Module II Roadway Design and SMD Workflow Training Manual

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Prepared For:

Mississippi Department of Transportation

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1. MODULE 2 OVERVIEW

1.1 Overview

This course is intended to give the MDOT Roadway Design and ROW users a wide range of instruction for the various workflows during MDOT's Pre-Construction phases A and B. Users of this document will learn how to navigate and utilize survey data created in the District's Preliminary Survey process and use that data to produce Final ROW plans, Acquisition Maps, Final Construction plans, 3D models, and other field deliverables.

The Design and ROW phases are critical to MDOT's Pre-Construction and Construction processes in the fact that design data and plans are provided to utility companies, other Pre-Construction Divisions, District surveyors, District inspectors, contractors, and GIS. This data is far-reaching in regards to stakeholders and it is imperative that this data is accurate, easy to understand, and kept up-to-date throughout a project's lifecycle at MDOT.

One key to making these processes go smoothly is directly tied to full implementation of ProjectWise which is the first topic covered in this document. The ProjectWise section covers detailed steps for Roadway Design utilizing MDOT's ProjectWise environment in their daily workflows such as quickly accessing initial and additional survey data, creating consistently named files for downstream clarity, and sharing and accessing design data with other Pre-Construction divisions such as Bridge, Hydraulics, Geotechnical branch, and Traffic.

OpenRoads is another key to providing accurate and up-to-date downstream design data to MDOT stakeholders. Every major grading project that's been constructed in recent years has utilized 3D models and Automated Machine Guidance (AMG) to perform the grading. OpenRoads will allow the Roadway Designer to construct 3D models in its design process and deliver to District personnel and eventually contractors saving time, money, and errors associated with re-engineering design data for field use. The 3D process and new dynamic horizontal and vertical tools are also critical in discovering and eliminating errors in the design process instead of during construction.

OpenRoads technology represents Bentley's continued evolution of merging functionality of Bentley's survey, road design, drainage analysis and design, bridge modeling, and construction activities. It, along with ProjectWise, are the key to moving data fluidly throughout MDOT's project lifecycle.

Topics that are covered in this document include new OpenRoads tools Terrains, Horizontal Geometry, Vertical Geometry, Templates, Superelevation, Corridor

Modeling, 3D deliverables, Cross Sections, and how to mesh these new tools with legacy GEOPAK tools to create the optimal design plans. These are core engineering processes for Roadway and ROW users and it is imperative to learn these new tools because of their ease of use, dynamic capabilities, and the eventual removal of legacy GEOPAK tools.

1.2 Target Audience

This module is recommended for the following audience(s):

- MDOT Roadway Design users
- MDOT Roadway SMD users
- District Plan Production users

1.3 Prerequisites

- Knowledge of MicroStation.
- General survey knowledge.
- General Transportation Engineering knowledge.

1.4 Course Objectives

After completing this course, the users will be able to:

ROADWAY DESIGNER

- Navigate MDOT's ProjectWise structure
- Properly create files in ProjectWise
- Work with survey data and terrains
- Create and annotate horizontal and vertical geometry, etc.
- Calculate superelevation
- Build templates and corridor models
- Place and edit civil cells
- Properly drain 3D models.
- Establish right-of-way
- Calculate earthwork with the surface to surface process.
- Create cross-sections with OpenRoads
- Create plan and profile sheets
- Create PDF plans

ROADWAY SMD USERS

- Navigate MDOT's ProjectWise structure
- Properly create files in ProjectWise
- Work with survey, property, and design data
- Utilize horizontal geometry to create parcels
- Produce Acquisition Maps
- Send web links to utility companies

1.5 Software Covered

Software tools that will be covered include:

ProjectWise
MicroStation
GEOPAK
Bentley Map
Print Organizer

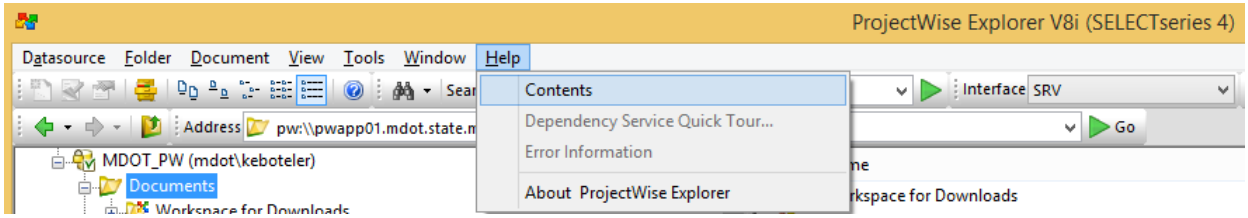
2. PROJECTWISE

2.1 Section Overview

ProjectWise (PW) is the project collaboration and content management software that houses MDOT's engineering related documents. It provides capabilities for information sharing, cross-functional work process management, and content management to help improve agility and increase transparency throughout the project lifecycle.

ProjectWise provides MDOT managed workspaces, consistent file naming/folder structure, up-to-date design/survey data for all stakeholders at all times, automated attributes for sheet creation, a secure method of working with external MDOT stakeholders, and much more, all leading to a very productive environment within the agency.

This Section introduces MDOT's ProjectWise environment, file creation processes, file management, etc. For more details of commands and processes not covered in this document, utilize ProjectWise's Help as shown below.



2.2 Section Prerequisites

- Fundamental MicroStation proficiency
- Understanding of survey, design, and right-of-way terminology

2.3 Section Objectives

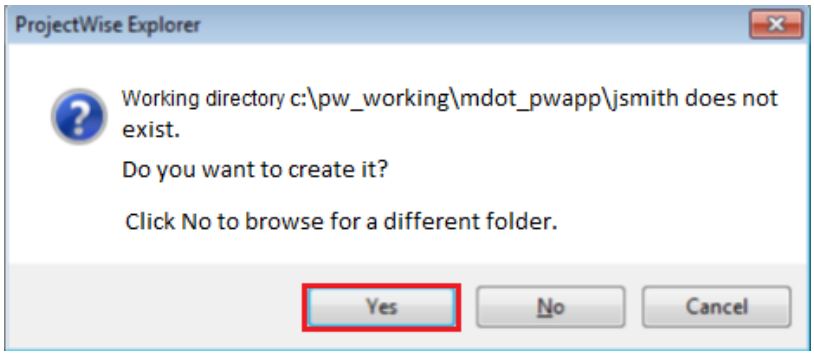
After completing this section, you will be able to:

- Navigate MDOT's ProjectWise folder structure
- Create and open files in ProjectWise
- Check Out and Check In Files
- Import documents
- Email a ProjectWise link
- Search MDOT's ProjectWise folders

2.4 MDOT's ProjectWise Processes

2.4.1 Local Working Directory

When logging into ProjectWise for the first time you will be prompted to create a working directory (Example: c:\pw_working\mdot_pwapp\jsmith). Click **Yes** to create this directory. This will be the local working directory used by ProjectWise to house files temporarily when they are checked out and being worked on. **Do not open or delete files directly from this directory.** Use the Local Document Organizer inside of ProjectWise Explorer to manage the local working directory.



Notes:

- The working directory is created at the user's workstation. If you log in to ProjectWise from another workstation, you may see this dialog again and need to create it there also.

- GEOPAK .RSC files and MicroStation preferences are also saved locally at the location below.

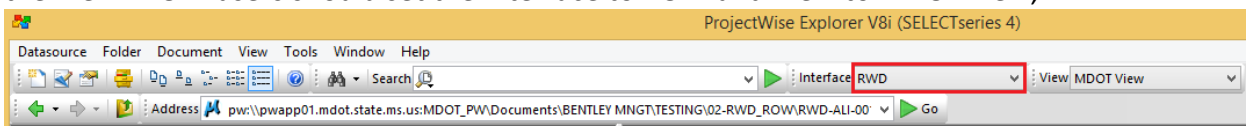
  C:\Users\John.Doe\AppData\Local\Bentley\PowerGEOPAK\8.11\OQ4n1D1p0OEPifXB1vNrKw

2.4.2 Managed Workspace

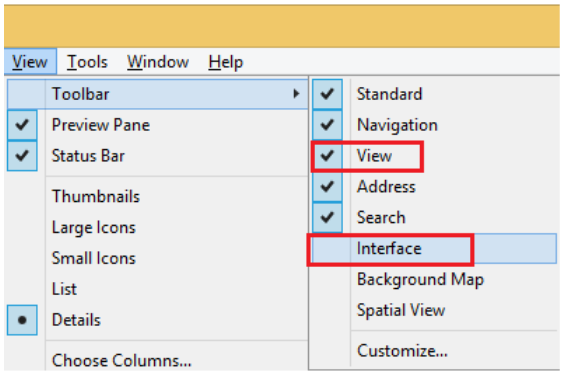
MDOT has implemented a managed workspace environment for ProjectWise. These are MicroStation workspaces for each Division pushed out to the end user and updates are checked for and loaded each time a user opens ProjectWise. The first time a user opens ProjectWise, the workspace load time takes several minutes because the entire workspace is being downloaded. In subsequent ProjectWise sessions, only workspace files that have been modified are downloaded so the download time is generally a matter of seconds. The main benefit of the managed environment is that everyone is working with the same up-to-date workspace. An example is that if a cell is added to a cell library, the cell library is pushed out to all users the next time they open ProjectWise.

2.4.3 PW Interface

Roadway Design users should make sure their PW Interface and View is set as shown below. RWD should be chosen for the Interface and MDOT View chosen for the View. ROW users should set the interface to ROW and View to MDOT view,



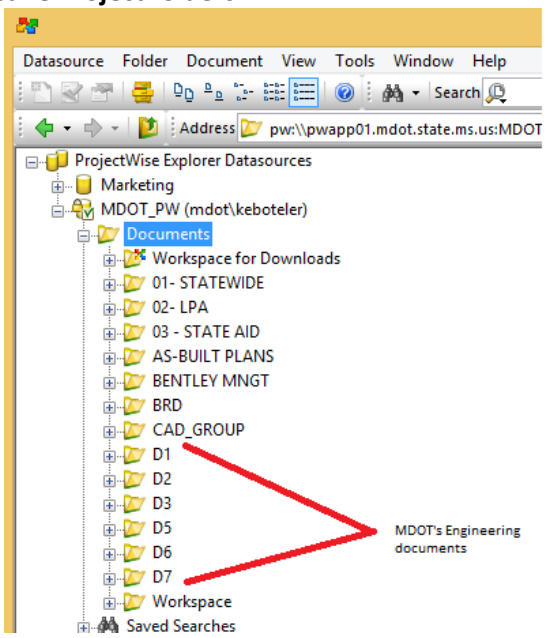
If these selections are not shown, turn these on by choosing **View -> Toolbar ->** turn on **View and Interface**. Then select **RWD** in the interface and **MDOT View**.



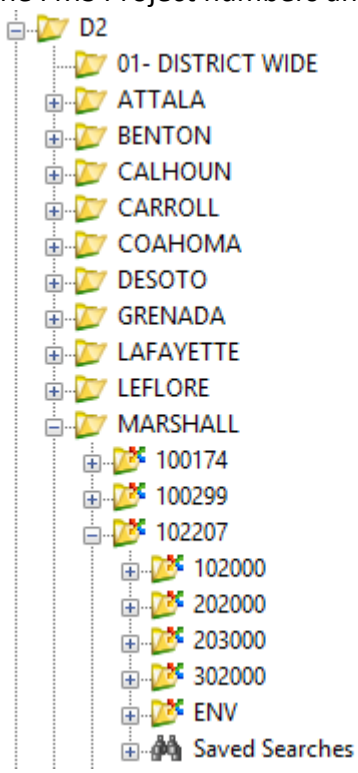
2.4.4 Folder Structure

MDOT's engineering documents created during the pre-construction and construction phases of a project are found in the District (D1, D2, D3, D5, D6, D7) folders located under Documents as shown below.

2.4.4.1 Active Project folders



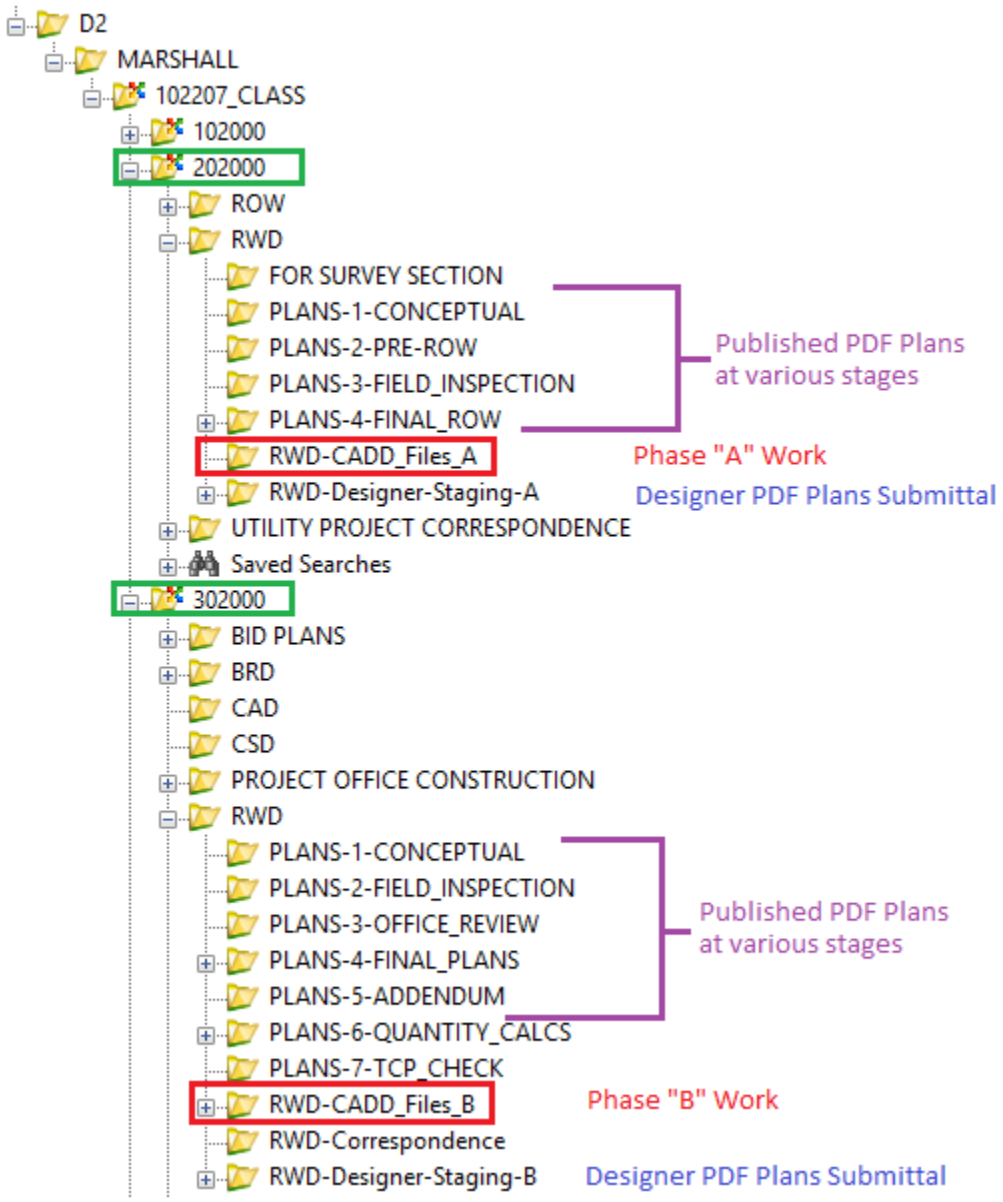
Under each District folder, counties for each District are listed. Below each county, the FMS Project numbers and then FMS detail are listed.



10*000 details – Pre-ROW Detail.
20*000 details – ROW Detail
30*000 details – Construction Detail

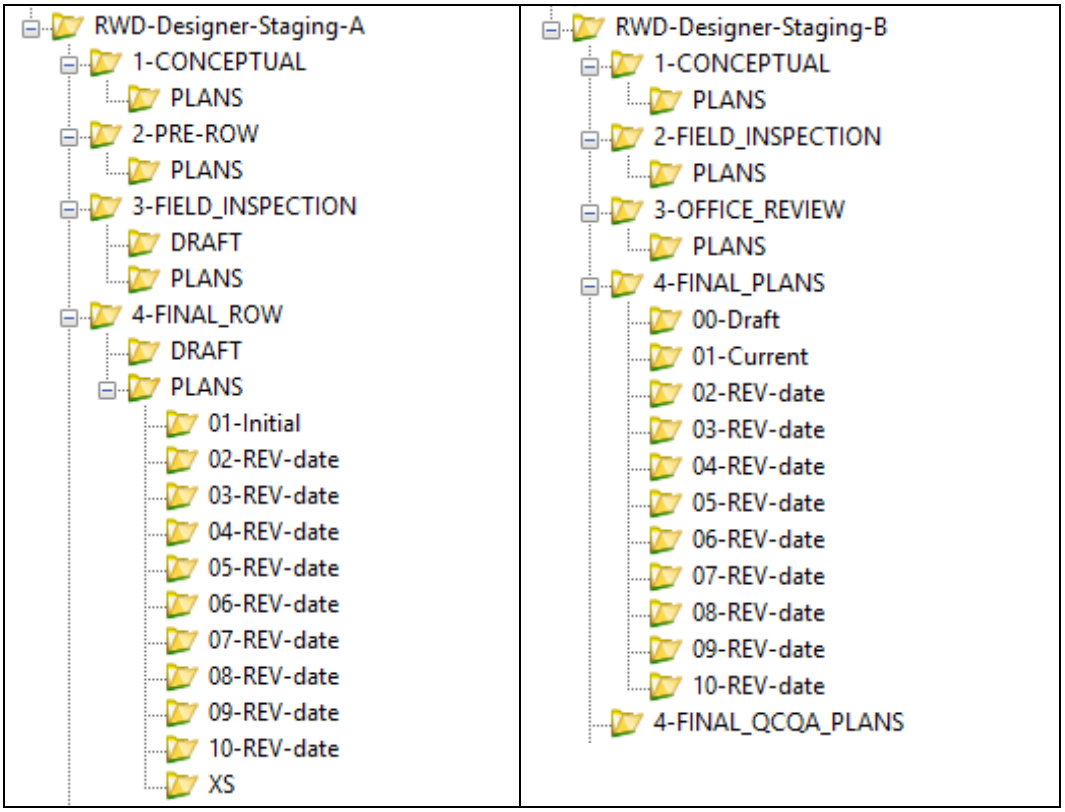
2.4.4.2 RWD Working folders

Below is an image with the FMS Details expanded which highlights the directories where Roadway Design performs Phase A and Phase B related work.



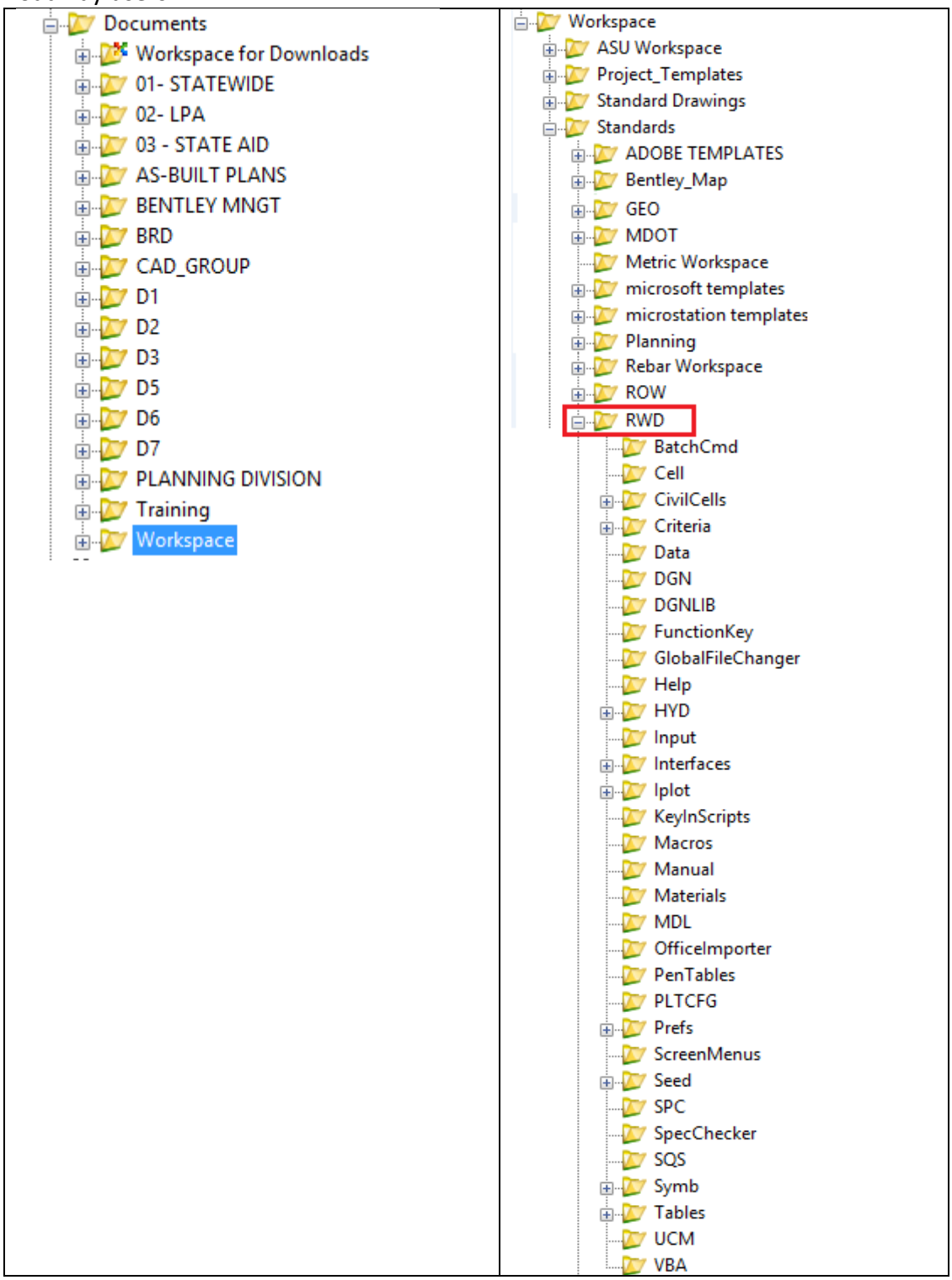
2.4.4.3 Designer-Staging folders

Designer-Staging folders are folders used for submittals of PDF plan sets by designers at various stages of project development.



2.4.4.4 Workspace folder

Below is the workspace folder where each division will access MicroStation related Seed files, PLT settings files, Features, cell libraries, etc. RWD is intended for Roadway users.



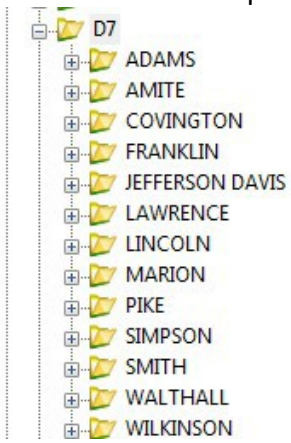
2.4.4.5 Survey Folders

Accessing Survey Data is discussed in the ACCESSING SURVEY DATA section of this document.

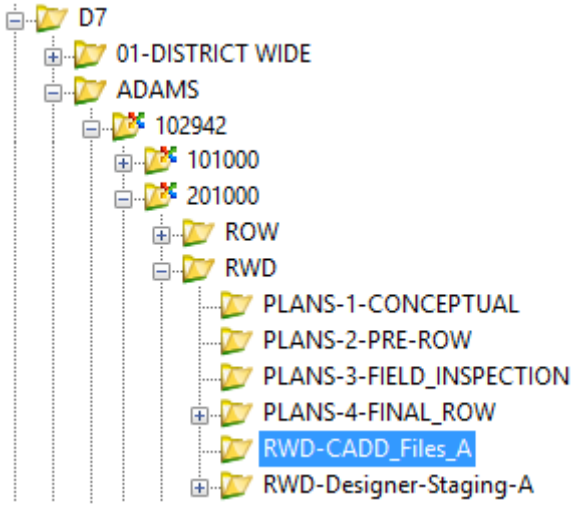
2.4.5 Creating files in PW

2.4.5.1 Advanced Wizard

1) In ProjectWise Explorer, locate the folder where you want to create a new document. For Roadway Design this location is in the **RWD-CADD_Files_A** folder, District/County/FMS/20*000 details/RWD/**RWD-CADD_Files_A**
Note: For this example we will be using Adams County.

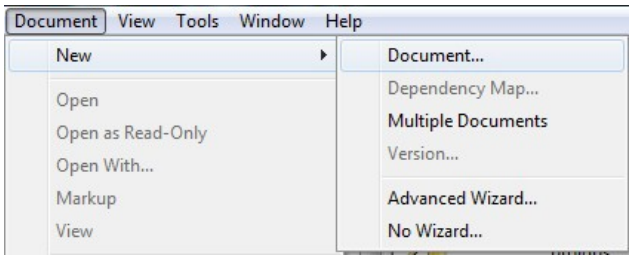


Navigate to the appropriate county folder. Look for the correct FMS number associated with the project and the correct project detail code.
Example: D7\Adams\102942\201000\RWD\RWD-CADD_Files_A

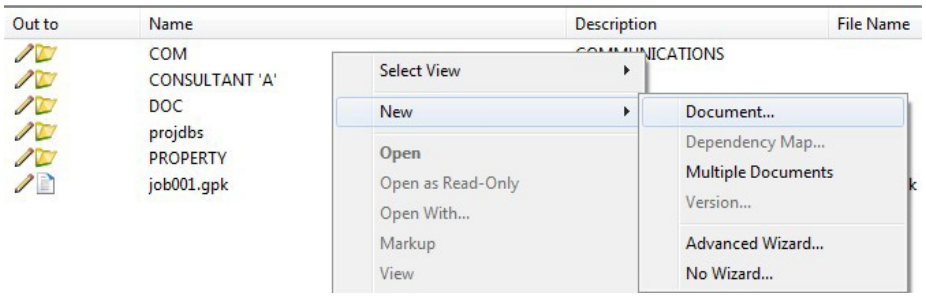


NOTE: Before continuing to the next step make sure to have the correct folder highlighted where the new document will be created.

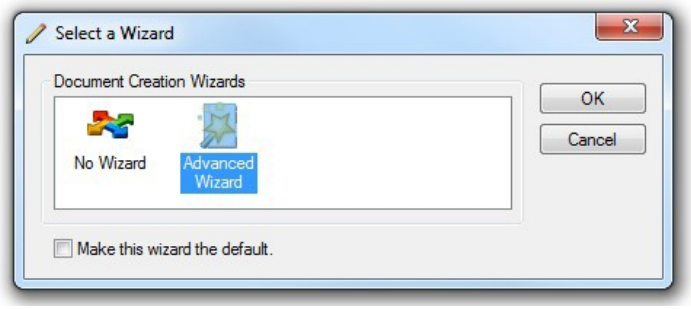
2) With the correct location selected, create a new document by right clicking the folder and choosing **Document -> New -> Document** from the drop down menu.



NOTE: Alternatively, you can also open the creation wizard by right clicking in the top right window (not on a file) and selecting **New -> Document**.

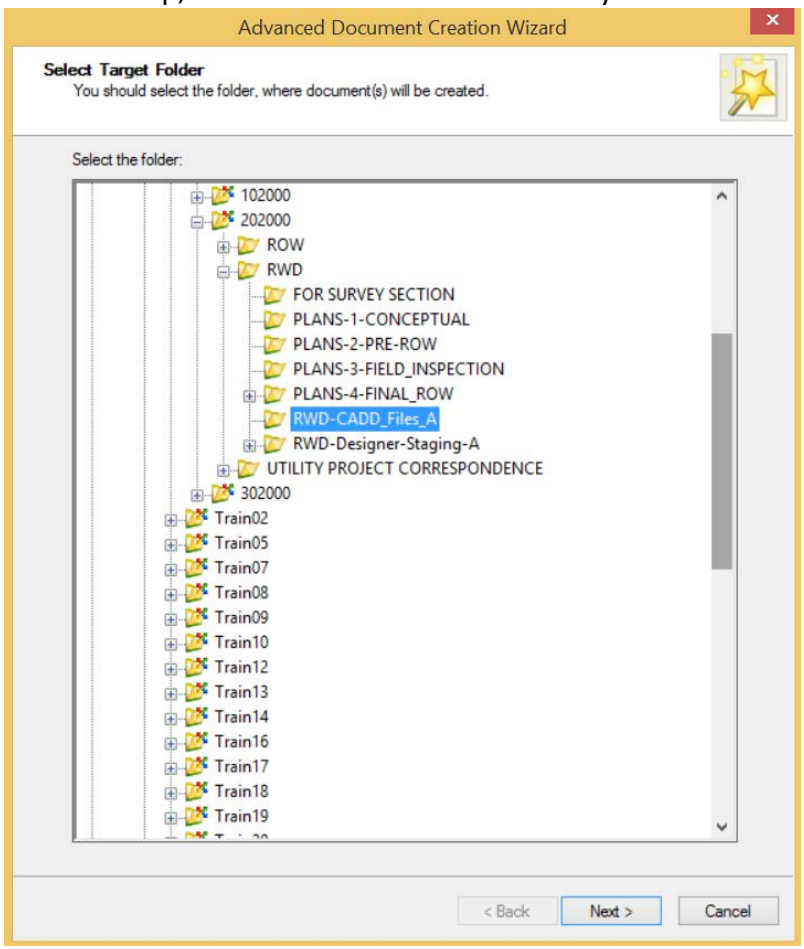


3) Once you selected the above methods for accessing the Document creation wizard, select **Advanced Wizard** then press **OK**.

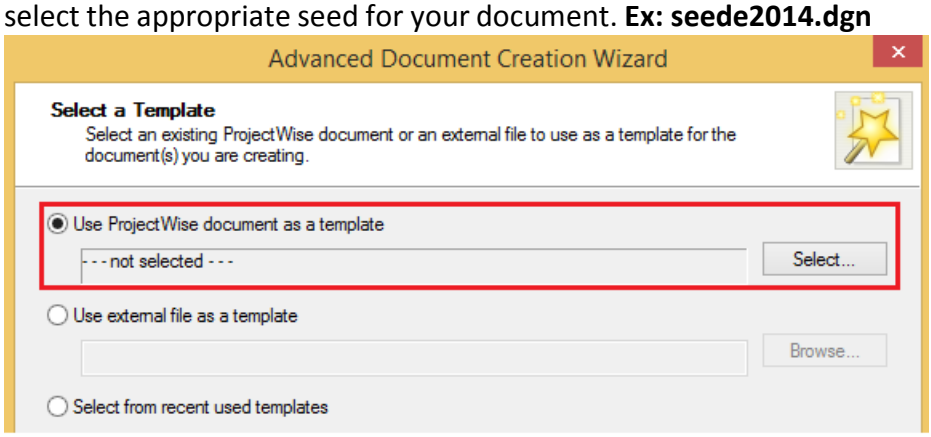


4) The next screen that will appear is the **Welcome to the Advanced Document Creation Wizard.** Click **Next** to proceed to the next window.

5) Select the correct Target folder where the new document will be created. If you did the first step, then the location should already be selected for you. Click **Next**.



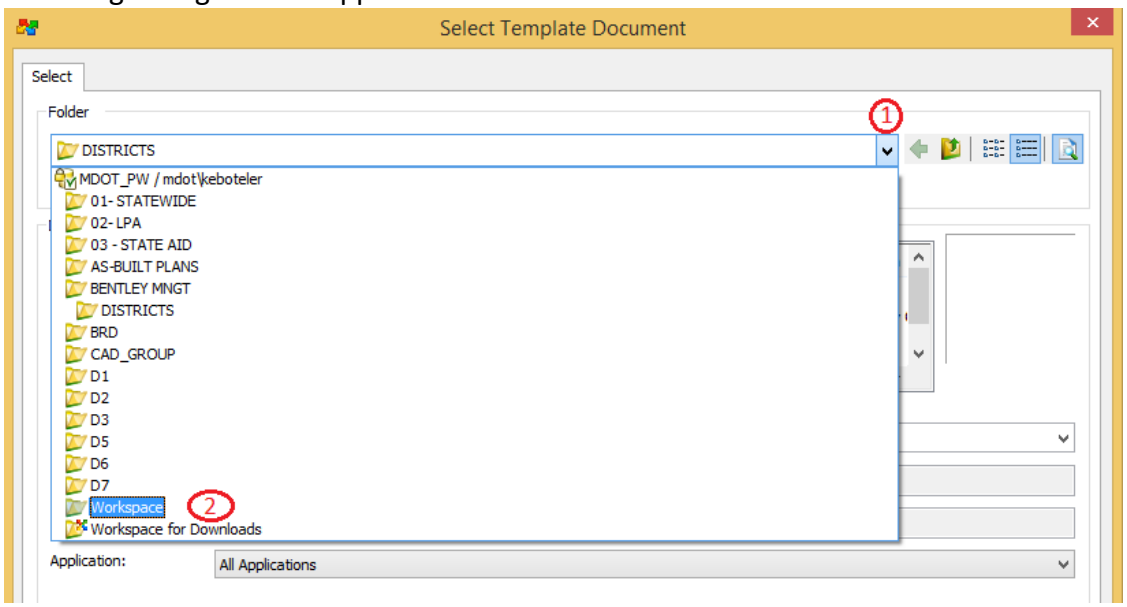
6) After you have selected the correct location for your new document, you must now select the appropriate seed for your document. **Ex: seede2014.dgn**



The first time you create a new type of document, you will need to navigate to the correct location of the seed file as shown in the steps below. The next time you need to create the **SAME** type of document it will appear in the bottom selection

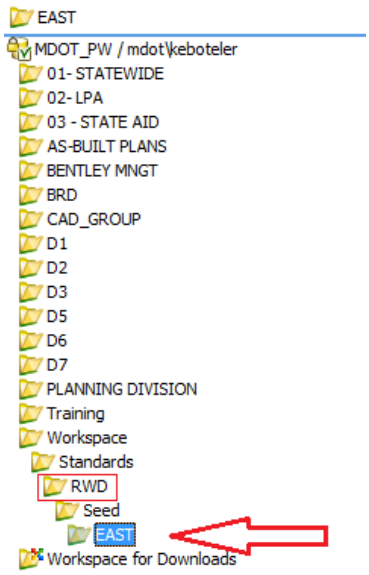
window and you just choose **Select from recent templates**.

When you click **Select** next to the **Use ProjectWise document as a template**, the following dialog box will appear.

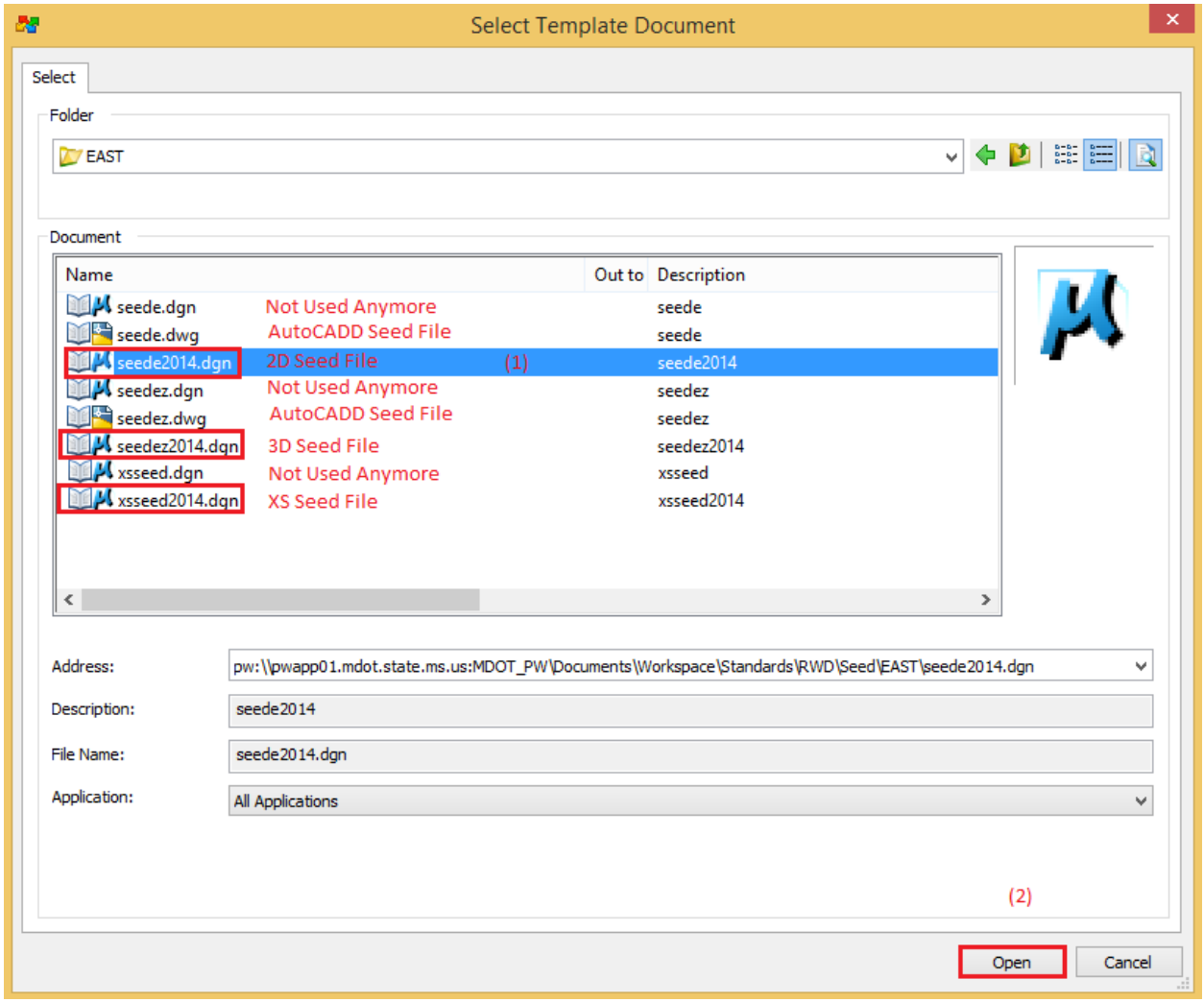


Navigate to the correct location by selecting the drop down arrow in the **Folder** dialog location (1) and then choose the **Workspace** folder (2).

Navigate to **Standards -> RWD -> Seed -> East or West.**



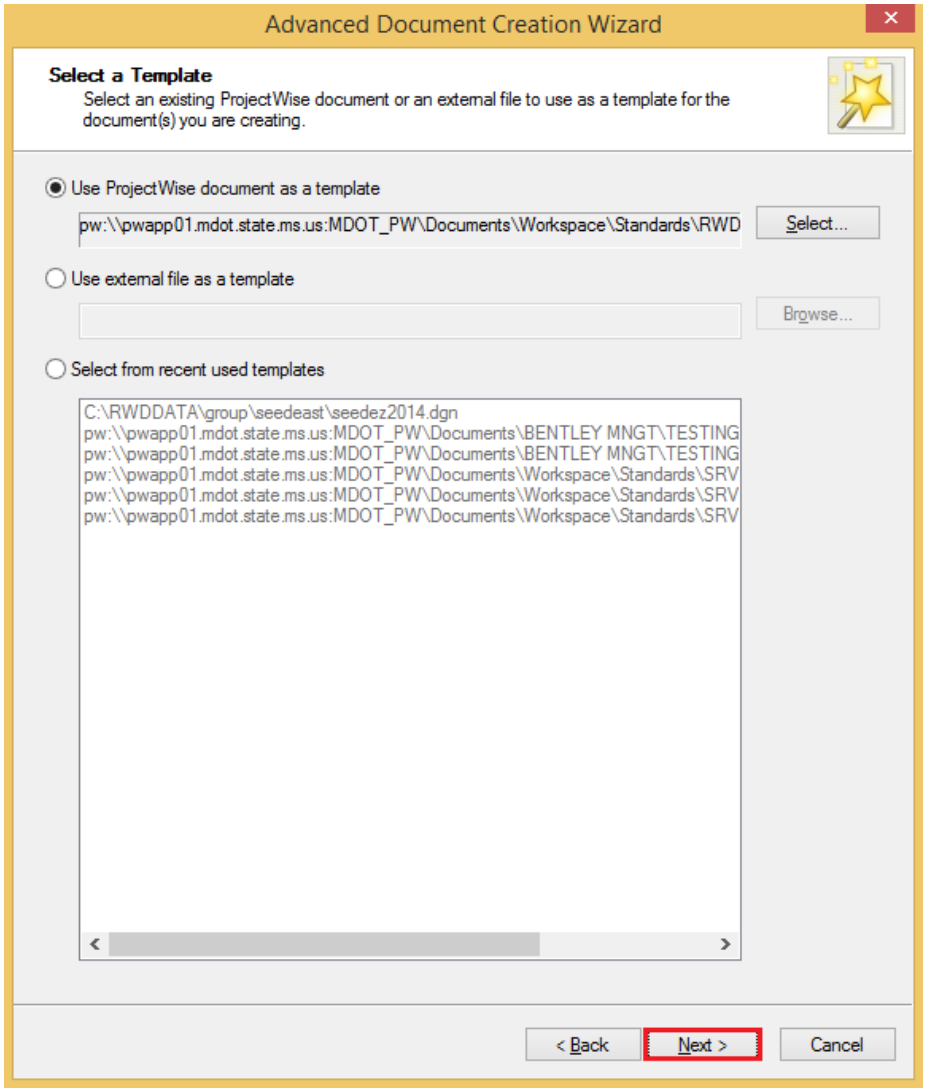
Choose the appropriate Seed file and choose **Open**.



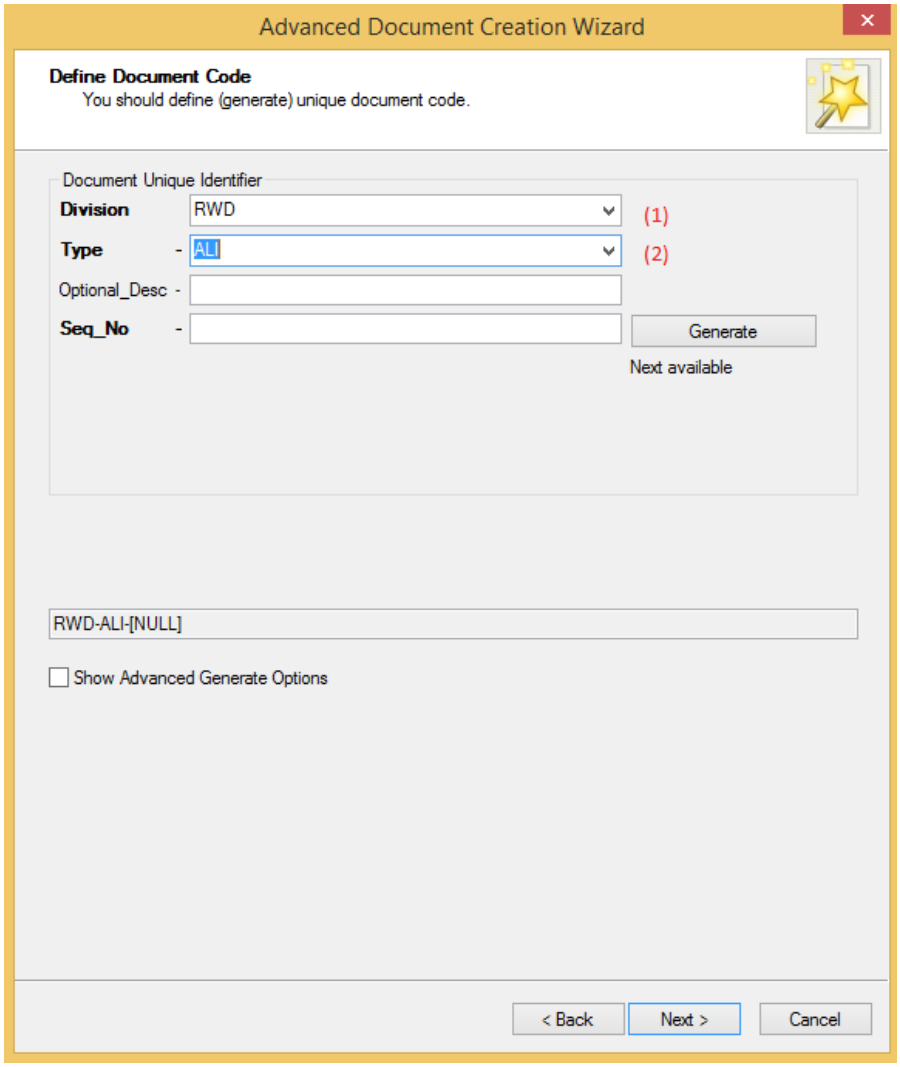
Notes:

- Choose the seede2014.DGN (or seedw2014.dgn if West SPCS) for creating a 2D Seed file.
- The Seed Files labeled "Not Used Anymore" are not used on new projects but are still used if the project was originally created in DGN files with International Feet as their unit.

7) Click **Next** on the dialog shown below.



8) Now that ProjectWise knows what seed file to use to create your new document, it must be named. This will provide a standard naming convention used for all working DGN files at MDOT. To do this, just click the drop down arrow next to the appropriate selection box.



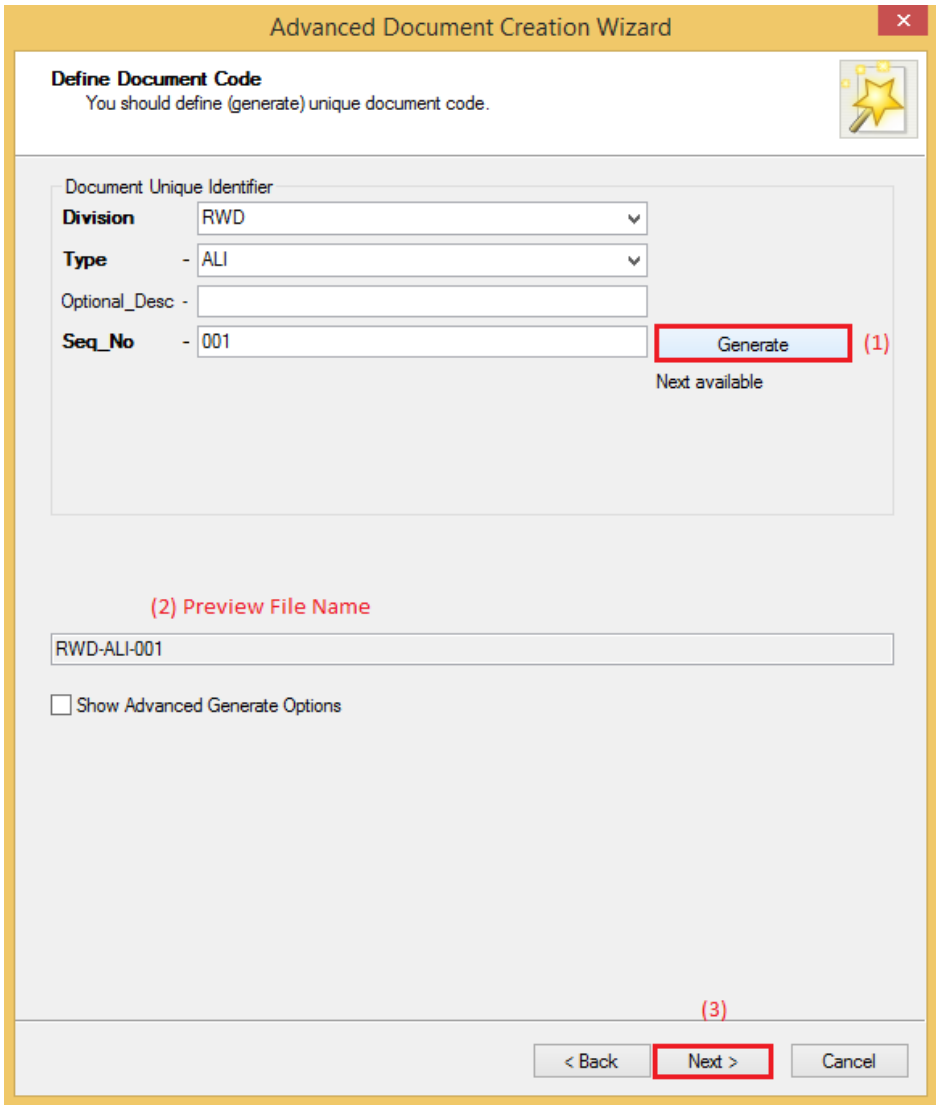
Notes:

- The file **types** available for the RWD process are shown below.

ALI - (ALIGNMENT)
ATOPO - (ADDITIONAL TOPOGRAPHY)
BORDER - (PLAN AND PROFILE BORDER FILE)
CORRIDOR - (CORRIDOR MODEL)
DCS - (DETAILED CONSTRUCTION SIGNING)
DCS - (DETAIL OF CONSTRUCTION SIGNING)
DI - (DETAILED INDEX)
DRN - (PROPOSED DRAINAGE FILE)
DTM-D - (DESIGN TERRAIN MODEL)
DTM-X - (EXISTING TERRAIN MODEL)
ECP - (EROSION CONTROL PLAN)
EP - (EDGE OF PAVEMENT FILE)
EQ - (ESTIMATED QUANTITIES)
EW - (SURFACE EW CALCULATIONS)
FG - (FORM GRADE)
GN - (GENERAL NOTES)
ID - (INTERSECTION DETAIL)
ITS - (ITS)
LAY_SH - (XS SHEET FILE)
LIGHT - (LIGHTING)
MD - (MISC DETAIL)
MISC
PAT - (PATTERN LINES)
PMD - (PAVEMENT MARKINGS DETAILS)
PROFILE - (PLAN AND PROFILE)
PSP - (PERMANENT SIGNING)
ROW - (PROPOSED RIGHT OF WAY)
SQS_SH - (SUMMARY OF QAUNTITES SHEET)
SUPER - (SUPERELEVATION)
TC_SH - (TRAFFIC CONTROL SHEET)
TCP - (TRAFFIC CONTROL PLAN)
TCPH - (TRAFFIC CONTROL PHASING)
TITLE_SH - (PROJECT TITLE SHEET)
TOPO - (TOPOGRAPHY)
TPMD - (TEMPORARY PAVEMENT MARKINGS)
TS - (TYPICAL SECTIONS)
TSI - (TRAFFIC SIGNAL)
VS - (VEGETATION)
WK_SH - (WORKING SHEETS)
XS - (CROSS SECTIONS)

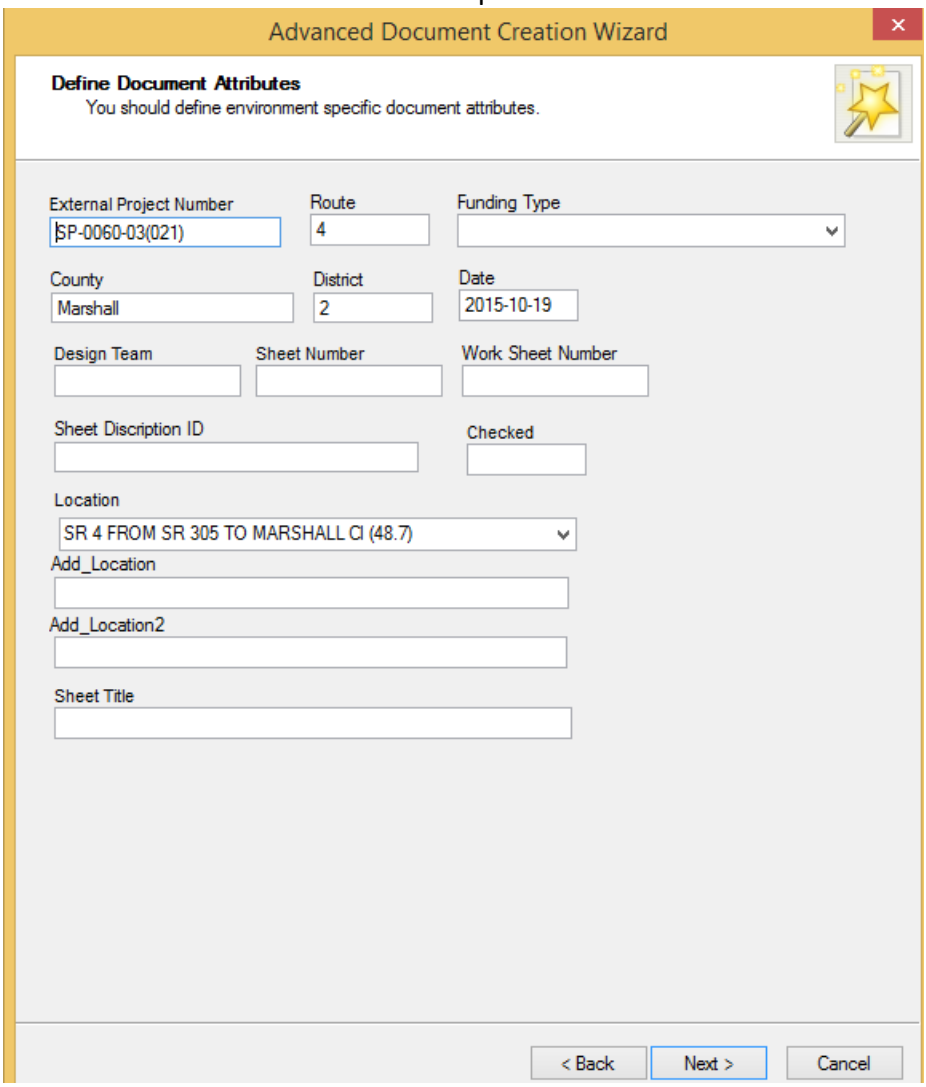
- Optional_Desc adds a user defined description to the file name. An example would be **20Scale** for a 1"=20' scale alignment file if multiple scaled drawings were needed.

9) Once you have selected the correct Sheet Type and Discipline, click the **Generate** button to generate the next Sequence Number. This assures that no two documents have the same name. Preview the name and then choose **Next.**

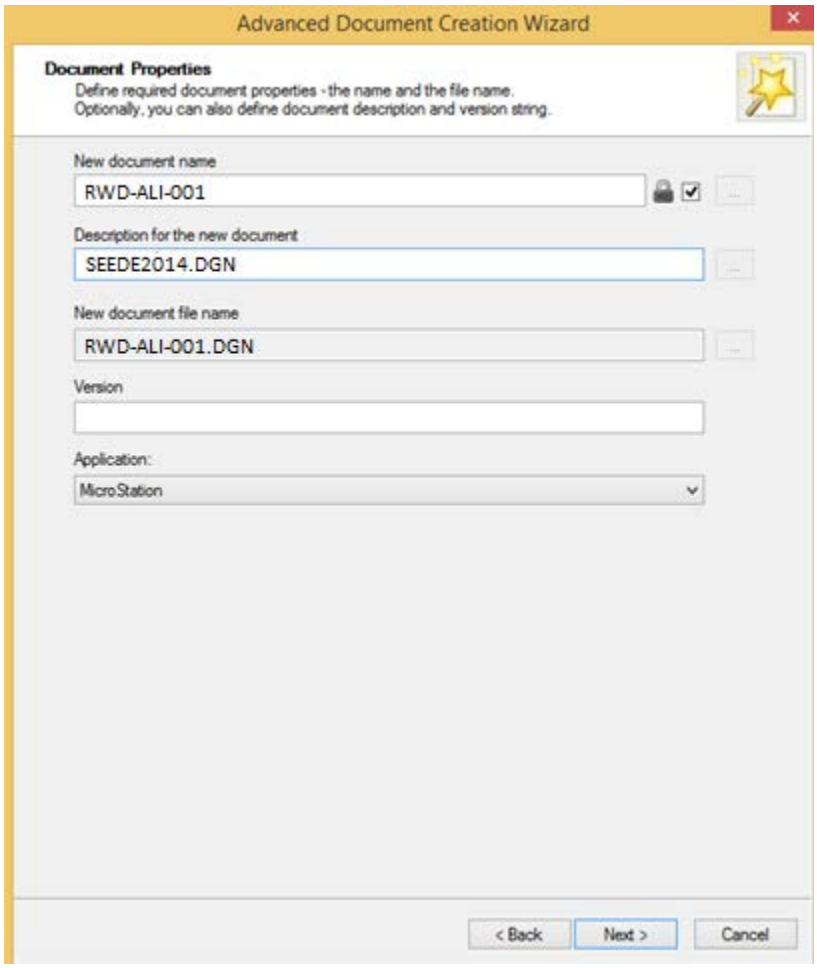


10) The next dialog is filled with some optional attributes to fill out. You can fill them out or simply skip this dialog by clicking **Next**.

Note: The document attributes are specific to each interface.

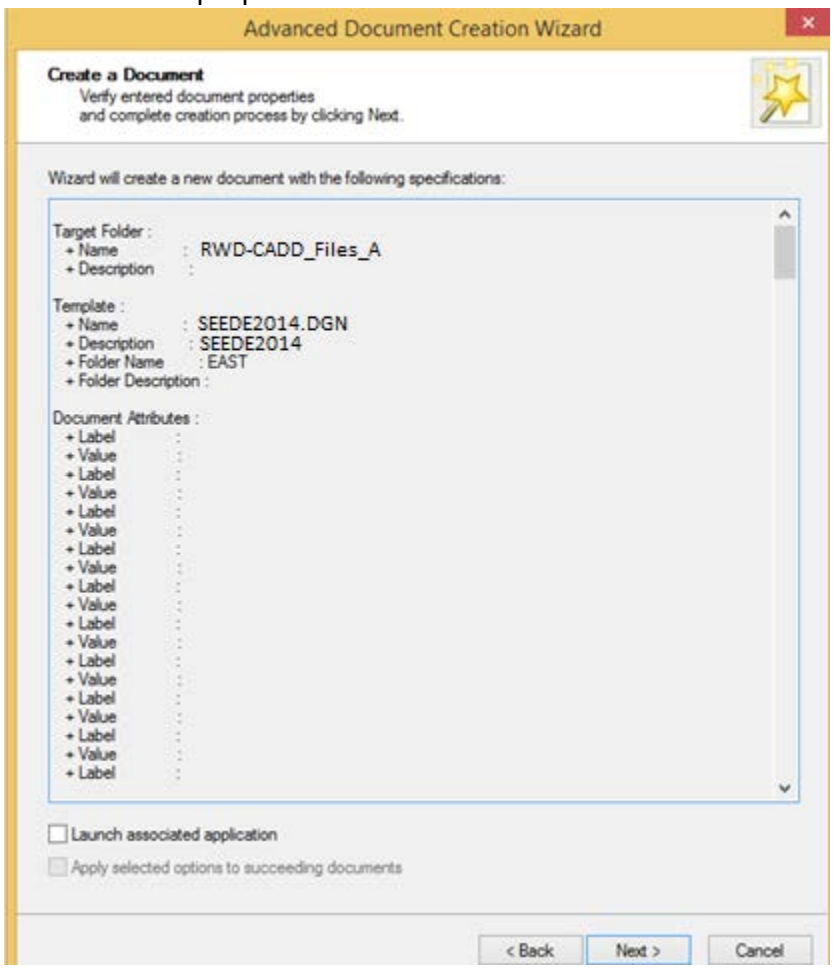


11) In the next Dialog box you will fill out the Description for the new document. The dialog box may be left as is but this description is listed next to the file in PW and can add valuable information to what is contained in the document.



Once you have entered the Description, click **Next**.

12) The Final Dialog is a review of the Document properties. Review this information to ensure that all properties to the new document are correct.



13) Click **Next** and your new document will be created. Once the wizard is done creating your document, click **Finish**.

Now that your new document is created, double-click on it and MicroStation will open the new document which is shown below.

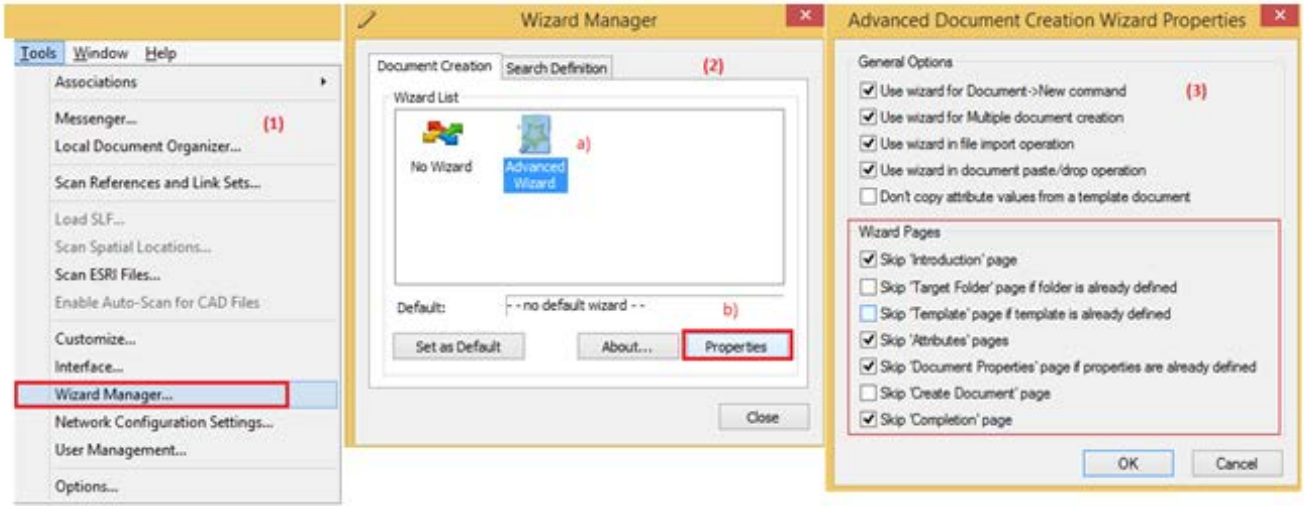
Out to	Name	Description	Created	Updated	File Name
	RWD-ALI-001	SEEDE2014	11/6/2015 8:58:12 AM	11/6/2015 8:59:36 ...	RWD-ALI-001.dgn

Notes:

- The above workflow for creating new documents can be used to create any document type including Word, Excel, etc.

- File names begin with the division that created them. Example: SRV, RWD, BRD, etc.

- Some of the dialogs you go through when creating a document can be bypassed by going through the process below and checking the **Skip** page checkmarks under Wizard Pages. These are normally all unchecked but ones you may want to skip are checked below.



- Creating new files from within MicroStation or any application will invoke ProjectWise's New Document application and the file will be created in MicroStation.

2.4.5.2 Bypassing the Wizard

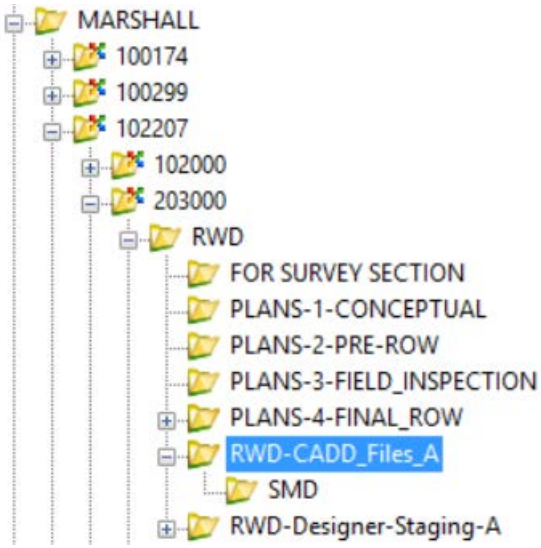
The Advanced Wizard is primarily used for creating DGN files in order to obtain a standard naming convention. Using **No Wizard** can be used for other methods such as dragging and dropping external files, creating test files, and various MicroStation processes (i.e. exporting a terrain.) When using **No Wizard**, attributes are not applied.

2.4.6 Importing Documents

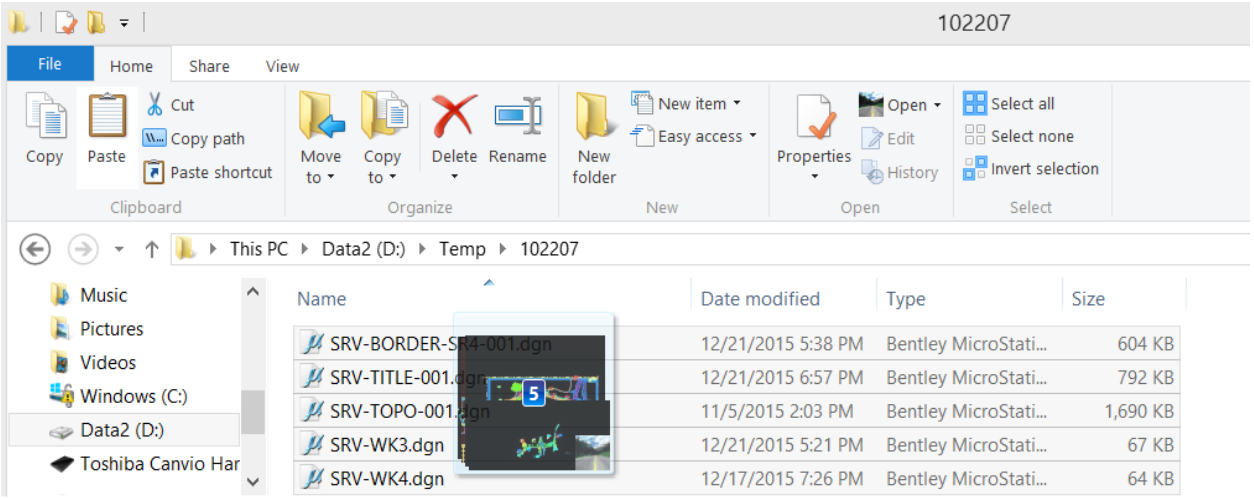
The simplest method to import documents into PW is to select, drag, and drop from Windows Explorer. In addition to covering importing documents, this section will cover **Scan References** and **Link Sets Operation**. The scan references tool looks inside each DGN file, searches for any reference files attached, and tries to resolve them by changing them to appropriate PW references. This means that when a document is open, ProjectWise sees the reference files and downloads a copy to the local machine automatically.

2.4.6.1 Importing Documents

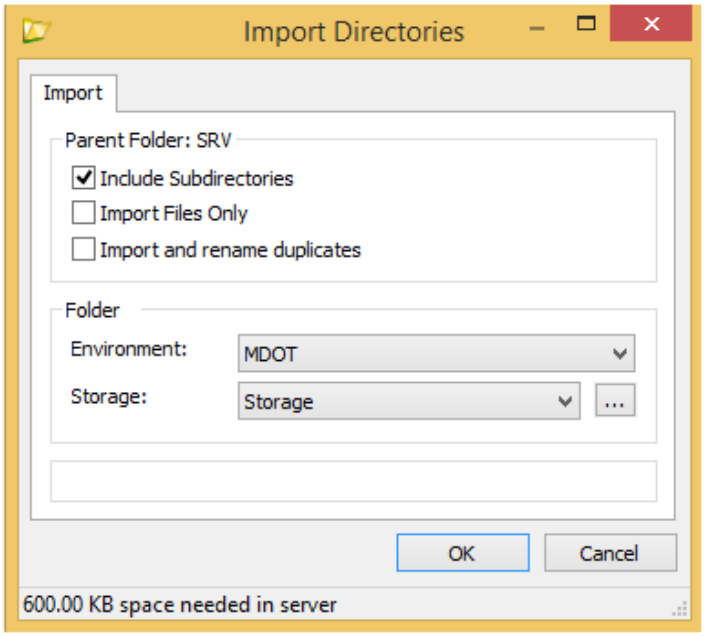
1) Open and login to ProjectWise and locate the desired folder to drop the documents into. For this example we will use D2\MARSHALL\102207\203000\RWD\RWD-CADD_FILES_A



2) Locate the existing files on the local machine in Windows Explorer. For this example we will use D:\temp\102207.
3) Select all documents in the windows directory. Once you have selected all of the folders and documents, hover in the Windows Explorer window and click and hold down the left mouse button, move your mouse into the ProjectWise folder, and release the mouse button.



4) The Import Directories dialog box opens and gives you the following options. Make sure you check **Include Subdirectories**. Then click **OK**.



5) This will begin copying the folders and documents.

Notes:

- If you do not see all of your folders or documents, you should hit the F5 key on your keyboard. This will refresh your view in the same way it does with Windows Explorer.
- Review content and folder structure and clean any unnecessary files/folders prior to import.

2.4.6.2 Scan References and Link Set Tool

The **Scan for references** tool is typically run after the document is imported in ProjectWise in order to establish links. If the DGNs are created in ProjectWise and no references are attached, there is no reason to run this tool as ProjectWise records when the attachment action happens.

In order for ProjectWise to automatically locate and copy reference files, we have to tell it that the files exist and where they are. The tool we will use for this process is the **Scan References and Link Sets** tool. You can access this tool from two locations.

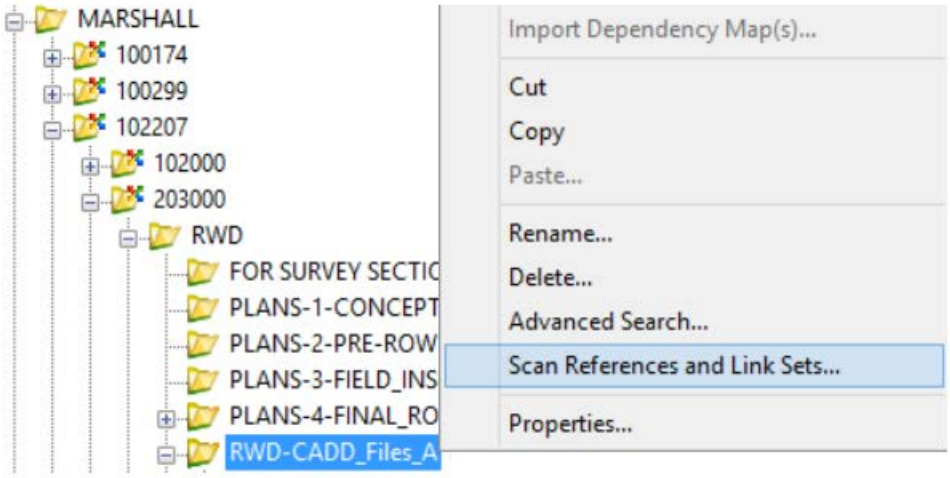
- Under the main menu bar **Tools -> Scan References and Link Sets**

- Using the **right click** on a folder and find the **Scan References and Link Sets** on the drop down menu.

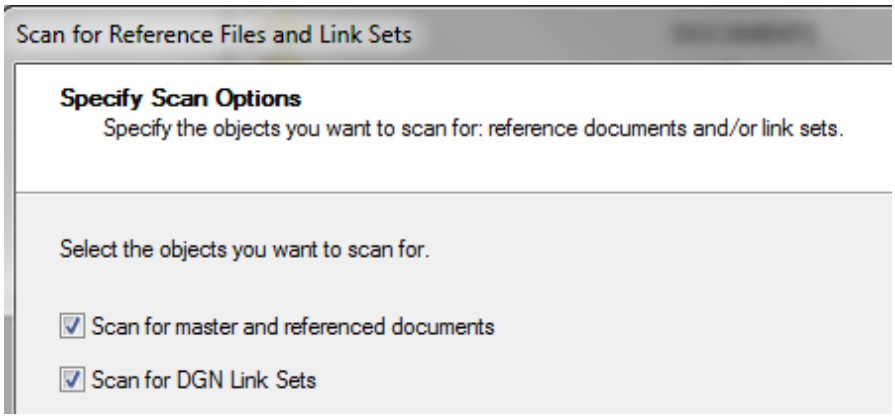
Both methods work the same way, however, the right click method allows you to pre-populate some of the following dialogs. This will ensure that you do not try to scan the whole data source, which will take an excessive amount of time.
For this example, we will use the **right click method**.

1) Highlight the folder in ProjectWise where you imported all of the folders and documents.

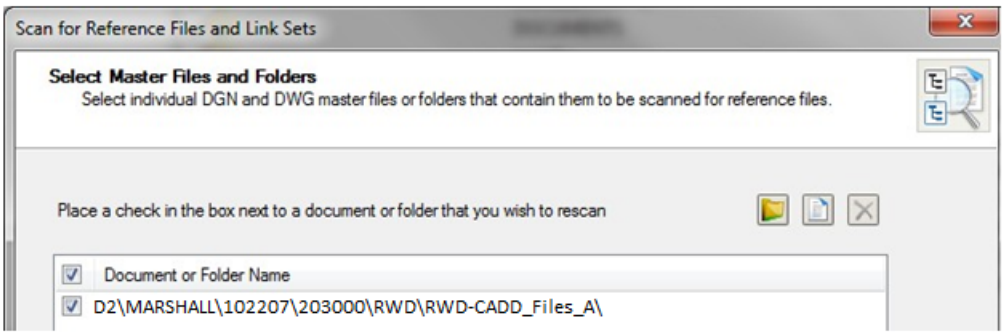
2) Right mouse click and **choose Scan References and Link Sets.**



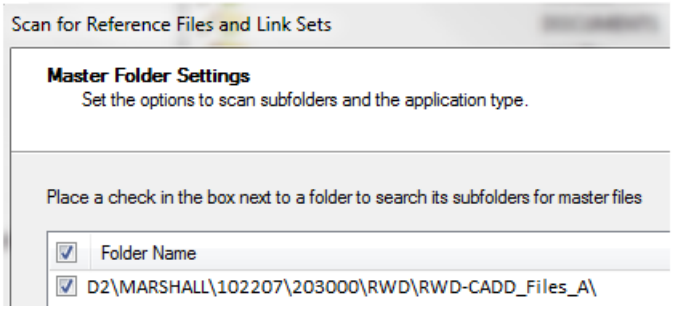
3) Click **Next** on the welcome page.
4) **Check both boxes** and click **Next**.



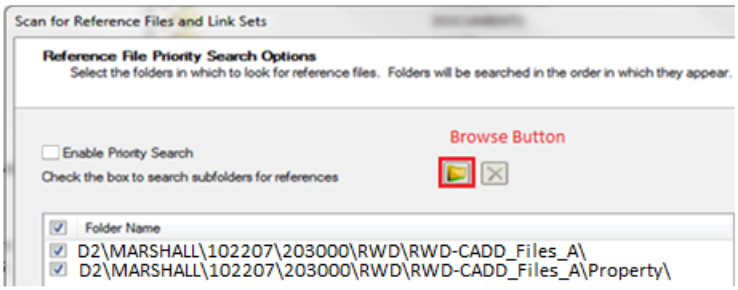
You will notice that the directory is automatically filled in. Click **Next**.



5) **Check the folder name** for the Master Folder Settings dialog and click **Next**.



Note: If you enable the **Priority Search** on the next dialog, you can choose which folders to find and attach the references from in case you have more than one file named the same in different folders. Use the **browse button** to navigate to the proper folders and subfolders.



6) We will not enable the Proximity Search Options. This option allows you to search up in the directory structure. Click **Next**.

7) You now have the option to create a **log file**. It will create a text file with all of the paths that are found and the ones that are not located for whatever reason. This file can be created on your local computer by hitting the browse button and navigating to a folder. For this example we will not save a log file. Click **Next**.

8) Click **Finish** to begin the scanning function.

Note: This process will take a few minutes depending on the number of files being scanned. It is worth the time taken to do this task, because ProjectWise can now locate all the reference files without you having to manually reattach each one. Once the scan references process is finished you will notice that some of your files will have a small icon attached at the bottom of the Bentley MicroStation icon. This means that this file has references attached. By right mouse clicking on the file and choosing the **Set -> Show References** you can see which files are referenced.

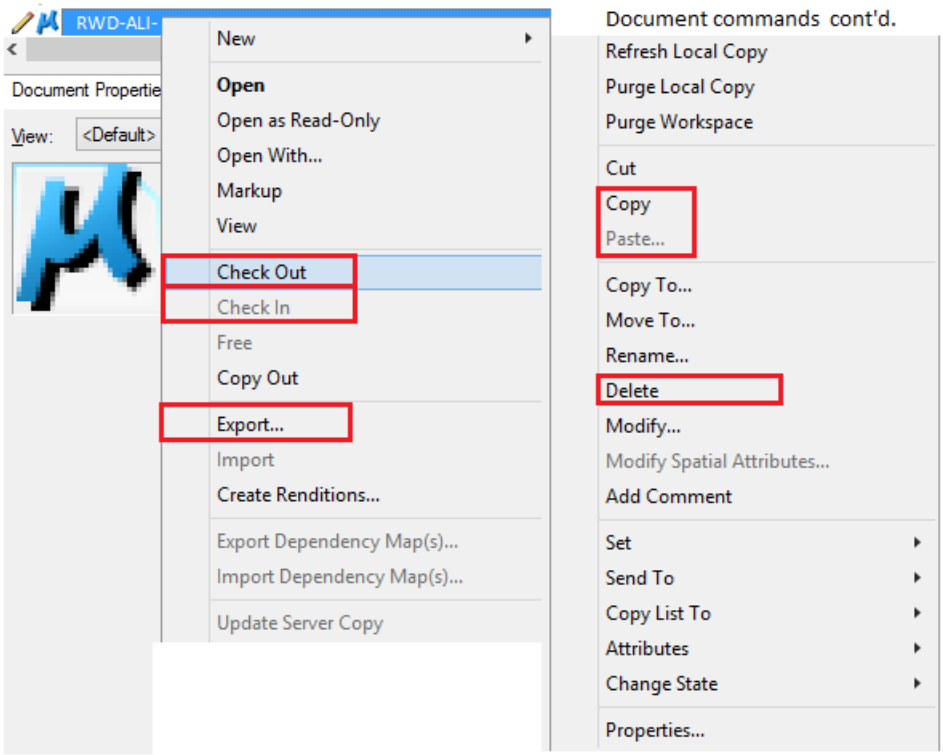
Notes:

- This process will take a few minutes depending on the number of files being scanned. It is worth the time to do this task, because ProjectWise can now locate all the reference files without you having to manually reattach each one.
- Once the scan references process is finished you will notice that some of your files will have a small icon attached at the bottom of the Bentley MicroStation icon. This means that this file has references attached. By right clicking on the file and choosing the **Set ->Show References** you can see which files are referenced.
- Scan for Reference tool works as follows in the background based on the selections in wizard:
  - Downloads and opens every document selected, either picked individually or by folder and subfolders.
  - Reads reference file name information from the drawing file it has opened and searches for the reference file name in the ProjectWise folder(s).
  - The priority list is important in case you have duplicate reference files imported. ProjectWise will link back to the first file name it found based on priority of the folders where that file lives.
  - Once the reference file is found, ProjectWise records association based on the internal document ID so file names and location within ProjectWise is not important anymore.
  - If the reference is not found in the folders, the tool will report in the log as an error. However, what that error means is ProjectWise did not find a reference file in the folders given; that reference file may have been imported to the different folder or not at all.
  - Once all references are found, the master document is checked back in and the tool proceeds to the next file on the list.

2.4.7 Opening Files in PW

To Open a file:

1) Double click the file and it will be checked out and opened. This process is the preferred method.
2) Right click the file and choose **Check Out** or **Open** as shown below**.**



You can see other document commands in the menu above. The ones in red are used often and explained below.

Check Out – Downloads the copy locally for work, but does not open in application.

Check In – MDOT automatically checks in dgn files, however, this command checks any document in and saves the changes.

Export "Send to Folder" - Copies to the local computer but does not check out, hence changes are not saved to PW.

Export –Locks the file and the changes can be re-imported.

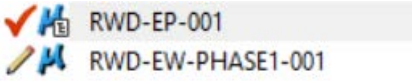
Copy and Paste – Used to copy files from one PW folder to another.

Delete – Deletes the file.

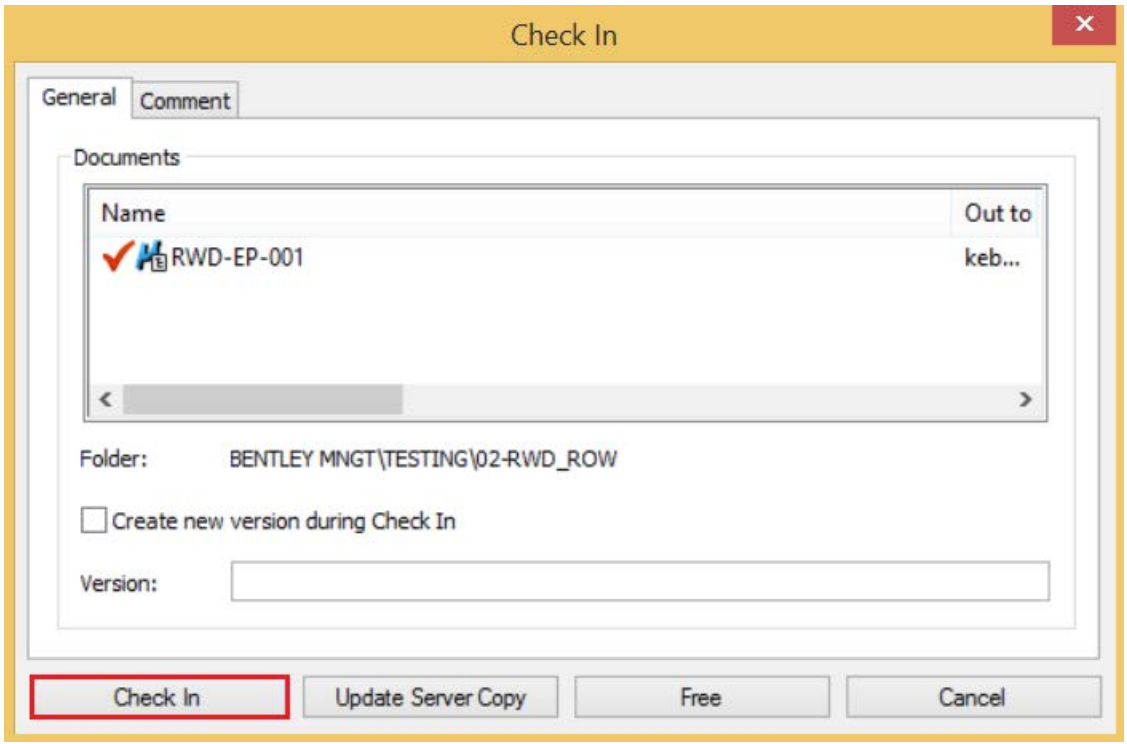
Free – Is not highlighted but moves the file from the "check out" state, but does not save changes. **ALL WORK WILL BE LOST IF YOU CHOOSE FREE.**

2.4.8 Checking in Files in PW

When a file is checked out, a red check replaces the pencil (write) next to the file.



When you exit MicroStation files, PW is set to automatically check the file in. With other file types, you will be prompted to **Check In** the file in as shown below.



NOTE: <u>FREE will check the document in but not save any changes.</u> <u>Generally you will not use Free as it could cause loss of data.</u>

2.4.9 Preview Pane

At the bottom of the preview pane of the ProjectWise Explorer interface, there are tabs that may provide further details on selected files. An example is the Photo Preview tab that previews content of a selected word document, image or design file.

2.4.9.1 Example Survey document

DTM.dgn	DTM	DTM.dgn	kparker	8/22/2014 9:45:02 AM
feacode.err	feacode	feacode.err	kparker	8/22/2014 9:45:03 AM
geopak.rpt	geopak	geopak.rpt	kparker	8/22/2014 9:45:03 AM
geopak.rsc	geopak	geopak.rsc	kparker	8/22/2014 9:45:04 AM
gpkdcolldata.bin	gpkdcolldata	gpkdcolldata.bin	kparker	8/22/2014 9:45:05 AM
gpktools.rsc	gpktools	gpktools.rsc	kparker	8/22/2014 9:45:06 AM
gprefer.rsc	gprefer	gprefer.rsc	kparker	8/22/2014 9:45:07 AM
ji20okp.jou	ji20okp	ji20okp.jou	kparker	8/22/2014 9:45:08 AM
ji20omh.jou	ji20omh	ji20omh.jou	kparker	8/22/2014 9:45:09 AM
ji20opw.jou	ji20opw	ji20opw.jou	kparker	8/22/2014 9:45:10 AM
ji20ouf.jou	ji20ouf	ji20ouf.jou	kparker	8/22/2014 9:45:11 AM
job001.gpk	blank	job001.gpk	kparker	8/22/2014 9:45:11 AM

Document Properties | Project Properties | Folder Properties | Photo Preview | Dependency Viewer | Access Control

RWD-200 (SURVEY SUBMITTAL FORM)
11/01/2004

1. PROJECT DESCRIPTION

PROJECT NO. (PE – FMS & EXTERNAL)	NHS-0020-01() 104443
ROUTE	I-20
COUNTY	RANKIN
DISTRICT	DISTRICT 5
TERMINI	I-20 @ W BRANDON INTCH, NEW WB RMP
DATE OF SUBMITTAL	3-15-05
SUBMITTED BY	S.PARKER

SURVEY TYPE
☒Initial Survey ☐Additional Survey ☐Hydraulics (Bridge) Survey Only ☒Final Property

Description of Survey if Additional: ____

Check the items below if they are included with the survey described above.

The following files should be included with the Survey in addition to the files specified in the sections below & the Survey Manual.

☒ ASCII Coordinate Files – All points collected should be submitted in ASCII files.
☒ Raw Data (Data Collector Files) – Place in /raw sub-directory.

☒ **2. CONTROL**

Horizontal and Vertical Control must be shown in a Microstation Design file called TOPO.DGN or CONTROL.DGN. All Horizontal Permanent Control Markers must be
description of the marker, N, E, ELEV (If Vertical ran through marker). Vertical only Benchmarks should be shown with Benchmark stamp information complete. SPC
as Grid to Ground factors must be shown in this file also. All Primary and Secondary Control must also be submitted in an ASCII file called CONTROL.COR

2.4.9.2 Example Design file selected

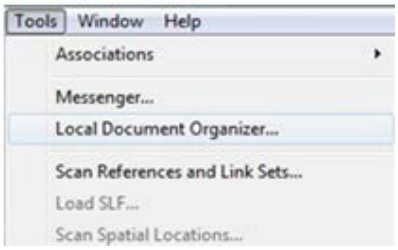
NWRAMP.dat	NWRAMP	NWRAMP.dat	kparker	8/22/2014 9:45:17 AM	1,181 KB
NWRAMP.TIN	NWRAMP	NWRAMP.TIN	kparker	8/22/2014 9:45:18 AM	3,333 KB
padpts.tmp	padpts	padpts.tmp	kparker	8/22/2014 9:45:19 AM	0 KB
profilesI20.ikp	profilesI20	profilesI20.ikp	kparker	8/22/2014 9:45:20 AM	2 KB
projmgr.rsc	projmgr	projmgr.rsc	kparker	8/22/2014 9:45:20 AM	23 KB
RWD-200.doc	RWD-200	RWD-200.doc	kparker	8/22/2014 9:45:21 AM	78 KB
rwdsurv 4-1-10.doc	rwdsurv 4-1-10	rwdsurv 4-1-10.doc	kparker	8/22/2014 9:45:22 AM	69 KB
rwdsurv 6-1-10.doc	rwdsurv 6-1-10	rwdsurv 6-1-10.doc	kparker	8/22/2014 9:45:23 AM	69 KB
SPOTS.txt	SPOTS	SPOTS.txt	kparker	8/22/2014 9:45:23 AM	4 KB
SRV-ATOPO-105536-101000-004	TELEPHONE AND SLOPE PAVI...	SRV-ATOPO-105536-101000-004.dgn	kparker	8/22/2014 9:45:24 AM	285 KB

Document Properties | Project Properties | Folder Properties | Photo Preview | Navigator | Dependency Viewer | Access Control

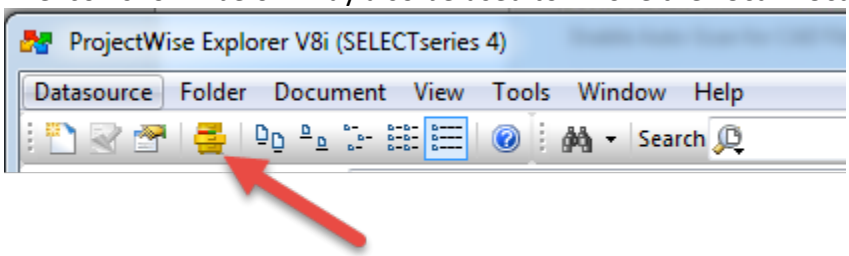
2.4.10 Local Document Organizer

The Local Document Organizer is primarily intended to aid the user in managing ProjectWise files that have been stored locally. The Organizer is the only tool that should be used to manage both Checked Out and Copied Out files from ProjectWise.

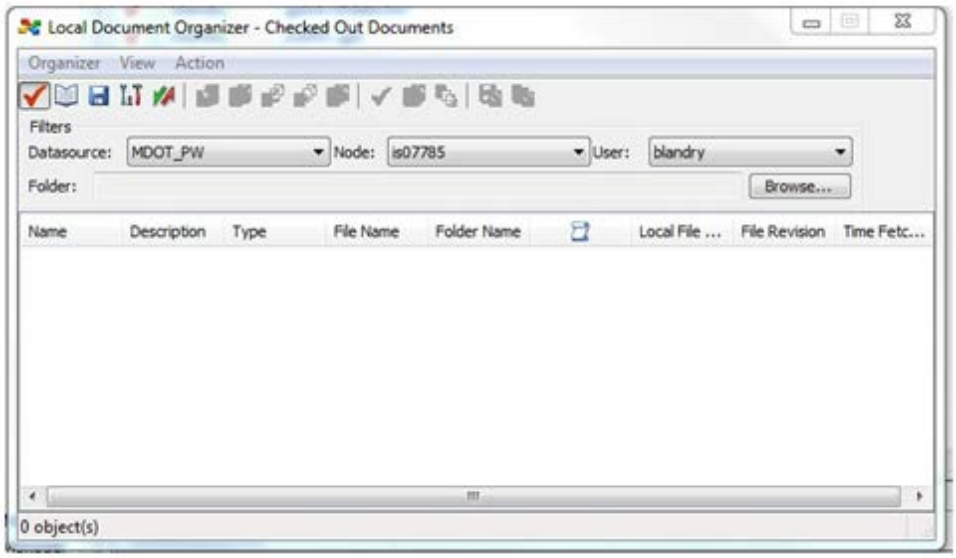
1) Within the ProjectWise Explorer menu, navigate and click the **Tools** menu pull-down, and select "**Local Document Organizer"** from the menu.



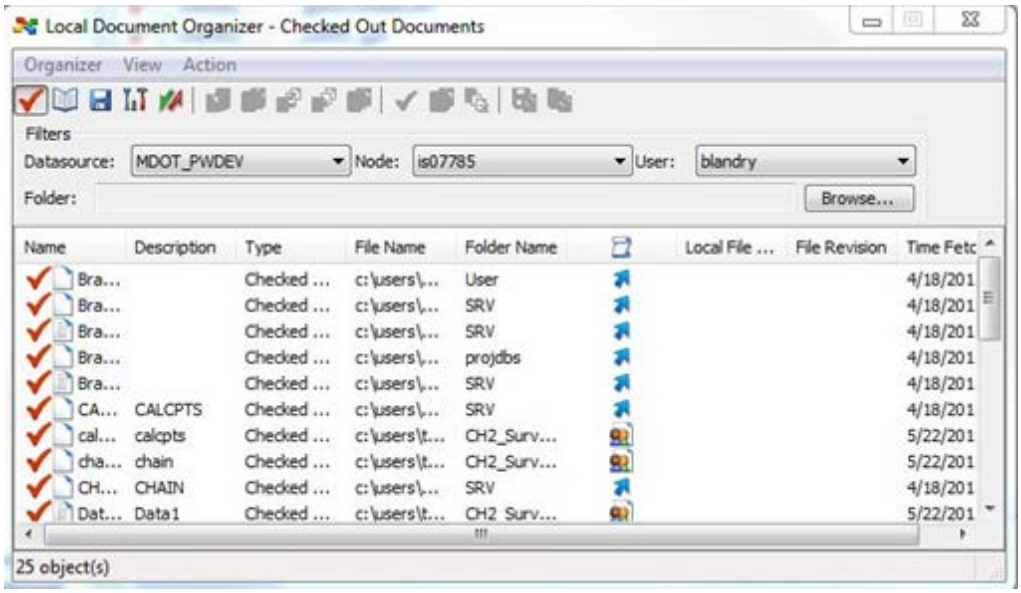
Note:
The icon shown below may also be used to invoke the **Local Document Organizer.**



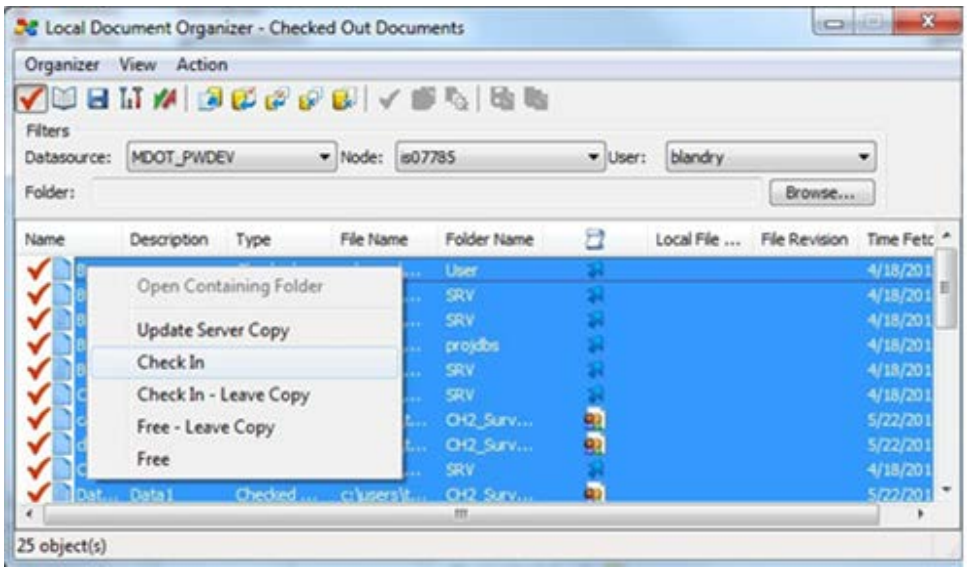
It will open the **Local Document Organizer** dialog box.



2) Select the red checkmark. You will notice that all documents currently checked out to you are listed.



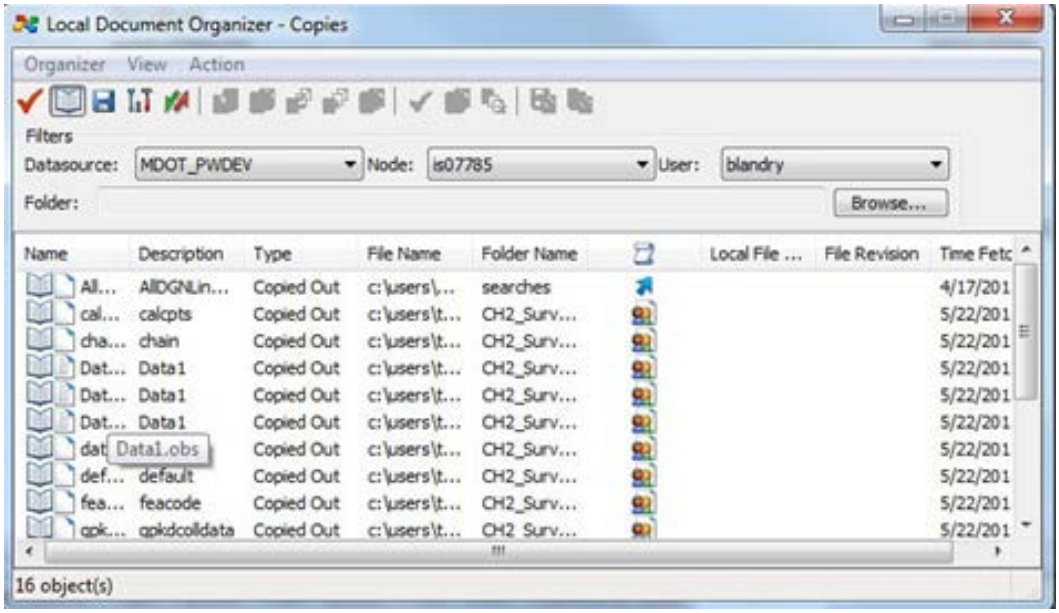
3) Select all the documents. This can be done by selecting the top file and pressing **Ctrl+A** on your keyboard. You can also select them one by one while holding the Ctrl key on your keyboard. Right click the documents and select **Check-in** to update all copies within ProjectWise.



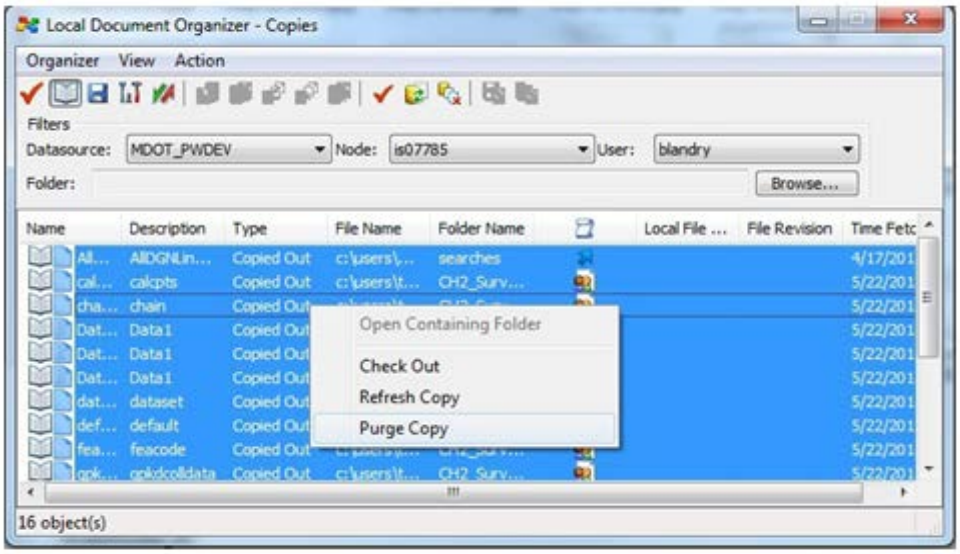
Note: There are several options available from this drop down menu.

- **Update Server Copy** – This option copies the changes made to a file back into ProjectWise for everyone to see while leaving it checked out to you and allowing you to continue to work on the file. No one else can modify it.
- **Check In – Leave Copy** – This option sends modifications and checks in the file to ProjectWise. The document becomes available for other people to check out and make modifications while leaving a local copy on the local computer.
- **Free – Leave Copy** – This option does not send any modification done to ProjectWise and it also frees the document so everyone can check out and modify if needed. It also leaves a local copy of the document.
- **Free** – This option does the same as above, but deletes the local copy from local computer.
  ** **Free** and **Free – Leave Copy** should be used sparingly due to the fact that any changes made to the document will be lost once you free it. The document on the server will continue to be the last known good document and will be available for use by others. The reason for ProjectWise leaving the local copy is performance. When user checks out a document in ProjectWise it knows if there is a local copy to update and only sends the delta to that file. If no local copy exist, a complete file has to be downloaded.

4) Within the Organizer, locate and click the **Open Book** icon to display all Copied-Out documents.



5) Select all the documents. This can be done by selecting the top file and pressing Ctrl+A on your keyboard. You can also select them one by one while holding the Ctrl key on your keyboard. Right click the documents and select **Purge Copy** to remove all copies of documents from your computer. These files are temporary backups from the pw_working directory.



Notes: There are several options available from this drop down menu.

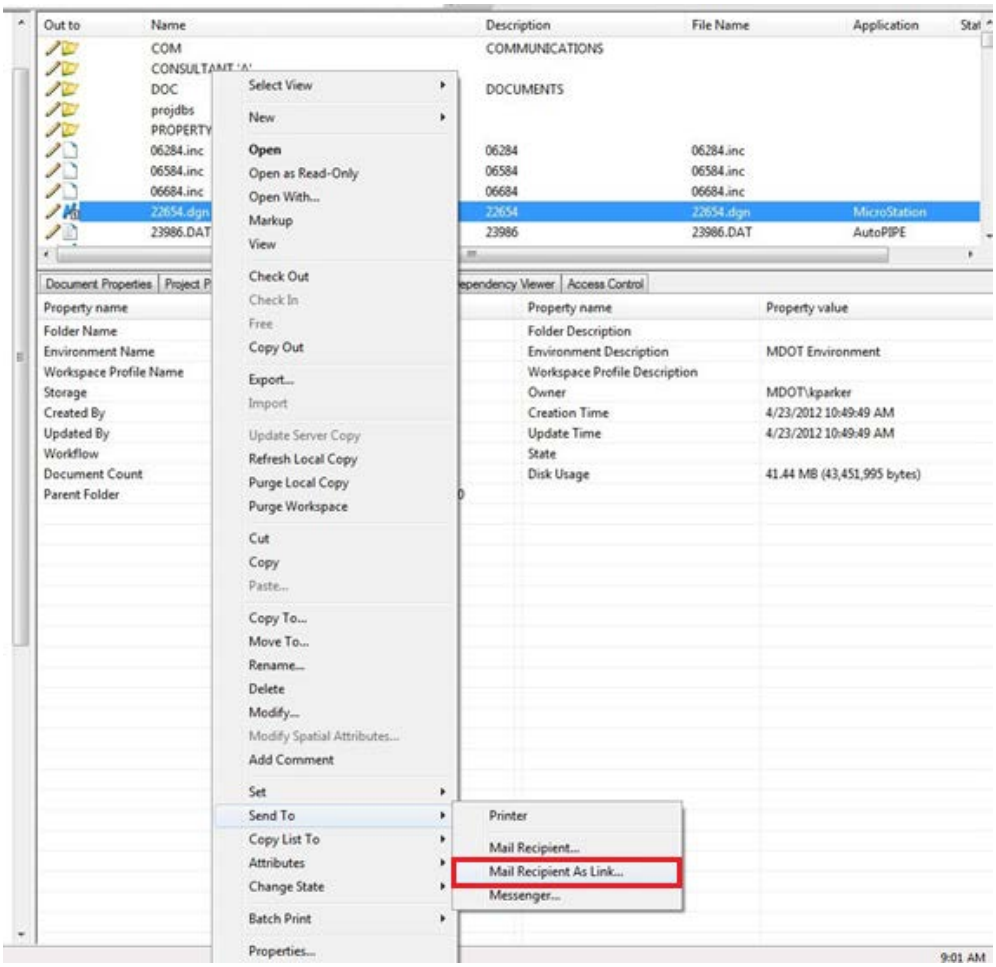
- **Check Out**-will check out all document's within the list to your user account

- **Refresh Copy**- will update all copies that are located on your computer
- **Purge** – removes all copies from your computer

2.4.11 Emailing a ProjectWise Link

1) Locate the file that you would like to send a location link for and highlight and right click the file.

2) With the right click menu up, navigate to the bottom and highlight **Send To**. Then select **Mail Recipient As Link**.



3) Outlook will open. Choose the recipients and send the email like you normally would.

2.4.12 Sub-folders

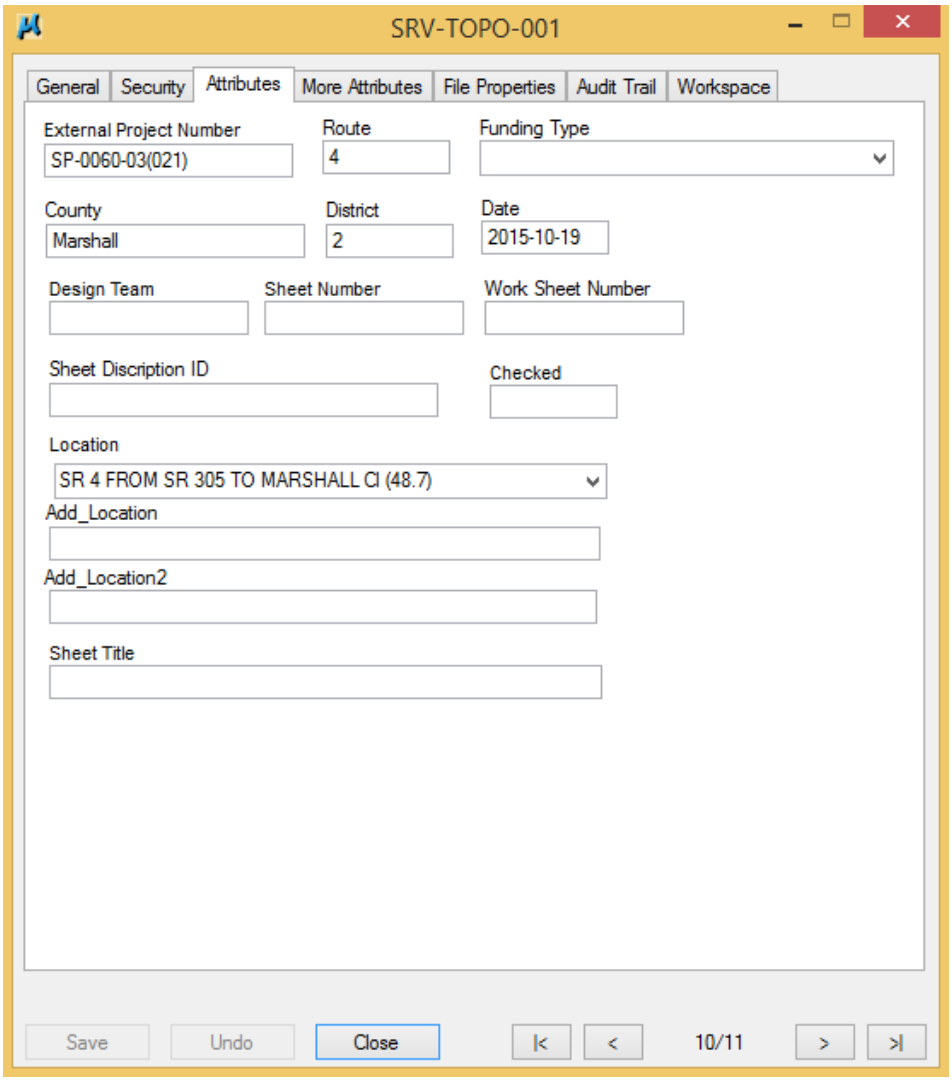
Although the user has the ability to create sub-folders, it is not the ideal workflow to create sub-folders in ProjectWise.

2.4.13 Attributes

Attributes are information associated with files to further help describe the file and search for the file in ProjectWise. ProjectWise has ability to enter additional document attributes. Some of the attributes are delivered with the application and some are custom configured by MDOT. Project number, route, county, file type, design team, etc. are types of attributes configured by MDOT. ProjectWise system attributes are located under the general tab in the properties and the custom attributes appear under the Attributes and More Attributes tabs. Some attributes may be prepopulated at document creation based on the rules set up for MDOT. Also some of the attributes may have a value list to choose from.

In order to review or update document attributes follow the procedure below:

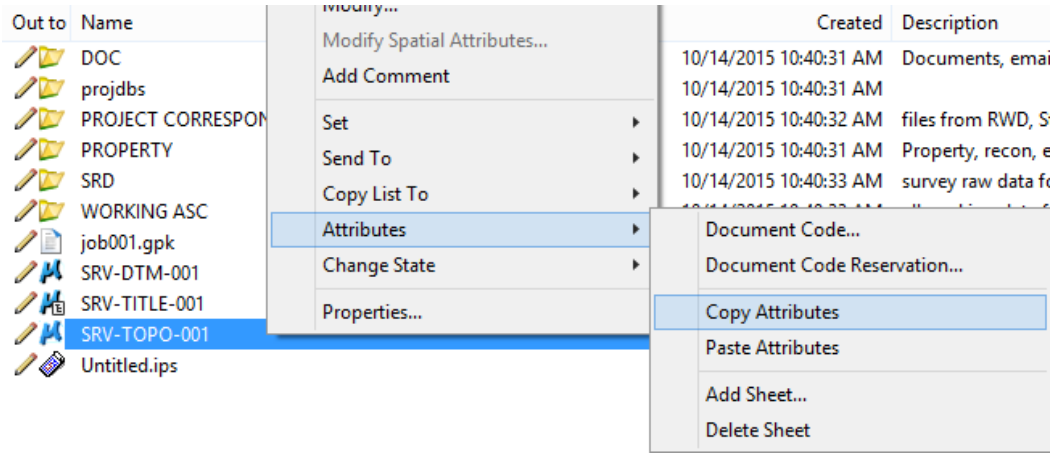
1) Right click on selected document and choose **Properties**, or also by selecting the document and pressing the space bar.
2) The general tab shows PW system attribution like document name, file name, etc.
3) Navigate to the Attributes tab to explore MDOT specific attribution.



4) You can enter and modify information in the form fields and click **Save** button to update the record.
5) Click **Close** to dismiss document property dialog.

Notes:

- Document attributes can be filled in at the time of document creation when using advanced document creation wizard.
- If the attribute tab is blank or different, most likely you need to choose the correct interface in ProjectWise Explorer menu.
- Attributes can be copied from one file to another file using the commands below and choosing the file to **Copy Attributes**, selecting file(s) you wish to copy attributes to, and then **Paste Attributes**.

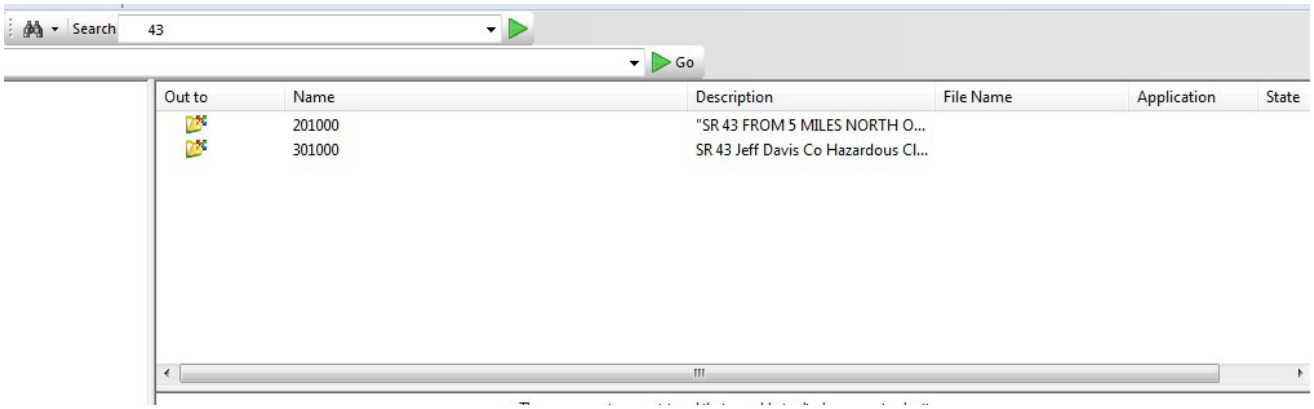


2.4.14 Quick Search

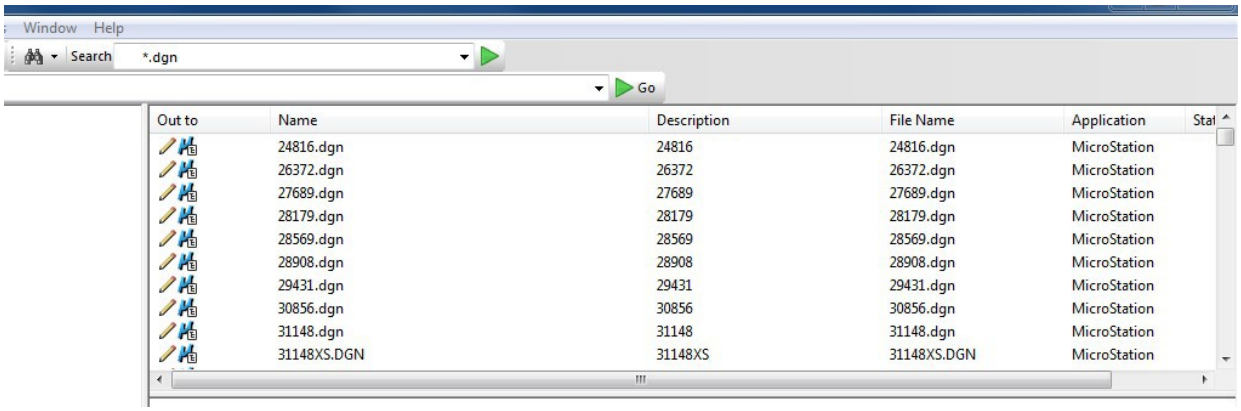
When you are creating documents and project folders, attributes are defined. Attributes are used by ProjectWise when performing search queries. The ability to use attributes as search criteria is why it is important to include as much information as possible when creating documents and project folders.

The search bar is located at the top of the ProjectWise toolbar.

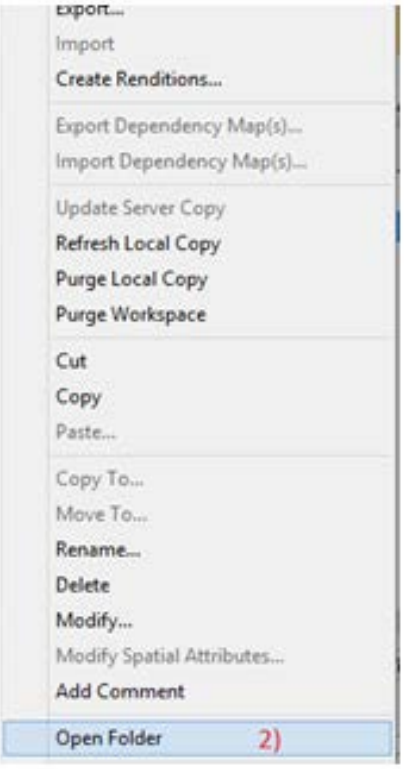
You can type any attribute about a project in this search box and it will find it. The first thing to remember is to **highlight the appropriate folder you want to conduct the search in.**



Another way you can search is by using what is called a **wildcard** in your search parameters.
Example:
***.dgn**



If you would like to locate the folder of where the result document resides, right click and choose **Open Folder**. ProjectWise Explorer will locate selected document in the folder it lives.

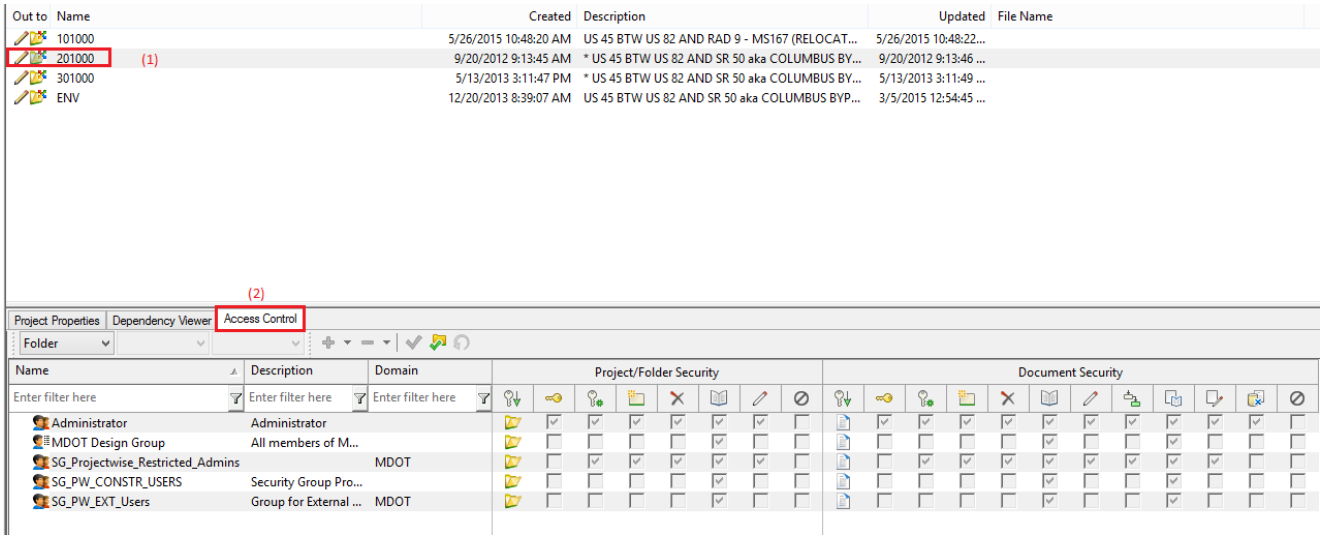


LAB I: PW Processes

1. Open ProjectWise and navigate to your assigned directory.
2. Create the file RWD-ALI-001.DGN (Use seede2014.dgn) as your seed file.
3. Open this file by double-clicking.
4. While in MicroStation, look at the PW window and you will see the document checked out.

5. Exit the file and the document is checked back in automatically.

6. In PW, Open Properties of the document you have created.
7. Navigate to the attributes tab
8. Enter information to the fields if not already populated:
   - External Project Number
   - Design Team
   - County
9. Click Save and close
10. Open properties again to verify changes has been saved.
11. To view what permissions are granted on a given file or folder choose the "Access Control" as shown below.



12. Open the file RWD-ALI-001.DGN again.
13. Navigate to quick search bar. Choose the Train** folder.
14. Type in *ALI* as a search criteria and hit enter.
15. Review search results
16. Reference the file SRV-ALI-001.DGN file from the 101000\SRV folder.

3. RWD WORKSPACE OVERVIEW

3.1 Section Overview

Parallel with the implementation of SS4 and OpenRoads, MDOT created a new workspace interface for each Division based on that Division's specific workflow tasks. It is comprised of some of the past workspace look and feel such as the "MDOT Main" menu but is streamlined with new OpenRoads processes more prevalent. This section provides an overview of some of the new tools and workflows that are detailed in subsequent sections of this document.

3.2 Section Prerequisites

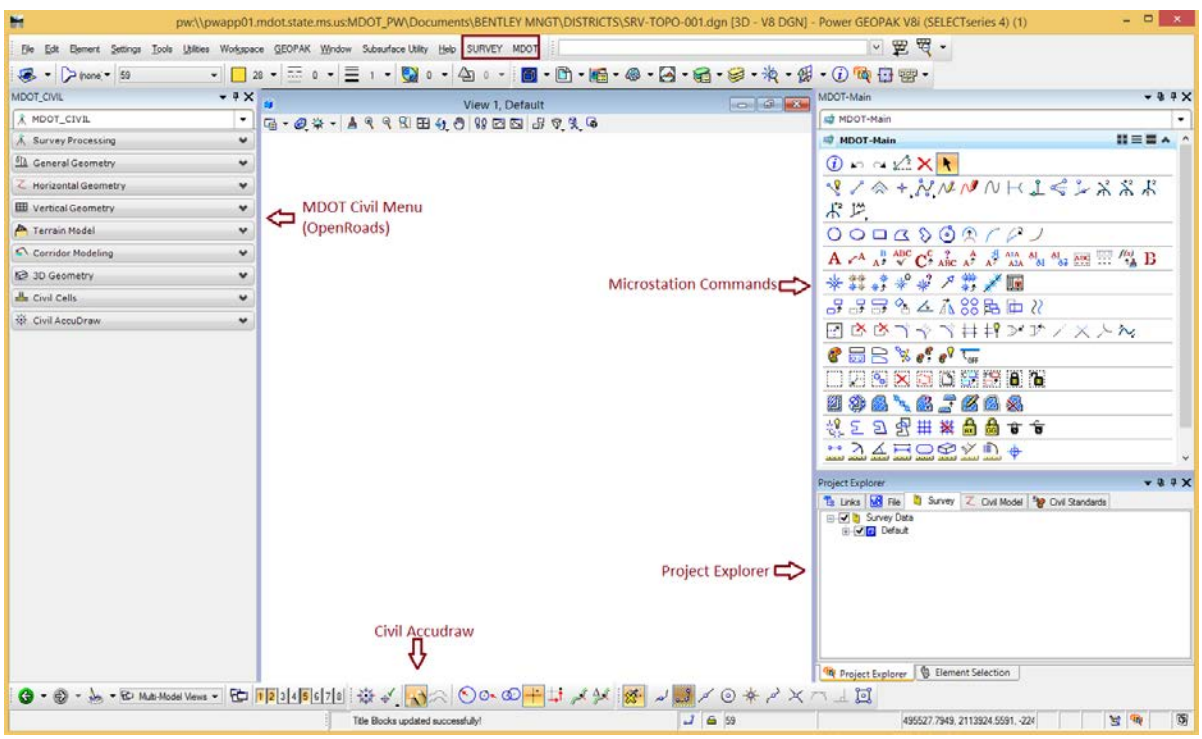
- MicroStation fundamentals
- Knowledge of surveying principals
- Basics of Horizontal Geometry

3.3 Section Objectives

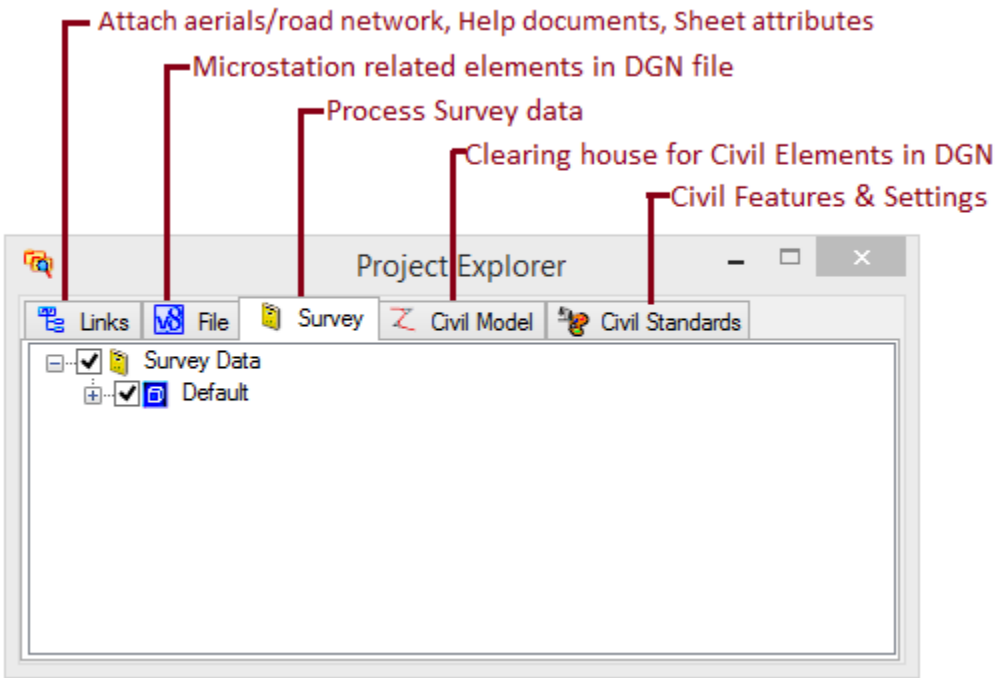
After completing this Section, you will:

- Be aware of the interface changes made
- Have knowledge of new OpenRoads tools
- Easily work with raster data
- Be aware of MicroStation models

3.4 The Interface

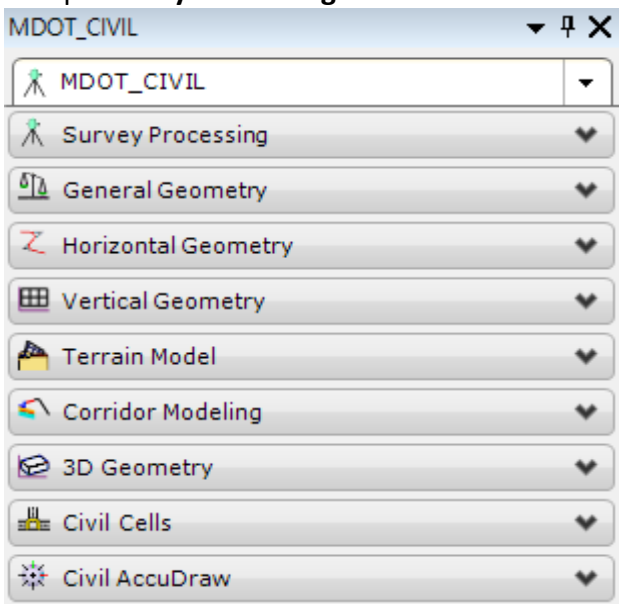


3.5 Project Explorer



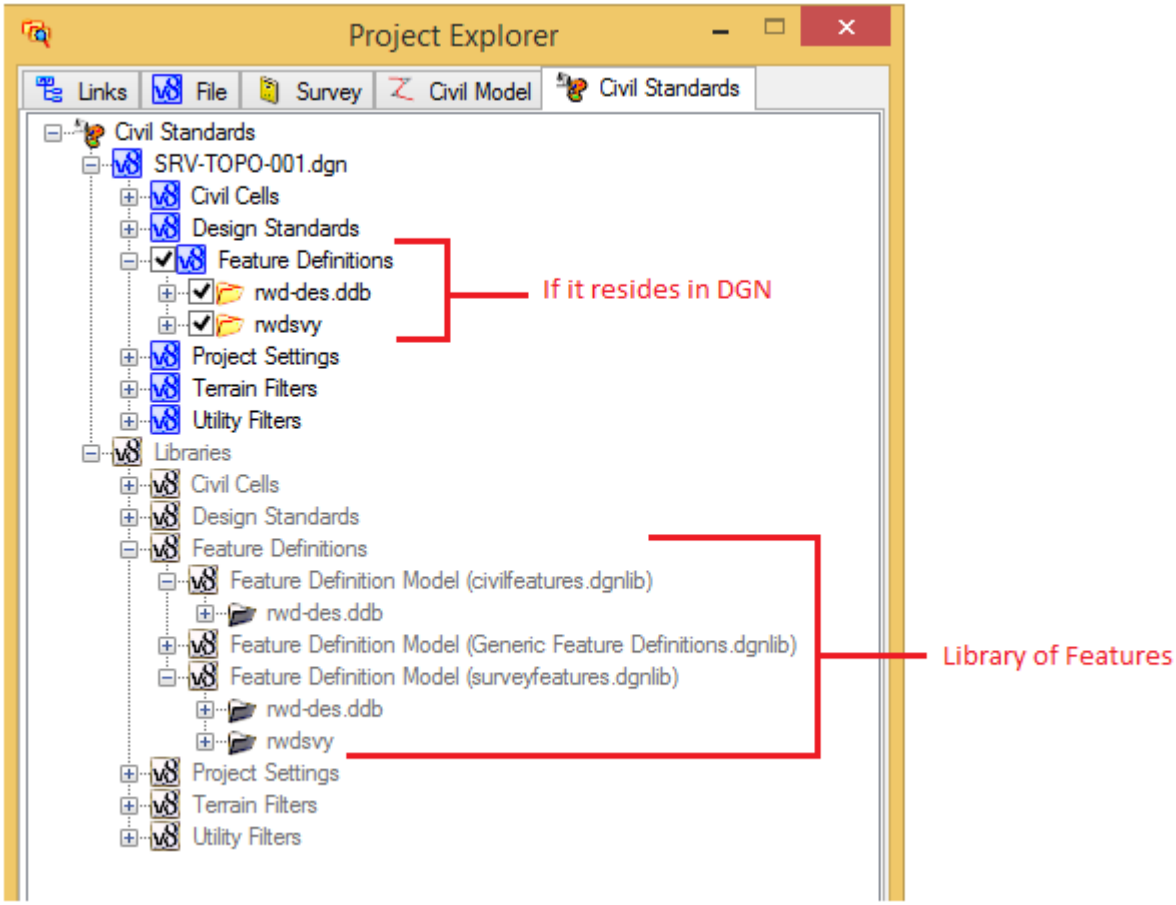
3.6 MDOT_Civil

MDOT_Civil houses OpenRoads new tools. This document focuses on all tools shown below except **Survey Processing**.

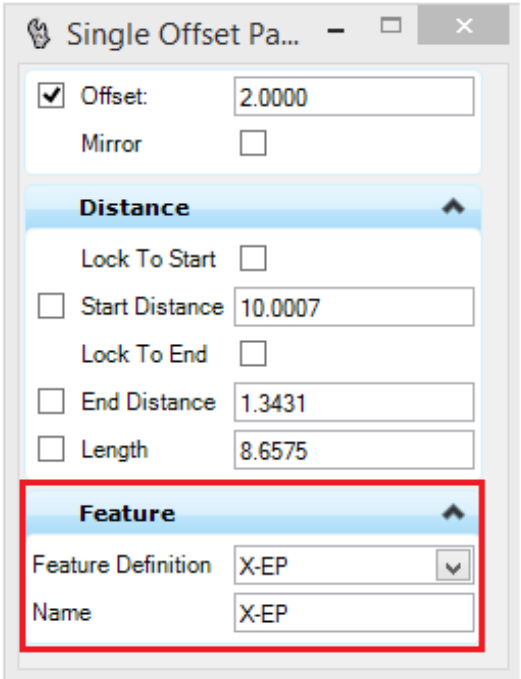
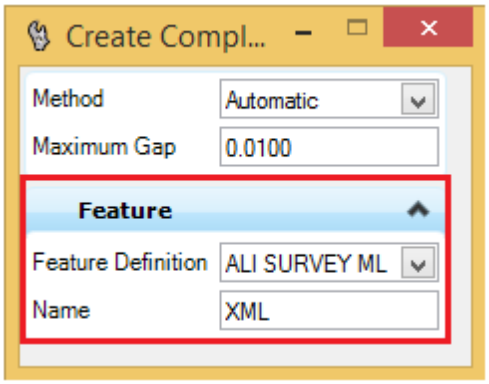


3.7 Civil Features

OpenRoads uses MDOT pre-defined **Features** for point, lines, complex elements (alignments), terrains, templates, etc. These primarily control level symbology but can encompass other tasks such as placing cells, controlling initial terrain display, etc. These can be viewed in **Project Explorer** and are actually copied to the DGN file when used.



A couple of examples of selecting features are shown below.

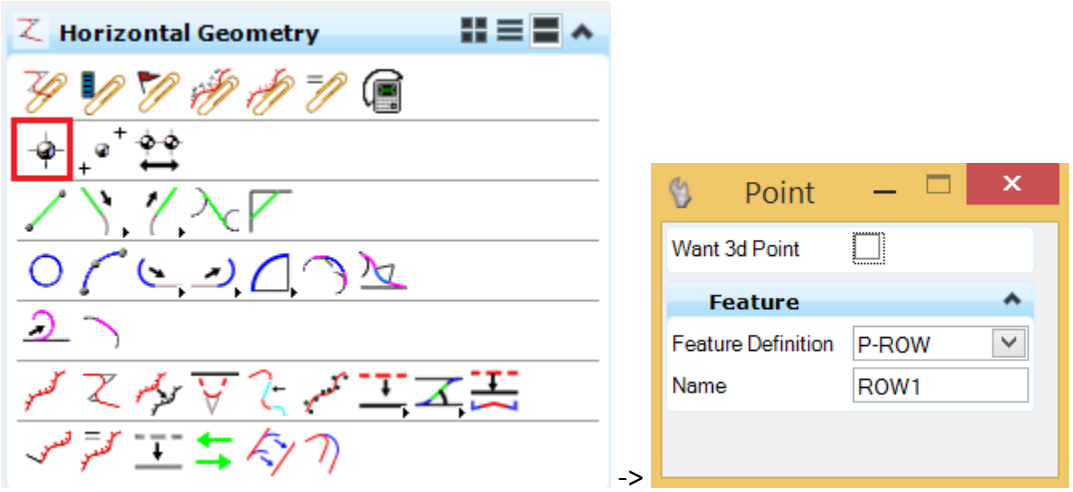
Single Offset Partial- Copying an element parallel and creating existing EP.  	**Create Complex** – Storing an alignment. 

3.8 Civil AccuDraw

Civil AccuDraw is the method to interact in terms of Station, Offset, and Elevation or XYZ Data Points to OpenRoads horizontal and vertical geometry elements. It is discussed in detail in the Horizontal Geometry section below,

3.9 Placing Cells

Placing Cells is now performed through the Horizontal Geometry **Place Point** tool and choosing the correct point feature.



3.10 MDOT Process Changes with OpenRoads

This section gives an overview of the process changes for the Roadway Designer moving to OpenRoads. These changes will be discussed in detail in the remainder of this document.

3.10.1 The Terrain Element

With MicroStation and GEOPAK SS3, terrain models were introduced as a new MicroStation element type which will replace GEOPAK's TIN file. Look in the TOPO DGN file for the terrain if a TIN file is not present in the survey delivery.

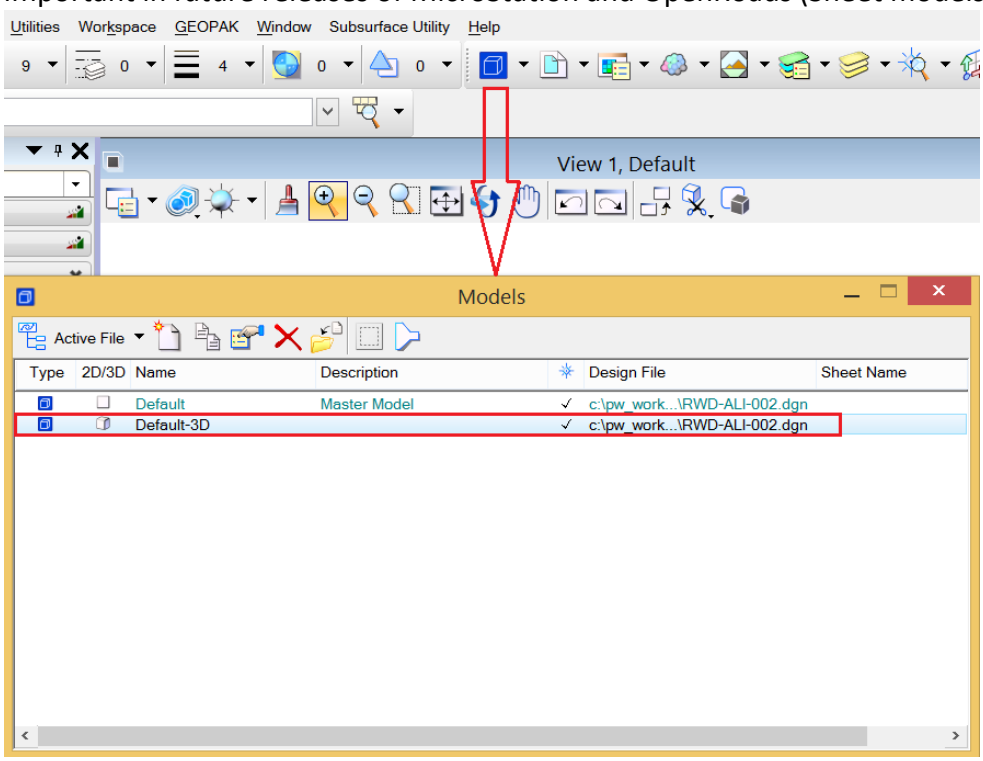
Additional survey, after the initial survey submittal, will be submitted via a SRV-ATOPO-date.DGN file and will contain the new terrain if a new terrain was generated.

3.10.2 Survey Processing and the TOPO file

The TOPO DGN file is now submitted in a 3D file that contains a 2D annotation model. It is best practice to reference the topo DGN's **Default** model from the SRV directory, as well as the annotation model. If annotation needs to be moved you will need to merge the reference into a DGN file located in a writable directory. If annotation, survey cells, or line styles need to be scaled you will need to also merge the references into a DGN file located in a writable directory. This process (at least for scaling related changes needed) will change in the near future as implementation of annotation scale will allow automatic scaling of text, cells, and line strings.

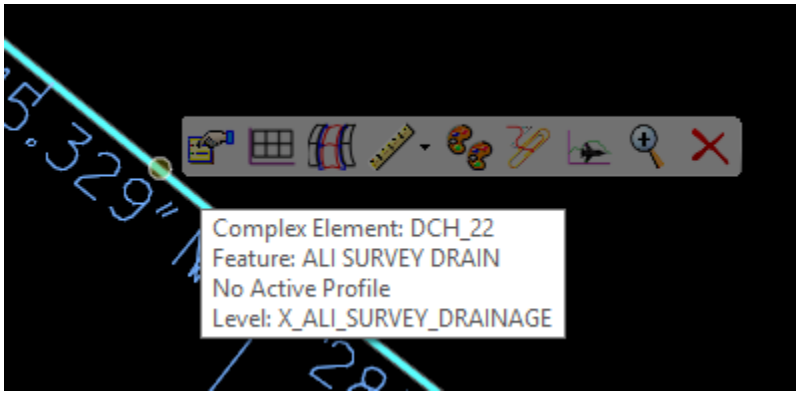
3.10.3 MicroStation Models

MDOT has generally used MicroStation **Default** model in all its processes. With implementation of OpenRoads, this will change as 3d models are created in 2d files and cross-section models are created in cross-section files. Models are much more prevalent in MDOT's workflows with OpenRoads implementation. They will even become more important in future releases of MicroStation and OpenRoads (Sheet models, etc.)



3.10.4 Context Menus

Context menus are menus that are invoked by selecting an element and then hovering over it to invoke the menu. The tools available on the menu are dependent on the element selected.



3.10.5 Horizontal and Vertical Geometry

These tools provide easy graphical editing and dynamic downstream change processes. There is no storage of this information in the external GPK file since all of the elements are stored in the DGN file.

Viewing an existing profile is now just the simple process of accessing the **View Profile** from a horizontal element's Context Menu. It is recommended that all linear elements (Edge of Pavement, Shoulder, etc.) be created using these tools, as opposed to the past process of using primarily for alignment creation only.

3.10.6 Superelevation

OpenRoads has a new process for calculating Superelevation with easy, graphical heads-up editing capabilities. Users also have the ability to calculate with traditional GEOPAK tools and import.

3.10.7 Corridor Models and Civil Cells

PAST -> XS Design with 3D byproduct
FUTURE -> 3D Design with XS byproduct

This new process enables end users to easily create the templates they need to build accurate 3D models for downstream use in MDOT's field construction and inspection processes. Civil Cells provides modeling in areas not easily covered with templates such as intersections, bridge areas, cross-overs, etc.

3.10.8 Ditch Drainage

Is now processed for the Corridor.

3.10.9 Cross-Sections

Interactive cross-section views that work with 3D data are available quickly through context menus, as well as a new process for creating the working cross-sections.

3.10.10 Earthwork

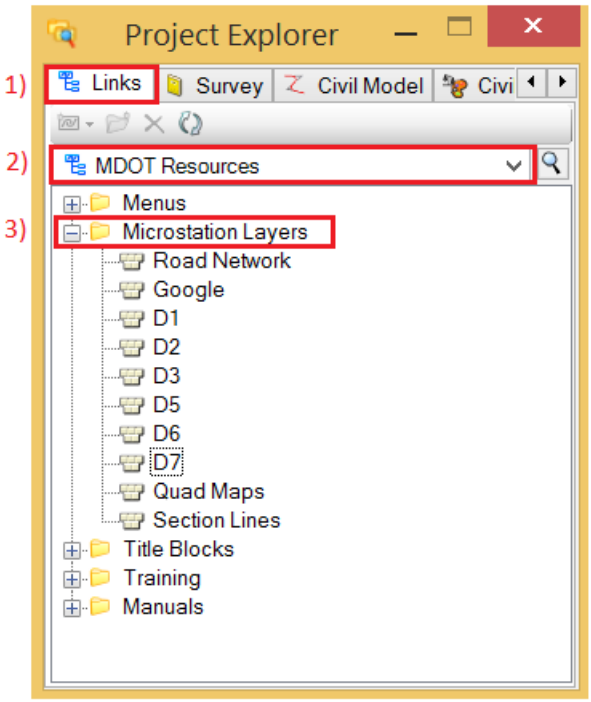
Terrain surface to surface calculations instead of traditional average end area will provide much more accurate earthwork in a more error free process.

3.11 Working with Raster Data

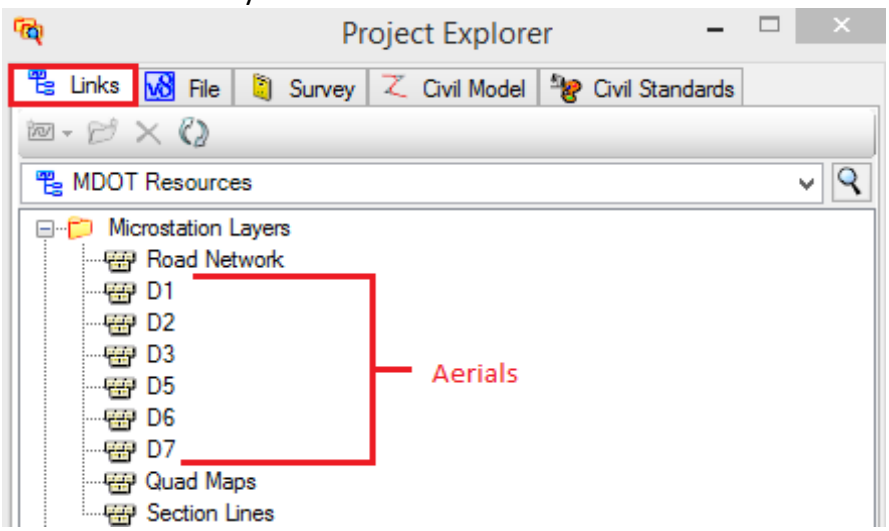
3.11.1 Overview and Steps

Raster data such as aerials, quads, the road network, etc. is now available through the **Links** tab of Project Explorer. To attach as a raster reference, expand the **MicroStation Layers** folder and double click which item you wish to attach.

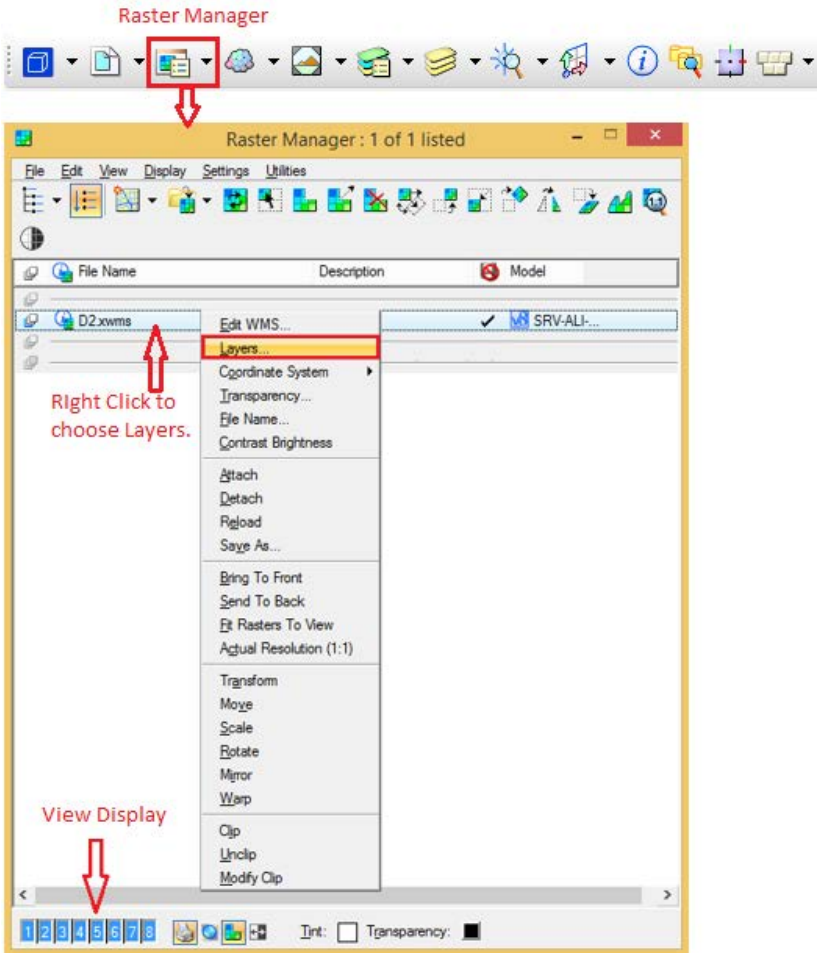
1) Go through the following steps in Project Explorer to view the Raster data available.



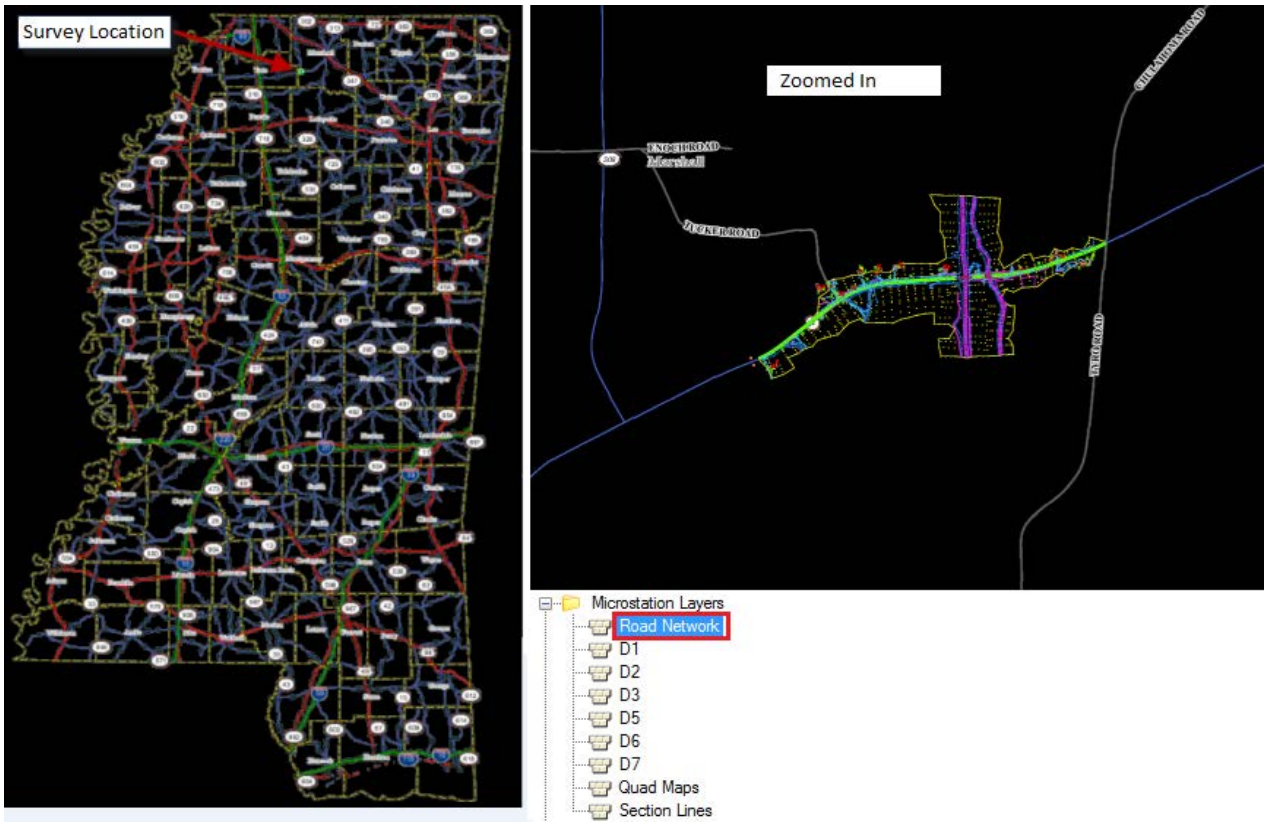
2) Double Click what you want to attach.



3) Once attached, you can open Raster Manager to view the file attached and control the layers displayed and which views they are displayed in.

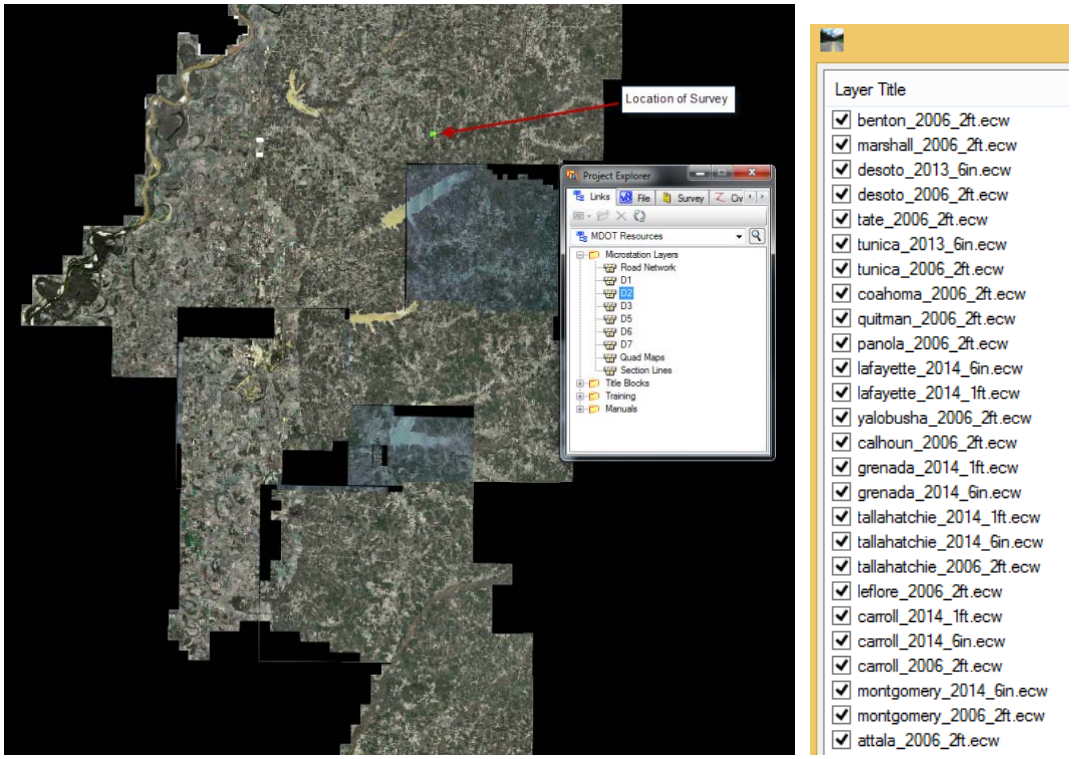


3.11.2 Road Network



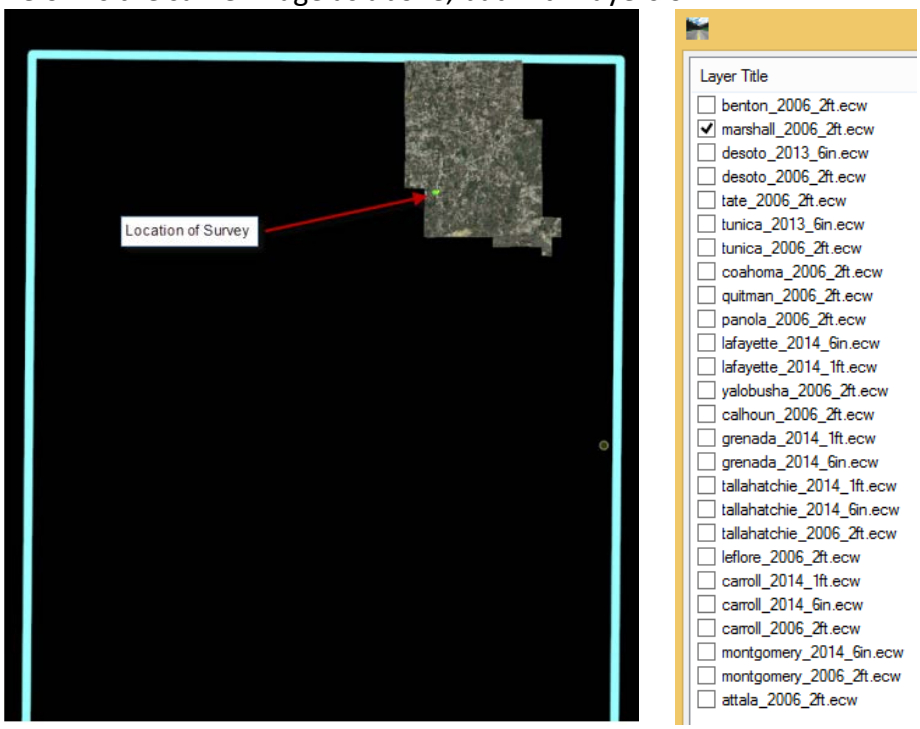
3.11.3 Aerials

D2 shown below.

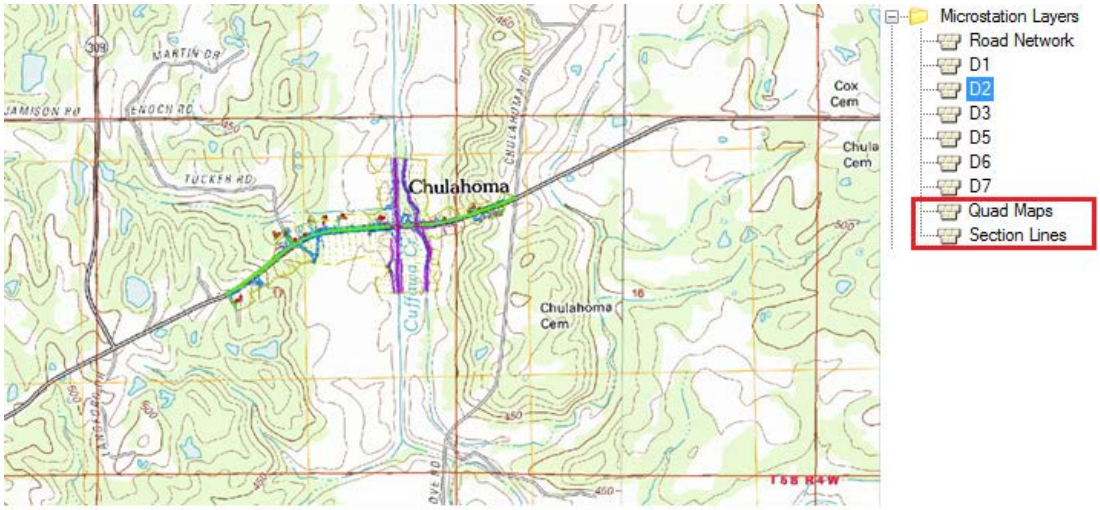


Note: You see the different aerials available in Layer Display and you'll need to turn some of these layers off (those outside project limits) to increase display speed.

Below is the same image as above, but with Layers off.



3.11.4 Quad Maps and Section Lines



3.12 MicroStation

General MicroStation knowledge is assumed for this course but below is an overview of the primary MicroStation processes and commands used in this document.

3.12.1 RWD-Main

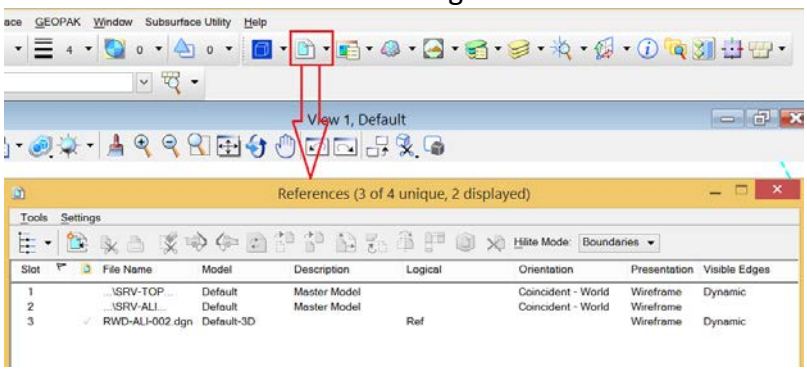
RWD-Main contains most of the needed MicroStation commands.

3.12.2 Models

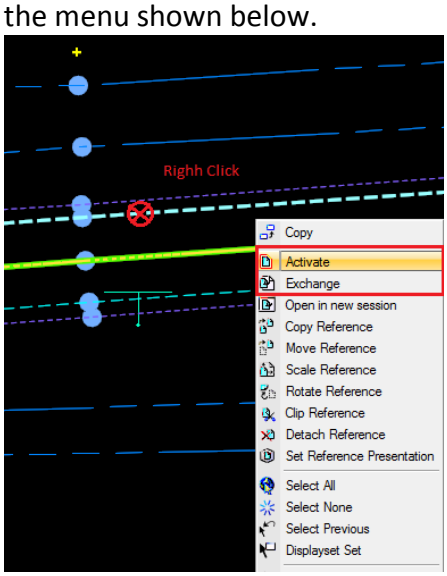
As discussed in the MicroStation Models section above, models are much more prevalent in MDOT's workflows with OpenRoads implementation. They will even become more important in future releases of MicroStation and OpenRoads (Sheet models, etc.).

3.12.3 Reference Files

DGN files can be attached as references through the Reference file command. The Reference file command and dialog are shown below.



One of the more recent changes to MicroStation that is extremely useful to the end user is using a context menu to **Activate or Exchange** to quickly edit referenced data. These commands are extremely useful in MicroStations's daily processes and shown below. These commands can be found by hovering over and then right clicking a reference element to get the menu shown below.



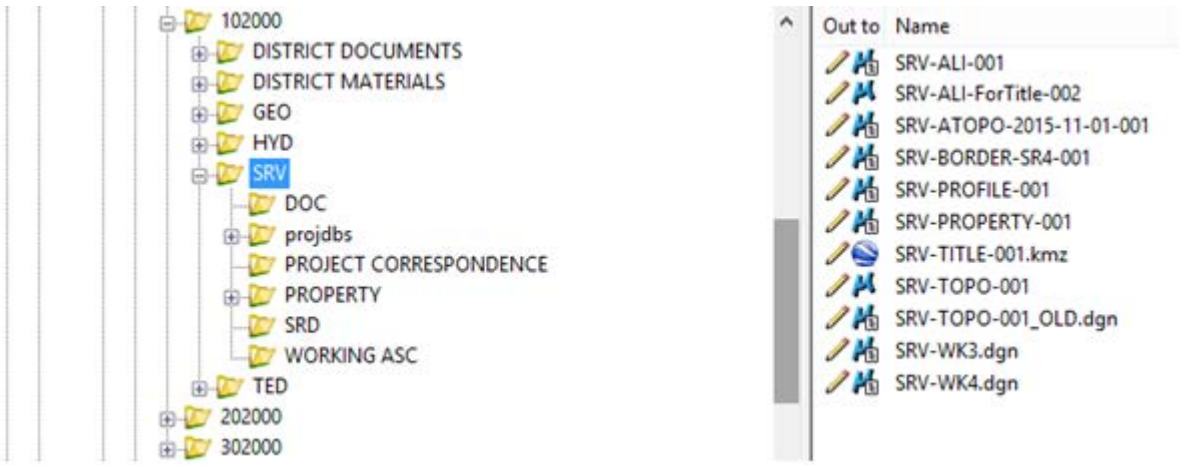
Activate – Leaves the user in the DGN file they are in but activates the reference so edits can be made to the reference file. Right clicking the windows and choosing **Deactivate default** takes the user back to the original DGN file.

Exchange- Opens the reference file in the same area that the current DGN file is in, allowing quick edits.

4. ACCESSING SURVEY DATA

4.1 Folder Structure

Preliminary Survey data is found in the SRV folder located under the District\County\FMS number\10*000 detail. It is preferred practice to reference any DGN files in this folder instead of copying them. GPK's should be copied to the RWD-CADD_Files_* folder. An example of the SRV folder is shown below.



4.2 Terrains

As mentioned earlier in this document:
With MicroStation and GEOPAK SS3, Terrain Models were introduced as a new MicroStation element type which will replace GEOPAK's TIN file. Look in the TOPO DGN file for the terrain if a TIN file is not present in the Survey delivery.

4.3 Additional Survey

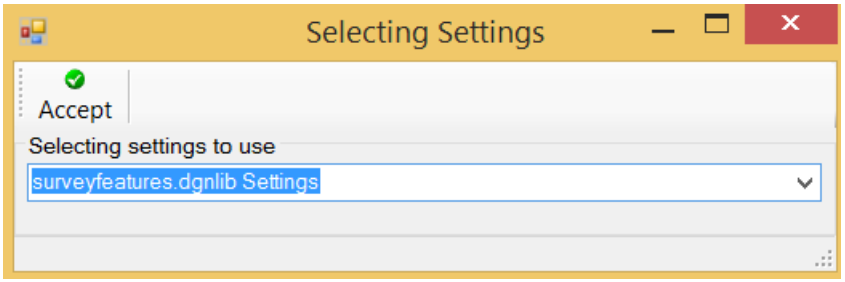
Additional survey will be submitted via a SRV-ATOPO-date.DGN file and will contain the new terrain if a new terrain was generated.

4.4 GPK Creation

If available, the Survey GPK can be copied from the District's SRV folder and used as the GPK during Design.

4.5 Copying

At this time, you should not copy referenced survey elements as this creates a Field Book in the DGN file you copied the element to and you may be prompted the following dialog at various times.



Note: See the **Working with Survey Linear Features** section under the **Horizontal Geometry** section for proper procedures of working with survey data.

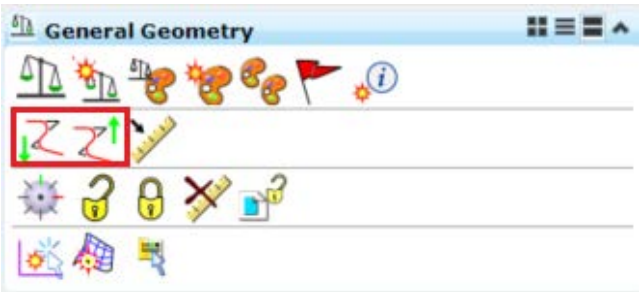
5. GENERAL GEOMETRY

5.1 Overview

General Geometry offers design and feature standards tools, tools to import and export alignments and profiles, rules related tools, and set active commands. This section concentrates on Importing and Exporting and setting the feature definition of an element.

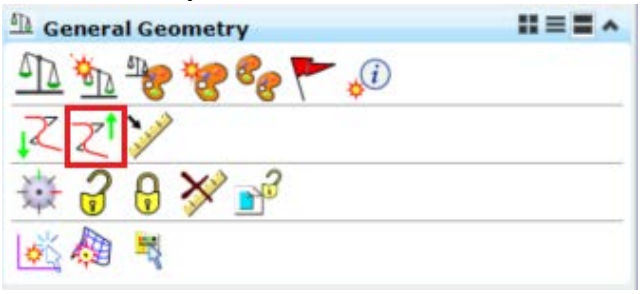
5.2 Importing and Exporting

Although MDOT has its alignment features set up to automatically be stored in the GPK (persisted) and annotated when stored as a complex element (and alignment features chosen), there may be the occasional need to import and export alignments from and to the GPK. These two commands are available through the task **General Geometry** as shown below.

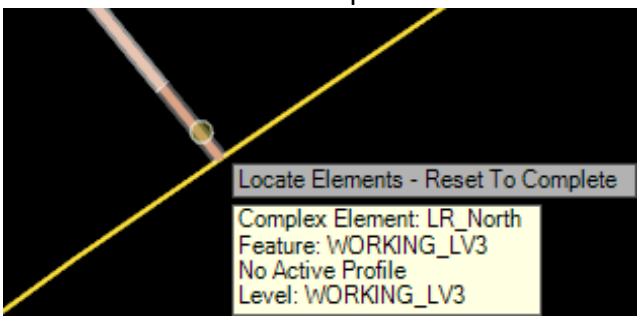


5.2.1 Steps to Export

1) Choose the **Export** command from the **General Geometry** task.

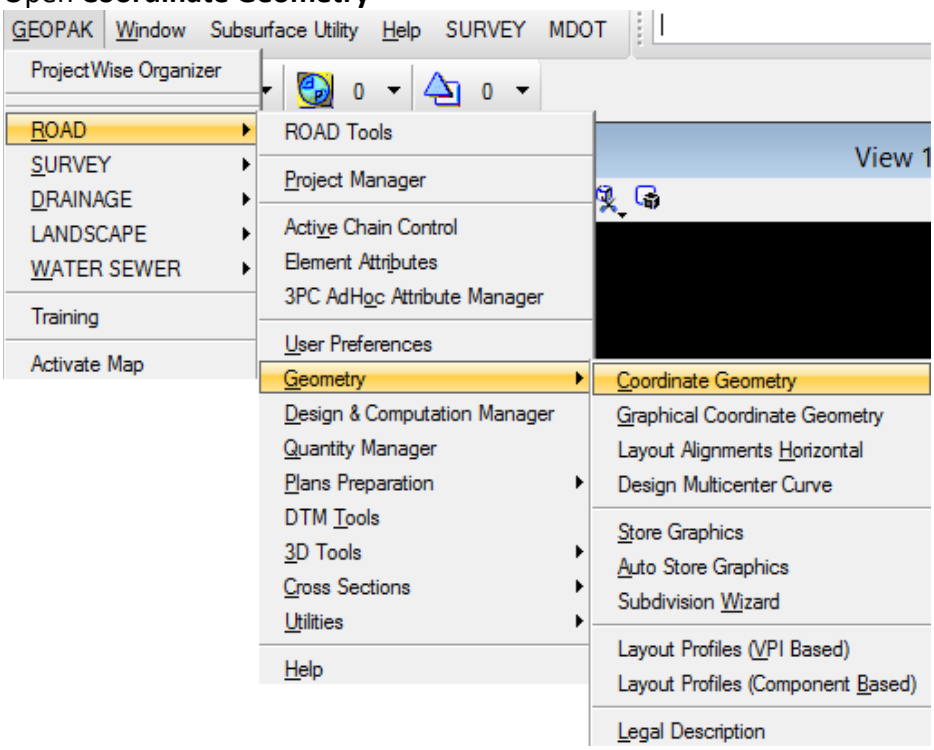


2) Choose the elements to export.

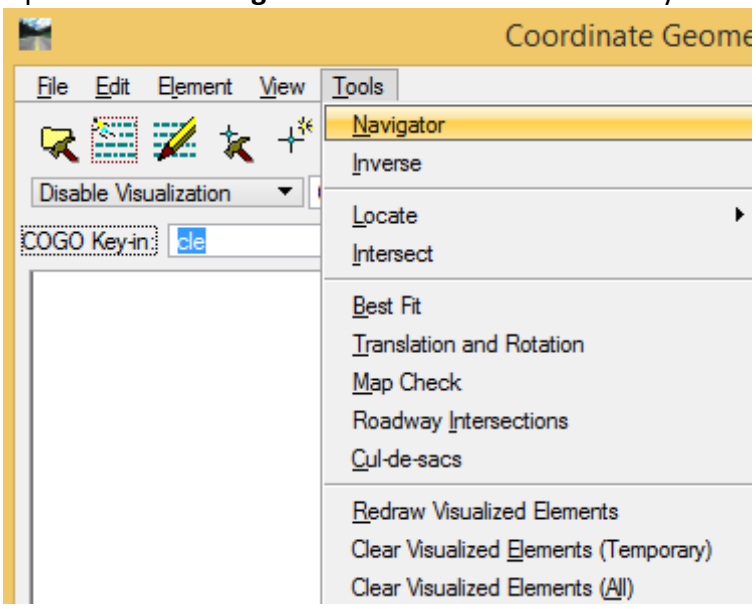


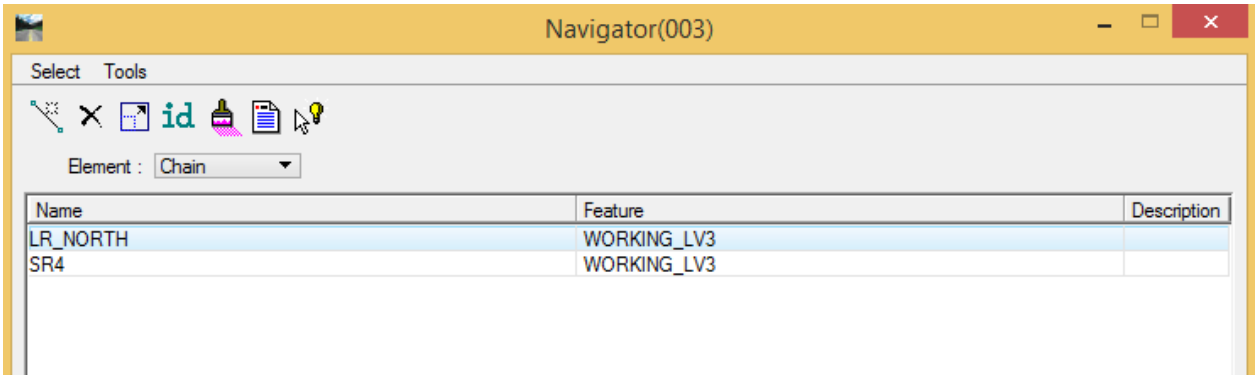
3) Reset and you will then be prompted to choose the GPK to export to. Select it and select **OK**.

4) Open **Coordinate Geometry**



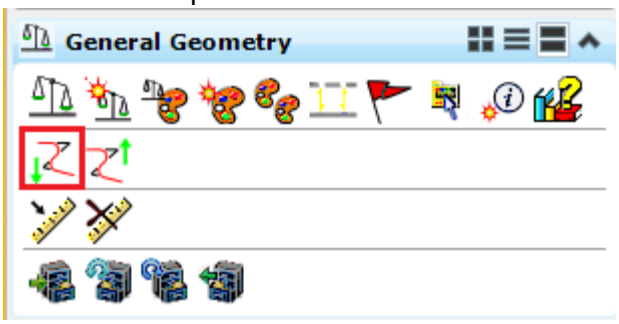
5) Open **Tools** -> **Navigator** and choose **Chain** to verify the alignment was stored in the GPK.





5.2.2 Steps to Import

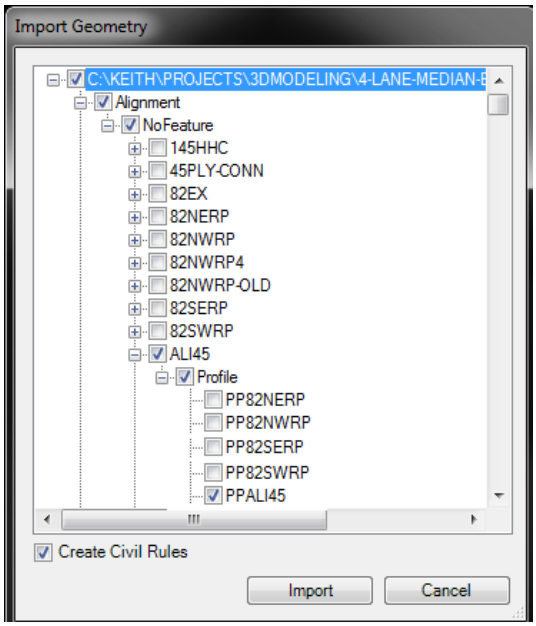
1) Choose the import command.



2) Choose the GPK.

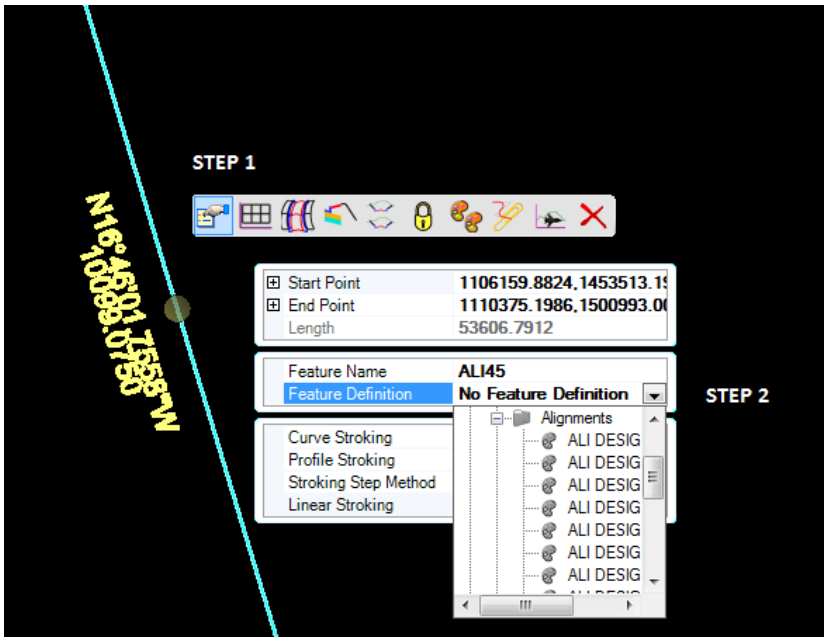
Note: This may take a little processing time before the next dialog opens.

3) Navigate and find the alignment and profile you wish to Import.



4) Select **Import**.

5) Fit View, click the alignment, and choose **Properties** from the context menu. Then, choose the **Feature Definition** (Alignment Type) to display alignment stationing.

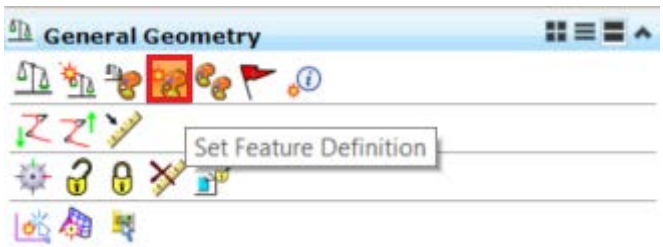


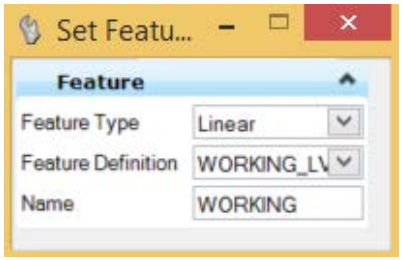
Notes:

1) If alignment feature is set and you delete the alignment in the DGN, the Chain in the GPK will be deleted.
2) If alignment feature is set and you use MicroStation's Undo after an import, the chain in the GPK is deleted.
3) If alignment feature is set and you change the feature type to something other than an alignment, the chain in the GPK is deleted.
4) If you just want to <u>import an alignment but not a profile, make sure you uncheck the **Profile** check box below the alignment or all profiles will be imported with that alignment.</u>
5) <u>Create Civil Rules</u> - If checked allows for graphical based editing of the imported alignment. Civil Rules are not applicable for profiles.

5.2.3 Features

To change a MicroStation element to a feature or change the feature of a civil element, use the **Set Feature** tool, choose the feature, and choose the element.

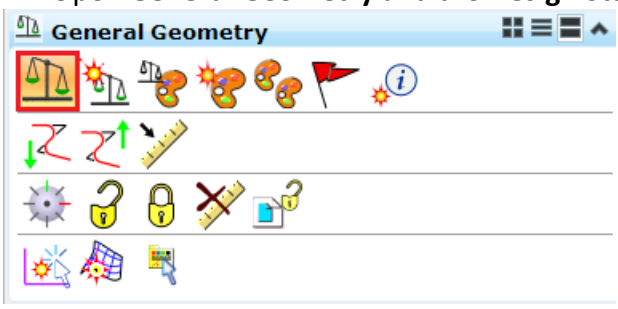




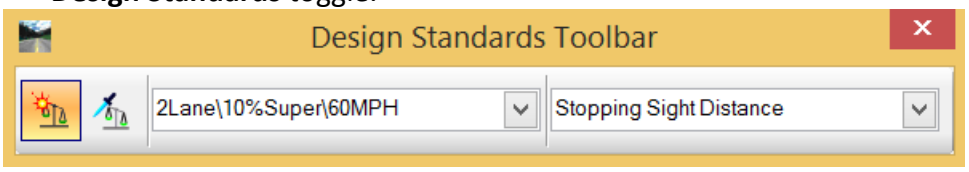
5.2.4 Design Standards

Default and minimum RADII design values have been established and can be chosen for curve design.

1. Open **General Geometry** and the **Design Standards Toolbar.**

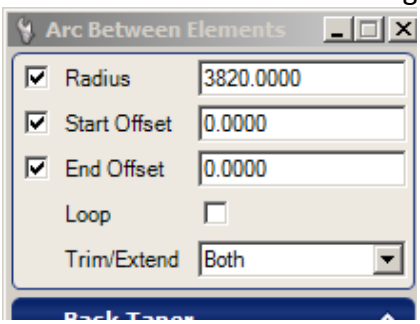


2. Choose the correct design speed, choose **Stopping Sight Distance**, and click the **Set Design Standards** toggle.

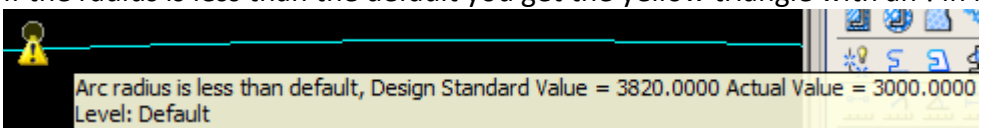


3. Choose the curve command you need.

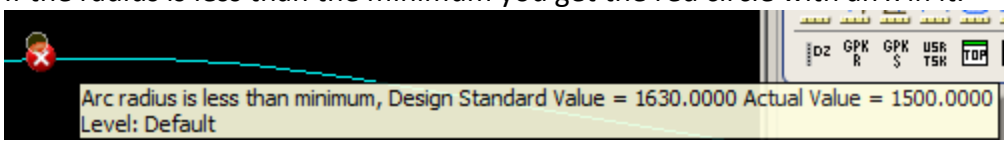
4. The default radius for that design speed is filled in automatically.



If the radius is less than the default you get the yellow triangle with an ! in it.



If the radius is less than the minimum you get the red circle with an x in it.



Note: Neither one of these symbols show up on a plot.

6. HORIZONTAL GEOMETRY

6.1 Section Overview

This section will cover the basics of using OpenRoads Horizontal Geometry tools to place linear and arc features and to create alignments related to the Roadway Design process.

In regards to Horizontal Geometry tools, any elements created with these tools are dynamically linked together based on how you construct them. They offer heads-up graphical editing capabilities as well.

6.2 Section Prerequisites

- MicroStation Fundamentals
- Knowledge of surveying principals
- Basics of Horizontal Geometry

6.3 Section Objectives

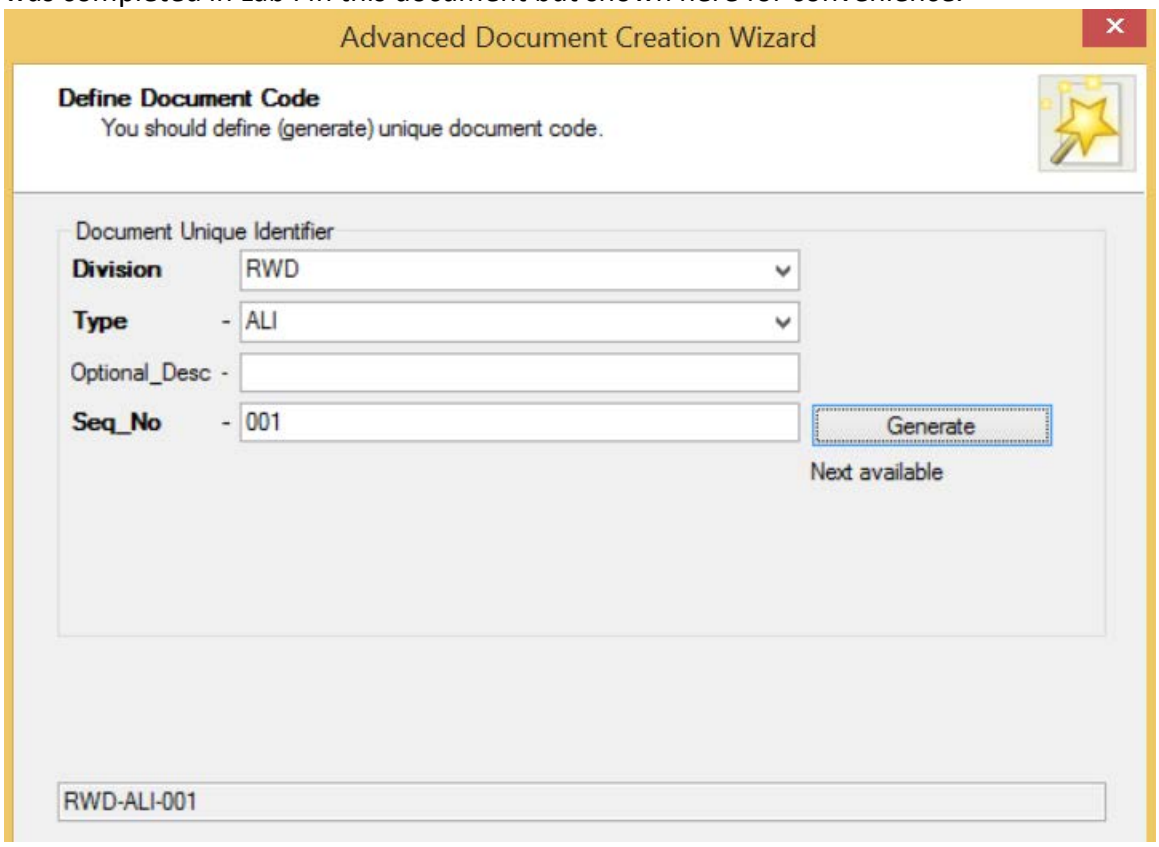
After completing this Section, you will be able to:

1) Create an Alignment DGN.
2) Work with Survey submitted alignments.
3) Use Horizontal Tools to draw lines and arcs that will be included in an alignment.
4) Store and Station an alignment.
5) Use Best Fit, Reverse Curves, etc. to create complex alignments.
6) Plot the Alignment at the intended scale.
7) Use Civil AccuDraw to work with Station/Offset values of Civil elements.
8) Use Horizontal Tools to draw design elements such as ROW markers and Edge of Pavement.

6.4 Creating the Alignment DGN file

Horizontal Geometry needs to be in a 2d model of a 2d Seed file so an Alignment file needs to be created using one of MDOT's 2D Seed files.

Below are the normal settings used in the Advanced document creation wizard. This step was completed in Lab I in this document but shown here for convenience.



6.5 Horizontal Geometry Tools

6.5.1 Overview

Below is RWD's Civil -> Horizontal Geometry menu. Specific commands related to MDOT's Roadway Design processes are discussed in the sections below.

In regards to storing alignments, you can generally ignore setting features when placing the lines, arcs, etc. You do want to choose an alignment feature though when storing the alignment (Complex command). This feature is set to automatically write to the GPK and station (annotate) the alignment.

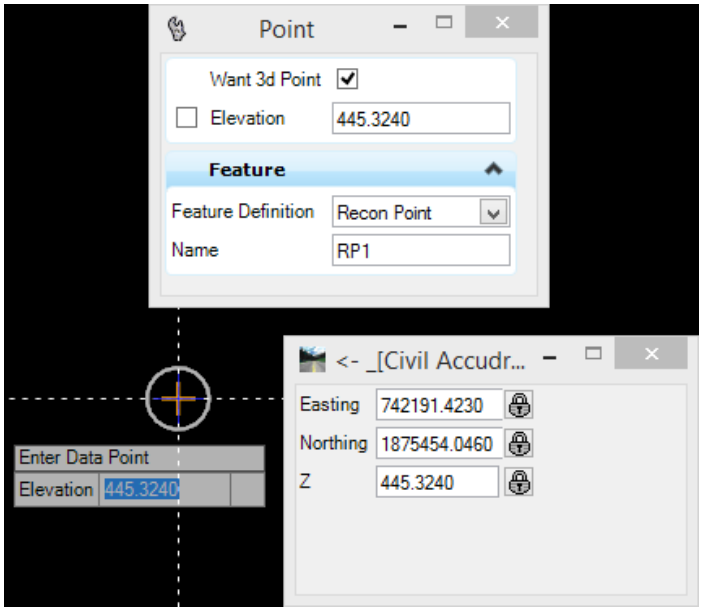
Note:
These commands work with a dialog and cursor based prompts. It is generally easier for the beginning user to fill out as much as you can in the dialog and then left click to accept the cursor based prompts.

6.5.2 Point Commands

6.5.2.1 Place Point

1) Select the Point tool.
2) Enter the Feature Definition and Name in the tool settings.
3) Check the Want 3D Point box and enter an Elevation in the field provided if you wish your point to have a vertical value.

4) Following the heads-up prompt **Enter Data Point**, move the cursor to the desired location then data point to place the point.

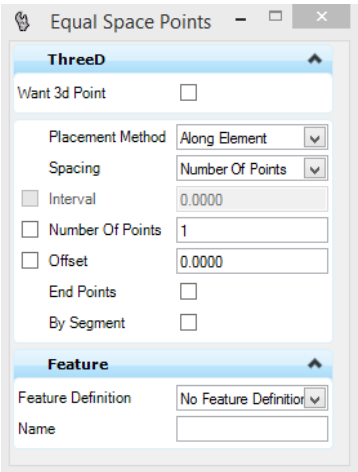


The image above also has Civil AccuDraw invoked which is discussed later in this section.

6.5.2.2 Equal Space Points

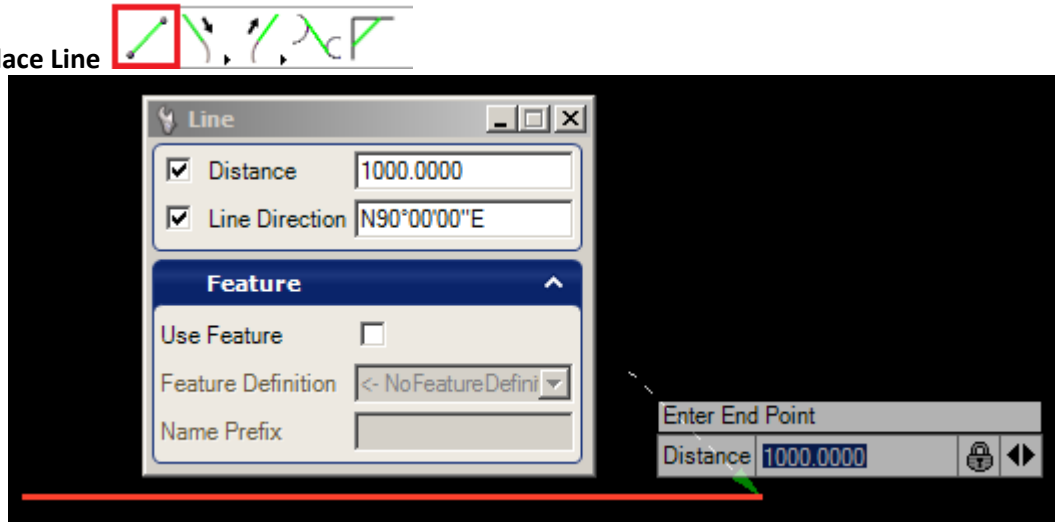
The Equal Space Points tool inserts a specified number of points, points at a defined interval, or a combination of both. The points can be placed between two points or along an element and optional offset.

The point can be placed in 2-D (X, Y) or 3-D (X, Y, elevation) in both 2D and 3D model views.

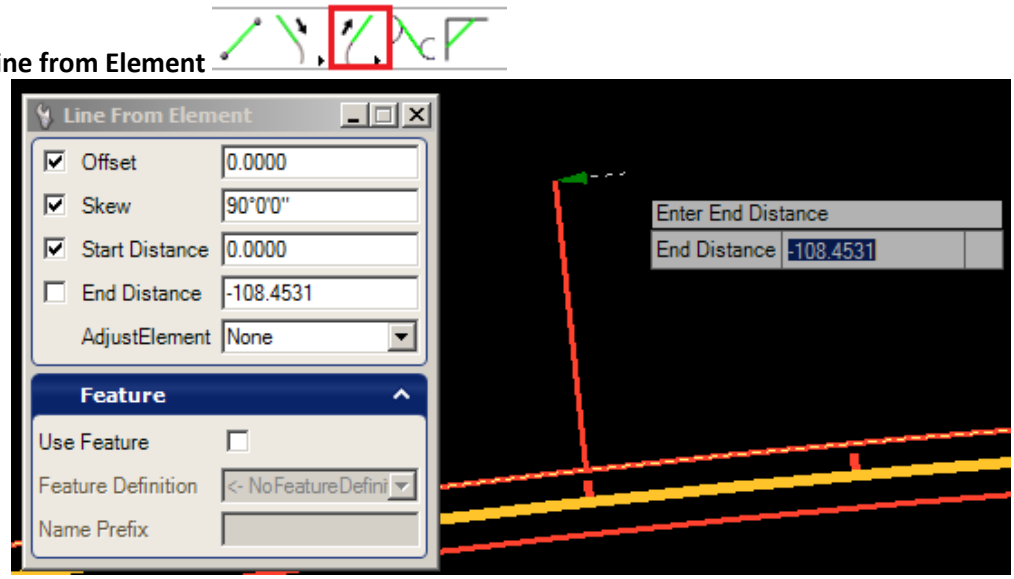


6.5.3 Line Commands

6.5.3.1 Place Line



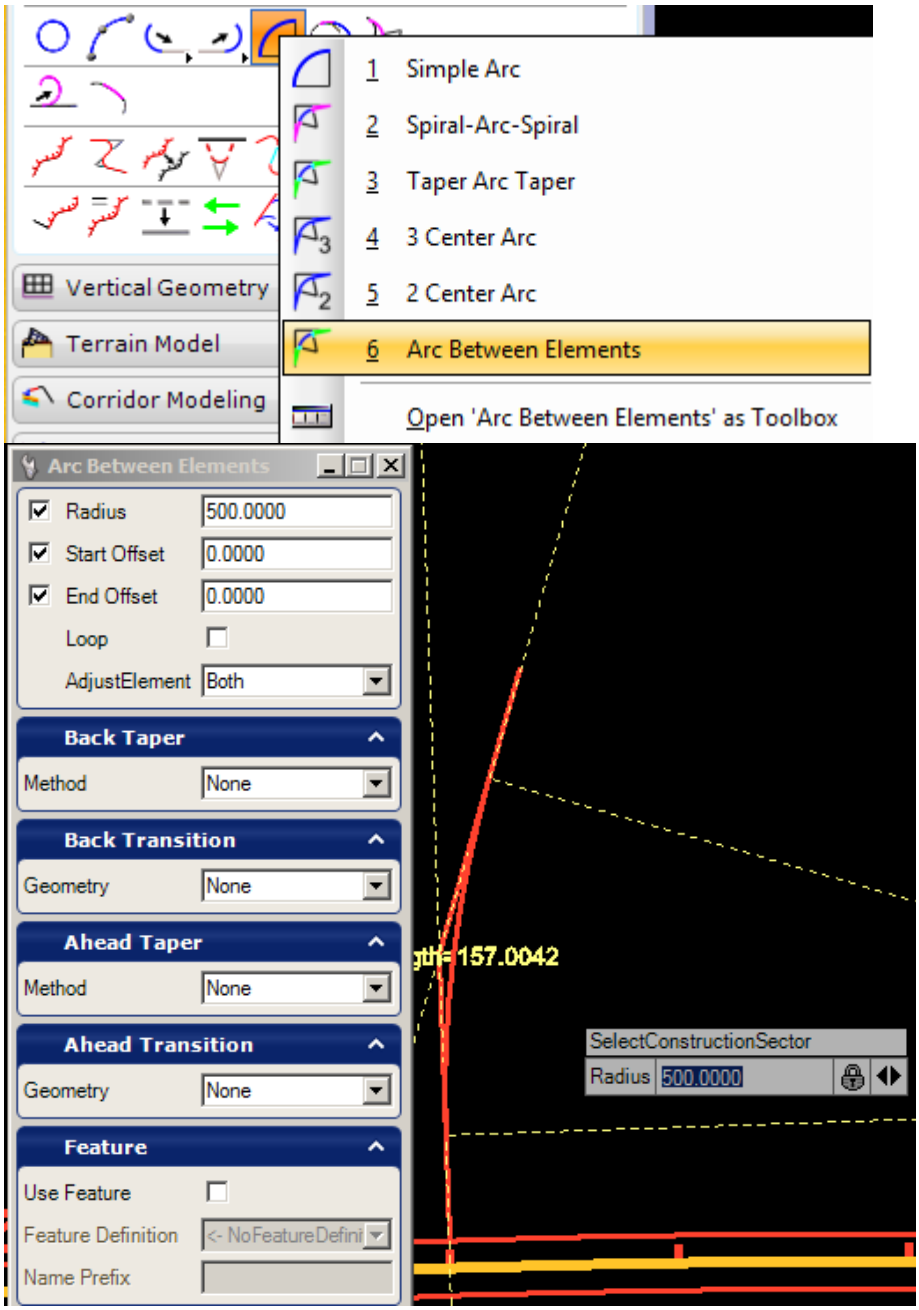
6.5.3.2 Line from Element



Note: Skew Angle is measured counterclockwise from the element in the direction it was created.

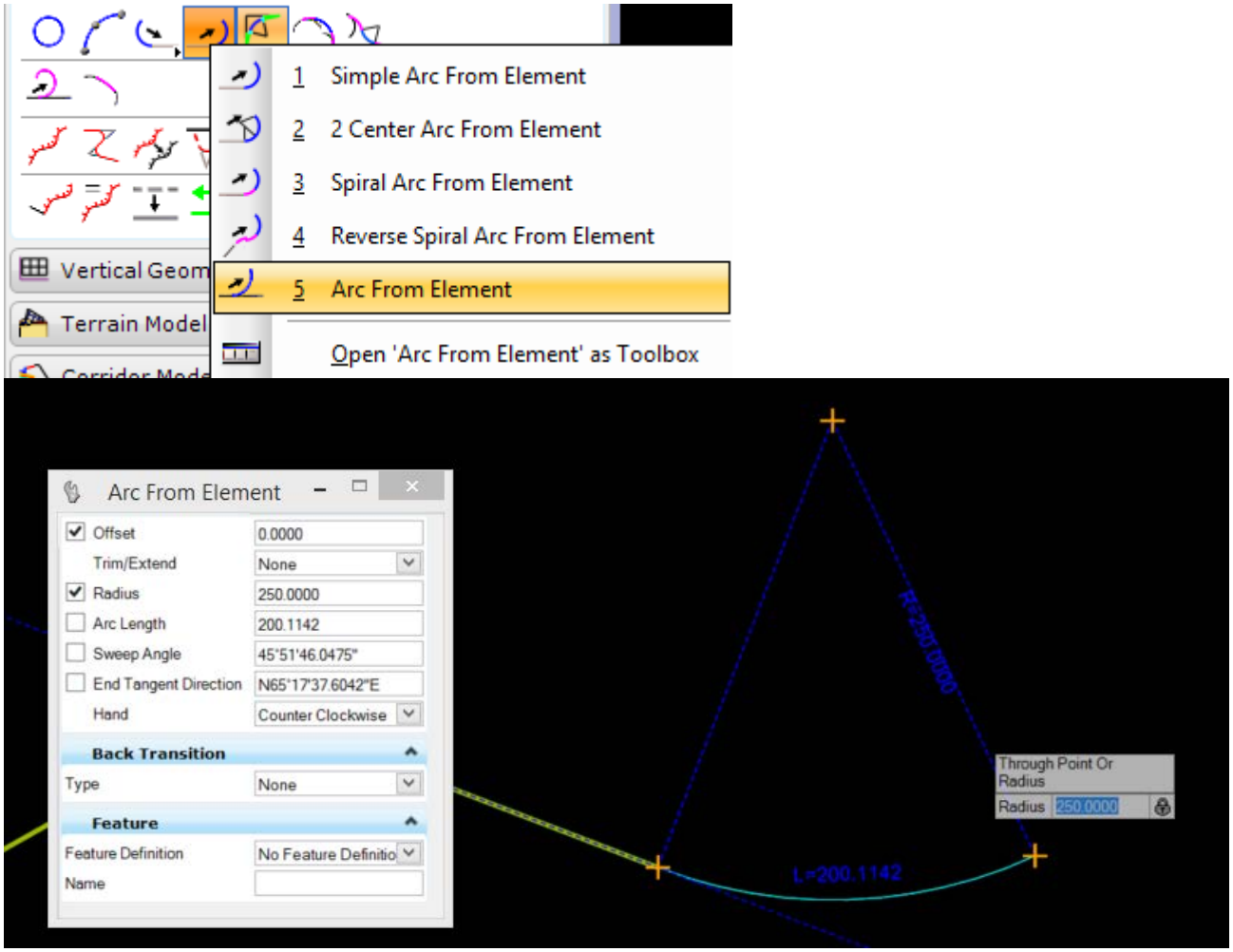
6.5.4 Arc Commands

6.5.4.1 Arc Between Elements



Note: Enter **d4** in the radius key-in field to place a 4 degree curve. (Lower case d.)

6.5.4.2 Arc from Element

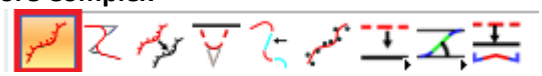


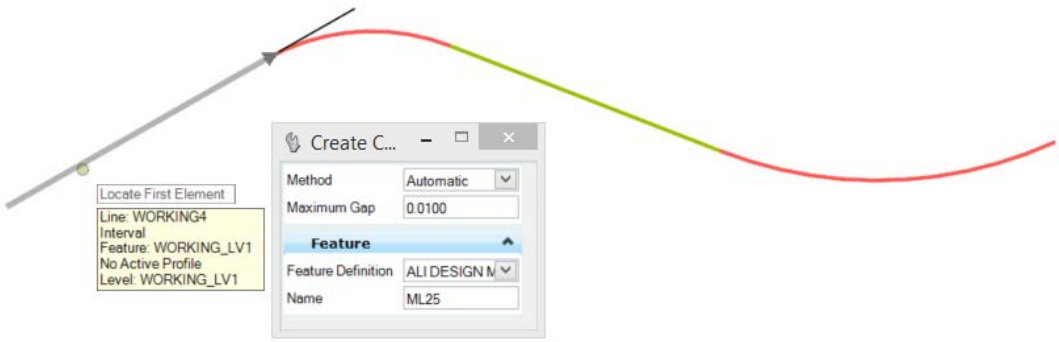
Note: Arc Sweep Angle is Curve Delta or Deflection

6.5.5 Complex Commands

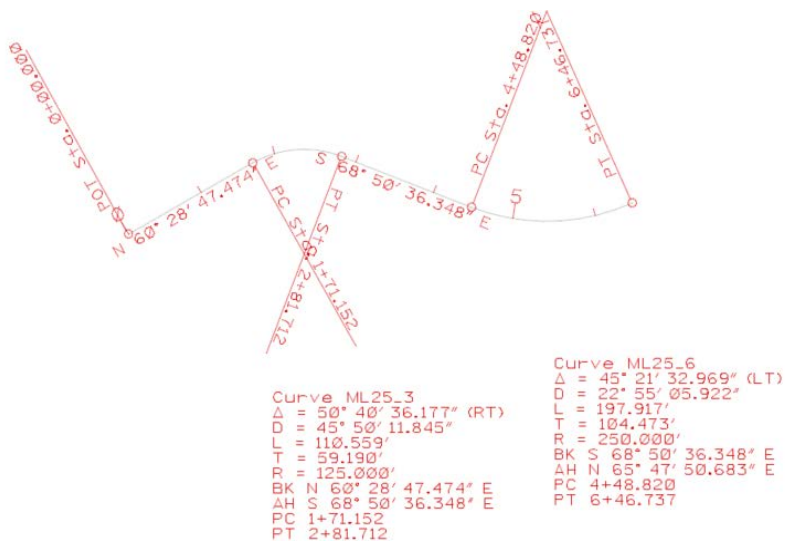
After connecting lines and arcs have been created, a complex element can be stored by using the command below and choosing the first element (lowest station side), and following the remaining prompts. Note that the complex element is assigned station 0+00 for the beginning station.

6.5.5.1 Store Complex

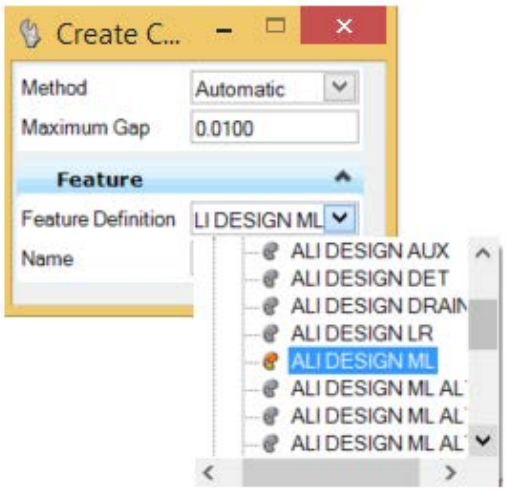




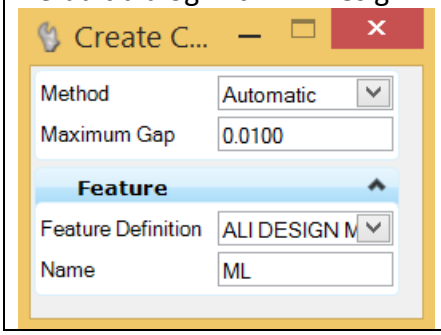
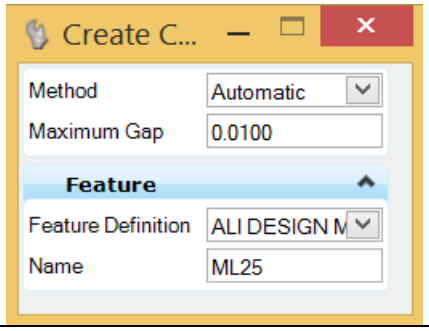
With the Ali Design* features, you are prompted for the GPK you wish to write the alignment to during this process. After chosen, the alignment is written to the GPK and annotated.



Below are the options for Design related alignment features:



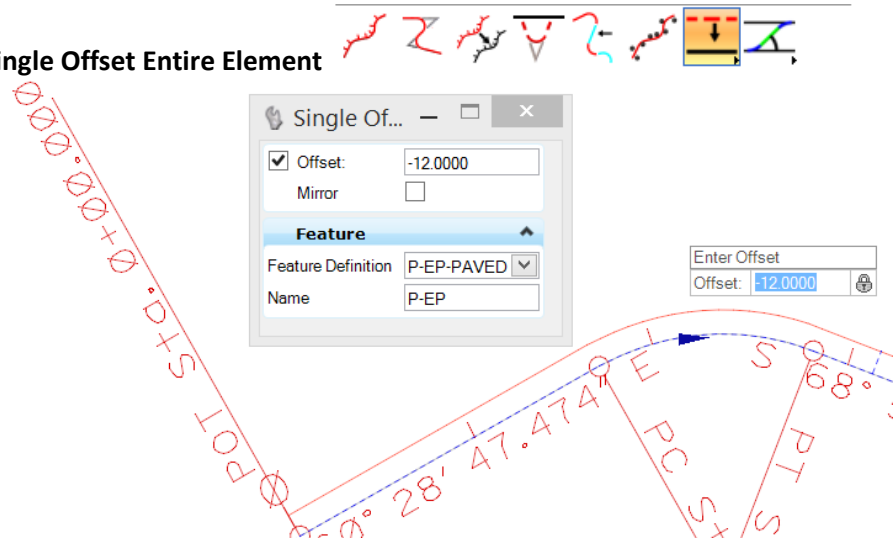
Also, note the **Name** as you will need to add text to it to better identify the alignment.

Default dialog with ALI Design ML chosen	User modified name.
	

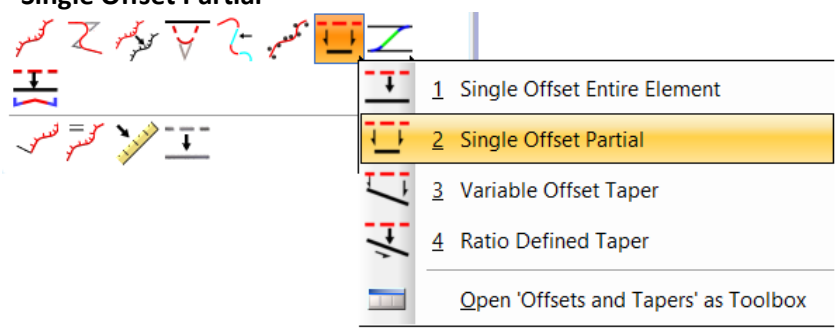
Since the feature above is set to write to the GPK, there are some limitations as to what can be used as chain names. You should only add text to the default name, use no characters other than an underbar and if numerals are used, use them as a suffix.

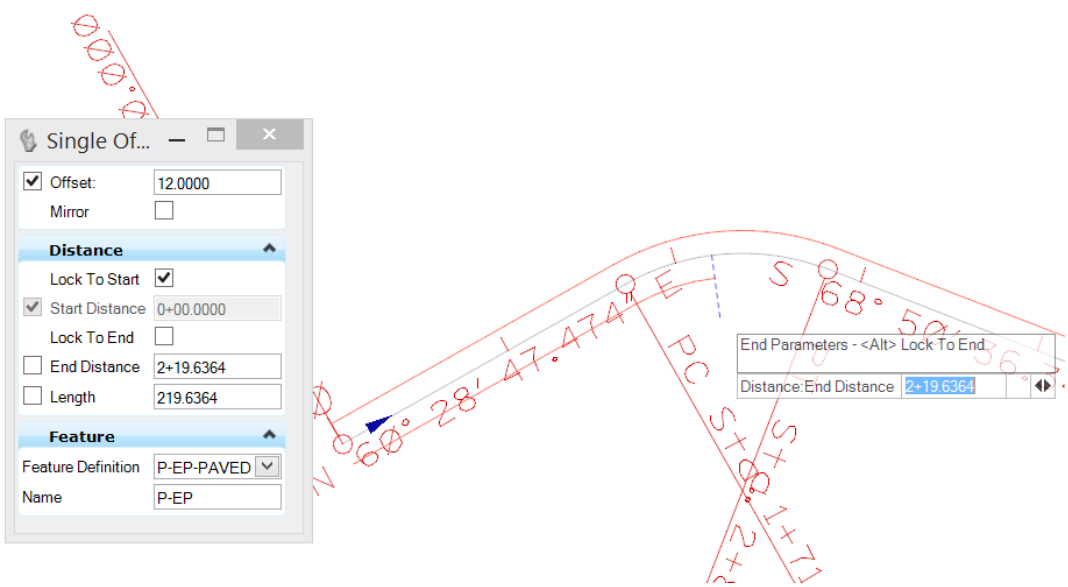
Examples that work: (ML471, MLSR1, etc.) Examples that do not work (ML471REV, ML49SR, etc.)

6.5.5.2 Single Offset Entire Element

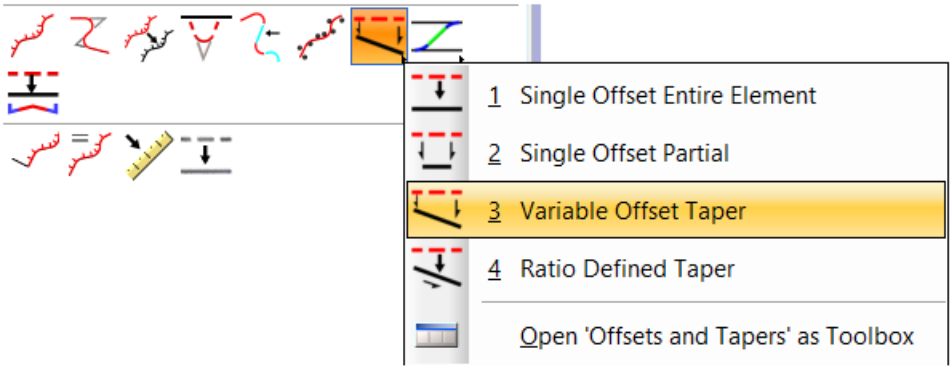


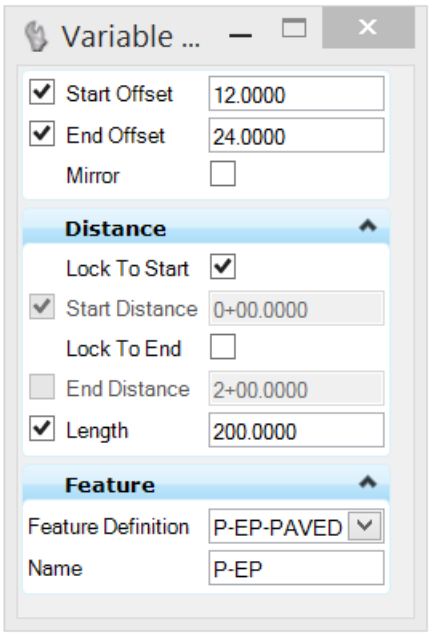
6.5.5.3 Single Offset Partial

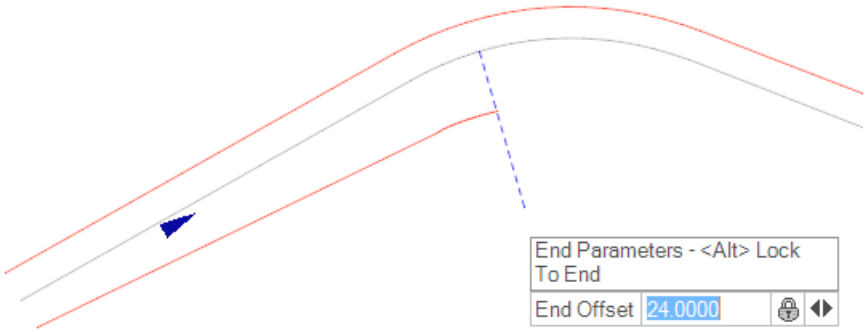




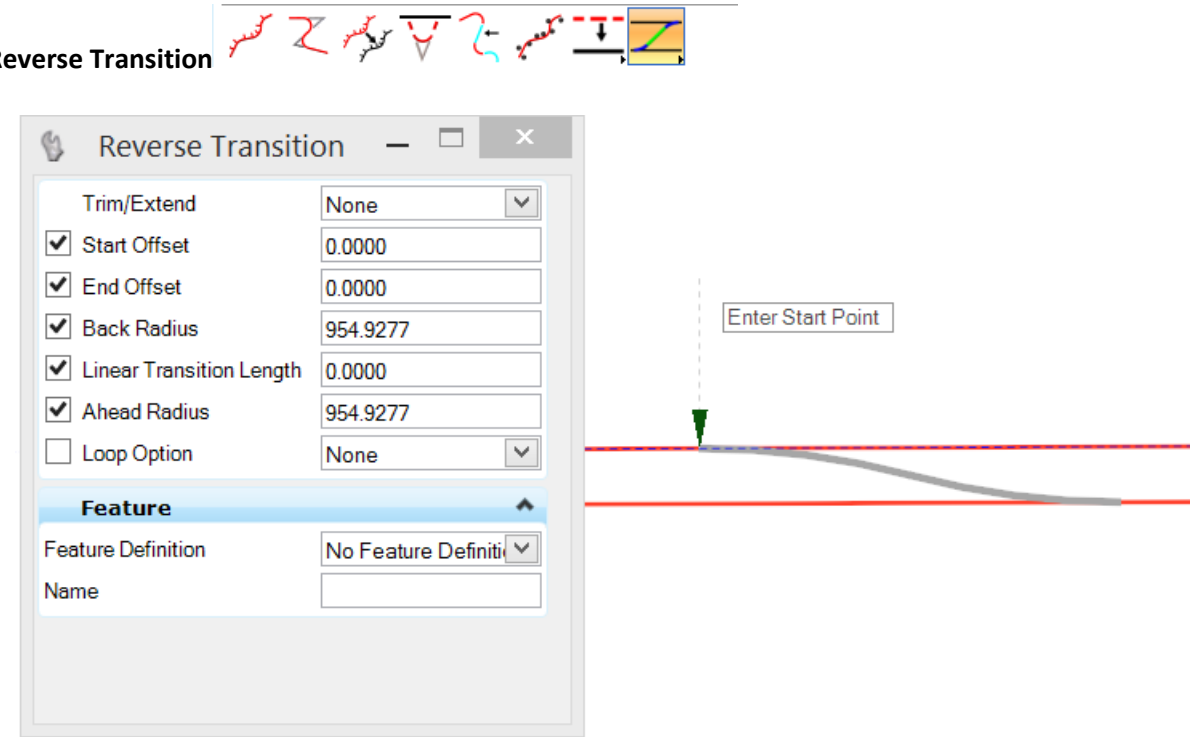
6.5.5.4 Variable Offset Transition





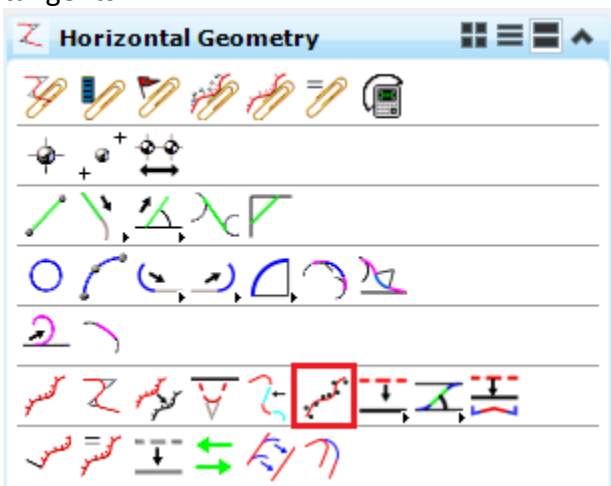


6.5.5.5 Reverse Transition

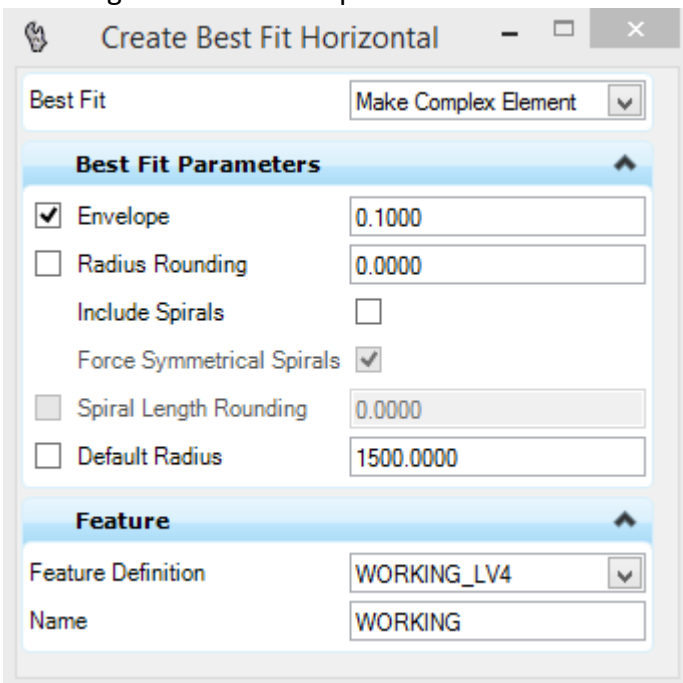


6.5.5.6 Best Fit Alignment

This tool, **Define Horizontal by Best Fit,** best fits a course defined by a selected linear object or defined between two edges. It is generally used to **Best Fit** a surveyed linear element comprised of multiple PI's. The tool tries to create a tangential alignment utilizing arcs and tangents.



Choosing this command opens the **Create Best Fit Horizontal dialog.**



6.5.5.6.1 Best Fit Options

a) Make Complex Element – Creates a **Best Fit** Horizontal Complex element comprised of curves and tangents from selection of a single element.
b) Make Single Element - Creates a **Best Fit** Horizontal Complex element comprised of a single element (line or arc) from selection of a single element.
c) Complex By Edges – Creates a **Best Fit** Horizontal Complex element comprised of curves and tangents between two edges. **Complex By Edges is a really useful tool when establishing the CL of two edge of pavements.**

6.5.5.6.2 Envelope

Defines the tolerance from the intended element that the **Best Fit** alignment can utilize for location. The tool tries to create a non-kinked alignment utilizing arcs and tangents. If it cannot, it will solve areas it can and introduce gaps. The user can then adjust (trial and error) the envelope to something greater to allow for a total solution. An estimated beginning envelope should be generally 0.1

6.5.5.6.3 Radius Rounding

Allows the user to specify a round increment for arcs – i.e. 10’

6.5.5.6.4 Include Spirals

Not generally done unless you know spirals were included during construction of the roadway.

6.5.5.6.5 Default Radius

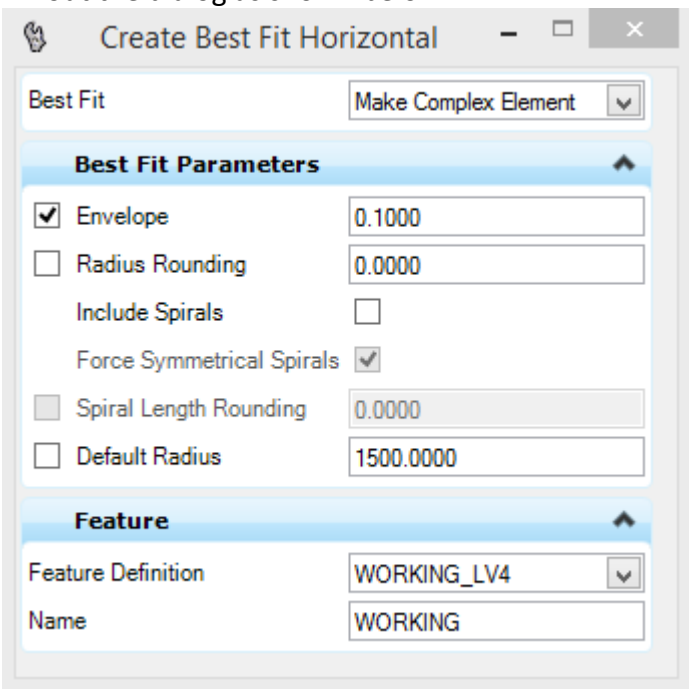
Generally leaved unchecked and let the software decide the best radius.

6.5.5.6.6 Feature Information

The feature and name the user wants to assign the **Best Fit** element created.

6.5.5.6.7 Steps

1) Fill out the dialog as shown below.



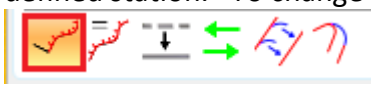
2) Follow prompts selecting the intended element you want to **Best Fit.**

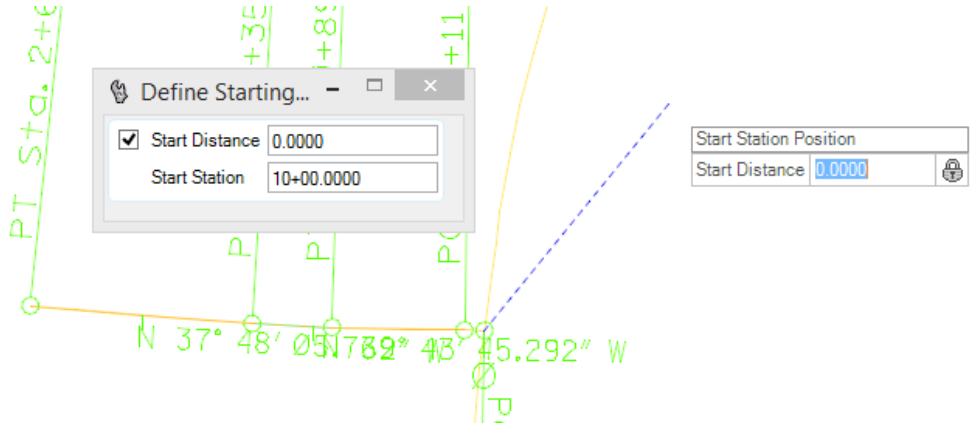
You can then use the various reports discussed in the Reports section to review geometry or station offset reports of the element created.

6.5.6 Modify Commands (Station, Equations, etc.)

6.5.6.1 Stationing

The complex command discussed above stations the complex element from 0+00 to a user defined station. To change this stationing,

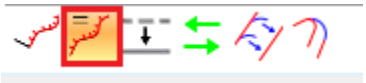


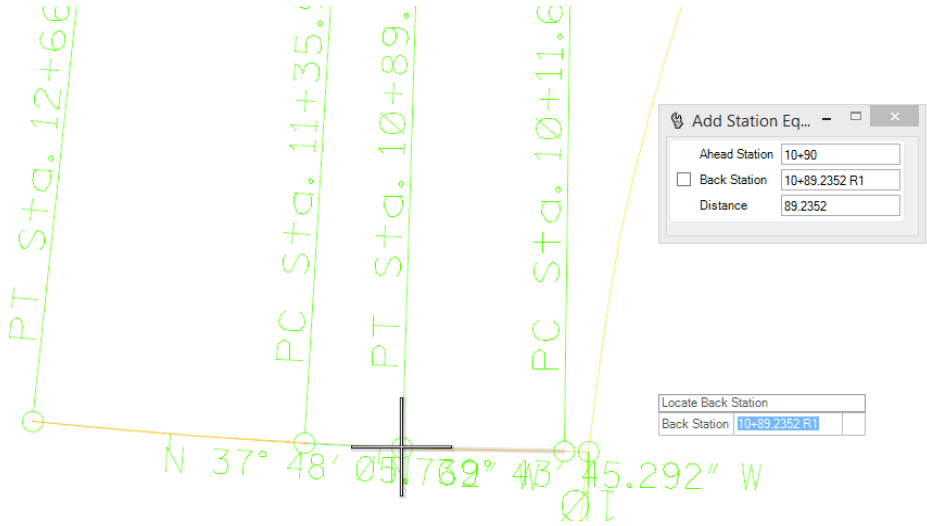


Note: Use the Start Station Command only once for an alignment. After that, you can edit the beginning stationing graphically.

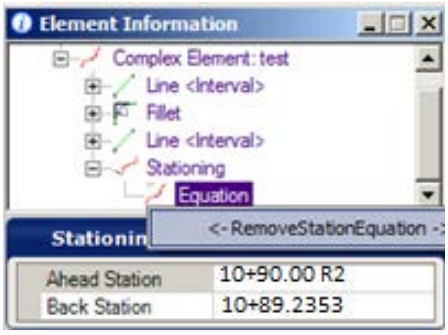
6.5.6.2 Station Equation

Adds a Station Equation at the intended location. In the example below the intended location is the PT of the arc.



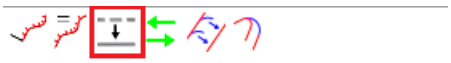


To remove Station Equations, select the alignment, open Element Info, and right click **Equation**.

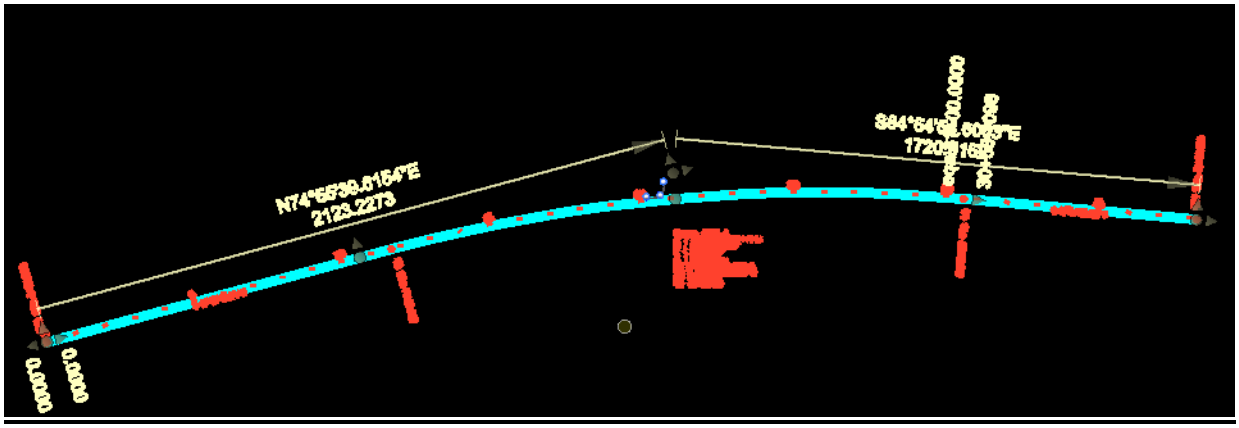


6.5.6.3 Copy

Makes a copy of an element.

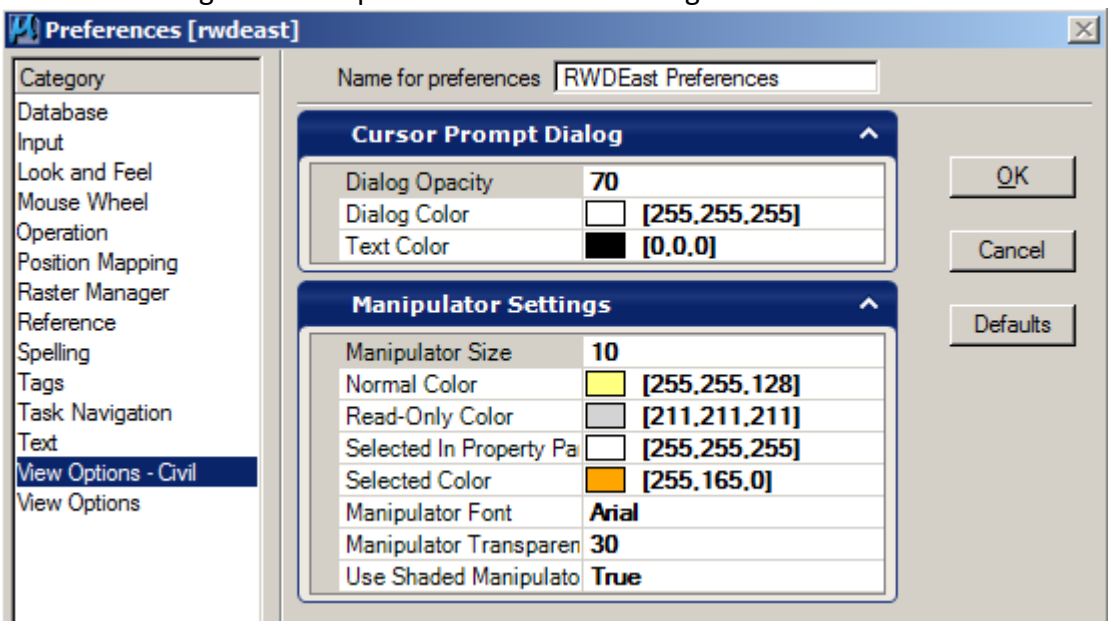


6.5.7 Editing Horizontal elements



1) Use MicroStation's **Element Selection** tool to choose the alignment. You can then use handlers to modify the alignment or edit any of the displayed text. Tag the circle handler on arcs to edit the radius.
2) You can make edits with MicroStation's **Element Info** tool as well.
3) You may be prompted to choose the GPK where the alignment is stored.
4) The alignment is updated in the GPK when changes are accepted.

Note: You can go to Workspace Preferences to change the color of the handlers and text.



6.5.8 MicroStation Commands

MicroStation tools that are allowed with Civil Geometry elements:

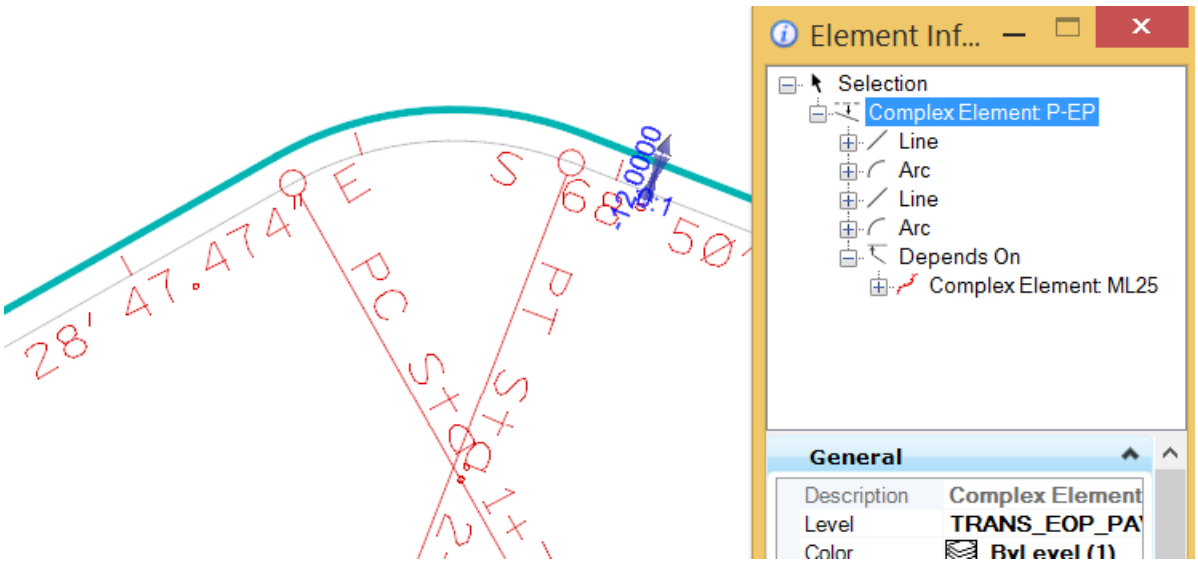
- Break Element
- Extend Line
- Trim to Intersection
- Trim to Element
- Insert Vertex
- Delete Vertex
- Drop
- Delete

6.5.9 Rules

Rules are created when horizontal elements are created which allows future edits to be passed on to downstream elements and to preserve design intent.

You can remove rules, replace references, lock, unlock, etc. from a horizontal elements context menu.

You can view a horizontal element's dependent elements through MicroStation's **Element Info** tool.



6.5.10 Reports

Horizontal Reports available are listed below. Choose these commands and then follow the prompts to generate the report which is then displayed in the **Bentley Civil Report Browser**.

Select in the Toolbox	Description
Horizontal Geometry Report	A filter to specify groups of horizontal alignments to include in the report data file.
Profile Report	A filter to specify groups of vertical alignments to include in the report data file.
Legal Report	A filter to specify information on closed alignments and reference alignments.
Map Check Report	A filter to specify information based on plotted data rather than the internal precision stored by the software.
Station Offset Report	A filter to specify information on station offset data for selected alignments or features.
Point Feature Station Offset Elevation	Creates a report that contains point name, point feature, station, and offset from selected points to a baseline MicroStation or civil horizontal geometry or survey element.
Station Base Report	A filter to specify information on station base data for selected alignments or features.
Superelevation Report	A filter to specify information on Superelevation and displays data on the selected sections.

A couple of report examples are shown below.

1) Horizontal Geometry Report

Horizontal Alignment Review Report

Report Created: 10/25/2015
Time: 9:35am

Project: Default
Description:
File Name: c:\pw_working\mdot_pwapp\keboteler\d0260386\SRV-ALI-GPK-003.dgn
Last Revised: 10/25/2015 09:29:30

Note: All units in this report are in feet unless specified otherwise.

Alignment Name: WORKING
Alignment Description:
Alignment Style: WORKING_LV4

		Station	Northing	Easting
Element: Circular				
PC	( )	0+000.0000	1875149.2109	741340.1699
PI	( )	0+038.7822	1875178.9331	741315.2571
CC	( )		1877779.5830	744478.3350
PCC	( )	0+077.5621	1875209.1219	741290.9117
Radius:		4094.7451		
Delta:		1°05'07.0393" Right		
Degree of Curvature (Arc):		1°23'57.2951"		
Length:		77.5621		
Tangent:		38.7822		
Chord:		77.5609		
Middle Ordinate:		0.1836		
External:		0.1837		
Tangent Direction:		N 39°58'09.5987" W		
Radial Direction:		N 50°01'50.4013" E		
Chord Direction:		N 39°25'36.0791" W		
Radial Direction:		N 51°06'57.4405" E		
Tangent Direction:		N 38°53'02.5595" W		

2) Point Feature Station, Offset, and Elevation report.

Station Offset Report

Report Created: 10/25/2015
Time: 9:33am

Project: Default
Description:
Baseline (Active) Alignment:
File Name: c:\pw_working\mdot_pwapp\keboteler\d0260386\SRV-ALI-GPK-003.dgn
Last Revised: 10/25/2015 09:29:30
Input Grid Factor:

Note: All units in this report are in feet unless specified otherwise.

Point	Feature	Station	Offset	Elevation
257	CL	0+034.3153	-0.0000	442.2693
258	CL	0+077.5618	0.0000	442.0856
259	CL	0+124.2531	0.0000	442.6292
260	CL	0+173.9156	0.0000	443.9839
261	CL	0+227.7734	-0.0000	445.6697
262	CL	0+254.5365	0.0000	446.4539

6.5.11 Civil AccuDraw

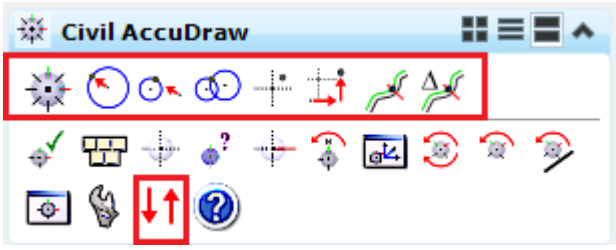
6.5.11.1 Overview

Civil AccuDraw allows the user to input or determine Station, Offset, and Elevation for Civil elements and profiles. It also allows for X, Y, Z input and change of X, Y, Z input. It is similar to MicroStation AccuDraw but its tools are customized for the civil process. It takes the place of GEOPAK's DP Offset tool as well.

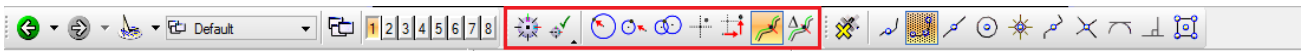
As mentioned, Civil AccuDraw is similar to MicroStation AccuDraw but the two are not recommended to be run simultaneously, nor do they work together. MicroStation AccuDraw is off by default in MDOT's workspace but if you utilize this tool, make sure it is off if you are going to use Civil AccuDraw.

Although available on the MDOT Civil menu, Civil AccuDraw is actually docked next to the MicroStation **Snaps** menu in MDOT's interface because of its importance in civil processes. It is disabled by default. Also, the menu changes whether you are working in a 3D file, 3D model, 2D file, 2D model, or profile view.

Below is the menu on MDOT's Civil Tasks menu.



Below is the menu opened and docked in MDOT's workspace which is by default at the bottom of the window.

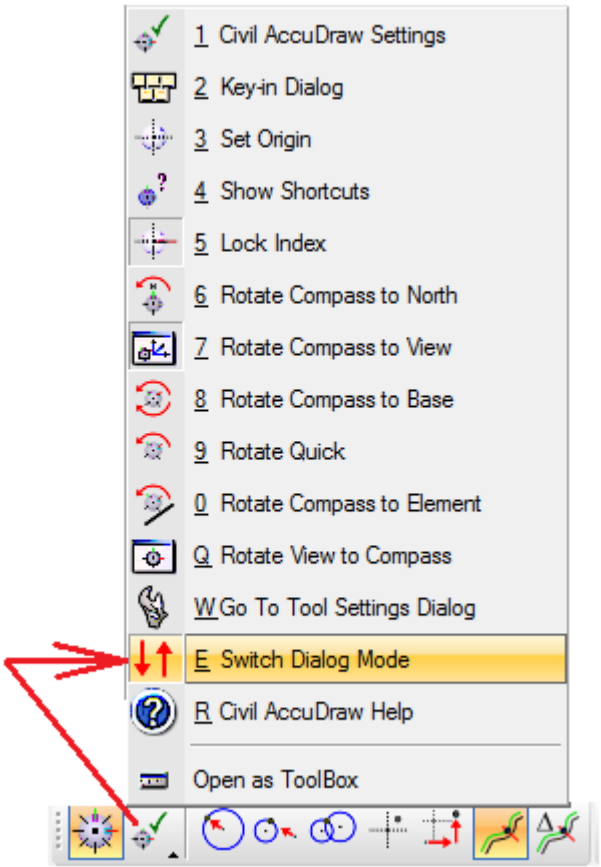


The remainder of this section concentrates on using the Station/Offset process to work with alignments and the docked menu. More Civil AccuDraw use related to working with profiles is discussed in the Vertical Geometry section.

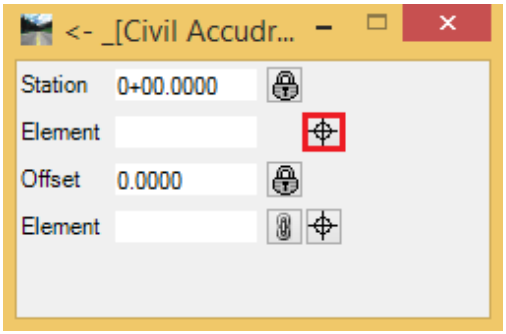
6.5.11.2 Steps

1) In a DGN file that contains Horizontal Geometry, toggle Civil AccuDraw ON.

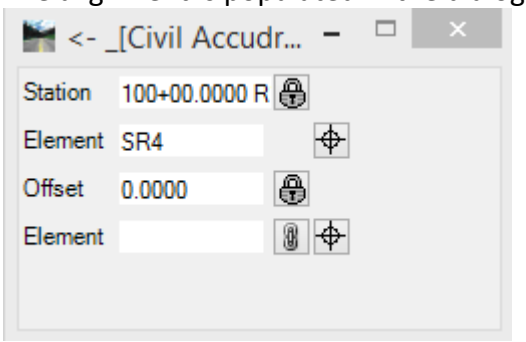
2) Left click and hold down the second button and choose **Switch Dialog Mode**.



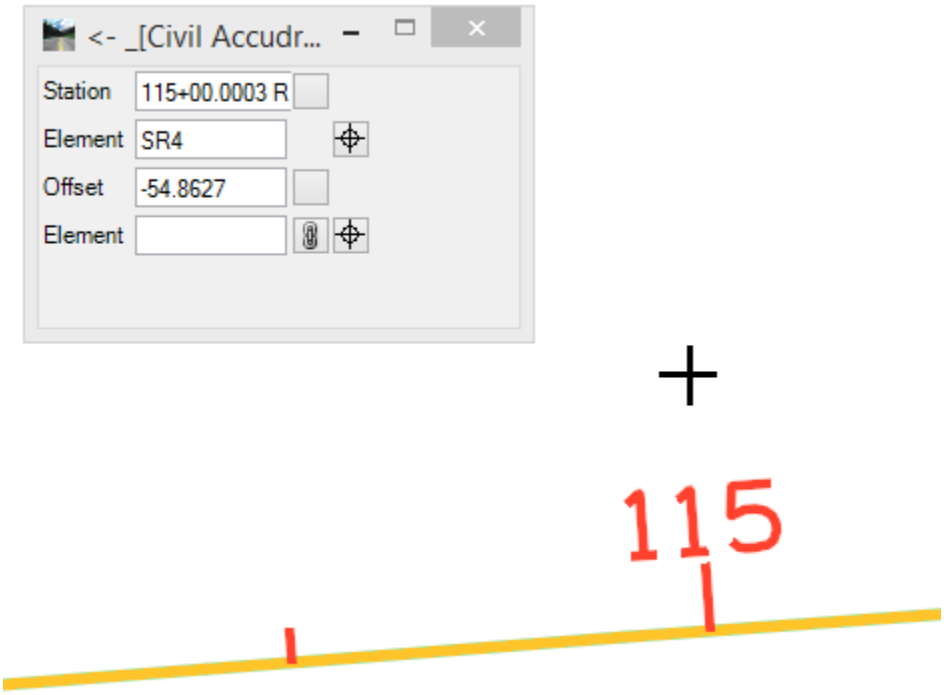
3) In the Default or 2D model, choose the **Select Point or Element** tool.



4) The alignment is populated in the dialog.

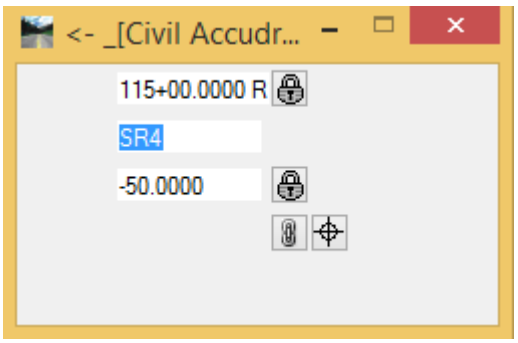


5) As you move the cursor along the element, notice the Station/Offset changing.

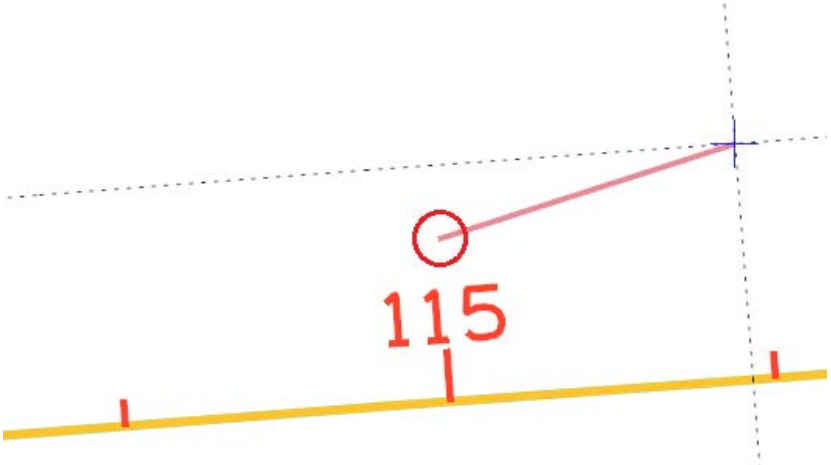


6) You can choose whatever command you wish and then enter a Station/Offset to send a DP for the command you have chosen. For example, Choose MicroStation's **Place Line** command.

7) Then enter the Station/Offset. (115+00, -50 in this example). Once you enter the station, hit the **TAB** key on your keyboard or select the lock button next to the station. Do the same for the offset.



8) Follow your MicroStation prompt and left click to send the data point.



Follow the prompts to finish the command, in this case entering another data point for the end of line.

6.6 Working with Survey Linear Features

6.6.1 Survey Linear Features

Horizontal Geometry tools such as **Copy**, **Single Offset, Arc Between Element**, etc. do not work with survey linear features. As mentioned earlier in this document, MicroStation's **Copy** command does but using this command is not preferred practice.

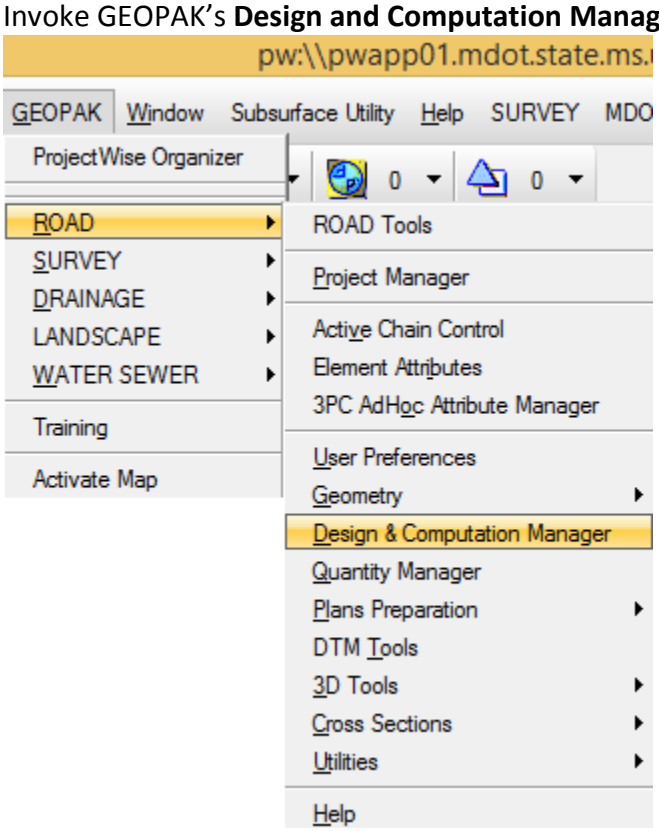
The process to create elements from survey linear features with the intention of selecting with the commands above or storing part or all of this copy as a Horizontal Alignments is to:

1) Reference the TOPO DGN.
2) Use MicroStation's **Create Complex Chain** command to create a copy in the ALI DGN file.
3) Drop these elements from complex to line_string and also drop line_strings to lines if any part of them will be included in a horizontal alignment.

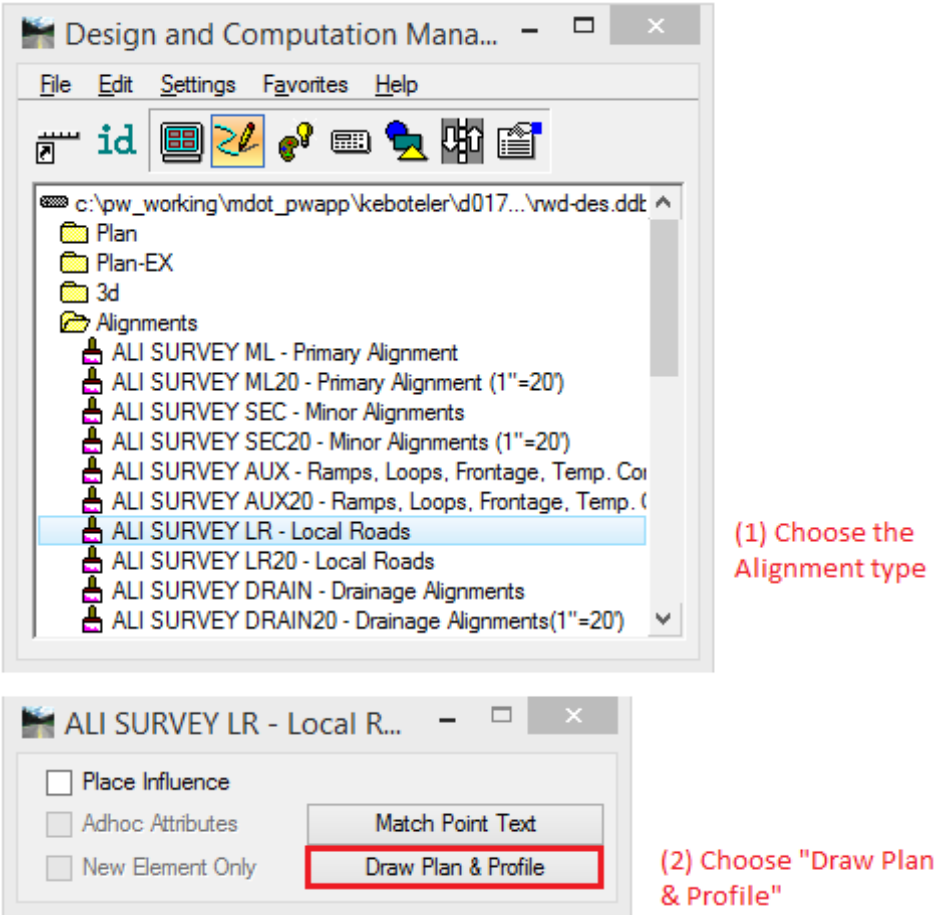
6.7 Plotting and Stationing Alignments

The steps for plotting alignments that are stored in the GPK is shown below if needed although the processes mentioned above do station (or annotate) alignments.

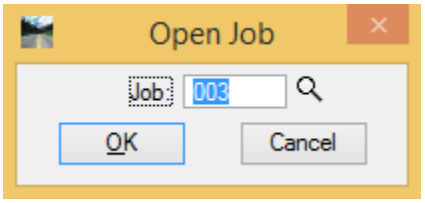
1) Invoke GEOPAK's **Design and Computation Manager**



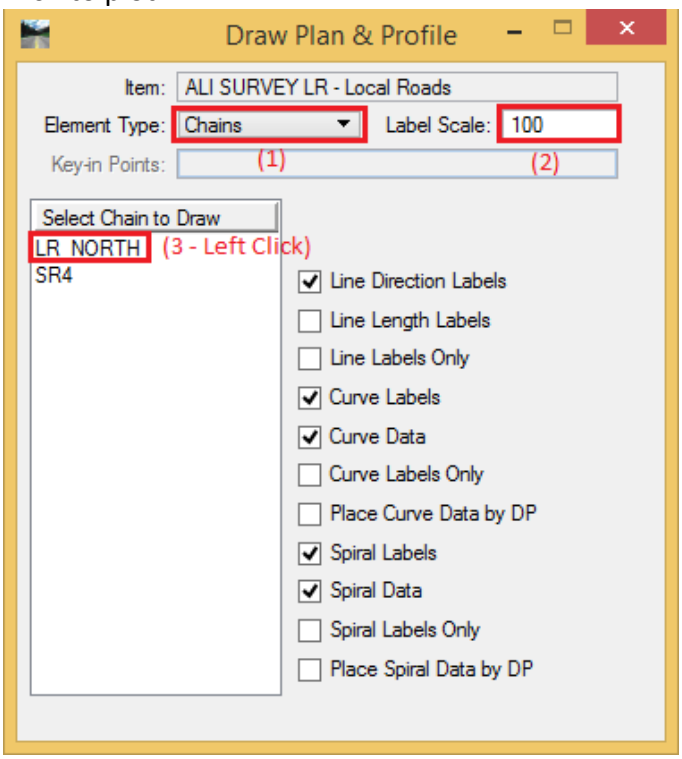
2) Two dialogs are invoked. Follow the steps shown in the image below to proceed.



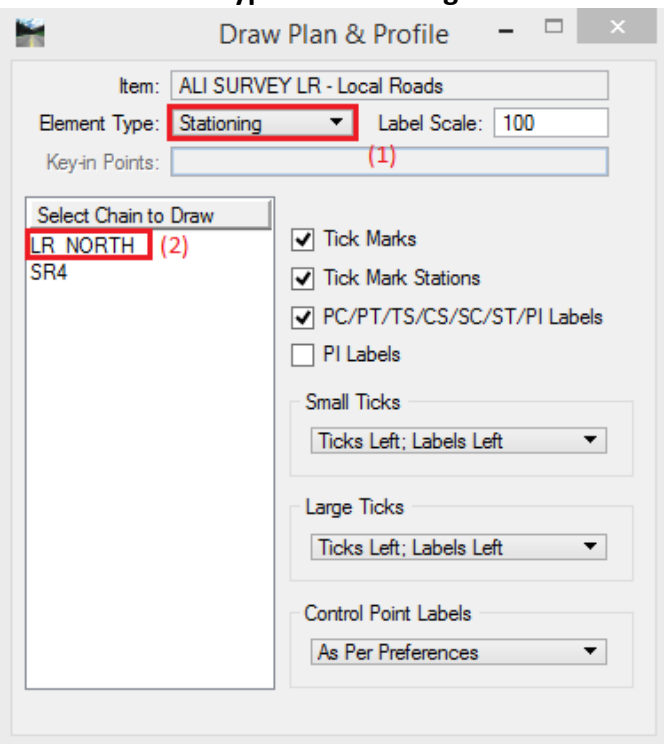
3) Choose the Job number.



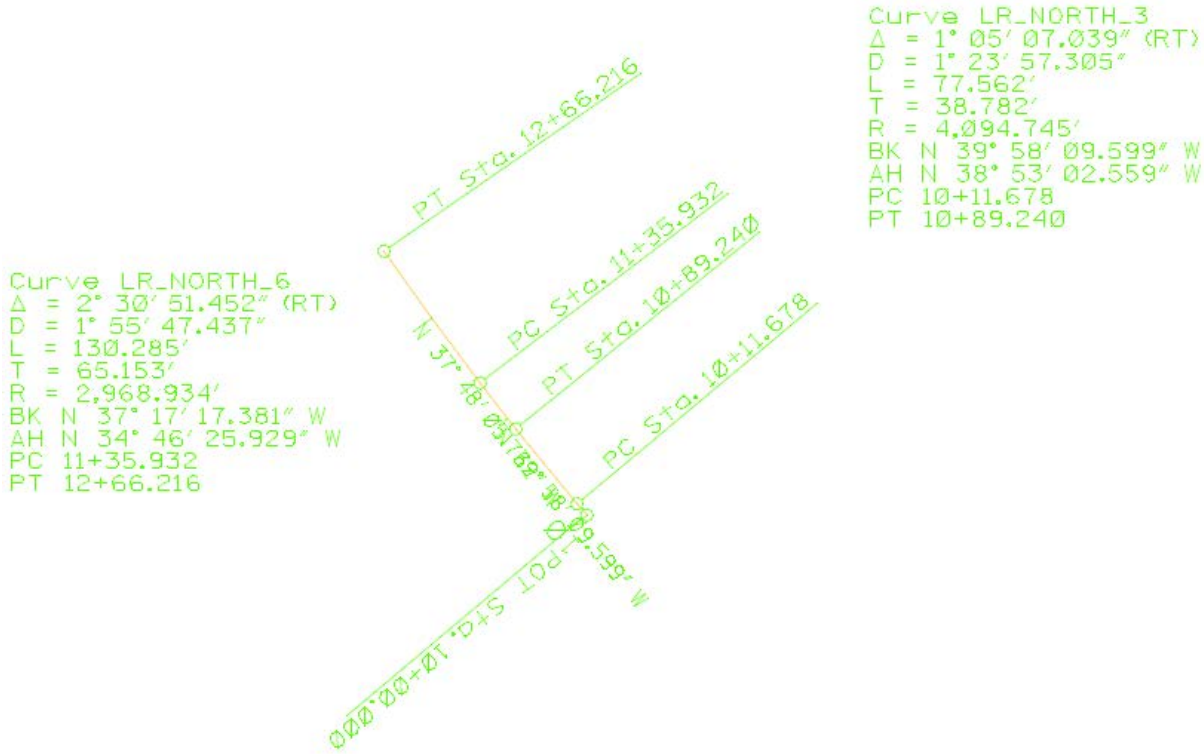
4) Set the **Element Type** to **Chain**, check or change the scale, and left click the chain you wish to plot.



5) Set the **Element Type** to **Stationing** and left click the chain you wish to station.

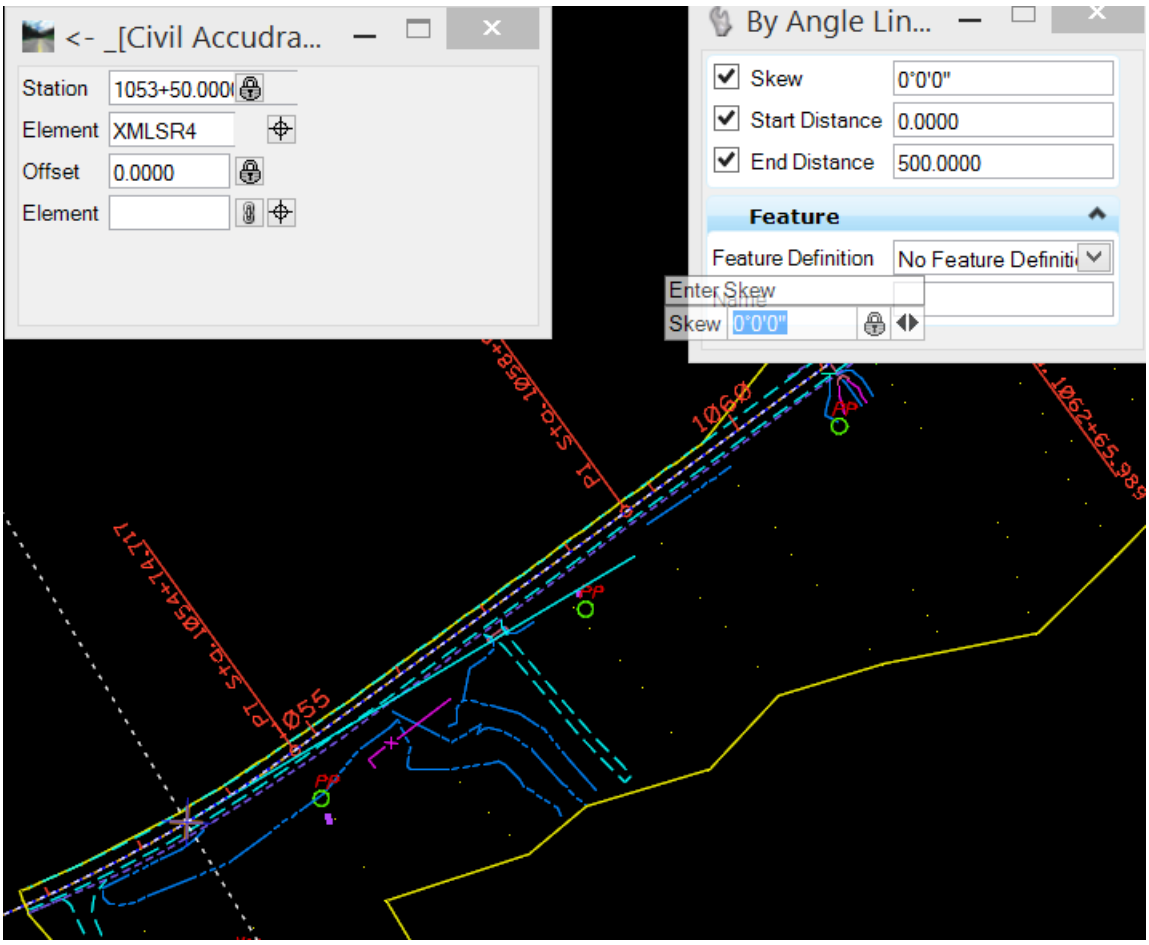


6) Your alignment is plotted and stationed.

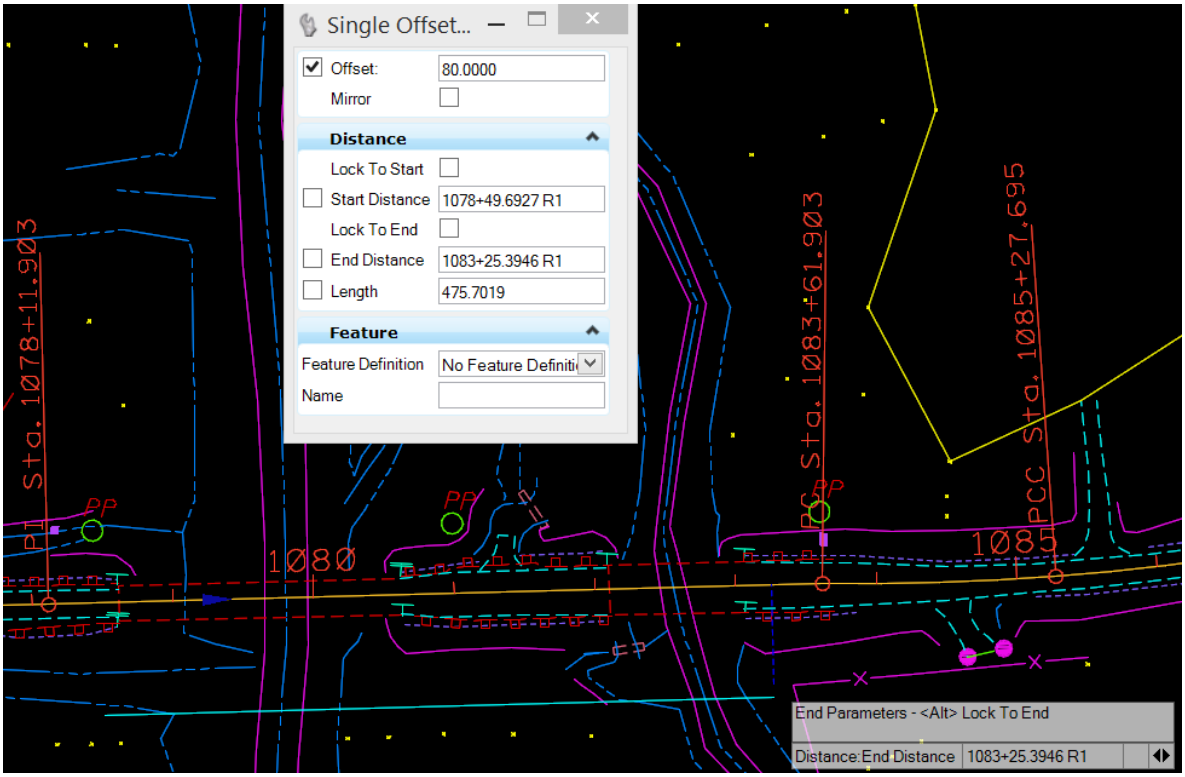


LAB II: Horizontal Geometry

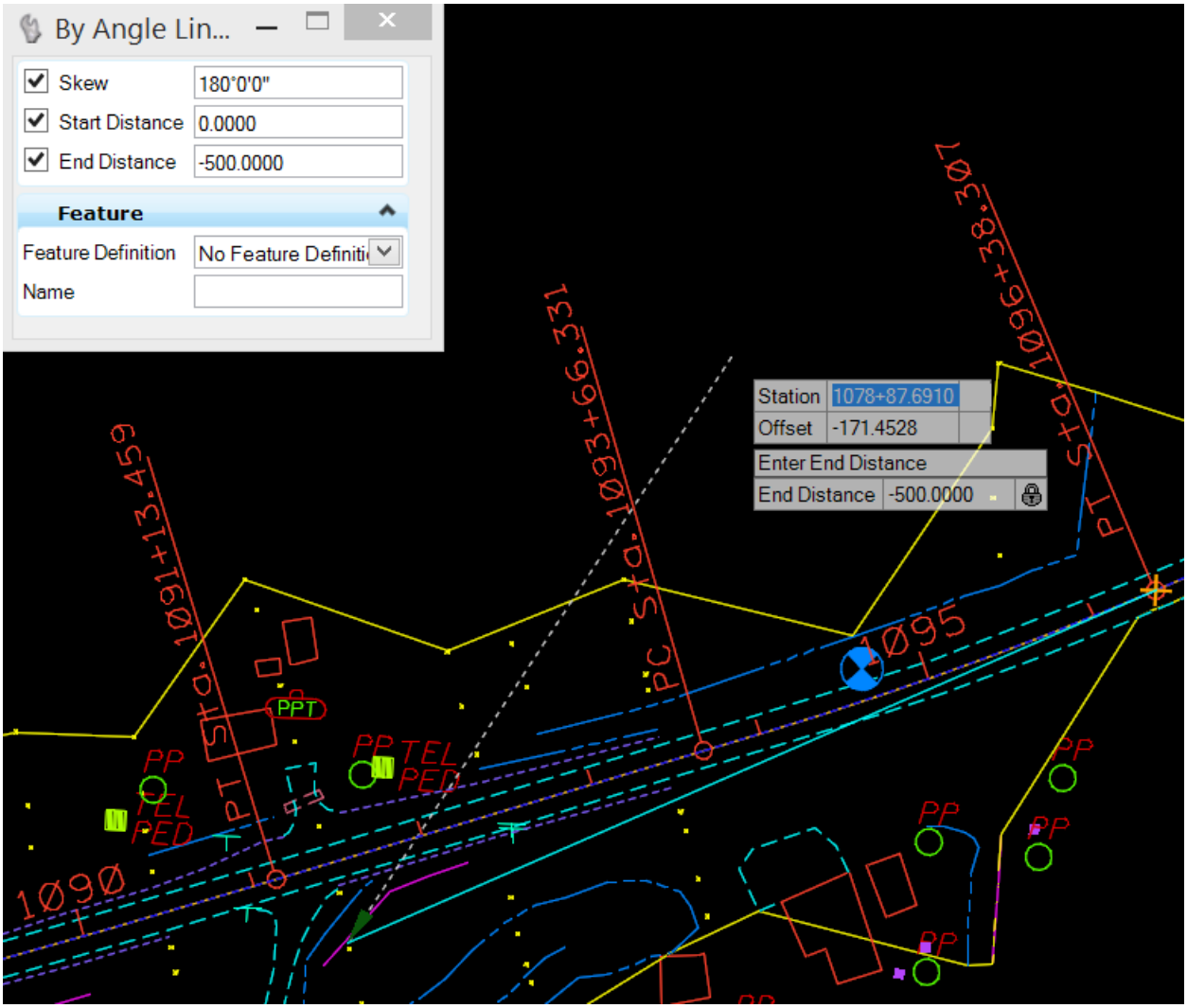
1. Copy the file JOBSR4.GPK from 101000\SRV folder.
2. In RWD-ALI-001.DGN, reference the files SRV-ALI-001.DGN and SRV-TOPO-001.DGN from the 101000\SRV folder.
3. Set the GPK working directory.
4. Create the SR 4 Mainline Alignment. Alignment and steps are shown below.
   1. Place line from element. See commands below and at a distance of 500'.



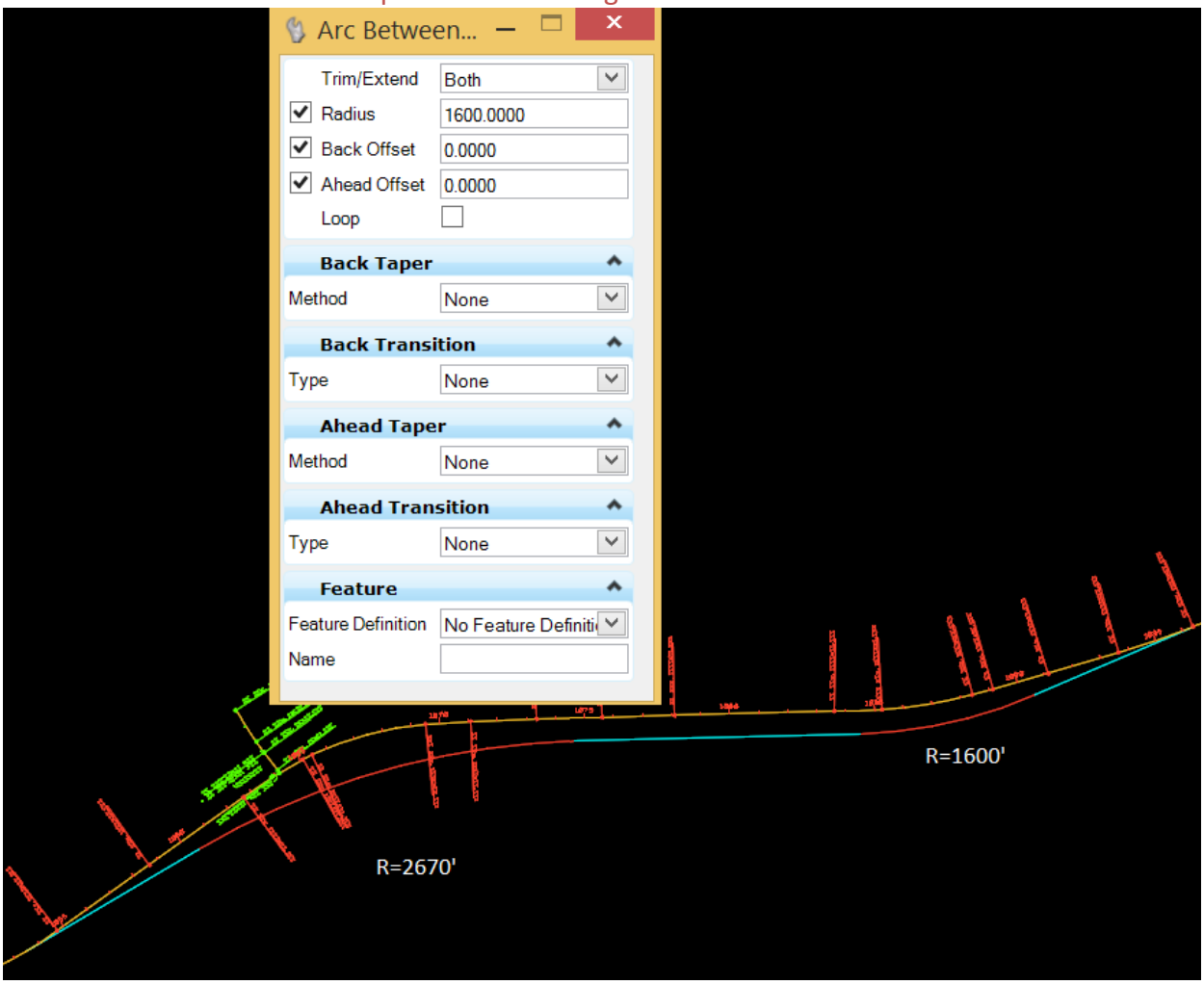
2. Use Single Offset Partial to copy parallel alignment XMLSR4 80’ to the right from approximately station 1078+50 to 1083+25.



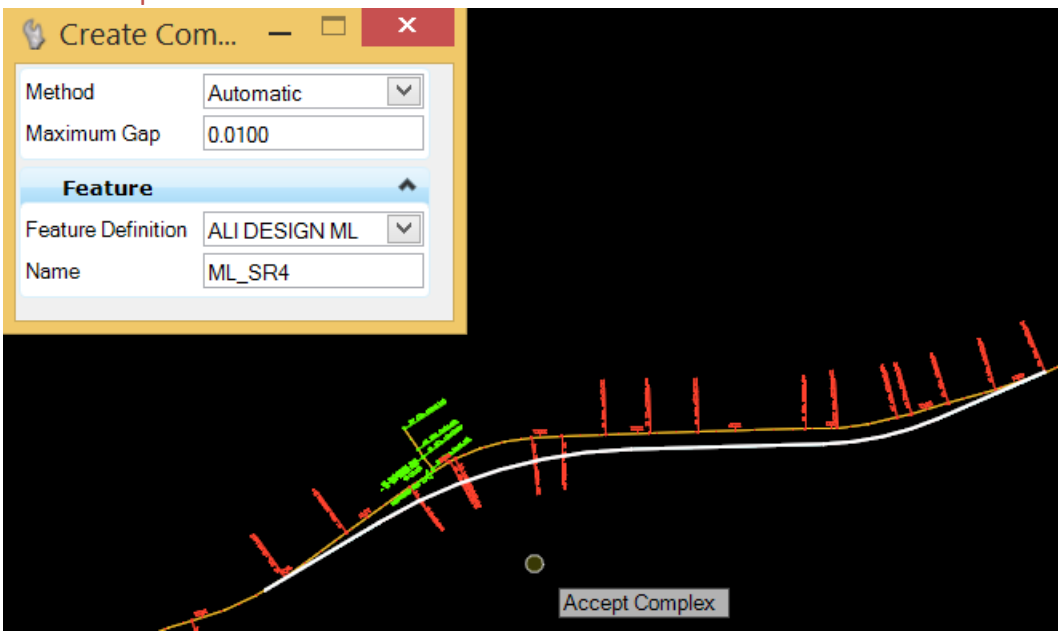
3. Place Line from Element – From PT Station 1096+38.307 back 500'.



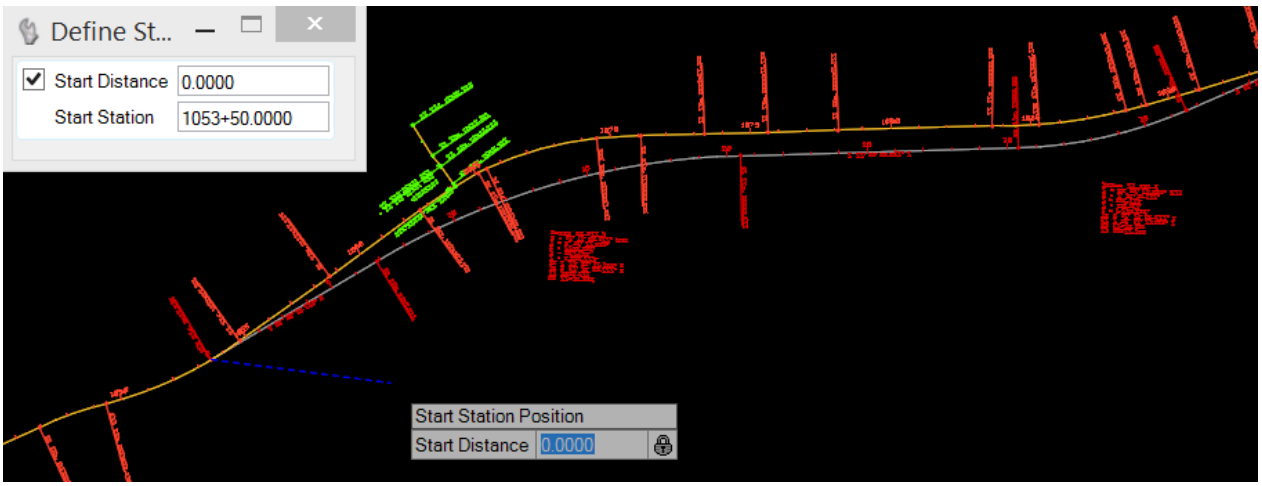
4. Use Arc Between Elements to place the following arcs.



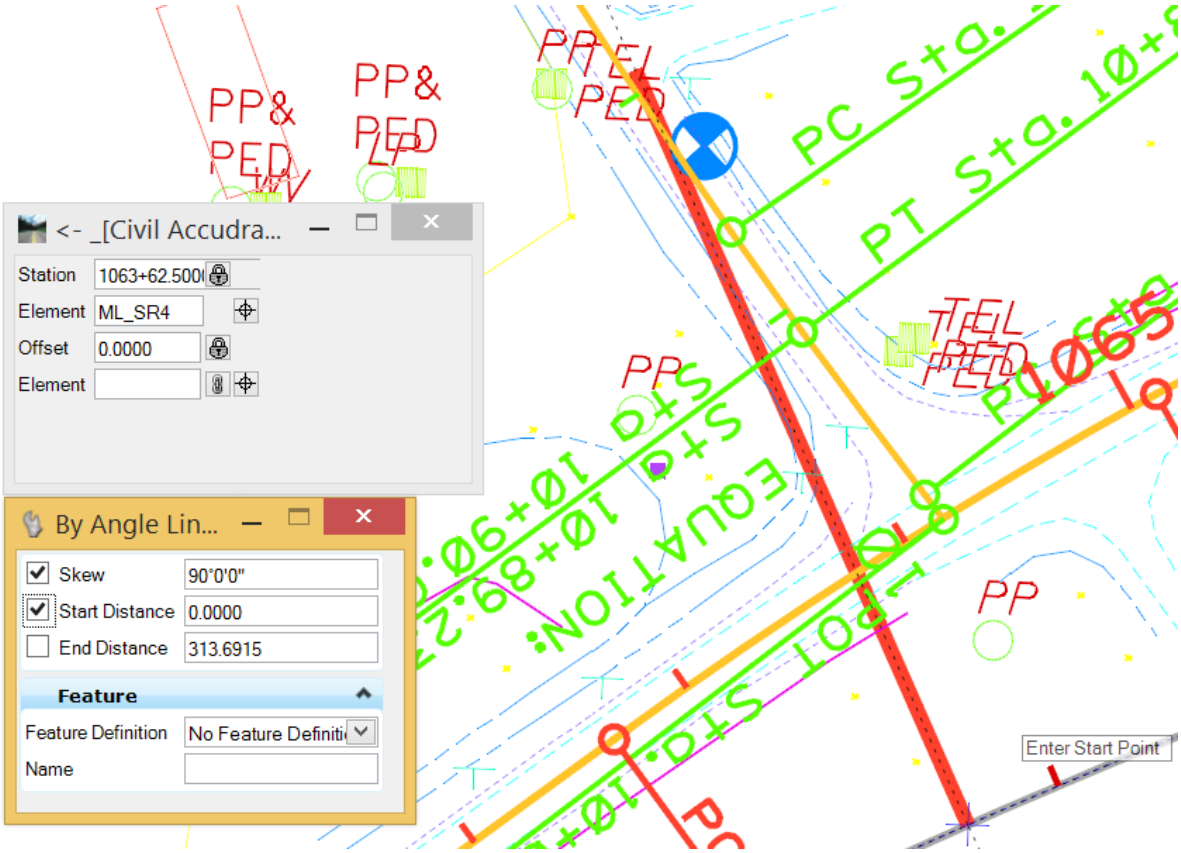
5. Store Complex



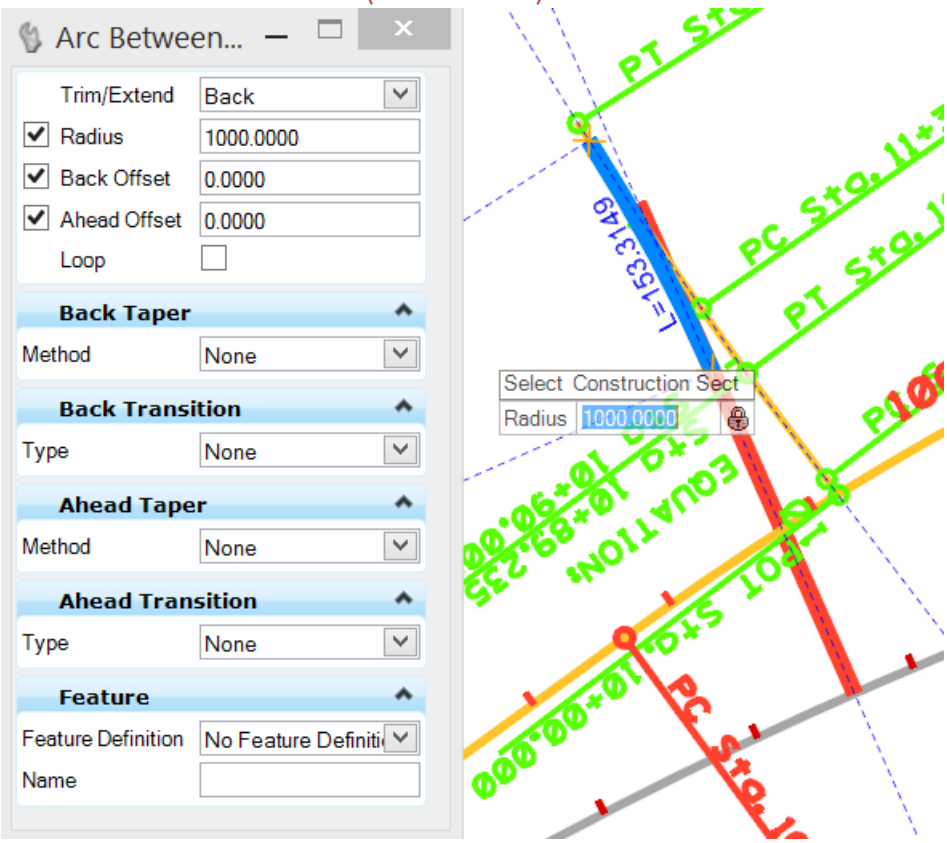
6. Station 1053+50



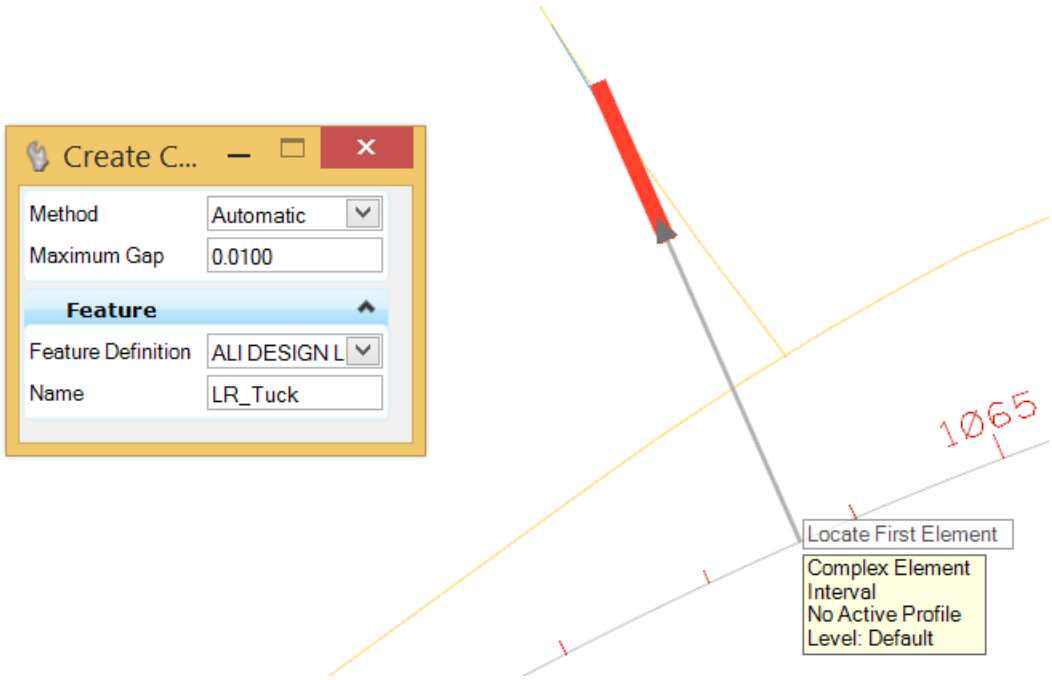
5. Store LR Alignment LR_Tuck.
   a) Place Line from Element (From alignment ML_SR4, 90 degrees, and just crossing alignment



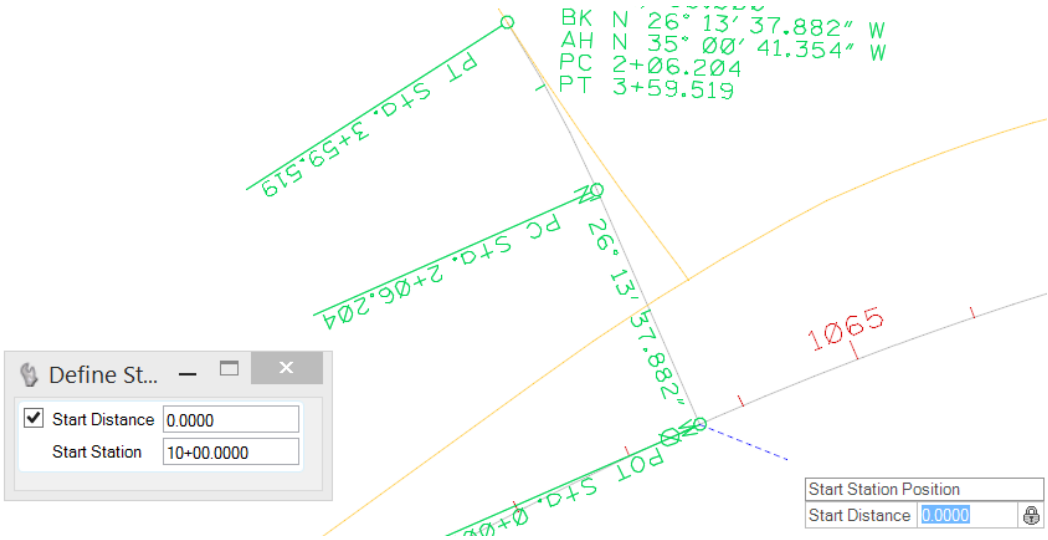
b) Place Arc Between Element (1000' radius)



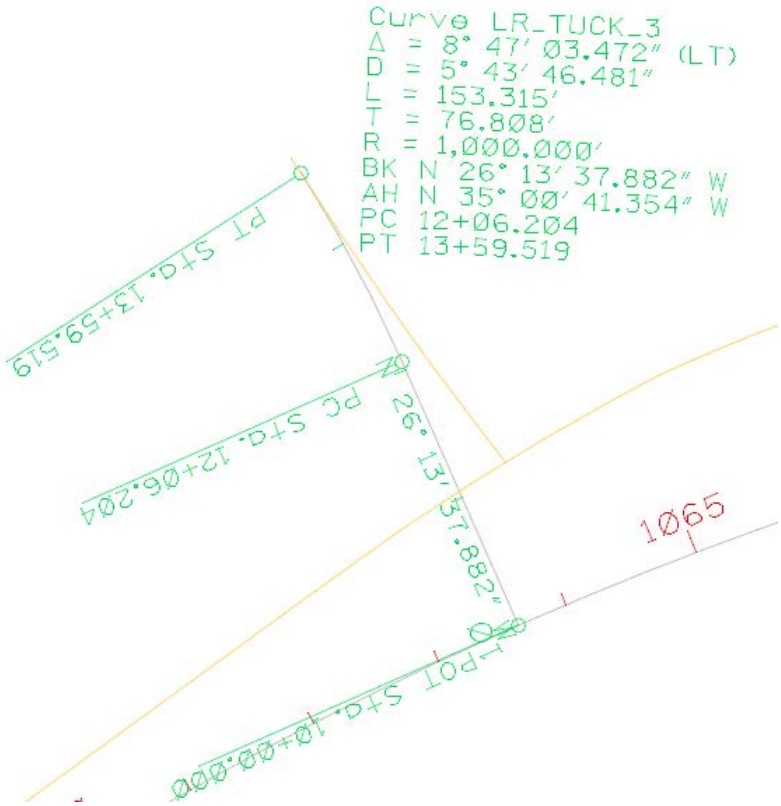
c) Store Complex with the Name LR_Tuck



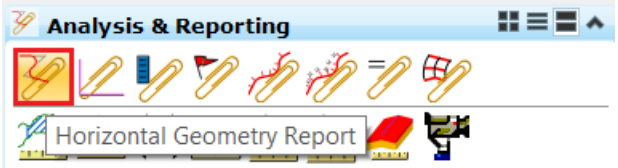
d) Station Beginning - 10+00



Finished LR


1065
L-POT Sta. 10+00.000
37.882"
26° 13'
PC Sta. 12+06.204
PT Sta. 13+59.519
Curve LR_TUCK_3
Δ = 8° 47' 03.472" (LT)
D = 5° 43' 46.481"
L = 153.315'
T = 76.808'
R = 1,000.000'
BK N 26° 13' 37.882" W
AH N 35° 00' 41.354" W
PC 12+06.204
PT 13+59.519

6. View the Horizontal Geometry Reports for both ML_SR4 and LR_Tuck.



Alignment Name: ML_SR4
Alignment Description:
Alignment Style: ALI DESIGN ML

		Station	Northing	Easting
Element: Linear				
POB	( )	105+350.0000 R1	1874487.0382	740504.4803
PC	( )	106+037.5615 R1	1874863.5223	741079.8068
Tangential Direction:		N 56°47'59.7334" E		
Tangential Length:		687.5615		
Element: Circular				
PC	( )	106+037.5615 R1	1874863.5223	741079.8068
PI	( )	106+733.6690 R1	1875244.6859	741662.2841
CC	( )		1872629.3635	742541.8035
PT	( )	107+399.4597 R1	1875292.9406	742356.7170
Radius:		2670.0000		
Delta:		29°13'30.3566" Right		
Degree of Curvature (Arc):		2°08'45.2582"		
Length:		1361.8981		
Tangent:		696.1074		
Chord:		1347.1822		
Middle Ordinate:		86.3640		
External:		89.2509		
Tangent Direction:		N 56°47'59.7334" E		
Radial Direction:		S 33°12'00.2666" E		
Chord Direction:		N 71°24'44.9117" E		
Radial Direction:		S 3°58'29.9100" E		
Tangent Direction:		N 86°01'30.0900" E		

Check Bearings to ensure no kinks.

ML_SR4 continued:

Element: Linear				
PT	( )	107+399.4597 R1	1875292.9406	742356.7170
PC	( )	108+388.3906 R1	1875361.4941	743343.2690
Tangential Direction:		N 86°01'30.0900" E		
Tangential Length:		988.9309		
Element: Circular				
PC	( )	108+388.3906 R1	1875361.4941	743343.2690
PI	( )	108+700.5299 R1	1875383.1318	743654.6574
CC	( )		1876957.6451	743232.3558
PT	( )	109+004.9254 R1	1875520.2241	743935.0796
Radius:		1600.0000		
Delta:		22°04'40.8995" Left		
Degree of Curvature (Arc):		3°34'51.5504"		
Length:		616.5348		
Tangent:		312.1393		
Chord:		612.7276		
Middle Ordinate:		29.6048		
External:		30.1629		
Tangent Direction:		N 86°01'30.0900" E		
Radial Direction:		S 3°58'29.9100" E		
Chord Direction:		N 74°59'09.6402" E		
Radial Direction:		S 26°03'10.8095" E		
Tangent Direction:		N 63°56'49.1905" E		
Element: Linear				
PT	( )	109+004.9254 R1	1875520.2241	743935.0796
POE	( )	109+599.5157 R1	1875781.3696	744469.2525
Tangential Direction:		N 63°56'49.1905" E		
Tangential Length:		594.5903		

Check Bearings

Check End Station

Check Bearings

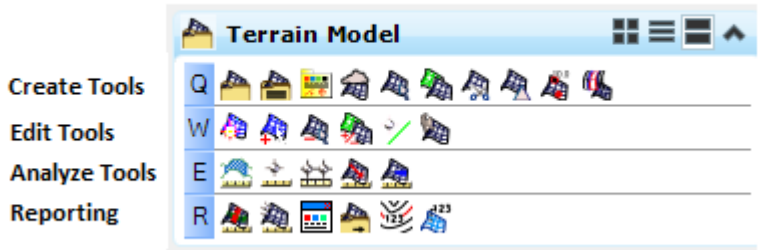
7. Create and enter the file RWD-EP-001.DGN
8. Reference the file RWD-ALI-001.DGN
9. Use Single Offset Entire Element to create Proposed Edge of Pavement for both alignments LR_SR4 (14’ from CL) and LR_Tuck (12’ from CL).

7. TERRAIN MODELS

7.1 Section Overview

With the implementation of version SS3, MicroStation created a new element type called **Terrain**. For GEOPAK users, the terrain is the intended replacement of the .TIN file. When processing survey, the terrain is created automatically based on certain Pcode features being assigned to be included in terrain creation.

This section is intended to introduce the user to terrains and basically shows detailed steps of the tools needed to make a TIN or terrain available for vertical geometry and corridor modeling work with a brief overview of other terrain model tools.



7.2 Section Prerequisites

- MicroStation Fundamentals
- Knowledge of surveying principals
- Basics of Horizontal Geometry

7.3 Section Objectives

After completing this section, you will be able to:

1) Import a TIN file as a Terrain.
2) Make a Terrain Active.
3) View Triangles and Contours.
4) Export a Terrain as a TIN or XML.
5) Have a good understanding of all the terrain tools available.

7.4 Terrain Menu

Below is the Terrain Model menu. Those identified by a maroon description are more often used in design processes.

7.4.1 Create Tools

Create from File	Creates a terrain model by importing from an external file. Numerous file formats are supported such as USGS DEM, DTED, Lidar (*.las), and native products (InRoads, GEOPAK, and MX).
Create Terrain Model from ASCII File	Creates a terrain model by importing from an ASCII file type using a user customizable format files.
Create Terrain Model by Graphical Filter	This is the method used to create Design Terrains from Corridor Models. Filters have been set up to basically search for specific symbology and then create the "Top Dirt" or "Finished Grade" terrains. This tool is discussed in detail in the AMG section of this document.
Create from Point Cloud	Creates a terrain model from MicroStation Point Cloud data.
Create from Elements	Creates a terrain model from 3D graphical elements. This tool is used quite frequently in Civil Cell construction.
Create Complex Terrain Model	Creates a new Complex terrain model by merging or appending multiple terrain models. This process is used in the design process in phased construction processes.
Create Clipped Terrain Model	Creates a terrain model by clipping an existing terrain model and providing an optional horizontal or vertical offset.
Create Delta Terrain Model	Creates a new terrain model by the difference between 2 terrain models or a terrain model and a plane (elevation).
Create Terrain by Text Interpolation	Creates a terrain model from 2D graphics which also contain an elevation label.
Create Corridor Alternate Surface	Creates a terrain model from user-specified points in a corridor model along any given path.

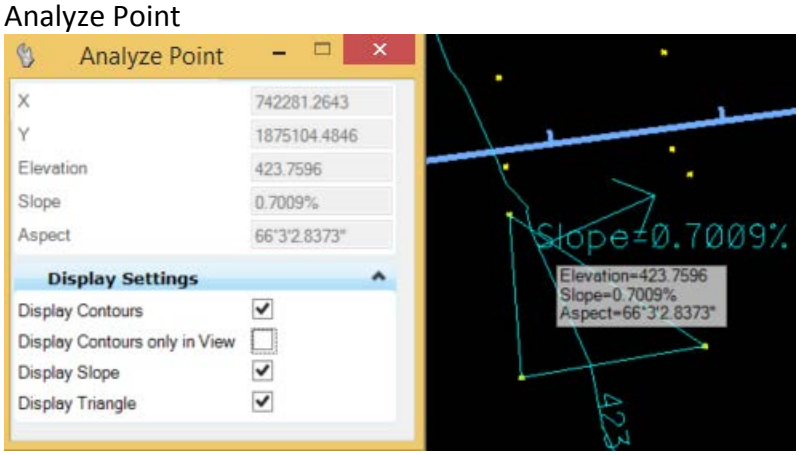
7.4.2 Edit Tools

Set Active Terrain Model	Sets the active terrain model file. The active terrain model is the model which is displayed by default in profile models and is the default target for corridor modeler.
Add Features	Adds more features into the terrain that was created using the create commands. Example, create the terrain from break lines, then add points. Used more often in Civil Cell creation.
Remove Features	Removes elements from a terrain which were added by Add Features or Create from Elements. Used more often in Civil Cell creation.
Edit Complex Terrain Model	Edits a complex terrain by changing the order of merging, change merge or append methods and add or remove component terrain models
Change Feature Type	Changes the terrain attribute of an element in a terrain model. For example, change a break line to a void.
Edit Terrain Model	Opens tool settings with several simple editing tools; delete, insert and move vertex, delete triangles, and swap lines.
Create Terrain Model Boundary	Allows the extraction of implied or stored boundaries from terrains with the ability to edit and rule the boundary.
Remove Terrain Model Boundary	Removes a boundary element from an un-ruled terrain model.

7.4.3 Analysis

Analyze Volumes	Calculates volume between 2 terrain models or a terrain model and plane (elevation). Capable of processing in an area (fence) or multiple areas and computing the volumes over a range of elevations. Cut and fill factors are also options. Used to calculate surface to surface earthwork. The tool is detailed in the Earthwork section of this document.
Analyze Point	Reports information about a user-specified point location in a terrain model (elevation, slope, contour, slope direction).
Analyze Between Points	Reports information between 2 point locations on a terrain model (elevation difference, length and slope).
Analyze Trace Slope	Traces along a surface either following a user-specified slope value or the steepest slope. Can trace upstream or downstream.
Analyze Pond	Analyzes terrain model for ponds (low point) located via a data point location on a terrain model (volume, area max depth).
Create Cut and Fill Volumes	Calculates cut and fill volumes between two surfaces, usually an existing a terrain and a surface (terrain or mesh) and creates a 3D mesh solid with volume attributes.

Analyze Point



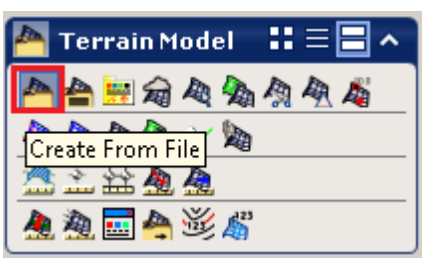
7.4.4 Miscellaneous

Report Crossing Features	Reports crossing features in a terrain model.
Report Conflicting Points	Reports duplicate points in a terrain model.
Graphical Filter Manager	Build, modify or review graphical filters and filter groups used as search parameters for Select by Filter and Create Terrain Model by Graphical Filter tools.
Export to File	Exports the terrain model to the specified file format, i.e., LandXML or native product (GEOPAK TIN, InRoads DTM, MX FIL).
Label Terrain Contours	Places additional contour labels to supplement those placed automatically by the terrain model element. For example, add contour labels in locations where the automatic labels are not present.
Label Terrain Spots	Places spot elevation labels.

7.5 Importing a TIN file

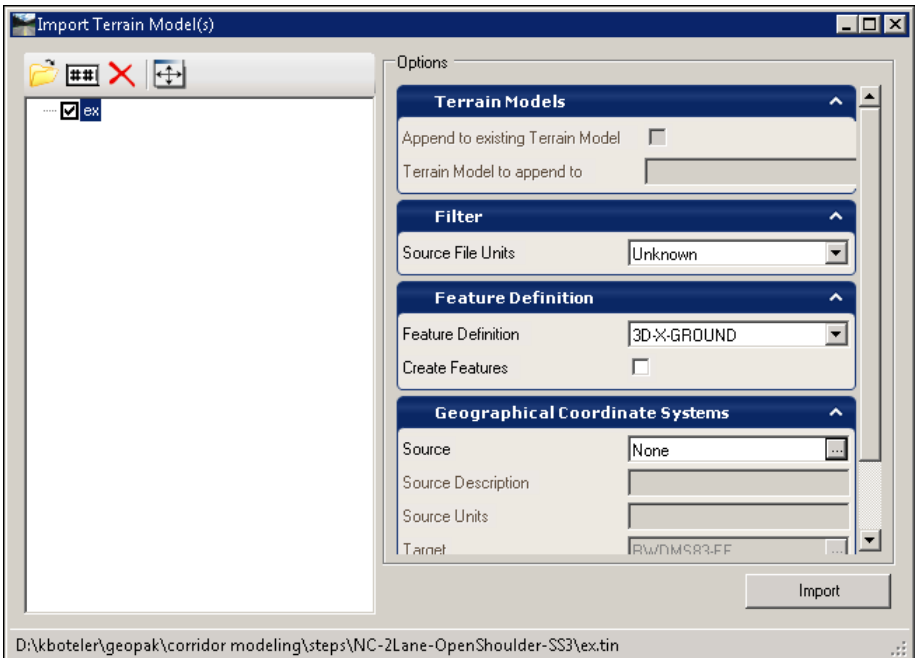
If a TIN is submitted with the survey:

1) In a DGN file created from a 3D seed file, choose the **Create From File** button on the Terrain Model menu.



2) Choose the TIN file.

3) Choose 3d-x-ground as the feature definition and select **Import**.



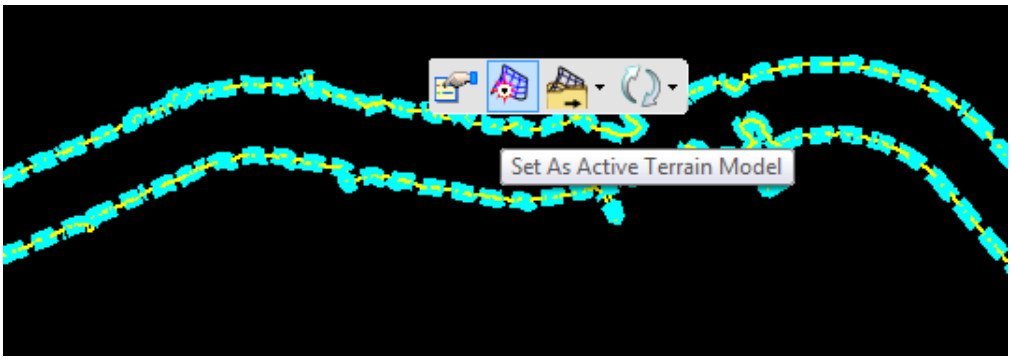
4) Close the dialog above and fit view to see the TIN.
Notes:
- Only the boundary is displayed initially.
- You can rename the model after to Import by going to Terrain Properties on the context menu.

5) Reference the DGN file containing the terrain to any DGN file that needs access to the terrain (ALI, Corridor, etc.) and make it active as described below.

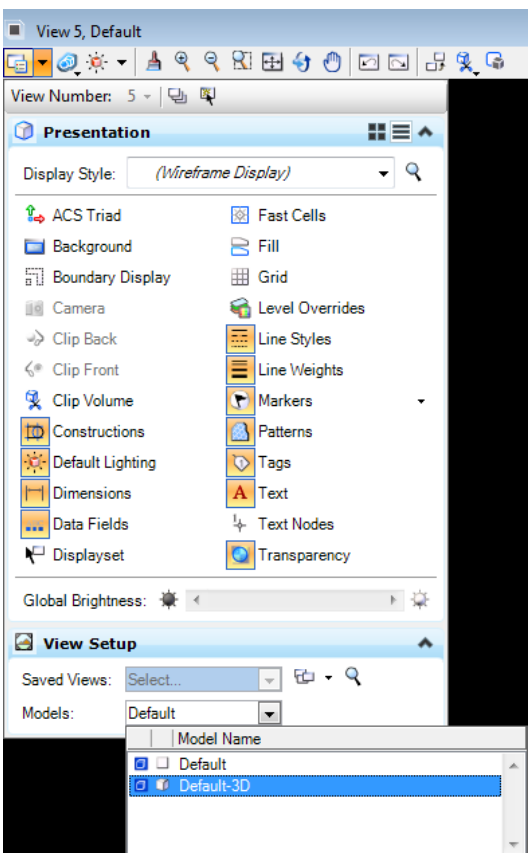
7.6 Set as Active Terrain Model

To set a Terrain Model as Active (so GEOPAK will know what to cut a profile from, what to target with corridor end conditions, etc.), from the context menu, set it as the Active Terrain Model.

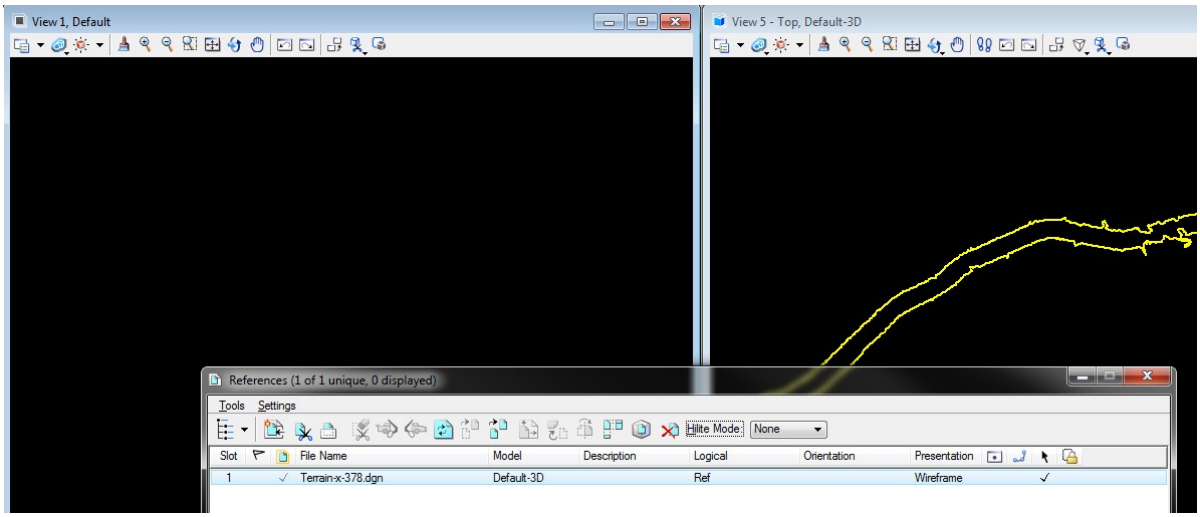
1) Data point the TIN and a context menu should appear. Choose **Set Active**.



2) Once you select **Set Active** in a 2d DGN file, a Default-3d model is created.
3) Open View 5 and open the Default-3d model.

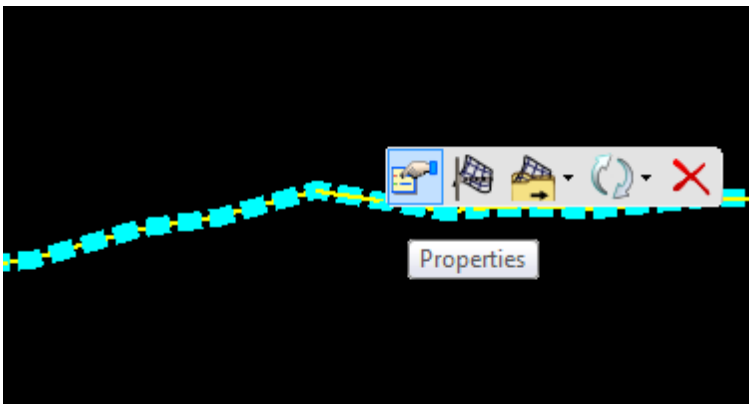


4) When the Default-3d model was created, it was referenced to the Default model. It is good practice to turn this reference file off. Select View 1, open the ref. dialog and turn off display for the Default-3d model.

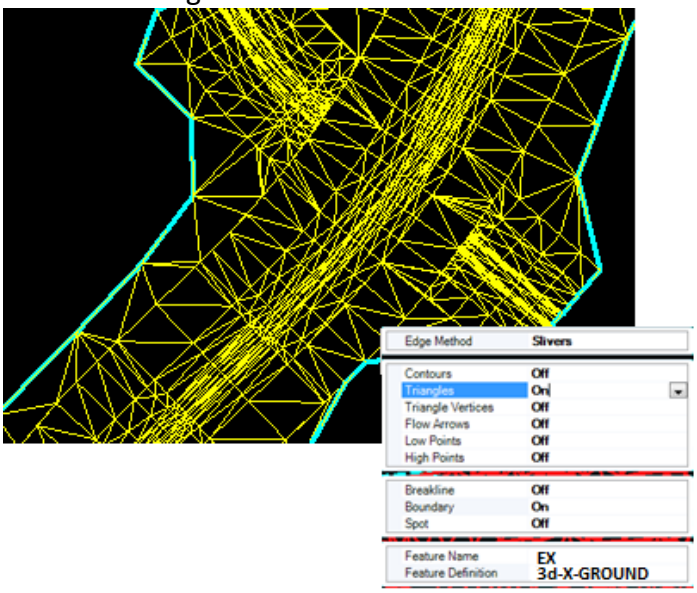


7.7 Triangle Display

1) Choose, then hover over the terrain boundary and choose **Properties** from the context menu.



2) Turn ON Triangles.



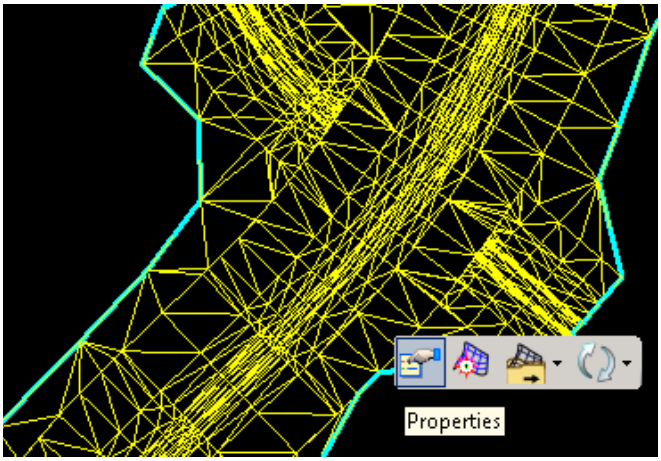
Note: You have to be in the DGN that contains the terrain to perform this process.

7.8 Working with a Terrain Model

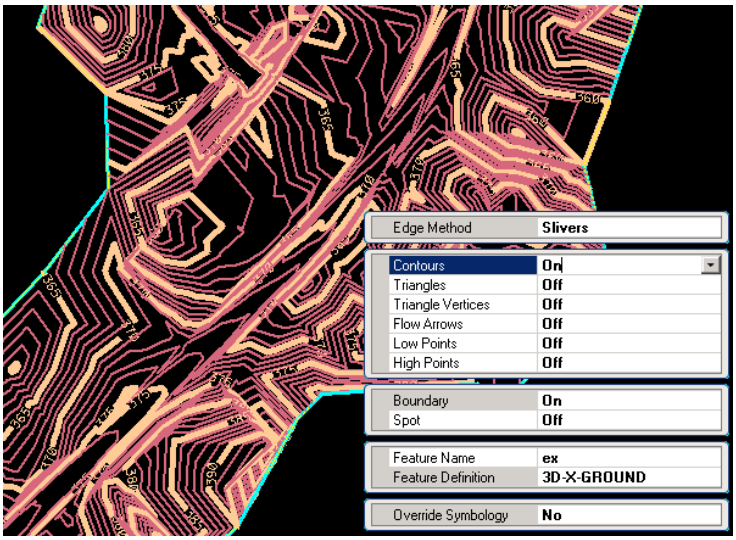
In lieu of a TIN being submitted with the survey, just reference in the DGN file containing the terrain model and **Set Active.**

7.9 Viewing Contours, Flow Arrows, etc.

1) Choose **Properties** from the context menu.

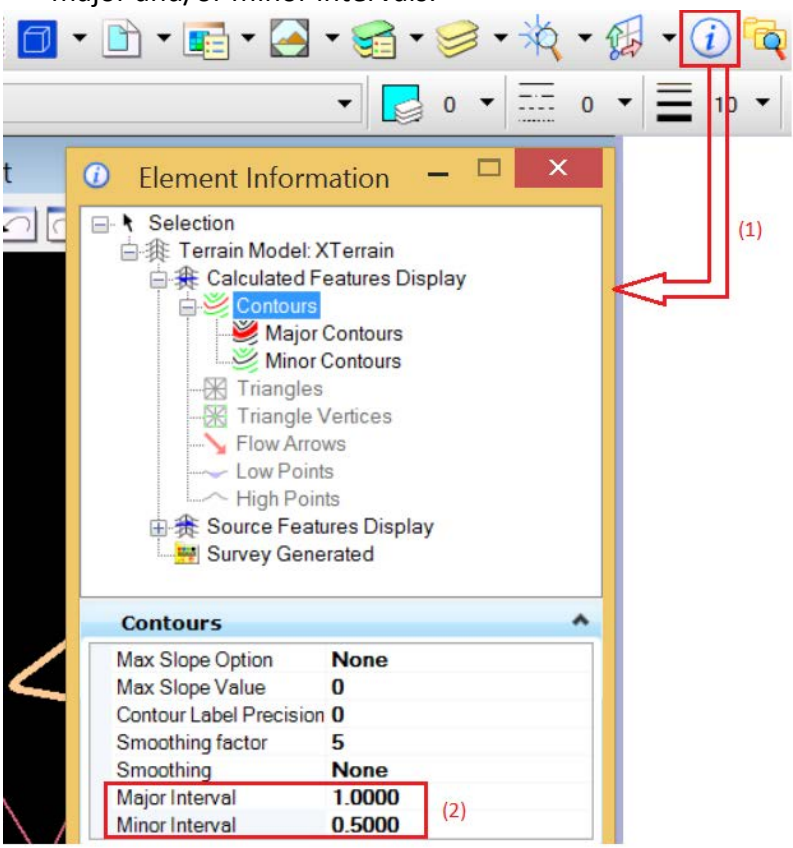


2) Turn on Contours.



Notes:

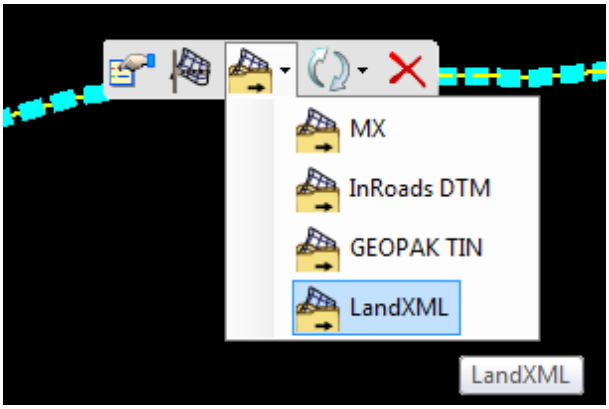
- On the dialog above, you can also display flow arrows, low points, etc.
- Contour interval can be controlled by going to **Element Information** and changing the major and/or minor intervals:



7.10 Other Context Tools

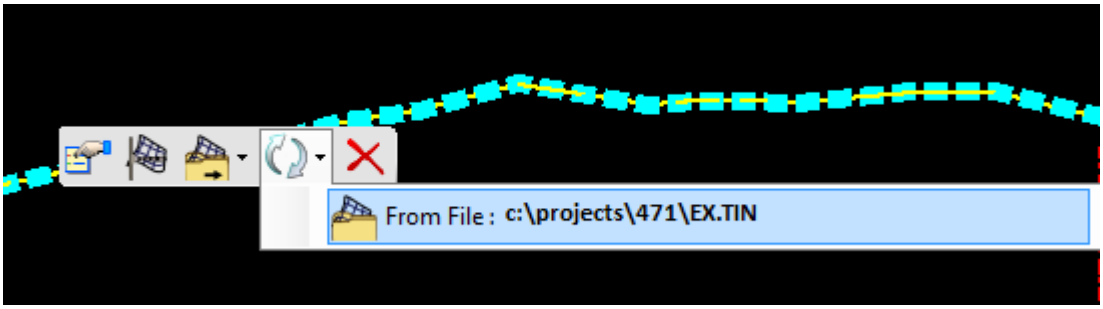
7.10.1 Context - Export

Export to another format (from the context menu).



7.10.2 Context - Update from Source

If the TIN has been changed, you will need to update the Terrain in the DGN file from the changed TIN.



8. VERTICAL GEOMETRY

8.1 Section Overview

This section will cover all tools related to creating and working with profiles with OpenRoads.

8.2 Section Prerequisites

- MicroStation Fundamentals
- Knowledge of surveying principals
- Vertical Geometry Basics

8.3 Section Objectives

After completing this Section, you will be able to:

1) Open a Profile View
2) Create and name an existing profile from a terrain along a Horizontal Alignment.
3) Basic Vertical Geometry commands.
4) Import and Export profiles to the GPK.
5) Annotate Profiles

8.4 The Profile View

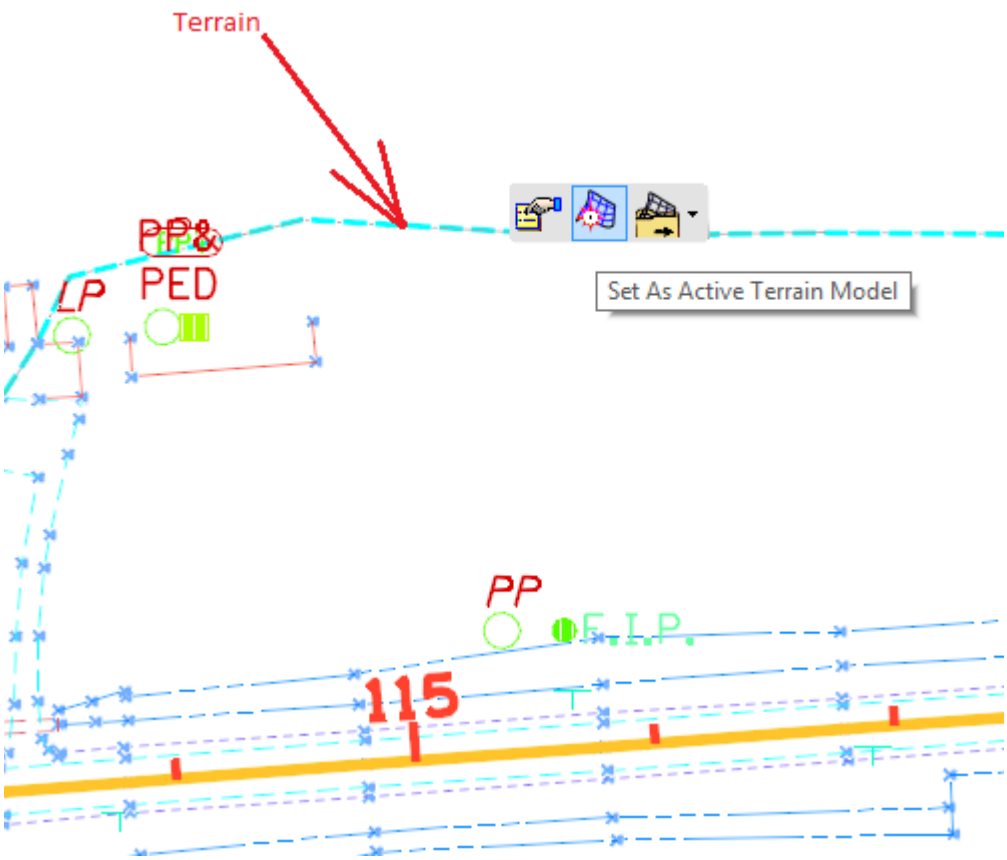
8.4.1 Overview

Users can open a profile view (MicroStation View) of every horizontal element created as long as:

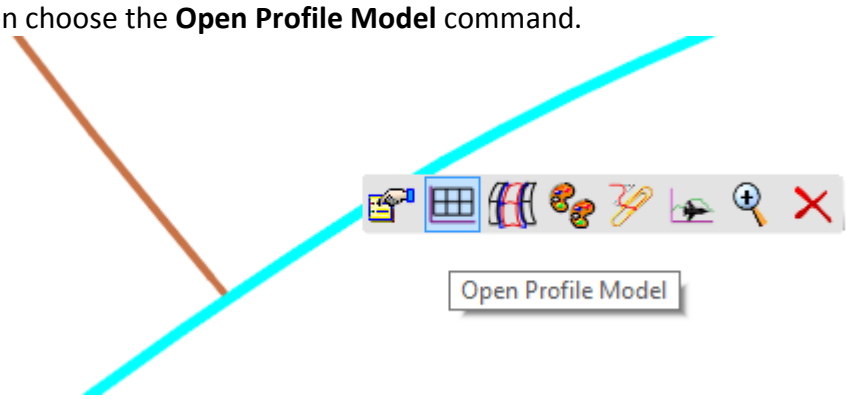
1) There is a terrain active.
2) You are in the same DGN that the horizontal element exists.

8.4.2 Steps

1) In the file containing the Horizontal Alignment (RWD-ALI-001.DGN) and with the file containing the terrain referenced (SRV-TOPO-001.DGN), from the context menu (Select and then hover over the element) choose the **Make Active** command.



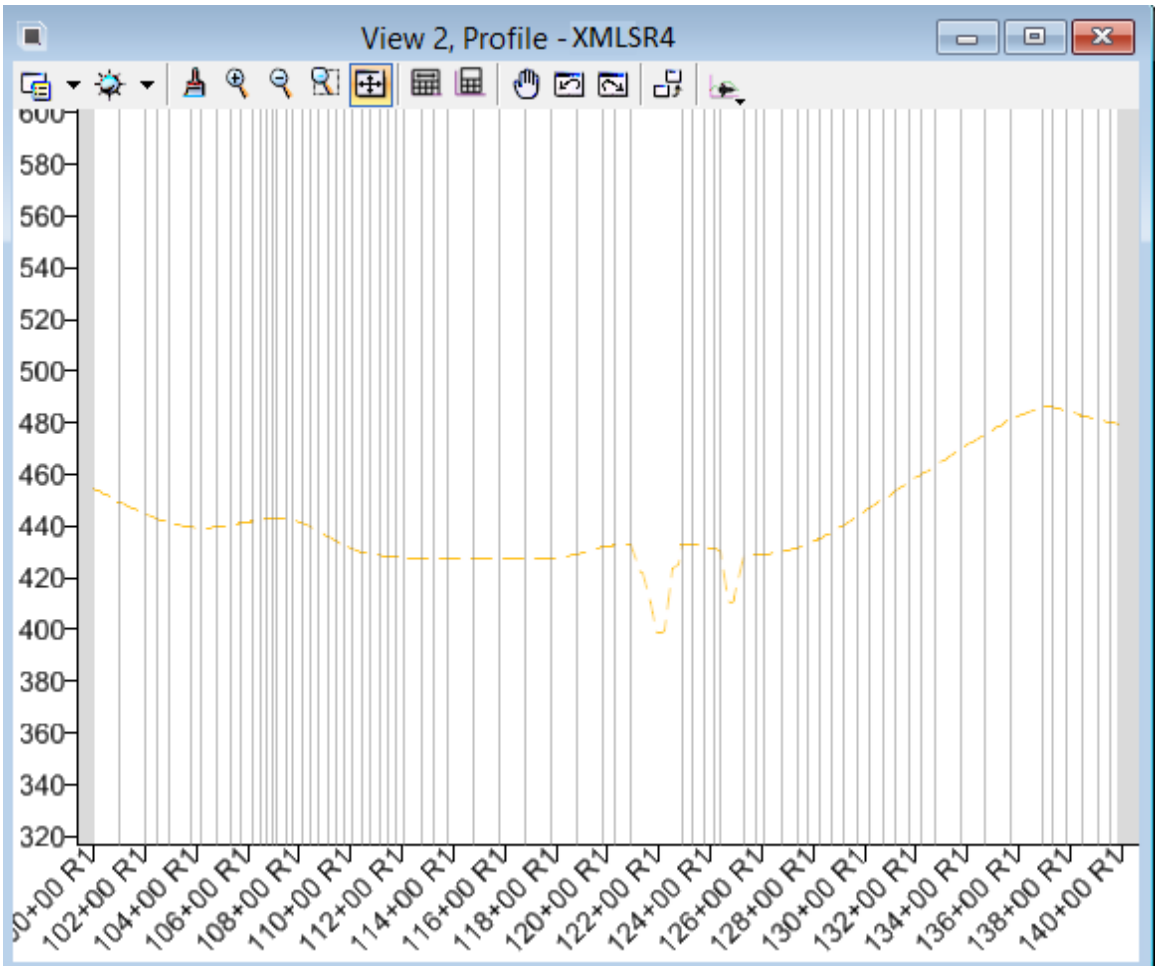
2) Choose and then hover over the Horizontal Alignment you wish to see a profile of and then choose the **Open Profile Model** command.



3) You are then prompted to **Select or Open View.**

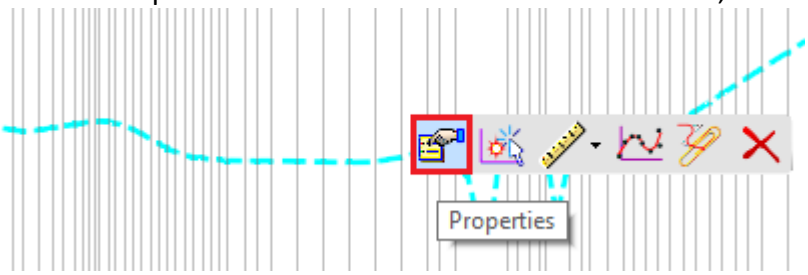
4) Select a view (any view) from MicroStation's Views.

5) Once the view is Open, DP (Left Click) in the view and the view presents the profile of the chosen horizontal element.

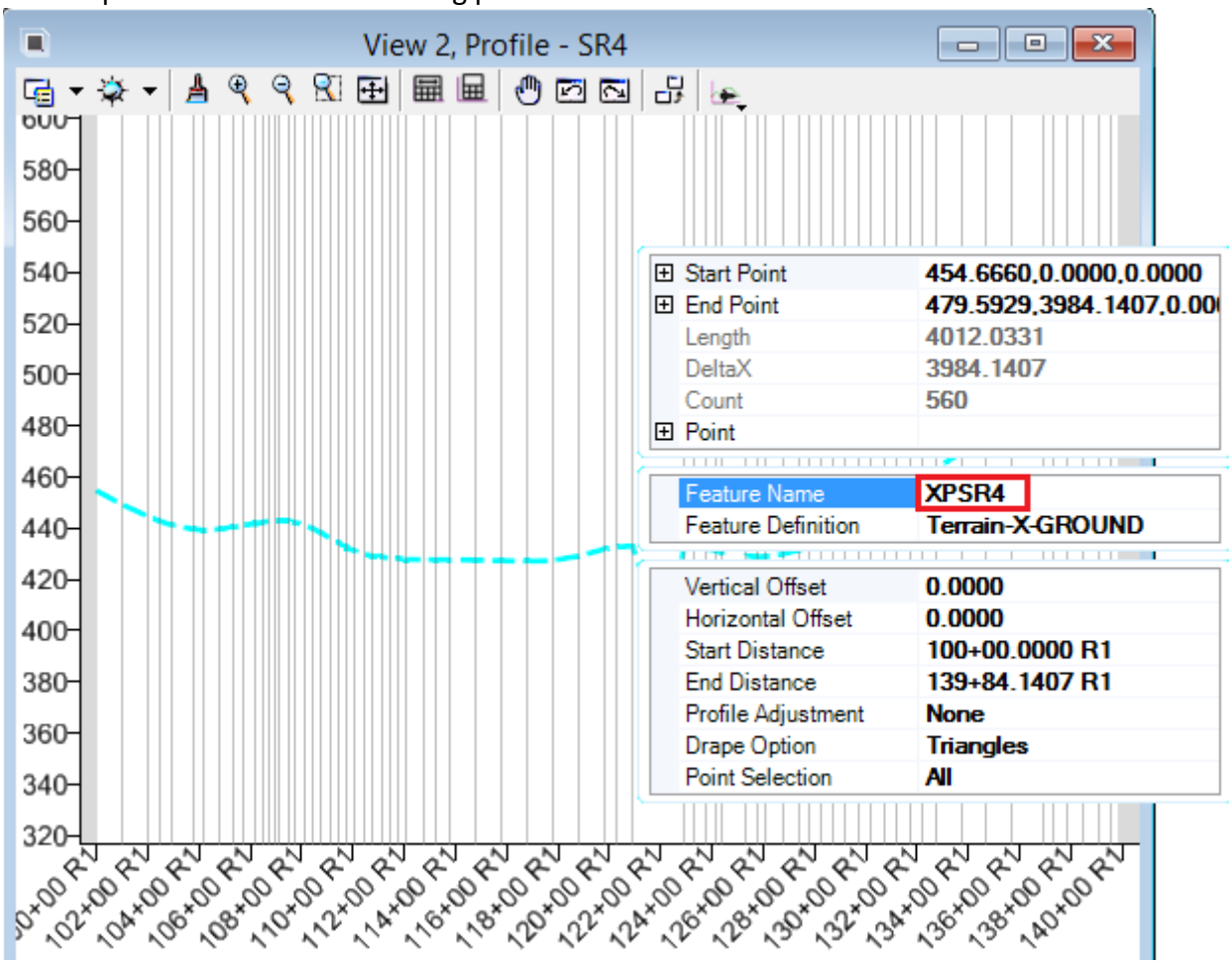


This view is like most MicroStation views in the fact you can Zoom In/Out, Fit, etc. It also shows the datum elevations and stations.

6) Choose the profile element and from the context menu, choose **Properties.**



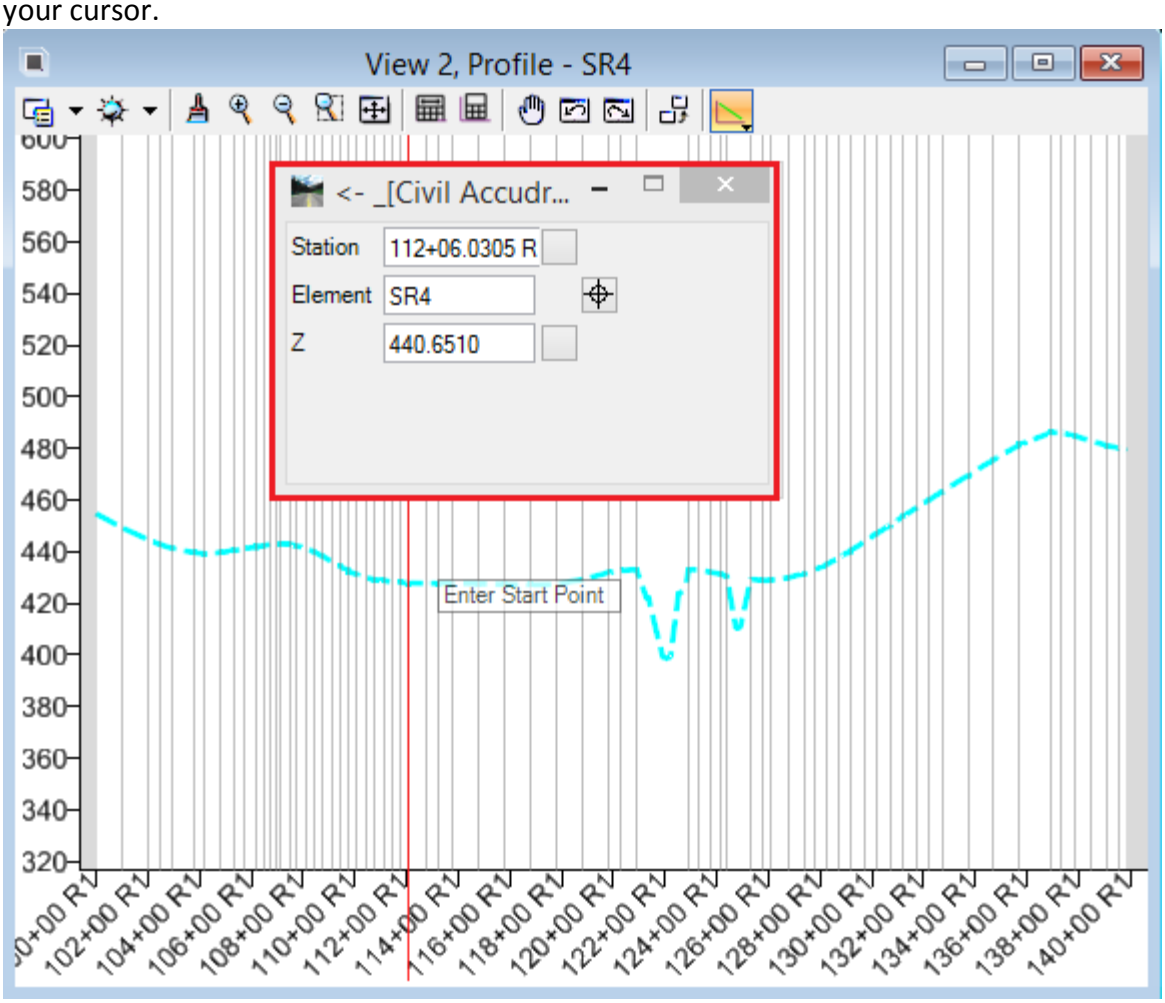
7) Enter a profile name for the existing profile.



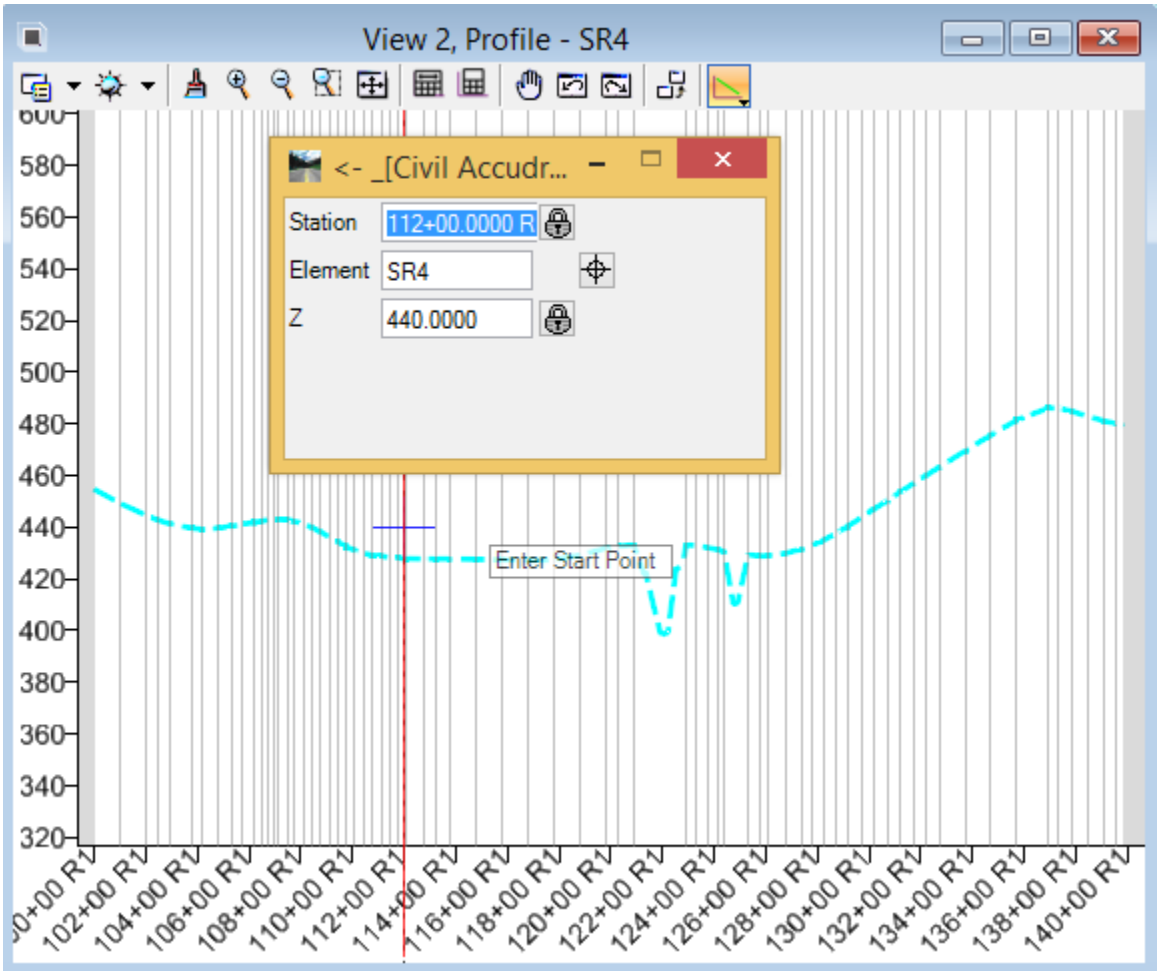
8.5 Civil AccuDraw for Profiles

The basics of Civil AccuDraw and how to invoke and use related to Horizontal alignments was discussed in the Horizontal Geometry section of this document. How to use it related to the profile view is discussed below.

1) Toggle on Civil AccuDraw.
2) Choose the view by selecting the view.
3) Scroll to see Civil AccuDraw automatically reporting Station and Elevation as you move your cursor.



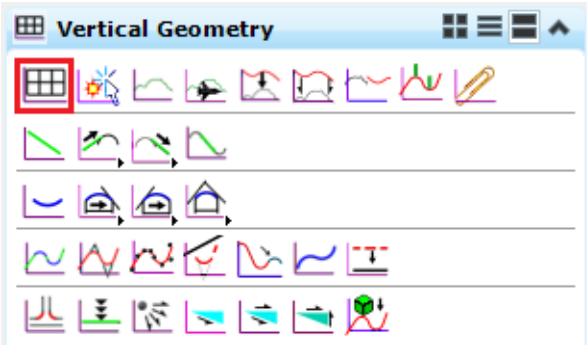
4) As with Horizontal Geometry, choose a command and then key in and tab through station and elevation to lock them to perform that command on the user provided station and elevation.



8.6 Vertical Profile Commands

8.6.1 Overview and Commands

Vertical Geometry (profiles) commands are listed below.



MAIN - Open Profile View, Set active Profile (Design), etc.

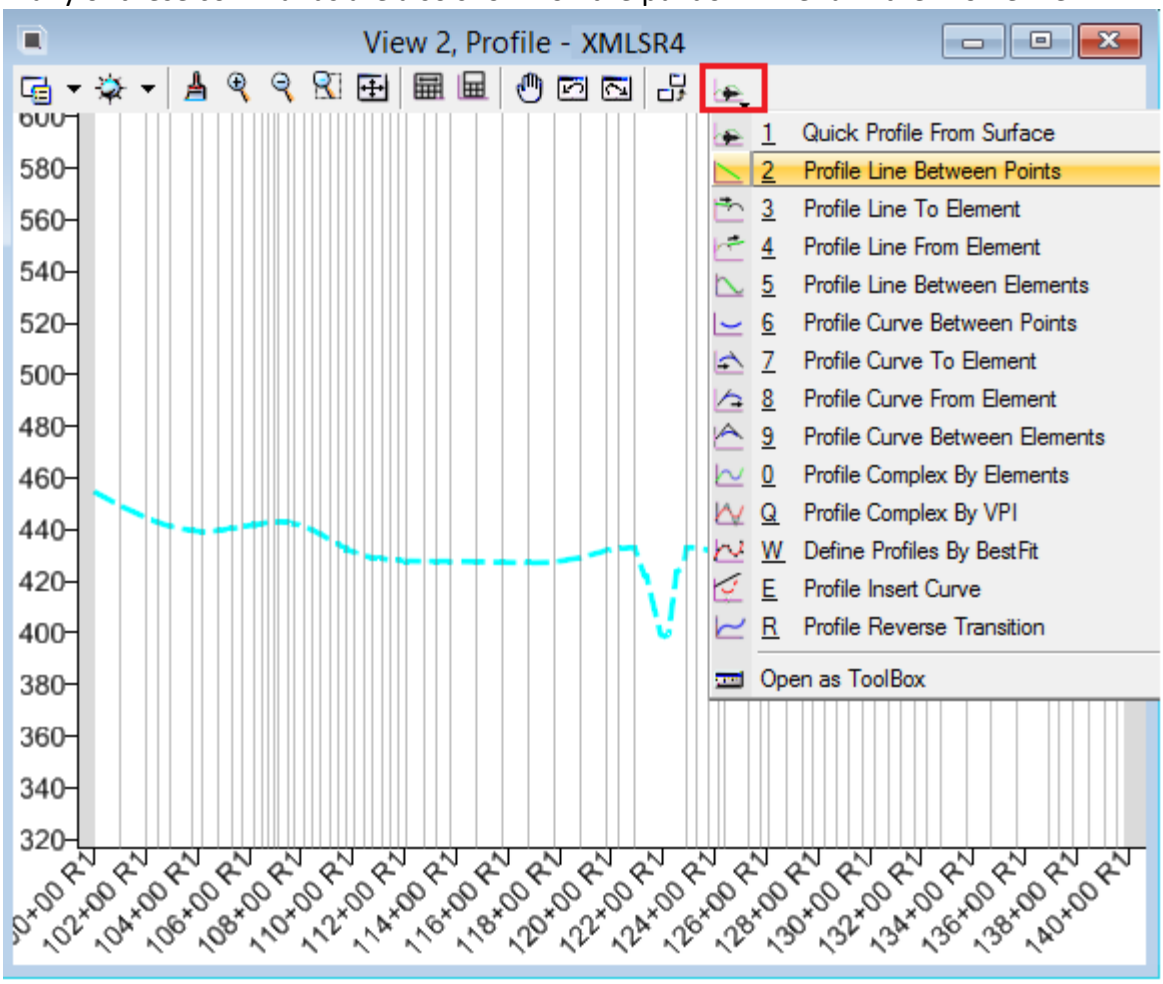
LINE - PLace Line commands

CURVE - Place curve commands

COMPLEX - Create complex, etc.

DEFINE ELEMENT PROFILES - 3D related commands

Many of these commands are also shown on the pulldown menu in the Profile View.



Open Profile Model	Generates a View that presents a desired feature in profile thus enabling the Vertical Geometry tools to interact with the chosen feature.
Set Active Profile	Designates which of potentially several profile elements will drive the 3D model. The result is the creation of a 3D spline in the 3D model representing the combination of the Horizontal alignment plus the Design profile.
Profile From Surface	Generates a profile whose elevations are determined by draping onto a surface. The surface may be a terrain model, a mesh, or mesh solid.
Quick Profile From Surface	Generates a profile of a civil horizontal element by draping onto a surface (terrain model, a mesh, or mesh solid).
Project Profile To Element	Shows one element's profile in the Profile View of another element.
Project Profile Range To Element	Shows a portion of one elements profile in the profile space of another element.
Project Extended Profile	Shows, in an element's profile view, the profiles of adjacent elements.
Place Profile Intersection Point	Indicates in a Profile View where one element crosses another. The point is placed at the station and elevation of the intersected element. The intersected element must have a designated active profile.
Profile Report	Creates an XML report data file that includes information about the selected vertical alignments. To run this command the user is prompted to select one or more vertical elements from a long section view.

Profile Line Between Points	Constructs a profile line, between two user-defined points.
Profile Line To Element	Constructs a profile line, at a delta slope, from a designated location to a reference element.
Profile Line From Element	Constructs a profile line, at a delta slope, from a reference element to a designated location.
Profile Line Between Elements	Constructs a profile line between two previously placed profile curves.

Profile Curve Between Points	Constructs a vertical curve between designated points.
Profile Curve To Element	Constructs a vertical curve from a designated point to an element.
Profile Curve From Element	Constructs a vertical curve between an existing element and a point you will designate.
Profile Curve Between Elements	Constructs a vertical curve between two designated elements.
Profile Complex By Elements	Constructs a complex profile element from previously placed elements.
Profile Complex BY VPI	Constructs a profile complex defined by vertical points of intersection (VPI).
Define Profiles By Best Fit	Construct a profile complex defined by best fitting through a selected profile.
Profile Insert Curve	Inserts a vertical curve into a profile element.
Append Profile Element	Appends additional elements to a previously established complex element.
Profile Reverse Transition	Constructs reverse curves between previously drawn elements with an optional tangent length between the two curves.
Profile Offset Transition	Constructs profile elements at an offset from a base element. The base element may be a line, arc, spiral, or complex.

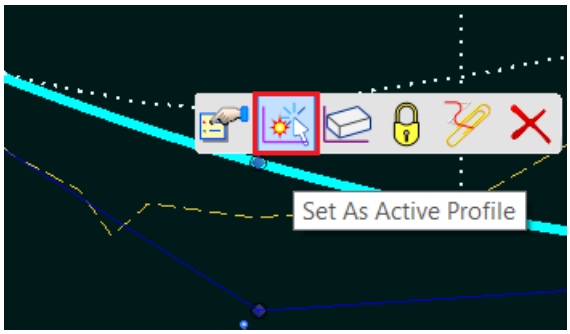
Quick Profile Transition	Defines the profile of an element by matching the slope and elevation of adjoining elements. Depending on the configuration of adjacent elements, either a single crest/sag curve is created or a reverse transition.
Profile By Constant Elevation	Defines a flat profile at a given elevation for the entire element.
Profile By Slope From Point	Defines a profile of an element by computing a slope from a 3D point.
Profile By Slope From Element	Defines an element's profile by projecting a fixed slope from another element with a design profile.
Profile By Variable Slope From Element	Defines an elements profile by projecting a variable slope from another element with a design profile. This command differs from the Profile by Slope command only in the fact that you have additional options. Specifically, you can define a range instead of the entire element, and there are multiple methods of slope rather than fixed slope alone.
Profile By Vertical Offset From Element	Defines the profile of an element based on a vertical offset. The results are similar to Profile by Variable Slope command, except that, instead of transitioning two slopes, two vertical offsets are used.
Profile By 3D Element	Produces a profile (in profile space) from a 3D element in the drawing.
Create Civil Rule Feature	Assigns Civil Geometry rules to elements created by tools other than civil geometry commands.

8.6.2 Creating a Design Profile

The process to create proposed profiles is similar to the process of creating horizontal alignments. Create the connecting lines and curves that will make up the profile and then choose the **Profile Complex By Elements** command shown above. Civil AccuDraw can also be used in this process. Use of these place line and curve commands and the process of complexing to create the profile is shown in the lab for this section.

8.6.3 Make Active

An alignment can have one **Active Profile** which is generally the design profile. Prior to creating a corridor, an alignment must have an active profile to know what elevation to place the templates. This command can be accessed via the context menu of a profile view element as shown below.

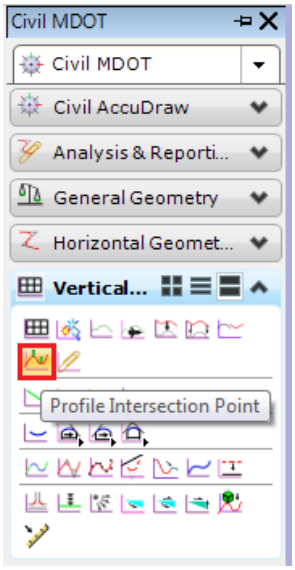


8.6.4 Project Slope commands

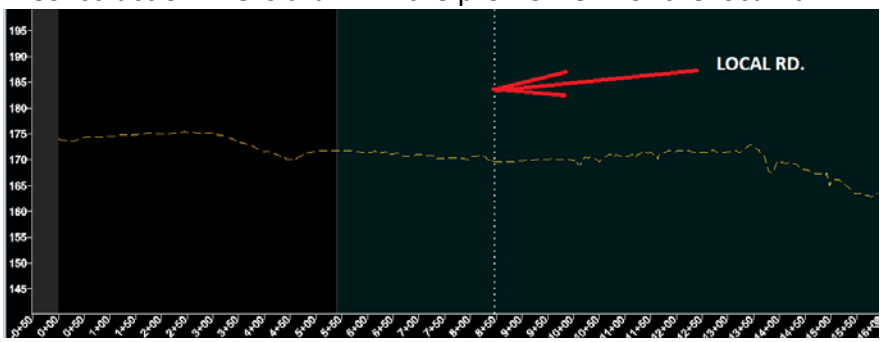
Project Slope commands are generally used to create profiles for elements used as references for Civil Cell placement. An example of this are elements created to represent edge of pavement for intersection cell placement. This profile edge of pavement is required as a reference of the intersection cell along with a profiled LR centerline. The edge of pavement is profiled from the mainline alignment by projecting the Superelevation slope(s) to it. This process is demonstrated in the **Civil Cell** -> **Intersection** area but discussed here since these **Project Slope** commands are under the Vertical category.

8.7 Locating Crossing Roads

1) Open a Profile View for your mainline alignment.
2) Locate the crossing alignments in your profile view by using the Vertical Geometry command **Profile Intersection Point.**
   a) Choose the command below.



   b) Select the ML alignment when prompted to **Locate Element to Show Intersection**.
   c) Select a crossing route when prompted to **Locate Element Which Intersects.**
   d) A Construction line is drawn in the profile view for the local rd.



   e) Continue choosing crossing routes that intersect.

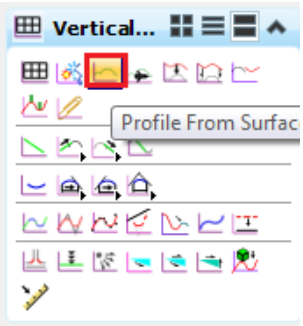
8.8 Generating Kick-Off Grades

8.8.1 Perquisites

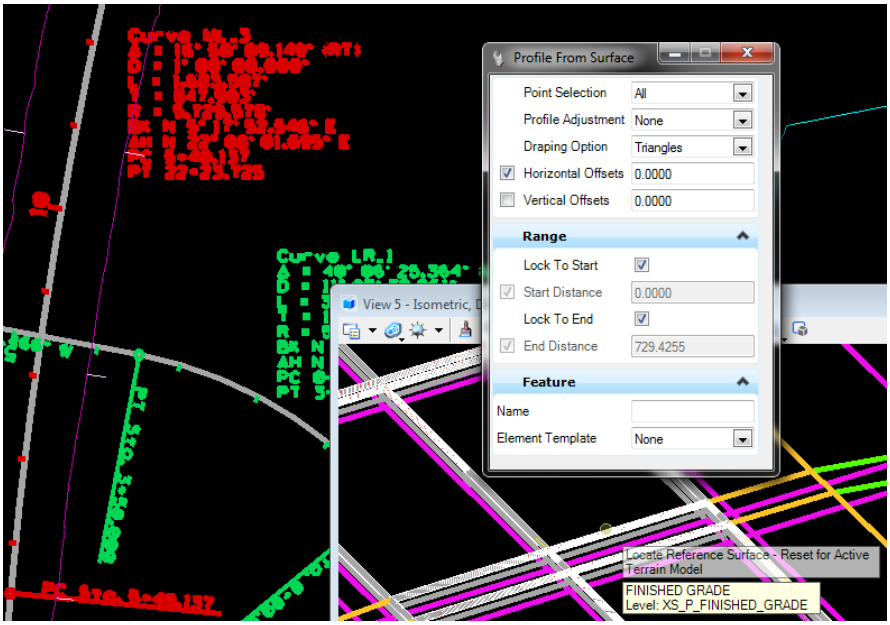
1) A Terrain referenced to an alignment DGN file.
2) An alignment in the DGN you are in.
3) Primary alignment Grade set, Corridor created, Superelevation applied.

8.8.2 Steps

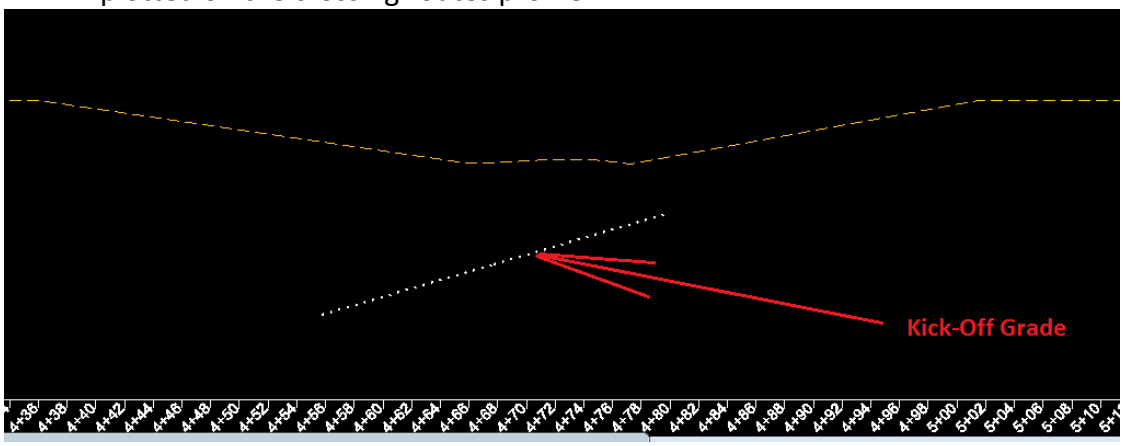
1) Open a profile model for a secondary route (i.e. local rd.)
2) Choose the Profile from Surface tool.



3) Follow prompts:
   a) **Locate First Element to Profile** – Select the crossing rd. (i.e. local rd.)
   b) Reset and you will be prompted to **Locate Reference Surface – Reset for Active Terrain Model.** Do not reset. In a 3d view, select the pavement area of the corridor elements and then reset.



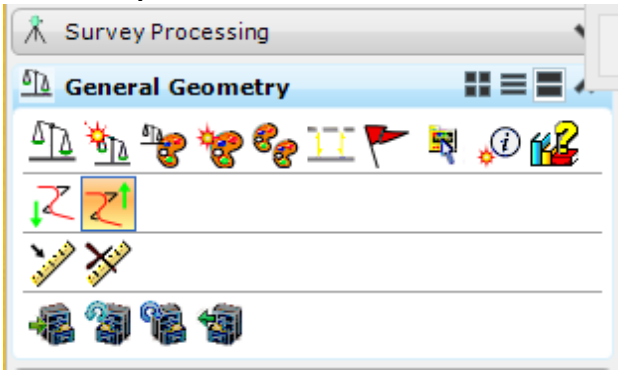
c) Follow the remaining prompts and a profile of the primary route's pavement will be plotted on the crossing routes profile.



8.9 Importing and Exporting Profiles to the GPK

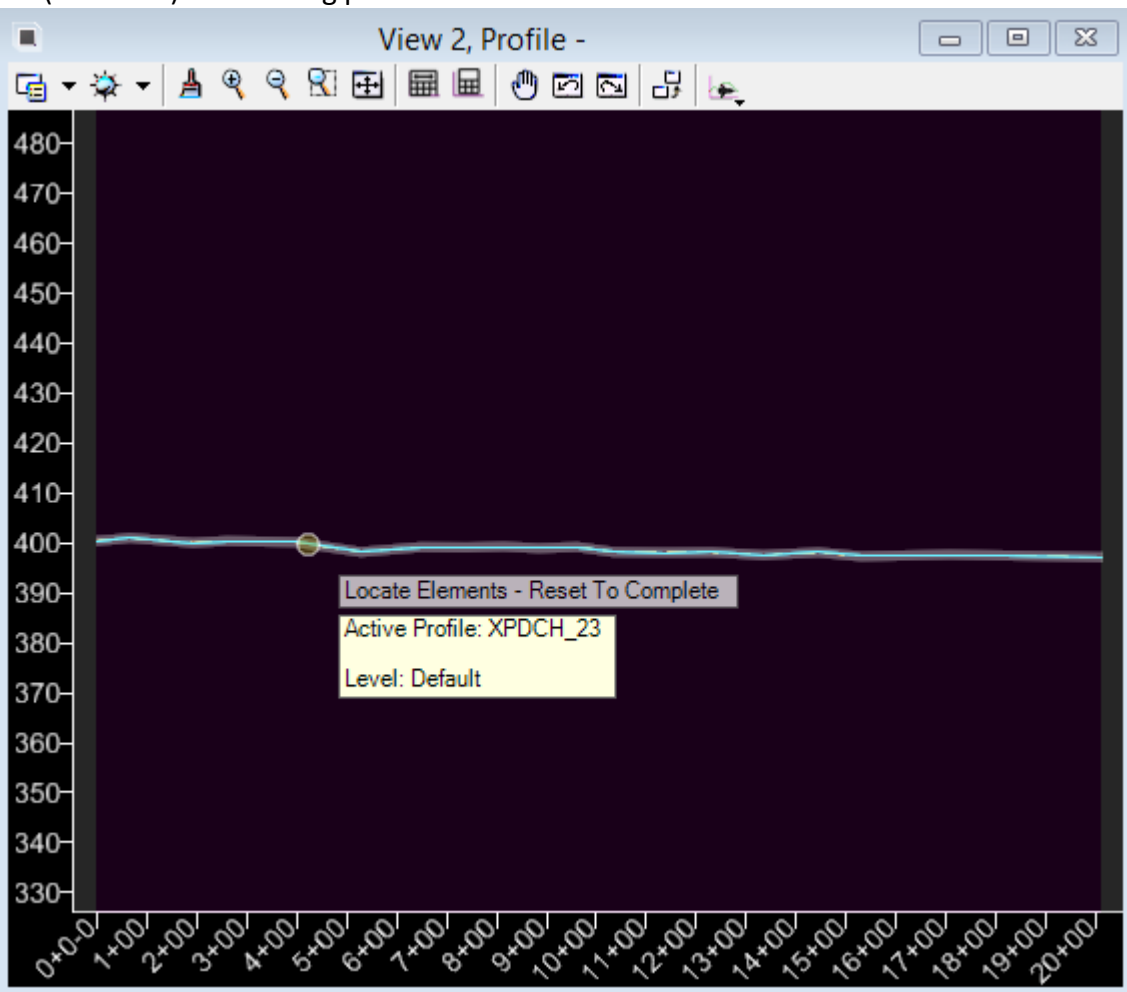
Exporting and importing is discussed in the General Geometry section but steps are shown below for exporting a profile. Importing is used if you utilize GEOPAK's older tools to create the proposed profile. Exporting has to be done for the existing profile and also the proposed profile if it is created in the profile view. Exporting is required to be able to annotate the profile. Below are steps showing exporting of an existing profile.

1) Open the **General Geometry** task.
2) Choose **Export.**



3) As prompted, **Choose elements – Reset to Complete.**

4) DP (Left Click) the existing profile.



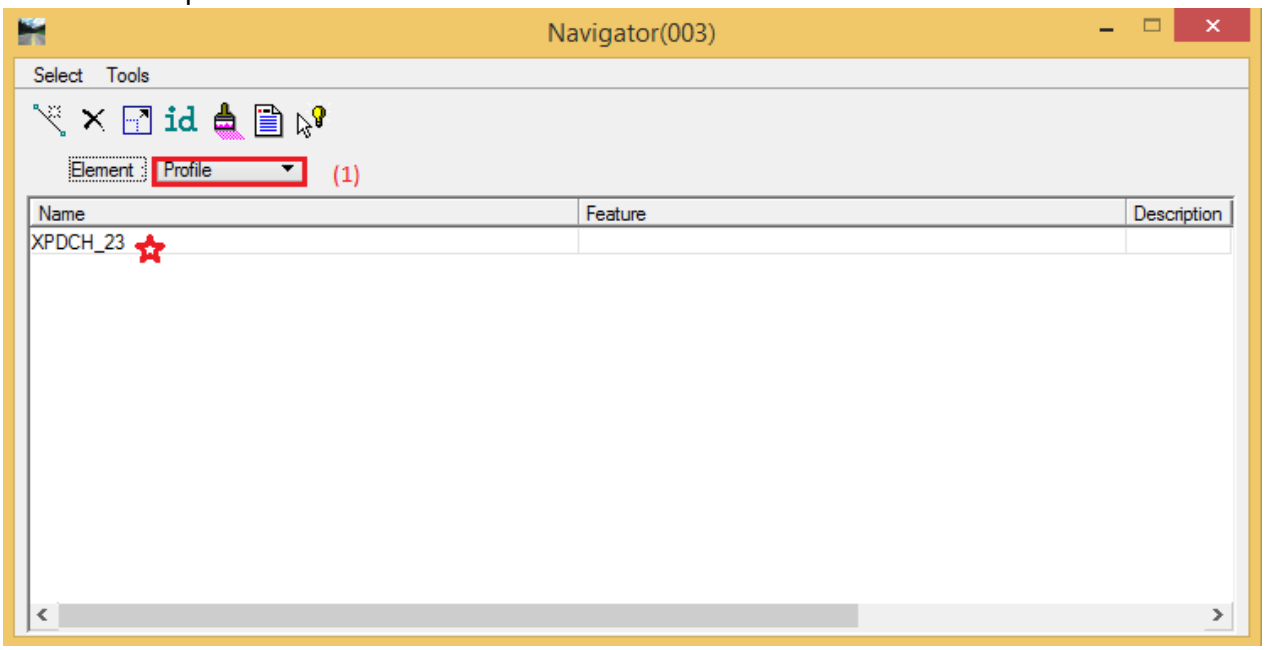
Note:

- Make sure the profile has a name prior to exporting the profile. Choose Properties from the profile's context menu to check.

5) You are prompted to choose the **Job Number.**

At which point the profile is stored in the GPK.

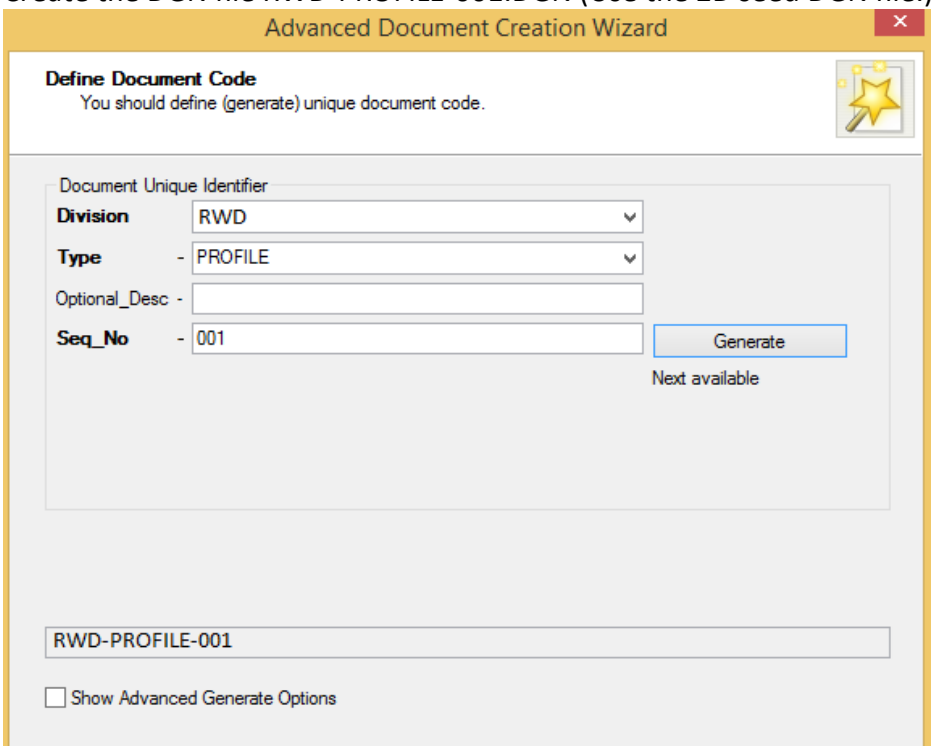
6) As stated in the Horizontal Geometry section, open Coordinate Geometry and Navigator to ensure the profile was stored.



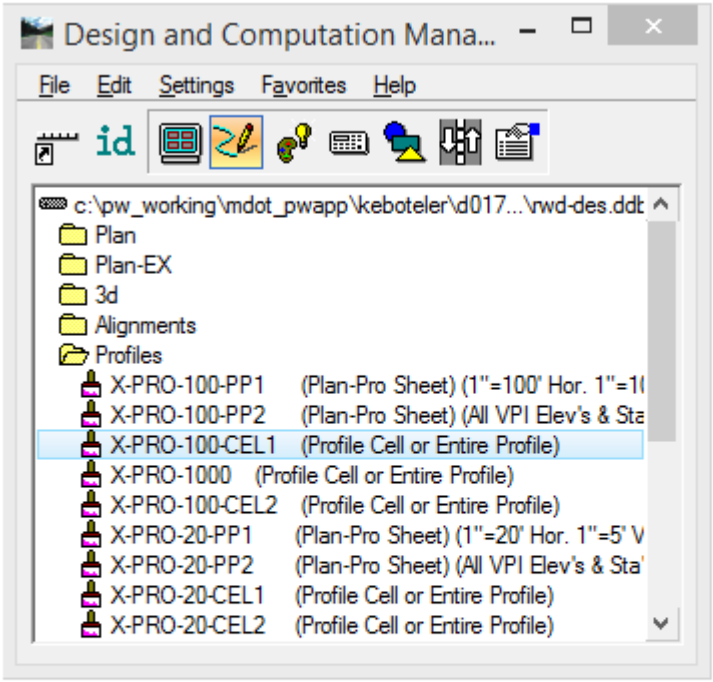
8.10 Plotting and Annotating Profiles

We'll create a new DGN to plot (or annotate) profiles.

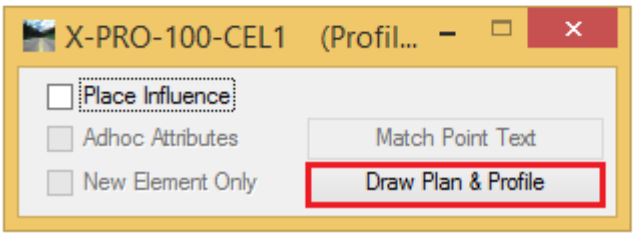
1) Create the DGN file RWD-PROFILE-001.DGN (Use the 2D seed DGN file.)



2) Enter this DGN file and reference your Alignment and Topo files.
3) Invoke GEOPAK's Design and Computation Manager.
4) Choose the Profile Type and then choose **Draw Plan & Profile.**



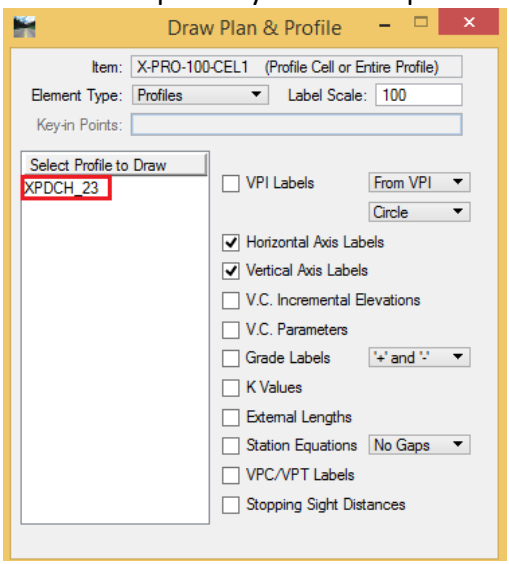
(1) Choose



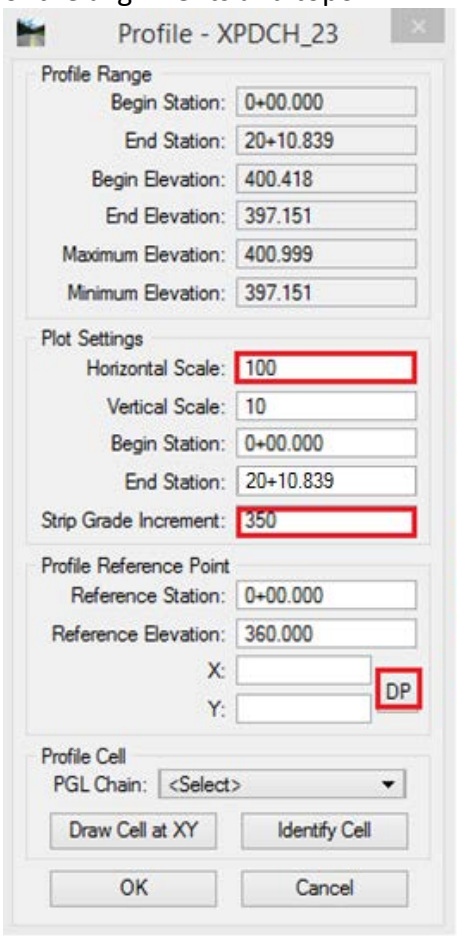
(2)

5) Choose the Job Number when prompted.

6) Choose the profile you wish to plot.



7) Fill out the dialog below and choose DP and then choose the location you want to plot the profile. This can be anywhere in the DGN file but it should be close and to the right of the alignments and topo.



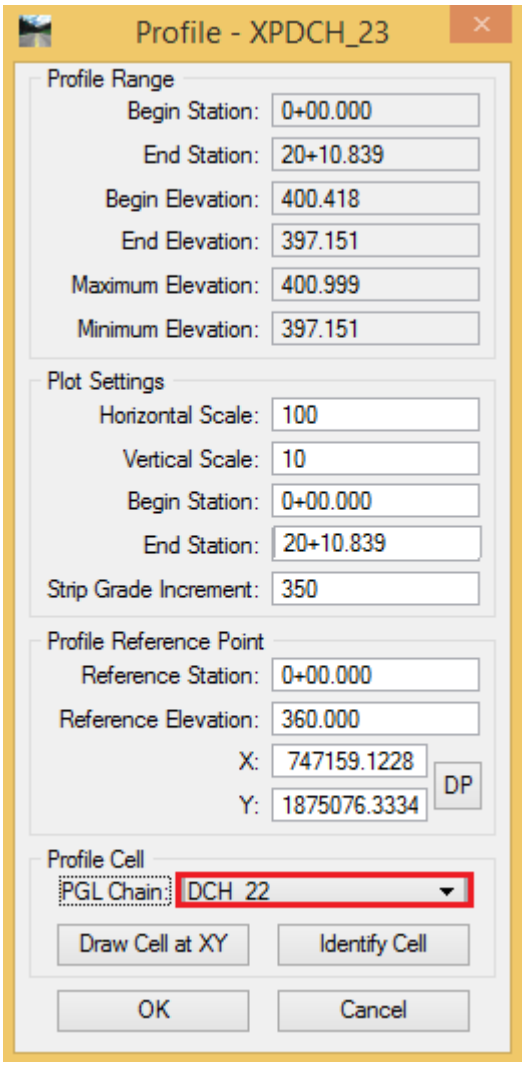
(1) - Match scale shown on previous dialog,

(2) - Enter elev. 40-50 feet lower than minimum listed above.

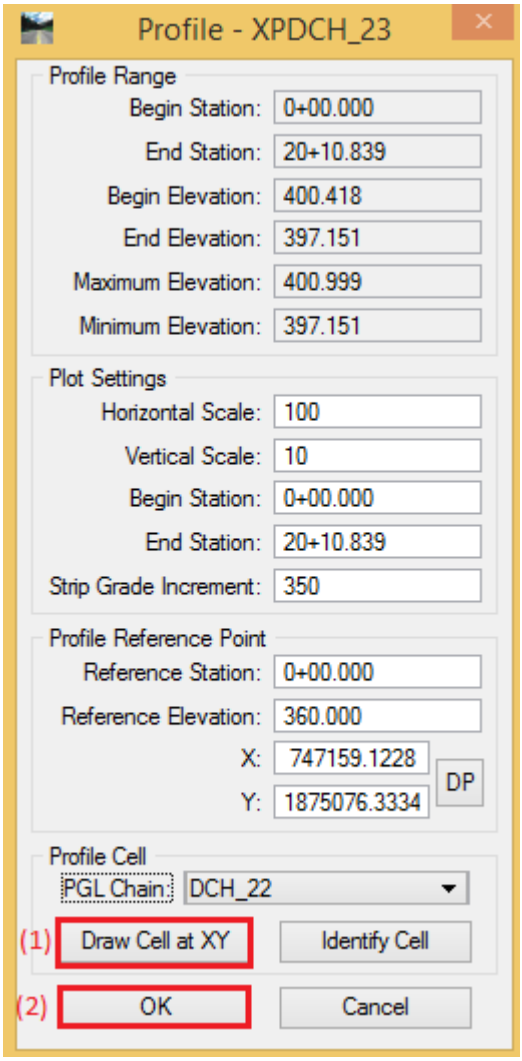
(3) Tag DP.

8) DP anywhere in the DGN, to the right of the alignments and topo references.

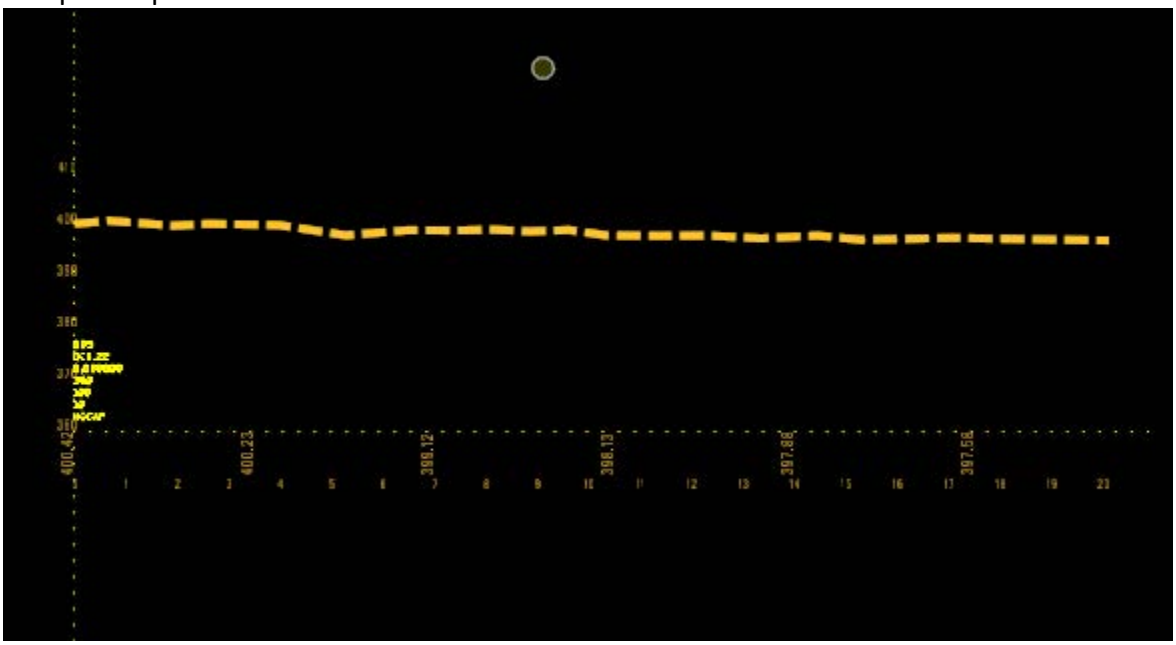
9) Choose the PGL Chain which is the chain the profile was taken from.



10) Select **Draw Cell at XY** and then select **OK** to plot profile.

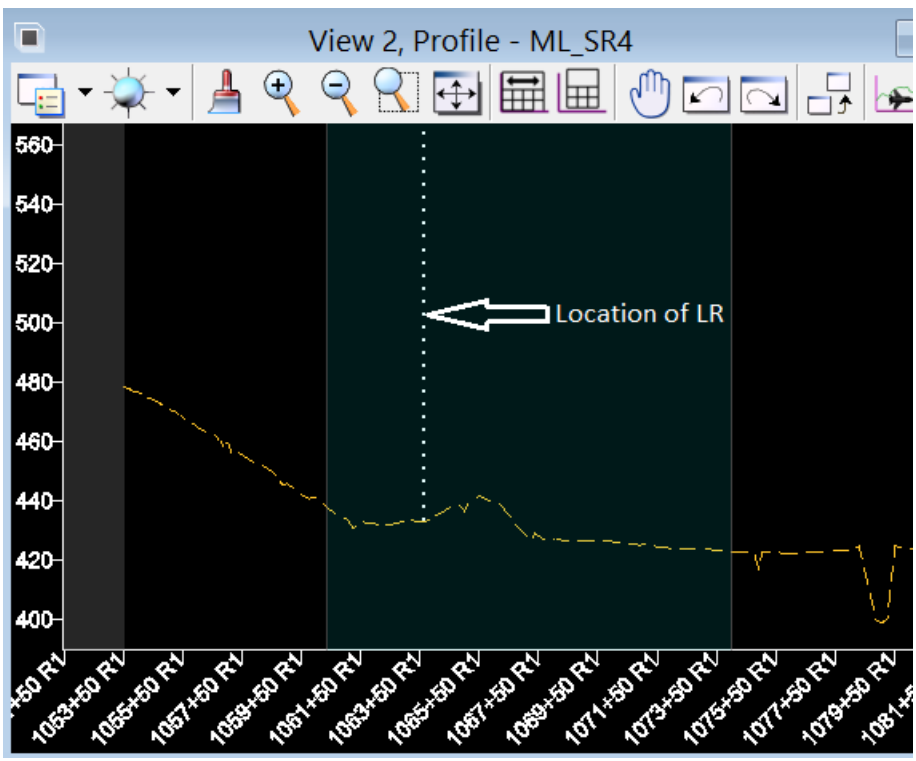


11) The profile plotted.



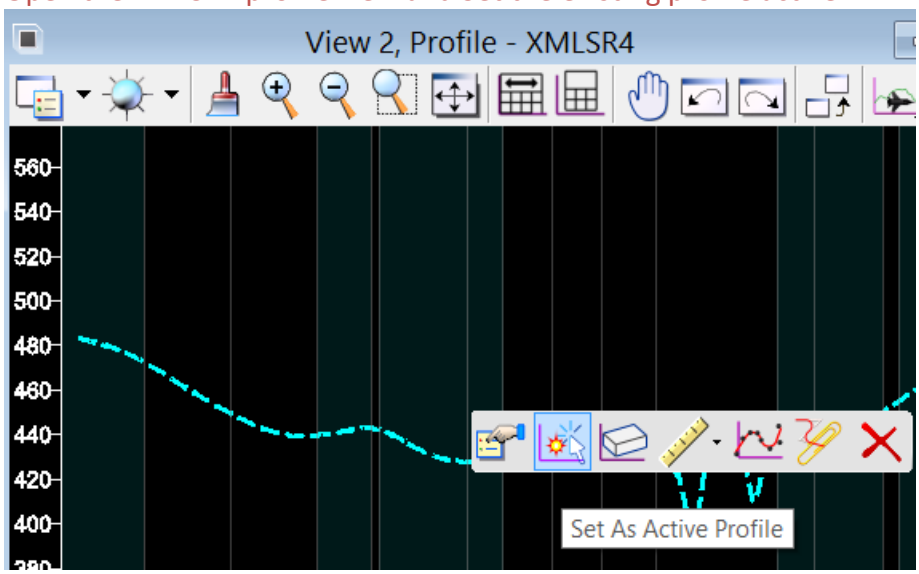
LAB III:

1. In RWD-ALI-001.dgn, open the profile view of alignment ML_SR4.
2. Go to Profile Properties on the Context menu and change the name of the profile to XPML_SR4.
3. Do the same for LR_North (XPLR_North)
4. Export these profiles to the GPK.
5. Open the Profile view for ML_SR4.
6. Choose the command **Profile Intersection Point** and show the intersection of LR_Tuck with ML_SR4.

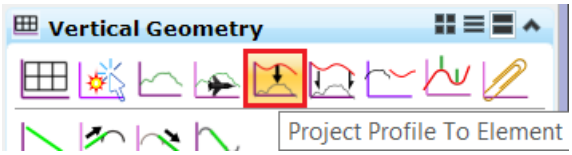


7. Project the existing CL profile to the realigned SR4 alignment. This allows you to see the existing roadway grade when setting your new grade.

   a. Open the XMLSR4 profile view and Set the existing profile active.

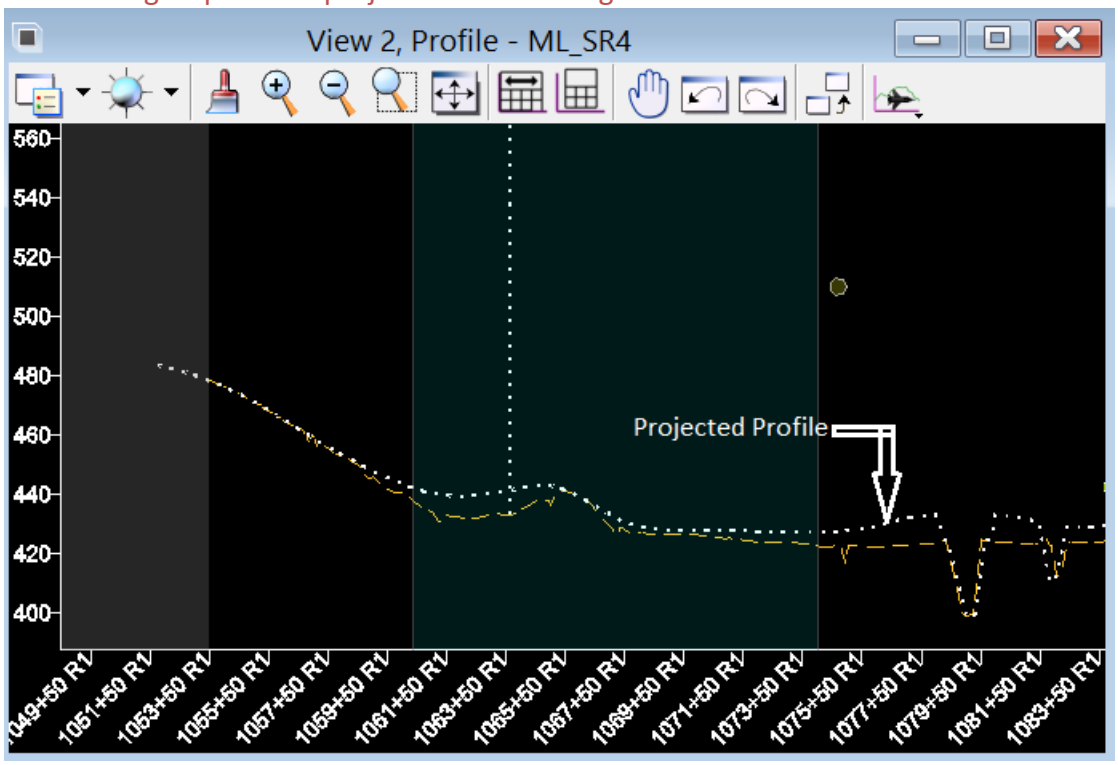


   b. Open the profile view of ML_SR4 and choose the **Project Profile to Element** command.



   c. You are prompted to choose the element to project which is XMLSR4.
   d. You are prompted to select the plan view element to project onto which is ML_SR4.

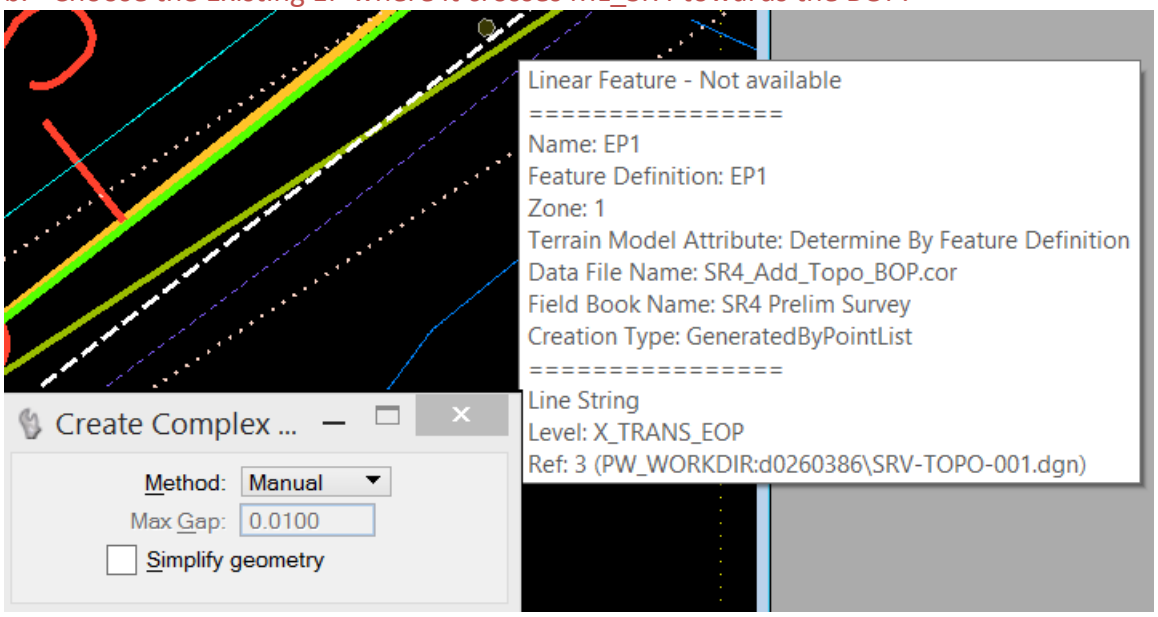
e. The existing CL profile is projected to the realigned SR4.



8. Two other control points for setting the proposed grade is where ML_Sr4 intersects the existing edge of pavements. To show these two points:

a. Choose MicroStation's **Create Complex Chain** command.

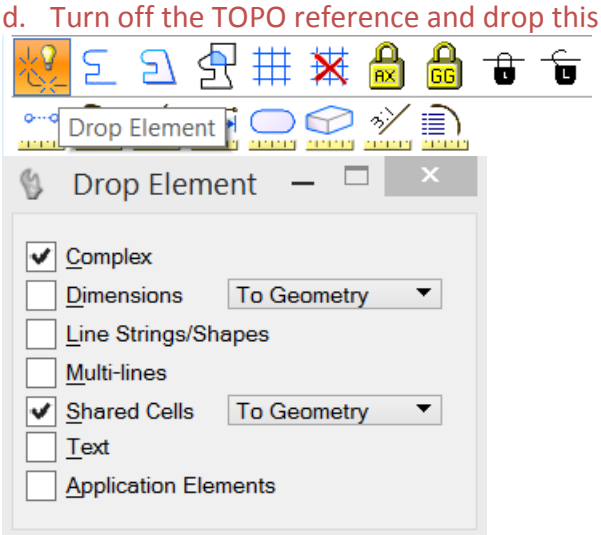
b. Choose the Existing EP where it crosses ML_SR4 towards the BOP.



DP to accept and then reset to create the element.

c. DP the same for the Existing EP and ML_SR4 intersection towards the EOP.

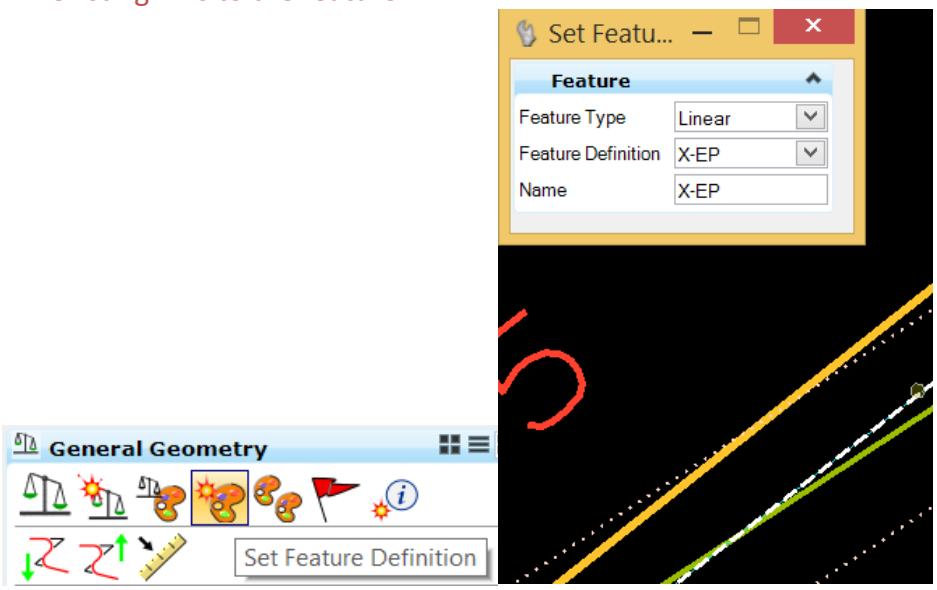
d. Turn off the TOPO reference and drop this element.



Note:

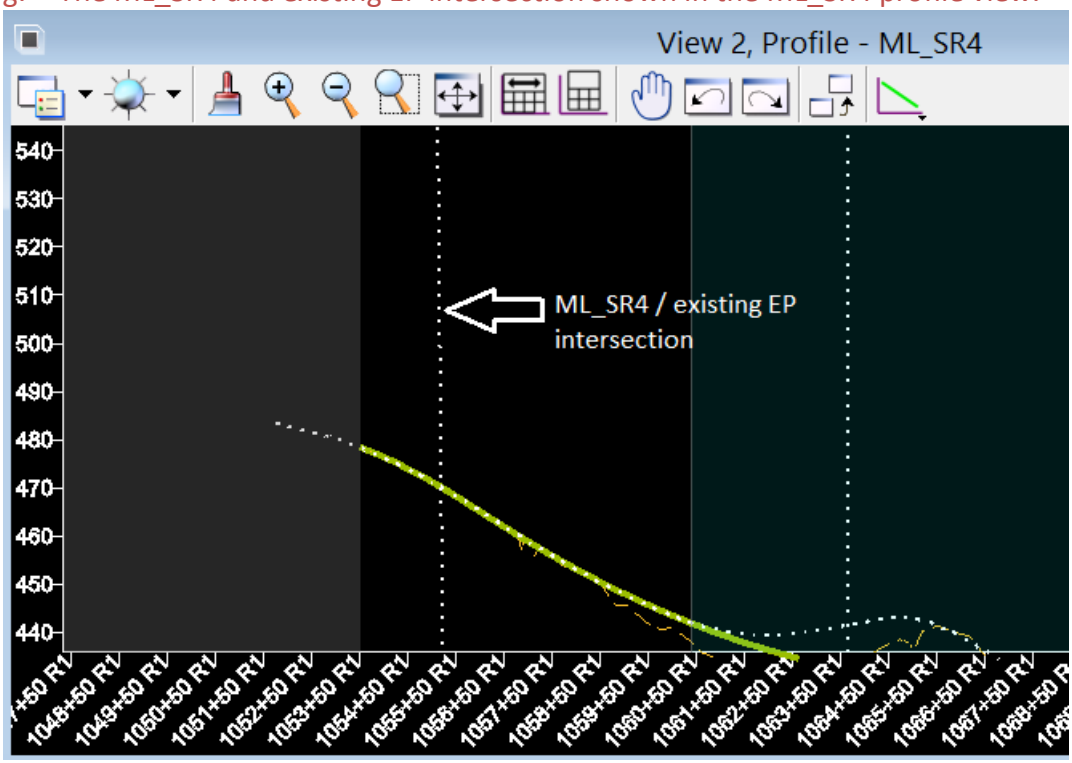
- Don't drop the line_string.

e. Choose Set Feature Definition from the General Geometry menu and set the existing EP's to the feature X-EP.

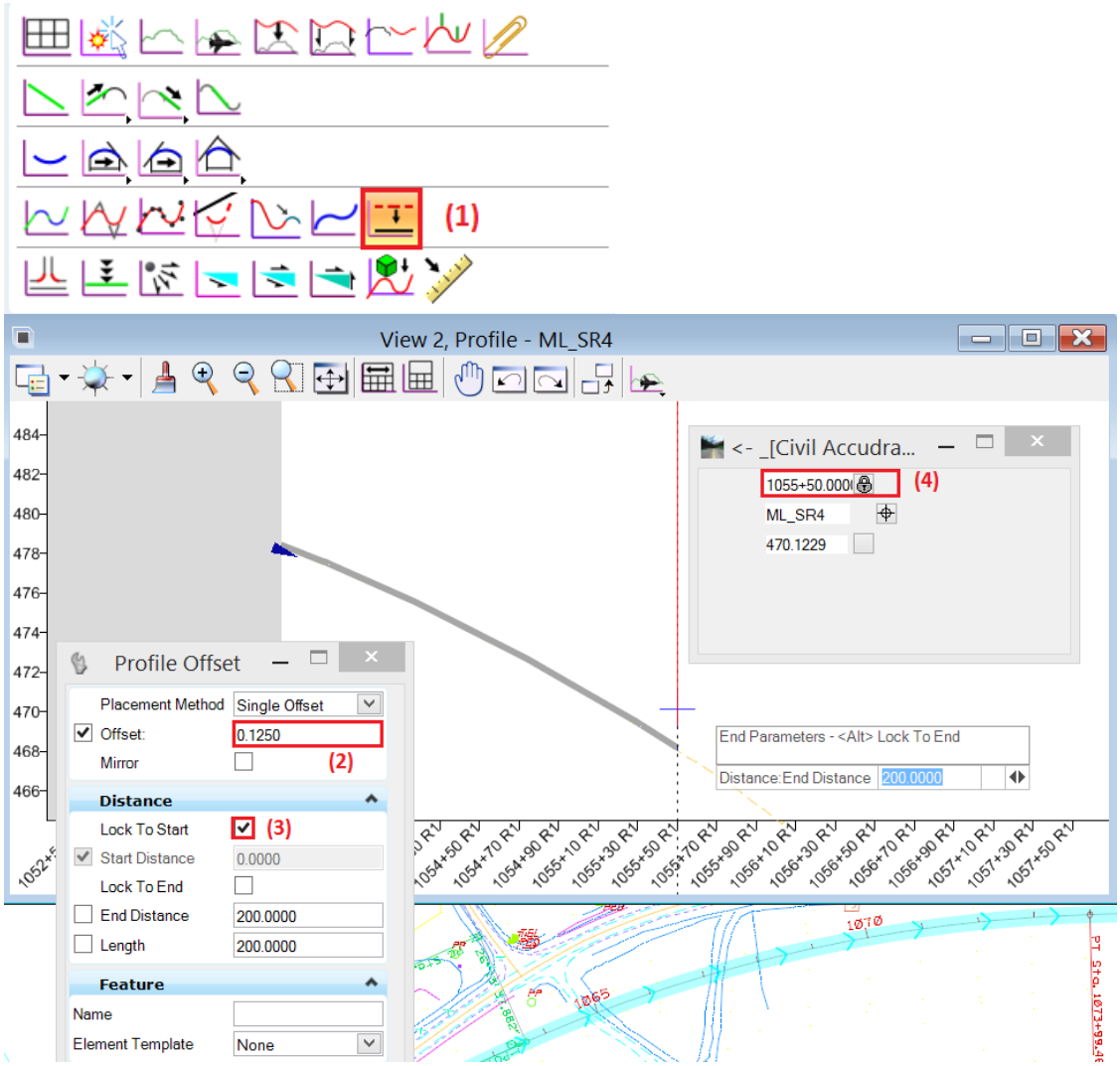


f. Choose the Profile Intersection command.

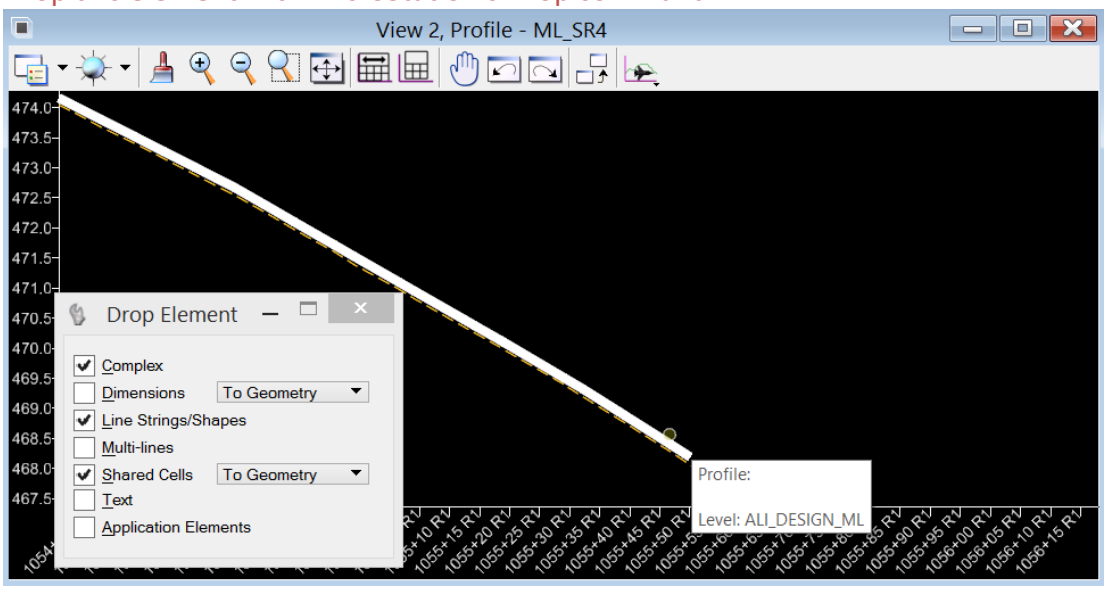
g. The ML_SR4 and existing EP intersection shown in the ML_SR4 profile view.



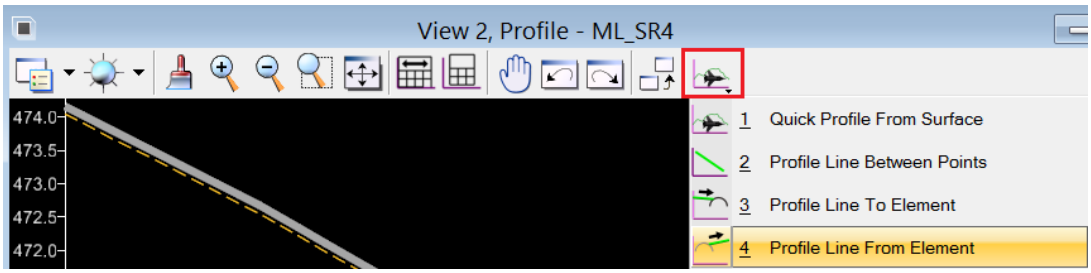
9. Create the proposed profile PPML_SR4 with the following steps.
   1. Use the **Profile Offset Transition** tool to offset the existing profile 0.125 from the BOP to station 1055+50.

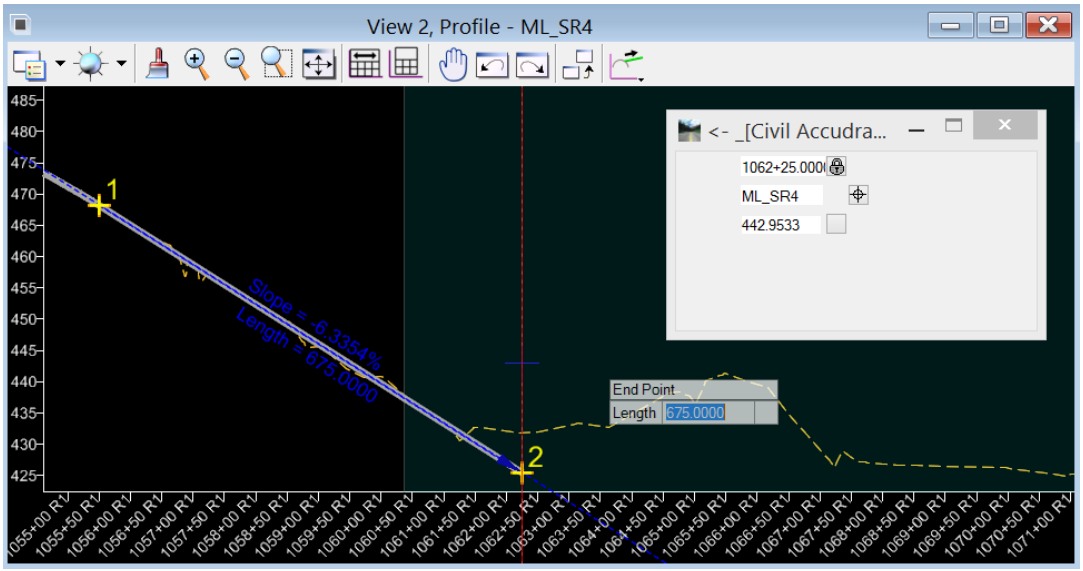


2. Drop this element with MicroStation's Drop command.



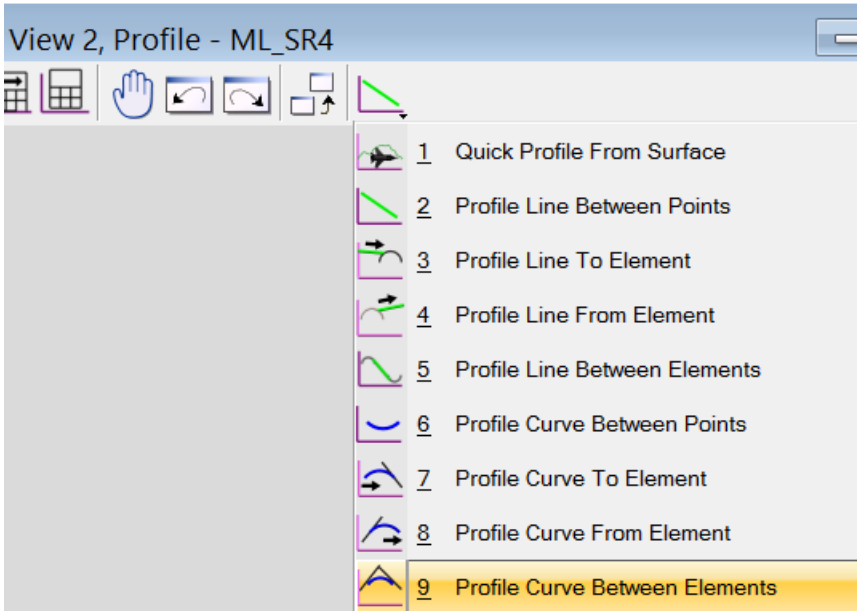
3. Choose the **Profile Line from Element** command and place a line tangent to end of the offset parallel line created above and ending at station 1062+25.

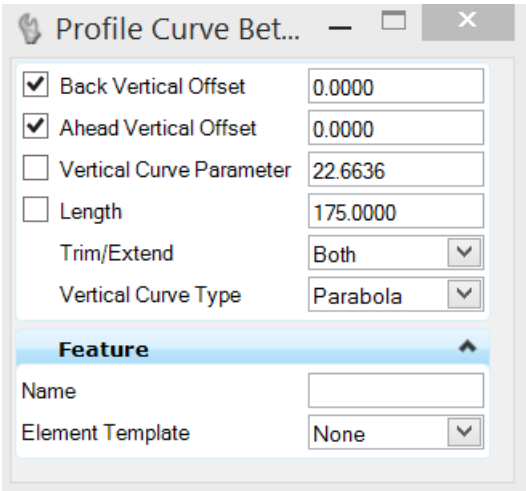




4. Choose the **Place Line** command and place lines from the previous line placed line and the following VPI's.
   1084+00, Elevation 439.57
   1090+25, Elevation 464.07
   1094+25, Elevation 487.75
   1095+99.5157, Elevation 482.4776

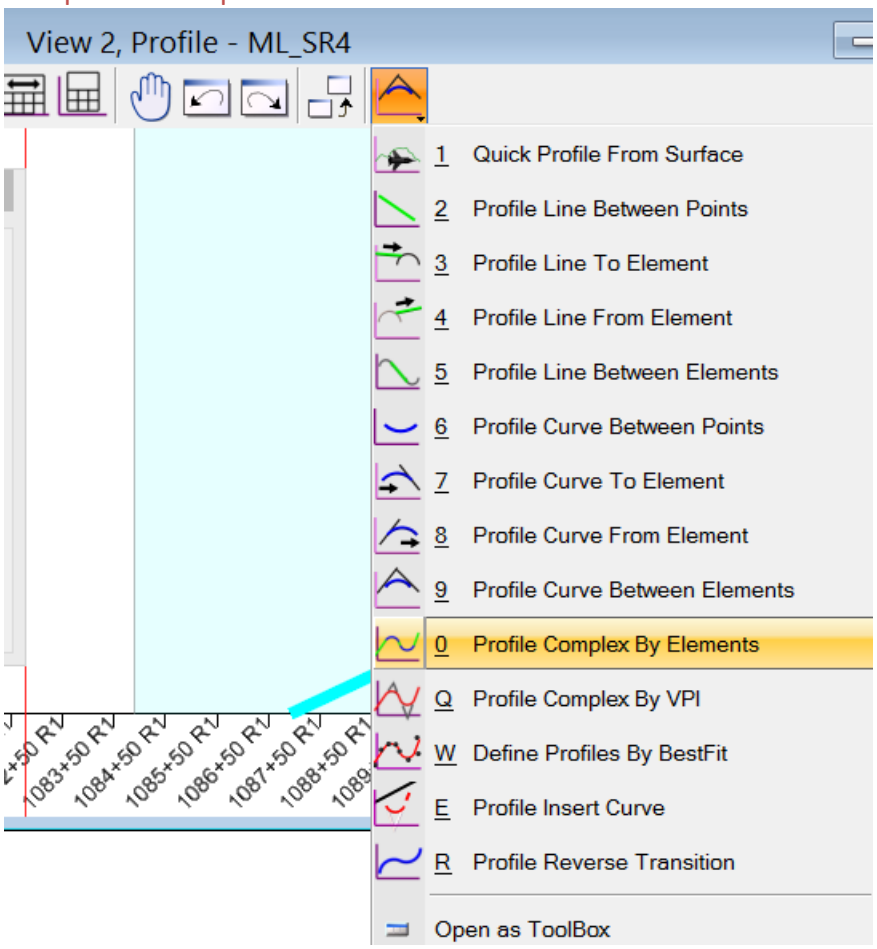
5. Choose **Profile Curve Between Elements.**

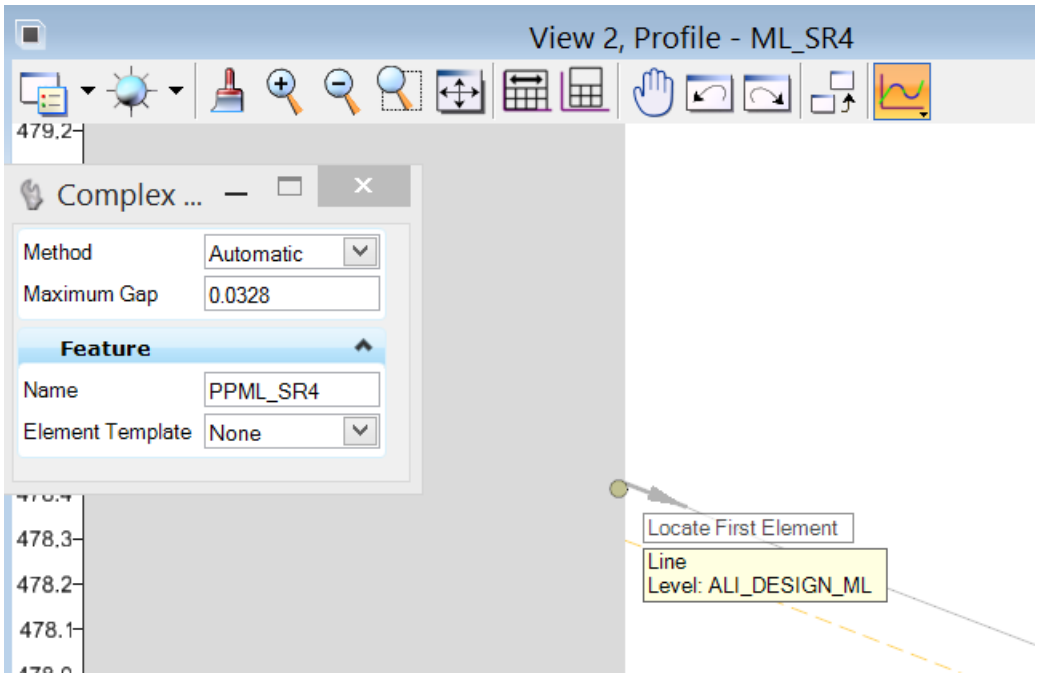




6. Insert the following vertical curves:
   1062+25.00 – 1150'
   1084+00.00 – 850'
   1090+25.00 – 350'
   1094+25.00 – 175'

7. Complex the Proposed Profile.





8. Export this profile to the GPK.
9. Review the Profile Report.

Below is just the beginning of the report.

Horizontal Alignment: ML_SR4
Horizontal Description:
Horizontal Style: ALI DESIGN ML

Vertical Alignment: PPML_SR4
Vertical Description:
Vertical Style: ALI DESIGN ML

		Station	Elevation
Element: Linear			
	POB	105+350.0000 R1	478.4216
	PVI	105+351.3301 R1	478.3702
	Tangent Grade:	-3.8681%	
	Tangent Length:	1.3301	
Element: Linear			
	PVI	105+351.3301 R1	478.3702
	PVI	105+353.0490 R1	478.2961
	Tangent Grade:	-4.3080%	
	Tangent Length:	1.7189	
Element: Linear			
	PVI	105+353.0490 R1	478.2961
	PVI	105+361.3252 R1	477.9764
	Tangent Grade:	-3.8632%	
	Tangent Length:	8.2762	
Element: Linear			

Below is the end of the report.

Element: Symmetrical Parabola

PVC	107+975.0000 R1	436.8068
PVI	108+400.0000 R1	439.5700
PVT	108+825.0000 R1	459.5471
Length:	850.0000	
Entrance Grade:	0.6502%	
Exit Grade:	4.7005%	
r = (g2 - g1) / L:	0.4765	
K = l / (g2 - g1):	209.8593	
Middle Ordinate:	4.3035	

Element: Linear

PVT	108+825.0000 R1	459.5471
PVC	109+337.5000 R1	483.6371
Tangent Grade:	4.7005%	
Tangent Length:	512.5000	

Element: Symmetrical Parabola

PVC	109+337.5000 R1	483.6371
PVI	109+425.0000 R1	487.7500
PVT	109+512.5000 R1	485.1065
VHIGH	109+444.0300 R1	486.1408
Length:	175.0000	
Entrance Grade:	4.7005%	
Exit Grade:	-3.0211%	
r = (g2 - g1) / L:	-4.4124	
K = l / (g2 - g1):	22.6636	
Middle Ordinate:	-1.6891	

Element: Linear

PVT	109+512.5000 R1	485.1065
POE	109+599.5157 R1	482.4776
Tangent Grade:	-3.0211%	
Tangent Length:	87.0157	

10. Create the file RWD-PROFILE-001.DGN
11. Reference the RWD-ALI-001.DGN file and SRV-TOPO-001.DGN file.
12. To a general area to the right of the alignment and topo area, plot the existing and proposed profiles for ML_SR4.
13. We'll go through a few more Vertical related lab commands in the Superelevation lab after placing a corridor and applying Superelevation.

9. TITLE SHEET CREATION

9.1 Section Overview

This section covers the process of creating a MDOT Title Sheet and automatically labeling portions of it with ProjectWise's project related attributes and MicroStation's **Tag Sets** which are buried in the sheet cells.

9.2 Section Prerequisites

- MicroStation Fundamentals

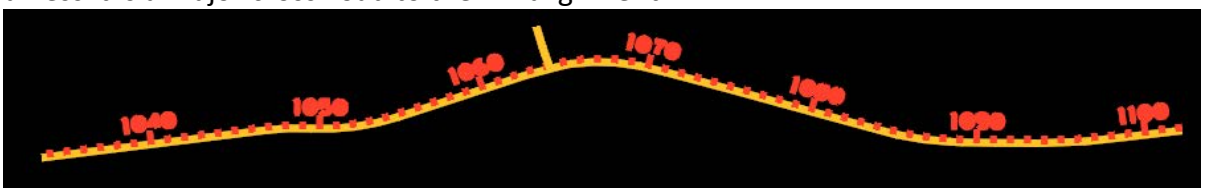
9.3 Section Objectives

After completing this Section, you will be able to use Planning Division's County Map data, create a Title Sheet, and label FMS #, County, etc. automatically.

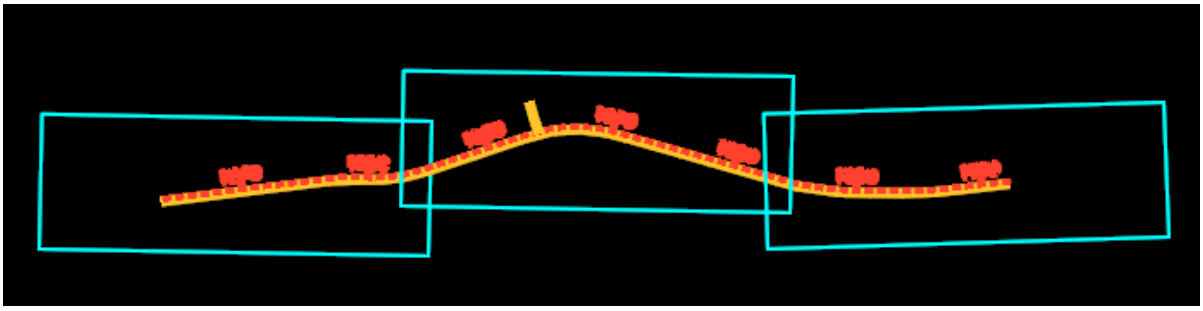
9.4 Creating a Title Sheet

9.4.1 Initial Process

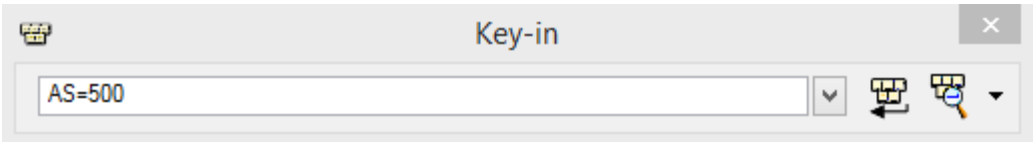
1) Create the Title Sheet DGN file. RWD-TITLE-001.DGN
2) Create an alignment file and plot the ML Alignment <u>without</u> PC/PT labels, curve data, and bearings through D&C Manager with the properly scaled stationing (AS=500) in this example and this will vary with the length of project and the space to fit this in on the Title sheet, which requires some trial and error. RWD-ALI-TITLE-002.DGN
3) You also need to plot any other road alignments without any stationing/curve/bearings unless it is a major cross-road to the ML alignment.



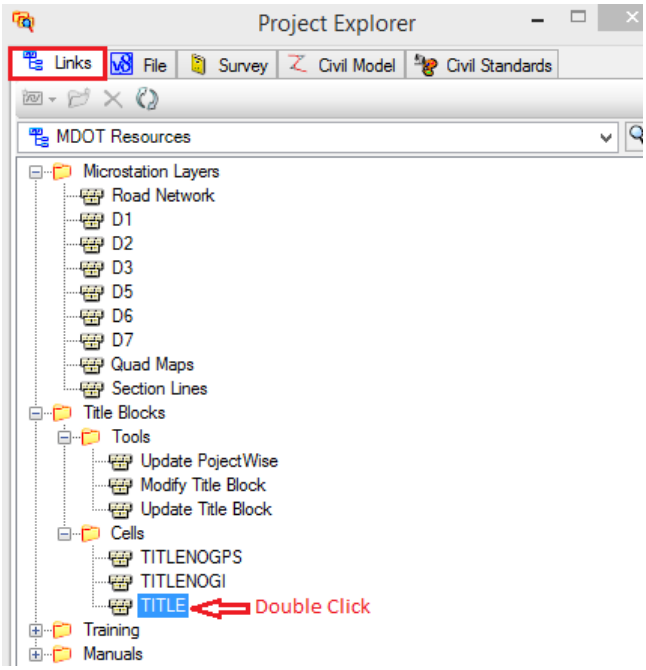
4) Enter the Title sheet file and reference the ALI DGN file generated for the title scale and reference the Border DGN file.

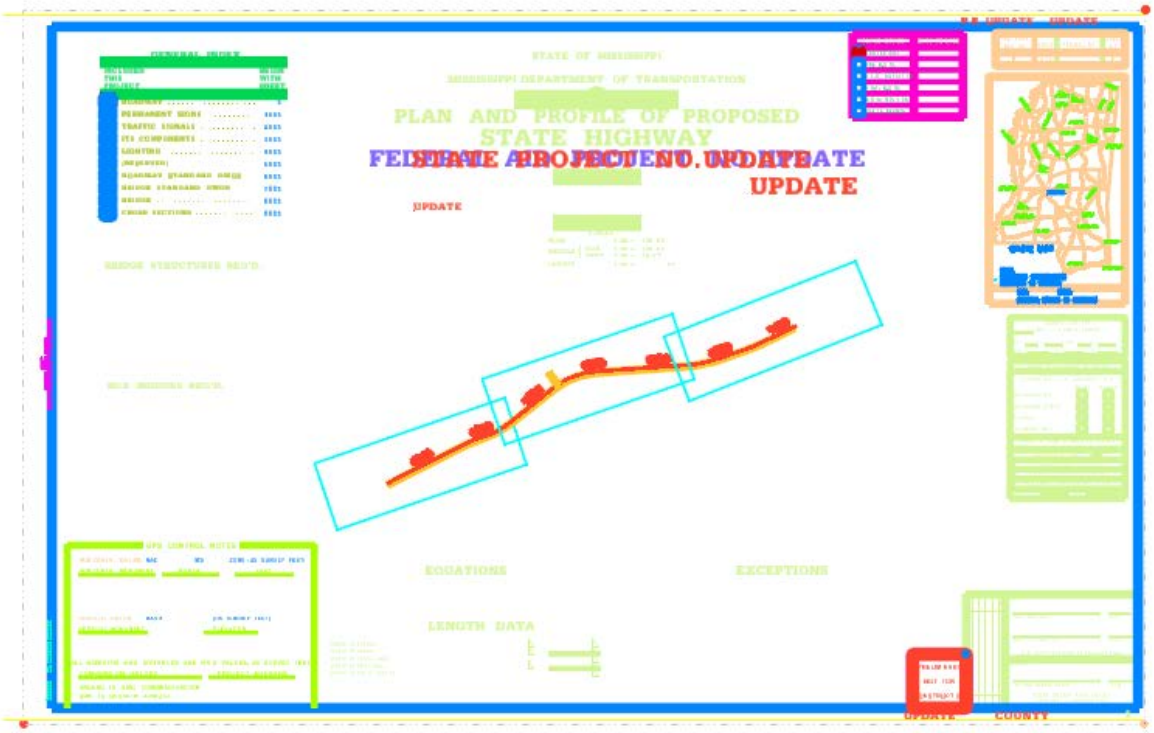


5) Set the Active Scale to the intended scale.



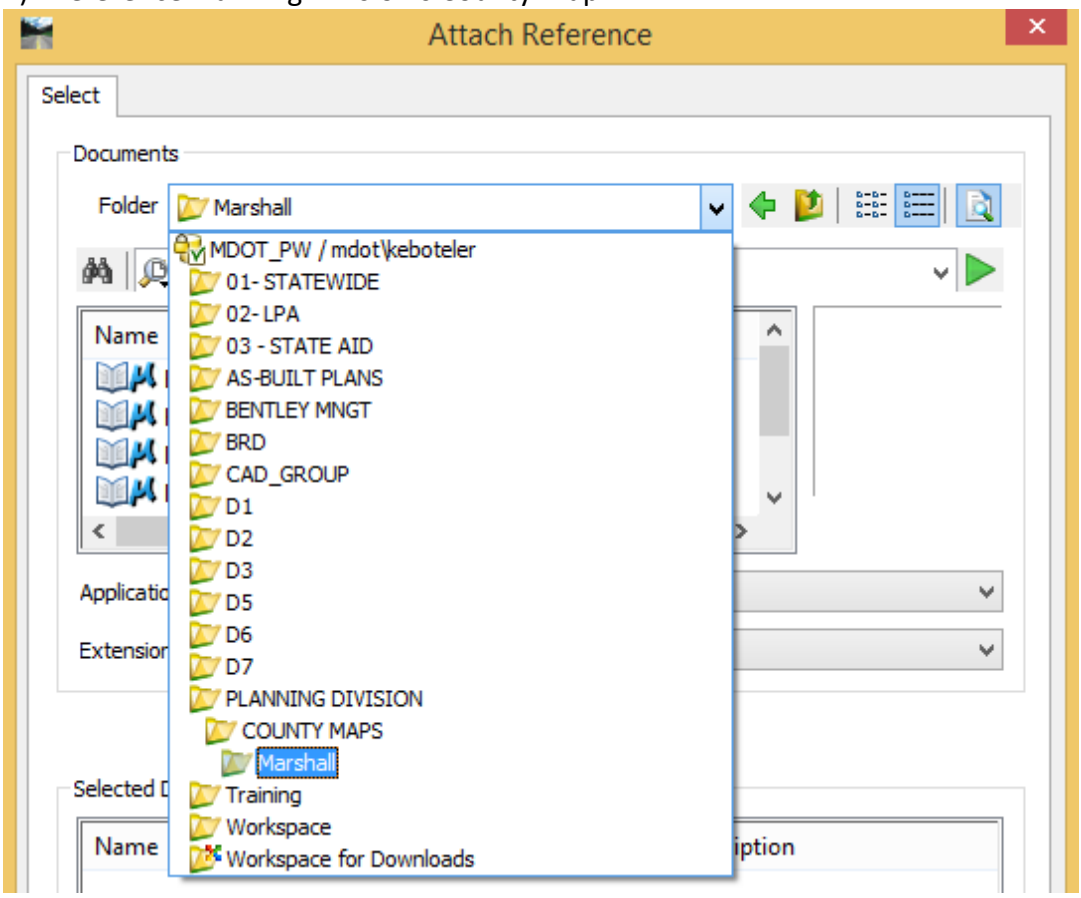
6) Place the Title Sheet.



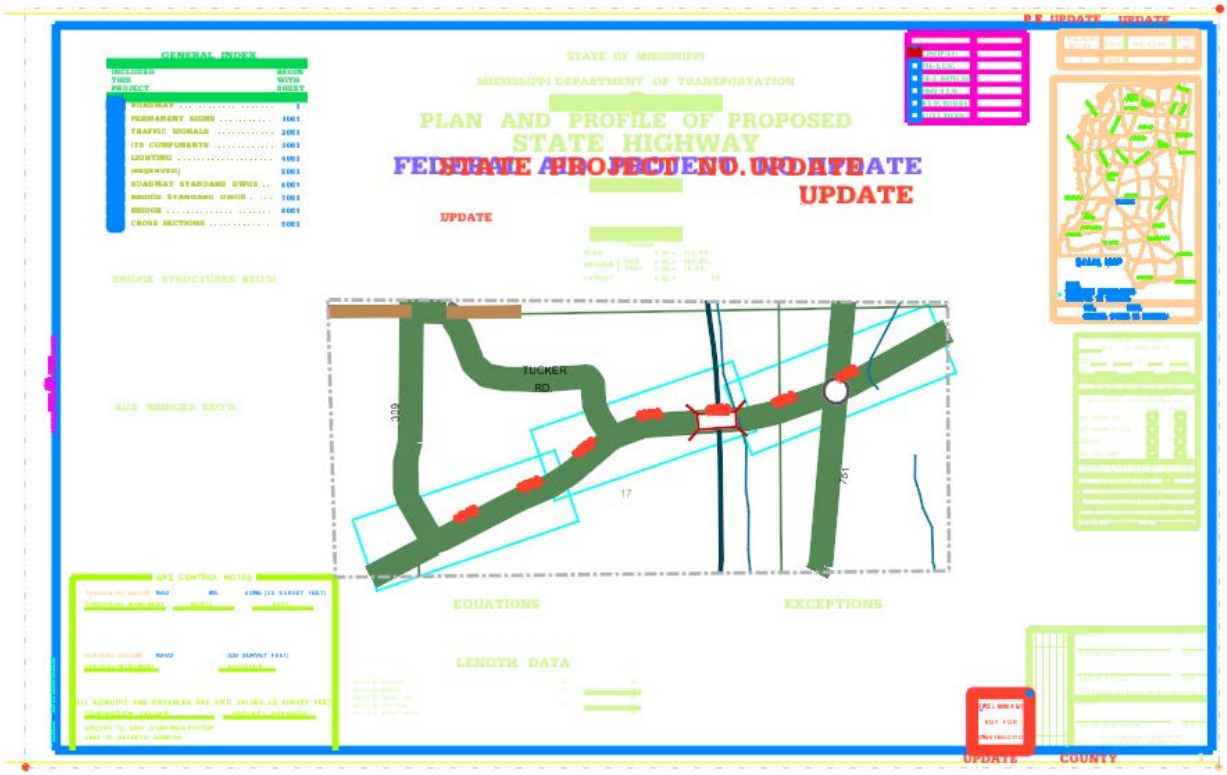


9.4.2 Referencing Planning's County Maps

7) Reference Planning Division's County Map.



8) Clean up copied or modified text, line styles, etc. as needed.



9.5 Title Block integration with ProjectWise

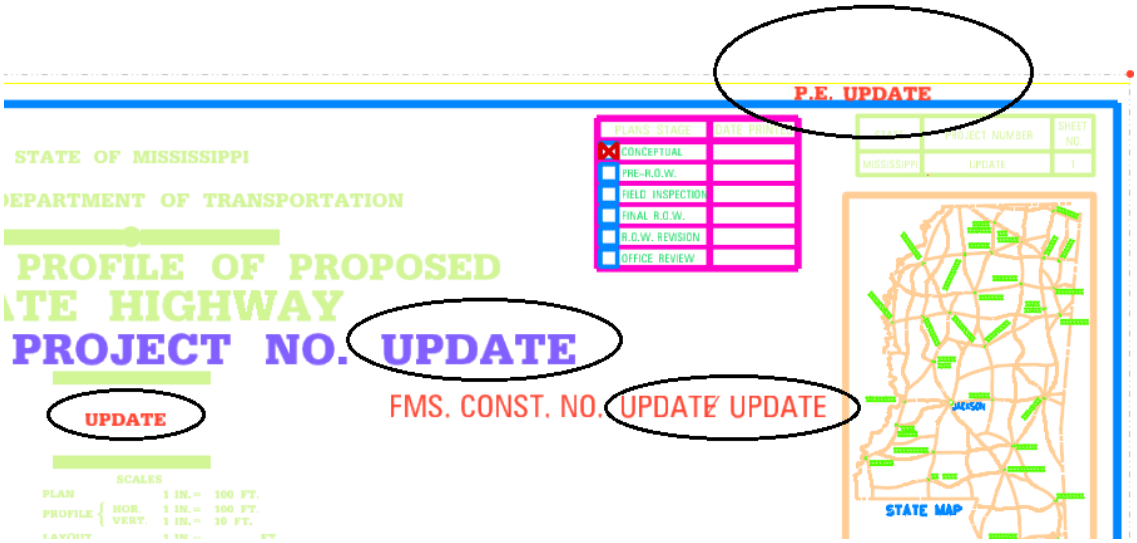
Title block integration allows ProjectWise to populate title block information in MicroStation with Attributes from the Project Directory. Once the administrator has set up title block integration, tag elements contained within files are automatically populated with data from the DGN file or from within ProjectWise.

Example of document attributes in ProjectWise are synchronized with the drawing content in the images below.

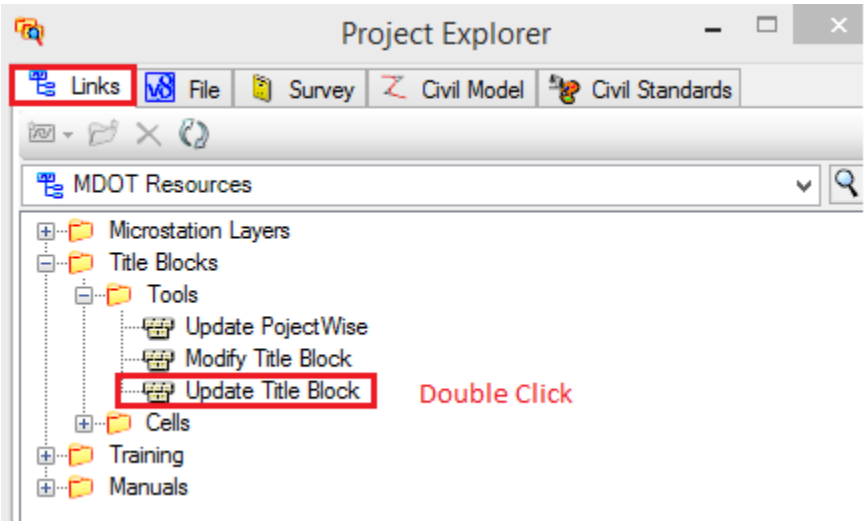
Tag Data has been set up for all MDOT standard sheets including the Title, Plan, Plan and Profile, and Cross-Section.

Steps to fill in the Tag Data (Update Title Block):

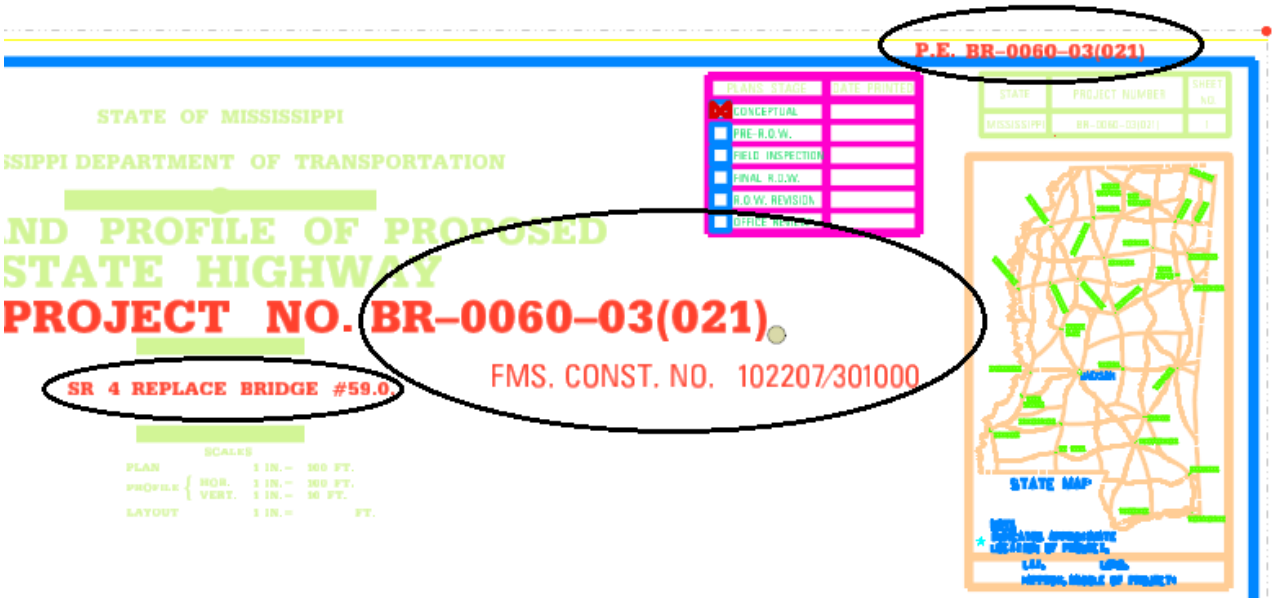
1) You'll notice the word **Update** on the Title sheets in several locations.



2) These tags are updated when you run the **Update Title Block** command.

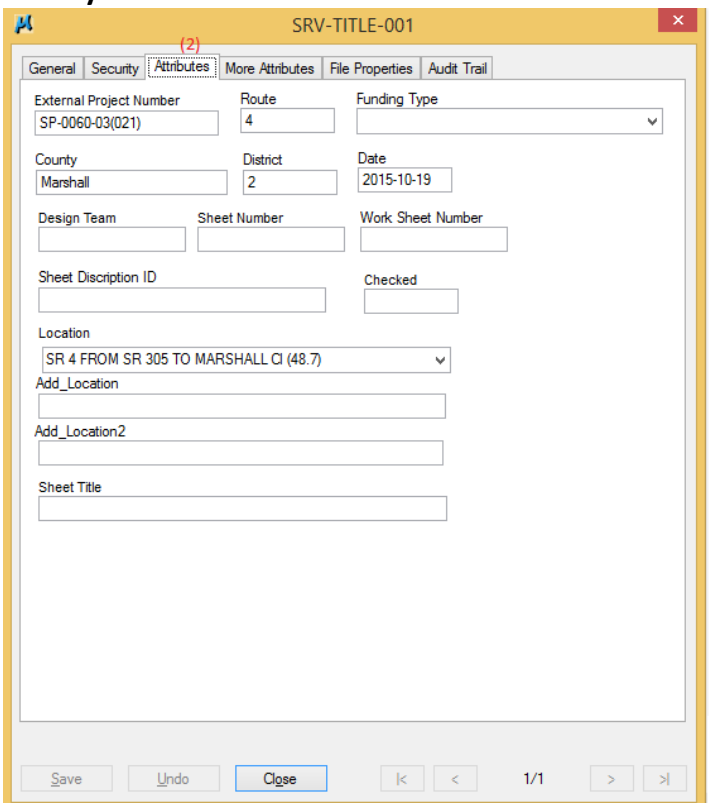


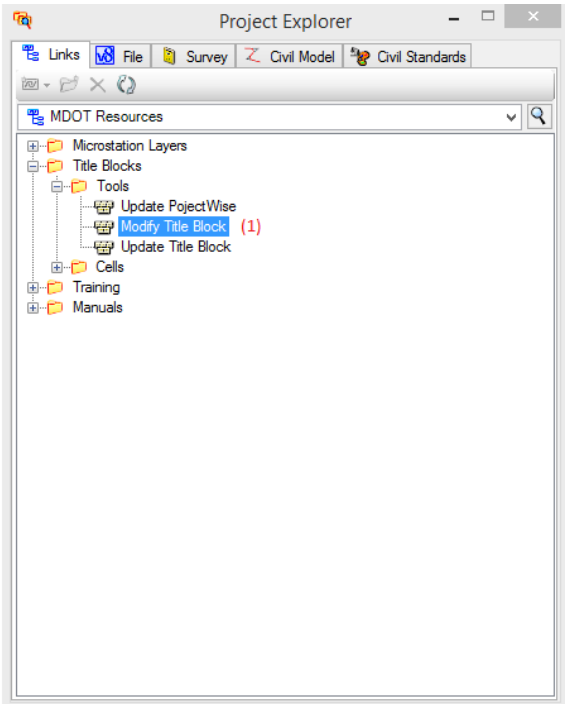
Updated Title Sheet



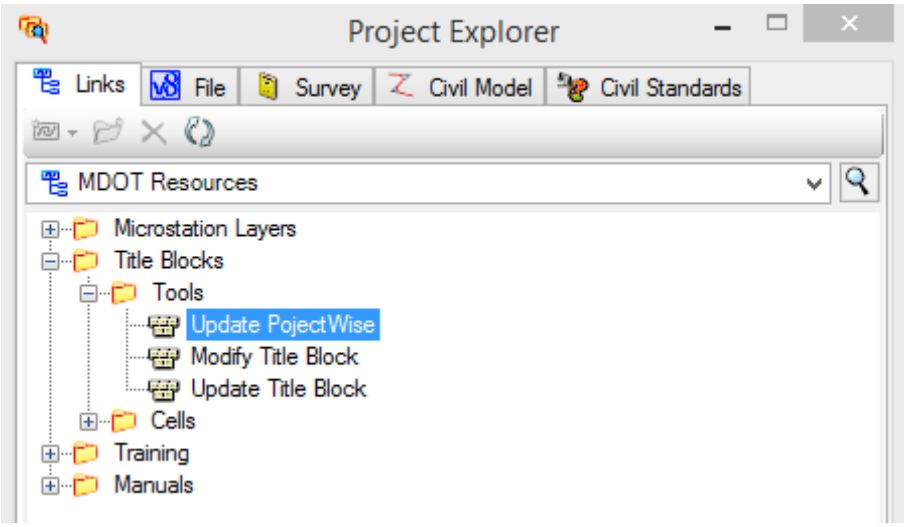
Once these tags are placed in the title sheet, attribute exchange commands can be used.

Modify Title Block – Allows the user to invoke and edit PW Attributes while in MicroStation.





Update ProjectWise – Allows user to push any changes from MicroStation to ProjectWise.



Note: ProjectWise auto updates the title block every time the DGN file is opened, checked out or copied out, so the latest attribute information is reflected in the drawing. However this may be dangerous in a scenario where the DGN is imported into ProjectWise and no attribution has been filled in yet. The first time that the DGN is opened, all mapped tags will be removed since these attributes are blank in ProjectWise. Hence, ProjectWise should be used from the creation of the drawing rather created externally and placed into ProjectWise.

LAB IV: Title Sheet Creation

Title block update

1. Create the file RWD-ALI-TITLE-002.dgn
2. Enter this file and plot the alignment MLSR4 through D&C Manager (500 scale)
3. Create the file RWD-Title-001.dgn
4. Enter this file and place a Title Sheet Cell.
5. Reference Planning Division's District 2 Marshall County Map.
6. Execute **Modify Title Block** command
7. Verify title block in DGN has been updated.
8. Update **Design Team** attribute in the properties save and close.

10. PLAN AND PROFILE SHEET CREATION AND LABELING TOOLS

10.1 Section Overview

Plan and Profile labeling and sheet creation with GEOPAK are discussed in this section.

10.2 Section Prerequisites

- MicroStation Fundamentals

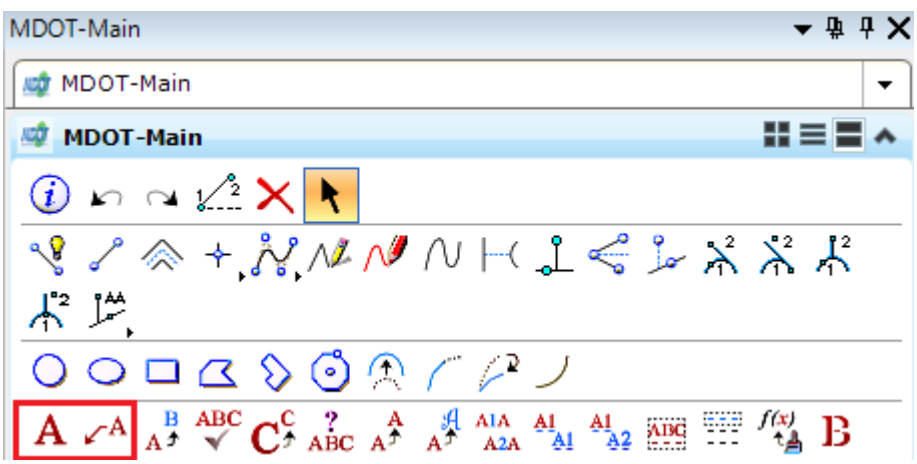
10.3 Section Objectives

After completing this Section, you will be able to:
1) Use GEOPAK's Plan and Profile Sheet Labeling application.
2) Label VPI's of a ditch profile.
3) Create Plan and Plan/Profile Sheets with GEOPAK's Sheet Composition tool.

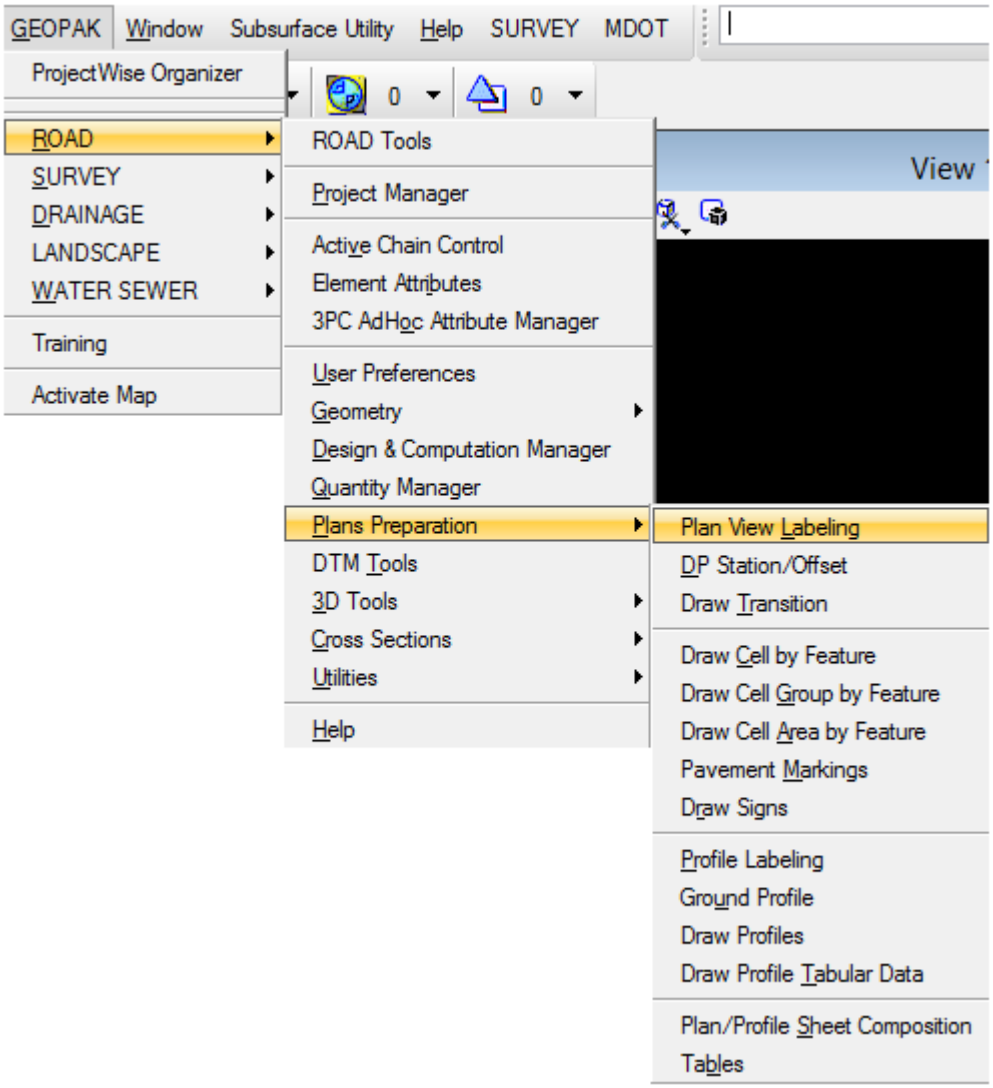
10.4 Labeling (Plan and Profile)

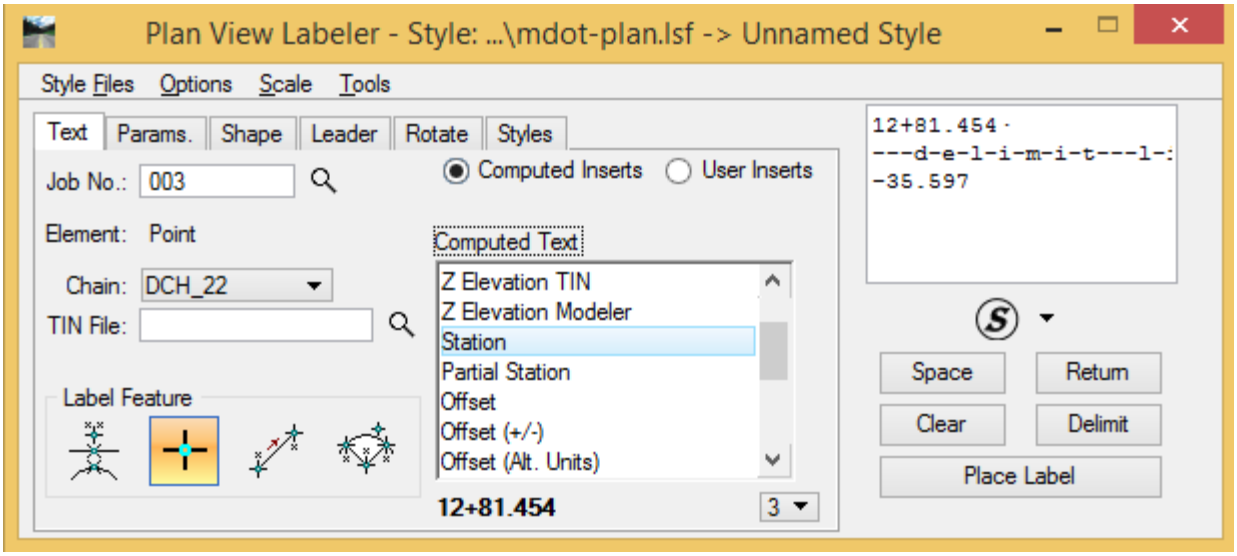
Annotation or Labeling is still performed by:
Establishing the correct text symbology and size and then using MicroStation's **Place Text** or **Place Note** tools or GEOPAK's Plan View Labeling tool.

10.4.1 Place Text and Place Note



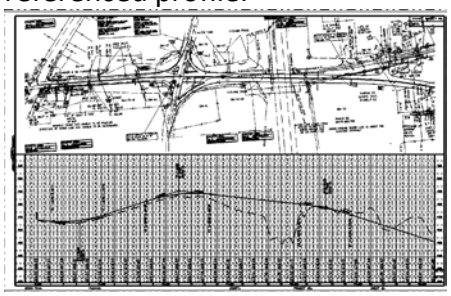
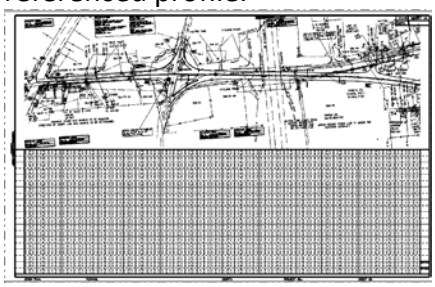
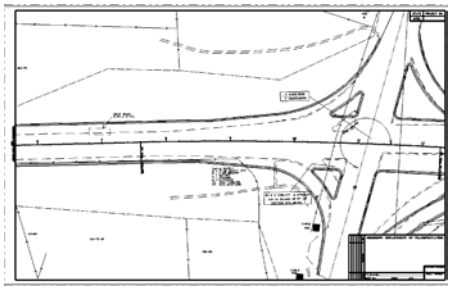
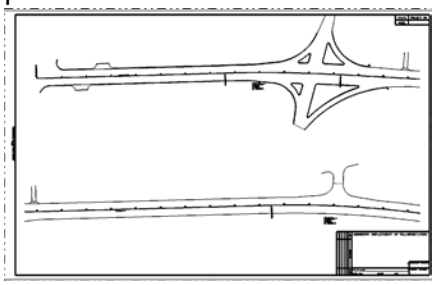
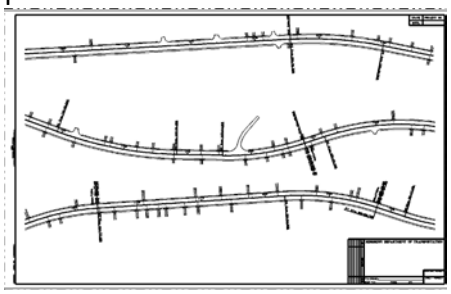
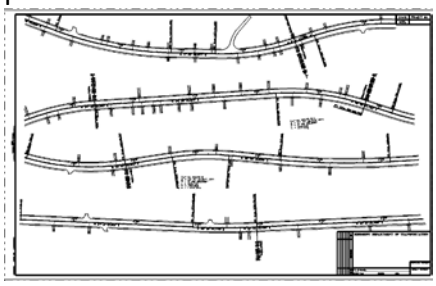
10.4.2 Plan View Labeler





10.5 Creating Sheets

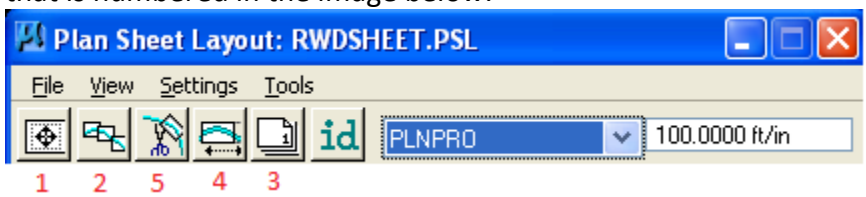
This section contains specific instructions of how to use GEOPAK's Plan and Profile Sheets application to create the following type sheets:

PLNPRO – Plan Profile Sheet w/ referenced profile. 	PLNPRO-PLN ONLY – Plan Profile w/o referenced profile. 
PLAN – Plan Sheet, one reference port. 	PLN2 – Plan Sheet, two reference ports. 
PLN3 – Plan Sheet, three reference ports. 	PLN4 – Plan Sheet, four reference ports. 

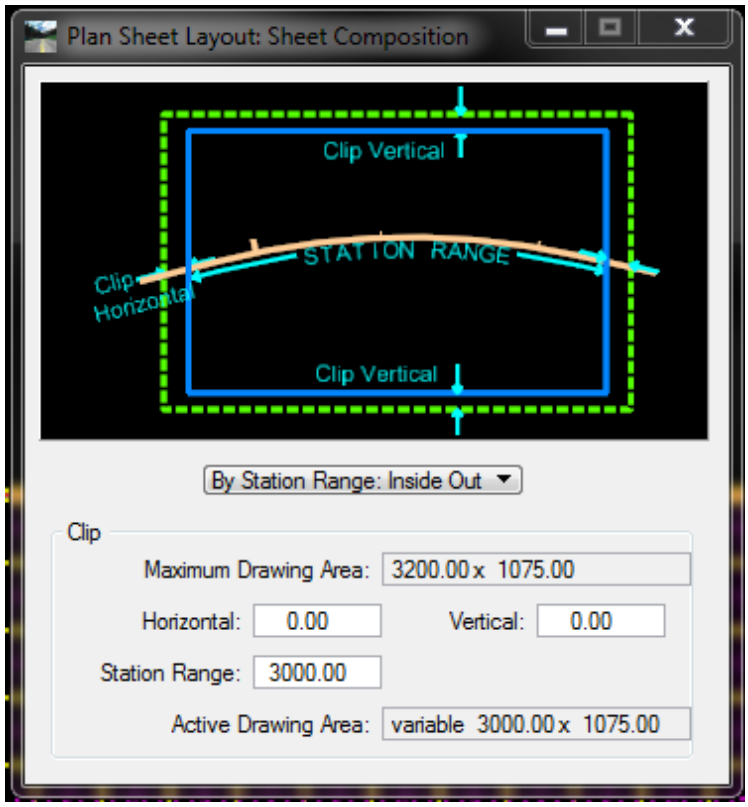
10.5.1 Steps to Create

Note: The steps below refer to a different dataset than what is used by most of this document (Chain H471 and Profile PP471).

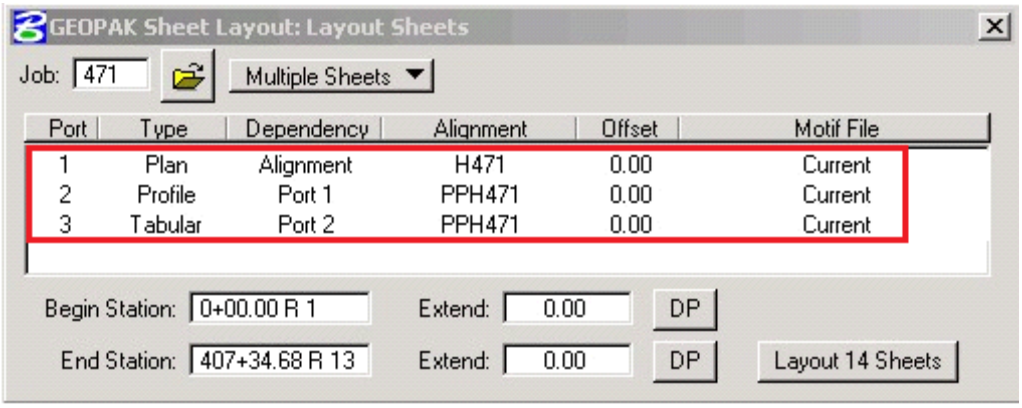
1) In RWD-BORDER-001 or RWD-BORDER-H471-001 (H471 is an optional description), reference all sheets you want attached to the Plan and Profile Sheet.
2) Set the Type Sheet and Scale on the dialog below. The general process after that is numbered in the image below.



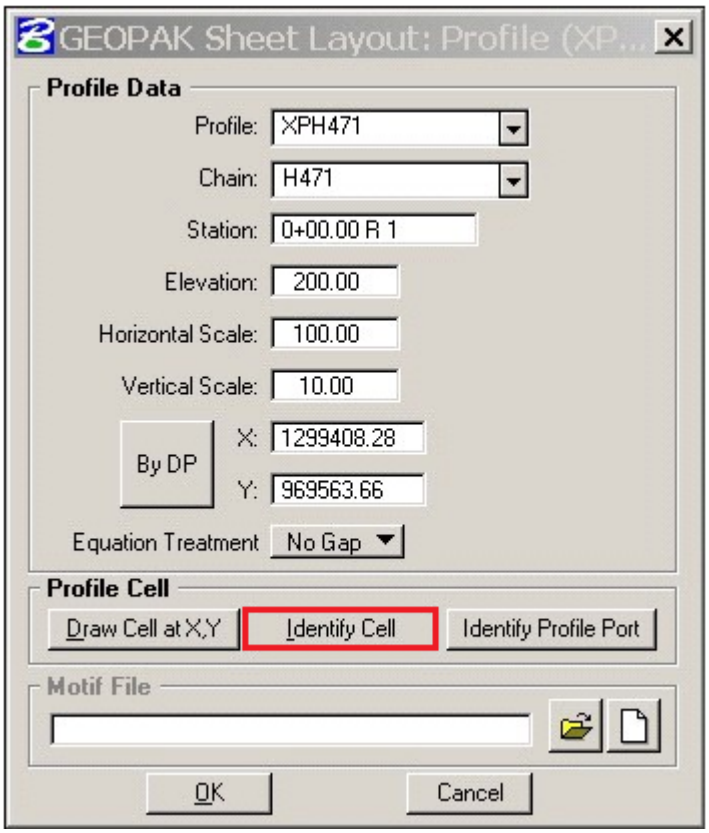
3) Sheet Composition Button – (1)



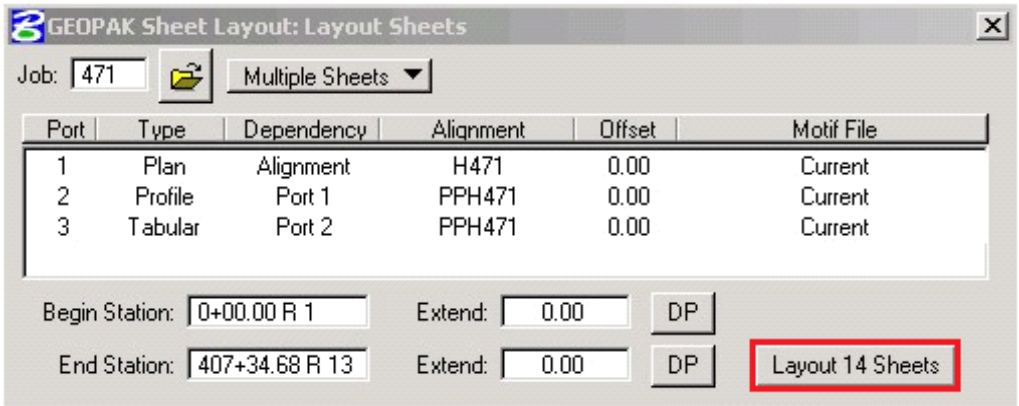
4) Layout Sheets Button – (2)



5) Double Click each line and fill out the appropriate info. If profiles are involved, the Profile and Tabular dialogs can be filled out by selecting **Identify Cell**.

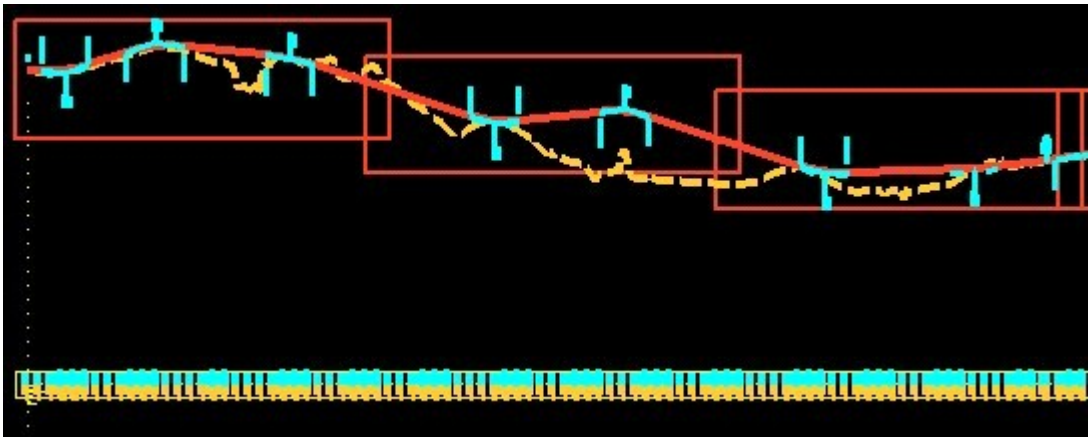


6) Select **Layout Sheets** to place your borders as shown below:

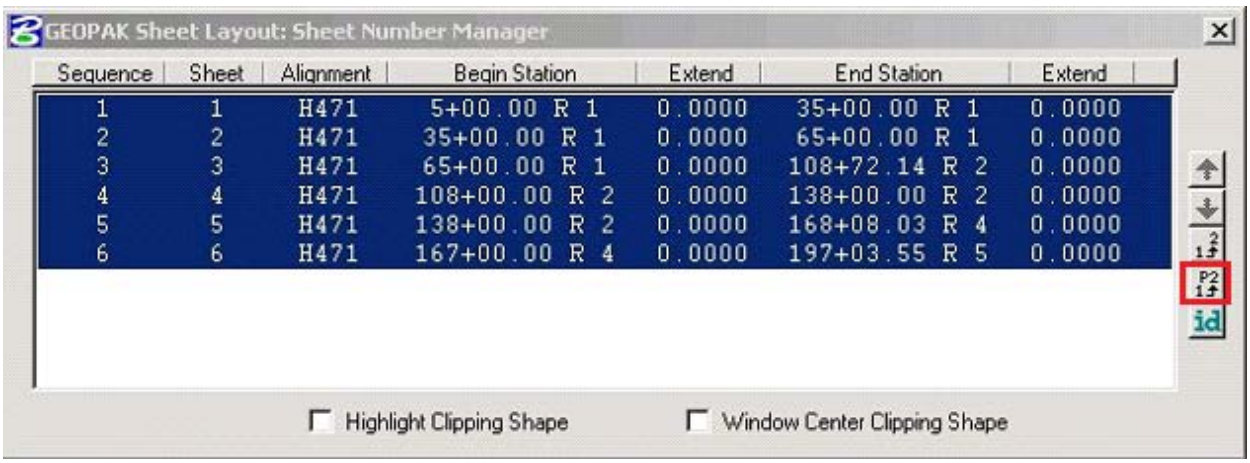


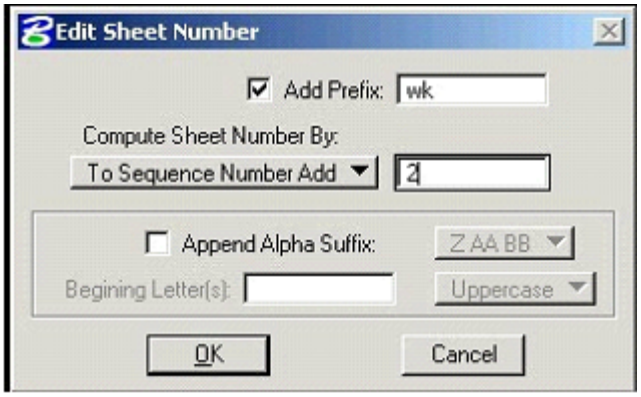
Plan Borders

Profile Borders



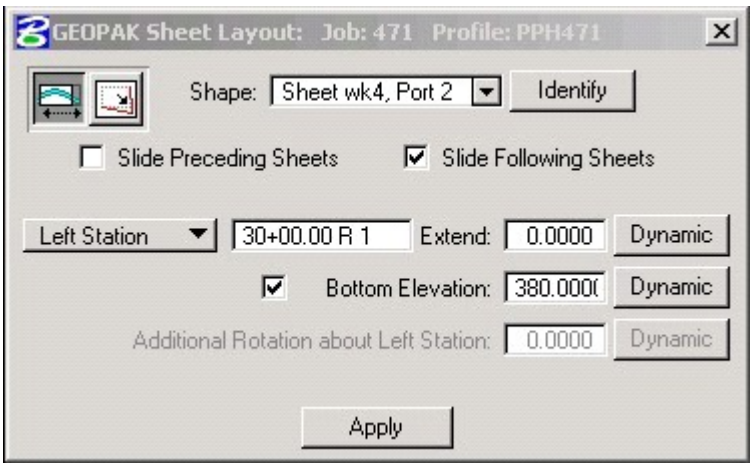
7) Editing Sheet Numbers –(3)
Choose all the lines and then select the edit sheet number button on the right to get the second dialog shown below. Fill it out as needed to get the proper DGN file name for each sheet.



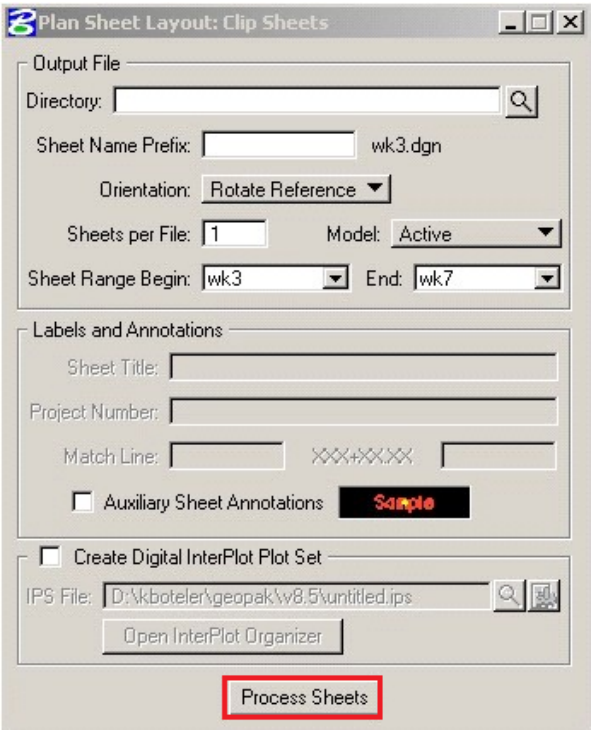


8) Modifying Borders –(4)

Use the following dialog to move borders as needed to best fit topo, etc. Also, at times, you'll need to enter a reference file, **Activate reference,** and move text instead of the border. Select **Identify** and then select the border you need to move. Profile borders need to be moved in even 10' increments.



9) Sheet Clip – (5)



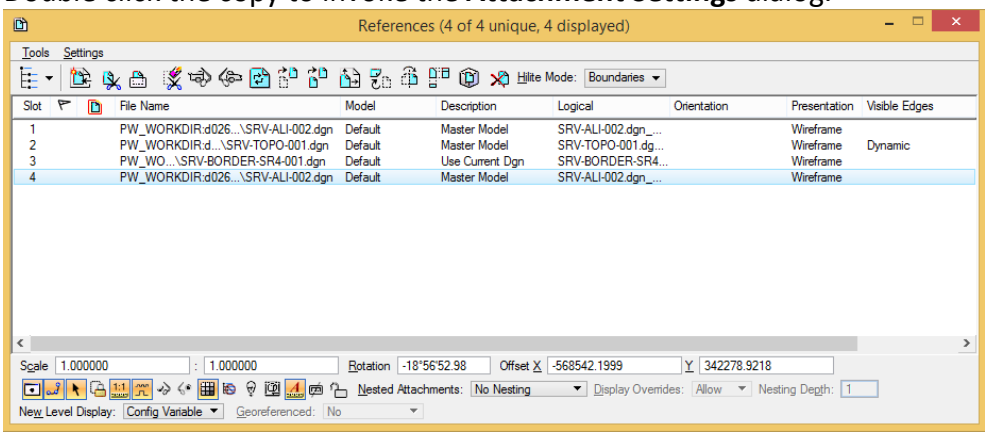
10.5.2 Adding reference Files.

To add reference files to previously created Plan and Profile Sheets, follow the steps below:

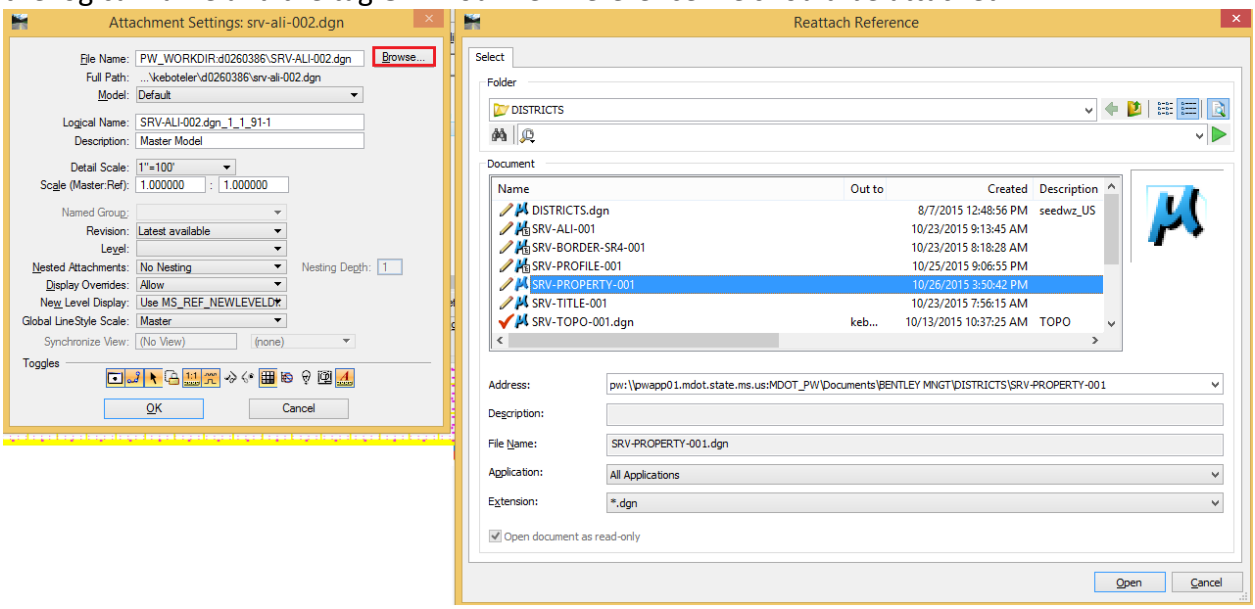
1) Invoke MicroStation's Reference Dialog.

2) Copy one of the Plan view attachments (Tools -> Copy). You will be prompted to DP the **from** and **to** location which should be the same point.

3) Double click the copy to invoke the **Attachment Settings** dialog.



4) Change the File Name or Browse to Select the DGN file you wish to attach. Also change the logical name and the tag **OK**. Your new reference file should be attached.



LAB V: Sheet Creation

1. Create a Border DGN file (RWD-BORDER-001.DGN).
2. Reference your alignment, topo, and EP DGN files.
3. Reference your profile DGN file.
4. Go through the Sheet Setup process to create Plan and Profile sheets. (Names should be RWD-WK3, RWD-WK4, etc.)

11. TEMPLATES

11.1 Section Overview

Corridor Models are built by dropping templates at intervals along a profiled alignment. A template is basically a typical section comprised of a series of points and components that represent breakline features. Templates are created in the **Create Template** tool available in the Corridor Modeling task. Templates are stored in a template library (*.itl).

Although MDOT provides a Template Library (RWD.ITL) with standard templates that you are encouraged to use, you will almost always have to make edits to the templates to handle project specific requirements. It is even ideal at times to modify things such as structure thickness, shoulder width, etc. to match project and typical section requirements. This section:

1) Describes copying the ITL to your Project Directory.
2) Describes MDOT's Template Library
3) Describes MDOT's Standard Point Names.
4) Discusses basics of accessing and using the Create Template dialog to create templates or combine components.

11.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal and Vertical Geometry
- Proposed Cross-Section Geometry

11.3 Section Objectives

After completing this section you will be able to:

1) Navigate and choose components and templates from RWD.ITL to create Project specific templates.
2) Create Templates from scratch.
3) Use Template Organizer to copy templates from other ITL files.

11.4 Project ITL

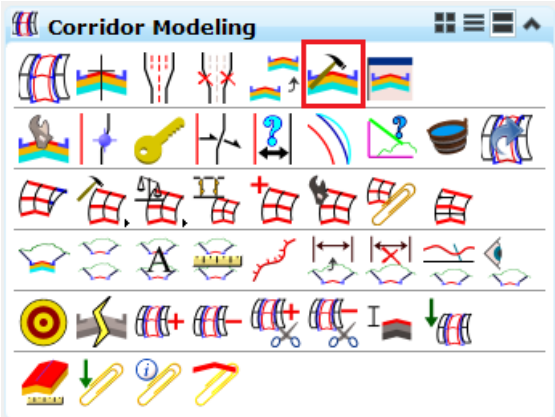
MDOT's standard template library is located at:
pw:\\pwapp01.mdot.state.ms.us:MDOT_PW\Documents\Workspace\Standards\RWD\ITL\

Prior to dropping Templates, you need to copy the ITL from the path above to your project directory. You will then create the templates you need by copying pre-built templates to the **Project Specific** folder in the ITL and modifying as needed as discussed in the remainder of this section.

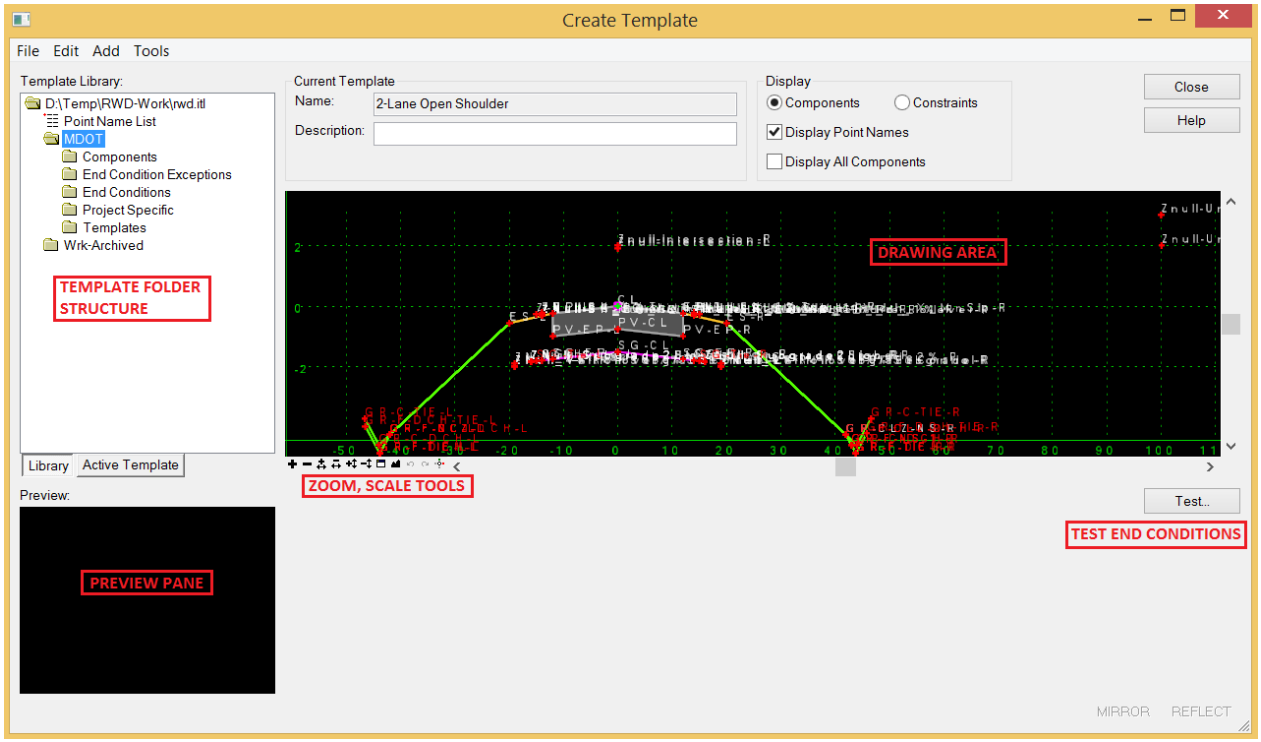
11.5 Create Template

11.5.1 Opening

Choosing the following tool invokes the Create Template dialog.

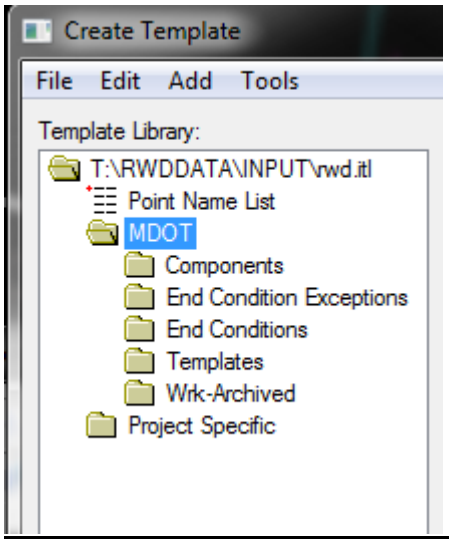


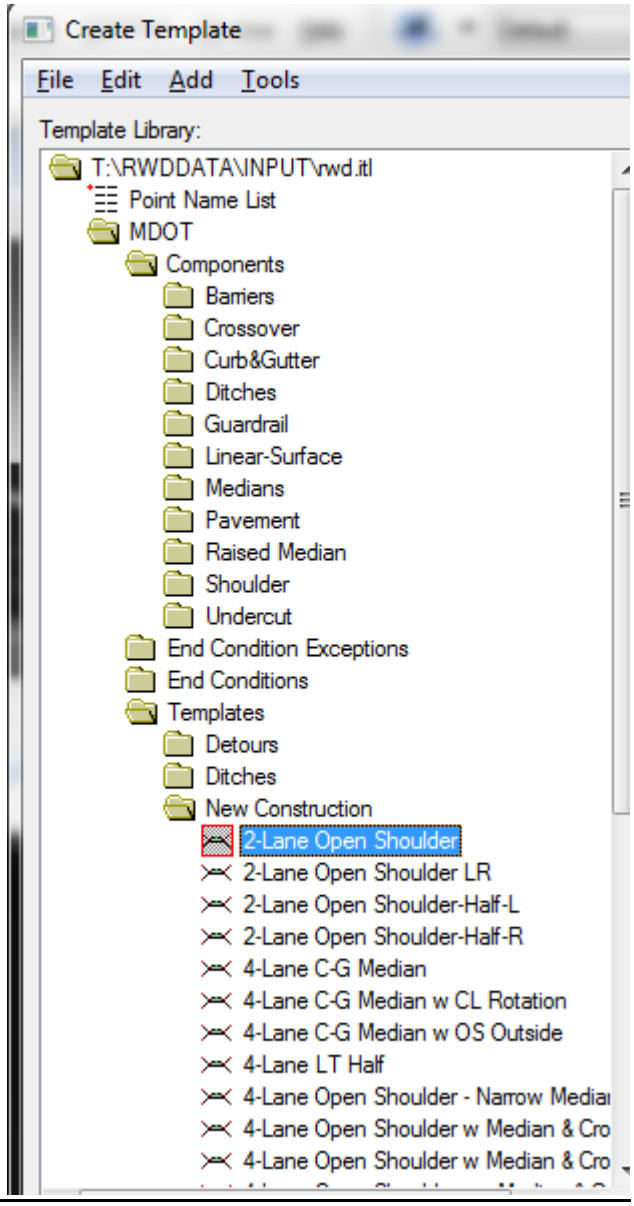
11.5.2 Dialog



11.5.3 MDOT's Templates

The current folder structure is shown below. Templates have been pre-built for most roadway types and with built-in shoulder and subgrade standards. Components and End Conditions have also been built to be able to easily drag and drop to combine different component types.

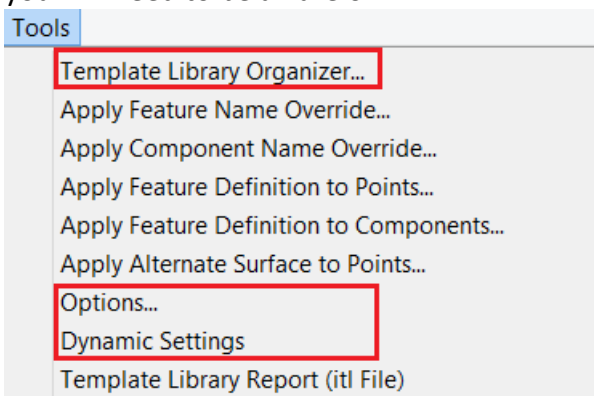




It is highly recommended you copy any templates you need to edit to the <u>Project Specific</u> folder prior to editing. This will allow you to import the MDOT structure when updates occur without overwriting your project specific templates.

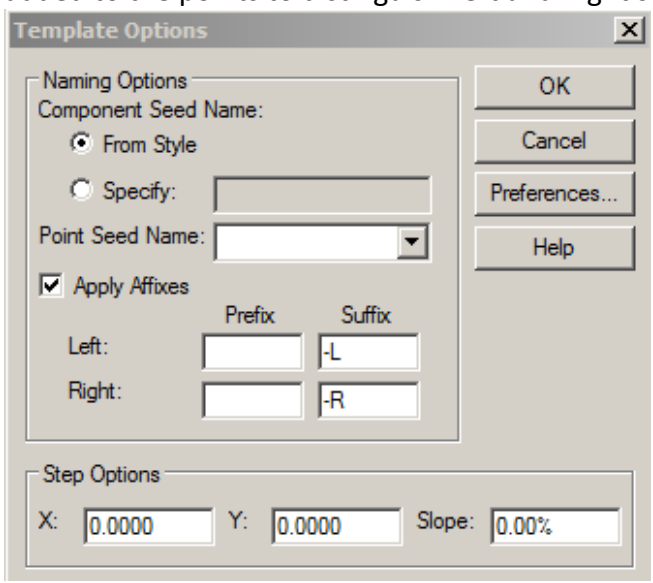
11.6 Tools Menu

This section describes the Tools pulldown menu and a few of the tools available on it that you will need to be aware of.



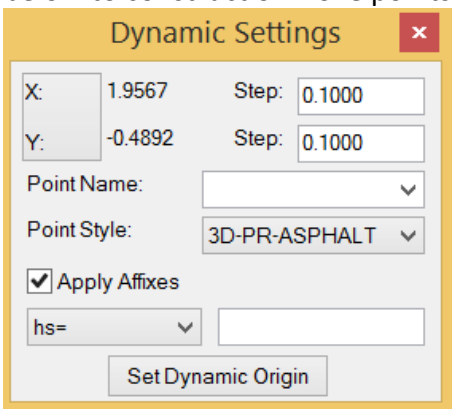
11.6.1 Template Options

Tools –> Template Options: Apply Affixes needs to be disabled sometimes and enabled sometimes depending on the task you are trying to accomplish. If enabled a –L or –R is added to the points to distinguish Left and Right sides.



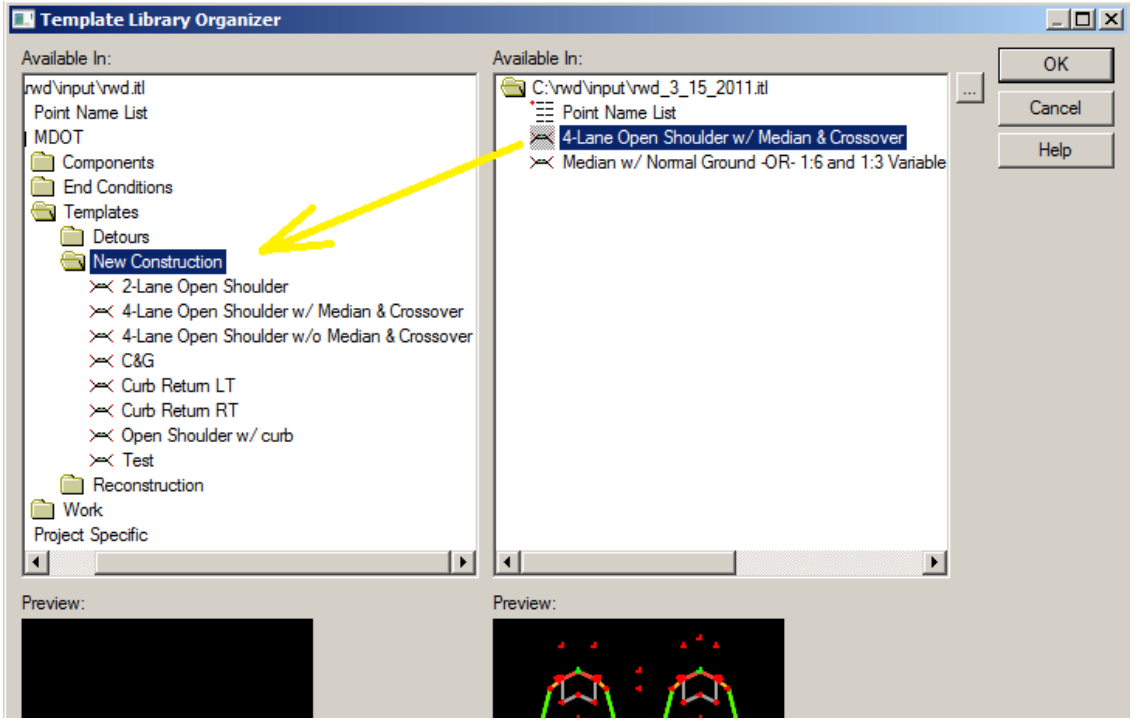
11.6.2 Dynamic Settings

Tools -> Dynamic Settings: Dynamic Settings generally needs to be opened and set as shown below to construct or move points to specific points.



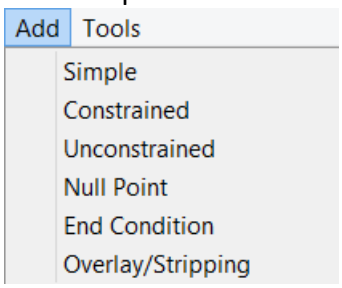
11.6.3 Template Library Organizer

Allows you to copy components or templates from a library to your current library.



11.7 Add Menu

The **Add** pulldown menu is how you add elements to the drawing area.

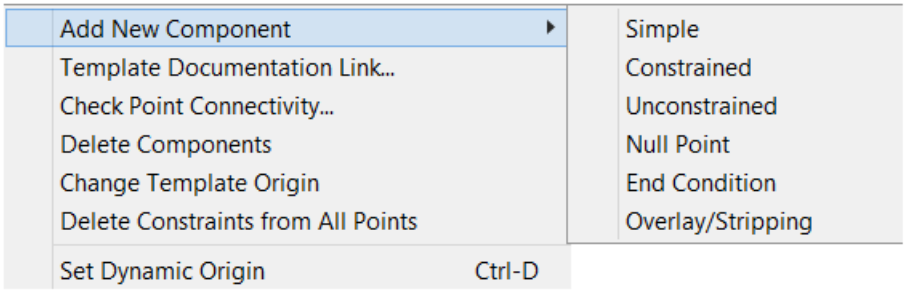


The element types available:

- **Simple** is a closed shape such as pavement.
- **Constrained** or **Unconstrained** are just lines and generally used for shoulder, ground, curb and gutter, etc.
- **Null Point** is just a point.
- **End Conditions** are just lines but they search for a terrain to solve for and are generally the foreslope and backslope.
- **Overlay/Stripping** appear in the template dialog as just lines but they expand to the terrain as closed shapes in the Corridor Modeling process to create overlay and milling areas.

Note:

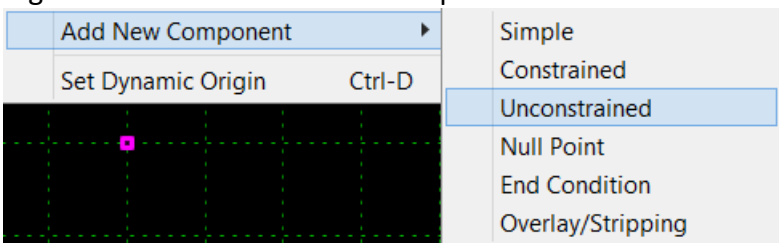
- In lieu of using the Add menu to place elements, you can right click the drawing area and choose **Add New Component.**



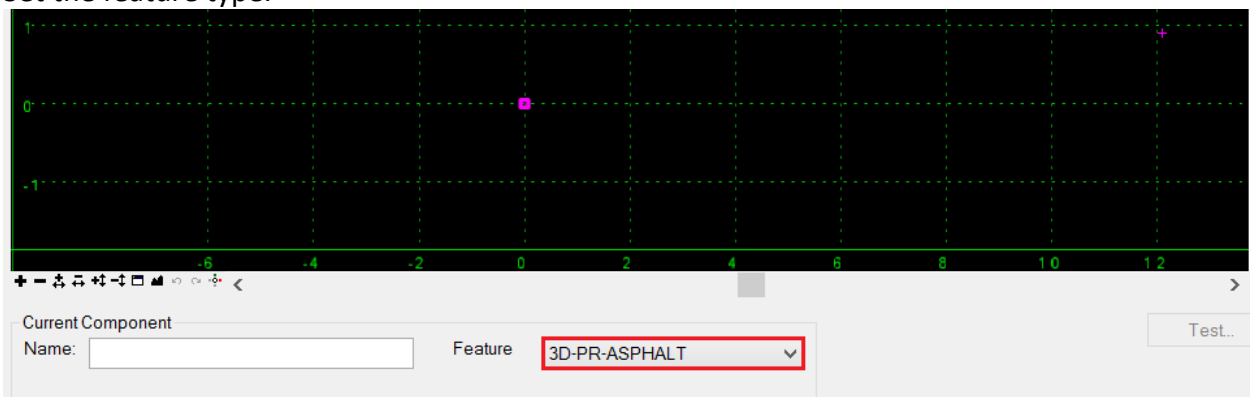
11.8 The Basics

11.8.1 Adding a component

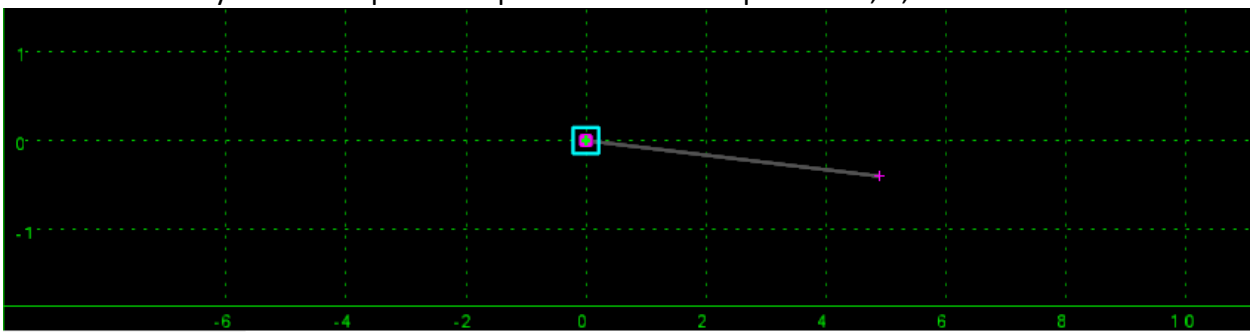
1) Right Click and choose Add a component.



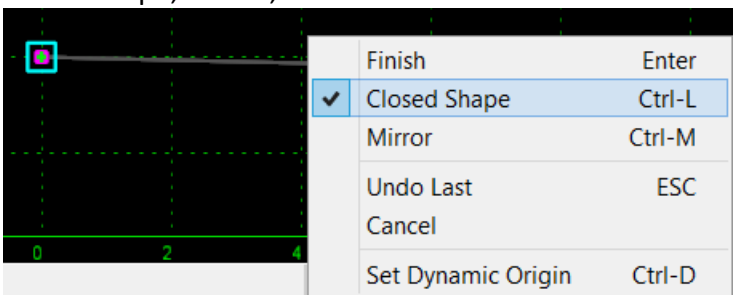
2) Set the feature type.



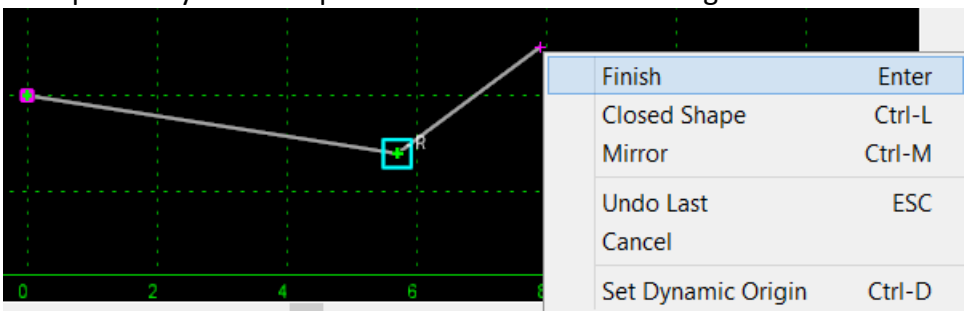
3) Left click where you wish to place the point. In the example below; 0,0.



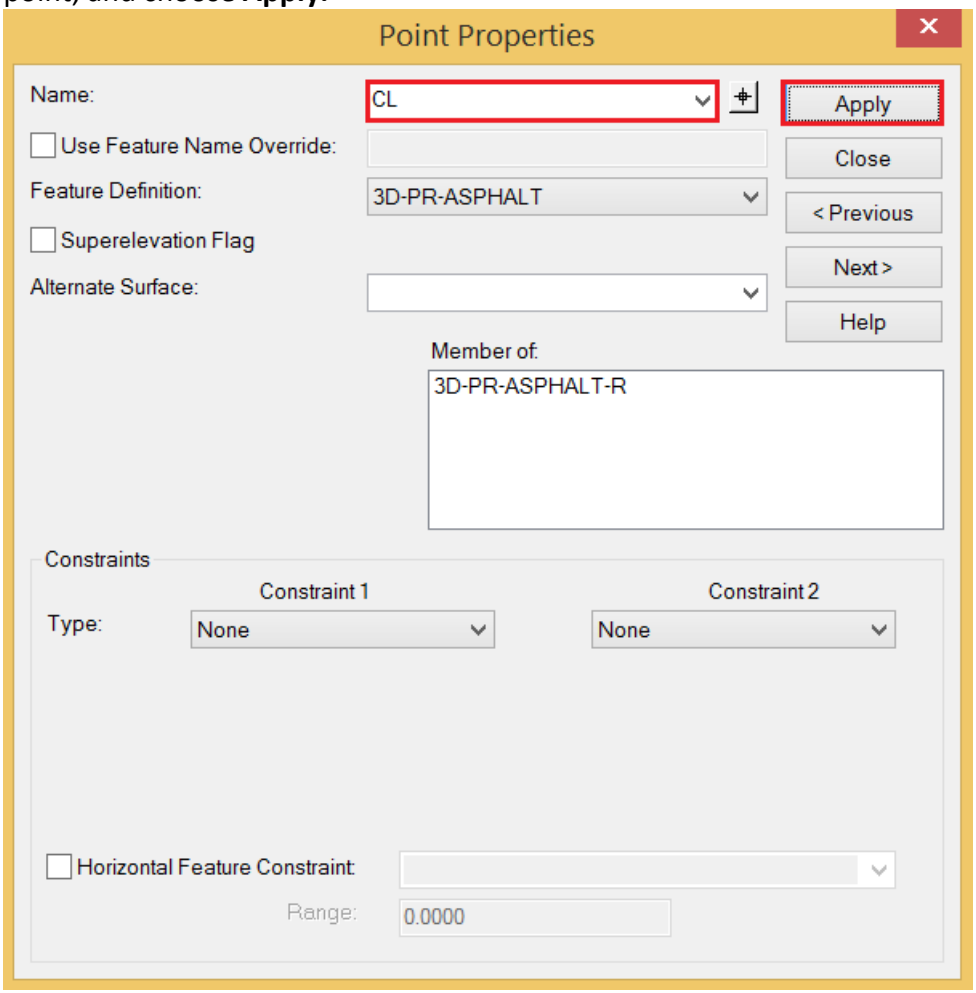
4) You can right click to invoke the following menu which allows you to cancel, uncheck closed shape, mirror, etc.



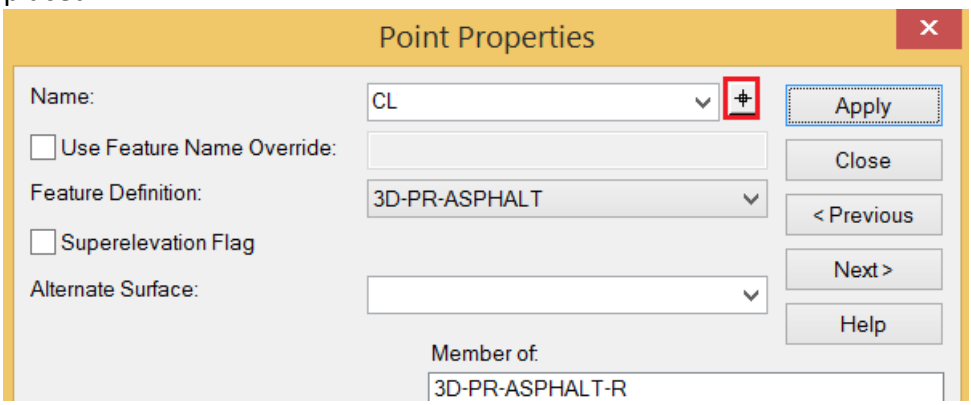
5) Data point anywhere to place the element and then right click and choose **Finish.**



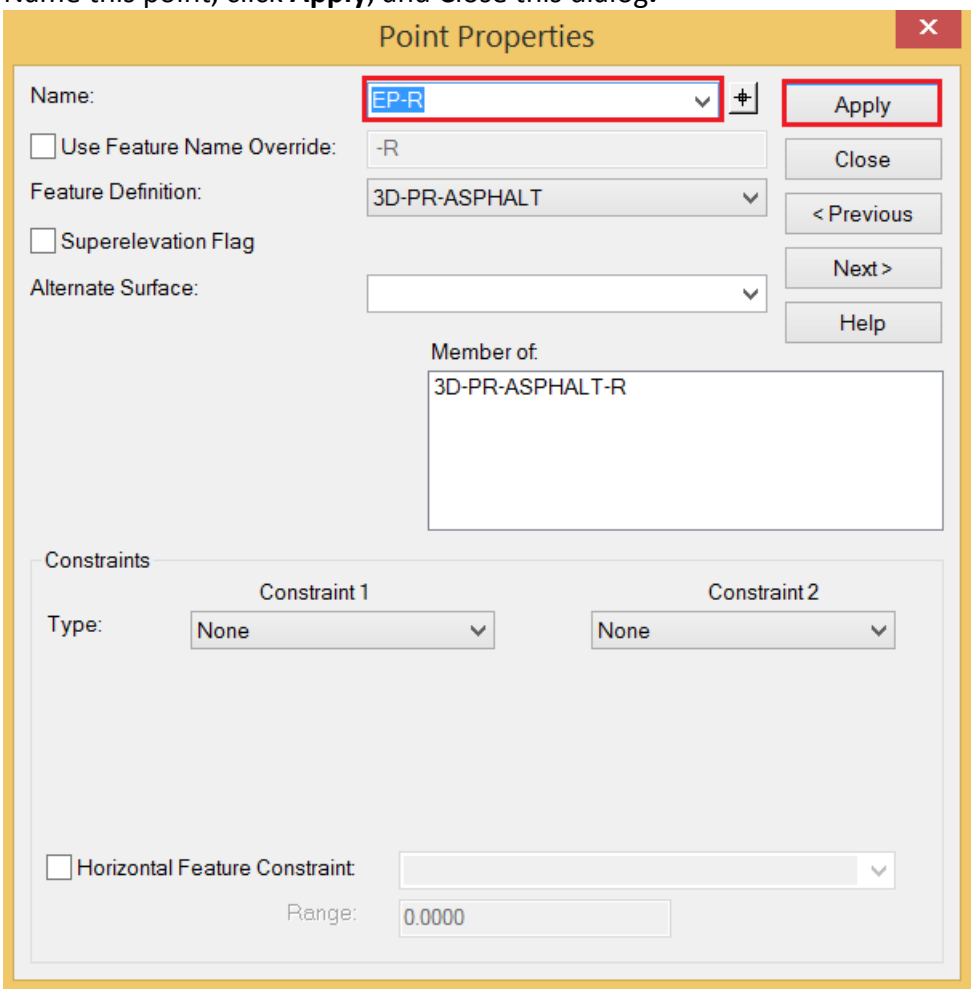
6) Double click the point placed at 0,0 to invoke the **Point Properties** dialog, name the point, and choose **Apply.**



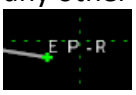
7) Choose the button next to the Name which allows you to go choose the other point placed.



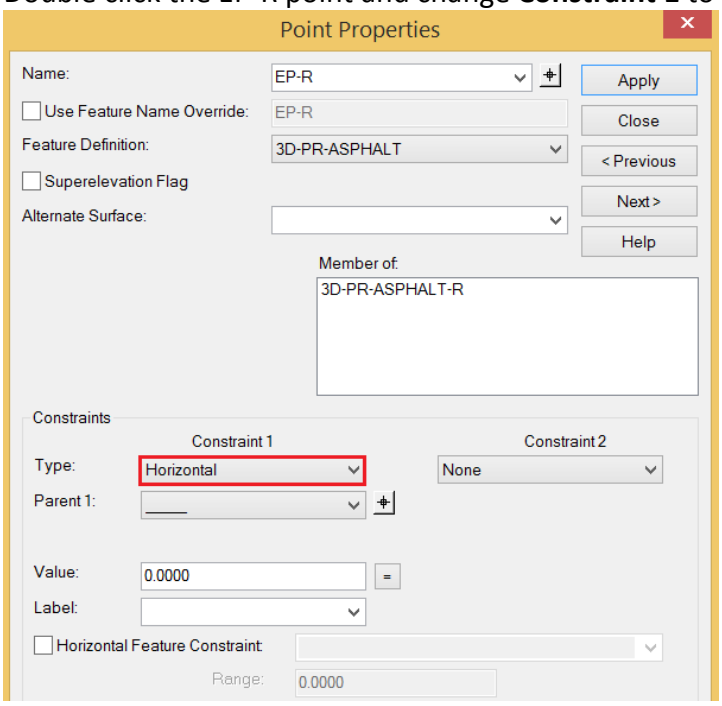
8) Name this point, click **Apply**, and Close this dialog**.**



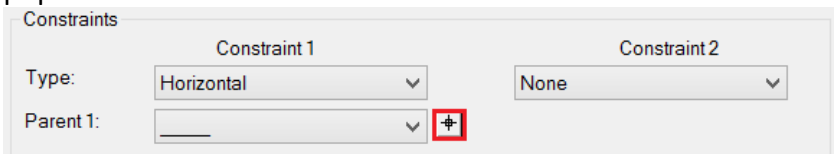
9) Notice the color of the EP-R point is green. This indicates this point is not constrained to any other point.



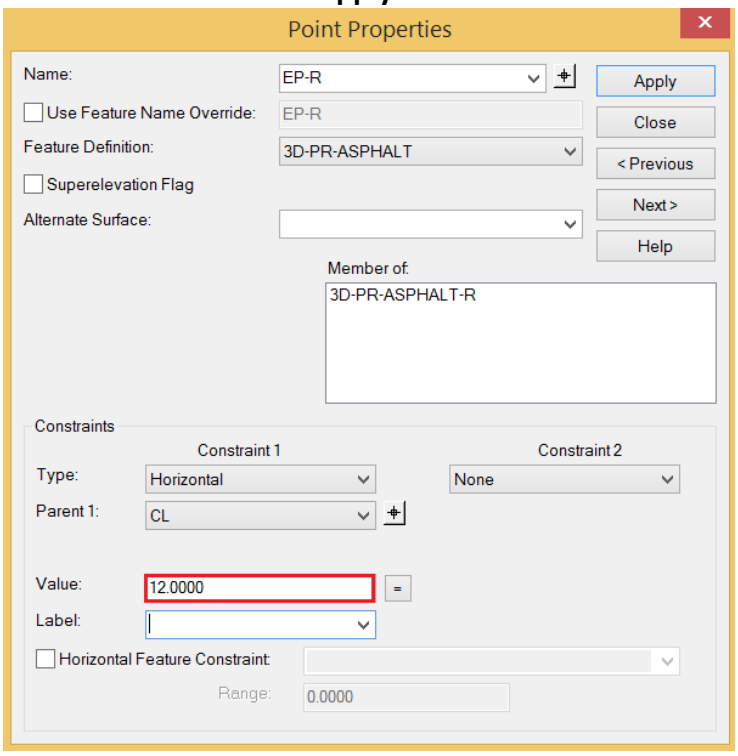
10) Double click the EP-R point and change **Constraint 1** to **Horizontal.**



11) Choose the Select button to the right of **Parent 1** and then left click the CL point which populates Parent 1 with CL.

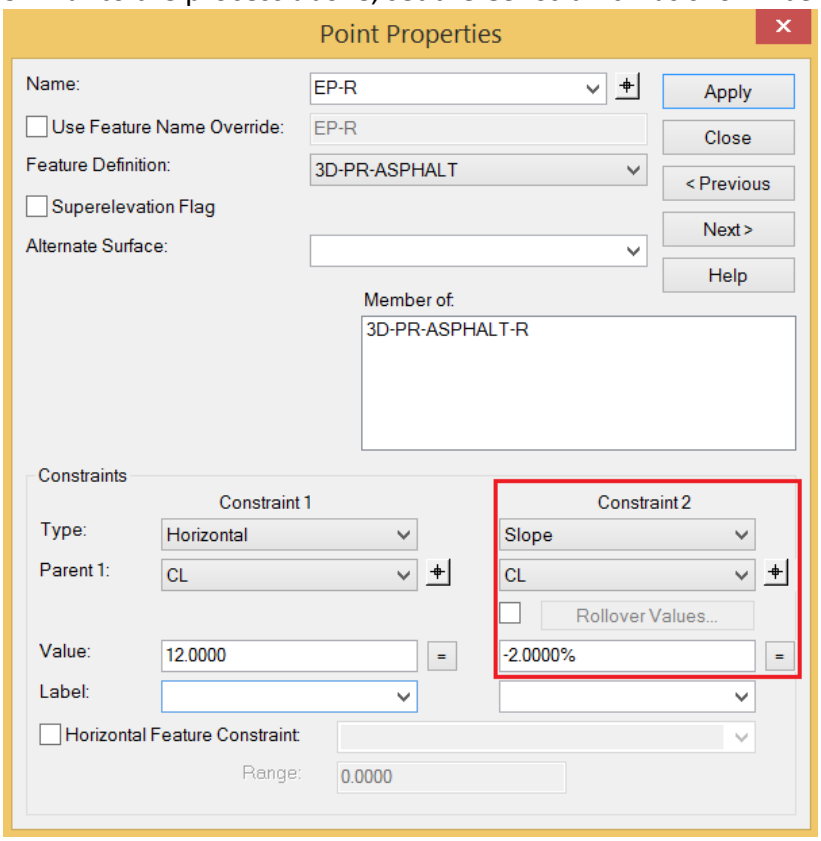


12) Set the **Value** to 12 and **Apply.**

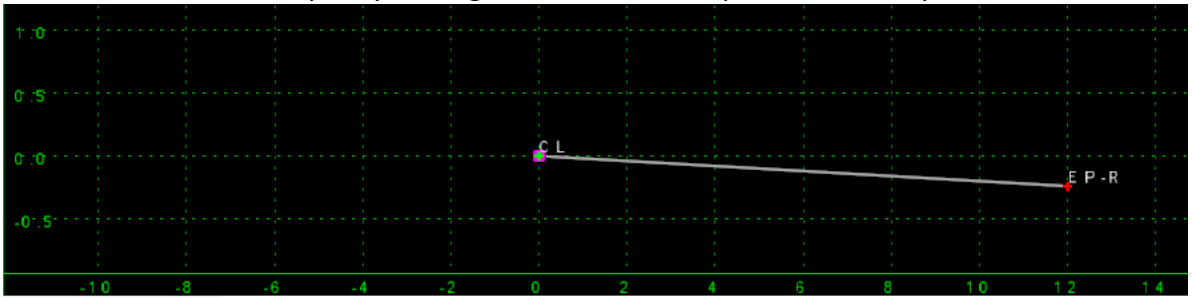


13) Notice the color of point EP-R now. It should be yellow which means the point has one constraint.

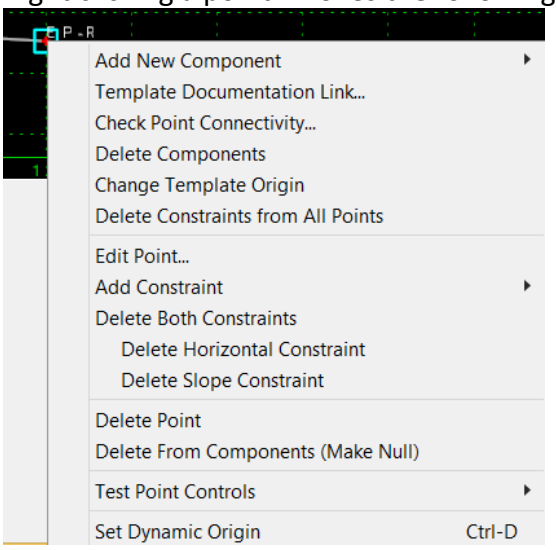
14) Similar to the process above, set the **Constraint 2** as shown below and choose **Apply.**



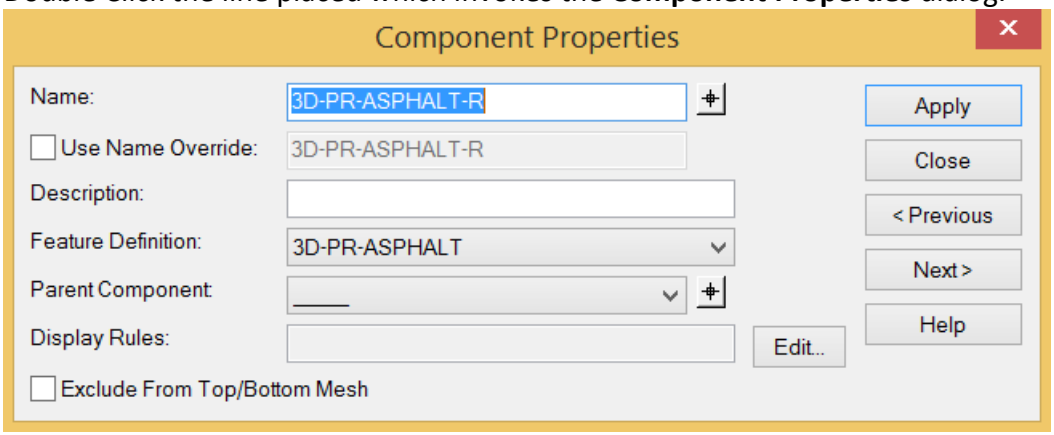
15) Close the point dialog and notice the color of point EP-R is now red which means it is fully constrained. Also notice the point EP-R is physically located in the drawing area where the constraints specify, 12' right and at a -2% slope from the CL point.



16) Right clicking a point invokes the following menu.



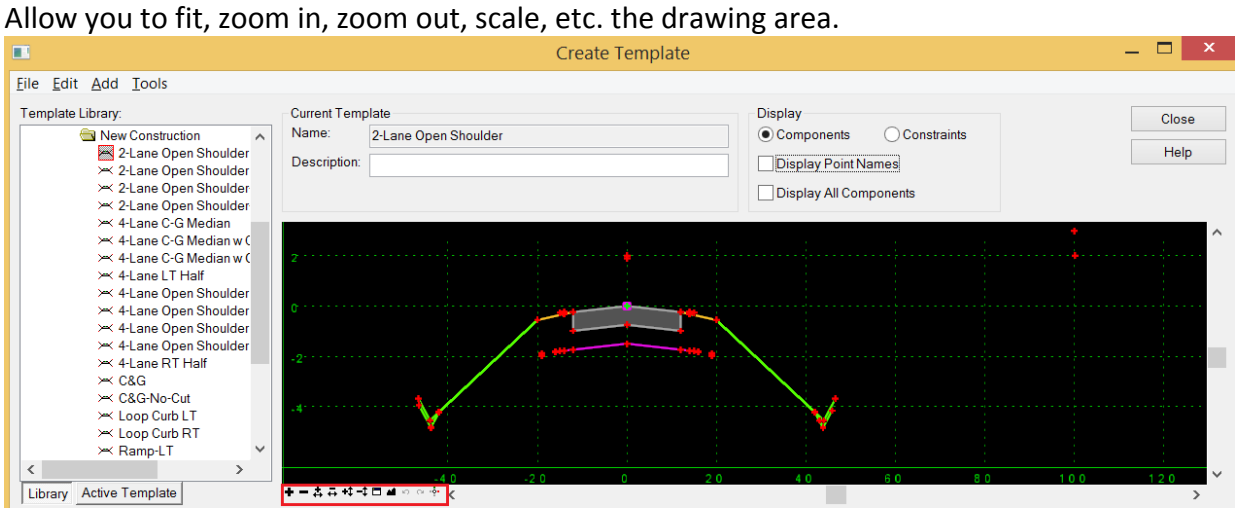
17) Double Click the line placed which invokes the **Component Properties** dialog.



Parent Components and Display Rules will be discussed in more depth in the Component dialog area below.

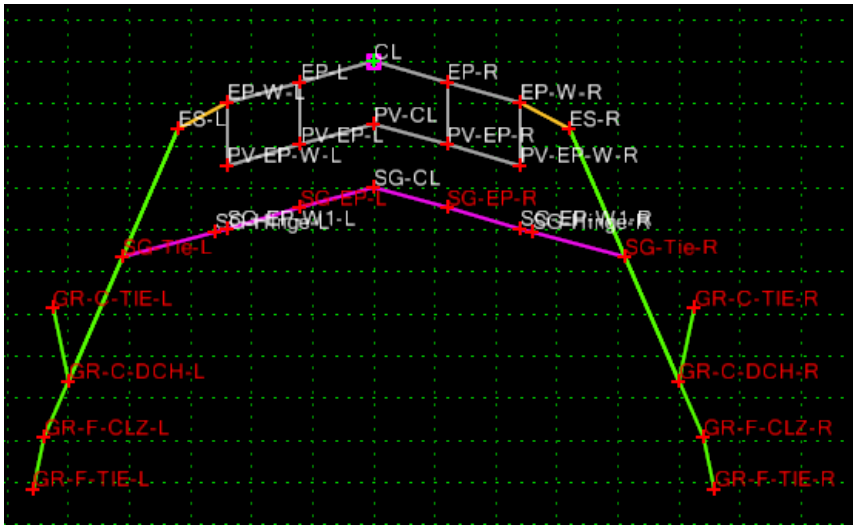
11.8.2 View Commands

Allow you to fit, zoom in, zoom out, scale, etc. the drawing area.



11.9 Point Properties

11.9.1 MDOT's Standard Template Point Names



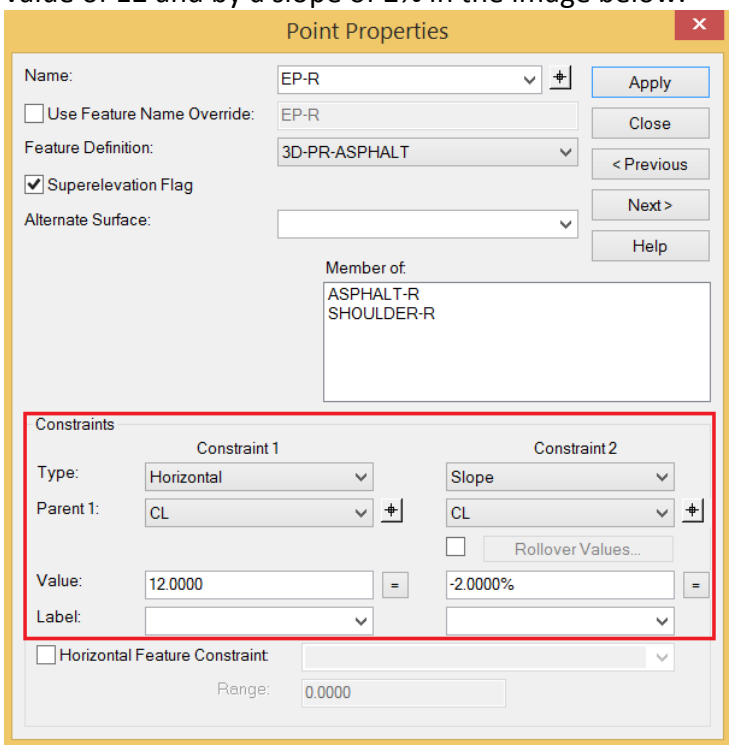
POINT	CATEGORY	DESCRIPTION	SURFACE FEATURE STYLE	PLAN VIEW STYLE CONSTRAINT
CG-BC	Curb	Back of Curb	3D PR CONCRETE	
CG-FC	Curb	Face of Curb	3D PR CONCRETE	
CG-FG	Curb	Face of Gutter	3D PR CONCRETE	
CL	Pavement Top	Centerline	3D PR ASHPHALT	
EP	Pavement Top	Normal Width EP	3D PR ASHPHALT	
EP-W	Pavement Top	Widened EP (Outside super)	3D PR ASHPHALT	P-EP-PAVED
EP-X	Pavement Top	Existing Edge	3D PR ASHPHALT	X-EP
ES-P	Shoulder	Paved Edge	3D PR ASHPHALT	P-SHLD-PAVED
ES	Shoulder	UnPaved Edge	3D PR SHOULDER	P-SHLD-UNPAVED
GR-C-DCH	Ground	Cut Ditch	3D PR GROUND	
GR-C-TIE	Ground	Cut Tie	3D PR GROUND	
GR-F-CLZ	Ground	Fill Safety Slope End	3D PR GROUND	P-CLEAR-ZONE
GR-F-TIE	Ground	Fill Tie	3D PR GROUND	
PV-CL	Pavement Bottom	Centerline	3D PR ASHPHALT	
PV-EP	Pavement Bottom	Normal Width EP	3D PR ASHPHALT	
PV-EP-W	Pavement Bottom	Widened EP (Outside super)	3D PR ASHPHALT	
PV-EP-X	Pavement Bottom	Existing Edge	3D PR ASHPHALT	
PV-ES-I	Paved Shoulder Bottom	Paved Inside Bottom	3D PR ASHPHALT	
PV-ES-O	Paved Shoulder Bottom	Paved Outside Bottom	3D PR ASHPHALT	
SG-CL	Subgrade	Subgrade CL	3D PR SUBGRADE	
SG-EP	Subgrade	Subgrade at EP	3D PR SUBGRADE	
SG-EP-W	Subgrade	Subgrade at EP Widened	3D PR SUBGRADE	
SG-TIE	Subgrade	Subgrade TIE	3D PR SUBGRADE	
SW	Sidewalk		3D PR CONCRETE	P-SIDEWALK
ZDNC		Do not Construct		
Znull		Null Points		

Notes:

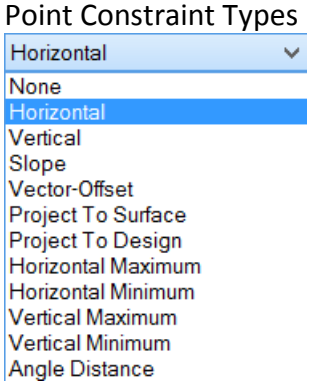
- It is imperative to use this naming convention as close as possible because this is what controls the name of breakline features.
- -L and -R are added to each point for Left and Right sides of the Template. –MR and -ML are added for median sides.

11.9.2 Constraints

A point can have two constraints. Point EP-R is constrained to point CL horizontally with a value of 12 and by a slope of 2% in the image below.

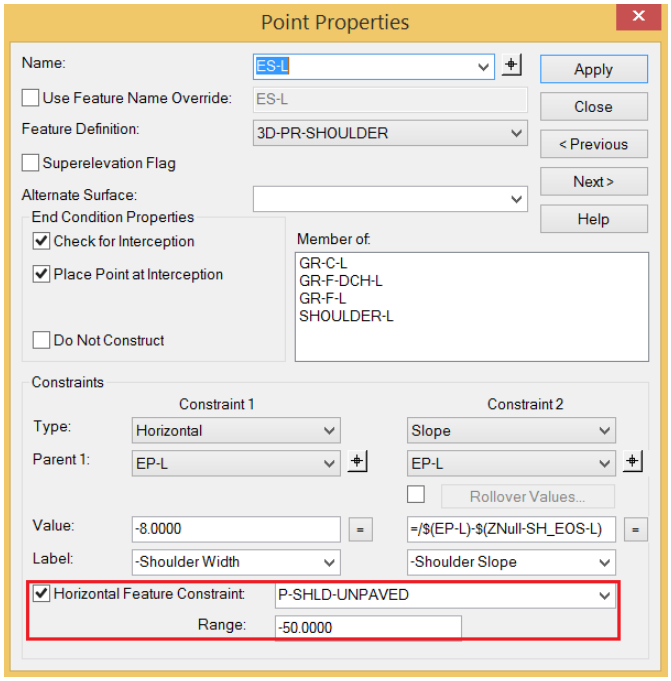


Point Constraint Types



11.9.3 Horizontal Feature Constraints

Below you'll see an example of a **Horizontal Feature Constraint.** Point ES-L is constrained to EP-L both by slope and horizontally. ES-L also has a **Horizontal Feature Constraint** set so that if the feature P-SHLD-UNPAVED is found within a distance of -50', point ES-L is moved to this location.

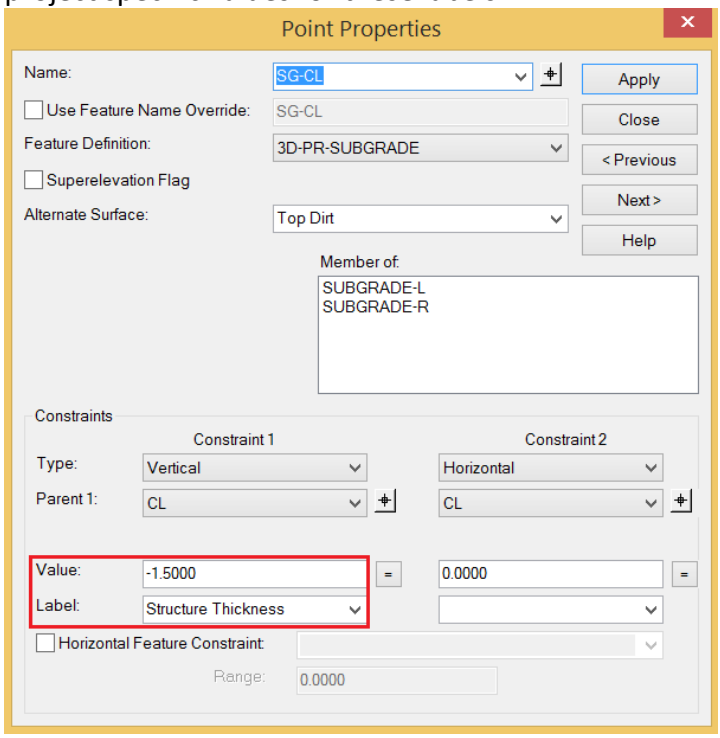


Note:

- Horizontal features have to be defined as Corridor Model **External References** to be eligible to be searched for as a Horizontal feature Constraint.

11.9.4 Parametric Constraints

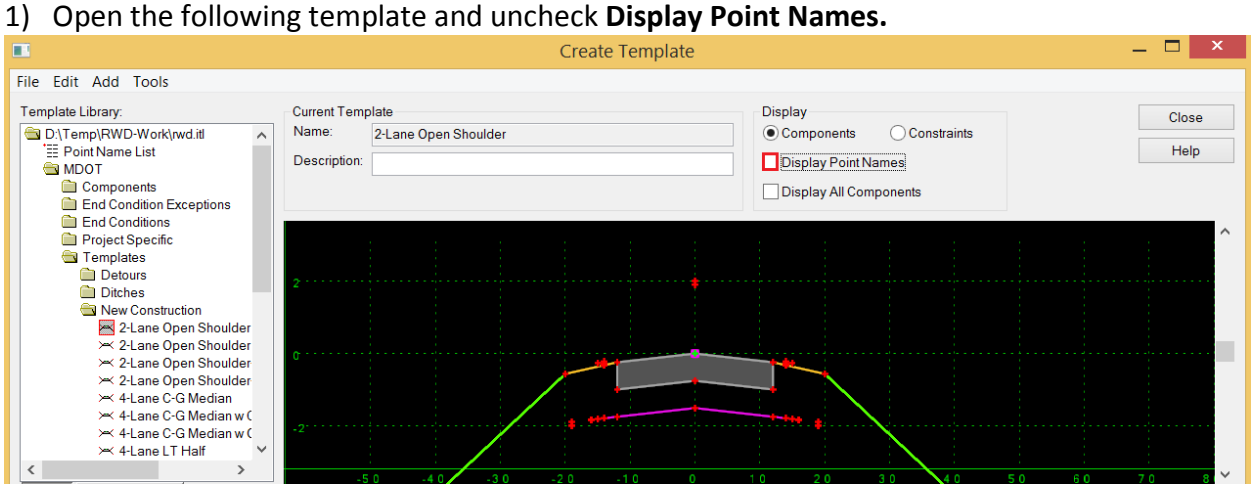
Notice that **Constraint 1** below for SG-CL has a **Label** called **Structure Thickness** and a **Value** of -1.5 which is the vertical distance between points CL and SG-CL. These labels can be defined as a **Parametric Constraint** for a Corridor thus allowing users the ability to define project specific values for these labels.



11.10 Component Properties

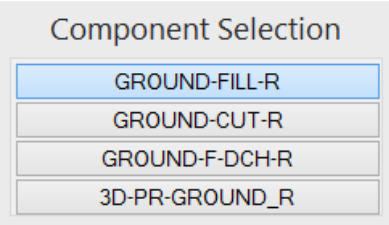
11.10.1 Parent Component

1) Open the following template and uncheck **Display Point Names.**

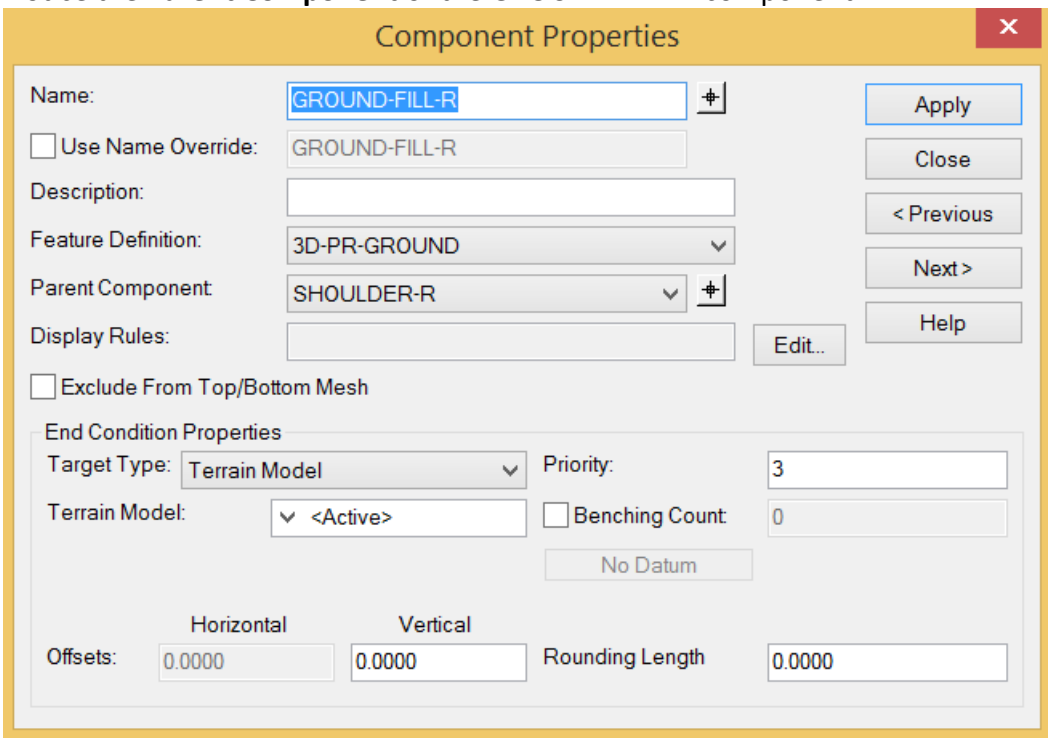


2) Double click the end condition (green) to the right of the right shoulder.

3) You are prompted the following dialog from which you should choose GROUND-FILL-R.



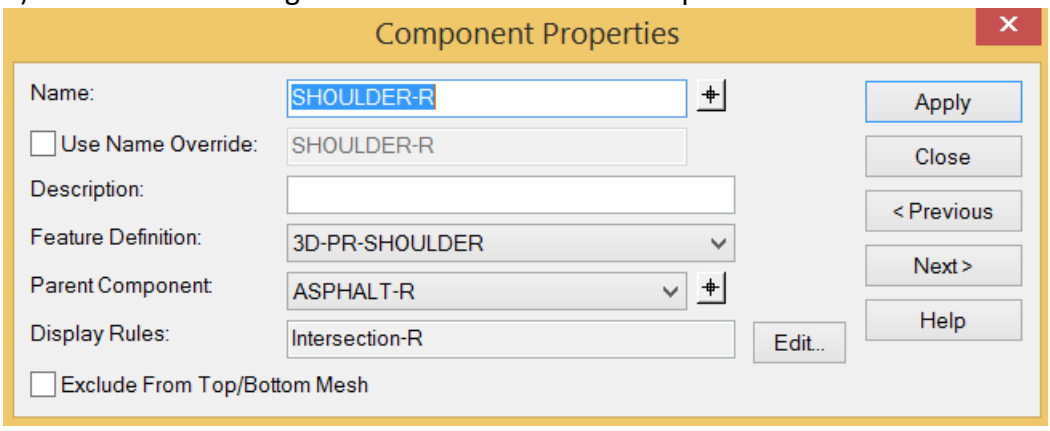
4) Notice the **Parent Component** of the GROUND-FILL-R component.



Parent components basically work in conjunction with Display Rules. If SHOULDER-R is not displayed, GROUND-FILL-R will not be displayed.

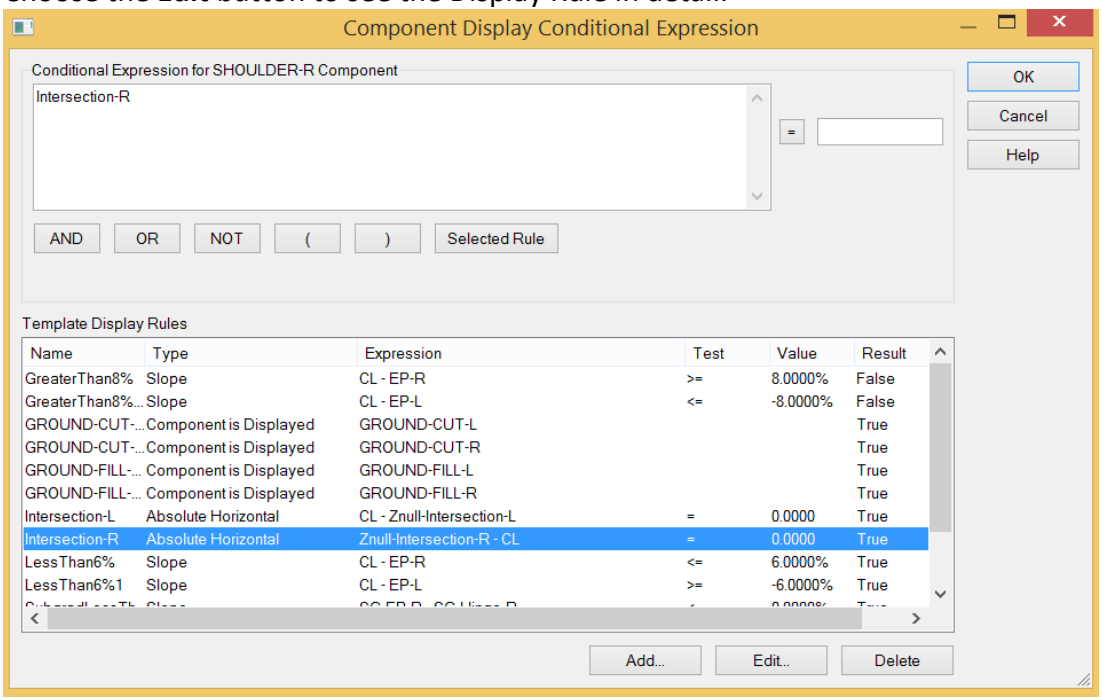
11.10.2 Display Rules

1) Double click the right shoulder to invoke its Component



Notice the **Display Rule** associated with it. Display Rules can be added by selecting the **Edit…** button here and basically control the display of an element based on specific criteria being met.

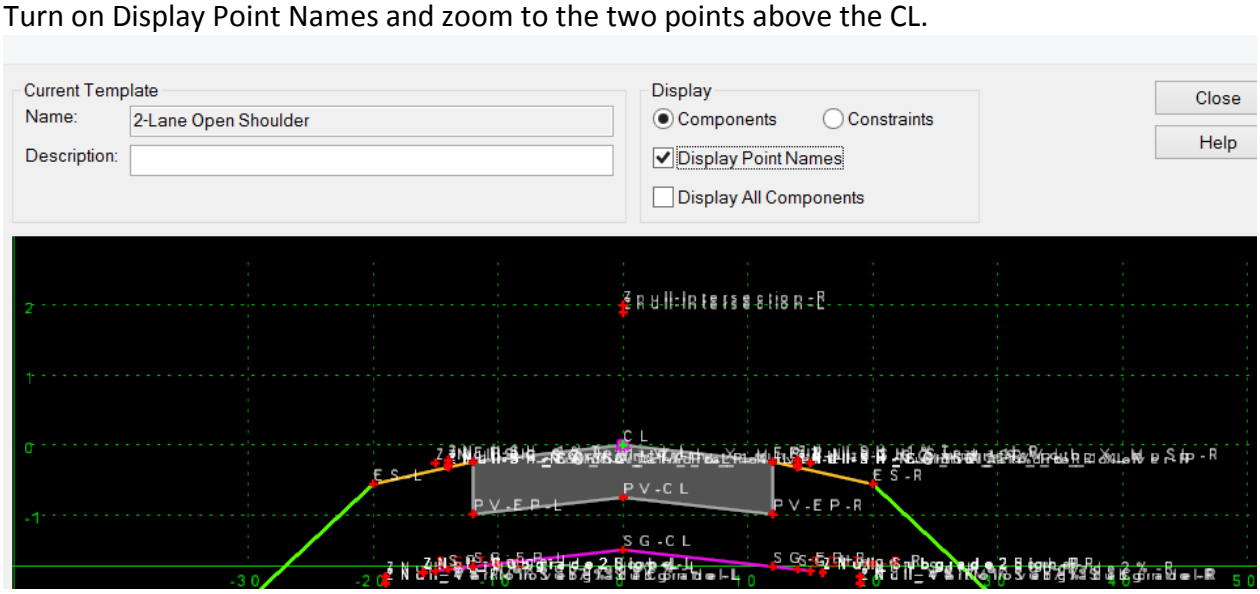
2) Choose the **Edit** button to see the Display Rule in detail.



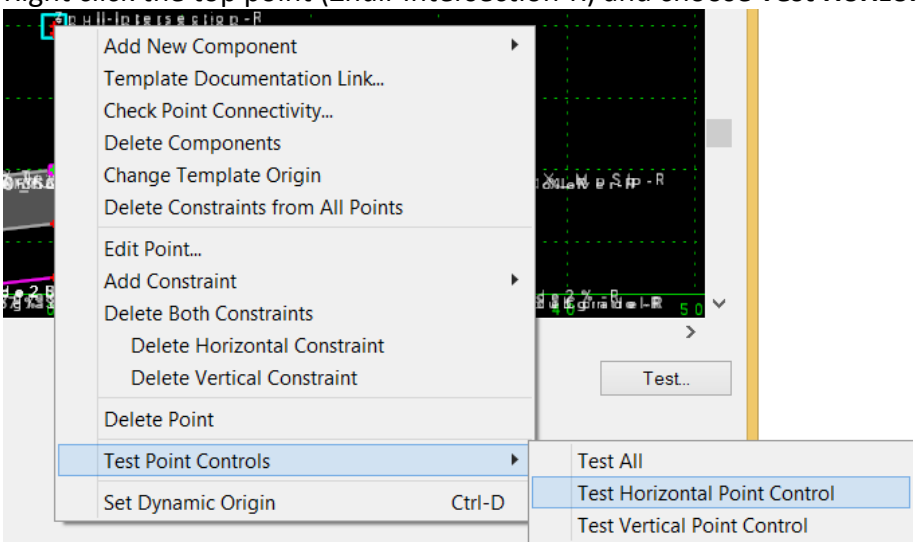
Notice that when the Absolute Horizontal distance is 0, the component is displayed. Also note that you can choose **Add** to add a new rule although this document does not cover this process.

3) Choose the Cancel button to exit this dialog and also close the Component Properties dialog.

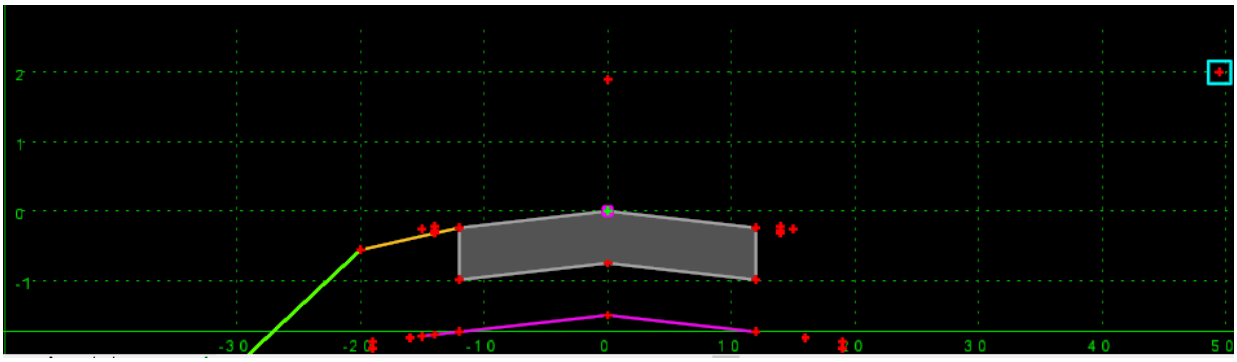
4) Turn on Display Point Names and zoom to the two points above the CL.



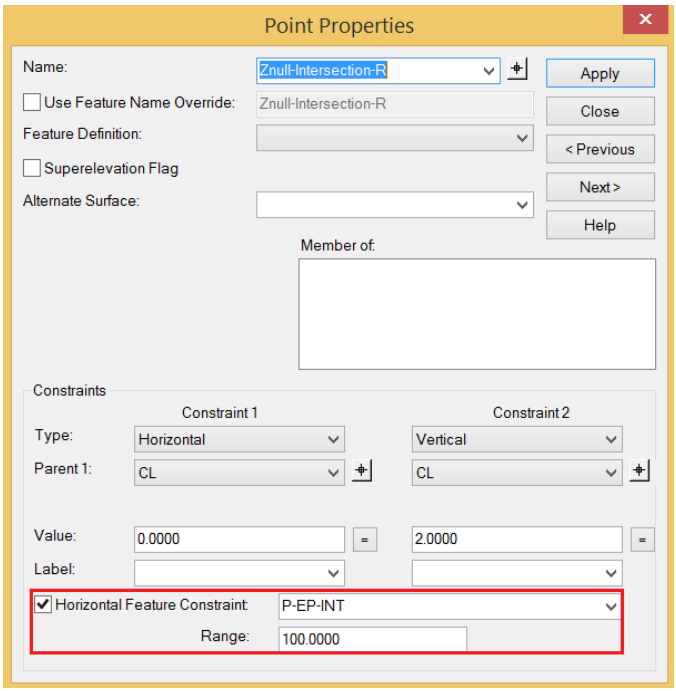
5) Right click the top point (Znull-Intersection-R) and choose **Test Horizontal Point Control.**



6) Notice when you move the point, display of the shoulder and ground is turned off. This is because of the display rule on the shoulder and the ground being a child of the shoulder.



7) Double click the Znull-Intersection-R point and see the **Horizontal Feature Constraint** is set to P-EP-INT. So the way the display rule works is if Znull-Intersection-R sees a P-EP-INT feature (an intersection), the point is moved to this location and the horizontal distance between this point and the CL is not = 0 and the display of the shoulder is turned off.

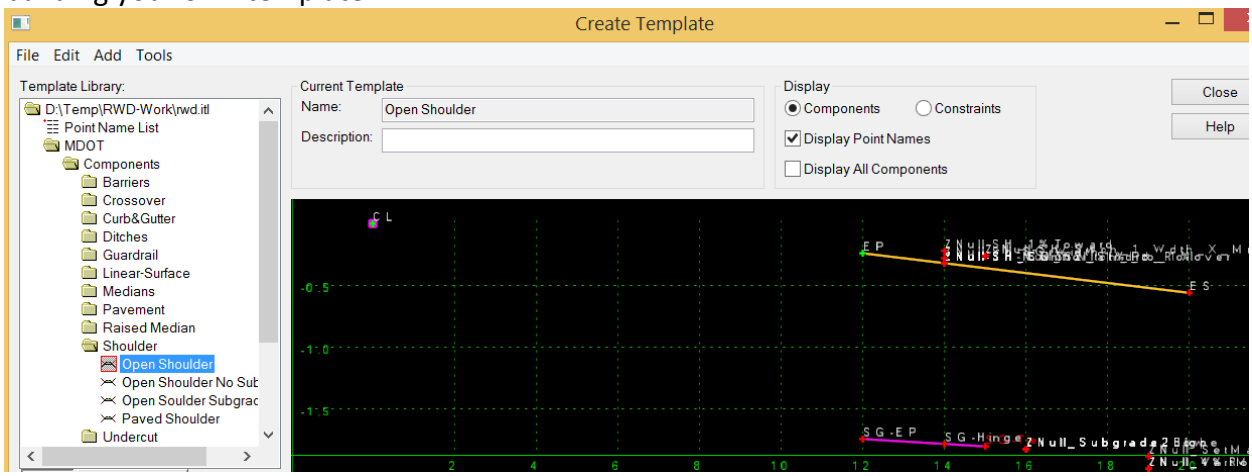


Most templates in MDOT's library are built with Display rules. A few of these are listed below.

- Find Intersection – If the feature P-EP-INT (an intersection) is found when added as an External Reference, end conditions, shoulder, subgrade, and undercut are not displayed outside the EP.
- Undercut – If the Parametric Constraint **Undercut Thickness** is set to -3, Design Soil (or Undercut) will be displayed.
- X-OVER – If the feature P-X-OVER (a cross-over) is found when added as an External Reference, end conditions, shoulder, subgrade, and undercut are not displayed in the median.
- SGLessthan0% - SG alternate based on pavement slope.

11.10.3 MDOT's Shoulder and Subgrade Components

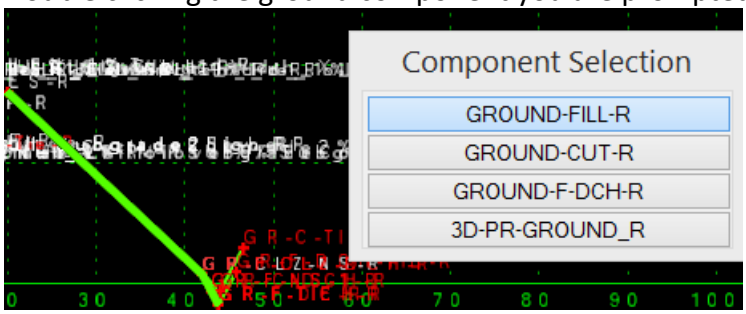
MDOT's **Open Shoulder** component is shown below. Notice all the points associated with it. These points make the shoulder slope match MDOT standards based on pavement slope. The Open Shoulder component is complicated and it is recommended you use it even if building your own template.



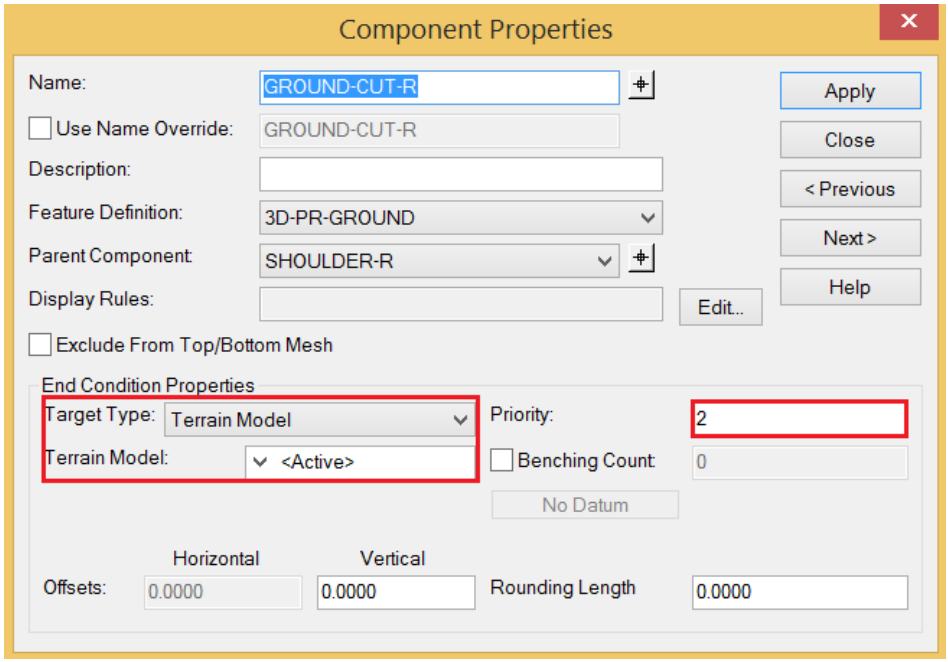
11.11 End Conditions

An End Conditions is a component that generally targets the existing terrain. These are basically used for the ground outside the shoulder and multiple ones are drawn from a single point and each has a priority. Whichever solves first in the order of priority is the one drawn.

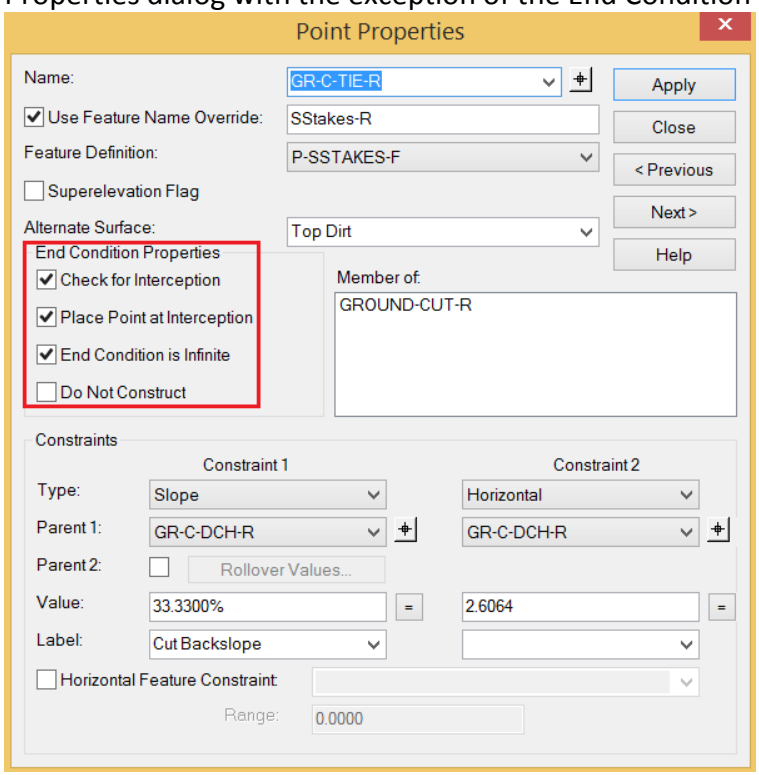
Double clicking the ground component you are prompted with the following dialog.



Looking at the GROUND-CUT-R component, you see the **Priority** is 2 and the **Target Type** is set to the Terrain Model.

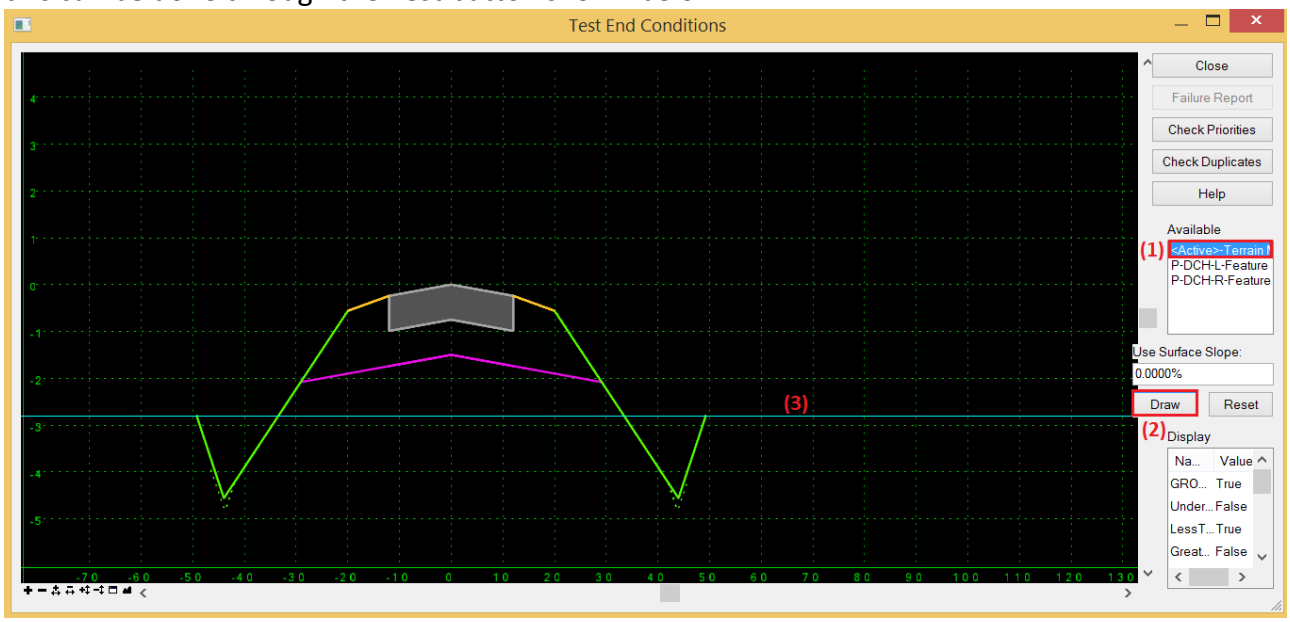


Double clicking the point GR-C-TIE-R you will notice the dialog is similar to a regular Point Properties dialog with the exception of the End Condition Properties.



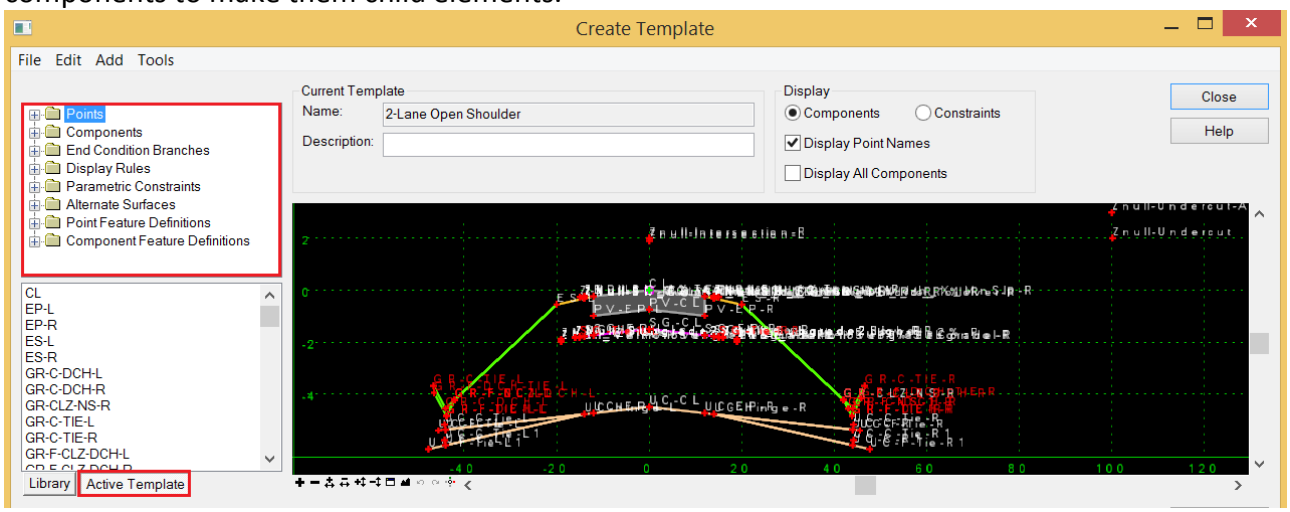
11.12 Test (End Conditions)

When End Conditions are placed, it is good practice to Test them to see how they work and this can be done through the Test button shown below.



11.13 Active Template

Allows you to view the points, components, end conditions, display rules, etc. of a template as well as showing all non-displayed elements such as the yellow undercut below. You can go in and rename these elements in these lists and also drag components on top of other components to make them child elements.



11.14 Overlay/Striping components

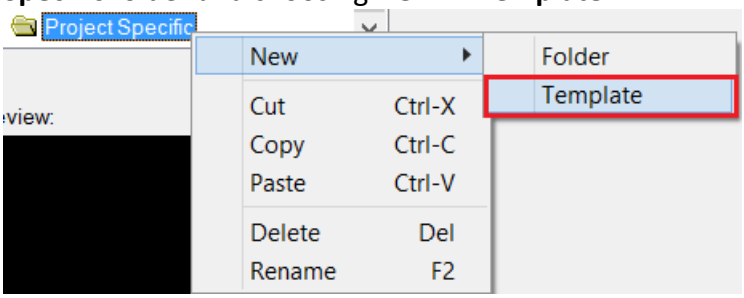
Discussed in the **Corridors** -> **Overlay** section.

11.15 Creating Templates

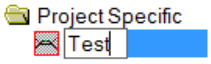
This section covers building templates utilizing the **Preview** pane and MDOT's components.

11.15.1 From Components

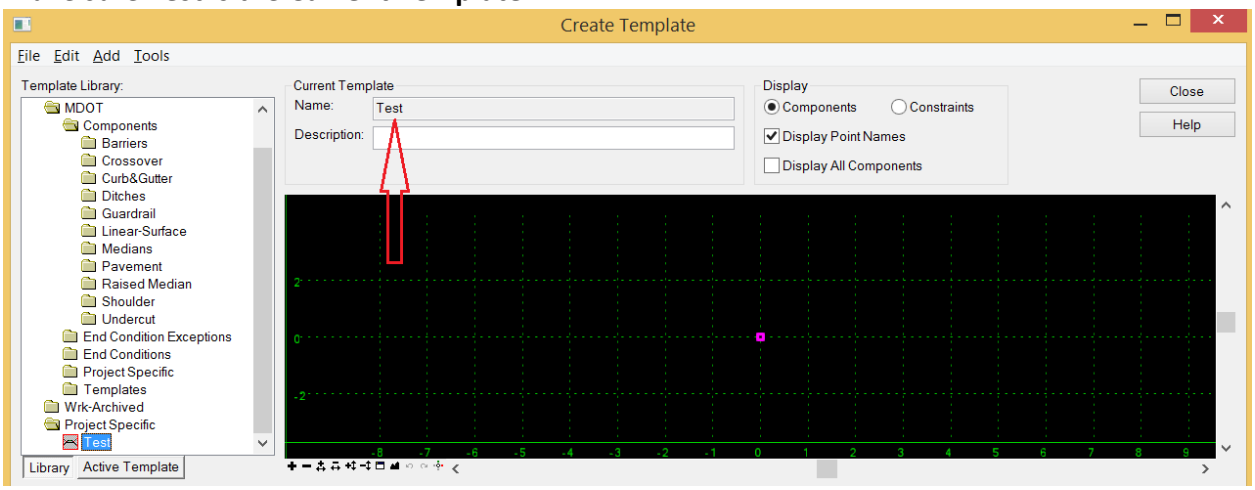
1) Under the **Project Specific** folder, create a new template by right clicking the **Project Specific** folder and choosing **New -> Template**.



2) Rename the **New Template** to **Test.**



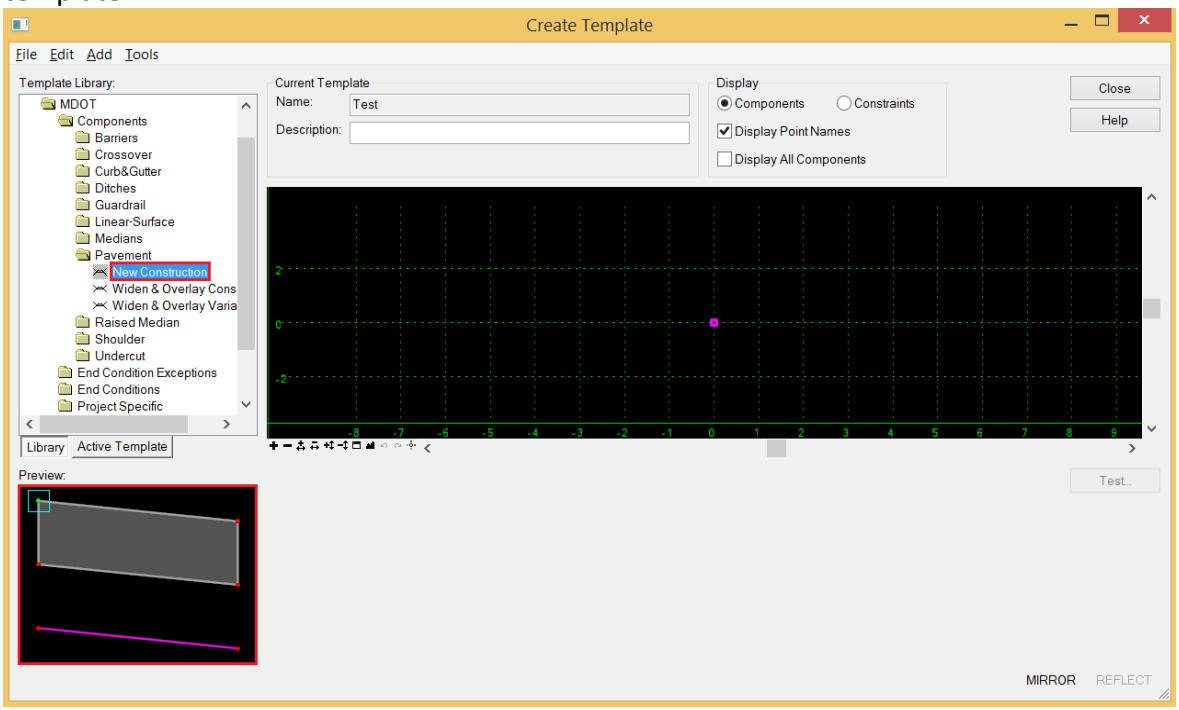
3) Make sure **Test** is the **Current Template**.



Note:

- You double click a template to make it the current template.

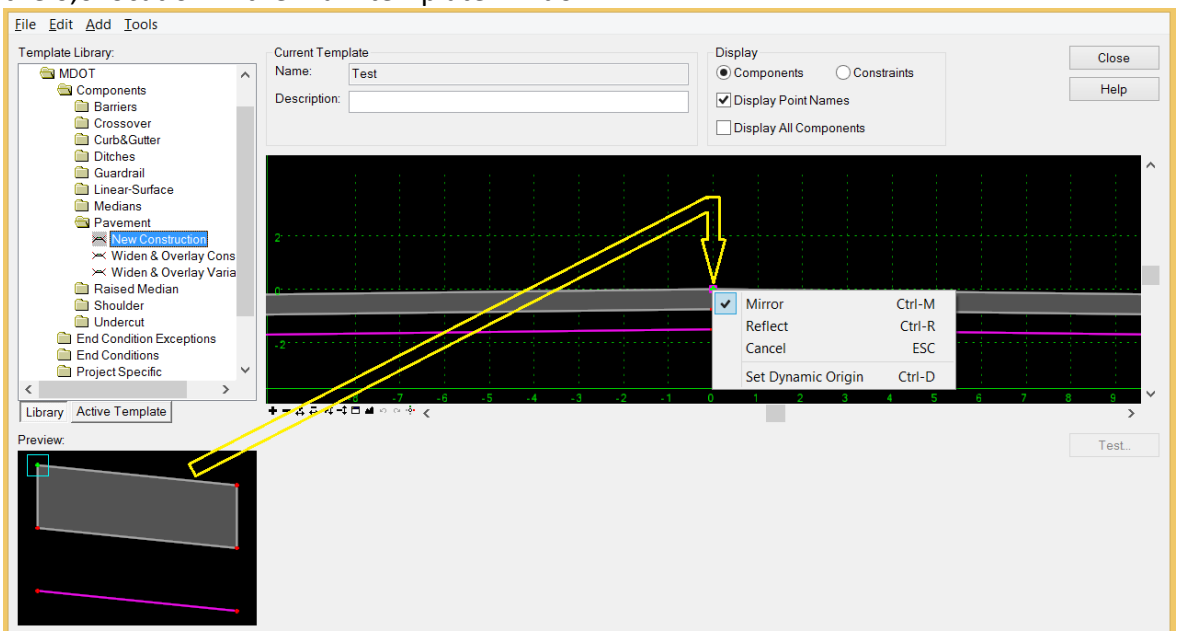
4) Open **MDOT -> Components -> Pavement** and single click the **New Construction** template.



Note:

- This shows the **New Construction** template in the **Preview** pane.

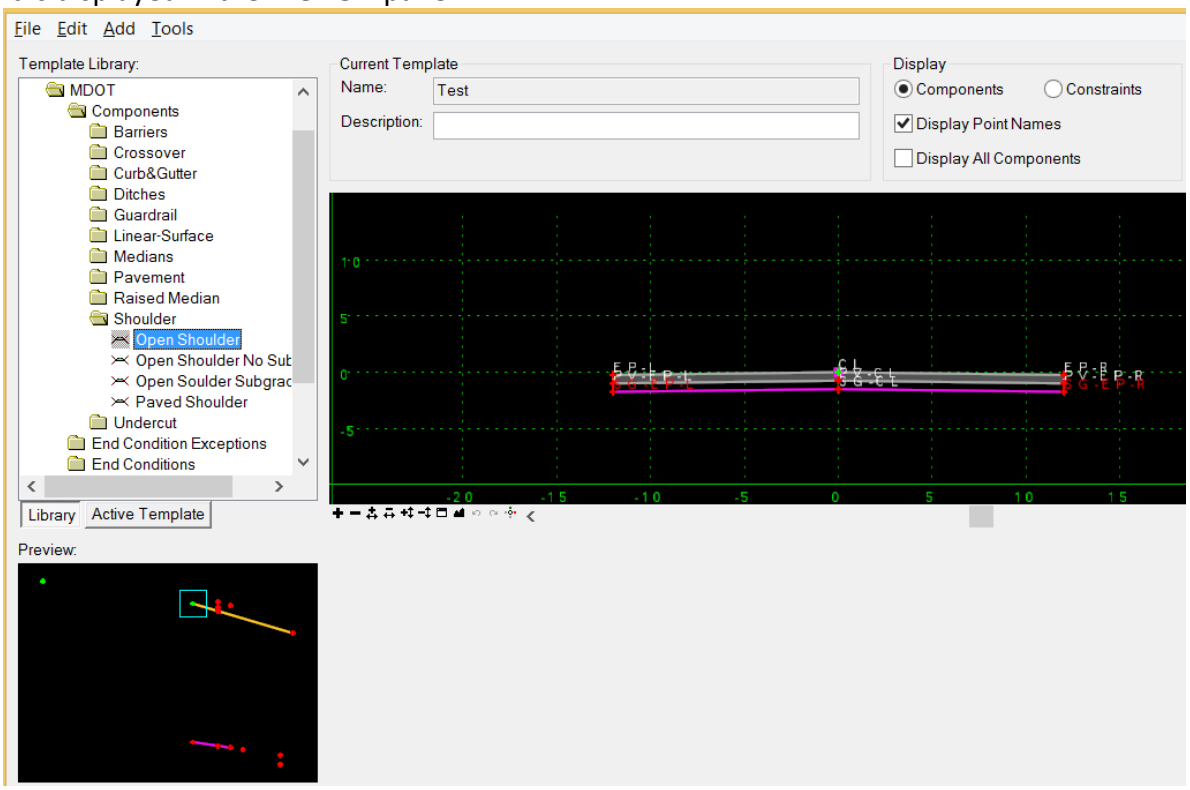
5) Left click and hold down the left mouse button in the **Preview** pane and drag and drop at the 0,0 location in the main template window.



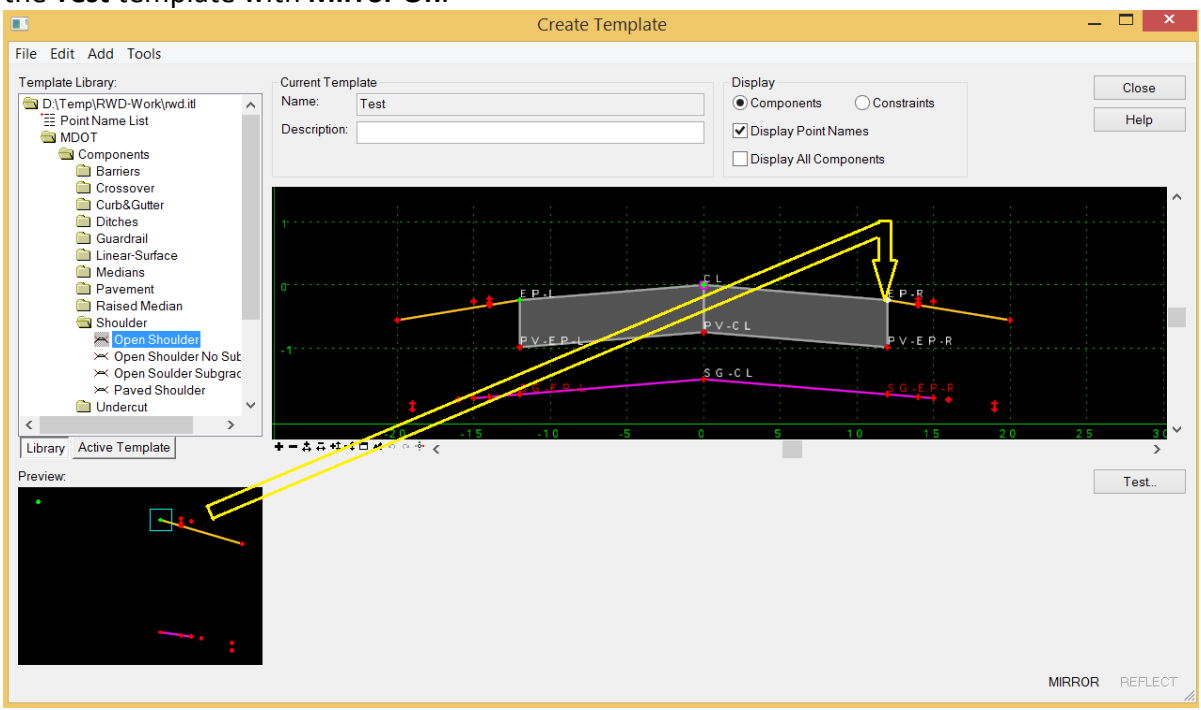
Notes:

- Right clicked to choose **Mirror** to place on both the left and right sides at the same time.
- You can use your mouse wheel to zoom in and out.

6) Open **MDOT -> Components -> Shoulder** and single click the **Open Shoulder** template so it is displayed in the **Preview** pane.



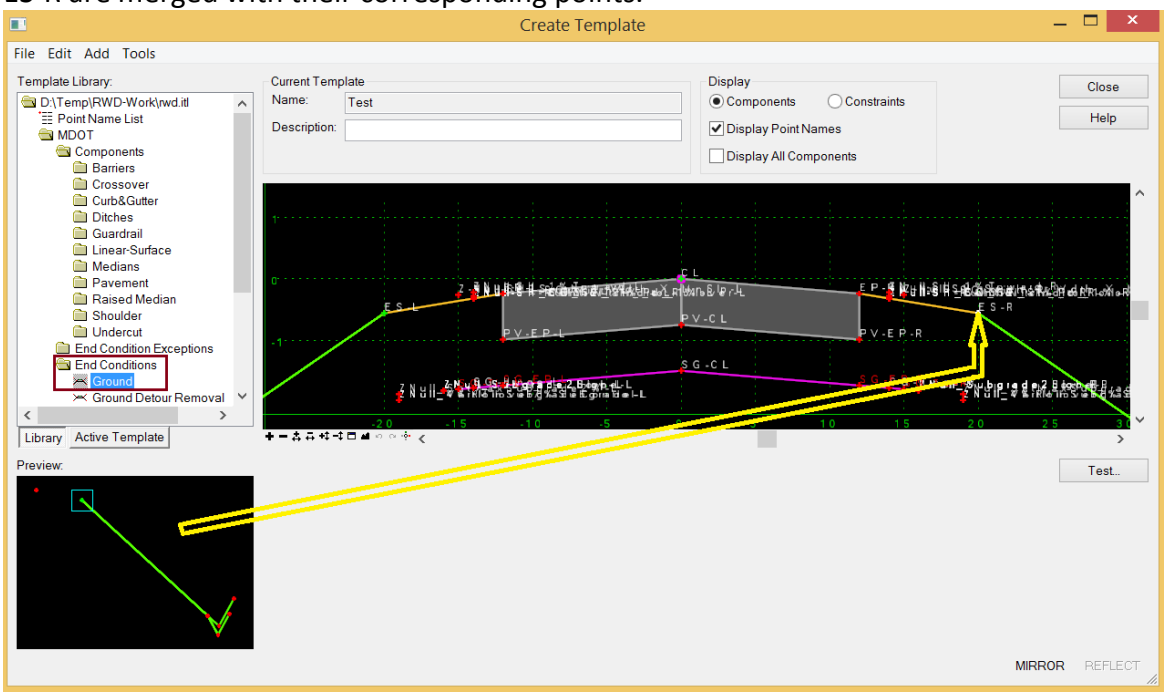
7) Drag and Drop the **Open Shoulder** template from the **Preview** pane to the **EP-R** point on the **Test** template with **Mirror On**.



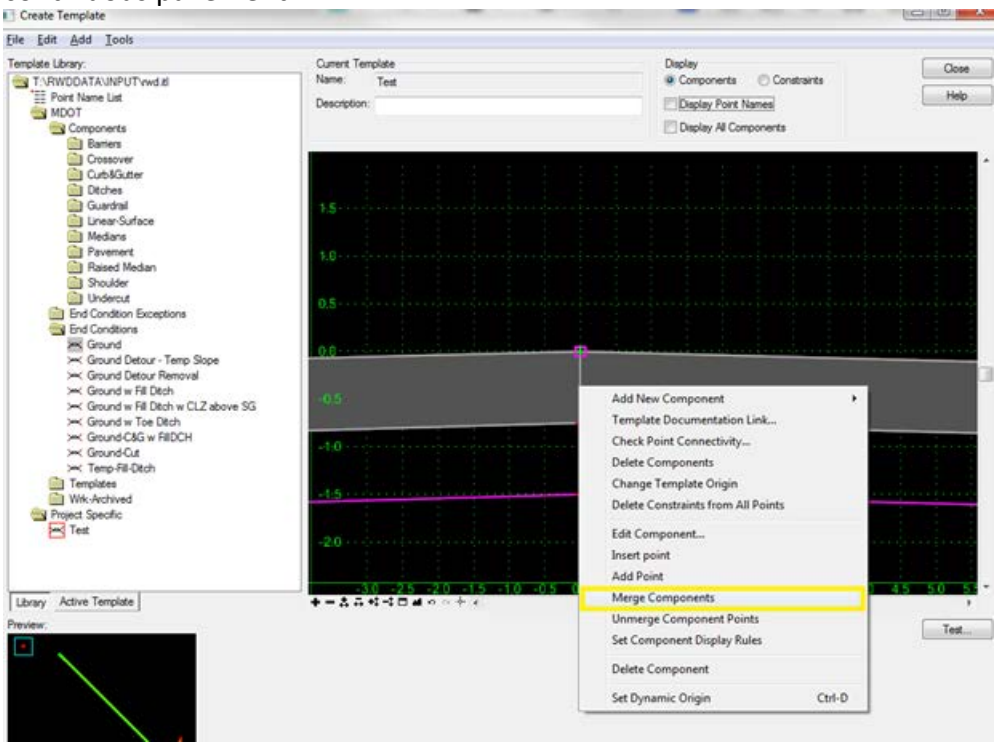
Note:

- CL, EP-R, EP-L, SG-EP-L, and SG-EP-R were all merged to the corresponding Test points because they are geometrically the same measurements on each template.

8) The next step is to open the folder **End Conditions** and drag and drop the **Ground** end condition to the **Test** template on point ES-R with Mirror on. Points EP-L, EP-R, ES-L, and ES-R are merged with their corresponding points.

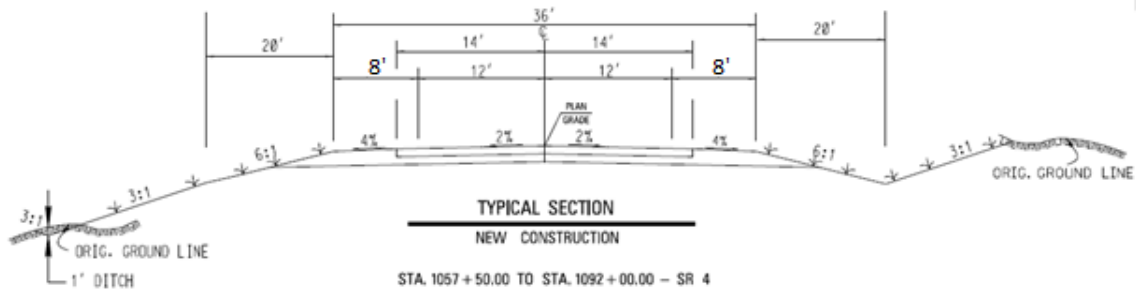


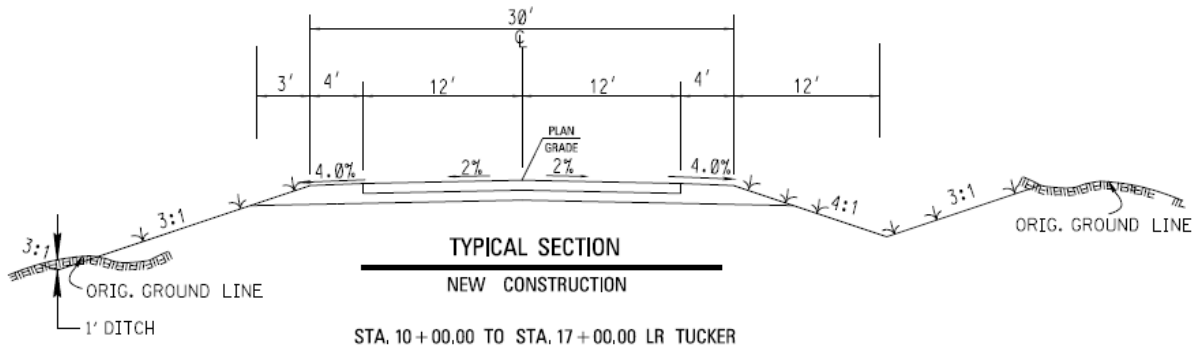
9) Right Click the Vertical Pavement line under CL and **Merge Components** to have one continuous pavement.



LAB VI: Templates

1. Copy RWD.ITL to your assigned working folder.
2. Build the following two templates by copying the **2-Lane Open Shoulder** and **2-Lane Open Shoulder LR** templates and modifying to match the dimensions below.
3. Rename the templates SR4 and LRTuck.

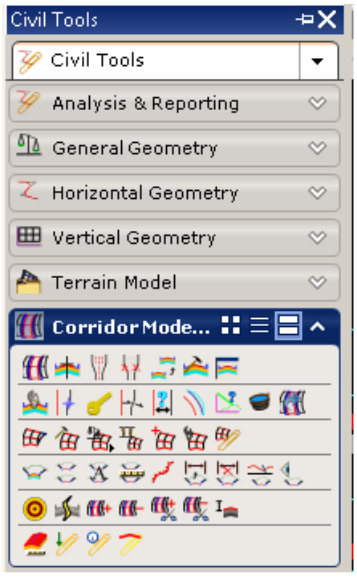




12. CORRIDORS

12.1 Section Overview

The **Corridor Modeling** task is Bentley's application which creates 3d models of highways.



CREATE
MODIFY
SUPERELEVATION
X-SECTIONS
MISCELLANEOUS
REPORTS

A corridor is created on each given roadway with an established proposed profile. Template drops are the type of template you wish to place on a corridor for a given station range.

12.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal and Vertical Geometry basics, Terrain knowledge

12.3 Section Objectives

After reviewing this section, you will be able to:

1) Create a Corridor DGN file.
2) Create a corridor, add template drops.
3) Modify the corridor with point controls, parametric constraints, etc.
4) Open a cross-section view
5) Synchronize templates and process corridors.

12.4 Best and Required Practices

1) Corridor DGN files should be created for the mainline roadway for one mile segments maximum and for each phase of construction. Mainline corridors along with all adjoining local road and/or auxiliary corridors will be created in these files per phase of construction.

2) Separate Corridor DGN files should be created for each area between bridges with each drop extending into the bridge. This area will be clipped in the later stages.

3) Each phase of construction should be represented by a corridor. Phases are not required if sheet piling is used with no temporary slopes.

4) Template Drop Increments – 10' high speed and 5' low speed roadways required. Corridor stage **Phase A** is set by default to 5 x INC. = 25' sections, **Phase B** is set to 1 x INC. = 5' sections.

5) Limit clipping which causes processing overhead. Templates are set up to automatically turn off end conditions and shoulders through intersection areas when the P-EP-INT lines placed with cells are added as external references.

6) AMG deliverables are discussed more in the **AMG Deliverables** section in this document.

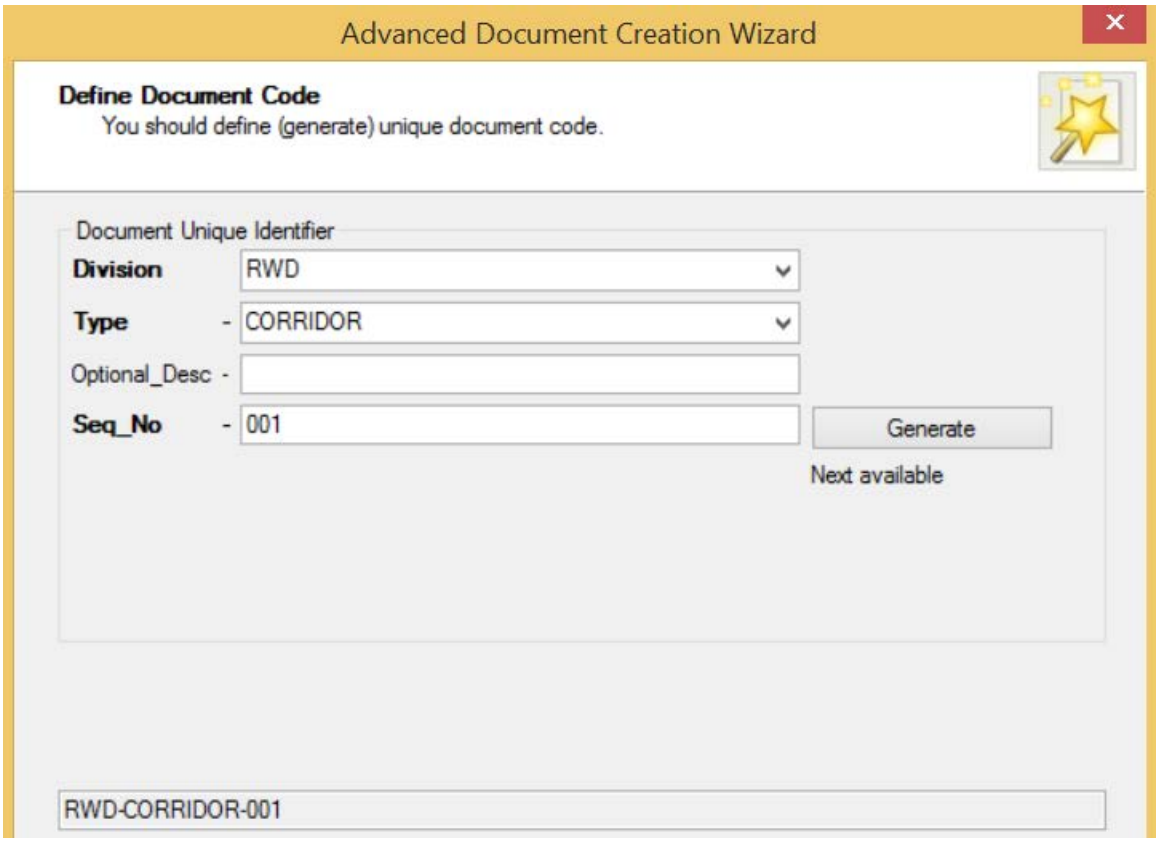
12.5 Workflow

1) Create a Corridor DGN file.
2) Reference the ALI DGN file.
3) Reference the TOPO DGN file (File containing the Terrain).
4) Reference the Superelevation DGN file.
5) Set the Active Terrain. Generally this will be a referenced file (SRV-TOPO-001.DGN) containing the Terrain or imported TIN.
6) Create a corridor for the Mainline Alignment.
7) Add template drop(s).
8) Associate mainline superelevation information.
9) Add horizontal and/or vertical controls for particular points (if needed).
10) Define any transitions and connect.
11) Review the results and make adjustments.
12) Add Civil Cells at intersecting roadways, cross-over's, bridges, etc.
13) Add external constraints to drop end conditions through intersections and cross-overs.
14) Add mainline templates.

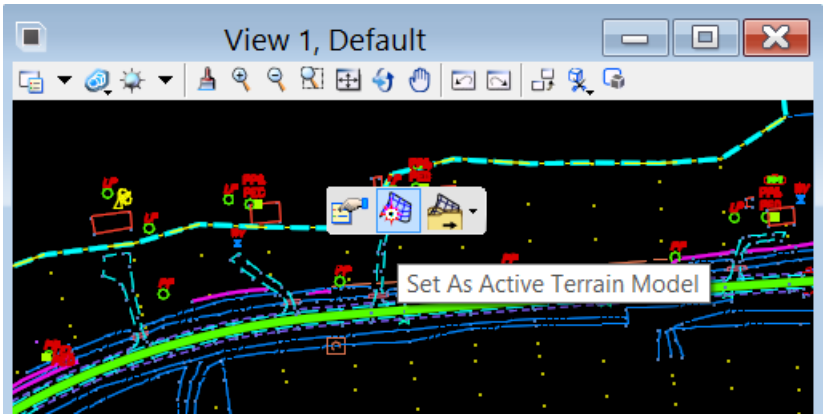
12.6 Create Corridor

Once your alignment and profile is created, you can create a Corridor.

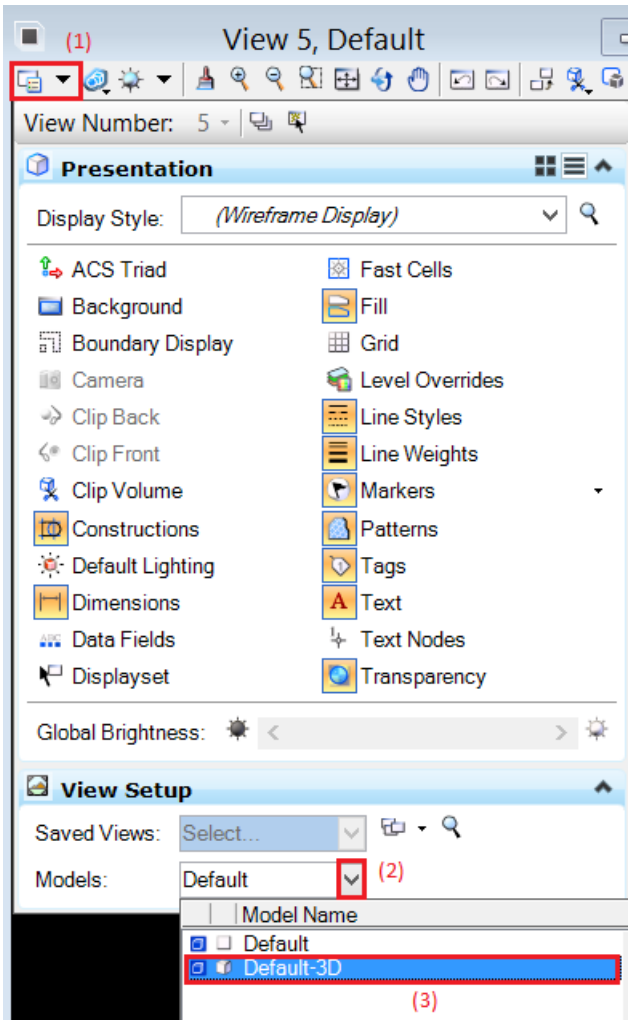
1) Create the file Corridor DGN file using a 2d seed file.



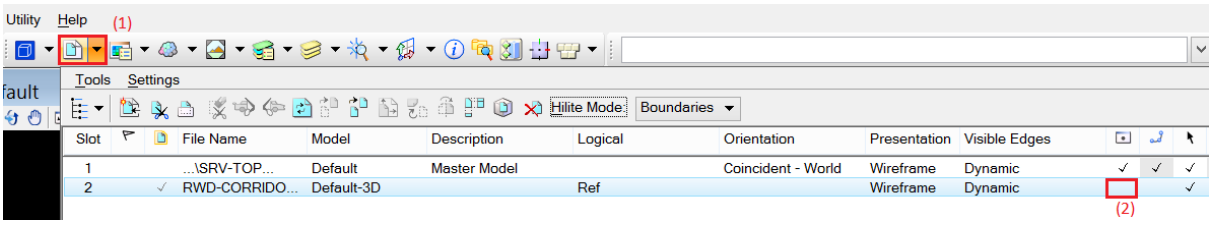
2) Reference the file containing the existing terrain and make it active.



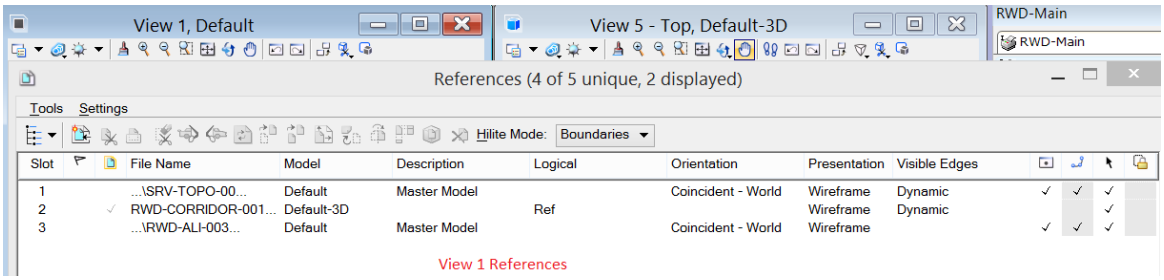
3) Open or Fit View 5 and open the Default-3d model.

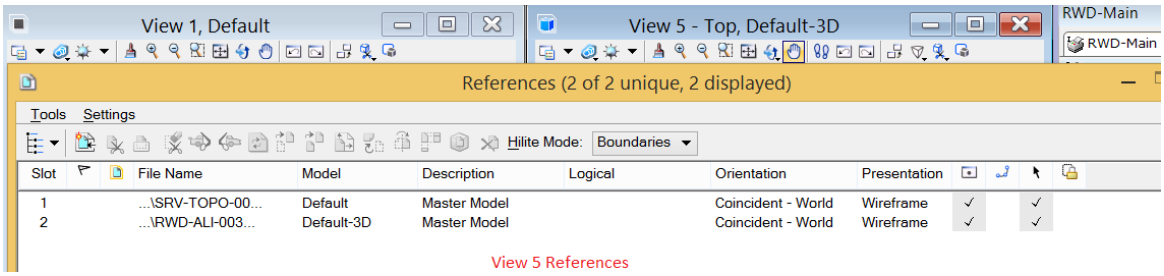


4) When the Default-3D model was created, it was also attached as reference to View 1. Turn off display of this reference to View 1.

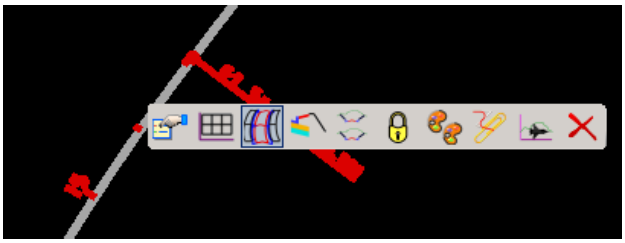
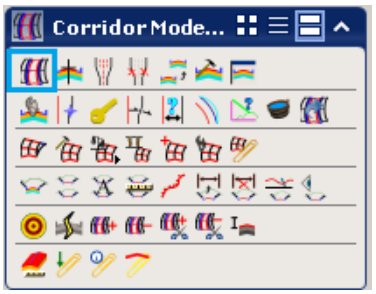


5) Reference the Alignment DGN file to View 1 (Default model). Default-3d model is referenced automatically.

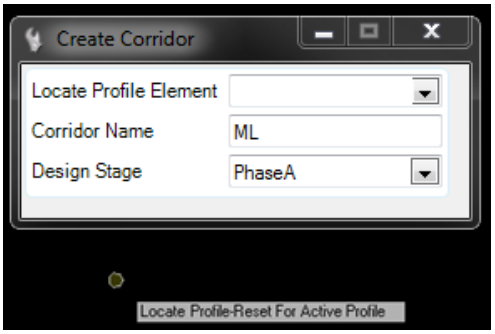




6) Choose the **Create Corridor** command from the **Corridor Modeling** menu or the context menu by clicking the alignment.

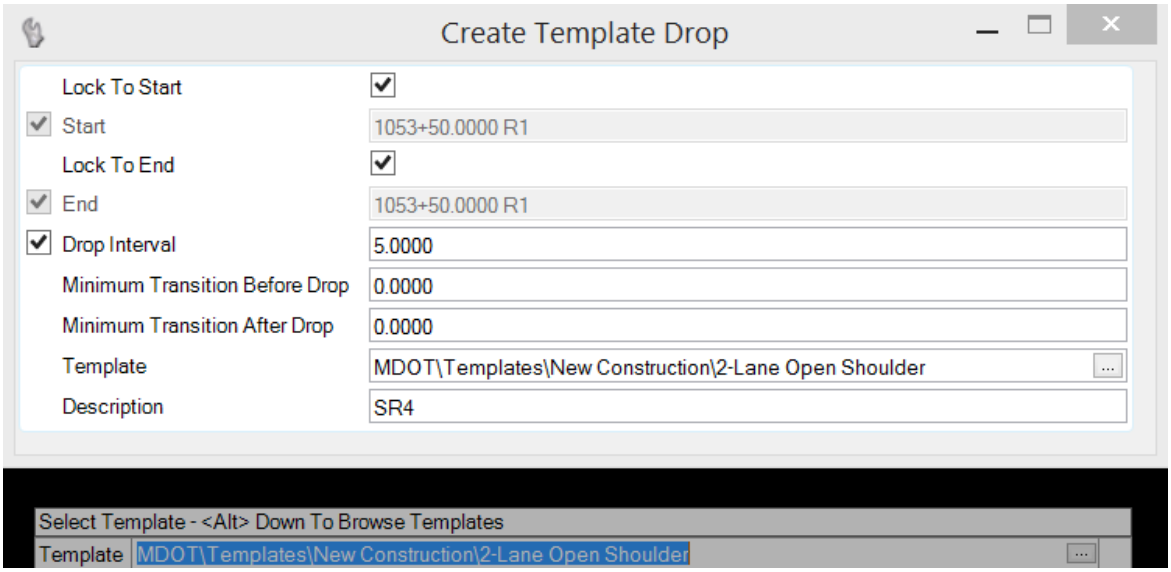

or


7) You're prompted with the following. Choose the profile or reset if you set the proposed profile as the active profile.

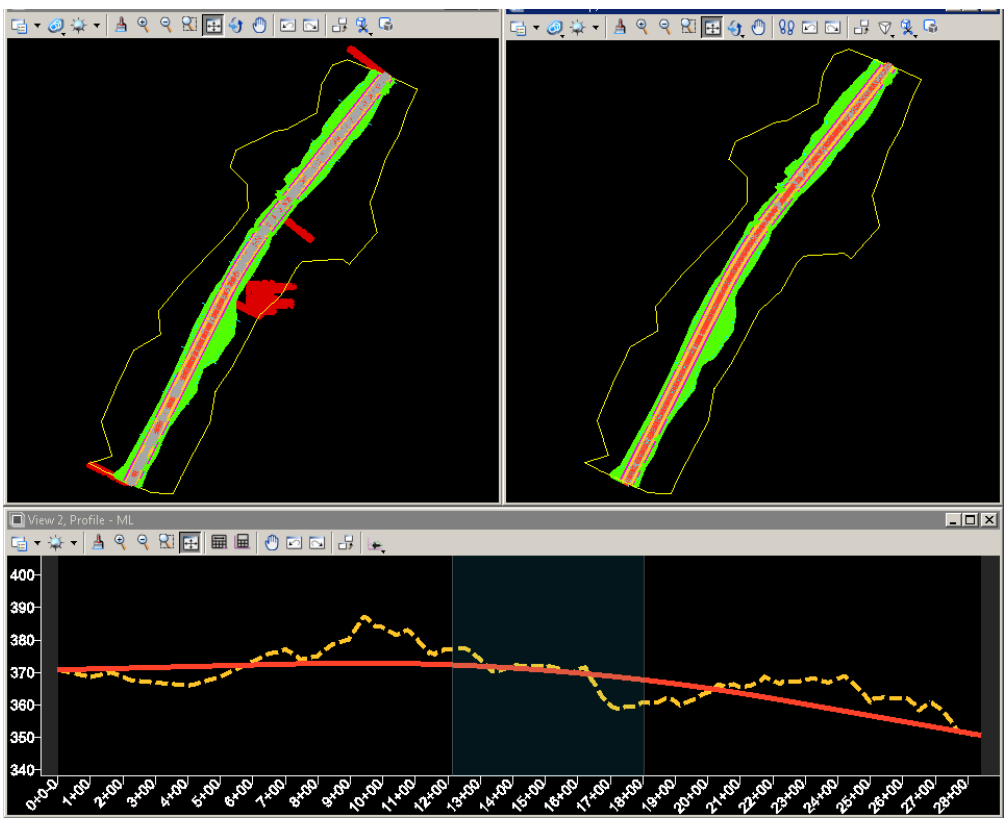


The Design stage can and will need to be changed later. **Phase A** will give you template drops 5 times the template drop increment (normally 5') which you'll specify on the next dialog. **Phase B** will give you sections 1 times the template drop increment.

8) You're prompted with the **Create Template Drop** dialog. Choose the station range and template you want to drop.



9) Your model should be processed.



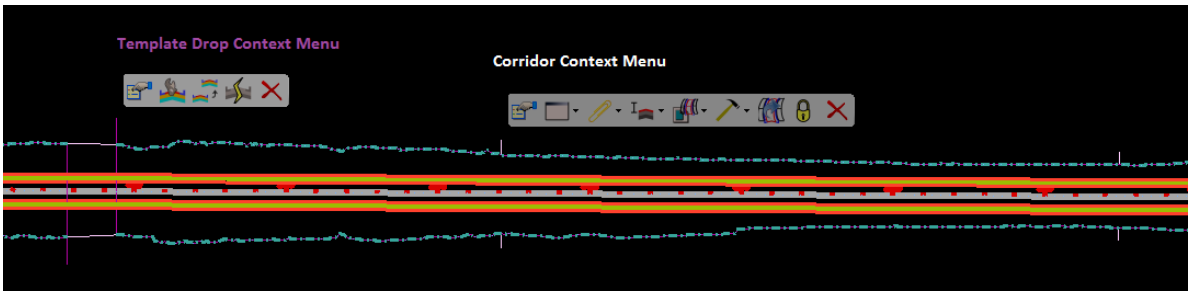
Note:

- The template dropped is as drawn in the template library.
  - No superelevation yet.
  - Possibly incorrect lane and shoulder widths.
  - Structure and pavement depth needs project specific adjustment.
  - Clear zone,ditch depth,fill slope, cut slope, etc. possibly need adjustment.

The following topics and steps show how to make these project specific adjustments.

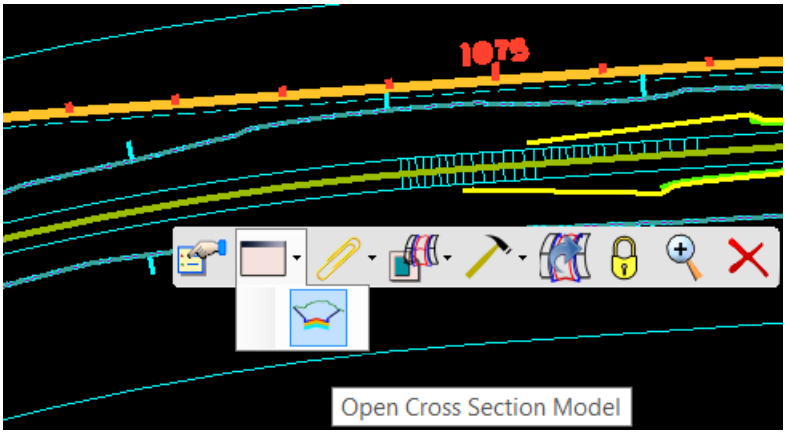
12.7 Context Menus

Context Menus leading to most of the commands available on the Civil MDOT menu are available by choosing the **Template Drop** or **Corridor Handlers** shown below and then hovering your cursor over them. These handlers are construction elements.



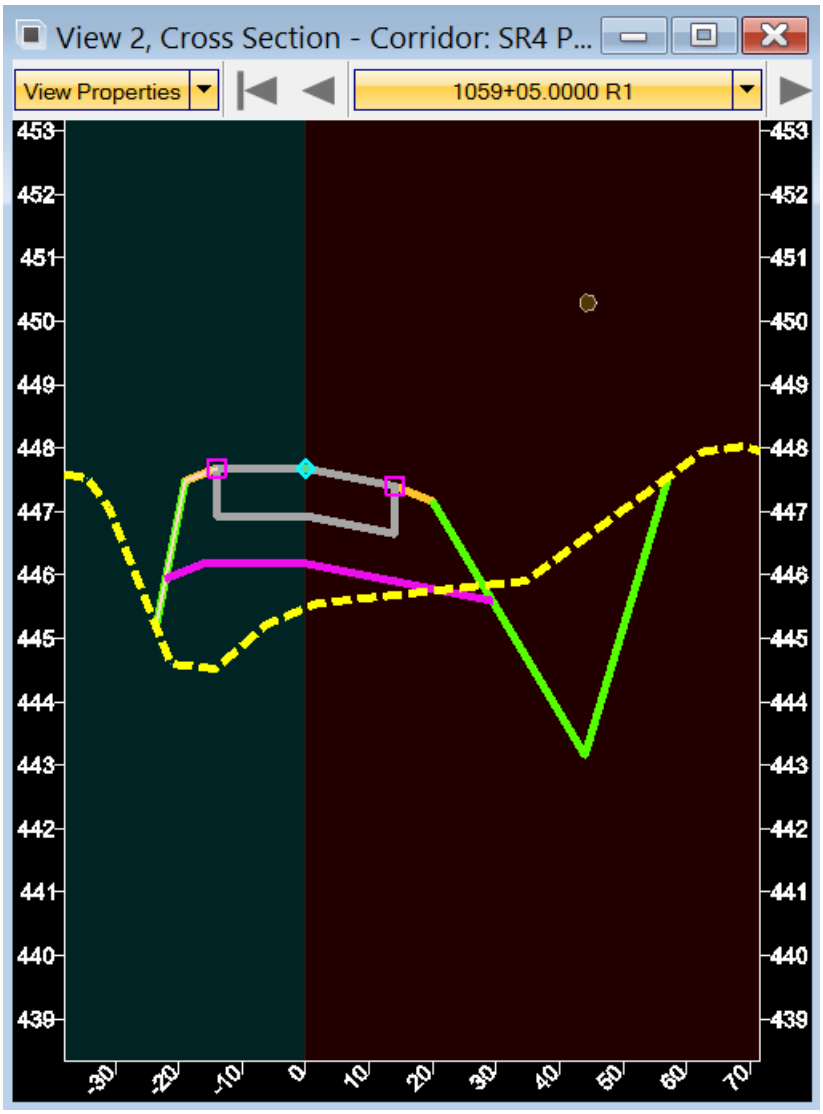
12.8 Cross-section View

1) From the corridor context menu, choose the following command to open a cross-section view.



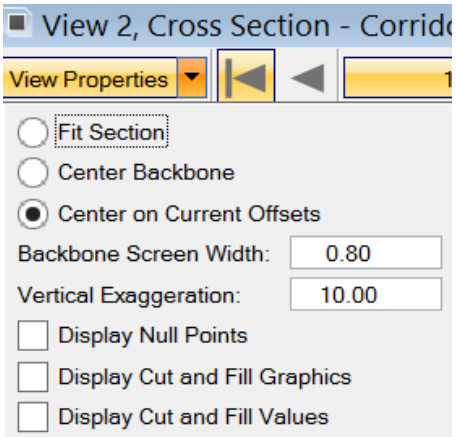
2) You will be prompted to **Select or Open View.**

3) The cross section view opened:



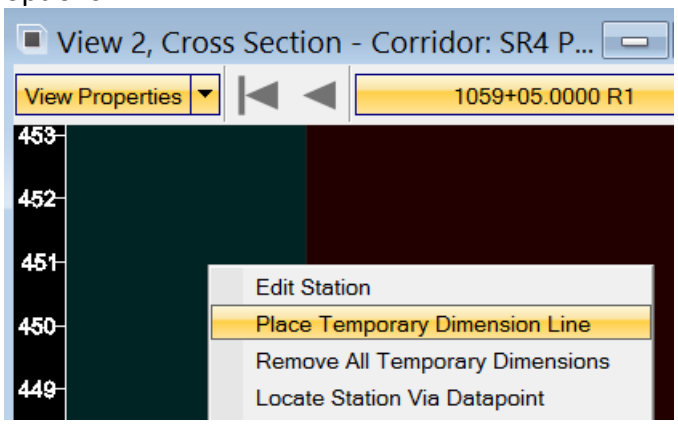
12.8.1 View Properties

Aids you in controlling the cross-section view.

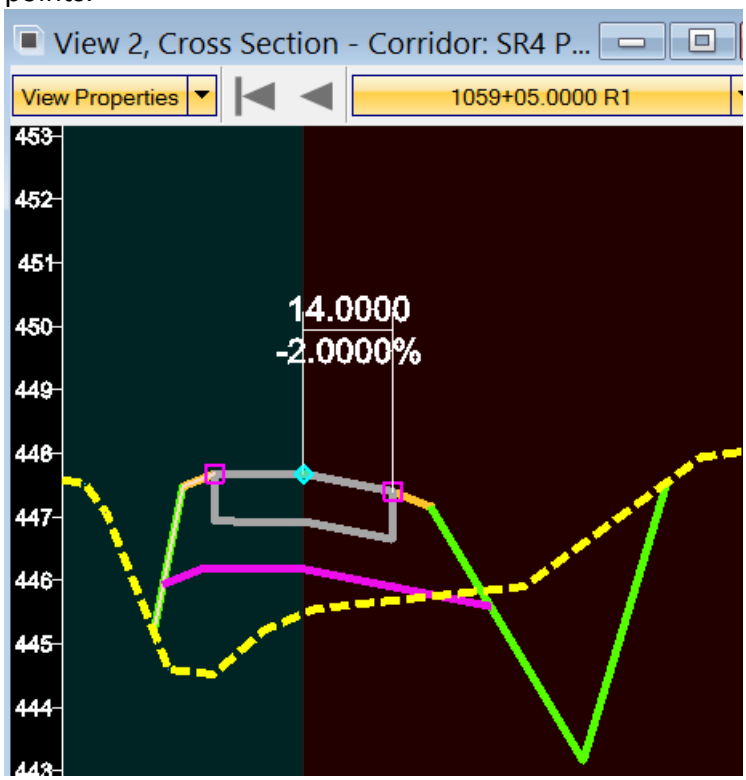


12.8.2 Temporary Dimensions

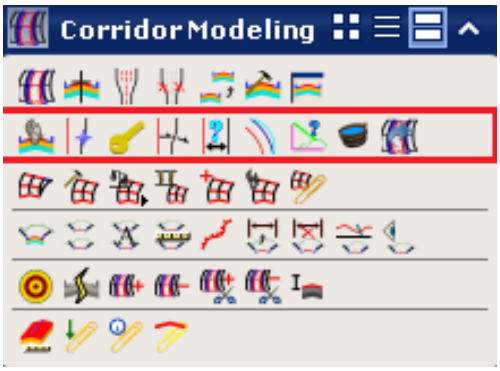
If you right click the cross-section view, you are provided some specific cross-section view options.



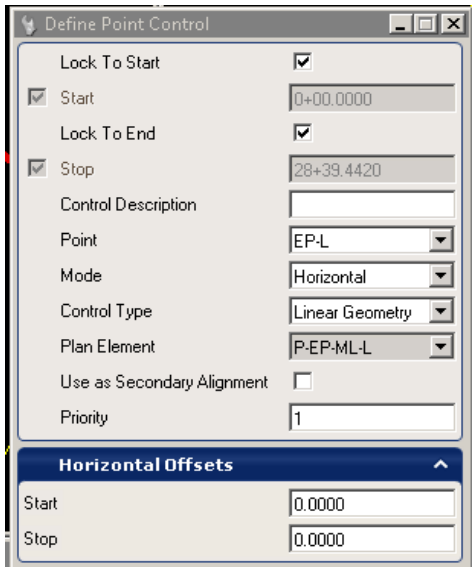
Place Temporary Dimension Line allows you to place dimensions between cross-section points.

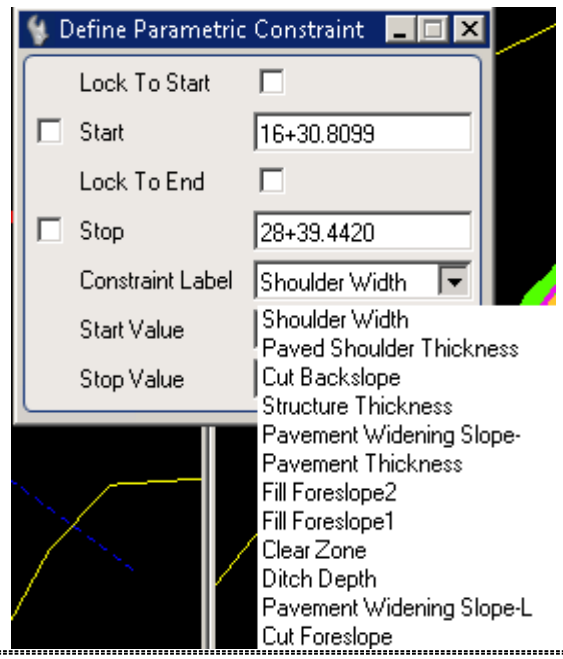


12.9 Modify Corridor



The tools highlighted above are used for tying template points to graphical elements (point controls), defining project specific variables (parametric constraints), etc. **Point Controls**, **Parametric Constraints**, and **External References** are discussed in depth in subtopic areas below.

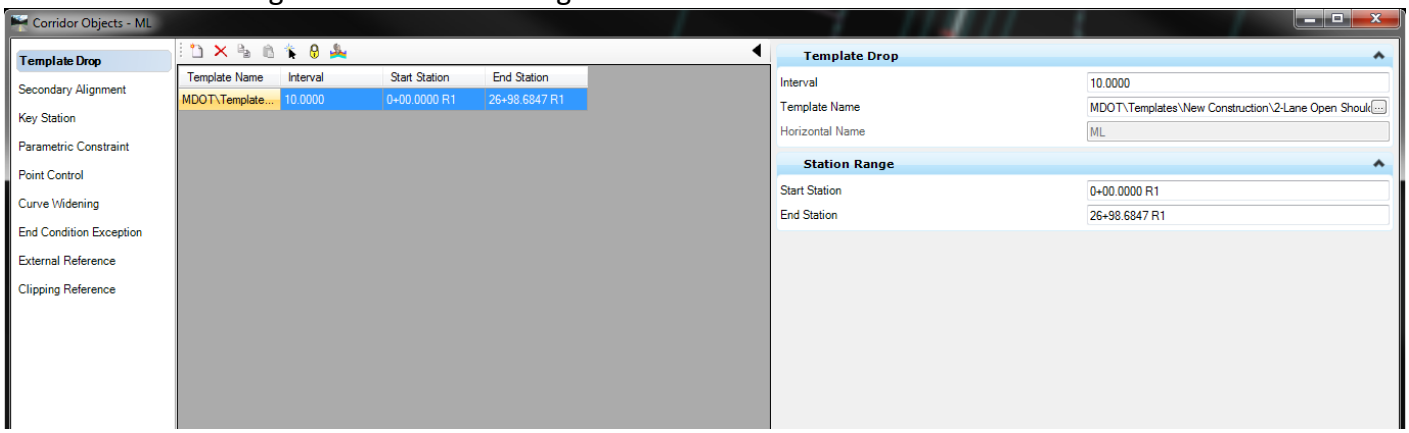
	Edit Template Drop	Opens the current template library and displays the template with the selected template drop. While the dialog is the template library interface, keep in mind that the editing is only being done to the template within the template drop, not the actual template library. Therefore, if any changes are made, the template associated with the template drop is no longer in sync with the template library. For project specific circumstances, this may be required. If the changes are needed in the template library, use the Create Template tool.
	Point Control	Basically, this tool is used to tie template points to horizontal or vertical geometry. For example, tying your ditch point to a ditch profile or tying your EP to a graphical, or plan view, EP as shown in the example below. 

	Create Key Station	After prompting for corridor selection and station (entered dynamically or by key-in), the station is added to the corridor for processing. This tool is useful to add stations that are not coincident with the template interval, when a special circumstance of the project occurs (driveway, etc.) and it is desirable to include the station in processing.
	Create Secondary Alignment	Sets parameters for secondary alignments, which are used to modify the direction of cross section processing. Requirements include corridor selection, secondary alignment definition, beginning and ending station (in cases where only part of the alignment element is to be used) and beginning and ending offsets.
	Parametric Constraints	This tool allows you to define project specific variables such as pavement thickness, structure thickness, clear zone, etc. **Note:** • 3' Design Soil has been added to most templates. You would create a parametric constraint and choose **Undercut Thickness** and set the value to -3 for specific Station Ranges where the Design Soil is required. 
	Curve Widening	Applies horizontal controls to points to move them farther from the centerline at each curve of the controlling alignment.
	Create End Condition Exception	Defines end condition exceptions, which are used to modify the behavior of an end condition solution without requiring the use of additional template drops.

	Corridor Objects	One-stop viewing of data relating to corridor objects. Excellent for managing your corridor data, as it encompasses template drops, key stations, parametric constraints, point controls, various references and end condition exceptions all within one dialog.
	Process Corridor	Processes the corridor to ensure that it is up to date.

Note:

- (Corridor Objects) Gives you access to all the above plus external references. You can view and/or add new point controls, parametric constraints, end conditions, etc. through this tool. The dialog is shown below.

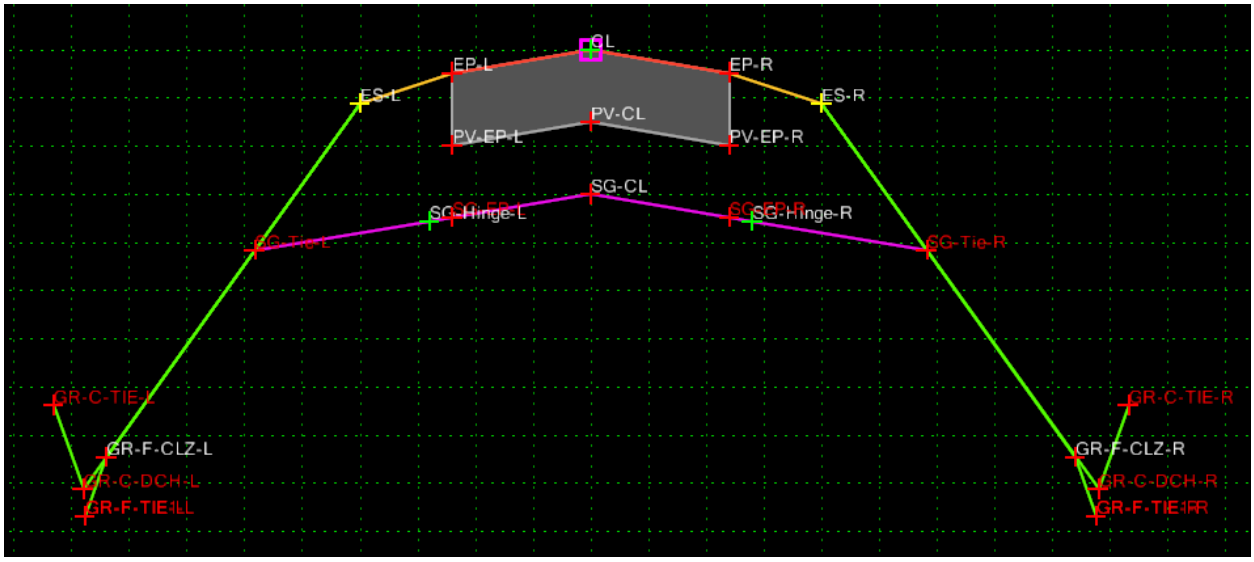


12.10 Point Controls

After the templates are dropped, **Point Controls** need to be added that tie the template points to actual horizontal and/or vertical features. Some examples include:

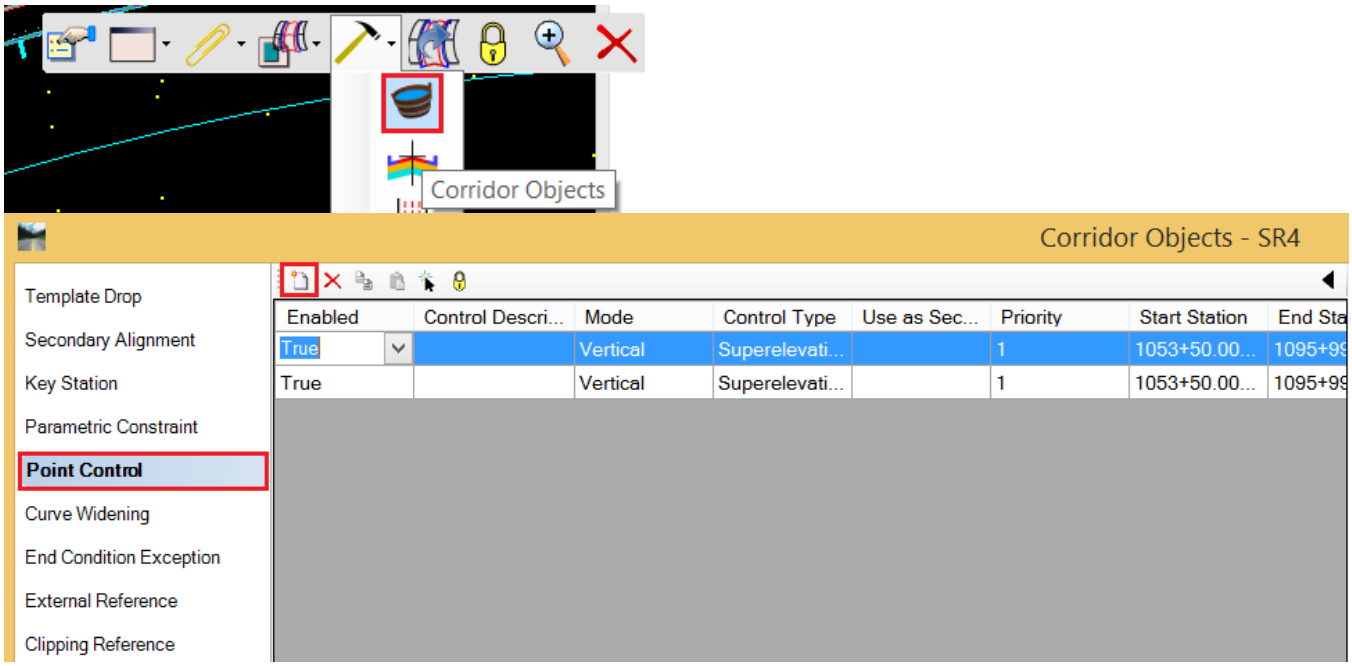
- The template you chose may show 2 - 12’ lanes but your need a 5-lane section.
- The template you chose is a 4-lane divided template with a CL to CL distance of 88’ but you have a variable CL to CL distance through part(s) of your project.

12.10.1 Standard Template Point Names

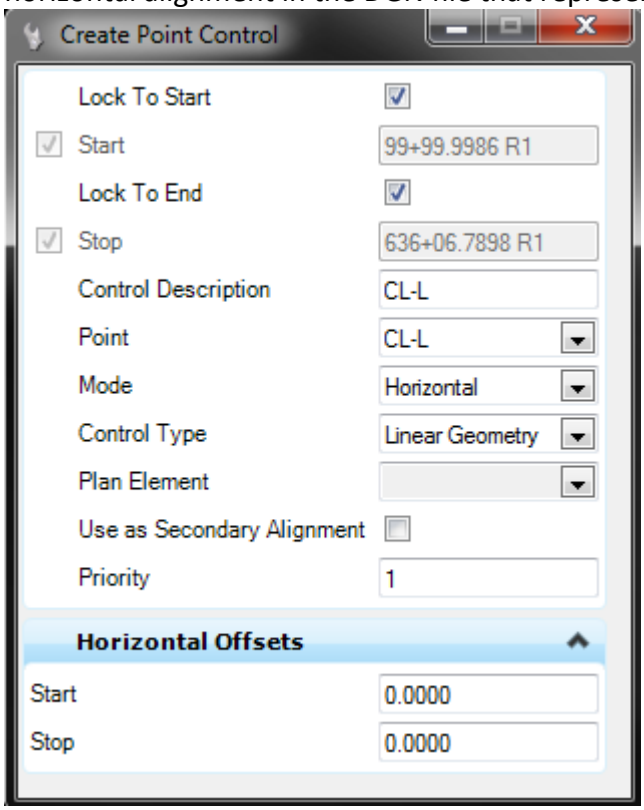


12.10.2 Adding a Point Control

1) Choose Corridor Objects from the context menu, select Point Control, and choose New.



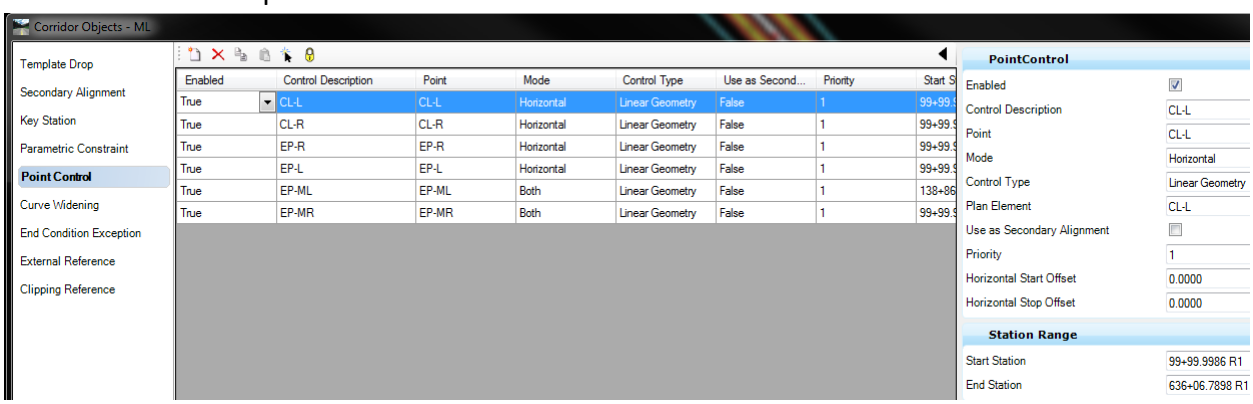
2) Enter a **Control Description** and choose the point you're wanting to tie down. Then, follow the prompts. The example below is tying the CL-L point of a 4-lane divided template to the horizontal alignment in the DGN file that represents the CL of the Left Lanes.



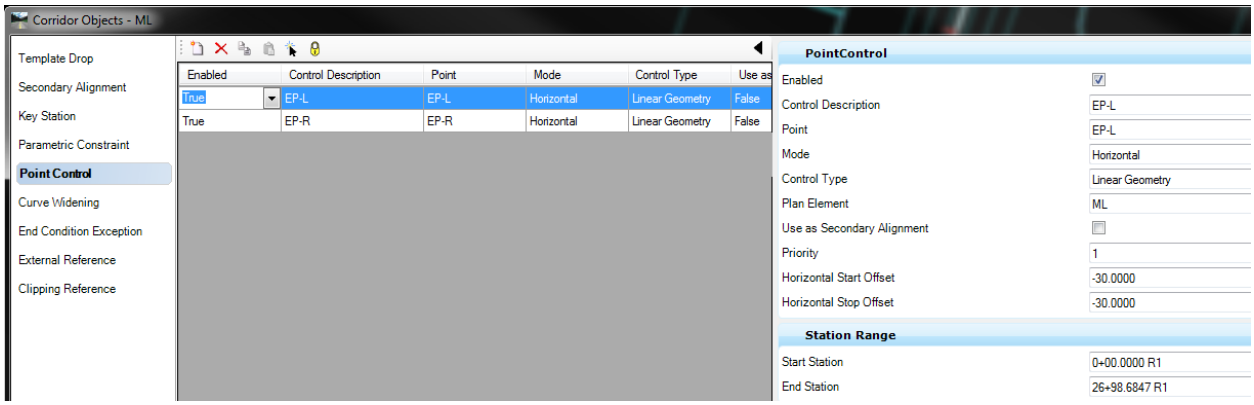
12.10.3 Example Point Controls

These examples do not show superelevation point controls.

1) 4-Lane Divided Template.



2) 5-Lane Template.



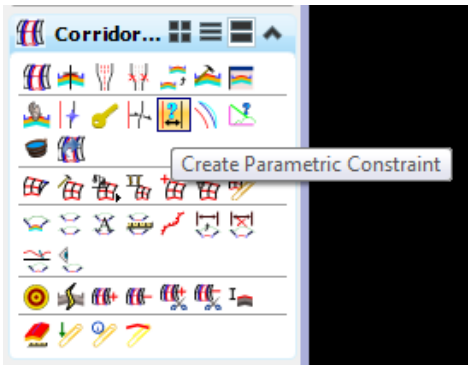
Notice the offsets of -30 for the point EP-L. This will move the template point from a -12' offset to -30' from the CL alignment (ML).

12.11 Parametric Constraints

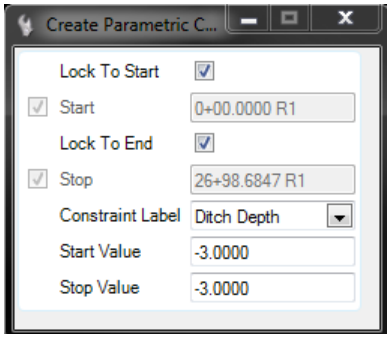
Parametric Constraints are the same thing as **Define Variables** in GEOPAK's **Process Cross-Section tool**. They allow you to define a value for a given template component. Some examples are **Shoulder Width, Pavement Thickness, Structure Thickness, Foreslope, Clear Zone**, etc.

12.11.1 Adding a Parametric Constraint

1) Choose the command.



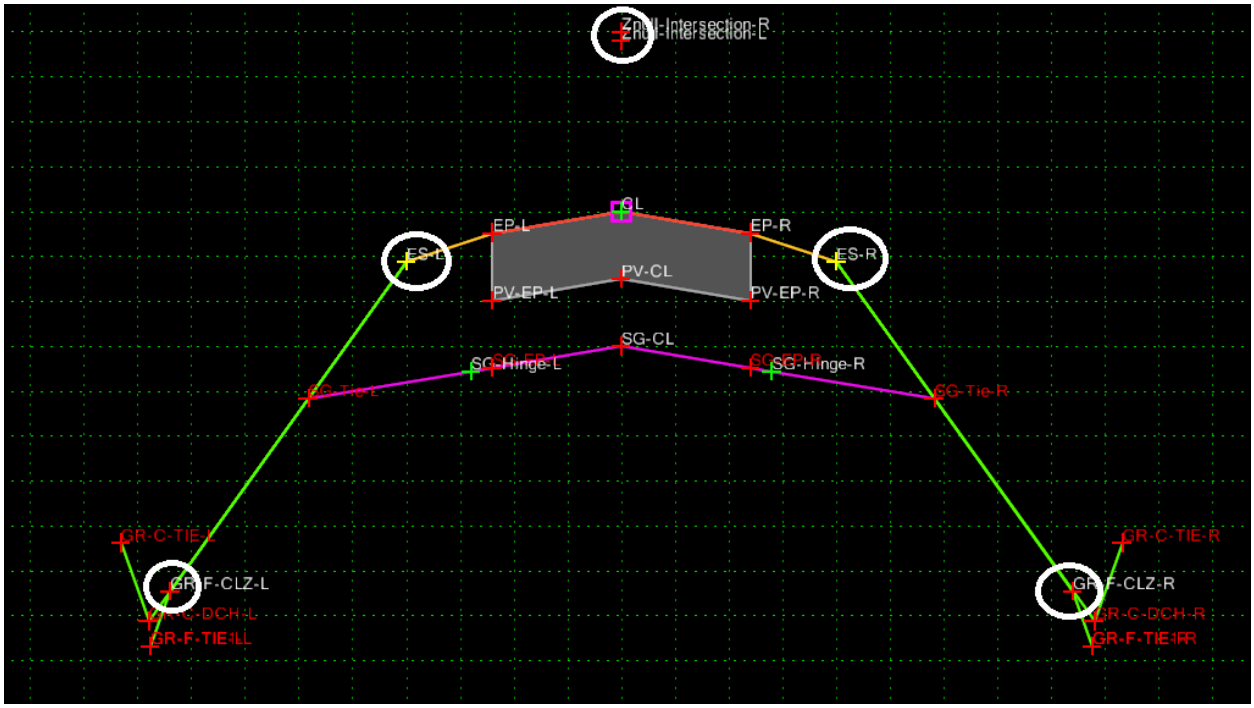
2) Follow the prompts.



12.12 External References

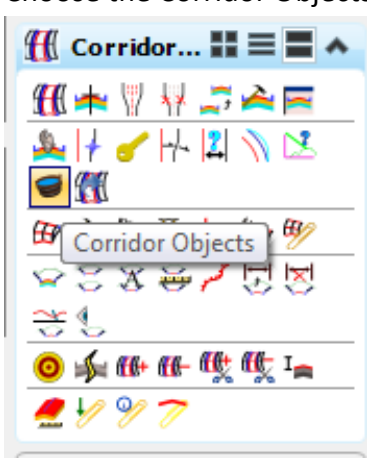
Graphics in DGN files can be added as External Reference for template points outside of the normal Point Control assignment. External References are generally used for cross-overs, intersections, and shoulder widening where template points have been told to look for Horizontal Feature Constraints. Civil Cells have been created with External References embedded in them so after placement of a Civil Cell, just add the intended graphics as External References to the appropriate corridors and end conditions, shoulder, and subgrade outside the pavement will be undisplayed from the corridor. In the case of shoulder widening at a bridge, the shoulder will be widened.

Points with Horizontal Constraints are circled below:

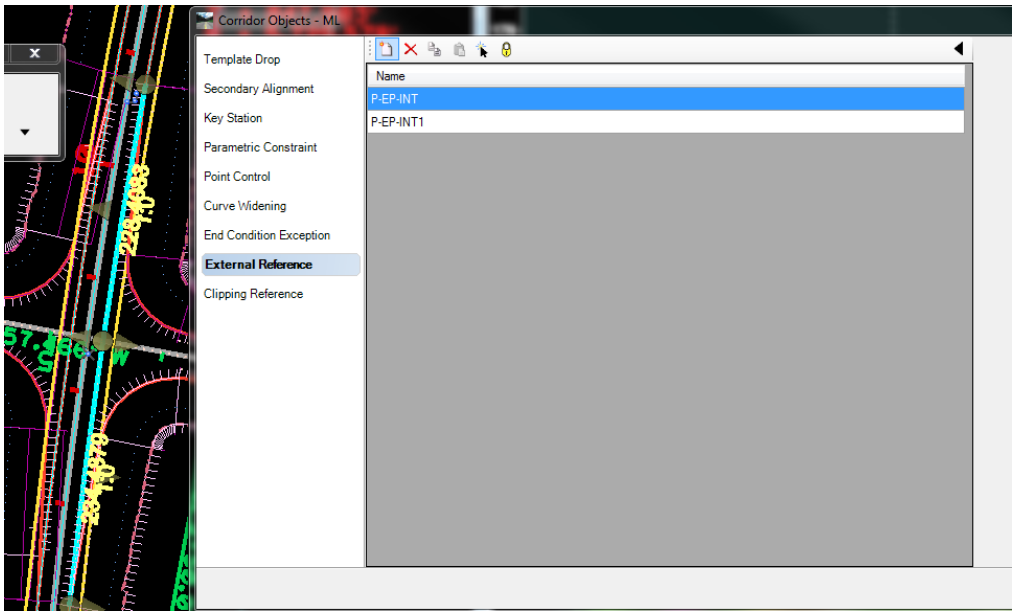


12.12.1 Adding an External Reference

1) Choose the Corridor Objects Tool.

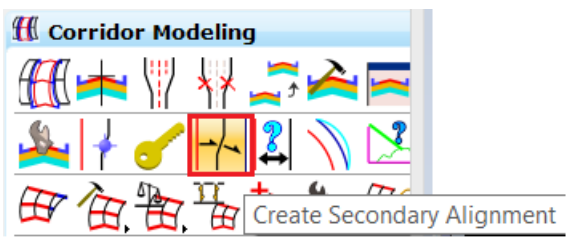


2) Select **Add New** at the top of this dialog after the **External References** tab is chosen.

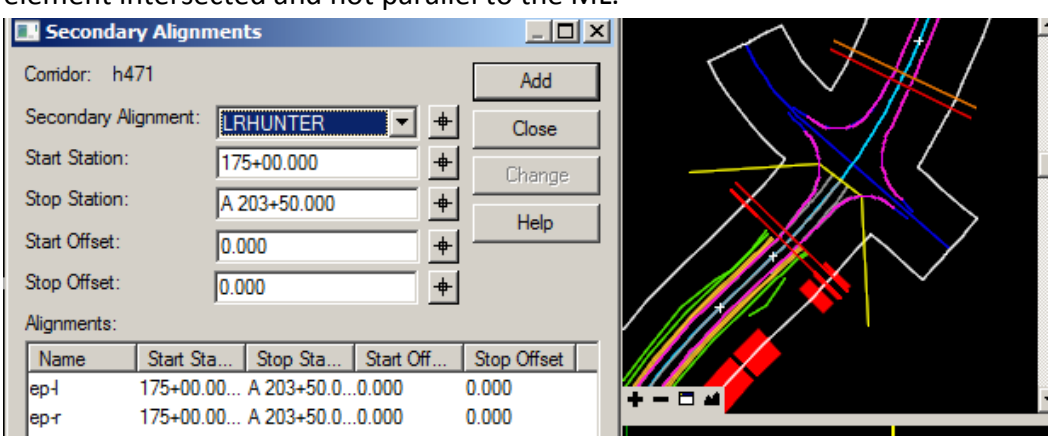


3) You're prompted to choose the external references which in the case above were features P-EP-INT and P-EP-INT1 which were placed with the Intersection cells. End conditions and shoulders of the ML Corridor are turned off as a result.

12.13 Secondary Alignments

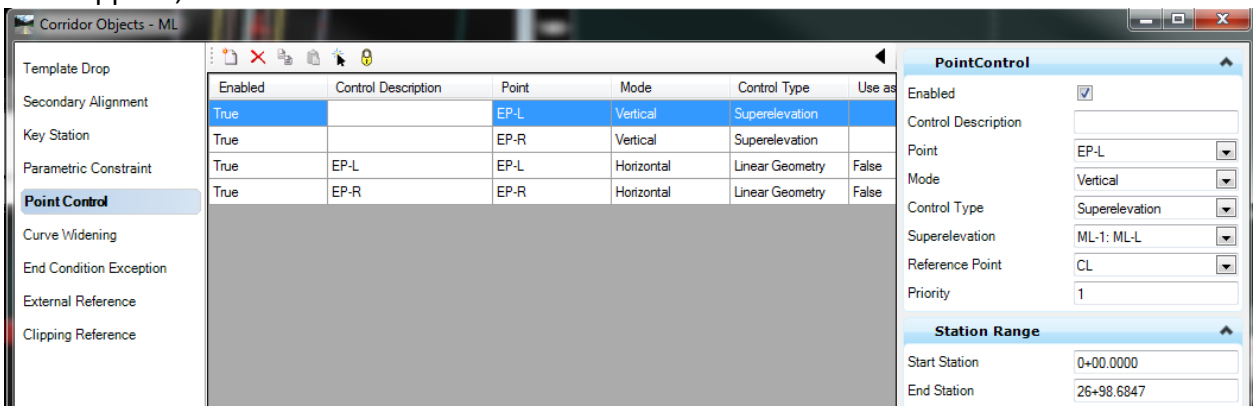


Secondary Alignments are used to change the direction of x-section processing. See the yellow cross-section line below. Note: Generally EP but basically the first plan view element intersected and not parallel to the ML.



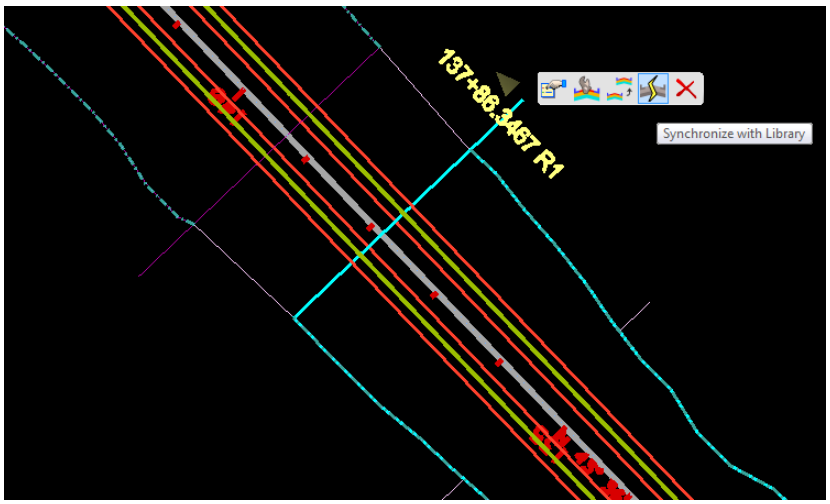
12.14 Applying Superelevation

Superelevation should be applied next. See the **Superelevation Section** for instructions. Once applied, **Point Controls** are added to the corridor.



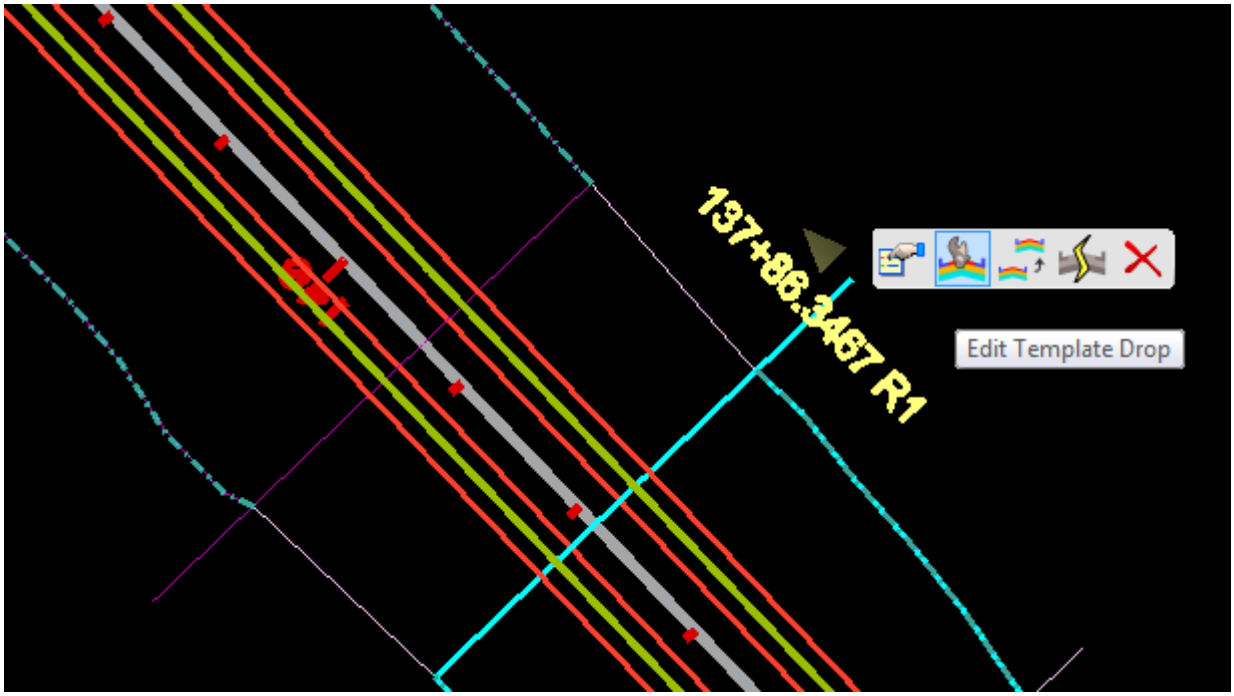
12.15 Synchronize

If you make changes to a template and want it to be reflected in the template drop, choose **Synchronize with Library**.



12.16 Edit Template Drop

You can edit a Template Drop and not affect the ITL library by choosing edit template drop.

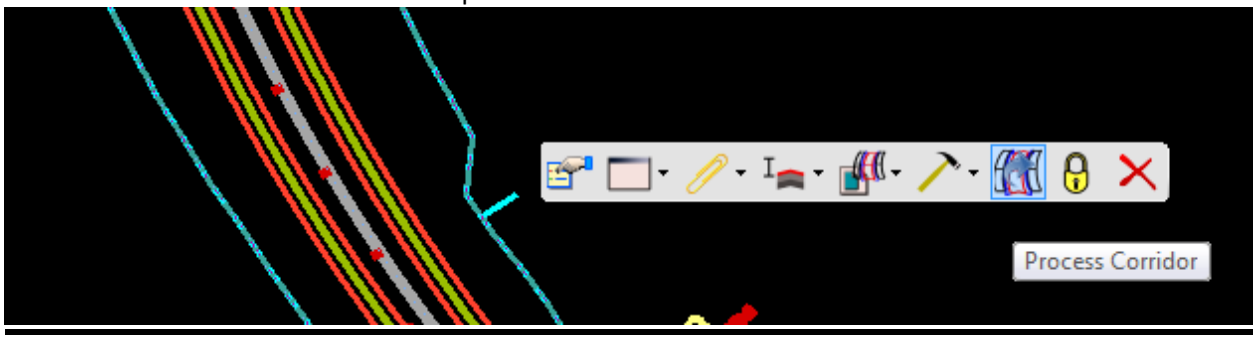


Note:

- Subsequent Syncs will cause a loss of these edits.

12.17 Process Corridor

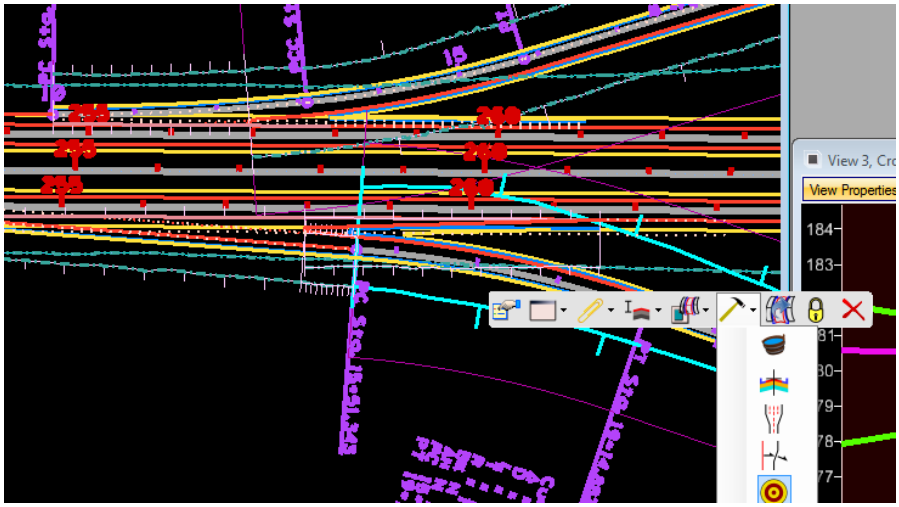
Processes the corridor to ensure it is up to date.

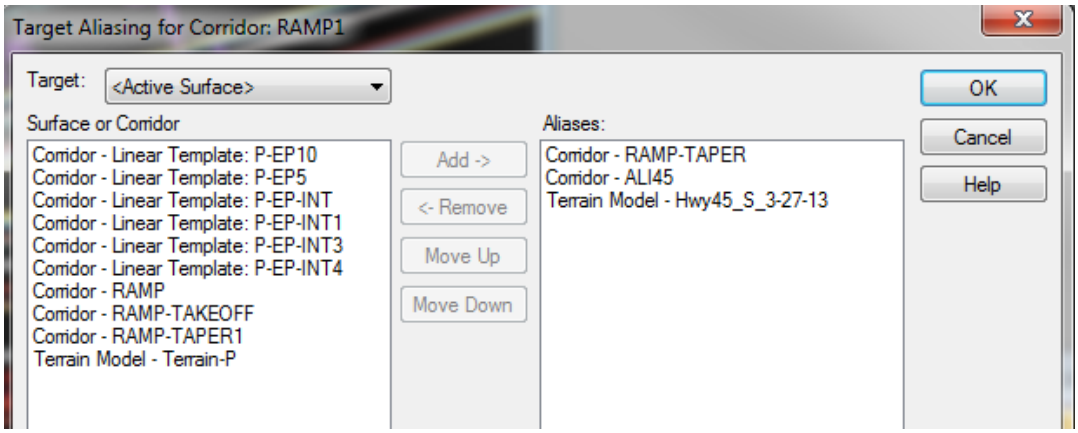


12.18 Target Aliasing and Clipping

A combination of **Target Aliasing** and **Clipping** can be used to tie (merge) different corridors together. This process is shown below between a ramp and mainline roadway.

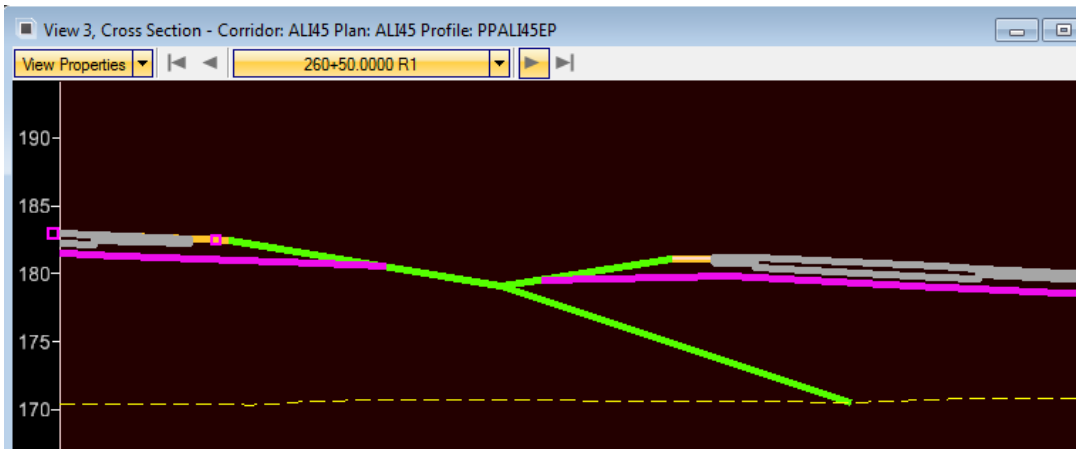
1) Add the ramp taper, ML corridor and existing terrain as **Target Alias** to the ramp corridor.



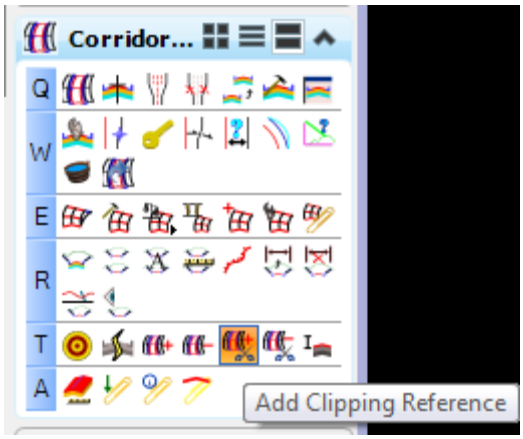


Note that order of the Aliases does apply.

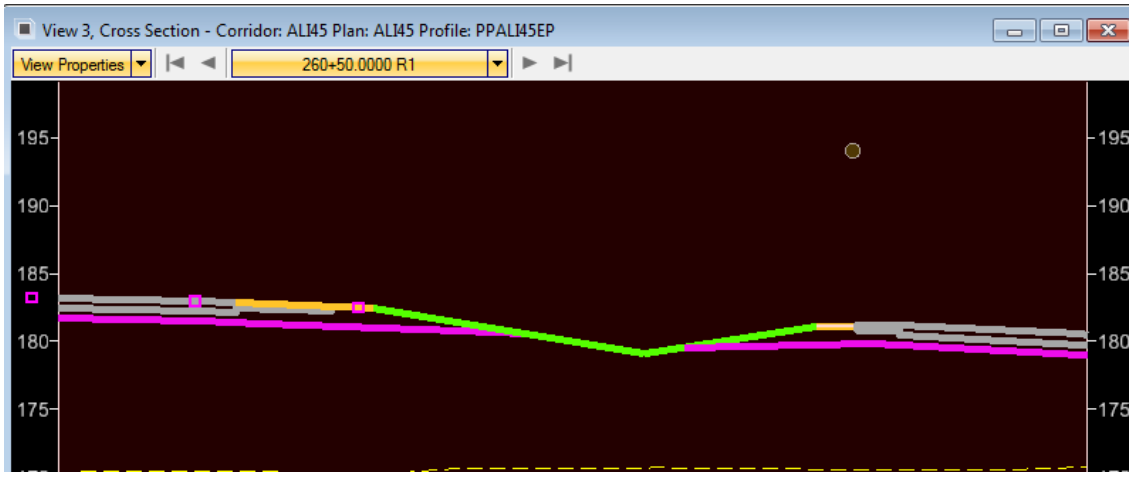
This should give you the following x-section look.



2) Add a clipping reference of the ramp corridor to the ML corridor and ramp taper corridor.



Results are shown below.

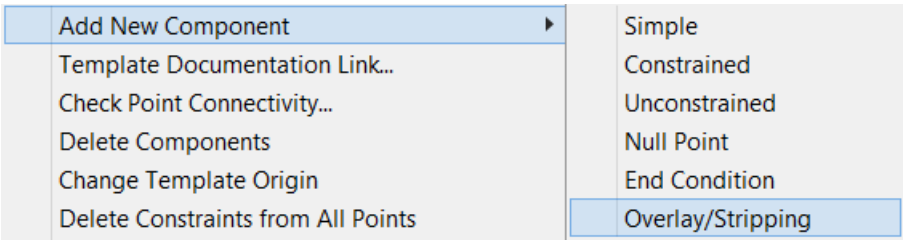


12.19 Overlays

This section discusses the basics of a template **Overlay/Stripping** component, corridors vertical adjustment feature, and the use of both of these features to create the ideal profile for overlay and/or milling projects.

12.19.1 Overlay/Stripping components

A type of component available when creating a template is the Overlay/Stripping component as shown below.



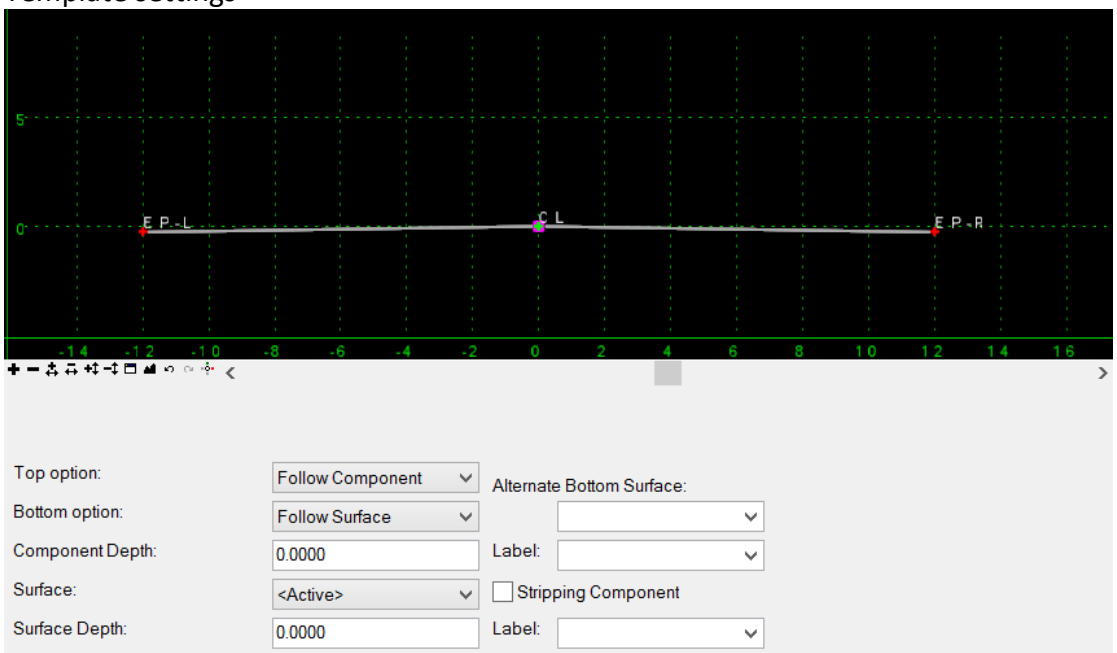
An overlay/stripping component is placed the same way as other template components are placed, by defining the component by selecting or creating points.

In the case of an overlay/stripping component, the points of the component define the "top" of the component only. The "bottom" of the component is then drawn up or down to the existing terrain surface according to the top and bottom options as shown and described in the two sections below.

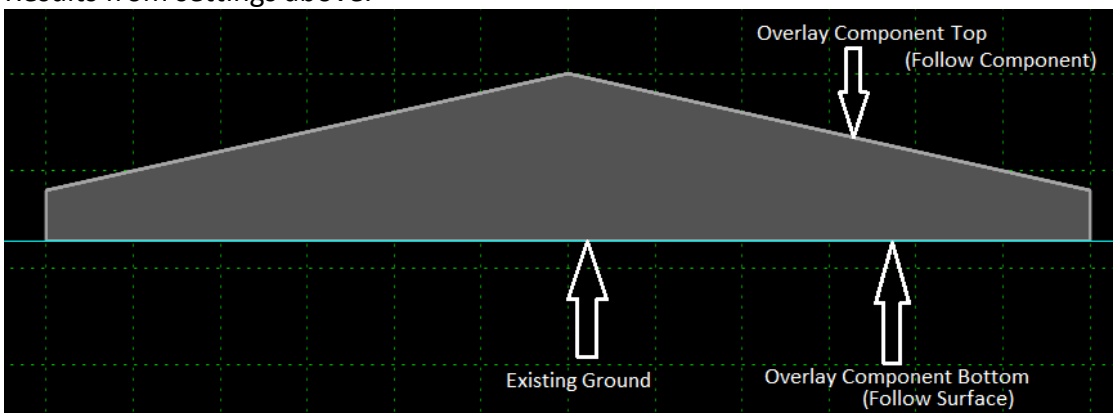
The process calculates values for the top and bottom of the component by looking at all existing terrain surface points between the start and end component points, as well as all the component points and all intersections where the component segments and surface cross.

12.19.2 Overlay component settings

Template settings

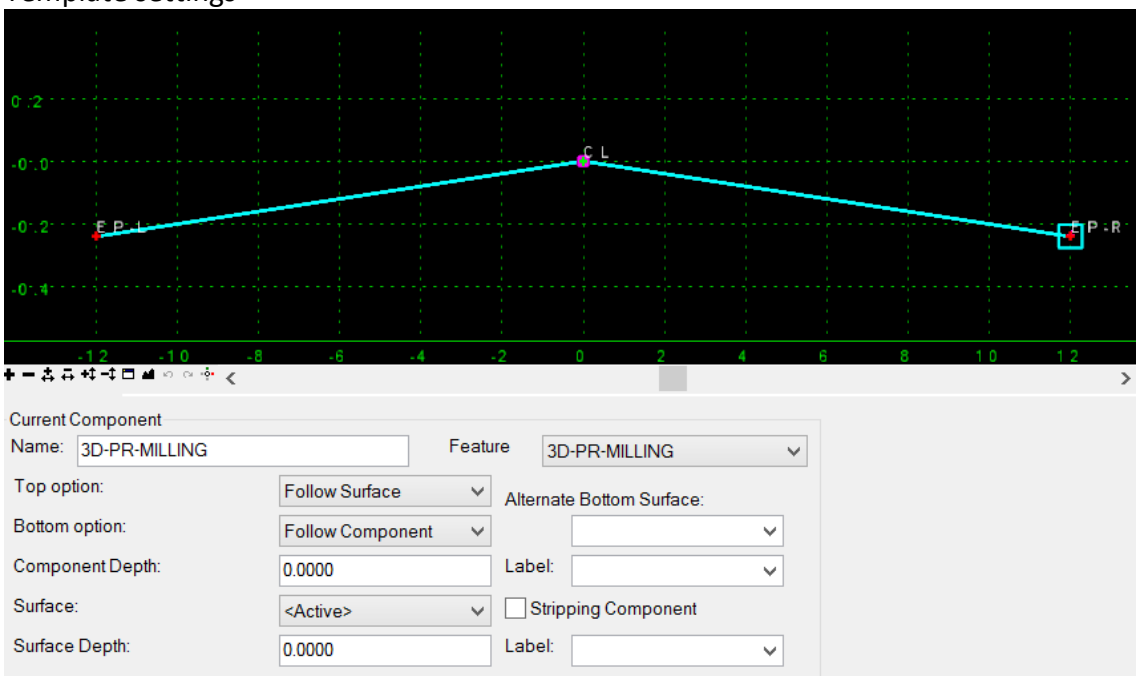


Results from settings above.

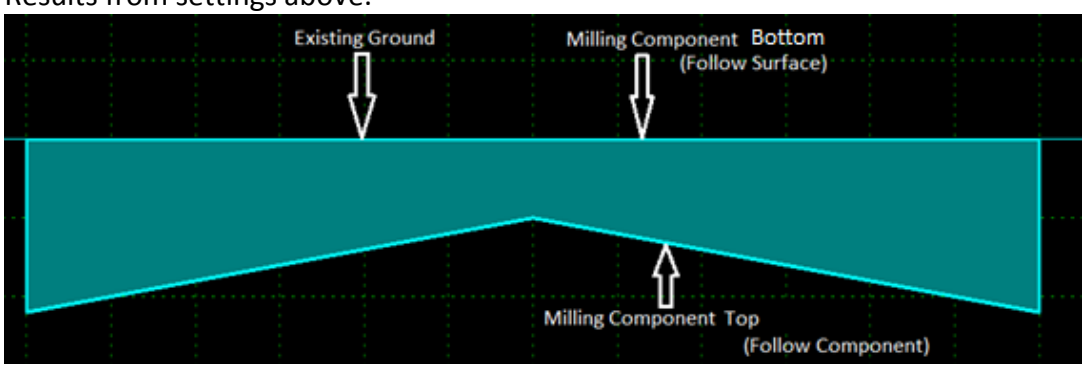


12.19.3 Milling Component Setting (Constant)

Template settings



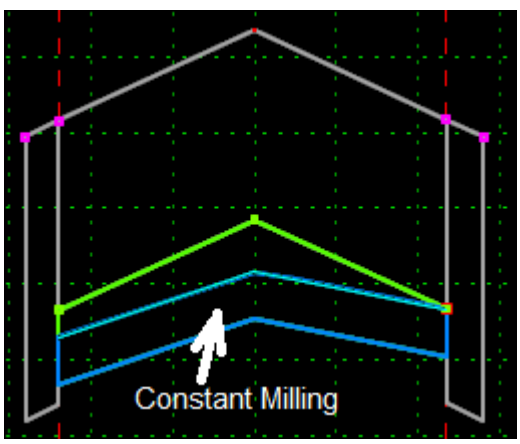
Results from settings above.

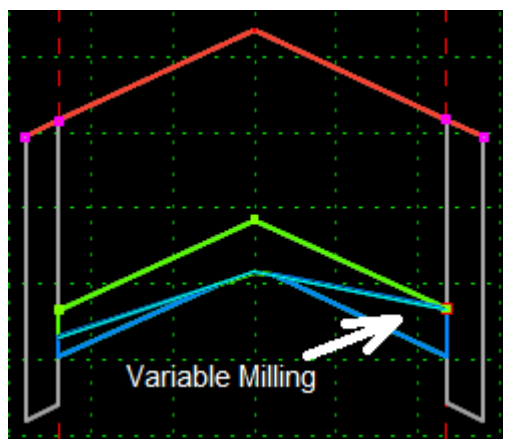


Below are MDOT's standard overlay templates. These templates have two overlay/stripping components built into them, one representing overlay and the other representing milling. The **Pavement Only** templates are meant for use in the process of determining the optimal vertical alignment.

- Reconstruction
  - Overlay & Widening
    - Constant Mill
      - 2-Lane Open Shoulder CM
      - C&G CM
      - C&G CM No DCH
    - Pavement Only
      - Overlay - Constant Mill Depth
      - Overlay - Var Mill Depth
      - Overlay & Widen - Constant Mill Depth
      - Overlay & Widen - Var Mill Depth
    - Variable Mill
      - 2-Lane Open Shoulder VM
      - 2-Lane Open Shoulder VM LR
      - 4-Lane Overlay Left
      - 4-Lane Overlay Right
      - C&G CM
      - C&G CM No DCH

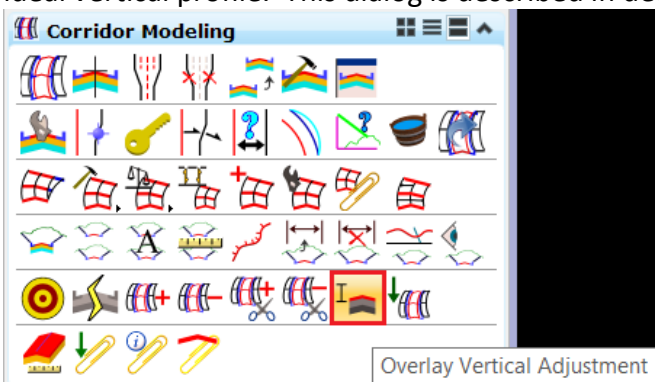
The difference in the constant and variable overlays is shown below. Constant milling templates parallel the existing pavement surface at a specified depth. Variable milling templates parallel the design pavement and the milling is variable across the existing paving surface.





12.19.4 Vertical Overlay Adjustment

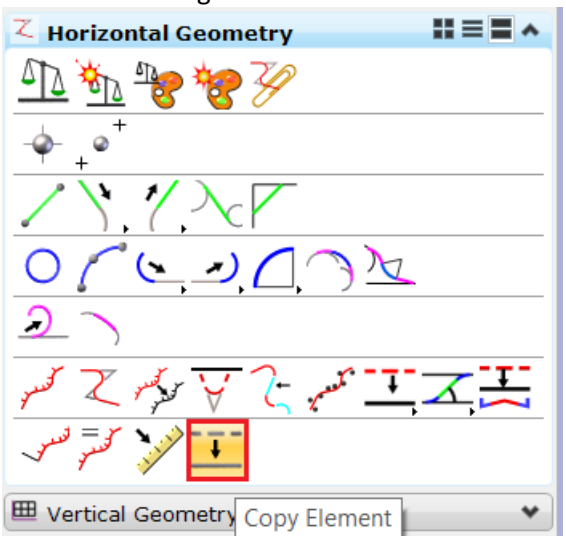
The Vertical Overlay adjustment tool found on the Corridor Task menu and shown below applies the overlay/stripping components to the Corridor based on user input creating the ideal vertical profile. This dialog is described in detail in the steps below.



12.19.5 Steps (Min. Overlay, No Milling)

The example below will take you through the steps to use the overlay templates to calculate an optimal profile for a no mill, variable overlay situation.

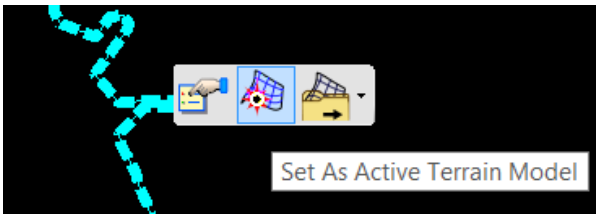
1) Create a Corridor DGN file (RWD-CORRIDOR-OVERLAY-001.DGN) (Use a 2d Seed file.)
2) Reference the alignment DGN file and TOPO DGN file (TOPO contains the existing terrain).
3) Use Horizontal Geometry **Copy** command to copy the alignment into this file and turn off display or detach the alignment reference.



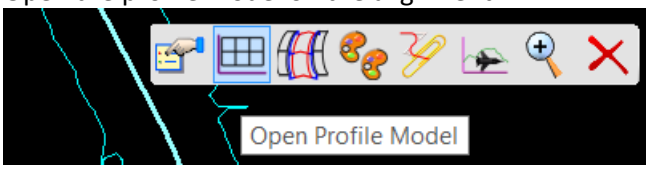
Note:

- The alignment is copied because the **Vertical Overlay Adjustment** does not work with referenced geometry.

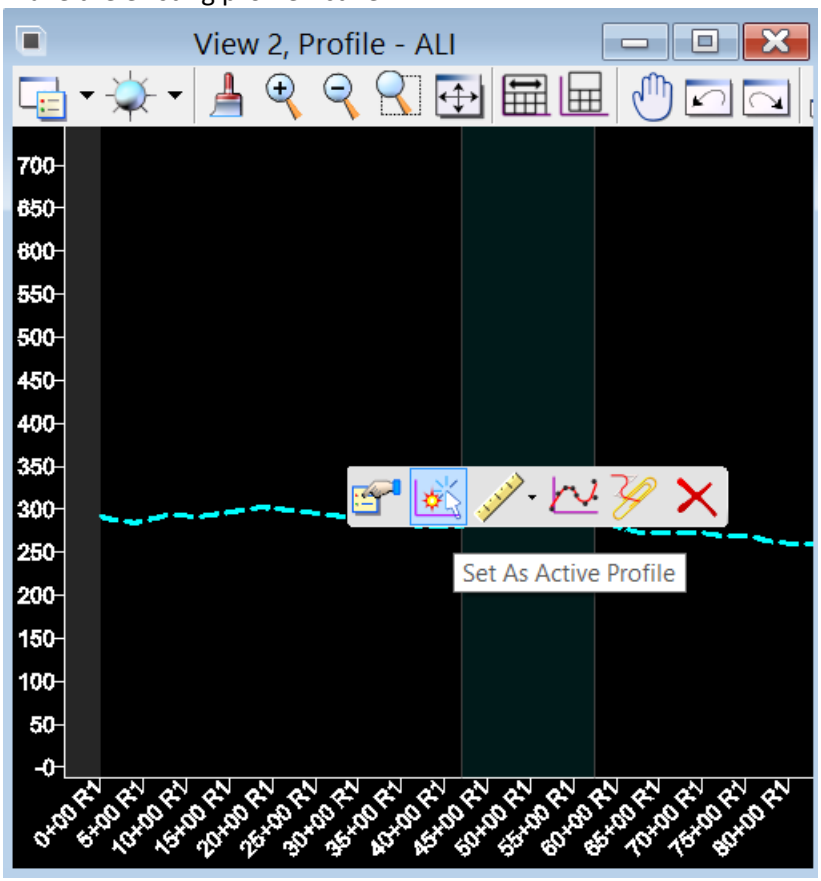
4) Make the Terrain Active.



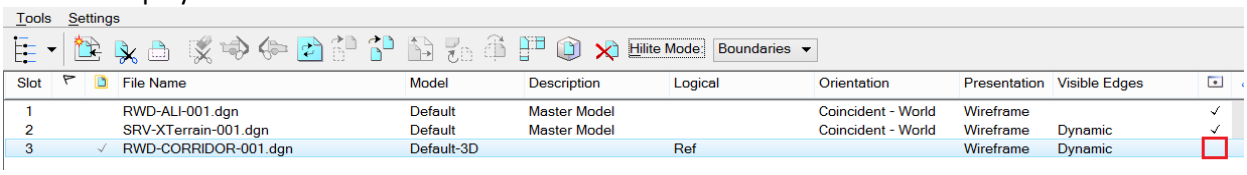
5) Open the profile model of the alignment.



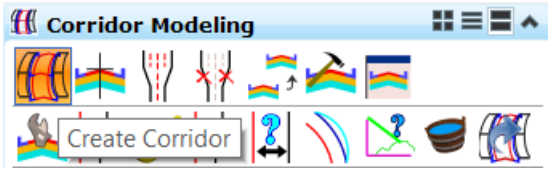
6) Make the existing profile Active.

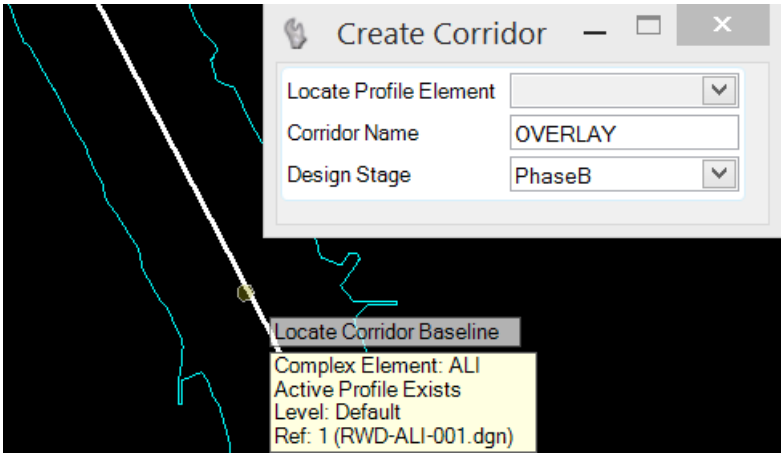


7) Turn off Display of the Default-3D model in the Default view.

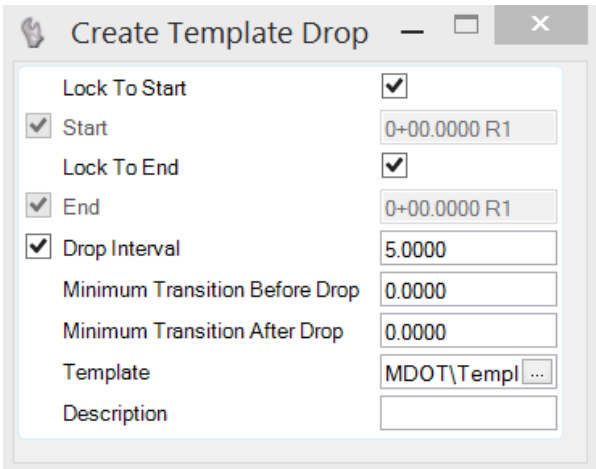


8) Create a Corridor called **OVERLAY.**

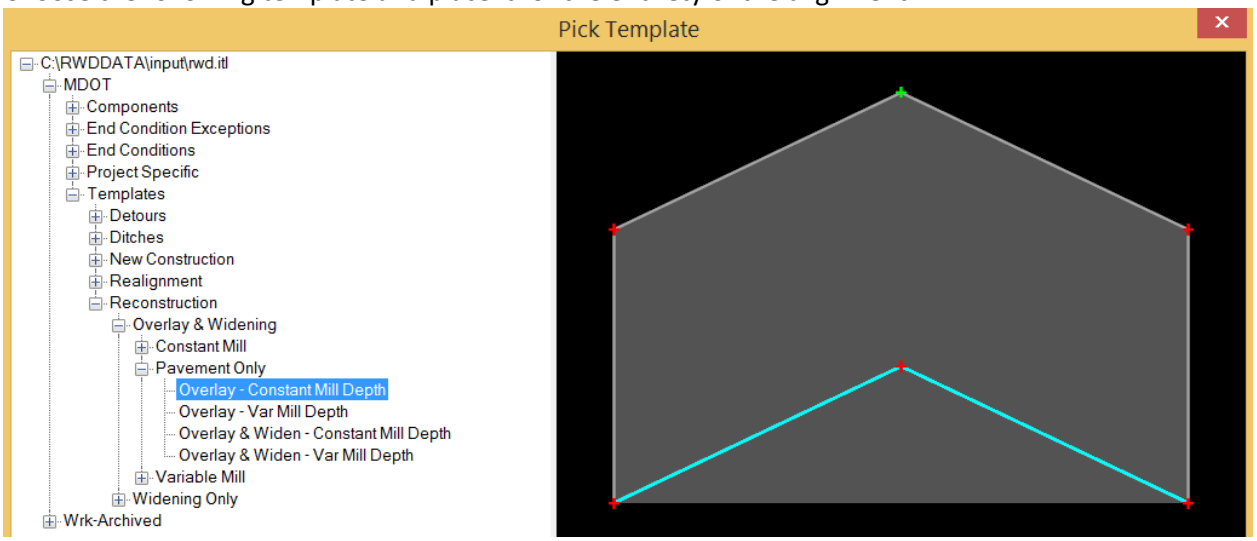




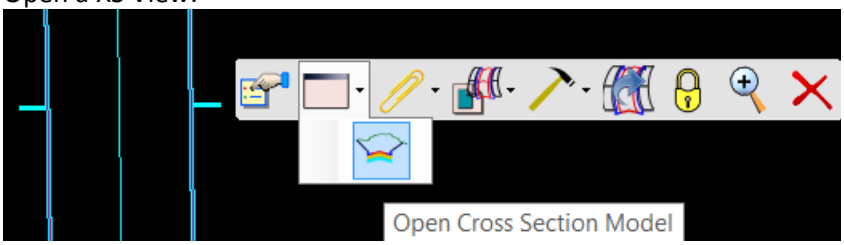
9) You should be prompted by the following dialog. Fill iIf not, choose the Place Template tool from the Corridor menu.

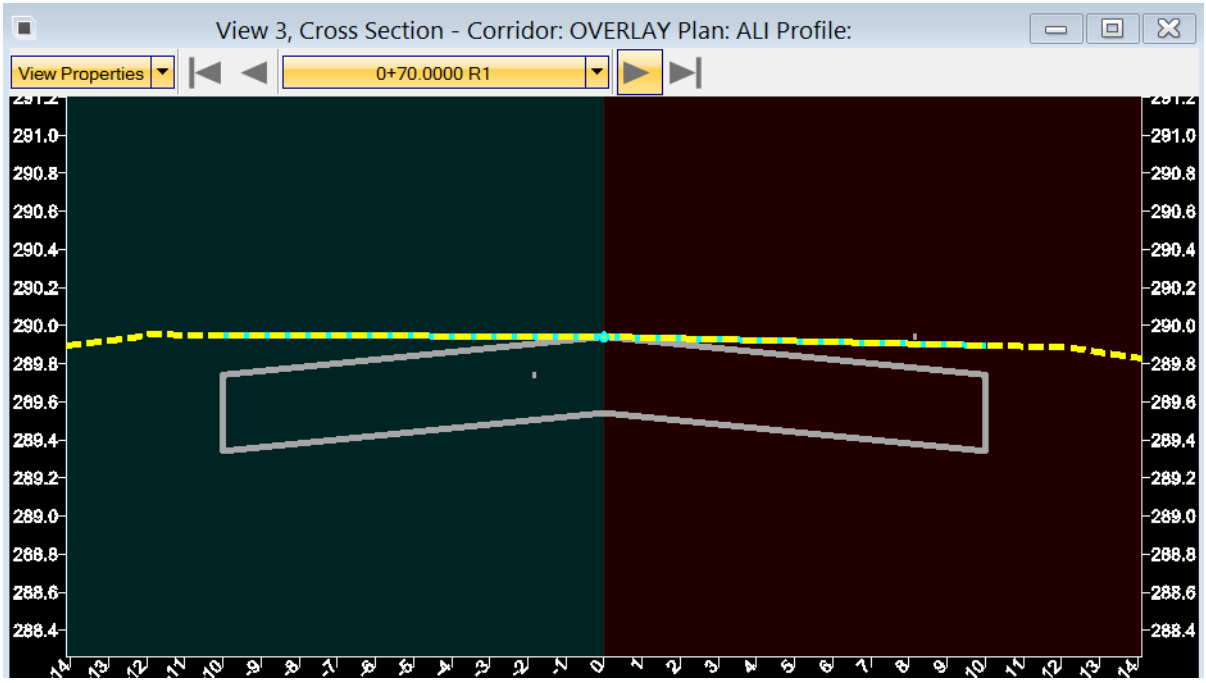


10) Choose the following template and place it for the entirety of the alignment.



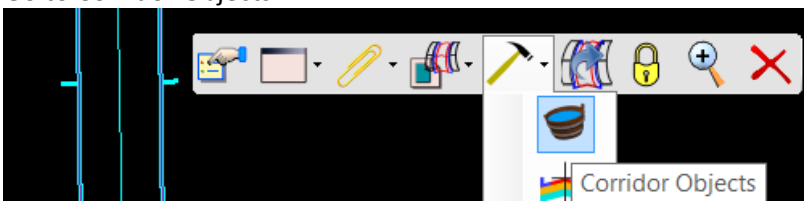
11) Open a XS View.



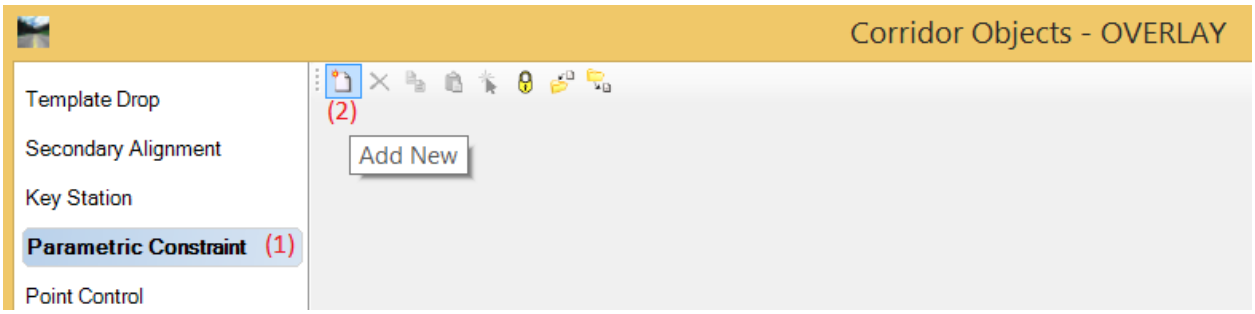


Note the template is following the existing ground profile.

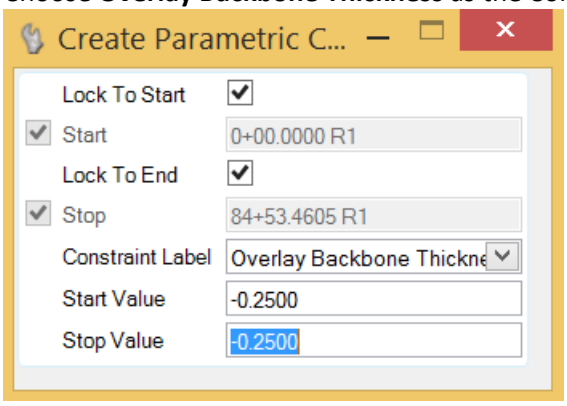
12) Go to Corridor Objects.

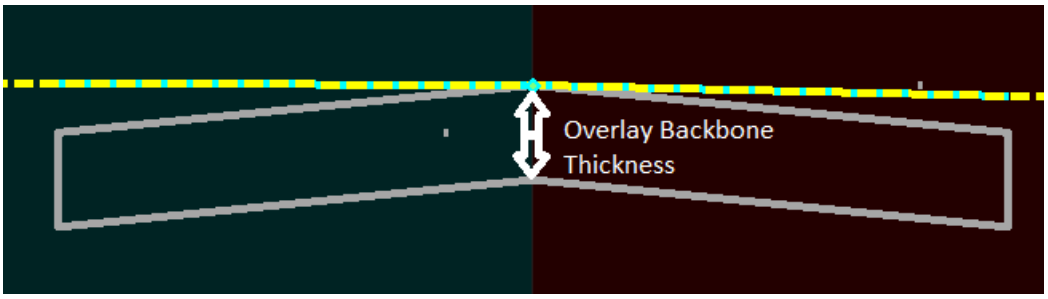


13) Choose Parametric Constraints and **Add New** as shown below.

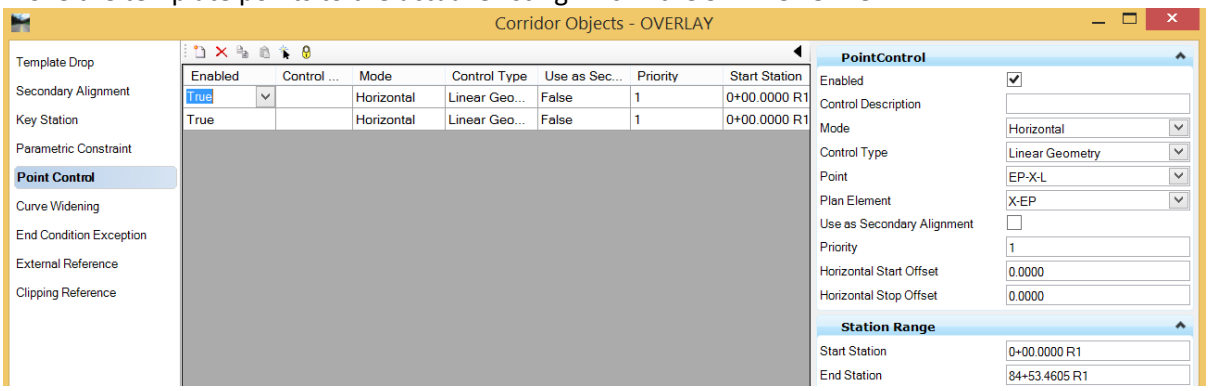


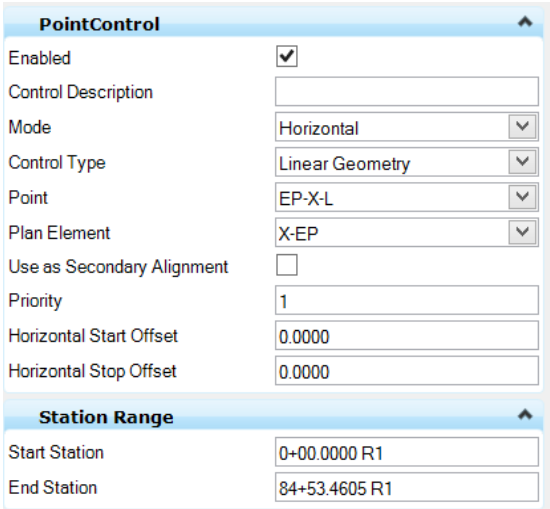
14) Choose **Overlay Backbone Thickness** as the Constraint Label and set the value to -0.25

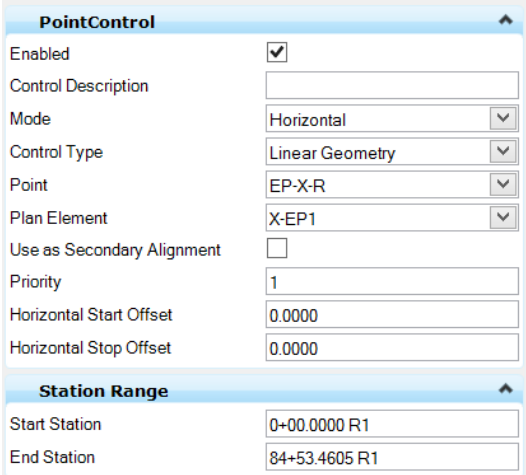




15) In **Corridor Objects**, create the two point controls for the existing EP as shown below. These move the template points to the actual existing EP's in the SRV-TOPO file.

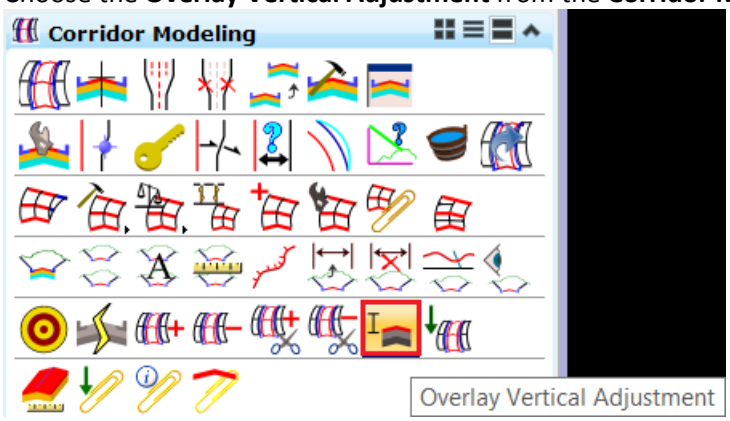




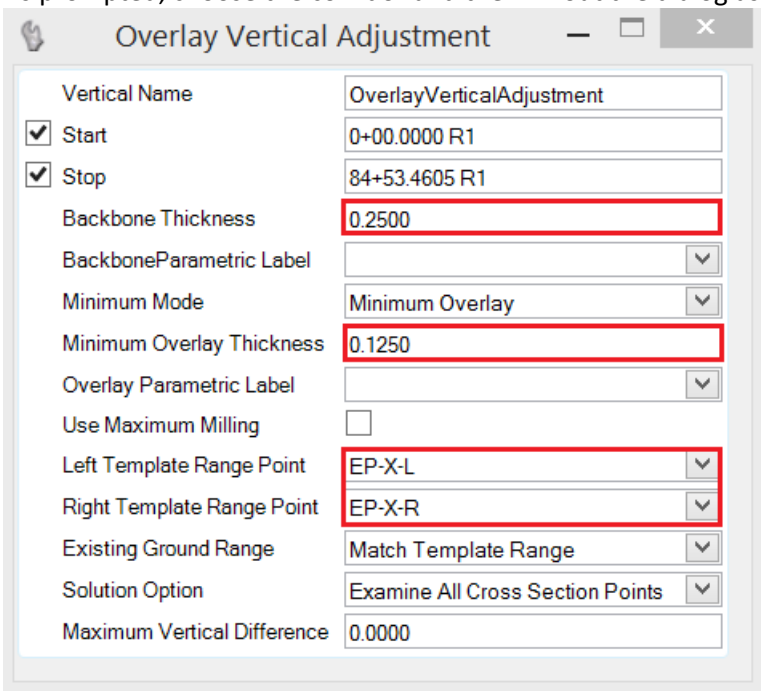


16) If we had superelevation, this would be applied now.

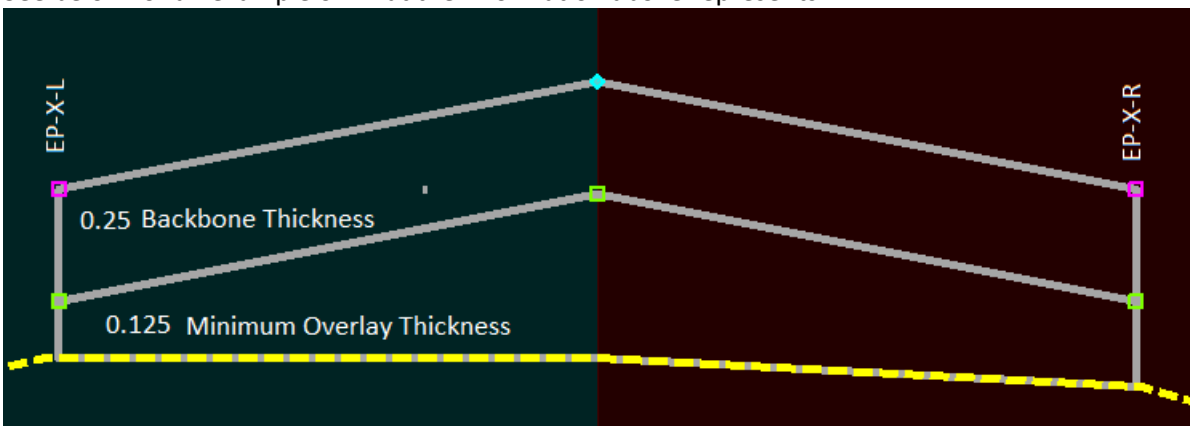
17) Choose the **Overlay Vertical Adjustment** from the **Corridor Modeling** task.



18) As prompted, choose the corridor and then fill out the dialog as shown below.

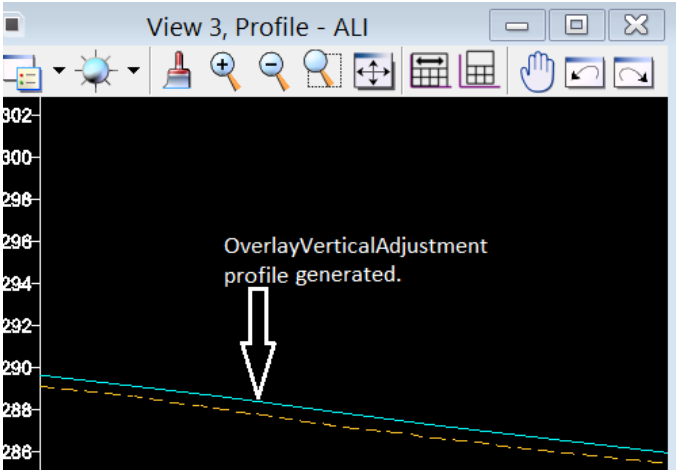


See below for an example of what the information above represents.

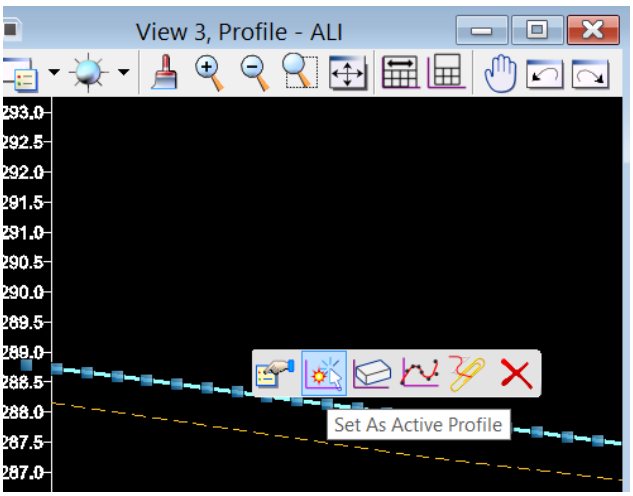


19) If the profile view is not open, open it.

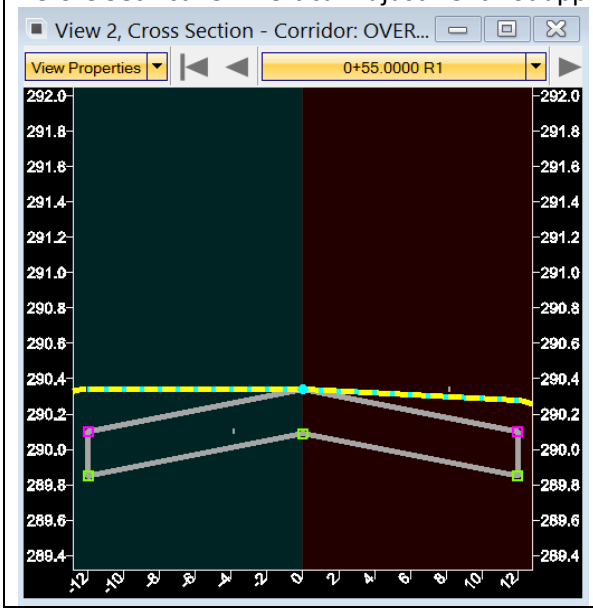
20) Note the overlay profile adjustment profile created.



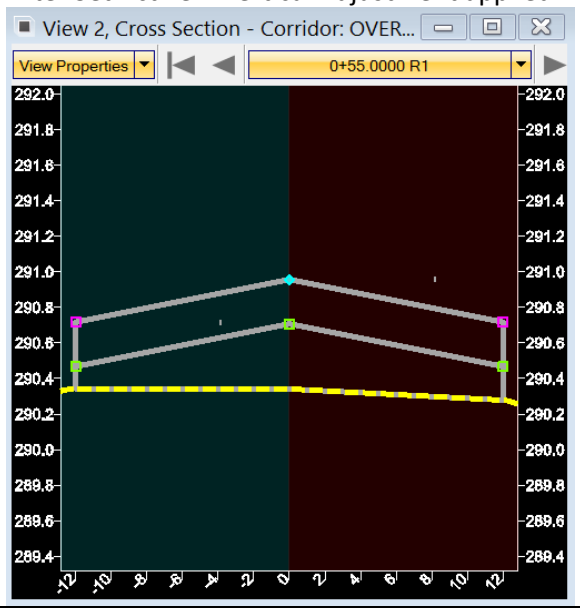
21) Set it Active



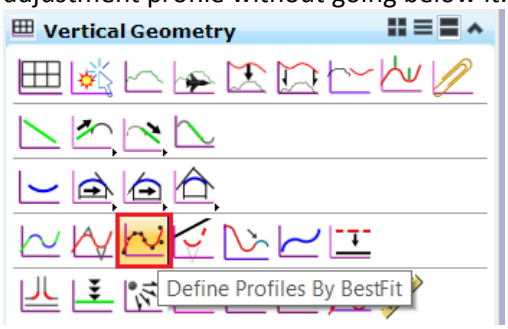
Before Set Active – Vertical Adjustment not applied



After Set Active – Vertical Adjustment applied.

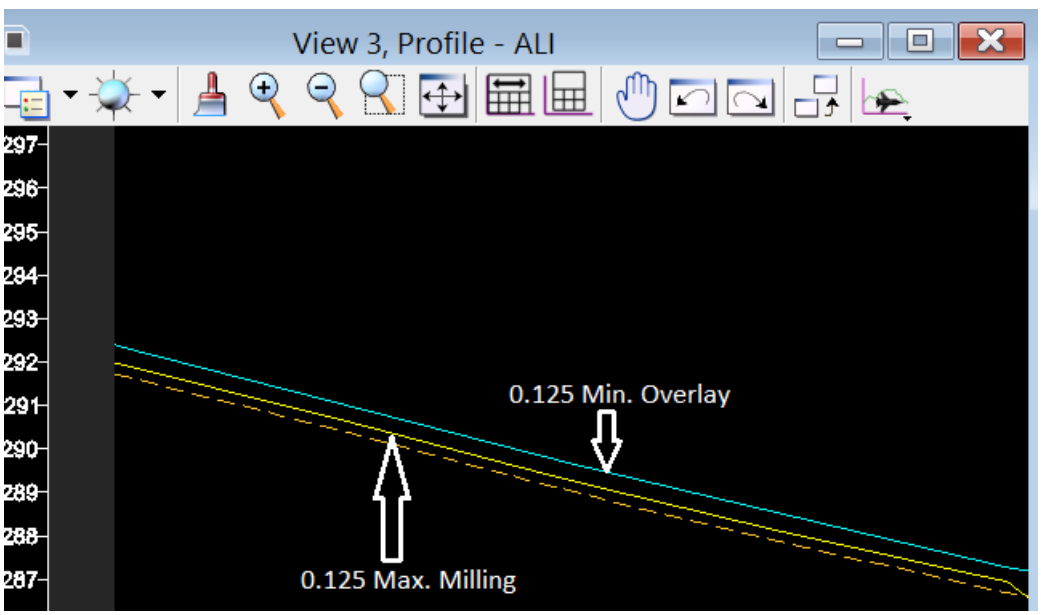


22) Now use Best Fit or Vertical commands to create a profile as close to this overlay vertical adjustment profile without going below it.



23) Name the profile, set it Active, and export it to annotate or plot it.

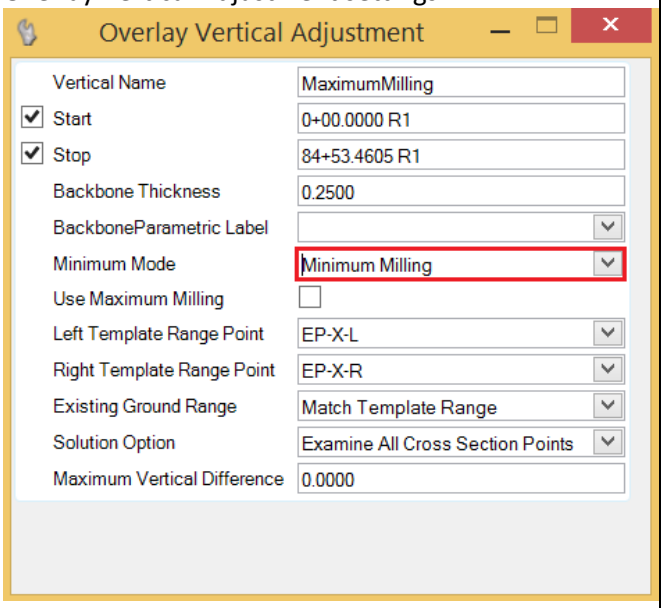
Other settings and options for calculating the ideal grade are discussed below. It is ideal practice when both Min. Overlay and Maximum Milling are used to create two profiles using the steps described above and in the section below and fitting a profile between these two profiles.



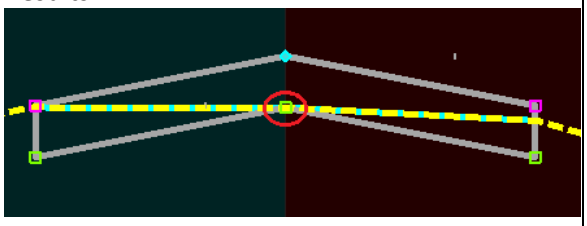
12.19.6 Other Settings

12.19.6.1 Minimum Milling

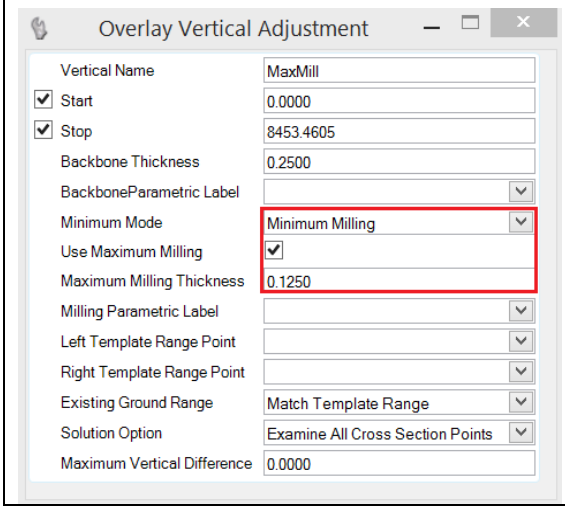
Overlay Vertical Adjustment settings



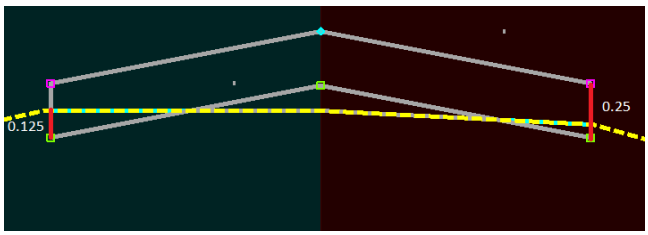
Results



12.19.6.2 Maximum Milling

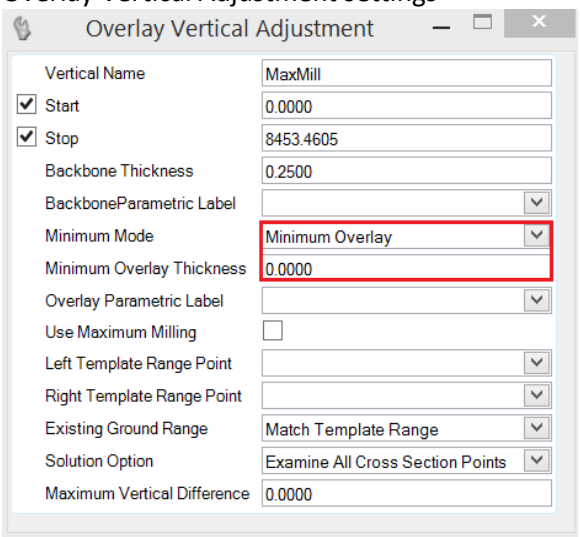


Results

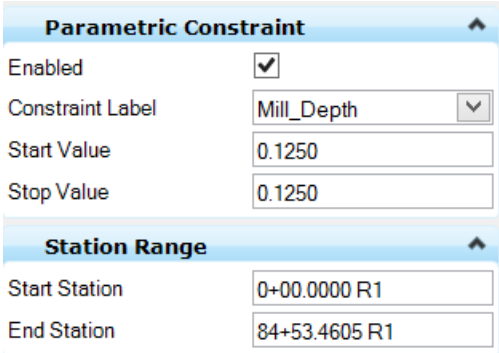


12.19.6.3 Minumum Overlay with Milling depth

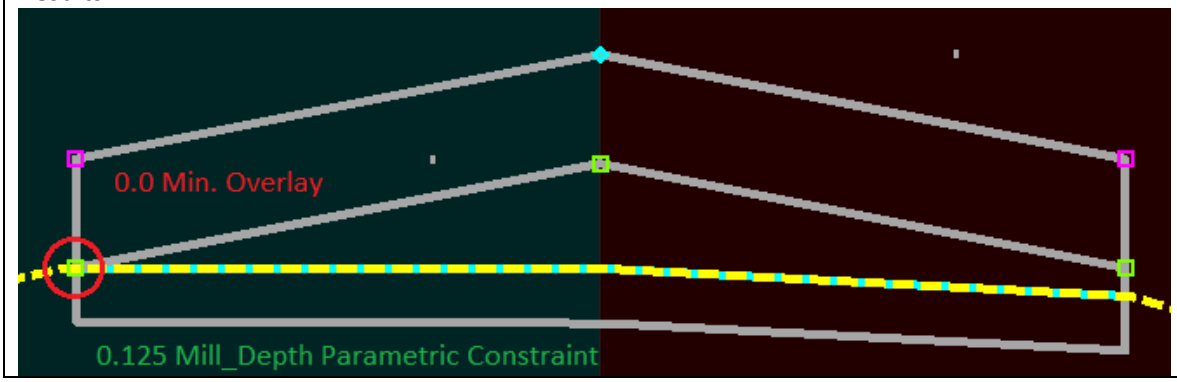
Overlay Vertical Adjustment settings



Corridor Objects – Parametric Constraint added.

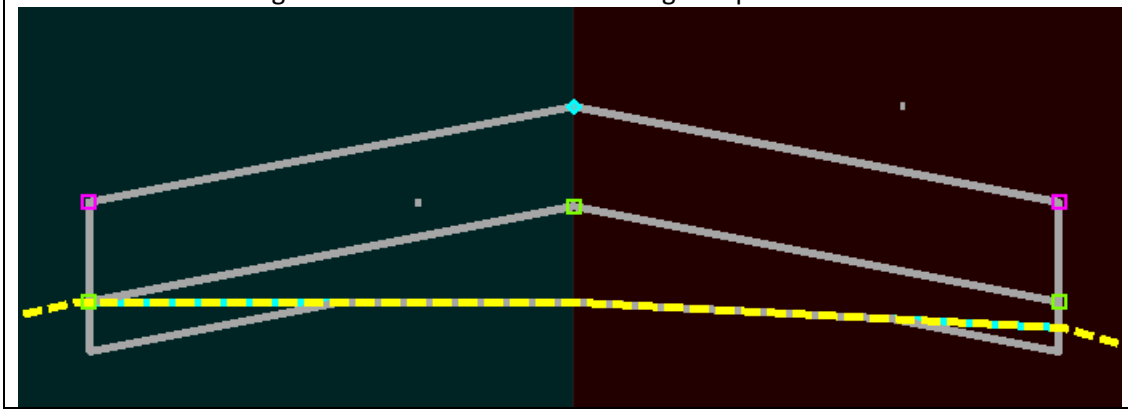


Results



12.19.6.4 Minumum Overlay with Variable Milling depth

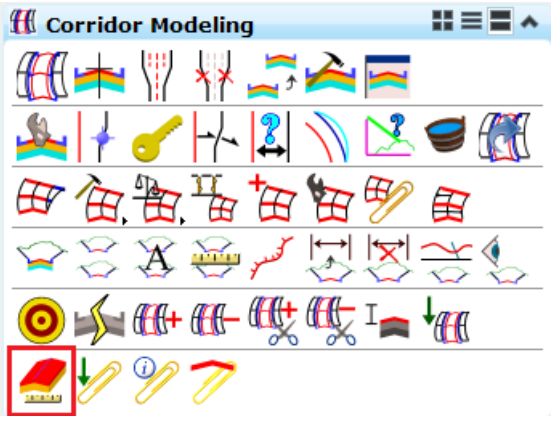
Results – Same settings above but with Variable Milling Template

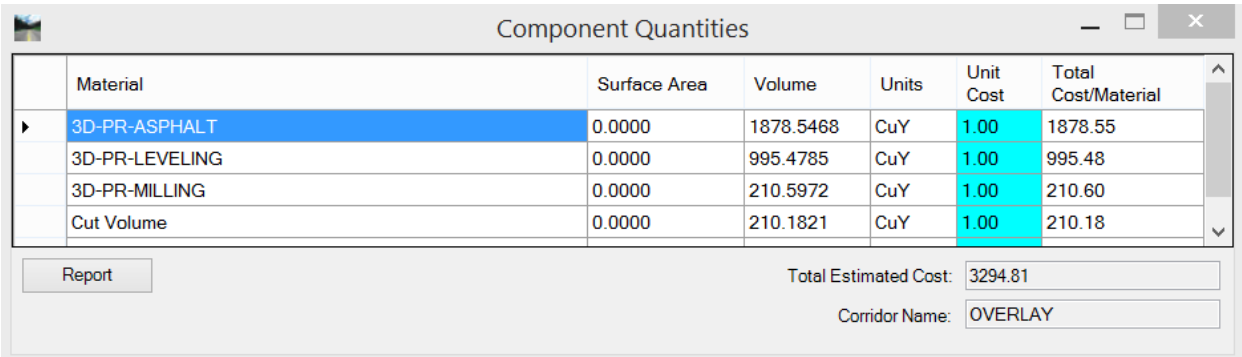


12.19.7 Reports

12.19.7.1 Component Quantities

Users can review milling and asphalt quantities based on the profile they established by choosing **Component Quantities** on the Corridor Modeling task as shown below.



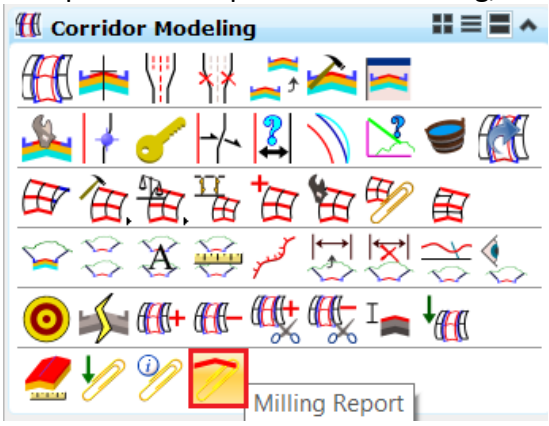


Material	Surface Area	Volume	Units	Unit Cost	Total Cost/Material
3D-PR-ASPHALT	0.0000	1878.5468	CuY	1.00	1878.55
3D-PR-LEVELING	0.0000	995.4785	CuY	1.00	995.48
3D-PR-MILLING	0.0000	210.5972	CuY	1.00	210.60
Cut Volume	0.0000	210.1821	CuY	1.00	210.18

Changing the profile will affect the amount of overlay leveling and milling required on the project which in turn affects the total estimated cost.

12.19.7.2 Milling Report

Often milling costs are estimated based on the planar area to be milled. The Corridor Component Quantities tool provides milling quantities by volume but not by area. To get true planar area quantities for milling, use the Roadway Designer Milling Reports tool.



Below is an example milling report.

Roadway Design Milling Report

Report Created: 12/21/2015
Time: 7:41am

Station	Left Offset/ Elevation	Right Offset/ Elevation	Planar Area
0+00.0000 R1	-12.0000 291.6523 10.1053 291.6902	-6.7081 291.7582 12.0000 291.6523	0
0+16.4042 R1	-12.0000 291.5154 8.3698 291.5880	-6.5925 291.6235 12.0000 291.5154	41
0+32.8083 R1	-12.0000 291.3856 8.3585 291.4584	-6.5390 291.4948 12.0000 291.3856	45

LAB VII:Corridor Modeling

1. Create the file RWD-CORRIDOR-001.DGN (2d Seed file).
2. Reference SRV-TOPO-001.DGN and Make Active the terrain.
3. Open the Default-3D model in View 5.
4. Turn off Display of RWD-CORRIDOR-001.DGN (Default-3d) in View 1.
5. Reference RWD-ALI-001.DGN, RWD-EP-001.DGN, and SRV-ALI-001.DGN.
6. Create the Corridor SR4 for alignment ML_SR4.
7. Drop the ML template created in the previous lab between stations 1056+99.9993 and 1080+50.
8. More Corridor processes such as point controls, parametric constraints, etc. will occur after the Civil Cells lab, as well as creating a Corridor for LRTuck.

13. SUPERELEVATION

13.1 Section Overview

With OpenRoads SS4, you can calculate and apply superelevation to Corridors with OpenRoads new superelevation tools or calculate superelevation with GEOPAK traditional superelevation tool, format, and then import to apply to Corridors.

13.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal Geometry
- Basic superelevation knowledge

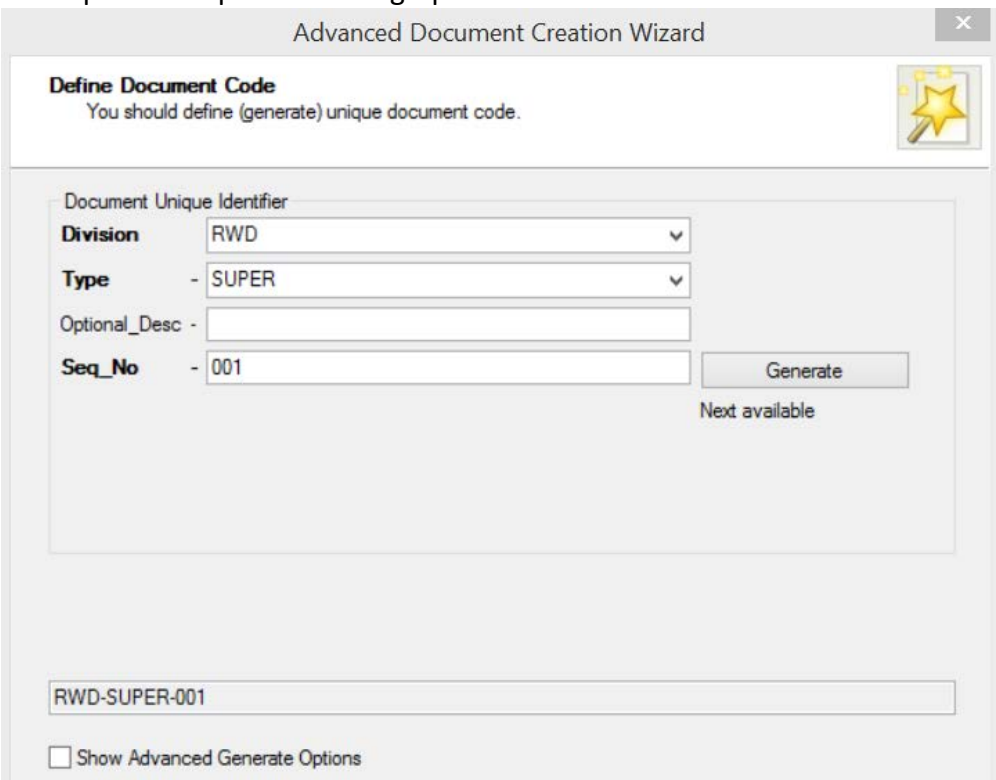
13.3 Section Objectives

After completing this section you will be able to:

1) Calculate and create superelevation.
2) Import superelevation from GEOPAK legacy calculations.
3) Apply superelevation to a corridor.

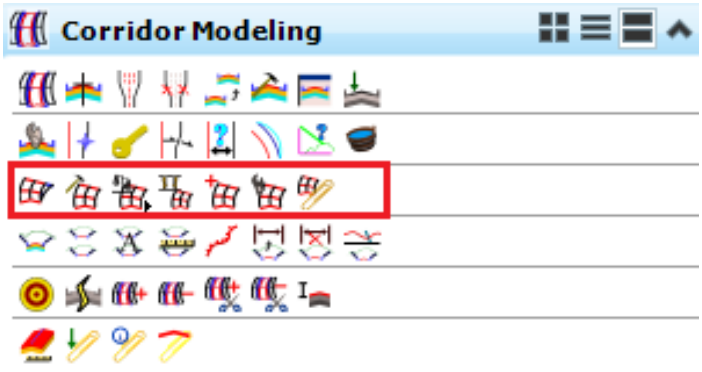
13.4 Create the Superelevation DGN file

All superelevation can exist in one DGN file so it is preferred to use one DGN file unless overlap in the superelevation graphics causes selection issues or confusion.



13.5 Superelevation Tools

Are found under the Corridor Modeling Task.

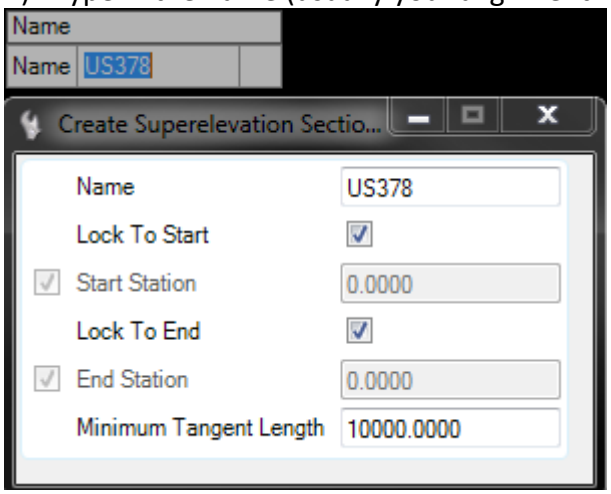


13.6 Steps

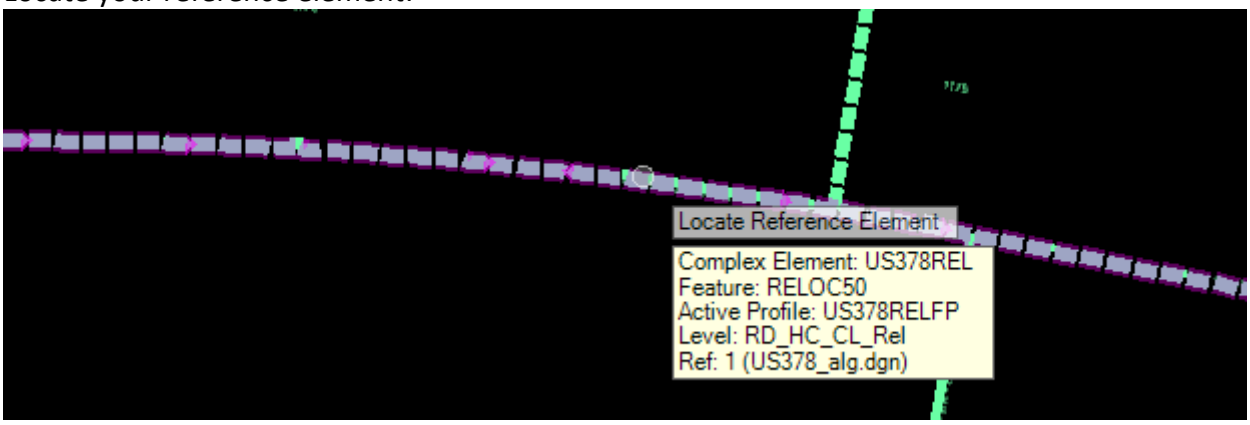
13.6.1 Create Super Sections

One superelvation section should be created for the entire alignment unless the Design Speed changes within the alignment.

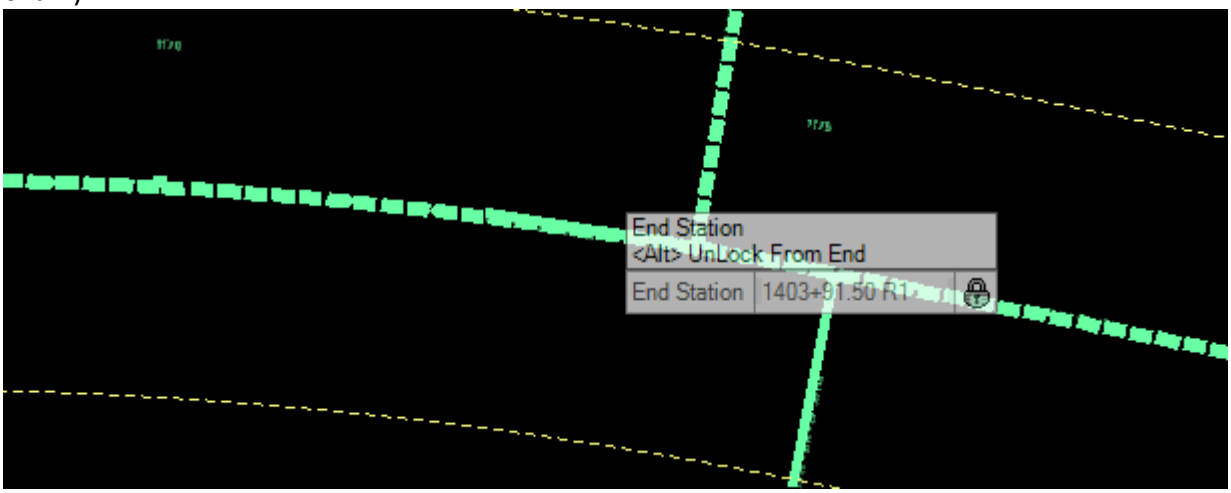
1) Select the **Create Super Sections** tool.
2) Type in the name (usually your alignment name) into the heads up prompt:



3) Locate your reference element:



4) Select your start and stop stations (or hit alt to lock to the start and stop stations of the chain):

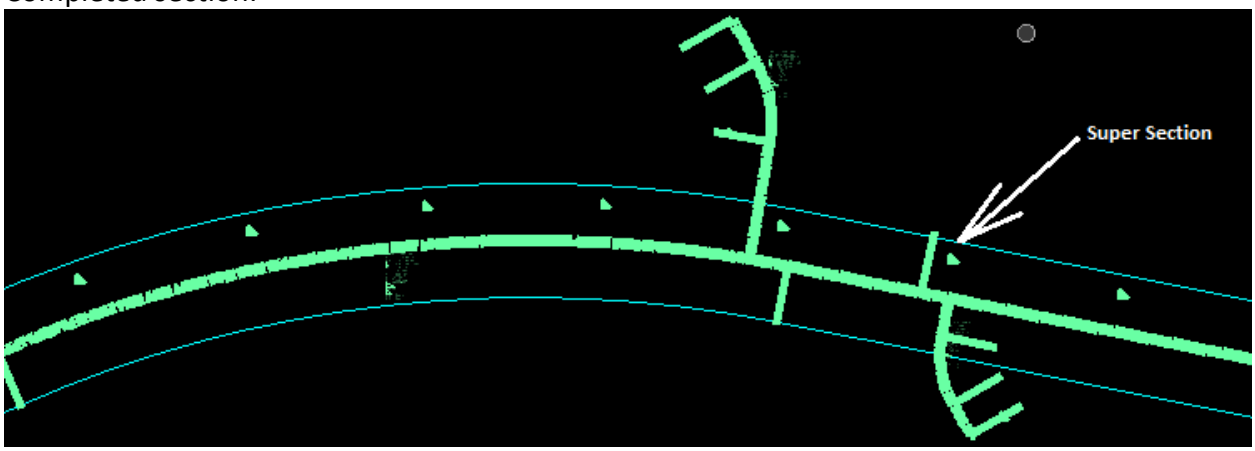


5) Enter 10000 for the minimum tangent length.

Minimum Tangent Length 10000.0000

6) **Minimum Tangent Length** represents the minimum length of tangent between curves. OpenRoads will use this to determine how many super sections to create. If 0, a super section is created for each curve. With it set to 10000, only one super section is created for the entire alignment.

Completed section:



Note:

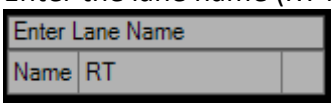
- If there are significant changes to the road, i.e., changing from 2 lane rural to 4 lane divided, separate sections should be created for the appropriate station range.

13.6.2 Create Superelevation Lanes

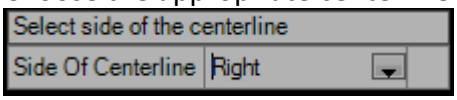
This will create the lanes for super processing.

13.6.2.1 Process (2-Lane)

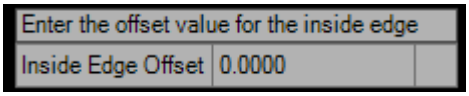
1) Select the **Create superelevation lanes** tool .
2) Locate the superelevation sections. You can do this one of two ways. You can select each section one at a time and then reset or you can zoom out, click and drag from the upper left side of the screen to the bottom right and release. This will select all sections GEOPAK created in the previous process.
3) Enter the lane name (RT for the right lane, LT for the left lane).



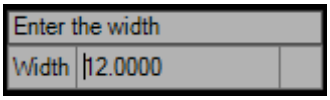
4) Choose the appropriate centerline side.



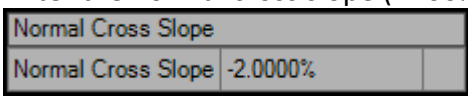
5) Enter the offset value for the inside edge. This value is the distance from the centerline to lane start. This value is 0 for this example.



6) Enter the lane width.



7) Enter the normal cross slope (-2.00% for normal crown).



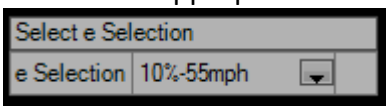
13.6.3 Calculate Superelevation

This will calculate the superelevation from the lanes created in the previous section.

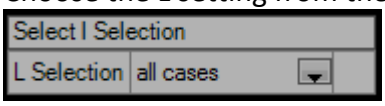
1) Select the **Calculate superelevation** tool from the task bar
2) Select the superelevation sections like before (by using either the select method or the click and drag method).
3) Use the alt+down arrow to access the superelevation standards and select the appropriate one.

   _local_rd_40less.sep
   09_local_rd_40less.sep
   09rural_a_column.sep
   09rural_b_column.sep
   09urbn_45less_a.sep
   09urbn_50_a.sep
   09urbn_50_b.sep
   rural_a_column.sep
   rural_b_column.sep
   urbn_45less_a.sep
   urbn_45less_b.sep
   urbn_50_a.sep
   urbn_50_b.sep

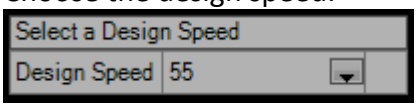
4) Choose the appropriate e value.

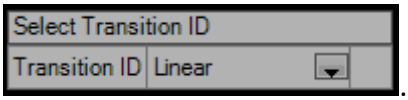
5) Choose the L setting from the drop down.

6) Choose the design speed.

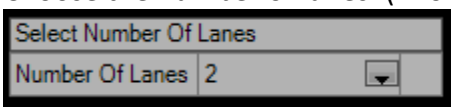
   

7) Choose linear transition.

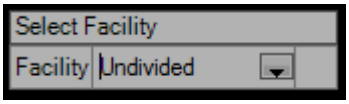
   

   .

8) Choose the number of lanes. (2 for a 2-lane section, 6 for a 5-lane section,

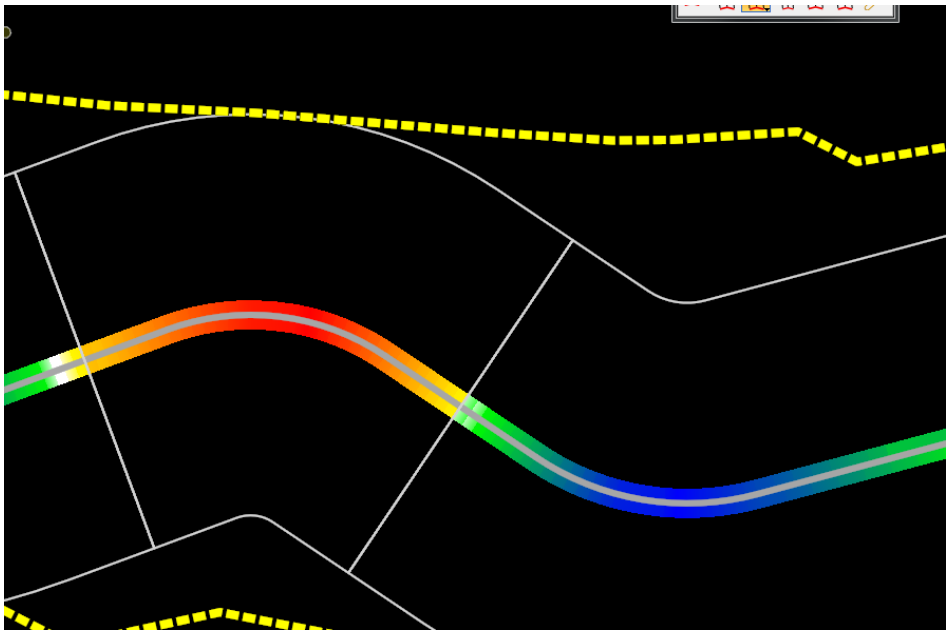
   

9) Choose either divided or undivided.

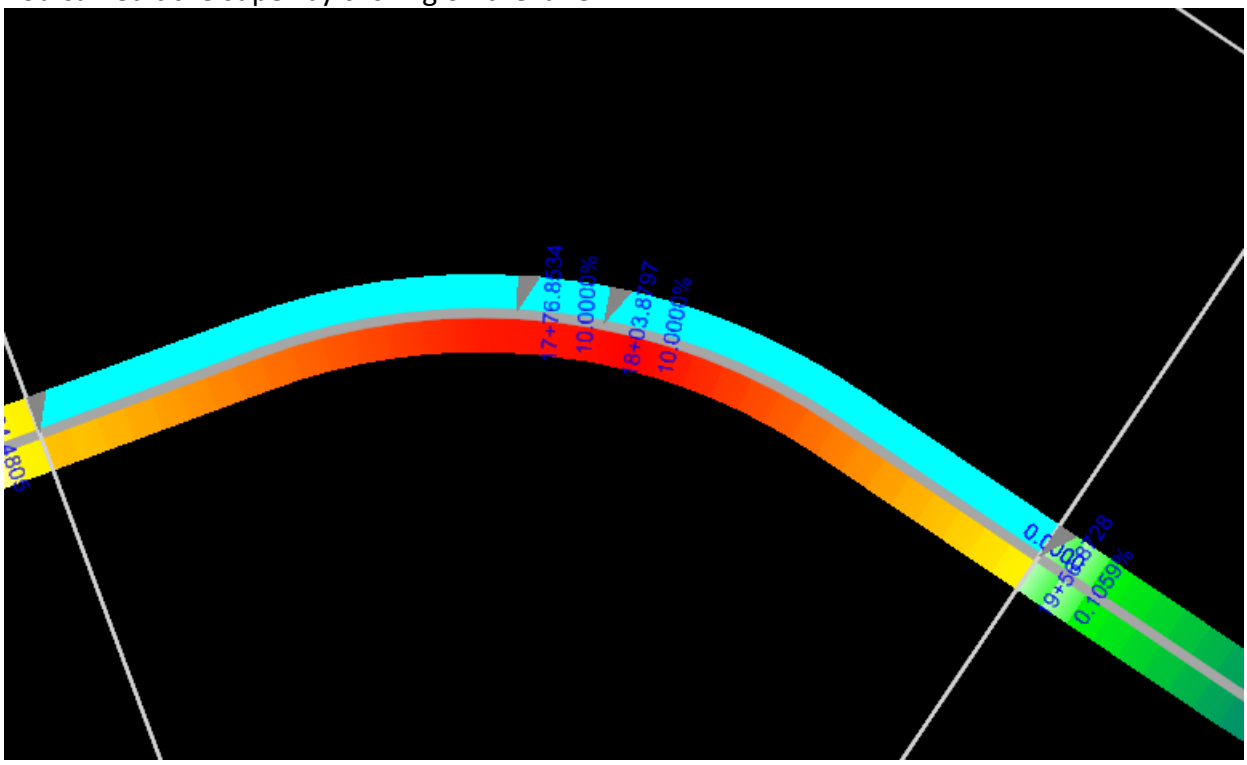
   

10) Choose whether or not you want to open the editor. If you choose no, you can open the editor later using the editor button.

If you have fill turned off in the view, turn it on. You can see the super lanes created with a raindow of colors representing the amount of super in the curves.



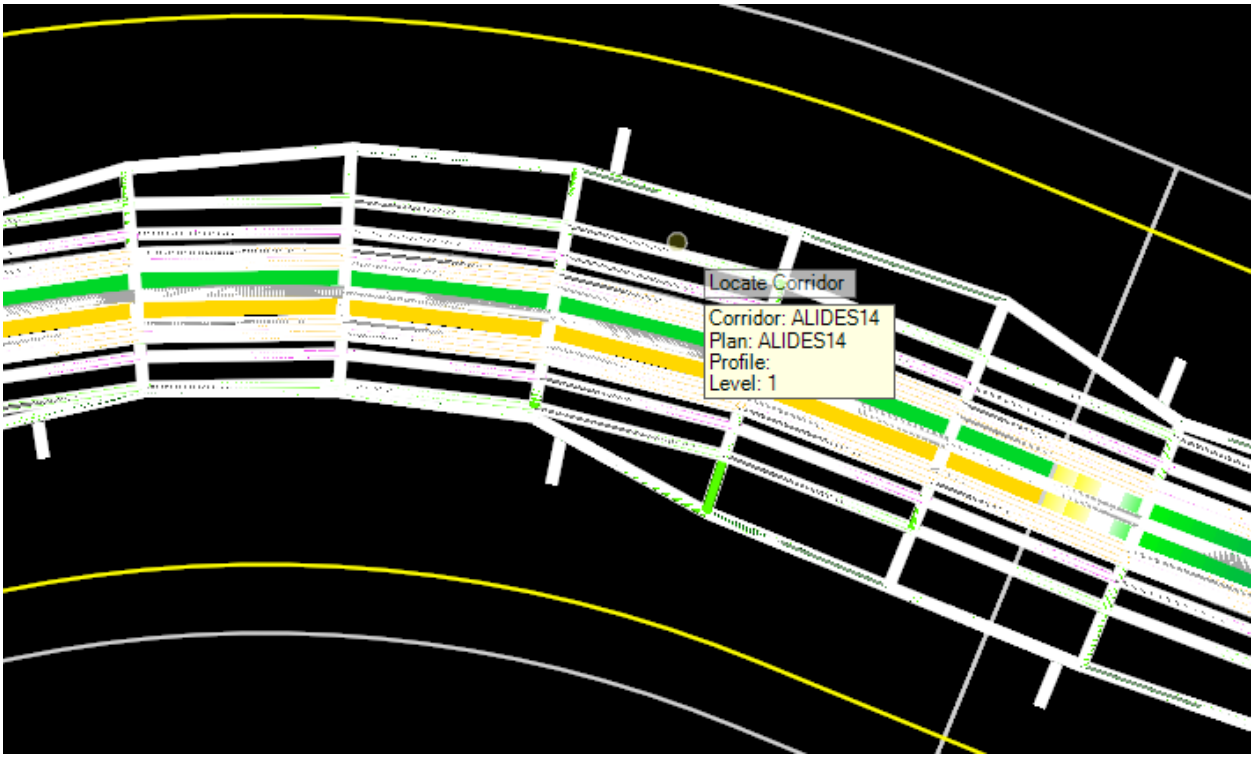
You can edit the super by clicking on the lane.



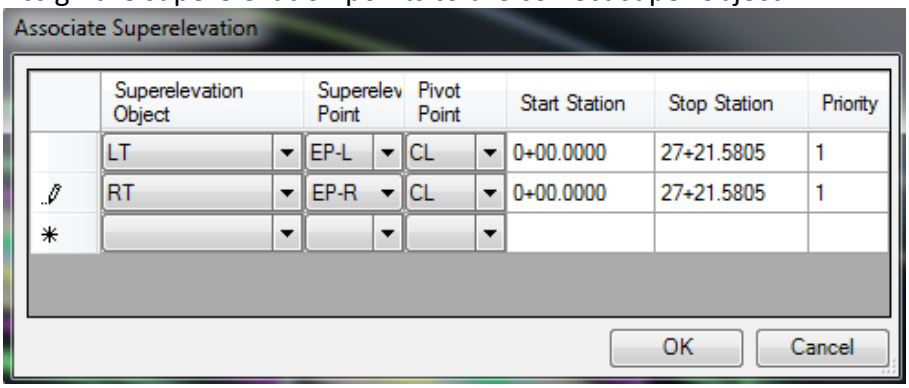
13.6.4 Assigning Superelevation to a Corridor

This will allow us to assign the super created in the previous process to a corridor.

1) Select the **Assign Superelevation to Corridor** tool
2) Select the superelevation sections like before (by using either the select method or the click and drag method).
3) Locate the corridor.



4) Assign the superelevation points to the correct super object:

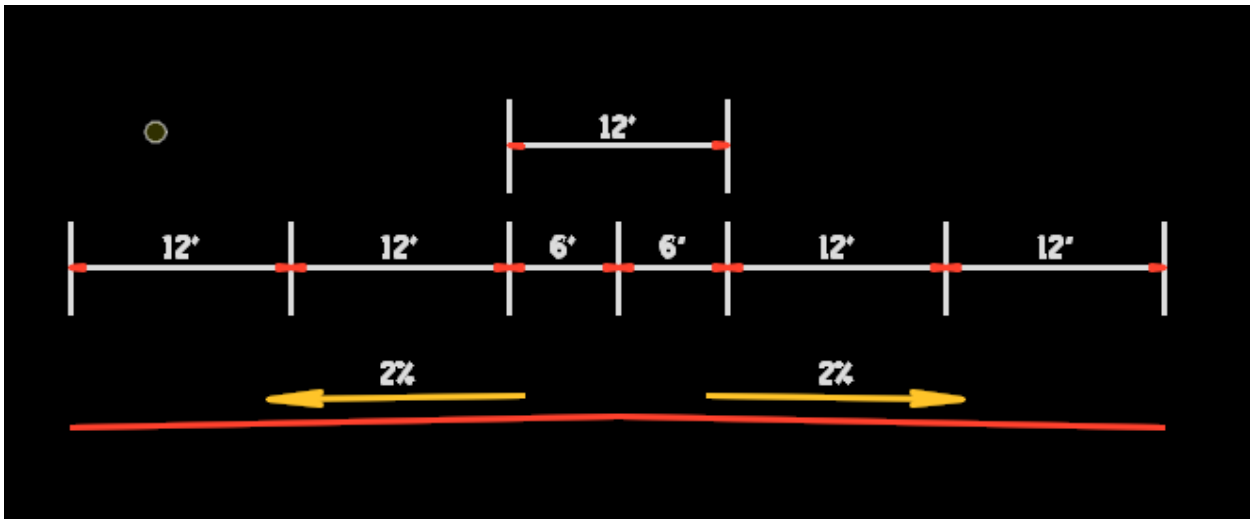


13.7 Multiple Lanes (5-Lane)

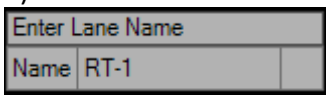
General steps above can be followed for 5-Lane super but creation of lanes and Assign Super to Corridor are discussed below.

13.7.1 Create Lanes (5-Lane)

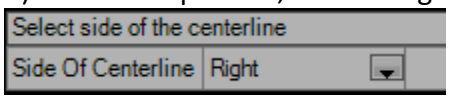
A 5-lane requires multiple lanes to be processed. Three RT lanes (1@6', 2@12') and three LT lanes (1@6', 2@12') will need to be assigned.



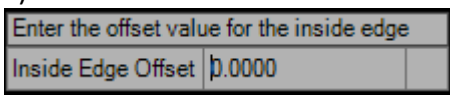
1) Select the **Create Superelevation Lanes** tool .
2) Locate the superelevation sections. You can do this one of two ways. You can select each section one at a time and then reset or you can zoom out, click and drag from the upper left side of the screen to the bottom right and release. This will select all sections GEOPAK created in the previous process.
3) We will create multiple lanes for each side of the roadway.
   a) Enter the lane name RT-1.



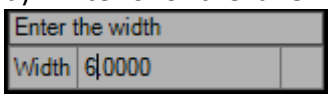
   b) In the drop down, choose Right.



   c) Enter 0 for the offset value.



   d) Enter 6 for the lane width.



f) Enter -2% from the normal cross slope (unless specified otherwise).

Normal Cross Slope	
Normal Cross Slope	-2.0000%

g) Now, we will add a second lane to the right side. Enter the name RT-2.

Enter Lane Name	
Name	RT-2

h) Choose the Right side of the centerline again.

i) For the inside edge offset value we will want to use 6 this time. The first lane you created was a 0' offset from the centerline. This will offset the currently lane 6' from the centerline since our new lane needs to be created after the RT-1.

Enter the offset value for the inside edge	
Inside Edge Offset	6.0000

j) For the lane width, we need to enter 12 since this is a full lane.

Enter the width	
Width	12.0000

k) Enter -2% for the cross slope.

l) Now we need to create our final right lane. Enter RT-3 for the name.

Enter Lane Name	
Name	RT-3

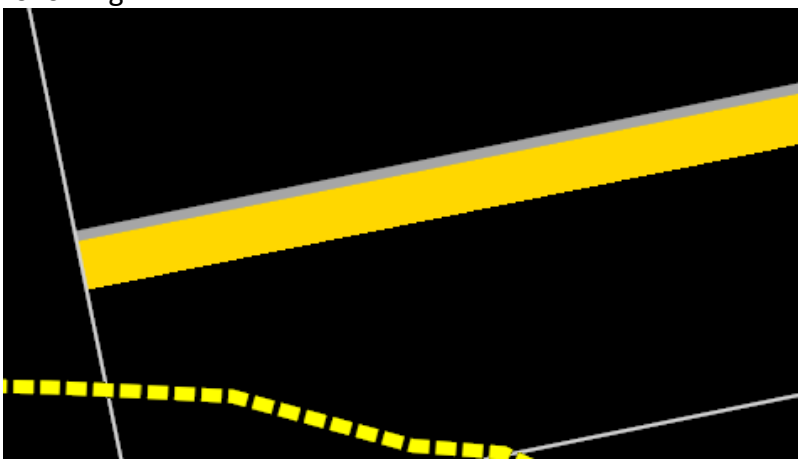
m) Choose the right side of the centerline again.

n) Enter 18 for the offset value. (6+12=18)

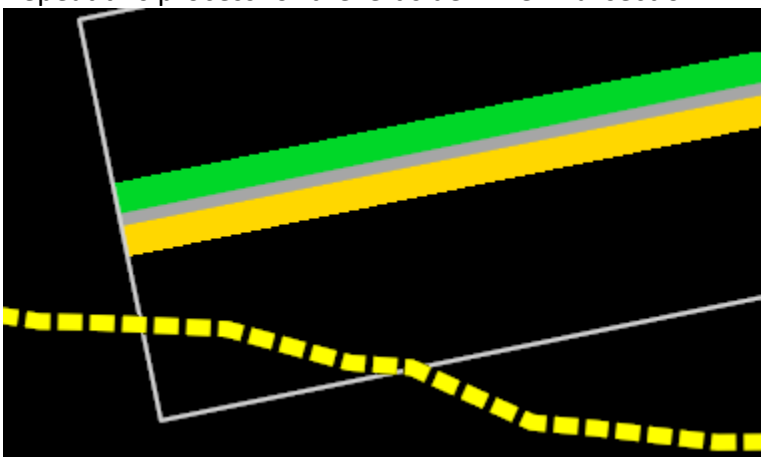
Enter the offset value for the inside edge	
Inside Edge Offset	18.0000

o) Enter 12 for the lane width.

p) Enter -2% for the cross slope. Once completed your final right side should look like the following:

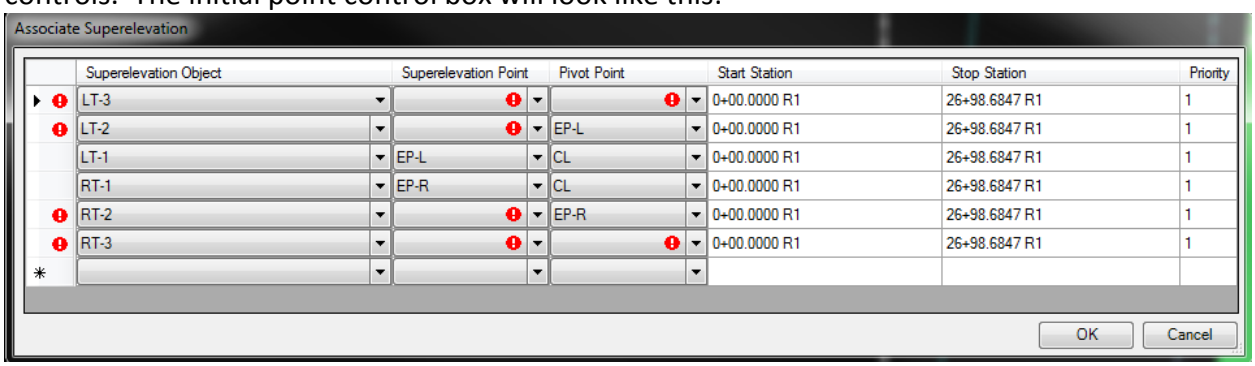


q) Repeat this process for the left side. The final section will look like this:



13.7.2 Assign 5-Lane to Corridor

In order to properly assign super to corridor for a 5-lane section, you must assign the correct point controls. We created 6 lanes, however we will have to delete some of the point controls. The initial point control box will look like this:

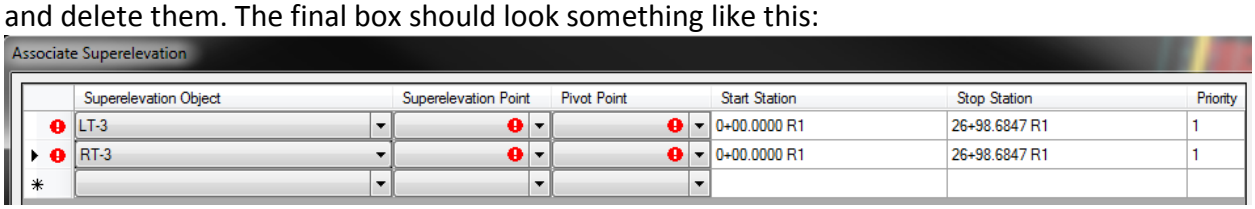


Associate Superelevation

Superelevation Object	Superelevation Point	Pivot Point	Start Station	Stop Station	Priority
LT-3			0+00.0000 R1	26+98.6847 R1	1
LT-2		EP-L	0+00.0000 R1	26+98.6847 R1	1
LT-1	EP-L	CL	0+00.0000 R1	26+98.6847 R1	1
RT-1	EP-R	CL	0+00.0000 R1	26+98.6847 R1	1
RT-2		EP-R	0+00.0000 R1	26+98.6847 R1	1
RT-3			0+00.0000 R1	26+98.6847 R1	1

OK Cancel

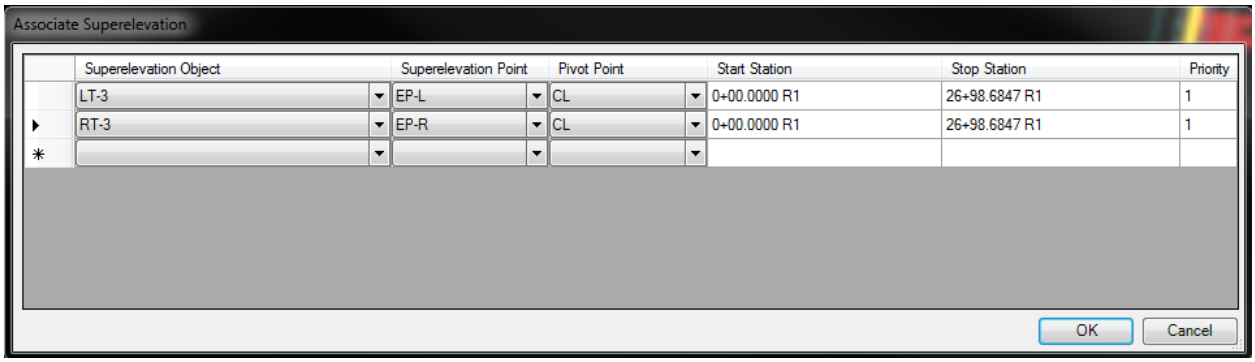
When you get this dialog, you need to delete all of the super elevation objects except for LT-3 and RT-3. You do this by clicking on the far left box where the arrow is. Click on each one and delete them. The final box should look something like this:



Associate Superelevation

Superelevation Object	Superelevation Point	Pivot Point	Start Station	Stop Station	Priority
LT-3			0+00.0000 R1	26+98.6847 R1	1
RT-3			0+00.0000 R1	26+98.6847 R1	1

Now you need to assign the superelevation point and the pivot point. The correct combination is as follows:



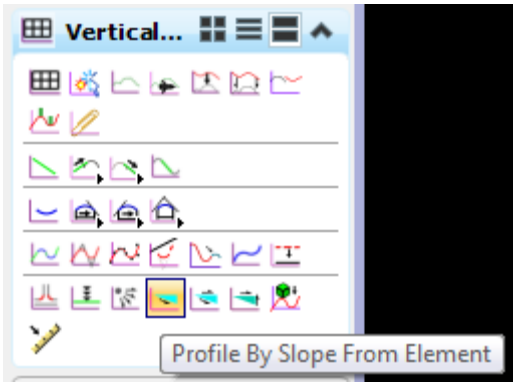
Scroll through the cross sections to make sure the superelevation was applied properly.

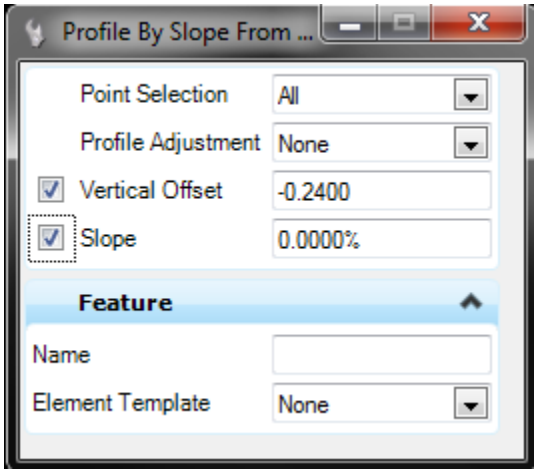
13.8 4-Lane Divided Superelevation with Median Edge Rotation.

The same general steps discussed in the 2-lane example can be followed for 4-Lane superelevation but creation of lanes and the process of assigning superelevation to the corridor is discussed below.

13.8.1 Establishing the EP profile.

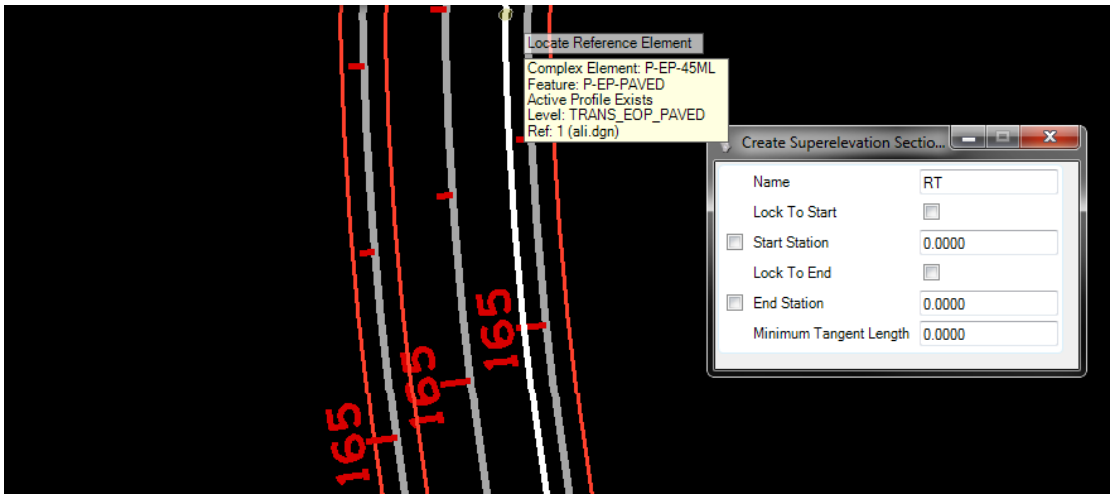
Use the vertical command **Profile By Slope From Element** with a slope of 0% and a vertical offset of -0.24 to create the profile for the median EP's. You'll choose the alignment that is profiled and then the inside EP. Use this process twice for each lane if you have 2 independent profiles. This applies a rule so if the CL profile(s) change, the EP profile also changes.





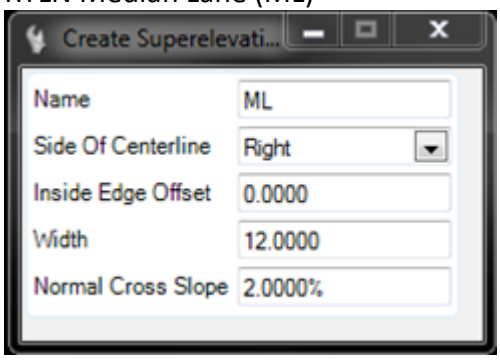
13.8.2 Creating Superelevation Section for RTLNS

RTLN

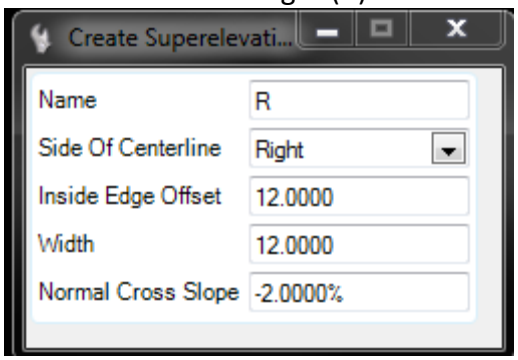


13.8.3 Create Right Lane Superelevation

RTLN Median Lane (ML)

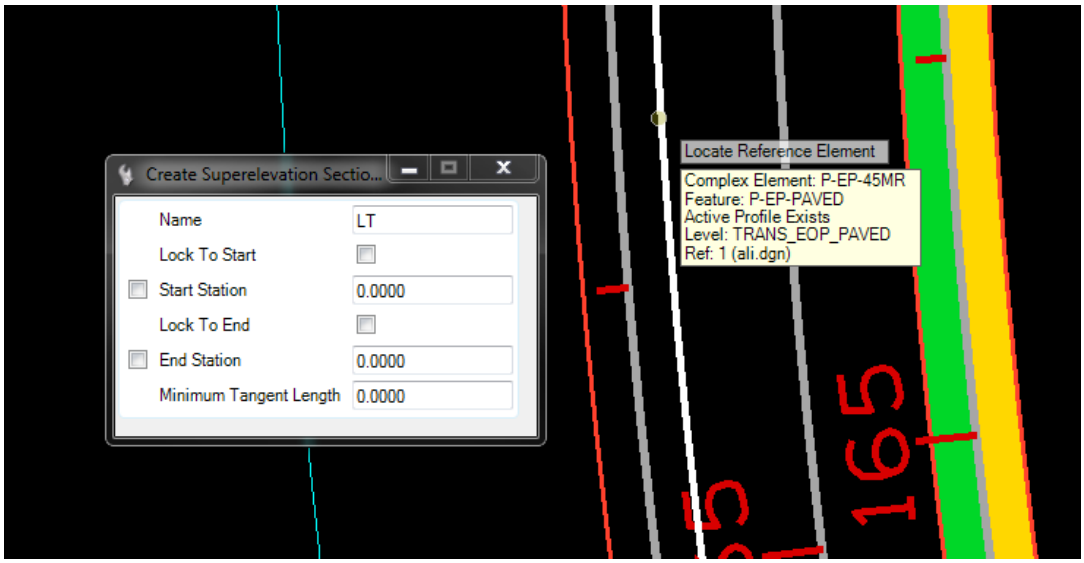


RTLN Outside Lane Right (R)



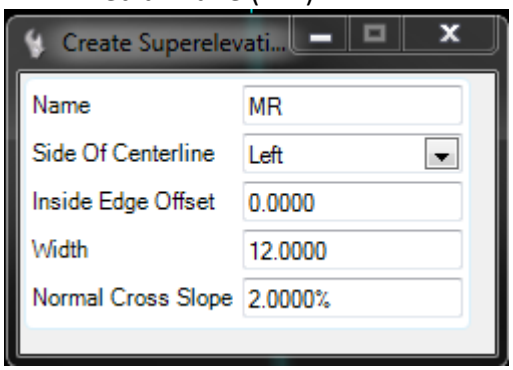
13.8.4 Creating Superelevation Section for Left Lanes

LTLN

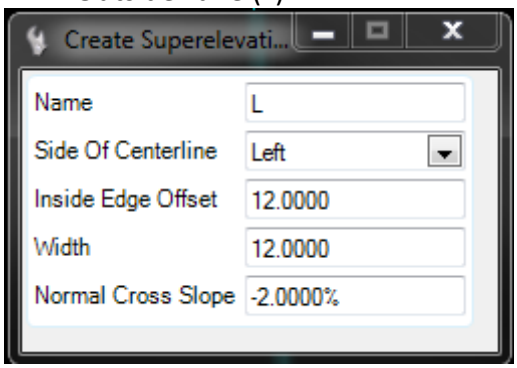


13.8.5 Create LTLN Lanes

LTLN Median Lane (MR)

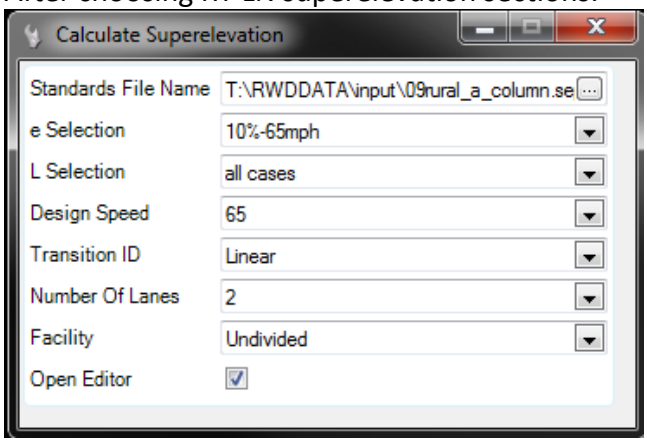


LTLN Outside Lane (L)

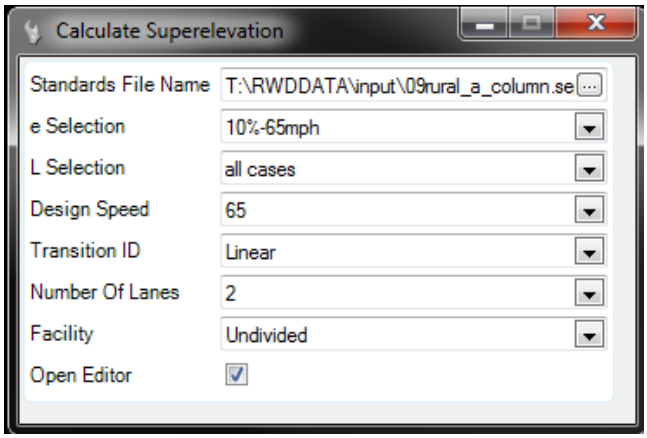


13.8.6 Calculate Super for RTLN's

After choosing RT LN superelevation sections:



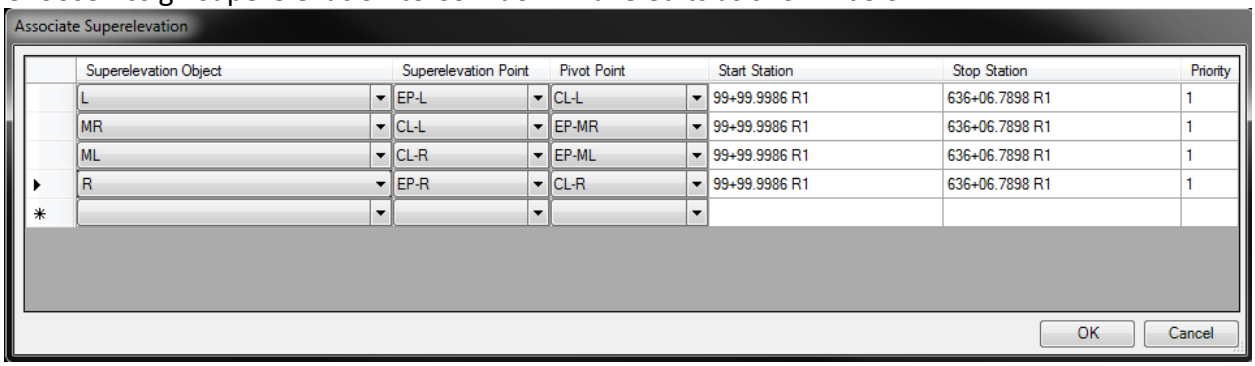
13.8.7 Calculate Super for LTLN's



13.8.8 Assign Superelevation to Corridor

Enter the DGN file that contains your Corridor, reference the superelevation DGN file, and select the superelevation Sections.

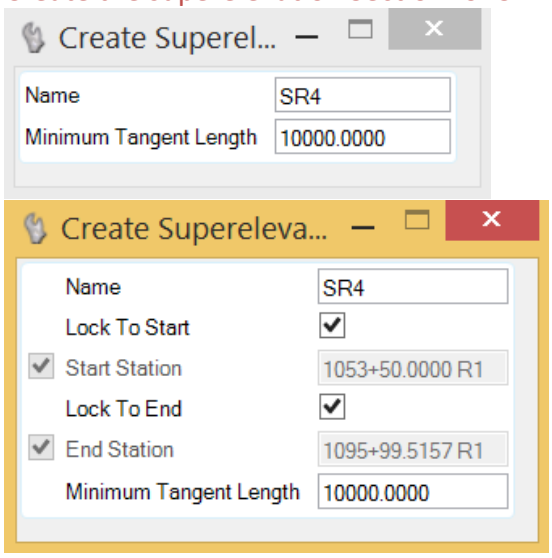
Choose Assign superelevation to Corridor. Make edits as shown below.



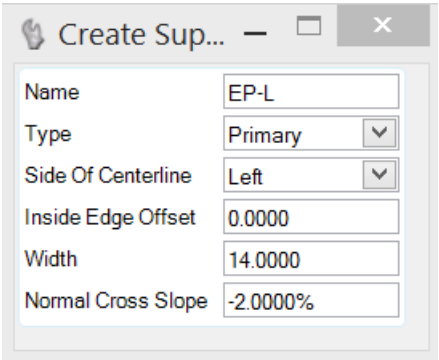
Superelevation Object	Superelevation Point	Pivot Point	Start Station	Stop Station	Priority
L	EP-L	CL-L	99+99.9986 R1	636+06.7898 R1	1
MR	CL-L	EP-MR	99+99.9986 R1	636+06.7898 R1	1
ML	CL-R	EP-ML	99+99.9986 R1	636+06.7898 R1	1
R	EP-R	CL-R	99+99.9986 R1	636+06.7898 R1	1

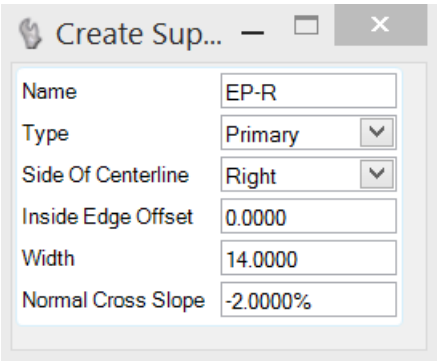
LAB VIII: Superelevation

1. Create the file RWD-SUPER-001.DGN (Use 2d Seed file).
2. Calculate and Create superelevation for ML_SR4 and LR_Tuck.
   SR4 Steps:
   a. Create the superelevation Section for SR4.

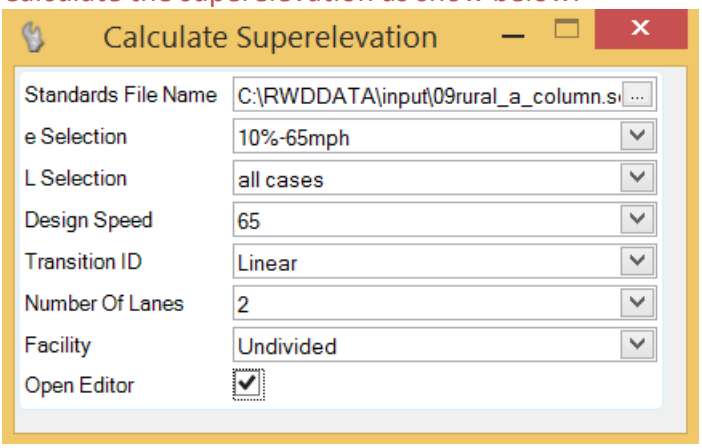


b. Create the lanes.





c. Calculate the superelevation as show below.



Results:

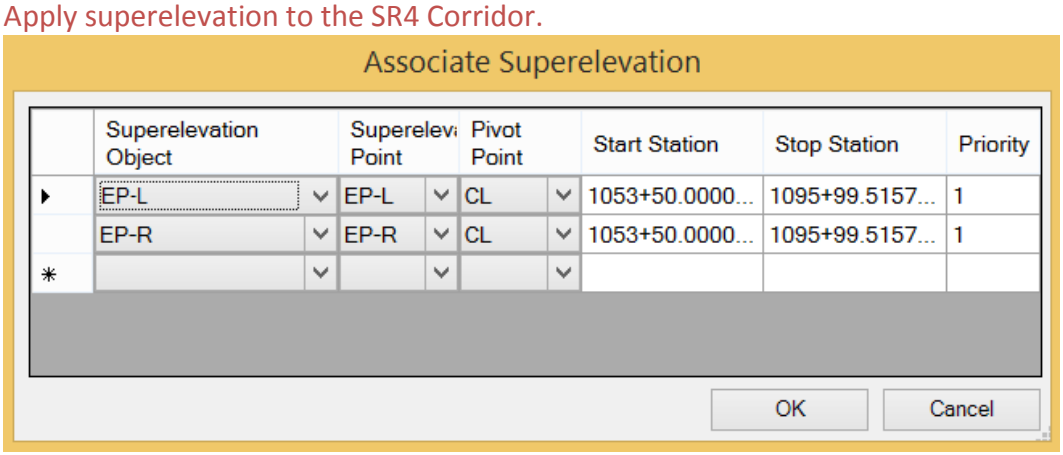
Superelevation: EP-L

Station	Cross Slope	Point Type	Transition Type
105+350.0000 R1	-2.0000%	Normal Crown	
105+804.5615 R1	-2.0000%	Normal Crown In	Linear
105+904.5615 R1	0.0000%	Level Crown In	Linear
105+960.4439 R1	2.0000%	Reverse Crown In	Linear
106+094.5615 R1	6.8000%	Full Super In	Linear
107+342.4597 R1	6.8000%	Full Super Out	Linear
107+476.5773 R1	2.0000%	Reverse Crown Out	Linear
107+532.4597 R1	0.0000%	Level Crown Out	Linear
107+632.4597 R1	-2.0000%	Normal Crown Out	Linear
108+253.0049 R1	-2.0000%	Normal Crown In	Linear
108+470.2906 R1	-9.8000%	Full Super In	Linear
108+923.0254 R1	-9.8000%	Full Super Out	Linear
109+140.3111 R1	-2.0000%	Normal Crown Out	Linear
109+599.5157 R1	-2.0000%	Normal Crown	Linear

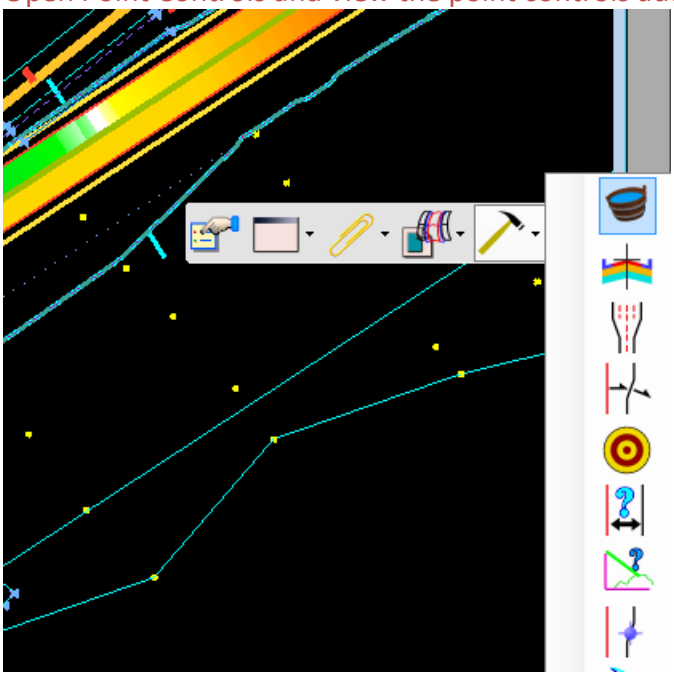
Superelevation: EP-R

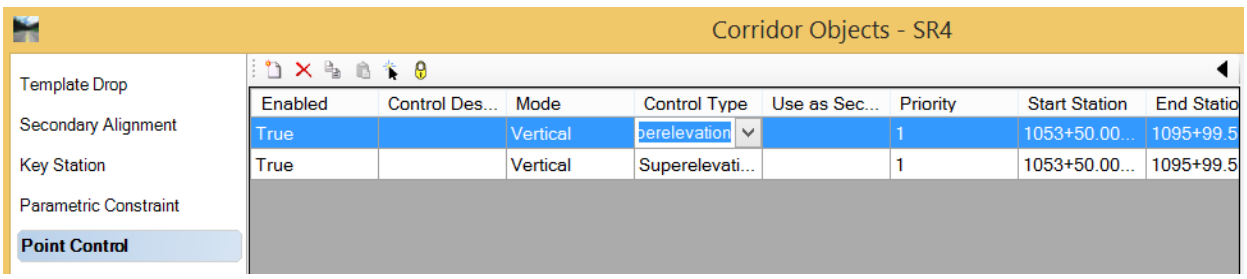
Station	Cross Slope	Point Type	Transition Type
105+350.0000 R1	-2.0000%	Normal Crown	
105+960.4439 R1	-2.0000%	Normal Crown In	Linear
106+094.5615 R1	-6.8000%	Full Super In	Linear
107+342.4597 R1	-6.8000%	Full Super Out	Linear
107+476.5773 R1	-2.0000%	Normal Crown Out	Linear
108+097.2906 R1	-2.0000%	Normal Crown In	Linear
108+197.2906 R1	0.0000%	Level Crown In	Linear
108+253.0049 R1	2.0000%	Reverse Crown In	Linear
108+470.2906 R1	9.8000%	Full Super In	Linear
108+923.0254 R1	9.8000%	Full Super Out	Linear
109+140.3111 R1	2.0000%	Reverse Crown Out	Linear
109+196.0254 R1	0.0000%	Level Crown Out	Linear
109+296.0254 R1	-2.0000%	Normal Crown Out	Linear
109+599.5157 R1	-2.0000%	Normal Crown	Linear

3. Enter the Corridor DGN file and reference RWD-SUPER-001.DGN
4. Apply superelevation to the SR4 Corridor.



5. Open Point Controls and view the point controls added.

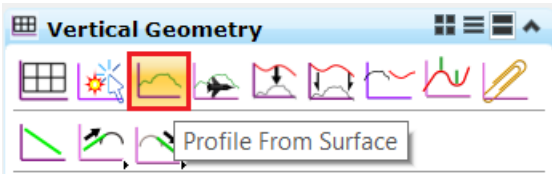




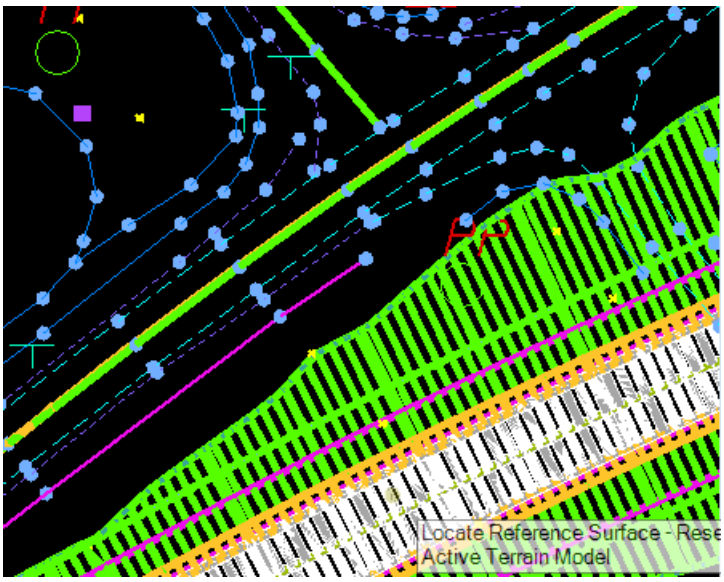
6. Open the file RWD-ALI-001.DGN
7. Reference the RWD-COR-001.DGN (Default-3d to the Alignment DGN files Default-3d model).
8. Open the profile view for alignment LR_Tuck.
9. Got to Properties from the context menu of the LRTUCK existing profile and name the profile XPLRTUCK.

10. In the Default view, choose the alignment command **Profile from Surface** choosing LR_Tuck as the element to profile and the pavement mesh of ML_SR4.

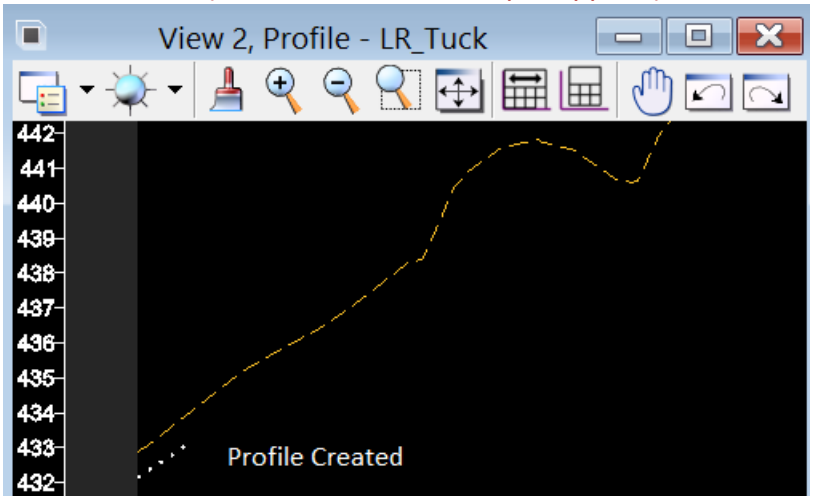
Command:



Pavement Mesh to choose as Reference Surface



Profile Created (SR4 Pavement with Super applied)



11. Choose the LR_Tuck profile view to display the Pavement of ML_SR4.

12. Create the following profile using Vertical Geometry commands and Civil AccuDraw.
    VPI S 10+13.9997 EL. 433.0886 GRADE 6.8000% (Tangent to SR4 Pavement)
    VPI S 11+50 EL. 438.9366 L 100
    VPI S 12+50 EL. 442.6183 L 100
    VPI S 13+59.5191 EL. 444.3575 (Tie to existing ground at End of Profile)

13. Name this profile PPLRTUCK.
14. Set this profile Active.
15. Export these to Profiles to the GPK.

14. CIVIL CELLS

14.1 Section Overview

Civil Cells are pre-built cells placed through GEOPAK's **Place Civil Cell** command. There are 2D and 3D cells available. 3D cells are used to place 3D geometry in areas that are not handled with template runs such as intersections, median cross-overs, bridge spill-throughs, etc. The cells do have quite a few construction elements in them that were used to build the cells. These will not plot and can be ignored unless there is a need to make edits to them.

The general procedure to place and then the overview of placement steps for each type of **Civil Cell** is discussed below.

14.2 Section Prerequisites

- MicroStation Fundamentals
- Basic superelevation knowledge
- Horizontal and Vertical Geometry

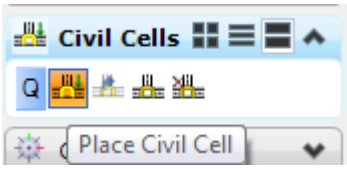
14.3 Section Objectives

Ater completing this section, you will be able to:

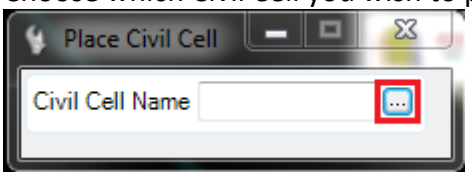
1) Place MDOT's Civil Cells.
2) Modify the Civil Cells vertical geometry to meet project and geomerty specific requirements.

14.4 General Procedure

1) Choose the **Place Cell** command.



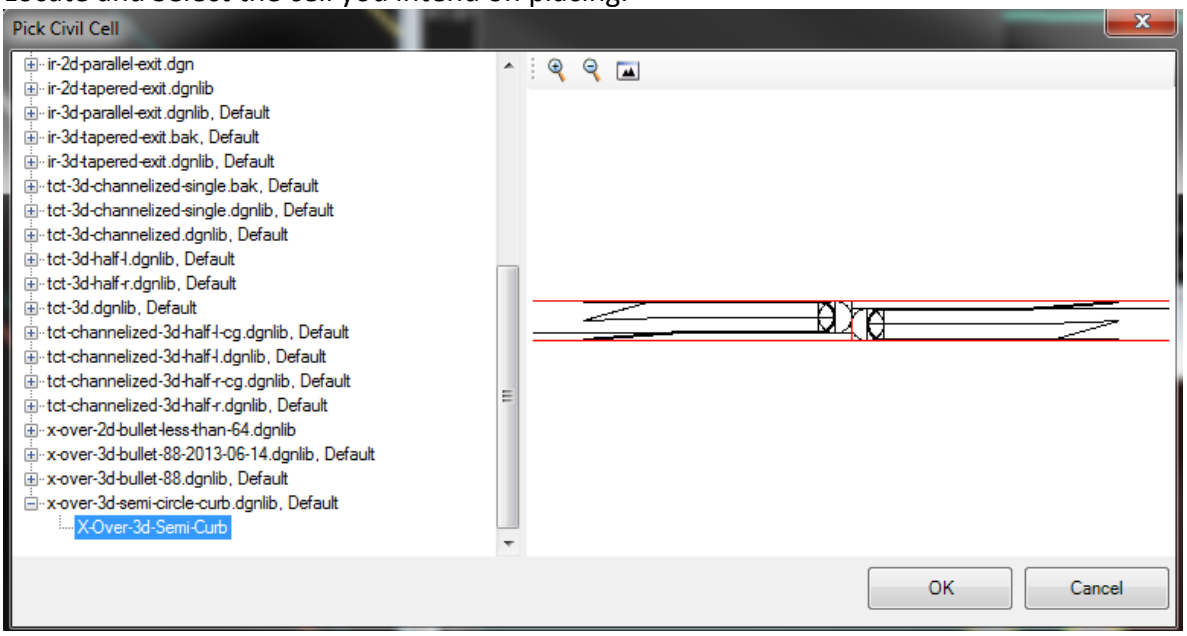
2) Choose which Civil Cell you wish to place by choosing the select button below.



Note:

- If the button above cannot be selected, reset outside the dialog to activate it.

3) Locate and Select the cell you intend on placing.



Note:

- Each cell will prompt you to identify certain elements to let the software know where you want to place the cell. 3d cells will require selection of elements that have been profile in most cases. Specifics of pre-requisite elements needed are discussed for each cell type below.

4) Edit the cell with **Point Controls, Parametric Constraints,** etc. as needed to match your project.
5) Add **External References** to the ML and local road corridors to drop the shoulder and template end conditions through these cells.

14.5 Intersections

Intersections cells have to be placed per quadrant. There are two cells created for each type (*-l and *-r). They are placed for a right or left quadrant based on standing on the ML roadway and looking at the local road.

Notes:

- Adjustments can be made if you don't need a taper on one or both ends of the quadrant.
- **Parametric Constraints** are pre-populated in the cell.
- The **Urban Cells** contain Type 3a curb and gutter and have curb and gutter along the tapers; the rural, Type 2.

14.5.1 Cells

- int-c-3d-channelized-single.dgnlib, Default
- int-c-3d-half-l-Rural.dgnlib, Default
- int-c-3d-half-l-Urban.dgnlib, Default
- int-c-3d-half-r-Rural.dgnlib, Default
- int-c-3d-half-r-Urban.dgnlib, Default
- int-tct-3d-channelized-half-l-Rural.dgnlib, Default
- int-tct-3d-channelized-half-l-Urban.dgnlib, Default
- int-tct-3d-channelized-half-r-Rural.dgnlib, Default
- int-tct-3d-channelized-half-r-Urban.dgnlib, Default
- int-tct-3d-channelized-single-Rural.dgnlib, Default
- int-tct-3d-half-l-Rural.dgnlib, Default
- int-tct-3d-half-r-Rural.dgnlib, Default

Notes:

- Rural is Type 2 curb and gutter
- Urban is Type 3a
- INT-C = Simple arc, no tapers
- INT-TCT = Arc with tapers.
- *single* = Single island.

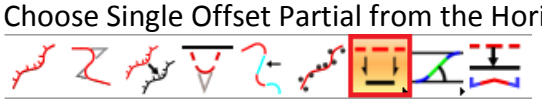
14.5.2 Pre-Requisites

1) Element representing ML EP with profile through the intersection area extending 300-400' either side of the intersection.
2) Local road CL has profile and extends at least 225' from the mainline EP for INT-TCT* cells. Intersections with no tapers (INT-C* cells) need to extend 125' from the mainline EP.

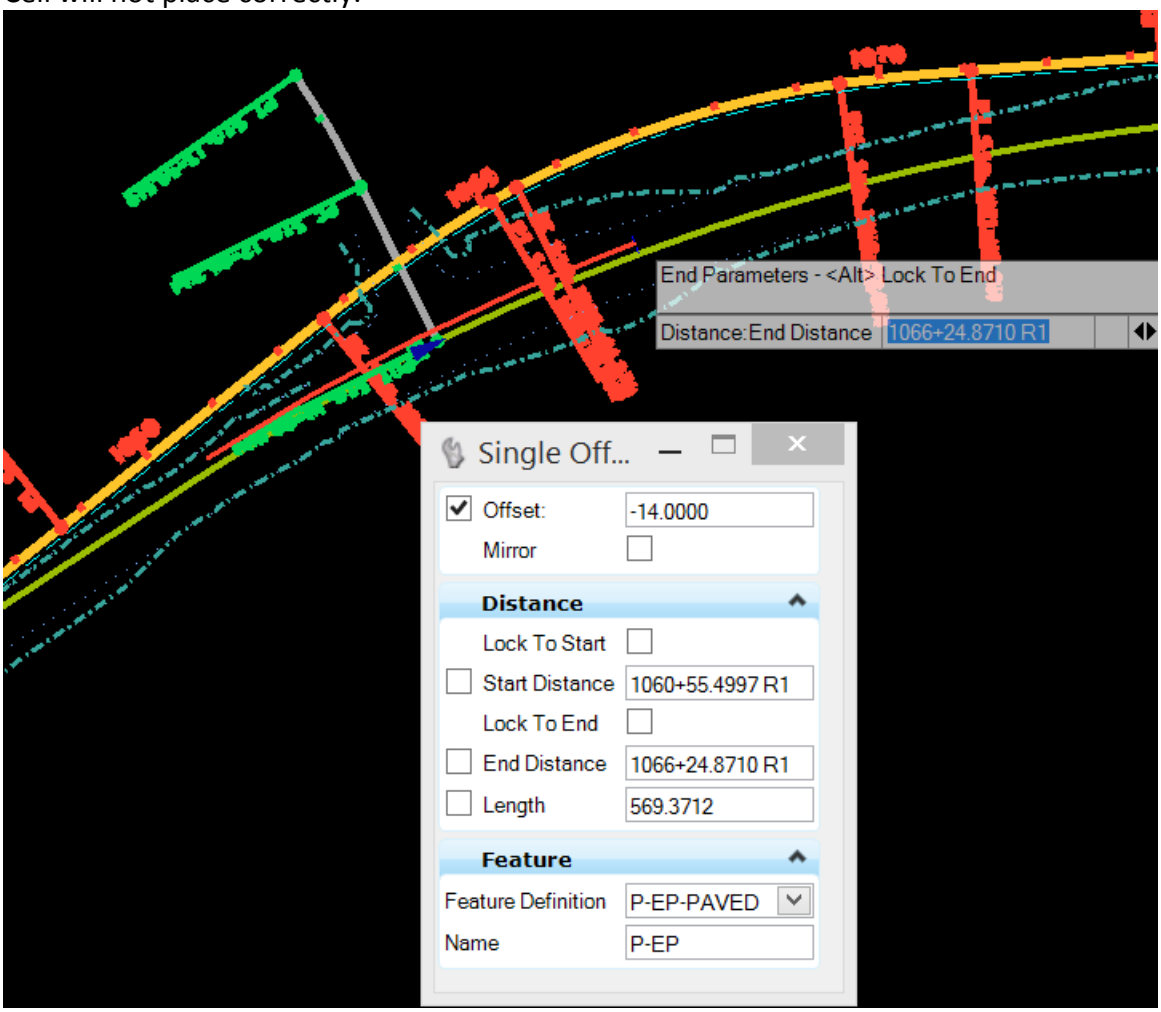
14.5.3 Creating the ML EP profile

The steps to create the partial edge of pavement (ML EP) is shown below.

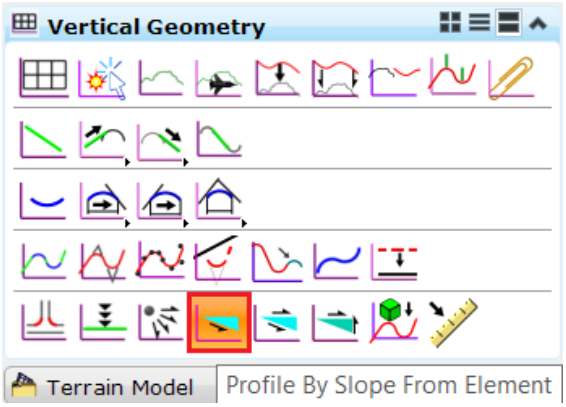
1) Choose Single Offset Partial from the Horizontal Geometry menu.



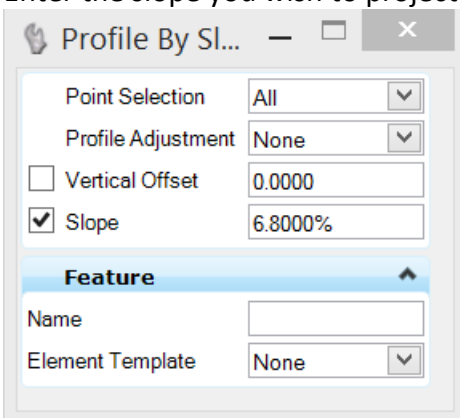
2) Create this partial element from the ML CL at the edge of pavement offset and extending 300-400' either side of the intersection. If this element is too short, the Civil Cell will not place correctly.



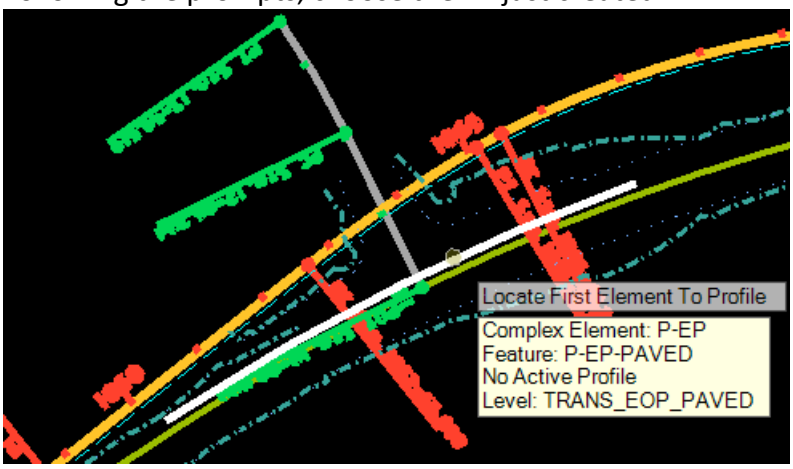
3) Choose the **Profile By Slope From Element** command from the **Vertical Geometry** menu.



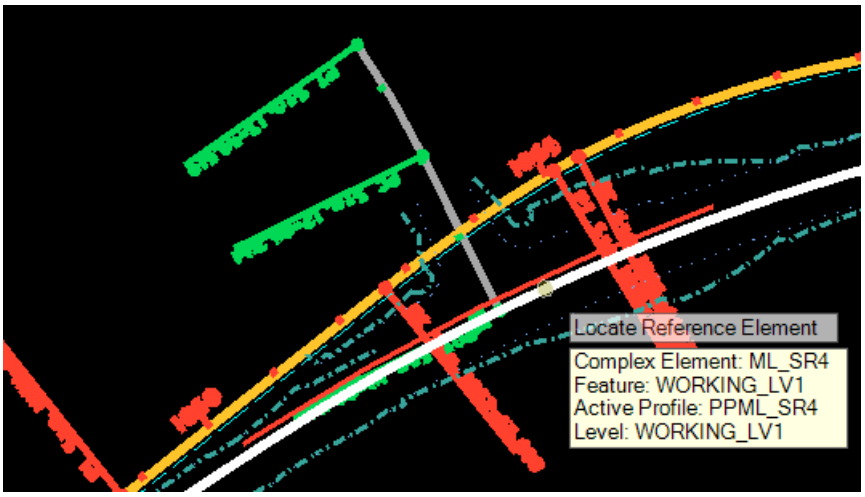
4) Enter the slope you wish to project as shown below.



5) Following the prompts, choose the EP just created.



6) Reset and then locate the reference element which is the ML CL.

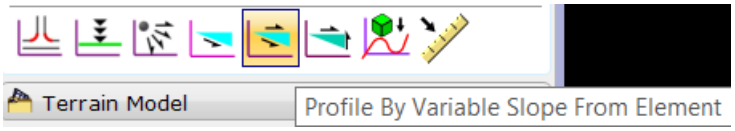


7) Enter the slope to project and follow the remaining prompts to profile the element representing the EP.

8) Open the profile view to make sure the profile was created and it is active.

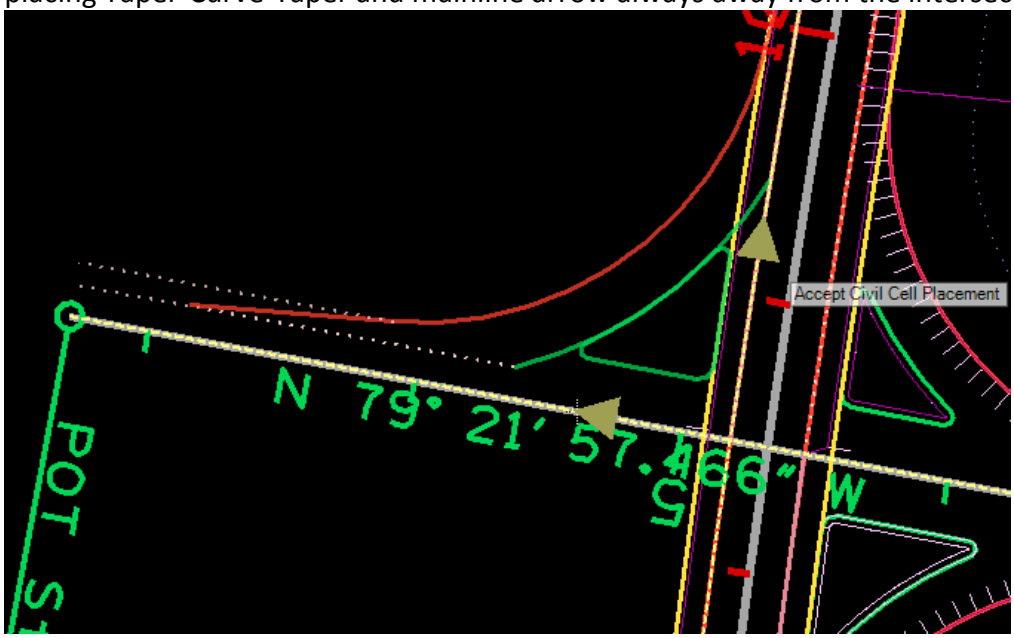
Note:

- If superelevation is in transition, you need to use the **Profile By Variable slope to Element.**



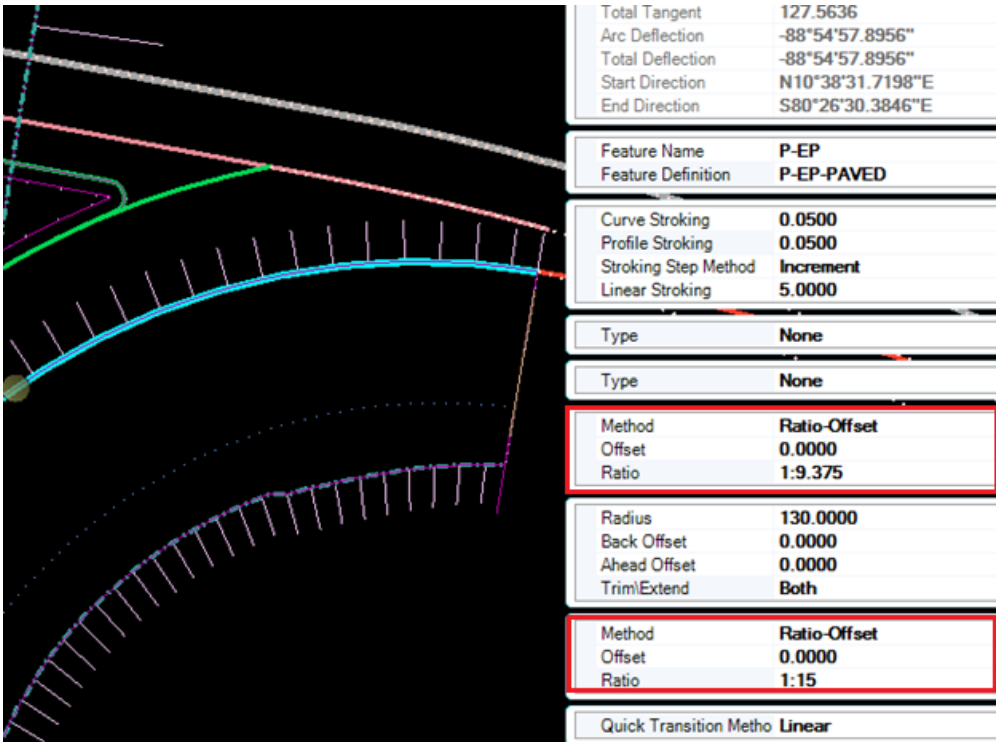
14.5.4 Cell Placement

Arrow's for Left Placement: Local road arrow always towards intersection side you are placing Taper-Curve-Taper and mainline arrow always away from the intersection.

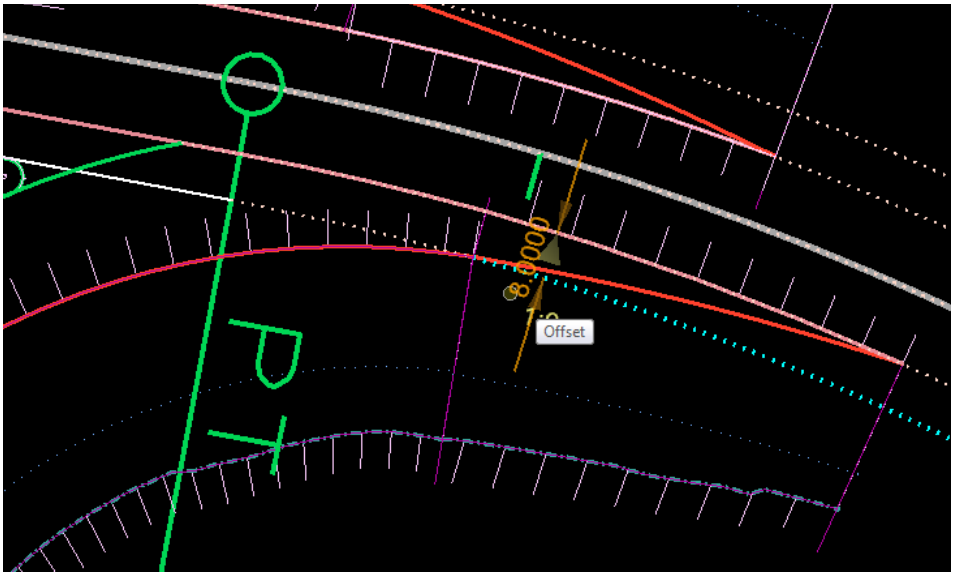


14.5.5 Editing

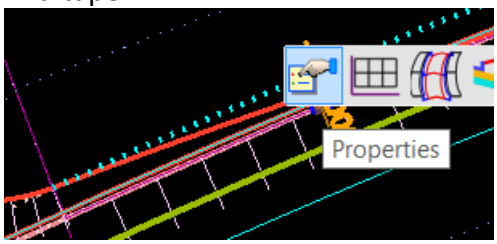
1) Edit the curves to adjust radii.
2) If taper geometry is edited, also edit the ahead and back tangent ratio's of the arc. If taper is not needed, change the **Ratio-Offset** method to **None** for the appropriate tapers and curve.



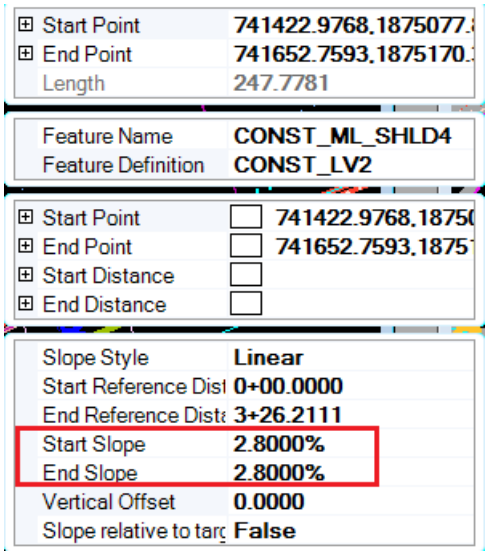
3) Offsets can be edited by selecting one of the parallel construction elements as shown below.



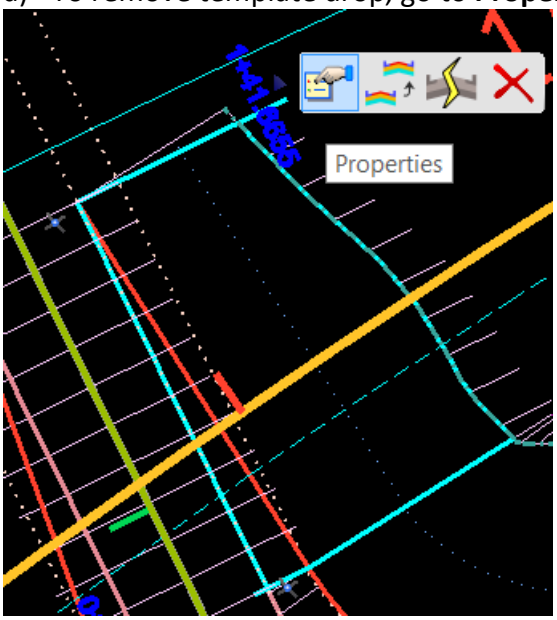
4) EP vertical has been established based on a normal crown ML and LR. EP profiles will need to be adjusted to match ML and LR Super. You can choose **Properties** of parallel construction elements to control slope at PC or PT by editing the **Project Variable Slope** variables.
   a) Choose **Properties** from the parallel construction element that ties into the **Begin** or **End** taper.

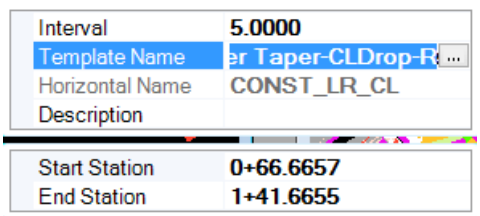


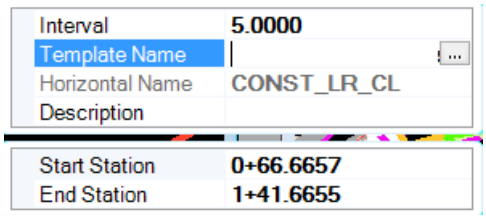
   b) In the example below, the dialog originally had -2.0% and was changed to +2.8% because the curve was in 6.8% super and with a maximum of 4% rollover, 6.8-4 = 2.8%



5) Tapers – Placed as corridors, super can be applied, or template drop can be removed if no taper is needed.
   a) To remove template drop, go to **Properties** of the template and clear the template.

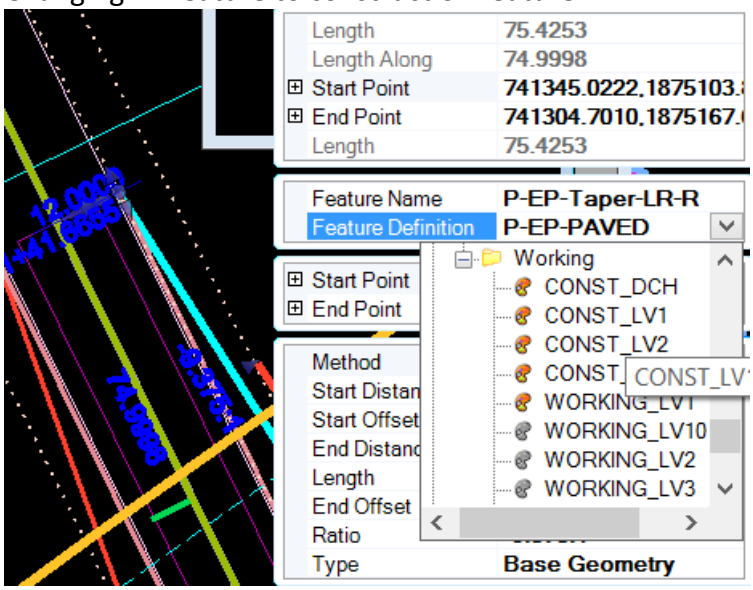




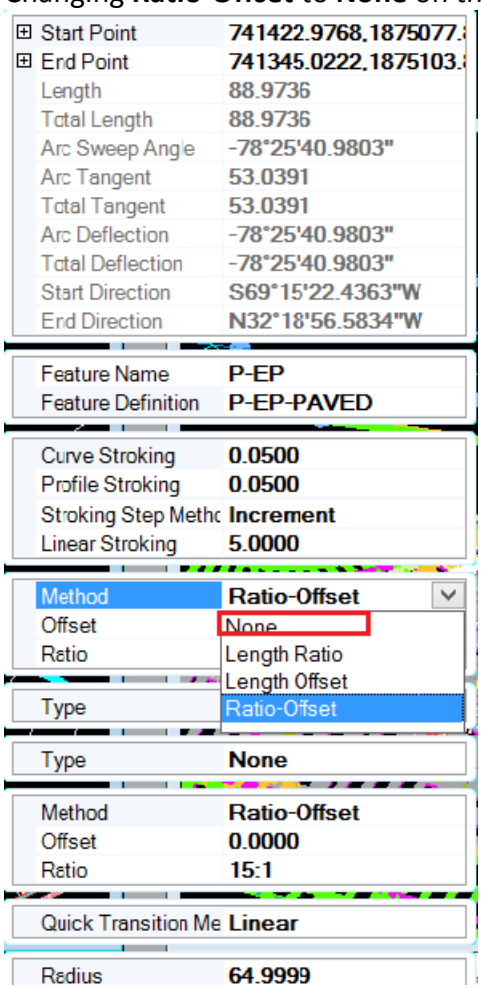


   c) If no tapers, change the **Properties** of it to a CONST_* level and as mentioned earlier, change the **Ratio-Offset** method to **None** for the appropriate tapers and curve.

Changing EP feature to construction feature:

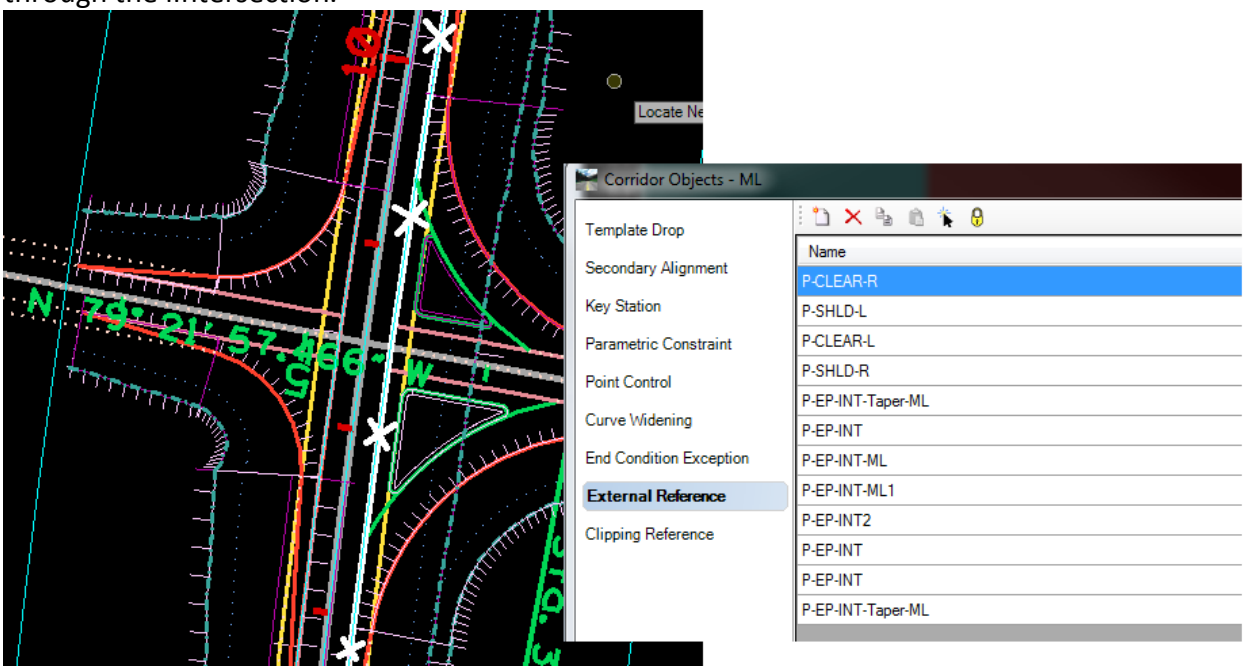


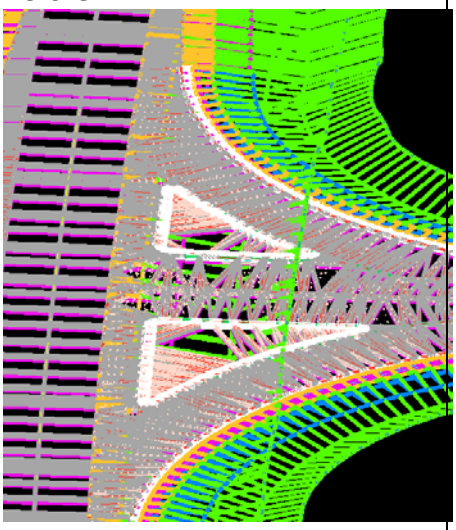
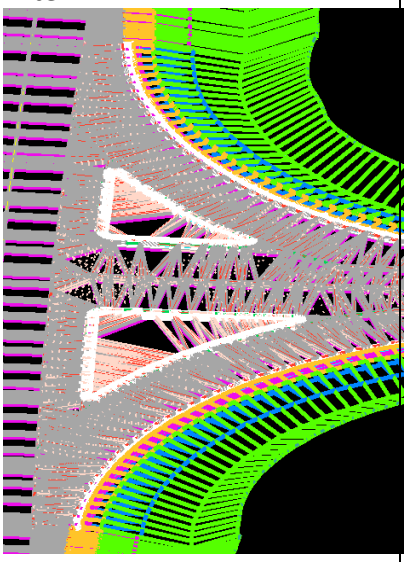
Changing **Ratio-Offset** to **None** on the arc for the taper side that was removed.



6) Curve Point Control – Will need to be added to arcs to CL point to project to the proposed pavement terrain to obtain correct shoulder rotation.

7) Add P-EP-INT to the ML and LR Corridors to drop the ML and Taper end conditions through the iIntersection.



Before	After
	

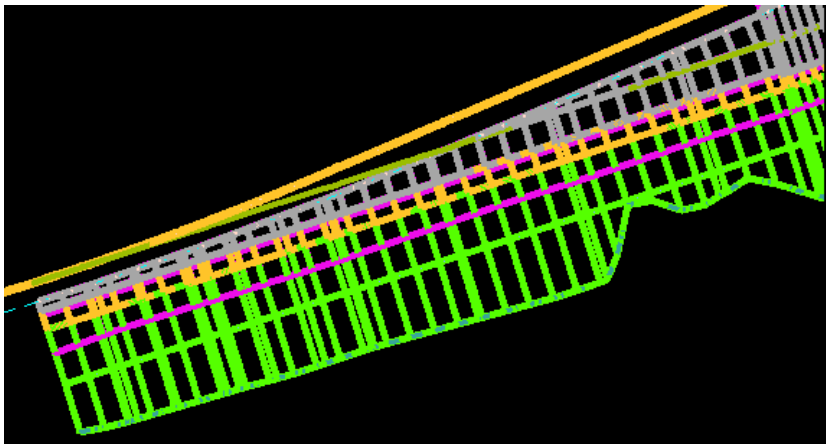
14.6 Detourand Realignment Takeoff

14.6.1 Cells

detour-takeoff-3d-LT-1lane.dgnlib, Default
detour-takeoff-3d-LT.dgnlib, Default
detour-takeoff-3d-RT-1lane.dgnlib, Default
detour-takeoff-3d-RT.dgnlib, Default

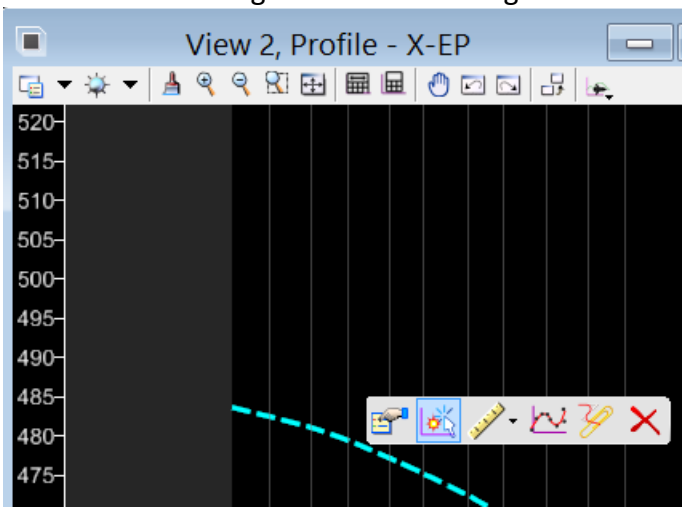
realignment-takeoff-3d-LT.dgnlib, Default
realignment-takeoff-3d-RT.dgnlib, Default

The only difference between the detour and realignment takeoff cells is the templates used in the cells have different shoulder widths and end conditions. Steps below discuss the detour takeoff cells but the same information applies to the realignment takeoff cells. The cell:



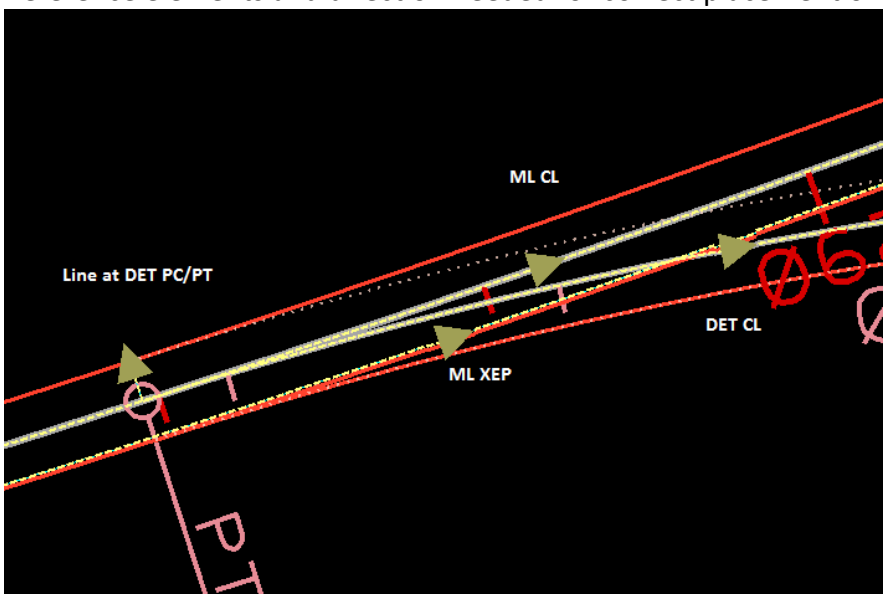
14.6.2 Detour process

1) Store horizontal alignments for both ML and DET.
2) Profile from existing terrain the ML alignment and **Make Active** the exising profile unless you have a grade already set.
3) Complex ML existing EP on detour side for about 400’ from ML and DET intersection.
4) Profile from existing terrain the existing EP and **Make Active** the existing profile.

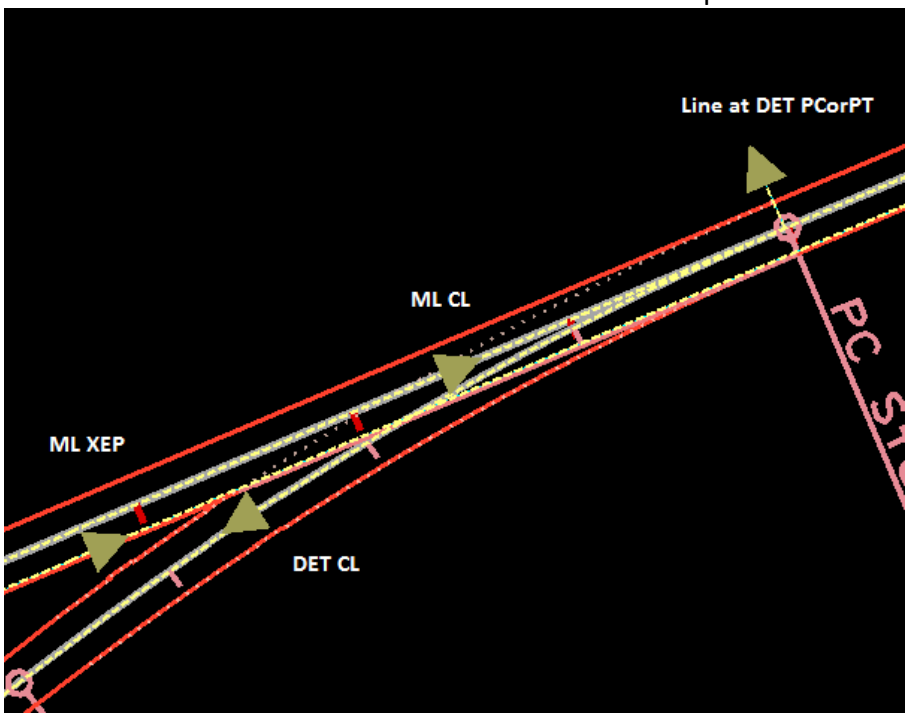


5) Place a short line perpendicular to the ML at PC or PT of detour (where it intersects ML).
6) Place the Detour-Takeoff-RT-3d or Detour-Takeoff-LT-3d. Use the appropriate one based on a perspective of standing on the ML outside the Detour (Is the detour left or right of the ML).
7) Use **Profile from Surface** to generate kick-off grades for the detour profile. Choose the existing terrain and the asphalt surface placed with the cells.
8) Create the entire profile of the detour.
9) You would then drop the detour corridor.

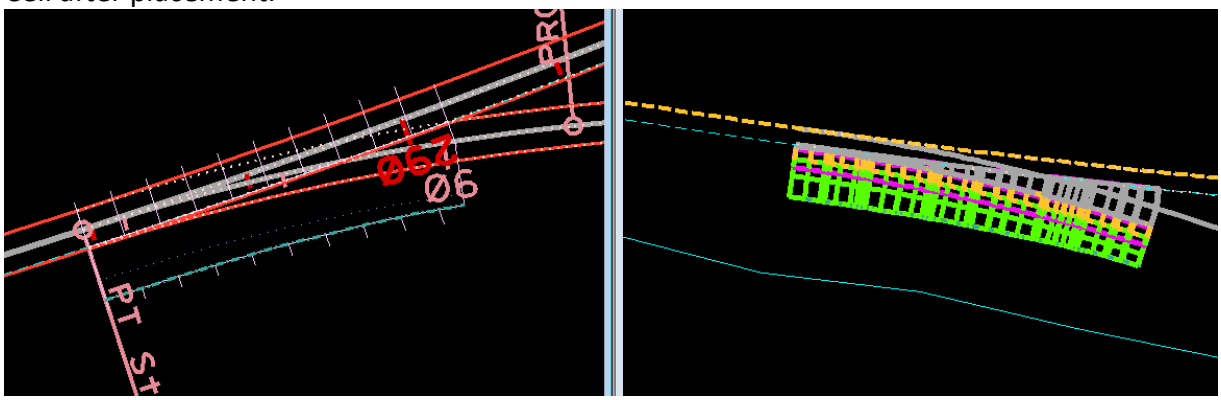
Reference elements and direction needed for correct placement of Detour-Takeoff-RT-3d:



Reference elements and direction needed for correct placement of Detour-Takeoff-LT-3d:



Cell after placement.



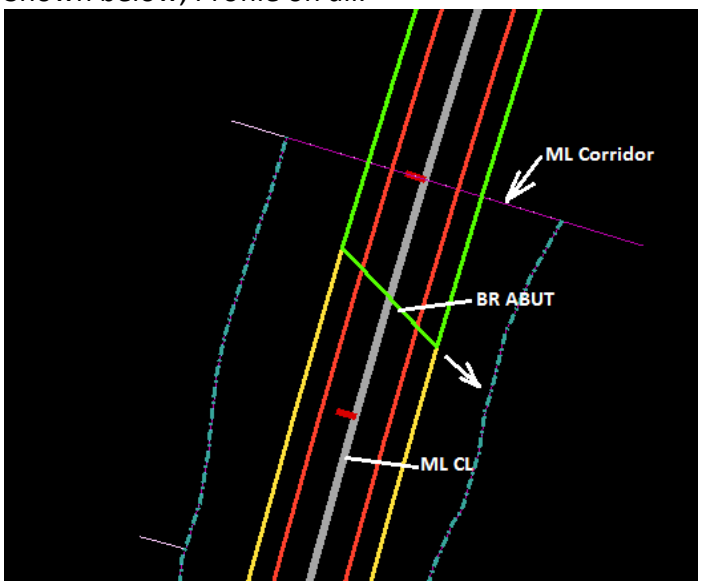
14.7 Guardrail and Bridge Spill Thrus

14.7.1 Guardrail cells process

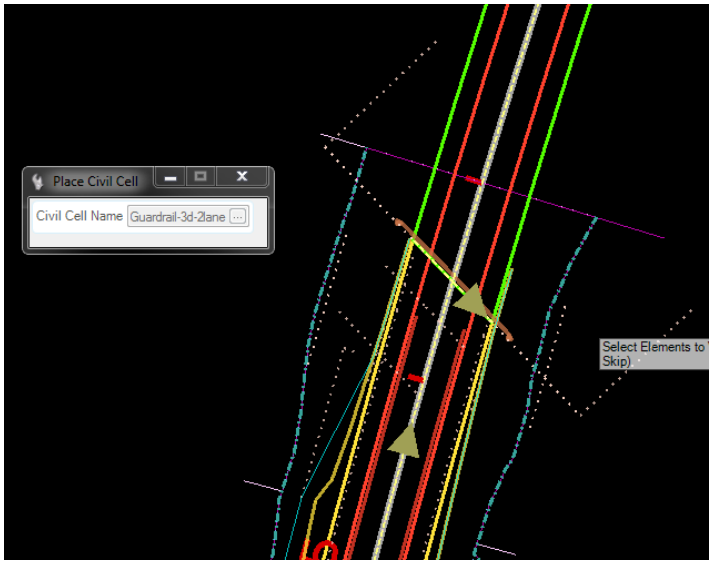
1) Extend ML corridor 50-75’ past bridge abutment.
2) Place a horizontal element which represents the bridge abutment (BR ABUT below) left to right looking at the bridge from the guardrail side. Use **Civil AccuDraw** and place this at a Station Offset so that it can be easily moved later.
3) Profile the bridge abutment from pavement surface (From ML corridor).
4) Extend each end of profile to width of bridge and store profile as complex.
5) Place the cell.

14.7.2 Pre-Requisites

Shown below, Profile on all.

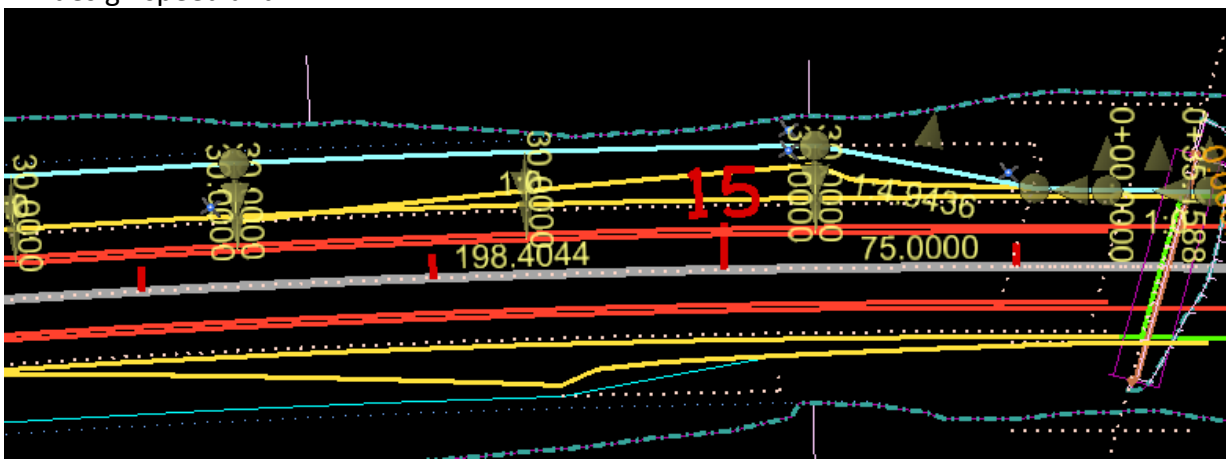


Direction of Arrows needed.

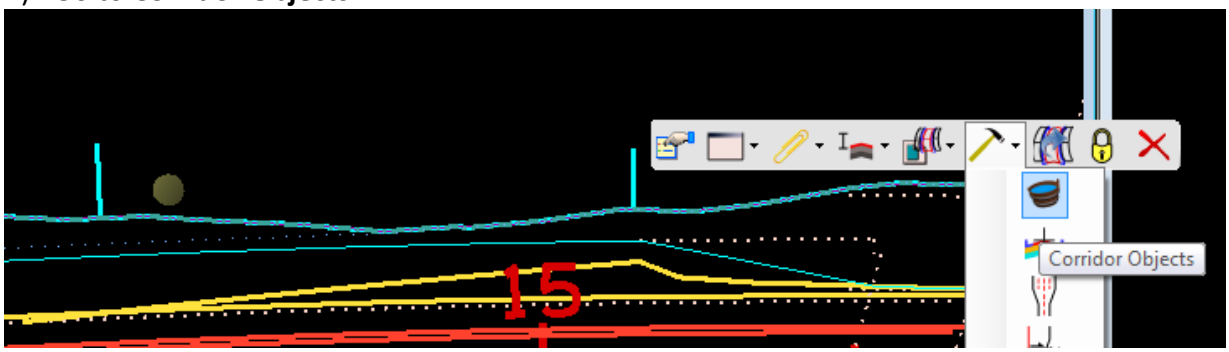


14.7.3 Editing

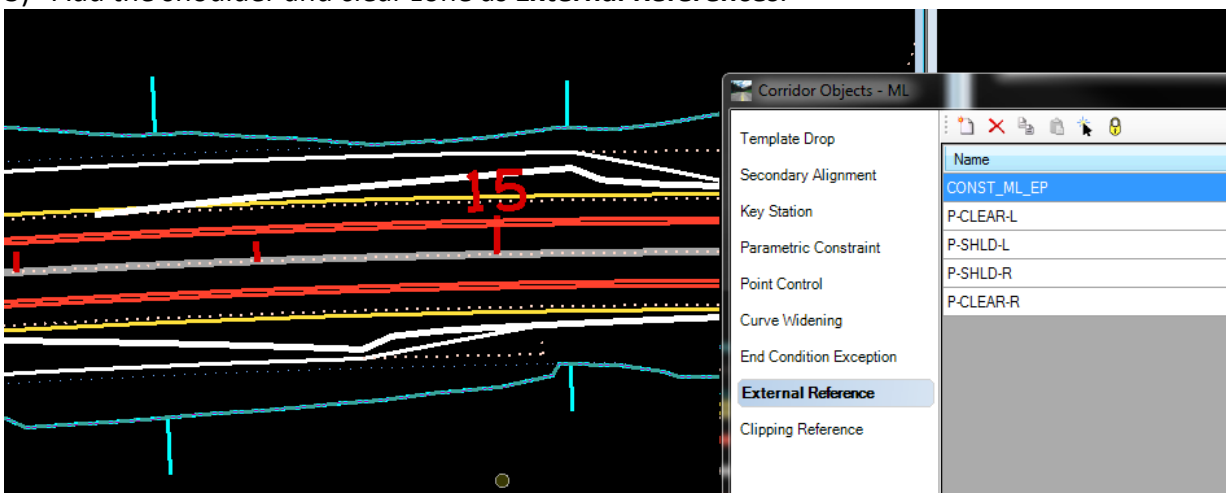
1) Make any adjustments to guardrail, shoulder, and clear zone needed based on your design speed and ADT.



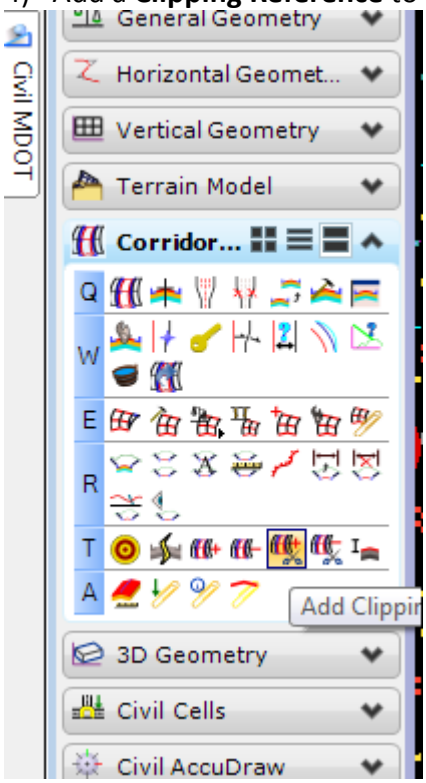
2) Go to **Corridor Objects**.

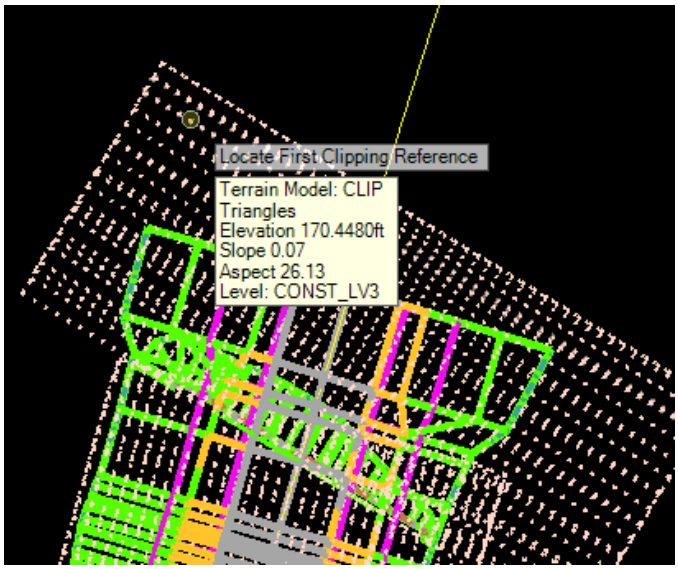


3) Add the shoulder and clear zone as **External References**.

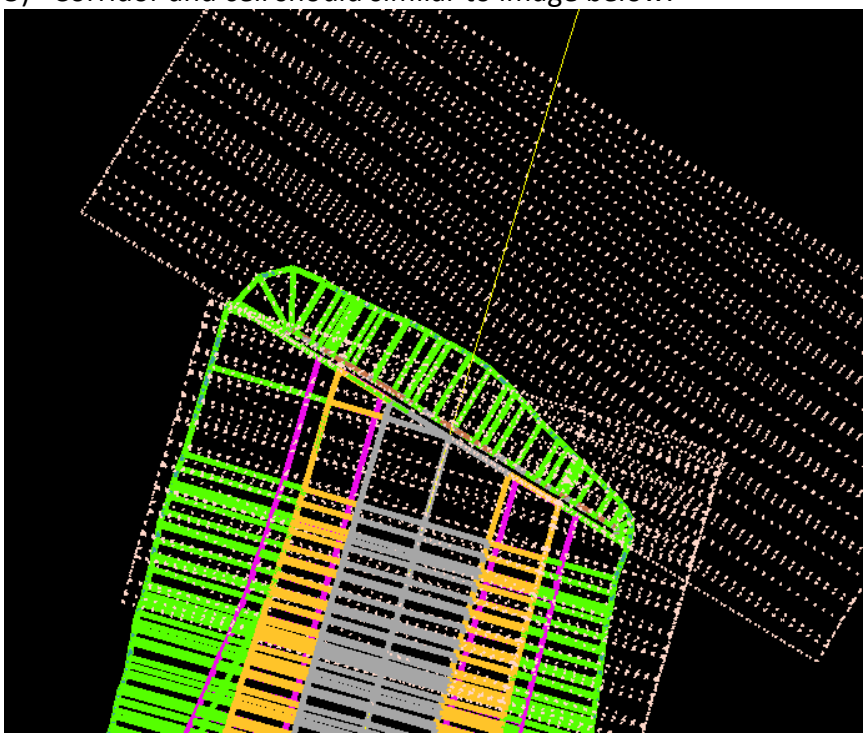


4) Add a **Clipping Reference** to the corridor.

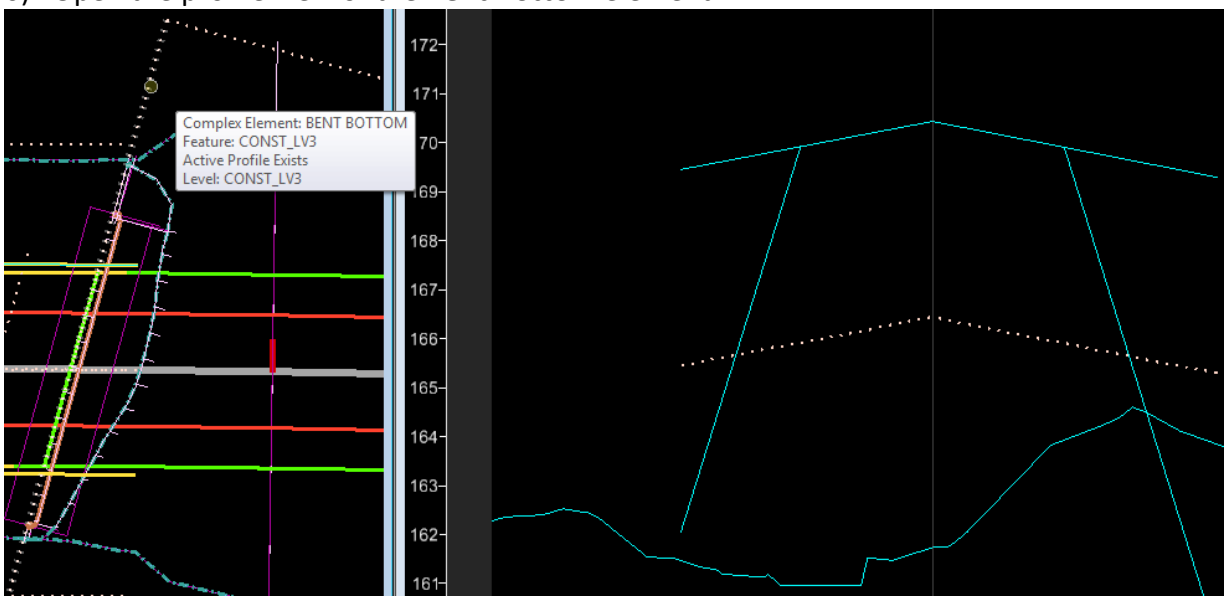




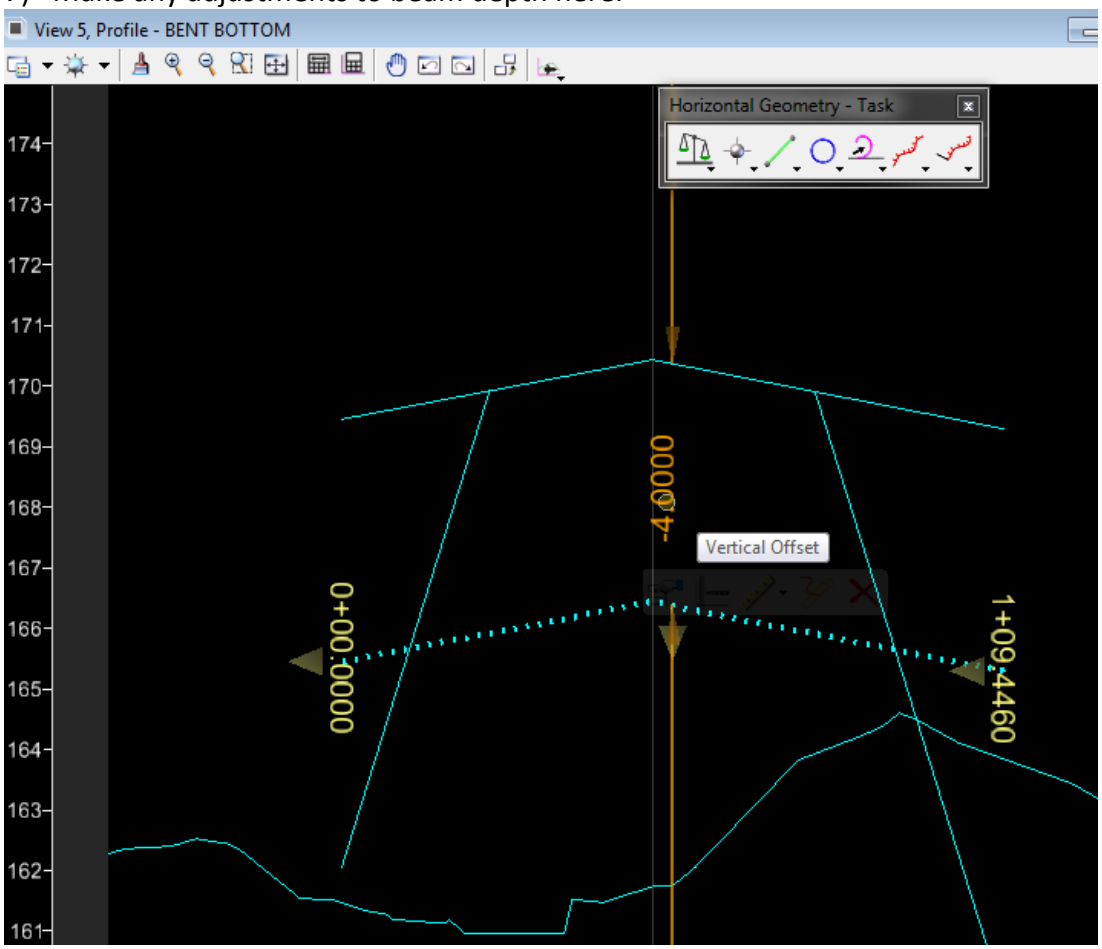
5) Corridor and cell should similar to image below.



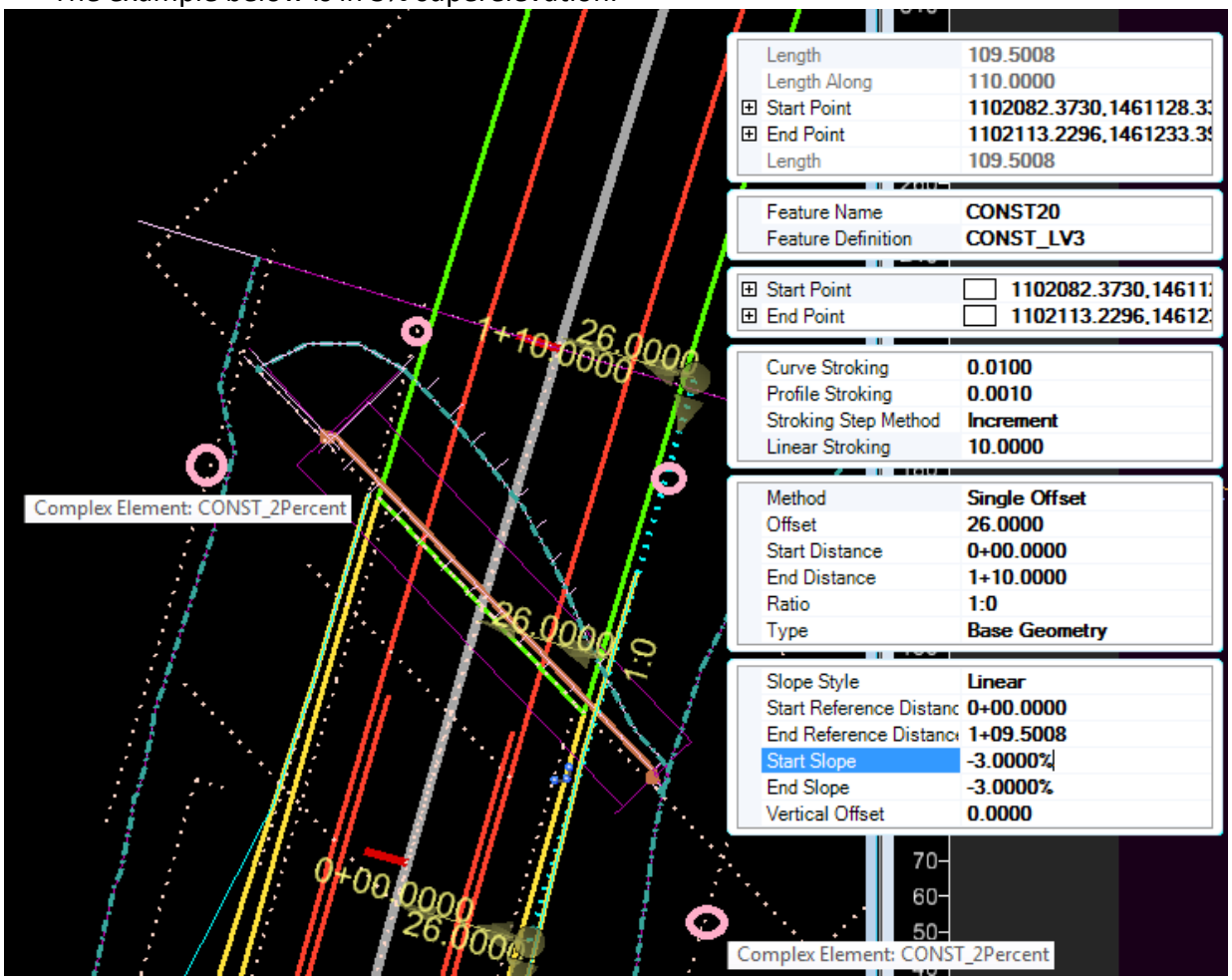
6) Open the profile view of the **Bent Bottom** element.



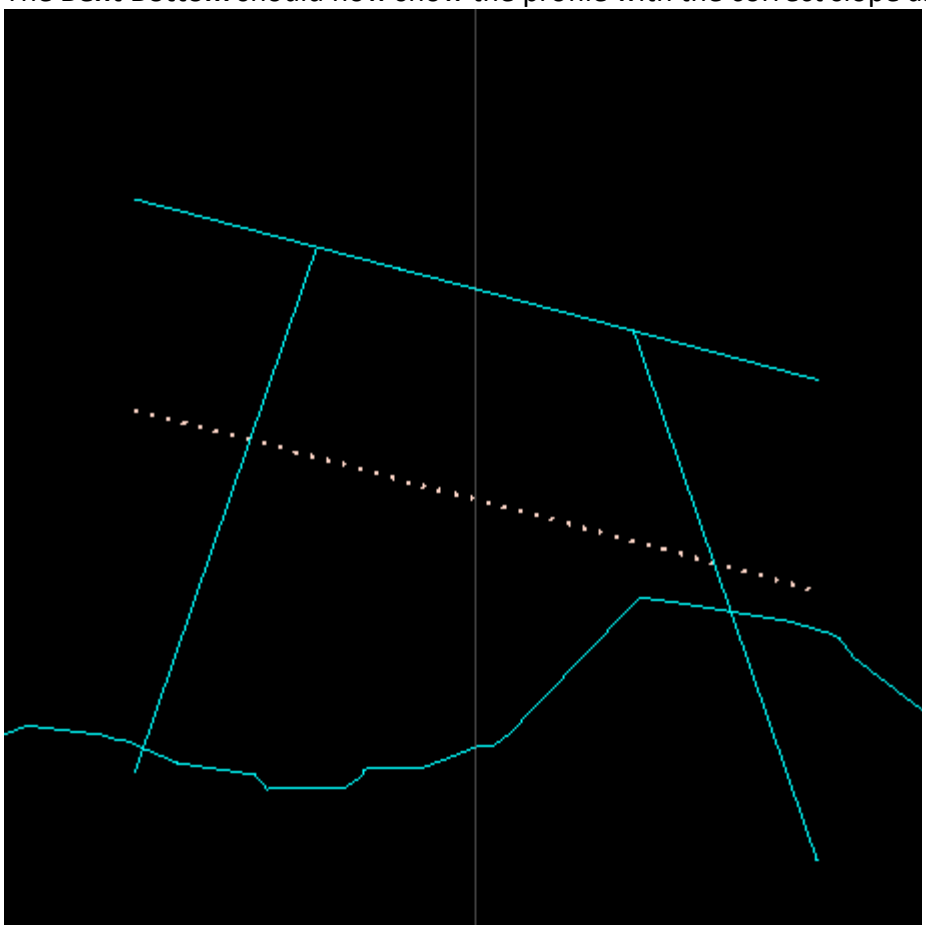
7) Make any adjustments to beam depth here.



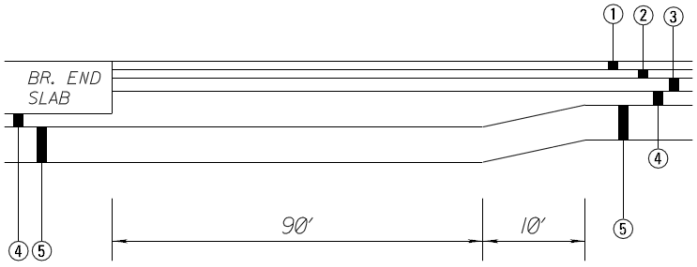
8) Adjust bridge to match pavement slope.
Change the **Start** and **End Slope** of the elements circled below to your pavement slope.
The example below is in 3% superelevation.



The **Bent Bottom** should now show the profile with the correct slope as shown below.



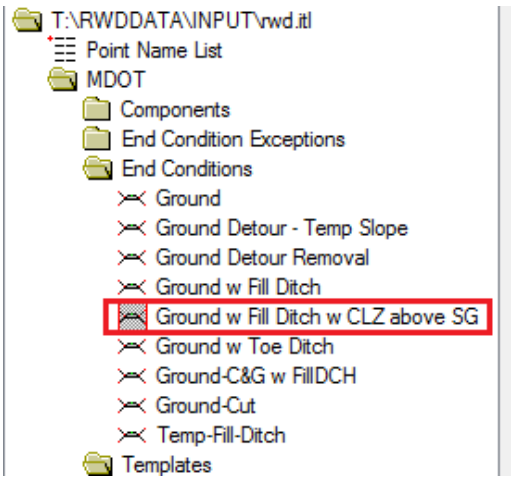
9) Transition the **Shoulder Slope** and **Structure Thickness** at the bridge abutment with **Parametric Constraints**.

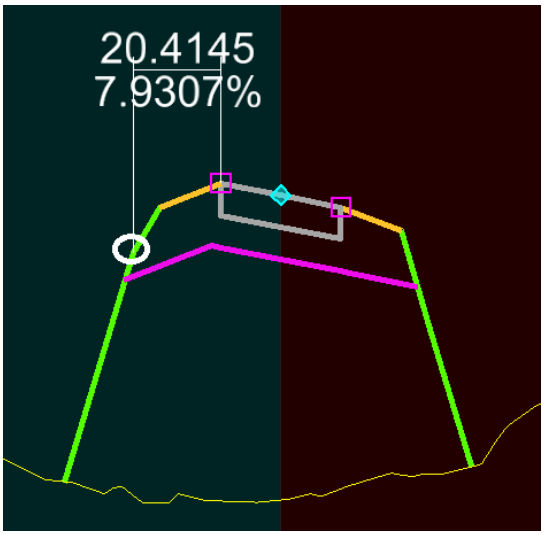


DETAIL FOR PAVEMENT TRANSITION AT BRIDGE ENDS

1. 1½" HOT MIX ASHPALT, MT (9.5 mm MIX) (1 @ 1½") REQ'D.
2. 1½" HOT MIX ASHPALT, MT (12.5 mm MIX) (1 @ 1½") REQ'D.
3. 2¼" HOT MIX ASHPALT, MT (19 mm MIX) (1 @ 2¼") REQ'D.
4. 2¼" HOT MIX ASHPALT, MT (19 mm MIX) (1 @ 2¼") REQ'D.
5. 6" CHEMICALLY TREATED GRANULAR MAT'L (9/C)

10) Add **End Condition Exceptions** through the station limits where point **GR-F-CLZ-*** rises above the **SG Tie** point. Exceptions are added because this point does not need to be included in the **Top Dirt** terrain if it is above the **SG Tie** point. With the end condition below, this point feature is different than the normal feature and excluded in any **Top Dirt** triangulation.





14.8 Bridge End Pavement Subgrade Transition

14.8.1 Cell

BridgeEnd-SG-Trans
Used to locate the Subgrade Transition points of the Subgrade Transition leading up to the Bridge End Pavement. Note that you use the same reference elements as used with the Guardrail/Bridge Spill-Through cells discussed above.

14.9 Median Cross-Overs

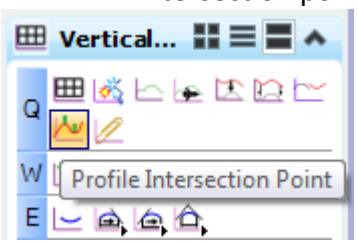
Bullet and Semi-Circle x-over cells have been created.
You need to create a line that represents the X-Over CL and runs 90 degrees off Median EP RT to Median EP LT. This line has to be profiled, as well as having the Median EP's profiled.

14.9.1 Cells

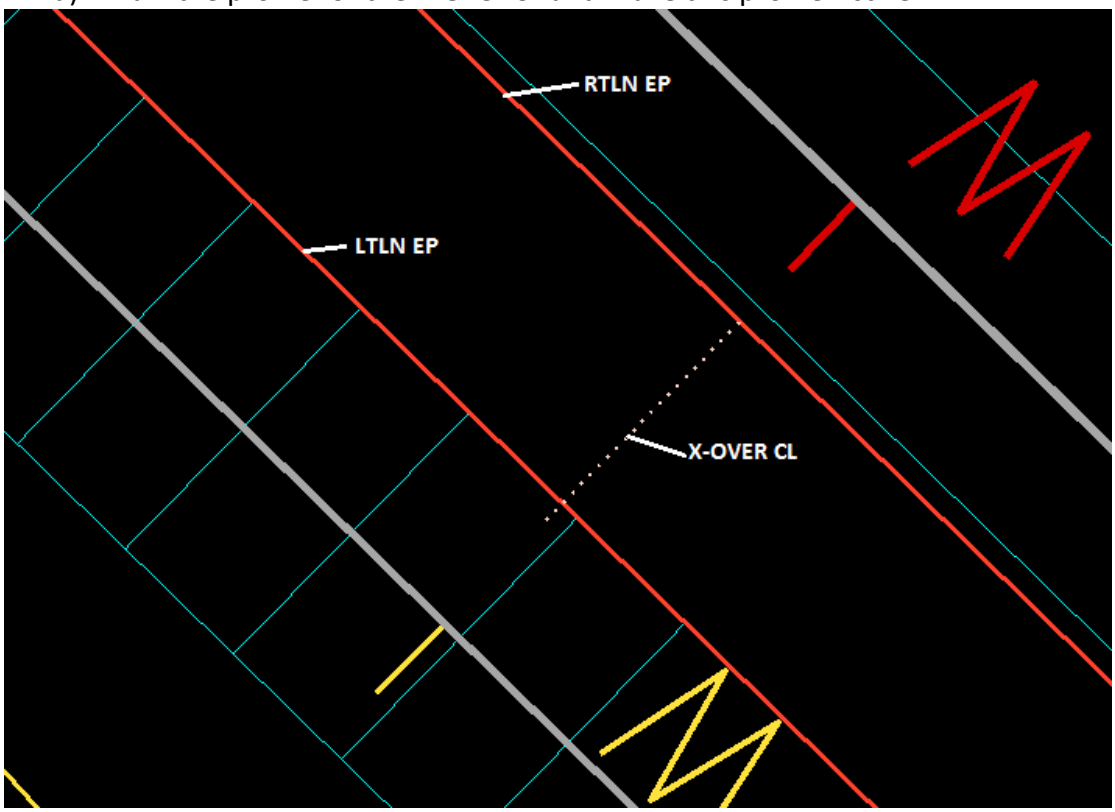
- x-over-2d-125cc.dgnlib, Default
- x-over-2d-bullet-less-than-64.dgnlib
- x-over-3d-125cc.dgnlib, Default
- x-over-3d-bullet-88-curb.dgnlib, Default
- x-over-3d-bullet-88.dgnlib, Default
- x-over-3d-semi-circle-curb-1turn-lower.dgnlib, Default
- x-over-3d-semi-circle-curb-1turn-upper.dgnlib, Default
- x-over-3d-semi-circle-curb.dgnlib, Default

14.9.2 Pre-Requisites

1) Median EP LT and RT drawn and have profiles. Note that these EP's need to extend 1000' each side of the intended X-OVER CL.
2) Line constructed that represents X-OVER CL and runs 90 degrees off median EP RT to Median EP LT and has profile.
   a) Create a line perpendicular to the median RT EP and crossing the LT EP.
   b) Open the profile View of this line.
   c) Use the vertical command **Project Profile Intersection Point** to show the LT and RT EP intersection points.

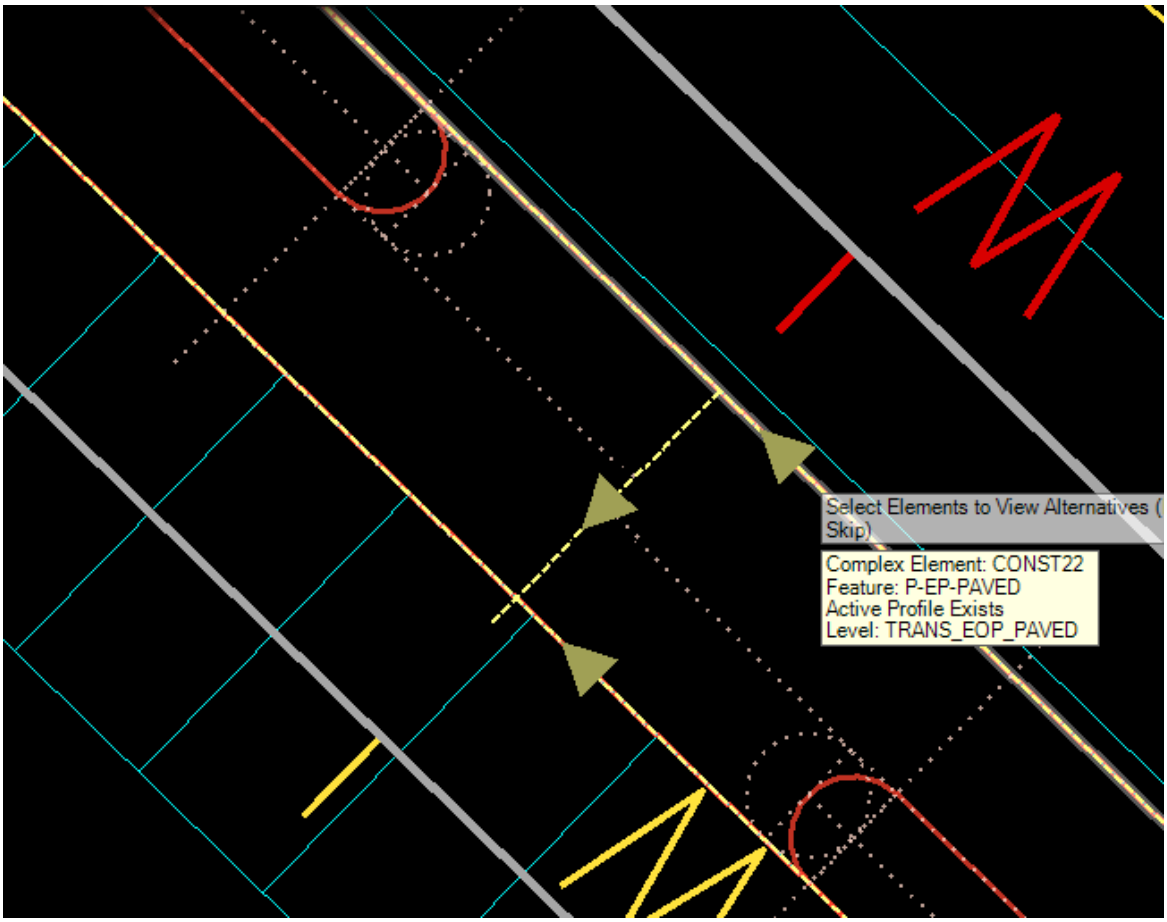


   d) Draw the profile for the X-Over CL and make this profile Active.



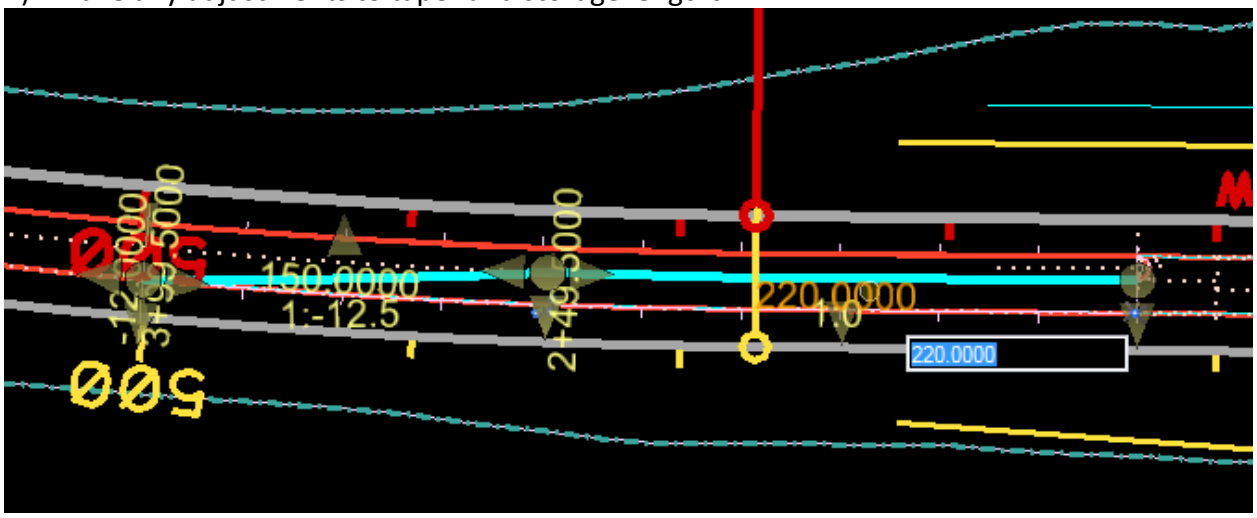
14.9.3 Steps

Place the cell.

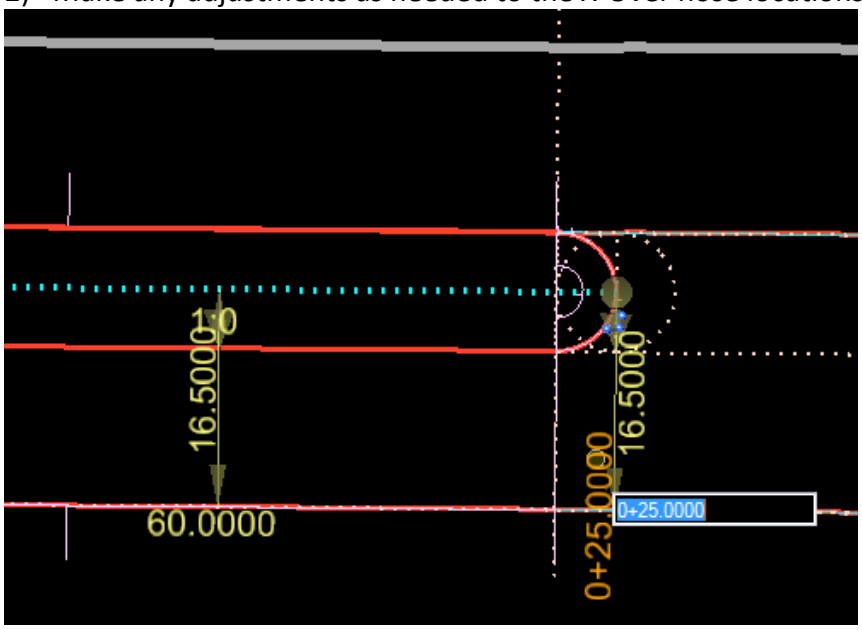


14.9.4 Edits

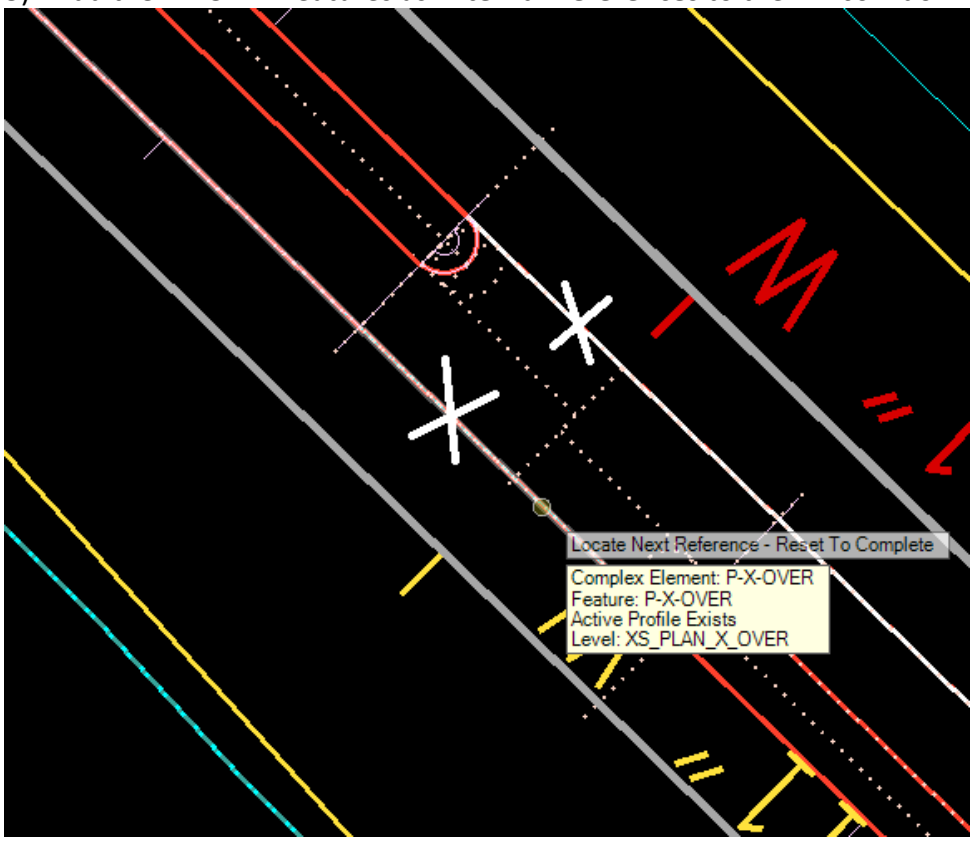
1) Make any adjustments to taper and storage lengths.



2) Make any adjustments as needed to the X-Over nose locations.

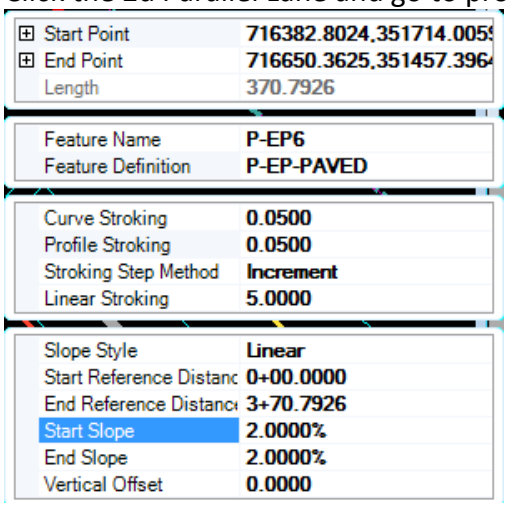


3) Add the P-XOVER features as **External References** to the ML corridor.

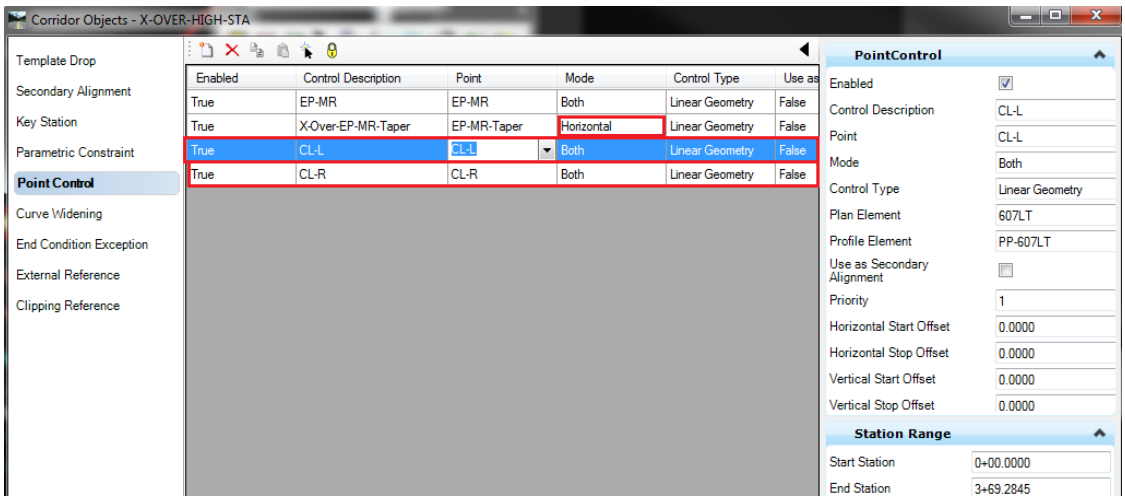


4) The turn lane and parallel EP's drawn were projected at a slope of 2% off the normal median EP. If the X-Over is in superelevation you can:
   a) If constant or variable from beginning to end.

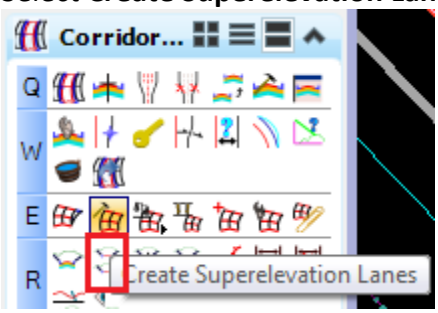
      Click the 2d Parallel Lane and go to properties to change the slope if needed.



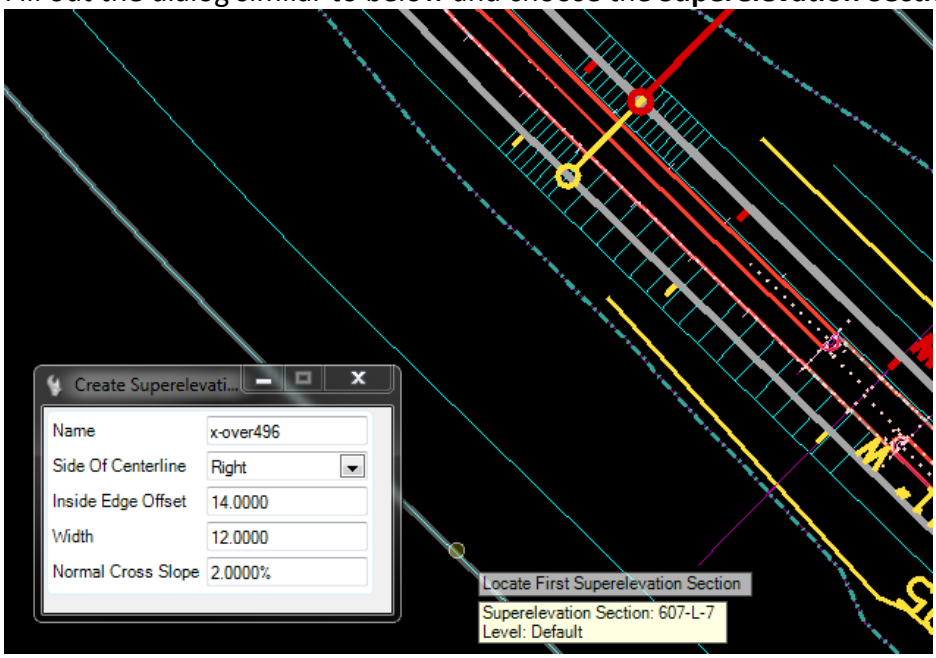
   b) If variable slope and you want to just project and not edit, add CL **Point Controls** to the LT and RT lanes and change the taper **Point Control** mode from **Both** to **Horizontal**.



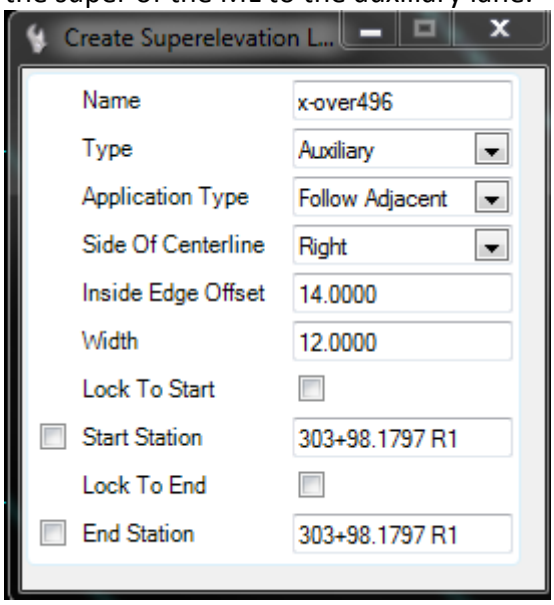
c) If variable slope and you want to project but have the ability to edit, add a superelevation auxillary lane.
Select **Create Superelevation Lanes**:



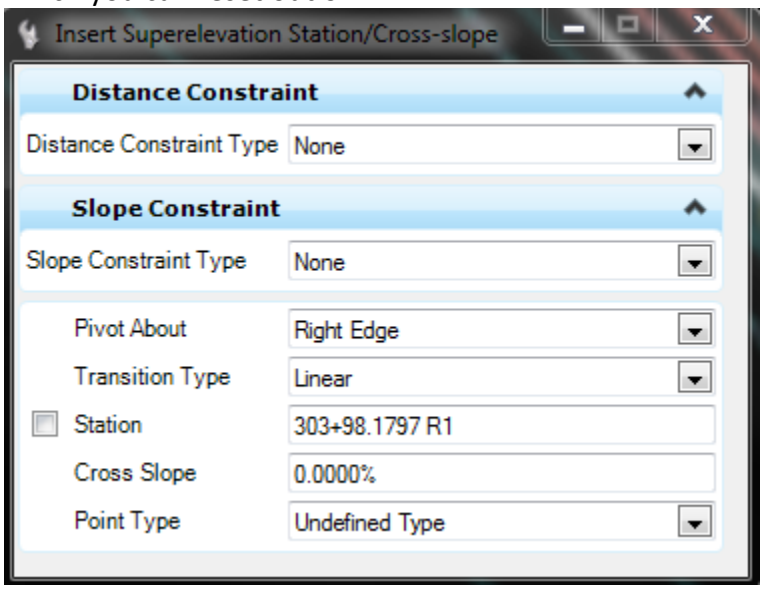
Fill out the dialog similar to below and choose the **Superelevation Section**.



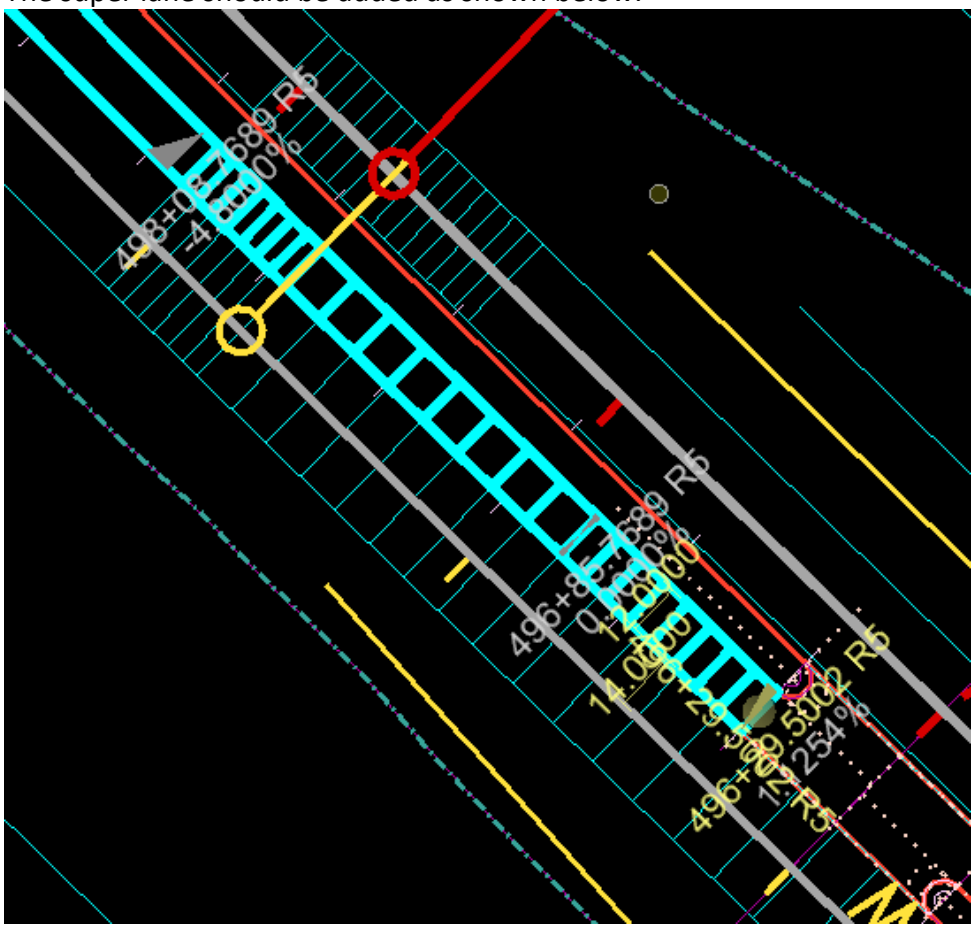
Fill out the resulting dialog as shown below. The **Follow Adjacent** setting will project the super of the ML to the auxiliary lane.



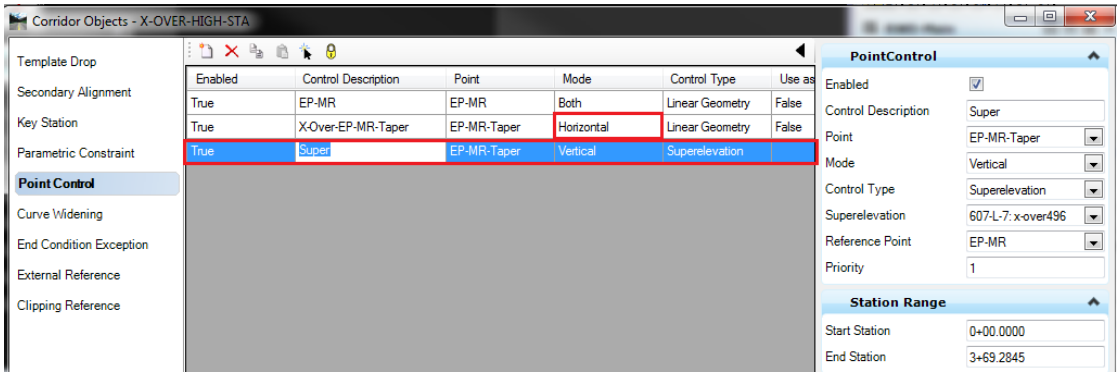
Once you follow the prompts from the dialog above, the following dialog will appear which you can reset out of.



The super lane should be added as shown below.

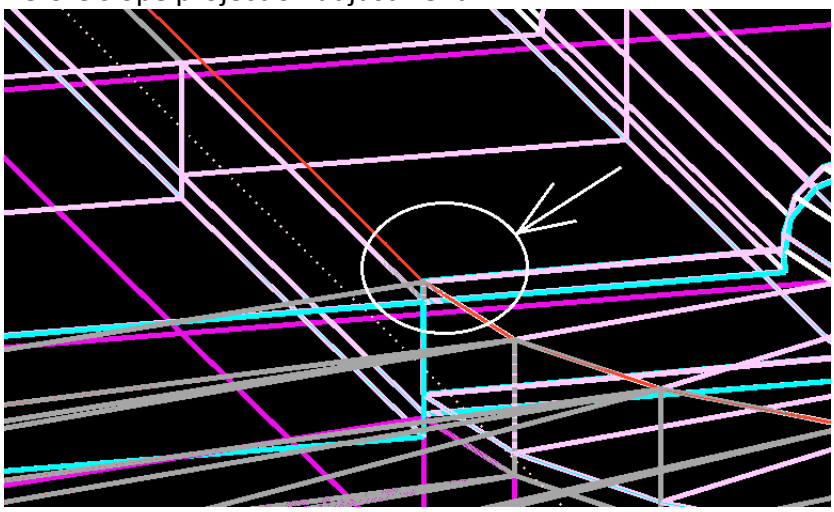


Add superelevation **Point Control** and change the taper point to just **Horizontal** mode as shown below.

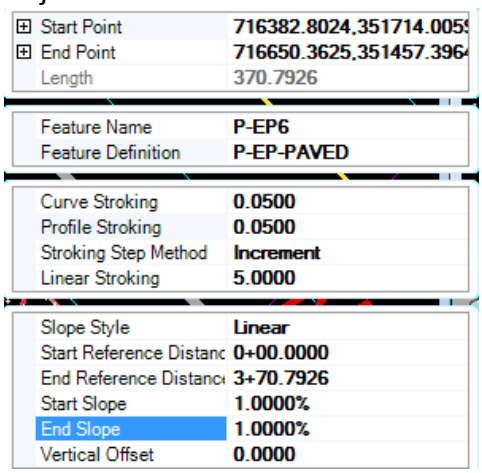


If super was applied or CL **Point Controls** added, you'll notice the taper and parallel EP does not line up vertically with the top face of curb. It needs to match at the nose PC to make the x-over terrain accurate so project the superelevation slope at this location to the EP by going to the **Horizontal Properties** of this element and changing the slope.

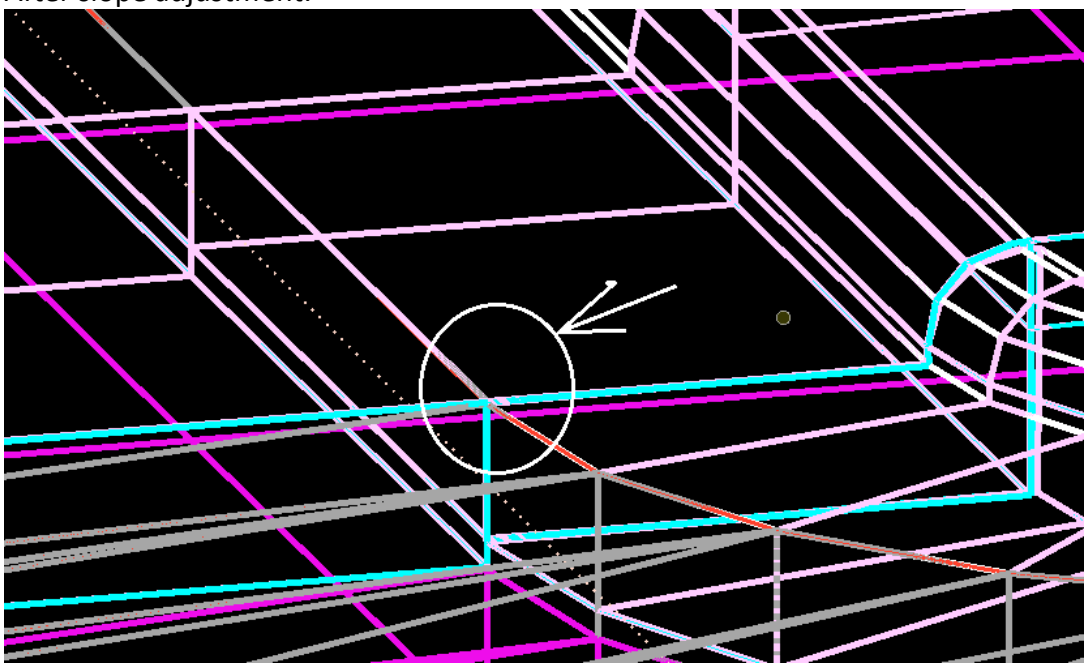
Before slope projection adjustment.



Adjustment.



After slope adjustment.



14.10 Interchange Ramps

The following steps you through either 2d or 3d interchange ramp cells. The 3d cells available are pre-built with many surface templates, corridors and linear templates. These are items you would have to meticulously place if only the 2d cell is dropped. It is ideal to go ahead and drop the 3d cell in lieu of its counterpart 2d cell and then change vertical and horizontal geometry based on the projects geometry. The reason why is that much of the decisions on the horizontal location of the interchange ramp involves looking at grades, sight distance, etc.

General Steps:

1) Place the 2d or 3d cell.
2) Drop the cell and then complete the ramp alignment tie-in to the crossing roadway.

If 3d:

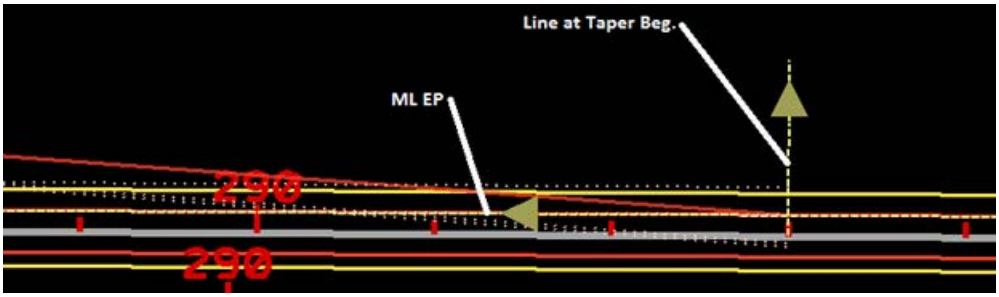
3) Add **Const-INT** elements placed with the cell to the mainline corridor as **External References** to remove the mainline shoulder and end conditions through the interchange area.
4) If 3d, calculate superelevation, change projected slopes or profiles of the elements controlled by these slopes, set complete ramp profile, and apply superelevation.
5) Add **Target Aliasing** and **Corridor Clips** for the overlapping areas of the mainline corridor and ramp corridor.

14.10.1 Pre-Requisites

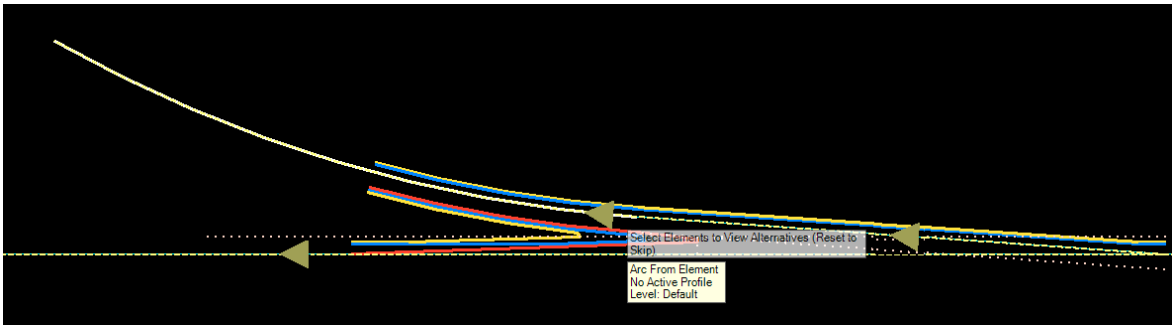
1) ML EP
2) Line 90 degrees to EP and at location where the Ramp begins. Place with **Civil Accudraw** and specify station so ramp can be moved later if needed by moving this line. This line is where the parallel lane ends or taper ends for all cells except the tapered exit at which case this is where the taper begins. See image below.

If 3d Cell:

3) ML EP profiled at least a 1000' each direction.
4) ML Corridor dropped and superelevation applied.
5) Crossing road profile set, corridor dropped, and superelevation applied.

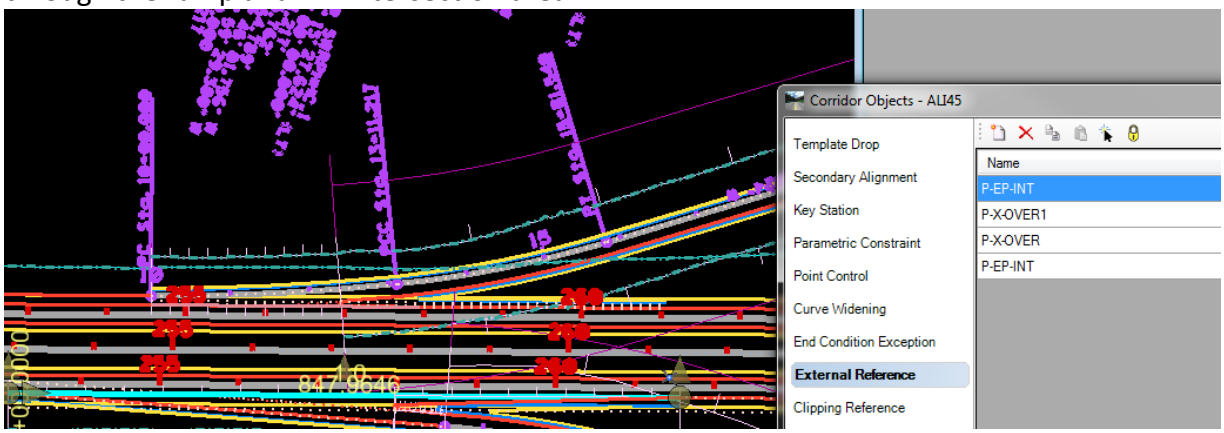


Direction of Arrows needed.

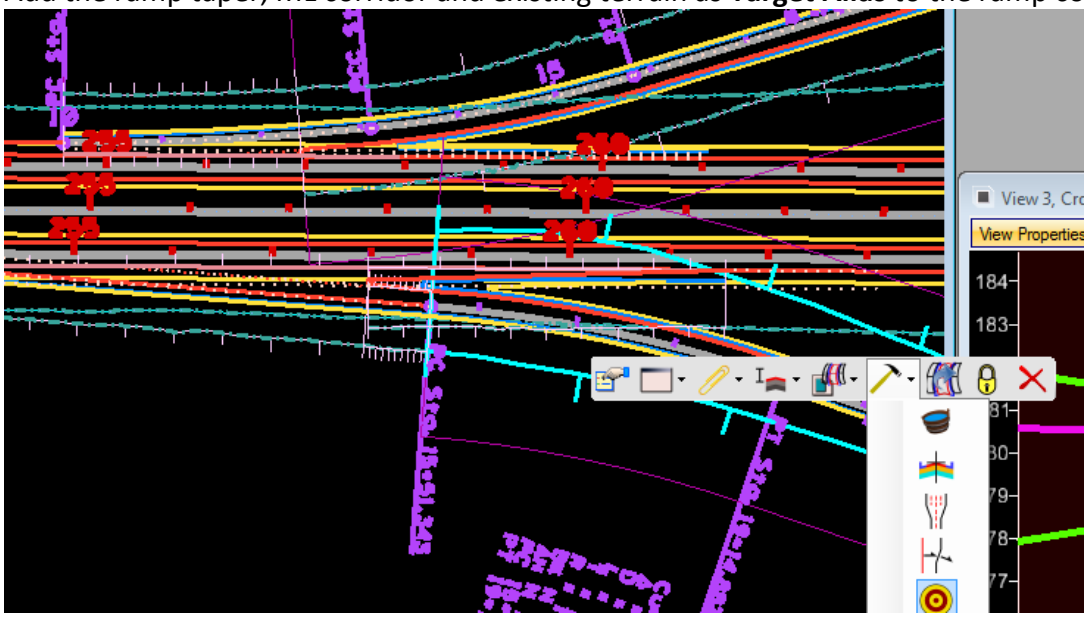


14.10.2 Editing

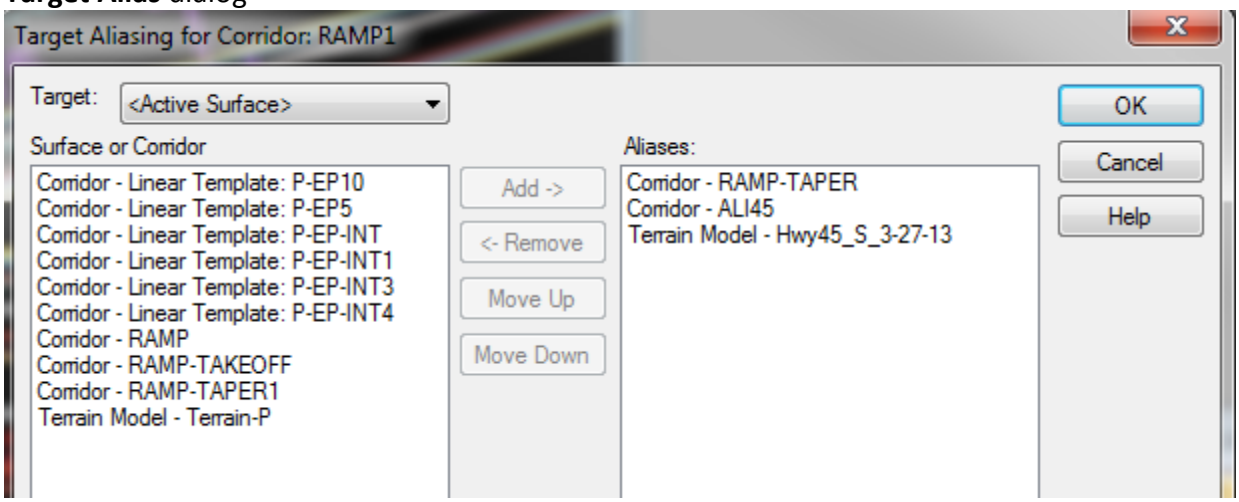
1) Add the P-EP-INT line as an external reference. This line is placed on top of the ML EP through the ramp and ML intersection area.



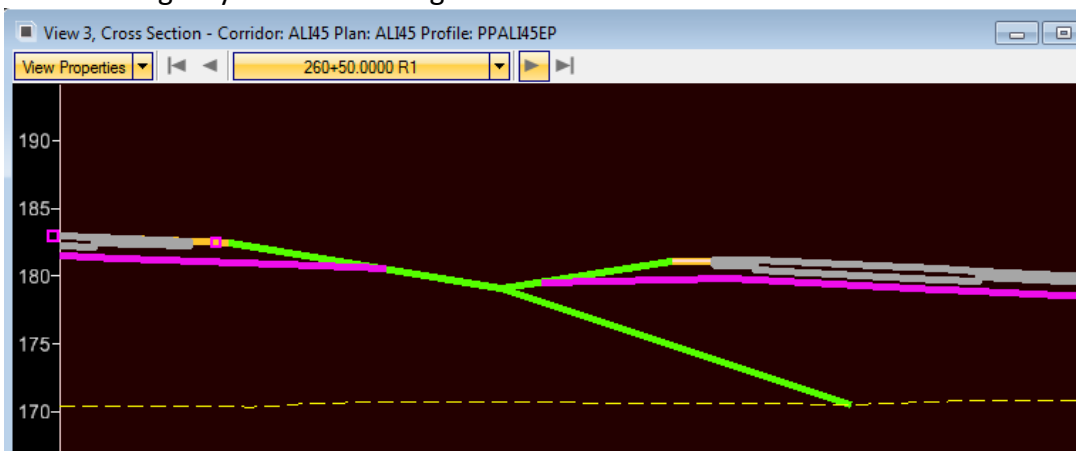
2) Add the ramp taper, ML corridor and existing terrain as **Target Alias** to the ramp corridor.



Target Alias dialog

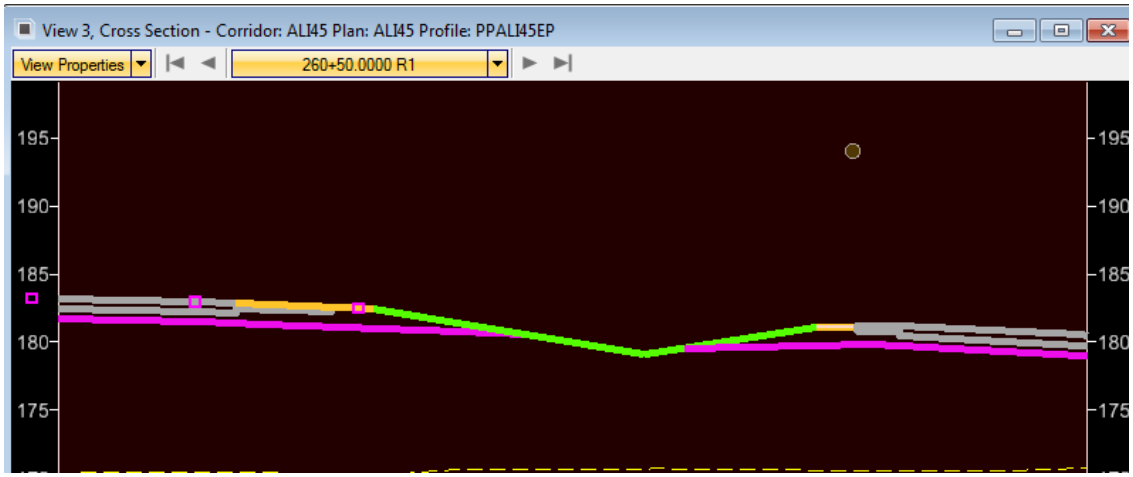


This should give you the following x-section look.



3) Add a clipping reference of the Ramp Corridor to the ML Corridor and Ramp Taper Corridor.

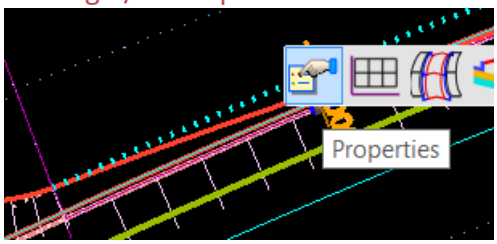
Results are shown below.



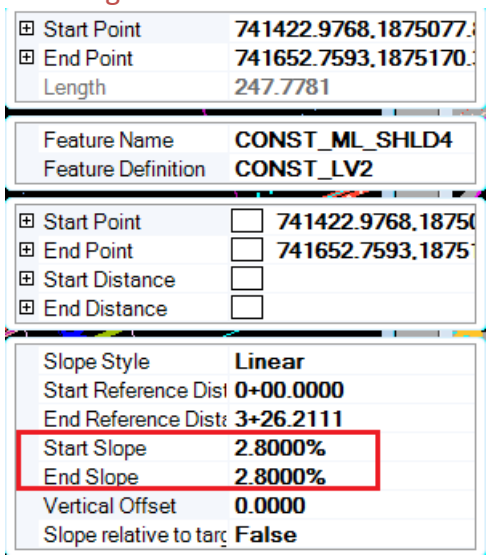
4) Apply Super to Ramp Corridors.

LAB IX: Civil Cells

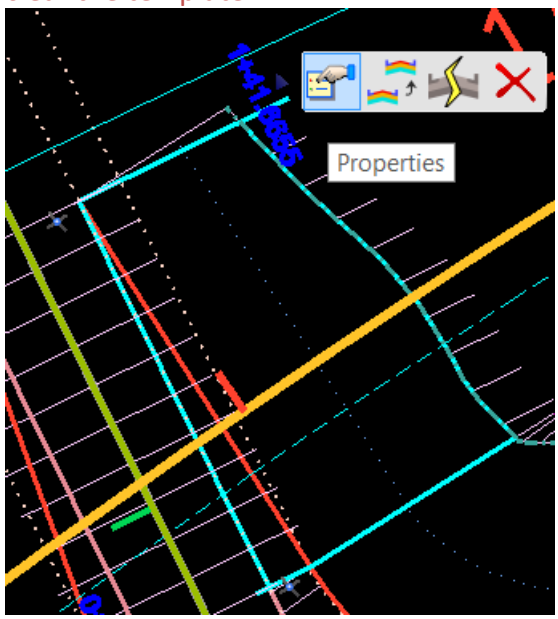
1. Placing cell (realignment-takeoff-3d-RT)
    - In the Corridor DGN file, use Microstation's **Create Complex Chain** command to create a copy of the TOPO referenced right existing EP, drop it (including linestrings), and store complex with a feature of X-EP.
    - Open the profile view of this X-EP and set the existing profile active.
    - Place a line at the BOP on a working or construction level and at 90 degrees to the alignment. This line will be used as a reference.
    - Place the detour cell **realignment-takeoff-3d-RT** at the BOP.
2. Place the intersection cells **int-c-3d-half-l-Rural and int-c-3d-half-r-Rural** at the intersection of LR Tucker and SR4.
    - In the Corridor DGN file, copy parallel partial SR4 alignment with a 14' offset and 300'-400' to each side of LRTUCK. Profile this with the **Vertical Profile by slope from Element** command using +6.8% slope.
    - Place the intersection cells.
    - Add the **P-EP-INT** lines (four elements on the ML side) in the cell as **External References** to corridor SR4 to turn off display of the SR4 corridor through the intersection.
    - Choose **Properties** from the parallel construction elements that tie into the begin/end taper.

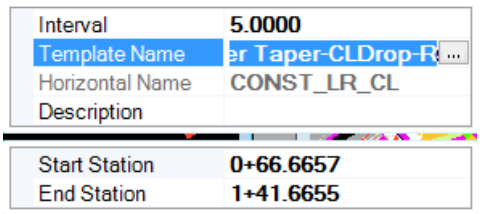


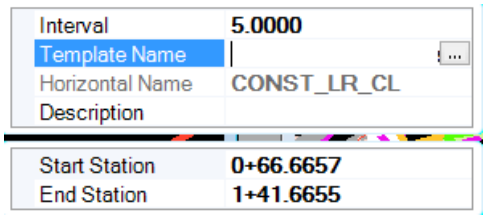
- Since the superelevation is 6.8%, change the slopes as shown below to +2.8% adhering to a maximum 4% breakover value.



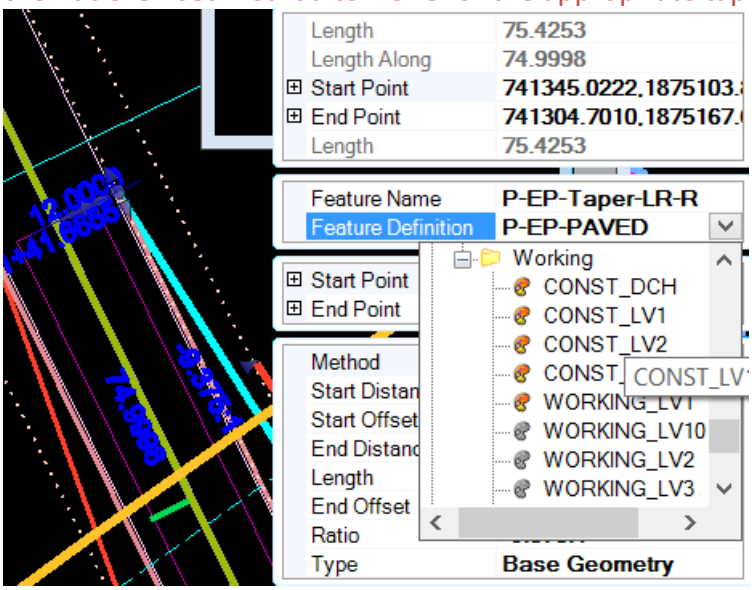
- Choose **Properties** of the ML tapers.
- Change the **Slopes** of the ML tapers to 2.8%
- Remove the tapers on the LR side by going to **Properties** of the template and clear the template.



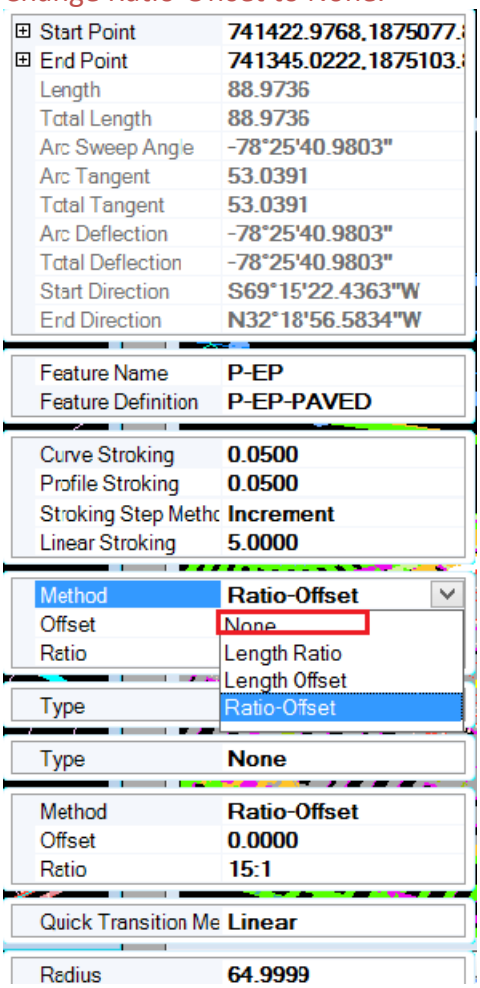




- Change the **Properties** of the LR side tapers to a **Construction** level and change the **Ratio-Offset** method to **None** for the appropriate tapers and curve.



Change Ratio-Offset to None.



3. Place the Guardrail-3d-2lane cell. (See reference elements needed in the Civil Cell instruction area.)

LAB X: Corridor Edits

1. Create the LRTuck corridor and drop the LR Template created beginning where the civil cell ends.
2. Add the shoulders at the guardrail area as **Point Controls**.
3. Change the Beam Depth to 4.5’

15. 3D GEOMETRY TOOLS

15.1 Section Overview

3D Geometry tools contain two categories, **3D Tools** and **Edit**. **3D Tools** contain tools for drawing **Civil 3D** elements and applying linear and surface templates. Other tools include **3D by Volume** (useful for pond design) and **3D By Slope to Target** which allows the user to project a slope to a terrain from a horizontal element that has an active profile.

The **Edit Tools** contain editing tools for template drops and applied surface templates and synchronizing tools for templates with the template library.

Most Civil Cells are created by using some form of linear and/or surface templates. Linear templates are just templates dropped on a linear element that has an active profile and without creating a Corridor. Surface templates are templates inserted into the DGN relative to a terrain. Surface templates generally represent pavement areas of intersections and cross-overs.

Most of the edit tools available are available on **Context Menus**.

15.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal and Vertical Geometry basics
- Templates
- Corridor Models

15.3 Section Objectives

1) Understand linear and surface templates.
2) Knowledge of the 3D slope to Target tool.

15.4 3D Geometry

3D Tools

Select in the Toolbox	Description
Additional 3D by Plan Profile	The Additional 3D by Plan Profile tool creates a 3D element from a portion of a profile line.
Apply Linear Template	Accesses the Pick Template dialog then inserts the chosen template into the drawing relative to a linear element.
Apply Surface Template	Accesses the Pick Template dialog then inserts the chosen template into the drawing relative to a terrain model.
Apply 3D By Slope To Target	Creates a 3D element computed from a linear element to a surface.
Plan By 3D Element	Creates a 2D element from a 3D MicroStation element and utilizes the original 3D element for the active profile.
Create3D By Volume	Creates a terrain modeling computed by volume from another reference surface.

Edit Tools

Edit Template Drop	Opens the current template library and displays the template with the selected template drop.
Synchronize Template	Updates a template within a template drop with the template of the same name from the current template library. Any changes previously made to the template in the template drop are overwritten with no warning.
Edit An Applied Surface Template	Opens the current template library and displays the template with the selected surface template for editing.
Synchronize Applied Surface Template With Library	Updates a surface template with the template of the same name from the current template library. Any changes previously made to the template are overwritten with no warning.

16. Drainage

16.1 Section Overview

This section covers adding profiles for ditches where needed and updating the Corridor to reflect these Ditch Profiles and also discussed

16.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal and Vertical Geometry, Corridor Modeling

16.3 Section Objectives

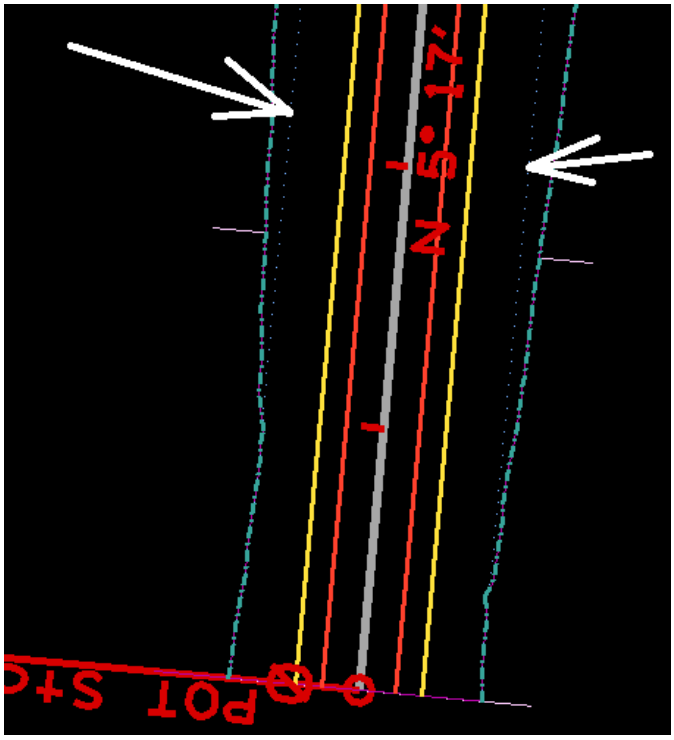
After completing this section you should be able to:

1) Drain the corridor.
2) Profile and determine length of culvert.

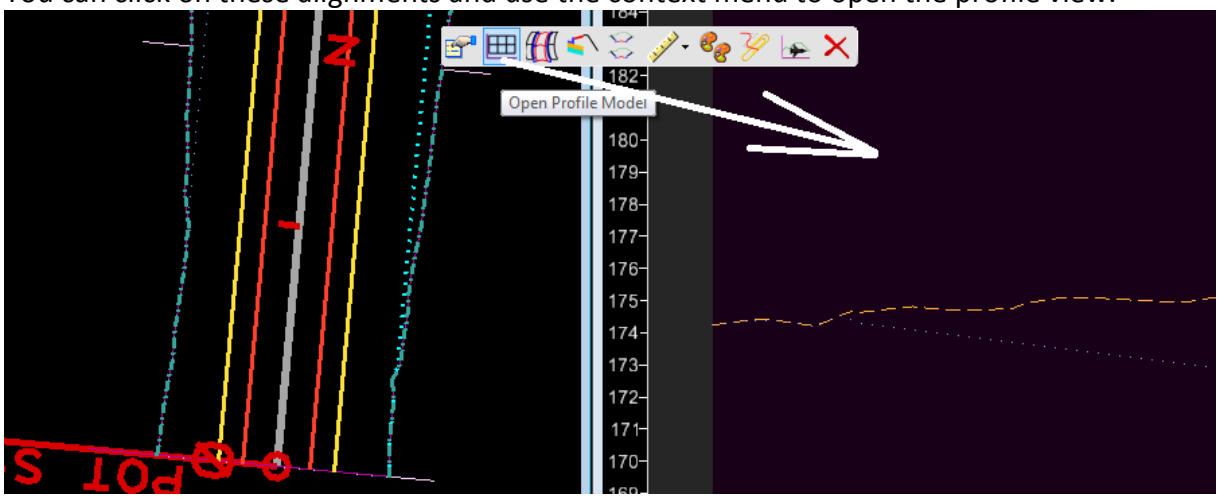
16.4 Ditch Drainage

16.4.1 Overview

Templates are pre-built to create **LOW point** alignments/profiles of each side of the roadway. This element is generated from the ditch bottom in cut or the tie point in fill. These are Construction elements as shown below and are named LOW-L or LOW-R.



You can click on these alignments and use the context menu to open the profile view.



You cannot set ditch grades in this profile view and then assign point controls to draw to that profile because of circular dependency of the corridor and elements drawn. The process for evaluating, creating, and applying ditch grades is discussed below.

16.4.2 General Process (Cut Ditches)

Templates are pre-built to search for the Vertical External Feature P-DCH-RT or P-DCH-LT to allow for the easy addition of a Ditch profile in Fill Ditch areas.

1) Process your template.
2) Open the LOW-L or LOW-R alignments in a profile view.
3) Draw profiles where needed.
4) Delete rules of the drawn profiles.
5) If alignment is referenced, use Horizontal Geometry's Copy command to copy the element in the Corridor DGN file.
6) Open the profile view of the corridor alignment.
7) Project the profiles to the corridor alignment.
   Make sure you do not set these as the **Active Profile**.
8) Delete the rules of the projected profiles.
9) Name the profiles.
10) Add vertical point controls to these ditch profile elements.
    Note: For each area you are changing the natural ditch grade, you will need to go through these steps.

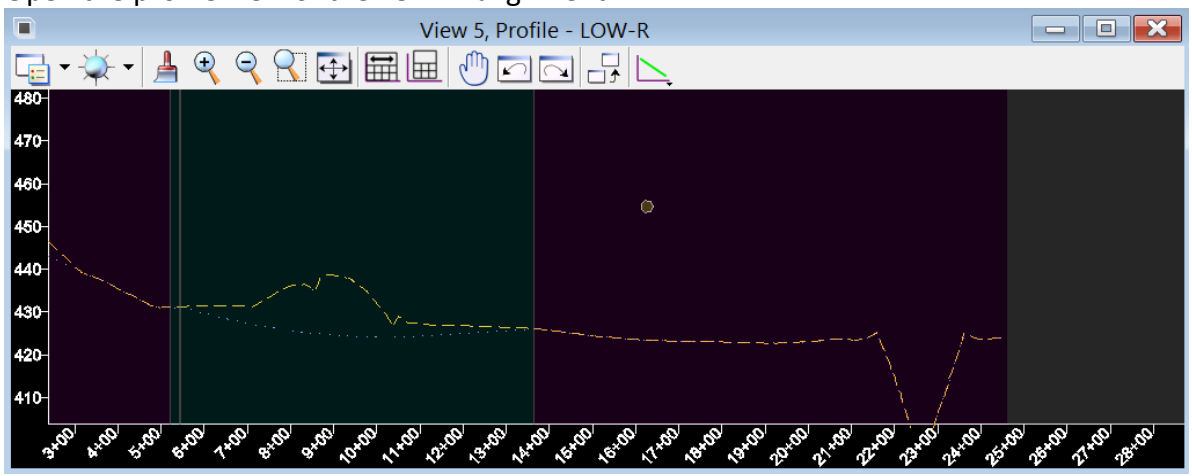
16.4.3 General Process (Fill Ditches)

Templates are pre-built to search for the **Vertical External Reference Features P-DCH-RT** or **P-DCH-LT** to allow for the easy addition of a Ditch profile in Fill Ditch areas.

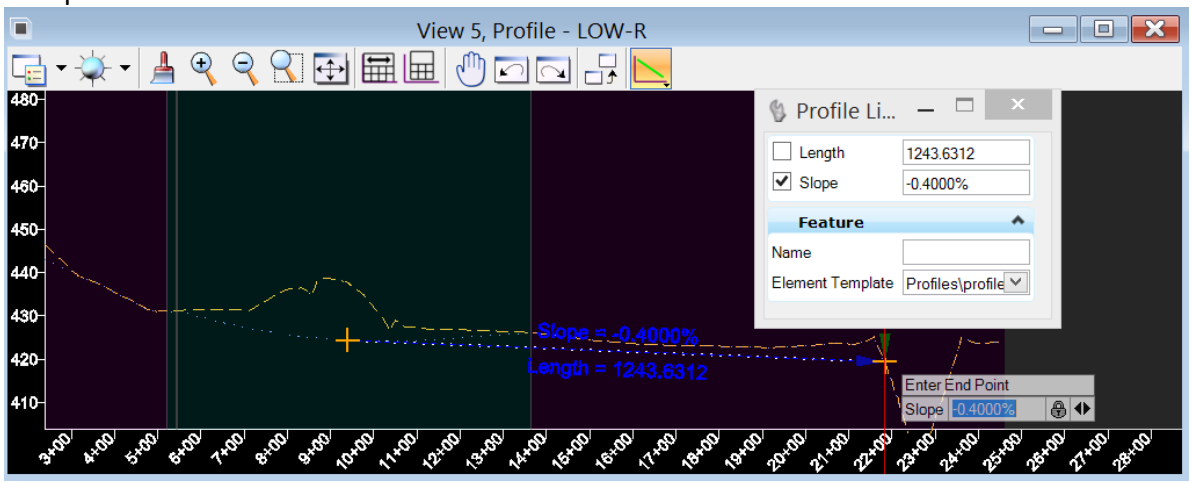
16.4.4 Initial Ditch Flow and Setting Grades

The example below goes through setting grades for the Right Ditch Profile. You'll use the same process for the Left Ditch, but with different Features.

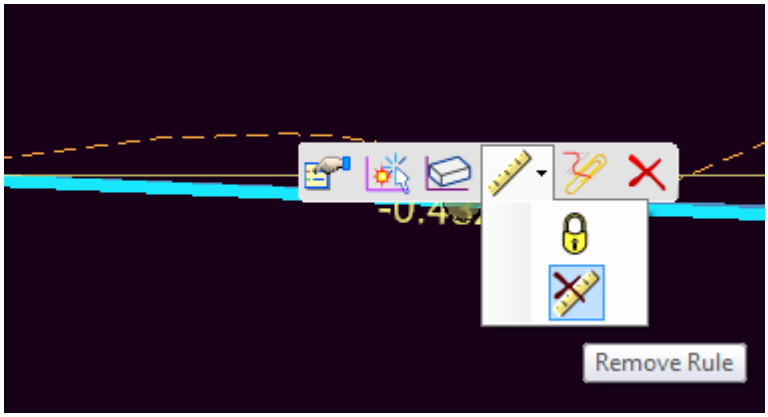
1) Open the profile view of the LOW-R alignment.



2) Add profiles to drain.

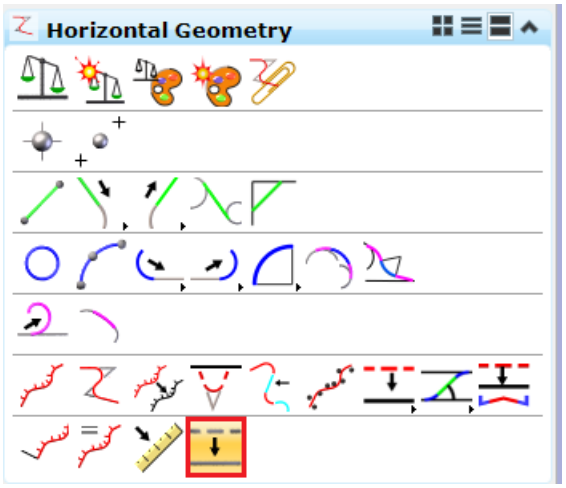


3) Remove the rule created for this element.

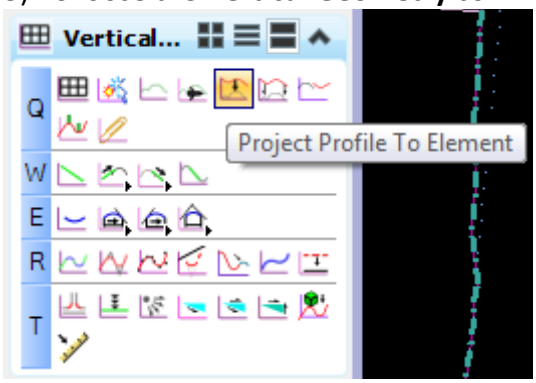


16.4.5 Projecting to the Alignment.

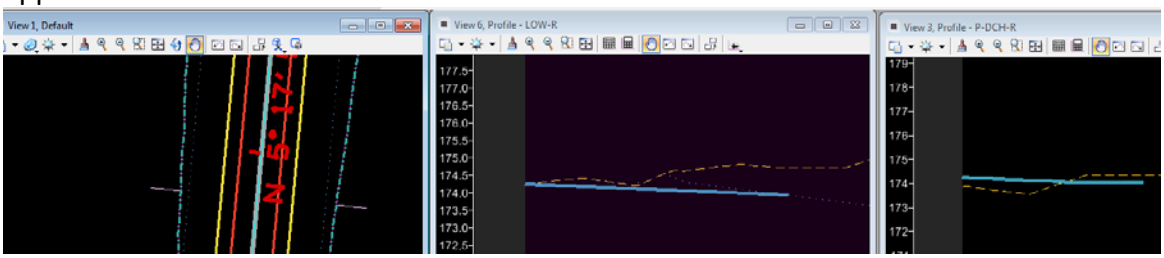
1) If the corridor alignment is referenced, copy the corridor alignment into the DGN file. Rename to DCH.



2) Open the profile view of this copied alignment.
3) Choose the **Vertical Geometry** command shown below.



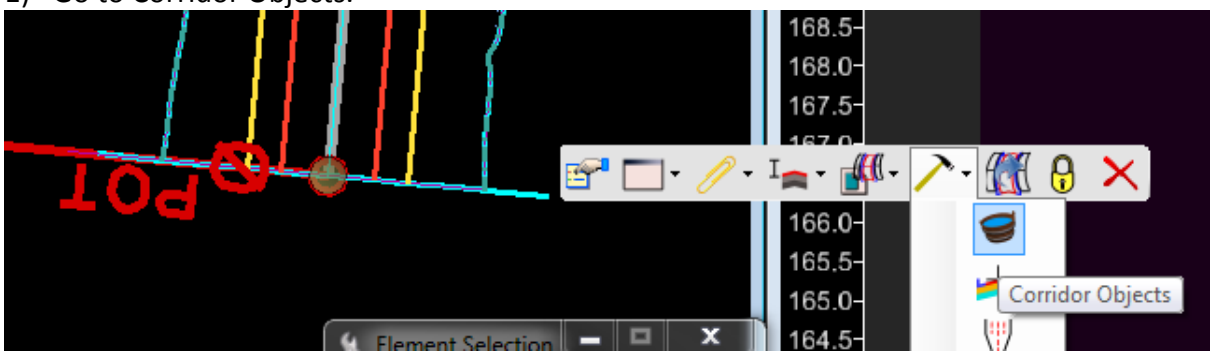
4) Choose the profile that was drawn in the LOW-R profile view and then choose the horizontal alignment just created with the **Copy** command. You should see the profile appear in the DCH view.



5) Rename this profile DCH-R.

16.4.6 Applying Ditch Profiles to Corridor

1) Go to Corridor Objects.



2) Add P-DCH-R as an External Reference.

3) The Ditch profiles should now be a part of your Corridor.

16.5 Pipe Culvert Placement

16.5.1 Overview

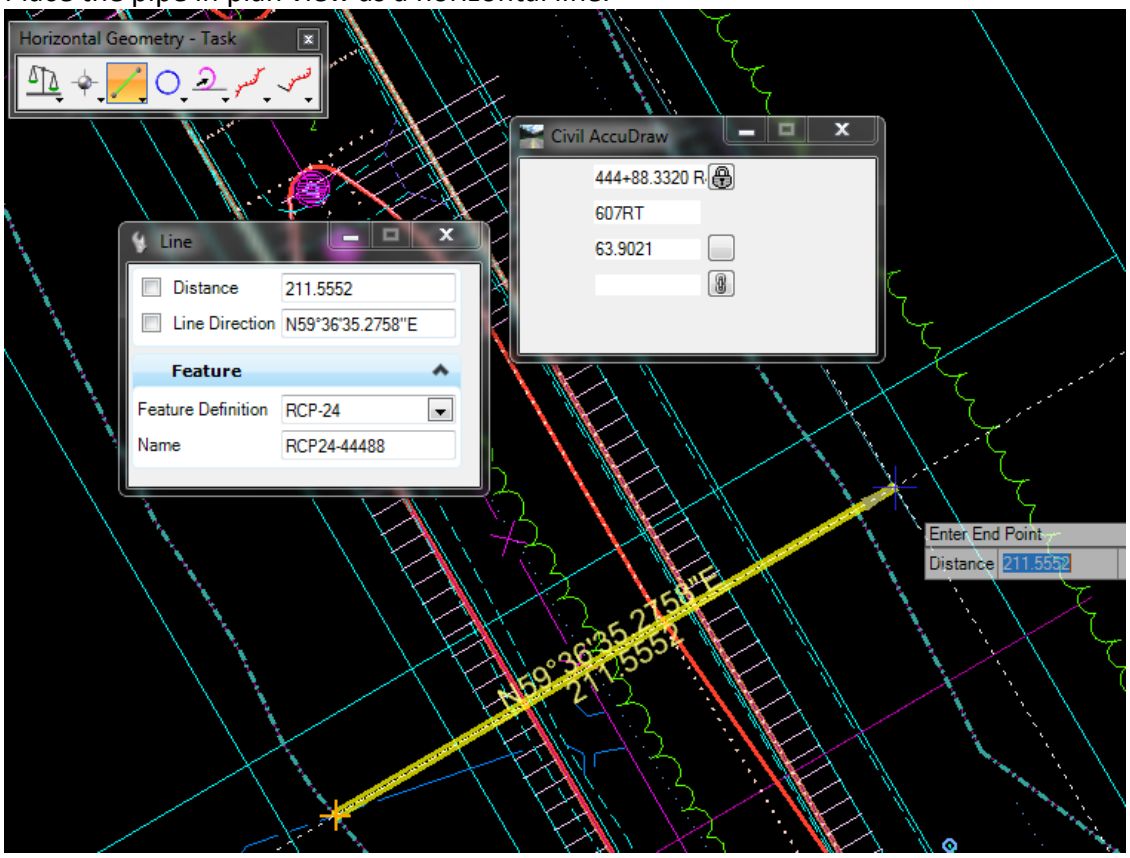
Roadway has created features for pipes for plan, profile, and 3d views. A **Civil Cell** has been created for **Box Culvert** placement. The steps below show how to place pipes and culverts.

16.5.2 Process Prerequisites

1) Corridor placed on roadway that intended drainage is being placed on.
2) Create a RWD-DRAIN-002.DGN file, reference your existing terrain, make active, and open the default-3d model in view 5.
3) Reference in the DGN containing your roadway corridor, both Default model to View 1 and Default-3d model to View 5.

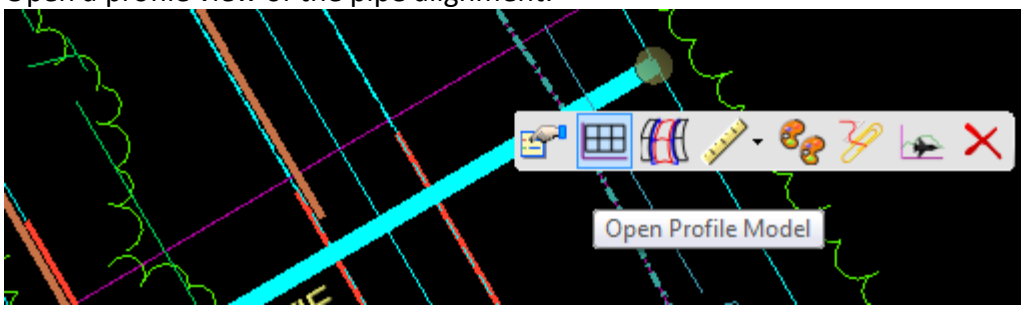
16.5.3 Placing a Pipe

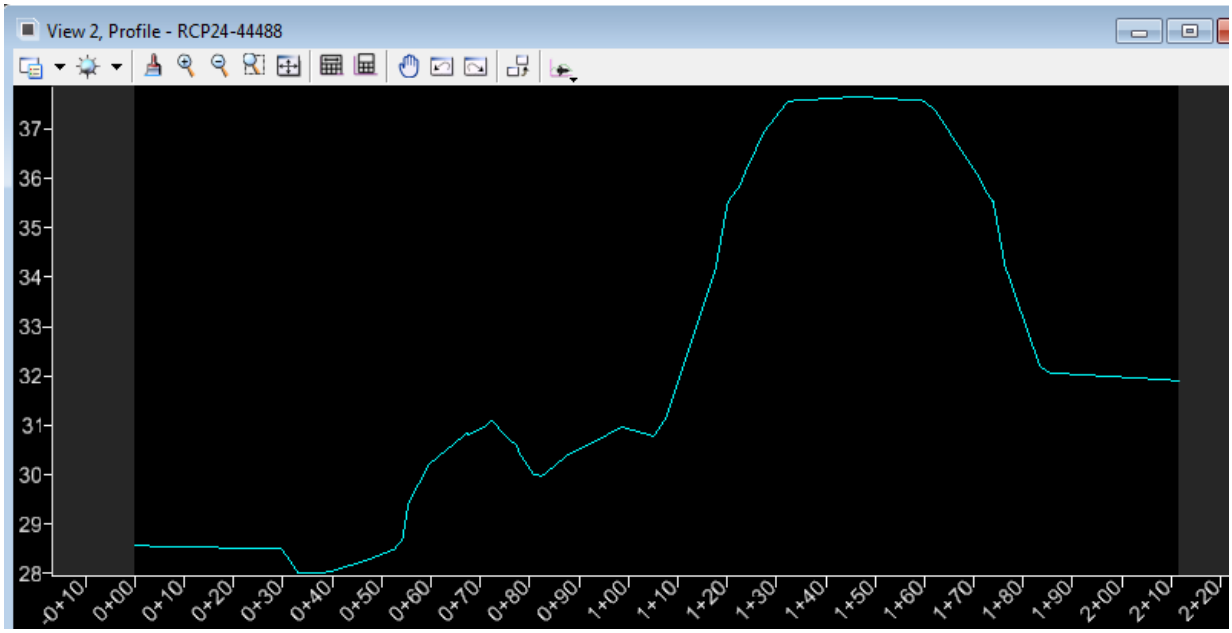
1) Place the pipe in plan view as a horizontal line.



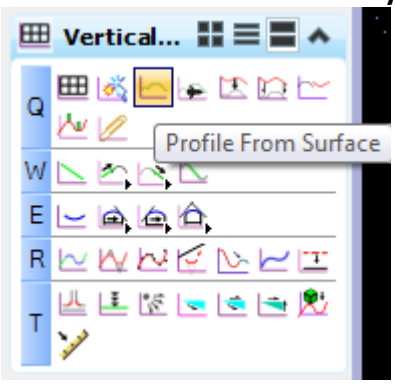
Length doesn't matter at this time, just make sure it is initially at or outside your construction limits.

2) Open a profile view of the pipe alignment.

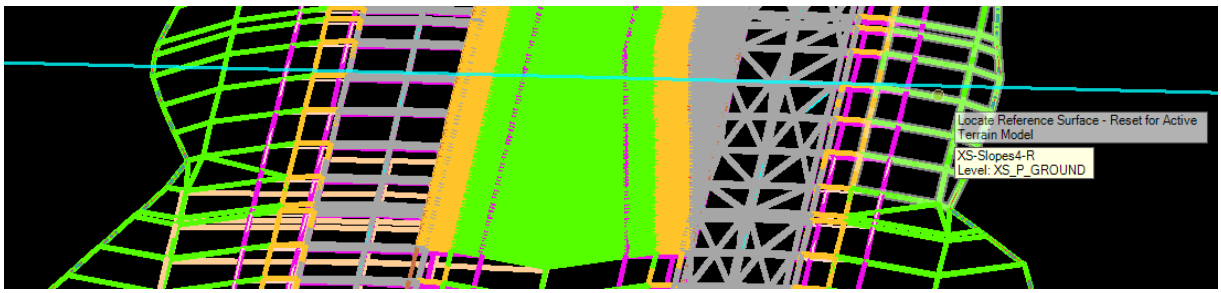




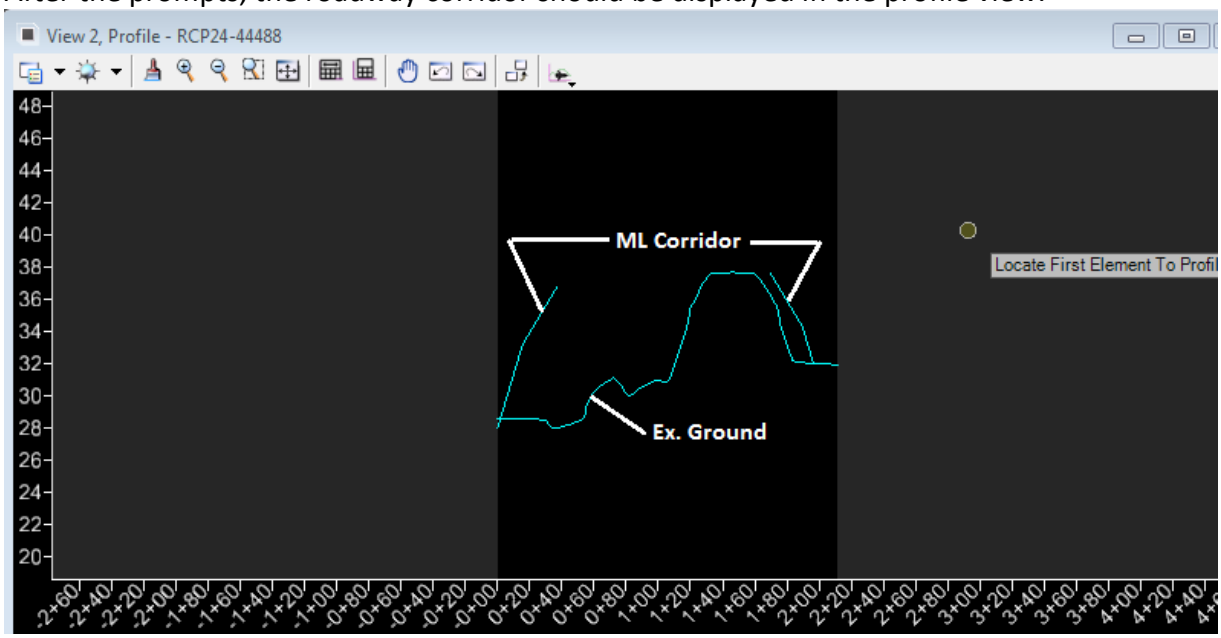
3) Choose the **Vertical Geometry** command **Profile from Surface**.



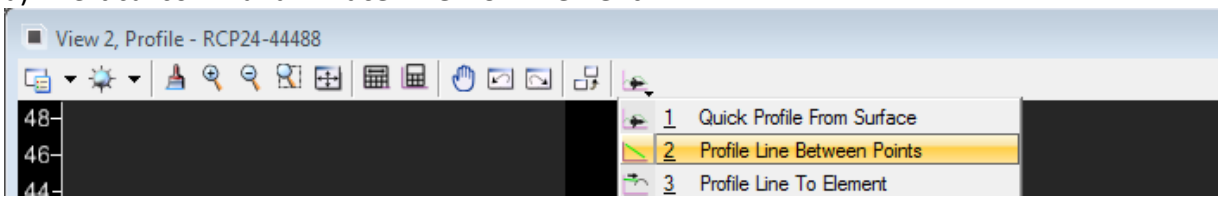
4) Choose the pipe and then connection roadway 3d corridor elements (ground and any other surface needed in the area of the pipe) when prompted to choose the **Reference Surface**. To help locate this area in a 3d view, open a x-section view of the roadway corridor to see the blue line shown below.

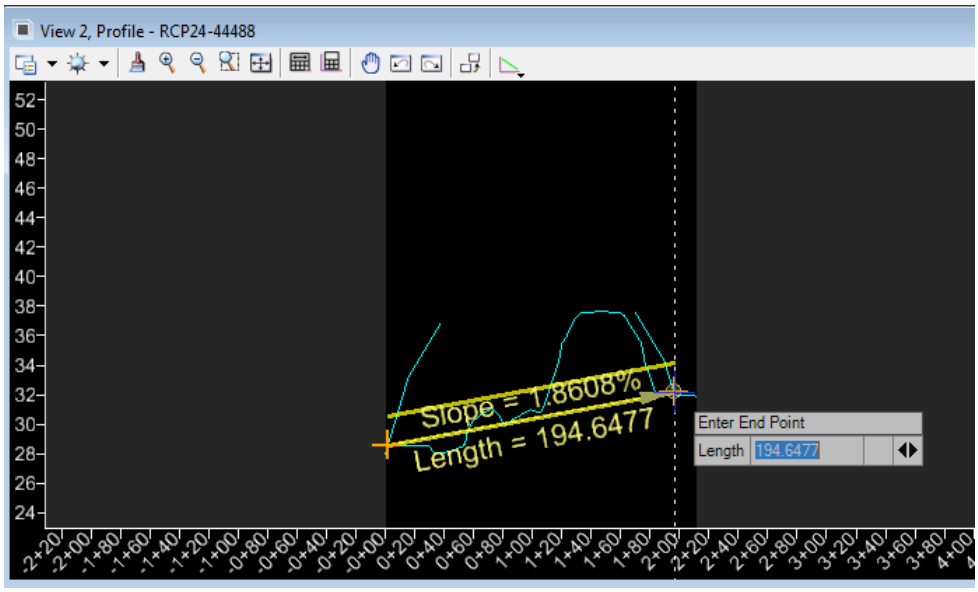


5) After the prompts, the roadway corridor should be displayed in the profile view.

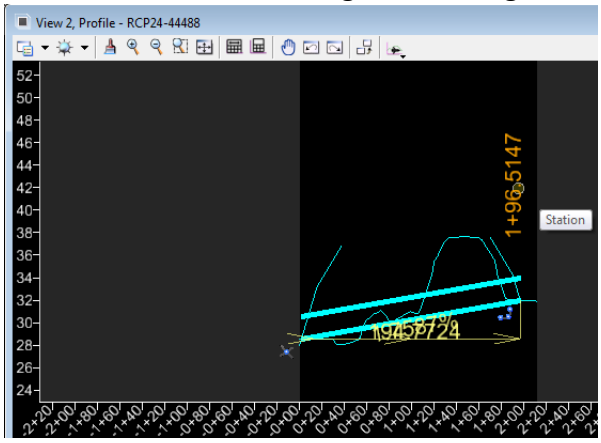


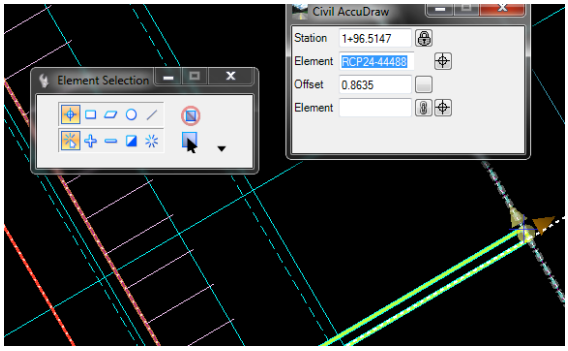
6) Draw your proposed pipe profile.
   a) Vertical command – **Place Line from Element**.



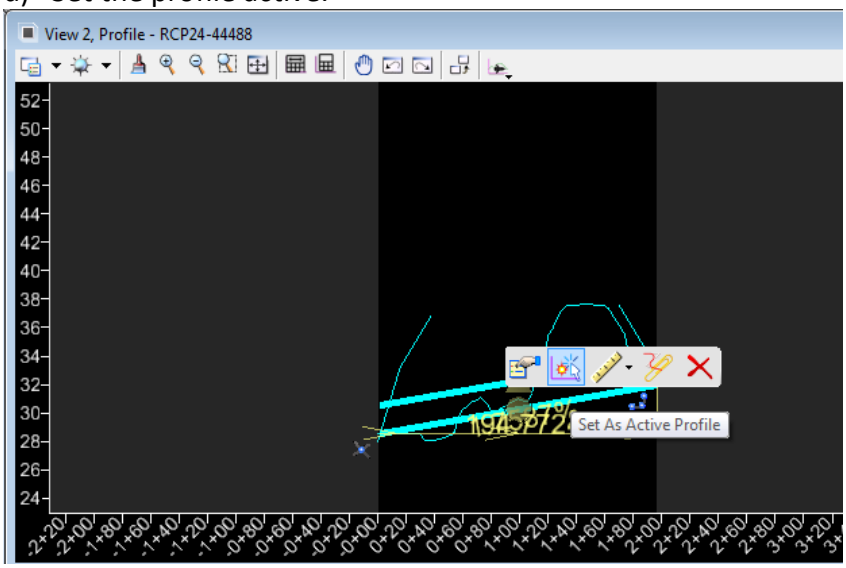


   b) Trim the pipe profile length back to take **Flared End Sections** into consideration if they are present.
   c) If the profile is not as long as the hprizontal pipe drawn, find out what station the profile ends at and then change the ending station of the horizontal pipe to match the profile.

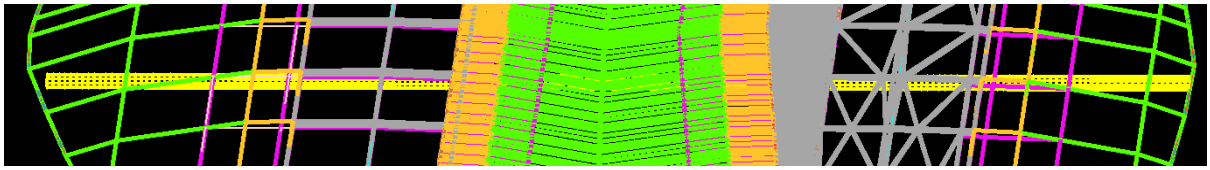




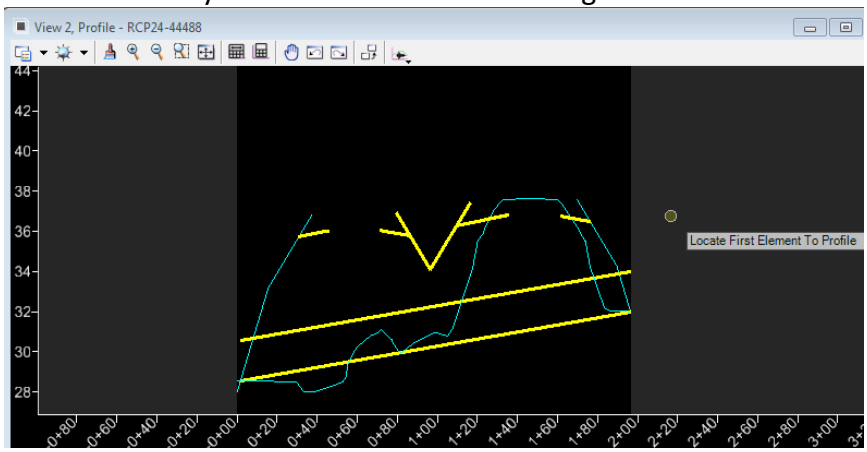
d) Set the profile active.



e) 3d Pipe is drawn when the profile is set active.

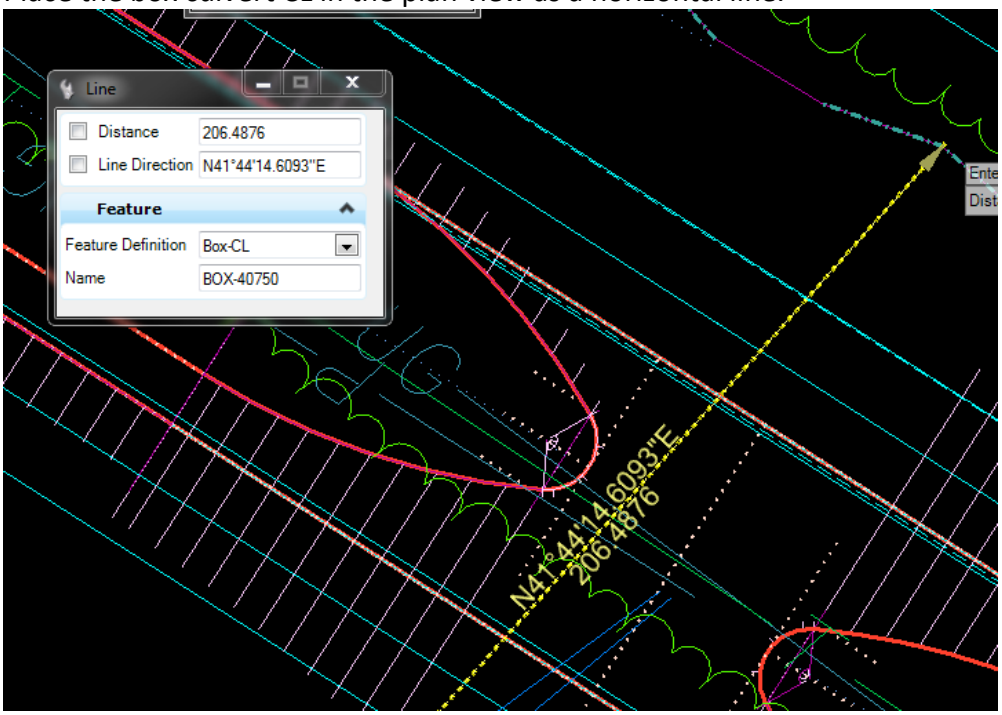


f) You can use the **Vertical Geometry** command **Profile from Surface** to choose more surfaces of your corridor to check for height of cover.



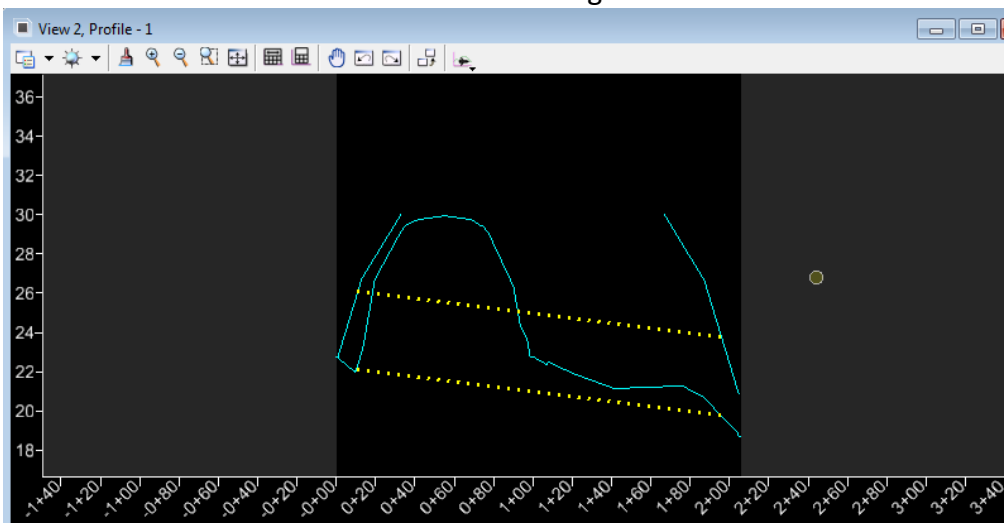
16.5.4 Placing a Box Culvert

1) Place the box culvert CL in the plan view as a horizontal line.

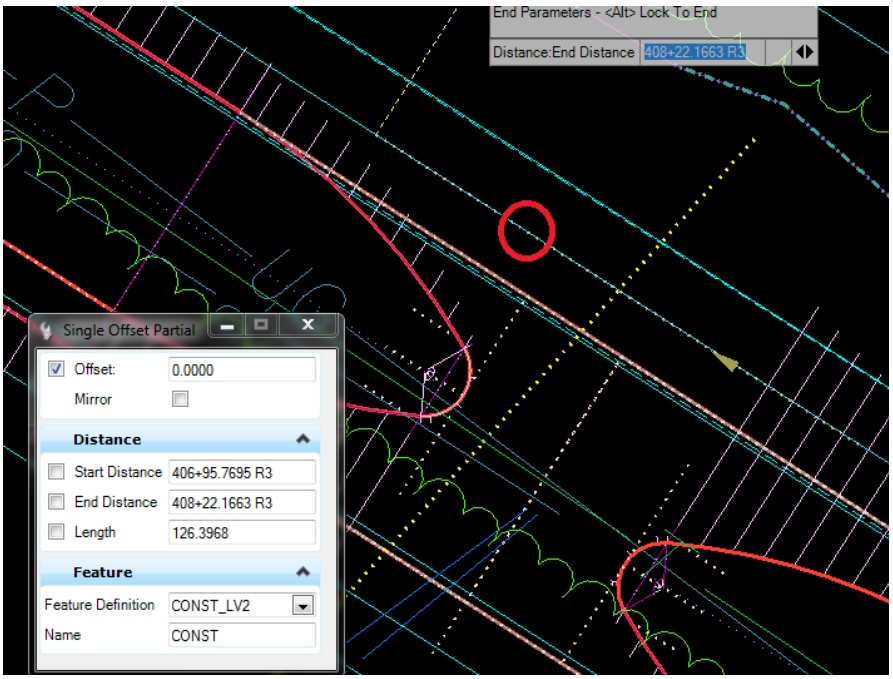


Length doesn't matter at this time, just make sure it is initially at or outside your construction limits.

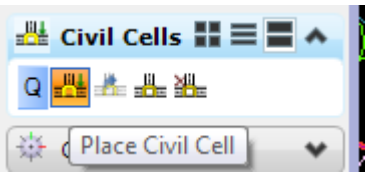
2) Follow steps in in the Pipe Culvert section for profile creation. You should have an active profile for the box culvert CL that looks similar to below and the horizontal length should have been modified to match the vertical length.



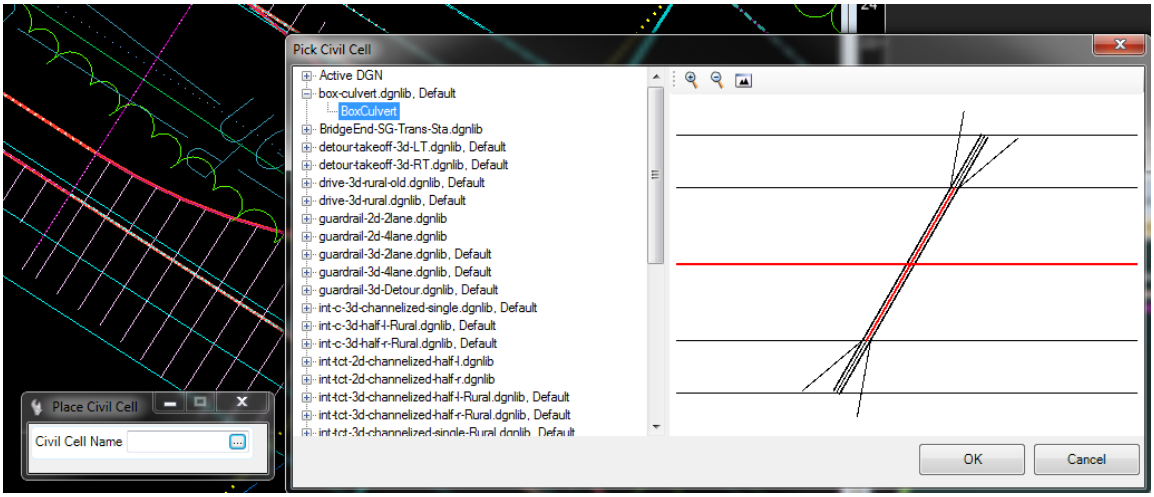
3) Copy parallel partial your roadway alignment, 0’ offset, a distance of +/- 100’ from the intersection of the box culvert CL.



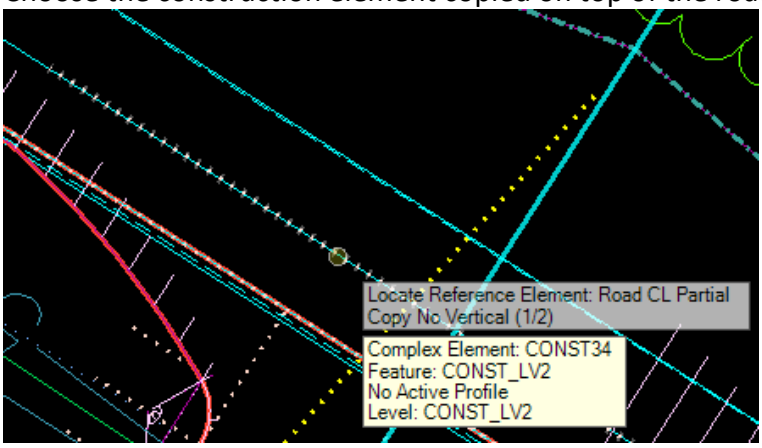
4) Choose the **Place Civil Cell** command.



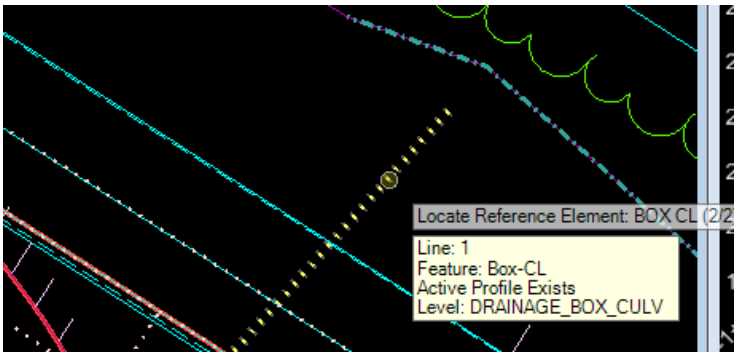
5) Choose the **Box Culvert** cell.



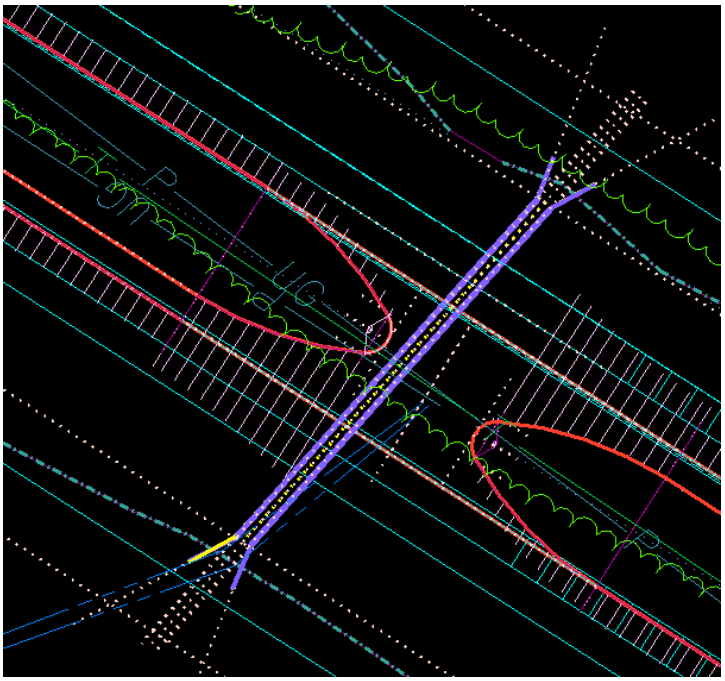
6) Choose the construction element copied on top of the road alignment.



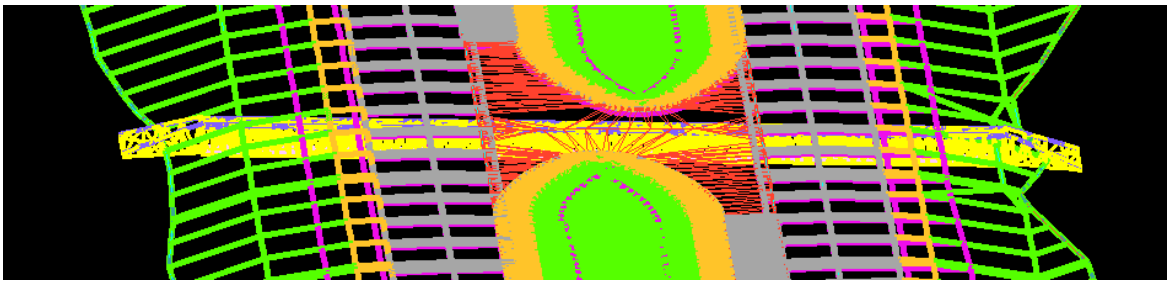
7) Choose the box culvert CL.



8) Follow remaining prompts to place box. You can see 2d and 3d views of the box below.
2D View

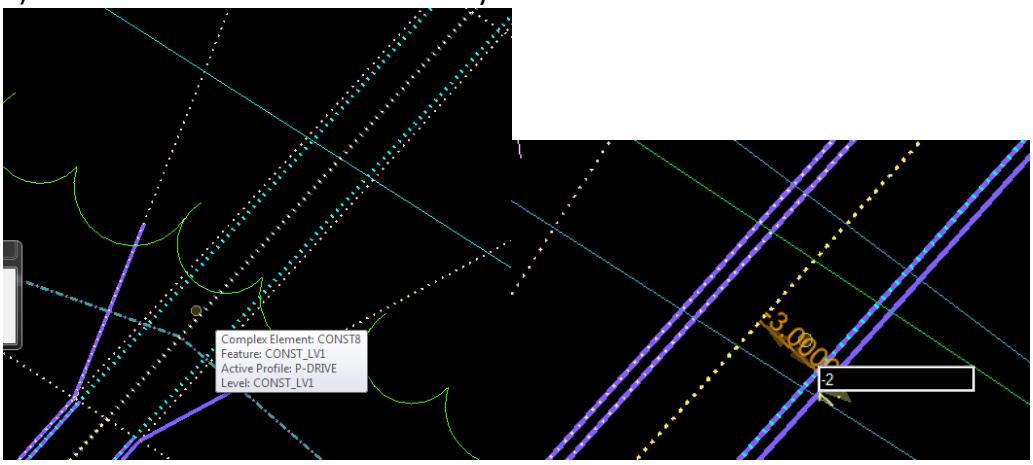


3D View

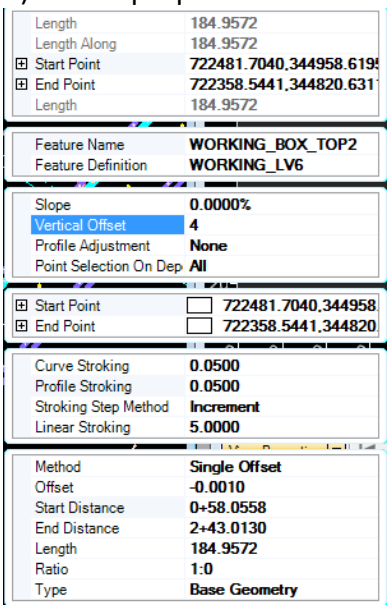


9) The box is default 6'x6' with associated thicknesses. Make any adjustments needed as shown below.

a) Select the 2 lines below to modify box width.

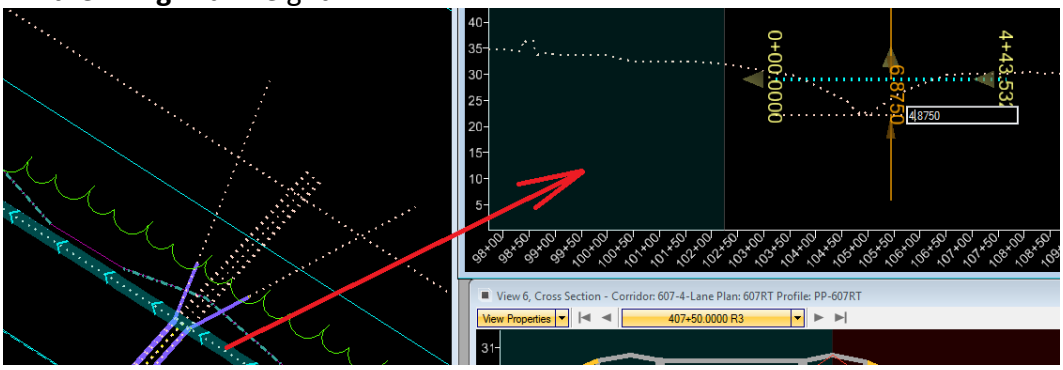


b) Go to properties on the **Working_BOX_TOP*** elements to modify height.

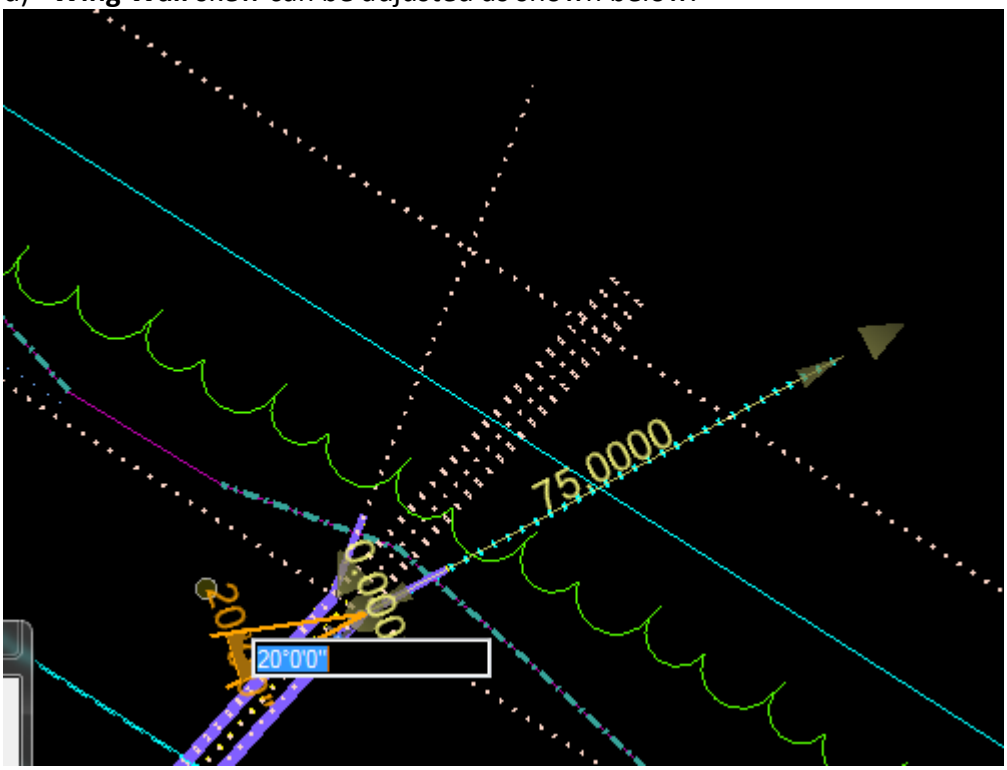


Length	184.9572
Length Along	184.9572
Start Point	722481.7040,344958.619
End Point	722358.5441,344820.631
Length	184.9572
Feature Name	WORKING_BOX_TOP2
Feature Definition	WORKING_LV6
Slope	0.0000%
Vertical Offset	4
Profile Adjustment	None
Point Selection On Dep	All
Start Point	722481.7040,344958.
End Point	722358.5441,344820.
Curve Stroking	0.0500
Profile Stroking	0.0500
Stroking Step Method	Increment
Linear Stroking	5.0000
Method	Single Offset
Offset	-0.0010
Start Distance	0+58.0558
End Distance	2+43.0130
Length	184.9572
Ratio	1:0
Type	Base Geometry

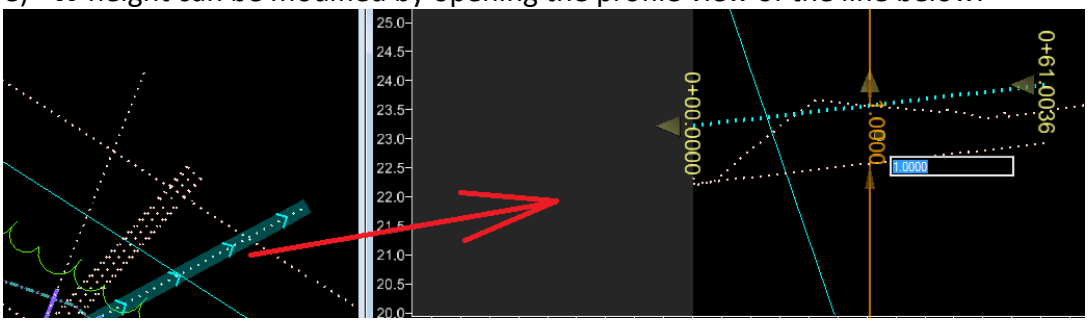
c) You'll need to modify the profile of the line below on each side of the box to adjust the **Wing Wall** height.



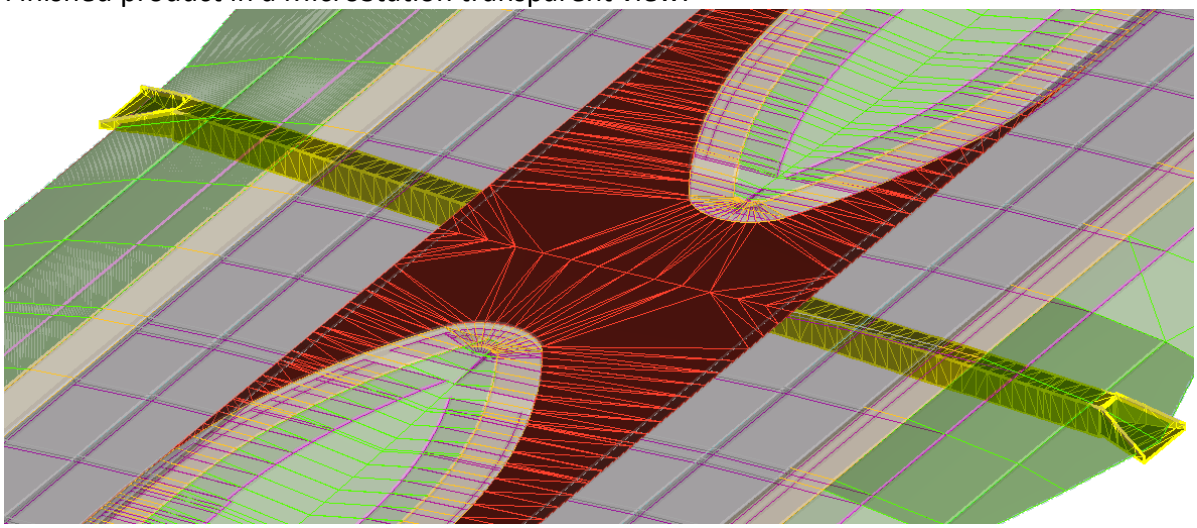
d) **Wing Wall** skew can be adjusted as shown below.



e) **W** height can be modified by opening the profile view of the line below.



Finished product in a MicroStation transparent view.



LAB XI: Ditching and Drainage

17. CROSS-SECTIONS

17.1 Section Overview

In this section you will learn how to quickly view and create cross-sections with OpenRoads tools, label cross-sections, and create cross-section sheets.

17.2 Section Prerequisites

- MicroStation Fundamentals
- Knowledge of surveying principals

17.3 Section Objectives

After completing this Section, you will be able to:

1) Create cross-sections from a Corridor.
2) Create Cross-section sheets

17.4 OpenRoads XS View

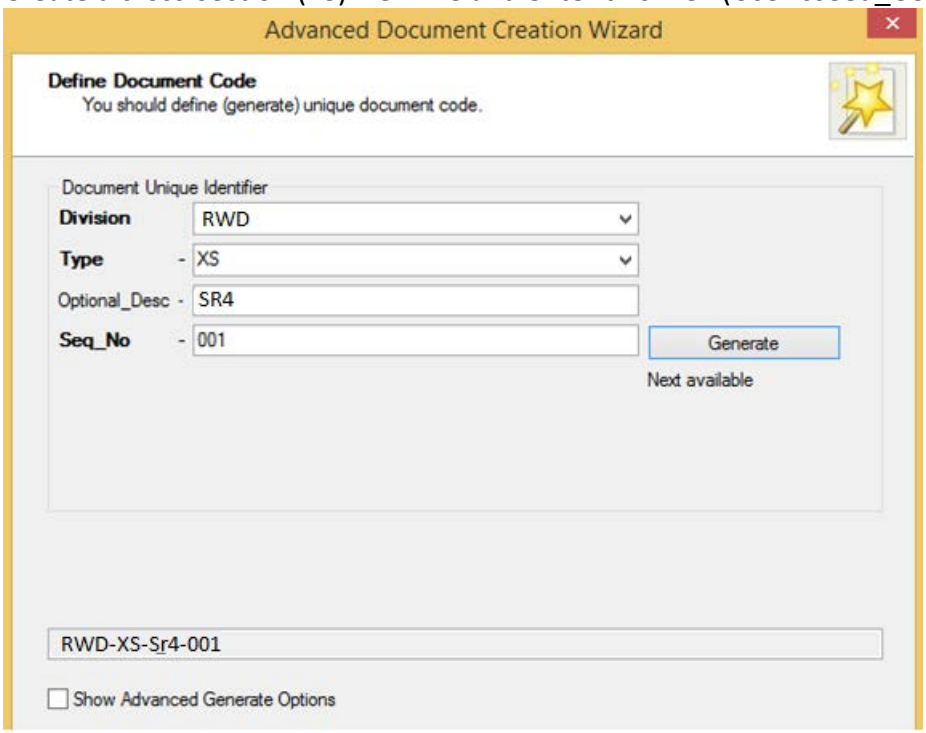
This process is discussed in the **Corridor Modeling** section of this document.

17.5 Creating Cross sections

Creating cross-sections in a DGN file for eventual sheet plotting is performed with the following steps.

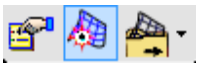
17.5.1 At Even Intervals

1) Create a cross-section (XS) DGN file and enter this file. (Use xsseed_US.dgn)



2) Reference in your alignment file, file containing the terrain, and file containing the corridor.

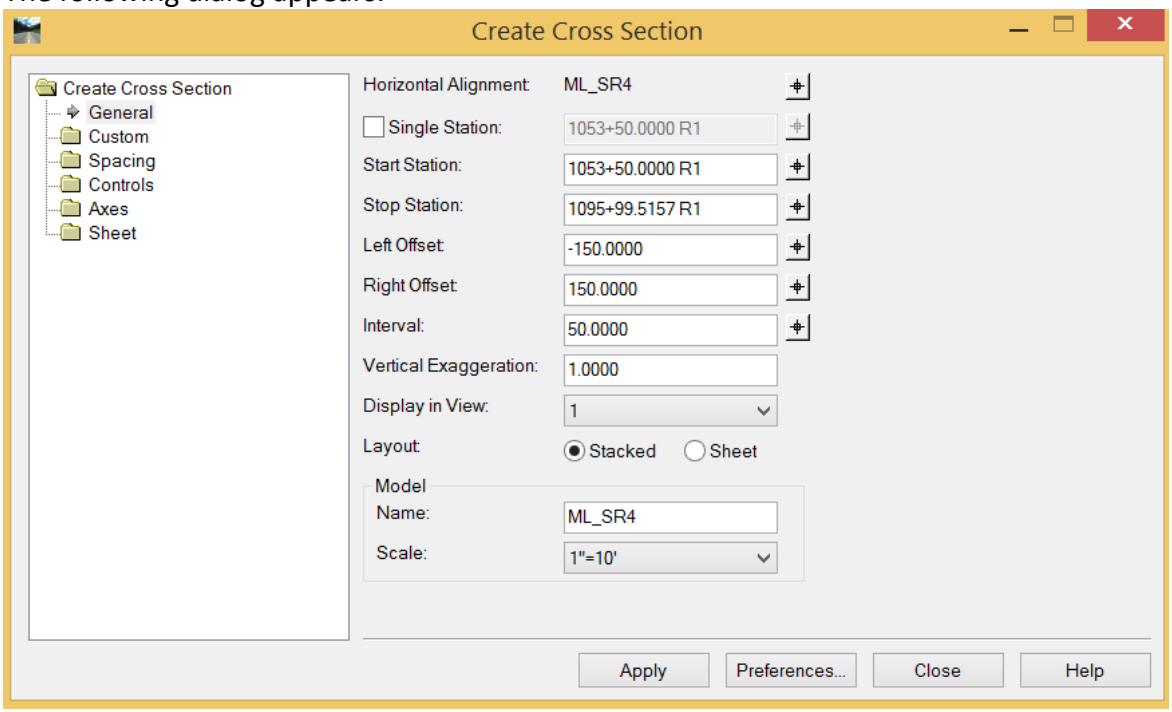
3) Make Active the terrain.



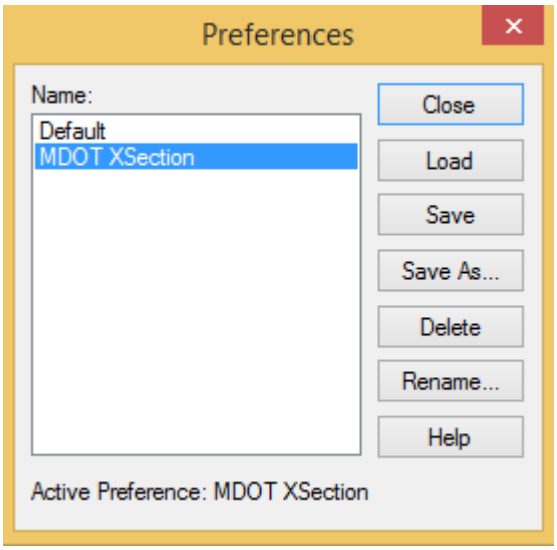
4) Choose the **Create Cross-Section** tool from the Corridor Modeling Task.

5) As prompted, **Locate Alignment** (the alignment you wish to cut cross-sections about).

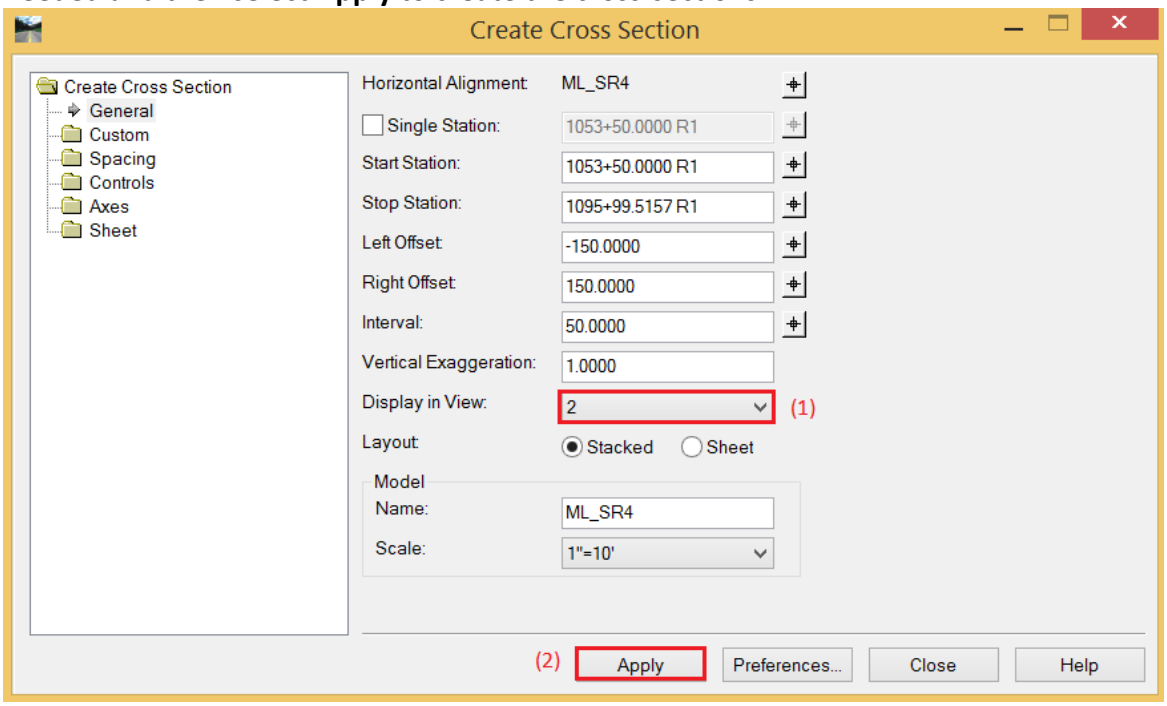
6) The following dialog appears.

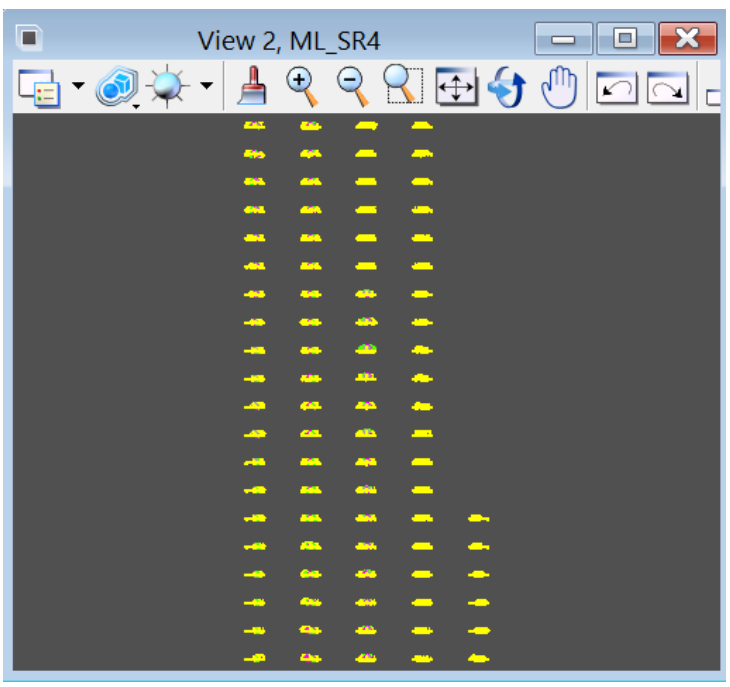


7) Choose **Preferences** and choose MDOT XSections.



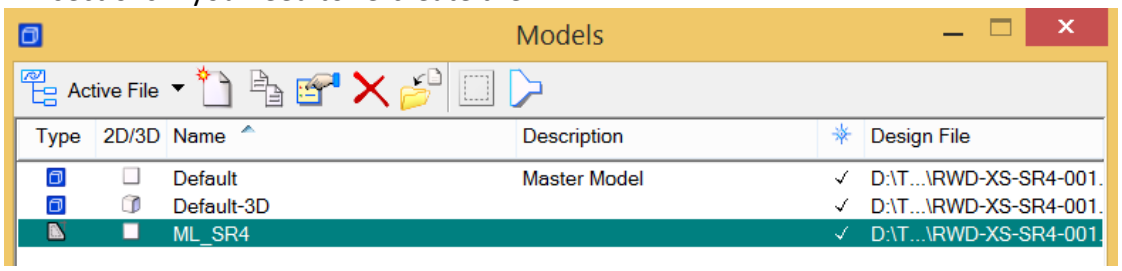
8) Change the **Display in View** to **2** and change the **Station Range**, **Offsets**, **Interval** as needed and then select **Apply** to create the cross-sections.



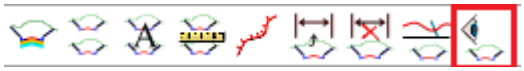


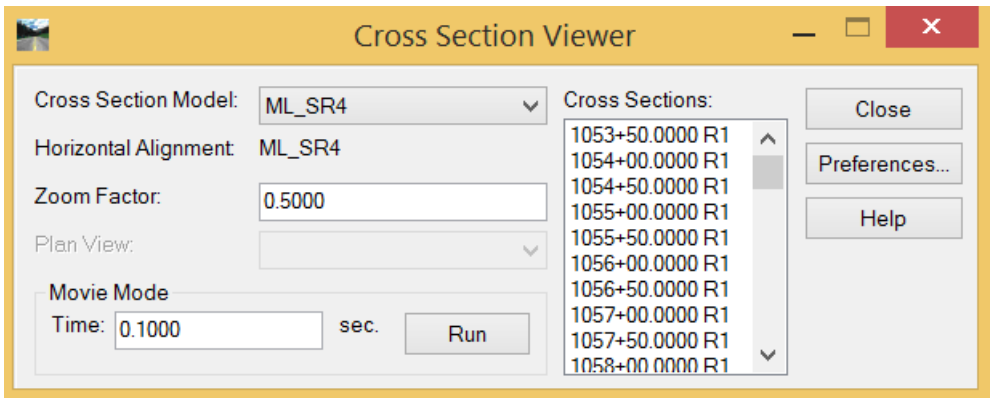
Notes:

- Cross sections are created in their own separate model named after the alignment they were processed about. Deleting the model will delete the cross-sections if you need to re-create them.



- You can use the **Cross Section Viewer** to navigate through the cross-sections.



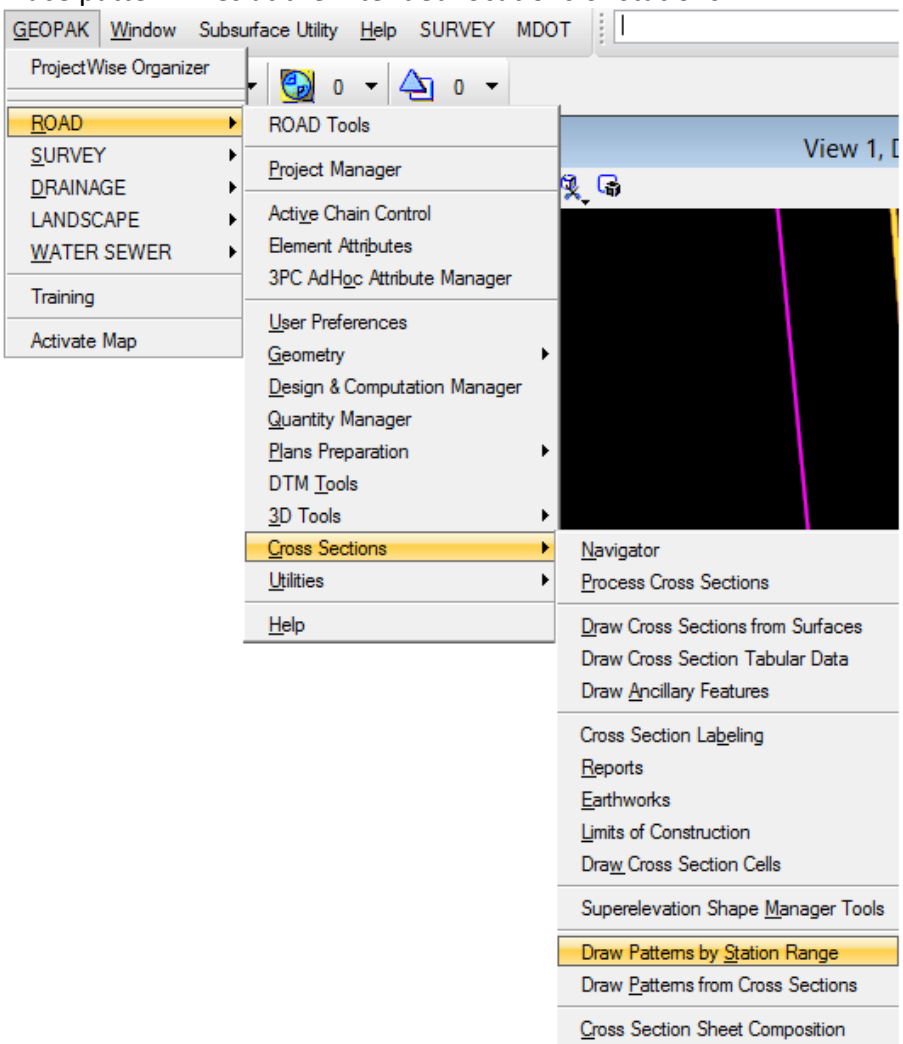


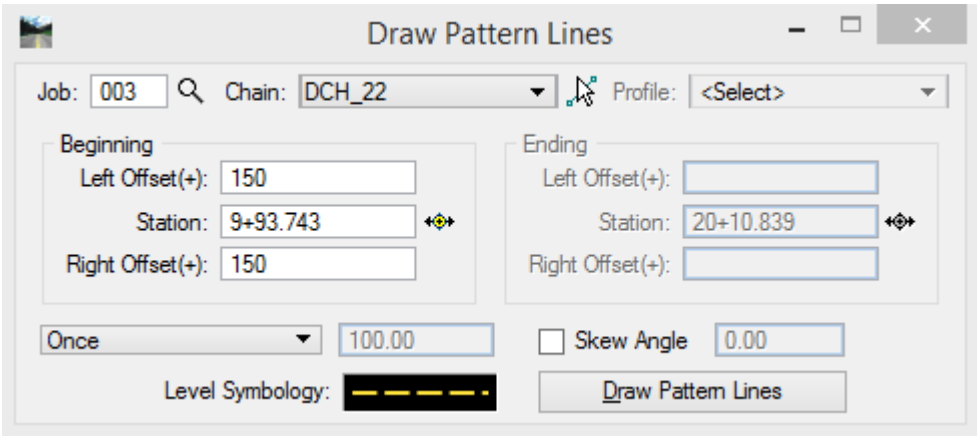
- These are traditional GEOPAK working cross-sections so you can use GEOPAK's cross-section labeler, etc. to label.

17.5.2 By Pattern Lines

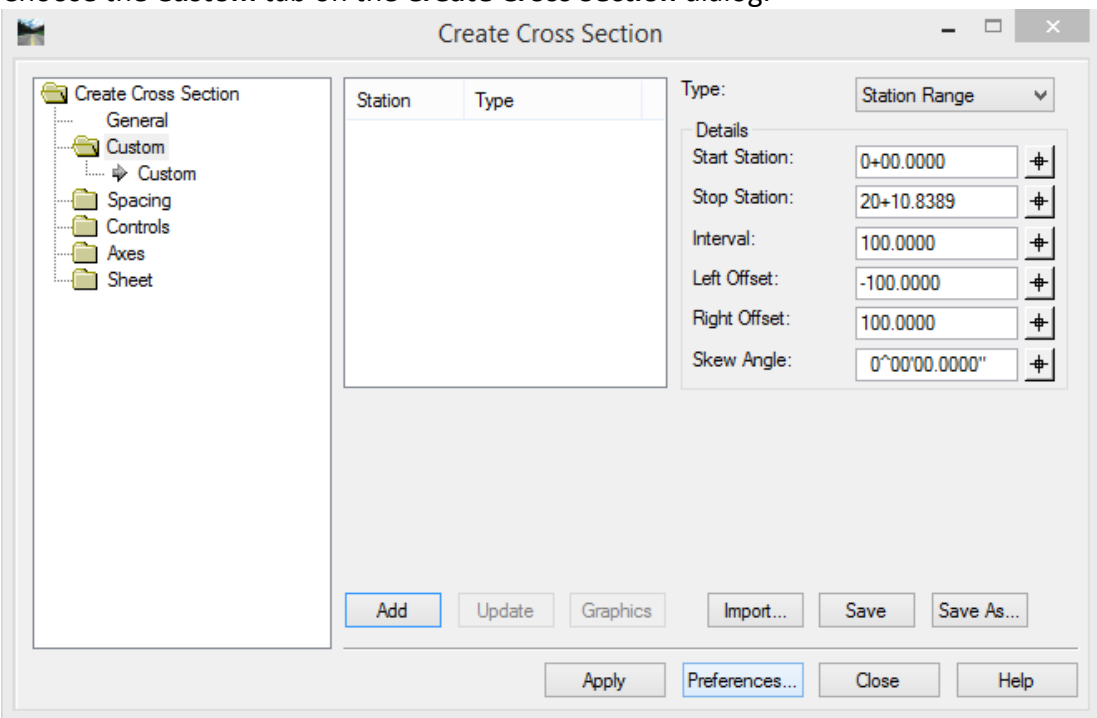
If you want cross-sections cut at specific stations:

1) Place pattern lines at the intended locations or stations.

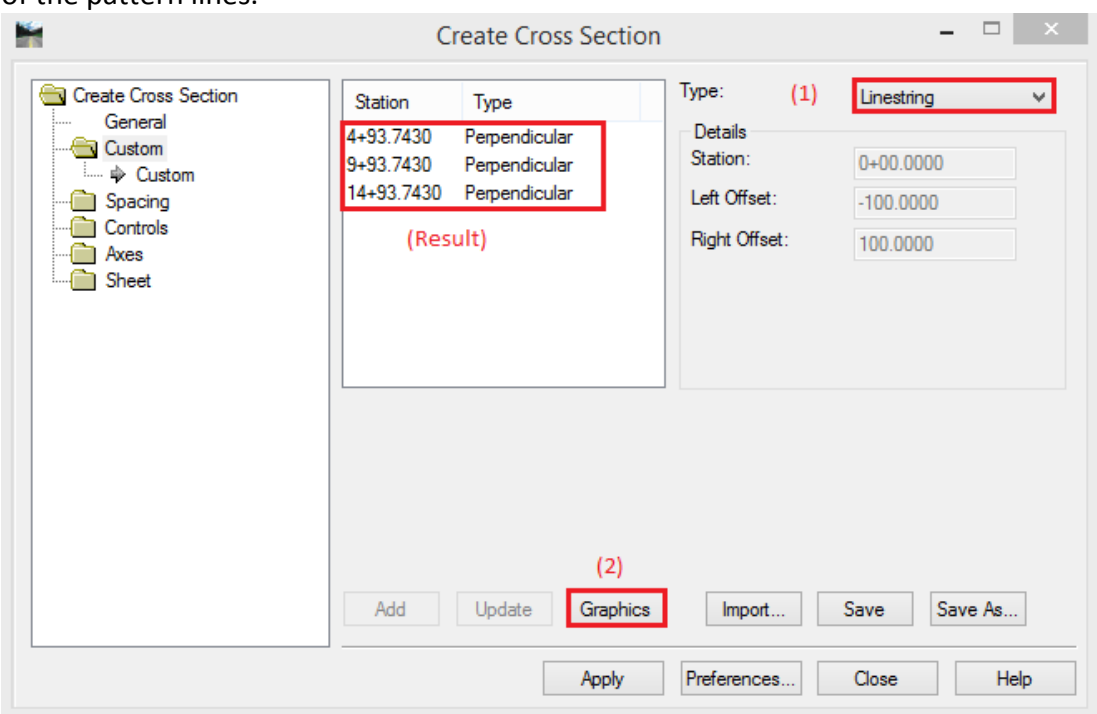




2) Choose the **Custom** tab on the **Create Cross Section** dialog.



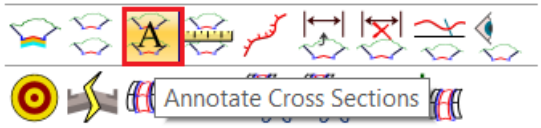
3) Use MicroStation's select set tool to select the pattern lines.
4) Change **Station Range** to **Linestring** and then select **Graphics** to fill out the Stations of the pattern lines.



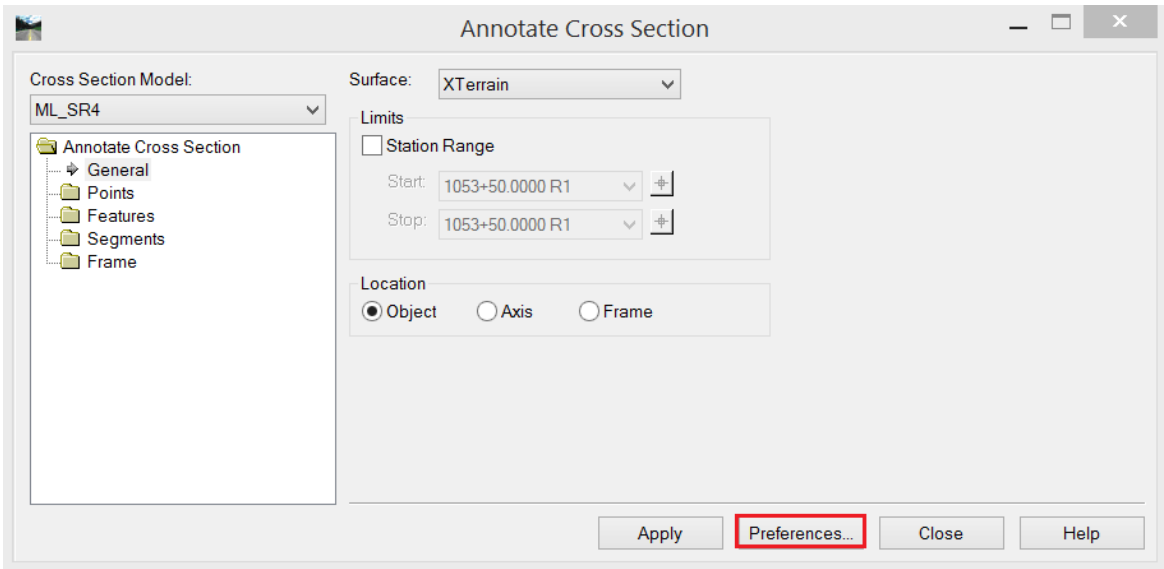
5) Select **Apply** to create the cross-sections.

17.6 Annotation Cross-Sections

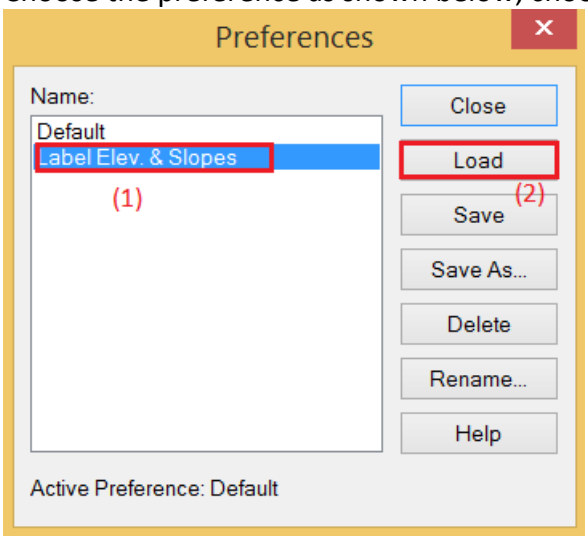
2) Choose the Annotate Cross Sections tool from the Corridor Modeling task.



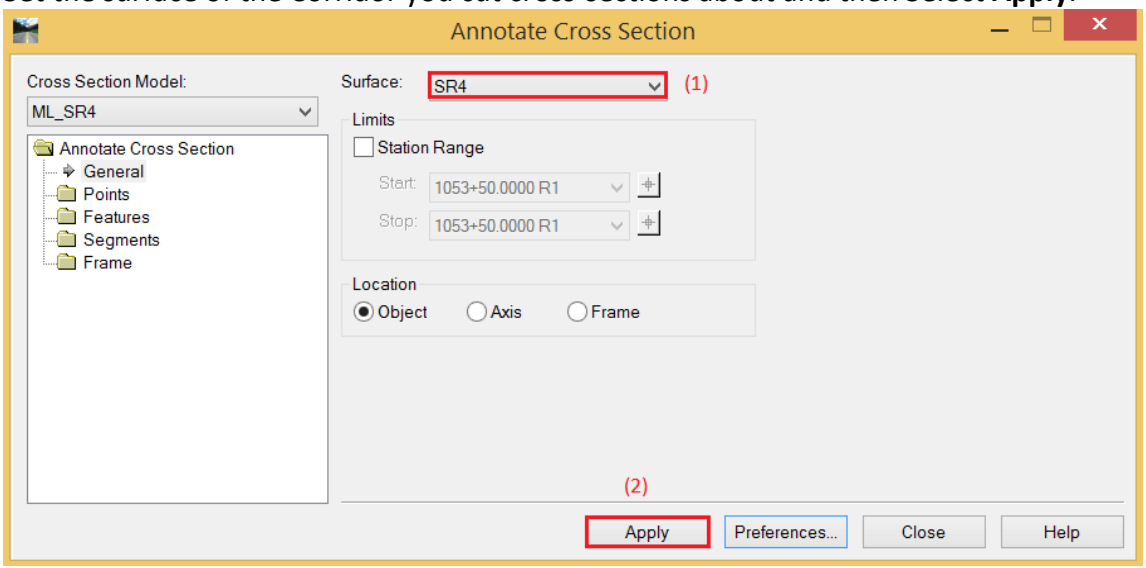
3) Select Preferences.



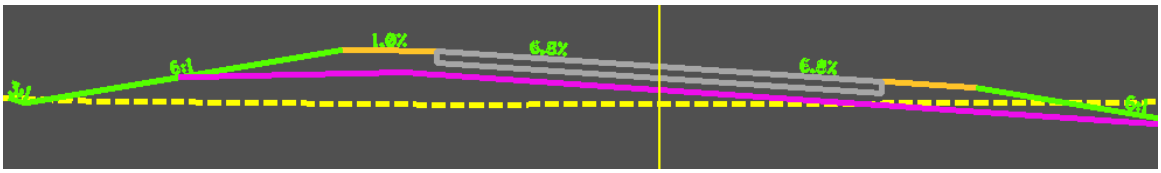
4) Choose the preference as shown below, choose Load, and then choose Close.



5) Set the surface of the Corridor you cut cross-sections about and then Select **Apply**.

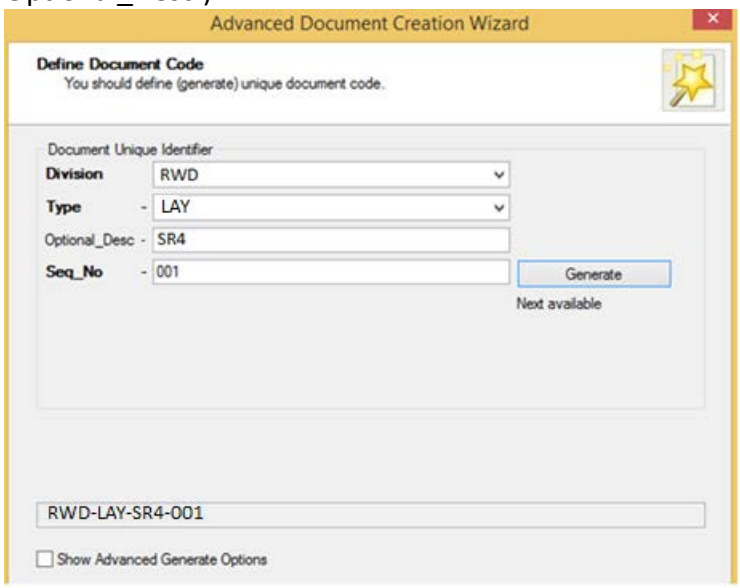


The annotations are shown below.

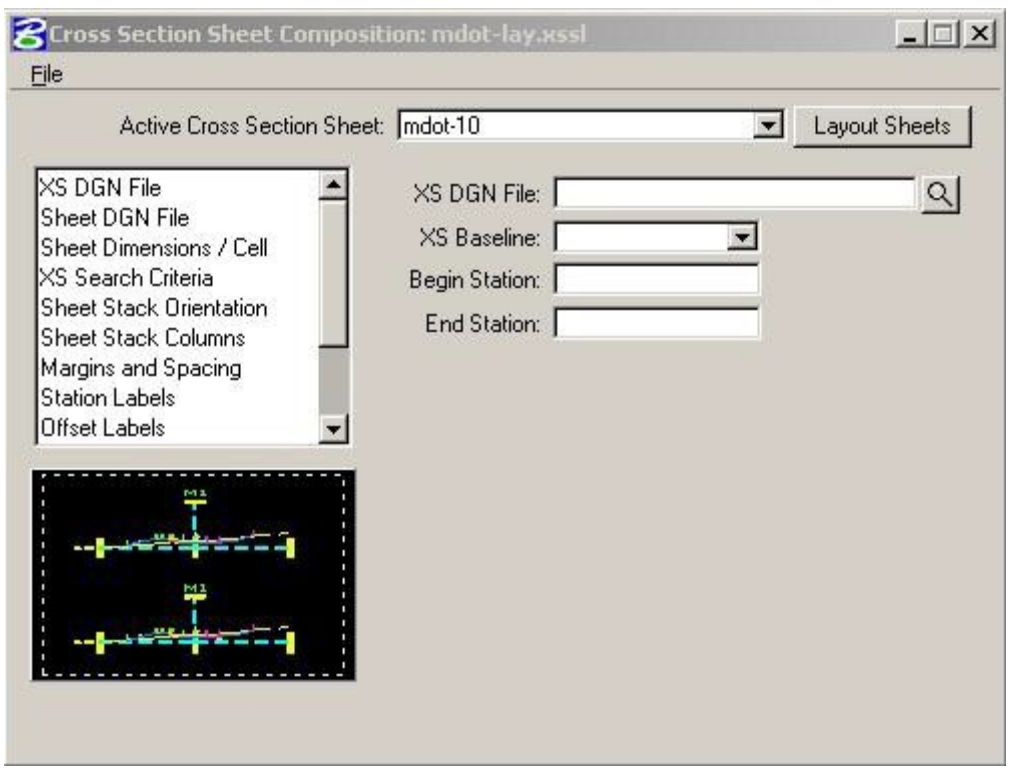


17.7 Cross Section Sheets

1) Create a 2d design file (Use xsseed DGN) (Include the alignment name in the Optional_Desc.)



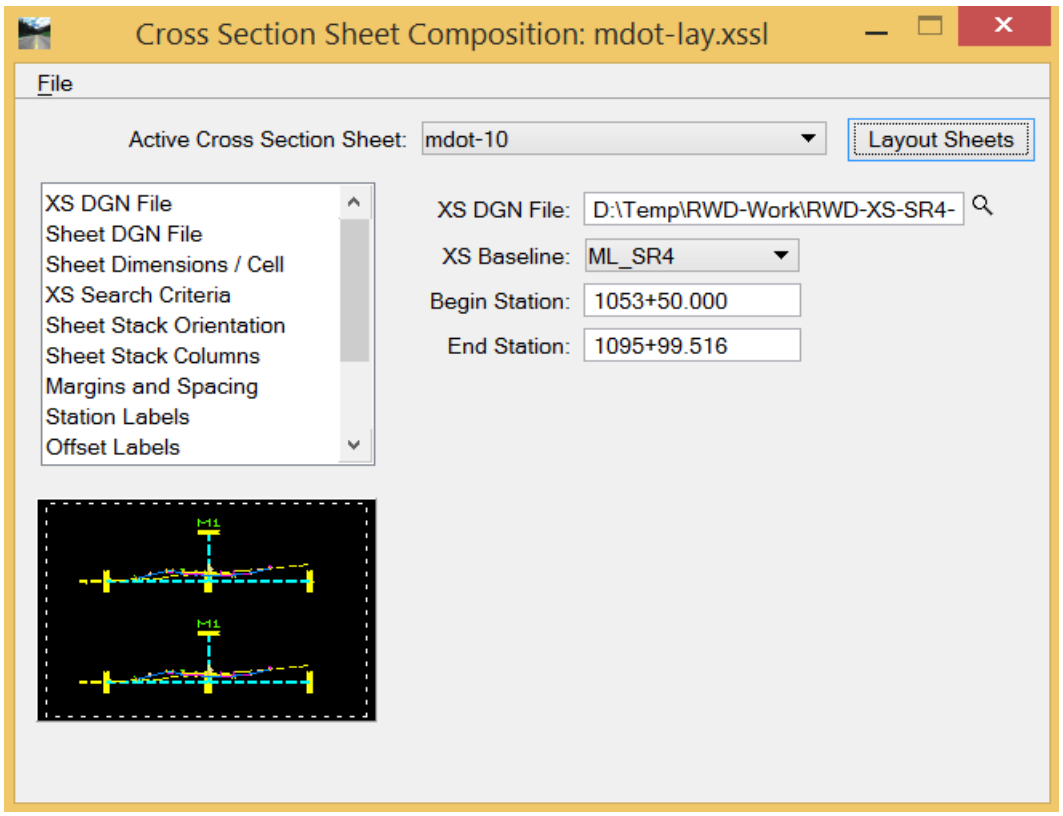
2) Open GEOPAK's Cross-Section Sheet Composition.



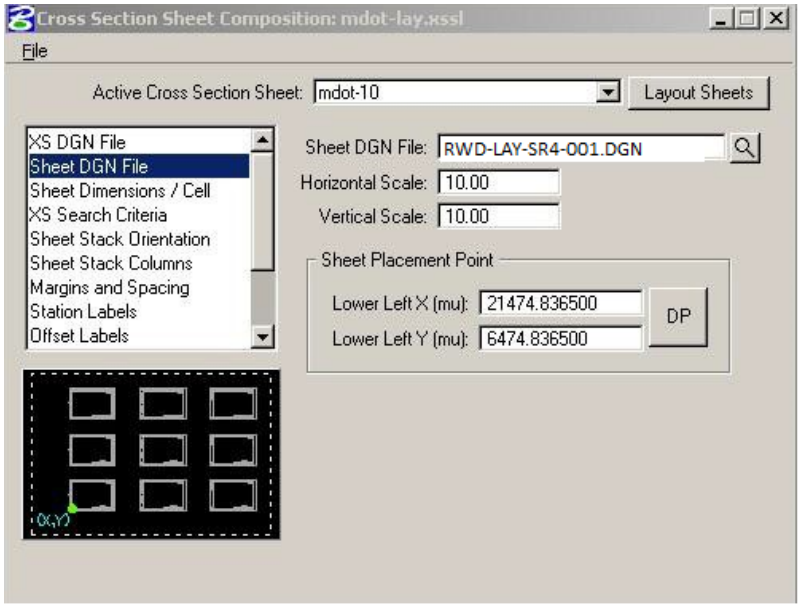
3) Active Cross-Section Sheet
Choose the ACTIVE CROSS-SECTION SHEET at the top of this dialog.

MDOT-10 -> 1”=10’ Single Stacked.
MDOT-5 -> 1”=5’ Single Stacked
MDOT-10-DS –> 1”=10’ Double Stacked
MDOT-20 -> 1”=20’ Single Stack
MDOT-10-2ew -> 1”=10’ Single Stack (2 EW Phases)
MDOT-10-3ew -> 1”=10’ Single Stack (3 EW Phases)

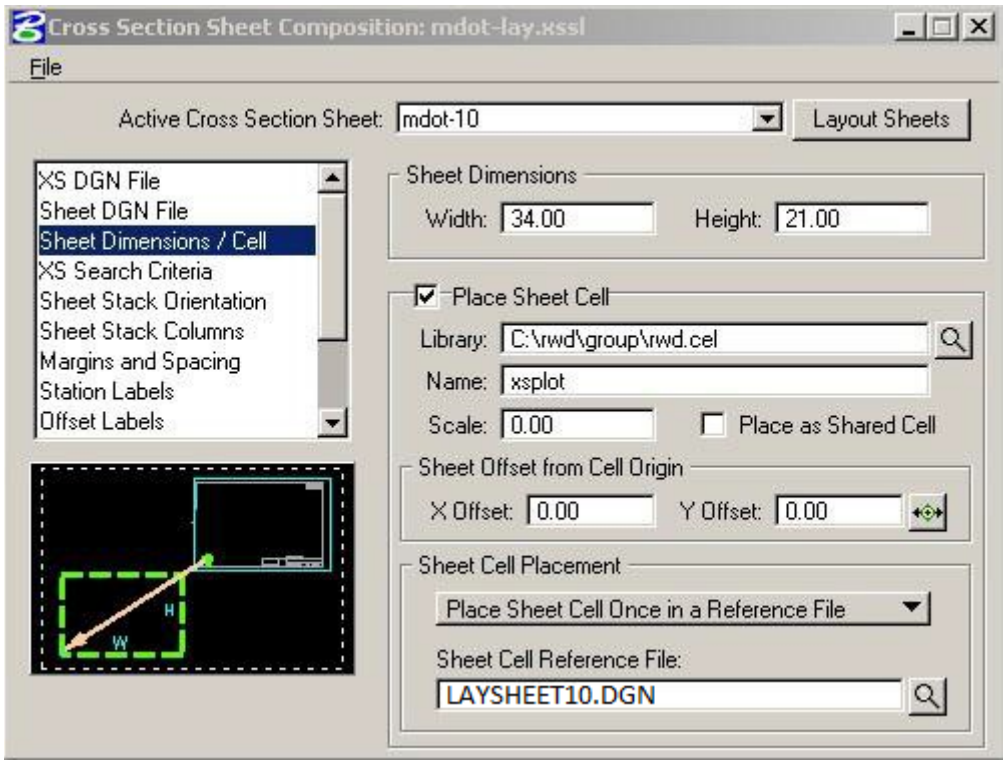
4) XS DGN Tab
Select the **XS DGN** tab on the left of the dialog and then choose the XS DGN file. The XS Baseline and Beginning and Ending Stations should be filled out automatically.



5) Sheet DGN File Tab
Select the SHEET DGN FILE tab and choose the DGN file you want the XS Sheets created in. This will be the DGN file created in step 1.



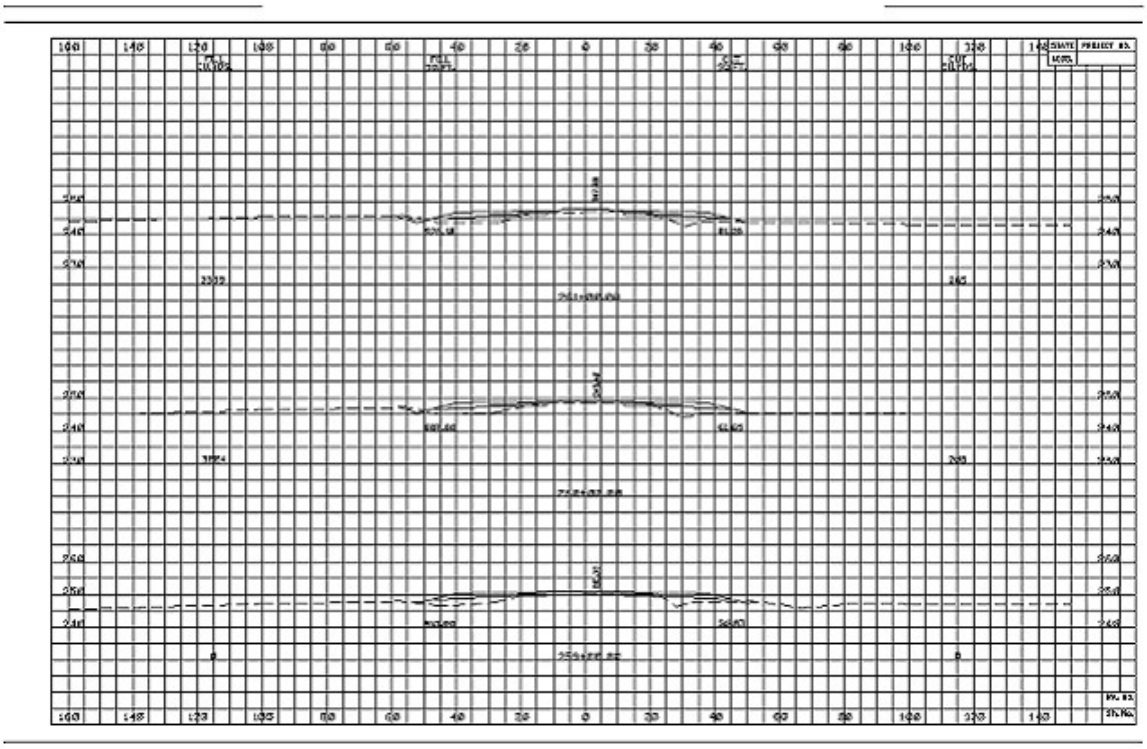
6) **Sheet Dimensions/Cell**
Select the **Sheet Dimensions / Cell** tab and make sure the **Place Sheet Cell** is checked, and then enter the name of the Sheet Cell Reference File which will be created.



Note: The Sheet cell **xsplot** or **xsplot5** will be placed in the file specified for the **Sheet Cell Reference File** and referenced to your XS Sheet DGN file for each XS Sheet.

7) Layout Sheets
Select **LAYOUT SHEETS** or **FILE -> LAYOUT** Sheets on the main dialog.

SINGLE STACKED X-SECTIONS
AT A SCALE OF 1"=10' <1:100>



LAB XII: CROSS-SECTIONS

1. Create cross-sections for corridor SR4.
2. Annotate the cross-sections.
3. Create cross-section sheets for the SR4 cross-sections.

18. SETTING ROW

18.1 Section Overview

After limits of construction have been created through the **Corridor** and **Civil Cell** process, ROW limits can be established and ROW markers placed using **Horizontal Geometry** tools and **Civil AccuDraw**.

18.2 Section Prerequisites

- MicroStation Fundamentals
- Horizontal and Vertical Geometry basics

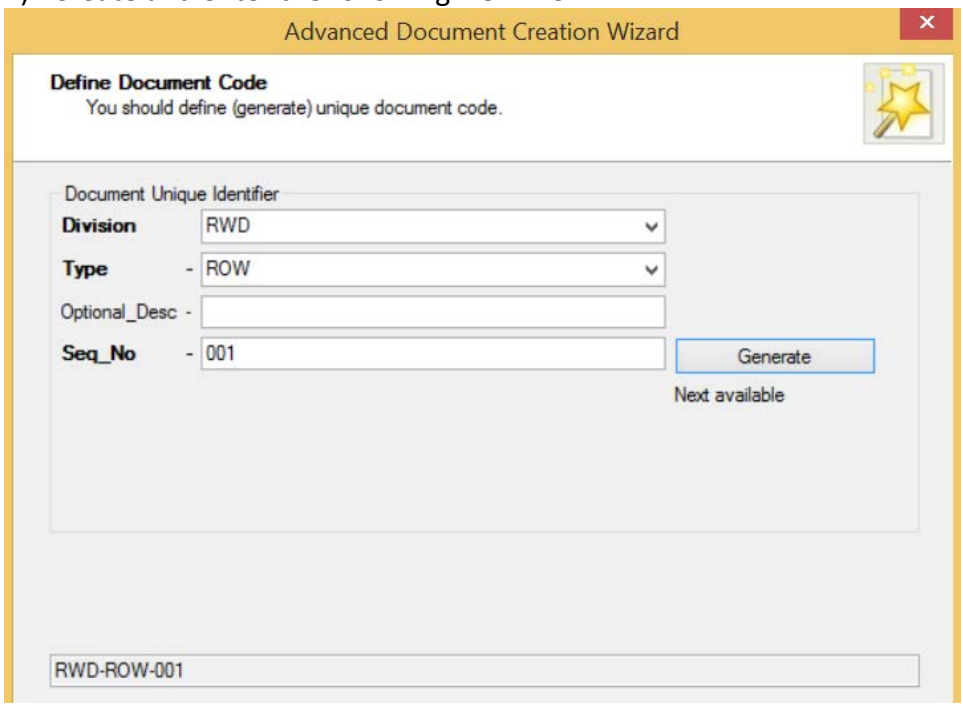
18.3 Section Objectives

After completing this section, you will be able to:

1) Use Horizontal Geometry to create ROW line work and place ROW Markers.

18.4 Creating the ROW DGN file

1) Create and enter the following DGN file.



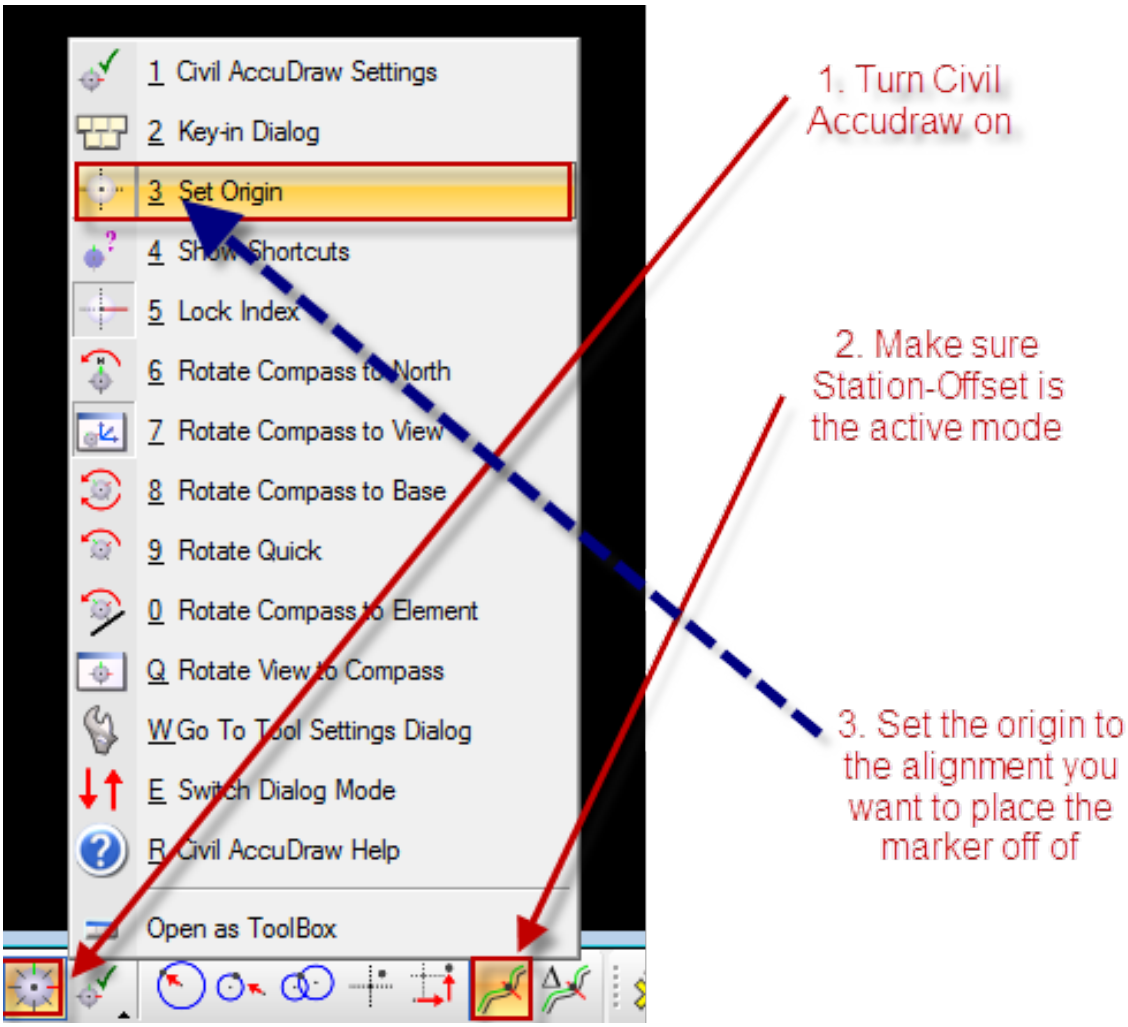
2) Reference RWD-ALI-001.DGN, SRV-TOPO-001.DGN, and RWD-CORRIDOR-*.DGN

18.5 Placing Markers

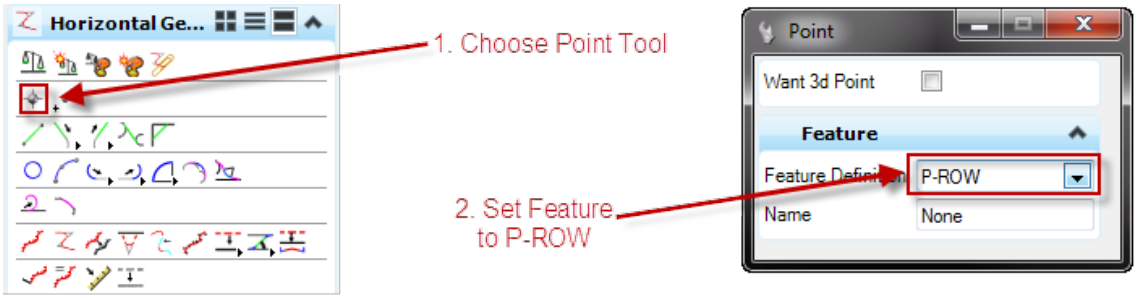
Notes:

- All alignments must be placed using civil geometry or imported with civil rules.
- This method is the same for placing easement points. Use the feature definition P-Easement for the point and ROW-Easements for the line.

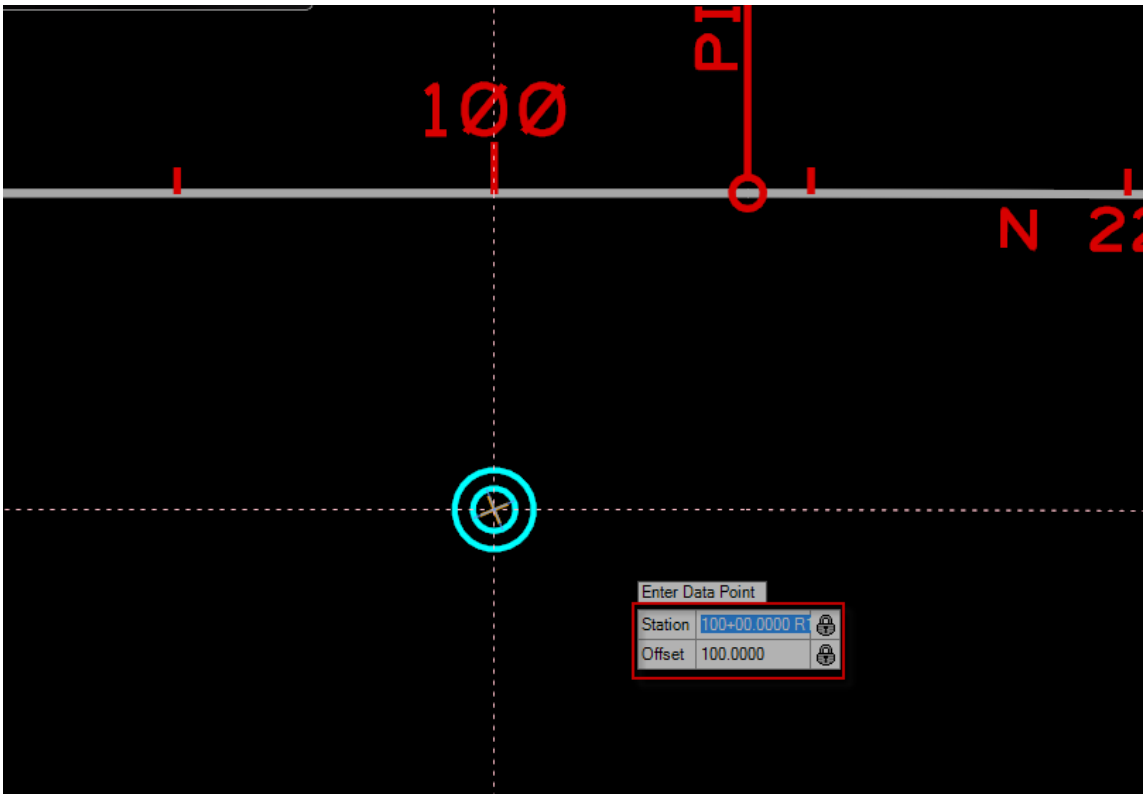
1) Turn on Civil AccuDraw and set your origin to the alignment you want your marker to be placed off of. Make sure Station-Offset is the active mode.



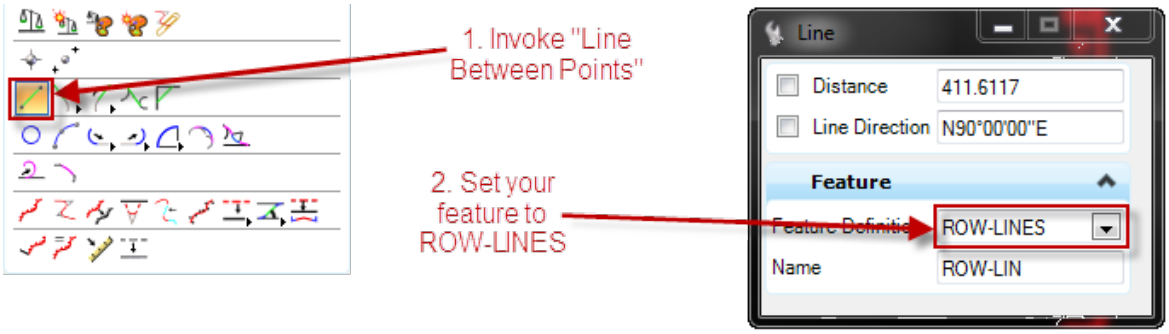
2) Invoke the point command and set the feature to P-ROW.



3) Enter the station and offset you want to place the marker on in the Civil AccuDraw menu (you must move the mouse to accept the input).



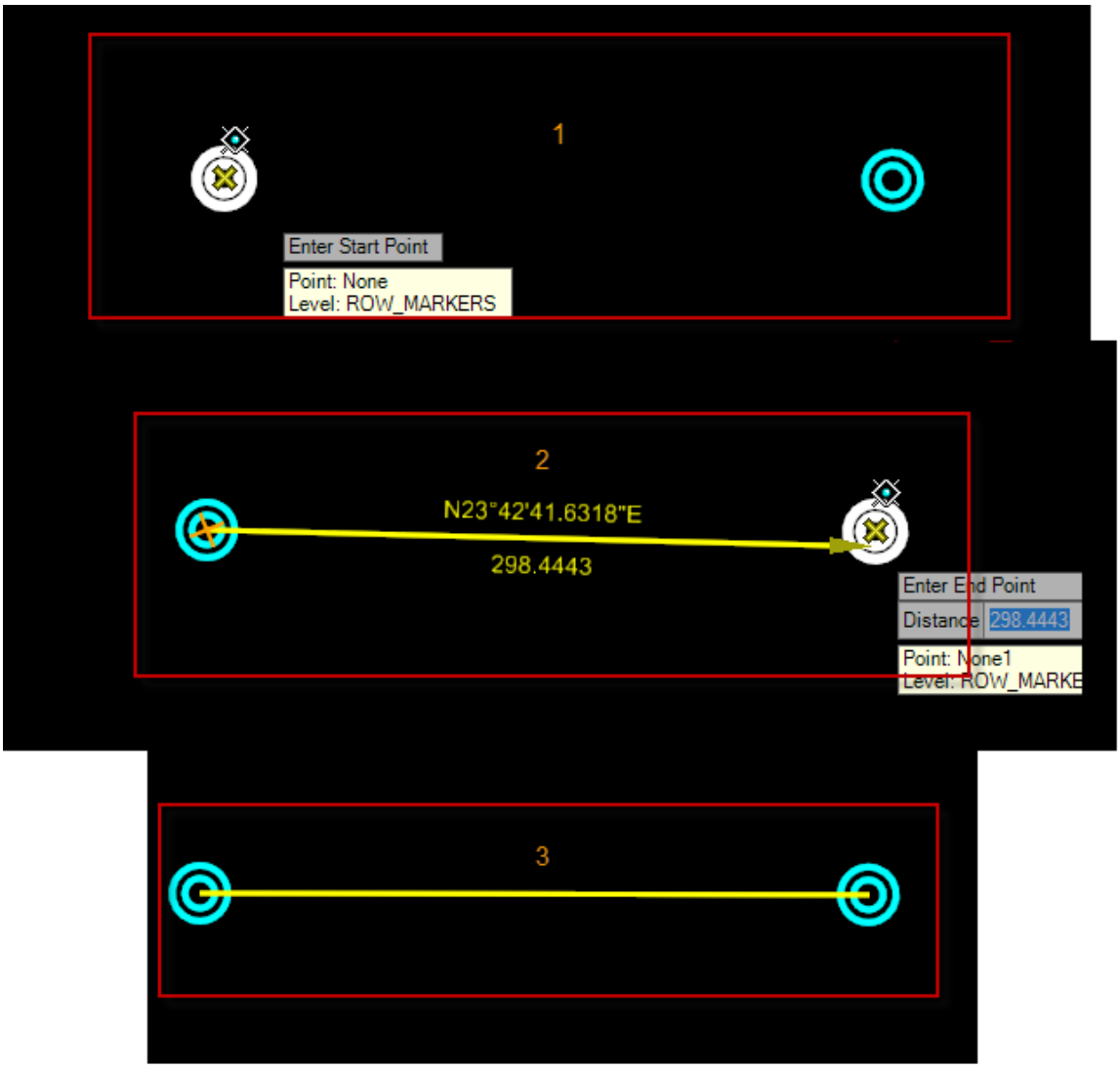
4) After you've placed multiple markers, you will want to draw the connecting ROW line. Invoke the **Line Between Points** dialog and set your feature to ROW-LINES.



Notes:

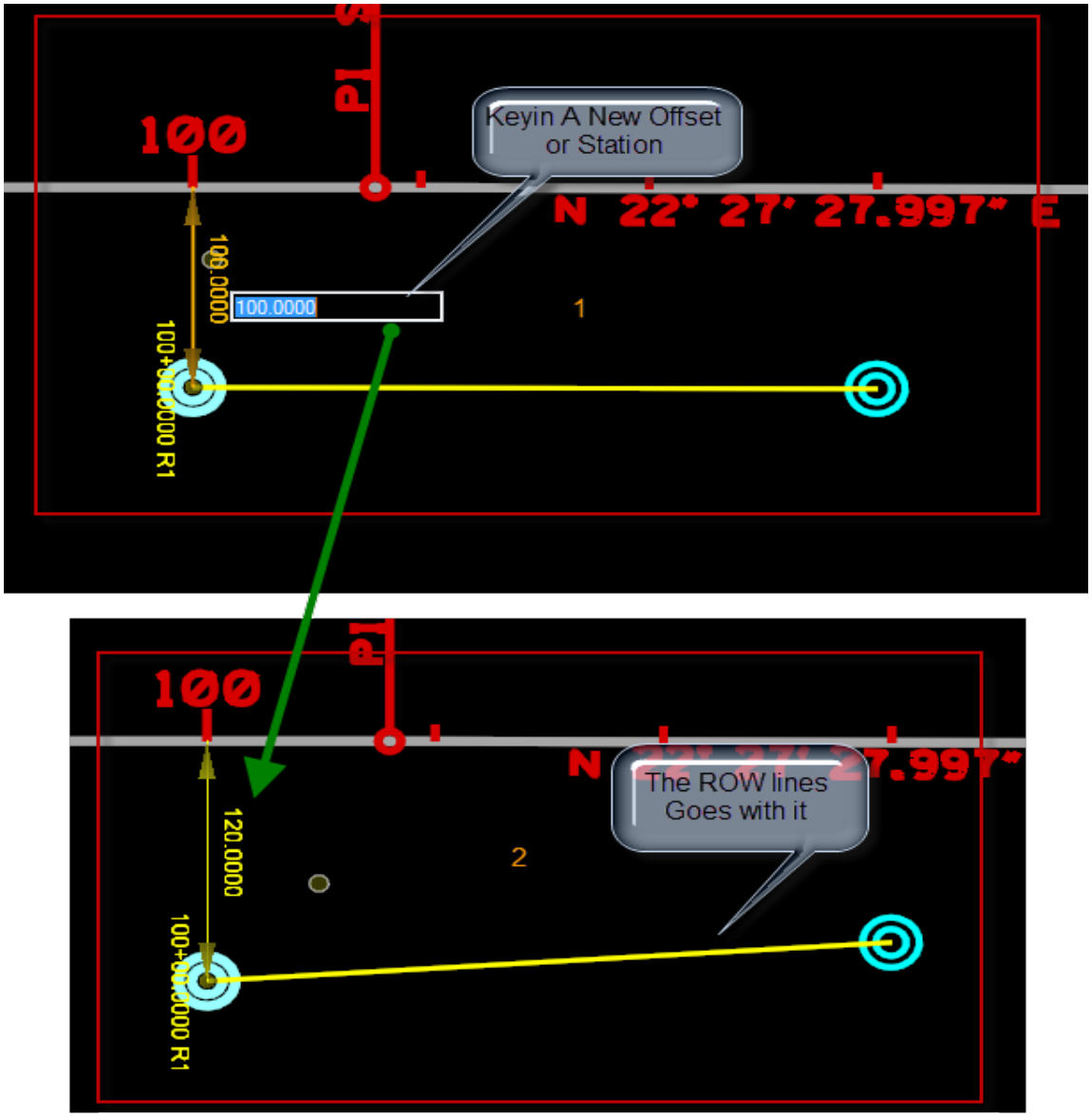
- You will need to use origin snap.
- You can also turn off civil AccuDraw).

5) Snap to the origin of the first ROW marker and then to the next to complete the line.



18.6 Modifying ROW Placement

To modify the marker's placement, simply click on the marker and change the station and/or offset. The ROW line will move with it.



LAB XIII: SETTING ROW

1. Create the file RWD-ROW-001.DGN and reference the Corridor DGN file to view the limits of construction, RWD-ALI-001.DGN, and SRV-TOPO-001.DGN

2. Place the following markers using the P-ROW feature.
   1053+50 50’ RT
   1053+50 90’ RT
   1060+37.5615 90’ RT
   1073+99.4597 90’ RT
   1073+99.4597 135’ RT
   1083+88.3906 140’ RT
   1083+88.3906 115’ RT

3. Place the ROW lines using the ROW-LINE feature.

4. Change the marker at 1073+99.4597 from 135’ offset to 140’ offset.

19. EARTHWORK

19.1 Section Overview

Surface to Surface Earthwork calculations are accomplished by:

1. Generating terrains of your **Top Dirt** surface via AMG preparation steps.
2. Placing shapes along the intended alignment that match your **Plan and Profile** sheet stationing.
3. Using the **Analyze Volumes** Terrain Tool.

Calculations and shapes used to identify volume areas should be shown in the same DGN file in which AMG deliverables are generated.

19.2 Section Prerequisites

- MicroStation fundamentals
- Horizontal and Vertical Geometry basics

19.3 Section Objectives

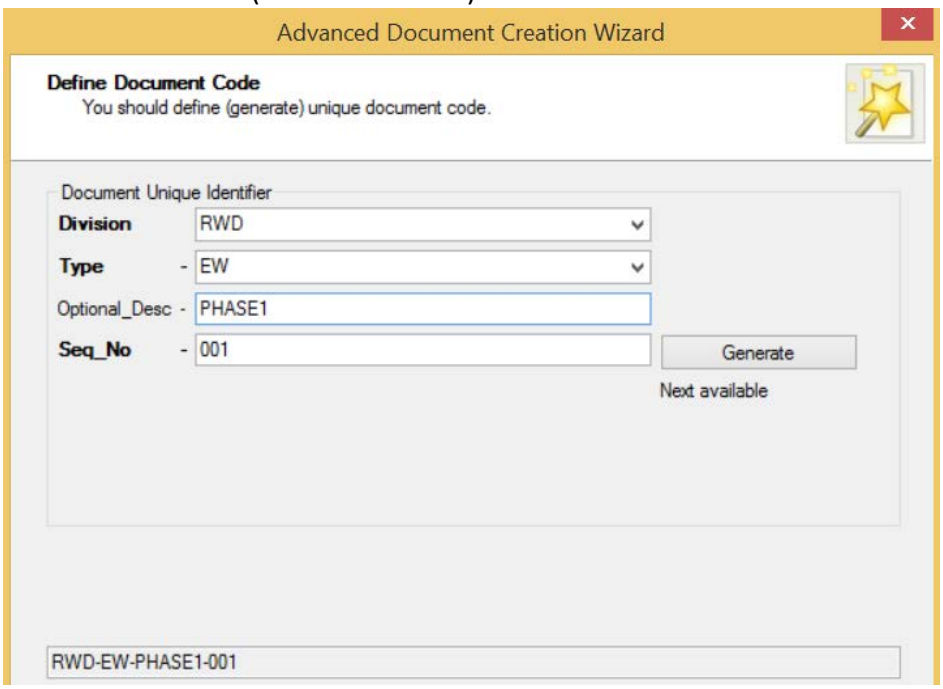
After completing this section you will be able to:

1) Calculate earthwork between terrains and within the limits of your Plan and Profile borders.

19.4 Steps: Surface to Surface

Follow the **AMG-Delivery** instructions in this document to generate a **Top Dirt** Terrain.

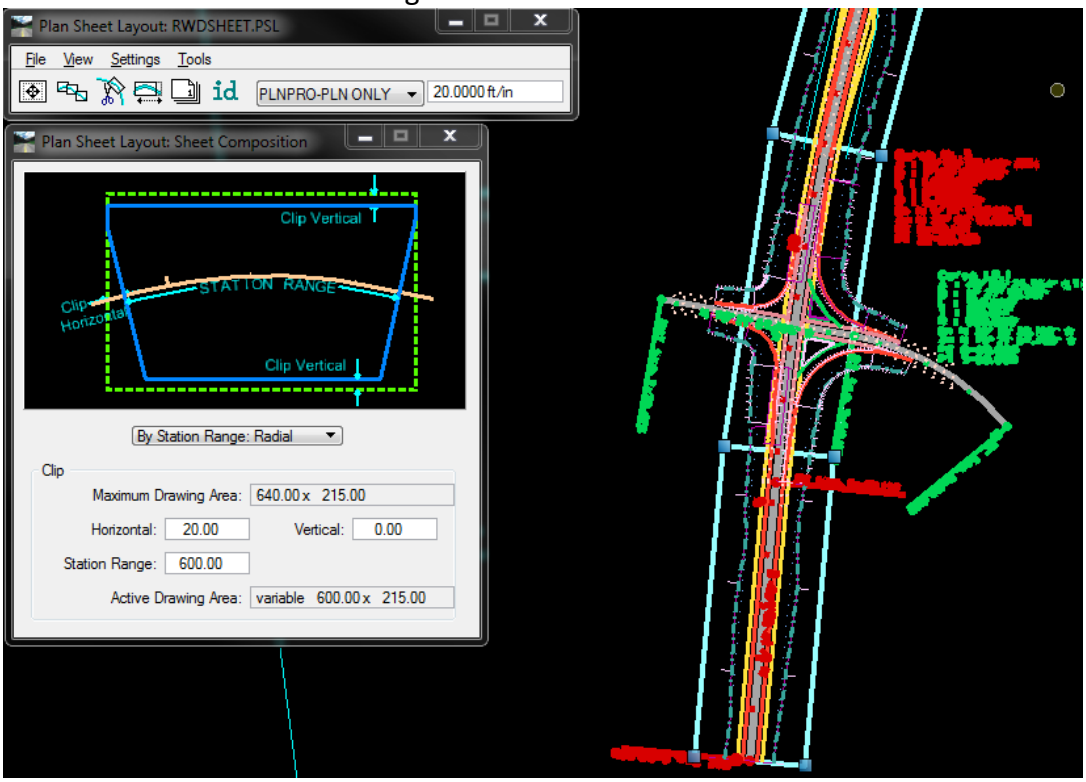
1) Create and enter the file RWD-EW-PHASE1-001.DGN to calculate Surface to Surface earthwork (Use 2d Seed file).



2) Reference SRV-TOPO-001.DGN, the file containing the existing ground terrain.
3) Reference RWD-3d-Terrain-D-*.DGN
4) Place shapes along the alignment that represent the Plan and Profile station limits.

Note:

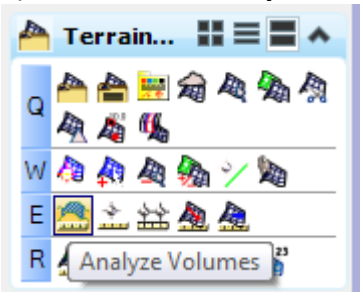
- You can utilize GEOPAK's Plan and Profile tool with settings as shown below to place these shapes. Note the values shown below are for 1"=20' sheets and would need to be changed for 1"=100'.



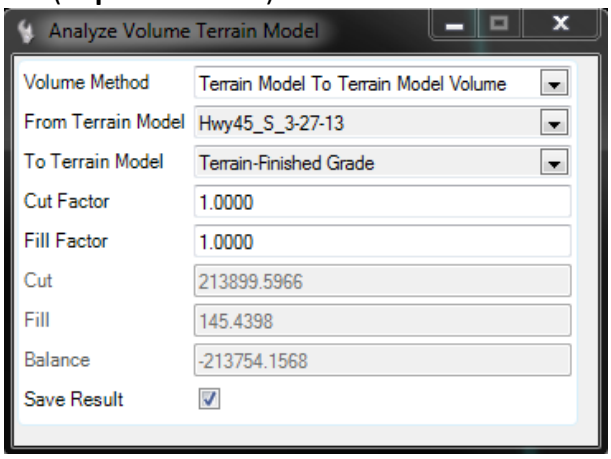
Note:

- **Choose By station Range: Radial** which is not the setting used in Plan and Profile sheet setup.

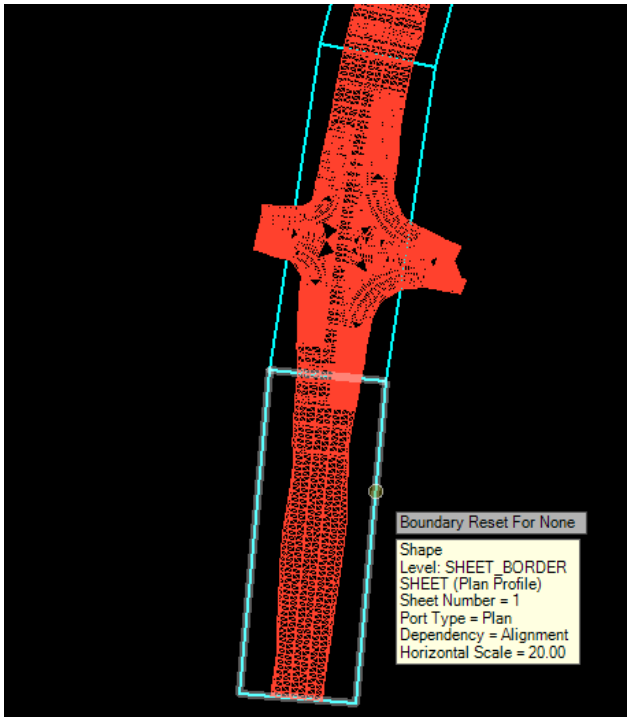
5) Choose the **Analyze Volumes** command from the **Terrain** tools.



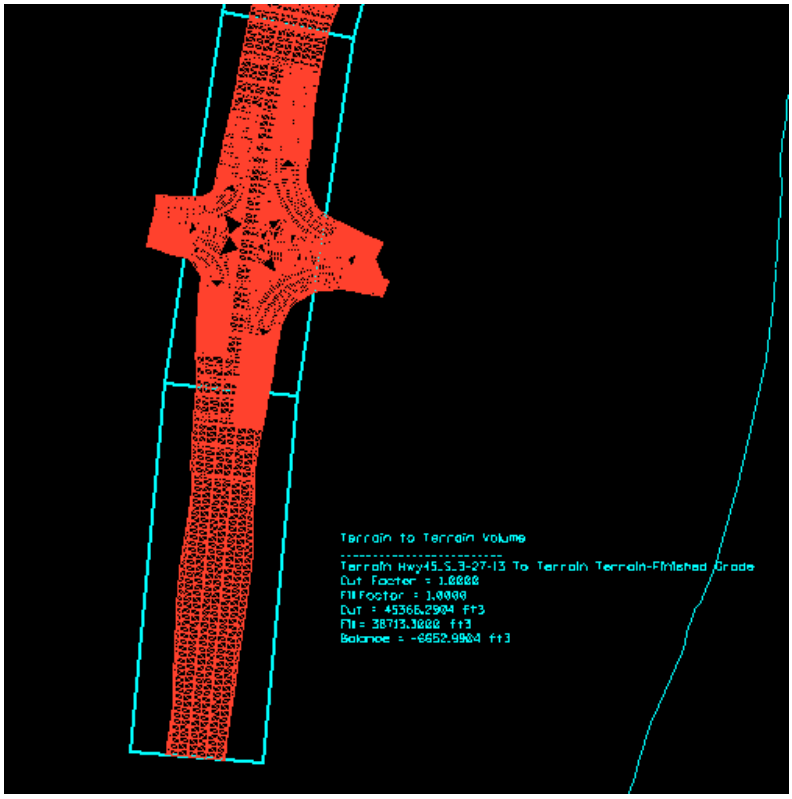
6) Choose the **From Terrain Model** (existing ground terrain) and **To Terrain Model** (**Top Dirt** terrain).



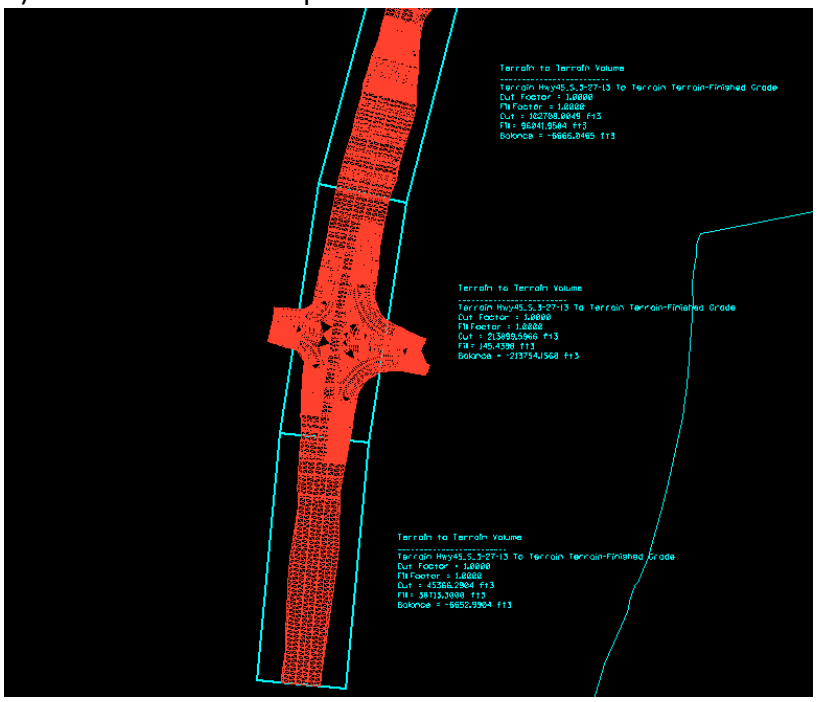
7) Follow the prompts. When prompted for **Boundary**, choose the first Plan and Profile sheet.



8) Click **Save Results** and then place the volumes by the appropriate boundary element.



9) Use these same steps to calculate volumes for each boundary.



20. PDF CREATION

20.1 Section Overview

This section covers PDF plot creation through Plot Organizer and creating PDF's with the correct naming convention.

20.2 Section Prerequisites

- MicroStation fundamentals
- ProjectWise fundamentals

20.3 Section Objectives

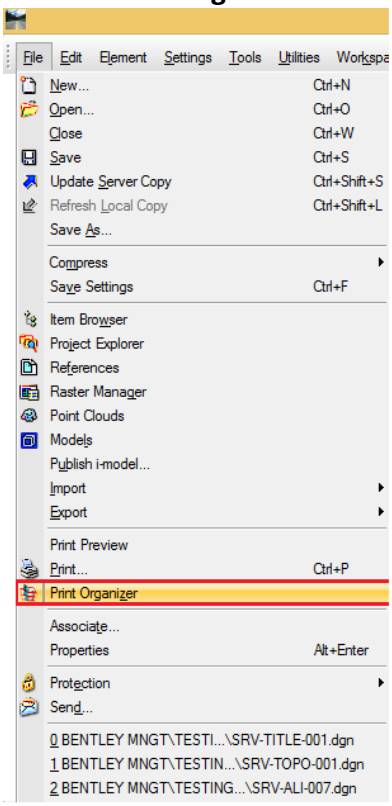
After completing this Section, you will be able to:

1) Create a PDF plot set with the PDF having the proper naming convention.
2) Number sheets automatically.

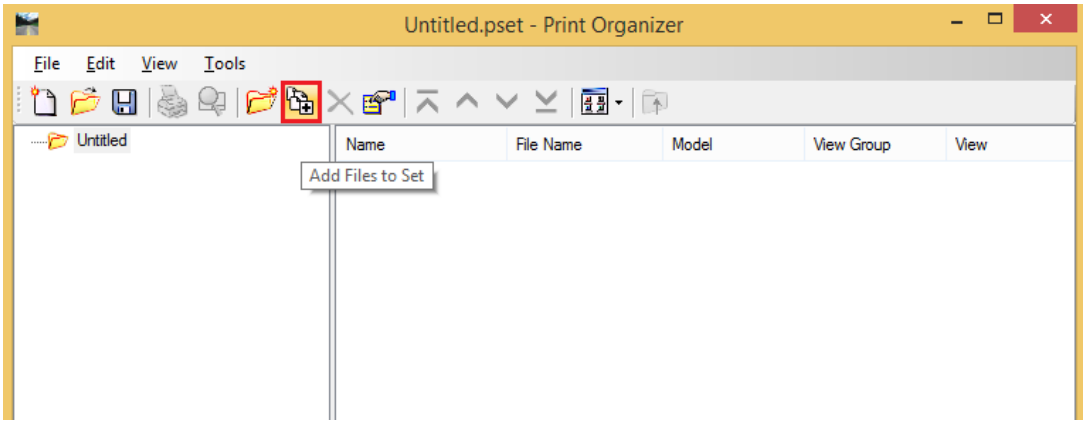
20.4 PDF creation Process

While in MicroStation:

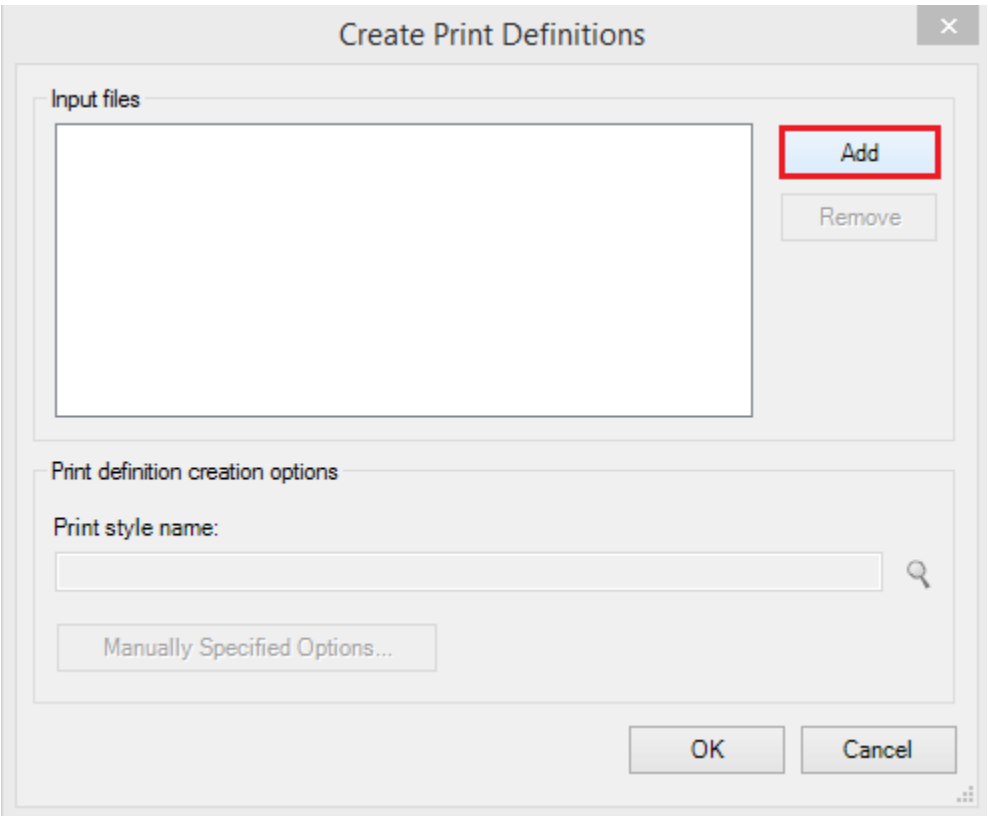
1) Choose **Print Organizer** from MicroStation's **File** pulldown.



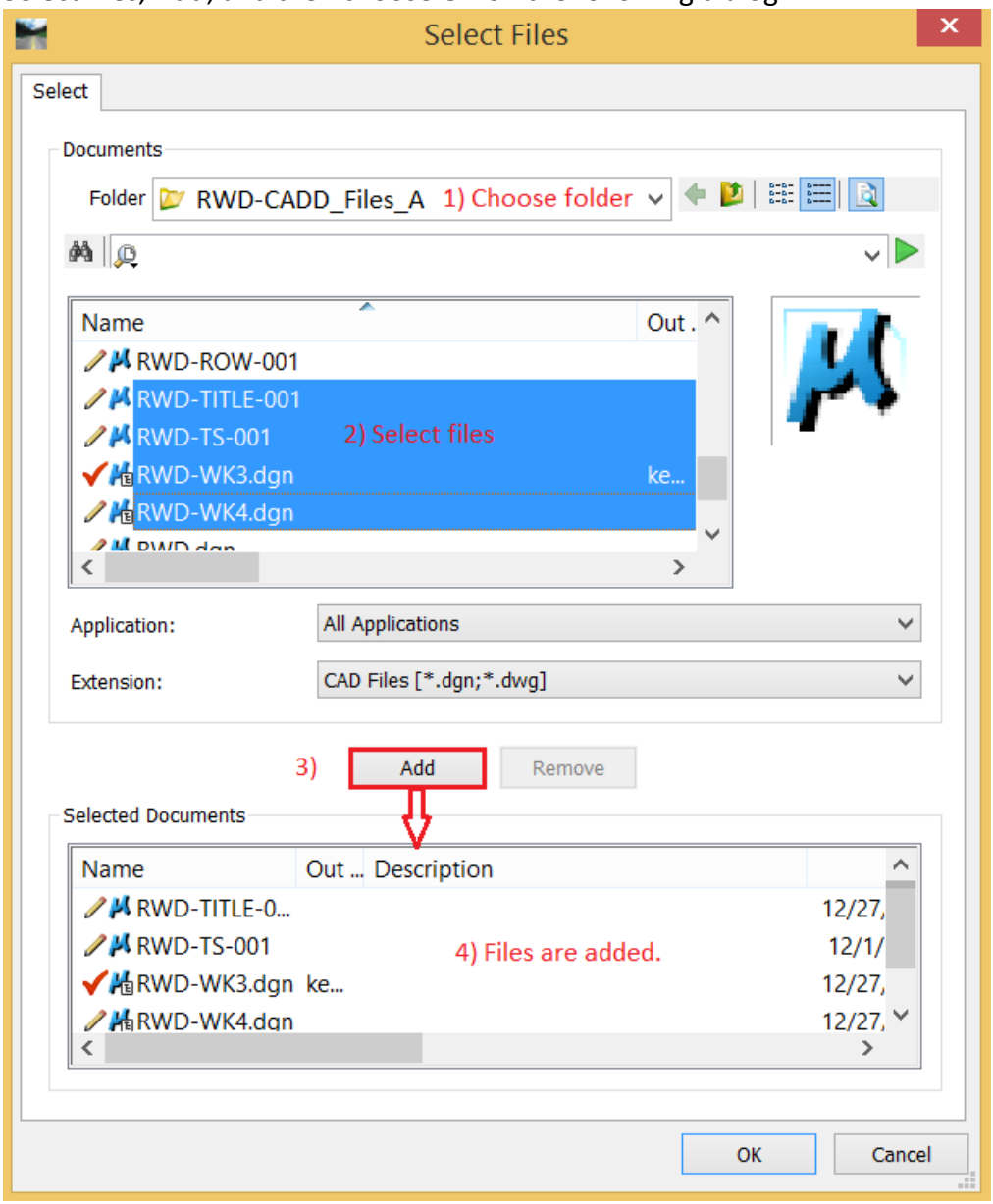
2) Choose **Add Files to Set** on the Print Organizer dialog.



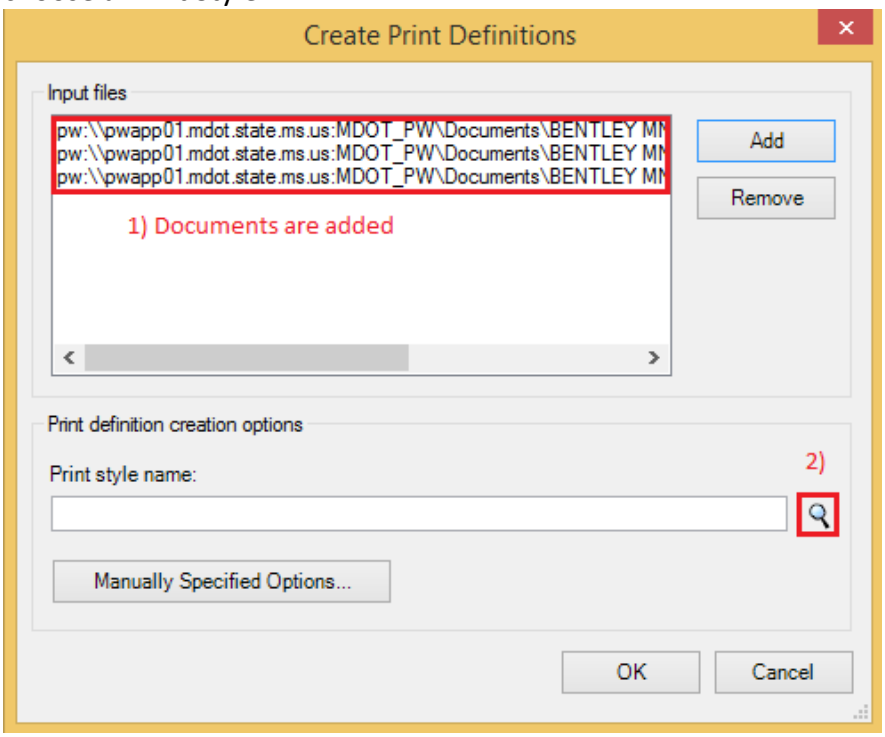
3) Choose **Add** on the **Create Print Definitions** dialog.



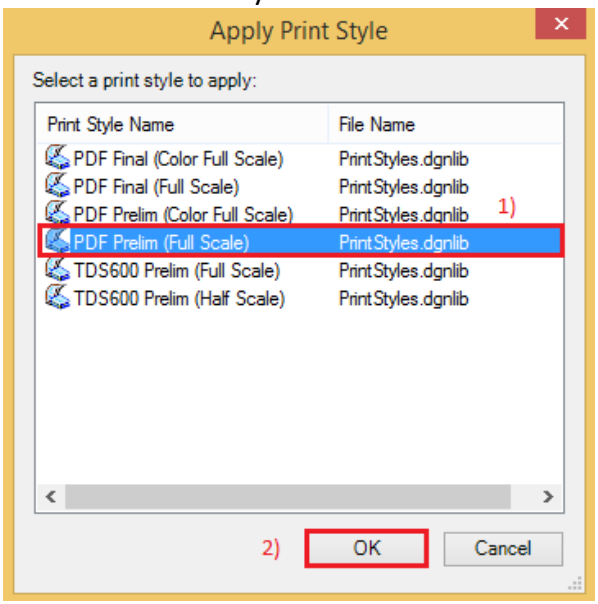
4) Select files, **Add**, and then choose **OK** on the following dialog.



5) Files are added to the dialog below. Choose the browse button shown below to choose a Print Style.

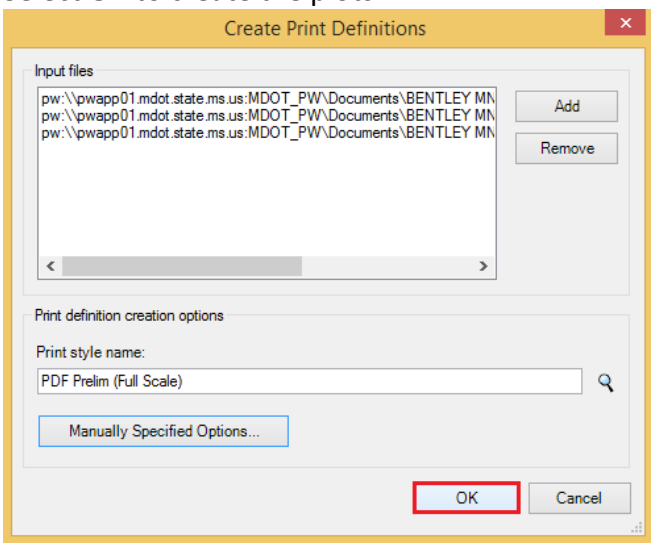


6) Choose the Print Style and select **OK**.



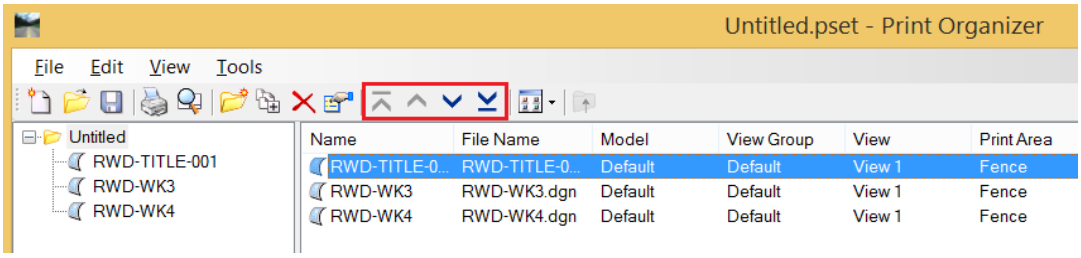
Note:
The PDF Prelim as with other plan specific Print Styles are set to look for line style 6 (sheet border style) for the plotting limits and set to maximize to the correct paper size of 34.6 x 22.

7) Select **OK** to create the plots.

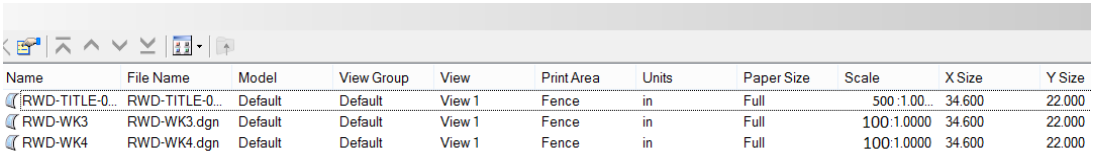


The **PDF Prelim** as with other plan specific print styles are set to look for line style 6 (sheet border style) for the plotting limits and set to maximize to the correct paper size of 34.6 x 22.

8) Arrange the plots with the buttons below to get them in the correct plotting order.



9) Make sure the Paper Size, Scale, X and Y sizes are all correct.

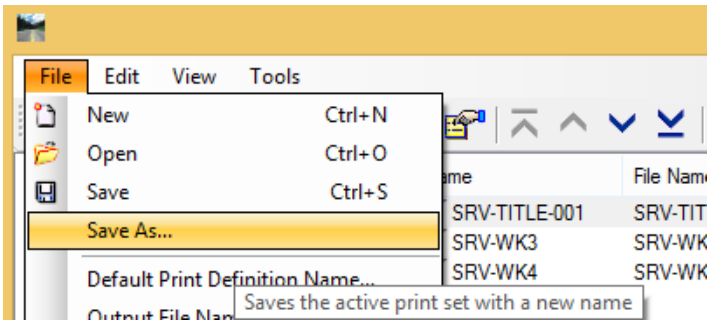


Name	File Name	Model	View Group	View	Print Area	Units	Paper Size	Scale	X Size	Y Size
RWD-TITLE-0...	RWD-TITLE-0...	Default	Default	View 1	Fence	in	Full	500:1.00...	34.600	22.000
RWD-WK3	RWD-WK3.dgn	Default	Default	View 1	Fence	in	Full	100:1.0000	34.600	22.000
RWD-WK4	RWD-WK4.dgn	Default	Default	View 1	Fence	in	Full	100:1.0000	34.600	22.000

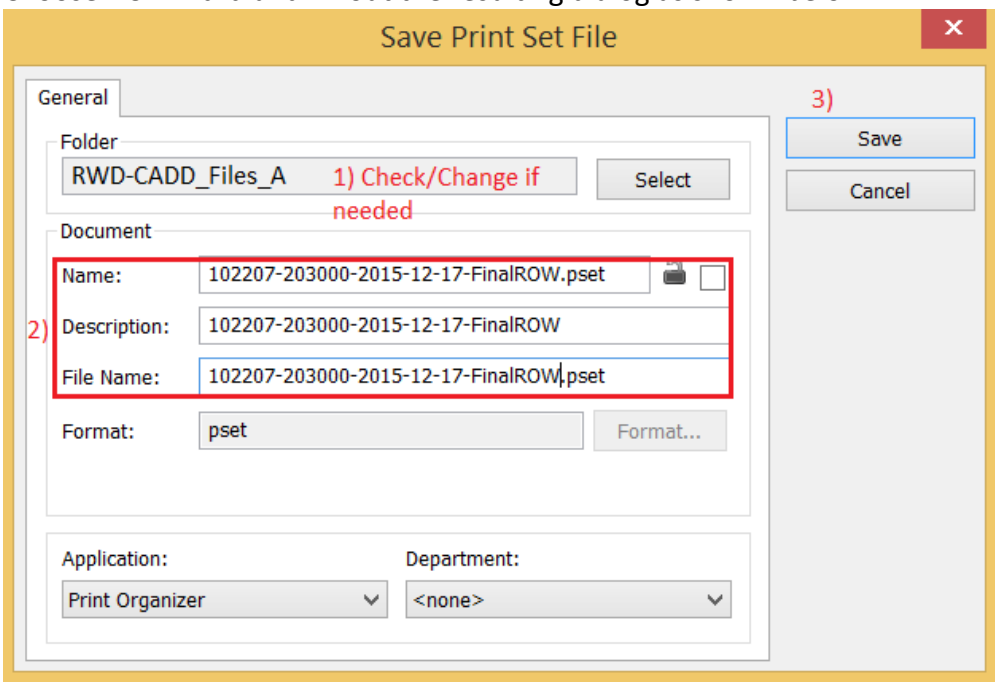
Note:

- Plans are always created as a PDF with the size 34.6 x 22 (Full Scale). They can be printed through Adobe at half scale or any scale the user needs.

10) Choose **File -> Save As**…

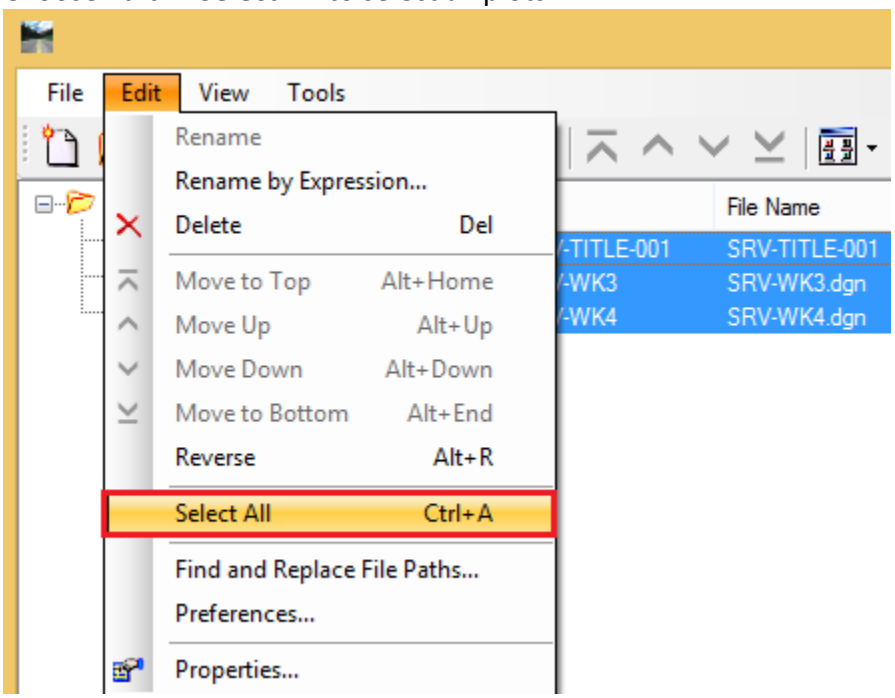


11) Choose **No Wizard** and fill out the resulting dialog as shown below.

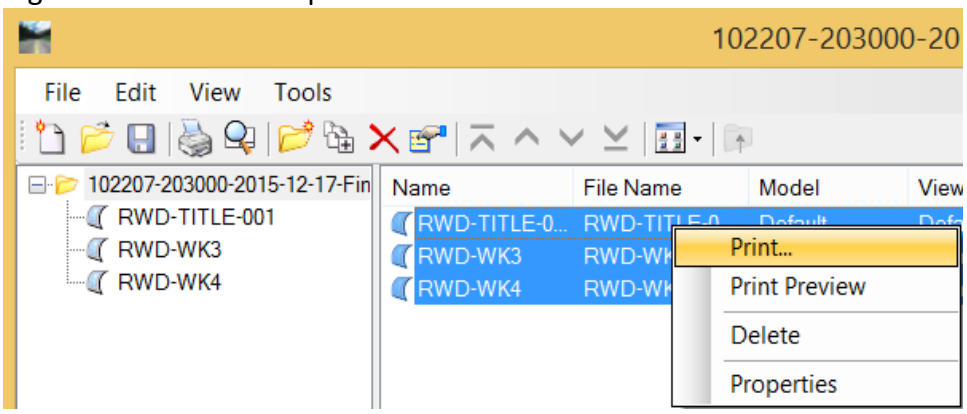


Note: This process saves a .pset in your PW specified folder so that you can open it later if you need to re-create the PDF.

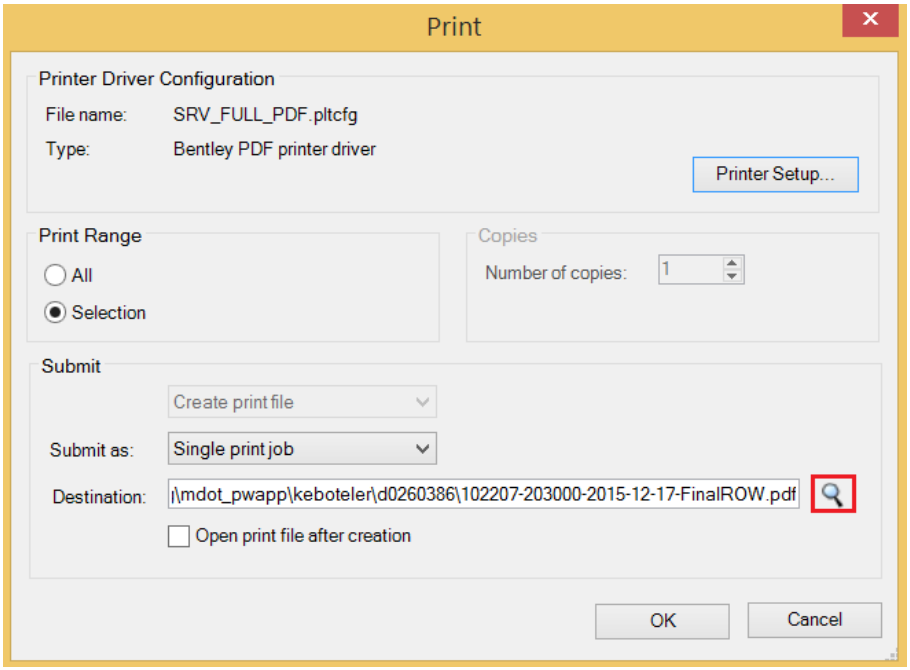
12) Choose **Edit -> Select All** to select all plots.



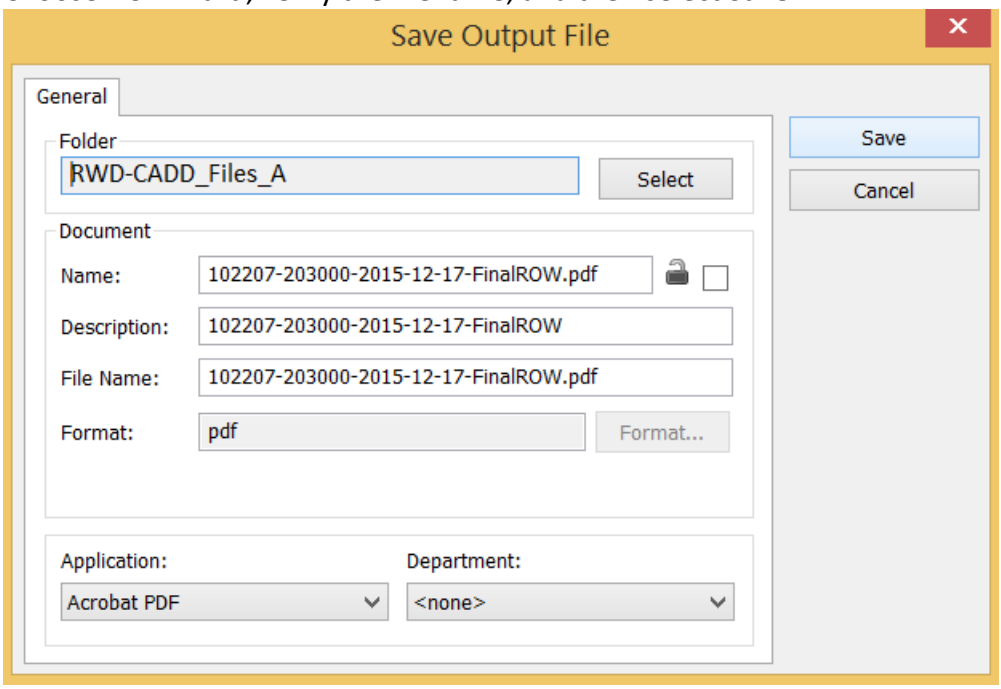
13) Right click the selected plots and choose **Print**.



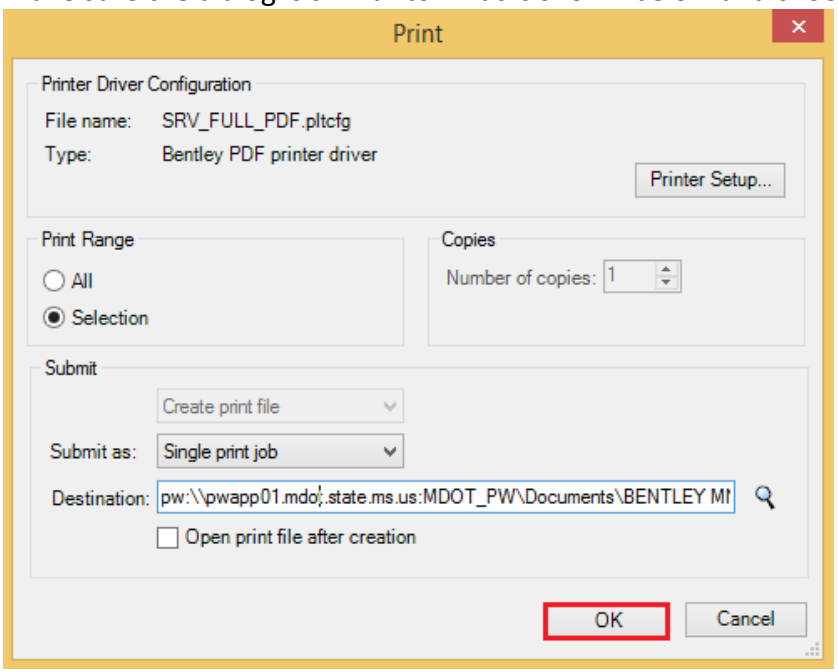
14) Choose the selected location for the PDF creation.



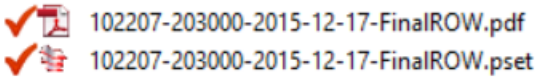
15) Choose **No Wizard**, verify the filename, and then select **Save**.



16) Make sure the dialog is similar to what is shown below and choose **OK**.



17) View the PSET and PDF's created during the process.



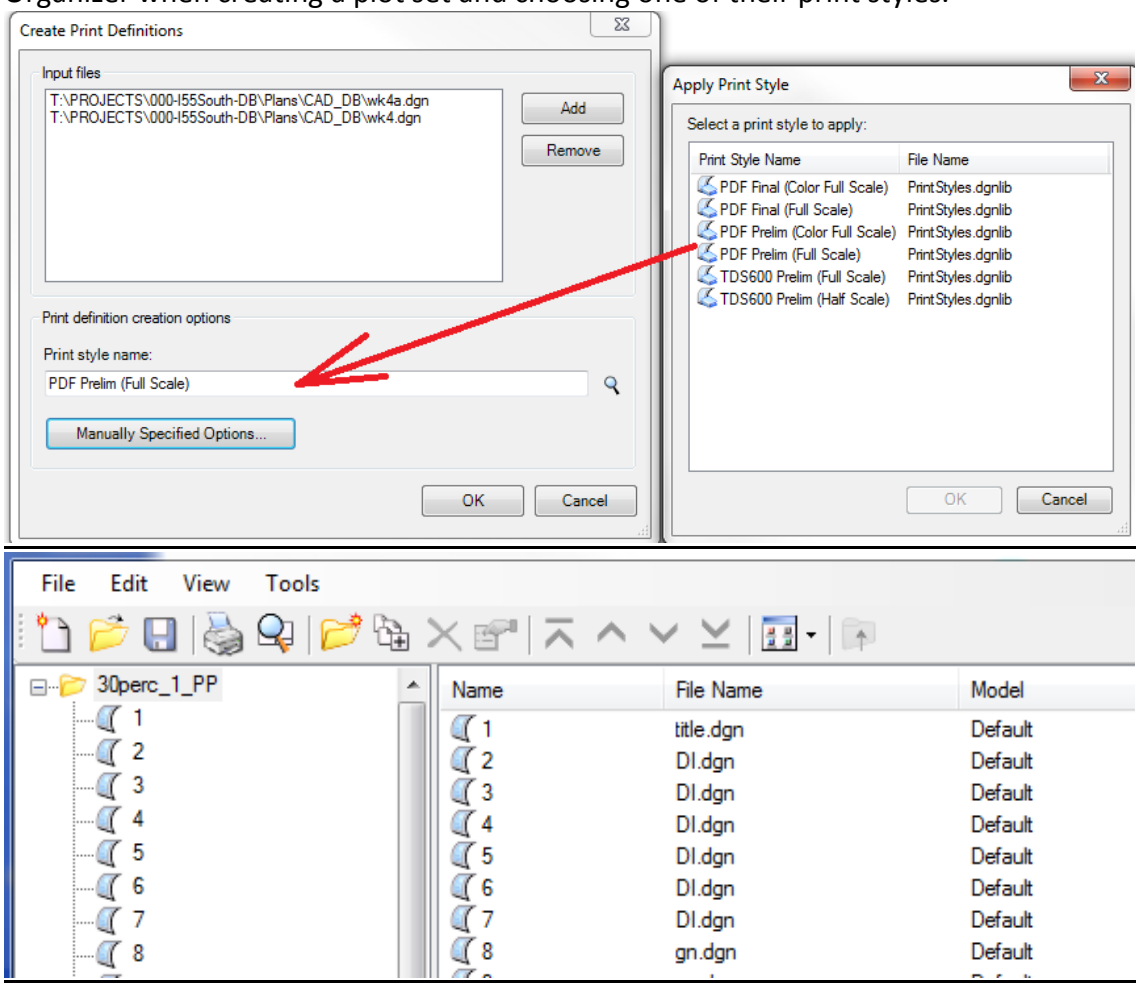
Note:

- This example shows the standard file naming convention for the Final ROW PDF and PSET.

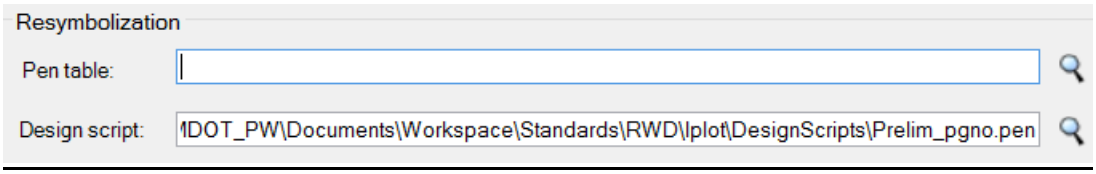
20.4.1 Automatic Page Numbering

Pre-Req: PG on your sheets and level on.

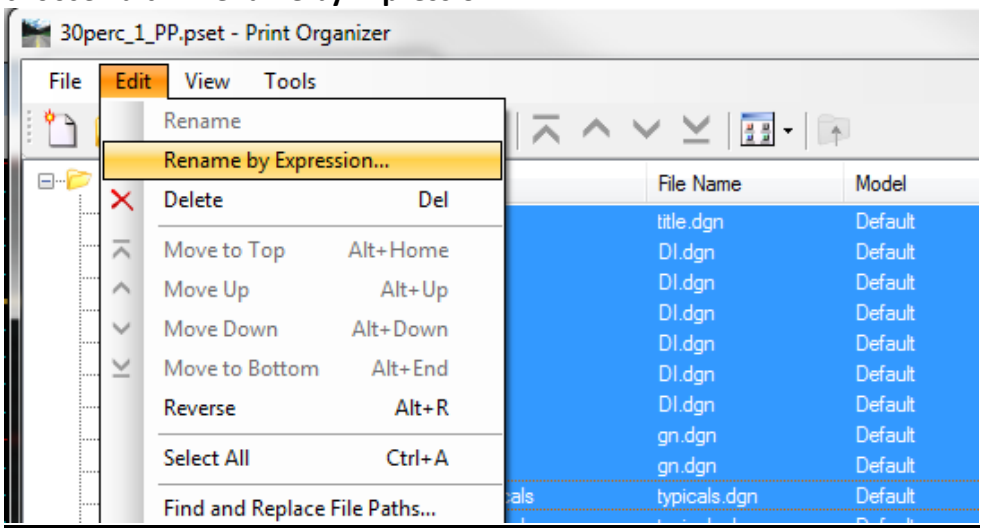
MDOT has configured their workspace to automatically number plots in Print Organizer when creating a plot set and choosing one of their print styles.



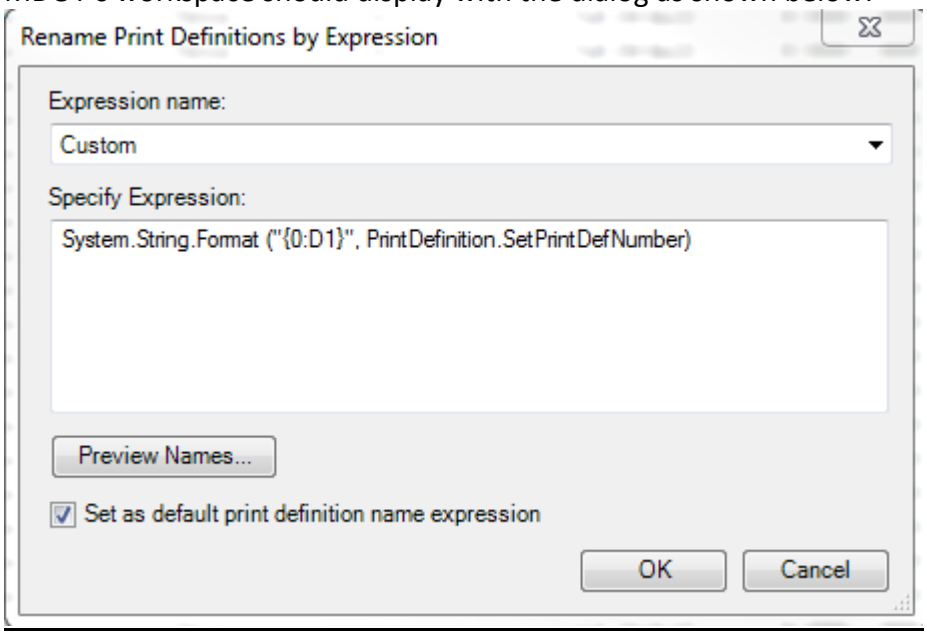
Actual numbering of sheets is accomplished when the PDF is created by PG on each sheet being replaced with the name column value above. The design script assigned when the print style is chosen is the mechanism for performing this function.



1) If you need to re-number plots, select the plots you wish to number and then choose **Edit -> Rename by Expression**.



2) MDOT's workspace should display with the dialog as shown below:



If the dialog does not display the expression shown above, just set the dialog to custom and copy and paste the following string to the **Specify Expression** area.

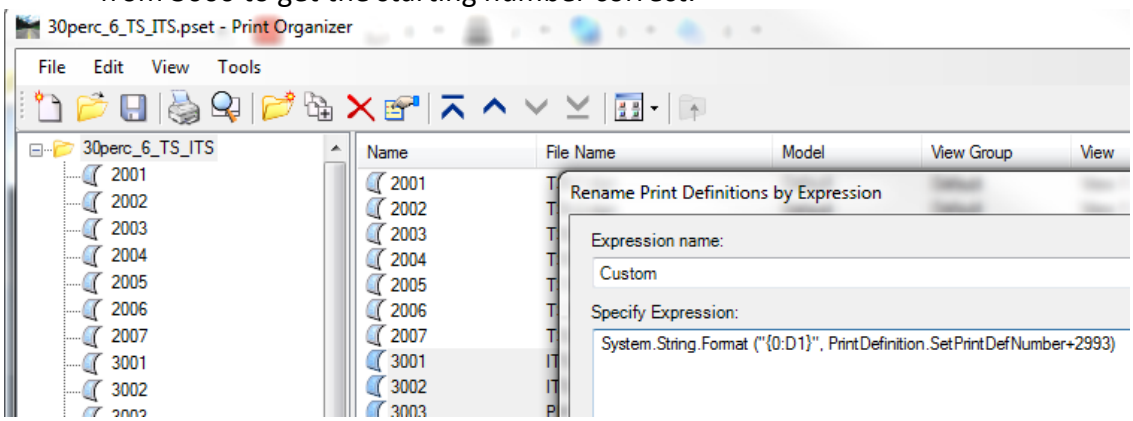
System.String.Format ("{0:D1}", PrintDefinition.SetPrintDefNumber)

3) If you need to start at a number other than 1, modify as shown below.
The example is showing starting at 9001.

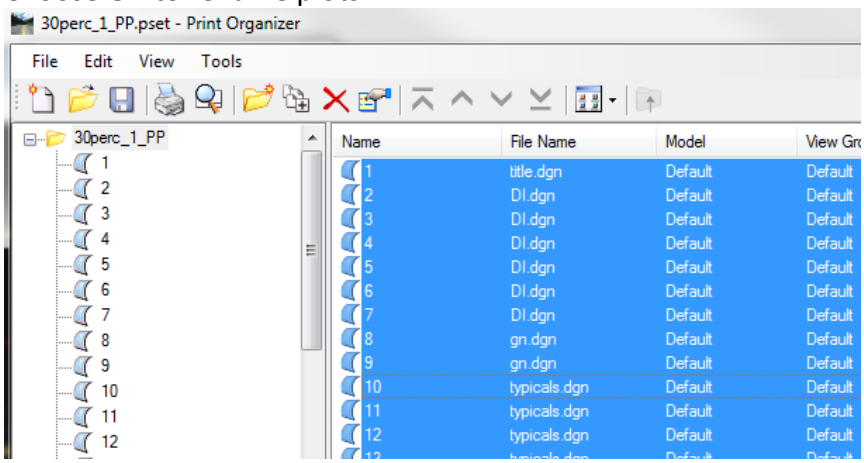
System.String.Format ("{0:D1}", PrintDefinition.SetPrintDefNumber+9000)

Note:

- If you have to start sheets at another number further down the PSET (i.e 3001 for ITS), subtract the number of sheets above the intended 3001 sheet from 3000 to get the starting number correct.



4) Choose **OK** to rename plots.



LAB XIV: PDF CREATION

1. Open any DGN file.
2. Through Print Organizer, plot the Title and WK files created in earlier steps as a combined PDF.

21. SMD PROCESSES

21.1 Section Overview

This section will go through the process of utilizing the District's Property Map, Roadway Design's ROW, Survey and Design alignments. Although use of OpenRoads Horizontal Geometry commands is covered earlier in this document, the general use of these commands as it relates to storing parcels will be covered along with GEOPAK's Coordinate Geometry Store Parcel command to store parcels and create deeds. Also covered will be Bentley Map to access and view GIS parcel data.

21.2 Section Prerequisites

- MicroStation Fundamentals
- Knowledge of surveying principals
- Basic Horizontal Geometry knowledge

21.3 Section Objectives

After completing this Section, you will be able to:

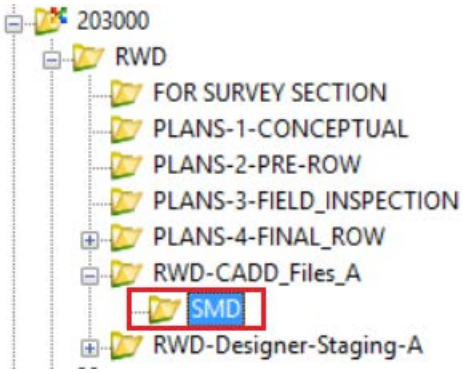
1) Access Survey and Roadway Design data in PW.
2) Create the ROW Acquisition drawing.
3) Create a Parcel using Horizontal Geometry commands.
4) Export this parcel to the GPK.
5) Create a deed using the legal description editor.
6) Use Bentley Map to view GIS parcel data.

21.4 ProjectWise Processes

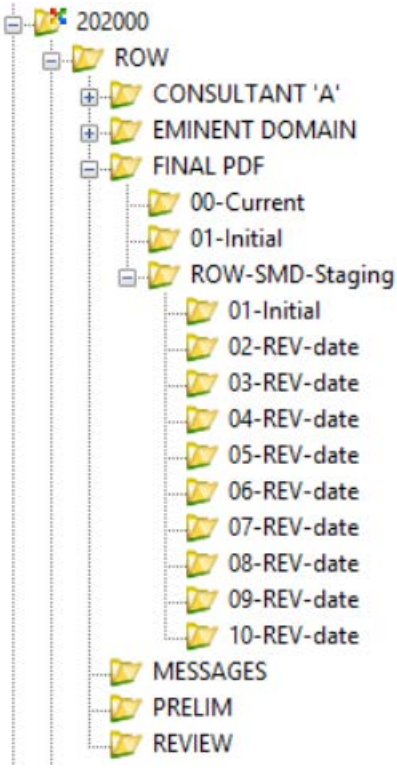
This section discusses the PW SMD structure, accessing Survey and Roadway Design data in PW, and creating the Acquisition Map base DGN file.

21.4.1 SMD CADD files

SMD PW CADD work is performed in the following folder.



21.4.2 ROW PDF Acquisition Map folder



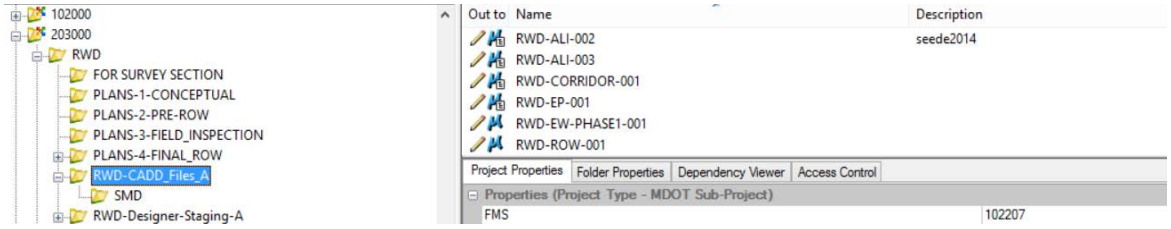
21.4.3 Utilizing Survey and Roadway Design Data in PW

21.4.3.1 PW Folders

Survey and Roadway Design CADD data is found in the following folders. It is best practice that the SMD user reference any files needed from these folders.

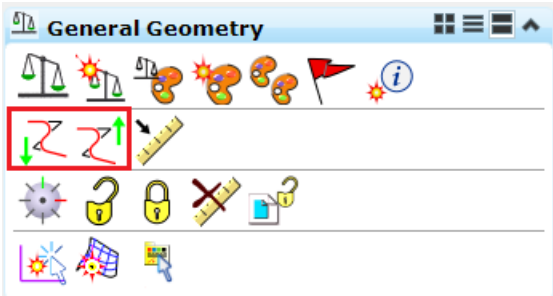
Survey

Roadway Design



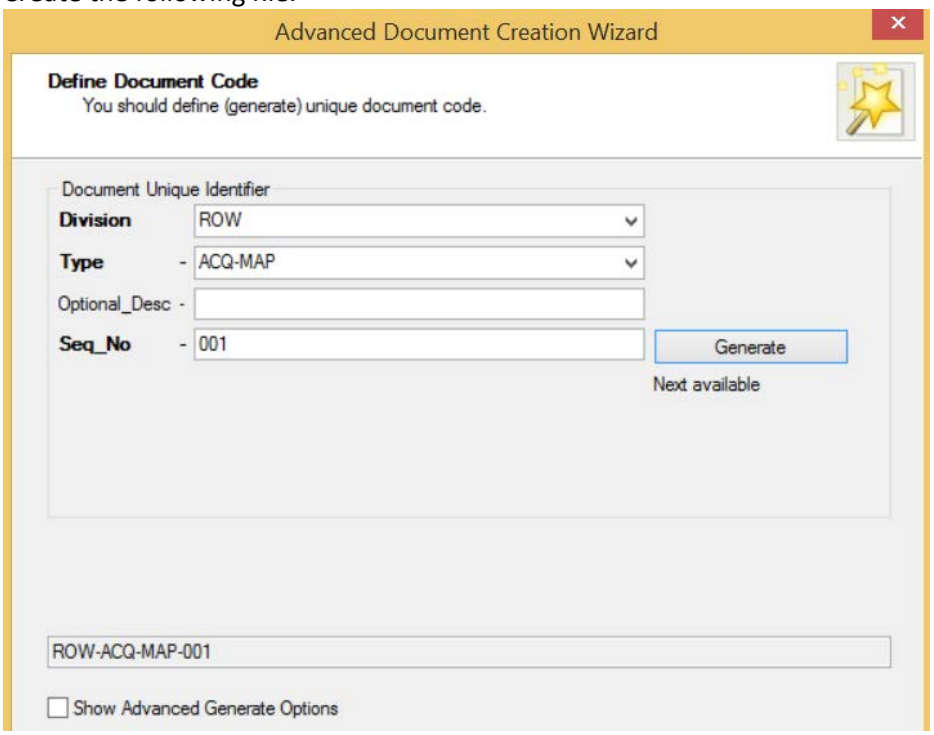
21.4.3.2 Importing Alignments

See the General Geometry section in this document for detailed instructions but the general process is to copy Roadway Design's GPK, export the alignments needed, and then import the alignments needed into the SMD GPK.



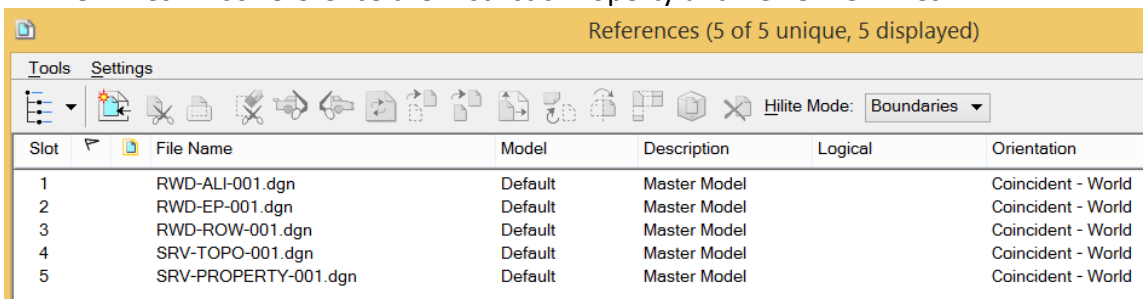
21.4.4 Creating the Acquisition Drawing

1) In the SMD folder, choose document new.
2) Create the following file.



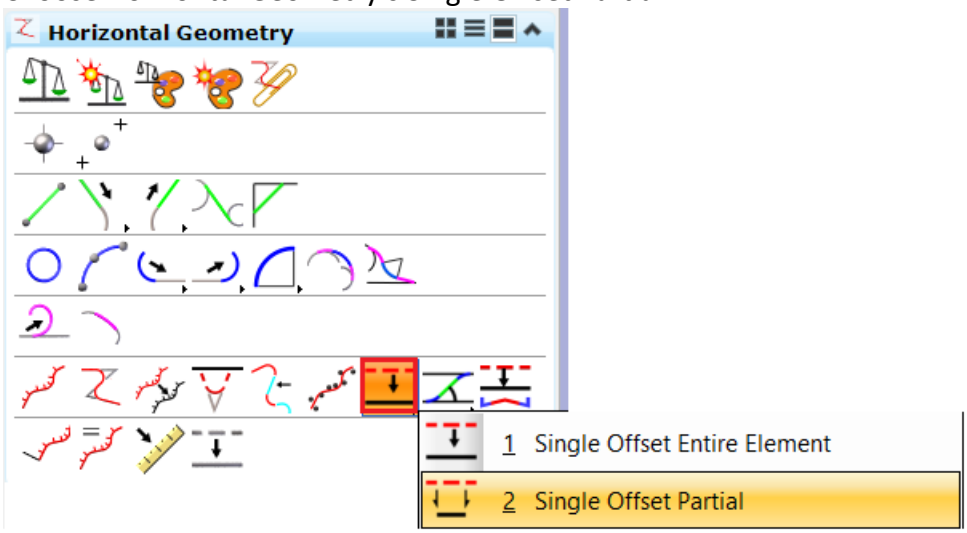
21.5 Creating Parcels

1) In the file ROW-ACQ-001.DGN file, reference RWD's ROW, EP, and Alignment DGN files. Also reference the District's Property and TOPO DGN files.

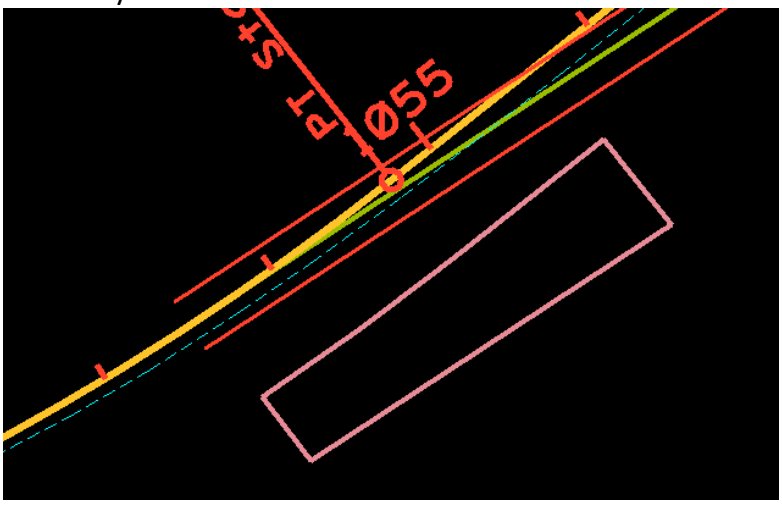


Slot	File Name	Model	Description	Logical	Orientation
1	RWD-ALI-001.dgn	Default	Master Model		Coincident - World
2	RWD-EP-001.dgn	Default	Master Model		Coincident - World
3	RWD-ROW-001.dgn	Default	Master Model		Coincident - World
4	SRV-TOPO-001.dgn	Default	Master Model		Coincident - World
5	SRV-PROPERTY-001.dgn	Default	Master Model		Coincident - World

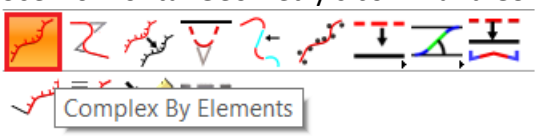
2) Choose Horizontal Geometry's Single Offset Partial



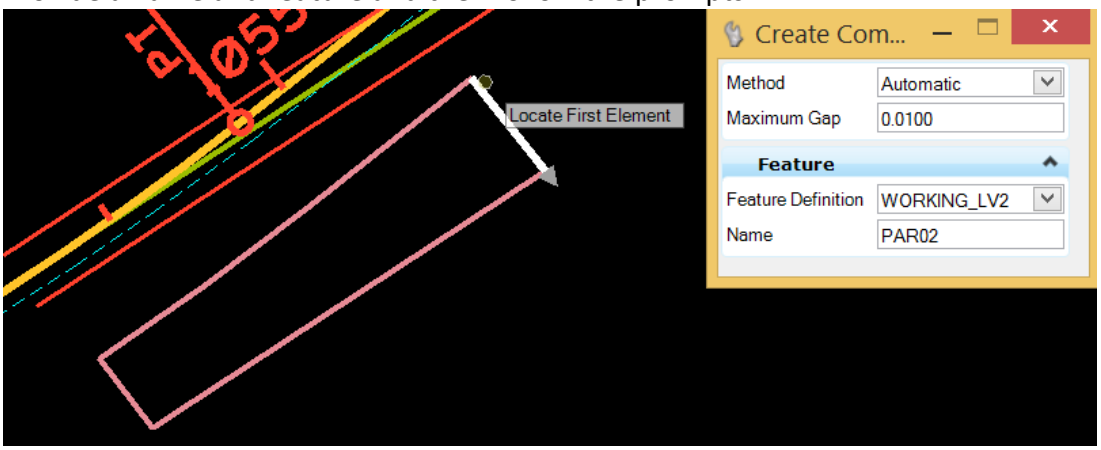
3) Use this command to copy parallel each element needed to create the parcel boundary.



4) Use Horizontal Geometry's command **Complex By Elements** to complex.

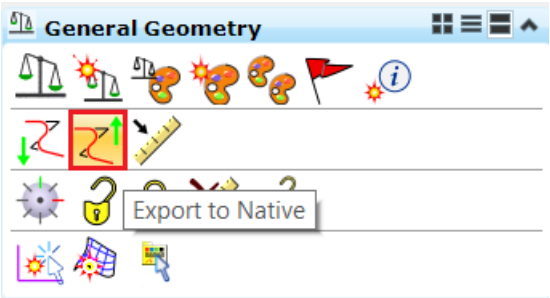


Provide a name and feature and then follow the prompts.



Note:
At this time, there is no Horizontal Geometry command to store a parcel (closed shape). For the time being, use the Complex By Elements command, export to the GPK, describe the chain to see what elements are in it, delete the chain, and then store the parcel. This process is described in the steps below.

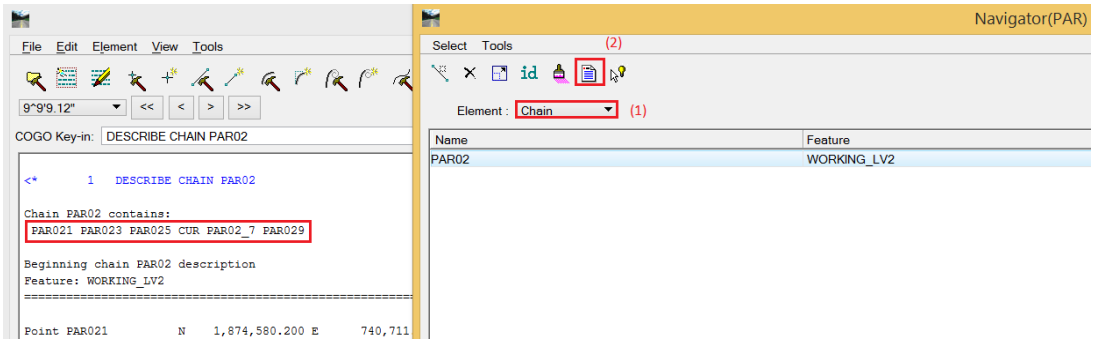
5) Go to the General Geometry task and choose Export.



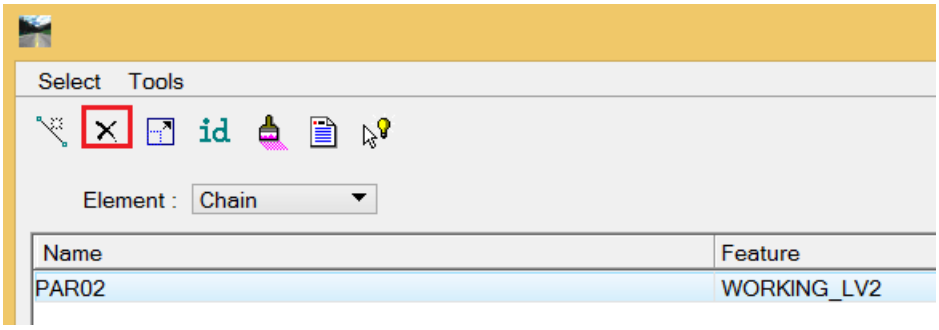
6) Choose the Parcel(s) to export, reset to accept, then choose the GPK to export the parcel(s) to.

7) Enter COGO and select **Tools -> Navigator**.

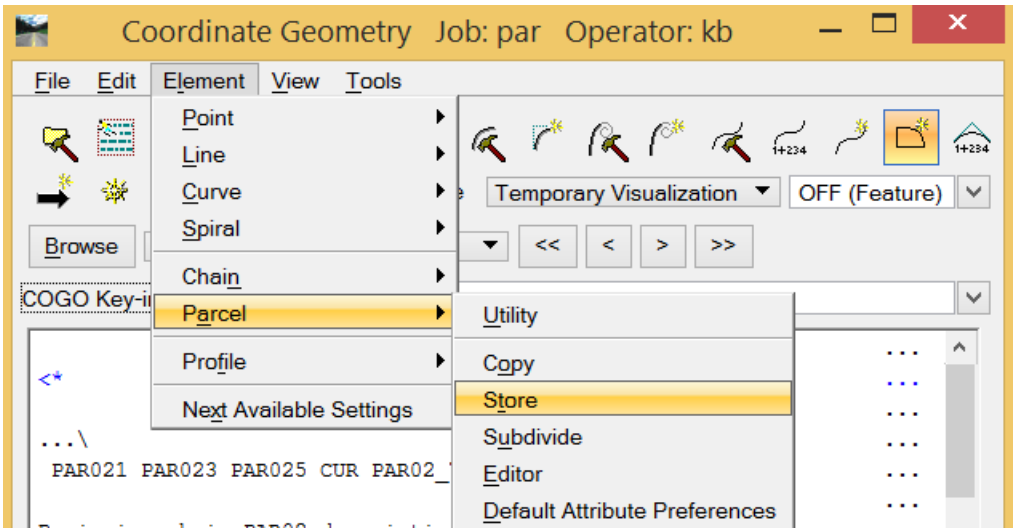
8) Go through the steps below to see what elements are in the chain.



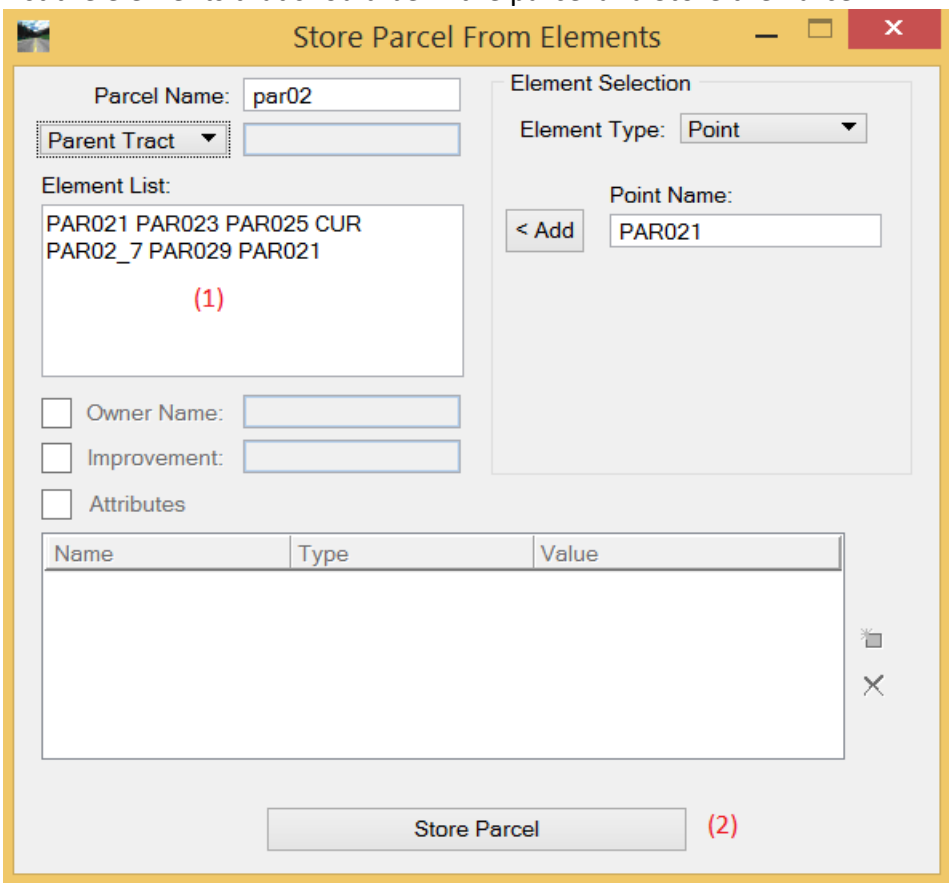
9) Delete the chain.



10) Choose the Store Parcel command.



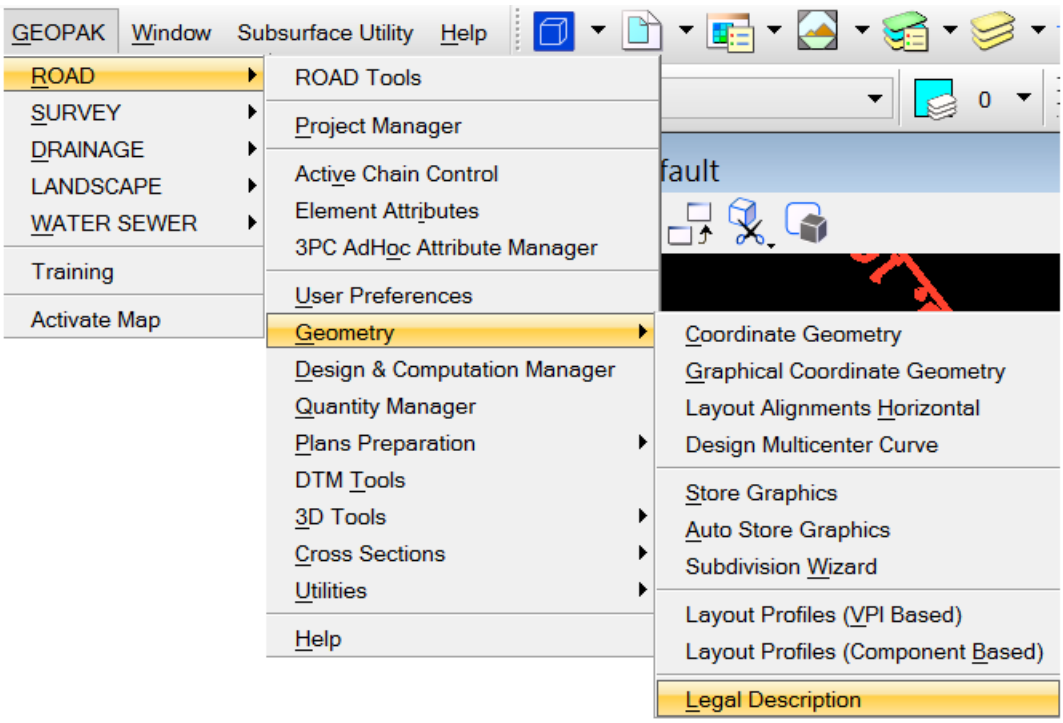
11) List the elements that should be in the parcel and Store the Parcel.

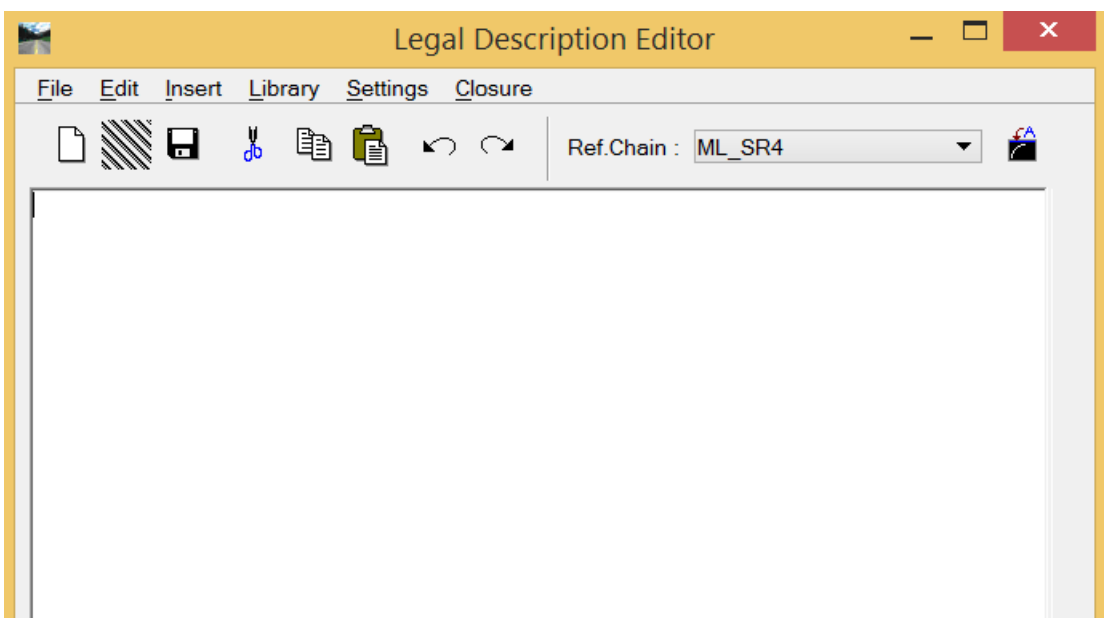


21.6 Legal Description Editor

The Legal Description Editor is a powerful tool for the automated generation of legal descriptions. Its power lies in the completely customizable terminology, styles, and preferences, all easily accomplished via dialogs.

21.6.1 Accessing



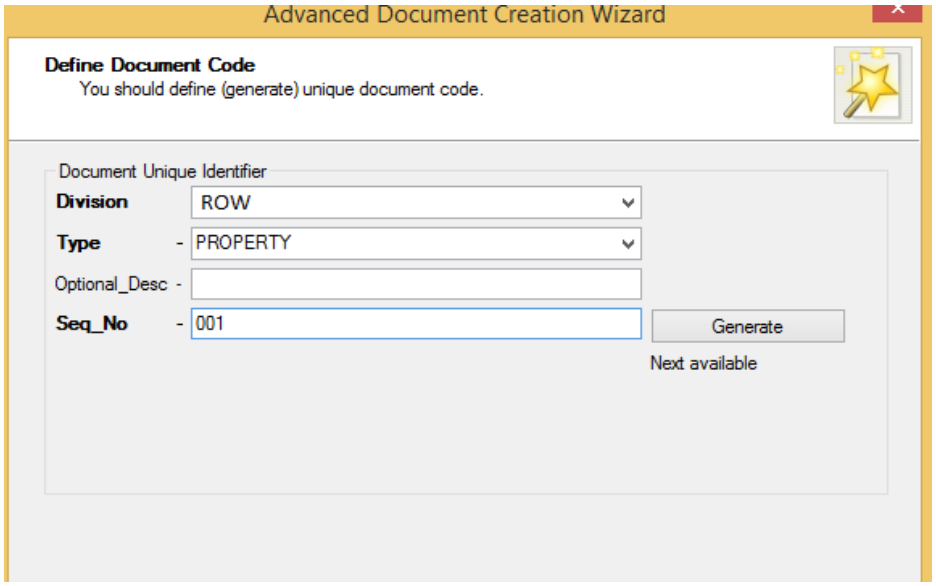


21.7 Using Bentley Map to plot GIS Data

Below are steps for displaying MDOT's GIS information in MicroStation through Bentley Map including but not limited to parcel data, NGS, county/city boundaries, etc. The steps below discuss opening Bentley Map, connecting to GISPROD (MDOT's GIS data source), displaying available features, labeling features, and displaying feature attributes. The steps below (beginning at the Querying features section) are specific to parcels but apply to all available GIS features.

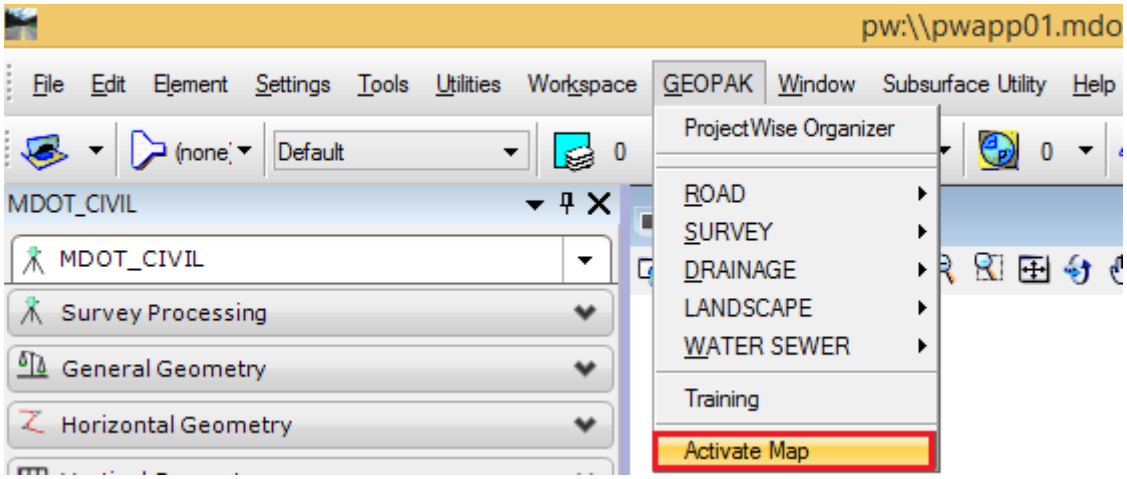
21.7.1 Create the Property DGN

Create ROW-PROPERTY-001.DGN and enter this file. Reference the TOPO DGN file and fit view.



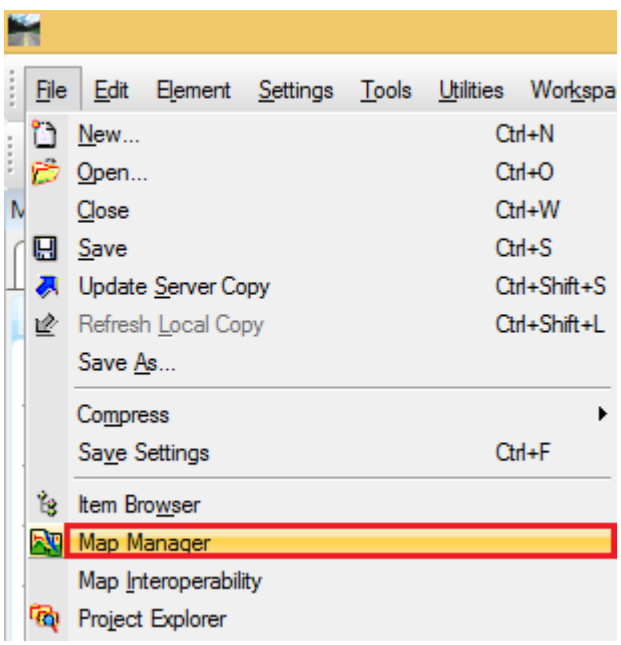
21.7.2 How to start Bentley Map

To start Bentley Map, simply click on the **GEOPAK** Tab and click **Activate Map**. Bentley map is now ready for use.

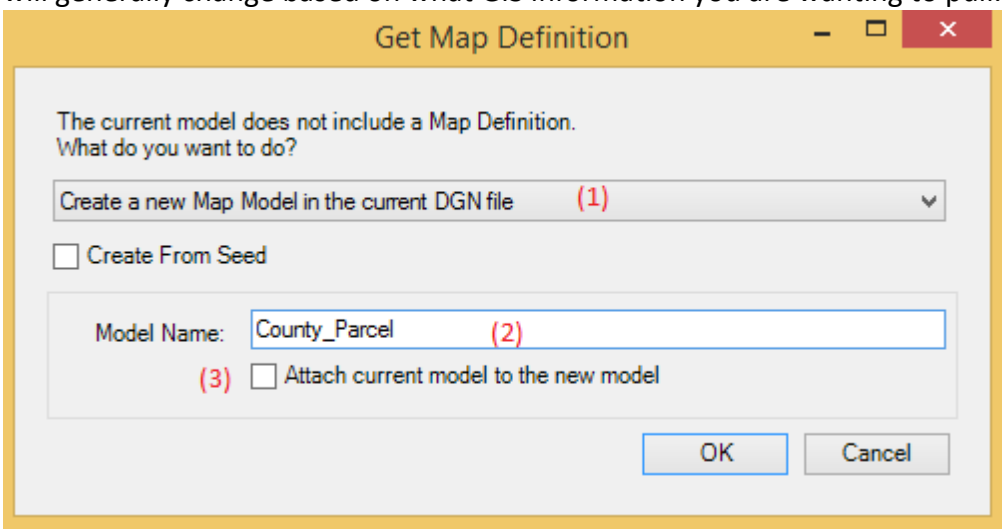


21.7.3 Using Bentley Map to retrieve Oracle Spatial Data

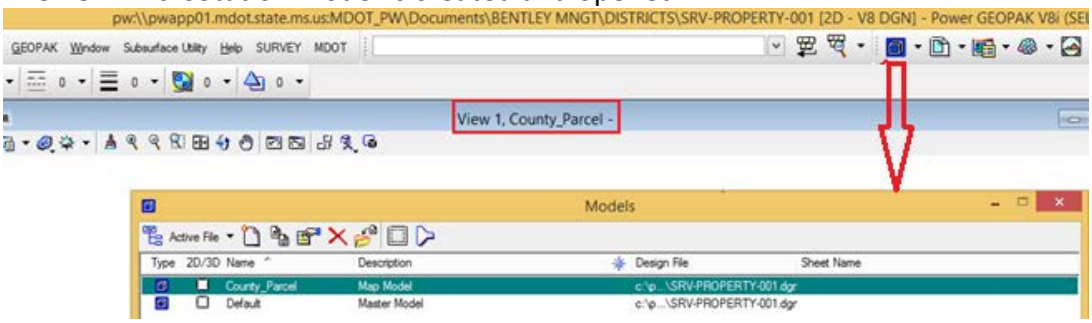
1) Create a Map Model by clicking **Map Manager** from the **File** menu.



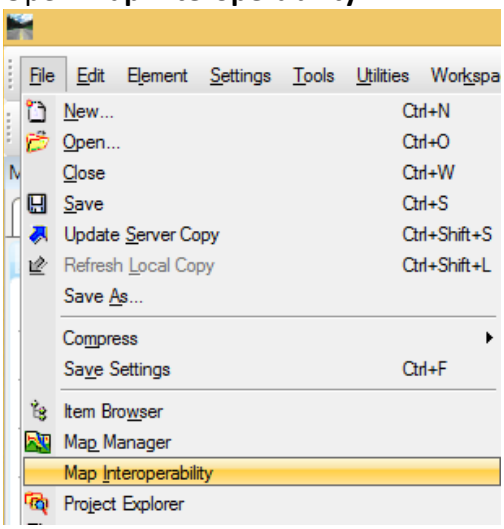
2) Fill out the dialog as shown below and select **OK**. Note the name is custom and will generally change based on what GIS information you are wanting to pull.



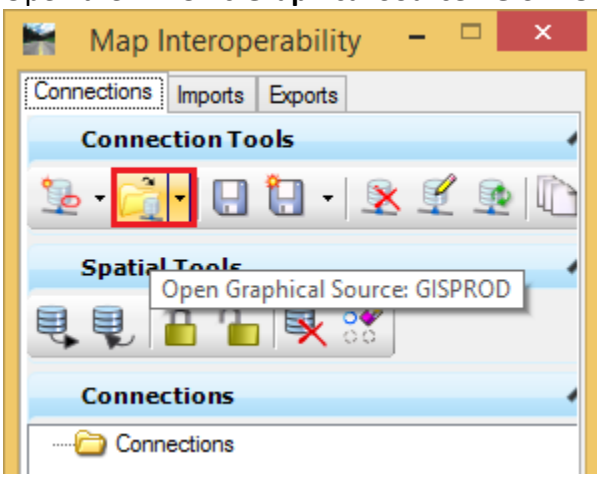
The new MicroStation model is created and opened.



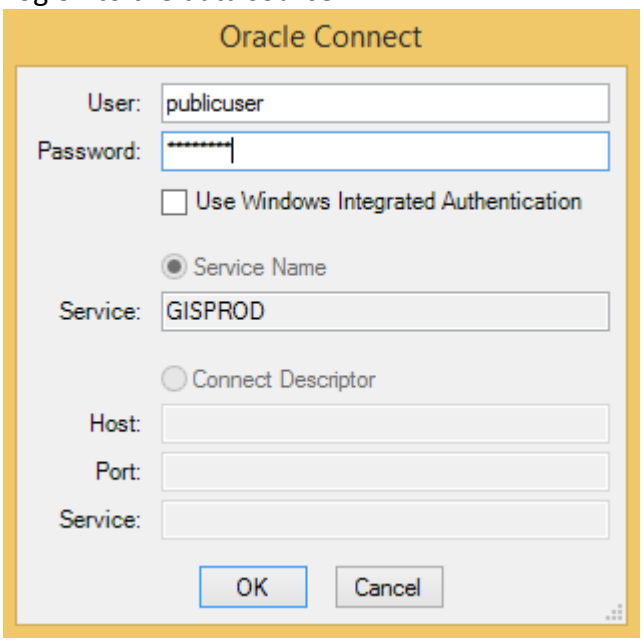
3) Reference TOPO to this model and fit view.
4) Open **Map Interoperability.**



5) Open the MDOT's **Graphical Source - GISPROD**



6) Log on to the data source



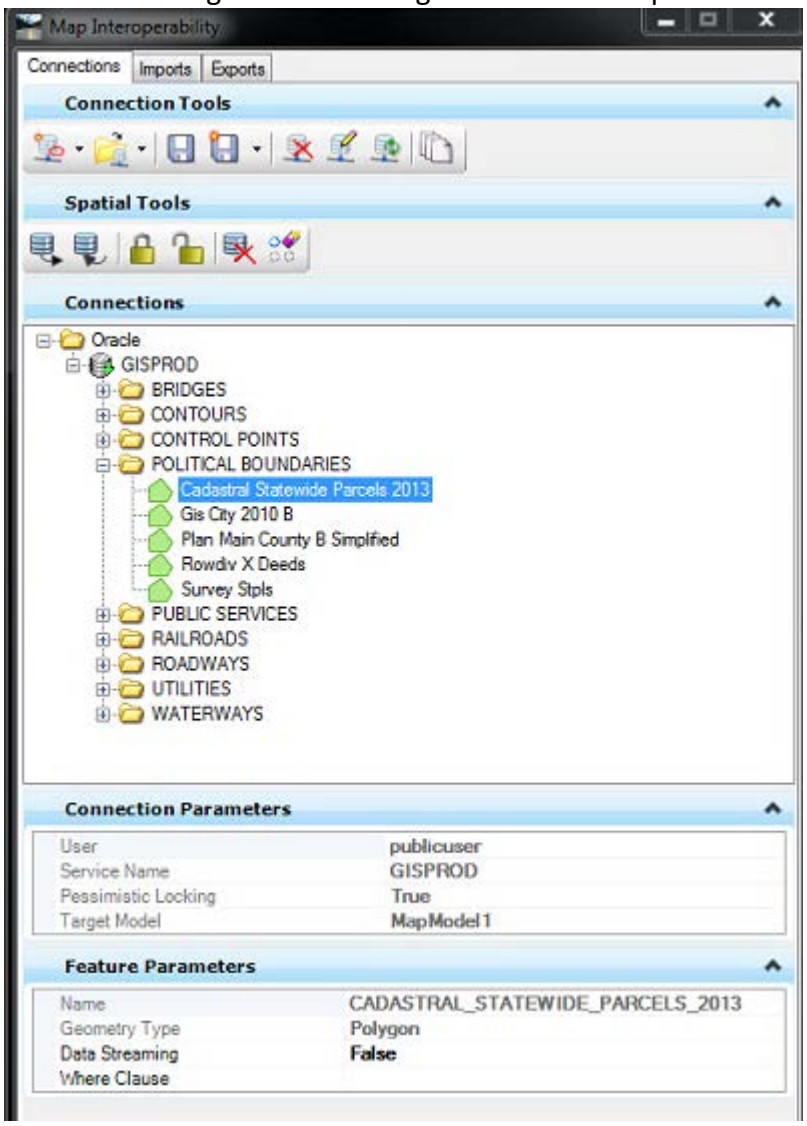
User – publicuser
Password – password

We are now fully connected and setup to start querying data from the Oracle Server and from the Map Interoperability dialog.

21.7.4 Querying features from Oracle

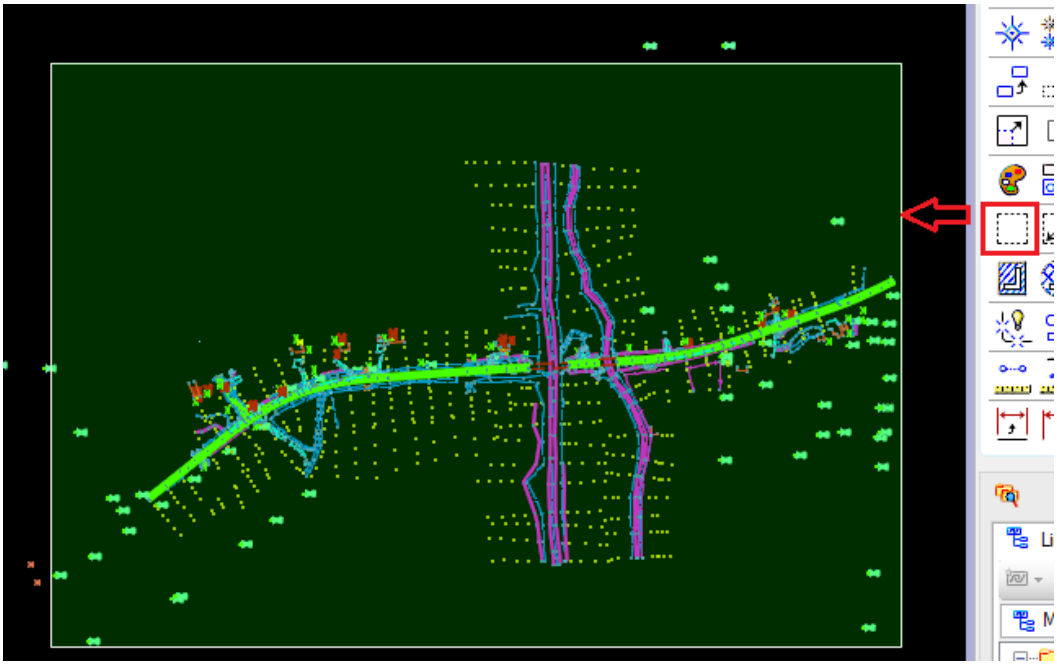
Querying features is basically the process of displaying graphical GIS features such as parcel data in the DGN file.

Below is an image with the categories of features pulled from GISPROD.

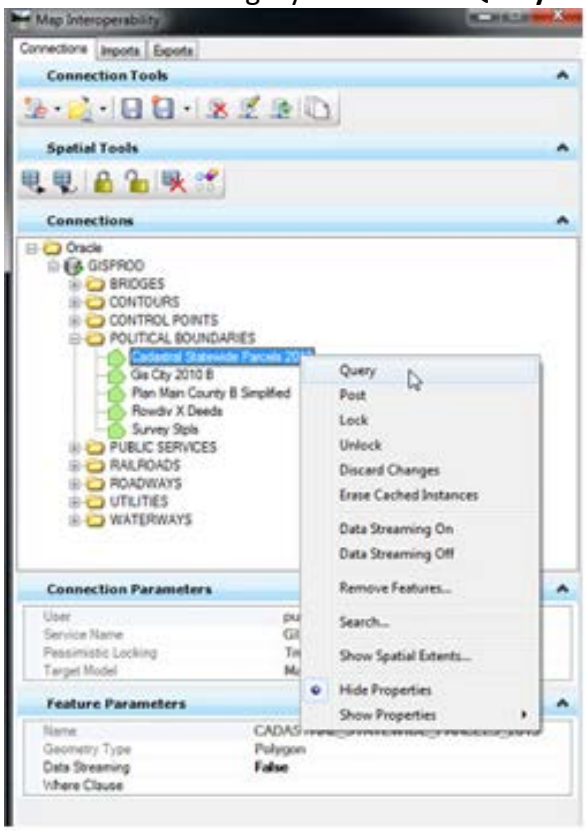


1) Place a Fence in the area you wish to display data.

From MDOT-Main, Choose the **Place Fence** tool and place the fence in the approximate location needed.

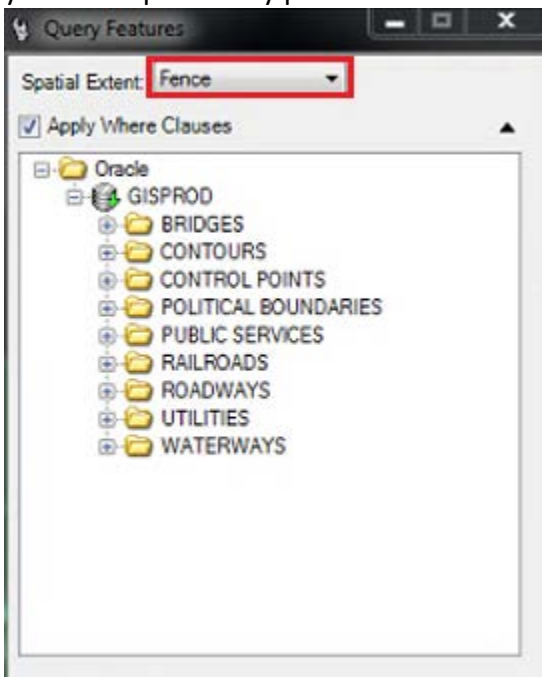


2) Right Click **Cadastral Statewide Parcels 2013** under GISPROD's **POLITICAL BOUNDARIES** category and choose **Query**.

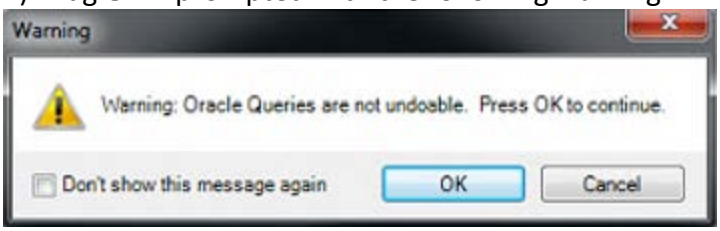


Right Click & Choose Query

3) Choose **Fence** on the **Query Features** dialog. This option is not available if you didn't previously place a fence.



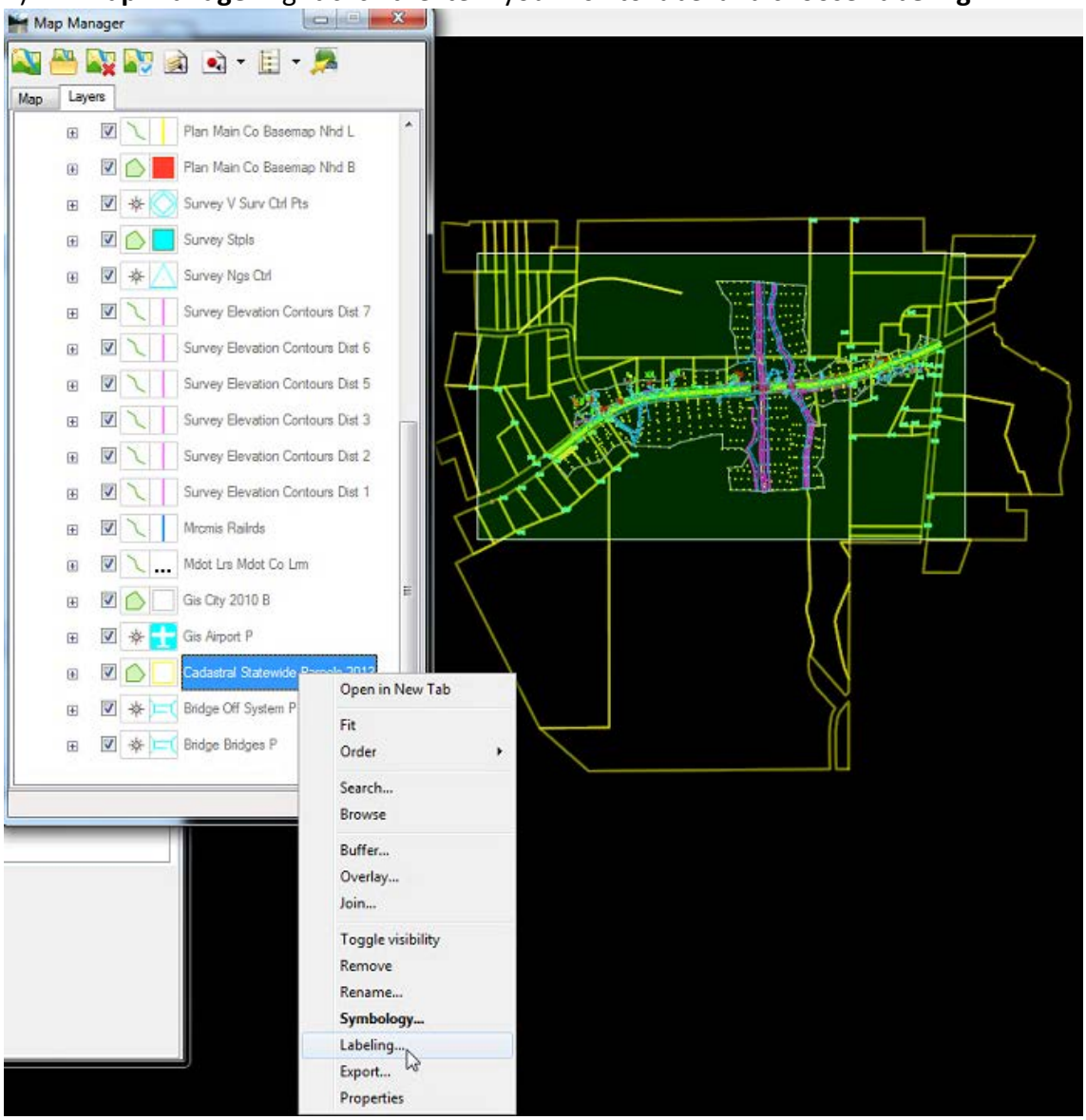
4) Tag **OK** if prompted with the following warning.



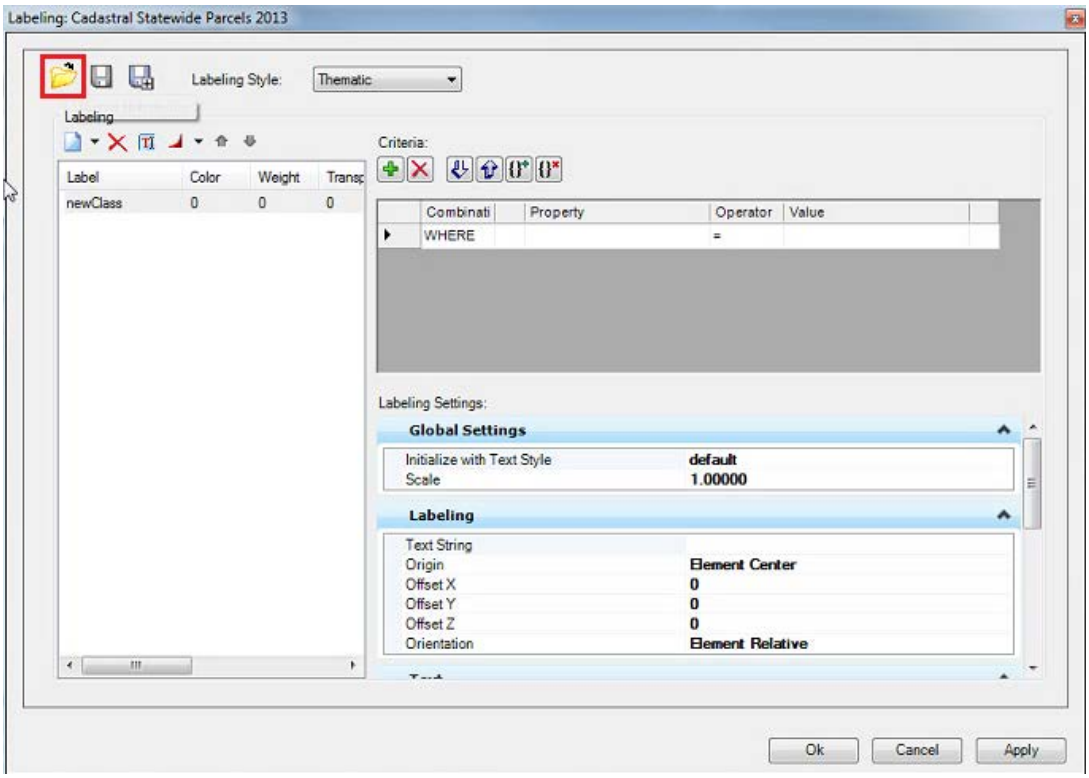
5) Parcel data is loaded.

21.7.5 Labeling

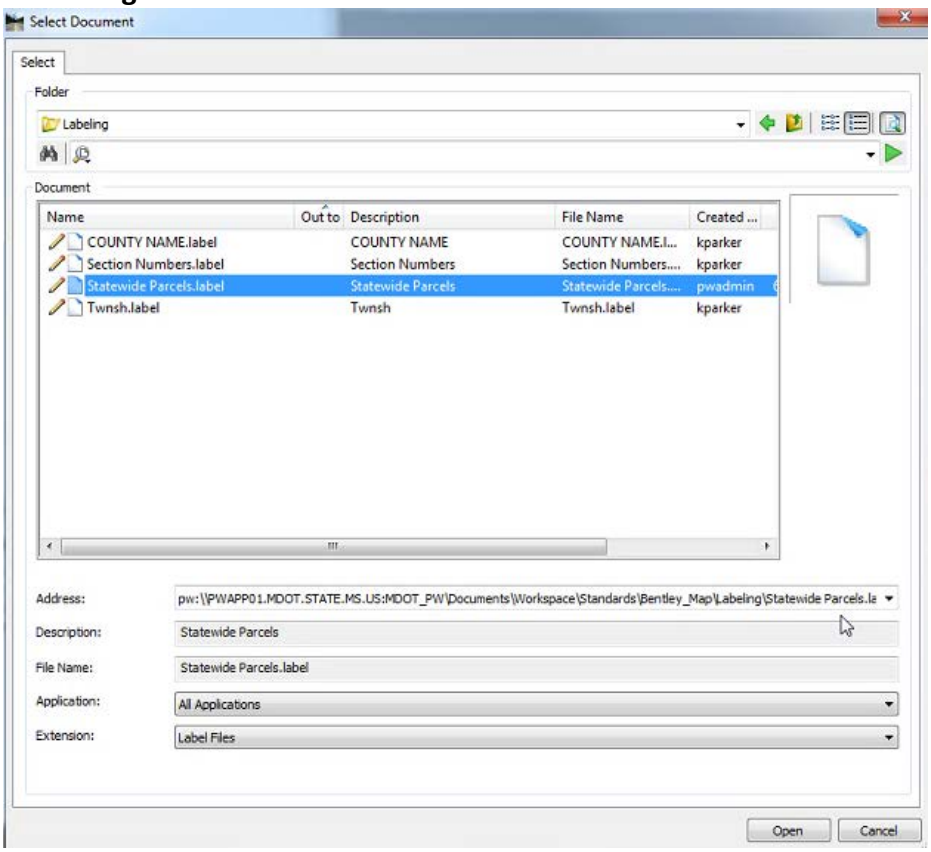
1) In **Map Manager** right click the item you wish to label and choose **Labeling**.



2) On the labeling dialog, set the labeling style to thematic and choose a label file by clicking on the **Open** button.



3) Choose **Statewide Parcels.label** from **Workspace -> Standards -> Bentley Map -> Labeling** as shown below.

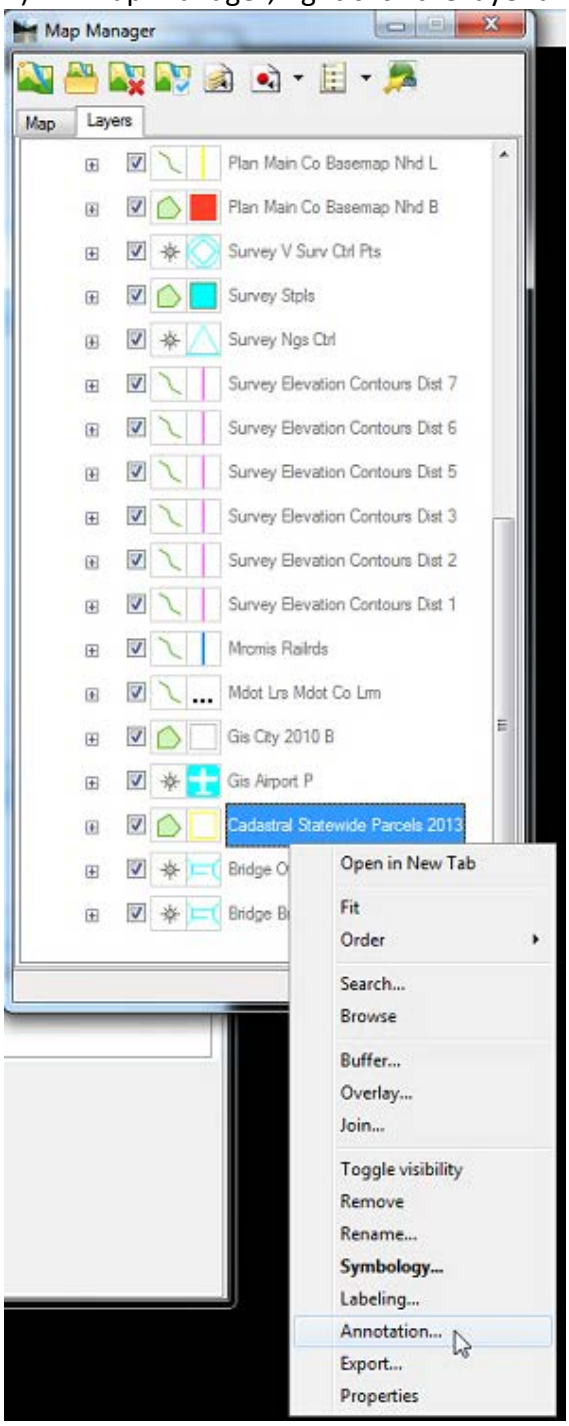


Labels are displayed.

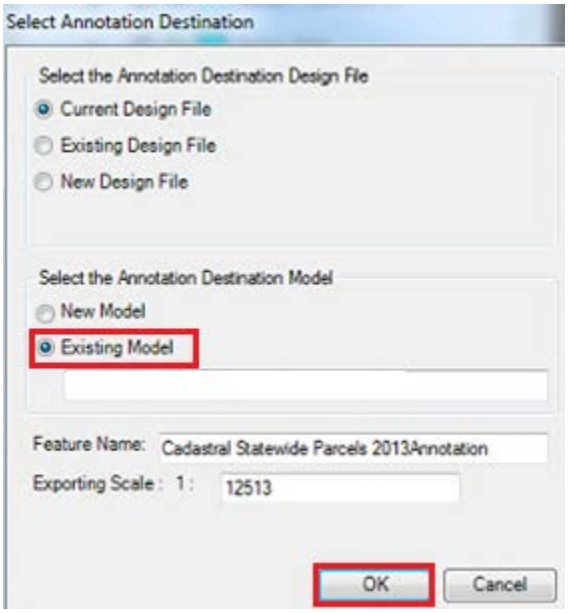
Note: Labels are temporary items and if you exit and re-enter MicroStation, they will not be available. To make these elements permanent in MicroStation, you will use the annotation tool as discussed below.

21.7.6 Annotations

1) In Map Manager, right click the layer and choose **Annotation.**

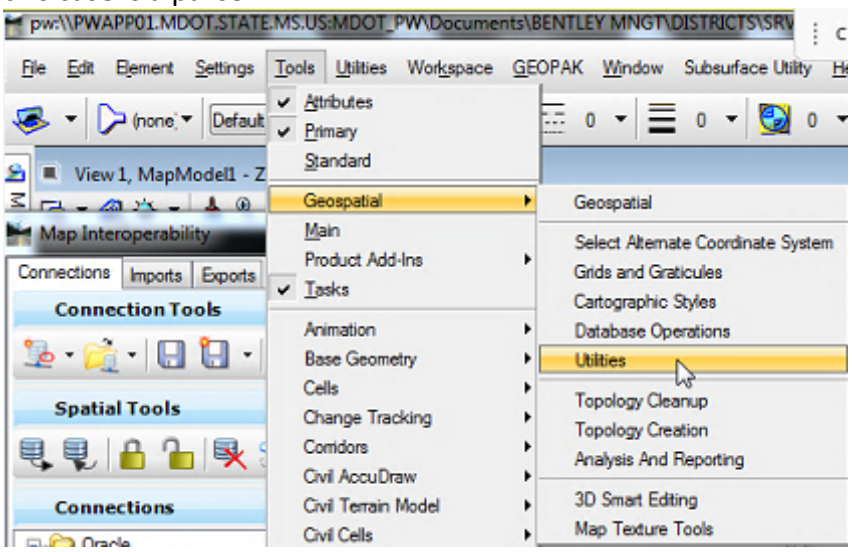


2) You can choose to create a new model for annotations or choose the existing model which is the method shown below.

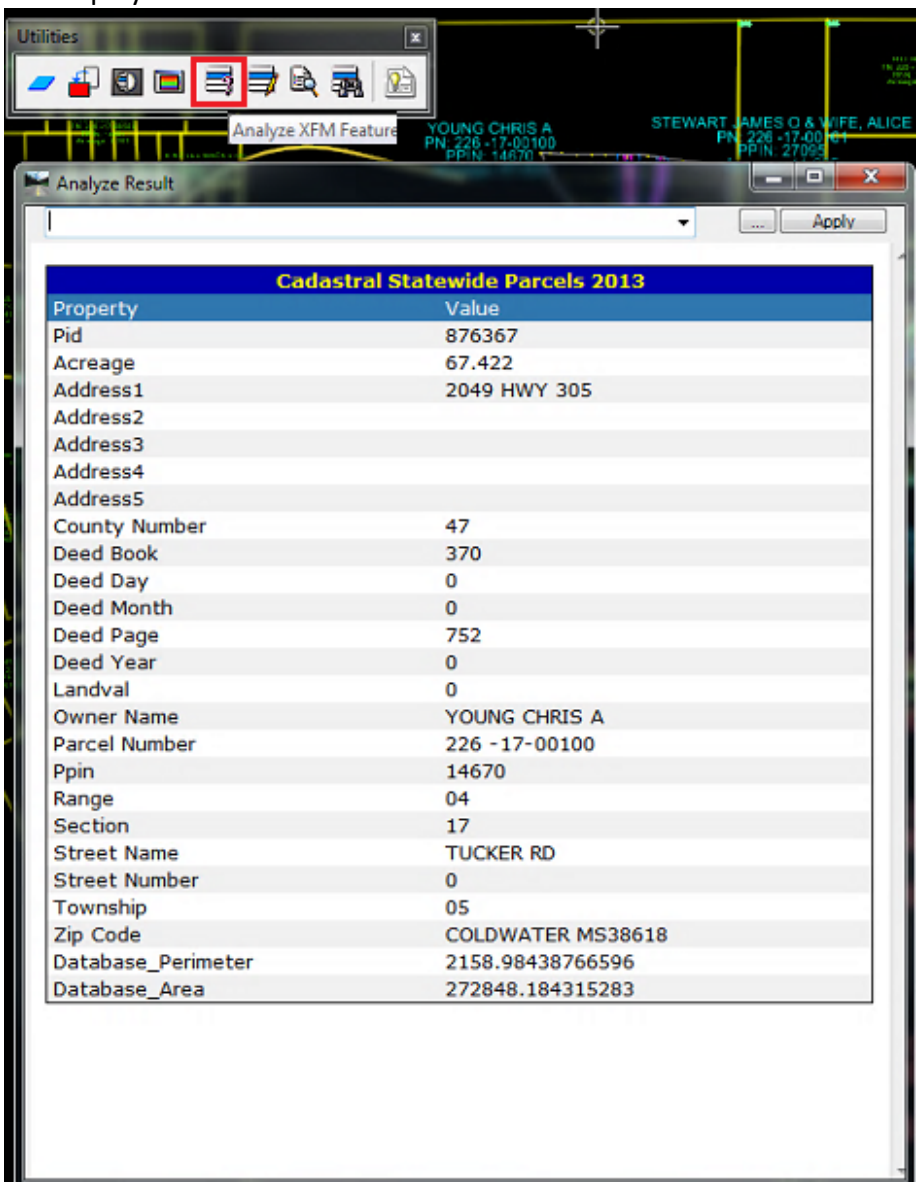


21.7.7 Feature Data

You can view information on features by opening Tools -> Geospatial -> Utilities and choosing **Analyze XFM feature** as shown below. The data presented in the second figure below is detailed information about the particular feature selected which in this case is a parcel.



Choose the command **Analyze XFM Feature**, and choose the element. The results are displayed.



Cadastral Statewide Parcels 2013	
Property	Value
Pid	876367
Acreage	67.422
Address1	2049 HWY 305
Address2	
Address3	
Address4	
Address5	
County Number	47
Deed Book	370
Deed Day	0
Deed Month	0
Deed Page	752
Deed Year	0
Landval	0
Owner Name	YOUNG CHRIS A
Parcel Number	226 -17-00100
Ppin	14670
Range	04
Section	17
Street Name	TUCKER RD
Street Number	0
Township	05
Zip Code	COLDWATER MS38618
Database_Perimeter	2158.98438766596
Database_Area	272848.184315283

22. PHASE “B” PROCESSES

22.1 Section Overview

This section will cover some of MDOT’s Phase B processes including Summary of Quantites, AMG preparation, and surface to surface earthwork calculations.

22.2 Section Prerequisites

- MicroStation fundamentals
- ProjectWise fundamentals
- Phase B processes

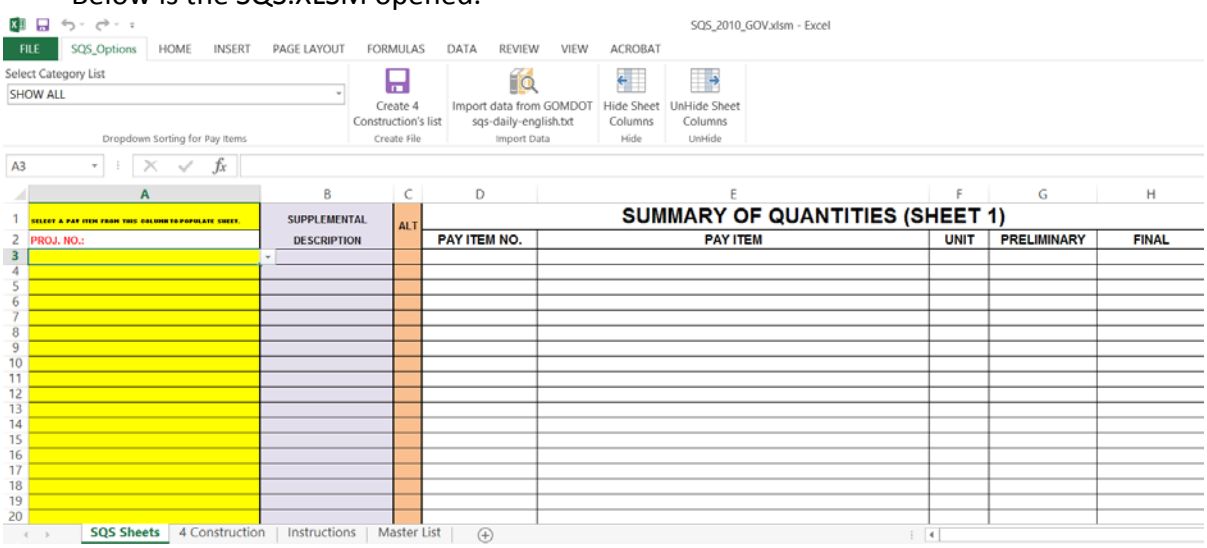
22.3 Section Objectives

After completing this Section, you will be able to:

1) Create Summary of Quantity sheets.
2) Create design terrains for use in AMG and construction inspection.
3) Calculate estimated earthwork using the surface to surface method.

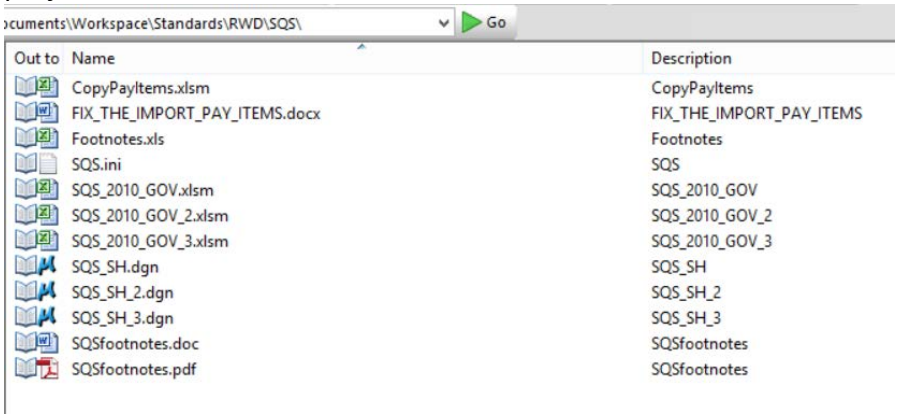
22.4 Summary of Quantities

Below is the SQS.XLSM opened.



22.4.1 Copying the XLSM File

The appropriate **SQS XLSM** file and associated DGN file should be copied from PW's Workspace\Standards\RWD\SQS\ folder to the **RWD-CADD_Files_B** directory of the project. Below is a list of available files in this folder.



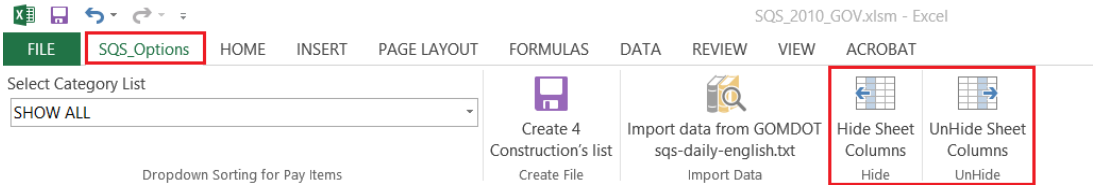
Note:
The _2 or _3 in the file names represent projects that span 2 or 3 counties.

22.4.2 General Information

1) This excel spreadsheet is used to create a Summary of Quantities data file for Construction division and link to MicroStation for plotting.
2) Enter the Project Number the excel file is associated with. This field is located near the top of column **A** just above the first pay item selection cell.
3) All quantity data needs to be entered in this spreadsheet. NO quantity data should physically entered in the MicroStation design files.
4) Retain this excel spreadsheet with its corresponding MicroStation design file. This will maintain the link and give the ability to revise items.
5) This spreadsheet allows the distribution of preliminary project quantities without having to access MicroStation.
6) The most up-to-date Master data source pay items are kept up-to date at the following web address server location: http://sp.mdot.ms.gov/RoadwayDesign/Pay%20Items/sqs-daily-english.txt
7) For all users -- to update the pay items list in this spreadsheet, use the **Import Data from GOMDOT**... button under **SQS_Options** tab on the Ribbon.
8) The import button updates the **Master List** worksheet. DO NOT manually modify this worksheet.
9) To generate a data file for Construction Division worksheet, use the **Create Constructions List** option under **SQS_Options** on the Ribbon.
10) NEVER manually create your own pay item or modify a pay item description. Please contact your supervisor or construction division if a new item is needed.
11) **Column widths**: A, B, and C can be changed, all others should not be changed.
    D=16 E=110 F=8 G and H=15

12) **Row Heights:** Row heights should not be changed.
Row(1)=21 Row(2)=15.75 Black Shaded Rows=20 All Other Rows=12
Each Sheet has 55 Rows (not including the heading rows 1 and 2) for pay item entry. Do not add or remove any rows, they should remain at 55 rows + 2 for the headings.

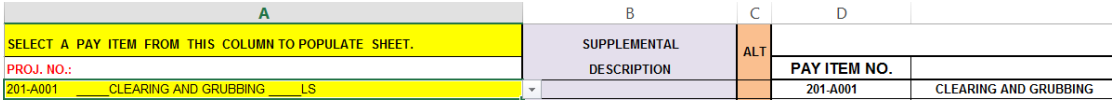
13) Hiding and Unhiding Columns: There are two macros available to hide and unhide columns.
The purpose is to hide or unhide the sheet columns (excluding the Preliminary columns) to help make it easier to move pay items and quantities together.
You can run these macros with the buttons on the Ribbon Bar under the SQS Options tab.



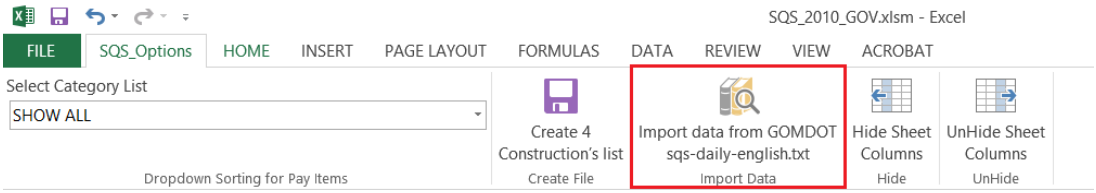
14) Cell Protection: All uneditable cells have been locked. If you wish to edit them you must unprotect the SQS Sheets worksheet with **REVIEW** > **UNPROTECT SHEET**

22.4.3 Entering data in the XLSX

1) Select the **SQS Sheets** worksheet tab and to make it active. This tab is where you will choose pay items to populate the sheet's **Pay Item Number, Description, Unit**, and **Preliminary quantity**.



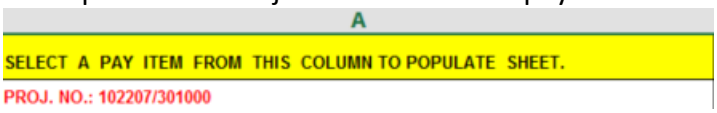
2) To update the **Master List** of pay items, select **Import data from…** button on the ribbon.



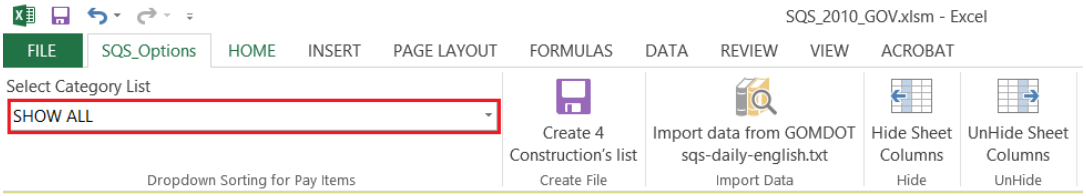
Notes:

- The pay item list in the excel file is static. It has to be updated manually with the Import button.
- RWD automatically updates the source file daily and distributes it to the web site server folder.

3) Enter a project number the excel file is associated with. This field is located near the top of Column A just above the first pay item selection cell.



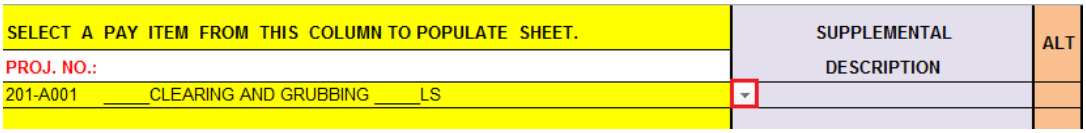
4) Optional: Select a pay item filter grouping in the **SQS_Options** ribbon under the **Select Category List** field. (Default is to **Show All** pay items.)



Note:

- The Pay Item List is very large making it time-consuming to scroll through. The filter is used make it easier to find specific types of pay items.

5) Locate the yellow-shaded column labeled as **SELECT A PAY ITEM FROM THIS COLUMN TO POPULATE SHEETS.**
6) Select the **LIST** arrow at the right most end of the cell. Scroll to the desired pay item and select it.



7) The **Sheet** table next to your row selection is automatically populated with the pay item number, description, and unit.
8) If the pay item requires a supplemental description, enter it in the purple-shaded column. The column is directly right of the yellow column.
9) If there are Alternate pay items in your list these need to be have an **Alternate Code** entered in the orange column labeled **ALT**.

Note:

- Use AA1 for the first set of pay items and enter AA2 for the alternate set of pay items. If other alternates are required use AB, AC, AD, etc.

10) Continue by selecting additional pay items to fill-in the remainder of the sheets.
11) Enter the pay items in numerical order. Anticipate inserting pay item later, and try to leave blank lines to accommodate these.
12) The **SQS Sheets** worksheet contains ten (10) blank SQS sheets for entering data.
13) Each of the SQS Sheet tables are numbered and each single sheet is designed to fit inside a single Roadway Design plan sheet cell.

14) Calculate all quantities and manually enter the amounts in the **PRELIMINARY** column for each pay item.

	E	F	G	H
1	SUMMARY OF QUANTITIES (SHEET 1)			
2	PAY ITEM	UNIT	PRELIMINARY	FINAL
3	CLEARING AND GRUBBING	LS		
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

15) If you move a pay item to a different line you must also move the quantity numbers in the **PRELIMINARY** column.
16) You CANNOT insert or delete a column or row to the spreadsheet on the **SQS_SHEETS** tab.
17) You CAN copy pay items or descriptions in the first 3 columns (A, B, and C shaded cells) and paste them to other cells in the same column.
18) You can delete an item in columns A, B or C by selecting the cell and pressing the **DELETE** key on the keyboard.

22.4.4 Linking the XLSX to the DGN file.

1) You can link the sheets in the **SQS Sheets** worksheet tab at any stage of completion. The link allows updating the MicroStation file to match each sheet.
2) You can copy a template design file called **SQS.dgn** located in the folder ...\SQS folder to your project or create a new design file.

Notes:

- It is recommended that you keep the name SQS.DGN.
- The template file (SQS.dgn) contains ten (10) blank SQS sheets with guide points already placed to help you link the excel spreadsheet data.
- If creating your own file, use the cell **SQSGUIDE** as a guide to linking data. The origin of the cell matches the corner of a Plan Sheet border cell.

3) In this spreadsheet, locate a sheet (example is, Sheet 1) and use a "hold and drag" method of selecting the entire sheet.

Notes:

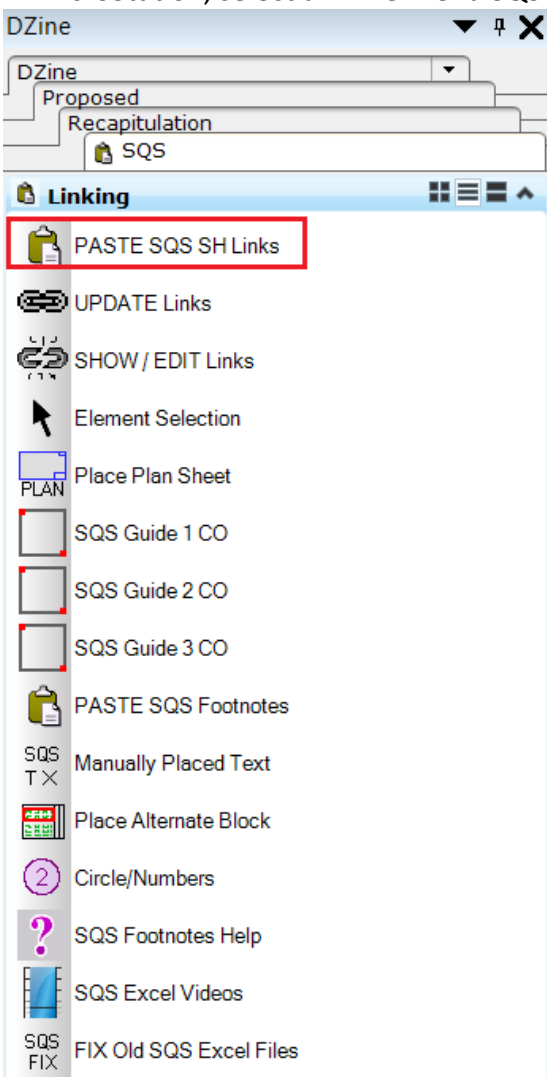
- Use the **Zoom** tool in the lower right corner of excel to scale the view enough to see a complete sheet.
- Select only once sheet at a time and only the items that need linking into the design file.

4) Once the selection is made, use the **COPY** command in excel to place a copy of the selected data into the clipboards memory.

Note:

- If you have made changes to the pay item data you must **SAVE** the file first, before doing a **COPY.**

5) With your SQS design file open, position the view in MicroStation at the location that matches the sheet number you copied in the previous step.
6) In MicroStation, select a DZine Menu SQS Paste command.

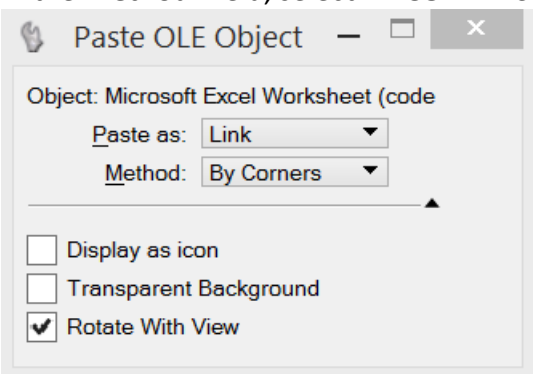


7) In the MicroStation's **TOOL SETTING** dialog the tools options for **Paste OLE** (Object-Linking-Embedding) appears.
8) In the **Paste As:** field, select **LINK.**

Note:

- DO NOT use Picture or Embedded options. These two options will cause problems maintaining a link to this excel file.

9) In the **Method:** field, select **BY CORNERS**



10) Use the RED active points of the **SQSGUIDE** cell as the corners that MicroStation prompts for you to identify.
11) You should now have the sheet pasted into MicroStation. Continue to copy and paste all the other sheets that you have entered data into on the spreadsheet.

Note:

- If you used the SQS template DGN file then you should delete any unused sheets in MicroStation to avoid having them located during batch plotting.

22.4.5 Maintaining the Link

1) DO NOT delete the excel file. This file must exist to provide a way to update the linked sheets in MicroStation.
2) In MicroStation you can locate and open the excel source by one of the following methods:
   a) (Recommended) Use the **Selection** tool to double-click on the excel sheet object and the excel sheet will automatically open in the excel application.
   b) Select the **Edit -> Links** commands. In the dialog, select from the list of links the item you want to open and select the **Open Source** button.

3) If Excel is opened to a spreadsheet before opening a design file and you double-click on a linked sheet to open the source, you may get an error message until you close the open excel sheet.
4) After making a revision to a sheet in an Excel file, **SAVE** it before updating it in MicroStation.
5) To update MicroStation to match a revised Excel sheet, you can use on of the following methods:
   a) (Recommended) Select the **Edit -> Update Links** options. This will automatically update all revisions made in the linked excel sheets.
   b) Select **Edit -> Links**, then select the items in the list and select the **Update Now** button.
   c) Save and close the saved Excel Sheet.
   d) Select the **Update Link** option on the DZine SQS menu.

22.4.6 Construction Data File

The following steps are done performed by Construction division.

1) To create a data file in a format usable by Construction Division can use a worksheet tab is located in this Excel file called **4 CONSTRUCTION.**
2) By default this worksheet is empty. To populate the SQS Sheet data into this worksheet a macro has been provided within this file.
3) On the ribbon, locate the **SQS_Options -> Create 4 Construction's List** option and select the icon. This will populate the **4 Construction** worksheet based on the data in the **SQS Sheets** tab.
4) This formatted data on this worksheet can then be exported by Construction.

22.4.7 Plotting the SQS Sheets

You may need to exit or close the excel sheet before you plot the objects. When the excel data sheet is open, MicroStation may display a diagonal hatching object over the spreadsheet.

Note:

- This hatching WILL plot as a shaded object. Closing out the excel file will eliminate this side-effect.

- The excel SQS sheets have been designed to fit within the limits of a Plan Sheet cell when snapping to the red dots on the **SQSGUIDE** cell.

  Using the **By-Corner** method of placing the link will create the linked object with a text size that falls within the normal range of standard text sizes.

- If your SQS design file contains blank sheets then these may plot when using the **BATCH** plotting procedures.

  The SQS.DGN template file contains 10 pre-made sheets. Remove the ones that are not used.

22.5 AMG Deliverables

22.5.1 Overview and Required. Practices

Automated Machine Guidance (AMG) delivery will require the following:

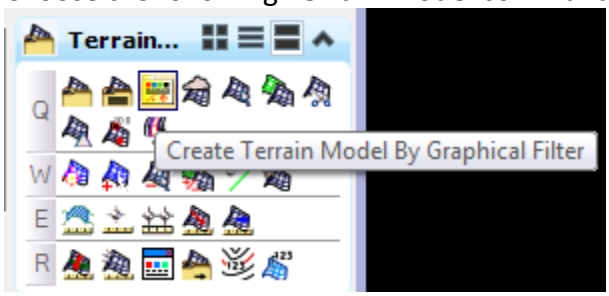
3) **FMS#-ALIGNMENTS.xml**
   Design alignments and profiles in LandXML format.
4) **Roadwayname-Phase-TOPDIRT-StationRange.xml**
   Top Dirt terrain (In LandXML) for each phase of construction limited to 3 MB of file size on the LandXML file.
5) **Roadwayname-Phase-DESIGNSOIL.xml**
   Design soil terrain (In LandXML) limited to 3 MB of file size on the LandXML file.
6) Generation of the files above from 5’ Template Drops and Template drops at all horizontal and vertical control points. (10’ allowable for high speed roadways.)
6) Voids are required in overlay areas.
7) Channel changes are required and should be designated in the name.

22.5.2 Create Design Terrains (Steps)

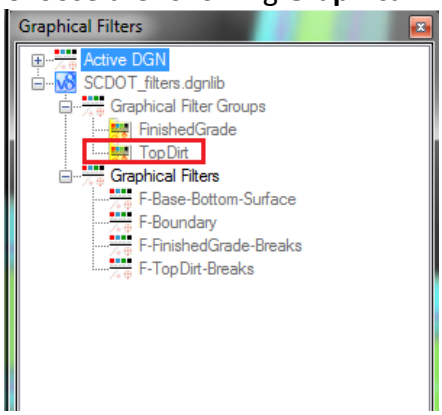
1) Create a DGN file called 3d-Terrain-D-*.DGN (Use 3d Seed file)

   3D-TERRAIN-D-roadwayname-(phase)-(stationlimits.DGN).DGN

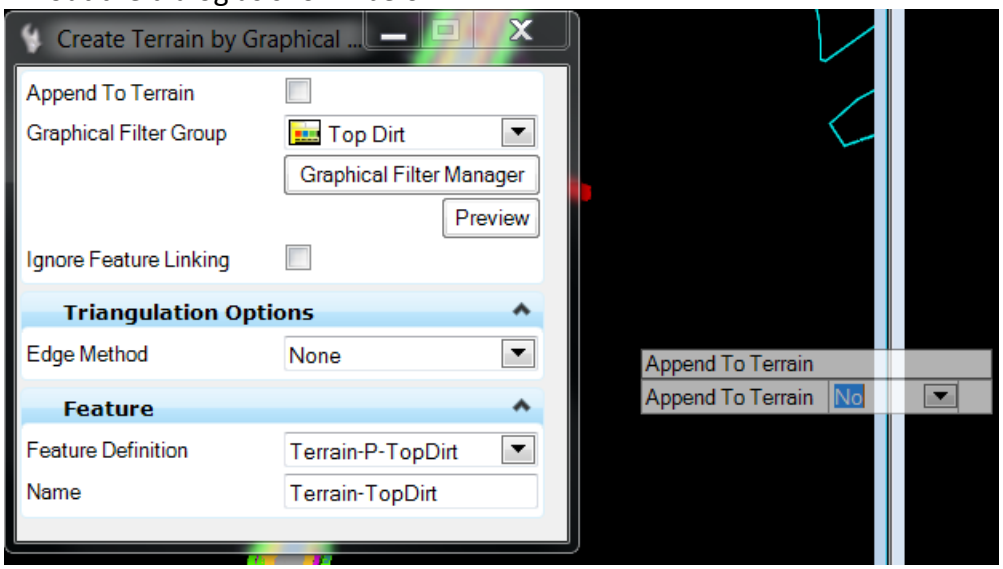
2) Reference your corridor (Defaul-3d view)
3) Choose the following **Terrain Model** command.



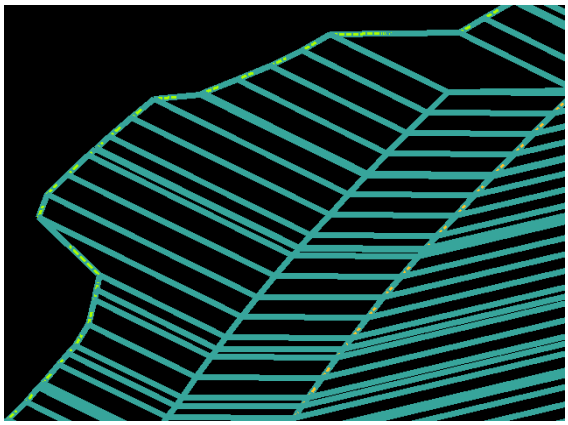
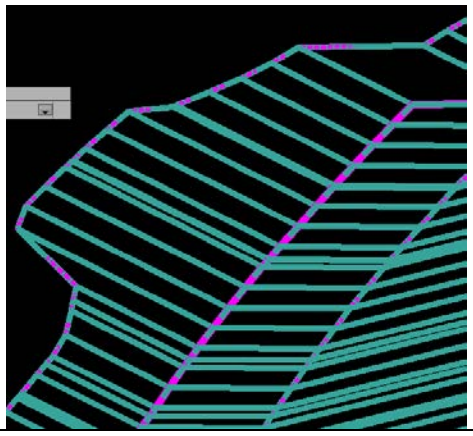
4) Choose the following **Graphical Filter Group.**



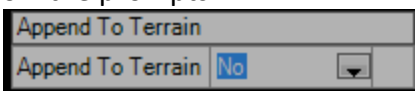
5) Fill out the dialog as shown below.

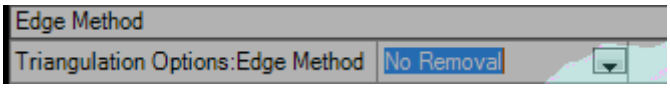


6) Select **Preview** to view the breaklines the filter is seeing.

No Preview	Preview
	

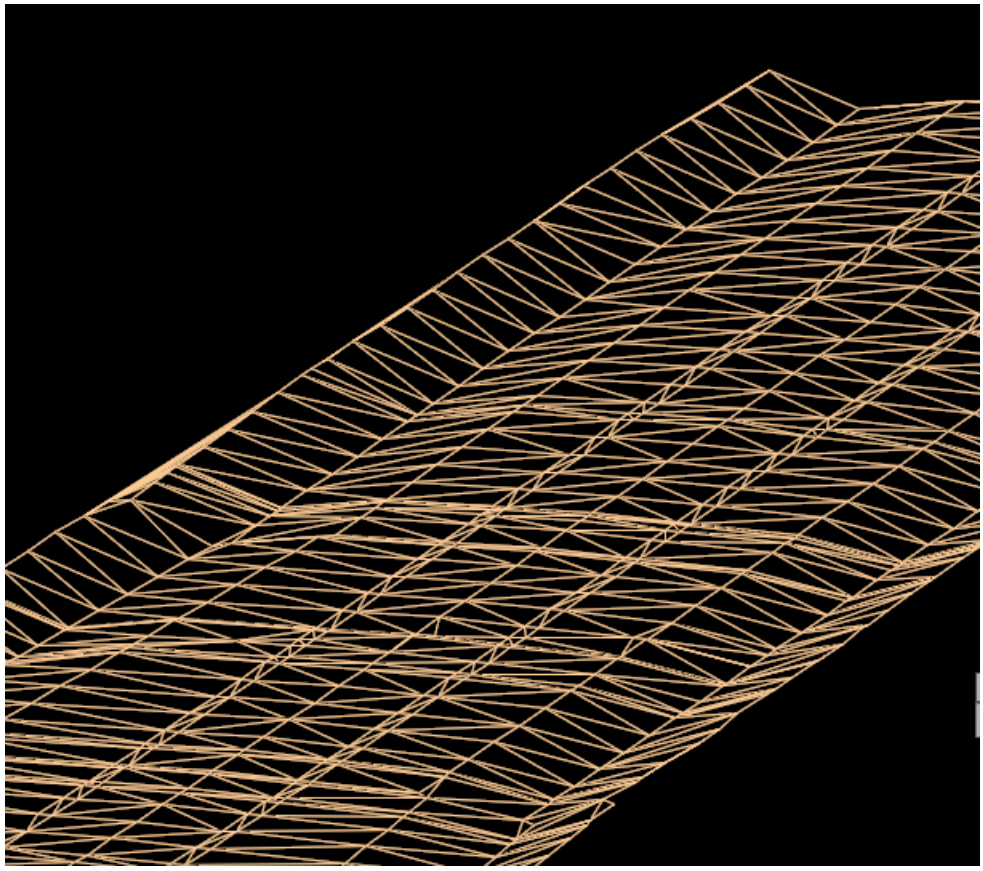
7) Follow the prompts.

a) 

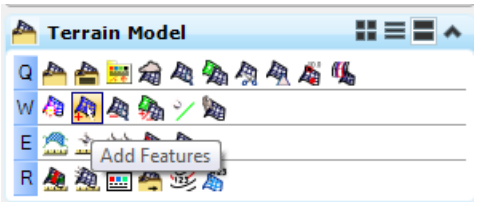
b) 

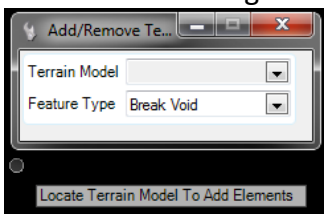
c)

Below is an example of a terrain created with the corridor reference for the Defaul-3d model turned off.



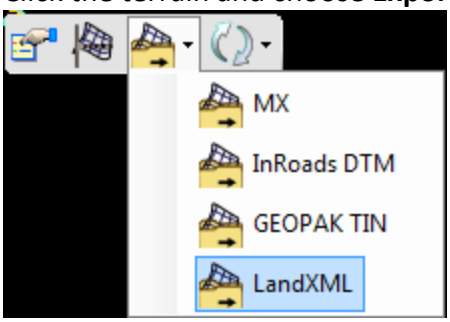
8) Add any drape void areas as needed. (i.e. Overlay Areas). These will need to be closed shapes. In the case of drape voids, no elevation is needed on the elements. In the case of an overlay, it will be the existing EP’s but closed.



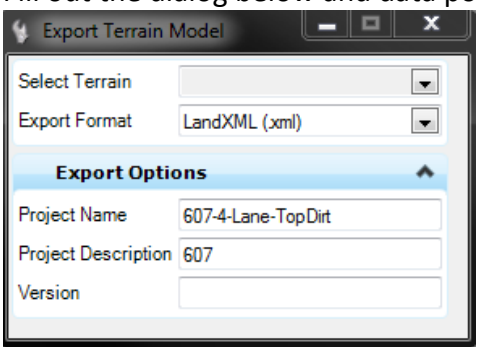


22.5.3 Create LandXML (Steps)

1) Click the terrain and choose **Export -> LandXML.**



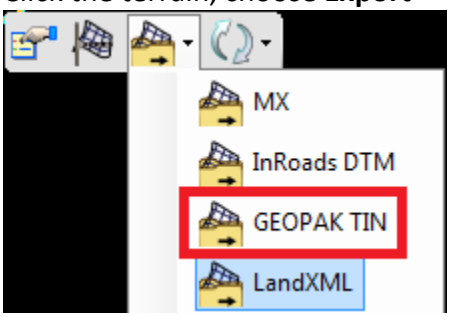
2) Fill out the dialog below and data point through the prompts.



3) You'll be prompted to save the XML file. Name it the same as the Project Name above.

22.5.4 Create GEOPAK TIN

1) Click the terrain, choose **Export -> GEOPAK TIN**, and follow prompts.



Note:

- You can use this TIN to cut XS's from surface on top of the x-sections created from the corridor to verify the terrain accuracy. **<u>This QC process is highly recommended.</u>**

LAB XV:AMG Deliverables

1. Create the file RWD-3D-TERRAIN-D-TOPDIRT.DGN
2. Reference the corridor file.
3. Create the **Top Dirt** terrain for corridor SR4.
4. Create the **Finished Grade** terrain for corridor SR4.
5. Export these terrains to XML and TIN files.
6. Create cross-sections from the TIN files on top of the design cross-sections generated earlier to verify TIN accuracy.

LAB XVI: Earthwork

1. Create the file RWD-EW-PHASE1-001.DGN
2. Reference your Border DGN file.
3. Calculate earthwork per sheet.