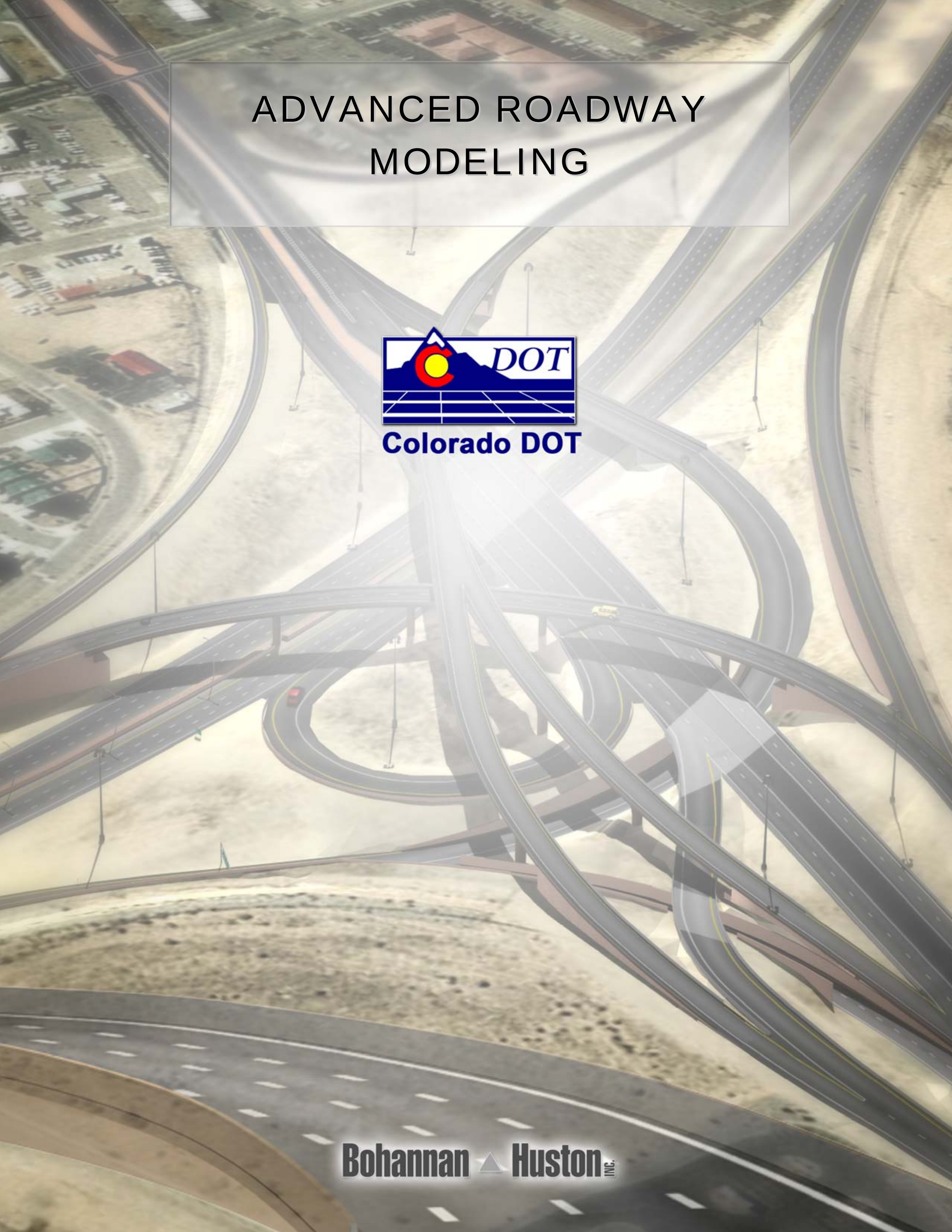
ADVANCED ROADWAY MODELING



Colorado DOT

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Notice

Software Versions

The software products referred to in this publication are furnished under a license and may only be used in accordance with the terms of such license. This document intended for use with the following software versions:

MicroStation® version 08.05.02.55
InRoads® version 08.05.00.00 – Service Pack 5

0607 – Version 03.01 CDOT Configuration

Document Conventions

There are several conventions that are used throughout this document to indicate actions to be taken or to highlight important information. The conventions are as follows:

Item	Meaning
View Perimeter	a command name or a file that you are to select
Tools > Options	a command path that you are to select – usually from the pull-down menus
Key in	entering data with the keyboard
Document name	style used when referring to another document
Note: text	information about a command or process that you should pay particular attention to
Emphasis	an important word or phrase
1. Numbered Steps	actions that you are to perform as part of the lab activities
<D> or **Data**	press the data button on the mouse
<R> or **Reset**	press the reset button on the mouse
<T> or **Tentative**	press the tentative button on the mouse

Table of Contents

Getting Started

Introduction

The document is designed for use in an instructor-led classroom environment, but will be useful for new users to refer back to as they begin applying the learned techniques to their projects. However, it is not meant to be a software reference guide or to replace the on-line help available through InRoads.

The lab activities are written to provide the students with step-by-step instructions for the main focus of the chapter, with additional challenge labs in many of the chapters for those who finish early or want to dig deeper into the topics.

Prerequisites

Before attending this course, you should know how to:

In MicroStation

- Use the ‘select group’ utility
- Use the ‘project creation’ utility
- Use the standard CDOT project directory structure
- Understand the concept and practice of selecting a ‘project’ in the **MicroStation Manager** interface.
- Use the basic file management tools in MicroStation (open, copy, new, rename)
- Use the view manipulation commands in MicroStation (zoom in/out, fit, pan, recall saved view(s), turn levels on/off
- Manipulate MicroStation References – display on/off, turn references levels on/off
- How to work in a 3D MicroStation file. View rotation, active depth, view depth, depth lock.
- Use the tentative (snap) button on the mouse for precision graphics location

In InRoads

- Use the InRoads locks
- Create, review and modify basic horizontal and vertical alignments.
- Create and modify typical sections.
- Create basic decision tables.
- Create roadway definitions and template transitions.
- Run Roadway Modeler.
- Have a general understanding of feature based DTM's.
- Generate and update cross sections.

CDOT CADD Resources

There are many resources available to assist you when working on your CDOT CADD project. These resources can be found on the CDOT CADD & Engineering Innovation Web site.

CDOT CADD & Engineering Innovation Web Site

The CDOT CADD & Engineering Innovation web page is available at:

http://internal/cadd/ It can also be found on the internal CDOT website:

Organizations > Project Development > CADD and Engineering Innovation.

The website (presently only available to CDOT) provides CDOT users with up to date information, tools, and resources related to CADD and the Colorado Engineering Software Transition (CEST) project.

This website is a valuable resource for CADD users and includes links to:

CADD Library -- provides links to manuals, newsletters, standard details, Tips and Tricks *etc*.

CADD Manual -- documents standardized procedures for the exchange of information. The Manual also addresses software issues, tools, techniques, standards and procedures, etc. which will aid the user in the efficient production of CDOT plan sets.

CDOT Workflows -- step-by-step CDOT-specific procedures for certain tasks that you may encounter when working in MicroStation or InRoads on a CDOT project.

Issues Logs -- to determine the status of submitted requests.

Requests and Support -- provides CADD help solutions where you can submit questions or requests, obtain InRoads, InRoads Survey and MicroStation support, and link to IT Services for support.

Training -- sign up for training classes or review online computer-based training (CBT) for MicroStation, InRoads and InRoads Survey.

Training files

The training lab files for this course will be available after you complete the training. Your computer will have a training files icon in **CDOT Customization** Group accessed from the **Windows Start** menu. A link is also available in **IT Services** on the **CADD & Engineering Innovation** website. The icon and link perform the same self extracting zip process to install the training files on your machine.

It is highly recommended that you install the training files and continue practicing with MicroStation and InRoads by completing the lab exercises contained in this course guide, especially if you do not plan to start work on a MicroStation/InRoads project soon.

Files used by InRoads

InRoads uses several different files to store parameters driving the design and display of InRoads graphics, as well as to store the design data. These files are loaded into memory during a design session and with some exceptions must be saved if they have been modified. The typical files used in a project are shown below.

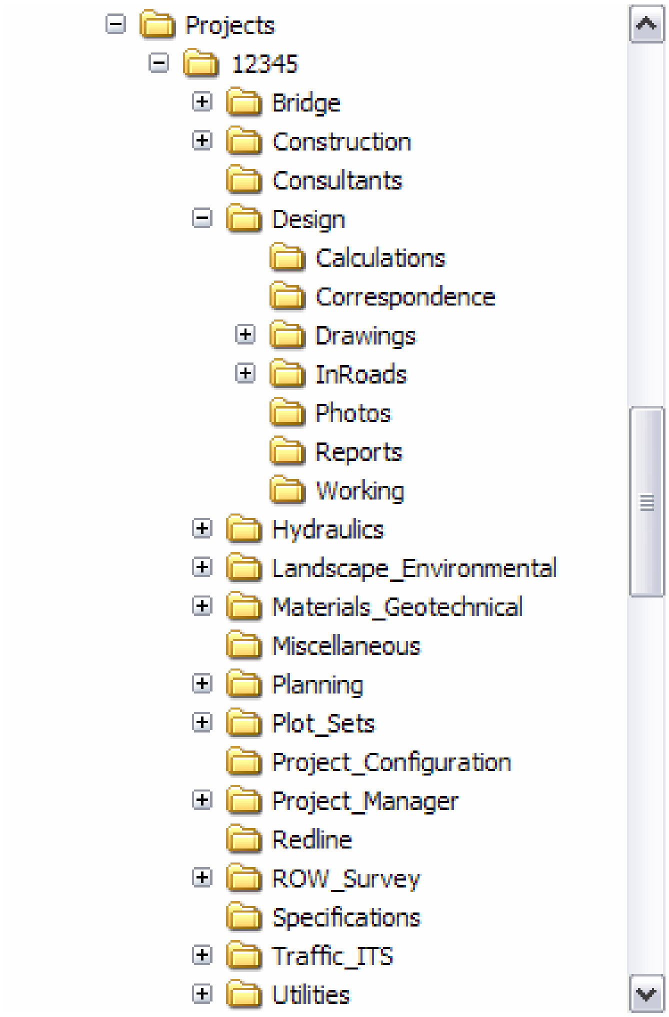
File	Ext.	Format	Comes From	*	Contains	Method of Saving
Preferences (CDOT-preferences.ini)	.ini	ASCII	CDOT Standard	M	Units Precision Readout Command preferences	**
Styles (CDOT-styles.ini)	.ini	ASCII	CDOT Standard	M	Geometry Styles Controls symbology of alignments and cogo points.	**
Digital Terrain Models	.dtm	Binary	Existing - from Survey Design - created by InRoads	S	Topographic information for ground surface. Used for contouring, profiles, cross section, etc.	Must be saved before exiting. May use File>Save As>*.dtm
Geometry Project	.alg	Binary	Survey Copied and added to during design	S	Horizontal alignments Vertical alignments Superelevation Cogo points	Must be saved before exiting. May use File>Save As>*.alg
Typical Section Library	.tml	Binary	CDOT Standard** Make copy for project use so you can edit	M	Templates Tables: Decision, Cut/Fill, Material TC (transition control) Names	Must be saved before exiting. May use File>Save As>*.tml
Roadway Library	.rwl	Binary	Created for each project	S	Roadway Definitions (Station & Template setups, etc.)	Must be saved before exiting. May use File>Save As>*.rwl
Project	.rwk	ASCII	Created for each project	S	List of files used in project.	The project file saves all the individual files using File>Save or Save As. NOTE: Files saved are only those listed in the .rwk.

* M=Multiple Project Use, S=Single Project Use

** CDOT configuration does not allow modification of standards, preferences or styles.

Project File Structure

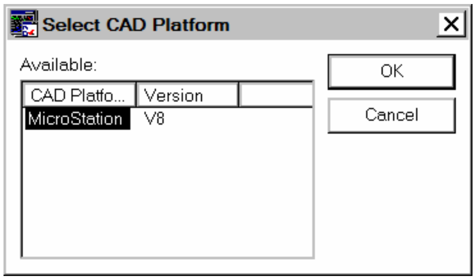
The sample project in this document uses the standard CDOT file structure with 12345 = CDOT JPC number.



Starting InRoads

If you are using a machine that has both MicroStation and AutoCAD loaded, or more than one version of MicroStation, you must tell InRoads which CAD platform to use before starting InRoads.

Choose **Start > All Programs > Bentley Civil Engineering > Select CAD Platform** and select MicroStation V8, then choose **OK**.

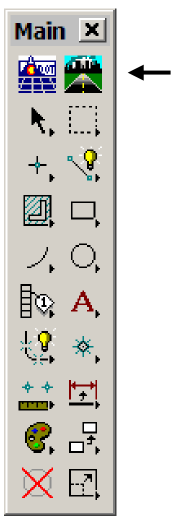


There are three main methods of starting InRoads:

a. Choose **Start > All Programs > Bentley Civil Engineering > Bentley InRoads** and MicroStation will start and allow you to choose the design file, then InRoads will start.

b. Choose the Desktop icon for InRoads if one is available on your machine. MicroStation will start and allow you to choose the design file, then InRoads will start.

c. If you already have MicroStation open, you can choose the InRoads icon from the MicroStation main toolbar.



Project Defaults

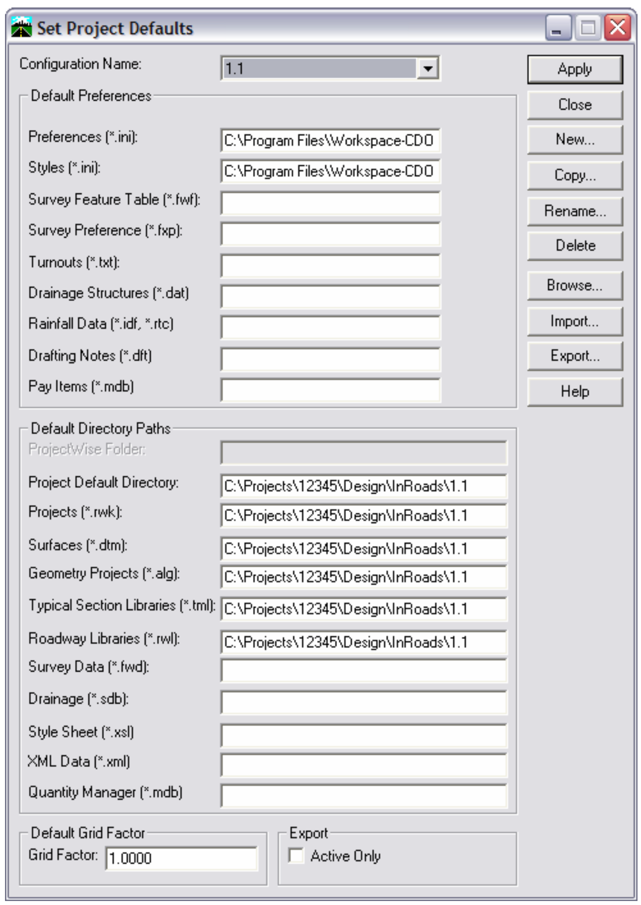
InRoads loads a preferences file and a styles file when it starts. You may create **Project Defaults** to have InRoads load your CDOT customized files automatically. If you do not, it will load the default files out of the InRoads product directory and you will have to load yours (**CDOT-preferences.ini** and a **CDOT-styles.ini**) through a project file (**.rwk**) or individually.

The **Project Defaults** also set the path that InRoads will use to open or store data files that you load or save. These paths are not absolute; they are just the starting point to which InRoads defaults.

Multiple **Project Defaults** may be created and stored on a machine, and you can switch between them when switching between projects.

The **Project Defaults** are found on the InRoads menu under **File > Project Defaults** as shown below.

Important!: Throughout the **Advanced Roadway Modeling** lab exercises, it is critical that you set the correct **Project Defaults** configuration name. Each lab exercise requires that you load the correct InRoads data files, which are located in separate sub-folders.



1. Alignment Creation

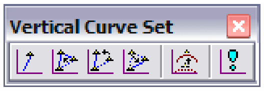
There are several methods for creating horizontal and vertical alignments using InRoads. This chapter explores these methods which include:

- Using the **Horizontal Curve Set** tools with text input files (@ files)
- Using **Horizontal Elements** to create alignments without PIs
- Using **Coordinate Geometry** (Cogo)
- Importing alignments and cogo points (.ics files, graphics)

In addition you'll learn how to assign geometry styles to your alignments and geometry points as well as generate reports based on alignments and features.

Text Input Files and Alignments

You learned how to create alignments with **Horizontal** and **Vertical Curve Set** tools in the ***Roadway Design using InRoads*** class. These tools allow you to interactively create your alignment by placing PIs for your tangents, then placing curve sets by specifying the radius, degree of curve or pass through points for simple or compound curves (with or without spirals).

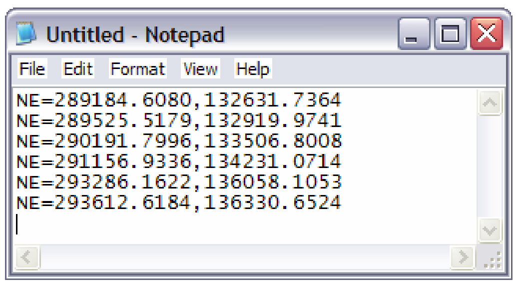


To automate the process of placing PIs, you can use text input files (also know as @ files), which store your precision keyins for PI locations.

Creating text input files

You can use any word processor (including Windows Notepad) to create a text input file. Just make sure you save the file as ASCII text. Text Input files store any MicroStation keyin which can later be processed in sequence. When laying out alignment PIs, valid keyins include:

- ***xy=<x,y,z> or <easting,northing,elevation>***
- ***ne=<n,e,e> or <northing,easting,elevation>***
- ***di=<distance,direction>***
- ***so=<station,offset,elevation,alignment>*** where alignment is the name of the alignment that your offsetting from.



Place each keyin on separate line, then save the file. You can then process the entire sequence of keyins in one step by reading the text input file while the **Add PI** command is active.

Processing text input files

To process the file, select the **Add PI** command, then keyin:

@ <path\filename>

The keyins stored in the file are processed in order, the geometry is created in active alignment of the geometry project, and the graphics are placed in the design file.

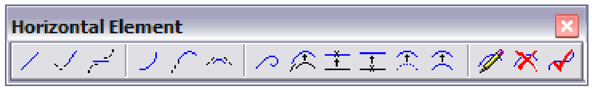
Advantages of text input files

Text input files allow you to:

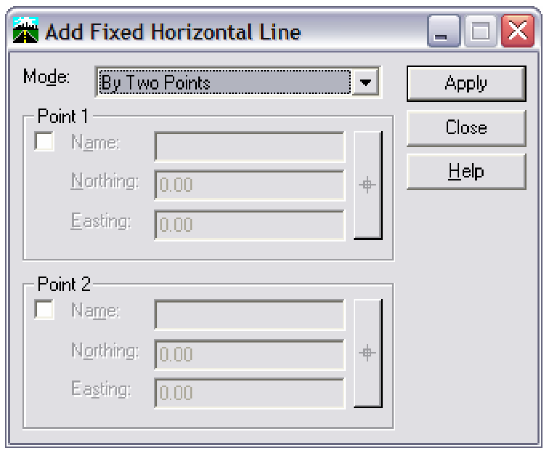
- Document your alignment
- Easily edit your alignment by changing your stored keyins and then reprocessing the text file

Horizontal Element Tools

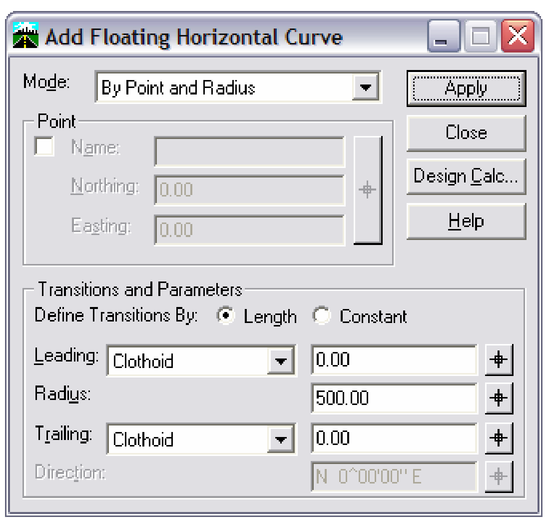
There are 14 tools that can be used to create horizontal element alignments. One of the greatest advantages of the horizontal element alignments is that they do not have to be continuous. For example, you can create elements that have the most constraints, then join them together with unconstrained tangents and curves.



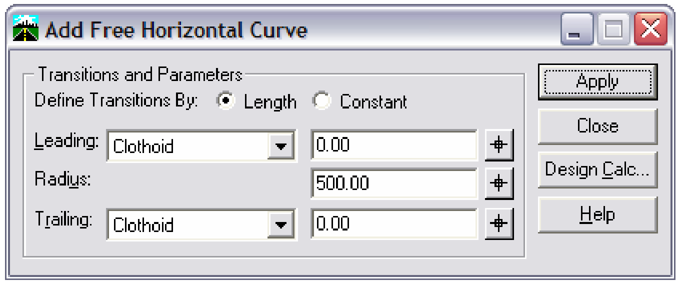
When creating elements, you have three basic constraint options. **Fixed elements** are those with no degrees of Freedom. You know exactly where the element is going to be located and you, in effect, lock it in place. Fixed elements are not locked in length, however, and expand or shrink to be tangent with adjacent elements.



Floating elements are established with a pass-through point and a radius (for curves) and with a pass-through point or a bearing for lines.



Elements that connect two fixed entities and have no known location (just a radius for the curves) are said to be **free elements**. They are often used to connect fixed elements, such as tangents connecting two fixed curves.



To create a horizontal element alignment, first give the alignment a name description and style, then use a combination of the element commands to define the alignment.

Coordinate Geometry (COGO)

InRoads has a series of coordinate geometry commands built into the software. There is no need to exit and start another product in order to use them.

Cogo points and alignments are in most cases interchangeable with horizontal edit points and alignments. There are a few key differences, however:

- Cogo points are always numbered as you go
- Cogo points can stand alone, such as when locating a fire hydrant or sign

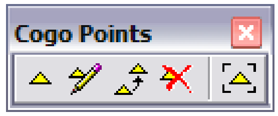
There are several toolbars devoted to coordinate geometry that will be used to either:

- Define an alignment (figure) with Cogo commands or
- Import Alignments and Cogo Points (.ics files)

Define an alignment (figure) with COGO commands

You can define points for the alignment using one of the following tools:

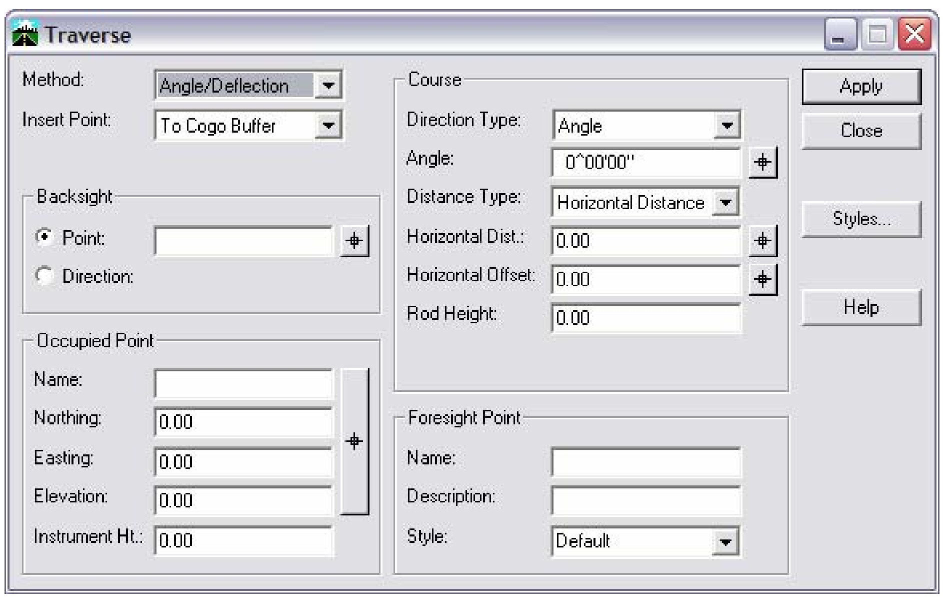
- **Tools >Customize >Cogo Points**



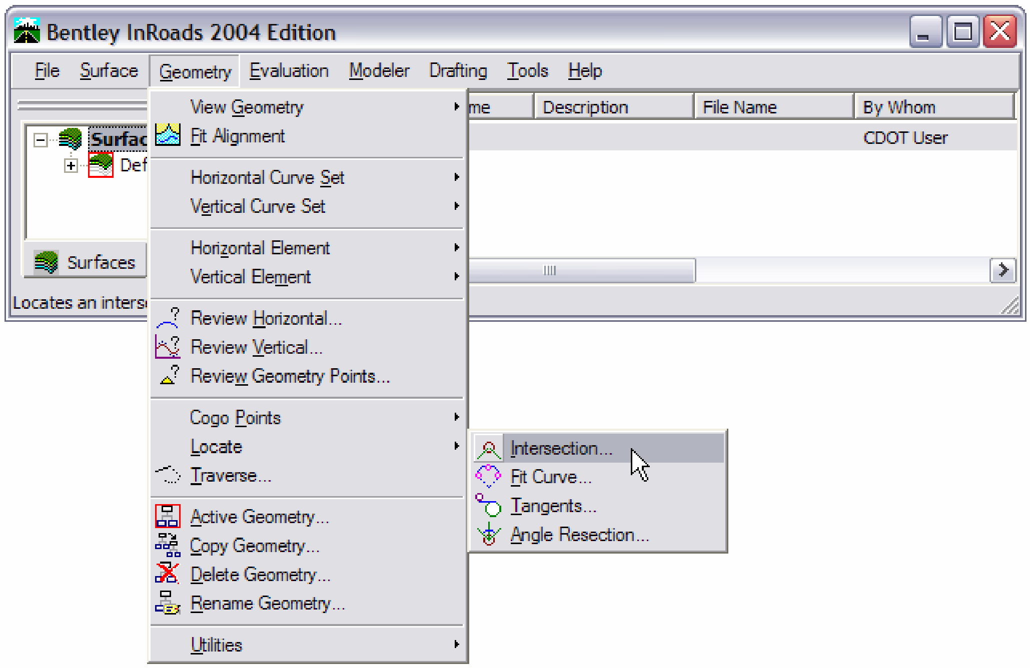
Use **New Cogo Point** to store individual points by coordinates or by station and offset from an existing alignment

- **Locate** (includes **Traverse**)

  Use **Traverse** commands to input cogo points by distance, direction, angle or chord from previous point. Use **Add to Cogo Buffer** or **Radial** options to define only cogo points. Use **Insert Before** or **After Alignment** to add new points to an existing alignment.



- Use other **Locate** commands to locate cogo points based on other points or alignments. For example, you can locate a new point based on the intersection of a direction from an existing cogo point to an alignment.



When you have created the points you want, chain them together by storing an alignment:

- **Geometry >Utilities >Create/Edit Alignment by Cogo Points**

If you need to define easements, for example, you can use **Geometry > Utilities** to parallel existing alignments:

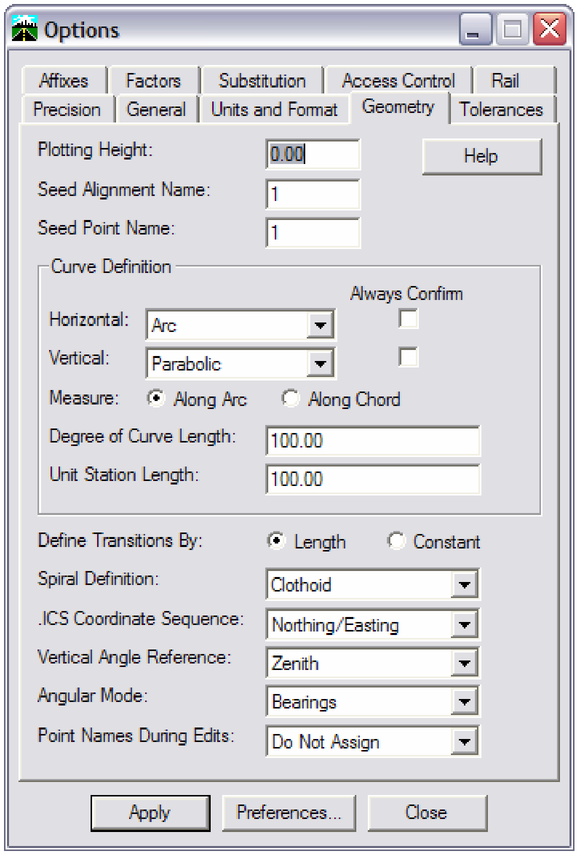
- **Alignment > Parallel Horizontal by Element** or
- **Alignment > Parallel Horizontal by Station**

Importing alignments and cogo points

You can import alignments and cogo points by several methods. Before importing, however, you should check your InRoads preferences using:

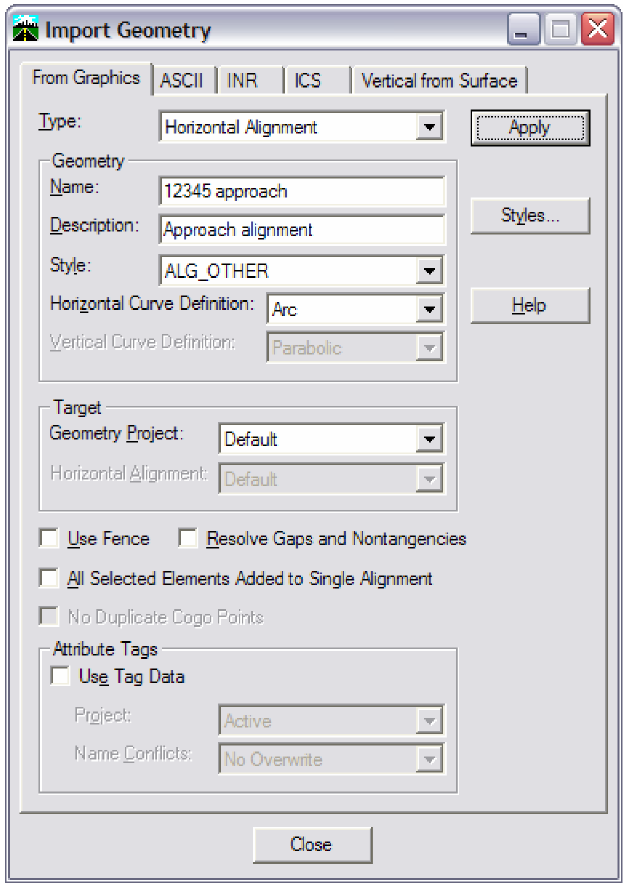
- **Tools >Options >General** and
- **Tools >Options >Geometry**

The most critical option is the northing/easting field if you're bringing in any kind of ASCII data.



You also want to check your lock settings. Turning **Write** lock on makes the import displays permanent and turning **Report** lock on (during some imports) opens a Results box that shows what is being imported.

Read in the data using **File >Import > Geometry**. Import options include:



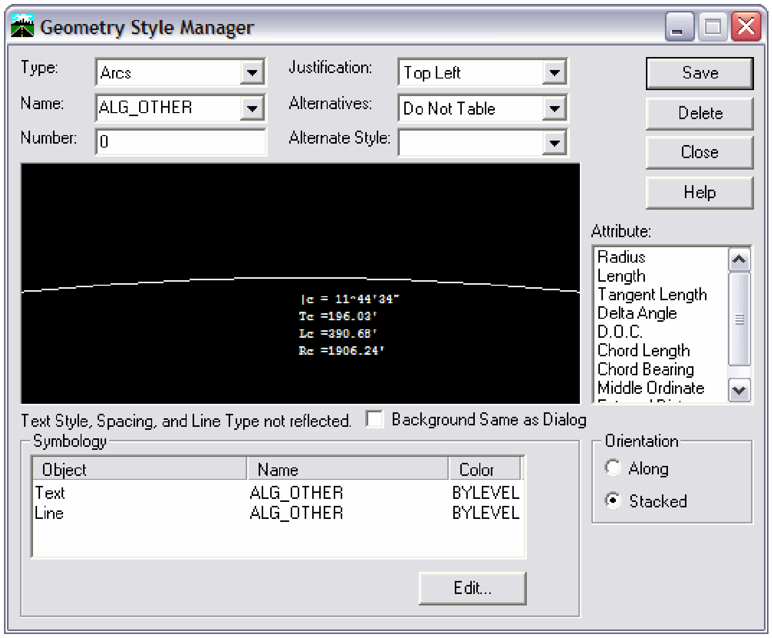
- **ICS** for loading in cogo input files.
- **From Graphics** for importing graphics as cogo points, alignments, or event points.
- **INR** for loading ASCII inr files that were saved from InRoads.
- **Vertical from Surface** for creating a vertical alignment that follows a DTMs elevations.

Styles

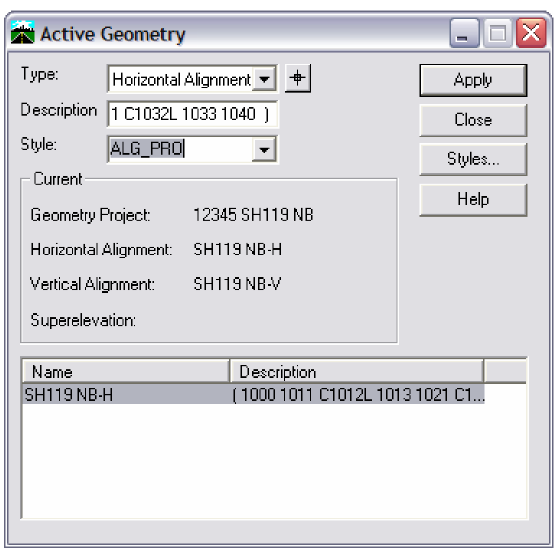
Each alignment is assigned one style name. However, there are four available types of styles. For an alignment you will typically need at least three of them: **points**, **lines** and **arcs**. You may also need the fourth: **spirals**. Each of the styles must be created with the same name that you assign to the alignment.

For cogo points that stand alone, such as a fire hydrant point, you only need to create a **point** style.

Use **Geometry >View Geometry >Geometry Style Manager** to view your available CDOT geometry styles.

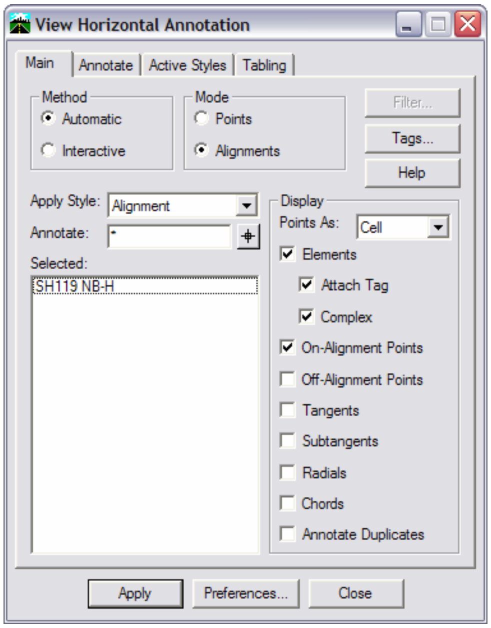


Assign the new style to your alignment using **Geometry >Active Geometry**.

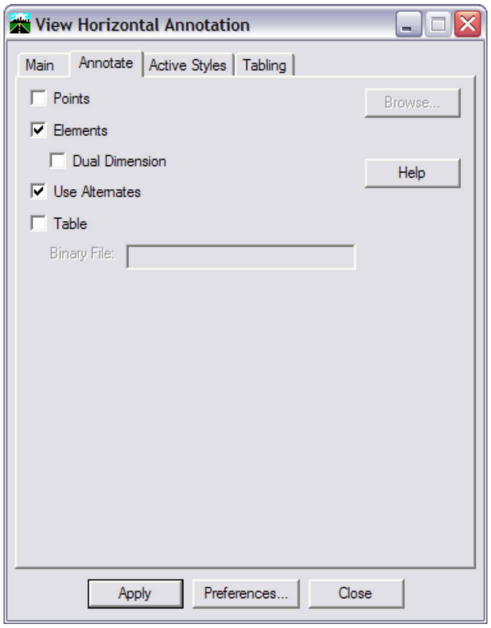


Display the alignment using either:

- **Geometry >View Geometry >Active Horizontal** to display the alignment with no annotation, or
- **Geometry >View Geometry >Horizontal Annotation** to display with annotation



From the **Main** tab, select the alignment in the **Annotate** box, turn on the display options, then select the **Annotate** tab and choose the items for annotation.

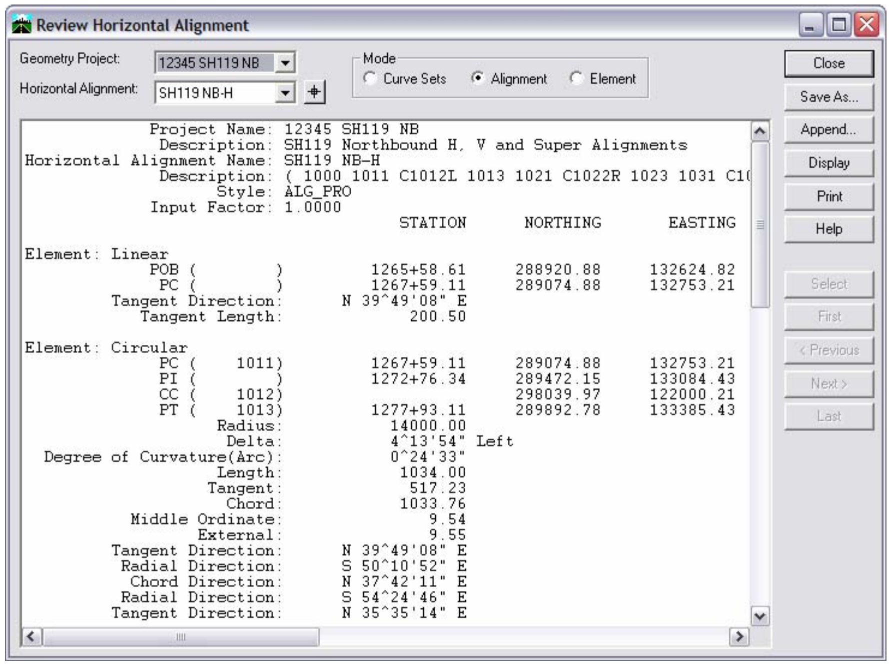


Note: If you do not want to assign the style to the alignment, you can display the alignment using the Active Style.

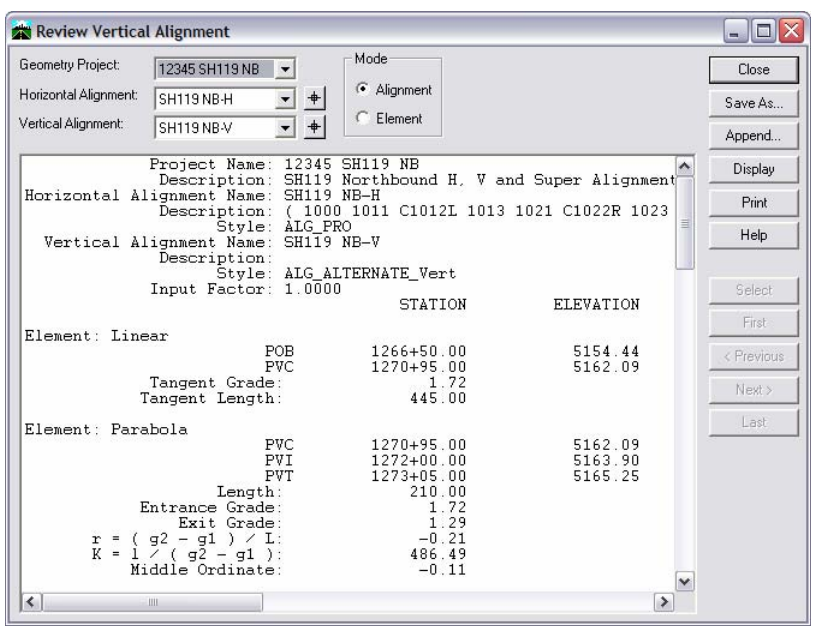
Generating Reports

Several different types of geometry reports can be generated in InRoads with the following commands:

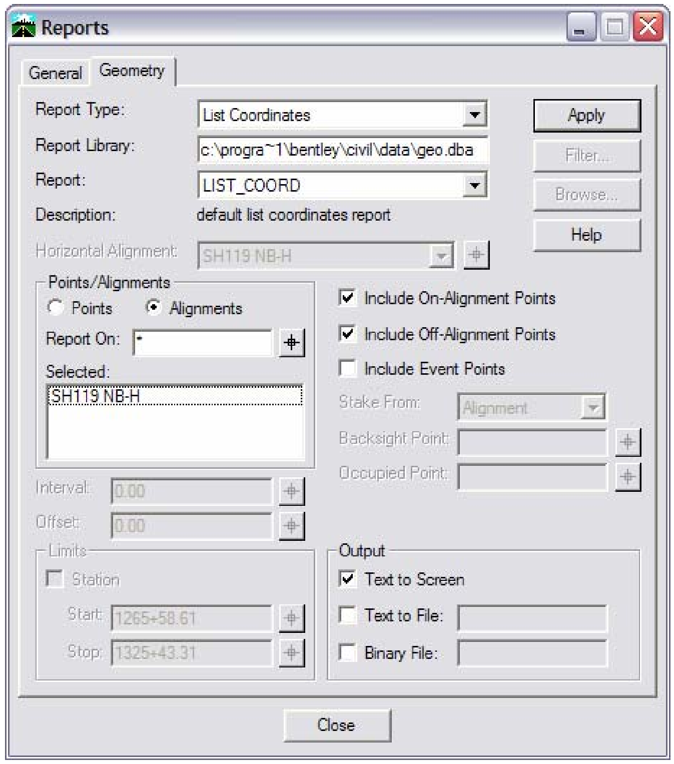
- **Geometry >Review Horizontal** to generate a standard horizontal alignment report



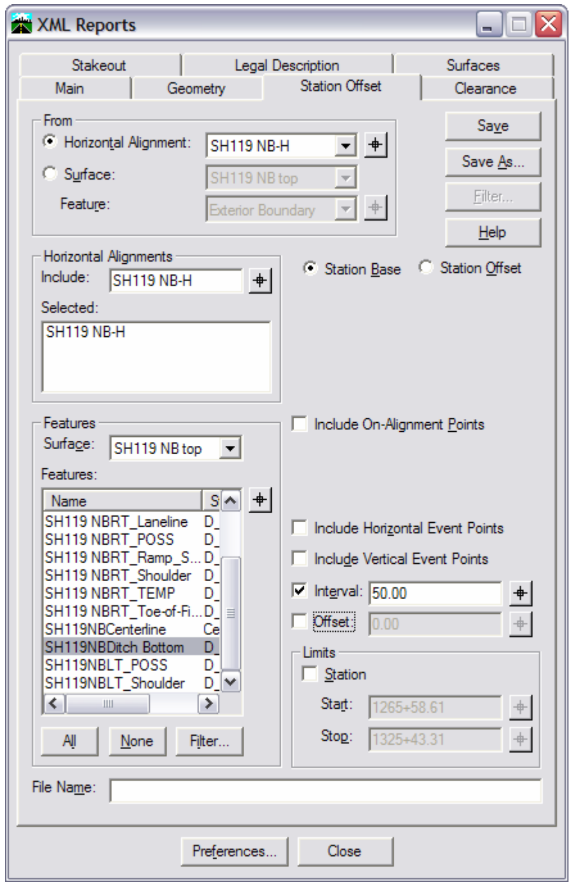
- **Geometry >Review Vertical** to generate a standard vertical alignment report



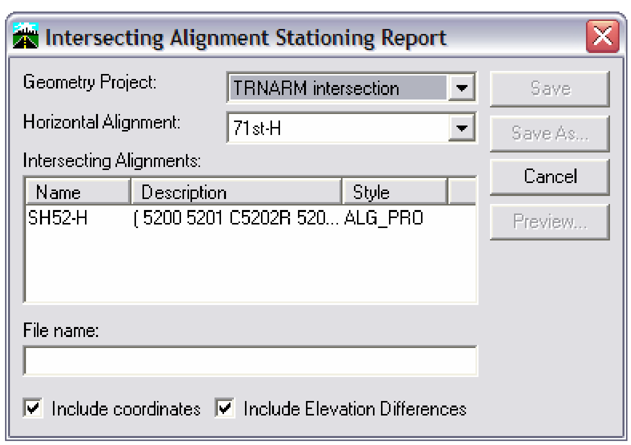
- **Tools >Reports >Geometry** to generate various DBAcess reports (Area, Coordinates, Traverse, Alignment, etc.) on alignments and points in the geometry project



- **Tools >XML Reports** to generate station/offset, clearance, stakeout and legal description reports



- **Tools >Run Macro** to generate an intersecting alignments report



Lab 1.1 – Right Turn Lane

Start MicroStation InRoads

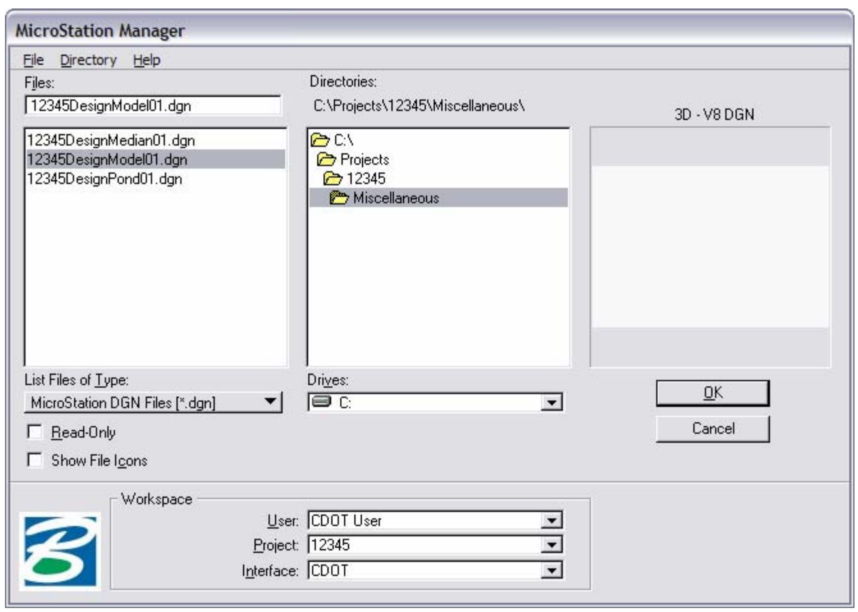
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK.**

Set Project Defaults

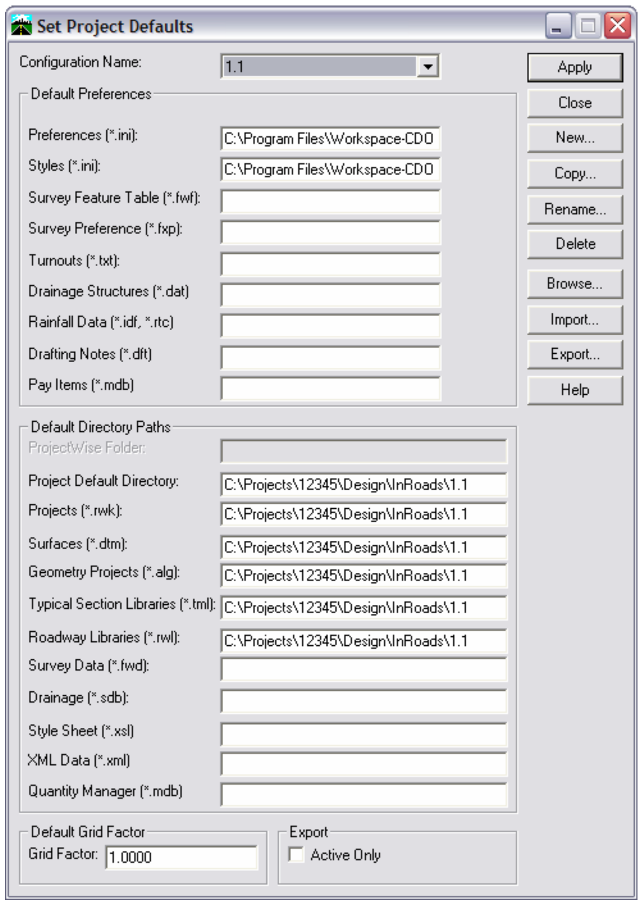
1. Select **File > Project Defaults.**

2. Set the **Configuration Name** to **1.1.**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

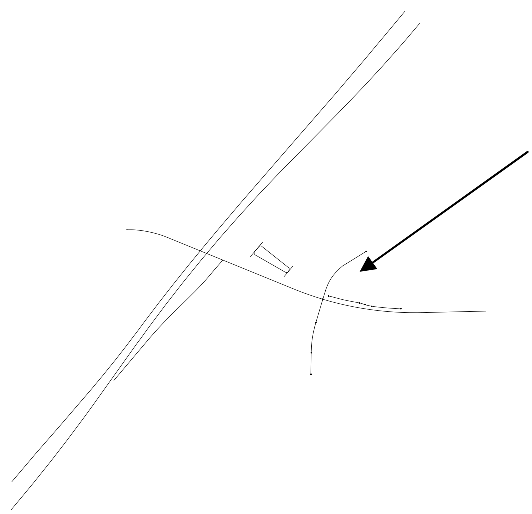
Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH52

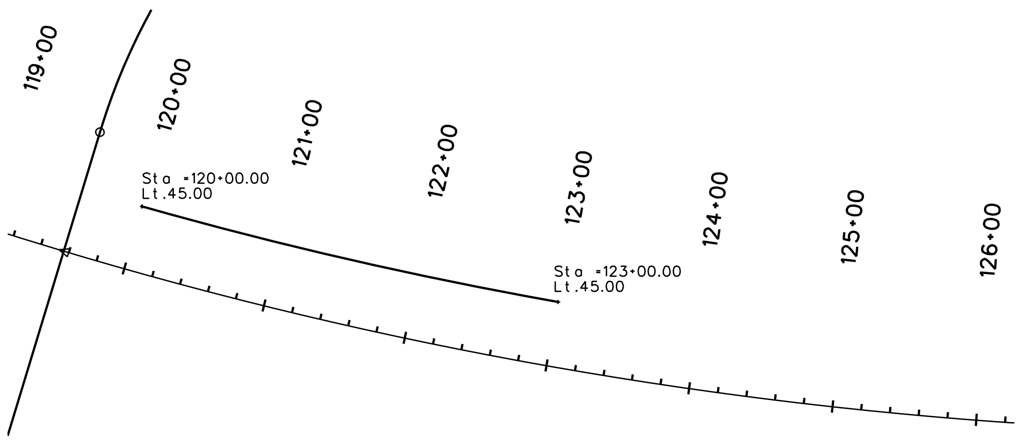
1. Set **File of Type** to **Geometry Projects (*.alg).**
2. Highlight **12345 SH52.alg** and then select **Open.**
3. **Cancel** the **Open** dialog box.



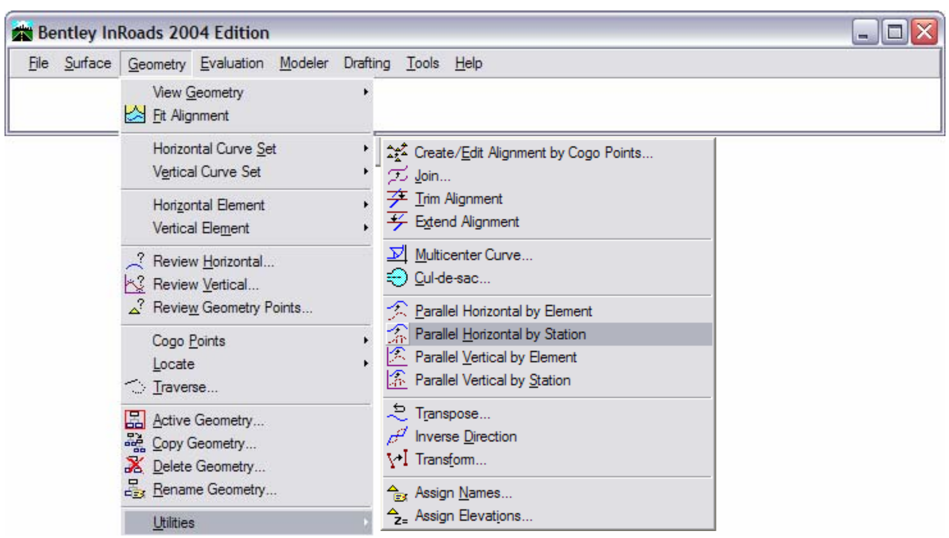
In this activity, you will create a right turn lane for West-bound SH52 to turn onto 71st Street. Your goal is to create a 300 foot turn lane that parallels SH52, with a symmetrical, 300'R reverse curve taper. You will be using the Horizontal Element tools to create the alignment.

Copy the main alignment parallel

The first step is to copy SH52 parallel to for the main part of the turn lane alignment that is offset 45'. Then, you will make another parallel copy, offset 33' to serve as the starting alignment for the reverse curve. (The current outside lane line is 33' from the centerline.)



1. Choose **Geometry > Utilities > Parallel Horizontal by Station**.



2. When prompted to **Identify the Alignment**, Data Point **<D>**on SH52.

3. When prompted to:

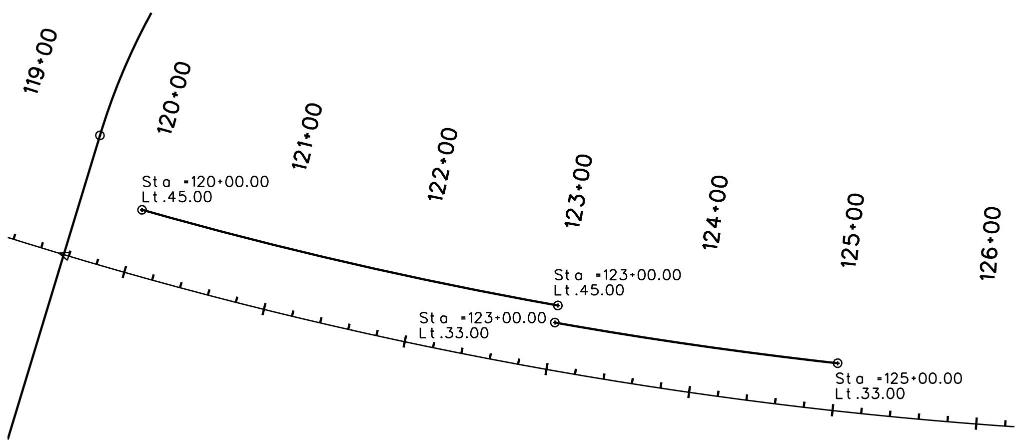
    - **Identify first Station/Key in Station**, key in ***12000***
    - **Identify second Station/Key in Station**, key in ***12300***
    - **Identify location/Key in Offset**, key in ***– 45***

Note: The negative is because the copy is on the left side of SH52.

    - **Accept/Reject**, **<D>**to accept the copy.

The parallel copy is a new alignment, automatically assigned the name 1.

Copy SH52 again for the approach to the turn lane.



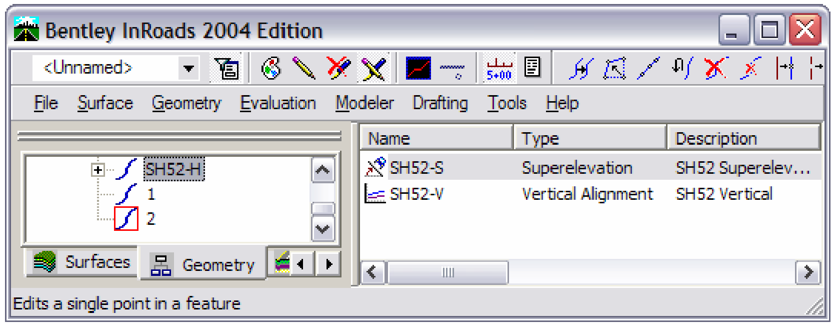
1. Choose **Geometry > Utilities > Parallel Horizontal by Station**.
2. When prompted to **Identify the Alignment**, Data Point **<D>** on SH52.
3. When prompted to:

    - **Identify first Station/Key in Station**, key in ***12300***
    - Identify second Station/Key in Station, key in ***12500***
    - **Identify location/Key in Offset**, key in ***– 33***

Note: The negative is because the copy is on the left side of SH52.

    - **Accept/Reject**, **<D>** to Accept the copy.

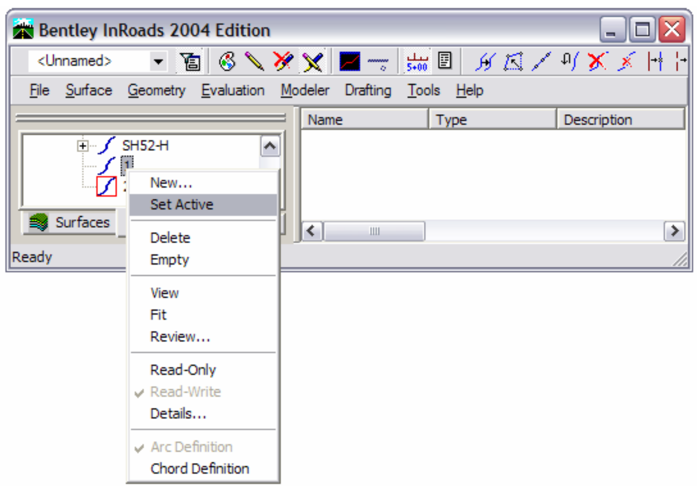
The parallel copy is a new alignment, automatically assigned the name 2.



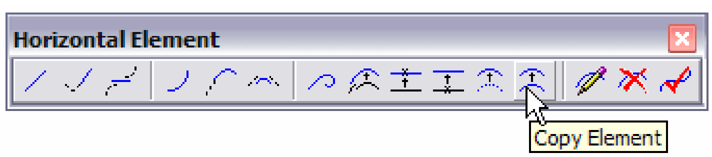
Copy alignment 2 into alignment 1

Since you want to create one alignment, you will copy alignment 2 into alignment 1.

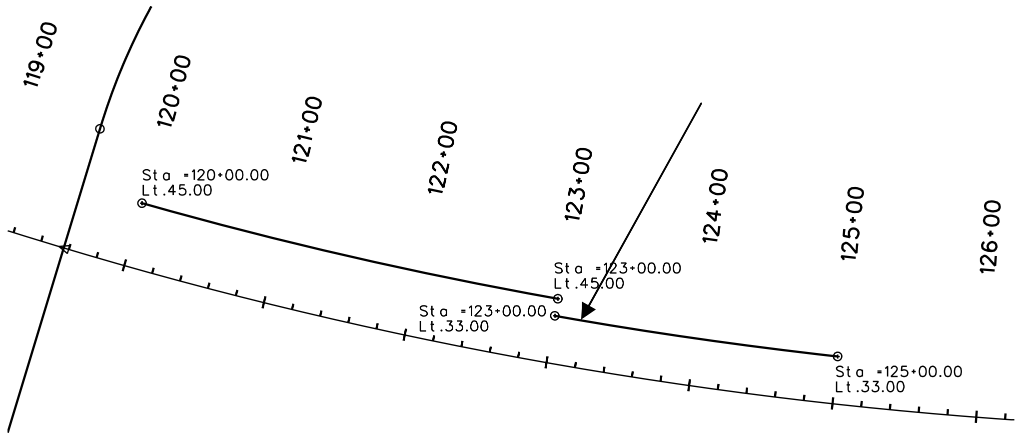
1. In the **InRoads Explorer** menu under the **Geometry** tab, right-click on alignment **1** and choose **Set Active**.



2. Choose **Geometry > Horizontal Element > Copy Element.**



3. When prompted to **Identify the Alignment**, Data Point **<D>** on alignment 2.



4. When prompted to:

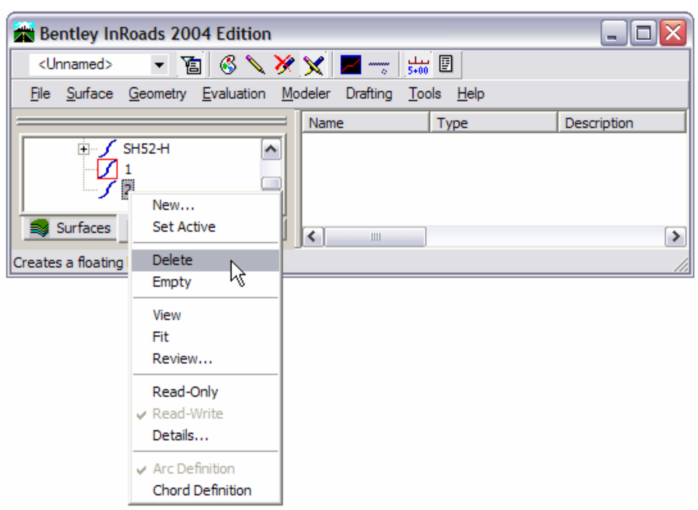
   - **Identify first Element**, **<D>** on alignment 2.
   - **Identify last Element**, **<D>** on alignment 2 again.

   The first and last elements are the same in this case, since alignment 2 consists of only 1 element.

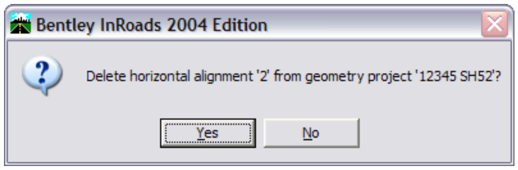
   - **Identify a point**, Key in ***0***
   - **Accept/Reject**, **<D>** to accept the location.

   Alignment 2 is now a part of alignment 1, although there is still a gap between them.

5. In the **InRoads Explorer** menu under the **Geometry** tab, right-click on alignment **2** and choose **Delete**.

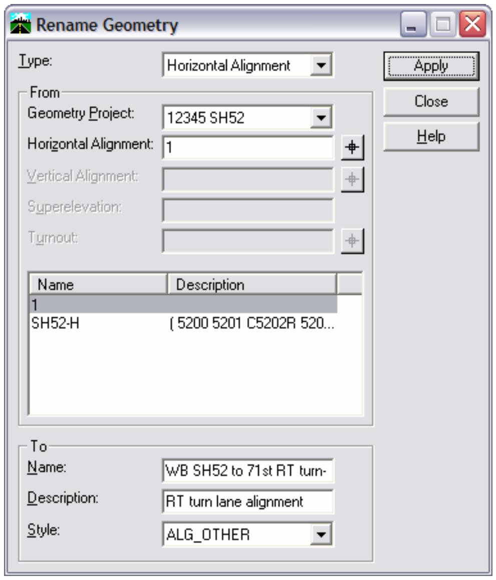


6. When prompted, to delete it from the geometry project, select **Yes**.



At this point, you will change the name of the alignment.

7. Choose **Geometry > Rename Geometry.**



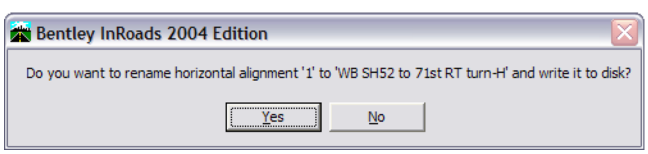
8. Set the **Type** to **Horizontal Alignment.**

Since 1 is the active alignment, it should show up in the **From** category automatically. If not, double-click it in the listing.

9. In the **To** category,

- Key in the Name ***WB SH52 to 71st RT turn-H***
- Key in the Description ***RT turn lane alignment***
- Select the Style **ALG_OTHER.**
- Choose **Apply.**

10. When prompted to rename the alignment, select **Yes**.

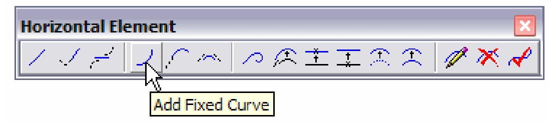


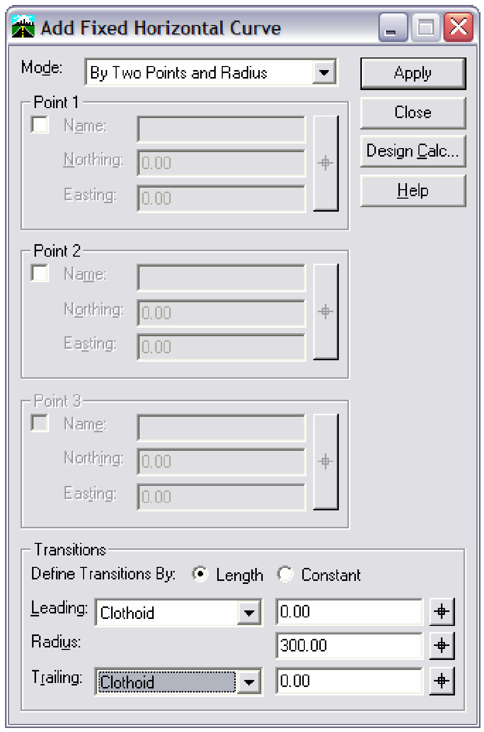
11. **Close** the dialog.

Create a curve using Horizontal Elements

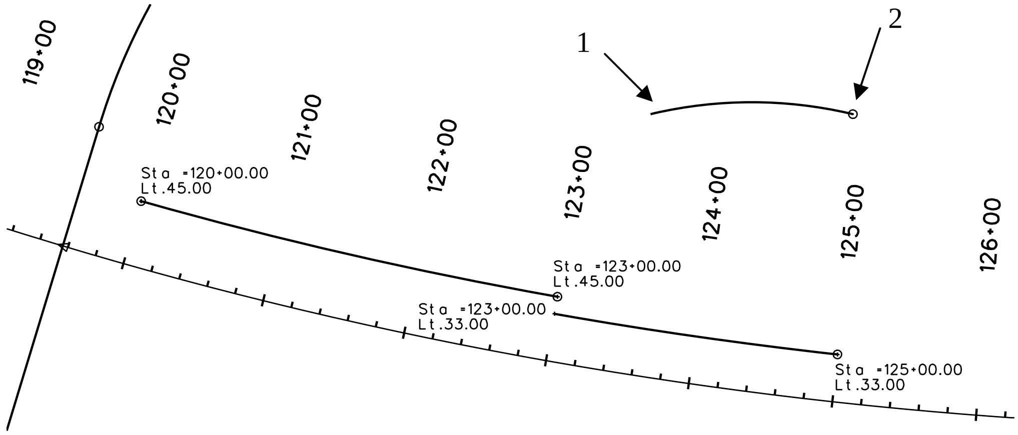
If you want to maintain the 300’ turn lane length, you must start the reverse curve at the current end of the 300’ section. To do this, you will create a separate curve and move it to the proper location.

1. Choose **Geometry > Horizontal Element > Add Fixed Curve.**





2. Set the **Mode** to **By Two Points and Radius.**
3. At the bottom of the dialog, key in the Radius ***300***
4. **Apply.**

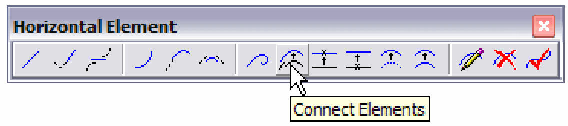


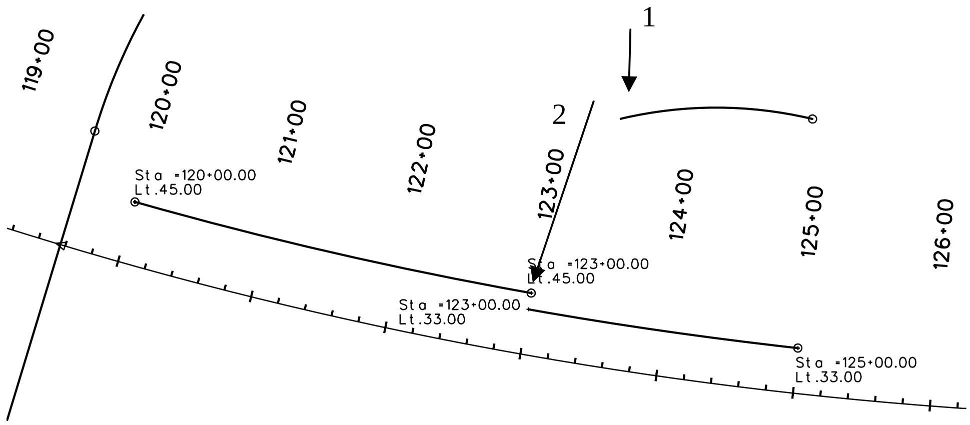
5. When prompted to:

- **Identify first point**, **<D>** in a clear area away from the alignment for the first point. As shown in the previous diagram.
- **Identify second point**, **<D>** a short distance away from the first point to define the curve.
- **Accept/Reject**, **<D>** to Accept the new curve.
- **Reset <R>** and **Close** the **Add Fixed Curve** dialog.

Move the curve into the proper location.

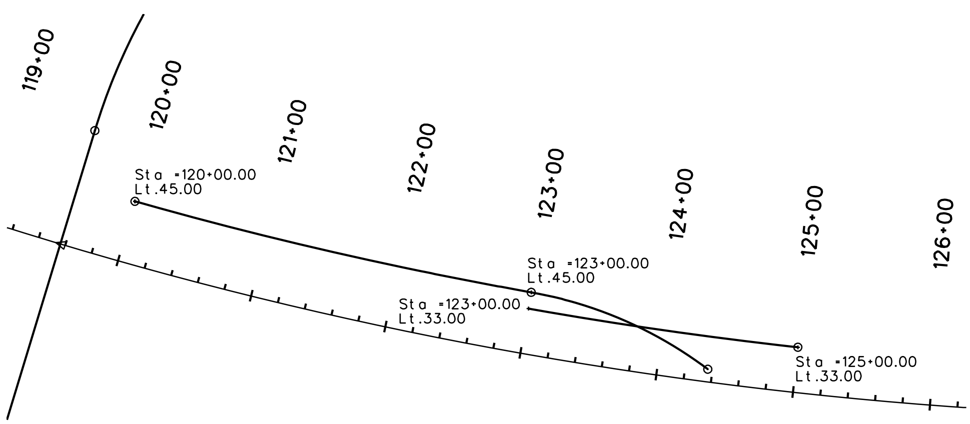
1. Choose **Geometry > Horizontal Element > Connect Elements.**





2. When prompted to:

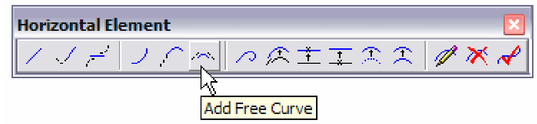
   - **Identify element**, **<D>** on the curve near the beginning.
   - **Identify alignment**, **<D>** on the 300' section of turn lane, near the end.
   - **Accept/Reject <D>** to Accept.

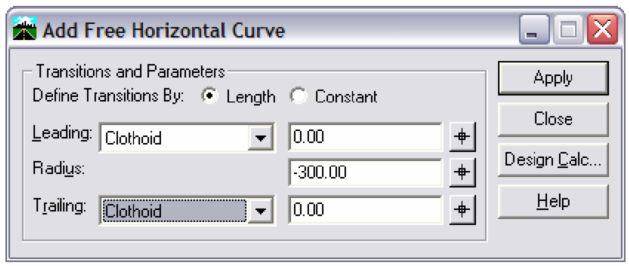


Close the gap with a Free Curve

To finish the reverse curve, you will now close the gap using the Free Curve command.

1. Choose **Geometry > Horizontal Element > Add Free Curve**.





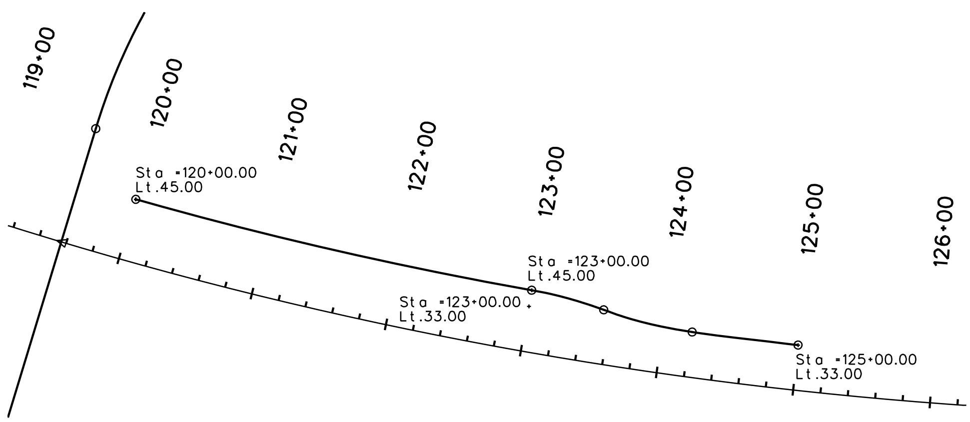
2. Key in a **Radius** of ***– 300***

   The negative is because the curve goes to the left.

3. Choose **Apply.**

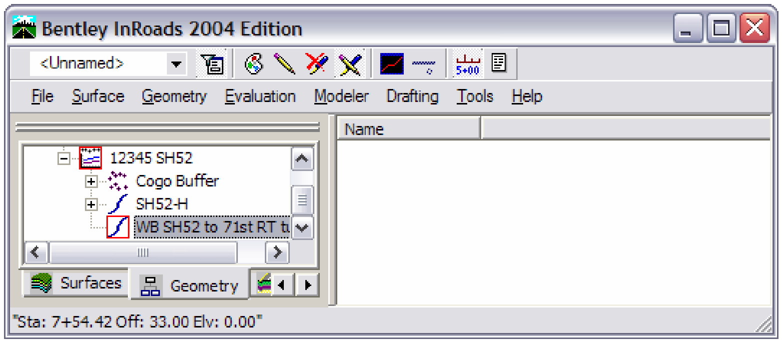
4. When prompted to:

   - **Identify first element**, **<D>** near the end of the curve you just created.
   - **Identify second element**, **<D>** on the element which was formerly alignment 2.
   - **Accept/Reject <D>** to Accept.
   - **<R>** then **Close** the **Add Free Curve** dialog.



Track the alignment

1. In the **InRoads Explorer** menu under the **Geometry** tab, right-click on alignment **SH52-H** and choose **Set Active**.
2. Select **Utilities > Tracking > Horizontal Alignment.**
3. **<D>** on the new turn lane alignment.
4. Move your cursor back and forth, noting the offset. When you select a second alignment in the tracking command, the offset shows the distance between the active alignment and the chosen one.



5. **<R>** out of the tracking command.
6. **Save** your geometry project.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All.**
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data file.

1. From MicroStation, select **File > Exit.**
2. If prompted to save data files select **Yes**.

Lab 1.2 – Horizontal Alignment for Ramp A

Start MicroStation InRoads

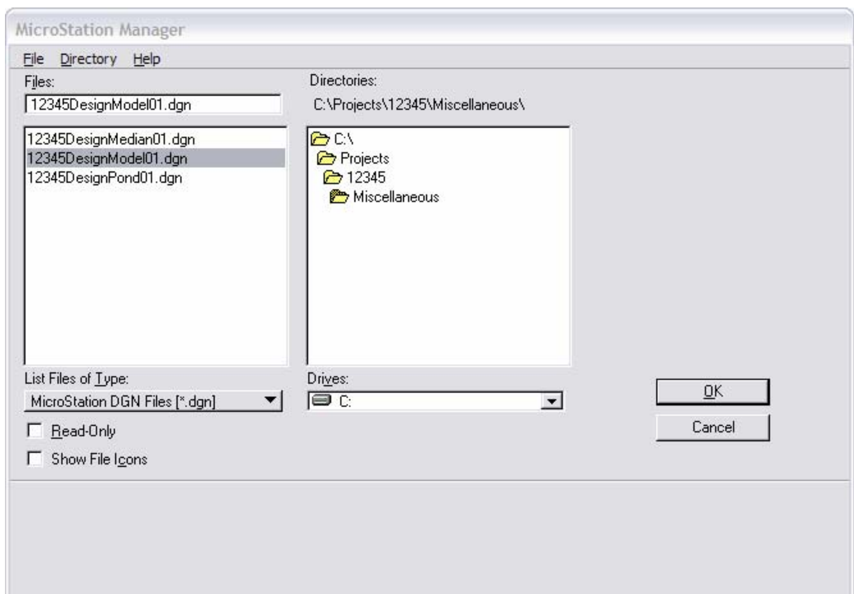
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK.**

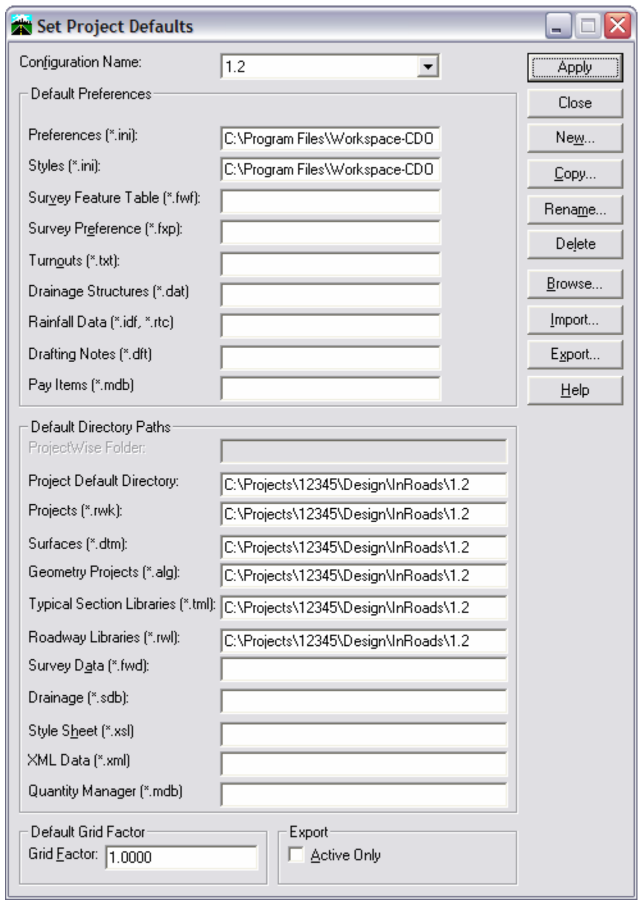
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **1.2.**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

Important! Verify your dialog box appears as shown:



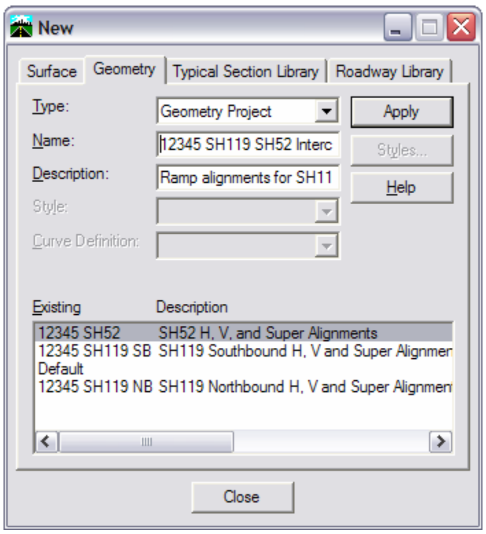
Load data files

Load geometry projects

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg).**
3. Highlight **SH119 NB.alg** and then select **Open** for the North bound alignment.
4. Highlight **SH119 SB.alg** and then select **Open** for the South bound alignment.
5. Highlight **SH52.alg** and then select **Open** for the highway 52 alignment.
6. **Cancel** the **Open** dialog box.

Create a new geometry project for the interchange geometry

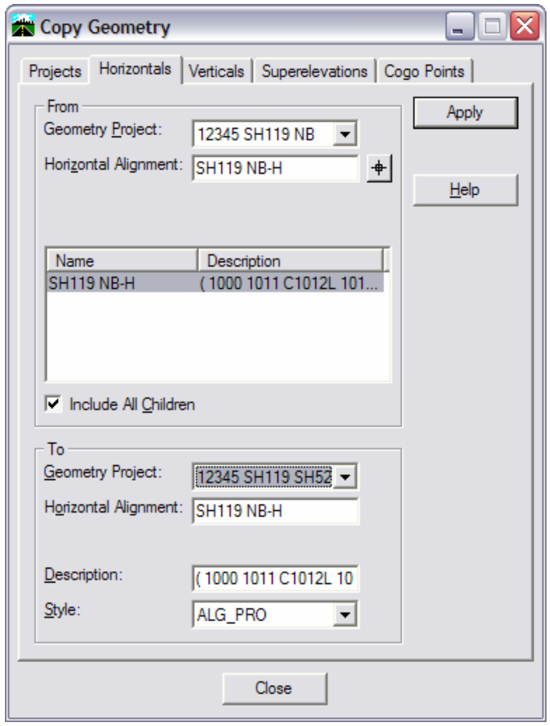
1. Select **File > New**.



2. On the **Geometry** tab:
   - Set **Type** to **Geometry Project.**
   - Key in a **Name** of ***12345 SH119 SH52 Interchange.***
   - Key in a **Description** of ***Ramp alignments for SH119 and SH52.***
3. Select **Apply,** then **Close.**

Copy the roadway alignments for reference

1. Select **Geometry > Copy Geometry**.



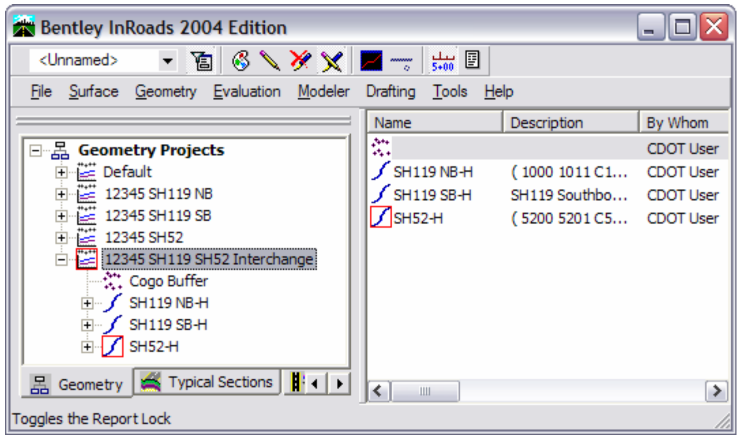
2. Select the **Horizontals** tab:

   - Set the **From Geometry Project** to **12345 SH119 NB.**
   - Double-click the Alignment **SH119 NB-H.**
   - Toggle on **Include All Children.**
   - Set the **To Project** to **12345 SH119 SH52 Interchange.**

If the **To Alignment** name doesn't show up, double-click the alignment again in the **From** category.

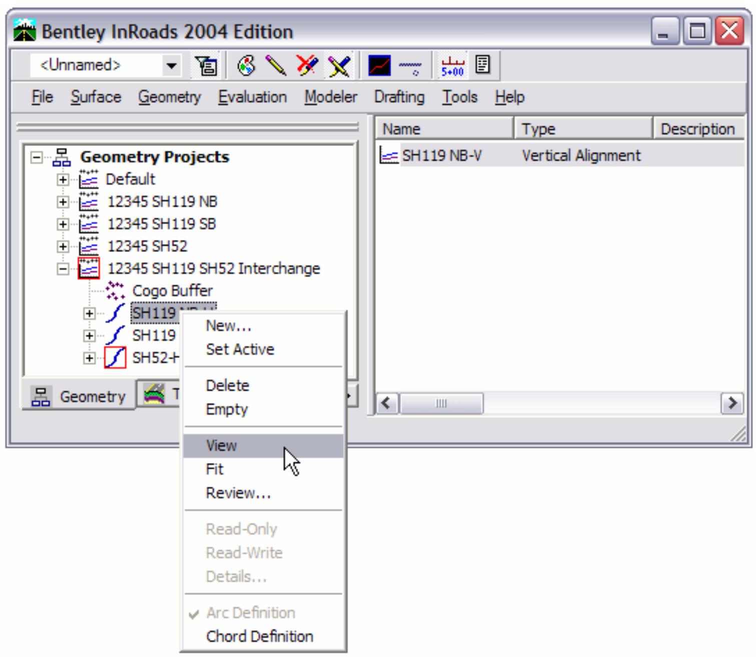
   - Choose **Apply.**

3. Repeat this process to copy the **SH119 SB** alignment, and again to copy the **SH52** alignment.

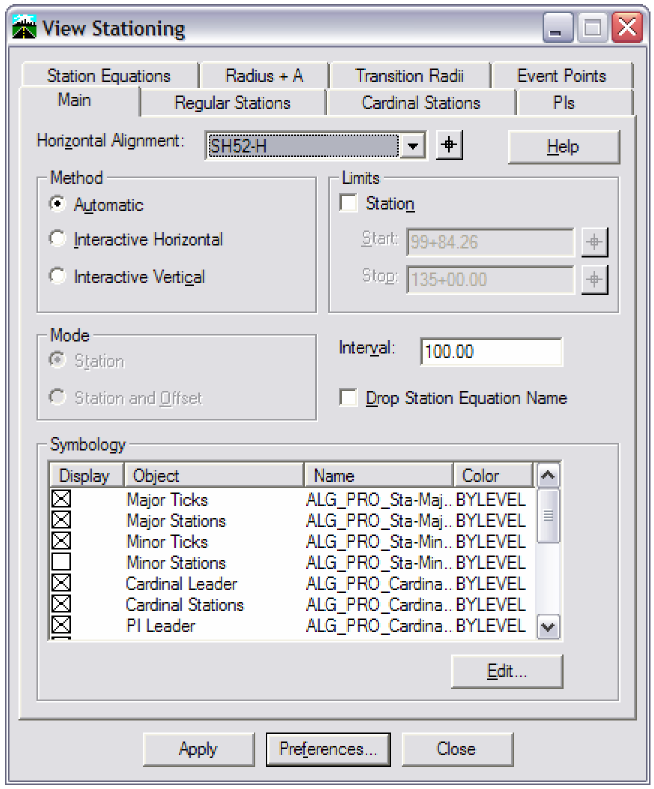


View the associated alignments

1. In the **InRoads Explorer** menu, right-click and View **SH119 SB**, **SH119 NB** and **SH52**.

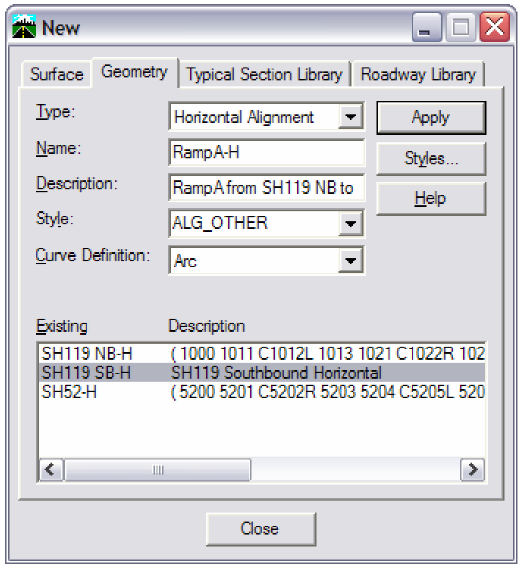


2. Station any of the alignments you would like. (**Geometry > View Geometry > Stationing**).



Create a new alignment slot for ramp A

1. Make certain your interchange geometry project is active.
2. Select **File > New.**

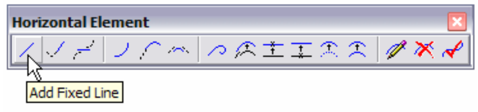


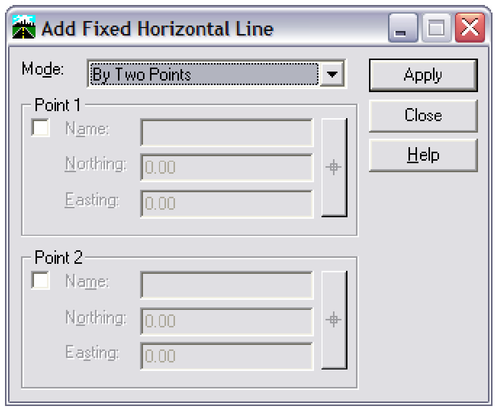
3. Set **Type** to **Horizontal Alignment.**
4. Key in a Name of ***RampA-H***
5. Key in a Description of ***RampA from SH119 NB to SH52***
6. Set **Style** to **ALG_OTHER.**
7. Select **Apply,** then **Close.**

Develop ramp using Elements

First you'll set a tangent at the beginning of the ramp and another, separate one at the end of the ramp.

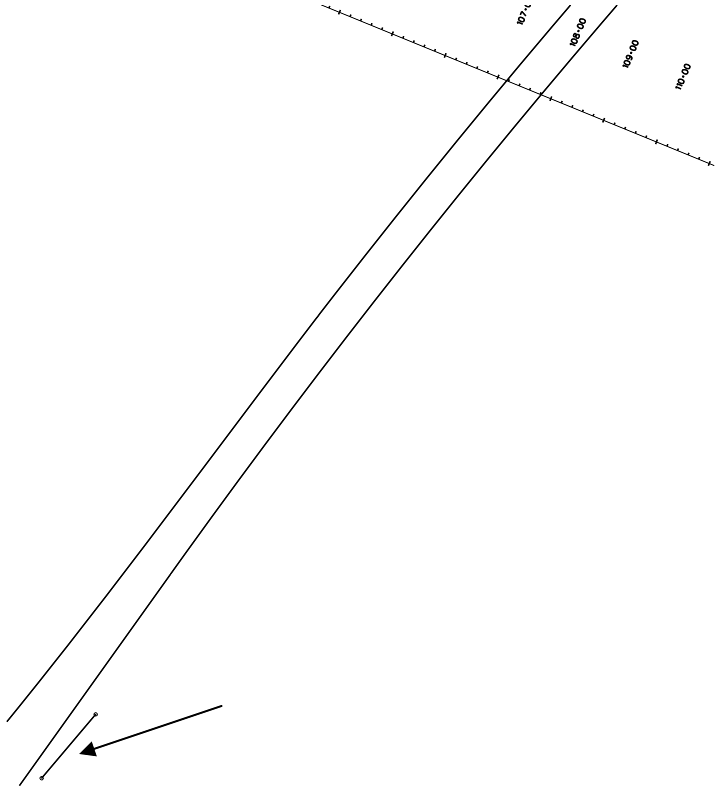
1. Select **Geometry > Horizontal Element > Add Fixed Line**.





2. Set the **Mode** to **By Two Points.**
3. Choose **Apply.**
4. Key in ***so=128111.83,24,0,SH119 NB-H***
5. Key in ***so=128257.83,36,0,SH119 NB-H***

6. **<D>** to accept the new tangent which defines the taper at the beginning of the ramp.



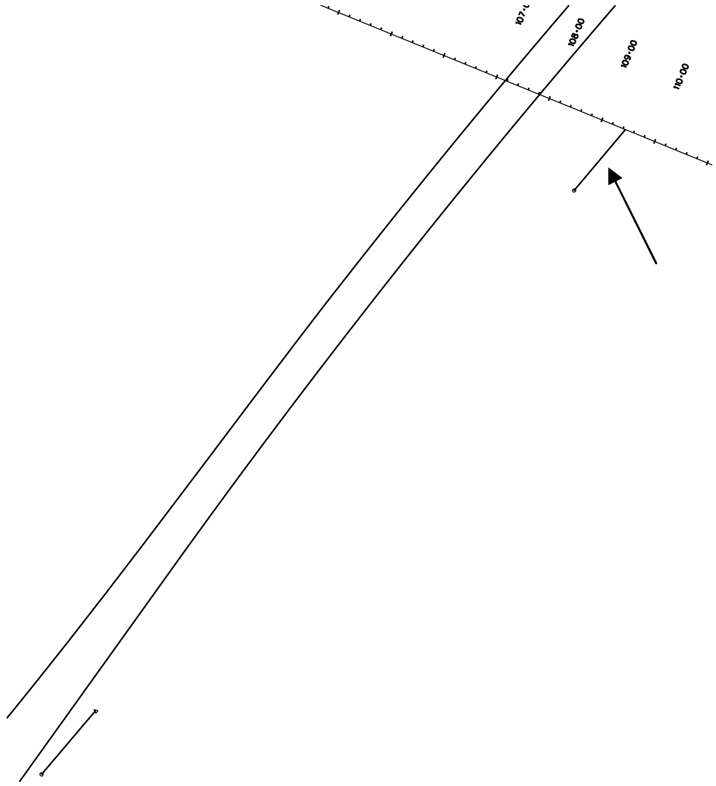
7. **<R>** to stop the next tangent.

   Note: If you Reset twice, and the dialog pops back up, you'll need to Apply Again.

8. Key in ***so=10944.56,0,0,SH52-H***

9. Key in ***di=140,S40^06'58.54"W***

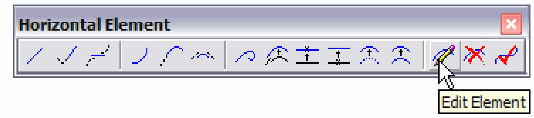
10. **<D>** to accept the tangent that defines the end of the ramp.

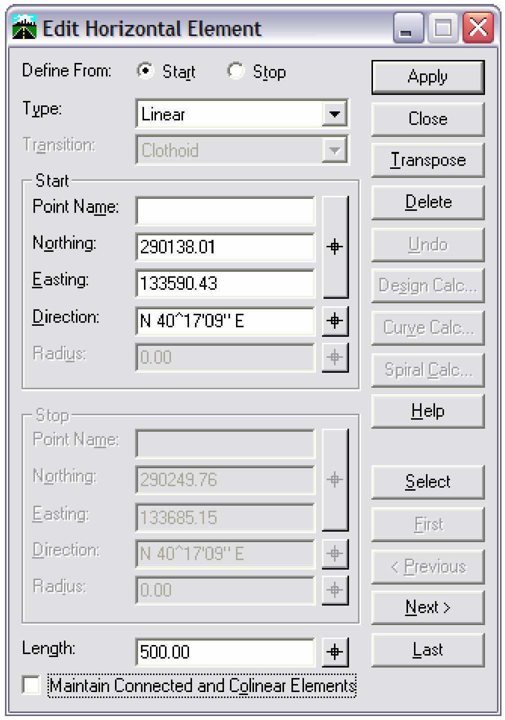


11. **<R>** twice, then **Close** the command.

12. Now, you will modify each of the tangents. The first one is not long enough, so you will lengthen it to 500'. The second tangent is placed in the wrong direction, so you will transpose it.

13. Select **Geometry > Horizontal Element > Edit Element.**





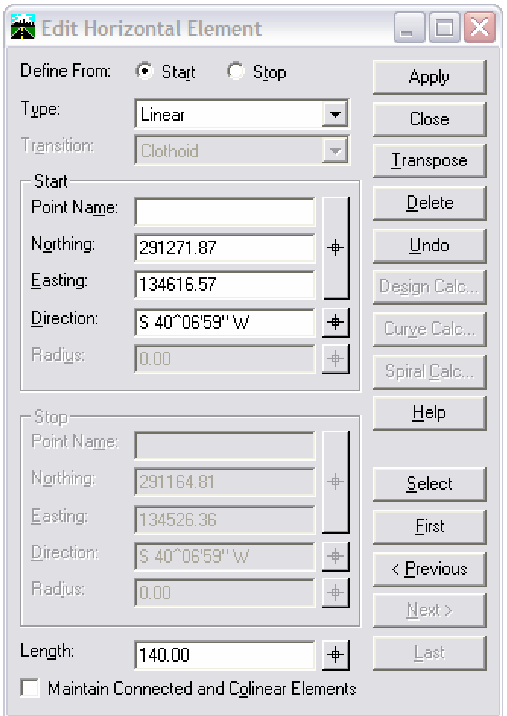
The first element is automatically highlighted.

14. Set the **Define From** to **Start.**

15. Change the **Length** to ***500***

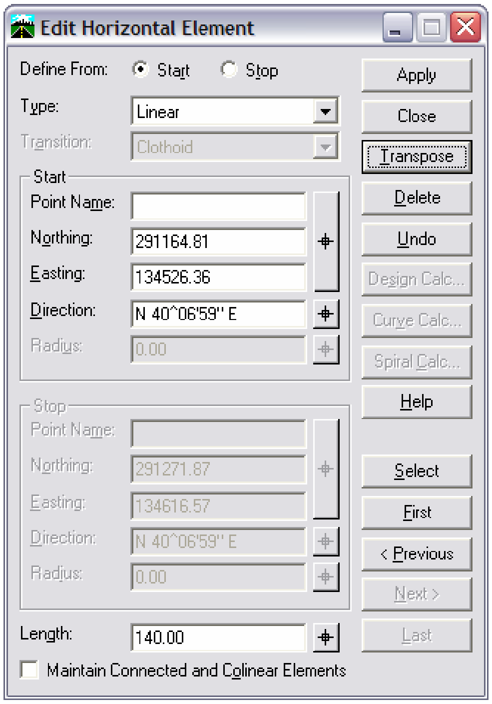
16. Choose **Apply.**

17. Select **Next** (or **Last**) to go to the second tangent.



Notice the Direction is **SW**.

18. Select **Transpose.**



Notice the **Direction** changes to **NE**.

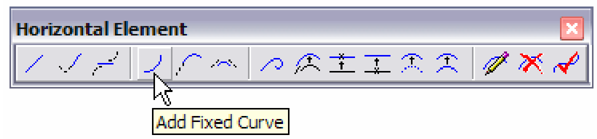
19. **Close** the **Edit Element** dialog.

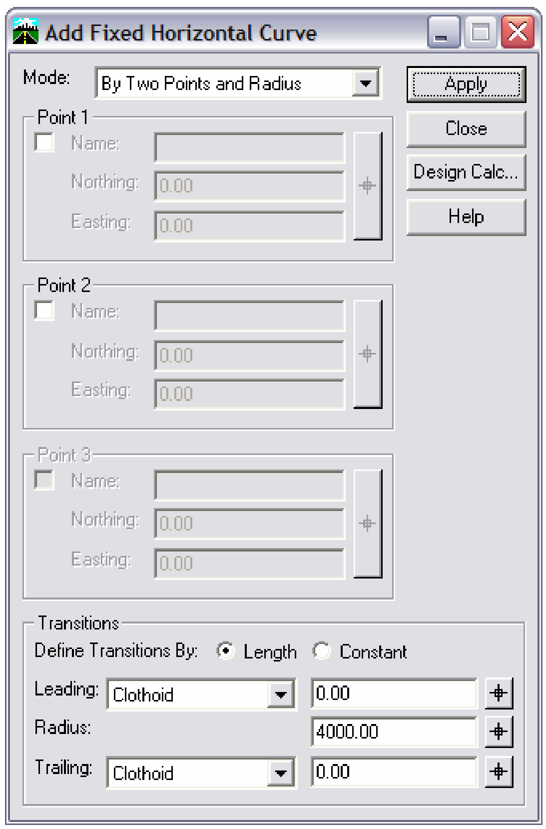
Add Curves

Next, you'll add curves between the two alignments. In this example, you know the radii of the curves, so you will add them to each current tangent, then close the gap between the curves with a new tangent.

Since you want to maintain the current lengths of the tangents, you cannot use the **Add Floating Line** or the tangent length is adjusted. Instead, you will place the curves by themselves, then connect them to the existing tangents.

1. Choose **Geometry > Horizontal Element > Add Fixed Curve**.



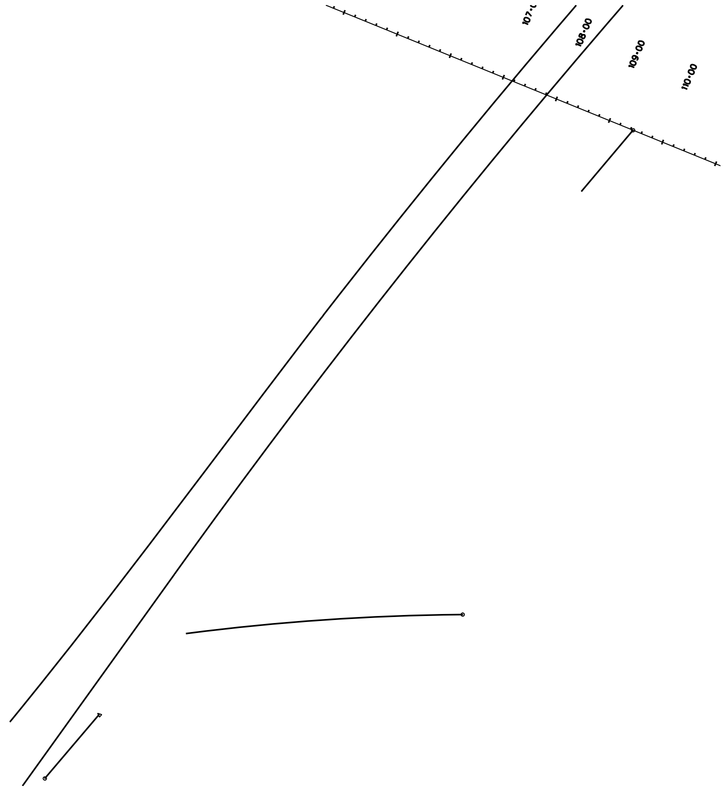


2. Set the **Mode** to **By Two Points and Radius.**

3. Key in a **Radius** of ***4000***

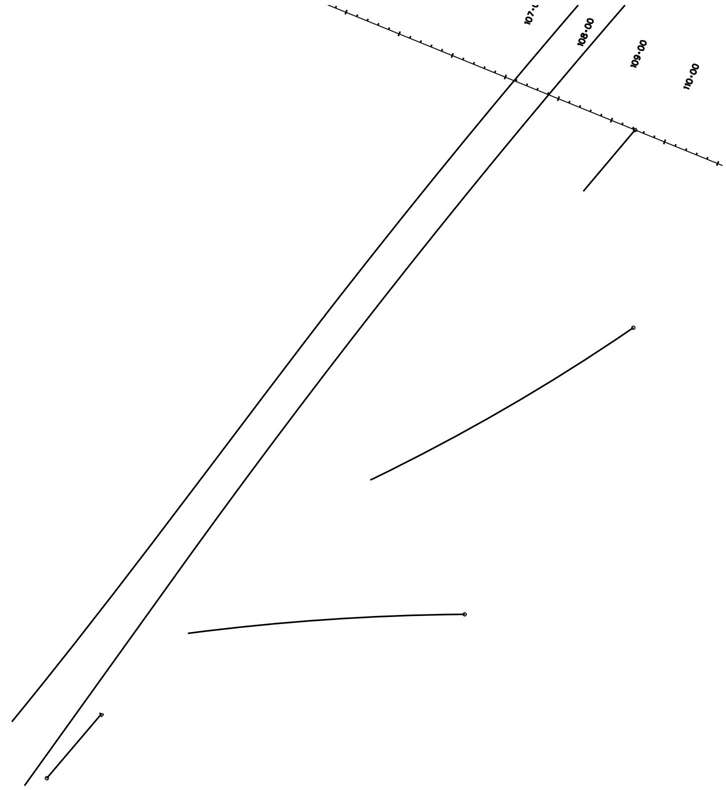
4. Place the two points anywhere in the area. You do not need to place the curve at the end of the tangent.

5. **<D>** to Accept the curve.



6. **<R>** to bring the dialog back up.

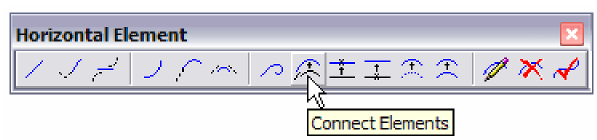
7. Repeat the process, but change the Radius to ***-3500*** for the next curve. (It's a curve to the left, so don't forget the negative sign).



8. **Close** the **Add Fixed Curve** dialog.

   Next, you'll connect the curves to their respective tangents.

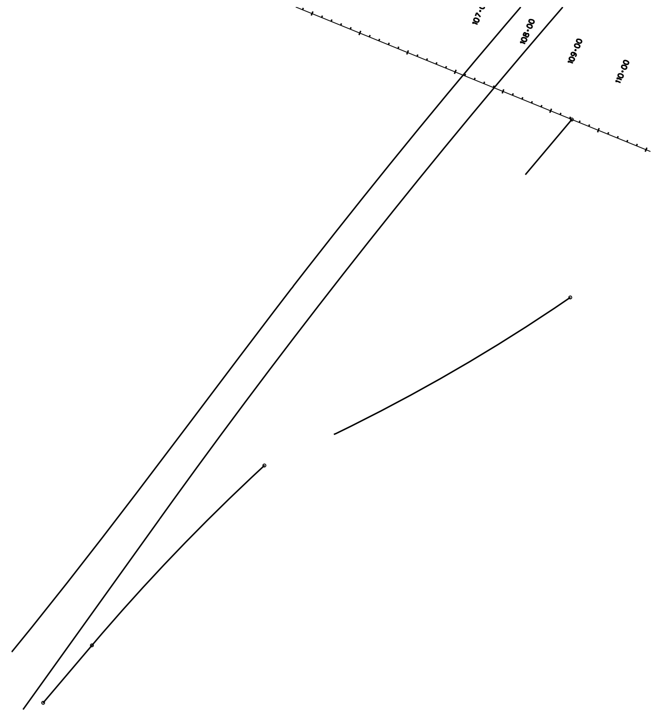
9. Select **Geometry > Horizontal Elements > Connect Elements**



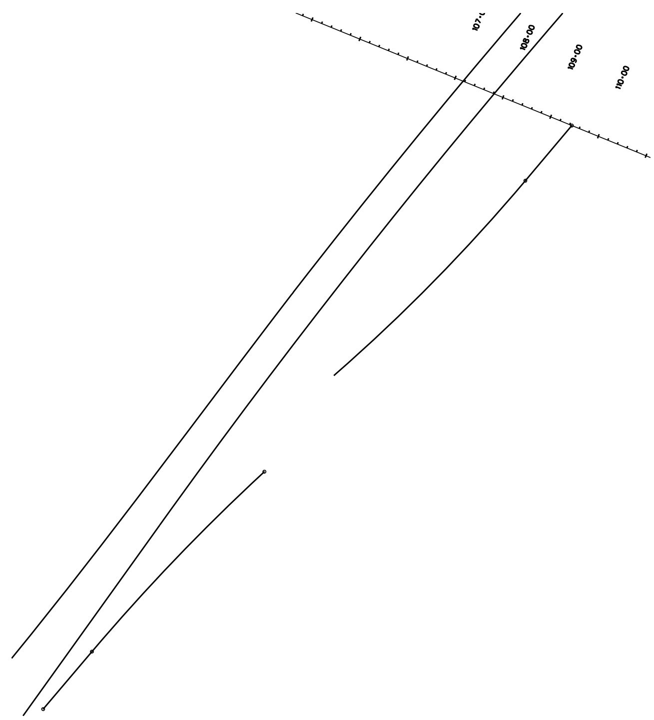
10. Pick the beginning of the first curve with a **<D>** for the element.

11. Pick the end of the first tangent with a **<D>** for the alignment.

12. If the curve moves to the correct location, Accept it with another **<D>.**

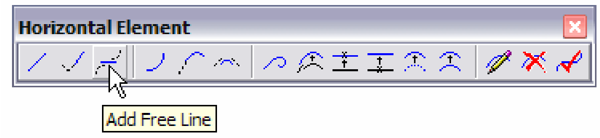


13. Repeat the process to move the second curve to the second tangent.



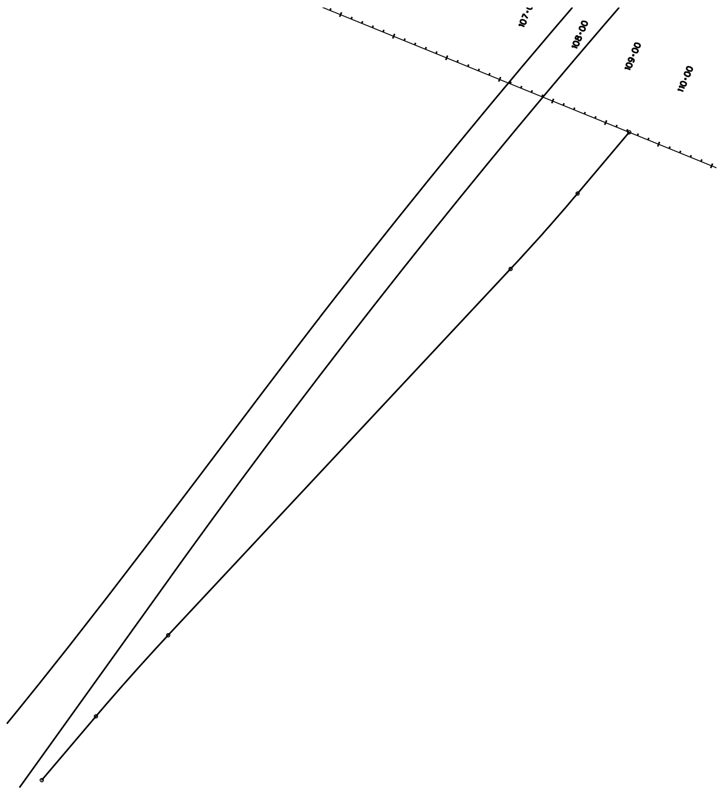
14. Connect the curves with a tangent.

15. Select **Geometry > Horizontal Elements > Place Free Line.**



16. **<D>** on the ***4000'*** radius curve.

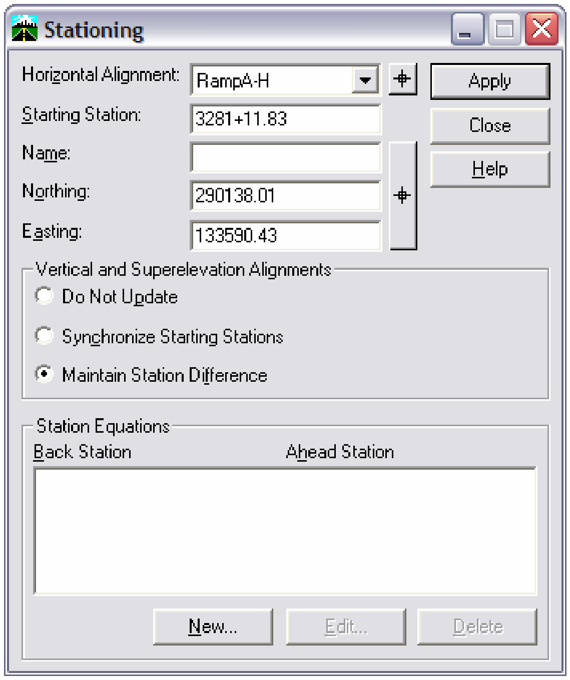
17. **<D>** on the ***-3500'*** radius curve.



The tangent between the two curves is added to the alignment.

Set the stationing on Ramp A

1. Select **Geometry > Horizontal Curve Set > Stationing**.

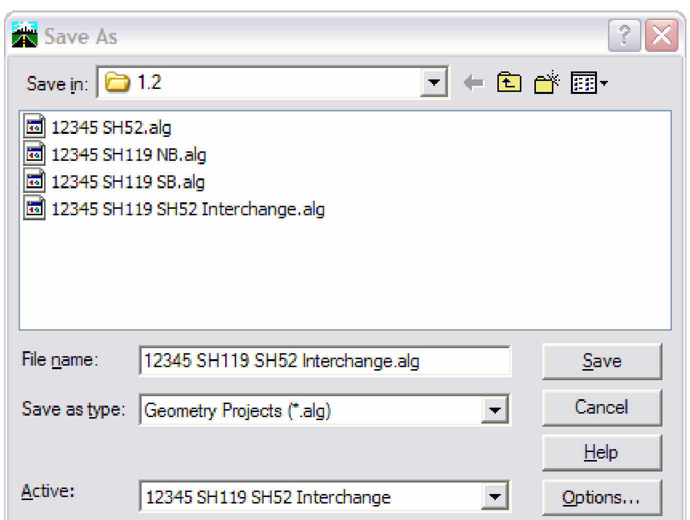


2. For the **Starting Station**, key in ***3281+11.83*** to match the stationing of SH119 NB at the beginning of the ramp.

3. Select **Apply.**

4. **Close** the dialog.

5. **Save** the geometry project.



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All.**
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data file.

1. From MicroStation, select **File > Exit.**
2. If prompted to save data files select **Yes**.

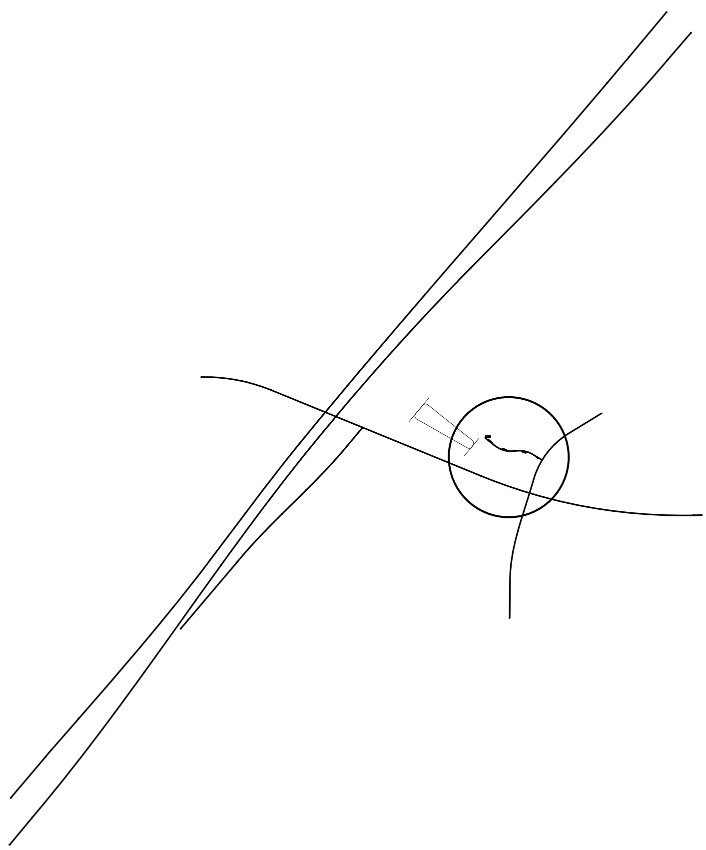
Challenge Lab 1.3 – Creating an alignment with Horizontal Elements

In this activity, you will create a horizontal alignment using the **Horizontal Element** tools.

Given: **12345 71st.alg** – This geometry project contains the horizontal alignment for 71st Street.

Diagram showing pertinent information about the alignment.

Required: **Hotel-H** – You will create alignment for the Hotel Access road that starts perpendicular to the 71st-H alignment at station 602+00. It has a 60' initial tangent, then reversing 150' radius curves and ends at the coordinates shown.



Preliminary set-up

1. Start MicroStation InRoads and open the file **12345DesignModel01.dgn**.

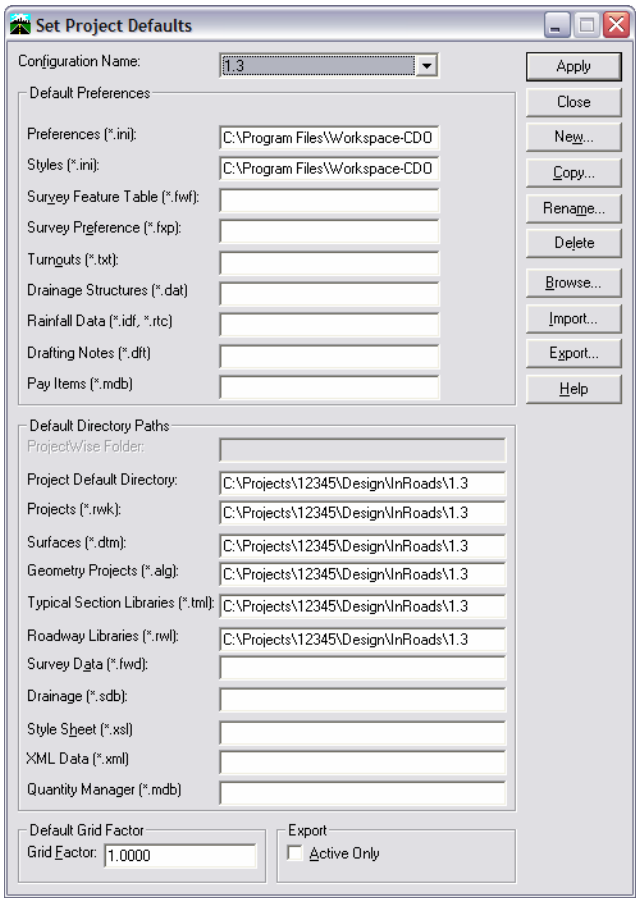
2. Select **File >Project Defaults**.

3. Set the **Configuration Name** to **1.3**

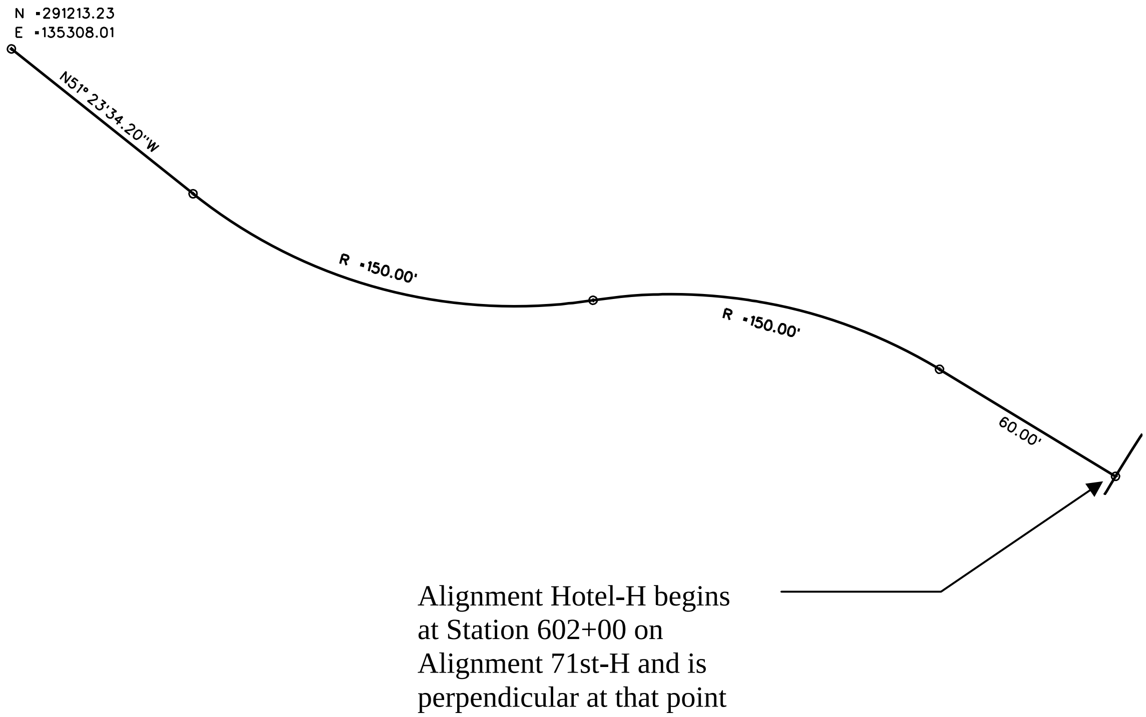
Important! Be sure to select the correct configuration name to ensure that you load the correct files.

4. Select **Apply**.

Important! Verify your dialog box appears as shown:



5. **Open** the appropriate data files (refer to **Given** statement).

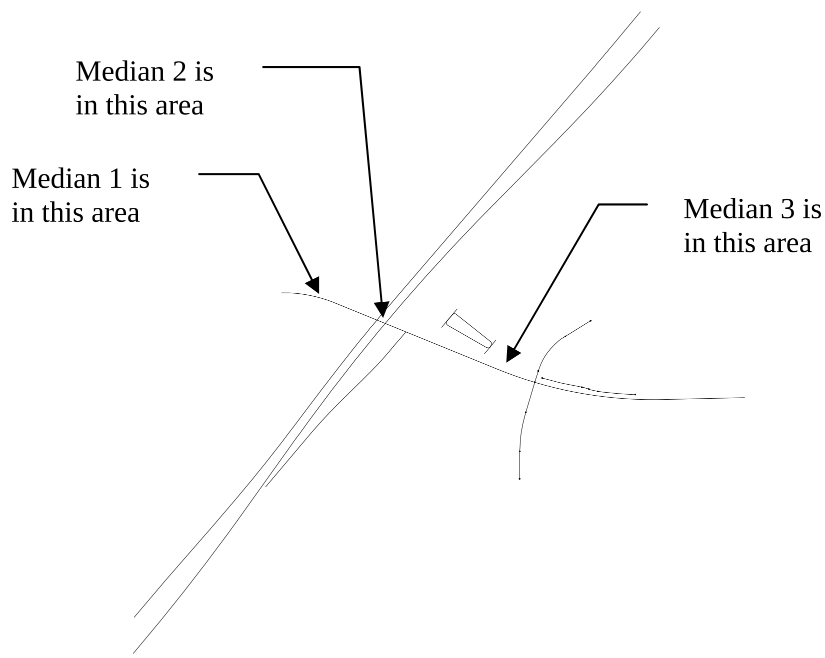


Create the alignment

1. Using the information provided, create the alignment with horizontal element tools.

Lab 1.4 – Creating horizontal and vertical alignments from graphics

In this activity, you will use a 3-dimensional graphic element to create horizontal and vertical alignments. The example you will use is an outline of a median in SH52. Since you initially are given a 2-dimensional outline, you must add elevations by draping the outline on the surface of SH52 prior importing the outline to create horizontal and vertical alignments.



Start MicroStation InRoads

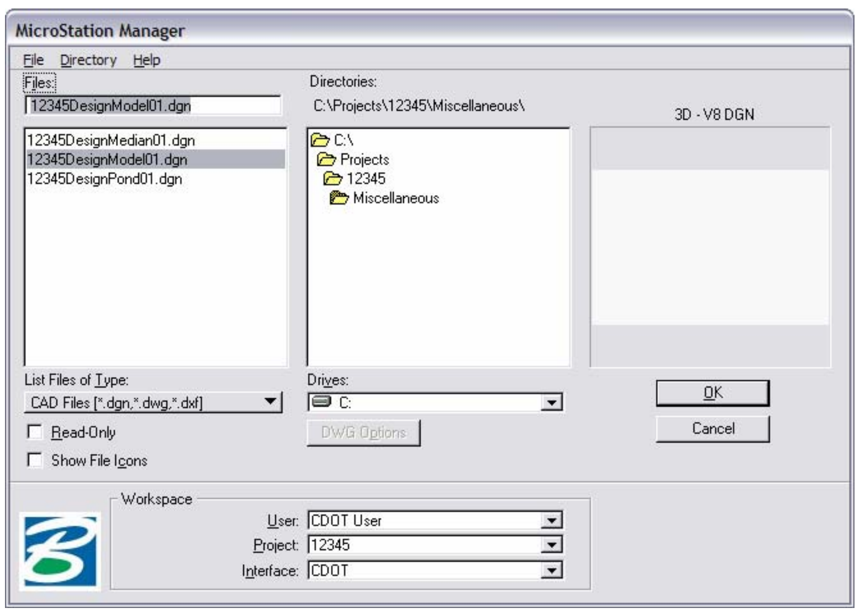
2. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

3. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.



4. Select **OK.**

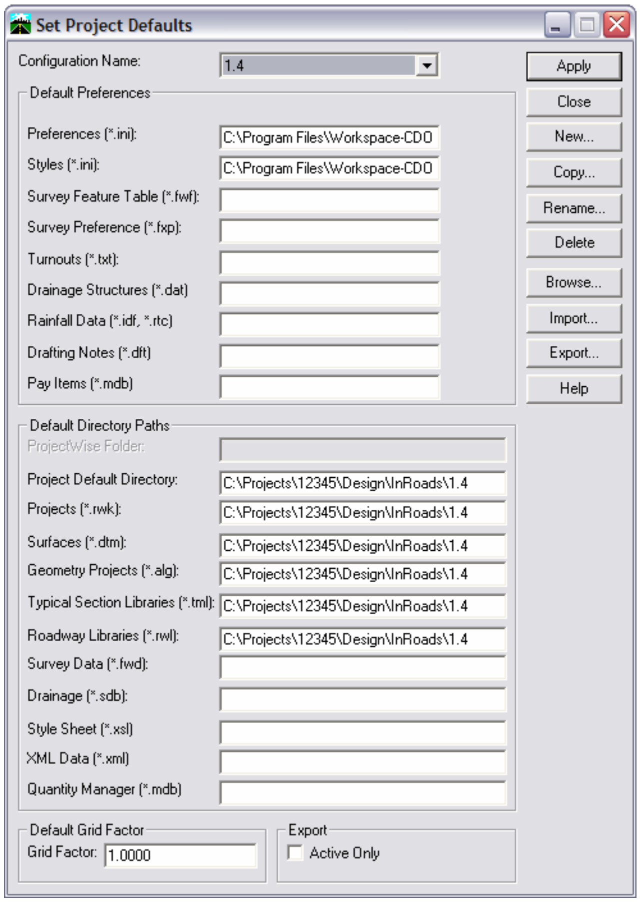
Set Project Defaults

1. Select **File > Project Defaults.**
2. Set the **Configuration Name** to **1.4**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

Important! Verify your dialog box appears as shown:



Load data files

Load the SH52 DTM

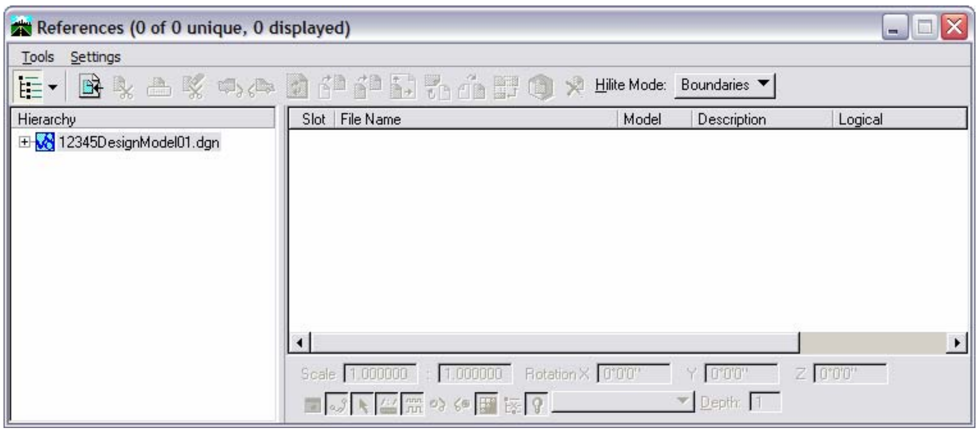
4. Select **File > Open.**
5. Set **File of Type** to **Surfaces (*.dtm).**
6. Highlight **SH52 top.dtm** and then select **Open.**
7. ***Do not*** cancel out of the dialog box.

Load geometry project for SH52

8. Set **File of Type** to **Geometry Projects (*.alg).**
9. Highlight **12345 SH52.alg** and then select **Open.**
10. **Cancel** the **Open** dialog box.

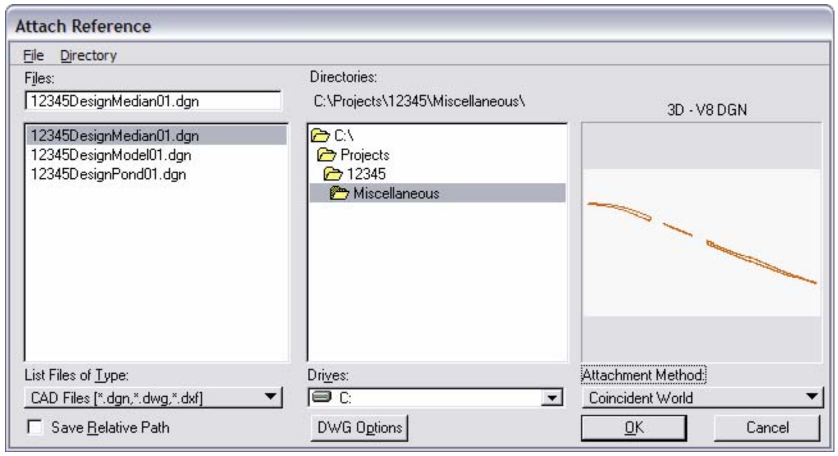
Attach the median reference

11. In MicroStation, select **File > Reference.**



12. In the **References** dialog box, select **Tools > Attach.**
13. In the **Attach Reference** dialog, set the directory path to **C:\Projects\12345\Miscellaneous.**

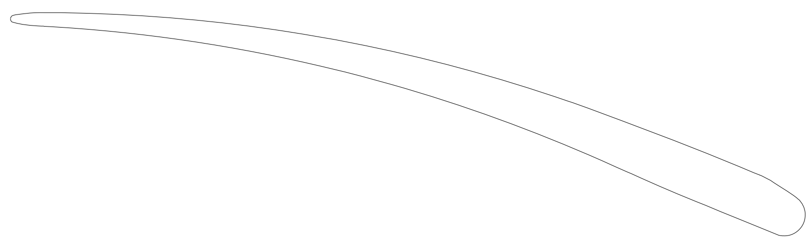
14. Highlight the file **12345DesignMedian01.dgn.**



15. Set the other options as shown.

16. Select **OK.**

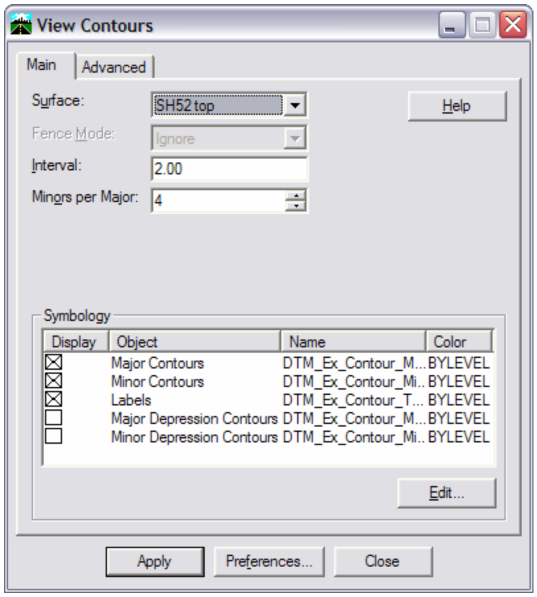
17. **Window in** on the first median outline near the beginning of SH52.



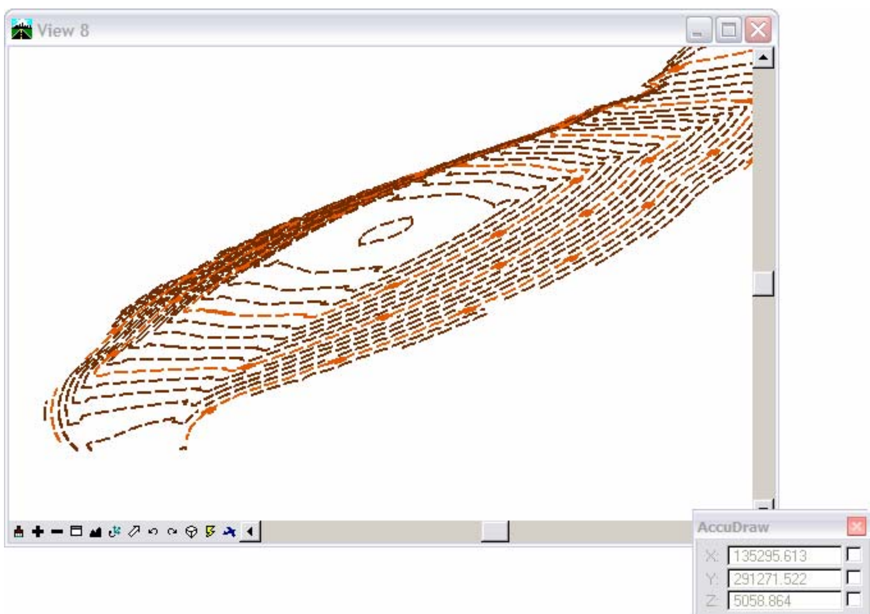
Drape the median onto the SH52 surface

Assign elevations to the graphic by draping it onto the SH52 surface.

1. View the contours for SH52 top
(**Surface > View Surface > Contours**).

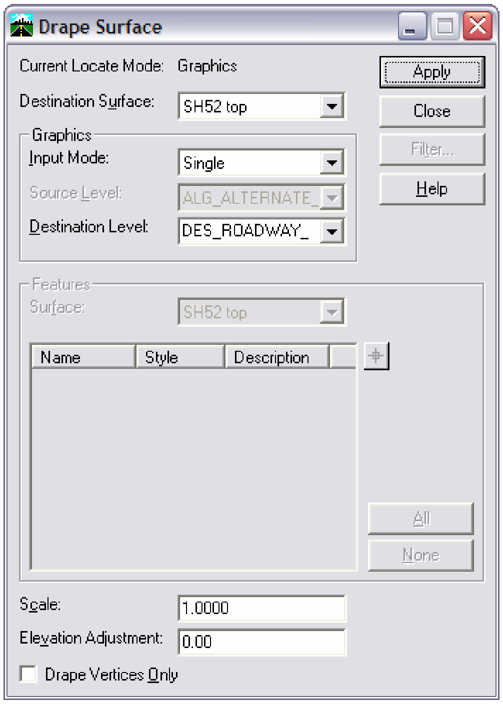


2. Toggle on **View 8.**



3. Set the **Locate** lock to **Locate Graphics.**

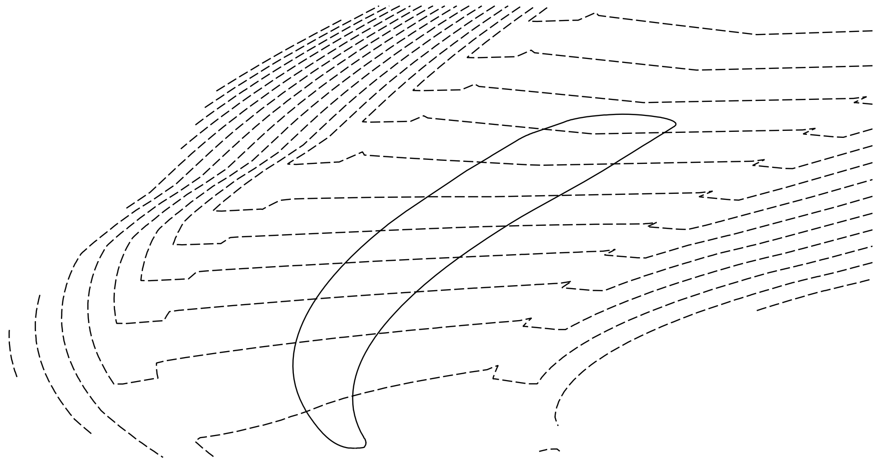
4. Select **Surface > Design Surface > Drape Surface.**



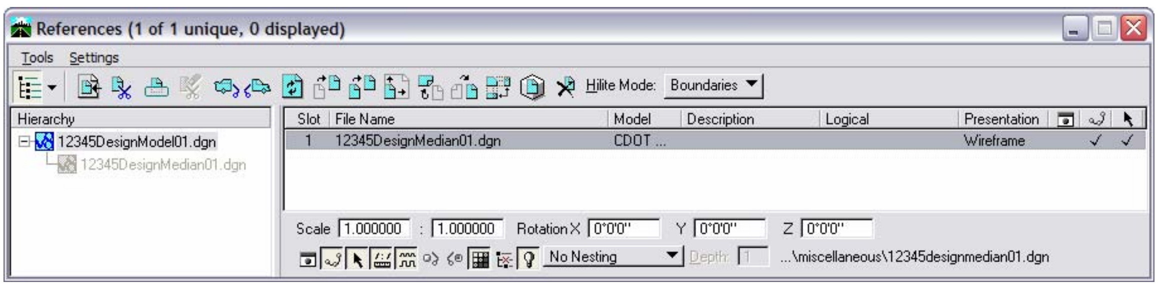
- Set the **Destination Surface** to **SH52 top.**
- Set **Input Mode** to **Single.**
- Set **Destination** Level to **DES_ROADWAY_Misc.**
- **Apply.**
- When prompted to **Identify Element**, **<D>** on the median outline in View 1 (the Top View).
- **<D>** to accept.

5. **Close** the **Drape Surface** box.

Notice in View 8, you can see that the outline has been draped onto the surface.



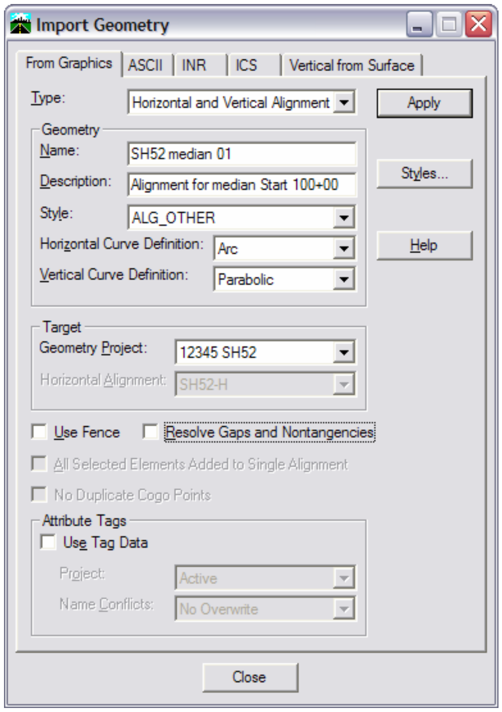
6. Select **References.**



7. Toggle off the **Display** of the Reference File.

Import the median as an alignment

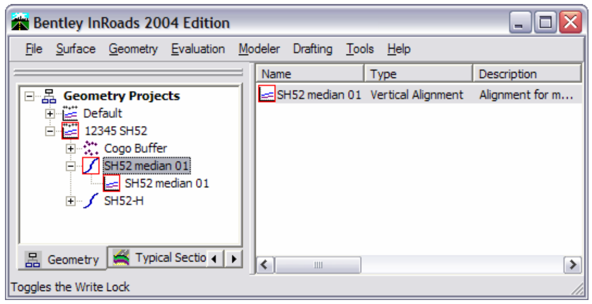
1. Select **File > Import > Geometry.**



2. Select the **From Graphics** tab:

   - Set **Type** to **Horizontal and Vertical Alignment.**
   - Key in a **Name** of ***SH52 median 01***
   - Key in a **Description** of ***Alignment for median Start 100+00***
   - Set **Style** to **ALG_Other.**
   - Make sure the **Geometry Project** is set to **12345 SH52.**
   - Set the other options as shown.
   - When prompted to **Identify Element**, **<D>** on the median outline.
   - **<D>** to accept.
   - **<R>** when done.

3. Check your geometry project in the InRoads Explorer window.



   You now have horizontal and vertical alignments for the median.

4. **Close** the **Import Geometry** box.

Evaluate the alignments

1. View the Horizontal Alignment.
2. View triangles for SH52 top.
3. Window in and notice where there are vertices in the alignment.

   When you import a graphic, it creates a PI everywhere there was a vertex in the original element. When you drape an element, it picks up a vertex everywhere there is a triangle crossing, plus it segments any arcs. That's why in the curves there are more PIs.

4. Review the vertical alignment.

   Notice the VPIs are at all different elevations.

5. Repeat this process for the other medians.
6. **Save** the geometry project.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All.**
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data file.

1. From MicroStation, select **File > Exit**
2. If prompted to save data files select **Yes**.

Lab 1.5 – Create an alignment using Cogo commands

Start MicroStation InRoads

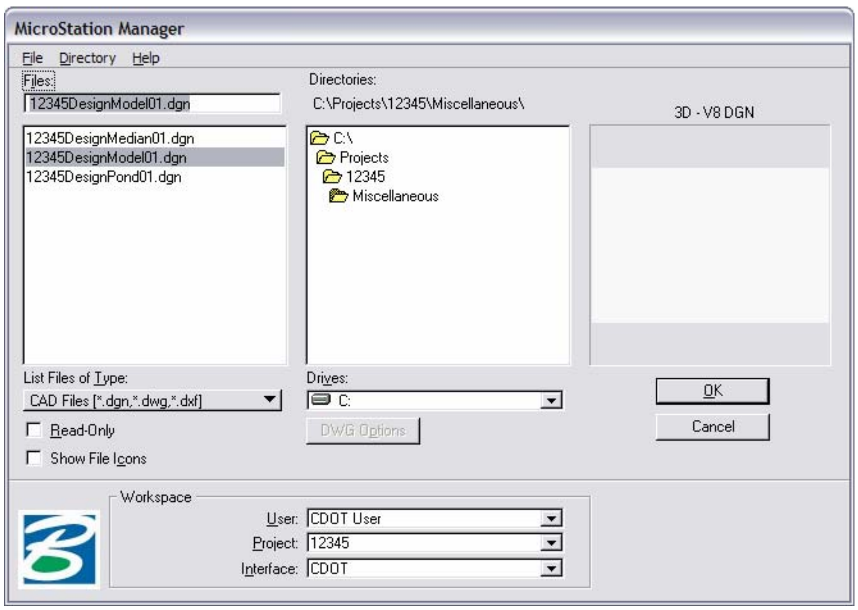
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK.**

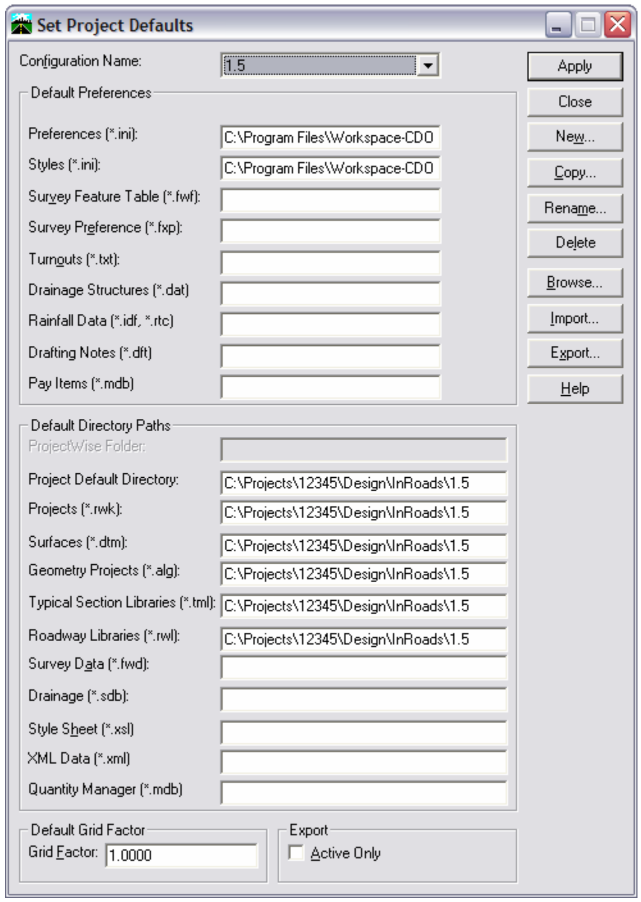
Set Project Defaults

1. Select **File > Project Defaults.**
2. Set the **Configuration Name** to **1.5**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

Important! Verify your dialog box appears as shown:

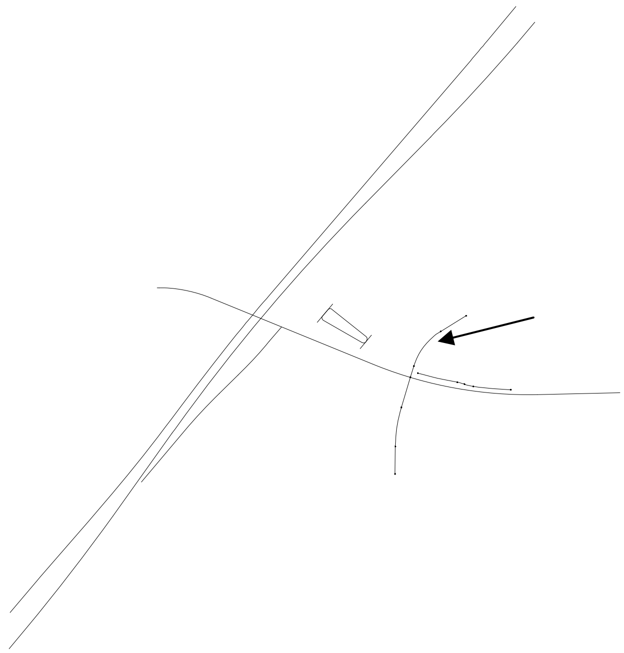


Load data files

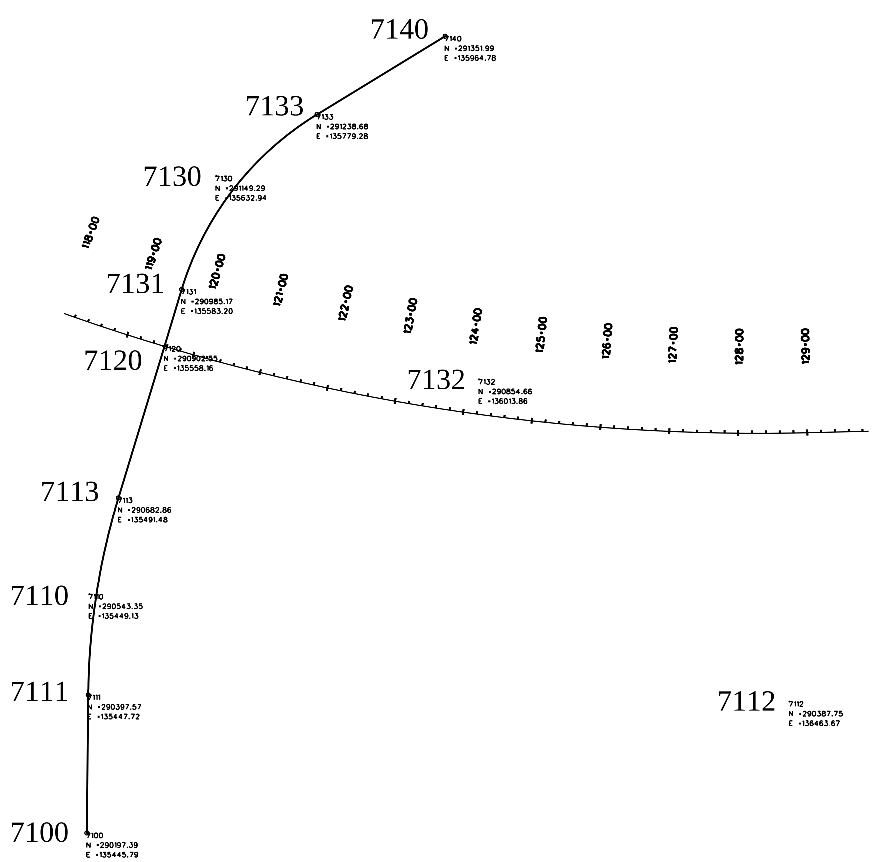
Load geometry project for SH52

1. Select **File > Open.**
2. Set **File of Type** to **Geometry Projects (*.alg).**
3. Highlight **12345 SH52.alg** and then select **Open.**
4. **Cancel** the **Open** dialog box.

Create an alignment for 71st Street using Cogo commands



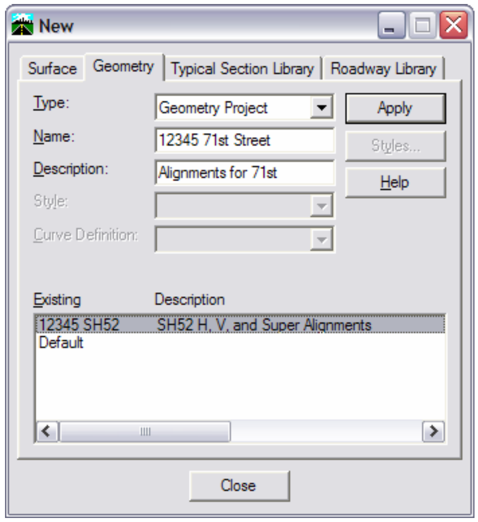
The finished alignment appears as shown. Refer to this diagram as needed.



Preliminary set-up

Create a new geometry project for 71st Street

1. Select **File > New.**

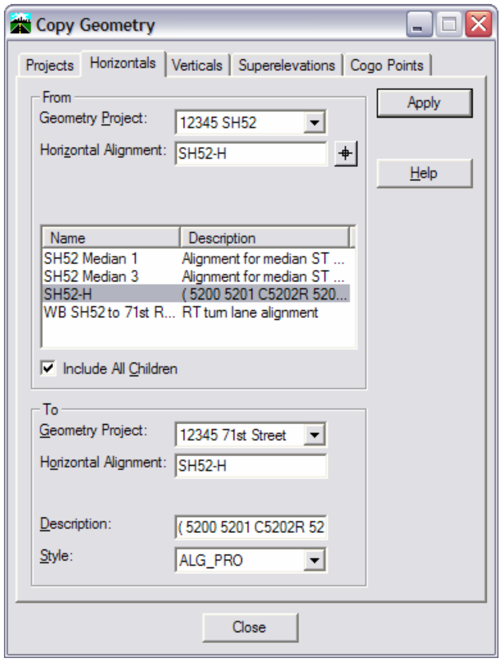


On the **Geometry** tab:

- Set **Type** to **Geometry Project.**
- Key in a Name of ***12345 71st Street***
- Key in a Description of ***Alignments for 71st***
- Select **Apply,** then **Close.**

Copy the roadway alignments for reference

2. Select **Geometry > Copy Geometry.**



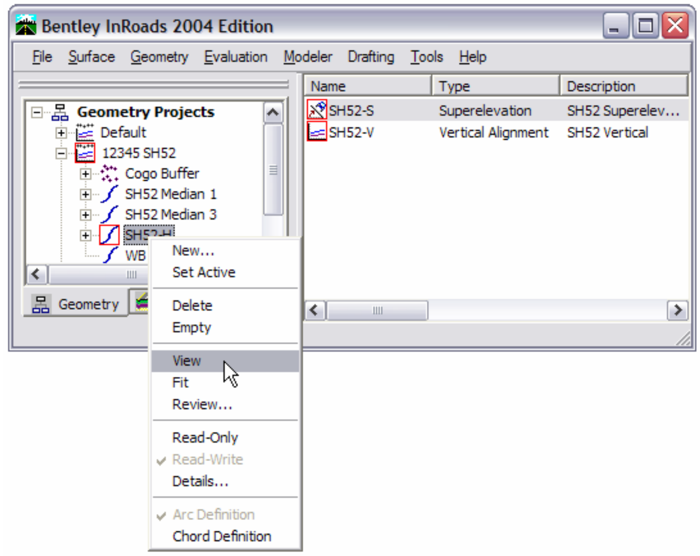
3. Select the **Horizontals tab**

- Set the **From Project** to **12345 SH52**.
- Double-click the Alignment **SH52-H**.
- Toggle on **Include All Children**.
- Set the **To Project** to **12345 71st Street**.

Note: If the **To Alignment** name doesn't show up, double-click the alignment again in the **From** category.

- Choose **Apply**.

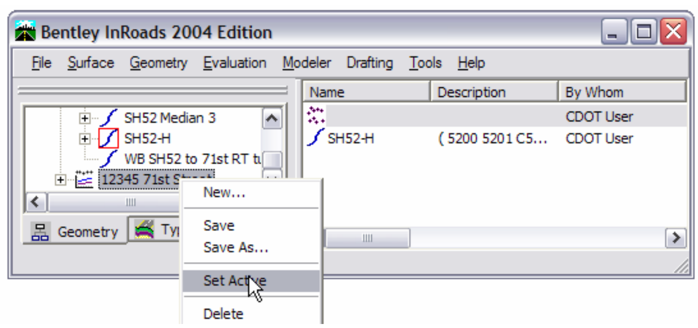
View SH52 for reference



4. Right-click **SH52-H** in the **InRoads Explorer** menu and choose **View**.

Station the alignment if desired.

5. Right-click on **12345 71st Street** in the **InRoads Explorer** menu and choose **Set Active**.

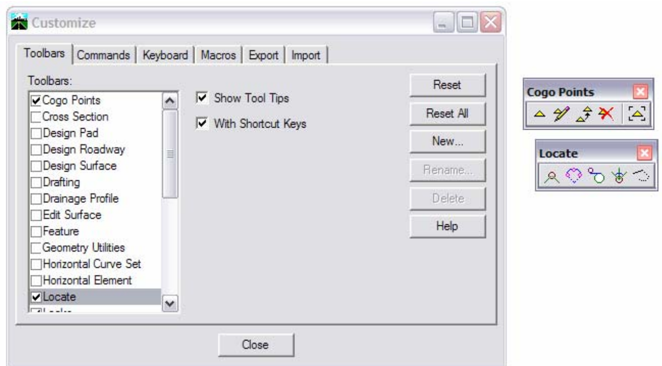


Set locks

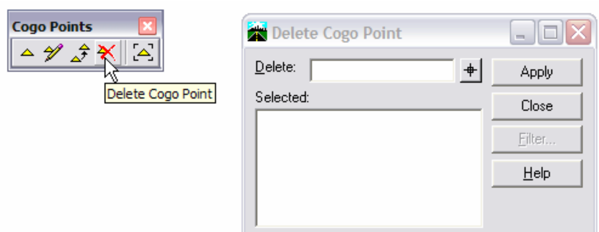
6. Toggle on **Report** lock.

7. Toggle on **Write** lock.

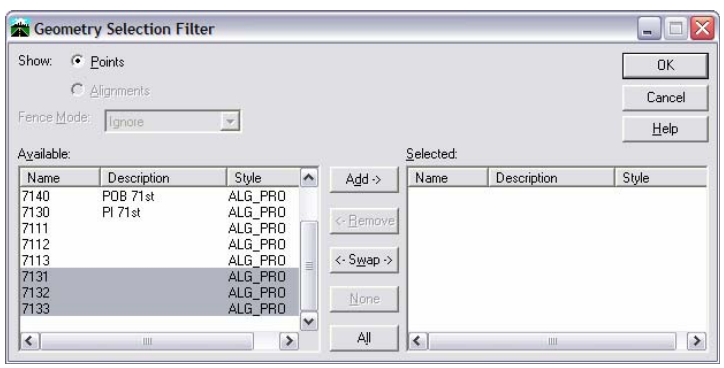
Note: Throughout this exercise, you can choose the cogo commands from the pull-down menu or from one of the cogo toolbars. To access the toolbars choose **Tools > Customize and** toggle on **Cogo Points** and **Locate**.



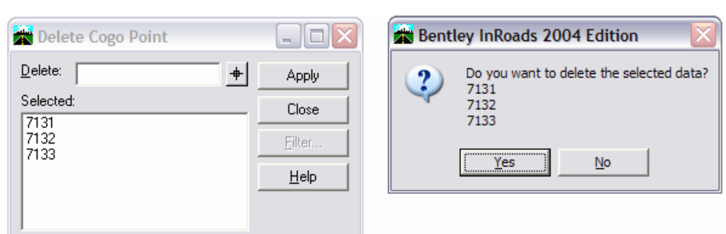
If, at any time, you make a mistake and need to delete a cogo point, you can use **Geometry > Cogo Points Delete**.



Key in the number of the points you want to Delete, or choose **Filter** and you can pick them from a list of available points.

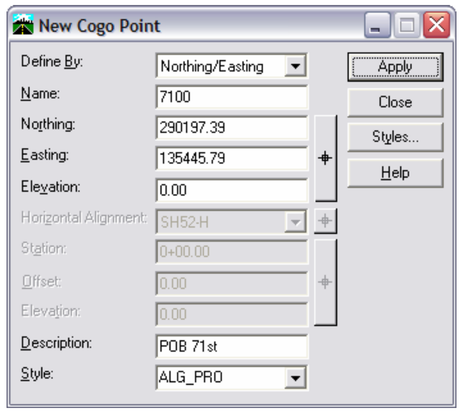


Once selected, choose **Apply**, then confirm to delete the selected points.



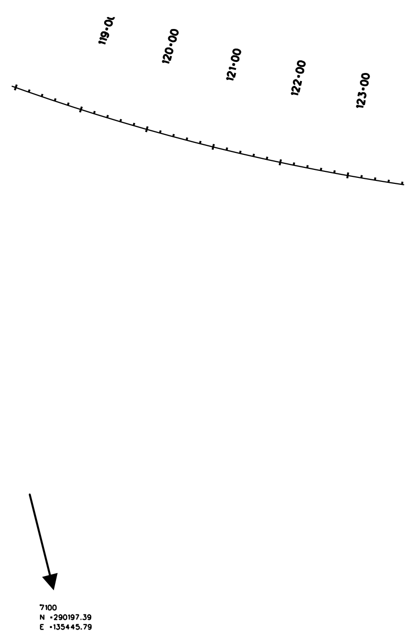
Establish the POB for 71st Street

1. Select **Geometry > Cogo Points > New**.

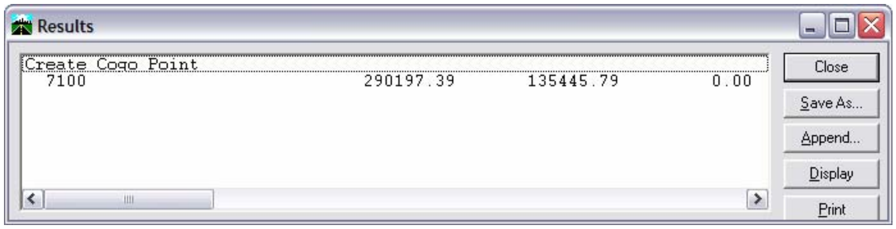


- Set the **Define By** to **Northing/Easting**.
- Key in the name ***7100***
- Key in a Northing coordinate of ***290197.3900***
- Key in an Easting coordinate of ***135445.7850***
- Key in a **Description** of ***POB 71st***
- Select a **Style ALG_PRO**.

2. Select **Apply**.



The cogo point is created and a **Results** box will appear confirming that the point was established.

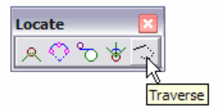


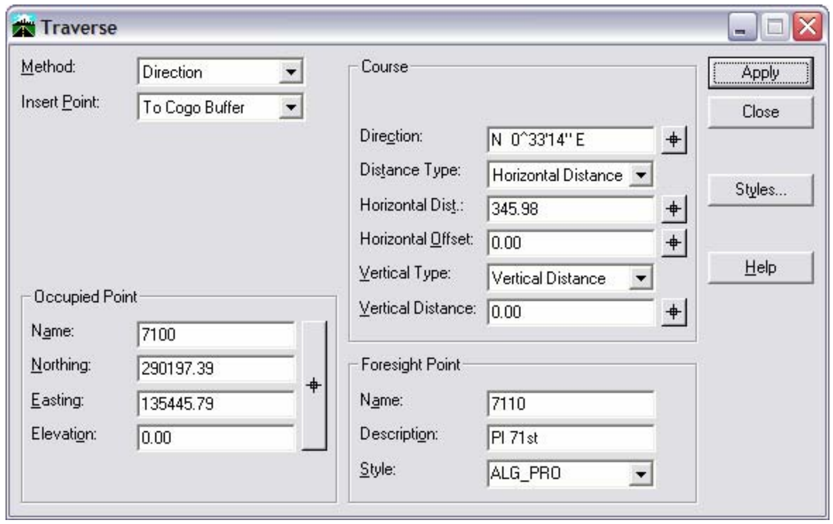
Note: ***Do not*** close the Results box, just slide it over to the side. It appears because the Report lock is on, and will continue to re-appear with every command if you close it. If you leave it open, it creates a running list of everything you have done with Cogo commands.

3. **Close** the **New Cogo Point** dialog.

Establish the PI for the first curve using a distance and direction from the POB

1. Select **Geometry > Traverse**.





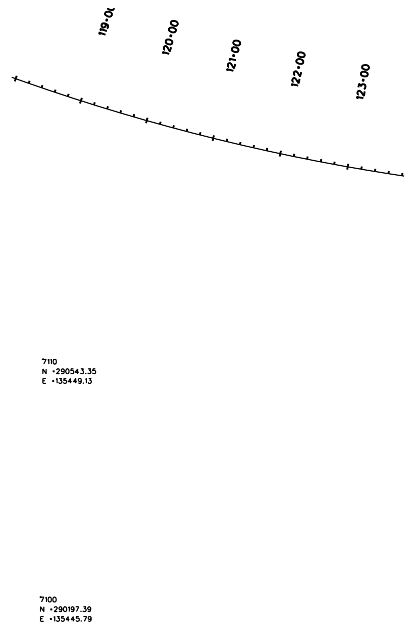
- Set the **Method** to **Direction**.
- Set **Insert Point** to **Cogo Buffer**.
- For the **Occupied Point**, key in ***7100*** or toggle on **Point Snap** and use the **Target Button** to choose the point graphically.
- For the **Direction**, key in ***N 0 33 14.23 E***

Notes: Alternate formats for direction input include:
N 0^33'14.23" E or ***N 0-33-14.23 E***

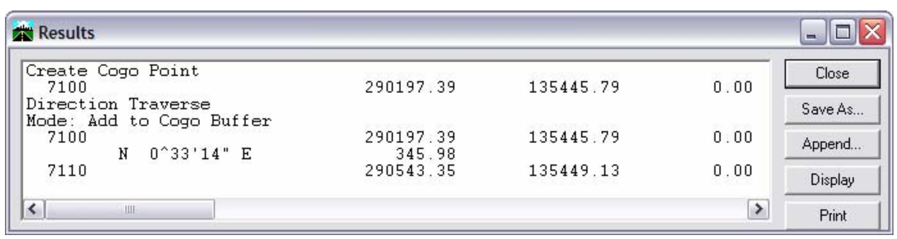
If you want to see the two decimal place precision readout in the dialog box, change your **Angular** precision under **Tools > Options**.

- Set the **Distance Type** to **Horizontal Distance**.
- Key in a **Horizontal Distance** of ***345.98***
- Key in a **Foresight Point** ***7110***
- Key in a **Description PI 71st**
- Select a **Style ALG_PRO**.

2. Select **Apply**.



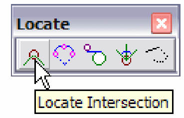
The second point is created. On your screen, you should see a reference line showing the point from which the new one was located. It is not visible here and won't be on your screen after you zoom in, out or update. The Results box also shows the point was created.

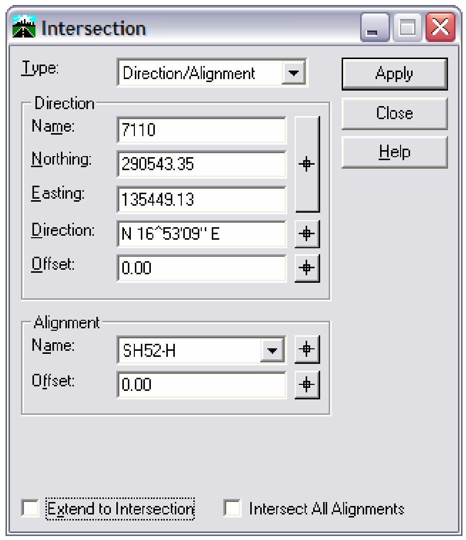


3. **Close** the **Traverse** dialog.

Establish the point where the alignment crosses SH52

1. Select **Geometry > Locate > Intersection**.

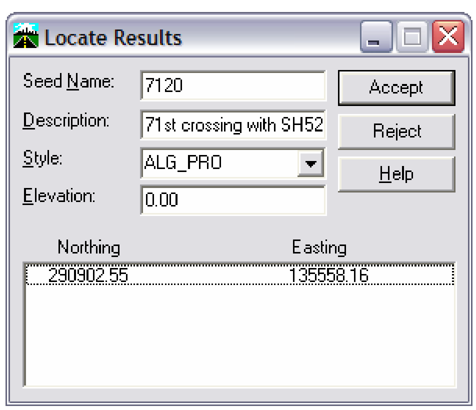




- Set the **Type** to **Direction/Alignment**.
- Key in the name ***7110***
- Key in the **Direction** ***N 16 53 08.54 E***
- Set the **Alignment Name** to **SH52-H**.

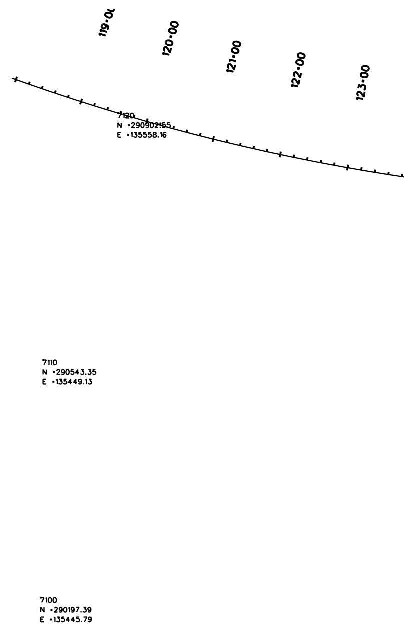
2. Select **Apply**.

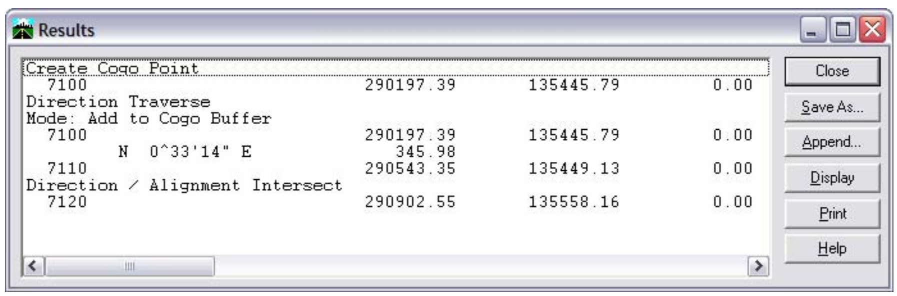
3. When the Locate **Results** box appears,



- Key in a **Point Name** ***7120***
- Key in a **Description** ***71st crossing with SH52***
- Select a **Style ALG_PRO**.

4. Select **Accept**.

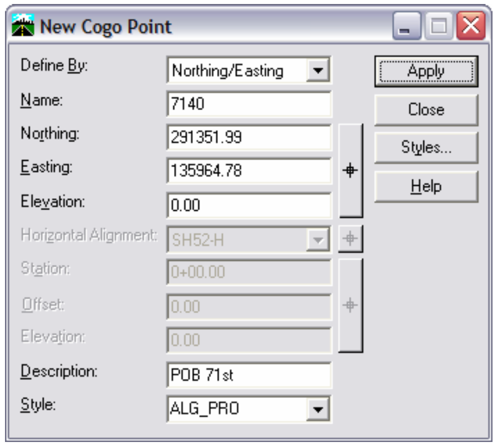




Establish the North side of SH 52

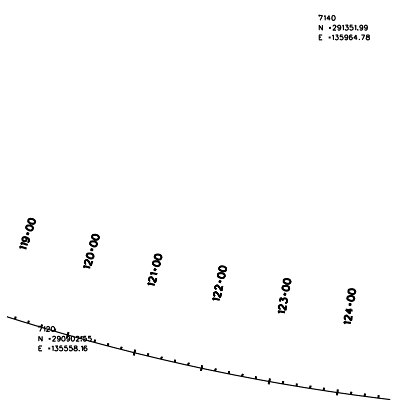
For the North side of SH52, you will establish the end point first, then use directions from point 7120 and the POE to determine the PI for the curve.

1. Select **Geometry > Cogo Points > New**.



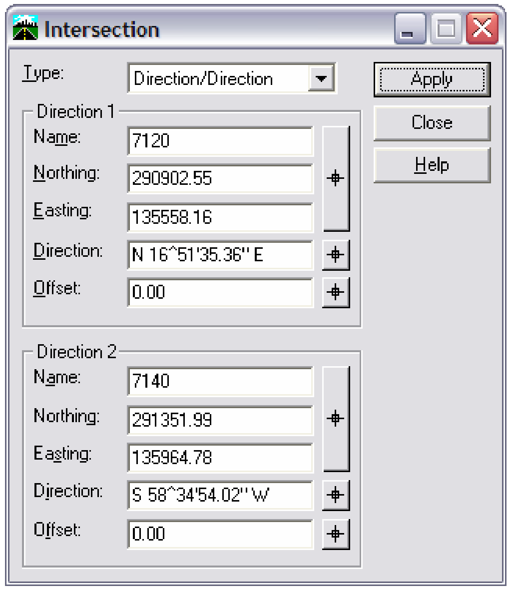
- Set the **Define By** to **Northing/Easting**.
- Key in the **name *7140***
- Key in a **Northing** coordinate of ***291351.9891***
- Key in an **Easting** coordinate of ***135964.7757***
- Key in a **Description** of ***POE 71st***
- Select a **Style ALG_PRO**.

2. Select **Apply**.



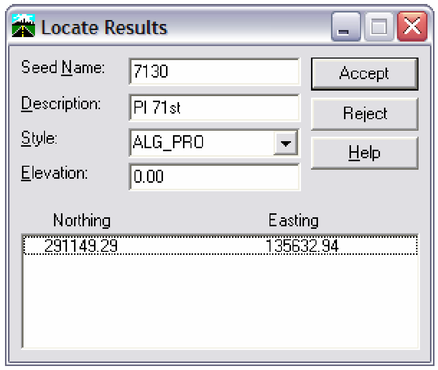
Establish the PI for the curve North of SH52 using directions from two known points.

1. Select **Geometry > Locate > Intersection**.



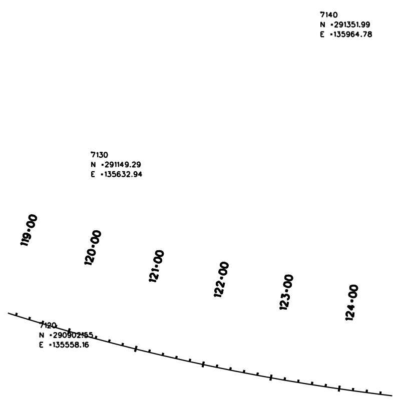
2. Set the **Type** to **Direction/Direction**.
3. In the **Direction 1** category,
   - Key in the **name *7120***
   - Key in the **Direction *N 16 51 35.36 E***
4. In the **Direction 2** category,
   - Key in the **name *7140***
   - Key in the **Direction *S 58 34 54.02 W***
5. Select **Apply**.

6. When the Locate **Results** box appears,



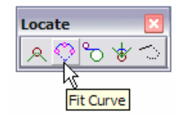
- Key in a **Point Name** ***7130***
- Key in a **Description** ***PI 71st***
- Select a **Style ALG_PRO**.

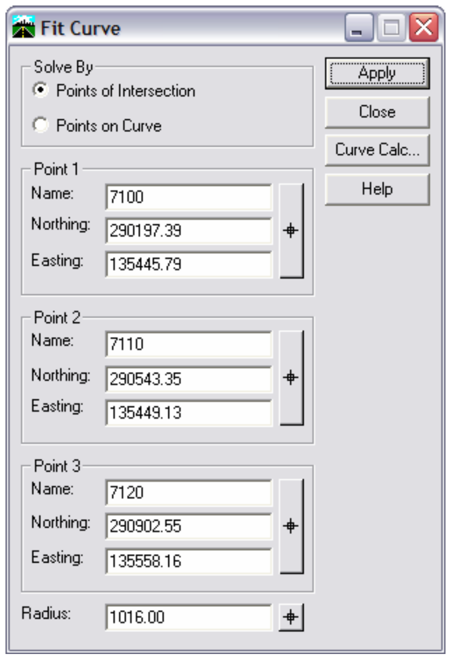
7. Select **Accept**.



Create PCs and PTs and CCs for the two curves on 71st

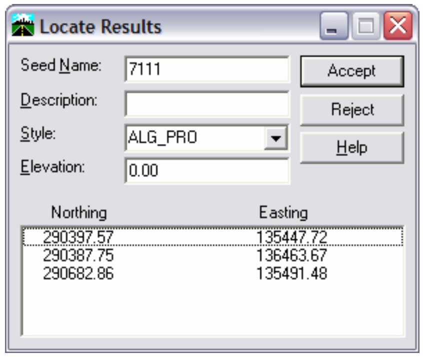
1. Choose **Geometry > Locate > Fit Curve**.





2. Set the **Solve By** option to **Points of Intersection**
   - For **Point 1**, key in ***7100***
   - For **Point 2**, key in ***7110***
   - For **Point 3,** key in ***7120***
   - For the **Radius**, key in ***1016***
3. Select **Apply**.

4. When the **Locate Results** box appears,

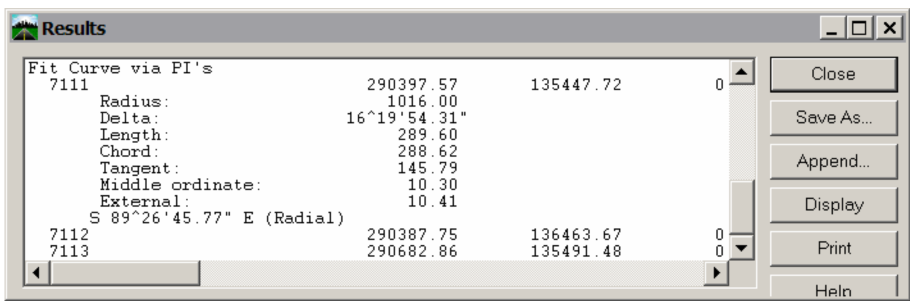


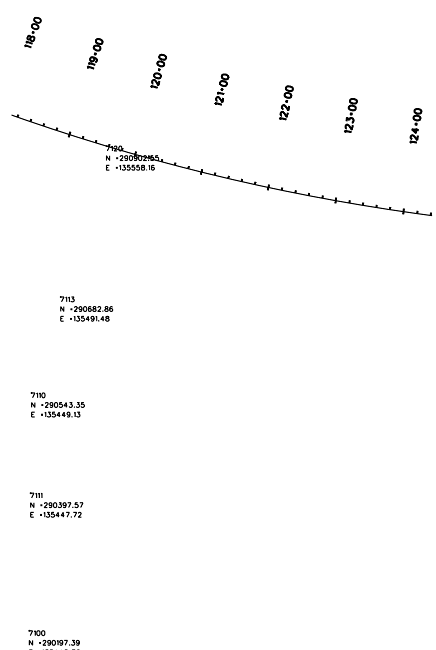
- Key in a **Point Name** of ***7111***

The Point Name of 7111 is a seed name. In this case, the PC will be 7111, the CC 7112 and the PT 7112.

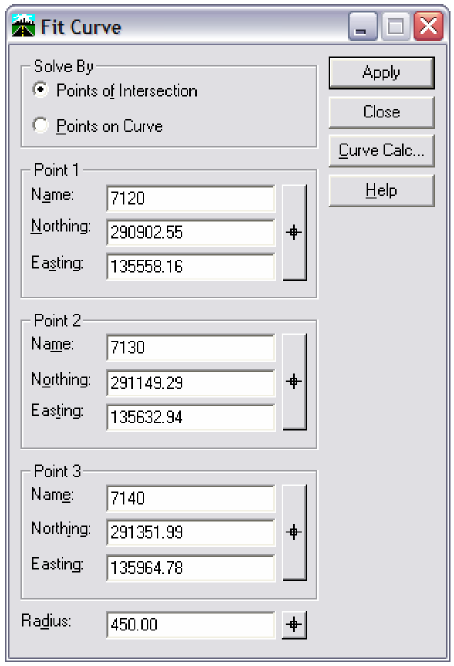
- Select a **Style ALG_PRO**.

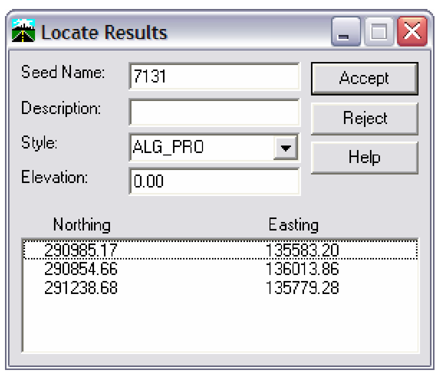
5. Select **Accept**.

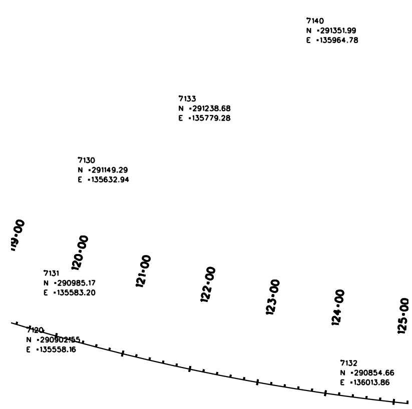




6. Repeat for the second curve, using **Points of Intersection *7120***, ***7130*** and ***7140*** and a radius of ***450*** as shown.



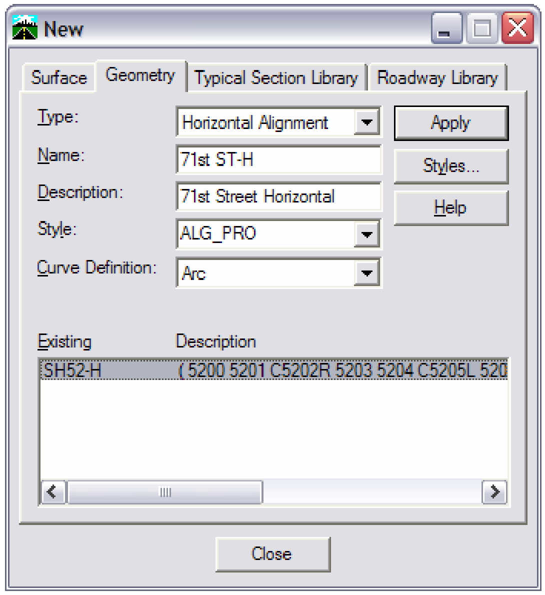




Create a name for the new alignment in the geometry project

1. Select **File > New**.

2. Select the **Geometry** Tab.

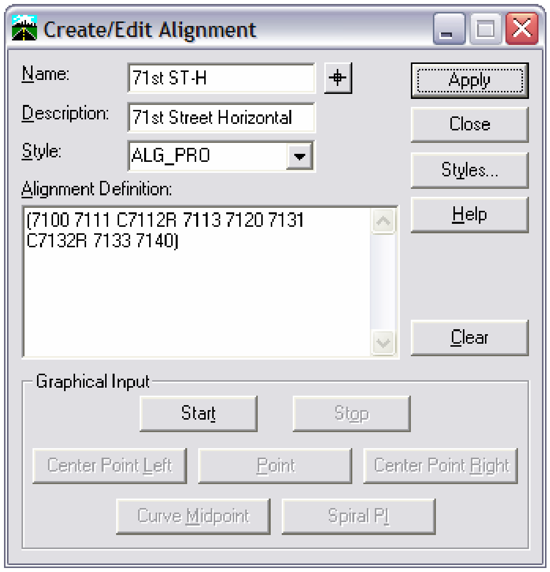


- Set the **Type** to **Horizontal Alignment**.
- Key in the **name** ***71st ST-H***
- Key in a **Description** of ***71st Street Horizontal***
- Select the **Style ALG_PRO**.
- Leave the **Curve Definition** set to **Arc**
- Select **Apply**.

3. **Close** the dialog.

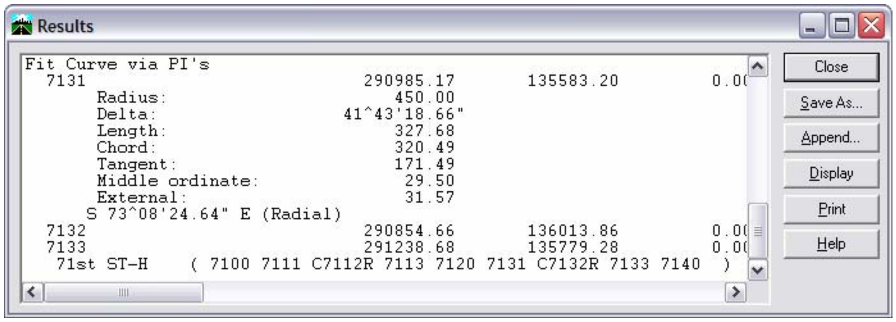
Create the alignment from cogo points

1. Select **Geometry > Utilities > Create/Edit Alignment by Cogo Points**.

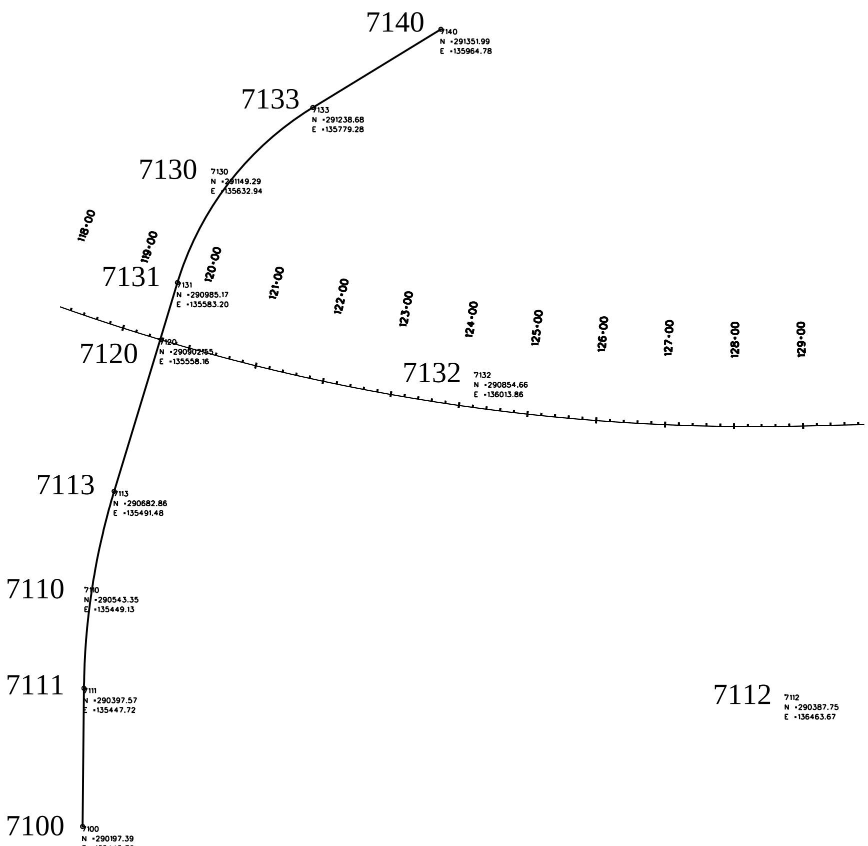


2. Click in the **Alignment Definition** field and key in ***(7100 7111 C7112R 7113 7120 7131 C7132R 7133 7140)***

3. Choose **Apply**.

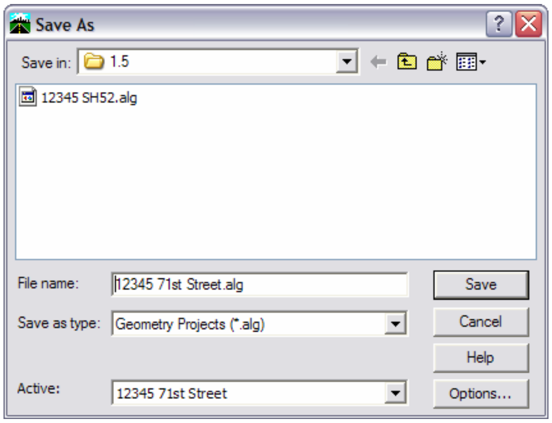


Since the **Report** lock is on, the **Results** box will appear showing the alignment you just created.



4. **Close** the dialogs.

5. **Save** the Geometry Project.

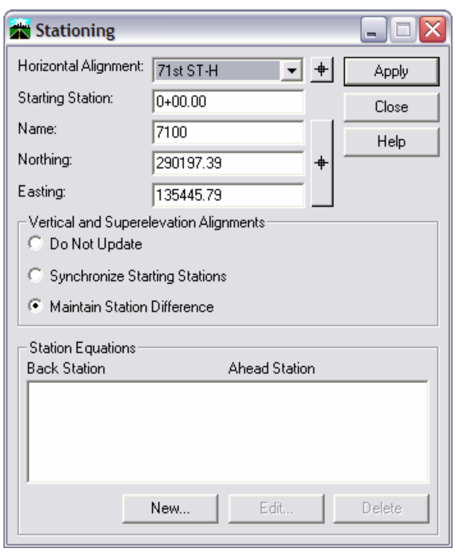


Station the alignment

For the stationing of 71st Street, you know that you want the station where the alignment crosses SH52 to be 600+00. You will next use the **Stationing** command to accomplish this.

1. Toggle on **Point Snap**.

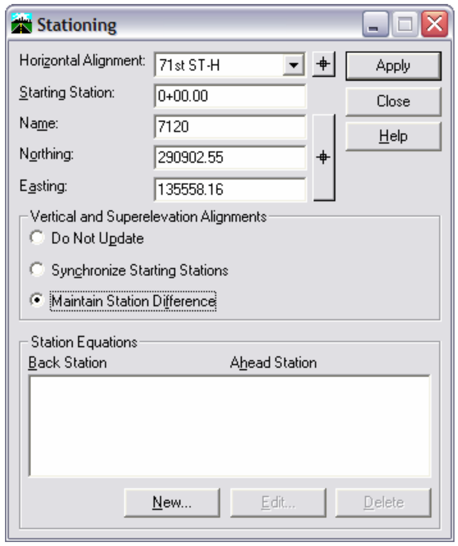
2. Select **Geometry > Horizontal Curve Set > Stationing**.



Note: The Starting Station is 0+00. If you knew the starting station, you could key it in. However, you will instead let InRoads calculate the starting station from the stationing of a known point.

3. Select the larger **target button** next to the Name and Coordinate information.

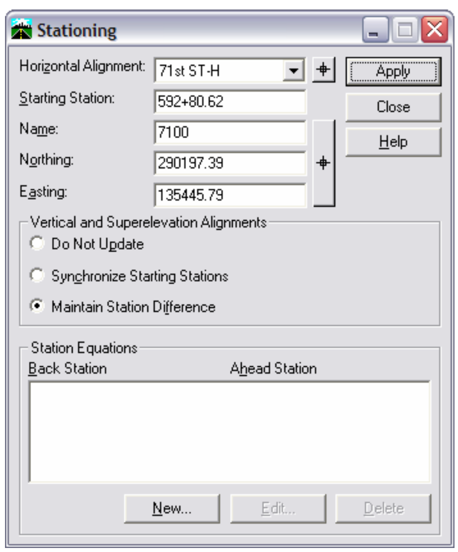
4. Data point **<D>** in the design file near the point where SH52 and 71st cross.



7120 should show up in the **Name** field. (You could have also just keyed in 7120, since you know the number of the point where the alignments cross.

5. Key in ***600+00*** for the **Starting Station**.

6. Choose **Apply**.



<u>Note</u>: The Stating Station is 'backed out' from the crossing point.

7. **Save** the geometry project again.

Clean-up your design file for the next lab

<u>Important</u>! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**
2. Select the MicroStation **Delete** command

   All graphics placed in the file should now be deleted.

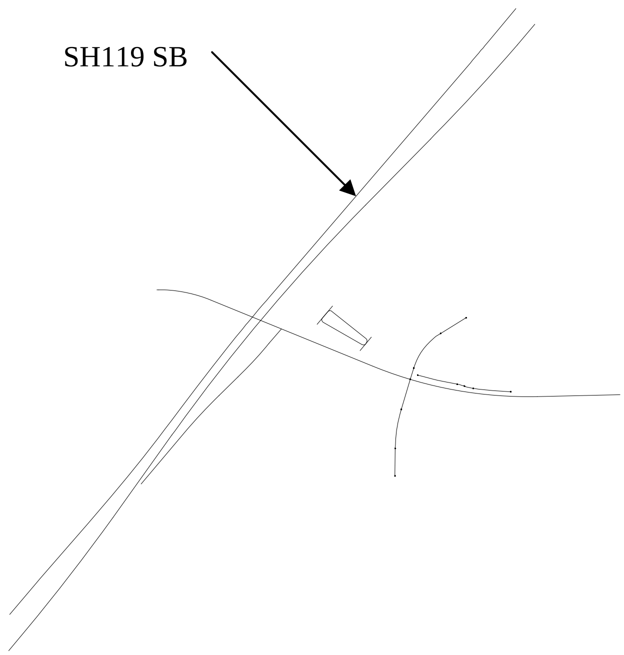
Exit InRoads and MicroStation

<u>Important</u>! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**
2. If prompted to save data files select **Yes**.

Lab 1.6 – Importing a text file for alignments

In this activity, you will create horizontal and vertical alignments using an @ ('at') file. This is a text file that contains key-ins. You run the @ file while in a command and it is just like typing all of the key-ins interactively. Any MicroStation or InRoads key-in commands can be used in an @ file.



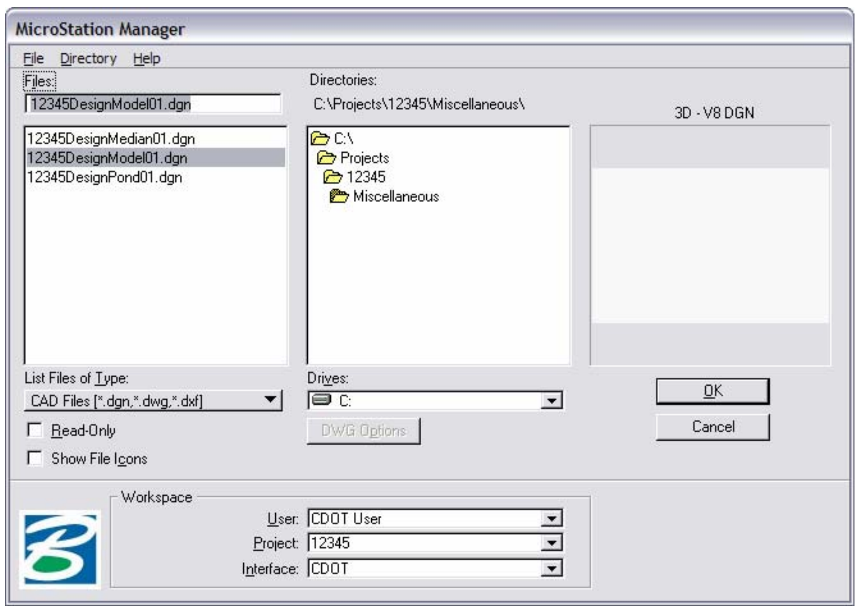
Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop

2. In the **MicroStation Manager** Dialog box:
   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK.**

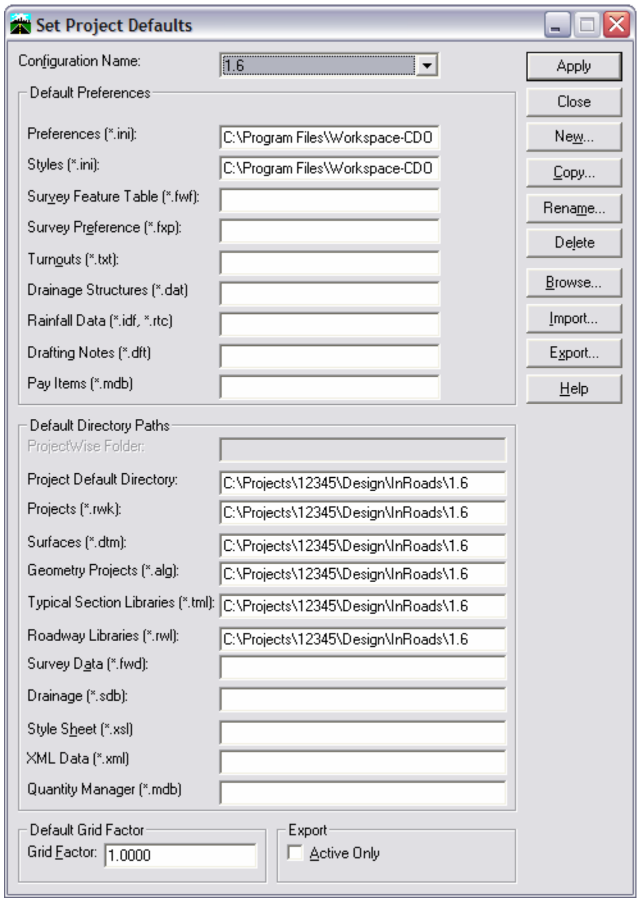
Set Project Defaults

1. Select **File > Project Defaults.**
2. Set the **Configuration Name** to **1.6**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

Important! Verify your dialog box appears as shown:



Load data files

Load the existing surface

4. Select **File > Open.**
5. Set **File of Type** to **Surfaces (*.dtm).**
6. Highlight **12345 Exist01.dgm** and then select **Open.**
7. **Cancel** the **Open** dialog box.

Create geometry slots for SH119 SB

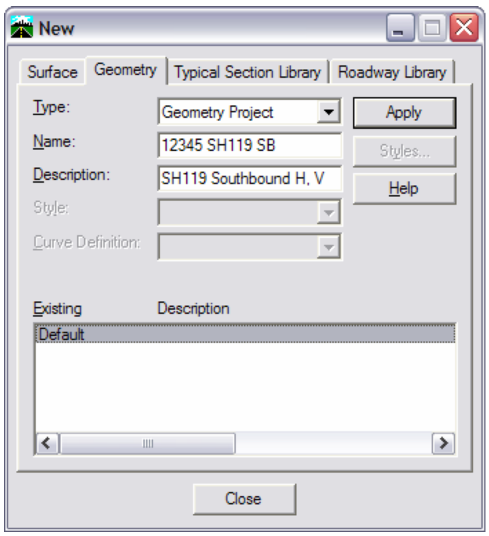
You will now create a geometry project and alignments slots for State Highway 119 South Bound.

Create a new geometry project

1. Select **File > New.**

   On the **Geometry** tab:

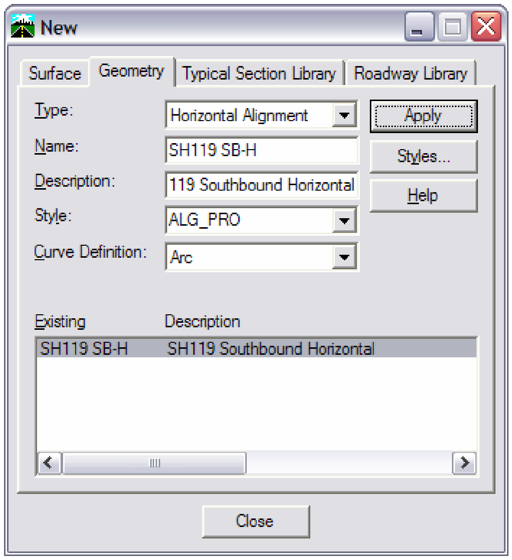
   - Set **Type** to **Geometry Project.**
   - Key in a Name of ***12345 SH119 SB***
   - Key in a Description of ***SH119 Southbound H, V and Super Alignments***
   - Select **Apply.**



Create a new alignment slot for 119 Southbound

2. Set **Type** to **Horizontal Alignment.**
3. Key in a Name of ***SH119 SB-H***
4. Key in a Description of ***SH119 Southbound Horizontal***
5. Set **Style** to **ALG_PRO.**

6. Select **Apply.**



7. **Close** the **New** dialog box.

Develop the Horizontal Alignment using an @ file

You'll use the Horizontal Curve Set tools to create the SH119 SB alignment. However, instead of keying in coordinates or bearings and distances, you'll use a text or script file to store your entries.

Create the script file (the @ file)

1. From the Windows **Start Menu** select
   Start > All Programs > Accessories > Notepad

2. In **Notepad**, enter in the following MicroStation keyins for the alignment PIs (use one line per keyin):

   NE=289184.6080,132631.7364

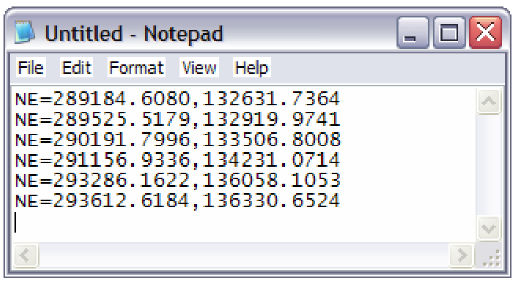
   NE=289525.5179,132919.9741

   NE=290191.7996,133506.8008

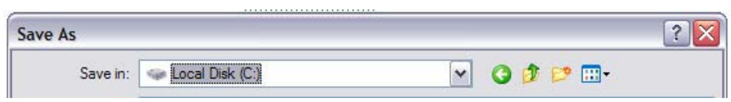
   NE=291156.9336,134231.0714

   NE=293286.1622,136058.1053

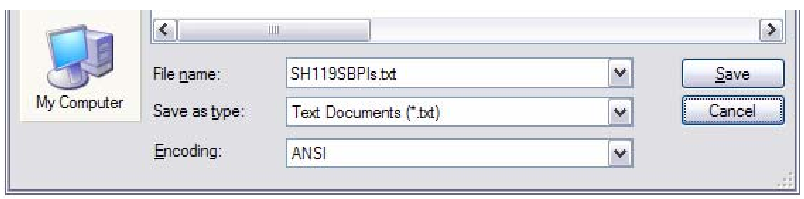
   NE=293612.6184,136330.6524



3. In **Notepad**, Select **File > Save As.**



4. Set the **Save in** folder to **C:**



5. Key in a **File Name** of ***SH119SBPIs.txt***

6. Make sure the **Save as Type** option is set to **Text Document (*.txt).**

7. Select **Save.**

8. In **Notepad**, select **File > Exit.**

Create the alignment PIs using the script file

9. Set the Snap lock to **No Snap**.

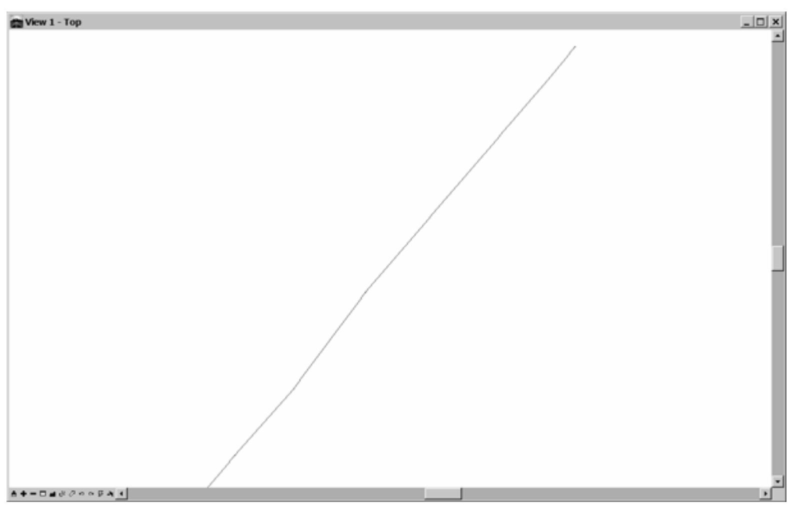
10. Select **Geometry > Horizontal Curve Set > Add PI.**

11. In the Key-in box, key in ***@C:\SH119SBPIs.txt***

<u>Note</u>: The @ symbol is used to designate a MicroStation script file. The directory must be typed in exactly specifying where the script file was stored in order to be executed. For ease of typing, you stored the file in the c:\ directory. Normally, this file would be stored in your project directory. The NE= keyins from the script file are processed in order and the alignment is created.

12. **<R>** to exit the **Add PI** command.

13. From the **InRoads Explorer**, click the **Geometry** tab, right-click on the **SH119 SB-H** alignment and select **Fit.**



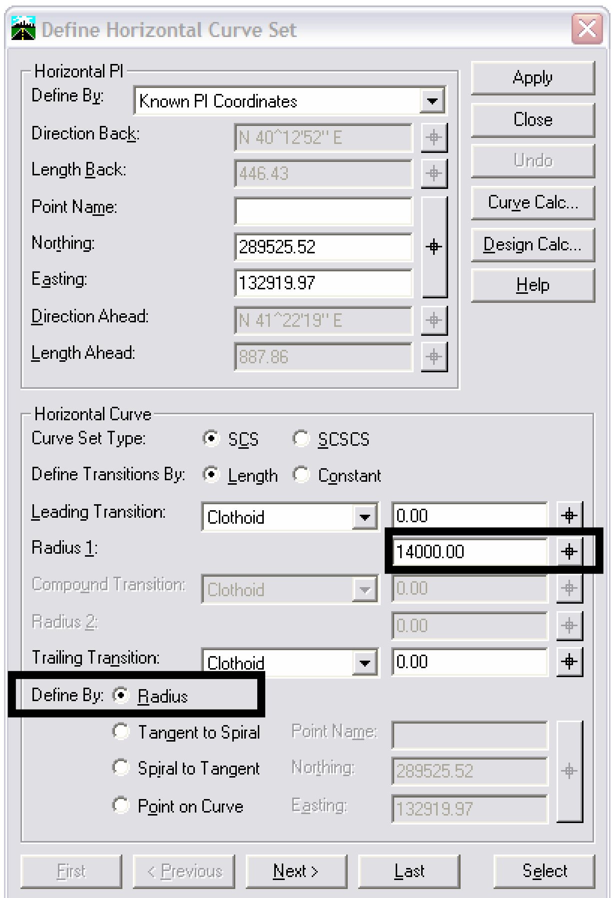
Create the alignment curves

14. Select **Geometry > Horizontal Curve Set > Define Curve.**

    The first set of tangents highlight (on south end of alignment).

15. In the **Horizontal Curve** section of the dialog box (lower half):

    - Set **Define by** to **Radius.**
    - For **Radius 1** key in ***14000***
    - Set all other options as shown.



16. **Apply.**

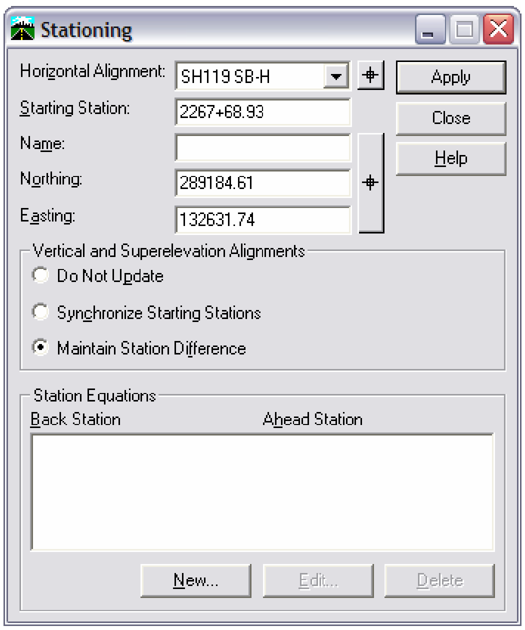
17. Select **Next.**

18. Repeat the process and set the following radii for the remaining curves (don't forget to **Apply** after each curve):
    - Curve 2: For **Radius 1** key in ***14000***
    - Curve 3: For **Radius 1** key in ***14062***
    - Curve 4: For **Radius 1** key in ***14000***
19. **Close** the **Define Curve** dialog.

Set the beginning station

The beginning station is set to match the stationing of the existing alignment.

1. Choose **Geometry > Horizontal Curve Sets > Stationing.**
2. Set the **Starting Station** to ***226768.93***

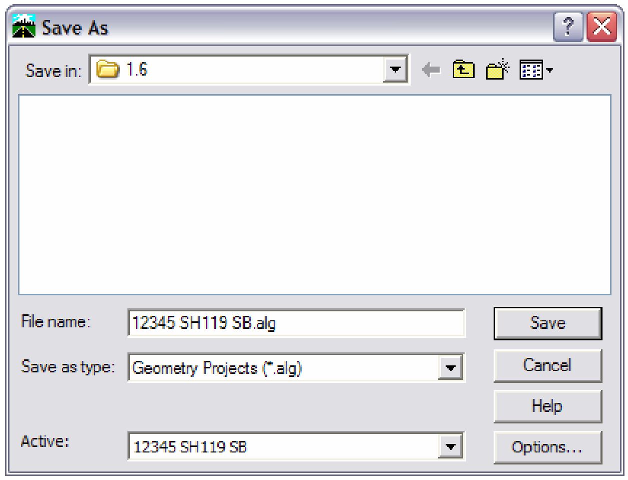


3. Choose **Apply.**
4. **Close** the **Stationing** dialog box.

Save geometry project

1. Select **File > Save > Geometry Project.**

2. On the resulting dialog, make certain the **Active** project is **12345 SH119 SB** and the file name is **12345 SH119 SB.alg.**



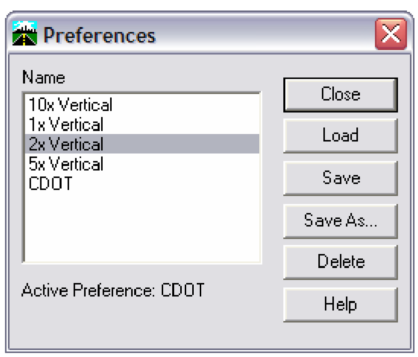
3. Choose **Save.**

4. **Cancel** the **Save As** dialog box.

Create a profile of the horizontal showing existing

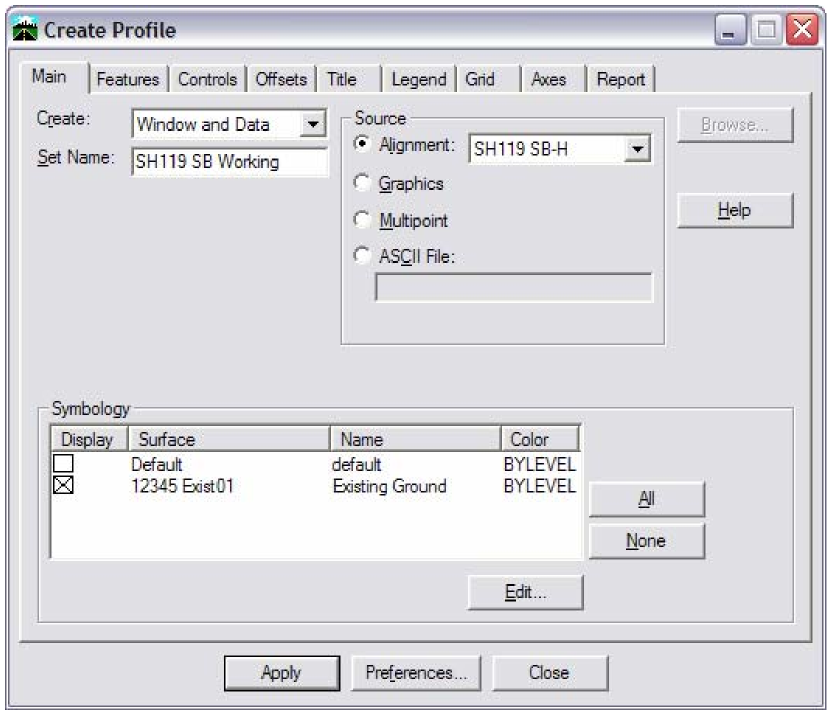
1. Select **Evaluation > Profile > Create Profile.**

2. Select **Preferences**, highlight the **2x Vertical** preference, then **Load** and **Close.**

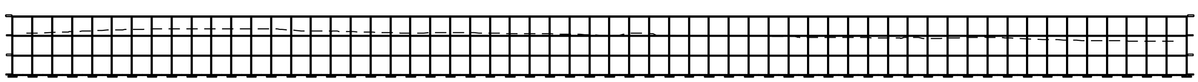


3. On the **Main** tab:

   - Verify that **Alignment** is **SH119 SB-H.**
   - Key in a **Set Name** of ***SH119 SB Working***
   - Toggle **on** the surface **12345 Exist01.**



4. **Apply** and then **<D>** for the location of the lower left corner of the profile.

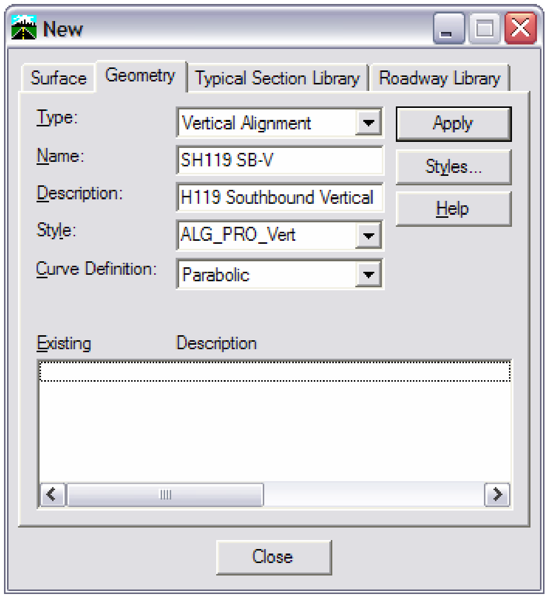


Create a slot for the vertical alignment

1. Select **File > New.**

2. Select the **Geometry** tab

   - Set **Type** to **Vertical Alignment.**
   - Key in a Name of ***SH119 SB-V***
   - Key in a Description of ***SH119 Southbound Vertical***
   - Set **Style** to **ALG_PRO_Vert.**



3. Select **Apply.**

4. **Close** the dialog box.

Develop the Vertical alignment using an (@ file)

Create the script file

1. Start **Notepad**
2. In **Notepad**, enter in the following MicroStation keyins for the alignment PIs (use one line per keyin):

   SE=2269+50.00,5160.057

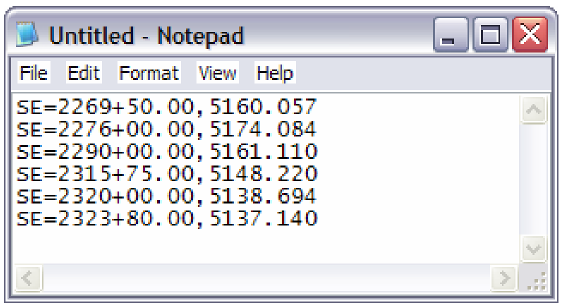
   SE=2276+00.00,5174.084

   SE=2290+00.00,5161.110

   SE=2315+75.00,5148.220

   SE=2320+00.00,5138.694

   SE=2323+80.00,5137.140



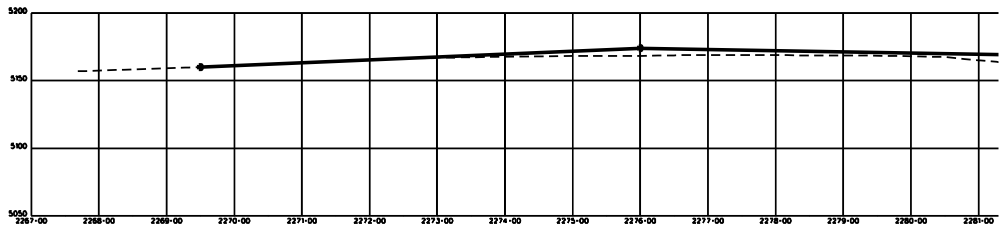
3. In **Notepad**, Select **File > Save As.**
   - Set the **Save in** folder to **C:**
   - Key in a **File Name** of ***SH119SBVPIs.txt***
   - Make sure the **Save as Type** option is set to **Text Document (*.txt).**
4. Select **Save.**

Create the vertical PIs using the script file

5. Select **Geometry > Vertical Curve Set > Add PI.**
6. On the **Dynamic Settings** box, choose **Apply.**
7. Click in the MicroStation key-in field and key in ***@C:\SH119SBVPIs.txt***

   The keyins from the script file are processed in order and the alignment is created.
8. Reset twice, then **Close** the **Add Vertical PI** dialog to stop the command.

9. Window around the beginning of the profile to see the vertical alignment (red graphic).



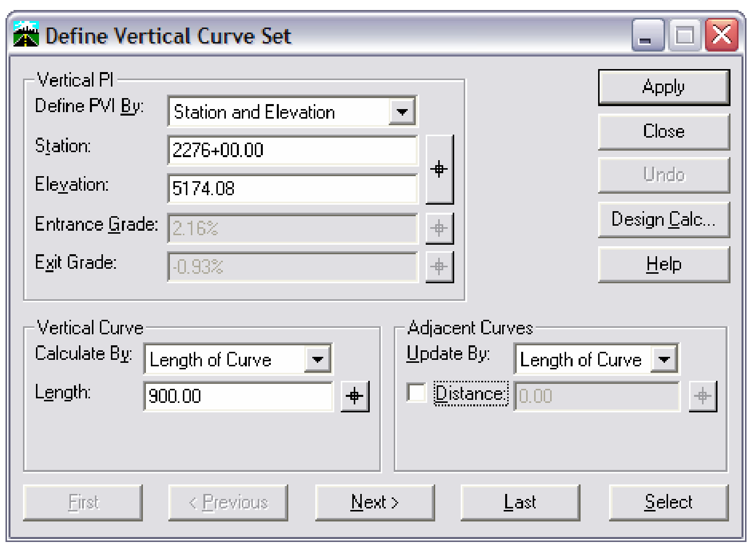
Add curves to the vertical alignment

10. Select **Geometry > Vertical Curve Set > Define Curve.**

    The first set of tangents highlight (on left end of alignment).

11. In the **Vertical Curve** section of the dialog box (lower half):

    - Set **Calculate by** to **Length of Curve.**
    - For **Length** key in ***900***
    - Set all other options as shown.



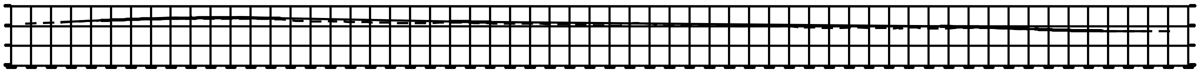
12. **Apply.**

13. Select **Next.**

14. Repeat the process and set the following radii for the remaining curves (don't forget to **Apply** after each curve):

    - Curve 2: For **Length** key in ***210***
    - Curve 3: For **Length** key in ***440***
    - Curve 4: For **Length** key in ***340***

15. **Close** the **Define Curve** dialog.

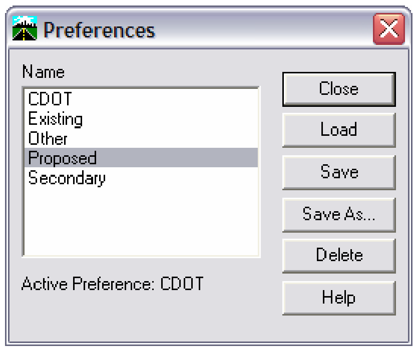


The four curves appear blue on the profile.

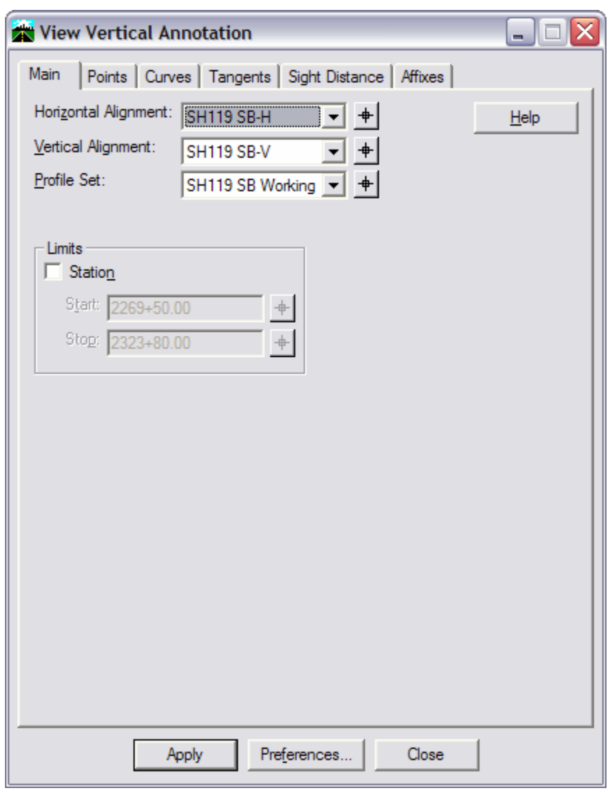
Annotate the vertical alignment

1. Select **Geometry > View Geometry > Vertical Annotation.**

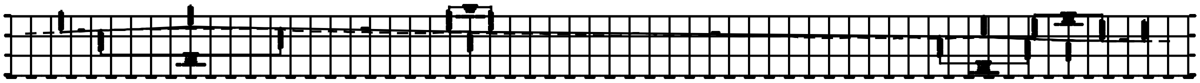
2. Select **Preferences**, highlight the **Proposed** preference and **Load.**



3. Verify that the horizontal and vertical alignments and profile set are as shown.

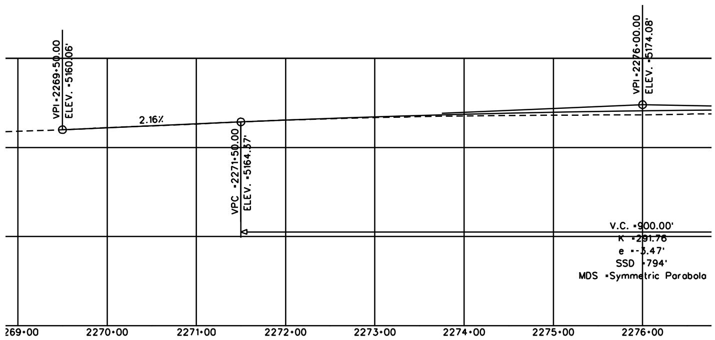


4. **Apply** the command.



The vertical alignment is displayed and annotated with the proposed preference.

5. **Window** in to take a closer look at the vertical alignment on the profile.



6. **Close** the **Vertical Annotation** box.

Save the geometry project

1. Select **File > Save > Geometry > Geometry Project.**

Clean-up your design file for the next lab

<u>**Important**</u>! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All.**
2. Select the MicroStation **Delete** command.

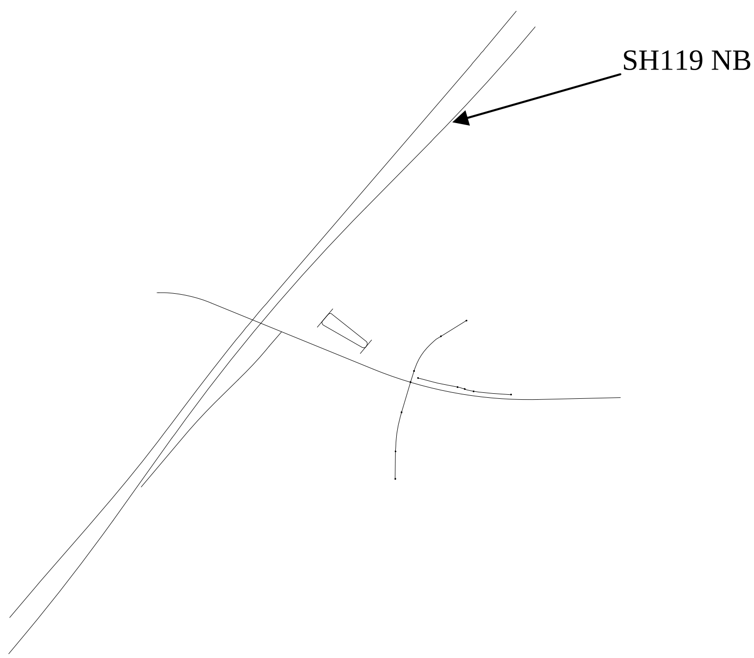
   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

<u>**Important**</u>! ***Do not*** skip this step. You must exit in order to start the next lab session with new data file.

1. From MicroStation, select **File > Exit.**
2. If prompted to save data files select **Yes**.

Lab 1.7.1 – Using .ics files to create horizontal and vertical alignments – SH119 NB



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

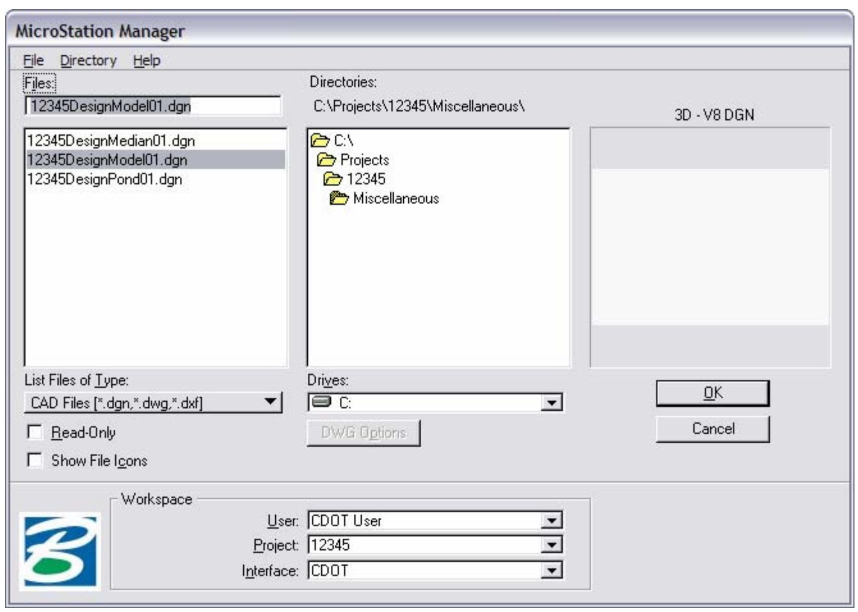
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn.**
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK.**

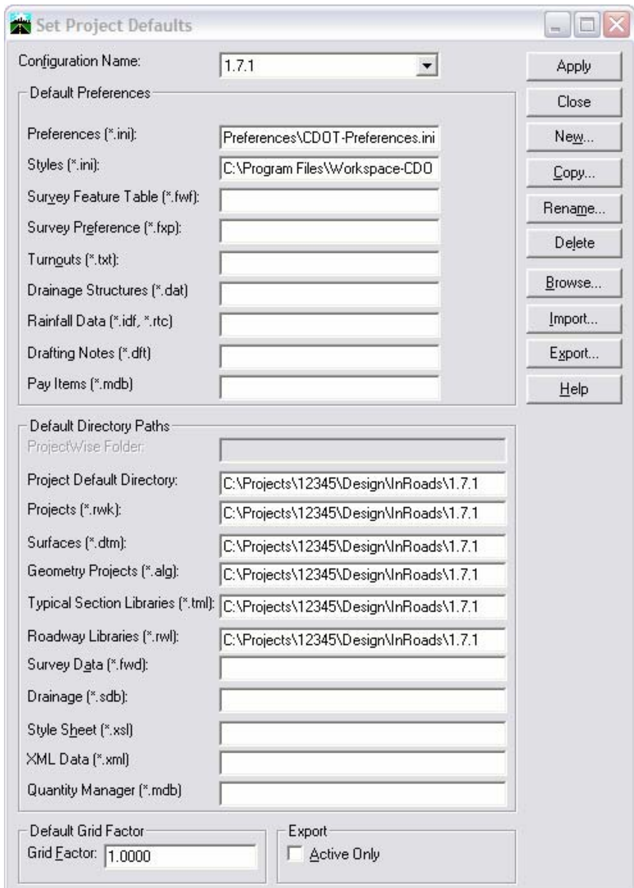
Set Project Defaults

1. Select **File > Project Defaults.**
2. Set the **Configuration Name** to **1.7.1**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply.**

Important! Verify your dialog box appears as shown:



Load data files

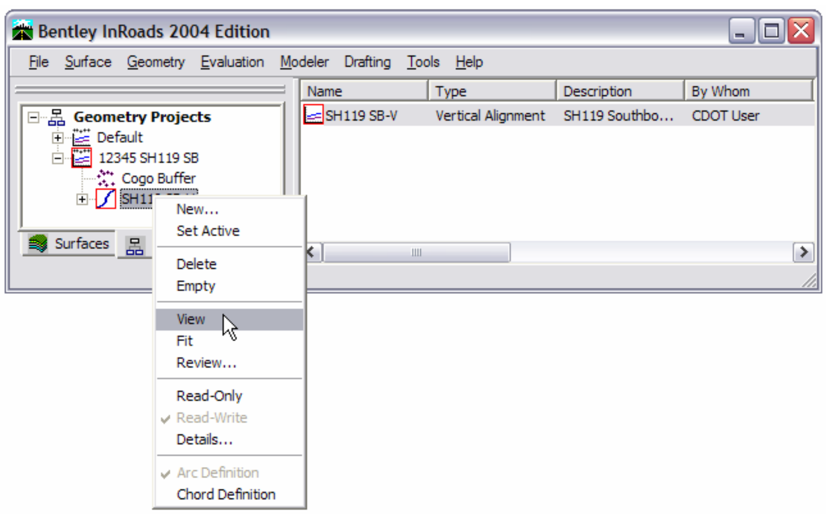
Load geometry project for SH119 SB

1. Select **File > Open.**
2. Set **File of Type** to **Geometry Projects (*.alg).**
3. Highlight **12345 SH119 SB.alg** and then select **Open.**
4. ***Do not*** cancel out of the dialog box.

Load the existing DTM

5. Set **File of Type** to **Surfaces (*.dtm).**
6. Highlight **12345 Exist01.dtm** and then select **Open.**
7. **Cancel** the **Open** dialog box.

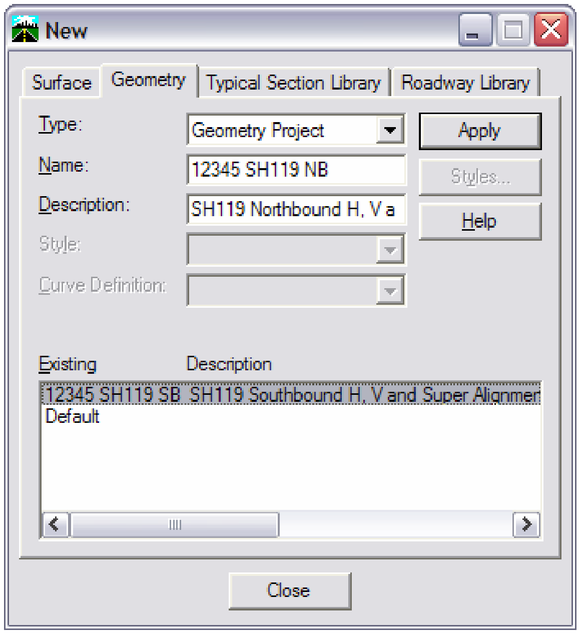
View SH119 Southbound for reference



1. Right-click on **SH119 SB-H** in the InRoads Explorer menu and select **View**.

Create geometry project for SH119 NB

1. Select **File > New**
2. On the **Geometry** tab:
   - Set **Type** to **Geometry Project.**
   - Key in a **Name** of ***12345 SH119 NB***
   - Key in a **Description** of ***SH119 Northbound H, V and Super Alignments***



3. Select **Apply**, then **Close** the **New** dialog box.

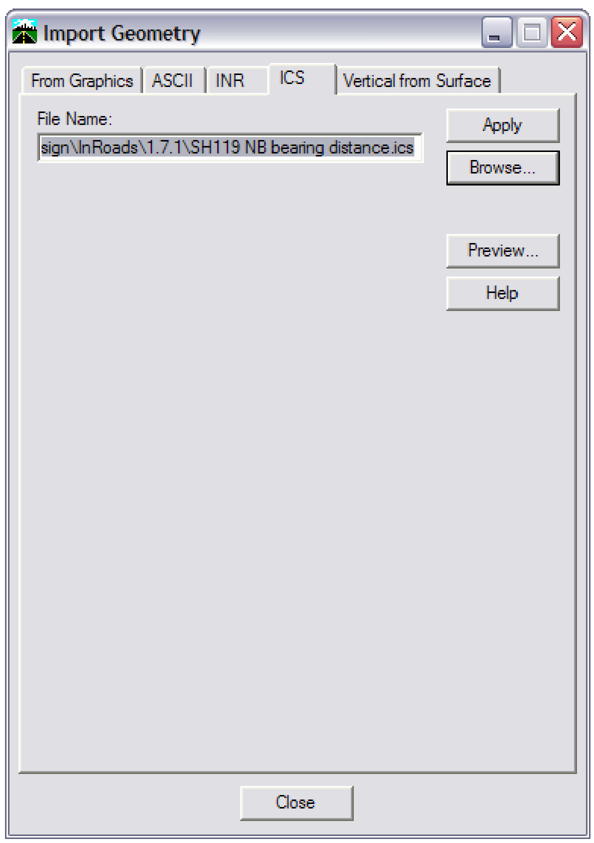
Develop Horizontal Alignment given an ics file

Instead of using the Horizontal Curve Set tools to create the State Highway 119 North Bound alignment, or using a script file (@ file), you'll import an ICS file that stores COGO coordinates and commands to create the alignment.

Import the ICS file to create the alignment

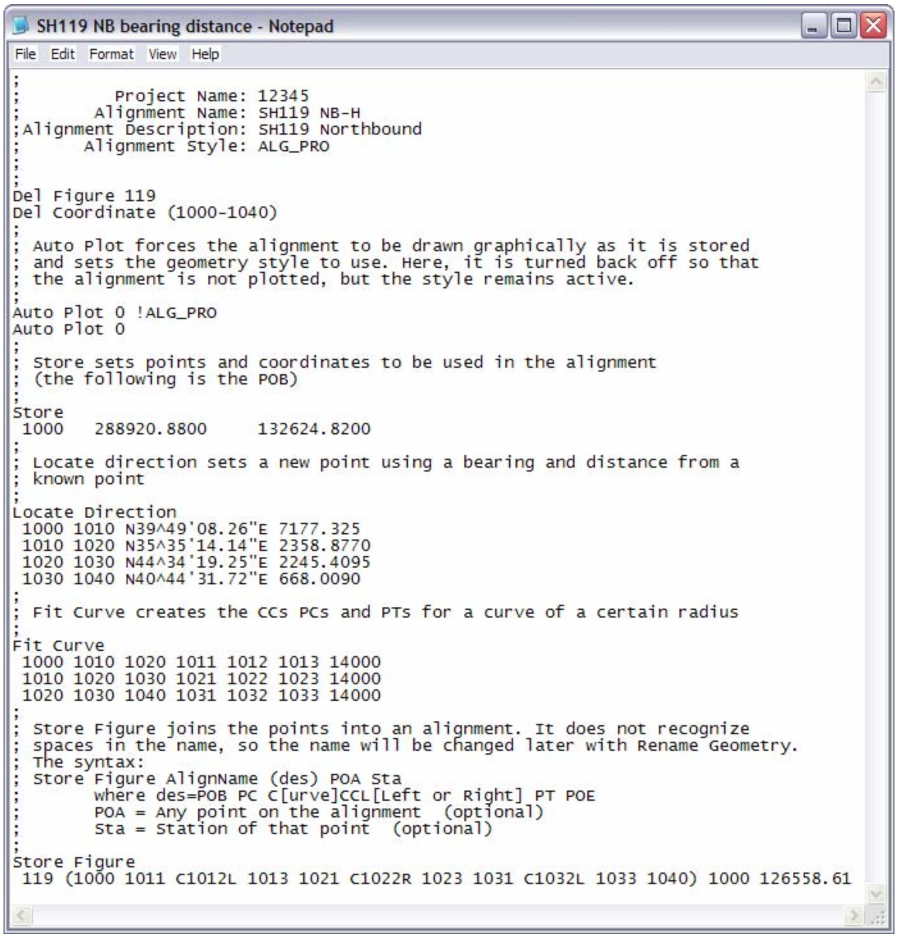
1. Toggle **on** the **Report** lock.

2. In InRoads, select **File > Import > Geometry.**
3. Select the **ICS** tab.
4. Click in the **Filename** field and select **Browse.**
5. Set the **Look in** folder to **C:\Projects\12345\Design\InRoads\1.7.1**
6. Choose the file **SH119 NB bearing distance.ics** and then select **Open.**



7. Select the **Preview** button.

   The Preview function uses **Notepad** to open the file. This file contains COGO commands for storing PIs as well as commands for joining the points to create the alignment with curves. Finally, it will plot the alignment using the specified geometry style.



SH119 NB bearing distance - Notepad

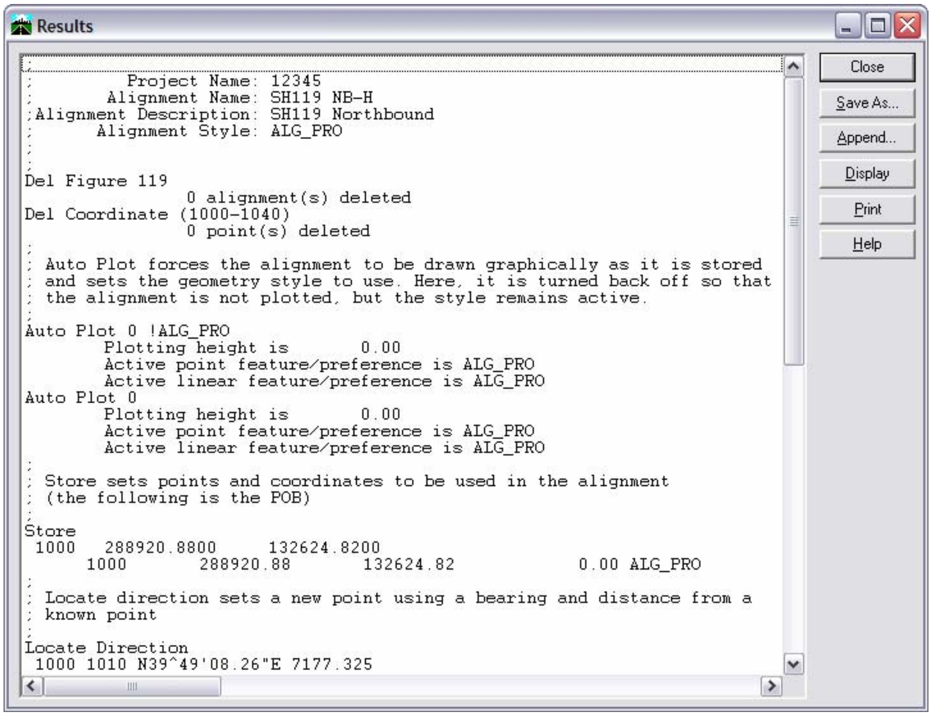
File Edit Format View Help

```
;
;          Project Name: 12345
;        Alignment Name: SH119 NB-H
;Alignment Description: SH119 Northbound
;       Alignment Style: ALG_PRO
;
;
Del Figure 119
Del Coordinate (1000-1040)
;
; Auto Plot forces the alignment to be drawn graphically as it is stored
; and sets the geometry style to use. Here, it is turned back off so that
; the alignment is not plotted, but the style remains active.
;
Auto Plot 0 !ALG_PRO
Auto Plot 0
;
; Store sets points and coordinates to be used in the alignment
; (the following is the POB)
;
Store
 1000   288920.8800     132624.8200
;
; Locate direction sets a new point using a bearing and distance from a
; known point
;
Locate Direction
 1000 1010 N39^49'08.26"E 7177.325
 1010 1020 N35^35'14.14"E 2358.8770
 1020 1030 N44^34'19.25"E 2245.4095
 1030 1040 N40^44'31.72"E 668.0090
;
; Fit Curve creates the CCs PCs and PTs for a curve of a certain radius
;
Fit Curve
 1000 1010 1020 1011 1012 1013 14000
 1010 1020 1030 1021 1022 1023 14000
 1020 1030 1040 1031 1032 1033 14000
;
; Store Figure joins the points into an alignment. It does not recognize
; spaces in the name, so the name will be changed later with Rename Geometry.
; The syntax:
; Store Figure AlignName (des) POA Sta
;        where des=POB PC C[urve]CCL[Left or Right] PT POE
;        POA = Any point on the alignment  (optional)
;        Sta = Station of that point  (optional)
;
Store Figure
 119 (1000 1011 C1012L 1013 1021 C1022R 1023 1031 C1032L 1033 1040) 1000 126558.61
```

8. When finished reviewing the .ics file, select **File > Exit** from **Notepad.**

9. Select **Apply** to import the ICS file.

   Notice the **Results** dialog telling you what has happened with the .ics file. This dialog appears because the **Report** lock is on.



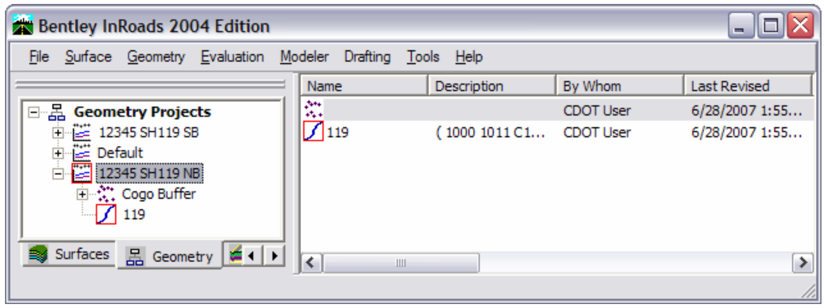
10. **Close** the **Results** box.

11. **Close** the **Import Geometry** box.

View the alignment

1. From the **InRoads Explorer**, select the **Geometry** tab.

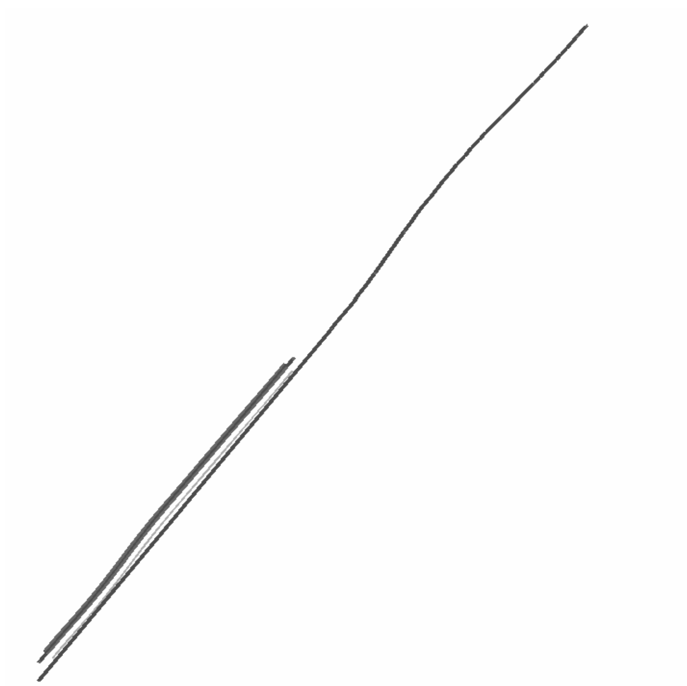
2. Expand the **12345 SH119 NB** geometry project to find the **119** alignment.



The ICS import command automatically creates the alignment slot name and imports the data to create the alignment. ICS files do not function well with alphanumeric names for the alignment, so here you are using 119 and will change it with **Rename Geometry** in a later step.

3. Right-click on the **119** alignment and select **View.**

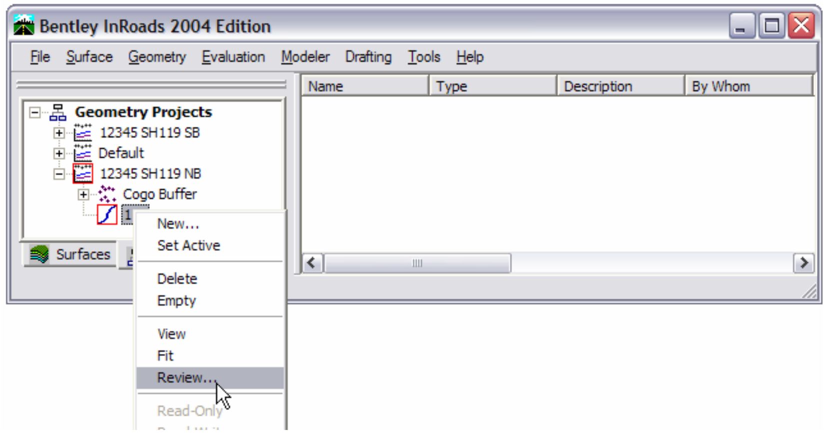
4. **Fit** the view.



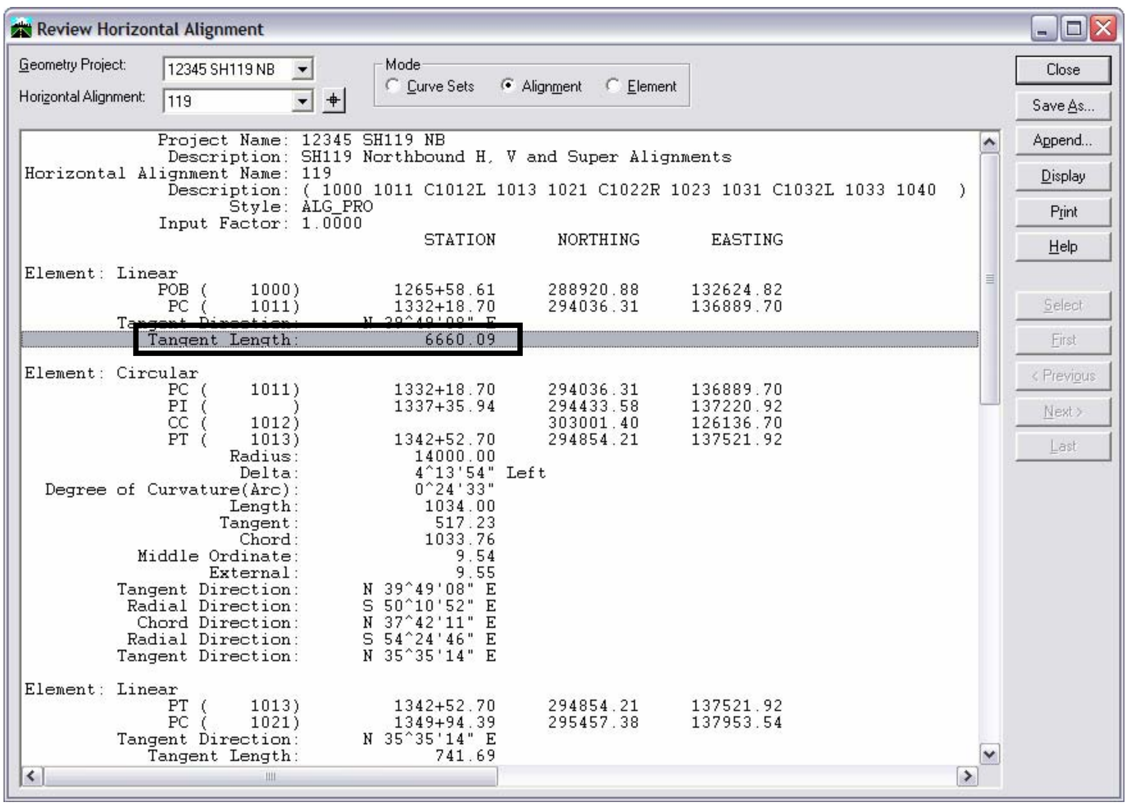
5. Notice that the alignment has problems – it is far too long for this project so you must review the alignment and then look at the .ics file to find out the problem.

Review the Alignment

1. From the **InRoads Explorer**, right-click on the alignment and select **Review.**



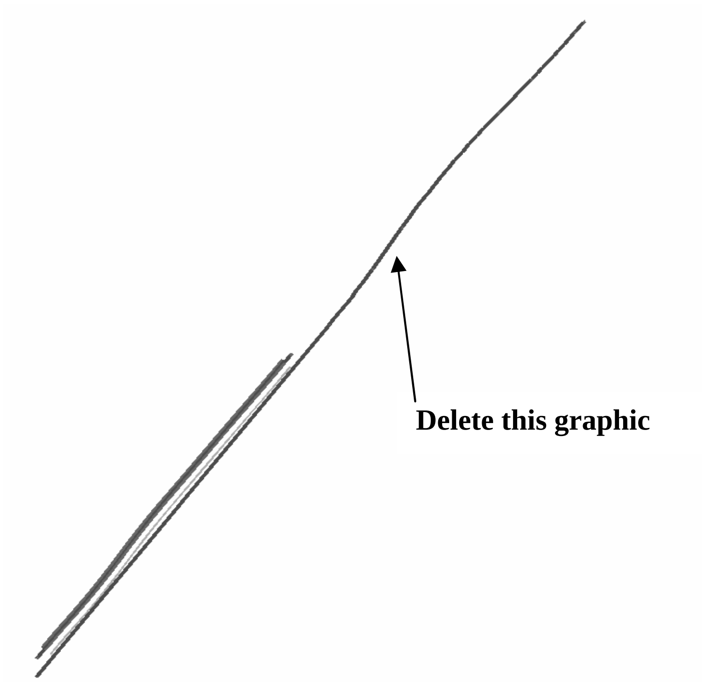
2. Look at the first tangent. The length is obviously suspect.



3. **Close** the **Review Horizontal Alignment** dialog box.

Delete the alignment graphics

1. Select MicroStation's **Delete Element** command.
2. **<D>** on the SH119 NB-H alignment graphic to delete it.

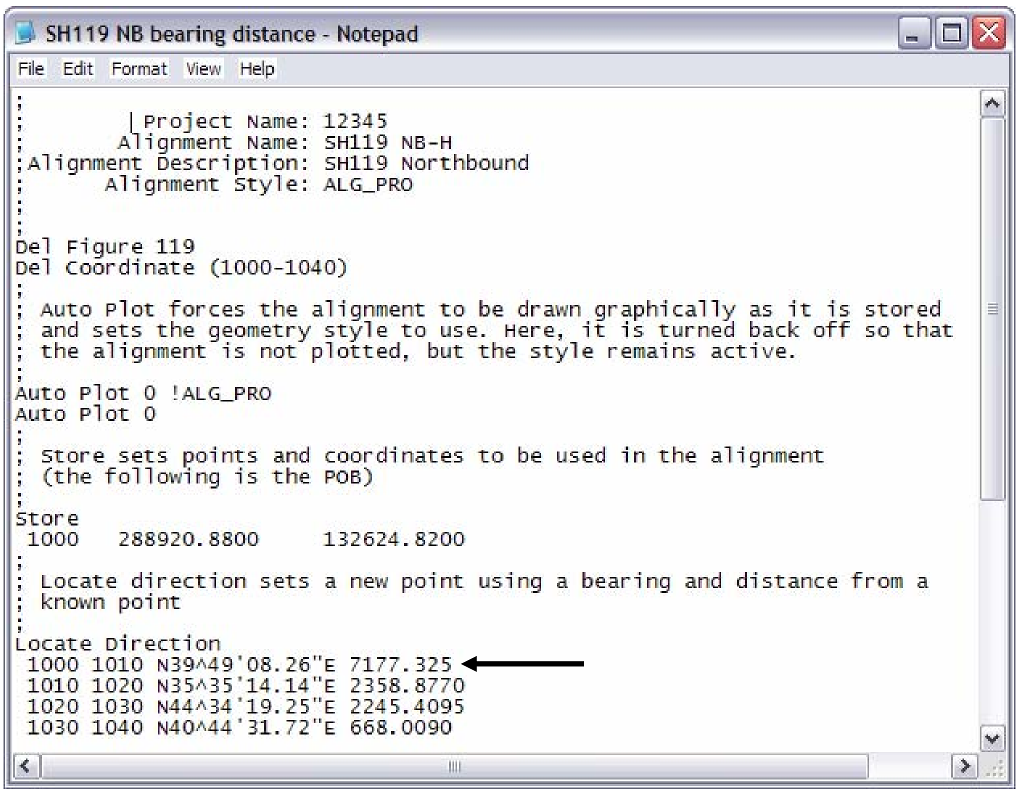


Correct the error in the .ics file

Open the file in Notepad

1. Select **File > Import > Geometry.**
2. On the **ICS** tab, **Browse** to select the **C:\Projects\12345\Design\InRoads\1.7.1\ SH119 NB bearing distance.ics** ICS file again if it is not already selected.
3. Select **Preview.**

   In **Notepad**, notice the first tangent length under the Locate Direction command is 7177.325. That is obviously an error. Upon investigation, you discover that the decimal is in the wrong place and the figure should be 717.7325.




```
;
;        Project Name: 12345
;      Alignment Name: SH119 NB-H
;Alignment Description: SH119 Northbound
;     Alignment Style: ALG_PRO
;
;
Del Figure 119
Del Coordinate (1000-1040)
;
; Auto Plot forces the alignment to be drawn graphically as it is stored
; and sets the geometry style to use. Here, it is turned back off so that
; the alignment is not plotted, but the style remains active.
;
Auto Plot 0 !ALG_PRO
Auto Plot 0
;
; Store sets points and coordinates to be used in the alignment
; (the following is the POB)
;
Store
 1000   288920.8800    132624.8200
;
; Locate direction sets a new point using a bearing and distance from a
; known point
;
Locate Direction
 1000 1010 N39^49'08.26"E 7177.325
 1010 1020 N35^35'14.14"E 2358.8770
 1020 1030 N44^34'19.25"E 2245.4095
 1030 1040 N40^44'31.72"E 668.0090
```

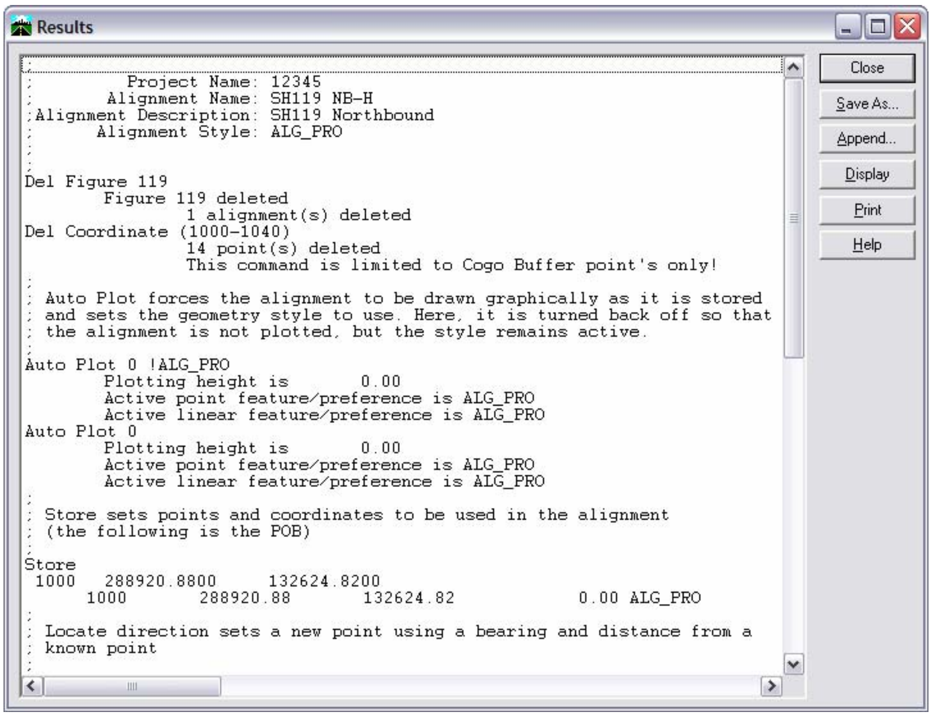
4. Change the first tangent to ***717.7325***
5. In **Notepad**, select **File > Exit** and then select **Yes** to save changes.

Run .ics file again

6. Select **Apply** to re-import the alignment.

   The alignment is replaced in the geometry project with the updated alignment from the ICS file.

   Notice in the Results box that the alignment and cogo points were deleted. This is because of the Del Figure and Del Coordinate commands that are at the top of the .ics file.



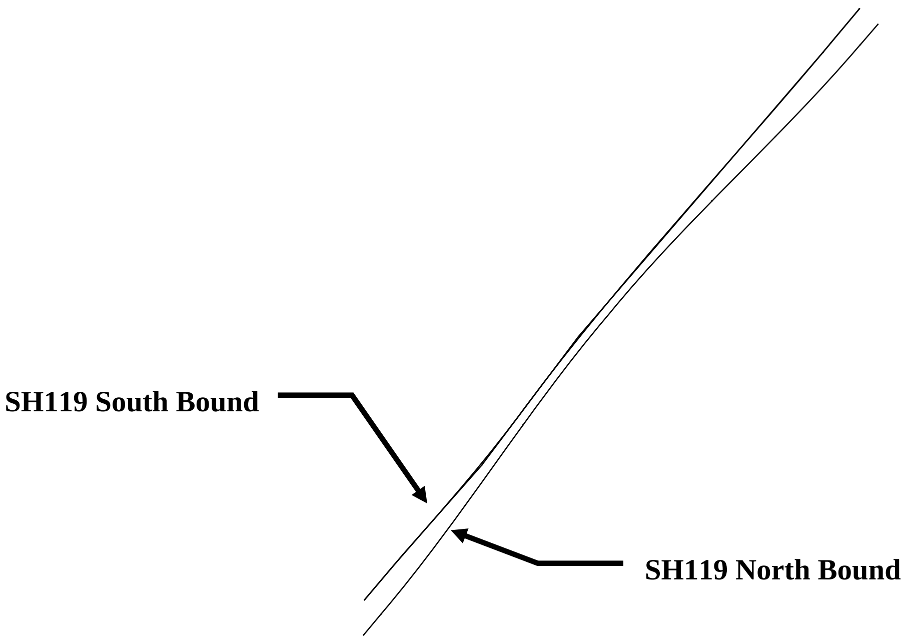
7. **Close** the **Results** box.

8. **Close** the **Import Geometry** box.

View the Alignment

1. From the **InRoads Explorer**, select the **Geometry** tab.
2. Right-click on the **119** alignment and select **View.**
3. **Fit** the view.

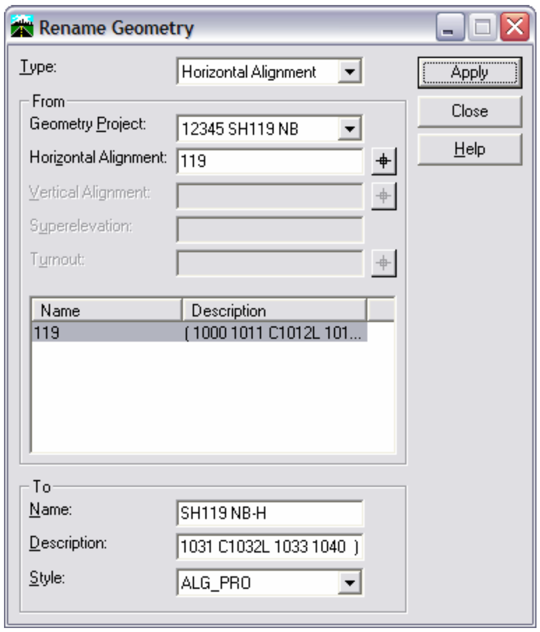
   Notice that the alignment now displays correctly.



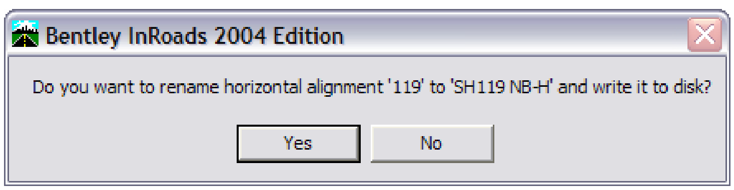
Rename the alignment

Since the alignment is now correct, you can rename it to the appropriate name. After renaming it, if the .ics file needs to be run again, you must manually delete the alignment first.

1. Select **Geometry > Rename Geometry.**
2. Set the **Type** to **Horizontal Alignment.**
3. Set the **From** to **119.**
4. Under the **To** category, key in ***SH119 NB-H***



5. Choose **Apply**.



6. Select **Yes** when asked if you want to make the change and write it to disk.
7. **Close** the **Rename Geometry** dialog.

Save geometry project

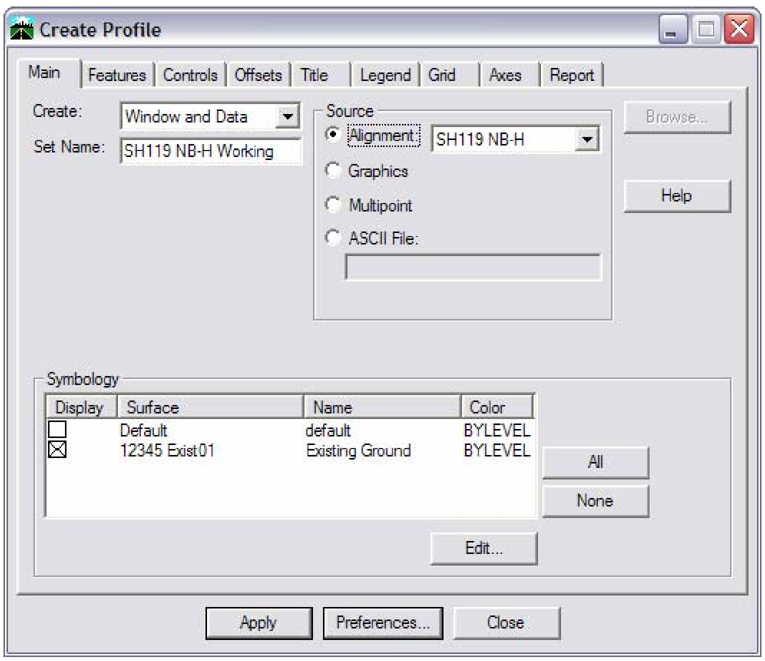
1. Select **File > Save > Geometry Project.**

Create a profile of the horizontal showing the existing ground

1. Select **Evaluation > Profile > Create Profile.**
2. Select **Preferences**, highlight the **2x Vertical** preference, then **Load**

   On the **Main** tab:

   - Verify that **Alignment** is **SH119 NB-H.**
   - Key in a **Set Name** of ***SH119 NB-H Working***
   - Toggle **on** the surface **12345 Exist01.**



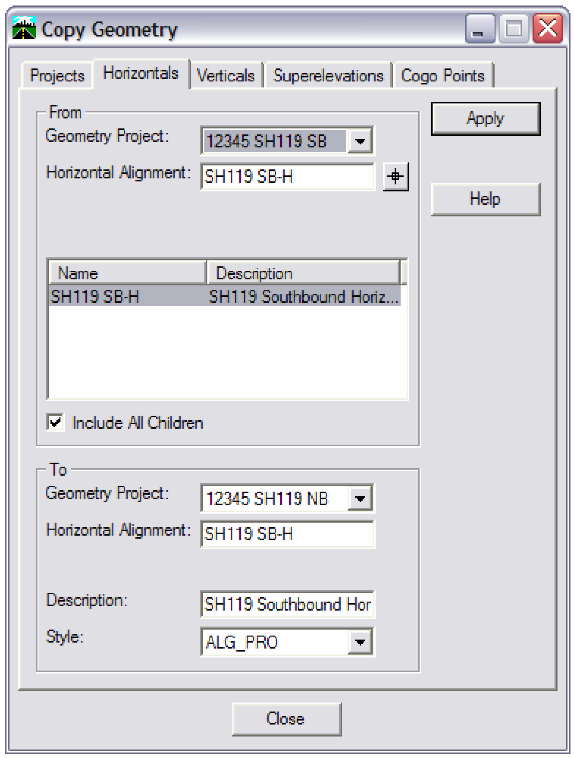
3. **Apply** and then **<D>** for the location of the lower left corner of the profile.
4. **Close** the **Create Profile** box.

Update the Profile with the CL of SH119 SB

Copy the SB alignment into the NB project

1. For reference, you will next display the vertical alignment elevations of SH119 SB onto the profile of SH119 NB. In order to do this, both horizontals have to be in the same geometry file. Therefore, you will first copy the southbound alignment into the northbound geometry project.

2. Select **Geometry > Copy Geometry**.



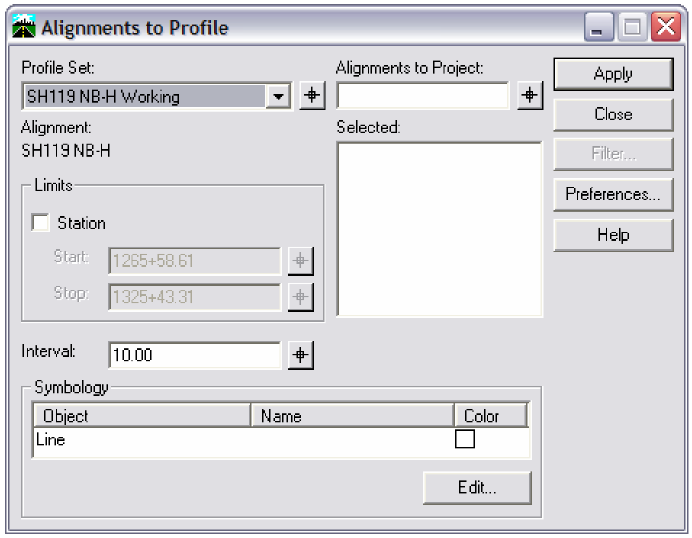
3. Select the **Horizontals** tab.

   - Set the **From Geometry Project** to **12345 SH119 SB**.
   - Highlight the alignment **SH119 SB-H**.
   - Set the to Geometry Project to **12345 SH119 NB**.

4. Select **Apply**, then **Close**.

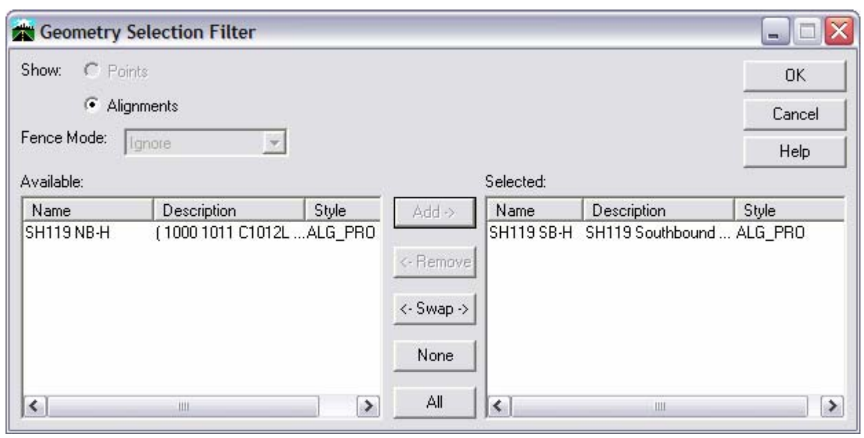
Project the SB Vertical onto the NB Profile

5. Select **Evaluation > Profile > Alignments to Profile.**



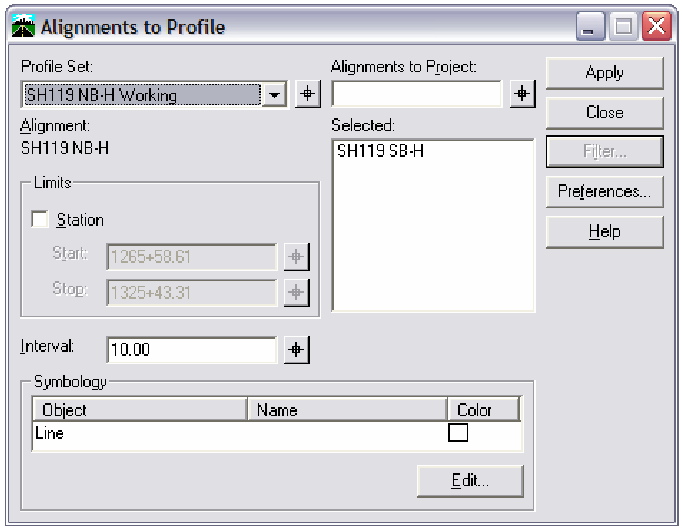
6. Verify that the **Profile Set is SH119 NB-H Working**.

7. **<D>** in the **Alignment to Project** field and select **Filter**.



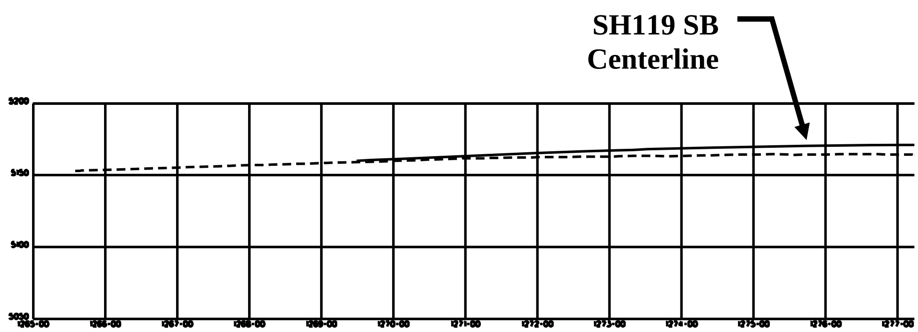
8. Highlight **SH119 SB-H** on the left and select **Add**.

9. Select **OK**.



10. **Apply**, then **Close** the **Alignments to Profile** box.

11. **Zoom in** to the beginning of the profile.

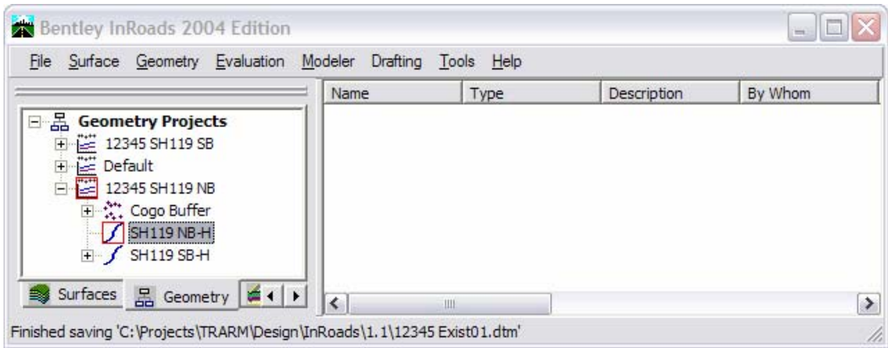


The profile is updated with the South Bound centerline vertical alignment. This command can be used to project any vertical alignment onto the profile of another horizontal.

Develop the Vertical using an .ics file

Instead of using the **Vertical Curve Set** tools or a script file, you'll create the vertical alignment for SH119 NB by importing an ICS file.

1. Verify that the **SH119 NB-H** horizontal alignment is active.



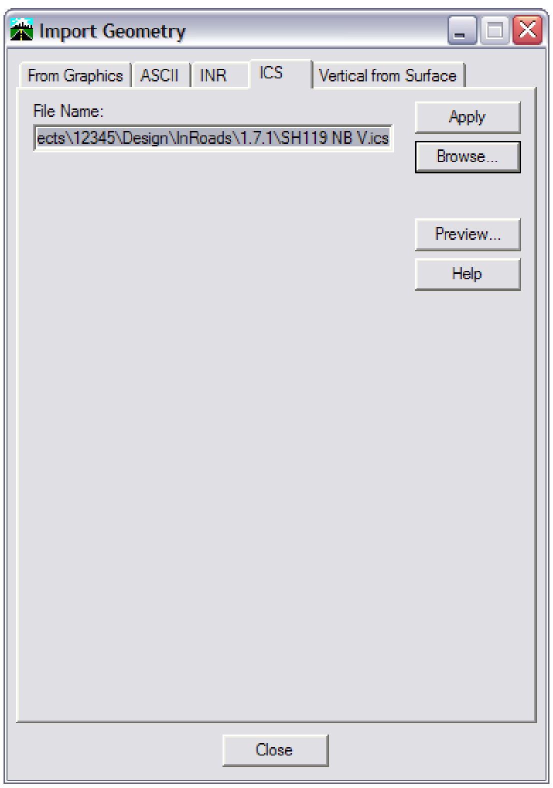
2. Select **File > Import > Geometry.**

3. Select the **ICS** tab.

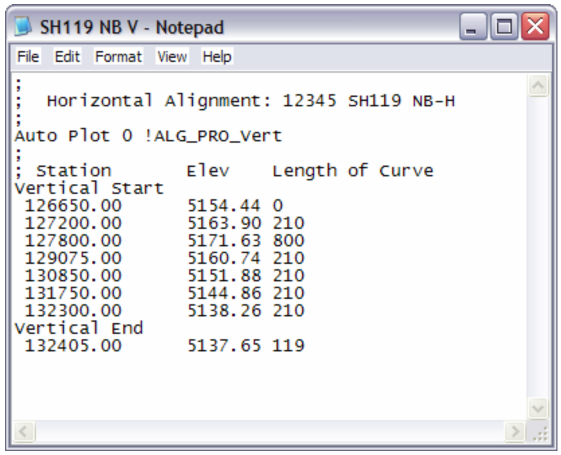
4. Click in the **Filename** field and select **Browse.**

5. Set the **Look in** folder to **C:\Projects\12345\Design\InRoads\1.7.1**

6. Choose the file **SH119 NB V.ics** and then select **Open.**



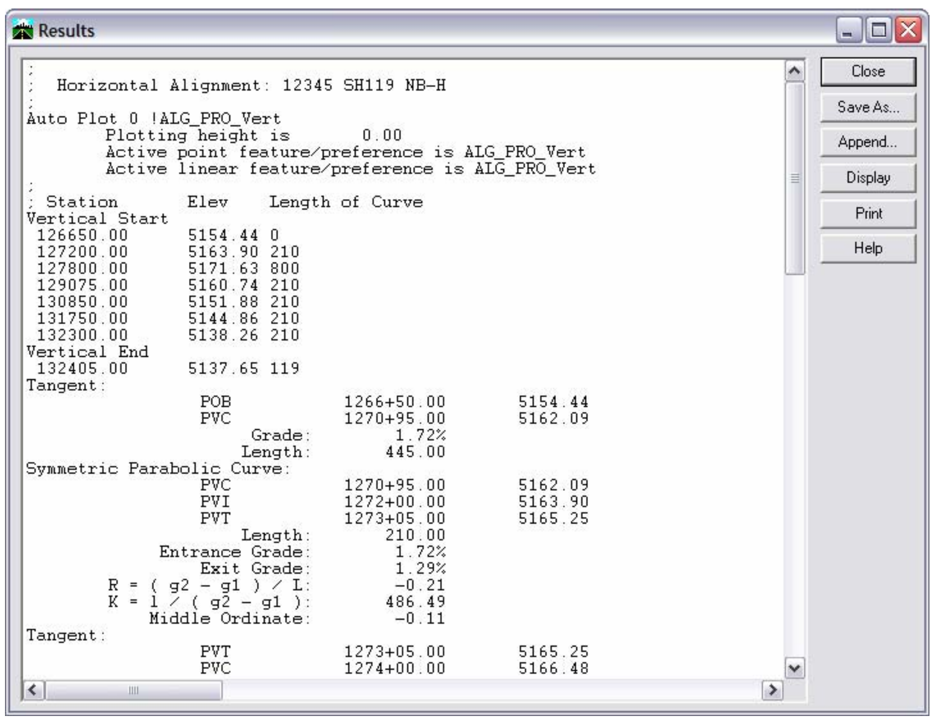
7. Select the **Preview** button.



The ICS file contains commands for creating a vertical alignment similar to those used to create the horizontal.

8. When you've finished review the ICS file, select **File > Exit** from **Notepad.**

9. Select **Apply** to import the ICS file.



The **Results** box, detailing all of the vertical geometry, appears since the **Report** lock is on.

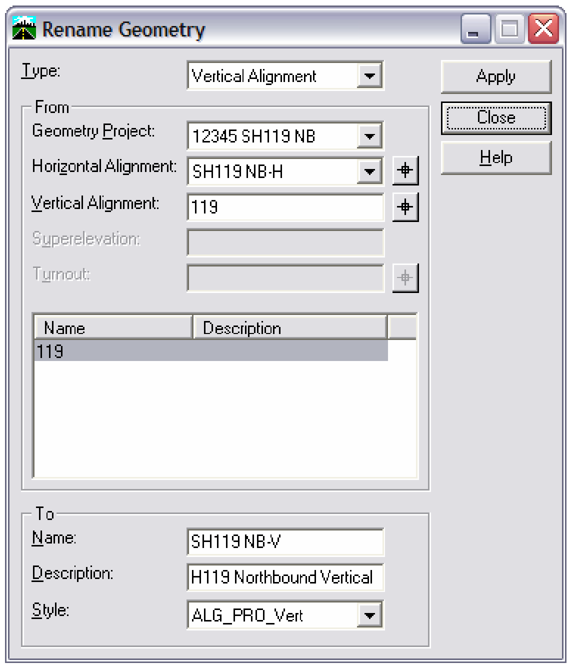
10. **Close** the **Results** box.

11. **Close** the **Import Geometry** box.

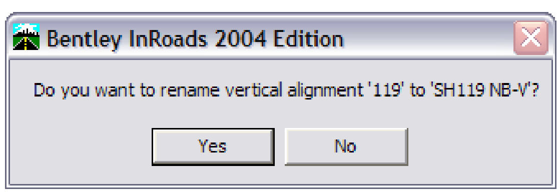
Rename the alignment

After renaming the vertical alignment, if the .ics file needs to be run again, you must manually delete the alignment first.

1. Select **Geometry > Rename Geometry.**
2. Set the **Type** to **Vertical Alignment.**
3. Set the **From Vertical Alignment** field to **119.**
4. Under the **To** category, key in ***SH119 NB-V*** for **Name.**
5. Set **Description** and **Style** as shown.



6. Choose **Apply**, then **Yes** when asked if you want to make the change and write it to disk.

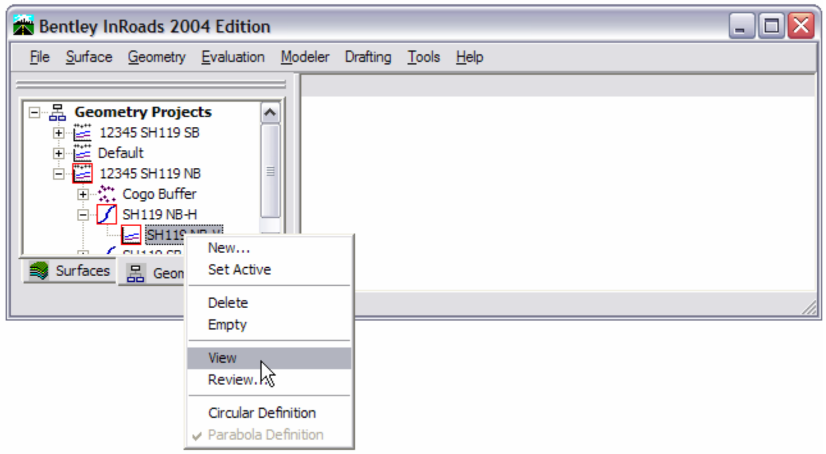


7. **Close** the **Rename Geometry** dialog.
8. **Save the Geometry Project.**

View the alignment

1. From the **InRoads Explorer Geometry** tab, expand the **SH119 NB-H** horizontal alignment to see the vertical alignment that you just imported.

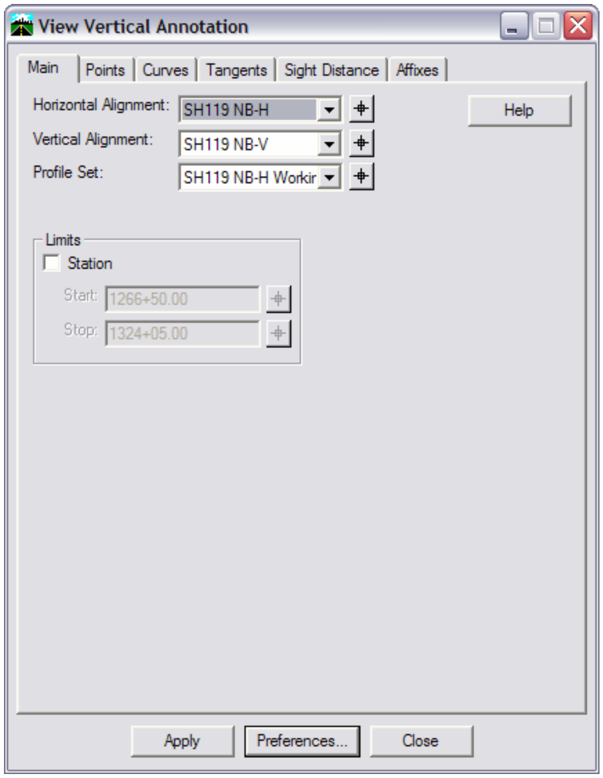
2. Right-click on the **SH119 NB-V** alignment and select **View.**



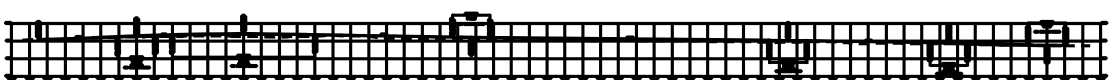
3. Window in on the **SH119 NB-H Working** profile to see the vertical alignment.

Annotate the vertical alignment

1. Select **Geometry > View Geometry > Vertical Annotation.**
2. Select **Preferences**, highlight the **Proposed** preference and **Load.**
3. Verify that the horizontal and vertical alignments and profile set are as shown.



4. **Apply** the command.



The SH119 NB vertical alignment is displayed and annotated with the proposed preference.

Save geometry project

1. Select **File > Save > Geometry Project.**

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All.**
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

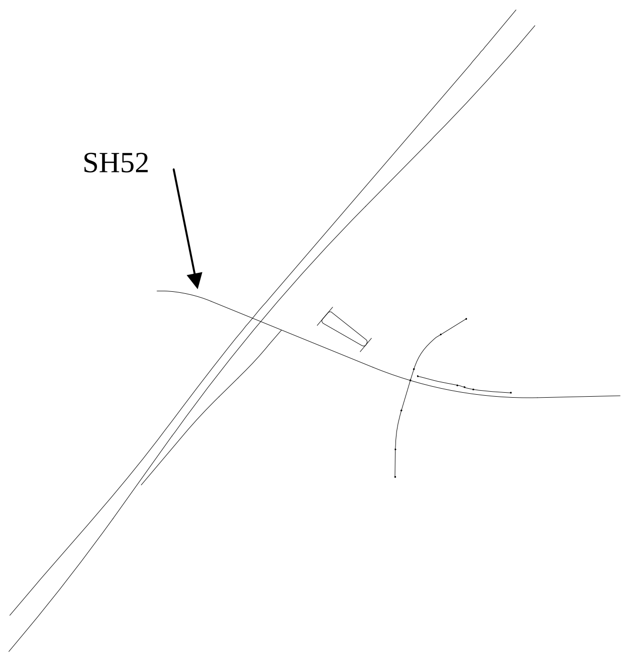
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit.**
2. If prompted to save data files select **Yes**.

Challenge Lab 1.7.2 – Create .ics files for SH52 Horizontal and Vertical alignments

In this activity you will develop .ics files and import them to create a horizontal and a vertical alignment for SH52. You will be given information about the alignments in electronic form to minimize the typing.



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

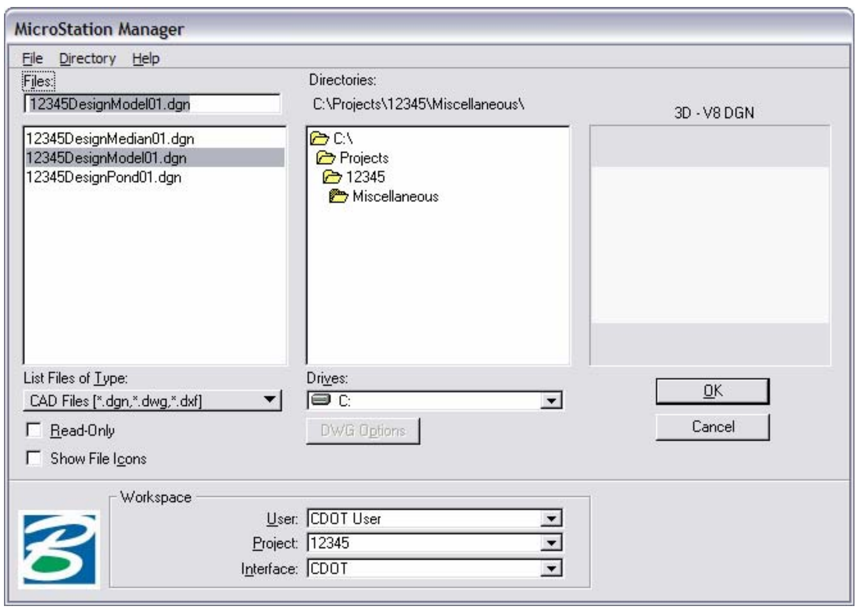
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Design\Working.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK**.

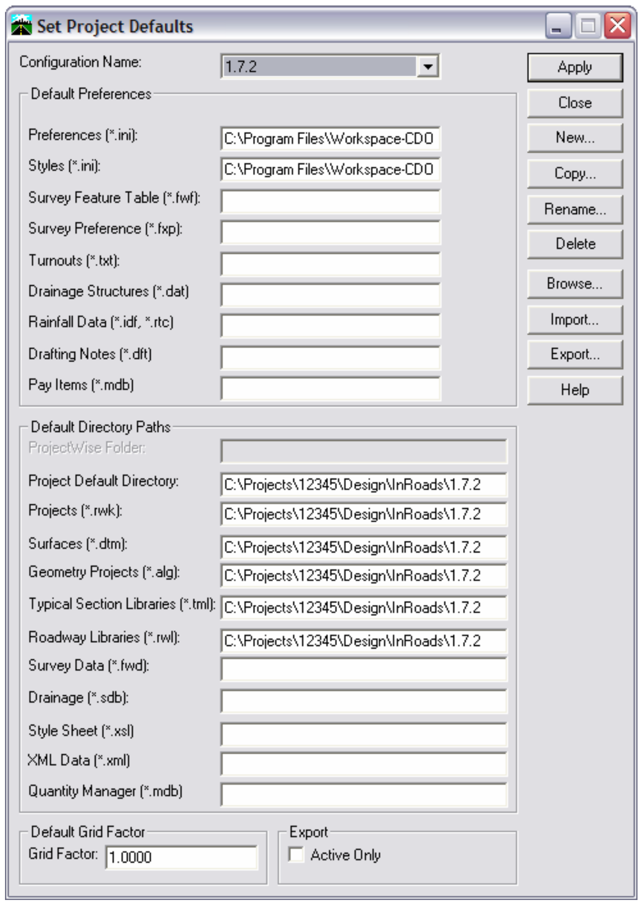
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **1.7.2**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry projects for SH119

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 NB.alg** and then select **Open**.
4. Highlight **12345 SH119 SB.alg** and then select **Open**.
5. ***Do not*** cancel out of the dialog box.

Load SH119 DTMs

6. Set **File of Type** to **Surfaces (*.dtm)**.
7. Highlight **12345 SH119 NB top.dtm** and select **Open**.
8. Highlight **12345 SH119 SB top.dtm** and select **Open.**
9. ***Do not*** cancel out of the box.

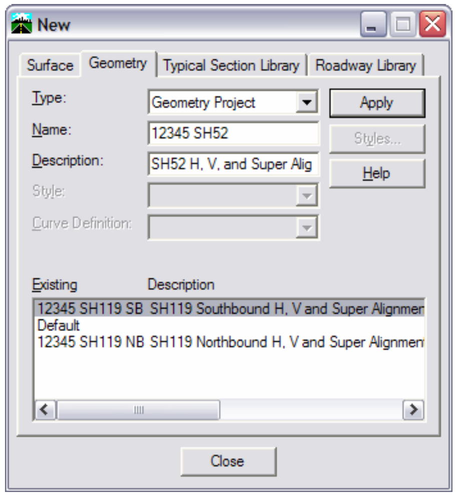
Load the existing DTM

10. Highlight **12345 Exist01.dtm** and then select **Open**.
11. **Cancel** the **Open** dialog box.

Create a new geometry project for 12345 SH52

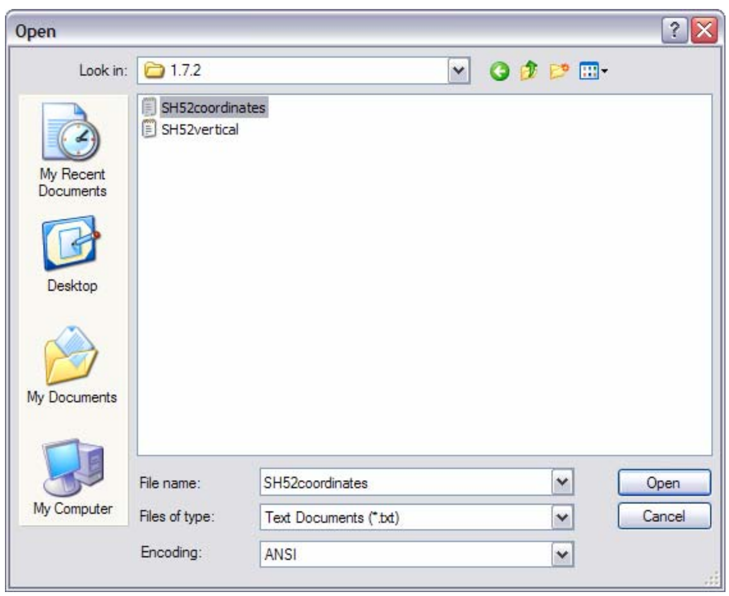
1. Select **File > New** and set the **Geometry** tab as shown:

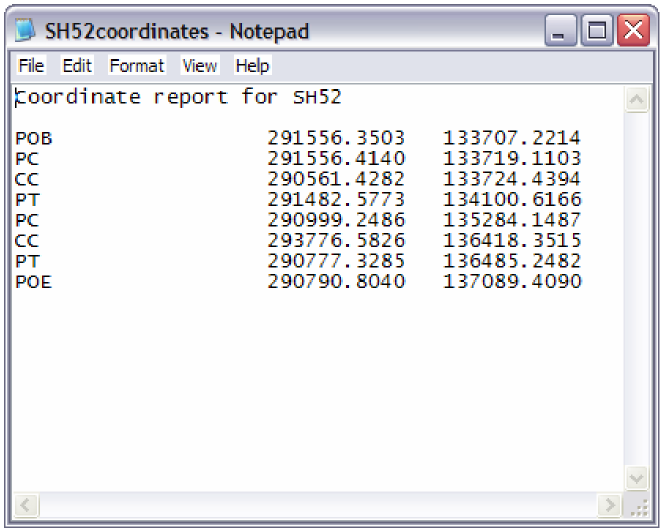
   Note: The entire **Description** is ***SH52 H, V, and Super Alignments.***



Create an ics file for the SH52 horizontal alignment

1. Start **Notepad** and open the file **SH52coordinates.txt**.





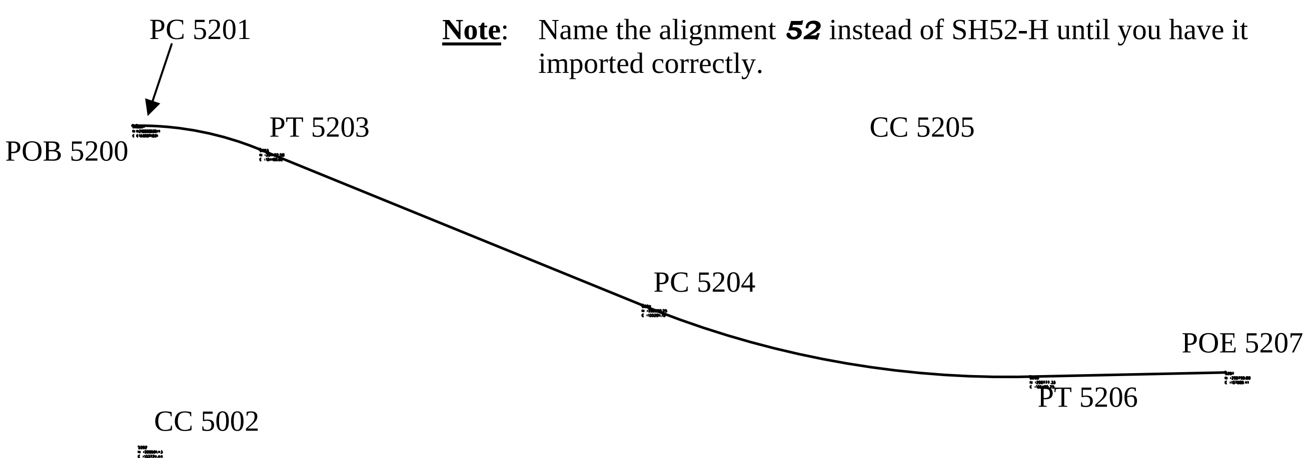
Coordinate report for SH52

POB	291556.3503	133707.2214
PC	291556.4140	133719.1103
CC	290561.4282	133724.4394
PT	291482.5773	134100.6166
PC	290999.2486	135284.1487
CC	293776.5826	136418.3515
PT	290777.3285	136485.2482
POE	290790.8040	137089.4090

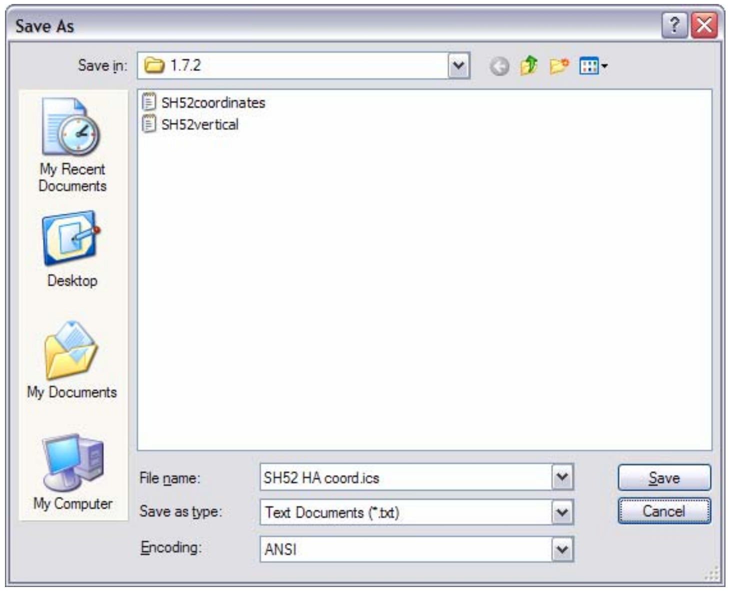
This file lists the Coordinates for the key points in SH52.

2. Using this information, your .ics file handout and what you have learned about .ics files, edit this file to make it into an .ics file that will create the horizontal alignment for SH52. For visual reference, you can use the picture below.

Note: Name the alignment ***52*** instead of SH52-H until you have it imported correctly.



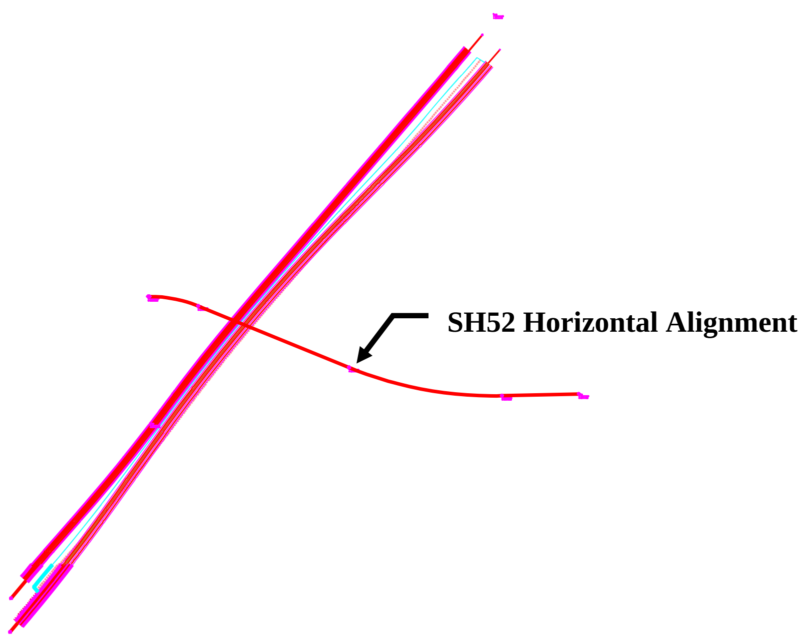
3. When you are ready to test your file, select **File > Save As** and save the file. Name it ***SH52 HA coord.ics***



Import your .ics file for SH52-H

1. In InRoads, select **File > Import > Geometry**.
2. On the **ICS** tab, import the file **SH52 HA coord.ics** from the **C:\Projects\12345\Design\InRoads\1.7.2** folder.

   The alignment is created and set active in the geometry project. If **Auto Plot** is toggled on in the **.ics** file, the alignment is automatically displayed along with the points used to form it.



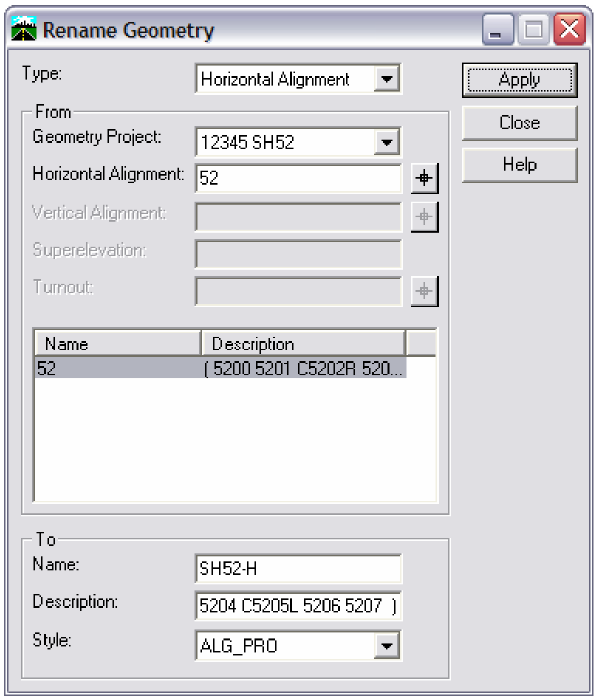
3. If something went wrong with your .ics file, you can **Preview** it from the **Import** dialog. This opens it in **Notepad** where you can make edits, **Save** them, **Close** the file and try the import again.

   Note: If your .ics file does not contain **Delete** commands for the alignment and points at the beginning of the file, you will have to manually delete these prior to importing again.

Rename the alignment

Once you have the .ics file completed, you can rename the alignment to the appropriate name. After renaming it, if the .ics file needs to be run again, you must manually delete the alignment first.

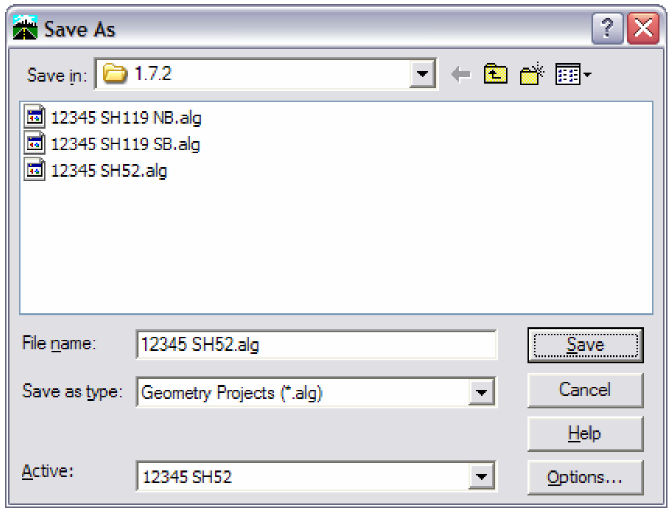
1. Select **Geometry > Rename Geometry** and rename the alignment from **52** to ***SH52-H***



Save geometry file

1. Select **File > Save > Geometry Project.**

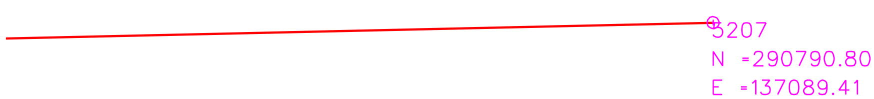
2. Make certain the **Active Project** and **File Name** are set to **12345 SH52.**



Set the stationing of the horizontal alignment

1. Select **Geometry > Horizontal Curve Set > Stationing.**

2. Window in on the end of the **SH52-H** alignment in your design file and note that it ends at cogo point 5207.



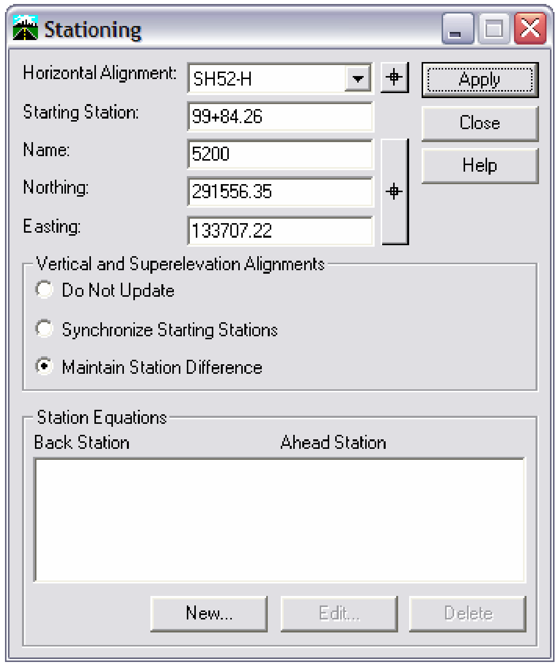
<u>Note</u>: You will set the beginning station by assigning a station to the end point. InRoads will then back out what the beginning station needs to be. Here, you want the end station to be 135+00.

3. In the **Stationing** dialog, key in ***13500*** for the **Start Station.**

4. Key in ***5207*** for the **Name.**

5. Choose **Apply.**

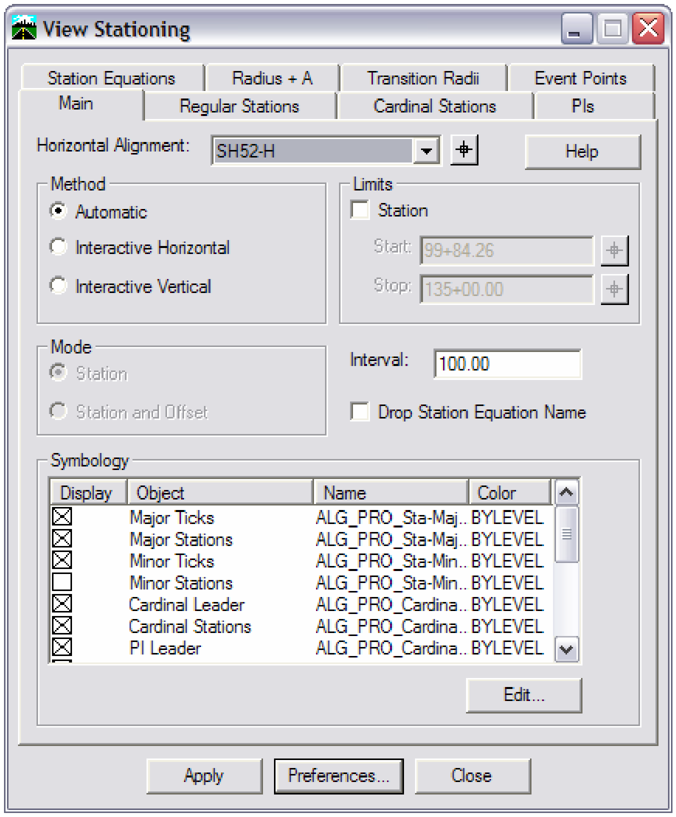
   The beginning station is now **99+84.26.**



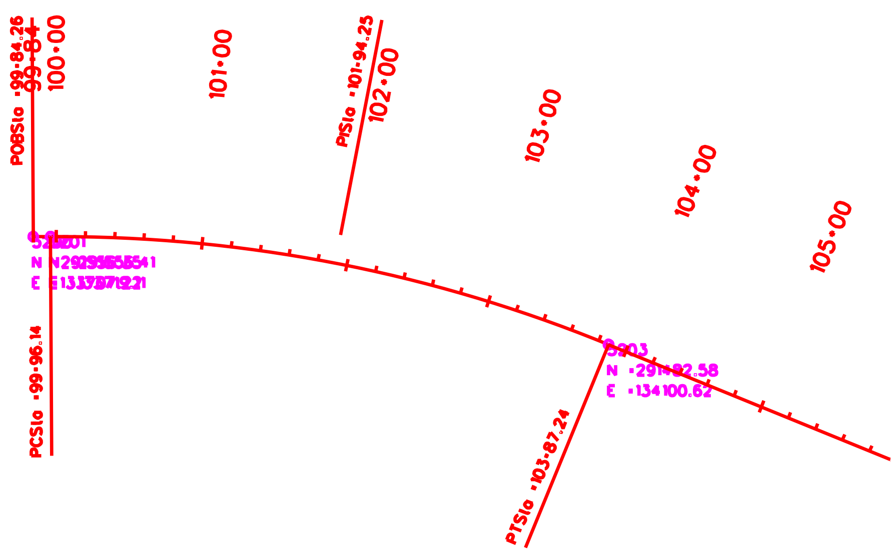
6. **Close** the Stationing dialog.

Station horizontal alignment

1. Select **Geometry > View Geometry > Stationing** and station the alignment using the **Proposed-100 Ft Interval** preference.

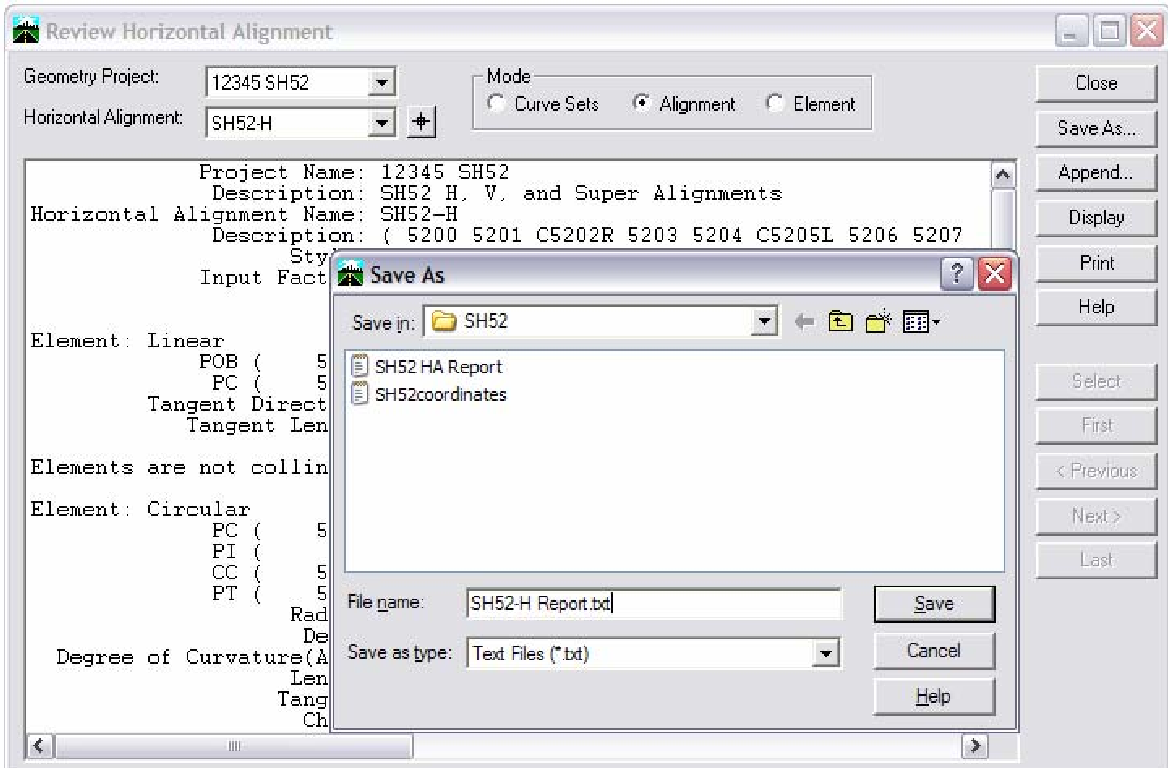


2. **Zoom in** to the beginning of the alignment and take a look at the stationing.



Generate report of horizontal alignment

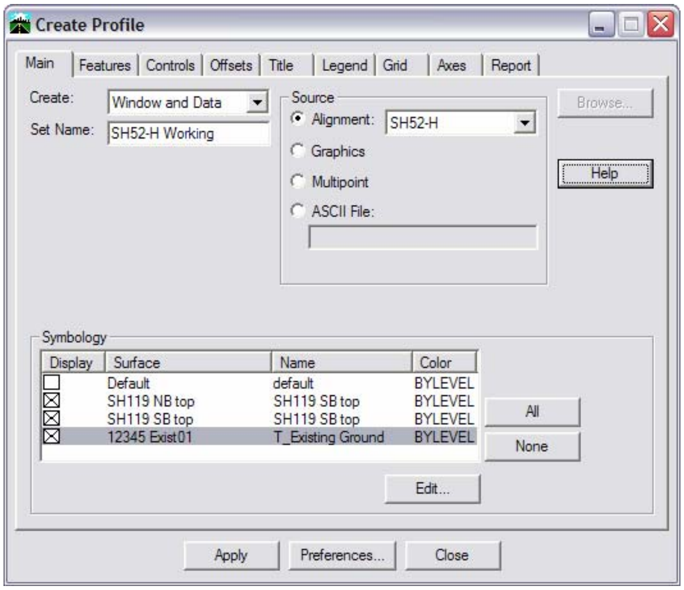
1. Select **Geometry > Review Horizontal**.
2. Review the report.
3. **Save** a copy of the text file and name it ***SH52-H Report.txt***



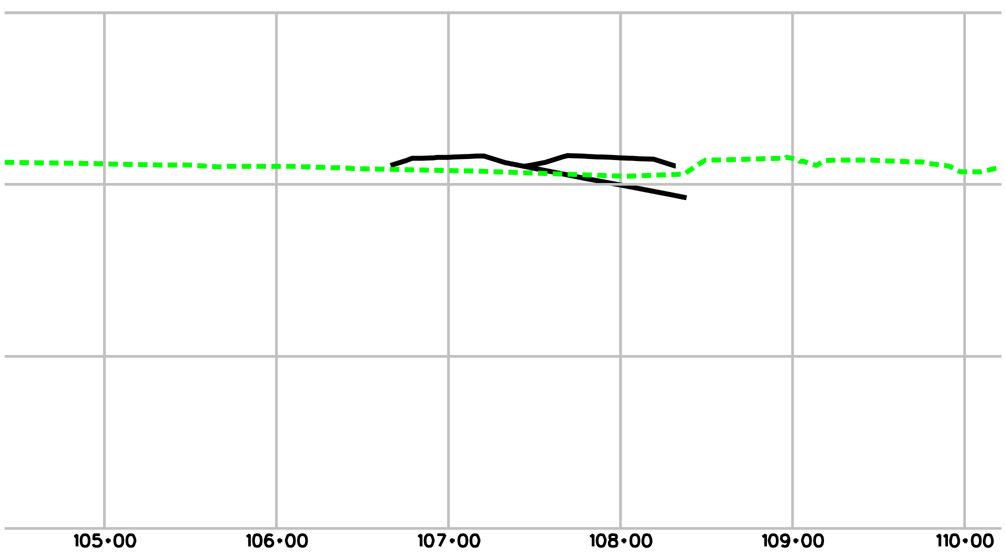
4. Save the geometry project (**File > Save > Geometry Project**).

Create a profile of SH52-H

1. Select **Evaluation > Profile > Create Profile**
    - Use the **2x Vertical** preference.
    - Use a **Set Name** of ***SH52 Working***
    - Toggle **on** the surfaces **12345Exist01, SH119 SB top** and **SH119 NB top.**

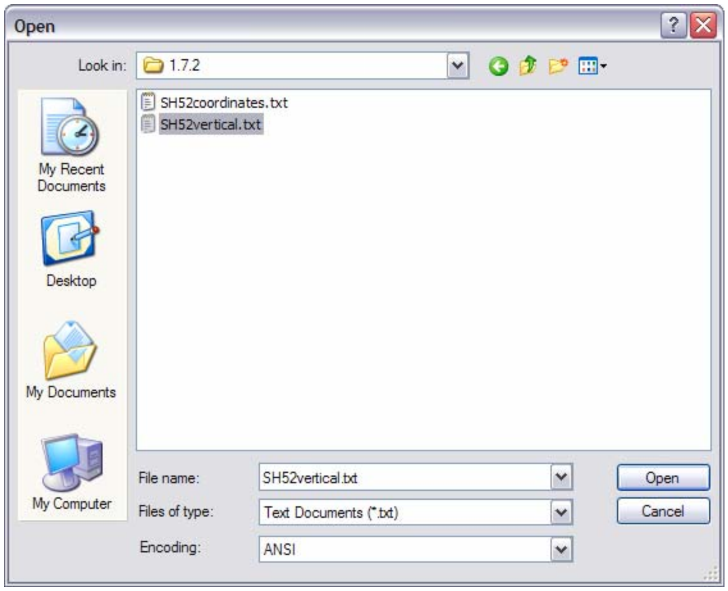


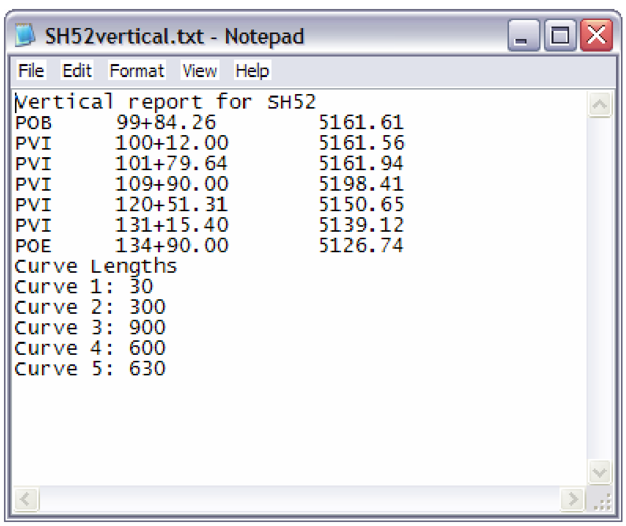
Note: The two SH119 surfaces have not yet been combined, so you will still see the right side of SH119 SB extended to form the target for SH119 NB.



Create an ics file for the SH52 vertical alignment

1. Start **Notepad** and open the file **SH52vertical.txt**.

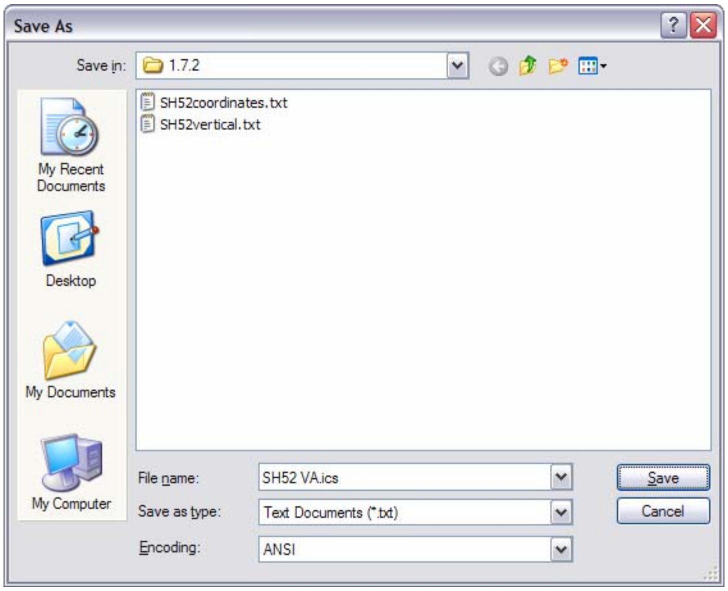




2. This file lists the vertical PIs and curve Lengths in SH52. Using this information, your .ics file handout and what you have learned about .ics files, edit this file to make it into an .ics file that will create the vertical alignment for SH52. For visual reference, you can use the following picture.

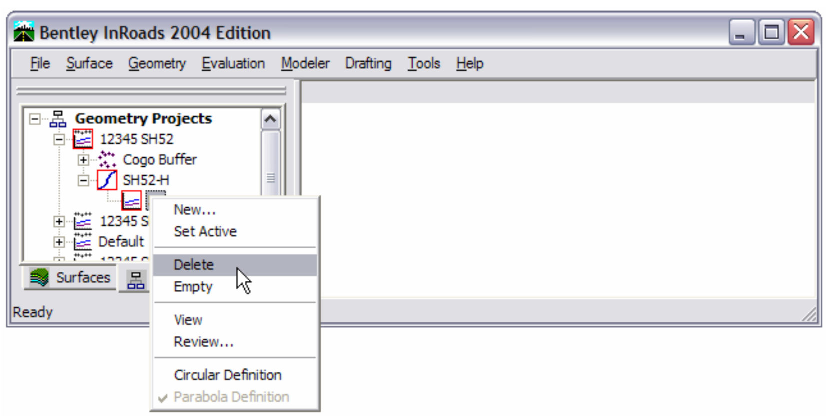
Note: Name the alignment ***52*** instead of SH52-V until you have it imported correctly.

3. When you are ready to test your file, select **File > Save As** and save the file. Name it ***SH52 VA.ics***



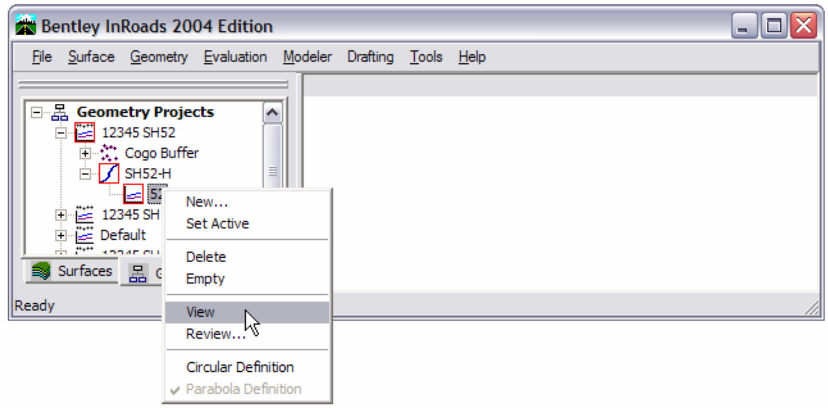
Import the .ics file

1. In InRoads, select **File > Import > Geometry.**
2. On the **ICS** tab, import the file **SH52 VA.ics** from the **C:\Projects\12345\Design\InRoads\1.7.2** folder.
3. If something went wrong with your .ics file, you can **Preview** it from the **Import** dialog. This opens it in **Notepad** where you can make edits, **Save** them, **Close** the file and try the import again.
4. Since you cannot delete the vertical alignment from within the .ics file, you must first **Delete** the erroneous one if it was created.

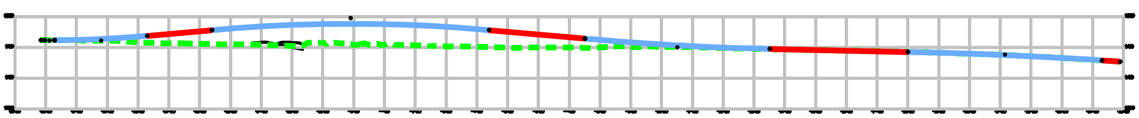


View the SH52 vertical alignment

1. View the alignment from the **InRoads Explorer Geometry** tab.



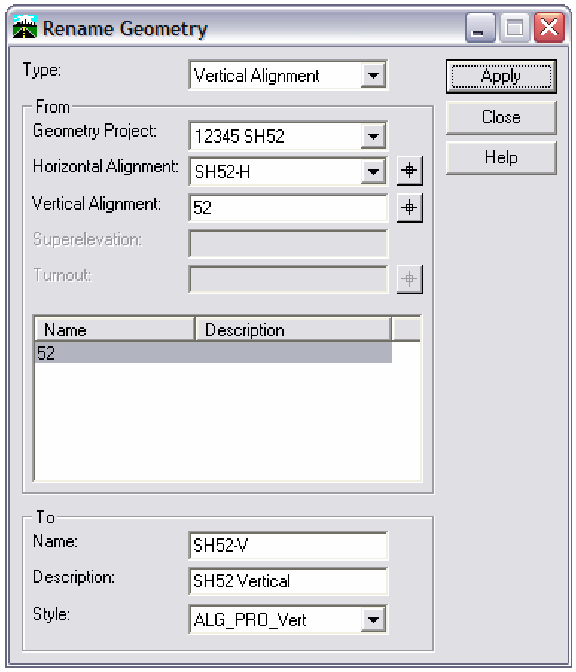
2. Window in on the **SH52 Working** profile to see the vertical alignment.



Rename the alignment

You can now rename it to the appropriate name. After renaming it, if the .ics file needs to be run again, you must manually delete the alignment first.

1. Select **Geometry > Rename Geometry** and rename the alignment from 52 to ***SH52-V.*** Set the other options as shown.



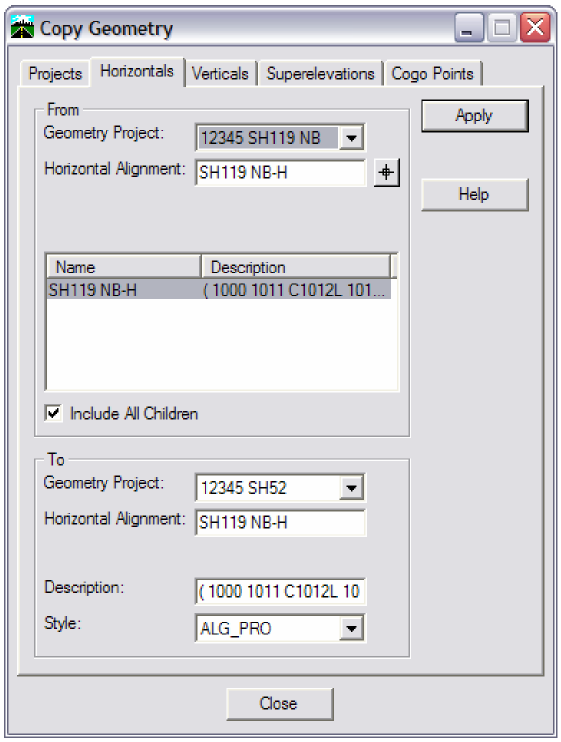
2. **Save** the geometry project.

Generate Vertical Clearance reports

In order to create a vertical clearance report between alignments, both must reside in the same geometry project. Here, you'll temporarily copy SH119 NB-H into the current geometry project to create the report.

Copy the alignment

1. Select **Geometry > Copy Geometry** and copy the **SH119 NB-H** alignment ***from*** project **12345 SH119 NB** ***to*** the current project **12345 SH52**. Be sure to toggle ***on*** **Include All Children**.

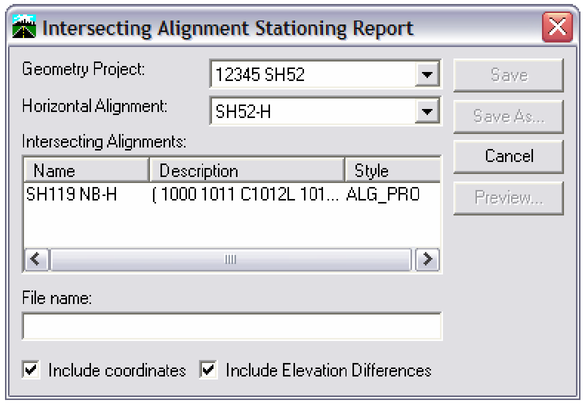


Generate the Clearance Report

Use a macro to generate the clearance report between SH52-H and SH119 NB-H.

1. Select **Tools > Run Macro.**
2. Select the macro **IntersectingAlignmentStnRpt.dll.**
3. Select **Open.**

4. Set the dialog box as shown.

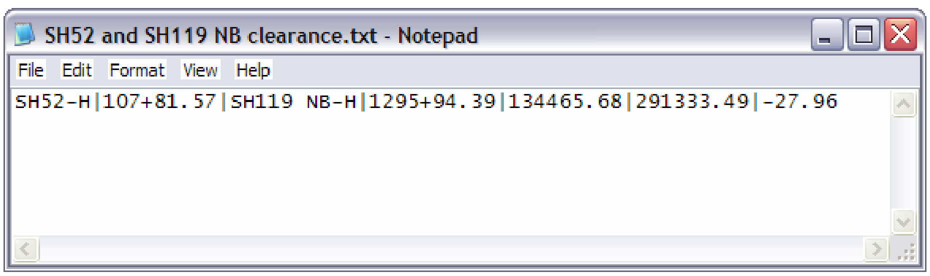


5. Click in the **File name** field, the select **Save As...**

6. In the **Save As File name** box, key in ***SH52 and SH119 NB clearance.txt***

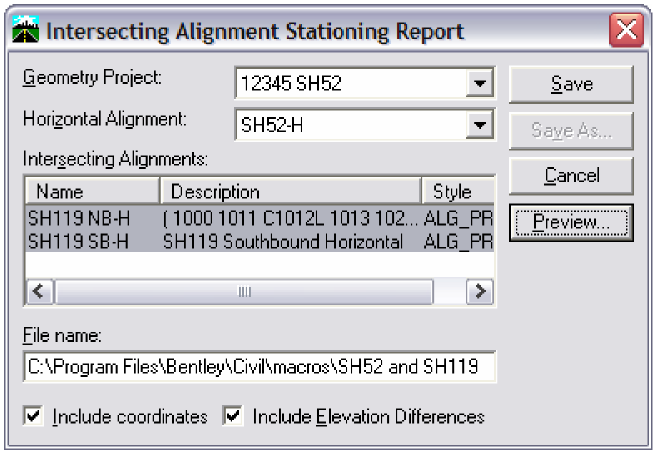
7. Select **Save.**

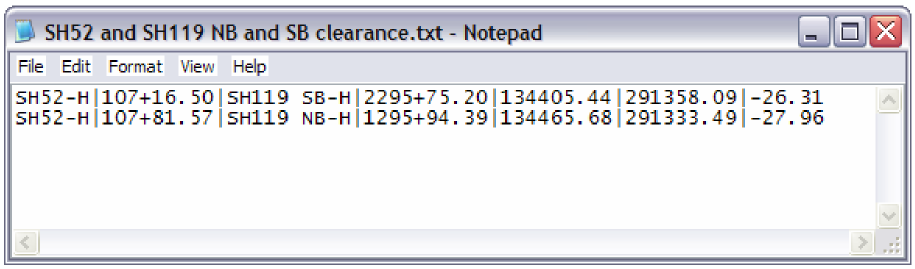
8. Select **Preview** to view the report.



Note: This may not be the tightest clearance due to girders, supers, etc.

9. Repeat this process and copy **SH119 SB-H** into the **SH52** project. You can highlight both NB and SB to generate one report showing both clearances.





10. Save the geometry project (**File > Save Geometry Project**).

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Challenge Lab 1.8 – Creating an ics file for Ramp A vertical

In this activity, you will create an .ics file for RampA's vertical alignment. The vertical is controlled by SH119 NB at the beginning, so it must match the elevations of the widened SH119 NB initially. The given information here has been or will be created in other activities in this class. It is provided so you can concentrate on the area of interest.

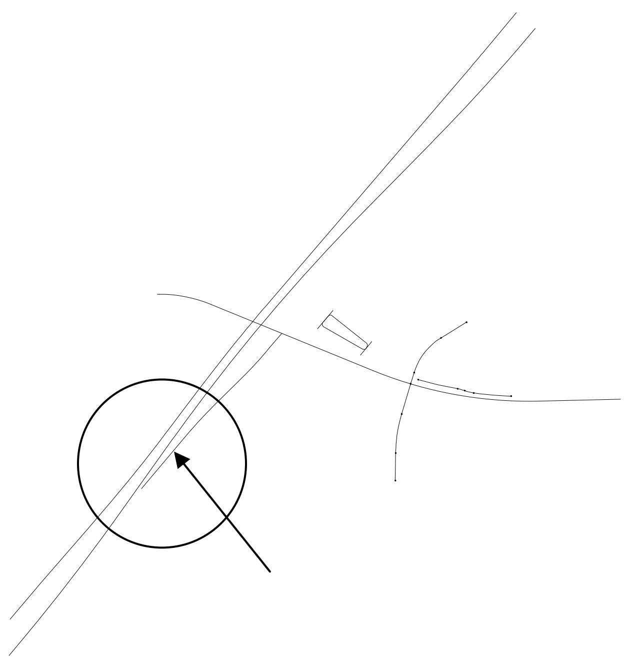
Given: **12345 SH119 NB top.dtm** – This DTM has already been modeled and widens to meet the horizontal for RampA.

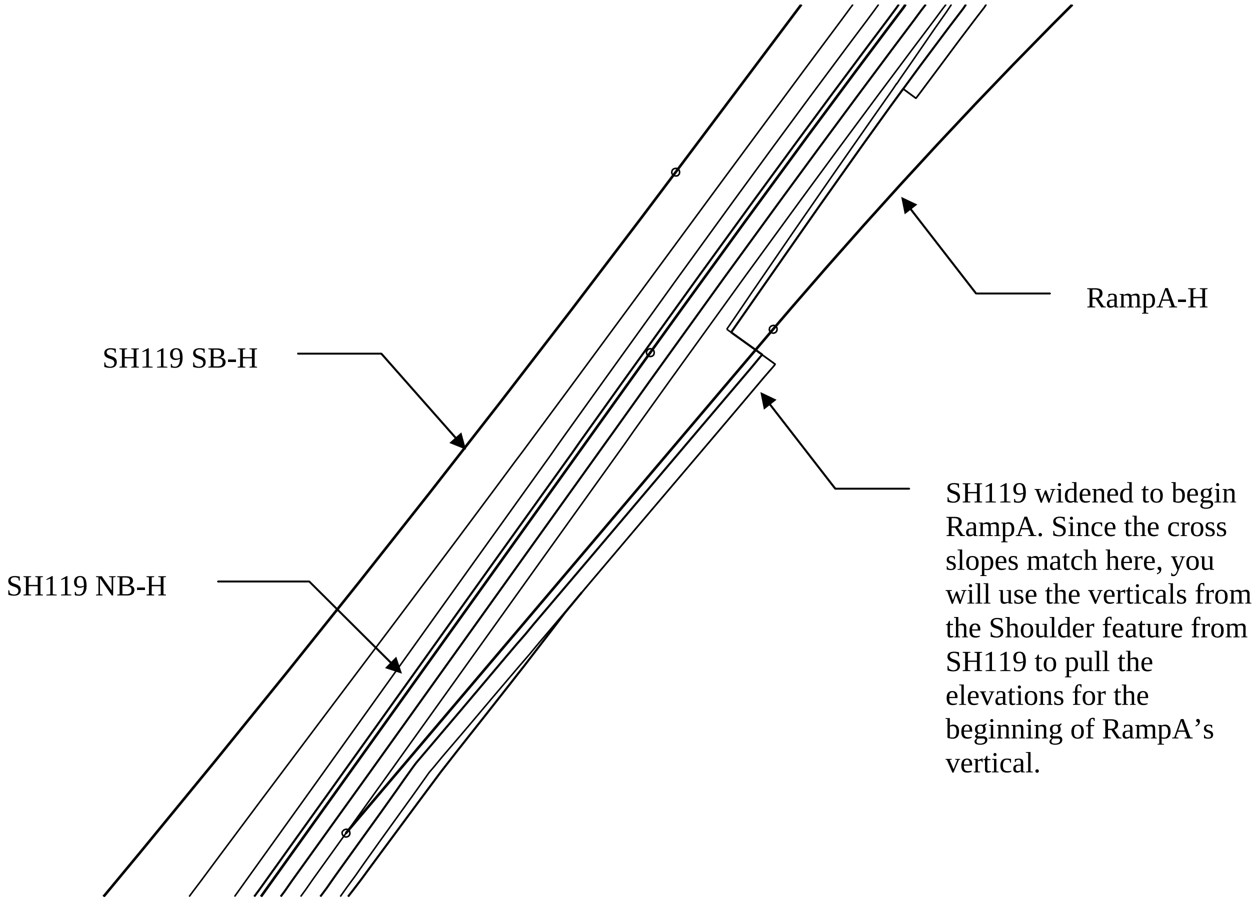
12345 SH52 71st intersection.dtm – This is the DTM the ramp will tie into at the other end.

12345 SH119 SH52 Interchange.alg – This geometry project contains the horizontal alignment for RampA.

PI and Vertical Curve information for the portion of RampA that is not controlled by **SH119 NB**.

Required: **RampA-V** – You will create an ics file for RampA-V based on a report of the elevations from SH119 NB at the beginning, then use the VPI and curve data for the rest of the vertical.




SH119 SB-H
SH119 NB-H
RampA-H
SH119 widened to begin RampA. Since the cross slopes match here, you will use the verticals from the Shoulder feature from SH119 to pull the elevations for the beginning of RampA's vertical.

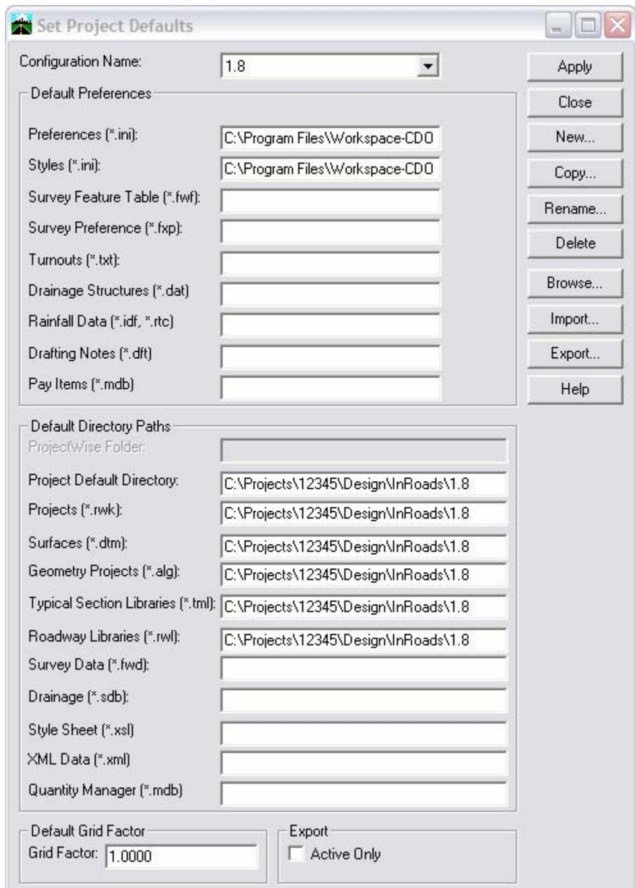
Preliminary set-up

3. Start MicroStation InRoads and open the file **12345DesignModel01.dgn**.
4. Select **File >Project Defaults**.
5. Set the **Configuration Name** to **1.8**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

6. Select **Apply**.

Important! Verify your dialog box appears as shown:

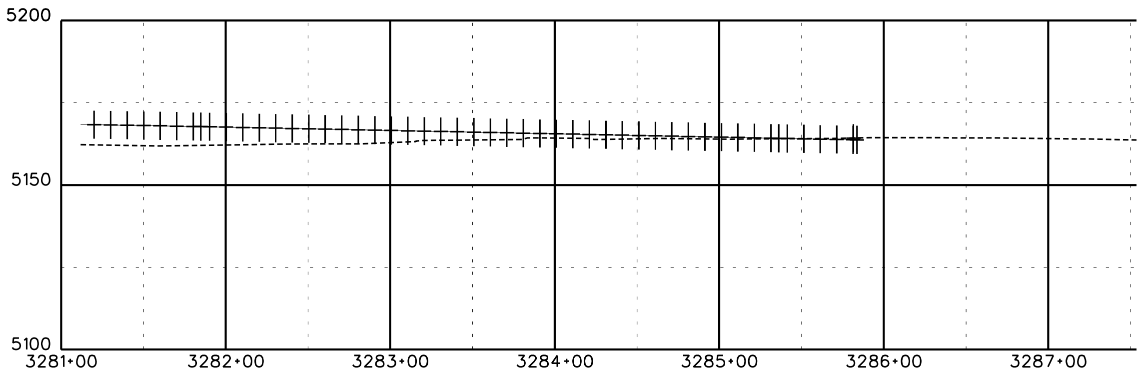


7. **Open** the appropriate data files (refer to **Given** statement).

Create a profile of RampA

On the profile of RampA, you will show the feature from SH119 NB top that indicates the elevations you must match when creating the vertical alignment.

1. Profile the Ramp A Horizontal Alignment.
2. Show Surfaces: **12345 Existing01**, **SH119 NB top**, **SH52 71st intersection.**
3. On the **Feature** tab, toggle on **Projected Features** and highlight only **SH119NBRT_Ramp_Shoulder**.



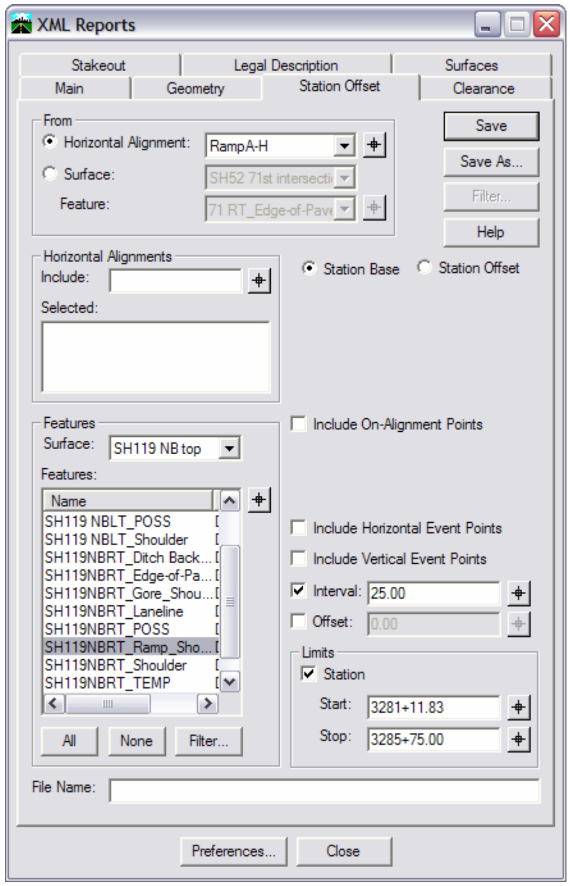
Notice the feature at the beginning of the profile, showing where the ramp is vertically at that horizontal location. You could annotate the feature with elevations, but in this case there’s a better method of getting that information. You will generate a report showing the exact elevations, which you can use as part of the vertical alignment for the ramp.

Since you’ll be using a report to generate the elevations, you don’t need to leave the feature projected onto the profile and can toggle it off with the **Update Profile** command.

Create a report with station elevation information

In the report, you'll need station information every 25 feet along RampA, with the corresponding elevations for the Shoulder feature from SH119 NB.

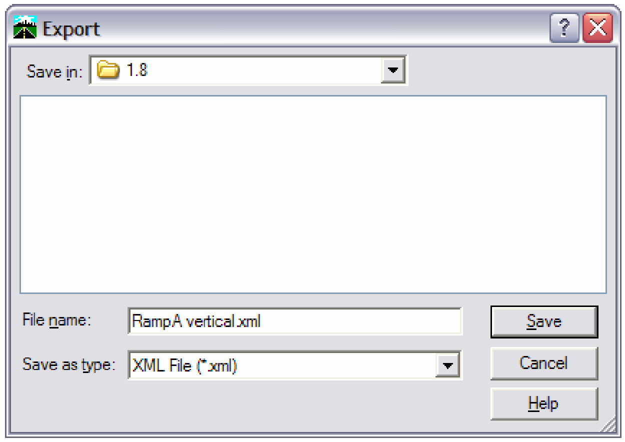
1. Select **Tools > XML Reports**.



2. Select the **Station Offset** tab.

   - Choose the From Horizontal Alignment **RampA-H**.
   - Under the **Features** category, Set the **Surface** to **SH119 NB top**.
   - Highlight the feature **SH119NBRT_Ramp_Shoulder**.
   - Toggle on **Station Base**.
   - Set the **Interval** to ***25***.
   - Toggle on **Station Limits** and set the **Stop station** to ***3285+75***
   - Since you know that the ramp will only be controlled by SH119 NB up until that station, you can stop the report there.

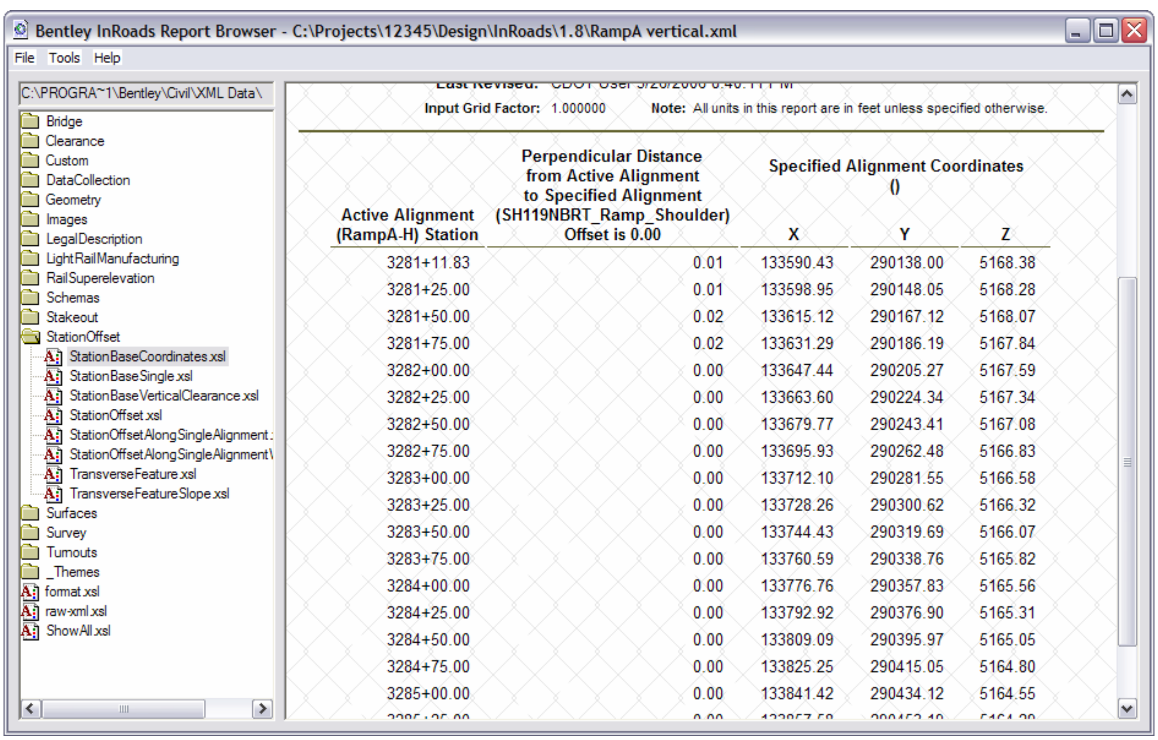
3. Select **Save**.



4. When prompted for a file name, key in ***RampA vertical.xml***, then **Save**.

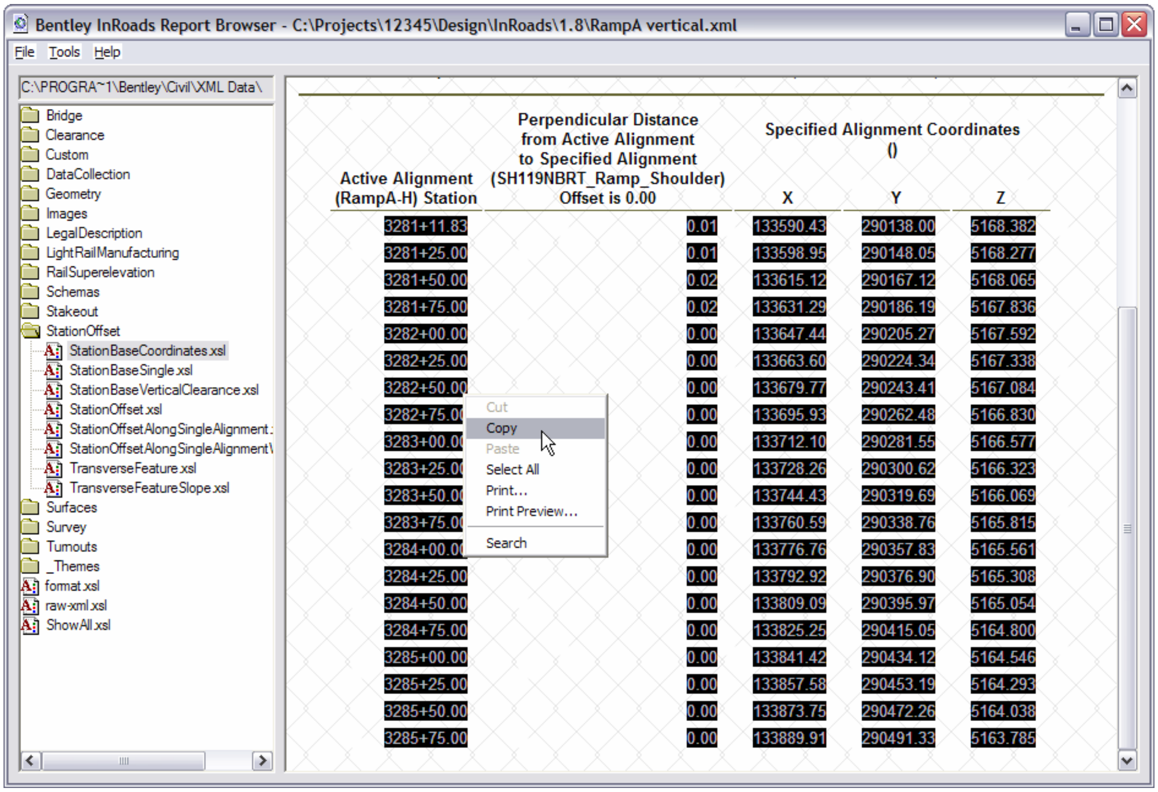
5. When the **Report Browser** starts, it will format the data according to a default style sheet as shown on the left. Try selecting different style sheets to see if you can find the data needed. Remember, you're after 25' stations along RampA along with corresponding elevations of the shoulder from SH119 NB.

   Notice none of the reports gives you that information exclusively, however select the **StationBaseCoordinates** style sheet and you'll see that it contains the needed information.



To create the vertical alignment that matches the widened ramp, you can use this station and elevation information, but it will need to be formatted into an .ics input file and you want 3 decimal precision on the elevations.

6. Select **Tools > Format Options** and change the **Elevation** precision.



7. Highlight the data as shown, then right-click and select **Copy**.

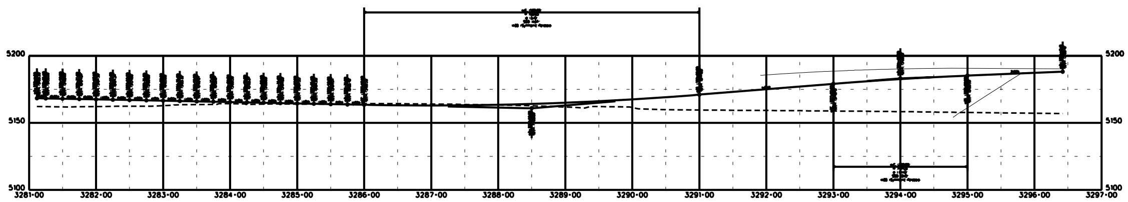
8. **Close** the **Report Browser**.

9. Open **Notepad** and paste the data.

10. Beginning with this information, create an .ics file to build the vertical alignment. Additional information needed to complete the alignment is shown below.

Additional PVIs		**Curve Length**
3288+50.0000	5160.990	500
3294+00.0000	5183.190	200
POE		
3296+42.1000	5188.180	

11. After you have created and imported the .ics file, annotate the vertical alignment on the profile of RampA-H.



Clean-up your design file for the next lab

<u>Important</u>! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit >Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

<u>Important</u>! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File >Exit**.
2. If prompted to save data files select **Yes**.

2. Templates, Transitions and Superelevation

In this chapter you will learn how to build more complex templates, then model with these templates by using independent control and setting up transitions in the Roadway Library. You will also explore some of the more advanced features of **Roadway Modeler** and learn how to manually edit superelevation tables.

Template Overview

Working with and creating templates (also known as typical sections) was covered in the ***Roadway Design Using InRoads*** training class. The following is a short overview of templates from this class:

The library

Templates are stored in a typical section library along with cut/fill tables, material tables, and decision tables. The CDOT typical section library has some standard CDOT typical sections that can be copied and modified for each project.

Only one template library can be loaded at a time, so use the **Copy Typical** Sections command to copy templates from various libraries into your project library as needed.

The Template Editor

The template Editor is your interface for creating new or modifying existing typical sections. It is accessed by selecting **Modeler >Define Typical Sections**. On the Templates tab, highlight the template your wish to modify and choose **Edit**. You may also copy a template or crate a new one from this tab.

Templates are built by ***layer***, ***zone*** and ***segment***. Template segments are built with a horizontal width and slope, which can be defined in various formats. You can also specify the segment ***fixity***, to determine if the segment will vary in width, slope or both.

The following diagram is an overview of the options available in the **Template Editor** when building a template.

The Layer tab

LAYERS

Template layers are created for each surface you wish to define. The layer names are used to name a corresponding surface created during a **Roadway Modeler** run.

Multiple layers can be used in a single template to define finished grade, and several subgrades.

In order for the template to transition properly, the layers must be built in the same order in every template, and identical names must be used for like layers in different templates.

The first template in the roadway definition must contain all layers used through the model. Subsequent templates cannot introduce new layers.

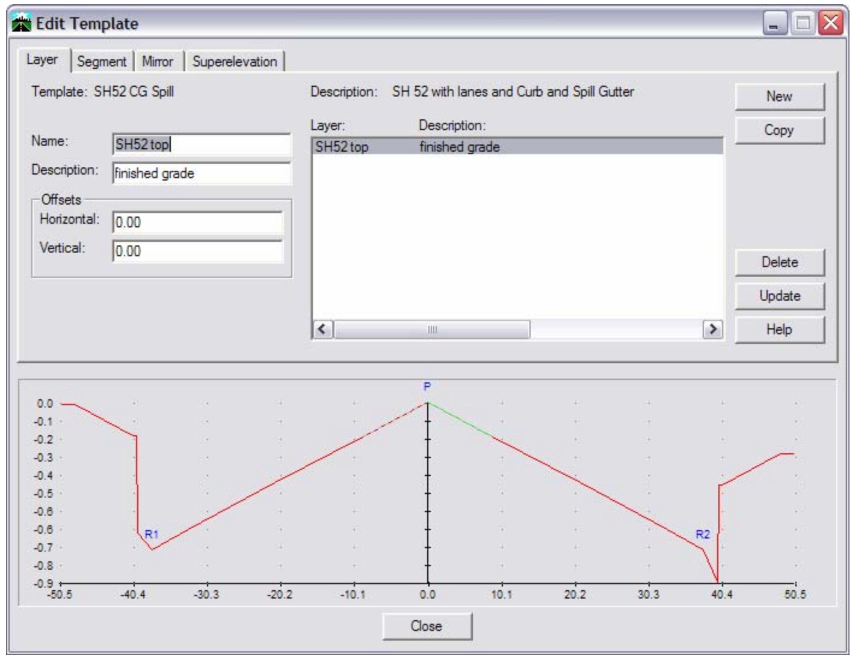
The main layer projects to intersection with the existing terrain.

Subgrades project into either the main layer, or the layer processed just previous to the current one.

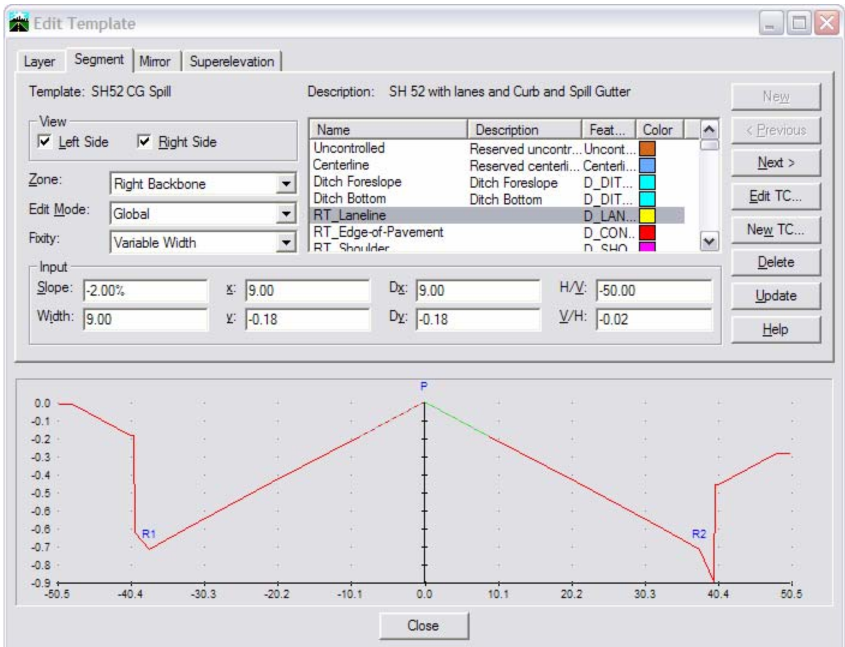
In superelevation, use cut and fill segments to project to other layers if you don't want these segments to superelevate.

Only the active template layer may be modified. It is shown in red with the active segment highlighted in green. All other layers in the template are shown in black. **Horizontal** and **Vertical Offsets** from the center may be set for the individual layers.

New is used to add layers (Key in the layer name first, then choose add, then set offsets), **Delete** to delete a layer and all corresponding segments, and **Update** to change a layer's name, description or offsets.



The Segment tab



SEGMENT

View selects the portion of the template to be shown in the dialog box.

Zone specifies which of the six parts of the template is active for editing: Left or Right Backbone; Left or Right Cut; Left or Right Fill.

A template consists of a left and right side, each containing a backbone, cut and fill.

Each of these portions or zones of the template contains up to 255 segments

The last fill section is negative and the last cut section is positive.

If you are strictly using tables for sideslope calculations, the templates itself does not have to have any cut and fill definitions.

The hinge point is the point between the backbone and the cut and fill segments and is also known as the POSS (Point of Slope Selection).

Upon dropping the template, the software checks the hinge point to determine where to use the cut or the fill section.

If a decision table is specified for the particular template drop, it is used regardless of the hinge point location.

Edit Mode has four options for manipulating template segments. **Add After** allows you to use the **Add** button to add a segment after the active (green) segment. **Add Before** adds the segment before the active one. **Global** allows you to edit any of the Input parameters for the currently active segment. All other segments retain their current slopes and lengths. **Local** also allows editing of the active segment, but changes the next segment's slope and length so that all other segments maintain their relationship to the centerline.

INPUT

In the input section, you have six options for specifying the slope and width. The **DX** and **DY** options are for the current segment, while the **X** and **Y** options are the overall coordinates based on the grid defined by the center of the template being 0,0. Specify the values in master units. If you prefer using ratios for the slopes, either **H/V** or **V/H** may be specified. After the slope and width are entered using two of these parameters, select **New** to add the segment to the active layer. It is added before or after the currently active segment depending upon the **Edit Mode** option you have set. **Previous** and **Next** step you through the template's active section. **Delete** removes the currently active segment.

TC NAMES

TC or **Transition Control** names are assigned to the end point (farthest from the centerline) of the specified segment. The box lists all TC names defined in the loaded template library. CDOT has standard TC names that are located in the seed typical section library. Many of the predefined templates already have been assigned TC names.

Create new TC names using **New TC**. To assign a TC name, highlight the segment using **Next** and **Previous**, highlight the TC name to assign, and choose **Update**.

Use TC names for several purposes: controlling the symbology of transition control lines, controlling template transitioning, reporting and independent control.

The symbology of the resulting TC line is control by the **Feature Style** assigned to the TC name.

By assigning a unique TC name to a point on the template, you can control the point's path. To do so, independent control is established for the point in question.

FIXITY

Segment fixity is shown for the active segment. Options include:

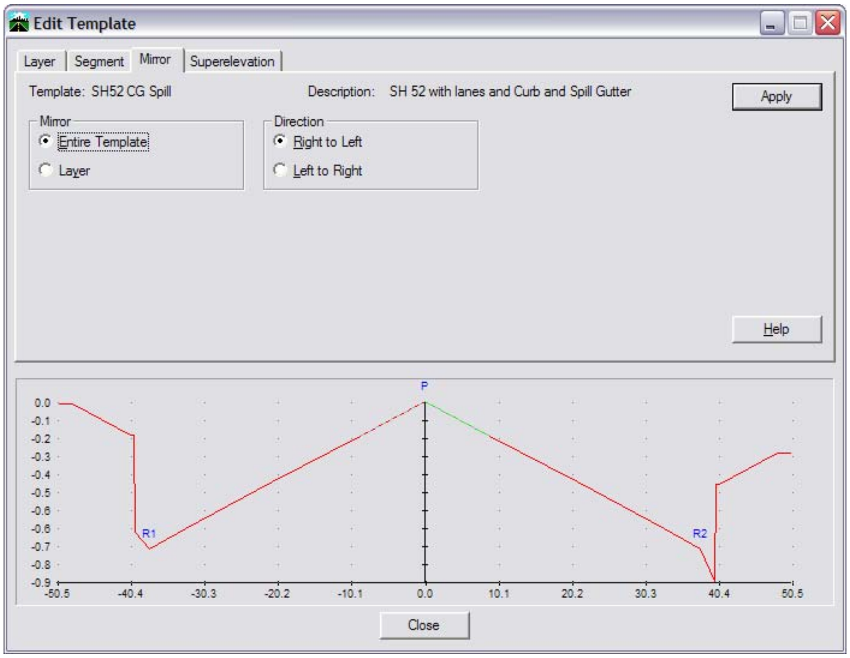
Fixed for no horizontal or vertical transition control;
Variable Slope for when you want this segment's slope to vary to accommodate either horizontal or vertical transition control ;

Variable Width for when you want this segment's width to vary to accommodate either horizontal or vertical transition control ; and

Variable Slope and Width for when you are defining both horizontal and vertical controls.

Note: The variable segment does not have to be the segment next to the transition control point.

The Mirror Tab



Mirror allows you to develop only one side of a symmetrical template, then copy either the whole template (all layers) or one layer to the opposite side. This copies the backbone, cut and fill sections of the template. TC names are copied as well, so you should edit them once the copy is complete.

The Superelevation tab

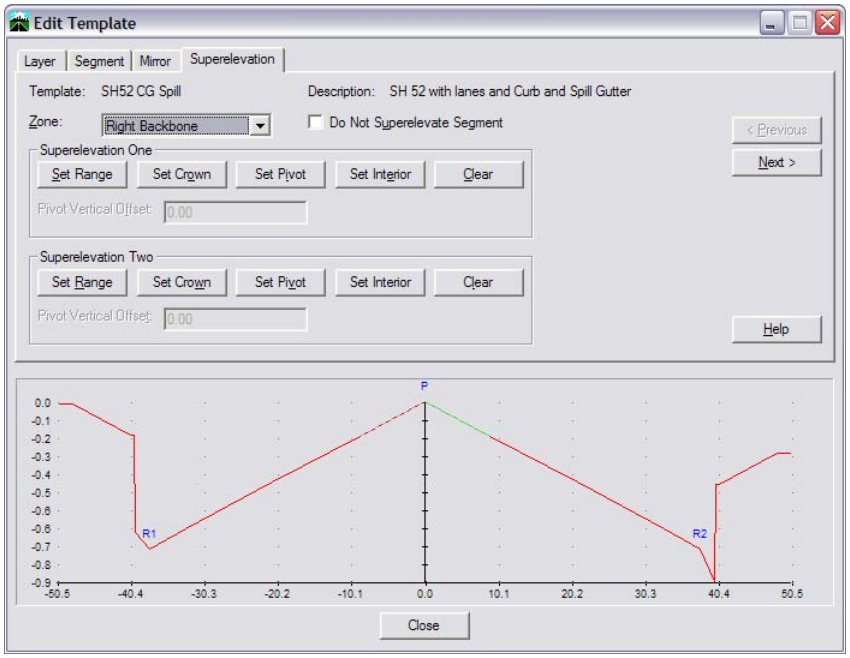
Superelevation

Set Range One (or Two) allows you to "point and click" the two points on the active layer between which you want the segments to rotate with superelevation. Each point is known as a range point; there are no super begin and end points per se. Super One Range points are used when only one series of segments are supered; Use Super One and Super Two Range points when two separate series of segments are supered, such as in a divided highway.

Set Pivot also allows you to "point and click," to define the pivot point for the specified range. The pivot point can be coincident with either of the range points or any point in between, but cannot fall outside the range

Set Crown also allows you to "point and click," to define the crown point for the specified range. The crown point is the point at which the super rates are calculated and show in the Build Application Station Dialog.

Do Not Superelevate Segment allows you to define a segment that will not rotate during super (*e.g.* a near vertical pavement segment). To use, highlight the segment with **Previous** or **Next**, then toggle on this option.



Roadway Libraries

Roadway libraries store station and template setups, called roadway definitions. Only one library can be loaded at any given time, but each library can contain multiple definitions. In addition to setting which template is used where, the roadway definition establishes other modeling criteria like how the sideslopes are calculated, what the template interval is and how the transitioning between templates occurs.

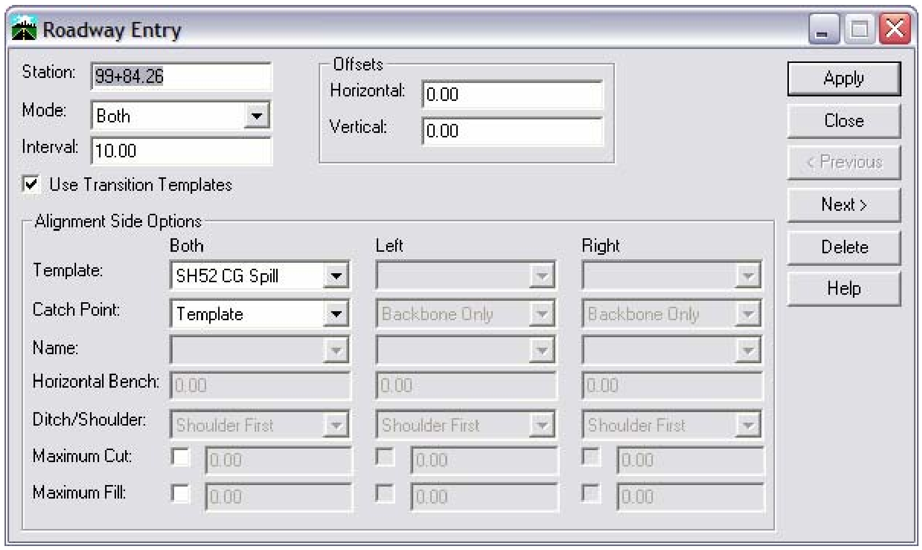
Independent control is established in the roadway library as part of the roadway definition. Unique TC names on the template are assigned a path to follow other than that of the centerline.

Creating roadway definitions

The following diagram is an overview of the options available in the **Define Roadway** dialog box used when creating roadway definitions.

USE TRANSITION TEMPLATE
When **on**, the software linearly interpolates and applies intermediate templates between entries in your roadway definition list. When **off**, the transition occurs during the interval between normal drops.

MODE
Both — The template is applied to both the left and right sides of the alignment.
Left (or Right) — Only the portion of the template to the left (or right) of the centerline is applied.
Left and Right — At first glance, this appears to be the same as the Both option, but it allows you to specify different templates (or tables) to be used on the left side of the alignment versus the right. Depending upon which of the options you select, either the “Both” column or “Left” and “Right” columns of the dialog box are active.



CATCH POINT
This option determines how the software calculates sideslopes. Choices are **Backbone only**, **Cut/Fill Table**, **Material Table**, **Decision Table** or **Template**. You can alternate choices by specifying different set-ups at different stations.

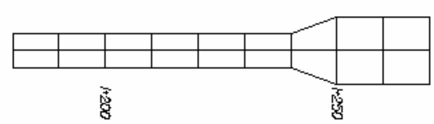
HORIZONTAL BENCH
Specifies the reference elevation for calculating the elevation of benches that don’t follow the vertical alignment. (Only available with Cut/Fill or Material Tables)

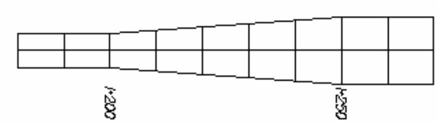
DITCH/SHOULDER (CUT/FILL TABLE ONLY)
Shoulder First — Applies the shoulder option (from the fill table) to see if the end of the shoulder is above ground. If so, it places the shoulder and a fill slope.
Ditch, Last Segment — Places the ditch defined in the cut table, if any portion of the last segment is below grade.
Ditch, Last Point — Places a ditch only if the last point on the ditch is below grade.

Template transitions

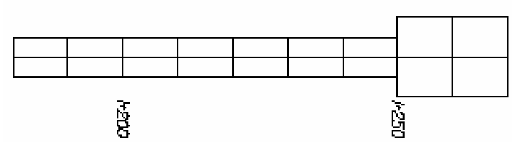
Roadway definitions determine the transition lengths between two templates. If the two templates are farther than one template interval apart, the transition length is determined by the **Use Transition Template** toggle in the roadway entry. If it is toggled on, the transition will occur between the two stations listed for the template in each roadway entry. If the toggle is off, the transition will occur between the last drop of the first template and the first drop of the second template.

To accomplish an immediate transition, specify a very small distance between the template drops. The distance must be large enough for a triangle to be formed, and 0.001 is the InRoads-recommended smallest.





The example above shows the effect of the Transition Template toggle. In both diagrams, the template interval is 10; at station 1+200, the narrower template was dropped. At 1+250, the wider template was dropped. With Transition Template off, the transition occurred in the last 10m (left diagram). With Transition Template on, the transition occurred over the full 50m (right diagram).



The example above shows an immediate transition. To accomplish this, a template was dropped at 1+249.9, just prior to the 1+250 station where the template changes. This forces the transition to occur in the last 0.1m. It is recommended that Transition Template be toggled off for these small transitions.

During the transitioning of templates, transition control lines are drawn by connecting like-named points on each template. These lines become breaklines in the DTM, and have a feature name that corresponds to their TC name. The transition control lines that are joined must be in the same zone of the template. In other words, TC lines cannot cross the centerline or hinges.

Offsets can augment the available transitioning in cases where a TC line needs to cross the centerline. For example, if a left turn bay crosses into a median, the centerline can be offset to the left, allowing the lane to remain continuous through the transition. While more than one template is required, it does avoid creating a template whose centerline is in the middle of a lane.

Independent Control

Typical Section Setup

Independent control can greatly enhance the use of templates by allowing you to vary widths and slopes of backbone segments during **Roadway Modeler** runs without using a second template. The first step of defining independent control is to set up your template.

> **Tip**: Independently controlled points in the template must be within the backbone.

TC Names

The points in a template are controlled using TC names. This requires that unique names be used to designate the points. There are certain cases when you may want the names to be the same. For example, if you are setting a grade that you want both sides of a template to follow, the same name can be used on both and they are controlled with one independent control setup. Another case of using the same names is when you are controlling horizontal transition and want a main layer and subgrade(s) to follow the same setup. However, in most cases the names will be unique, and the same name for horizontal control can not be used on both sides of the template.

> **Tip**: The TC names used for independently controlled points must be assigned to each template used in the area being controlled.

Fixity

The template may also be edited to tell the variable segment how it can vary. While the independent control will work without this step, you are leaving it to the software to determine how the segment varies as well as which one to vary. It is better to establish this using the fixity options.

> **Tip**: When a variable segment is used outside the station range of independent control, it is treated as fixed.

The choices for fixity include fixed, when you do not want the segment to change because of independent control, variable slope for independent vertical control, variable width for independent horizontal or vertical control and variable slope and width for independent horizontal ***and*** vertical control.

Template Segment

H & V Controls	Variable Slope	Variable Width	Variable Slope & Width
Independent Vertical Control	YES	YES	YES (width is held constant)
Independent Horizontal Control	NO	YES	YES (slope is held constant)
Independent Horizontal & Vertical Control	NO	NO	YES

This table describes valid horizontal and/or vertical controls for different types of variable template segments.

> **Tip**: The variable segment does not have to be adjacent to the independently controlled point.

Independent Control Definitions

Independent Control is setup and stored in the roadway library, with the individual roadway definitions. In order to define the controls, you must have the geometry file loaded with the alignment active that is to be used with Roadway Modeler, the template library must be loaded and the roadway library. The geometry file should also contain any alignments you plan to assign to different points on the template.

> **Tip**: The alignment that is to be used with **Roadway Modeler** must be active when creating independent control setups.

The independent control setup in the roadway definition is the critical link between the TC names on the template and the path you want them to follow.

There are two types of controls – horizontal and vertical. They can be used individually, or in combination.

Use ***Horizontal controls*** when the separate path is defined by a separate horizontal alignment or by stations and offsets from the mainline. Horizontal controls are used in conjunction with variable width template segments, typically for items such as lane widenings or turn lanes.

Use ***Vertical controls*** when the separate path is defined by a separate vertical alignment, a vertical difference alignment, or by vertical offsets from the mainline vertical.

- A ***Vertical difference*** alignment is an alignment whose elevations are based on offsets from a mainline vertical rather than true elevations. It is used for superelevation in some cases.

Use ***Horizontal and Vertical*** controls when you want to hit a certain location regardless of the slope or width required.

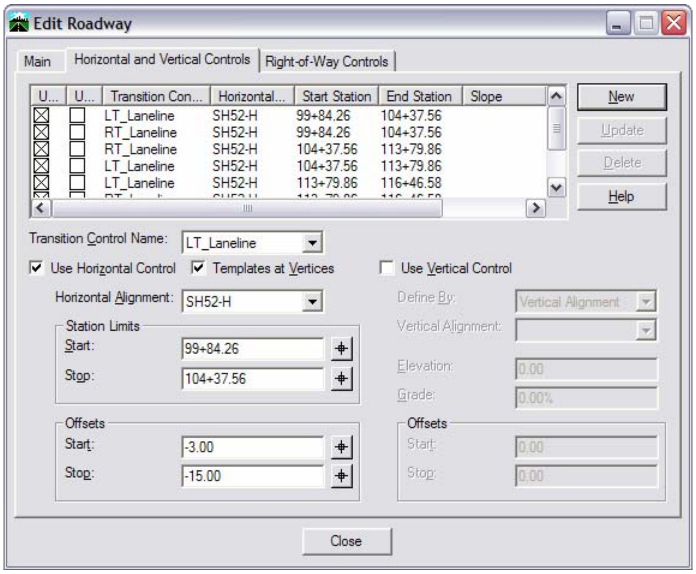
Horizontal and Vertical Control dialog box

Toggle on **Use Horizontal Control** when the path is defined by a separate horizontal alignment, or by stations and offsets from an alignment. When used by itself, **Horizontal Control** typically defines control for a variable-width template segment, such as a lane widening.

Toggle on **Use Vertical Control** when the path is defined by a separate vertical alignment, or an elevation and grade. You can also define a difference alignment. (See explanation at right.) If the variable segment in the template is variable width, the slope is held constant, and the elevation defined by the independent control is used to compute the width of the segment. If the template segment is variable slope, the width is held constant and the slope is defined by the independent control elevation.

Toggle on both **Horizontal and Vertical Control** when a variable slope and width segment is defined in the template. Any of the three **Vertical Control** options is valid for use in this situation.

Select the **Transition Control Name** from the list. This is the name that is also specified for the control point in the template.



To control the TC name with alignments, select horizontal and vertical alignments from the list boxes. If you use offsets from the alignment, specify them as well.

Set the elevation and grade if the **Vertical Control** Define By option is set to Elevation & Grade.

Use **Elevation & Grade** to define a specific starting elevation and longitudinal grade for a variable slope or variable width segment.

Use **Vertical Alignment** to define the path for variable slope or variable width segments in the template, such as a center median or an independent ditch.

Use **Vertical Difference** to specify a vertical alignment whose elevations are the vertical distance between it and the centerline vertical alignment as the elevation. **Difference Alignments** are typically used in defining superelevation by vertical alignment, and the **Superelevation Vertical Control Alignments** command creates them according to your superelevation criteria.

Tips: If you temporarily want to omit an independent control setup, toggle the entry off, but leave it in the list. That way you won't have to re-create it if you decide to use it again.

The stationing in the independent control setup is the stationing of the mainline, not the stationing of a control alignment. It is important that the mainline is active when you enter the dialog.

Independent Control Special Cases

The previous discussion included the work flow for independent control that accomplishes most of the design cases you need. There are a couple of other situations that you may run into, however.

Centerline control

When the typical section you are running needs to vary completely from the horizontal and/or vertical alignment, you can independently control it. This occurs when you are running a ditch alongside a road and want the stationing to match the mainline and the slopes to be perpendicular to the mainline, even though the alignment may not be parallel. It is also sometimes used when modeling each side a divided highway separately, but relating both sides to the same alignment.

To accomplish centerline control, use the TC name Centerline when defining the independent control setup. Keep in mind that the name Centerline is automatically assigned to the center of each layer in the template, so one entry controls all layers. Since the entire template is being offset, there are no variable segments or additional TC names to assign to the template.

Tip: When independently controlling the centerline, one entry controls all layers

Subgrade control

Whether or not you control the main layer centerline of the template with independent controls, there are times when you may need to individually control the centerline of subgrade layers in a template. Since they are automatically assigned the TC name Centerline (just like the main layer), you cannot directly control them separately.

However, there is a workflow that allows separate control of the centerlines. If you create a TC name that exactly matches the name of the layer you want to control, you can assign independent control to that TC name and it will control the center of the subgrade. You do not assign the TC name to the template. See the following workflow for details.

Tip: Both of these special case techniques are required in some instances, such as a cut-out that must match the superelevation on the existing road.

Superelevation

Setting up superelevation to match hand-calcs

InRoads superelevation uses AASHTO 2001 superelevation tables. Since CDOT has adopted the AASHTO 2004 standards, some editing will need to occur in the superelevation. You can code templates to create the superelevation; you can have InRoads calculate the super, then manually edit the **Application Stations**; and you can calculate the superelevation in a spreadsheet that can then be exported to a text file and imported into InRoads. You will be using the latter two methods in you lab activities.

Troubleshooting

What do you do when things won't work? This section is designed to give you a feel for troubleshooting common problems with Corridor Modeling. While not an all-inclusive process, the thought patterns suggested here can help diagnose and solve other problems as well.

There are several things that can go wrong when modeling, and with experience you will learn to narrow down the troubleshooting workflow based on the symptoms. To start you off, however, the following is a list of items that must be input correctly to get the desired results from corridor modeling.

General problems

Surface

- The existing surface must be loaded, have triangles, and fall within the range of your alignments.

Alignments

- The horizontal and vertical alignment must be active and contain no discontinuities.
- It occasionally causes a problem when the horizontal and vertical do not start at the same station; if not, try using station limits and starting inside the shorter alignment.

Typical Section Library

- The templates used in the roadway definition must be identical in name to those in the library.
- All tables referenced by the roadway definition must be identical in name to those in the loaded template library.
- If a table is not used for the intercept option, the template must contain cut and fill for both sides.
- Subgrades must contain both a left and right backbone even though they can be completely offset to one side of the template. The exception is if the template is run right or left only.

Roadway Definition

- The roadway definition must be established and contain templates found in the current template library.
- The names of the templates must be identical (case included) to those in the template library.
- The roadway definitions must define the intercept type for every entry.
- If tables are used, they must reside in the template library. Their name in the roadway definition must be identical to that in the template library.
- If “No roadway entry found” message occurs, check to see that the roadway definition stations start prior to the horizontal/vertical alignments.

Sideslope problems

- If sideslopes are not correct, check:
- Are the slopes defined properly in the template or table?
- Do the slopes tie correctly, then continue? Make certain the exterior boundary option is on under **Roadway Modeler**.

Transition problems

- If cross section cut between template drops in transition areas do not correctly show the transition, check to see if the TC lines transition properly. If not, assign appropriate TC names to adjacent templates and re-model. If so, add the TC lines to the proposed DTM and re-triangulate.

Independent Control

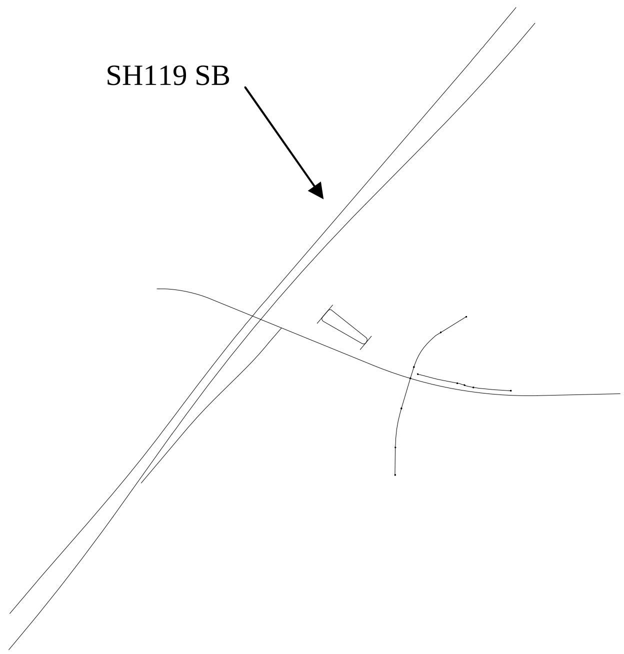
If the control does not work at all after running **Roadway Modeler**:

- Make certain the TC name assigned to the template is the same one in the independent control setup
- Make certain the TC name assigned is unique (if applicable)
- Check the stationing on the independent control setup. Is it correct? It should reflect the mainline stationing, not that stationing of a control alignment.
- Are offsets being used? If so, they should be from the alignment, not from the TC point location.
- If you get an error “Exterior Boundary Crossing Itself”, check to see if you are using the same TC name on each side of the centerline in your template, then using the name for independent horizontal control. Independent horizontal control points must be unique to one side of the template.

- If the transition control works, but the offsets or transitions are not correct, check the offsets listed in the independent control setup (they are from the mainline alignment). Also, check the offsets in the roadway definition and in the template itself.
- If the transition control works, but the transition occurs at the wrong station, check the stationing listed in the independent control setup. (The alignment you are using to model the roadway should be active when setting up independent control.

Lab 2.1 – Using the template editor

In this activity, you will create templates from scratch for practice using the template editor.



Start MicroStation InRoads

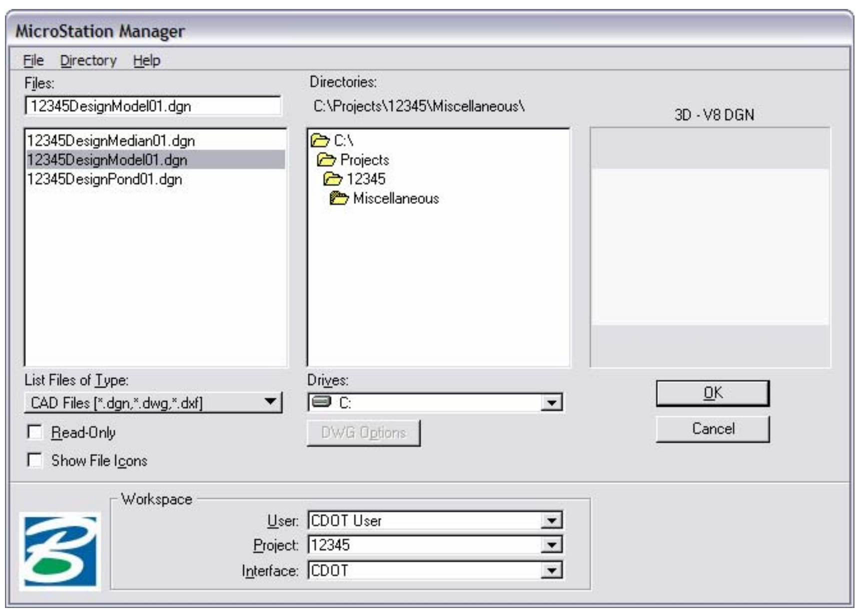
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous**.
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

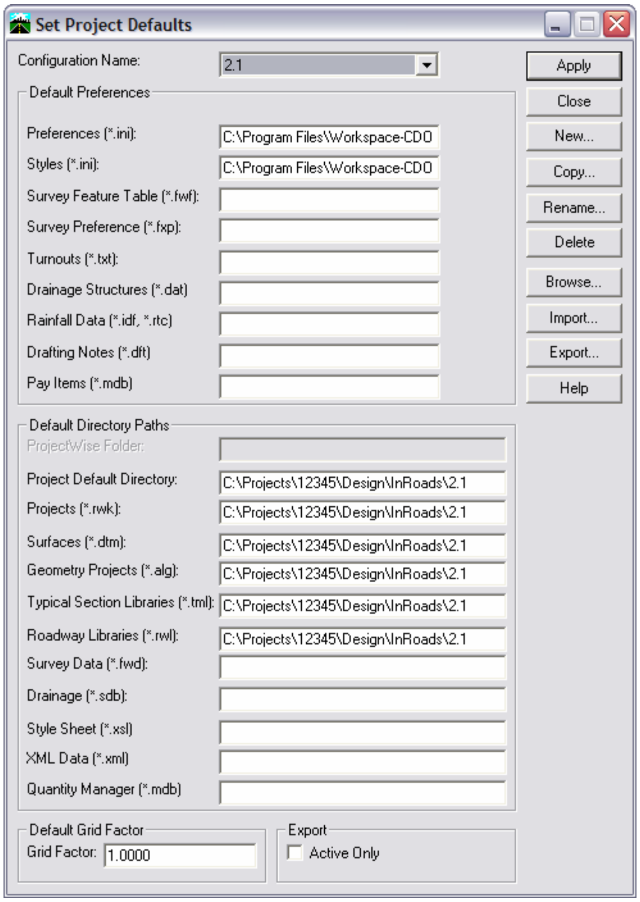
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **2.1**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH119 SB

1. Select **File > Open.**
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 SB.alg** and then select **Open**.
4. Do not cancel out of the box.

Load the existing DTM

5. Select **File > Open**.
6. Set **File of Type** to **Surfaces (*.dtm)**.
7. Highlight **12345 Exist01.dtm** and then select **Open**.
8. **Cancel** the **Open** dialog box.

Create a typical section library for SH119 SB

You will first create typicals for SH119 SB. For this model, there are initially two templates needed. One template will be used to create the roadway and a 6:1 sideslope for the median. The second will be used to create the roadway and a 10:1 sideslope for the median. After creating the templates, you will set up the transition so that the median becomes shallower through the overpass area.

Naming convention

You will be creating several templates and will name them according to the roadway, the number of lanes on either side of the centerline and a description of the template. For example, the first template:

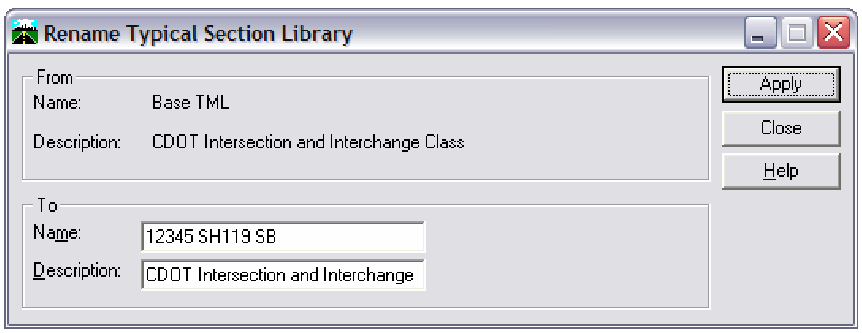
- is for SH119 Southbound,
- has 2 lanes on the left of the centerline and no lanes to the right,
- and has a 6:1 median slope.

The template name, therefore, is:

SH119 SB 2L-0L 6:1 Median

Copy a standard typical section library

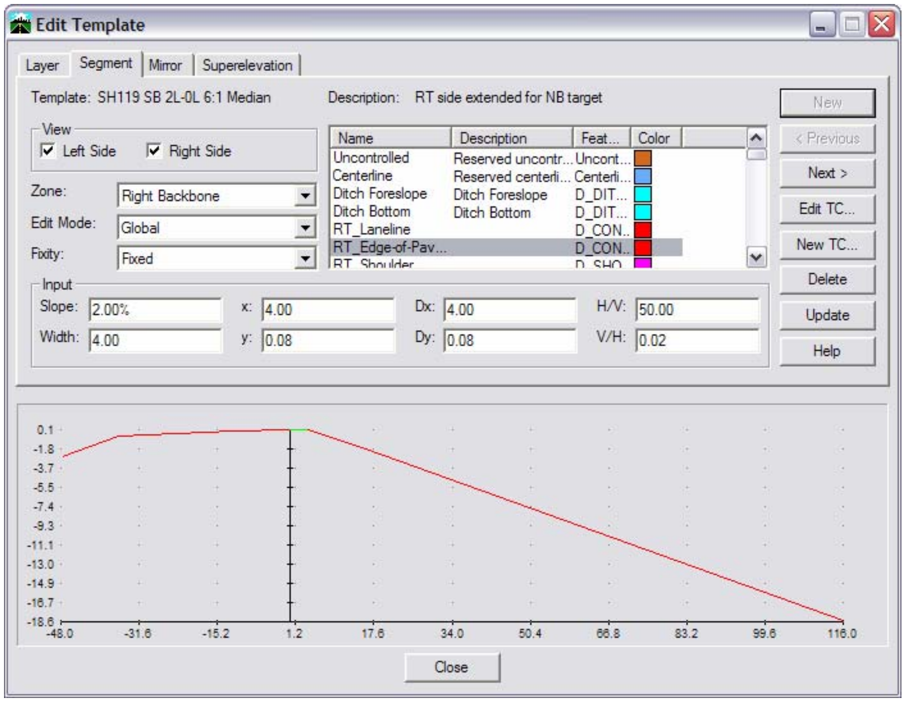
1. Select **File > Open**
   - Toggle the **Files of type** option to **Typical Section Libraries (*.tml)**.
   - Open **Base TML.tml**.
2. **Cancel** the dialog.
3. Select **File > Save As**.
   - Toggle the **Save as type** to **Typical Section Libraries (*.tml)**.
   - Key in ***12345 SH119 SB*** for the **File name**.
   - Choose **Save**.
4. **Cancel** the **Save As** dialog.
5. Select **Modeler > Rename Typical Section Library**.



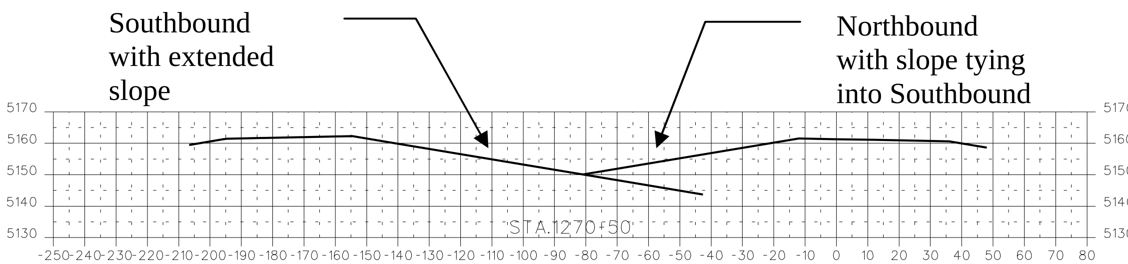
6. In the **To Name** field, key in ***12345 SH119 SB***

   You may change the description if desired.
7. Choose **Apply**, then **Close** the **Rename** box.

Develop the first median template (6:1 median slope)

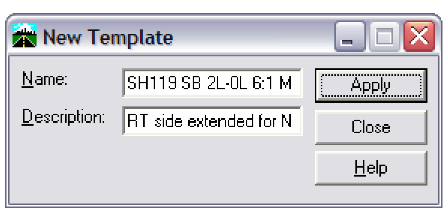


This typical will be used to model the Southbound portion of the roadway. Since the Northbound portion will tie into the median when it is run, the right side of this template is an extended sideslope that does not tie to the existing ground. Instead, it will be used as a target for the median slope from the Northbound.



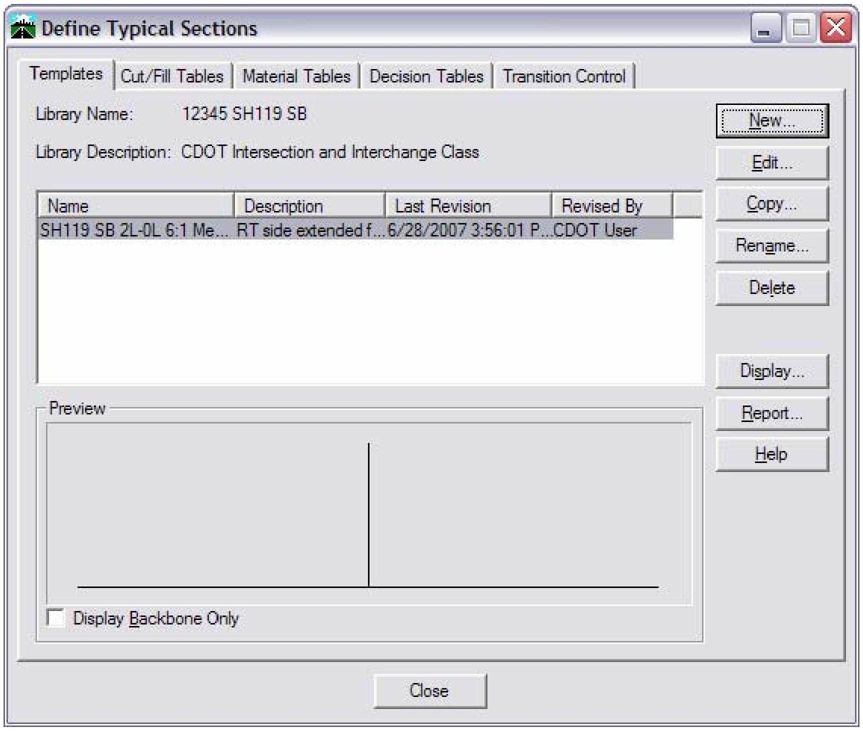
Name the template

1. From the **Define Typical Section** dialog box, select **New.**



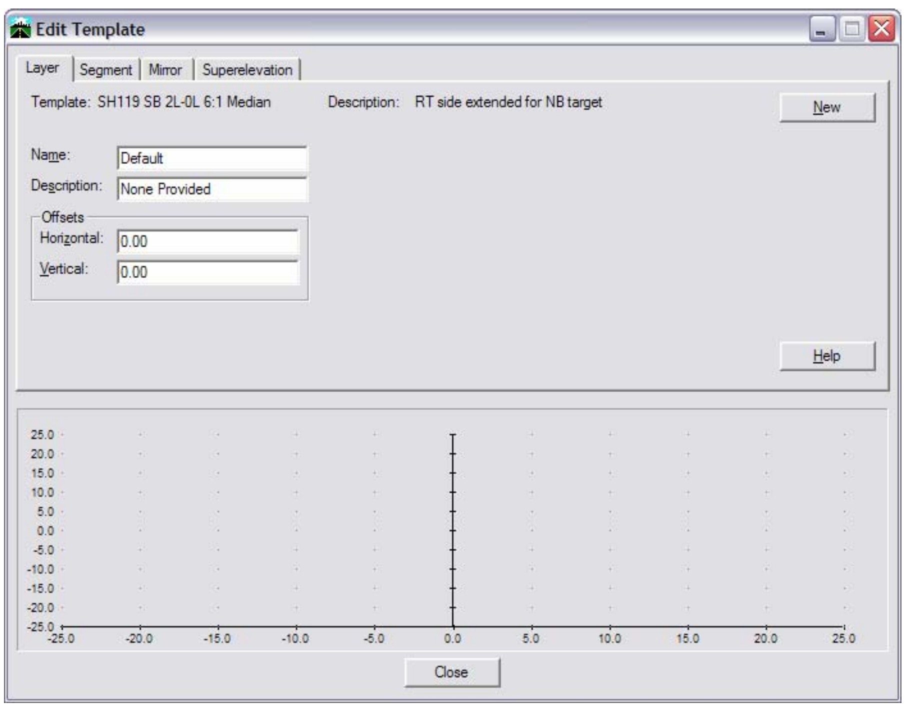
2. Key in the **Name *SH119 SB 2L-0L 6:1 Median***
3. Key in a **Description *RT side extended for NB target***

4. **Apply**, then **Close** the **New** box.



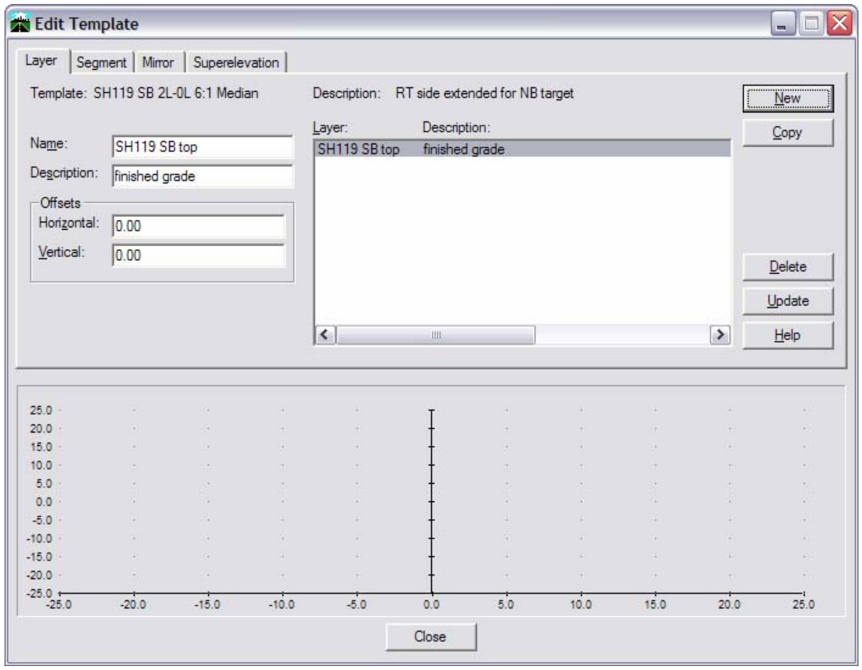
Create the left backbone

5. Highlight the template and select **Edit.**

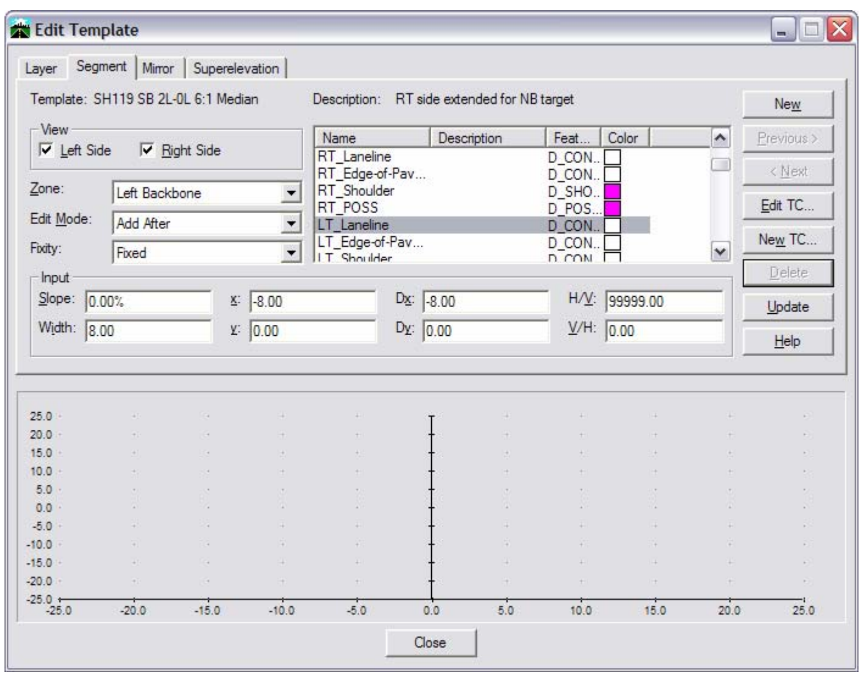


6. On the **Layer** tab:

   - Key in the **Name *SH119 SB top***
   - Key in a **Description** of ***finished grade***
   - Select **New.**



7. Select the **Segment** tab:



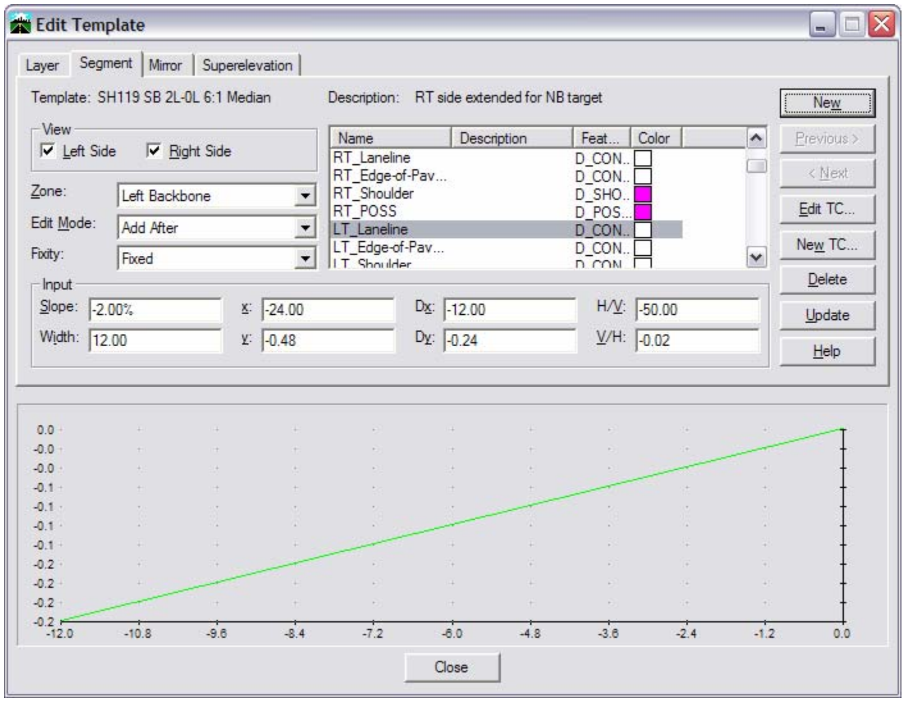
   - Set **Zone** to **Left Backbone.**
   - Set **Edit Mode** to **Add After.**

8. For the First Segment (Laneline1):

   - Key in a **Slope** of ***-2%***

   Don’t forget to use the percent sign and make the slope negative

   - Key in a **Width** of ***12***
   - Highlight the TC Name **LT_Laneline.**
   - Select **New.**



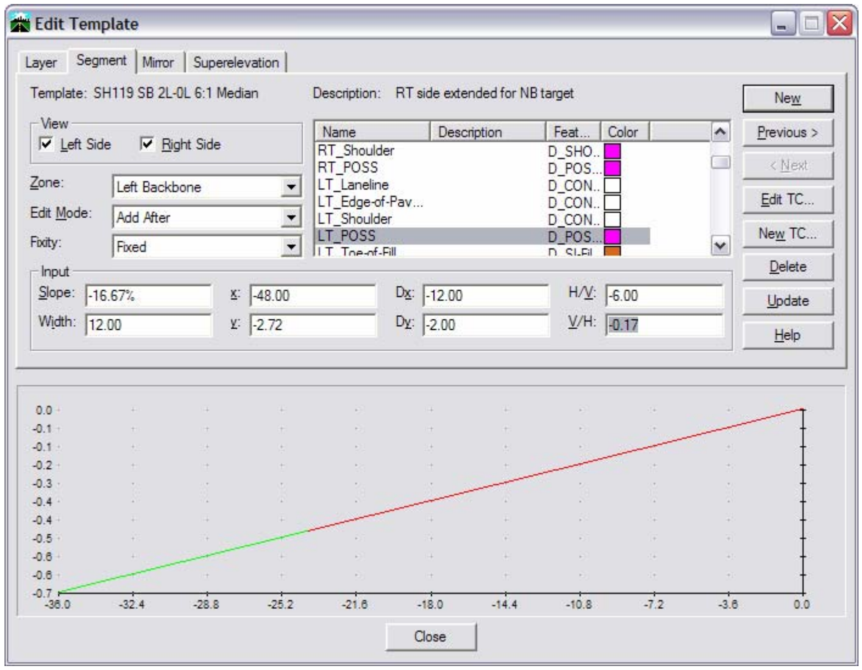
9. For the Second Segment:

   - With the **Slope** still set to ***-2%*** and the **Width** set to ***12***, highlight the TC Name **LT_Shoulder.**
   - Select **New.**

10. For the Third Segment:

    - With the **Slope** still set to ***-2%*** and the **Width** set to ***12***, highlight the TC Name **LT_Edge-of-Pavement.**
    - Select **New.**

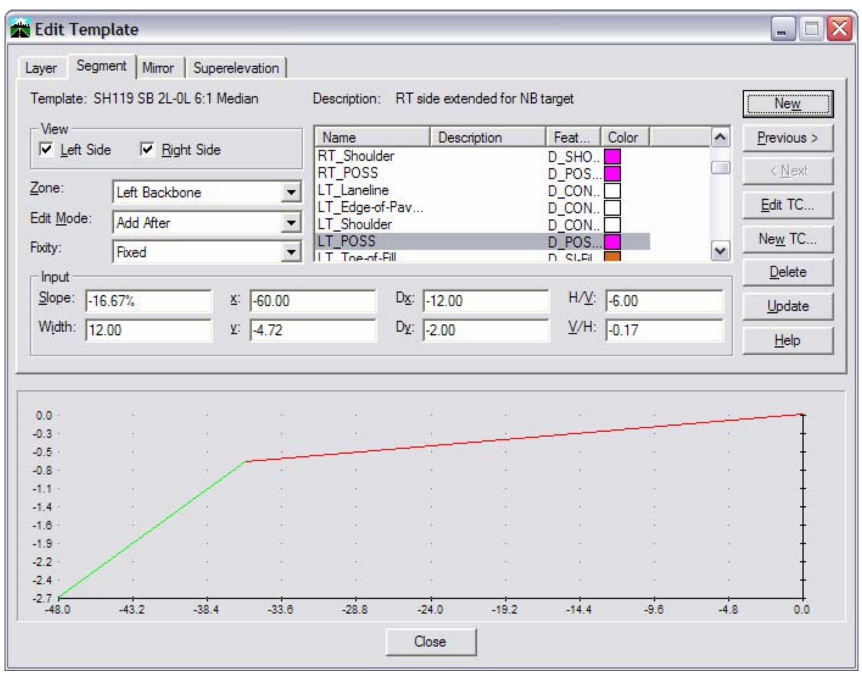
11. For the Fourth Segment (POSS):



- Key in a **H/V** of ***-6***

Don't forget the negative sign

- Key in a **Width** of ***12***
- Highlight the TC Name **LT_POSS.**
- Select **New.**



Build the Right Backbone

12. Select the **Segment** tab:

    - Set **Zone** to **Right Backbone.**
    - Set **Edit Mode** to **Add After.**

13. For the First Segment:

    - Key in a **Slope** of ***2%***

    On the right side, the slope is positive

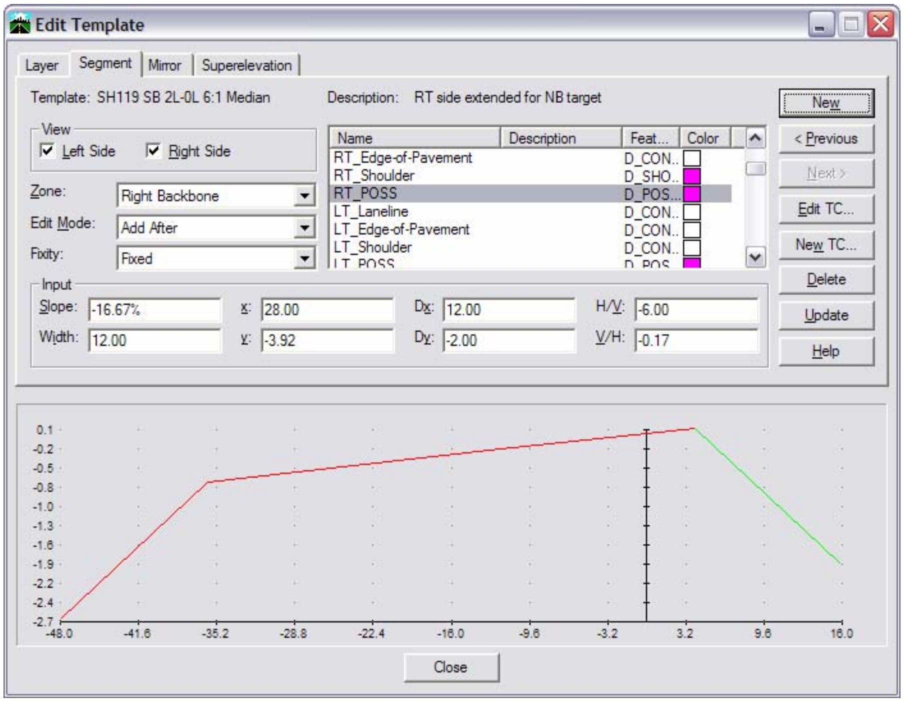
    - Key in a **Width** of ***4***
    - Highlight the TC Name **RT_Edge-of-Pavement.**
    - Select **New.**

14. For the Second Segment (POSS):

    - Key in a **H/V** of ***-6***

    Don't forget the negative sign

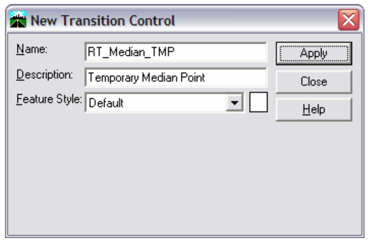
    - Key in a **Width** of ***12***
    - Highlight the TC Name **RT_POSS.**
    - Select **New.**



Create the Median slope on the right side

15. Create the extended sideslope that will become the target for the Northbound Modeler run:

    - Key in a **H/V** of ***-6***
    - Key in a **Width** of ***100***
    - Select **New TC.**

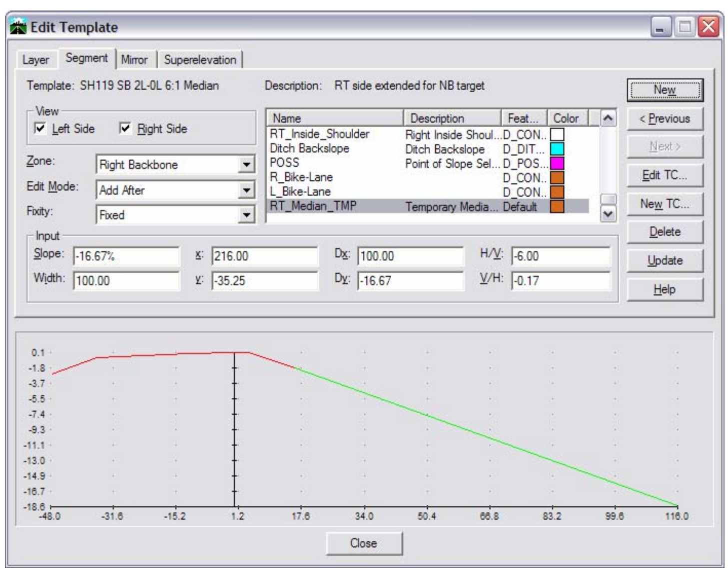


- Key in the name ***RT_Median_TMP***
- Key in a description ***Temporary Median Point***
- Select a Feature Style **default.**

<u>**Note**</u>: This feature will not be used in the final model, so the default style will be fine.

- **Apply**, then **Close** the **New** box.
- Highlight the TC Name **RT_Median_TMP** (it will be at the bottom of the list since you just created it).

16. Select **New.**



You set the width very large in order for the North-bound template to intercept it later.

17. Select **Close.**

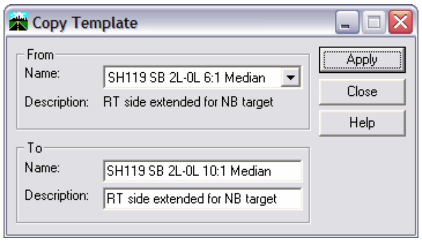
Develop the second median template (10:1 median slope)

The second template for SH119 SB is identical to the one you just created, except it has a 10:1 median slope for use in the overpass area.

Since you have a template so similar, you will copy it and modify the median slope.

Copy the 6:1 median slope template

1. From the template list, highlight the **SH119 SB 6:1 Median** template and select **Copy.**

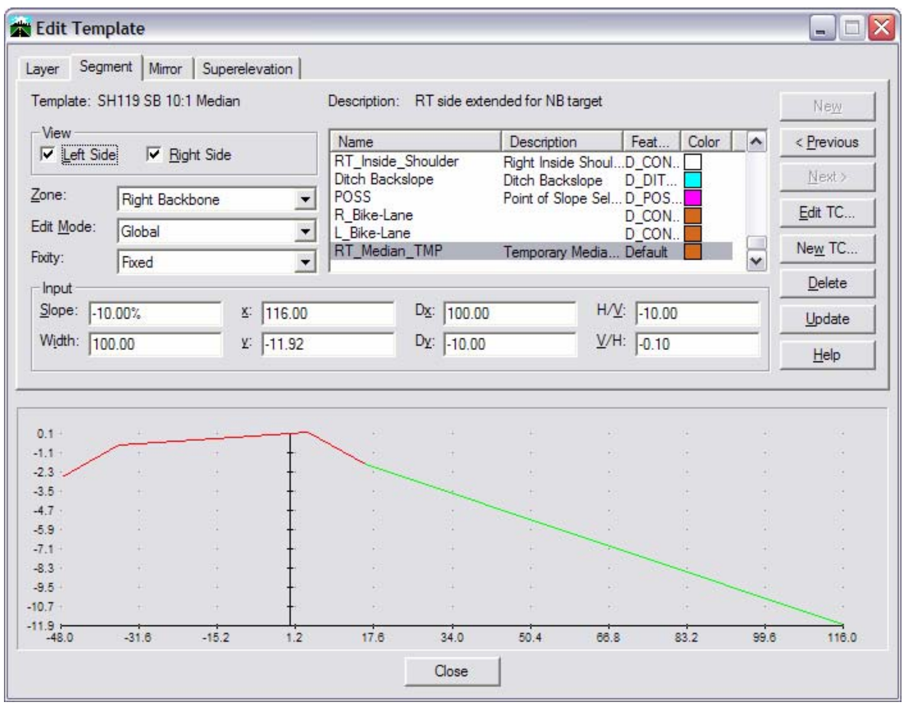


2. In the **To** section:

   - Key in a Name of ***SH119 SB 2L-0L 10:1 Median***
   - Key in a Description of ***RT side extended for NB target***
   - **Apply**, then **Close.**

Edit the 6:1 template to create a 10:1 median slope on the right side

3. Highlight the **SH119 SB 10:1 Median** template and choose **Edit.**



4. On the **Segment** tab:.

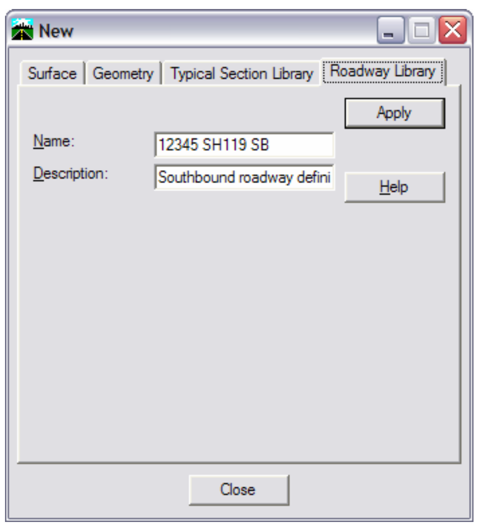
   - Set **Zone** to **Right Backbone**
   - Set **Edit Mode** to **Global.**
   - Select **Next** until you've reached the **RT_Median_TMP** segment (last segment).
   - In the **H/V field**, key in **-10**, then press **Tab.**

   The segment updates to the new slope.

5. In the **Edit Template** dialog box, select **Close.**
6. In the **Define Typical Sections** box, select **Close.**
7. Select **File > Save > Typical Section Library.**

Create a Roadway Library for SH119 SB

1. Select **File > New.**
2. Select the **Roadway Library** tab.
3. Key in a **Name** of ***12345 SH119 SB***
4. Key in a **Description** of ***Southbound roadway definitions***

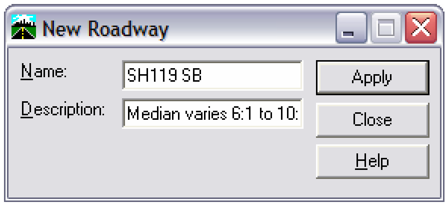


5. **Apply,** then **Close** the dialog box.

Create a Roadway Definition slot

1. Select **Modeler > Define Roadway.**
2. Select **New.**
3. Key in a **Name** of ***SH119 SB***

4. Key in a **Description** of ***Median varies 6:1 to 10:1; RT side extended for NB target***



5. **Apply**, then **Close.**

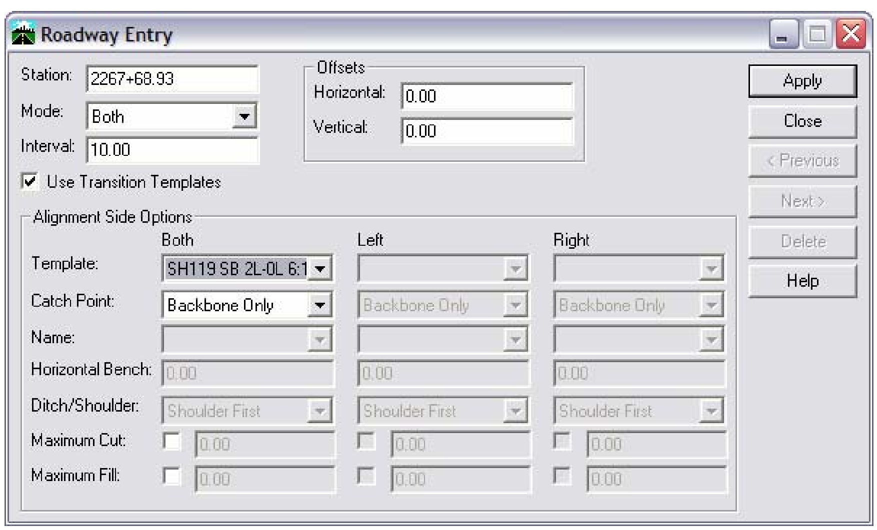
Create the Roadway Definition for transitioning templates

1. Select **Edit.**
2. In the **Edit Roadway** dialog box, select **New.**

First entry: 6:1 median template

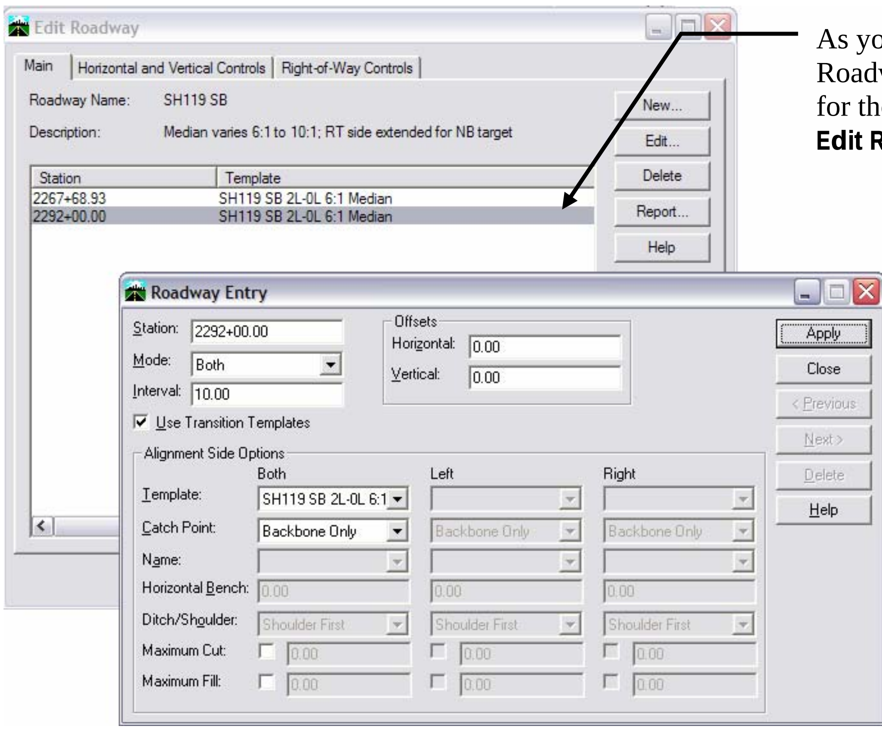
The station defaults to the beginning of the alignment.

3. Set **Mode** to **Both.**
4. Key in an **Interval** of ***10***
5. Toggle **on Use Transition Template.**
6. For **Template**, choose **SH119 SB 2L-0L 6:1 Median.**
7. For **Catch Point** choose **Backbone Only.**
8. **Apply.**



Second entry: 6:1 median template (begin transition to shallower sloped section under bridge)

9. Key in a **Station** of ***2292+00***
10. For **Template**, choose **SH119 SB 2L-0L 6:1 Median.**
11. For **Catch Point** choose **Backbone only.**
12. **Apply.**



As you add entries to the Roadway Definition, watch for the list to build in the **Edit Roadway** box

Third entry: 10:1 median template

13. Key in a **Station** of ***2293+00***
14. For **Template**, choose **SH119 SB 2L-0L 10:1 Median.**
15. For **Catch Point** choose **Backbone only.**
16. **Apply.**

Fourth entry: 10:1 median to begin transition back

17. Key in a **Station** of ***2300+00***
18. For **Template**, choose **SH119 SB 2L-0L 10:1 Median.**
19. For **Catch Point** choose **Backbone only.**
20. **Apply.**

Fifth entry: 6:1 median

21. Key in a **Station** of ***2301+00***

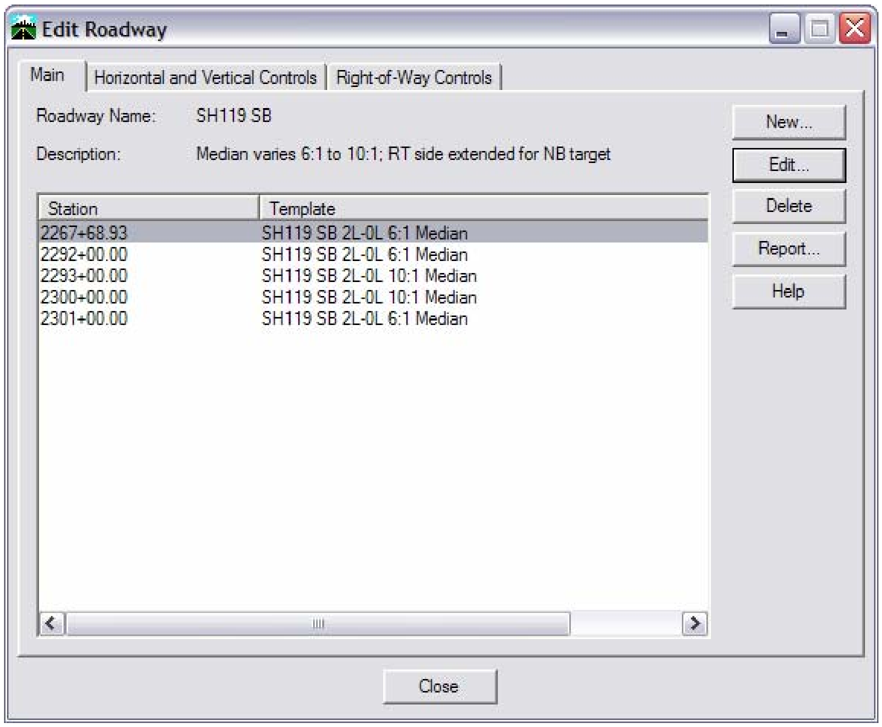
22. For **Template**, choose **SH119 SB 2L-0L 6:1 Median.**

23. For **Catch Point** choose **Backbone only.**

24. **Apply.**

25. Select **Close.**

    The entries should appear as follows in the **Edit Roadway** dialog box:



26. Close the **Edit Roadway** dialog box.

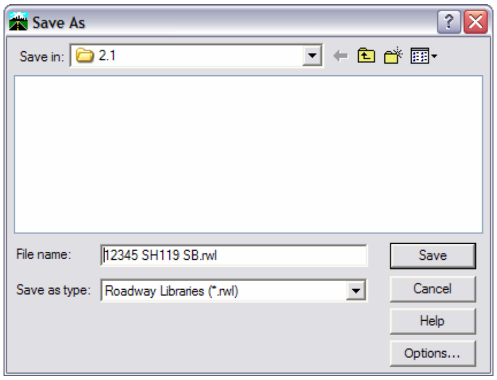
27. Close the **Define Roadway** box.

Save roadway library

1. Select **File > Save > Roadway Library.**

2. On the Save As dialog,

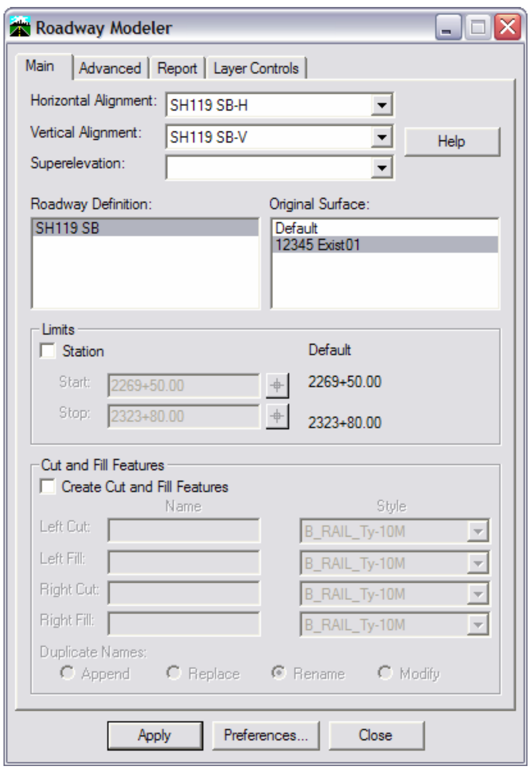
   - Verify that the name is ***12345 SH119 SB.rwl***
   - Select **Save**, then **Cancel** the dialog box.



Model SH119 SB

1. Select **Modeler > Roadway Modeler.**

2. Set the **Main** tab as shown.



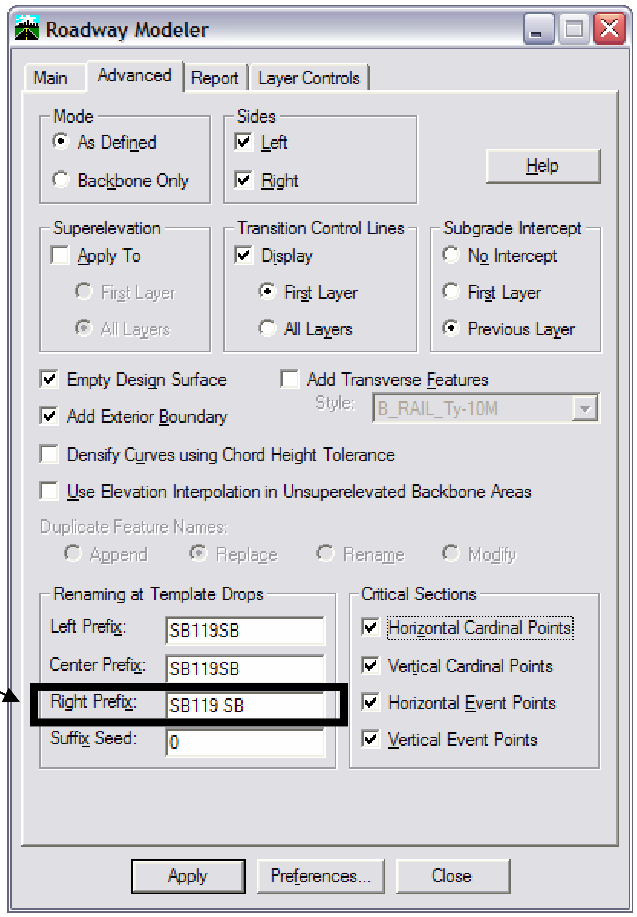
3. On the **Advanced** tab

   - Toggle **off Apply To** under **Superelevation.**
   - Key in ***SB119SB*** for **Left and Center**.
   - Key in ***SB119 SB*** for the **Right Prefix.**

<u>Note</u>: Left and Right prefixes cannot be identical; therefore you will use a space in the Right one.

   - Set all other options as shown.

Use a space before "SB" for Right Prefix



4. On the **Layer Controls** tab, make sure **Use Layer Controls** is turned **off.**

5. Select the **Main** tab again and then select **Apply.**

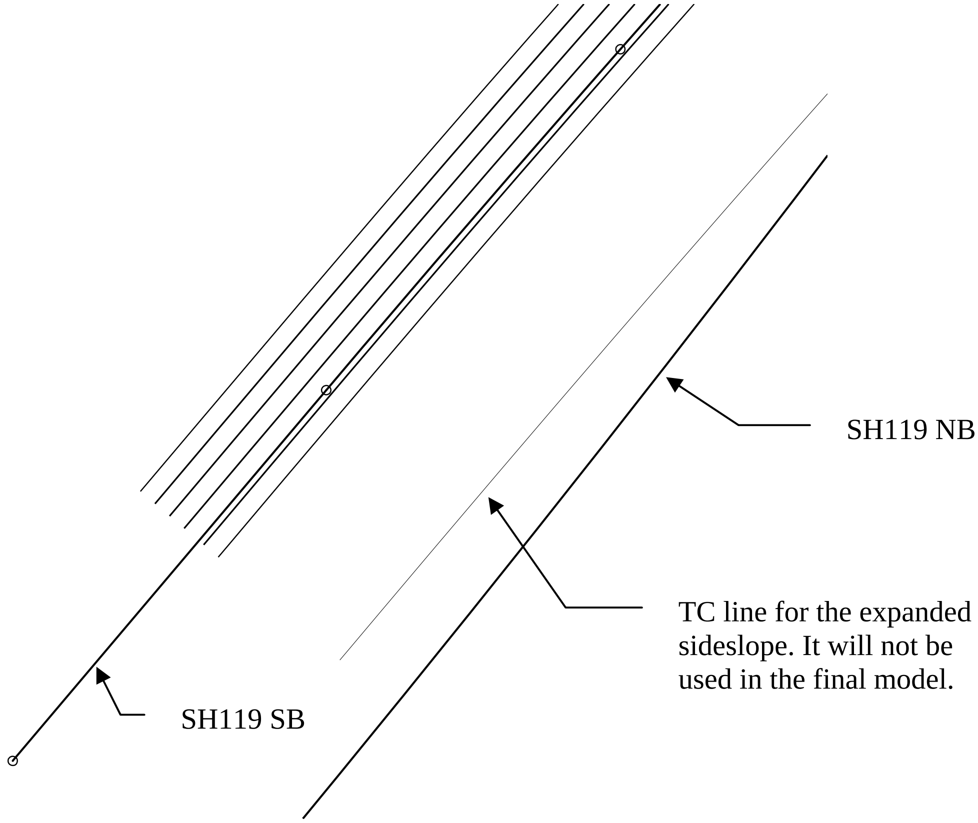
   The SB 119 corridor is modeled with the backbone on West (left) side and large sideslopes on East (right) side as defined in the template.

6. **Close** the **Roadway Modeler** box.

7. **Fit** the view.

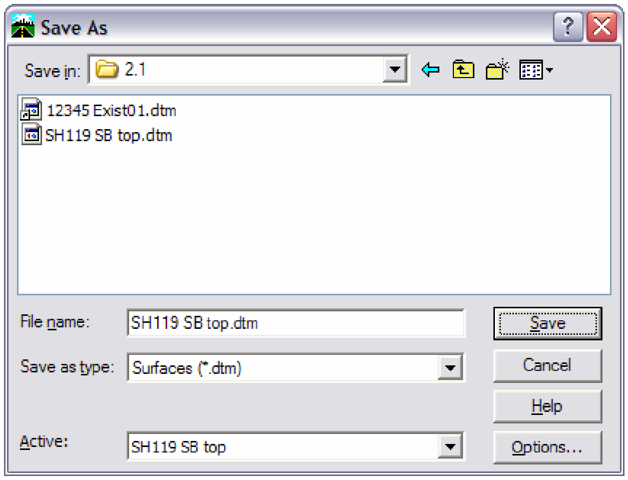
Note: Make sure that **Expand Clipping Planes** is turned on in the **Fit View** Settings box.

8. **Zoom in** to the beginning of the alignment to see the TC lines.



Save the SB 119 finished surface

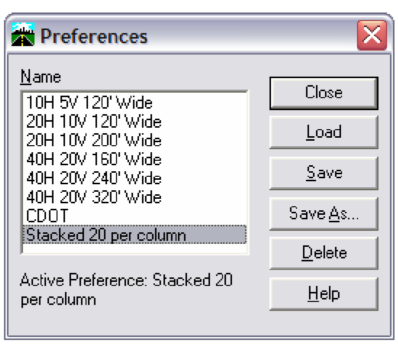
1. Choose **File > Save As**.
2. Set the **Save as type** to **Surfaces (*.dtm).**
3. Make certain you're in the 2.1 sub-folder.
4. Set **Active** to **SH119 SB top.**
5. Verify that the **File name** is also **SH119 SB top.**



6. Select **Save.**
7. **Cancel** the dialog box.

Generate Cross Section along SH119 SB

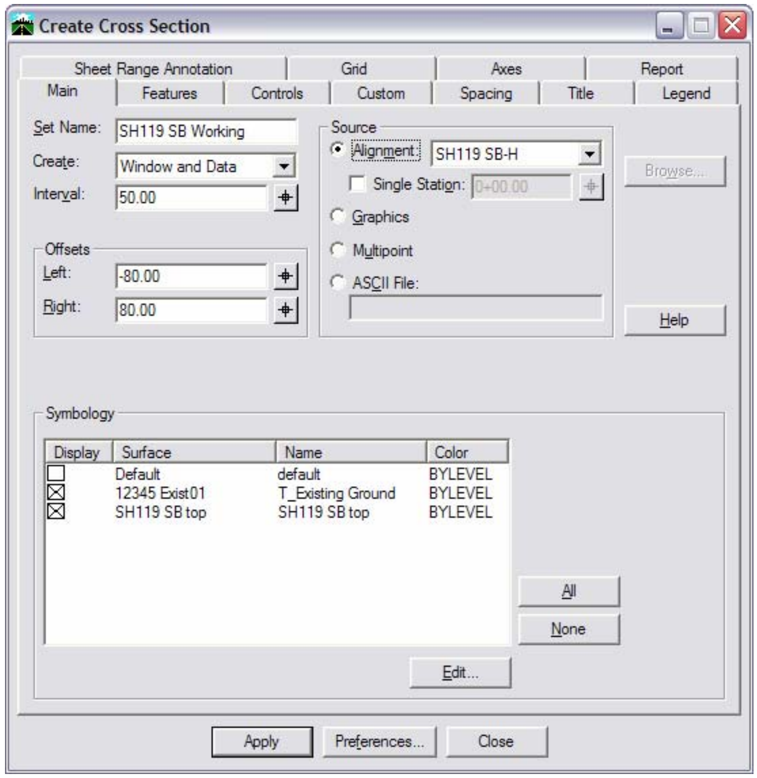
1. Change the **Text Scale Factor** to ***40*** under **Tools > Options > Factors**.
2. Select **Evaluation > Cross Section > Create Cross Section.**
3. Select **Preferences**, highlight the **Stacked 20 per column** preference and **Load.**



4. **Close** the Preferences box.

5. Set the **Main** tab as shown.

   - Make sure that alignment **SH119 SB-H** is selected and
   - Turn **on** the **12345 Exist01** and **SH119 SB top** surfaces.
   - Key in the **Set Name** ***SH119 SB Working***

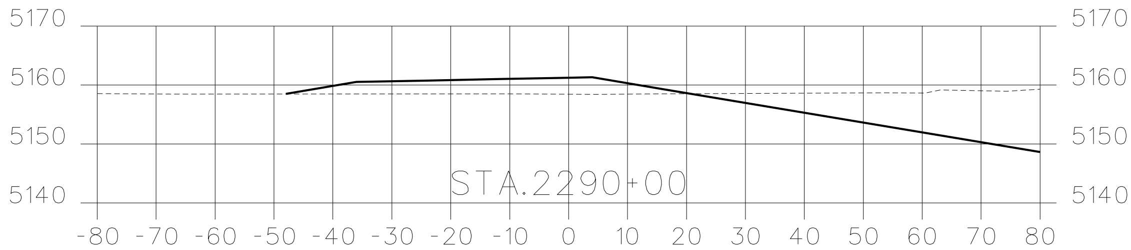


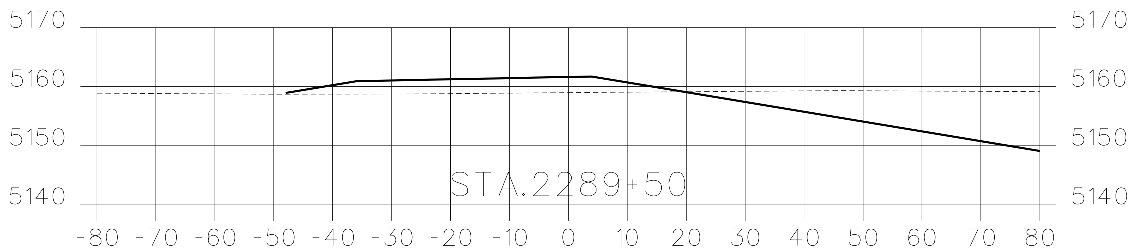
6. **Apply.**

7. **<D>** anywhere in a clear area to plot the cross sections.

8. **Window** in and take a look at the some of the cross sections.

   Note: The minor grid lines have been turned off in the diagram below for clarity purposes.

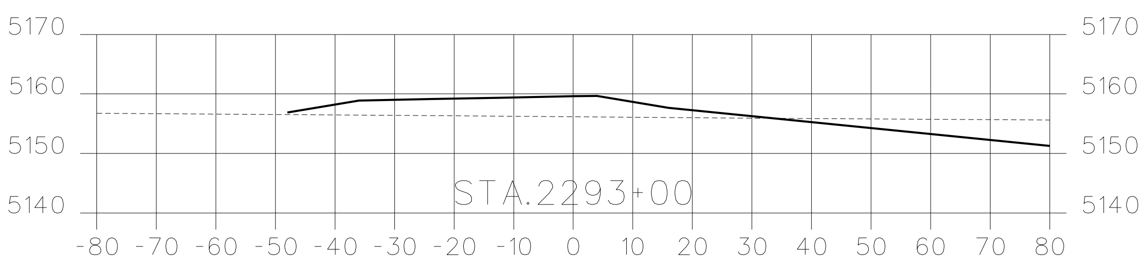




Use Cross Section Viewer to review sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to **SH119 SB Working** and the other options as shown.
3. Select **Run.**

   Note: Watch for the 6:1 to 10:1 transition between stations 2292+00 and 2293+00.



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

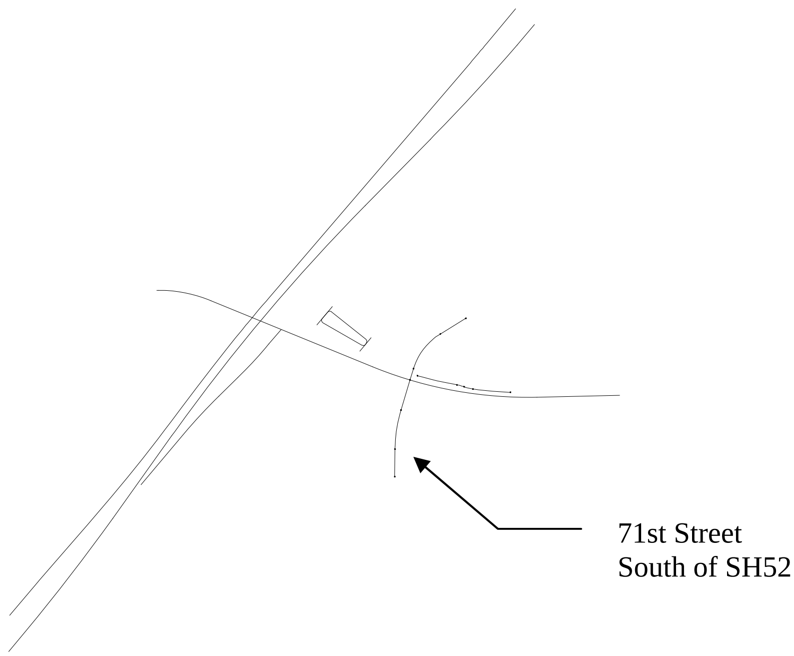
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 2.2 – Modeling with Superelevation and Independent Controls

In this activity, you will model 71st Street with lane widening using horizontal controls. You will also set up Superelevation to match hand calculations, and modify the templates and super so that left lanes at the intersection will match the cross slope of the turn lane from SH52.



Start MicroStation InRoads

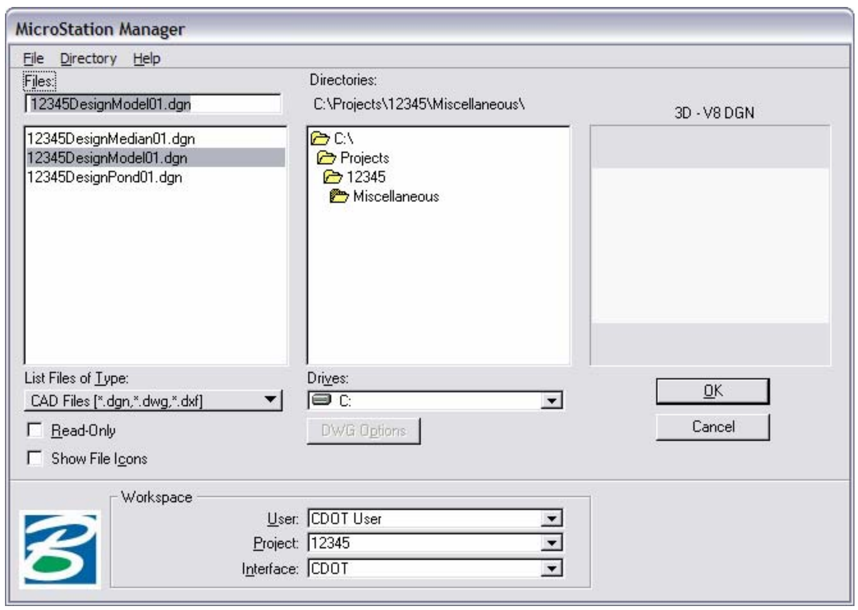
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

Set Project Defaults

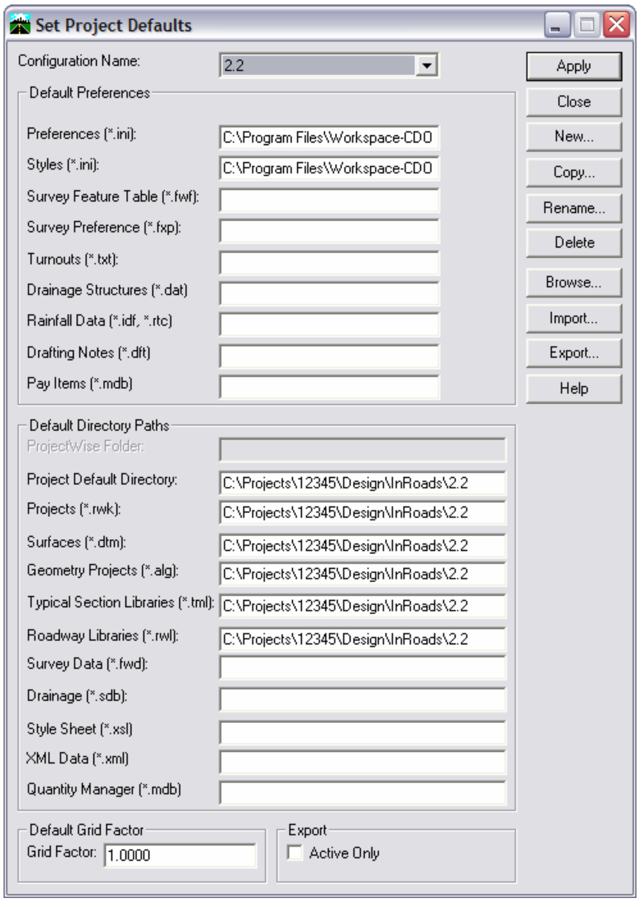
1. Select **File > Project Defaults**.

2. Set the **Configuration Name** to **2.2**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for 71st Street

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 71st.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for 71st Street

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 71st.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load 71st Street DTM

8. Set **File of Type** to **Surfaces (*.dtm)**.
9. Highlight **12345 SH52 top.dtm** and select **Open**.
10. ***Do not*** cancel out of the box.

Load the existing DTM

11. Highlight **12345 Exist01.dtm** and then select **Open**.
12. **Cancel** the **Open** dialog box.

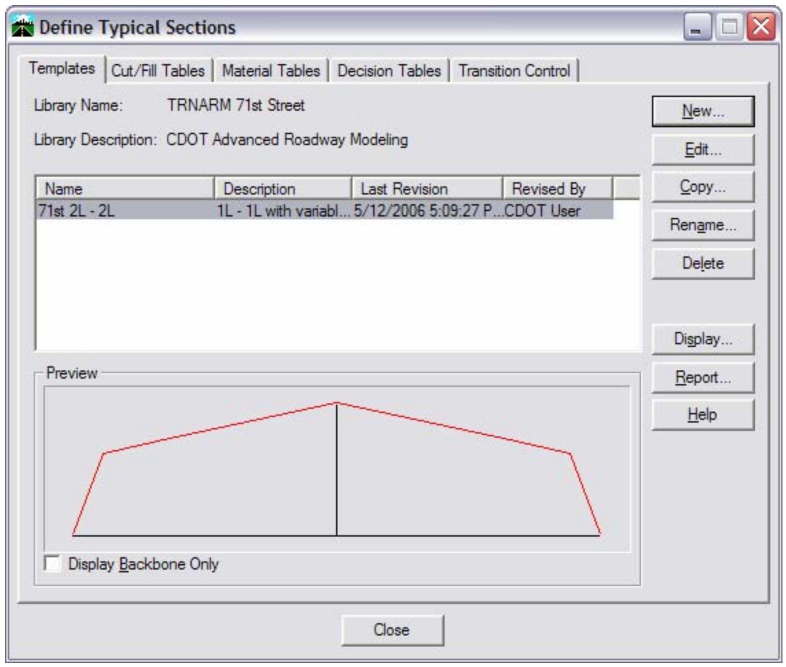
Review Data

View 71st Street horizontal

1. Select **Geometry > View > Active Horizontal.**

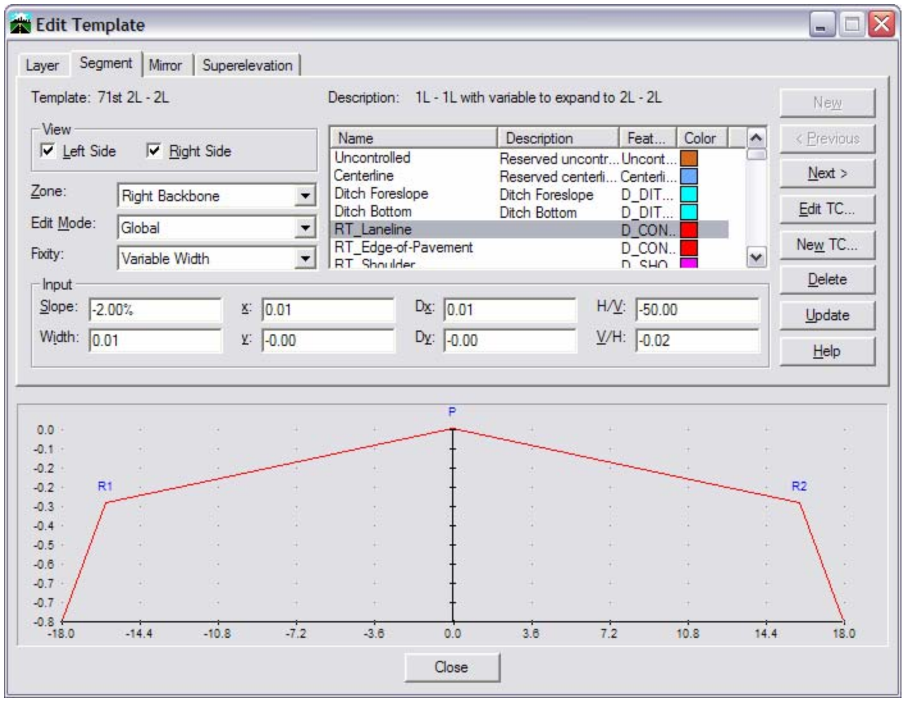
Review the typical section for 71st street

2. Select **Modeler > Define Typical Section.**



3. Highlight the template **71st 2L – 2L** and select **Edit.**
4. Select the **Segment** tab and set the **Zone** to **Right Backbone.**

5. Use the **Next** button to review the segments in the backbone.

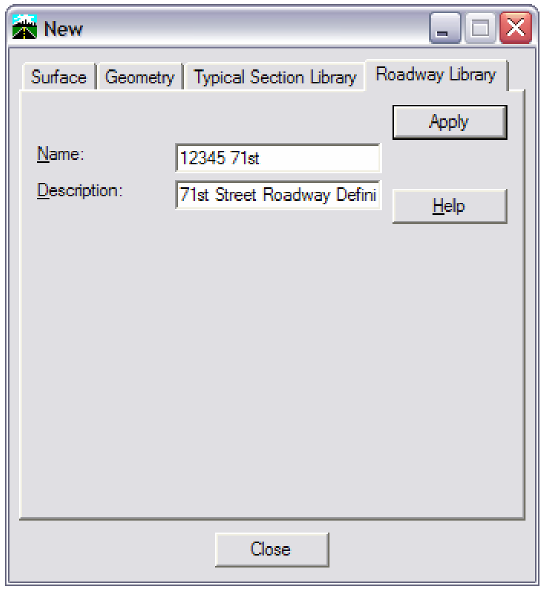


Notice the inside segment is a tiny variable width segment that you will set up to expand, creating an additional lane on the inside.

6. **Close** the **Edit Template** box.

Create a Roadway Library for 71st street

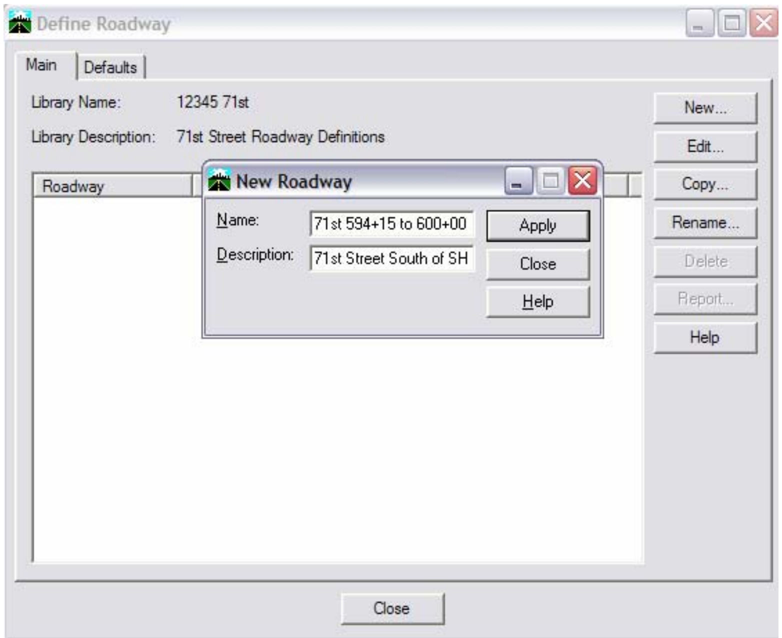
1. Select **File > New.**
2. Select the **Roadway Library** tab.



3. Key in a **Name** of ***12345 71st***
4. Key in a **Description** of ***71st Street Roadway Definitions***
5. **Apply.**

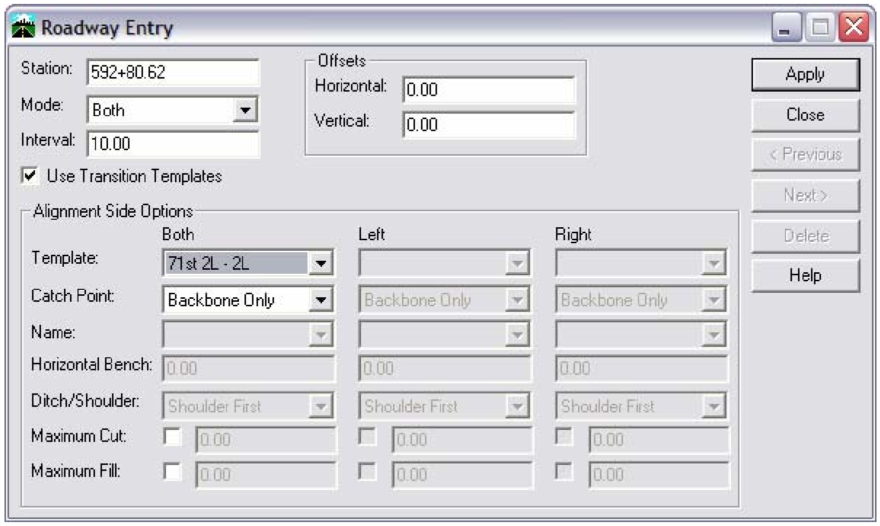
Develop roadway definitions

1. Select **Modeler > Define Roadway.**
2. Select **New.**



3. Key in a **Name** of ***71st 594+15 to 600+00***
4. Key in a **Description** of ***71st Street South of SH52***
5. **Apply**, then **Close.**
6. Highlight the definition you just created and select **Edit.**

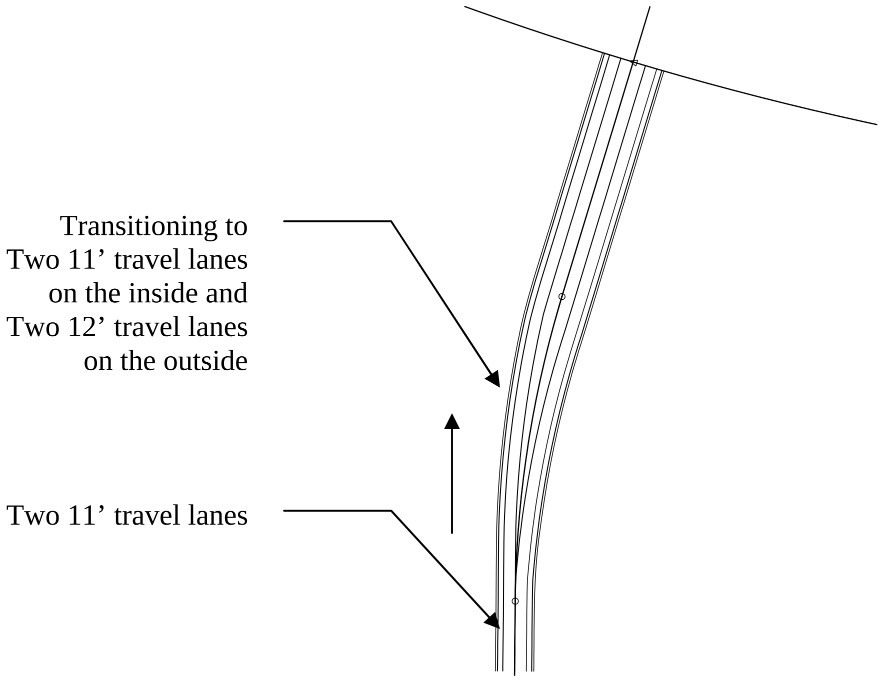
7. In the **Edit Roadway** dialog box, select **New.**



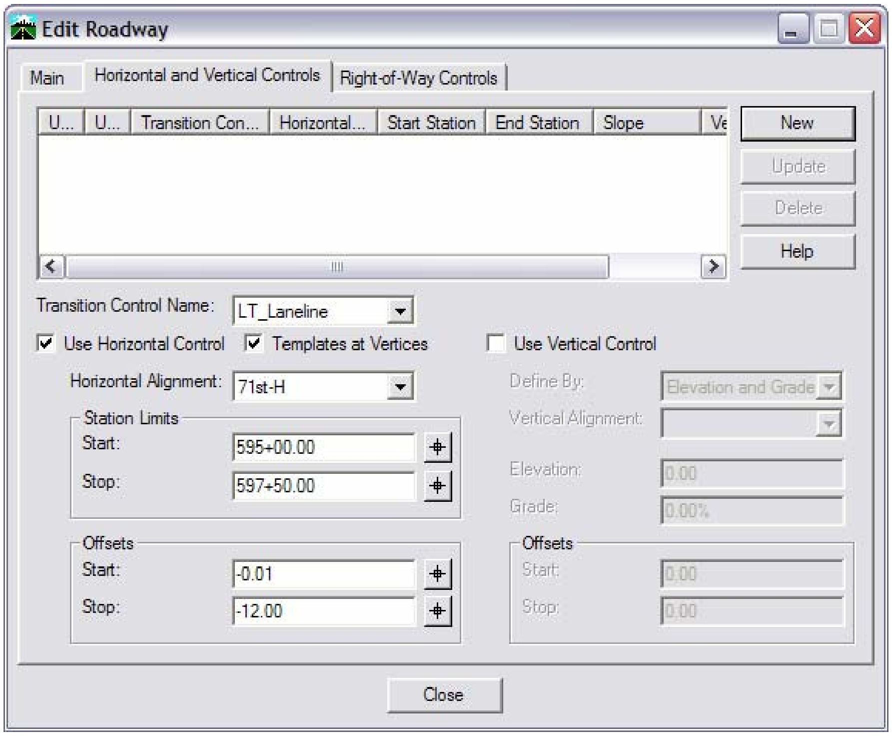
8. Keep the initial default station.
9. Set **Mode** to **Both.**
10. Key in an **Interval** of ***10***
11. For **Template**, choose **71st 2L – 2L.**
12. For **Catch Point** choose **Backbone Only.**
13. **Apply.**
14. **Close** the **Roadway Entry** box.
15. **Close** the **Define Roadway** box.

Widening

71st Street begins with two 11’ travel lanes to match with existing and transitions to a section with an 11’ and a 12’ lane on both sides of the alignment. In the next steps, you’ll set up independent control to establish the transitions.



1. Select **Modeler > Define Roadway**.
2. **Edit** the roadway definition.
3. Select the **Horizontal and Vertical Controls** tab.
4. For the first entry,



- Set the Control Name to **LT_Laneline**.
- Toggle on **Use Horizontal Control**.
- Toggle on **Templates at Vertices**.
- Toggle off **Use Vertical Control**.
- Select the horizontal alignment **71st-H**.

Under Station Limits:

- Set the Start station to ***595+00***

Note: This is the station where you want the inside lane to begin widening.

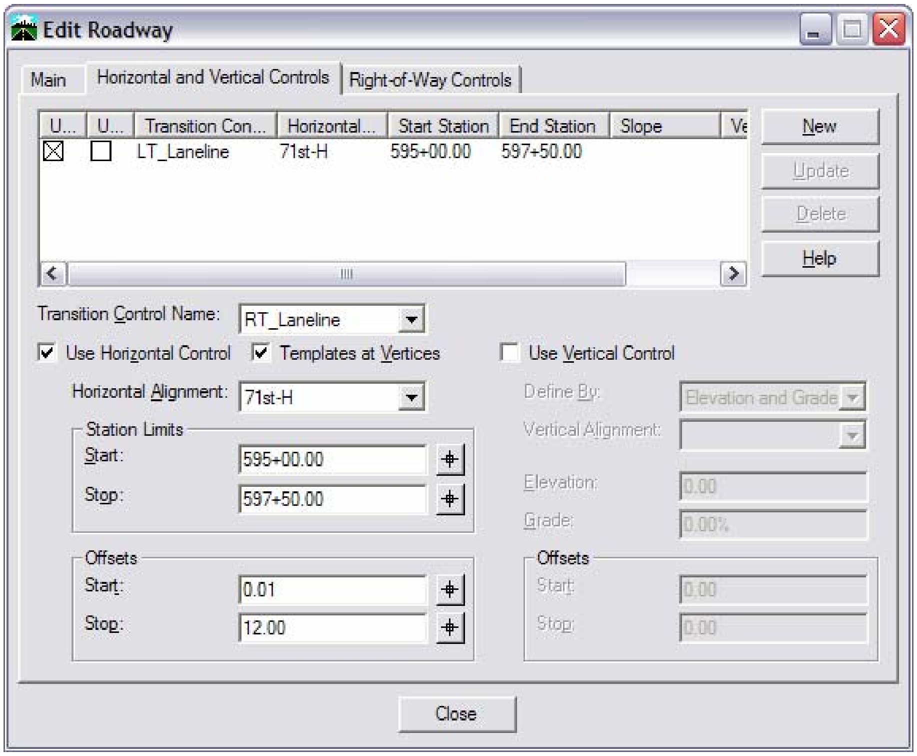
- Set the End station to ***597+50***

Note: This is the station where you want the inside lane to be the full width.

- Key in a Start offset of ***-0.01***
- Key in a Stop offset of -***12***

5. Select **New**.

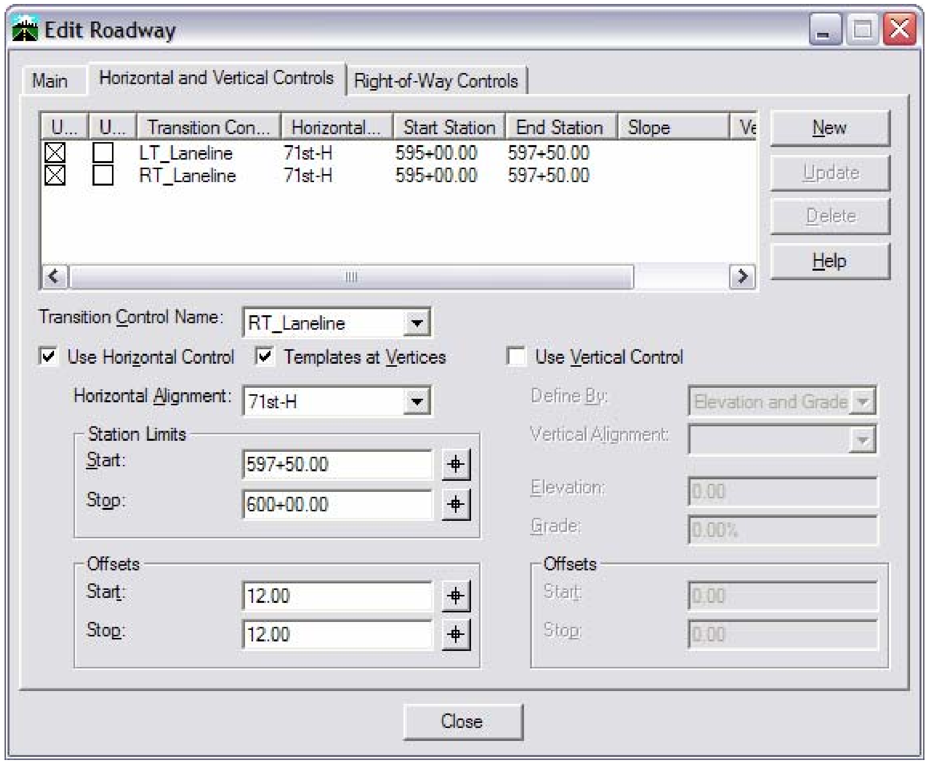
6. For the second entry,



- Change the TC name to **RT_Laneline**.
- Change the offsets to positive.

7. Select **New**.

8. For the third entry,

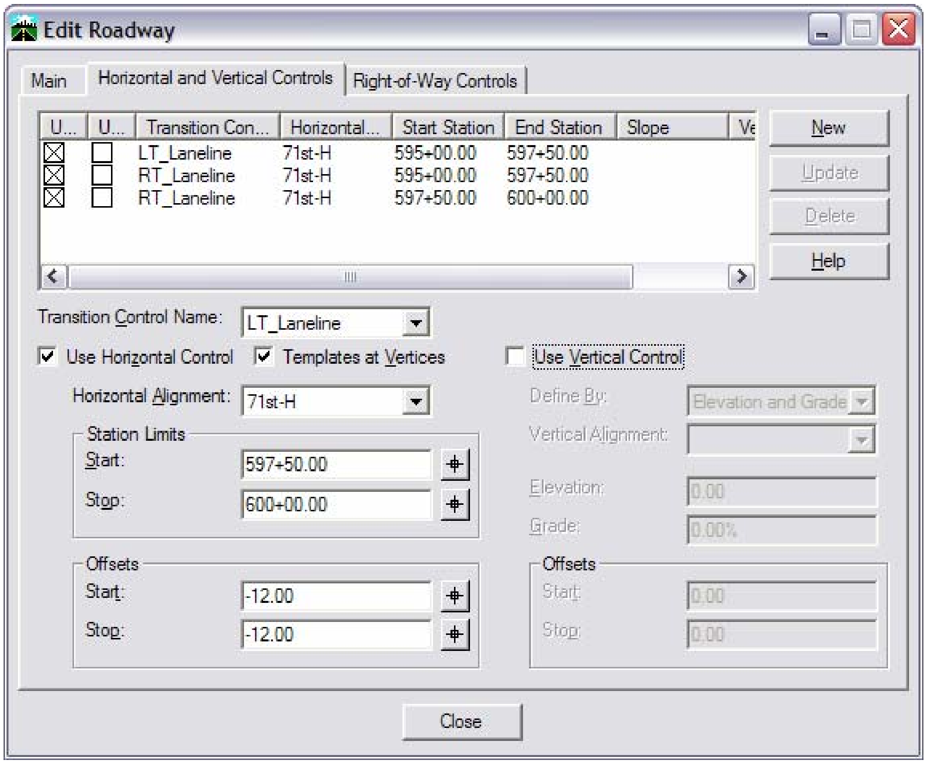


Under Station Limits

- Set the Start station to ***597+50***
- Set the End station to ***600+00***
- Key in a Start offset of ***12***
- Key in a Stop offset of ***12***

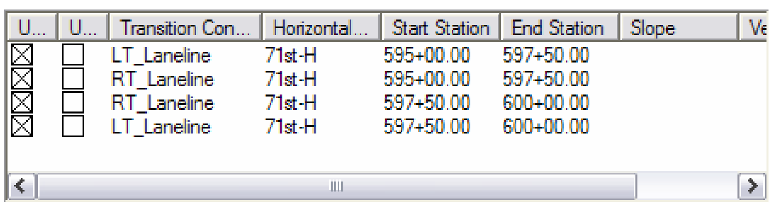
9. Select **New**.

10. For the fourth entry,



- Change the TC name to **LT_Laneline**.
- Change the offsets to negative.

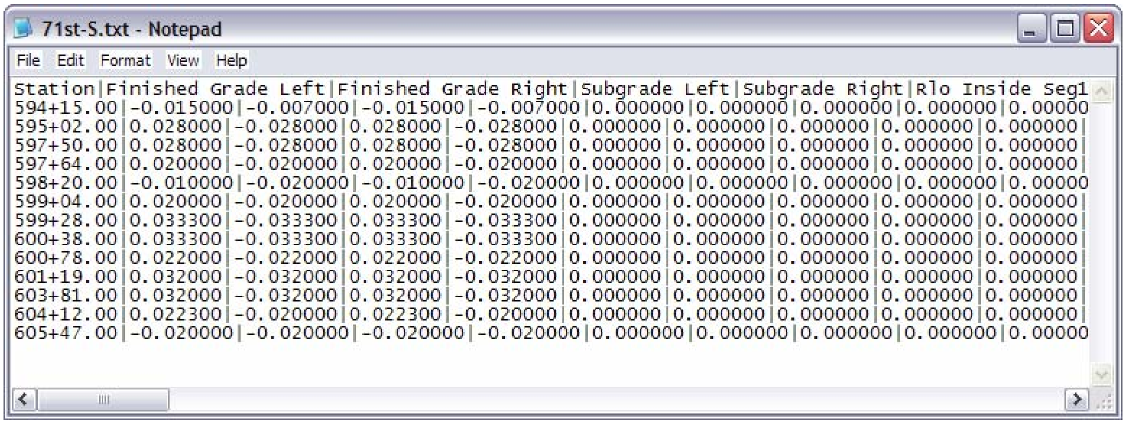
11. Select **New**, then **Close**.



12. **Save** the roadway library.

Superelevation

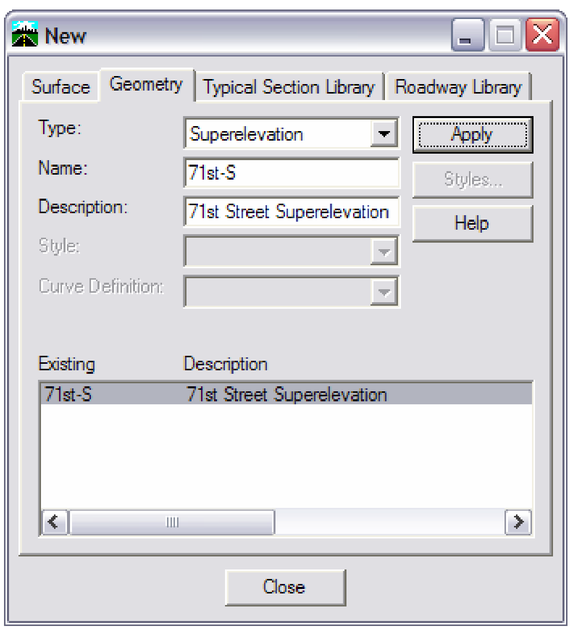
The superelevation must match the existing cross slopes at the beginning of the alignment and the longitudinal slope of SH52 at the intersection. This superelevation has already been worked out in a spreadsheet which you can view in your project files (**71st-S.txt**).



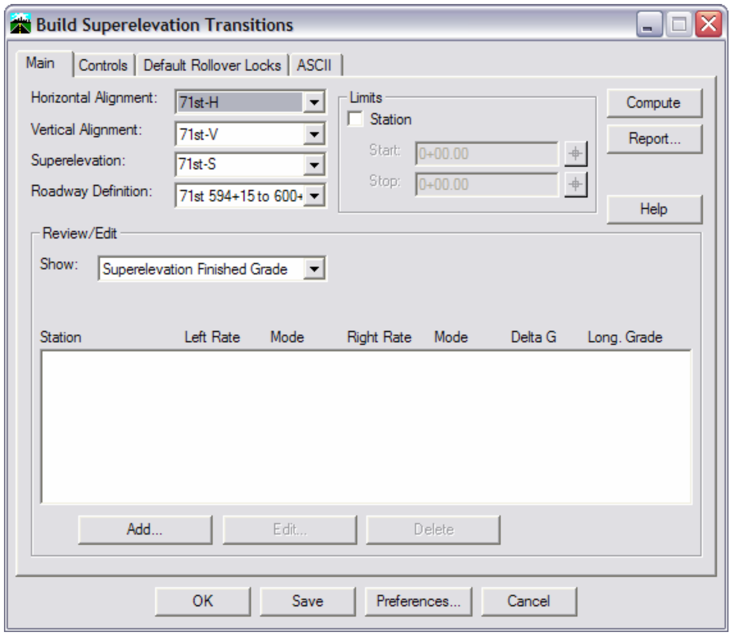

```
Station|Finished Grade Left|Finished Grade Right|Subgrade Left|Subgrade Right|Rlo Inside Seg1
594+15.00|-0.015000|-0.007000|-0.015000|-0.007000|0.000000|0.000000|0.000000|0.000000|0.00000
595+02.00|0.028000|-0.028000|0.028000|-0.028000|0.000000|0.000000|0.000000|0.000000|0.000000|
597+50.00|0.028000|-0.028000|0.028000|-0.028000|0.000000|0.000000|0.000000|0.000000|0.000000|
597+64.00|0.020000|-0.020000|0.020000|-0.020000|0.000000|0.000000|0.000000|0.000000|0.000000|
598+20.00|-0.010000|-0.020000|-0.010000|-0.020000|0.000000|0.000000|0.000000|0.000000|0.00000
599+04.00|0.020000|-0.020000|0.020000|-0.020000|0.000000|0.000000|0.000000|0.000000|0.000000|
599+28.00|0.033300|-0.033300|0.033300|-0.033300|0.000000|0.000000|0.000000|0.000000|0.000000|
600+38.00|0.033300|-0.033300|0.033300|-0.033300|0.000000|0.000000|0.000000|0.000000|0.000000|
600+78.00|0.022000|-0.022000|0.022000|-0.022000|0.000000|0.000000|0.000000|0.000000|0.000000|
601+19.00|0.032000|-0.032000|0.032000|-0.032000|0.000000|0.000000|0.000000|0.000000|0.000000|
603+81.00|0.032000|-0.032000|0.032000|-0.032000|0.000000|0.000000|0.000000|0.000000|0.000000|
604+12.00|0.022300|-0.020000|0.022300|-0.020000|0.000000|0.000000|0.000000|0.000000|0.000000|
605+47.00|-0.020000|-0.020000|-0.020000|-0.020000|0.000000|0.000000|0.000000|0.000000|0.00000
```

You can also view the text version of this spreadsheet (**71st-V.txt**) which will be imported to form the superelevation transition table. The text file is a pipe-delimited export of the spreadsheet.

1. Select **File > New** and create a new Superelevation Alignment for 71st Street.



2. Select **Modeler > Superelevation > Build Transitions**.

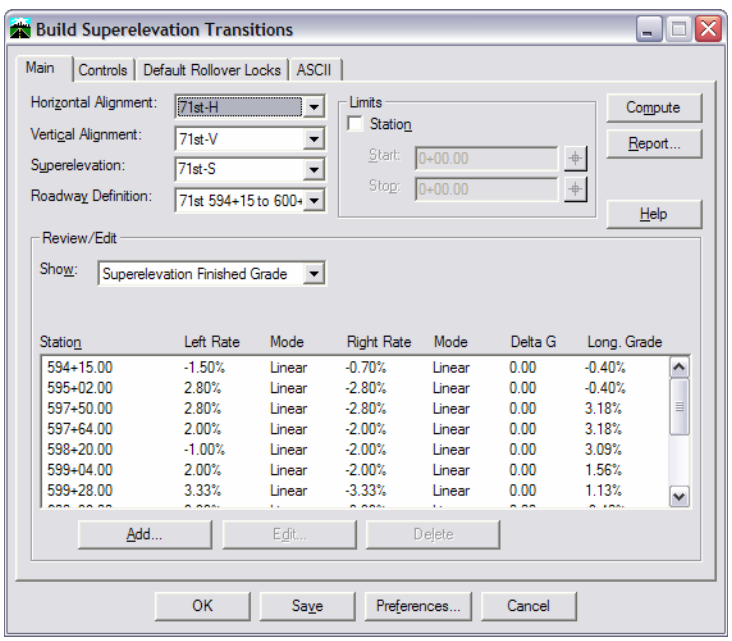


3. Select the **ASCII** tab.

4. Select **Browse** and choose the **71st-S.txt** file from the **C:\Projects\12345\Design\InRoads\2.2** folder.

5. Select **Open**.

6. Go back to the **Main** tab to see the table you imported.

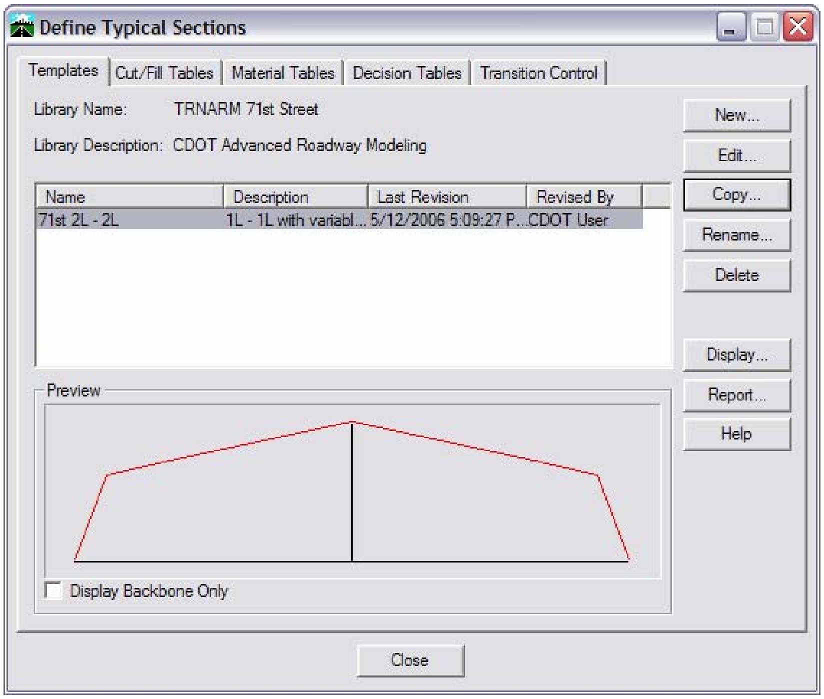


7. Choose **Save**, then **OK**.

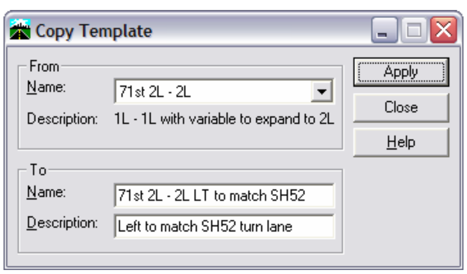
Copy the current typical

In the approach to SH52, the left lane of 71st ties into the right turn lane of SH52. Since the SH52 turn lane is at -1%, you will force the left lane of 71st to match this cross slope. At station 598+20, you want the super of the left travel lane ‘locked’ at -1%. Since the 71st Street template is being supered at the end to match the longitudinal grade of SH52, you will override the super for the outside lane by switching to a template with a different slope and super range point on the left.

1. Select **Modeler > Define Typical Sections**.



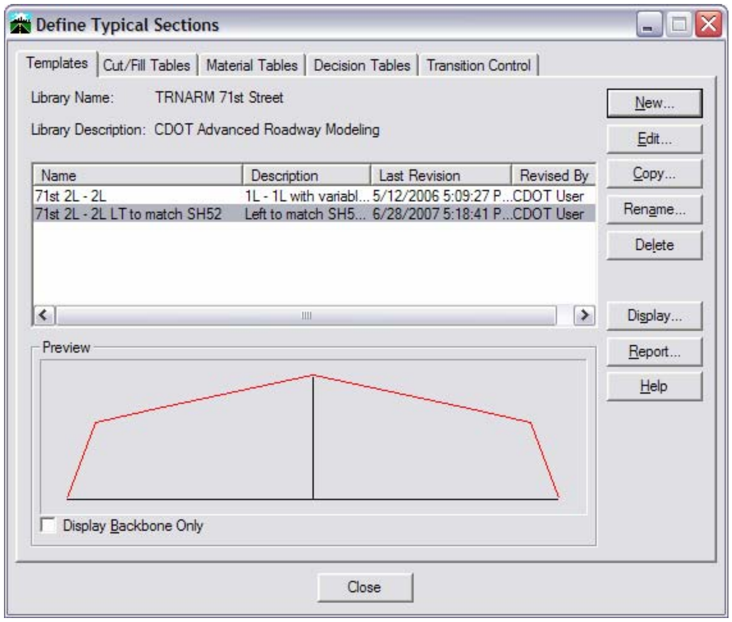
2. Highlight **71st 2L – 2L** and select **Copy**.



3. In the **To** field, key in the **Name** ***71st 2L – 2L LT to match SH52***.

4. For the **Description**, key in ***Left to match SH52 turn lane***.

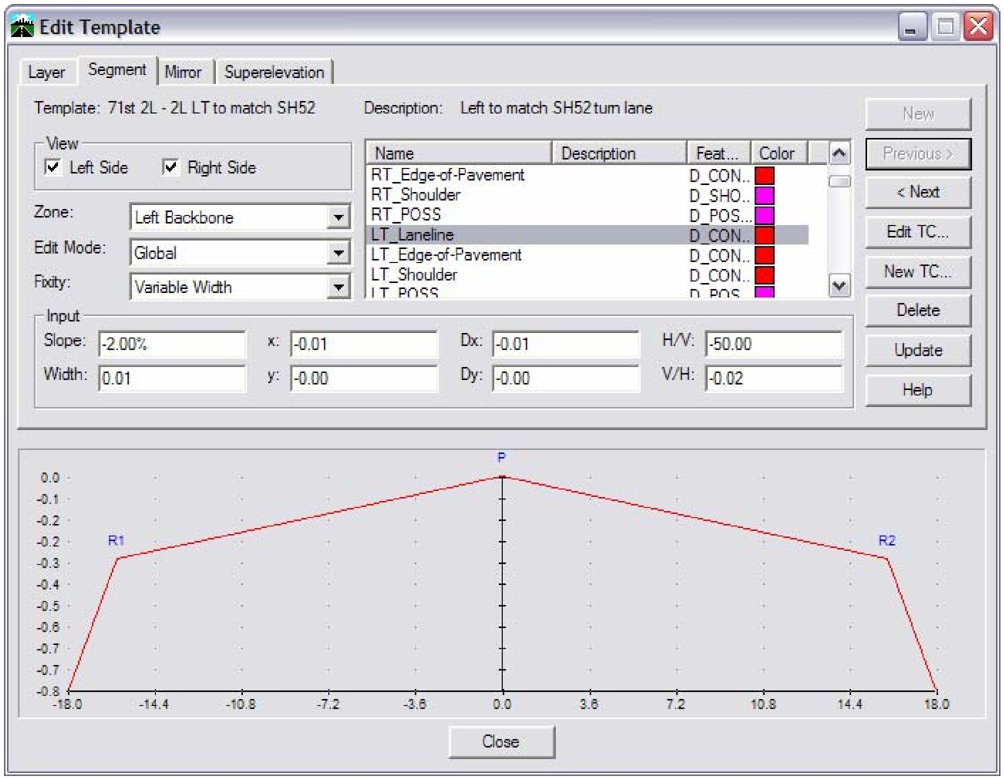
5. **Apply**, then **Close** the dialog.



Edit the new template.

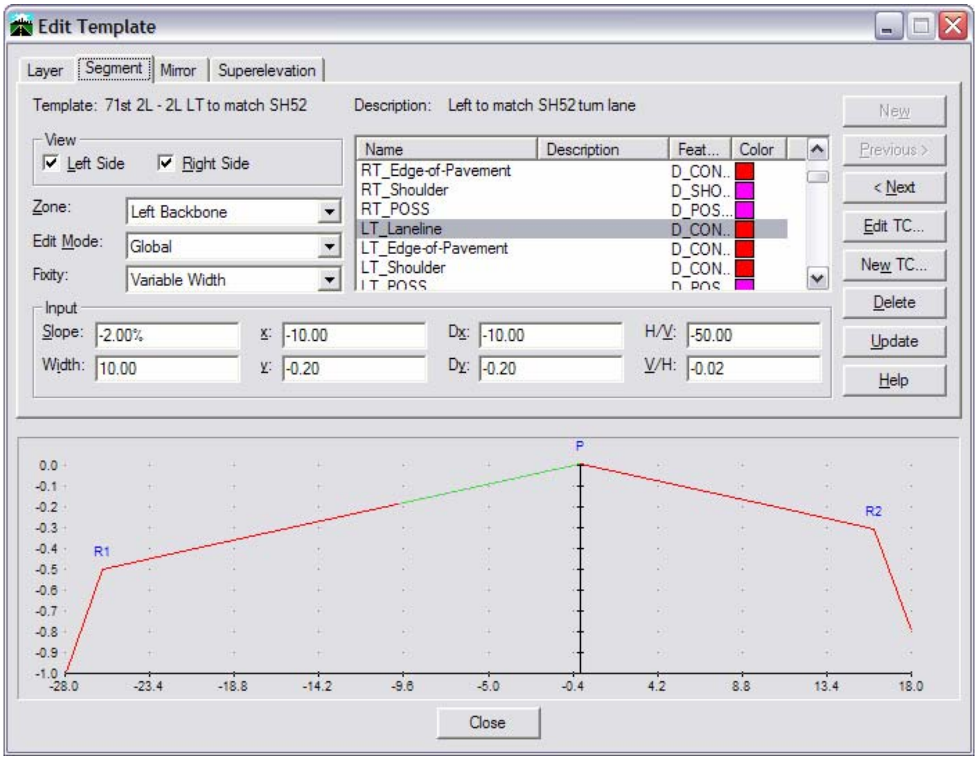
You goal is to set the superelevation range point at the Left Laneline. However, since the Left Laneline is only 0.01’ away from the Centerline, it is very difficult to set the range point at the correct location. In the next series of steps, you’ll widen the segment to make it easier to establish the range point.

1. On the **Segment** tab,



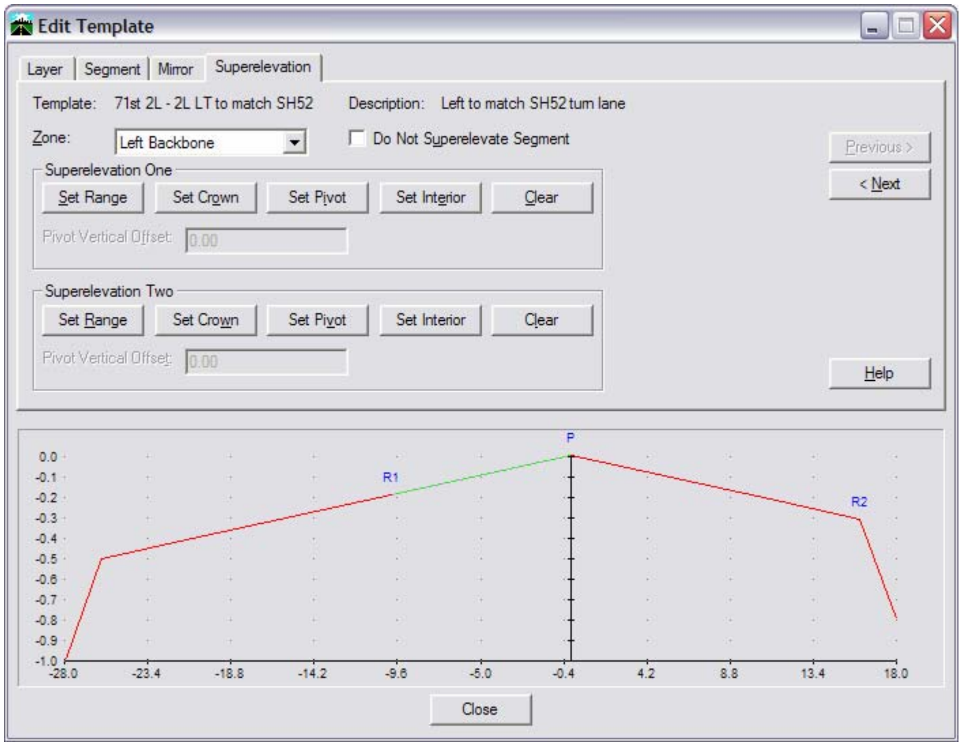
- Set the **Zone** to **Left Backbone**.
- Set the **Edit Mode** to **Global**.
- Use **Previous** or **Next** to make sure you’re sitting on the **Left Laneline**.

- Change the width from **0.01** to ***10*** and **Tab**.

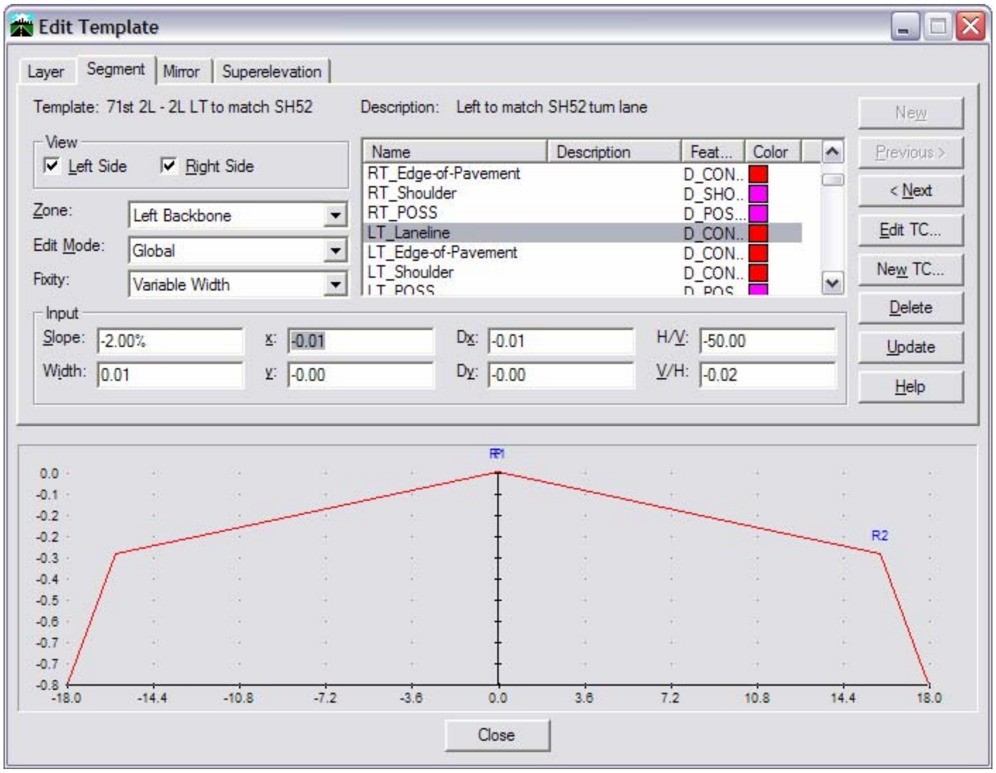


2. Select the **Superelevation** tab:

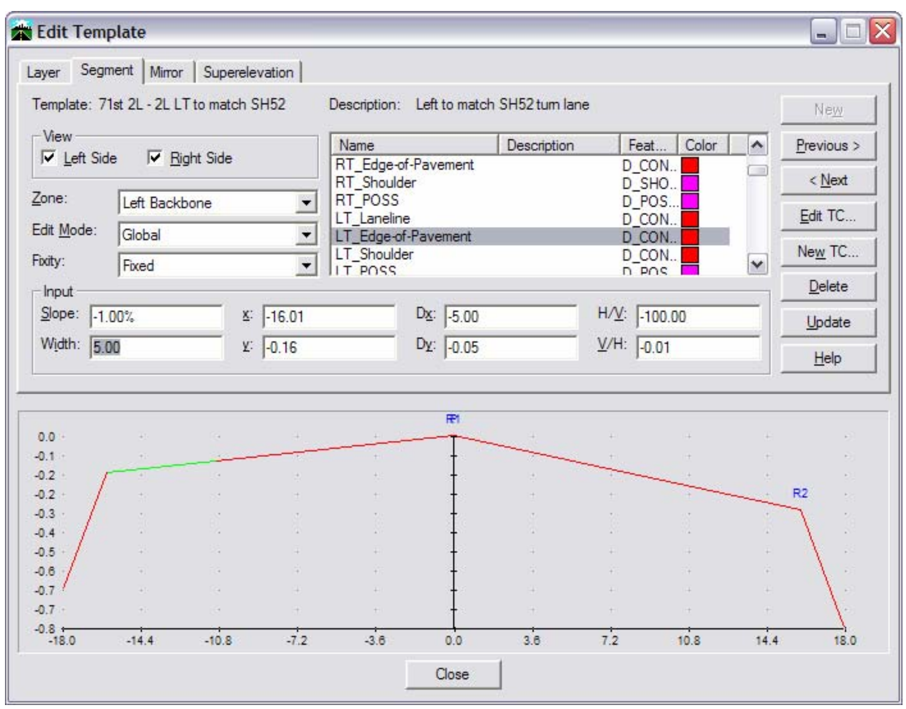
    - **Clear** the Superelevation, then set:
    - **Set Range** points at the Left Laneline and at the Right Edge-of-Pavement.
    - **Set Pivot** at the Centerline.



3. Change the width of the segment back to ***0.01***



4. Change the **Slope** of the other two segments on the left backbone to ***-1%***

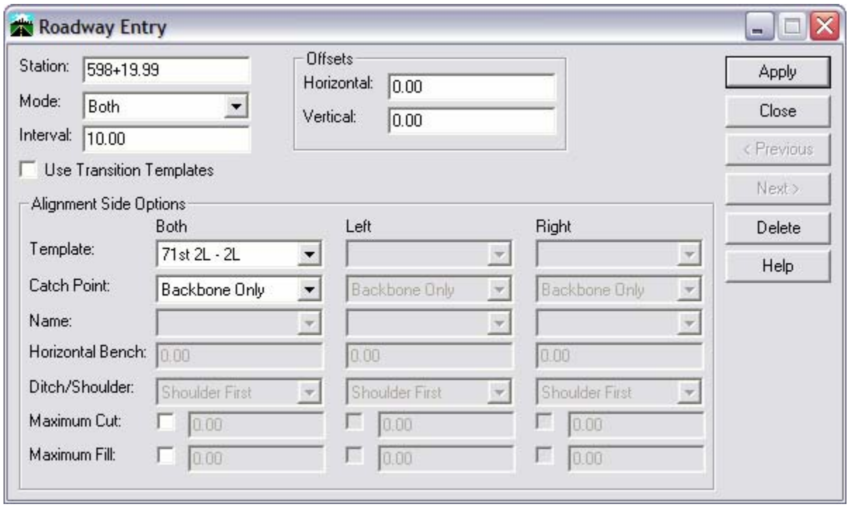


5. **Close** the dialogs and **Save** the typical section library.

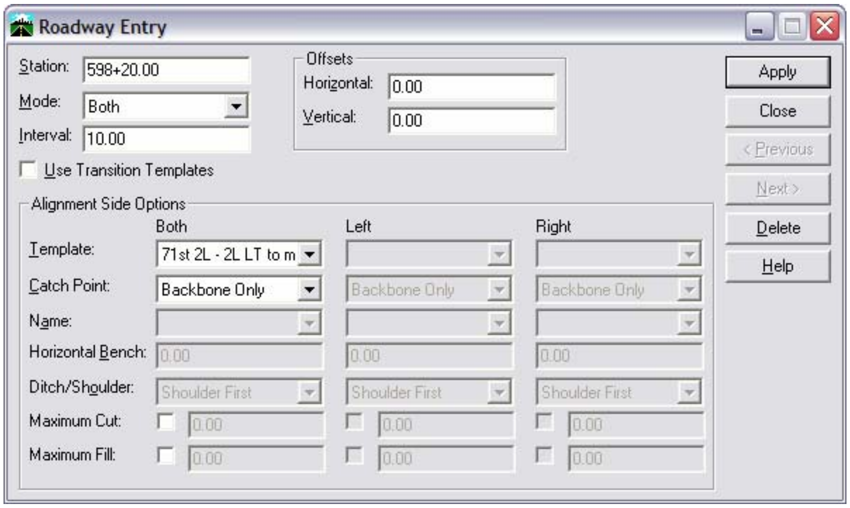
Add the transition to the roadway definition

1. Select **Modeler > Define Roadway**.
2. Choose the roadway definition and **Edit**.
3. Select **New** and add the following entries to transition to the template with the different left range point. Make ***CERTAIN*** **Use Transition Template** is toggled ***OFF***.

   - ***598+19.99 71st 2L – 2L***



   - ***598+20.00 71st 2L – 2L LT to match 52***

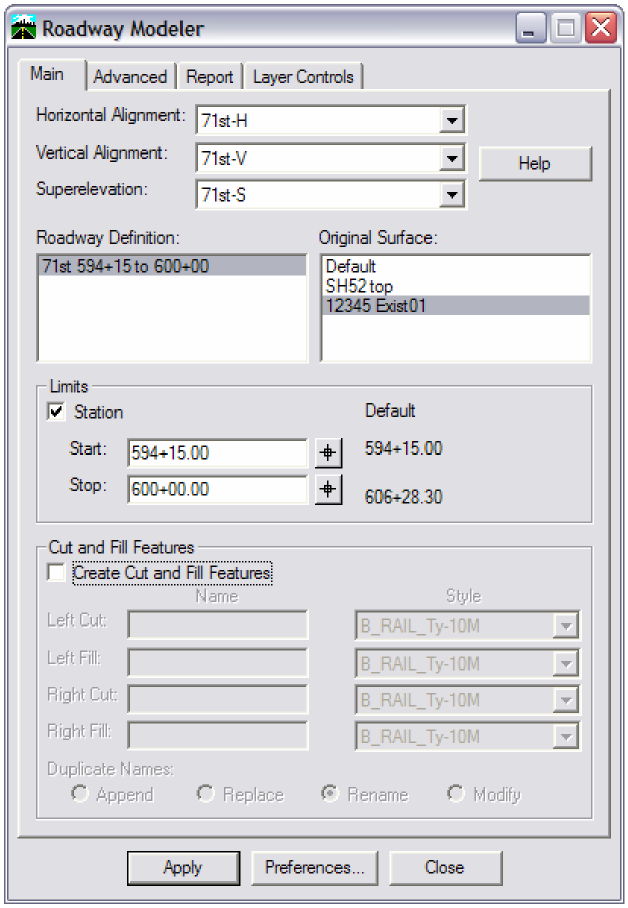


4. **Close** the dialogs and save your roadway library.

Note: We are only modeling the south side of SH52. If you model both sides, you will need to switch back to the original template on the other side of SH52.

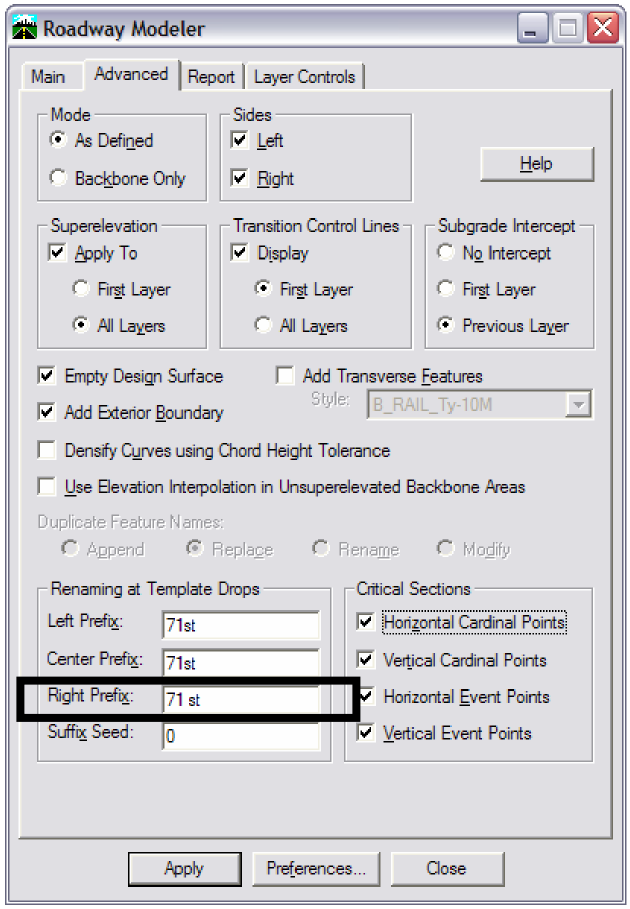
Model South 71st street

1. Select **Modeler > Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. Set the **Main** tab as shown, limiting the **Modeler** run to the south side of SH52.

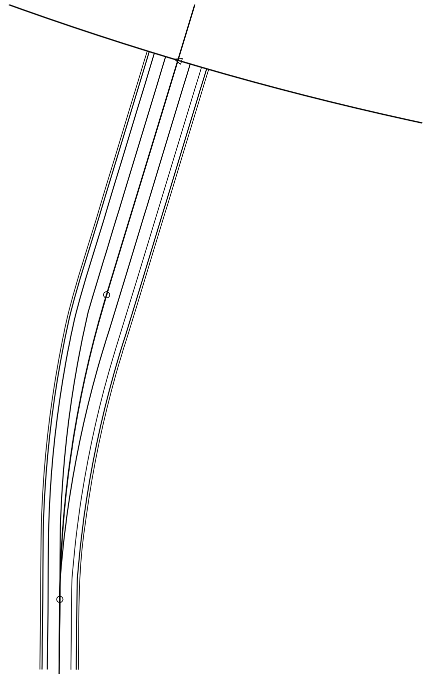


4. Set the **Advanced** tab as shown. In the **Superelevation** section, makes sure **Apply To** is toggled **on** and select **First Layer**.

Important! Don't forget the space in the **Right prefix**.



5. Select **Apply.**



6. **Zoom in** to the alignment to see the TC lines. Note the transitions from two to four lanes.

7. **Save** the new surface.

Generate Cross Section along 71st street

1. Select **Tools > Options** and set the **Text Scale Factor** to ***40***.

2. Select **Evaluation > Cross Section > Create Cross Section.**

3. Select **Preferences**, highlight the **Stacked 20 per column** preference and **Load.**

4. **Close** the Preferences box.

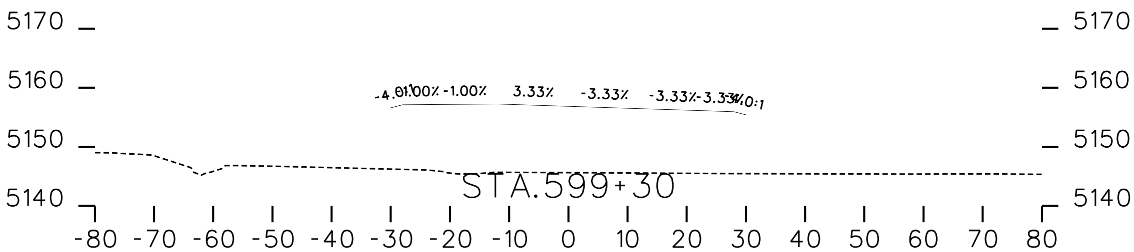
5. Set the **Main** tab as shown.

    - Make sure that alignment **71st-H** is selected and
    - Turn on the **71st top** surface.
    - Key in the **Set Name** 71st Working
    - **Apply.**

6. **<D>** anywhere in a clear area to plot the cross sections.

Review sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to **71st Working** and the other options as shown.
3. Select **Run.**
4. Annotate slopes on the sections to see how the left lane stays at -1% rather than going into super at the end of the model run.



5. Review the surface by viewing contours and/or triangles.

   Note that the returns are obviously not in place. You will be modeling them in a later chapter.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

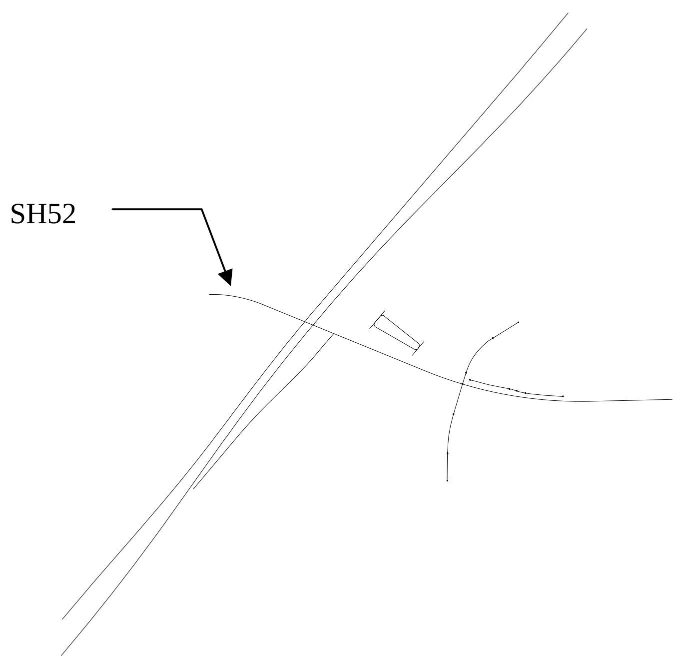
1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 2.3 – Templates, Transitions, and Superelevation

In this activity, the roadway is a multi-lane divided typical with curb and gutter, and raised medians. One approach to modeling this type of situation is to work out the details in steps. This makes it much easier to trouble-shoot when there are problems with the model.

To start, you will create a simple model with one lane on either side of the centerline and use it to work out the details of the superelevation. Once that's done, you will model again with a multi-lane template and use independent control to widen the roadway.

In a later activity, you will be modeling the raised medians and including them in the surface created here.



Start MicroStation InRoads

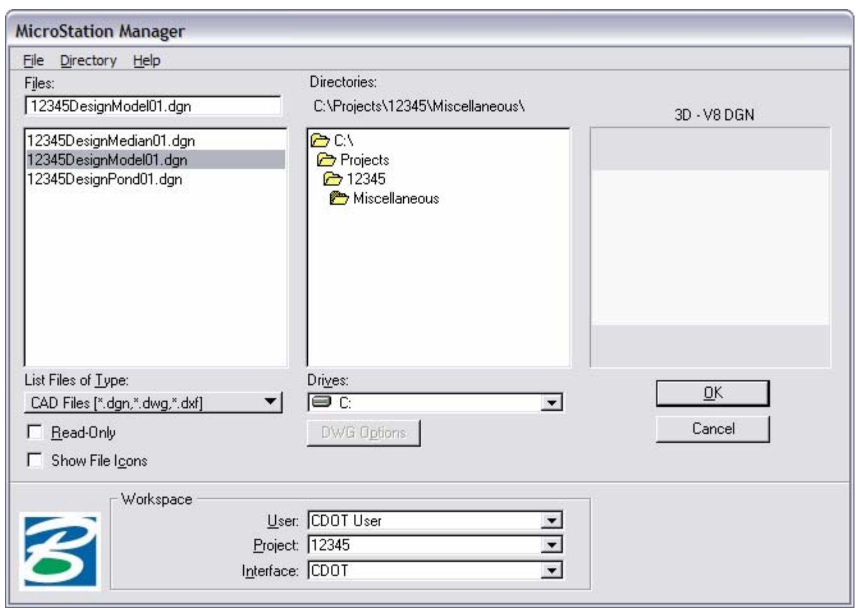
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

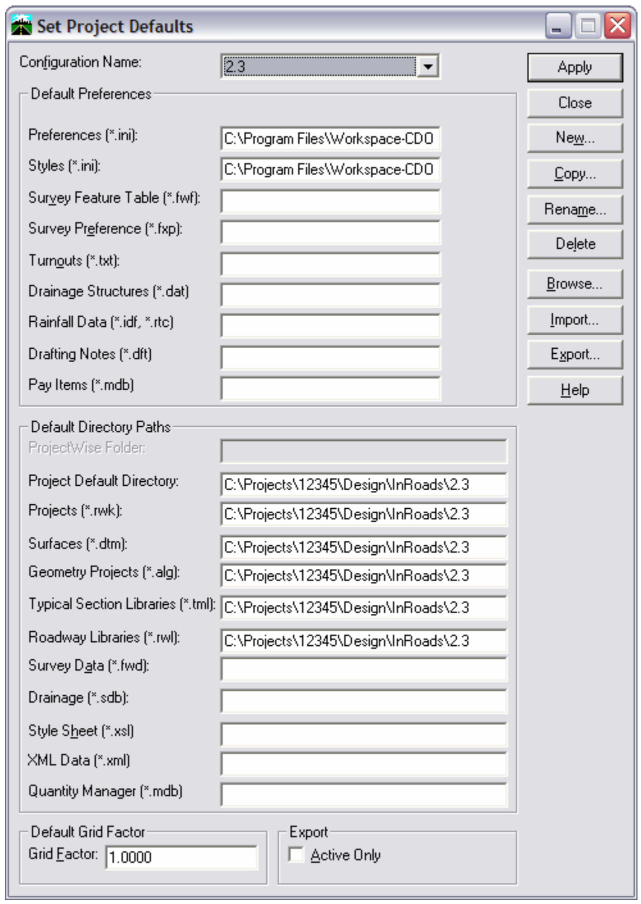
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **2.3**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH52

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH52.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for SH52

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 SH52.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load SH119 NB and SH119 SB DTMs

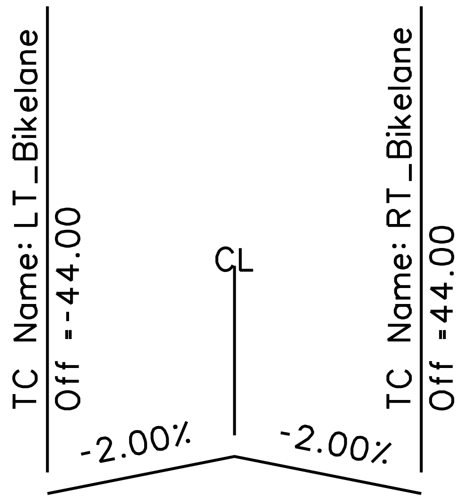
8. Set **File of Type** to **Surfaces (*.dtm)**.
9. Highlight **12345 SH119 NB top.dtm** and select **Open**.
10. Highlight **12345 SH119 SB top.dtm** and select **Open**.
11. ***Do not*** cancel out of the box.

Load the existing DTM

12. Highlight **12345 Exist01.dtm** and then select **Open**.
13. **Cancel** the **Open** dialog box.

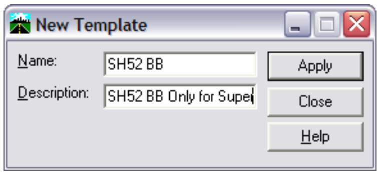
Develop a basic template (backbone only)

You'll create a basic cross slope template for working out superelevation. This template has a single 44' lane on each side of the CL.



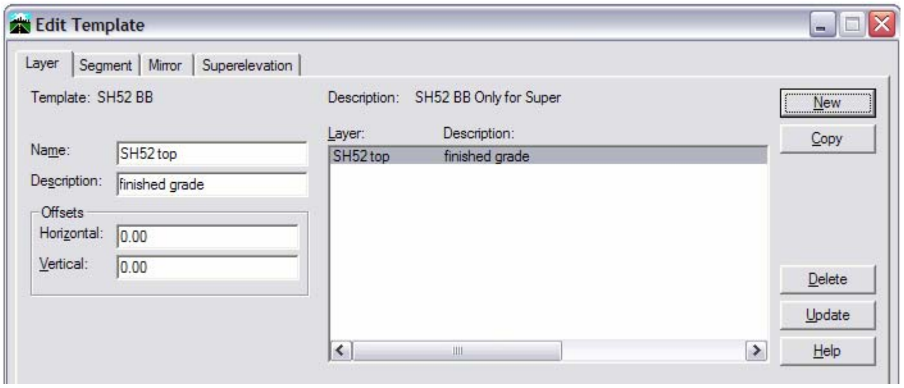
Create the template name

1. Select **Modeler > Define Typical Section**.
2. Create a template named ***SH52 BB*** with a description ***SH52 BB Only for Super***



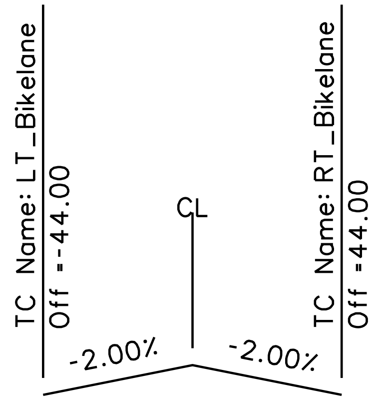
Create the layer name

3. Set the **Layer** tab as shown, then select **New**.



Build the backbone only template

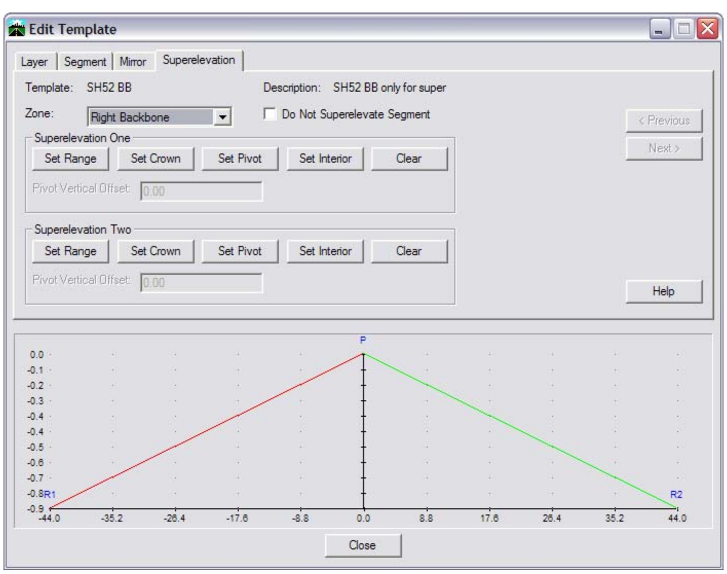
4. Select the **Segment** tab and build the template using the typical diagram.



Set the superelevation range and pivot points

5. Select the **Superelevation** tab.
6. Under the **Superelevation One** section, choose **Set Range.**
7. **<D>** near the **LT_Bike-Lane** point for the first range point.
8. **<D>** near the **RT_Bike-Lane** point for the second range point.
9. Select **Set Pivot.**
10. **<D>** near the crown point to place the pivot point

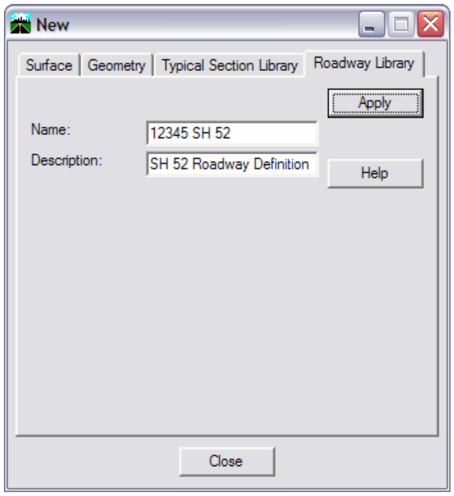
<u>**Note**</u>: If you get a range or pivot point in the wrong location, choose **Clear** under **Superelevation One** and start over.



11. **Close** the **Edit Template** box.
12. **Close** the **Define Typical Section** box.
13. **Save** the typical section library.

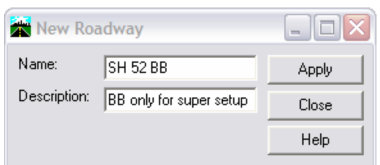
Create a Roadway Library for SH52

1. Select **File > New > Roadway Library.**



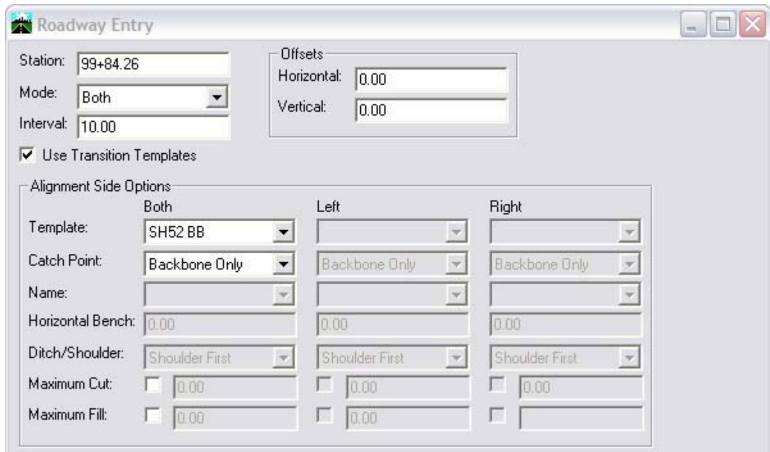
Create a Roadway Definition

1. Select **Modeler > Define Roadway.**
2. Create the new definition as shown:



Create the station/template entry for this definition

1. **Edit** the **SH52 BB** entry**.**
2. In the **Edit Roadway** dialog box, select **New** and create a single station/template entry as shown:



3. **Save** the roadway library.

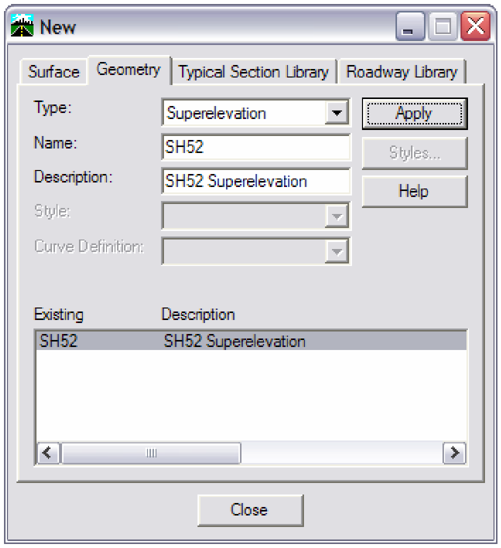
Superelevation

Create a Superelevation slot

1. Make sure that the **SH52-H** horizontal alignment is active (**Geometry > Active Geometry** or **InRoads Explorer**).

2. Select **File > New > Geometry.**

3. Create new **Superelevation** geometry as shown**:**



Calculate rates

The first curve in SH52 has a design speed of 30mph and a maximum super rate of 4%.

1. Select **Modeler > Superelevation > Rate Calculator.**

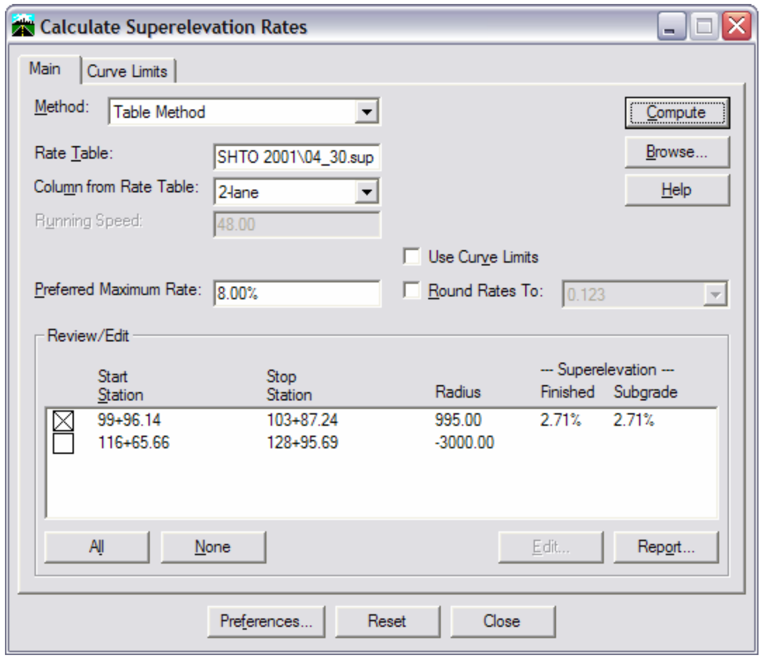
2. Set the **Method** to **Table.**

3. Click in the **Rate Table** field, clear out the current entry and select **Browse.**

4. Set the **Look in** folder to **C:\Program Files\Workspace-CDOT\Standards-Global\InRoads\Superelevation Tables\AASHTO 2001**

5. Select the file **04_30.sup**, then select **Open.**

6. Set the dialog box as shown: be sure to toggle on only the first curve in the bottom of the box.



7. Select **Compute** to compute the rates for the ***first*** curve.

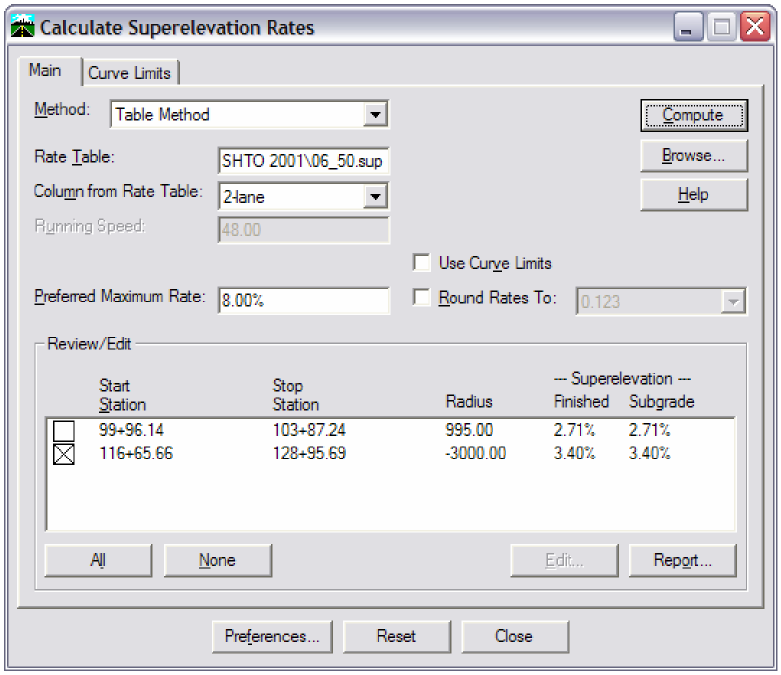
   The second curve in SH52 has a design speed of 50mph and a maximum super rate of 6%.

8. Click in the **Rate Table** field and select **Browse.**

9. Set the **Look in** folder to **C:\Program Files\Workspace-CDOT\Standards-Global\InRoads\Superelevation Tables\AASHTO 2001**

10. Select the file **06_50.sup**, then select **Open.**

11. Set the dialog box as shown, be sure to toggle on only the ***second*** curve in the bottom of the box.

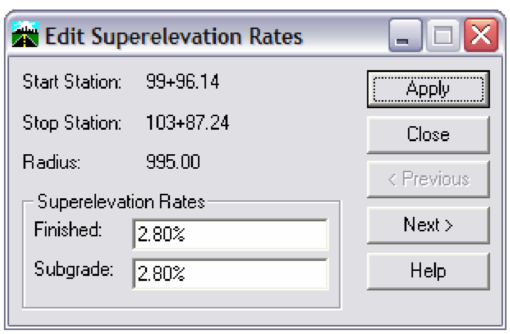


12. Select **Compute** to compute the rates for the second curve.

From your hand calculations, you know that the first curve should in fact be 2.80% super.

13. Highlight the first curve and choose **Edit** at the bottom of the dialog.

14. Change the super rates to ***2.8%***



15. Choose **Apply.**

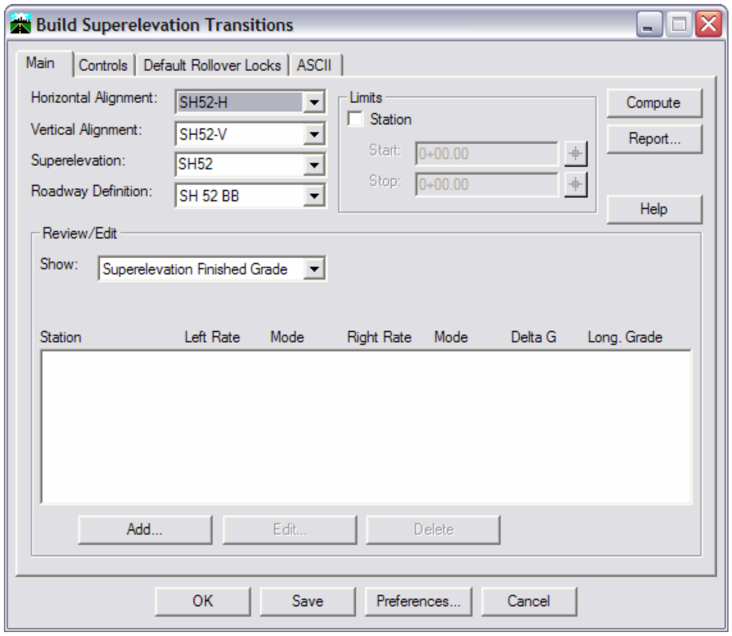
16. **Close** the **Edit Superelevation Rates** dialog.

17. **Close** the **Calculate Super Rates** box.

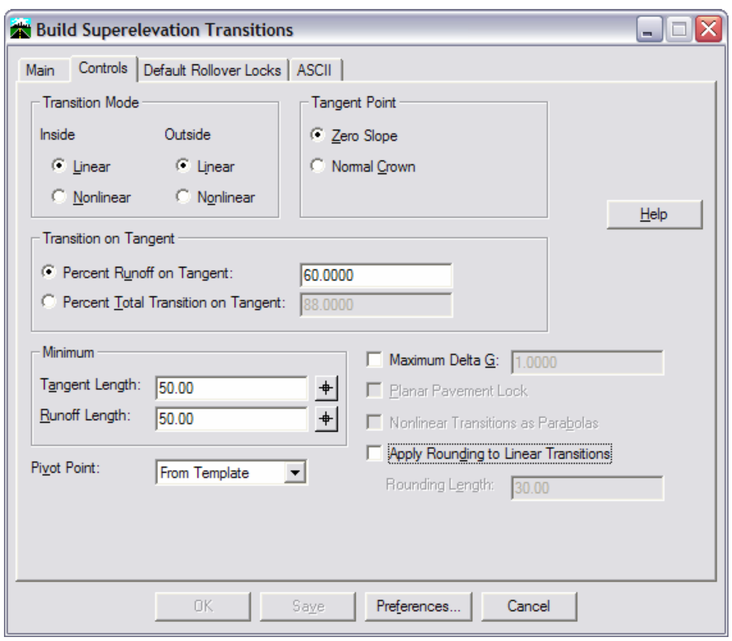
Build Transitions

1. Select **Modeler > Superelevation > Build Transitions**

2. Verify that the **Main** tab is set as shown:

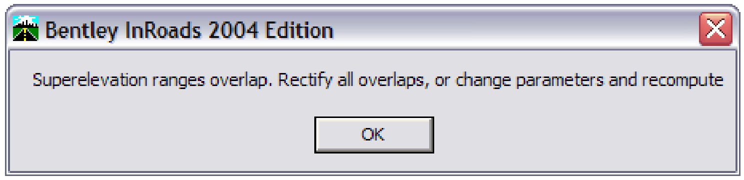


3. Verify the **Controls** tab is set as shown. Toggle ***off*** **Apply Rounding to Linear Transitions**.



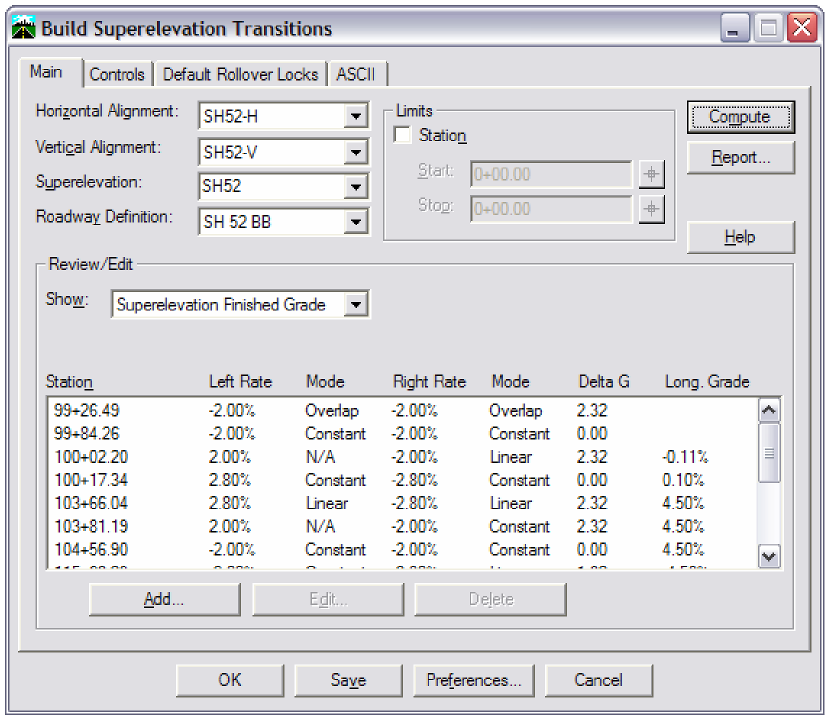
4. Back on the **Main** tab, select **Compute.**

5. Select **OK** when asked to rectify overlaps, as you will be adjusting the entries below and taking care of any problems.



6. **Close** the **Results** box (save the contents of the box in your project folder using **File > Save** if desired.)

   Rates are computed and shown in the bottom of the dialog box.



Adjust transitions

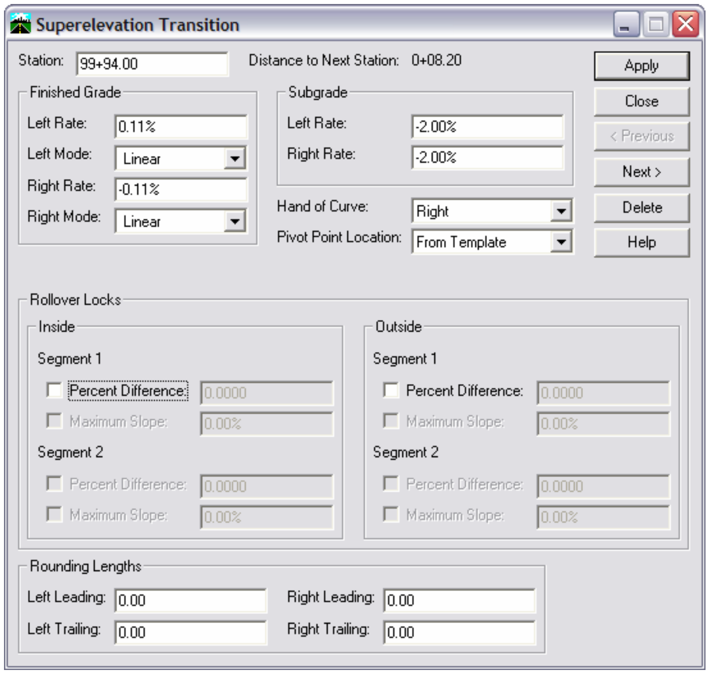
The rates used are from the AASHTO 2001 green book and not up to 2004 standards.

You will need to adjust the rates so that they match the 2004 standards. You'll do this by editing the rates based on the following superelevation hand calculations.

Station	Left Rate	Mode	Right Rate	Mode
99+94.00	0.11%	Linear	-0.11%	Linear
100+79.00	2.80%	Linear	-2.80%	Linear
103+57.00	2.80%	Linear	-2.80%	Linear
103+79.00	2.00%	Linear	-2.00%	Linear
104+87.00	-2.00%	Linear	-2.00%	Linear
115+21.00	-2.00%	Linear	-2.00%	Linear
116+64.00	-2.00%	Linear	2.00%	Linear
117+14.00	-3.40%	Linear	3.40%	Linear
128+47.00	-3.40%	Linear	3.40%	Linear
130+41.00	-4.96%	Linear	-0.50%	Linear

1. Highlight the first entry in the **Build Superelevation Transitions** dialog box, which you will modify to match the cross slope at the beginning of the model.

2. Select **Edit.**



3. Change the **Station** to ***99+94*** (the beginning of construction).

   For the beginning of construction, the super must match that of the existing roadway.

4. Key in the **Left** rate of ***0.11%*** from the spreadsheet.

5. Key in the **Right** rate of ***-.11%***

6. Set both left and right Modes to **Linear.**

7. Select **Apply.**

8. Choose **Next** to go to the next superelevation application station.

9. Choose **Delete** twice to delete the next two entries (99+84.26 and 100+02.20) since you will transition from the beginning station to the full super.

10. Change the **100+17.34** station to ***100+79***

11. Set both **Left** and **Right Modes** to **Linear.**

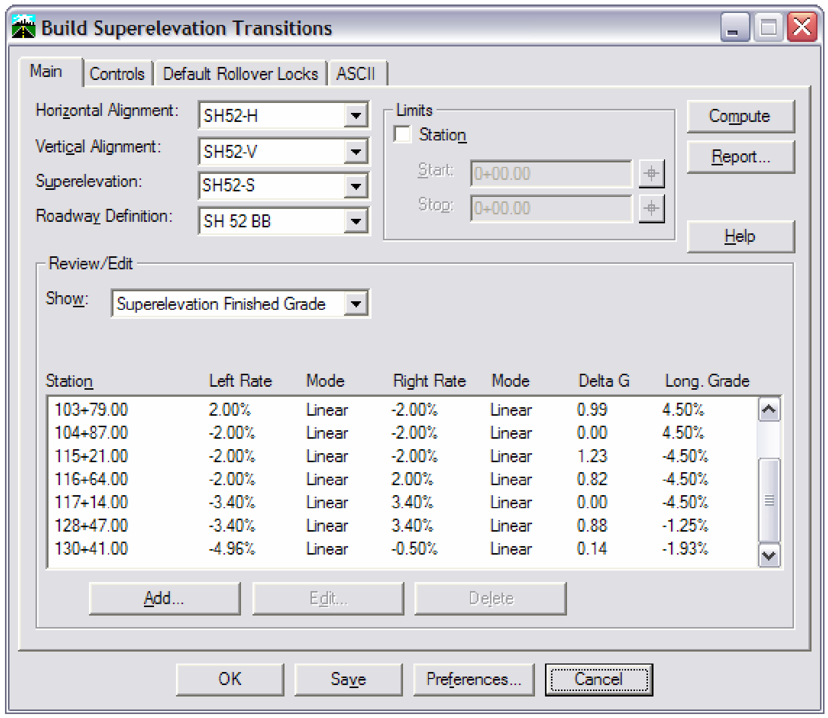
12. Key in the rates from the spreadsheet (previous page) for this station, then **Apply.**

13. Continue adjusting the rates until you've entered all the stations from the spreadsheet (don't forget to **Apply** after each entry).

14. You will **Delete** the last two entries

Note: The final entry is at **130+41**, where SH52 will be transitioned back to the existing cross slopes and construction ends.

Your adjusted rates should appear as shown below (the first few stations has scrolled off the list in this picture).



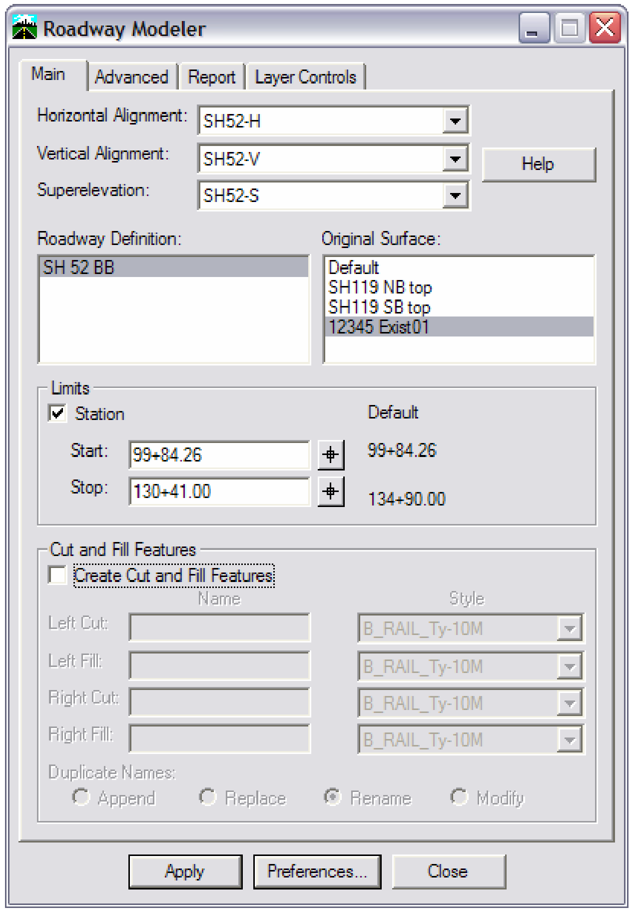
15. **Close** the **Superelevation Transition** box.

16. In the **Build Superelevation** Transitions box, select **Save**, then **OK** to save the changes and close the box.

17. **Save** the geometry project.

Model SH52 with superelevation

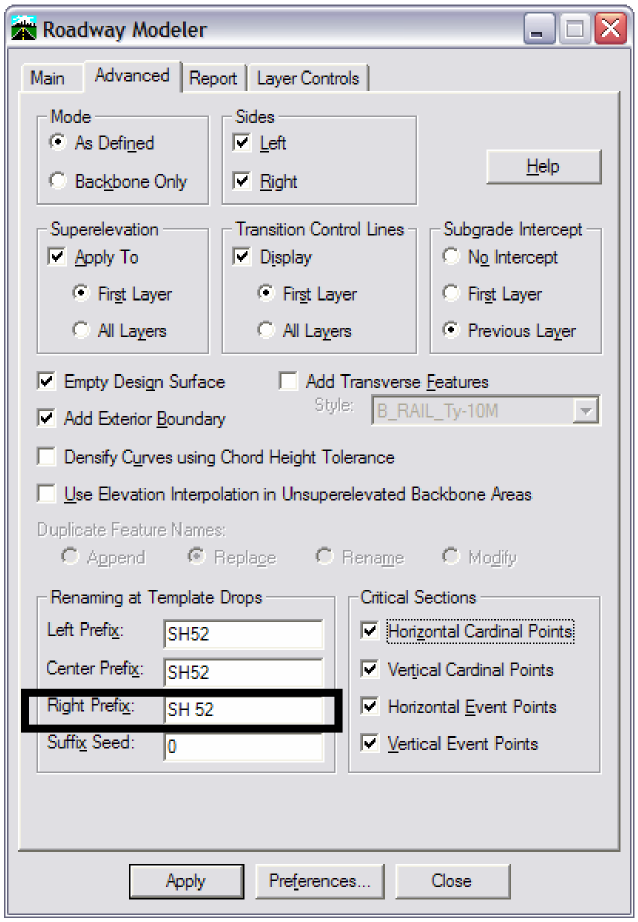
1. Select **Modeler > Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. Set the **Main** tab as shown:



4. Set the **Advanced** tab as shown. In the **Superelevation** section, makes sure **Apply To** is toggled ***on*** and select **First Layer.**

   For the prefixes, set the **Left** to **SH52**, **Center** to **SH52** and **Right** to **SH 52**

   Note: **Be certain to use the space!** Modeler will not allow left and right prefixes to be the same, and if you enter the same one, the right will be replaced with **Right_**

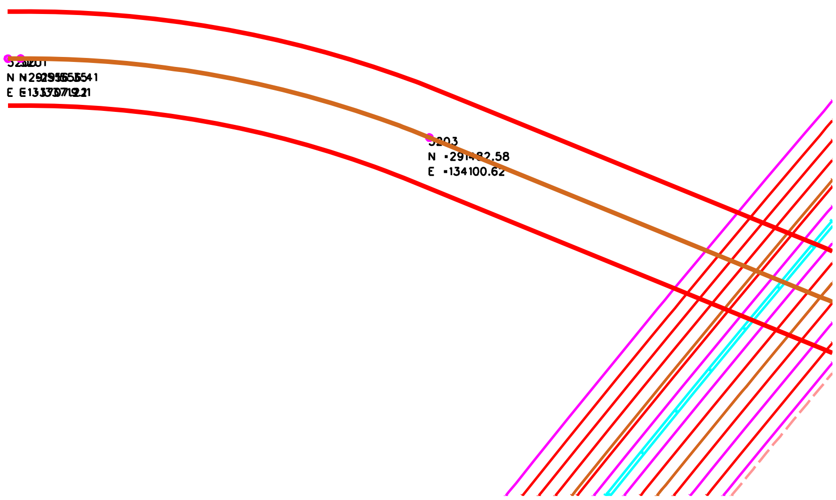


5. Select the **Main** tab again.

6. Select **Apply.**

   The SH 52 corridor is modeled with the typical section as defined (backbone only) and with superelevation.

7. **Zoom in** to the beginning of the alignment to see the TC lines.

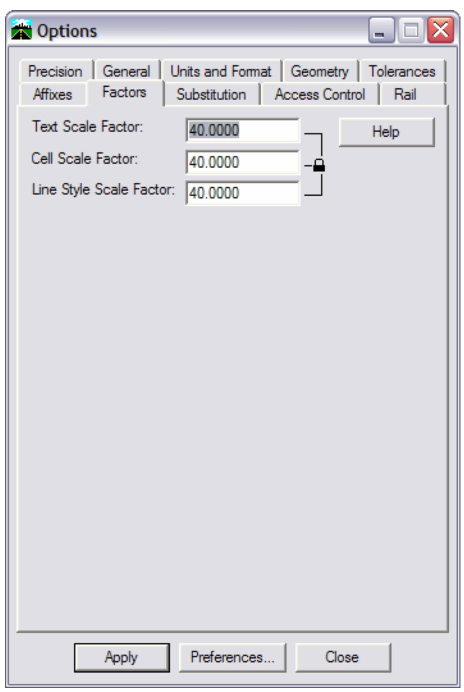


Evaluate SH 52 basic model

Generate Cross Section along SH 52

Set the Text Scale Factor

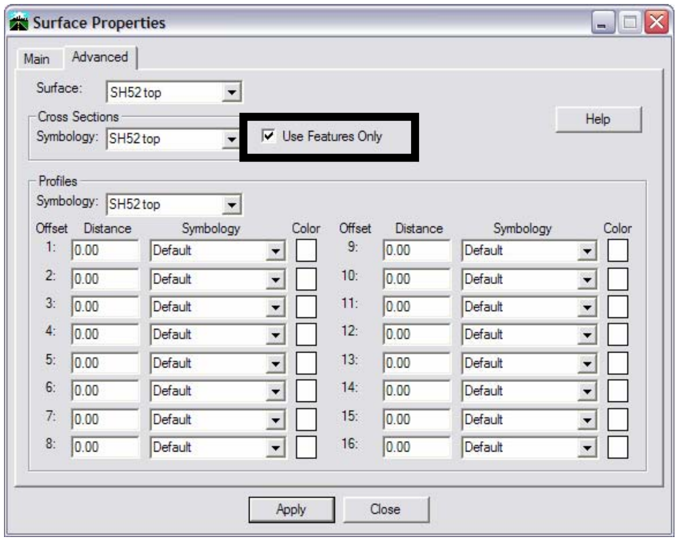
1. Select **Tools > Options.**
2. Select the **Factors** tab and set the **Text Scale** Factor to ***40***



Generate cross section using features instead of triangles

3. Select **Surface > Surface Properties.**

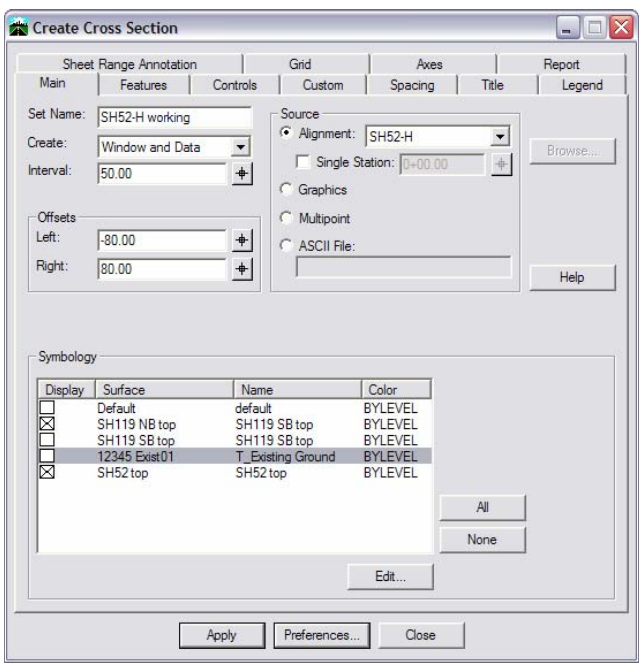
4. On the **Advanced** tab, toggle ***on*** **Use Features Only for the SH52 top** surface.



5. Select **Apply**, then **Close.**

Generate the sections

6. Load the **Stacked 20 per column** preference and cut sections along the SH52-H alignment showing the **12345 Exist01** and **SH52 top** surfaces. Key in the **Set Name** as shown:



7. On the **Features** tab, toggle ***off*** **Include Features.**

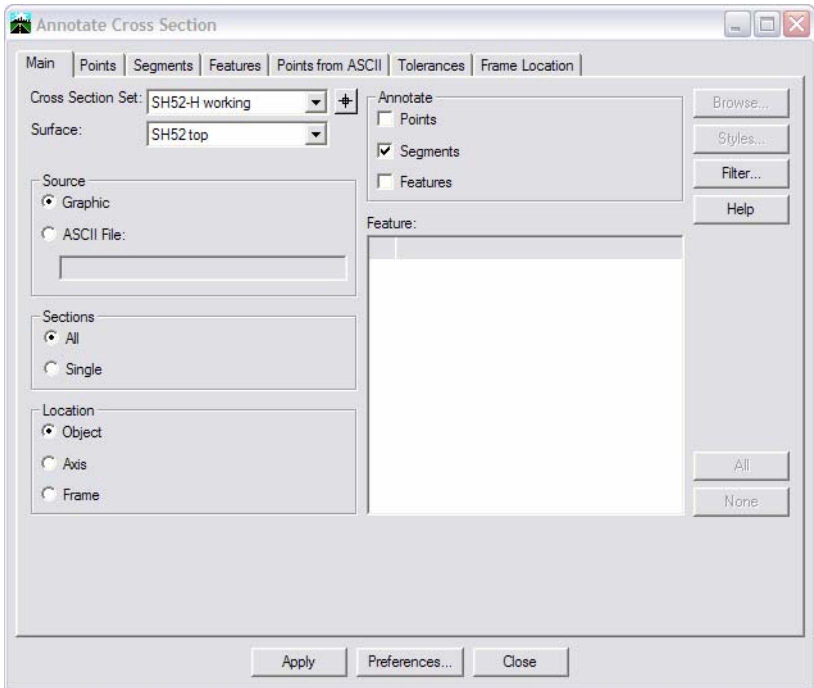
8. **Apply** the command and **<D>** to define the location of the cross section set.

Annotate Sections with slopes

Annotate the sections to show the cross slopes to check superelevation.

1. Select **Evaluation > Cross Section > Annotate Cross Section.**

2. Set the **Main** tab as shown:

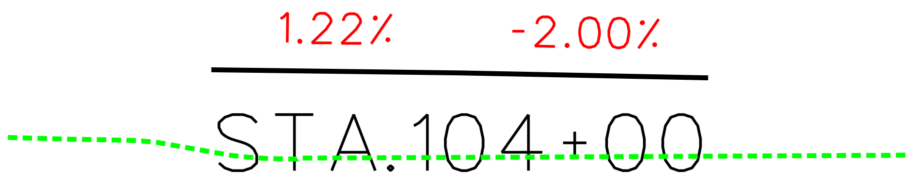


3. On the **Segments** tab, make sure **Slope** is toggled on under the **Symbology** section.

4. **Apply.**

Review the sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to **SH52 Working** and the other options as shown.
3. Select **Run.**



Model with median template and independent control

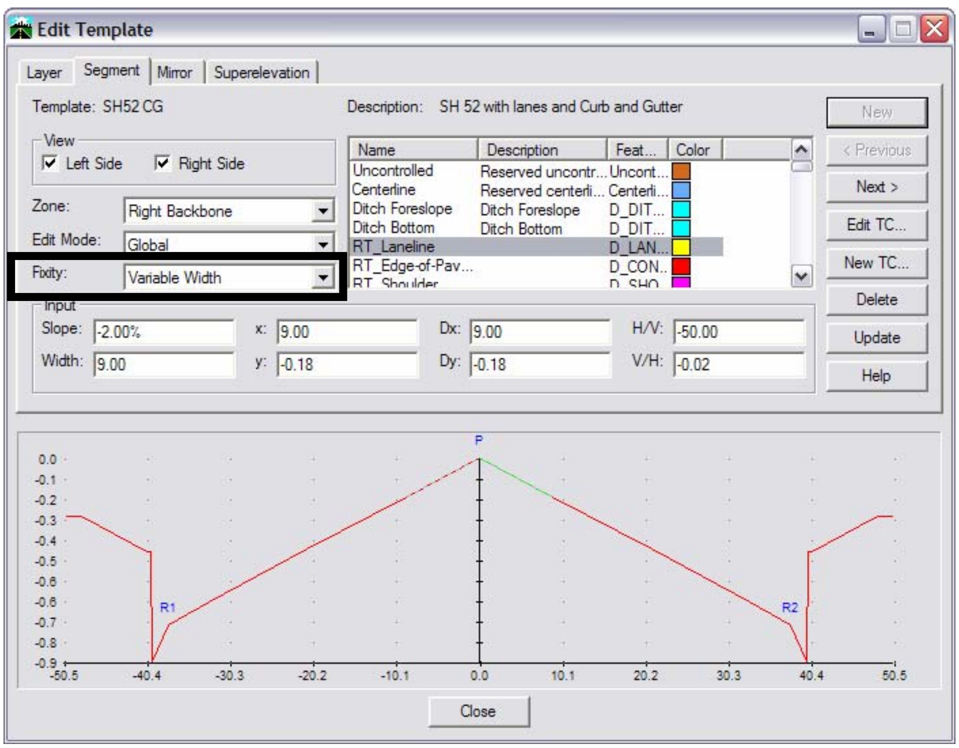
Now that the superelevation is worked out for SH 52, you'll model with a template that includes a median width, turn lanes, sidewalk, etc. (see lane sketch on next page).

Review the typical section SH52 CG

1. Select **Modeler > Define Typical Section.**
2. Highlight the template **SH52 CG** and select **Edit.**

   Select the **Segment** tab. Using the **Next** and **Previous** buttons, review the template **Zones Right Backbone, Right Cut,** and **Right Fill.**
3. Set the **Zone** back to **Right Backbone.**
4. Highlight the first RT_Laneline segment – first segment after the centerline (use the **Previous** button, if necessary).

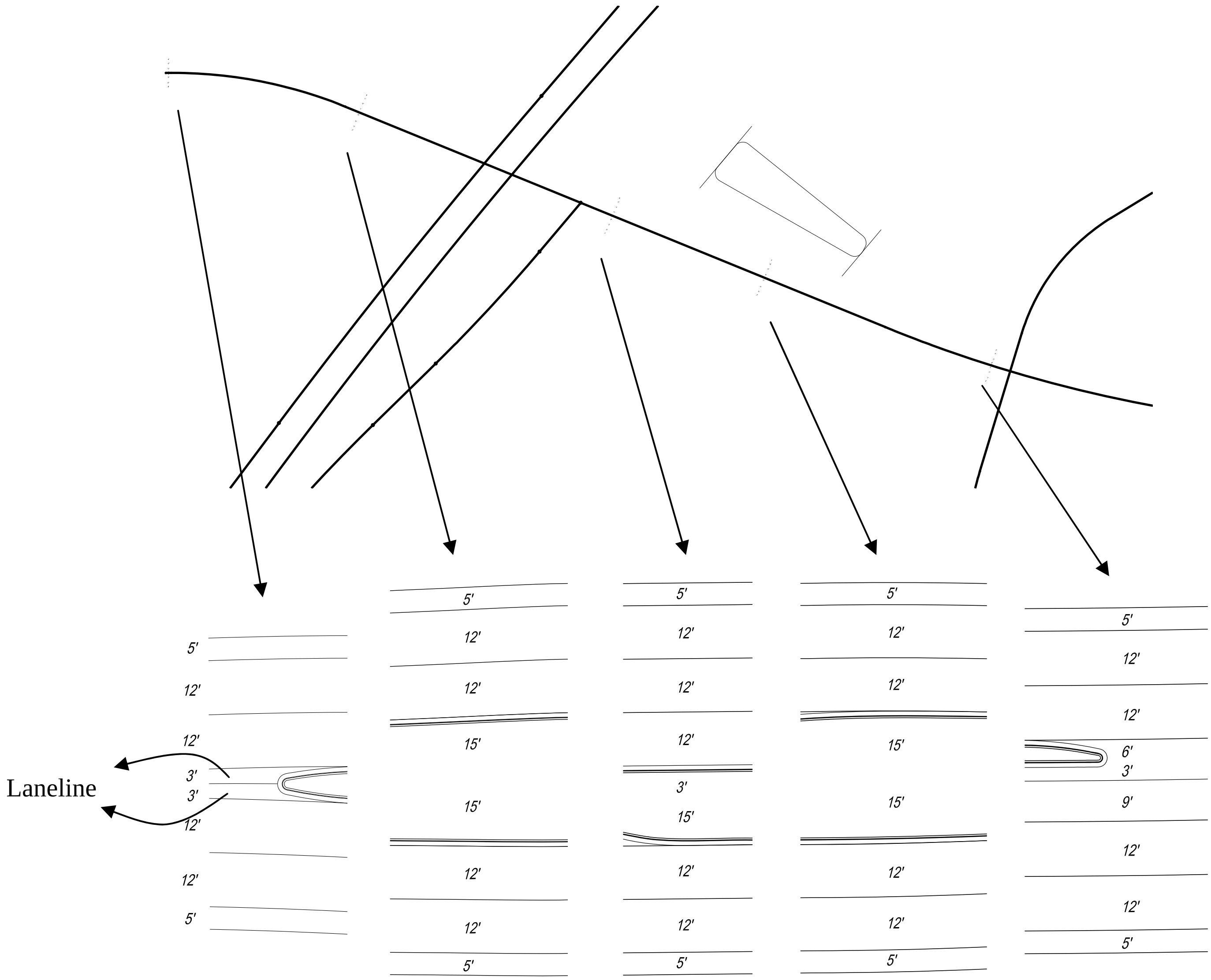
   The segment appears dashed. Note that this segment's **Fixity** is set to **Variable Width** for independent control, which you'll set up next.



5. **Close** the **Edit Template** box.
6. **Close** the **Define Typical Sections** box.

Set up independent control

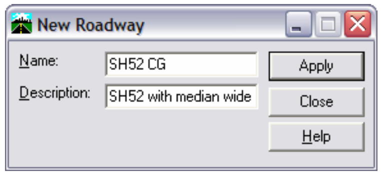
You’ll use independent control with stations and offsets to define the width of road, which changes as noted in the following lane sketch. Later, you’ll be adding a median that will vary in width and also will vary to form left turn lanes.



Notice that the outside three segments are always the same (12’, 12’ 5’). Therefore, you can use the Lanline to control the widening.

Create a Roadway Definition

1. Create a new Roadway Definition with the Name **SH52 CG** and Description **SH52 with median widening and CG**.

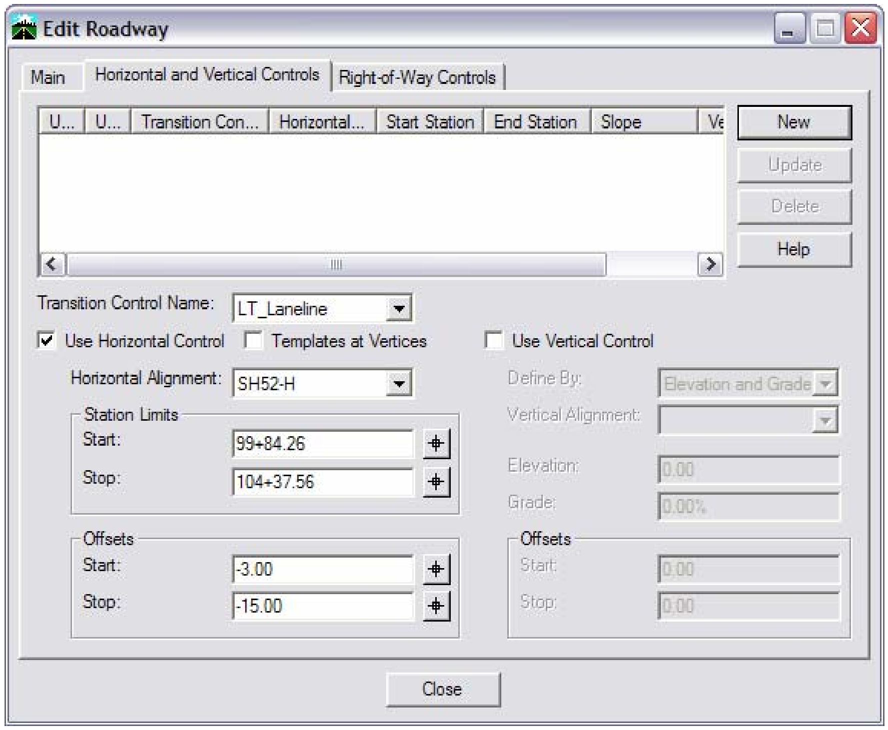


2. In the **Define Roadway** box, highlight the **SH52 CG** roadway definition that you just created and select **Edit.**

3. Select the **Horizontal and Vertical** controls tab.

H&V Entries

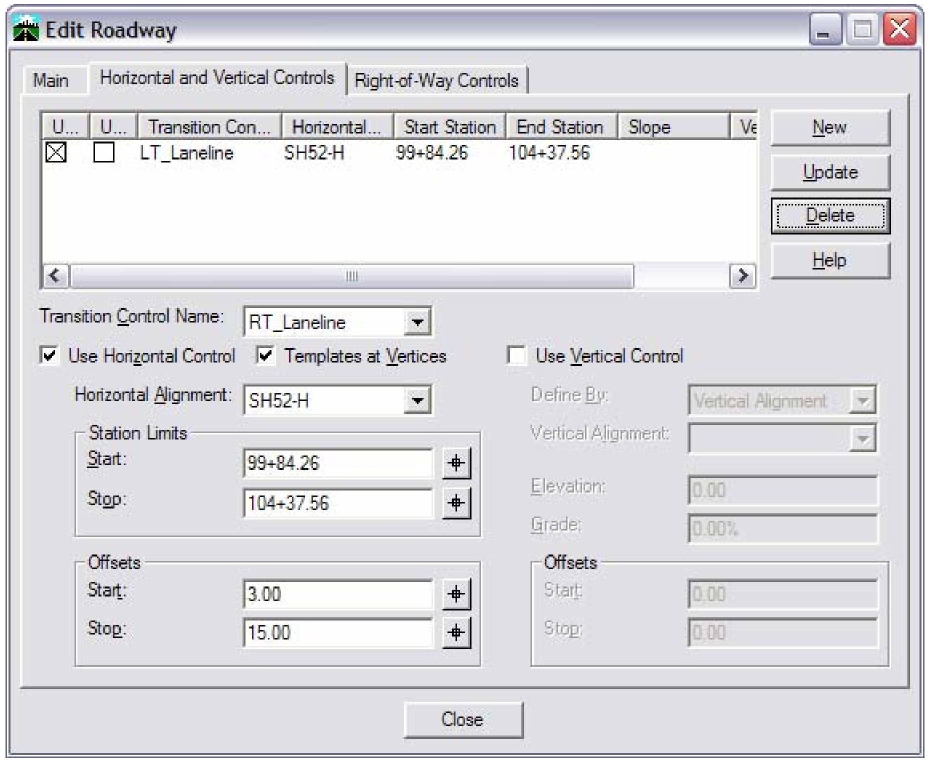
First Entry



4. Set the following options:

- **Transition Control Name** to **LT_Laneline.**
- Toggle **on Use Horizontal Control.**
- Toggle **on Templates at Vertices.**
- Toggle **off Use Vertical Controls.**
- Set **Horizontal Alignment** to **SH52-H.**
- Keep the default **Start station** .
- Set **Stop station** to ***104+37.56***
- Set **Start offset** to ***-3***
- Set **Stop offset** to ***-15***
- Select **New.**

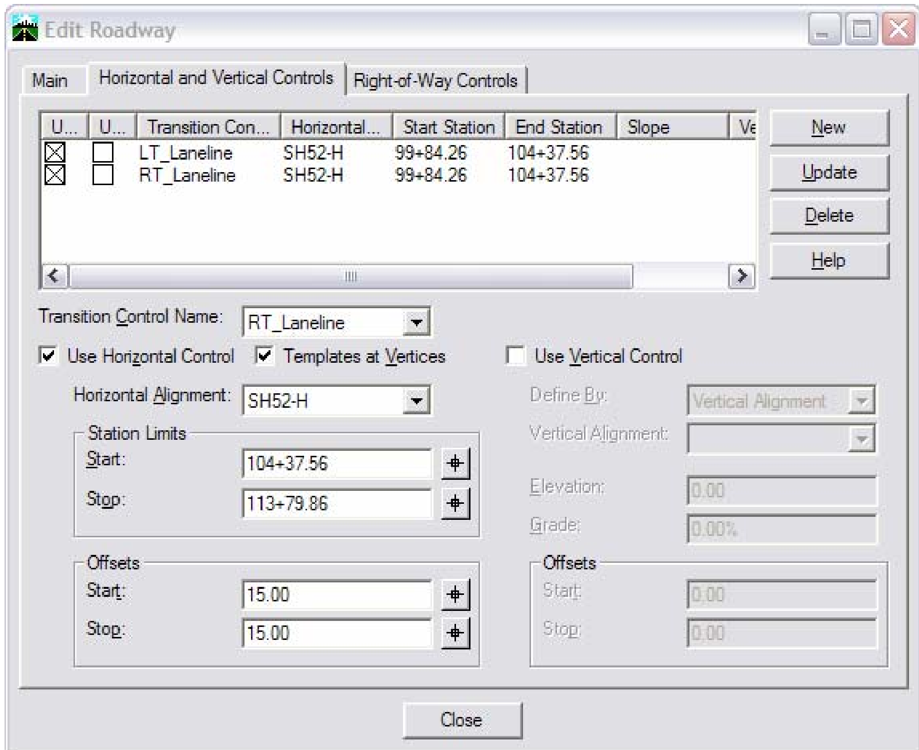
Second Entry



5. Set the following options:

- Change the Transition Control Name to **RT_ Laneline.**
- Change the offsets to ***positive***.
- Select **New**.

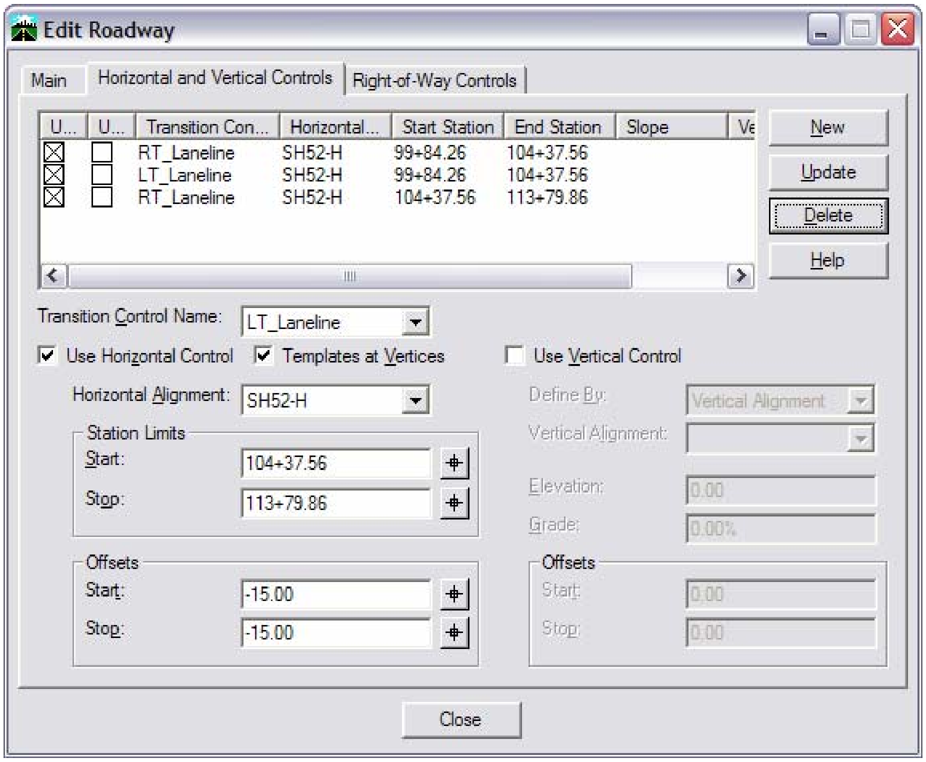
Third Entry



6. Set the following options:

   - Set **Start station** to ***104+37.56***
   - Set **Stop station** to ***113+79.86***
   - Set **Start offset** to ***15***
   - Set **Stop offset** to ***15***
   - Select **New.**

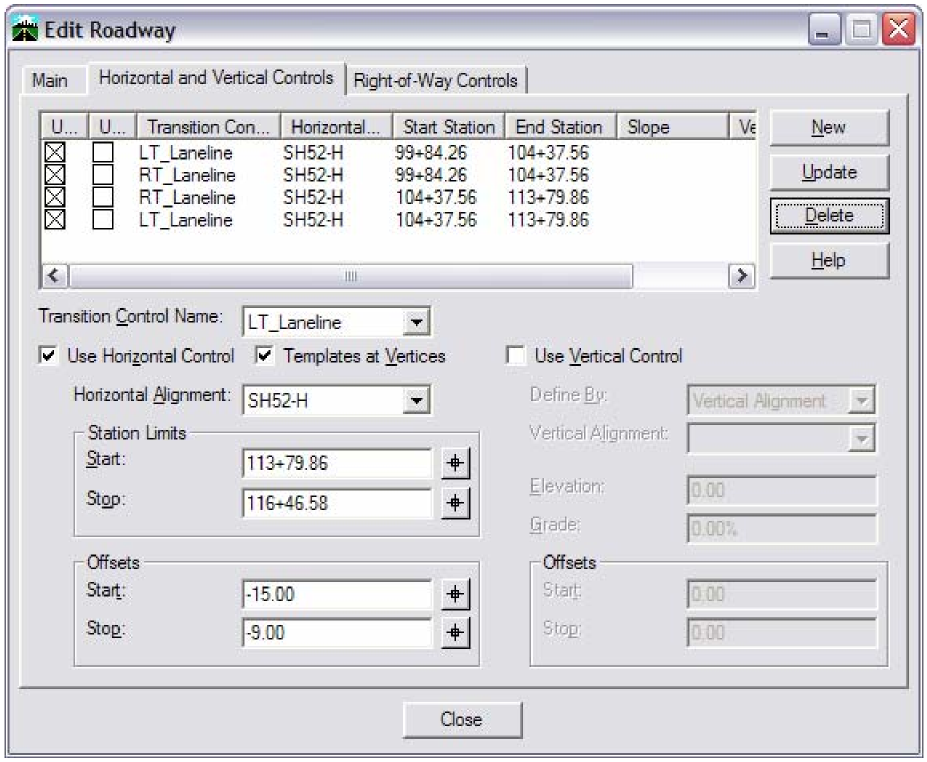
Fourth Entry



7. Set the following options:

- Change the Transition Control Name to **LT_ Laneline.**
- Change the offsets to ***negative***.
- Select **New**.

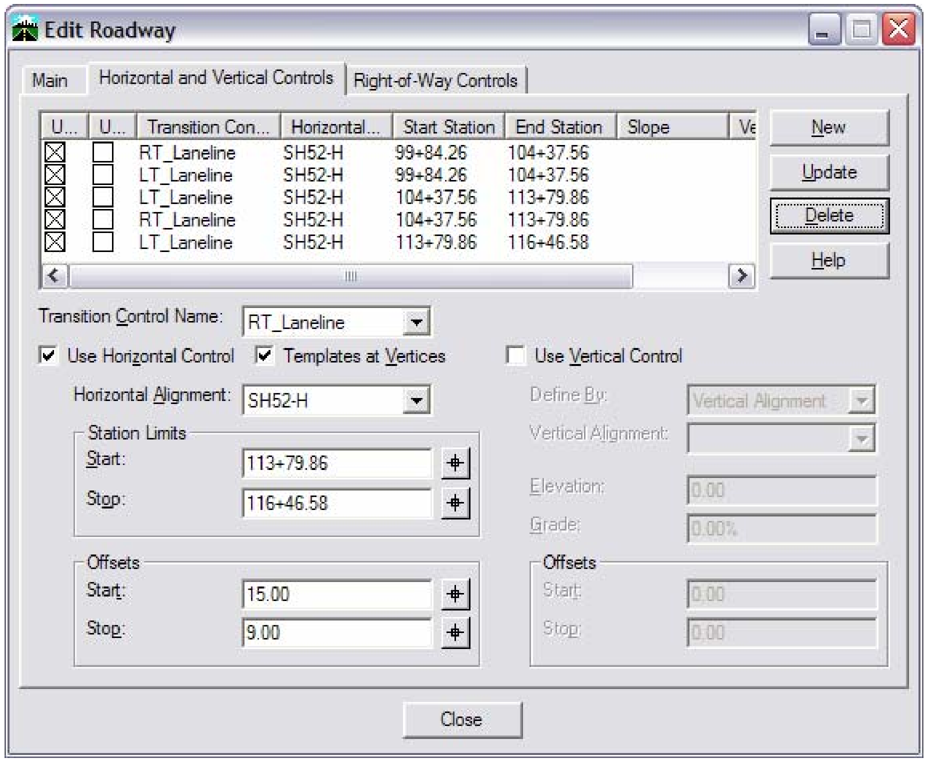
Fifth Entry



8. Set the following options:

- Set **Start station** to ***113+79.86***
- Set **Stop station** to ***116+46.58***
- Set **Start offset** to ***-15***
- Set **Stop offset** to ***-9***
- Select **New.**

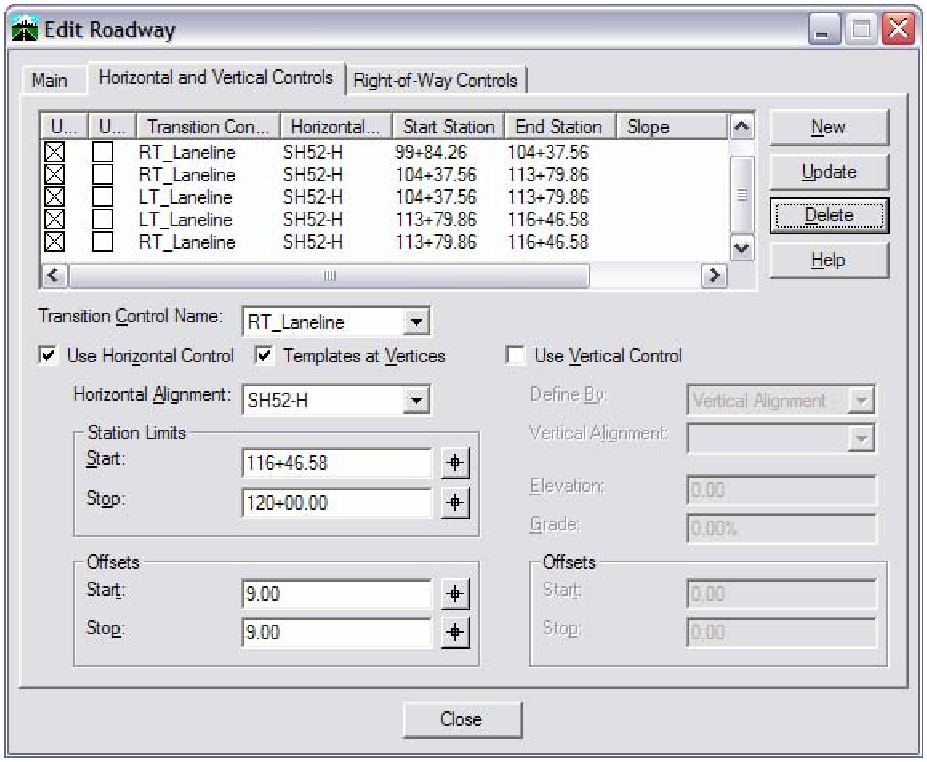
Sixth Entry



9. Set the following options:

   - Change the Transition Control Name to **RT_ Laneline.**
   - Change the offsets to ***positive***.
   - Select **New**.

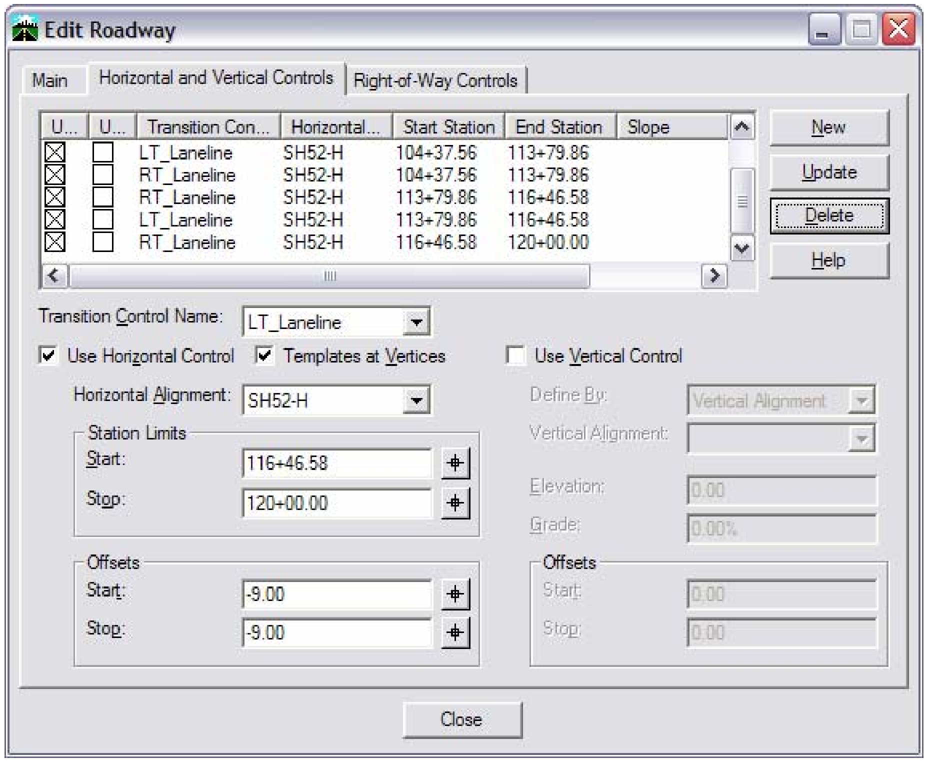
Seventh Entry



10. Set the following options:

- Set **Start station** to ***116+46.58***
- Set **Stop station** to ***120+00.00***
- Set **Start offset** to ***9***
- Set **Stop offset** to ***9***
- Select **New.**

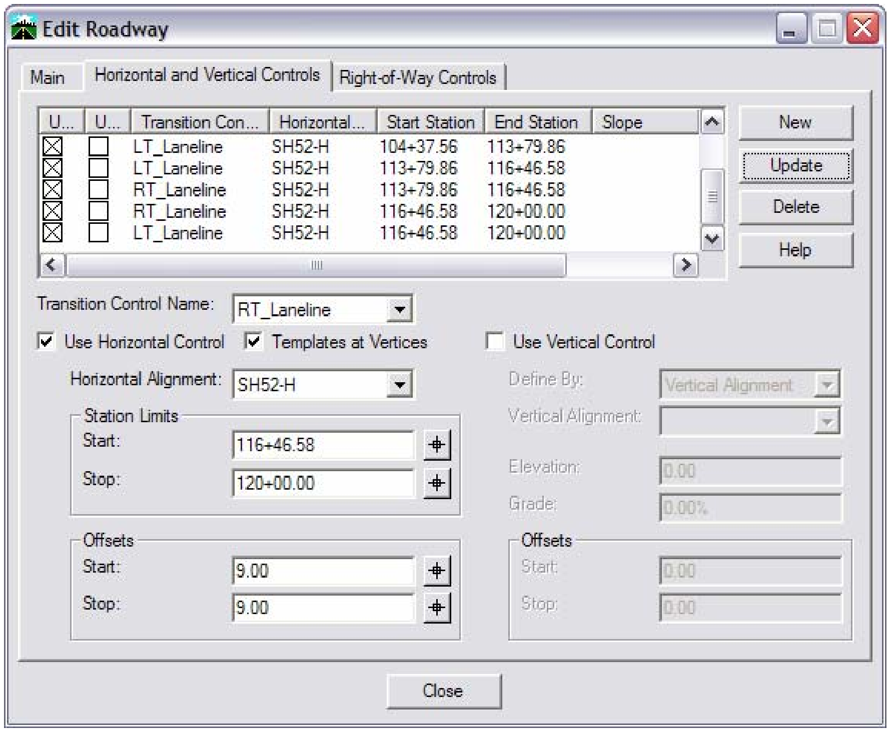
Eighth Entry



11. Set the following options:

- Change the Transition Control Name to **LT_ Laneline.**
- Change the offsets to ***negative***.
- Select New.

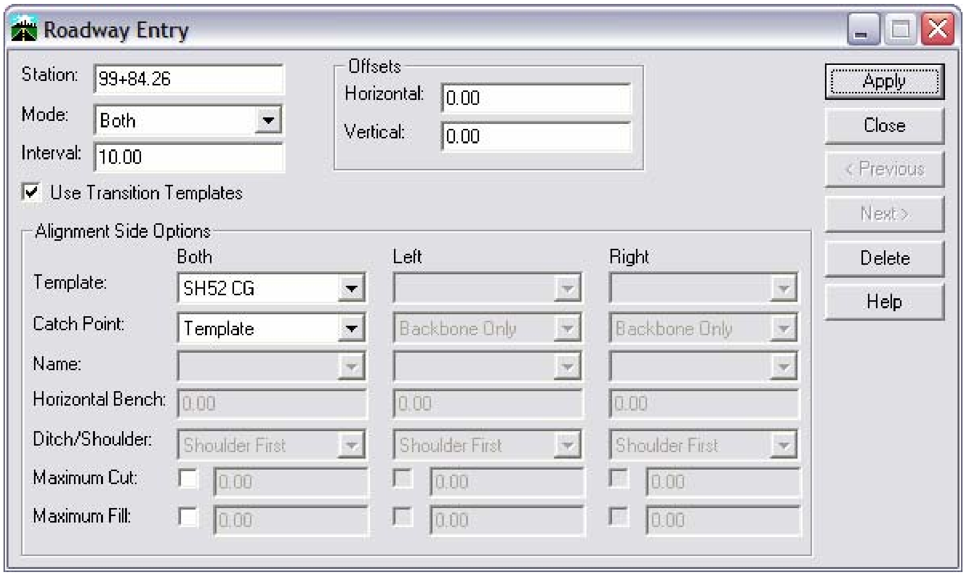
12. When done, you should have 8 entries:



13. Choose **File > Save > Roadway Library**.

Create the Roadway station/template entries

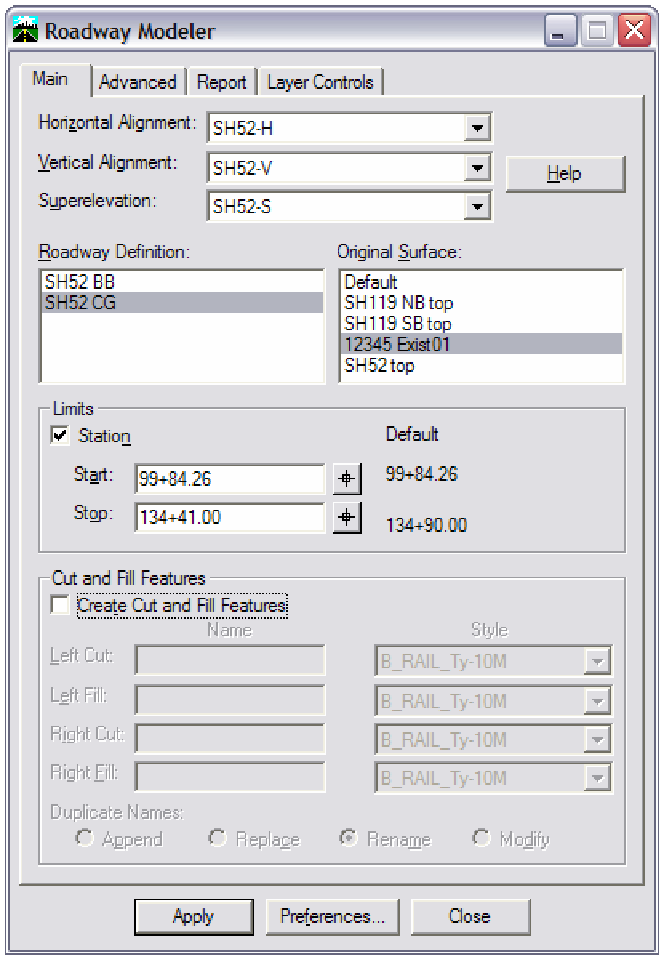
1. Select the **Main** tab.
2. In the **Edit Roadway** dialog box, select **New.**



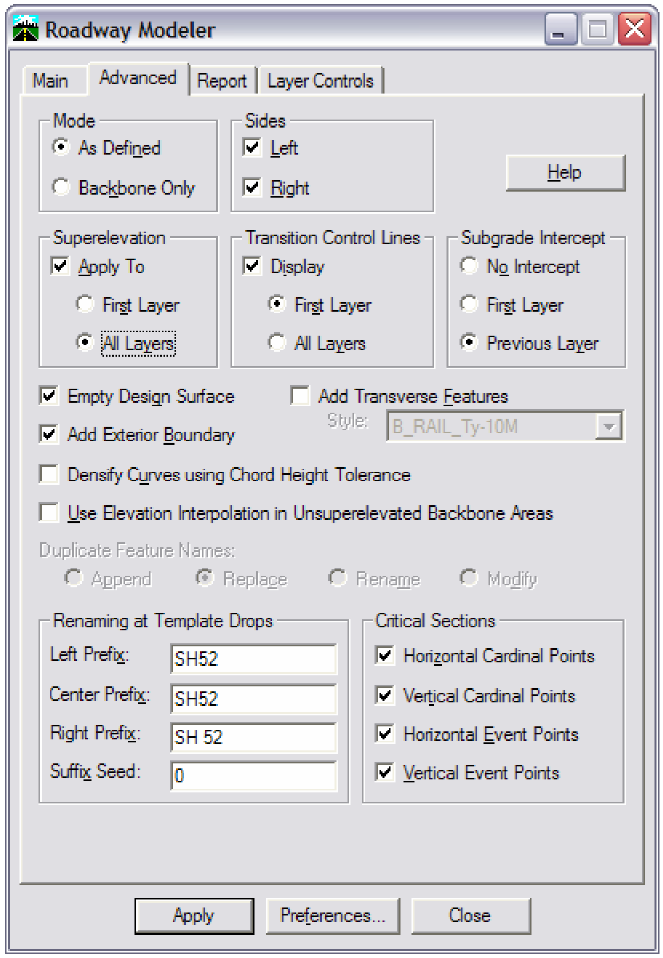
3. Keep the beginning station as is.
4. Set **Mode** to **Both.**
5. Key in an **Interval** of ***10***
6. For **Template**, choose **SH52 CG.**
7. For **Catch Point** choose **Template.**
8. **Apply.**
9. **Close** the **Roadway Entry** box.
10. **Close** the **Define Roadway** box.
11. **Save** the roadway library.

Model SH 52 with independent control and superelevation

1. Select **Modeler > Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. Set the **Main** tab as shown:



4. Set the **Advanced** tab as shown. In the **Superelevation** section, makes sure **Apply To** is toggled ***on*** and select **First Layer**.



5. Select **Apply.**

6. **Close** the Modeler.

Update Cross Sections

1. Select **Evaluation > Cross Section > Update Cross Section.**

2. Set the **Cross Section Set** to **SH52 Working.**

3. Set **Mode** to **Refresh.**

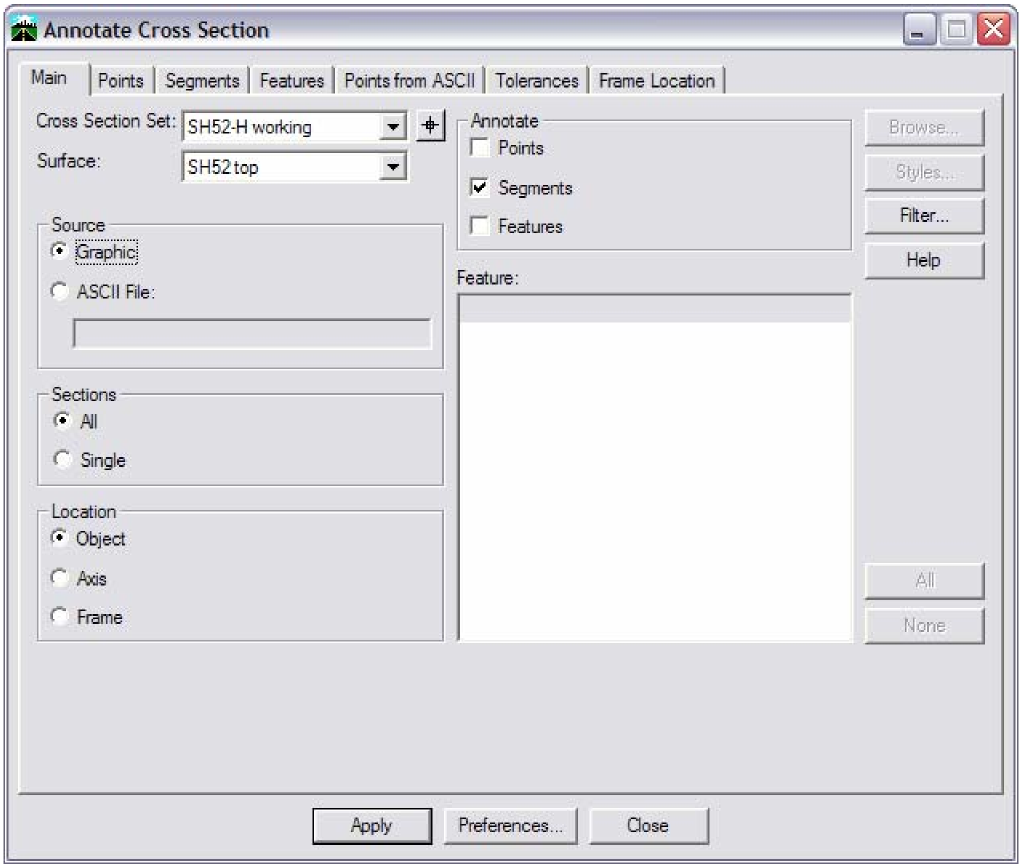
4. Select the **Surface SH52 top.**

5. **Apply**, then **Close.**

   The cross sections are updated to show the new template and independent control for varying the median.

Annotate Sections with slopes

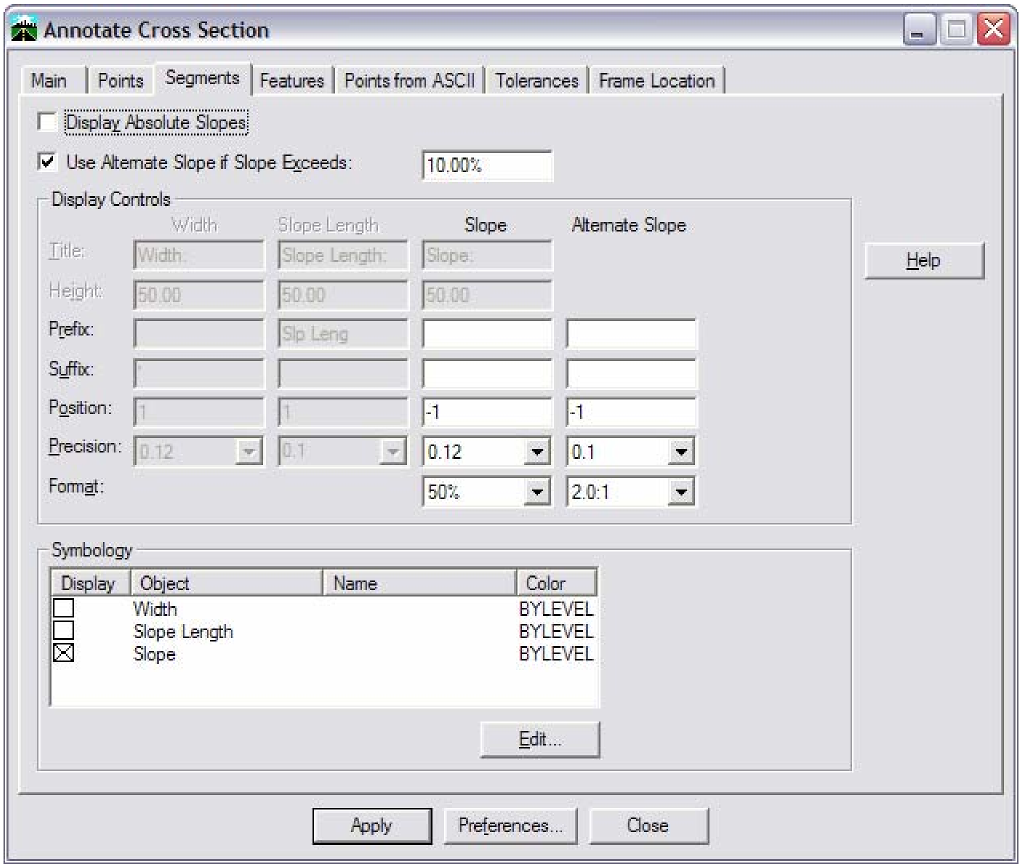
1. Select **Evaluation > Cross Section > Annotate Cross Section.**
2. On the **Main** tab:



- Set **Cross Section Set** to **SH52-H Working.**
- Set **Surface** to **SH52 top.**
- Under **Annotate**, toggle **on Segments** and toggle **off Points** and **Features.**
- Set the other Main tab options as shown.

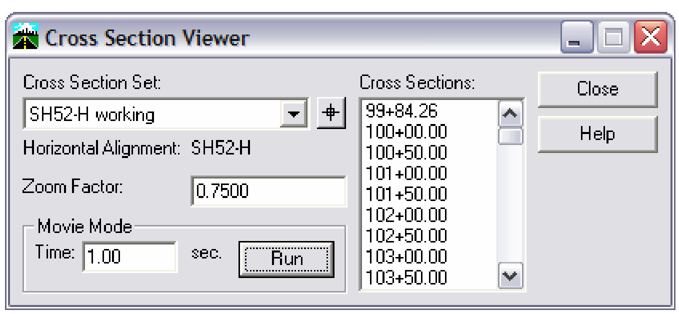
3. On the **Segments** tab, make sure **Slope** is toggle on under the **Symbology** section.

4. **Apply.**



Review sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**



2. Set **Cross Section Set** to **SH52 Working** and the other options as shown.

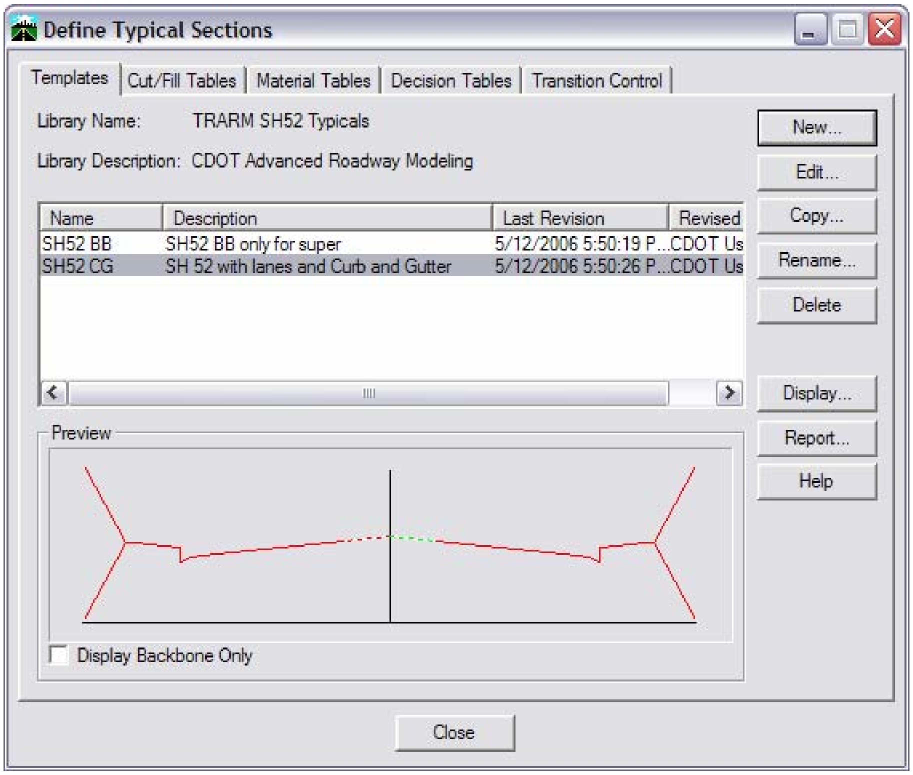
3. Select **Run.**

Model with a spill gutter

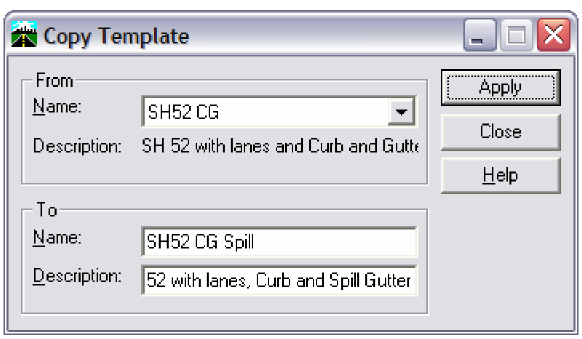
Through the first curve of SH52, you will transition to a spill gutter on the high side of super. First, you will copy the template and change the gutter to spill, then you will set up the transition in the roadway definition.

Copy and modify the template

1. Select **Modeler > Define Typical Section.**



2. Highlight the template **SH52 CG** and select **Copy.**



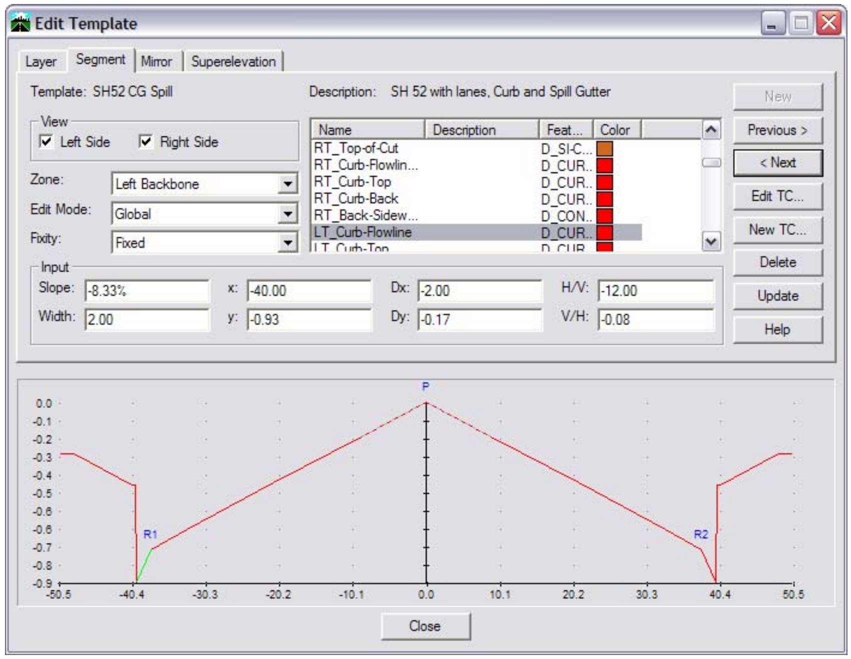
3. In the **To Name** field key in ***SH52 CG Spill***

4. Key in a **Description** of ***SH 52 with lanes, Curb and Spill Gutter***

5. **Apply**, then **Close** the **Copy Template** box.

6. Highlight the new template and choose **Edit**.

7. Select the **Segment** tab and set the **Zone** to **Left Backbone.**

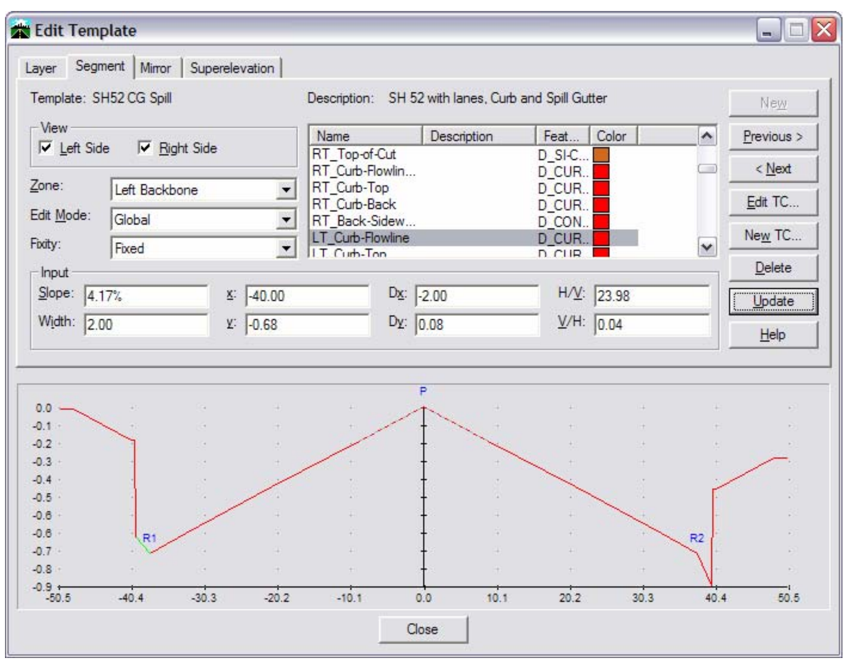


8. Use the **Next** button to step through the segments in the backbone until you get to the gutter (TC name **LT_Curb-Flowline**).

9. Set the **Edit Mode** to **Global**.

10. Change the **Slope** to ***+4.17%***

11. Select **Update**.

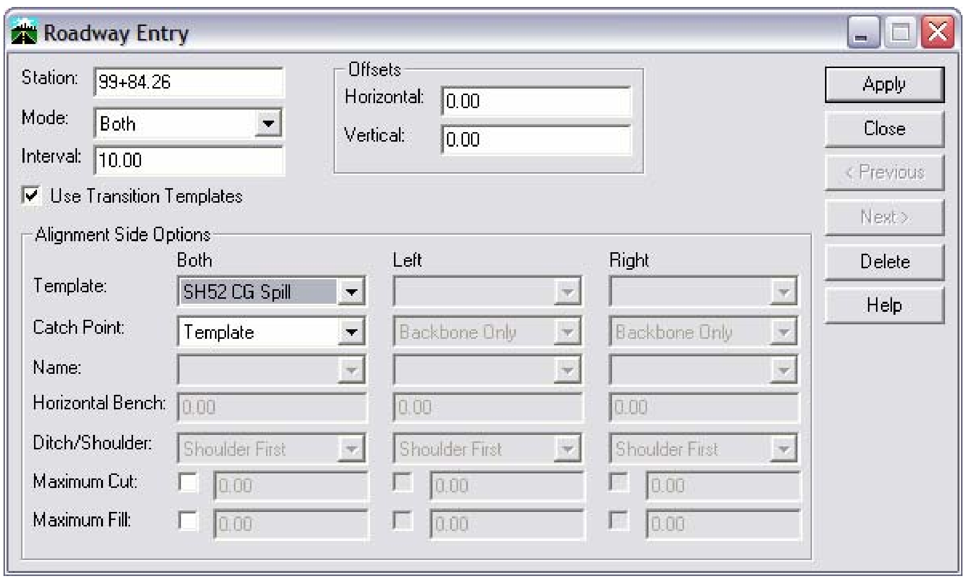


12. **Close** the **Edit Template** dialog.
13. **Close** the **Define Typical Sections** dialog.
14. **Save** the Typical Section Library.

Edit the Roadway Definition

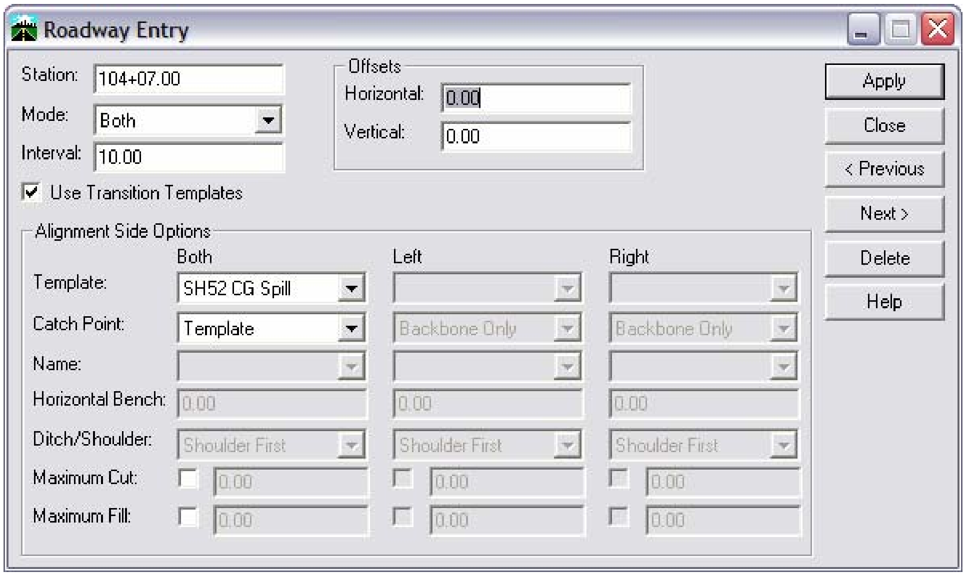
You will set up the roadway definition to start the model with the spill gutter, carry it through to station 104+07, then transition over 50 feet to the catch gutter template.

1. Select **Modeler > Define Roadway.**
2. Select the **SH52 CG** roadway definition.
3. Select **Edit.**
4. In the **Edit Roadway** dialog box, select Edit.

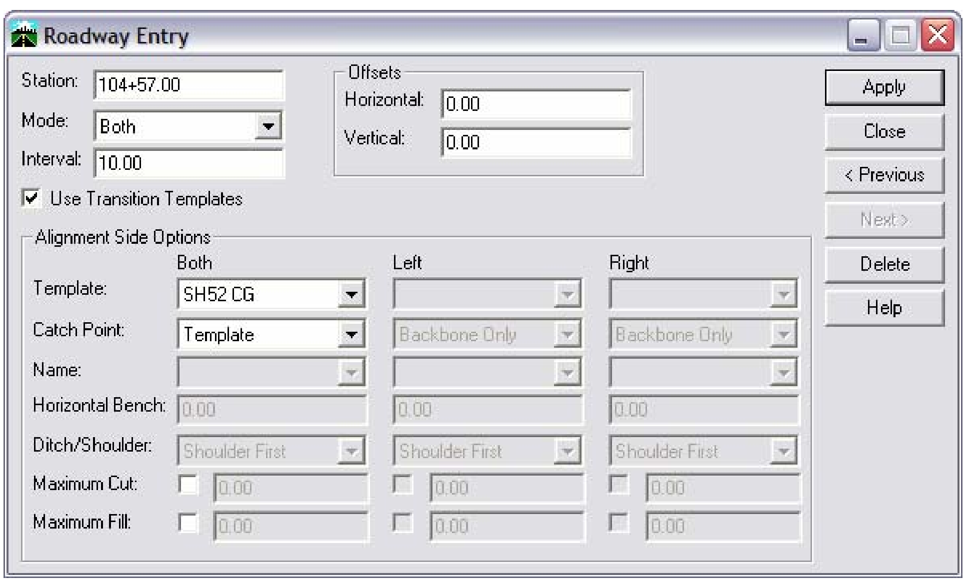


5. Change the **Template** to **SH52 CG Spill**.
6. Select **Apply**.
7. Select **Close**.

In the **Edit Roadway** dialog box, select **New.**

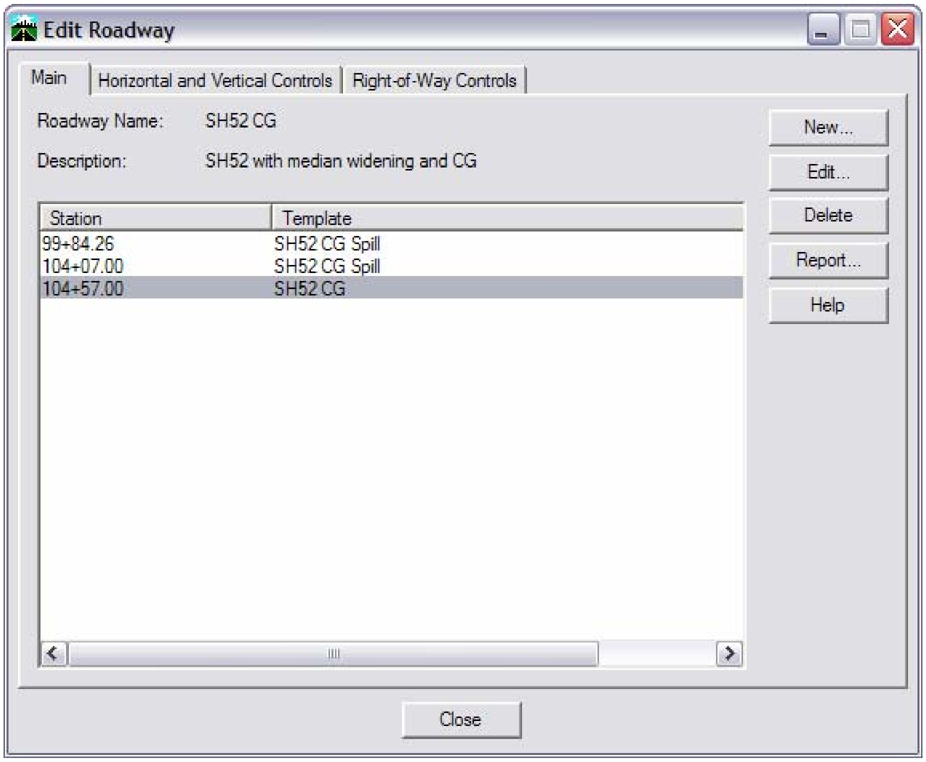


8. Key in a **Station** of **104+07**
9. For **Template**, select to **SH52 CG Spill.**
10. Keep **Catch Point** set to **Template.**
11. **Apply.**



12. Key in a **Station** of **104+57**
13. For **Template**, choose **SH52 CG.**
14. **Apply.**

15. **Close** the **Roadway Entry** box.

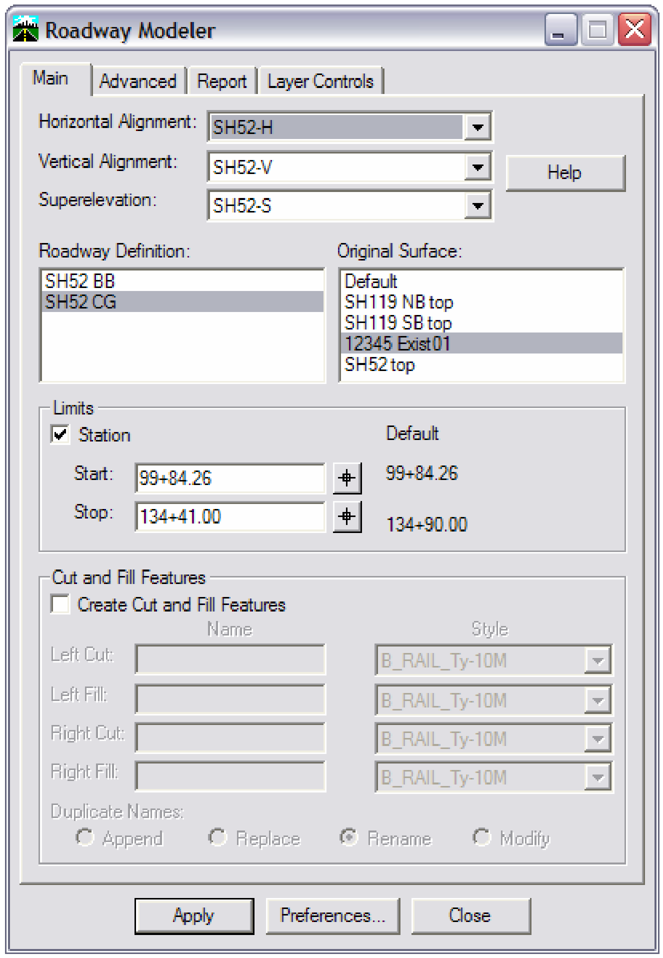


16. **Close** the **Define Roadway** box.

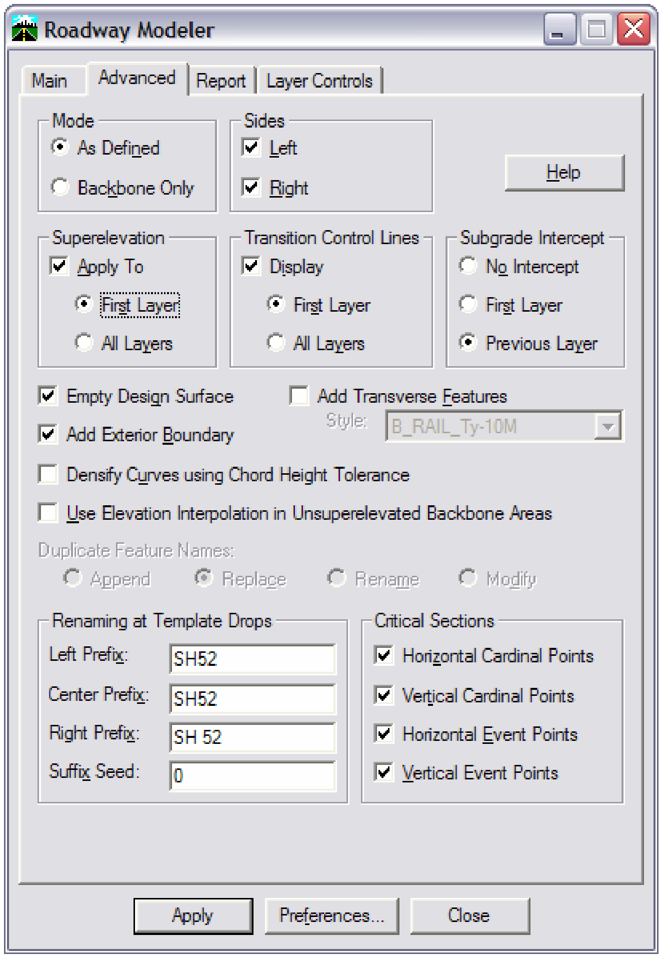
17. **Save** the roadway library.

Model SH 52 with spill gutter to catch gutter transition, independent control and superelevation

1. Select **Modeler > Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. Set the **Main** tab as shown:



4. Set the **Advanced** tab as shown. In the **Superelevation** section, makes sure **Apply To** is toggled ***on*** and select **First Layer**.

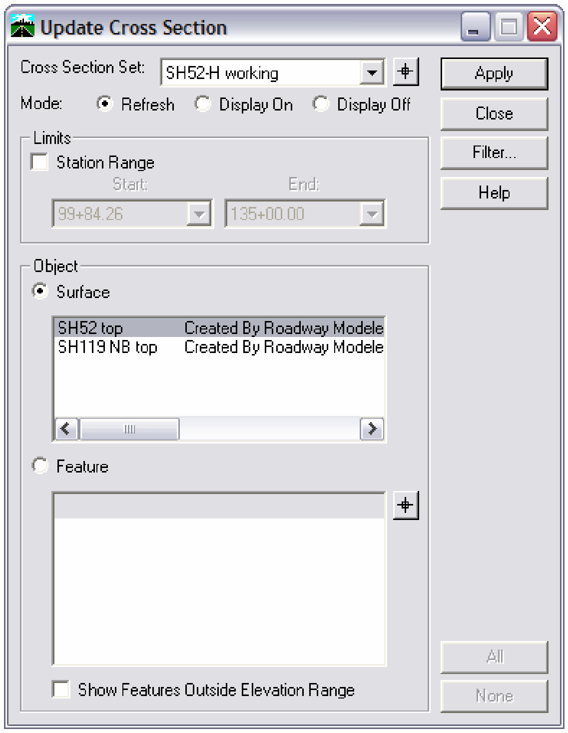


5. Select the **Main** tab again.

6. Select **Apply.**

Update Cross Sections

1. Select **Evaluation > Cross Section > Update Cross Section.**



2. Set the **Cross Section Set** to **SH52 Working.**
3. Set **Mode** to **Refresh.**
4. Select the **Surface SH52 top.**
5. **Apply**, then **Close**.
6. **Save** the SH52 top surface.

Annotate Sections with slopes

1. Select **Evaluation > Cross Section > Annotate Cross Section.**
2. On the **Main** tab:
   - Set **Cross Section Set** to **SH52 Working.**
   - Set **Surface** to **SH52 top.**
   - Under **Annotate**, toggle **on Segments** and toggle **off Points** and **Features.**
   - Set the other Main tab options as shown.
3. On the **Segments** tab, make sure **Slope** is toggle on under the **Symbology** section.
4. **Apply.**

Review results

Review the sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to **SH52 Working** and the other options as shown.
3. Starting at the beginning, step through a few sections to see the gutter transition from spill to catch.
4. **Close** the **Cross Section Viewer**.

Review the surface.

5. View contours and/or triangles for **SH52 top**.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Challenge lab 2.4 – Model the right turn lane from SH52 onto 71st

Given: **12345 Exist01.dtm**

12345 Sh52.alg

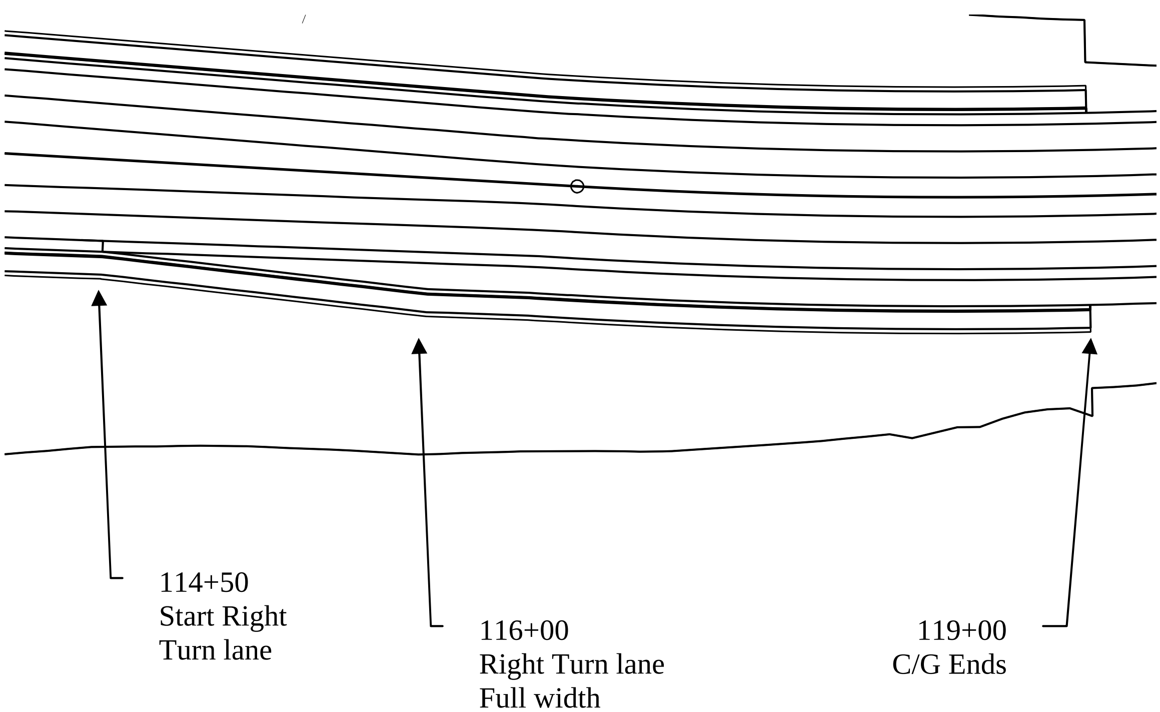
12345 SH52.tml

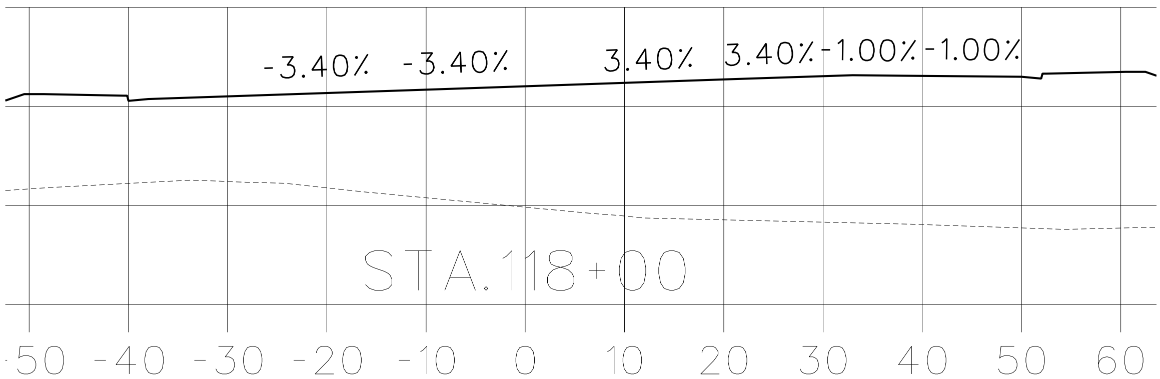
12345 SH52.rwl

Required: Add a right turn lane for SH52 EB to turn onto 71st. Start the turn lane at 114+50, with the full width attained at 116+00. The turn lane continues to the intersection at 119+00, where you will transition to a template with not C/G.

The turn lane needs to be at a -1% slope, even though SH52 is in a 3.4% super at the intersection. You will need to transition the slope of the turn and bike lanes to follow the -1%.

A transition from Spill to Catch Gutter was previously completed, so begin with the SH52CG roadway definition.




-3.40%
-3.40%
3.40%
3.40%
-1.00%
-1.00%
STA.118+00
-50 -40 -30 -20 -10 0 10 20 30 40 50 60

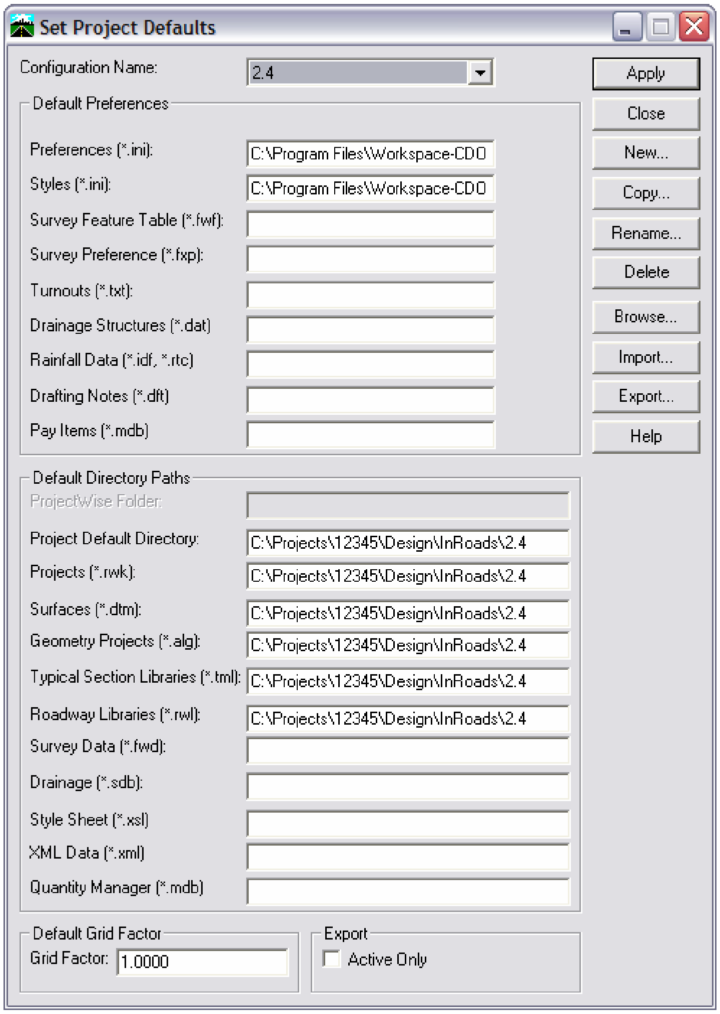
Preliminary set-up

1. Start MicroStation InRoads and open the file **12345DesignModel01.dgn**.
2. Select **File>Project Defaults**.
3. Set the **Configuration Name** to **2.4**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

4. Select **Apply**.

Important! Verify your dialog box appears as shown:



5. **Open** the appropriate data files (refer to **Given** statement).

Note: If you need additional assistance with this lab, follow the steps below.

Create the narrow right turn lane template

For the turn lane onto 71st Street, you will copy SH52 CG to create SH52 CG RT. Since this is a new lane, you will create a template with a very narrow turn lane to begin the transition, then create a template with the full width (12') turn lane.

Copy the template

1. Select **Modeler>Define Typical** Section.
   - Highlight the template **SH52 CG** then select **Copy.**
   - In the **To Name** field key in ***SH52 CG Start RT***
   - Key in a **Description** ***of SH 52 with lanes, Curb and Gutter and RT turn***
2. **Apply**, then **Close** the **Copy Template** box.

Add the narrow turn lane segment

3. Highlight the **SH52 CG Start RT** template that you just copied.
4. Select **Edit.**
5. Select the **Segments** tab.
   - Set the **Zone** to **Right Backbone.**
   - Set the **Edit Mode** to **Global.**
   - Use the **Next** button to highlight the **RT_Edge-of-Pavement** segment.
   - Highlight the TC Name **RT_Turn**.
   - Select **Update**.
   - Set the **Edit Mode** to **Add After**
   - Key in a **Slope** of ***-2%***
   - Key in a **Width** of ***.01***
   - Select the TC Name **RT_Edge-of-Pavement.**
6. Select **New.**
7. **Close** the **Edit Template** dialog box.

Create a 12’ wide turn lane template

Now, you’ll create the full width turn lane template.

Copy the template

1. Highlight the template **SH52 CG Start RT** then select **Copy**.
   - In the **To Name** field key in ***SH52 CG 12’ RT***
   - Key in a **Description** of ***SH 52 with lanes, Curb and Gutter and 12’ RT turn***
2. **Apply**, then **Close** the **Copy Template** box.

Modify the right turn lane segment

3. Highlight the **SH52 CG 12’ RT** template that you just copied.
4. Select **Edit.**
5. Select the **Segments** tab.
   - Set the **Zone** to **Right Backbone.**
   - Set the **Edit Mode** to **Global.**
   - Use the **Next** button to highlight the **RT_Edge-of-Pavement** segment.
   - Key in a **Width** of ***12***
6. Press your **Tab** key to update the segment.

   The template segment widens from .01 to 12’.
7. **Close** the **Edit Template** dialog box.

Create the Roadway Definition

Copy the previous roadway definition and add the turn lane transition.

1. Select **Modeler>Define Roadway.**
2. Select the **SH52 CG** roadway definition.
3. Select **Copy.**
   - Key in a **Name** of ***SH52 CG RT***
   - Key in a **Description** of ***SH52 with median widening, CG and RT turn***
4. Select **Apply**, then **Close**.
5. In the **Edit Roadway** dialog box, select **Edit**
6. Select **New**.

First entry

7. Key in a station of ***114+49.99***
8. For **Template**, choose to **SH52 CG.**
9. Keep **Catch Point** set to **Template.**
10. **Apply.**

Second Entry

11. For the next entry, key in a **Station** of **114+50**
12. For **Template**, choose **SH52 CG Start RT.**
13. **Apply.**

Third Entry

14. Key in a **Station** of ***116+00***
15. For **Template**, choose **SH52 CG 12' RT.**
16. **Apply.**

Fourth and fifth entries

17. Continue adding the following entries.
    - ***119+00.00 SH52 CG 12' RT***
    - ***119+00.01 SH52 No CG 12' RT***
18. **Close** the **Roadway Entry** box.
19. **Close** the **Define Roadway** box.
20. **Save** the **Roadway Library**.

Vary the right turn lane slope

The turn lane on SH 52 occurs in the superelevated area, but you want the turn lane to slope in the opposite direction to tie into 71st street. There are several ways to accomplish this task, one of which is to use a rollover lock with the superelevation.

You know the superelevation is 3.4% at it's max, which is in the turn lane area. You know you want the turn lane (and bike lane) to be at -1%. That translates to an algebraic difference of 4.4%. Since you are 'rolling' two segments (turn and bike), you will set the first segment to a maximum algebraic difference of 4.4%. The second segment references the first, so its algebraic difference is 0.0%.

1. Select **Modeler>Superelevation>Build Transitions**.
2. Highlight the **116+64** entry and choose **Edit**.
3. Under **Rollover Locks**,
   - Toggle on **Segment 1 Percent Difference** and enter ***4.4***
   - Toggle on **Segment 2 Percent Difference** and enter ***0.0***
4. **Apply**.
5. Choose **Next**.
   - Make the same changes to this full super entry and choose **Apply**.
6. Choose **Next**.
   - Again, make the same changes to this full super entry and choose **Apply**.
7. ***Do not*** change the last entry.
8. **Close** the **Superelevation Transition** dialog.
9. **Save**, then **OK** the **Superelevation Transition** dialog.
10. **Save** the geometry project.

Model SH 52 with the right turn lane

1. Select **Modeler>Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. On **Advanced** tab in the **Superelevation** section, makes sure **Apply To** is toggled on and select **First Layer**.
4. Select the **Main** tab again.
5. Select **Apply.**

Cut Cross Sections

6. Select **Evaluation>Cross Section>Create Cross Sections.**
   - Show the Existing and the new surfaces.
7. **Apply**, then **Close.**

Annotate Sections with slopes

8. Select **Evaluation>Cross Section>Annotate Cross Section.**
9. On the **Main** tab be sure to:
   - Set **Cross Section Set** to **SH 52 Working.**
   - Set **Surface** to **SH52 top.**
   - Under **Annotate**, toggle **on Segments** and toggle **off Points** and **Features.**
10. On the **Segments** tab, make sure **Slope** is toggle on under the **Symbology** section.
11. **Apply.**

Review sections

12. Select **Evaluation>Cross Section>Cross Section Viewer.**
13. Set **Cross Section Set** to **SH52 Working** and the other options as shown.
14. Select the section **118+00** and review the slopes.

    If everything worked correctly, the travel lanes will be in full super (3.4%) and the bike and turn lanes will be at -1%.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

15. From MicroStation, choose **Edit>Select All**.
16. Select the MicroStation **Delete** command.

    All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

17. From MicroStation, select **File>Exit**.
18. If prompted to save data files select **Yes**.

Challenge lab 2.5 – Model SH52 median with gutter transitions from spill to catch

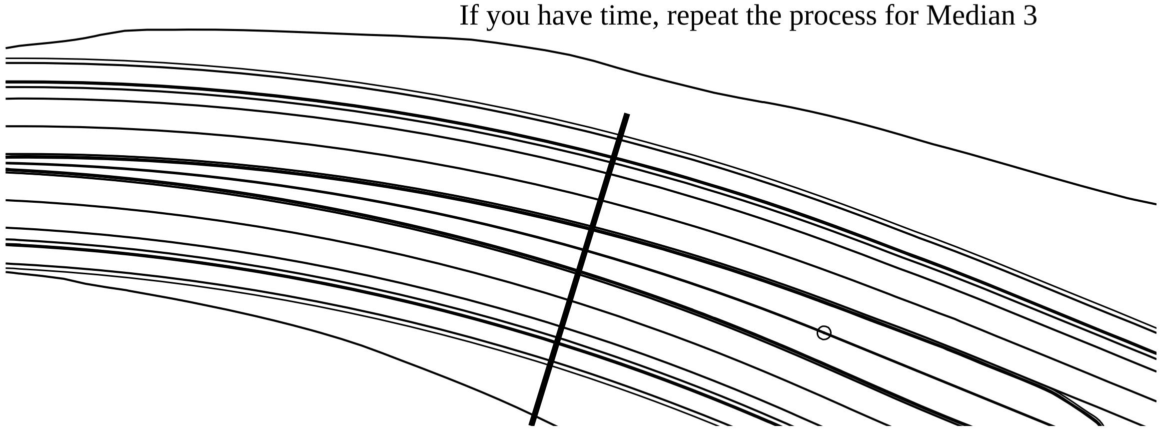
Given: **12345 Exist01.dtm**
12345 SH52 top
12345 SH52.alg (w/median geometry)
12345 SH52.tml w/ SH52 Median CG; SH52 Median CG Spill

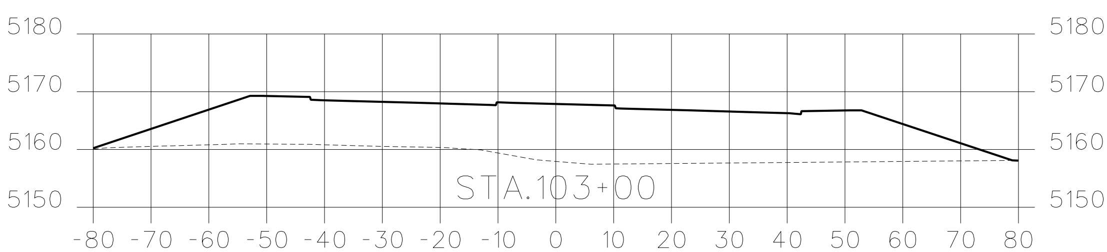
Required: Model the Curb and Gutter for Median 1, using a catch gutter on the high side of super on SH52 and a spill gutter on the low side.

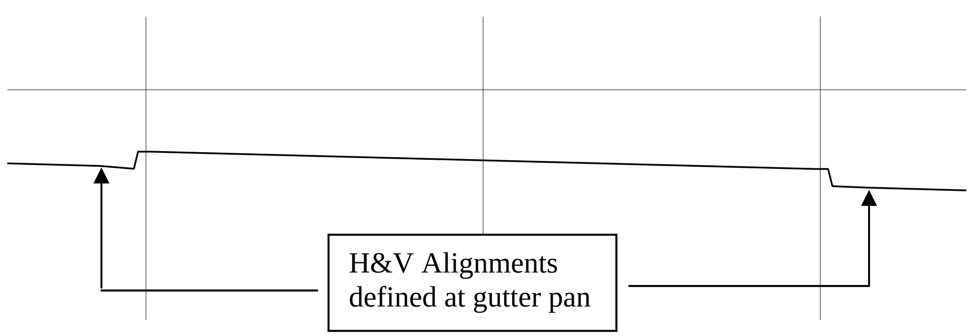
The given geometry is based on Horizontal and Vertical alignment locations as shown below.

Save the median model as SH52 Median 1.dtm

If you have time, repeat the process for Median 3







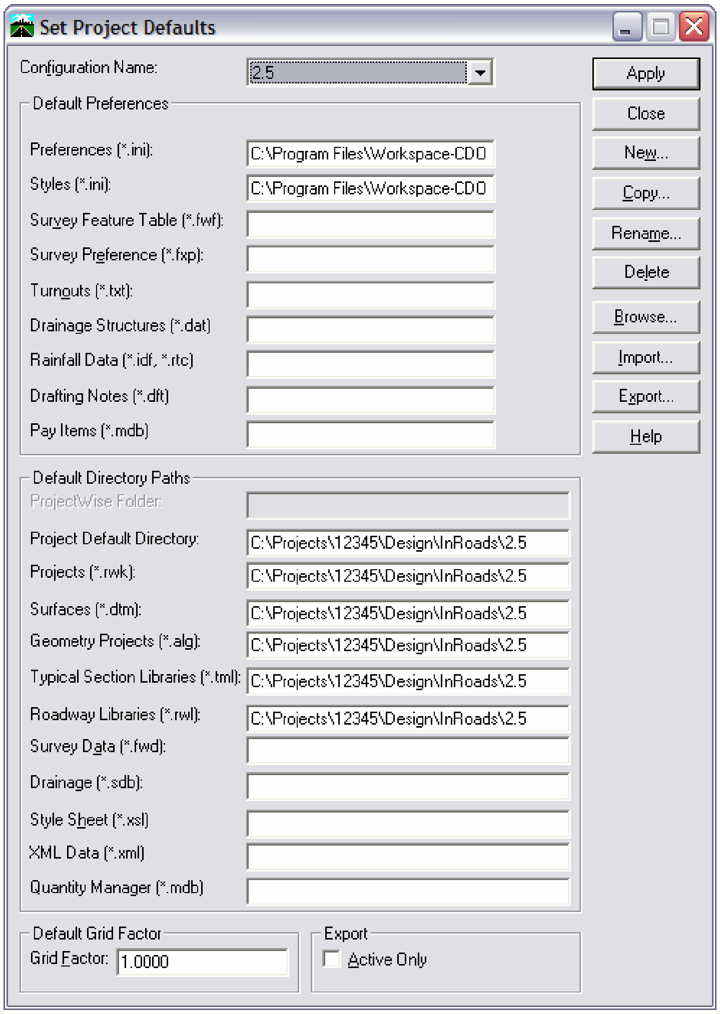
Preliminary set-up

1. Start MicroStation InRoads and open the file **12345DesignModel01.dgn**.
2. Select **File>Project Defaults**.
3. Set the **Configuration Name** to **2.5**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

4. Select **Apply**.

Important! Verify your dialog box appears as shown:



5. **Open** the appropriate data files (refer to **Given** statement).

Note: If you need additional assistance with this lab, follow the hints below.

Model the median

Review Curb and Gutter typicals

1. Review the typical **SH52 Median CG**, which is a catch gutter template just for modeling the median.
2. Also review the typical **SH52 Median CG Spill**, which is a spill gutter template just for modeling the median.

Create a Roadway Definition slot for the median

Set up roadway definition so catch to spill transition occurs around ends of median with catch on the high side (left) and spill on the low side (right).

1. Select **Modeler>Define Roadway.**
2. Select **New.**
3. Key in a **Name** of ***SH52 Median 01***
4. Key in a **Description** of ***SH52 Median starting at sta 100+00***
5. **Apply**, then **Close.**

Create the Roadway Definition for catch to spill transitioning around median

1. Highlight the **SH52 Median 01** roadway definition.
2. Select **Edit.**
3. In the **Edit Roadway** dialog box, select **New.**

First Entry

4. Keep the beginning station at ***0+00***
5. Set **Mode** to **Left.**
6. Key in an **Interval** of ***5***
7. Toggle **on Use Transition Template.**
8. Under the **Left** Column:
    - Set **Template** to **SH52 Median CG Spill.**
    - For **Catch Point** choose **Backbone Only.**
9. **Apply.**

Second Entry

10. Key in a **Station** of ***5+00***
11. Maintain all other settings and **Apply.**

Third Entry

12. Key in a **Station** of ***5+30***
13. Set **Template** to **SH52 Median CG**.
14. **Apply**.

Fourth Entry

15. Key in a **Station** of ***10+20***
16. **Apply**.

Fifth Entry

17. Key in a **Station** of ***10+40.30***
18. Set the **Template** to **SH52 Median CG Spill**.
19. **Apply**

Model SH 52 median with catch/spill gutters

1. Select **Modeler>Roadway Modeler.**
2. Select **Preferences** and **Load** the **CDOT** preference.
3. In the **Superelevation** section of the **Advanced** tab, makes sure **Apply To** is toggled ***off***.
4. Select **Apply.**
5. Zoom in to the alignment to see the TC lines.
6. Cut sections to see the median.
7. Save the new surface if you are happy with it.
   SH52 Median 1.dtm

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit>Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File>Exit**.
2. If prompted to save data files select **Yes**.

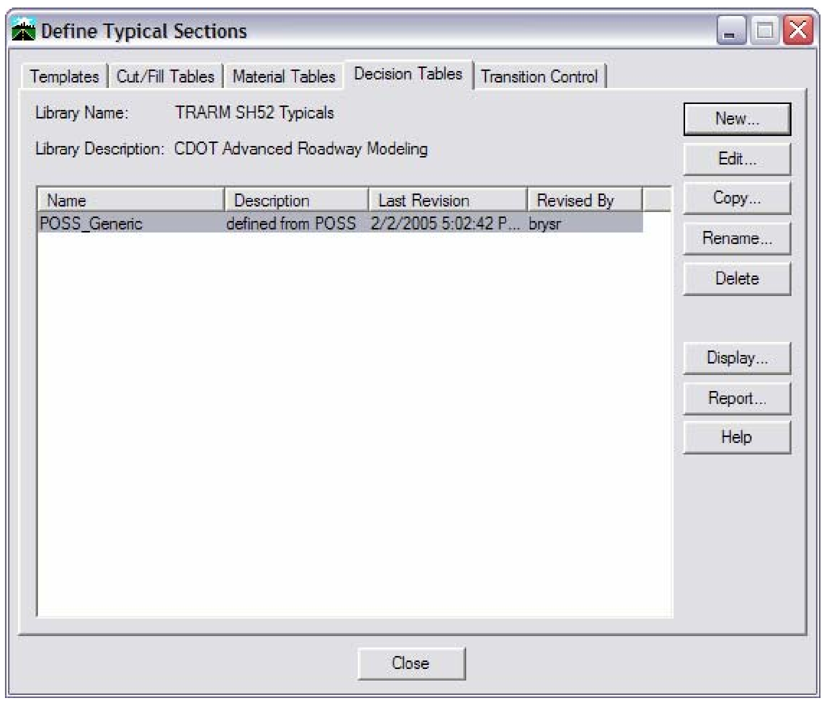
3. Decision Tables

Overview of Decision Tables

Decision tables are made up of a series of records, each similar to a segment of a template, that defines a sideslope. A table can have more than one definition, and can have multiple targets — making it a very powerful tool in defining complex sideslopes.

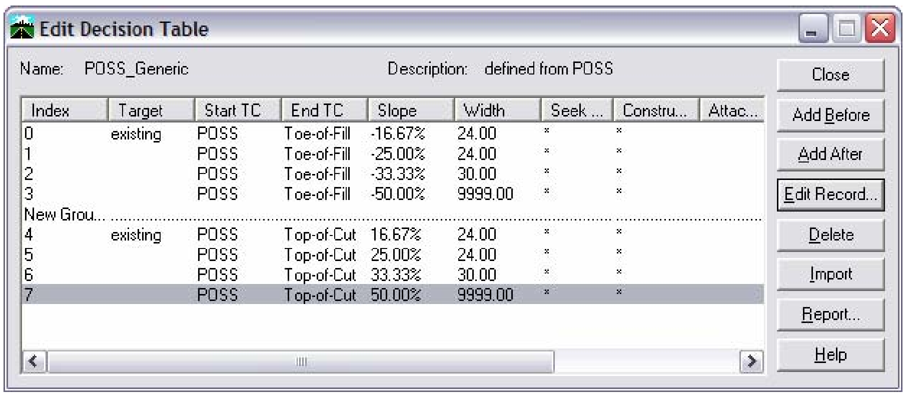
Template backbones are still used, but the decision tables take over at the hinge points to calculate sideslopes. The tables can also used with 3D graphical elements or features to calculate sideslopes, such as from ditch bottoms or walls.

Decision tables are stored in the typical section library. CDOT has one default decision table stored in **CDOT-Typical Sections.tml**. When this file is copied into the project directory, the decision table may be copied and modified as needed.



Parts of a Table

Decision tables are made up of a series of records that define a sideslope condition. The records use transition control (TC) names to define the beginning and ends of the segments in the sideslopes, with each record defining a slope and width as well as the criteria under which the segment will be successful. The decision tables are processed perpendicular to a linear control, which can be either a template backbone, a 3D graphical element, or a DTM feature.



Records

A record is a single line in a decision table made up of a starting TC name, an ending TC name, a slope and a width (along with other criteria discussed later). The TC names have two purposes: they define the symbology of the longitudinal feature resulting from running the table, and they also provide a method for the table to back-track to a previous location in the sideslope.

Target Blocks

A target block is a series of records that, together, seek the same target. For example, you can create several records that make up cut and fill scenarios, but all seek the same existing ground surface, or target. Within the target block, you can backtrack if one solution, such as a shallow fill slope, fails, and the next solution will be attempted.

Processing occurs from the top down, evaluating each record in turn. The target block continues processing until one segment meets the target. Once a segment meets the target, the block is successful and no other records within that target block are evaluated. Any records that were not lost to backtracking prior to hitting are placed along with the successful record.

> **<u>Tip</u>**: A target block is successful if one of the records in the block meets its target.

If no records in a target block meet the target, the block is unsuccessful and all records in the block are discarded. If a record in the target block meets the target, the block is successful. In either case, the table looks to see if any other target blocks exist in the group (see below). If so, the next target block in line is processed (unless it is marked **Attach After**).

Groups

One or more target blocks making up a mutually exclusive sideslope condition form a group. Only one group in a decision table can be successful, since all processing stops when a group is successful.

An example of mutually exclusive sideslopes broken into groups includes: testing with one group to see if a design surface is met, and with another group to see if the original ground surface is met, such as the case of a divided highway run at separate times.

> **<u>Tip</u>**: A group is successful if its last target block is successful. (Previous target blocks may also be successful.)

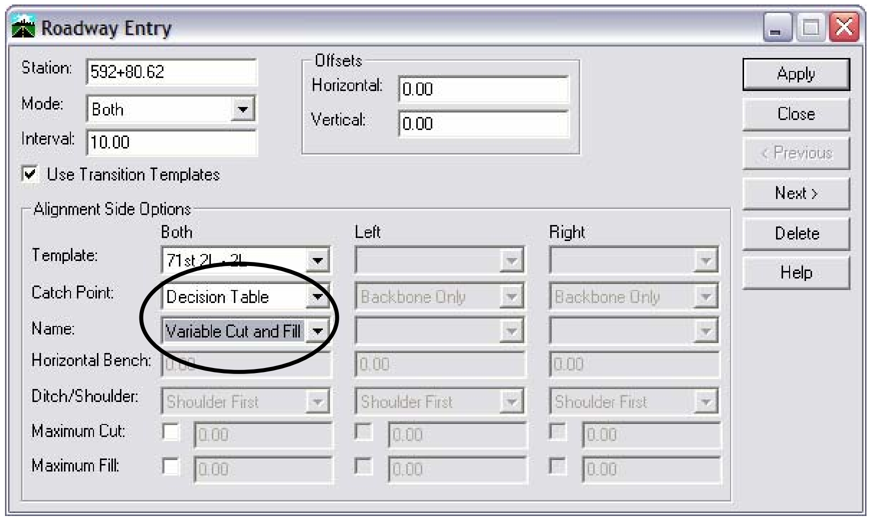
Other previous target blocks may be successful also, but the last one must be. Once a group is successful, the processing ends at the current location.

If the last target block in a group is unsuccessful, all previously successful records are discarded and the processing starts over again with the next group in the table. If there are no more groups, the decision table fails and no sideslope is created at this location.

Running a decision table with Roadway Modeler

The most common use of decision tables is to define sideslopes along a roadway corridor. This is done using **Roadway Modeler**, just like using template, cut/fill table or material table sideslopes.

In the roadway definition, the **Catch Point** is set to **Decision Table** and a decision table entered. Decision tables are listed in the roadway definition editor, so they are selected without having to remember the name and key it in. When the roadway is modeled, the decision table picks up at the hinge point with its calculations and the cut and fill portions of the template are ignored.



In some situations, a different decision table is needed on each side of the roadway. For these times, the roadway definition mode is set to **Left** and **Right** and a different decision table listed for each. You can also specify a decision table for one side and one of the other sideslope alternatives (cut/fill or material table, or template) for the other.

Decision table results

The results of running decision tables with **Roadway Modeler** are twofold. First, a DTM is created just like when the sideslopes are calculated with templates. Second, graphical elements are created longitudinally by connecting like TC points in the tables from template drop to template drop. These longitudinal lines are actually the features that are part of the resulting DTM, and are named according to the TC names in the table.

Tip: In order to see the features created by **Roadway Modeler**, the TC name's **Feature Style** must have the **3D Plan/Display** toggled ***on*** and the **Transition Control Lines** Display option must be turned on in **Roadway Modeler** (on the **Advanced tab**.)

Building a Decision Table

After creating several decision tables you will no doubt come up with your own methods for developing them. Many times, existing tables are copied and modified to fit new conditions, saving time in the creation and testing process. The following steps define a good path to follow when starting out with decision tables, and one that you can modify to fit your needs as your proficiency increases.

The building of a decision table is an iterative process and may require trial and error. When starting with the path outlined, keep in mind your initial division of target blocks and groups may need to be amended as additional variables are uncovered in the design process.1

1. The best method of starting a decision table is to ***sketch the desired sideslope results***. When completing the sketch or sketches, try to think of as many existing conditions as possible, and the sideslopes that will best fit the conditions. Typically, you will need sideslopes for both cut and fill (at a minimum).

2. The next step in building the table is to ***break the sideslope conditions into groups***, or mutually exclusive designs. In a very simple table only one group may be necessary, since both cut and fill can be addressed in the same group, or even the same target block.

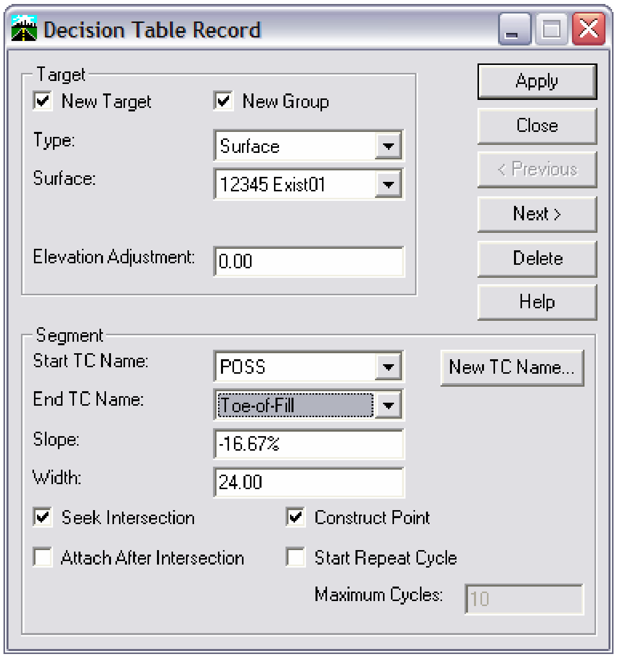
   Tip: When breaking sideslopes into groups, keep in mind only one group is successful at any given location, so a group must contain a complete sideslope definition.3

3. After determining the different groups required, ***break each group into target blocks***. A target block is allowed only 1 “hit”, so one must be developed for each instance a target is reached in a sideslope. For example, you may have a fill slope extend to the existing ground (target 1), then continue and place a ditch at the toe of slope, coming back and intercepting the same existing ground again (target 2).

4. With the preliminary work done, the next step is to ***create the table***. Since decision tables may be very complex, it’s always a good idea to test the table as you go. Build one group (or even one target block) and display the table or test it on a small section of roadway where you know it should work. This will help spot problems when it’s easier to determine the cause.

The Decision Table Interface

Decision tables are stored in template libraries. They are built record by record through a dialog interface, which can also be used to edit the table later. When developing each record, criteria are used to determine how the record will react under certain conditions. Each of the criteria is described below.



Start TC Name — This is the beginning name of the record. The TC Name must exist in the current template library, but it may be created "on-the-fly" by selecting **New TC name** on the **Decision Table Record** dialog. The TC names are used to determine backtracking and the name and style of the features resulting from application of the table.

Tip: The beginning TC name does not have to be Hinge.

End TC Name — The end TC name also determines the name of the resulting feature, and serves as a starting point for subsequent records.

The TC Name must exist in the current template library, but it may be created "on-the-fly" by selecting **New TC Name** on the **Decision Table Record** dialog.

Slope — This is the slope of the segment created by the current record. It is used in all instances with two exception: when the target type is Align XYZ, the slope will be variable to meet the horizontal and vertical alignments specified. In this case, the slope can be set to 0%, as it will be ignored. The same is true when the target if Feature XYZ

Width — If the target is reached prior to full width, the segment stops (assuming seek intersection is turned on — see Seek Intersection). Otherwise the full width is used to place the segment. In segments seeking a target, a width greater that ever needed must be used. In other words, the segment does not project further than the width, like template cut and fill.

New Group — This toggle is used to denote the record as the first one in a group. The first record in a table must be the first in a group, and the first record in a group must begin a new target block.

Seek Intersection — With seek intersection toggled on, the segment stops if the specified target is met. If the toggle is off, the segment extends to full width even if it passes through the target.

Start Repeat Cycle — The start repeat option is useful when repetitive records occur in a table, such as in benching situations. Turn the toggle on and then key in a number, which specifies the number of times the current record and all subsequent records in the block are repeated until an intersection is met, or until all repetitions of the records are placed.

The last record in a table cannot be part of a repeat cycle, so an extra “dummy” group may need to be included.

Attach After Intersection— In some situations, a target block is only needed if the previous block is successful. This is the case in toe-of-slope ditches. The target block containing the ditch is needed if the previous fill slope target block successfully reaches its target.

This keeps the ditch from being placed if the fill slope fails. This option is often used when multiple targets are met with one group, but the subsequent target blocks are only used if the previous is successful.

Construct Point — Also called Generate Point, this option determines whether or not the point (if part of a successful solution) will be used as a DTM point in the resulting model.

This option is typically on. Examples of where it should be toggled off include determining a variable slope for right-of-way by placing a record at 0% slope for the right-of-way width, then placing a second record at a near vertical to intercept the DTM. The point resulting from the first record should not be part of the DTM.

New Target — Toggling this option on indicates that the record is the first one in a target block. It is turned on, even if the record itself is not seeking an intersection. All subsequent records seek this target (if Seek Intersection is on) until the next New Target record.

Target Type — There are several target types available: Surface, Fixed Elevation, Alignment Elevation, Alignment XYZ, Alignment XY, Feature XY, Feature XYZ and Feature Elevation. Each of these options is discussed in detail later.

Target — After choosing the target type for the block of records, this field is used to specify what the target is: the DTM name, alignment name(s) or elevation.

> **Tip**: With Align Z, you must specify the Horizontal alignment it belongs to, even though it is not actually used for the horizontal location.

Elevation Adjustment — This option is used if the desired target needs to be met at an offset. An example is a toe-of-slope ditch where the fill slope continues to a desired offset under the DTM.

The adjustment is calculated by offsetting the surface if the target is a DTM, so the actual intercept point may not be the same depth as the elevation adjustment.

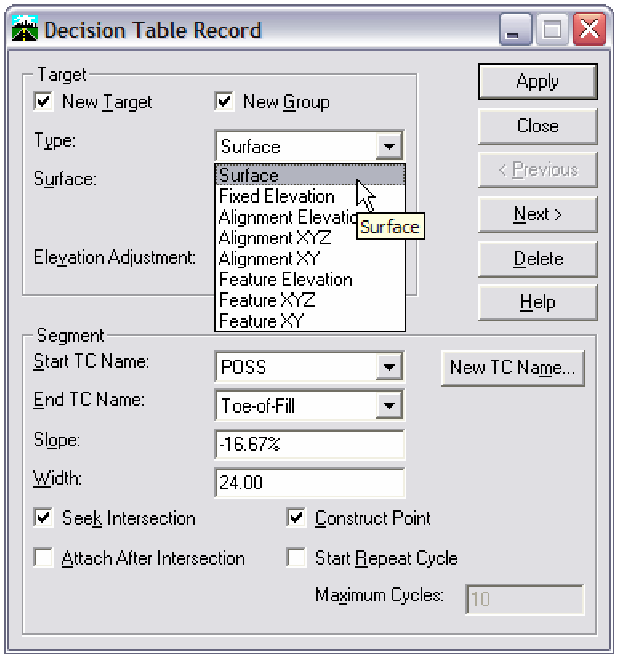
It is beneficial to display the decision table during the building process to check the records for problems with slopes and connectivity. Display a decision table using **Utilities >Display Decision Table** from the main decision table dialog.

> **Tip**: The display uses the attached color table and beginning with color 1, changes colors with each target block. Within the target block, if there is backtracking, each record displays with a different line style, beginning with line style 0.

Target Options

One of the most powerful parts of a decision table is the ability to seek an intersection with targets other than DTMs. With this benefit, you can accomplish the equivalent of independent control outside the backbone of your template, along with other equally complex sideslopes.

The eight available targets are: Surface, Align XY, Align XYZ, Align Elevation, Feature XY, Feature XYZ, Feature Elevation, and Fixed Elevations. Each of the options is described below.



Surface

Surfaces or Digital Terrain Models (DTMs) are the most common targets for decision tables. Even if other targets are used, the sideslope ultimately intercepts a DTM (in most cases). The decision table is more flexible than the template or other table options, even in seeking a surface. It allows specific DTMs to be targets, thus removing the one DTM limitation of template and cut/fill table sideslopes.

Allowing the choice of different surfaces requires loading DTMs prior to creating the decision table. It also means in order to use a decision table on multiple projects, the surfaces either need to be named identically, or the decision table needs to be edited to specify project-specific surface names.

Using multiple surfaces within one sideslope condition is useful when cutting through different materials. For example, if you have enough data to form a surface for rock, it is specified as the initial target in the decision table and different sideslope or benching options used. Once the rock surface is intercepted, the next target can be the existing ground surface, using different sideslopes.

Multiple surfaces are also used when there is more than one surface where the sideslope can terminate. This occurs in several situations, such as when two adjacent DTMs form the existing ground surface. Two groups are used in the decision table, identical except for the surface name. It also occurs when running a roadway model that ties into a proposed surface in one area and the existing terrain in another, such as a divided highway where the two travel ways are run independently.

Alignment Elevation

The vertical alignment option, called Alignment elevation, allows you to target an elevation based on a vertical alignment. The slope specified in the table is constant and the elevation of the vertical controls the width of the segment, widening or shortening it as necessary. The segment cannot widen past the width specified for the record, so it must be large enough to take care of all situations.

Since the horizontal location of the target is calculated, the same vertical alignment can used for both sides of the alignment if desired. It is created under the mainline horizontal on the main profile grid. If different alignments are needed, the TC names must be unique on each side and a different alignment created.

This option is used in several situations, including independent ditches that require a constant foreslope, but whose grade is best defined by a vertical alignment. It is also used in divided highway situations where the median slopes are constant and two different profile grade lines are used.

Alignment XY

The horizontal alignment option, called Alignment XY, allows you to target a xy location based on a horizontal alignment. The slope specified in the table is constant and the location of the horizontal controls the width of the segment, widening or shortening it as necessary. The segment cannot widen past the width specified for the record, so it must be large enough to take care of all situations.

Since the horizontal location of the target is specified by an alignment, the same alignment cannot be used for both sides of the road.

Alignment XYZ

The horizontal and vertical alignment target (Alignment XYZ) is the only target that ignores the slope specified in the record. When this target is used, the sideslope is formed from the starting point of the record directly to the location of the combined horizontal and vertical alignments. Even though the slope is ignored, the width must still be large enough to encompass all situations.

If the desired result is to join to a 3D graphic element, the element must be used to create a horizontal and a vertical alignment. This is accomplished with **File >Import >Geometry** and choosing the From Graphics tab. Set the type to **Horizontal and Vertical Alignment**.

> **Tip**: Whether the alignments are created from scratch or from graphics, the direction of the alignment does not matter.

Examples where the **Alignment XYZ** option is used include:

- ***independent ditches*** that do not have a constant sideslope, but rather a defined horizontal path,
- ***divided highways*** that have separate profile grade lines and separate horizontal alignments, and
- ***urban areas*** where slopes are designed to match existing topographic features next to the roadway, such as a curb line of a parking lot.

Feature XY

The Feature XY option is similar to the Align XY target, but rather than using an alignment, a DTM feature is used.

Feature XYZ

The Feature XYZ option is similar to the Align XYZ target, but rather than using alignments to define the exact location for the target, a DTM feature is used.

Feature Elevation

The Feature Elevation option is similar to the Align Elevation target, but rather than using an alignment, a DTM feature is used to determine the target elevation.

Fixed Elevation

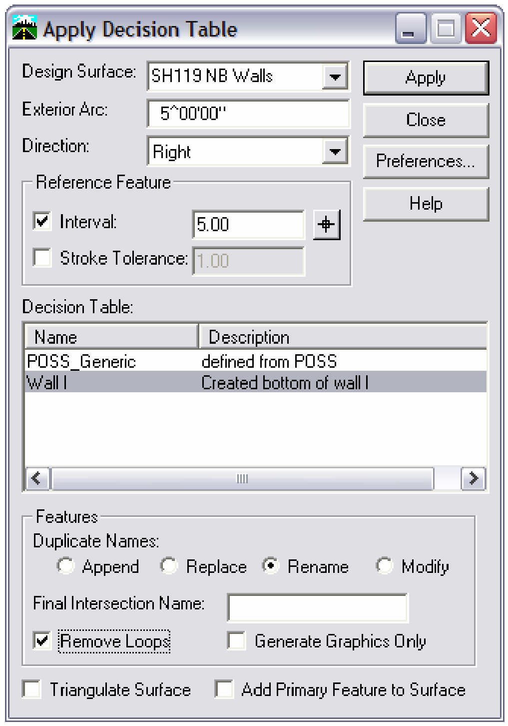
The fixed elevation target allows sideslopes to stop at a certain elevation, then proceed with another target block and target. The most common example is horizontal benching. If the benching is repetitive after reaching the first elevation (i.e. the subsequent benches are the same height and width), it is more efficient to switch to a DTM target and use Start Repeat option.

When to use a new target

The new target option is toggled on whenever you are changing targets and/or when the previous target block has already hit its target. For example, when creating berms at the top of cut, or toe-of-slope ditches, your initial DTM target may be the same as the DTM intercepted with the ditch or berm. In instances where the additional target is only used if the previous one is successful, the **Attach After Intersection** option is also toggled ***on***.

Application of decision table with graphic elements

Decision tables are used for more than just corridor modeling. There are often times when a decision table is needed to calculate sideslopes in areas where it is not convenient to run a template, such as gores, ditches, and intersection returns. In these instances, the decision table can be run against a 3D MicroStation element or a DTM Feature using the **Apply Decision Table** command on the **Design Surface** toolbar or under **Surface >Design Surface**.



This command functions in a very similar manner to using decision tables with roadway modeler. The table is applied perpendicular to the element or feature at a user-defined interval, and can be applied to either side.

Dialog options

The **Apply Decision Table** dialog has several options, described below.

Decision Table — The decision table must be selected from the list box, which shows decision tables available from the current template library. If there are no decision tables in the current library, the command will not activate.

Reference Feature Interval — This option determines how often the decision table is processed or “dropped”. It can be likened to the template interval when using **Roadway Modeler**. If the option is toggled off, the decision table will be processed according the **Stroke Tolerance** option.

Stroke Tolerance — If toggled on, this option serves two purposes, both of which densify the decision table interval as applied.

First, it forces the decision table to be applied to all vertices of the graphic element, in addition to the reference feature interval. Second, it “strokes” any curves, arcs or curvestrings in the graphic element. This is accomplished by segmenting the element based on chord height. The value is the tolerance in master units of the chord height used to segment or stroke curve, arc, or curvestrings.

Exterior Arc — This is the angle used to determine the number of “drops” around an exterior corner. The smaller the arc, the smoother the toe line.

Direction — The decision table is applied to the left, right, or both sides of the feature or element. Left and right are determined by either the direction the element was created (when the Reset for Entire element option is used) or by the direction of the start and end data points (when the Data for Beginning, Data for Ending option is used).

Decision table results

When applying the decision table, there are several options for the format of the results. Graphics are generated longitudinally, connecting TC names (if the Display option is turned on for each TC name used in the decision table). The symbology of the lines is controlled by the TC name as it is when decision tables are used with **Roadway Modeler**. The exception to this is the **Final Intersection Name** as described below.

In addition, a DTM can be built from running the decision table, similar to using **Roadway Modeler**. The creation of the surface and various options are controlled by the following toggles:

Generate Graphics Only — When toggled off, this option adds longitudinal features from the TC lines to the specified **Design Surface** as breaklines.

If you are testing a decision table, for example, you may only want the graphics from this command and can toggle this option on.

Triangulate Surface — Once the linear features are added to the surface (see above), the surface can be triangulated. If more than one run is used (for example, if you are running one table on the right side of an element and another on the left), this option can be left off, and the surface triangulated after all runs are complete.

Add Primary Feature to Surface — The primary feature is not included in the surface generated by running the decision table, unless this toggle is on. Unless the element used as the primary feature is already a part of the surface, you will typically want this option on.

Duplicate Names — If the **Generate Graphics Only** options is toggled ***off***, you have options on what to do when the software runs into features that are named the same as the ones created by this command (the features are named according to the TC names).

- **Append** combines the features into one,
- **Replace** deletes the original feature,
- **Rename** assigns a suffix to the feature name, and
- **Modify** changes the portion of the feature that is duplicated.

Final Intersection Feature Name — The name used here will be the transition control name assigned to the final intersection point when the decision table is run. The feature name specified must exist as a TC name in the typical section library. If this entry is left blank, the TC name specified by the table is used.

Remove Loops — Toggle the **Remove Loops** option on and the software attempts to uncross any overlaps caused by sharp curves or interior corners in the original element.

Applying the command

Before Applying the command, you must set the Locate Feature/Locate Graphics toggle to the desired option. The command works under either, depending upon whether the source is a feature or graphic element. The prompts change depending on the toggle, asking for either features or elements.

When the command is applied, it prompts for the primary feature (or element), which is identified graphically. The option is then given to Reset for the entire element, in which case the direction the element was created is the determining factor in what is left and what is right. The other option is to data point for the beginning, then the end of the area you want to apply the table, in which case the left and right are determined by the beginning and end points.

Troubleshooting

It is easiest to troubleshoot decision tables as they are being built, but sometimes that is not possible. In cases where you run into a decision table that doesn't work, try the following options to diagnose the problem.

> **Tip**: If your decision table is not working correctly, a backbone will still be created when you use **Roadway Modeler**. If **Roadway Modeler** does not run, your problems are not typically with a decision table.

Display the table

Displaying the decision table can often uncover problems that would be otherwise hard to diagnose. Look for the proper slopes, and the division of groups and target blocks. You may want to display the decision table at the hinge point of your backbone in a cross section where the slopes are not working properly. This is very beneficial in determining which, if any, of the sideslopes should have met the target.

Check connectivity

Make certain that the TC names are used correctly so that any planned backtracking can take place.

Draw the table

Go through the table step-by-step, drawing and labeling TC names for each record. Be certain to note what is toggled on and what is toggled off.

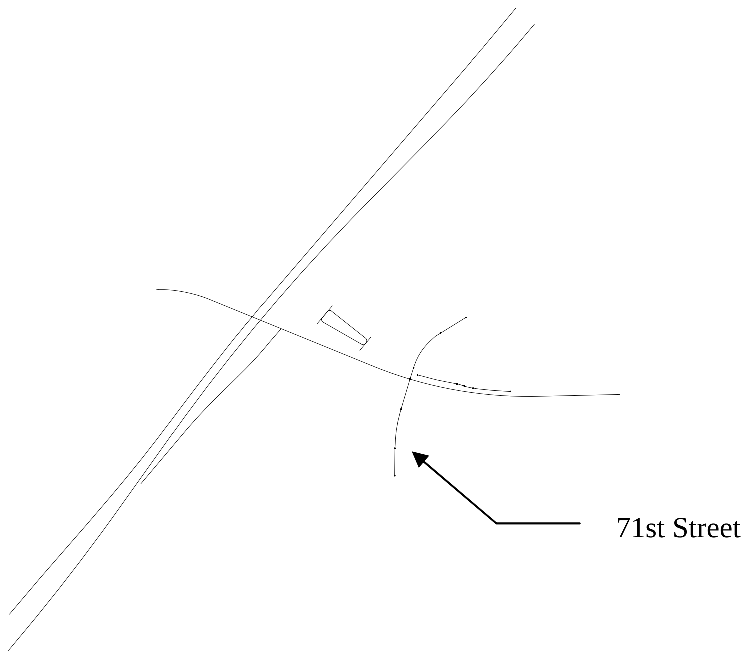
Check the "rules"

Remember, the last target block in a group must succeed in order for the group to succeed, even if previous target blocks are successful. You may need to divide a group into two groups if there are two mutually exclusive target blocks, since the last one will likely fail when the first is successful.

Lab 3.1 – Create a decision table for variable slopes

In this activity, you will create a decision table from scratch to intercept the DTM at multiple slopes. The criteria for determining which slope to use is the depth of cut or the height of fill.

You will run the decision table along the 71st Street corridor.



Start MicroStation InRoads

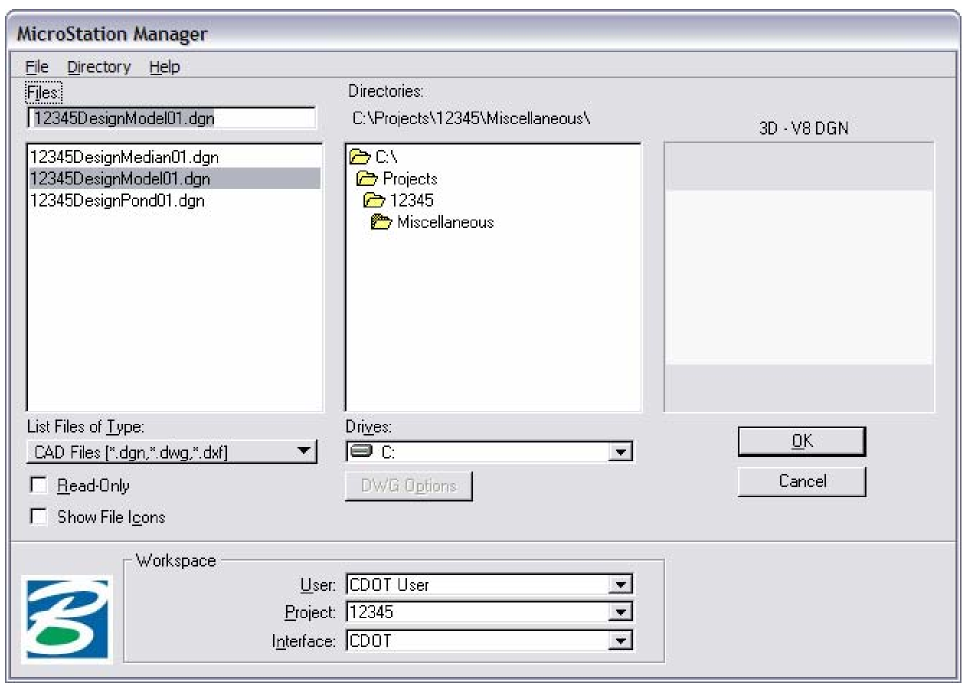
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellandous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

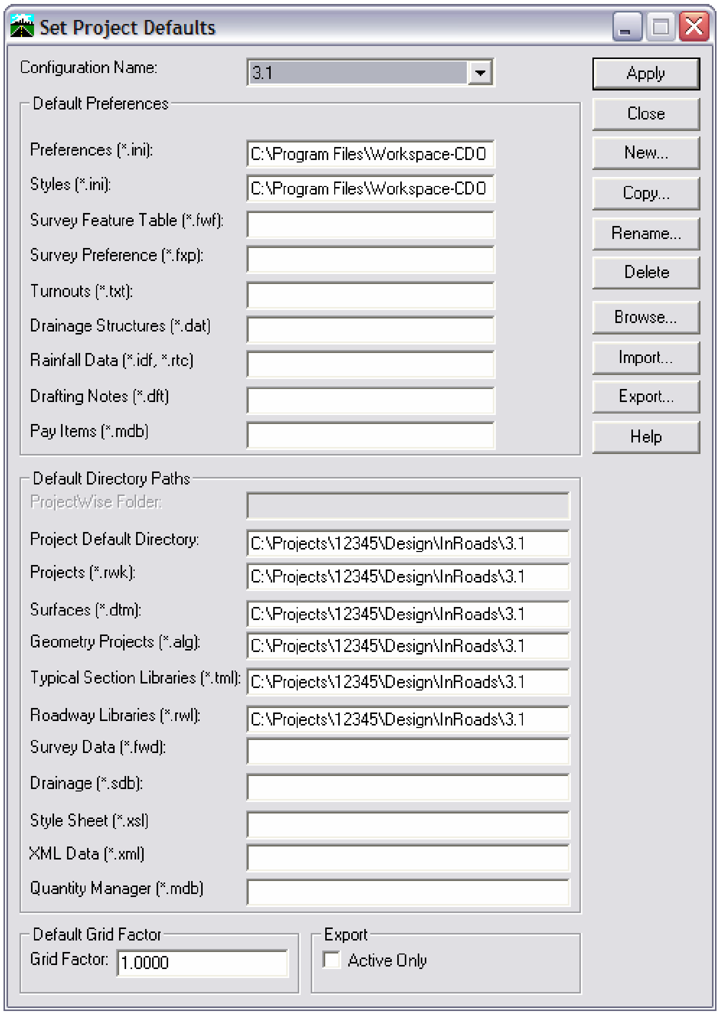
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **3.1**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for 71st Street

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 71st.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for 71st Street

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 71st.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load the roadway library for 71st Street

8. Set **File of Type** to **Roadway Libraries (*.rwl)**.
9. Highlight **12345 71st.rwl** and then select **Open**.
10. ***Do not*** cancel out of the box.

Load the existing DTM

11. Set **File of Type** to **Surfaces (*.dtm)**.
12. Highlight **12345 Exist01.dtm** and then select **Open**.
13. **Cancel** the **Open** dialog box.

Create a decision table

1. The following criteria must be met for your sideslopes:

   Cut Slopes

   Slope 6:1 where Cut is 5’ or less

   Slope 4:1 where Cut is 5’ to 10’

   Slope 3:1 where Cut is 10’ to 15’

   Slope 2:1 where Cut is over 15’

   Fill Slopes

   Slope 6:1 where Fill is 5’ or less

   Slope 4:1 where Fill is 5’ to 10’

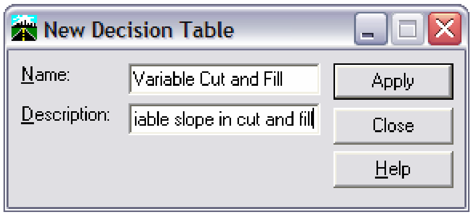
   Slope 3:1 where Fill is 10’ to 15’

   Slope 2:1 where Fill is over 15’

2. Sketch the decision table before proceeding.

Create a name for the decision table.

1. On the **Design Roadway** toolbar, select **Define Typical Sections**.



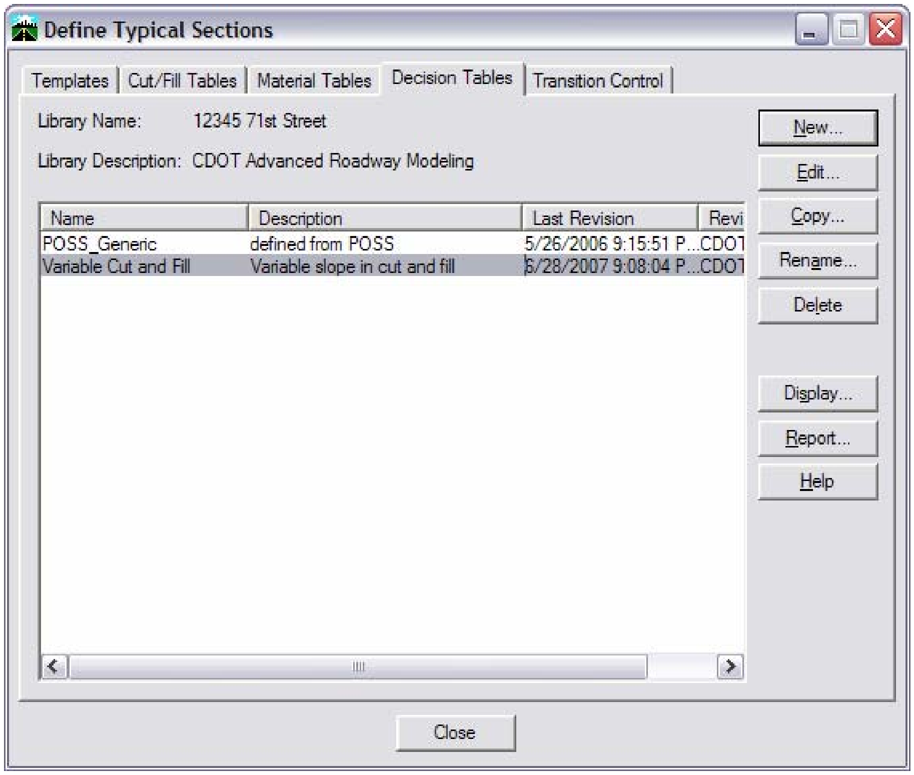
2. Select the **Decision Tables** tab.

    - Select **New**.
    - Enter the **Name**: **Variable Cut and Fill.**
    - Enter the **Description**: **Variable slope in cut and fill**

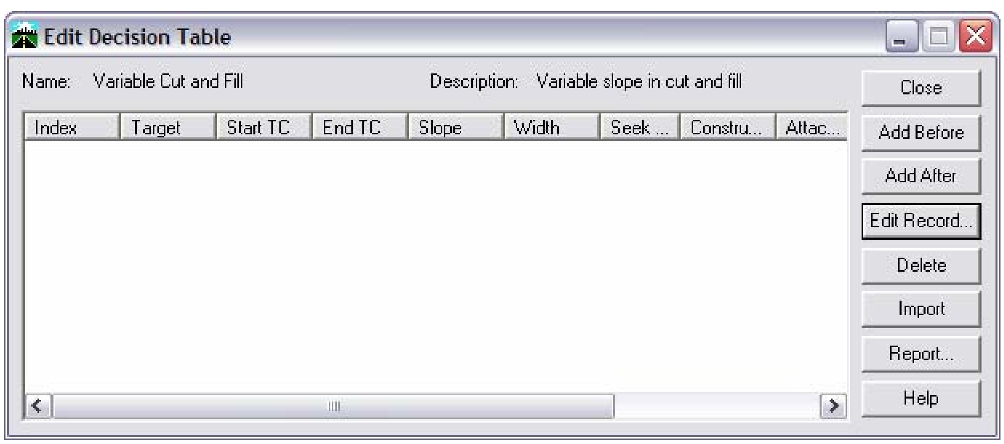
3. Select **Apply**, then **Close**.

Define the cut slopes.

1. Select **Variable Cut and Fill** from the available list.

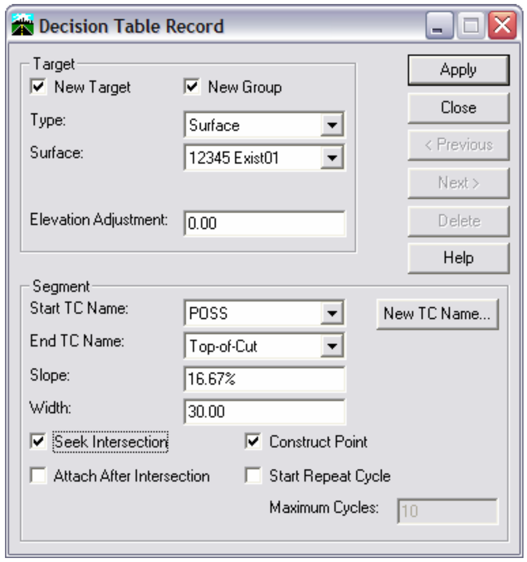


2. Select **Edit**.



Define the first record

3. Select **Add After**.



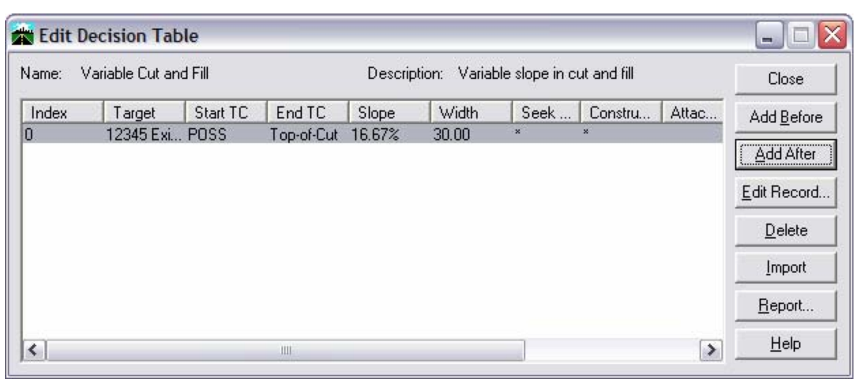
4. First, set the **Target** information:

   - Toggle on **New Target.**
   - Toggle on **New Group.**
   - Toggle the **Target Type** to **Surface.**
   - Toggle the **Surface** to **Existing01.**

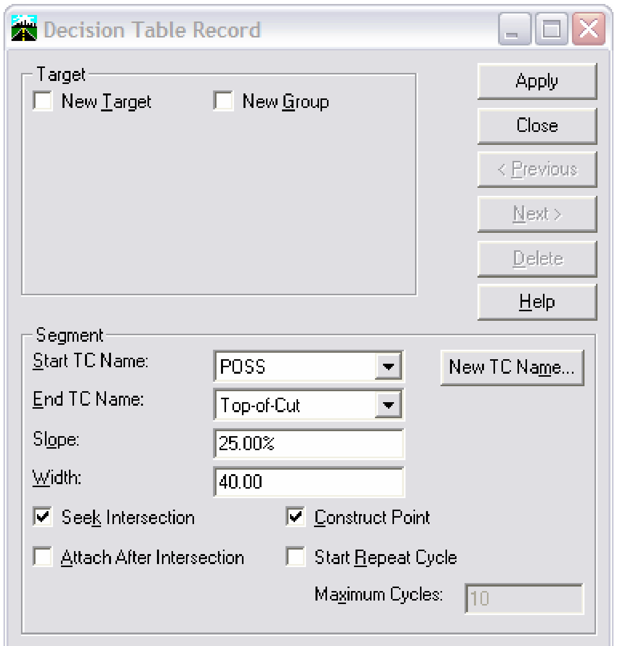
5. Next, set the Segment Information:

   - Start TC Name: **POSS.**
   - End TC Name: **Top-of-Cut.**
   - Slope: ***1:6***
   - Width: ***30*** (which corresponds to a 5' depth)
   - Toggle on: **Construct Point** and **Seek Intersection.**
   - Toggle off: **Attach After** … and **Start Repeat Cycle.**

6. Choose **Apply.**



Define the second record while in the Decision Table Record dialog



7. First, set the Target information:

   - Toggle off **New Target.**
   - Toggle off **New Group.**

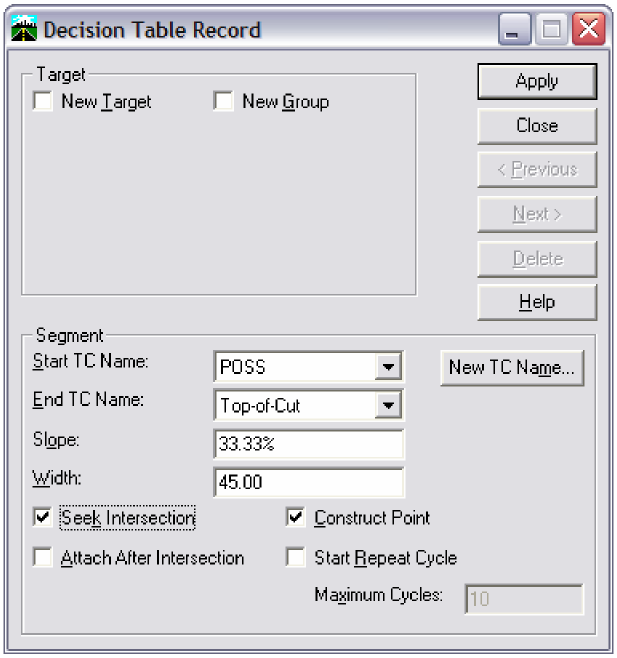
   This segment is part of the same target block and therefore must not have either of these toggled on.

8. Next, set the Segment Information:

   - Start TC Name: **POSS.**
   - End TC Name: **Top-of-Cut.**
   - Slope: ***1:4***
   - Width: ***40*** (which corresponds to a 10' depth)
   - Toggle on: **Construct Point** and **Seek Intersection.**
   - Toggle off: **Attach After** … and **Start Repeat Cycle.**

9. Choose **Apply**.

Define the third record



10. First, set the **Target** information:

    - Toggle off **New Target.**
    - Toggle off **New Group.**

    This segment is part of the same target block and therefore must not have either of these toggled on.

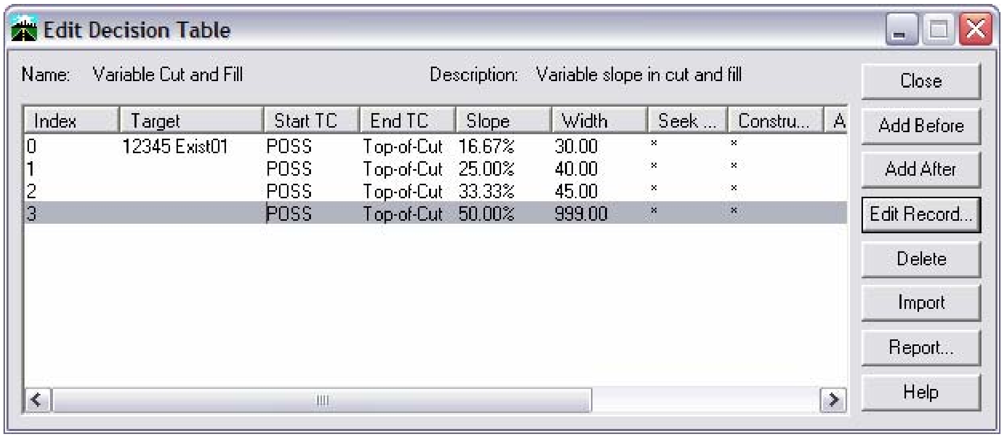
11. Next, set the **Segment** Information:

    - Start TC Name: **POSS.**
    - End TC Name: **Top-of-Cut.**
    - Slope: ***1:3***
    - Width: ***45*** (which corresponds to a 15' depth)
    - Toggle on: **Construct Point** and **Seek Intersection.**
    - Toggle off: **Attach After** … and **Start Repeat Cycle.**

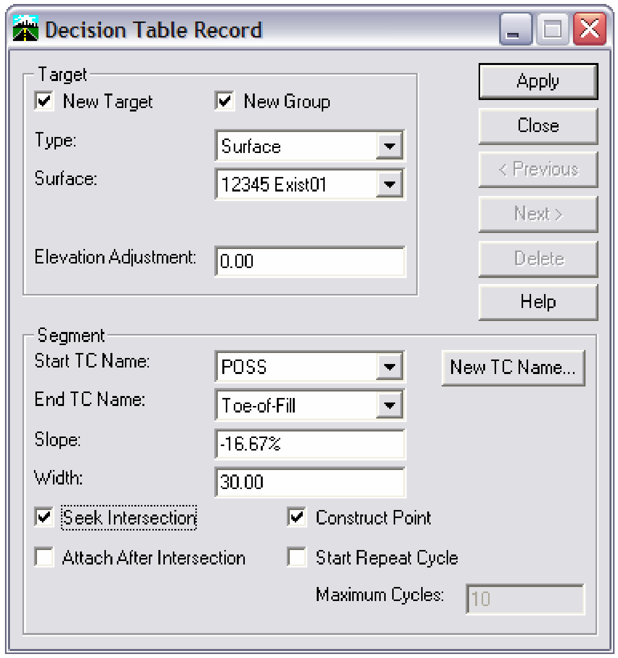
12. Choose **Apply**.

Define the fourth and final record in the cut group

Be certain to use a large width, since the last record must be able to catch when all previous records have failed.



Define the first record in the fill group



13. First, set the **Target** information:

    - Toggle on **New Target.**
    - Toggle on **New Group**.
    - Toggle the **Target Type** to **Surface.**
    - Toggle the **Surface** to **Existing01.**

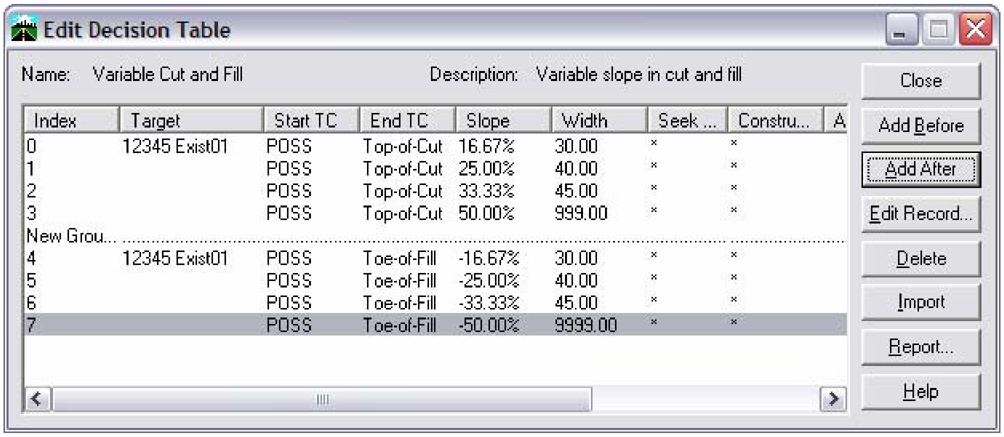
14. Next, set the Segment Information:

    - Start TC Name: **POSS.**
    - End TC Name: **Toe-of-Fill.**
    - Slope: ***-1:6***
    - Width: ***30*** (which corresponds to a 5' height)
    - Toggle on: **Construct Point** and **Seek Intersection.**
    - Toggle off: **Attach After** … and **Start Repeat Cycle.**

15. Choose **Apply**.

Define the other fill records from the table

Don't forget, the fill slopes must be negative.



16. Choose **Close** on the **Edit Decision Table** dialog.

    Note: The cut and fill are in separate groups so they can easily be distinguished when editing or reviewing the table. However, they could also be in the same group as long as they are in the same target block.

17. **Close** the **Define Typical Section** dialog.

Save the decision table

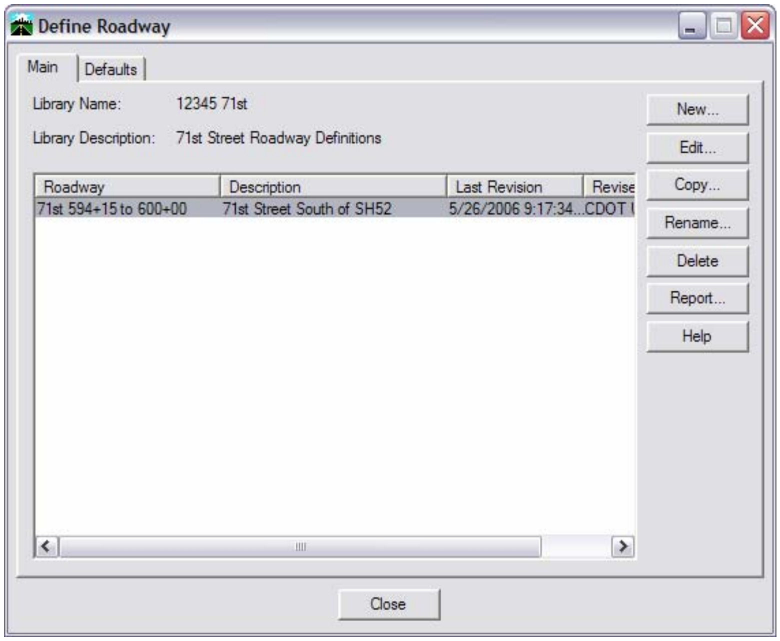
The decision table is stored in the typical section library.

1. Choose **File > Save > Typical Section Library**.

Create a new roadway library entry

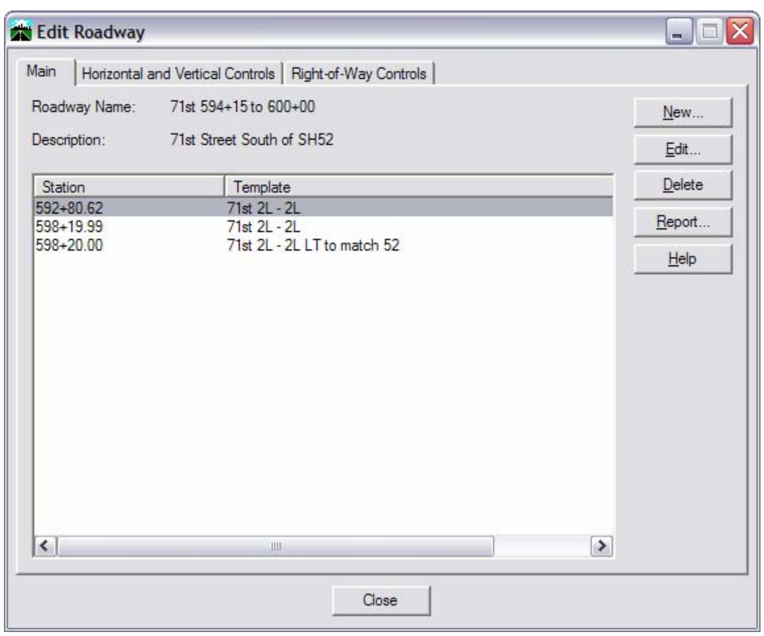
You will modify the existing roadway definition to use the decision table created in the previous steps.

1. Select **Modeler > Define Roadway**.



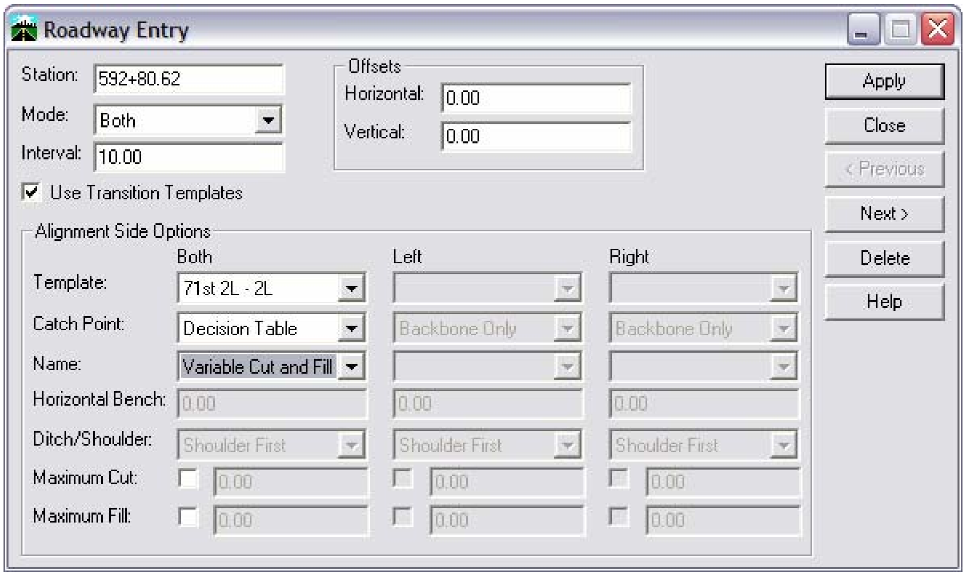
2. From the **Define Roadway** dialog box,

   - Highlight the new roadway definition, **71st 594+15 to 600+00**.
   - Select **Edit**.



3. Select the first station in the list and select **Edit**.

   - Set the **Catch Point** to **Decision Table**.
   - In the **Name** field and select **Variable Cut and Fill** from the drop-down list.



4. Select **Apply**.

5. Select **Next** to move to the next station entry in the list.

6. Continue for all the stations setting:

   - **Catch Point** to **Decision Table** and **Name** to **Variable Cut and Fill**
   - **Apply** after each, then choose **Next**.

7. When complete, select **Close** to dismiss the **Roadway Entry** dialog box.

8. Select **Close** to dismiss the **Edit Roadway** dialog box.

9. Select **Close** to exit the **Define Roadway** box.

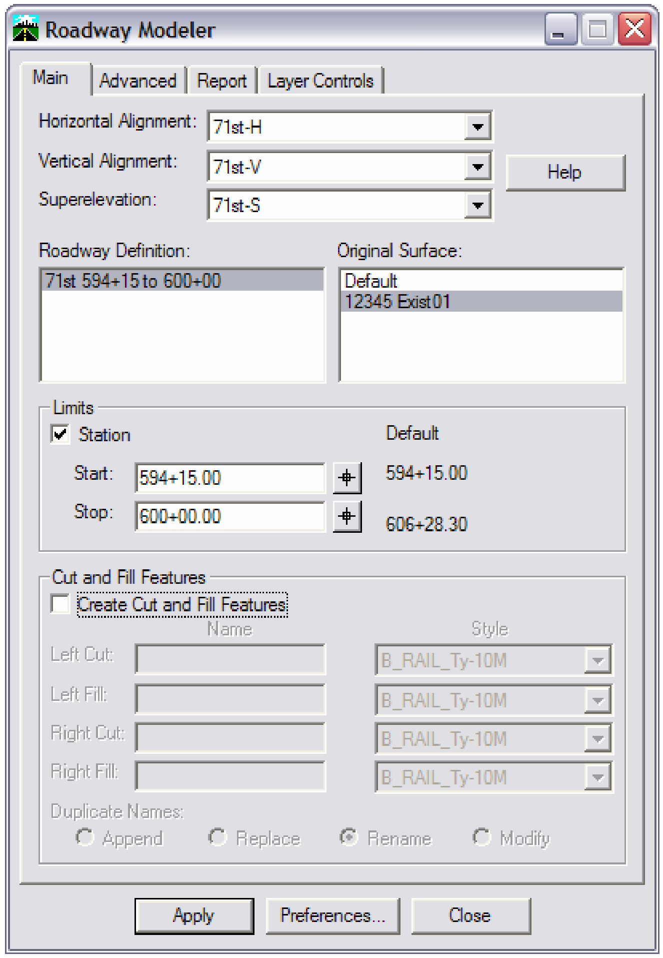
Save the roadway definition

1. Select **File > Save > Roadway Library**.

   The file **12345 71st.rwl** is saved to the hard disk.

Run Roadway Modeler

1. Select **Roadway Modeler**.
2. On the **Main** tab, select the data to be used by **Roadway Modeler**.



- Under the **Roadway** list select **71st 594+15 to 600+00**.
- Under the **Original Surface** list highlight only **12345 Exist01**.
- For the station limits, set the **Stop** station to ***600+00***.

3. Select **Apply**.

   The templates are applied along the alignment for the backbone, using the decision table to determine the sideslopes.

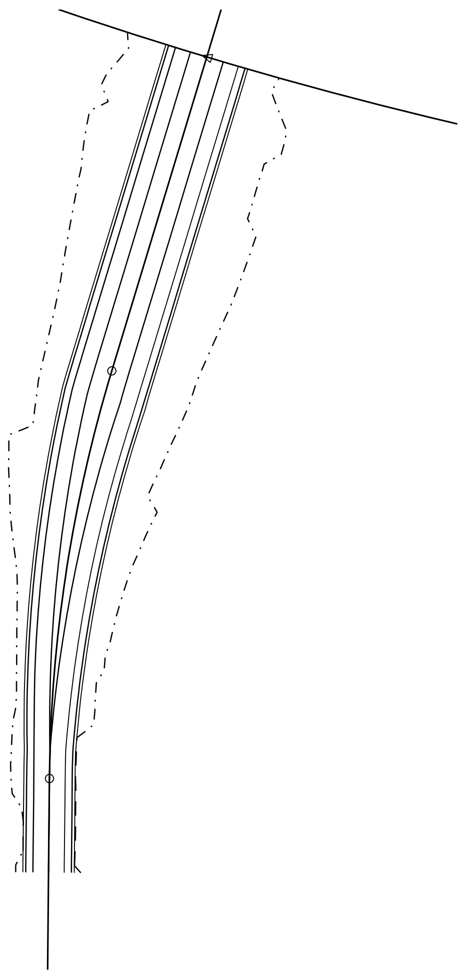
4. Select **Close** to dismiss the **Roadway Modeler** dialog box.

Save your new surfaces

1. Save the finished grade surface created with **Roadway Modeler** to the hard disk.

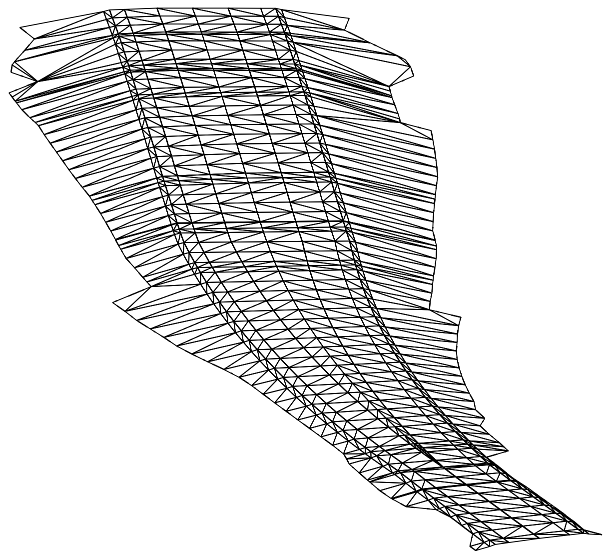
View the results of Roadway Modeler

1. **Zoom in** or **out** as needed with MicroStation to visually review the display of the Transition Control (TC) lines.



Display the triangles for the proposed surface

1. Select **Surface > View Surface > Triangles**.
2. Set the **Surface** to **71st top**.
3. Select **Apply** then **Close**.
4. Use the MicroStation **View Control** commands to take a closer look at the display. (Try rotating a view to see the variable slopes.)



5. Use MicroStation **Delete Element** to delete the triangle display (graphic group lock on).

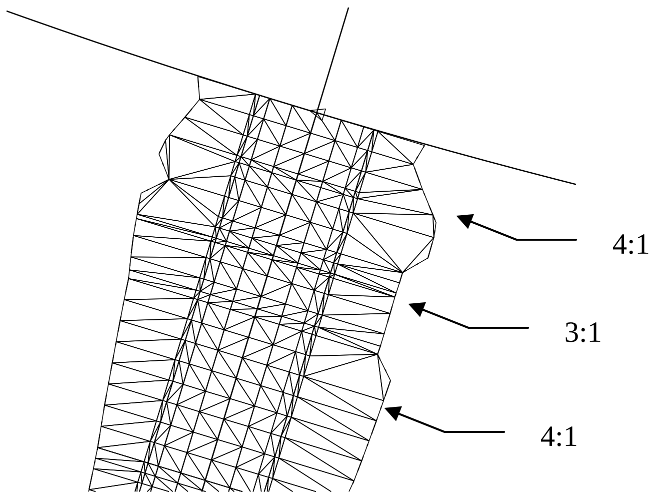
View contours for the proposed surface

1. Select **Surface > View Surface > Contours**.
   - Set the **Surface** to **Finished Grade**.
   - Select **Preferences** and load **Proposed 10' Mjr. – 2' Minor**.
2. Select **Apply**.
3. Use MicroStation **View** commands to take a closer look at the contours.
4. Use MicroStation **Delete Element** command to delete the contour display.

   Remember that the contour display is a graphic group.

Challenge

Notice the areas near the intersection where the sideslopes ‘jump’ back and forth from a 4:1 to a 3:1 and back to 4:1.



Suppose you decide that the slopes should remain 4:1 through this area. How would you go about forcing the slopes?

Create Cross Sections

1. Create cross sections showing the new surface along with the existing surface.
2. Run the **Cross Section Viewer**.

   Watch for the sideslopes to change as defined by the decision table.
3. **Close** the **Cross Section Viewer** dialog.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

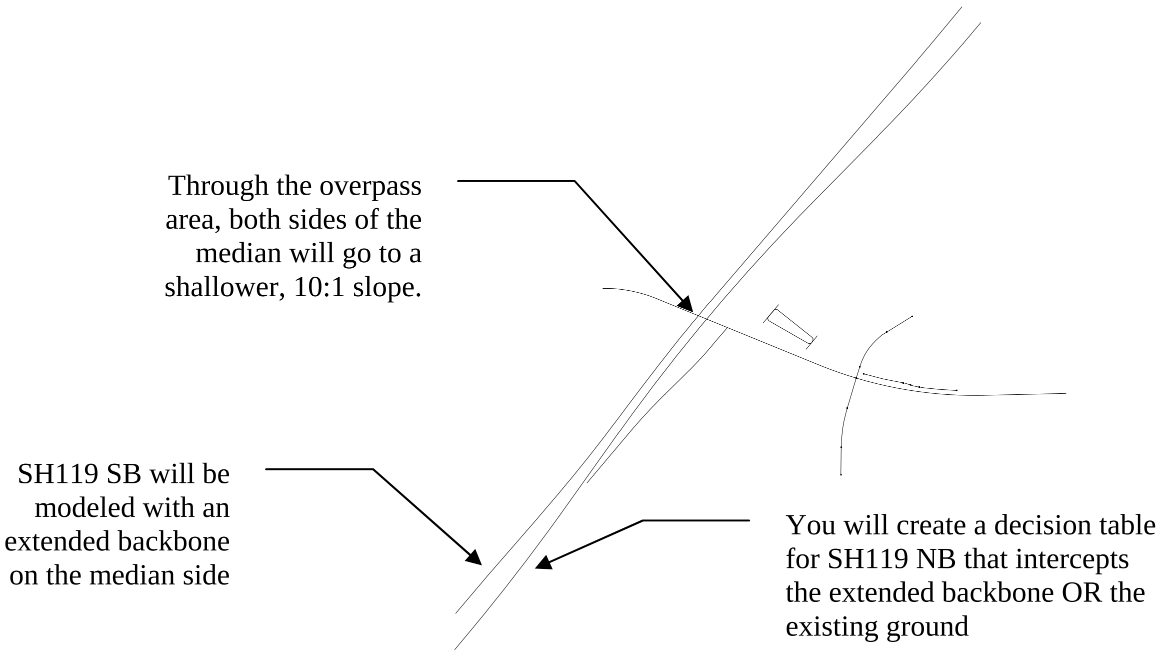
Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 3.2 – Using a decision table to ‘catch’ another surface

In this activity, you will create a target surface for a decision table to catch. SH119 SB will be modeled with an extended backbone on the median side to provide a target for the decision table. Then, you will create a table that catches this extended backbone where it can, and the existing ground where it cannot.

If you completed lab 2.1, you created identical templates. Here, you’ll only review them before modeling.



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

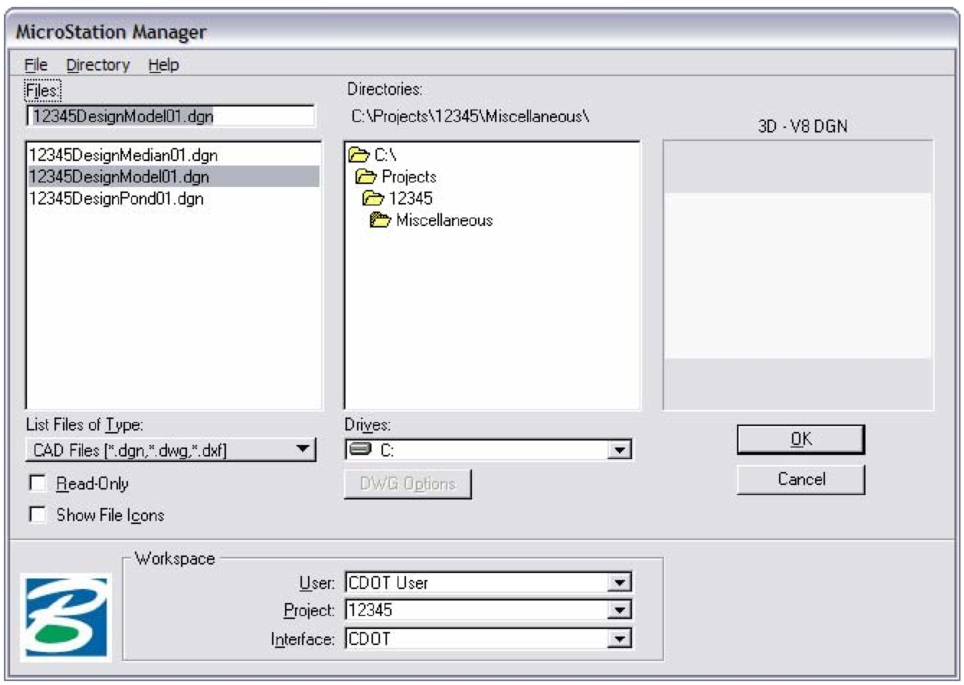
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK**.

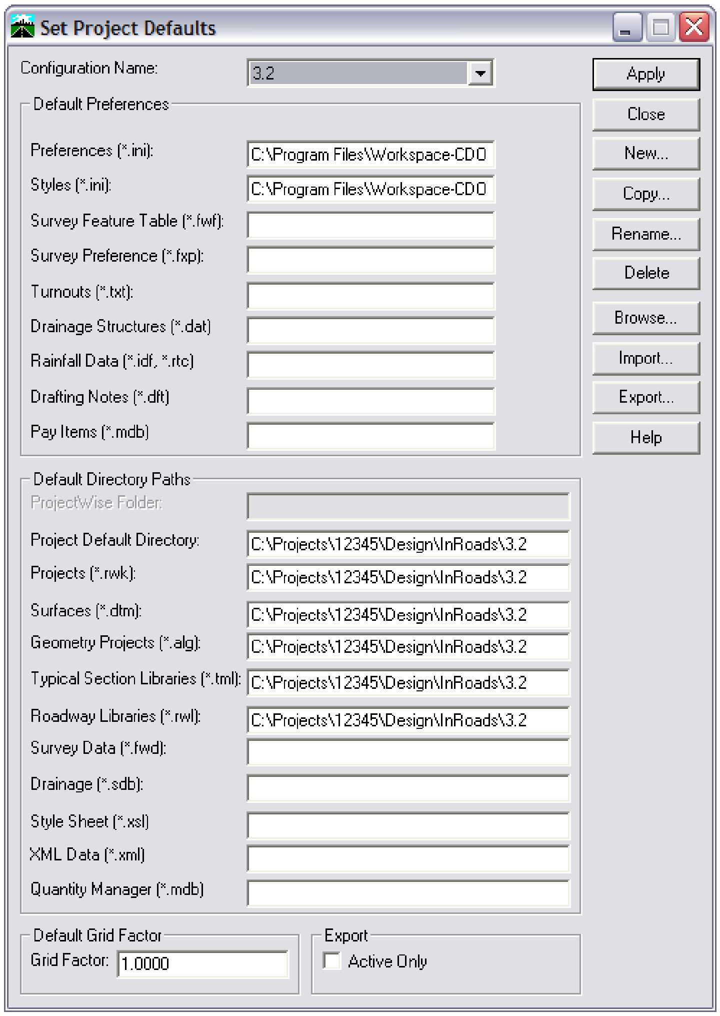
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **3.2**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH119 SB

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 SB.alg** and then select **Open**.
4. Do not cancel out of the box.

Load the template library for SH119 SB

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 SH119 SB.tml** and then select **Open**.
7. Do not cancel out of the box.

Load the roadway library for SH119 SB

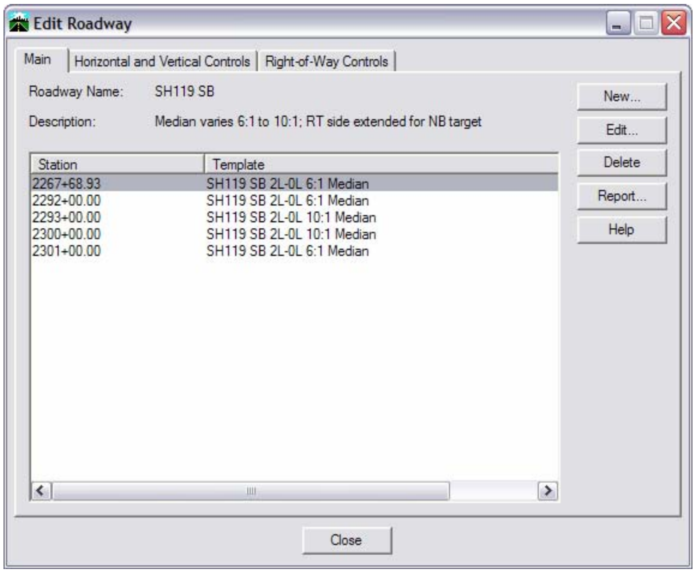
8. Set **File of Type** to **Roadway Libraries (*.rwl)**.
9. Highlight **12345 SH119 SB.rwl** and then select **Open**.
10. Do not cancel out of the box.

Load the existing DTM

11. Set **File of Type** to **Surfaces (*.dtm)**.
12. Highlight **12345 Exist01.dtm** and then select **Open**.
13. **Cancel** the **Open** dialog box.

Review the current setup for SH119 SB

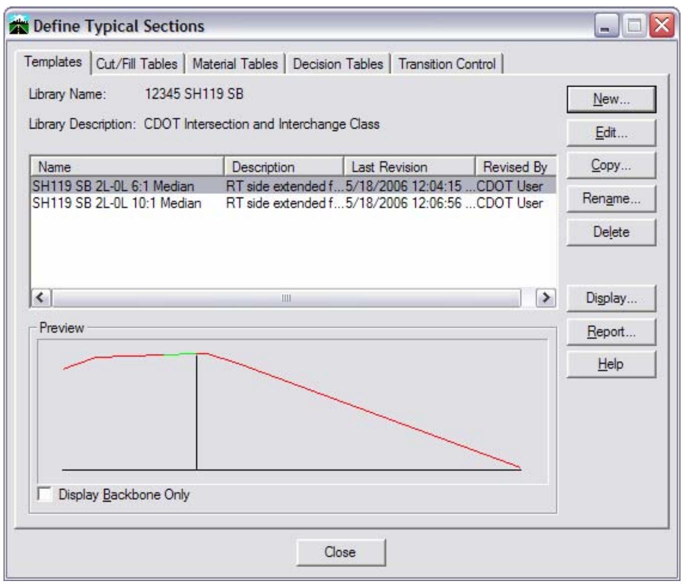
1. Select **Modeler > Define Roadway** and review the roadway definition.



Notice there are two templates used; the 6:1 median and the 10:1 median.

2. **Edit** the entries and notice that the **Catch Point** is set to **Backbone Only** for all entries.

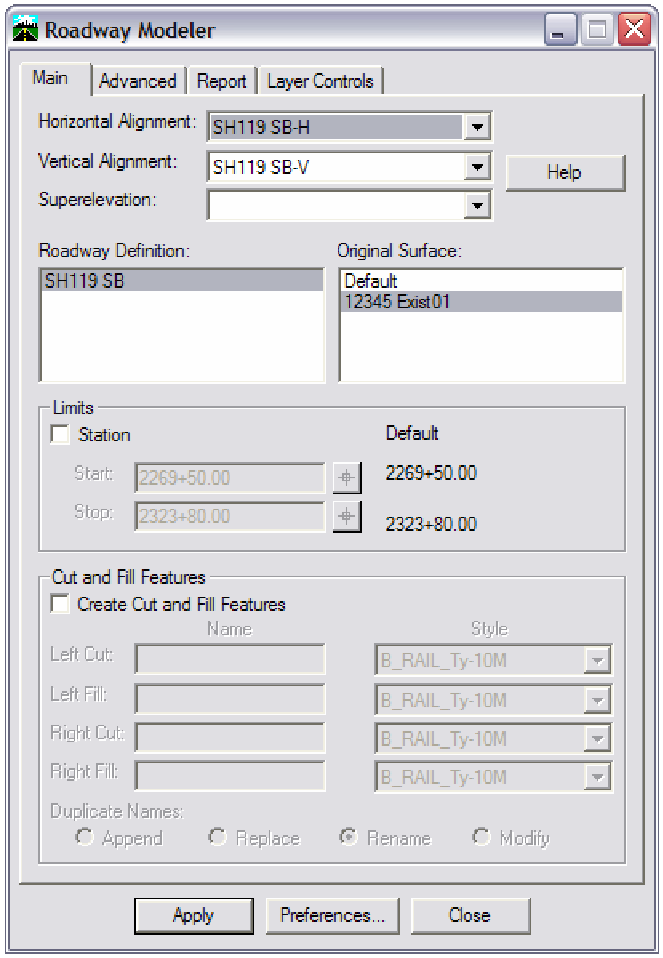
3. Select **Modeler > Define Typical Sections**.



Notice each of the two templates has an extended slope in the right backbone, which will provide the target for the decision table on the Northbound side.

Model SH119 SB

1. Select **Modeler > Roadway Modeler.**
2. Set the **Main** tab as shown.



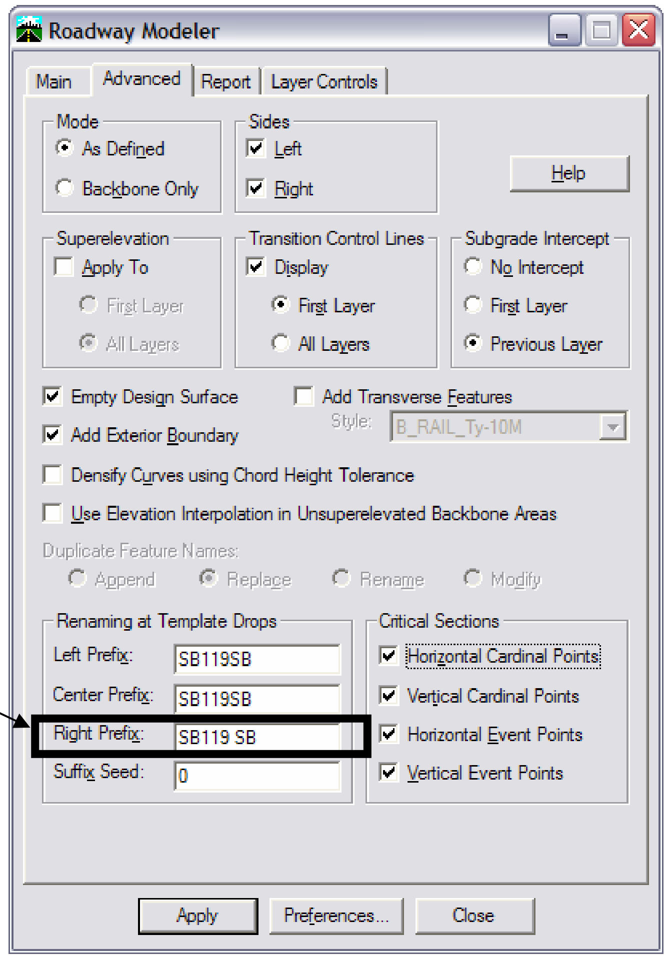
3. On the **Advanced** tab

   - Toggle **off Apply To** under **Superelevation.**
   - Key in ***SB119SB*** for **Left and Center**.
   - Key in ***SB119 SB*** for the **Right Prefix.**

   Note: Left and Right prefixes cannot be identical; therefore you will use a space in the Right one.

   - Set all other options as shown.

Use a space before "SB" for Right Prefix



4. On the **Layer Controls** tab, make sure **Use Layer Controls** is turned **off.**

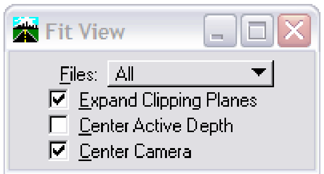
5. Select the **Main** tab again and then select **Apply.**

   The SB 119 corridor is modeled with the backbone on West (left) side and large sideslopes on East (right) side as defined in the template.

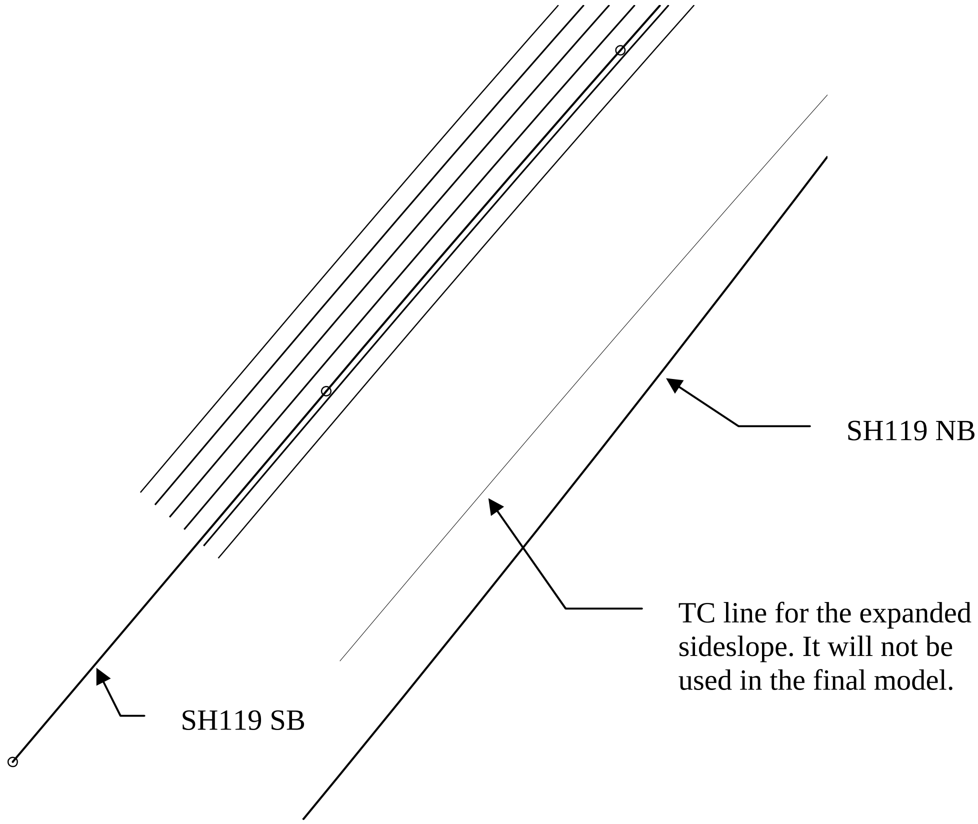
6. **Close** the **Roadway Modeler** box.

7. **Fit** the view.

Note: Make sure that **Expand Clipping Planes** is turned on in the **Fit View** Settings box.



8. **Zoom in** to the beginning of the alignment to see the TC lines.

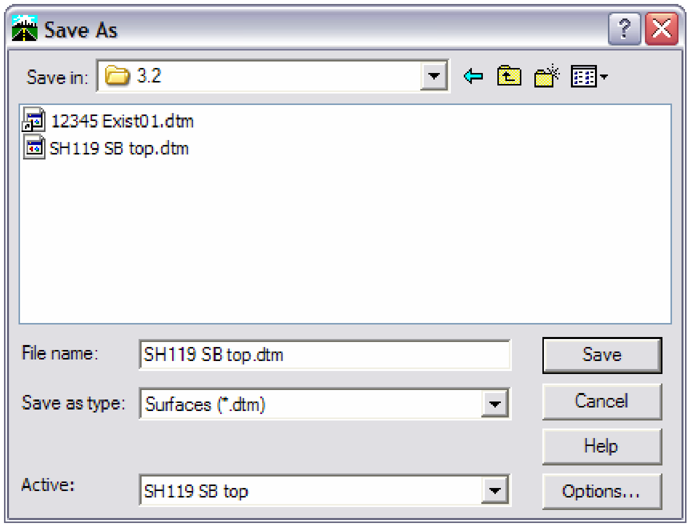


Save the SH119 SB finished surface

1. Choose **File > Save As**.
2. Set the **Save as type** to **Surfaces (*.dtm).**

   Note: Make certain you're in the 3.2 sub-folder.

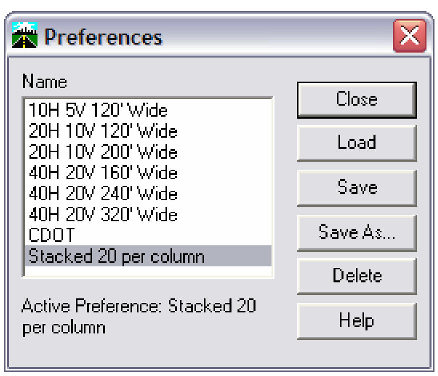
3. Set **Active** to **SH119 SB top.**
4. Verify that the **File name** is also **SH119 SB top.**



5. Select **Save.**
6. **Cancel** the dialog box.

Generate Cross Section along SH119 SB

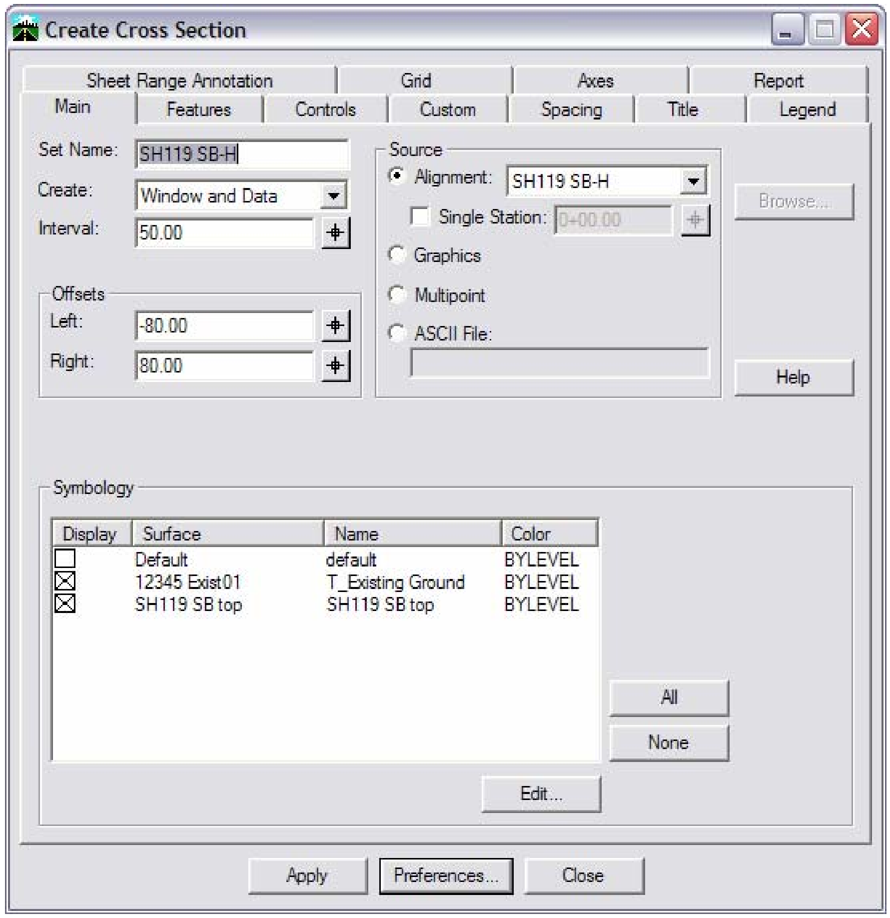
1. Change the **Text Scale Factor** to ***40*** under **Tools > Options > Factors**.
2. Select **Evaluation > Cross Section > Create Cross Section.**
3. Select **Preferences**, highlight the **Stacked 20 per column** preference and **Load.**



4. **Close** the Preferences box.

5. Set the **Main** tab as shown.

   - Make sure that alignment **SH119 SB-H** is selected and
   - Turn **on** the **12345 Exist01** and **SH119 SB top** surfaces.
   - Key in the **Set Name** ***SH119 SB Working***

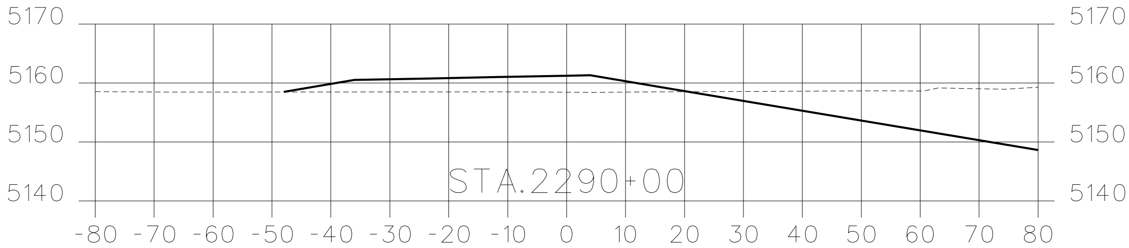


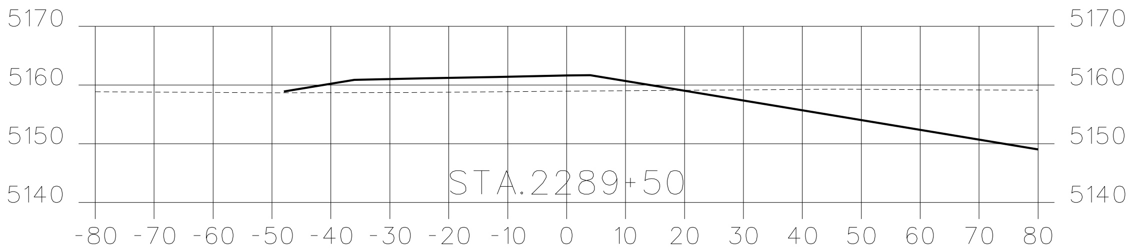
6. **Apply.**

7. **<D>** anywhere in a clear area to plot the cross sections.

8. **Window** in and take a look at the some of the cross sections.

   Note: The minor grid lines have been turned off in the diagram below for clarity purposes.

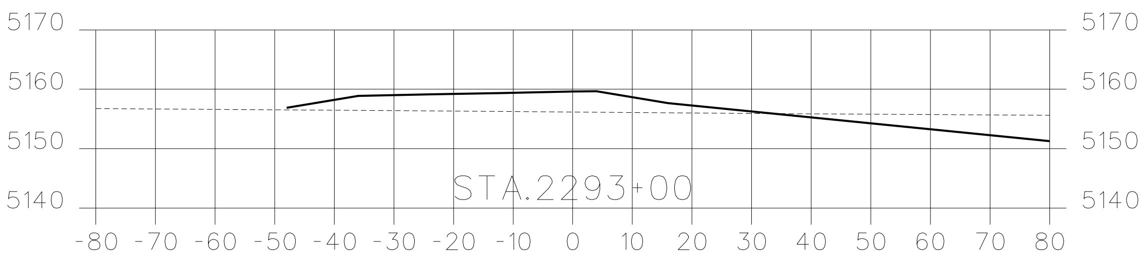




Use Cross Section Viewer to review sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to **SH119 SB Working** and the other options as shown.
3. Select **Run.**

   Note: Watch for the 6:1 to 10:1 transition between stations 2292+00 and 2293+00.



Load files for SH119 NB

Now that the target is ready, you will continue with the Northbound median decision table.

Load geometry project for SH119 NB

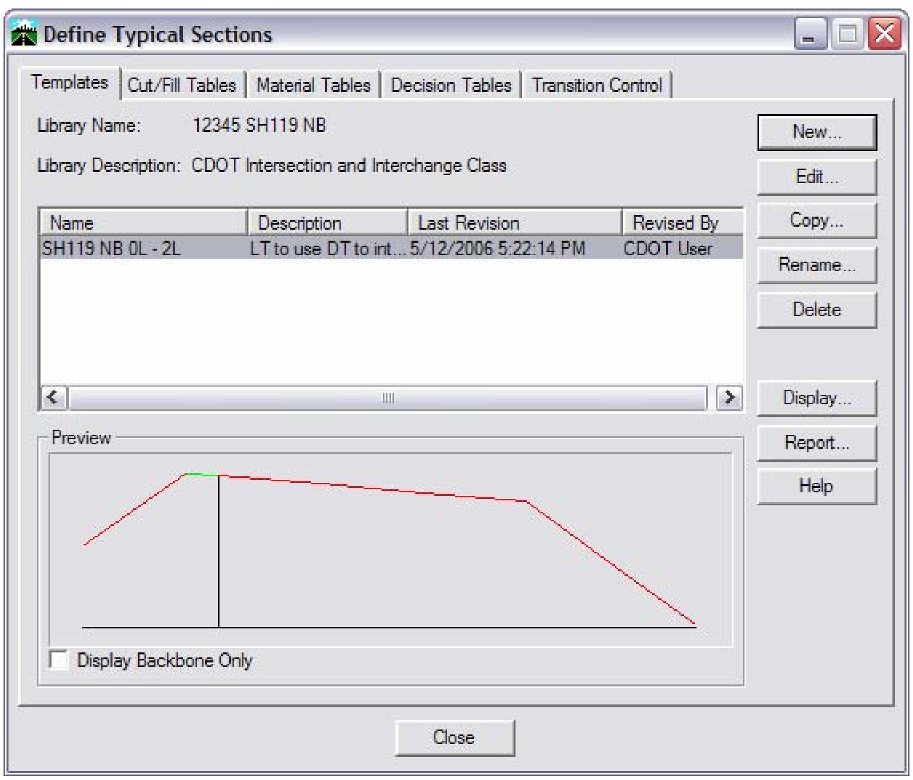
1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 NB.alg** and then select **Open**.
4. Do not cancel out of the box.

Load the template library for SH119 SB

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 SH119 NB.tml** and then select **Open**.
7. **Cancel** the **Open** dialog box.

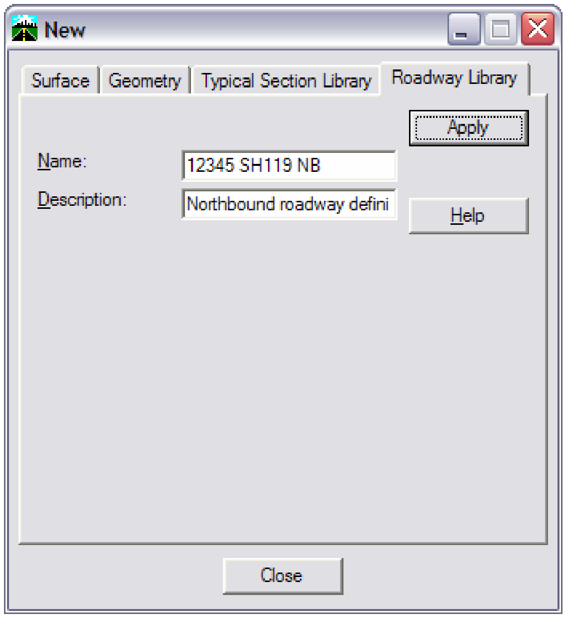
Review Data

8. Make **SH119 NB-H** the active horizontal alignment
9. Review the template in **SH119 NB.tml.**



Create a Roadway Library for SH119 NB

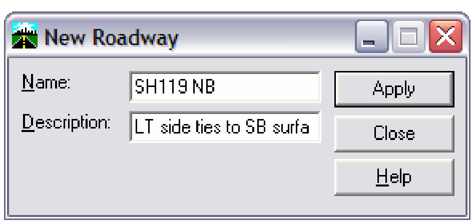
1. Select **File > New.**
2. Select the **Roadway Library** tab.
3. Key in a **Name** of ***12345 SH119 NB***
4. Key in a **Description** of ***Northbound roadway definitions***



5. **Apply**, then **Close** the **New** box.

Create a Roadway Definition slot

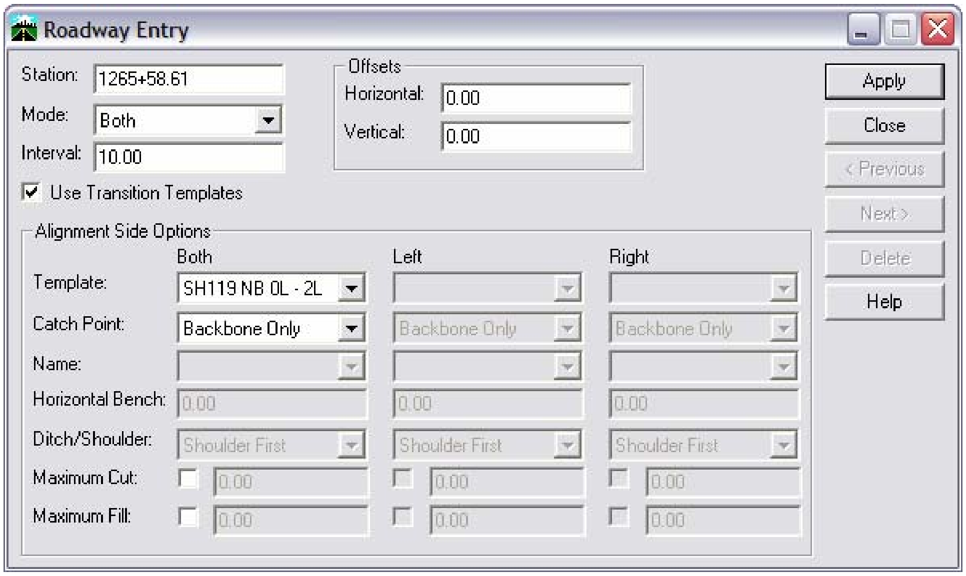
1. Select **Modeler > Define Roadway.**
2. Select **New.**
3. Key in a **Name** of **SH119 NB.**
4. Key in a **Description** of ***LT side ties to SB surface***



5. **Apply**, then **Close.**

Create the Roadway Definition for one template

1. Select **Edit.**
2. In the **Edit Roadway** dialog box, select **New.**
    - Keep the default beginning station.
    - Set **Mode** to **Both.**
    - Key in an **Interval** of ***10***
    - For **Template**, choose **SH119 NB 0L – 2L.**
    - For **Catch Point** choose **Backbone Only.**



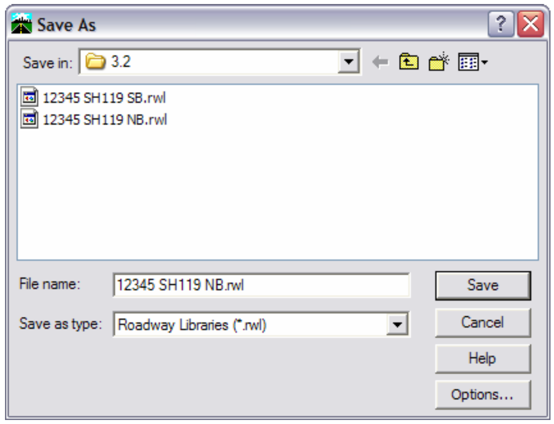
3. **Apply.**
4. **Close** the **Roadway Entry** box.
5. **Close** the **Define Roadway** box.

Save roadway library

1. Select **File > Save > Roadway Library.**

2. In the **Save As** dialog box, verify that the **File name** is set to ***SH119 NB.rwl***

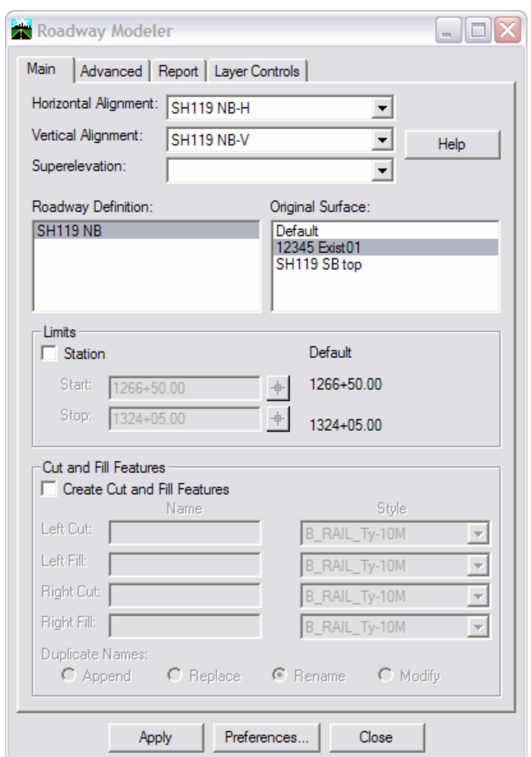
3. Select **Save**, then **Cancel** the dialog box.



Model SH119 NB (backbone only)

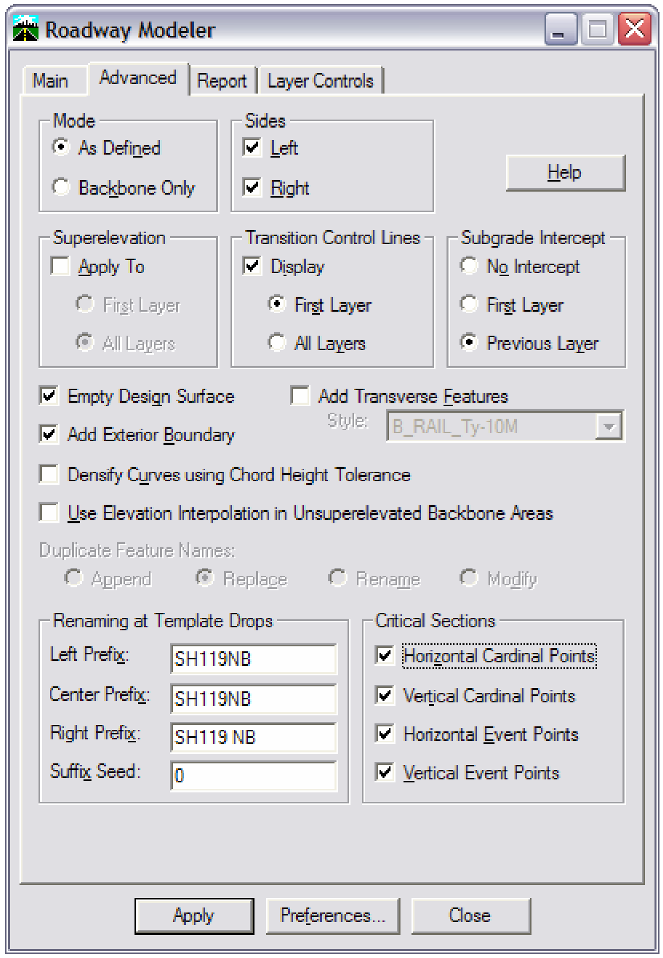
1. Select **Modeler > Roadway Modeler.**

2. Set the **Main** tab as shown.



3. Set the **Advanced** tab as shown.

   Note: Don't forget to key in the alignment name prefixes. The Left and Right prefixes ***must*** be unique, so include a space before the N for the Right Prefix (e.g. **SH119 NB**).

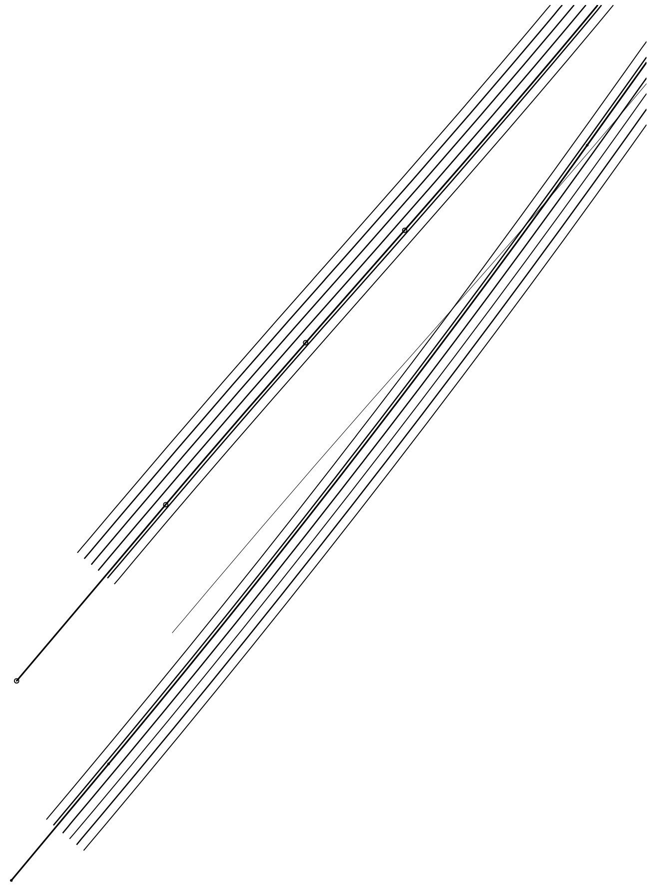


4. Select **Apply.**

   The SH119 NB corridor is modeled with the backbone only on both the East and West sides. A new surface **SH119 NB top** is created.

5. **Close** the **Roadway Modeler** box.

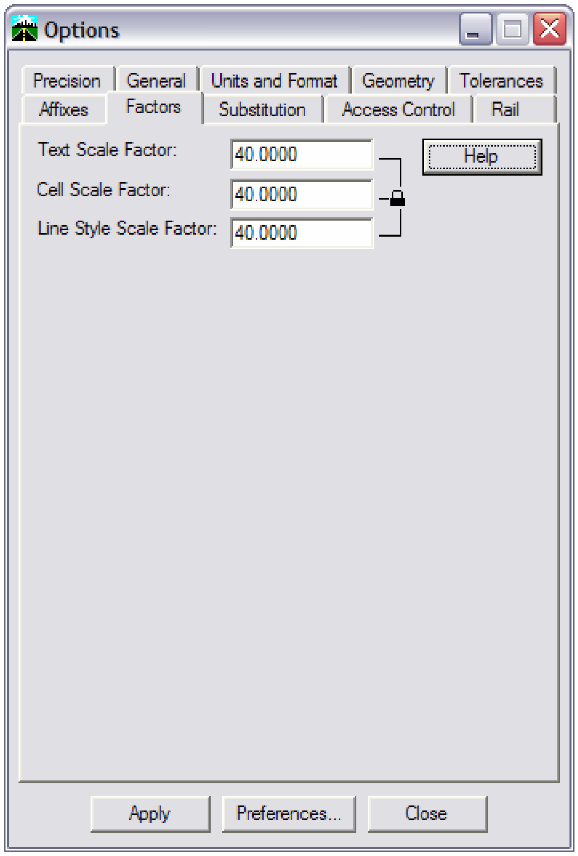
6. **Zoom in** to the alignment to see the TC lines.



Generate Cross Section along SH119 NB-H

You'll create cross sections wide enough to show the SH119 SB surface.

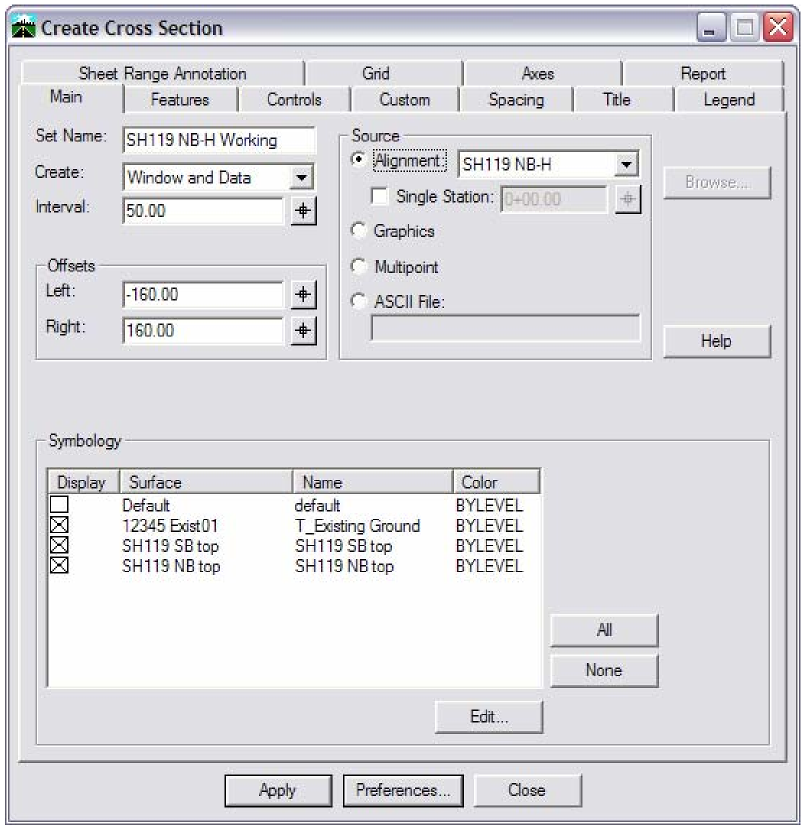
1. Set the **Scale Factors** to ***40***



2. Select **Evaluation > Cross Section > Create Cross Section.**
3. Select **Preferences**, highlight the **Stacked 20 per column** preference and **Load.**
4. **Close** the Preferences box.

5. Set the **Main** tab as shown.

   - Make sure that alignment **SH119 NB-H** is selected and
   - Key in the **Set Name** as shown.
   - For the **Left** and **Right** offsets, key in ***-160*** and ***160***
   - Turn on the **12345 Exist01**, **SH119 SB top** and **SH119 NB top** surfaces.



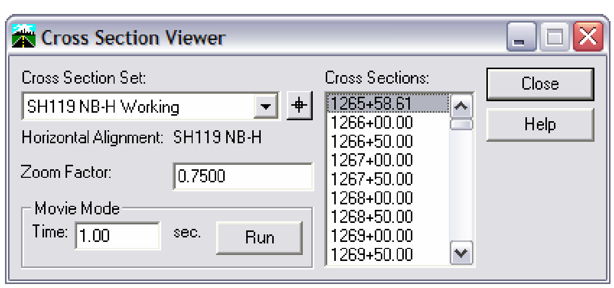
6. **Apply.**

7. **<D>** anywhere in a clear area to plot the cross sections.

Review sections

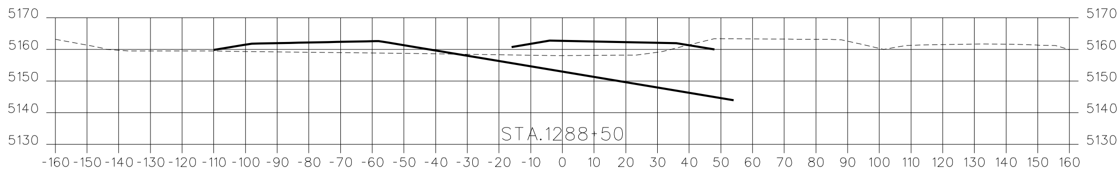
1. Select **Evaluation > Cross Section > Cross Section Viewer.**

2. Set **Cross Section Set** to **SH119 NB-H working** .



3. Select **Run.**

   The cross sections show the backbone surface of the SH119 NB alignment as it relates to the Existing and SH119 SB finished surfaces (minor gridlines removed below for clarity purposes).



Create a decision tables for sideslopes on the left

You'll now create sideslopes for the left (West) side of SH119 NB to tie into either the existing surface with a 3:1 slope or the SH119 SB median surface with a 6:1 slope or a 10:1 slope.

1. Create a sketch for your decision table.

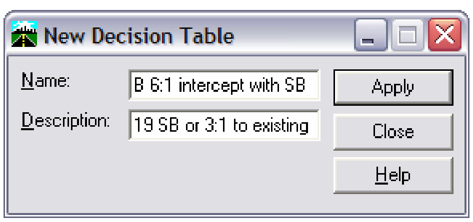
2. Select **Modeler > Define Typical Section.**

3. Select the **Decision Table** tab.

4. Select **New.**

5. Key in a **Name** of ***SH119 NB 6:1 intercept with SB***

6. Key in a **Description** of ***6:1 to SH119 SB or 3:1 to existing***



7. **Apply**, then **Close** the **New** box.

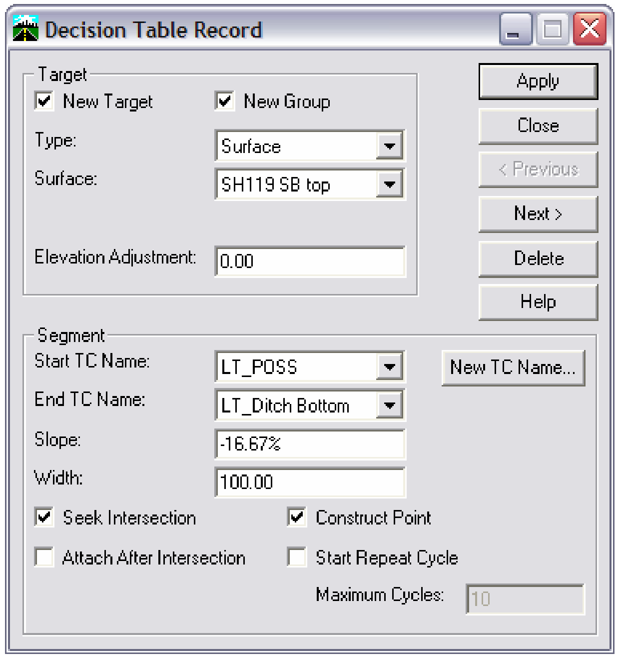
8. Select **Edit.**

9. In the **Edit Decision Table** box, select **Add After.**

First record

10. The first record is for the -6:1 median sideslope that seeks the SH119 SB surface where there is not enough room to tie into the existing ground.

    - Set the dialog box as shown:

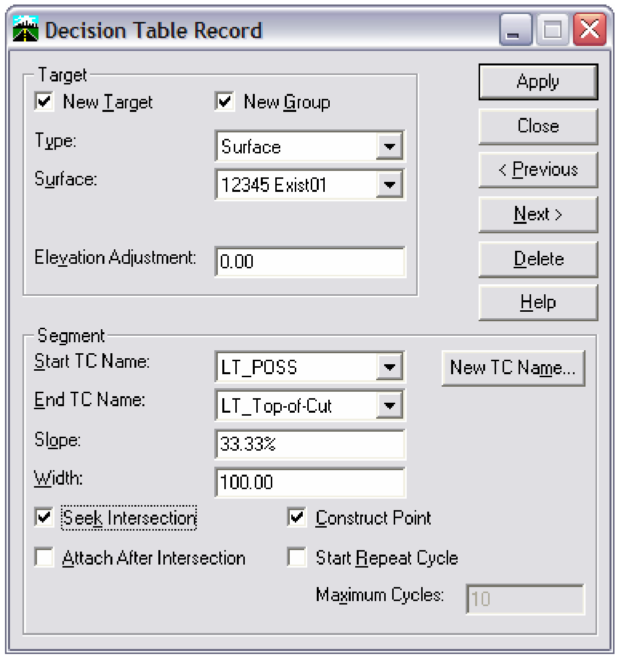


    - **Apply.**

Second Record

11. The second record is for a 3:1 “wide” median situation where you’re seeking the existing ground (new group) with a 3:1 *cut* slope.

    - Set the dialog box as shown:

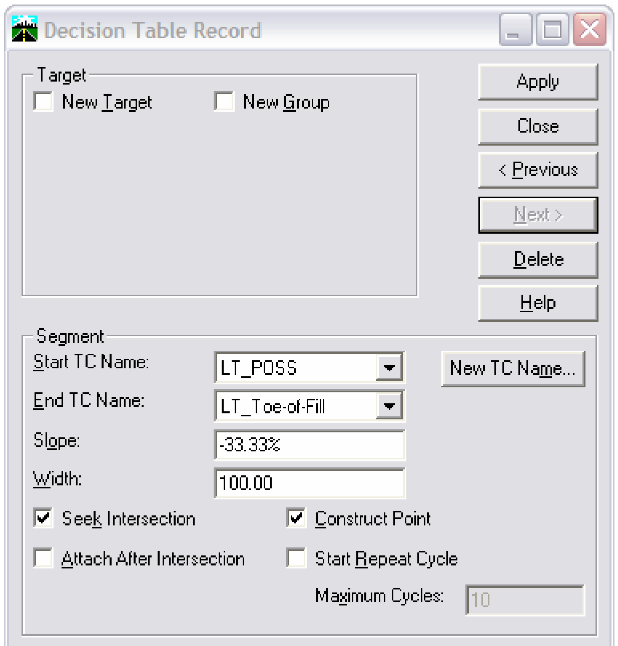


    - **Apply.**

Third Record

12. The third record is for a 3:1 "wide" median situation where you're seeking the existing ground with a 3:1 *fill* slope.

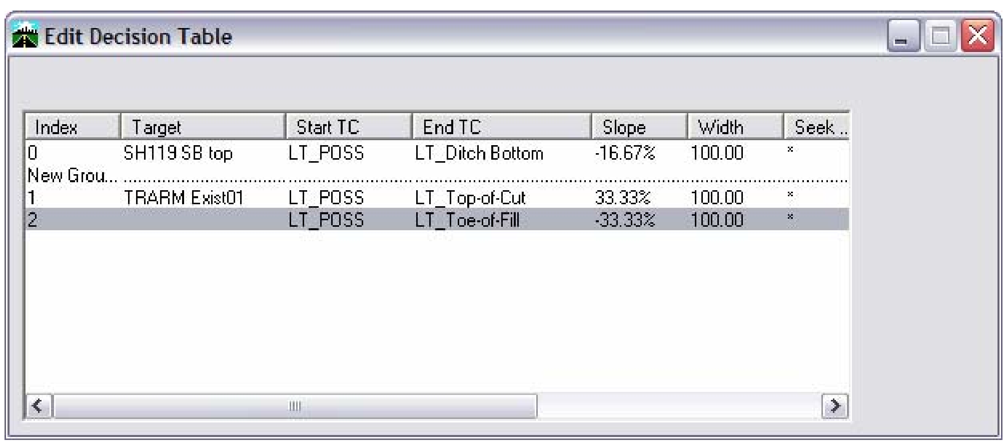
    ▪ Set the dialog box as shown:



    ▪ **Apply.**

13. **Close** the **Decision Table Record** dialog.

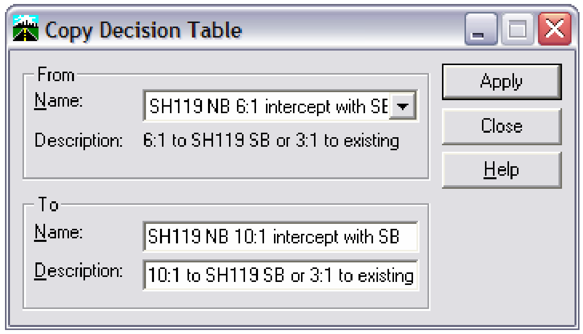
    The Decision Table should appear as shown.



14. **Close** the **Edit Decision Table** dialog.

Copy and Edit the table to create a 10:1 table

1. Highlight the new decision table and choose **Copy.**
2. Change the name and description to indicate a 10:1 slope as shown.

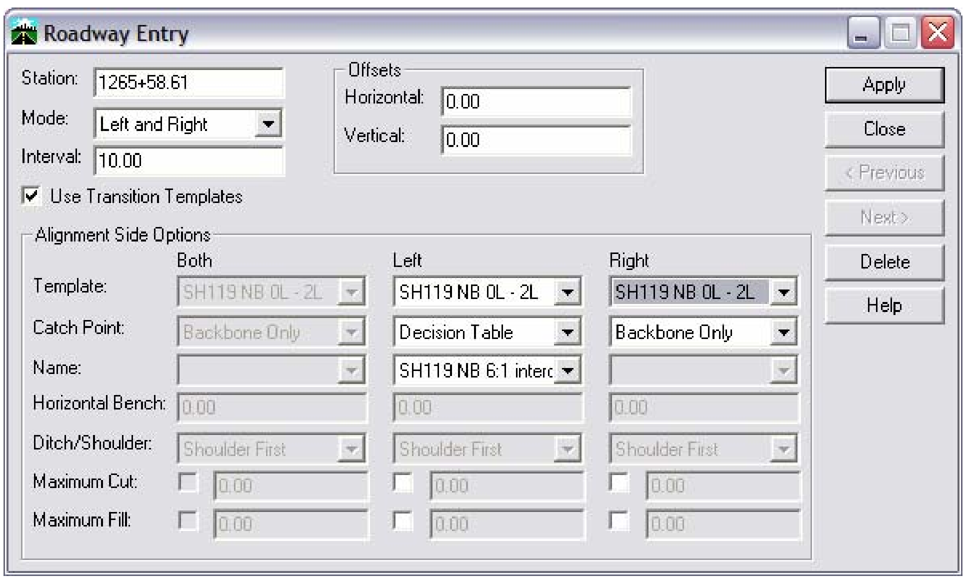


3. Choose **Apply,** then **Close.**
4. Edit the copied decision table to have a -10:1 slope for the median.
5. **Save** the **Typical Section Library.**

Edit roadway definition

Change the roadway definition to model your sideslopes. Use the decision table for the left side and model the right side backbone only.

1. Select **Modeler > Define Roadway.**
2. Highlight the **SH119 NB** definition and select **Edit.**
3. In the **Edit Roadway** box, highlight the station/template entry and select **Edit.**
4. Set **Mode** to **Left and Right.**
5. Under the **Left** column:
   - Set **Template** to **SH119 NB 0L – 2L.**
   - Set **Catch Point** to **Decision Table.**
   - Set **Name** to **SH119 NB 6:1 intercept with SB.**
6. Under the **Right** column:
   - Set Template to **SH119 NB 0L – 2L.**
   - Set **Catch Point** to **Backbone Only.**



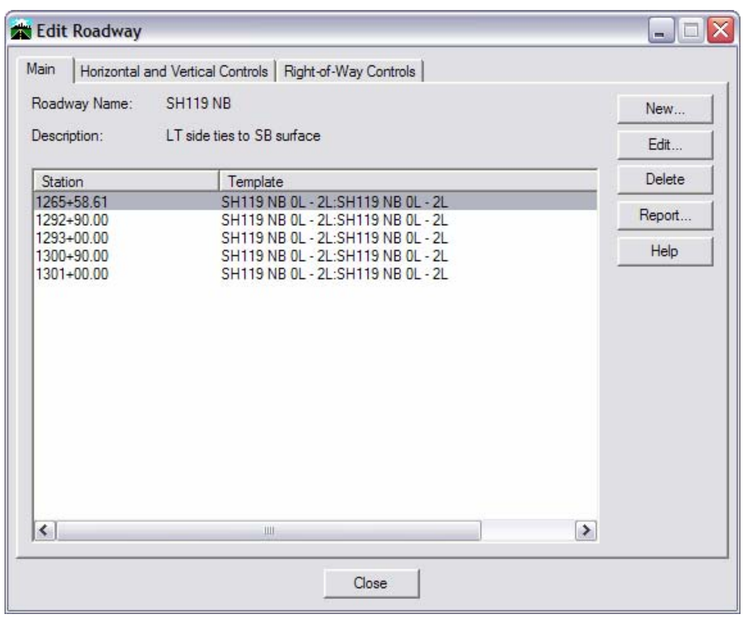
7. **Apply.**
8. **Close** the **Roadway Entry** dialog.

9. From the **Edit Roadway** box, Select **New** to add new entries as shown:

   Note: Don't forget to **Apply** after each new entry.

Station	Left Template / Catch Point	Right Template / Catch Point
1292+90	SH119 NB 0L – 2L	SH119 NB 0L – 2L
	SH119 NB 6:1 intercept with SB	Backbone Only
1293+00	SH119 NB 0L – 2L	SH119 NB 0L – 2L
	SH119 NB 10:1 intercept with SB	Backbone Only
1300+90	SH119 NB 0L – 2L	SH119 NB 0L – 2L
	SH119 NB 10:1 intercept with SB	Backbone Only
1301+00	SH119 NB 0L – 2L	SH119 NB 0L – 2L
	SH119 NB 6:1 intercept with SB	Backbone Only

10. After the last entry, **Apply**, then **Close** the **Roadway Entry** box. The entries should appear as shown.

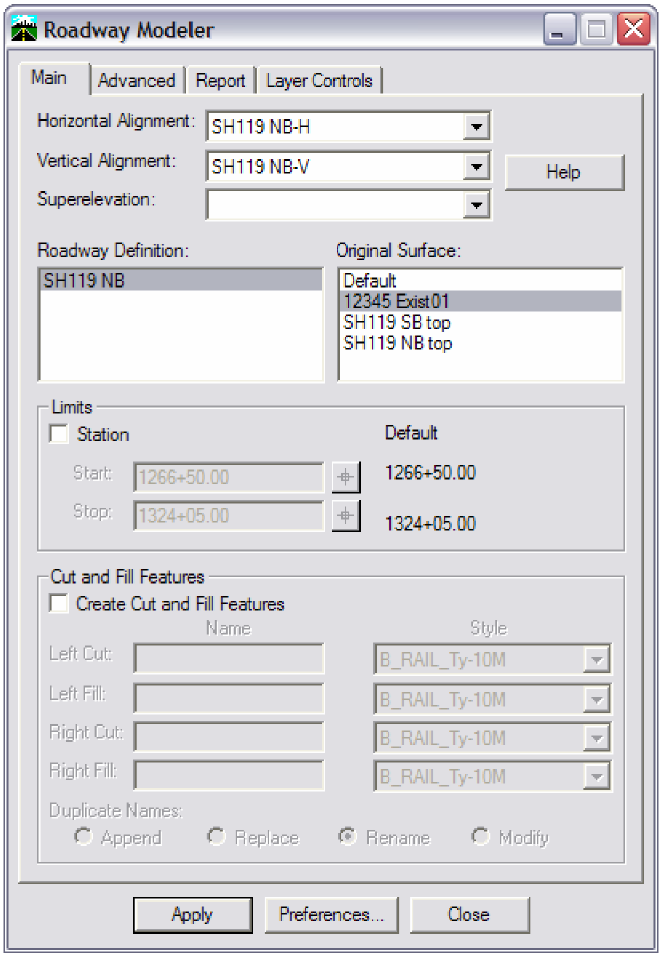


11. **Close** the **Edit Roadway** box.

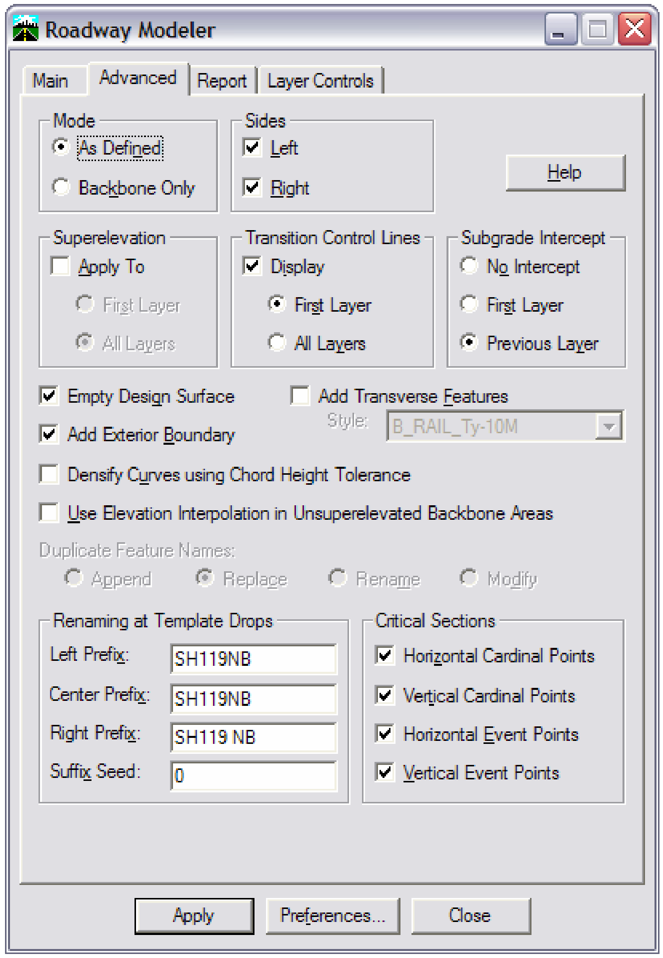
12. **Save** the Roadway Library.

Re-Model SH119 NB with sideslopes on the left

1. **Delete** the TC lines from the previous model run.
2. Select **Modeler > Roadway Modeler.**
3. Set the **Main** tab as shown.



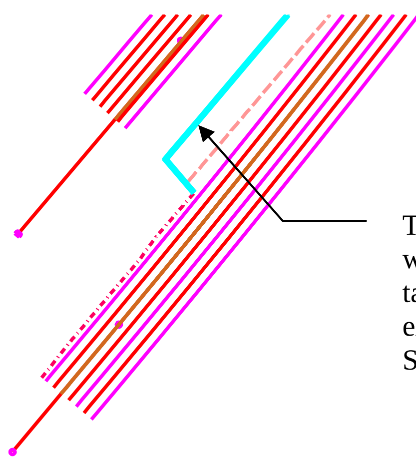
4. Set the **Advanced** tab as shown.



5. Select **Apply.**

   The SH119 NB corridor is modeled with the sideslopes from the decision table on West (left) side.

6. **Zoom in** to the alignment to see the TC lines.

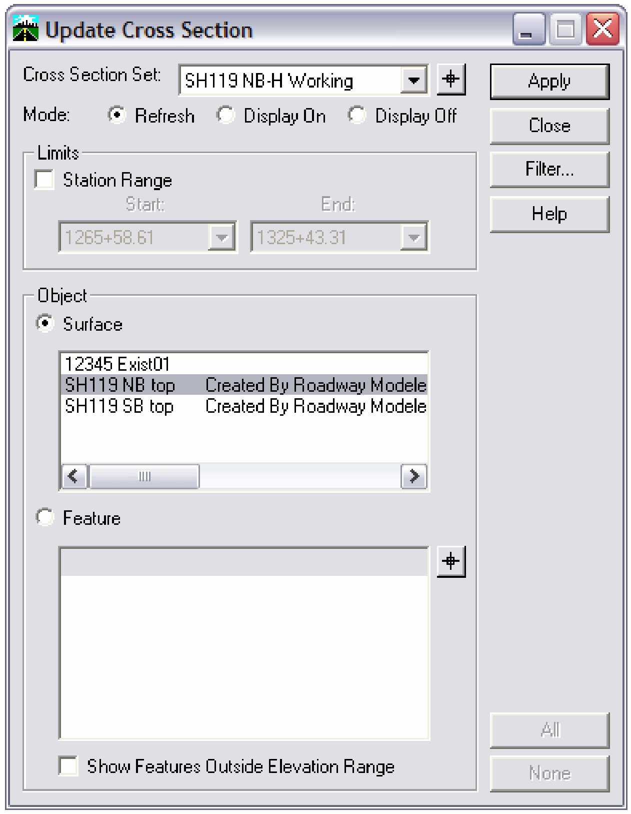


TC line showing point where NB decision table 'catches' the extended slope from SB.

Update cross sections

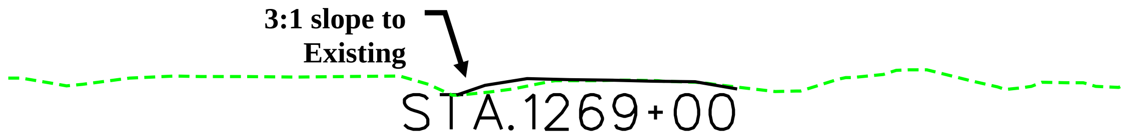
1. Select **Evaluation > Cross Section > Update Cross Section.**

2. Set the dialog box as shown.

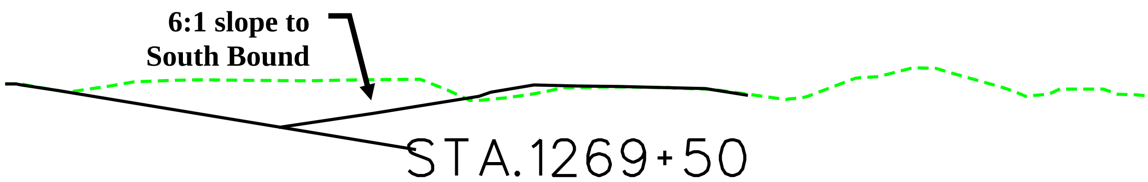


3. **Apply.**

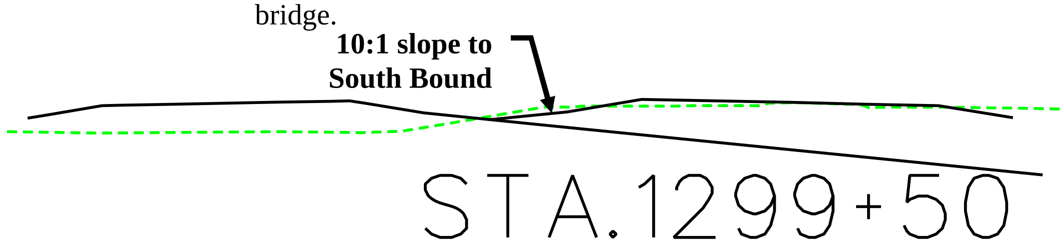
Window in on the **SH119 NB working** cross section set and review cross sections. Note the 3:1 sideslope on the left that ties to the existing ground.



The 6:1 sideslope on the left that ties to the SB119 finished surface.

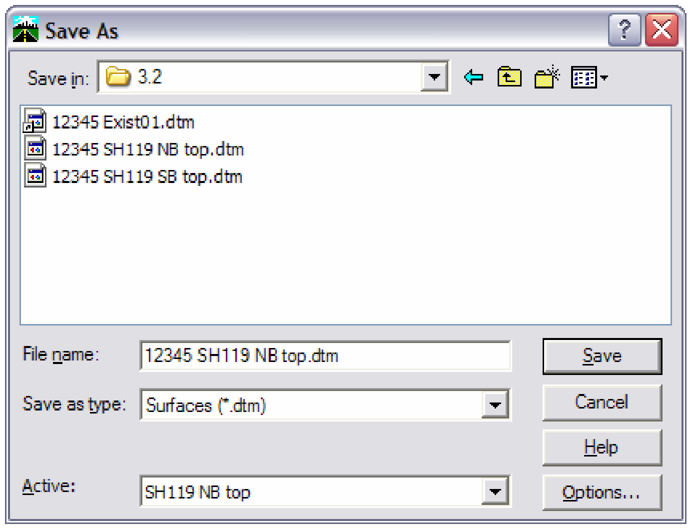


Also note the change to the -10:1 slope under the proposed SH 52 bridge.



Save the SH119 NB finished surface

1. Choose **File > Save As**.
2. Set the **Save as type** to **Surfaces (*.dtm).**
3. Set **Active** to **SH119 NB top.**
4. Set the **File name** to **12345 SH119 NB top.**
5. Select **Save.**



6. **Cancel** the dialog box.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

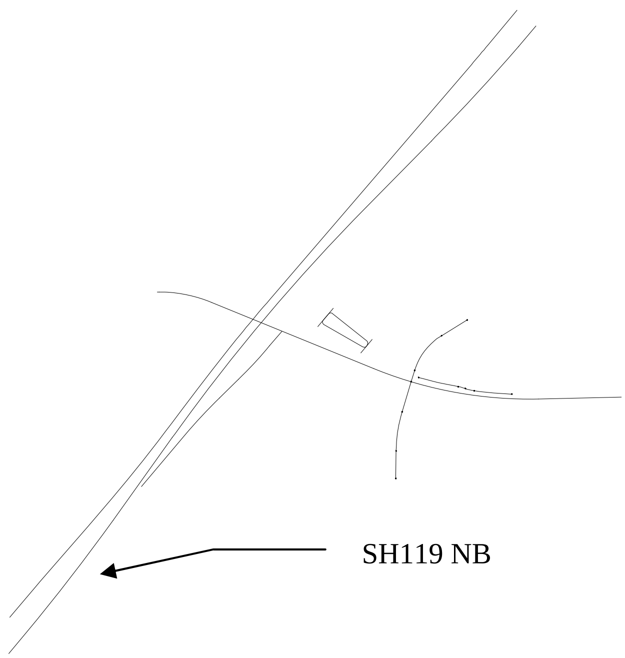
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 3.3 – Using a decision table to intercept an existing feature

In this activity, the left side of SH119 NB uses a decision table to tie into a surface created by modeling SH119 SB (which establishes the median). On the right side you will create a different decision table to tie into features in the existing terrain. This technique can be used for tying into existing ROW, an existing ditch bottom, etc.



Note: SH119 NB is always in a fill situation, which makes the table somewhat simpler than if it passed through both cut areas and fill areas.

Start MicroStation InRoads

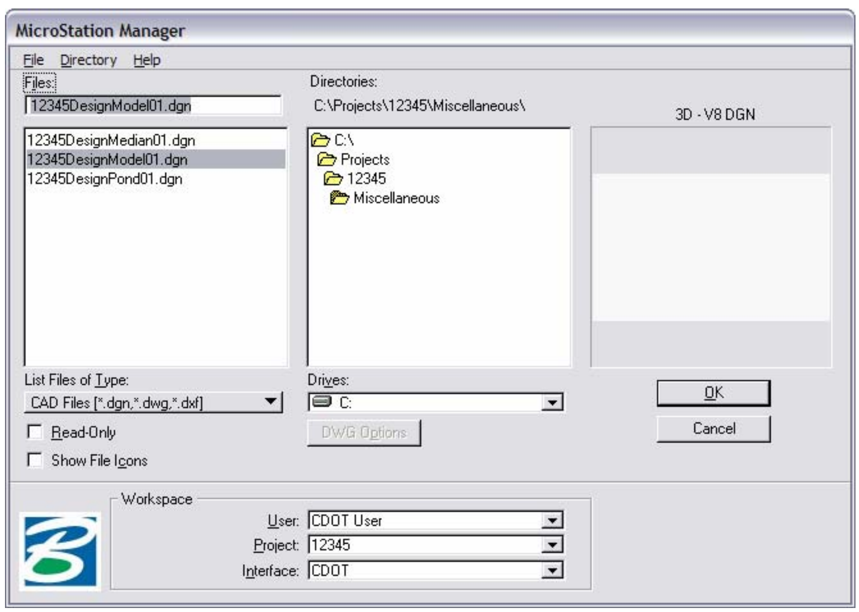
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

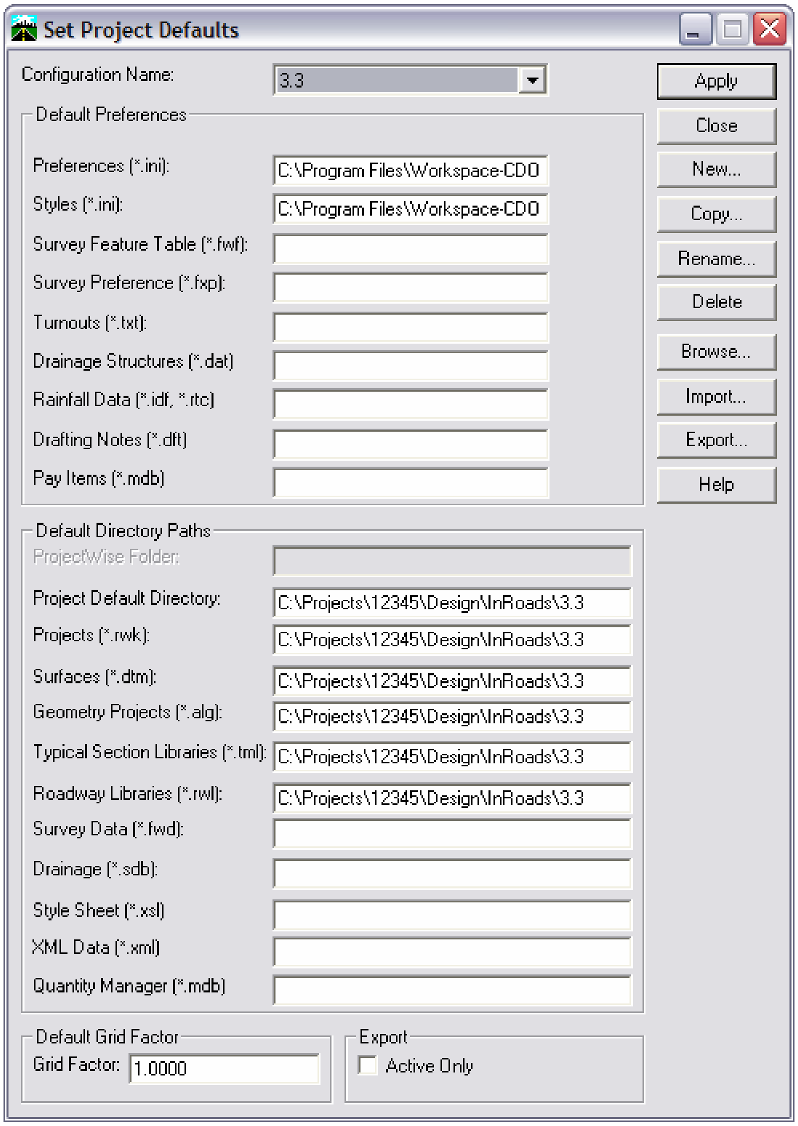
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **3.3**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH119 NB

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 NB.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for SH119 NB

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 SH119 NB.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load the roadway library for SH 119 NB

8. Set **File of Type** to **Roadway Libraries (*.rwl)**.
9. Highlight **12345 SH119 NB.rwl** and then select **Open**.
10. ***Do not*** cancel out of the box.

Load the SH119 SB DTM

11. Set **File of Type** to **Surfaces (*.dtm)**.
12. Highlight **12345 SH119 SB top.dtm** and select **Open**.
13. ***Do not*** cancel out of the box.

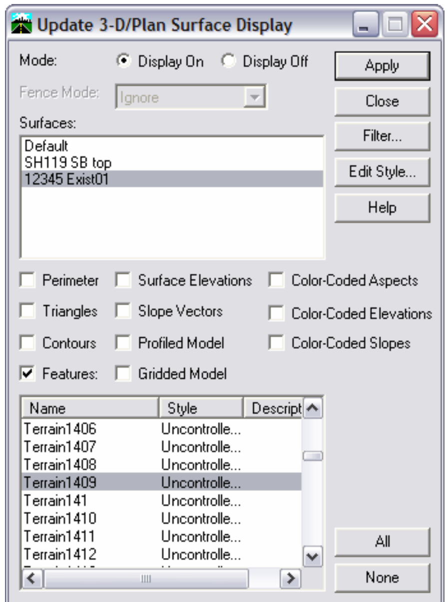
Load the existing DTM

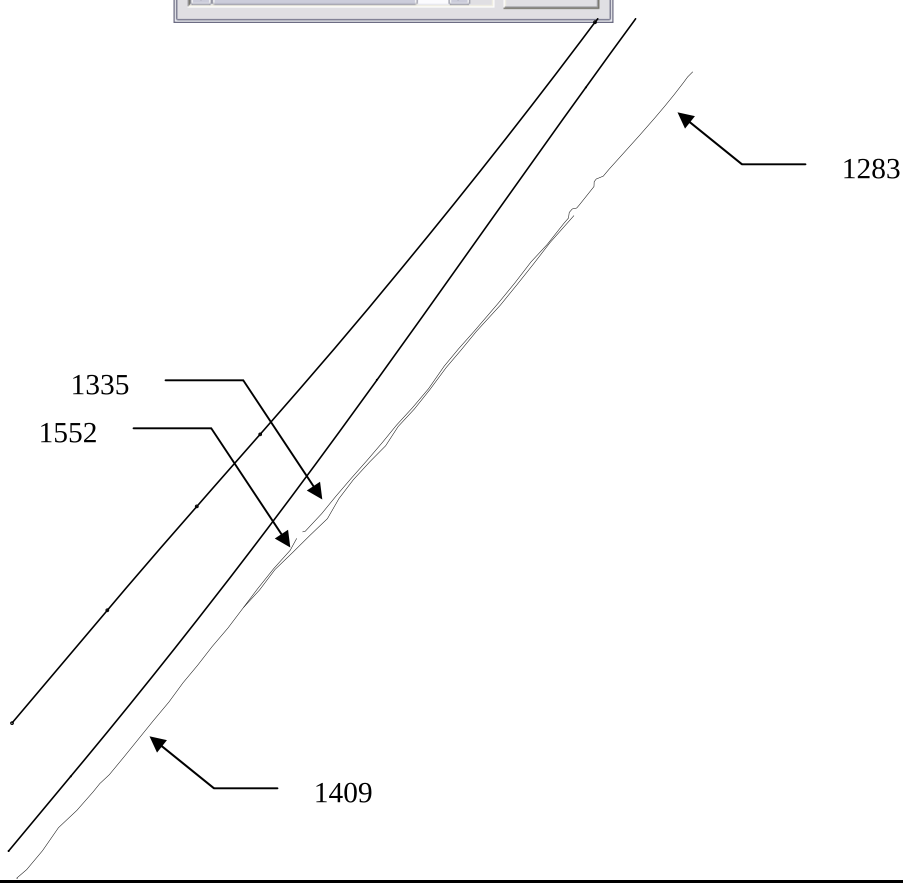
14. Highlight **12345 Exist01.dtm** and then select **Open**.
15. **Cancel** the **Open** dialog box.

View Features for tie-in

The diagram below shows the different features that you want to tie into. Your goal is to tie into the feature closest to the POSS, which will determine the order of the records and groups in the decision table.

1. View the features **Terrain 1552**, **1335**, **1283** and **1409** from the surface **TRNARM Exist01.**





Sketch the table

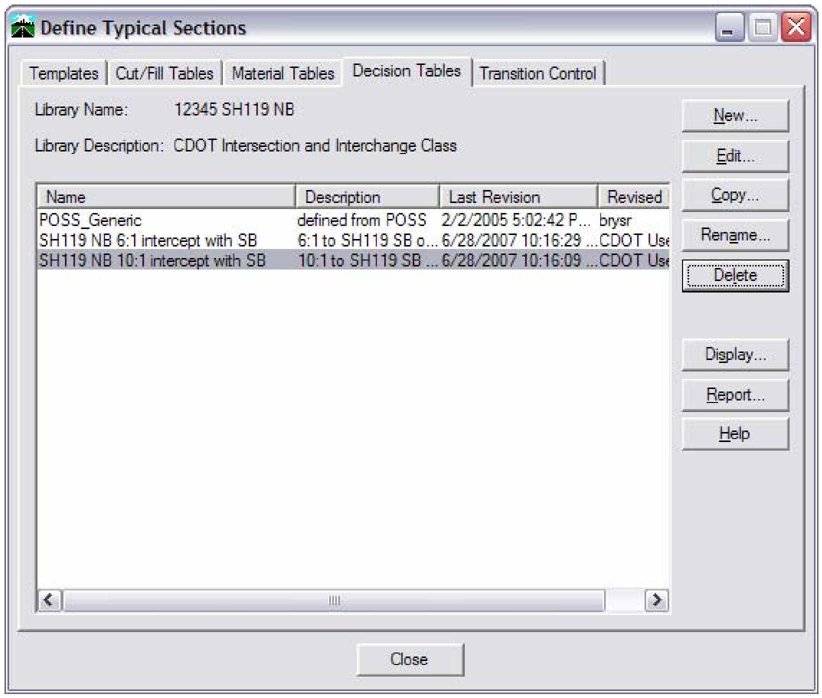
2. Sketch the different scenarios you will run into with the sideslopes. Each scenario should represent one complete sideslope and therefore one group in the table. Study the features you're tying into carefully to determine the order the records will need to be in the table.

Challenge

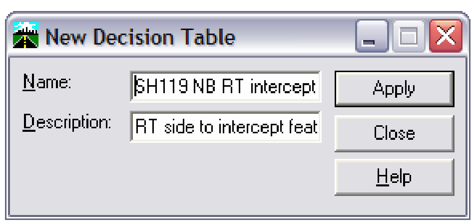
If you would like to test your decision table skills, create the table without referring to the following steps. Run it on the right side of SH119 NB and check your results. If you need more practice before tackling a decision table on your own, continue with the steps below.

Build the table

1. Select **Modeler > Define Typical Section**.
2. Select the **Decision Table** tab.



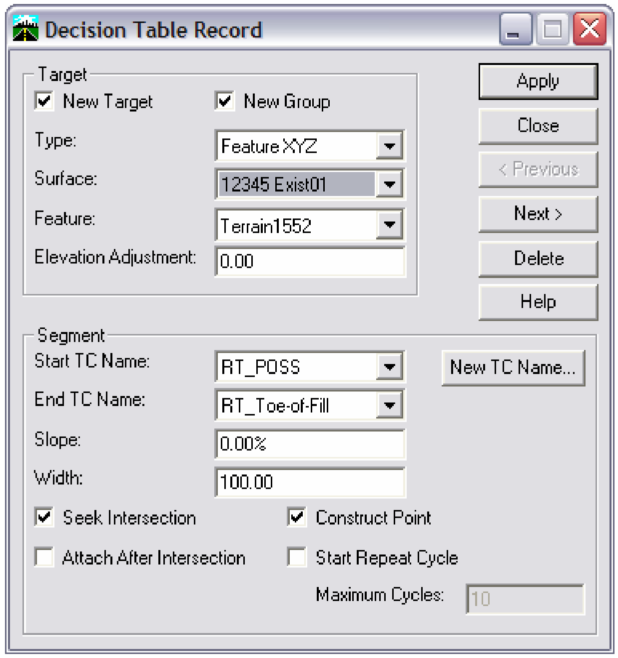
3. Select **New**.



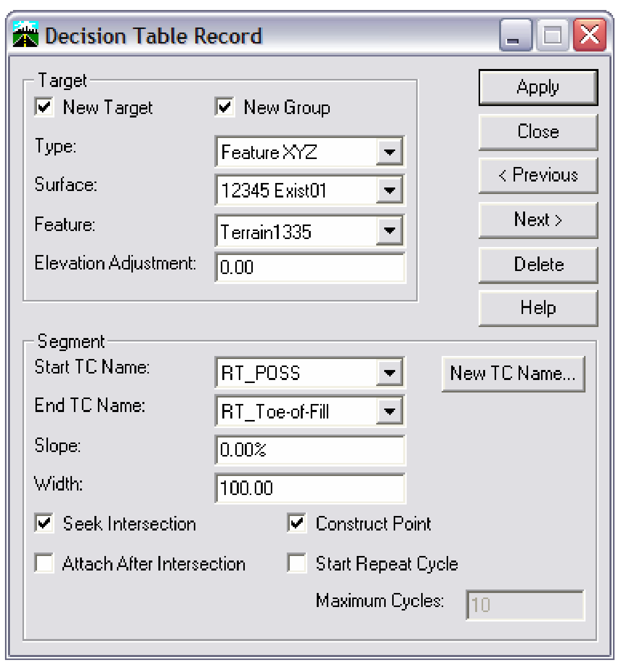
4. Key in the name ***SH119 NB RT intercept exist ftrs***.
5. Key in the description ***RT side to intercept feature in Existing surface***
6. Select **Apply**.
7. Make certain the new table is highlighted and select **Edit**.

First record

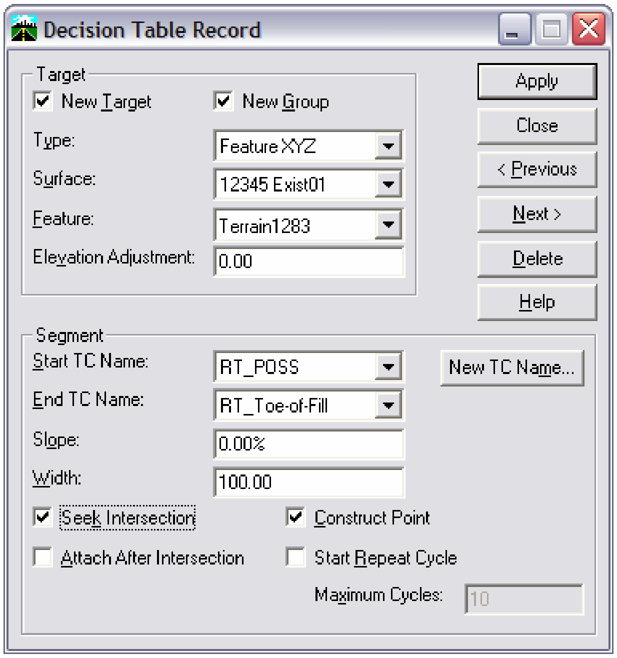
8. Choose **Add After** and set the options for the first record as shown.



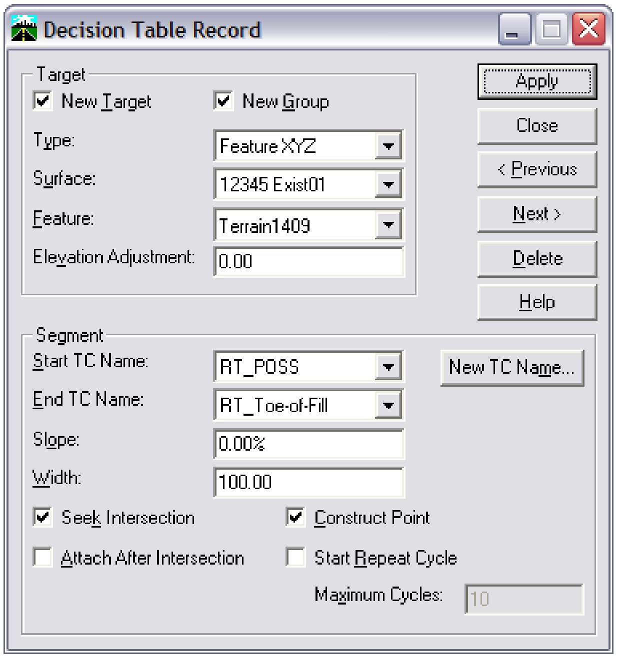
Second record:



Third record:

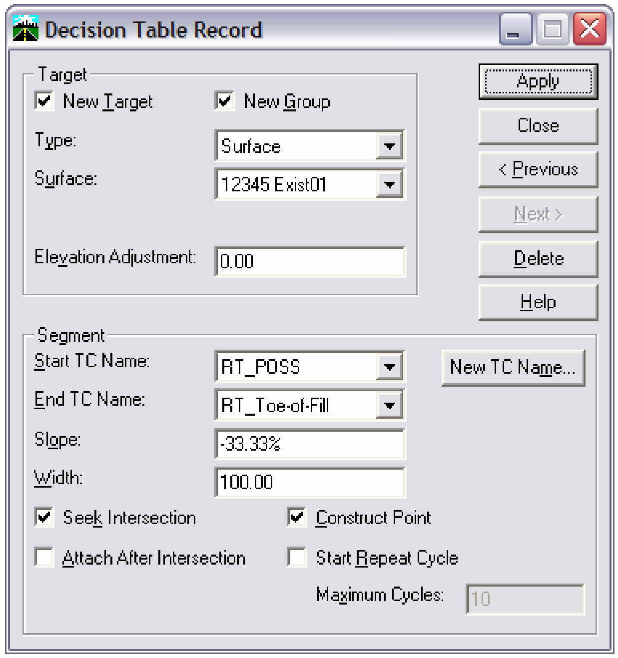


Fourth record:

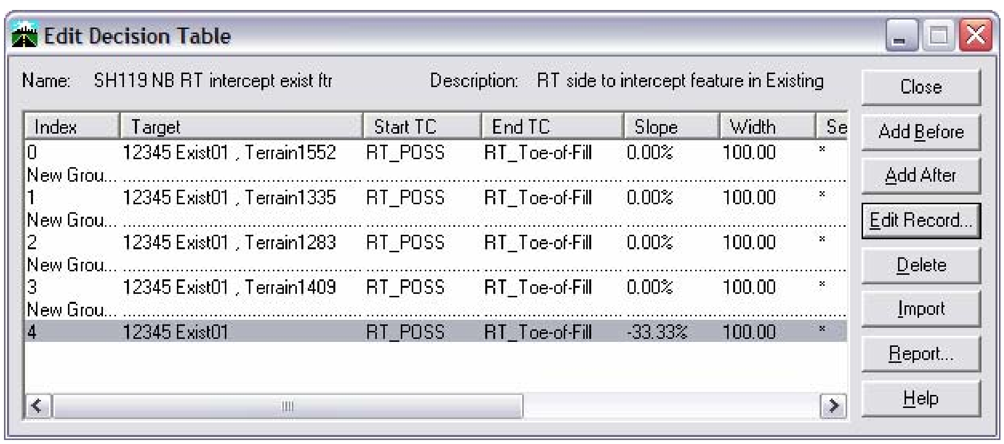


Fifth record

9. For the fifth record, you will use a new group that seeks to intercept the existing ground at a -3:1 sideslope in areas where you are not intercepting an existing feature.



Your decision table should look like the one below.

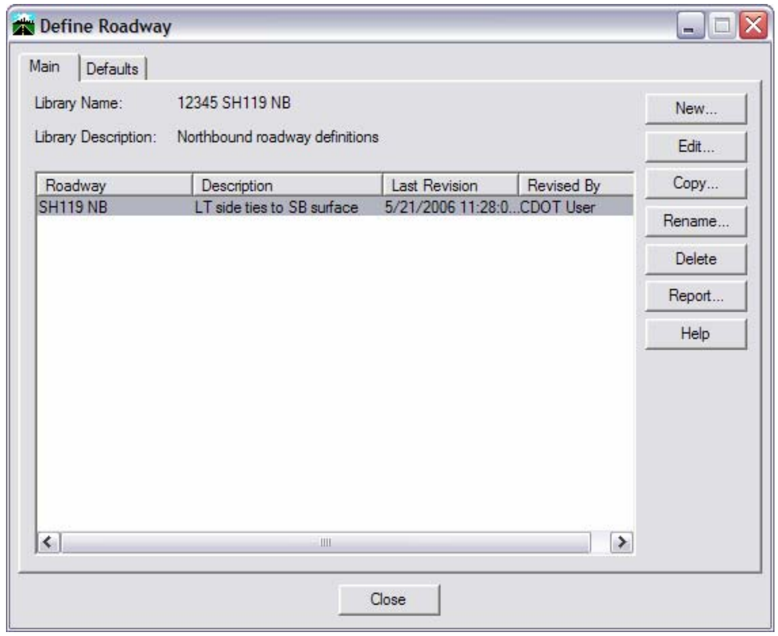


10. **Close** the open dialogs.

11. **Save** the **Typical Section Library**.

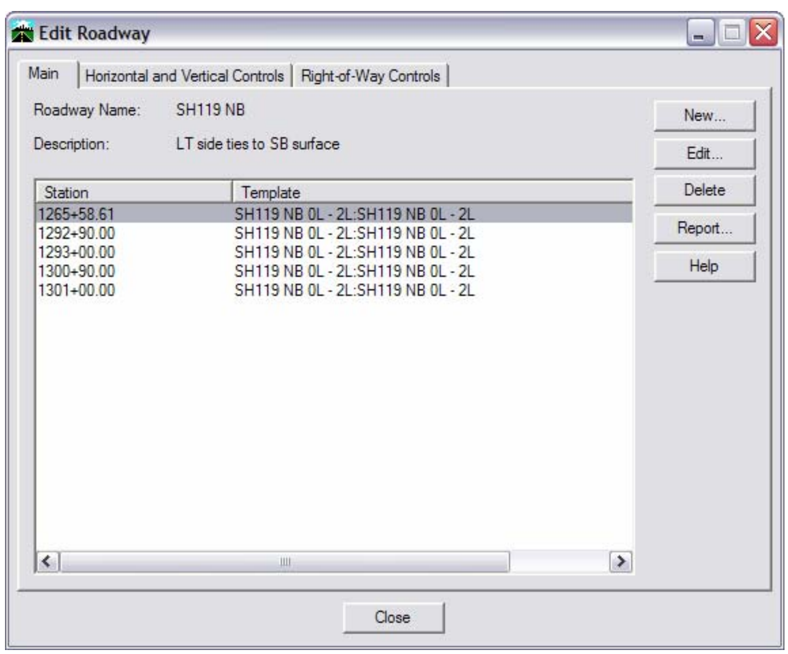
Update the Roadway Definition

1. Select **Modeler > Define Roadway**.

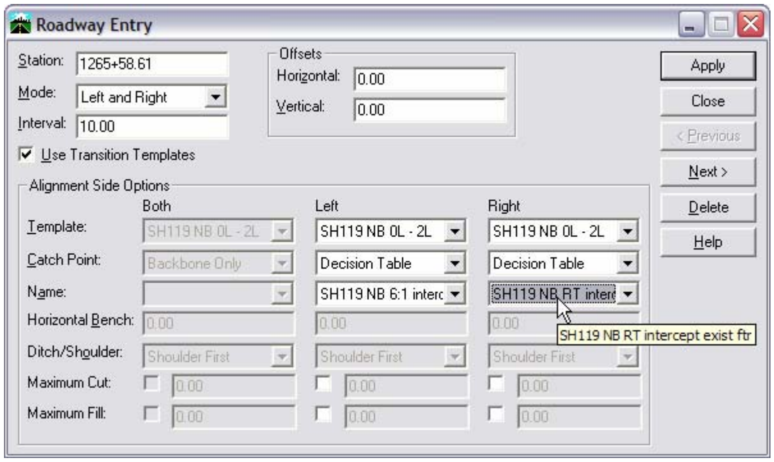


2. Highlight **SH119 NB** and choose **Edit**.

   You want the sideslope on the right to tie into the existing features up to the point that the modeling starts using the ramp template. Since this occurs at station ***1285+82.30***, you will use the new decision table for the first entry in this definition. In a later exercise, you will be adding to this roadway definition to transition into the ramp.



3. Highlight the first entry and select **Edit**.



4. In the **Right** column, change the **Catch Point** to **Decision Table**.

5. For the **Name**, select **SH119 NB RT intercept exist ftr**.

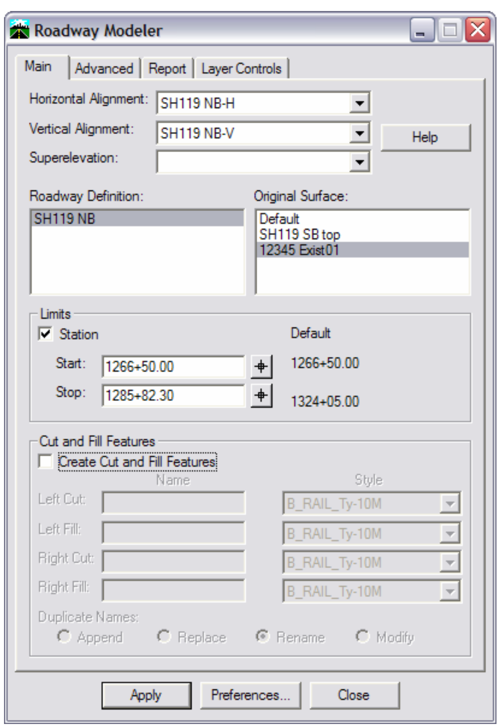
6. Choose **Apply**.

7. **Close** the open dialogs.

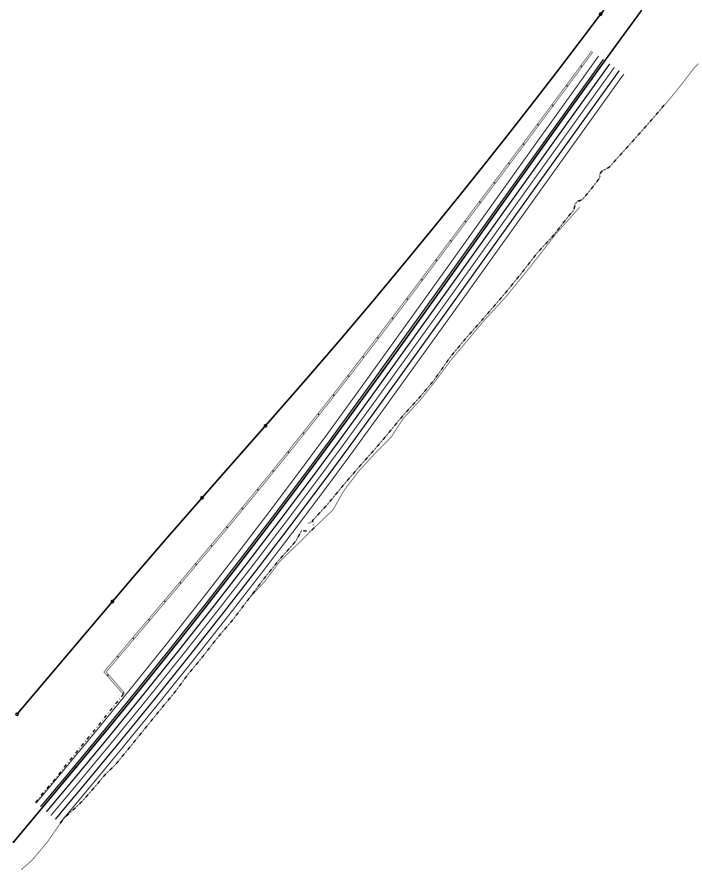
8. **Save** the roadway library.

Run modeler

1. Run Roadway Modeler on **SH119 NB** from the beginning of the alignment up to station ***1285+82.30***

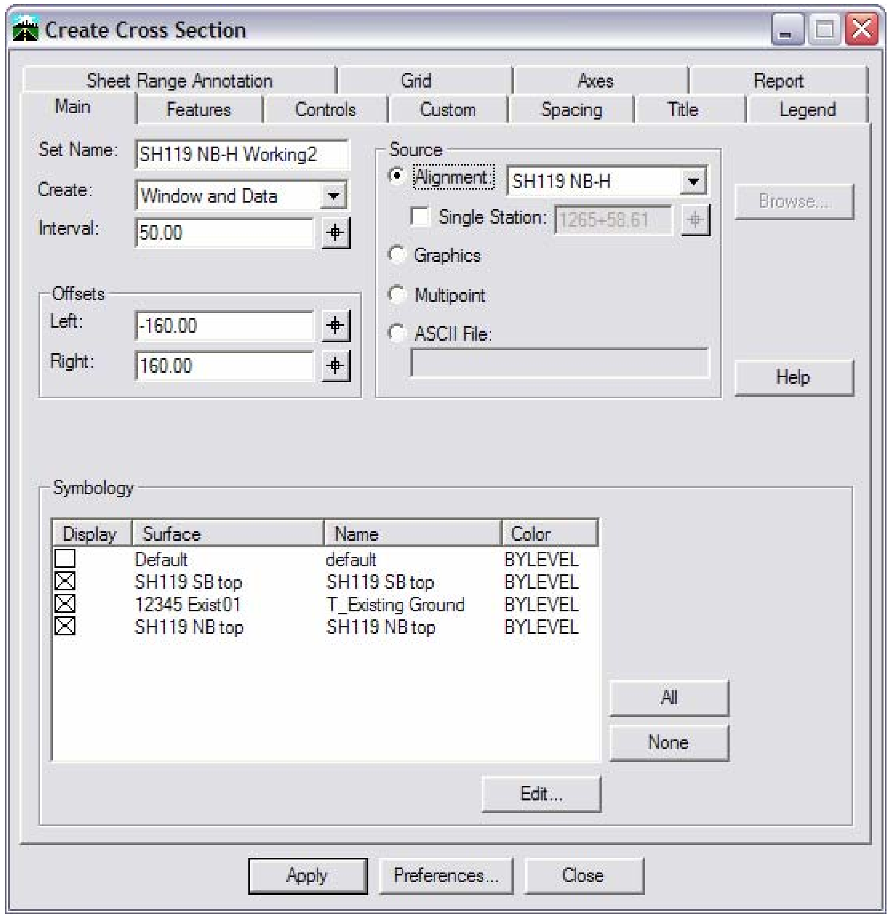


2. Review the SH119 NB features in plan to see that they follow the existing features.



3. Cut cross sections for the same station range as the model and review the sideslopes. Alternately, you can update the previously cut sections.

4. Show: **SH119 SB top**, **SH119 NB top**, **TRNARM Exist01**.



Clean-up your design file for the next lab

<u>**Important**</u>! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.

2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

<u>**Important**</u>! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

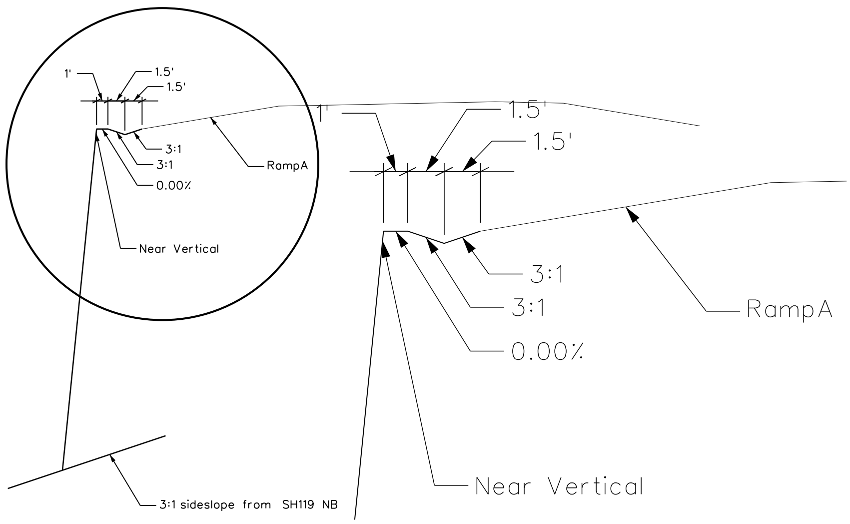
1. From MicroStation, select **File > Exit**.

2. If prompted to save data files select **Yes**.

Challenge Lab 3.4 – Create decision table to develop wall between ramp and NB 119

Given: **12345 Exist 01.dtm**
12345 SH119 NB top.dtm
12345 RampA.rwl
12345 RampA.tml

The following sketch:



Required: Build a table for the left side of the ramp

Preliminary set-up

1. Start MicroStation InRoads and open the file **12345DesignModel01.dgn**.

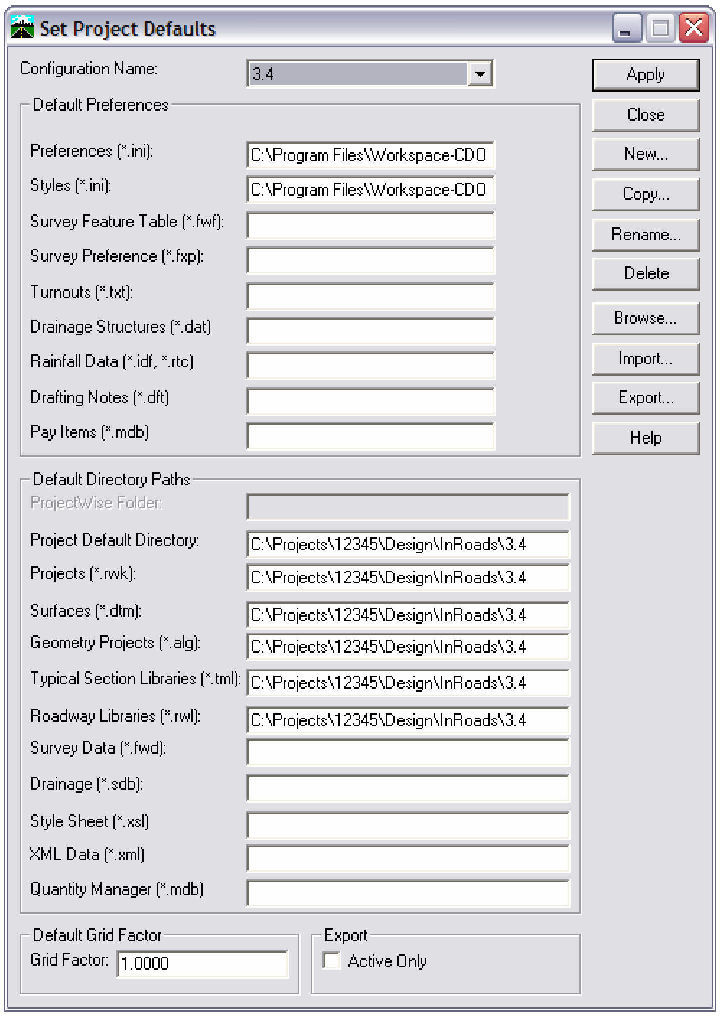
2. Select **File>Project Defaults**.

3. Set the **Configuration Name** to **3.4**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

4. Select **Apply**.

Important! Verify your dialog box appears as shown:



5. **Open** the appropriate data files (refer to **Given** statement).

Build the table

1. Since the area prior to the beginning of the wall will use a variable slope and triangulate between the SH119 NB and RampA, you do not have to include anything in the table except the wall. The wall will fail in the areas prior to where it is necessary, allowing for the variable slope.

2. **Save** your .tml

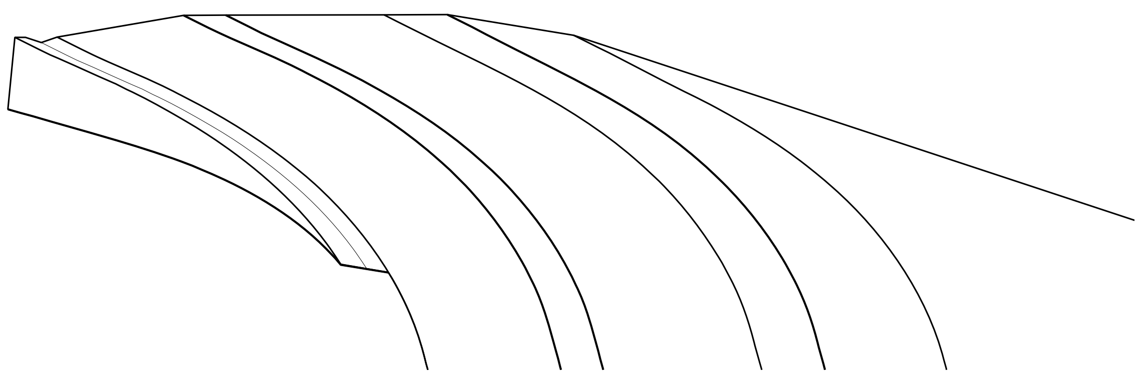
Update the Roadway Definition

1. Update roadway definition to use the decision table to create a wall on the left side.

2. **Save** .rwl.

Model with the table

1. Run **Roadway Modeler** between stations ***3285+83*** and ***3296+00*** to create the ramp with the wall on the left side.



Create cross sections

2. Create Cross Sections of **SH119 NB.**

    - Show **SH119 NB top**, **SH119 SB top**, **RampA.**

3. Save **RampA** surface when you are satisfied with the results.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit>Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File>Exit**.
2. If prompted to save data files select **Yes**.

4. Feature Modeling and Manipulation

Overview

It is not unusual for a project to require more detail than a surface generated by **Roadway Modeler** can provide. Intersections, interchanges, and divided highways are but a few of the many examples. In these cases, it is often a first inclination to merge surfaces and build the model in phases. While this is sometimes a viable solution, the surfaces do not always merge properly and after many merges it's not unusual for a surface to refuse to merge further.

Another option to consider is using a feature modeling approach. Rather than try to build a final surface by continual merges, build breaklines for your surface. With this approach, you can use almost any tool you need to contribute to the model. Instead of trying to force one command (e.g., Modeler) to create everything, use individual commands to produce only their proficiency, and then combine their resulting breaklines for your overall model.

Also, since features within a DTM are editable, you can create the composite model as described above, but instead of waiting until the end and doing your "cleanup" with MicroStation, you can add the features to the model as they are created. Then, using the **Surface Edit** tools, you can do any cleanup necessary. The surface edit tools are similar to MicroStation commands, except they work directly with the DTM data.

Techniques

The techniques shown here can be used in one of two ways. With the wire-frame method, they are used to generate MicroStation graphics which will later be loaded into a single surface. This method typically required some "cleanup" work to be completed with MicroStation. Several of the commands have an option to **"Generate Graphics Only"**, which is useful for this method when you do not want to build the model as you go.

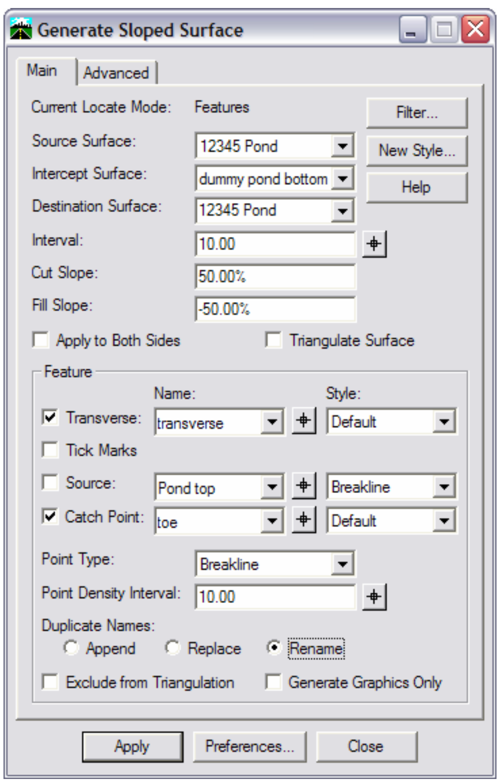
The second method is used to build the model as you go. Each of the commands is used to create breaklines in a DTM ***in addition to*** the graphical elements. Then, instead of using MicroStation for the cleanup, you can use the **Surface Editing** tools (as described in the next section) to fine-tune the DTM directly.

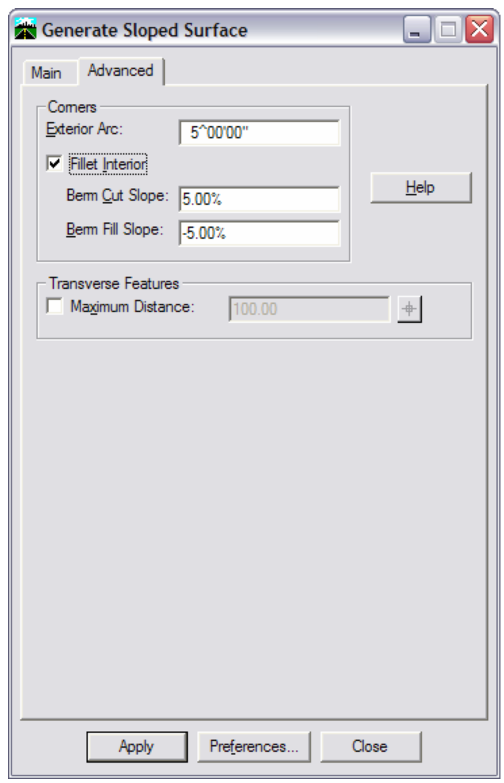
Roadway Modeler

Anything that can be defined with a typical section and a horizontal and vertical alignment can be modeled with **Roadway Modeler**. What do you get from **Roadway Modeler** that can be used for feature modeling? Features, of course. These breaklines are easily generated and can often form the basis for your overall model. When creating and assigning TC names, keep in mind that it will be much easier to build an accurate model if you can easily tell what the elements represent. Do this by assigning proper TC names when building templates. You may need to run Modeler several times to develop all of the necessary features.

Generate Sloped Surface

This command, found under **Design Surface**, creates breaklines in the graphics file and optionally in the surface that form slopes from a MicroStation element or a feature. For example, you can create a sideslope around a building pad, or slopes from a detention pond bottom to an existing DTM. The results of the command are MicroStation elements forming the toe of slope and transverse lines from the original element to the toe at each point a slope is calculated. These elements can also be created as features in the resulting DTM.

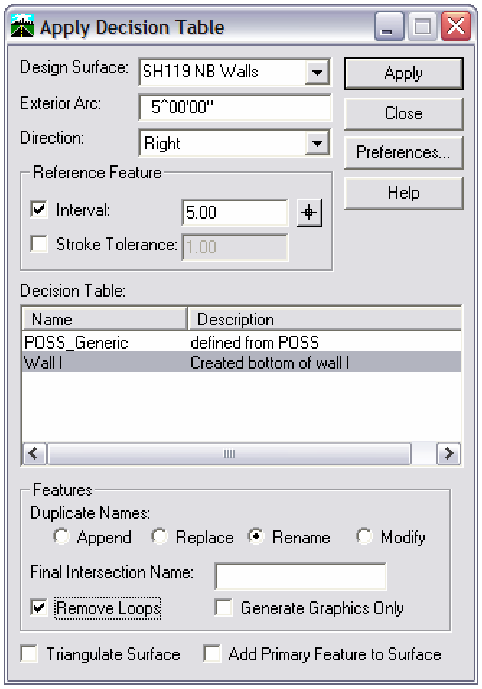




Tip: When only the toe of slope is required for the wire-frame, turn ***off*** all options except **Toe-of-slope**.

Decision Tables

Decision tables are used with great results in computing sideslopes during **Roadway Modeler** runs, but they can also be used to generate slopes from a graphic element. With **Design Surface > Apply Decision Table** you can use a decision table from the loaded template library to create slopes from one or both sides of a graphic element or feature to the target or targets listed in the table.

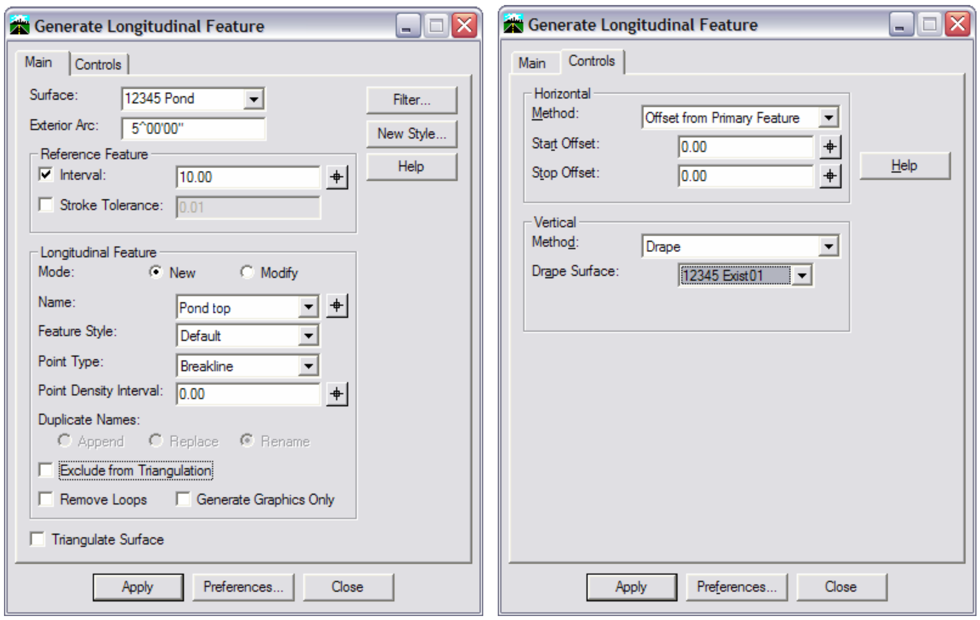


You have a choice of results when using this command. You can either use the graphics as part of your overall wire-frame model, or you can toggle off the **Generate Graphics Only** option and the features are added to the specified surface as breaklines.

A decision table can achieve some of the same results as the **Generate Sloped Surface** command, but it allows more flexibility in the sideslopes themselves, since the decision table can try various sideslopes, seek multiple targets, etc.

Generate Longitudinal Feature

The **Generate Longitudinal Feature** command is a useful tool for drawing 3D elements. It allows you to draw a MicroStation element without regard to the elevation, then execute this command to copy it and define horizontal and/or vertical offsets from the original element. The vertical definition can include offsets from the original element, desired actual elevations of the ends of the element, an elevation and slope along the element, etc. This is great for developing 3D breaklines with certain slopes, such as the bottom of a special ditch, the perimeter of a parking lot, or the bottom of a detention pond.



Again, this command can either create only MicroStation elements (by turning on **Generate Graphics Only**), or it can add the resulting features to the specified DTM as breaklines.

3D Alignment

If you find it easier to define horizontal and vertical alignments to set the elevations and grades of your proposed breaklines, then **View > 3D Alignment** is for you. It allows you to "combine" the horizontal and vertical alignment to form a 3D linestring. Using this option, you can create the horizontal alignment, profile it, then use the vertical edit or vertical design tools to generate the necessary elevations.

If you prefer to draw with MicroStation, use **File > Import > Geometry from Graphics** to load the initial alignments from your MicroStation file.

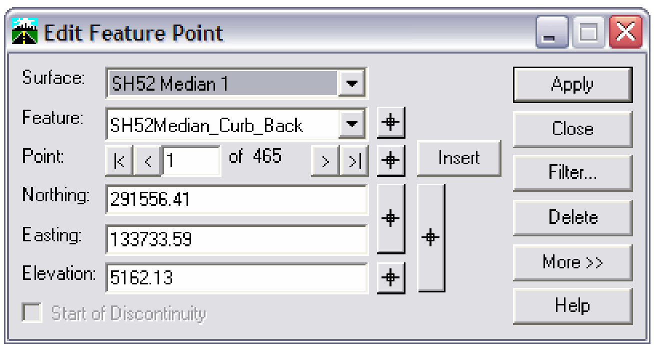
While the 3D Alignment command does not create breaklines directly, you can use **File > Import > Surface > From Graphics** to load the features as breaklines into the composite model or **File > Export > Geometry to Surface**.

Graphics

In addition to the InRoads commands that are available, you can also use MicroStation tools to develop 3D breaklines. While the InRoads tools are often more flexible in defining the z-coordinate, there are times when these commands work just as well.

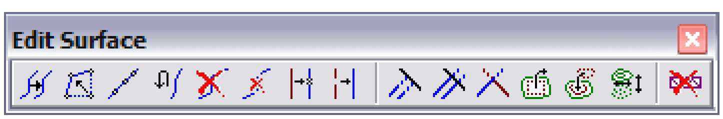
Feature Editing Tools

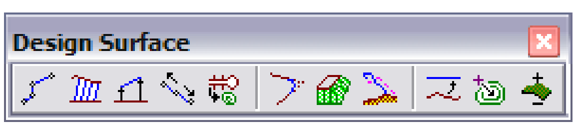
If you choose to build the DTM as you go while using the **Design Surface Tools**, there is a series of tools available for use in editing, including many you'll recognize as similar to graphical editing tools — **Partial Delete**, **Trim**, **Extend** and **Intersect** to name a few. In addition, there are some very handy tools designed specifically for editing features. Two examples include **Edit Feature Point**, which allows the editing of individual points in a feature, and **Set Slope Along Features**, which allows you to set the slope (directly or indirectly with elevations) between any two points in a feature, with the intermediate points adjusting to accommodate the slope.



You can also edit features in cross sections and affect individual sections or a range of sections. This is most useful when the features are longitudinal along a corridor.

The tools used for editing features in plan are predominately found on the **Edit Surface** and **Design Surface** toolbars.

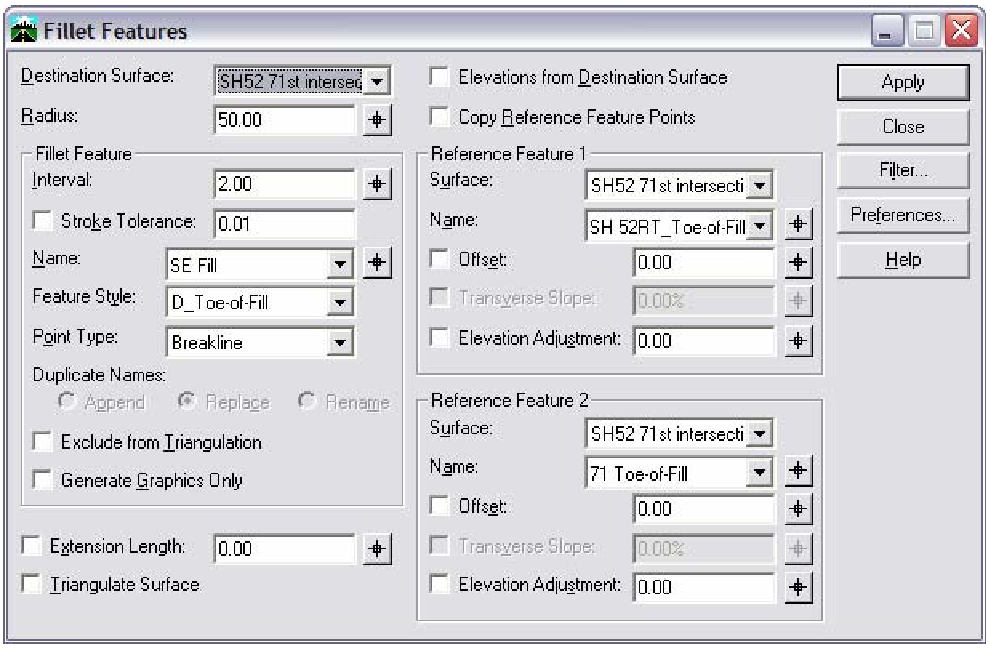




Creating Master Proposed Models

Cleanup

If you're careful when building the different features, then cleanup will not be too difficult. However, if the model requires two or more runs of **Roadway Modeler**, you often have duplicate lines where the modeler runs intersect or are adjacent. It is very important to make certain there are not duplicate breaklines in the model; care should be taken to cleanup or trim back any unnecessary overlaps. You may also need to use **Generate Longitudinal Feature, Fillet Features** or others to "join" two **Roadway Modeler** runs, such as for creating returns in intersection areas.



If you build the model as you go, adding features to the surface, then the cleanup is accomplished by editing features rather than graphics.

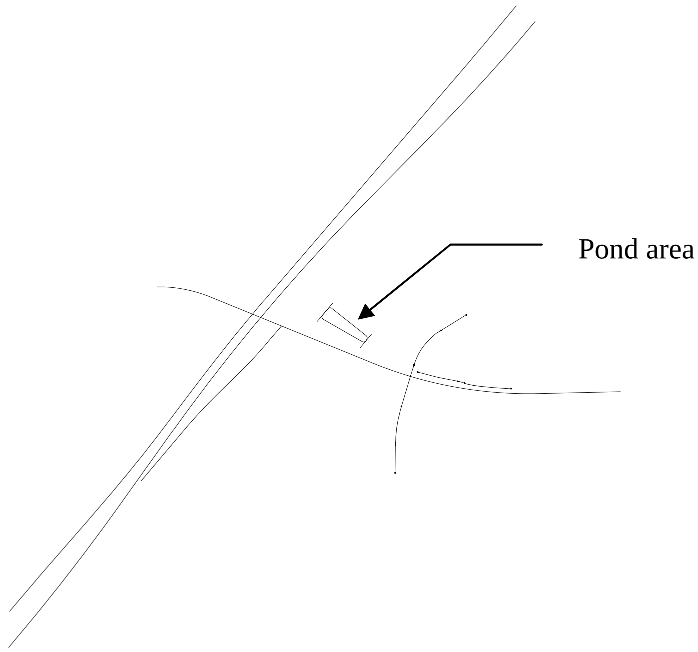
Feature modeling tips

When building feature-based models with MicroStation graphics, there are several tips that can help ensure good results.

- Correct bad elements or features by copying them with **Generate Longitudinal Feature** using no horizontal or vertical offsets. This can sometimes correct problems such as small overlaps that are difficult to find in an element or feature.
- Use **Maximum Segment Length** and/or **Point Density Interval** when importing the graphics. Long, narrow triangles can cause tolerance problems when triangulating wire-frames. This is not unusual in TC lines created by **Roadway Modeler**, especially when they are very close together horizontally, such as the two lines defining the face of a curb. This is sometimes corrected by simply setting a maximum length between the points on a breakline.
- Check the DTM before triangulating by reviewing crossing segments or mismatched elevations. Choose **Surface > View Surface > Crossing Segments** and specify whether you want to see crossing and/or mismatched elevations on crossing segments. The problem areas are noted with the desired symbol and a report. Any problems can be corrected prior to triangulation.

Lab 4.1 – Using Feature-editing tools to create a detention pond

In this activity, you will create a proposed digital terrain model without using **Roadway Modeler**. Instead, you will use a combination of feature creation and editing tools to develop the breaklines for a pond.



Start MicroStation InRoads

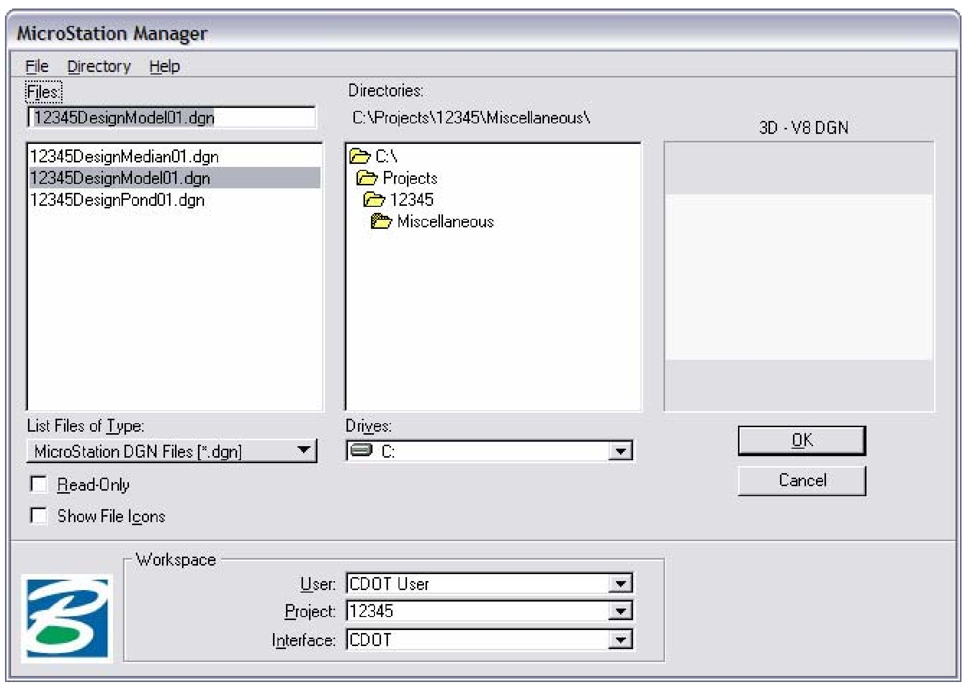
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

Set Project Defaults

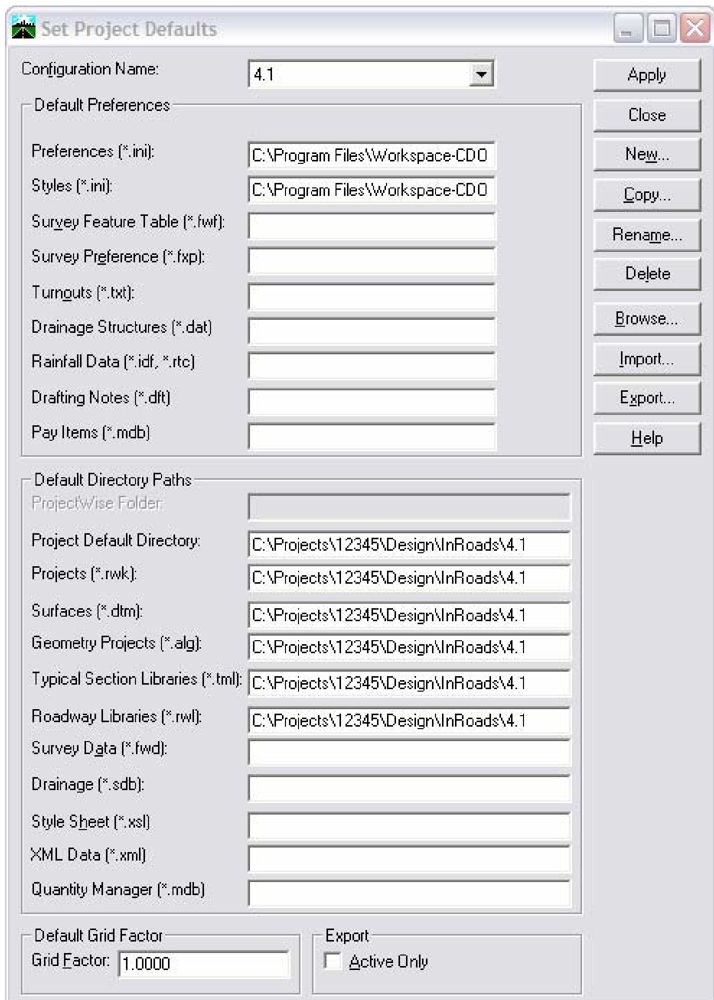
1. Select **File > Project Defaults**.

2. Set the **Configuration Name** to **4.1**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load the existing DTM

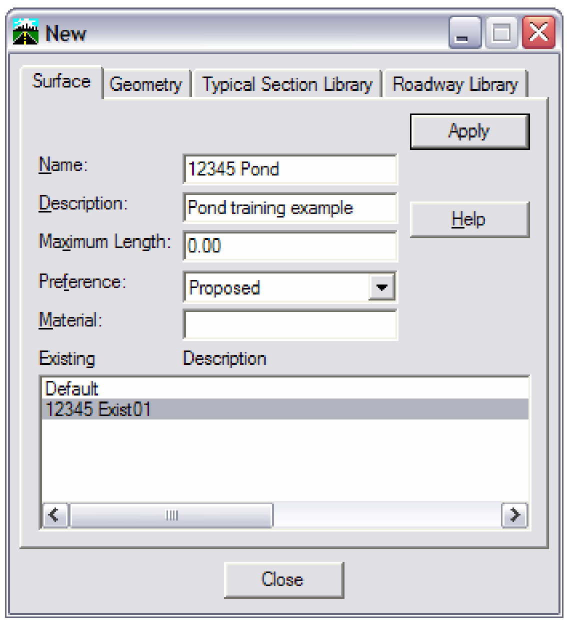
1. Select **File > Open**.
2. Set **File of Type** to **Surfaces (*.dtm)**.
3. Highlight **12345 Exist01.dtm** and then select **Open**.
4. **Cancel** the **Open** dialog box.

Set Locks

1. Toggle **Locate Features/Locate Graphics** to **Locate Graphics**.

Create a surface for the pond

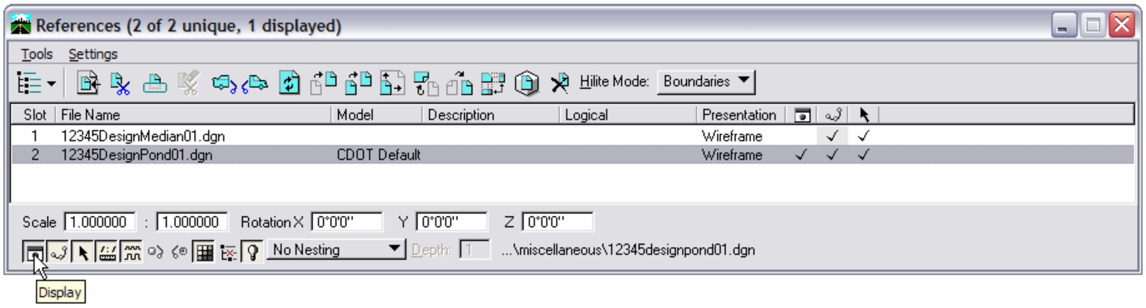
1. Select **File > New**.



2. Select the **Surface** tab:
   - Key in the name: ***12345 pond***
   - Key in the description: ***Pond training example***
3. Select **Apply** and **Close** the **New** dialog.

Display the pond graphics

1. Toggle ***on*** the display for the **12345DesignPond01.dgn** reference file.



The pond you are going to create is beside a new roadway SH52. The toe of slope for the roadway is the boundary for the pond on the South side, with the existing ROW limiting the size on the North and other existing features dictating the basic shape of the pond. The graphic that you just toggled on shows what has previously been determined as the outer limit of the pond.

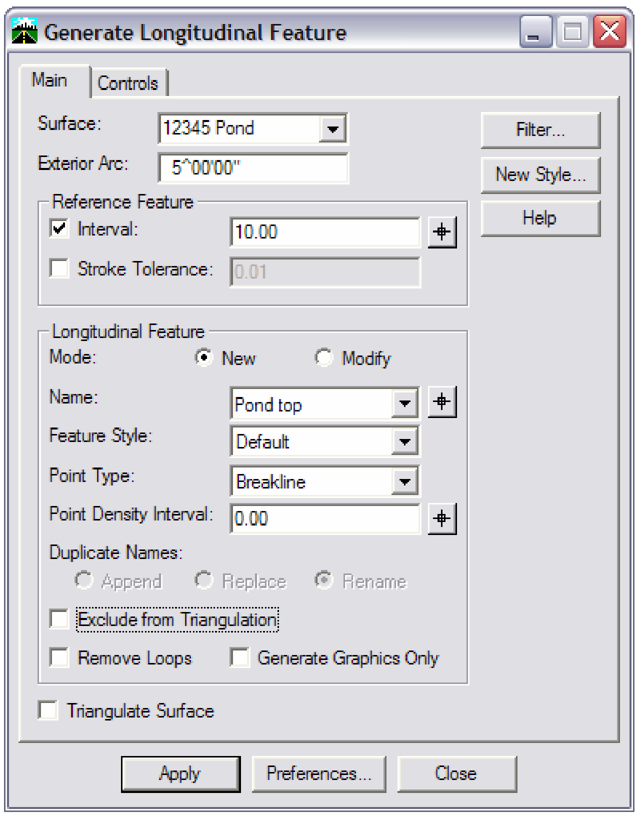
Set the elevations of the boundary

In this case, you are going to start with the known outside of the pond, so you must first set the elevations of this boundary. You will do this by draping the graphic element onto the existing topo.

1. Select **Surface > Design Surface > Generate Longitudinal Feature**.

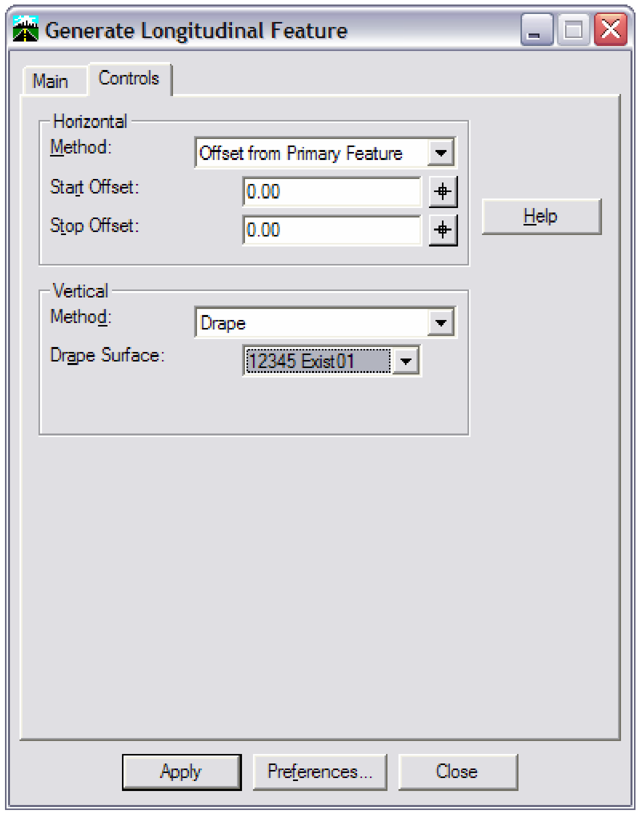
2. Select the **Main** tab:

   - Select **12345 pond** as the **Surface**.
   - Toggle ***on*** **Interval** and set it to ***10***
   - Toggle ***on*** **New** for the **Mode**.
   - Key in the feature Name ***Pond top***
   - Set the **Feature Style** to **default**.
   - Set the **Point Typ**e to **Breakline**.
   - Leave the **Point Density Interval** set to ***0***

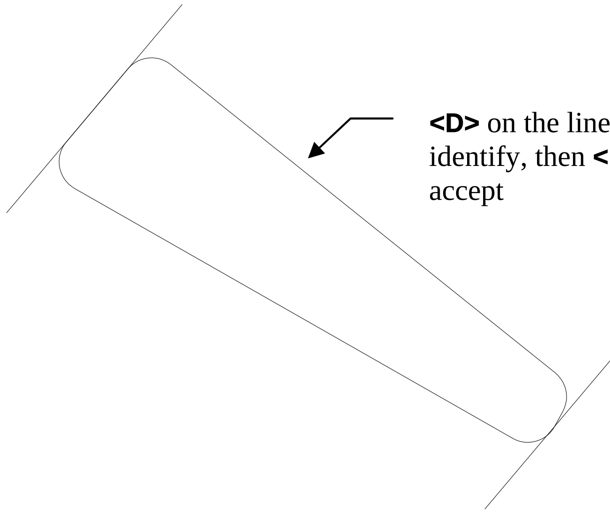


3. Select the **Controls** tab

   - Set the **Horizontal Method** to **Offset from Primary Feature**.
   - Set both **offsets** to ***0.00***
   - Set the **Vertical Method** to **Drape**.
   - Set the **Drape Surface** to **12345 Exist01.**



4. **Apply**, then **Identify** and **Accept** the pond outline as the Primary Element.



<D> on the line to identify, then **<D>** to accept

5. **Identify** and **Accept** the same shape again as the Reference Element.

6. Reset **<R>** for the Entire shape.

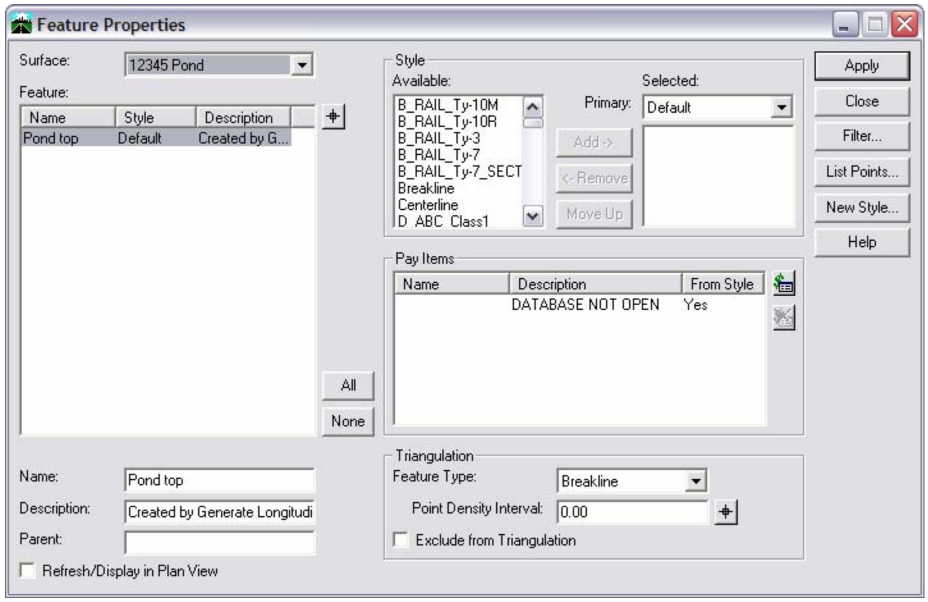
7. **<D>** anywhere for the Location.

Note: If your Horizontal Offsets were not 0, you would be telling InRoads which side to offset by moving your cursor to that location before **<D>**; since they are both 0, it does not matter where you identify the location.

The shape is draped on the existing model, but placed in the new surface.

Review the feature

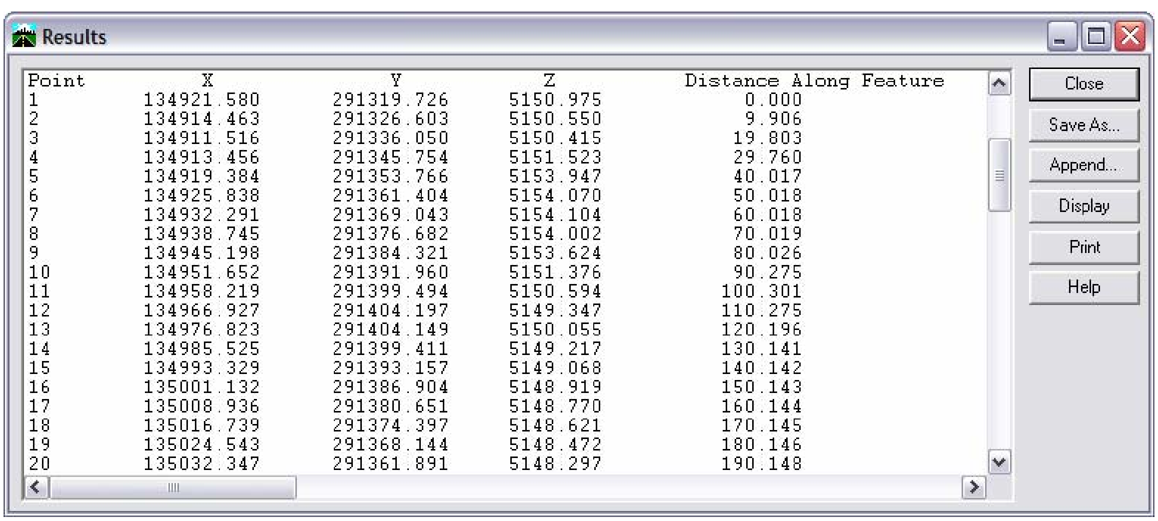
1. Select **Surface > Feature > Feature Properties**.



2. Set the **Surface** to **12345 pond**.

3. Highlight the **Pond top** feature and choose **List Points**.

   Note: If you do not see the Pond top feature in the surface, go back and try the **Generate Longitudinal Feature** command again.

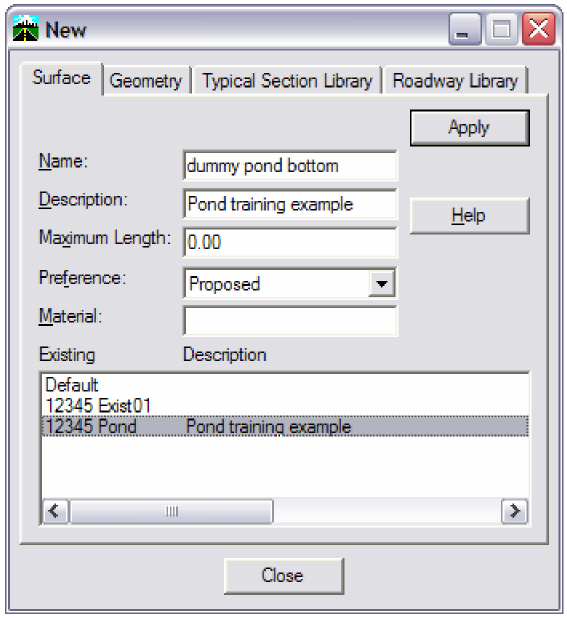


4. You should see all different elevations for the feature. If you have a feature listed, but the elevations are not in the range shown, use **Surface > Edit Surface > Delete Feature** to delete the feature, then try again.

Create a target for the pond bottom

In this series of steps, you will create features from the two lines at either end of the pond. The one on the West side represents the 5144 elevation and on the right end 5141. These features will then be triangulated to form a 'dummy' surface that can be used as a target to create the pond bottom.

1. Select **File > New**.



2. Select the **Surface** tab:

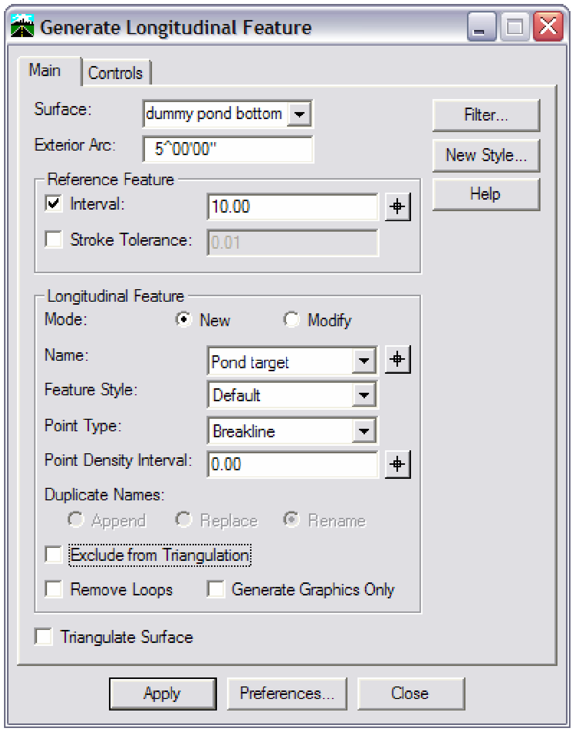
   - Key in the name: ***dummy pond bottom***
   - Key in the description: ***Pond training example***

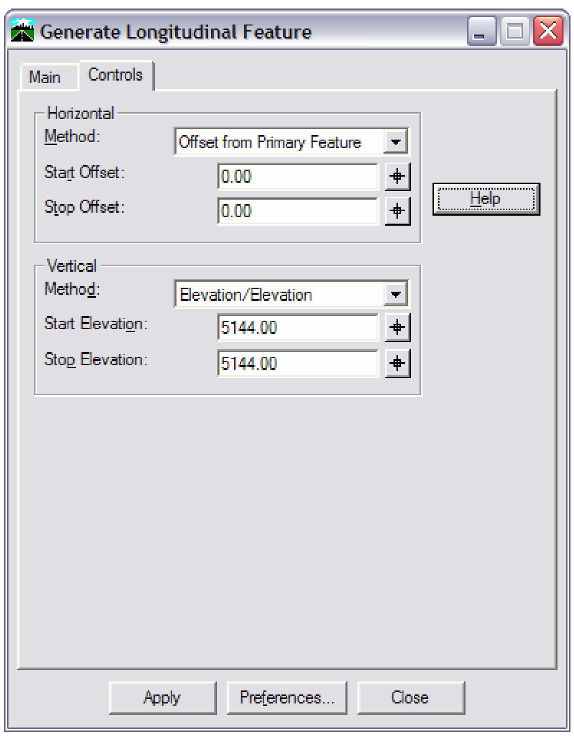
3. Select **Apply** and **Close** the **New** dialog.

4. Select **Surface > Design Surface > Generate Longitudinal Feature** (**GLF**).

5. Select the Surface **dummy pond bottom**.

6. Set the other criteria as shown to create a new feature.





7. **Apply**.
8. Select the West linestring with a data point **<D>**

   The linestring highlights and you are prompted to **Accept/Reject**.
9. **<D>** to accept.

   You are prompted to **Identify Reference Element**.
10. Select the **same** linestring again with a **<D>** and press **<D>** to **Accept** when the linestring highlights.

    A tracking line appear and you are prompted to **Identify Beginning (Reset for Entire Element)**.

    - **Reset** to copy the entire element.
    - **<D>** for the location.

<u>**Note**</u>: Since the horizontal offsets are 0.00, the location of the data point does not matter. If there were horizontal offsets, the data point would tell the software which way to make the copy, similar to a MicroStation copy command.

The shape is made into a feature at elevation 5144 in the surface dummy pond bottom.

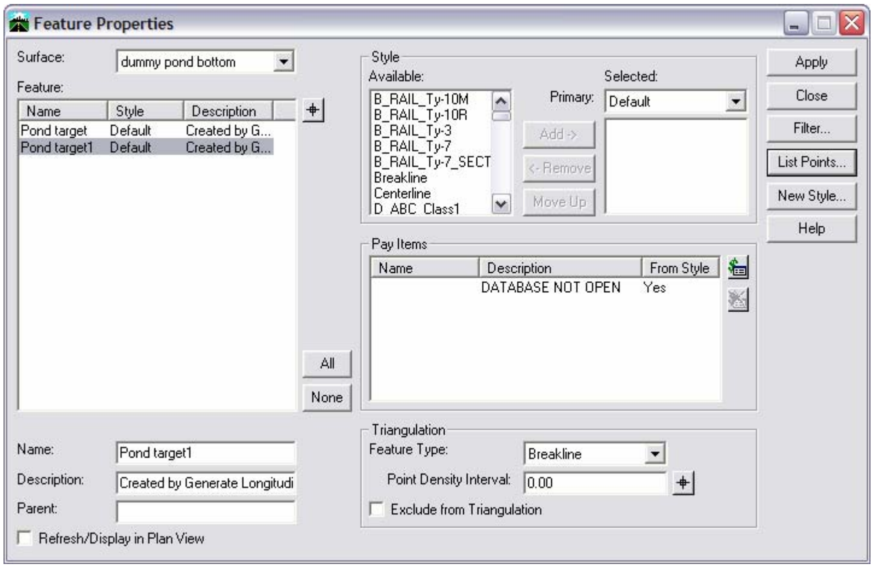
Review the feature

1. Select **Surface > Feature > Feature Properties**.
2. Set the **Surface** to **dummy pond bottom**.
3. Highlight the **5144** feature and choose **List Points**.

   You should see all 5144 elevations for the feature.

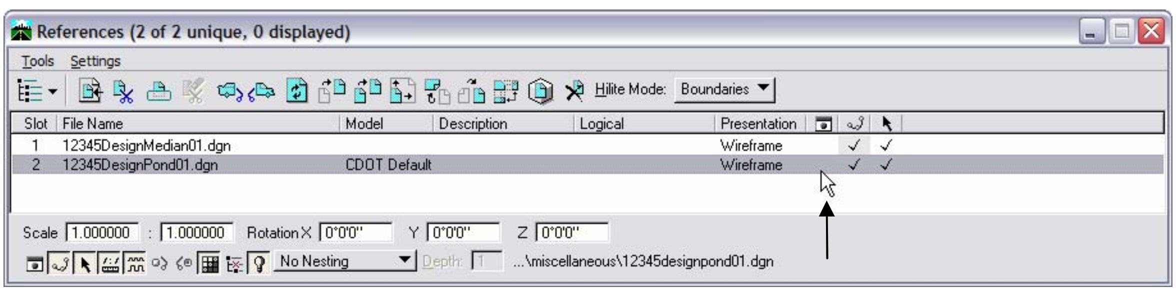
4. Repeat this process to create a feature in the same surface for the **East line**, which should be set to an elevation of 5141.

   You should now have two features in dummy pond bottom.

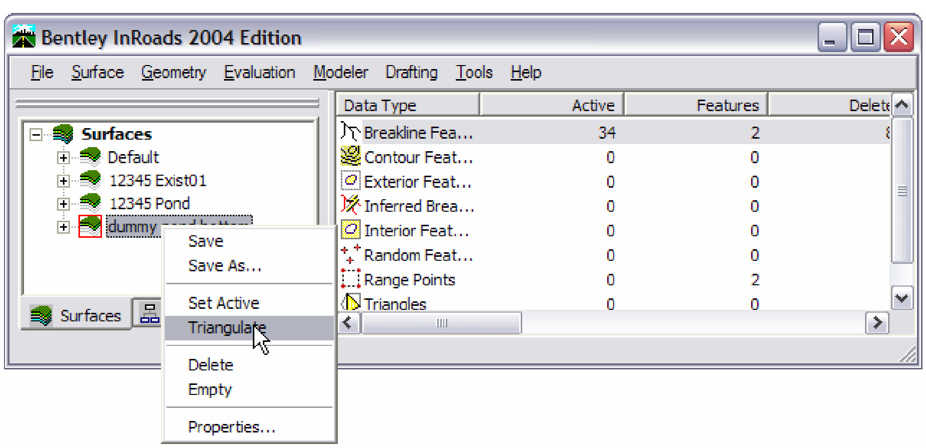


5. Select **Close** to dismiss the **GLF** dialog box.

6. Turn ***off*** the reference with the original pond graphics.



7. **Triangulate** the dummy pond bottom surface.



Define the pond side slopes

This series of steps takes you through creating sideslopes from the new top-of-pond outline down to the target DTM.

Make the lock settings

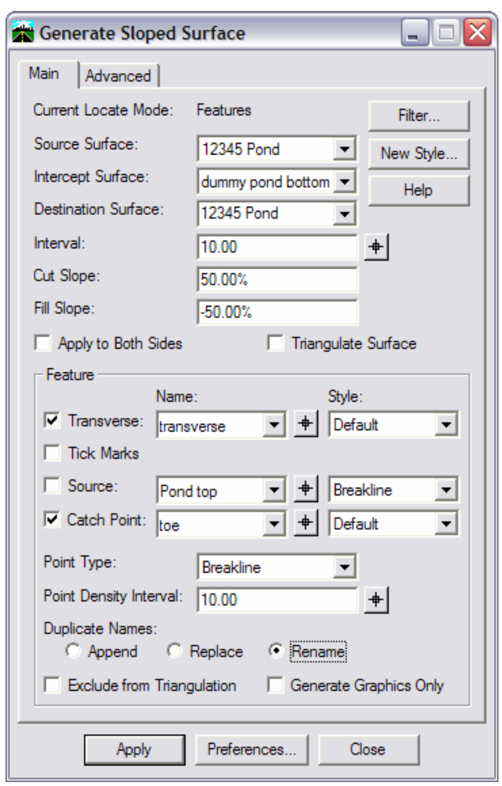
1. Set the **Locate** mode to **Features**.

Since the source for the slopes is the feature created for the bottom of the pond, you must first change the **Locate** mode.

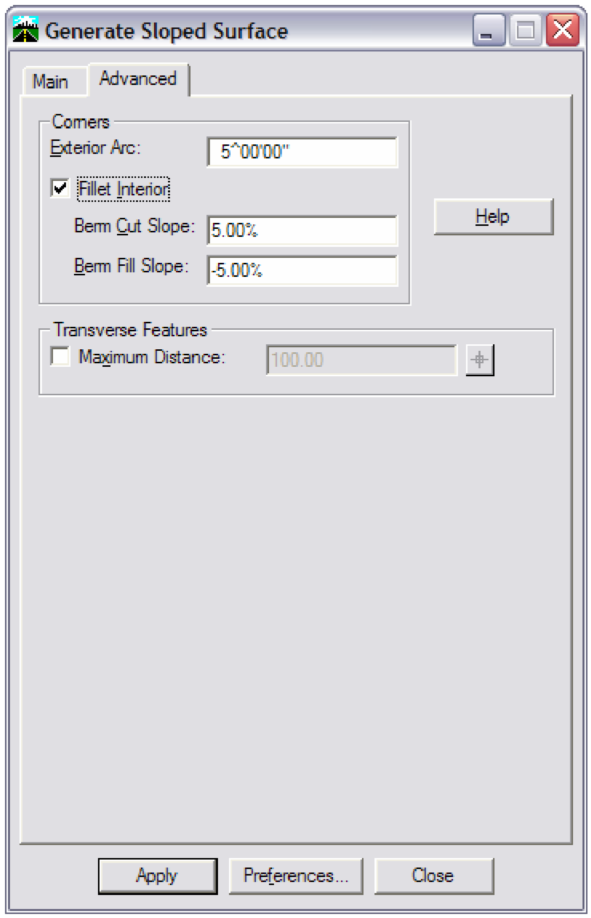
2. Select the **Surface > Design Surface > Generate Sloped Surface** (**GSS**).

3. Set the following parameters on the **Main** tab:

   - Source Surface: **12345 pond**.
   - Intercept Surface: **dummy pond bottom**.
   - Destination Surface: **12345 pond**.
   - Interval: ***10***
   - Cut Slope: ***50%***
   - Fill Slope: ***-50%***



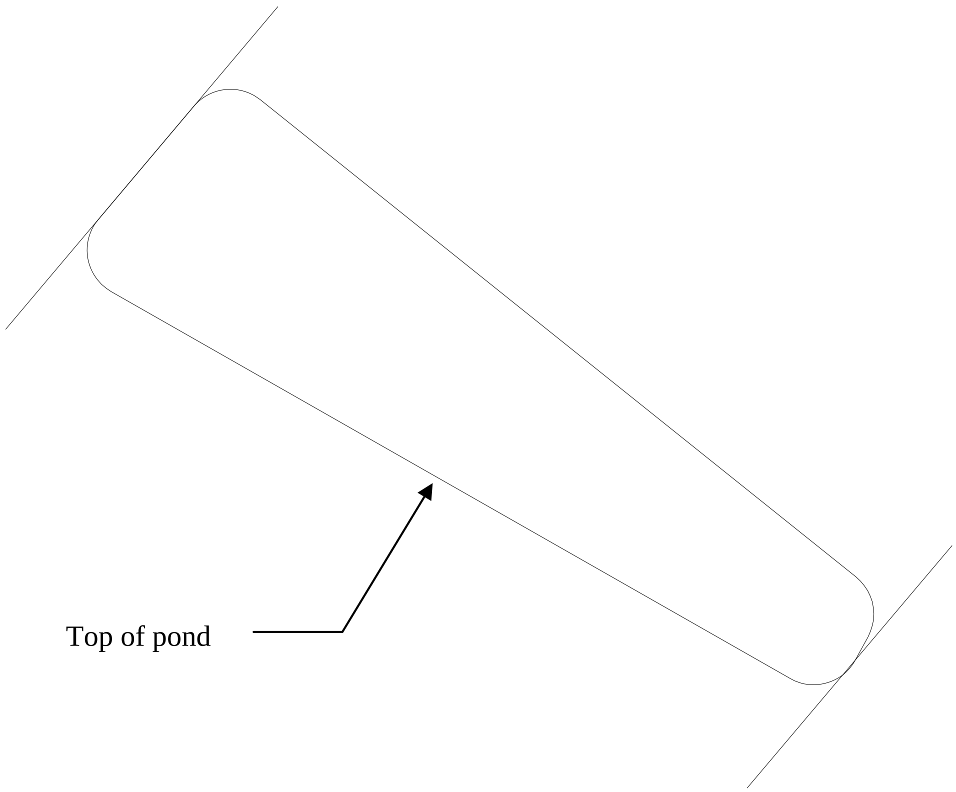
4. In the **Feature** category:
   - Turn ***off*** **Generate Graphics Only**.
   - Toggle ***off*** **Tic Marks** and **Source**.
   - Toggle ***on*** **Transverse**. Key in ***transverse*** for the **Name** and set the **Feature Style** to **default**.
   - Toggle ***on*** **Catch Point**. For Catch Point key in ***toe*** and set the **Feature Style** to **default**.
   - Set the **Point Type** to **Breakline**.
   - Set the **Point Density Interval** to ***10.000***
5. On the **Advanced** tab, set the **Exterior Arc**: ***5^00'00.00"***



6. Select **Apply** to run the **GSS** command.

   You will be prompted to **Identify Feature**.

7. Place a data point on the closed feature that represents the top of your pond.



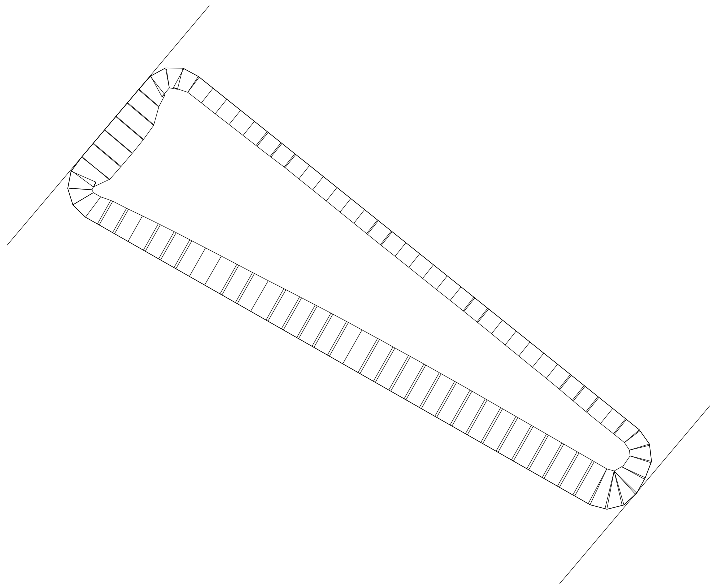
   The entire pond top will highlight and you will be prompted to **<Accept/Reject>**

8. **<D>** in an area away from the shape to accept the pond bottom.

   When prompted to **Identify beginning/Reset for Entire**,

9. **<R>** to run side slopes around the entire complex shape.

10. When prompted for Location, **<D>** ***inside*** the shape, so the sideslopes will go in instead of out.

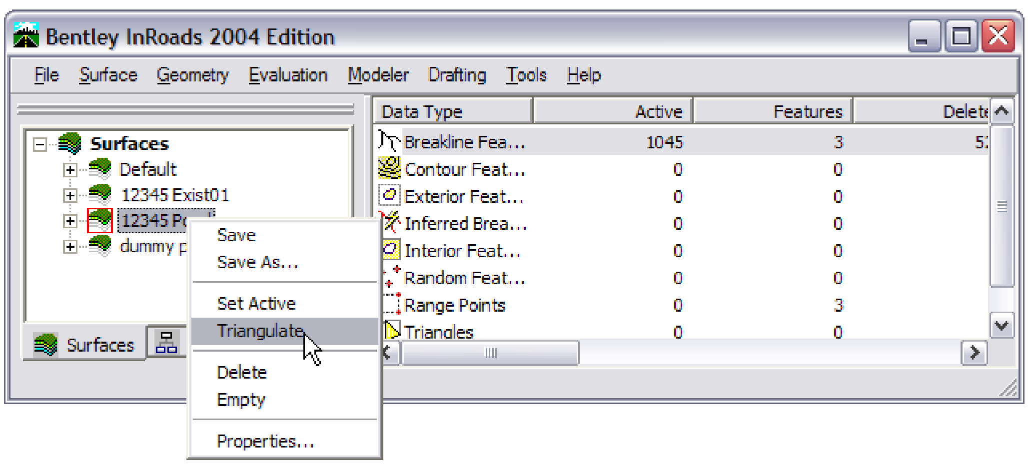


Graphics will appear as shown.

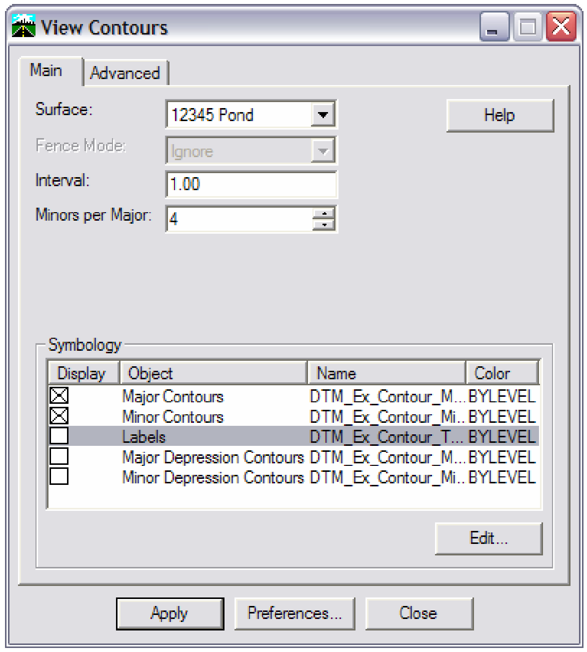
11. **<R>** and then select **Close** to dismiss the dialog box.

Evaluate the pond surface

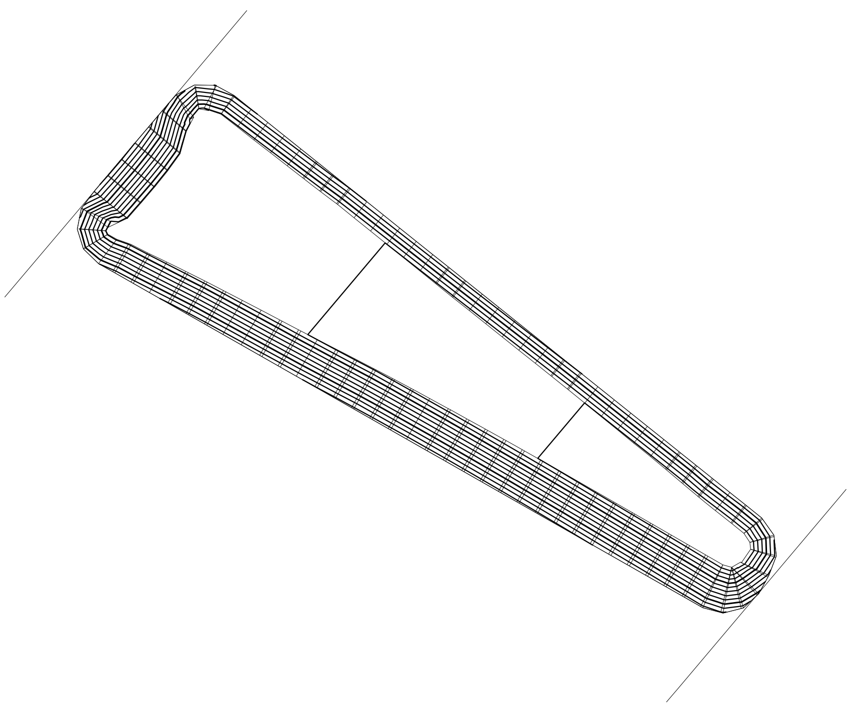
1. **Triangulate** the pond surface.



2. View the contours for the pond surface.

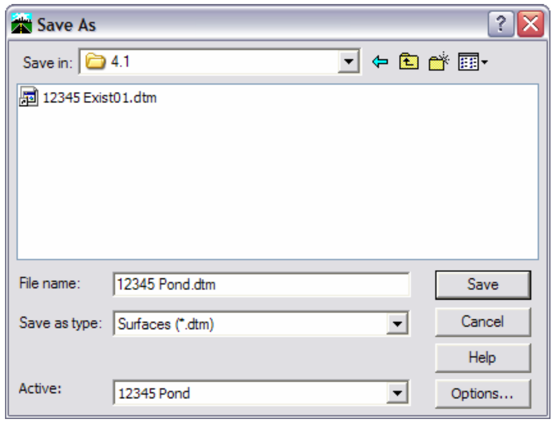


- Use a ***1ft* interval** for the contours.
- Toggle **Write** lock ***off*** before you display the contours.



Save the pond surface to the hard disk

1. Select **File > Save As**.



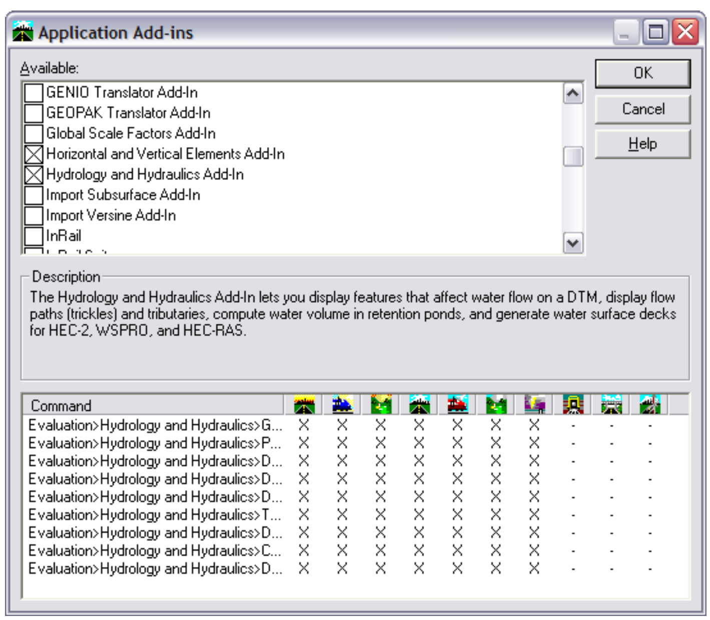
   - Set the **Save as type** to **Surfaces (*.dtm)**.
   - Set the **Active Surface: 12345 pond**.
   - Verify the **Name** is: ***12345 pond.dtm***

2. Select **Save**.

3. **Cancel** the **Save As** box.

Calculate the pond's capacity

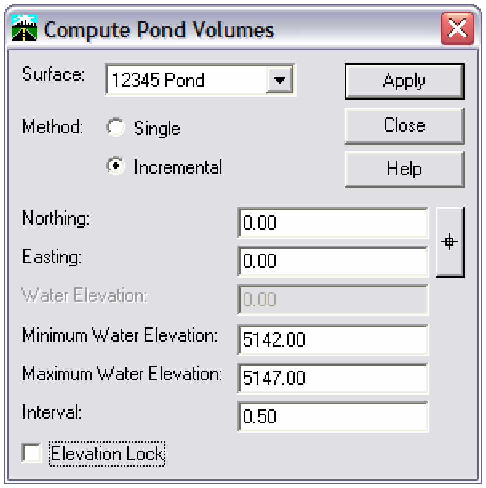
1. Select **Tools > Application Add-ins**, toggle ***on*** **Hydrology and Hydraulics Add-in** (if it's not already on) and choose **OK**.



The command for calculating the pond volume is located on this add-in.

Compute the volume of water your pond will hold for a range of water elevations.

2. Select **Evaluation > Hydrology and Hydraulics > Compute Pond Volumes**.



3. Set the **Surface** to **pond**.

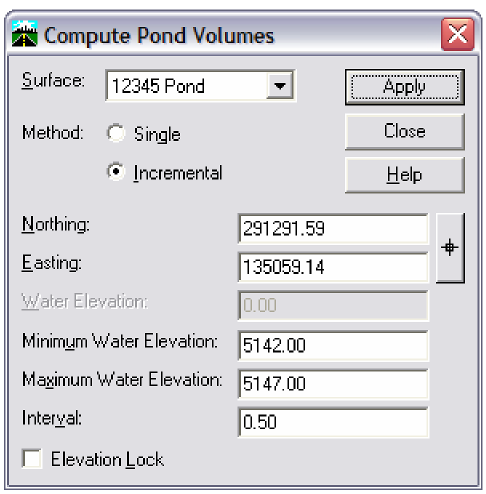
4. Set the **Method** to **Incremental**.

5. Set the **Minimum Water Elevation** to ***5142***

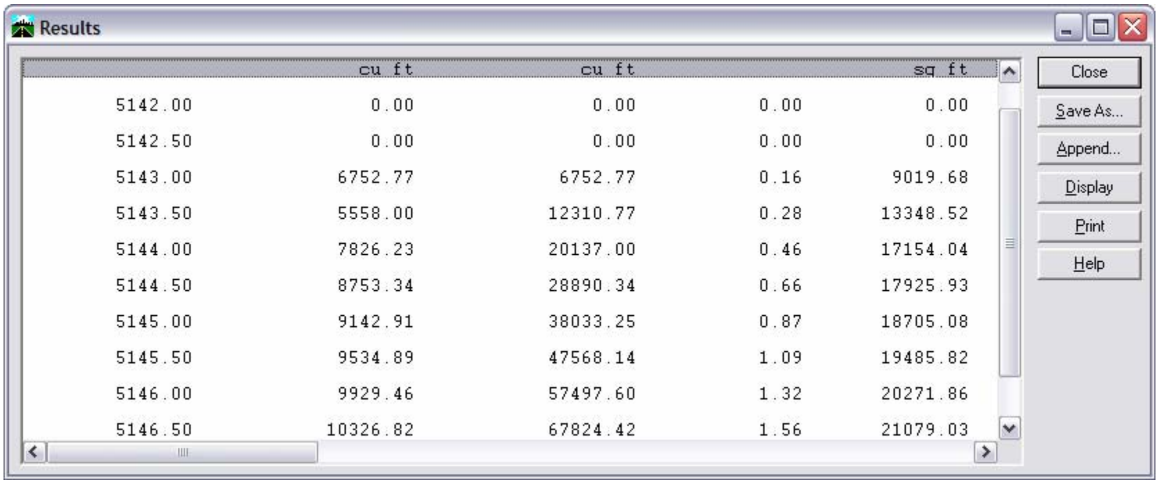
6. Set the **Maximum Water Elevation** to ***5147***

7. Set the **Interval** to ***0.5***

8. Select the **Target** button and place a **<D>** in the middle of your pond toward the lower end.



9. **Apply** and the volume is calculated for the range of elevations you entered. A report is shown with the incremental volumes.



	cu ft	cu ft		sq ft
5142.00	0.00	0.00	0.00	0.00
5142.50	0.00	0.00	0.00	0.00
5143.00	6752.77	6752.77	0.16	9019.68
5143.50	5558.00	12310.77	0.28	13348.52
5144.00	7826.23	20137.00	0.46	17154.04
5144.50	8753.34	28890.34	0.66	17925.93
5145.00	9142.91	38033.25	0.87	18705.08
5145.50	9534.89	47568.14	1.09	19485.82
5146.00	9929.46	57497.60	1.32	20271.86
5146.50	10326.82	67824.42	1.56	21079.03

10. **Save** the report to your hard drive if desired.

11. **Close** the **Compute Pond Volumes** dialog.

Challenge

If you would like a challenge on this activity, complete the following steps. Otherwise proceed to ***Clean-up your design file***.

1. Add a micro pool of your own design at the deep end of the pond.

2. Add a trickle channel from the upper end down to the micro pool.

3. **Zoom in** close to the upper end of the pond and look at the pond toe line. Clean up the problems in the corner using **Edit Feature Point**.

Clean-up your design file for the next lab

<u>Important</u>! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

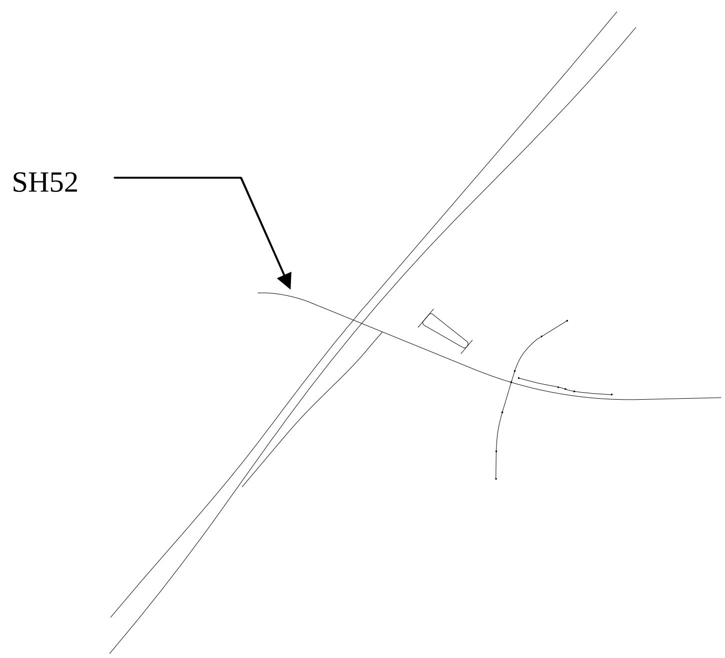
<u>Important</u>! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 4.2 – Using feature editing tools to clean up a surface from Roadway Modeler

In this activity, you will go beyond **Roadway Modeler** in creating a surface. In previous activities, SH52 was modeled with superelevation and independent control. The medians were draped onto this surface, imported as horizontal and vertical alignments, and a Curb and Gutter template run on them to transition from a catch gutter on the high side to a spill gutter on the low side.

Here, you will start with these surfaces and create a combined model for a 'final' SH52.



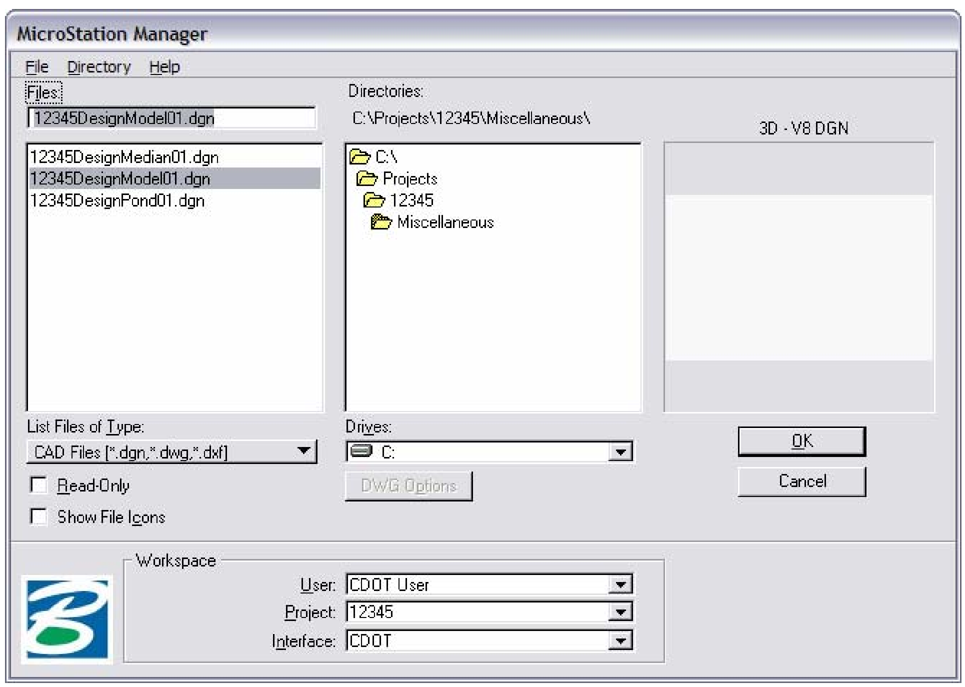
Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:
   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

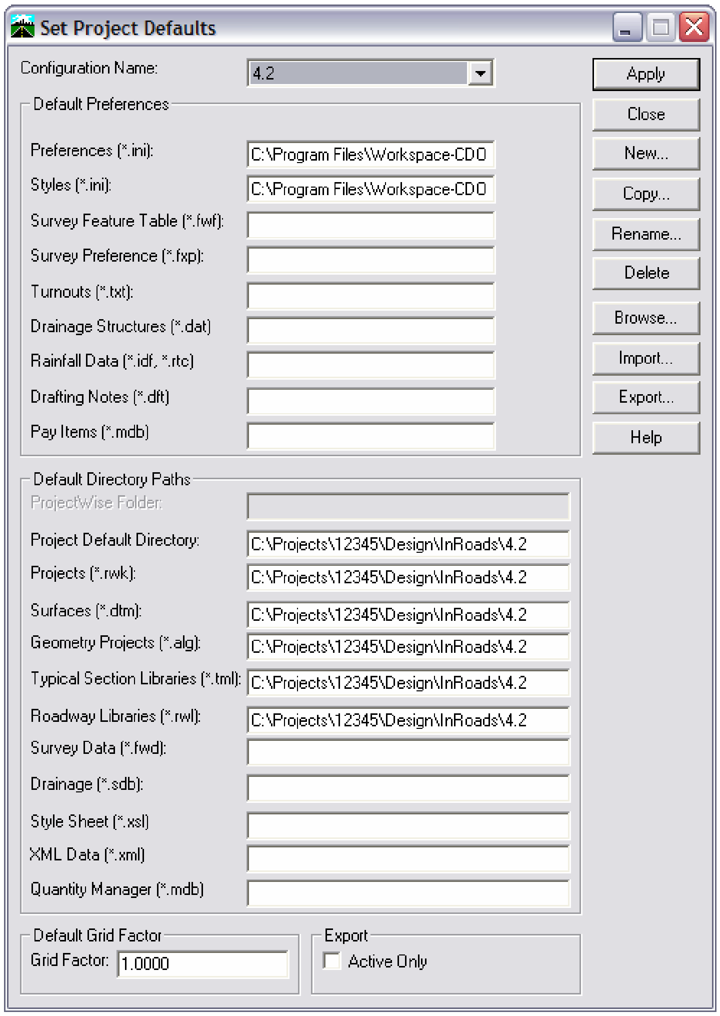
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **4.2**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH52

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **SH52.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load SH52 DTMs

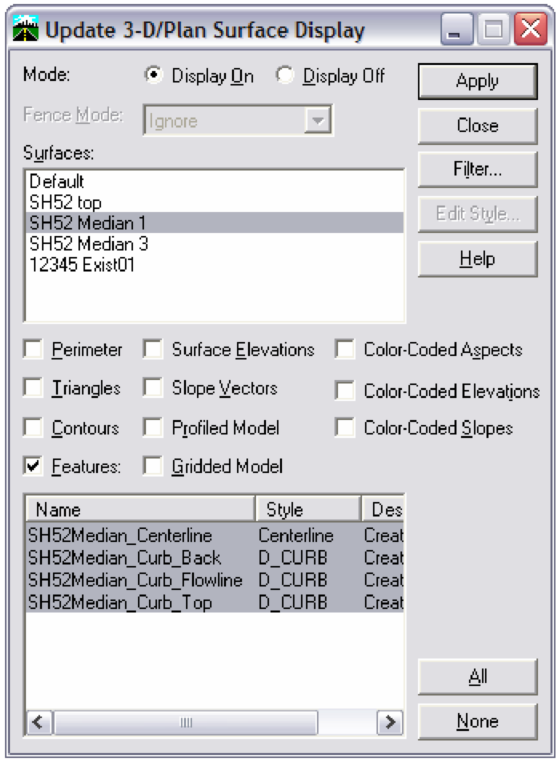
5. Set **File of Type** to **Surfaces (*.dtm)**.
6. Highlight **SH52 top.dtm** and select **Open**.
7. Highlight **SH52 Median 1.dtm** and select **Open**
8. Highlight **SH52 Median 3.dtm** and select **Open.**
9. ***Do not*** cancel out of the box.

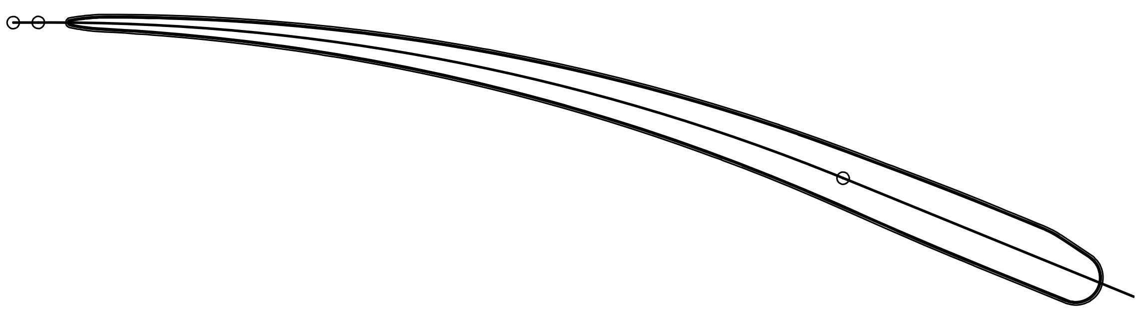
Load the existing DTM

10. Highlight **12345 Exist01.dtm** and then select **Open**.
11. **Cancel** the **Open** dialog box.

View features for the first median surface

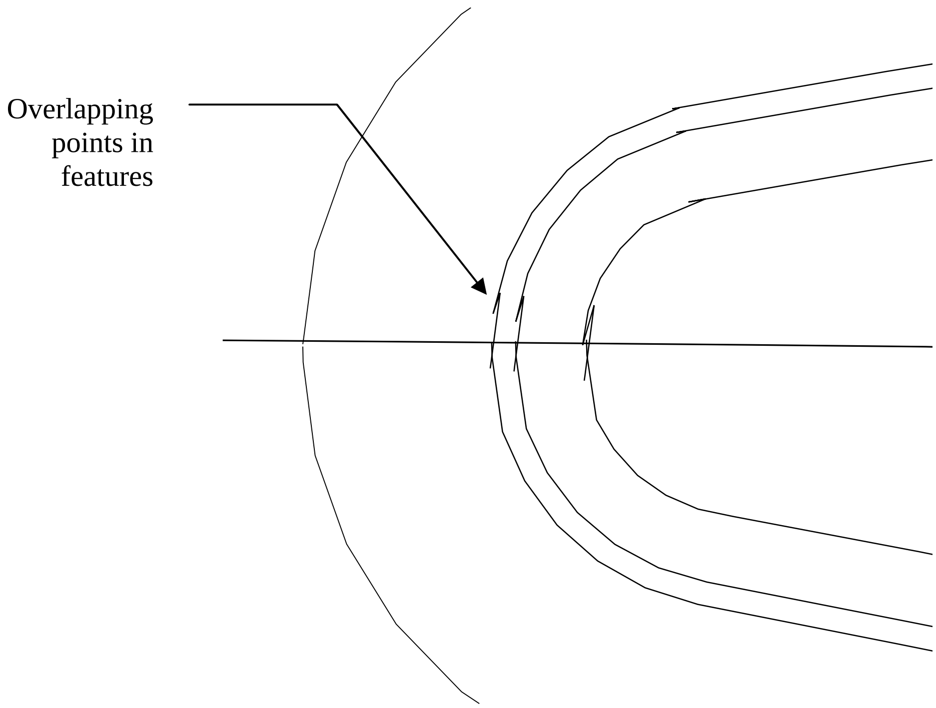
1. Select **Surface > Update 3-D/Plan Surface Display** and set the options as shown for all features.





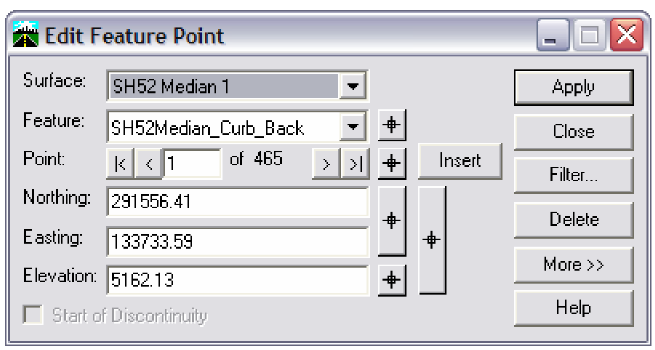
Correct errors in the median surface

1. **Window in** very tight around the first portion of the median.



Since the template was run around such a tight curve on the median, there are some features that overlap. In the next steps, you will use **Edit Feature Point** to correct the problem.

2. Select **Surface > Edit Surface > Edit Feature Point**.

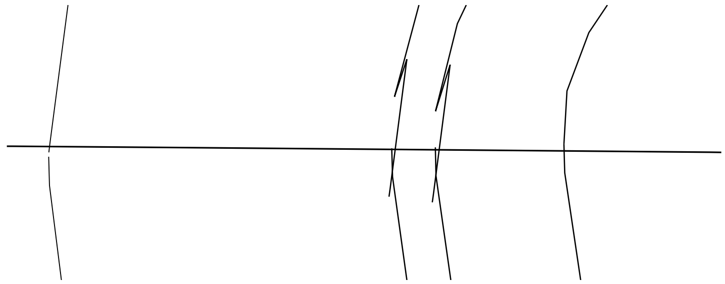


3. Set the **Surface** to **SH Median 1**.

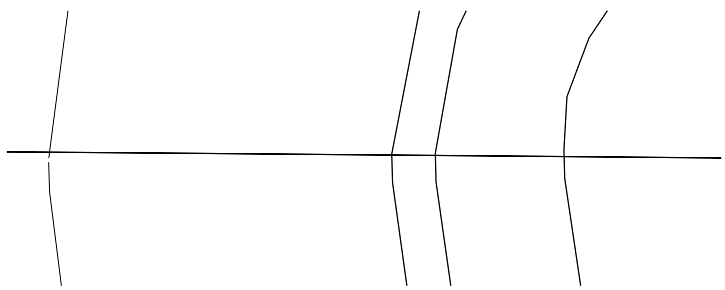
4. Select the **target button** next to the feature name and choose the ***inside*** feature **SH52Median_Curb_Back**.

5. Use the DVD-type controls (**< >** , etc.) to select one of the 'bad' points and choose **Delete**.

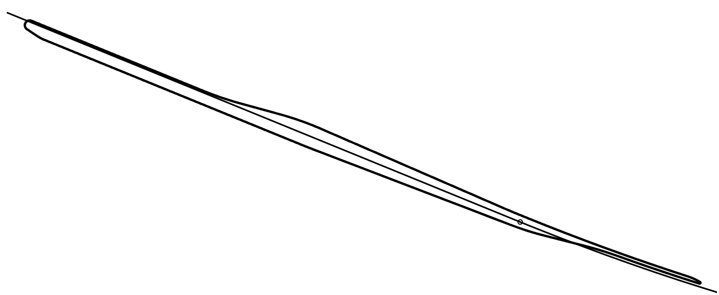
6. Continue using this command to delete or fix the other bad points.



7. Continue correcting the problems with the other features.

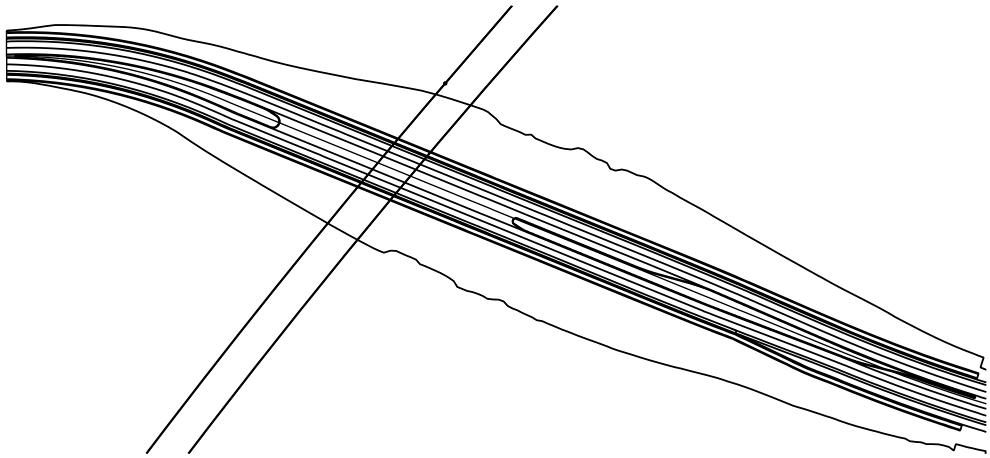


8. **Triangulate** the surface when done.
9. **Save** the surface.
10. View features for **SH52 Median 3**.

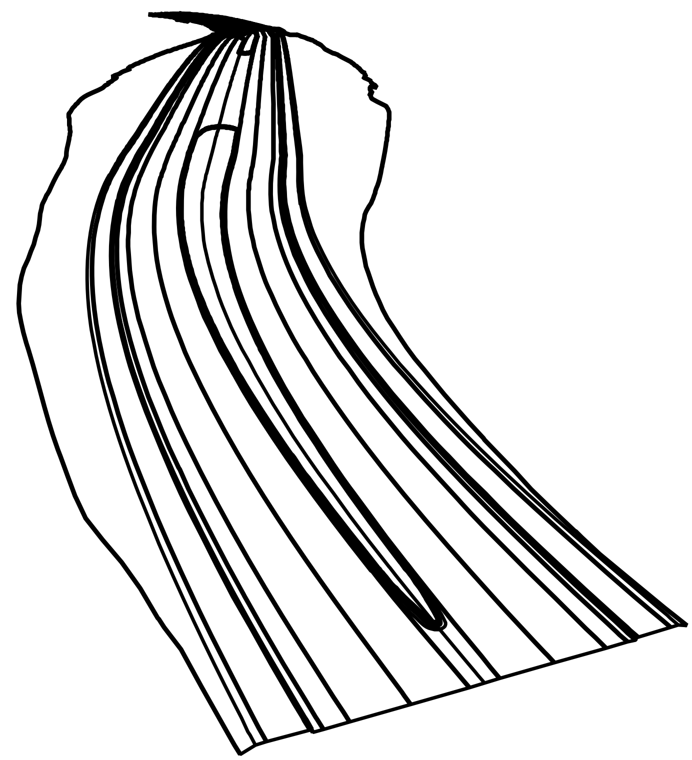


11. **Delete** the graphics for the SH52 horizontal alignment if you have them displayed.

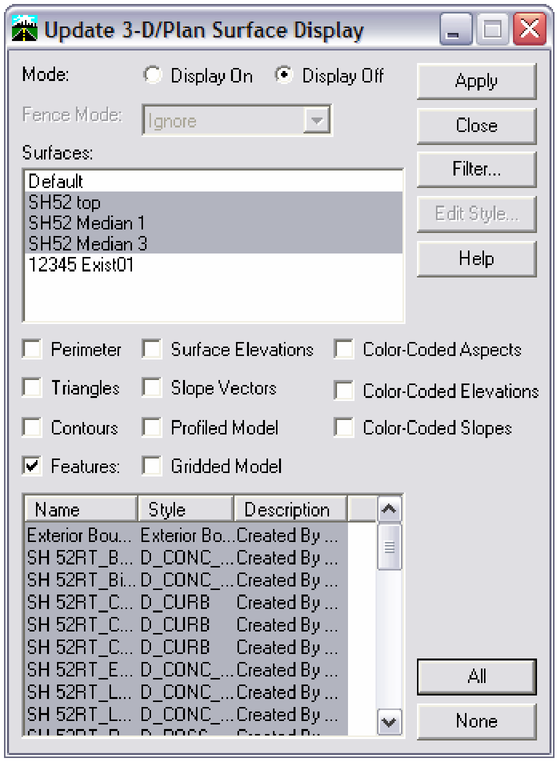
12. View features for **SH52 top**.



13. Graphically review the features to see how the medians fall on the SH52 surface.



14. When done, toggle ***off*** all feature displays.

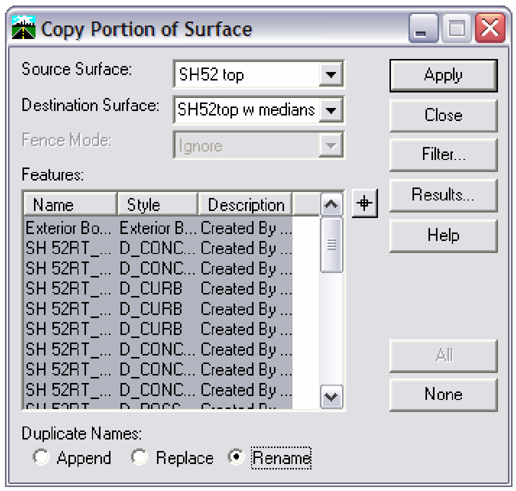


Combine surfaces

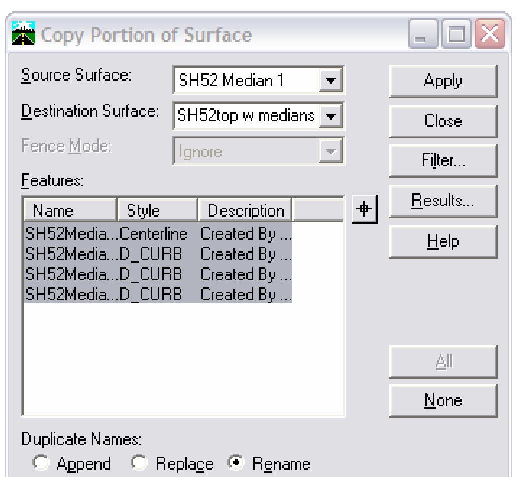
Copy surface features to create a combined surface

Use Copy Portion of Surface to copy the SH52 top and median features from each surface into a new combined surface.

1. Select **Surface > Edit Surface > Copy Portion of Surface.**
2. Set **Source Surface** to **SH52 top.**
   - Set **Destination Surface** to **SH52top w medians.**
   - Set **Duplicate Names** to **Rename.**
   - **Apply.**

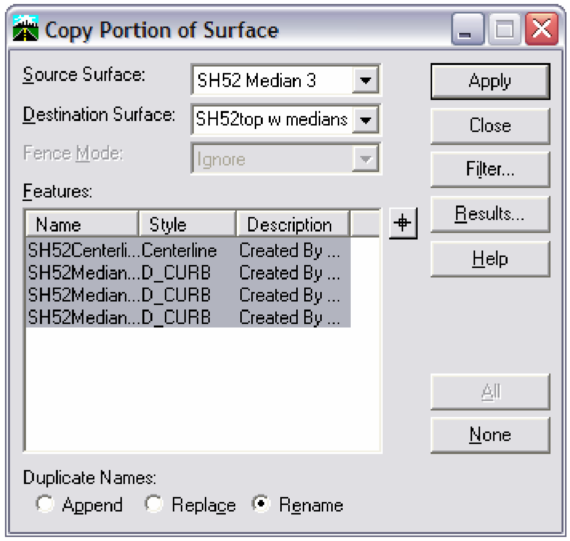


3. Set **Source Surface** to **SH52 Median 1.**
   - Set **Destination Surface** to **SH52top w medians.**
   - Set **Duplicate Names** to **Rename.**
   - **Apply.**



4. Set **Source Surface** to **SH52 Median 3.**

   - Set **Destination Surface** to **SH52 top w medians.**
   - Set **Duplicate Names** to **Rename.**
   - **Apply.**



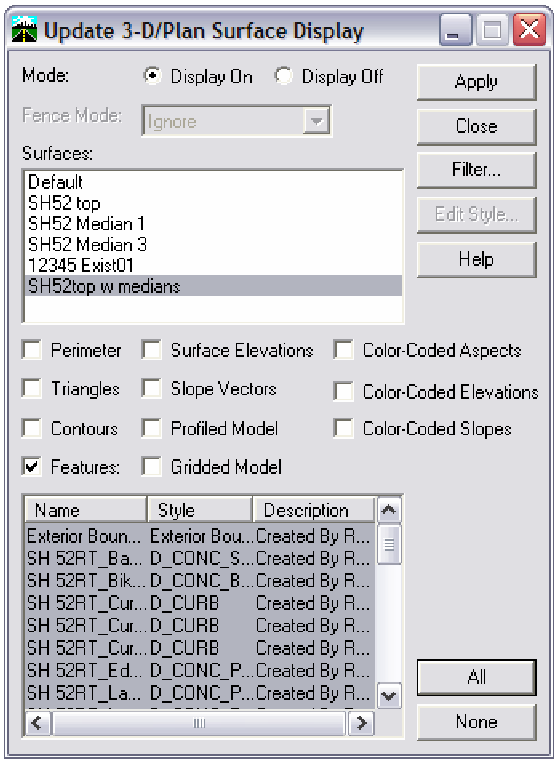
5. **Save** the **SH52 top with medians** surface.

Display the new surface

1. **Delete** all the graphics from previous **Modeler** runs, and the **SH52** alignment is you haven't already.

2. Select **Surface > Update 3D/Plan Display**.

   - Toggle the **Mode** to **Display On**.
   - Highlight the Surface **SH52top w medians**.
   - Toggle ***on*** **Features** and everything else ***off***.
   - Select **ALL** to highlight all the features.

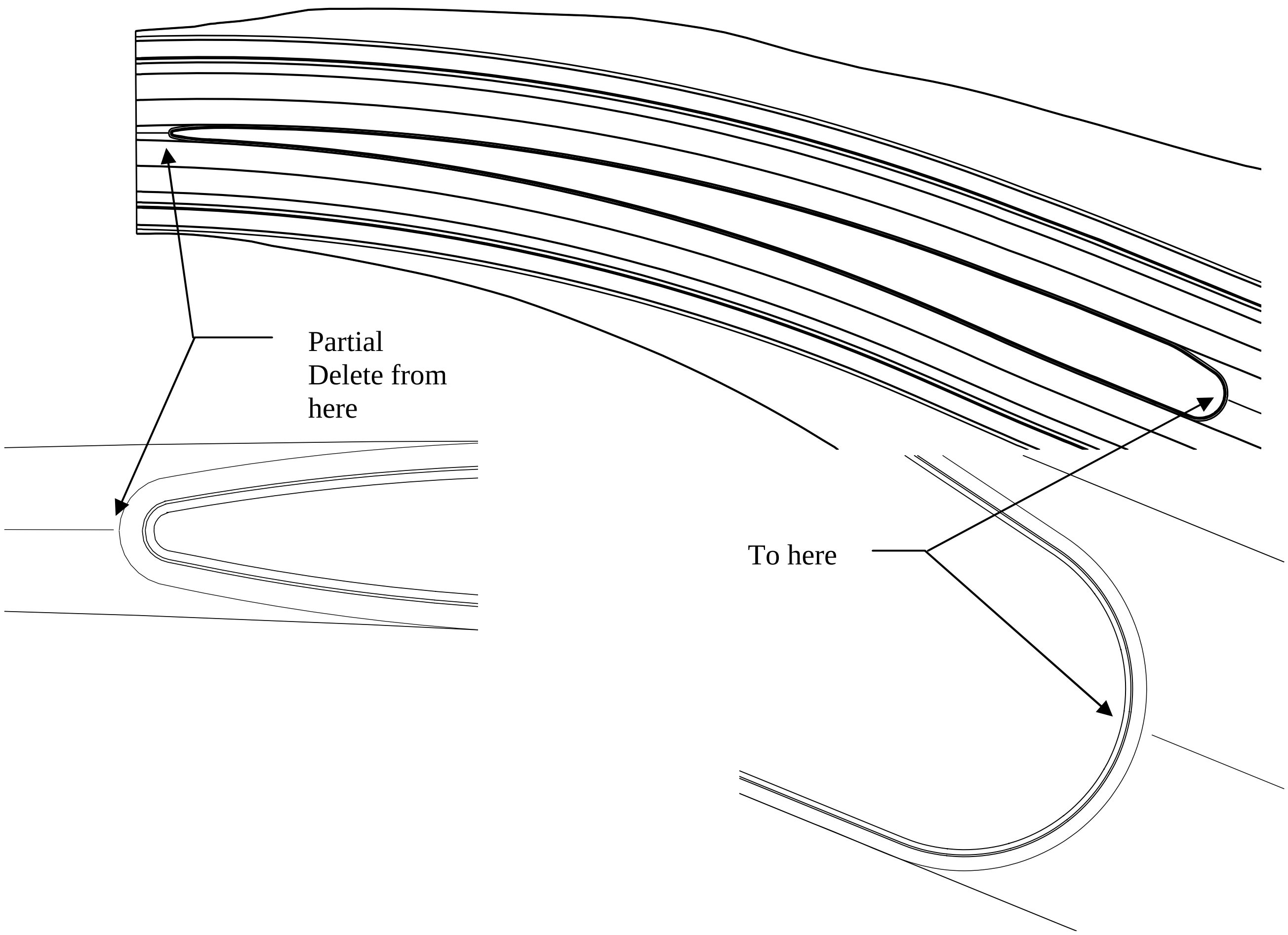


3. Choose **Apply**.

Partial Delete centerline

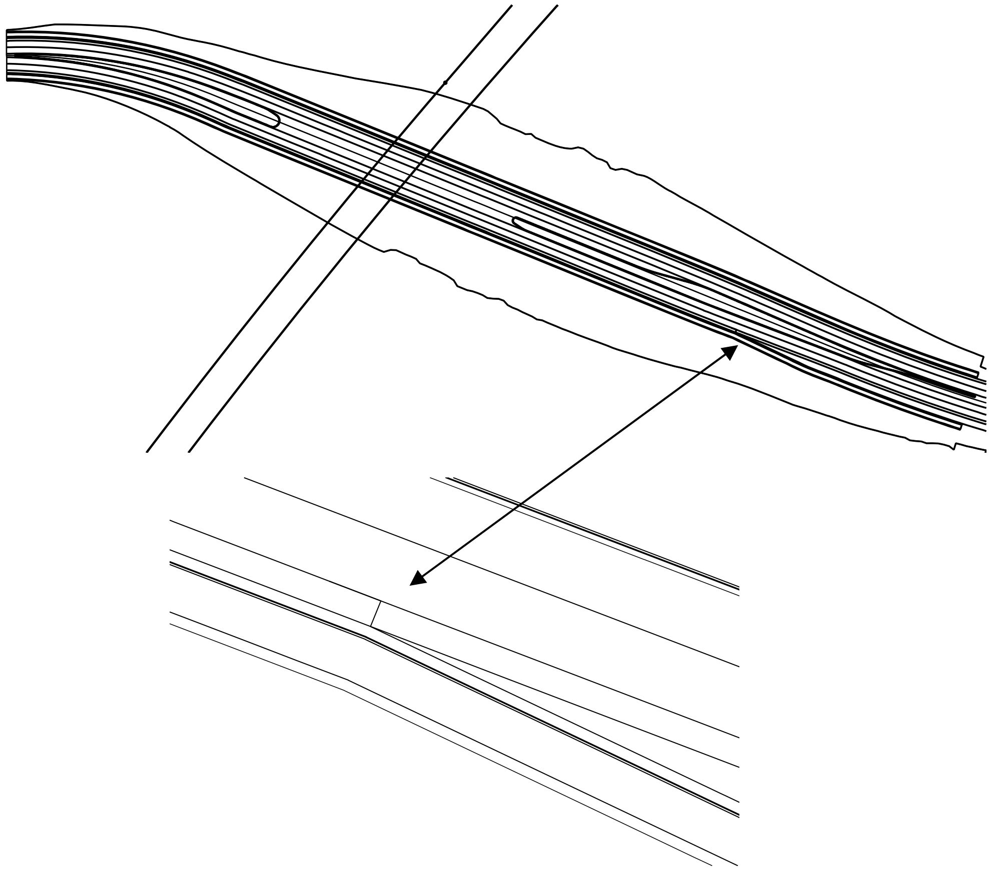
Use **Partial Delete** to partially delete CL in areas where median crosses.

1. First, make the surface **SH52top w medians** active.
2. Select **Surface > Edit Surface > Partial Delete**.
3. Follow the prompts to delete the portions of the Centerline from SH52 that fall within the median.



4. Repeat for the other median.
5. There are also areas where the outside feature of the median is a duplicate with one of the lane lines. In these cases, you should also **Partial Delete** the lane line to avoid tolerance problems when triangulating.
6. **Save** the surface.

Correct errors in the combined surface



1. **Window in** to the first portion of the right turn lane.

   Notice how the turn lane feature transitions back further than it should.

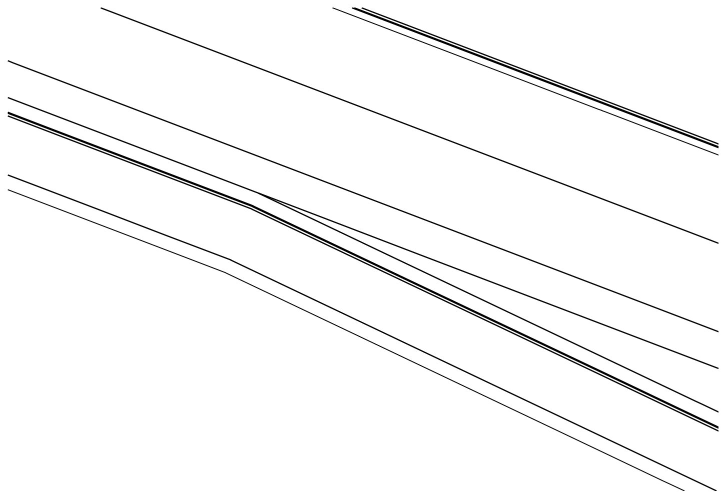
2. Select **Surface > Edit Surface > Edit Feature Point**.

3. Set the **Surface** to **SH52 top w medians**.

4. Select the **target button** next to the feature name and choose the feature for the turn lane.

5. Use the DVD-type controls (**< >** , etc.) to select one of the extra points and choose **Delete**.

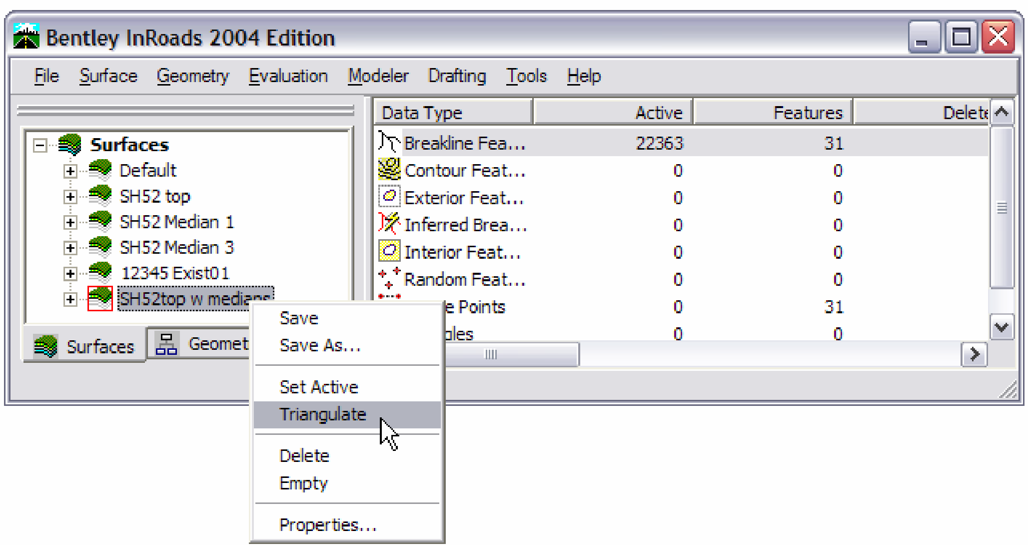
6. Continue using this command to delete the unnecessary points.



7. **Save** the surface.

Triangulate SH 52

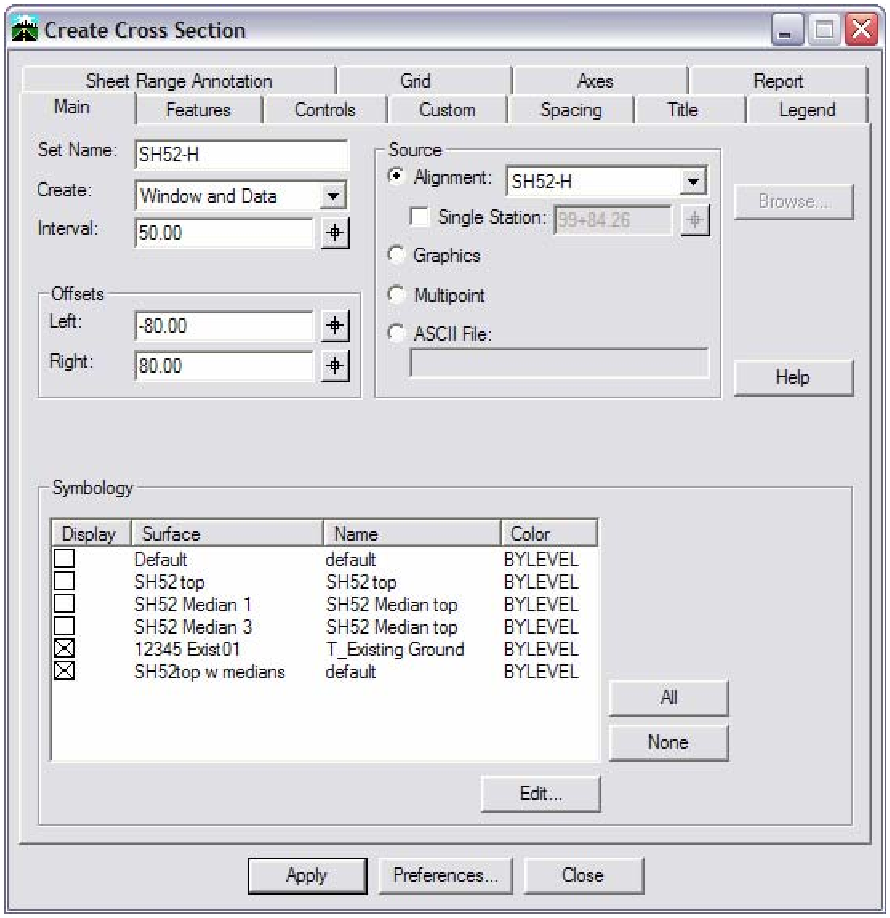
1. Right-click on the surface in the **InRoads Explorer** menu and choose **Triangulate**.



2. **Save** the surface.

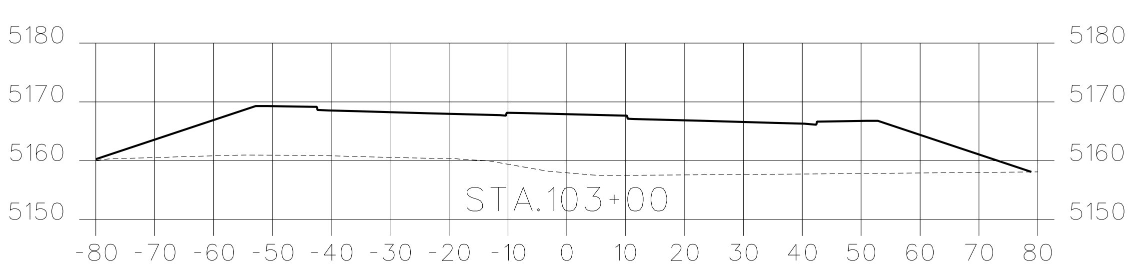
Create Cross Sections

1. Set the **Scale Factors** to ***40***
2. Create cross sections along SH52, showing the surfaces **SH52top with medians and 12345 Exist01.**



Review sections

1. Select **Evaluation > Cross Section > Cross Section Viewer.**
2. Set **Cross Section Set** to the set you just cut.
3. Select **Run.**



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

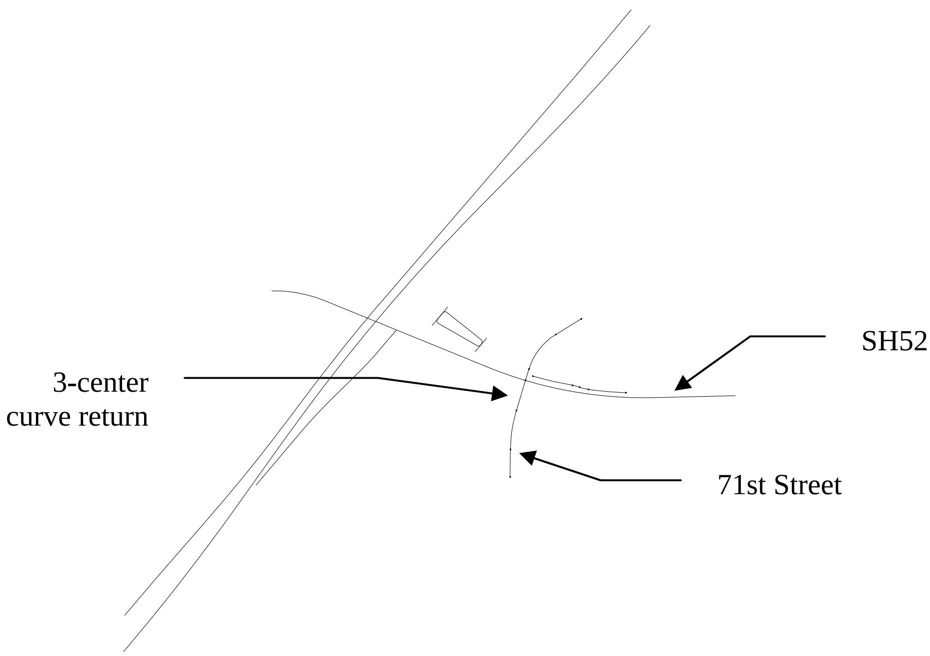
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 4.3 Creating Intersection returns using a 3-Centered Curve

In this activity, you will start with two roadways previously modeled – SH52 and 71st Street. Starting from there, you will create the horizontal and vertical geometry for a 3-center curve in one of the quadrants. Using that geometry, you will model the return with **Roadway Modeler**, then combine the DTMs for SH52, 71st and the return.



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

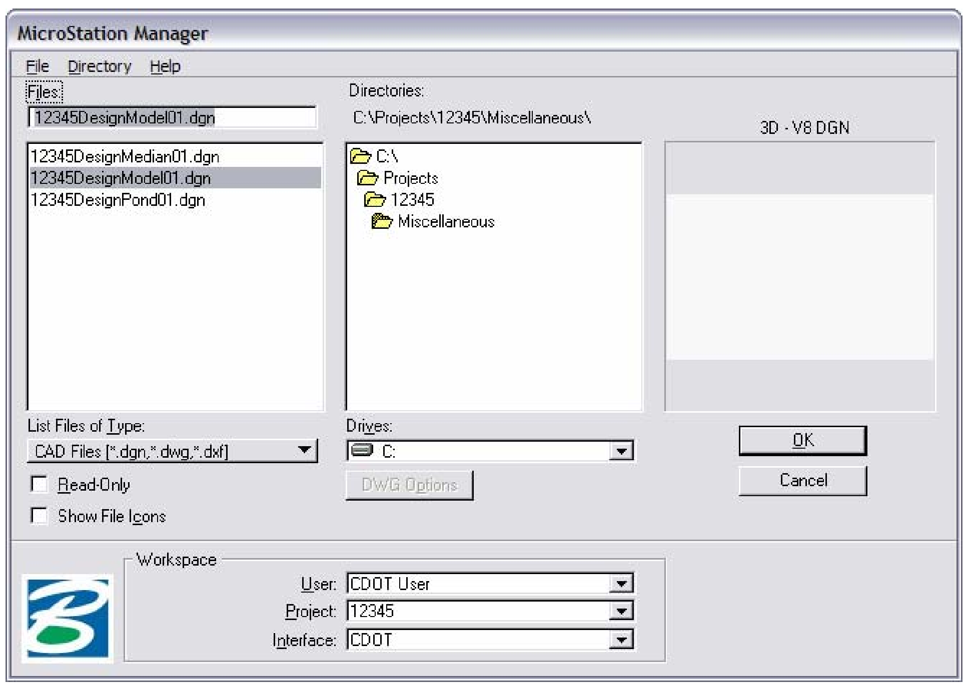
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK**.

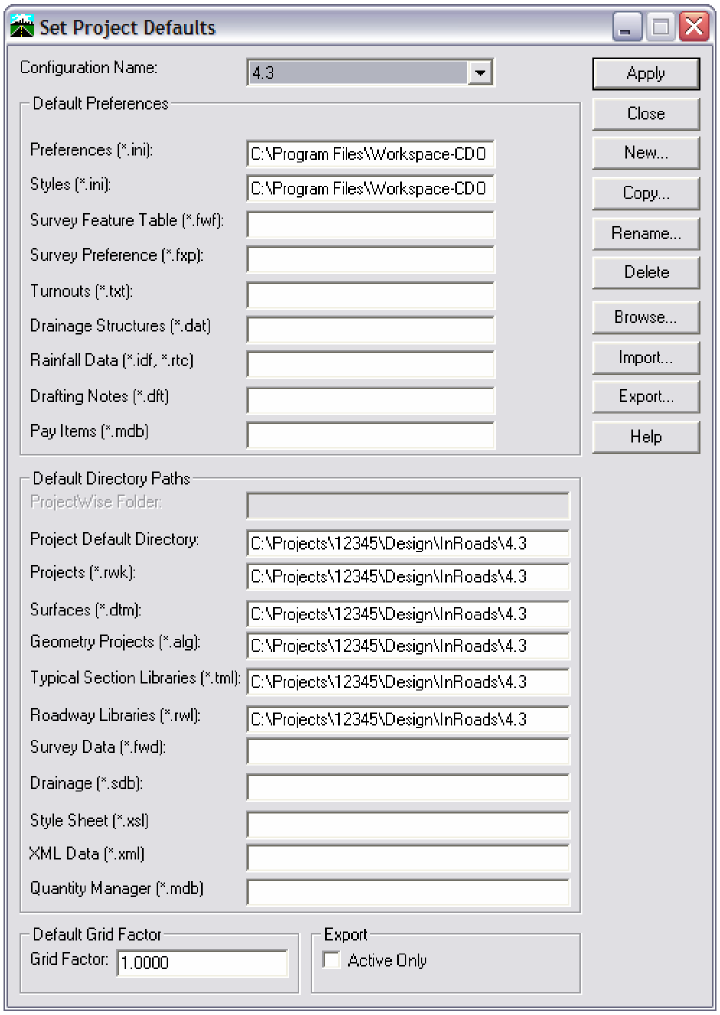
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **4.3**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH52 and 71st Street

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH52.alg** and then select **Open**.
4. Highlight **12345 71st.alg** and then select **Open**.
5. ***Do not*** cancel out of the box.

Load the template library for the SH52 and 71st intersection

1. Set **File of Type** to **Typical Section Libraries (*.tml)**.
2. Highlight **12345 Intersection.tml** and select **Open**.
3. ***Do not*** cancel out of the box.

Load SH52 and 71st Street DTMs

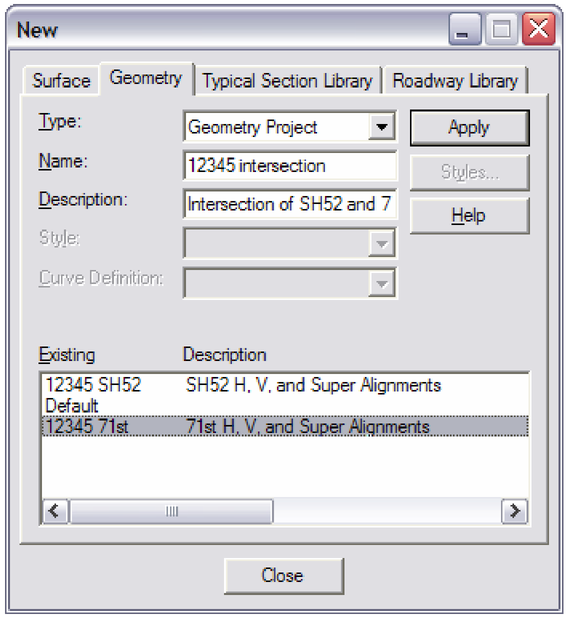
4. Set **File of Type** to **Surfaces (*.dtm)**.
5. Highlight **12345 SH52top w medians.dtm** and select **Open**.
6. Highlight **12345 71st top.dtm** and select **Open**.
7. ***Do not*** cancel out of the box.

Load the existing DTM

8. Highlight **12345 Exist01.dtm** and then select **Open**.
9. **Cancel** the **Open** dialog box.

Create a new geometry project for the intersection

1. Select **File > New.**



On the **Geometry** tab:

- Set **Type** to **Geometry Project.**
- Key in a Name of ***12345 intersection***
- Key in a Description of ***Intersection of SH52 and 71st***

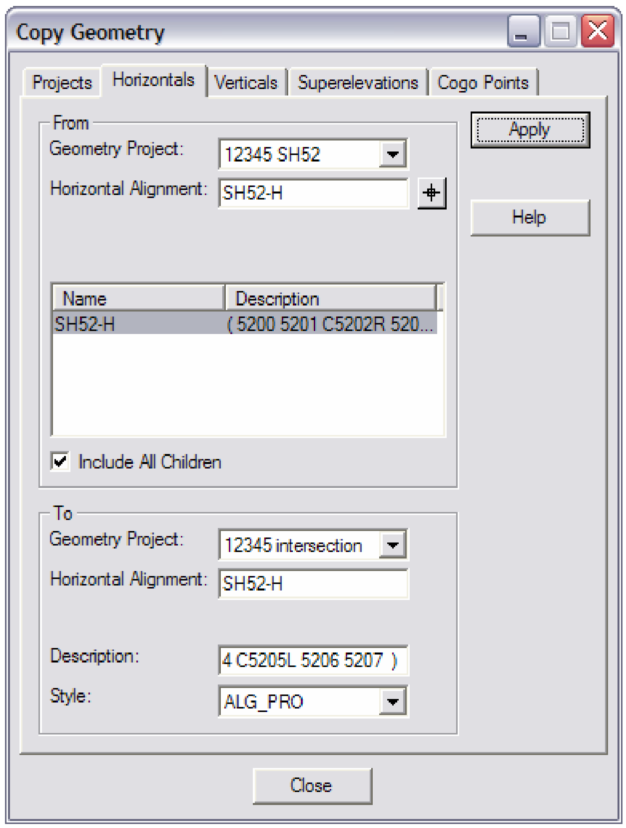
2. Select **Apply.**

Copy alignments into project

Copy the horizontal and vertical alignments for SH 52 and 71st street into the intersection project as follows:

Copy the alignments

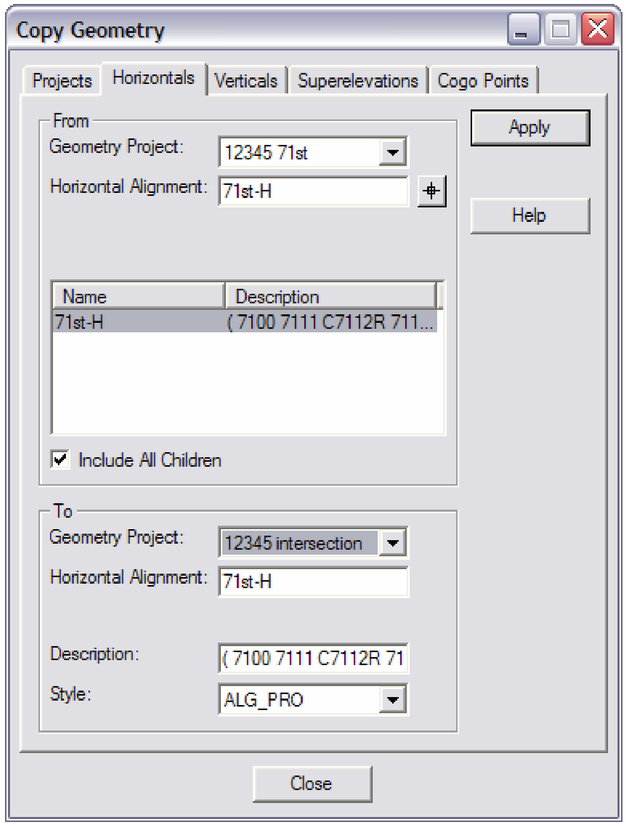
1. Select **Geometry > Copy Geometry.**
2. Select the **Horizontals** tab.
3. In the **From** section:
   - Set **Geometry Project** to **12345 SH52.**
   - Select the **Target Button** next to **Horizontal Alignment** and **<D>** on the **SH52-H** alignment.
   - Toggle **on Include children** (to copy the verticals).



4. In the **To** section, set **Geometry Project** to **12345 intersection.**
5. **Apply.**

6. In the **From** section:

   - Set **Geometry Project** to **12345 71st.**
   - Select the **Target Button** next to **Horizontal Alignment** and **<D>** on the **71st-H alignment.**
   - Toggle **on Include children** (to copy the verticals).

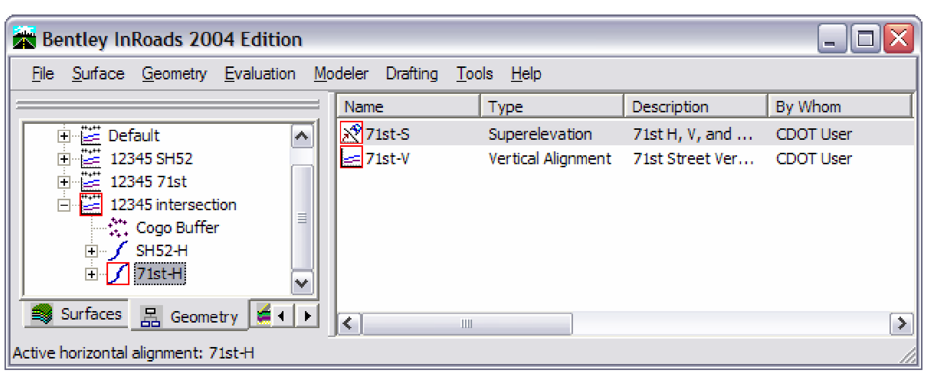


7. In the **To** section, set **Geometry Project** to **12345 intersection.**

8. **Apply.**

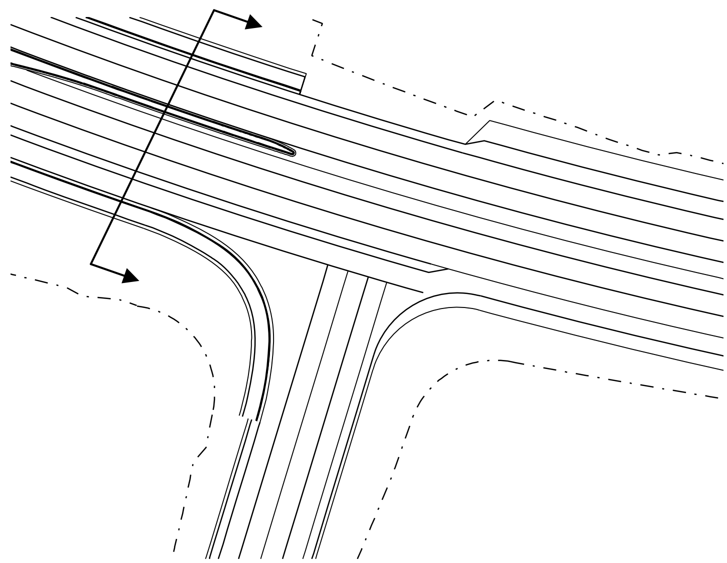
9. **Close** the dialog box.

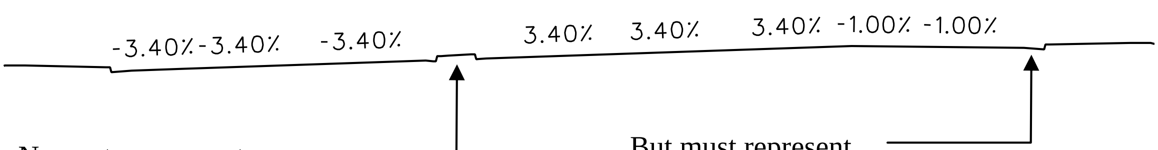
   You now have **SH52-H** and **71st-H** in the intersection geometry project.



Create Horizontal and Vertical for SW return

For the returns, you will use a different method for the SW and SE quadrants. For the SW, you will use the **Multi-Center Curve** command to create a three-centered curve. This command creates a horizontal and a vertical alignment for the return, which you can modify, if necessary (for drainage, for example). You can then either generate a feature directly from the alignments or run **Modeler** to create features.





New return geometry will be based on CL horizontal and verticals …

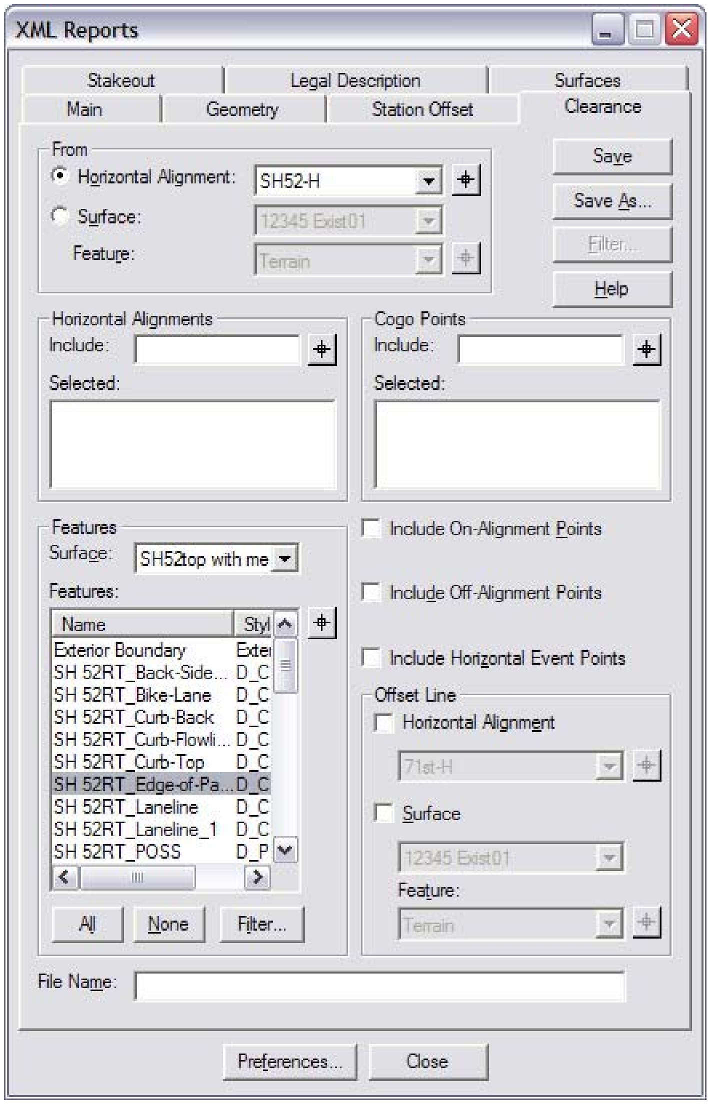
But must represent horizontal and vertical of edge.

You will be creating the return geometry at the edge of pavement. However, this command uses the intersecting horizontal and vertical alignments to create the new geometry. Therefore, you need to find out **either** the cross slope from the centerline to the edge of pavement, **or** the vertical difference from the centerline to the edge of pavement.

Typically, the cross slope might be the easiest to determine. However, SH52 is in a 3.4% super, and the edge of pavement is at the end of the turn lane, which has a -1% cross slope. Therefore, you will need to use a vertical difference. You have a similar situation on 71st, since the two left lanes are at different cross slopes as they approach SH52.

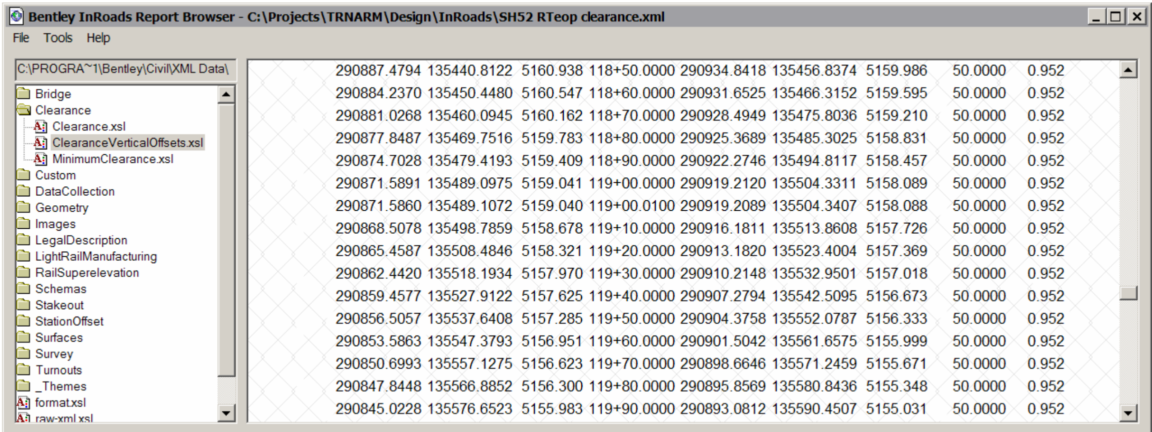
One method of finding this information is by using a report to determine the vertical difference between the alignment and the feature.

1. Select **Tools > XML Reports**.



2. Choose the **Clearance** tab.
3. Set the **From Horizontal Alignment** to **SH52-H**.
4. In the **Features** category, set the **Surface** to **SH52 top w medians**.
5. Highlight the feature **SH 52RT_Edge-of-Pavement**.

6. Choose **Save** (or **Save As**) and key in a name ***SH52 RTeop clearance***



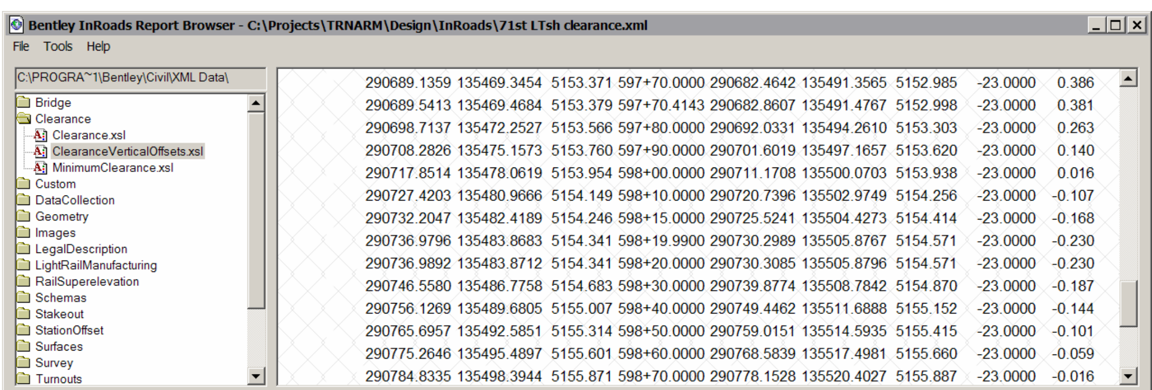
When you Save, the report automatically appears. The format, however, is not exactly what you need.

7. On the left of the **Report Browser** dialog, choose the format **ClearanceVerticalOffsets.xsl**.

8. To increase the number of decimals on the offset, choose **Tools > Format Options** and set the **Elevation** to **3** decimals.

9. Scroll down in the report to the area approaching the intersection, stations 117+00-119+00 and note the vertical difference in the far right column. It should read 0.952 at an offset of 50'.

10. Repeat the procedure to determine the vertical difference for the Left Shoulder of 71st Street. You know the return will meet the shoulder at approximately station 598+50, so you can see from the report that the vertical difference at that point is -.101 and the offset is 23'.



11. Select **Geometry > Utilities > Multicenter curve.**

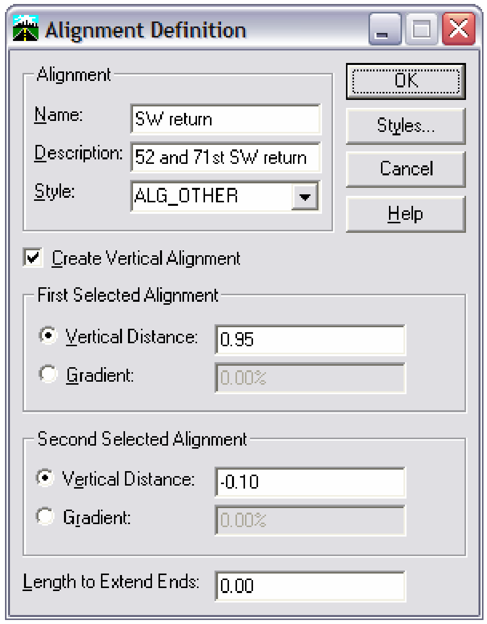
12. Set **Curve Type** to **Three Center.**

13. Set **Define By** to **Offsets at PCC/PCC.**

14. Select **Alignments.**

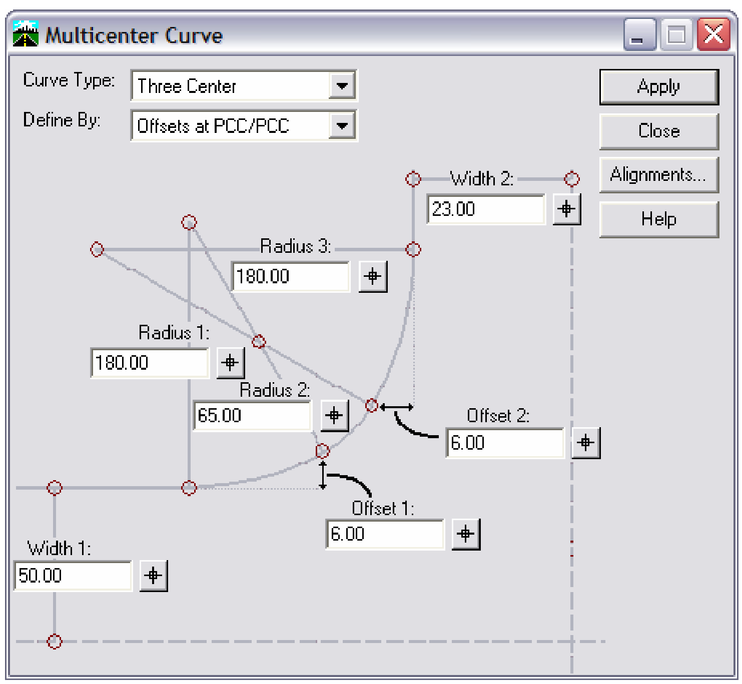
15. In the **Alignment Definition** box:

    - In the **Name** field key in ***SW return***
    - In the **Description** field, key in ***SH52 and 71st SW return***
    - Toggle **on Create Vertical Alignment.**
    - Set the other options as shown.

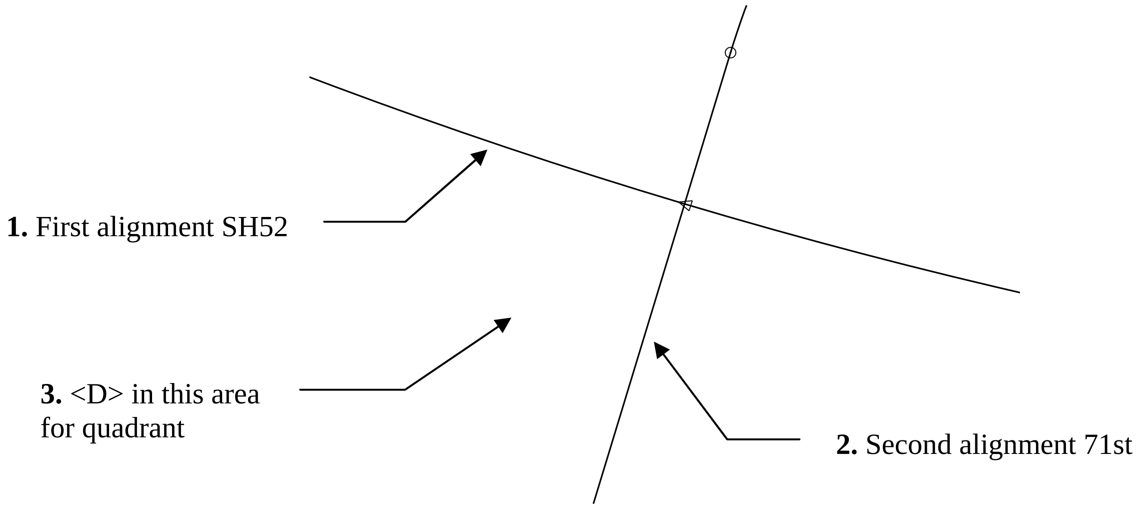


    - Select **OK.**

16. Set the **Widths**, **Radii** and **Offsets** as shown.

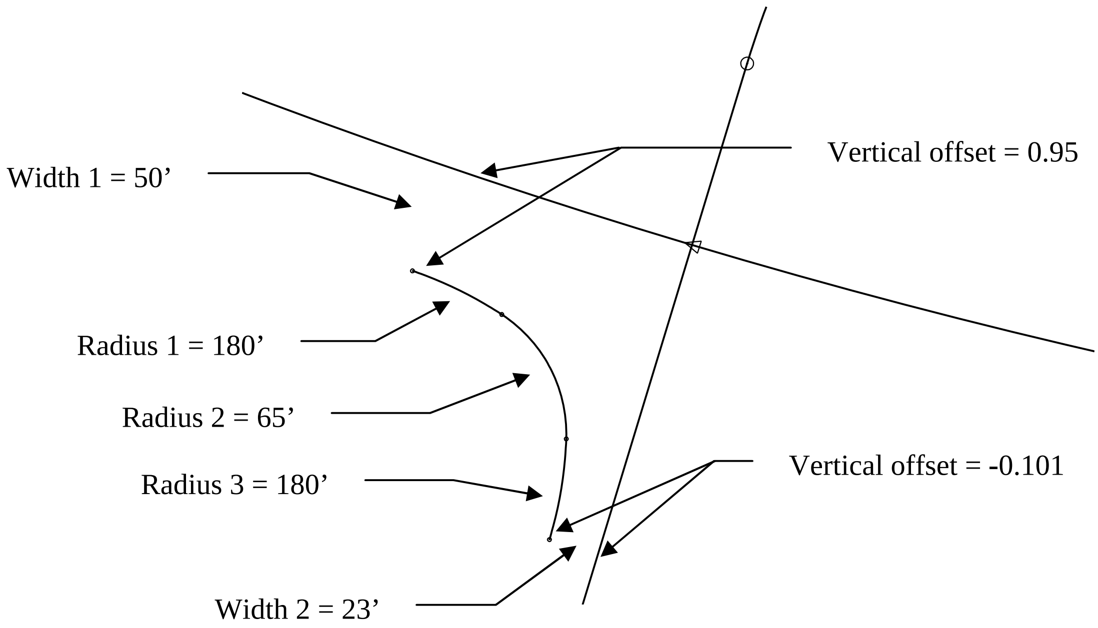


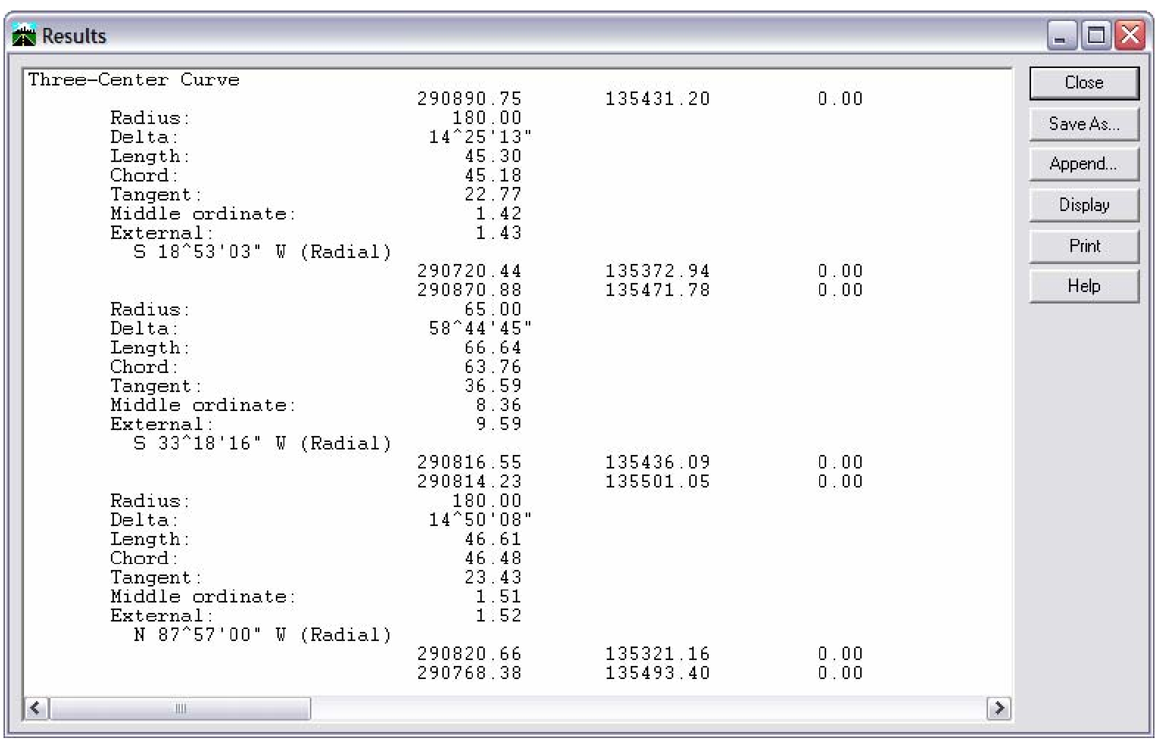
17. **Apply** the command.



18. When prompted **<D>** to identify **SH52** as the first alignment.
19. When prompted **<D>** to identify **71st** as the second alignment.
20. When prompted **<D>** to define the **SW quadrant** for the return.
21. **<D>** to accept.

The return alignment is created and plotted in the design file.



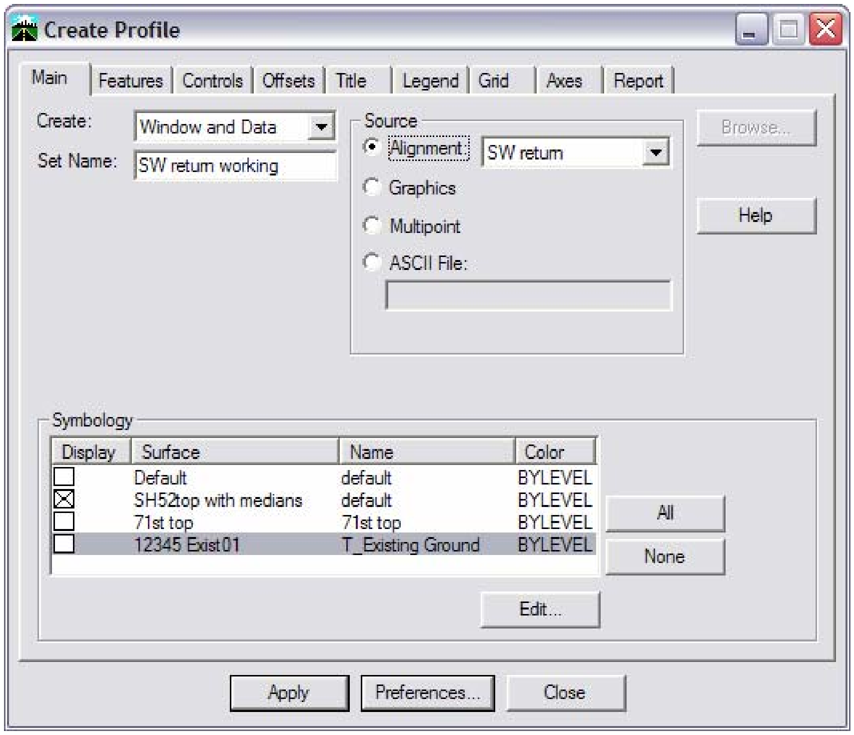


22. Save geometry project (Select **File > Save > Geometry Project**).

Create a profile of the new horizontal

Next, you'll profile the return alignment and show the existing, SH 52 and 71st street surfaces.

1. Select **Evaluation > Profile > Create Profile.**

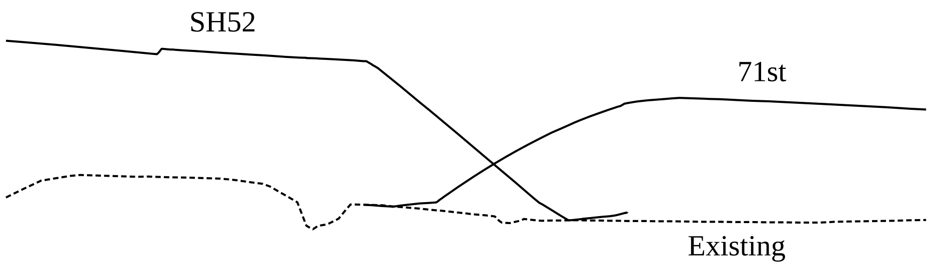


2. Select **Preferences**, highlight the **2x Vertical** preference, then **Load.**

   On the **Main** tab:

   - Verify that **Alignment** is **SW return.**
   - Key in a **Set Name** of ***SW return working***
   - Toggle **on** the surfaces **12345Exist01, SH52 top w medians** and **71st top.**

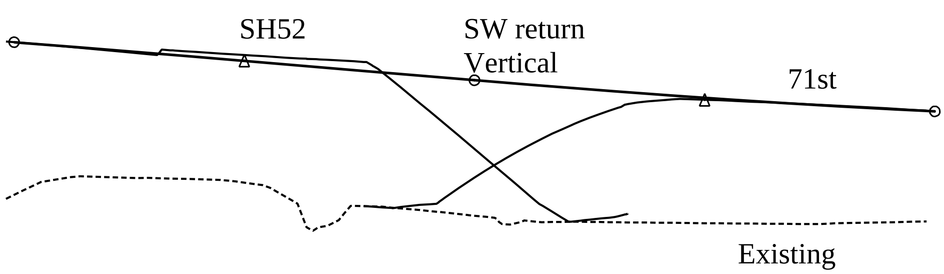
3. **Apply** and then **<D>** for the location of the lower left corner of the profile.



Display vertical alignment

1. Select **Geometry > View > Active Vertical.**

   At this point, if you need to, you can make changes to the vertical alignment for drainage requirements, etc. Any of the vertical alignment editing tools can be used.



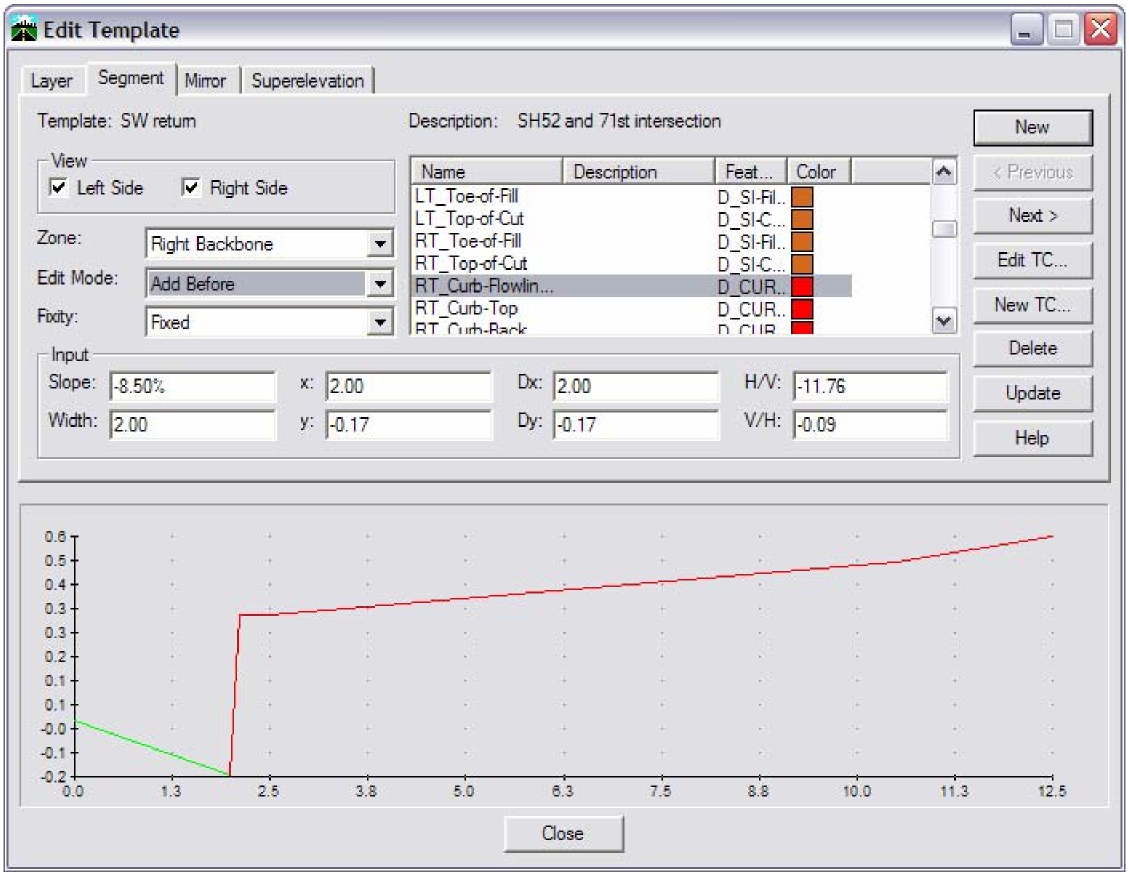
Save the intersection geometry project

1. Select **File > Save > Geometry Project.**

   Since you have a horizontal and vertical alignment, you can run a template to create the curb and gutter through the return.

Review the SW return template

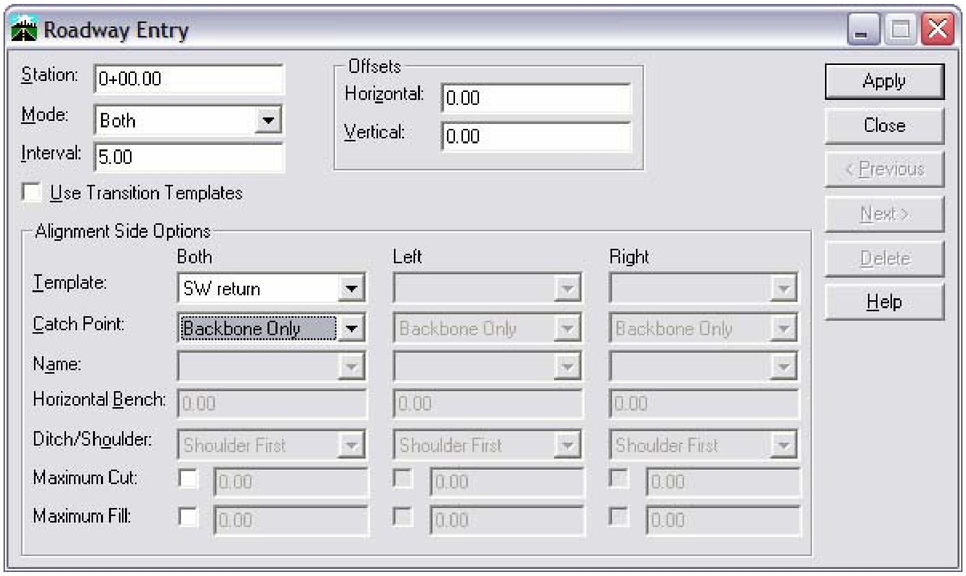
1. Select **Modeler > Define Typical Sections**.
2. Highlight and Edit **SW return**.



Notice it is a template consisting only of the segments from the gutter out, with no cut and fill. This return consists of such a combination of a tight return and long enough fill slopes that if you model the fill slopes coming from this template, they would overlap before tying into the existing ground. Therefore, you will model Backbone Only and use another method to join the Toes-of-Fill.

Create a Roadway Library

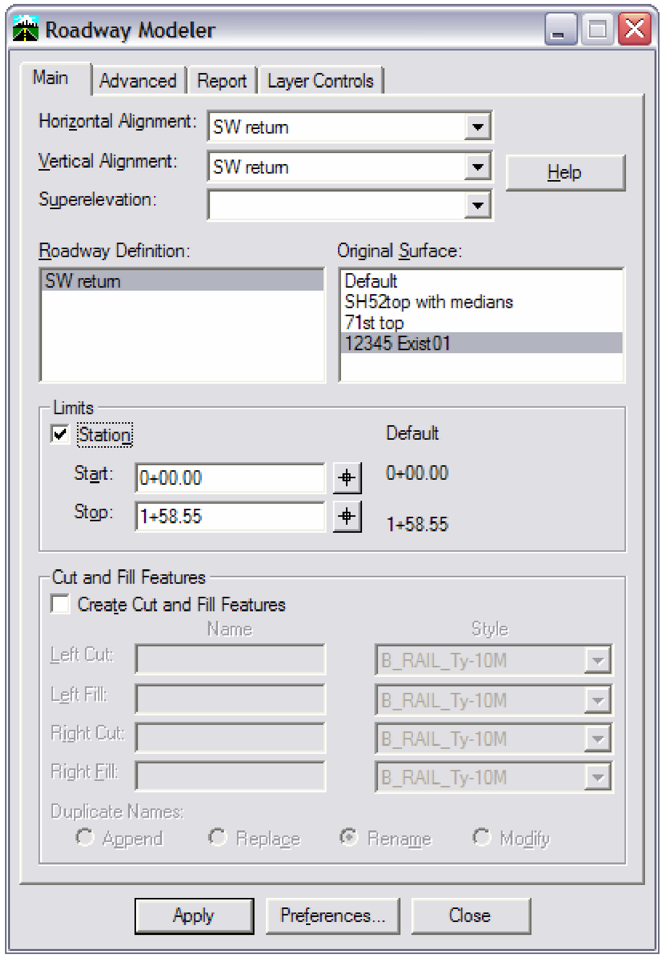
1. Create a roadway library and a roadway definition to run **Modeler** for the return. Set the **Interval** to ***5*** and the ***Catch Point*** to ***Backbone Only***.



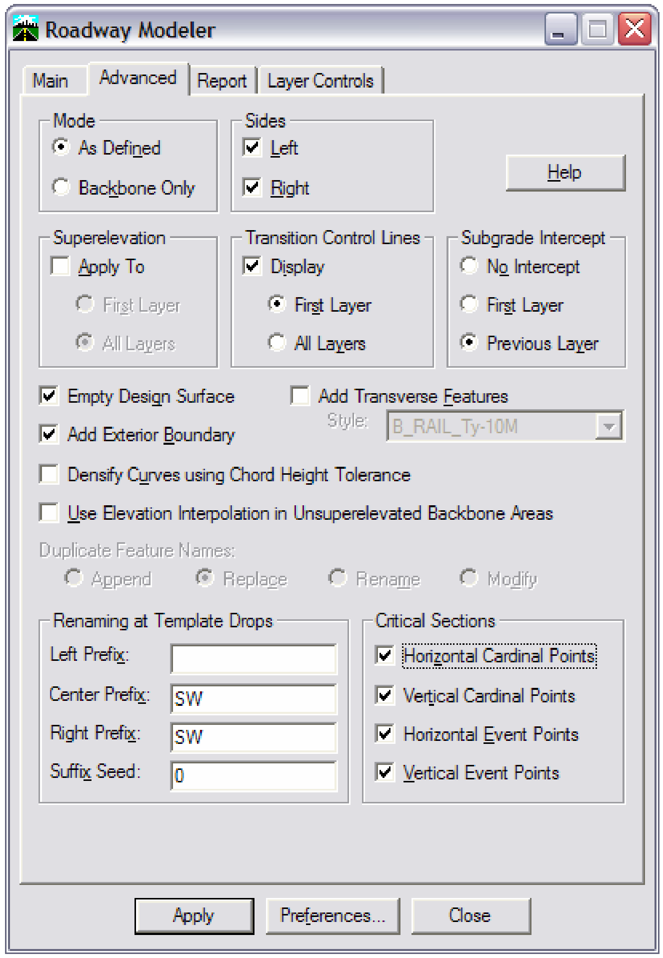
Model the return

1. Select **Modeler > Roadway Modeler**.

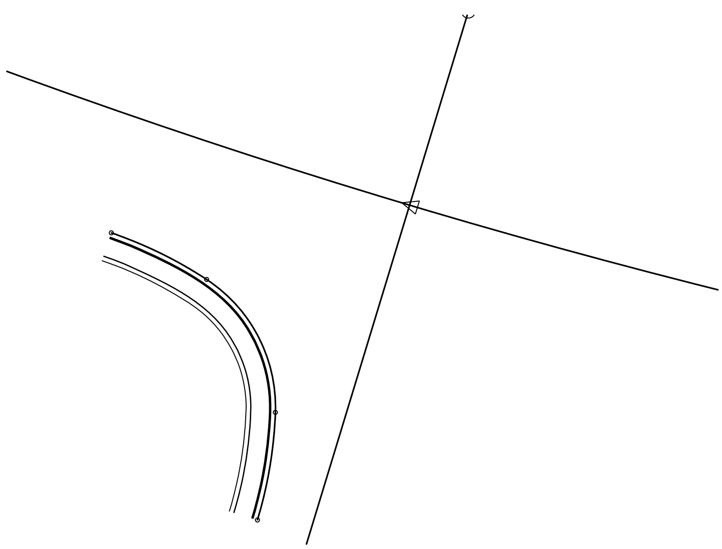
2. Set the **Main** tab as shown:



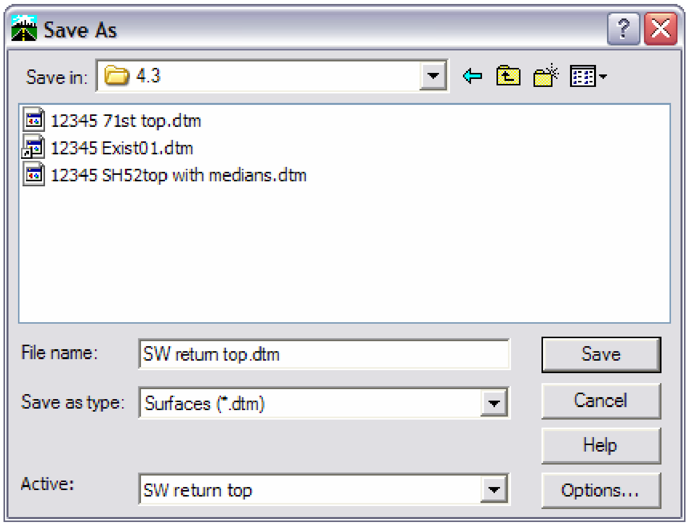
3. Set the **Advanced** tab as shown



4. **Apply**.



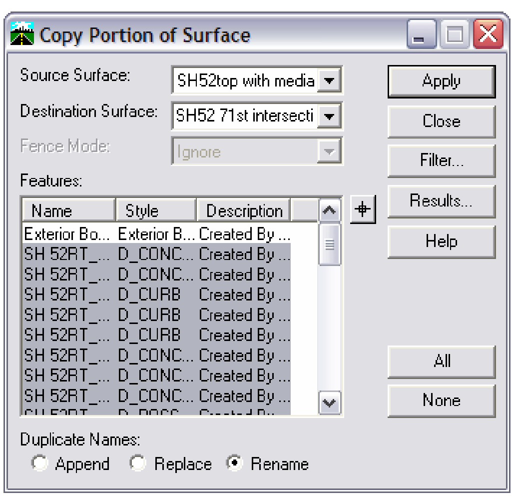
5. **Save** the **SW return top** surface.



Combine features from Modeler run on return with other surface

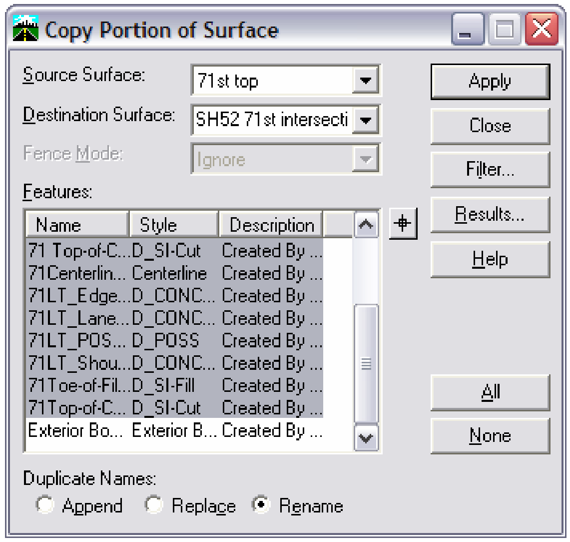
You have now modeled SH52, 71st Street and the SW return. The rest of the process of creating the intersection will be handled using feature editing tools, so the next step is to combine all of the models into one.

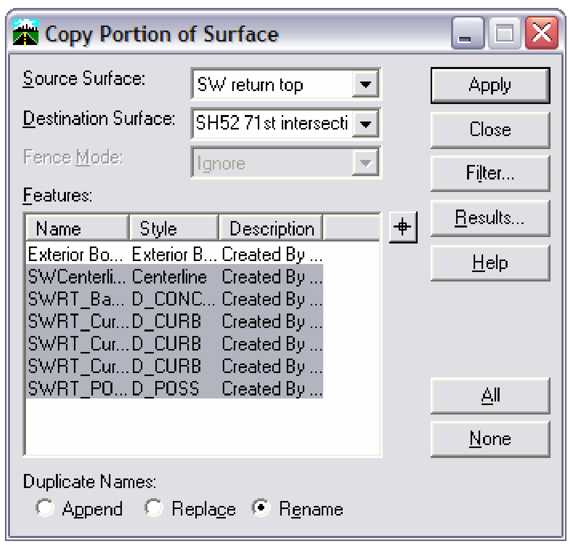
1. Select **Surface > Edit Surface > Copy Portion of Surface.**
2. Set **Source Surface** to **SH52 top w medians.**
3. Set **Destination Surface** to **SH52 71st intersection.**
4. Set **Duplicate Names** to **Rename.**
5. Toggle ***off*** the **Exterior Boundary**.



6. **Apply.**

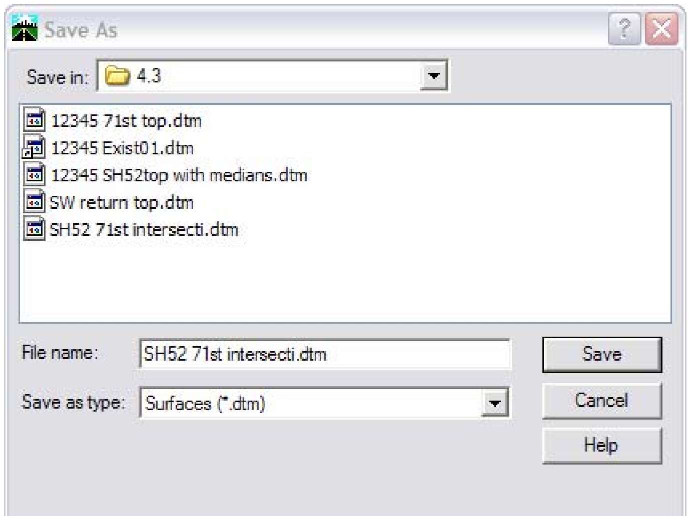
7. Repeat this process using the source of **71st ST top**, then the source of **SW return top**, making certain to toggle ***off*** **Exterior Boundary** each time.



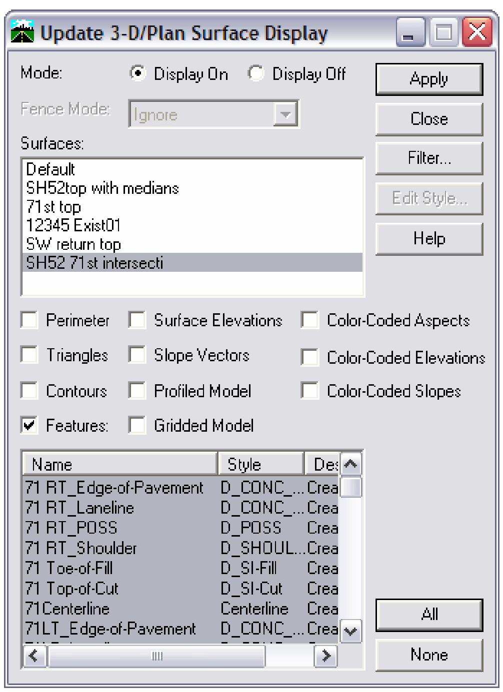


When done, all three surface should be combined into SH52 71st intersection.

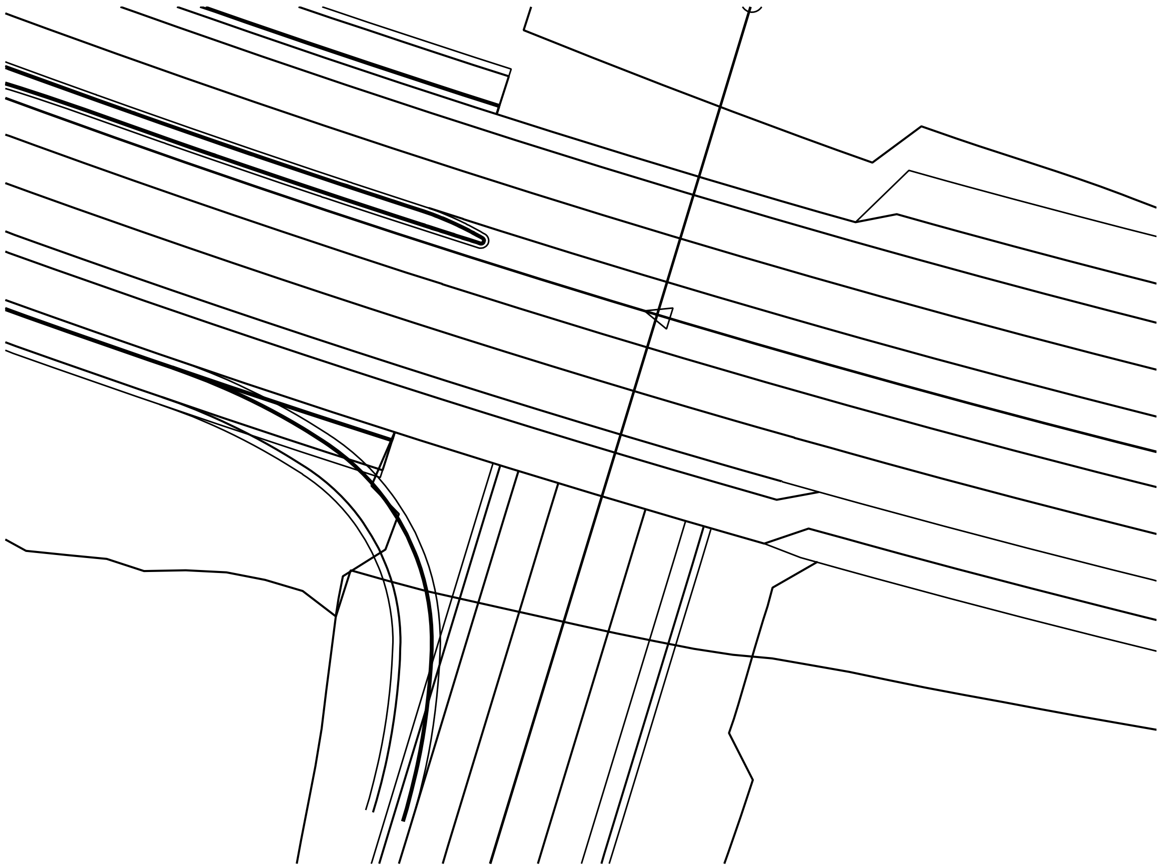
8. **Save** the new intersection surface.



9. Use MicroStation to **Delete** all of the feature graphics that are currently in your design file.
10. Select **Surface > Update 3D/Plan Display**.
11. Set the **Mode** to **Display On**.
12. Highlight the surface **SH52 71st intersection**.
13. Toggle ***on*** **Features**.
14. Select **All**.



15. **Apply**.



In lab 4.4, you will start with a set of files that matches what you just did, and from there complete the intersection.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

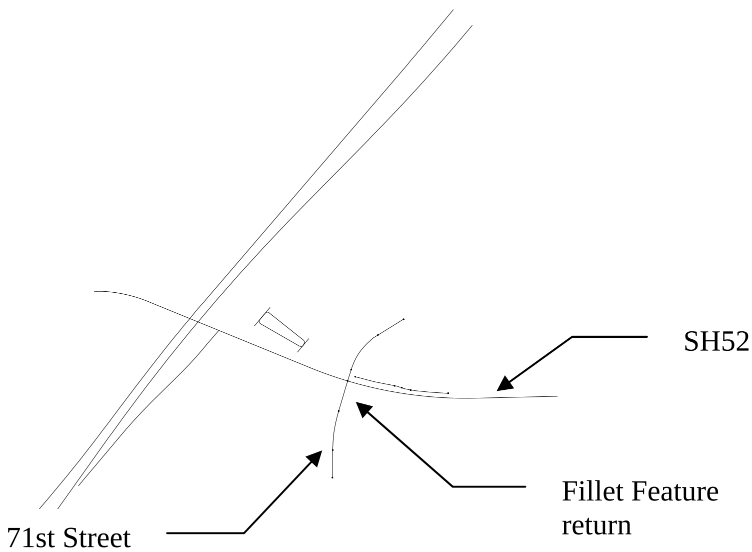
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 4.4 Creating Intersection returns using Fillet Features

In this activity, you will start with two roadways previously modeled – SH52 and 71st Street. These roadways have been combined, along with the DTM for the SW quadrant of the intersection. Starting from there, you will create features for the SE quadrant using **Fillet Features**.



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

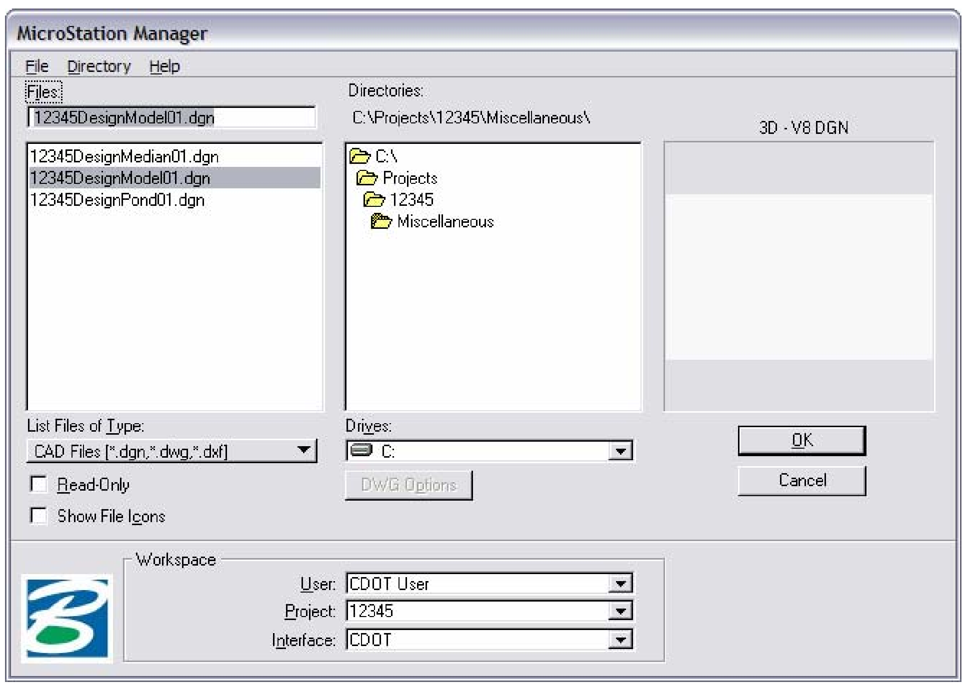
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK**.

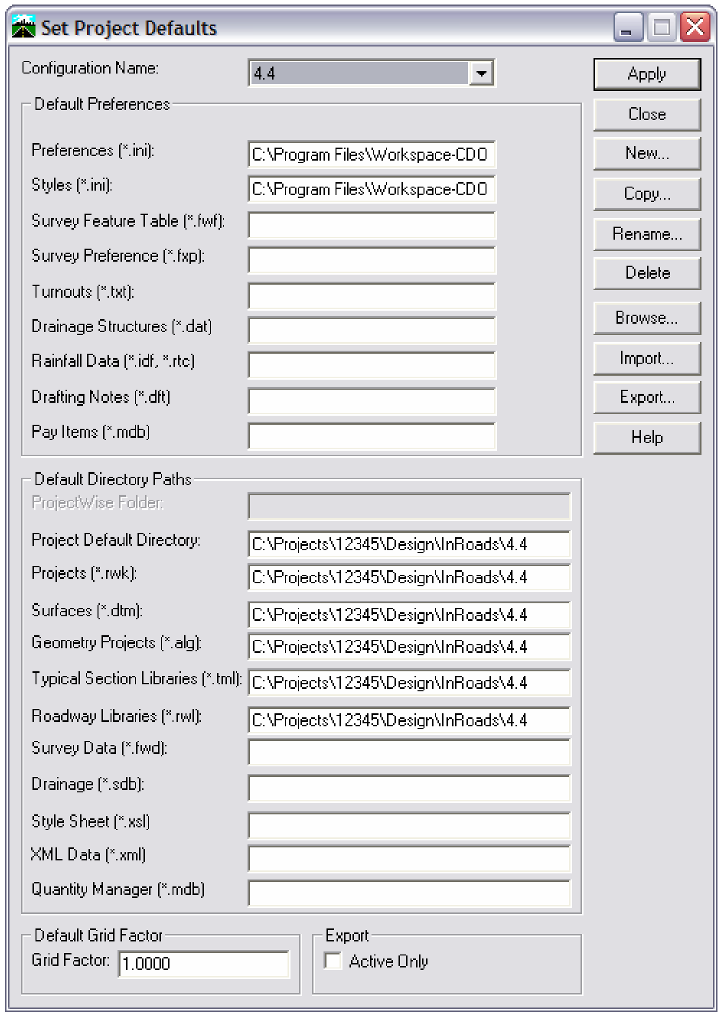
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **4.4**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load the SH52 & 71st intersection DTM

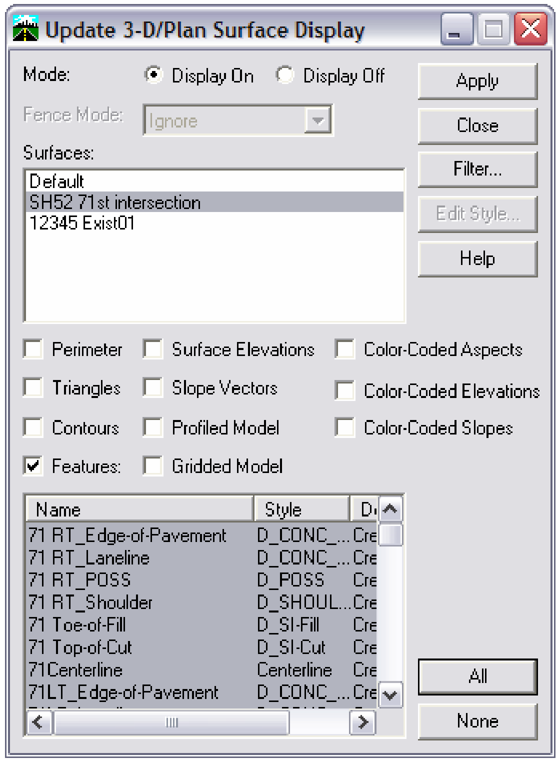
1. Select **File > Open**.
2. Set **File of Type** to **Surfaces (*.dtm)**.
3. Highlight **12345 SH52 71st intersection.dtm** and select **Open**.
4. ***Do not*** cancel out of the box.

Load the existing DTM

5. Highlight **12345 Exist01.dtm** and then select **Open**.
6. **Cancel** the **Open** dialog box.

View the features

1. **Select Surface >Update 3D/Plan Surface Display** and display all the features in the intersection surface.

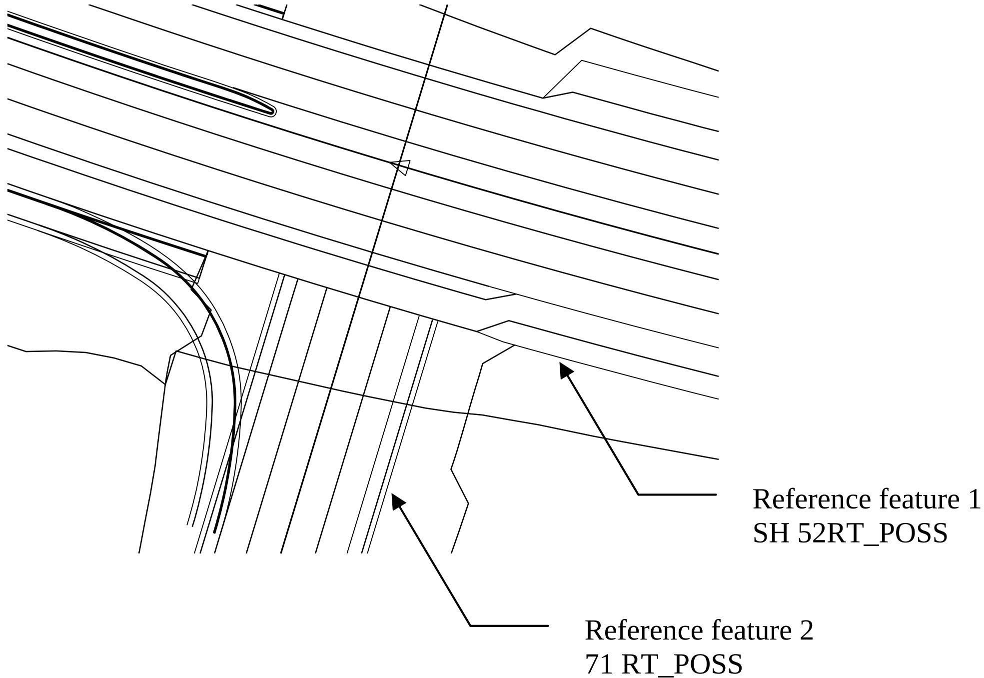


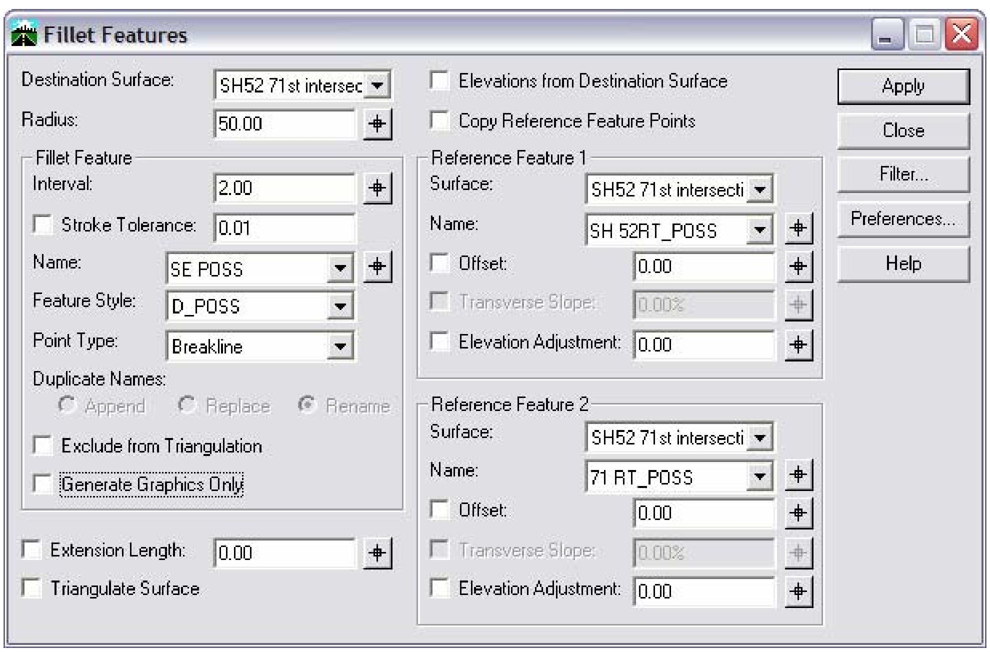
Model the SE return

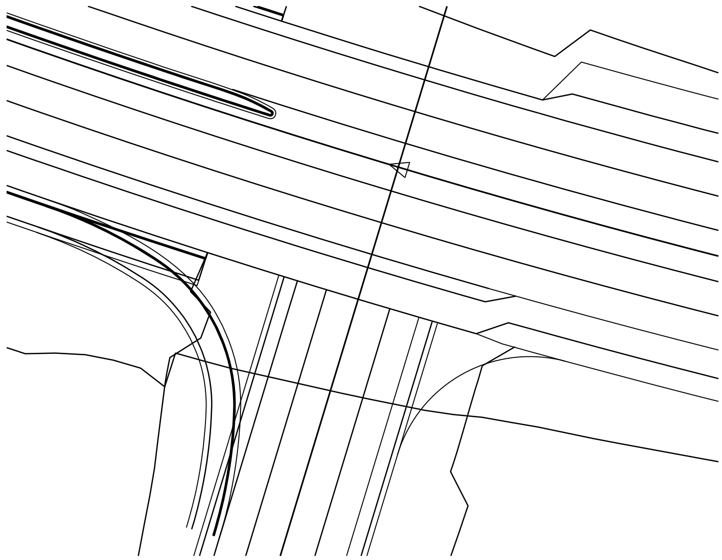
1. Ensure that **Write** lock is on in **Pencil** Mode.

2. Ensure that **Locate Feature/Locate Graphics** is set to **Locate Features**.

3. Select **Surface > Design Surface > Fillet Features**. Set the dialog as shown. Use the **target button** to graphically choose the features.



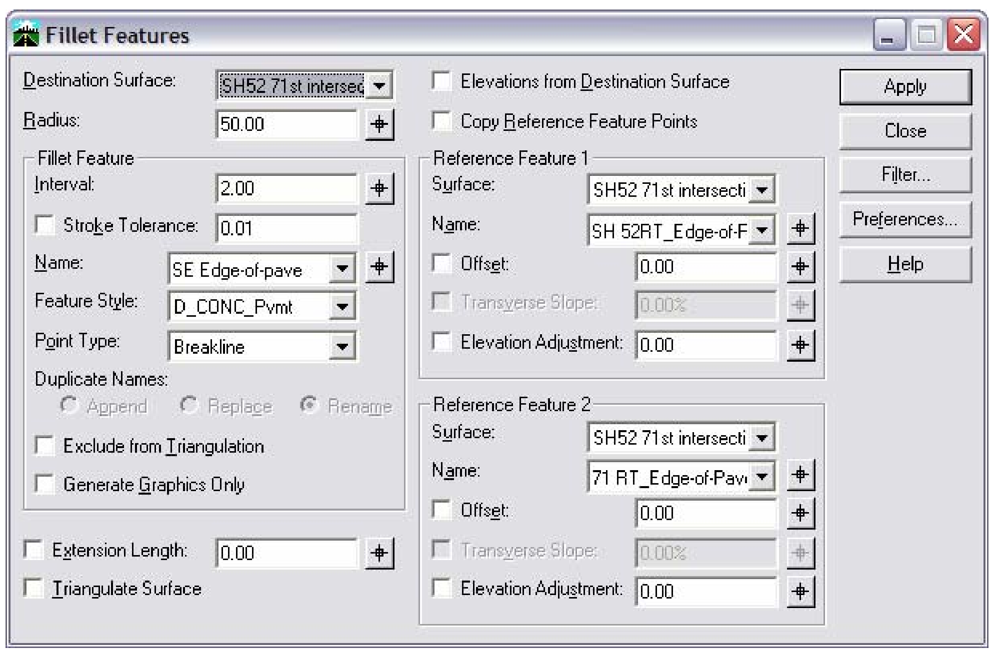




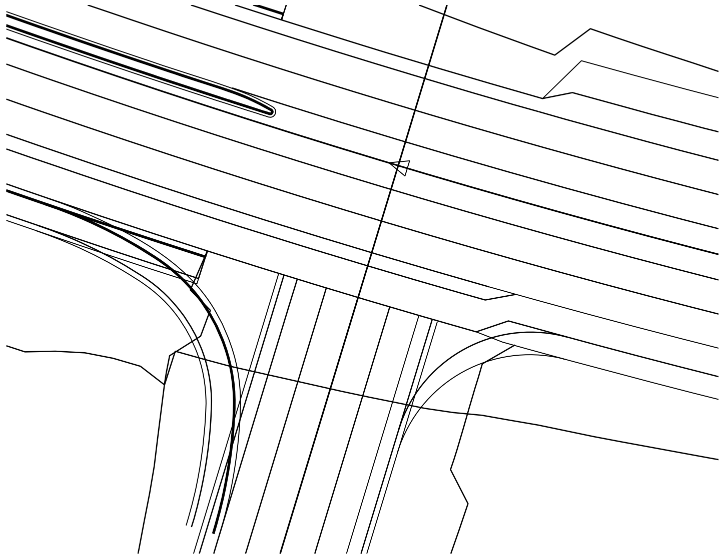
4. **Apply** and move your cursor to see the options for filleting the two POSS features.

   - When the fillet is in the quadrant you want, **<D>** to accept it.

5. Change the **Reference Features**, Feature **Name** and **Feature Style** as shown.

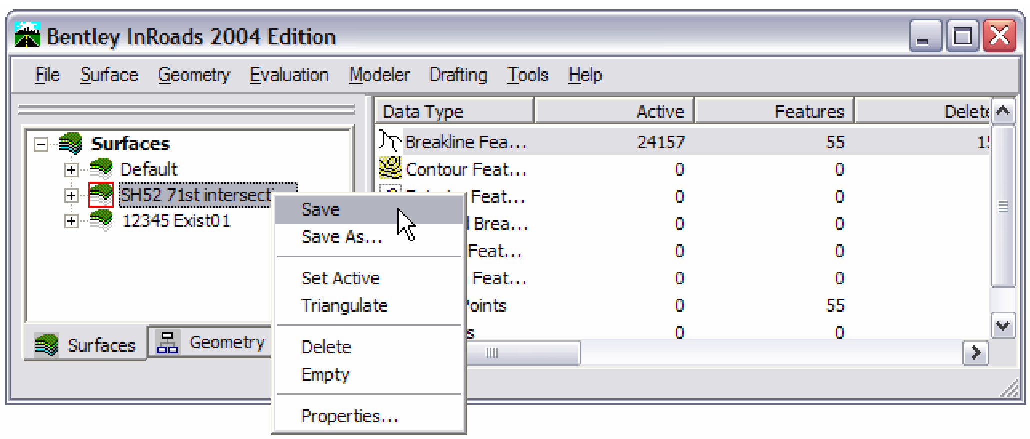


6. **Apply** and **Accept** with a **<D>** to fillet the Edges of Pavement.

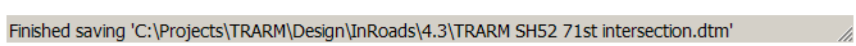


Save the Intersection Surface

1. Save the intersection surface by right-clicking it in the **Explorer** menu and selecting **Save**. You will need to choose the **Surfaces** tab first.



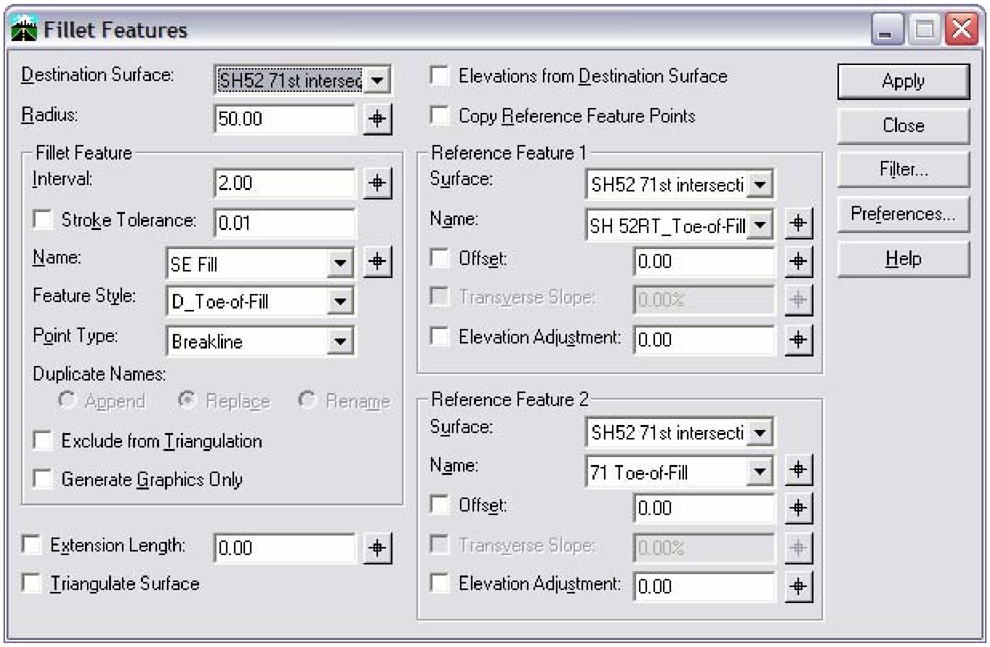
After choosing Save, the message will appear as shown below, letting you know the surface has been saved to the hard drive.

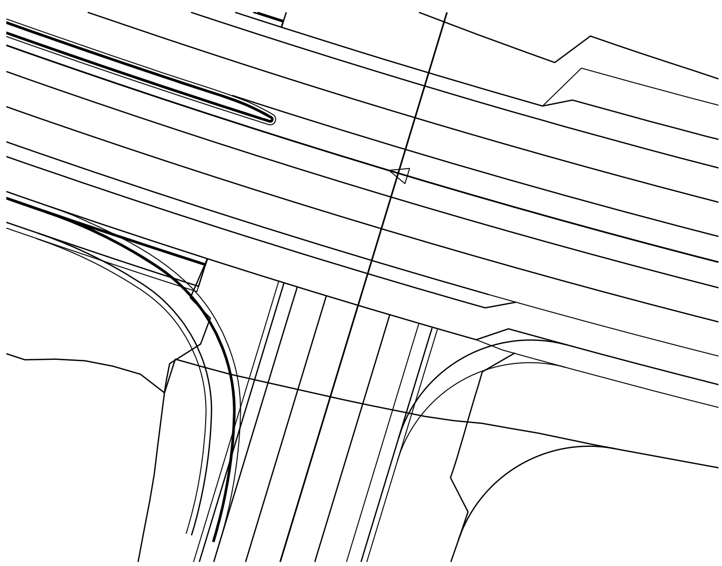


You can save your surface using this method at any time.

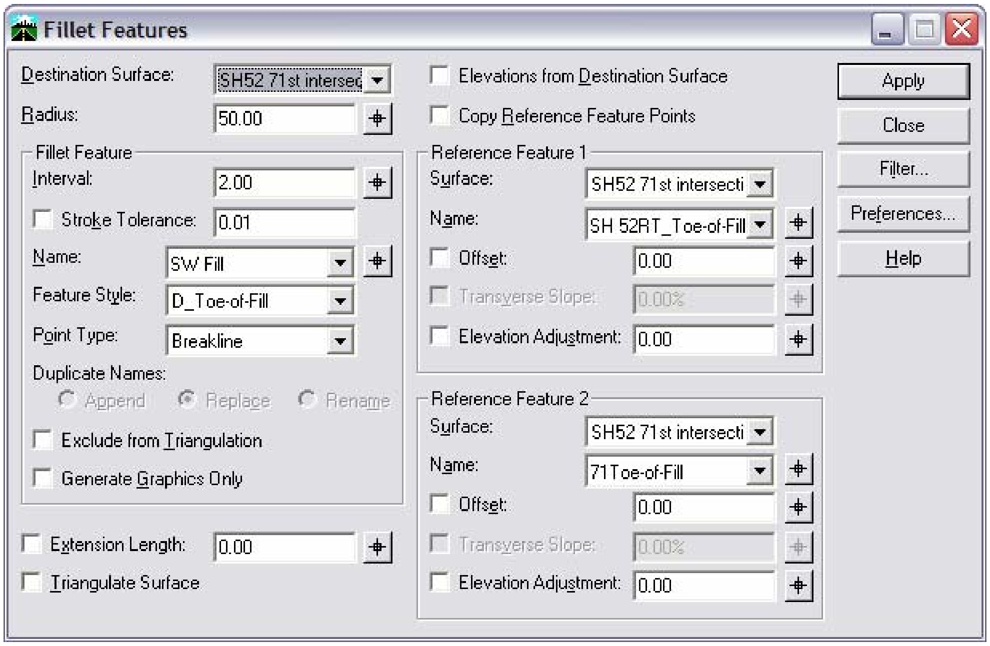
Model the Fill slopes

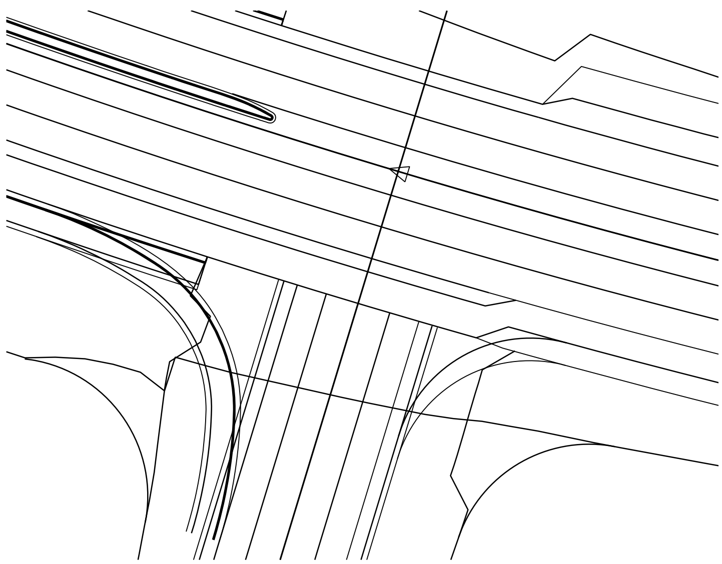
1. Continue using the **Fillet Features** command to fillet the fill slopes in the SE quadrant.





2. Repeat for the fill slopes in the SW quadrant.





3. Again, **Save** the intersection surface.

4. In the next lab, you will clean up the intersection.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

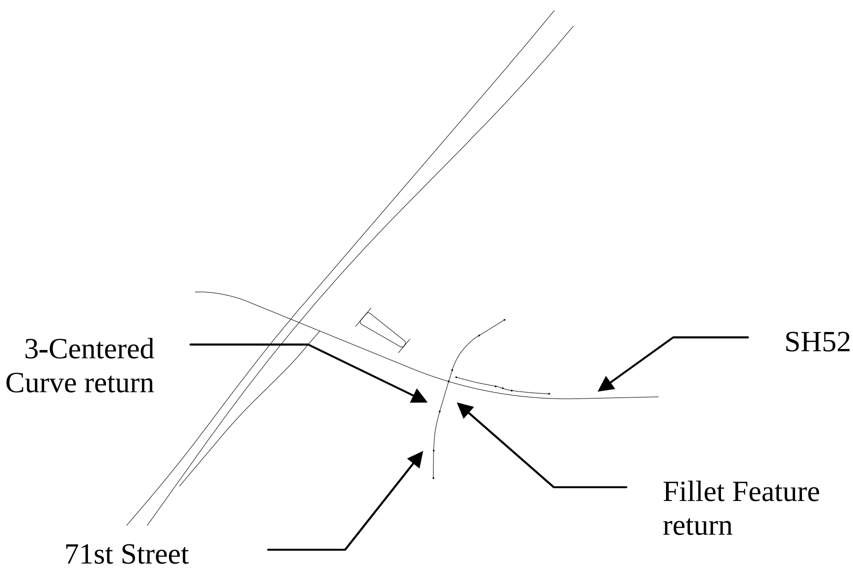
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 4.5 Cleaning up the Intersection

In this activity, you will start with a DTM that contains the features from SH52 top w medians, 71st top, SW Return top, and the features created with **Fillet Feature**. In effect, all features have been created that you need for the intersection, and you will now ‘clean up’ the features to form the completed model.



Start MicroStation InRoads

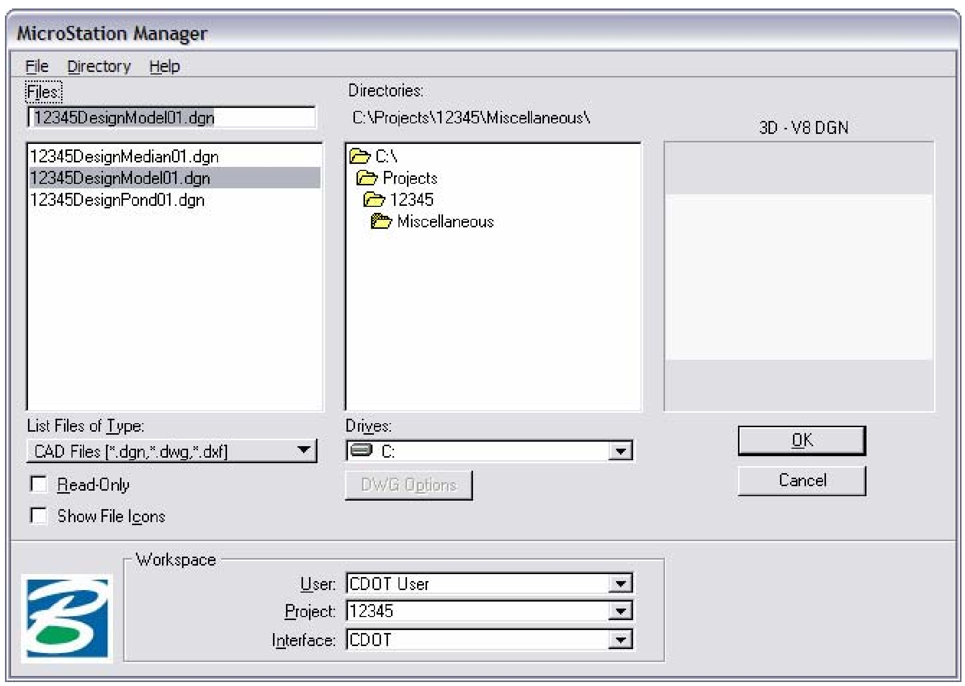
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Design\Working.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

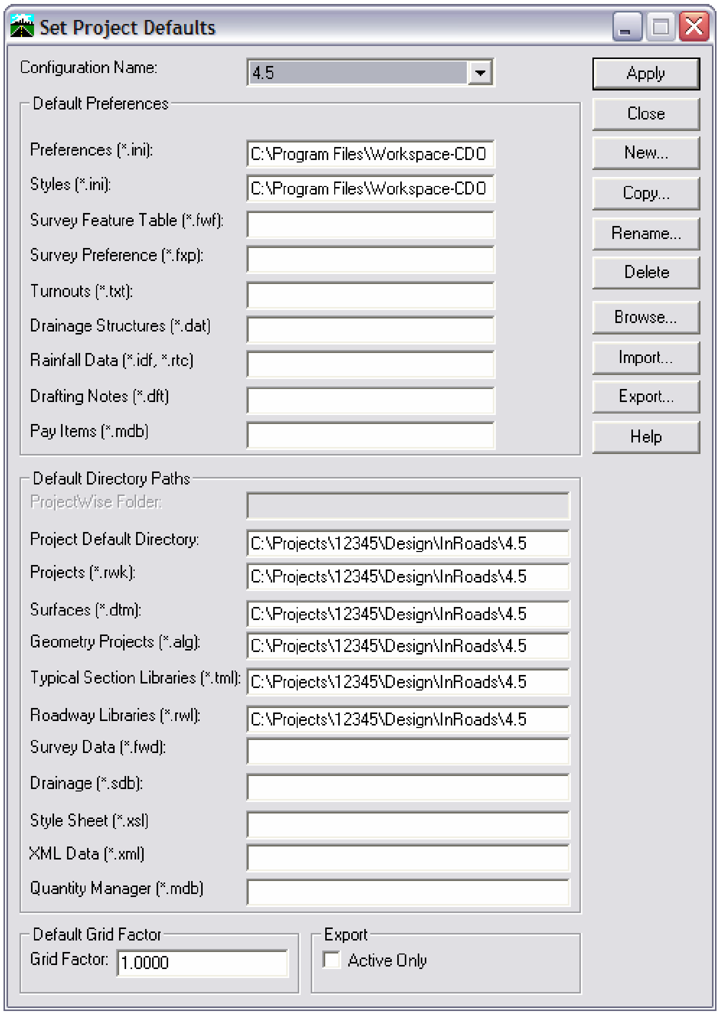
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **4.5**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load the SH52 & 71st intersection DTM

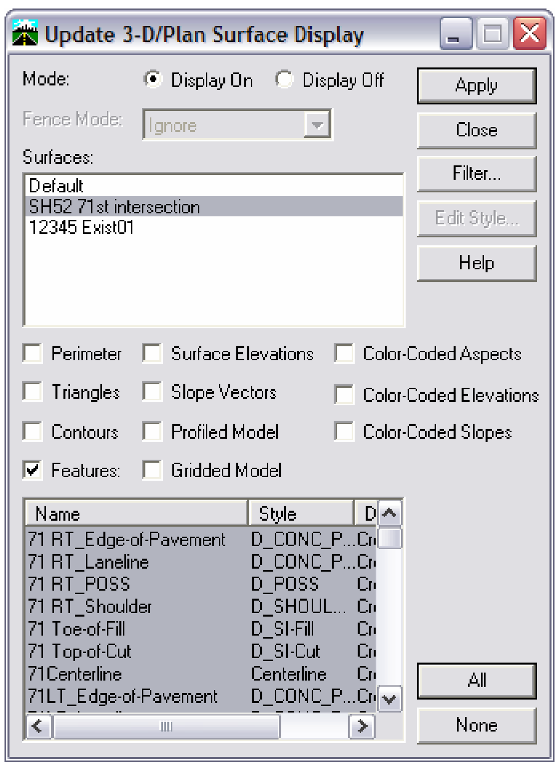
1. Select **File > Open**.
2. Set **File of Type** to **Surfaces (*.dtm)**.
3. Highlight **12345 SH52 71st intersection.dtm** and select **Open**.
4. ***Do not*** cancel out of the box.

Load the existing DTM

5. Highlight **12345 Exist01.dtm** and then select **Open**.
6. **Cancel** the **Open** dialog box.

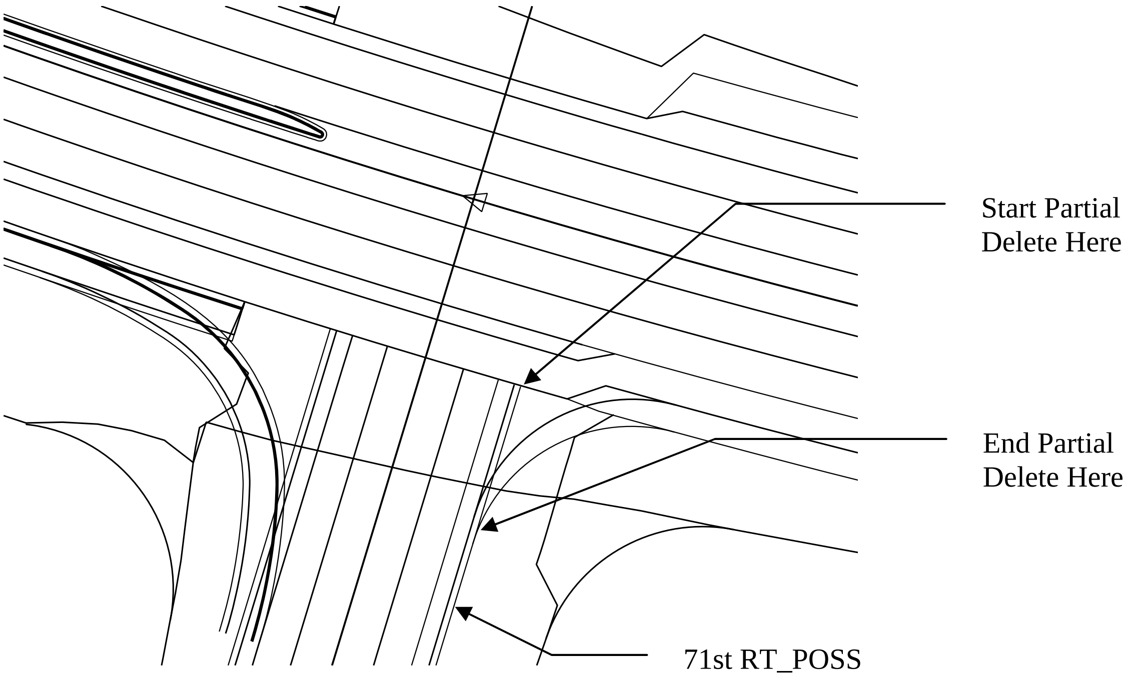
View the features in the intersection surface

7. **Select Surface > Update 3D/Plan Surface Display** and display all the features in the intersection surface.



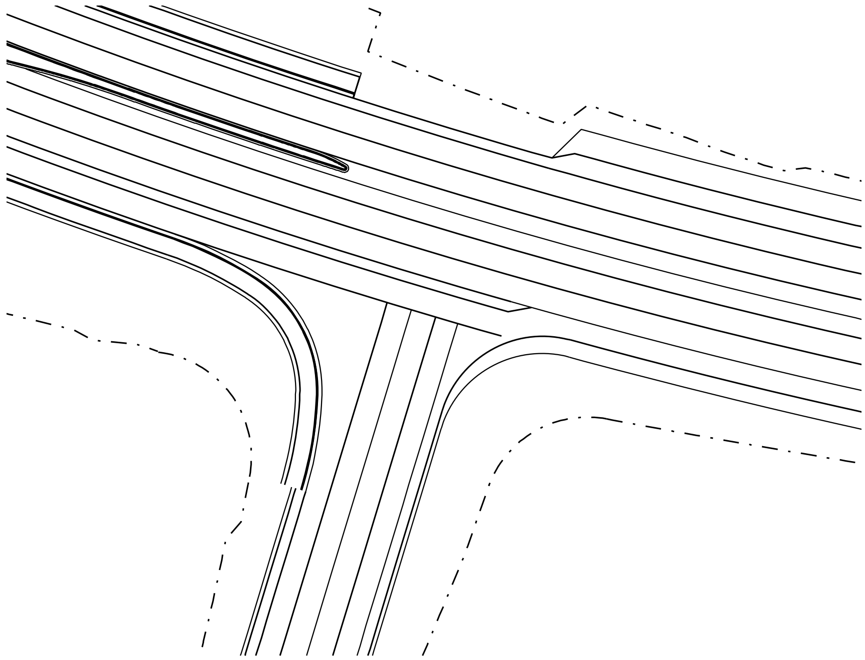
Clean up the features in the intersection

1. Select **Surface > Edit Surface > Partial Delete**.
2. Select the **71 RT_POSS** feature and **Accept** it (Read your prompts).



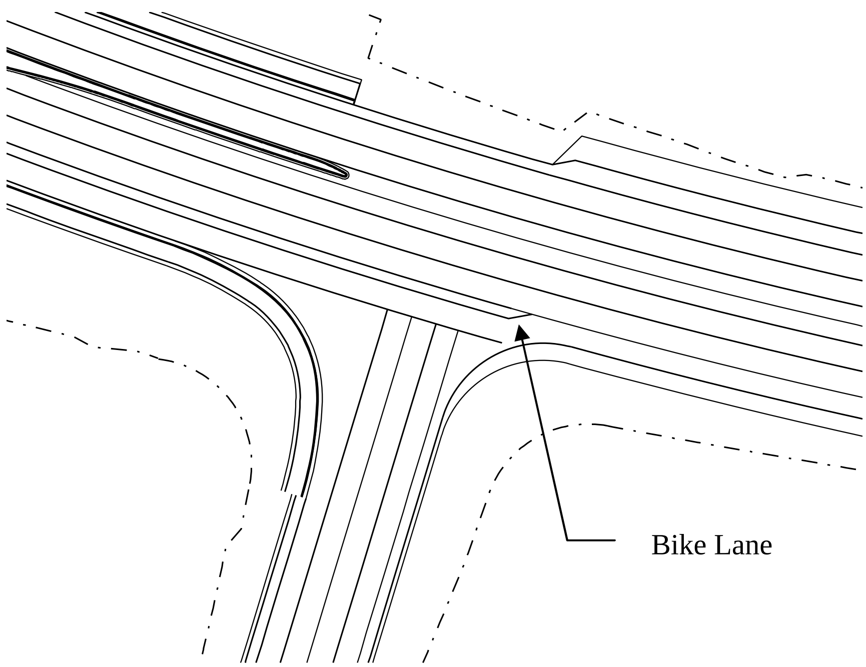
3. Track off the end of the feature and **<D>** to identify the **Starting Point**.
4. Snap to the 71st Street end of the POSS radius to identify the **Ending Point**.

5. Continue using **Partial Delete** to clean up all the features as shown.

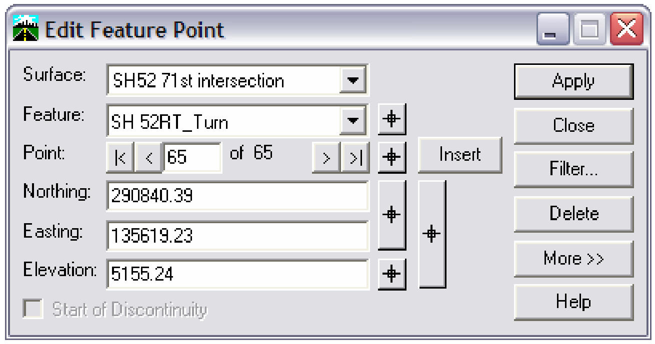


6. **Save** the intersection surface.

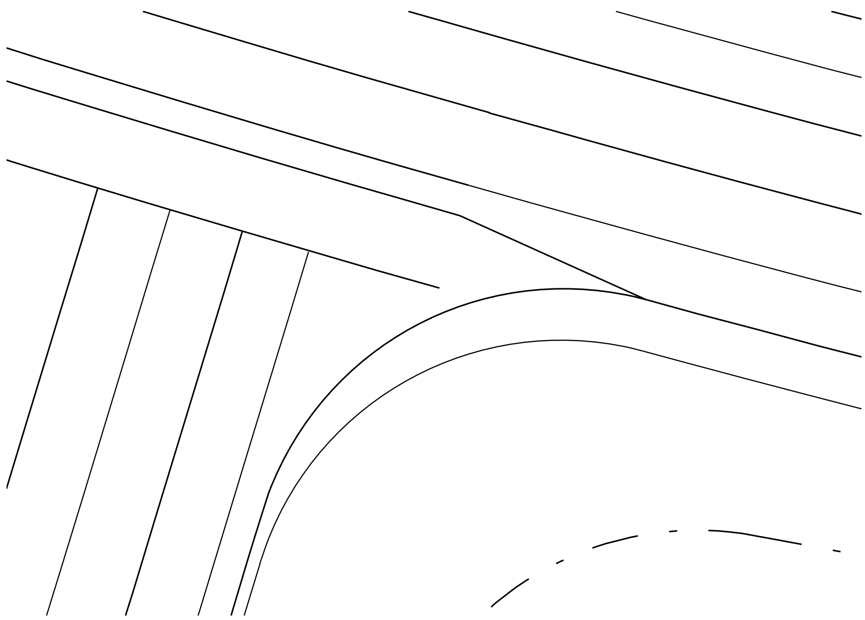
   Notice the Bike lane ends on the East side of the intersection. You would prefer that it transition into the shoulder, so you will next edit the feature to force the transition.



7. Select **Surface > Edit Surface > Edit Feature Point**.



8. Edit the **SH52RT_Turn** feature as by changing the coordinates of the end point.



9. **Save** the intersection surface.

Triangulate and review the surface

Next, you will triangulate the surface and review it to see if there are any problems. Since you have not yet created an exterior boundary, there will be triangles in all concave areas of the perimeter. Don't worry about those, just review the surface inside the perimeter for problems. The exterior will later be added to limit the trianglization.

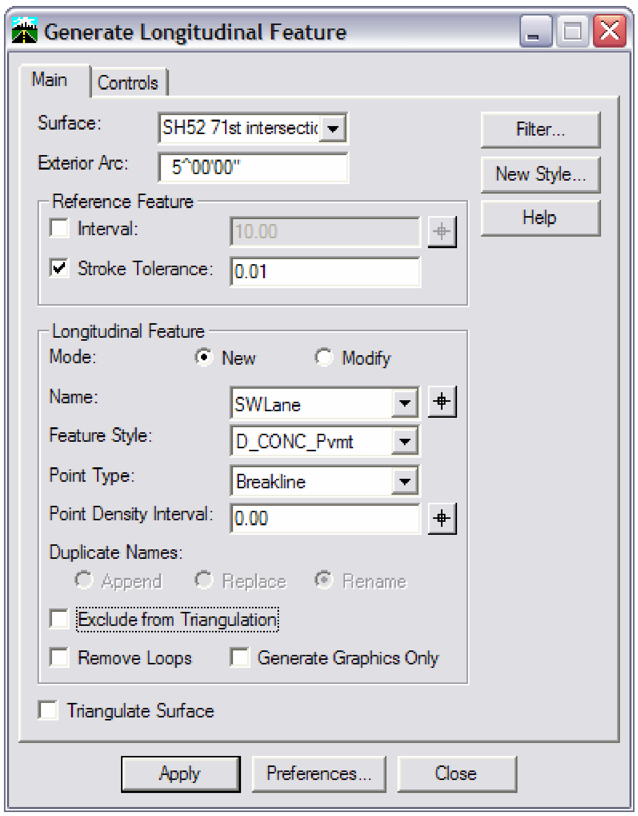
1. Triangulate the surface (**Surface > Triangulate**).
2. **Save** the intersection surface.

Use GLF to create taper between two different width lanes

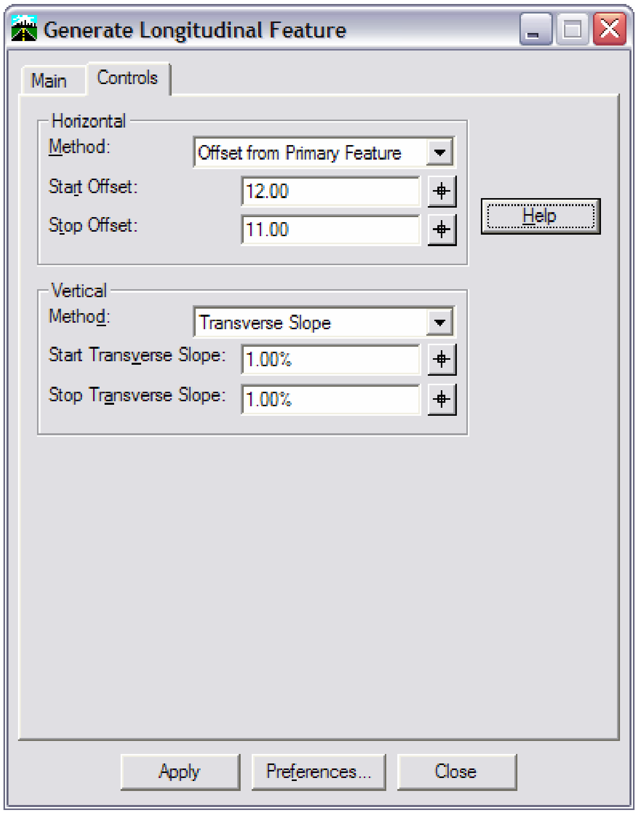
The right turn lane from SH52 onto 71st street transitions from a 12' lane to an 11' one. The goal is to hold the -1% cross-slope through the transition, so you will next add a breakline to further define the surface. Since you have the inside edge (SWCenterline), you can use **Generate Longitudinal Feature** to copy it while at the same time tapering the offset and maintaining the -1% slope.

1. Choose **Surface > Design Surface > Generate Longitudinal Feature**.

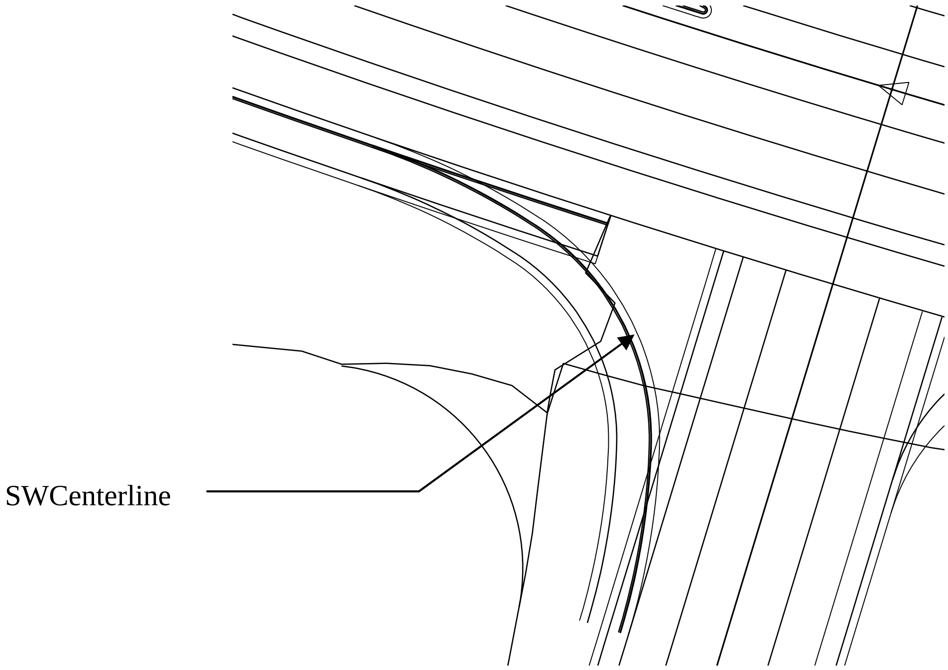
   - Select the **Main** tab and set the dialog as shown.



- Select the **Controls** tab and set the dialog as shown.



2. **Apply**, then **<D>** on the SWCenterline to Identify the **Primary Feature**.

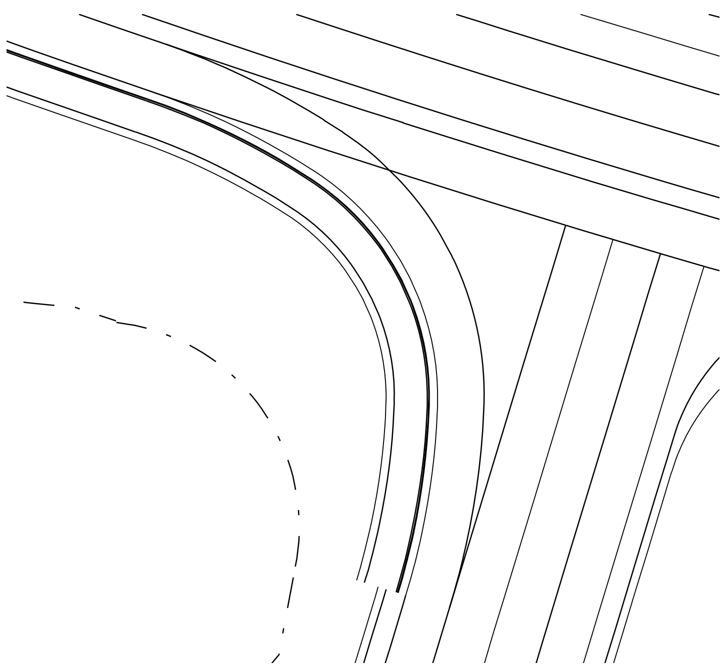


3. **<D>** again to **Accept**.

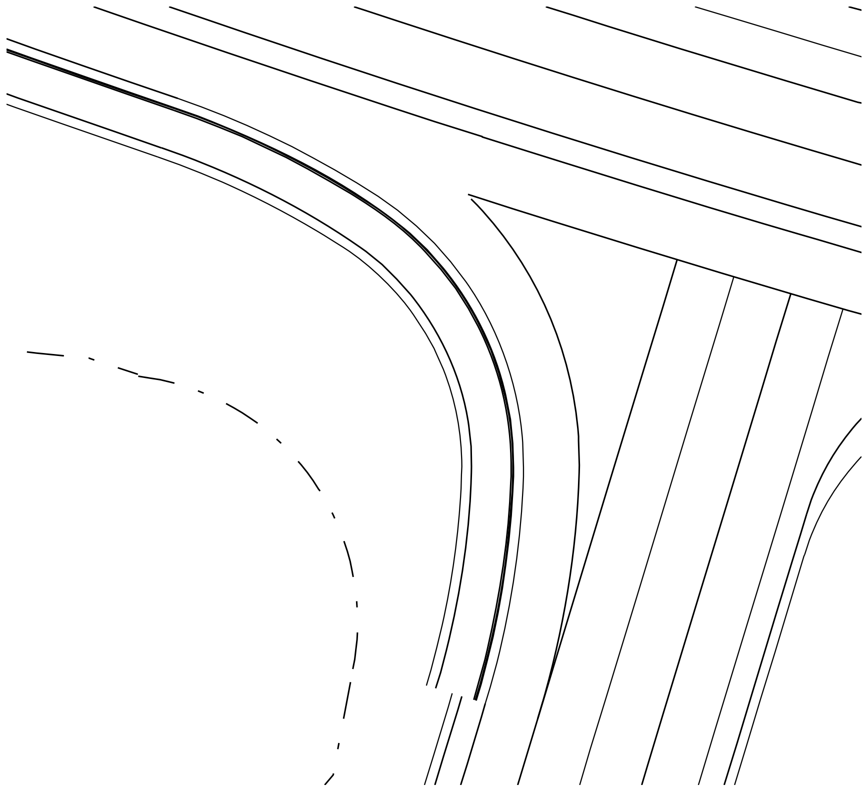
4. Repeat and identify the same feature as the **Reference**.

5. When prompted to **Identify Beginning/Reset for Entire**, **<R>** (right-mouse click) to copy the entire feature.

6. **<D>** to **Accept** the new feature on the intersection side.

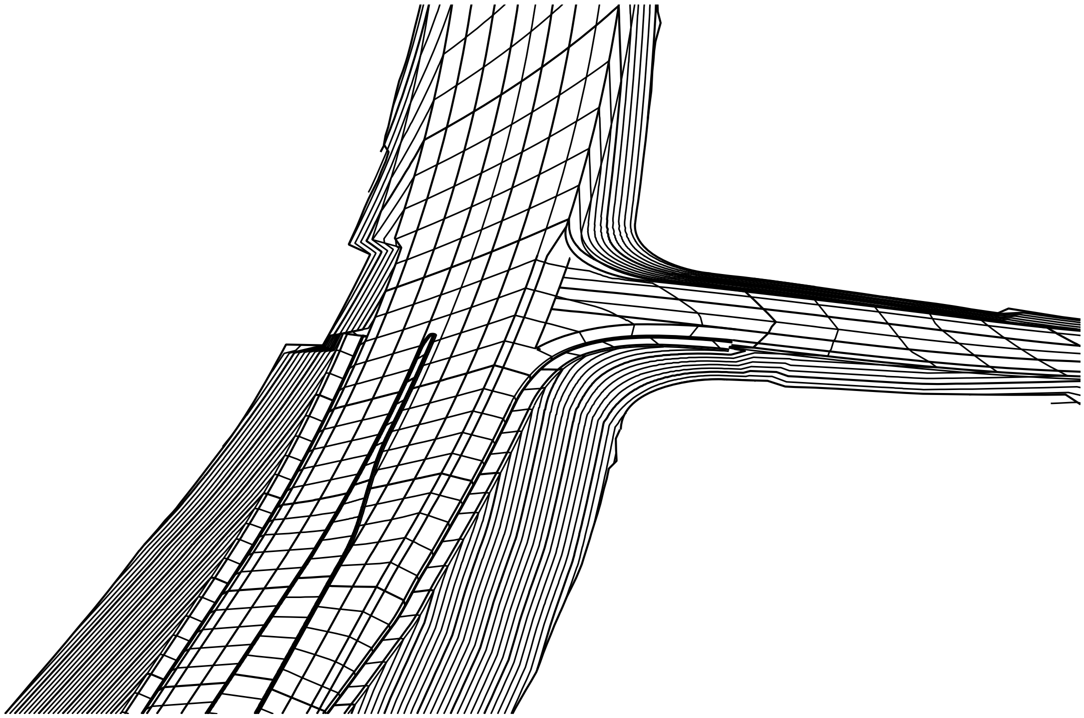


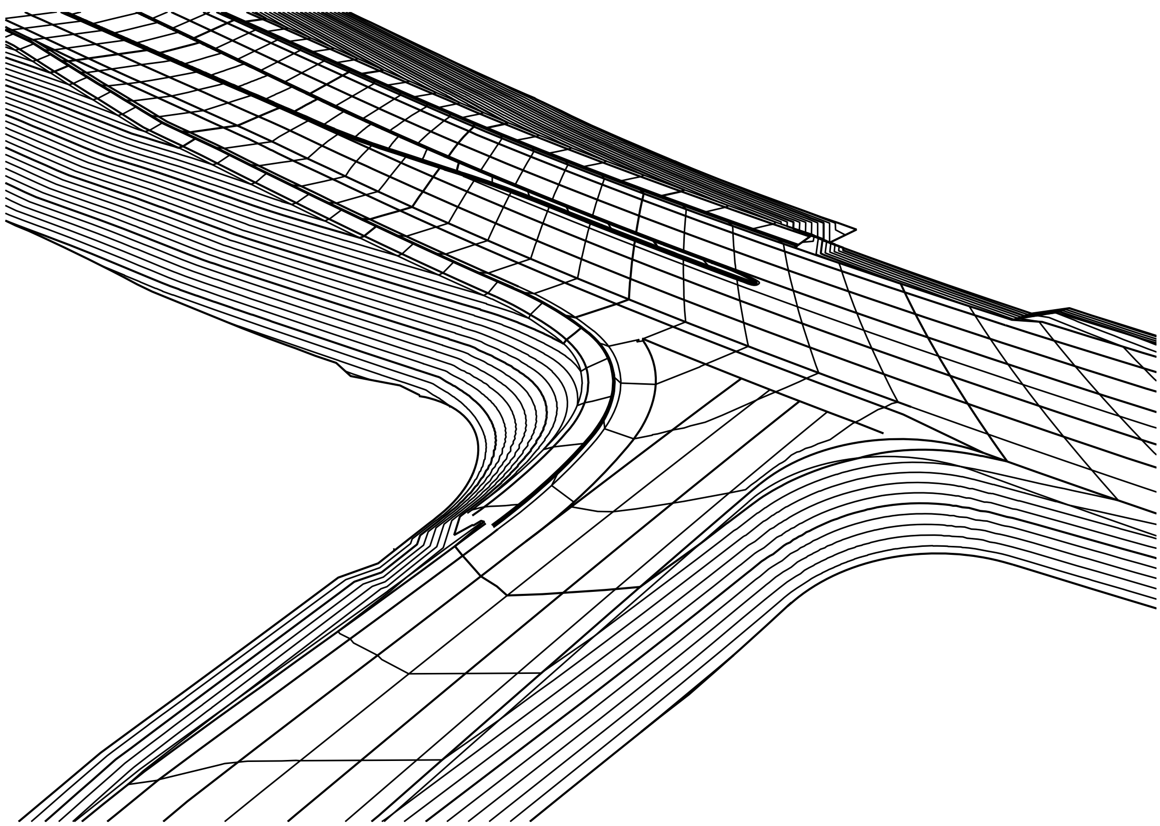
7. **Close** the **Generate Longitudinal Feature** command.
8. Use **Partial Delete** to trim the feature as shown.

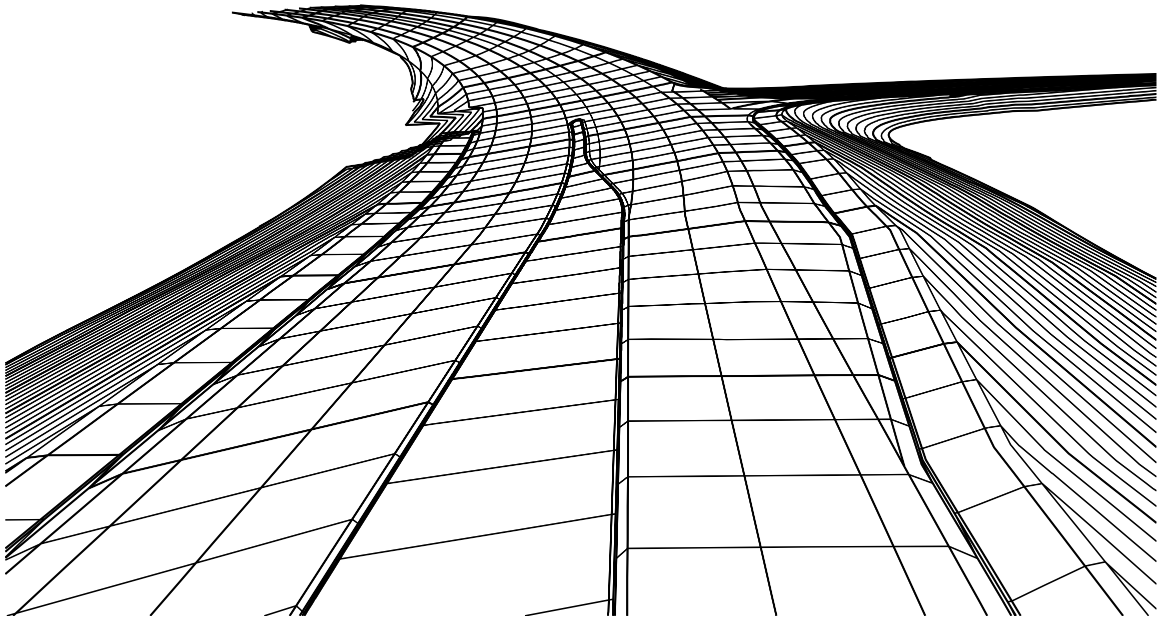


9. **Save** the intersection surface.

10. **Triangulate** and review the surface again.







11. **Save** the surface when you are satisfied.

Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

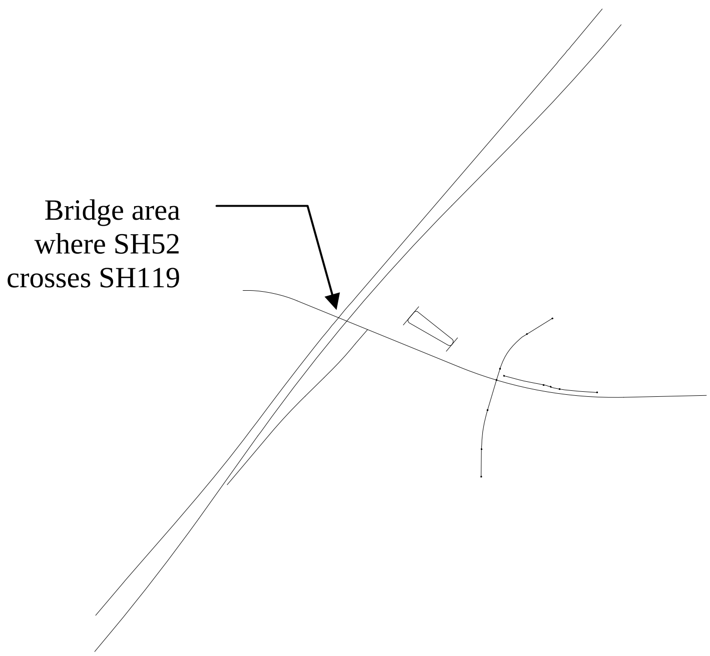
5. Interchange Modeling

In modeling the interchange, you will be putting all your previous modeling techniques together to create a master model of different surfaces. You'll be using **Roadway Modeler** with independent controls, superelevation, etc. for the roadways, the feature modeling techniques used previously in creating intersections and the feature modeling techniques used to create the pond (this time used for walls).

Overall, the modeling of the interchange will be a recap on everything you've done in this course.

Lab 5.1 Separating bridge area features from roadway features

In previous activities, you have modeled SH52 without taking into account that it actually contains a bridge. In this activity, you will take the previously modeled SH52 and 'cut out' the bridge area to create two new surfaces: SH52 without the bridge, and a surface for the bridge itself. Although the bridge surface is not an actual representation of the bridge, you may want to use it later for visualization purposes only.



Start MicroStation InRoads

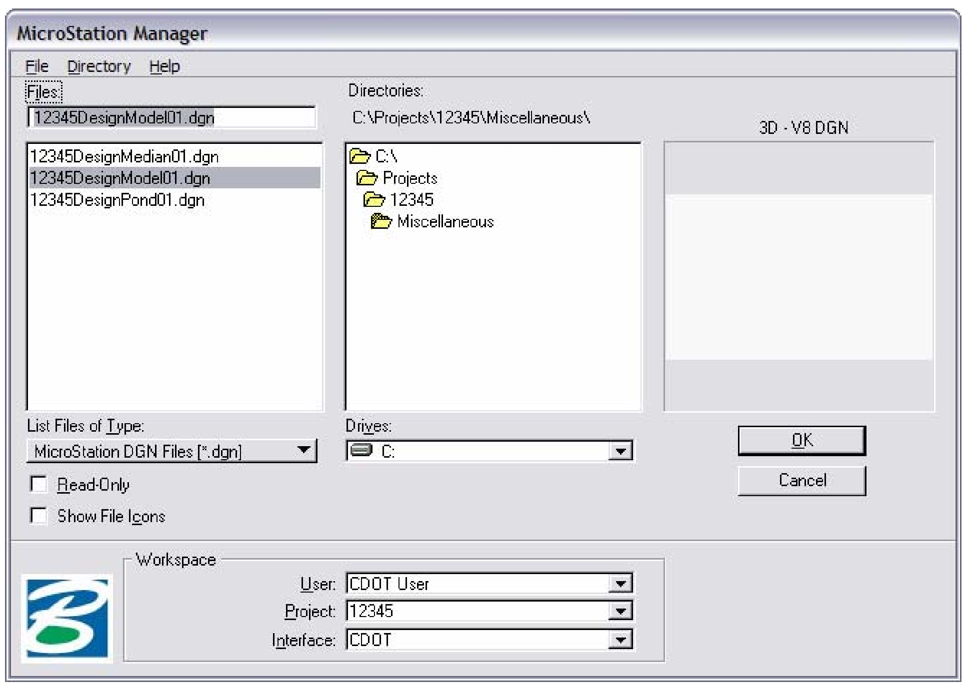
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\MIscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

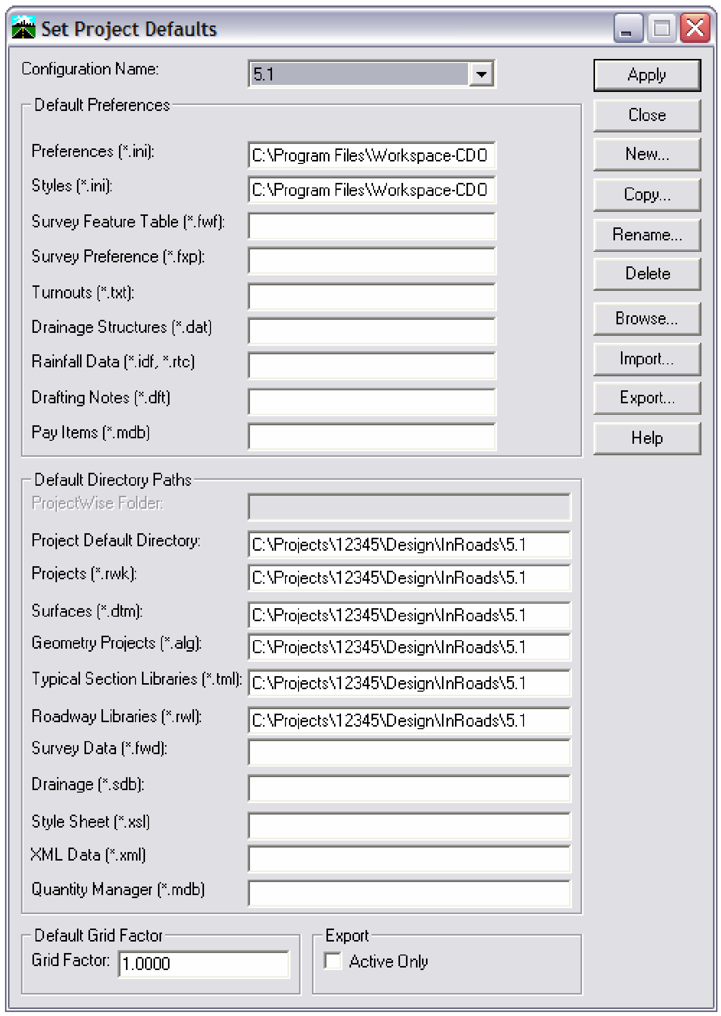
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **5.1**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

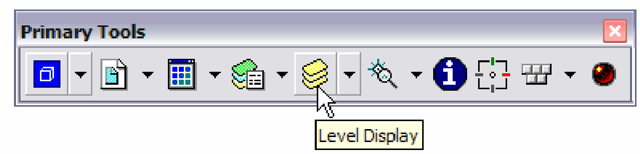
Load the SH52 & 71st intersection DTM

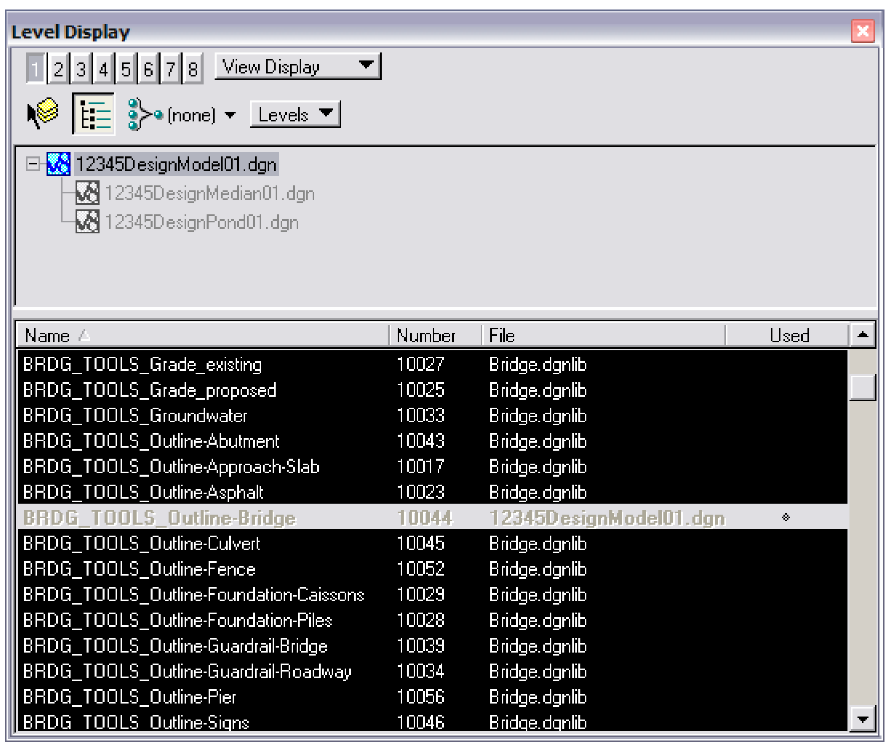
1. Select **File > Open**.
2. Set **File of Type** to **Surfaces (*.dtm)**.
3. Highlight **12345 SH52 71st intersection.dtm** and select **Open**.
4. ***Do not*** cancel out of the box.

Turn on bridge outline

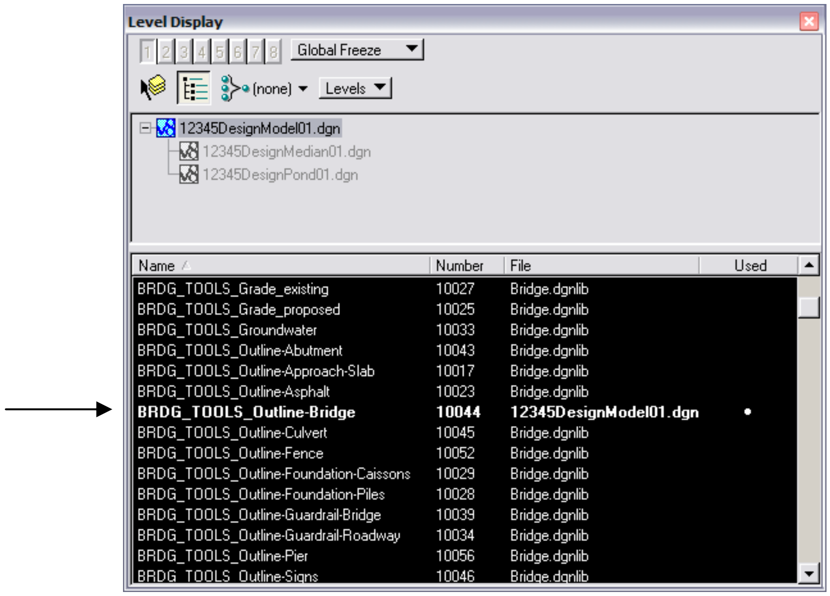
The outline of the bridge is in your design file, but it is on a level that has been frozen.

5. Open the **Level Display** dialog.

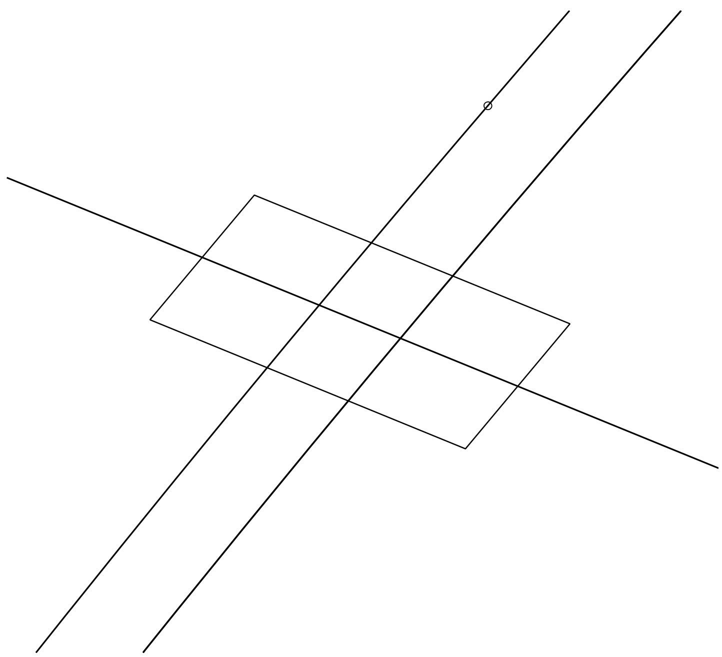




6. Toggle the **View Display** option to **Global Freeze**.
7. Toggle ***on*** **BRDG_TOOLS_Outline-Bridge**.

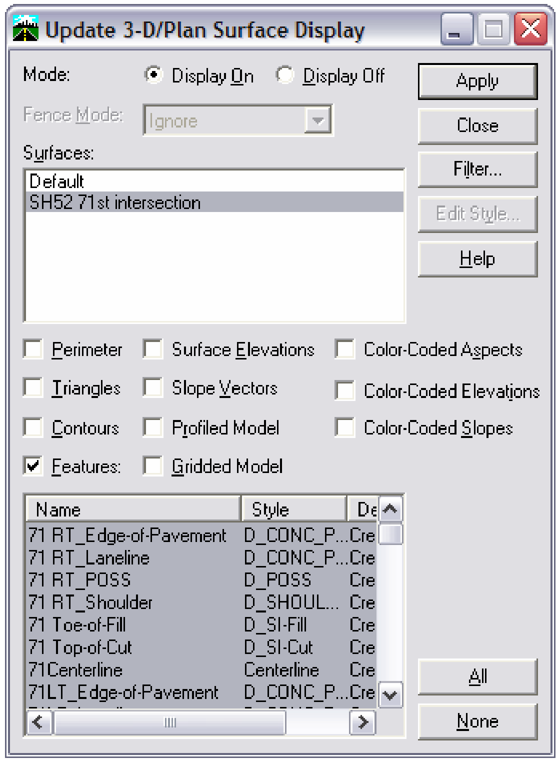


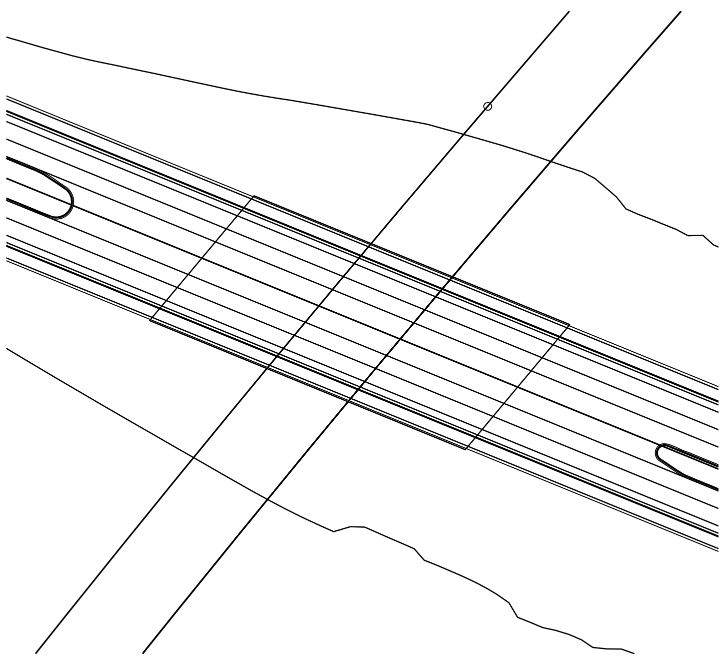
8. **Close** the **Level Display** dialog.



View the Intersection surface

1. Select **Surface > Update 3D/Plan Surface Display** and view all the features.



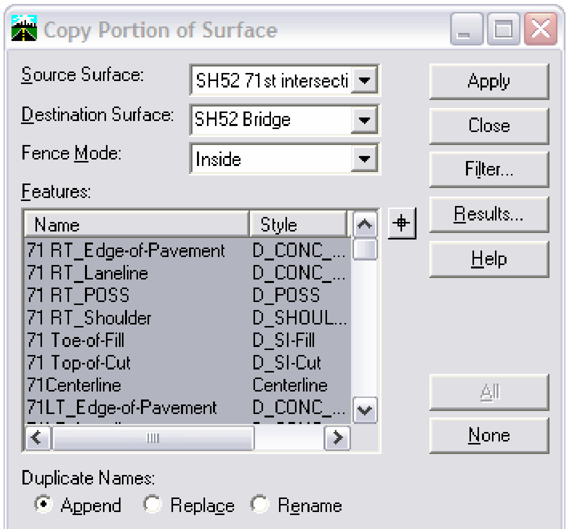


Create a surface with the bridge features

1. Choose the MicroStation **Fence** command.
2. Toggle the **Fence Type** to **Element**.
3. Select the bridge outline.

Copy features into a bridge surface

1. Select **Surface > Edit Surface > Copy Portion of Surface**.

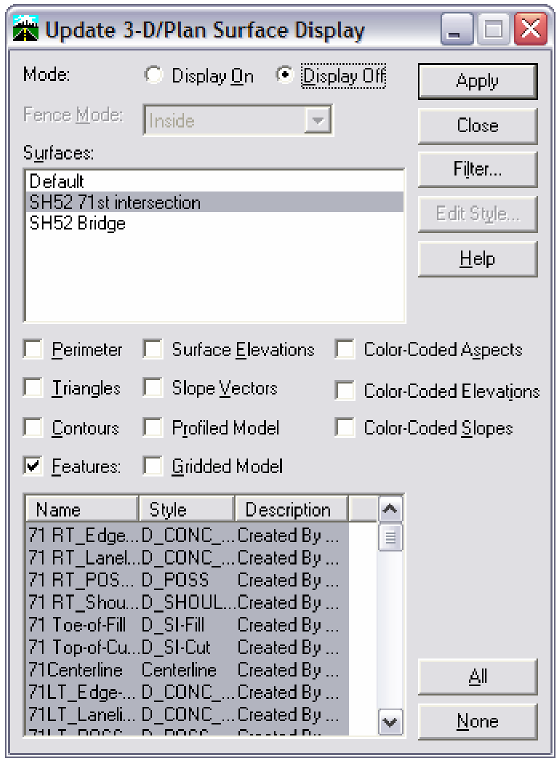


- Set the **Source Surface** to **SH52 71st intersection**.
- Key in the **Destination Surface** ***SH52 Bridge***
- Set the **Fence Mode** to **Inside**.
- Select **All** to highlight all the features.

2. Choose **Apply**.

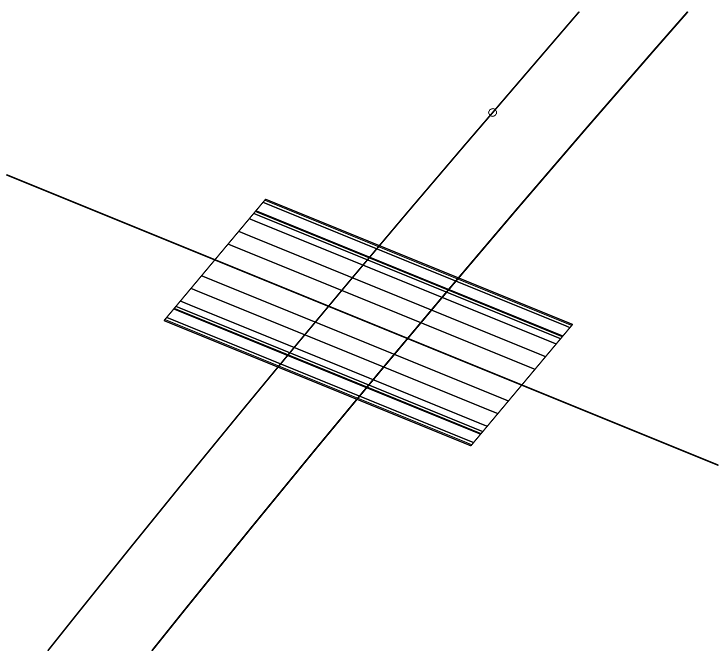
View the bridge features

1. Select **Surface > Update 3D/Plan Surface Display**.



2. Turn the **Display Off** for all of the **SH52 71st intersection** features.

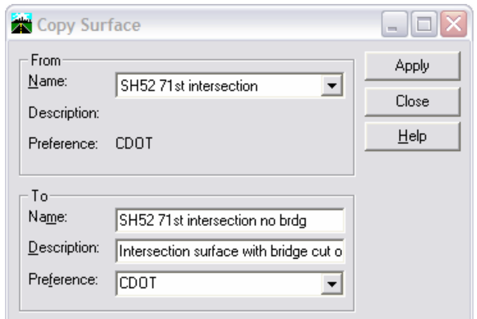
3. Turn the **Display On** for all of the **SH52 Bridge** features.



Delete these features out of SH52 71st intersection

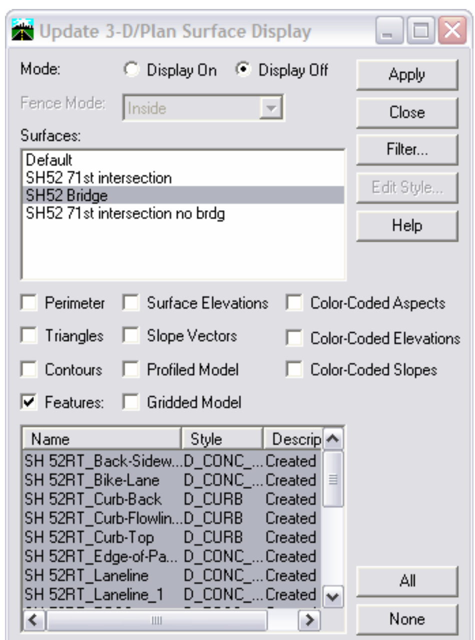
1. First, you'll make a copy of the surface, then cut the bridge features out of the new surface.

   - Select **Surface > Copy Surface**.



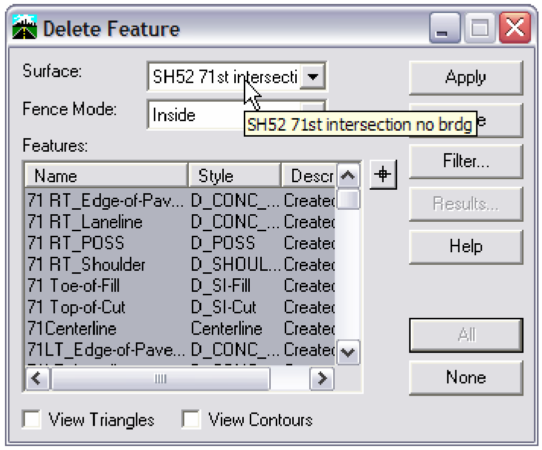
   - Select **SH52 71st intersection** as the **From** Surface.
   - Key in a name ***SH52 71st intersection no brdg***
   - Key in a description of ***Intersection surface with bridge cut out***
   - **Apply**.

2. Select **Update 3D/Plan Surface Display**.

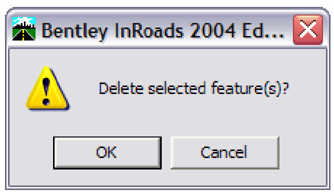


   - Turn ***off*** the display of the **SH52 Bridge** surface features.
   - Turn ***on*** the display of the new 'no brdg' surface features.
   - Make certain the **Fence Mode** is set to **Ignore**.
   - **Close** the dialog.

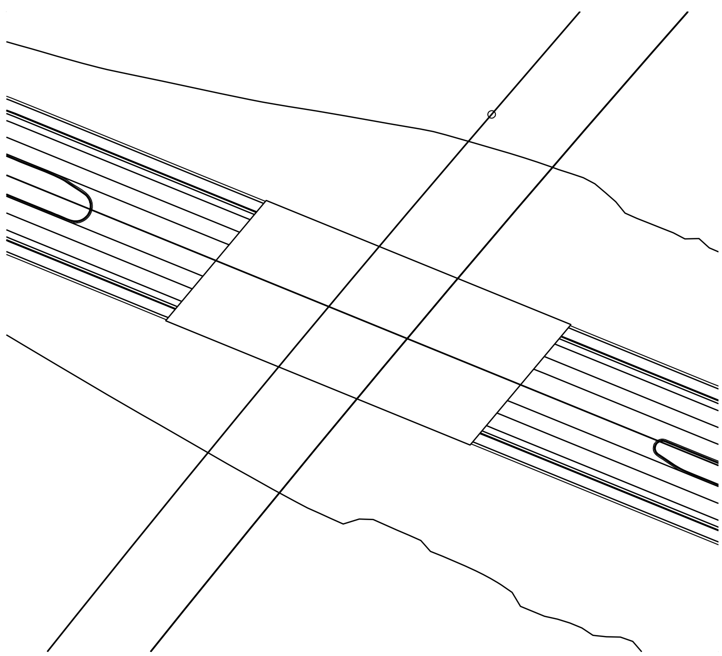
3. With the same fence you used before, Select **Surface > Edit Surface > Delete Features**.



- Set the **Surface** to **SH52 71st intersection no brdg**.
- Set the **Fence Mode** to **Inside**.
- Select **All** to highlight all the features.
- Choose **Apply**.



- Select **OK** when prompted.



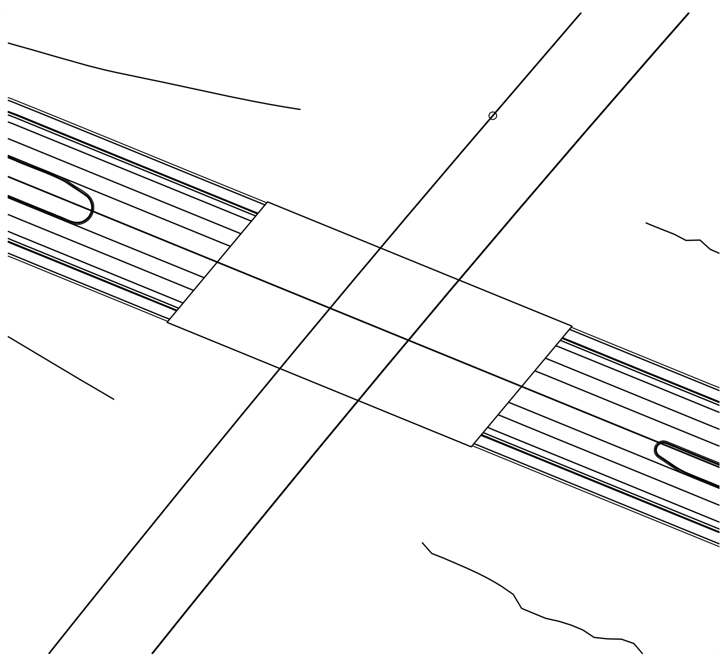
The features in the area of the bridge are cut out of the surface.

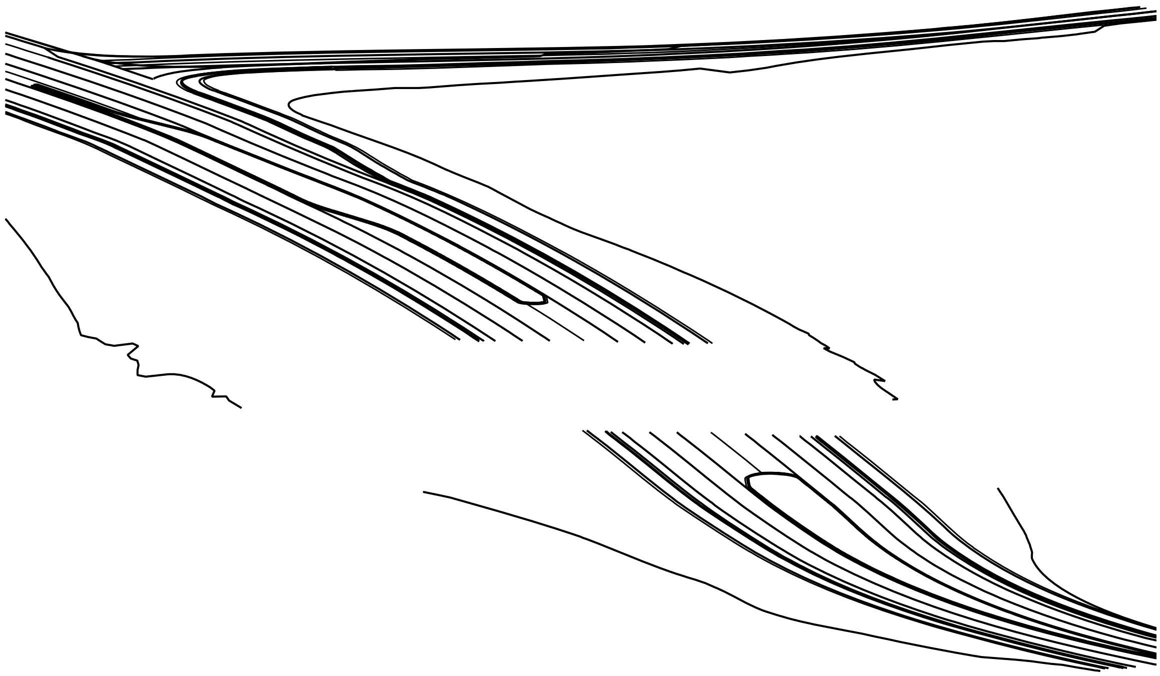
Trim Features

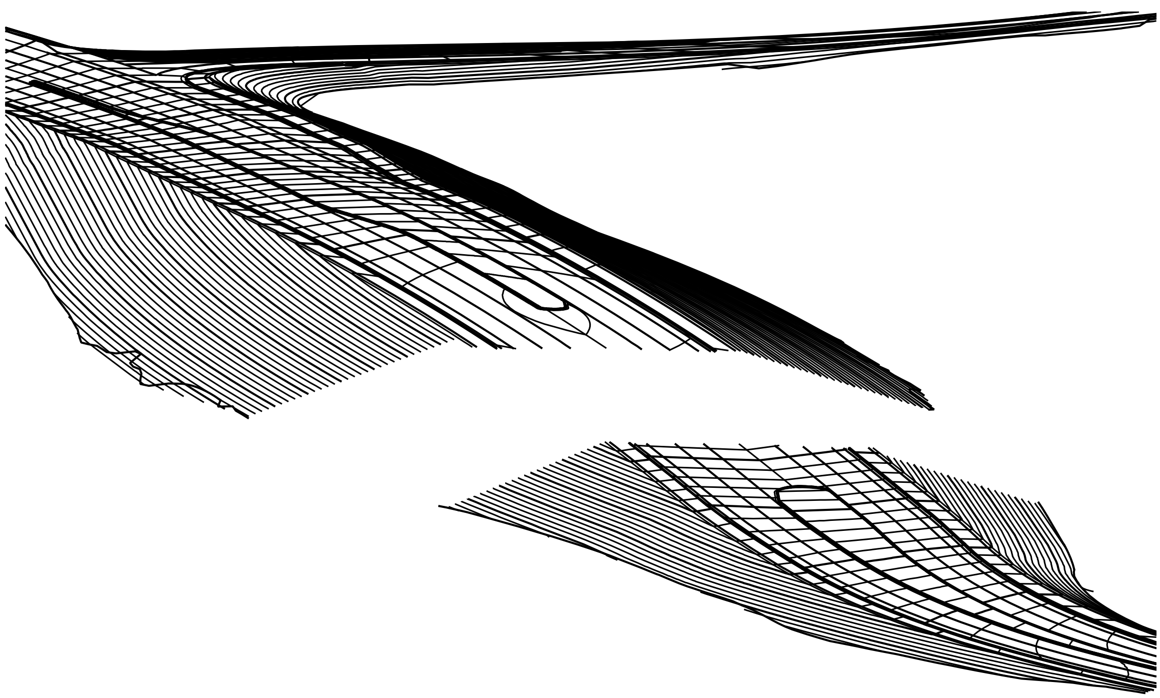
1. Use **Surface > Edit Surface > Partial Delete** to trim out the toes of slope. You do not need to be precise with this part, as the toes will be edited later when this surface is combined with the ramps, walls, etc.

Review the surface

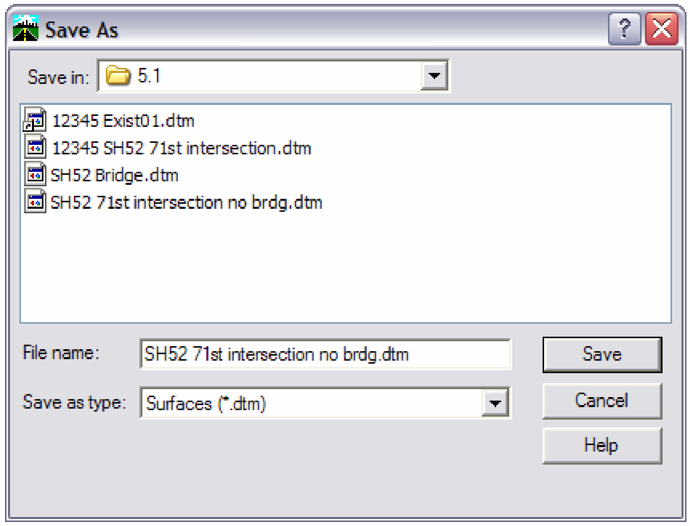
1. Use any of the displays you would like to review the surface. However, keep in mind that triangulation will not honor the gap between the features and will triangulate across the bridge area. Therefore, when using the surface displays, be sure to say No when prompted to re-triangulate the model.







2. **Save** the two new surfaces you just created.



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

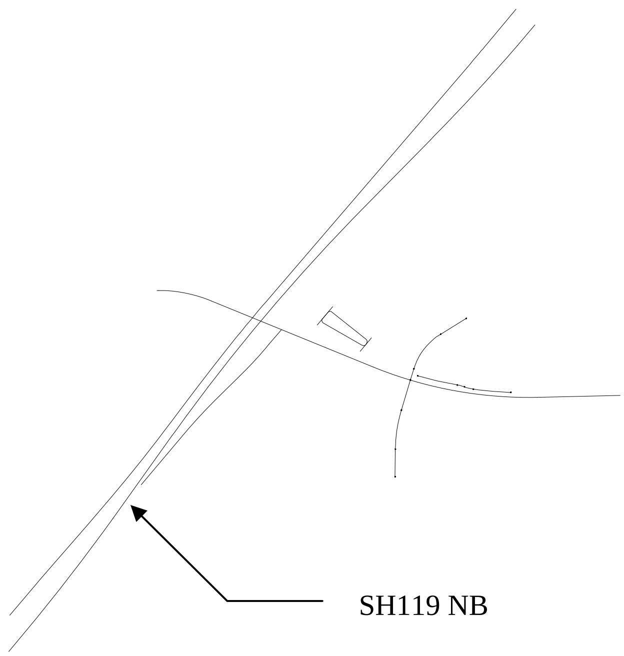
Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 5.2 Modeling a mainline and introducing a ramp

In previous activities, you have built horizontal and vertical alignments, created and modified templates, set up independent controls, created decision tables and modeled. Here, you'll be combining these procedures to create a model of SH119 NB that intercepts the SH119 SB surface on the left side and features from the existing DTM on the right. In addition, you will widen SH119 NB to introduce RampA. In the next activity, you will model RampA and eventually put the surfaces together with others to form the completed interchange model.



Start MicroStation InRoads

1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

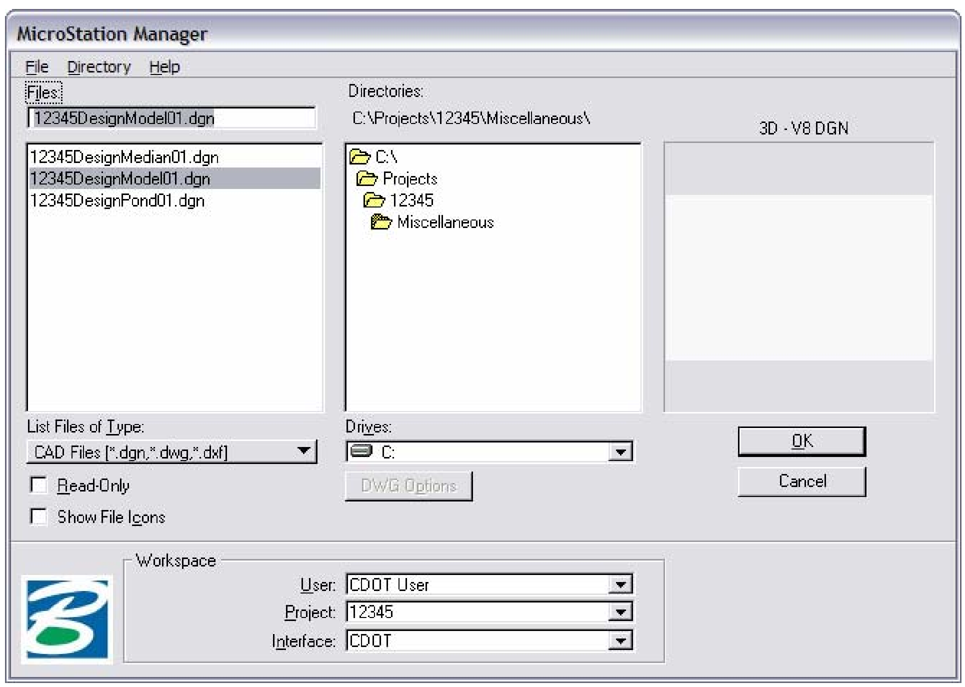
   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.

3. Select **OK**.

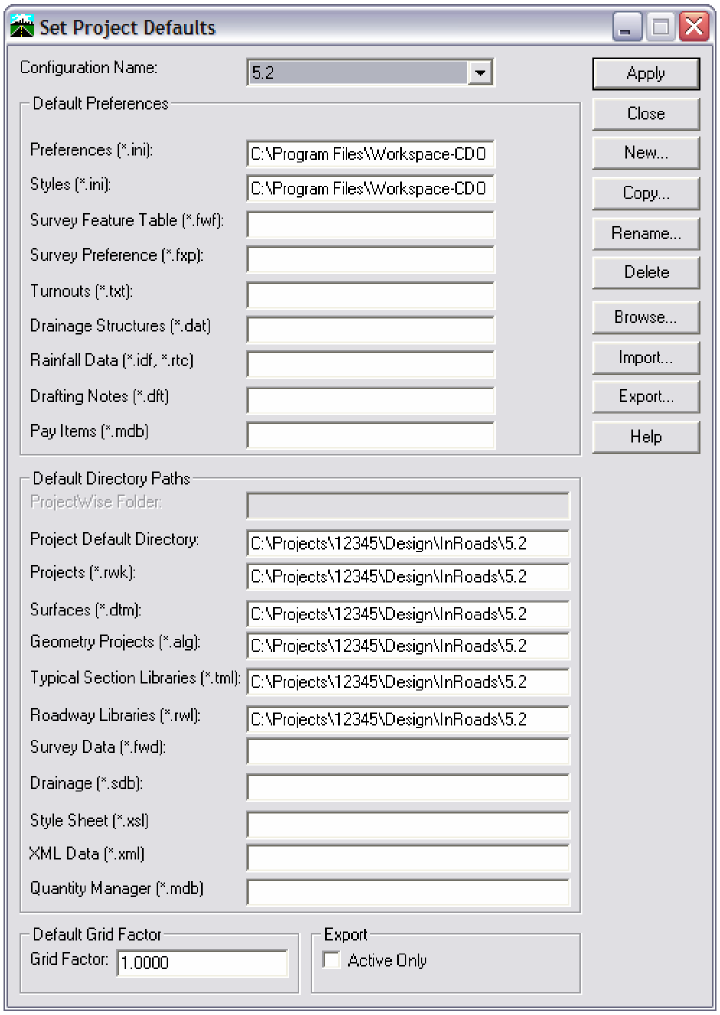
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **5.2**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH52 & SH 119 interchange

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 SH52 interchange.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for SH119 NB

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 SH119 NB.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load the roadway library for SH 119 NB

8. Set **File of Type** to **Roadway Libraries (*.rwl)**.
9. Highlight **12345 SH119 NB.rwl** and then select **Open**.
10. ***Do not*** cancel out of the box.

Load the SH119 SB DTM

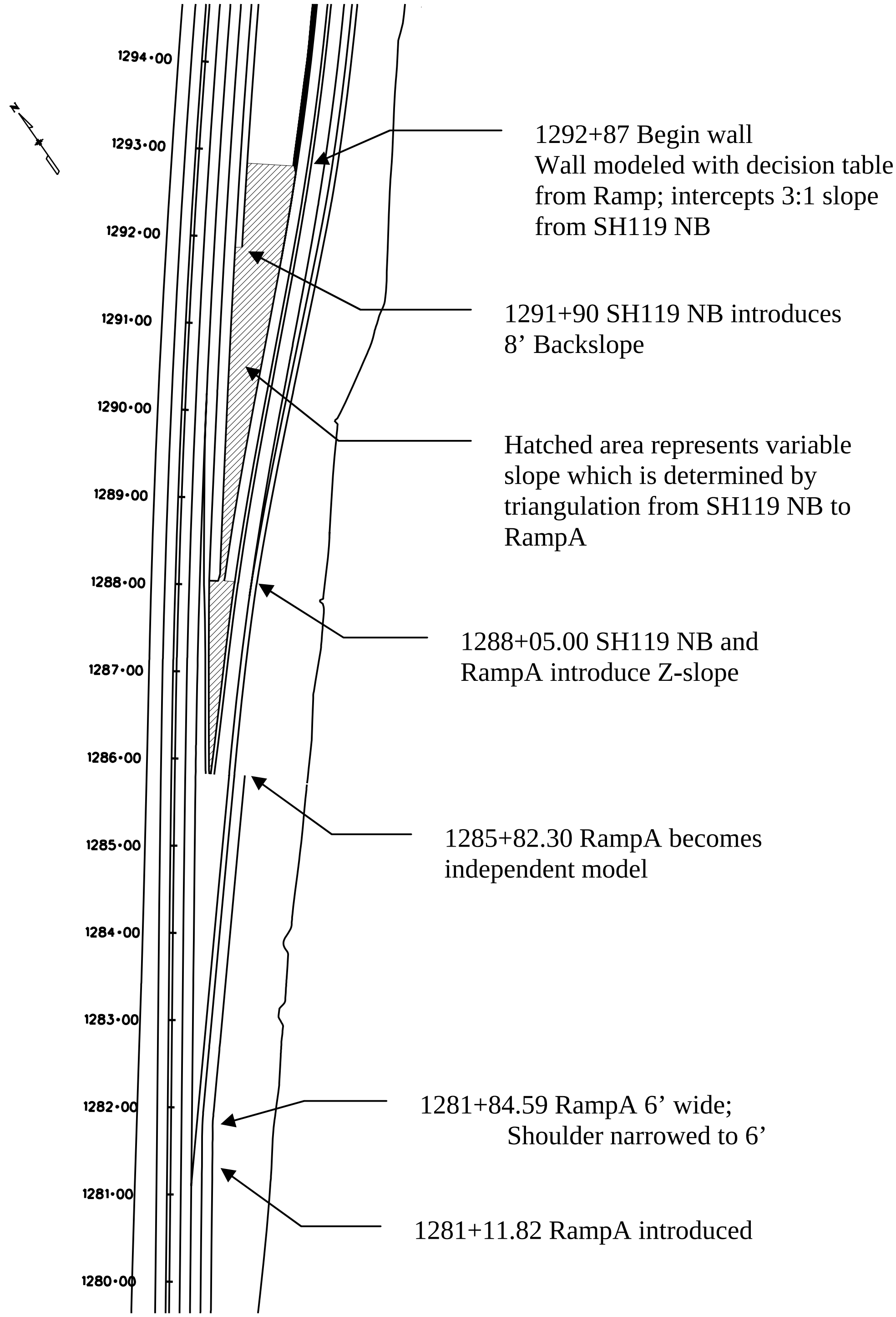
11. Set **File of Type** to **Surfaces (*.dtm)**.
12. Highlight **12345 SH119 SB top.dtm** and select **Open**.
13. ***Do not*** cancel out of the box.

Load the existing DTM

14. Highlight **12345 Exist01.dtm** and then select **Open**.
15. **Cancel** the **Open** dialog box.

Add a ramp to SH119 NB

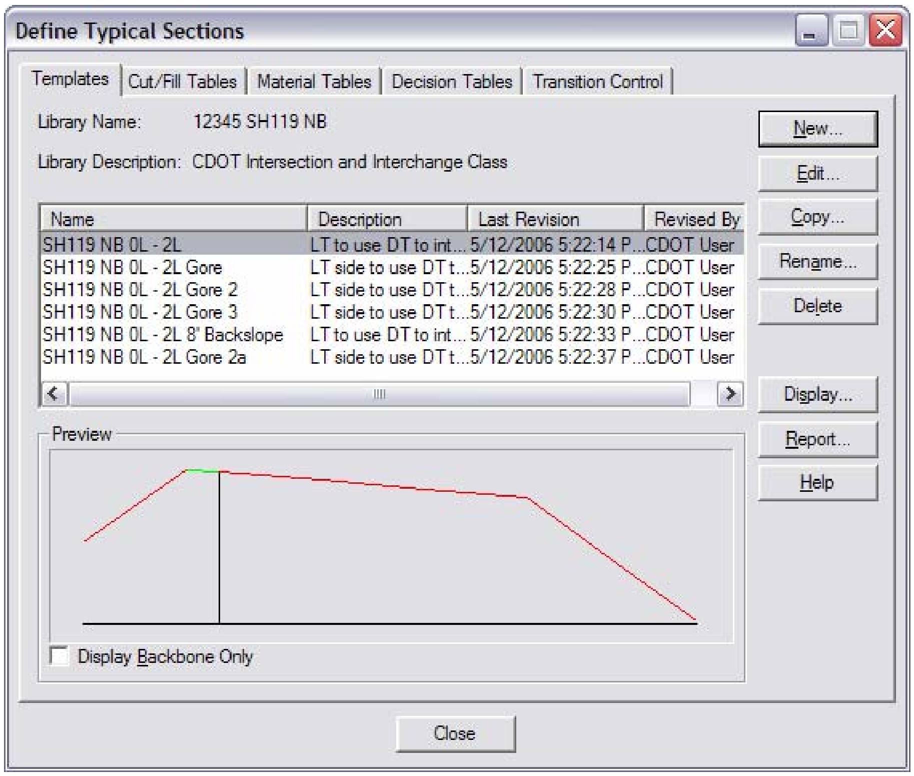
In the following steps, you will take the basic SH119 NB template and modify it to introduce RampA. In addition, there are several additional typicals needed through the area. Refer to the following lane sketch showing the various transitions.



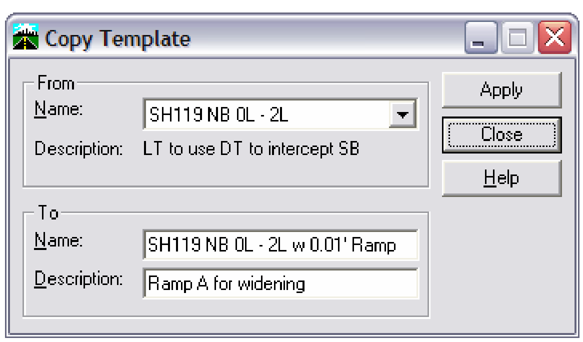
Copy the SH119 NB 0L - 2L template

The basic SH119 NB template is given in the typical section library. (It is a mirror image of the SH119 SB template that was created in a previous activity.) Here, you will copy and modify it to create the template introducing the turn lane. Initially, the turn lane starts out as a 0.01-width segment.

1. Select **Modeler > Define Typical Section**.



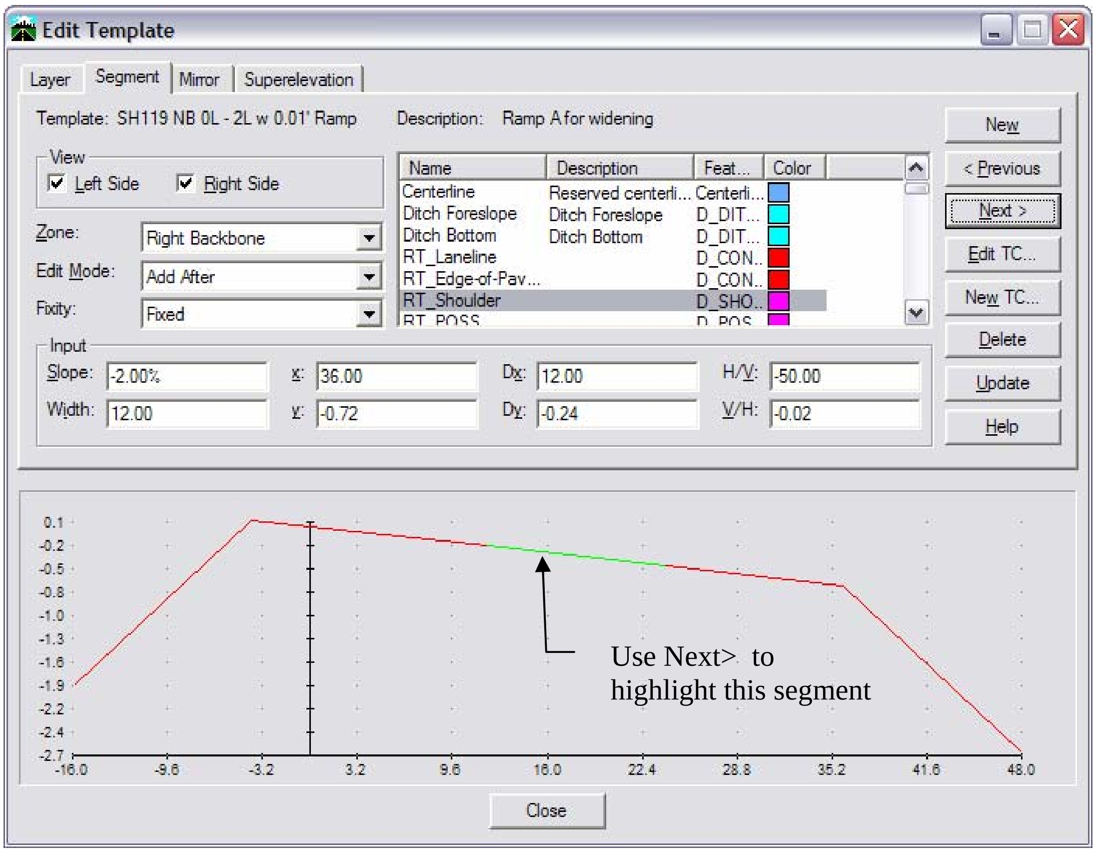
2. Highlight the template and choose **Copy**.



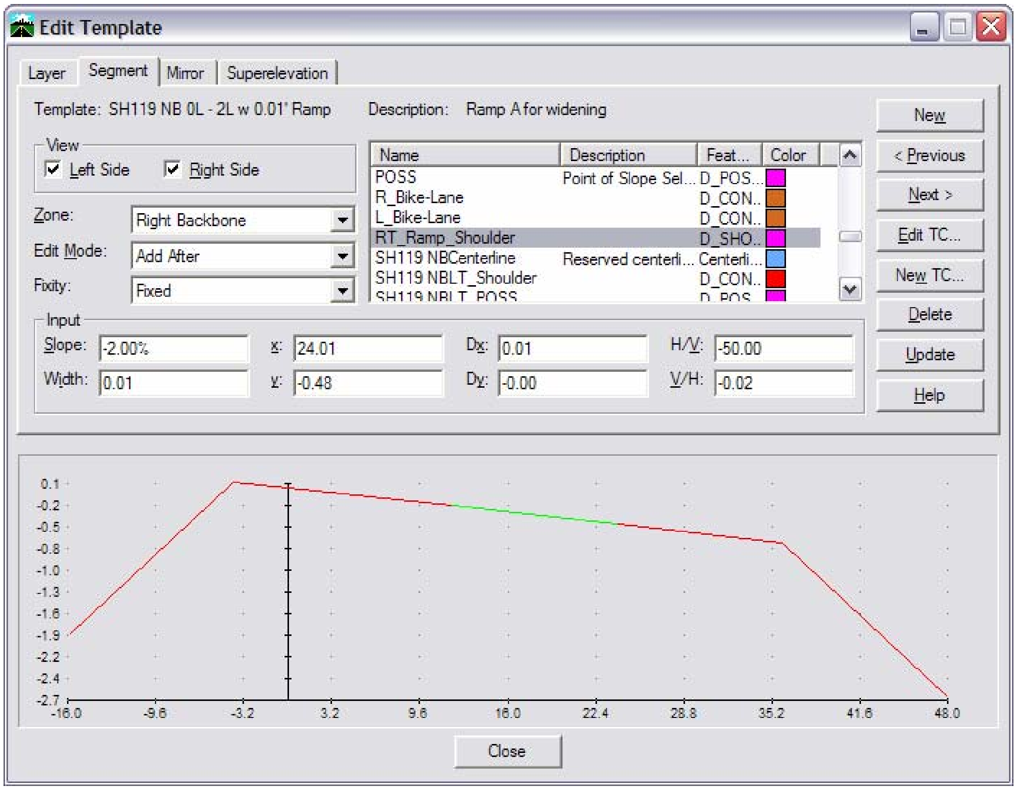
3. In the **To Name** field, key in ***SH119 NB 0L - 2L w 0.01' Ramp***
4. In the **Description** field, key in ***Ramp A for widening***
5. **Apply**, then **Close** the box.

Edit the template to add the ramp segment

6. In the **Define Typical Section** box, highlight the template you just copied and select **Edit**.
7. Select the **Segment** tab.
8. Set **Zone** to **Right Backbone**.
9. Set **Edit Mode** to **Add After**.
10. Use **Next** to highlight the segment **RT_Shoulder**.



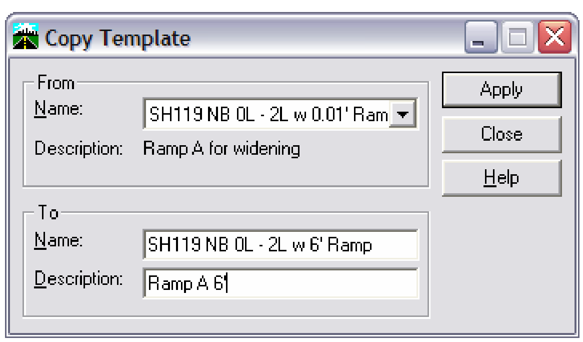
11. Key in a **Slope** of ***-2.0%***
12. Key in a **Width** of ***.01***
13. Select a **TC name** of **RT_Ramp_Shoulder**.



14. Select **New**.
15. **Close** the **Edit Template** box.

Copy the SH119 NB 0L - 2L w 0.01' Ramp template

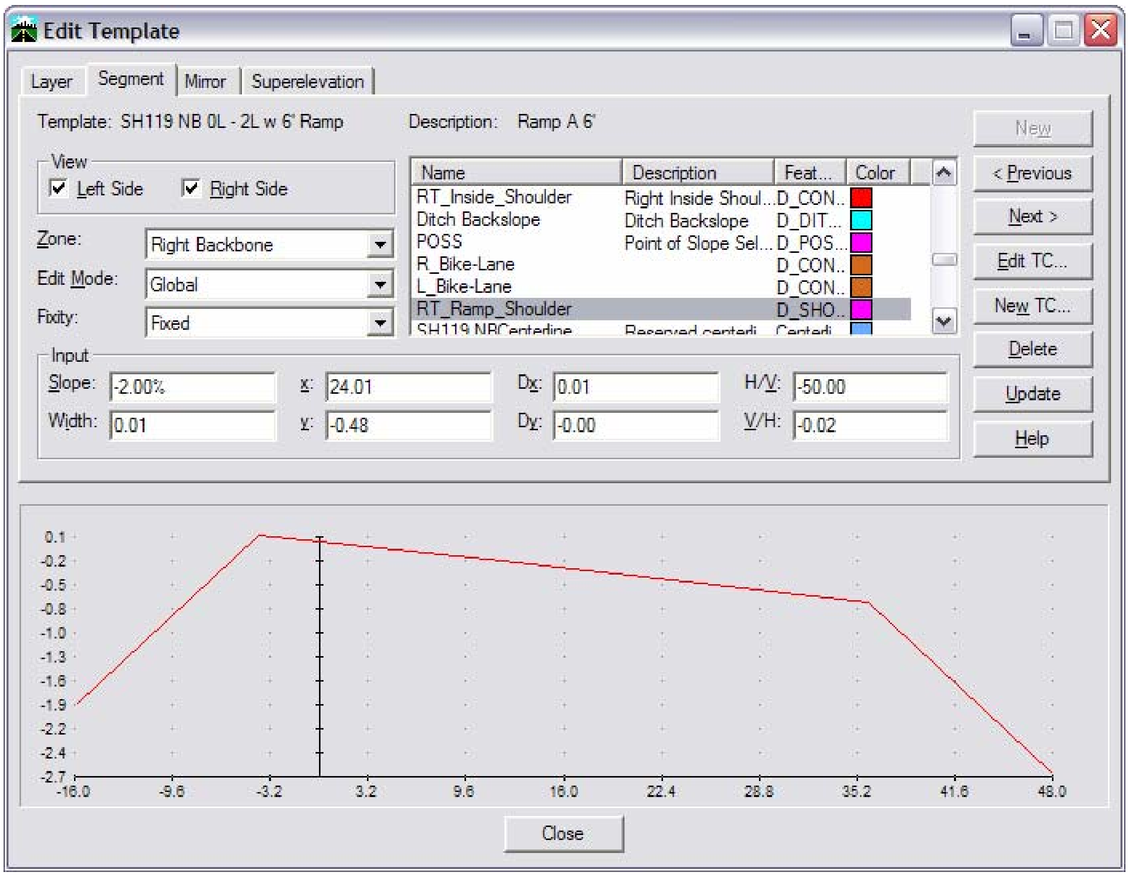
16. Highlight the template you just edited and select **Copy**.



17. In the **To Name** field, key in ***SH119 NB 0L - 2L w 6' Ramp***
18. In the **Description** field, key in ***Ramp A 6'***
19. **Apply**, then **Close** the box.

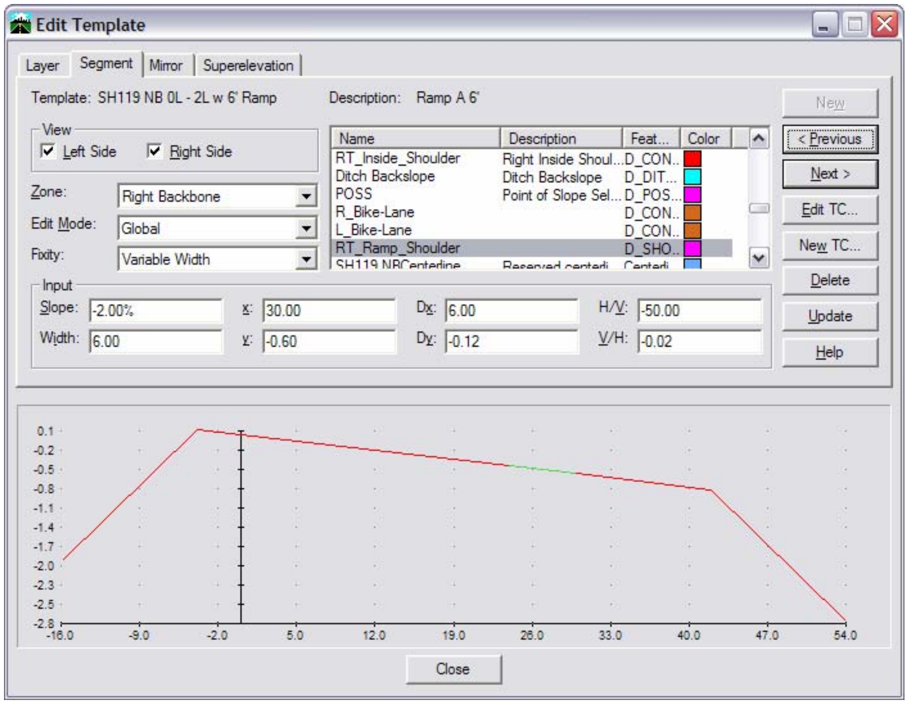
Edit the template to widen the ramp segment

20. In the **Define Typical Section** box, highlight the template you just copied and select **Edit**.
21. Select the **Segment** tab.
22. Set **Zone** to **Right Backbone**.
23. Set **Edit Mode** to **Global**.
24. Use **Next** to highlight the 0.01’ segment **RT_Ramp_Shoulder**.



25. Key in a **Width** of ***6***
26. Change the **Fixity** to **Variable Width**.

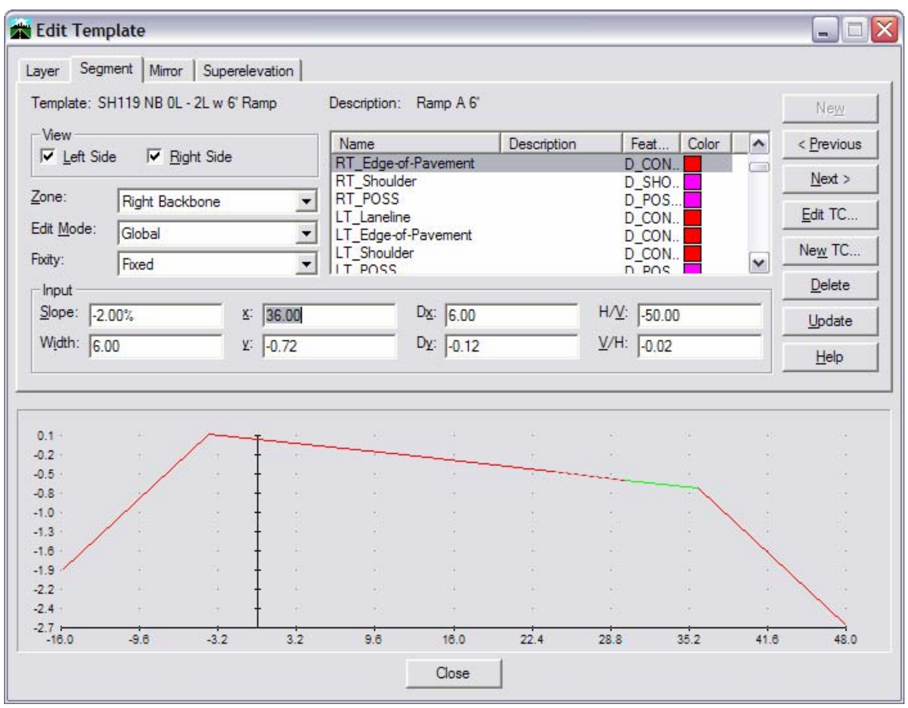
27. Select **Update** to modify the segment.



28. Use **Next** to highlight the segment **RT_Edge-of-Pavement**.

29. Key in a **Width** of ***6***

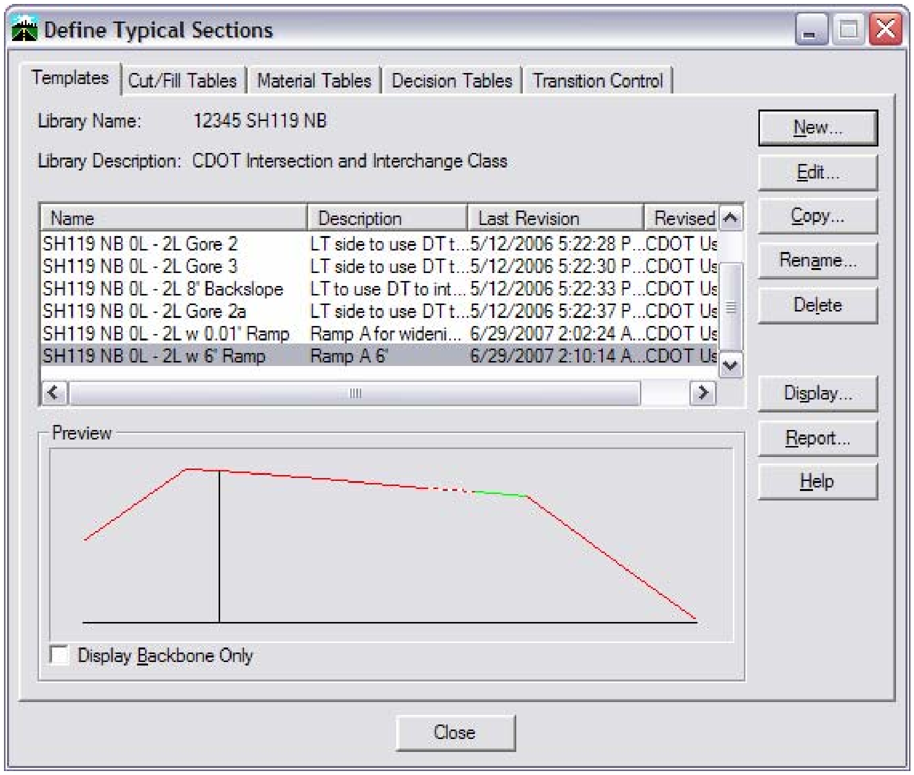
30. Press the **Tab** key to update the segment.



31. **Close** the **Edit Template** box.

Note: Other templates needed for modeling are already in the typical section library.

32. Review the templates.



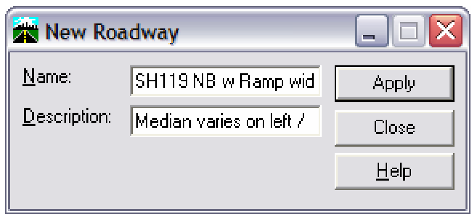
0L – 2L Gore	Used beginning where RampA becomes independent
0L – 2L Gore2	Used where the Gore Shoulder is 6' wide
0L – 2L Gore2a	Used beginning beyond RampA where the Z-slope is reintroduced
0L – 2L Gore3	Used where the Gore Shoulder tapers away
0L – 2L 8' Backslope	Used beginning at station 1291+90; contains the large 3:1 slope which will provide the target surface for the wall decision table that will be run with RampA

33. **Save** typical section library.

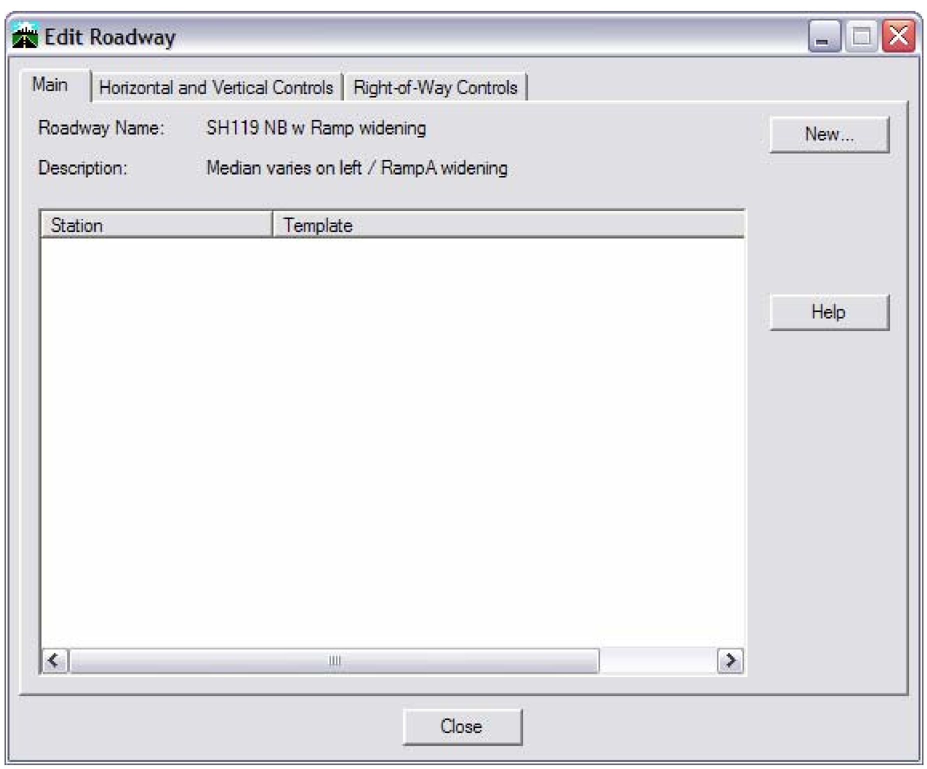
Create a new SH119 NB roadway definition

In the following steps, you will create a new roadway definition that uses a decision table on the left to intercept the surface from SH119 SB at a 6:1 slope, transitioning into and out of a 10:1 slope in the bridge area. On the right, it will use independent control to widen for RampA and uses the other typicals through the ramp area. It also widens to provide a target for the decision table used to create a retaining wall between SH119 NB and RampA.

1. Make certain **SH119 NB** is the active horizontal alignment.
2. Select **Modeler > Define Roadway**.
3. In the **Define Roadway** box, select **New.**

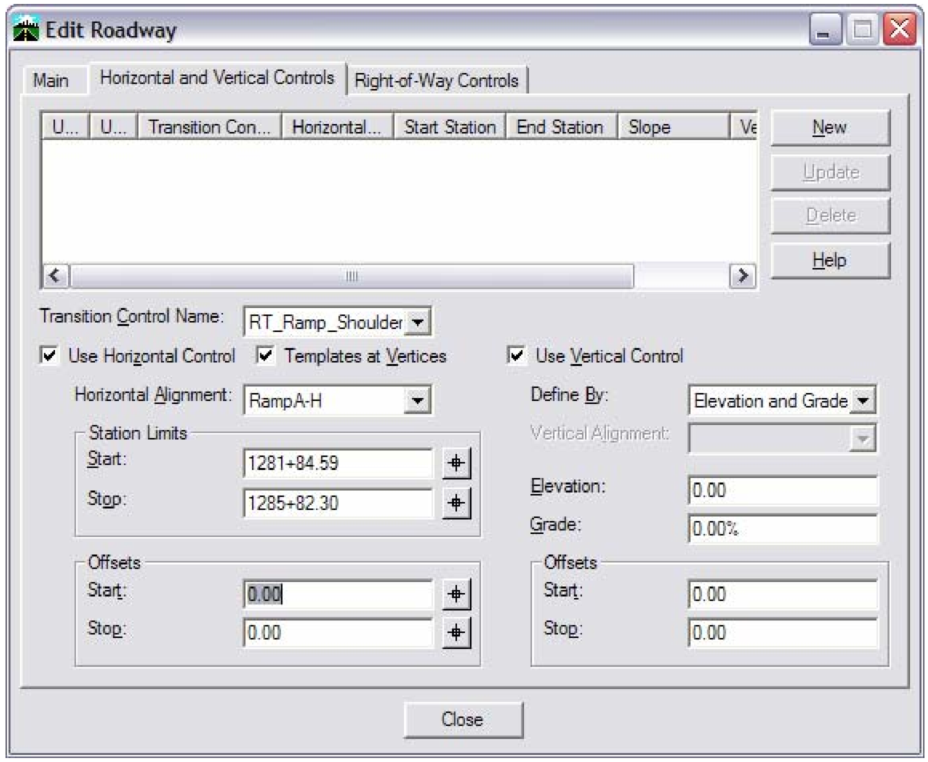


4. Key in the **Name *SH119 NB w Ramp widening***
5. Key in the **Description** of ***Median varies on left / RampA widening***
6. **Edit** the definition.



First, you will establish independent control to widen for RampA by assigning the RT_Ramp_Shoulder to follow the RampA alignment.

7. Select the **Horizontal and Vertical** controls tab.



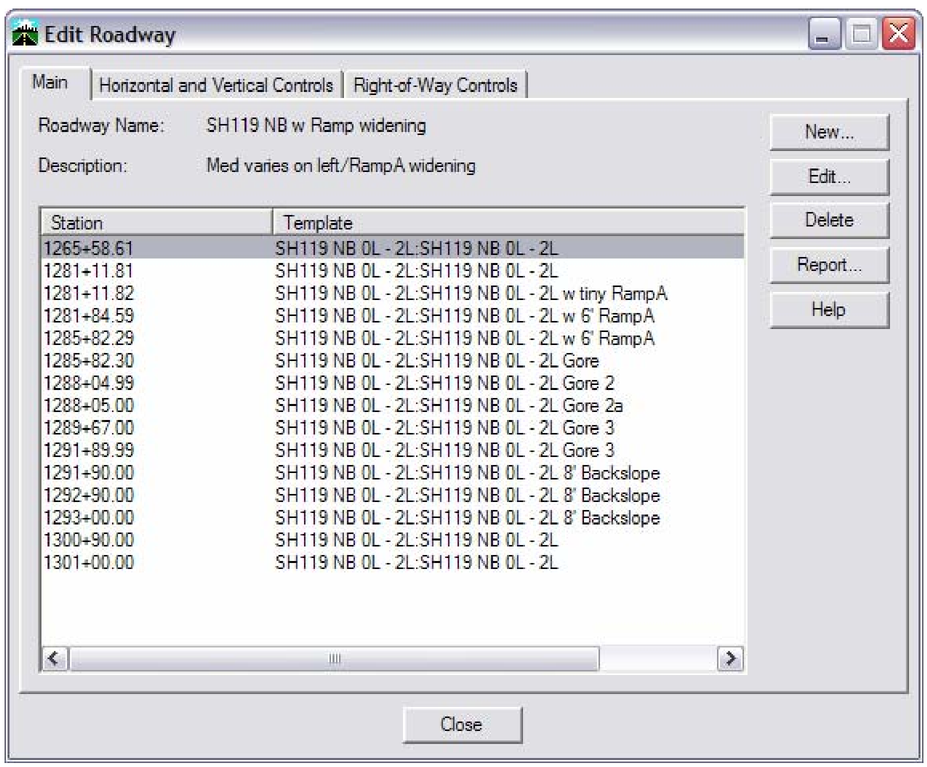
8. Set the following options:

- **Transition Control Name** to **RT_Ramp_Shoulder.**
- Toggle ***on*** **Use Horizontal Control.**
- Toggle ***on*** **Templates at Vertices.**
- Toggle ***off*** **Use Vertical Controls.**
- Set **Horizontal Alignment** to **RampA-H.**
- Key in a **Start Station** of ***1281+84.59***
- Key in an **End Station** of ***1285+82.30***
- Select **New.**

9. Select the **Main** tab.

10. Select **New** and add the following entries.

Station	Left Template	Left Catch	Right Template	Right Catch
1265+58.61	0L – 2L	DT 6:1	0L – 2L	DT RT intercept exist ftr
1281+11.81	0L – 2L	DT 6:1	0L – 2L	DT RT intercept exist ftr
1281+11.82	0L – 2L	DT 6:1	0L – 2L w 0.01 Ramp A	DT RT intercept exist ftr
1281+84.59	0L – 2L	DT 6:1	0L – 2L w/6' Ramp A	DT RT intercept exist ftr
1285+82.29	0L – 2L	DT 6:1	0L – 2L w 6' RampA	DT RT intercept exist ftr
1285+82.30	0L – 2L	DT 6:1	0L – 2L Gore	BB Only
1288+04.99	0L – 2L	DT 6:1	0L – 2L Gore 2	BB Only
1288+05.00	0L – 2L	DT 6:1	0L – 2L Gore 2a	BB Only
1289+67.00	0L – 2L	DT 6:1	0L – 2L Gore 3	BB Only
1291+89.99	0L – 2L	DT 6:1	0L – 2L Gore 3	BB Only
1291+90.00	0L – 2L	DT 6:1	0L – 2L 8' Backslope	BB Only
1292+90.00	0L – 2L	DT 6:1	0L – 2L 8' Backslope	BB Only
1293+00	0L – 2L	DT 10:1	0L – 2L 8' Backslope	BB Only
1300+90.00	0L – 2L	DT 10:1	0L – 2L 8' Backslope	BB Only
1301+00.00	0L – 2L	DT 6:1	0L – 2L	BB Only

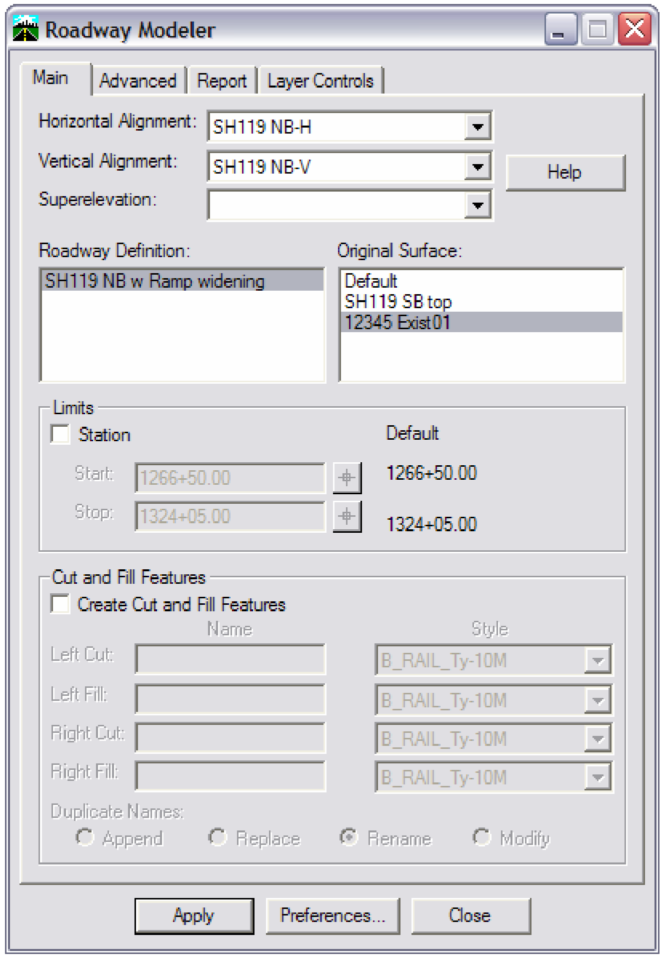


11. **Save** Roadway Library.

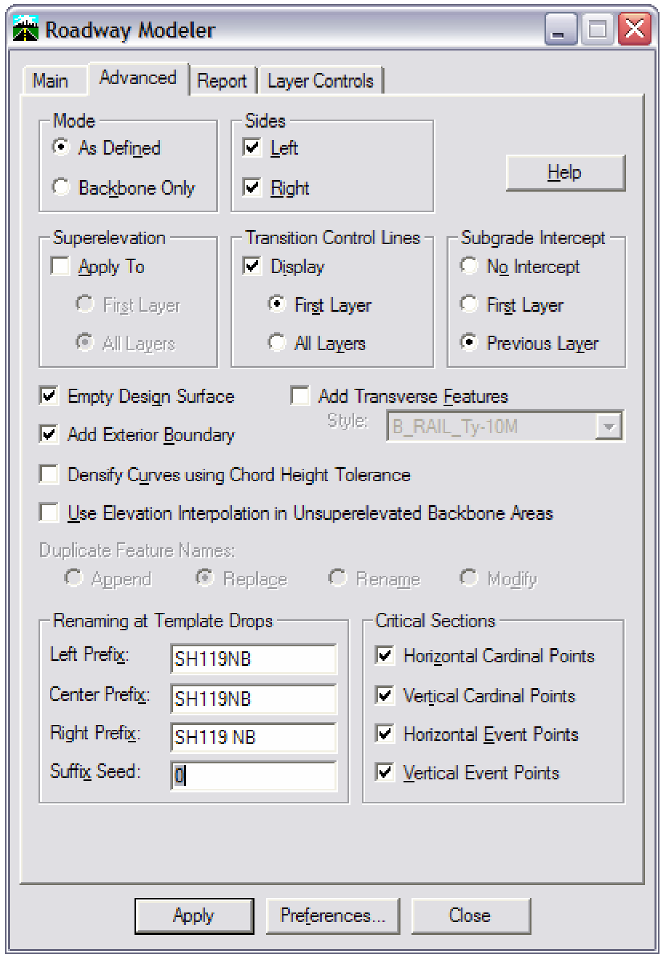
Model SH119 NB

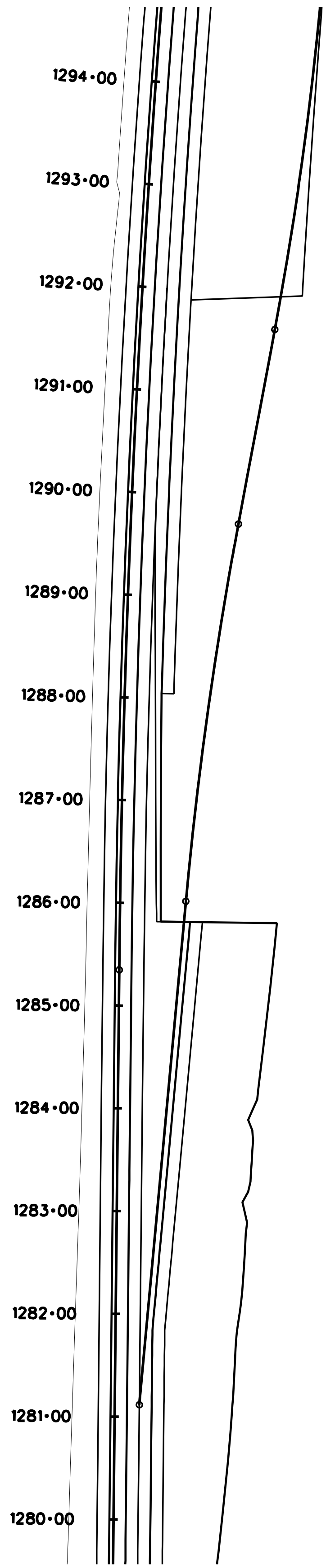
1. Run **Modeler** to create the new **SH119 NB top** surface.

   - **Main** tab setup:



- **Advanced** tab setup:

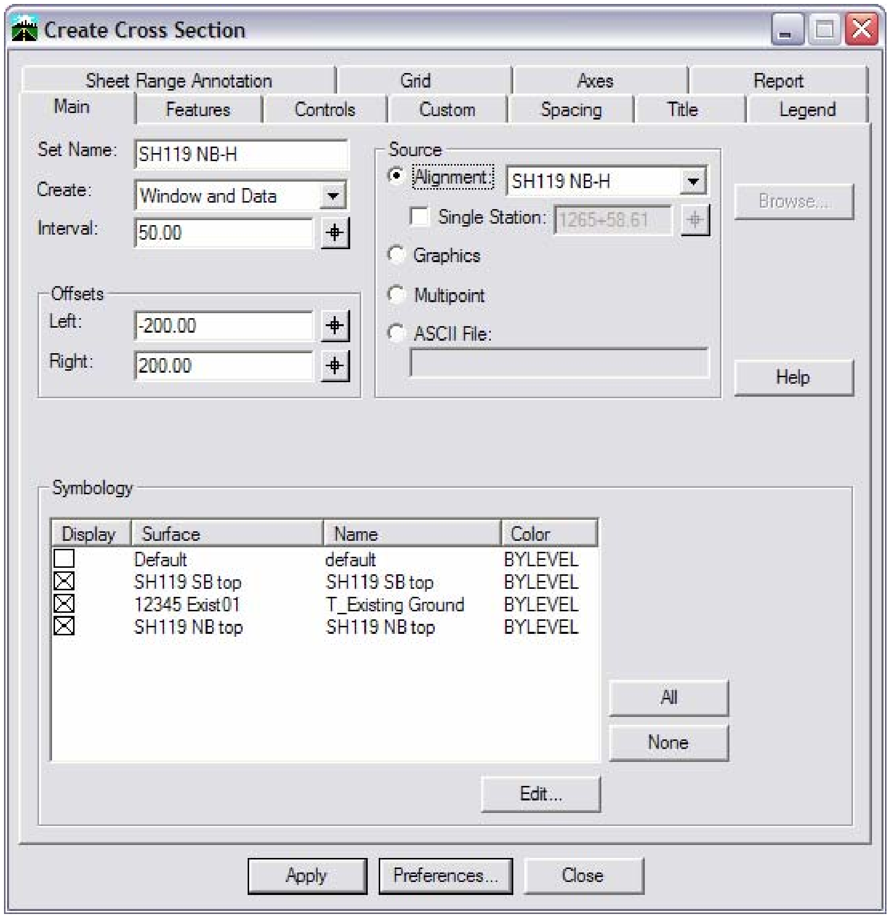



1294+00
1293+00
1292+00
1291+00
1290+00
1289+00
1288+00
1287+00
1286+00
1285+00
1284+00
1283+00
1282+00
1281+00
1280+00

2. **Save** the **SH119 NB top surface**.

3. Create a set of cross sections and review.

   - Show **SH119 NB top**, **SH119 SB top** and **Exist01**.



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.

2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

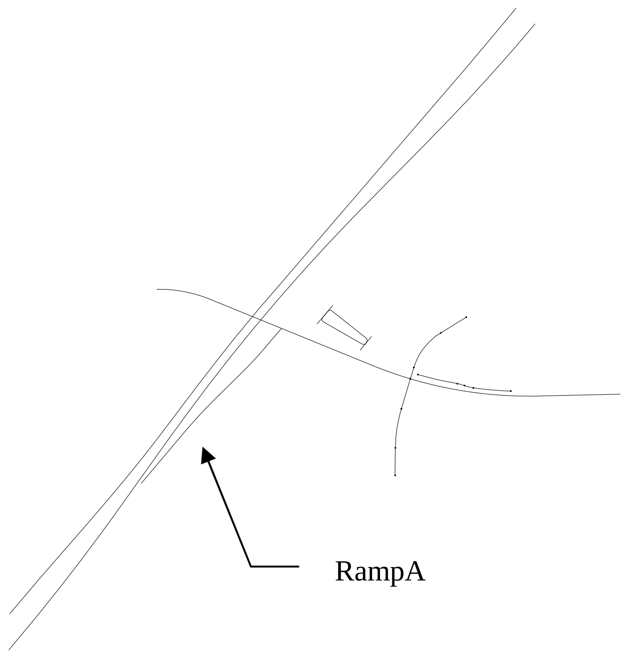
Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.

2. If prompted to save data files select **Yes**.

Lab 5.3 Modeling Interchange Ramp A

In this activity, you will model RampA for the SH119 SH52 interchange. The alignments were built in previous activities, as was the decision table. Similar templates have been built also, so the templates are provided here.



Start MicroStation InRoads

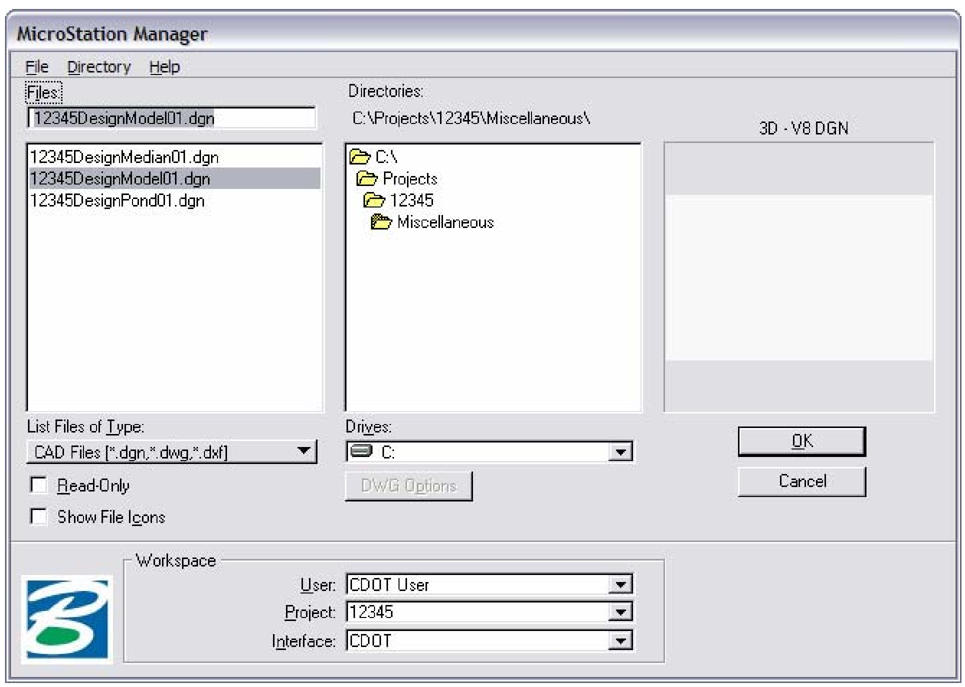
1. Select **Start > All Programs > Bentley Civil Engineering > Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Design\Working.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

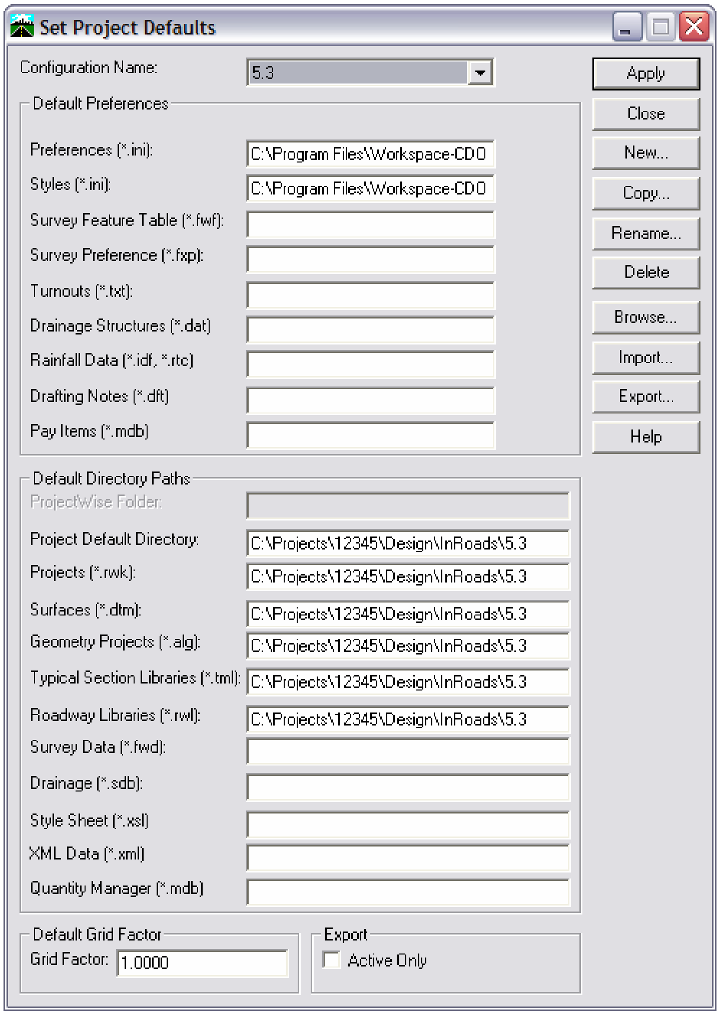
Set Project Defaults

1. Select **File > Project Defaults**.
2. Set the **Configuration Name** to **5.3**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for SH119 & SH52 interchange

1. Select **File > Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 SH119 SH52 interchange.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for Ramp A

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 RampA.tml** and then select **Open**.
7. ***Do no***t cancel out of the box.

Load SH119 DTMs

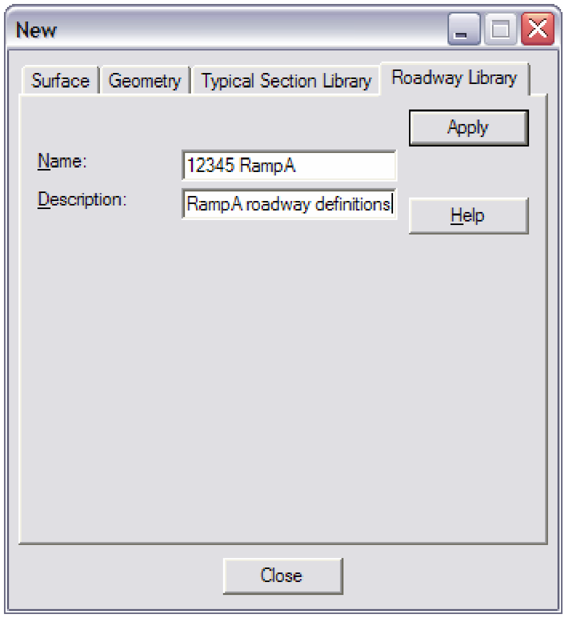
8. Set **File of Type** to **Surfaces (*.dtm)**.
9. Highlight **12345 SH119 NB.dtm** and select **Open**.
10. Highlight **12345 SH119 SB.dtm** and select **Open**.
11. ***Do not*** cancel out of the box.

Load the existing DTM

12. Highlight **12345 Exist01.dtm** and then select **Open**.
13. **Cancel** the **Open** dialog box.

Create a Roadway library

1. Select **File > New** and choose the **Roadway Library** tab.



2. **Name**: ***12345 RampA***
3. **Description**: ***RampA roadway definitions***
4. Create a Roadway definition with the following entries.

Station	Left Template	Left Catch	Right Template	Right Catch
3281+11.83	1L – 0L	DT RampA wall	1L – 0L	DT intercept exist ftr
3288+04.99	1L – 0L	DT RampA wall	1L – 0L	DT intercept exist ftr
3288+05.00	1L – 0L w Z slope	DT RampA wall	1L – 0L	DT intercept exist ftr

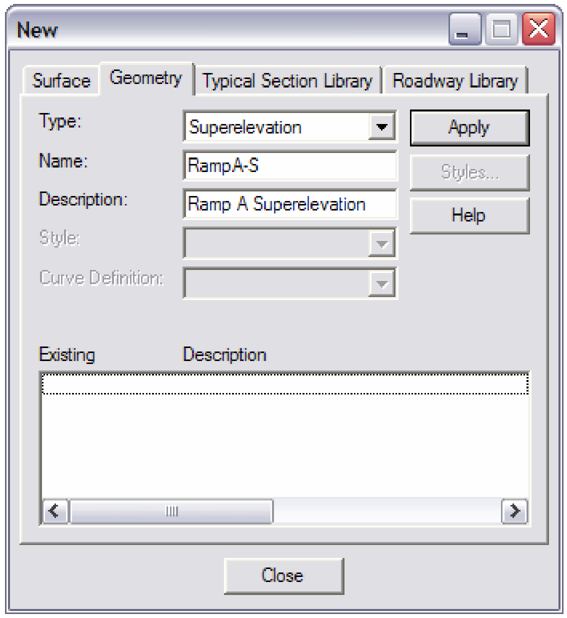
The decision table on the left will create a wall that intercepts the 3:1 slope from SH119 NB. The decision table on the right is a copy of the one created for SH119 NB that intercepts features from the existing DTM.

5. **Save** the roadway library.

Set up the Superelevation

The Superelevation for RampA must match the cross slope from SH119 NB at the point where the ramp becomes independent, super through the curves, then match the longitudinal slope where it ties into SH52. This superelevation has been worked out already and is in a text file that you will import to create the superelevation table.

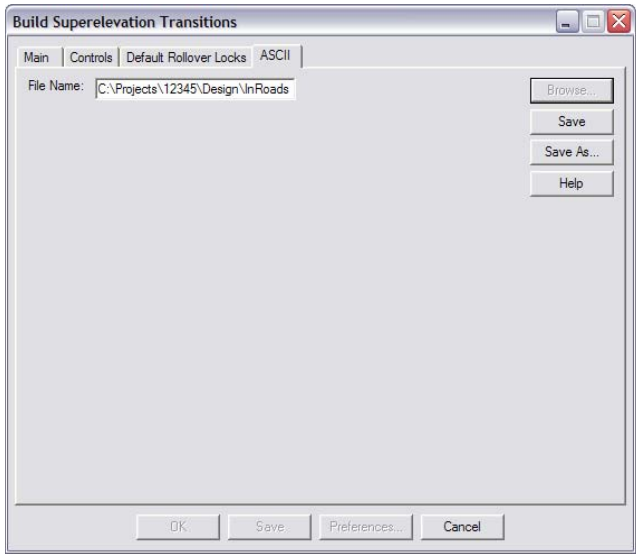
1. Select **File > New > Geometry**.



2. Toggle the **Type** to **Superelevation**.
3. Key in the **Name *RampA-S***
4. Key in a **Description *RampA Superelevation***
5. Select **Apply**, then **Close** the dialog.

6. Select **Modeler > Superelevation > Build Transitions**.

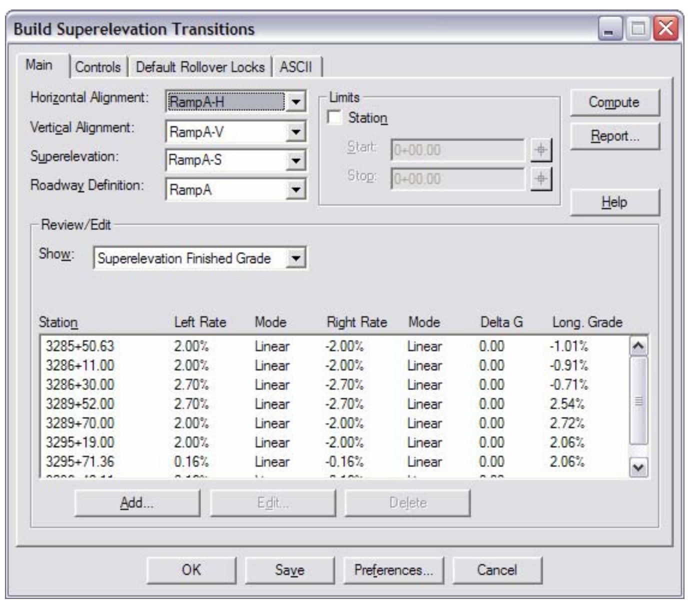
7. Select the **ASCII** tab.



8. **Browse** to find the file **RampA-Super.txt**.

9. Select **Open**.

10. Select the **Main** tab.



Notice the superelevation starts at a 2% super to match SH119 NB, then transitions into and out of a 2.7% super for the curve, then transitions to a 0.16% super to match the grade of SH52.

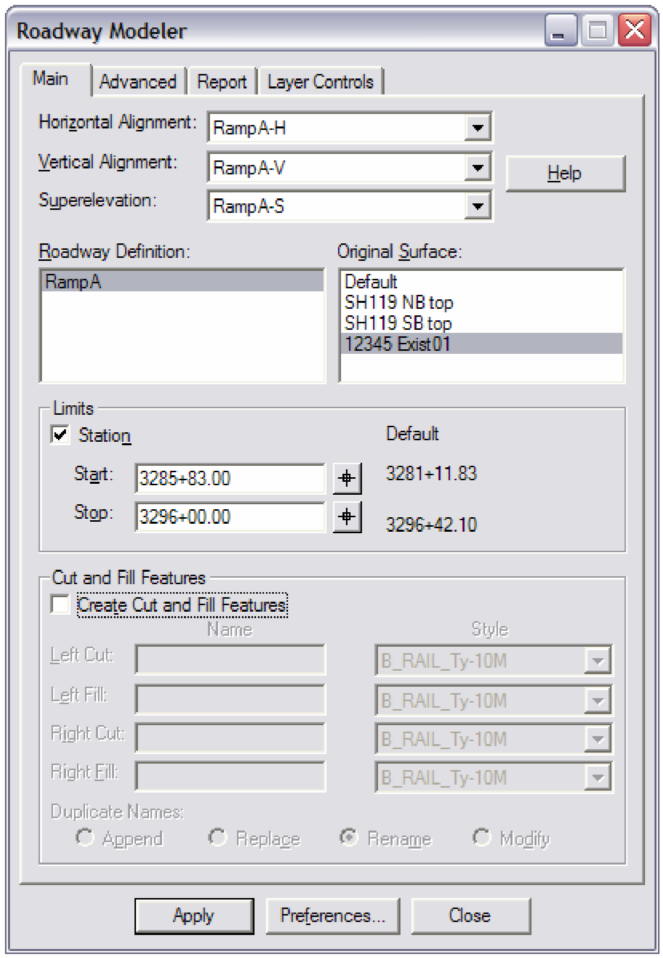
11. Select **Save**, then **OK**.

12. **Save** the .alg.

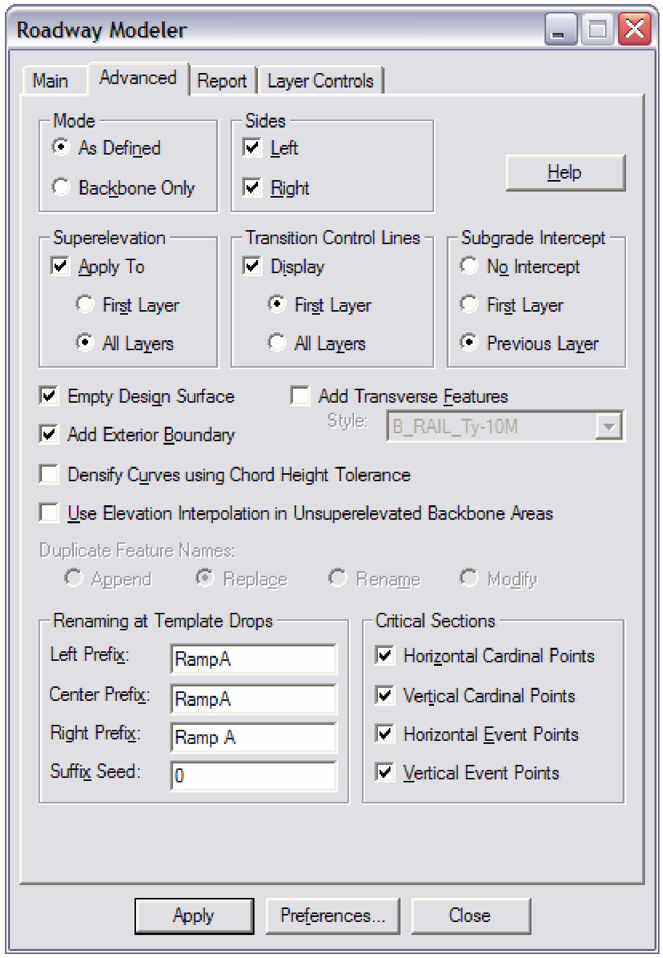
Run Roadway Modeler

1. Run **Modeler** for the ramp, beginning at station **3285+83** (where the ramp alignment takes over from the mainline and ending at station **3296+00**, where the ramp ties into SH52.

    - Set the **Main** tab as shown:



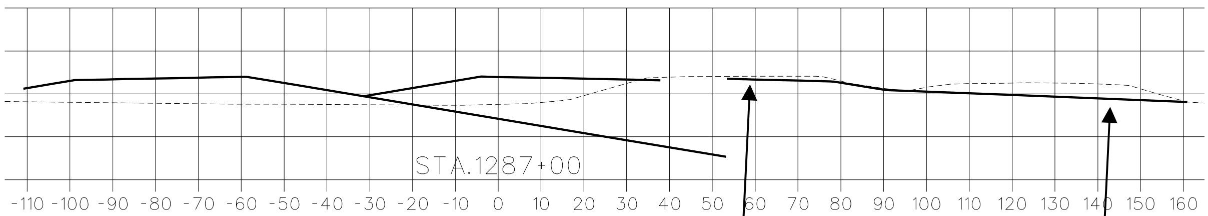
- Set the **Advanced** tab as shown:



2. After modeling, **Save** the **RampA** surface.

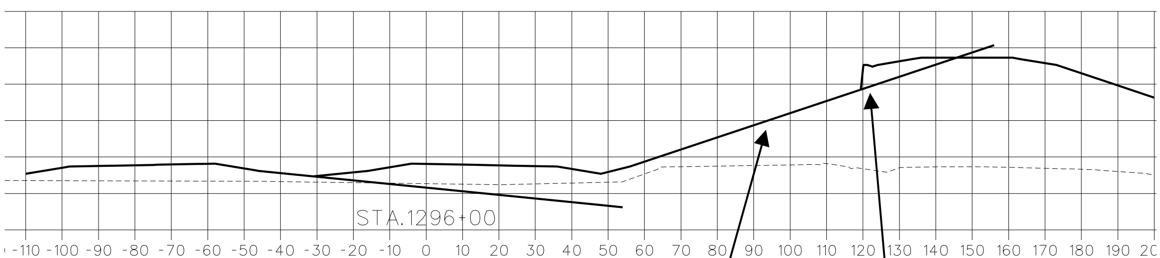
Create Cross Sections to review

1. Create cross sections along the SH119NB alignment and show **SH119 NB top**, **SH119 SB top**, **12345 Exist01, RampA top**.



RampA splitting from SH119NB
The gap between them will be a variable slope created by triangulating between the two when the surfaces are later combined.

Sideslope ties into an existing feature

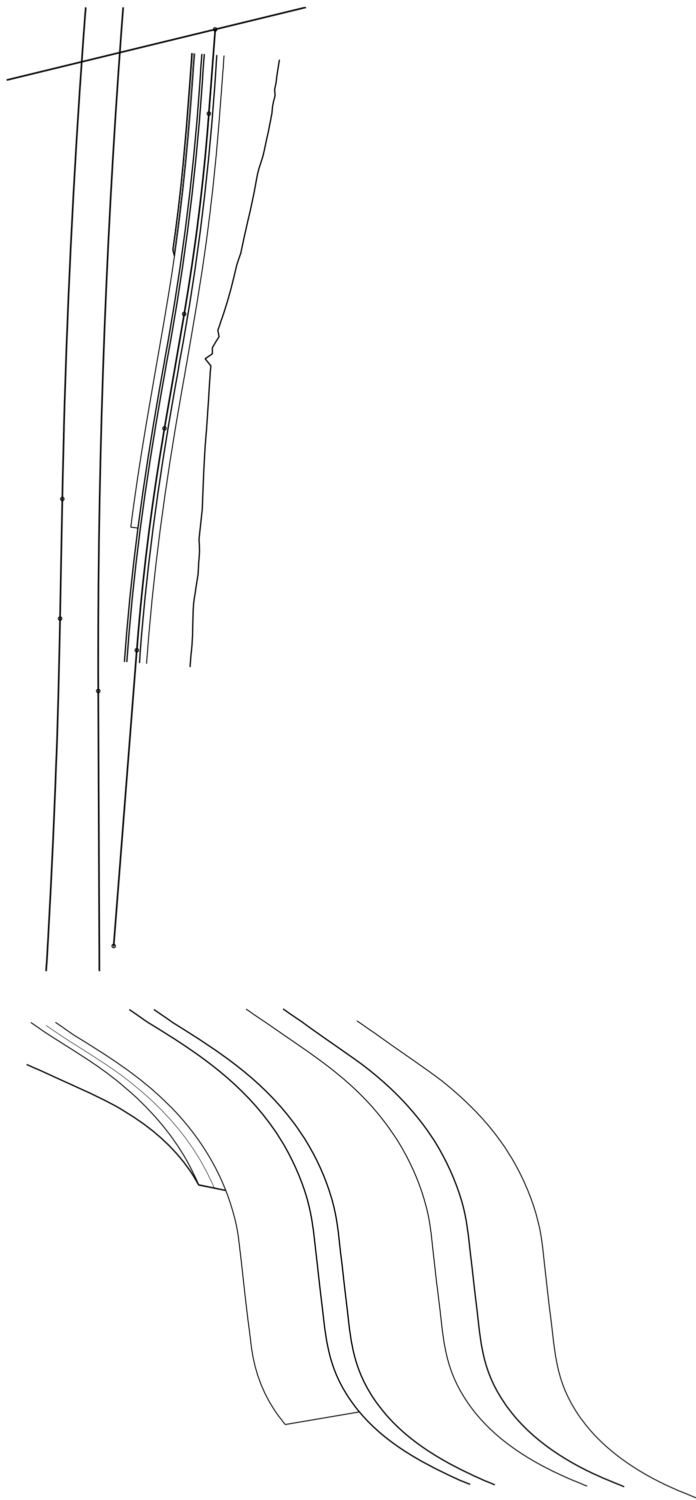


Slope formed by SH119 NB

Wall created by decision table intercepting slope from SH119 NB

Review the DTM

2. Using triangles, contours, etc., review your new surface.



Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit > Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

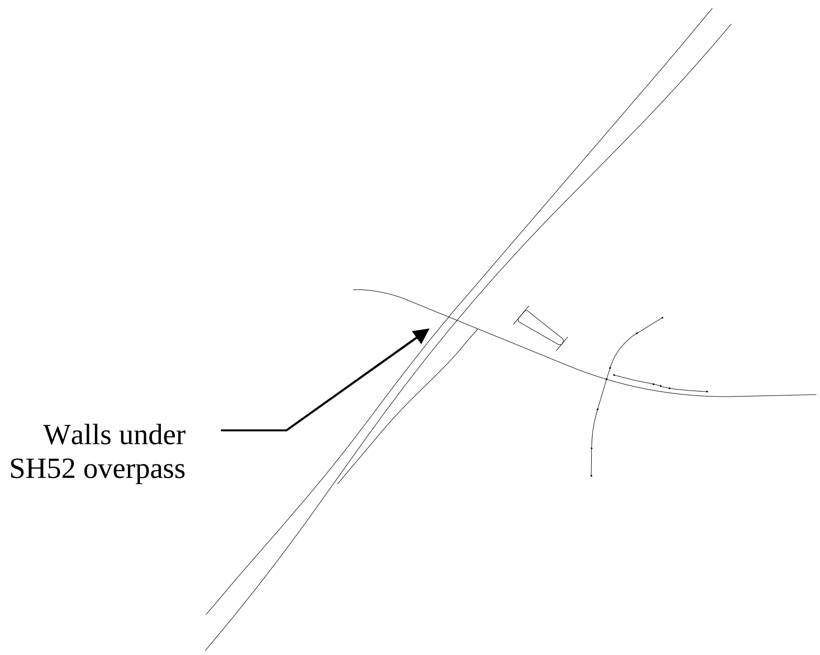
Exit InRoads and MicroStation

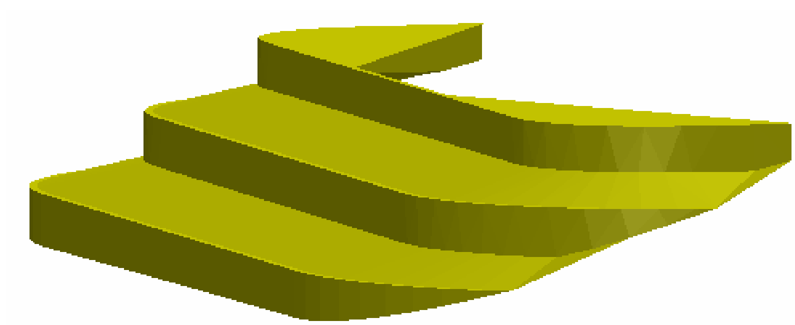
Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File > Exit**.
2. If prompted to save data files select **Yes**.

Lab 5.4 – Creating walls with feature tools

In this activity, you will use a combination of feature tools to create the walls under the SH52 overpass on SH119 NB. The wall geometry has been provided so that you can concentrate on the feature modeling.





Start MicroStation InRoads

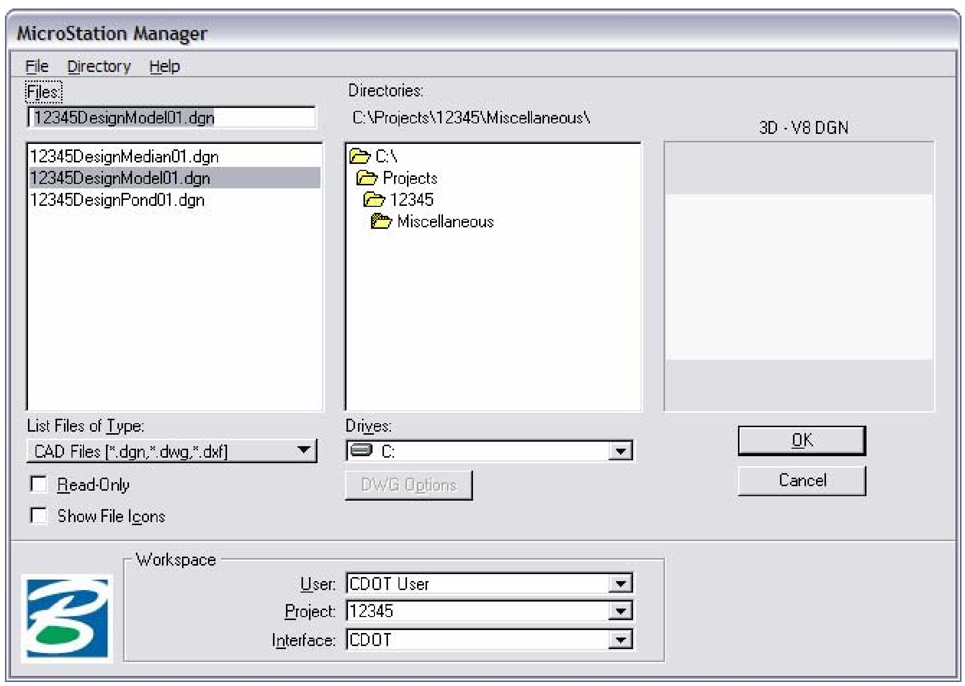
1. Select **Start >All Programs >Bentley Civil Engineering >Bentley InRoads**

   or

   Double-click on the **InRoads** icon on your desktop.

2. In the **MicroStation Manager** Dialog box:

   - Set the directory to **C:\Projects\12345\Miscellaneous.**
   - Select the file **12345DesignModel01.dgn**.
   - Make sure the **Workspace** and all other options are set as shown.



3. Select **OK**.

Set Project Defaults

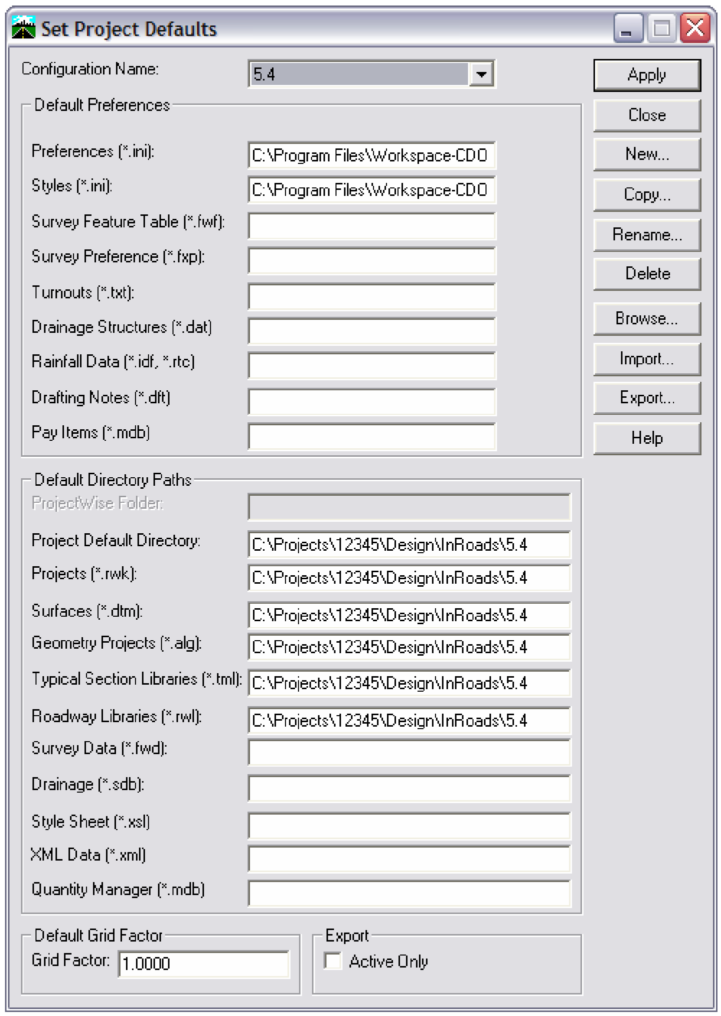
1. Select **File >Project Defaults**.

2. Set the **Configuration Name** to **5.4**

Important! Be sure to select the correct configuration name to ensure that you load the correct files.

3. Select **Apply**.

Important! Verify your dialog box appears as shown:



Load data files

Load geometry project for the walls

1. Select **File >Open**.
2. Set **File of Type** to **Geometry Projects (*.alg)**.
3. Highlight **12345 Walls.alg** and then select **Open**.
4. ***Do not*** cancel out of the box.

Load the template library for the walls

5. Set **File of Type** to **Typical Section Libraries (*.tml)**.
6. Highlight **12345 Walls.tml** and then select **Open**.
7. ***Do not*** cancel out of the box.

Load SH119 DTMs

8. Set **File of Type** to **Surfaces (*.dtm)**.
9. Highlight **12345 SH119 NB top.dtm** and select **Open**.
10. Highlight **12345 SH119 SB top.dtm** and select **Open**.
11. ***Do not*** cancel out of the box.

Load the existing DTM

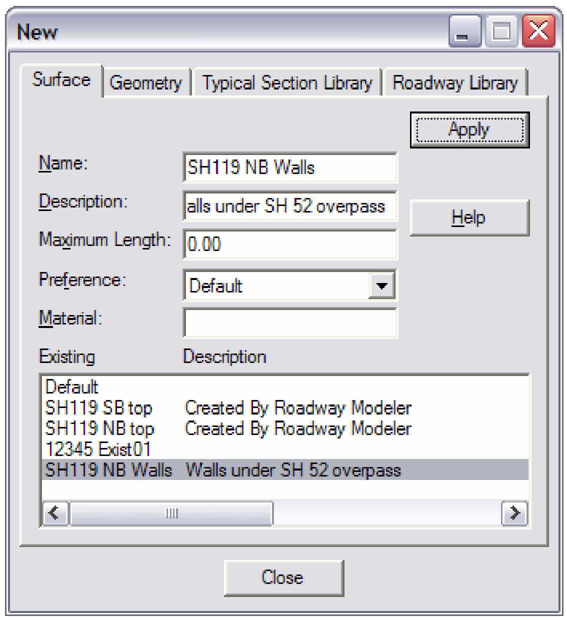
12. Highlight **12345 Exist01.dtm** and then select **Open**.
13. **Cancel** the **Open** dialog box.

Set Locks

1. Toggle ***on*** **Write** lock.
2. Toggle **Locate Features/Locate Graphics** to **Locate Graphics**.

Create new surface for walls

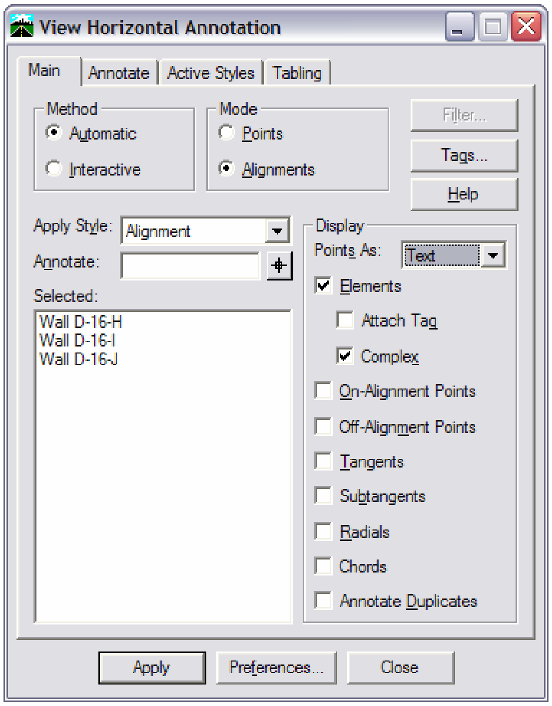
1. Select **File >New**
2. On the **Surface** tab,
3. Key in ***SH119 NB Walls***

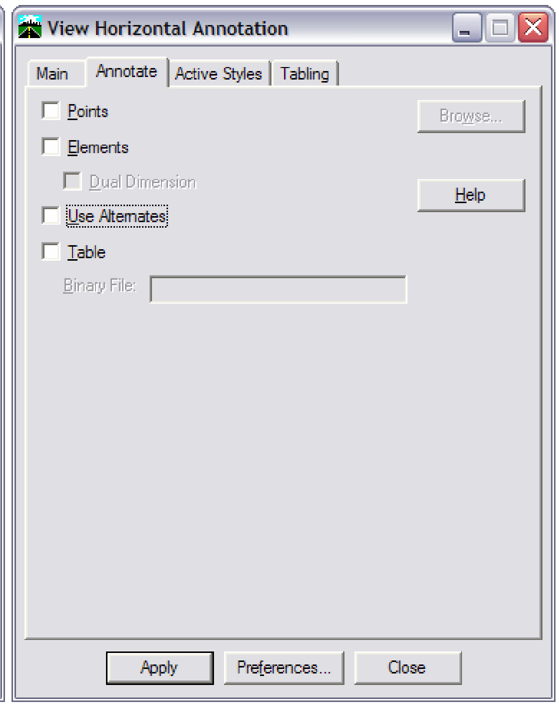


View the wall alignments

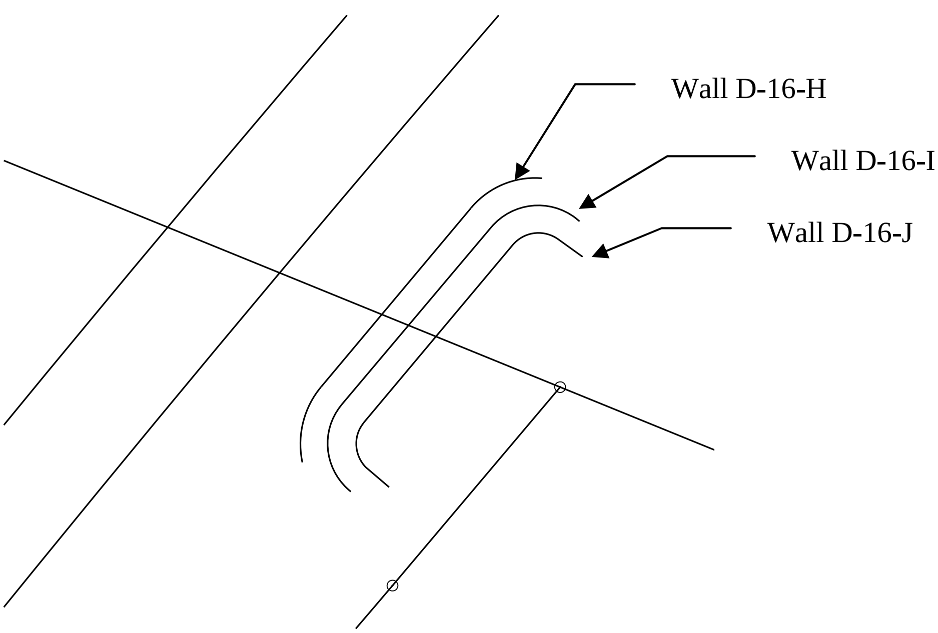
Next, you will view the alignments representing the horizontal location of the walls

1. Select **Geometry >View Geometry >Horizontal Annotation.**





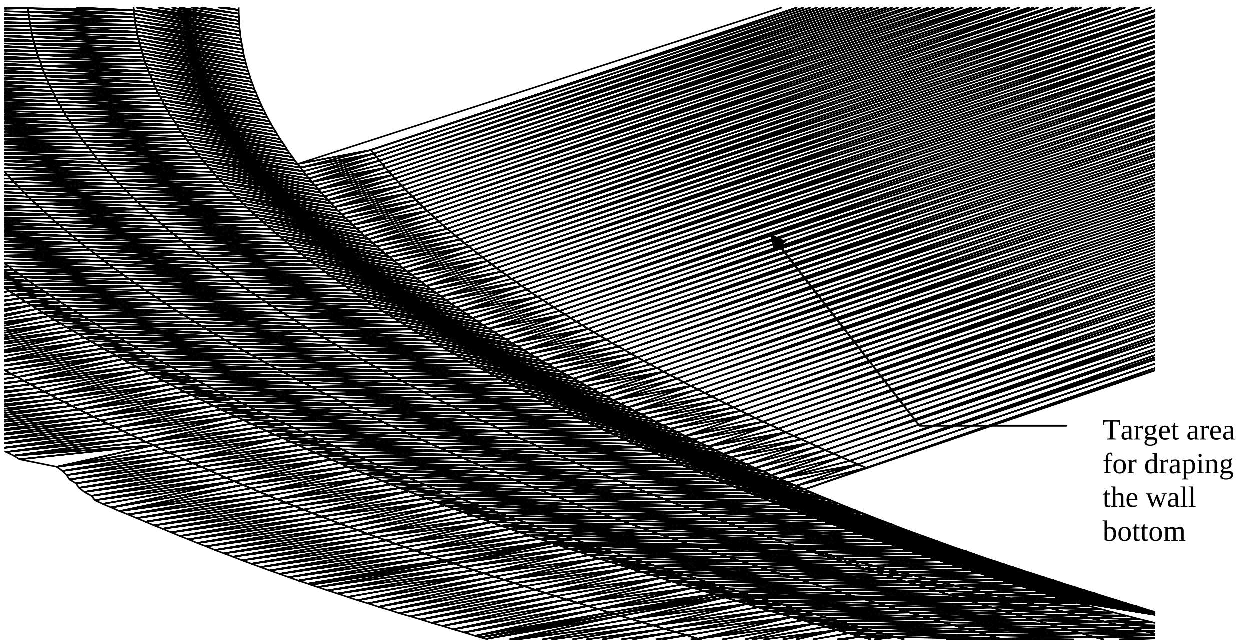
2. Set the dialogs as shown, being sure to toggle ***on*** **Complex** in the **Display** category.



View the target

The model SH119 NB top that you created previously contains a 3:1 sideslope in the area of the walls.

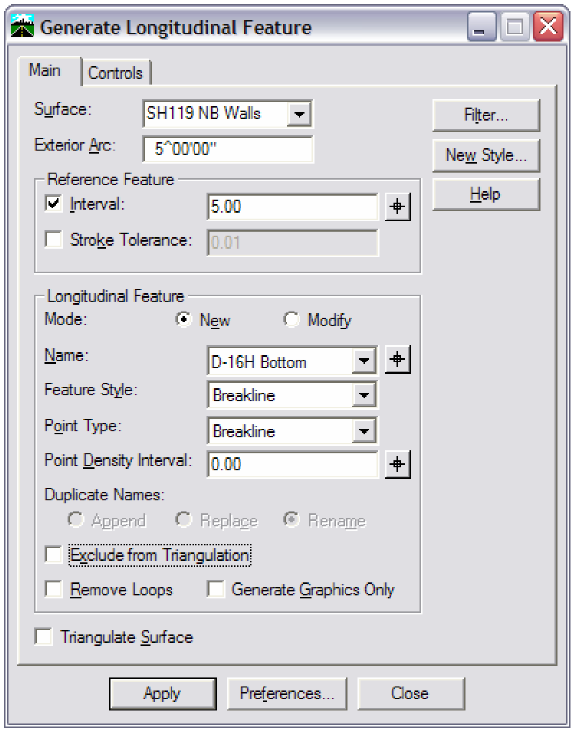
3. View the triangles for **SH119 NB top**.

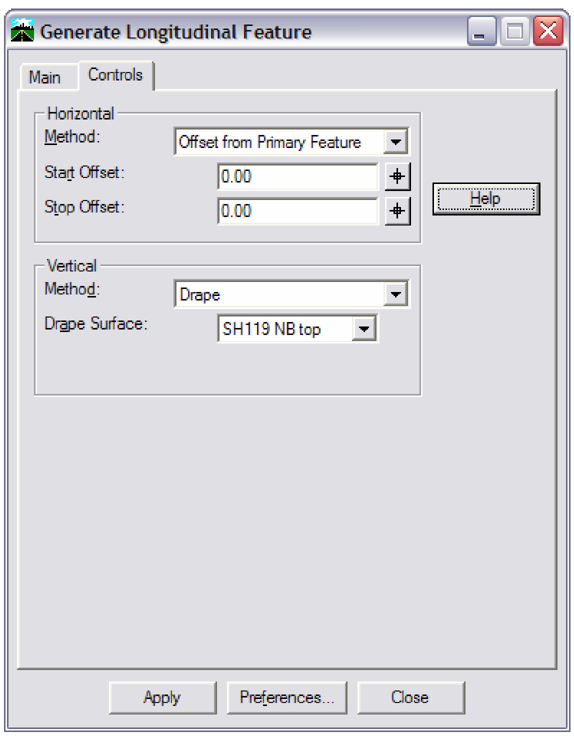


Since the bottom of the first wall (H) begins at the elevation of this 3:1 sideslope, you will first drape the alignment onto the SH119 NB model.

4. Select **Surface >Design Surface >Generate Longitudinal Feature.**

5. Set the dialogs as shown.





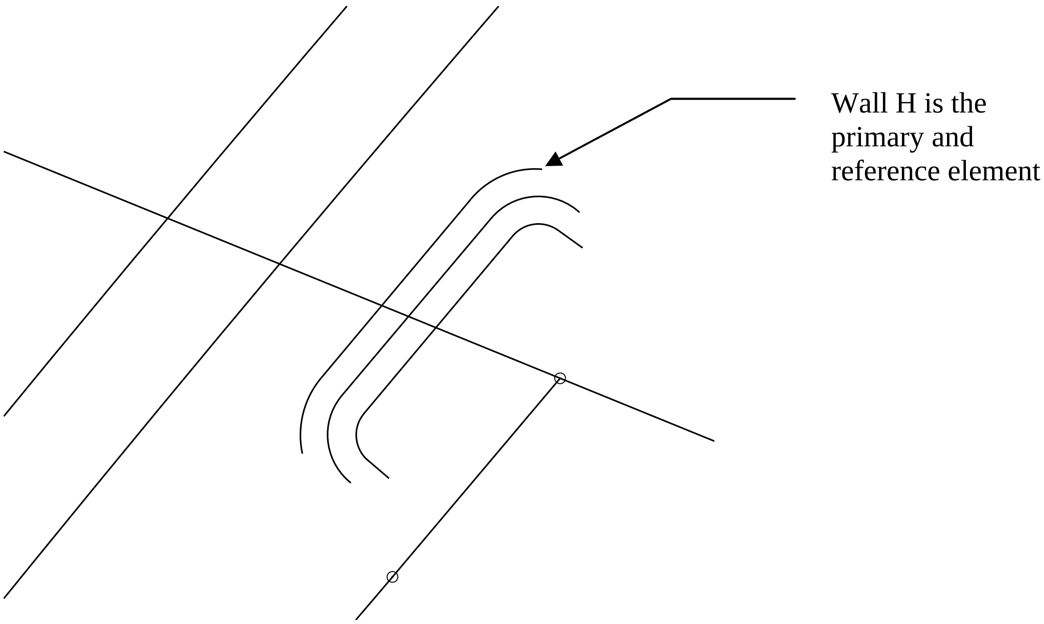
6. Select **Apply**.

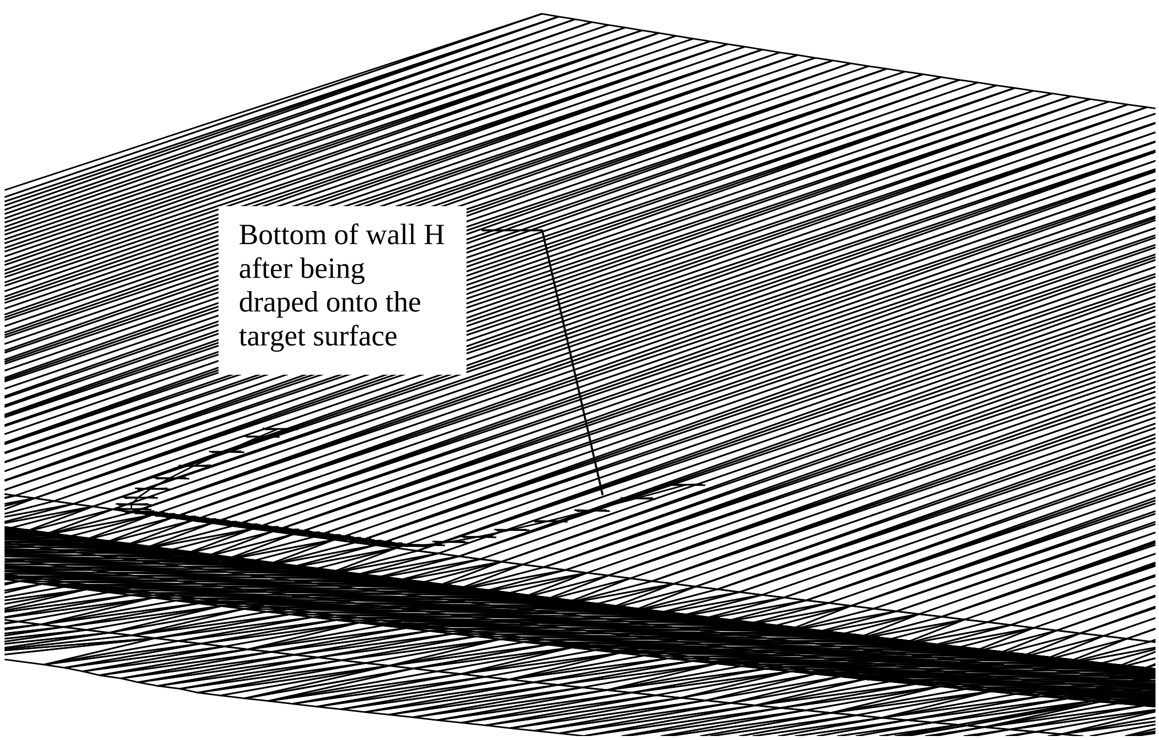
7. When prompted, identify and accept wall H as both the **Primary** and **Reference** Elements.

8. Reset **<R>** to use the whole wall, and

9. Data **<D>** to accept the location.

10. If there were horizontal offsets, you would be identifying the side of the wall to offset. Since they are set to 0 this time, you can **<D>** anywhere for the location.





Create the top of the wall

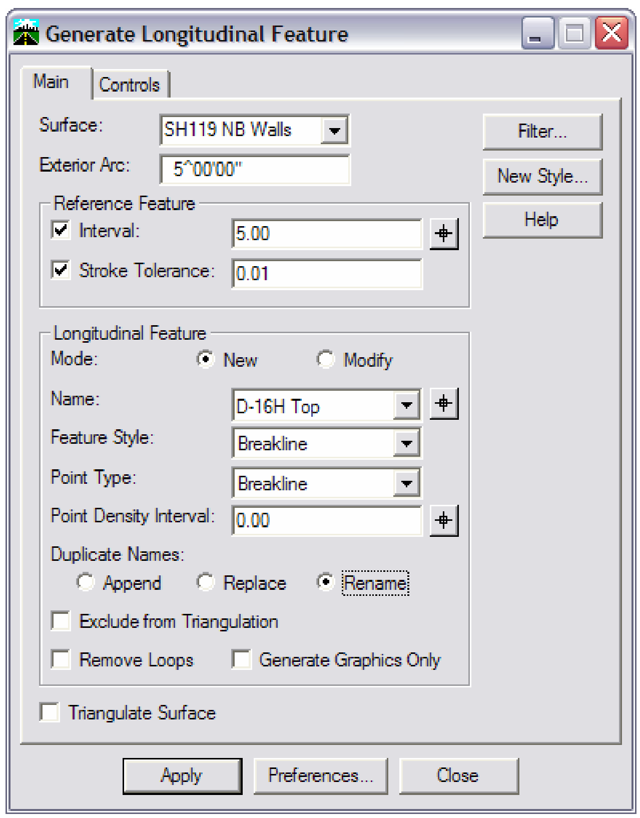
The top of the wall is at elevation 5164, and is 1' wide.

1. Toggle the **Locate Features/Locate Graphics** lock to **Locate Features**.

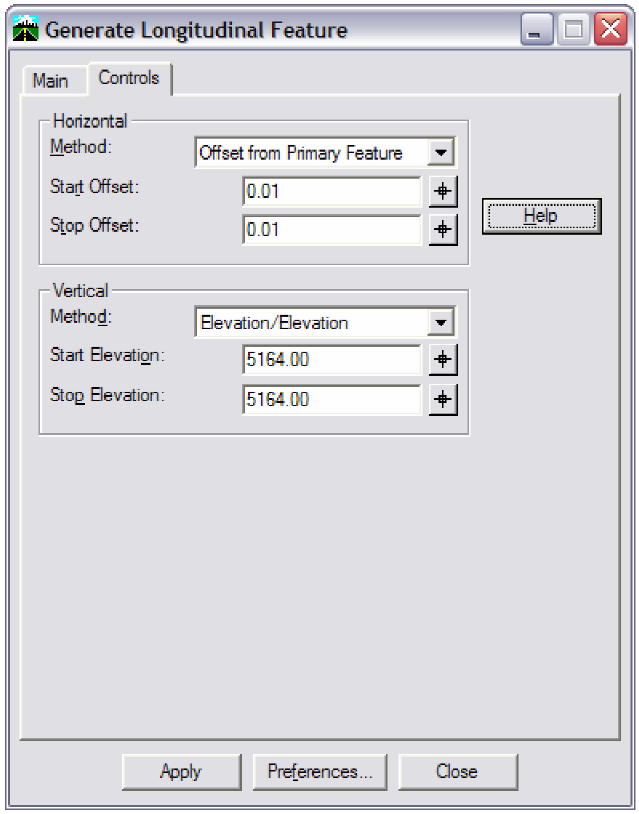
2. **Delete** the triangle display to make it easier to see and pick the wall. You can also delete the outline of the original wall.

3. Back in **Generate Longitudinal Feature**,

   - Set the **Main** tab as shown:



4. Set the **Controls** tab as shown:



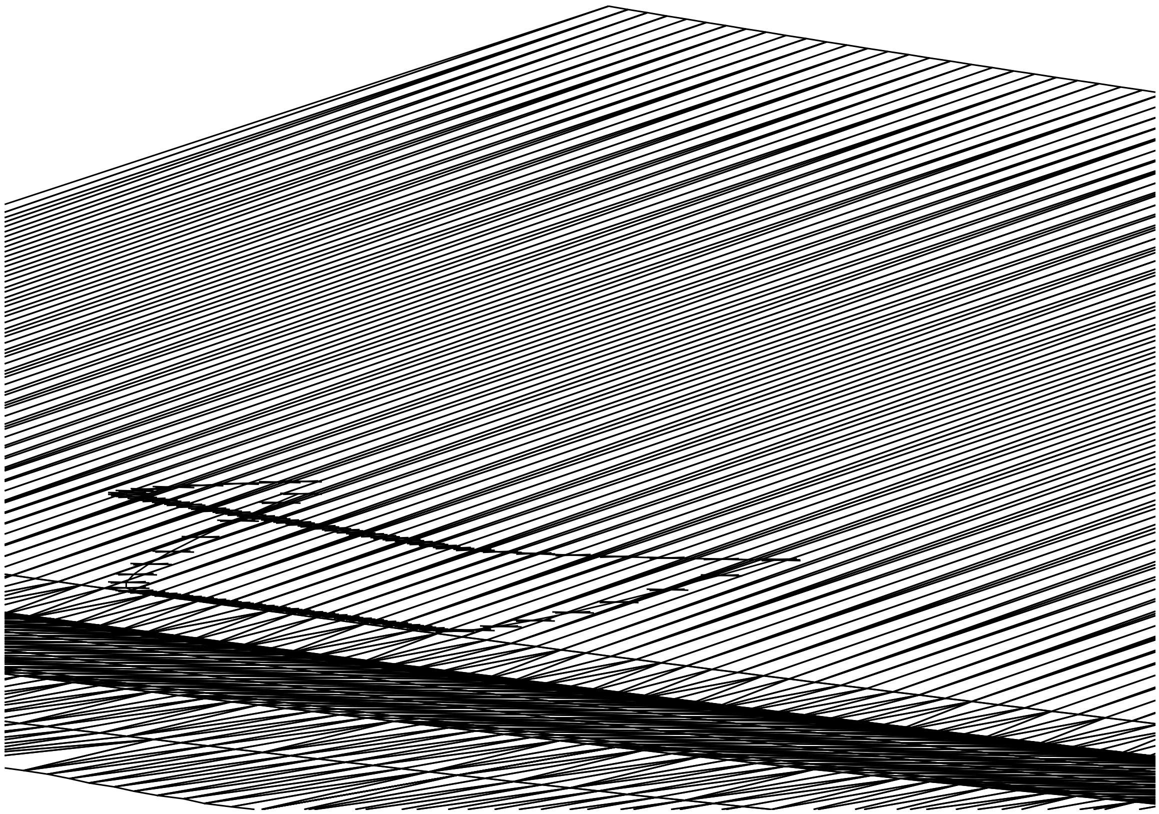
Notice the 0.01 Horizontal Offsets. This ensures that there is 'room' to triangulate the face of the wall, since you cannot have a true vertical in a DTM.

5. **Apply** and identify the wall feature as the **Primary** and **Reference** Features.

<u>Note</u>: The pictures here show rotated views. However, it is much better to work in plan view (top) and use a rotated view for reference/visual checks.

6. Reset **<R>** to copy the entire feature.

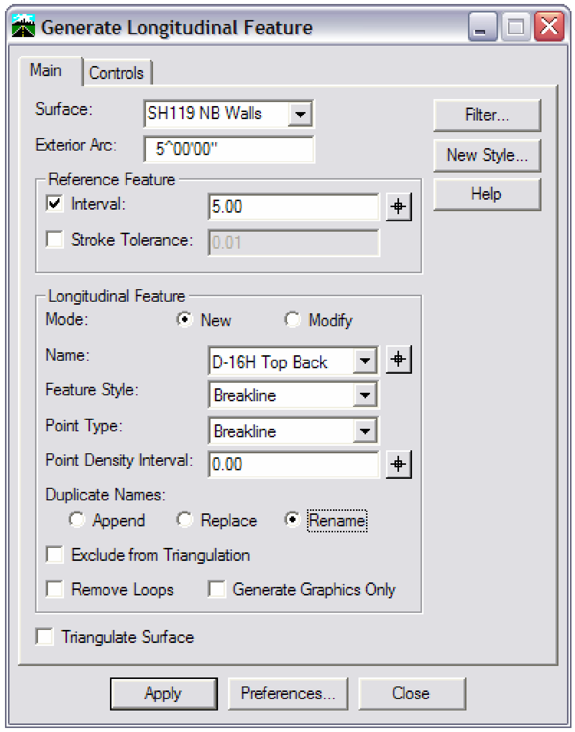
7. When prompted for the location, be certain to **<D>** on the East side of the wall outline. This is identifying the side of the feature to put the new copy on and you need to make certain the top of the wall is offset to the inside.

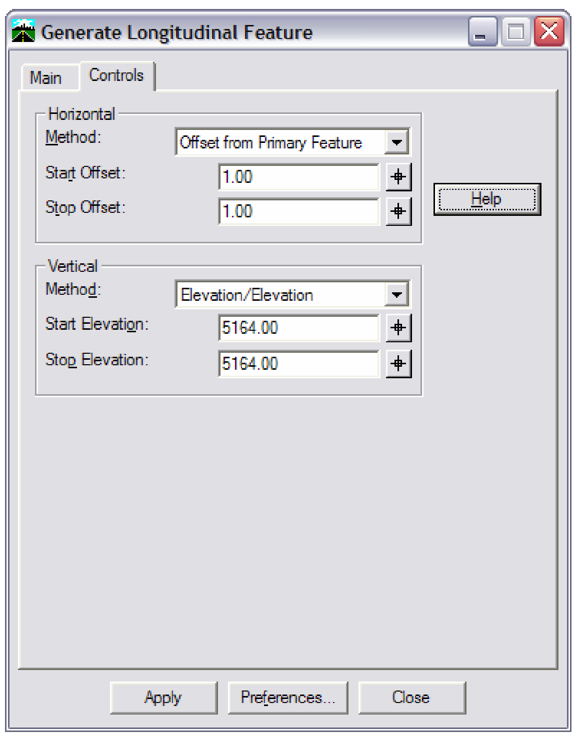


In the top view, it is difficult to see the two features, since they are so close together, but if you zoom in close enough, you should be able to see both.

Create the back of the top-of-wall

The top of the wall is 1' wide, so set up the GLF dialog as shown.

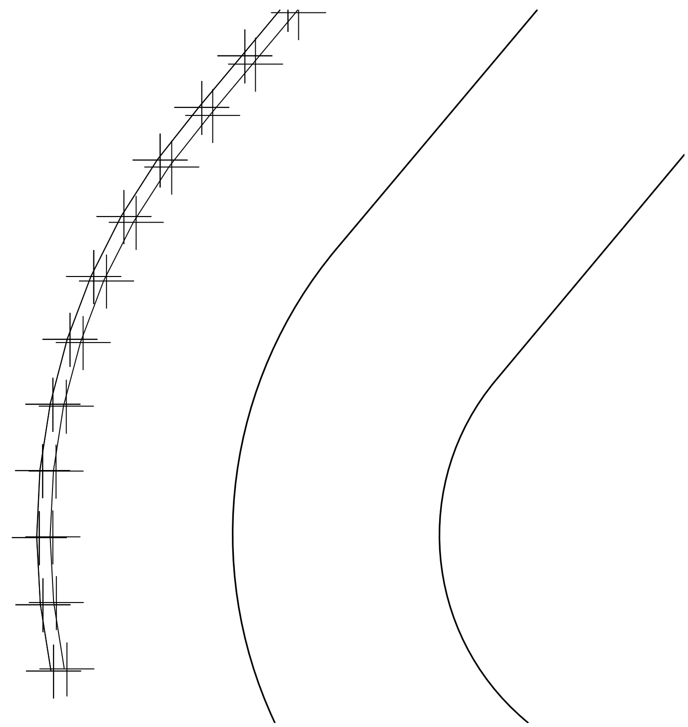




8. **Apply** and this time identify the Top of the wall as the Primary and **Reference** Features. Read your prompt to be certain you are choosing the correct feature.

9. When prompted for location, be certain to **<D>** on the East side of the wall.

> Accept/Reject D-16-H Top



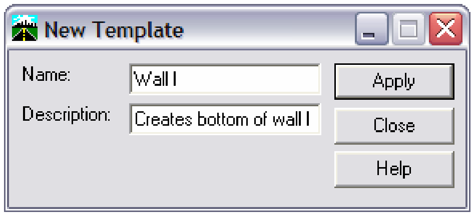
Using a decision table along a feature

The bottom of the next wall (I) is set horizontally, but not vertically. The goal is to have a 4:1 slope between the Top of Wall H, which you just created, and the bottom of wall I. On method of accomplishing this is by using a decision table that seeks a horizontal alignment.

In the next series of steps, you will create a decision table to accomplish this.

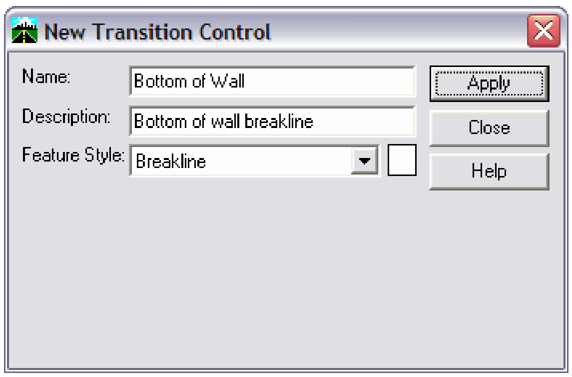
Create a decision table

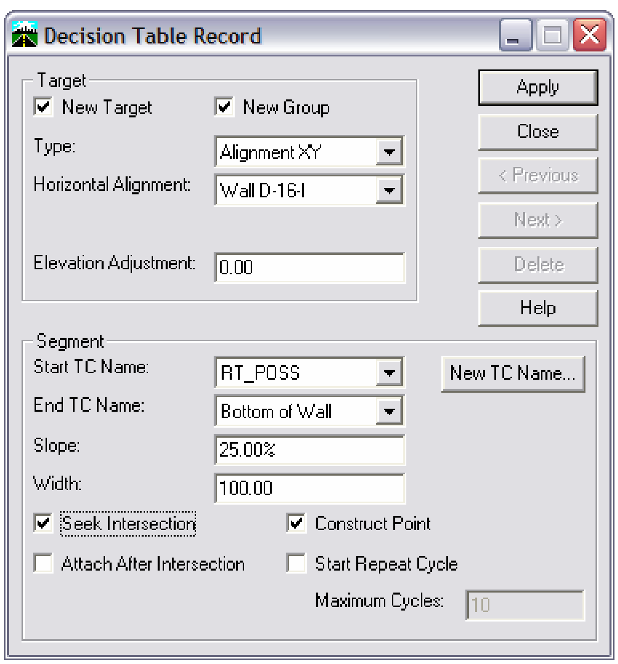
1. Create the table name and description.

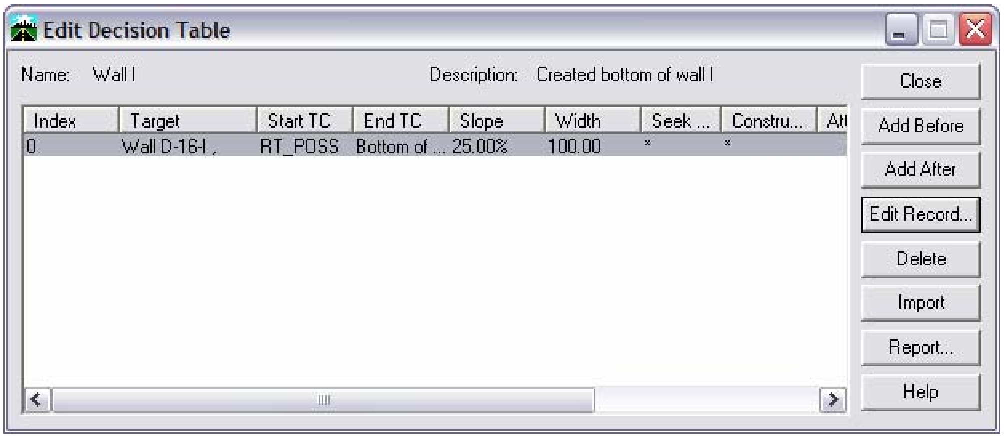


This table requires only one record, since the only slope you are interested in is from the top of Wall H to the bottom of Wall I.

2. There is not a TC name for the **Bottom of Wall**, so you will need to create one. You can use the feature style **Breakline**.







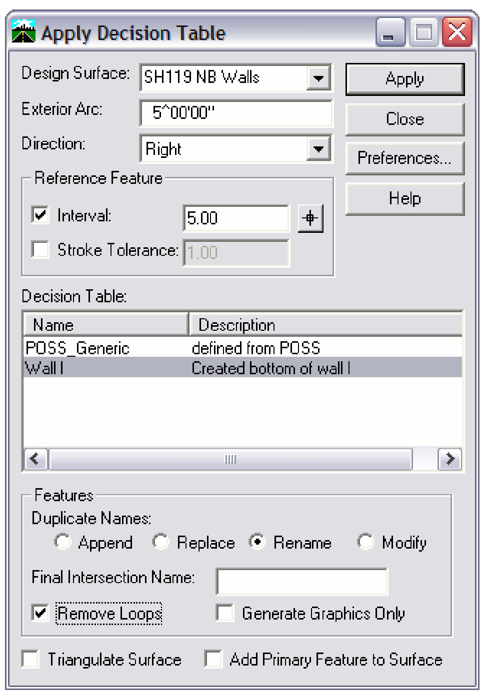
3. **Save** the typical section library.

4. **Apply** the decision table.

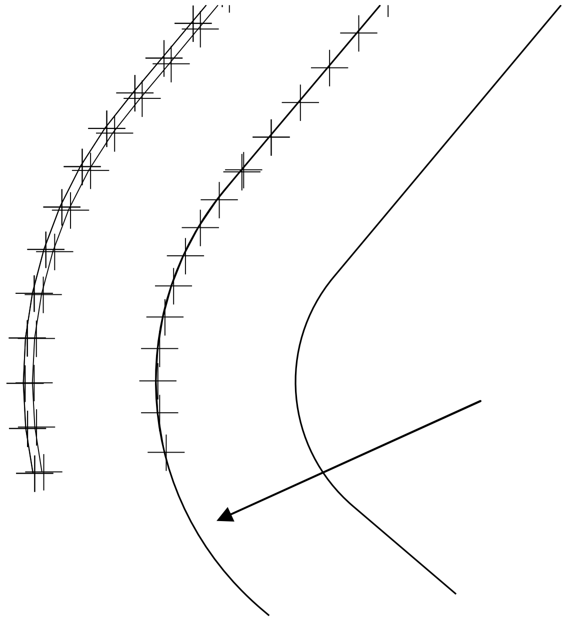
   Next, you will apply the decision table to the feature for the top back of the previous wall. In previous uses of decision tables, you have run them using Roadway Modeler and a template. This time, you will simply apply the table to the feature, which will act like the Hinge point in a template.

Apply the decision table

1. Select **Surface >Design Surface >Apply Decision Table.**



2. **Apply** and identify the top back of wall H as the **Primary** and **Reference** Features.

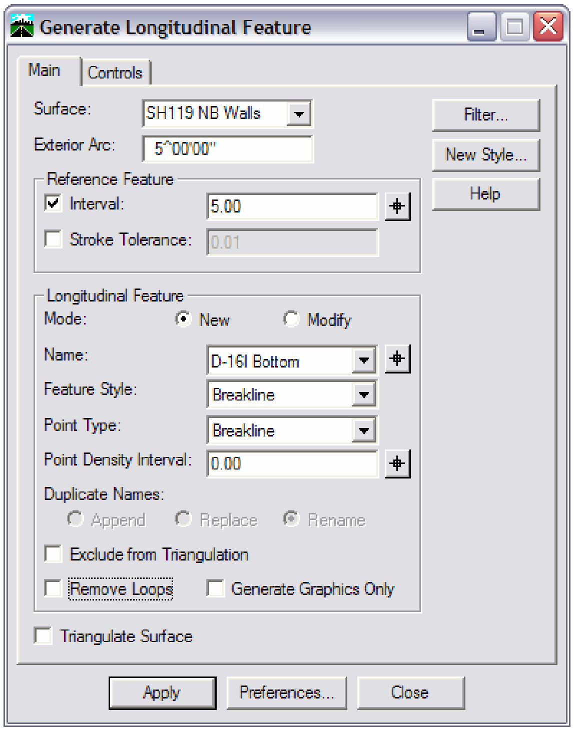


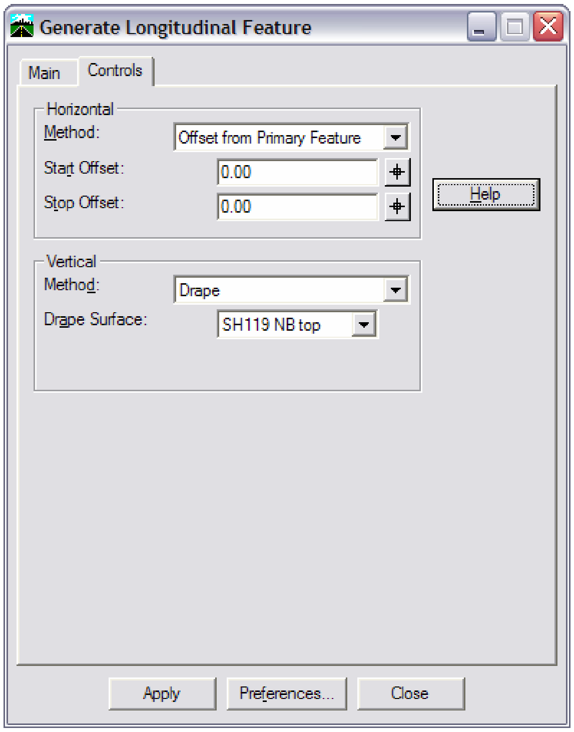
Notice the ends of the wall D-16-I were not created, as they are not perpendicular to the top of wall D-16-H. From this perpendicular point, you want to tie into the 3:1 target surface anyway, so you will drape each end of the wall onto the surface.

3. Since the ends of the wall are still graphical, set the **Locate Feature** back to **Locate Graphics**.

4. Select **Surface >Design Surface >Generate Longitudinal Feature.**

5. Set the dialog as shown.



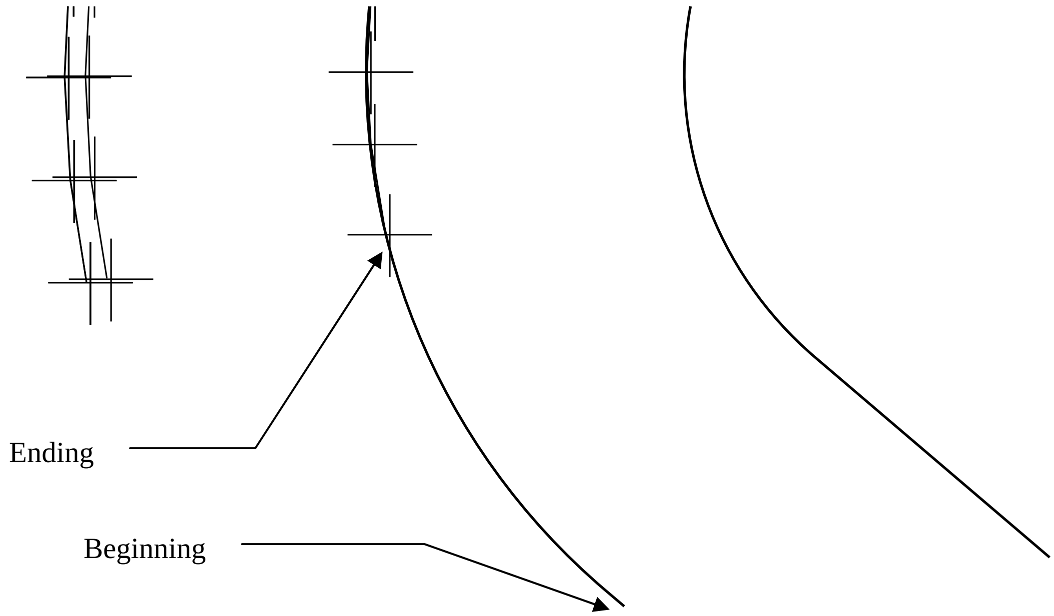


6. **Apply** and identify Wall D-16-I as the **Primary** and **Reference** Elements.

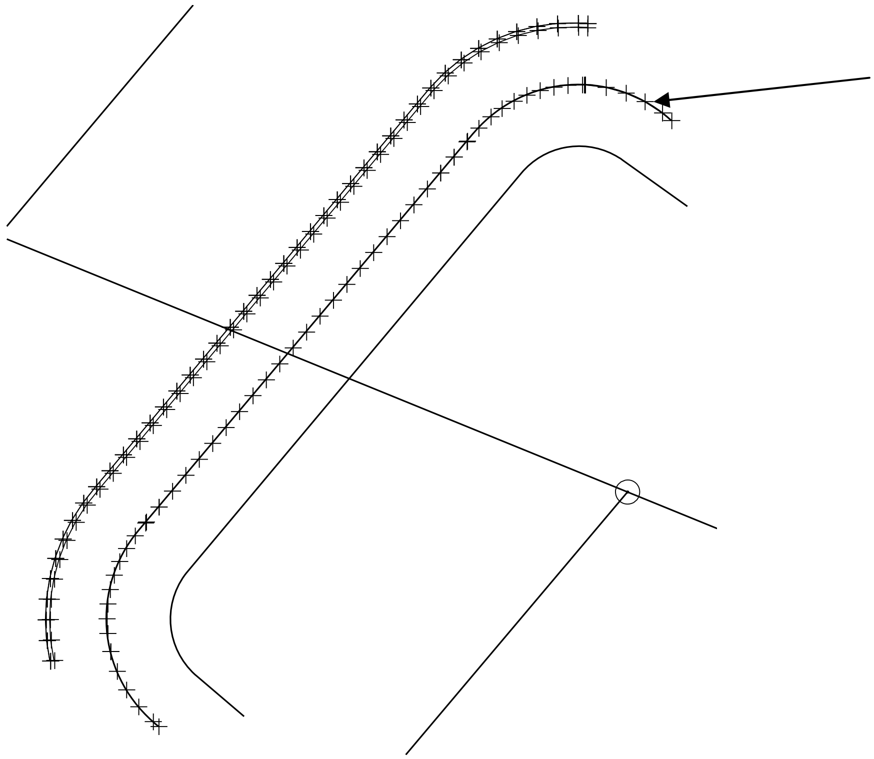
7. When prompted to **Identify Beginning**, Snap to the point where the bottom of wall feature ends.

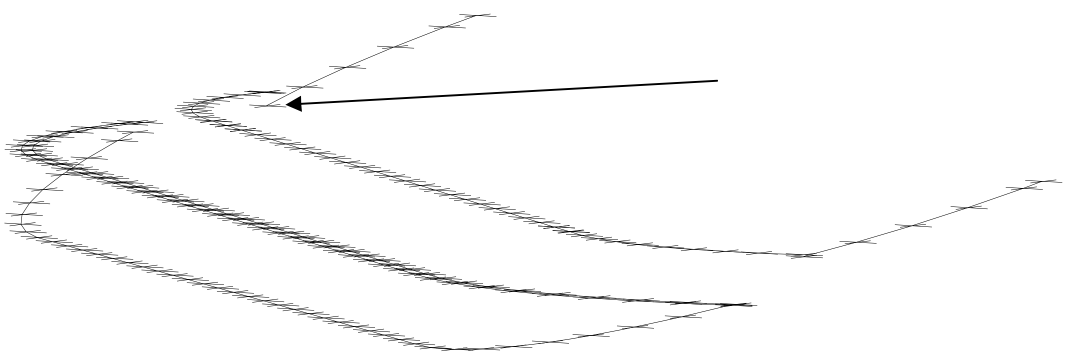
8. When prompted to **Identify Ending**, Drag your cursor out to the end and **<D>.**

9. **<D>** anywhere for the location, since the Horizontal Offsets are 0.

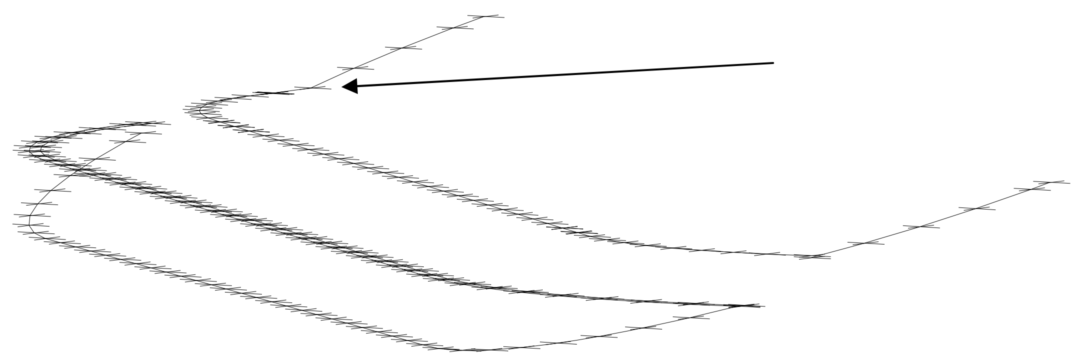


10. Repeat the process for the other end of the wall.





11. Notice that the features don't quite tie in elevation. Use **Surface > Edit Surface > Edit Feature Point** to modify the latest feature to match the original bottom of wall I.



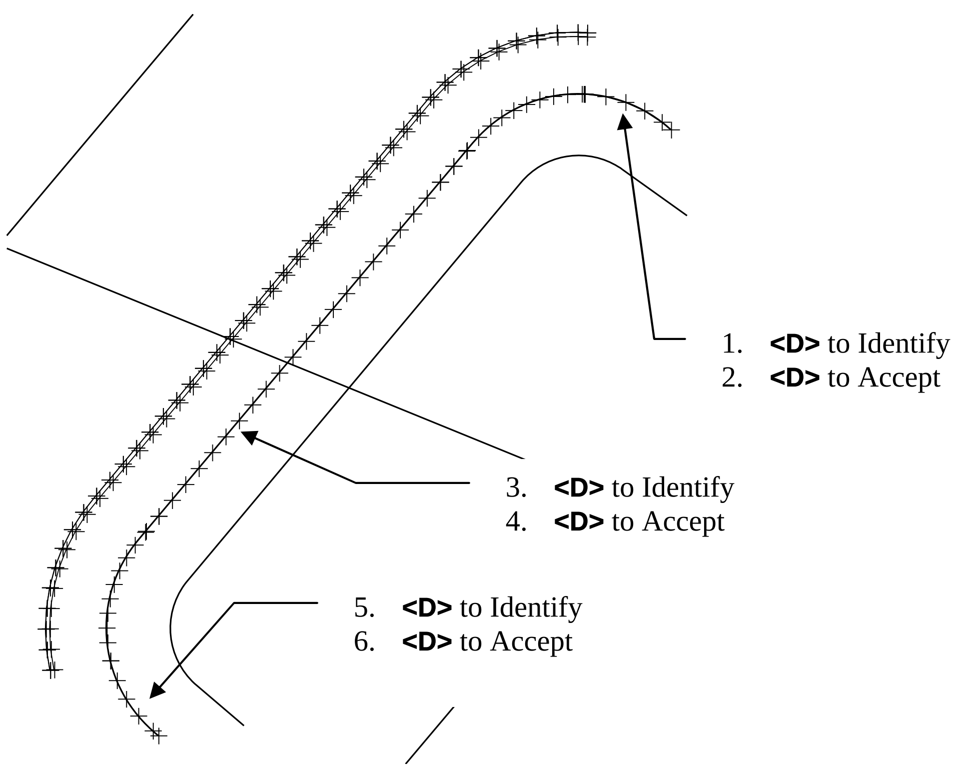
Join features

The bottom of D-16-I now consists of 3 separate features. Before proceeding, you will join them to make one feature.

1. Select **Surface >Edit Surface >Join Features.**

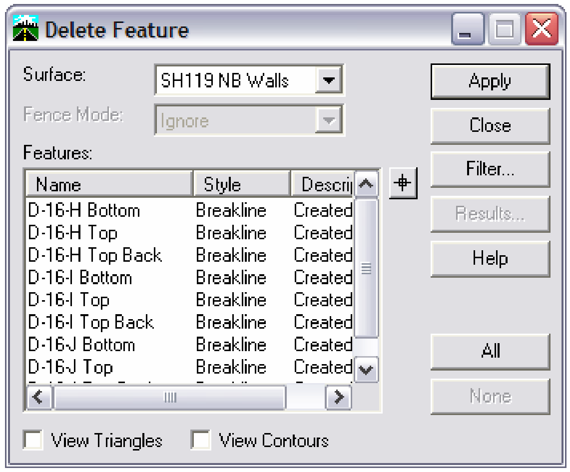
2. Identify and Accept each feature in turn starting with the Southern-most feature.

   __Note__: You must Accept each feature before identifying the next.

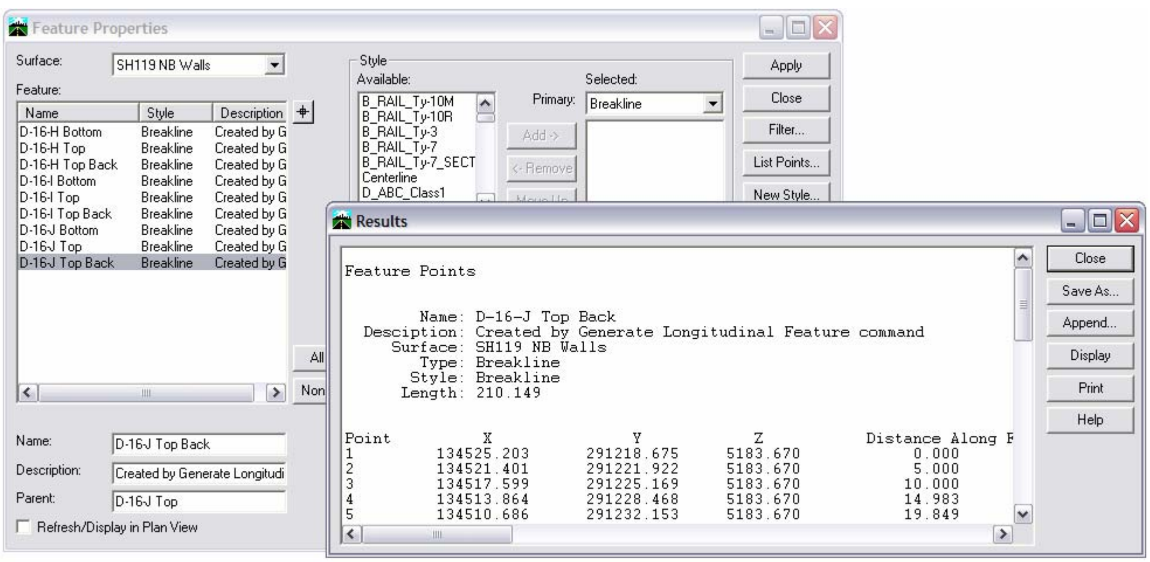


Finish the walls

In the next series of steps, you will be repeating this process to create the rest of the walls. As you go through, if you need to delete a feature, use **Surface >Edit Surface >Delete Feature**.



If you need to rename or review the elevations of a feature, use **Surface >Feature >Feature Properties**.

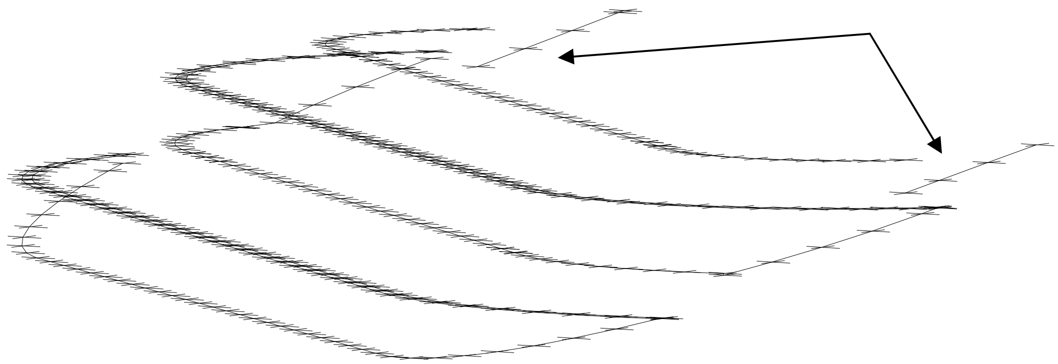


With what you have learned creating the previous wall features,

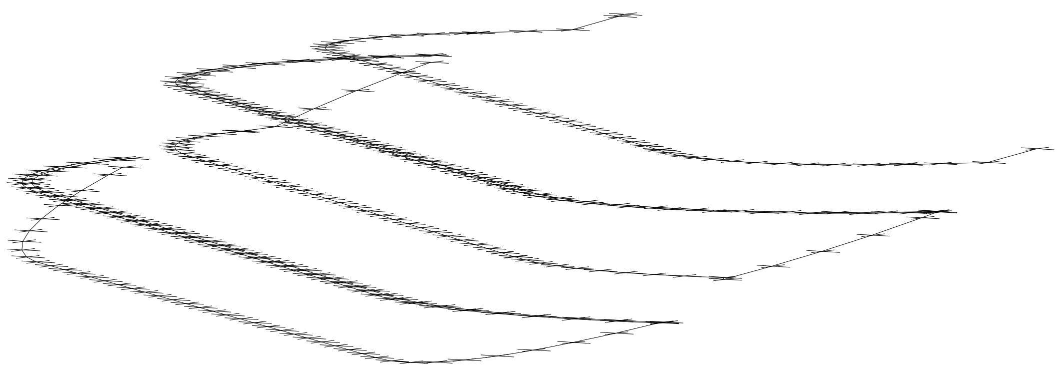
1. Use **GLF** to copy **D-16-I Bottom** to create **D-16-I Top** at elevation 5174.
2. Use **GLF** to create D**-16-I Top Back** 1’ off from the top of wall.

3. Create a decision table to model **the D-16-J Bottom** at a 4:1 slope.

4. Use **GLF** to drape ends of **wall D-16-J** onto **SH119 NB top.dtm**.



5. Notice the ends do not match as well here. Use **Edit Feature Point** to set the elevation of the points that are lower than the bottom of the wall to the approximate elevation of the bottom of the wall.

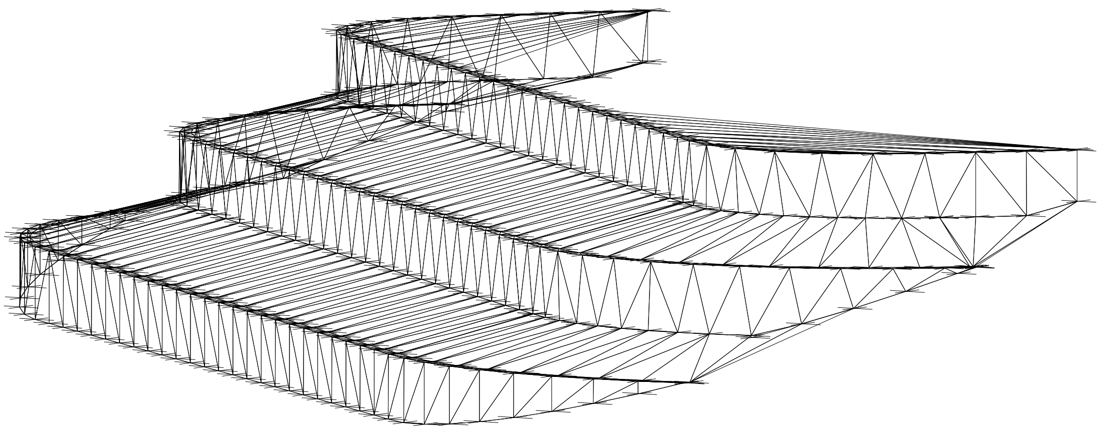


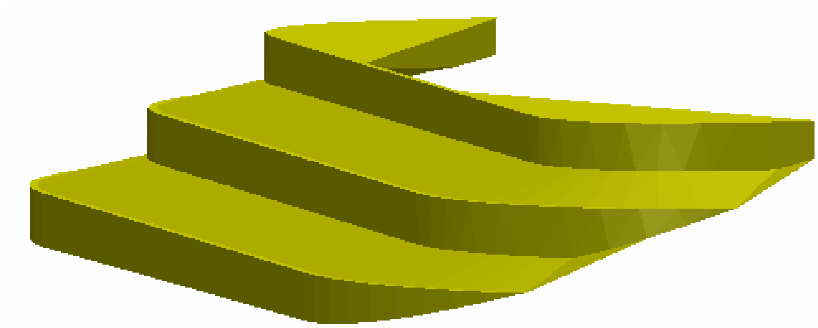
6. **Join** features for **D-16-J Bottom**.

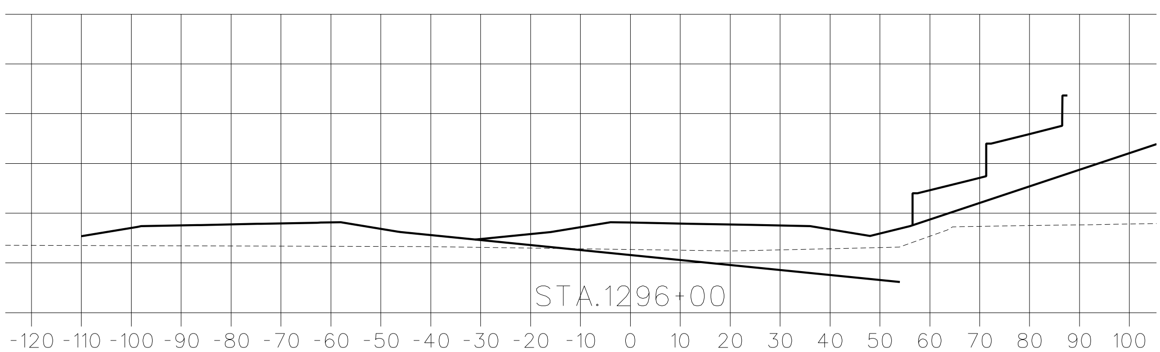
7. Use **GLF** to copy feature to create **D-16-J Top** and **D-16-J Top Back** at elevation ***5183.67***

8. **Save** the surface.

9. **Triangulate** the surface and review.







Clean-up your design file for the next lab

Important! ***Do not*** skip this step. You will need a clean design file for the next lab.

1. From MicroStation, choose **Edit >Select All**.
2. Select the MicroStation **Delete** command.

   All graphics placed in the file should now be deleted.

Exit InRoads and MicroStation

Important! ***Do not*** skip this step. You must exit in order to start the next lab session with new data files.

1. From MicroStation, select **File >Exit**.
2. If prompted to save data files select **Yes**.

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