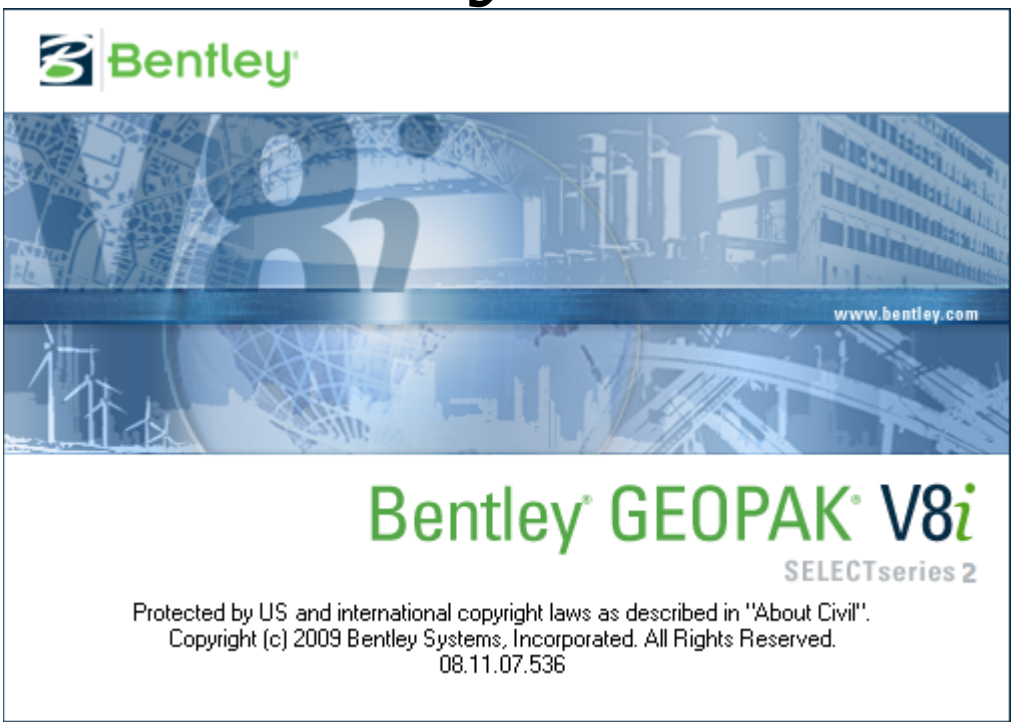
Introduction to GEOPAK®

MDT Road Design Geometry V8i SS2



Montana Department of Transportation

EISS CADD Unit

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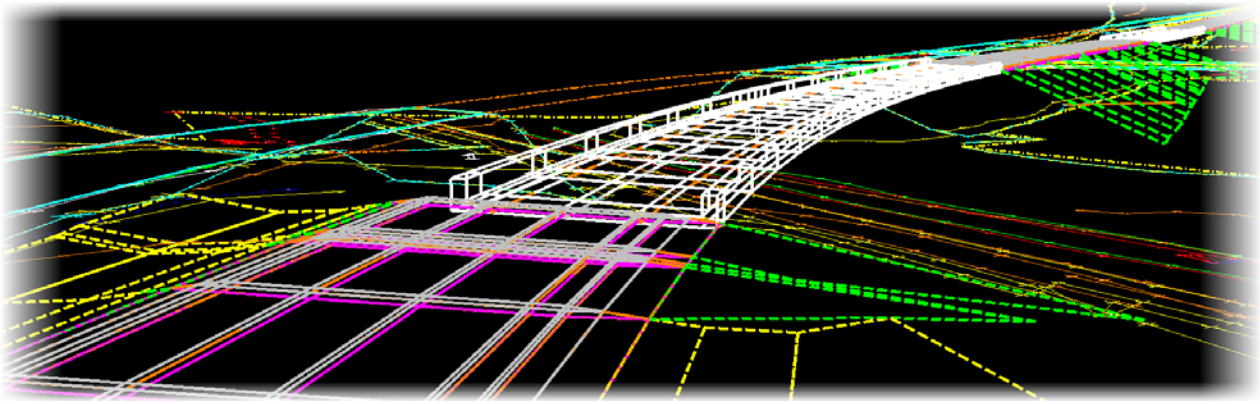
2 Introduction

GEOPAK is a comprehensive civil software package for the design and production of complex computer generated plan sets for roadway and site projects. Geopak is fully integrated with Microstation CAD software to allow for user interactive design.



This manual is intended to cover the Road tasks for **Geopak Roadway Designer Projects** and does not cover Geopak Proposed XS methods.

It is **REQUIRED** that users taking this class have taken the Introduction to Microstation class and have established a good understanding of Microstation commands and its overall funcionality.

Users are also **REQUIRED** to have a basic understanding of Road Design concepts and practices and be familiar with the components of Horizontal Alignments, Vertical Profiles, Cross Sections and be familiar with the basic Design Criteria for Roadways set forth in the MDT Road Design Manual.

In some cases there may be more than one way to perform a specific task in Geopak. Users are required to become familiar with tasks in this documentation and are encouraged to use alternate methods when feasible. When using any alternate method for a task not covered in this manual it is recommended that users contact EIS Cadd Support to insure that the method being used is accepted and that there is no known software issues with that method.

Any Questions regarding the information within this document please contact the MDT EIS Cadd Suppport users listed below.

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3 File Management

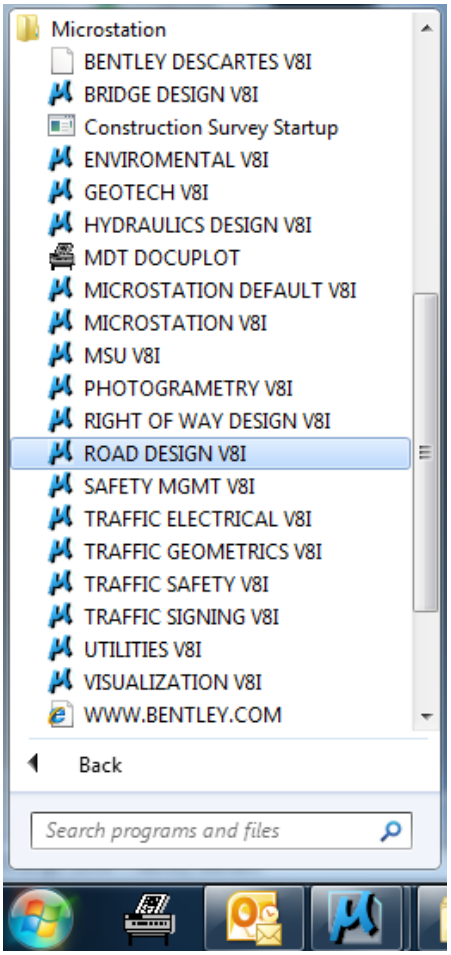
During Geopak sessions there are several files that are used and created when performing the various tasks for Geopak Road Design Projects. Some but not all of these files will need to be stored on DMS. It is up to the user to become familiar with these files and determine what files need to be uploaded to DMS.

Note: *** = Geopak Job Number
####### = MDT Uniform Project Number (UPN).

JOB***.GPK	This is a binary file that contains all the data for the horizontal and vertical alignments. The number used when creating this file should be related to the project UPN number. (i.e. CN 1426, JOB# **142** OR **426**).
NAME***.IOC	This is a text file that contains all the input commands used during a Geopak Cogo session. This file can be used to recreate the horizontal alignments stored during Cogo sessions back into the .GPK file in the case the .GPK file becomes corrupted. (I = Input, OC = operator code)
J***OOC.INP	This is a text file that is created when an alignment is stored graphically or when storing profiles. This file can be used to recreate the horizontal alignments stored graphically and vertical profiles back into the .gpk file in the case the .gpk file becomes corrupted. (OC = operator code)
#######RDMAP001.DGN	This is the design file that contains the Horizontal and Vertical Alignments.
#######RDXSF001.DGN	This is the design file that contains the Working Cross-sections.
#######RDLAY001.DGN	This is the design file that contains the Working Cross-section Sheet's that are used for plotting plan sets.
#######RDPLP001.DGN Or #######RDPLN001.DGN	This is the design file that contains the Plan Sheets Sheet's that are used for plotting plan sets.

4 Starting Microstation/Geopak

By default Geopak is installed on all MDT PC's that have Microstation installed. Geopak is automatically loaded when Microstation is started but must be activated each time a Microstation session has been started.



Step 1:

For Geopak Criteria Projects Start Microstation using the installed **Road Design v8i** Shortcut located under:

Windows>All Programs>Microstation>

Note:

Never double click Microstation DGN files in windows explorer to start Microstation. Geopak will not be available and users will receive unexpected results during Microstation sessions.

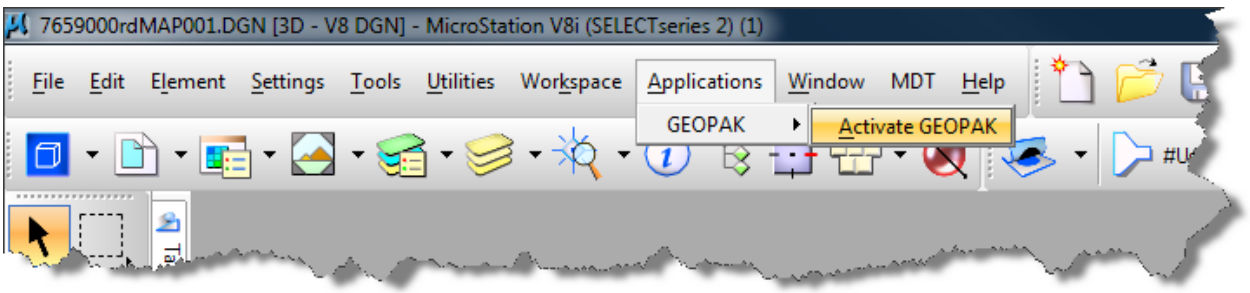
Step 2:

Open a valid Microstation DGN file or navigate and open the following file:

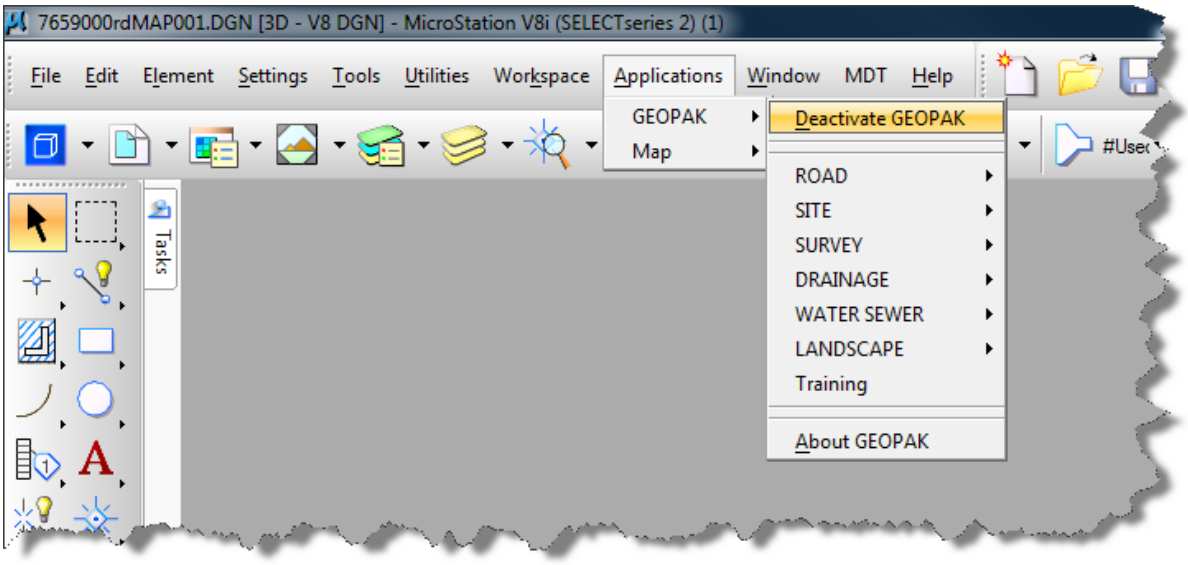
C:\MDOH\MDT.DGN

Step 3:

Once Microstation has been started the **Application** pull down will be available on the main Microstation toolbar. To activate Geopak select **Application>GEOPAK>Activate Geopak**



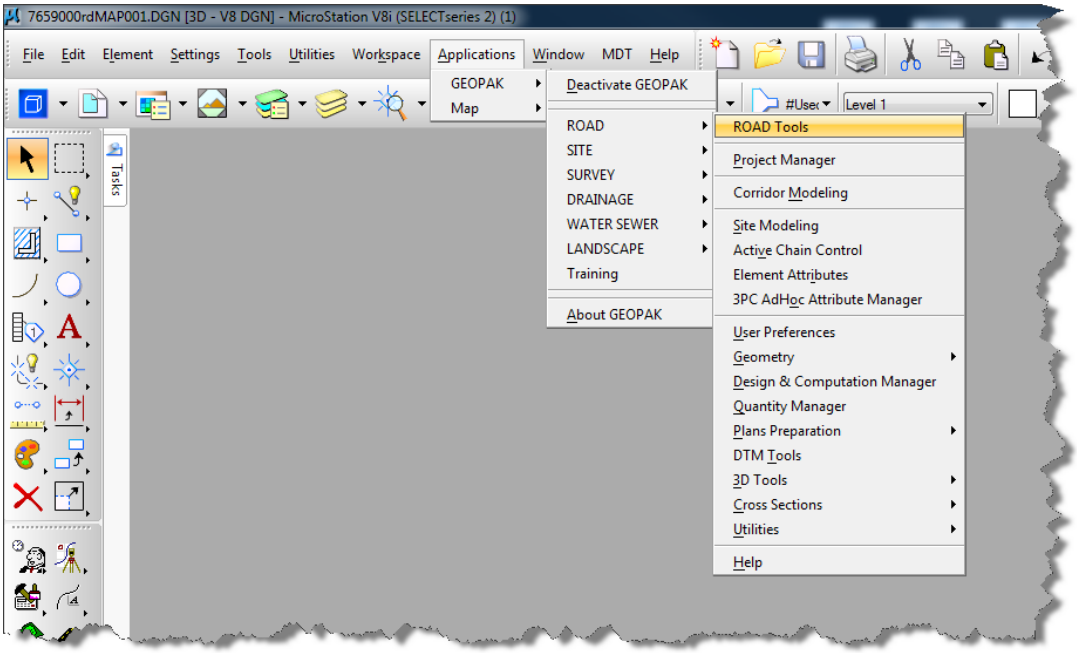
After GEOPAK activates, all the available Geopak Design modules are now available under **Applications**> **GEOPAK**



There are two options when using the **GEOPAK ROAD** module.

- Use the **Application>Geopak>Road** pull-down menu (shown below)
- Use the **Application>Geopak>Road>Geopak Road Tools**

For this class we will be using the **Geopak Road Tools** option. To load the **Road Tools** frame, select **Applications > GEOPAK >ROAD > ROAD Tools**.

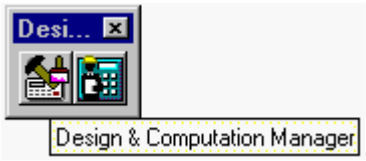


5 GEOPAK ROAD Tools frame

As an alternative to the pull-down menus invoking various GEOPAK tools, tool frames and tool boxes are supported within Geopak. The Geopak tool frame is similar to the Microstation main tool frame. It is resizable and dock able but cannot be customized. The Geopak Road tools frame consists of 8 individual tool boxes. Of these eight, three are single item tool boxes, i.e., consisting of one icon.

Each icon in the Road Tool Frame is a tool box that can be pulled out to become a "tool box." The individual tool boxes can be docked resized and can be customized.

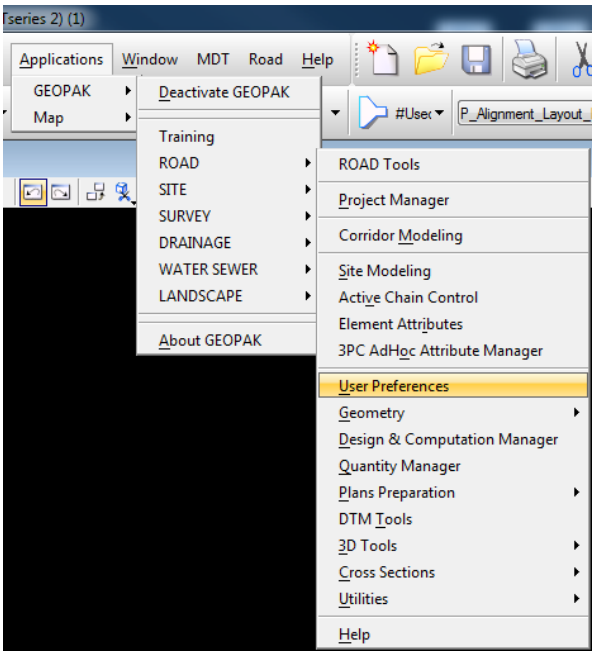
When the Geopak Road Tools Frame or any of the tool boxes within are opened when closing out of Microstation they will be reopened once Microstation and Geopak are restarted.



If the function of an icon is not apparent, position the cursor on the icon. A detailed description is displayed in the status bar and a tool tip appears, as shown.

6 Setting User Preference

To provide maximum flexibility to the designers, GEOPAK provides numerous system parameters to allow the user to easily set or change the number of decimal places for output files, station formatting, coordinate format, working units, etc.



These parameters are utilized so the user can set the parameters to the most commonly used options which GEOPAK remembers each time GEOPAK is accessed. However, when a change is needed for a particular application, or the user wants to change the default settings, this can easily be accomplished using the **User Preference** dialog.

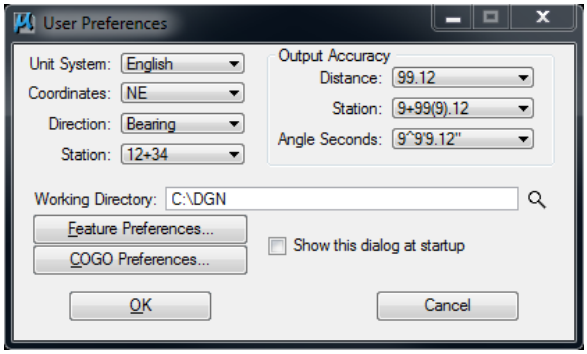
Step 1:

From the **Applications** pull-down

- Select **Geopak\Road\User Preferences**.

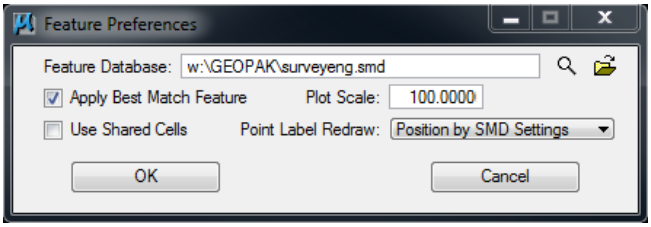
Set the User Preferences Options using the following settings shown. This is the current MDT Default Settings for Road Projects.

User Preferences



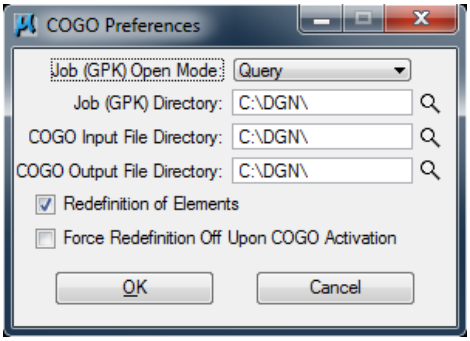
Unit System = English
Coordinates = NE
Direction = Bearing
Station = 12+34
Distance = 99.12
Station = 9+99(9).12
Angle Seconds = 9^9’9.12”
Working Directory = C:\DGN

Feature Preferences



Feature Database = W:\GEOPAK\surveyeng.smd
Apply Best Match Feature = True
Use Shared Cells = False
Plot Scale = 100.00
Point Label Redraw = Position by SMD Settings

Cogo Preferences



Job(GPK) Open Mode = Query
Job (GPK) Directory = C:\DGN
COGO Input File Directory = C:\DGN
COGO Output File Directory = C:\DGN
Redefinition of Elements = Checked
Force Redefinition Off COGO Activation = False

7 New Road Project

The following covers the basic requirements for beginning any Geopak Road Design project. Please refer to the MDT CADD Standards Manual for additional information related to Survey CADD files and MDT CADD Design Standards.

7.1 Download Survey Data Set

When starting a new Geopak Project Design a completed survey data set of the project corridor must be completed and loaded onto DMS. The four files listed below are the minimum files needed to begin any Geopak Road Project.

Download the following files from DMS for the appropriate project corridor.

File Name	File Description	DMS Folder
#######DIMAP001.DGN AND\OR #######PHMAP001.DGN	This is the survey design file(s) that contains the Existing features within the surveyed corridor.	DI PH
#######DIDTM001.TIN	This is the binary file that contains the data for the existing ground surface of the surveyed corridor	DI PH
#######SUCON001.IFT	GPS Point Location File	SU
#######SUCON001.DES	GPS Point Description File	SU

During the design phase additional Survey CADD files may be made available. Refer to the CADD Standards Chapter 2 Survey for additional information related to the various types of surveys encountered during the road design process.

Note:

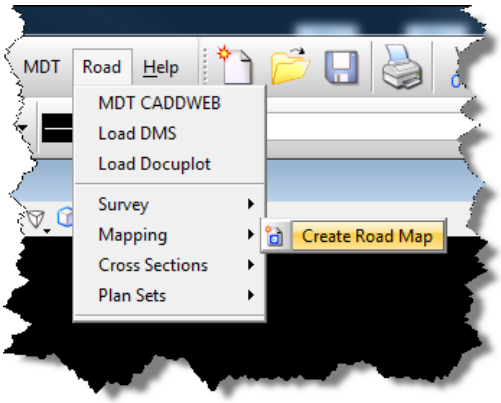
The *.IFT & *.DES files are required in order to confirm that GPS control has been set. If these files do not exist than no design should be done until at which time the GPS control has been set.

7.2 Create Mapping Files

When designing a Road project users are required to create a mapping file to be used for the project. The mapping file will consist of 2 models one **(2D)** where all the design elements will be placed by the users and the one **(3D)** model to be used for visualization existing and proposed DTM's.

Note:

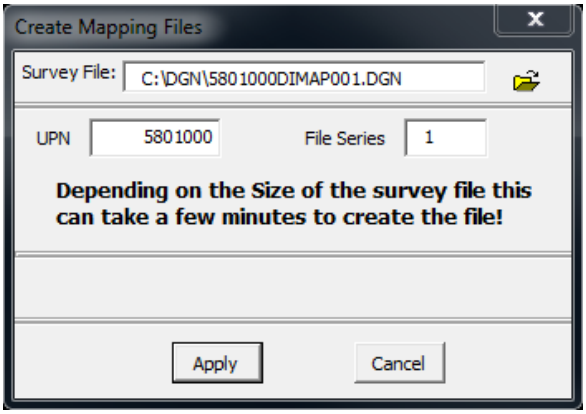
- MDT uses a custom macro that will assist the user in creating the file.
- The file will need to be uploaded to DMS



Step 1:

From the Microstation **Road** pull down

- Select **Road\Mapping\Create Road Map**



Step 2:

- Select the Survey **DIMAP** or **PHMAP** file Previously down loaded to the C:\DGN folder. This will be the seed file from which the Road Map Files will be created.

Note: The UPN and Series number will be populated after the Survey File has been selected.

- Select **Apply**

Note:

The size of the survey mapping file will determine how long it will take to create the Road Map File. The larger the survey mapping file the longer it will take to create the road map files.

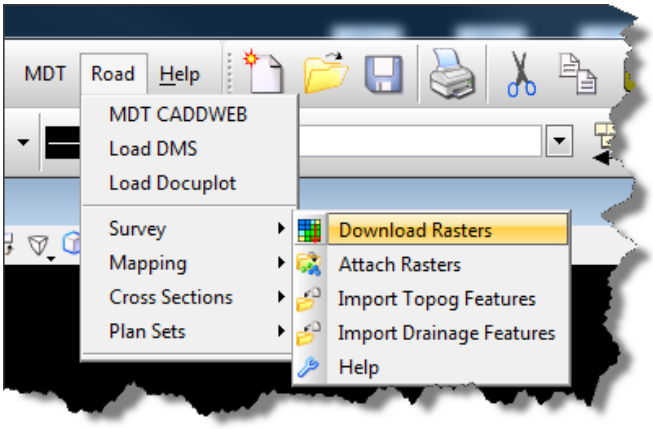
The file should now be created and located in the C:\DGN folder

7.3 Attach Raster's

Raster files are aerial photos formatted to be used during the design process. Raster files are available and can be downloaded in *.sid format and referenced to design files during the design phase of a project. Raster can be downloaded from http://nris.mt.gov/nsdi/orthophotos/naip_2011.asp

Note:

Due to the large size of raster files it is up to the user to determine if they want to upload the raster files to DMS. By uploading raster files to DMS this will greatly increase the transfer time of the design files referencing the raster's.

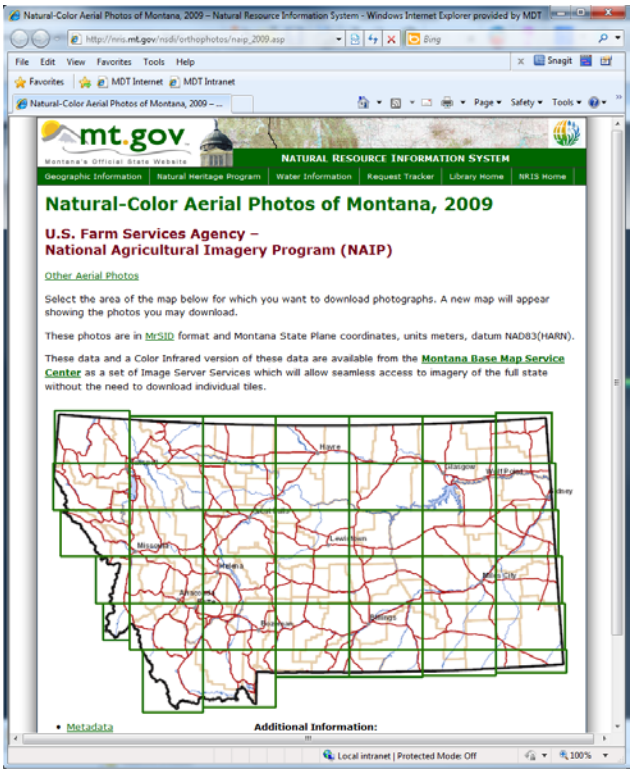


Step 1:

Open the **RDMAP(RASTER)** Model

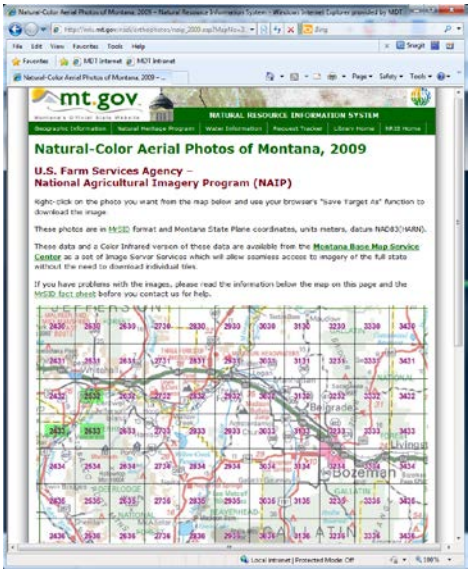
From the Microstation **Road** pull down

- Select **Road\Survey\Download Rasters**



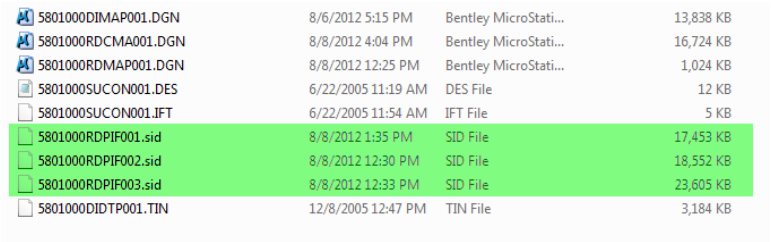
Step 2:

- Select the region from the State Map for which the project corridor is located.



Step 3:

- Select the photo from the map for which the project corridor is located, and save them to the **C:\DGN** folder



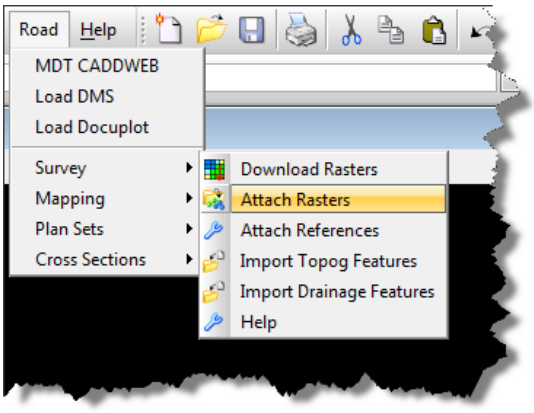
5801000DIMAP001.DGN	8/6/2012 5:15 PM	Bentley MicroStati...	13,838 KB
5801000RDCMA001.DGN	8/8/2012 4:04 PM	Bentley MicroStati...	16,724 KB
5801000RDMAP001.DGN	8/8/2012 12:25 PM	Bentley MicroStati...	1,024 KB
5801000SUCON001.DES	6/22/2005 11:19 AM	DES File	12 KB
5801000SUCON001.IFT	6/22/2005 11:54 AM	IFT File	5 KB
5801000RDPIF001.sid	8/8/2012 1:35 PM	SID File	17,453 KB
5801000RDPIF002.sid	8/8/2012 12:30 PM	SID File	18,552 KB
5801000RDPIF003.sid	8/8/2012 12:33 PM	SID File	23,605 KB
5801000DIDTP001.TIN	12/8/2005 12:47 PM	TIN File	3,184 KB

Step 4:

- Rename the downloaded *.SID files following current MDT naming standards.

Note:

This only needs to be done if the raster files will be uploaded to DMS



Step 5:

From the Microstation **Road** pull down

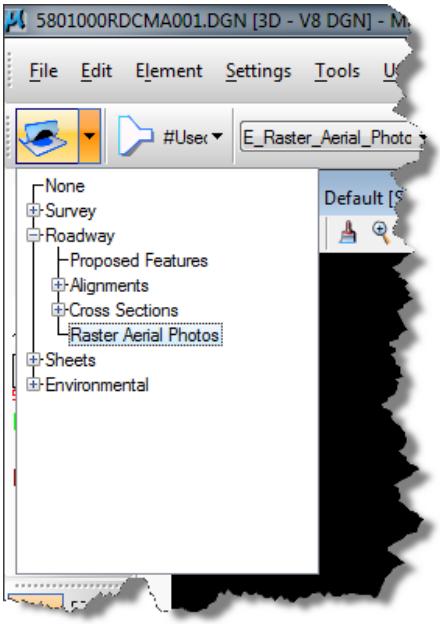
- Select **Road\Survey\Attach Rasters**

Or

From the Microstation **Primary** Tools

- Select **Raster Manager**>**Attach**

This will load the **Raster Manager**

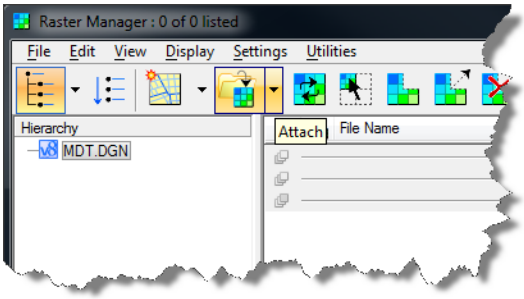


Step 6:

From the Microstation **Attributes** Tools Box

- Select **Template>Roadway> Raster Aerial Photos**

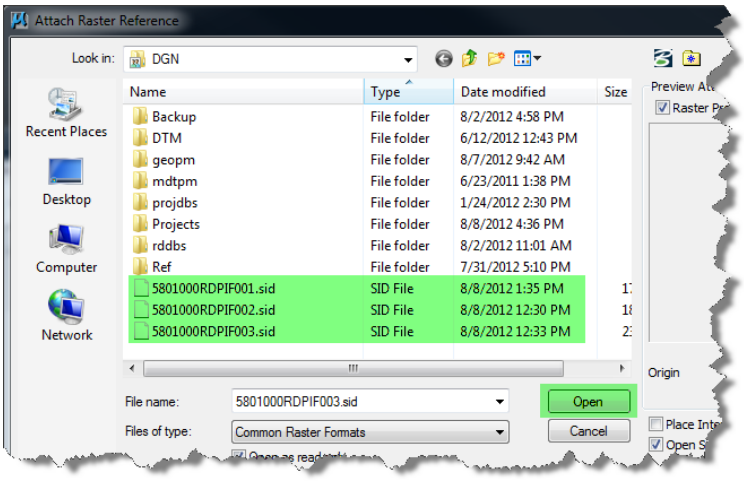
This will set the level for the Raster files to be placed on when their attached.



Step 7:

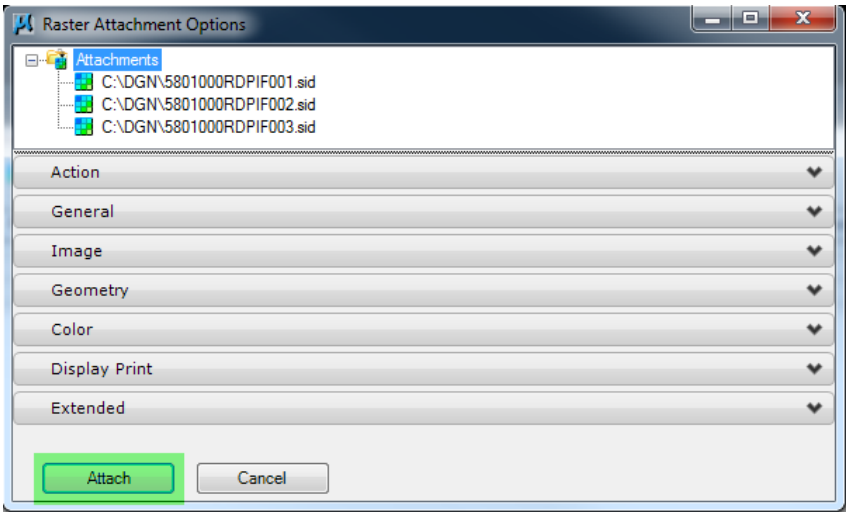
From the **Raster** Tools

- Select **Attach**



Step 8:

- Select the Rasters to Attach
- Select **Open**



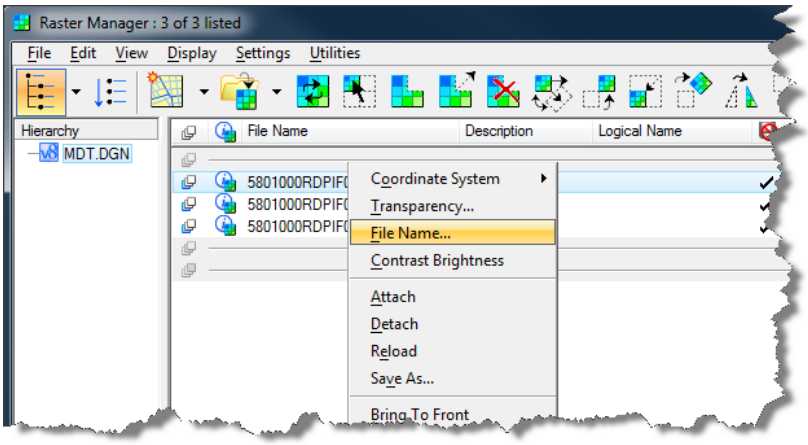
Step 9:

To Attach the Rasters

- Select **Attach**

From the Microstation **View** tools

- Select **Fit View**



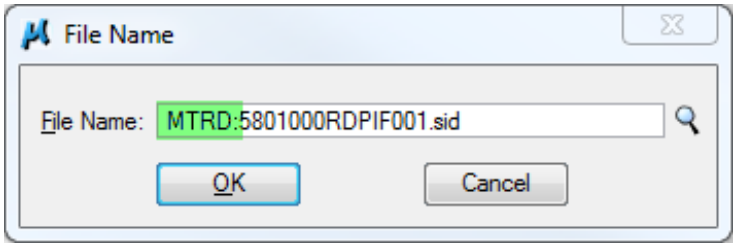
Step10:

Right Click on each Raster

- Select **File Name**

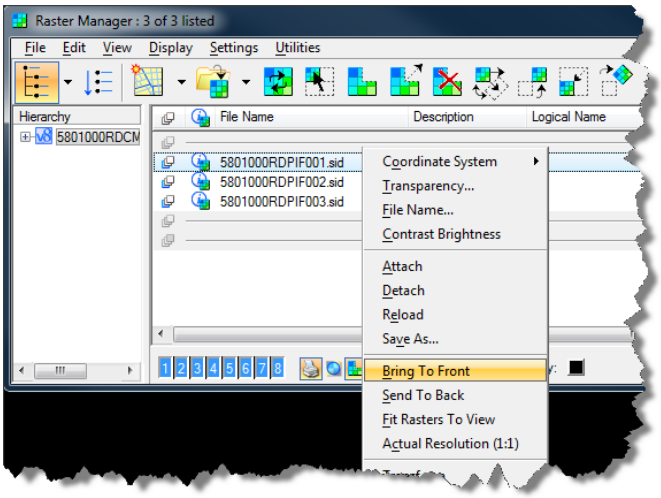
Note:

This only needs to be done if the raster files will be uploaded to DMS



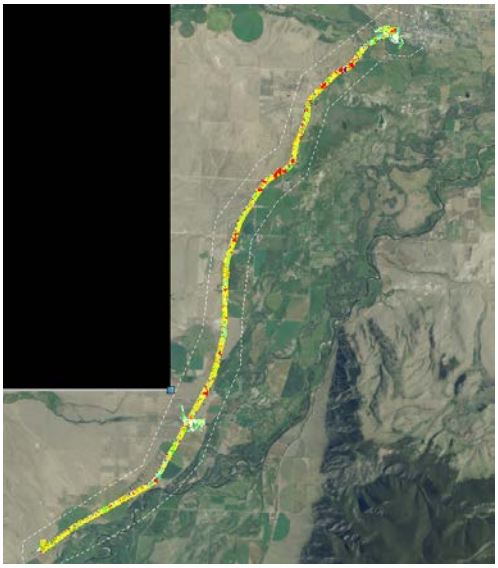
Add the workgroup **Logical Prefix** to the Raster attachment to be used with DMS.

- Select **OK**



Step 11:

- **Right Click** on each Raster
- Select **Bring To Front**



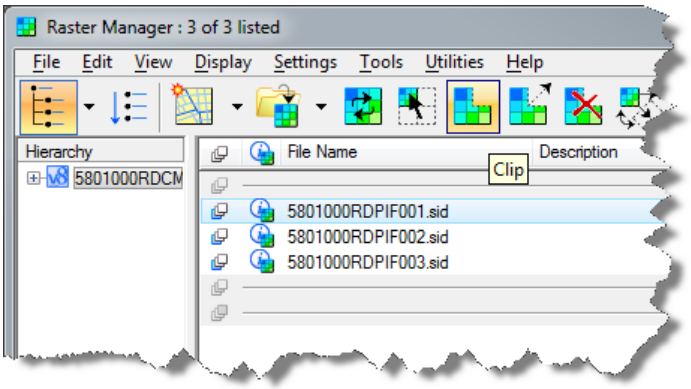
Step 12:

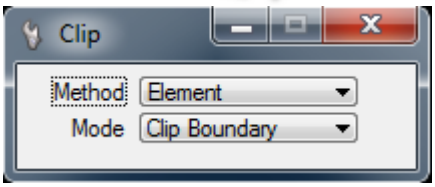
From the Microstation **View** tools

- Select **Fit View**

Using the Microstation **Place Shape** Tool

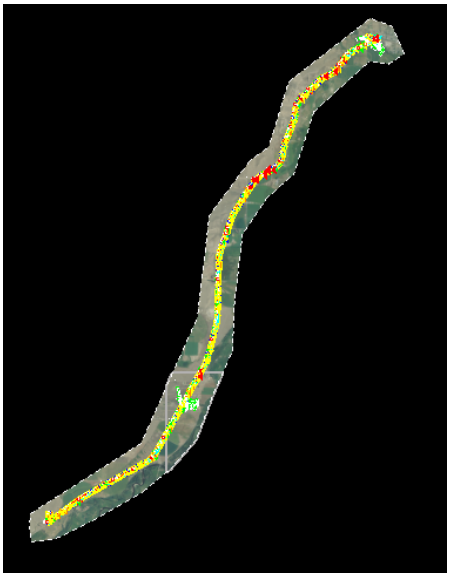
- Place a Shape around the surveyed corridor.





Step 13:

- Select the first Raster in the list
- Select the **Clip Raster** Tool.
- Set the **Clip Method** to **Element**
- Select the Raster Clip boundary shape previously drawn in the DGN file.



Note:

This will need to be performed on all Rasters that are attached

7.4 Attach References

Attach any Additional Survey Mapping files to both the (2D) and (3D) files.

Step 1:

From the Microstation **Road** pull down select **Road\Survey\Attach Survey's**

Step 2:

Select **References** at the Top of the Road Dialog

Step 3:

Select the References to Attach

Note:

Once all the references have been attached according to MDT standards move the references into the c:\dgn\ref folder.

7.5 Review Survey Data

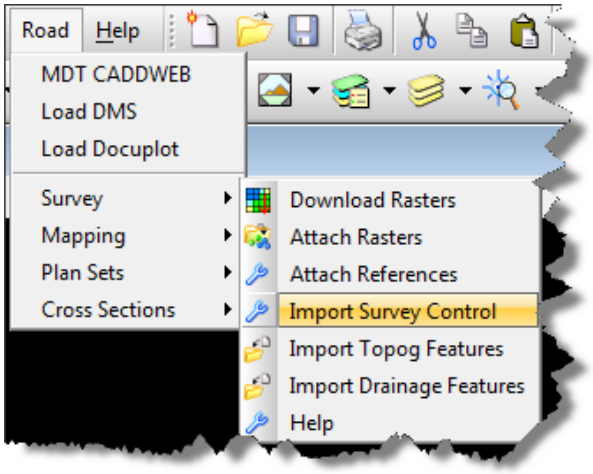
When beginning any road project users should perform the following task to check the survey CADD files for errors. This will save time during the design phase of a project if any errors can be caught and fixed before any design begins.

7.5.1 Import Survey Control

The **Import Survey Control** Tool is a MDT macro that has been developed to Import the GPS control and plot the control features in the **RDMAP (2D)** and **(3D)** models.

Note:

The *.IFT & *.DES files are required in order to confirm that GPS control has been set. If these files do not exist than no design should be done until at which time the GPS control has been set.

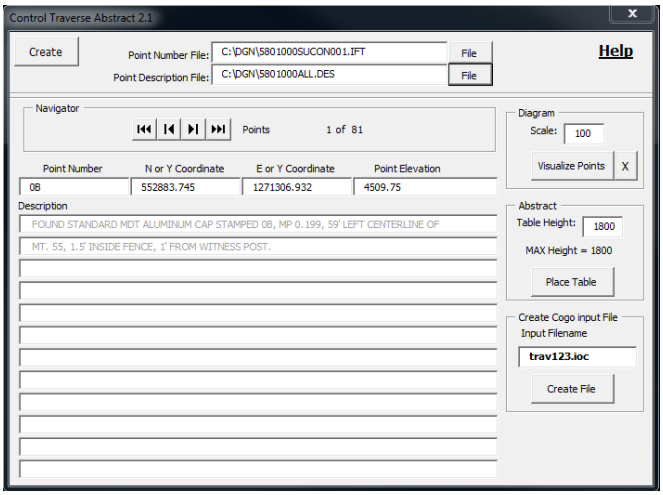


Step 1:

Open the **RDMAP(CMA)** Model

From the Microstation **Road** pull down

- Select **Road\Survey\Import Survey Control**



Step 2:

- Select **Point Number File**
- Select **Point Description File**
- Select **Visualize Points**

Note:

To Delete the points select the X next to the Visualize button.

The Survey control points should now be displayed in the DGN file.

7.5.2 Load DTM Features

The Geopak **DTM Tools** are used to perform a wide range of task on Digital Terrain Models (DTM). DTM's are binary files consisting of triangulated algorithms of the Existing Ground surface. DTM's are currently generated by MDT's survey Section, MDT's Photogrammetry Section or by a Consultant.

Step 1:

Open the **(3D) RDMAP(CMA)** Model

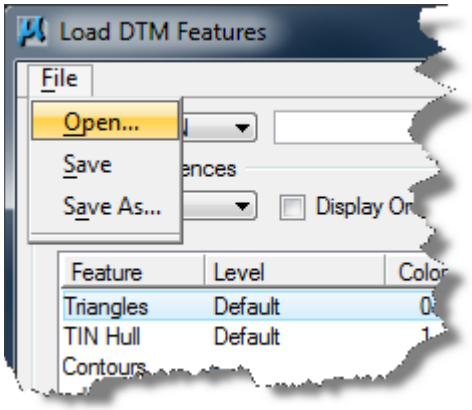
From the Geopak **Road Tools**

- Select **DTM Tools**

Step 2:

From the **DTM Tools**

- Select **Load DTM Features**



Step 3:

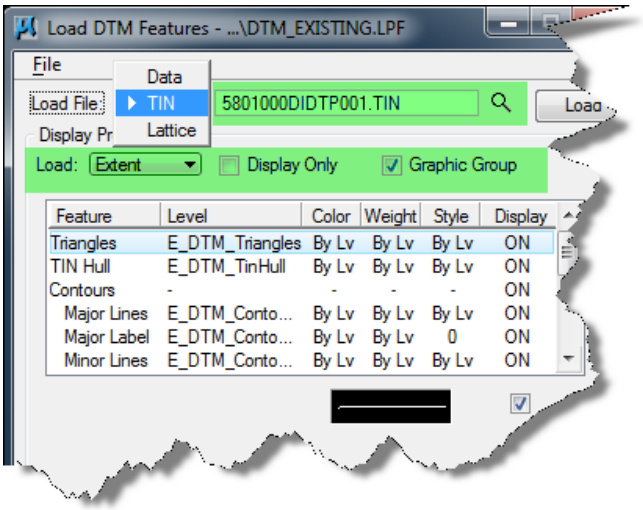
Copy the following file to the **C:\DGN** folder
W:\Geopak\Preferences\DTM_EXISTING.LPF

From The **Load DTM Features** Dialog

- Select **File Open**

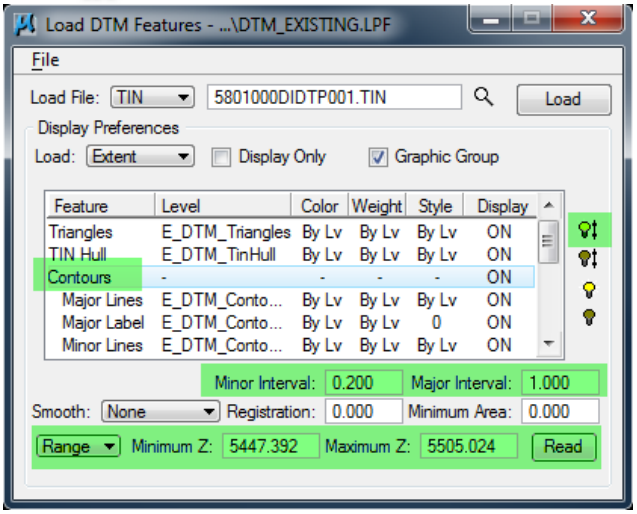
From the DTM **File Open** dialog

- Select the file **C:\DGN\DTM_EXISTING.LPF**
- Select **Open**



Step 4:

- Set **Load File** option to **TIN**
- Select the **TIN** file for the project corridor.



Step 5:

- Set **Display** Feature to **All Items On**.
- Select **Contours** Feature
- Select **Read**

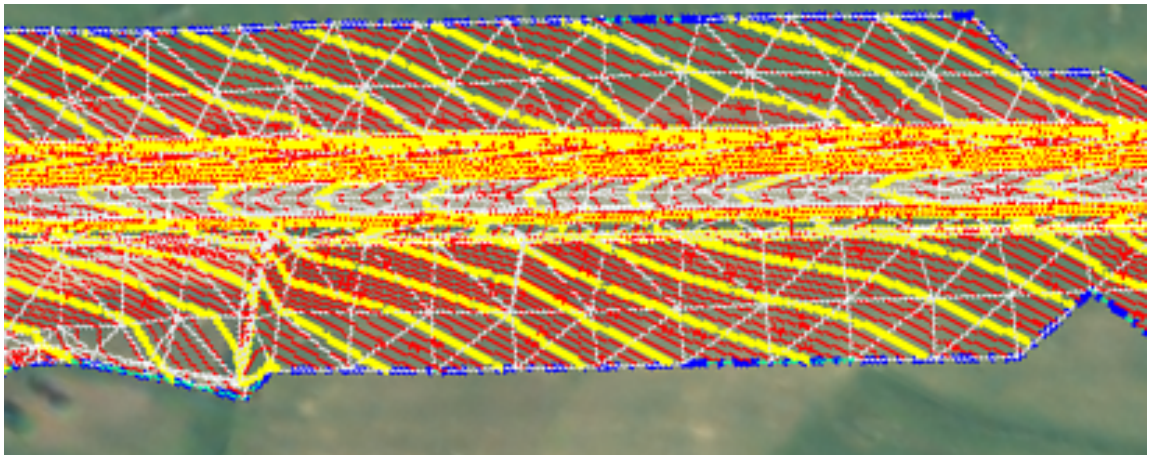
Note:

Take note of the elevation range of the TIN and adjust the contour Intervals accordingly.

Step 6:

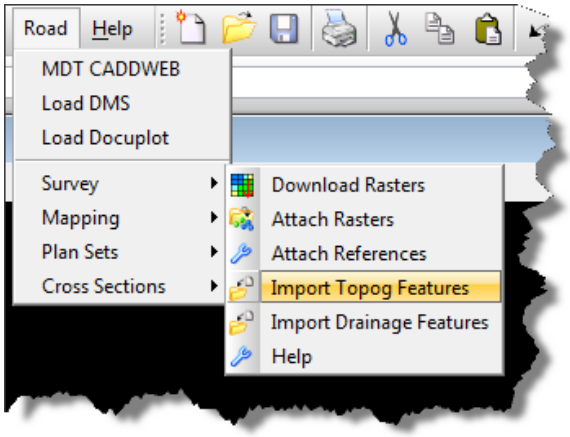
- Select **Load**

The DTM Features Should now be drawn in the DGN file.



7.5.3 Importing Existing Topog

The **Import Existing Topog** Tool is a MDT macro that has been developed to extract cell features from survey files and plot the features in the **(3D)RDCMA** and **(2D)RDXSF** DGN files.

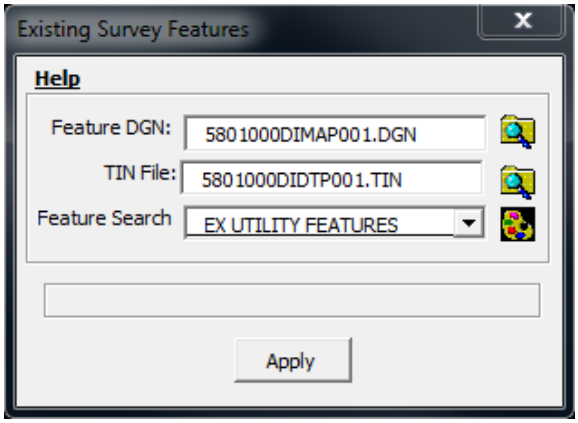


Step 1:

Open the **(3D) RDMAP(CMA)** file

From the Microstation **Road** pull down

- Select **Road\Survey\Import Topog Features**



Step 2:

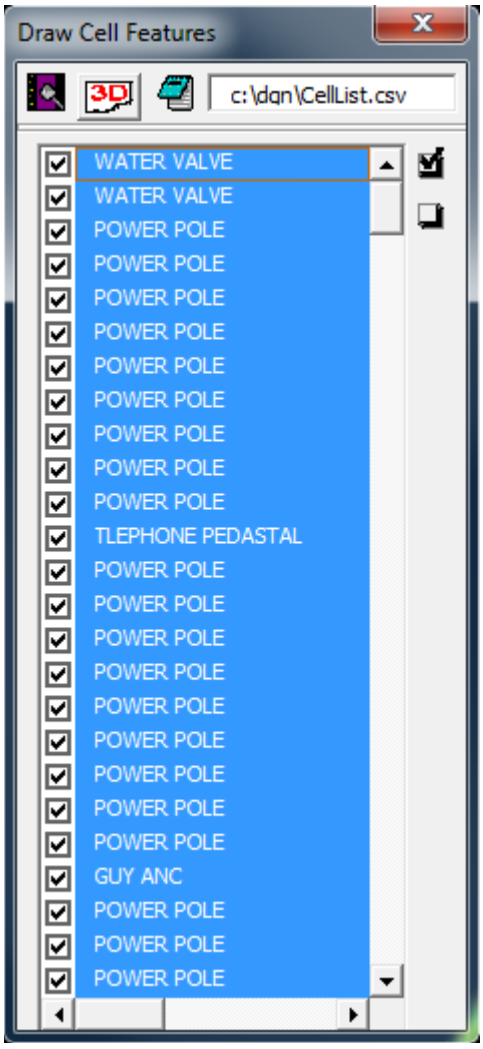
- Select the **Feature DGN** File
- Select the **TIN File**
- Select the **Feature Search** option

Note:

The following Cell Feature Groups are supported.

- Utility Features
- Roadway Features
- Natural Features
- Drainage Features.

- Select **Apply**



Step 3:

- Select **All Cells**
- Select **3D**

Step 4:

- Check the **Cell search setting** and repeat for each additional Feature Group to Import.

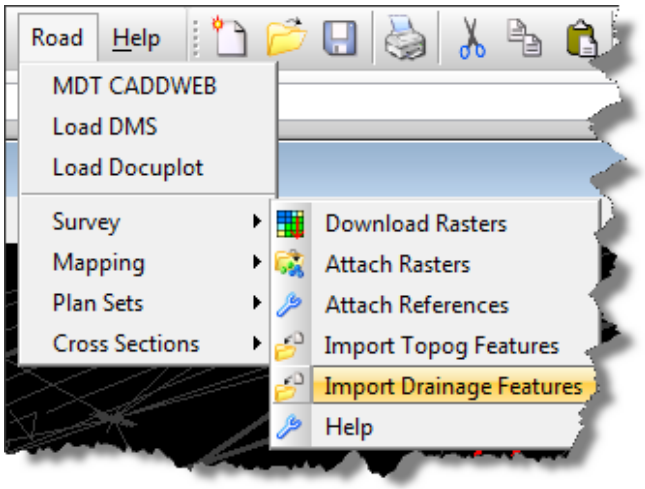
The 3D Cells should now be drawn in the (3D) RDMAP(CMA) DGN file

7.5.4 Importing Existing Drainage

This **Import Existing Drainage** Tool is a MDT macro that has been developed to extract culverts from the survey files and plot them in the 3D and XS DGN files.

Note:

This process requires the survey crews to attach the culvert survey information as adhocs to the surveyed culvert points within the **(3D) DIMAP** file.

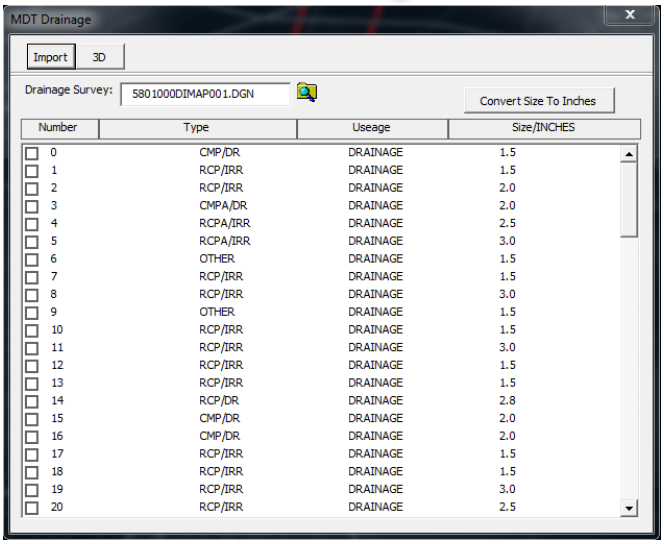


Step 1:

Open the **(3D) RDCMA** file

From the Microstation **Road** pull down

- Select **Road\Survey\Import Drainage Features**



Step 2:

- Select **Drainage Survey** File

Step 3:

- Select **Import**

Note:

Select the **Convert Size to Inches** if not already done in inches.

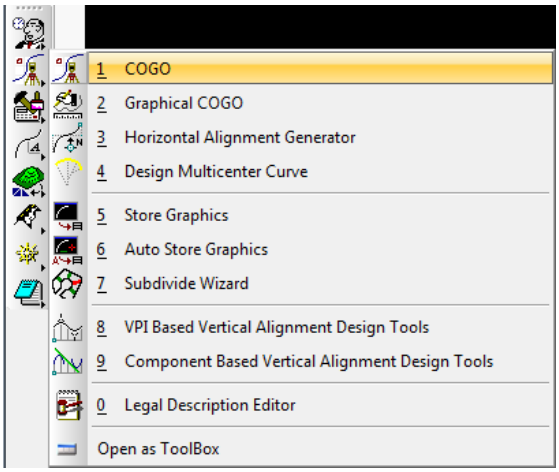
Step 4:

- Select **3D**

The Culverts should now be drawn in the 3D file

7.6 Create Geopak GPK File

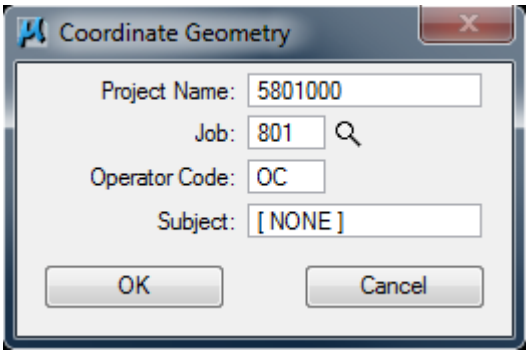
The Geopak GPK file is the binary file that contains all the Horizontal & Vertical Alignment information. This file will need to be uploaded to DMS.



Step 1:

From the Geopak **Road Tools** Frame

- Select **COGO**

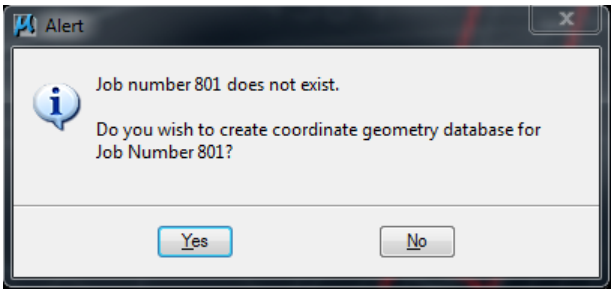


Step 2:

Enter the information for the project.

- For **Project Name** use the Project UPN
- For **Job** Use the First 3 or last 3 values of the Project Control Number
- For the **Operator Code** use OC
- For **Subject** use RECON, OVERLAY, REHAB etc.

- Select **OK**



Step 3:

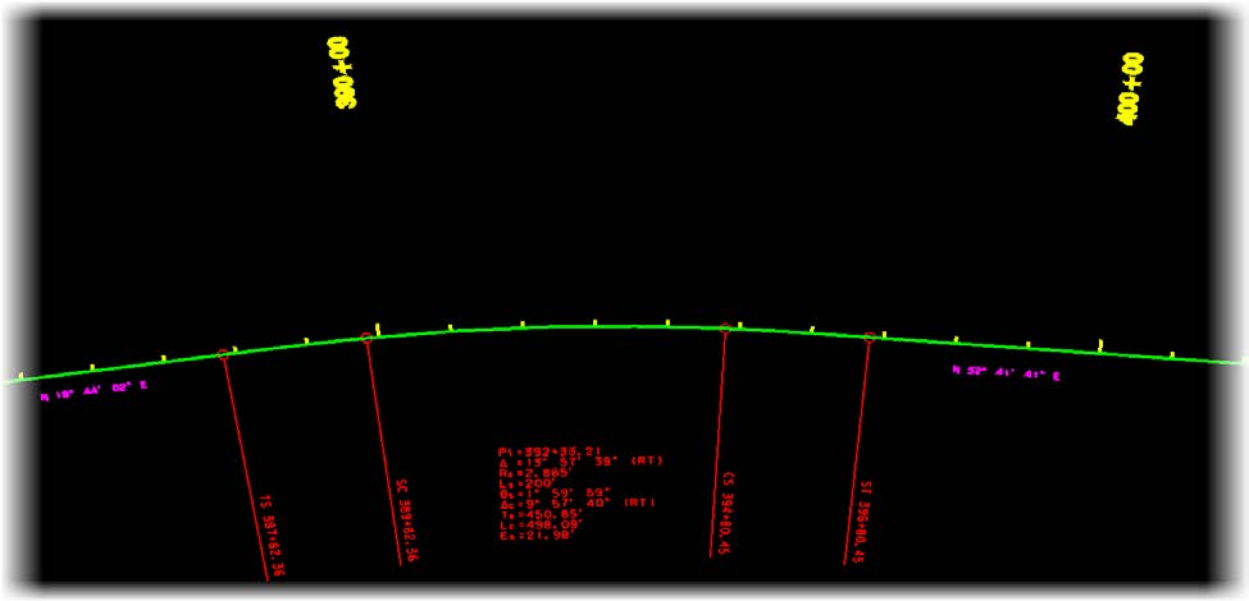
A prompt to create the GPK will be displayed

- Select **Yes**

8 Horizontal Alignments

There are several ways to store horizontal alignments into Geopak. Horizontal alignments are stored as Chains consisting of points, lines, curves, and spirals and are stored as Cogo elements within the Geopak Coordinate Geometry database (GPK File).

- Store Alignments in Geopak Coordinate Geometry.
- Store Alignments from Graphics
- Store Alignments with Microstation Geometry tools.



There are several types of alignments that can be stored such as Existing Alignments, Design Alignments, Curb & Sidewalk Alignments, Ramp Alignments, Ditch Alignments, etc. Each type of alignment will have different design criteria that will need to be applied when storing that type of alignment such as, min curve radius, simple curves or spiral curves, deflection angles, etc.

When storing Centerline alignments one must consider the sources of information available for laying out the alignment, and whether the alignment can be stored independently as a new alignment or if the alignment must follow the existing staked alignment. Most common sources of information are as-Builts and survey mapping files.

The type of project will have a direct effect on the way the alignment will be stored in Geopak. For reconstruct projects the new alignment will be stored uncontrolled by the existing alignment for the exception of the beginning and ending connections of the project. Overlay & Rehab jobs will use the best fit method and follow the survey PTW and Asbuilt information as close as possible.

Existing Alignments:
When storing Existing Alignments do not use as-built bearings, most likely the as-built basis of bearings were derived by solar observations or by assuming them. For that reason the most common method of storing the Existing Staked Alignment is the best fit method and should be used following the PTW feature in the survey mapping file. This is due to the fact that all new projects requiring survey are now tied by GPS.

Design Alignments:
When storing Design alignments provide additional tangent length when possible for connections at the beginning and end of the project and where projects begin at the beginning of a curve.

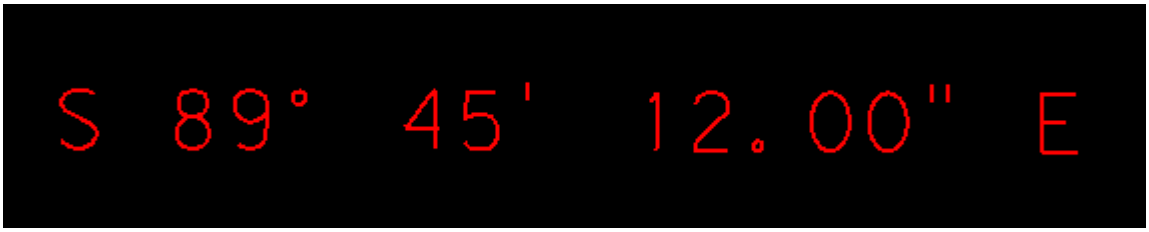
Chain Names:
MDT currently does not have a standard on Chain names, Chain names should be limited to 8 characters..

Stationing:
When storing an alignment the chain station will be determined by whether or not existing stationing needs to be used. Projects requiring stationing tied to existing station must calculate the beginning station based on a fixed surveyed feature with known asbuilt stationing. For all projects not requiring the existing stationing to be tied, the stationing can begin at 0+00.00

Bearings:
When storing alignments all bearings should be rounded to current MDT standards set forth in the MDT Road Design Manual. Bearings should be rounded prior to notifying R/W that the alignment is available. In the event that the alignment changes R/W needs to be notified.

Incorrect

Correct



Points:
MDT has adopted the following point naming convention for storing points in Geopak GPK files to help expedite the information to the construction crews. Below is a list of point place holders for each work group utilizing Geopak to store points during the design process.

Min. req. pnts.		Proposed range
2000	Cadastral Survey	1-1999
1000	Road Design	2000-2999
4000	R/W	3000-6999
1000	Placeholder for Traffic	7000-7999
1000	Placeholder for HYD	8000-8999
1000	Placeholder for Bridge	9000-9999
10,000	R/W parcels	10,000-19,999
1000	Placeholder for GEOTECH	20,000-20,999
5000	Placeholder for ENVIRO.	21,000-25,999
	Unused placeholder	26,000-49,999
500,000	Pre-Survey (includes Constr.)	50,000-to end

For complex projects that have multiple design chains such as urban projects users may also use an Alpha numeric point convention if they wish. This assists the user in identifying what chain the points belong to when reviewing GPK points. At this time it is at the user's discretion to determine the alpha characters for their point names. As a recommendation and for consistency, users can use the Chain Name for the alpha character along with a point number for their workgroup placeholder listed above.

Example: (ChainName)(PointNumber)
DESIGN2000

Note: Geopak Point names are limited to 15 Characters

When using an alpha Numeric point name other than the chain name users must be aware of any survey points that may have already used an alpha numeric point name for their project. Users need to be sure not to use single or double Alpha characters such as A, AA etc. as this format is already used by survey personal for control points.

Below is a list of the current Survey Alpha Numeric points that are encountered.

1) MDT Control points are currently numbered A+4 digit control number (A5764) thru ZZ + 4 digit control number (ZZ5764).
2) Existing old MDT Control that is still being used (milepost + alpha) that we convert to alpha-numeric.
3) NGS Benchmarks are all over the board E.g. coppweld, 1JEB, W270.
4) Photogrammetry uses 600-799 + 4 digit control number (6045764).

Curves:

When storing curves, use the following naming convention for the curve names. This will help identify what curves belong to the chain when the chain is stored. By using different names for simple vs spiral curves this will help identifying what curves have spirals.

Simple Curves
Chain Name + _C1

Example: **DESIGN_C1**

Spiral Curves
Chain Name + _S1

Example: **DESIGN_S1**

Alignment Coordinate Tables:

When importing alignments into a data collector, the Point Of Beginning of the alignment defaults to the first station in the downloaded typicals. This may not be the actual start of the project, sometimes the alignment starts before the project to allow for transitions.

The following is a list of points that are required to be stored in all chains used for centerline alignments. These are critical points and must be stored for a seamless import to the Data collector.

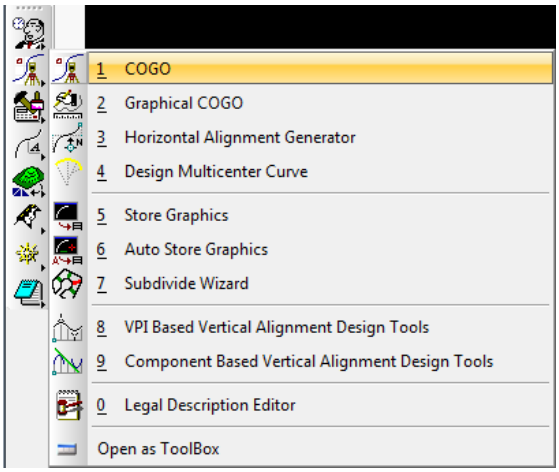
- **Beg Alignment**
- **Beg Prj. Transition**
- **Project Beginning**
- **Equations**
- **Bridge Ends**
- **Intersections**
- **Beg Prj. End Transition**
- **Project End**
- **End Alignment**

8.1 Coordinate Geometry Tools

GEOPAK Coordinate Geometry tools calculate and store points, lines, curves, spirals, chains, parcels and profiles. In addition, it calculates roadway super elevation, bridge deck elevations, geometric relationships, intersections between alignments and many other functions.

All the coordinate geometry is stored within a binary database, named job**.gpk, (where ** is a two or three digit alphanumeric code) which is compatible across all platforms.

While computing coordinate geometry, GEOPAK's visualization mode displays the computations on the screen, so the designer can immediately see the results of the calculations. In addition to visualizing the computations, GEOPAK also builds an audit trail, which can be saved at the designer's option. If changes occur at a later time, the designer simply accesses the input file, makes the correction, and then stores the information again.

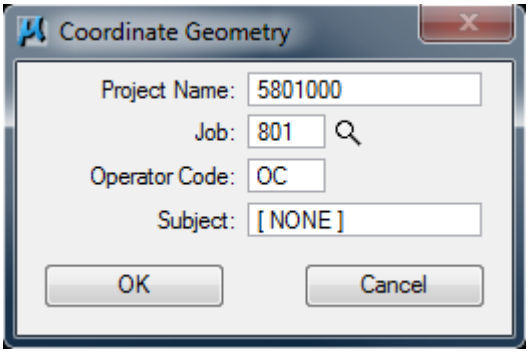


Step 1:

Open the **(2D) RDMAP(Default)** Model

From the **Geopak Road Tools** frame

- Select **COGO**

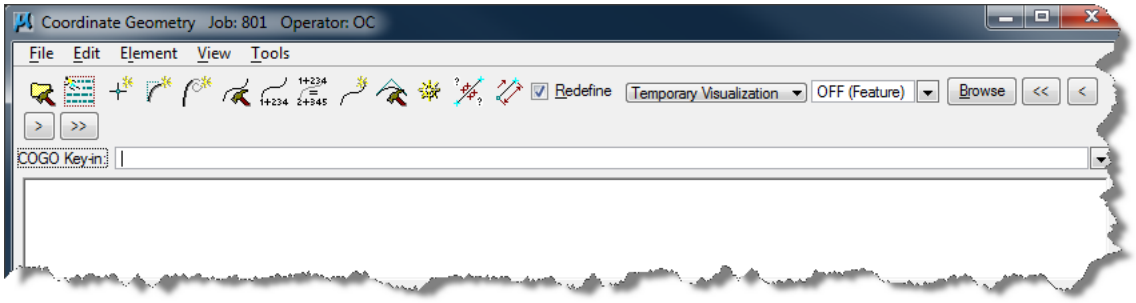


Step 2:

Enter the information for the project

- For Project Name use the Project UPN
- For Job Number Use the First 3 or last 3 values of the Project control Number
- For the Operator code use OC
- For The subject use RECON, OVERLAY, REHAB etc.

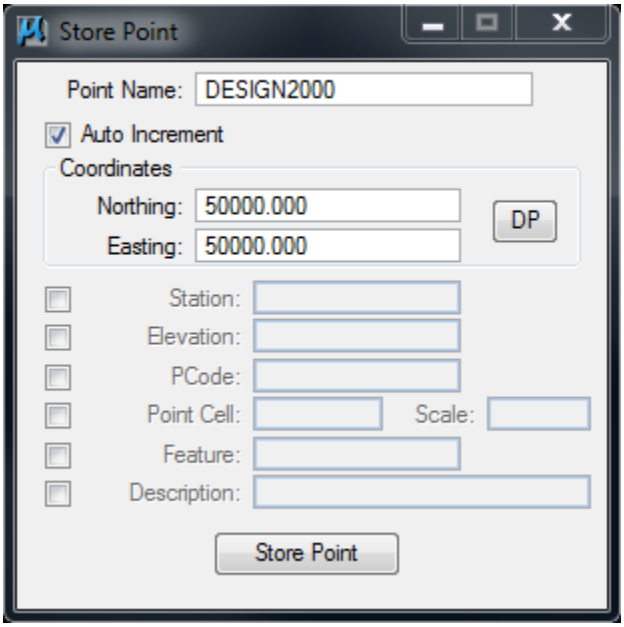
- Select **OK**



- Within the Coordinate Geometry Data base there are several ways to activate the cogo tools.
- All tools are avaialble via the pull downs located at the top of the interface.
- The Coordinate geometry interface is customizable and can be set to each users preference.
- The interface supports a customizable frame to display links to all the tools available.
- When using Cogo tools you must be in the **(2D)RDMAP(Default)** Model

8.1.1 Store Points

The store point tool is used to store points in the GPK file.



Step 1:

From the **Cogo Tools** pull down

- Select **Element>Point>Store**

Set the Point Name following the MDT Geopak point numbering standard.

- Select **Auto Increment**

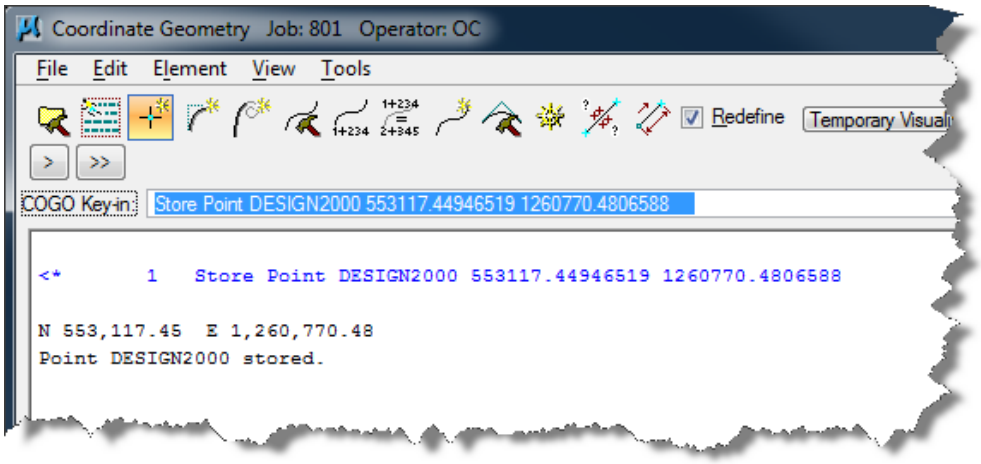
Step 2:

- Select the **DP** button and identify the point on the screen to set the coordinates of the point to be stored or input the known coordinates of the point in the Northing & Easting fields.

Step 3:

- Select **Store Point**

In the Coordinate Geometry window, the information confirming the storing of the point will appear.

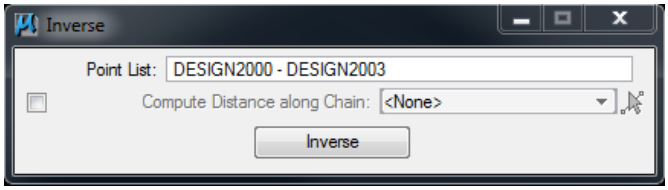


Step 4:

- Repeat steps 2 & 3 and store 3 more points.

8.1.2 Inverse Tool

The inverse tool is used to check the Bearing & Distance between points.



Step 1:

From the **Cogo Tools** pull down

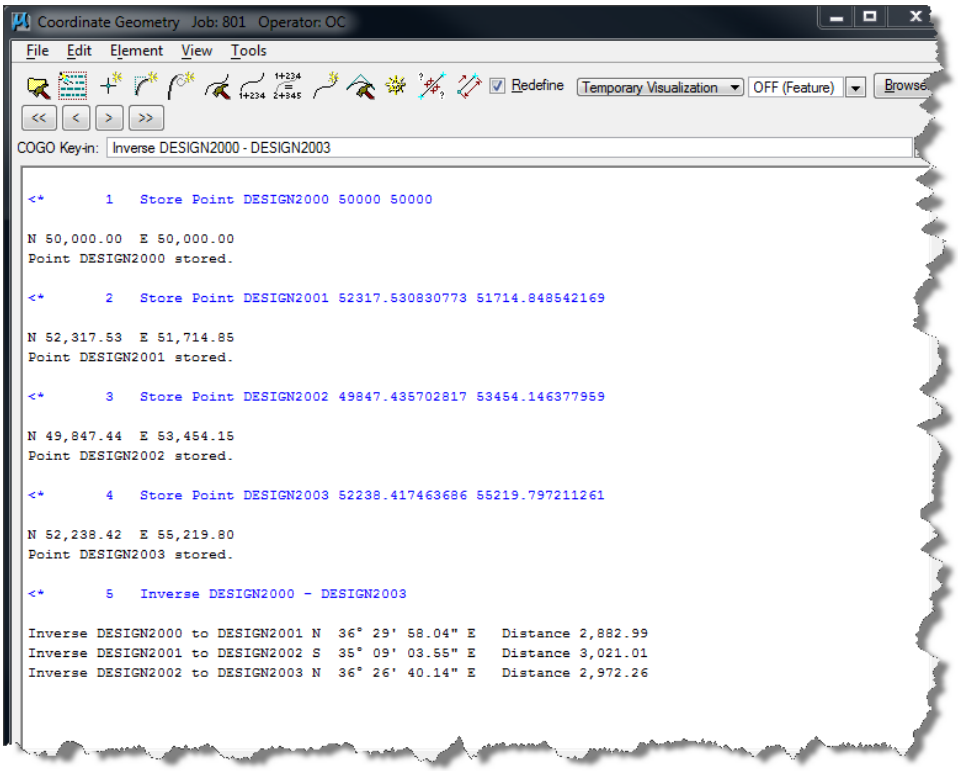
- Select **Tools > Inverse**

Enter the range of points to check the distance & bearing.

Step 2:

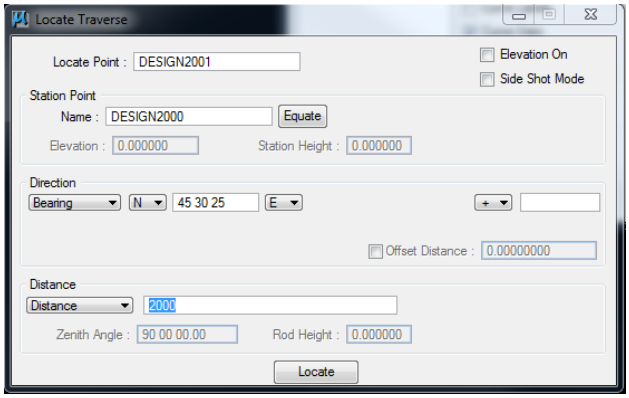
- Select **Inverse**

In the Coordinate Geometry window, the information showing the bearing & distance between the points will appear.



8.1.3 Locate Points from Stored Points

The Locate Traverse tool will locate and store points relative to points previously stored.



Step 1:

From the **Cogo Tools** pull down

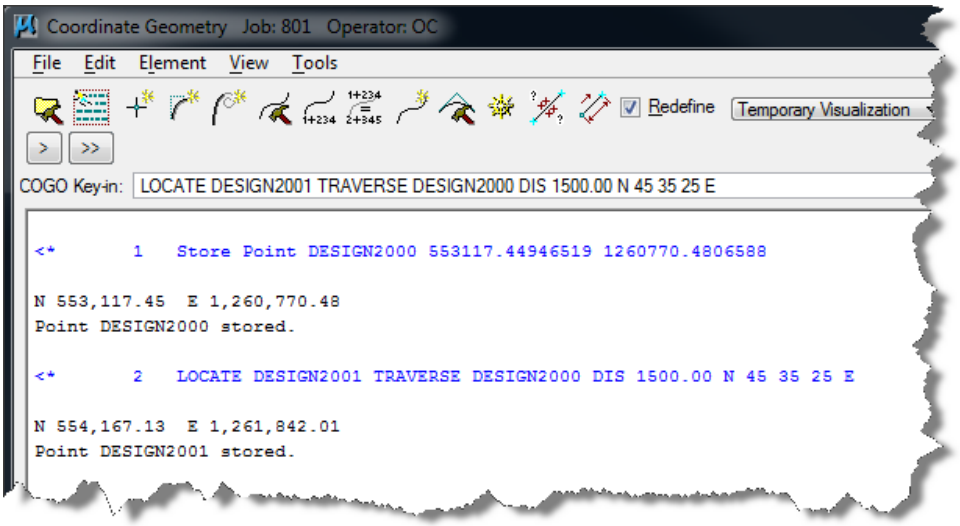
- Select **Tools>Locate>Traverse**
- Set the **Direction** option to **Bearing**
- Set the **Distance** option to **Distance**

Step 2:

Fill in the following
Locate Point
Start Point
Direction (round to the nearest second 0^00'00")
Distance (Round to the nearest .01)

- Select **Locate**

In the Coordinate Geometry window, the information confirming the storing of the point will appear

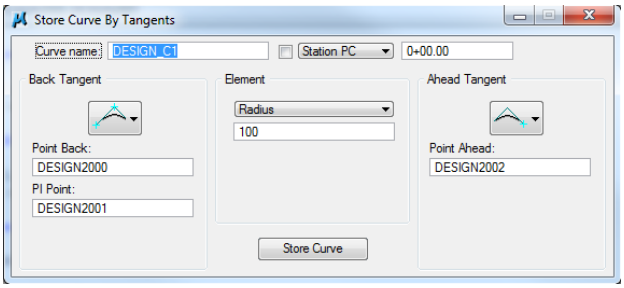


Step 3:

- Repeat **Step 2** for all additonal points

8.1.4 Store Simple Curve from points

The Store Simple Curves Tool is used to store simple curves.



Note:
A Minimum of 3 points must be stored in the GPK file in to store a Simple Curve.

Step 1:

From the **Cogo Tools** pull down

- Select **Element>Curve>Store>By Tangents**
- Set the Back Tangent option to **Point Back / PI Point**
- Set the Element option to **Radius**
- Set the Ahead Tangent option to **Point Ahead**

Step 2:

Enter The following:
Curve Name
Point Back
PI Point
Radius
Point Ahead

Step 3:

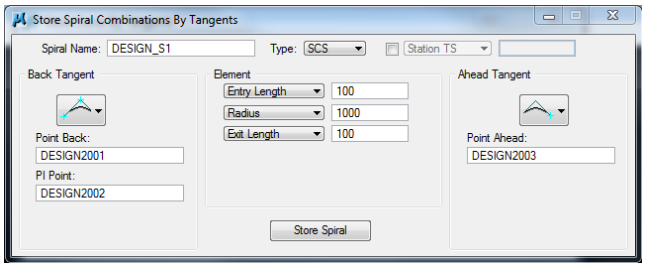
- Select **Store Curve**

In the Coordinate Geometry window, the information confirming the storing of the curve will appear.

```
                              Curve Data
                             *----------*
Curve DESIGN_C1
P.I.  Station              7+83.85  N          554,167.13  E        1,261,842.01
Delta        =       76° 10' 57.20" (RT)
Degree       =        5° 43' 46.48"
Tangent      =                783.85
Length       =             1,329.64
Radius       =             1,000.00
External     =               270.60
Long Chord   =             1,233.83
Mid. Ord.    =               212.97
P.C.  Station              0+00.00  N          553,618.60  E        1,261,282.06
P.T.  Station             13+29.64  N          553,754.39  E        1,262,508.40
C.C.                                N          552,904.24  E        1,261,981.85
Back         = N  45° 35' 25.00" E
Ahead        = S  58° 13' 37.80" E
Chord Bear   = N  83° 40' 53.60" E
Curve DESIGN_C1 stored
```

8.1.5 Store Spiral Curve Spiral from points

The Store Spiral Curve Tool is used to store curves with spirals.



Note:
A Minimum of 3 points must be stored in the GPK file in to store a spiral curve.

When spirals are stored they are stored as 3 separate elements in Cogo, the Back Spiral the Simple Curve & the Ahead Spiral. Coordinate geometry will automatically add the suffix to the spiral names identifying them accordingly.

Example:

Spi = DESIGN_S1**B**
Cur = DESIGN_S1
Spi = DESIGN_S1**A**

Note:
B = Back
A = Ahead

Step 1:

From the **Cogo Tools** pull down

- Select **Element>Curve>Spiral>Store**
- Set the Back Tangent option to **Point Back / PI Point**
- Set the Element options to **Entry Length** **Radius** **Exit Length**
- Set the Ahead Tangent option to **Point Ahead**

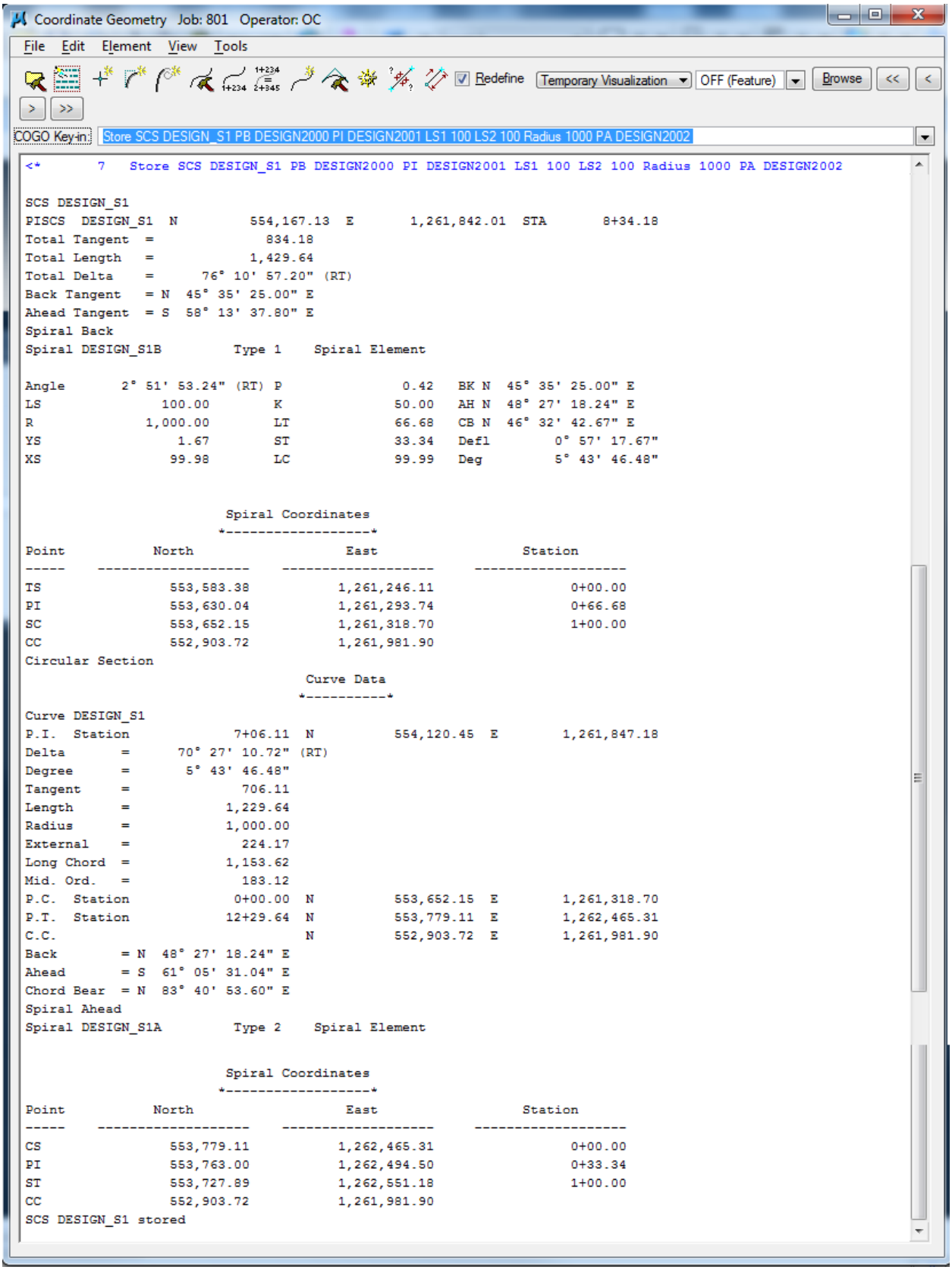
Step 2:

Enter The following:
Spiral Name
Point Back
PI Point
Entry Length
Radius
Exit Length
Point Ahead

Step 3:

- Select **Store Curve**

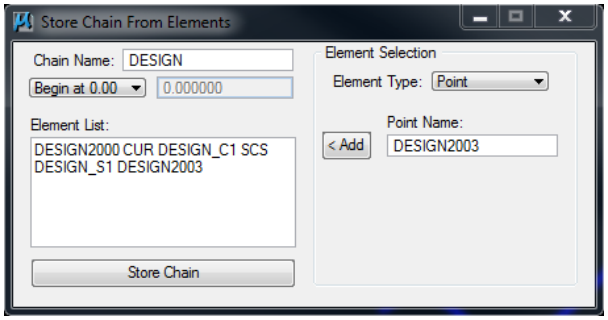
In the Coordinate Geometry window, the information confirming the storing of the spiral curve spiral combination will appear.




```
<*       7   Store SCS DESIGN_S1 PB DESIGN2000 PI DESIGN2001 LS1 100 LS2 100 Radius 1000 PA DESIGN2002

SCS DESIGN_S1
PISCS  DESIGN_S1  N         554,167.13  E       1,261,842.01  STA       8+34.18
Total Tangent  =              834.18
Total Length   =            1,429.64
Total Delta    =      76° 10' 57.20" (RT)
Back Tangent   = N  45° 35' 25.00" E
Ahead Tangent  = S  58° 13' 37.80" E
Spiral Back
Spiral DESIGN_S1B         Type 1    Spiral Element

Angle       2° 51' 53.24" (RT) P              0.42   BK N  45° 35' 25.00" E
LS               100.00        K             50.00   AH N  48° 27' 18.24" E
R              1,000.00        LT            66.68   CB N  46° 32' 42.67" E
YS                 1.67        ST            33.34   Defl        0° 57' 17.67"
XS                99.98        LC            99.99   Deg         5° 43' 46.48"


                        Spiral Coordinates
                       *------------------*
Point           North                East                Station
-----    -------------------    -------------------    -------------------
TS               553,583.38          1,261,246.11                0+00.00
PI               553,630.04          1,261,293.74                0+66.68
SC               553,652.15          1,261,318.70                1+00.00
CC               552,903.72          1,261,981.90
Circular Section
                                  Curve Data
                                 *----------*
Curve DESIGN_S1
P.I.  Station             7+06.11  N          554,120.45  E        1,261,847.18
Delta       =      70° 27' 10.72" (RT)
Degree      =       5° 43' 46.48"
Tangent     =              706.11
Length      =            1,229.64
Radius      =            1,000.00
External    =              224.17
Long Chord  =            1,153.62
Mid. Ord.   =              183.12
P.C.  Station             0+00.00  N          553,652.15  E        1,261,318.70
P.T.  Station            12+29.64  N          553,779.11  E        1,262,465.31
C.C.                               N          552,903.72  E        1,261,981.90
Back        = N  48° 27' 18.24" E
Ahead       = S  61° 05' 31.04" E
Chord Bear  = N  83° 40' 53.60" E
Spiral Ahead
Spiral DESIGN_S1A         Type 2    Spiral Element


                        Spiral Coordinates
                       *------------------*
Point           North                East                Station
-----    -------------------    -------------------    -------------------
CS               553,779.11          1,262,465.31                0+00.00
PI               553,763.00          1,262,494.50                0+33.34
ST               553,727.89          1,262,551.18                1+00.00
CC               552,903.72          1,261,981.90
SCS DESIGN_S1 stored
```

8.1.6 Store Chain from Cogo Elements

The Store Chains Tool allows you to create chains from elements that have been previously stored in the GPK.



Note:

When storing Spiral-Curve-Spiral Curves be sure to enter them as SCS "Curve Name". This is the only way to get the PISCS to show in Alignment output file.

DO NOT use the ADD button to store spiral curves.

Step 1:

From the **Cogo Tools** pull down

- Select **Element>Chain>Store>From Elements**

Step 2:

- Enter the **Chain Name**

Step 3:

- Set the **Beginning Station** value.

Step 4:

- Set the element type option to correspond with the first element to be stored in the chain
- Select **ADD**
- Repeat this step for each element to be stored in the chain.

Note:

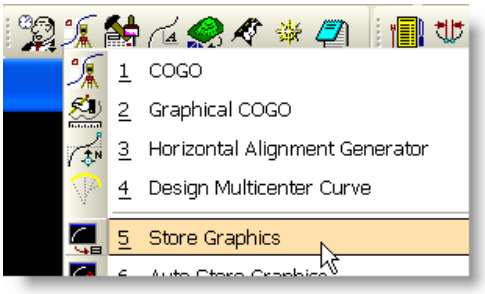
Points will not be displayed and are required to be input manually.

Step 5:

- Select **Store Chain**

In the Coordinate Geometry window, the information confirming the storing of the chain will appear.

8.1.7 Store Chain from Graphics

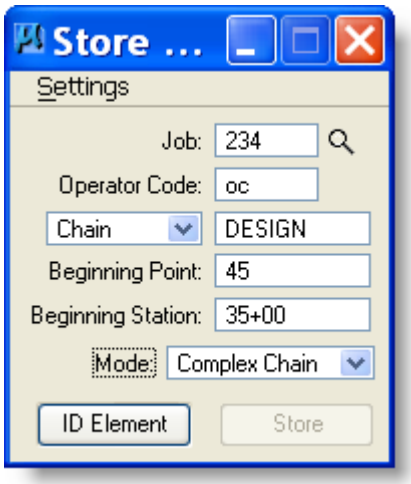


STEP 1:

Open the **(2D) RDMAP(Default)** Model

From the Geopak **Road Tools**

- Select **Store Graphics**



STEP 2:

Enter the Following

- Select Job
- Enter Operator Code
- Set Method to Chain
- Enter Chain Name
- Enter Beg Point Name
- Enter Beg Station
- Set Mode To Complex Chain

STEP 3:

- Select the **ID Element** button
- Select the first element in the chain to be stored. Continue to accept the pieces of the alignment until the whole chain is highlighted and the **STORE** button is highlighted in dialog box.

STEP 4:

- Click **STORE** to store the alignment in the .GPK file.

Note:

This will give you a message telling you the chain was stored in the .GPK file and the commands were saved in an .inp file. Keep this .inp file so that you can recreate the .GPK file if it becomes corrupt or lost.

8.2 Layout Existing Staked Alignment (Best Fit Method)

For existing alignments establish a best fit alignment following the surveyed PTW feature using any Asbuilt curve data following steps below,

STEP 1:

Open the **RDMAP(Default) (2D)** Model

From the **Attribute Templates**

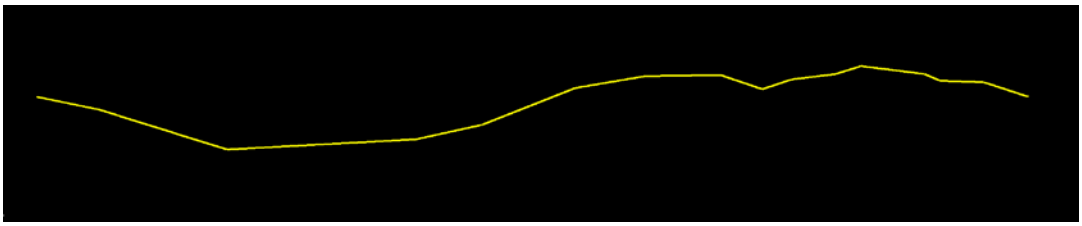
- Select **Roadway\Alignments\Alignment Layout**.
  This will set the active symbology for alignment layouts.

STEP 2:

- Using basic Microstation lines place a line using the surveyed PTW points as reference points and establish the ahead tangent bearing from the beginning of the alignment to the approx PT of the first curve or POT

STEP 3:

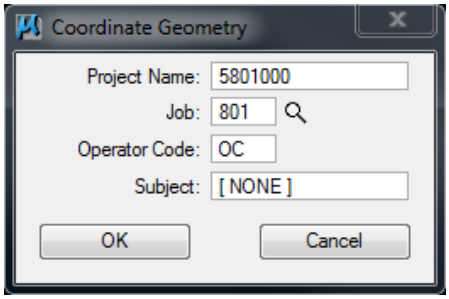
- Next place a line using the surveyed PTW points as reference points and establish the ahead tangent bearing from the back POT or the PT of the first curve to the PC of the second curve or next POT. Intersect the elements to determine the PI location. Repeat the steps for each additional PI or POT along the chain being stored



STEP 4:

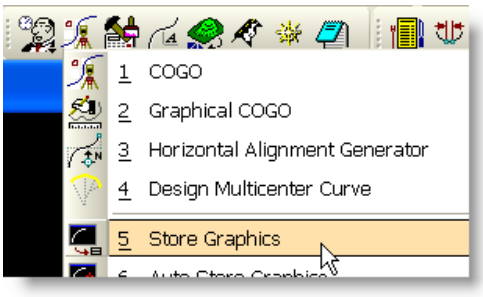
From the **Geopak Road Tools** Frame

- Select **Cogo**



Enter the information for the project.

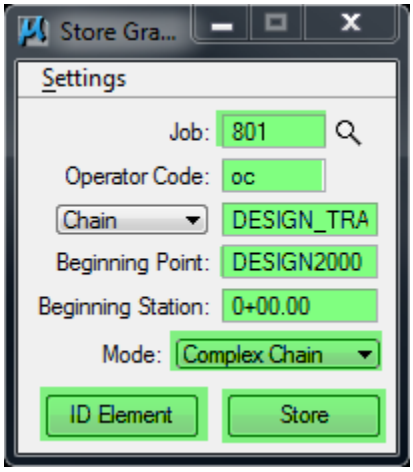
- For Project Name use the Project UPN
- For Job Number Use the First 3 or last 3 values of the Project control Number
- For the Operator code use OC
- For The subject use RECON, OVERLAY, REHAB etc.



STEP 5:

From the **Geopak Road Tools** Frame

- Select **Store Graphics**



STEP 6:

Enter the Following

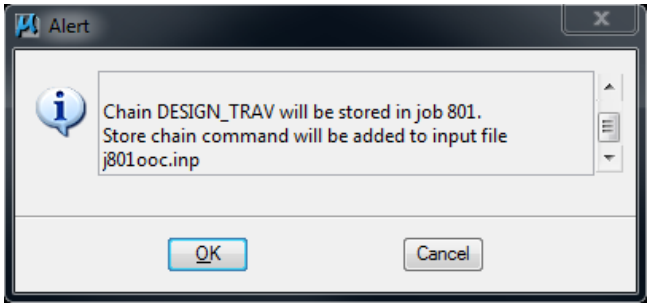
- Job
- Operator Code
- Method = Chain
- Chain Name
- Beg Point Name
- Beg Station
- Mode =Complex Chain

STEP 7:

- Select the **ID Element** button
- Select the first element in the chain to be stored. Continue to accept the elements until the whole chain is highlighted and the **STORE** button is highlighted in dialog box.

STEP 8:

- Click **STORE** to store the Chain in the .GPK file.

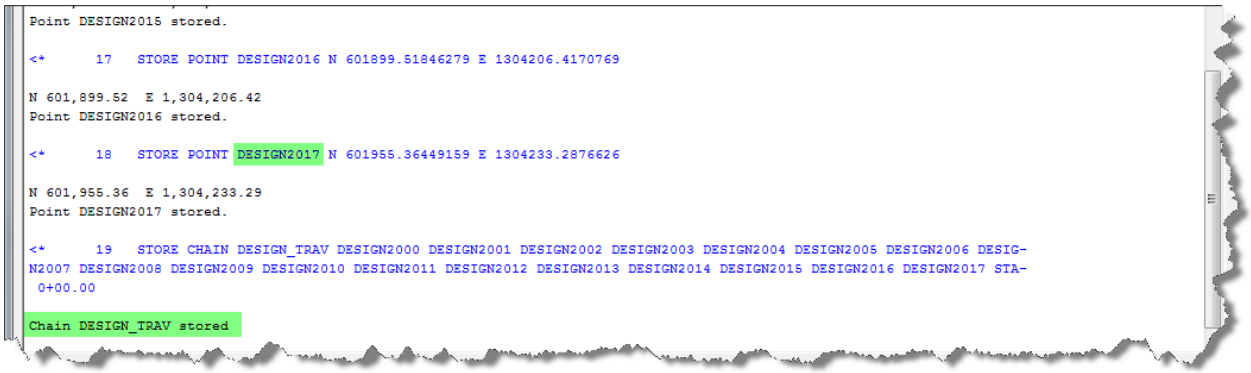


STEP 9:

To store the Chain in the **GPK** file.

- Click **OK**

In the Coordinate Geometry window, the information confirming the storing of the chain will appear. Take note of the number of points that were stored with the chain.



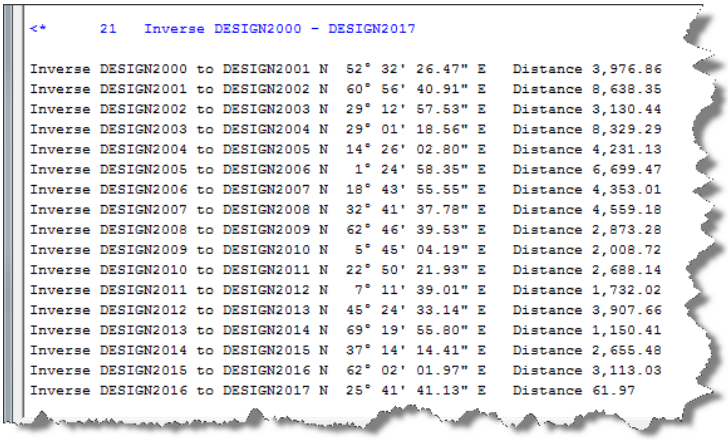
STEP 10:

From the Geopak **Cogo** pull down

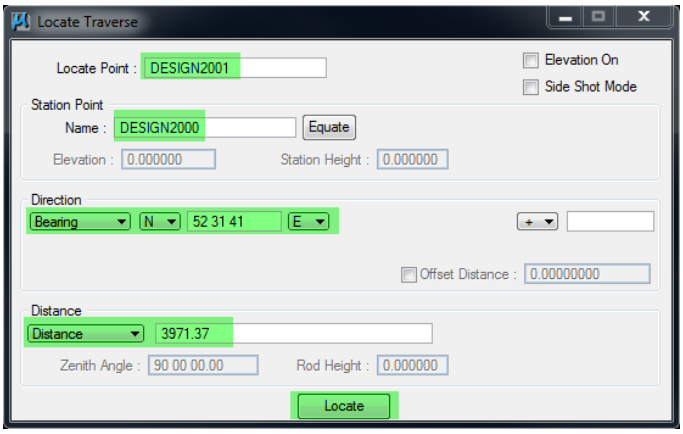
- Select **Tools>Inverse**

Type in the range of points

- Select **Inverse**



In the Coordinate Geometry window, the information showing the distance and bearing between all the points will appear.



STEP 11:

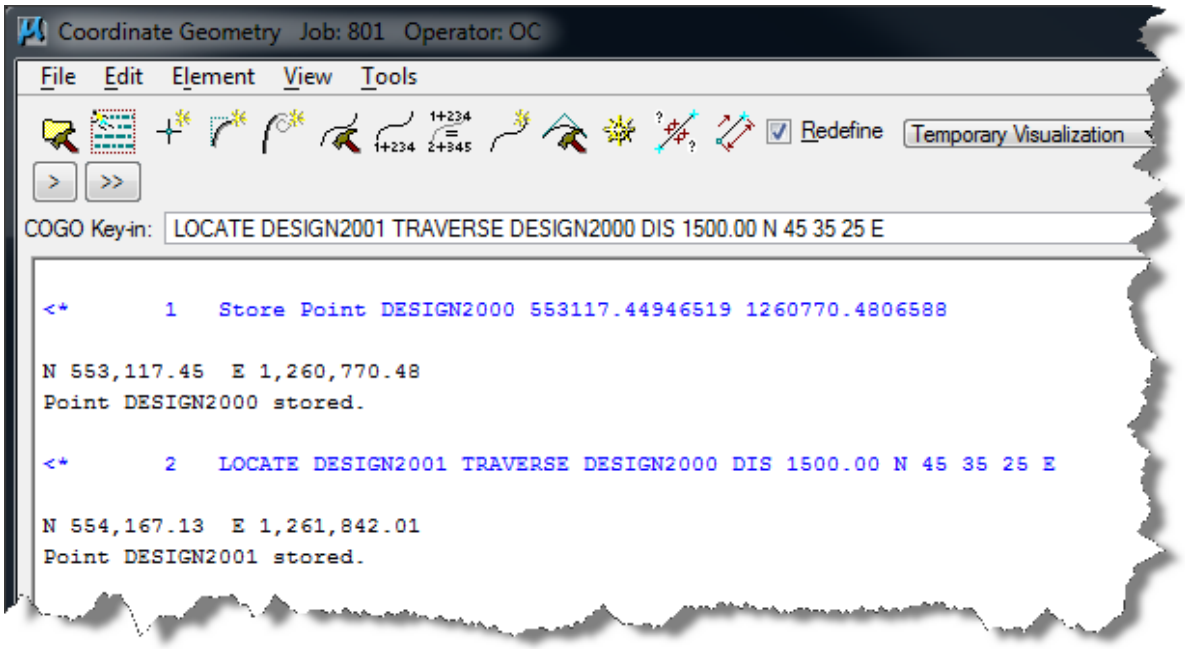
From the **Cogo Tools** pull down

- Select **Tools>Locate>Traverse**
- Set the Direction option to **Bearing**
- Set the Distance option to **Distance**

Enter the following

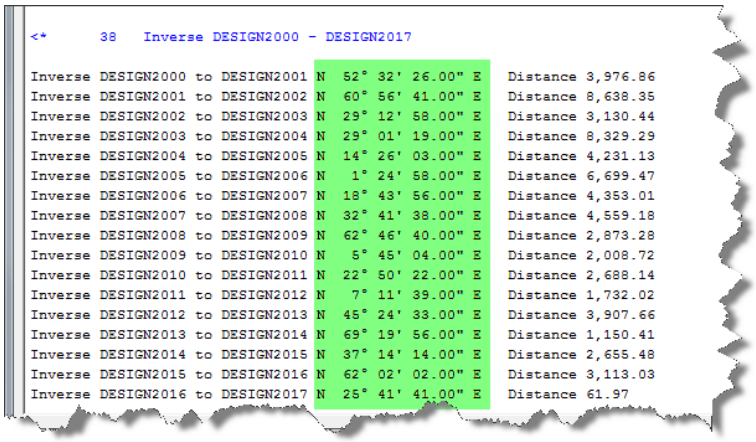
- Locate Point
- Start Point
- Direction (round to the nearest second 0^00'00")
- Distance (Round to the nearest .01)
- Select **Locate**

In the Coordinate Geometry window, the information confirming the storing of the point will appear.

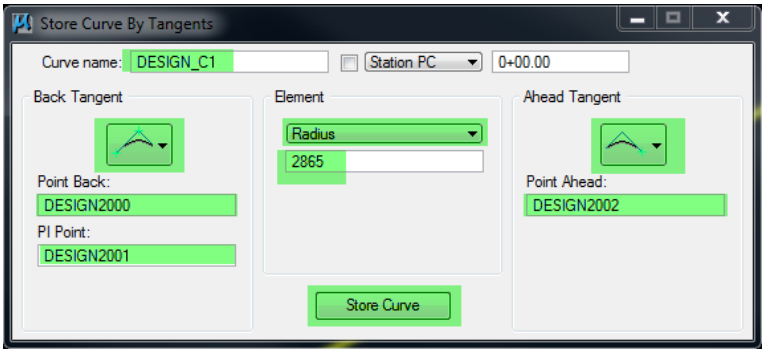


Step 12:

- Repeat **Step 11** for all points along the chain.



```
<*      38   Inverse DESIGN2000 - DESIGN2017

Inverse DESIGN2000 to DESIGN2001 N  52° 32' 26.00" E   Distance 3,976.86
Inverse DESIGN2001 to DESIGN2002 N  60° 56' 41.00" E   Distance 8,638.35
Inverse DESIGN2002 to DESIGN2003 N  29° 12' 58.00" E   Distance 3,130.44
Inverse DESIGN2003 to DESIGN2004 N  29° 01' 19.00" E   Distance 8,329.29
Inverse DESIGN2004 to DESIGN2005 N  14° 26' 03.00" E   Distance 4,231.13
Inverse DESIGN2005 to DESIGN2006 N   1° 24' 58.00" E   Distance 6,699.47
Inverse DESIGN2006 to DESIGN2007 N  18° 43' 56.00" E   Distance 4,353.01
Inverse DESIGN2007 to DESIGN2008 N  32° 41' 38.00" E   Distance 4,559.18
Inverse DESIGN2008 to DESIGN2009 N  62° 46' 40.00" E   Distance 2,873.28
Inverse DESIGN2009 to DESIGN2010 N   5° 45' 04.00" E   Distance 2,008.72
Inverse DESIGN2010 to DESIGN2011 N  22° 50' 22.00" E   Distance 2,688.14
Inverse DESIGN2011 to DESIGN2012 N   7° 11' 39.00" E   Distance 1,732.02
Inverse DESIGN2012 to DESIGN2013 N  45° 24' 33.00" E   Distance 3,907.66
Inverse DESIGN2013 to DESIGN2014 N  69° 19' 56.00" E   Distance 1,150.41
Inverse DESIGN2014 to DESIGN2015 N  37° 14' 14.00" E   Distance 2,655.48
Inverse DESIGN2015 to DESIGN2016 N  62° 02' 02.00" E   Distance 3,113.03
Inverse DESIGN2016 to DESIGN2017 N  25° 41' 41.00" E   Distance 61.97
```



Step 13:

From the **Geopak Cogo** pull down

- Select **Tools>Inverse**
- Enter the range of points
- Select **Inverse**

In the Coordinate Geometry window, the information showing the distance and bearing between all the points will appear. Confirm that the bearing have been rounded for all points.

Step 14:

From the **Cogo Tools** pull down

- Select **Element>Curve>Store>By Tangents**
- Set the Back Tangent option to **Point Back / PI Point**
- Set the Element option to **Radius**
- Set the Ahead Tangent option to **Point Ahead**

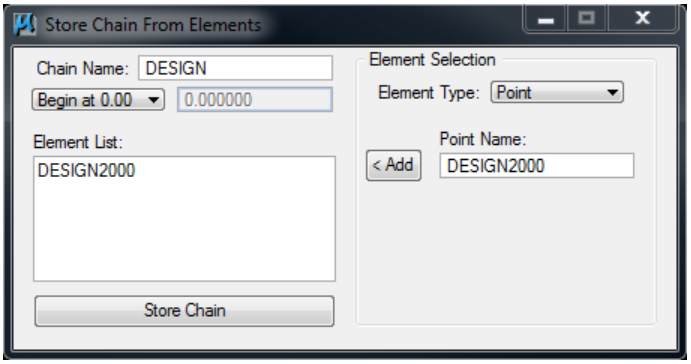
Enter The following:

- Curve Name
- Point Back
- PI Point
- Radius
- Point Ahead

- Select **Store Curve**

Step 17:

- Repeat **Step 14** for all curves along the alignment.



Step 18:

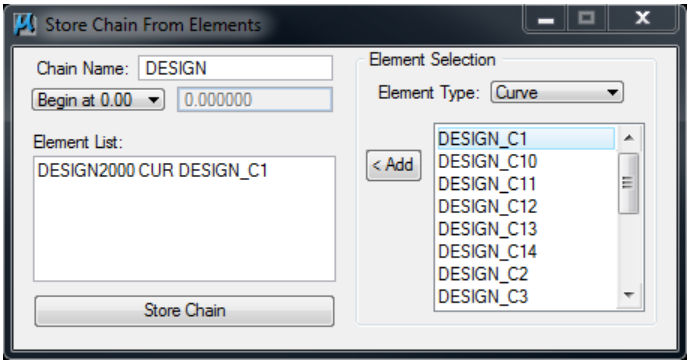
From the **Geopak Cogo** pull down

- Select

Element>Chain>Store>From Elements

Enter The following:

- Chain Name
- Begin Station



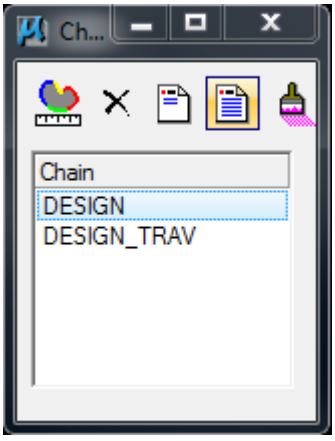
Step 19:

- Set the Element Type to point and type in the first point along the chain
- Select **ADD**
- Set the Element Type to the next element in the chain
- Select **ADD**

Do this for all elements that are to be stored in the chain.

Step 20:

- Select **Store Chain**

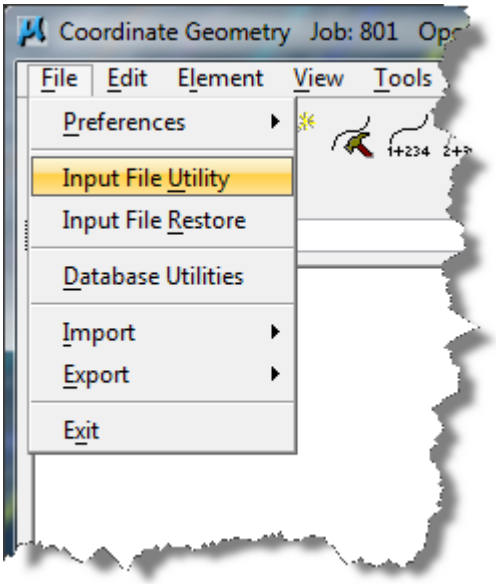


Step 21:

From the **Geopak Cogo** pull down

- Select **Element>Chain>Utility**
- Select the **Chain**
- Select **Describe Chain**

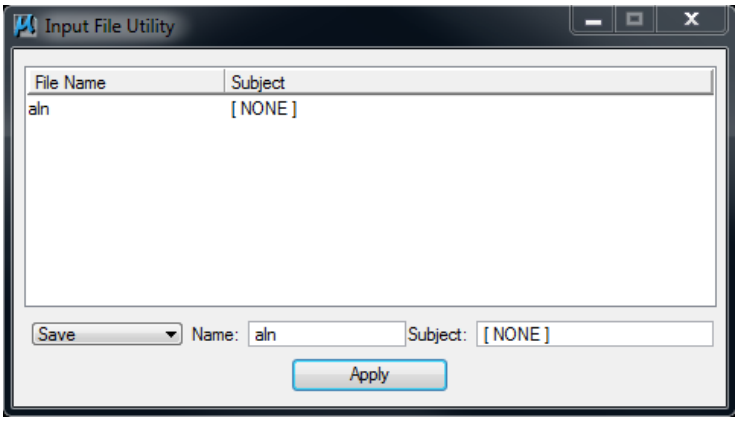
In the Coordinate Geometry window, the information showing all the alignment information for the chain will appear.



Step 22:

From the **Geopak Cogo** pull down

- Select **File>Input File Utility**



- Set the option to **Save**
- Input a file name, limit to 3 char.
- Select **Apply**

The Cogo input file should now be stored in the C:\DGN folder and you can now exit out of Geopak Coordinate Geometry.

8.3 Draw Horizontal Alignment - Design and Computation Manager

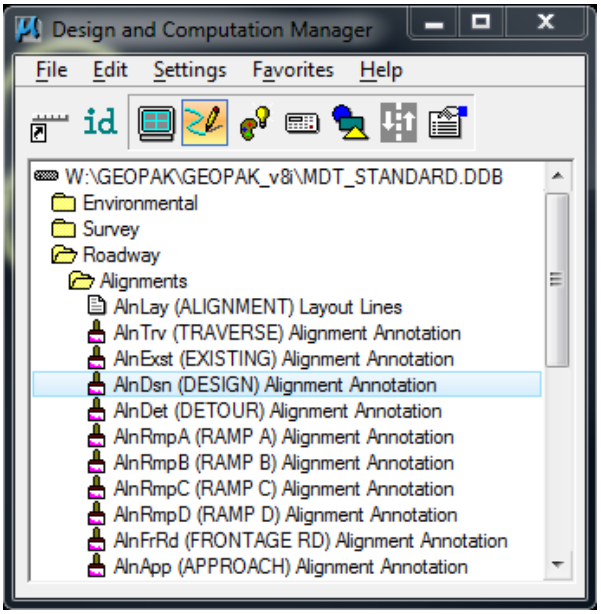
The D&C manager is used to Draw Alignment features into design files.

Step 1:

Open the **(2D) RDMAP(Default)** Model

From the **Geopak Road Tools** frame

- Select the **D&C Manager** Tool



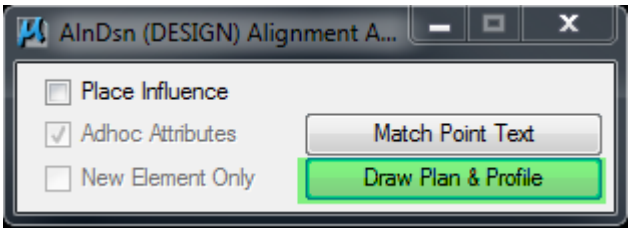
Step 2:

To draw the alignment in the design file.

- Select **Roadway>Alignments>AlnDsn**

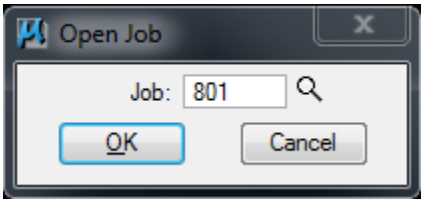
Step 3:

- Select the **Design** Tool



Step 4:

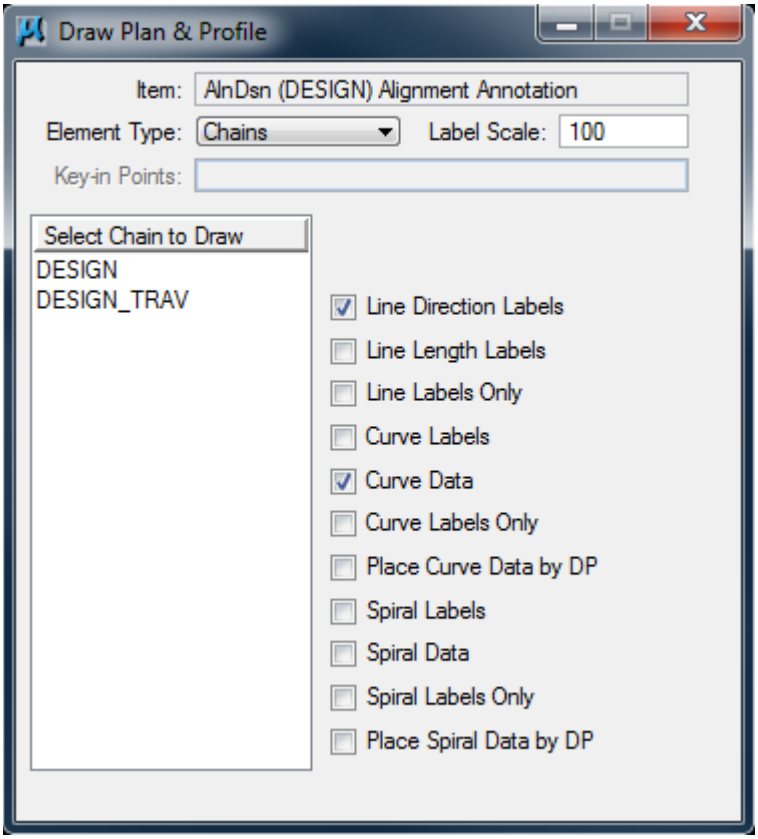
- Select **Draw Plan & Profile**



Step 5:

- Select the **Job(GPK)** File

Step 6:



- Set the **Label Scale** to 100

  This will scale the alignment information to fit the scale of the drawing.

  - Rural = 100
  - Urban = 50
  - Detail = 20
  - Detail = 10

Step 7:

- Set the Element Type to **Chains**
- Select the **Chain** in the list.

Step 8:

- Set the Element Type to **Stationing**
- Select the **Chain** in the list.

The alignment should now be annotated in the design file.

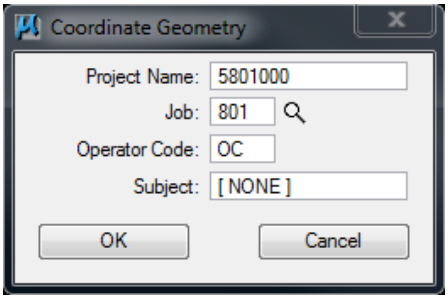
8.4 Export Alignment Information

Exporting Alignment information is a Coordinate Geometry function and should be done for all Centerline alignments.

STEP 1:

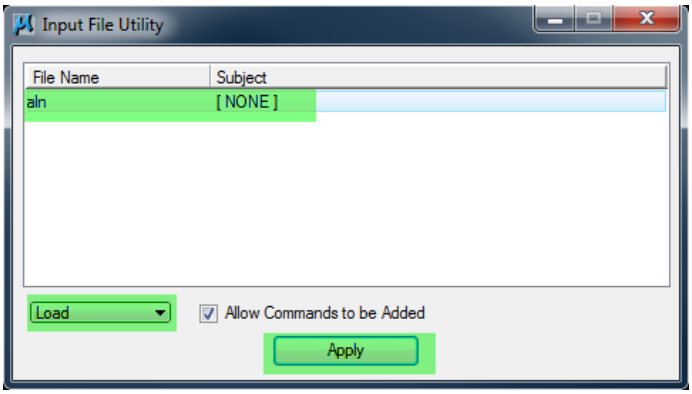
From the **Geopak Road Tools**

- Select **Cogo**



Enter the information for the project.

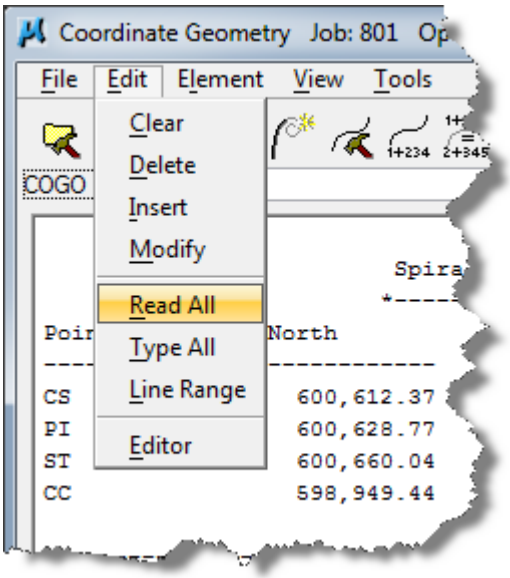
- For Project Name use the Project UPN
- For Job Number Use the First 3 or last 3 values of the Project control Number
- For the Operator code use OC
- For The subject use RECON, OVERLAY, REHAB etc.
- Select **OK**



Step 2:

From the **Geopak Cogo** pull down

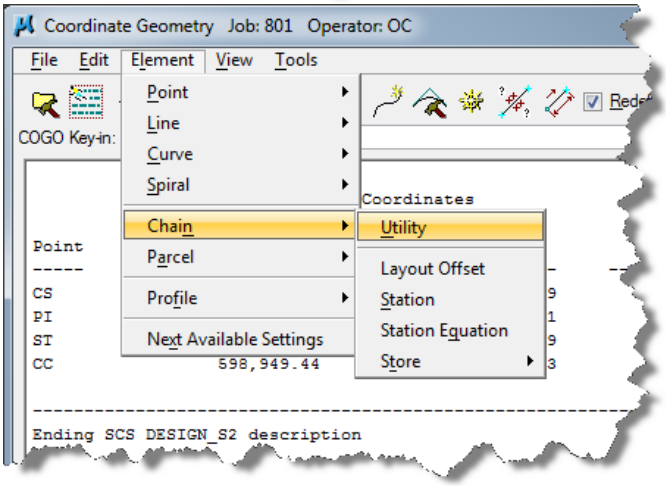
- Select **File>Input File Utility**
- Set the option to **Load**
- Select the input file to load
- Select **Apply**



Step 3:

From the **Cogo** pull down

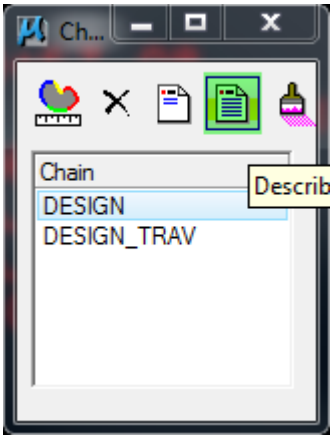
- Select **Edit>Read All**



Step 4:

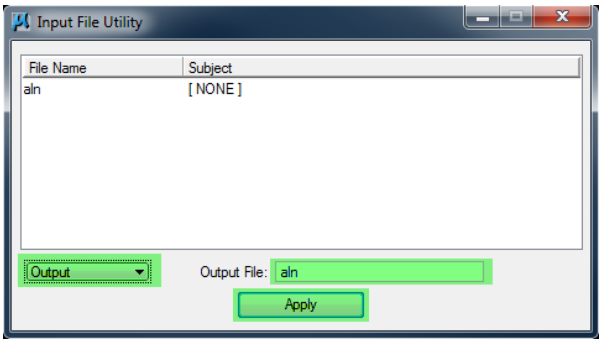
From the **Cogo** pull down

- Select **Element>Chain>Utility**



Step 5:

- Select the **Chain**
- Select **Describe Chain**



Step 6:

From the **Geopak Cogo** pull down

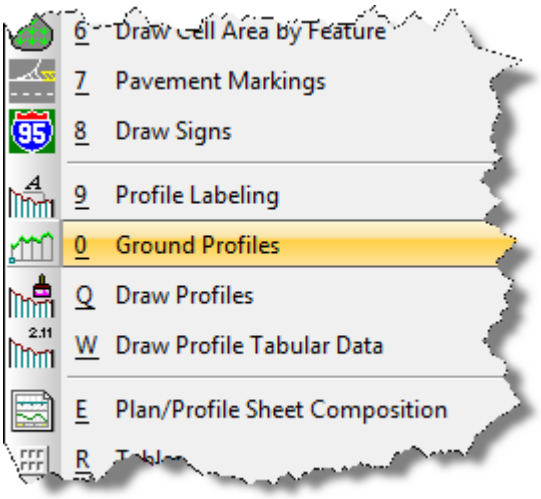
- Select **File>Input File Utility**
- Set the option to **Output**
- Input a file name, limit to 3 char.
- Select **Apply**

The Cogo output file should now be stored in the C:\DGN folder and you can now exit out of Geopak Coordinate Geometry.

9 *Existing Ground Profile*

The **Ground Profile** Tool is used to extract the Existing Ground Profile along the Chain.

9.1 Extract Existing Ground Profile



Step 1:

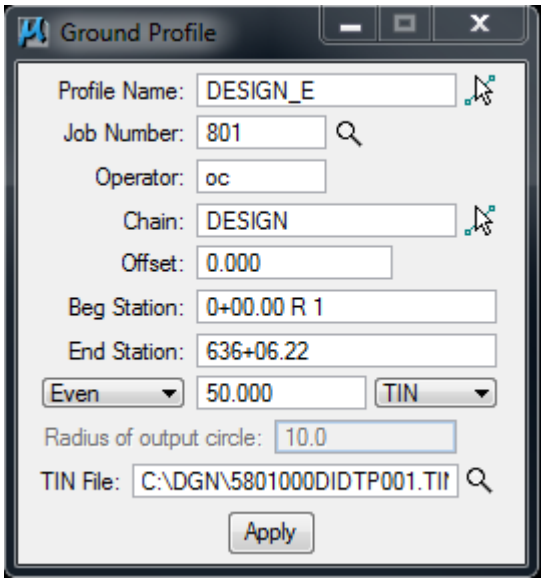
Open the **(3D) RDMAP(CMA) Model**

Set the Active level to **Level 1**

From the **Geopak Road Tools** Frame

- Select **Ground Profiles**

Step 2:

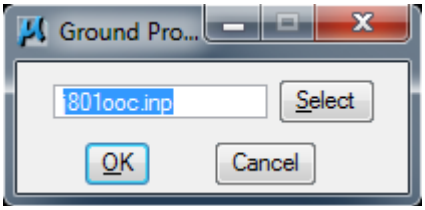


- For the Existing Profile name use the Chain name and append _E to the name

  STKD_E

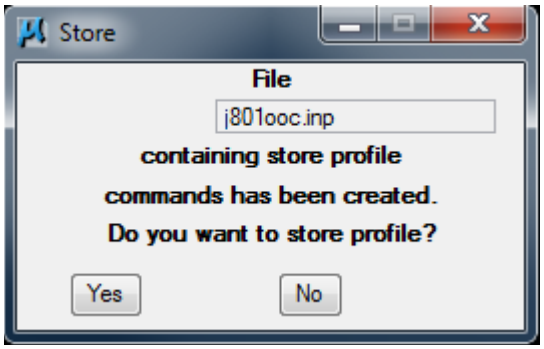
- Select Job
- Enter Operator Code = OC
- Select Chain
- Enter Offset = 0
- Check Station Range
- Set Strip Grade to Even = 50
- Select the TIN File

- Select **Apply**



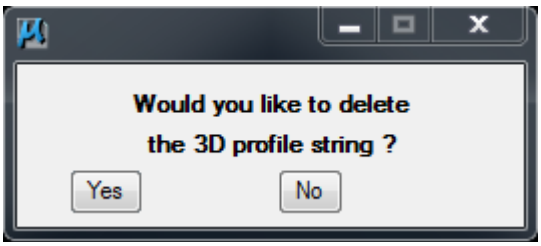
Step 3:

- Select **OK**



Step 4:

- Select **YES**



Step 5:

- Select **YES**

9.2 Draw Existing Ground Profile

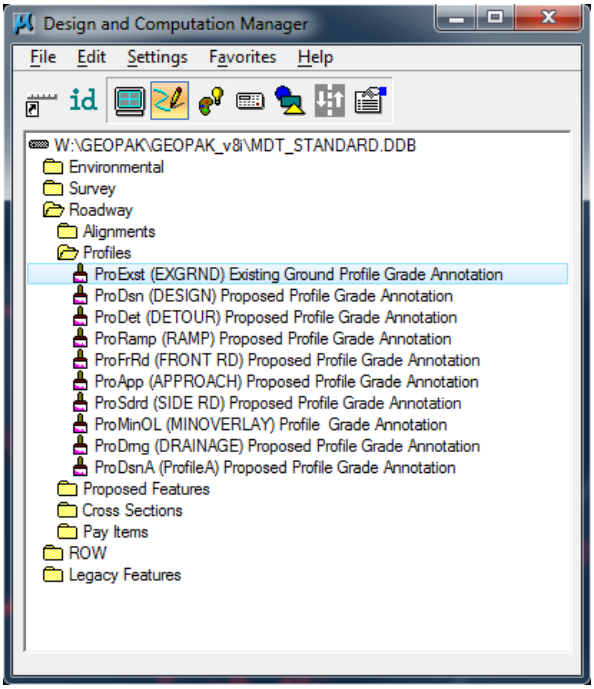
Step 1:

From the **Geopak Road Tools** frame

- Select **D&C Manager**

Criteria
W:\GEOPAK\MDTENGLISH.DDB

Roadway Designer
W:\GEOPAK\Geopak_v8i\MDT_Standard.DDB



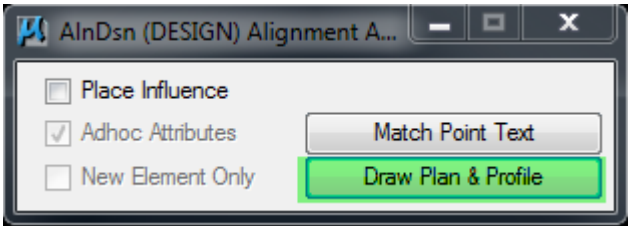
Step 2:

- Select the following feature to draw the Existing Ground profile in the design file.

  Roadway>Profiles>ProExst

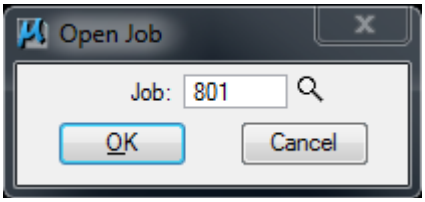
Step 3:

- Select the **Design** Tool



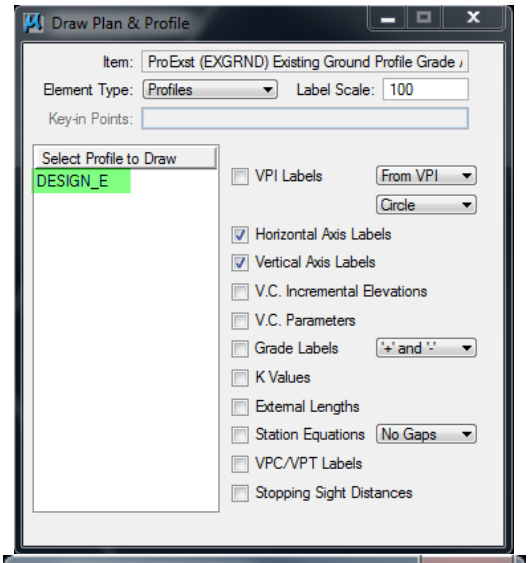
Step 4:

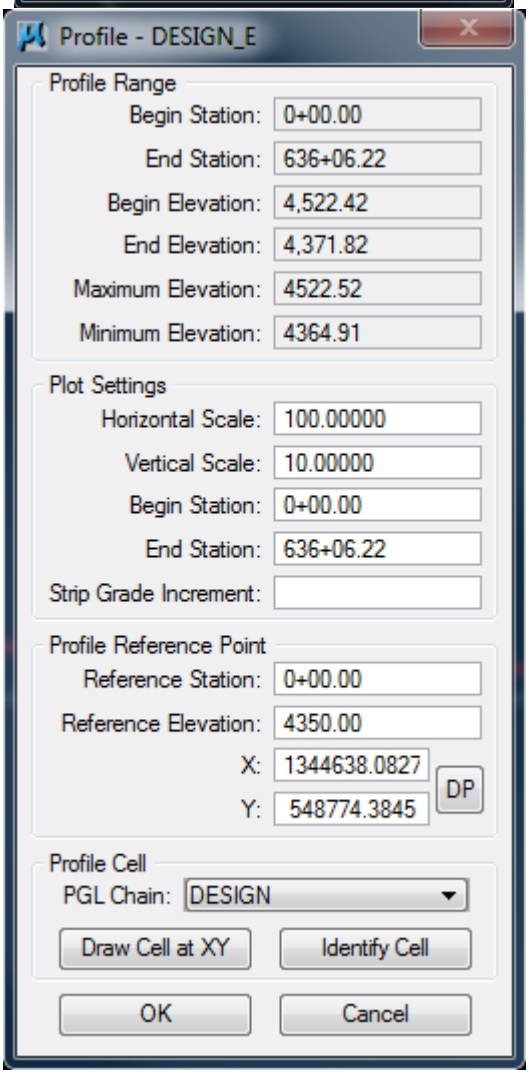
- Select **Draw Plan & Profile** Button



Step 5:

- Select the **Job** number





Step 6:

- Select the **Profile** from the list

The top of this dialog will show the information about the selected profile.

Step 7:

Plot Settings

- Set **Horiz Scale = 100**
- Set **Vert scale = 10**
- Set **Begin Sta** to Beg the Beg. Sta. of the Profile
- Set **Ending Sta** to End Sta. of the Profile
- Leave **Strip Grade** Blank

Profile Reference Point

- Set **Reference Station** to Beg. Prof Sta
- Set **Reference Elev** lower than Min Elevation Use a rounded elev. in increments of 10
- Set **DP** for Profile Reference Point

Profile Cell

- Select the **PGL Chain**
- Select **Draw Cell at XY**

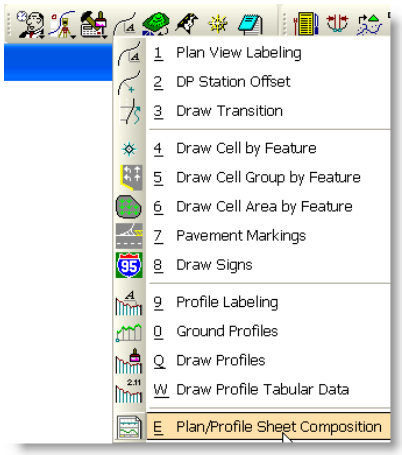
- Select **OK**

The Existing Ground profile should now be drawn in the design file.

10 Plan & Profile Sheet Composition

The **Plan & Profile Sheet Composition** tool is used for creating sheet files for plan sets.

10.1 Layout Plan & Profile Sheets

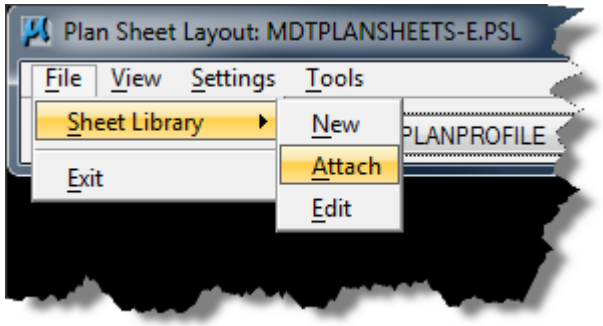


Step 1:

Open the **(2D) RDMAP** File

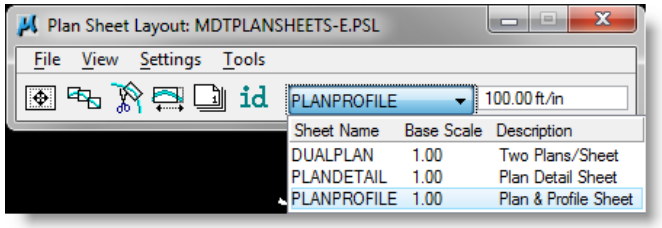
From the **Geopak Road Tools** frame

- Select **PlanProfile Sheet Composition** Tool



Step 2:

- Select **File>Sheet Library>Attach** attach MDTPLANSHEETS-E.PSL. (*w:\geopak\mdtplansheets-e.psl*) if not already attached.



Step 3:

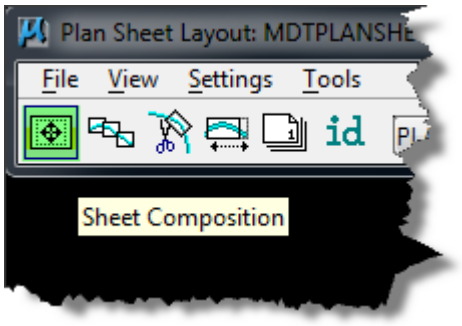
- Select the **Sheet Option** for the desired sheet configuration.

Step 4:

- Enter the **Scale** for your Sheets.

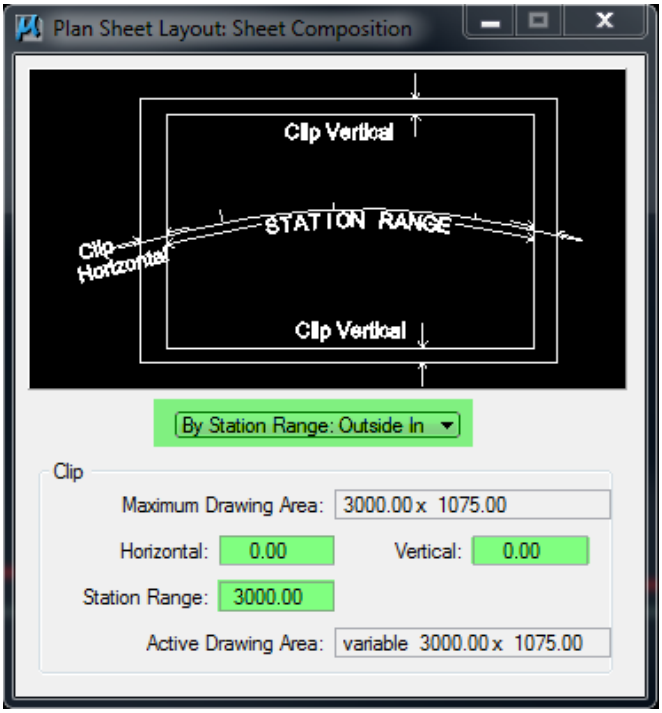
Scales for Half Size Plans

- 100 for 1in = 100ft.
- 50 for 1in = 50ft.
- 20 for 1in = 20ft.
- 10 for 1in = 10ft.



Step 5:

- Select **Sheet Composition**



Step 6:

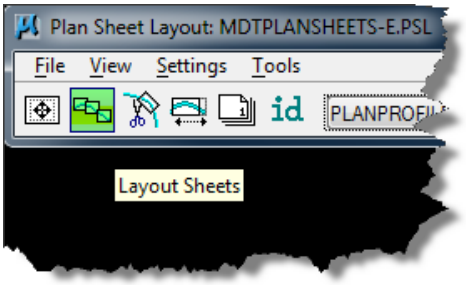
- Set "By Station Range: Outside In"
- Set Horizontal to 0
- Set Vertical to 0

Station Range should read

- 3000 for 100ft./in.
- 1500 for 50ft./in.
- 150 for 20ft./in.
- 30 for 10ft./in.

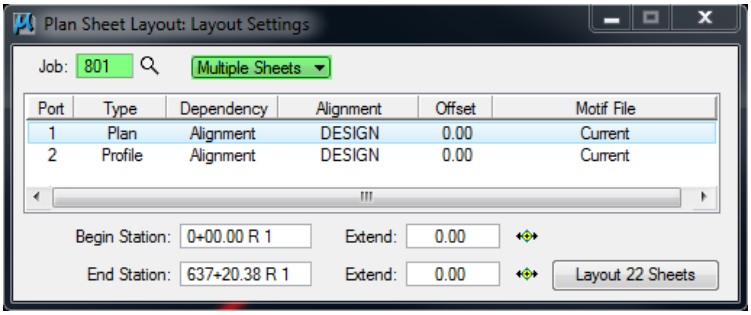
Step 7:

- Close the dialog



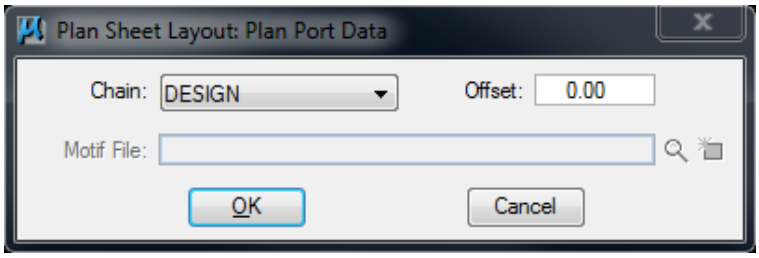
Step 8:

- Select **Layout Sheets**



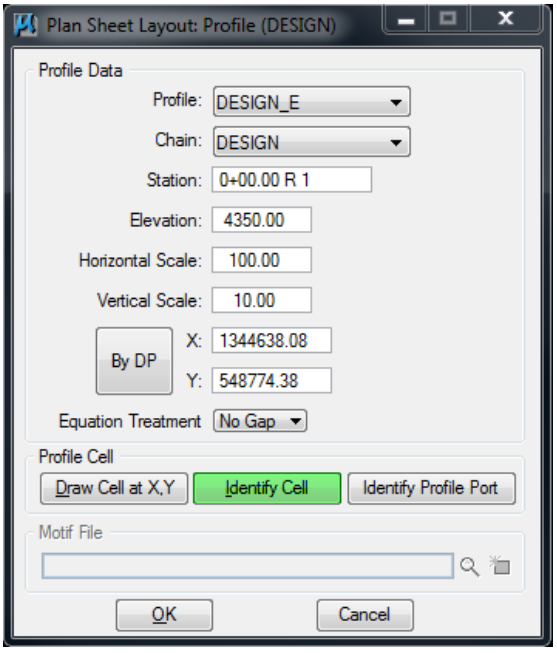
Step 9:

- Select **Job**
- Select **Multiple Sheets**



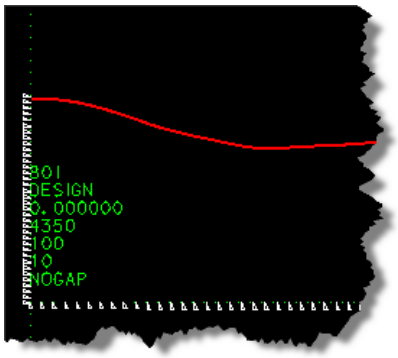
Step 10:

- Double click the **Plan Port** and assign the **Chain** to the plan port Dependency

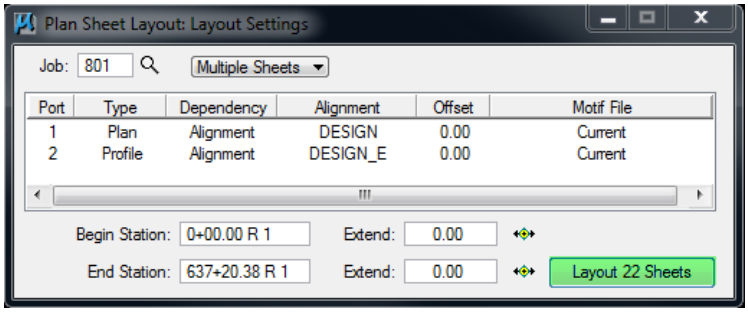


Step 11:

- Double click the **Profile Port.** Assign the profile location by selecting the **Identify Cell** button and identify the profile cell in the DGN file shown below left.



- Select **OK**



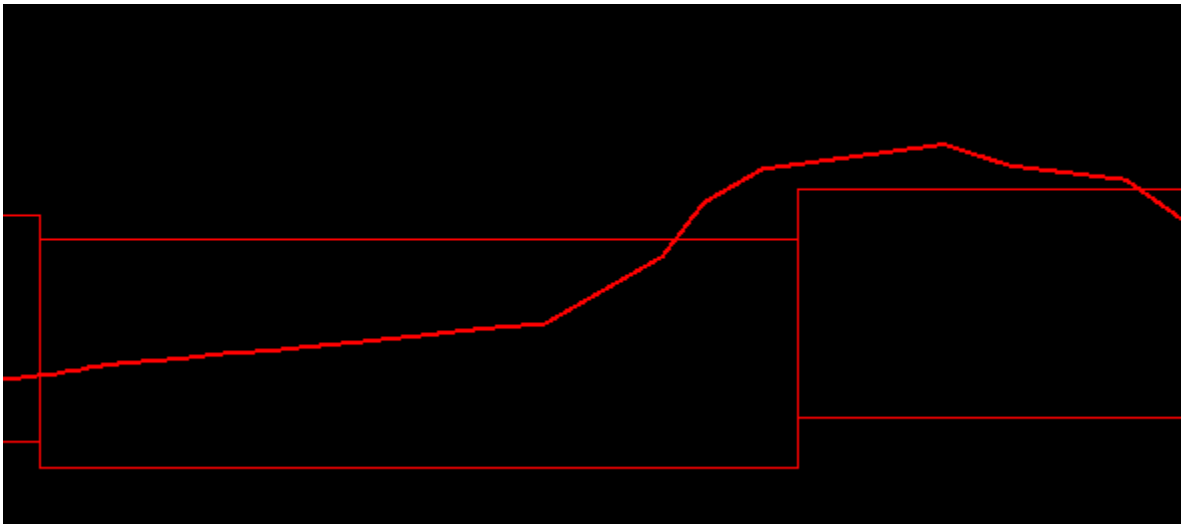
Step 12:

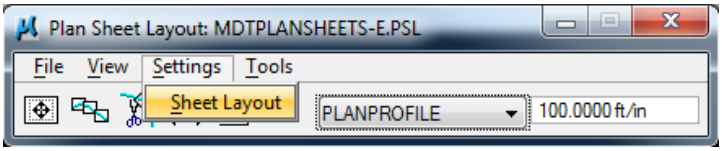
- Select **Layout ** Sheets**

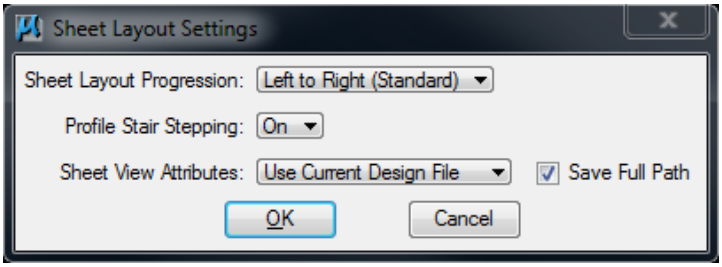
The Sheet clips should now be drawn in the design file on the plan and profile.

10.2 Profile Stair Stepping

Check the profile sheets to be sure that the profile falls within the boundary of the sheets. If the profile does not fall within the boundaries of the sheets, delete the sheets and follow the steps below**.**







Step 1:

From the **Plan Sheet Layout Tools**

- Select **Settings>Sheet Layout**
- Set **Profile Stair Stepping** to **ON**

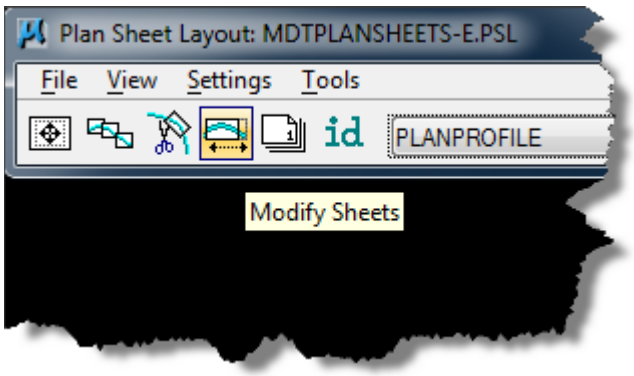
Step 2:

- Select **Layout ** Sheets**

10.3 Modifying Plan & Profile Sheet Clips

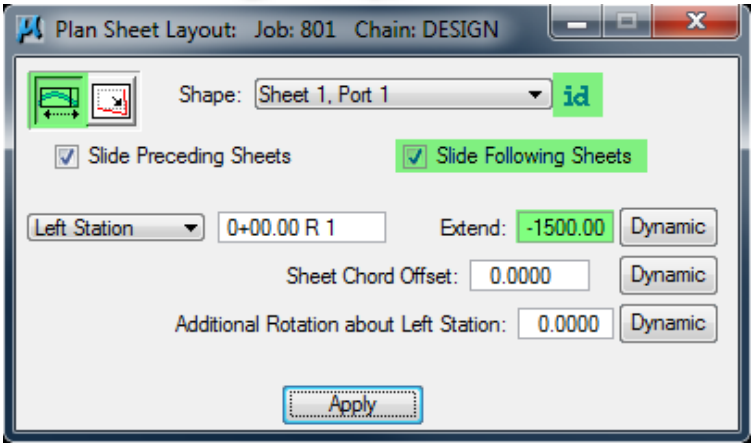
The **Modify Sheet Clips** Tool is used for adjusting the placement of the sheets in relation to the Chain stationing. This tool is used for adjusting the sheet clips to provide additional space on the first sheet for the Beginning Project Note.

Note:
This tool requires Sheet Clips to already be drawn on the Chain & Profile



Step 1:

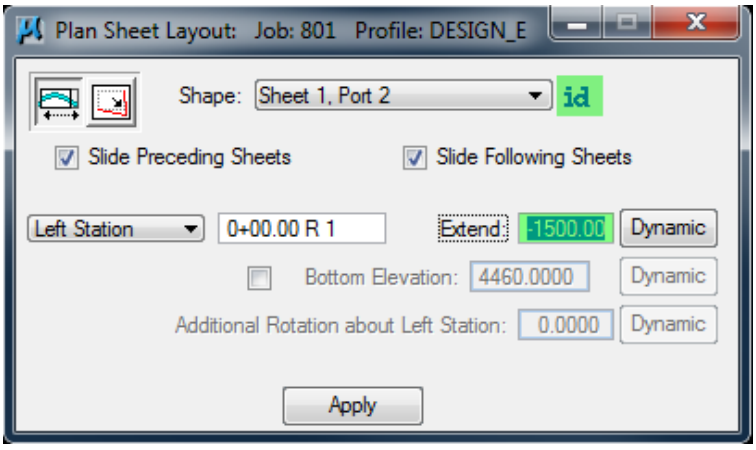
- Select **Modify Sheets**



Step 2:

- Select the **Slide Sheet** Option Top Left
- Select the **ID** button for the sheet shape and select the first sheet clip on the chain.
- Check the **Slide Following Sheets** Option
- Enter a negative value in the **Extend** option to adjust the Left Edge of the First plan sheet clip.

- Select **Apply**



Step 3:

- Select the **ID** button for the sheet shape and select the first sheet clip on the profile.
- Enter the same negative value used for the plan port in the Extend option to adjust the Left Edge of the first profile sheet clip.

- Select **Apply**

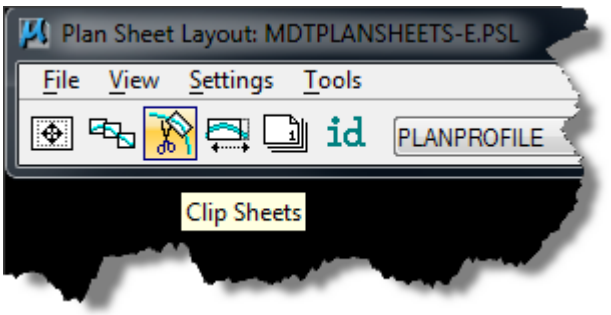
10.4 Clipping Plan & Profile Sheets

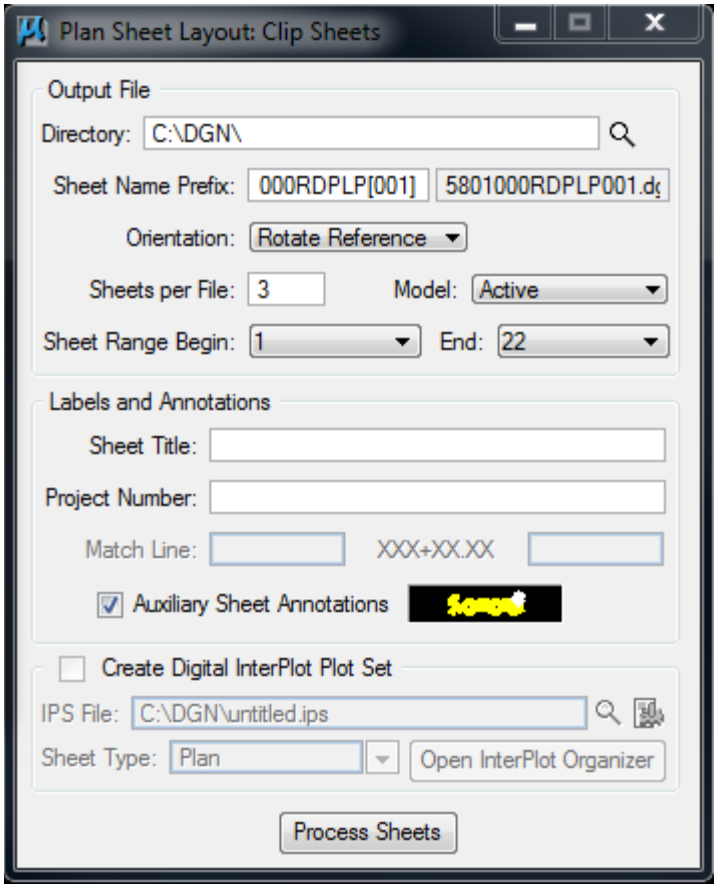
The **Clip Sheets** Tool is used for creating and clipping the sheet clips into the design files used for the plan sets.

Note:
Before clipping sheets

- Attach all additional reference files available UTMAP, PHMAP, ETC.
- Turn On & Off the desired levels that are to be displayed in the Plan Sheets.

  This will eliminate the repetitive task of Attaching additional reference files and turning levels on and off for each plan file that gets created.





Step 1:

- Select **Clip sheets**

Step 2:

- Set the Directory to **C:\DGN**
- Enter the **Sheet Name Prefix** following MDT's Naming standard for the type of sheet being created.

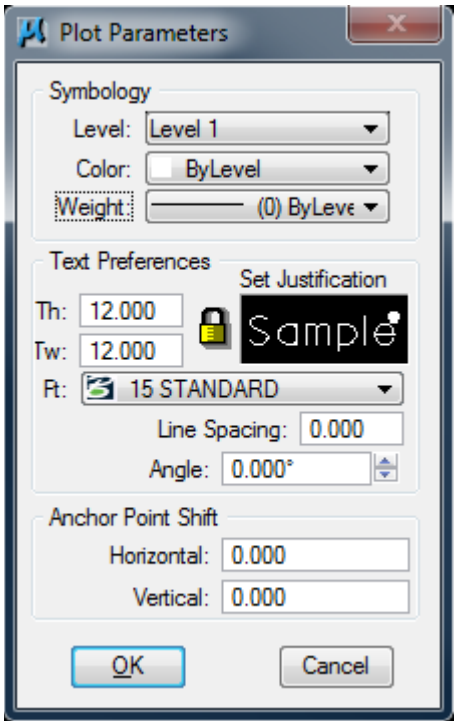
  Sheet File Options:
  #######RDPLP[001]
  #######RDPLN[001]
  #######RDDET[001]

  Note:
  Append [001] to the Sheet name, this will increment the file names when multiple files are created.

- Set the **Orientation** to Rotate Reference
- Set **Sheets per File** = 3
- Set **Model** to Active
- Set **Sheet Range Begin & End**

Step 3:

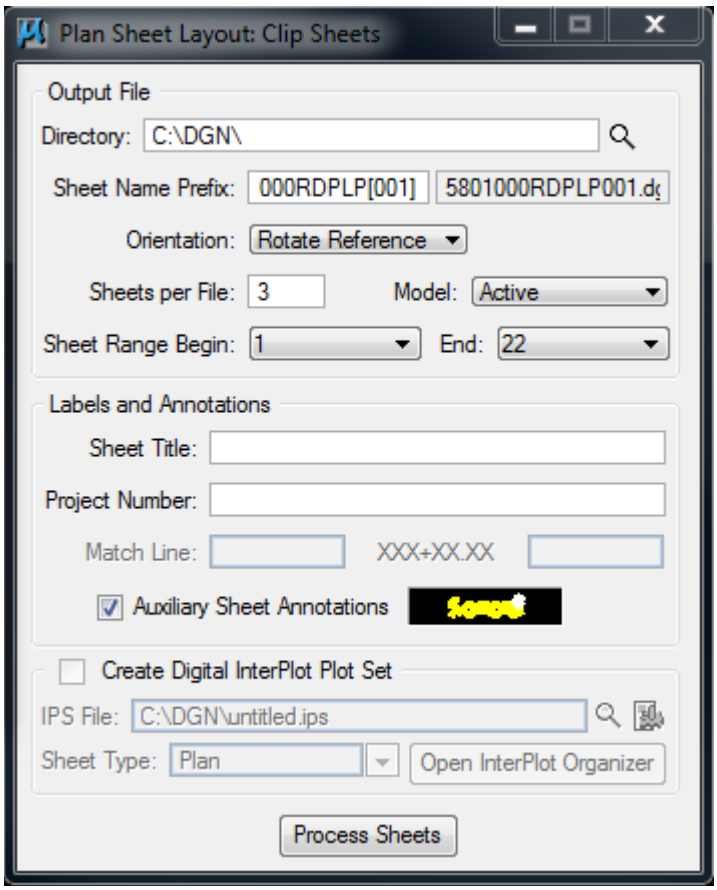
- Check **Auxiliary Sheet Annotations** and double click the Sample symbology preference box.



Step 4:

- Set **Level = Level 1**
- Set **Color = ByLevel**
- Set **Weight = ByLevel**
- Set **Th: = 12.0**
- Set **Tw: = 12.0**
- Set **Justification = Upper Right**
- Set **Ft = 15 STANDARD**
- Set **Line Spacing = 0**
- Set **Angle = 0**
- Set the **Anchor Point Shift** Values to **0**

- Select **OK**



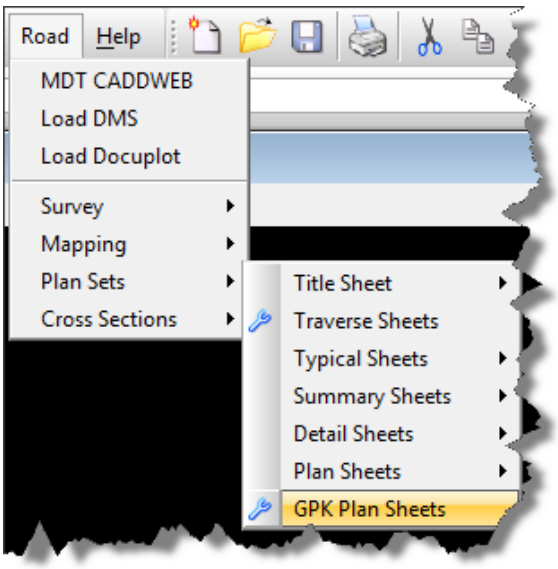
Step 5:

- Select **Process Sheets**

The Plan Sheets Should Now be created and located in the c:\DGN Folder

10.5 Attaching Plan & Profile Sheets to Geopak Clipped Sheet Files

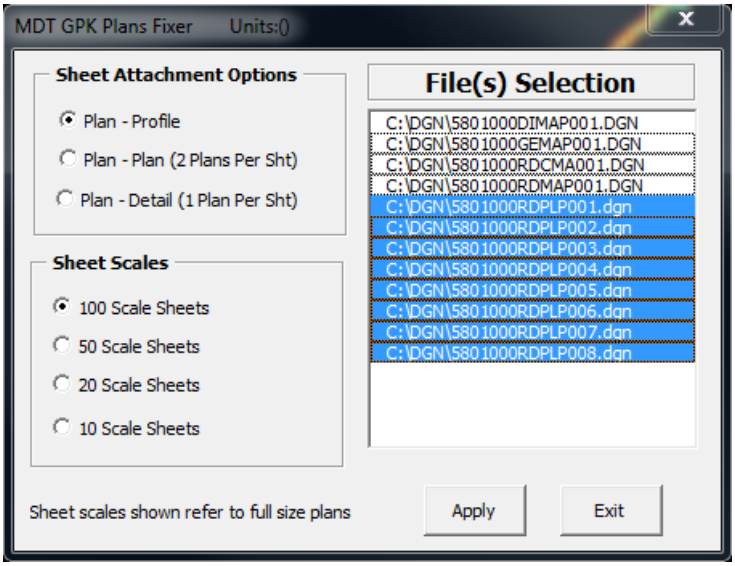
MDT uses a custom macro that will assist the user in attaching Sheet Borders to the plan files that were clipped by Geopak. This is due to the fact that Geopak does not have the capability to format the plan sheet files correctly to be used with Docuplot.



Step 1:

From the **Road** pull down

- Select **Road>Plan Sets>GPK Plan Sheets**



Step 2:

- Select **Sheet Attachment Option**
- Select **Sheet Scale**
- Select the File(s) to be processed

- Select **Apply**

11 Cross Sections

Cross Sections are required on most Road project. Cross sections are a graphical representation of the existing & Proposed surfaces that are used to perform detailed tasks such as Earthwork calculations, Plotting Limits of Construction, Culvert Design, Approach and Irrigation Ditch Design etc.

Users are required to create 2 files for Road projects requiring Cross Sections, one for performing design tasks the **(RDXSF)** Working XS File & one for plotting the **(RDLAY)** Cross Section Sheet Layout file**.**

Note:

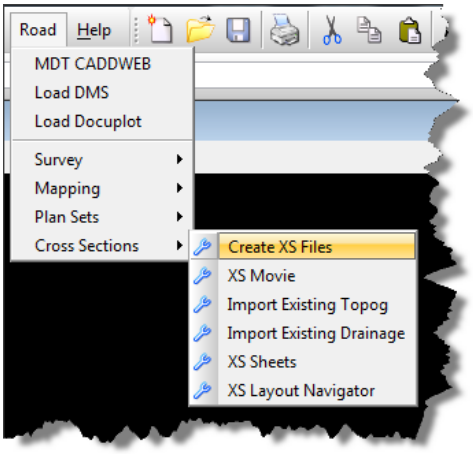
- MDT uses a custom macro that will assist the user in Creating these files
- These files will need to be uploaded to DMS
- The **(RDLAY)** File is used For Plotting the XS Plan Sets only and should never be used for drawing any design features.

Critical Cross Sections

When importing **XS** into a data collector, the following **XS** are required for all centerline alignments. These are critical points and must be stored for a seamless import to the Data collector.

- **Beg Transitions**
- **End Transitions**
- **Horizontal Control Points**
- **Vertical Control Points (Proposed Profiles Only)**
- **Super Elevation Transitions (Proposed Shapes Only)**
- **Horizontal Event Points (Proposed Surfaces Only)**
- **Vertical Event Points (Proposed Surfaces Only)**

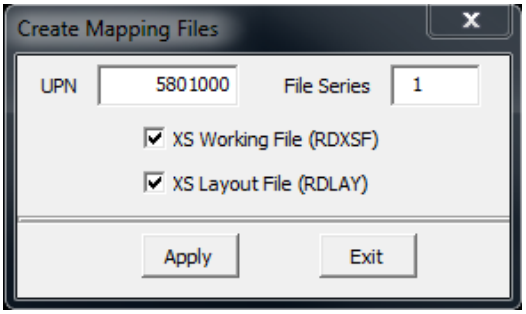
11.1 Creating XS Files



Step 1:

From the Microstation **Road** pull down

- Select **Road\Cross Sections\Create XS Files**



Step 2:

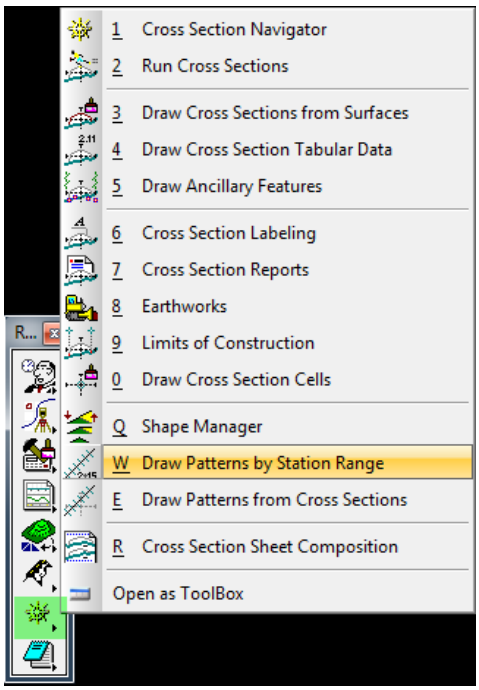
- Input **UPN**
- Input **File Series**
- Check **Sheet Options**

- Select **Apply**

The Cross Section files should now be created and located in the c:\dgn folder

11.2 Draw Pattern Lines By Station Range

Pattern lines are drawn into a 2D plan-view design file, one for each desired cross section. Although not required by GEOPAK, it is useful for the designer if they are drawn into a MicroStation design file containing the alignment to be used to generate the XS.

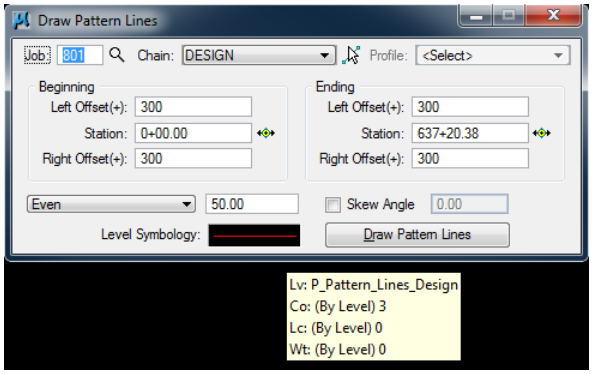


Step 1:

Open the **(2D) RDMAP** File

From the Geopak **Road Tools** Frame

- Select **Draw Pattern Lines by Station Range**

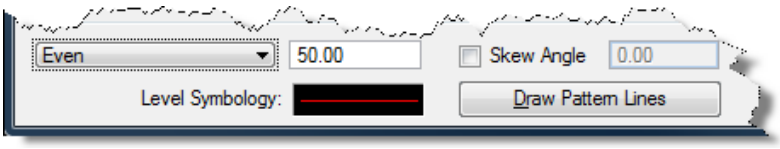


Step 2:

- Select **Job**
- Select **Chain**
- Enter the **Beginning Station**
  Set the **Offsets** to 300 Feet for both left and right.
- Enter the **Ending Station**
  Set the **Offsets** to 300 Feet for both left and right.

Note:

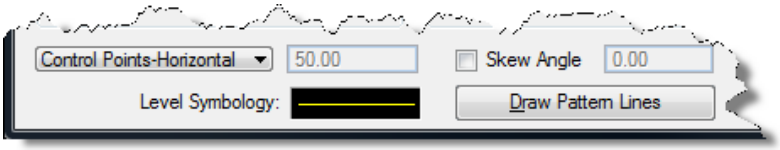
Clicking **DP** to the right of each station gives the designer the option to graphically select the station by placing a data point on the screen.



Step 3:

- Set the **Station Option** to Even
- Set the **Station Placement** value to
  Rural = **50** Feet
  Urban = **25** Feet

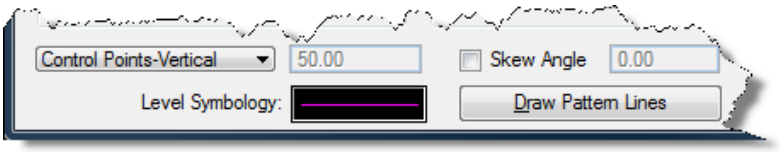
Select **Draw Pattern Lines**



Step 4:

- Set the **Station Option** to **Control Points Horizontal**
- Change Pattern Color to **CO=4**

Select **Draw Pattern Lines**

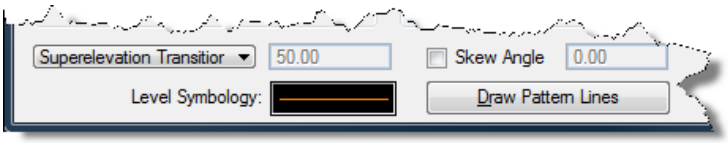


Step 5:

- Set the **Station Option** to **Control Points Vertical**
- Change Pattern Color to **CO=5**

Select **Draw Pattern Lines**

Used for Proposed Profiles Only

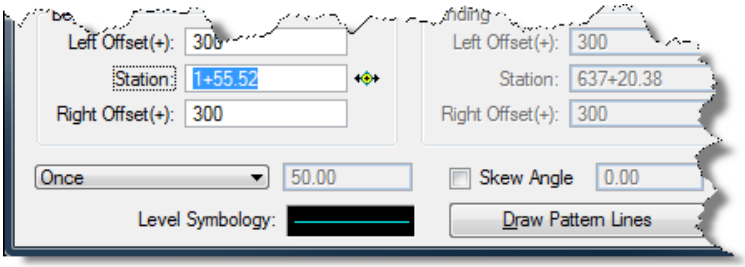


Step 6:

- Set the **Station Option** to **Super Elevation Transitions**
- Change Pattern Color to **CO=6**

Select **Draw Pattern Lines**

Used for Proposed Shapes Only



Step 7:

- Set the **Station Option** to **Once**
- Change Pattern Color to **CO=7**
- Enter the Station

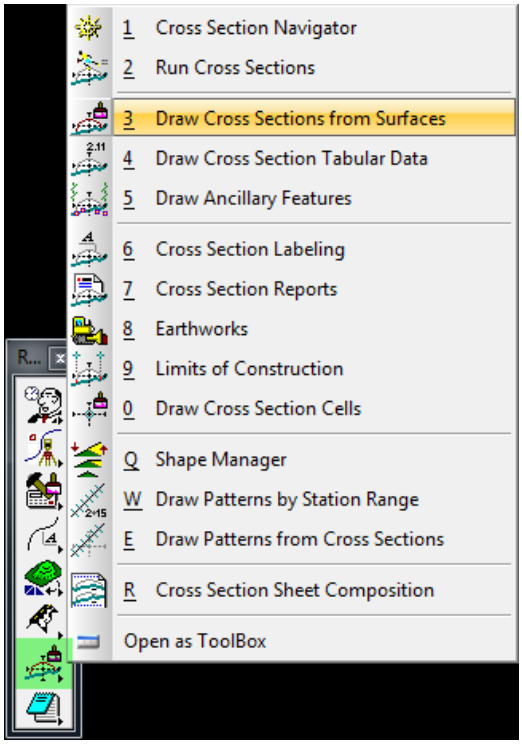
Select **Draw Pattern Line**

Note:

This option is used to cut Cross sections at specified stations for Culverts, Approaches, Curb Returns etc.

11.3 Draw Cross Sections From Surfaces

The Draw Cross Sections Using Surfaces tool draws existing ground lines or other surface lines (within a 2D MicroStation design file) utilizing a GEOPAK binary TIN file, DTM file, Site Object, or Site Model.

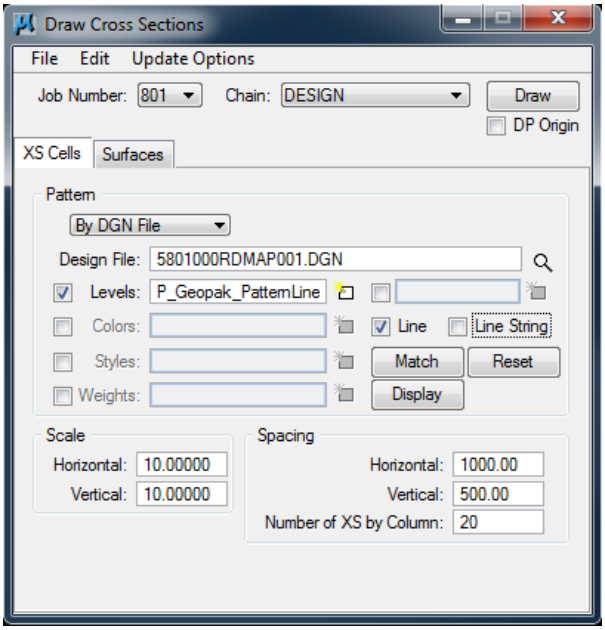


Step 1:

Open the **RDXSF** File

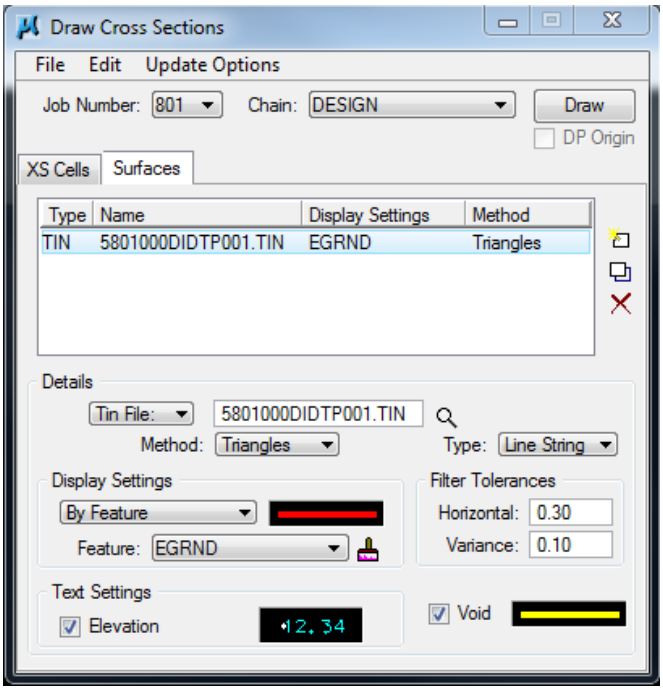
From the Geopak **Road Tools** Frame

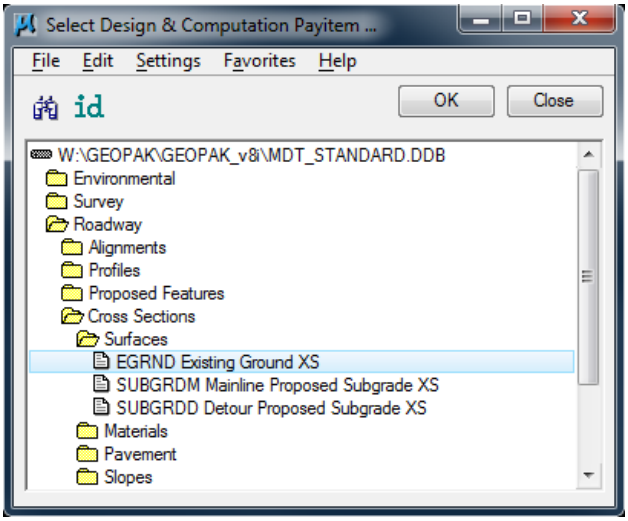
- Select **Draw Cross Sections from Surfaces**



Step 2:

- Select **Job Number**
- Select **Chain**
- Select **Pattern By DGN File**
- Select **Design File**
- Set **Pattern Level**
- Select **Line** Option
- Set **Horz Scale** = 10
- Set **Vert Scale** = 10
- Set **Horz Spacing** = 1000
- Set **Vert Spacing** = 500
- Set Number of XS by Column = 50





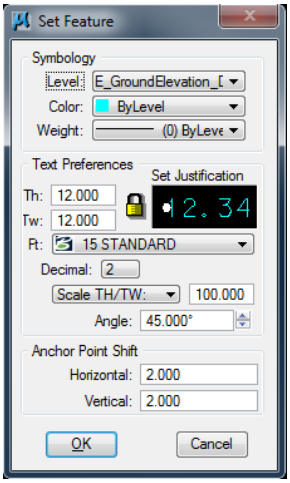


Figure 11.3.1

Step 3:

- Select the **Surfaces** Tab

- Set Details option to **TIN File**
- Select **TIN File**
- Set **Method** to **Triangles**
- Set **Type** to **Line String**
- Set **Filter Tolerances**
  Horz = 0.30
  Variance = 0.10

- Set Display Settings To **By Feature**
- Set Feature to **EGRND**
- Check **Void Option**

Note:

Right Click on **By Feature Symbology**
Select **Copy**

Right Click on **Void Symbology**
Select **Paste**

Double Click on **Void Symbology**
Change the color

- Check **Elevation** and **double click** the symbology window.

Note:

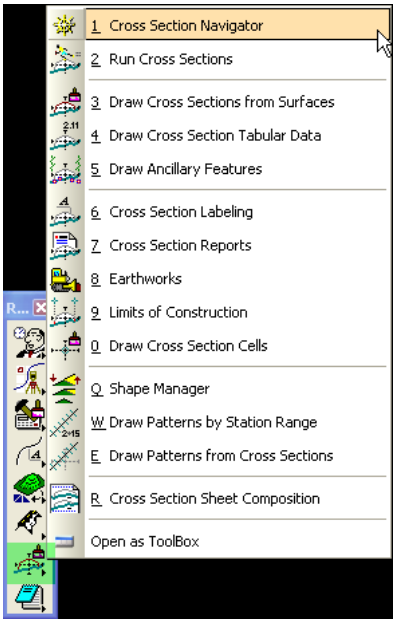
Set the Symbology preference as show in Figure 21.3.1

- Select **Add Surface**

- Select **Draw**

11.4 Cross Section Navigator

The Cross Section Navigator tool is a quick and simple method of scanning through cross sections or locating specific sections. In addition, tools are supported to draw cross section lines and set active angles.

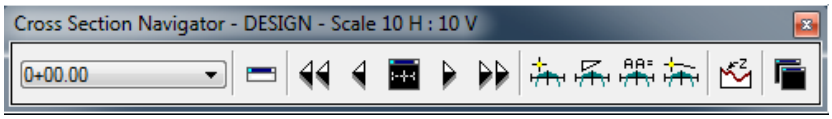


Step 1:

Open the **RDXSF** File

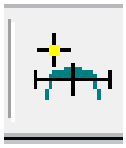
From the Geopak **Road Tools** Frame

- Select **Cross Section Navigator**

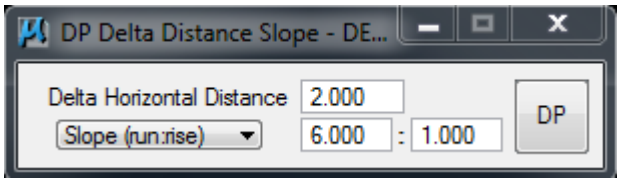


XS Navigator Tools

DP Offset Elevation



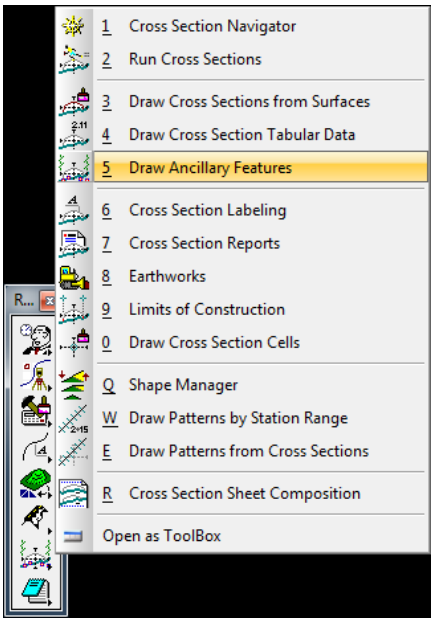
DP Delta Distance Slope



11.5 Draw Ancillary Features

11.5.1 Draw Linear Ancillary Features (GEOPAK)

The Geopak Draw Ancillary Features tool enables the user to draw linear features such as right of way, utilities, and other ancillary data onto cross sections or profiles. Ancillary features that cross the profile or pattern lines are drawn at the specified elevation on the Cross Sections or profile.



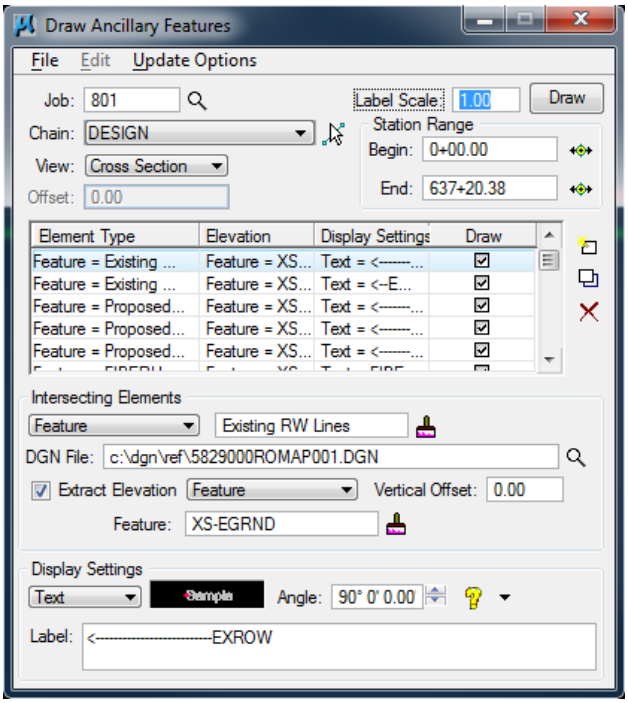
Step 1:

Open the **RDXSF** File

Copy the following file to the c:\DGN folder
W:\Geopak\Preferences\DTM_Existing.LPF

From the Geopak **Road Tools** Frame

- Select **Draw Ancillary Features**



Step 2:

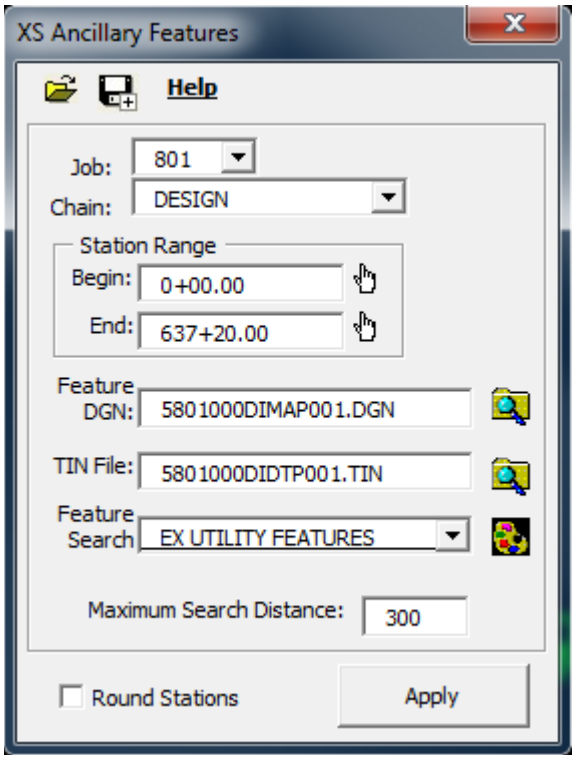
- Select **Job**
- Select **Chain**
- Set **View** = Cross Section
- Set Label Scale = 1.0
- Set **Station Range**

Step 3:

- Select **Element Type Feature**
- Set **Intersecting Elements** Settings
- Set **Display Settings**

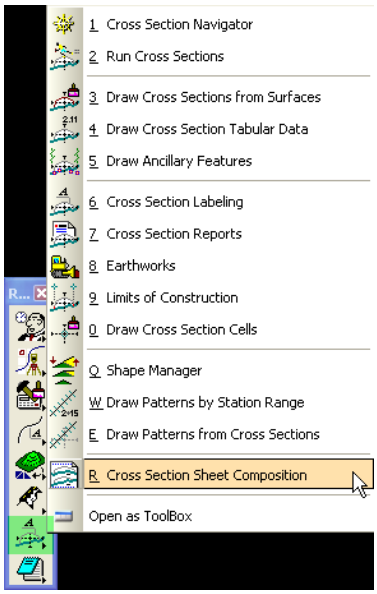
- Select **Draw**

11.5.3 Draw Cell Ancillary Features (MDT MACRO)



11.6 Cross Section Sheets

The GEOPAK sheet layout tool is an automated tool to draw cross section data in a format suitable for producing hard-copy cross section construction drawings. The input includes specifying sheet layout parameters as well as the graphic design file where the cross sections were originally created by GEOPAK. The output is a MicroStation design file which references the cross sections and contains labels such as station, offsets and elevation.



Step 1:

Open the **RDLAY** File

From the Geopak **Road Tools** Frame

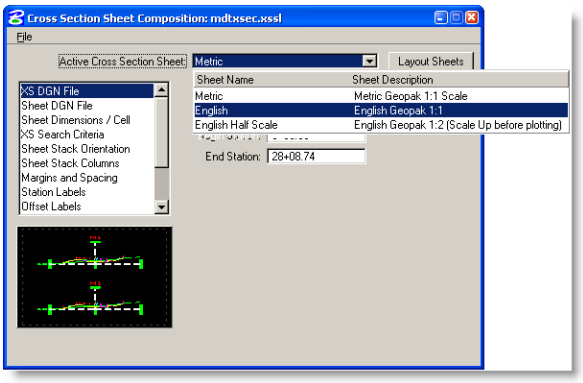
- Select **Cross Section Sheet Composition**

Note:
Copy the file from the following location to the

C:\DGN\ folder and rename it to the Project UPN.

W:\GEOPAK\MDTXSEC.XSSL

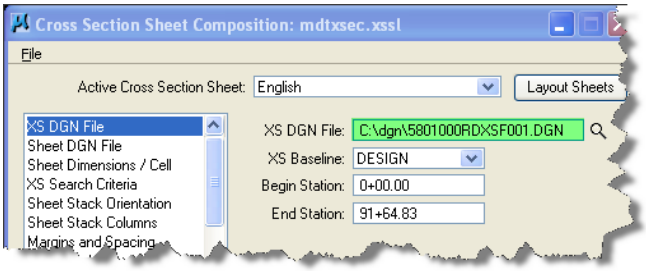
- Select **File>Sheet Library>Attach**
- Select **C:\DGN\5801000.XSSL**



Step 2:

Set the Active Cross Section Sheet Option to

- **English** for Rural 100 Scale
- **English Half Scale** for Urban 50 Scale

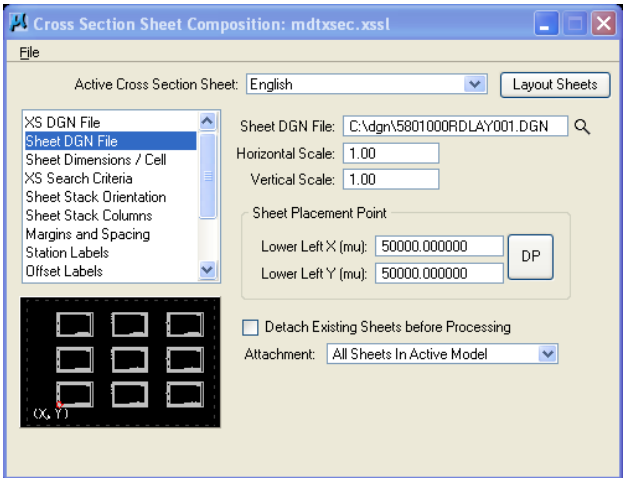


Step 3:

- Set the Working Cross Section File

Note:

The chain and Station range should be filled in based on the XS available in the XSF file.

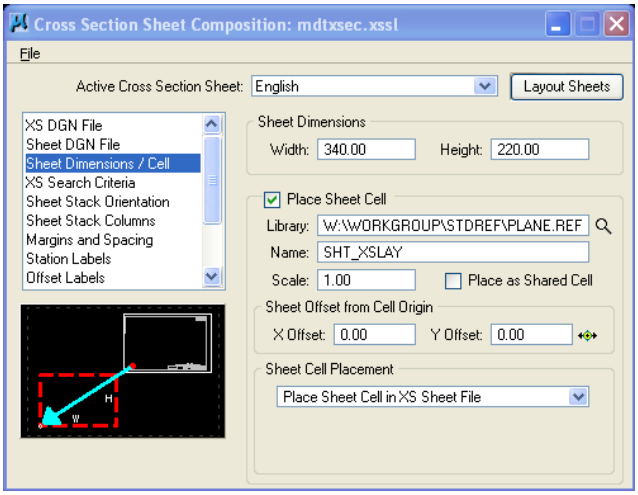


Step 4:

- Select the **Cross Section Layout** File

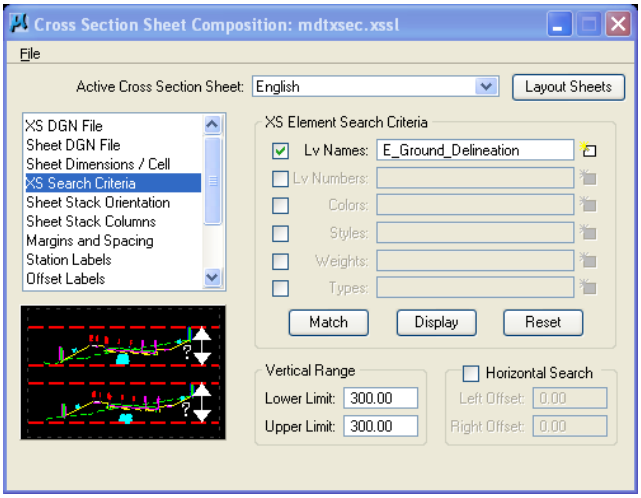
Note:

If this is the first time Laying out the XS sheets then make sure to check off the **Detach Existing Sheets before Processing.**



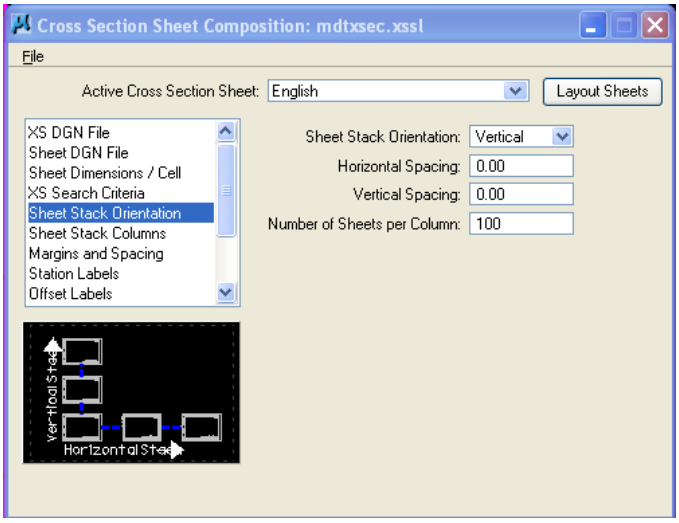
Step 5:

- Check the settings shown left and make sure they are set accordingly.



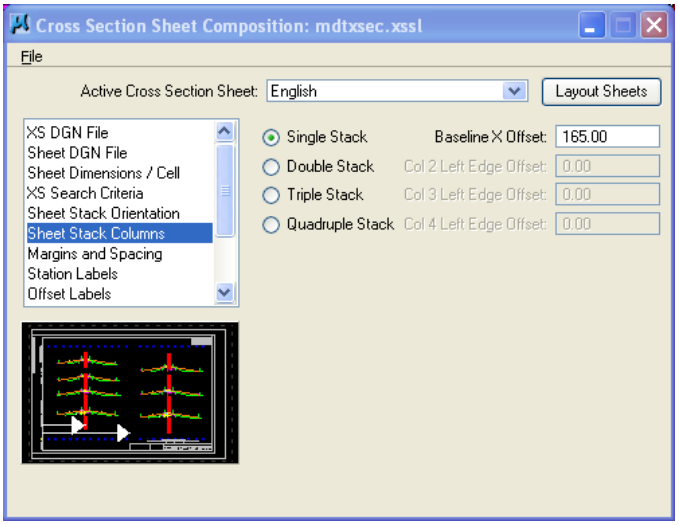
Step 6:

- Set the XS Element search Level symbology to include all the levels that need to be shown for the XS.



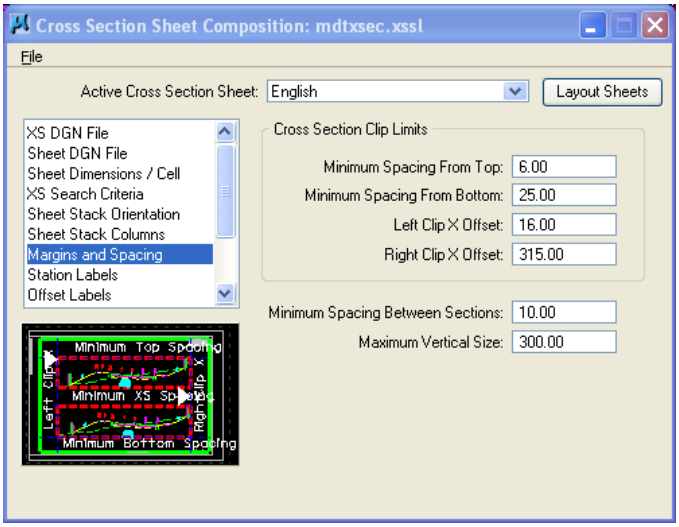
Step 7:

- Check the settings shown left and make sure they are set accordingly.



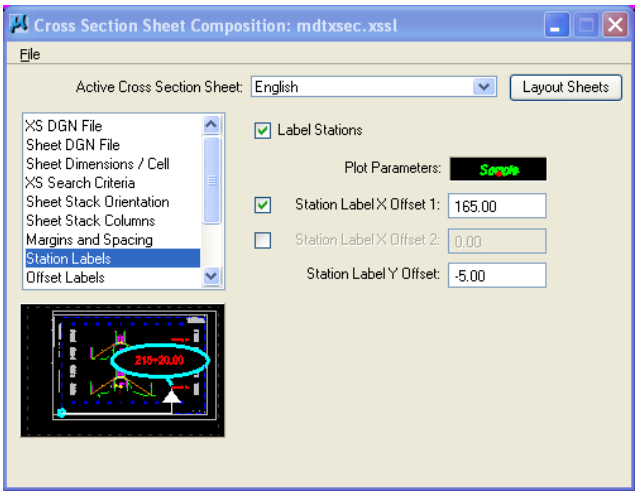
Step 8:

- Check the settings shown left and make sure they are set accordingly.



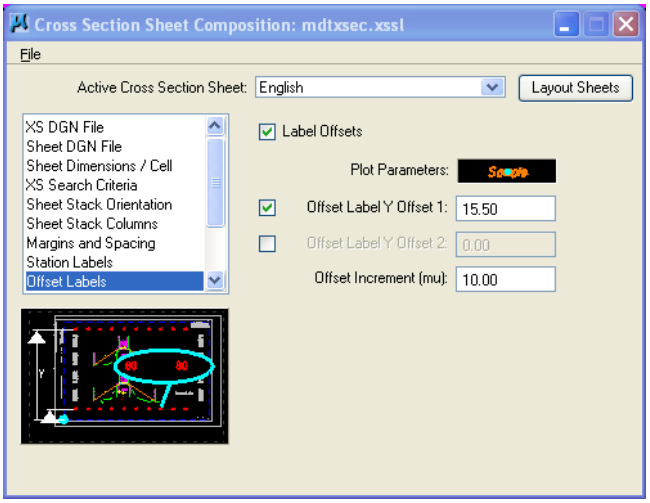
Step 9:

- Check the settings shown left and make sure they are set accordingly.



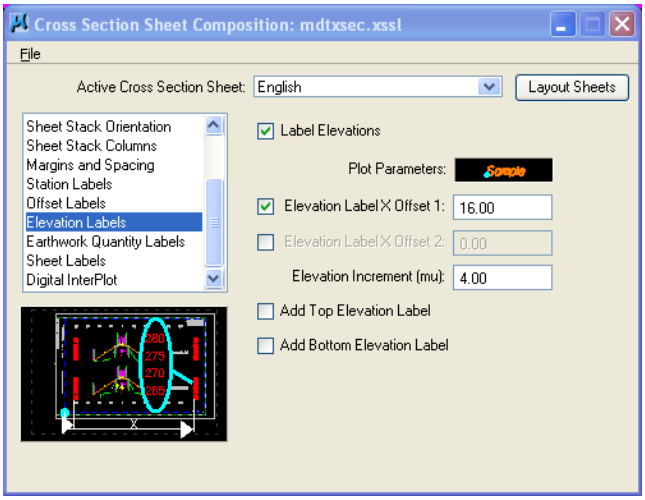
Step 10:

- Check the settings shown left and make sure they are set accordingly.



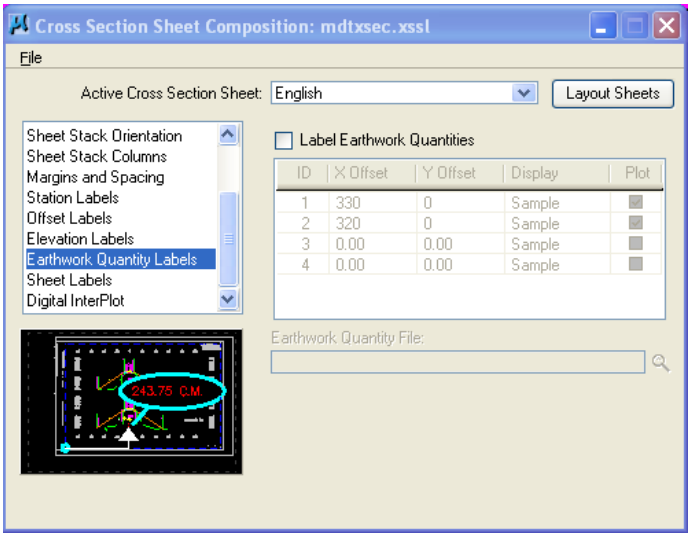
Step 11:

- Check the settings shown left and make sure they are set accordingly..



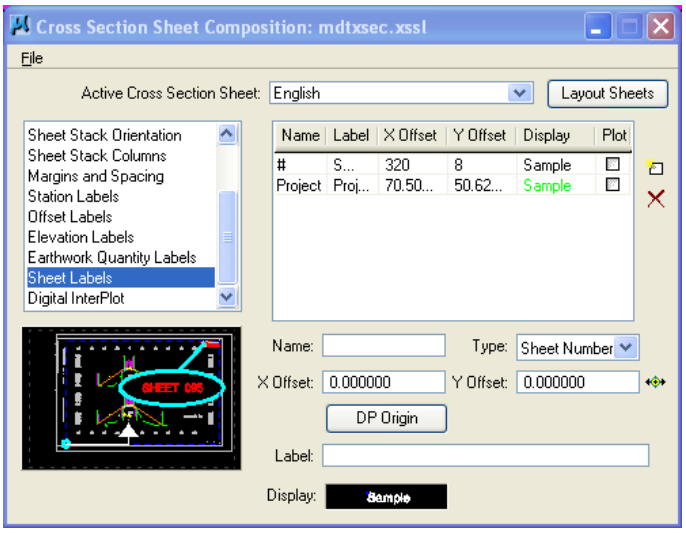
Step 12:

- Check the settings shown left and make sure they are set accordingly.



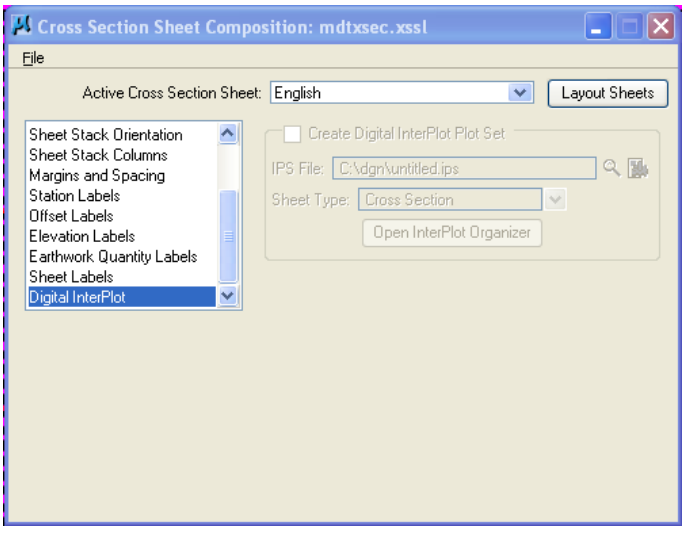
Step 13:

- Check the settings shown left and make sure they are set accordingly.



Step 14:

- Check the settings shown left and make sure they are set accordingly.



Step 15:

- Check the settings shown left and make sure they are set accordingly.

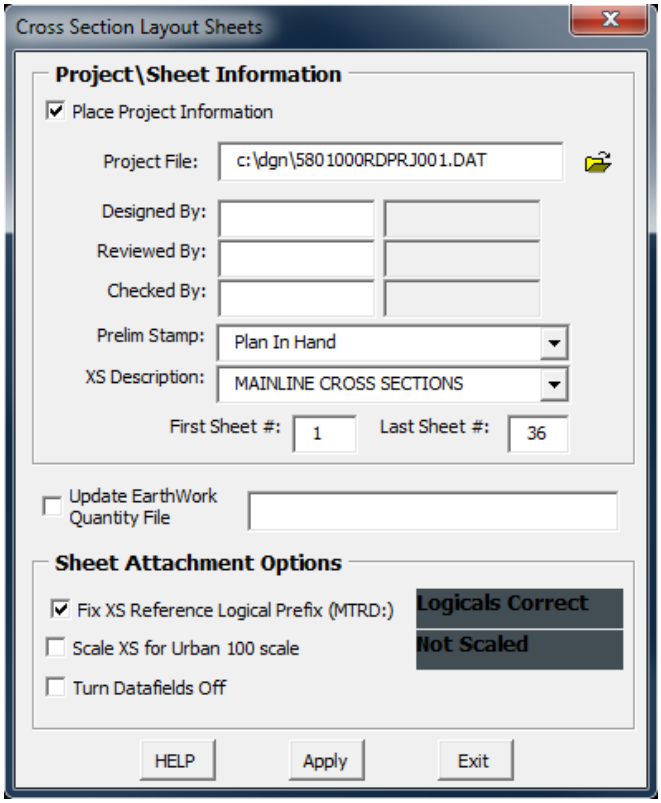
Step 16:

- Select **Layout Sheets**

Step 17:

- Select **File>Sheet Library>Save**

11.6.1 Labeling Cross Section Sheet



Step 1:

From the **MDT** Pull down

- Select **Road Design**
- Select **XS Sheets** Tab
- Select **XS Sheets**

Step 19:

- Select **Place Project Information**
- Select **Project File**
- Enter **Design By**
- Enter **Reviewed By**
- Enter **Checked By**
- Set **Prelim Stamp**
- Set **XS Description**
- Check **Fix XS Reference Logical Prefix**

- Select **Apply**

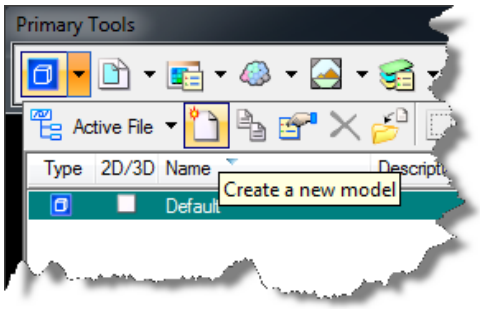
I. Microstation Models

When you draw or place elements in a DGN file, you are creating a **model**. A model is a container for elements. It can be either 2D or 3D, and is stored as a discrete object within the DGN file. It may be helpful to think of a DGN file as a stack of cards, with each card being a model.

When you first create a new DGN file from one of the seed files, this provides the empty container setup with a default model ready for you to create your design. If you use a 2D seed file, then the default setup is 2D, while a 3D seed file defaults to a 3D setup. In either case, you can create both 2D and 3D models in the open DGN file.

Every model has its own set of eight views. The model whose views are displayed or available for display at a given time is the active model.

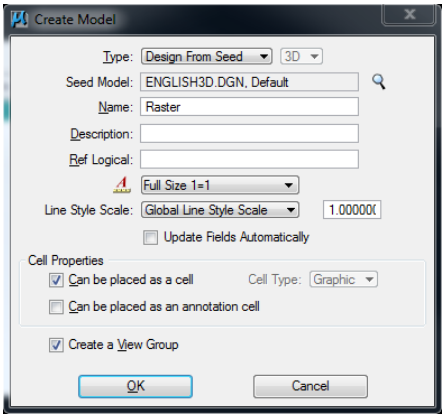
Creating Models



Step 1:

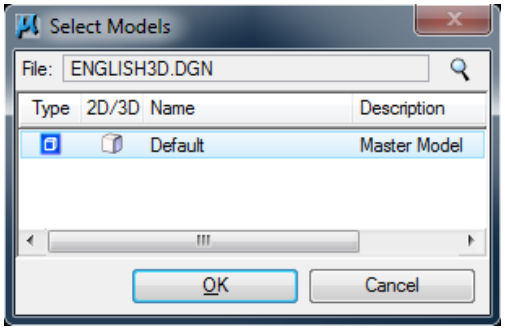
From the Microstation **Primary** Tool

- Select **Models** >**Create a new Model**



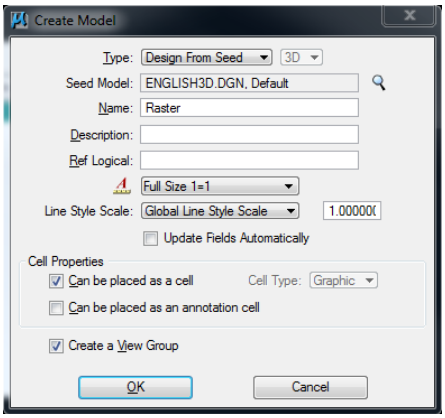
Step 2:

- Set **Type** = Design From Seed
- Set **Seed Modal** = English2D/English3D

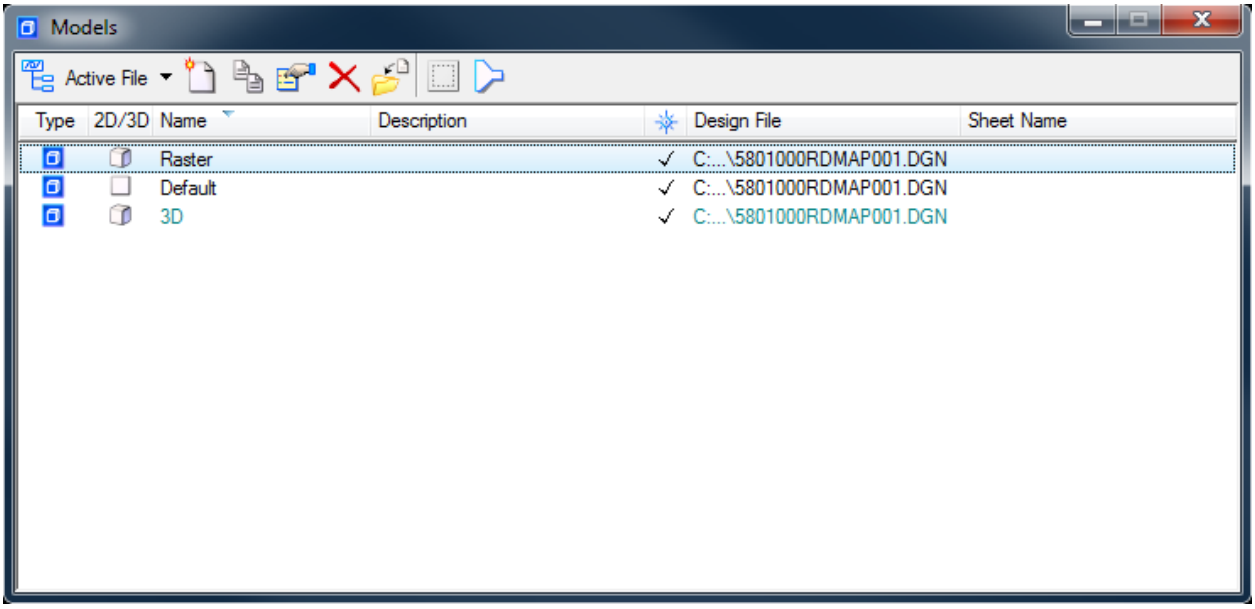


Step 3:

- Select the **Default** model from the seed file



- Set **Name** = Raster,3D etc.
- Select **OK**



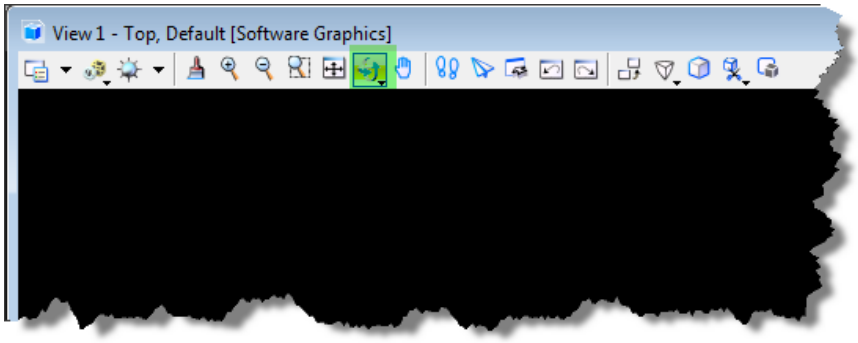
II. Viewing 3d Files

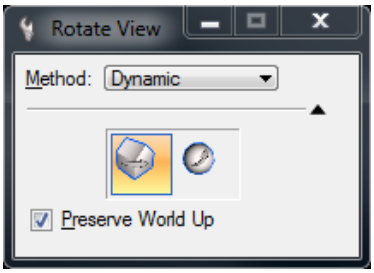
When rotating views in 3D, an important point to consider is the axis about which you want the view to rotate. By default, the pivot point is the center of the view, at the active depth. If the active depth is far behind the elements in the view, then you can quickly rotate the geometry out of sight. You can, however, move the pivot point to another location prior to rotating the view.

To dynamically rotate a view (Cube option)

Step 1:

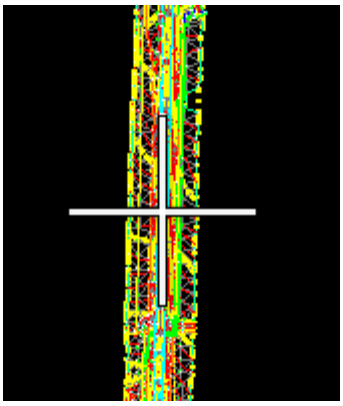
Select the *Rotate View* control.





Step 2:

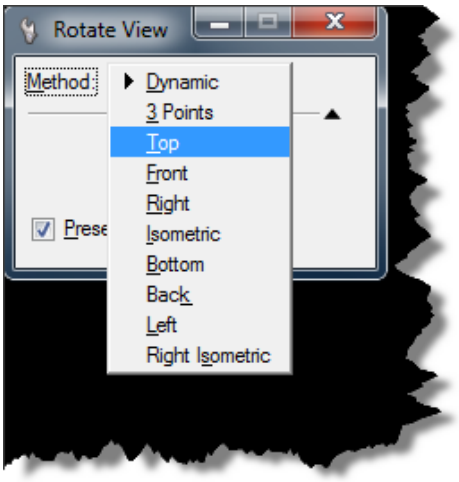
- Set Method to Dynamic.
- In the extended settings, click the Cube icon.
- Select Preserve World Up



Step 3:

Set the Z axis rotation point

Enter a data point (away from the cross-hairs) in the view to rotate.
Two white dots display in the view, a larger dot at the center of rotation and a smaller dot at the starting point of the rotation.
As you move the screen pointer from this first data point, the view is rotated

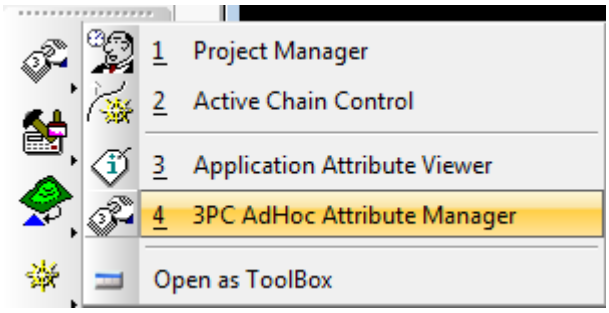


To return to the default view, rotate the current view to the Top view.

- Set the Method to **Top**

III. Geopak Adhocs

Some surveyed features have additional information that is picked up at the time of survey. These features will have that information attached to the surveyed element when available.

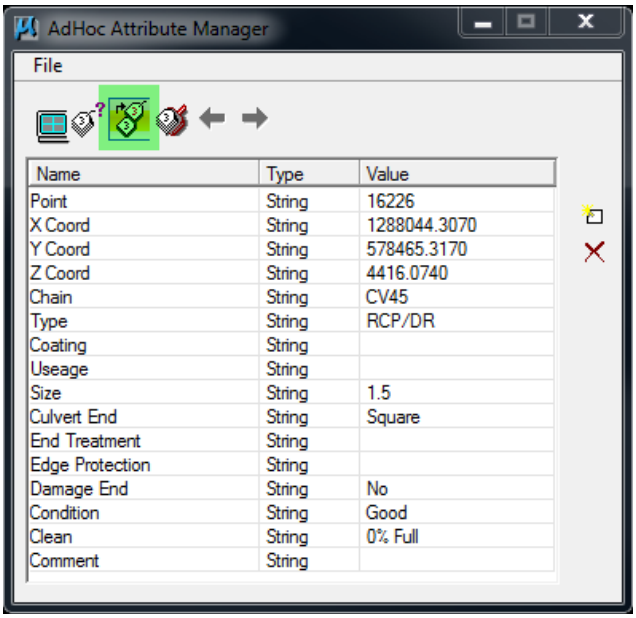


Step 1:

To determine the adhoc attributes assigned to any **MicroStation** element

From the Geopak **Road Tools** Frame

- Select **3PC Adhoc Attribute Manager**



Step 2:

- Click **Identify** at the top of the dialog, then select and accept any element.

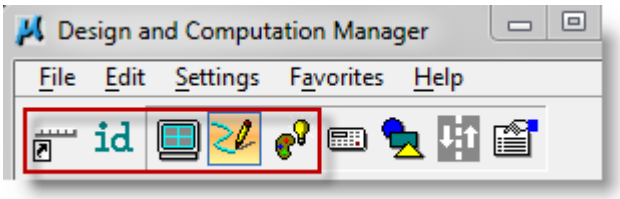
Note:
If attributes are assigned, the list box within the dialog is automatically populated.

If the selected element has no attributes, a prompt in the **MicroStation** message field indicates "No attributes."

IV. Geopak D&C Manager

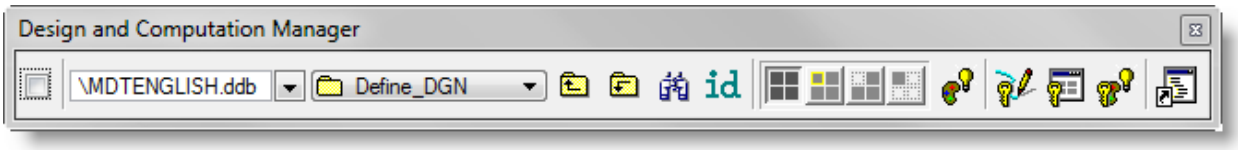
Design and Computation Manager Tools

This document will show the function of the 1st 5 buttons on the D&C Manager Dialog.



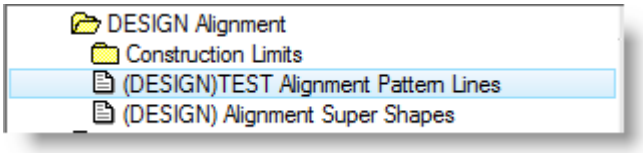
Switch to Toolbox Mode - 

D&C Manager is switched from Dialog Mode to Toolbox. Switch back by clicking icon on the far right.

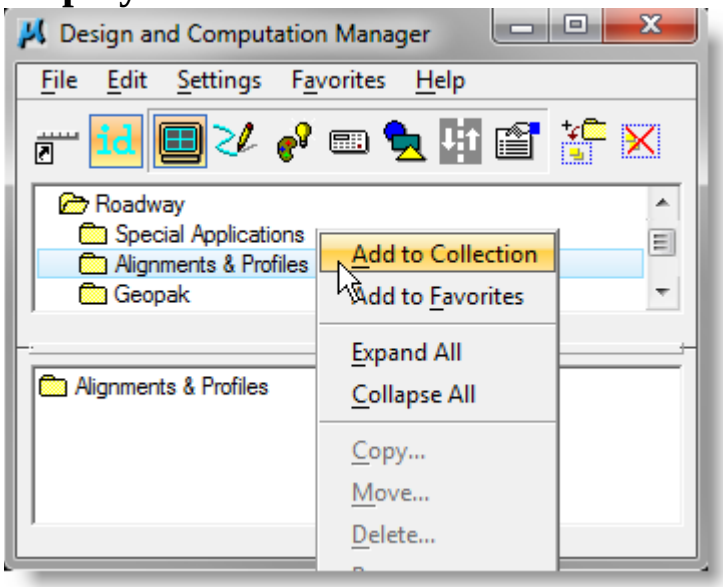


Identify Item - 

Clicking Id icon and then select an element in the design file. If the elements symbology is set to a feature defined in the D&C Manager, that feature will be selected in the item's entry in the D&C Manager. For example clicking on a pattern line will show the following in the D&C Manager:



DisplayMode -



Clicking Display opens another window in the D&C Dialog. This window shows what has been selected into a collection. To select items or groups of items, right-click the item and click Add to Collection. To remove from the Collection, simply double-click on the item in the Collection window.

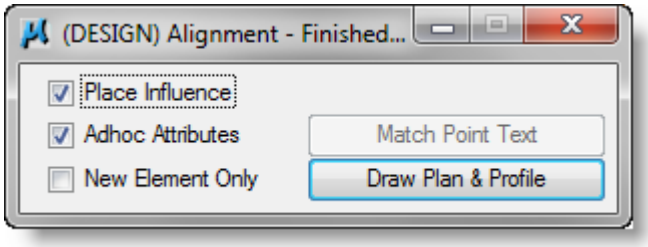
Also, another dialog opens showing four buttons

Normal Display - the items of interest change from gray back to their original element symbology
Highlight Selection - the desired elements are displayed in the current MicroStation highlight color, while any other elements remain unchanged.
Hide Selection - the desired items are blanked from the screen, however all other elements are displayed. This is the reverse of the **Display Only Selection** tool.
Display Only Selection - only the items in the collection box appear, while the rest are blanked from the screen.

While Display is on these buttons work on ANY entry that is highlighted within the D&C Manager.

Design -

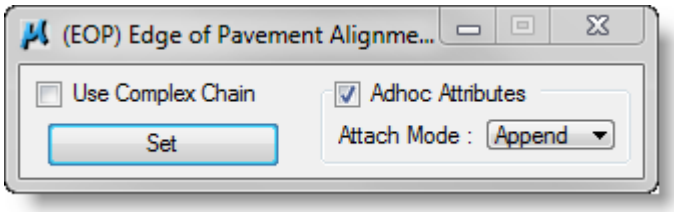
Clicking Design icon opens the DESIGN Dialog box



The title on this box should match the name of the element that is highlighted in the D&C manager.
The **Place Influence** tool on the Design and Computation Manager determines the level, symbology and attribute tags of MicroStation draw and manipulation functions. These level symbology and attribute tags are defined in the hierarchical database in terms of pay items and/or feature names.
When the **Place Influence** tool is inactive, MicroStation commands draw elements at the active MicroStation level/symbology. However, when the **Place Influence** toggle is set, any element placement or copy function draws elements at the element symbology and attributes associated with the selected item on the Design and Computation Manager.
It is not necessary to reselect the MicroStation command, nor is it necessary to toggle the Place Influence on again. Once the Influence is toggled on, it remains on until it is toggled off. If a generic MicroStation command without the Influence is desired, simply deactivate the toggle.
If the **Adhoc Attributes** toggle is on, any adhoc attributes stored with the item are applied to the Place Influenced element. If the **Adhoc Attributes** toggle is off, the element symbology of the Item is utilized, but no adhoc attributes are assigned or modified.
If the **New Element Only** is toggled off, then the Place Influence is applied to any selected element, including those previously placed. If toggled on, only elements being placed utilize the Place Influence. Any other selected element retains its original symbology.

Set Mode -

Clicking the Set icon opens another dialog box.



Clicking on the Set button and then selecting an element in the design file will change that element's symbology to the item highlighted in the D&C Manager.

V. Geopak Problem Resolution Steps

The following suggestions are steps that may help when encountering a problem in Microstation or Geopak.

1. When the initial problem is encountered the following steps should be done in the order described.
    a. Double check all dialog box entries to insure they are as expected.
    b. Double check all symbology selected to insure it is exactly what you need for the function you are attempting.

2. If an error message is encountered:
    a. If an error is displayed, read it before continuing. If you understand it and can fix the problem, then fix the problem and restart the attempted function.
    b. If you do not understand the error or don't know how to fix it, seek out help from your fellow team mates – one of them may have seen and/or resolved that error before.

3. Initialize Geopak/Microstation:
    a. Run KILLTASK.BAT enter 'Y' and hit Enter when prompted. KILLTASK.bat should reside on your desktop. It is located on CADDSTD for copying.
    b. Restart Microstation/Geopak
    c. Reattempt the function that you were having problems with.

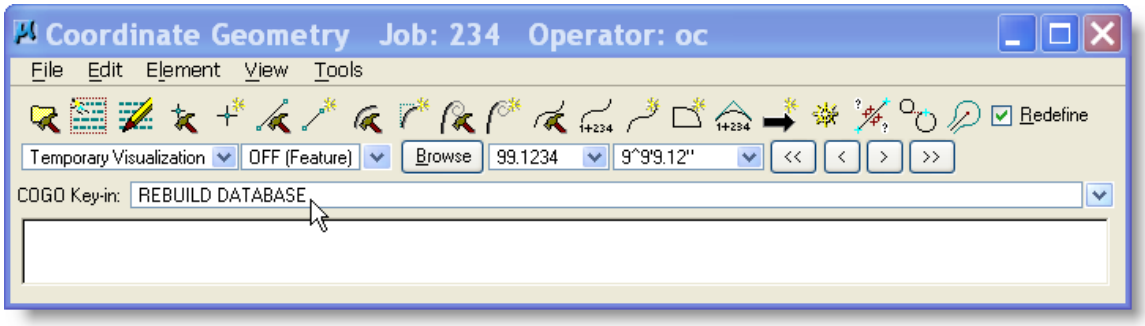
4. Recreate .upf file
    a. Exit Microstation
    b. Go to C:\mdoh folder
    c. Highlight file U####V8.upf (where # is your employee number) and rename it to SAVEU####V8.upf. This file contains your preferences for Microstation.
    d. Restart Microstation/Geopak – this will recreate the U####V8.upf file. You will notice that toolbars & menus may have changed from your preferred settings.
    e. Reattempt the function that you were having problems with. If this works you should delete the saved .upf file.

5. Still no resolution send an email to U2894 that contains the following:
    - Computer Number Eg. MDTHLNRODC164
    - Project Number
    - GPK File
    - Pxsprj.inp (Proposed Cross Section Input File)
    - Proposed DGN file containing Patterns, Shapes and Profiles
    - Cross Section Drawing where sections are processed and you give me a reference to the problem cross section, if applicable.
    - Existing topo drawing – TIN file

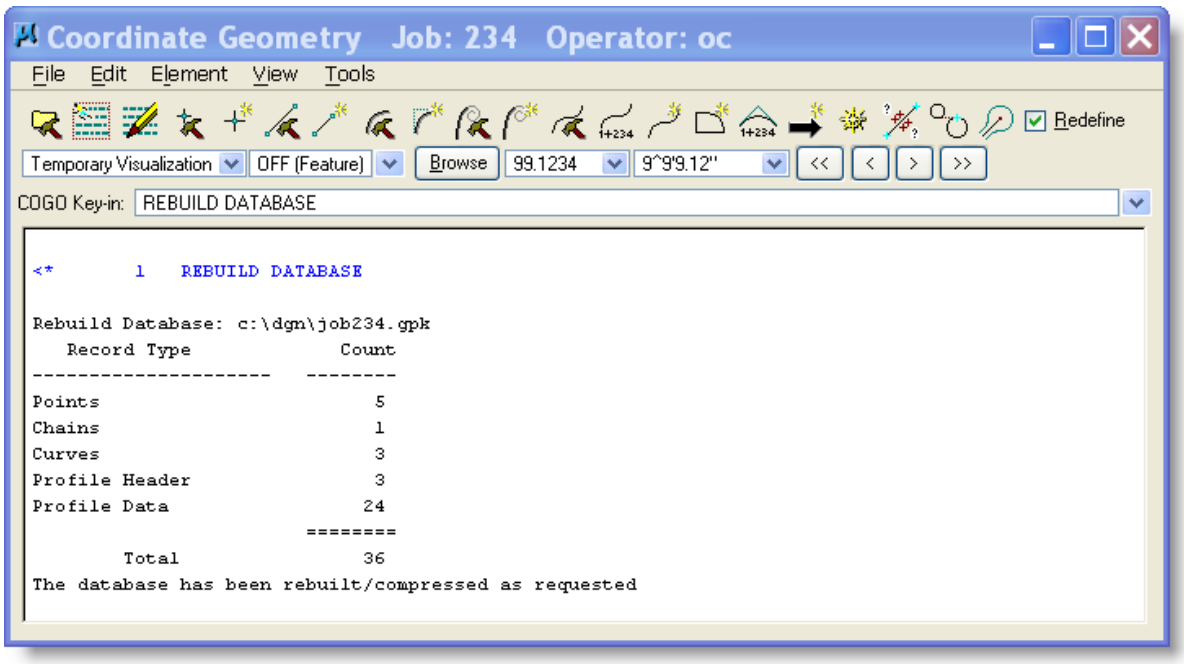
    A **DETAILED** description of the problem or situation

VI. Fix Corrupt GPK

Dealing with corrupt GPK or basic maintenance - From the Coordinate Geometry dialogue at the COGO key-in enter REBUILD DATABASE.



Press Enter
It may take several minutes to process the GPK.
When complete the rebuilt statistics will be displayed.



This should be done occasionally and definitely before zipping for the archive or posting to DMS