

INROADS GEOMETRY FUNDAMENTALS



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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

0408 – Version 03.02 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:

<u>Example Item</u>	<u>Meaning</u>
View Perimeter	a command name or a file that you are to select, including directory path
Name:	field name, button or icon in a dialog box
Dialog Header	dialog box name
Tools > Options	a command path that you are to select - usually from the pull-down menus
<i>Dialog Area</i>	heading for separated areas within a dialog box
<i>Tab</i>	heading for tabs found within dialog boxes
Key in	entering data with the keyboard or items selected from drop-down list
<i>Document name</i>	style used when referring to another document
Note: text	information about a command or process that you should pay particular attention to
Concept: text	detailed definition of a concept, procedure or process
Emphasis	an important word or phrase
Prompt	user prompt
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

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1. Getting Started

Course Overview and Introduction

This course focuses on coordinate geometry (cogo) and alignments as they relate to Bentley's InRoads suite of software. Geometry data models are commonly referred to as **Alignment Geometry** projects (ALG's). The purpose of this manual is to familiarize the user with the commands and functions of the InRoads suite of software necessary to evaluate, validate, and annotate both Horizontal and Vertical geometry. Additionally, tools to create and modify Horizontal geometry will be covered.

Items addressed in this course will be:

- The InRoads Environment
- Understanding terminology
- Project defaults and Geometry Options
- Understanding Geometry Projects
- Exploring Horizontal Geometry
- Exploring Vertical Alignments
- Creating Geometry entities
- Editing Geometry
- Geometry Reports

Foundation

Intended Audience

This course is for those who want to gain a better understanding of InRoads geometry tools through the use of display, reporting, and annotation tools. It is also for those who may have the need to generate or make modifications to geometry entities and for those who wish to create profiles or cross sections relative to alignments.

Prerequisites

The attendees must have a basic understanding of MicroStation prior to attending this course. It is assumed the student has a fundamental understanding of coordinate and alignment geometry.

Duration

Overall length of this training section is 16 hours. Format is instructor lecture and demonstration followed by hands-on lab exercises.

Focus

- The display, annotation, and evaluation of both Horizontal and Vertical alignments.
- The generation of and editing of Horizontal Alignments.

Goal

- The purpose of this course is to provide CDOT personnel with an understanding of how to use the geometry features in InRoads. This understanding will aid in the analysis of geometry developed by others and allow users to create and edit geometry as necessary.

Introduction

Introduction of course goals and content

Instructor

Introduction of Instructor(s) and brief summary of credentials

Students

Introduction of students and a brief summary of student knowledge as it relates to MicroStation and InRoads and/or geometry.

Student Interests

Query as to specific interests of individual students and the class as a whole.

Schedule

Establish schedule for class breaks, lunch, and course termination.

About this document

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. This document is not meant to be used as a software reference guide or a replacement to the on-line help available through InRoads.

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

Fundamental Concepts

Software Terminology

Understanding the difference between InRoads and MicroStation

InRoads

InRoads is something of a generic term, it refers to a **Suite** of Software offered by Bentley Systems, Inc. A brief summary follows:

InRoads - Commonly used term to define the suite of software (InRoads Suite)

InRoads - Site and corridor modeling tools.

InRoads Site - Specific module designed with a focus on site design (a sub-set of InRoads with limited corridor modeling tools)

InRoads Survey - Specific module designed for the reduction of survey data. (Limited commands from InRoads Site are included)

InRoads Rail - InRoads with additional functions unique to the design of railways.

InRoads Bridge - InRoads with additional functions unique to the design of structures.

MicroStation - A CADD platform that provides the 'graphics engine' for InRoads.

MicroStation

MicroStation is necessary to run any of the software applications in the InRoads software suite. InRoads does not possess a CADD (graphics display) engine which is a fundamental necessity for the operation of the software.

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.



CADD Home Page

CADD Support News

[Tips & Tricks of the week](#)

- Home
- CADD Library
- CADD Manual
- CDOT Work Flow
- Issue Logs
- Mtg Minutes & Agendas
- Requests & Support
- Training
- Useful Links

News from the CADD Manager

On Wednesday 5-9-07, an update to the V3.01 configuration was deployed through the Standard Workspace Update procedure. Two items of particular importance are as follows. The **JPC#ApproximateQuantities##.dgn** (SAQ sheet) found in the C:\Projects\JPC#\Design\Drawings folder was updated. Any project that was created the week of 4-25-07 through 5-9-07 with V3.01 workspace, should replace this file. Download the file from [Here](#). The **CDOT Preferences** file was updated to include the following features: *D_CURB_Back, D_Hinge, D_CONC_Pvmt, D_CONC_Sw, D_CURB_FL_LT and D_CURB_FL_Rt*. If you need assistance with either of these updates, contact the Help Desk @ (303)757-9317 to have a support person contact you. [Click Here](#) to review the Configuration ReadMe file.

If you are noticing that your reference files are showing up RED, call the Help Desk (303)757-9317. A support person will contact you and guide you through the process of updating your PCF file. You should **NEVER** have to detach and re-attach your reference files once they have been attached.

To view Previous CADD NEWS check:
[Past CADD Support News](#)

Tips & Tricks

[Back to CADD Support News tab](#)

InRoads

InRoads Menu Location

Did you know that your Bentley InRoads Menu always want to open on your primary monitor? Through discussions with Bentley, it has been determined that this phenomenon is by design. It is necessary because Laptop computers can be used to run InRoads, and if the InRoads menu was banked on the secondary monitor, it would be lost when the laptop was used stand-alone. If you drag the InRoads menu to your secondary screen, leaving only a very small sliver on the primary screen, the menu will stay banked and you won't have to move it each time you open InRoads. **Thanks to Daniel Thomas with Region 4 Traffic.**

To view additional tips and tricks check:
[All Tips & tricks](#)

20424



Email: [Page Master](#) regarding information on this page
Email: [Web Master](#) regarding website functionality



Last Modified: Tue, Feb 28, 2006
[Back to Top](#)

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

CADD Library

The **CADD Library** page provides links to manuals, newsletters, standard details, *etc.* One extremely useful link is to the **Tips and Tricks** section for MicroStation and InRoads. This information changes daily, so check back often.



CADD Library

- [Details.](#) • [Manuals.](#) • [Newsletters.](#) • [Old Docs.](#)
- [Tips and Tricks.](#) • [Useful Links.](#)

Details

- [Bridge...](#) • [Construction...](#) • [Design...](#) • [Environmental...](#)
- [Hydraulic...](#) • [ProjectWise...](#) • [Survey\ROW...](#) • [Traffic...](#) • [Utility...](#)

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CADD Manual

The CDOT Computer Aided Design and Drafting (CADD) Manual outlines CDOT's use of Bentley's MicroStation and InRoads software. It documents standardized procedures for the exchange of information between CDOT regions, specialty groups, and consultants working on CDOT projects. 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.

The CDOT CADD Manual and the associated electronic files contained in the CDOT configuration are used in the generation of electronic plans by both CDOT internal designers and the consulting firms doing business with CDOT. The electronic version of the Manual provides hyperlinks to each chapter as well as context sensitive index and search functions. You can also print chapters or the entire manual.

The CDOT CADD Manual can be accessed several different ways including:

- From the CDOT internal CADD web site home page link;
- From the CDOT Design and Construction Project Support Page (external web site);
- From the CDOT Menu (Help > CADD Manual).

The screenshot displays a web browser interface for the CDOT CADD Manual. The top navigation bar includes buttons for 'Contents', 'Index', 'Search', 'Print', and 'Glossary', along with a search input field and a 'Powered by: RoboHelp' logo. A left-hand sidebar contains a table of contents with links to various chapters and appendices. The main content area is titled '1.0 Chapter One - Introduction' and features the CDOT logo. The text describes the manual's purpose and the CEST project. Below this, the '1.1 Background' section details the project's goals and lists key activities. The '1.2 Trademarks' section discusses the use of Bentley's software trademarks.

1.0 Chapter One - Introduction

This document is intended to outline the Colorado Department of Transportation's (CDOT) use of Bentley's MicroStation V8 2004 Edition and InRoads V8.05, as well as internally developed tools and procedures. Following these standardized procedures will help to facilitate the exchange of information between CDOT regions, specialty groups, and consultants working on CDOT projects. The CDOT Computer Aided Design and Drafting (CADD) Manual will address issues such as: software, tools, techniques, standards, and procedures, which will aid the user in the efficient production of CDOT plan sets. The CDOT CADD Manual and the associated electronic files contained in the CDOT configuration are to be used in the generation of electronic plans by both CDOT internal designers and the consulting firms doing business with CDOT.

1.1 Background

At CDOT, the CADD migration project is known as the Colorado Engineering Software Transition (CEST) Project. Beginning in 2004 the CEST project began with 15 first adopter projects, migrating each to the Bentley suite of software. Growing from these 15 first adopter projects to a statewide rollout in 2005 the CEST project has encompassed, at some level, each critical item in a project of this magnitude. These include:

- Creation of electronic files making up a comprehensive standard, including, but not limited to:
 - Seed files
 - Levels and symbology
 - Cells
 - Linestyles
 - Text and dimensions
 - InRoads preferences
 - Standard templates and typical sections
- Updating existing projects to the Bentley suite of software.
- User training
- Development of standard workflows

In the initial phases of this project, Survey and Roadway Design were addressed to a much greater degree than other disciplines. The goal over the next three years is to continue the CEST vision by addressing each of the specialty groups within CDOT as well as continued enhancement of the current configuration. To accomplish this, CDOT will continually update and add to CDOT's software, configuration, workflows, and training programs. Ultimately, the CEST project will create a complete electronic project delivery system integrating each user and system from planning through construction. The combination of software, configuration, and workflows will allow all users to work seamlessly together in the most productive and efficient CADD environment available. At the end of FY08, the plan will be complete with interconnection of all groups and complete automation, including electronic bid letting.

1.2 Trademarks

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. MicroStation and InRoads are trademarks of Bentley Systems Incorporated. Where other designations appear in this book, and the authors were aware of a trademark claim, the designations have been capitalized.

CDOT Workflows

There are several standardized MicroStation and InRoads workflows that CDOT has developed to assist you. These workflows are step-by-step CDOT-specific procedures for certain tasks that you may encounter when working in MicroStation or InRoads on a CDOT project. Many of these workflows are referenced throughout the course.

In addition to accessing the workflows from the CDOT CADD Web site Home page link **CDOT Work Flow**, you can also access workflows:

- From the Windows Start menu
(Start > All Programs > _CDOT_CADD_Information > Workflows);
- From the CDOT Menu (Help > Workflows).

New workflows are typically added with CDOT configuration updates, so check back often.



CDOT Work Flow

Work Flow :

[CDOT Alignment Display in Cross Section.Ink](#)
[CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
[CDOT Batch Printing.Ink](#)
[CDOT Batch Processing.Ink](#)
[CDOT Configuration ReadMe file.Ink](#)
[CDOT Converting AutoCAD Files to MicroStation.Ink](#)
[CDOT Creating Multiple Plan Sheets.Ink](#)
[CDOT Directory Structure.Ink](#)
[CDOT Displaying Features in Cross Section and Profile.Ink](#)
[CDOT Exporting Fieldbook Files.Ink](#)
[CDOT Greek Characters.Ink](#)
[CDOT Level Update for V03.01.Ink](#)
[CDOT Linking MicroStation to Excel Documents.Ink](#)
[CDOT MicroStation Printing.Ink](#)
[CDOT Note Sheets.Ink](#)
[CDOT PCF Management.Ink](#)

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- Requests & Support
- Training
- Useful Links

Issues Logs

Check the issues log to determine the status of submitted requests.

Requests & Support

This page provides CADD help solutions where you can:

- Learn how to get help;
- Submit a questions;
- Submit a request (e.g. request a new MicroStation level or InRoads preference), as well as
- Obtain InRoads, InRoads Survey and MicroStation support.

There is also a link to **IT Services** for hardware support, “how to” instructions, installation, training files, and work space setup.



Requests & Support

[• How to Get Help...](#) • [Email CADD Manager...](#)
• [Team Members...](#) • [Support Schedule...](#) • [IT Services...](#)

[Home](#)

[CADD Library](#)

[CADD Manual](#)

Training

Use this link to find out how to sign up for training classes. You can also review online computer-based training (CBT) for MicroStation, InRoads and InRoads Survey.

Overall Scope

Training Data

SH 86 Elbert County

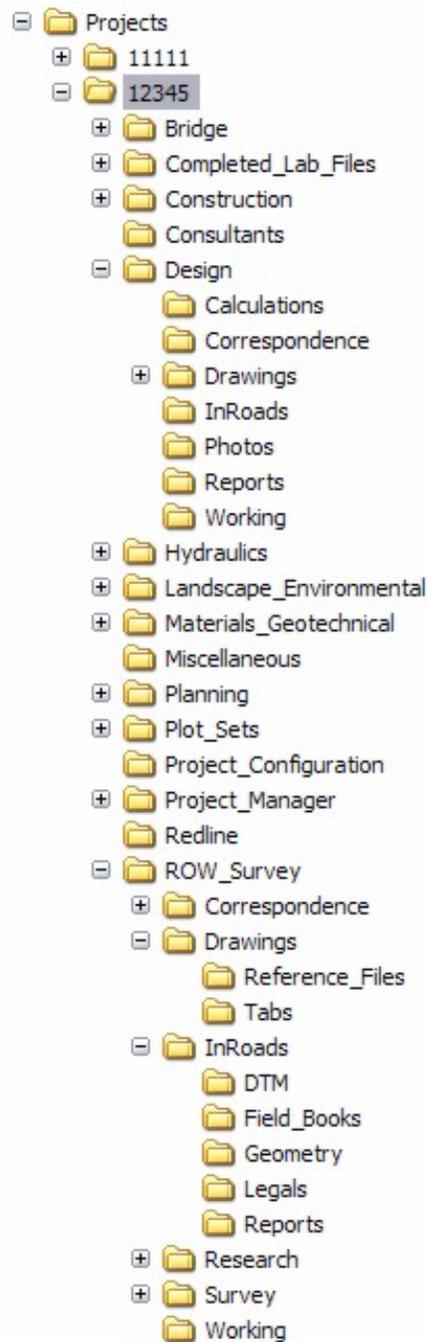
This same data set was used for the InRoads Survey Data Reduction instruction. This data was chosen to provide geometry developed by the survey process to use as a reference for evaluation of existing conditions and the creation of subsequent geometry.

Note: It is important the student recognizes that the tools presented in the following exercises can be applied to any discipline.

Training Directory Structure

All class work files will be in the **C:\Projects\12345** folder which has a combination of design and survey sub-folders and data files.

The sample project in this document uses the standard CDOT file structure with 12345 = CDOT Project Code (sub account).

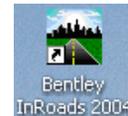


2. Working with InRoads

Lab 1: Getting Started in InRoads

InRoads Operation

1. There are three main methods to **Start InRoads**:
 - Choose **Start > All Programs > Bentley Civil Engineering > Bentley InRoads** and MicroStation will start and allow you to choose the design file, once the design file opens InRoads will start.
 - Choose the Desktop icon for InRoads if one is available on your machine. MicroStation will start and allow you to choose the design file, once the design file opens InRoads will launch.



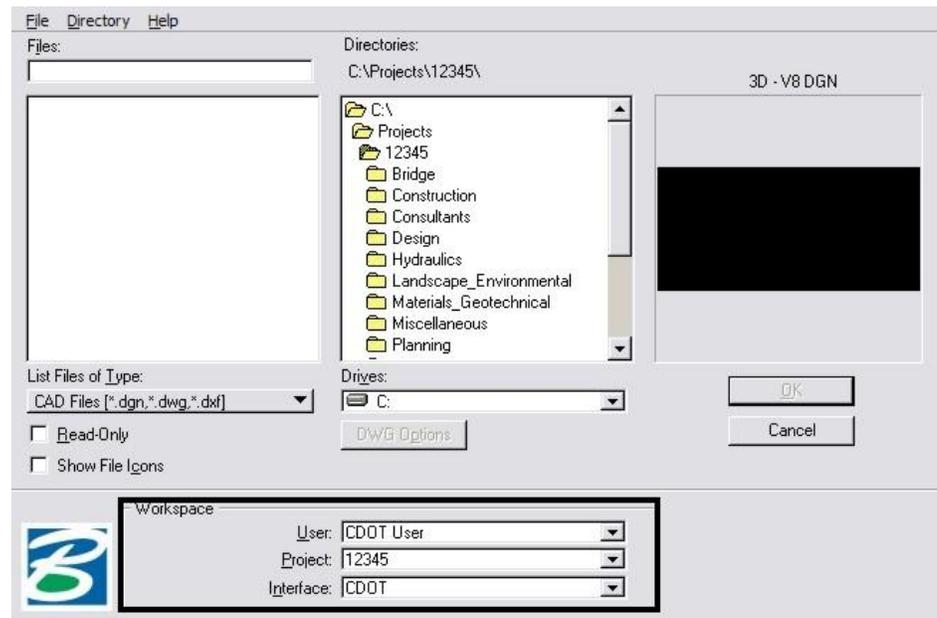
Note: If MicroStation is already open, you can choose the InRoads icon from the MicroStation main toolbar.



2. Use one of the first two methods listed above to initialize InRoads which will open the MicroStation Manager window.

Once MicroStation or InRoads has launched, you will be presented with the **MicroStation Manager** dialog.

3. In the **MicroStation Manager** dialog, go to the **Workspace** group section and change the **User** field to **CDOT USER**, the **Project** field to **12345** and the **Interface** field to **CDOT**.



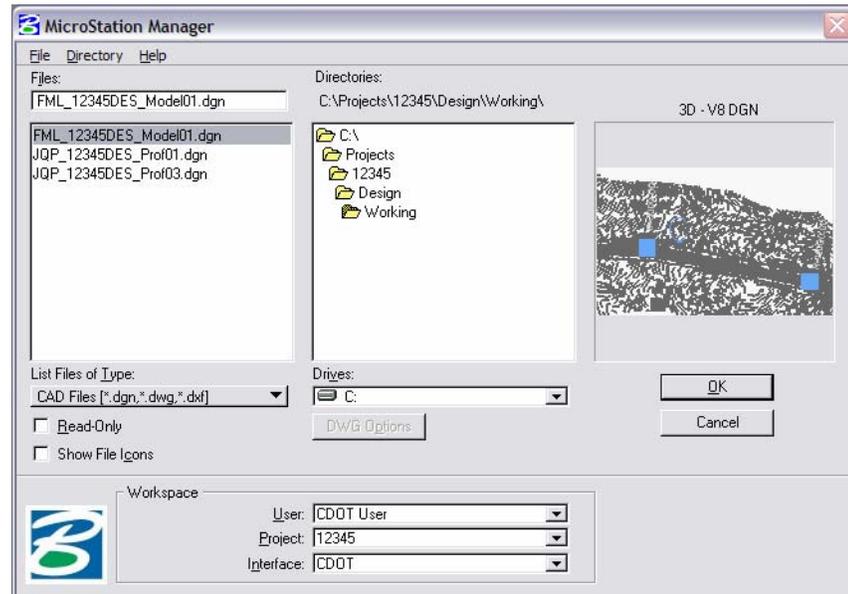
This workspace setup should load the correct MicroStation environment when a MicroStation file is opened. The Project field sets the PCF file that defines a specific directory that MicroStation defaults to when opening up a DGN file or referencing model files. PCF files are extremely useful when multiple users are accessing the same project directory across the network, or when DGN files are moved from one directory to another. For more information regarding the PCF please refer to the CDOT Notes document titled “CDOT PCF Management.pdf”

Note: Each discipline has developed unique directory structures to meet specific needs. If necessary, you can use Windows Explorer to easily investigate the directory structure developed for a specific discipline. Note the various folders for drawings, InRoads information, correspondence, etc.

4. Navigate to the file folder **\12345\Design\Working** by double clicking the directory folders.

Note: CDOT standards stipulate Users to prefix any files in the **Working** directory with their own initials. For training purposes use FML (First, Middle, Last) for uniformity.

5. The file FML_12345DesignModel01.dgn will show in the **MicroStation Manager** dialog. <D> OK to open the file.

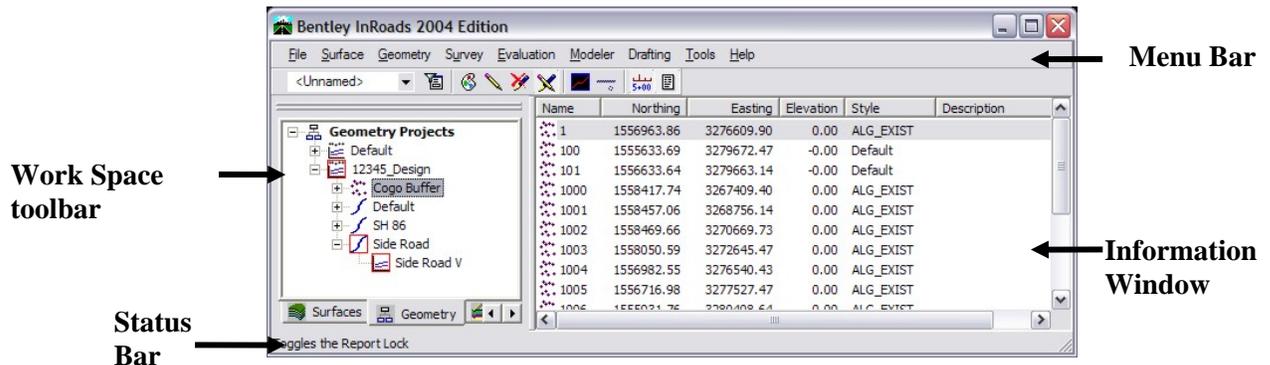


Note: From this point forward, unless specifically instructed to use MicroStation commands, all references to the selection of icons, tools, or menu pull-downs refer to the **InRoads** interface.

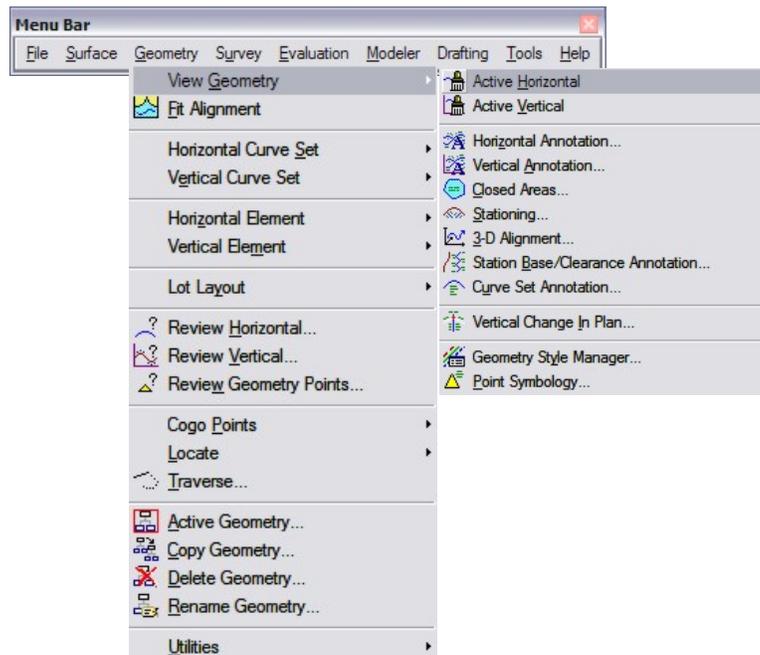
Lab 2: The InRoads Interface

Remember, InRoads is running on top of MicroStation. This means the InRoads interface can be moved outside the MicroStation environment to another screen and that the InRoads interface may hide MicroStation dialog boxes.

There are four main parts to the InRoads Interface, the **Menu Bar**, **Work Space toolbar**, **Information Window**, and **Status Bar**.



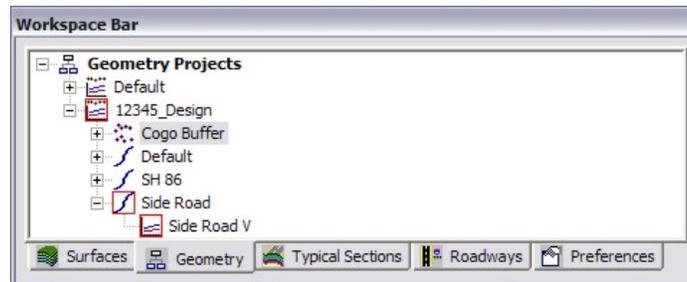
Menu Bar



- The Menu Bar pull-down menus are used to access commands, settings, and toolbars.
- An arrow (>) in the pull down will expand to a submenu.

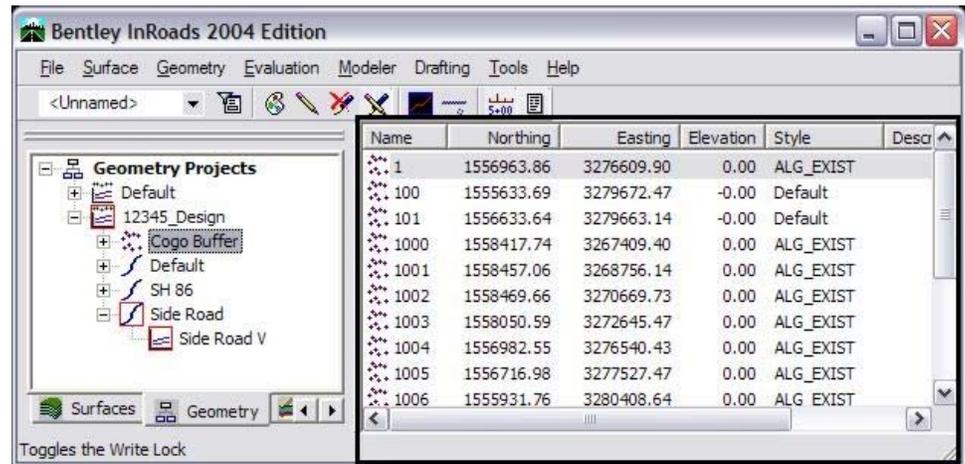
- 3 successive periods(...) indicate a dialog by that name will open
- Pull-down menus will vary with the application add-ins that you are using.

Work Space toolbar



- The Workspace Bar is used to manage and separate the different file formats of the program.
- Right clicking is allowed in the Workspace Bar. The active shortcut menu will vary depending on which Tab is selected.
- The Workspace Bar can be undocked as shown or docked to either side or bottom of the InRoads interface.
- To switch between tabs use the scroll arrows or right click to open a shortcut menu.

Information Window



- The Information Window information varies depending on the type of data selected.
- Right clicking is allowed in the Information Window. The active shortcut menu will vary depending on the selected feature.

Status Bar

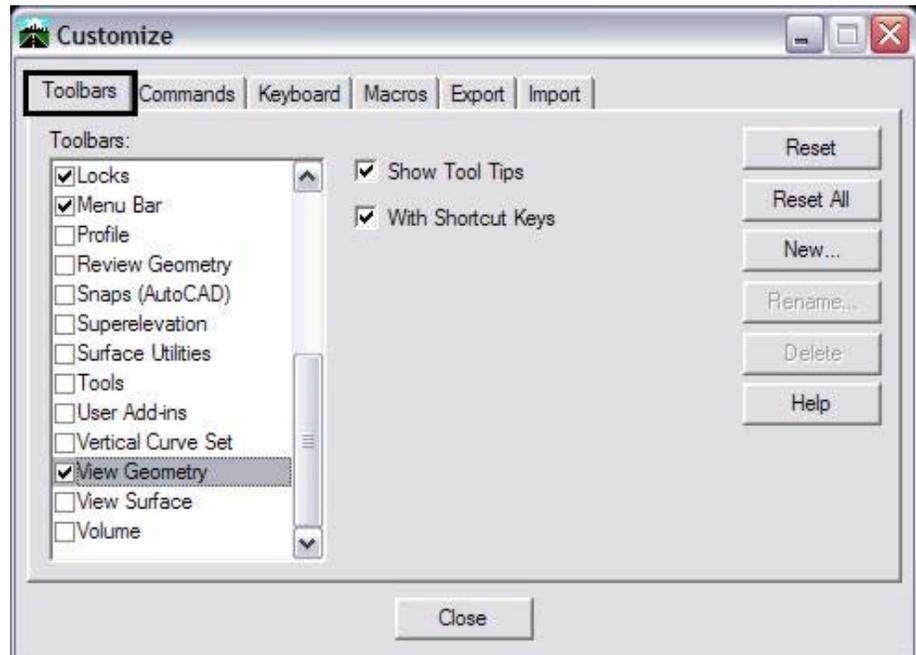


- Located in the lower left corner of the InRoads Interface, the status bar is used for observing the file processing information. The status of an active command can also be observed from this status bar.

Toolbars

Toolbars can be opened and docked in the InRoads interface. Toolbars in InRoads can be customized to fit the user's workflow or personal preference.

From the pull-down menu, select **Tools > Customize**. The **Customize** dialog will appear.



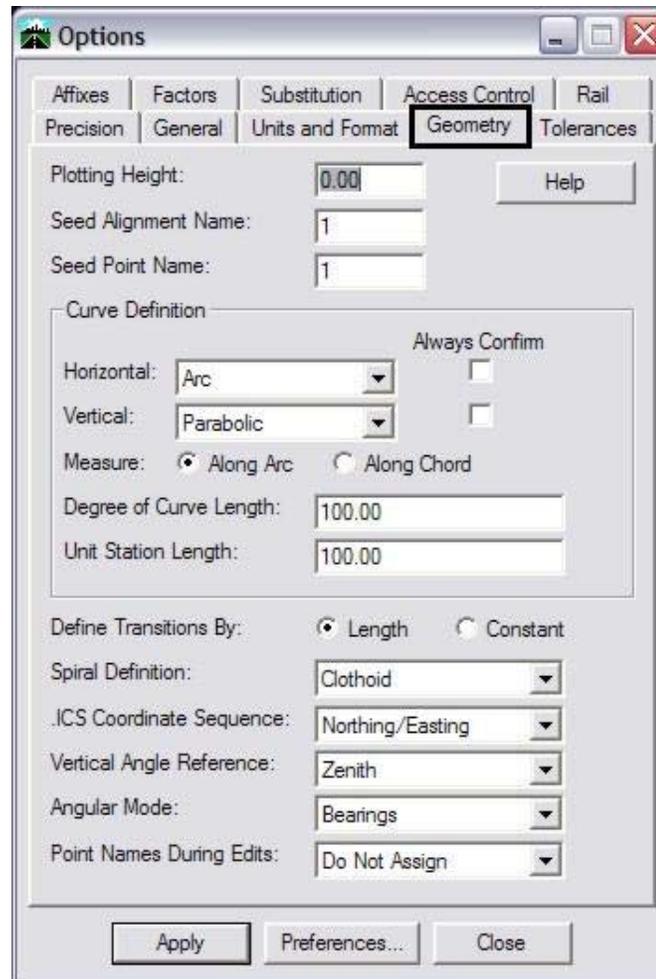
Toolbars are activated by clicking on the desired menu item and are immediately added to the InRoads interface.



If time permits, open the View Geometry toolbar, pause the cursor over the icons, and note the Tool Tips that appear on the screen.

Options

Options relative to geometry are found in the menu bar under **Tools > Options [Geometry]** tab.



Dialog Items

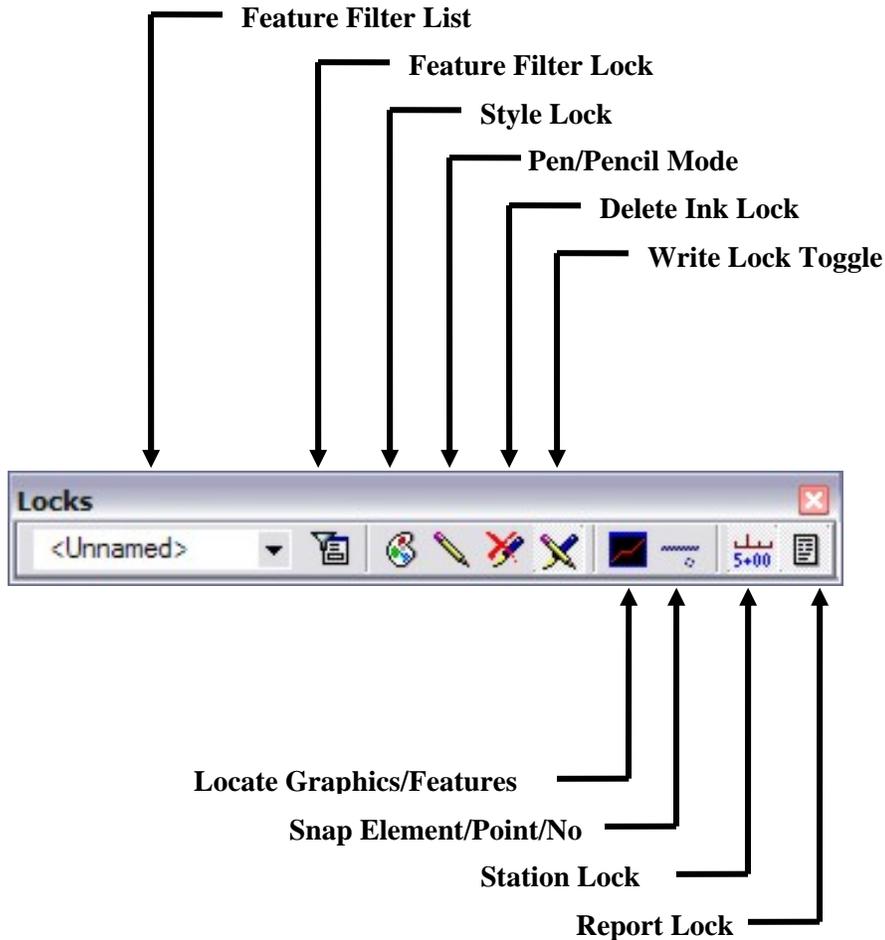
- **Plotting Height:** The default elevation geometry will be drawn in MicroStation if an elevation is not specified for the geometry element.
- **Seed Alignment Name:** Initial name assigned to newly created geometry unless otherwise specified.
- **Seed Point Name:** Initial name assigned to new cogo points.
- **Curve Definition:** Horizontal – Arc or Chord definitions
Vertical – Parabolic or Circular
- **Measure:** Along arc or along chord for curve definition
- **Degree of Curve Length:** Specifies central angle that subtends this distance
- **Unit Station Length:** Distance between major station intervals

- **Define Transitions:** Defines spiral transitions by Length or Spiral constant.
- **Spiral Definition:** Defines default method for defining spiral transitions
- **ICS Coordinate Sequence:** Defines input order of Northing/Easting's for ICS batch input files.
- **Vertical Angle Reference:** Defines vertical angle measurement in ICS files.
- **Angular Mode:** Specifies orientation for angles
- **Point Name during Edits:** Defines whether names are assigned to geometry points during creation or editing.

Locks Toolbar

There are several locks that are used by InRoads in addition to the MicroStation locks. These locks will be used throughout the course.

The locks toolbar is shown below.



Filter Name – Lists the name of the **Feature Filter** that is currently active. It has no affect if the **Feature Filter** lock is *off*. If the **Feature Filter** lock is *on*, it will limit dialog boxes to showing only the features that pass the filter. Feature Filters are stored in the **CDOT-Preferences.ini** file and are accessed by using the drop-down arrow next to the name.

Feature Filter lock – If on, activates the current filter. If off, has no affect and all surface features are shown in boxes that list features (shown here in the off position).



Style lock – The **Style lock**, if on, forces many of the **Surface View** commands to display the requested data (triangles, contours, etc.) without bringing up the dialog box. The preference used is the one associated with the surface under **Surface > Surface Properties**. **Style lock** also forces the **Cross Section Annotation** command to use the named symbology associated with the feature for annotation properties. If *off*, the **Style lock** has no affect (shown here in the off position).



Pen/Pencil (shown in *Pencil*) **Delete Ink** (shown off) **Write lock** (shown on)

These three locks work together.

Write lock – If **Write lock** is *off*, the displays will be temporary. Zooming in or out, updating the view, etc. will cause the added graphics to disappear.

If **Write lock** is *on*, there are two modes – **Pen** and **Pencil**.

If the **Pencil** mode is selected, the graphics are updated whenever the same display command is selected again. For example, if you display the contours, then change to a different preference and display again, the old contours are deleted and new contours are displayed.

If **Pen** mode is selected there are two options. If **Delete Ink** is *off*, the graphics are *not* updated when the same display command is selected again. Instead, another copy is placed in the design file. If **Delete Ink** is *on*, the graphics are treated like **Pencil** mode and the old ones are removed before new ones are placed.



Locate Features  / **Locate Graphics** 

There are several commands in InRoads that will work on either DTM Features or on MicroStation graphical elements (**Drape Surface**, for example). These commands will “look” for features if toggled to **Locate Features** and for MicroStation elements if it is set to **Locate Graphics**. It is shown here in **Locate Graphics** mode.



Point Snap has three modes: Off  Point Snap  and Element Snap 

Off – No affect

Point Snap – Some geometry commands (especially cogo commands) will lock onto the nearest geometry point's coordinates when you select something graphically. This is useful when you need to identify a PC or PT, for example. Also, some DTM editing commands, such as **Partial Delete Feature**, will lock onto the vertices or points that make up the feature.

Element Snap – In Geometry when commands require a distance or a bearing, the **Element Snap** can be used. An existing geometry element needs to be identified (such as part of an existing alignment) and it will read the elements length or bearing (whichever is required).



Station lock – Locks you onto even stations in the event that the alignment you are using does not start on an even station. The station will be determined by the interval you are using. For example, if you are stationing an alignment at 100 ft. intervals, the displays will show even 100 ft. stations. This affects not only station displays but virtually everything that uses a stationing interval, such as cross sections, profiles and modeling.



Report lock – Some commands will return information to you if this lock is **on**. For example, if you store a cogo point and the **Report** lock is **on**, a Results box will pop open showing the coordinate and point number of the new point. The box can be moved out of the way, it will keep a running list of messages, which can be saved to a text file if desired.

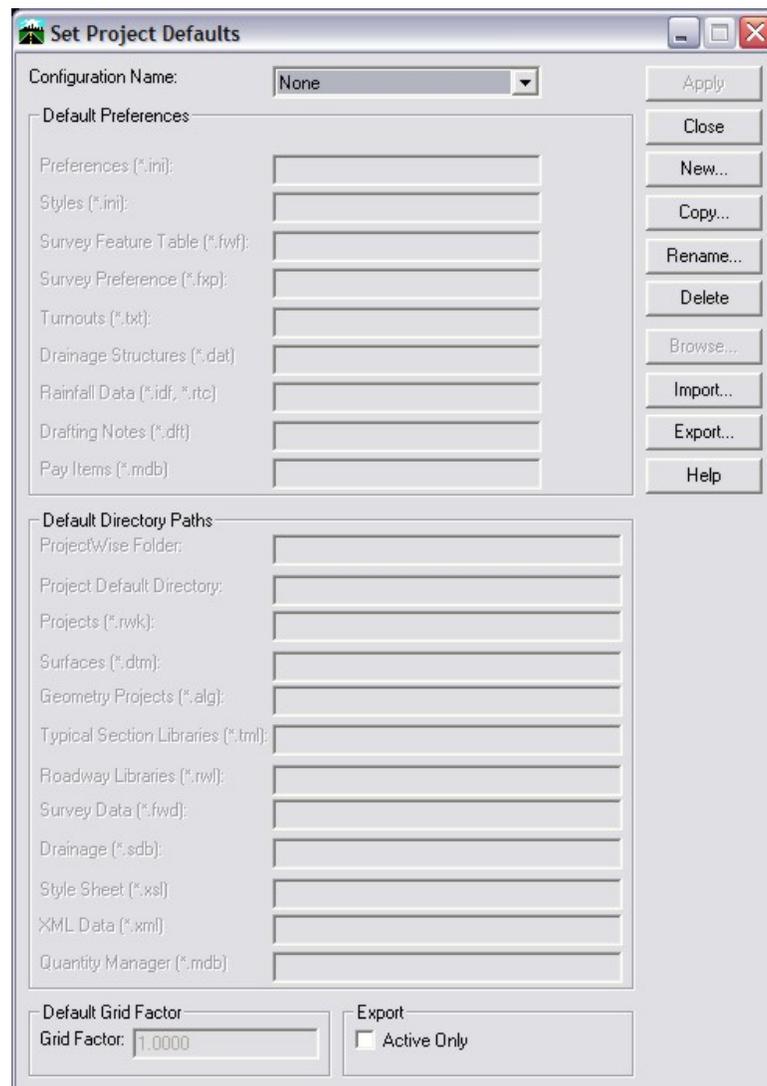
Lab 3: Default Directories and Resource Files

Setting default directories and resource files provides the user with quick access to project folder for opening files and then saving them to the correct location. It also ensures the correct CDOT InRoads resource files will be used.

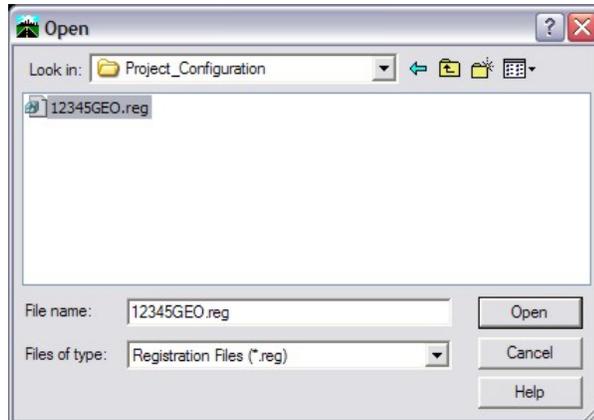
Objectives Lab 3

After completing this exercise you will know how to:

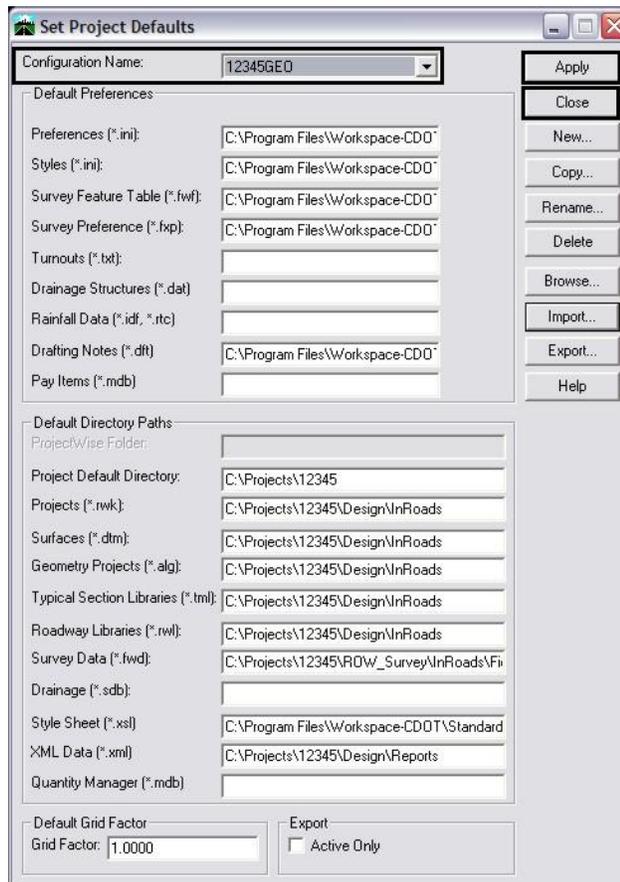
- Import and export Project Default settings.
1. Select **File > Project Defaults**. The **Set Project Defaults** dialog appears.



2. <D> the **Import** button. The **Open** dialog will appear.
3. Select C:\Projects\12345\Project_Configuration\12345GEO.reg and <D> **Open**



4. **12345GEO** should be active in the *Configuration Name* field



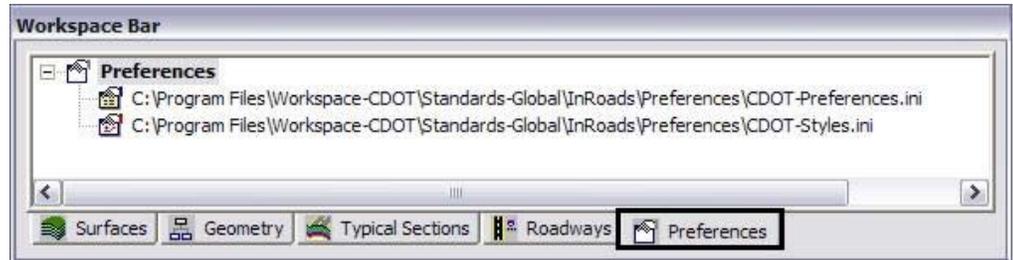
Notes: The blank Default Directory Paths are files that are not used by the particular InRoads application.

At your place of work, depending on the local configuration, you may have to map to network or shared drives to access default directory paths and project data.

5. <D> **Apply**
6. <D> the **Close** button on the **Set Project Defaults** dialog.

The default locations for both general InRoads resource files and project specific data files are now defined. This will make it easier to conform to graphics standards and assist in navigating to the correct project directories when loading or saving data files.

7. Select the **Preferences** tab on the Workspace bar and verify that the correct InRoads Project resource files are loaded.



Geometry Data from Survey

Survey data will be used as a foundation for our initial geometry work. The survey staff exports linear elements from the survey fieldbook as alignments and Cogo points at all survey shot locations.

This data may be used for:

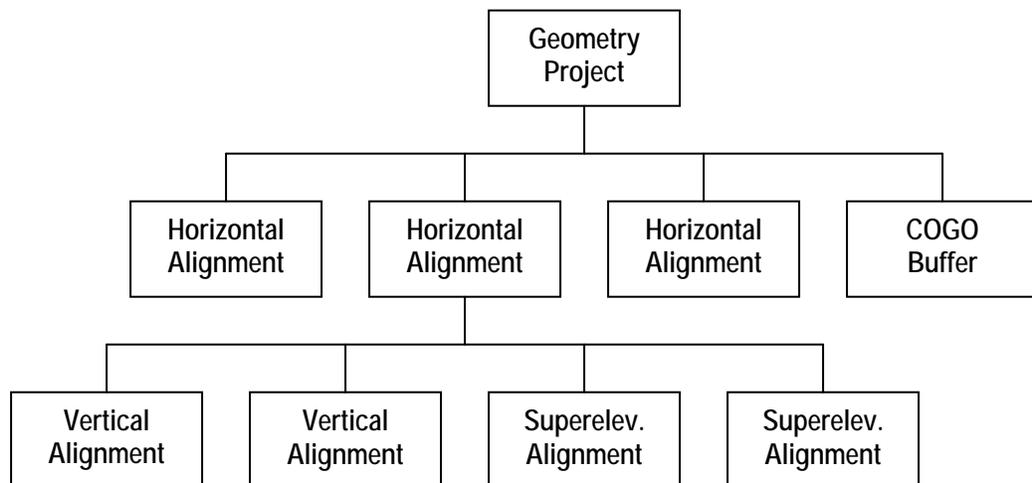
- Establishing the centerline of existing roadways
- Flow-lines of existing stream or other drainage
- Locations of existing retaining walls or bridge geometry
- Locations of existing signs or utilities
- Existing pavement limits or curb and/or gutter locations

The goal is to review some of the geometry data the survey staff produces.

The Geometry Project

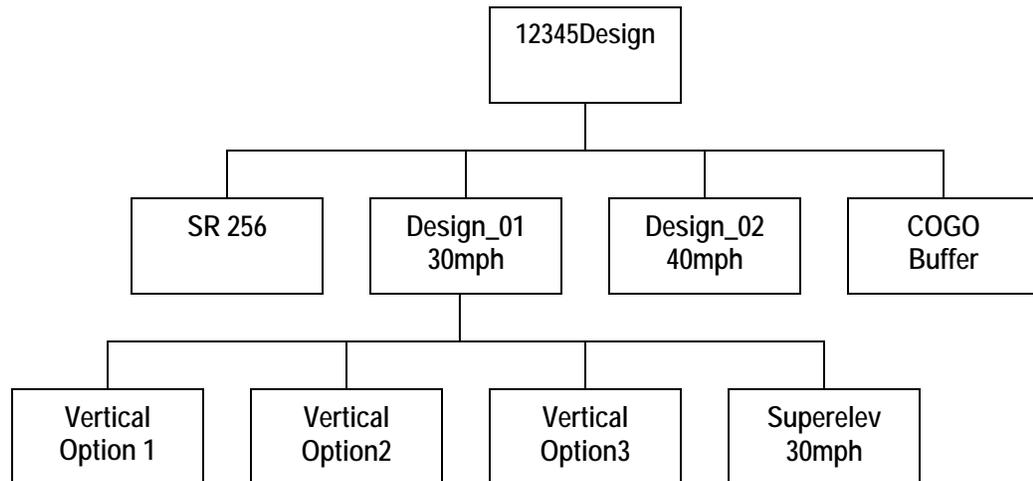
The geometry project, commonly referred to as the 'ALG' file, is the data file that stores horizontal and vertical alignments, superelevation alignments (stations where the super transitions occur and the corresponding slopes), and cogo points (called the cogo buffer).

The hierarchical relationship between the data stored in a geometry project is illustrated below.



Multiple geometry projects can be loaded into memory. However, only one geometry project can be active at a given time. Within the active geometry project, a single horizontal and a single vertical alignment can be active at any given time.

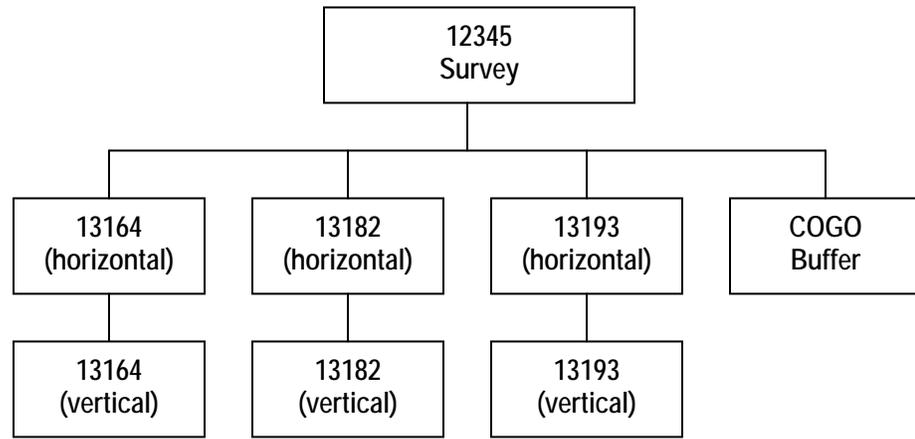
Sample Roadway Design Geometry Project



A typical design geometry project may contain horizontal alignments for the mainline, side roads, ditches, or alternative designs. Each horizontal alignment may have associated vertical alignments and superelevation solutions.

Sample Survey Geometry Project

(Exported from a Fieldbook)

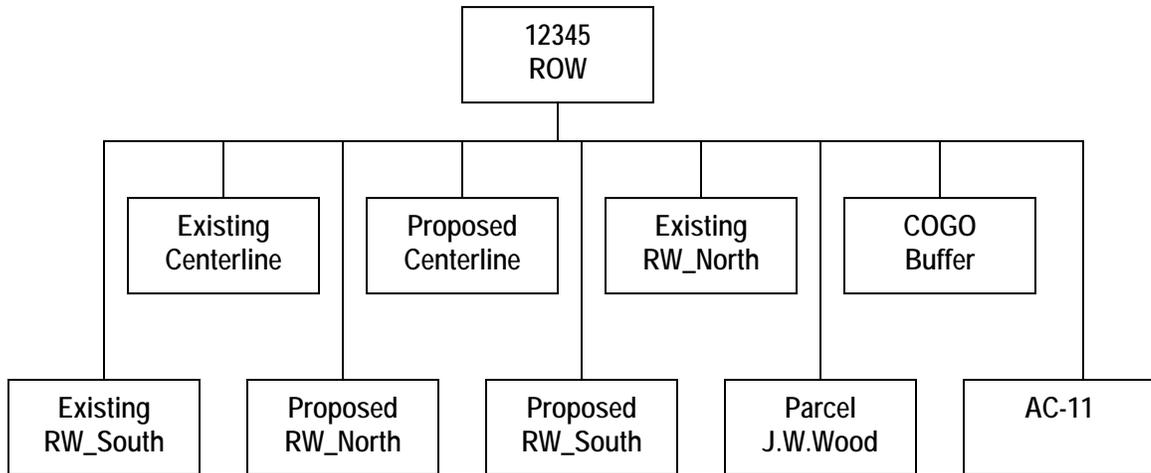


Sample Cogo Buffer Contents

2	Control Monument-Project	1575543.58	2869374.46	11492.10
3	Control Monument-Project	1573793.05	2846506.67	10269.52
219	Traffic Control No Pass Left Yellow	1556202.40	2843268.49	11423.11
220	Traffic Control No Pass Left Yellow	1556207.76	2843266.69	11423.44
221	Traffic Control No Pass Left Yellow	1556218.47	2843263.03	11424.10
222	Traffic Control No Pass Left Yellow	1556223.82	2843261.18	11424.43
223	Traffic Control No Pass Left Yellow	1556234.49	2843257.43	11425.10
224	Traffic Control No Pass Left Yellow	1556245.14	2843253.62	11425.76
225	Traffic Control No Pass Left Yellow	1556252.23	2843251.04	11426.20
226	Traffic Control No Pass Left Yellow	1556256.95	2843249.31	11426.50
227	Traffic Control No Pass Left Yellow	1556275.80	2843242.25	11427.68
228	Traffic Control No Pass Left Yellow	1556280.50	2843240.46	11427.98
229	Traffic Control No Pass Left Yellow	1556287.55	2843237.74	11428.43
230	Traffic Control No Pass Left Yellow	1556298.10	2843233.61	11429.10
231	Traffic Control No Pass Left Yellow	1556308.63	2843229.42	11429.77
232	Traffic Control No Pass Left Yellow	1556313.88	2843227.30	11430.11
233	Traffic Control No Pass Left Yellow	1556324.37	2843223.02	11430.79

A typical geometry project generated from a survey fieldbook will contain Cogo points for each point surveyed. These Cogo points are indexed with the shot number recorded in the field during collection. In addition to the Cogo points, horizontal and associated vertical alignments are created for each linear feature surveyed in the field such as; edge of oil, ditch or stream shots, or centerline shots. These alignments inherit their name from a combination of the survey collection code and an incremental index number.

Sample Right of Way Geometry Project



A typical Right of Way geometry project may contain only Cogo points and horizontal alignments. The horizontal alignments may represent existing or proposed ROW limits, easement limits, section lines, and parcels. A parcel is defined as an alignment that closes on itself.

Lab 4: Loading Geometry

As previously illustrated, all geometry, whether it's horizontal, vertical, cogo points, or superelevation solutions, is stored in a single digital container called a Geometry Project. To put it another way, individual horizontal, vertical, or cogo points cannot be written to disk by themselves, only within a geometry project. The same is true for loading data; only geometry projects can be loaded, not individual alignments.

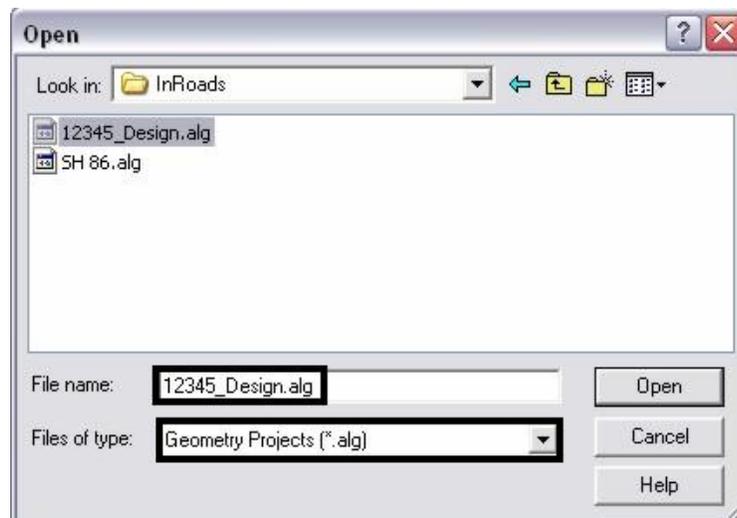
Start with the geometry that was created in the survey data reduction portion of this project. This geometry project contains all objects collected in the field. Linear objects such as pavement lines, breaklines, streamlines, etc are stored as horizontal alignments. In addition to survey shots along linear objects, all shots at features such as signs, utilities, ground shots, trees, etc. are written to the cogo buffer and stored as individual points.

It will be necessary to load the geometry data from the survey (ROW) directory structure versus the design directory as information from the survey phase of the project is being accessed. Because data from the survey is being accessed, it should not be modified in any way.

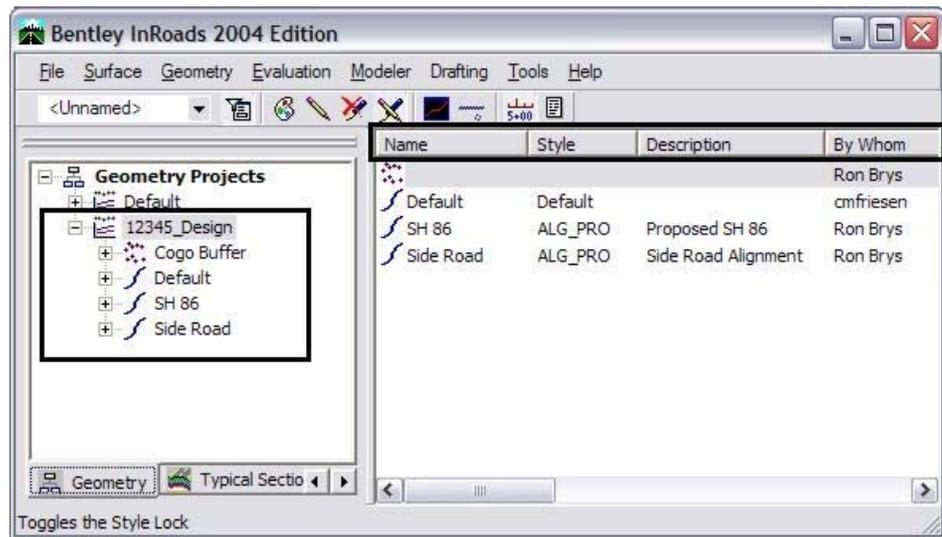
In subsequent exercises you will learn how to copy Geometry Projects in their entirety and also how to selectively copy information (alignments and cogo points) between separate Geometry Projects.

Loading Survey Geometry

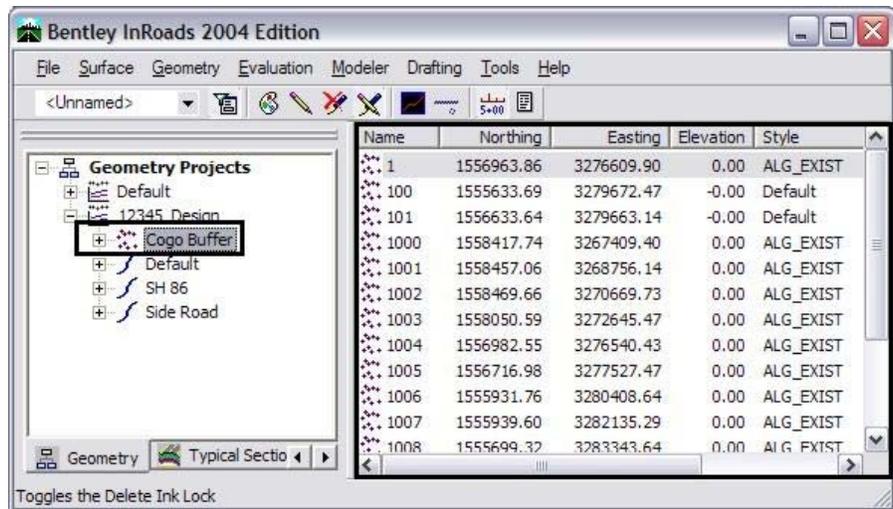
1. Select File > Open and set *Files of type* to **Geometry Projects**.
2. Navigate to the directory path C:\Projects\12345\Design\InRoads
3. <D> the geometry project 12345_Design.alg
4. <D> Open then Cancel. The Open dialog will close.



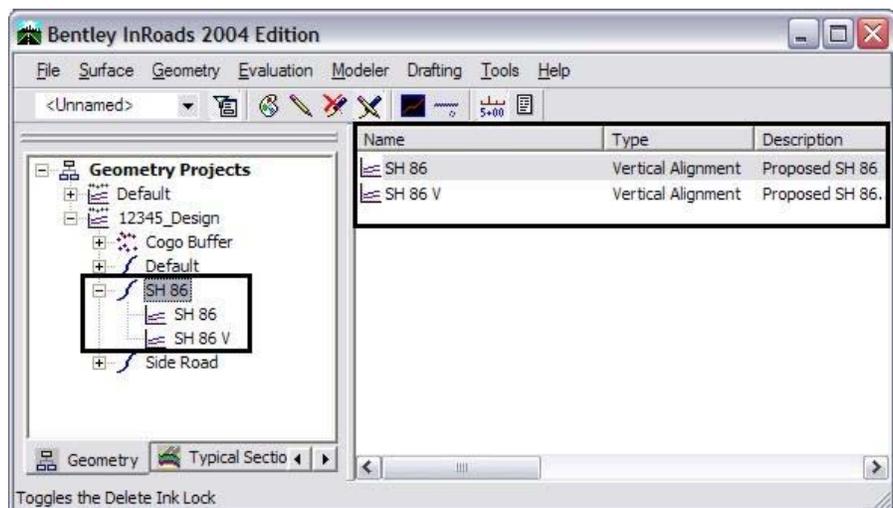
5. Check the InRoads interface to ensure the data loaded. You should see something similar to the below screen capture.



6. **Expand** the screen display of the geometry project by selecting the + (plus) symbol located to the left of the geometry project name.
7. Look to the **right** side of the InRoads pane. **Scroll** to view the columns of information to the right. Here you will see:
- Horizontal Alignment name
 - Description
 - Windows user ID of the person who created the alignment
 - Revision date
 - Access Mode
 - Associated geometry style
 - Integrity
 - Curve definition Arc or Chord
 - Beginning station value
 - Ending station value
 - Number of associated vertical alignments
 - Number of associated superelevation definitions
8. <D> on any of column headings to sort ascending or descending.
9. <D> and hold **down/slide** the mouse button on any of the column heading to reposition the columns either to the left or right.

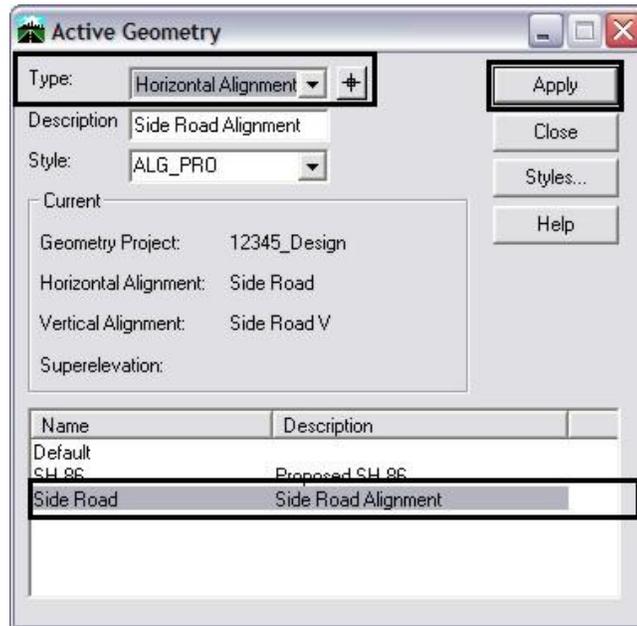


10. <D> on the Cogo Buffer. Notice the detail screen to the right showing the contents of the Cogo buffer. Also notice the columns showing Northing, Easting, and Elevation by adjusting the view pane.
11. <D> on the first horizontal alignment listed. Notice the associated vertical alignment.



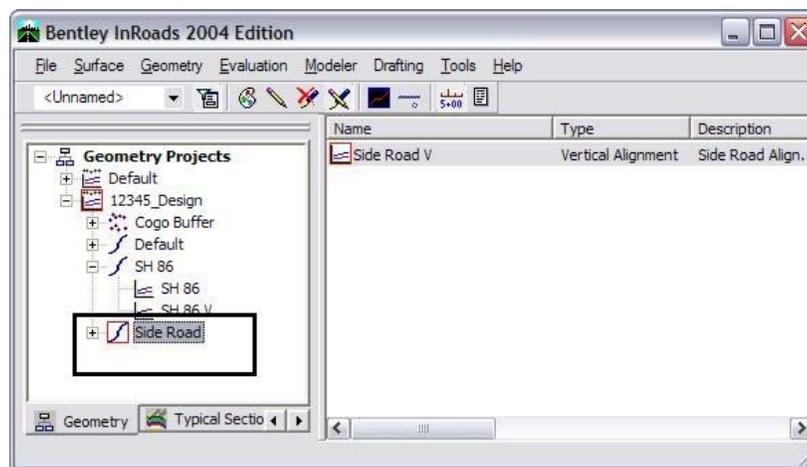
Note: Only one horizontal alignment can be active at a time. Being *active* specifies the alignment to be modified, displayed, or defined by default in dialog boxes.

12. Select **Geometry > Active Geometry**. The **Active Geometry** dialog will appear.



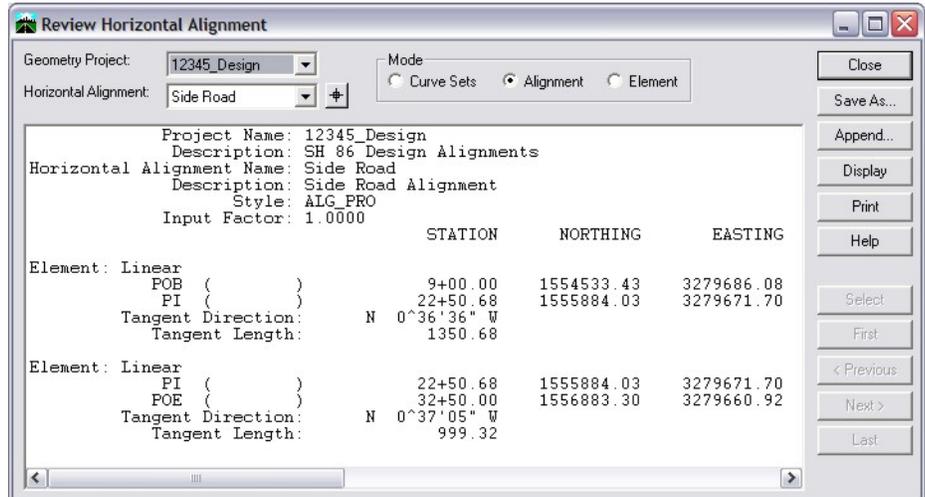
13. Set **Type** to Horizontal Alignment
14. <D> on alignment **Side Road**
15. <D> **Apply** then **Close**

Notice in the InRoads explorer pane that the alignment called **Side Road** shows a red indicator box signifying that it is the **active** alignment.



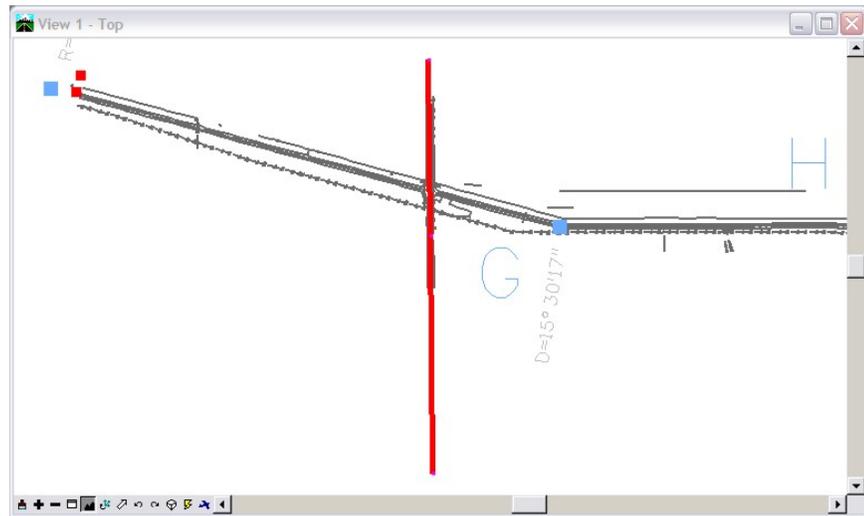
Reviewing & Viewing Geometry

16. Select **Geometry > Review Horizontal** for a textual display of the active alignment. When reviewing an alignment, a temporary dynamic display is shown in MicroStation representing the location of the alignment being reviewed.

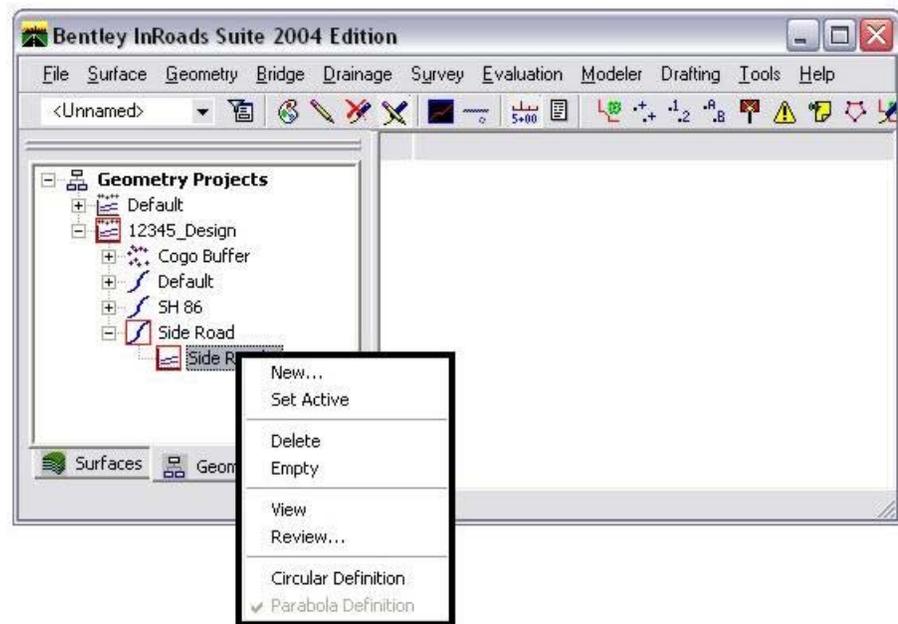


From the top of the dialog down:

- Active **Geometry Project** selection box
 - **Horizontal Alignment** selection box
 - **Project Name:** being displayed
 - **Description** for the geometry project (if any)
 - **Alignment name**
 - **Description** of the alignment (if any)
 - **Geometry Style** associated with the Horizontal alignment
 - **Element** definition (linear or circular)
 - **Vertices** type, point name/number, station value, northing, easting
 - **Tangent Bearing** and Distance or **Curve** data
17. **Review** this display for alignment information such as Cogo point ID assignments, bearings, distances, northing, easting, etc.
18. <D> the **Close** button.
19. Select **Geometry > View Geometry > Active Horizontal** to write the alignment to the MicroStation file.
20. Select **Geometry > Fit Alignment** to reposition the MicroStation view to the limits of the active alignment.
- In the MicroStation key-in field, type in an alignment name or <R> (press the right mouse button) in a MicroStation view to fit the active alignment.



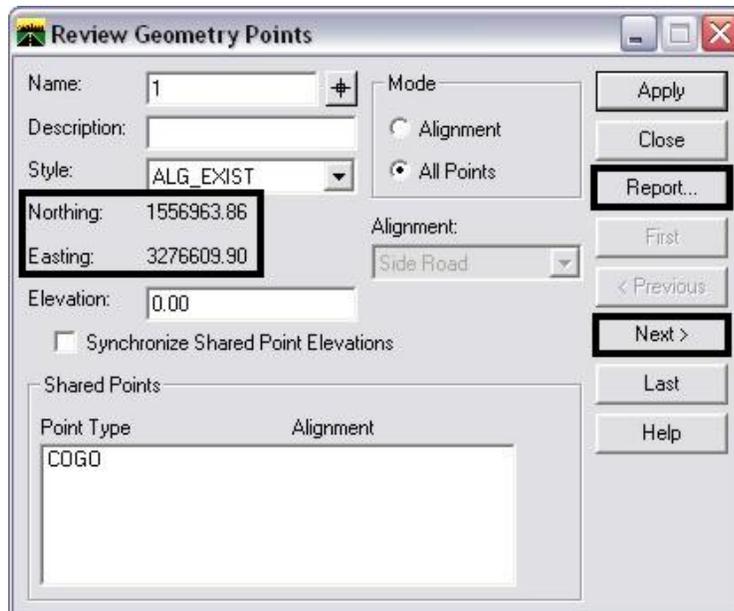
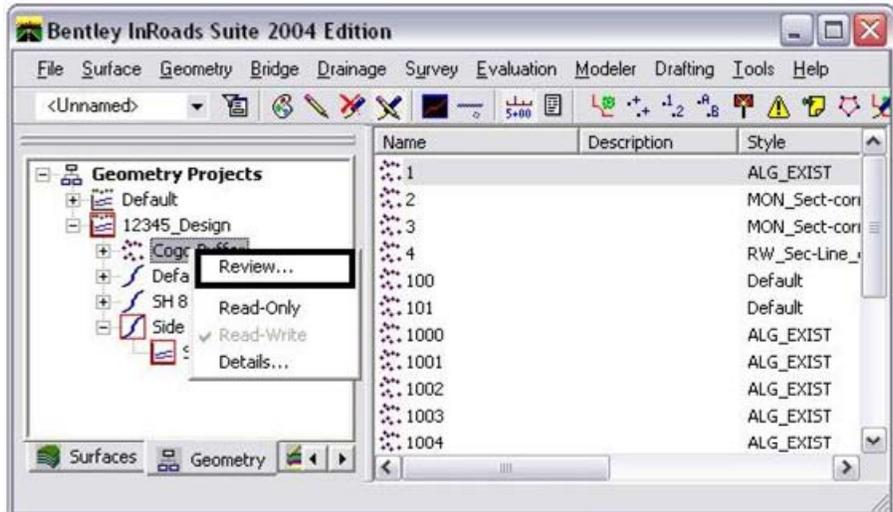
21. In the Workspace Bar <R> (right-click) on the active alignment name. Note the Active, View, Fit, and Review commands are available from the short-cut fly-out menu.



22. *Experiment* using this fly-out menu with any alignment

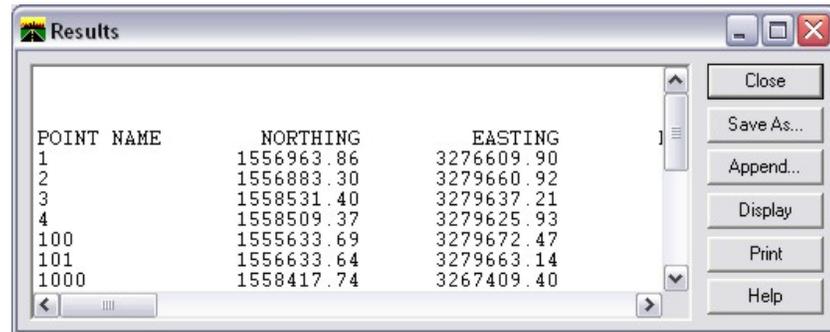
Reviewing the Cogo Buffer

23. In the Workspace Bar <R> on the *Cogo Buffer* and select *Review...*
The Review Geometry Points dialog will appear.



24. <D> the **Next >** button to review the information about subsequent points. Notice the available navigation buttons *First*, *Previous*, *Next*, and *Last*

25. <D> **Report** to list all Cogo points stored in the active geometry project.



Saving InRoads Results

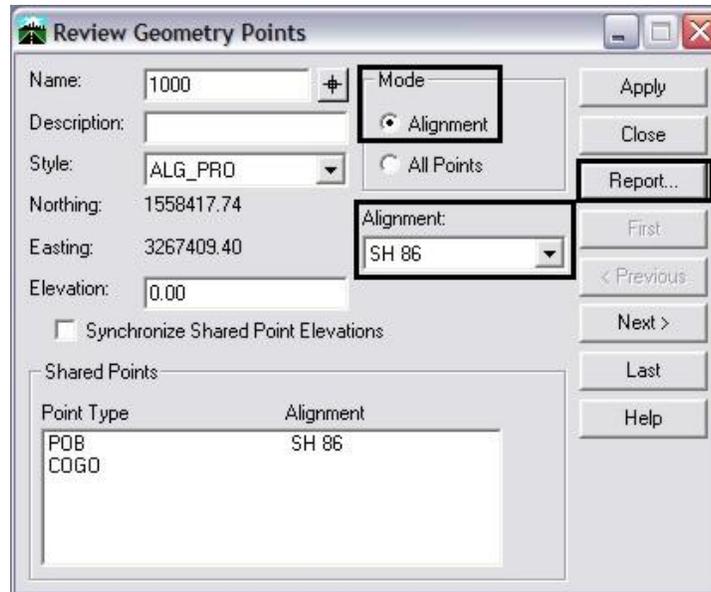
Note: The buttons on the right side of the **Results** dialog allow you to save or display this report. These options exist in many InRoads dialogs.

They are:

- **Close** - closes the **Results** dialog
- **Save As** - saves the contents of the dialog to an ASCII (text) file
- **Append** - appends to an existing ASCII file.
- **Display** - allows the user to select a location in the MicroStation drawing to place the dialog contents as text. It will use the active text and element settings when writing the text to the CADD file.
- **Print** - sends the contents to the default system printer.

26. <D> the **Close** button in the **Results** dialog

27. In the **Mode** section of the **Review Geometry Points** dialog, toggle the radio button to **Alignment**. Notice how the Alignment drop-down list is activated.
28. Select **SH86** in the **Alignment** drop-down list.



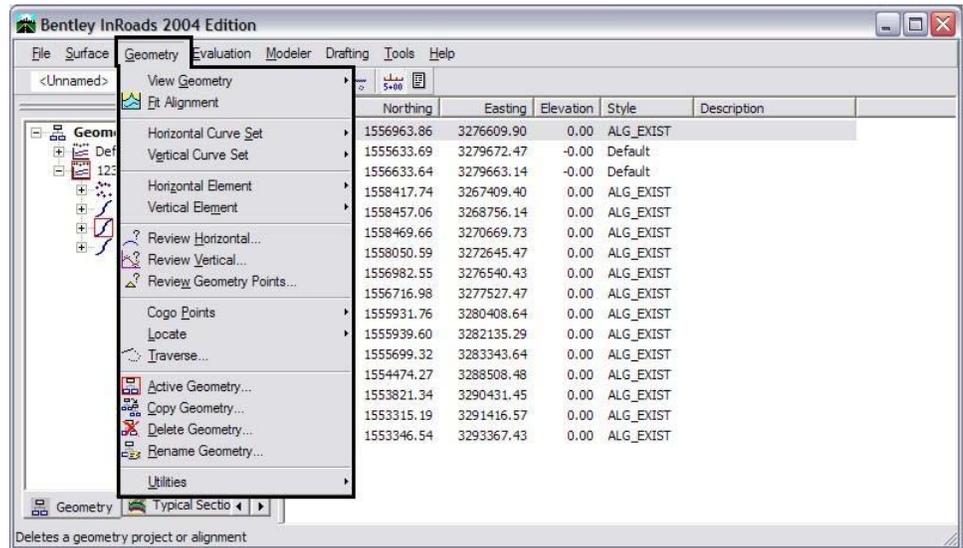
29. <D> the **Report** button again to review the vertices of the selected alignment. Note the Point Name column is not showing point numbers or names (other than point 1000) indicating this alignment was created as unnamed geometry points.

The screenshot shows the 'Results' dialog box with a table of geometry points. The table has five columns: POINT NAME, NORTHING, EASTING, ELEVATION, and STYLE. The first row shows point 1000. The following rows show unnamed points with their coordinates and 'ALG_PRO' style.

POINT NAME	NORTHING	EASTING	ELEVATION	STYLE
1000	1558417.74	3267409.40	0.00	ALG_PRO
	1558450.09	3268517.55	0.00	ALG_PRO
	1537339.09	3269133.91	0.00	ALG_PRO
	1558458.63	3268994.82	0.00	ALG_PRO
	1558467.52	3270345.09	0.00	ALG_PRO
	1555467.58	3270364.85	0.00	ALG_PRO
	1558402.30	3270987.32	0.00	ALG_PRO
	1558117.51	3272329.96	0.00	ALG_PRO
	1547356.90	3270047.57	0.00	ALG_PRO
	1557965.30	3272956.51	0.00	ALG_PRO
	1557001.57	3276471.06	0.00	ALG_PRO
	1585933.56	3284404.53	0.00	ALG_PRO
	1556963.86	3276609.90	0.00	ALG_PRO
	1556729.58	3277480.62	0.00	ALG_PRO
	1527759.88	3269685.99	0.00	ALG_PRO
	1556704.22	3277574.27	0.00	ALG_PRO
	1555971.14	3280264.16	0.00	ALG_PRO
	1555971.14	3280264.16	0.00	ALG_PRO

30. <D> the **Close** button in both the **Results** and **Review Geometry Points** dialogs

Note: The previous steps used the short-cut fly-out menus, all actions can also be found under the *Geometry* pull-down menus.



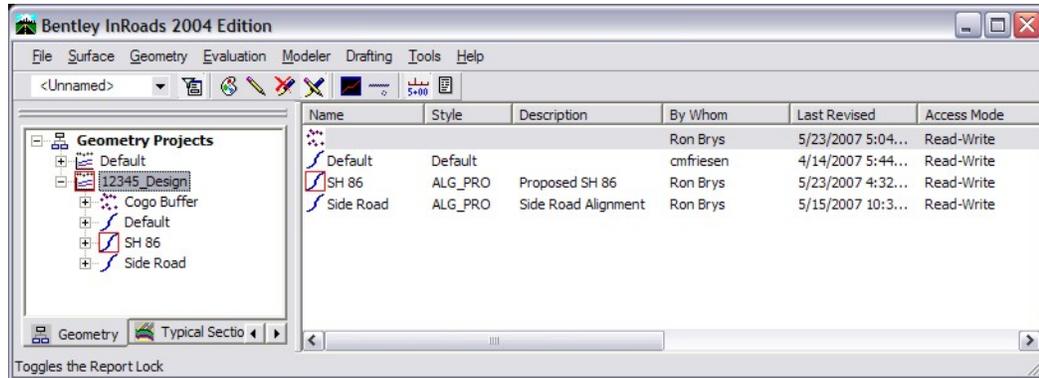
Graphics clean-up

At anytime during these labs you can delete all visible graphics in your MicroStation file using the element selection tool or a fence. Note that you are deleting the graphical display of data, not the data itself. The graphics can be redisplayed using the InRoads display commands shown in previous sections.

Note: The screened topography and the graphics used as training guides are either locked graphics or are attached as a reference file. These graphics will be used in future labs.

Alignment Information

Multiple Geometry Projects can be loaded into memory simultaneously. However, only one geometry project, horizontal, and vertical alignment can be active at any given time.



31. Use the previously covered commands to display the horizontal alignments **SH 86 & Side Road**

32. Use the review command to investigate the alignments

- What is the beginning station value for:

SH 86 _____

Side Road _____

- What is the overall length of:

SH 86 _____

Side Road _____

- What is the shortest radius used in:

SH 86 _____

Side Road _____

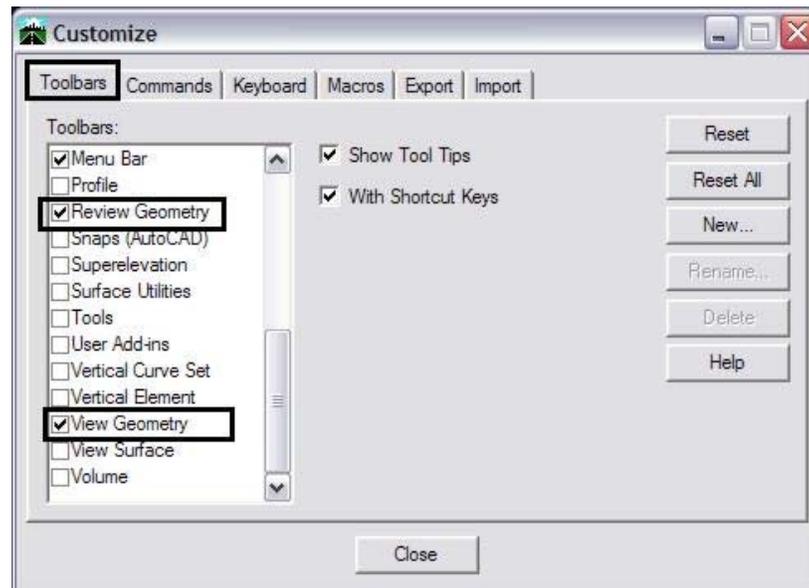
Lab 5: Toolbars

The InRoads Interface can be populated with toolbars for easy access to commands.

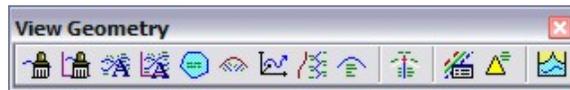
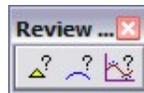
The pull-down menus can be used to select the correct tool, but it may be more convenient to use toolbar icons. All InRoads toolbars can be customized to fit your workflow or personal preferences.

Opening Toolbars

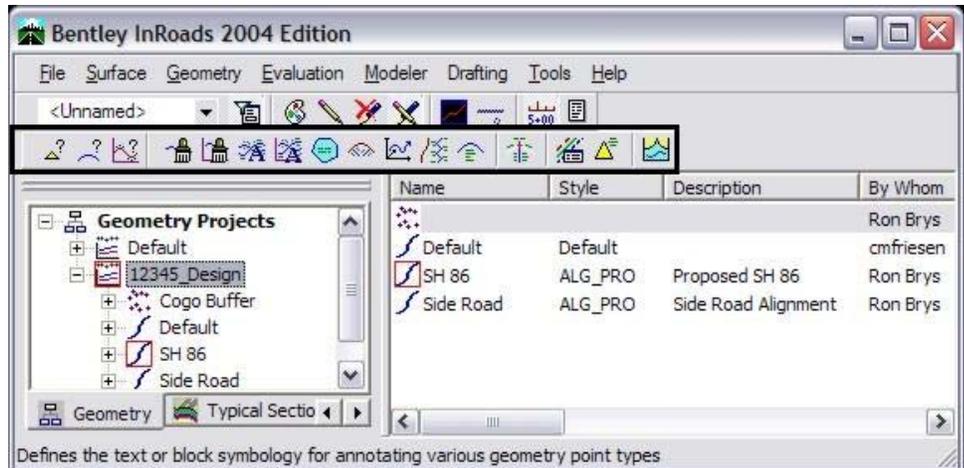
1. From the pull-down menu select **Tools > Customize**. The **Customize** dialog will appear.



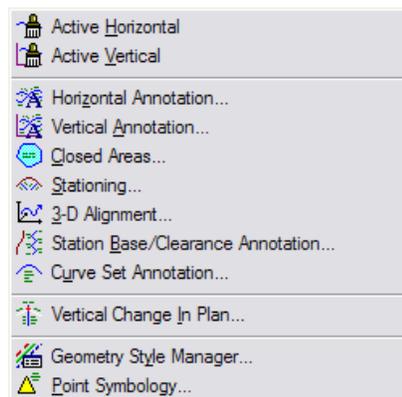
2. Under the **Toolbars** tab, check that the boxes for **Review Geometry** and **View Geometry** are selected. When checked on, the toolbars become active in the graphics file immediately
3. <D> the **Close** button in the **Customize** dialog



4. **Dock, Undock** and **Resize** the toolbars until you are comfortable repositioning them. Notice how toolbars can be docked in the InRoads interface but not MicroStation's.



5. From the pull-down menu, select **Geometry > View Geometry** look at each command and the associated image. Notice the correlation of the graphics between the pull-down menu and the toolbar.

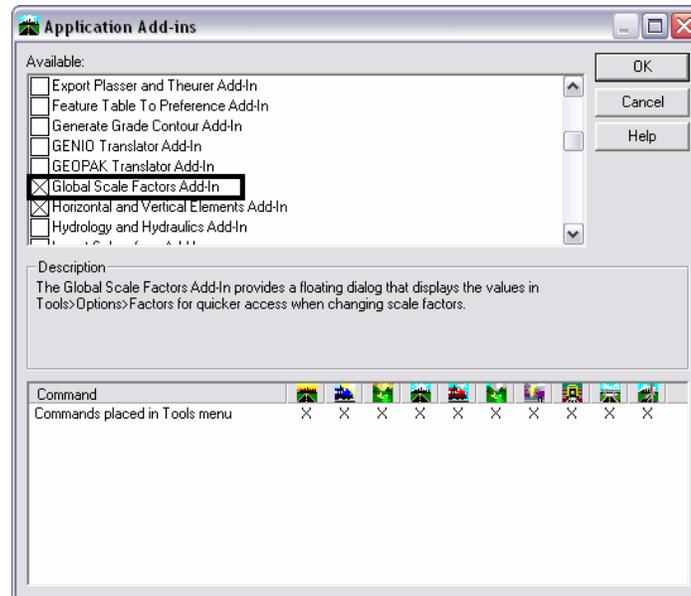


6. Place the cursor over an icon in any toolbar. A **Tool Tip** will appear at the lower right of the cursor, additionally a description of the command shows in the status field.
 - The tool tip feature is controlled in the **Customize** dialog (**Tools > Customize**) box via the **Show Tool Tips** checkbox and is turned on by default.

Global Scale Factors

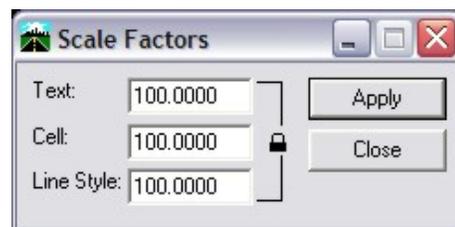
Global scale factors are used to determine the size of displayed text, cells, and linestyles. The global scale factor function can be found under **Tools > Options [Factors]** tab. However, enabling the command directly from the menu bar is more efficient.

7. Select **Tools > Application Add-ins** to display a list of available InRoads commands and functions that can be added to the InRoads interface.



Selecting an item will display a description. The command category shows both the menu location and the InRoads product(s) it can be activated with.

8. Toggle on **Global Scale Factor** <D> OK and close the dialog
9. Select **Tools > Global Scale Factors...**



10. Verify all three scale settings are set to **100**
11. <D> **Apply** then **Close**

These settings are multipliers for displayed graphics. Generally the values should be set to correspond to the plotting scale factor. As with most MicroStation or InRoads commands, you have the option of either enabling or disabling the lock symbol to input values universally or individually.

Note: Digital Terrain Models are not a core topic of this course. However, it is worth noting that Global Scale Factors apply to all InRoads data displayed. This

includes the display of features from a DTM. While possible to 'regenerate' plan view topography by displaying the features from a survey-supplied DTM, this is NOT an accepted workflow. The reason for this is because any attributes collected in the field are processed by InRoads Survey. These attributes (rotation, Q & Z reports, etc) are not stored in the DTM and the resulting graphics will be incomplete and/or incorrect without being evident.

Geometry Terminology and Attributes

Geometry Project

Is a data warehouse that stores:

- Cogo point information in the following format: name, x, y, and z
- Horizontal alignments
- Vertical alignments
- Superelevation definitions

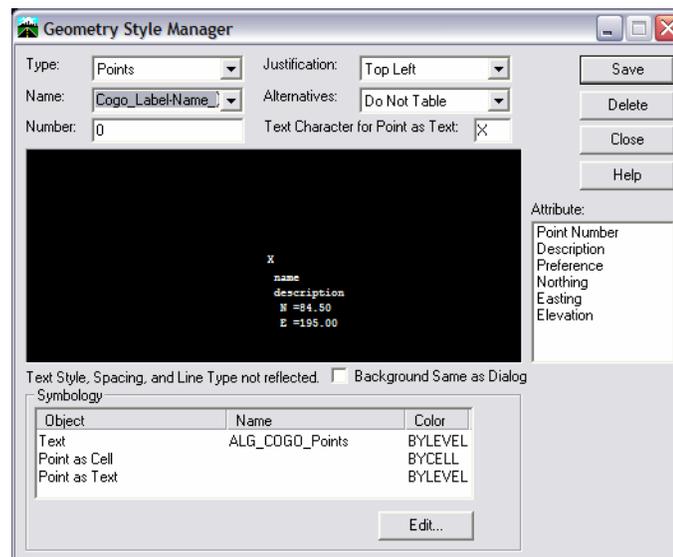
Geometry Styles

Geometry Styles are saved settings that can be assigned to a geometry alignment or cogo point. The Geometry Style definition stores how the alignment or cogo point will be displayed in the CAD file. Geometry Styles can be assigned to Points, Lines, Arcs, and Spirals; each style will have settings for planimetrics and annotation display. The Geometry Styles are defined in the **Geometry Style Manager** dialog box.

Geometry Style Manager – Overview

The Geometry Style Manager creates, edits, and deletes the Geometry Styles for Points, Lines, Arcs, and Spirals. The style definition is based on WYSIWYG (what you see is what you get) display in the dialog box. The symbology section of the dialog controls the planimetric and annotation display.

- Select **Geometry > View Geometry > Geometry Style Manager**
- Overview by Instructor



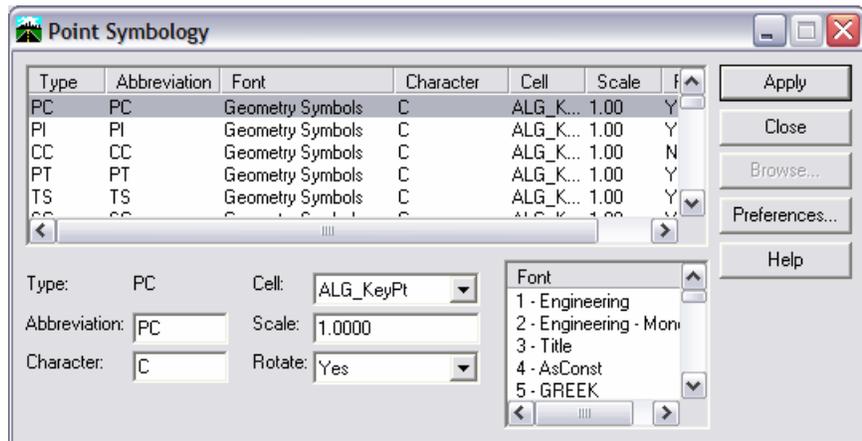
Note: See appendix A for additional information on this topic.

Geometry Point Symbology

Geometry Point Symbology is a saved setting for horizontal and vertical alignment keypoints (vertices). Each vertex will be defined in the alignment as 1 of 33 possible alignment keypoints such as: POB, PC, PI, PT, TS, PVT, PVT, etc. Each Geometry Point can be saved as a point Symbol Font or Cell definition depending on the annotation settings.

Geometry Point Symbology Manager - Overview

- Select **Geometry > View Geometry > Point Symbology**
- Overview by Instructor



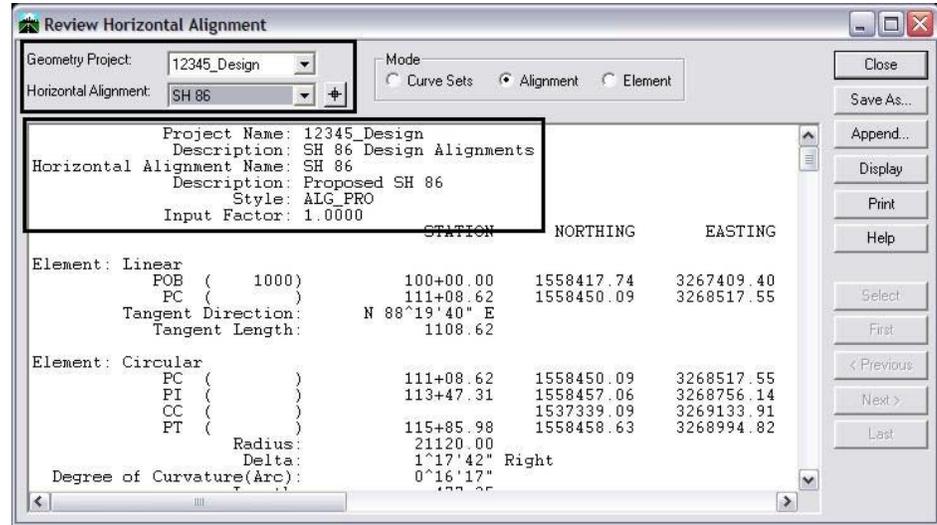
Note: See appendix B for additional information on this topic.

Lab 6: Alignment Attributes Assignment

The geometry *Name*, *Description*, and *Style* are assigned to an alignment or Cogo point when they are created. These attributes can be queried by utilizing the review geometry command.

Alignment Attributes

1. Select Geometry > Review Horizontal...

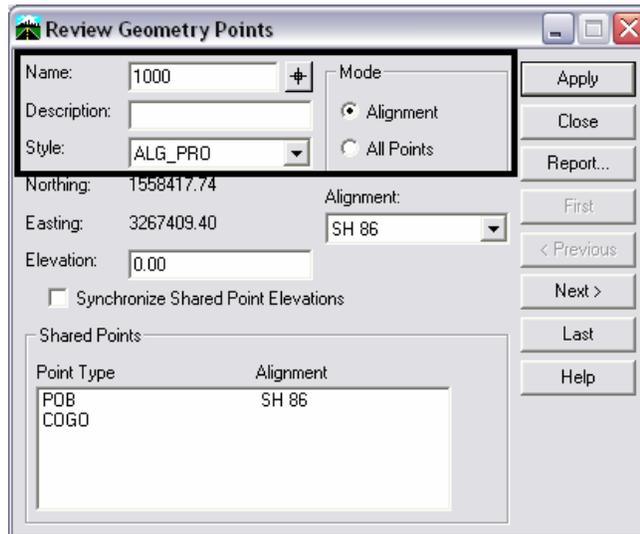


2. By using the selection box labeled Horizontal Alignment:
Compare the settings for the alignment **SH 86** with the attributes for alignment **Side Road**. Note the changes in Description & Style.

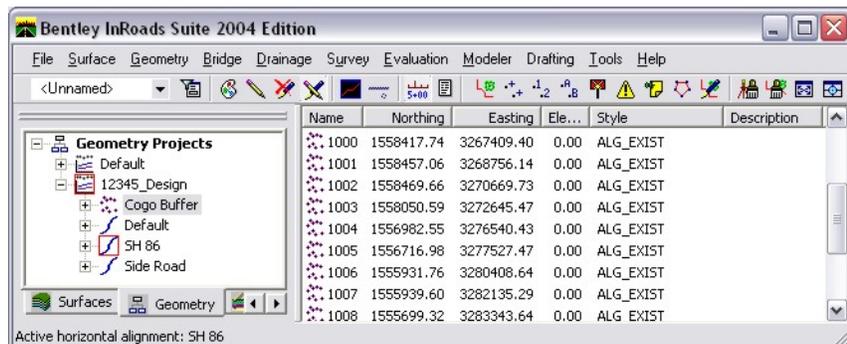
Cogo Point Attributes

3. Select **Geometry > Review Geometry Points...** to review Cogo point names, descriptions, and style assignments.

Note: This dialog is used to review both alignments and Cogo points based on the *Mode* setting.



4. This information can also be seen in the InRoads explorer pane. <D> on the *Cogo Buffer* and notice the description(s) and Style(s) as displayed in the feedback pane.

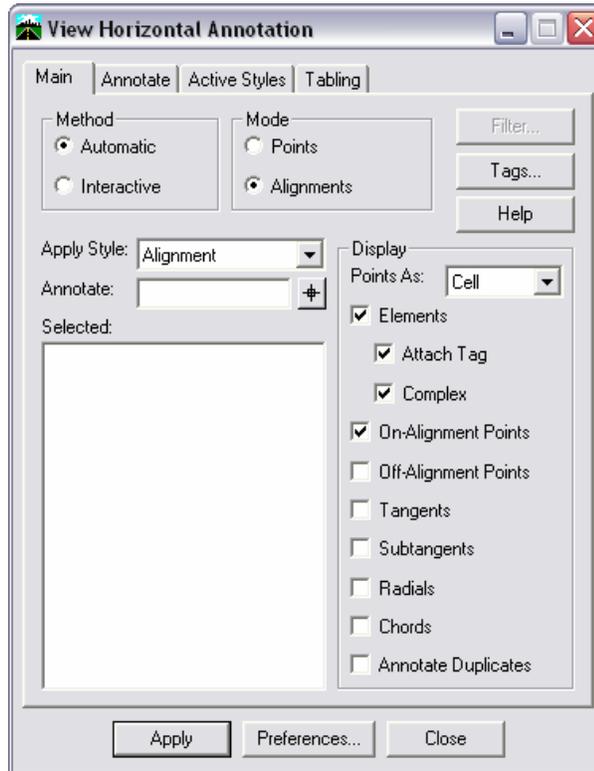


Note: If the *Style* assigned to the data is not a valid name when displaying an alignment or Cogo point (not existing in the Geometry Style Manager), a *Style* by the name *Default* will be used. The *Default* CDOT Style for all geometry elements has the same properties as the defined style **ALG_Proposed**.

3. Geometry Annotation

View Horizontal Annotation

Depending on the options selected, the user can define which alignments or Cogo points are annotated. This dialog is accessed by selecting:
Geometry > View Geometry > Horizontal Annotation



Main Tab

Method Section

- **Automatic:** Acts upon the entire length of the alignment
- **Interactive:** Allows the user to select individual alignment components

Mode Section

- **Points:** Toggle to operate on Cogo points
- **Alignments:** Toggle to operate on alignments and alignment keypoints

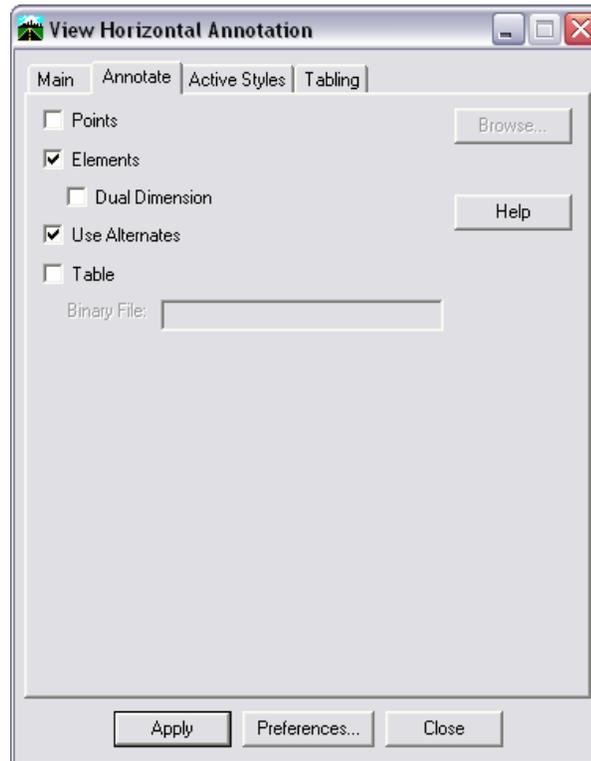
Display Section

- **Point As:** Cell or Text (see lab exercise 9 for additional information)
- **Elements:**
 - Attach Tag: Non-graphic attributes assigned in MicroStation
 - Complex: 'Chains' reference line graphics as a single entity
 - **On Alignment Points:** Display of POB, PC, PT, etc.
 - **Off Alignment Points:** Center of curves and PI's
 - **Tangent:** Curve tangents
 - **Subtangents:** Spiral curve tangents
 - **Radials:** Radial lines to center of curve
 - **Chords:** Circular curve chords
 - **Annotate Duplicates:** Labels points common to multiple alignments

Additional Items

- **Apply Style field:** *Options for over-riding geometry symbology*
- **Annotate field:** Input field for needed alignments or Cogo points
- **Key-in specific names**
- **Use of wildcards (% , *) allowed**
- **<D> in Annotate field,** the **Filter** button activates
- **Selected:** Alignments or Cogo points to be displayed and/or annotated

Annotate Tab

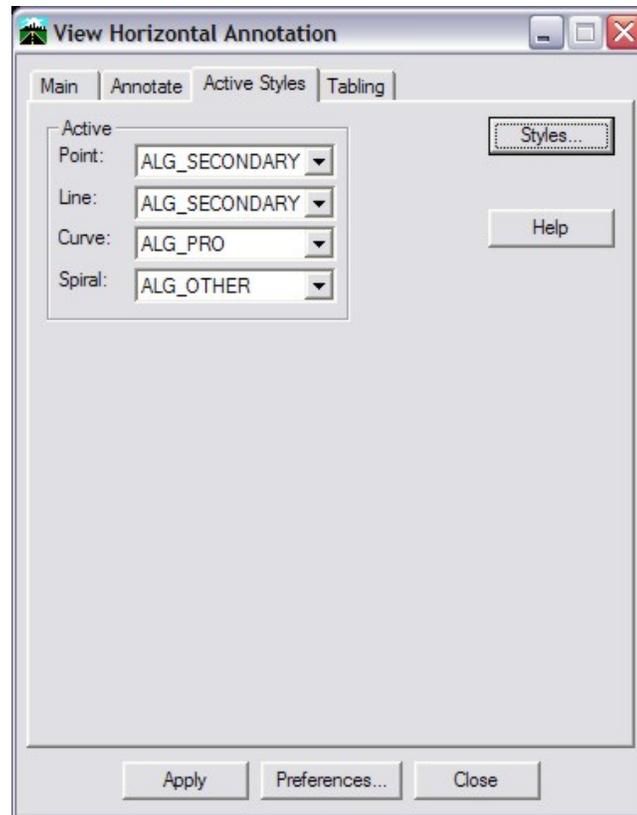


- **Points:** Text on/off for alignment keypoints or Cogo points
- **Elements:** Text on/off for Bearing & Distance annotation
- **Dual Dimension:** Imperial and Metric annotation
- **Use Alternates:** On/off for using alternate geometry styles
- **Table:** Label geometry components with index numbers and writes annotation to a binary file for further processing

Note: See Appendix A for additional information on the above topics.

Active Styles Tab

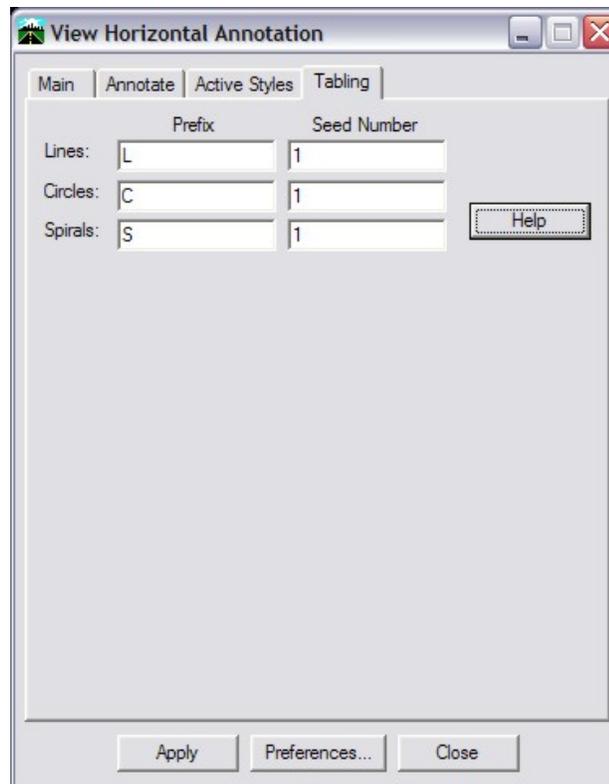
Active styles can only be selected when *Active* is selected from the Main tab of the dialog under *Apply Style*.



- ***Point*** – Temporary override of Geometry Point definition
- ***Line*** - Temporary override of Geometry Line definition
- ***Curve*** - Temporary override of Geometry Curve definition
- ***Spiral*** - Temporary override of Geometry Spiral definition

Tabling

This tab is used to format and assign numbers when Table is selected from the Annotate tab of the dialog.

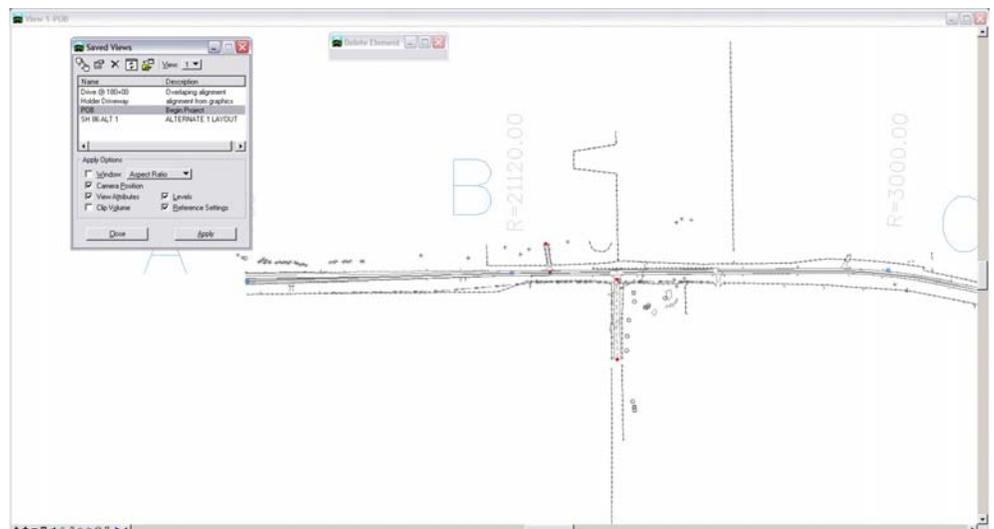
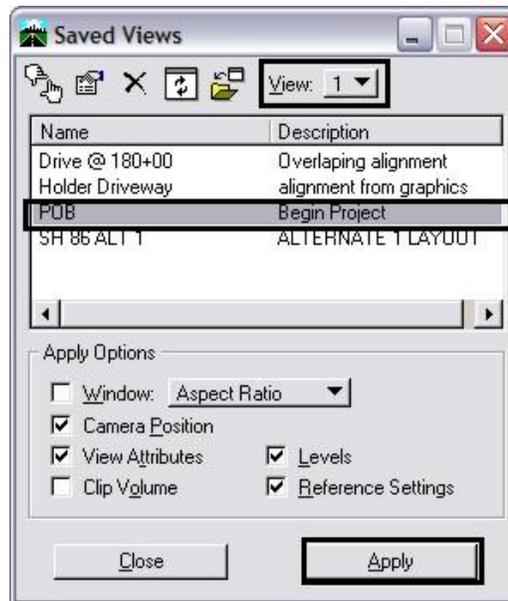


- **Lines** – Defines the **Prefix** and **Seed Number** for lines.
- **Circles** – Defines the **Prefix** and **Seed Number** for circles.
- **Spirals** – Defines the **Prefix** and **Seed Number** for spirals.

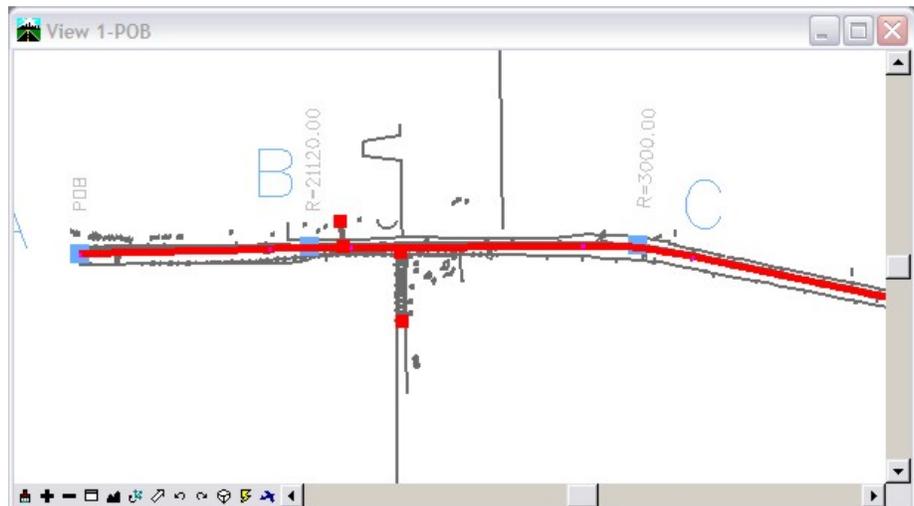
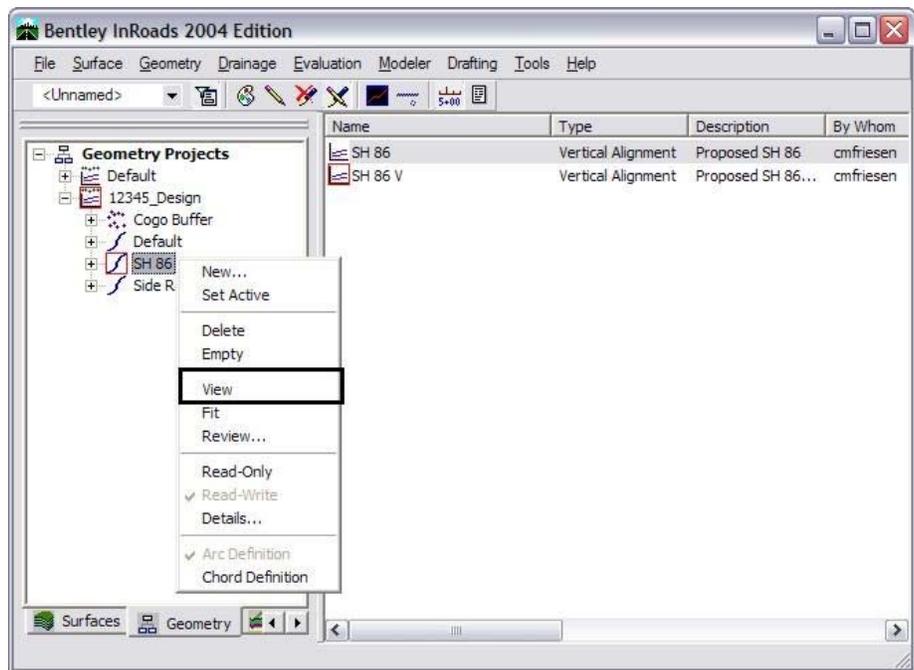
Lab 7: Geometry Display

Options for displaying horizontal alignments are available when using the Horizontal Annotation dialog.

1. Select **Tools > Global Scale Factors** and set all the scales to **100**
2. Using the *MicroStation* menus, select **Utilities > Saved Views** tools to open the saved views dialog.
3. <D> on the name **POB**, <D> Apply for view **1**, <D> Close

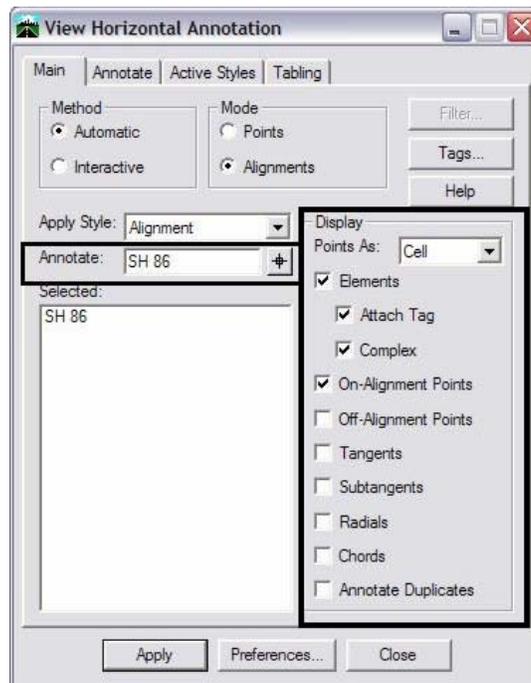


4. Display alignment **SH 86** from the Geometry Project **12345_Design** by right-clicking <R> on the alignment name and selecting **View** from the fly-out menu.

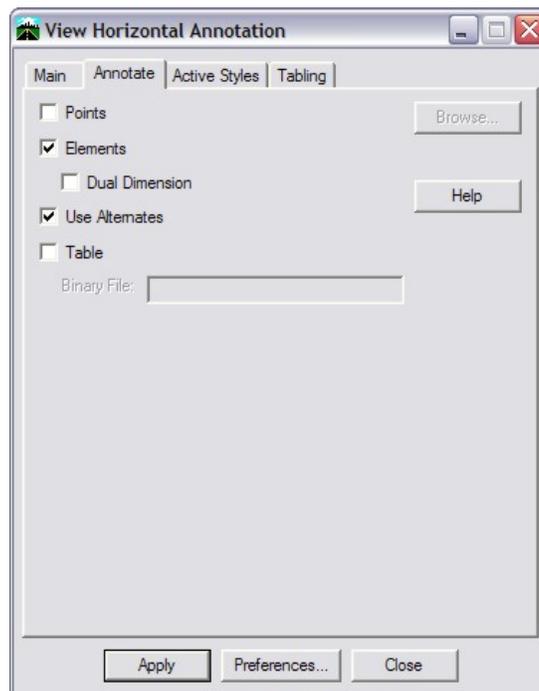


The alignment display is based on the geometry style assigned to the alignment. This display method is suitable but does not allow the user any options or allow annotation of the geometry. The next steps illustrate how to customize the graphics display for geometry elements.

5. Select **Geometry > View Geometry > Horizontal Annotation**



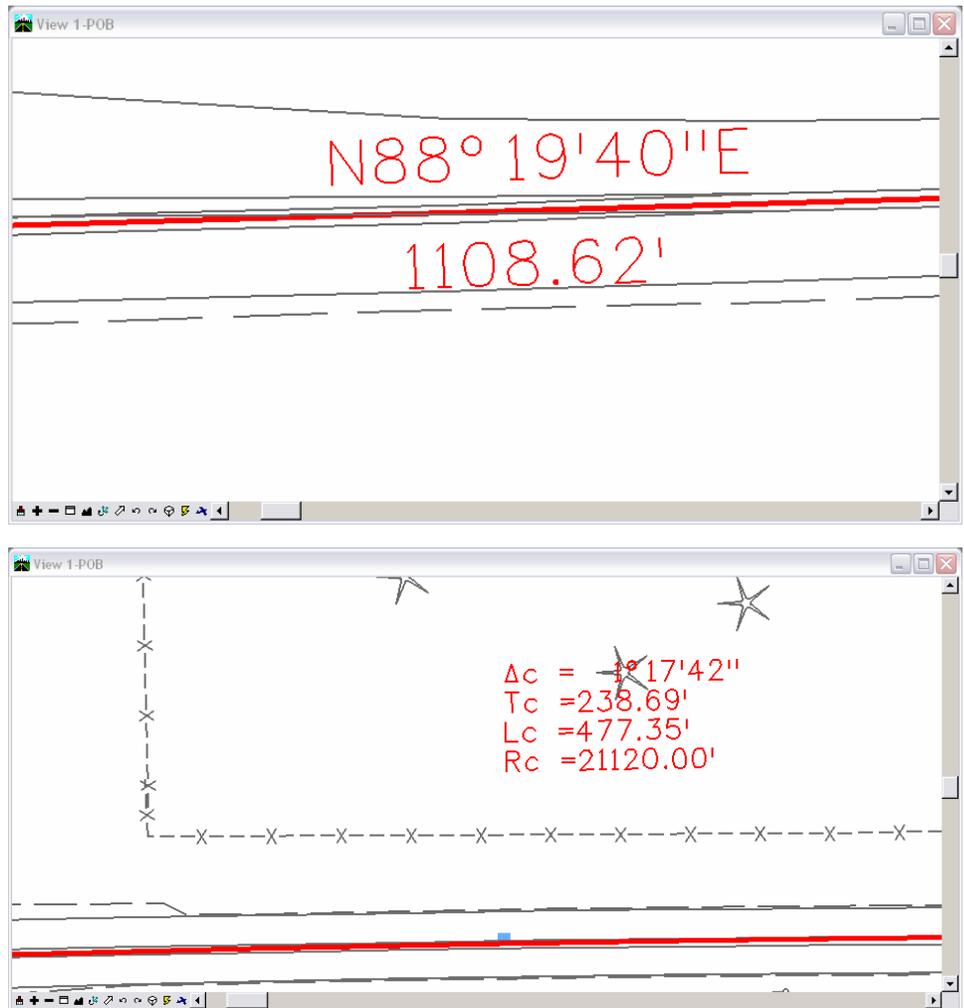
6. Key-in **SH 86** in the *Annotate* field and *Tab* from the field.
7. Set options for the **Display** section of the dialog as shown in the above screen shot.
8. Select the **Annotate** tab.



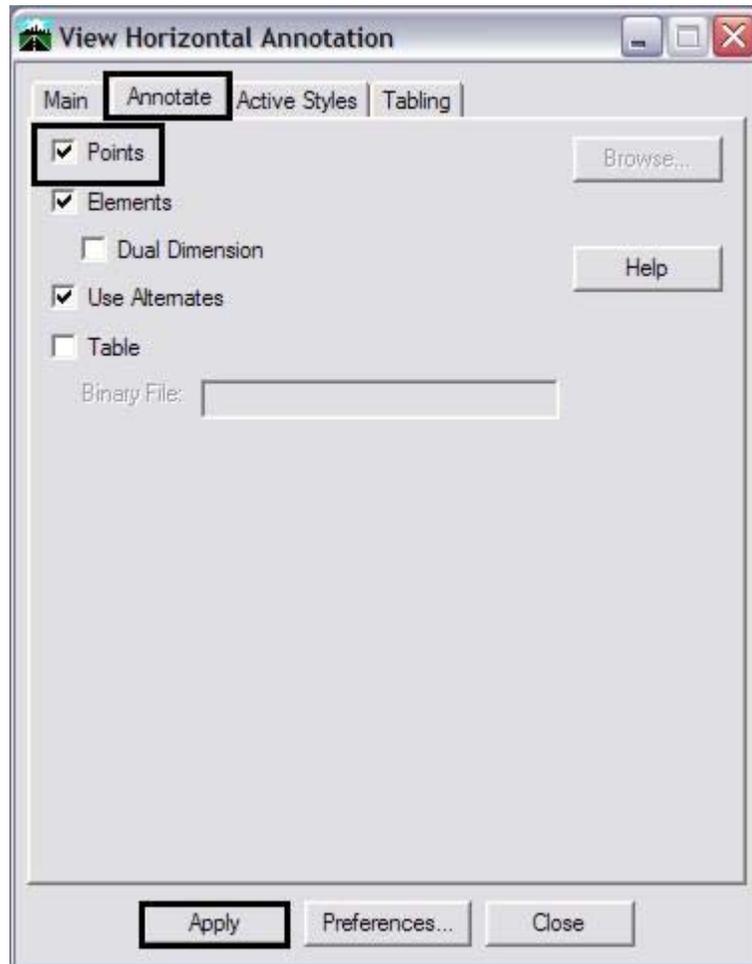
9. Check *on* **Elements** and **Use Alternates**. Toggle all other checkboxes *off*.

10. <D> the **Apply** button. This will write alignment **SH 86** to the MicroStation Screen and annotate the alignment.

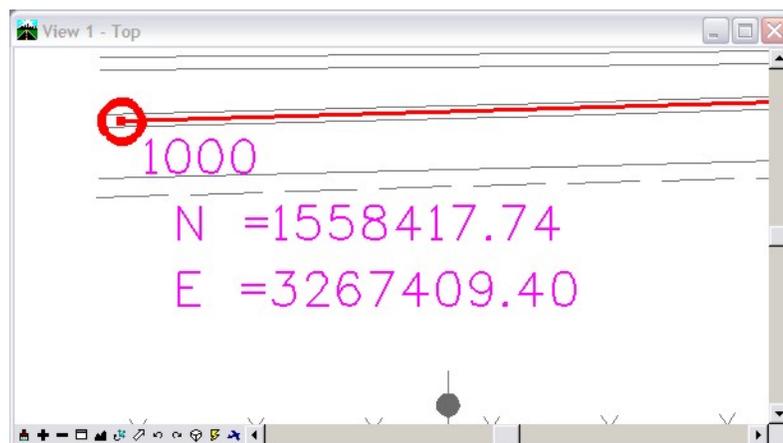
Note how Bearing and Distance annotation is displayed along the tangents. If the alignment contains horizontal curves, curve data is displayed.



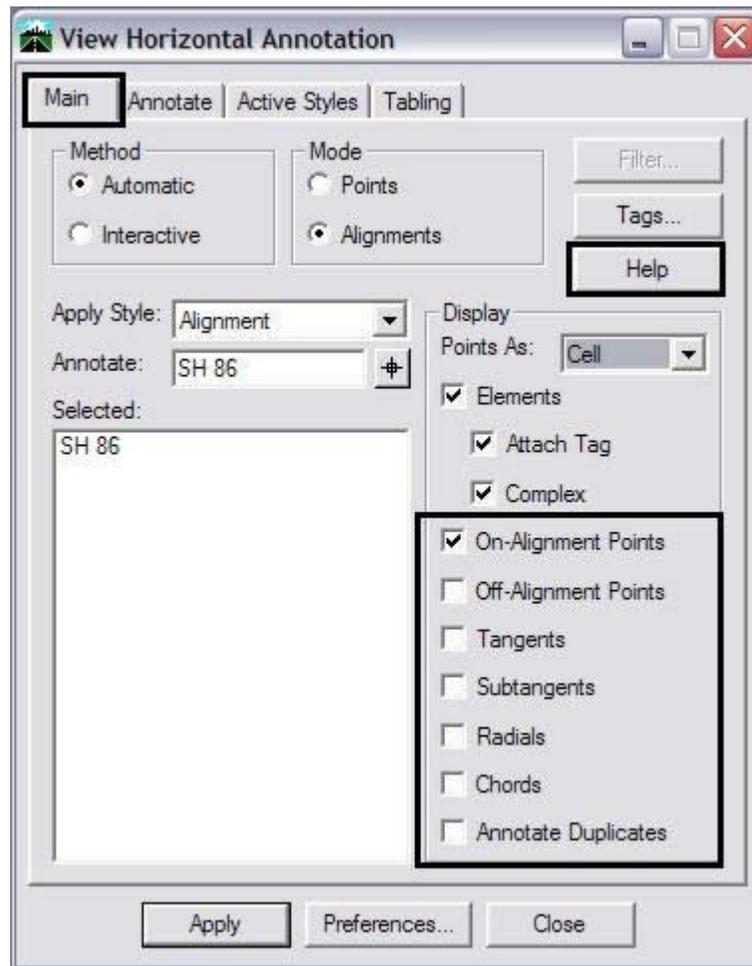
11. Return to the **View Horizontal Annotation** dialog
12. <D> the **Annotate** tab, Toggle on **Points**, <D> **Apply**



Notice that in addition to annotation for tangents and curves, alignment vertices are annotated.



13. On the Main tab, click the **Help** button and review the descriptions for the various components that can be displayed.

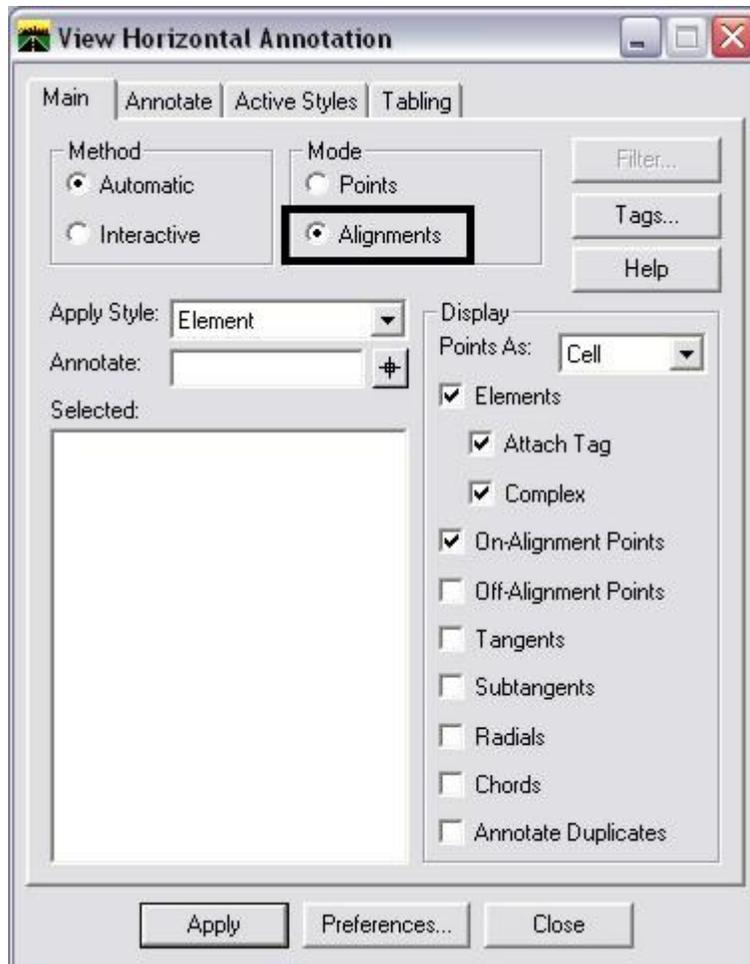


14. Experiment displaying an alignment with *Points* and *Elements* turned on or off on both the *Main* tab and the *Annotate* tab.
15. Experiment displaying the various components available in the display portion of the dialog.

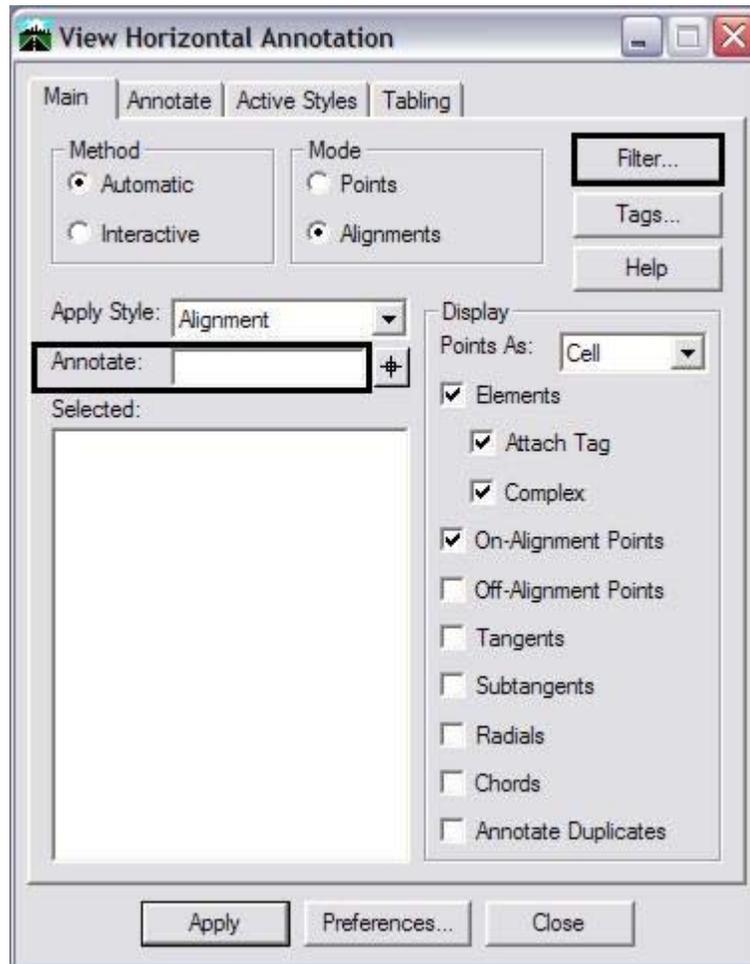
Lab 8: Selection of Geometry for display and/or Annotation

Methods for defining geometry elements for display and/or annotation.

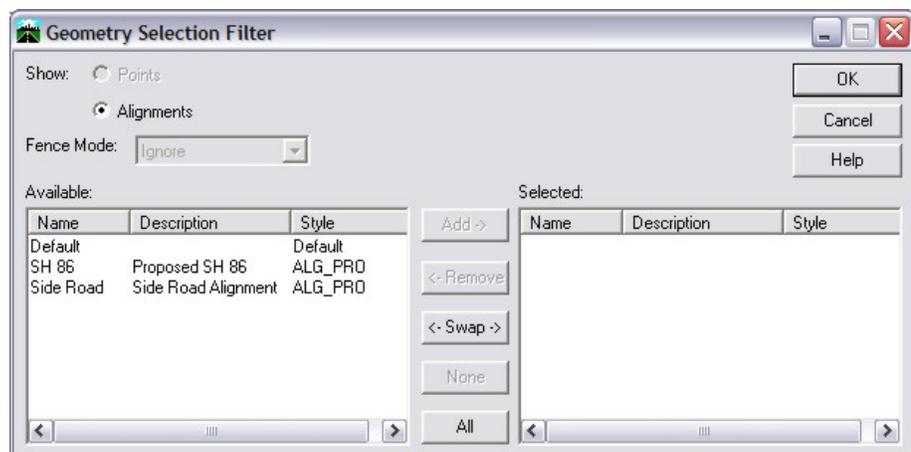
1. Select **Geometry > View Geometry > Horizontal Annotation**
2. <D> the **Main** tab
3. Set **Mode** to **Alignments**



4. Set the *Apply Style* to **Alignment**
5. <D> in the *Annotate* field. The Filter button becomes active



6. <D> the **Filter** button. The **Geometry Selection Filter** dialog will appear.



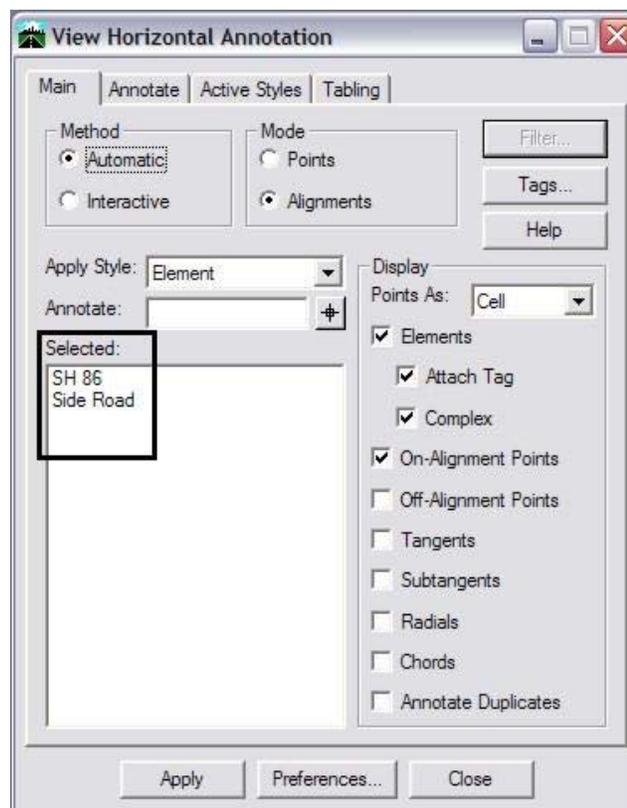
Note: *Available* alignments are shown on the left, *Selected* (for display or annotation) alignments are shown on the right. This makes it possible to select multiple alignments for display or annotation.

7. Add-> alignments **SH 86, Side Road** to the *Selected* field by selecting the names in the *Available* list <D>, and <D> ADD-> (or <D><D> on the names) in the **Geometry Selection Filter** dialog.

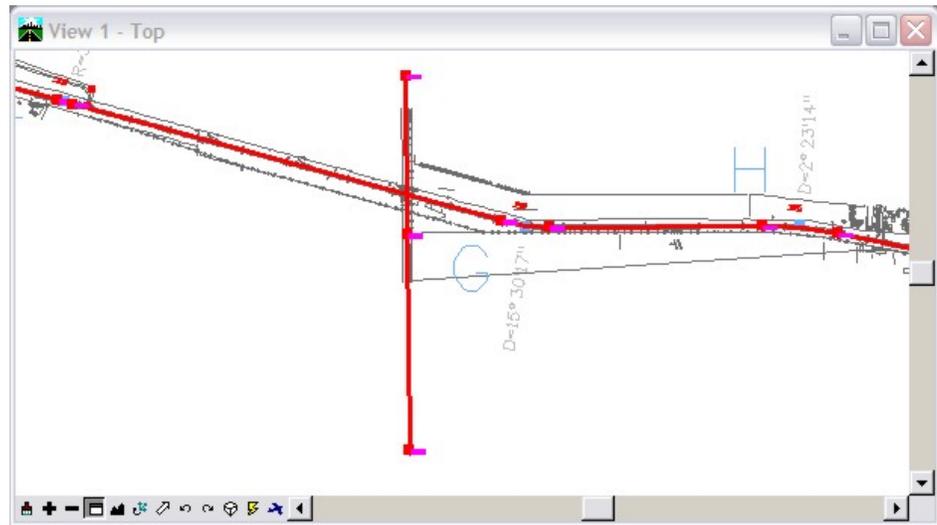
Note: The data in this dialog can be sorted by clicking <D> on the column headers. Multiple selections of alignments can be made through the use of the <CTRL> or <Shift> keys.



8. When done identifying the desired alignments in the Filter dialog, <D> OK – the Selected geometry is populated in the *Selected* field

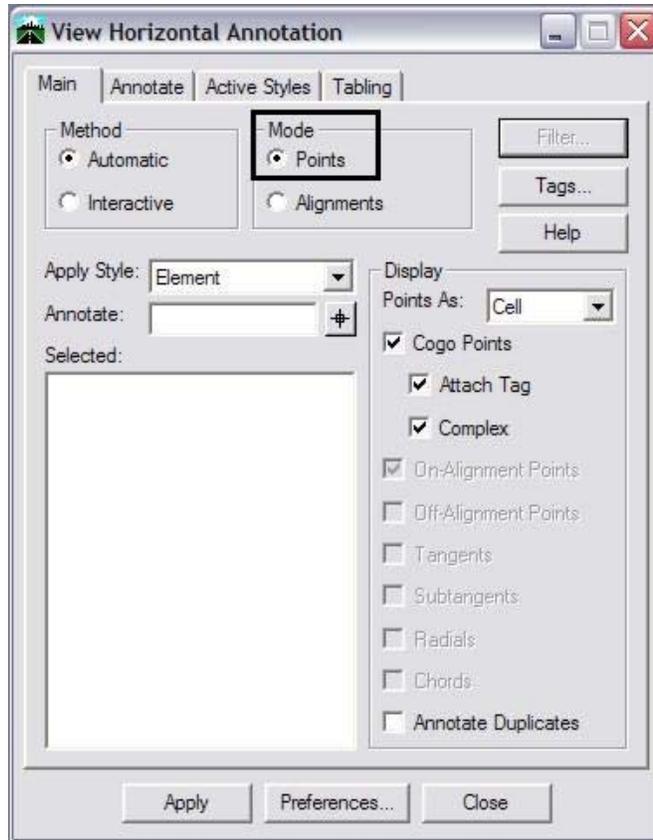


9. <D> **Apply**, the selected alignments will display in MicroStation
10. Review results in MicroStation



Lab 9: Display or Annotation of Cogo Points

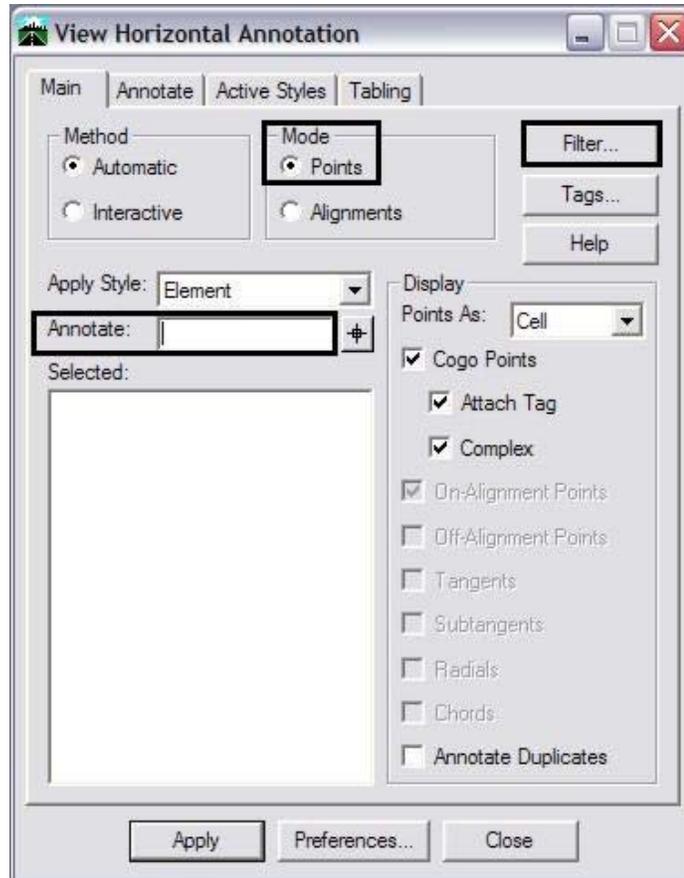
1. In the *Main* tab of the View Horizontal Annotation dialog, set *Mode* to *Points*



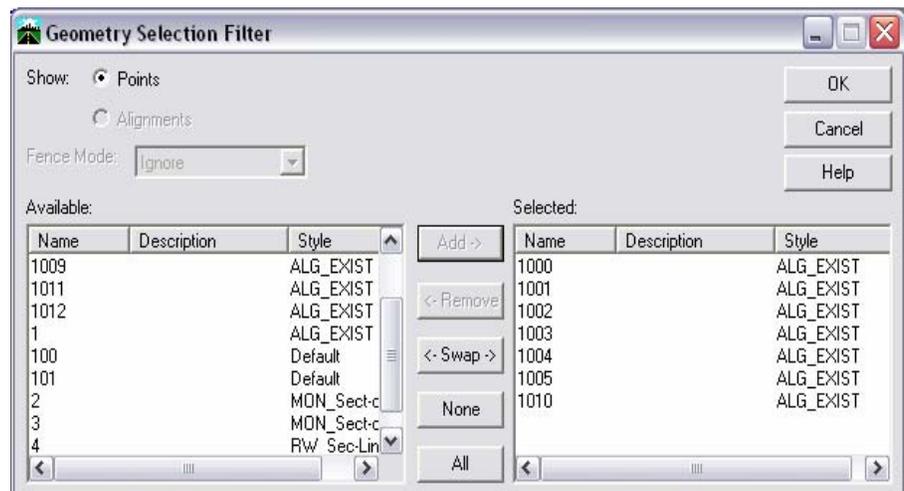
- Cogo points can be selected for display and/or annotation

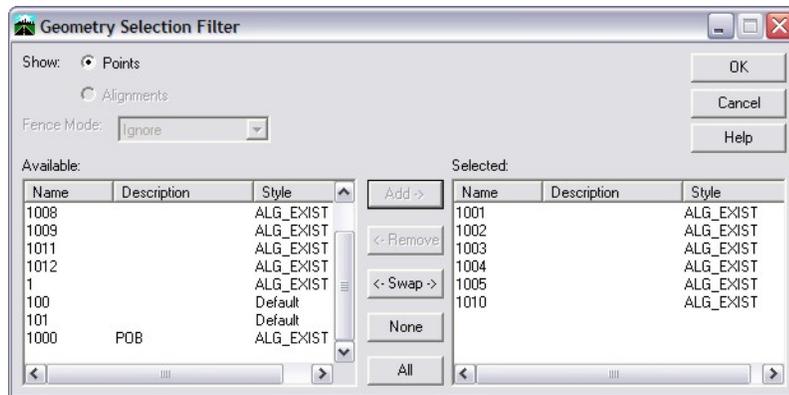
Note: Whether you are annotating Points or Alignments, keep in mind that the element selection button  can be used to graphically identify the geometry of interest. This is universally true in InRoads whenever the selection button is displayed.

2. <D> the **Annotate** field to activate the Filter button
3. <D> the **Filter** button. The **Geometry Selection Filter** dialog will appear.

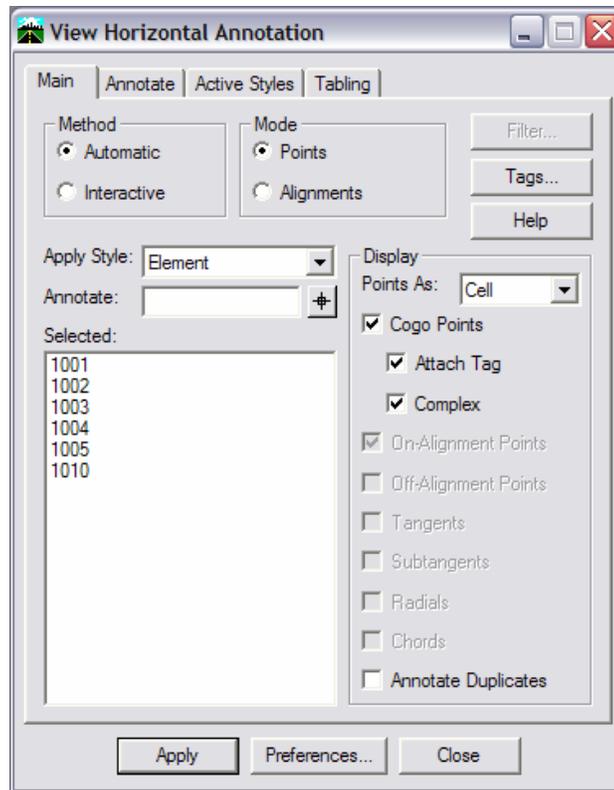


4. **Select** points **1001-1005 & 1010** from the **Available** field and add them to the **Selected** field.

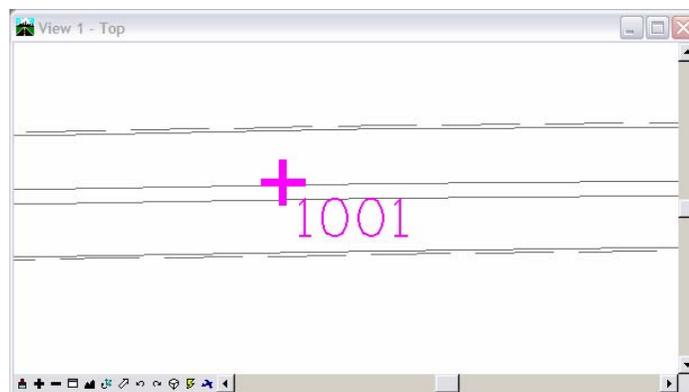




5. <D> the OK button. The points populate the *Selected* field



6. <D> the **Apply** button in the **View Horizontal Annotation** dialog.



7. Experiment displaying various *Alignments* and *Points* with the assorted settings.

Note: Remember to toggle on *Points* in the **Annotation** tab if you need to see Cogo Point numbers, Northing, and Easting. Keep in mind annotation settings are derived from the Geometry Style Manager Type: Points for the assigned Geometry Style.

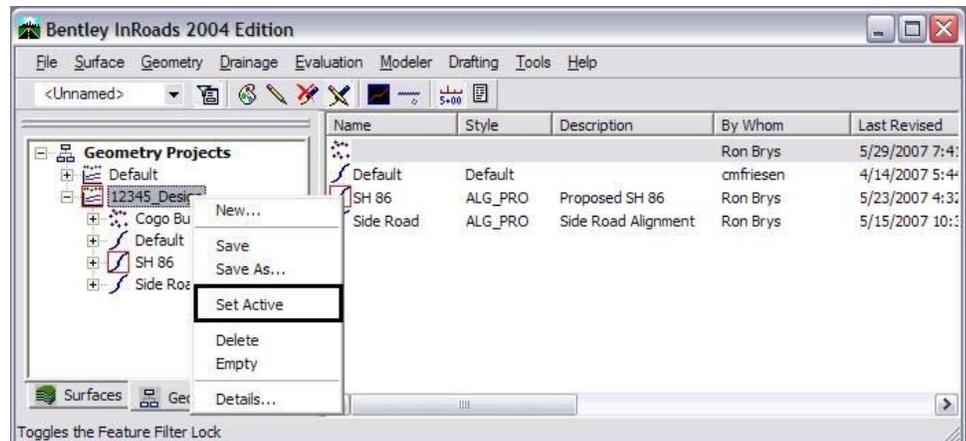


Lab 10: Alignment Stationing

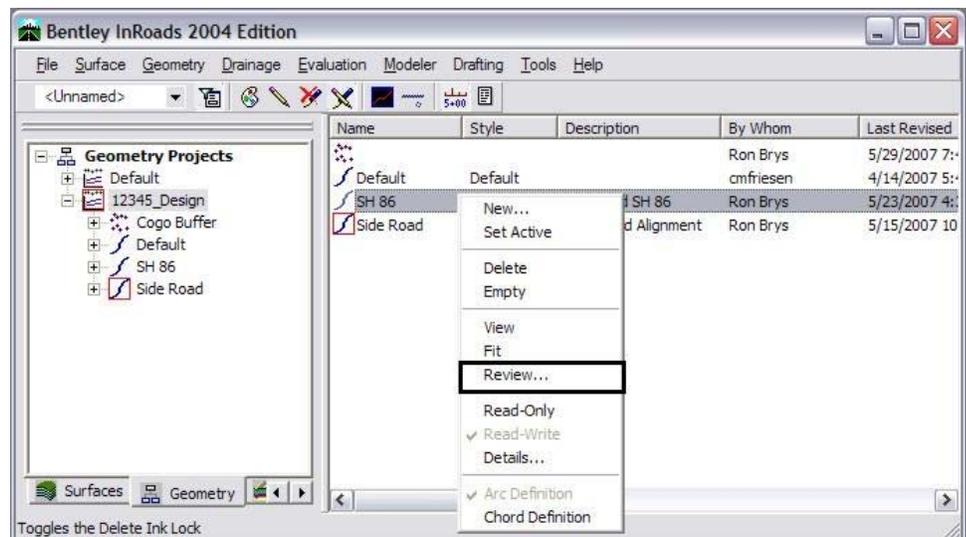
The default station at the beginning of a newly created horizontal or vertical alignment is 0+00. This value can be changed as shown later in this lab.

One of the easiest methods for determining assigned stationing values is through the alignment review commands.

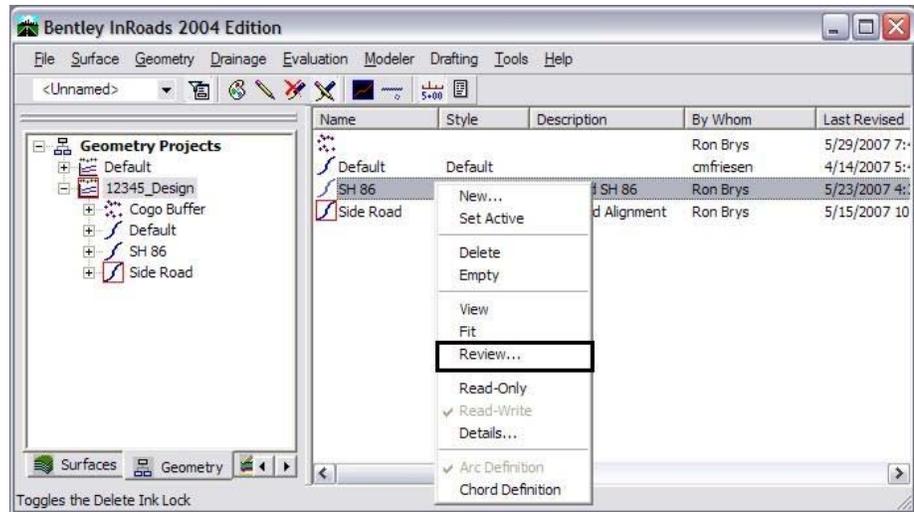
1. Make *12345_Design* the active geometry project by **right-clicking** on this geometry name and selecting **Set Active** from the fly-out menu.



2. **Right-click** on the alignment **SH 86** and select **Review** from the Fly-out menu. The Review Horizontal Alignment dialog will appear.

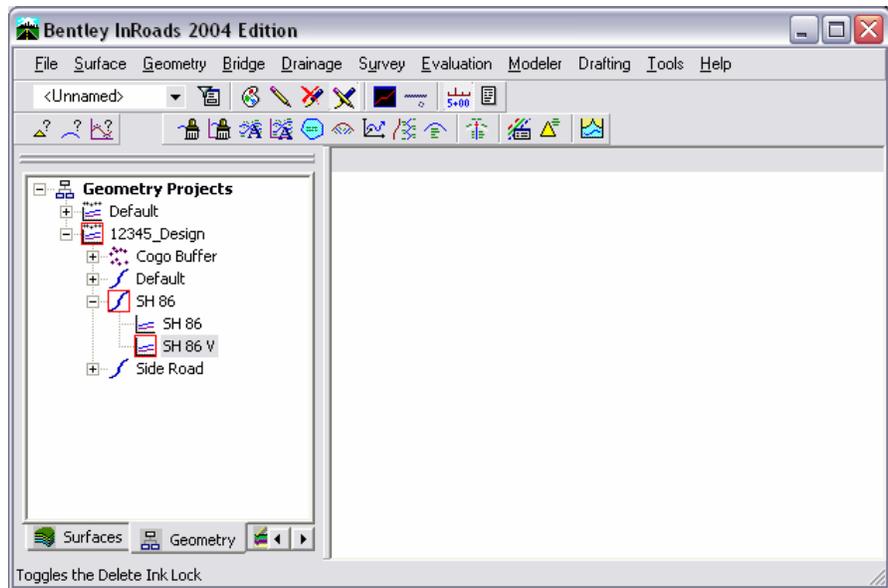


Note: Fly-out menus can be accessed from either the workspace or feedback panes. Also note that selecting an alignment for review switches it to being the **active** alignment.



3. Investigate the stationing assigned to horizontal Alignment **SH 86**

- Initial station value is: _____



4. Review the **Vertical** alignment **SH 86 V** associated with horizontal alignment SH 86.

- Is the stationing for the horizontal and vertical alignments synchronized?

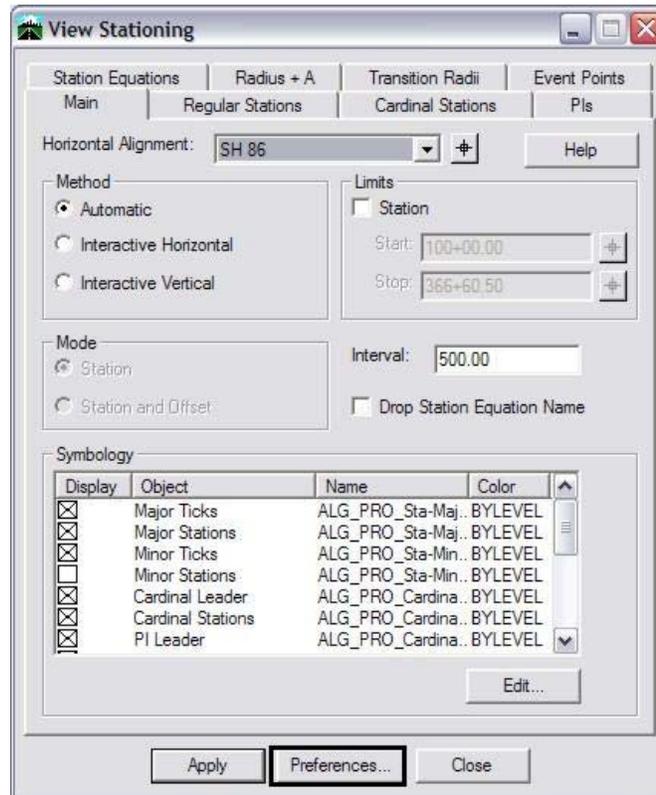
Lab 11: Displaying Stationing

Display stationing and alignment keypoints.

1. Prior to displaying the stationing, **display** the lifework for the horizontal alignment *SH 86*

Hint: Right-click on the alignment name in the InRoads explorer window and select **View** from the fly-out menu.

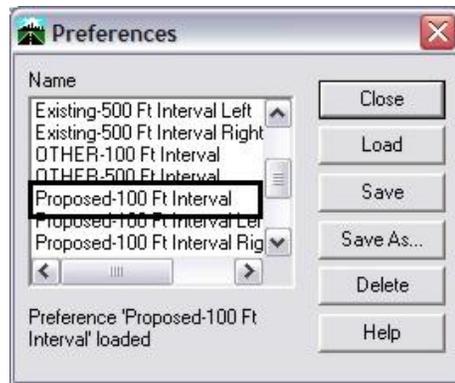
2. Select **Geometry > View Geometry > Stationing**. The **View Stationing** dialog will appear.



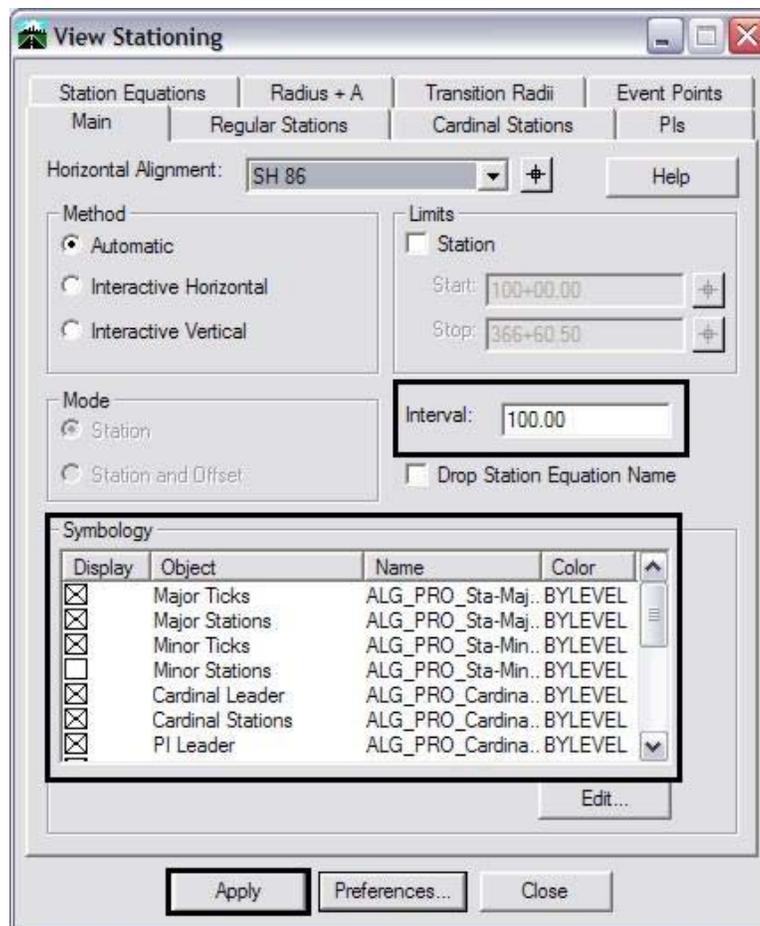
3. <D> the **Preferences** button.

Note: The Preferences dialog is used to load preset settings for a particular tool. In the View Stationing dialog the preference is setting the interval and symbology of the display graphics.

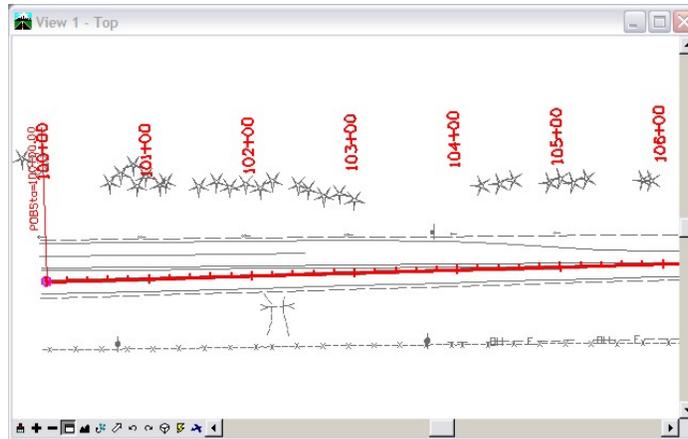
4. Load the Preference **Proposed-100 Ft Interval**.



5. <D> **Proposed-100 Ft Interval**
6. <D> **Load** then **Close** button.



7. In the **Symbology** portion of the dialog, select or de-select the alignment components for display. Loading the preference sets the default interval for major stations.
8. <D> **Apply** to display the stationing.

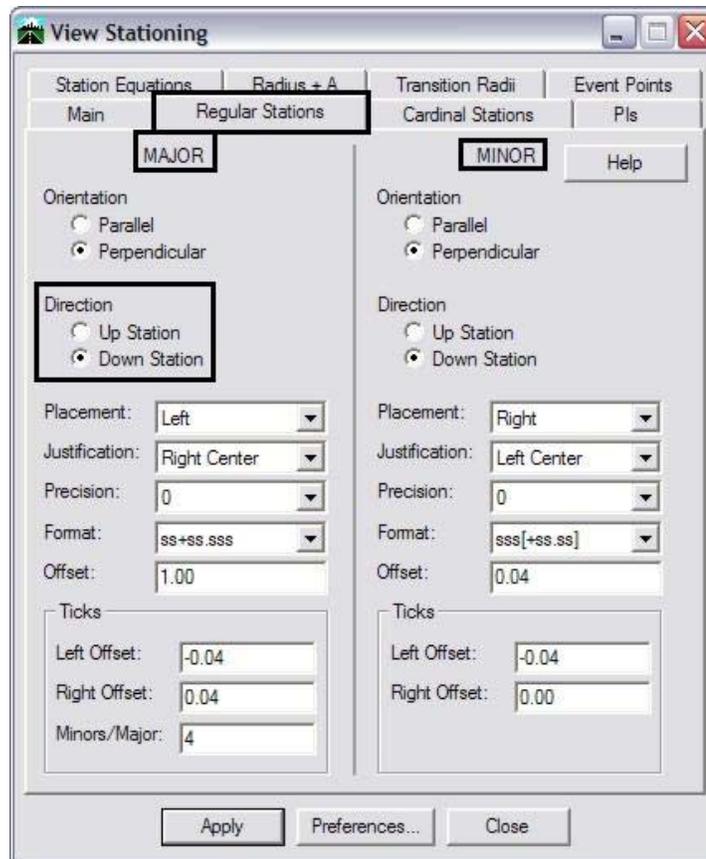


The **View Stationing** dialog is populated with the predefined settings from the stored preferences. Notice the *interval* field and settings under the *symbology* section. The display toggles define what will display; the name column reflects the InRoads named symbology defining graphical attributes for displayed items.

There are several standard CDOT preferences to choose from, depending upon the type of alignment stationing and station interval. Choose the appropriate **preference** and **<D> Apply** to see the stationing.

Keep in mind that text size is dependent on the Global Scale factor active at time of display. Select **Tools > Options [Factors]** if necessary.

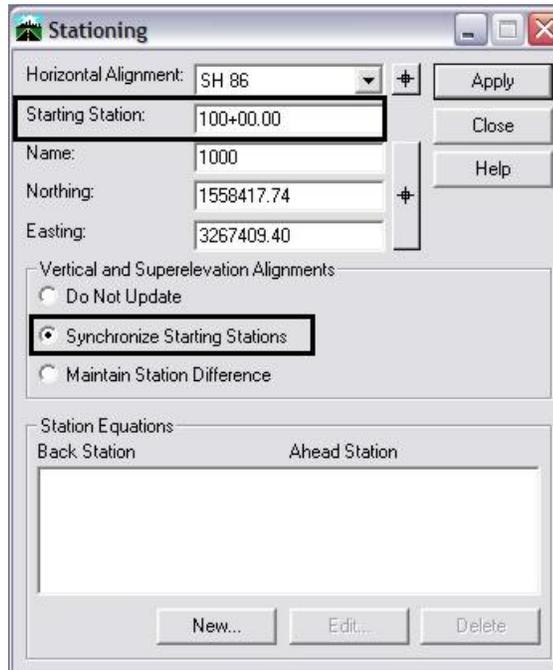
9. Change the *Global Scale Factor* and *redisplay* stationing.
10. *Experiment* displaying stationing using various CDOT preferences until presets becomes familiar.
11. *Experiment* with the various tabs and settings in the **View Stationing** dialog and investigate changes made when stationing is redisplayed.



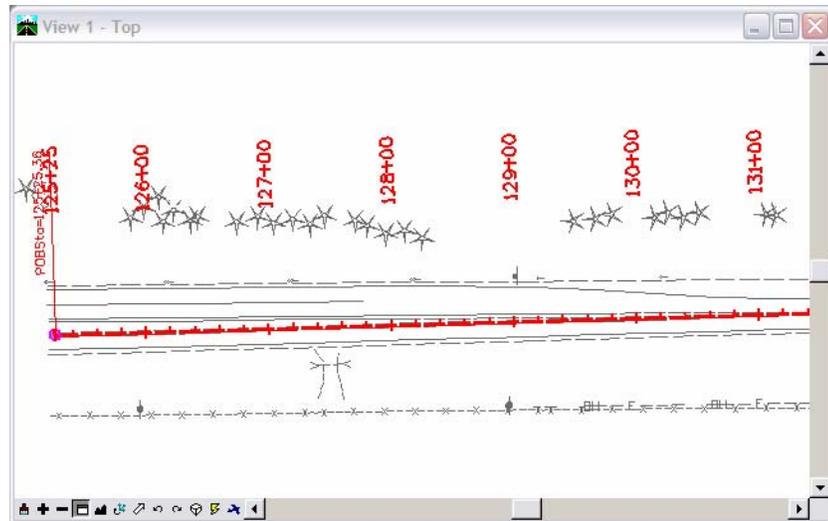
Lab 12: Defining Stationing

Upon creation, alignments are defined with a beginning stationing of 0+00. Stationing can be redefined from any location along the alignment. Additionally, station equations can be incorporated.

1. Select **Geometry > Horizontal Curve Set > Stationing**. By default, this dialog displays the beginning stationing value of the active alignment.



2. Select ***Synchronize Starting Stations*** in the ***Vertical and Superelevation Alignments*** field.
3. Set the beginning stationing of alignment ***SH 86*** by keying in ***125+25.36*** and choosing ***Apply***.
4. ***Verify*** the change has been applied by ***redisplaying*** the stationing using ***Geometry > View Geometry > Stationing*** and click ***Apply***. Also, check the beginning stationing value of any associated vertical alignments by using the review command.

**Notes:**

- The options for **Vertical and Superelevation Alignments** should be considered carefully. **Do Not Update** will leave the stationing of vertical and superelevation application stations as is, **Synchronize Starting Stations** will update their stationing to match that of the horizontal and **Maintain Station Difference** will keep any difference (delta) in the current starting stations.
 - InRoads does not require a '+' when keying in a station. The plus sign will be added automatically.
 - Any point along the alignment can be specified as the location for the input stationing value. The alignment location defined by either **name** or the **northing** and **easting** fields is the location the input stationing will propagate from.
5. Set the beginning station of alignment **SH 86** by keying in **32062.24** and choosing **Apply**.

Stationing

Horizontal Alignment: SH 86

Starting Station: 320+62.24

Name: 1000

Northing: 1558417.74

Easting: 3267409.40

Vertical and Superelevation Alignments

Do Not Update

Synchronize Starting Stations

Maintain Station Difference

Station Equations

Back Station Ahead Station

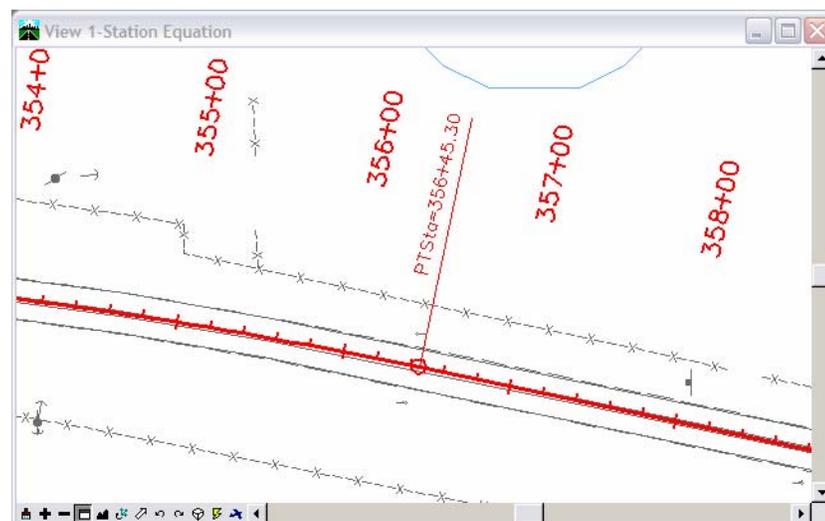
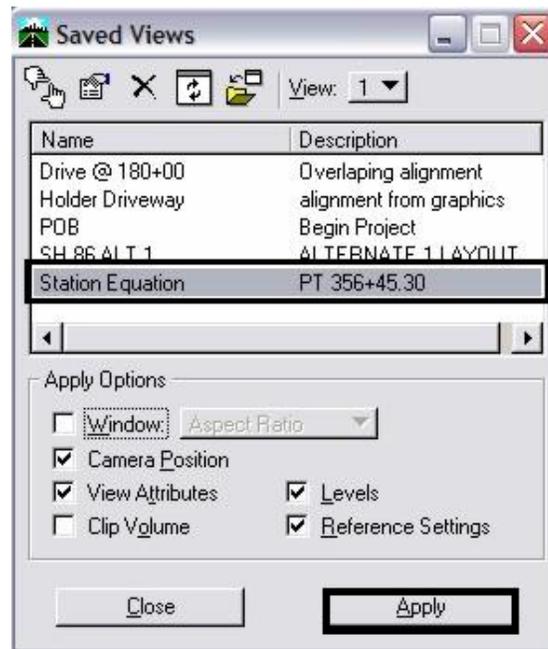
New... Edit... Delete

6. **Verify** the change has been applied by **redisplaying** the stationing. Select **Geometry > View Geometry > Stationing** then click **Apply**.

Lab 13: Station Equations

If there are inequalities in the alignment, station equations may be required. These equations can be either gap or overlap equations.

1. From MicroStation Select **Utilities > Saved Views**. **Apply** saved view **Station Equation**. Once applied, close the **Saved View** dialog



At the PT of the curve a station equation is necessary to tie to previous work. The values are:

Back = 356+45.30

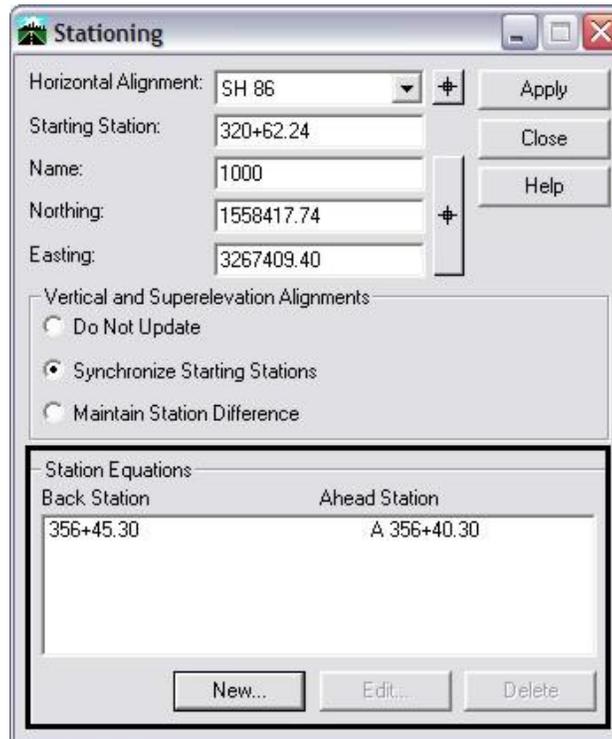
Ahead = 356+40.30

2. Select **Geometry > Horizontal Curve Sets > Stationing**. The **Stationing** dialog will appear.

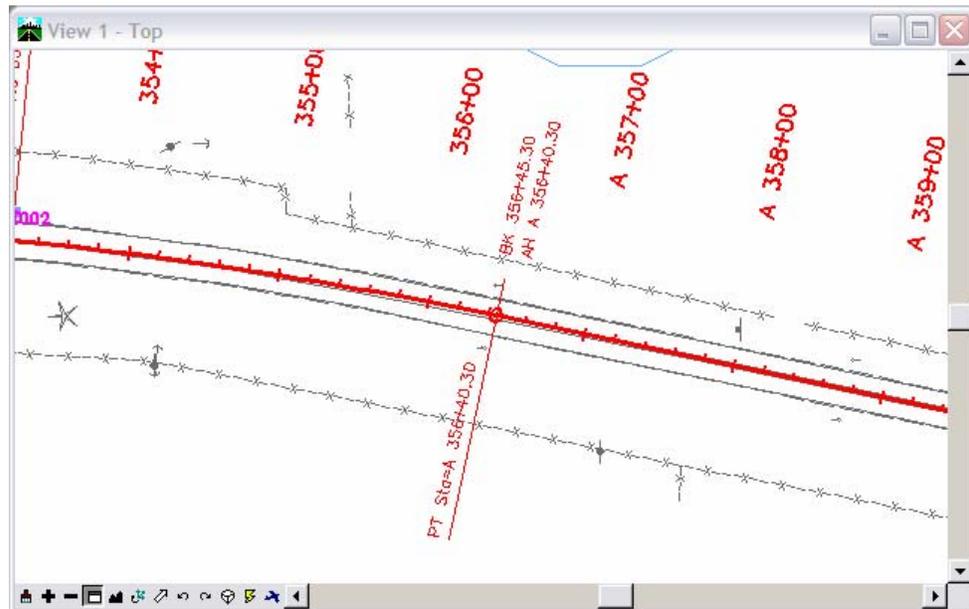
3. Verify **SH 86** is the horizontal alignment.
4. At the bottom of the dialog, choose **New**. In the resulting box, enter the **Back Station** and the **Ahead Station** as shown below.

5. <D> **Apply**

6. <D> **Cancel** to close the **Add Station Equation** dialog. The station equation will be shown in the parent dialog

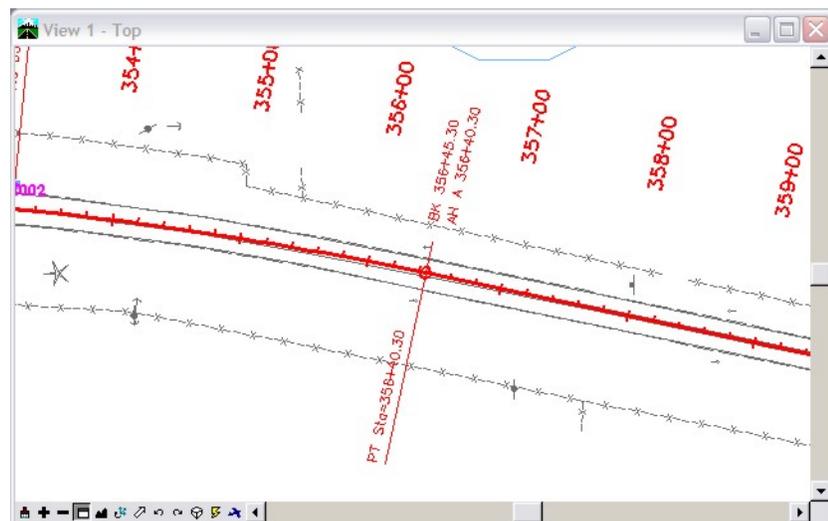
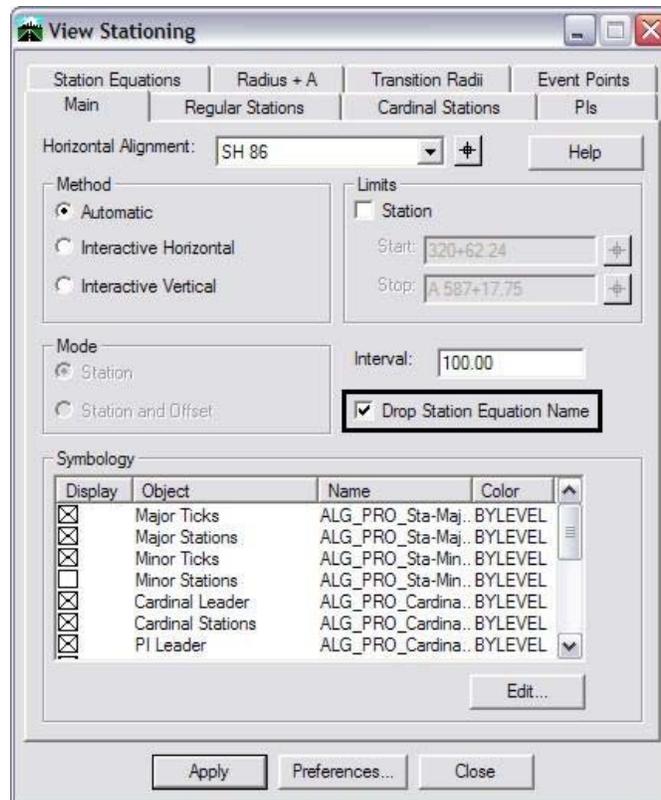


7. <D> **Close** in the **Stationing** dialog
8. **Redisplay** the stationing for alignment **SH 86**



Notes:

- The ahead station must be prefixed with an equation name. The name must consist of at least one alpha character.
- An alignment can contain multiple station equations.
- Annotation of stationing lying within the range of a station equation will be prefixed with the equation name. If the prefix is undesirable, toggle on **Drop Station Equation Name** in the **View Stationing** dialog and redisplay the stationing.

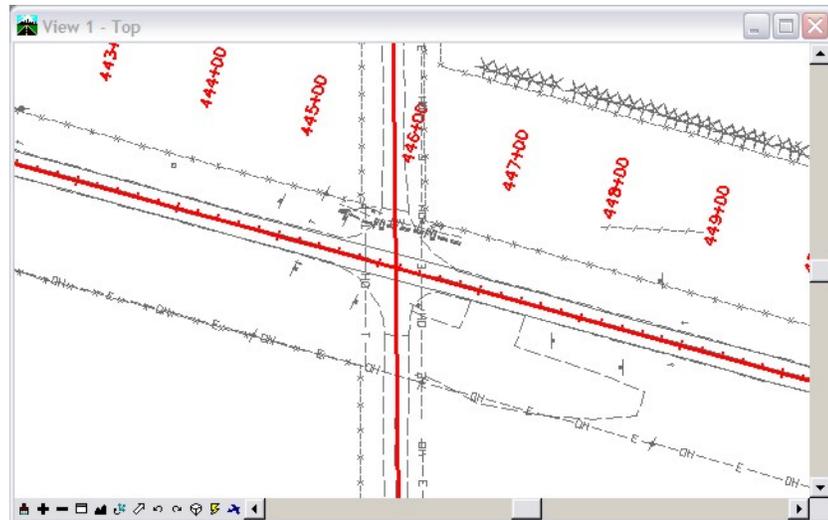


Lab 14: Horizontal Alignment Tracking

Two methods exist for receiving interactive information relative to a horizontal alignment. Both methods report on stationing, offset, elevation, etc. One method reports the elevation of the active surface, the other reports the elevation of the active vertical alignment.

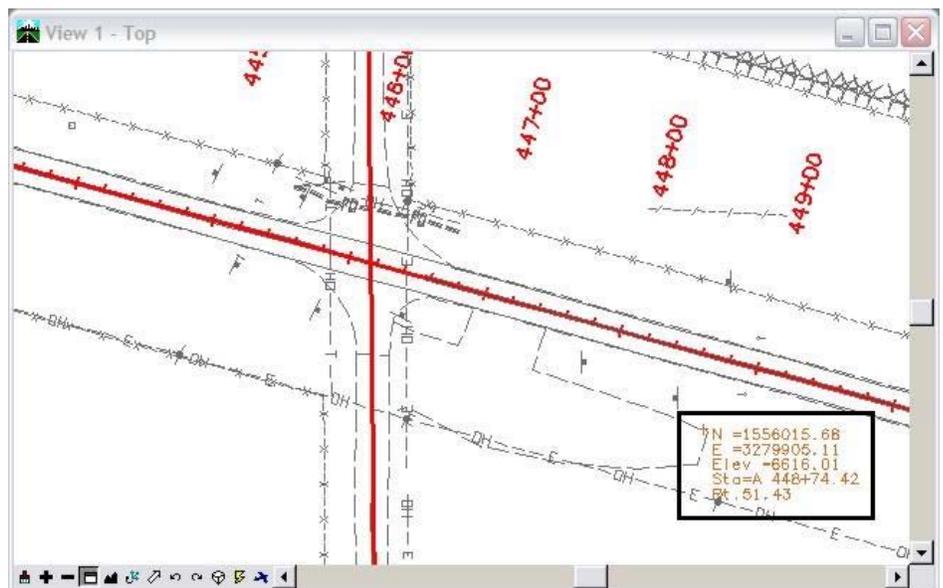
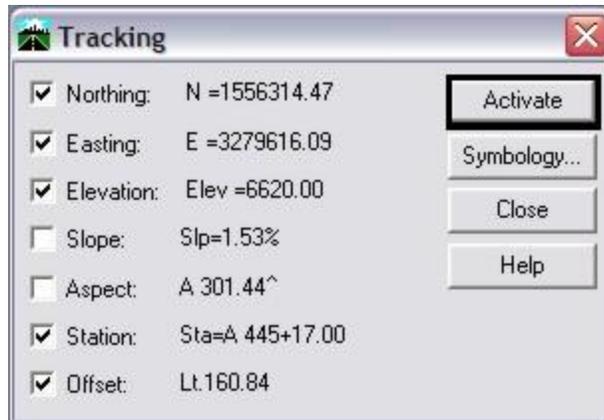
Horizontal Alignment & Surface Elevation Tracking

1. Recall Saved View Side Road



In addition to reporting on station and offset information relative to the active alignment, the following method will report on information relative to the active surface.

2. Select **File > Open** and load the surface *12345SURV_Surface_Existing.dtm* from the *C:\Projects\12345\ROW_Survey\InRoads\DTM* folder.
3. Select **Tools > Tracking > Tracking** to track both the active horizontal alignment and information relative to the active surface
4. Select **Activate** to initialize the command. Slide the cursor along the alignment to interactively update the display in the **Tracking** dialog. If a <D> (data point) is entered in the design file the information toggled on is displayed graphically

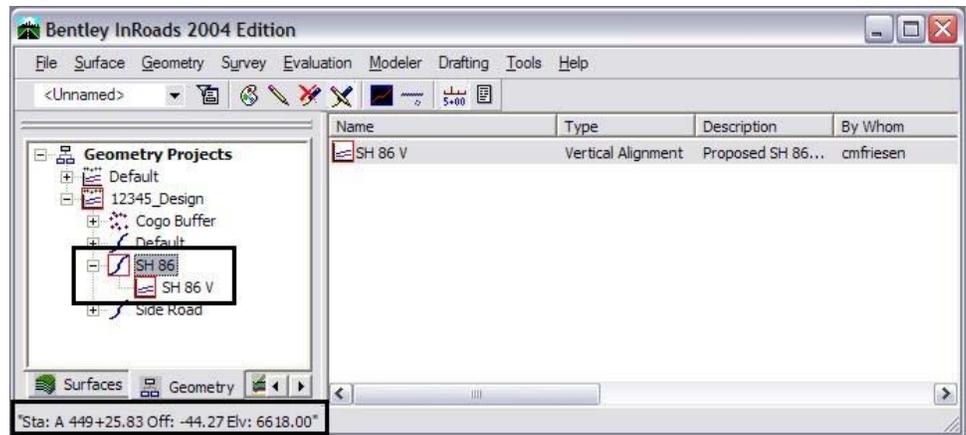


Note: Select the *Symbology* button in the Tracking dialog to examine the attributes assigned to annotation placed in the MicroStation design file.

Horizontal & Vertical Alignment Tracking

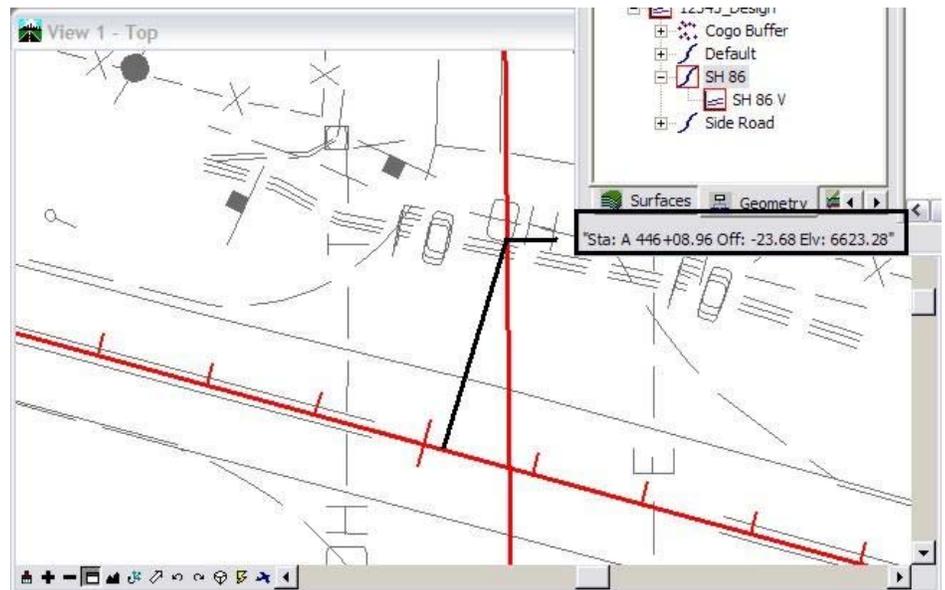
The second method tracks the station and offset relative to the active horizontal alignment along with the elevation of the active vertical alignment. Station, Offset, and Elevation information is displayed in the message field of the InRoads interface.

1. Select **Tools > Tracking > Horizontal Alignment** to track the active horizontal alignment.



2. The results display in the status bar of the InRoads interface.

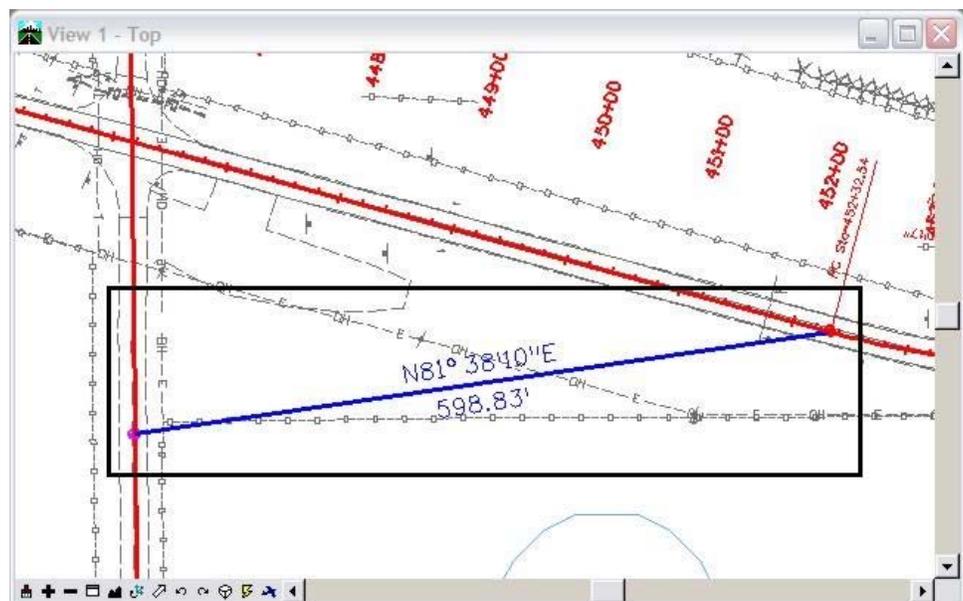
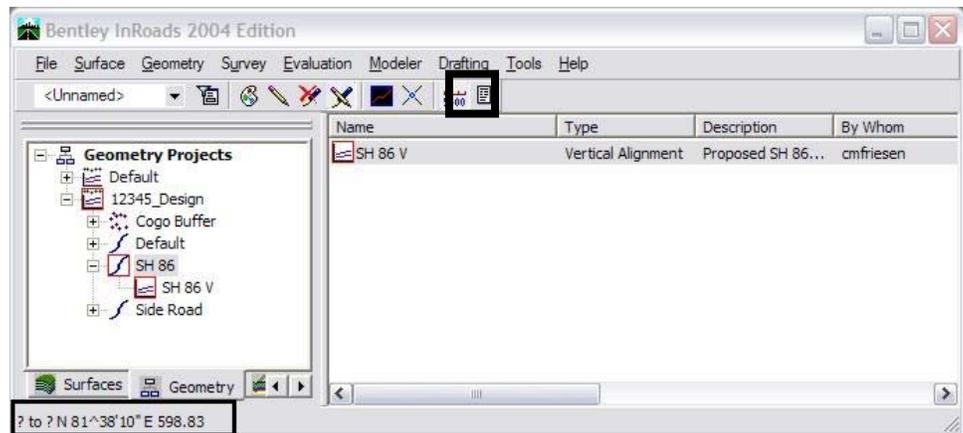
Note: The readout interactively reflects the location of the cursor relative to the active alignment. If a second horizontal alignment is selected with a data point, <D> the offset displayed will be relative to the two alignments perpendicular to the active alignment.



Inversing Between Alignments - Overview

Another useful geometry utility is **Geometry > Utilities > Inverse Direction**. This command can be used to interactively inverse between data <D> points identified graphically.

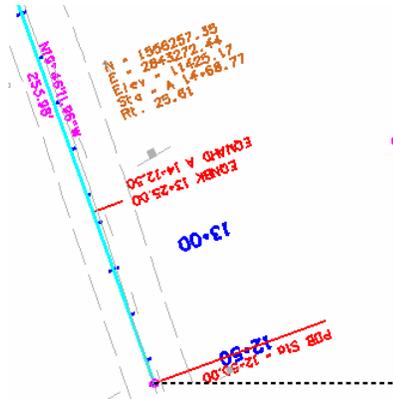
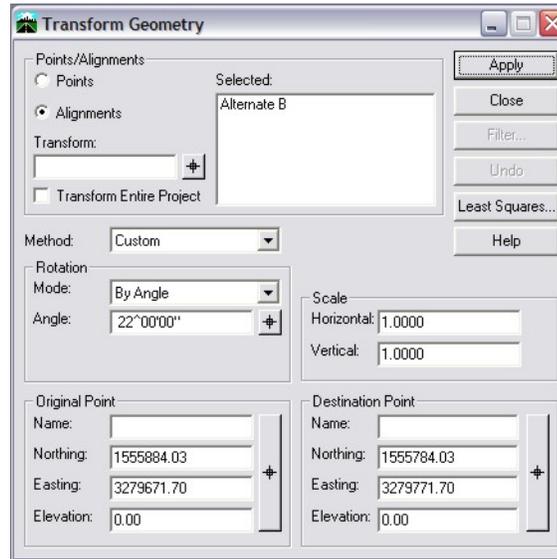
Enabling the geometry point snap will lock data points to defined alignment or Cogo keypoints. Executing a second graphic data point will post the inverted data to the MicroStation file.



Transforming Alignments - Overview

Entire geometry projects, individual alignments, or Cogo points can be transformed by moving, scaling, or rotating selected items.

The transform command is found under the pull-down menu **Geometry > Utilities > Transform**



Shown above is the transformation of alignment Alternate B. The alignment has been moved 100 feet east and 100 feet north as indicated in the delta coordinate values defined in **Original Point & Destination Point** fields. Additionally the alignment has been rotated 22 degrees clockwise. The point of rotation is about the coordinates defined in the **Original Point** fields.

Note: This command does not create a copy of the specified alignment. It will transform the original alignment specified. Use the **Geometry > Copy Geometry** command prior to use if a copy is desired.

4. Geometry Management

When the Survey/ROW group exports geometry from an InRoads Survey Fieldbook, the Geometry Style assigned to the geometry element is based on the InRoads Feature Style assigned to the surveyed element. If the associated Geometry Style is not found, the Style *Default* is used. After exporting, the user can change the geometry style associated with existing geometry and apply appropriate symbology. This is true if working with geometry generated from field survey information or from geometry created in the design process.

As standard procedure, CDOT may wish to direct each discipline to maintain independent geometry projects for specific projects. By doing so, the various disciplines would be responsible for maintaining their data and also be responsible for coordinating with other workgroups to ensure everyone is working with the correct foundation geometry.

Possible scenarios:

- When **Survey** exports the fieldbook to a geometry project it is stored in:
Drive:\JPC#\ROW\InRoads\Geometry\ as JPC#FB2006_02_06_A.alg
(FieldBook A dated February 06, 2006 or otherwise named)
- **Design** may have use for selective items such as the centerline of road, fences, utilities, etc. as alignments and/or Cogo points, but not need or want alignments and Cogo points for every single observation taken in the field. For efficiency, not to mention segregation of data, the roadway design discipline may wish to store the alignments they develop in:
Drive:\JPC#\DESIGN\InRoads\ as JPC#Design.alg (or otherwise named)
- **Hydraulics** or **Traffic** may desire alignments for drainage structures, waterways, or pavement design or marking. There may be no need for Design or Survey to access this data and vice versa.

Segregating geometry by discipline specific geometry projects lessen the possibility of loss of data through the regeneration of data. If the survey staff collects additional data or otherwise makes edits to the electronic fieldbook, they will have to re-export (regenerate) the Geometry Project to provide current information. In doing so, the possibility exists to over-write geometry created by other means.

Additionally, allowing individual disciplines the ability to create geometry as needed eliminates the task of managing who has read/write access to a single 'master' geometry project and when access would be available.

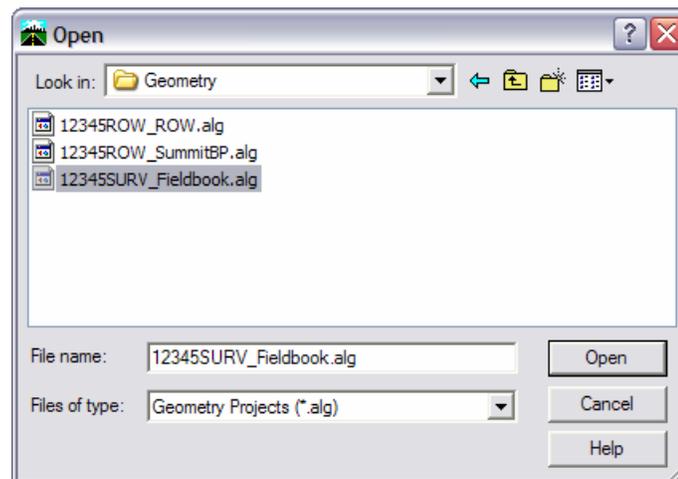
However, it does raise the issue of communication. If the disciplines are dependent on geometry information developed by others, it is imperative that down-stream users of that information are consulted and notified of relevant changes.

Lab 16: Copy a Geometry Project

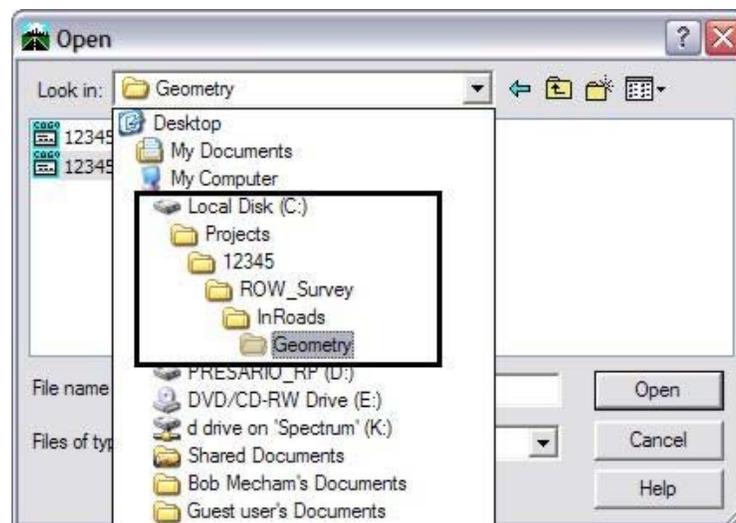
Goals are to:

- Access a Geometry Project created by the Survey/ROW discipline. Once accessed, rename and save a copy of the geometry project.
- Save the renamed Geometry Project in the Design project folder (vs. the Survey folder)
- Rename horizontal alignment names, add/modify descriptions, and review the geometry styles assigned to the alignments.

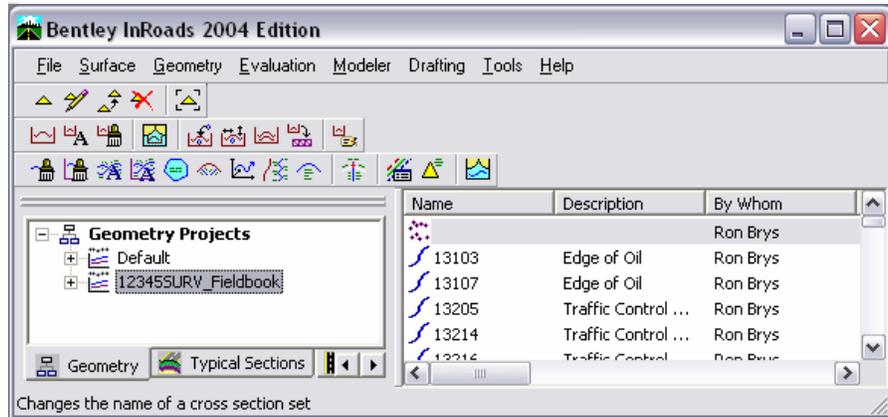
1. Select **File > Open** set the *Files of Type* to **Geometry Projects**



2. Navigate to the directory path
C:\Projects\12345\ROW_Survey\InRoads\Geometry



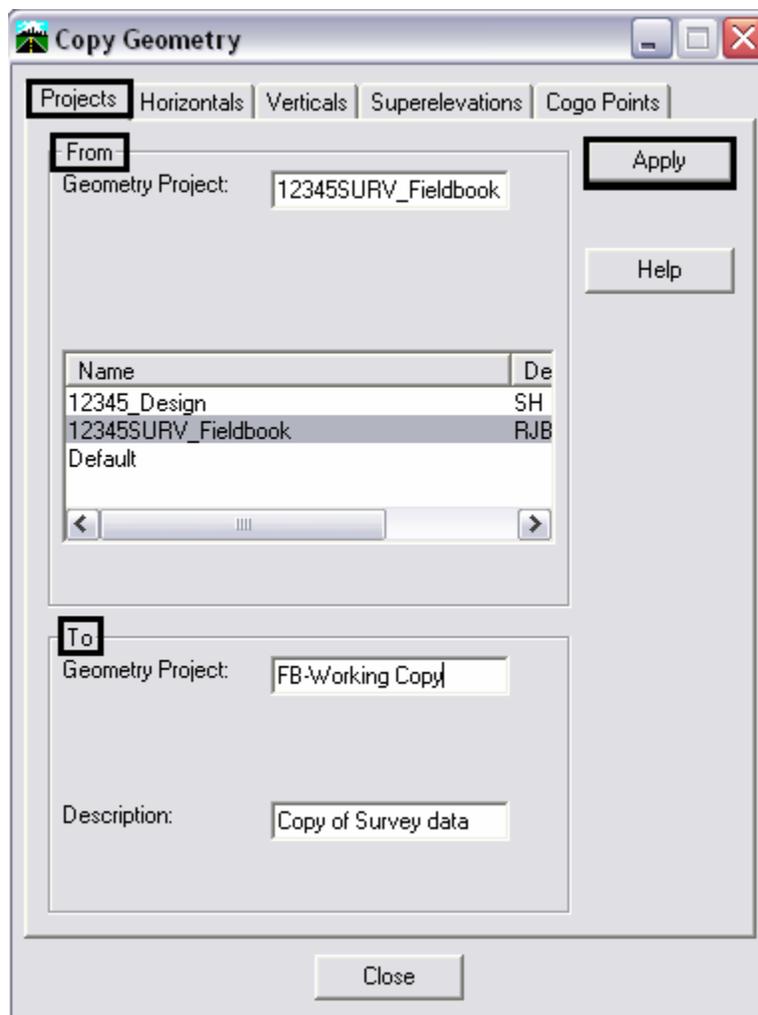
3. <D> the Geometry Project **12345SURV_Fieldbook.alg**
4. <D> the **Open** then **Cancel** button. The Open dialog will close.



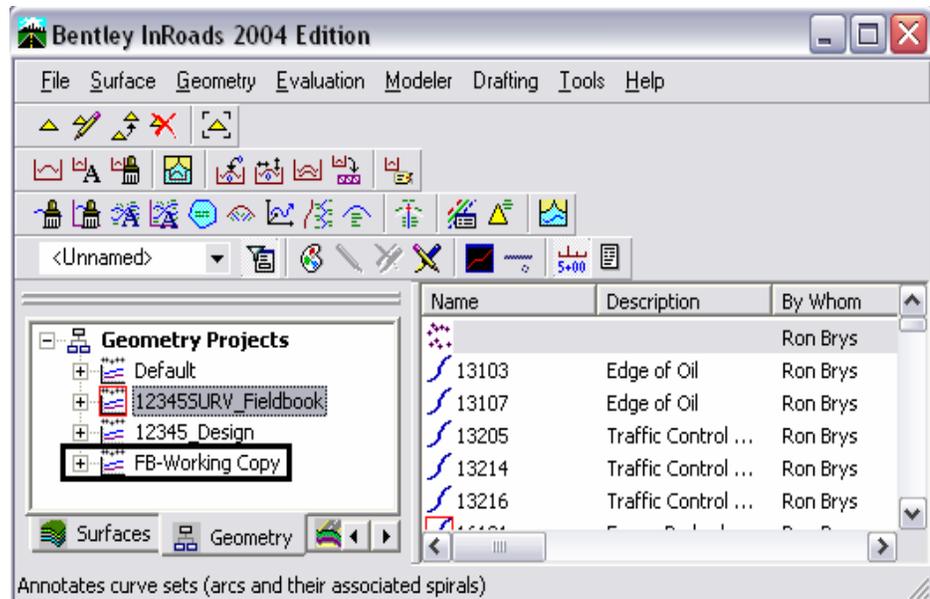
At this point, a 'copy' of the survey geometry project is loaded into memory. The following steps will rename the geometry project and save this copy in the Design discipline folder.

Note: Loading a file into InRoads makes it the active entity by default.

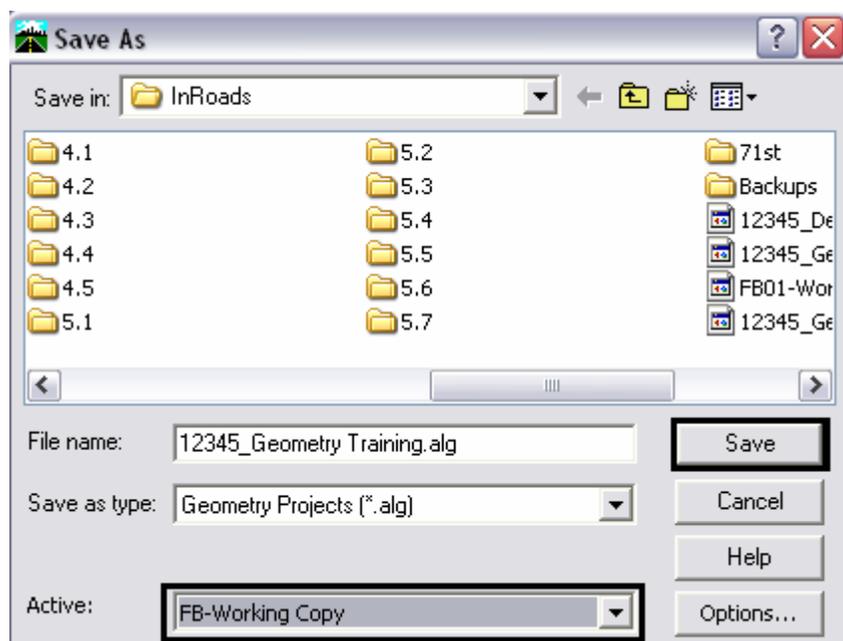
5. Select **Geometry > Copy Geometry**



6. On the **Projects** tab, in the **From** section select: **12345SURV_Fieldbook**
7. In the **To:** field key in **FB-Working Copy**
8. In the Description: field key in **Copy of Survey data**
9. <D> the **Apply** then **Close** buttons.
10. Verify the copy is created by checking the InRoads Explorer pane.



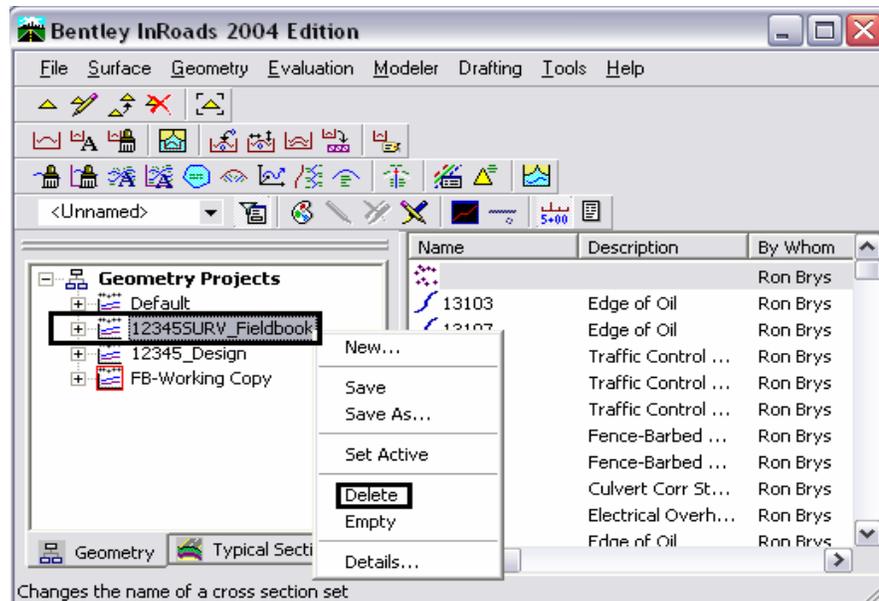
11. In the InRoads explorer window, <R> on **FB-Working Copy** geometry project and select **Save As...** from the shortcut list. The **Save As** dialog will appear.



12. Save ***FB-Working Copy*** to the **C:\Projects\12345\Design\InRoads** folder. If necessary, use the drop-down arrow in the **Active** field and reselect the desired name to ensure the saved file name will match the active surface name.
13. <D> the **Cancel** button. The Save As dialog will close.

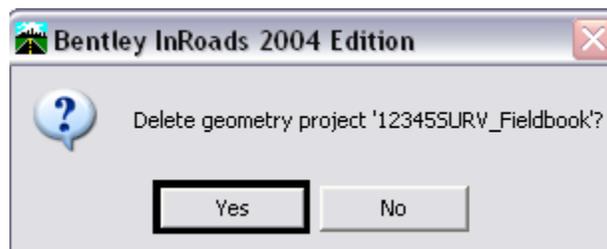
Note: Ensuring that the saved Geometry name in the project folder matches the Geometry name displayed in InRoads explorer will minimize confusion.

14. The original Geometry Project generated by the survey staff is no longer required. In the InRoads explorer window, <R> on the Geometry Project name *12345SURV_Fieldbook* and select *Delete* from the fly-out menu.



Note: This will ‘unload’ the geometry project from memory. It does not delete the original or copy from the hard drive.

15. <D> Yes and verify the geometry project is removed from memory



Lab 17: Renaming Alignments

In the case of the geometry project copied in the previous exercise, the horizontal alignment names (and geometry styles) were assigned when the survey fieldbook was exported based on the InRoads Survey feature table (FWF file). These attributes are assigned based on the feature coding assigned in the field. These names accurately reflect the coding used in the field, but could benefit from more intuitive naming.

Our goals are to:

- Modify the alignment names assigned to some the roadway centerline shots, add descriptions, and assign appropriate Geometry Styles.

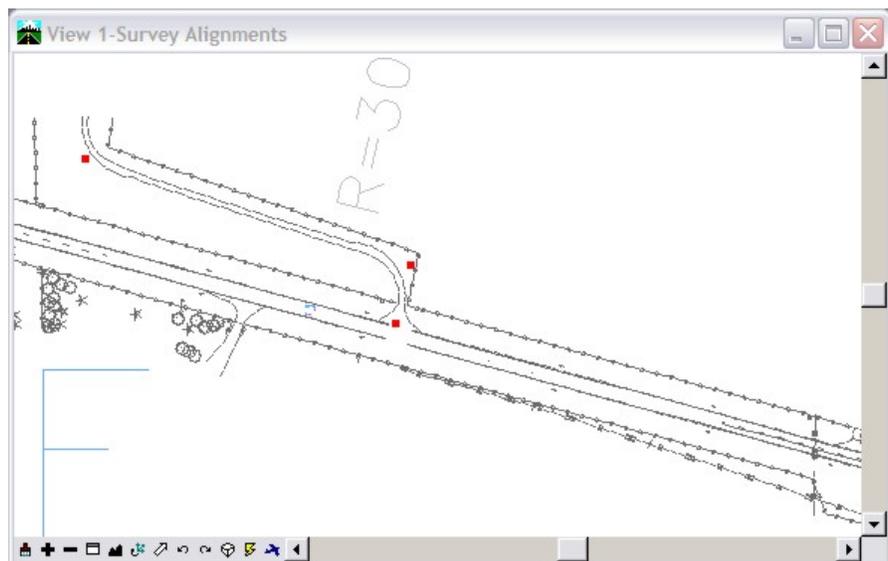
Graphics clean-up

Before continuing with this lab, delete all visible graphics in your MicroStation file using the element selection tool or a fence. Note that you are deleting the graphical display of data, not the data itself. The graphics could be redisplayed using the InRoads display commands shown in previous sections.

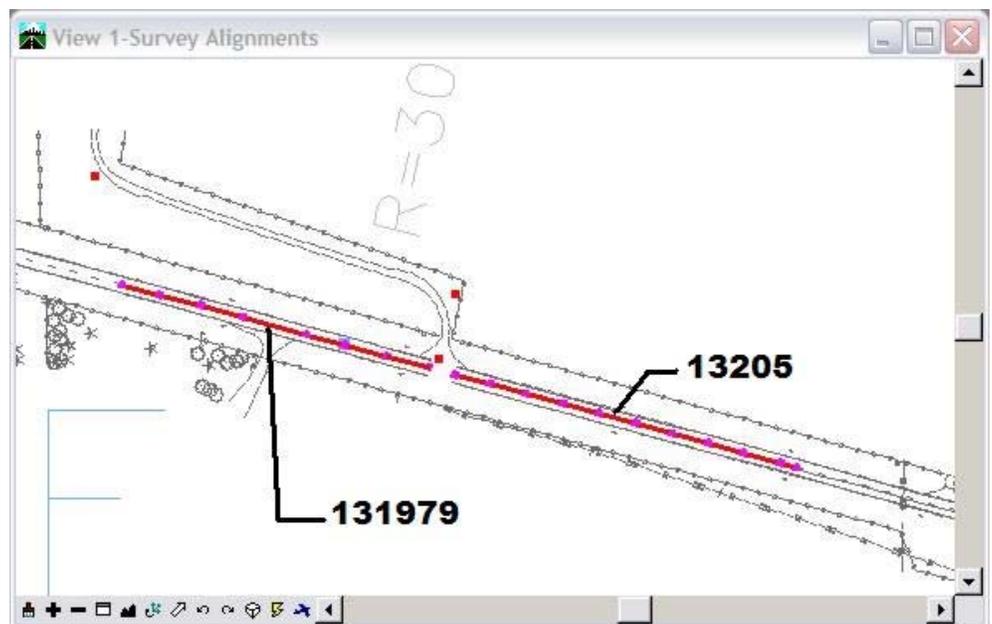
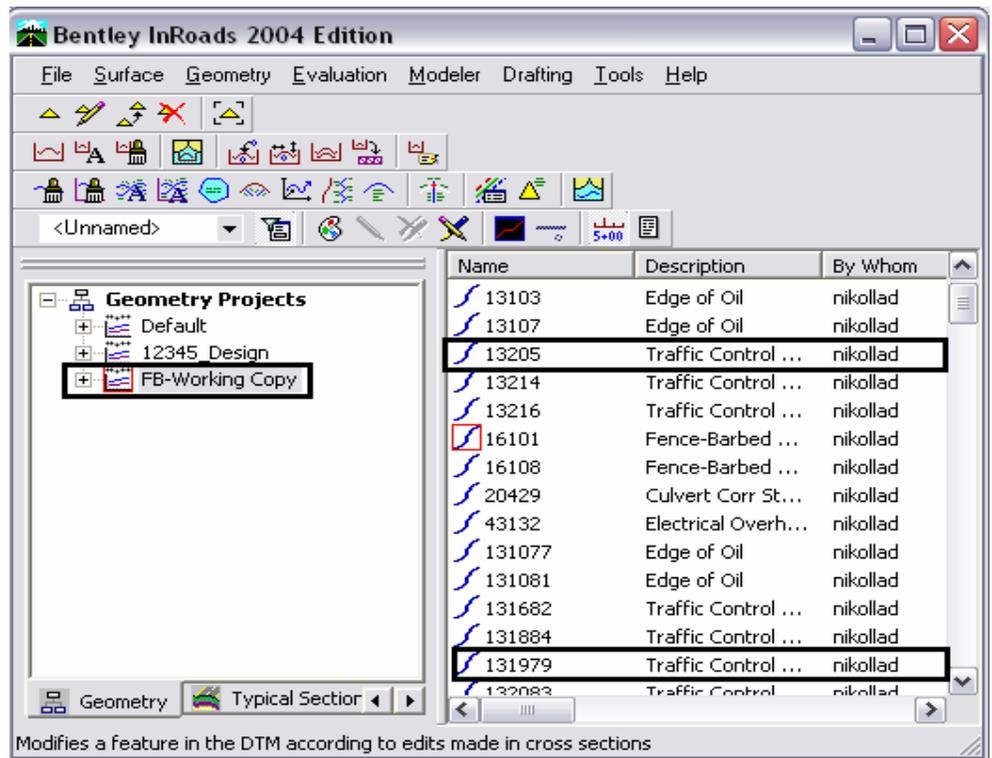
Note: The screened topography and the training guides are either locked graphics or in an attached reference file, you will not be able to delete these graphics and will use them for orientation.

Renaming Horizontal Alignments

1. Recall the MicroStation saved view *Survey Alignments*



2. Display alignments *13205* & *131979*



3. Select **Geometry > Rename Geometry**. The Rename Geometry dialog will appear.
4. From the **Type:** drop-down list select:
Horizontal Alignment

Rename Geometry

Type: Horizontal Alignment

Apply

Close

Help

From

Geometry Project: FB-Working Copy

Horizontal Alignment: 131979

Vertical Alignment:

Superelevation:

Turnout:

Name	Description
43132	Electrical Overhead Line ...
131077	Edge of Oil
131081	Edge of Oil
131682	Traffic Control Double Yell...
131884	Traffic Control Single Skin
131979	Traffic Control No Pass RI...
132182	Traffic Control No Pass I

To

Name: Existing CL Seg A

Description: Ex centerline segment A

Style: ALG_EXISTING

5. In the From section verify **FB-Working Copy** is the active Geometry Project.
6. In the From section list locate and <D> on alignment **131979**.
Note: This alignment represents the centerline of existing pavement.
7. In the **To** section key in the **Name: Ex CL Seg A**
8. In the **To** section key in the **Description: Ex centerline segment A**
9. In the **To** section set the **Style: ALG_EXISTING**

10. <D> the **Apply** button a confirmation dialog will appear



11. <D> the **Yes** button.

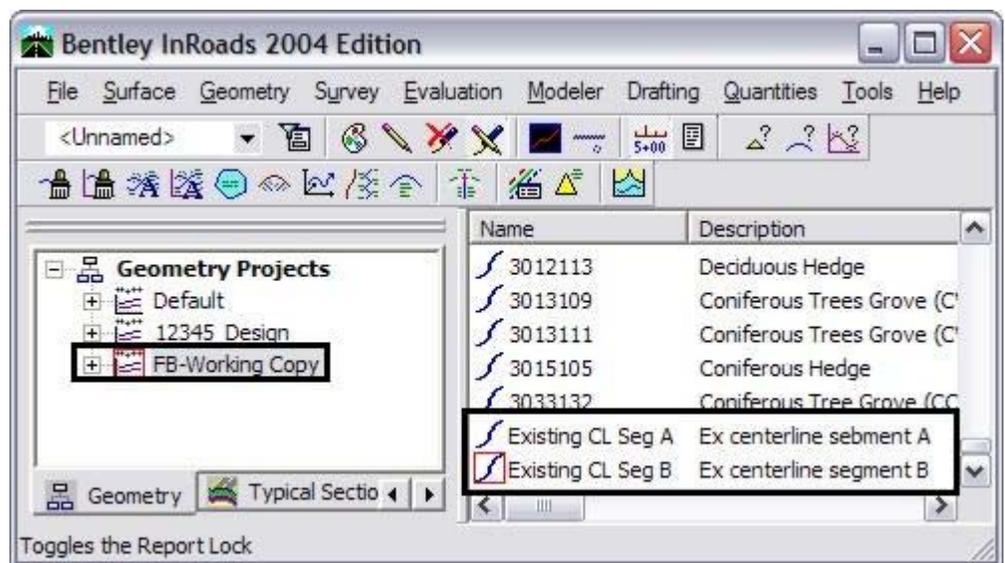
12. **Rename** the centerline alignment 13205 as follows:

Note: You can use the dialog selection icon  to graphically identify the alignments for renaming

- 13205
- Name: **Existing CL Seg B**
- Description: **Ex centerline segment B**
- Style: **ALG_EXISTING**

Caution: Profile or Cross Section sets that were created based on the original alignment names will lose their linkage to the alignment names after renaming of the alignments. Geometry renaming should be accomplished prior to the generation of Profile or Cross Section sets.

13. When done renaming the alignments close the Rename dialog and check the InRoads explorer window to verify the results.



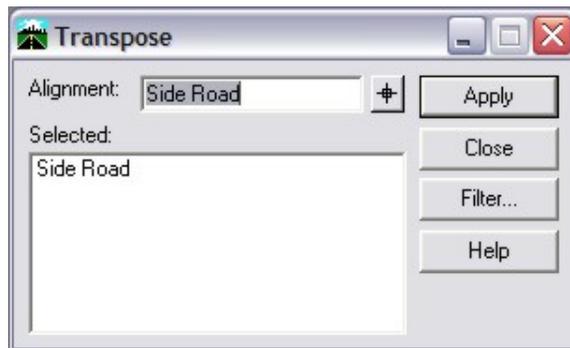
Geometry Utilities

Transposing Alignments

Transposing an alignment reverses the direction of that alignment. Tangent sections are reversed and left-hand curves become right-hand curves. The beginning stationing value is retained; however, any station equations previously defined are deleted. Associated vertical alignments are also reversed.

You may find the need to transpose an alignment if it was surveyed in a direction opposite from the direction you wish to design (up-stream vs. down stream). Other instances may be if you create an alignment by importing from graphics. InRoads will generate the alignment in the direction the MicroStation graphic was drawn which is not necessarily in the direction of 'up-station'. Or you may simply create an alignment in the wrong direction using any of the InRoads geometry commands.

The transpose alignment command is found under the pull-down menu **Geometry > Utilities > Transpose**



The command executes once the alignment (s) for transform are chosen and Apply is selected. The user will have to redisplay any associated stationing or annotation of the transformed alignment(s).

Transposing an alignment

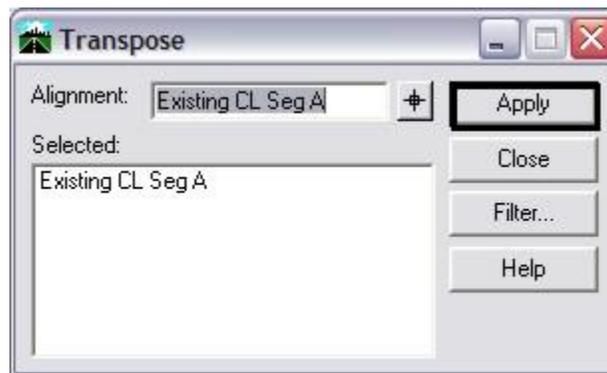
1. Use the review tools to evaluate both of the renamed horizontal alignments. What direction are the tangents running?

Notice that the alignment *Existing CL Seg A* runs northwest and that alignment *Existing CL Seg B* runs southeast?

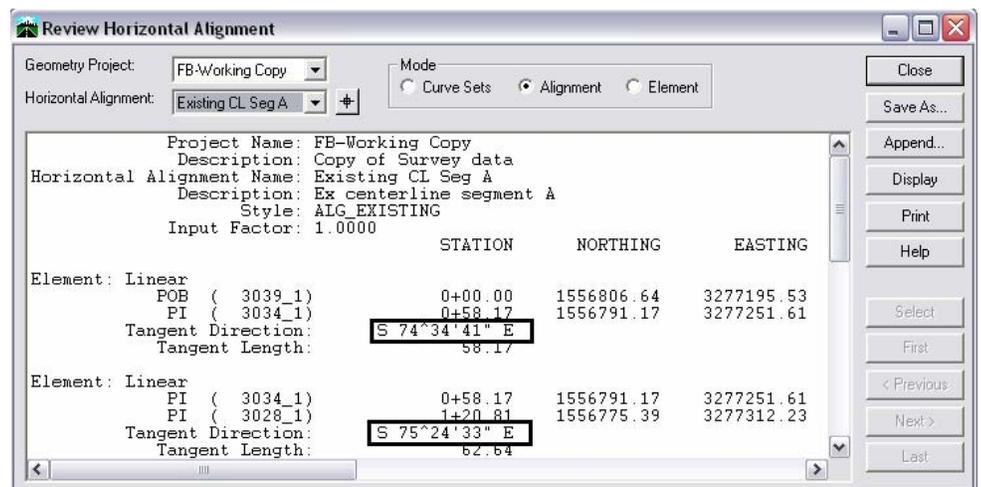
Alignments created by exporting an electronic fieldbook assume the direction of the data collection.

Both alignments should run in a Southeasterly direction.

2. Select **Geometry > Utilities > Transpose**



3. Select alignment *Existing CL Seg A* for transposing <D> **Apply**
4. **Review** the alignment to verify the transposition

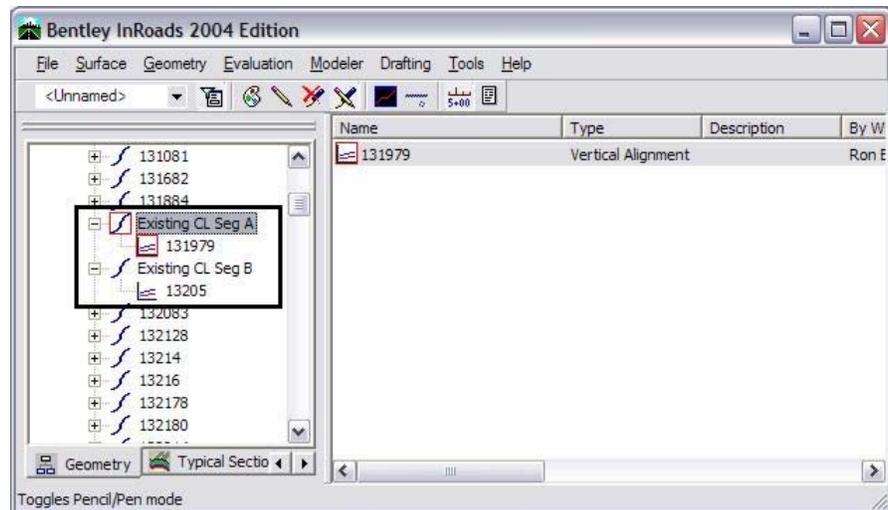


5. **Save** the geometry project *FB-Working Copy*

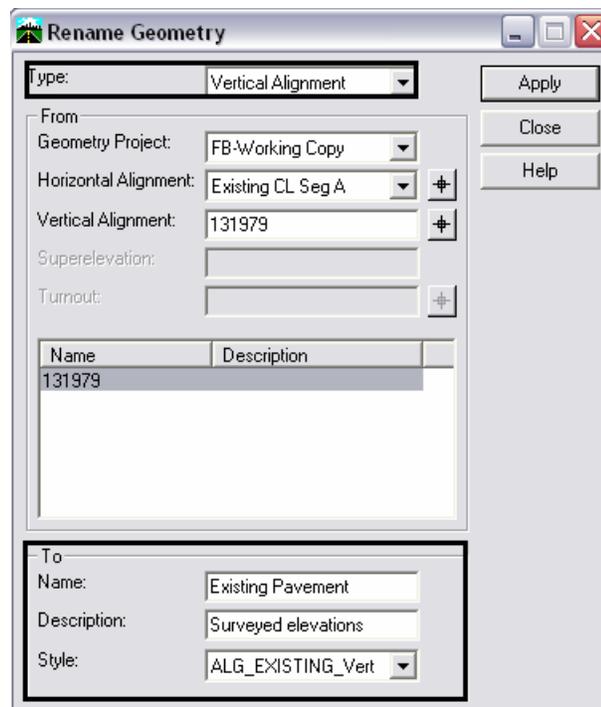
Renaming Vertical Alignments

Two horizontal alignments have been renamed, a description has been added and the alignments are assigned an appropriate geometry style. Horizontal alignments are 'parent' alignments which can contain 'child' vertical alignments.

1. In the Workspace bar under the Geometry tab check the horizontal alignments for associated vertical alignments by expanding the + icon.



2. Select **Geometry > Rename Geometry**. The Rename Geometry dialog will appear.
3. From the **Type:** drop-down list select: **Vertical Alignment**



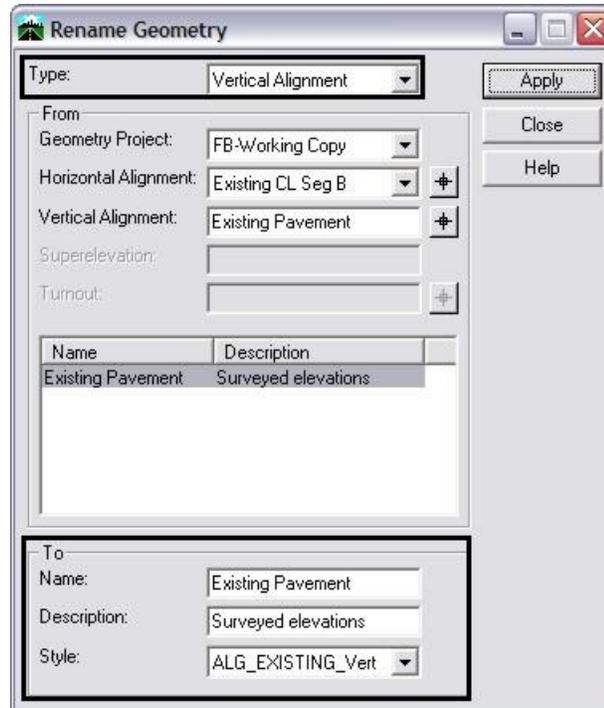
4. In the **From** section verify **FB-Working Copy** is the active Geometry Project
5. In the **From** section verify **Existing CL Seg A** is the active Horizontal Alignment
6. In the **From** section list locate and <D> on alignment **131979**

Note: This alignment represents the vertical elevations of existing pavement.

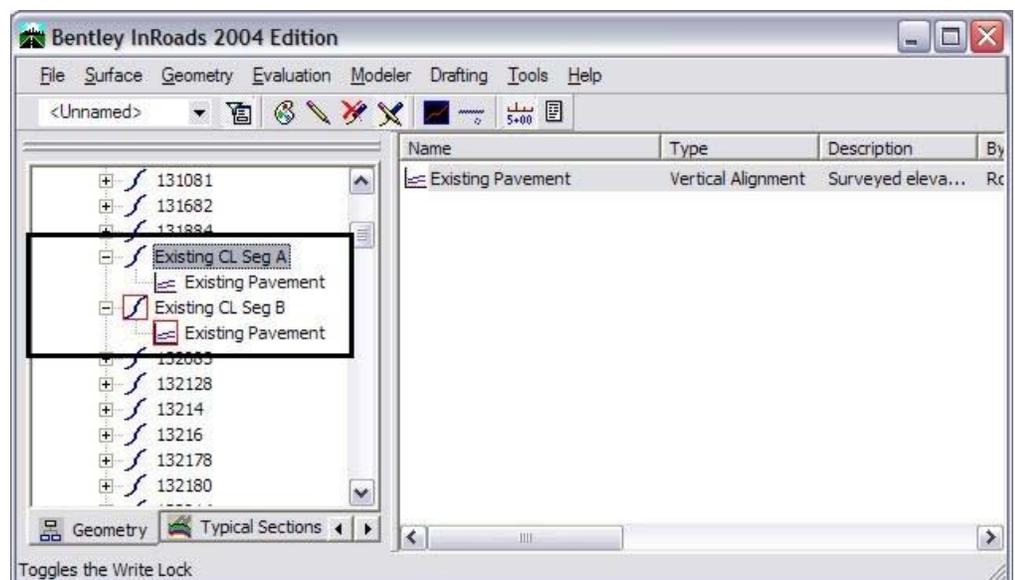
7. In the **To** section key in the Name: **Existing Pavement**
8. In the **To** section key in the Description: **Surveyed elevations**
9. In the **To** section set the Style: **ALG_EXISTING_Vert**
10. <D> **Apply** then <D> **Yes** button.
11. **Rename** the vertical alignment associated with the horizontal alignment **Existing CL Seg B**

Note: You can use the dialog selection icon  to graphically identify the alignments for renaming.

12. In the *To* section key in the Name: **Existing Pavement**
13. In the *To* section key in the Description: **Surveyed elevations**
14. In the *To* section set the Style: **ALG_EXISTING_Vert**



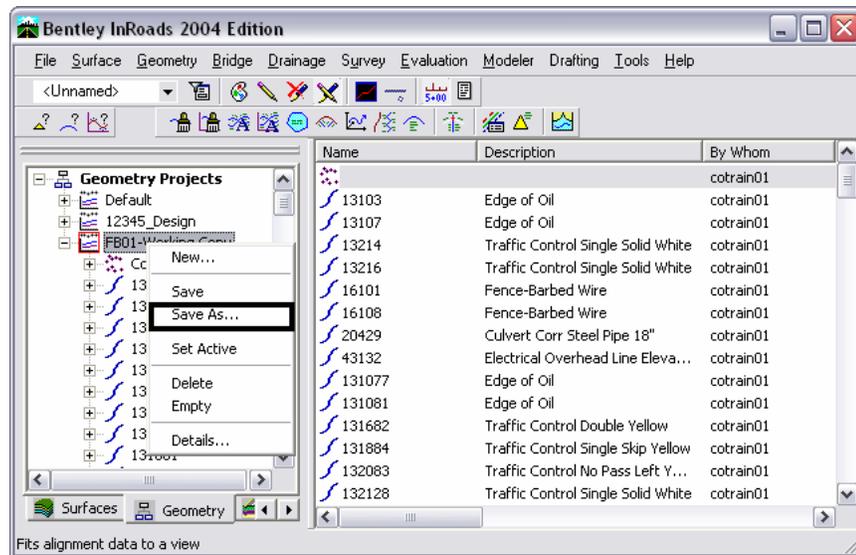
15. <D> **Apply** then <D> **Yes** button.
16. <D> **Close** the Rename Geometry dialog.



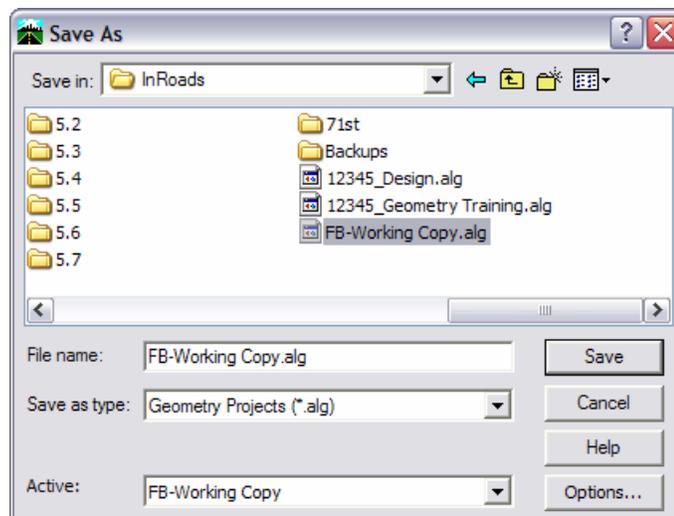
These changes have been made in a copy of the geometry project that was exported from the survey fieldbook. In this copy, some key horizontal and vertical alignments have been renamed, described, and assigned appropriate geometry styles to conform to CDOT standards with a naming convention that is more intuitive.

This is a good time to save the Geometry Project to disk.

17. <R> on the geometry project **FB-Working copy** and select **Save As** from the fly-out menu



The Geometry Project should be stored in the folder:
C:\Projects\12345\Design\InRoads

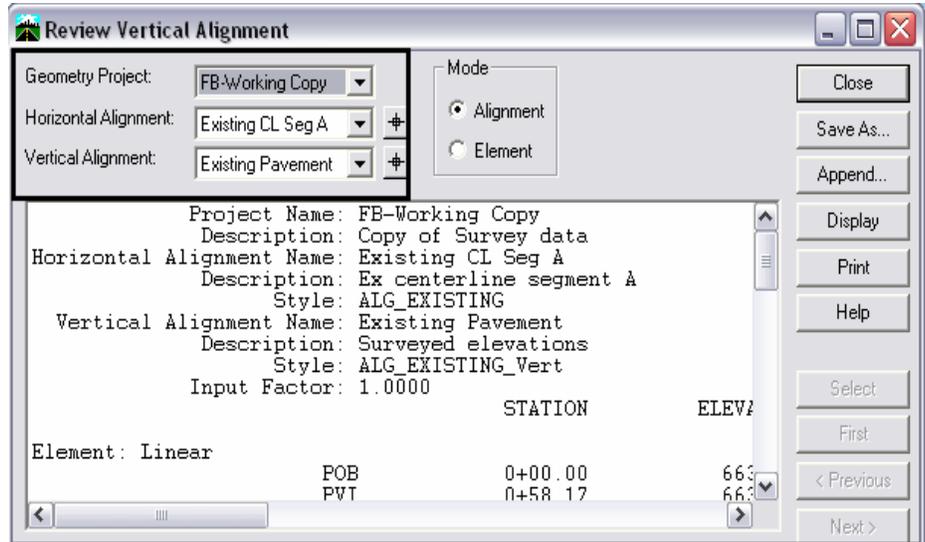


5. Exploring Vertical Alignments

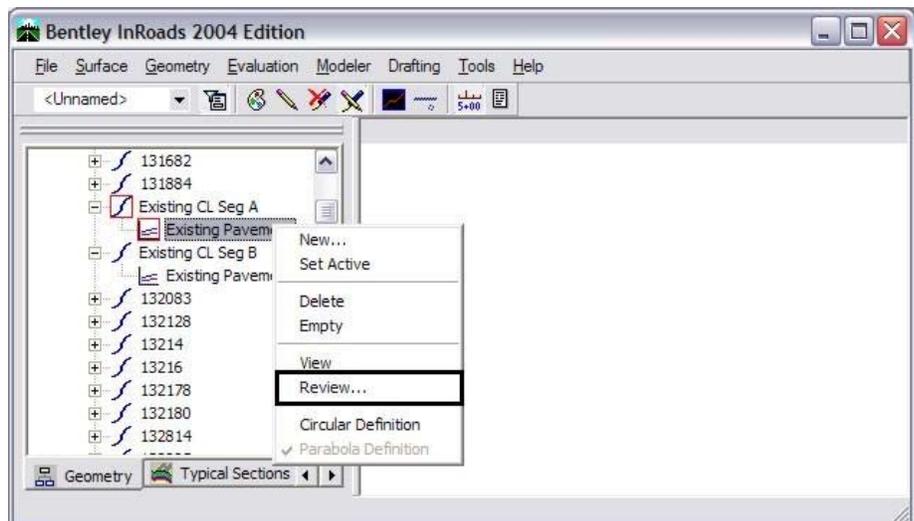
Lab 18: Reviewing Vertical Alignments

Reviewing vertical alignments is similar to reviewing horizontal alignments. The **Review Vertical Alignment** dialog allows you to easily change between multiple Geometry Projects, Horizontal, and Vertical alignments.

1. Select **Geometry > Review Vertical**



2. The review dialog can also be opened with the **right-click fly-out menus**

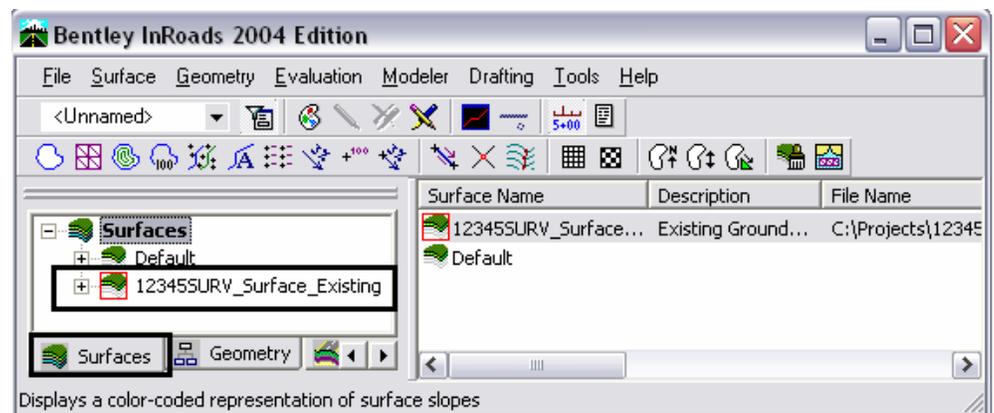


Lab 19: Creating Profiles

Prior to graphically displaying a vertical alignment a profile must be created. These are referred to as profile sets in InRoads. A profile set can be created using a horizontal alignment, a MicroStation element, or interactively to define the horizontal (plan) location the vertical information is extracted from. Upon creation, a profile can display DTM surfaces, vertical alignments and DTM features. Once created, a profile set can be refreshed to display additional data, turn the display or data off, or to redraw the graphics based on current DTM information.

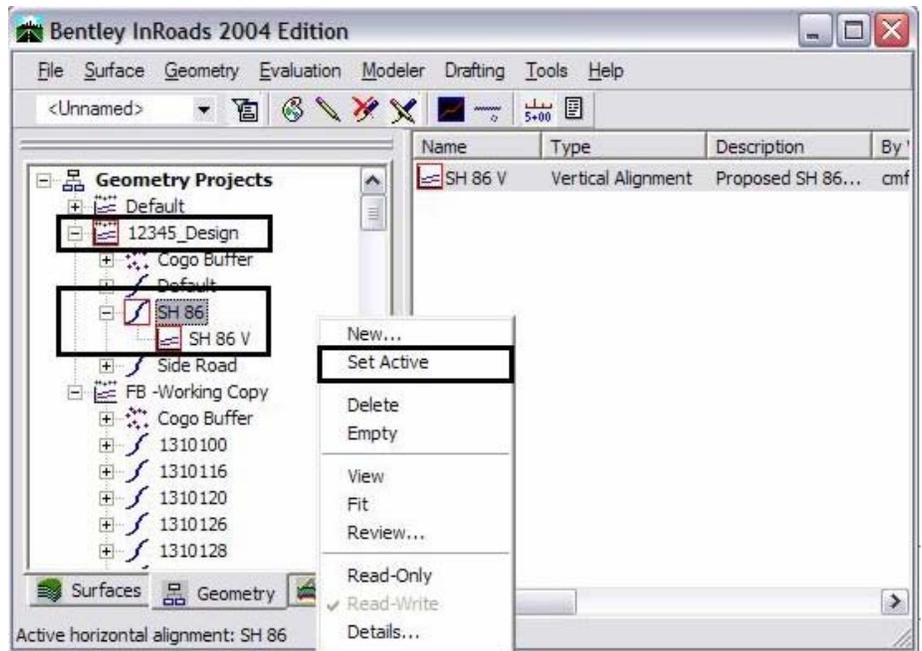
Prior to creating a profile set, load the DTM *12345Surv_Surface_Existing* if not already loaded. This surface will be used to display an existing ground-line.

1. Select File > Open

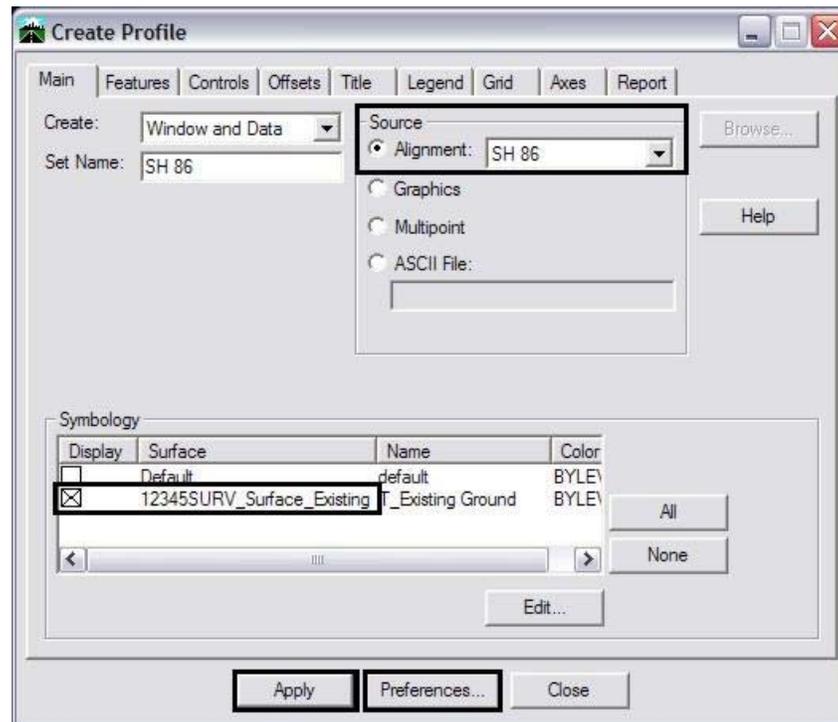


2. In the Workspace Bar under the Geometry tab, verify that *12345_Design* is the *active* Geometry Project and that the horizontal alignment *SH86* is the *active* alignment.

Hint: <R> on the name and select *Set Active* from the fly-out menu.



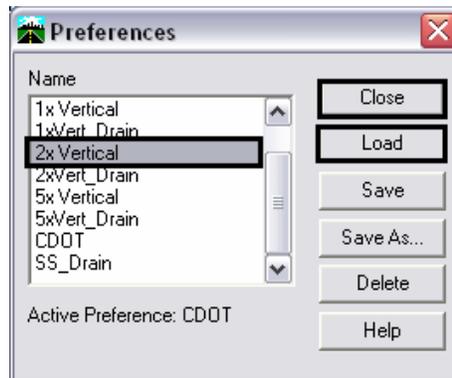
3. Select **Evaluation > Profile > Create Profile** the **Create Profile** dialog will appear.



Dialog items:

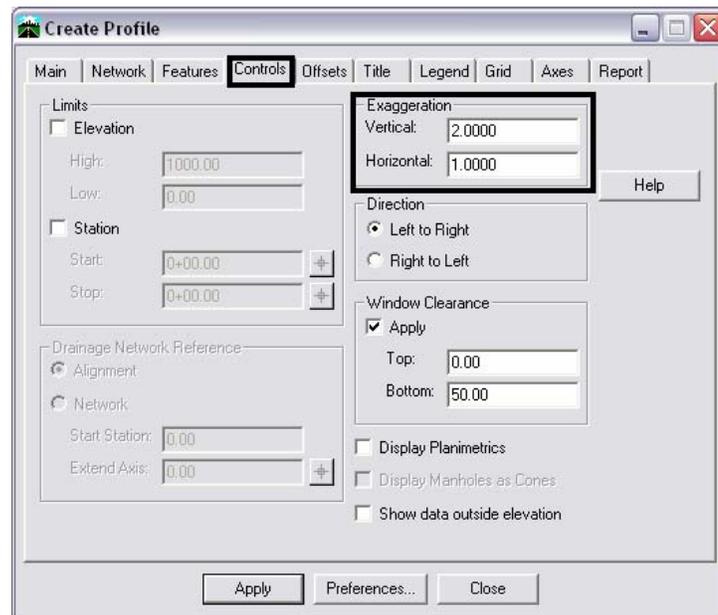
- **Create** - *Window and Data* creates the profile grid and displays DTM surface profile(s) as identified in the Symbology category. Multiple surfaces may be shown on one profile if they are identified for display here. The *Window Only* option creates an empty profile window. The *Data Only* option adds data to an existing profile window
- **Set Name** - Multiple profiles may be displayed in a single MicroStation file. InRoads tracks specific profiles by **Set Names**. By default the set name is populated with the active horizontal alignment name. This field is user definable by inputting a name of their choosing.
- **Source** - Horizontal location of profile extraction. Options are:
 - **Alignment** – extracted at location of horizontal alignment
 - **Graphics** – at location of user identified graphics
 - **Multipoint** – interactive user defined points
 - **ASCII** – a text file containing station and elevation information
- **Preferences** - There are several CDOT preferences for the different vertical exaggerations. Choose **Preferences** and **Load** to establish the dialog settings.

4. <D> the **Preferences** button. The Preferences dialog will appear
5. <D> the predefined settings for **2x vertical**

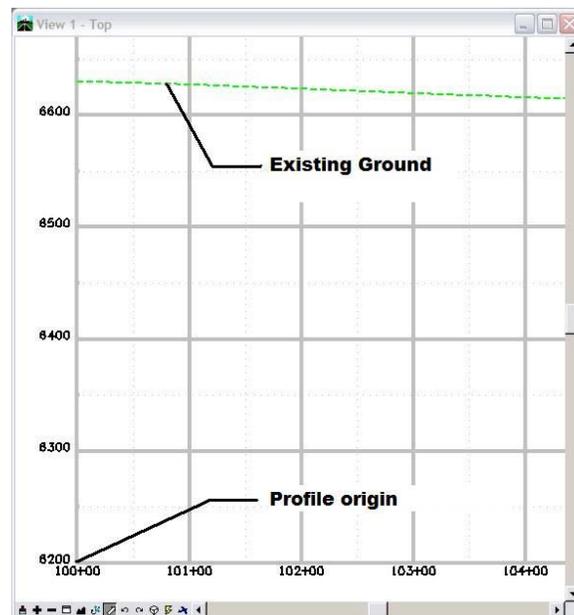


6. <D> the **Load** then **Close** buttons
7. **Verify** that **Alignment SH86** is identified
8. **Verify** that in the **Symbology** portion of the dialog, **12345SURV_Surface_Existing** is selected for **Display**

9. <D> the **Controls** tab and note the vertical exaggeration specified



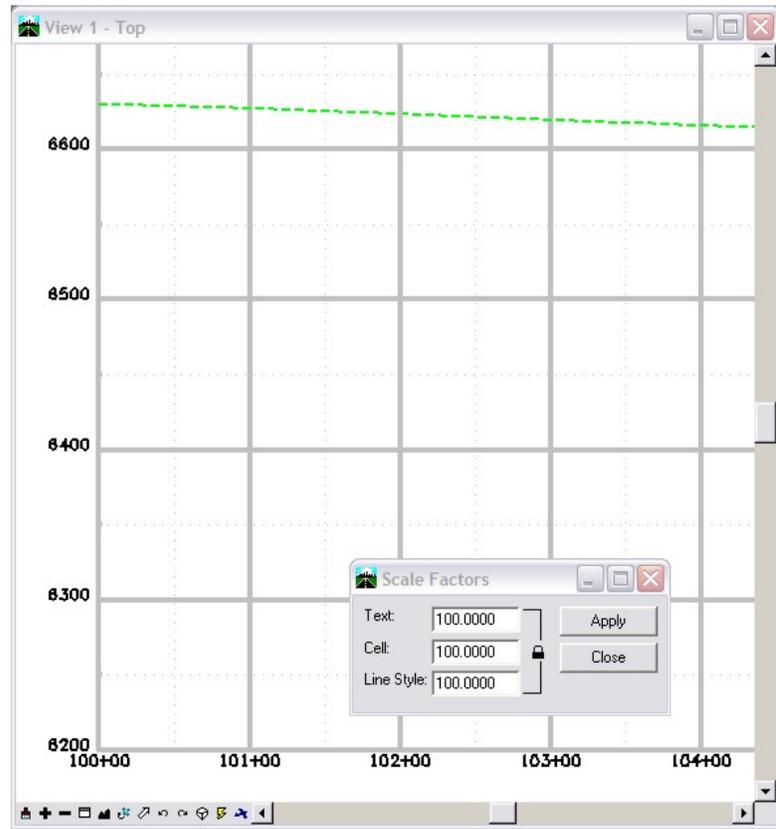
10. <D> the **Apply** button. The **Create Profile** dialog will temporarily minimize.
11. You are prompted by MicroStation to 'Identify location'. <D> in the MicroStation view. The Profile window will be placed and the **Create Profiles** dialog will restore.



Note: For convenience, we are displaying the profile in our current drawing. Standard practice dictates that separate drawings should be created for profile and cross section display. Consult the directory structure and file naming convention for your specific discipline to determine standards relating to profile display.

Viewing Vertical Alignments

12. Select **Geometry > View Geometry > Active Vertical** to display a graphic of the active vertical alignment
 - Alternately in the **Workspace Bar** under the **Geometry** tab you can <R> on the Vertical Alignment and select **View** just as you did with Horizontal Alignments.

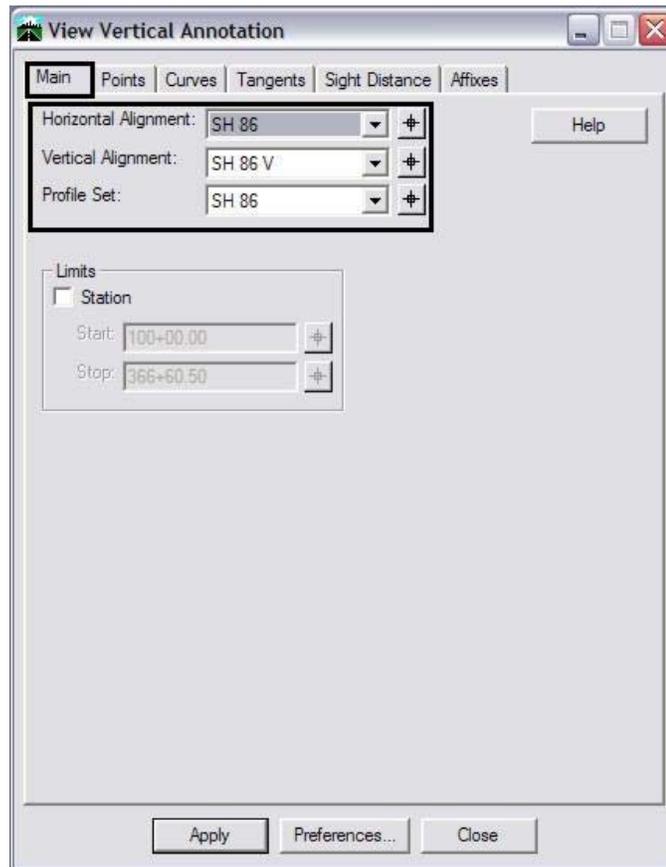


Note: Annotation size for the index elevations and stationing text is generated based on the global scale factor defined for text. The text size specified should be set based on the ultimate plotting scale. To change text size on a profile, delete the displayed profile, change the global scale factor, and regenerate the profile display.

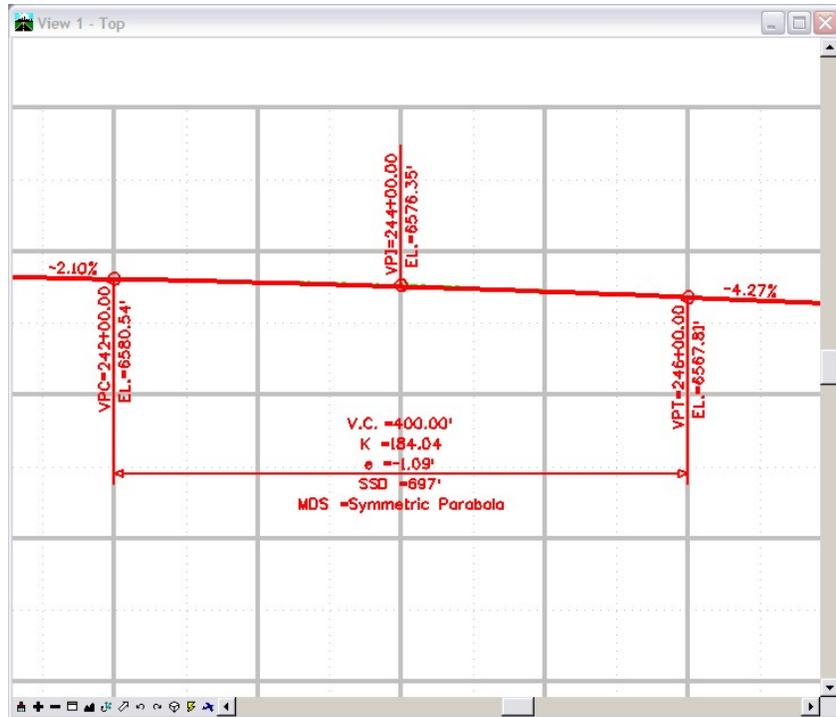
Annotating Vertical Alignments

Similar to horizontal stationing, annotation of vertical alignments is accomplished much the same way.

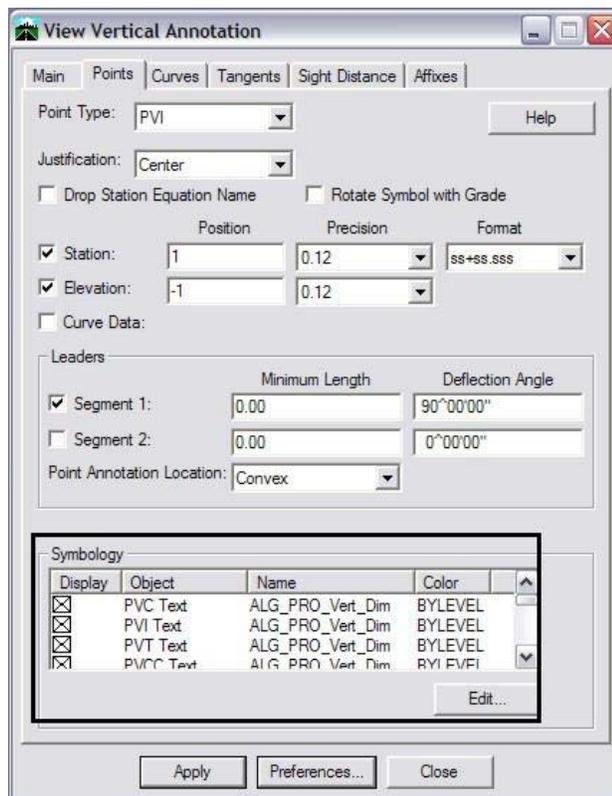
13. Select **Geometry > View Geometry > Vertical Annotation** to view vertical alignment annotation



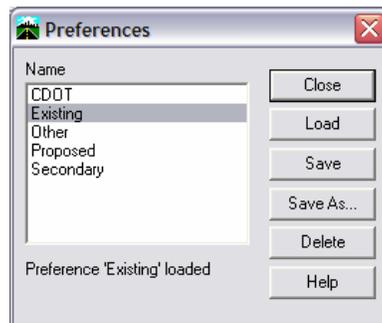
14. **Verify** the appropriate *Horizontal, Vertical Alignments*, and *Profile Set* are correctly identified
15. Click **Apply**



16. Take some time and investigate the remaining tabs along the top of the **View Vertical Annotation** dialog and the individual settings for each.
17. <D> the **Points** tab. Note the settings in the **Symbology** portion of the dialog. By default, **Symbology** for a **Proposed** alignment loads.



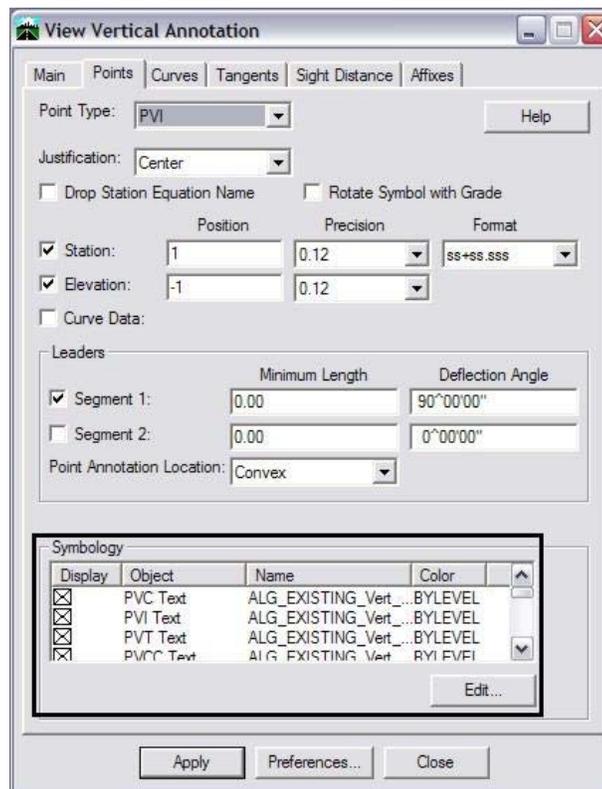
18. <D> the Preferences button.



19. <D> the name Existing.

20. <D> the Load then Close buttons.

21. Note the change in the defined *Symbology*



22. <D> the **Apply** button from the **View Vertical Annotation** dialog. Review the results in the MicroStation drawing. The content of the graphics should remain the same, however, different levels, color, style, and weight are utilized

23. Continue to **Load** and **Display** additional preferences as practice

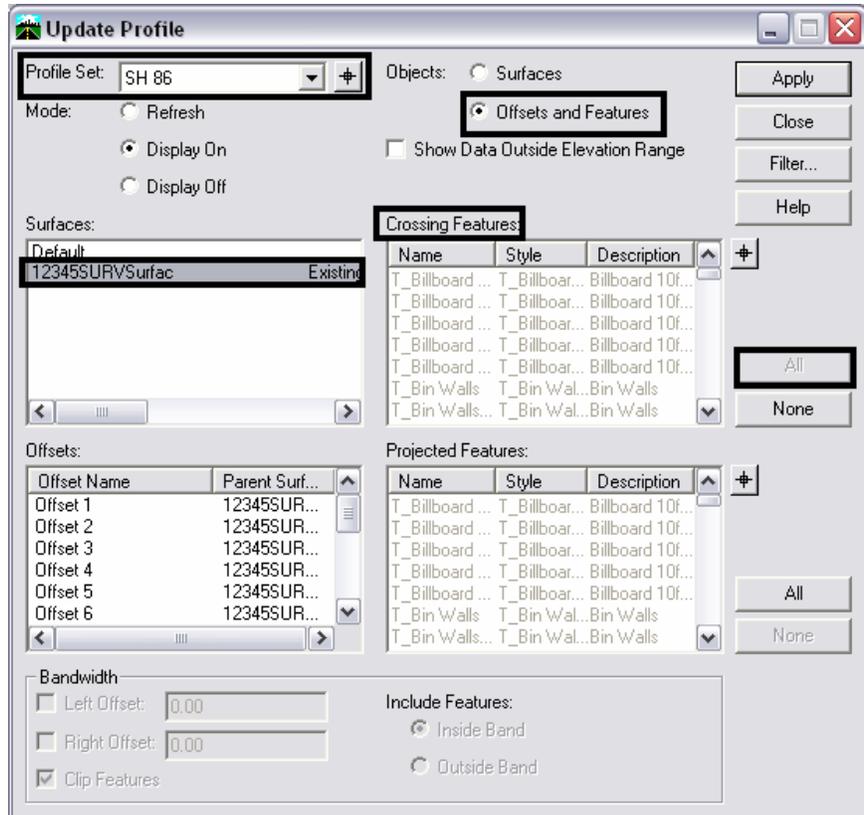
24. Investigate what levels the elements are being placed on. The various preferences determine the location of graphics.

Lab 20: Updating Profiles

When a profile is created the user has the option to display items such as: multiple surfaces, profile lines offset from the horizontal alignment, and features such as underground utilities and pipes.

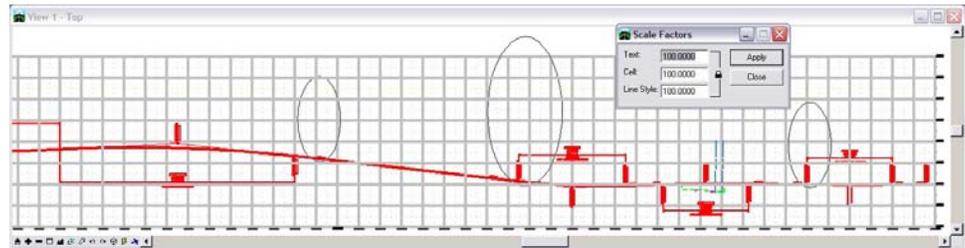
If there are changes that need to be made to a profile after it is created, update the profile for either surface line or features that exist in those surfaces.

1. From the pull down menu **Evaluation > Profile > Update Profile**. The **Update Profile** dialog will appear.

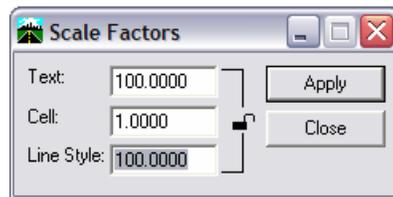


2. Verify **SH 86** is the active Profile Set
3. In the **Mode** section toggle the radio button **Display On**
4. In the **Objects** section toggle the radio button **Offsets and Features**
5. In the **Surfaces** section <D> **12345SUR_Surface**
6. <D> the **ALL** button next to the **Crossing Features** category.

7. <D> the **Apply** button. Using MicroStation viewing tools locate a crossing culvert.



Note: Profile and cross section displays are drawn at true horizontal scale. A vertical distortion will be applied to cells displayed in profiles or cross section views based on the vertical scale applied to the grid. DTM features displayed in these graphics are configured to display at their true horizontal (x-direction) sizes. Therefore, prior to displaying features in either profiles or cross sections the global scale factor for cells should be set to 1.



Note: Prior to correcting the scale for the culverts, two classes of elements displayed on profiles needs to be discussed.

One – True scale items such as culverts

Two – items represented by text such as utility crossings, flow-lines, ROW, etc.

For item 1:

The global scale factor for cells should be set to 1 and a subset of the dtm crossing features should be displayed (or refreshed in this case). This is accomplished with the use of feature filters.

For Item 2:

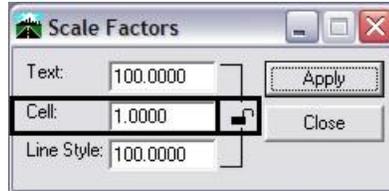
The global scale factor should be set equal to the plot scale.

See the following page for information on updating a profile to refresh the graphics.

Refreshing a Profile Display

First, take care of refreshing the display of the true-scale items such as the culverts.

8. Select Tools > Global Scale Factors



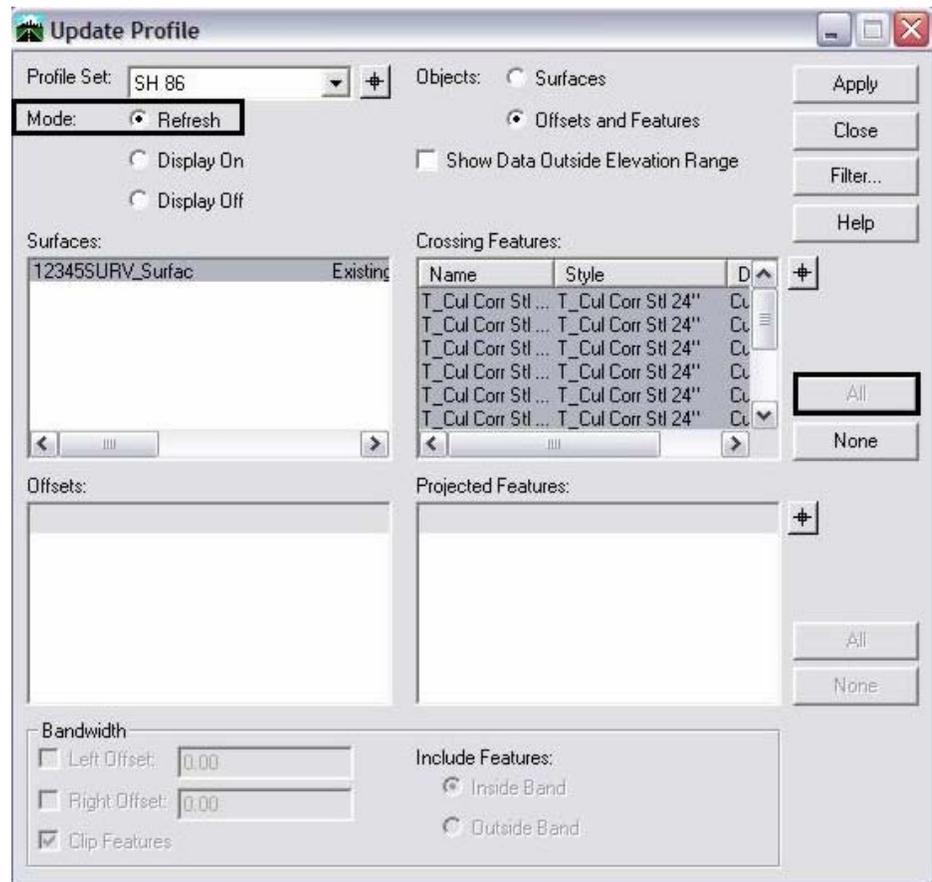
9. Key in the field **Cell: 1**

Note: You may need to *Unlock* the icon to allow modification to the cell scale only. By doing so, when you update the profile, the cells will draw at their true sizes. Leaving the Text and Line Style fields set the 100. This allows annotation and other commands to remain unaffected by the scale factor that was input specific for cells.

10. <D> the **Apply** then **Close** buttons in the **Scale Factor** dialog
11. In the main InRoads interface, select the filter **CELL_True-Scale** from the drop-down list. Also toggle **ON** the Feature Filter lock

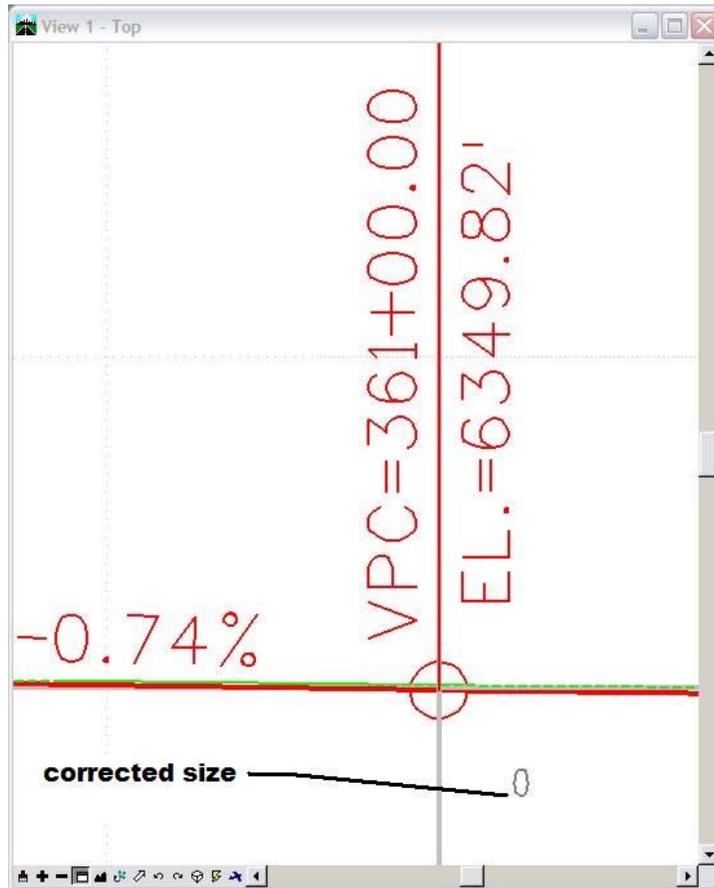


12. Close and reopen the Evaluation > Profile > Update Profile dialog



13. Verify **SH 86** is still the active Profile Set. Use the target button next to the Profile Set to graphically change the active profile set.
14. In the Mode section toggle the radio button **Refresh**
15. In the Objects section toggle the radio button **Offsets and Features**
16. <D> the surface name **12345SURV_Surface**
17. <D> the **ALL** button next to the Crossing Features category
18. <D> the **Apply** button.

19. Using MicroStation viewing tools, locate a crossing culvert and review the results

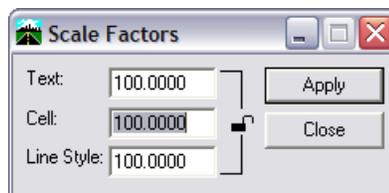


20. Use MicroStation Measuring tools to verify pipe size(s)
21. From the **Locks** toolbar select *CELL_Plot-Scale* filter from the pull down list.



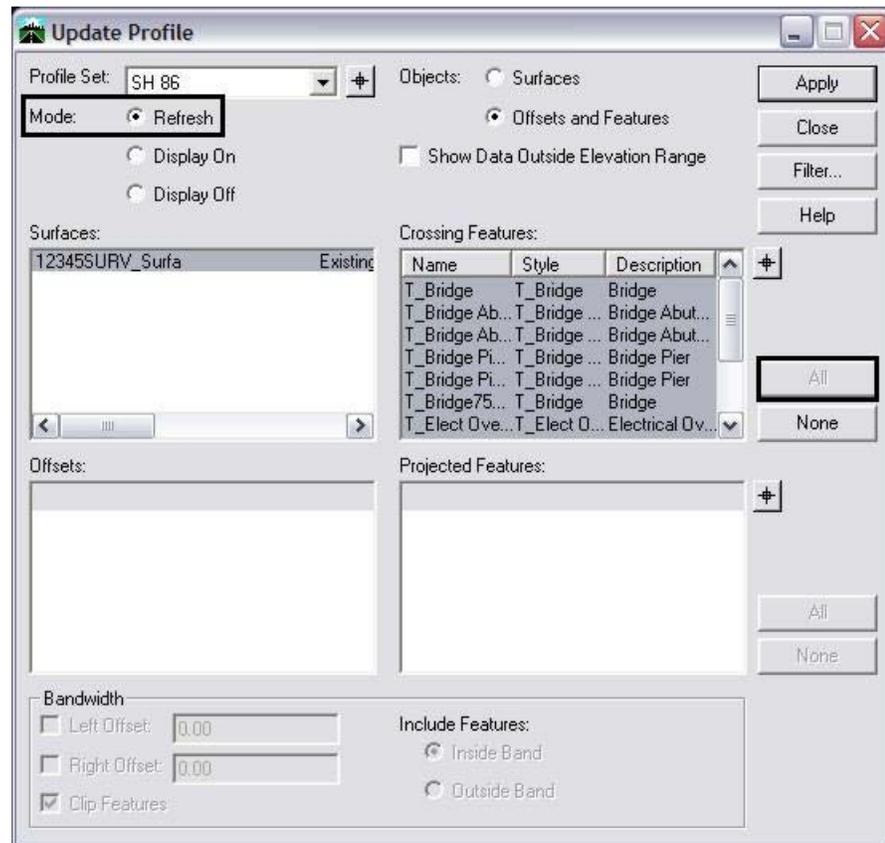
Note: Verify that the feature filter is toggled on.

22. Change the InRoads Scale Factor to 100.



Note: This is the desired plot scale change accordingly.

23. Close and reopen the **Evaluation > Profile > Update Profile** dialog



24. Verify **SH 86** is still the active Profile Set. Use the target button next to the Profile Set to graphically change the active profile set.

25. In the Mode section toggle the radio button **Refresh**

26. In the Objects section toggle the radio button **Offsets and Features**

27. <D> the surface name **12345SURV_Surface**

28. <D> the **ALL** button next to the Crossing Features category

29. <D> the **Apply** button.

30. Turn off the **Feature Filter** lock



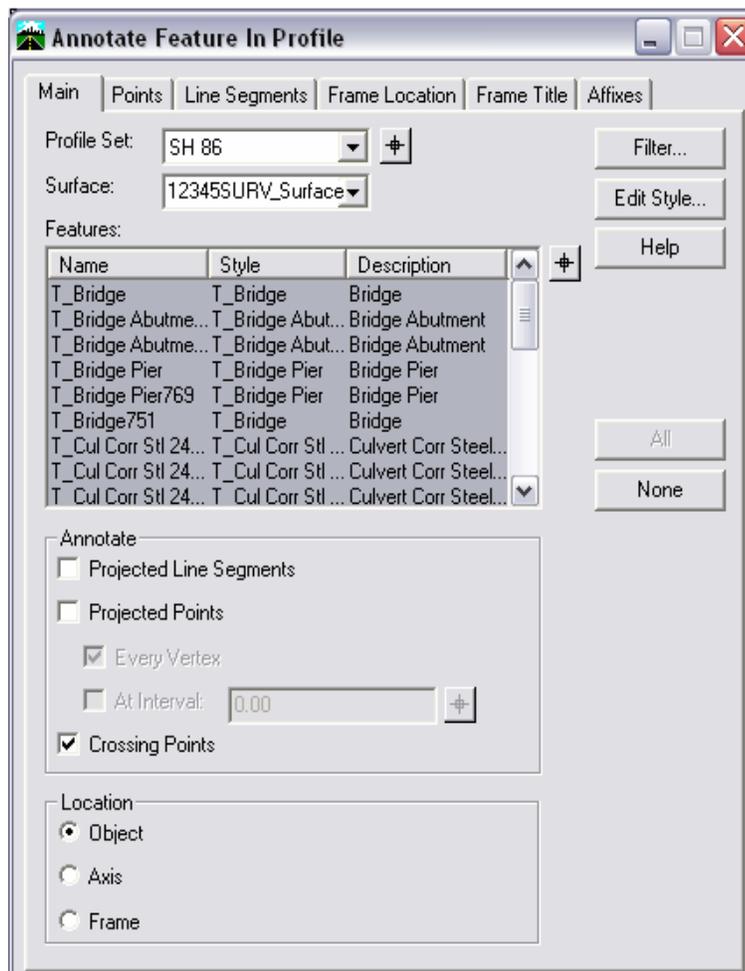
Lab 21: Annotating a Feature in a Profile

Features that have been displayed in profiles (or cross sections) can be annotated with information extracted from the surface model.

1. Using MicroStation commands, window into any culvert displayed in the profile created in the previous lab.
2. From the **Locks** toolbar select **CELL_PLOT-Scale** filter and verify the feature filter is toggled on.



3. Select **Evaluation > Profile > Annotate Feature in Profile**. The **Annotate Feature In Profile** dialog will appear



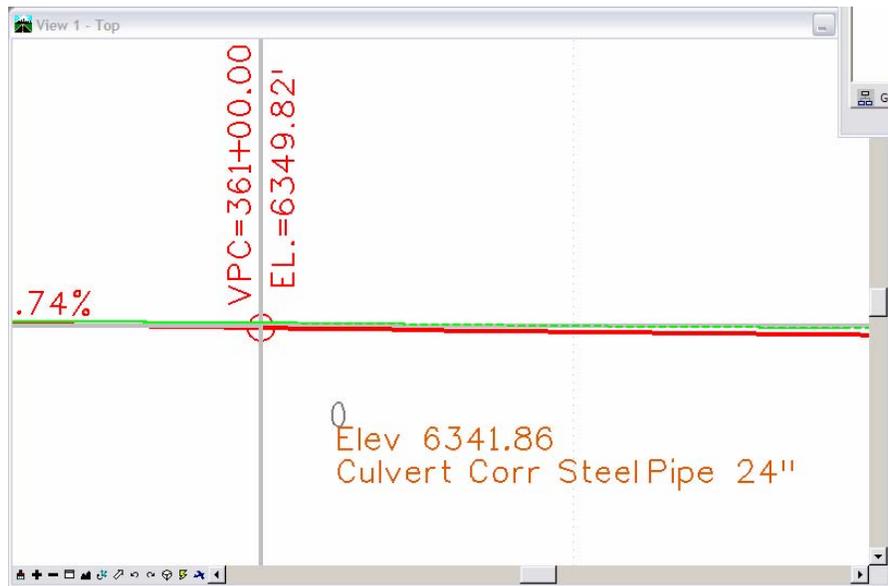
4. <D> the **Apply** button and review the results



5. <D> the **Points** tab
6. Check **ON** the *Description*

	Column	Row	Precision	Format
<input type="checkbox"/> Index:	1	1		
<input type="checkbox"/> Centerline Station:	1	2	0.12	ss+ss.ss
<input type="checkbox"/> Feature Station:	1	3	0.12	ss+ss.ss
<input type="checkbox"/> Horizontal Offset:	1	4	0.12	
<input checked="" type="checkbox"/> Elevation:	1	5	0.12	
<input type="checkbox"/> Feature Name:	1	6		
<input checked="" type="checkbox"/> Description:	1	7		
<input type="checkbox"/> Style:	1	8		

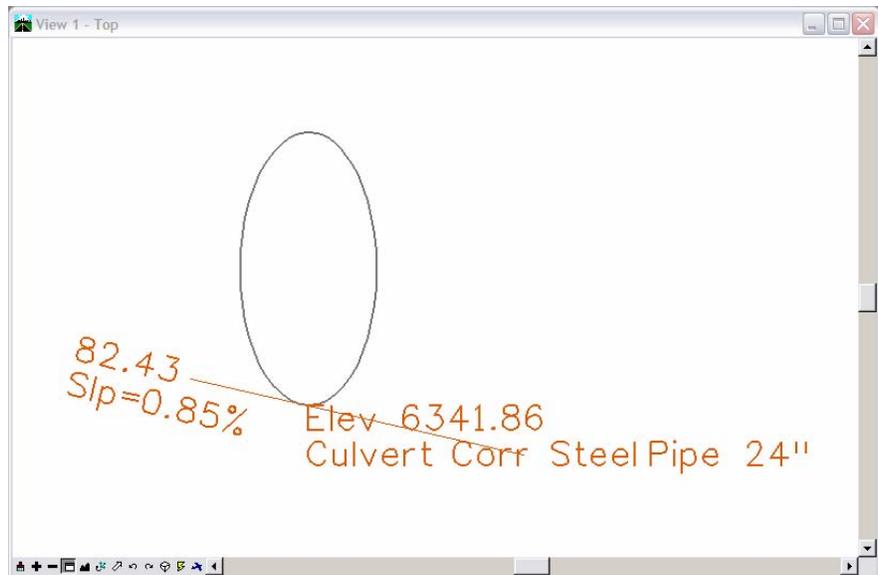
7. <D> the **Apply** button and review the results in your profile.



8. Experiment with enabling other options in the **Point** tab and redisplaying the annotation

Challenge Exercise:

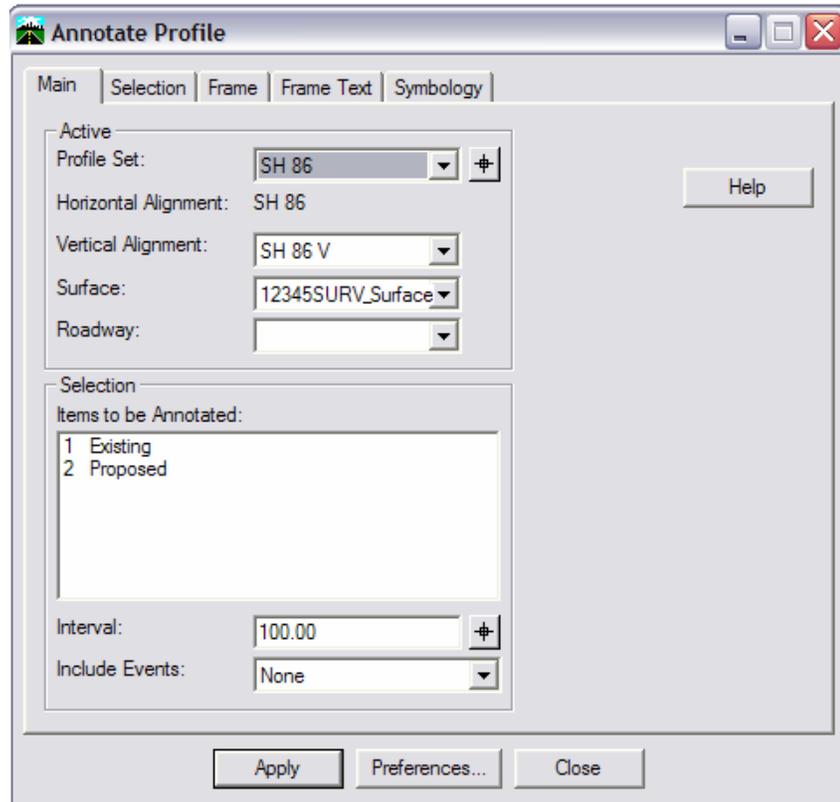
Update your profile to show *projected features*. Annotate the projected features.



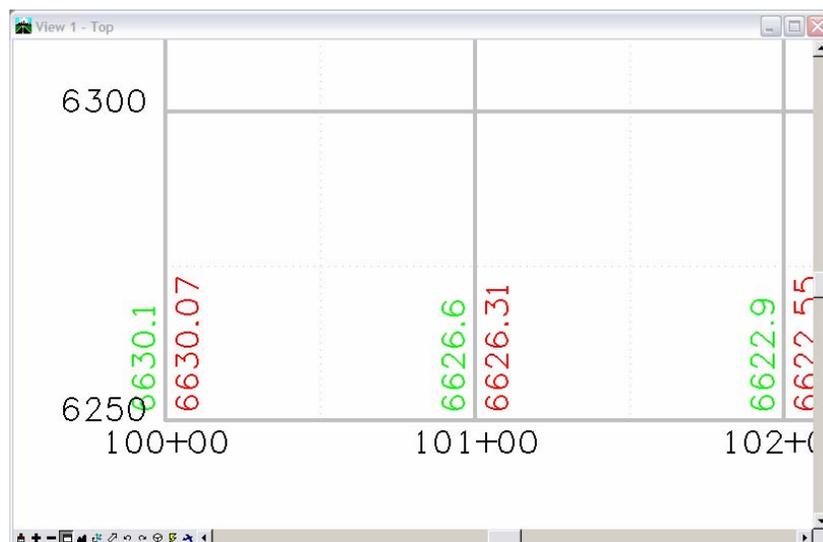
Lab 22: Annotating a Profile

In addition to annotating vertical alignments, profiles can be annotated with both existing and design information.

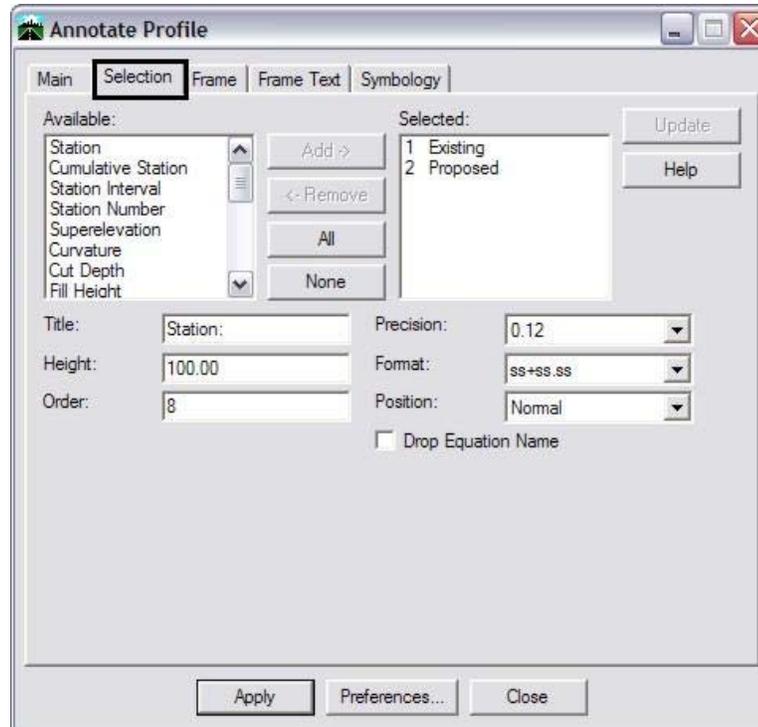
1. Select **Evaluation > Profile > Annotate Profile**



2. <D> the **Apply**. The existing and proposed grades annotate the profile.

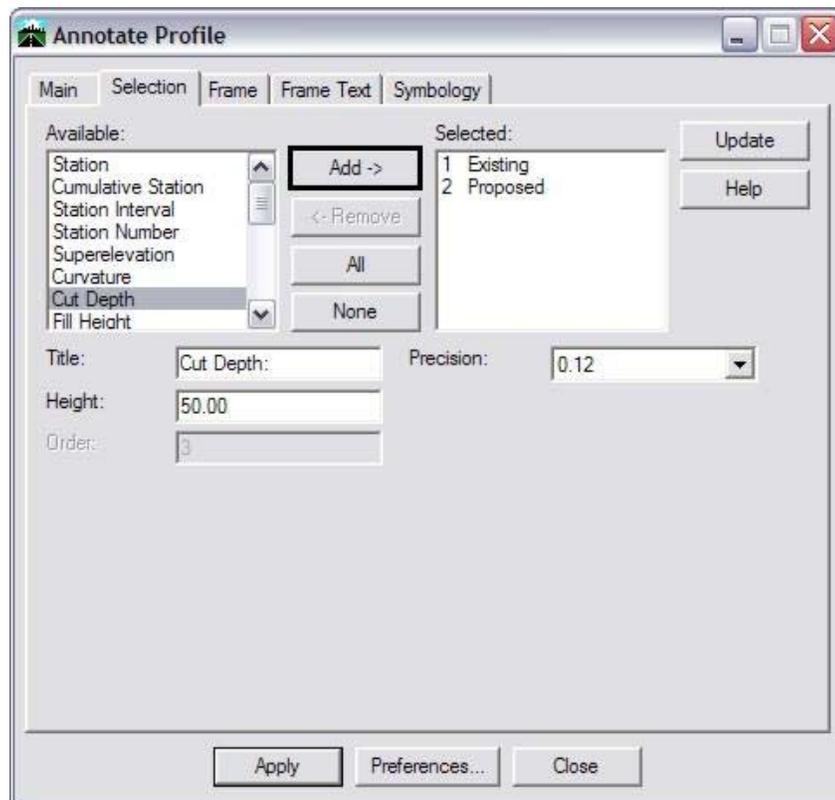


3. Take some time and review the tabs along the top of the **Annotate Profile** dialog. Investigate the remaining tabs and the individual settings for each.
4. Now go back and <D> the **Selection** tab.



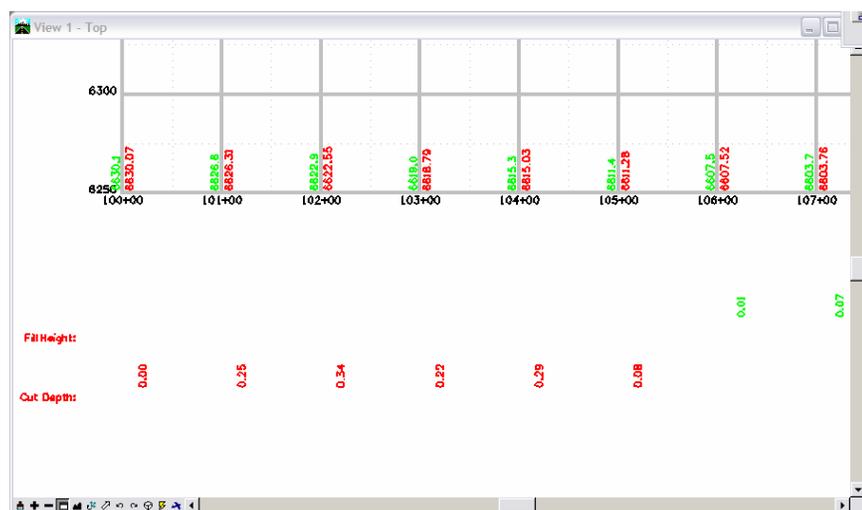
Note: The dialog shows two categories; **Available** and **Selected**. **Available** lists the items that can be annotated in a profile, **Selected** identifies the items chosen for annotation along with precision and other settings.

5. <D> the item **Cut Depth** from the Available list
6. <D> the **ADD->** button. Cut Depth will be added to the *Selected* list.



7. <D> the item **Fill Height** from the Available list.
8. <D> the **ADD->** button. Fill Height will be added to the Selected list.
9. <D> the **Apply** button and review the profile display.

Note: You may have to zoom out to view the additional annotation.

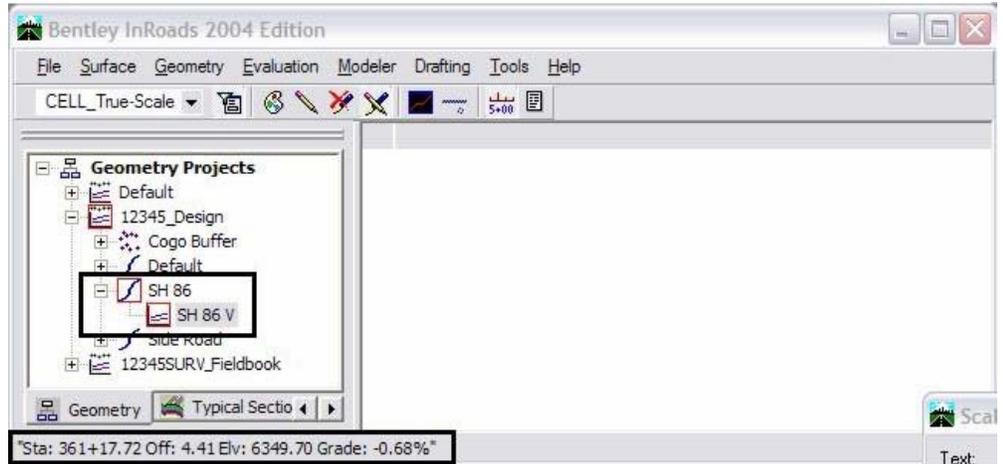


Lab 23: Vertical Alignment Tracking

Vertical alignments can be interactively queried similar to horizontal alignments.

Tracking Vertical Alignments in Profile View

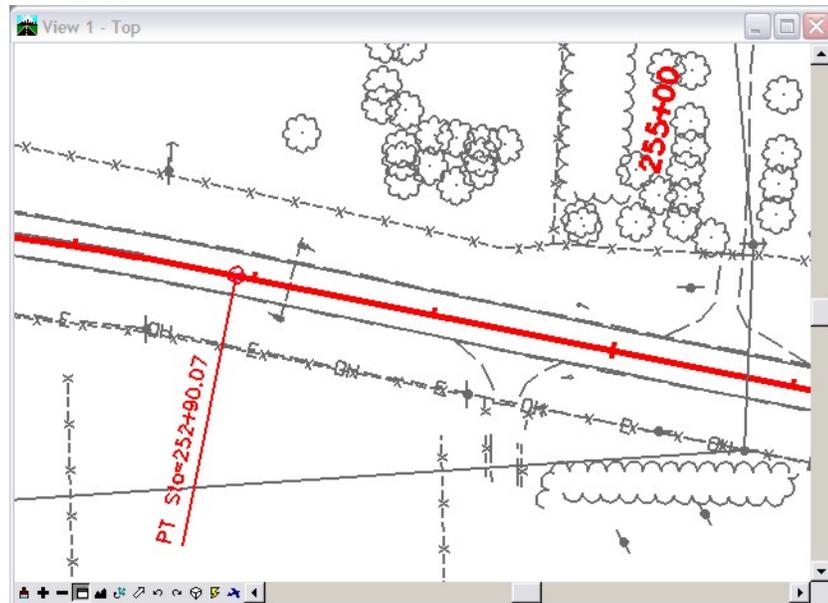
1. Select Tools > Tracking > Vertical Alignments
2. Move the cursor inside the Profile Set window and review the output in the InRoads Status bar.



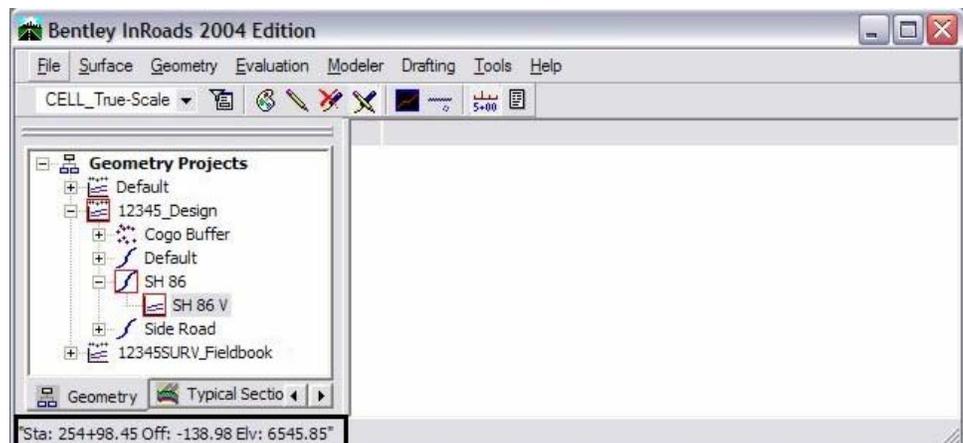
Note: As you move your cursor in the profile view InRoads displays vertical alignment information in the status field. There is *not* an option to write this information to the MicroStation file.

Tracking Vertical Grades in Plan View - Review

1. Select Tools > Tracking > Horizontal Alignment



2. Move the cursor along the active horizontal alignment and review the readout in the InRoads Status bar.



Results displayed are the station and offset relative to the active horizontal alignment. The elevation is relative to the active vertical alignment.

6. Creating Geometry

There are multiple methods for creating horizontal geometry in InRoads.

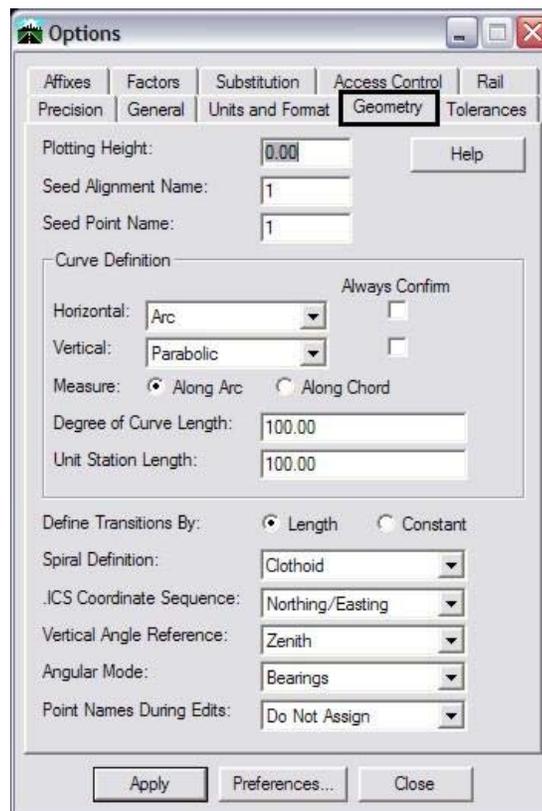
These methods are:

- Horizontal Curve set commands
- Importing from graphics
- Horizontal Element commands (overview only)
- Importing from an ASCII file (overview only)
- Importing from an ICS file (overview only)
- Joining Cogo Points together (covered in Geometry for ROW course)
- Traversing commands (covered in Geometry for ROW course)
- Creating parallel/offset alignments

Options

A review of the geometry options from Chapter 2

Options relative to geometry are found from the menu bar under **Tools > Options [Geometry]** tab.



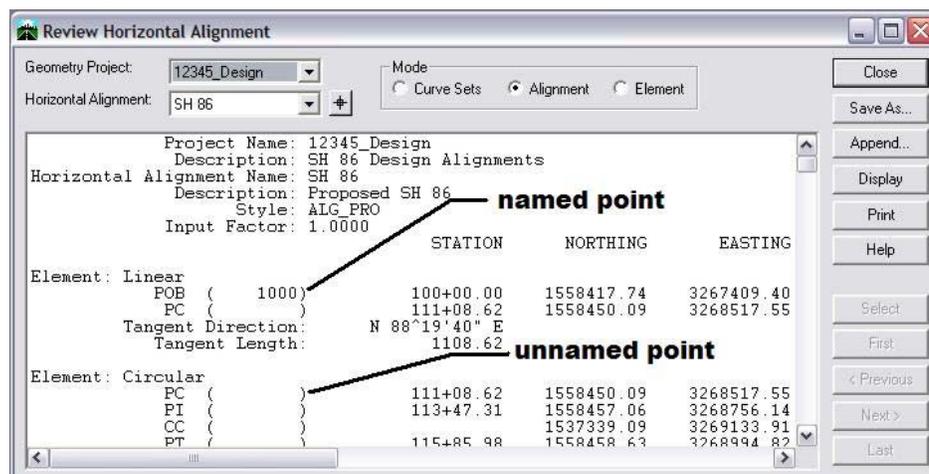
Dialog Items

- **Plotting Height:** The elevation for drawing horizontal geometry
- **Seed Alignment Name:** Initial name assigned to newly created geometry unless specified otherwise.
- **Seed Point Name:** Initial name assigned to new cogo points.
- **Curve Definition:** Horizontal - Arc or Chord definitions, Vertical - Parabolic or Circular
- **Measure:** Along arc or along chord for curve definition
- **Degree of Curve Length:** Specifies central angle that subtends this distance
- **Unit Station Length:** Distance between major station intervals
- **Define Transitions:** Defines spiral transitions by Length or Spiral constant
- **Spiral Definition:** Defines default method for defining spiral transitions
- **ICS Coordinate Sequence:** Defines input order of Northing/Easting's for ICS batch input files.
- **Vertical Angle Reference:** Defines vertical angle measurement in ICS files.
- **Angular Mode:** Specifies orientation for angles
- **Point Name During Edits:** Defines whether names are assigned to geometry points during creation or editing.

About geometry point names

Alignment key-points (PC, PI, PT, CC, etc) exist in one of three states:

- Unnamed
- Named
- Cogo Points



Reviewing an alignment displays the geometry point name. The above screenshot shows both named and unnamed points.

If **Point Name During Edits** is set to **Named**; alignment key-points are generated with a name based on the next available ID as specified in the **Seed Point Name** field. The specified seed point name can be alpha, numeric, or alphanumeric characters. The assigned name is also reserved in the Cogo buffer. However the point is not written to the Cogo Buffer automatically.

Writing the active alignment keypoints to the Cogo Buffer

Select **Geometry > Horizontal Curve Set > Events**

In the above example, all alignment key-points that were not previously assigned a name are written to the Cogo buffer beginning with the ID number of 200

ID	Station	Offset	Northing	Easting	Elevation	Style
200	1558450.09		3268517.55			
201	1537339.09		3269133.91			
202	1558458.63		3268994.82			
203	1558467.52		3270345.09			
204	1555467.58		3270364.85			
205	1558402.30		3270987.32			
206	1558117.51		3272329.96			
207	1547356.90		3270047.57			
208	1557965.30		3272956.51			
209	1557001.57		3276471.06			
210	1585933.56		3284404.53			

Note: The command **Geometry > Utilities > Assign Names** can be used to add, delete, or rename geometry points

Typical Workflow

A predefined workflow for creating geometry is not dictated by InRoads. However, a common workflow might be:

1. Create or open an existing geometry project
2. Create horizontal alignments (or Cogo points)
3. Assign stationing for alignments
4. Define alignment station equations, if any
5. Define alignment key-points (unique points of interest)
6. Review alignments
7. View created alignments
8. Display stationing for alignments
9. Annotate created alignments

Graphics clean-up

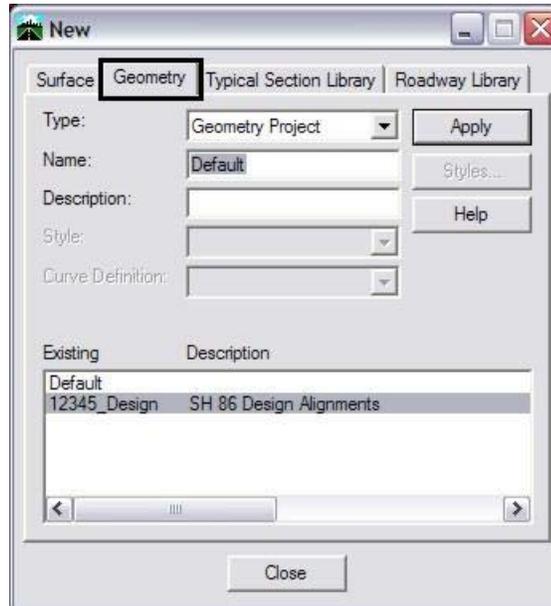
Before continuing with the labs, delete all visible graphics in your MicroStation file using the element selection tool or a fence. Note that you are deleting the graphical display of data, not the data itself. The graphics could be redisplayed using the InRoads display commands shown in previous sections.

Note: The screened topography and the training guides are either locked graphics or in an attached reference file, you will not be able to delete these graphics and will use them for orientation.

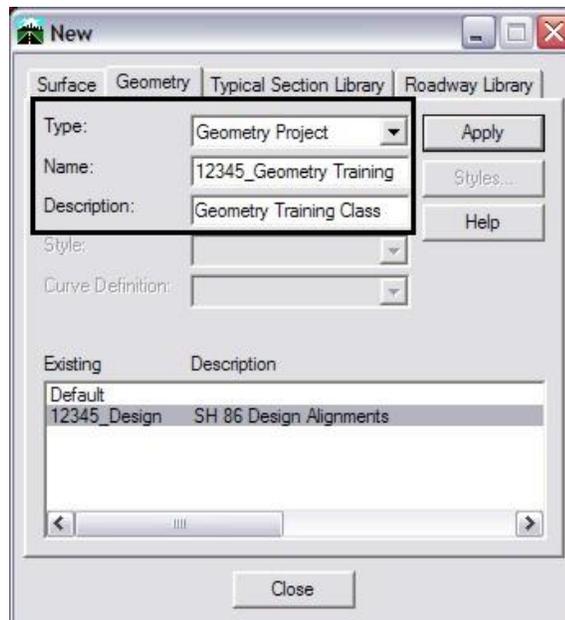
Lab 24: Create New Geometry

Create a new geometry project

1. From the pull-down menu **File > New**



2. <D> the **Geometry** tab
3. For the **Type**, choose **Geometry Project**
4. In the **Name** field, key in **12345_Geometry Training**
5. In the **Description** field, key in **Geometry Training class**

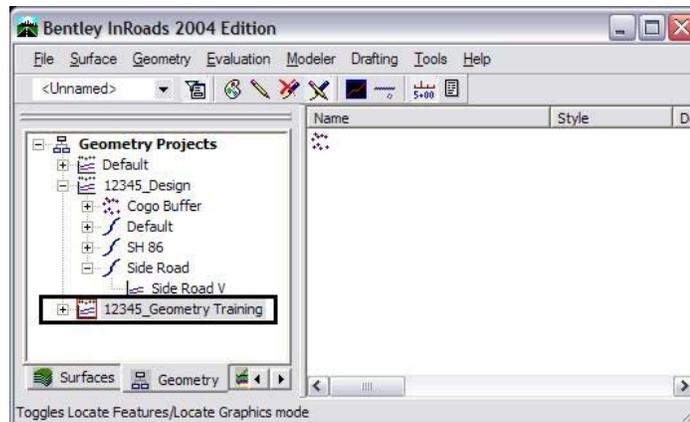


Note: The lower portion of the **New** dialog displays geometry projects that are currently loaded into memory

6. <D> **Apply**

Note: InRoads created the geometry project and made it the active geometry project. Any horizontal alignments created will be placed in the active geometry project.

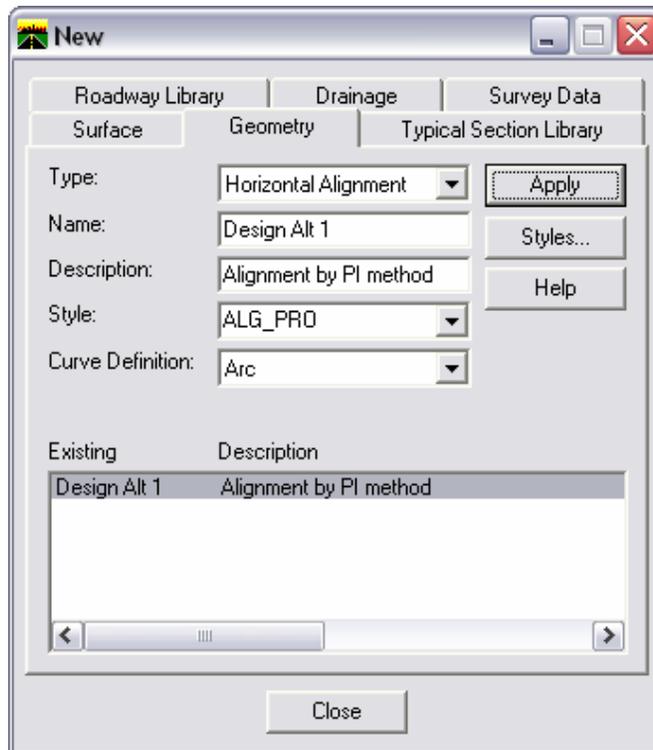
7. **Verify** that the Geometry Project has been created



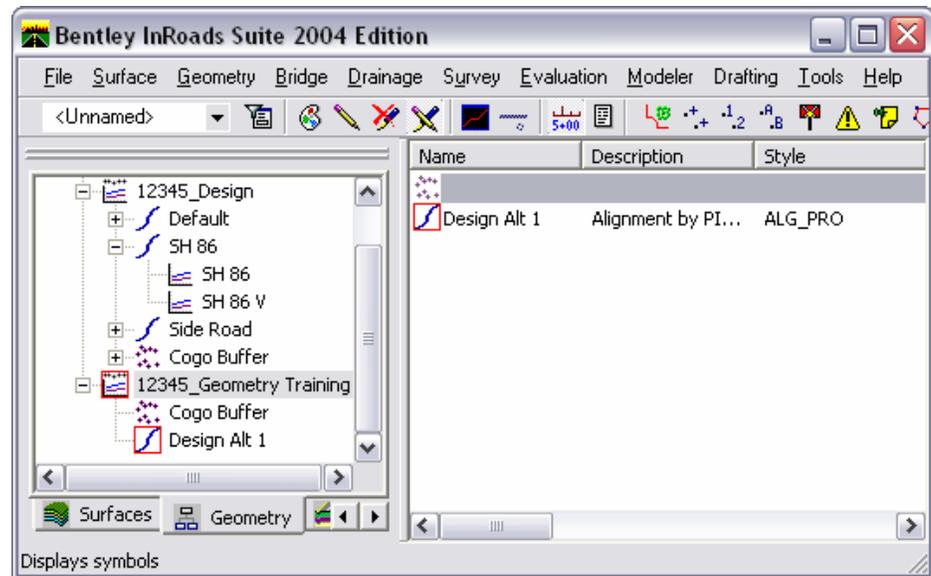
Note: This creates the Geometry Project where all new alignment data will be stored. At this point, it is held in RAM (Random Access Memory). When saved to the hard drive, the default extension will be ALG, as was assigned to previous geometry projects.

Create a New Horizontal Alignment

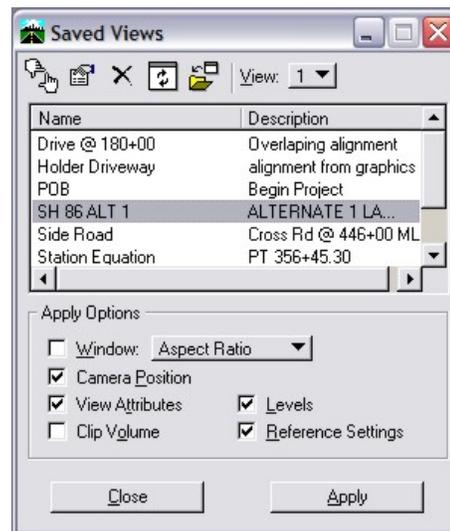
8. Continue to use the **New** dialog.
 - Type: **Horizontal Alignment**
 - Name: ***Design Alt 1***
 - Description: ***Alignment by PI method***
 - Style: **ALG_PRO**
 - Curve Definition: **ARC**



9. <D> the **Apply** then **Close** buttons



10. Verify the horizontal alignment is created in the active geometry project.
11. From the MicroStation pull-down menu **Utilities > Saved Views**
12. From the **Saved Views** dialog <D> saved view name **SH 86 ALT 1**



13. <D> the **Apply** button.

Points A-M represent the required location of alignment PI's. Horizontal curve set commands will be used to create the horizontal alignment. The steps will be to construct the tangents, then insert curves between the tangents once constructed.

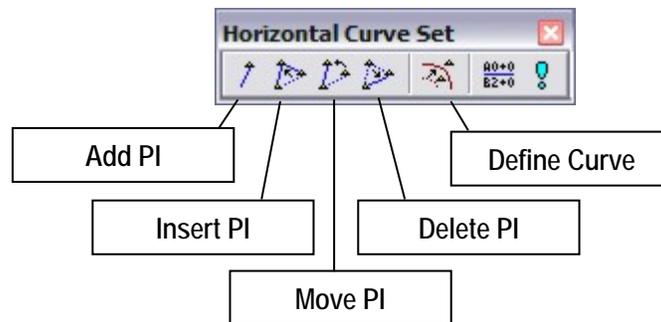


Notes:

- The following exercises will step you through creating an alignment using the Horizontal Curve Set, or PI method. While this exercise is roadway based, the tools and logic apply to any new alignment whether it is for drainage-ways, utilities, pavement marking, bridge geometry, parcels, or any other purpose.
- For orientation screened graphics and curve radius values are shown for the alignment that will be created.

Horizontal Curve Set commands

The **Horizontal Curve Set** commands present an easy way to create alignments. They consist of five primary commands described below and may be accessed from a toolbar (shown) or from the pull-down menu under **Geometry > Horizontal Curve Set**.



Add PI is used to create a PI that begins a new alignment, or to add a PI onto either end of an existing alignment thereby extending it.

Insert PI is used to add a PI to an existing alignment between two existing PIs.

Move PI is used to change the location of a PI previously established.

Delete PI is used to remove a PI from an existing alignment. For removing more than one PI, you must choose and **Accept** each one individually. To remove all PIs associated with an alignment, but leave the alignment name, right-click on the alignment name in the Explorer menu and choose **Empty**.

Define Curve is used to either establish curves or to edit curves previously defined.

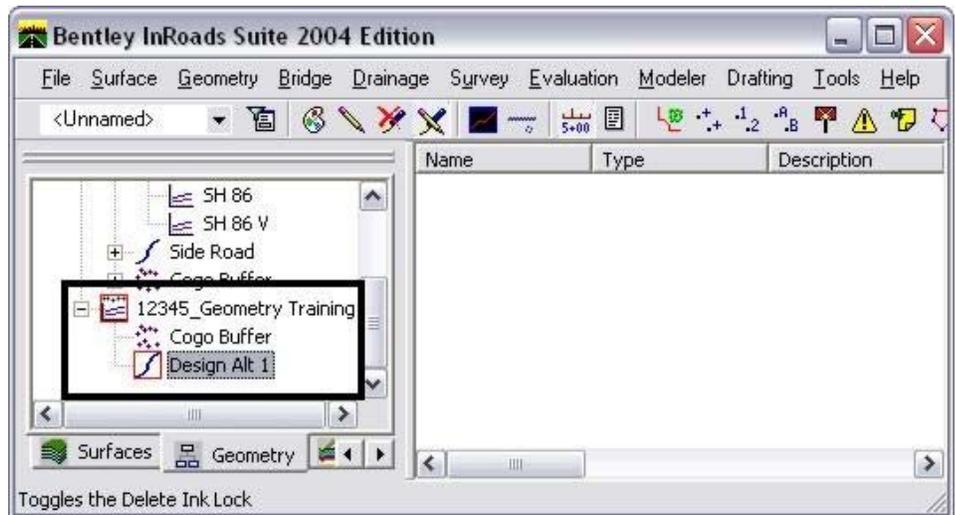
Stationing for establishing stationing or station equations along an alignment

Events are used to establish unique locations relative to an alignment, Cogo points, or the assignment of Cogo points along an alignment's keypoints.

Lab 25: Create Alignment Tangents

In this lab you will create an alignment using the Horizontal Curve Set, or PI method. Begin by inputting the tangent sections of the alignment by selecting locations graphically. This is accomplished by issuing a <D> at the desired location. Once the tangents are in place, curves between these tangents will be defined.

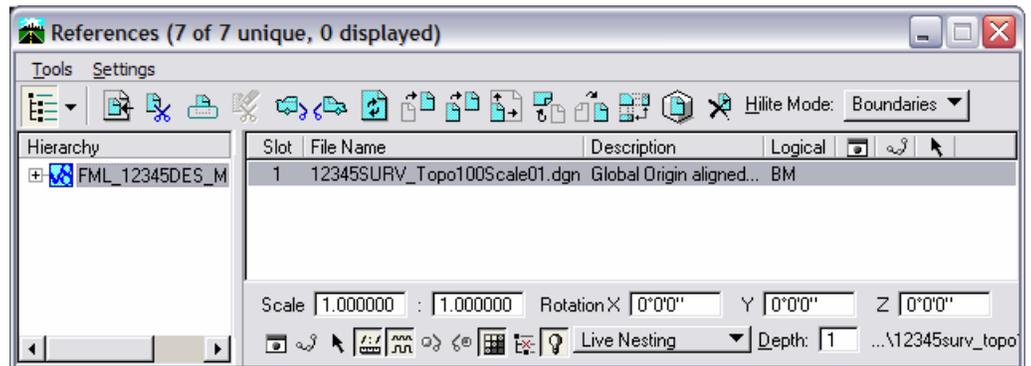
1. Before beginning, verify the proper alignment is *Active*. This is necessary as any geometry entered will be populated in the active alignment.



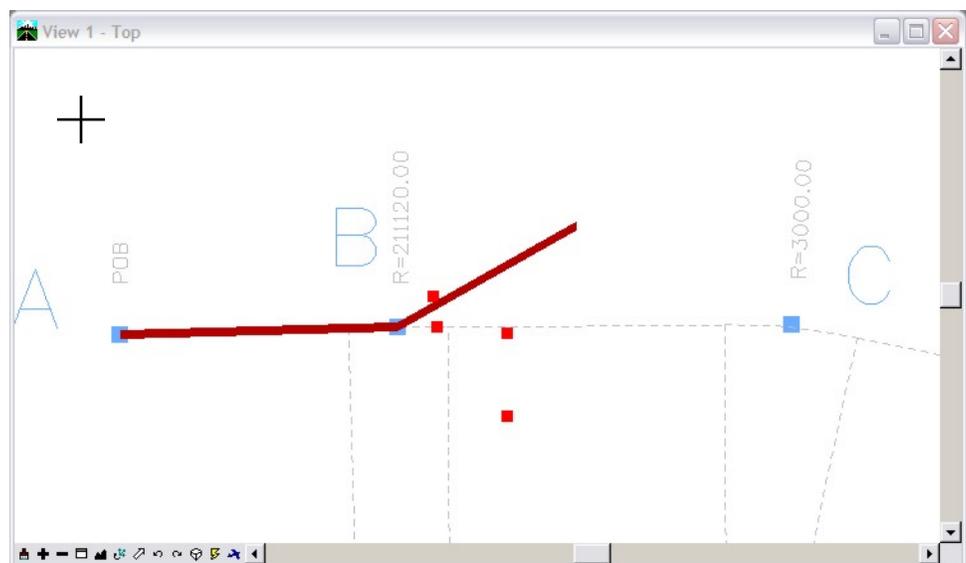
Design Alt 1 should be the active alignment. If not, several options exist to define it as the active alignment.

- Right-click <R> on the horizontal alignment name and select *Set Active* from the fly-out menu
- From the pull-down menu, select **Geometry > Active Geometry** and use the resulting dialog to set the active alignment.

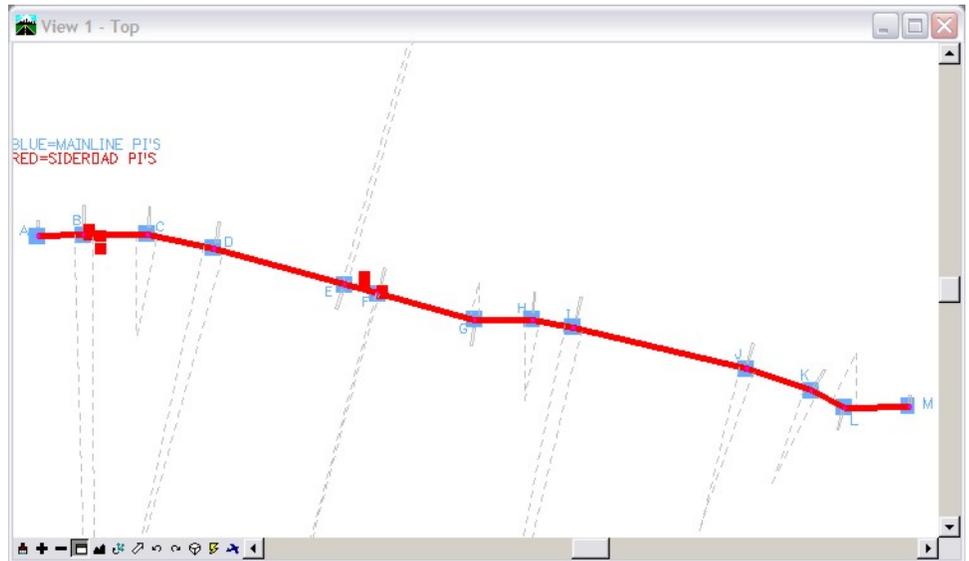
- To clear the MicroStation view turn the reference **Display Off** for the **12345SURV_Topo100Scale01.dgn** in the **References** dialog box.



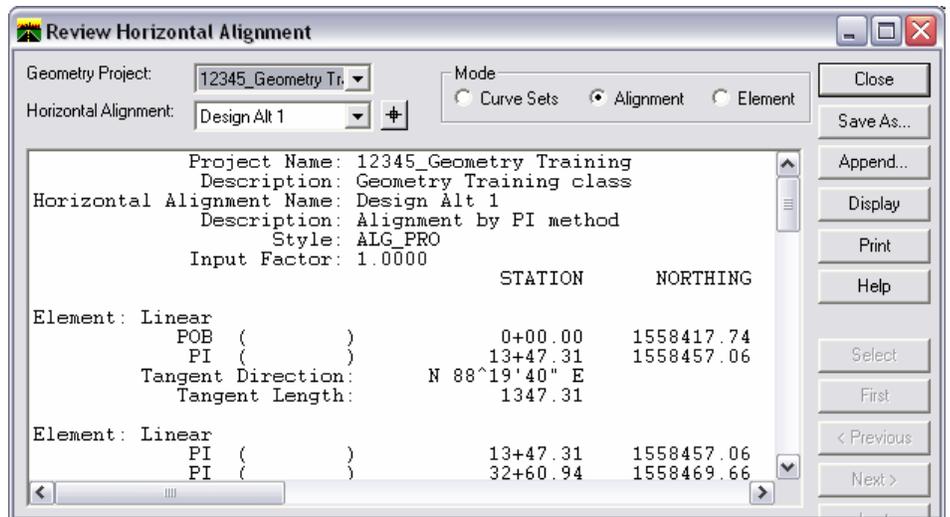
- Select **Geometry > Horizontal Curve Set > Add PI**. You are prompted in the MicroStation status bar to **Identify Alignment End**.
- <T> and <D> at point **A** (tentative or snap, and Data point).
The alignment interactively displays as you move the cursor.



- Continue to issue a series of points <T> & <D> through points B-M



- <R> (reset) when complete.
- If the alignment created does not pass through points A-M, use the **Insert, Move, or Delete PI** commands from the Horizontal Curve Set tools to correct the locations.
- Review the new alignment **Geometry > Review Horizontal...**



Summary of PI locations

PI	NORTHING	EASTING	BEARING	DISTANCE	STA.
A	1,558,417.74	3,267,409.40			0+00.00
B	1,558,457.06	3,268,756.14	N 88°19'39.62" E	1,347.31'	13+47.30
C	1,558,469.66	3,270,669.73	N 89°37'21.60" E	1,913.63'	32+60.94
D	1,558,050.59	3,272,645.47	S 78°01'28.88" E	2,019.69'	52+80.63
E	1,556,982.55	3,276,540.43	S 74°39'56.80" E	4,038.75'	93+19.38
F	1,556,716.98	3,277,527.47	S 74°56'25.98" E	1,022.14'	103+41.51
G	1,555,931.76	3,280,408.64	S 74°45'18.96" E	2,986.25'	133+27.77
H	1,555,939.60	3,282,135.29	N 89°44'23.81" E	1,726.67'	150+54.44
I	1,555,699.32	3,283,343.64	S 78°45'12.06" E	1,232.01'	162+86.44
J	1,554,474.27	3,288,508.48	S 76°39'23.63" E	5,308.14'	215+94.58
K	1,553,821.34	3,290,431.45	S 71°14'44.01" E	2,030.79'	236+25.37
L	1,553,315.19	3,291,416.57	S 62°48'22.55" E	1,107.55'	247+32.92
M	1,553,346.54	3,293,367.43	N 89°04'46.05" E	1,951.11'	266+84.03

Note: Results may vary based on the specific PI locations defined by the user.

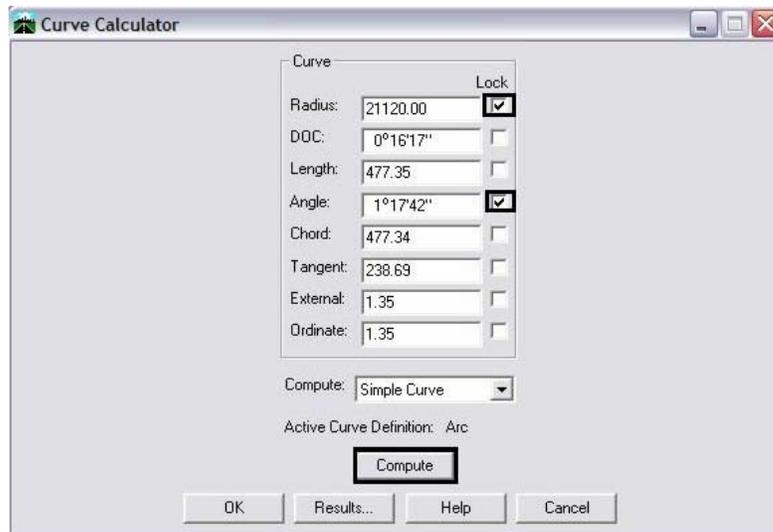
Defining Horizontal Curves

Define Horizontal Curve Set – is used to create a curve between alignment tangents or to revise an existing curve definition. The **Previous** and **Next** buttons can be used to step sequentially through the alignment. The **Select** button can be used to graphically identify an alignment location for editing. As alignment components are selected, they highlight in the MicroStation view.

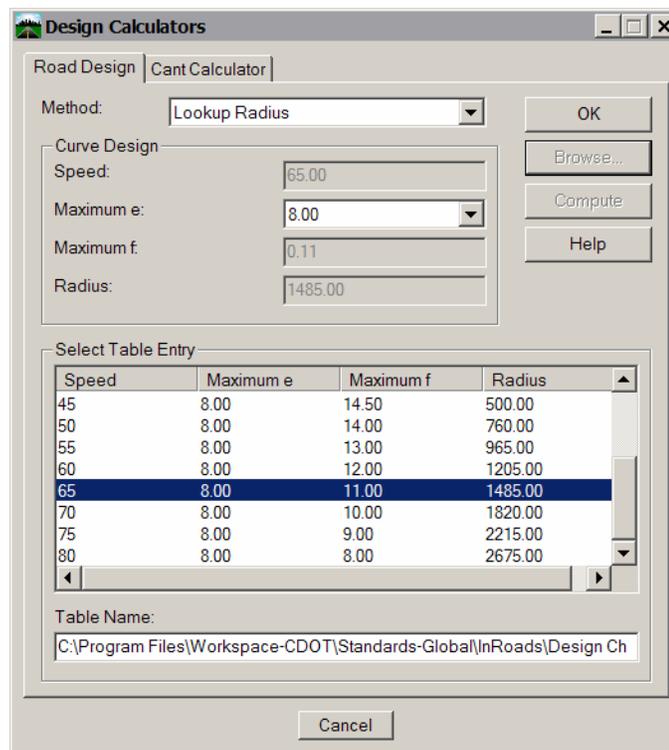
The screenshot shows the 'Define Horizontal Curve Set' dialog box. The 'Horizontal PI' section is at the top, with 'Define By' set to 'Known PI Coordinates'. Below this are fields for 'Direction Back' (N 88°19'40" E), 'Length Back' (1347.31), 'Point Name' (empty), 'Northing' (1558457.06), 'Easting' (3268756.14), 'Direction Ahead' (N 89°37'22" E), and 'Length Ahead' (1913.63). The 'Horizontal Curve' section is below, with 'Curve Set Type' set to 'SCS' and 'Define Transitions By' set to 'Length'. It includes fields for 'Leading Transition' (Clothoid, 0.00), 'Radius 1' (21120.00), 'Compound Transition' (Clothoid, 0.00), 'Radius 2' (0.00), and 'Trailing Transition' (Clothoid, 0.00). The 'Define By' section is at the bottom, with 'Radius' selected and 'Point on Curve' chosen. The 'Point on Curve' section includes 'Point Name' (empty), 'Northing' (1558450.09), and 'Easting' (3268517.55). At the bottom of the dialog are navigation buttons: 'First', '< Previous', 'Next >', 'Last', and 'Select'. The 'Next >' button and the 'Radius 1' field are highlighted with a black box.

The **Radius 1:** field is for input of the radius of a single circular curve. Leading and Trailing Transition fields are for the input of spiral curve radii.

The **Curve Calculator** is used to compute curve data for circular or spiral curves. In addition to deflection angle, one other curve criteria must be defined and locked prior to selecting the **Compute** button. The curve solutions can be passed to the parent dialog by selecting OK.



The **Design Calculator** is used to compute or look up curve data to meet design criteria



Lab 26: Define Alignment Curves

1. Select **Geometry > Horizontal Curve Set > Define Curve**. The first two tangents A-B and B-C highlight.
2. Key in **Radius 1: 21120**

Define Horizontal Curve Set

Horizontal PI
 Define By: Known PI Coordinates

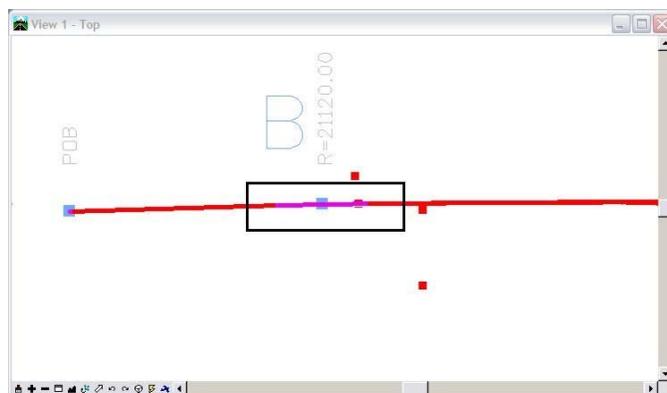
Direction Back: N 88°19'40" E
 Length Back: 1347.31
 Point Name:
 Northing: 1558457.06
 Easting: 3268756.14
 Direction Ahead: N 89°37'22" E
 Length Ahead: 1913.63

Horizontal Curve
 Curve Set Type: SCS SCSCS
 Define Transitions By: Length Constant
 Leading Transition: Clothoid 0.00
Radius 1: 21120.00
 Compound Transition: Clothoid 0.00
 Radius 2: 0.00
 Trailing Transition: Clothoid 0.00
 Define By: Radius
 Tangent to Spiral Point Name:
 Spiral to Tangent Northing: 1558450.09
 Point on Curve Easting: 3268517.55

Buttons: Apply, Close, Undo, Curve Calc..., Design Calc..., Help

Bottom Buttons: First, < Previous, Next >, Last, Select

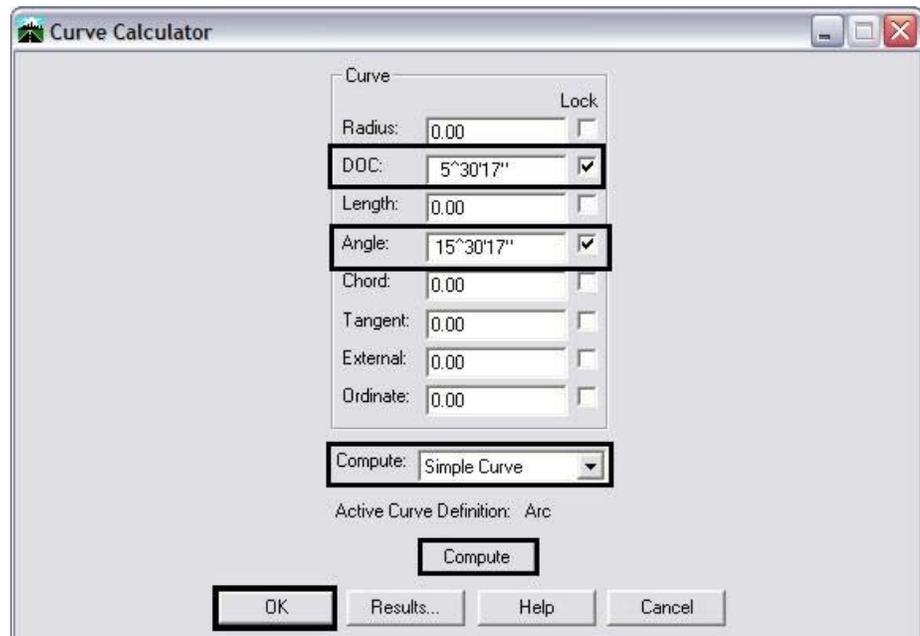
3. <D> the **Apply** button. The curve is created and displays.



4. <D> the **Next**> button. Tangents B-C and C-D highlight
5. Key in **Radius 1: 3000**
6. <D> the **Apply** button.
7. Repeat steps 4-6 for the curves at locations:
 - D Radius = 11,000.00
 - E Radius = 3,000.00
 - F Radius = 3,000.00

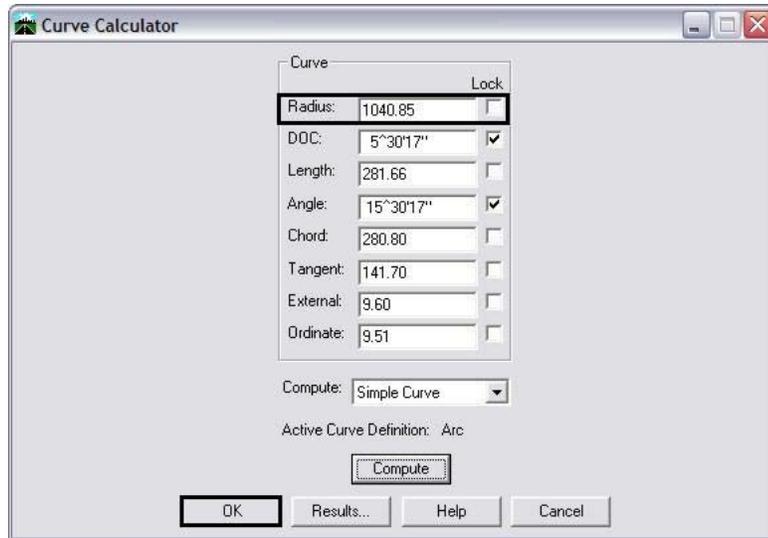
For the first 5 curves, radii were input to define the curves. For the curve located at point G, the degree of curve is the known component (along with the external deflection angle). Use the Curve Calc.... button to solve the curve data.

8. <D> the **Next**> button to define the curve at point G.
9. <D> the **Curve Calc...** button
10. Set Compute: to **Simple Curve**
11. Calculate based on a **5 degree 30 minute 17 second** curve
12. Key-in **5 30 07** for the **DOC**: – **Lock** the field (if locked, unlock the Radius option, only 2 fields should be locked)

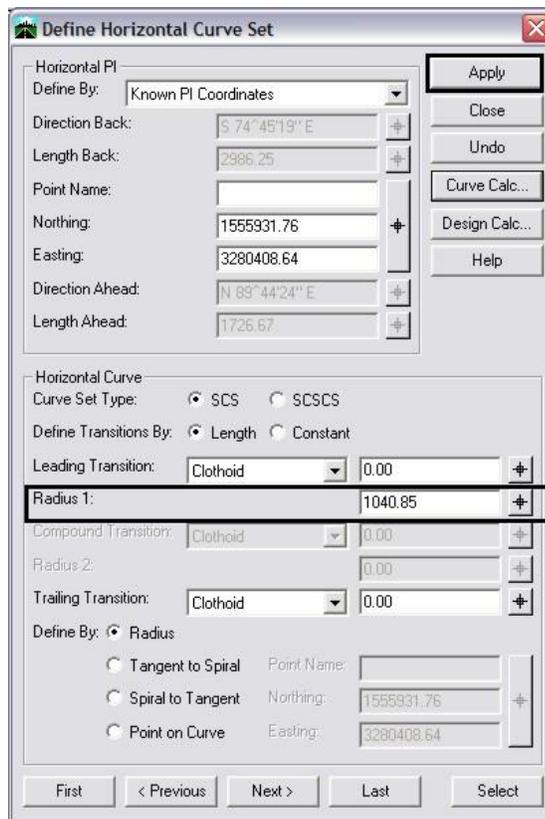


13. <D> **Compute**:

Notice the changes that occur in the dialog.



14. <D> OK the Curve Calculator dialog will close and the calculated radius will be populated in the **Radius 1** field in the parent dialog.



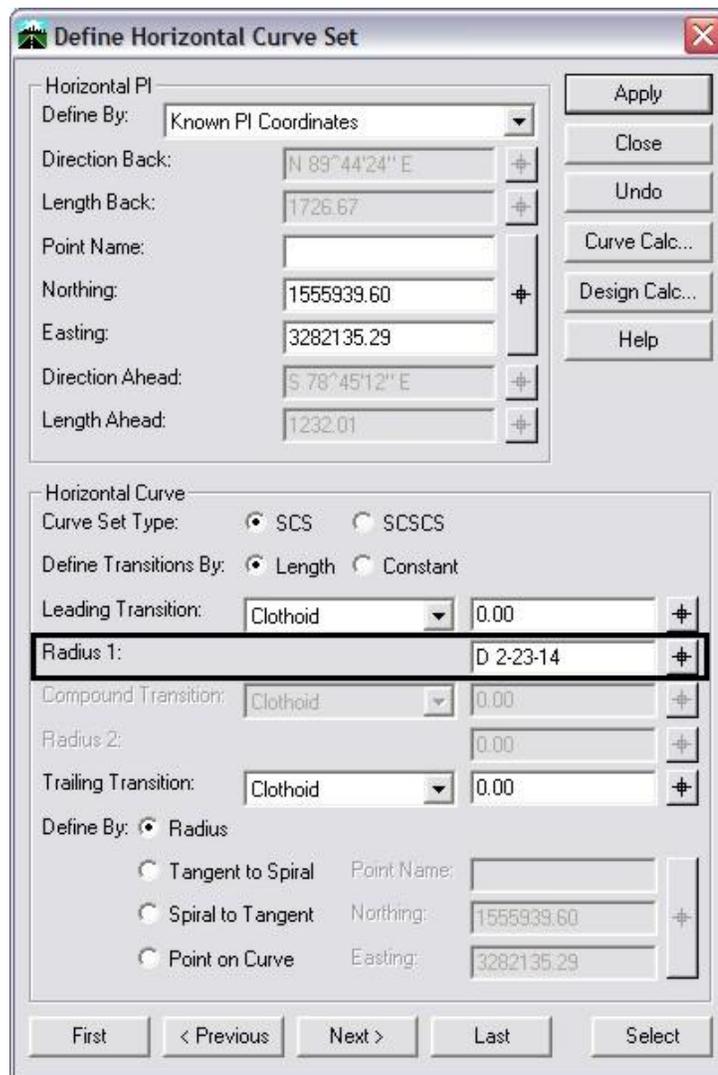
15. <D> Apply, the curve will be created

The next curve (location H) will also be developed using the degree-of-curve. However a short-cut will be used to generate the input for the Radius 1 field

16. <D> Next to select the tangents on either side of point H

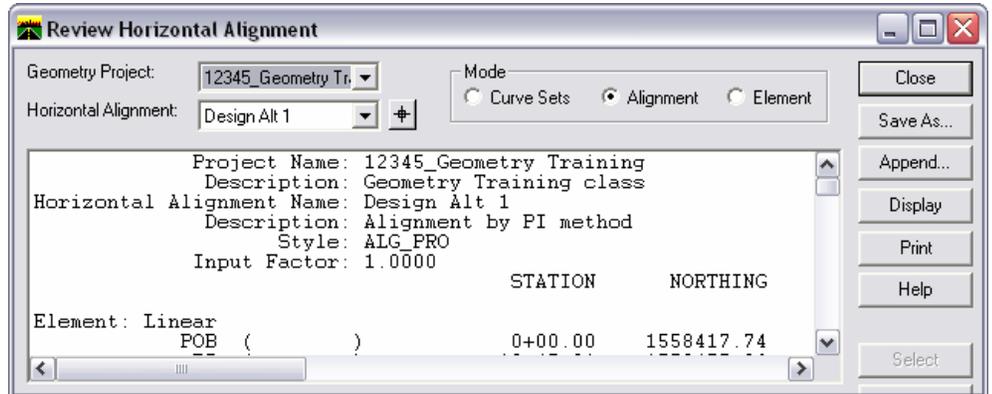


17. In the *Radius 1*: Field Key-in *D 2-23-14*



18. Press the keyboard <TAB> key to leave the field. The radius (2400.10) will compute for the selected location.

19. <D> **Apply** to form the curve
20. If time permits, complete the remainder of the curves as noted in the drawing and listed below:
 - I Radius = 15,000.00
 - J Radius = 5,000.00
 - K Radius = 3,000.00
 - L DOC = 3-34-52
21. Review the alignment data select **Geometry > Review Horizontal**



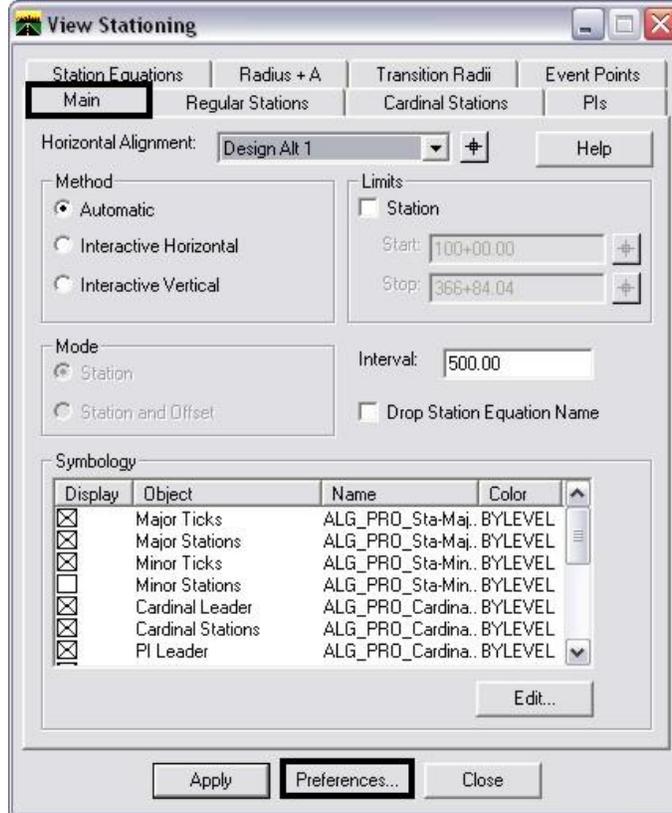
Lab 27: Alignment Stationing

The default station value assigned to the start of a new alignment is 0+00. Redefine the beginning station to 100+00.00

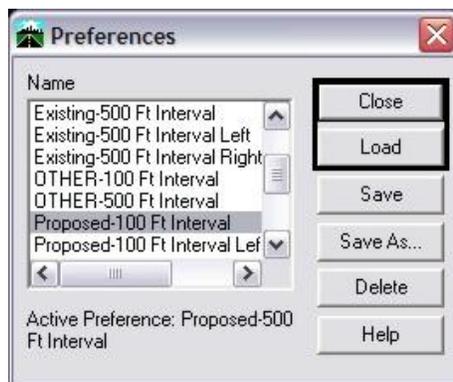
1. Select **Geometry > Horizontal Curve Set > Stationing**
2. Key in Starting Station: **100+00**
3. <D> the **Apply** button.



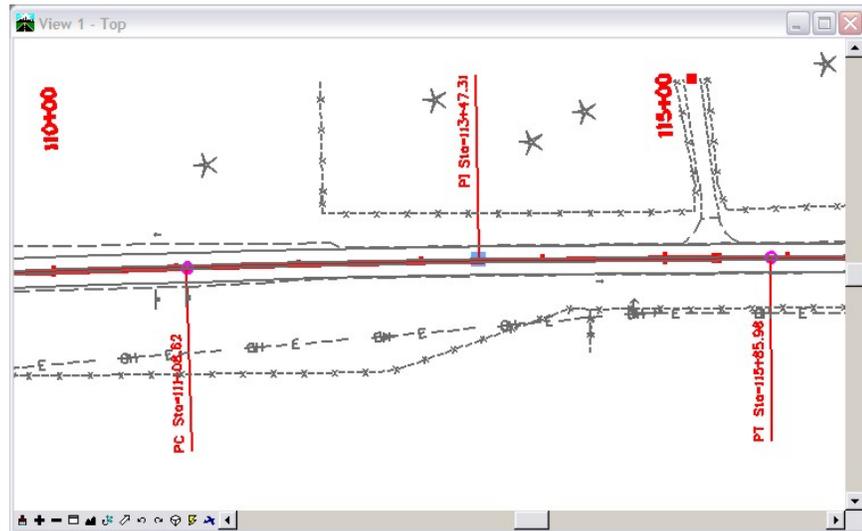
4. Verify your results using both of these methods:
 - **Geometry > Review Horizontal**
 - **Tools > Tracking > Horizontal Alignments**

5. Select **Geometry > View Geometry > Stationing**

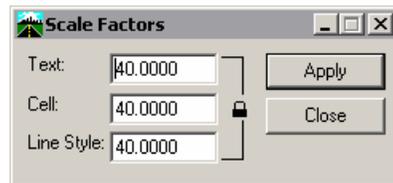
6. <D> the **Preferences** button.
7. <D>the saved preference name **Proposed-100 Ft Interval**
8. <D> Load and Close



9. <D> the **Apply** button from the **View Stationing** dialog. Stationing is displayed.



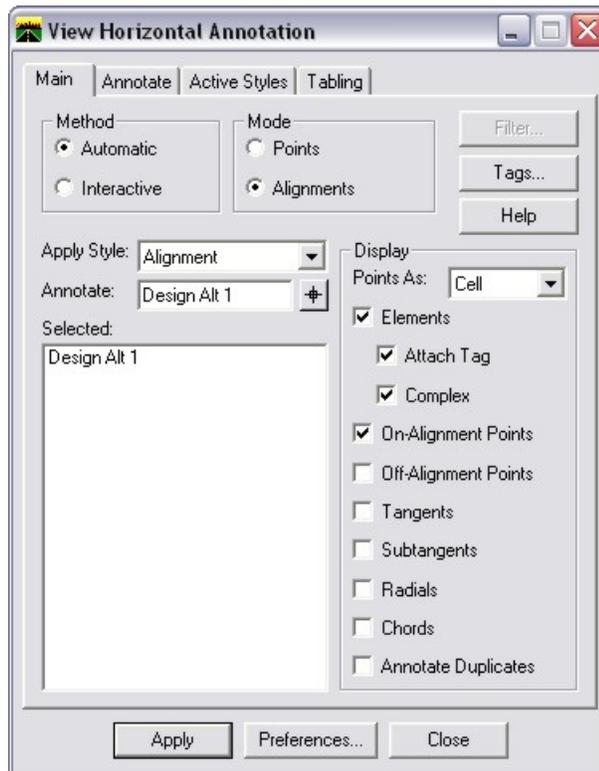
10. Experiment with changing the global scale factor value for text and redisplaying the stationing.



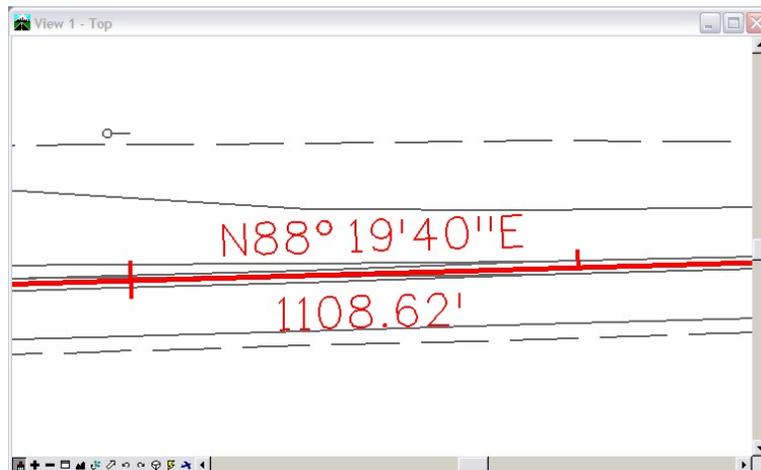
Lab 28: Annotating an Alignment

In addition to Stationing, alignment information such as tangent distance, direction, and curve data is required.

1. Select
Geometry > View Geometry > Horizontal Annotation



2. Verify settings and display alignment information
3. **Review** the results in MicroStation



Challenge Exercise:

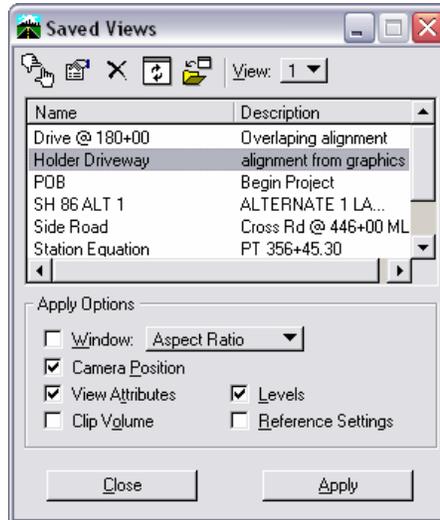
1. Use **Geometry>Copy Geometry** to **Copy** alignment **Design ALT 1** to a **new** Horizontal alignment named **Design ALT 1 Modified**

2. **to the copied alignment:**
 - Move an alignment PI
 - Redefine one or more horizontal curves
 - Define alignment stationing as ending at station 382+00
 - Redisplay stationing at a 500 foot interval
 - Introduce 2 station equations. One overlap and one gap.
 - Revert the alignment to a simple PI at point B (remove the curve definition)
 - Transpose the direction of the alignment
 - Create a profile showing the existing ground profile along the copied alignment with a 2x vertical exaggeration.

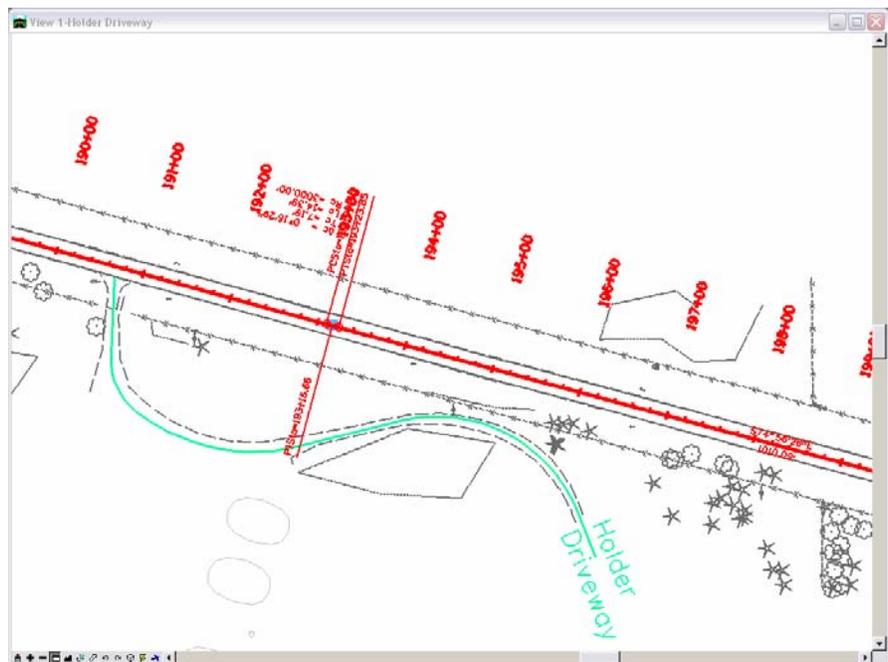
Lab 29: Horizontal Alignment from Graphics

Alignments can be created from existing MicroStation graphics. In this exercise a chained MicroStation element will be used to create an alignment.

1. From the MicroStation pull-down menu select **Utilities > Saved Views**
2. From the **Saved Views** dialog <D> saved view name **Holder Driveway**



3. <D> the **Apply** button

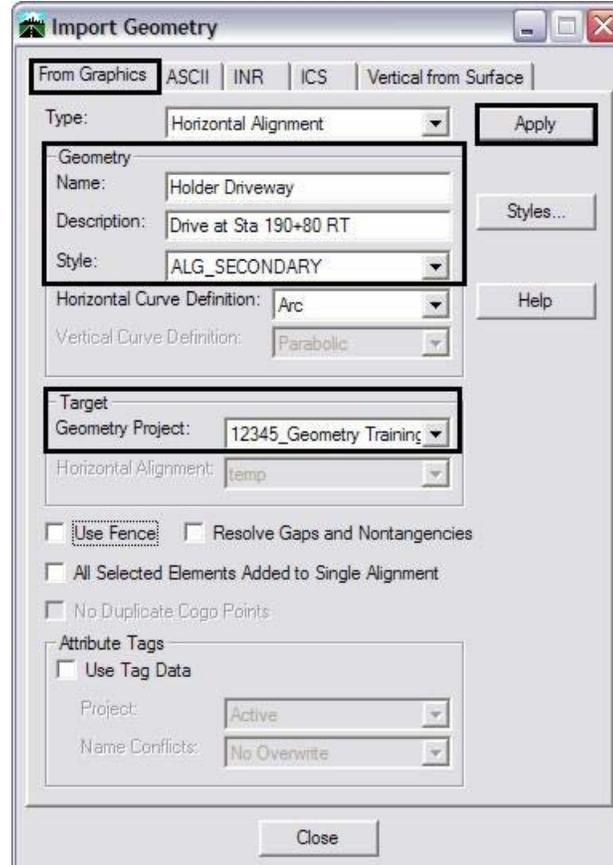


4. Select **File > Import > Geometry**. The **Import Geometry** dialog will open

Horizontal Alignments, Horizontal and Vertical Alignments, Cogo Points or Event Points can be imported from MicroStation graphics. If the alignment has curves, it is recommended to toggle on **Resolve Gaps and Nontangencies**. If the alignment was drawn as a series of lines and/or arcs that have not been chained together as complex elements toggle on **All Selected Elements Added to Single Alignment** (you must define a Fence or Selection Set of the elements).

After specifying the **Name**, the **Description** and the **Style**, choose **Apply**. If you created a Selection Set or defined a fence prior to initializing the command, you will be asked to Accept the contents. If this was not done, you'll be asked to identify the element. In either case, after accepting, an alignment or alignments will be added to the geometry project specified in the **Target** section.

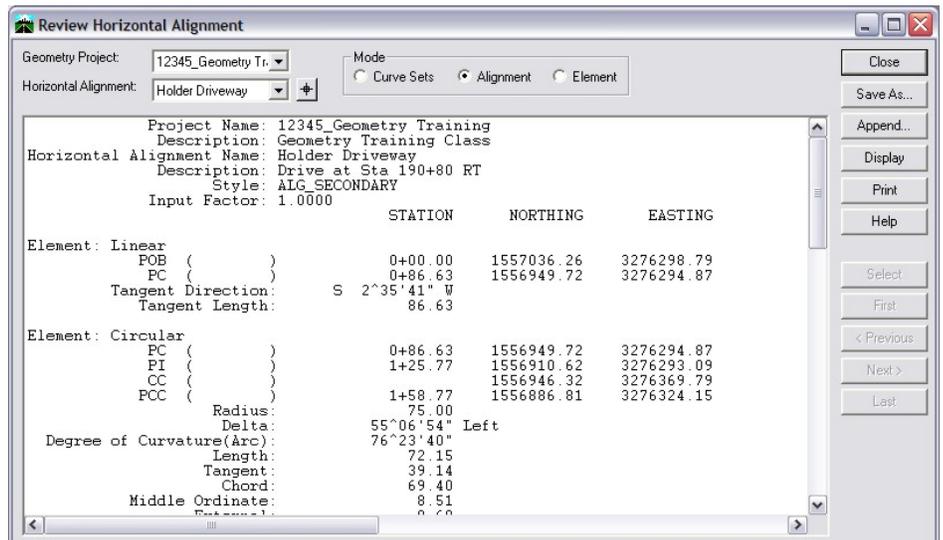
5. On the **From Graphics** tab select Type: **Horizontal Alignment**
 - **Name:** Holder Driveway
 - **Description:** Driveway at Sta 190+80 RT
 - **Style:** ALG_SECONDARY
6. <D> the Apply button. The **Import Geometry** dialog will minimize allowing you to see more of your MicroStation view



7. When prompted to Identify Element <D> on the MicroStation graphic drawn in the center of the driveway
 8. <D> again to accept the highlighted graphics in the MicroStation view
 9. <R> in the MicroStation view to terminate the command. The **Import Geometry** dialog will restore. The MicroStation graphics have been imported as an alignment
- Note:** The geometry name field increments for additional selection(s)
10. <D> the **Close** button to close the **Import Geometry** dialog
 11. **Verify** the alignment was created



12. Review the alignment **Geometry > Review Horizontal**



13. Time permitting, display the alignment graphics, stationing, and curve information.

Lab 30: Extend Alignment

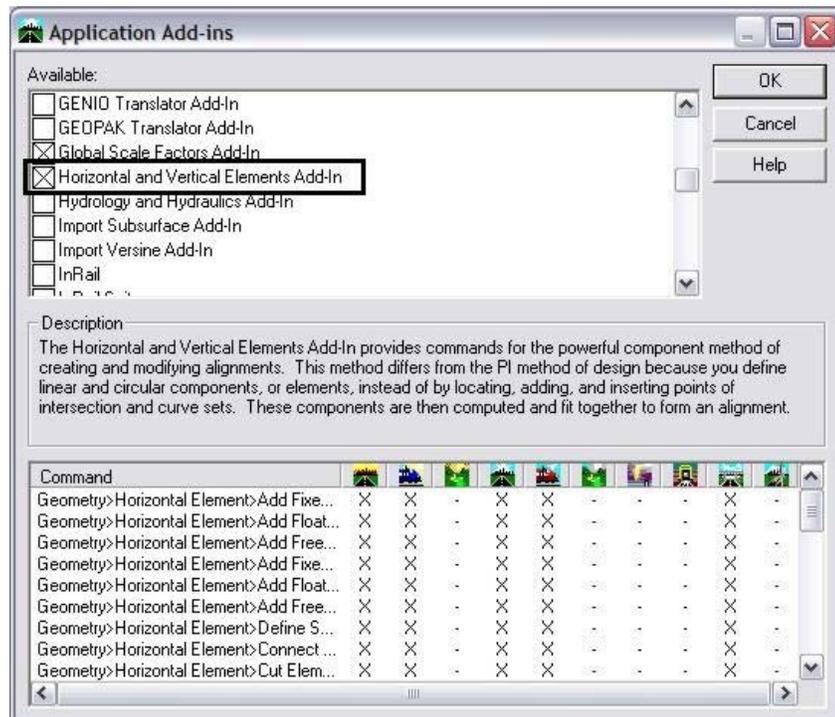
The alignment **Holder Driveway** does not intersect the reference line alignment **Design Alt 1**. Standard practice necessitates the driveway alignment to commence at the main-line reference line.

1. Select **Geometry > Utilities >** and hold

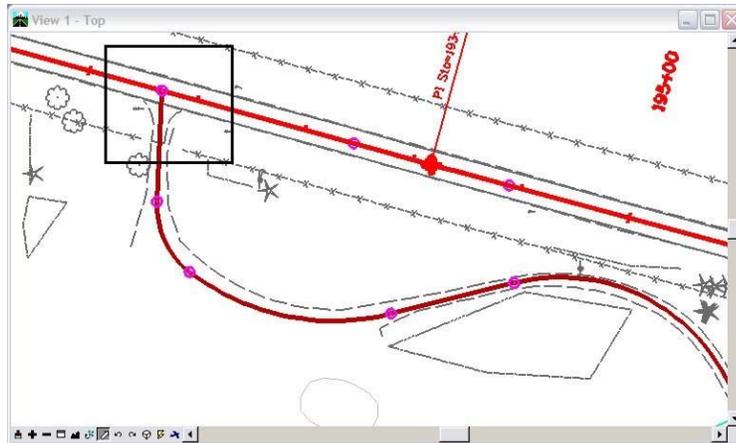
Note: The commands for Trim and Extend Alignment are dithered meaning they are not enabled. These 2 commands are an extension of the Horizontal & Vertical Elements command set which must be enabled.



2. Select **Tools > Application ADD-Ins**



3. **Enable *Horizontal and Vertical Elements Add-In***
4. Once enabled, **Select Geometry > Utilities > Extend Alignment**
5. At the prompt: ***Identify Alignment to extend to***, <D> on the alignment **Design Alt 1**
6. At the prompt: ***Identify Alignment to extend***, <D> on the alignment **Holder Driveway**
7. <D> to **accept** the presented solution



Note: The alignment-alignment intersection is now the initial point of the driveway alignment. Because the alignment was edited (extended) from its beginning, the initial station value was recalculated and is assigned a station value of -0+12.41. The negative value is due to the original points in the alignment retaining their assigned station locations.

8. From the pull-down menu **Geometry > Horizontal Curve Set > Stationing** define the driveway beginning station as **3+25**

Challenge Exercises:

- Display stationing at a 100 foot interval for Holder Drive
- Display alignment annotation for Holder Drive

Recall saved view Drive @ 180+00

- Import the graphics representing the driveway centerline into an alignment named **Drive 180+00**
- Use the command **Geometry > Utilities > Trim Alignment** to remove the portion of the driveway alignment that lies north of the main-line reference line.

Note: When using the trim alignment command, when prompted to select alignments, the order the alignments are selected is not important. However, the location of the data point in response to ***Identify portion to clip***, will determine both the alignment and the portion that will be eliminated.

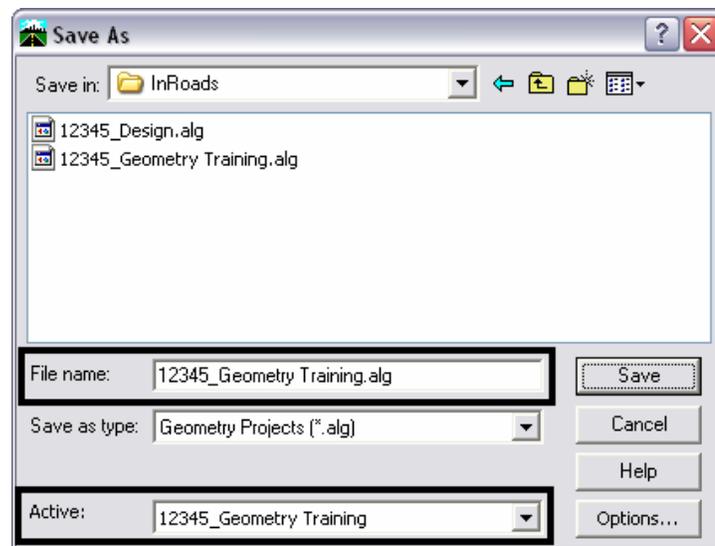
Lab 31: Saving Geometry

Alignments cannot be saved individually. They are saved when the geometry project is saved. Due to the fact InRoads works on geometry that is loaded in memory, the geometry project must be saved at appropriate times.

Geometry projects can be saved using several methods including:

1. From the pull-down **File > Save > Geometry Project**. The **Save As** dialog will appear with the Save as type set to **Geometry (*.alg)**.
2. Verify you are in the correct project directory.
C:\Projects\12345\Design\InRoads

Note: If the geometry project is already saved, then perform a **Save** operation instead of a **Save As** (see below).

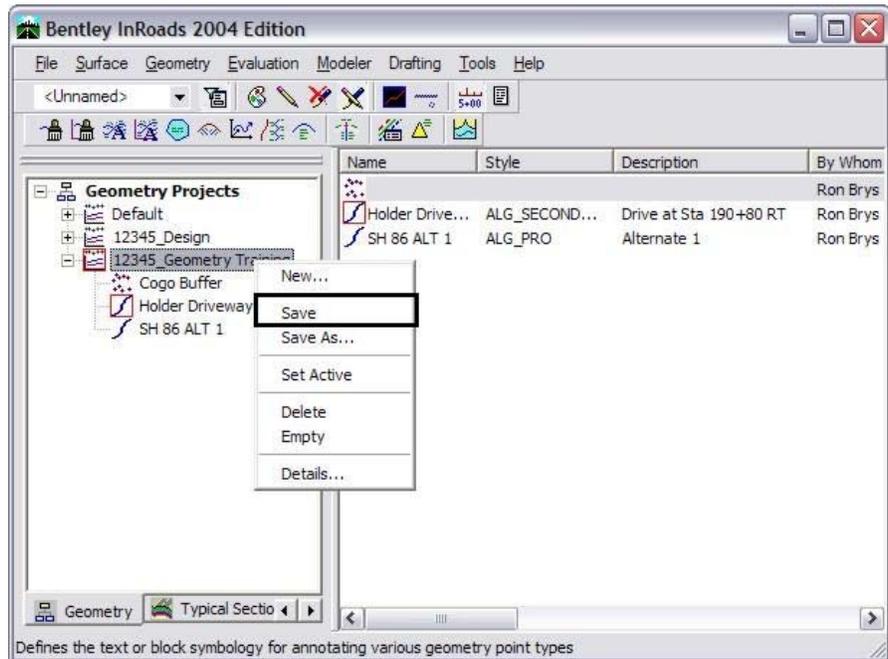


3. The file name should match the **Active** name at the bottom of the **Save As** dialog. If necessary, use the drop-down arrow in the **Active** field and reselect the desired name to ensure the saved file name will match the surface name.

Note: Geometry projects have both an internal name that appears in the dialog boxes in InRoads and a name on the hard drive that has an .ALG extension. Ensuring that the saved Geometry name in the project folder matches the Geometry name displayed in InRoads explorer will minimize any confusion.

4. <D> the **Save** button and then the **Cancel** button. The file will be saved to disk and the **Save As** dialog will close.

- Option 2 -Right-click on the **Geometry Project** in the Explorer menu and chose **Save**. The selected geometry project is saved.



Horizontal Elements - Overview



The **Horizontal Element** tools allow you to create alignments without knowing the PI information. They may be accessed from the toolbar shown above, or from the pull-down under **Geometry > Horizontal Elements**. Access to these tools is enabled as an application add-in (**Tools > Application Add-Ins**).

There are several advantages to this method. One of the greatest advantages of the horizontal alignments is that they do not have to be continuous. For example, you can create elements that have multiple constraints, leaving gaps between them, and then join them together with unconstrained tangents and curves.

Another advantage is the ease with which reverse and compound curves are created, as well as curves greater than 180 degrees.

When creating elements, you have three basic placement options for linear elements and the same three options for circular elements. These options are:

Fixed placement is used when you know exactly where the element is going to be located and you, in effect, lock it in place using a combination of coordinates, pass-through points, bearings or radii. When using the fixed placement options, the resulting elements are not tangent or coincident with any existing elements. This placement option is used to place standalone elements.

Floating placement is used to establish elements coincident and tangent to an existing element with a pass-through point and a radius (for curves) and with a pass-through point or a bearing for lines. They force the alignment to be coincident and tangent at the end where they join and will lengthen or shorten the element they are being attached to as necessary to meet the criteria specified. They will only ensure tangency and coincidence at the end where they are attached to an existing element. The floating placement options will not connect two existing elements.

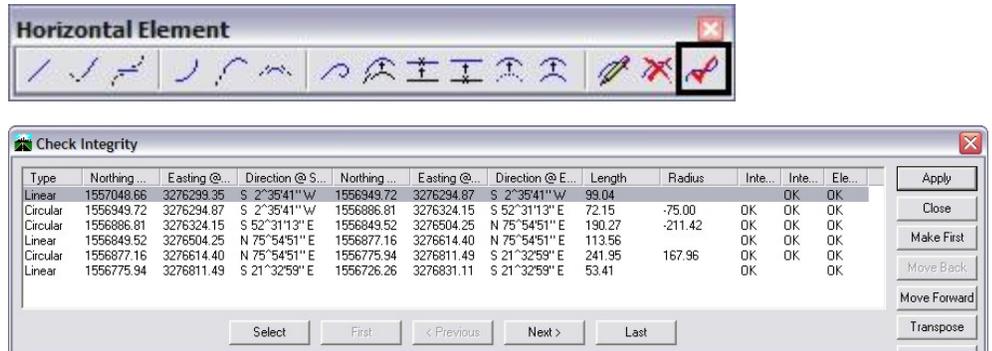
Free placement is used to connect two existing elements. It ensures coincidence and tangency at both ends where it connects to the existing elements. The existing elements may lengthen or shorten as necessary, but will not change locations.

Once an element is placed and accepted, it is treated the same as any other element no matter the placement method

To create a horizontal element alignment, first create an alignment name, assign a description and style, then use a combination of the fourteen commands to define the alignment. (The fifteenth command is for checking and correcting problems with the integrity of the alignment, described below.)

Check Integrity

The **Check Integrity** command on the **Horizontal Element** toolbar allows you to check the coincidence and tangency of horizontal alignments. The **Element** tools allow you to place the different components of the alignment in whichever order you wish, therefore it is not uncommon for elements to be “out of order”. This is one of the situations where **Check Integrity** can help, since you can check the integrity and make changes to elements to correct any integrity problems.



Horizontal Event Points - Overview

Horizontal Event points are points associated with an alignment that are not actually a part of the geometry of the alignment the way a PC, PT, or PI are. They are used for points that need to be annotated with stations and offsets, for points where you need special sections cut or for points where you want to be certain Roadway Modeler drops a template.

Select **Geometry > Horizontal Curve Sets > Events**.

Met...	Station	Offset	Northing	Easting	Elevation	Style
S+0	177+03.38	-53.90	1557461.16	3274998.84	-0.00	ALG_EXIST
N+E	177+03.38	-53.90	1557461.16	3274998.84	-0.00	ALG_EXIST

Horizontal Event Points may be added as either **Station and Offset** (they move with the alignment if it is relocated or re-stationed) or as **Northing and Easting** (they remain fixed by coordinate values. The station and offset values relate back to the alignment and update as the alignment shifts). This dialog can also be used to create Cogo points or to assign Cogo points at alignment vertices.

Cogo Commands - Overview

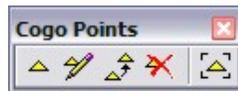
Coordinate geometry commands are delivered with InRoads. There is no need to exit, start, or launch another product to access them. These commands provide an alternative method for creating horizontal alignments. One of the main differences in creating the Cogo alignments (sometimes referred to as figures) and other alignments is that Cogo alignments require that the points be established first, then joined together to form the alignments.

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

- Cogo points are always numbered as you go (beginning with the seed number established in **Tools > Options > Geometry** or with the next available number..
- Cogo points can stand alone, such as when locating a fire hydrant or signs.

There are several toolbars devoted to coordinate geometry described here. These same commands may be found under the Geometry heading on the pull-down menu.

Cogo Point commands



Use the **Cogo Points** commands to create, edit, copy, delete, or navigate to Cogo points. These commands can be accessed through tool bars or by selecting Geometry pull-down menu.

Cogo Traverse commands

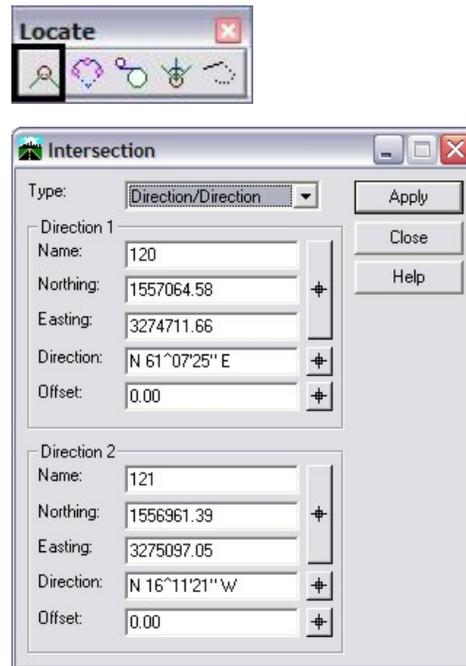


The Traverse dialog box contains the following fields and controls:

- Method:** Direction (dropdown)
- Insert Point:** To Cogo Buffer (dropdown)
- Occupied Point:**
 - Name: []
 - Northing: 1557457.43
 - Easting: 3274885.71
 - Elevation: -0.00
- Course:**
 - Direction: N 77°11'45" E
 - Distance Type: Horizontal Distance (dropdown)
 - Horizontal Dist.: 253.08
 - Horizontal Offset: 0.00
 - Vertical Type: Vertical Distance (dropdown)
 - Vertical Distance: 0.00
- Foresight Point:**
 - Name: 1
 - Description: []
 - Style: MDN_Set-ROW (dropdown)
- Buttons:** Apply, Close, Styles..., Help

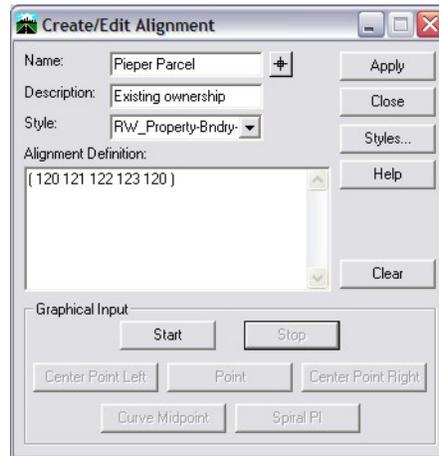
The **Traverse** commands can be used to generate Cogo points from known locations by inputting distance and bearing to the point being constructed (Direction Traverse). It may also be used for locating points by Angle or Deflection. Additionally, alignments and radial points can be created based on the status of the Insert Point.

Cogo Intersection Commands



The **Intersection** commands can be used to generate point locations based on known points, alignments, stationing, and/or offsets.

Create/Edit Alignment by Cogo Points



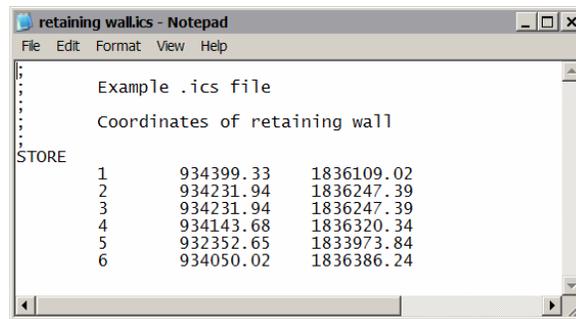
Alignments are created by chaining existing Cogo points together using the **Create/Edit Alignment** command. It is not necessary to create the alignment name prior to using this command; it may be entered here, along with a **Description** and **Style**. The points defining the alignment are listed in the **Alignment Definition**. The alignment can be defined graphically by selecting the **Start** button or the definition (or edits) can be keyed into the **Alignment Definition** field.

See the Bentley Help or InRoads Reference Guide for additional information on InRoads Cogo.

Geometry from Text Files -Overview

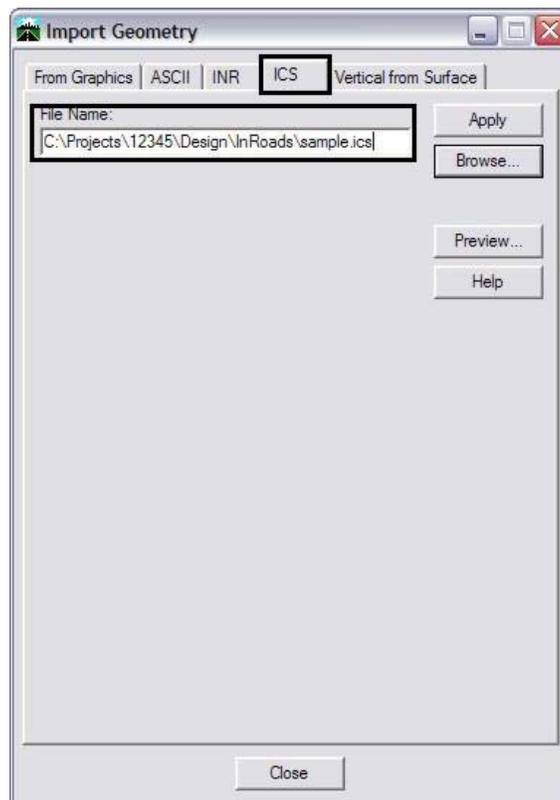
Text files may be imported in several formats, one of the easiest is to create an **.ics** file (Interactive Coordinate geometry Subsystem). This file type was first used with a product of the same name many years ago, but is still in use with InRoads today. It takes the format of commands along with the input for those commands.

For example a text file of coordinates can be formatted in an **.ics** file by adding a **Store** command at the top and formatting the file similar to the one shown below.



```
retaining wall.ics - Notepad
File Edit Format View Help
Example .ics file
Coordinates of retaining wall
STORE
1      934399.33  1836109.02
2      934231.94  1836247.39
3      934231.94  1836247.39
4      934143.68  1836320.34
5      932352.65  1833973.84
6      934050.02  1836386.24
```

Choose **File > Import > Geometry > ICS**. Browse to find the file, and then choose **Apply**.



The cogo points will be added to the active geometry project. You may then use **Geometry > Utilities > Create/Edit Alignment** to join the points, forming an Alignment and **Geometry > Horizontal Curve Sets > Define Curves** to add curves to the alignment. You can also accomplish these same tasks within the **.ics** file. See the Bentley Help topic *Alpha Cogo*.

ICS Geometry - Overview

ICS is the acronym for the “Interactive Coordinate Geometry Subsystem (also referred to as ‘Cogo classic’). ICS allows the user to use an ASCII format file to input and/or generate Cogo points. One of the benefits of using an ICS file is the documented history of commands used to generate Cogo points and the ability to edit and re-run the ICS command file.

A simple ICS may look like:

```
store 1000 3339.577 3225.237
locate direction 1000 1001 N25-56-26.4E 46.806
locate angle 1000 1001 1002 212^47'55.3" 196.801
locate angle 1001 1002 1003 205^37'27.1" 27.817
locate angle 1002 1003 1004 223^37'59.9" 49.787
locate angle 1003 1004 1005 205^24'32.3" 248.527
locate angle 1004 1005 1006 208^24'10.5" 47.488
locate angle 1005 1006 1007 240^34'12.5" 142.520
locate angle 1006 1007 1008 145^52'21.2" 98.809
locate angle 1007 1008 1009 215^31'58.3" 38.494
locate angle 1008 1009 1010 264^38'35.3" 36.027
locate angle 1009 1010 1011 195^46'57.3" 122.322
store figure boundary (1000-1011 1000)
```

This input format is similar to other alphanumeric Cogo software.

```
store 1 3351.824242 3921.504545 277.828485 !default *bmk1
store 2 3353.077879 3920.851212 278.283333 !default *bmk2
store 3 3353.636970 3920.560000 278.486061 !default *bmk3
store 4 3356.213939 3919.217879 277.382424 !default *bmk4
store 5 3357.152727 3918.728788 277.376364 !default *bmk5
```

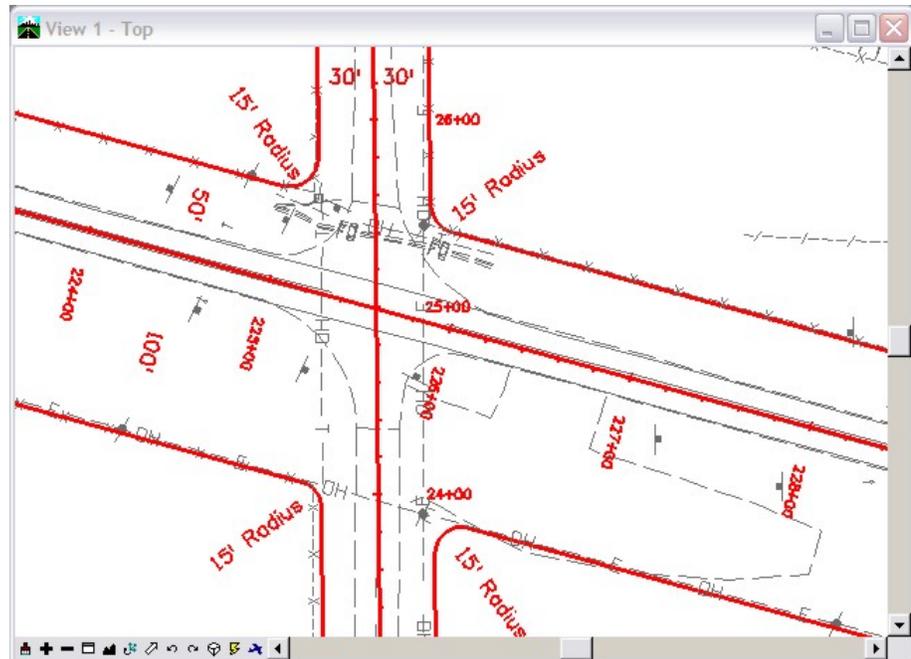
Additional data can be incorporated into an ICS file to include a preference name (!fname) as stored in your wysiwig.ini file and a description (*description).

A full list of available ICS commands and command format can be found in appendix C and in the InRoads Help menu by searching for “ics”.

Lab 32: Creating Parallel Horizontal Alignments

Offset alignments can be created to generate geometry for elements such as right-of-way limits, easement limits, under-drains, retaining walls, bridge decks, etc.

For this exercise generate right-of-way limits for the mainline road and the side road. The Side Road has a right-of-way width of 60' (30' on each side of centerline). The mainline alignment has a total right-of-way width of 150' being 50' feet north of the reference line and 100' south. At the intersection of the right-of-way lines a radius of 15' is required.

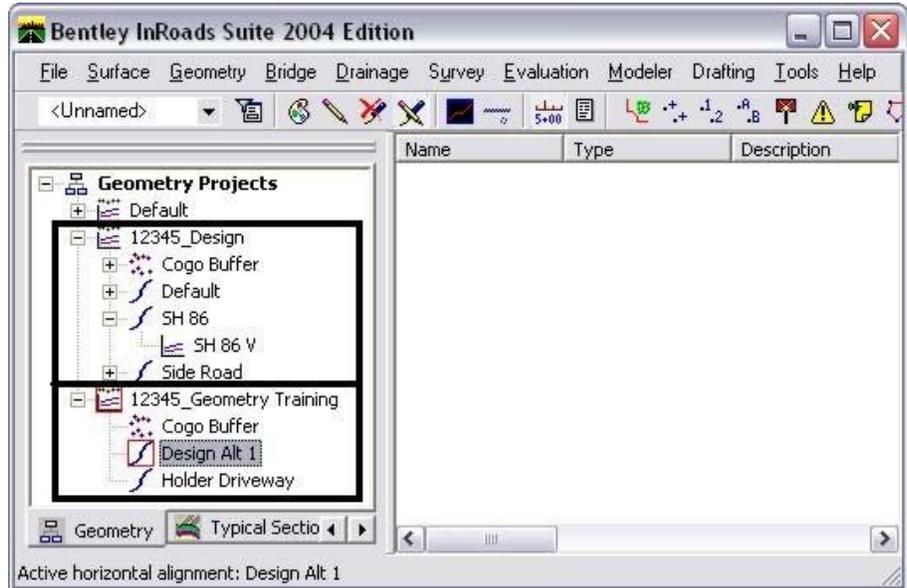


The workflow will consist of using an assortment of geometry commands:

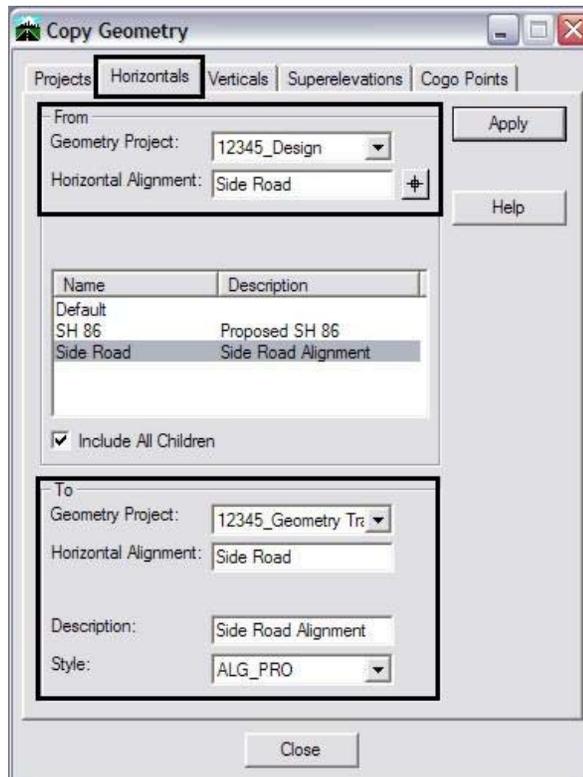
- **Copying Geometry** - between Geometry Projects
- **Multi-Center Curve** – radius returns
- **Parallel Horizontal Alignment** - offset alignments
- **Join Alignments** – connecting separate alignments
- **Join Elements** – simplifying geometry

Copying Horizontal Alignments

Alignments will be created relative to both the mainline alignment (SH 86) and the side road alignment (Side Road). These two horizontal alignments reside in two different geometry projects. To work efficiently, they should reside in a single geometry project.



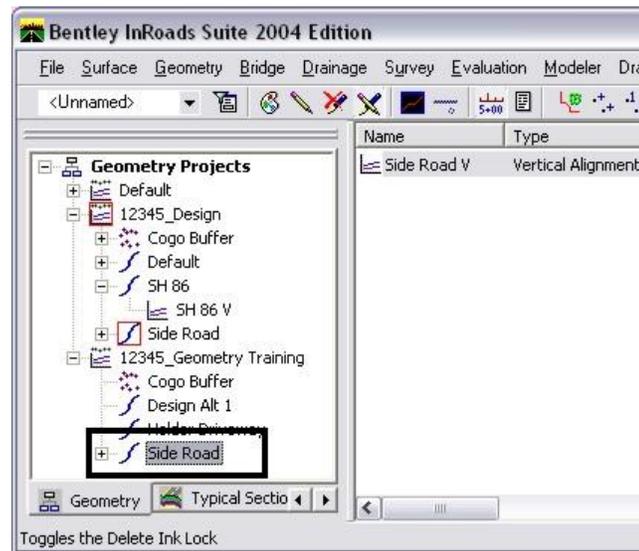
1. Select **Geometry>Copy Geometry**



2. **Copy** the alignment *Side Road* from geometry project *12345_Design* to the geometry project *12345_Geometry Training*

Note: Also copy alignment *SH 86* as *SH 86 ALT 1* if you feel the mainline alignment created by an earlier lab exercise may be problematic.

3. Verify the alignment was copied

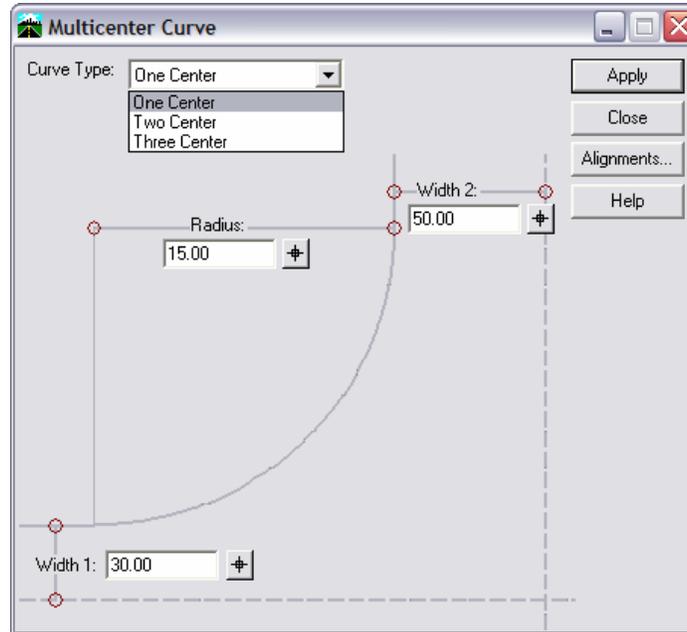


4. Set the Geometry project *12345_Geometry Training* as *Active* causing newly created geometry to populate this project

Multi-Center Curves

Begin by creating the radius returns north of the mainline alignment.

1. Select **Geometry > Utilities > MultiCenter Curve**



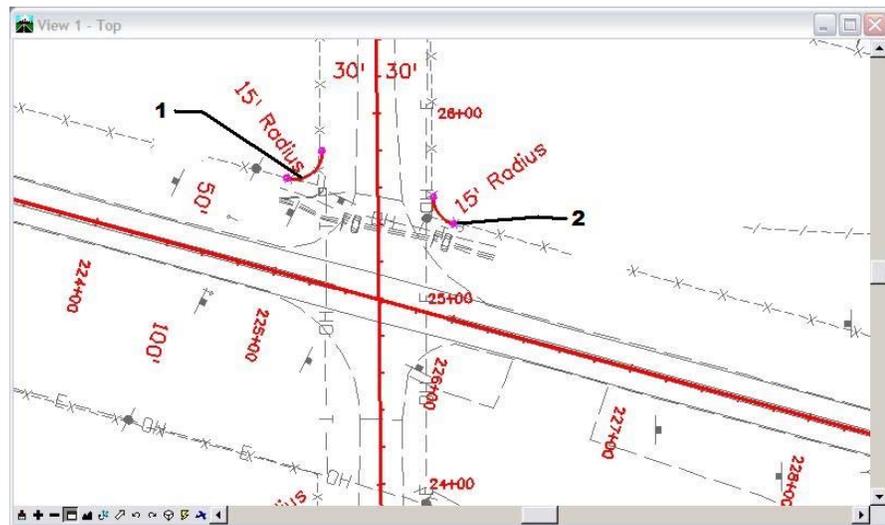
2. Choose **One Center**

Input:

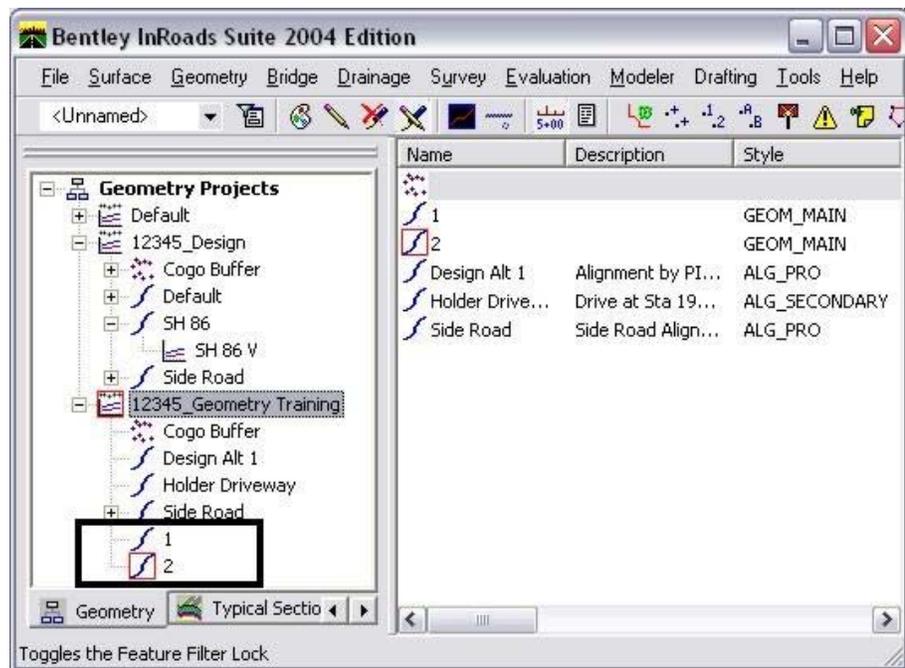
- Width 1: **30**
 - Width 2: **50**
 - Radius: **15**
3. <D> the Apply button. Follow the prompts.
 4. In the MicroStation view <D> on the **Side Road** alignment
 5. <D> on the **SH 86** alignment
 6. <D> in the **Northwest** quadrant, <D> to accept and create an alignment representing the radius return
 7. **Repeat** steps 3-5 & <D> in the **Northeast** quadrant

New alignments will be assigned names based on the seed alignment name specified in **Tools > Options [Geometry]**.

Two new alignments are created, 1 & 2



Note: Your stationing graphics may appear at a different location than shown above.



Offset Alignments by Station

Create the 50' offset alignment for the mainline alignment.

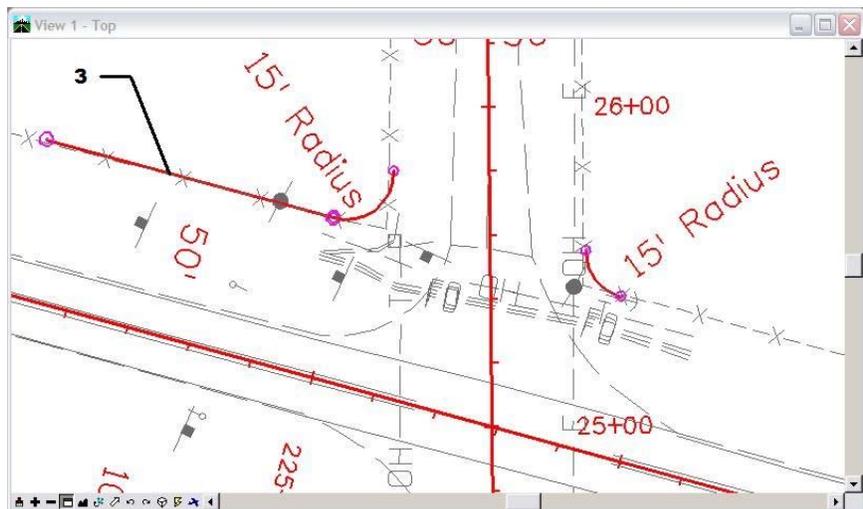
8. From the MicroStation pull-down menu, select **Utilities > Keyin**. The key-in browser is needed to input the desired station limits and offset distances. Without this, they could be defined graphically.



9. From the InRoads pull-down menu **Geometry > Utilities > Parallel Horizontal by Station**. Following the prompts.
10. In the MicroStation view <D> on the mainline alignment.
11. **Identify First Station/Key-in Station**: Key-in **224+00**
12. <D> the Run button (or <enter>)



13. **Identify Second Station/Key-in Station**: Key-in **224+93.20**
14. <D> the Run button.
15. **Identify Location**: key-in **-50** (50' to the left) alignment 3 is created and displayed.

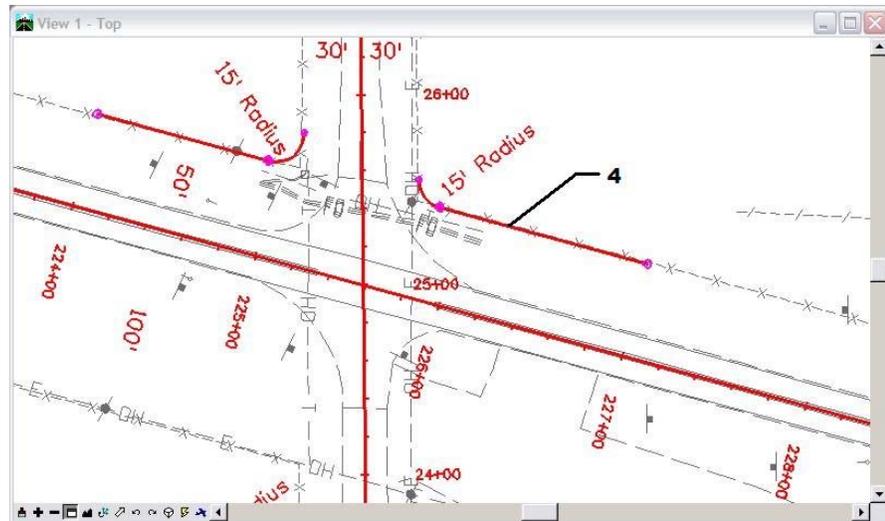


16. Repeat the **Geometry > Utilities > Parallel Horizontal by Station** command to the east of the sideroad.

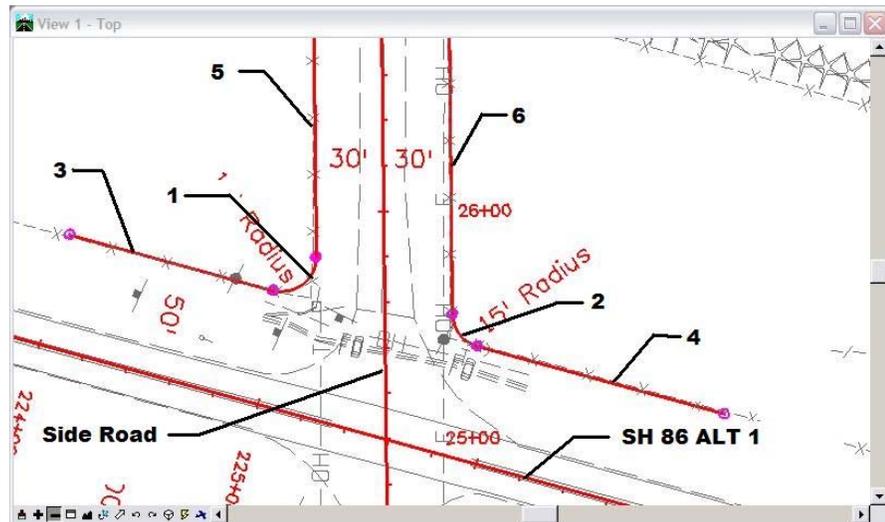
- Station limits of: **225+86.76 to 227+00**, 50' left of US 86 Alt 1

Note: The station limits can be graphically selected by issuing a data <D> point in the MicroStation view. The offset distance can also be graphically selected but using the key-in field allows a specific distance to be input.

Alignment 4 is created and displayed.



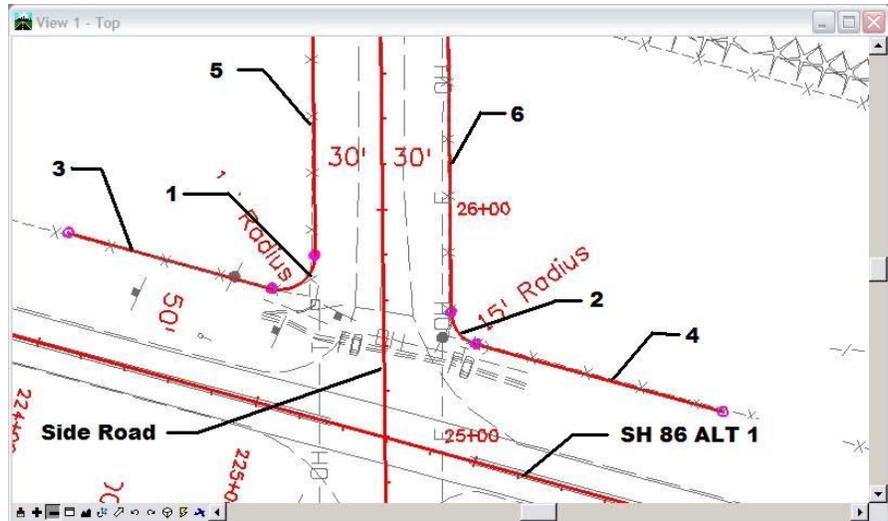
17. Re-execute the command to create the alignments along the Side Road north of the radius returns.



Join Alignments

The Join Alignment command connects continuous and non-continuous geometry components together to form a single alignment. This command operates by either connecting the components with a straight line segment or by paralleling an alignment to define the configuration of the created geometry.

Join alignments 3, 1, & 5 to create the Northwesternly right-of-way limits.



18. Select **Geometry > Utilities > Join**



19. Check *on* Delete Original Alignments. By doing so, the first alignment identified (3) will become the final alignment name and alignments 1 and 5 will be deleted upon completion of the command.

20. <D> the OK button and follow the prompts

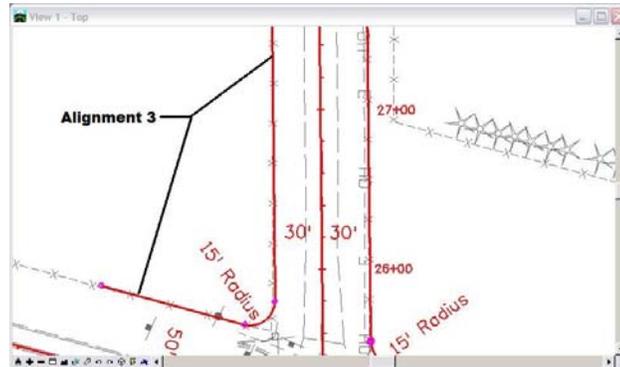
21. **Identify Initial Alignment:** <D> on alignment 3

22. **Identify Alignment to Parallel/Skip:** <D> alignment 1 to parallel (overlay) this alignment.

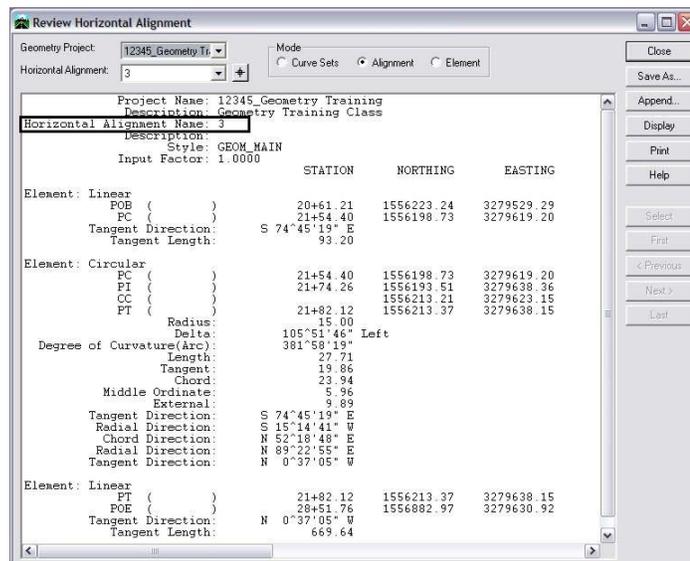
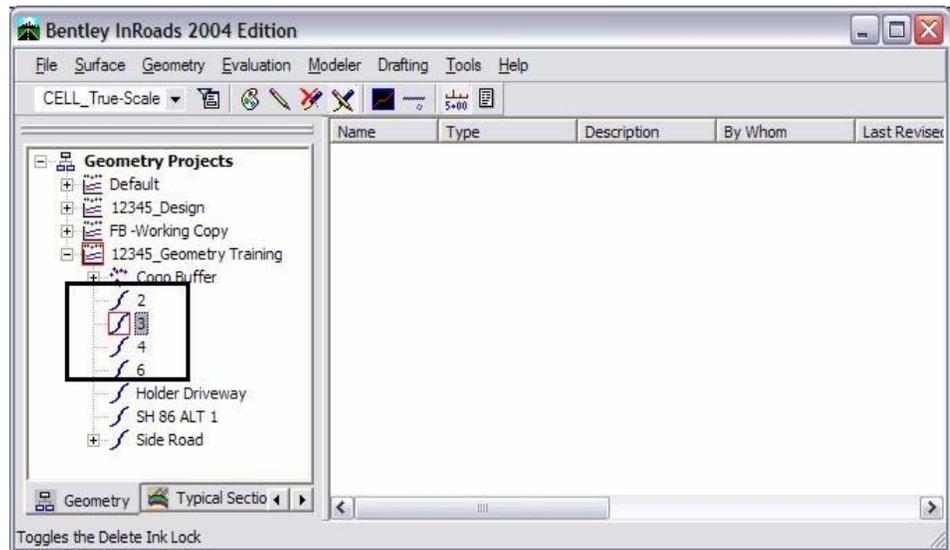
If a reset <R> is issued in the above step, a tangent line would be created from the end of alignment 3 to the beginning of alignment 5. By selecting the alignment representing the radius return, a curved section is generated at a zero offset to alignment 1

23. **Identify Next Alignment:** <D> on alignment 5

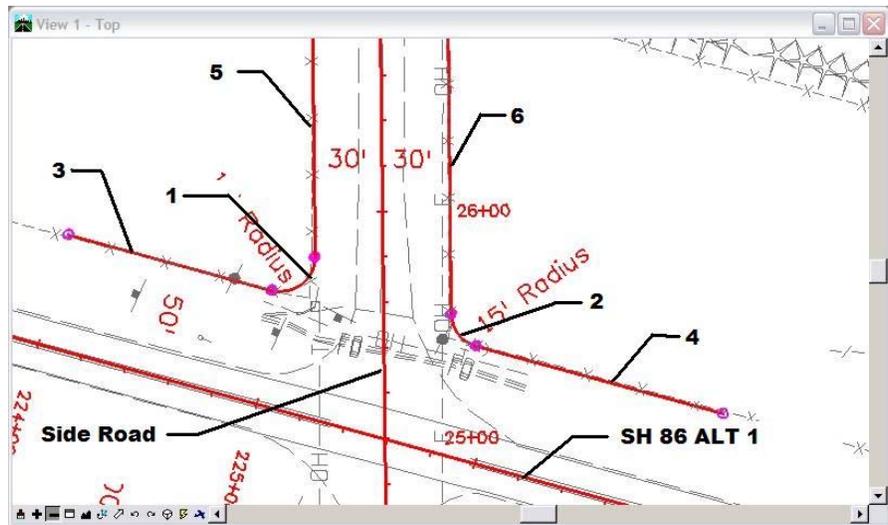
24. **Accept or Reject:** <D> to **accept** the dynamic display
25. Reset <R> <R> twice to **terminate** the command



Alignment 3 is now the combination of the alignments 3, 1, & 5.
Alignments 1 & 5 are removed from the geometry project..



26. Join alignments 6, 2, & 4 to create the northeasterly right-of-way limits.

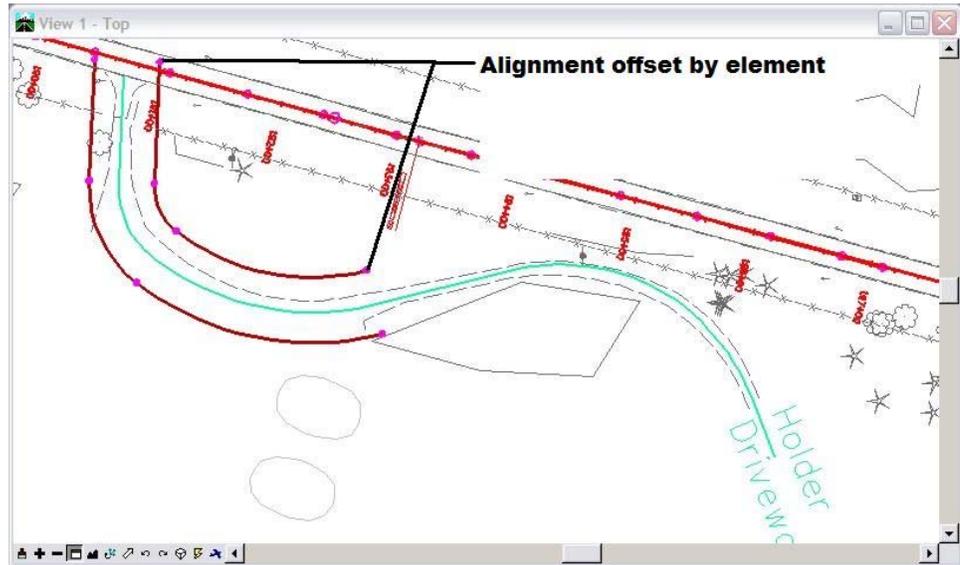


Once the above step is completed, alignments 3 and 6 define the right-of-way limits on the north side of the intersection.

Offset Alignments by Elements - overview

Choose **Geometry > Utilities > Parallel Horizontal by Element**

Parallel by *element* differs from by Station in that you can select the limits of the alignment to offset by selecting, <D>, alignment components (tangent or curve) to define the desired limits.

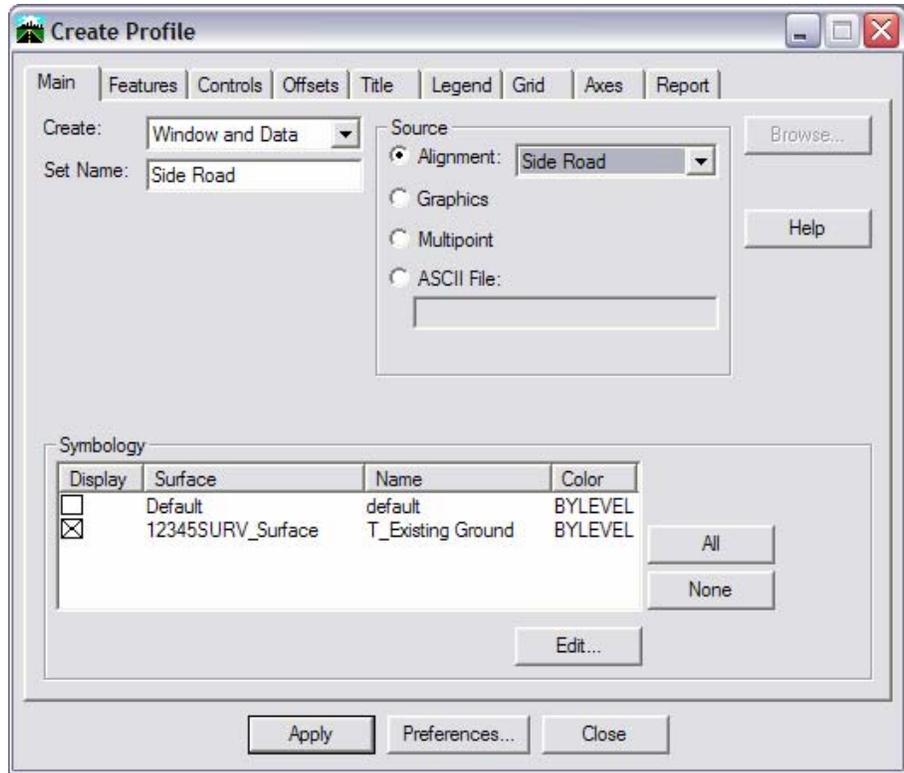


Creating Vertical Alignments – Overview

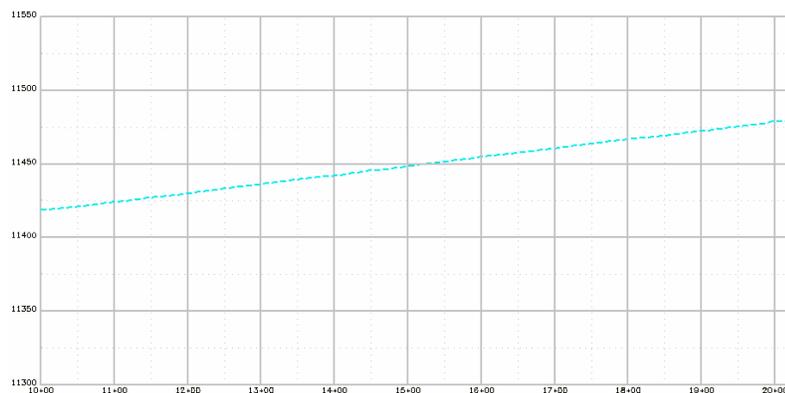
Creating Profiles

A profile of the horizontal alignment showing the existing surface ground line is required before creating the design profile - the vertical alignment.

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



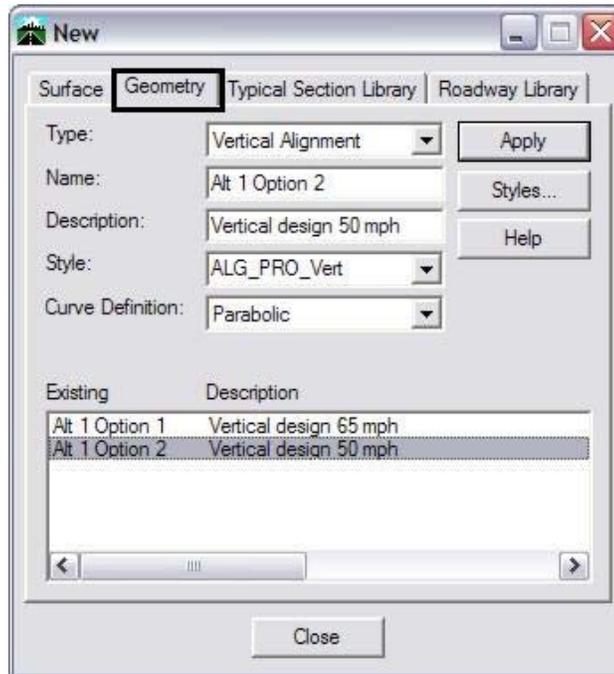
Multiple surfaces may be shown on one profile by selecting them in the **Symbology** category. You may also show features that cross the alignment and projected features on the profile. These may be toggled on from the **Features** tab before creating the profile.



Creating Vertical Alignments

A geometry project must be loaded prior to creating a vertical alignment. The vertical alignment must be created as a child to a parent horizontal alignment.

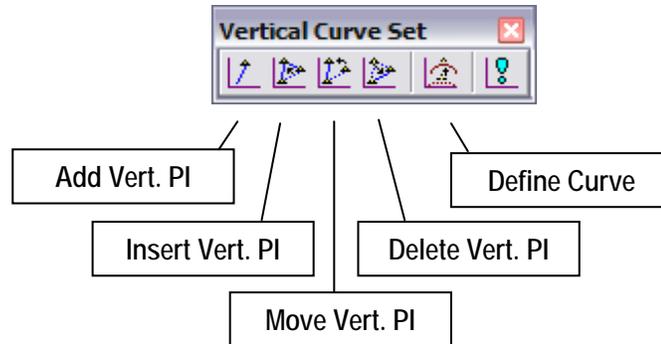
Once the geometry project is loaded (and the parent horizontal is active), you may create a new alignment name. Choose **File > New > Geometry** and set the **Type** to **Vertical Alignment**. Enter the **Name**, **Description** and select a **Style**.



<D> **Apply** after filling in the appropriate information. Once a profile set is created, the **Vertical Curve Set** or **Vertical Element** tools can be utilized to enter vertical alignment data.

Vertical Curve Set Commands

The **Vertical Curve Set** commands make up an easy way to create alignments. They consist of five primary commands described below.



Add Vertical PI – **Add Vertical PI** is used to create a PI that begins a new alignment, or to add a PI onto either end of an existing alignment.

Insert Vertical PI – **Insert Vertical PI** is used to add a PI to an existing alignment between two existing PIs.

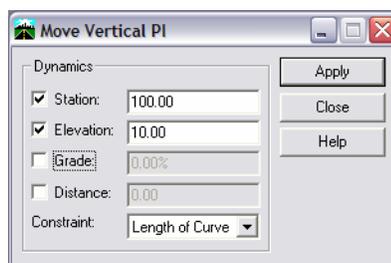
Move Vertical PI – **Move Vertical PI** is used to change the location of an existing vertical PI.

Delete Vertical PI – **Delete Vertical PI** is used to remove a PI from an existing alignment. For removing more than one PI, you must choose and accept each one individually. To remove all PIs associated with an alignment, but leave the alignment name, right-click on the alignment name in the Explorer menu and choose Empty.

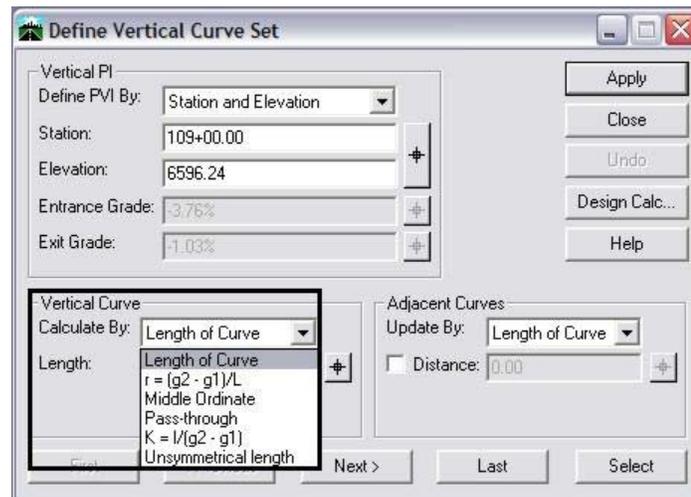
Define Vertical Curve – **Define curve** is used to create a curve at a PI on an alignment, or to revise an existing curve on an alignment. The **Previous** and **Next** buttons are used to step through the alignment. The tangents forming the PI where the curve is to be defined will be highlighted graphically.

Vertical Event Points – This last icon is used to define unique and specific locations relative to the active vertical alignment for supplemental template drops, cross section locations, design constraints, etc.

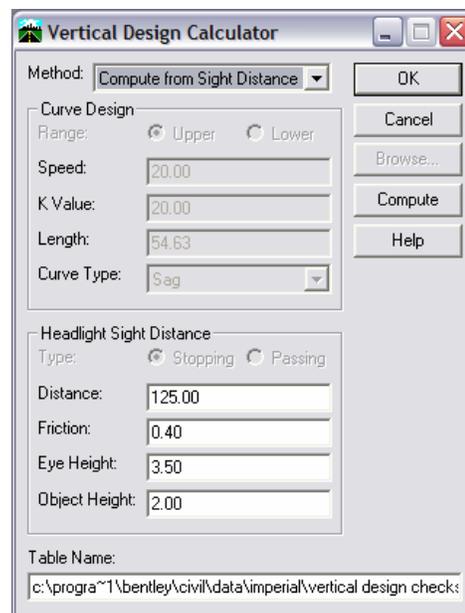
Dynamics – The **Dynamics** dialog allows you to set intervals for placement of the vertical PIs. It locks your cursor into the desired station, elevation and/or grade intervals.



Selecting **Geometry > Vertical Curve Set > Define Curve** provides multiple choices for defining vertical curves.



The **Design Calculator** is used to compute or look up curve data to ensure your design criteria are met.



Keyins – There are additional keyins that can be useful when creating a vertical alignment, including:

SE=station,elevation (SE=34500,8421)

DG=distance,grade (DG=1500,-2.5% or DG=1500,-.025)

Instructor demonstration – time permitting

7. Creating Cross Sections

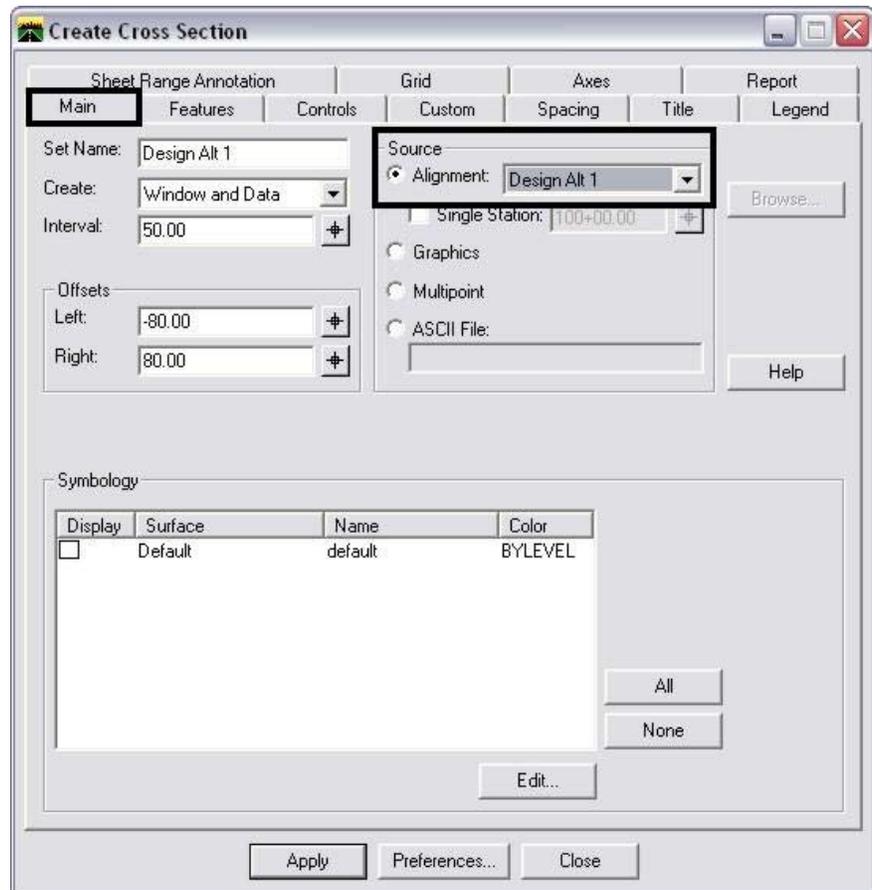
Cross Section Sets

Cross sections can be created at specified intervals, as single sections at specific locations, or skewed to the reference alignment.

1. Evaluation > Cross Sections > Create Cross Section

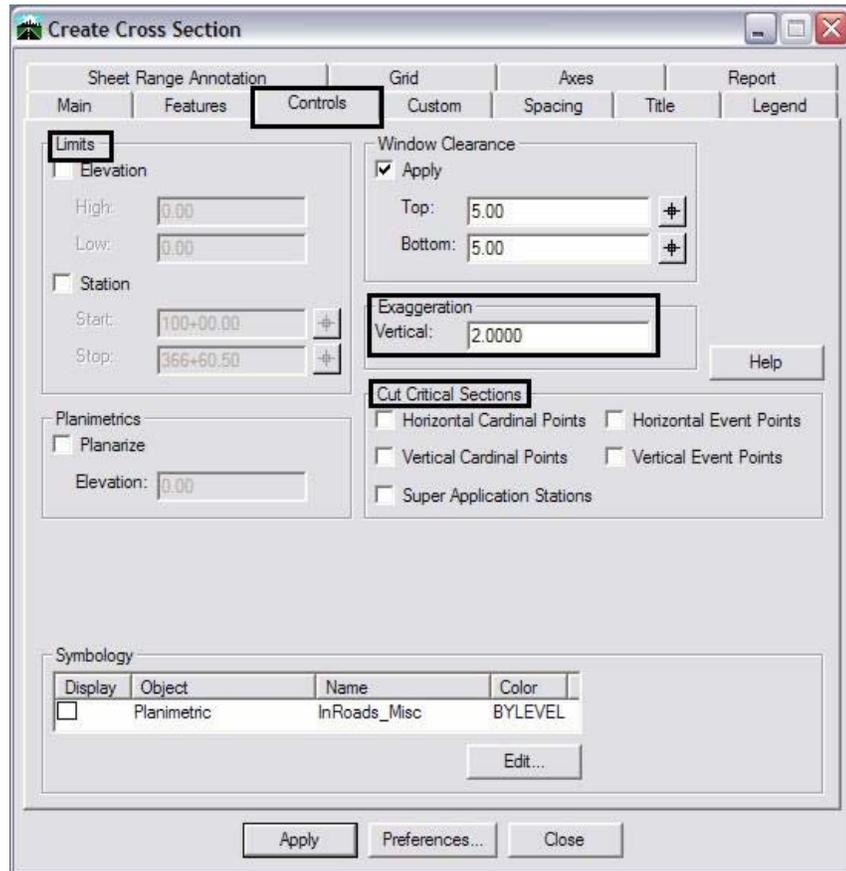
Cross Section **Main** Tab

- Cross sections created relative to alignment **Source *Design Alt 1***
- Sections created every **50' – Interval**
- Sections will be **160'** wide centered on reference line – **Offsets**
- One surface will display in sections – **Symbology**

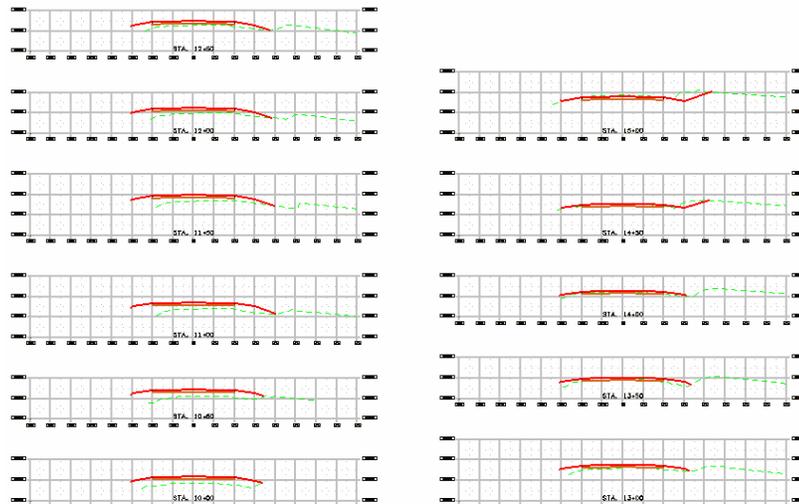


Cross Section **Controls** tab, allows:

- Station limits constraints
- Vertical constraints
- Vertical Exaggeration
- Supplemental sections



2. <D> Apply, <D> identify location for cross section set display in the CADD file

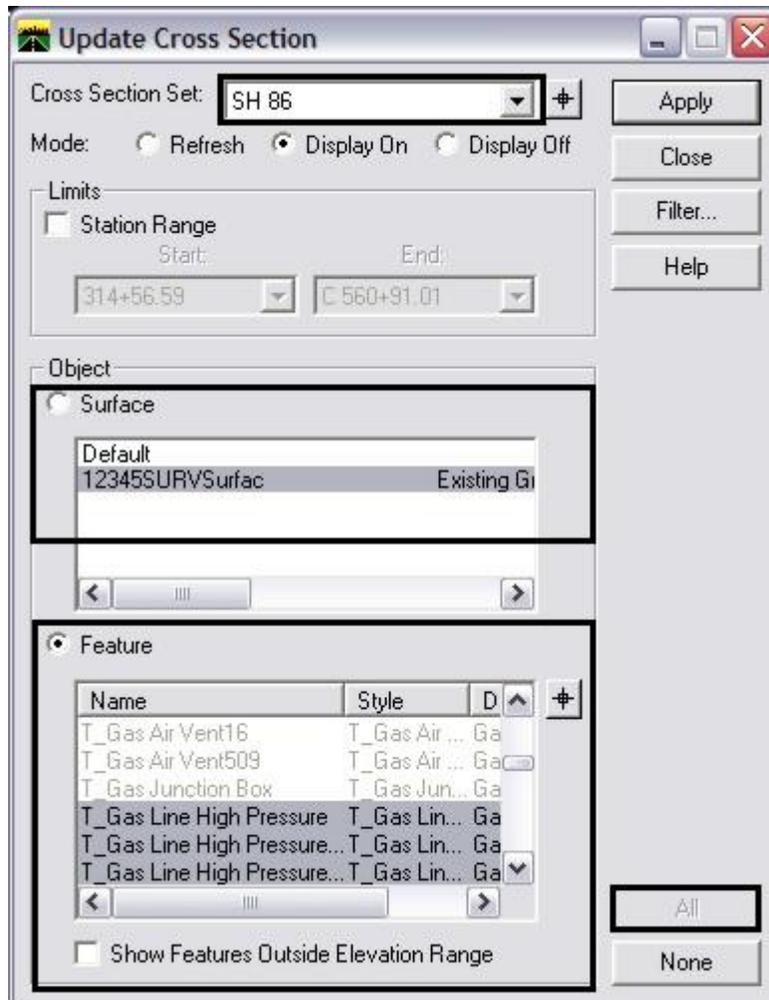


Updating Cross Sections

When a cross section set is created the user has the option to display items such as: multiple surfaces, profile lines offset from the horizontal alignment, and features such as underground utilities and pipes.

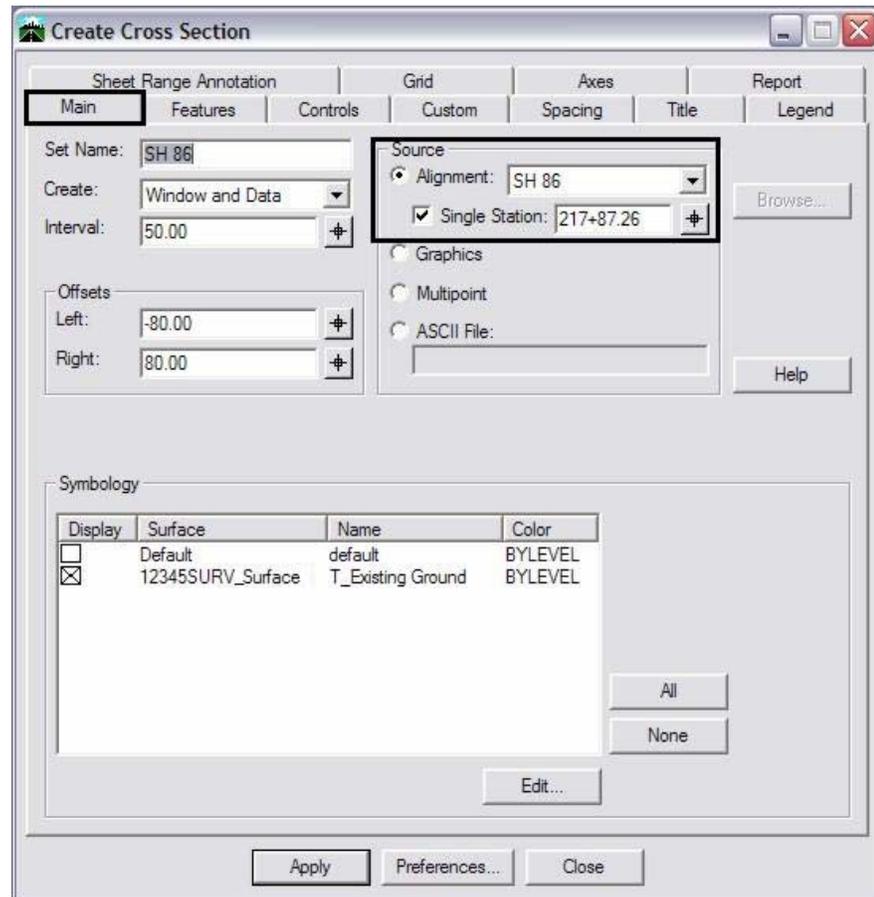
If there are changes that need to be made to a profile after it is created, update the profile for either surface line or features that exist in those surfaces.

1. From the pull down menu **Evaluation > Cross Section > Update Cross Section**. The **Update Cross Section** dialog will appear.

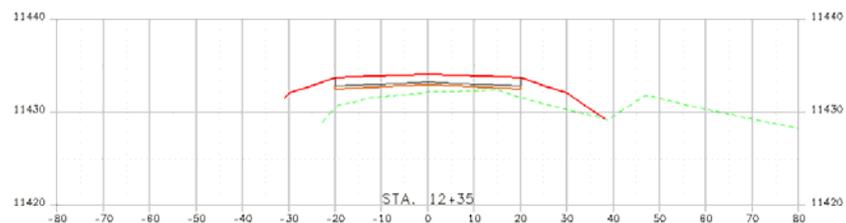


Individual Cross Sections

Cross sections can be created at individual locations. Beneficial for evaluating specific points of interest such as roadway intersections, access points, drainage, utility, or sign locations.



Source toggled to **Single Station**



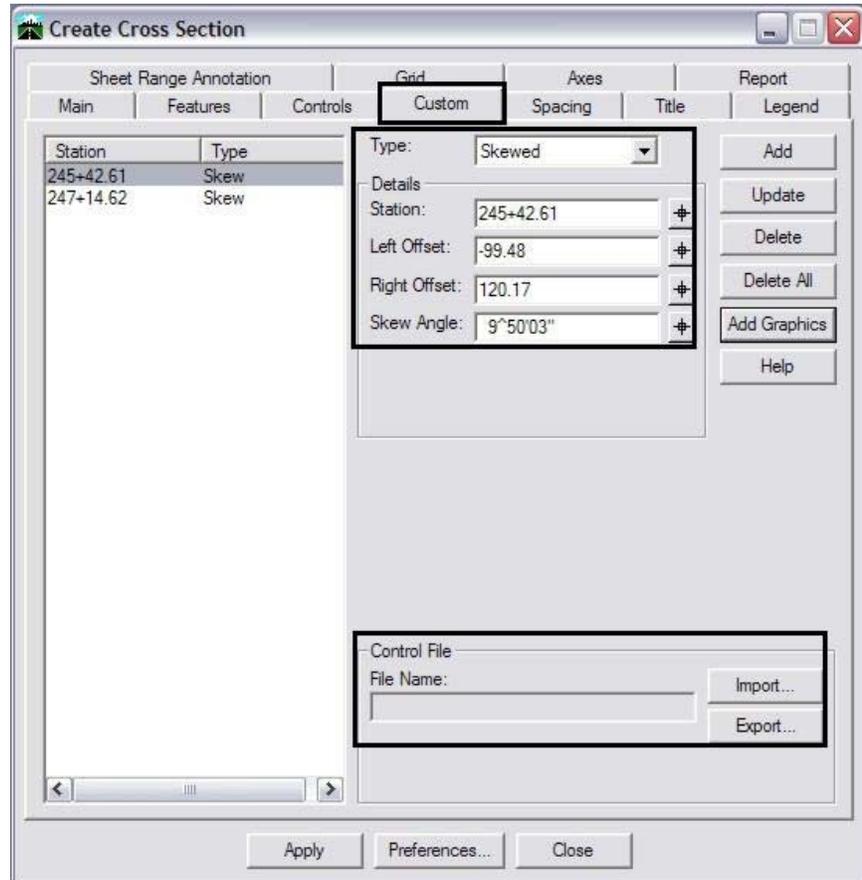
Cross Section generation options – Set Source to:

- Graphics – Select a MicroStation graphic to create cross sections perpendicular to selected object
- Multipoint – Creates cross sections relative to user selected <D> points

Skewed Cross Sections

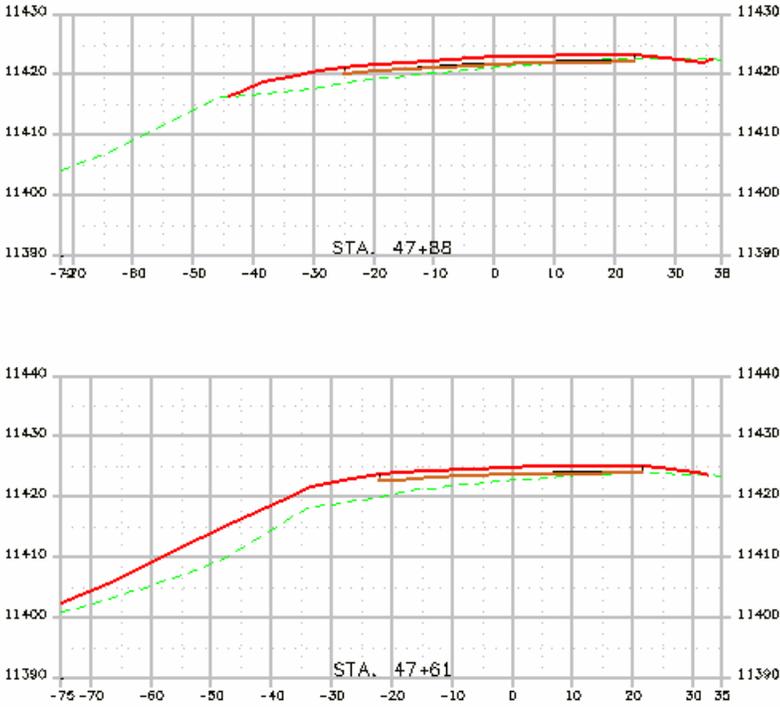
Cross sections can be generated that are created skewed to the reference alignment.

1. Evaluation>Cross Sections>Create Cross Sections



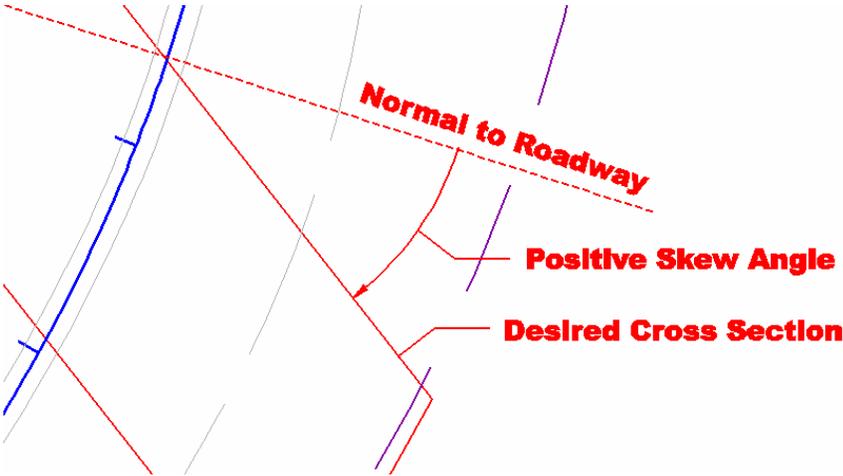
Cross Section **Custom** tab

- Type - Skewed
- List of sections to be created - Station | Type
- Station, Offsets, and Skew angles can be keyed-in
- <D> on Station , Type entry to review location details
- Cross section list can be stored to ASCII (Control) file for recall



The skew angle is computed in a clockwise direction. A perpendicular cross section has a skew angle of zero.

Caution: Skew angles between 90 and 270 degrees will create cross sections facing 'down station'.



Note: End area computations will not include skewed cross sections in earthwork computations.

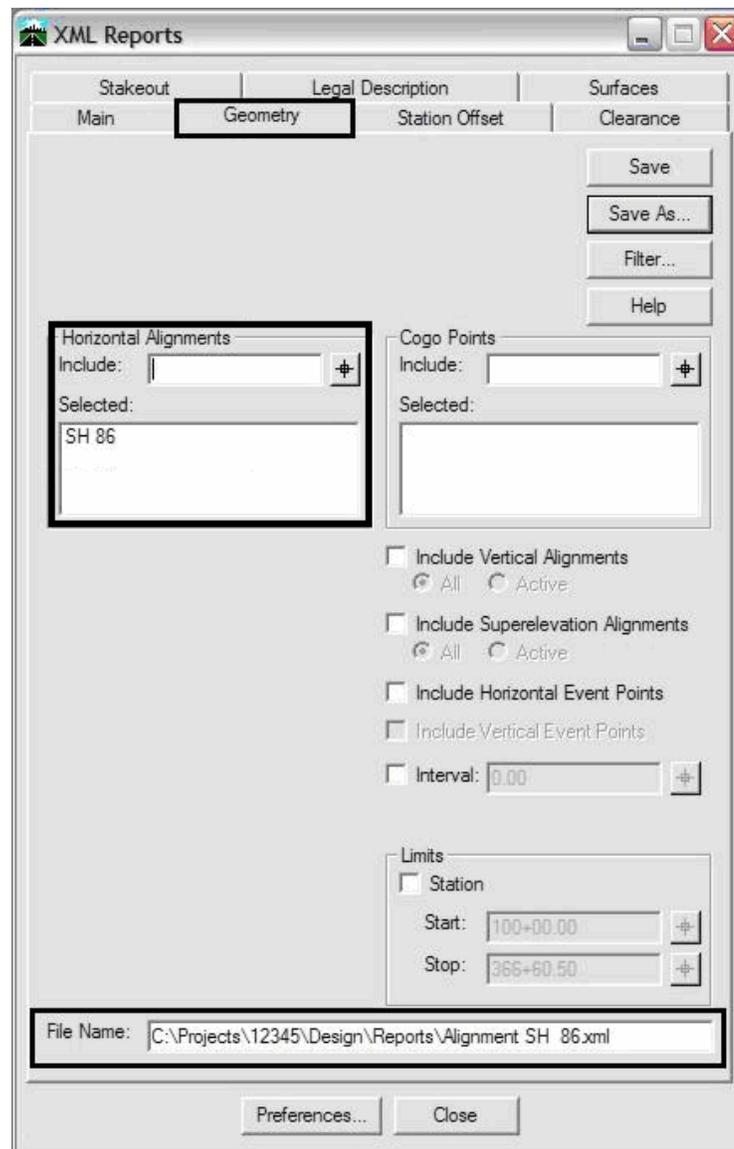
8. XML Reports - Overview

Two types of reporting are currently available within InRoads. The older version which is based on DBAccess reports is being discontinued with an upcoming release of InRoads. The old format is being replaced with a reporting utility based on the eXtensible Markup Language or more commonly referred to as XML. Like the HTML language used for web development, XML reporting is based on tags and attributes which delineate elements of data.

Another advantage of the XML reports is their use of a style sheet (.xsl) file to format the report. The programming of the format is very familiar to HTML, so if you're familiar with HTML programming, you can create your own style sheets or modify the predefined ones.

Generating an Alignment Report

Select **Tools > XML Reports**. (If the XML Reports command is not available on your pull-down menu in InRoads, first toggle **XML Reports** on in **Tools > Application Add-ins**.) Choose the tab associated with the type of report you wish to create, and specify the criteria on which to report.



Select **Save As** and specify a name for the **.xml** file that will be created. The **Tools > View XML Reports** command is automatically executed, and a default format chosen for your report.

Bentley InRoads Report Browser - C:\Projects\12345\Design\Reports\Alignment SH 86.xml

File Tools Help

C:\Program Files\Workspace-CDOT\Stand

- Bridge
- CDOT
 - CDOT Aline Description.xml
 - CDOT Air Rights Easement Descrip
 - CDOT Fee Parcel Description.xml
 - CDOT Permanent Easement Descr
 - CDOT Slope Easement Description
 - CDOT Temporary Easement Descr
 - CDOT Utility Easement Description.
 - CDOT_ListCoordinates.xml
 - CDOT_PropertyDescription.xml
- Clearance
- Custom
- DataCollection
- Geometry
- Images
- LegalDescription
- Schemas
- Stakeout
- StationOffset
- Surfaces
- Turnouts
- _Themes
- cdotformat.xml
- format.xml
- raw-xml.xml
- ShowAll.xml



List Coordinates Report

Report Created: 6/5/2007
Time: 10:50am

Project: 12345_Design
Description: SH 86 Design Alignments
File Name: C:\Projects\12345\Design\InRoads\12345_Design.alg
Last Revised: Ron Brys 6/4/2007 2:34:14 PM

Alignment Name: SH 86

POINT NAME	NORTH (ft)	EAST (ft)	ELEV (ft)	DESCRIPTION
1000	1558417.74	3267409.40	6630.07	
200	1558450.09	3268517.55	6594.09	
	1558457.06	3268756.14	6589.71	
201	1537339.09	3269133.91	0.00	
202	1558458.63	3268994.82	6579.87	
203	1558467.52	3270345.09	6604.18	
	1558469.66	3270669.73	6612.08	
204	1555467.58	3270364.85	0.00	
205	1558402.30	3270987.32	6611.28	

Other formats may be chosen from the list of styles sheets presented along the left of the screen.

Bentley InRoads Report Browser - C:\Projects\12345\Design\Reports\Alignment SH 86.xml

File Tools Help

C:\Program Files\Workspace-CDOT\Stand

- Bridge
- CDOT
- Clearance
- Custom
- DataCollection
- Geometry
 - Area.xml
 - ControlLineData.xml
 - HorizontalAlignmentAndEvents.xml
 - HorizontalAlignmentCurveSetReview
 - HorizontalAlignmentReview.xml
 - HorizontalAndVerticalAlignmentRev
 - HorizontalElementsXYZ.xml
 - ListCoordinates.xml
 - ListCoordinatesStation.xml
 - ProjectAlignmentListing.xml
 - SettingOut Table.xml
 - SlewDiagram.xml
 - SuperelevationAlignment.xml
 - SuperelevationData.xml
 - VerticalAlignmentAndEvents.xml
 - VerticalAlignmentReview.xml
- Images
- LegalDescription
- Schemas
- Stakeout
- StationOffset
- Surfaces
- Turnouts
- _Themes
- cdotformat.xml
- format.xml
- raw-xml.xml
- ShowAll.xml



List Coordinates with Station Report

Report Created: 6/5/2007
Time: 10:51am

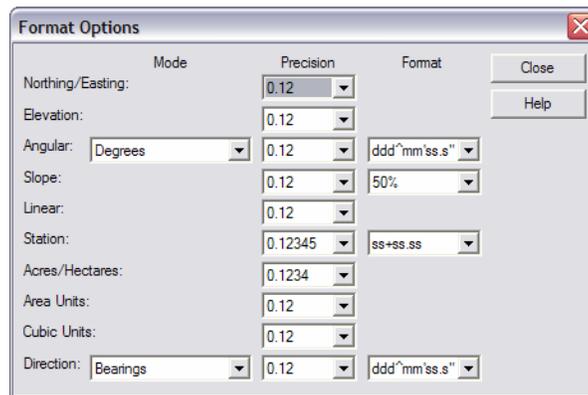
Project: 12345_Design
Description: SH 86 Design Alignments
File Name: C:\Projects\12345\Design\InRoads\12345_Design.alg
Last Revised: Ron Brys 6/4/2007 2:34:14 PM

Input Grid Factor: 1.000000 **Note:** All units in this report are in feet unless specified otherwise.

Alignment Name: SH 86

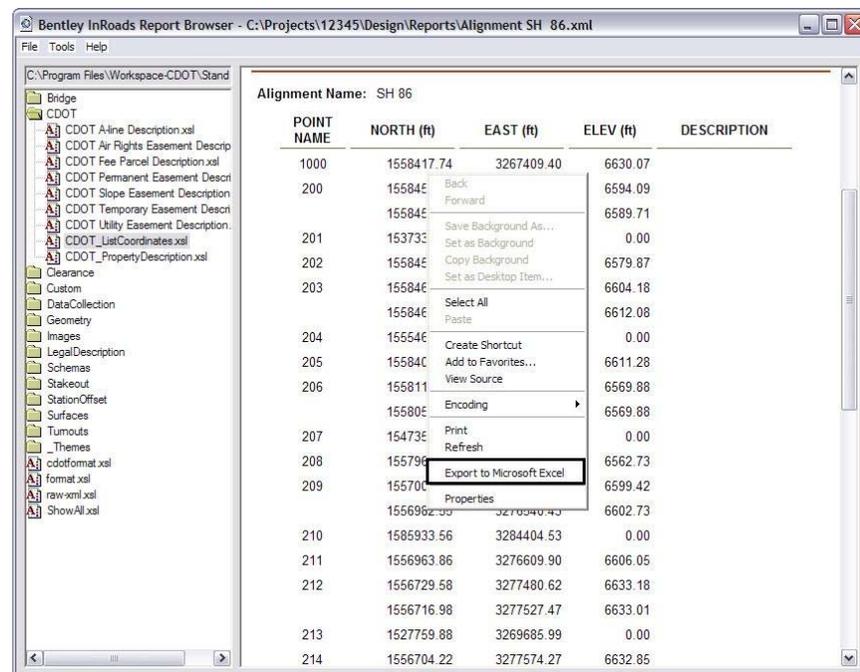
Station	Point Type	Easting (X)	Northing (Y)	Elevation (Z)
100+00.00000	POB	3267409.40	1558417.74	6630.07
111+08.62376	PC	3268517.55	1558450.09	6594.09
115+85.97549	PT	3268994.82	1558458.63	6579.87
129+36.27278	PC	3270345.09	1558467.52	6604.18
135+83.05577	PT	3270987.32	1558402.30	6611.28
149+55.56988	PC	3272329.96	1558117.51	6569.88
156+00.43484	PT	3272956.51	1557965.30	6562.73
192+44.72291	PC	3276471.06	1557001.57	6599.42
193+88.59372	PT	3276609.90	1556963.86	6606.05
202+90.28719	PC	3277480.62	1556729.58	6633.18
203+87.30106	PT	3277574.27	1556704.22	6632.85
231+75.29849	PC	3280264.16	1555971.14	6610.74
234+72.96901	PT	3280558.39	1555932.44	6601.66
248+08.08059	PC	3281893.49	1555938.50	6558.92

Choose **Tools > Format Options** from the XML report browser.

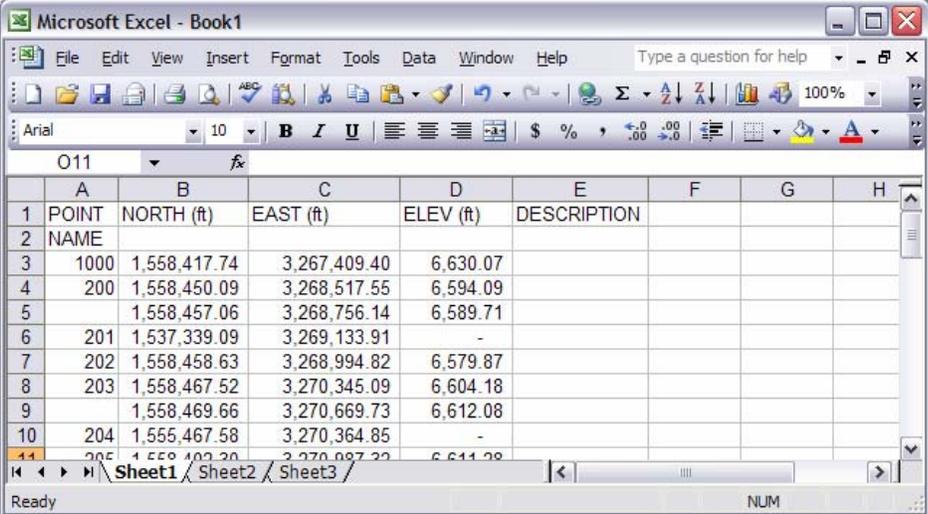


You can change any of the formats or precisions shown and it will automatically change the report.

While viewing the xml report, **<R>** on the screen - a fly-out menu appears.



<D> on **Export to Microsoft Excel** - Excel will launch and display the results



Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U

	A	B	C	D	E	F	G	H
1	POINT	NORTH (ft)	EAST (ft)	ELEV (ft)	DESCRIPTION			
2	NAME							
3	1000	1,558,417.74	3,267,409.40	6,630.07				
4	200	1,558,450.09	3,268,517.55	6,594.09				
5		1,558,457.06	3,268,756.14	6,589.71				
6	201	1,537,339.09	3,269,133.91	-				
7	202	1,558,458.63	3,268,994.82	6,579.87				
8	203	1,558,467.52	3,270,345.09	6,604.18				
9		1,558,469.66	3,270,669.73	6,612.08				
10	204	1,555,467.58	3,270,364.85	-				
11	205	1,558,402.20	3,270,097.22	6,611.28				

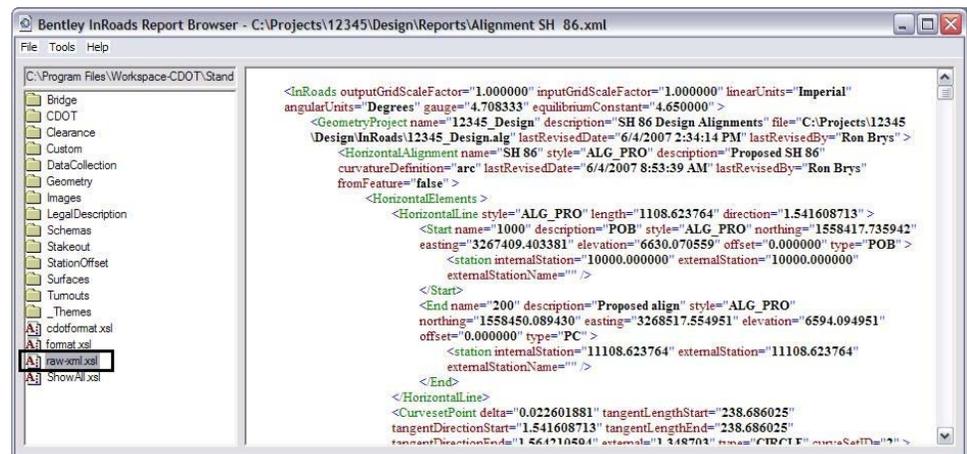
Sheet1 / Sheet2 / Sheet3 /

Ready NUM

Note: The output to Excel will only contain data from individual alignments based on the location in the xml report the fly-out menu was activated.

To view the source information the xml report was generated from:

In the Report browser, <D> Raw-xml.xml in the left panel



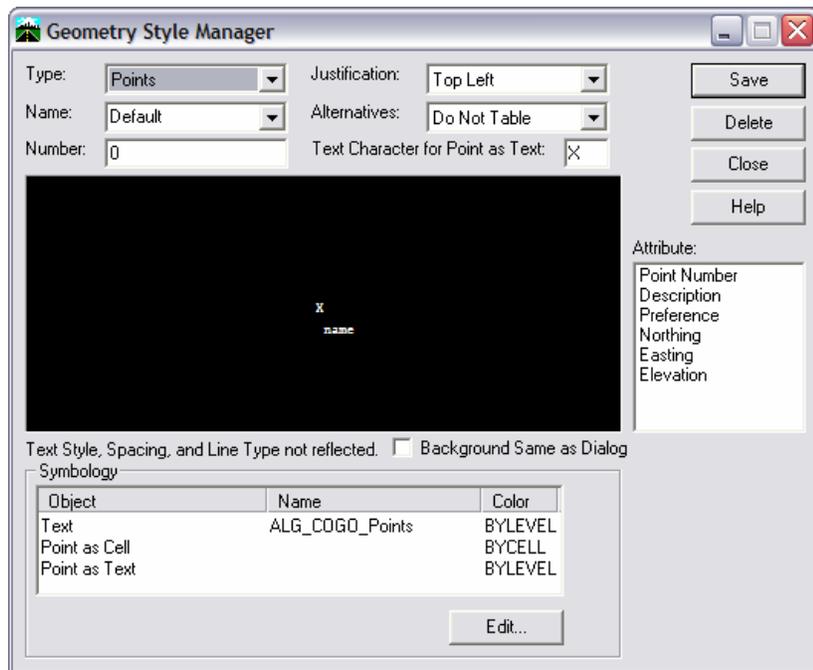
What you see are the xml tags and attributes which define the report contents. Formatting of this data for display is accomplished through the use of xsl, or style sheets. Style sheets can be developed by the user for customized reports or formats.

Appendix A - Geometry Style Manager

The attributes for Geometry Styles are set in the Geometry Style manager. These settings are stored in the CDOT-Styles.ini file. This file and/or settings are often referred to as the WYSIWYG editor or file, **What You See Is What You Get**. While this is generally true, you should display the graphics to the MicroStation screen to verify the formatting.

1. Select **Geometry > View Geometry > Geometry Style Manager**

If not already set in the dialog;



2. Set **Type** to **Points**
3. Set **Name** to **Default**

Type: *Points* refers to alignment *keypoints* or *Cogo* points.

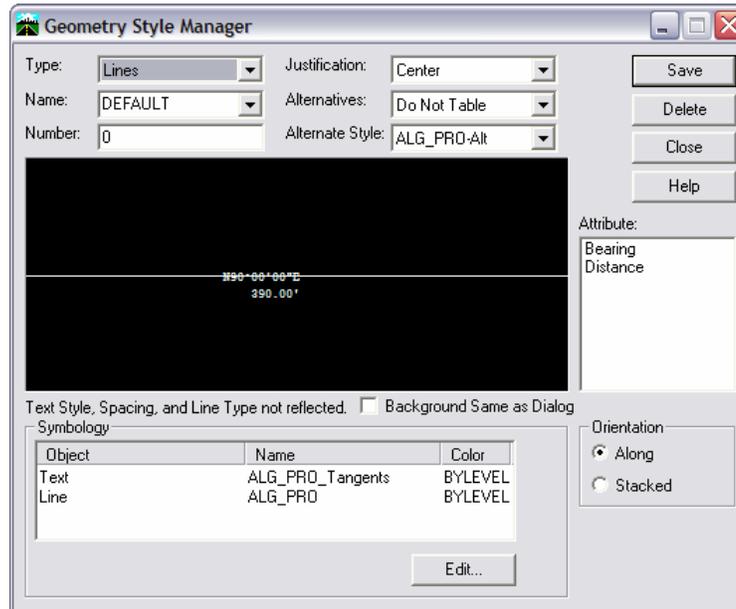
Name: Represents a Geometry Style by the name of *Default*

A display of the current definition of this combination is displayed in the center of the dialog.

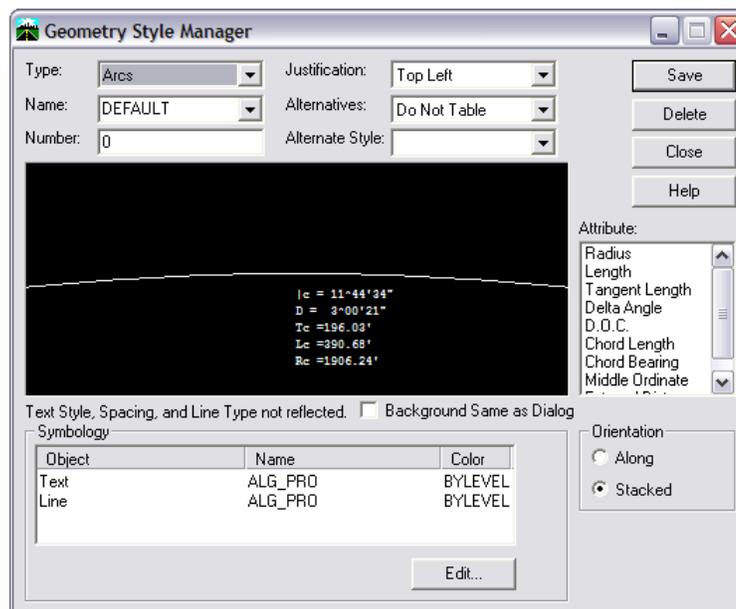
Note: The field **Text Character for Point as Text**. Defines the symbology for Cogo point locations if displayed *as text*. More detail on this in subsequent exercises.

Note: **For the remainder of this exercise:**
Always <D> No or Cancel If prompted to save changes to the **Geometry Styles**.

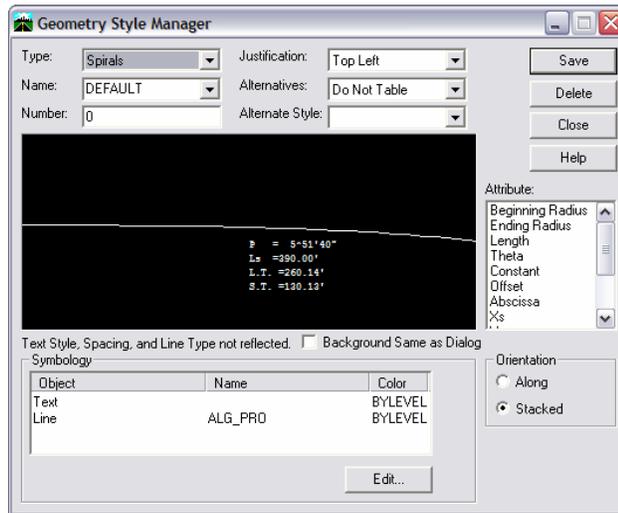
4. Change *Type* to Lines



5. Change the *Type* to Arcs



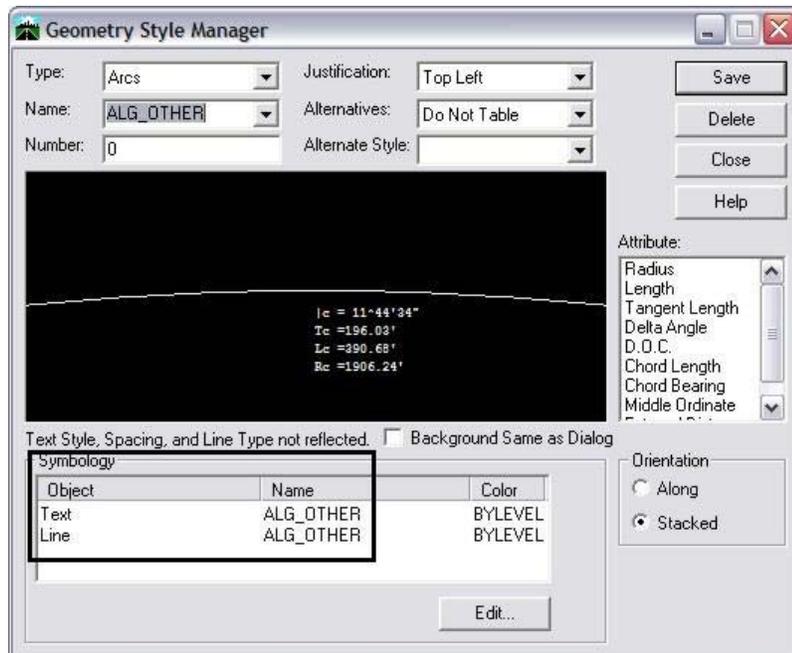
6. Change the *Type* to **Spirals**



The above steps displayed the 4 types of geometry components *Points*, *Lines*, *Arcs*, & *Spirals*. The preview pane displays the graphics and text contents and formatting.

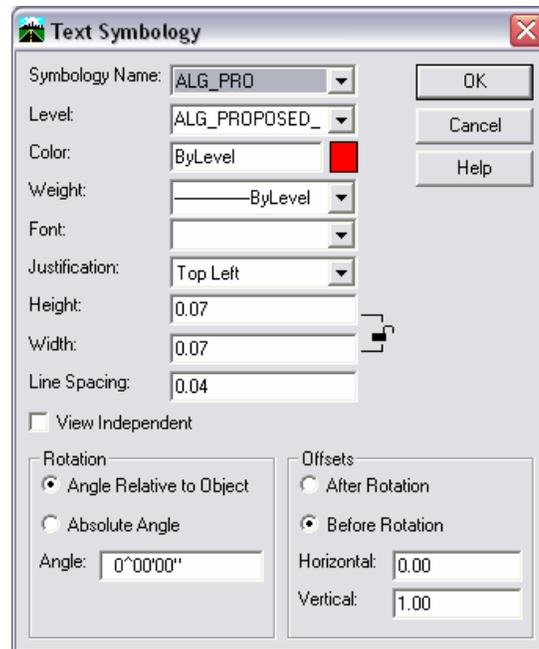
7. Switch the *Name* field to the different Geometry Styles, including those prefixed with ALG_ and investigate the change to the **Arc** annotation for these ALG_ styles.

Change the *Type* back to **Arcs**



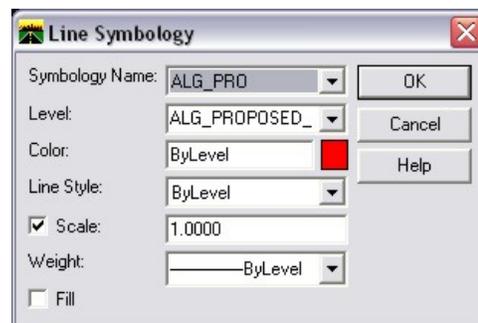
The Symbology portion of the dialog displays the MicroStation settings for the line-work and text.

8. <D> on *Text*, then <D> on the *Edit* button



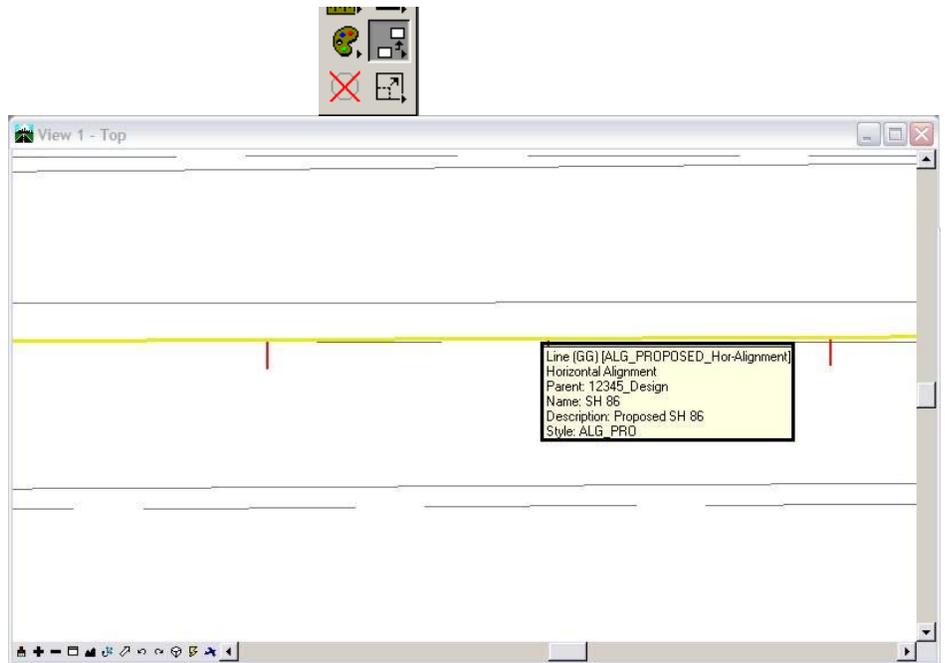
The settings for the text symbology display showing the *Named Symbology* and subsequent attributes for the annotation such as level, font, justification, text size, etc.

9. <D> Cancel to close the **Text Symbology** dialog
10. <D> on *Line*, then <D> on *Edit* again



The dialog shows the MicroStation settings for line-work display.

11. <D> Cancel to close the **Line Symbology** dialog
12. Use the MicroStation command **Copy** and *pause the cursor* over the graphics for alignment **SH 86** that were displayed in a previous exercise.

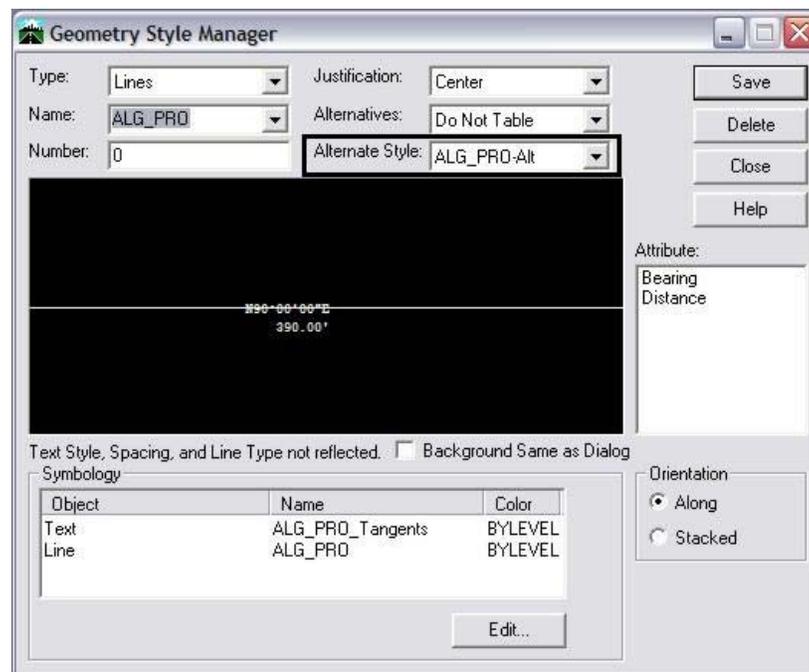


The MicroStation fly-out indicates that the alignment was written to the level **ALG_Proposed_Hor-Alignment** indicating that the geometry style **ALG_Pro** was used.

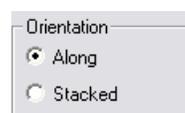
Alignment Alternatives

The previous section illustrates the display symbology and text settings for the annotation of alignments. Notice in the previous exercise that the bearing and distance along tangents are labeled *along the element*. If the text does not fit along the tangent line, an alternative alignment symbology can be specified. This alternate alignment can specify different symbology for annotation. These ‘secondary’ alignments (specifications) are defined in the Alternate field of the **Geometry Style Manager** dialog.

1. If not already open, select **Geometry > View Geometry > Geometry Style Manager**
2. Set **Type** field to: *Lines*
3. In the pick-list for **Names**: <D> on **ALG_EXISTING**

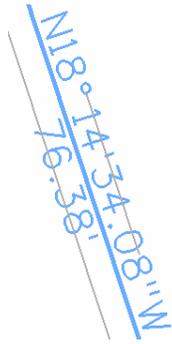


Note: In the *Alternate Style* field, the geometry style **ALG_PRO-Alt** is specified. InRoads will use the geometry style specified in the *Name* field for *all* geometry display. The exception is if the initial Geometry Style specified has the Orientation (text) is set to *Along*, and the Bearing/Distance text does not ‘fit’ along the tangent, InRoads will use the Alternate Style specified. Without an alternative style defined, InRoads would not display any text for said element.

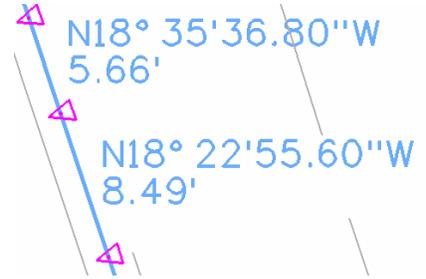


Note: As configured for CDOT, alternate styles have been developed for all *reference-line* alignments. The alternate styles specify

that bearing and distance labels are **Stacked** vs. **Along** and are orientated to the MicroStation drawing plane.

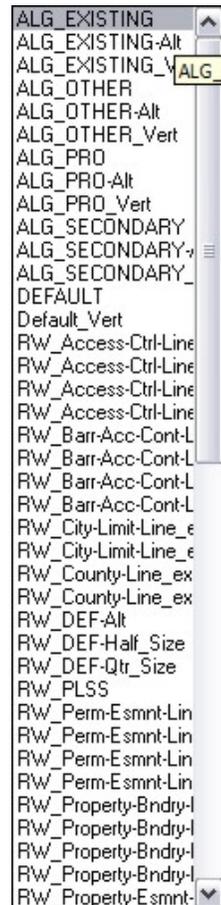


Along



Stacked

4. <D> in the *Name* field and note that all alignments prefixed with **ALG_** or **RW_** have alternate geometry styles defined.

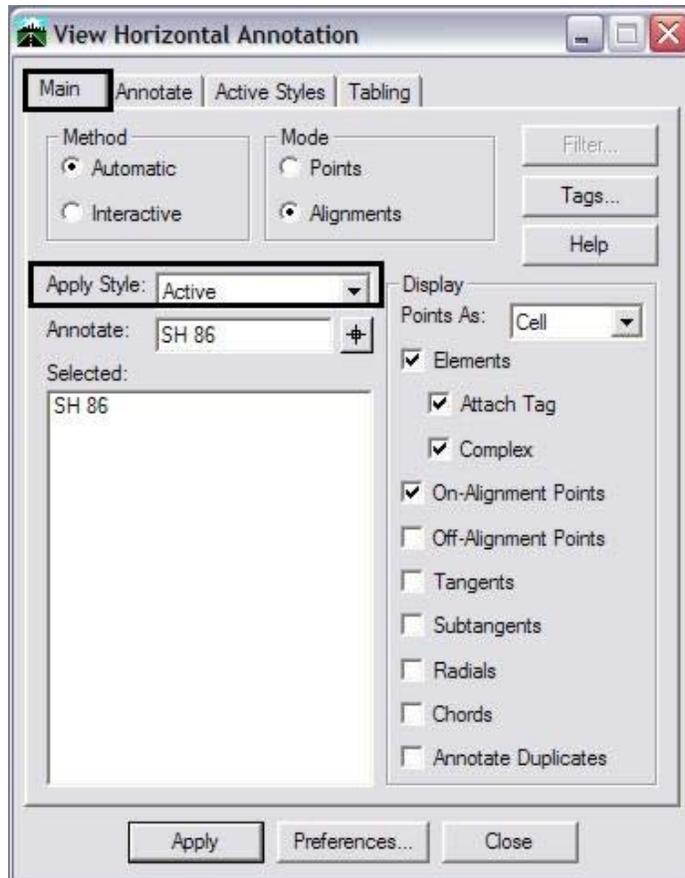


Note: Alternate styles are defined for *Type:Lines* only. The definitions for Points, Arcs, and Spirals are configured for *Stacked* text by default.

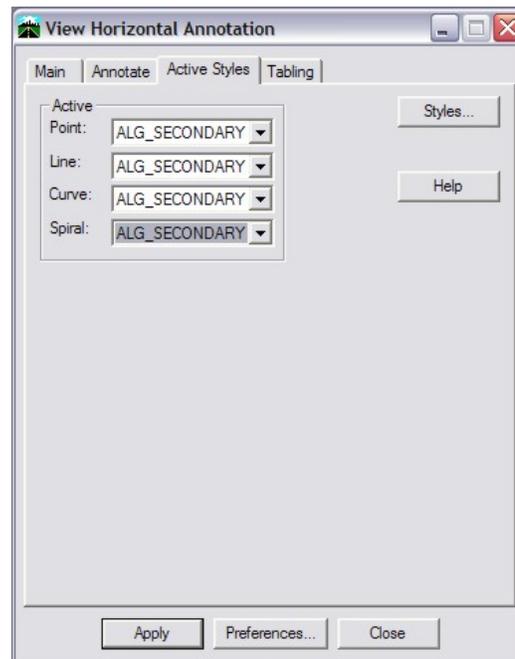
Geometry Style Overrides

1. Select **Geometry>View Geometry>Horizontal Annotation**
2. <D> the **Active Style** tab

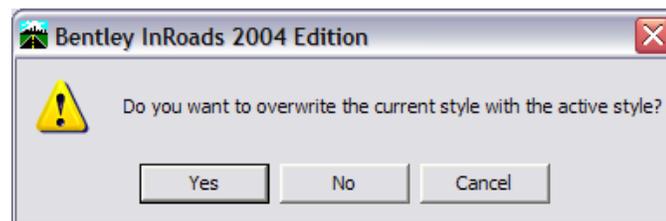
These fields allow the user to define display characteristics other than the geometry style associated with the alignment. They are available for input only when the **Apply Style** field on the **Main** tab is set to **Active**.



3. <D> the **Main** tab
4. Set **Style: Active**

5. <D> the **Active Styles** tab

The fields are now available for population with any combination of geometry styles. This operates as a temporary override for geometry display. Once the user selects the **Apply** button to initialize annotation, an alert dialog box offers 2 options.



Selecting **Yes** will *assign* the **Active** geometry style to the selected geometry element(s). Selecting **No** will simply *display* the geometry element with the **Active** styles.

6. <D> **No** and view the results in MicroStation to see the display properties selected.

Choosing **No** in the above step allows us to temporary over-ride the display properties of the geometry without modifying the style assigned to the geometry. This should not be dismissed as trivial as you may be working with geometry supplied by others and do not wish to modify their work.

Appendix B - Geometry Point Symbolology Manager

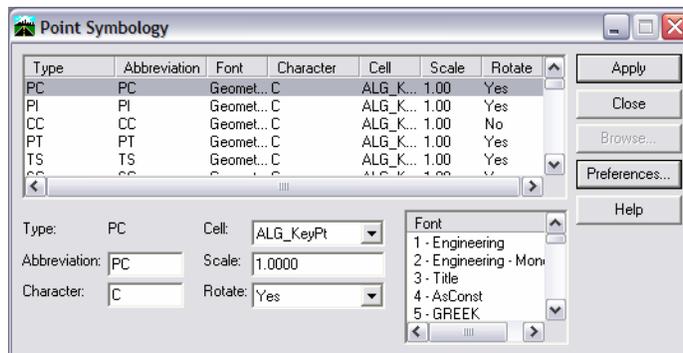
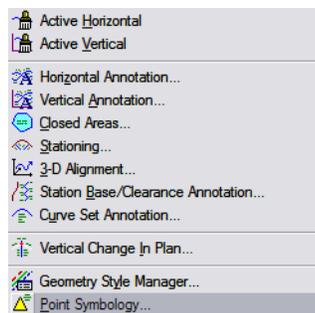
Point Symbolology

As covered in the previous section, attributes for Geometry Styles (line-work and text annotation) are set in the Geometry Style manager and these settings are stored in the CDOT-Styles.ini file.

Working in conjunction with the *Geometry Style Manager* is the *Geometry Point Symbolology Manager* which defines attributes for alignment vertices such as: POB, PC, PI, PT, TS, PVT, PVT, etc.

1. Close any dialog boxes open from the previous exercise

Select **Geometry > View Geometry > Point Symbolology**



2. Select the *Preferences* Button and *load* the preference **CDOT**

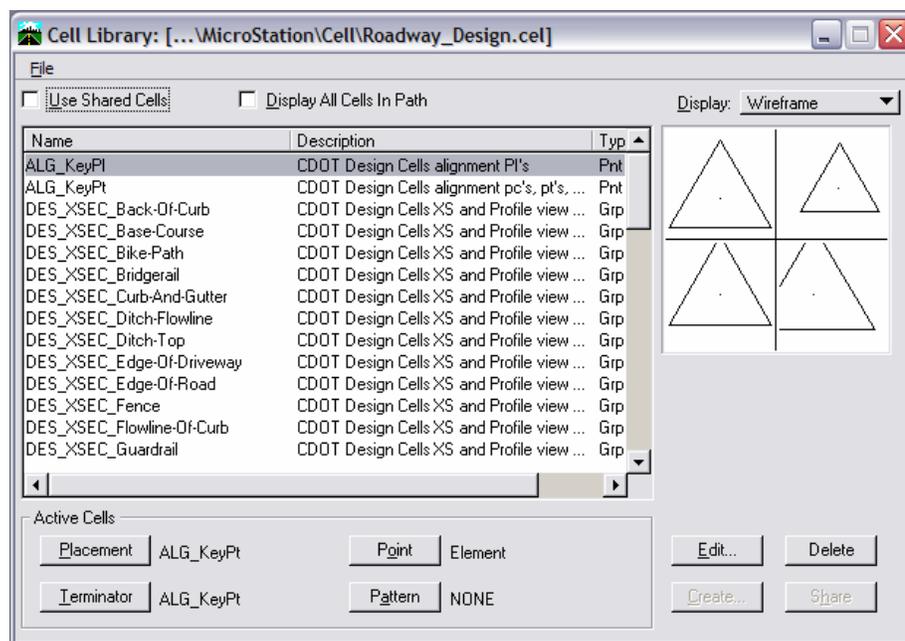
Note: The above step is not generally required; however some users have experienced the CDOT preference not being loaded by default. This is being attributed to a minor software problem and loading/reloading the preference ensures correct operation of the software.

Geometry Point Dialog Attributes:

- **Type:** 33 alignment vertices definitions
 - **Abbreviation:** Text label assigned when viewing stationing
 - **Font:** Font resource file containing 'text'
 - **Character:** Specifies character to use from the font resource file (*Point as Text in Geometry Style Manager - points*)
 - **Cell:** Cell to be placed from the attached cell library (*Point as Cell in Geometry Style Manager - points*)
 - **Scale:** Scale factor applied to cells or font (leave set to 1 as the Global Scale Factor accounts for this)
 - **Rotate:** Specifies if the cell or font rotate to the alignment direction
 -
- Note:** The bottom portion of the dialog contains input fields to populate the point symbology definitions.

Cell Selection

3. In *MicroStation*, Select **Element > Cells** to initialize the **Cell Library** dialog.



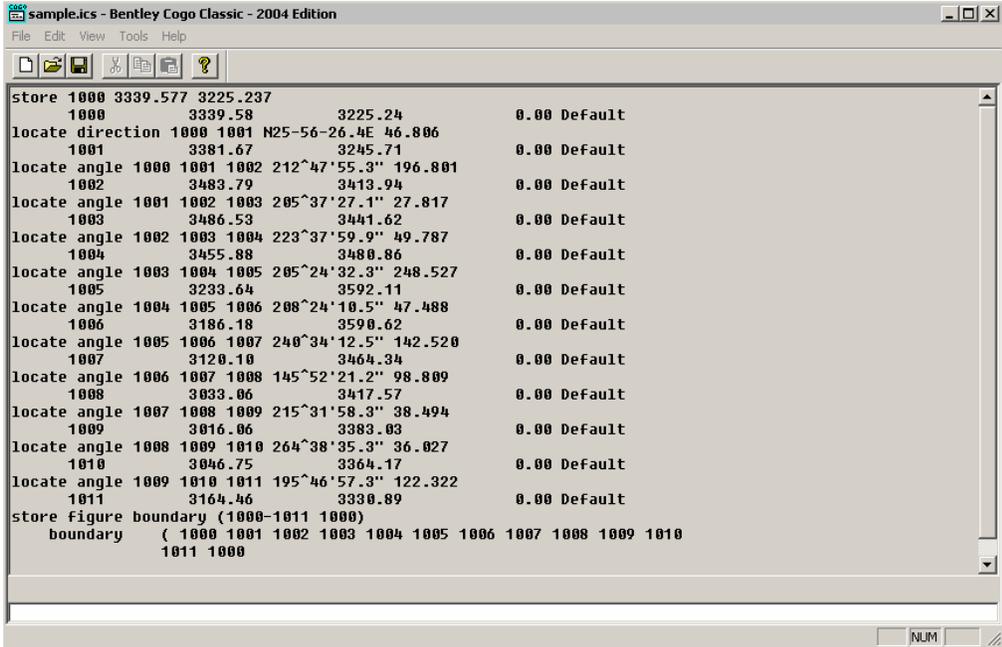
This is not a necessary step but done to illustrate the interaction between the Geometry Point definition and a MicroStation cell library. Notice that the Geometry Point definitions call the cells **ALG_KeyPI** or **ALG_KeyPT** cells for placement along an alignment.

4. <D> on the 'X' in the upper right-hand corner of the **Cell Library** dialog to close it.

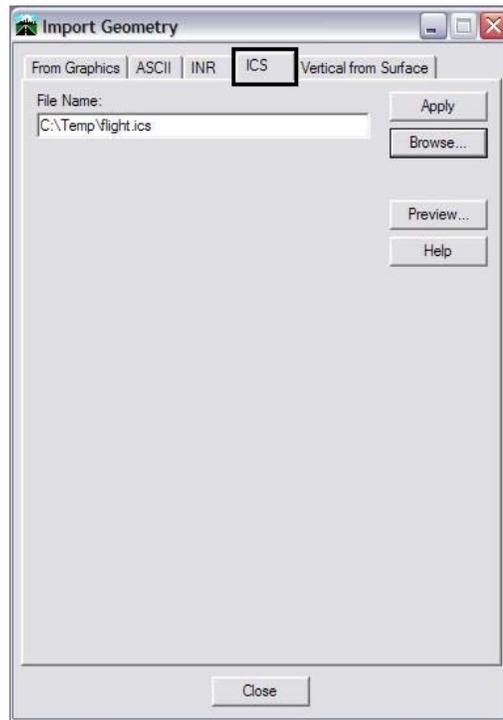
Appendix C – ICS

InRoads contains an alphanumeric interface for running Interactive Coordinate Geometry Subsystem (ICS) commands. This interface is also referred to as Cogo Classic and can be used to run batch runs of geometry commands.

ICS can be accessed through the Windows start menu by selecting **Start > All Programs > Bentley InRoads > Bentley Cogo Classic**



ICS files can also be imported into the InRoads graphical interface by selecting **File > Import > Geometry [ICS] tab**



Control Commands

CREATE PROJECT name description

LOAD PROJECT name

SAVE PROJECT fname

AUDIT FILE mode file.ext

mode: 0 - opens an existing file of the specified name so that data
can be added to the end of the file

1 - opens a new file of the name specified

-1 - closes the existing file

OUTPUT FILE mode file.ext

mode: 0 - records all input and output records in the output file

1 - suppresses recording of input and only records output

-1 - closes the existing file

AUTO PLOT preference /z /!fnam

This command turns on the graphic auto plot lock and sets the active preference for automatically plotting points and figures in the design file. Issuing the command again with fnum equal to 0 will turn the auto plot lock off in the graphic environment.

Example: AUTO PLOT 0 !ALIGN1 # turns auto plot lock on and

sets the active preference to ALIGN1

AUTO PLOT 0 # turns off auto plot lock

Parameter Commands

SET HEIGHT HtFS1 hi1 htBS1 /htFS2 /hi2 /htBS2

SET PARAMETER dir

0 = north azimuth 1 = bearing

SET PROTECTION set prot

0 = Point Protection ON 1 = Point Protection OFF

SET REFERENCE

Sets the vertical angle reference: v = horizon z = zenith

SET SEQUENCE seq

Sets the coordinate sequence: x = x,y,z n = n,e,e

SET TOLERANCE dtol /atol

Sets a distance tolerance dtol and angle tolerance atol for the following conditions:

- Colinearity of points on tangents
- Curve and spiral symmetry
- Curve and spiral tangency with subtangents
- Figure continuity at tangent points

Report Commands

ANGLES pBS pOC desFS

Computes and reports angles from pBS at pOC to points in desFS.

AREA DIRECTION des

Computes and reports the area and boundary courses of the closed figure defined by des.

DESCRIBE ALIGNMENT Hfg /x /sBEG /sEND

Lists the following alignment data for Hfg at interval x:

- coordinates and station of PC, PI, PT, CC
- distances and directions of tangents
- PI deflection angles
- curve data

DESCRIBE VERT ALIGN sBEG /sEND

Describes the active vertical alignment, including points of vertical inflection, curvature, tangency, high and low points, and grades.

DISTANCE des

Computes and reports distances between points in des.

INVERSE DIRECTION des

Computes and reports distances and directions between points in des.

LIST COORDINATES des /mode

Lists the coordinates of each point in des.

LIST FIGURES des

Lists the figures and figure descriptions in des.

TRAVERSE ANGLES des

Computes and reports the lengths and the interior angles of lines in the traverse defined in des.

STATIONS AND OFFSETS desAL2 /x /sBEG /sEND

Computes and lists the stations and offsets of points in desAL2 from the active horizontal alignment.

Point Commands

STORE n c1 c2 /z /p /!fnam -OR- p c1 c2 /z /-cno /!fnam

Stores point n with coordinates c1, c2, and z. If optional p is specified, n takes its value. If optional -cno is specified as -1, -2, or -3 the coordinate c1, c2, or z is modified, respectively.

DELETE COORDINATES des

Deletes points in des from the .tdp project file.

DEFINE Z p z

Defines the elevation of point p.

POINT DESCRIPTION des *description

Defines the alpha description for the known point(s) in des.

Figure Commands

STORE FIGURE nfg des /pAL sAL

Defines the figure nfg in the .tdp file as the list of points in des.

DELETE FIGURE fg

Deletes the figure descriptions (but not points) from the .tdp project file.

FIGURE DESCRIPTION des *description

Defines the alpha description for the known figure(s) in des.

Locate Commands

ANGLE RESECTION p1 p2 p3 ang1 ang2 /n

EXTEND ARC pPC pCC nPT [arc]

LEVEL RUN pBS rBS

LOCATE ANGLE pBS pOC nFS ang [dis] /vaFS /[off] /vaBS pVB

LOCATE DEFLECTION pBS pOC nFS defl [dis] /vaFS /[off] /vaBS /pVB

LOCATE DIRECTION p n dir [dis] /va /[off]

LOCATE FROM ALIGNMENT n sn /[off] /rod

Locates a point n along the active alignment at station sn at an optional offset off and rod reading rod.

rod = rod reading if Level Run is active

rod = elevation if Level Run is non-active

LOCATE LINE p1 p2 n [dis] /va /[off] /Mdis

TANGENT n1 pCC1 [r1] n2 pCC2 [r2] /dir /ext

TANGENT OFFSET n pOF p1 p2

Transformation Commands

COMPUTE TRANSFORM desFROM desTO

This command is initially used to set the rotation/translation values to be used in the transformation process. The "desFROM" values are two points that are located in the relative coordinate system. The "desTO" values are two points in the rotated/translated coordinate system that directly correspond with the two points in the relative coordinate system. The relationship between these two sets of points is that the measured distance must be exactly the same between each set of points (no scaling allowed).

TRANSFORM COORDINATES des

This command can be executed at any time, on any set of points/figures, AFTER the Compute Transform command has been processed. This command works with points or figures.

Divide Commands

DIVIDE ARC pPC pPT pCC div /n

Divides a clockwise arc with center pCC into div equal segments between pPC and pPT. Stores the resultant coordinates as n, n+1, etc.

DIVIDE FIGURE des div /n

Divides the figure des into div equal parts. Stores the resultant coordinates as n, n+1, etc.

DIVIDE LINE p1 p2 div /n

Divides line p1 p2 into div equal parts. Stores the resultant coordinates as points n, n+1, etc.

Intersect Commands

ARC ARC INTERSECT n pCC1 [r1] pCC2 [r2] pID

ARC LINE DIRECTION n pCC [r] p dir pID /[off]

ARC LINE POINTS n pCC [r] p1 p2 pID /[off]

CURVE SPIRAL n [r] pCC pID pTS dirBT [ls] [dc]

CURVE SPIRAL POINTS n [r] pCC pID pTS pSIT pSC

DIRECTION INTERSECT n p1 dir1 p2 dir2 /[off1] /[off2] /va1 /va2

FIGURE ARC INTERSECT n fg pCC r pID /[offg]

FIGURE FIGURE INTERS n fg1 fg2 pID /[off1] /[off2]

FIGURE LINE INTERSECT n fg p dir pID /[offg] /[off]

LINE SPIRAL n p1 p2 pID pTS dirBT [ls] [dc]

LINE SPIRAL POINTS n p1 p2 pID pTS pSIT pSC

POINTS DIRECTION INTER n p1 p2 p3 dir /[off1] /[off2] /va

POINTS INTERSECT n p1 p2 p3 p4 /[off1] /[off2]

SPIRAL SPIRAL n pTS1 dirBT1 [ls1] [dc1] pTS2 dirBT2 [ls2] [dc2] /pID

SPIRAL SPIRAL POINTS n pTS1 dirBT1 [ls1] [dc1] pTS2 pSIT pSC2 /pID

Curve Commands

FIT CURVE pBT pPI pAT nPC nCC nPT /[r] -OR- pPC pOC pPT

Alignment Commands

SET ALIGNMENT Hfg /pAL /sAL /Vfg

Activates a horizontal alignment and optionally defines the stationing.

CLEAR ALIGNMENT

Clears the active alignment, and makes the active alignment Cogo.

POINTS ON ALIGNMENT x /n /[off] /sBEG /sEND /odd

Locates and lists coordinates of points n, n+1, etc. at each interval x along the active alignment at an optional offset off between sBEG and sEND with odd defining station lock on or off.

odd = 1 - Station Lock on

odd = 0 - Station Lock off

FIT ALIGNMENT nTS pBT pPI [dc] [ls1] [ls2] defl sign

Parallel Commands

PARALLEL LINE p1 p2 [off] /n1 n2

Locates points parallel with the line p1 p2 at an offset distance off, and stores them as n1 and n2.

PARALLEL FIGURE des /[off] /n /nfg /dz

Locates a new parallel figure to des at an offset distance off, and stores points of the new figure as n, n+1, etc. and the new figure as nfg with an elevation difference of dz.

For an open figure:

+off = to the right

-off = to the left

For a closed figure:

+off = external

-off = internal

COGO Parameter Abbreviations

<i>ang</i>	- angle	<i>p</i>	- known point
<i>atol</i>	- angle tolerance	<i>pAL</i>	- point on the alignment
<i>arc</i>	- arc distance	<i>pAT</i>	- point of the ahead tangent
<i>-AL</i>	- alignment	<i>pBS</i>	- point of the backsight
<i>c1,c2</i>	- coordinates 1 and 2	<i>pBT</i>	- point of the back tangent
<i>cid</i>	- spiral curve identification; this parameter is not used by Simple Spiral, key in any number from 0 to 999.	<i>pID</i>	- known point that indicates which intersection is to be chosen; positive is near, negative is far from the <i>pID</i> .
<i>-cno</i>	- the field number of a coord to change in an existing point	<i>POC</i>	- occupied point OR point on the curve
<i>-CC</i>	- center of curve	<i>pOF</i>	- point that perpendicularly offsets the pt. to be calculated
<i>dc</i>	- degree of curve	<i>pVB</i>	- point of the vertical backsight
<i>defl</i>	- deflection angles	<i>PC</i>	- point of curvature
<i>delta</i>	- delta angle	<i>PI</i>	- point of intersection
<i>des</i>	- point or figure description	<i>PT</i>	- point of tangency
<i>desc</i>	- alpha description	<i>r#</i>	- curve radius
<i>dir</i>	- direction	<i>rBS</i>	- rod reading of the backsight
<i>dirBT</i>	- direction to the back tangent	<i>rod</i>	- rod reading or elevation
<i>dis</i>	- distance	<i>s</i>	- station
<i>div</i>	- number of divisions	<i>sAL</i>	- station on the alignment
<i>dtol</i>	- distance tolerance	<i>sBEG</i>	- beginning station
<i>dz</i>	- elevation difference	<i>sEND</i>	- ending station
<i>ext</i>	- externality	<i>seq</i>	- coordinate sequence (x or n)
<i>fg</i>	- figure	<i>sign</i>	- sign of angle
<i>fnam</i>	- feature name	<i>sn</i>	- station
<i>fname</i>	- file name	<i>SC</i>	- spiral to curve point
<i>fnum</i>	- feature number	<i>SIT</i>	- point of spiral

		<i>intersection</i>	
<i>-FS</i>	- foresight	<i>TS</i>	- tangent to spiral point
<i>Gdis</i>	- geodetic distance	<i>va</i>	- vertical angle
<i>Hfg</i>	- horizontal figure	<i>vaBS</i>	- vertical angle to backsight
<i>hi#</i>	- height of instrument	<i>vaFS</i>	- vertical angle to foresight
<i>ht#</i>	- height of target	<i>Vfg</i>	- vertical figure
<i>ls#</i>	- spiral arc length	<i>x</i>	- station distance
<i>Mdis</i>	- measured distance	<i>z</i>	- elevation
<i>mode</i>	- input/output mode		
<i>n</i>	- unknown point		[] - parameters shown in the square brackets utilize the Input Combined Grid Factor
<i>name</i>	- name of file		
<i>nfg</i>	- unknown figure		
<i>odd</i>	- station lock on/off		
<i>off</i>	- offset		
<i>offg</i>	- offset from figure		

Abbreviations for the ICS input commands

Abbrev.	Command	Comment
<i>an r</i>	<i>angle resection</i>	
<i>an</i>	<i>angles</i>	
<i>a a i</i>	<i>arc arc intersect</i>	
<i>a d</i>	<i>area directions</i>	
<i>a f</i>	<i>audit file</i>	
<i>a l d</i>	<i>arc line direction</i>	
<i>a l p</i>	<i>arc line points</i>	
<i>a p</i>	<i>auto plot</i>	<i>assigns feature name/number to all of the following commands, i.e.: a p house store 1 100 200 300 2 101 202 303 loc ang 1 2 30. 100.</i>
<i>c a</i>	<i>clear alignment</i>	
<i>c g f</i>	<i>combined grid factor</i>	
<i>c pr</i>	<i>create project</i>	
<i>c s p</i>	<i>curve spiral points</i>	

<i>c s</i>	<i>curve spiral</i>	
<i>c t</i>	<i>compute transform</i>	
<i>def z</i>	<i>define z</i>	
<i>del c</i>	<i>delete coordinate</i>	
<i>del f</i>	<i>delete figure</i>	
<i>des a</i>	<i>describe alignment</i>	
<i>des v</i>	<i>describe vertical</i>	
<i>di a</i>	<i>divide arc</i>	
<i>di f</i>	<i>divide figure</i>	
<i>di i</i>	<i>direction intersect</i>	
<i>di l</i>	<i>divide line</i>	
<i>dis</i>	<i>distances</i>	
<i>exi</i>	<i>exit</i>	
<i>ext a</i>	<i>extent arc</i>	
<i>f ar i</i>	<i>figure arc intersect</i>	
<i>f al</i>	<i>fit alignment</i>	
<i>f c</i>	<i>fit curve</i>	
<i>f d</i>	<i>figure description</i>	
<i>f f i</i>	<i>figure figure intersect</i>	
<i>f l i</i>	<i>figure line intersect</i>	
<i>i d</i>	<i>inverse direction</i>	
<i>i f</i>	<i>input file</i>	
<i>l a</i>	<i>locate angle</i>	
<i>l c</i>	<i>list coordinate</i>	
<i>l de</i>	<i>locate deflection</i>	
<i>l di</i>	<i>locate direction</i>	
<i>l fi</i>	<i>list figure</i>	<i>"list figure (point des, i.e. 1-4) -1" lists all figures that points in the parentheses are located in.</i>
<i>l fr a</i>	<i>locate from alignment</i>	
<i>l l</i>	<i>locate line</i>	
<i>l pa</i>	<i>load parameters</i>	
<i>l pr</i>	<i>load project</i>	
<i>l r</i>	<i>level run</i>	

<i>l s p</i>	<i>line spiral points</i>	
<i>l s</i>	<i>line spiral</i>	
<i>o f</i>	<i>output file</i>	
<i>pa f</i>	<i>parallel figure</i>	
<i>pa l</i>	<i>parallel line</i>	
<i>pl c</i>	<i>plot curve</i>	
<i>pl l</i>	<i>plot line</i>	
<i>pl p</i>	<i>plot point</i>	
<i>pl s</i>	<i>plot shape</i>	
<i>po de</i>	<i>point description</i>	
<i>po di i</i>	<i>point direction intersect</i>	
<i>po i</i>	<i>points intersect</i>	
<i>po o a</i>	<i>points on alignment</i>	
<i>sa pa</i>	<i>save parameters</i>	
<i>sa pr</i>	<i>save project</i>	
<i>se a</i>	<i>set alignment</i>	
<i>se d</i>	<i>set display</i>	<i>"set display 0" turns scrolling off and "set display 1" turns scrolling on</i>
<i>se h</i>	<i>set height</i>	
<i>se pa</i>	<i>set parameters</i>	
<i>se r</i>	<i>set reference</i>	
<i>se s</i>	<i>set sequence</i>	
<i>se t</i>	<i>set tolerance</i>	
<i>sp s</i>	<i>spiral spiral</i>	
<i>sp s p</i>	<i>spiral spiral points</i>	
<i>s a o</i>	<i>station and offset</i>	
<i>s f</i>	<i>store figure</i>	
<i>s</i>	<i>store</i>	
<i>t a</i>	<i>traverse angle</i>	
<i>t c</i>	<i>transform coordinates</i>	
<i>t o</i>	<i>tangent offset</i>	
<i>t</i>	<i>tangent</i>	

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