digital Terrain Module (DTM) file that is compatible with GEOPAK Software. GEOPAK default DTM file is known as .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:\Project\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.

5.2- <u>Geopak Files Names</u>

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.

Note:- In EFLHD the Job number will be assigned by the Highway Design Manager for all the projects. (See 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).

5.3- User Preference

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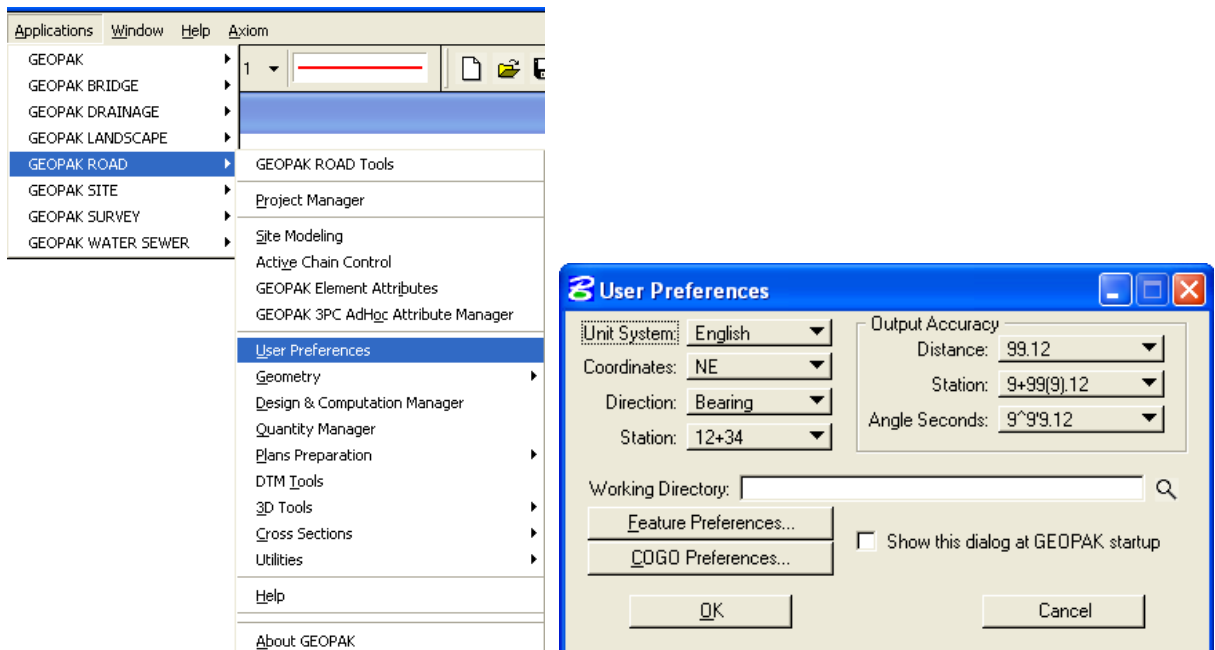
- The **Working Directory** identifies where the data files for a particular project can be found. If a user does not want to work within a specific project, the field may be left blank, and Geopak uses the directory wherein the open MicroStation file is located.

> *Note: - EFLHD designer usually work more than one project; the field to be left blank ALWAYS as a default preference.*

- By clicking the **Feature Preferences** button, the following dialog box is invoked.
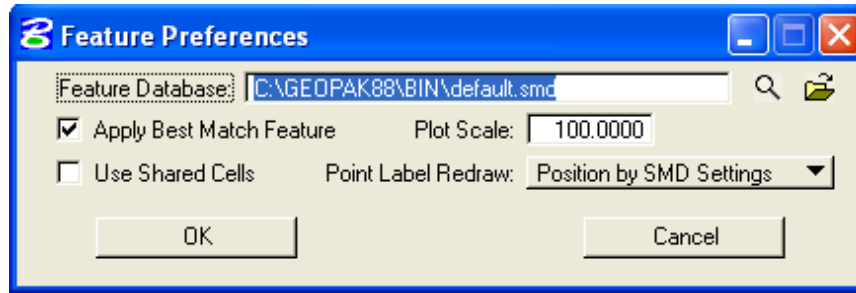
This defines the default file utilized for representation of coordinate geometry and survey elements when visualization is utilized during an active coordinate geometry session as well as the scale in which these elements will be displayed.

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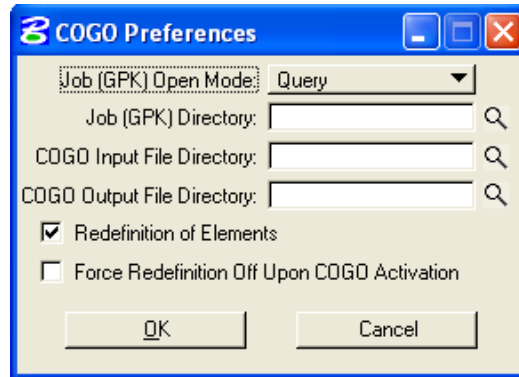
The **Job (GPK) Directory** field specifies the location of the **GPK** file. If any of the above directory fields are blank, they will default to the **Working Directory** set in the **GEOPAK User preferences dialog box** (EFLHD's preferred set up- Kept blank as above shown directory).

5.4- <u>Setting Up Project Manager (Geopak)</u>

5.4.1- 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).

Note:-It is required to use the Project Manager for all EFLHD projects working with MicroStation V8 and Geopak X30.

- Open MicroStation design file. Invoke **Project Manager** by either using the pull-downs **Applications** > **Geopak Road** > **Project Manager**
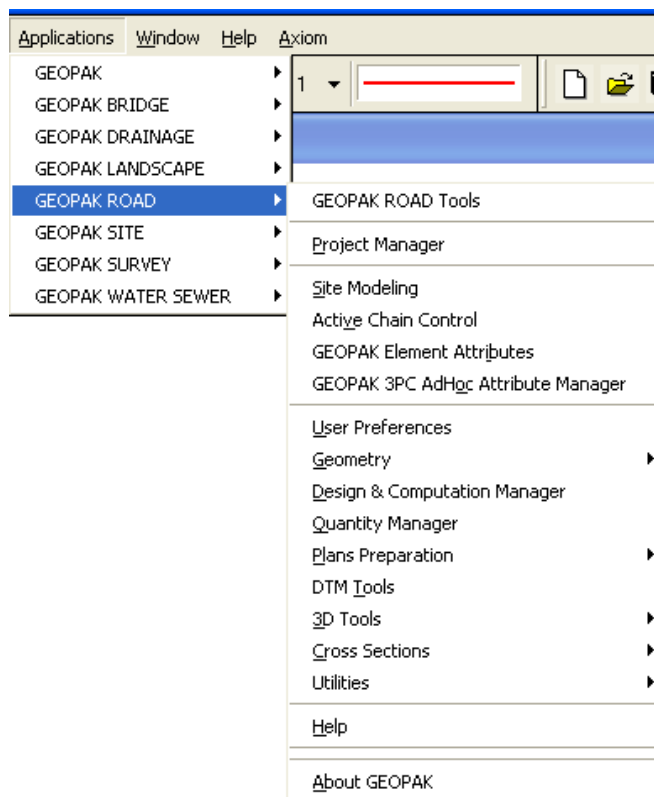
- Or by using the **Tools icon** shown below:

- 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.

Current directory is displayed

Existing Project file display area
- *Empty space means no existing project present at the current directory.*

To navigate the current directory structure area
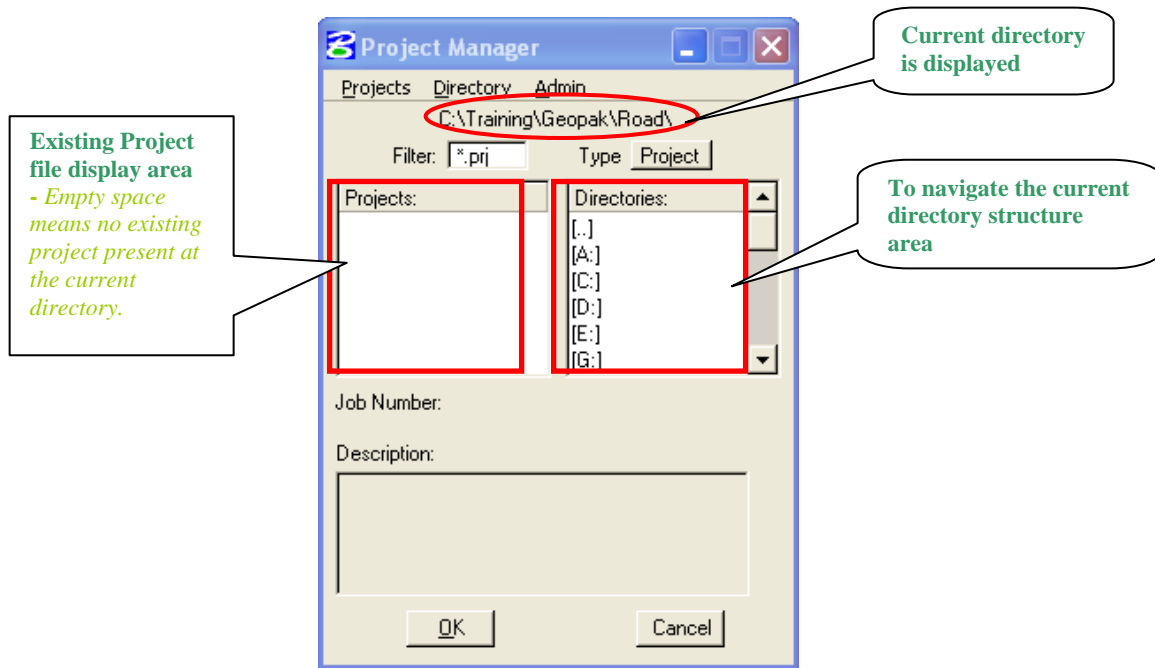
Project Tools

- There are four options under the **Projects** pull down, **New**, **Edit**, **Delete** and **Exit** as shown below.
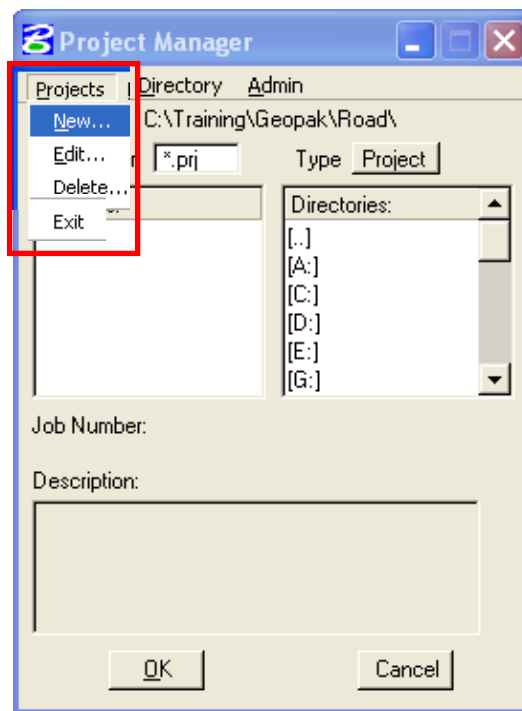
- The **New** menu option is used to create a new project. The .prj file is stored in the directory shown in the Directory path at the top of the Project Manager Dialog box.

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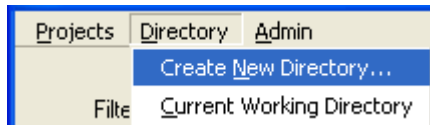
The **Create New Directory** option creates a new directory on your computer within the current directory. If the Current Working Directory option is chosen, the directory path in Project Manager is changed to that directory.

Note: - *Always select the Current Working Directory to access the Road Project.*

Administration Tools

- The **Administration menu** option is used to set a password on a project, if desired.
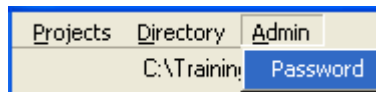
Note: - *Never Select Password for EFLHD's Project.*

5.4.2- Create a Project

Step I

- EFLHD always recommend 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:
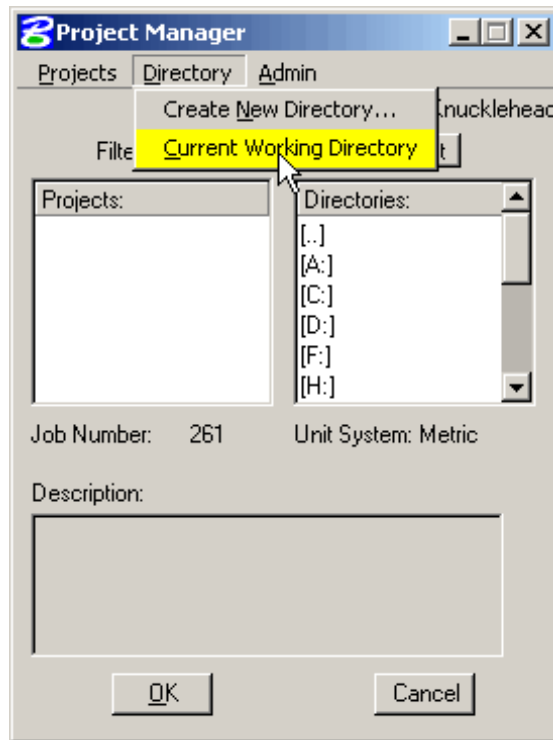
- Once the Directory is set, create the **New Project** by using the Project Manager pull-downs, **Projects** > **New** as shown below:
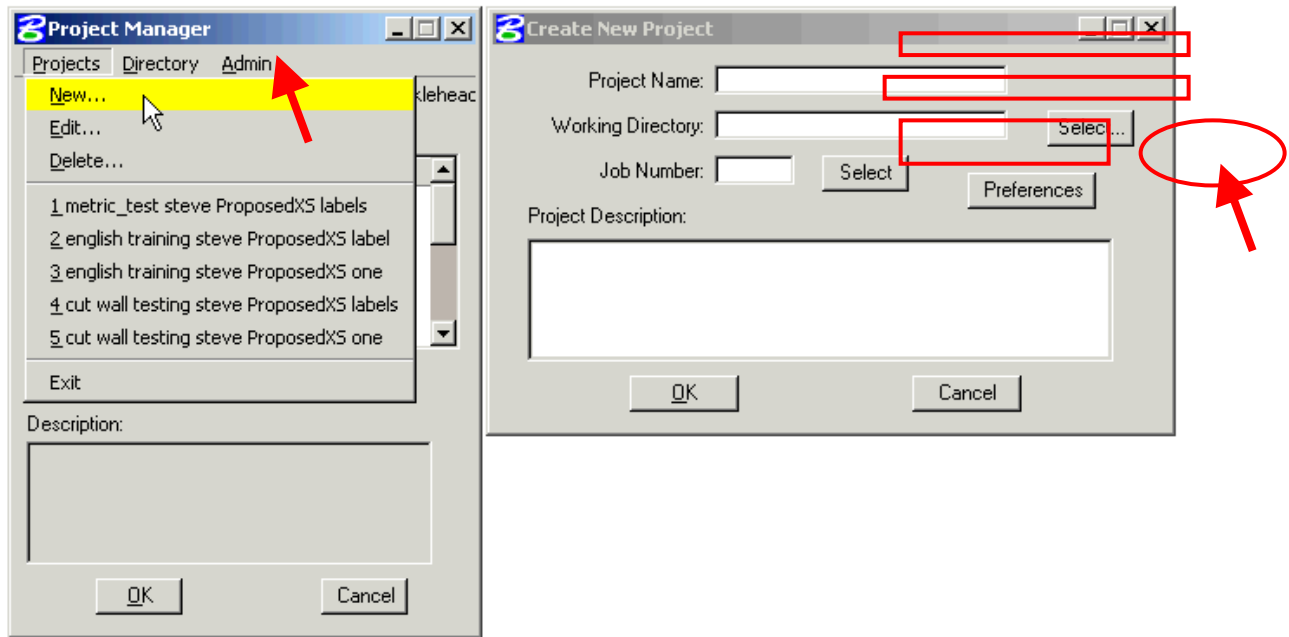
- Key in the **Project Name,** the **Project Name** can be any number of alphanumeric characters.

- 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 assigned by Highway Design Manager/CADD Coordinator.

    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:-i) The **Project Name** specified is combined with a ".prj" extension to create the main Project Manager set-up file in the working directory.*

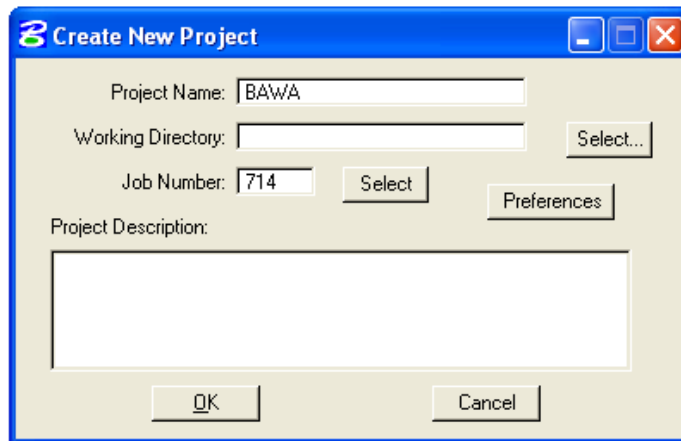   **Step II**

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

74
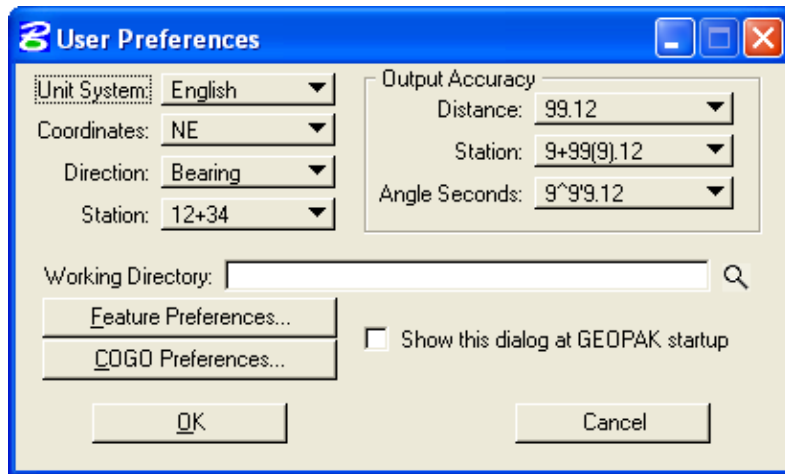
- Set the desired project related preferences. US Customary Unit specific preferences in EFLHD are shown in the dialog boxes below.

- 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 5.3**.*

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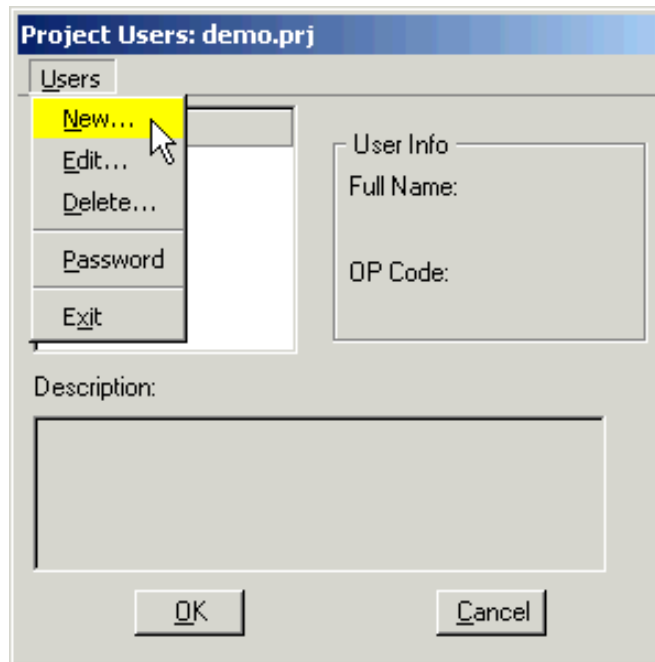

- Type a short **Project Description** in the "**Create New Project"** dialog box.

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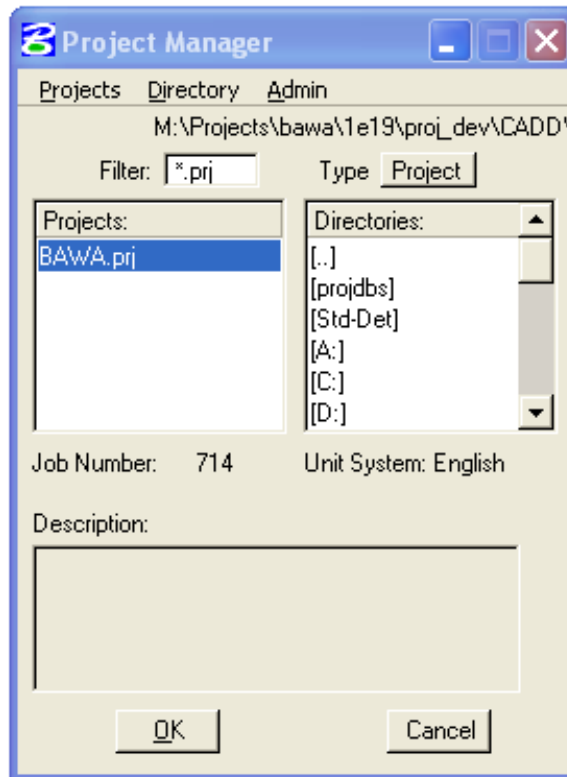
Step III

<u>Create a User</u>

- 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**:
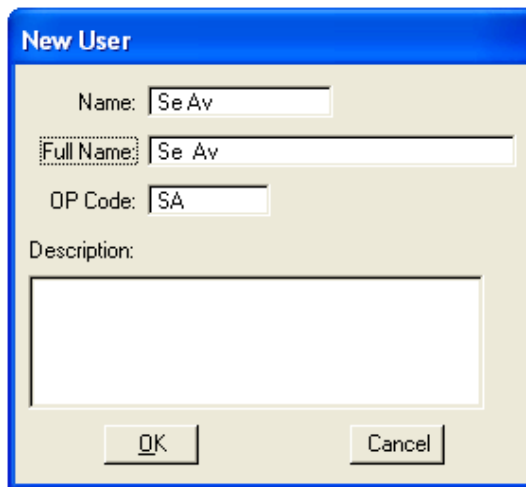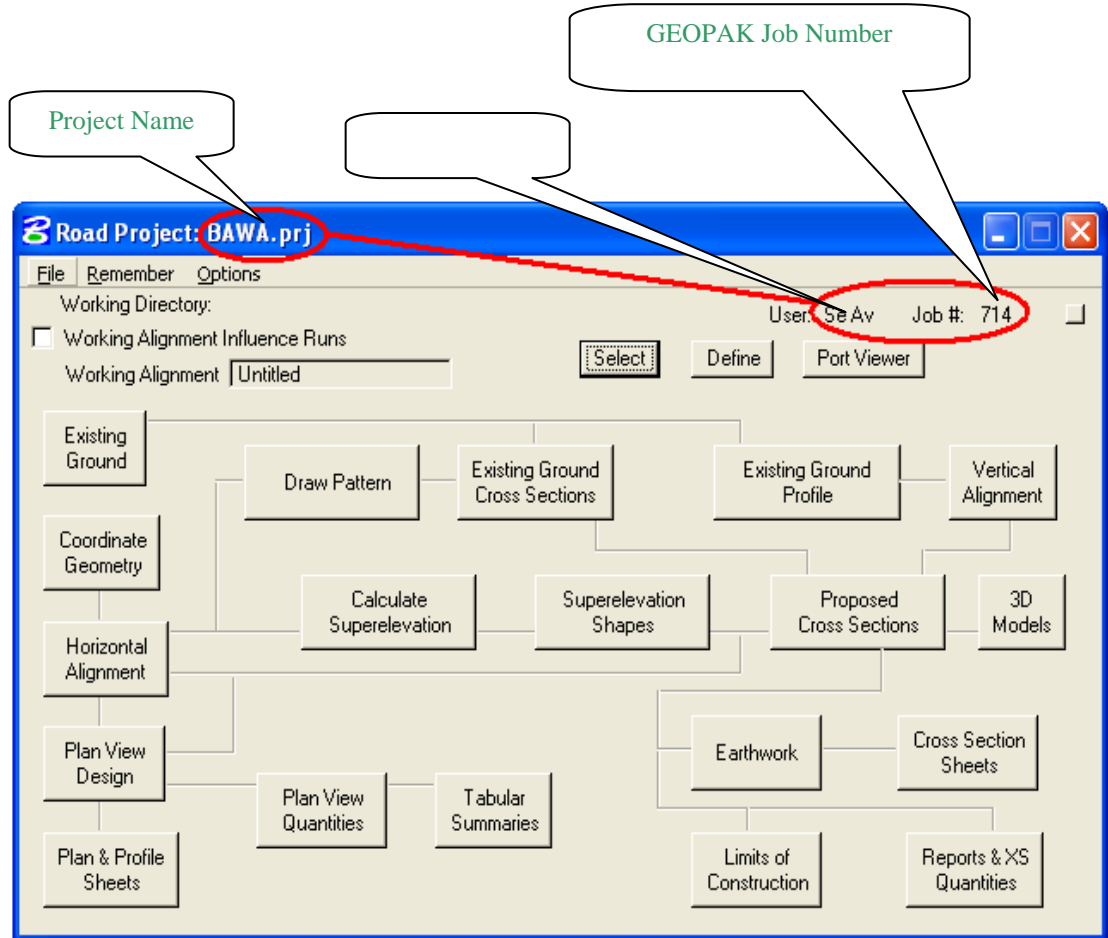

Note:- EFLHD policy is to create and use only one user for one project and not to use password.

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

Project Users: BAWA.prj

Users

Project Users:
[Se Av]

User Info
Full Name:
Se Av

OP Code:
SA

Description:

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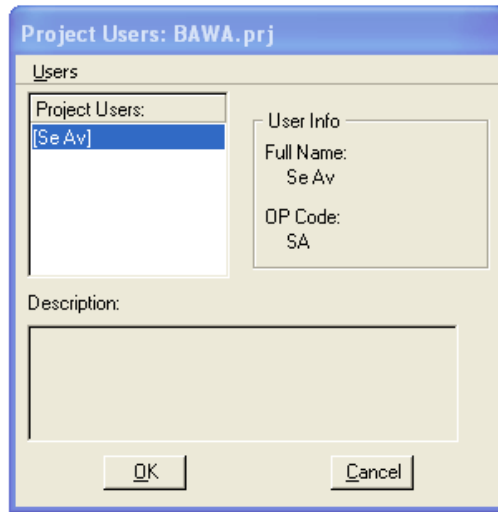
- When **OK** is pressed the Project Manager **Road Project** dialog will appear as shown below. Notice the **Project name**, the **User** name and **Job #** match what was previously set up.

GEOPAK Job Number

Project Name

Road Project: BAWA.prj

File   Remember   Options

Working Directory: User: Se Av   Job #: 714

☐ Working Alignment Influence Runs

Working Alignment [Untitled]   [Select]   [Define]   [Port Viewer]

Existing Ground

Draw Pattern   Existing Ground Cross Sections   Existing Ground Profile   Vertical Alignment

Coordinate Geometry

Calculate Superelevation   Superelevation Shapes   Proposed Cross Sections   3D Models

Horizontal Alignment

Plan View Design

Plan View Quantities   Tabular Summaries   Earthwork   Cross Section Sheets

Plan & Profile Sheets

Limits of Construction   Reports & XS Quantities

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.

File pull down menu support **Close** and **Exit**:-

Close- user returned to the Applications dialog box.
Exit-   user is exited from the Project Manager.

Click this square will expand/condense the dialog box

User can instruct the software to remember the **Project**, **User**, or Road in subsequent sessions.

Note: EFLHD prefer not to select any option here.

Auto Sink option can be enabled:

The Road Project flow chart sinks behind all open views when any tool is selected from the flow chart.
Once the tool is closed, the Road Project flow chart will be brought to the top of the view window.

5.4.3- 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 the required information. On a simple project, only one working alignments 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, and 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:
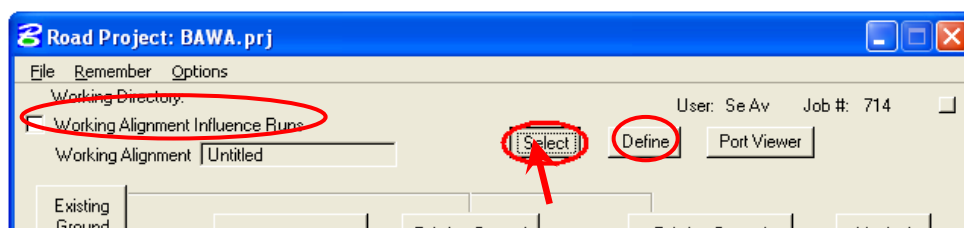
- The **Select Working Alignment** dialog appears. Use the pulldowns and select **Run** > **New** as shown below. Click on **OK**.
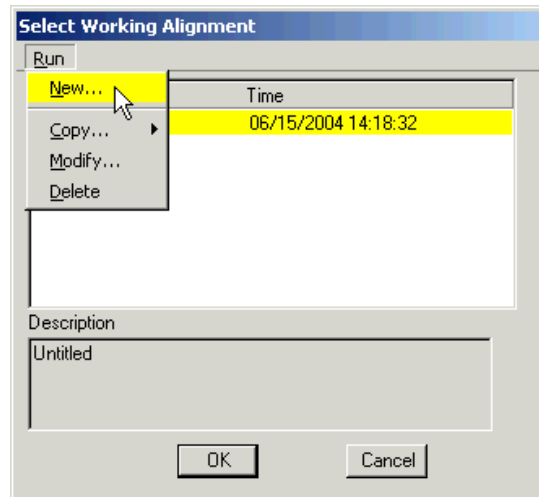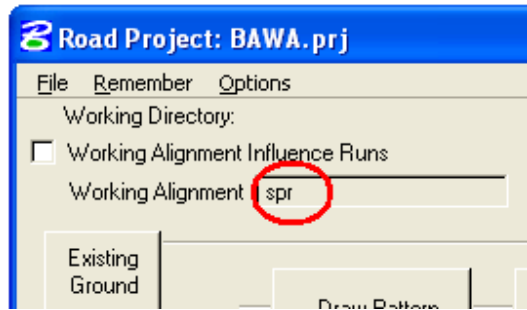

- The **New Run Name** dialog appears. Type in the name of the "Run" to create. The **Description** field is optional. Click on **OK**.
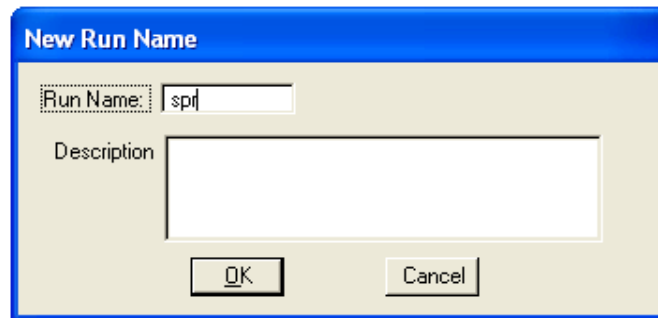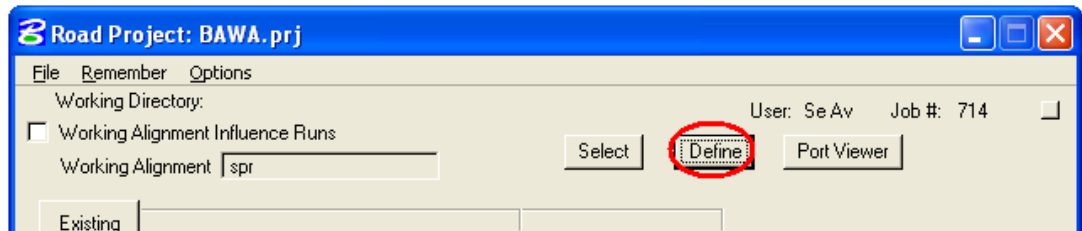

- The **Select Working Alignment** dialog appears. Highlight the desired run (you may eventually have several) and click on **OK**.
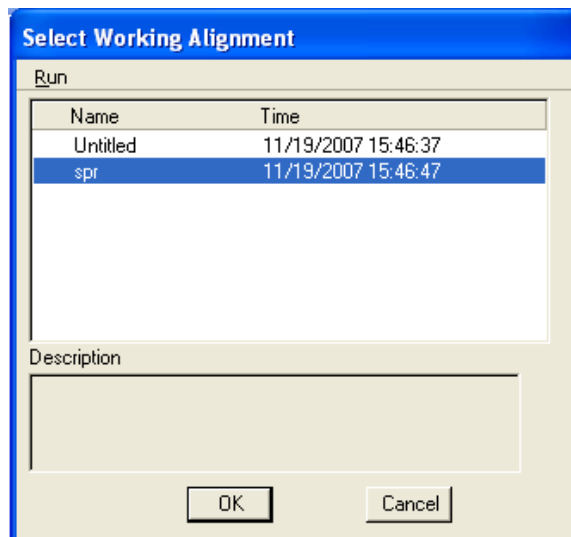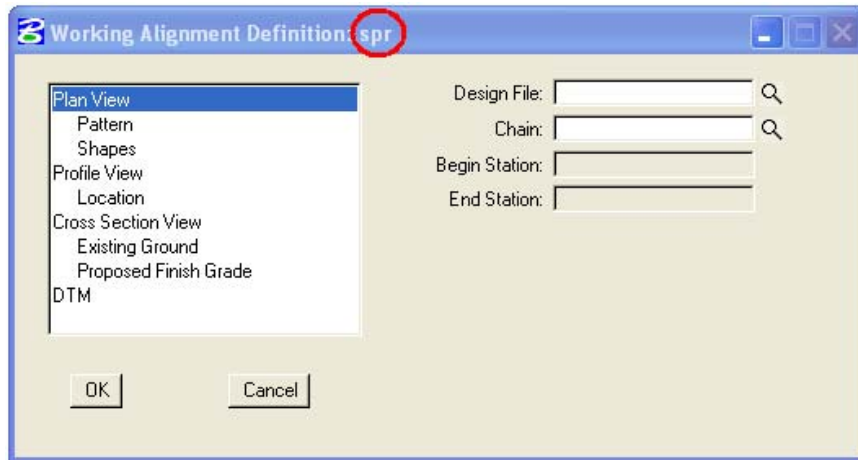
- Notice how the Project Manager (**Road Project**) dialog is now set to use the Working Alignment "**spr**", as shown below:

- 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 "**spr**".

- 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.

5.4.4- Project Manager Process
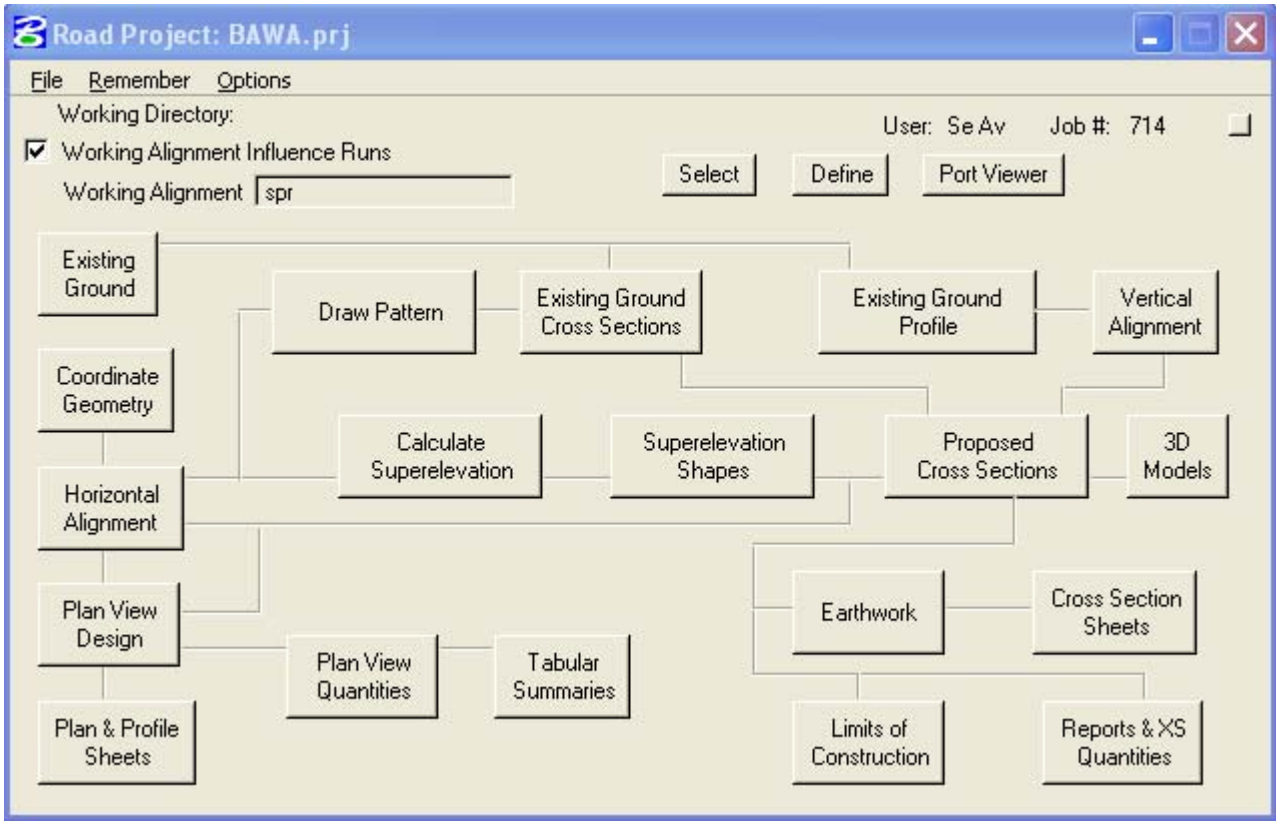
The primary **Project Manager** dialog box is depicted above. The advantage of utilizing the **Project Manager** rather than selecting functions directly from the **Road** menu is that pertinent information stored within the **Project Manager** is automatically displayed within the invoked dialog box. 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.

5.5- Create 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.

5.5.1- 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.

Tool Bar consist of drop down options and icons

COGO Key-in: This field enables manual entry of COGO commands.

Output Display Windows shows the results generated by the commands.
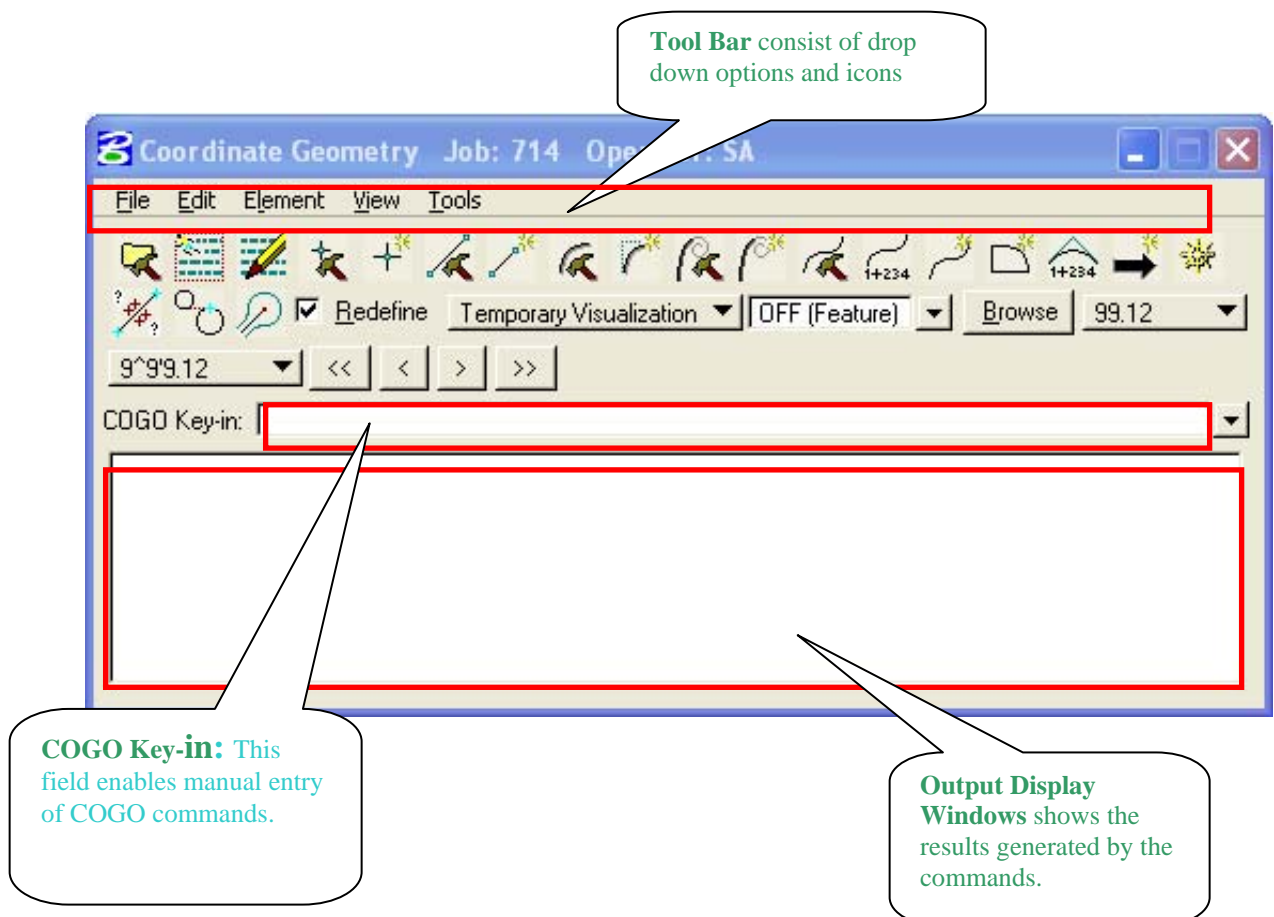
5.5.1.1- Steps to follow to create a Chain from Point A to B as shown:
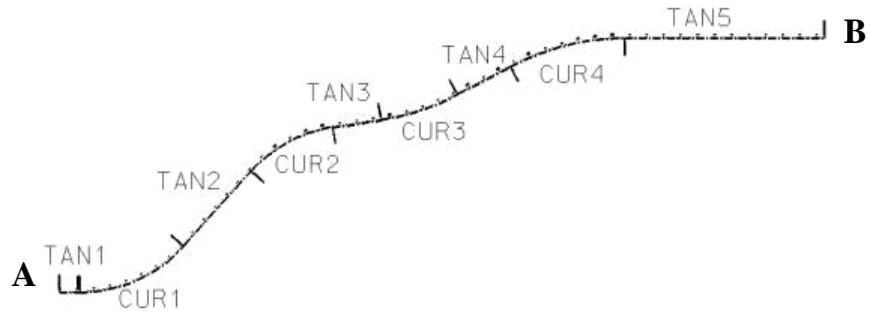
__Chain from Point A to Point B__

		Y (Northing)	X (Easting)	
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:
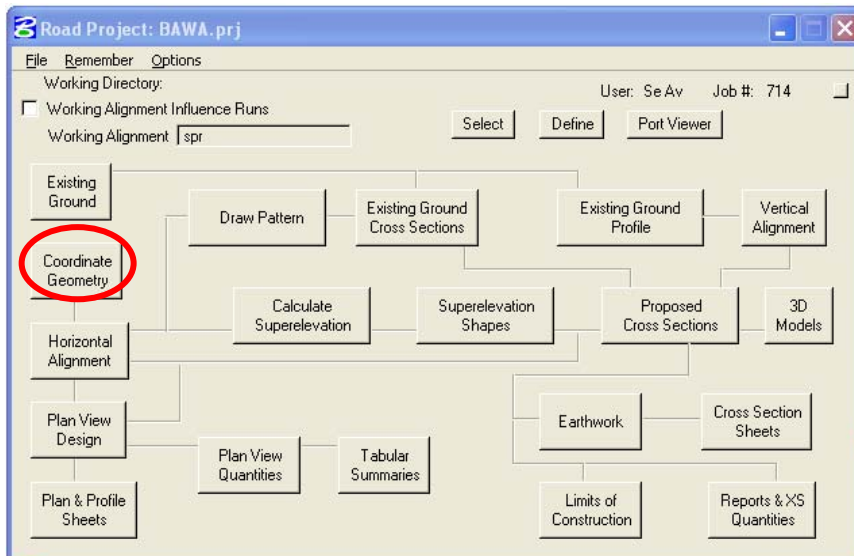
You can also select the Coordinate Geometry button on the GEOPAK main dialog box.
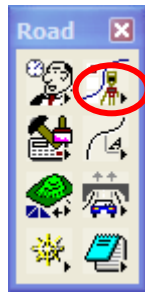
The Geopak Coordinate Geometry dialog box appears as shown below.
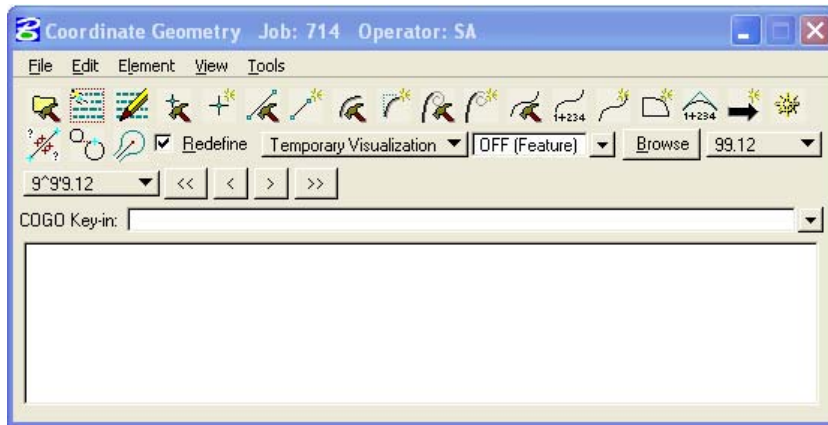
Note:-If you are using Project Manager, Coordinate Geometry dialog box will be invoked. Otherwise, the Job Number and Operator code will have to be entered in the COGO Startup dialog box. Project Name and Subject are optional fields. Press the OK button to bring up the Coordinate Geometry window.

Step 2: Store Points

Select Store Point follow **Element → Point → Store** from the **Coordinate Geometry** dialog box.
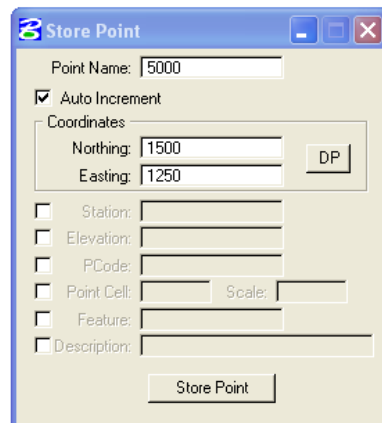
- Enter Point # (start with *5000*)
- Check the *Auto Increment* Box
- Enter the *Northing* and *Easting* for the point from above given data.
- Store Point
- Repeat until all *from* and *to* points have been stored. (You should have 10 points, starting from 5000, 5001………5009)
- Close the Store Point dialogue box.

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

Select Store Chain follow **Element →Chain → Store** from the **Coordinate Geometry** dialog box.
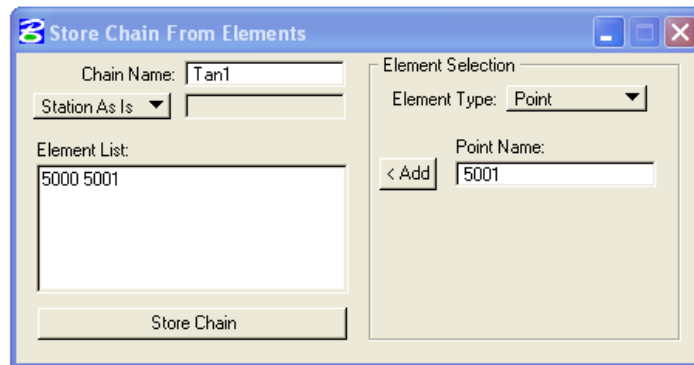
- Chain name: Tan# (Starting with *Tan1*)
- Change *Begin Station* to *Station As Is*
- Under Element Type select *Point*
- Point Name: Type in the points between which the tangent falls. (for example: Tan1 lies between 5000 and 5001, so type 5000 first and hit *Add*, then type 5001 and hit *Add*)
- 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 Curve**

Select Store curves follow **Element→Curve→Store→By End Points** from the **Coordinate Geometry** dialog box.
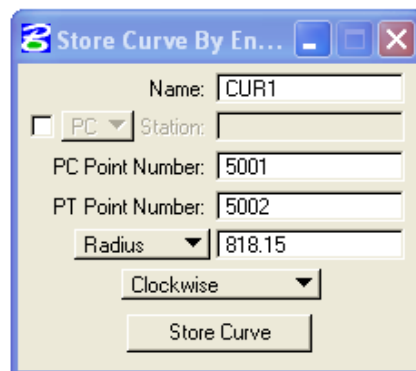
- Name: Cur# (Starting with *Cur1*)
- Enter the PC point# (To-point of back tangent)
- Enter the PT point# (From-point of ahead tangent)
- Change *PI Point to Radius*, and enter the *radius* of the curve from above given data.
- Choose *clockwise or counterclockwise* based on the direction of curve.
- Store Curve
- Repeat until all curves have been stored. (In all u should have 4 curves, starting from Cur1, Cur2…..Cur4)
- Close the Store Curve dialog box.

Step 4:   **Store Chain for whole Alignment**

Select Store Chain again follow **Element→Chain→Store→ From Element** from the **Coordinate Geometry** dialog box.
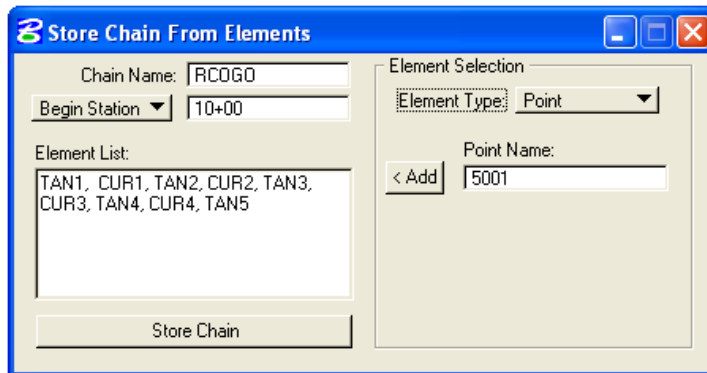
- Chain Name: *RCOGO*
- Change *As Is* to *Begin Station* and enter *10+00*
- Set the Element Type (which is *Point* at present) to *Chain* and add *TAN1*
- Now set the Element Type to *Curve* and add *CUR1*
- Continue adding all chains (tangents) and curves in the proper order. (TAN1, CUR1, TAN2, CUR2, ……….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.

5.5.2- 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.

5.5.2.1- Graphical COGO:

- Graphical COGO can be accessed by selecting:
  Applications>Geopak Road>Geometry>Graphical Coordinate Geometry, as shown below.
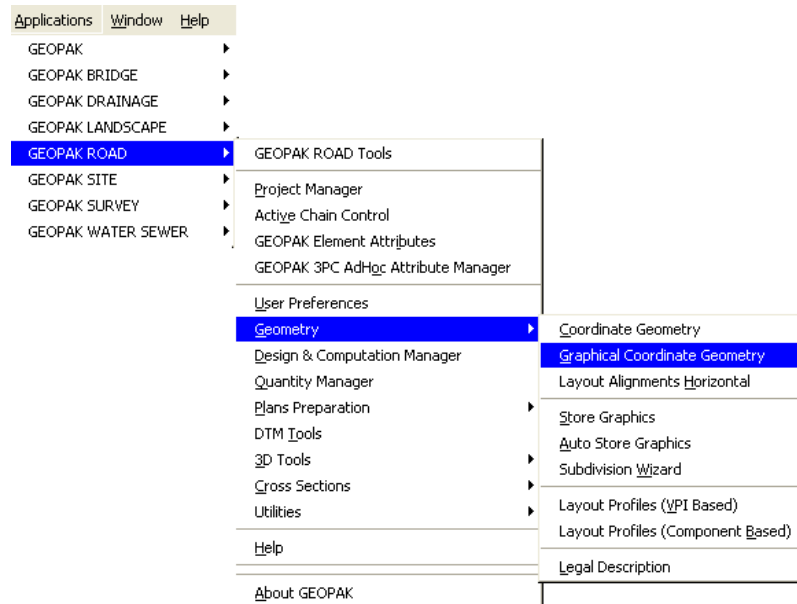
- **Graphical COGO** can also be accessed by selecting the icons from the main **Geopak Road** tool box.
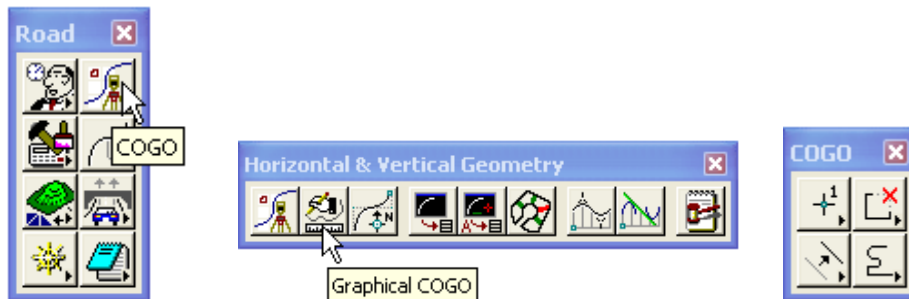
5.5.2.2- <u>Horizontal Alignment Generator:</u>

- Horizontal Alignment Generator can be accessed by selecting:
   Applications> Geopak Road >Geometry>Layout Horizontal Alignments, or

- **Or Horizontal Alignment Generator** can be accessed by selecting the icons from the main **Geopak Road** tool box.
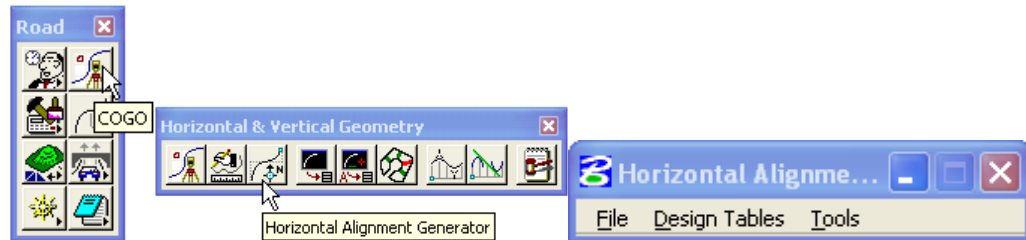
- The **Horizontal Alignment Generator** can also be accessed using **Project Manager** by clicking on the **Horizontal Alignment** button on the flow chart.

   *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.
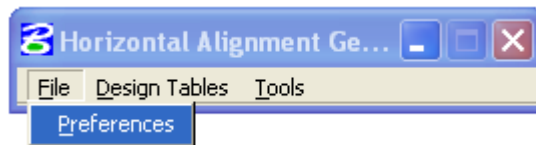
- The **User Preferences** dialog is very useful. It allows the user to preselect the **Element symbologies** for lines curves and spirals, as well as the symbology for the "Modify" tool. This makes it very easy to distinguish the geometric components from each other while laying out the alignment.
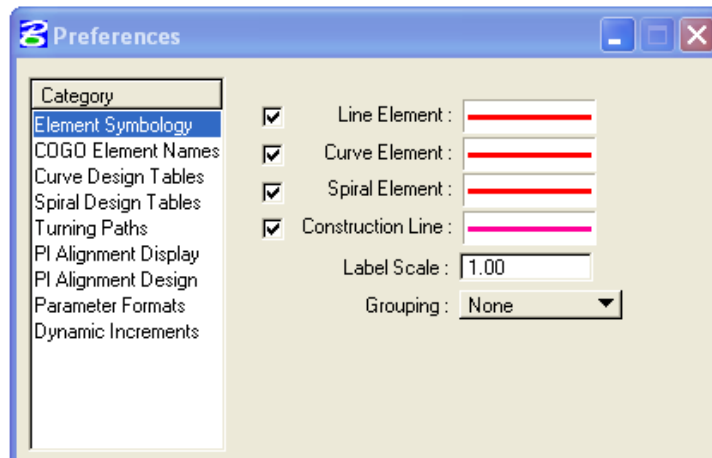
Note:-1) An important thing to remember is that the components never have to be drawn graphically in order to be manipulated later. COGO has several "Visualization" options. It is possible to simply "Temporarily Visualize" a component or components for manipulation or for storing the components as a 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. I would recommend using "Temporary Visualization". This way nothing is ever written to the file.

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…)
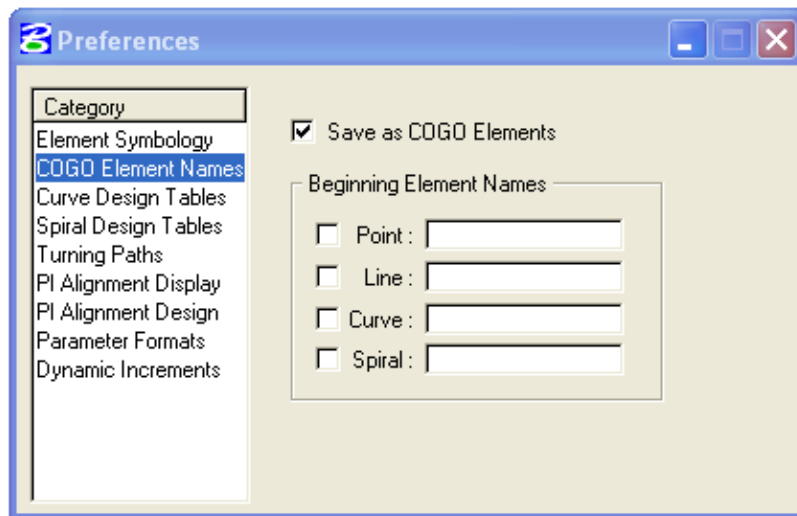
  One very important option on this dialog is "**Save as COGO Elements**", (mentioned earlier). This is what differentiates between whether the components will be stored as graphics (single precision) or as COGO elements (double precision). To save the components directly to the GPK database and as **double 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 does not have the Curve Design Tables setup yet. We are using as default setup by 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_v8\X_30\Standards\Bin\english or metric"
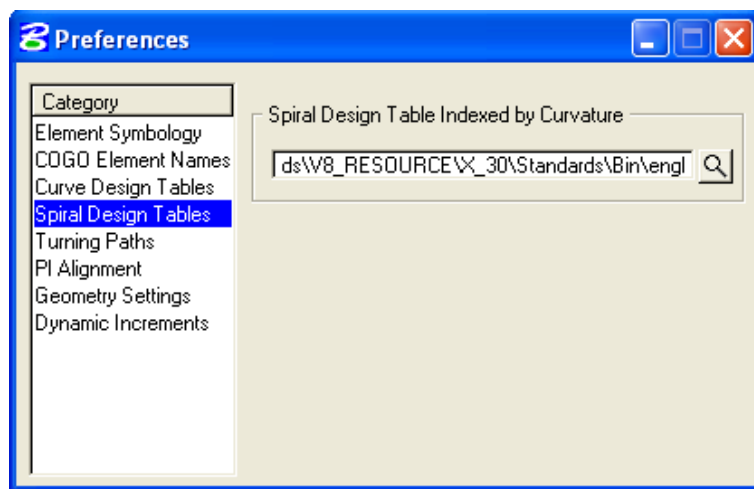
The **Design Tables** menu allows the user to view the settings for the current default design tables. In the **Design Tables** pulldown, the user sets the paths and file names for the tables to be accessed. Once the English or Metric Spiral Curve table is selected, select the design speed and number of lanes. These tables correspond with the AASHTO Green Book.
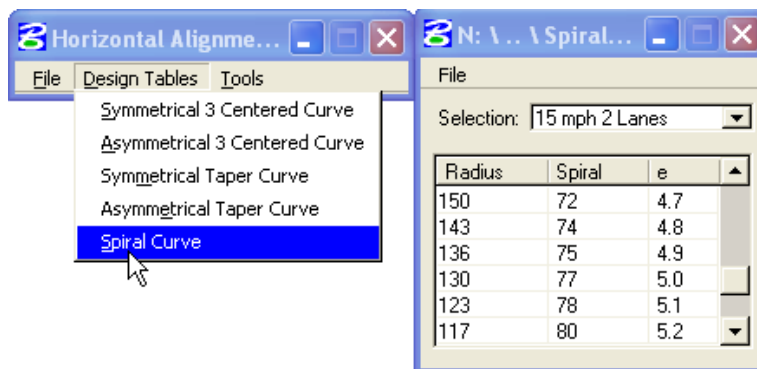
Note:-Currently EFLHD uses only the Spiral Curve tables (Metric and English).

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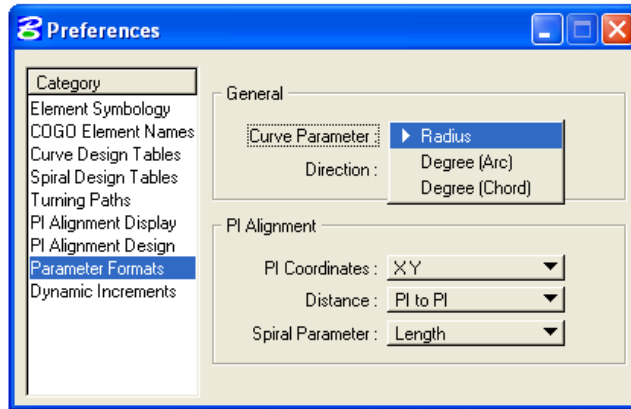
- Under the Category **Dynamic Increments,** the user selects the Increment adjustment Values, as shown below.

  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**.
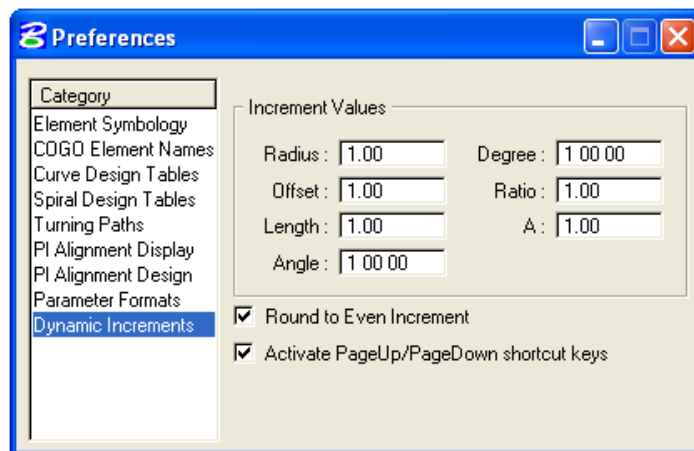
- The **tools** menu activates the COGO tools that will be used to create geometry elements. Selecting **Tools>Main** accesses the following tool frame.
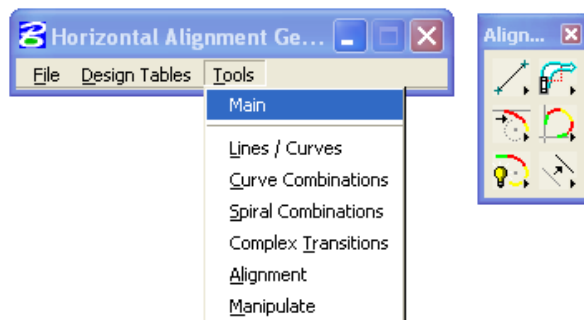
- From the main tool frame , shown above, additional tools may be accessed from each of the six main tool box icons. Each of the tool boxes, as well as the tools from Graphical COGO, may be used together to create any combination of geometry, from the simplest to the most complex.

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

5.5.2.3- 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_v8\X_30\Standards\Bin\english. Browse to this directory and select the appropriate table file.
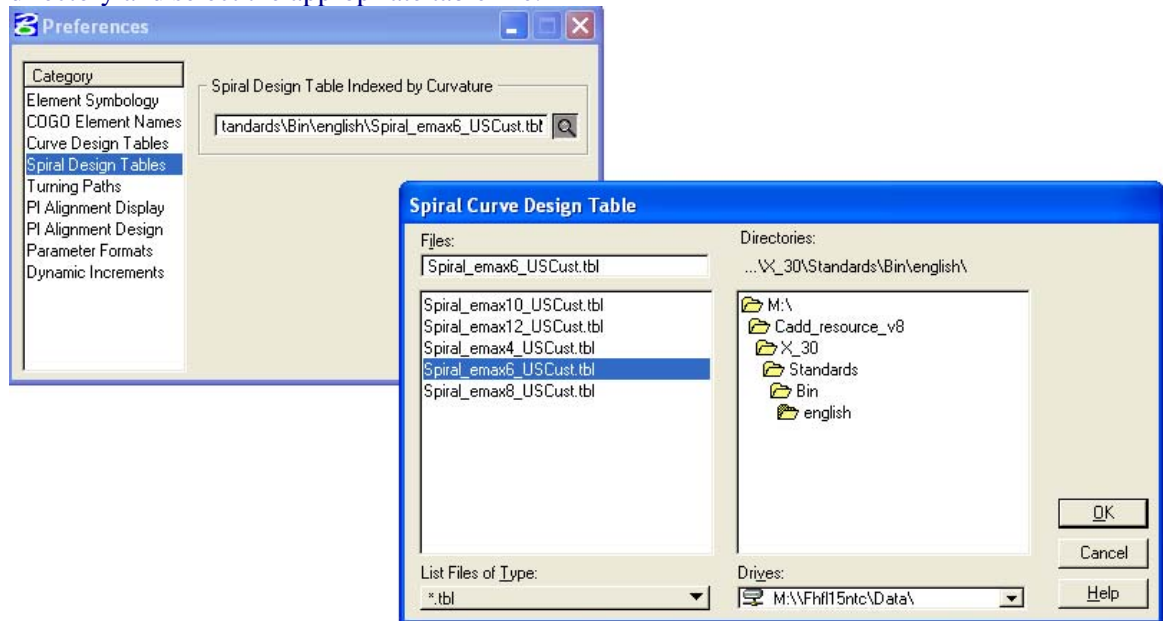
- Select the Main tool box from the Tools pulldown (as shown previously).
  To place a typical Spiral Curve Spiral (SCS), (most common way):

- 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.
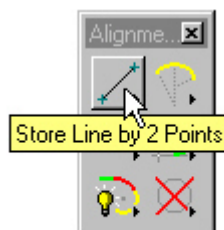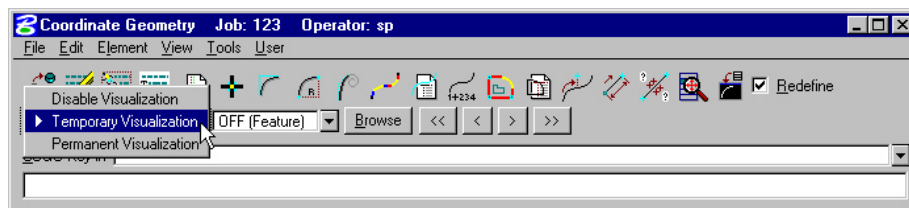
- Select the Place SCS (Intersecting Elements) tool. Identify the tangents, (follow the on screen prompts). Once the second tangent is identified, the 3 elements of the SCS will appear (as keyed-in in the dialog). To "Modify" the length values, you may highlight one of the length fields and use the little 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.**
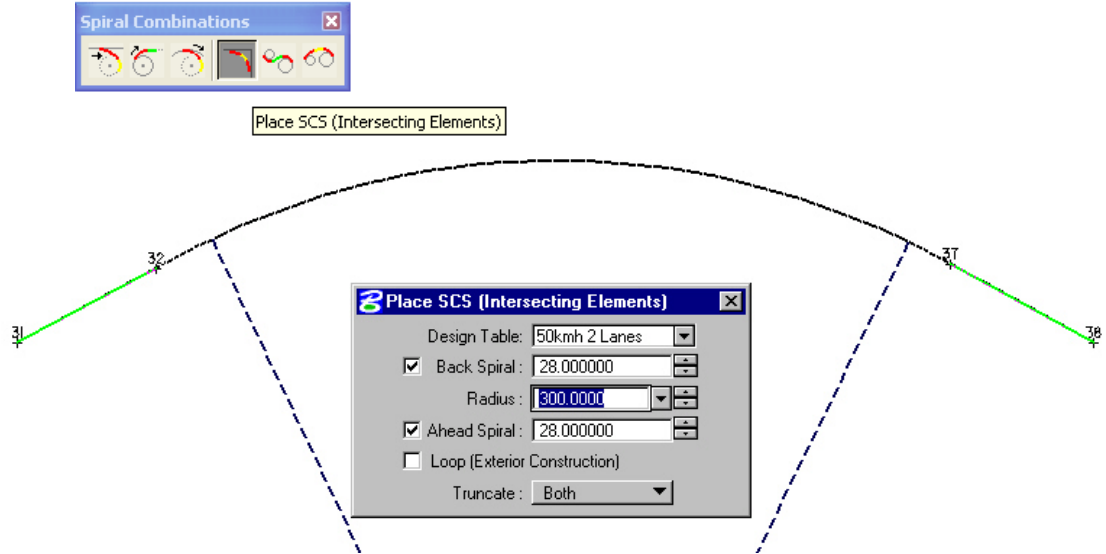
- Storing these components as a chain is much easier with Geopak 2001. Even though they are not actually drawn graphically… Geopak can see them. To store (for example) these 5 components as a chain, invoke the Geopak 2001 Store Chain tool.
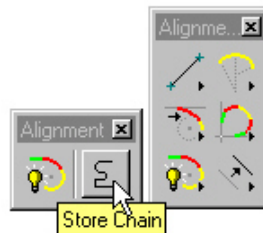
- With Geopak 2001 Store Chain there is no need to continuously click until all of the elements are collected. Simply complete the dialog with the Chain Name, Begin Station etc… and data point any component that is visualized and accept it with another data point. All adjacent components will be considered 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.
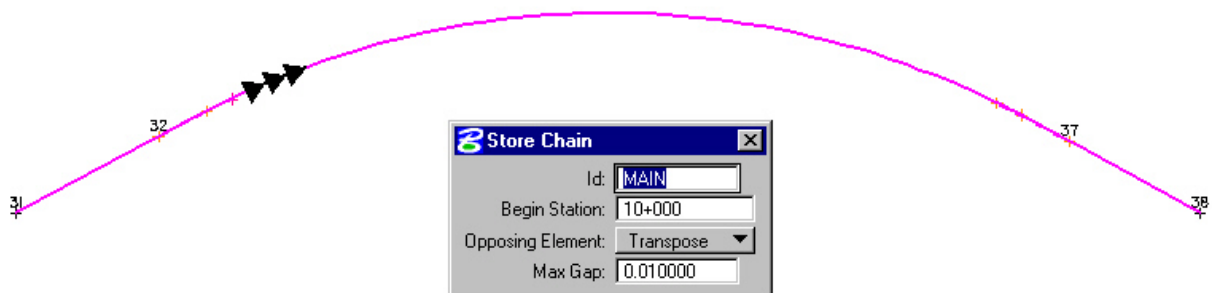
- You may have noticed that on the Store Chain dialog there is an "Opposing Element" option. The options are Transpose and Create. These options are given because sometimes the components may not be stored all going in the same direction. When you store the chain at a direction and some of the components 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.

<u>For a little more complicated example…. Let's place an SCSCS, (an easy way)</u>

- Make sure that **"Temporary Visualization"** has been selected in COGO**, (shown previously in SCS example).**
- Create the entry tangent, using the Store Line by 2 Points tool, (shown previously in SCS example).
- Create the first SC using the Place SC Tangent to Line tool.

Note: There is a "Truncate Back Element" option available with these tools, I would suggest using it to trim the back components.
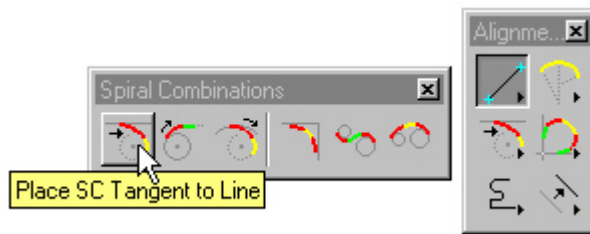
- **Create the** second SC **using the** Place SC Tangent to Curve **tool.**
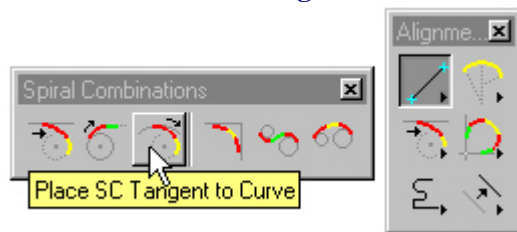
- **Create the** exit Spiral **and it's** exit Tangent **using the** Place ST Tangent to Curve **tool.**
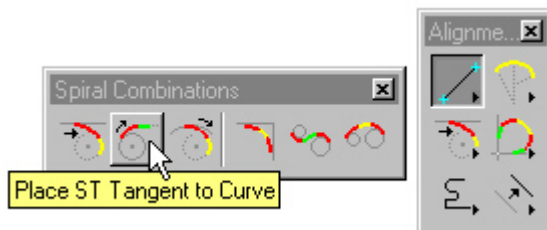
To create a switchback (delta that exceeds 180 degrees) SCS

- Make sure that "Temporary Visualization" has been selected in COGO, (shown previously in SCS example).
- Create the entry and exit tangents, using the Store Line by 2 Points tool, (shown previously in SCS example).
- Invoke the "Place SCS (Intersecting Elements)" tool. Make sure you have "Loop (Exterior Construction)" checked. Identify and accept the first tangent. Identify and accept the second tangent. Pretty simple!
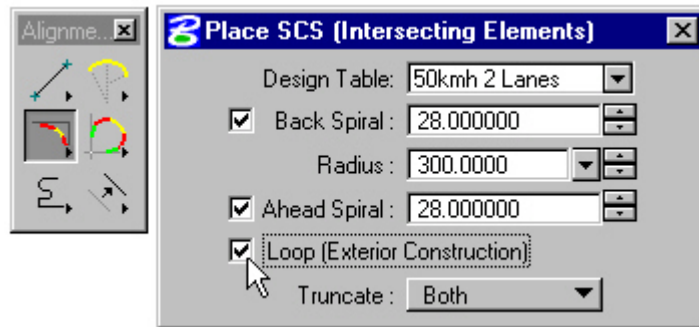
There are many other cool tools available with Geopak 2001... such as Place Dynamic Alignment... This tool allows you to pre-select geometric values and design "on the fly". Give it a try.
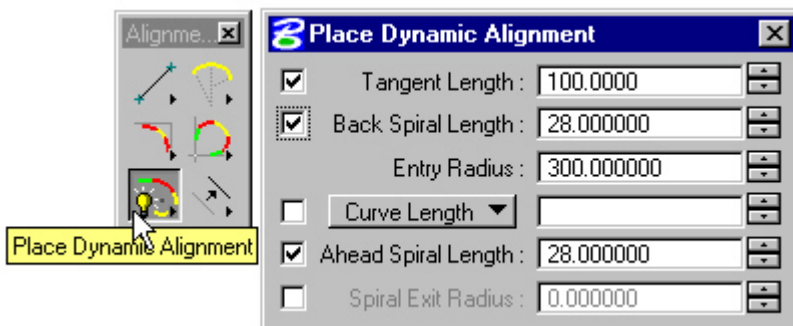
To Modify the Visualized elements:
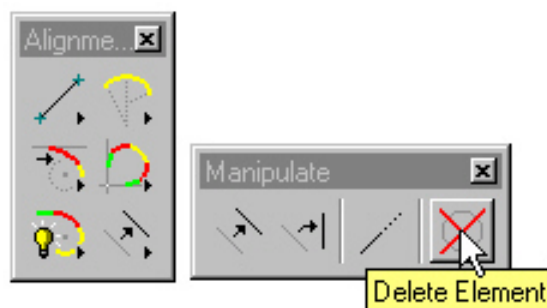
Visualized elements can be further manipulated using any of the 4 "Manipulate" tools.

- 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 similar to the old RDS listing that many people are familiar with.

OR…

- At the top of the COGO dialog box type DES CHA [chain name].
- …or… use the COGO pulldowns, 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.

5.5.3- <u>Store Graphics:</u>

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**
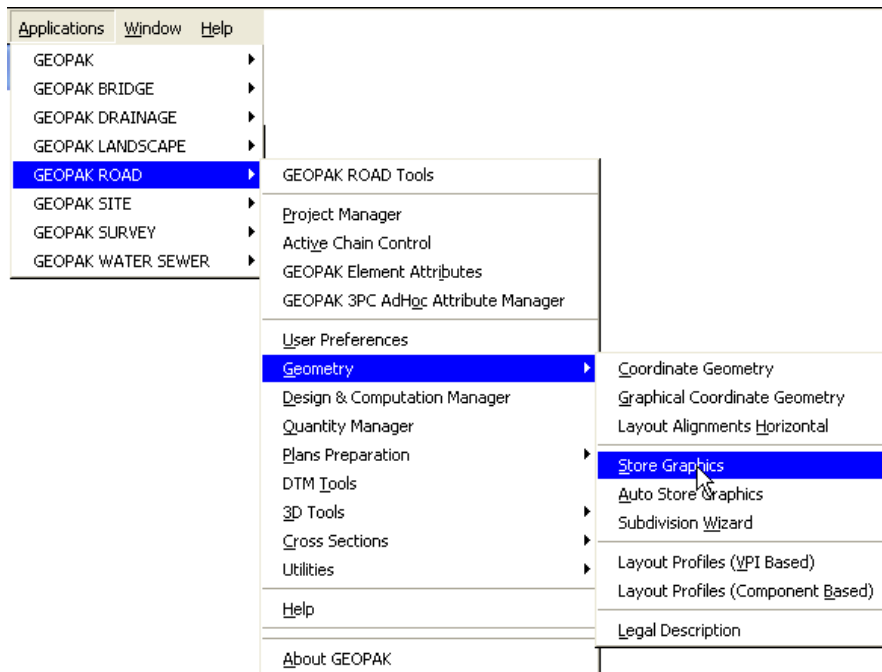
- Or by selecting the icons from the **Geopak Road tool** box as shown below:

- 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.
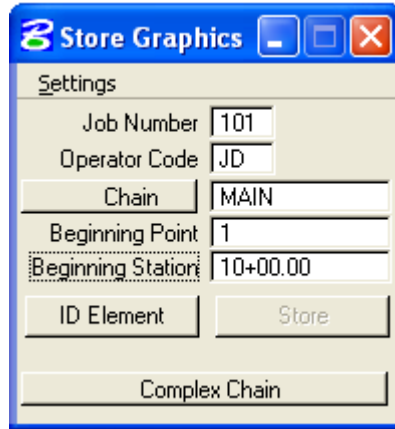
Note:-Advantages –Use simple Microstation commands to layout alignment, adjustments to alignment are quick, and the only point numbers used are on the alignment (usually just the first and last).

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.*

5.6- Display the Horizontal Alignment And Drawing Other Plan Features

5.6.1- 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_v8\X_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
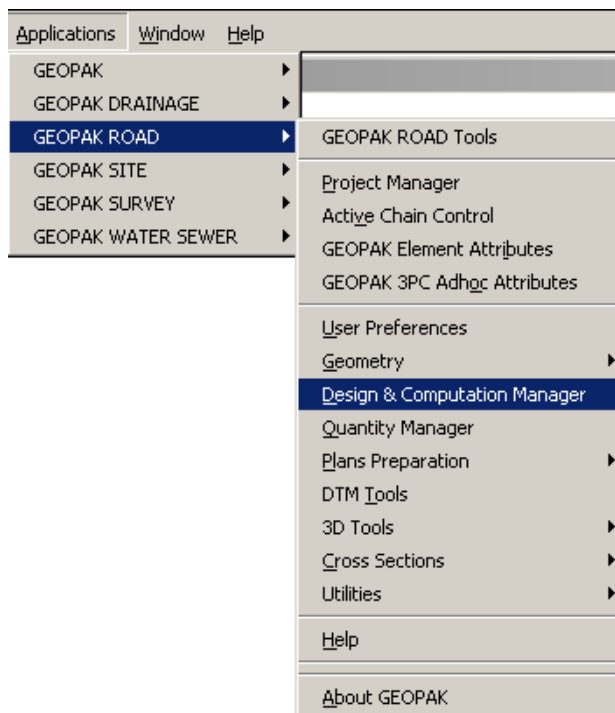
- Or can be access from the **Road Tools** icon as shown below:
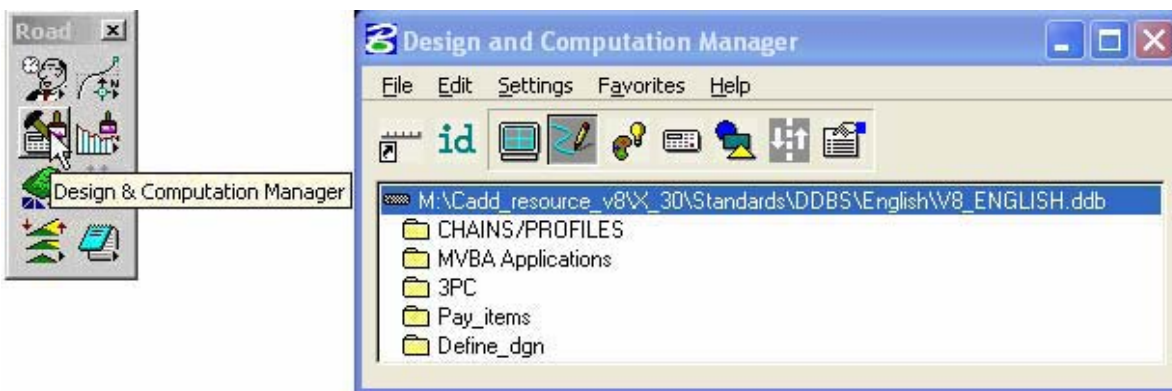
*Note:- The EFLHD **.ddb** file is already attached through **project configuration** setup. If **EFLHD's D&C Manager** is not attached as shown above, then change it through **File>Open**>and **select** the"*
M:\Engineering_Software\Cadd_resource_v8\X_30\Standard\DDBS\English\V8_English.ddb".

- In the **"Design and Computation Manager"** dialog box, Select CL Proposed Centerlines/Baseline as shown below:
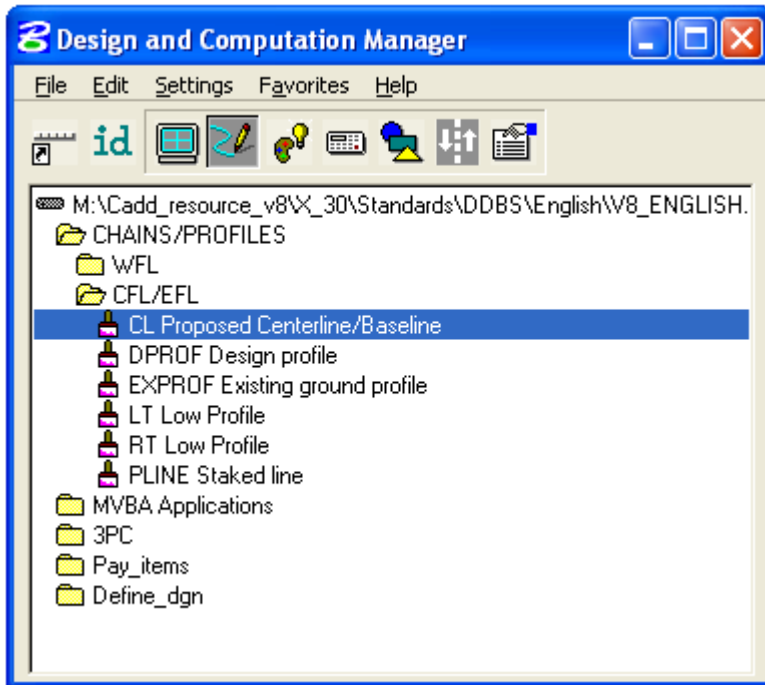
- **Single click on** Draw Plan & Profile **… as shown below:**
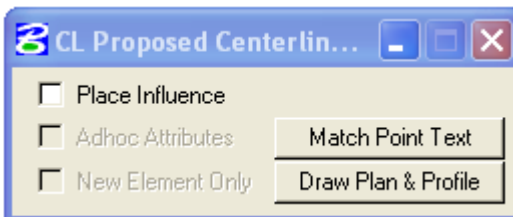
- **Key in or** Select **the** Job Number **… as shown below and click on** OK **(in both dialogs):**
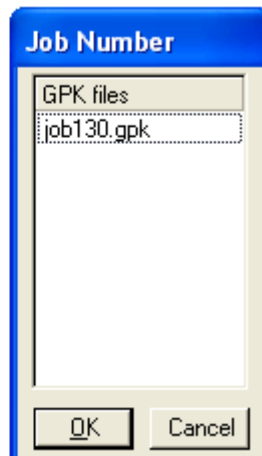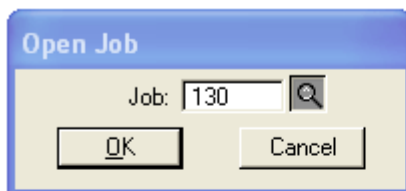
Note:- This step (shown above) will not be necessary if the Project Manage is open.

Display the Chain Information:

- Toggle "**Element Type**" to **Chains** … as shown below:
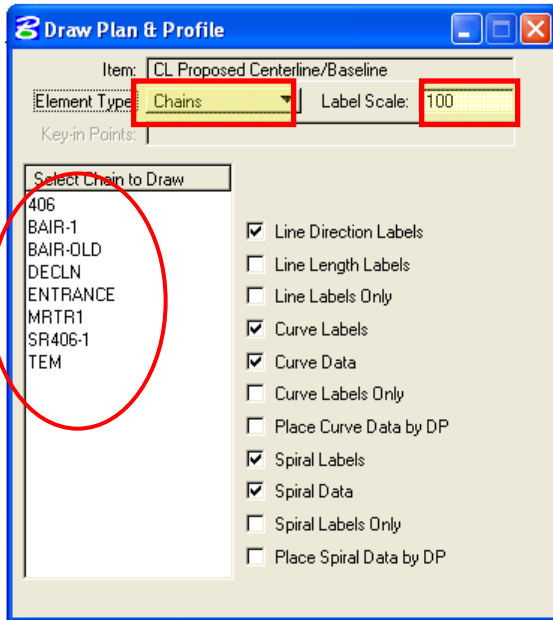
- Set the **Label Scale** as your Plan sheet scale.
- Select the **chain** you want to display with a single click shown inside the circle. Alignment information will display onto MicroStation file.

Annotate the Horizontal Alignment:

- Again toggle "**Element Type**" to **Stationing** … as shown below:
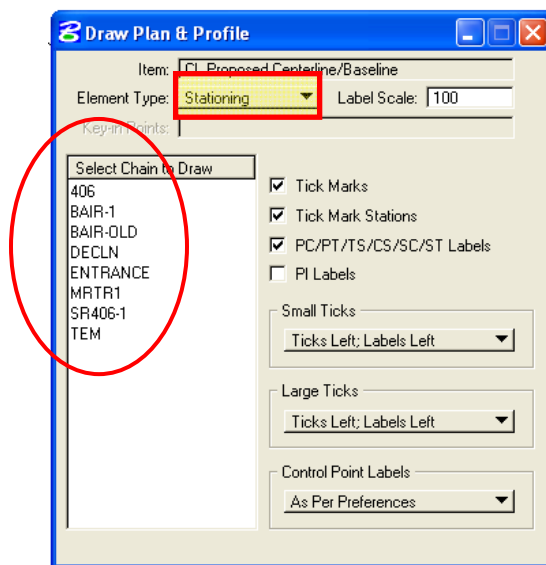
- Set the **Label Scale** as your Plan sheet scale.
- Select the **chain** you want to display with a single click inside the circle shown above. This will annotate your alignment stationing.

5.6.2- 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.
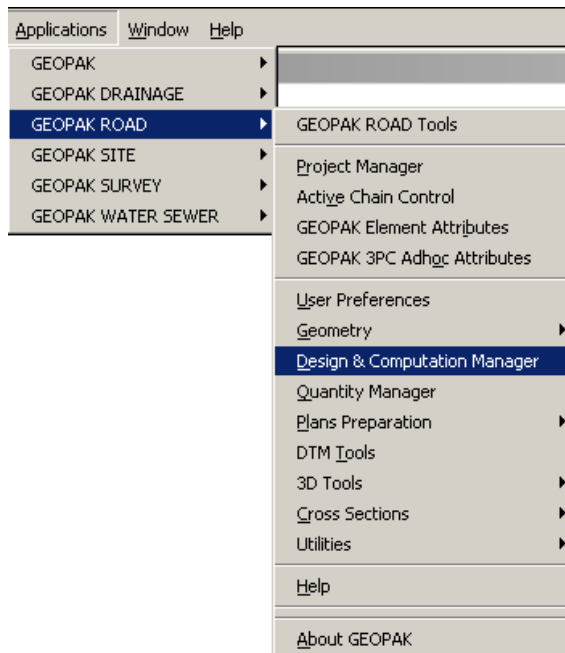
- Or can be access from the Road Tools icon as shown below:
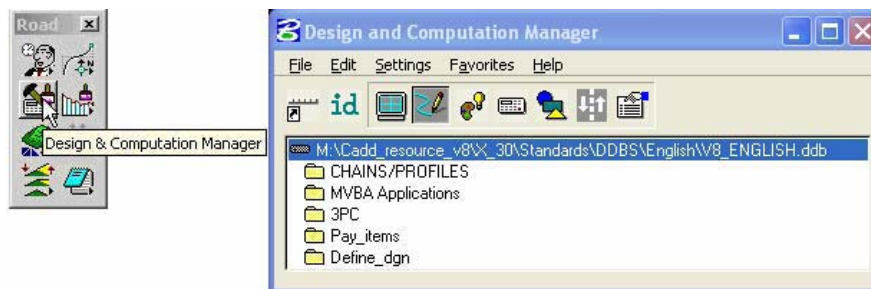
Note: *The V8_ENGLISH .ddb file is attached through project configuration setup. If FLH D&C Manager is not attached as shown above, then change it through File>Open>and select the"V8_English.ddb".*

- 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 su-categories 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.
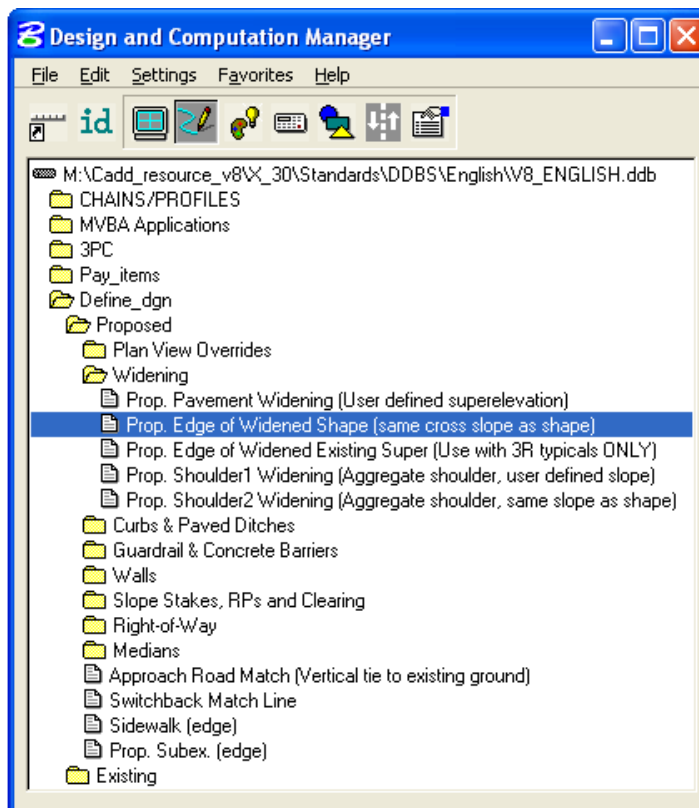
- In the **"Design and Computation Manager"** dialog box as shown above, Select **Prop. Edge Widened Shape (same cross slope as shape).** The second dialog box appears as shown below:
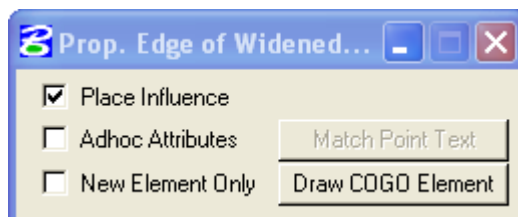
- Select **Place Influence** option as shown above.
  When the place Influence toggle is activated, elements are drawn using the level, symbology and attributes as defined in the GEOPAK database.

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.

- 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**.

> *Note: 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.*

5.7- 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.***

5.7.1- 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 Preparartion > Draw Profiles
  … or use the **Draw Profiles** icon, (as shown below):
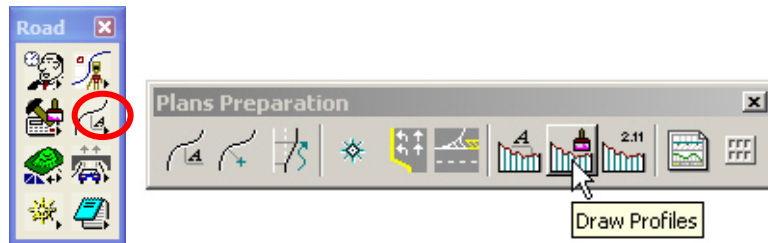
- When the dialog box (below) appears, Select the **Job Number** and **Chain.** You'll notice that unless you already have a profile cell placed in the design file, all fields will be ghosted out except for the 2 icons to the right of the **Job Number** and **Chain** fields. You must place a profile cell before you can create a profile.
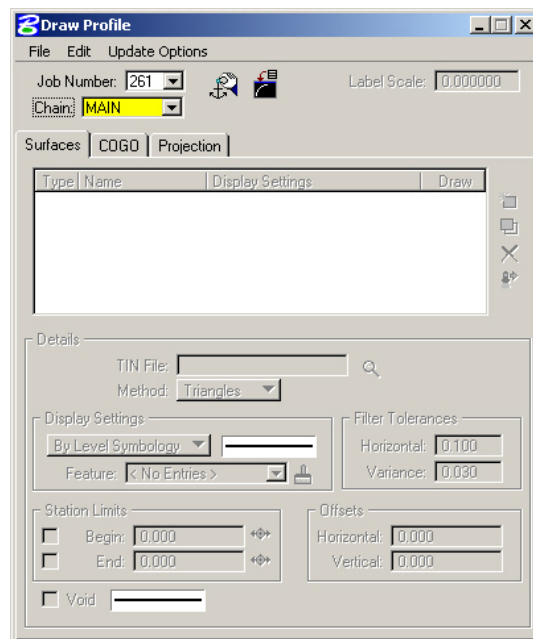
5.7.1.1- Create Profile Cell

- Click on the **Dialog Profile Cell Control** icon as shown below:
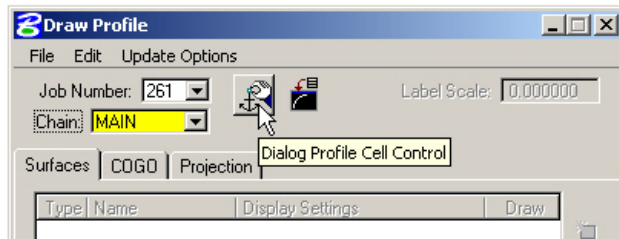
- The **Profile Cell Control** dialog appears as shown below. Click on **Place Profile Cell**:
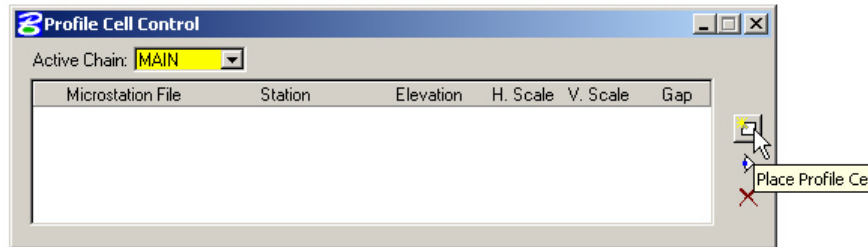
- The **Place Profile Cell** dialog appears (shown below) along with the Profile Cell attached to your cursor awaiting placement.

- 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.
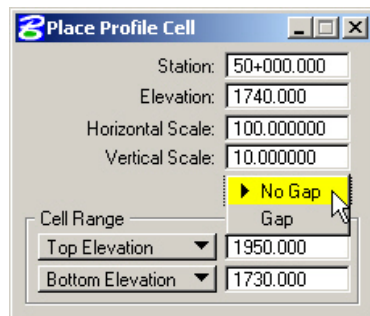
< Origin Elevation of the Profile cell

<Elevation range can be gotten from the contour lines elevations.

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

*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.

5.7.1.2- 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.
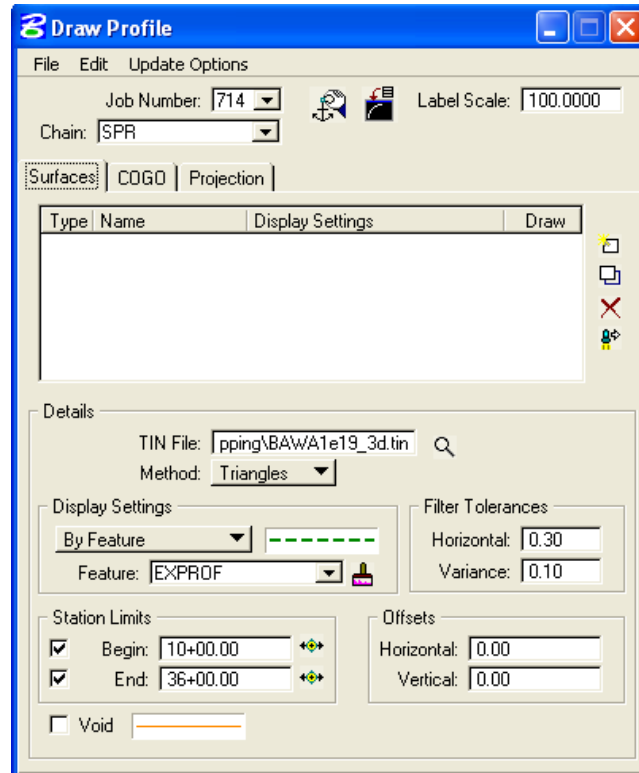
- Select **Label Scale** according to the Plan sheet scale for the texts size (e.g. 100 for 100 scale Plan Sheets).

- On **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** (**V8_English.ddb**).
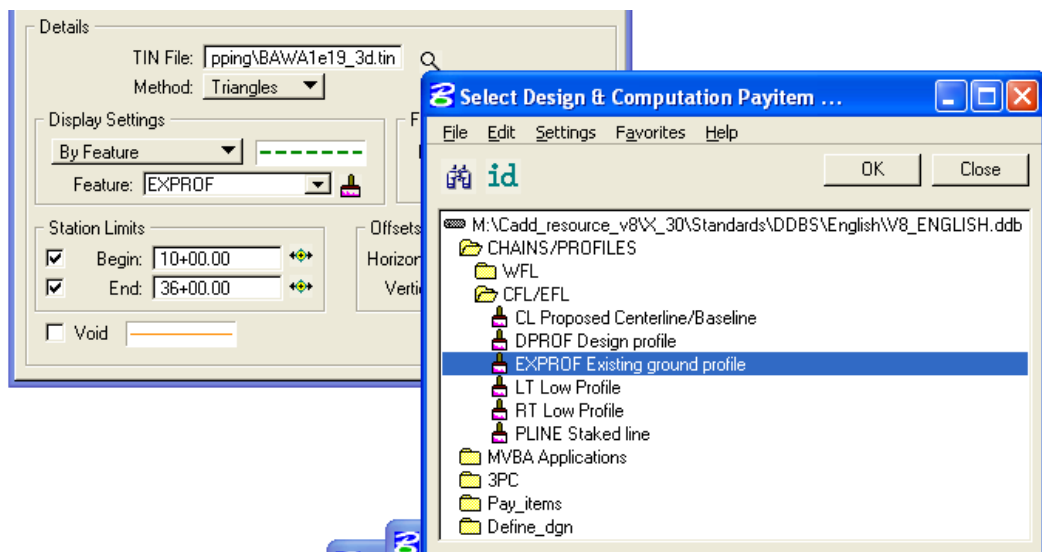
- Press OK.
- Click the Add Surface Setting icon to add the profile to the list box as well as draw the profile into the MicroStation file.
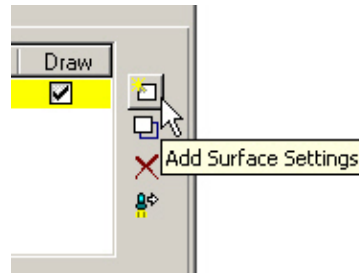
- The final setting on Draw Profile for Surface tab is as shown below. The recommended Filter Tolerances in EFL should be left at the **default** values of **Horizontal=0.30** and **Variance=0.10.**
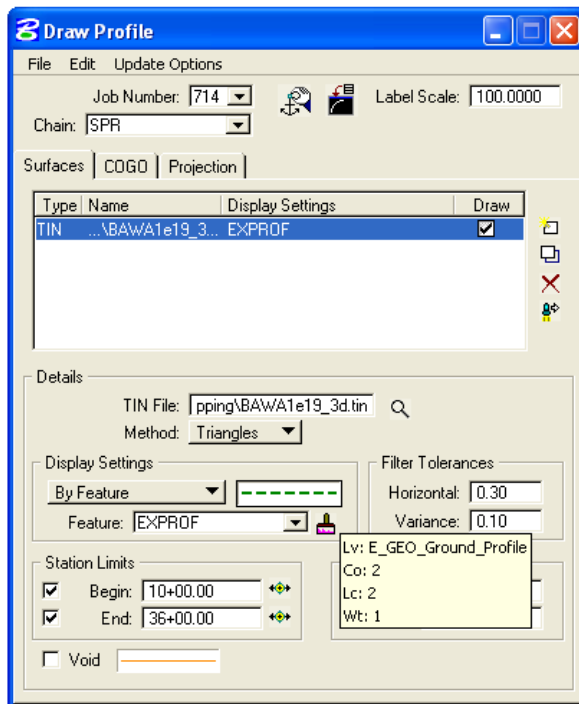
Note:- Use the following icon as shown below to store an Existing Profile in COGO, though it is not required to display into your MicroStation file in EFLHD.

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

5.8- Create Proposed Vertical Alignment (Geopak)

*There are two ways to create proposed Vertical Alignment **graphically**.*

5.8.1- The "VPI Based" Profile Design Tool:

- Select the **Vertical Alignment** button on the **Project Manager** dialog box as shown below:
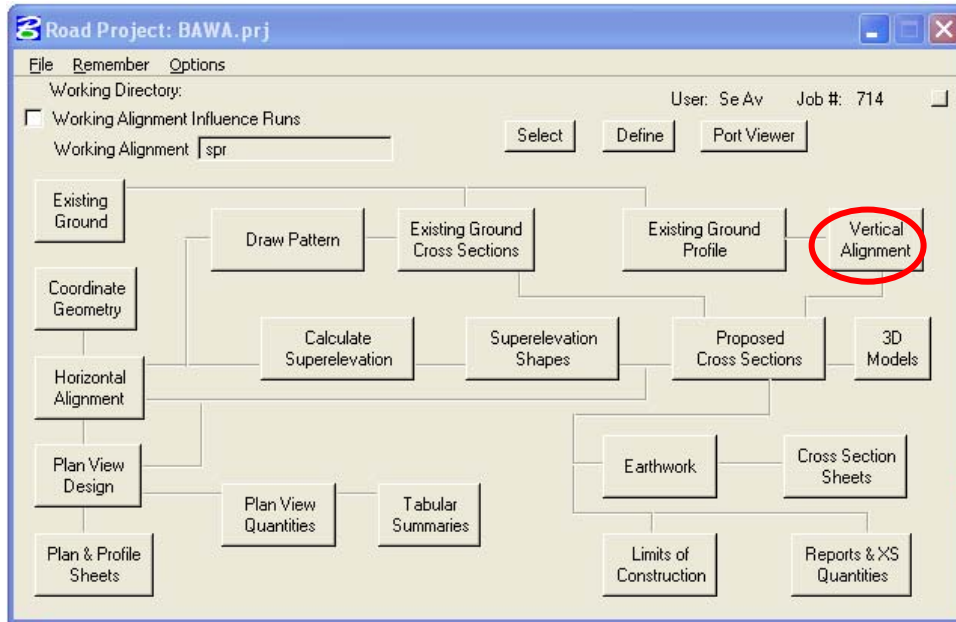
or   Select **APPLICATIONS > GEOPAK ROAD > GEOMETRY > LAYOUT PROFILES** (VPI Based) or from the Road Tools icon as shown below:
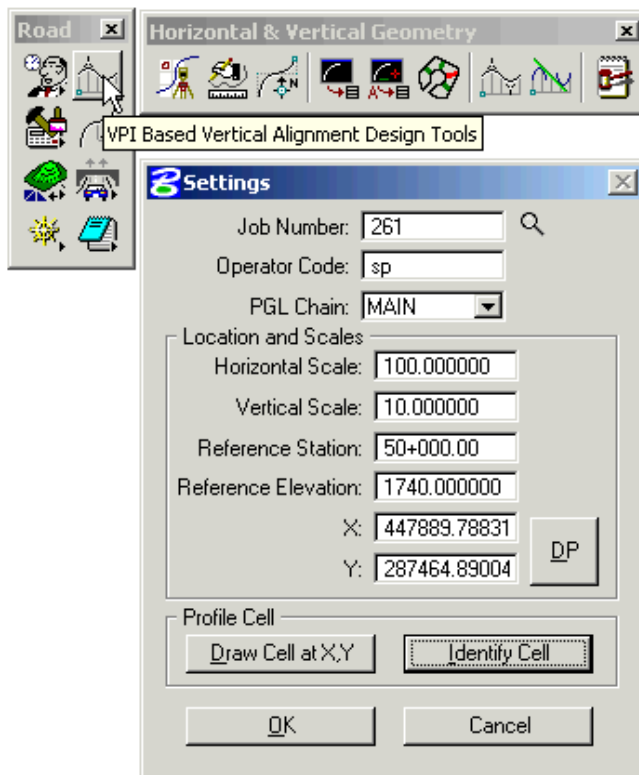
- Most likely… if you're at this point in your design, you have already extracted a ground profile and have it displayed graphically. Click on Identify Cell, data point the cell, click on OK.

- This will invoke the GEOPAK Profile Generator as shown below:
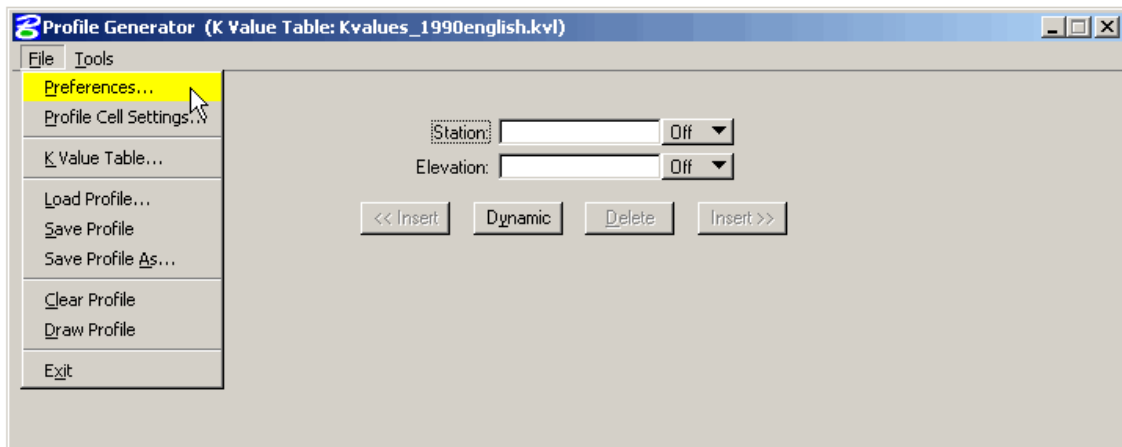
- From the pull down menu, select **File > Preferences…**. This invokes the **Preferences** dialog as shown below:
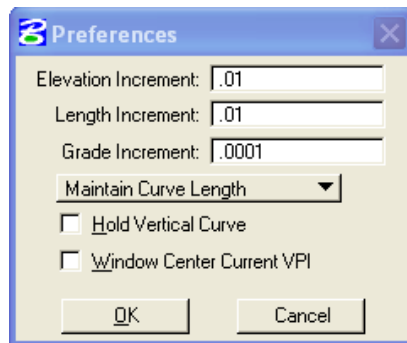
This is where you set the preferences for dynamically laying out the profile. User has the option of selecting **Maintain K Value** or **Maintain Curve Length**. We typically select **Maintain Curve Length**. When finished, click on **OK**.

- From the pulldown menu, select **File > K-Values Table**. This invokes the **K-Values Table** dialog as shown below:
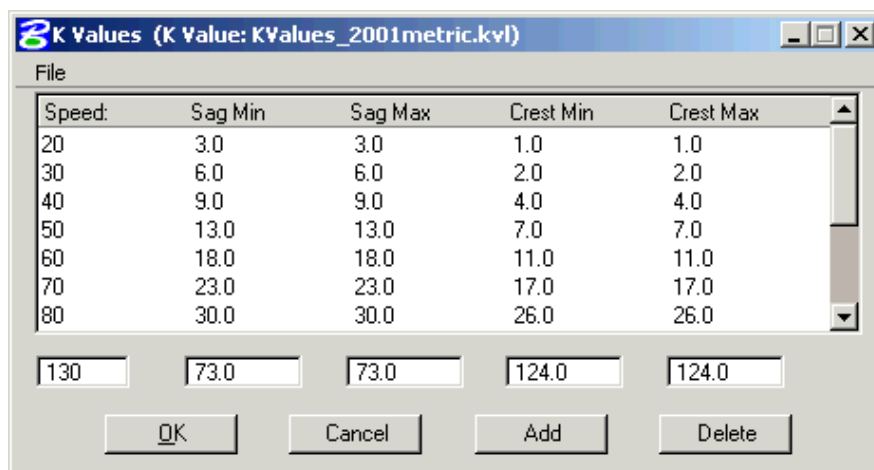
- Using the **File** pulldown, select **File** > **Open** and browse to the folder **M:\Engineering_Software\ Cadd_resource_v8\X_30\Standards\Bin\english** and select the appropriate **K-Value table**. Press **OK** as shown below. Press again **OK** on **K Values** dialog.
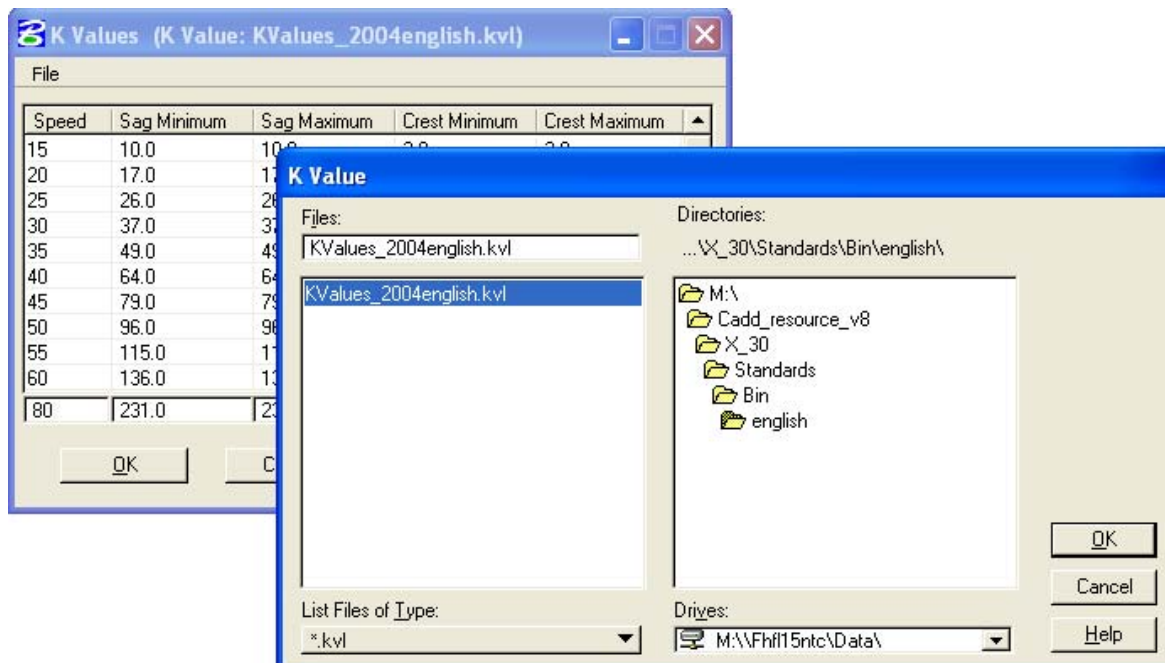
- The **GEOPAK Profile Generator** is shown below (with the K-Value table "**Kvalues_2004english.kvl**" selected):
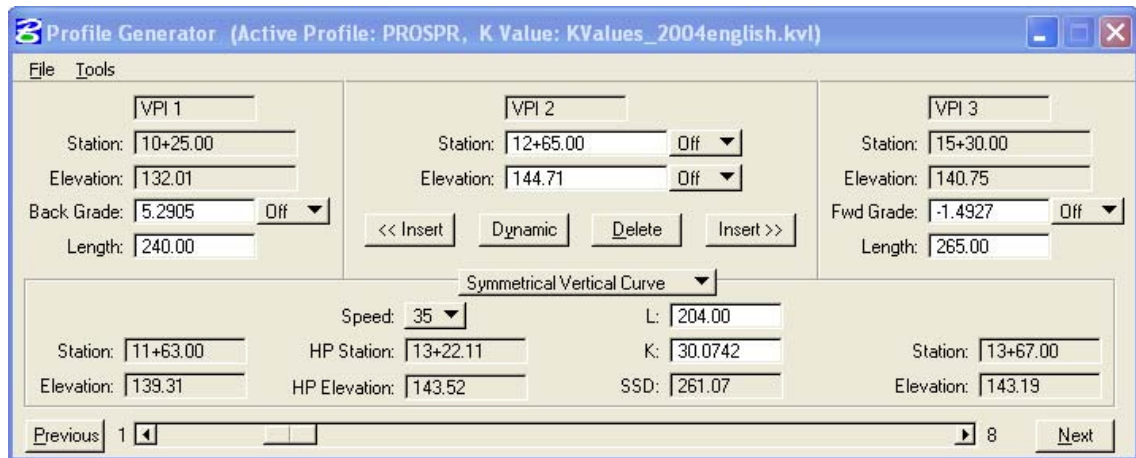
- To begin using the **GEOPAK Profile Generator**, click on **Dynamic** and snap to the beginning of where you want the profile to start.   This would usually be exactly at the beginning of the existing ground profile.   Accept the snap with a data point of the mouse.
- Pan on ahead, click on **Insert 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**.

5.8.1.1- Reload/Modify the Profile:

- Select the **Vertical Alignment** button on the **Project Manager** dialog box (as shown in Section 5.8.1).

- Click on Identify Cell, data point the cell, click on **OK** (as explained in Section 5.8.1).

- This will invoke the **GEOPAK Profile Generator**.

- Select **File > Load Profile** on **Profile Generator** dialog box as shown below.
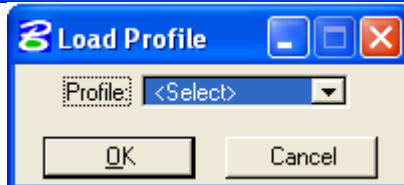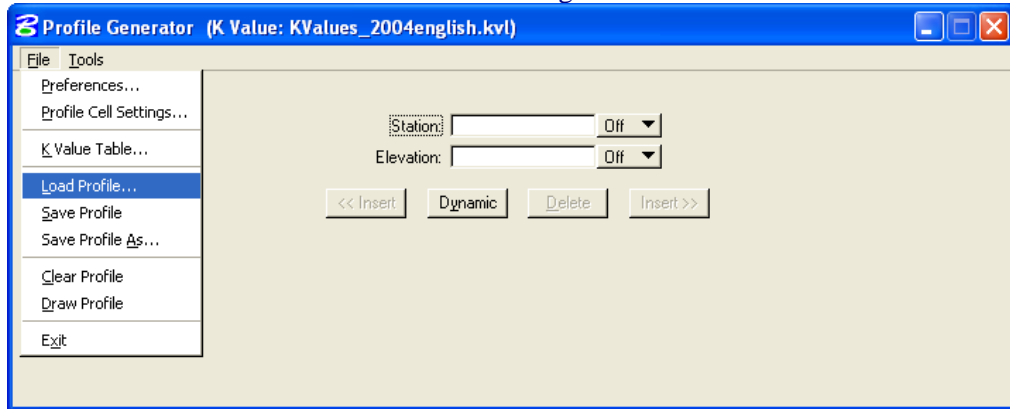
- Click on **Select** and pick the Profile.

- Click OK will load the Profile Generator with profile data for edit as shown below.
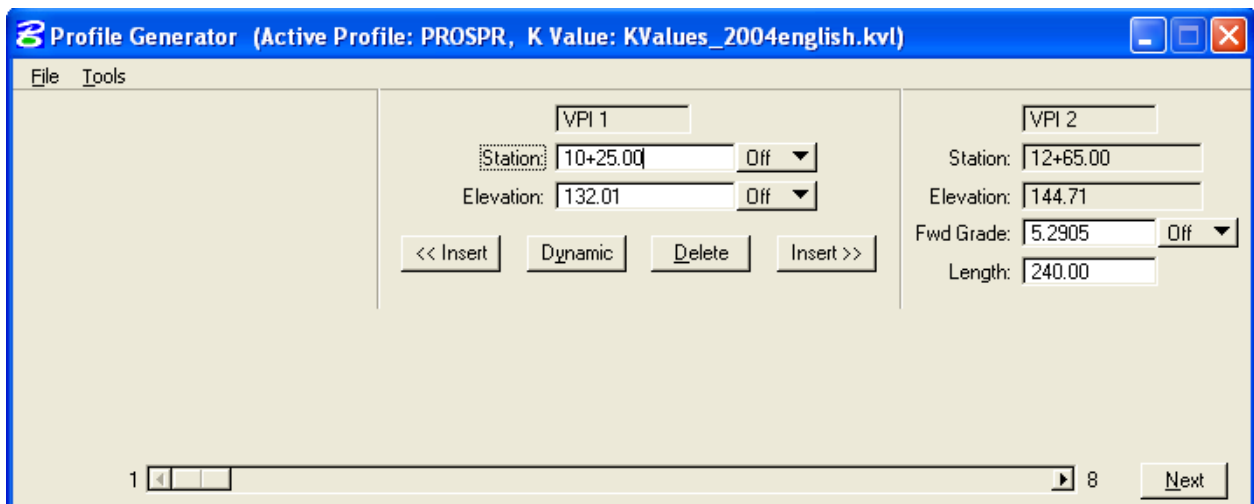
- Click on Next VPI to move to the VPI to be adjusted or use the horizontal slide bar.   When the little reference circle is on the VPI to be adjusted, click on **Dynamic** and slowly move the cursor into the circle.   Nothing will happen until the cursor gets close to the reference circle.   You may 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.

5.8.2- 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 pulldowns, (as shown below):
  Applications > Geopak Road > Plans Preparartion > Draw Profiles
  … or use the **Draw Profiles** icon, (as shown below):
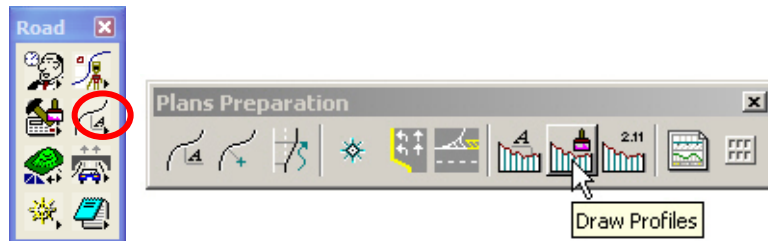
- Draw Profile dialog box appears as shown below.
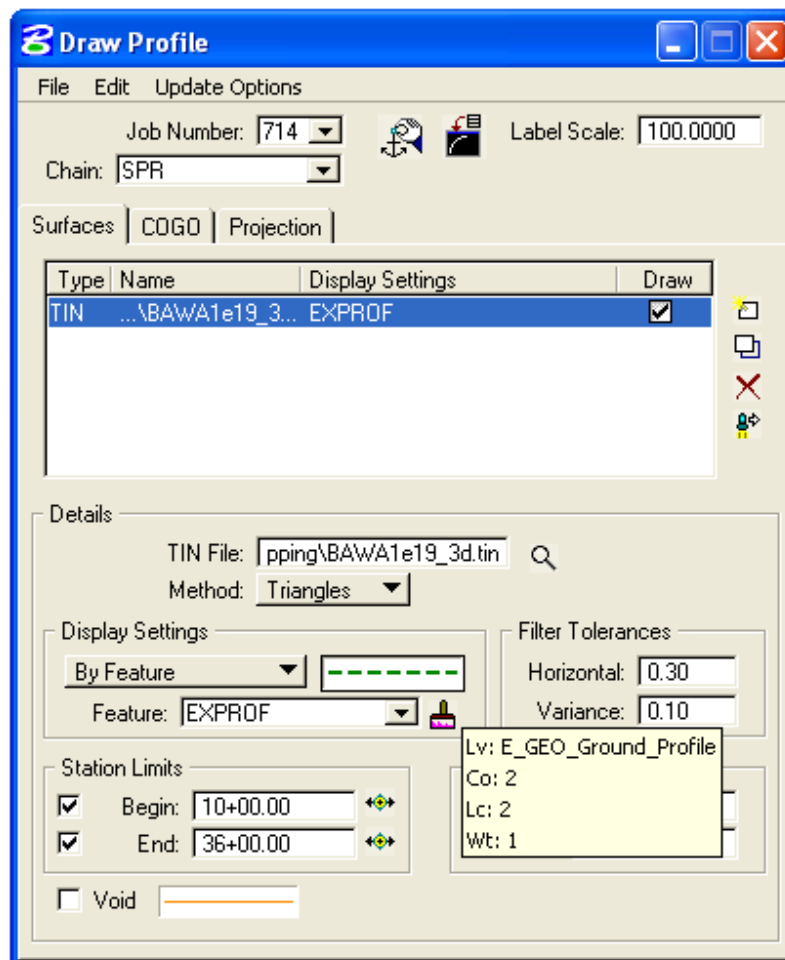
- **Select** the COGO tab.

5.8.2.1- <u>The "COGO" Tab</u>: *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 below.
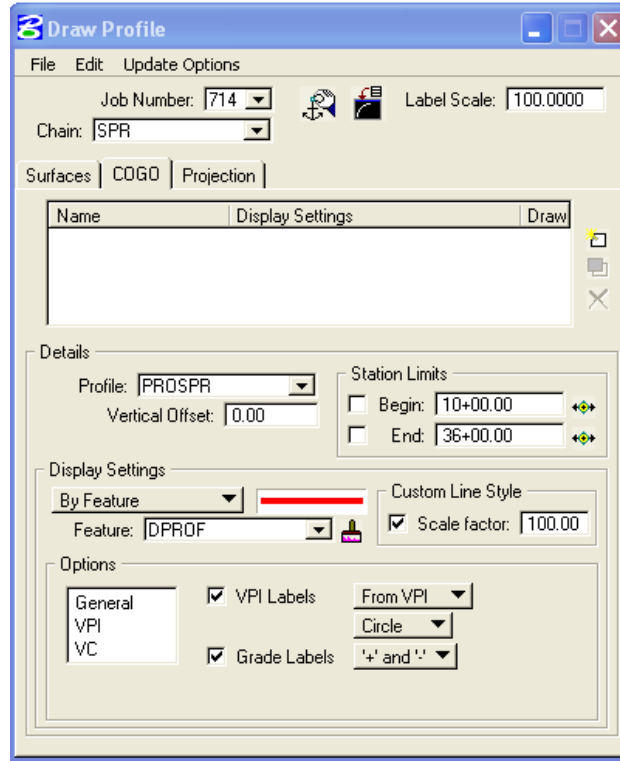
- Select the **Profile Name** to be drawn in **Details** section of the icon. Keep the Vertical Offset defaults to a value of 0. Station Limits may also be specified to have the software draw only a portion of the profile.

- 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** (**V8_English.ddb**).
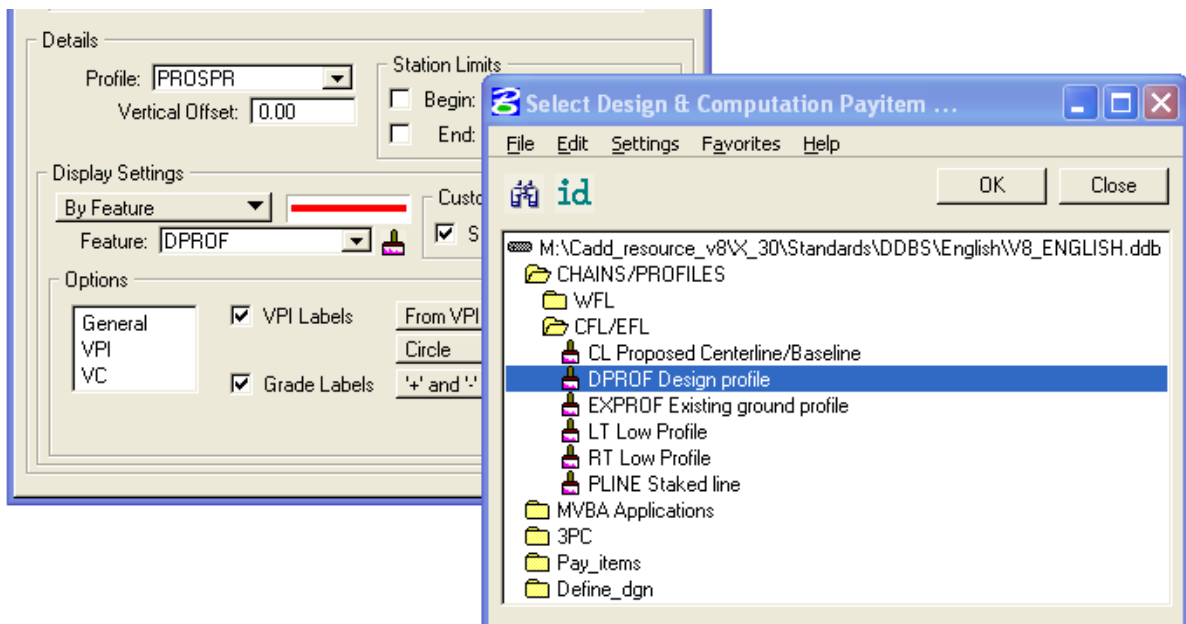
- Press OK.
- Click the Add COGO profile Setting icon to draw the profile into the MicroStation file as shown below.
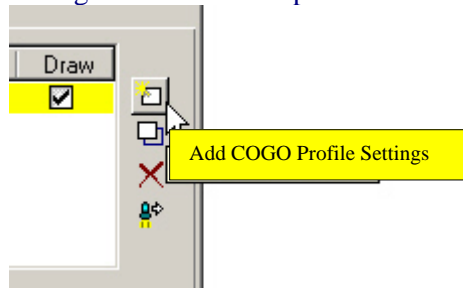
- Software now will display your Proposed and Existing Profile into MicroStation file.

5.8.3- 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.
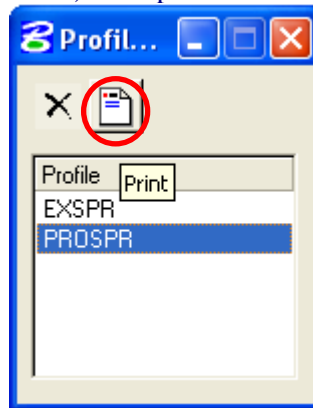
- Select Print icon as shown above. The Coordinate Geometry dialog box will display the Profile data as shown below.
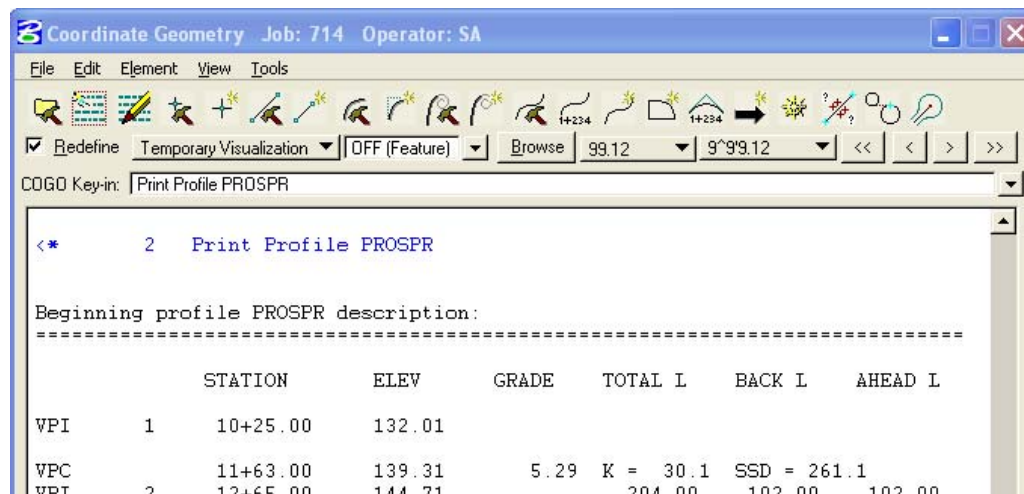
- Type 'Out ProSPR (File name, maxm 8 character) in COGO Key-in and Enter, as shown below.

- GEOPAK COGO will create an output file for the proposed data file ProSPR714.osa in working directory. Where 714 is the Job number and osa stand for Output for User SA for this project.

5.9- Existing Ground Cross Sections (Geopak)

5.9.1- 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:
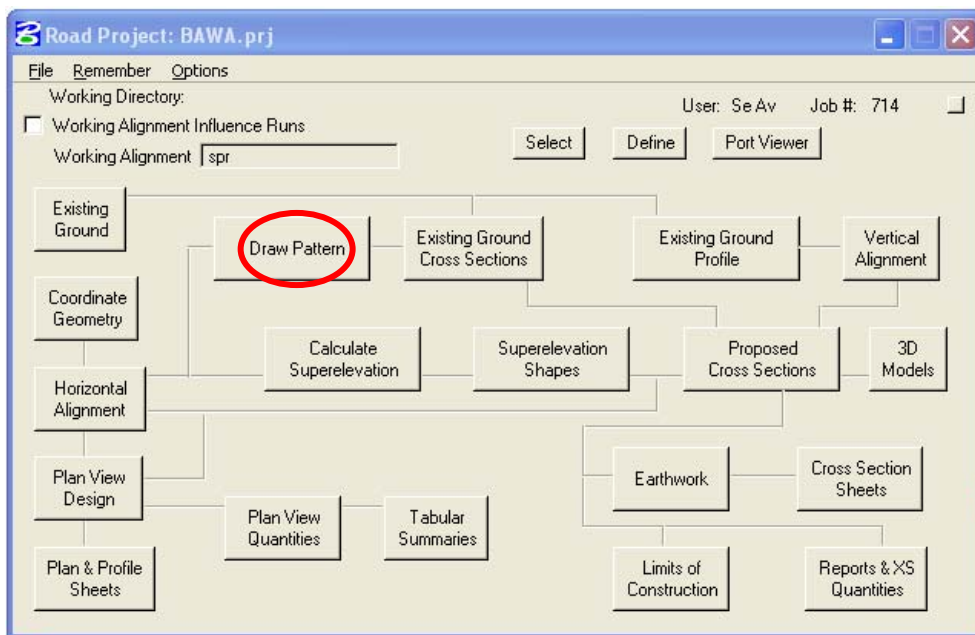
- The **Draw Pattern Lines** dialog appears as shown below:
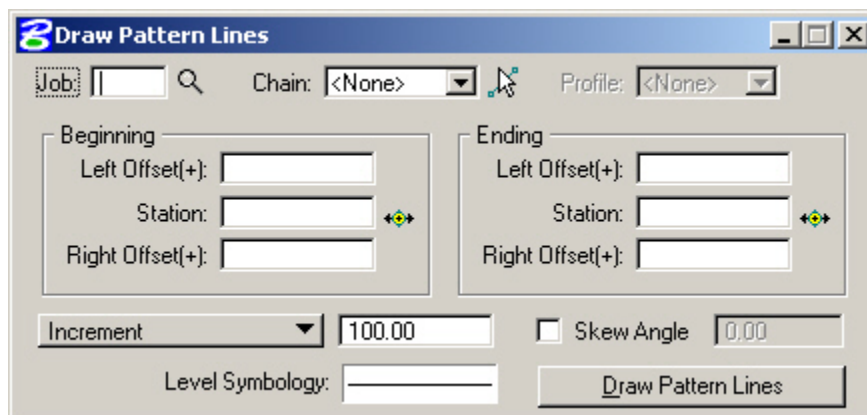
- This application will simply draw normal MicroStation line elements perpendicular to your chain at user specified **increments**, **station ranges**, and **widths** and at user specified **Level Symbology**. To

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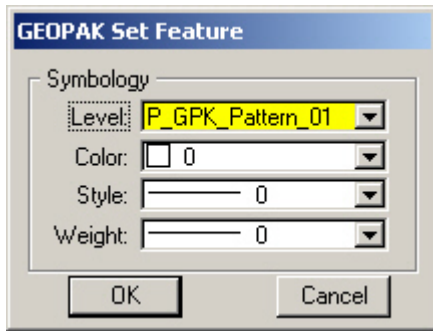
- Complete the **Geopak Set Feature** dialog settings as desired and press **OK**.
- Complete the **Draw Pattern Lines** dialog settings as desired and press **Draw Pattern Lines**. You should now have a series of lines **perpendicular** to your referenced chain. Later, we will use these lines to generate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

5.9.2- 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 5.9.1)**
3) *A horizontal alignment stored in COGO.* **(explained in Section 5.5**)
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**:**
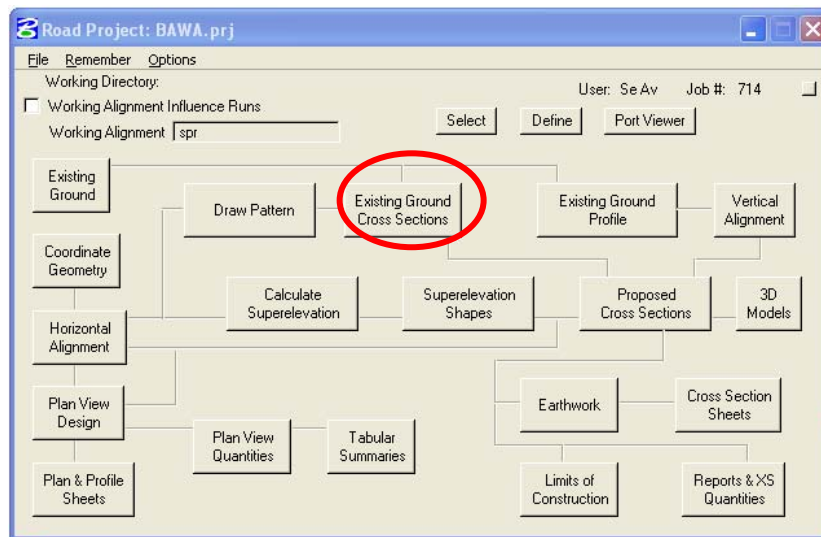
- The **Draw Cross Sections** dialog will appear as shown below:
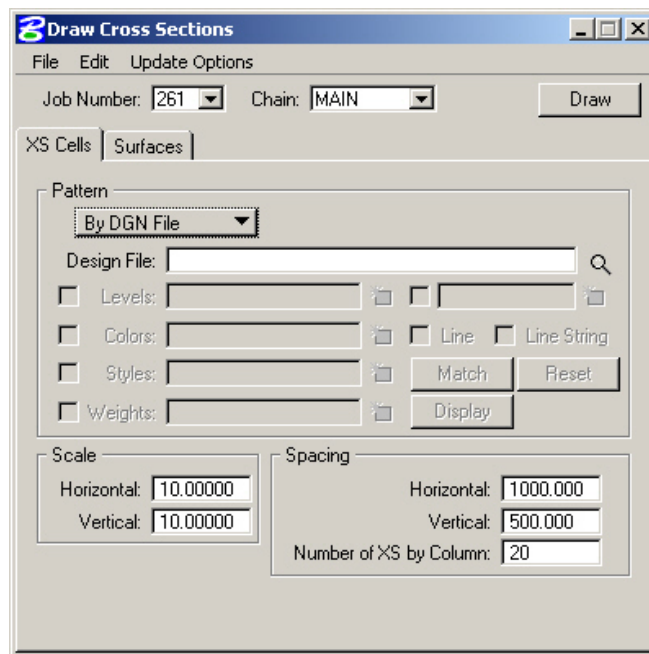
- Select the **"XS Cells"** Tab**:** Here the designer tells Geopak where to find the information to create the cross section cells and how they are to be laid out.

- 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).
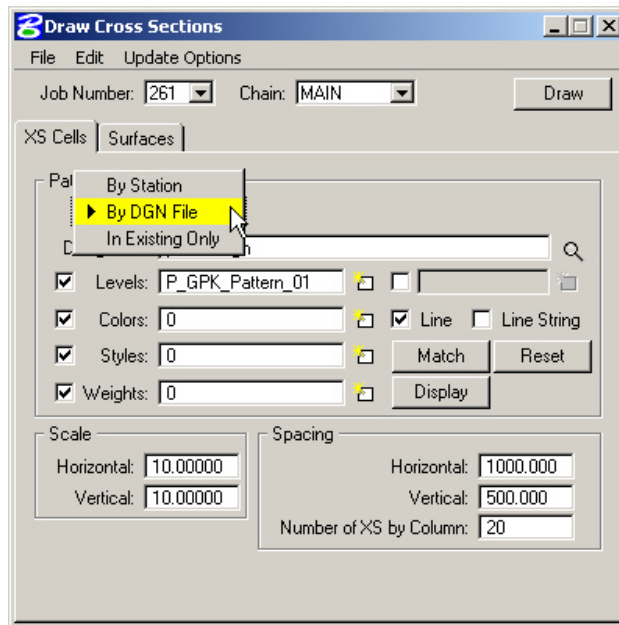
- Select **Scale** to 10 and 10 as a standard practice in **EFLHD**. And keep all the setting for spacing as default as shown above.

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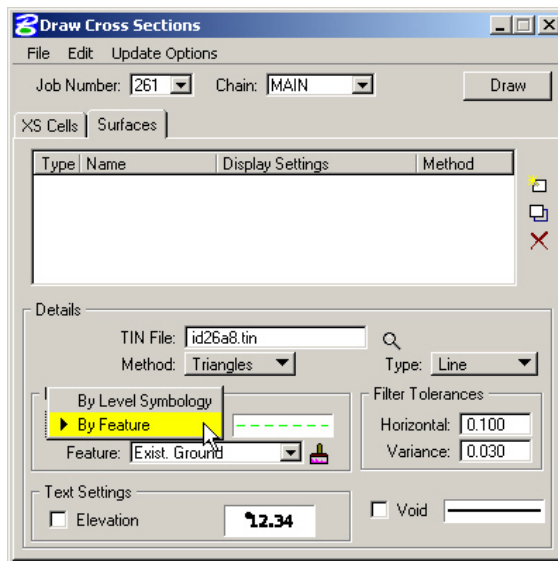
- Select the folder icon in the **Details** area, and then select the .TIN file to draw the cross section. Set the **Method** to **Triangles** (This instructs the software to compute elevations at each location that the pattern lines intersect a triangle leg from the TIN) and select **Type** to **Line**.

 *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** (**V8_English.ddb**) as shown below.
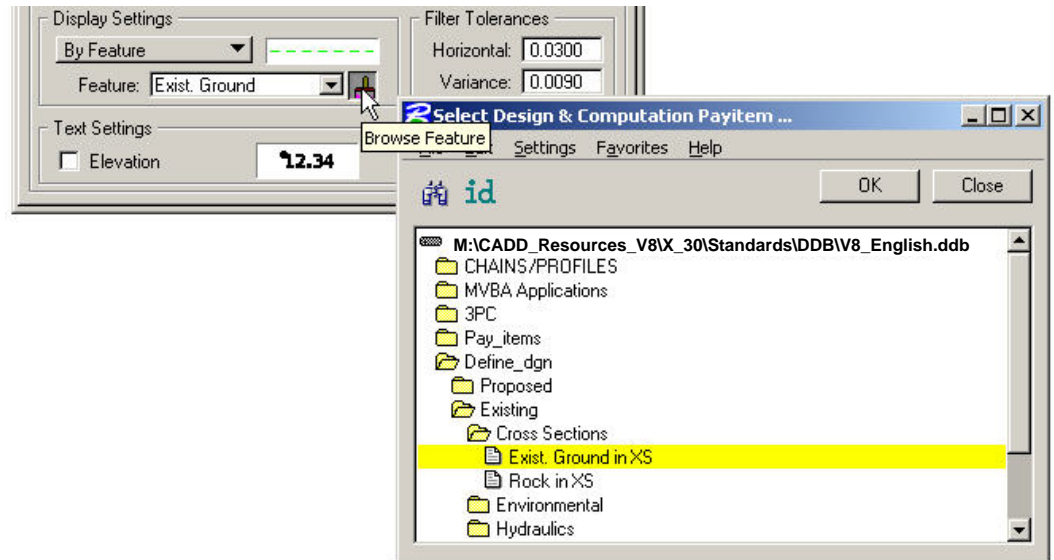
- Press OK.

- Recommended **Filter Toleraces** at E**FLHD** are shown below:

  - Metric **tolerances are** .03 **and** .009
  - US Customary **tolerances are** 0.10 **and** 0.03 **(as shown below):**
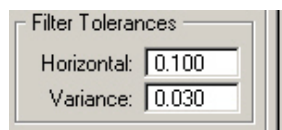
- Click the Add Surface Setting icon to add the surface to the list. *(Delete any incorrect surfaces)*
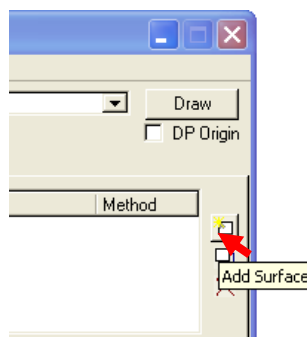
- Click on the Draw button located in the upper right corner of the dialog to draw the existing cross section in the design file.

5.10- Developing the Shape "Superelevation"(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:
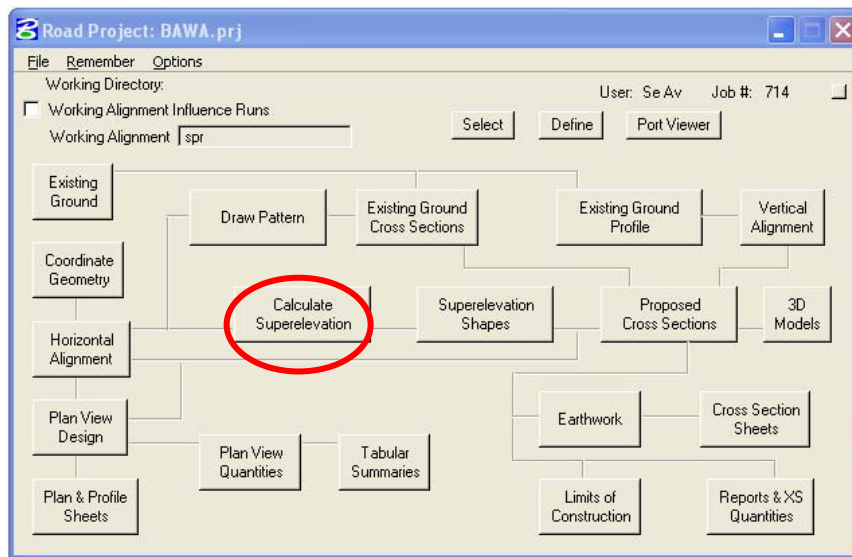
- The **Select Run** dialog appears. Use the pulldowns and select **Run** > **New** as shown below. Click on **OK**.
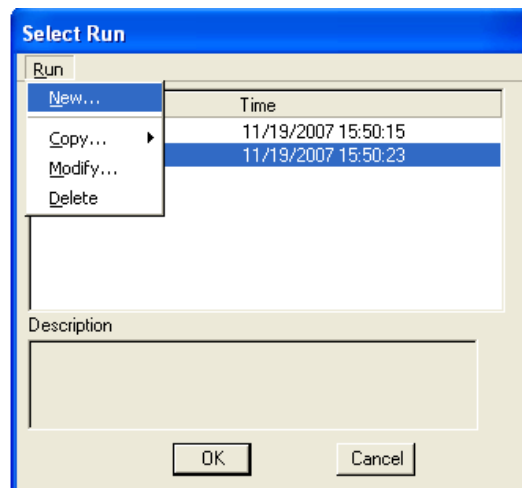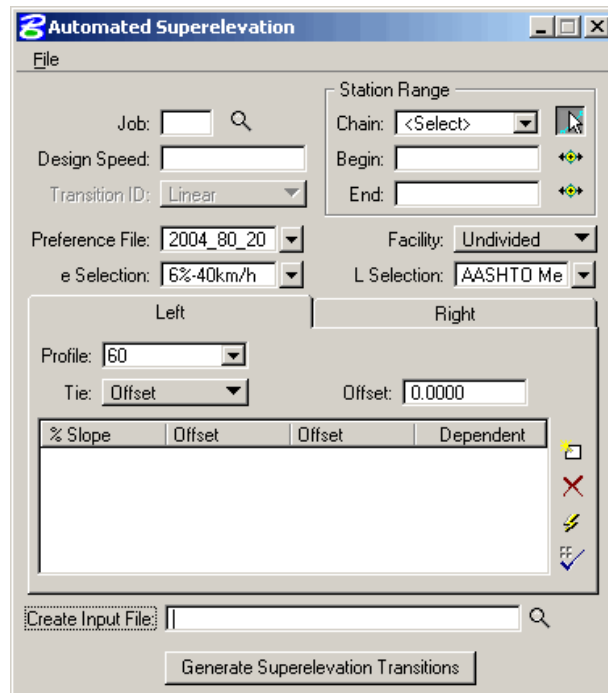
- The **New Run Name** dialog appears. Type in the name of the "Run" to create. The **Description** field is optional. Click on **OK**.
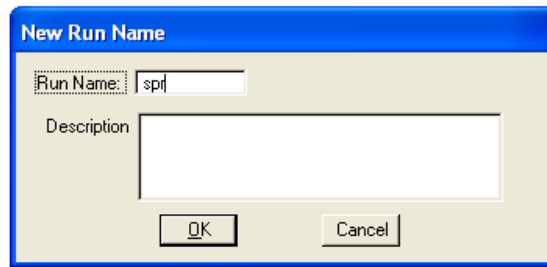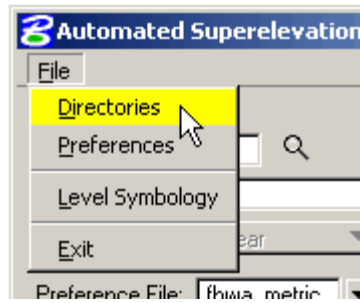

- The **Select Run** dialog appears. Highlight the desired run (you may eventually have several) and click on **OK**.
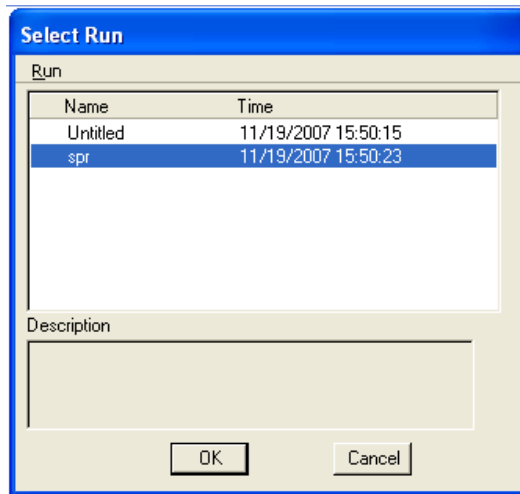
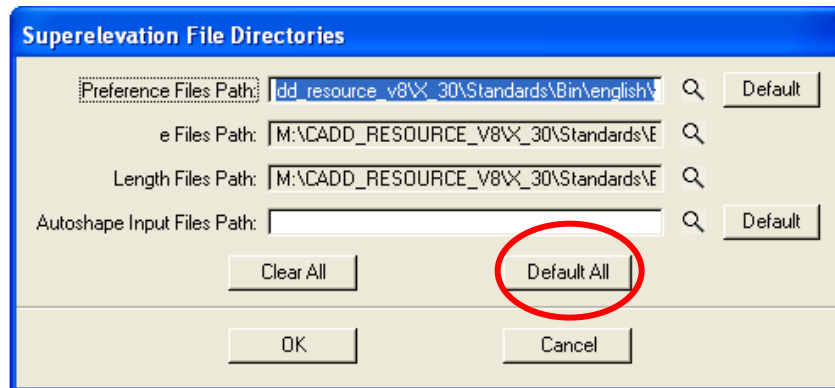- The **Automated Superelevation** dialog will appear as shown below:

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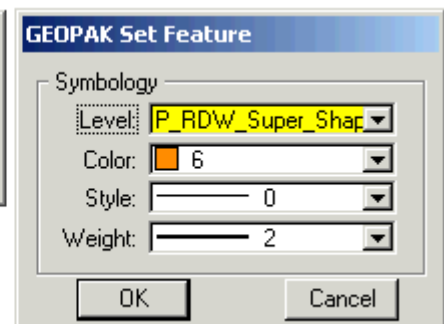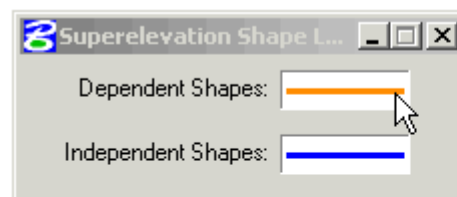

- Click on **Default All** (as shown below) and all directories will be set as shown below. The example below illustrates the English directory paths.

For Metric the path is **M:\Engineering_Software\Cadd_Resource_V8\X_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.
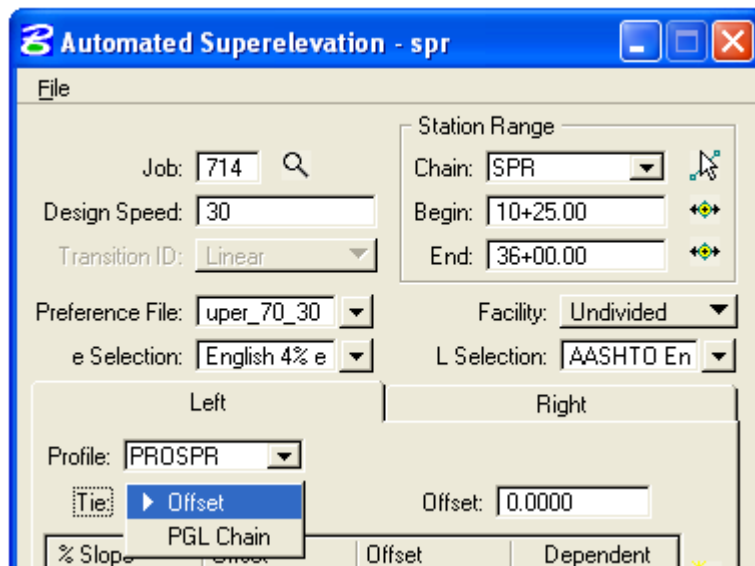
- The **Superelevation Preferences** (file) can be selected it from the **Automated Superelevation** dialog as shown below:

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 set of preferences 67-33, 70-30 and 80-20 for transition distribution as shown above.
Explanations of this can be found on page 175 in AASHTO 2001 and 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 **GPK** 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:

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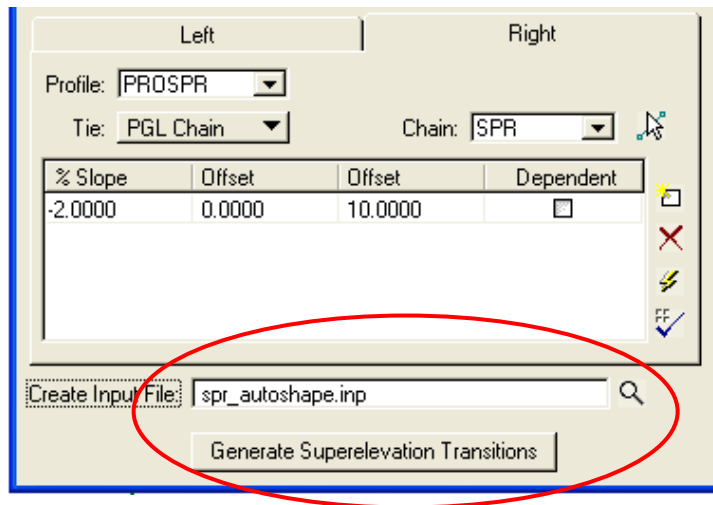
*Note:- Remember, all of this is done to simply create an **ASCII input file**, (which can be edited).*

- 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 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.

5.11- <u>Proposed Cross Section (Geopak)</u>

- 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:
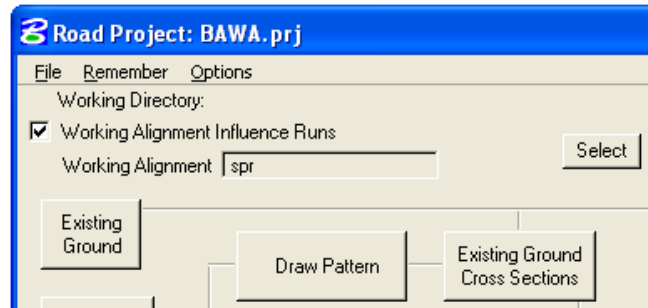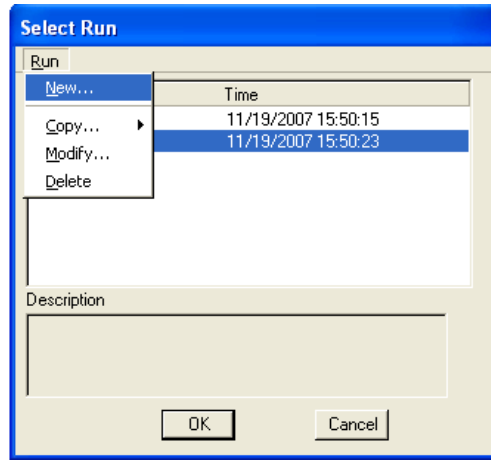

Note:- Making sure the working alignment is defined.
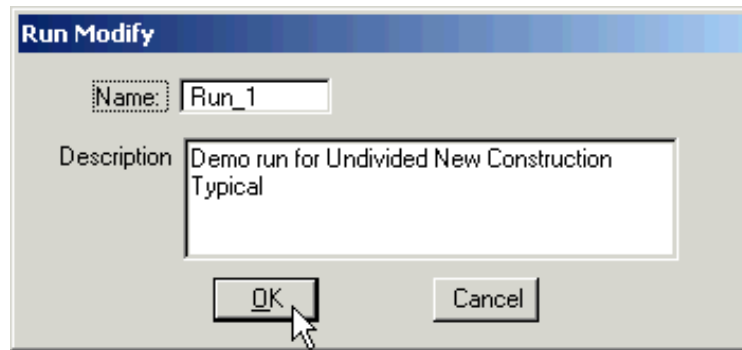
- Select the **Proposed Cross Section** button from the **Project Manager** dialog box as shown below**:**
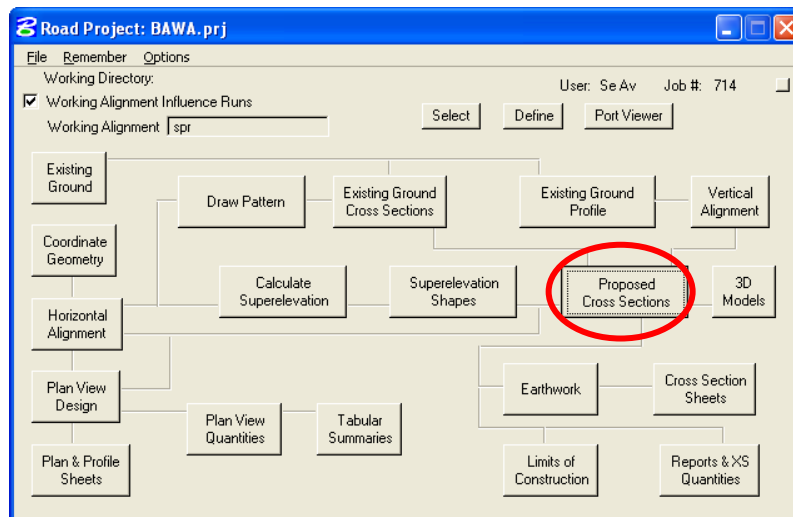
- The **Select Run** dialog appears. Use the pulldowns and select **Run** > **New** as shown below. Click on **OK**.

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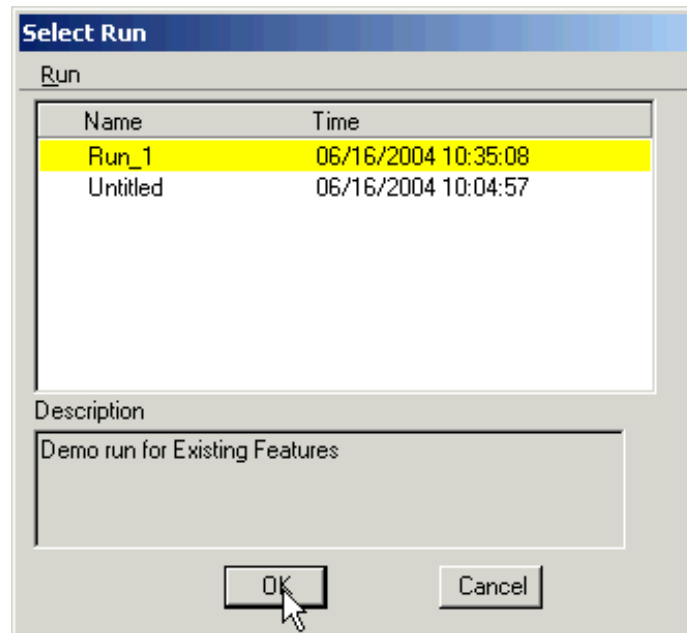
- The **Proposed Cross Sections** dialog appears. Notice that the name of the Run (in this case **Run_1**) also appears at the top of the dialog as shown below:

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

Note:- The "Tolerance" setting is very important.
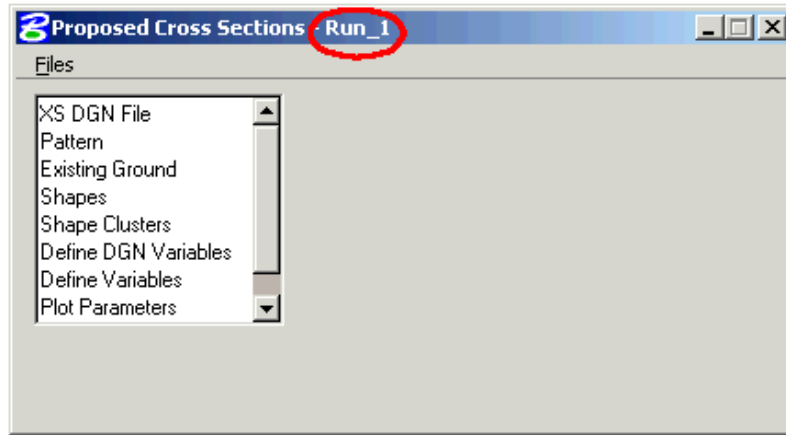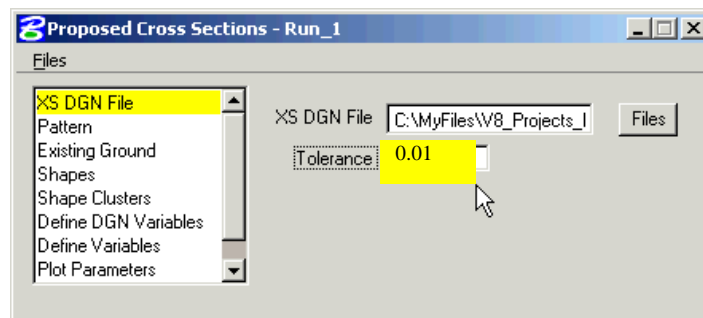*For **Metric** projects, **tolerance= 0.003, and for US Customary** projects, **tolerance= 0.01**.*

- 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 "**spr**", there is no need to identify them again.
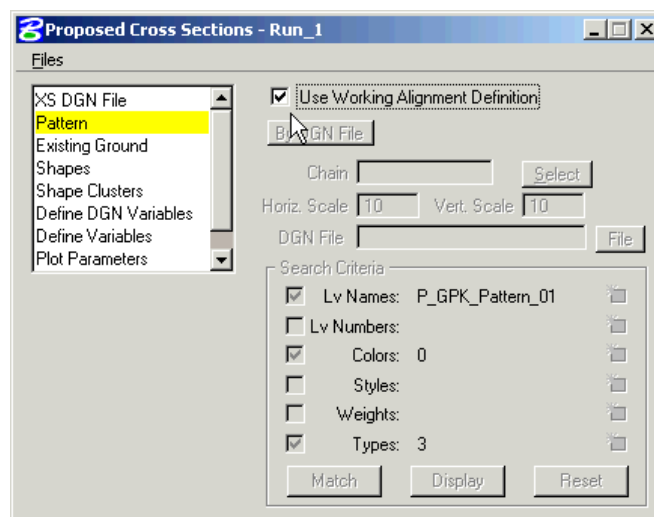
- Click on Existing Ground and put a check in the white box for Use Working Alignment. Since your Existing Ground has been previously defined in your working alignment "**spr**", there is no need to identify it again.
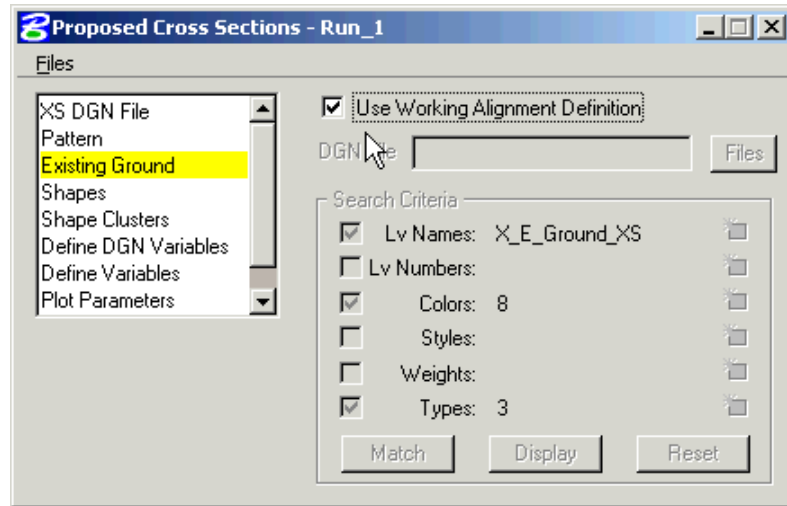
- Click on **Shapes**. This Typical Section **requires superelevation shapes**. Put a **check** in the white box for **Use Working Alignment**.
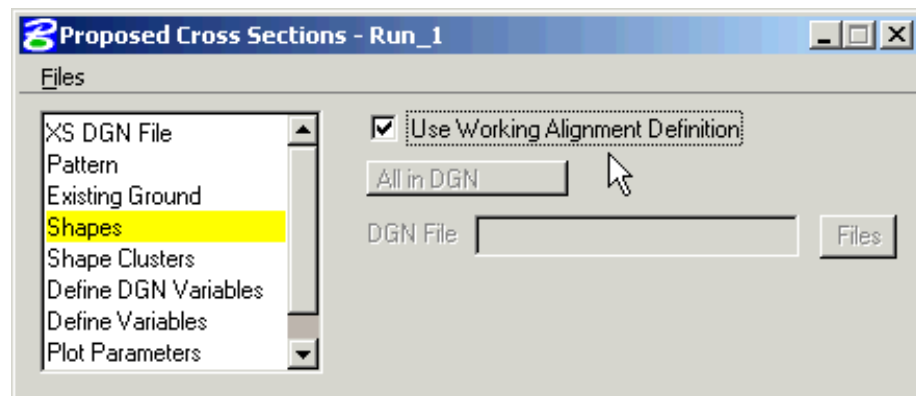
- Click on **Shape Clusters**. Initially the dialog appears as shown below, basically blank with many of the option buttons ghosted out:
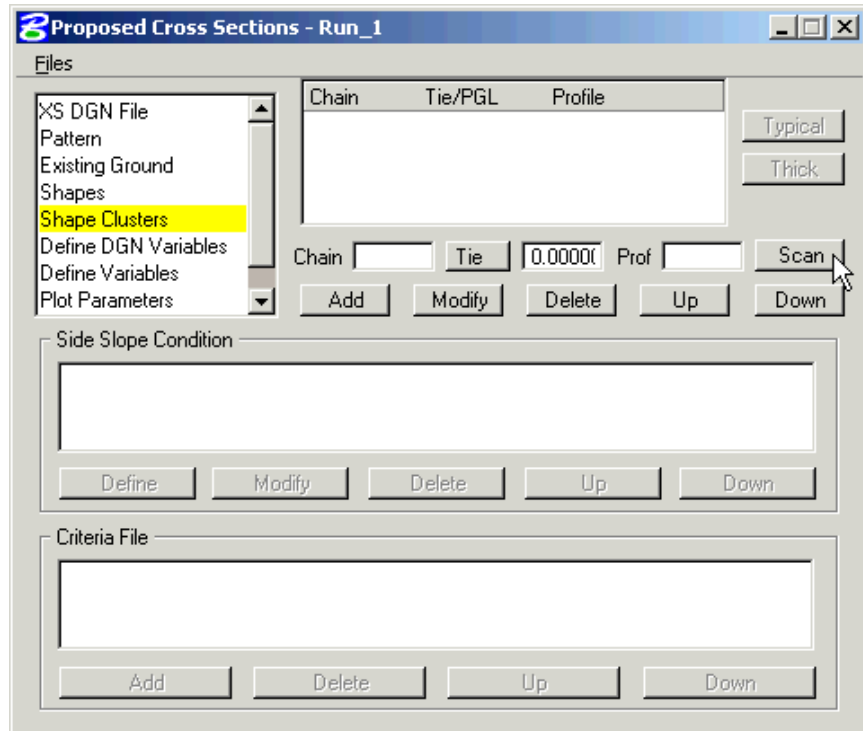
- Click on the **Scan** button and the **List of Clusters** dialog appears as shown below. Highlight the shape cluster:
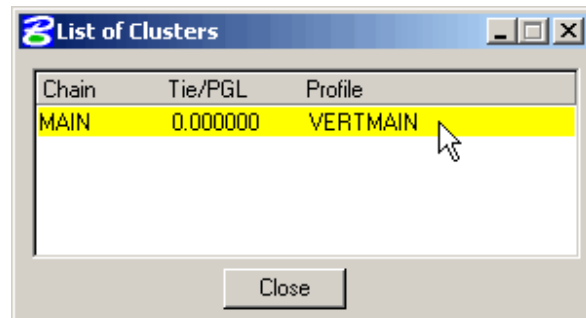
- Click on the **Add** button as shown below:
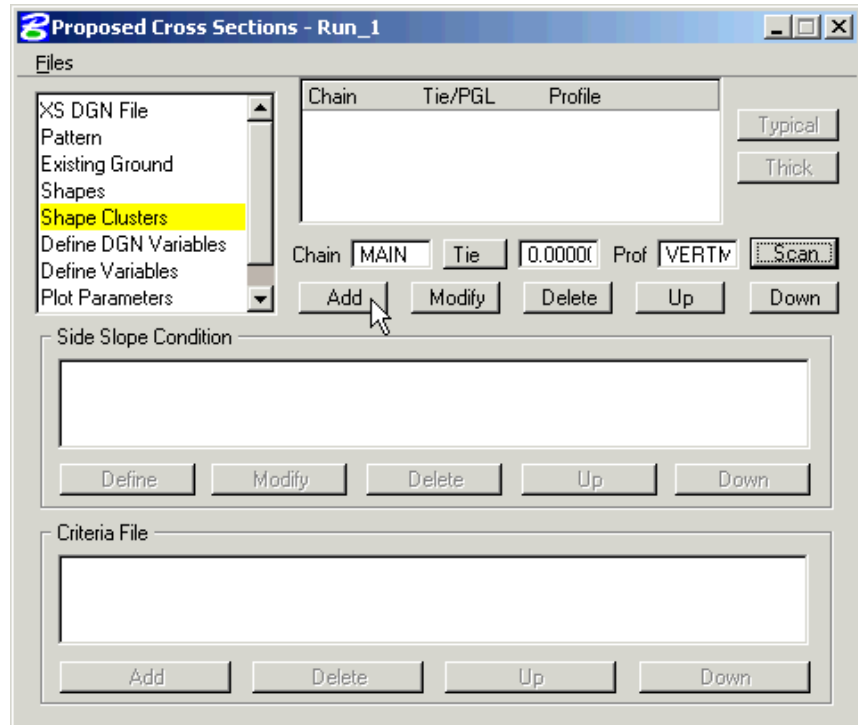
- When the **Add** button is pressed the shape cluster information gets added to the collection window. **Highlight** the information in the collection window. The **Typical** button becomes unghosted. Click on the **Typical** button as shown below:
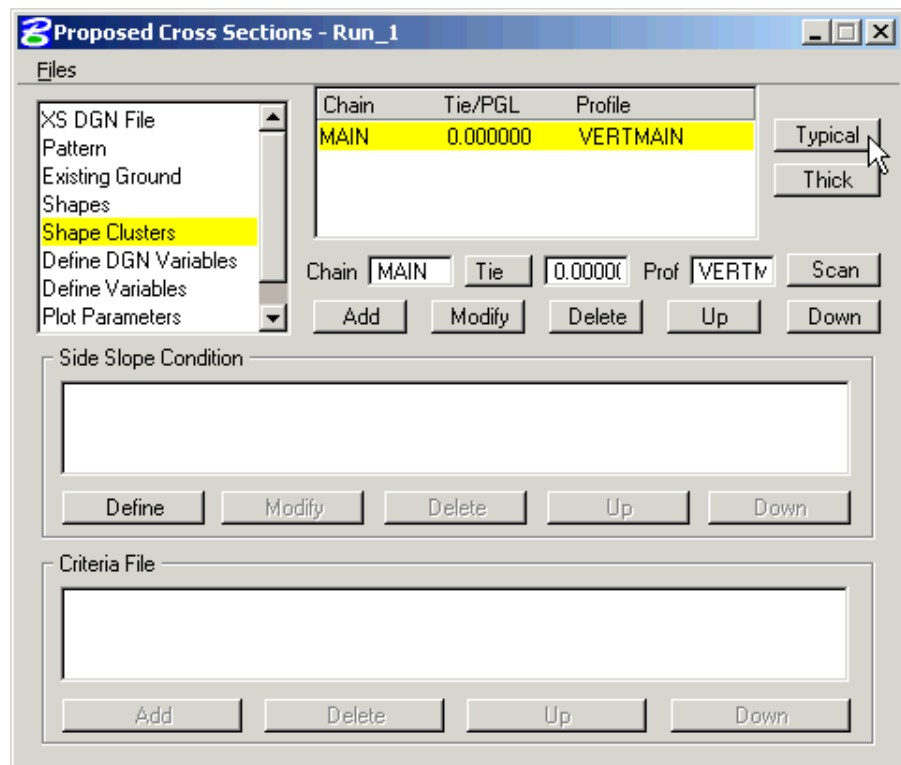
- The **Typical Sections** dialog appears as shown below. Select the desired Typical Section.
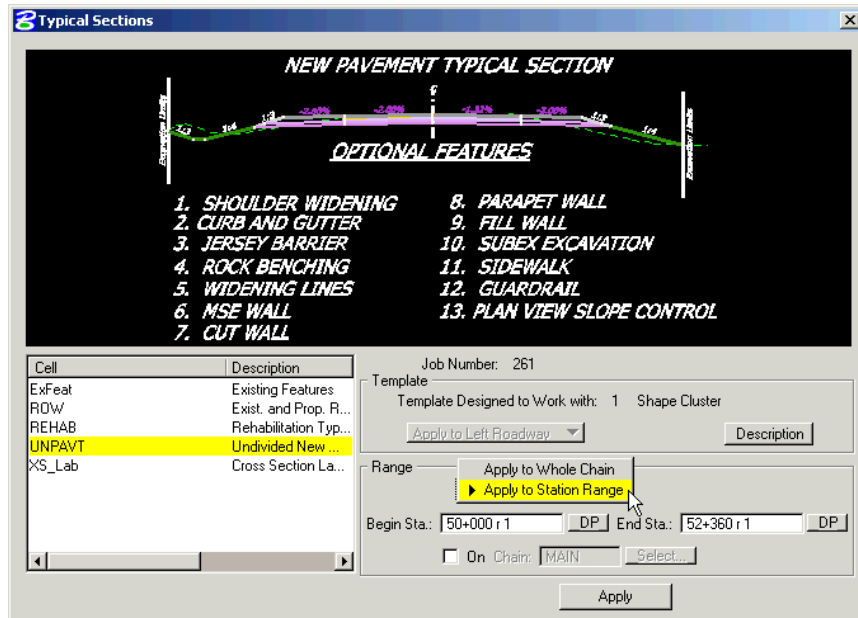
*Note:- Note the **Description** button located on the right side of the dialog. When pressed, this invokes a file that provides detailed information on how the typical works including detailed drawings.*

- 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:
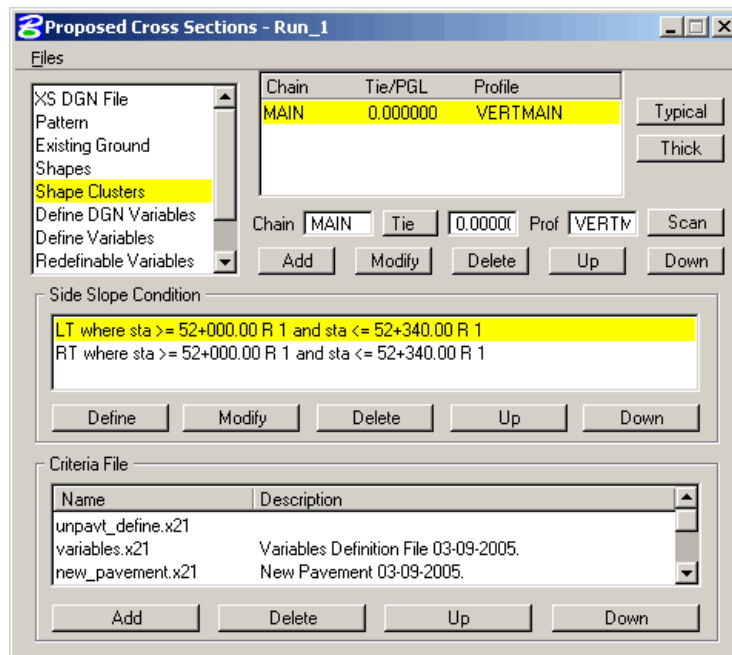
- Click on **Define DGN Variables**. You can ignore this portion of the **Proposed Cross Sections** dialog as it **only applies to the Automated Cross Section Labeling Typical**.
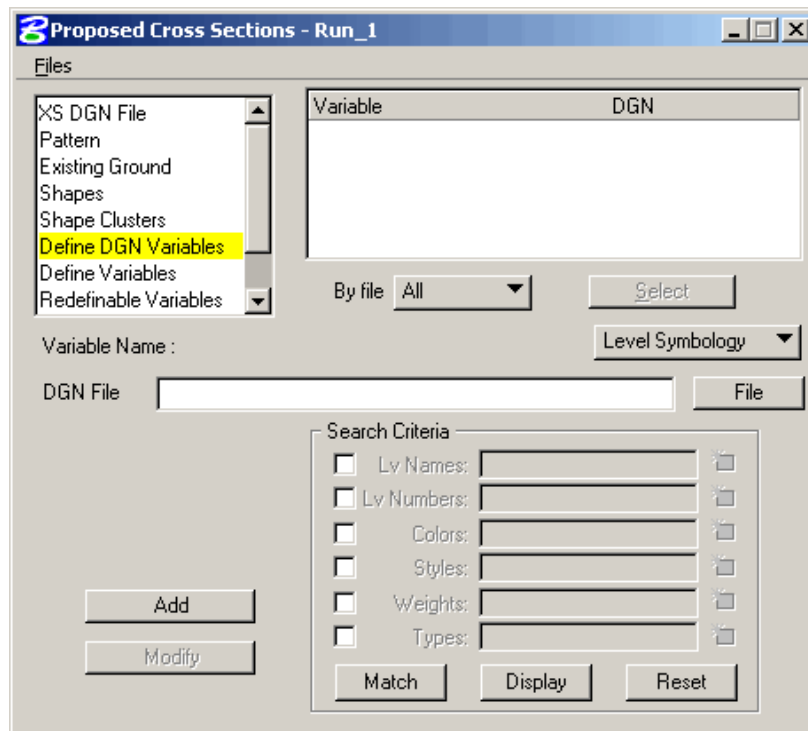
- Click on **Define Variables**. This portion of the dialog is where you specify "Global" variables such as the name of your mapping file where all the existing features are drawn (existing fence, existing edge of pavement…......). You must also specify the names of all other DGN files where the software 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**.**
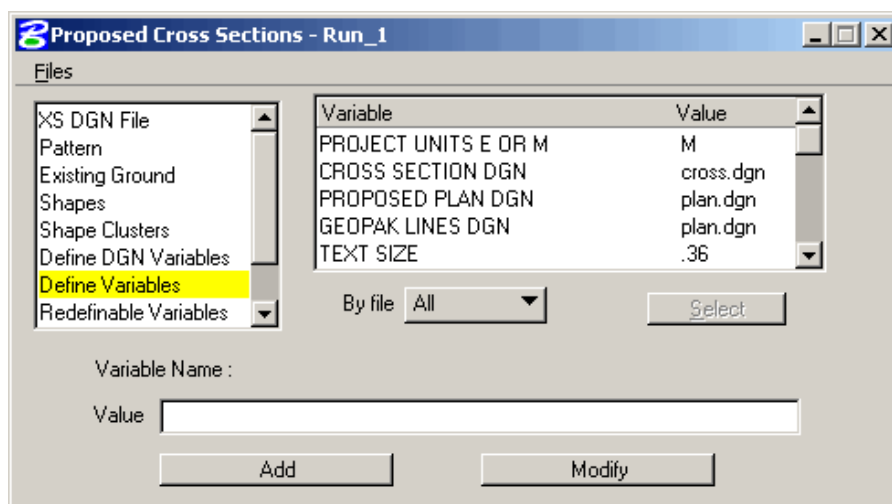
- Click on **Redefinable Variables**. This portion of the dialog is where the user can set **project specific values** for their design.

136

- 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 **0.03**. The **Save** button was pressed.
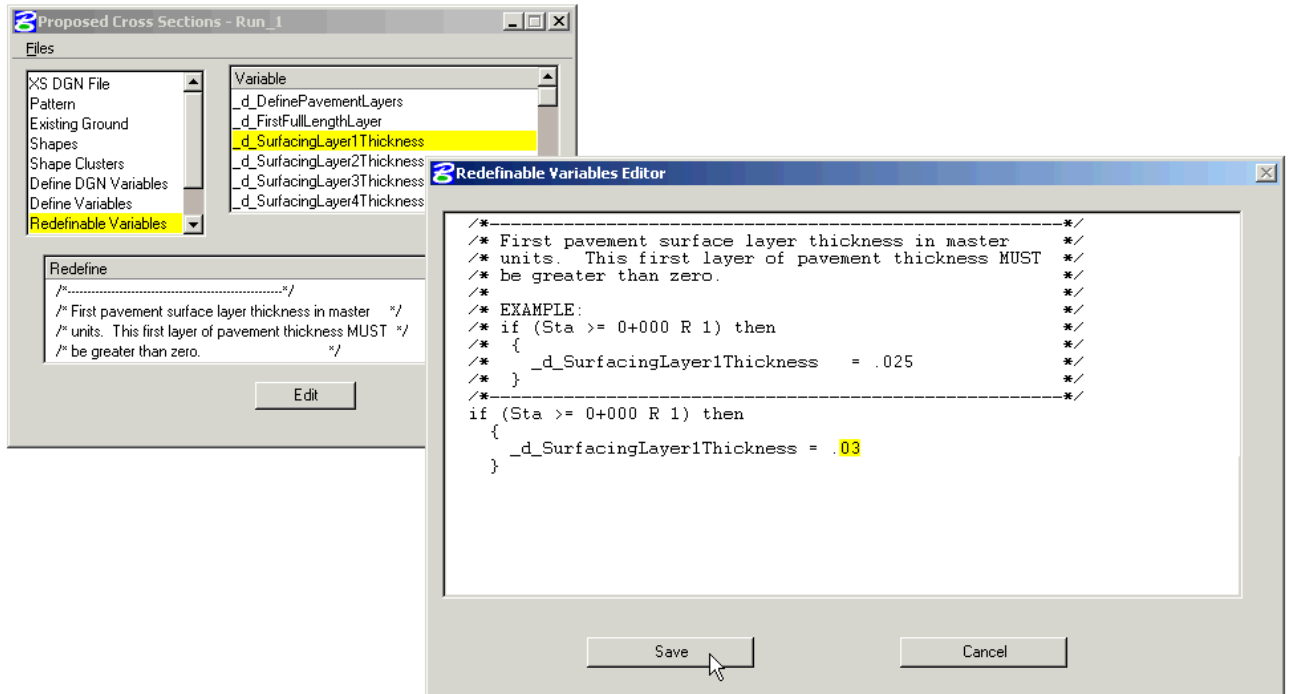
*Note:-See **Appendix-A** for more help on Editing **Redefinable Variables**.*

- Click on **Plot Parameters**. Uncheck all Plot options as shown below:
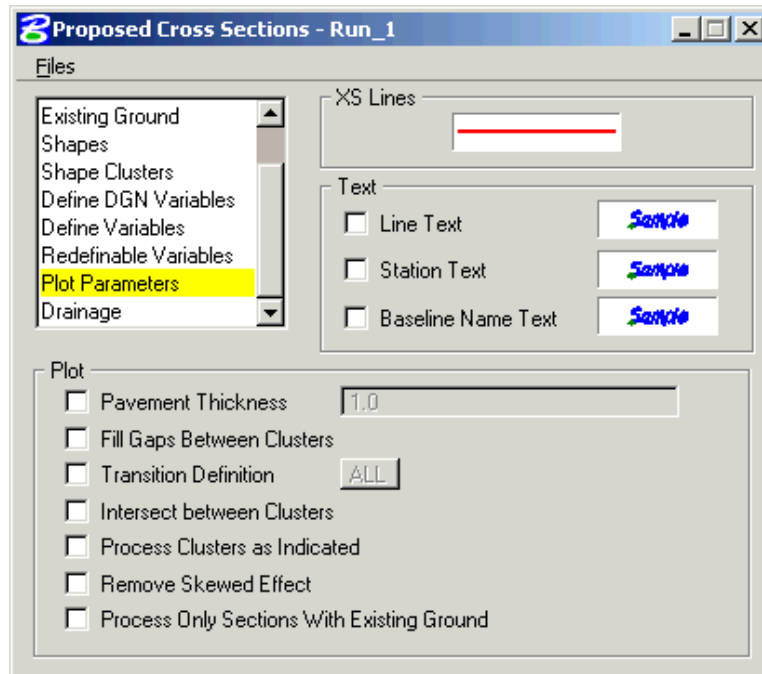
- **Drainage** is not used in Eastern Federal Lands.

- When all modifications are completed, save the Run settings using the pulldown **Files** > **Save Settings** as shown below:
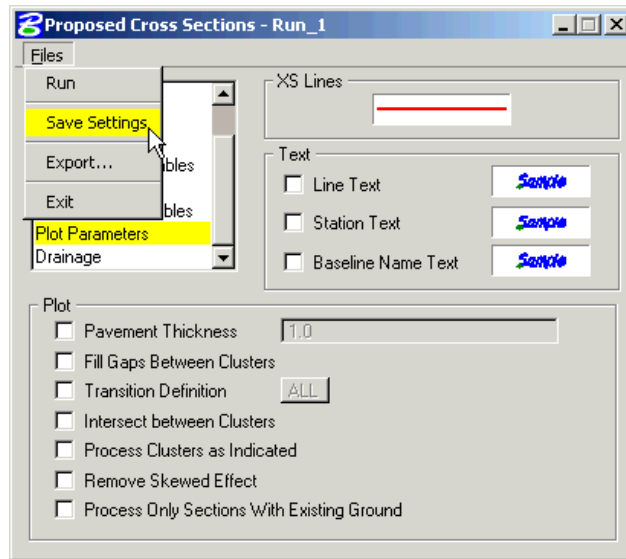
- To execute the Proposed Cross Section Run, use the pulldown **Files** > **Run** as shown below:
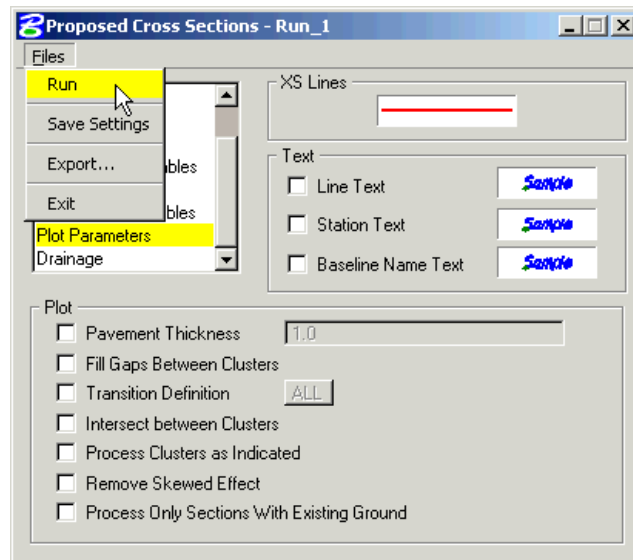
- The dialog below will appear. Set the dialog to **To Screen** or to create a .log file by selecting **To Log File**. Check **Pause On Each Section** and press **Apply**.
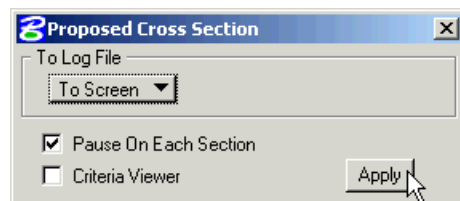
- After the first cross section is plotted, you may **uncheck** the **Pause on Each Section** toggle and press **Apply** again to complete the run.

5.11.1- Save Backup of Proposed Cross Section Run as an ASCII Input File
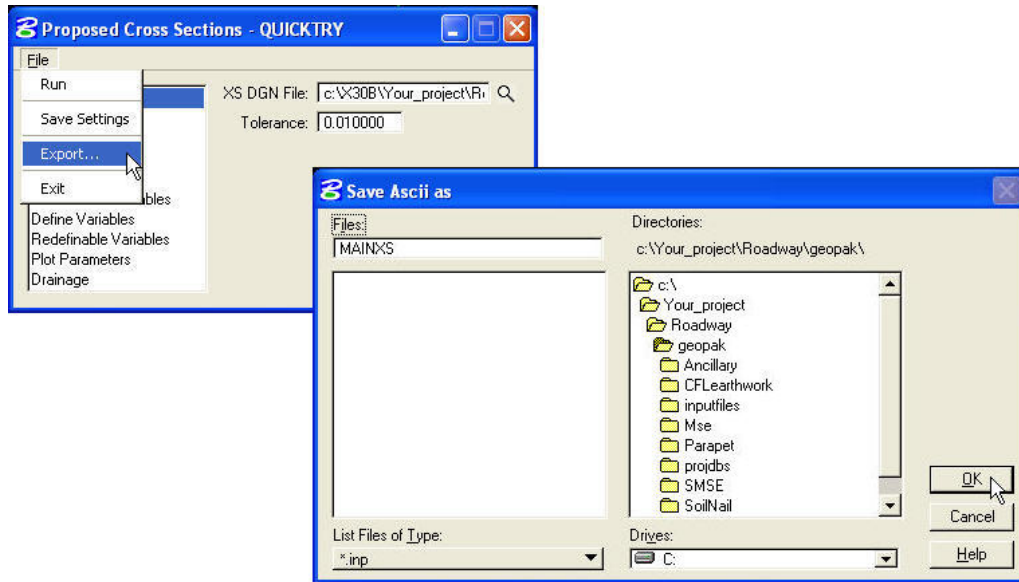
5.12- Draw Construction Limits (Geopak)

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:
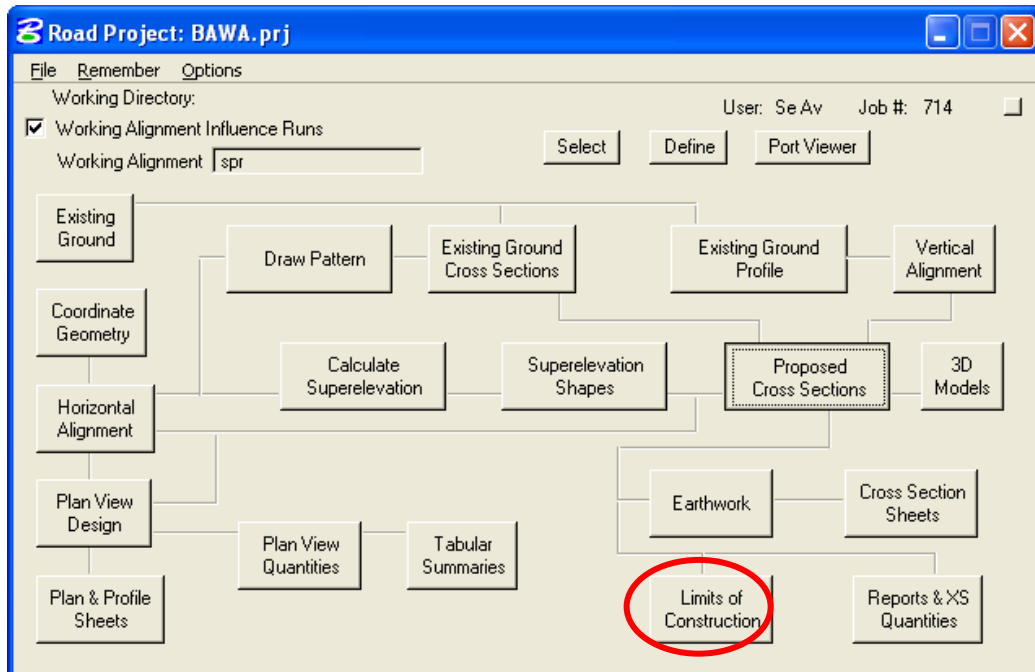
- The **Select Run** dialog appears. Use the pulldowns and select **Run** > **New** as shown below. Click on **OK**.
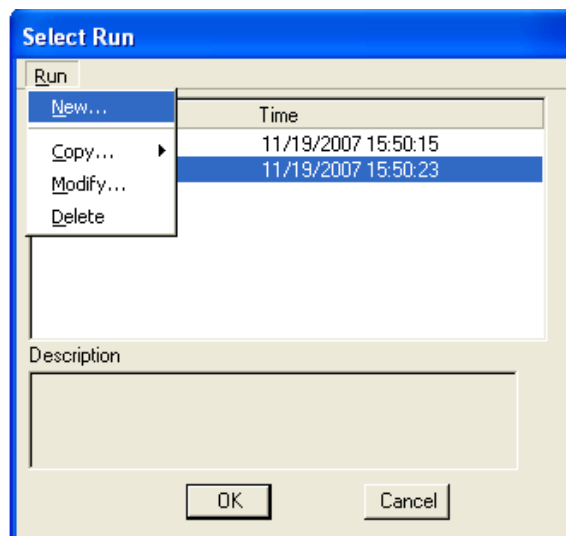
- The **New Run Name** dialog appears. Type in the name of the "Run" to create. The **Description** field is optional. Click on **OK**.
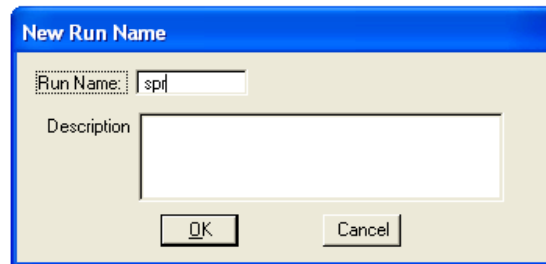
- The **Select Run** dialog appears. Highlight the desired run and click on **OK**.
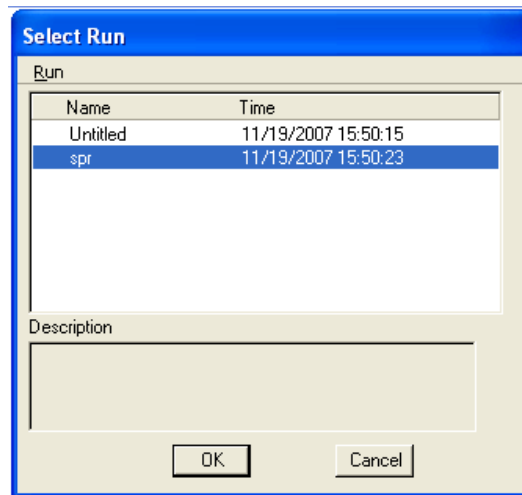
- The **Limit of Construction** dialog appears as shown below**:**
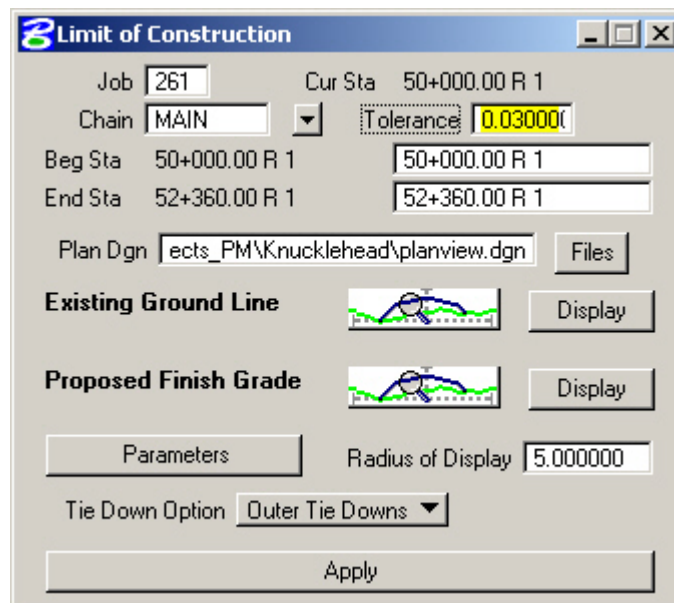
- Key in all appropriate data. The **Plan Dgn** (e.g. 01-xxxx_des.dgn) field is the name of the .DGN file that you want the construction limits elements to be drawn into. Set the **Tolerance** to **0.03**

- The **Parameters** button, when pushed, brings up the **Plot Parameters for Construction Limits** dialog.
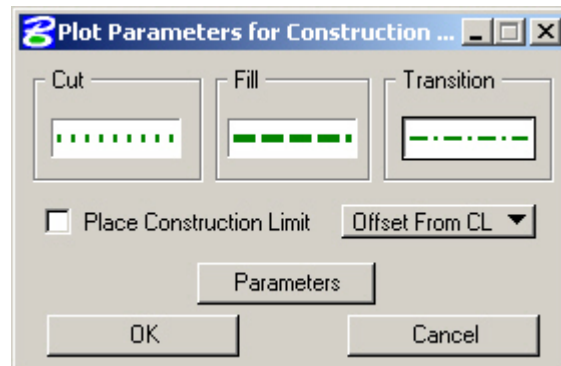
> *Note:-These construction limit lines should match the weights and line styles shown on the "**Conventional Symbols and Abbreviations**" sheet shown in your plans. The EFLHD CADD standards call for these lines to be drawn on Level name* ***P_RDW_Slope_Stake_Limits****.*
> *Cut Line**… color 2, weight 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 (never 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.

5.13- 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_V8\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
- 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:
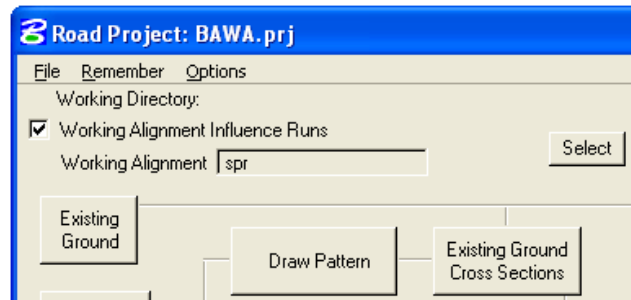
- Select the **Earthwork** button from the **Project Manager** dialog box as shown below**:**
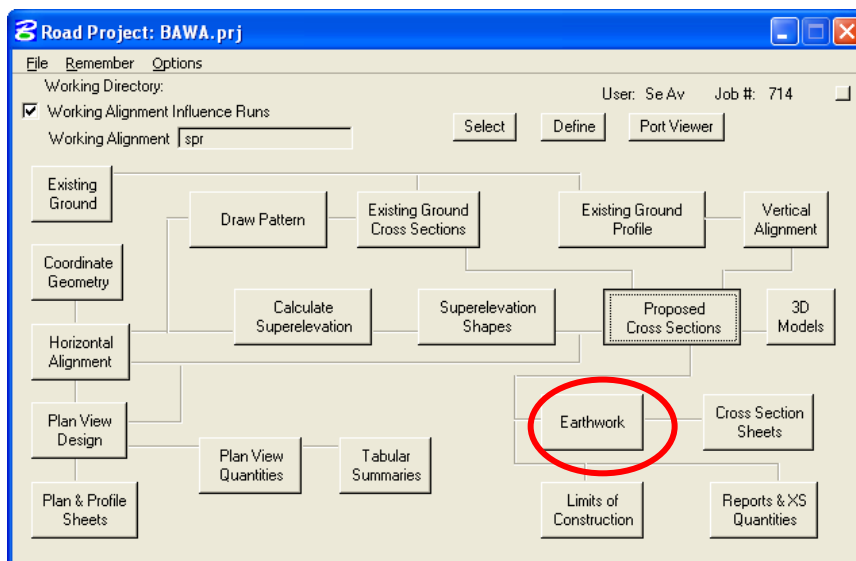
- Select **Run** > **Copy** > **Project** from the pulldowns, as shown below:
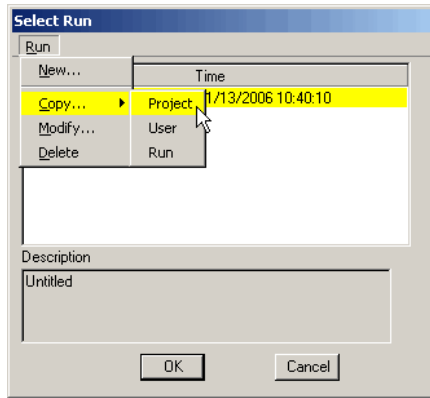
- Using the Browse capabilities of the **Directories** portion of the dialog, double click your way to the folder **M:\Engineering_Software\Cadd_Resource_V8\X_30\Standards\Seed_runs**, as shown below. Select **FLH.prj** and press **OK**.
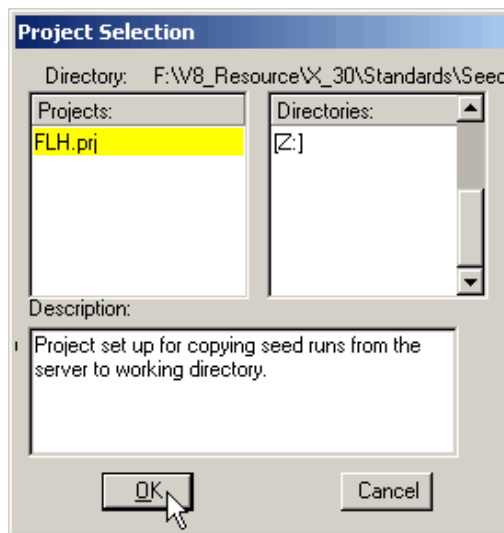
- Select **[user]** and press **OK**, as shown below:

- Select **earthwk** and press **OK**, as shown below:
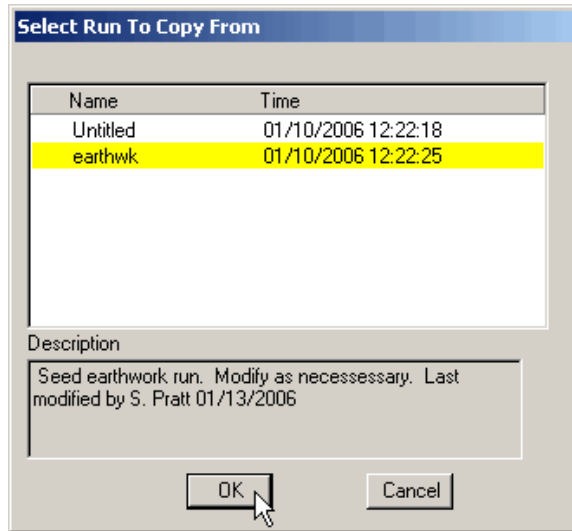
- Type in a **Run Name** that fits your project and an optional **Description**. Press **OK**, as shown below:
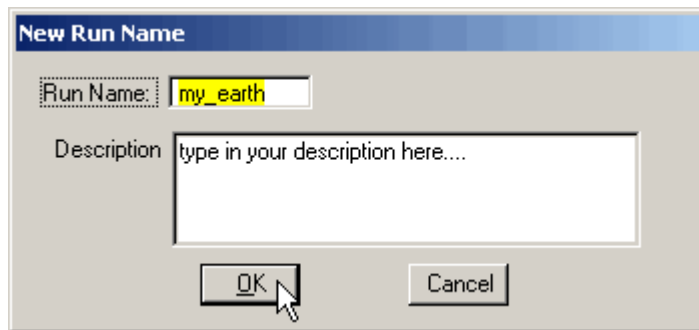
- Select your earthwork run and press **OK**, as shown below. Be patient, as it may take 30 seconds or so to copy the run from the server:
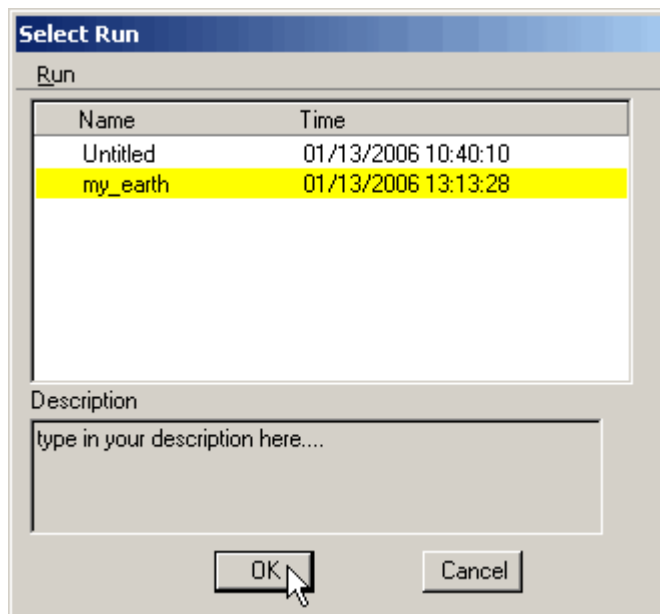
- The Project Manager **Earthwork** dialog will appear, as shown below. Notice the name of the run is shown in the blue title bar:
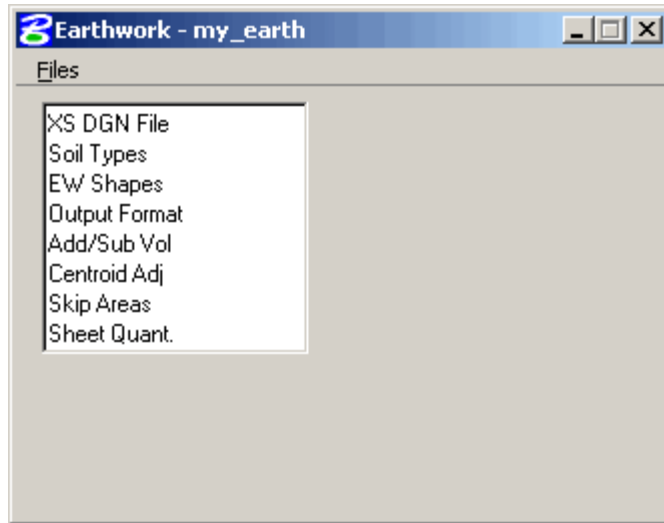
- Click on the **XS DGN File** category on the **left** side of the dialog and click on the **Select** button to select your cross section file.
- Adjust the **Tolerance** to one of settings shown below.
  - o   **Metric** projects should have a **Tolerance** setting of **0.001**
  - o   **US Customary** projects should have a **Tolerance** setting of **0.03**
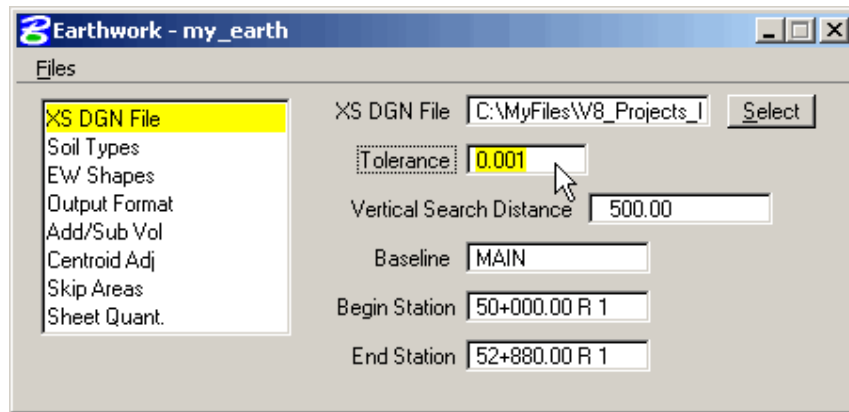
- Selecting the **XS DGN File** and setting the **Tolerance** setting are the only mandatory adjustments that need to be made to this run.

- 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:
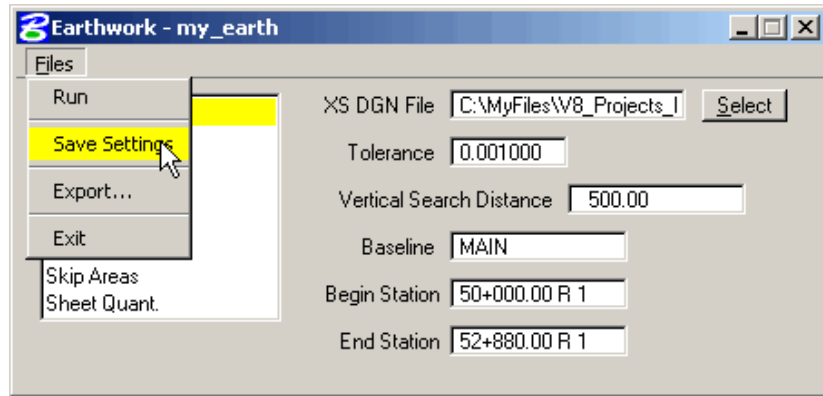
- To process the earthwork run, select **Run** from the pulldowns **File** > **Run**, as shown below:
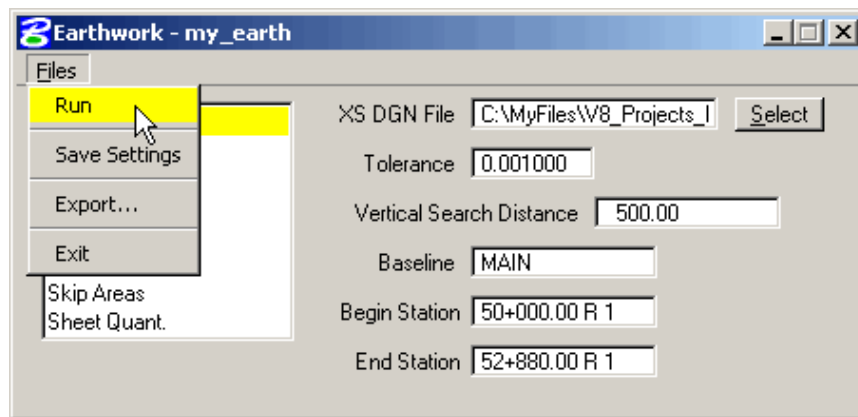
- The **Earthwork** dialog will appear as shown below. Set the dialog to **To Log File**, type in a name for your earthwork report, toggle **Pause On Each Section** to **ON** and press **Apply**.
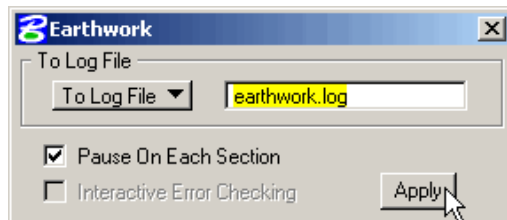
- After checking your first cross section, toggle **Pause On Each Section** to **OFF** and press **Continue** as shown below:

Process Cross Sections Display

```
                        Fill              0.6
              Mass ordinate for LAYER:
        LAYER4
              Common Exc         0.0
            Subgrade Exc         0.0
             Subsoil Exc         0.0
                    Fill         0.9
              Mass ordinate for LAYER4
        LAYER5
              Common Exc         0.0
            Subgrade Exc         0.0
             Subsoil Exc         0.0
                    Fill         1.2
              Mass ordinate for LAYER5
```

☐ Criteria Viewer
Continue ☐ Pause On Each Section
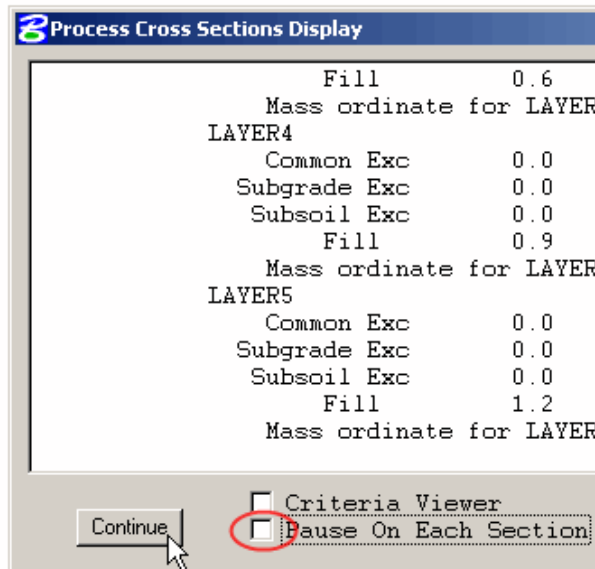
- The earthwork report can be reviewed using any ASCII text editor.

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 V8.
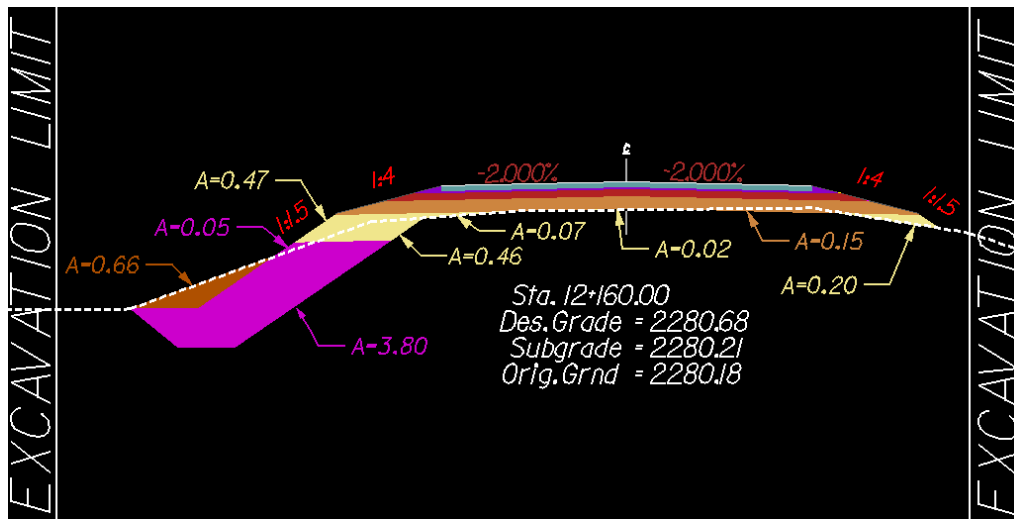
Below is what the output file (at station 12+160) would look like.

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

5.14- 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 Land has developed a Microsoft Visual Basic Application (MVBA) to generate a Subgrade Template Report. This new 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.

5.14.1- <u>Subgrade Template Report:</u>

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 sake 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_v8\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:
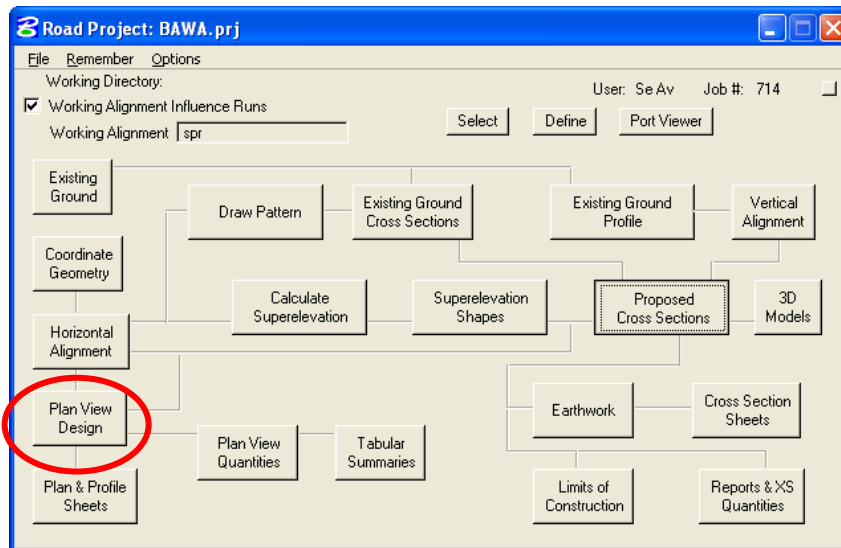
- The following dialog box will appear. Select the **Design and Computation Manager** Icon.

*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*

- Select the **CFL Subgrade Template Report** from the **MVBA Applications** category in the V8_English.ddb (D&C Manager) as shown below.
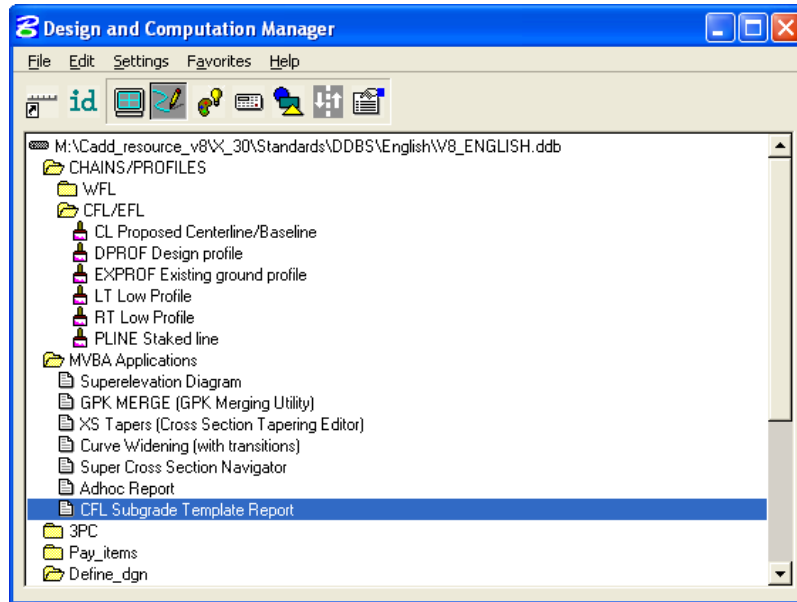
- Double click the **Subgrade Template Report**. The **Subgrade Template Report** dialog box will appear as shown below.
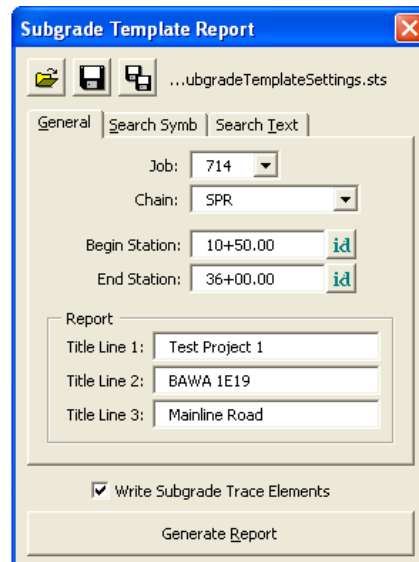
Note:-The Subgrade Template Report MVBA has three tabs which must be filled in prior to generating the Subgrade Template Report. The first tab entitled "General" contains general information including, Job #, Chain, Begin and End Station and the headers for the report.

- 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.
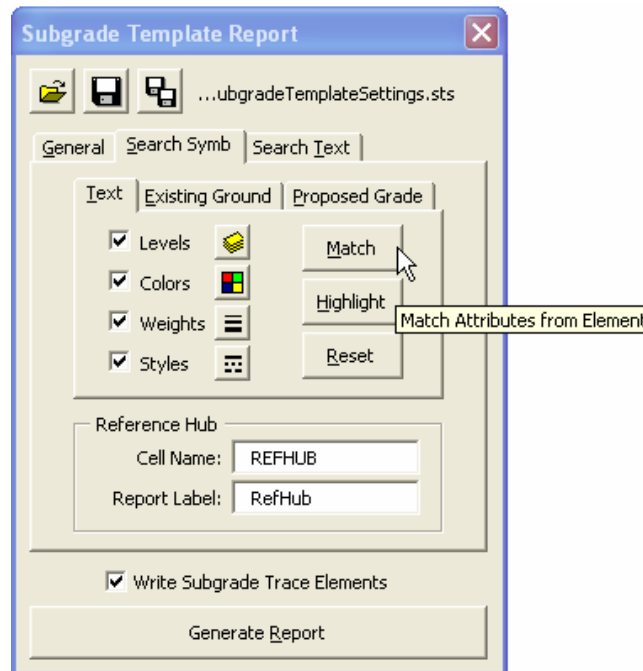
*Note:-When the Subgrade Template Report MVBA is invoked, the VBA loads a default Subgrade Template Settings (.sts) file and automatically places it into the working directory. The default Subgrade Template Settings (.sts) file contains all the settings of the **Search symb tab** and the **Search Text** 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

152

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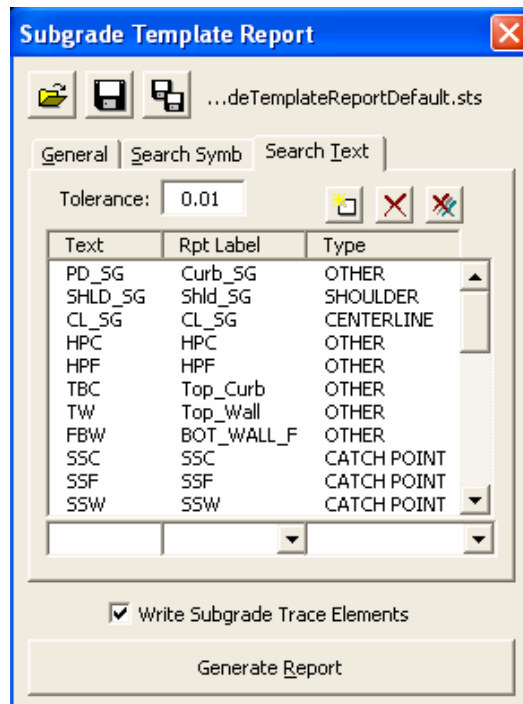
- The user can manipulate the search text list with the help of edit tools as shown above.

> *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.
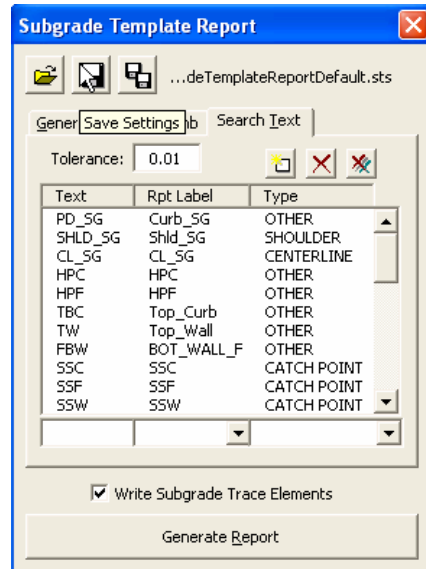
- Select Generate Report to create the report with the defined parameters.
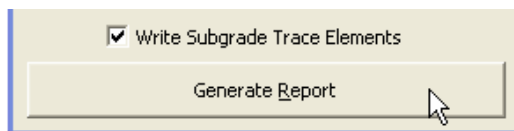
- The following dialog will appear asking to provide the name of the subgrade report file to be created. Provide a name and Select Save.
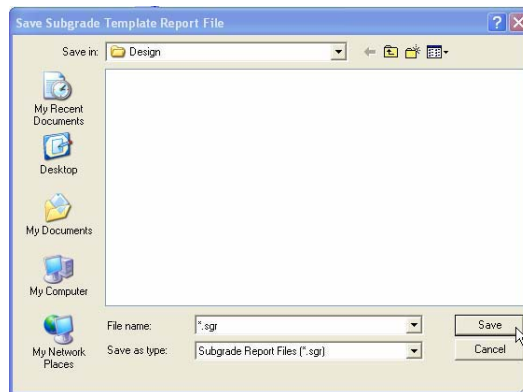
- Occasionally errors are found in the cross sections. These may be caused by incorrect symbology (either in the cross sections or that specified in the dialog) or by search text not specified correctly. When an error occurs on any given cross section the user will be presented with a dialog similar to the following:
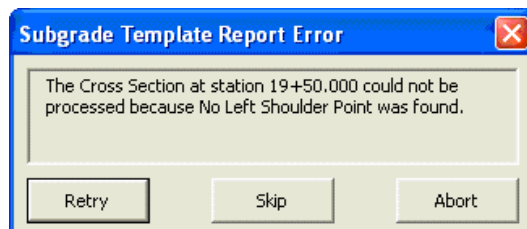
- The description of the error in the dialog will indicate the location and type of error that was found.

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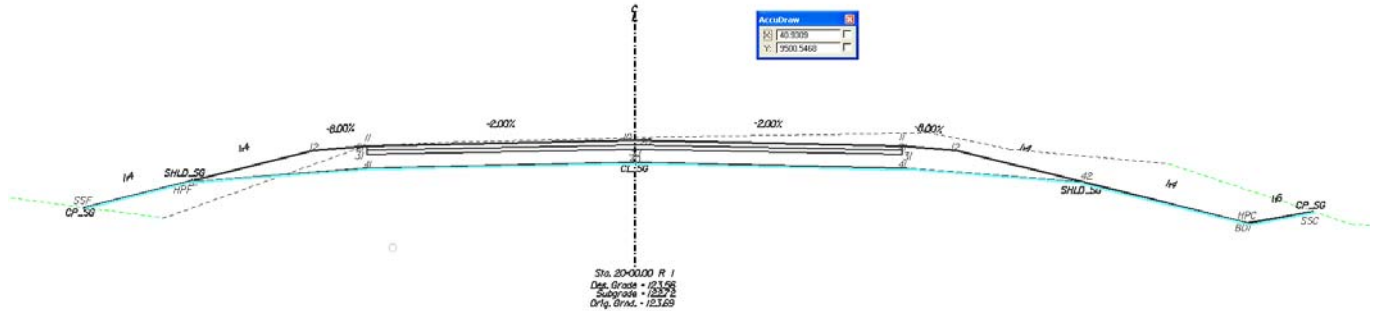
- The Subgrade Template Report will produce the following report as shown below. The report will be saved in the location specified and can be viewed and printed using any text editor application. UltraEdit is preferred for viewing and printing the **Subgrade Template Report**.

Test Project 1
Page# 20
BAWA 1E19
Mainline Road
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 Diff.	Horiz. Diff.	Vertical
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				
							0.045	-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.

155

Typical cut w/paved shoulders

Typical fill w/paved shoulders
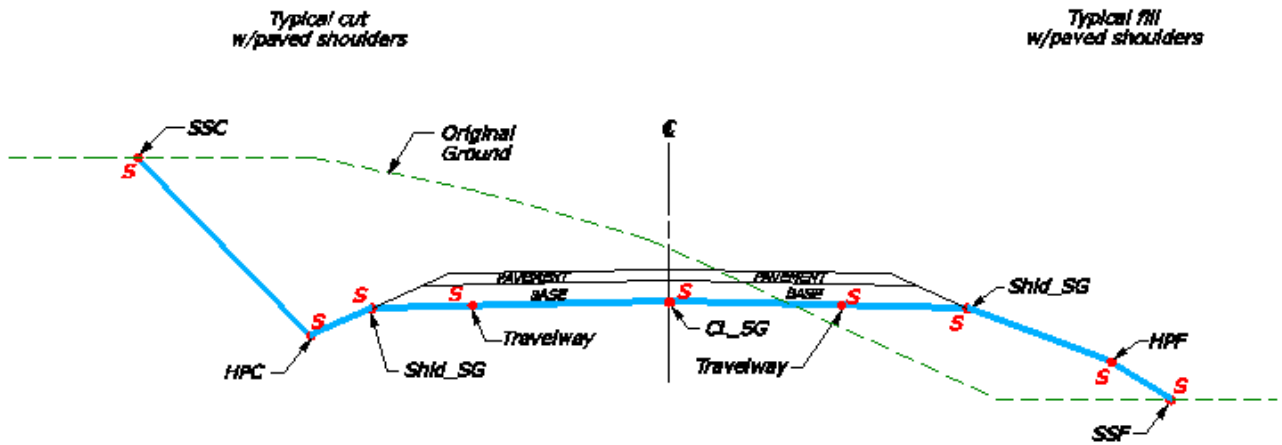
5.14.2- <u>Staking Detail Report:</u>

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**:**
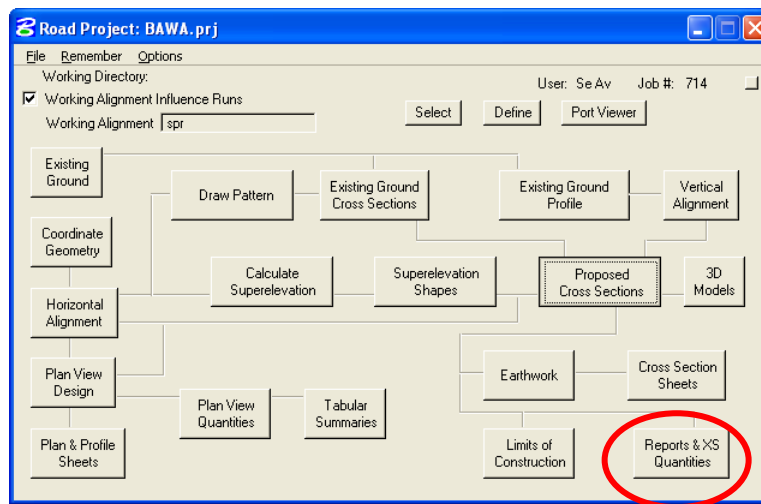
- The **XS Report** dialog will appear as shown below. Click **User** and fill out the **Report Header** Dialog box. This **Report Header** information can be saved by clicking on **File** and selecting the path and file name to be saved.
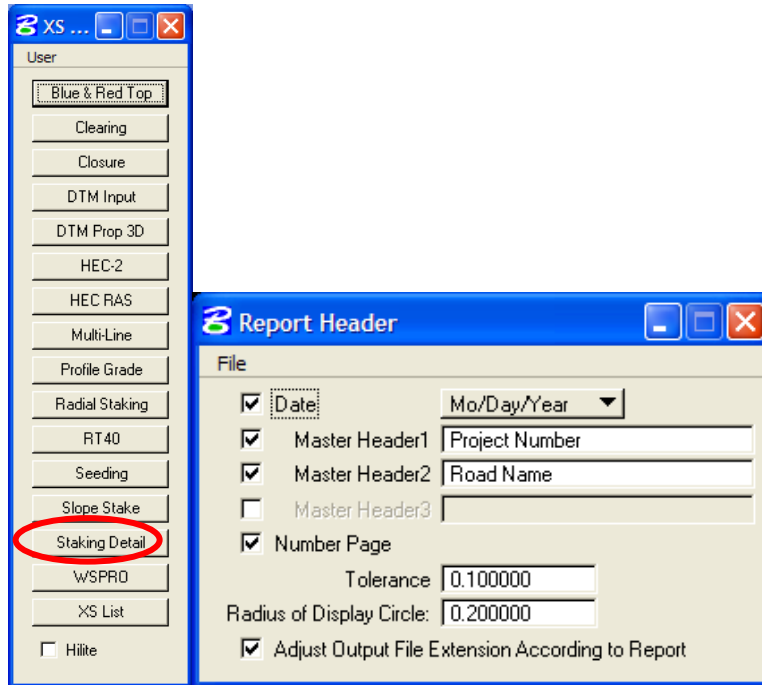
- Select the **Staking Detail button** from the **XS Report** dialog box. When selected, you will get the following dialog box.
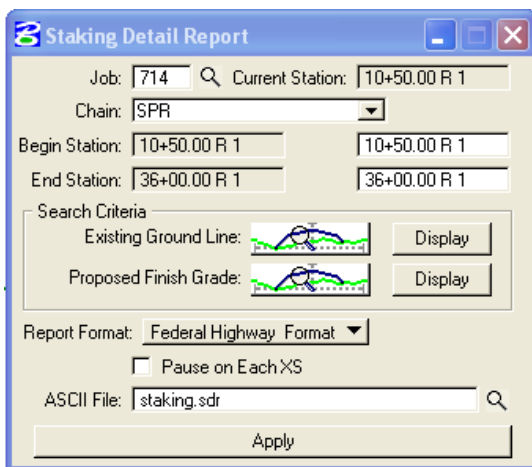
- To set the symbology values for the **Existing Ground Line** and **Proposed Finish Grade**, pick the symbology button to get the following dialog boxes:
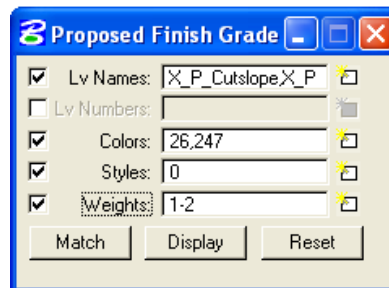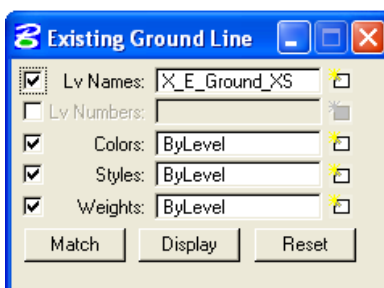
- Set the existing ground line symbology as shown above. Select the bottom of the pavement layer, ditch slope, cut slope and fill slope for proposed finish grade. The values shown in the Existing Ground Line and Proposed Finish Grade sections will allow GEOPAK to progress through the top of subgrade. 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)							
	Slope	Left Stake				Right Stake					Slope
STATION		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.

5.14.3- 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**(provide Northing, Easting values, and Elevations). To generate this report, access the MicroStation file containing the cross sections and select the **Blue & Red Top** buttonfrom 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:
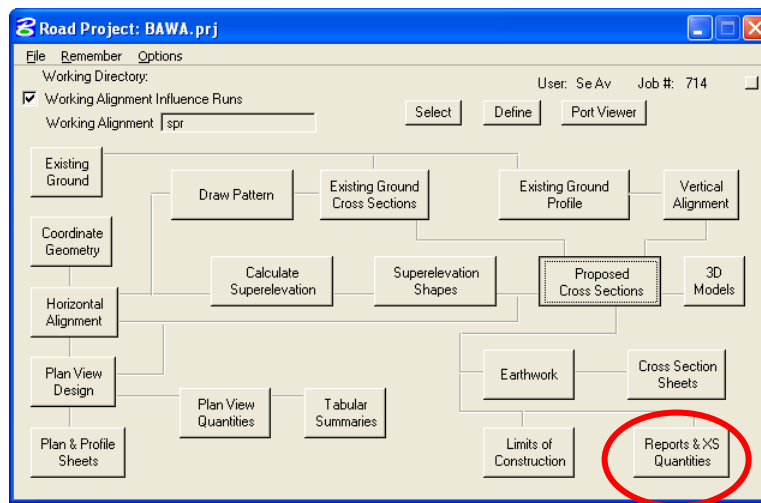

- The **XS Report** dialog will appear as shown below. Click **User** and fill out the **Report Header** Dialog box. This **Report Header** information can be saved by clicking on **File** and selecting the path and file name to be saved.
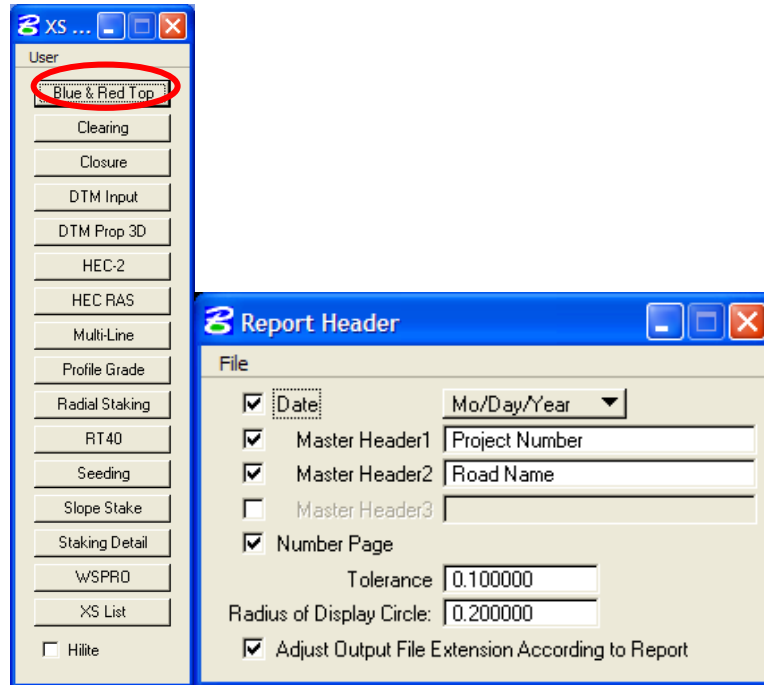
- Select the **Blue &Red Top button** from the **XS Report** dialog box. When selected, you will get the following dialog box.
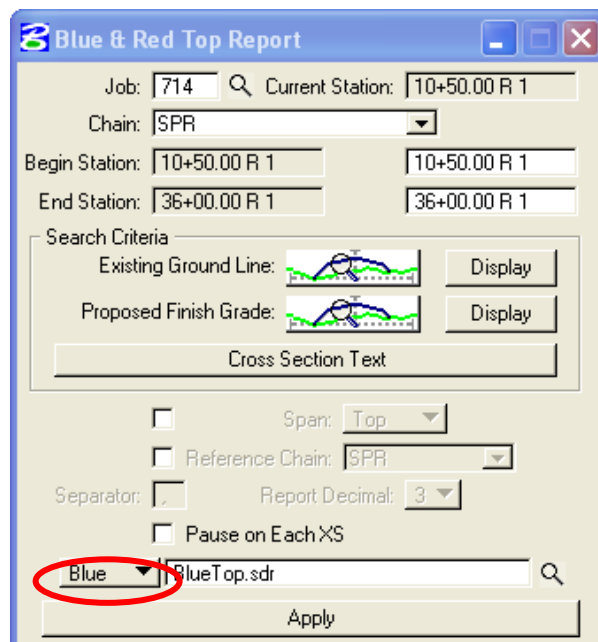
- Toggle the type of report to be generated, (located at the left of the directory path) to **Blue**.

- 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:
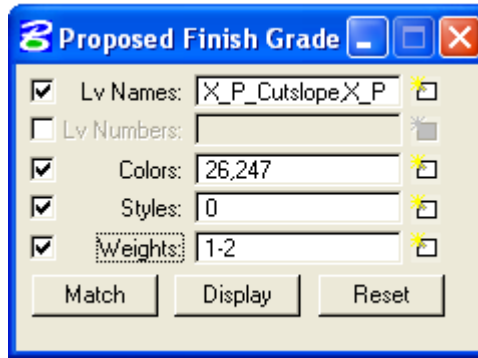
- The values defined in the Existing Ground Line and Proposed Finish Grade sections will allow GEOPAK to progress through the top of base course. You may need to include the top of pavement symbology if the foreslope has the same symbology along the base course as the pavement section. The values shown 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.
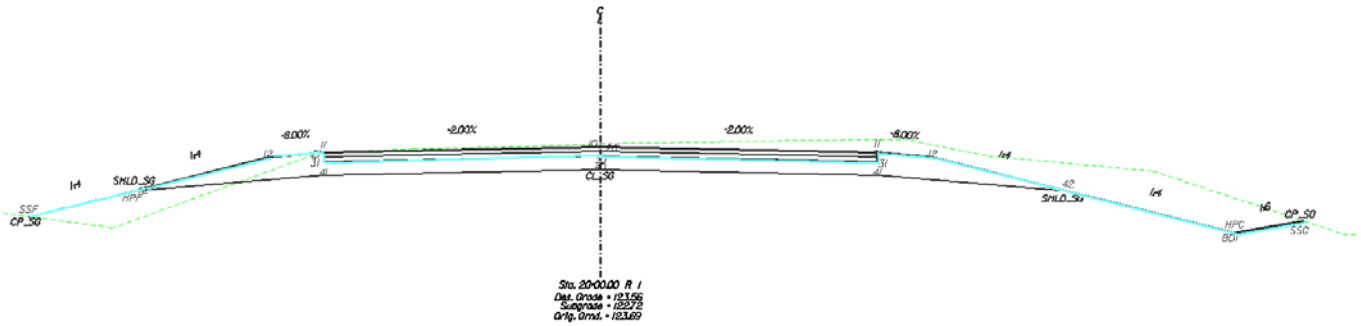
- Keep the Span and Reference button toggle off as shown below.
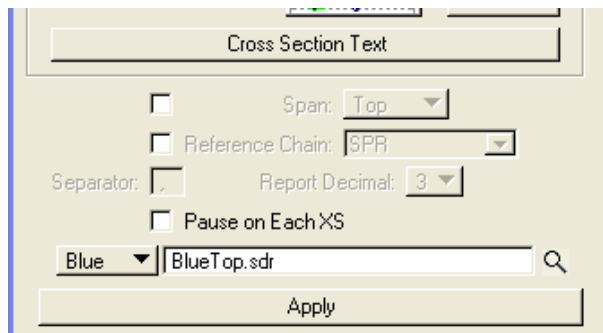
- Select the **Text** button to bring up the **Blue and Red Top Text Set** dialog box as shown below:
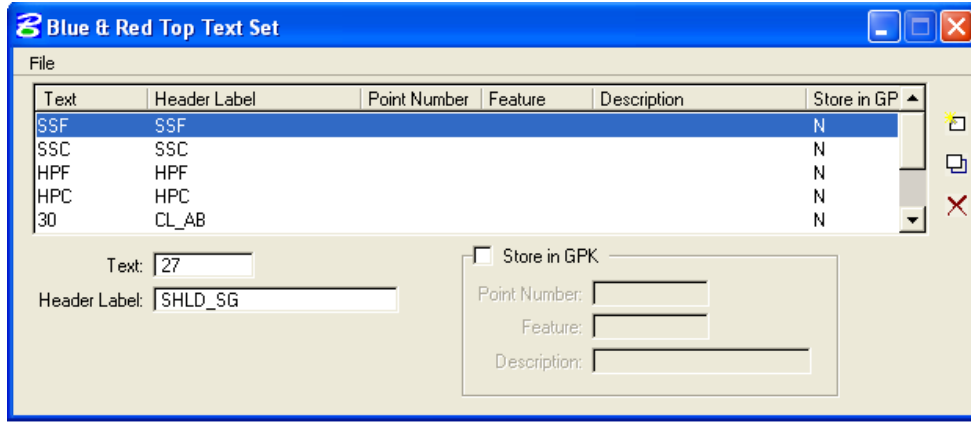
- Review the cross section to select text at the points that you want reported. For X_30 FHWA criteria, the text placed on your cross sections on a level named **X_Text_Search**. Review your cross sections and key in the text to search for and its description. Press **Add** or **Delete** after each entry. 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_v8\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	SSC
20+00.00R1[SPR]	121.03	121.97	123.20	123.02	123.36	123.22	123.36	123.02	123.20	120.47	120.88
	-20.65	-16.90	-12.00	-10.00	-10.00	0.00	10.00	10.00	12.00	22.90	25.39
		-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.
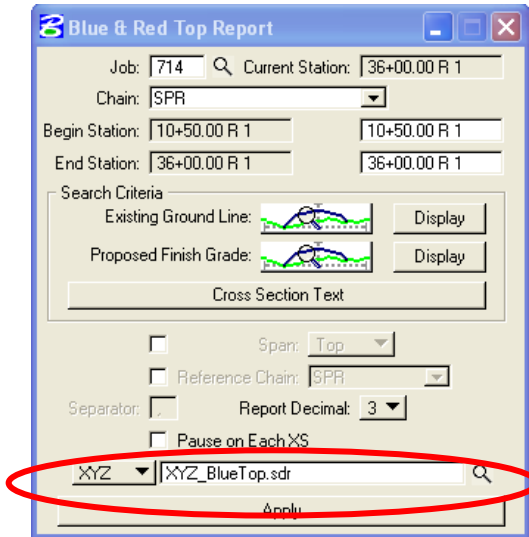
XYZ Blue Top Report

Station	X	Y	Z	Offset	ID	SLOPE
--------------------	------------	------------	------------	--------	------	------
20+00.00R1[SPR]	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	

SECTION 6: Geopak – EFLHD Procedures

6.1- GEOPAK Plan & Profile Sheet Clipping (Geopak 8.x)

Note:- The procedure outlined below is specific to creating plan & profile sheets, double plan, and separate plan and profile sheet for 11"X17" sheet sizes only.

GEOPAK will create **Plan sheets, Profile sheets**, **double plan sheets** and **plan/profile sheets**. These sheets are generally created at 20, 40, 50, and 100 scale English (ft/in).
Station range, drawing areas, and many other variables are contained in the sheet library files
eflhd_Eng_sheets.psl. The sheet library file contains many values specific to EFLHD such as cell library names and locations, specific sheet cells to be used, drawing scales, and a variety of text parameters. It cannot be modified by the user.
The sheet library files for EFLHD projects are located at:
M:\Engineering_Software\Cadd_resource_v8\Plan&Profile_Shts

The user copies this file into his/her working directory in order to run the Plan & Profile sheet smoothly.

Prior to using the GEOPAK Plan and Profile Sheet Composition tool, three files need to be created. **Clip.dgn**, **Plan_motif.dgn** and **Profile_motif.dgn** should be created to assure proper setup of plan and profile sheets. Outlined below are the uses and instructions for creating each file.

6.1.1- Create Clip Sheets and Motif Files

Clip Sheet file   Creating a drawing to display the sheet boundaries will allow the user to always have a visual representation of each sheet layout in relation to the others. If the design changes, having this file will allow the user to move sheets around to better fit any design changes. Create this sheet, and reference the map file, the horizontal alignment design file and profile design file into this new file. By referencing the overall design into the "**01-ProjectName_Clip.dgn**" file, any future design changes will be displayed in this new file, instantly showing the designer which sheets, if any, will need to be adjusted.

Motif files   Motif files act as seed files for clipping plan and profile sheets. Each Motif file should be a blank file with the proper reference files attached, and the proper levels for each file turned on or off. The Plan and Profile Sheet Composition tool will use these files when clipping each sheet and each clip sheet will have the correct files displayed with the correct levels on. For example, if the plan view in a final plan sheet needs to show overall design, mapping, raster images, ROW, etc., with specific levels on or off for each of these files, you would only need to setup this combination once in the motif file. This information would be used to create each sheet. These sheets should be named 01-**ProjectName-Plan_motif.dgn** and 01-**ProjectName-Profile_motif.dgn**. Create Plan_motif design file, attach each reference file that should be shown in the plan view, and turn on or off any levels to make the display look exactly like the final plan sheets in plan view. Repeat these steps for the Profile_motif design file, referencing the profile sheet into the motif file.

6.1.2- Plan/Profile sheets using GEOPAK

Open the Clip.dgn and select the Plan and Profile Sheet Composition tool from Project Manager by selecting the button for Plan & Profile Sheets. Select a Run or create a new Run.
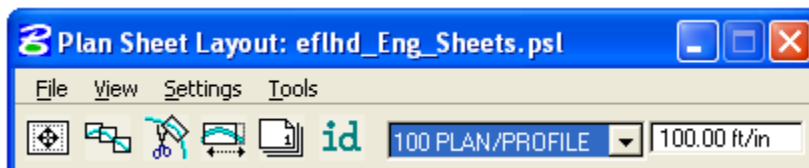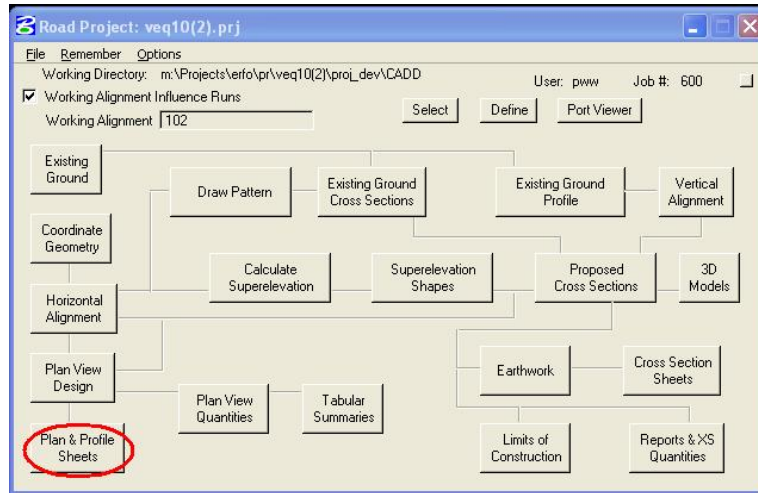
A row of icons is available to access the dialog boxes listed below. The corresponding menu access selections are noted in parenthesis.

 Sheet Composition (**Tool>Sheet Composition**)

 Layout Sheet (**Tools> Sheet Layout**)

 Clip Sheets (**Tools>Sheet Clip**)

 Modify Sheets (**Tools> Modify**)

 Sheet Number Manager (**Tools>Sheet Number Manager**)

To the right of the icons are the Sheet Name list box and the scale. This list box contains a list of sheet types that are configured in the currently selected sheet library.

Note: This tool requires what GEOPAK refers to as "Sheet Libraries" be set up ahead of time. These sheet libraries contain a variety of Agency specific information. Cell Library names and locations, drawing scales, variety of text parameters, locations for the graphics to be clipped and placed within the sheet cells.......... and many others.
This documentation is not targeted at teaching the process of setting up the Sheet Libraries. It is already setup for EFLHD users.

In order to complete the setup procedure you will need to know the scale you want the plan section of the P&P sheets to be drawn to. The following table outlines the available combinations of station range, horizontal, and overlaps for various scales that are commonly used in EFLHD.

TABLE 1

Sheet name	Scale	Station Range	Horizontal	Overlap	Remark
20 Plan/Profile	20	280	15	Multiple of 5	(Plan &Profile Sheet)
20 Sep P/P	20	280	15	Multiple of 5	(Separate Plan and Profile)
20 Double Plan	20	280	15	Any	(Double Plan Sheet)
40 Plan/Profile	40	550	15	Multiple of 10	(Plan &Profile Sheet)
40 Sep P/P	40	550	15	Multiple of 10	(Separate Plan and Profile)
40 Double Plan	40	550	15	Any	(Double Plan Sheet)
50 Plan/Profile	50	700	12.5	Multiple of 12.5	(Plan &Profile Sheet)
50 Sep P/P	50	700	12.5	Multiple of 12.5	(Separate Plan and Profile)
50 Double Plan	50	700	12.5	Any	(Double Plan Sheet)
100 Plan/Profile	100	1400	25	Multiple of 25	(Plan &Profile Sheet)
100 Sep P/P	100	1400	25	Multiple of 25	(Separate Plan and Profile)
100 Double Plan	100	1400	25	Any	(Double Plan Sheet)

### 6.1.3- Example -Clipping an English project using 100 Scale Plan/Profile sheets.

1. The following Plan Sheet Layout dialog box appears. Select 100 Scale Plan/Profile using the drop down arrow, and adjust the Scale field to 100 ft/in as shown below:
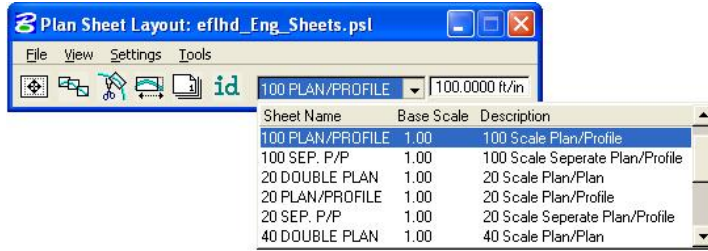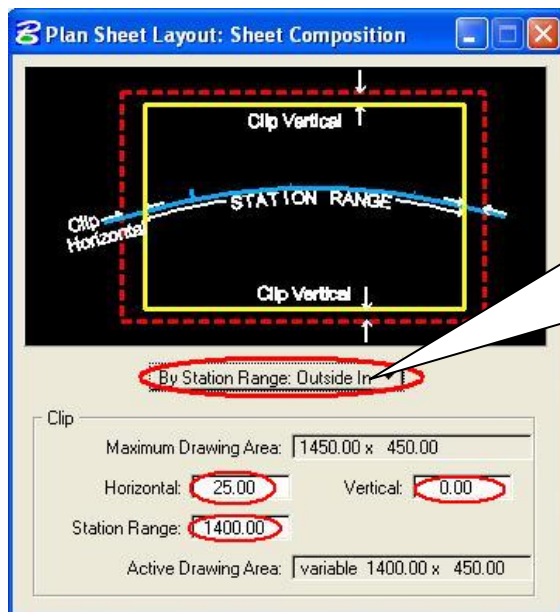
2. From the pull downs, select Settings > Sheet Layout and adjust the Sheet Layout Settings as shown below and press OK:
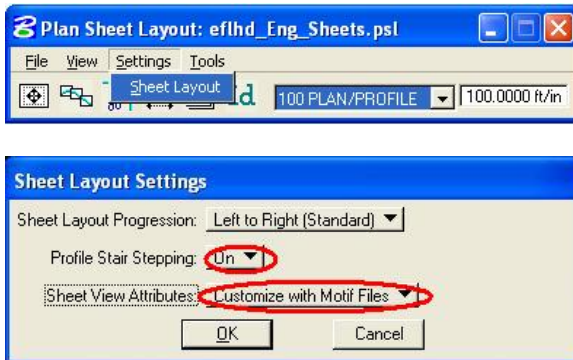
3. Invoke the Sheet Composition dialog by clicking on the Sheet Composition icon from the Plan Sheet Layout dialog as shown below:
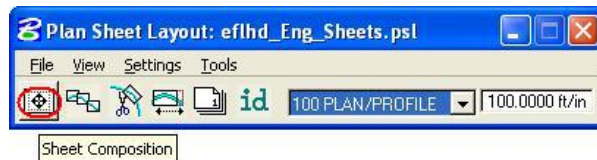
4. Modify the Sheet Composition dialog box as shown below:

Select either of them:

By BeginStation/OverLap
By Station Range: Inside Out
▶ By Station Range: Outside In
By Station Range: Radial

Note:-
- **Radial**, it makes it very clear and clean.
- **Others**, need some clean up but have more control

< Use **Table 1** to populate the Clip area

Note:
The dialog shown is settings for a 100 Scale PLAN/PROFILE "sheet style." Other "sheet styles" have been created for English projects. The settings can be found at the end of this documentation.

166

5. Invoke the Layout Sheets tools by selecting the Layout Sheets icon from the Plan Sheet Layout dialog as shown below:
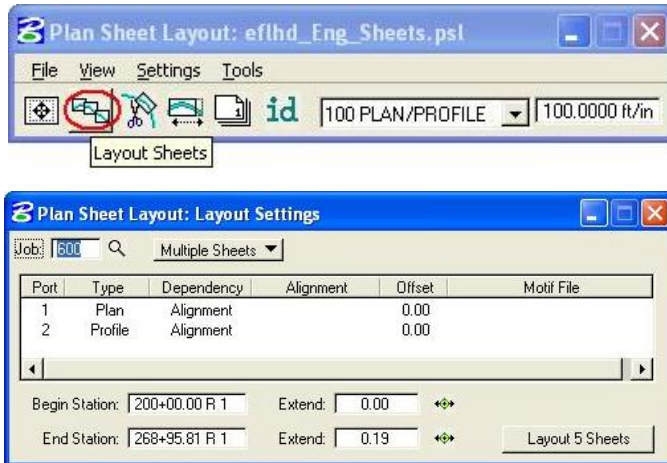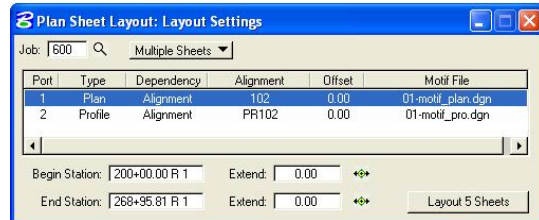

Layout Settings Tool

6. Select Multiple Sheets from the dialog box and Select the GPK file by keying it into the "Job:" box, or by browsing using the file open icon.

7. To populate the Plan Port Data dialog box, double click anywhere along the row for Port 1 in the Layout Settings dialog box and the following dialog box will be open.
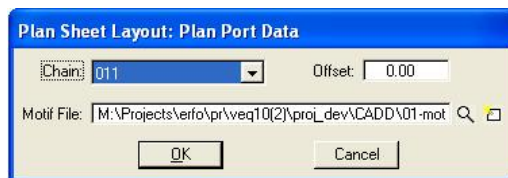
8. Select the correct Chain and the appropriate Plan Motif file. Press OK.

9. To populate the Profile Port Data dialog box, double click anywhere along the row for Port 2 in the **Layout Settings** dialog box and the following dialog box will be open.
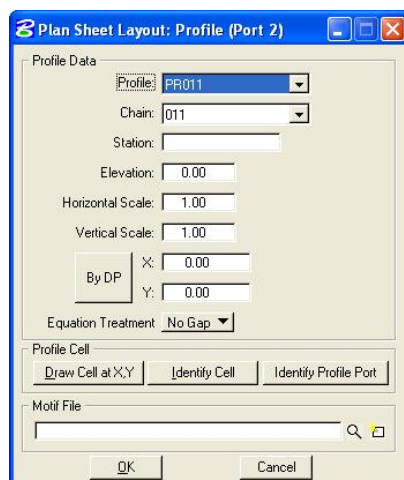

10. If a profile cell exists for the file that is referenced to the Clip.dgn file then click on Identify cell, place data point on the profile cell and accept. Profile Data dialog fields can be populated using this method, or by manually entering in the required information.

11. Select the appropriate Profile Motif file. Press OK.

12. GEOPAK will calculate the number of sheets to layout; number of sheets calculated will be placed on the button at the bottom right of the Layout Settings dialog box. The extend distance filed will allow the user to enter a value that will shift the clipping shapes backwards or forwards a given distance. If the number of sheets is acceptable, press the Layout 8 Sheets button and GEOPAK will draw clipping shapes into the drawing.
The clipping shapes for both the Plan and Profile have now been placed as shown below:
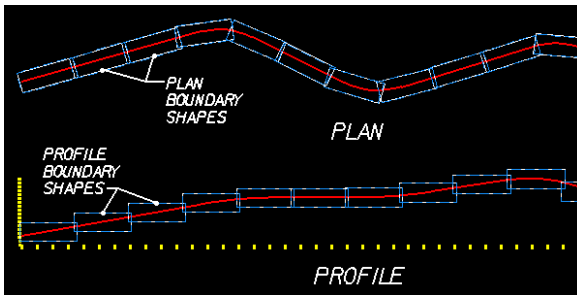
Close the Sheet Layout dialog by clicking on "X" at the top right.
Note: In order for the data to be clipped correctly, use the Sheet Layout Modify Tools. Two most common types of modification supported are sliding the sheets and modifying the drawing area. The drawing area cannot be increased in Length (Horizontal) or Height (Vertical) to exceed the Drawing Area setup in the sheet library.

13. For extremely curved chains and steep vertical curves it may be necessary to modify the clipping shapes once the clipping shapes are placed. Use the Modify Sheets icon, from the Plan Sheet Layout dialog to invoke the Modify tools, as shown below:
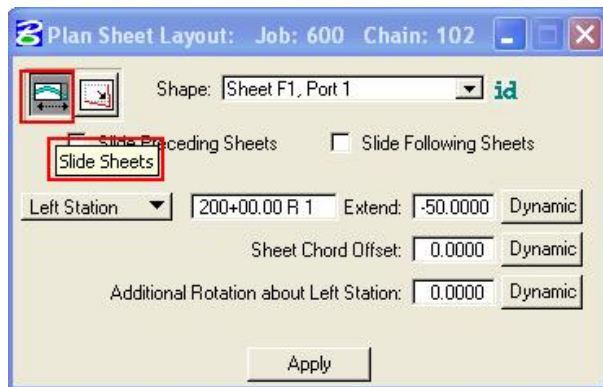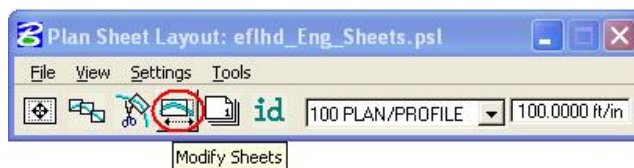
14. Identify the Sheet (Clipping Shape) to be modified by clicking on the ID button and then data pointing the clipping shape or simply select it from the pick list, via the down arrow.

168
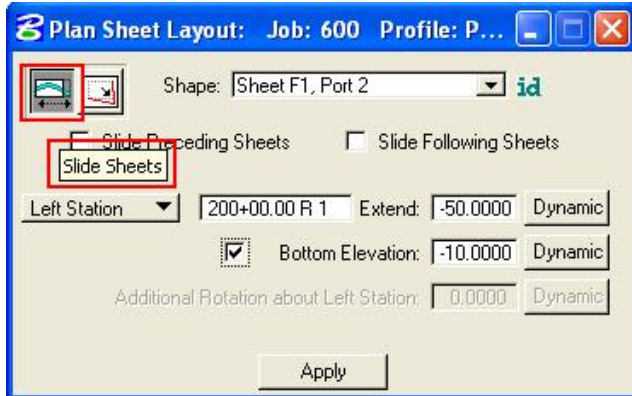
NOTE:
*The application is intelligent enough to know whether a Plan clipping shape or Profile clipping shape has been identified. When a Profile clipping shape is identified, the "Sheet Chord Offset" "field changes to "Bottom Elevation","(as shown above). When modifying the vertical position of a Profile clipping shape, toggle "Bottom Elevation" ON, type in the desired "bottom of the shape" "elevation, or press Dynamic and move the shape up or down.*

15. Use the Sheet Number Manager tool to number sheets according to EFL standards. To invoke the Sheet Number Manager tool, use the Sheet Number Manager icon, from the Plan Sheet Layout dialog, as shown below:
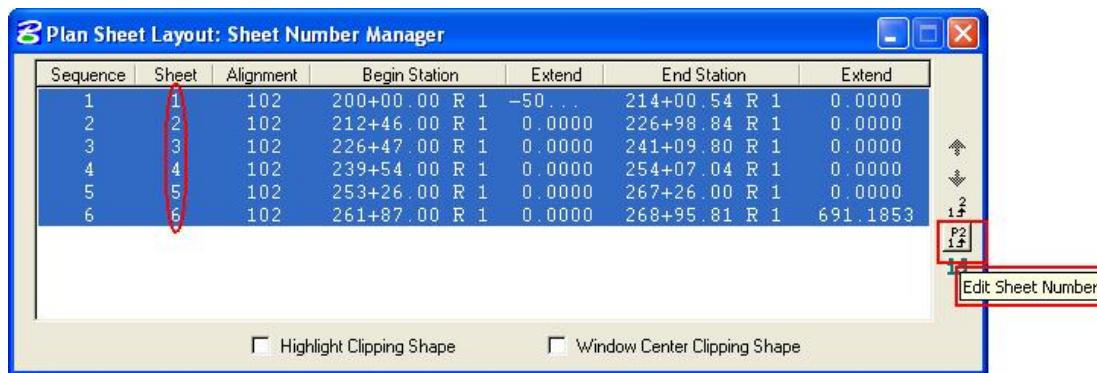
16. Click inside the white area anywhere on row one, hold down the shift key and click a second time anywhere on the last row. Once all rows are selected, click on Edit Sheet Number as shown above.

17. For EFL specific sheet numbering scheme where the sheets are numbered in sequence beginning with D1, complete the Edit Sheet Number dialog as shown below and press OK:
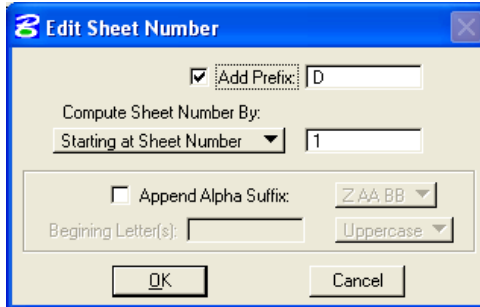
Edit Sheet Number Tool

18. When OK is pressed the Sheet Number Manager dialog will appear as shown below:
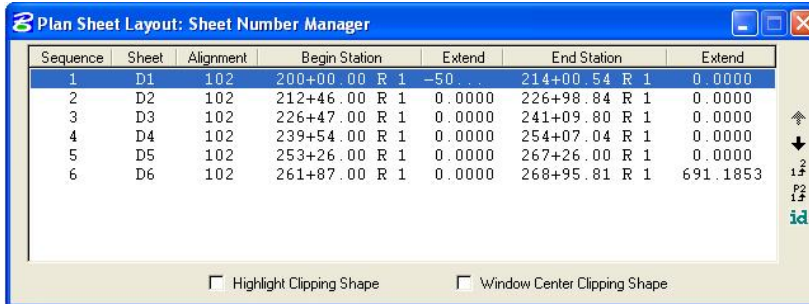
Note:- With different run for the same alignment clip, user must recheck the sheet number and sequence.

19. Once the clipping shapes are placed and satisfactorily modified, invoke the Clip Sheets tool. Select the Clip Sheets icon from the Plan Sheet Layout dialog as shown below:
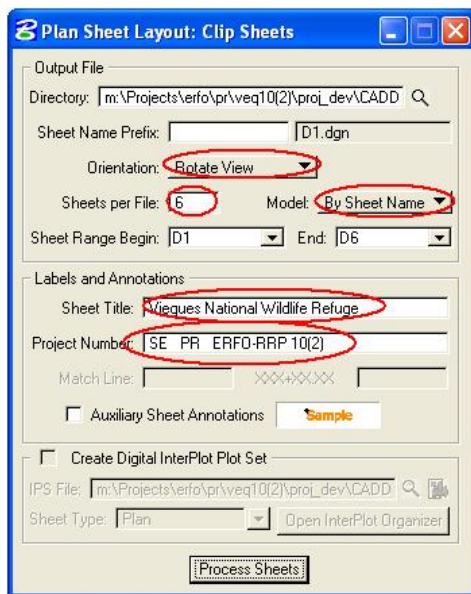
20. Select the working directory in the Output File box. Keep the sheet name prefix in the second field as blank, change the design file name latter after process. The Geopak appends the beginning sheet number to the "Sheet

Name". You most likely will have to rename this (or these) file(s) later as per EFLHD Naming Convention (eg. D-LOP(2)_p&p.dgn).

21. Select Orientation to Rotate View. The sheet cell and the view are rotated and the clipped graphics maintains its coordinate grid intelligence, thus allowing for labeling right on the sheet.

   Note: EFLHD policy to choose Rotate View, thus not to loose coordinate grid intelligence of the clipped graphics.

22. Select Sheet per File to total number of sheets, thus sheet will be drawn in different models of the design file. EFLHD prefer to use all sheet shown in different models of one design file.

   Note: EFLHD prefer to use models for all the sheets in one design file.

23. Select the Sheet Range required from the pick list, using the drop down arrows. Use the Sheet Number Manager Tool to renumber sheets to EFL specific sheet numbering scheme, (such as D1, D2, D3….) as explained earlier.

24. Enter Labels and Annotation. An example of a completed Clip Sheets dialog is shown below (illustrating the results of the completed Labels and Annotation fields)… when completed press Process Sheets.

*Note: Keep 9 space between SE (Region) and PR (state), and 11 space between PR(state) and ERFO-RRP 10(2)[Project Number]. These spaces depend on the length of the project number characters*

6.2- Cross Section Sheets

6.2.1- General Information:

The Cross Section Sheet dialog can be accessed by selecting **Application > GEOPAK Road > Cross Sections > Cross Section Sheet Composition** from the Microstation pull down menu, or from the GEOPAK Road tool palette, or the Road Project dialog as shown below.
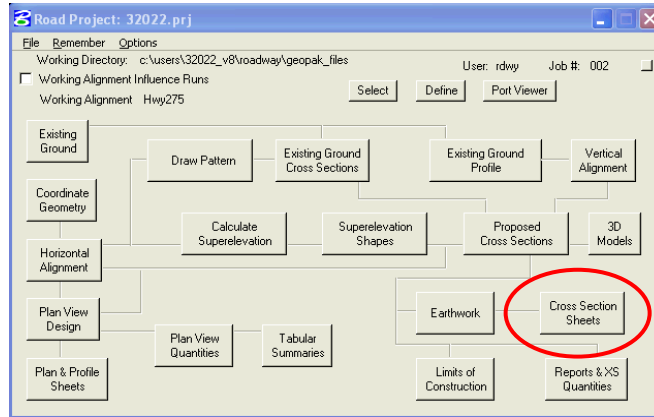
- Click on the Cross section Sheets icon as shown above.

    *Note:- When you access the Geopak Cross section Sheets function from the Road Project dialog box, you will be prompted to select a run. From the Select Run dialog box, select **Run > New** to create a new cross section sheet run. The New Run Name dialog box is opened. Key-in the **Run Name** and an optional **Description**. Select **OK**. The new run is created and is available for selection from the Select Run dialog box. From the Select Run dialog box, select the name of the run that you would like to open. Select **OK** to open the run.*

- The **Cross Section Sheet Composition** dialog box will be open as shown below.
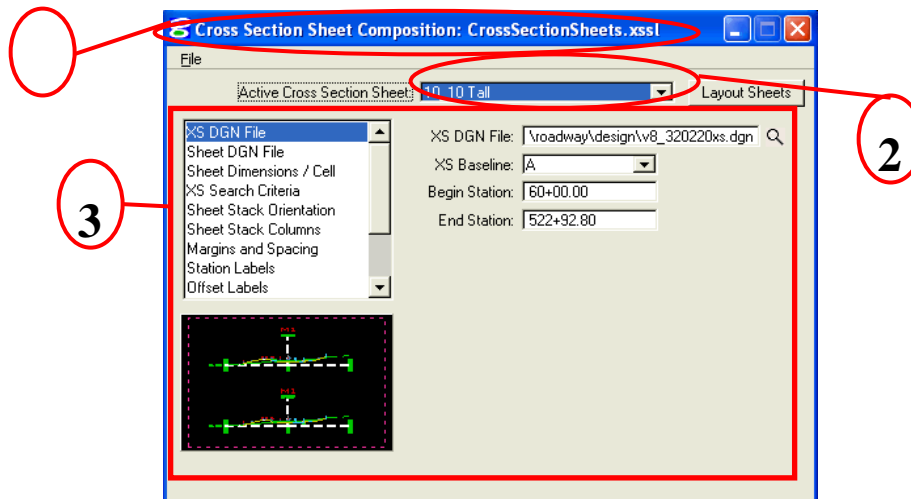
- The following step-by-step procedure refers to the marked-up graphic of the main **Cross Section Sheets Composition** dialog shown above.

(1) **Cross Section Sheet Composition's** file name is always displayed on the top of the dialog box. This file is the Sheet Library, which contains the parameters for the Cross Section Sheets and is saved in a

Sheet Library file. Sheet layout configurations can be saved in the sheet library and recalled for future use. Sheet libraries have a default extension of **"*.xssl** ".

The sheet library "**EFLHD_xssheet.xssl**" has been configured for use with EFLHD's Standard Cross Section Sheet Cells. This sheet library can be obtained from the following directory.

M:\Engineering_Software\Cadd_resource_v8\Cross-Section_Shts

*Note:-For Consultants, this file is available through the **CADD_Resources_V8.zip** download.*

(2) Active Cross Section Sheet: EFLHD has defined Cross Section sheets in different formats and scales. Select the format and scale from the Table 1:
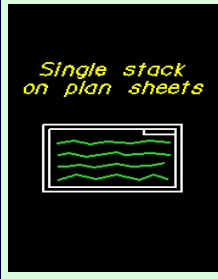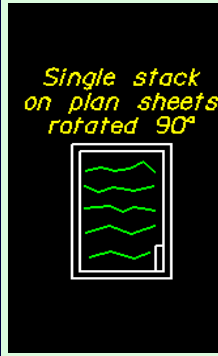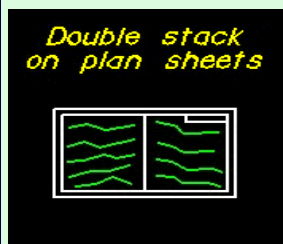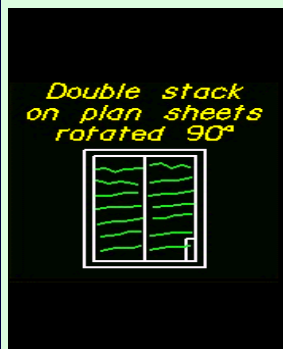
XS Sheet Format	English Scale			Active Cross section sheets	Notes
Single stack on plan sheets	1"=30'			xs_1xH_30_eng	
		1"=20'		xs_1xH_20_eng	
			1"=10'	xs_1xH_10_eng	
Single stack on plan sheets rotated 90°	1"=30'			xs_1xV_30_eng	
		1"=20'		xs_1xV_20_eng	
			1"=10'	xs_1xV_10_eng	
Double stack on plan sheets		1"=20'		xs_2xH_20_eng	
			1"=10'	xs_2xH_10_eng	
Double stack on plan sheets rotated 90°		1"=20'		xs_2xV_20_eng	
			1"=10'	xs_2xV_10_eng	

Table 1

173

(3) The left side of the Cross Section Sheet Composition dialog box contains a list of parameters. When a parameter is selected, a graphic explanation of the parameter appears in the lower left portion of the dialog box and key-in fields for each variable appear to the right.
XS DGN File, Sheet DGN File, and Sheet Labels parameters need to be edited by the user. The rest of the parameter is already set through the EFLHD'S Sheet library file.

6.2.2- Create Cross Section Sheets:

Step I
- Copy sheet library file "EFLHD_xssheet.xssl" from the **"M:\Engineering_Software\ Cadd_resource_v8\Cross-Section_Shts\"** into your project working directory.

> *Note:-For Consultants, this file is available through the **CADD_Resources_V8.zip** download.*

- Create a new MicroStation design file for your Cross Section Sheet in your working directory as explained in Section 4.1.2. Give the name of the file according to the Naming Convention as explained in Section 2.2 (e.g. T01-LOP(2)_xss.dgn)

Step II
- Open the cross section file that contains the cross sections that need to be placed on sheets.

- Open the Cross section sheets dialog through your Road Project dialog (shown in General Information earlier). The Cross Section dialog will appear as shown below.
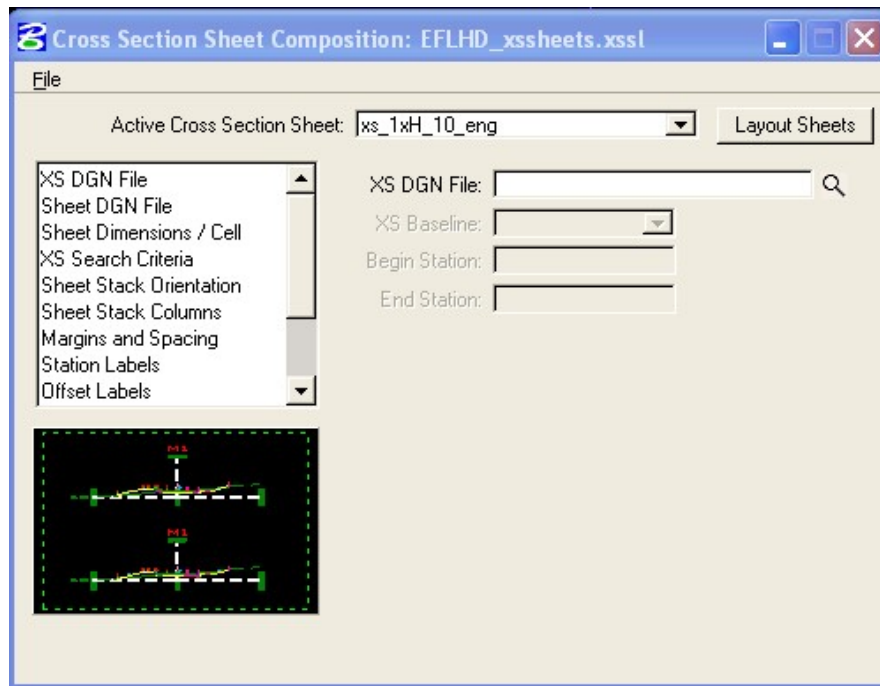
Step III

- Attach the cross section sheet library via the menu item File>Sheet Library>Attach (as shown below) and select "EFLHD_Eng_xssheet.xssl" from your working directory. The name of the attached Sheet Library is shown in the title bar.
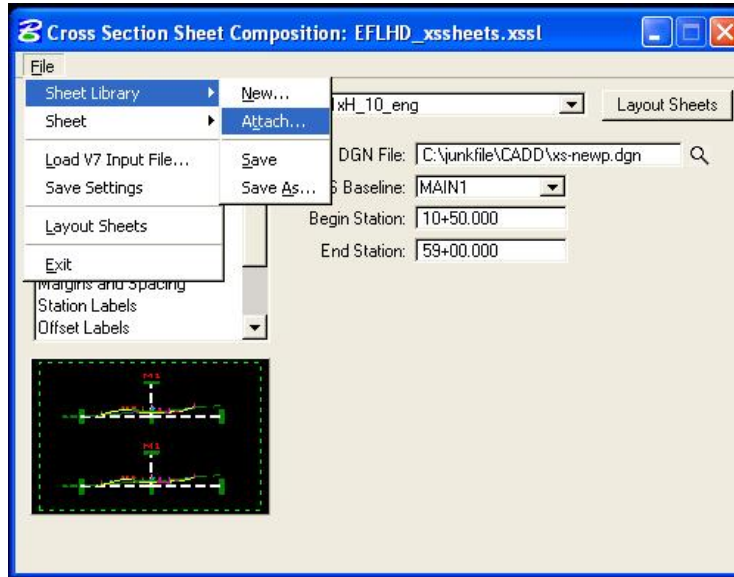
Step IV

- After attaching the EFLHD cross section sheet library, the Active Cross Section Sheet option will display the sheet layout options shown below.
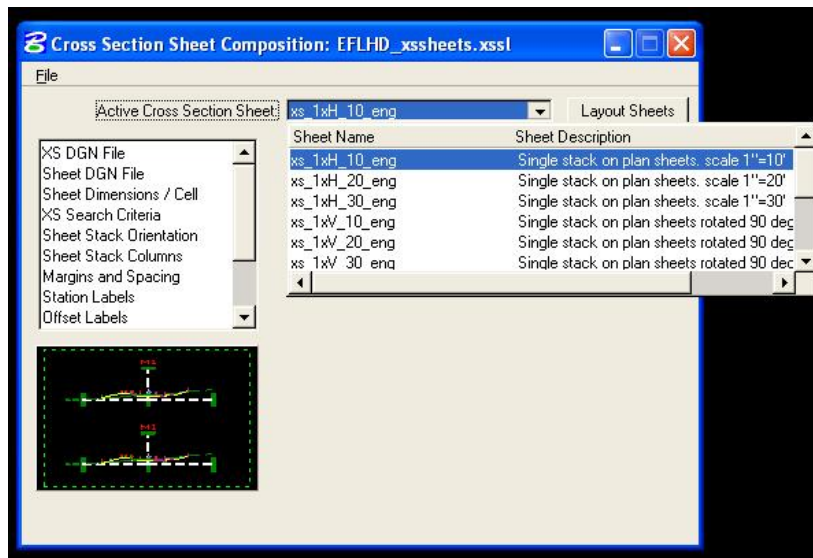
- Select the cross section sheet layout from the pull down menu of Active Cross Section Sheet. Use **Table 1** to select the sheet layout.

Step V

- Select XS DGN File option in the <u>left side</u> of the menu. The Cross Section Sheet dialog in the <u>right side</u> will appear as shown below.

- XS DGN File field in the <u>right side</u> of the menu is used to specify the name of the design file containing the original cross sections. Select the cross section file by use of the select XS DGN File icon. The Chain and stationing will be filled out automatically and the software will find all elements within the confines of the cross section cell.

Step VI

- Select Sheet DGN File option in the <u>left side</u> of the menu. The Cross Section Sheet dialog will appear in the <u>right side</u> as shown below.
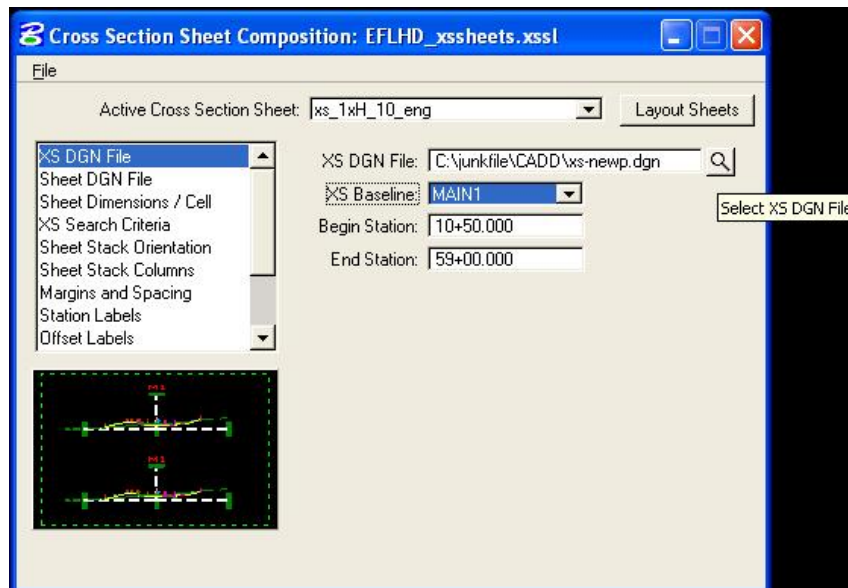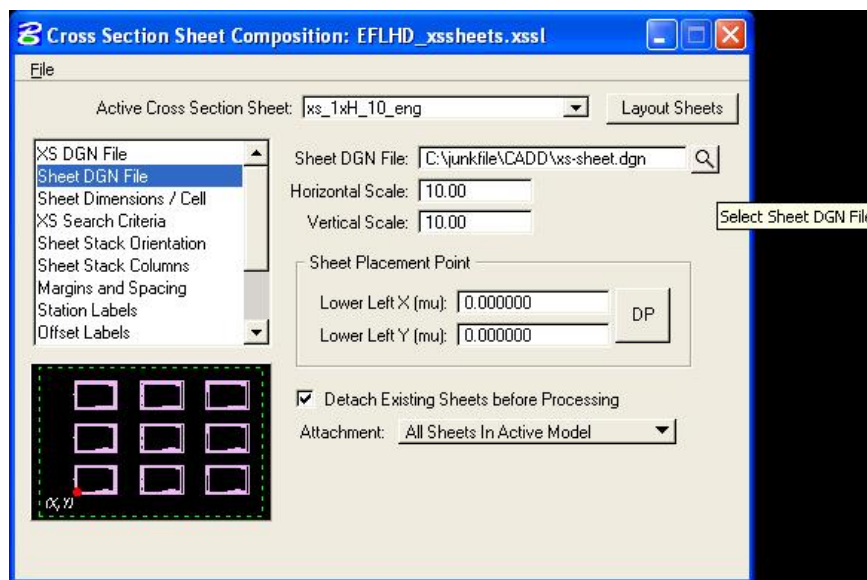

- Sheet DGN File field in the <u>right side</u> of the menu is used to specify the name of the design file where GEOPAK will compose the cross section sheets. Select the cross section sheet file created in STEP I by use of the select Sheet DGN File icon. Keep the rest of the key-in field of this option as default setup.

Note:- GEOPAK does not create the cross section sheet file. The file must be created prior to processing.

176

Step VII

- Select Sheet Labels option in the <u>left side</u> of the menu. The Cross Section Sheet dialog will appear as shown below.
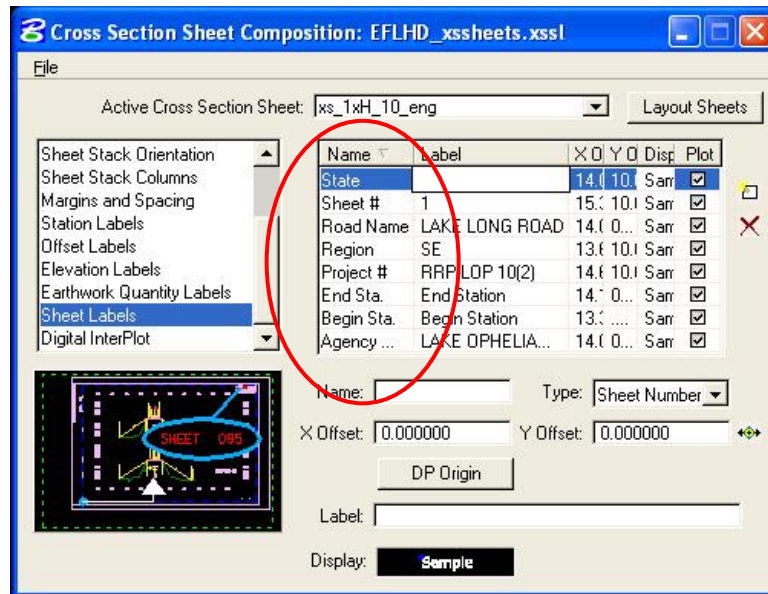

- Sheet Labels field in the <u>right side</u> of the menu has a table with Name, Label, X Coordinate, Y Coordinate, Display, and Plot column. EFLHD Sheet library has already been configured to place Sheet Labels on EFLHD Standard cross section sheet. Designer is only responsible for changing the field of Label column. Edit this field by selecting the row of the table and then click on the cell which needs to be change. The information for the Labels used by EFLHD is shown as below.

Agency Name

Road Name

Begin Sta., and End Sta.
(Don't change)

Region

State

Project #

Sheet #

Note:-Sheet Number have Prefix T or U or...
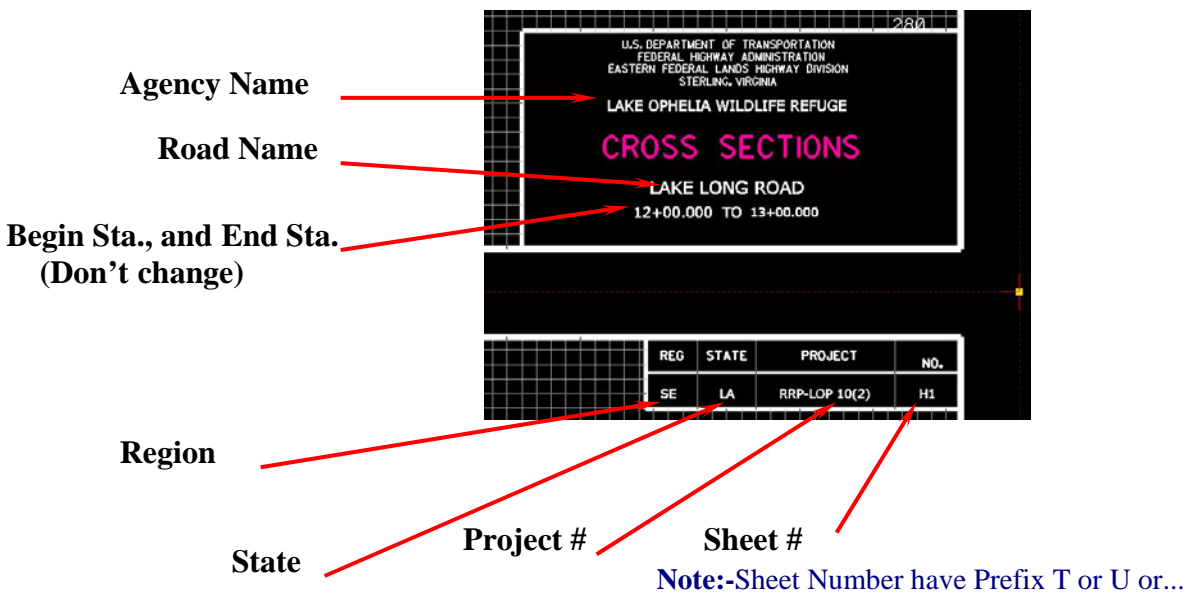
Step VIII

- Save your work by using **File>Sheet Library>Save**.
- Now click on **Layout Sheets** to process the cross section sheets layout.

6.3- Draw Graphics Elements as Pay Items Using D&C Manager

6.3.1- Intoduction:

The D&C Manager is also used by Geopak to standardize graphics elements for drafting and pay items quantities.
EFLHD Standard D&C Manager database "EFLHD_ENGLISH.ddb" has been developed by EFLHD to draw the graphics elements into the plan view sheets according to the EFLHD's symbols and abbreviations sheet and compute the quantity of the same.
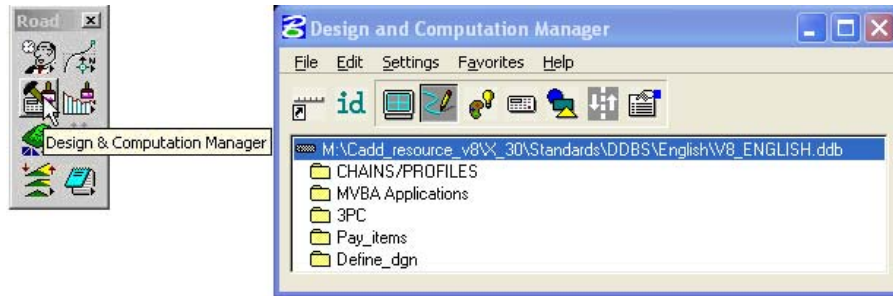
The D&C Manager database "**EFLHD_ENGLISH.ddb**" is located in the following directory:
M**:**\Engineering_Software\CADD_Resource_V8\X_30\Standards\DDBS\English\

Note:- *There are two D&C Manager Databases available in that directory,* ***EFLHD_ENGLISH.ddb*** *and* ***V8_ENGLISH.ddb****. The* ***V8_ENGLISH.ddb*** *database has been developed by FLH and is used to draw chain, chain stationing, profiles, and the elements for use with X30* criteria *(for proposed cross section).*

- The D&C Manager can be accessed by using the MicroStation pull downs:
Applications > Geopak Road > Design & Computation Manager ... or from the Road Tools icon as shown below:

- The default D&C Manager database is attached as **V8_English.ddb** which is set by EFLHD Configuration setup. The user needs to change the database.

- Select **File> Open** from the D&C Manager dialog box to access "**EFLHD_ENGLISH.ddb**" from the "M**:**\Engineering_Software\CADD_Resource_V8\X_30\Standards\DDBS\English\" directory.

- The currently selected database is displayed in the dialog as shown below.
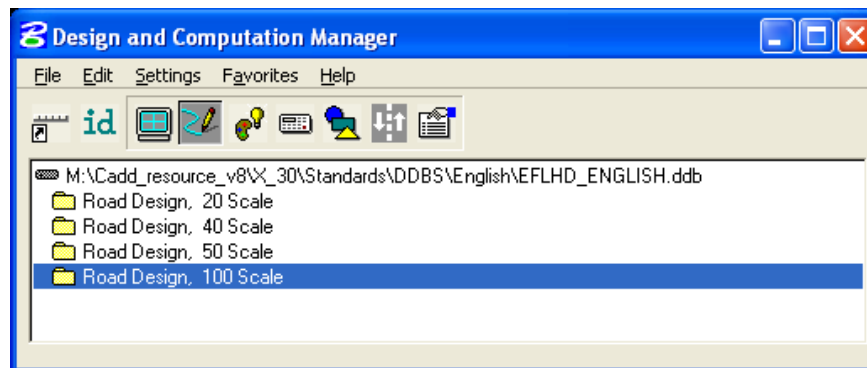
Note:- The D&C Manager database is a password protected file and can not be edited by the designer. Suggestions or request for enhancements should be forwarded to the CADD Coordinator at EFLHD.

- The basic component of the hierarchical tree is the Category. The database EFLHD_ENGLISH.ddb contains four sub categories: Roadway Design, 20 Scale, 40 Scale, 50 Scale and 100 Scale (These categories will be selected according to the scale of the plan sheet "11X17 sheet size"). A double-click on the Roadway Design, 100 Scale category will reveal several categories as shown below.
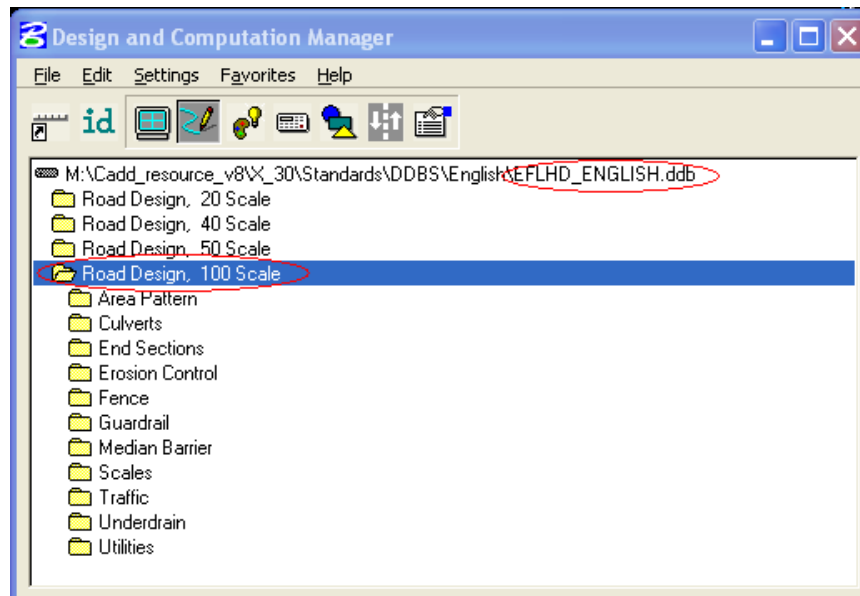
6.3.2- Drawing Custom Graphical Elements into Plan View

- A double-click on the Erosion Control category reveals several items as shown below:
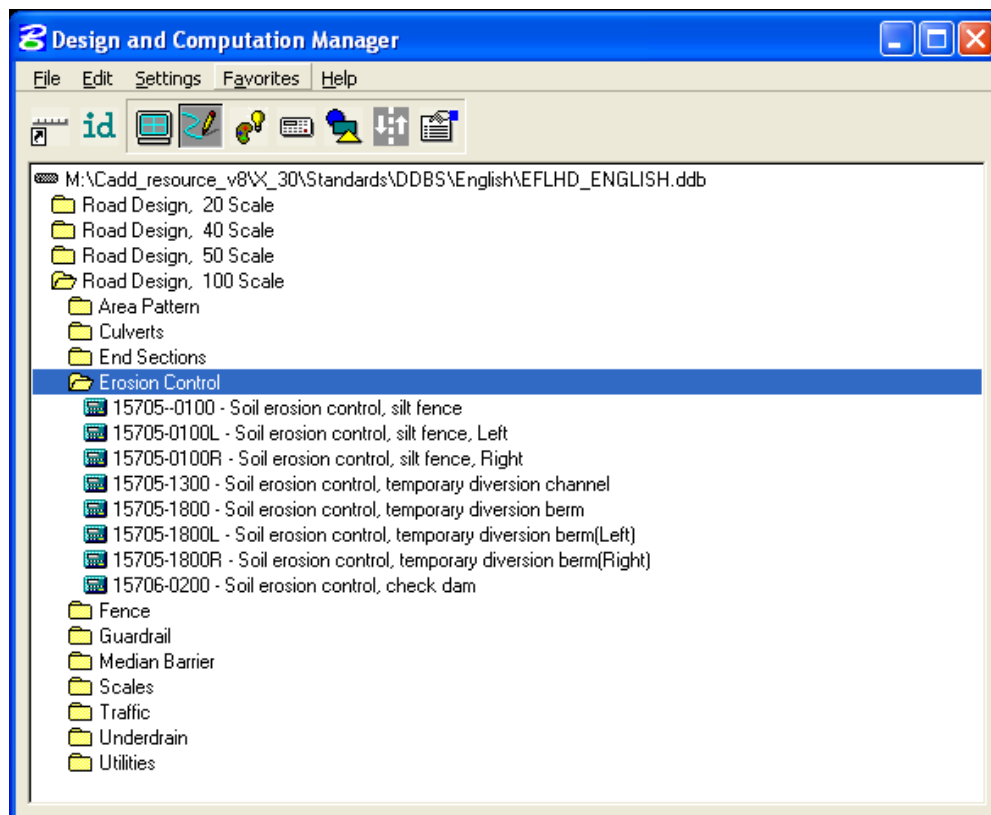
- Similarly each sub-category has several items within it.
- The items contain specific functions related to defining element symbology or placing pay items. These items will be used to set drafting standards for MicroStation commands and the resulting graphics are tagged with a pay item attribute that can be used to calculate plan quantities.

> *Note:-All item numbers are set according to the Pay Item number as per FP-03, US Customary Unit.*

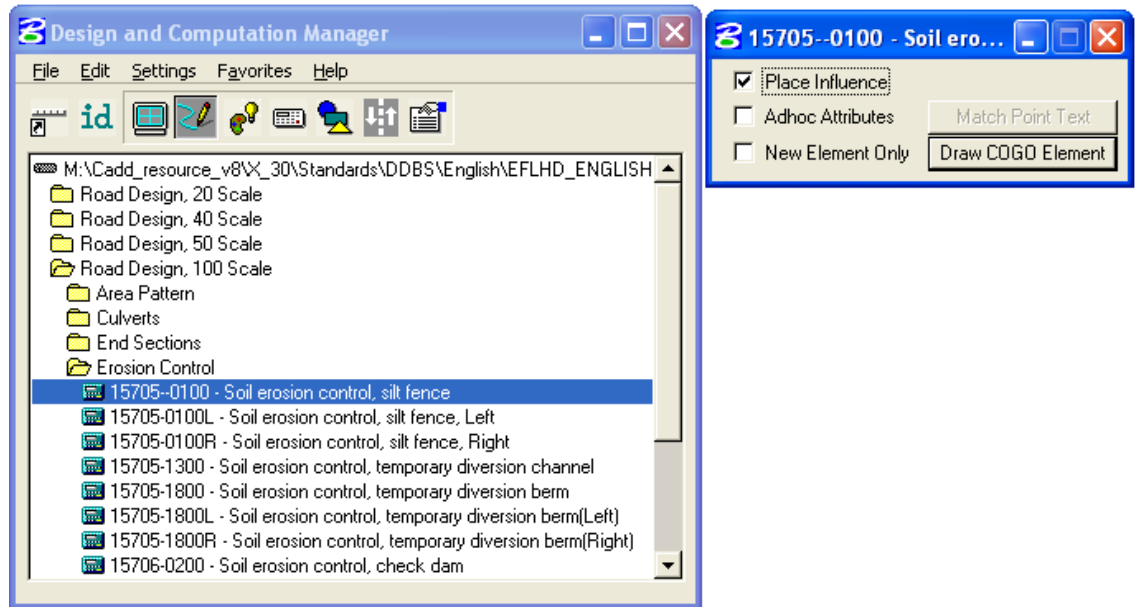- The Place Influence toggle is used to override the currently active MicroStation symbology settings. The Place Influence toggle button is located on the D&C Manager Tool Setting dialog as shown below.

> *Note:-When the **Place Influence** toggle is activated, elements are drawn using the level, symbology and attributes as defined in the GEOPAK database "EFLHD_ENGLISH.ddb".*

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

- If you double click the name of any item in EFLHD's D&C Manager that is used to place a cell, the place cell command will be automatically selected. If Place Influence is on, the cell will be floating on your cursor, ready to place in the design file. Similarly, if you click any item that is used to place line, the place line will be automatically selected. The line will be placed using the level, color, weight and custom line style setting associated with the line item.

6.3.3- Generating Quantities in D&C Manager

When generating quantities, a collection set can be defined for computation and easy recall. Collection sets can consist of entire categories or individual items.

Step I:

- Click on the **Compute** icon.
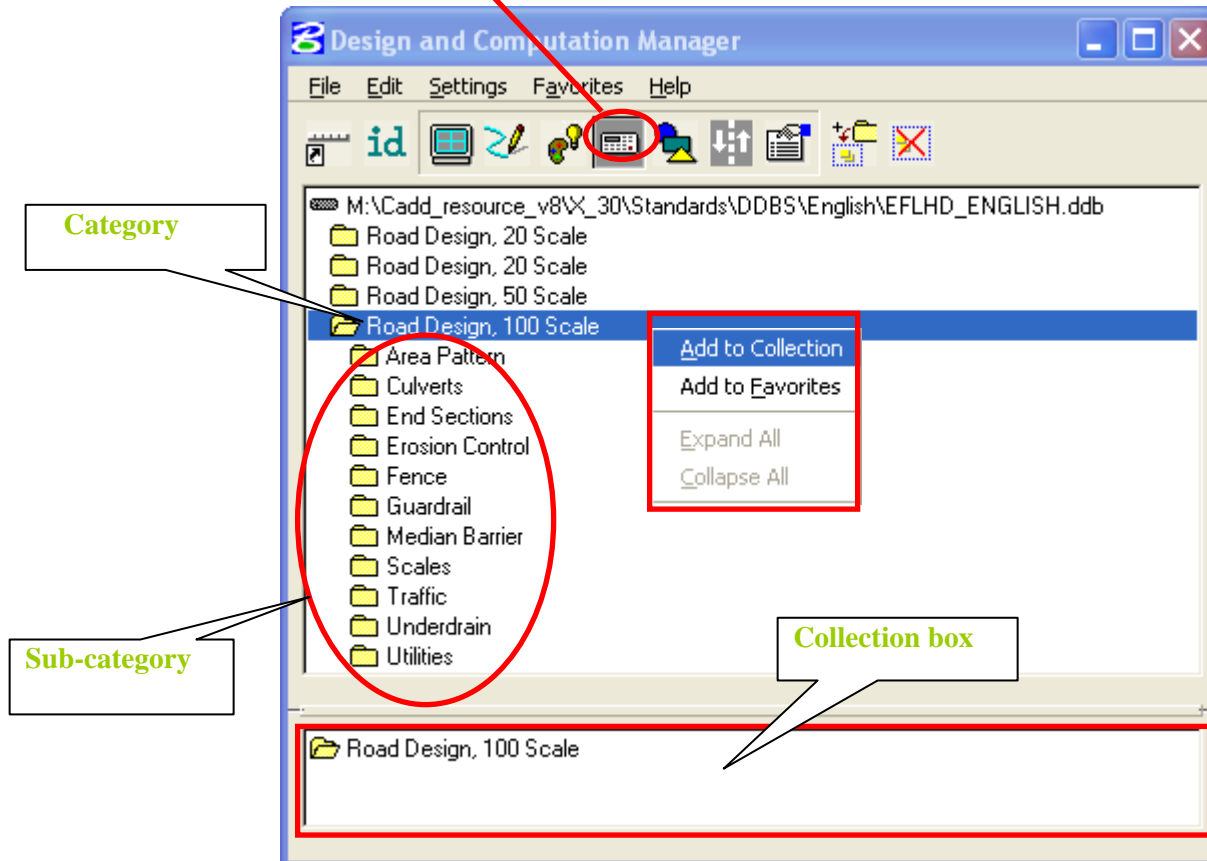
- Select the **Category**, and then with a right click, select the **Add to Collection** option from the pop-up menu. The designated category appears in the Collection list box located at the bottom of the dialog box. D&C Manager computes quantities for every item found in the selected Category as well as any Sub-categories.

Note:- To add individual items, select an individual Pay Item with a single click, and then right click on the highlighted item, selecting the Add to Collection option from the pop-up menu. You can also double click on the item to add the item into a collection set.

Step II

- **Plan Quantity Computation** dialog box as shown below will appear when user selects the **Compute** icon in **Step I**.
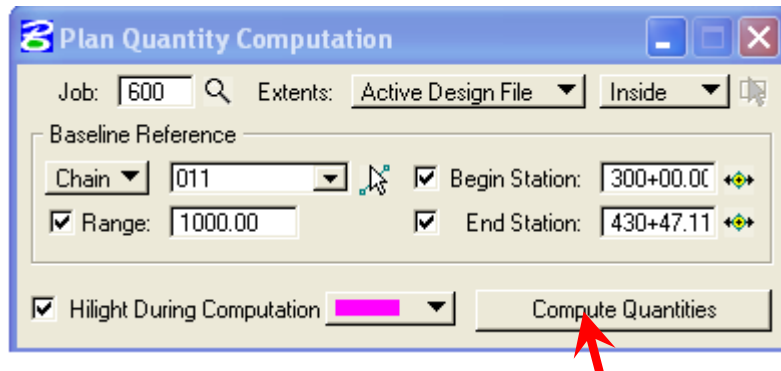
- Fill in the required information in the Plan Quantity Computation dialog box then click on Compute Quantities.

Note:-- *The "Extents" determines which elements are included in the set. In addition to the extents, if the Range option is active, the element must exist within the extents and range (distance left and right of the baseline) for the element to be computed.*

- Computation Results are as shown below:

- The dialog box displays the pay items and associated computed quantity. The user has the option to select the format of the quantity output. Now click on the **Export**, a text file will be created on the selected directory, which can be opened by any text editor.

APPENDIXES

Appendix A

More Help for Editing Redefinable Variables

Note: Plan View Override Elements overwrite all Redefinable Variable values

_d_DefinePavementLayers

This variable defines the number of proposed surfacing layers that are to be closed off vertically, and not "daylighted" to the shoulder foreslope in guardrail or aggregate shoulder locations. Use the _d_DefinePavementLayers variable where guardrail or aggregate shoulder is present.

The default value = 1

EXAMPLE: *EXAMPLE:*

   if (Sta >= 0+00 R 1) then   **if (Sta >= 0+00 R 1) then**
       {   **{**
 _d_DefinePavementLayers = 1   **_d_DefinePavementLayers = 2**
     }   **}**
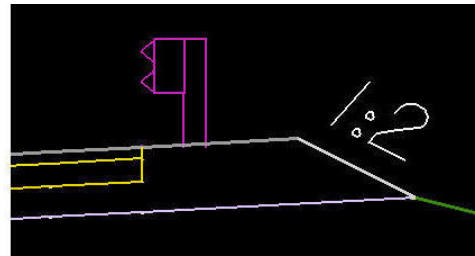
_d_FirstFullLengthLayer

This variable defines the number proposed surfacing layers to "daylight" to the shoulder foreslope. Use the _d_FirstFullLengthLayer variable where no guardrail or aggregate shoulders are present.

The default value = 1

EXAMPLE: *EXAMPLE:*

  if (Sta >= 0+00 R 1) then   **if (Sta >= 0+00 R 1) then**
       {   **{**
 _d_FirstFullLengthLayer = 1   **_d_ FirstFullLengthLayer = 2**
     }   **}**

_s_PavementClosureOption

This variable sets how the edge of pavement is to be closed if not "daylighted" to the shoulder foreslope (i.e. _d_FirstFullLengthLayers = 2 or more). The option was created for the different needs of the three FHWA divisions. Use a 1:1 pavement edge for typical Central Federal Lands (CFL) projects and a vertical edge for Easter Federal Lands (EFL) projects. Use ^V^ for a vertical closure or ^S^ for a one to one slope closure. The selected closure option also applies when guardrail is present.

*The default value = ^V^*

EXAMPLE: *EXAMPLE:*

```
 if (Sta >= 0+00 R 1) then              if (Sta >= 0+00 R 1) then
      {                                      {
 _s_PavementClosureOption = ^V^         _s_PavementClosureOption = ^S^
      }                                      }
```


_d_SurfacingLayer1Thickness

This defines the thickness of the first layer in the proposed pavement structure. Use this variable for all projects with a proposed driving surface. The first surfacing layer thickness must be greater than zero and expressed in master units.

The default values = 4/12 or .100

EXAMPLE:

```
 if (Sta >= 0+00 R 1) then
      {
 _d_SurfacingLayer1Thickness = 3/12
      }
```


_d_SurfacingLayer2Thickness to _d_SurfacingLayer5Thickness

These variables define the thickness of additional layers in the proposed pavement structure. Use these variables when more than one proposed pavement structure layers are desired. The surfacing layer thicknesses 2 through 5 may be set to zero.

Note: Cross Sections with guardrail will not be drawn correctly, without at least two layers of surfacing. The fill slope will begin at the top of the foreslope, instead of the bottom. One work around for this is to use two layers of surfacing, and then delete out the 'dummy' layer. For consistency in Staking Reports, use a 'dummy' layer through out the entire project.

185

_d_WedgeDepth

This variable defines the depth of the wedge adjacent to the non-daylighted surfacing layer(s) and is expressed in master units. Use this variable for projects that require a different shoulder material other than a surfacing lever. When used, the wedge will be drawn with different symbology (shoulder backfill) so that earthwork values can be separated. If the wedge depth is set to a value greater than the depth of the surfacing layers which are not "daylighted", the wedge will be drawn to the same depth as the surfacing layers which are not "daylighted". If no wedge is desired, set the value to zero.

The default value = 0 (no wedge)

EXAMPLE: **In this example, the first layer thickness is 3/12, the second layer is 6/12 and the third layer thickness is 8/12.**

```
if (Sta >= 0+00 R 1) then
     {
 _d_WedgeDepth = 10/12
}
```

```
if (Sta >= 0+00 R 1) then
     {
 _d_WedgeDepth = 10/12
}
```
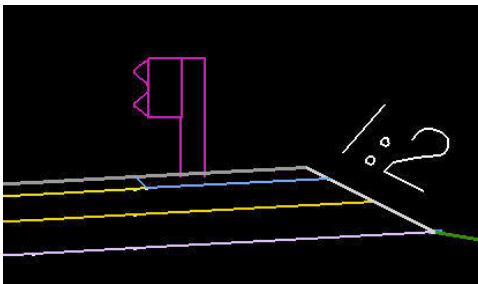

with: **_d_FirstFullLengthLayer = 2**
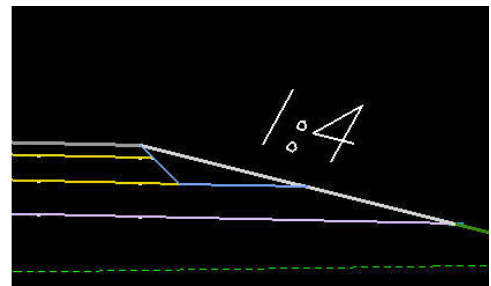
with: **_d_FirstFullLengthLayer = 3**

```
if (Sta >= 0+00 R 1) then
     {
 _d_WedgeDepth = 10/12
}
```

```
if (Sta >= 0+00 R 1) then
     {
 _d_WedgeDepth = 10/12
}
```


with: **_d_FirstFullLengthLayer = 2**
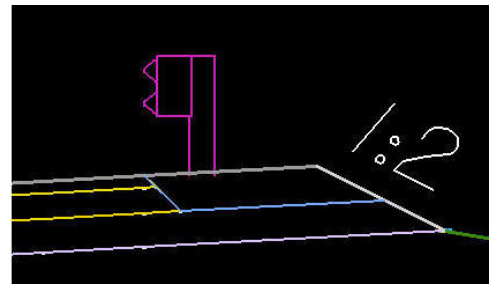
with: **_d_FirstFullLengthLayer = 3**

_d_ShoulderForeSlope

This variable defines the shoulder foreslope and is expressed in a rise:run format. All proposed cross section use this variable. The slope will always be assumed to be negative in value.

The default value = 1:4

Note: The shoulder foreslope variable can be overridden with plan view overrides.

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
     {
_d_ShoulderForeSlope = 1:2
     }
```
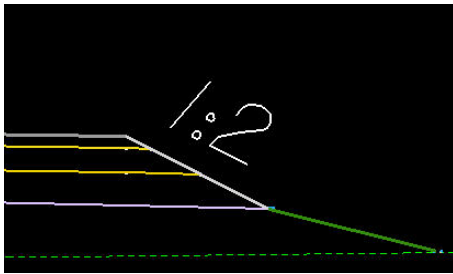

_s_RecoverableShoulderForeSlope

This variable is used to override the 'normal' shoulder foreslope when a recoverable slope is used. Only use this variable when the recoverable slope is preferred over the shoulder foreslope. Set this variable to ^Yes^ to override the shoulder foreslope variable with a recoverable slope. If set to ^No^, the shoulder foreslope will equal the shoulder foreslope variable.

This variable must be used in conjunction with the redefinable variable _d_RtRecoverableSlopeDist (or Lt). If these variables are set to zero, no override will occur. The slope of the recoverable distance is set with the Redefinable variable _d_RtRecoverableSlope (or Lt). The use of the variable _d_RtSecondarySlope is optional, if the value is set to 0:0 then the secondary fill slope will be selected from the fill slope criteria table.

The default value = Yes

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
     {
       _s_RecoverableShoulderForeSlope = ^Yes^
     }
```
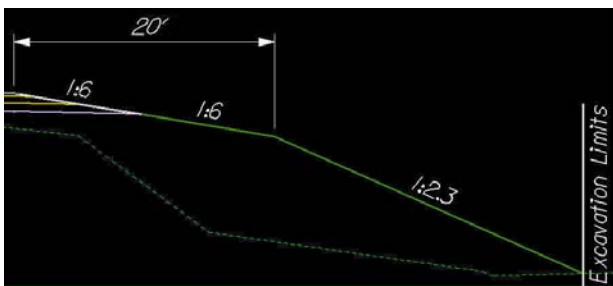

with:
```
_d_ShoulderForeSlope = 1:2
_s_RecoverableShoulderForeSlope = ^Yes^
_d_RtRecoverableSlopeDist = 20
_d_RtRecoverableSlope = -1:6
_d_RtSecondarySlope = -1:2.3
```

```
if (Sta >= 0+00 R 1) then
    {
      _s_RecoverableShoulderForeSlope = ^No^
    }
```


with:

```
_d_ShoulderForeSlope = 1:2
_s_RecoverableShoulderForeSlope=^No^
_d_RtRecoverableSlopeDist = 20
_d_RtRecoverableSlope = -1:6
_d_RtSecondarySlope = -1:2.3
```

_d_SubExDepth and _d_SubExType

These variables set the location, depth and type of subexcavation to be drawn in the proposed cross sections. Use these variables whenever it is necessary to show subexcavation in cross section views or to accurately measure the earthwork volumes associated with subexcavation.
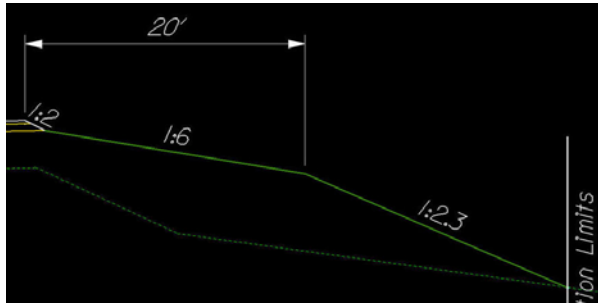
The variable _d_SubExDepth defines the depth of subexcavation. Use the variable in all locations of subexcavation regardless of the type of subexcavation defined (Type 1 or 2) which also must be defined. The variable needs to be expressed in master units and no negative sign is required. The depth is measured differently, depending upon the type of subexcavation selected; see the description of _d_SubExType for an explanation.

The default value = 0

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
      {
 _d_SubExDepth = 24/12
      }
```

The variable _d_SubExType defines the type of subexcavation. Use in conjunction with _d_SubExDepth for all subexcavation locations. Type 1 subexcavation, which is defined as below proposed subgrade, is invoked by setting the variable equal to 1. Type 2 subexcavation, which is defined as below existing ground, is invoked by setting the variable equal to 2.

The default value = ^2^

Note: The subexcavation type and depth variables can be overridden with plan view overrides.

EXAMPLE 1:   Note: The bottom of the Type 1 subexcavated area is parallel to the proposed subgrade and it automatically ends when it intersects the fill slope or the bottom of the ditch.   No plan view elements are required.

```
if (Sta >= 0+00 R 1) then
        {
  _d_SubExType = ^1^
        }
```
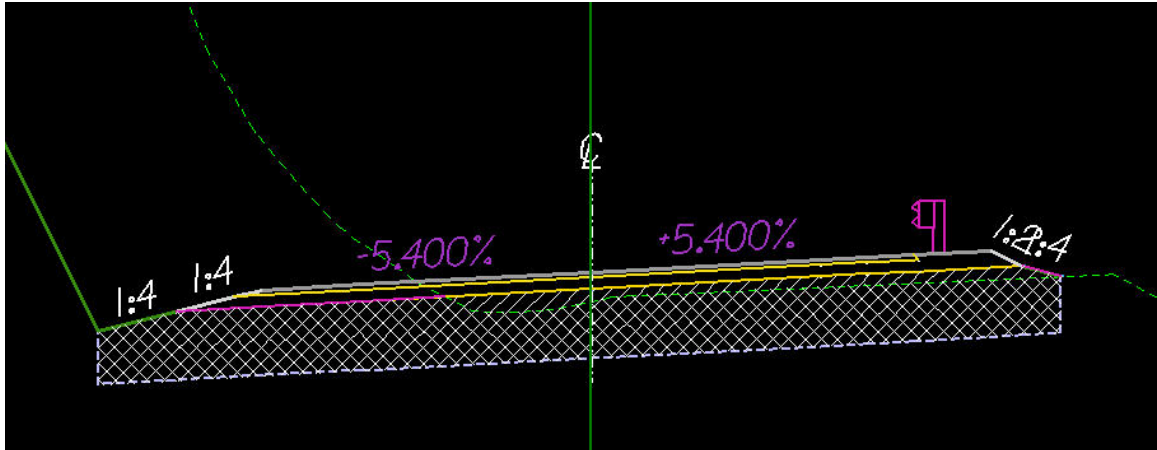

Subexcavation quantity = Crosshatched area
Subexcavation Backfill quantity = Crosshatched area + Hatched area

EXAMPLE 2:   Note: Type 2 Subexcavation requires two plan view lines (LV= P_RDW_Edge_of_Subexcavation) to define the offset distances from centerline. The bottom of the subexcavated area is horizontal and the depth is measured from the existing ground on the left hand side.

```
if (Sta >= 0+00 R 1) then
        {
  _d_SubExType = ^2^
        }
```
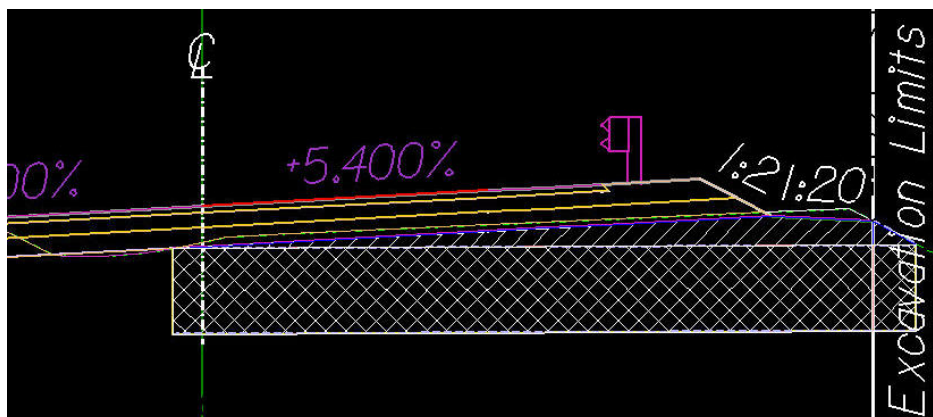

Subexcavation quantity = Hatched area + Crosshatched area
Subexcavation Backfill quantity = Crosshatched area

189

_d_MaxWidenSearchDistance

This variable defines the distance in master units to search for a pavement widening line in plan view. The distance is measured from centerline. This variable is used when cross sections may cross other edges of pavement widening from other roads or in switchbacks. Extraneous lines will cause errors when proposed cross sections are drawn.

The default values = 12 (ft) or 3.6 (m)

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
      {
 _d_MaxWidenSearchDistance = 40
      }
```

_d_BackofCurbSearchDistance

This variable defines the distance in master units to search for the back of Type 1 or Type 2 curb in plan view. The distance is measured from the edge of traveled way. Type 1 and Type 2 curb lines in plan view act as a trigger and exact horizontal position is not important. Use this variable to work with the plan view offset values drawn.

The default values = 3 (ft) or 1 (m)

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
      {
 _d_BackofCurbSearchDistance = 40
      }
```

_d_Type3CurbSearchDistance

This variable defines the distance in master units to search for Type 3 curb in plan view. The distance is measured from centerline. Type 3 curb lines in plan view act as a trigger and exact horizontal position is not important. Use this variable to work with the plan view offset values drawn.

The default value = 20

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
      {
 _d_Type3CurbSearchDistance = 20
      }
```

_d_ClrZoneRecovCutDist *and _d_ClearZoneCutSlope*

These redefinable variables are used define cut situation clear zone distances and allowable slopes. Additionally, these variables are used to label or check proposed cut slopes that do not meet the defined distance or exceed the allowable cut slopes within a clear zone. Any cut slope that exceeds the allowable slope within the defined clear zone will be labeled. The criteria will also label a case where the clear zone distance is not met.

Note: Use of these variables does not draw a "barn roof" clear zone section. These variables are used where "barn roof" sections are not proposed.

The variable _d_ClrZoneRecovCutDist defines the distance to perform the check from the top of the shoulder foreslope to the outer edge of the clear zone in a cut situation.

The variable _d_ClearZoneCutSlope sets the allowable clear zone slope in a cut situation.

If no check of the slopes is required, leave the _d_ClrZoneRecovCutDist variable set to 0 (default).

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
    {
        _d_ClrZoneRecovCutDist = 10
    }
```


with: *_d_ClearZoneCutSlope = 1:6*

_d_ClrZoneRecovFillDist and _d_ClearZoneFillSlope

These redefinable variables are used define fill situation clear zone distances and allowable slopes. Additionally, these variables are used to label or check proposed fill slopes that do not meet the defined distance or exceed the allowable fill slopes within a clear zone. Any fill slope that exceeds the allowable slope within the defined clear zone will be labeled. The criteria will also label a case where the clear zone distance is not met.

Note: Use of these variables does not draw a "barn roof" clear zone section. These variables are used where "barn roof" sections are not proposed.
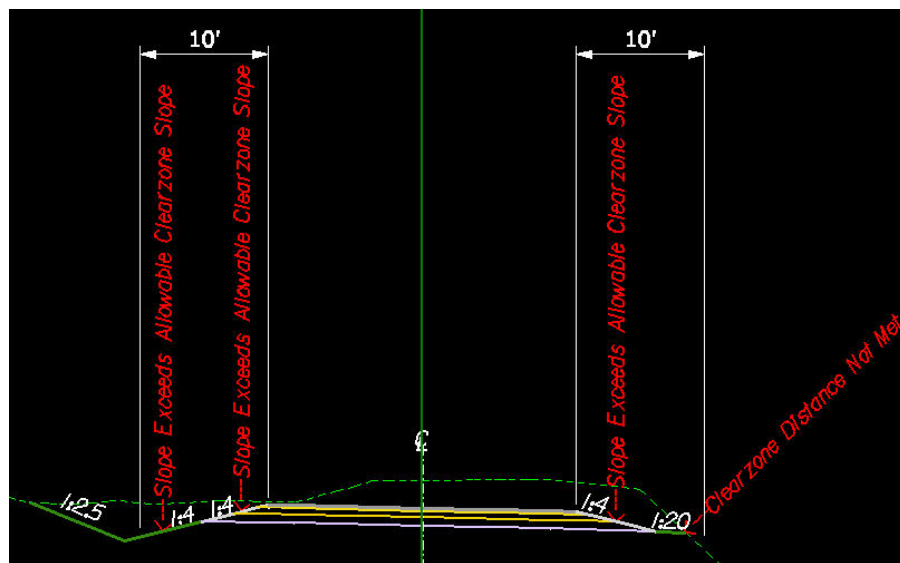
The variable _d_ClrZoneRecovFillDist defines the distance to perform the check from the top of the shoulder foreslope to the outer edge of the clear zone in a fill situation.

The variable _d_ClearZoneFillSlope sets the allowable clear zone slope in a fill situation.

If no check of the slopes is required, leave the _d_ClrZoneRecovFillDist variable set to 0 (default).

EXAMPLE:

```
if (Sta >= 0+00 R 1) then
 {
   _d_ClrZoneRecovFillDist = 10
 }
```
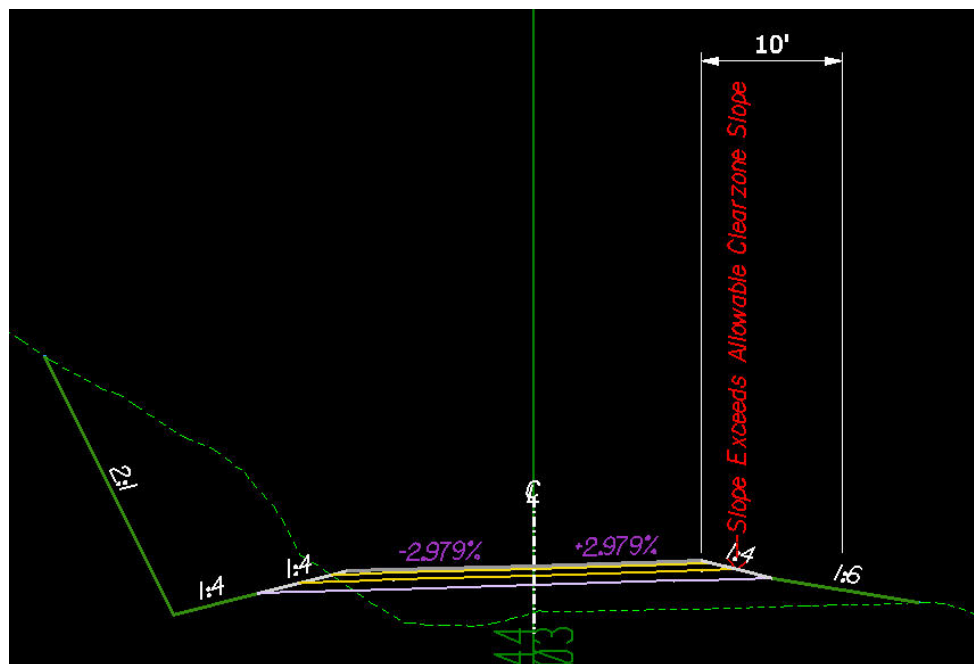

with: **_d_ClearZoneFillSlope = 1:6**

192

_d_LtRecoverableSlopeDist and _d_LtRecoverableSlope and _d_LtSecondarySlope

These redefinable variables are used to create a safe recovery area or "barn roof" section in cut and fill situations on the left side of the roadway. Use these variables to build safety into the proposed roadway or when the defined clear zone requirements are not met.

The variable _d_LtRecoveralbeSlopeDist defines the horizontal distance for the recoverable slope and is measured from the top of the shoulder foreslope or edge of pavement if no shoulder is proposed.

The variable _d_LtRecoverableSlope defines the slope for the recoverable slope and is expressed as negative rise:run values.

The variable _d_LtSecondarySlope defines a secondary slope and is used to set fill slopes when recoverable slopes are used. Use this variable if it is necessary to have a constant fill slope or if the standard fill slopes are not desired. Any value, expressed in a rise:run format, other than 0 (default) will override the fill slope table. If the secondary slope is flatter that the recoverable slope, the recoverable slope will be used instead. It is not necessary to set this variable when using recoverable slopes

If no recoverable slope is desired, set _d_LtRecoverableSlopeDist = 0 (default).

EXAMPLE:

if (Sta >= 0+00 R 1) then
{   *with*: **_d_LtRecoverableSlope = -1:6**
_d_LtRecoverableSlopeDist = 10   **_d_LtSecondarySlope = -1:3**
}   **_d_RecoverableShoulderForeSlope =**
^Yes^

Note: If _d_RecoverableShoulderForeSlope is set to ^No^, then the shoulder foreslope is controlled by the _d_ShoulderForeSlope variable.
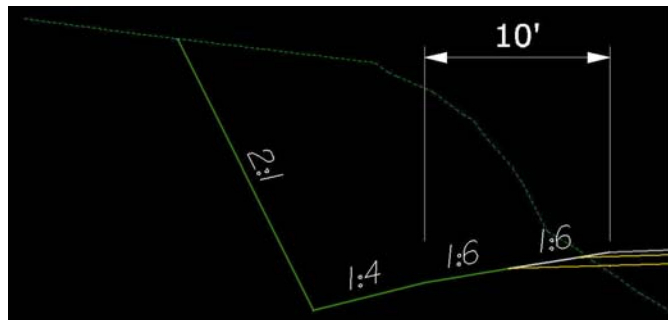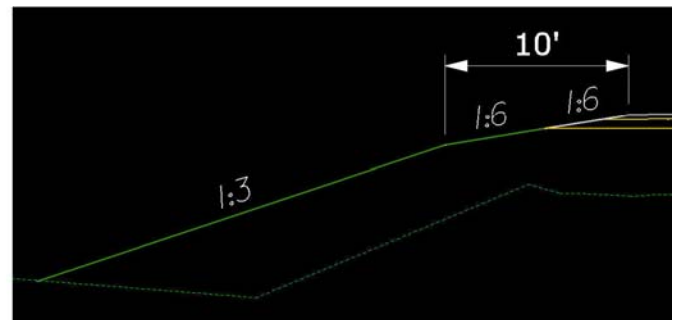
Cut Situation   Fill Situation

Note: In the cut situation, the secondary slope does not override the ditch slope, which is controlled by the redefinable variable _d_DitchForeslopeLt

_d_RtRecoverableSlopeDist and _d_RtRecoverableSlope and _d_RtSecondarySlope

These redefinable variables are used to create a safe recovery area or "barn roof" section in cut and fill situations on the right side of the roadway. Use these variables to build safety into the proposed roadway or when the defined clear zone requirements are not met. See the description above for the Left side variables.

_d_FillSlope1 and _d_ FillSlope1Height (and Fill Slopes 2 through 9)

These redefinable variables define the fill slope selection criteria, based on the height of the fill slope. The slope is expressed in a rise:run format. The slope will be assumed to be negative. The fill height is a maximum height for the corresponding slope and is expressed in master units.

Note: All fill slope variables can be overridden with plan view overrides.

```
 EXAMPLE:                            EXAMPLE:

if (Sta >= 0+00 R 1) then          if (Sta >= 0+00 R 1) then
  {                                  {
    _d_FillSlope1 = 1:6                  _d_FillSlope1Height = 2.0
 }                               }
```

In the example, all fill slopes with a height of two feet or less will be drawn at a -1:6 slope.

_d_CutSlope1 and _d_ CutSlope1Height (and Cut Slopes 2 through 9)

These redefinable variables define the cut slope selection criteria, based on the height of the cut slope. The slope is expressed in a rise:run format. The slope will be assumed to be positive. The cut height is the maximum height for the corresponding slope and is expressed in master units.

Note: All cut slope variables can be overridden with plan view overrides.

```
 EXAMPLE:                            EXAMPLE:

if (Sta >= 0+00 R 1) then          if (Sta >= 0+00 R 1) then
  {                                  {
    _d_CutSlope1 = 1:6                   _d_CutSlope1Height = 2.0
 }                               }
```

In the example, all cut slopes with a height of two feet or less will be drawn at a 1:6 slope.

_d_DitchForeslopeLt and _d_DitchForeslopeHeightLt and _d_FlatBottomDitchWidthLt

These redefinable variables set the design parameters of the left roadside ditches. Use them to vary the heights, slopes and shapes of ditches throughout a proposed project.

This variable _d_DitchForeslopeLt variable defines the slope of the left ditch from the subgrade hinge point in a rise:run format. The slope will always be assumed to be negative.
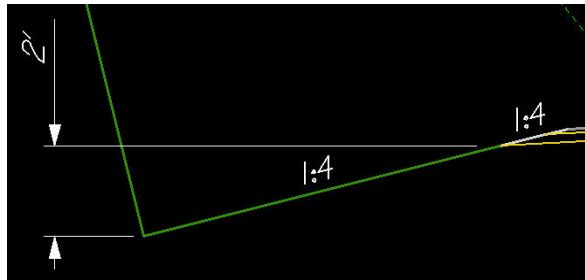
The default value = 1:4

> EXAMPLE:
>
> ```
> if (Sta >= 0+00 R 1) then
>     {
>       _d_DitchForeslopeLt = 1:4
>     }
> ```

This variable _d_DitchForeslopeHeightLt defines the vertical height of the left ditch from the subgrade hinge point in master units.

The default values = 1.5 (ft) and 0.5 (m)

> EXAMPLE 1:
>
> ```
> if (Sta >= 0+00 R 1) then
>     {
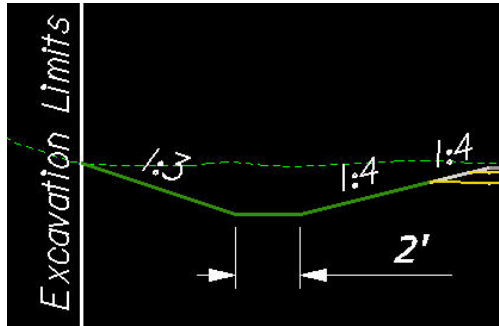>   _d_DitchForeslopeHeightLt = 2.0
>   }
> ```



Note: The ditch foreslope and the ditch foreslope height variables can be overridden with plan view overrides.

The variable _d_ FlatBottomDitchWidthLt defines the width of the left flat bottom ditch and is measured in master units. This variable is used when a flat bottom ditch is preferred over a "V" ditch. If a "V" ditch is desired, leave this variable set to zero (default).

Note: The flat bottom ditch width variable can be overridden with plan view overrides.

EXAMPLE 2:
if (Sta >= 0+00 R 1) then
　　{
　　_d_FlatBottomDitchWidthLt = 2
　　}

_d_DitchForeslopeRt and _d_DitchForeslopeHeightRt and _d_FlatBottomDitchWidthRt

These redefinable variables define the dimensions of the ditch on the right side. See the descriptions above for the left side ditch variables.

Note: The all these variables can be overridden with plan view overrides.

_d_GroundDropOffSearchDistance and _d_GroundDropOffSampleDistance

These variables are used to define how and when a ditch is created in a fill situation. If the shoulder subgrade point is above ground and the bottom of the ditch foreslope is below ground, the criteria will check to see if the ground slopes to a point below the defined ditch bottom. If this is the case, a fill slope will be drawn intersecting existing ground and a ditch will not be drawn.

Note: The bottom if the ditch foreslope is set by the variable for ditch foreslope height.

The variable _d_GroundDropOffSearchDistance defines the distance in master units used to determine how far to search to see "if" the ground falls below the ditch bottom in a fill situation. This distance is defined in master units and is measured horizontally from the shoulder subgrade point.

The default values = 50 (ft) and 15 (m)
EXAMPLE:

if (Sta >= 0+00 R 1) then
　　{
　　_d_GroundDropOffSearchDistance = 50
　　}

The variable _d_GroundDropOffSampleDistance sets the distance in master units used to determine the increment to move along the ground to determine if the ground falls off below the bottom of ditch in a fill situation.

The default values = 1 (ft) and 0.3 (m)

EXAMPLE:

if (Sta >= 0+00 R 1) then
　　{
　　_d_GroundDropOffSampleDistance = 1
　　}

_d_DaylightSlope and _d_DaylightWidth and _d_DaylightOption

These variables are used to define the slope width and type of "daylighted" slope that is drawn. "Daylighted" slopes are used in cut situations when there is a possibility to grade out a slope instead of having a roadside ditch.

_d_DaylightSlope defines the slope in rise:run format to draw the daylight slope.

The default value = -1:20

    EXAMPLE:

    if (Sta >= 0+00 R 1) then
      {
        _d_DaylightSlope = -1:20
      }

_d_DaylightWidth is a redefinable variable that defines the maximum width of the "daylighted" slope measured horizontally from the bottom of the ditch foreslope in master units. Use the variable in cut situations where there is a choice to either create a ditch or grade out to an existing slope.

The default values = 30 (ft) and 10 (m)

    EXAMPLE:

    if (Sta >= 0+00 R 1) then
      {
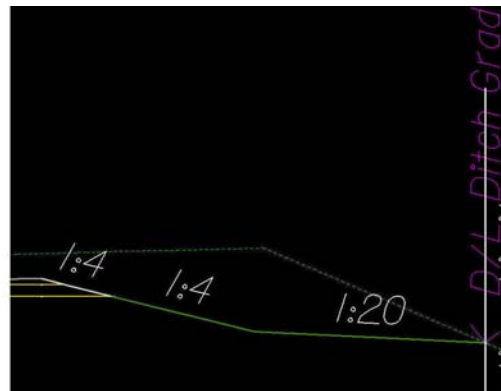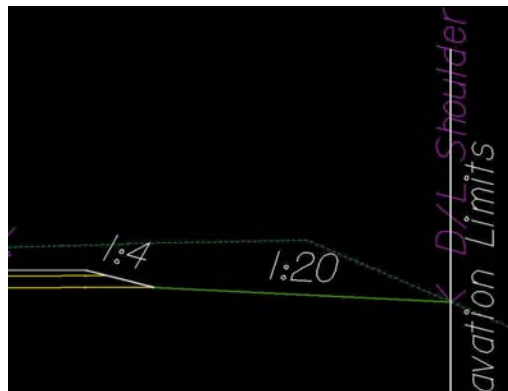   **_d_DaylightWidth = 10**
      }

_d_DaylightOption defines the method of daylighting a slope. Use ^S^ to daylight from the shoulder subgrade; use ^D^ to daylight from a ditch foreslope and use ^N^ if no daylight slope is desired.

*The default value = ^D^*

    EXAMPLE:

    if (Sta >= 0+00 R 1) then   **if (Sta >= 0+00 R 1) then**
      {   **{**
        _d_DaylightOption = ^S^   **_d_DaylightOption = ^D^**
   **}**   **}**

_d_RockSlopeLT and _d_RockSlopeRT

These redefinable variables are used to define the slope of the lower portion of a broken back cut slope. The slope of the upper portion of the broken back cut slope is defined by the slope selection criteria or by plan view overrides. The elevation where the change in slope occurs is triggered by a line drawn on the cross section with the D&C Manager.

The default value = 4:1

    EXAMPLE:

  if (Sta >= 0+00 R 1) then
   **{**
       _d_RockSlopeLt = 8:1
     }
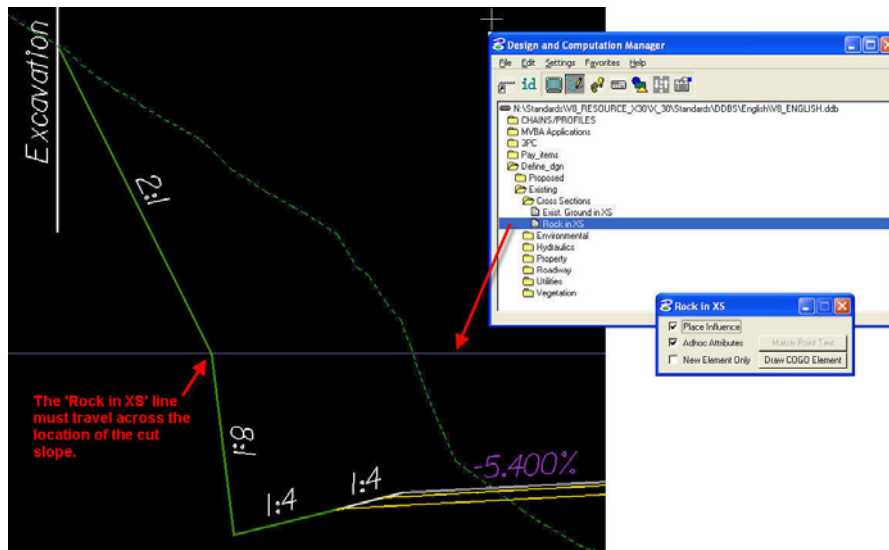
_s_ExcavationLimit and _s_ExcavationLimitOffset

These redefinable variables are used to label the limits of excavation. If no labels are desired, set the variable _s_ExcavationLimit to ^N^. The offset of the label can be positive (outside of tie) or negative (inside of tie).

    EXAMPLE:

if (Sta >= 0+00 R 1) then
    {
      _s_ExcavationLimit = ^Y^
    }

if (Sta >= 0+00 R 1) then
    {
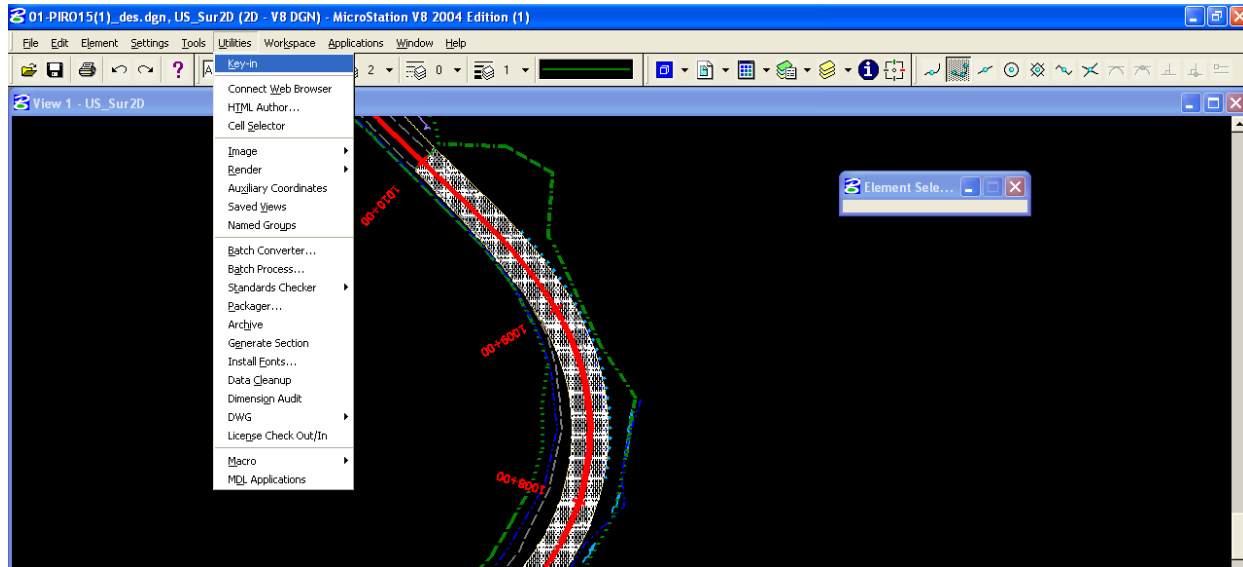   **_s_ExcavationLimitOffset = 0**
    }
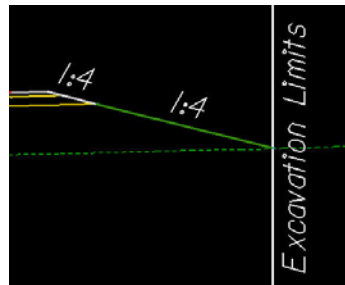
Note: Earthwork processes require the use of Excavation Limit labels.
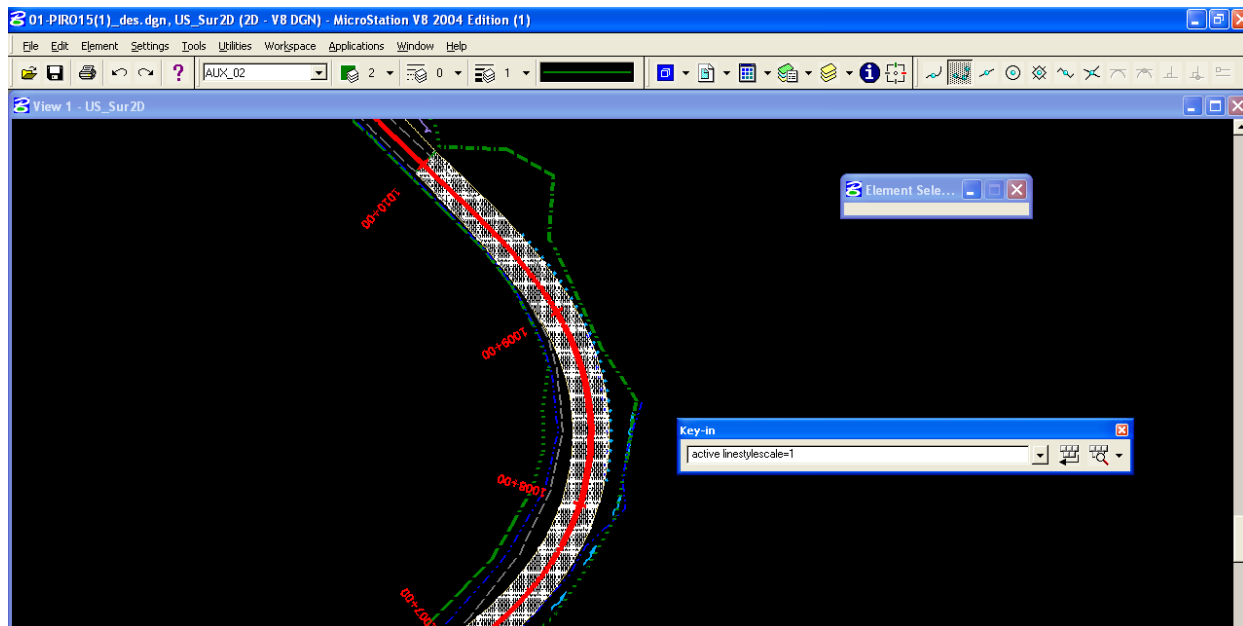
198

Appendix B

Optimizing Linestyle scales in Microstation

To make plan preparation easy, all base files should be set to a line style scale of 100. Before you begin placing any lines in the base file of a new project, go to <u>Utilities</u> ⟶ <u>Key-in</u> as shown below.

In the <u>Key-in</u> dialogue box, type in the following command: active linestyle scale=1

Be sure to "save settings" after entering this command (Ctrl + F). With this command, there will be no scaling of the linestyles when they are placed in the base file. Therefore, place all lines to the appropriate scale you would use on a 100 scale plan sheet. Using the D&C Manager, Eastern already has quite a few items sized for 100 scale plan sheets. However, in the event that the lines do not appear to be displaying at the correct line style scale, you can always edit the line style scale of an individual line, without modifying

the line style scale of other lines you have already placed. Go to Element ⟶ Linestyles ⟶ Custom as shown below.
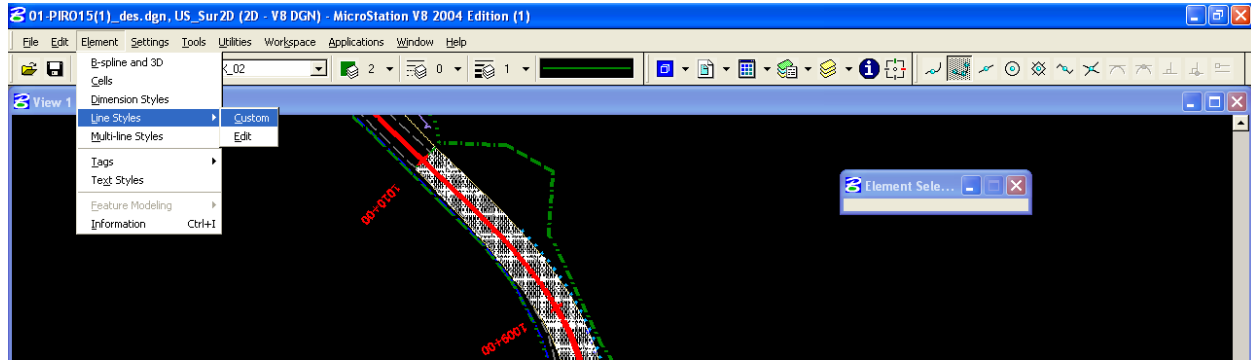

Using this dialogue box, you may change the scale factor by typing in a new scale factor for the line. The dialogue box will instruct you to "Click to Activate" once you have entered a new linestyle scale. Click on the diagram of the line style, and then use the line placement tool to begin placing a new line at the new linestyle scale.
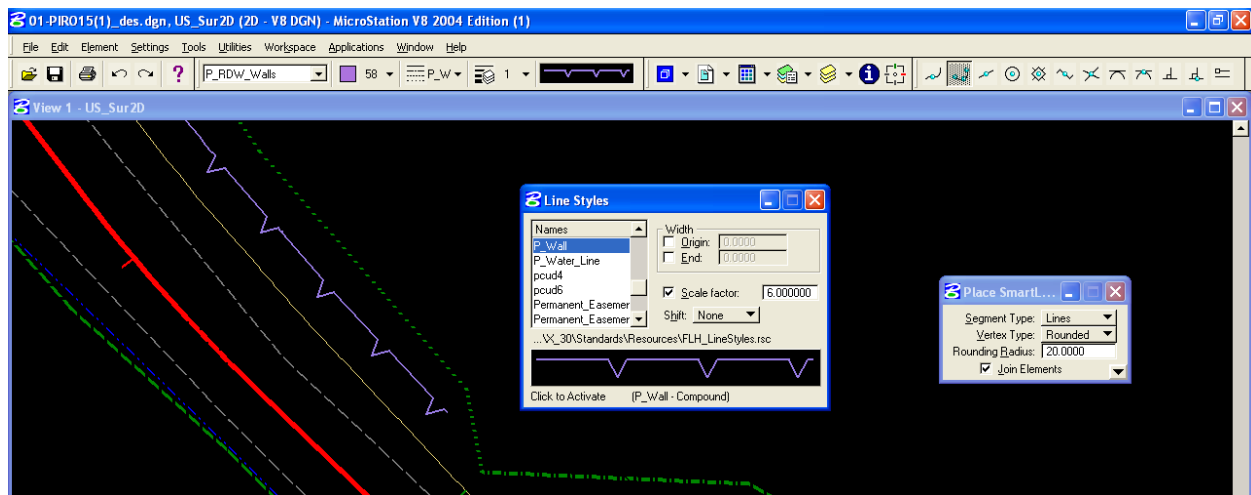

The real advantage of using this method is about to pay off. If you have drawn everything in the base file as you would use on a 100 scale plan sheet, it now becomes simple to cut plan or detail sheets at whatever scale you desire (20, 50, 100, 200, etc.). Simply cut the plan sheet as normal with the base file referenced in. Then, bring up the Utilities ⟶ Key-in dialogue as before. Then type in the linestyle scale of the new sheet you just created.

For a 50 scale plan sheet, type in the command: active linestyle scale=0.5
For a 200 scale plan sheet, type in the command: active linestyle scale=2.0
Etc.

The line style scales will automatically update to display at the correct size for the sheet scale you are using. This means, that with a single base file, you can cut plan sheets and details sheets at different scales, and have all of them come out looking correct. Just be sure to "save settings" again after entering the linestyle scale for the sheet you just created.
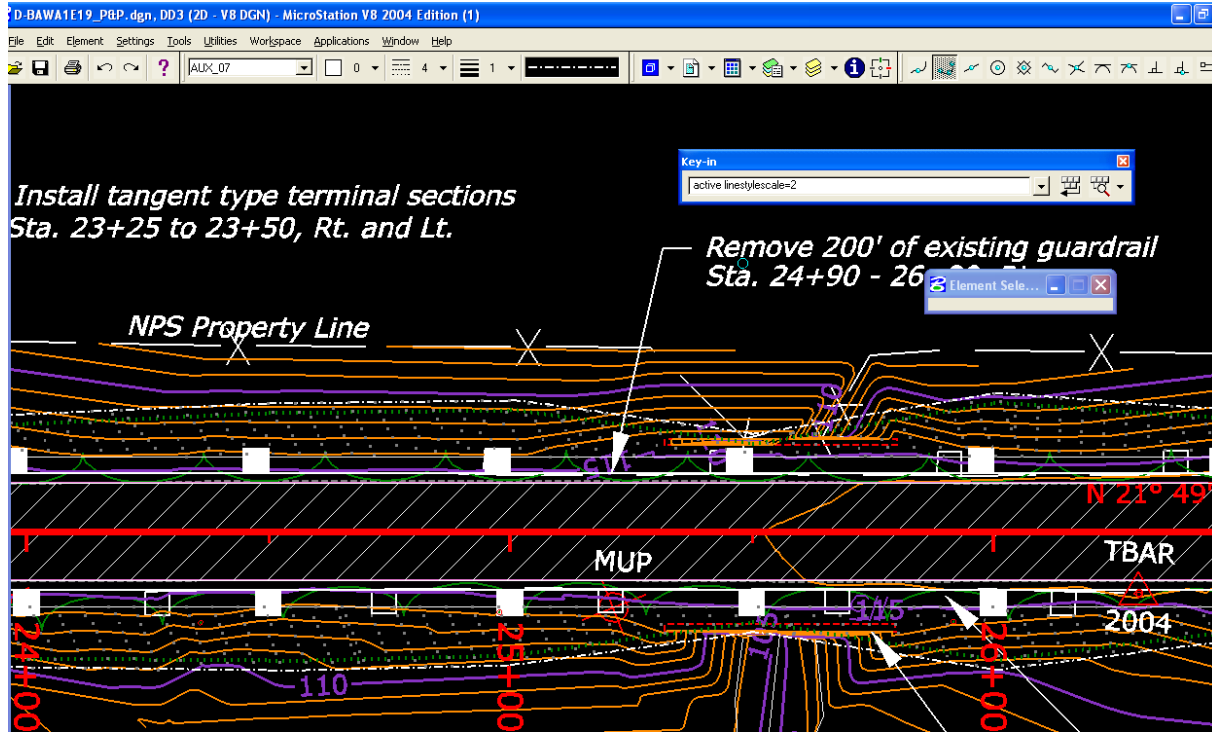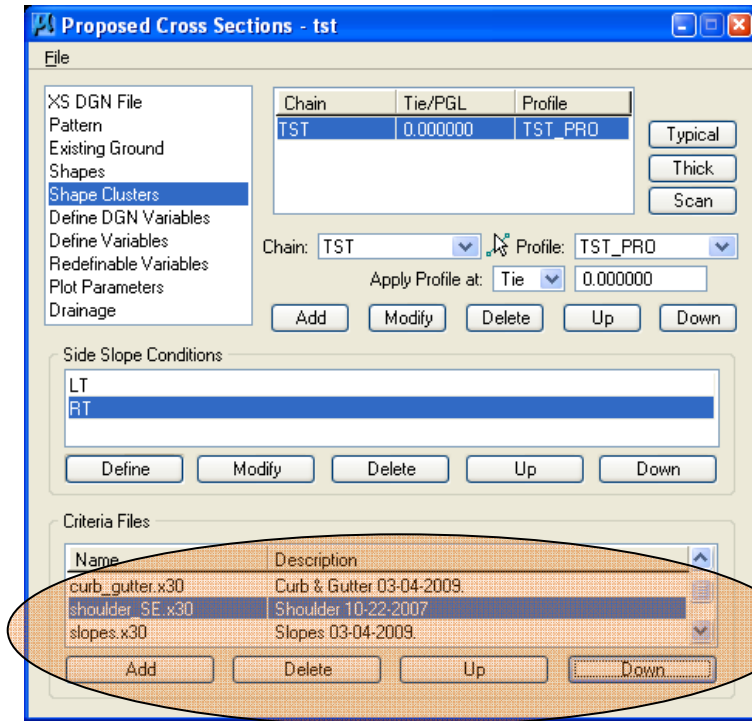
Linestyle scale as displayed at 200 scale
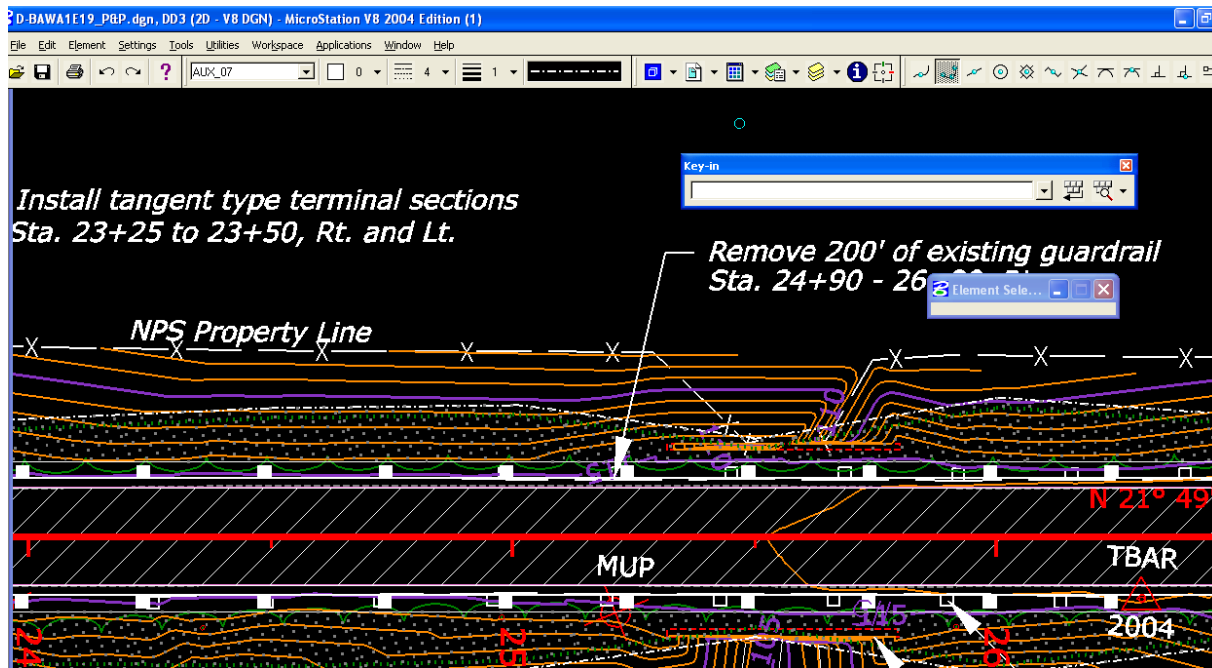
Linestyle scale as displayed at 50 scale

Appendix C
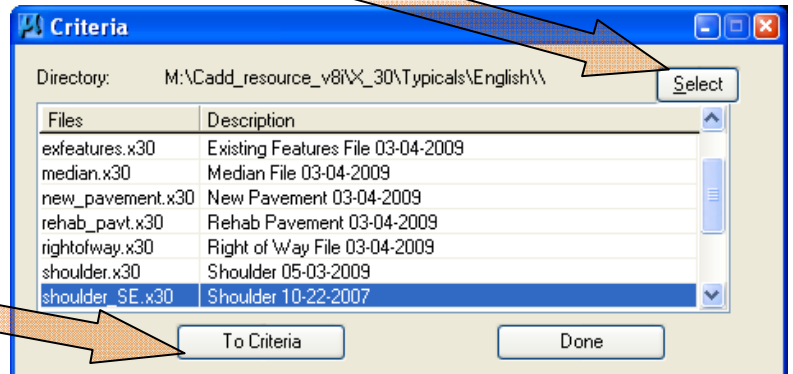
Using the Safety Edge Shoulder_SE.x30 Criteria File

In Project Manager > PROPOSED CROSS SECTIONS Tool
Scroll down to Shape Clusters, Highlight the RT Side Slope Condition, in the Criteria Files window,

1. **Delete** the shoulder.x30 criteria file (answer "yes" to the prompt)
2. **Add** the shoulder_SE.x30 criteria file (you may have to navigate to M:\Cadd_resource_v8\X_30\Typicals\English with the **Select** button)

Highlight and Hit "**To Criteria**"
Close the dialog with "**Done**"

This will add the Safety Edge criteria file shoulder_SE.x30 at the bottom of the list.

It is IMPORTANT that the sequence of the criteria files is maintained for the order in which Geopak wants to build your cross sections.

Use the "Up" button to move the file back into its proper order (directly AHEAD of the slopes.x30 criteria file)

**** REPEAT THE SAME FOR THE LT SLOPE CONDITION ****

Scroll down to **Redefinable Variables**, find and highlight the **_s_PavementClosureOption** Variable.
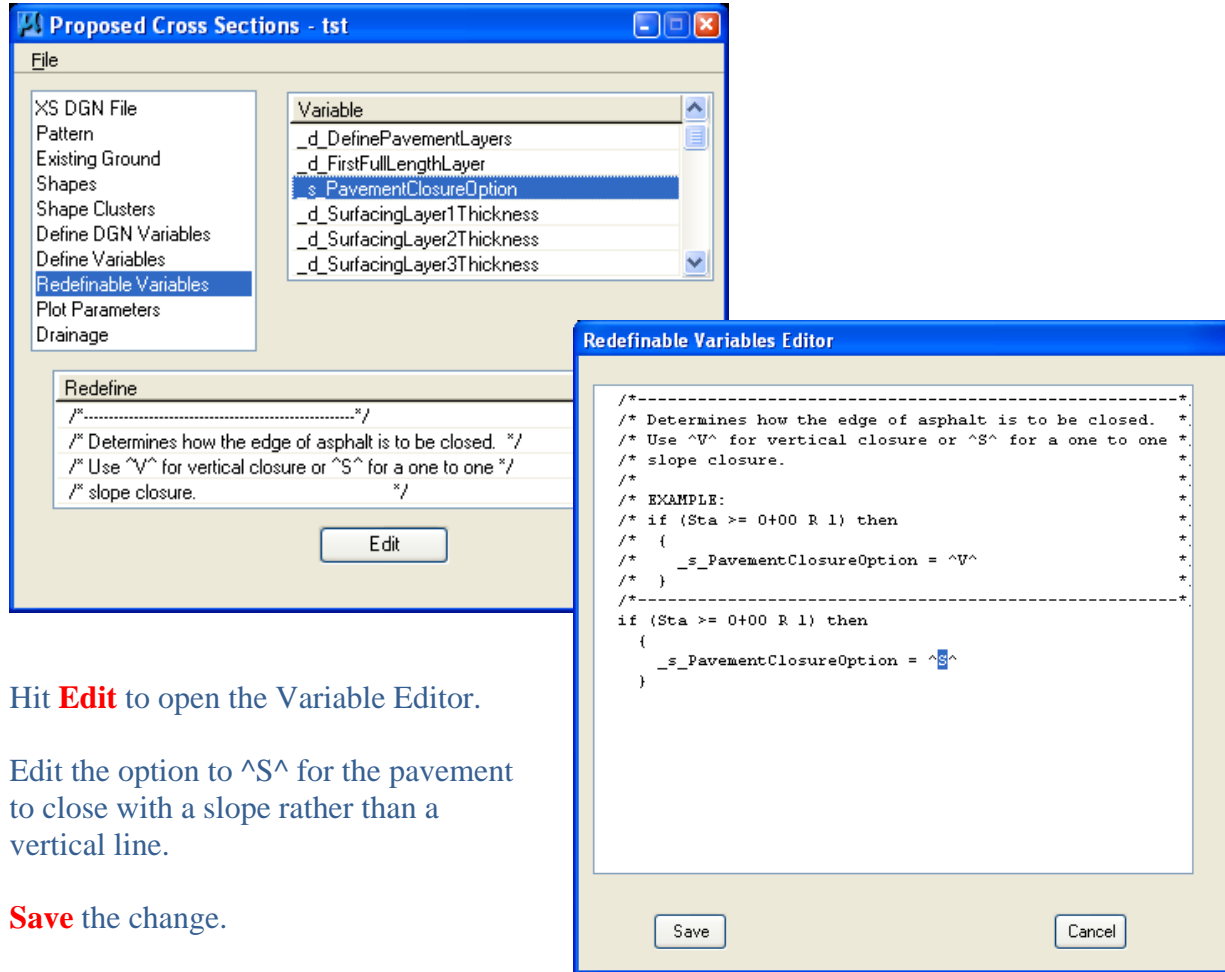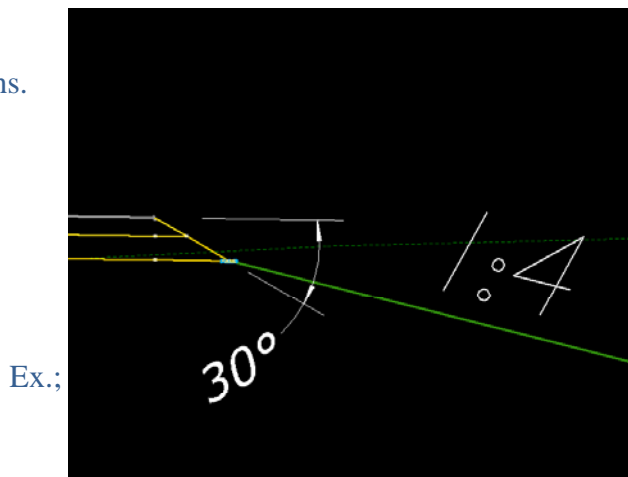

Hit **Edit** to open the Variable Editor.

Edit the option to ^S^ for the pavement to close with a slope rather than a vertical line.

Save the change.

(although the description still says "one to one slope" , the shoulder_SE.x30 we just added will build a 30 degree edge)

Save Settings and (re)Run your cross sections.

Ex.;

REFERENCES

1. The Complete Knuckleheads
   http://www.wfl.fhwa.dot.gov/resources/cadd/geopak-2004/
2. Bentley Systems, Incorporated.
   http://www.bentley.com/en-US/
3. Central Federal Lands Highway Division
   http://www.cflhd.gov/design/index.cfm
4. Western Federal Lands Highway Division
   http://www.wfl.fhwa.dot.gov/design/cadd/
5. EFLHD CADD Manual
6. MicroStation V8 Training Manual By Peter A. Man
7. FHWA Project Development and Design Manual (PDDM)
8. UGS Community (Connect Press)
   http://www.ugscommunity.com/featuretoctnt.php

9. MicroStation Connections
   http://www.microstationconnections.com