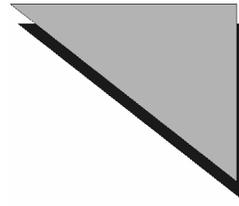


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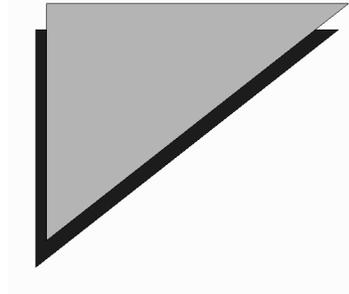
**Bentley® InRoads® XM  
Edition**

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*Roadway Designer  
Tutorial (Metric)*

---



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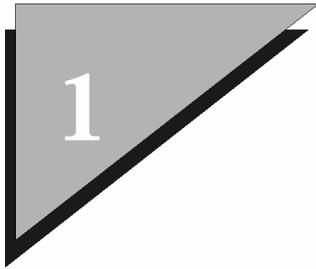
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# Introducing InRoads

Welcome to InRoads®! The latest in transportation engineering software by Bentley Systems, InRoads is a one-stop solution for transportation engineers and civilworks professionals. InRoads provides a comprehensive set of tools for transportation system design, civil and site engineering for roadways, highways, waterways, and airports. Developed using the familiar Microsoft® Windows®, standards, InRoads runs on the Windows 2000 Professional and Windows XP Professional operating systems.

InRoads lets you work in a graphic environment to create a 3-D digital surface, create horizontal and vertical alignments, cut profiles, define template criteria and roadway conditions, generate cross-sections and 3-D model, calculate volumes, generate reports, evaluate the design, and create plan and profile sheets. These extensive features, along with additional application add-in tools, make designing a complex highway system or simply laying out a small subdivision an interactive and easy process.

With InRoads, you can continue using the computer-aided design (CAD) platform with which you are familiar. When starting the product, you can select AutoCAD® 2004, 2005, or 2006, or MicroStation V8® 2004 Edition and MicroStation V8® XM Edition, as your CAD engine. This multiple CAD environment is a hallmark feature of civil engineering solutions by Bentley Systems.

## InRoads and the Bentley InRoads Group

The InRoads product group consists of a single source tree of civil engineering applications designed to run on MicroStation or AutoCAD. This single source tree approach provides unprecedented integration among individual products allowing a single installation regardless of which product is used and complete data integration across all products.

A single installation of InRoads provides access to any InRoads product based on the license key provided. The complete InRoads group consists of the following products:

- InRoads Survey
- PowerSurvey
- InRoads Storm & Sanitary
- InRoads Bridge
- InRoads Site
- InRoads
- Bentley InRail
- InRoads Site Suite
- InRoads Suite
- Bentley InRail Suite
- MicroStation Civil Extension - InRoads

**InRoads Survey** – Provides data transfer and reduction from total stations, GPS, and other raw data sources. InRoads Survey includes a complete set of tools for adjustments, data analysis and editing of raw input data. Also included are tools for coordinate geometry and DTM display. InRoads Survey allows you to save data in geometry and DTM file types for further usage by other applications within the InRoads product group. InRoads Survey does require that a copy of MicroStation or AutoCAD be present on the local machine.

**PowerSurvey** – Is the same product as InRoads Survey with the exception that it contains its own graphic engine (Bentley's PowerDraft). It does not require MicroStation or AutoCAD.

**InRoads Storm & Sanitary (S&S)** – Provides the ability to create physical 3-D models of storm, sanitary or combined sewer systems within the MicroStation or AutoCAD environment. DTMs and alignments or precision key-in can be used to create the models. S&S provides the ability to analyze or design these systems, create plan, profile and plan and profile drawing sets, and detailed reporting of analysis, bill of materials or user-defined reporting of any attributes of the system. S&S includes a complete set of hydrological tools and pond routing tools.

**InRoads Bridge** – Provides a complete set of tools for defining bridge geometry and extruding models along that geometry. InRoads Bridge provides the ability to report on clearances, girders, beams, screed elevations, placement locations and so on. Steel (AISC) and concrete (AASHTO) members are supported as well as many user-defined shapes.

**InRoads Site** – Provides tools for coordinate geometry, horizontal and vertical alignments, DTM creation and analysis, ROW, lot and parcel creation, plan and profile creation and many more design tools. InRoads Site is designed to meet all of the site designers' needs.

**InRoads** - InRoads is the flagship product of the InRoads product group and is a complete roadway design solution. It contains simple (PI method) and complex (design by elements) geometric design capabilities and DTM creation, analysis and viewing including hydrologic analysis. InRoads also contains the ability to form 3D models relative to horizontal and vertical geometry by applying a set of rules and decisions (templates) to those alignments and applying those decisions to DTMs and intelligent features. InRoads further provides all the tools necessary for extraction of cross sections and profiles and creation of finished drawings. InRoads provides a robust set of reporting tools. InRoads does contain all the functionality of InRoads Site.

**Bentley InRail** – Is an extension of the InRoads product for the rail industry. Bentley InRail contains all the functionality of InRoads plus additional curve transitions such as half-sine, bi-

quadratic, Bloss and more. Bentley InRail includes rail switch and cross-over libraries for AREA, German Rail and others. You can also create custom libraries. Bentley InRail includes a module for light rail manufacturing to support the creation and detailing of light rail hardware. It also contains special tools for tunnel analysis.

**InRoads Site Suite** – Is a single product containing all the functionality of InRoads Site, S&S and InRoads Survey.

**InRoads Suite** – Is a single product containing all the functionality of InRoads, InRoads Bridge, InRoads Site, S&S and InRoads Survey.

**Bentley InRail Suite** – Is a single product containing all the functionality of Bentley InRail, InRoads, InRoads Bridge, InRoads Site, S&S and InRoads Survey.

**MicroStation Civil Extension - InRoads** – Is a limited set of civil design and production tools to create advanced coordinate geometry, perform horizontal and vertical alignment design, create and review digital terrain models. Civil Extension allows you to perform a wide range of plans production activities.

## InRoads: What's New?

In this release, InRoads offers several new commands and enhanced features:

### □ **General Enhancements**

- Added MicroStation XM to the list of supported CAD platforms including MicroStation 2004 Edition and AutoCAD 2004\2005\2006.
- Added support for ProjectWise XM when used with MicroStation XM.

### □ **File Menu**

- Modified the Open dialog to display all InRoads format files by default.
- Added a toggle to Import Surface from Graphics that imports only the vertices of the target element (not every triangle crossing point on elevations from surface).
- Import > Surface Advanced. Added Vertices Only to Import Surface Advanced > Import Rule > Process Settings > General.
- Import > Surface > Surface Advanced > Rules > Edit Import Rule > Cell Names. Now displays the cells in the design file in the Available List.
- Translators > Import SRV. Added a Parent field to designate the Parent on the features.
- Translators > Import AMSA. Replaced numeric codes 1-10 with point numbers 301-310.
- Import > LAS Data. Added the ability to add additional files to the same feature.
- File > Project Defaults. Added a prompt to confirm deletion when selecting the Delete button.

### □ **Surface Menu**

- View Surface > Components. Components can now be selectively chosen for display.
- Edit Surface > Delete Feature Points. Added a fence option.
- Feature > Feature Selection Filter. Added the ability to filter based on Component Name.
- Edit Surface > Edit Feature Point. Highlighted points now persist when views are changed during Feature Point Edit.

**□ Geometry Menu**

- View Geometry > Stationing > Cardinal Stations. Added the ability to place point abbreviation before and after station annotation. This is enabled with a setting in the Tools > Variable Manager.
- View Geometry > View Vertical Annotation > Curves > Circular Curve. Added Tangent Slope Distance to this tab for both tangents.
- Utilities > Assign Names > Alignments. Added a method to interactively rename alignment points.
- View Geometry > View Active Vertical Alignment and Vertical Annotation. Changed the element type to Polyline from 3D Polyline for vertical alignments in AutoCAD.
- View Geometry > Stationing. Added an option to planarize stationing.
- View Geometry > Vertical Annotation. Added an option to place vertical alignment annotation at a constant offset from the top of profile grid.
- View Geometry > Vertical Annotation. Added the ability to annotate vertical point of beginning (VPOB) and vertical point of ending (VPOE). This is enabled with a setting in the Tools > Variable Manager.

**Bentley InRail and Bentley InRail Suite**

- View Geometry > Rails. Added the ability to create a surface from the rails. The Append to Surface option creates a feature in the surface with the name of the alignment and overwrites any existing feature with the same name.
- Horizontal and Vertical Regression > View Regression Points. Display Unacceptable Slew Points has been added to both commands. This displays/annotates points that have a value larger than the Acceptable Slew.
- Single Horizontal and Vertical Element Regression. These commands now allow dynamic element adjustments.
- Horizontal Regression > Horizontal Curve Diagrams. Additional design information can be plotted including Slews, Cant and Elements.
- Horizontal Regression > Convert Rails to Centerline. Enhanced the creation of horizontal, vertical and cant alignments from the rail data.
- Superelevation > Compute Cant from Existing. Added a command to make use of the existing cant alignment created in the Convert Rails to Centerline command.
- Turnouts > Create Turnout. Added Diamond Crossings as Type conforming to United Kingdom rail practice as defined in the Track Design Handbook.
- Turnouts > Create Switch & Crossing Connection. Now allows creation of turnout – connection – turnout where the two turnouts are positioned based

upon a known length.

- Light Rail Manufacturing > Annotate Rail Offsets. Added the capability to annotate the offset from a control baseline to near rails.

#### □ **Drainage Menu**

- Drainage > Edit/Review > Inlet > Gutter tab. Added locate buttons for the slope fields.
- Drainage > Network > Renumber. Areas can now be renumbered.
- Tools > Drainage > Structures File. The Drainage Structures File and the Sizes dialog boxes are now re-sizeable.
- Structure > Extend Culvert in Profile. Added the ability to extend Free Entrance and Free Exit ends of Pipes and Channels.

#### □ **Survey Menu**

- Survey to Surface. Added an option for Parent to identify data moved to the surface at the time of the command's execution.
- Import Survey Data > TSS. When using the convert.exe on the TSS import, the intermediate file (if specified) is used; otherwise, the TMP environment variable is used.
- Fieldbook Data. Added the ability to do point comparisons in the fieldbook, along with comparing check shots to backsights.
- Network. The dialog portions can now be independently resized.
- Fieldbook Data. The station and observation portions can be independently sized.
- Fieldbook Data. Added the ability to display Attributes and/or Notes in the lists for stations and observations.
- Fieldbook Data. Added the ability to edit survey attributes once they are defined (the attribute name, type, description).
- Inverse Survey Data. Added the ability to report directions as bearings.
- Survey Data to Surface. Added the ability to replace existing features in a surface that already exist with Append, Replace or Rename.
- Rotate Graphics on Dual-Coded Survey Points. Added the ability to rotate cells, symbols, and custom operations on dual-coded points relative to the first code on the point. This is enabled with a setting in the Tools > Variable Manager.

- **Evaluation Menu**
  - Create Cross Sections > Include. Added an option to adjust cross section vertical range for non-triangulated crossing features.
  
- **Modeler Menu**
  - Create Template. Added the capability to unmerge component points.
  - Superelevation sections can now be renamed.
  - Roadway Designer > Superelevation Wizard > Table Method. Added an Edit button on the Superelevation Sections Definitions dialog.
  - Create Template > Library View. Enabled the F2 key to the rename function for folders and templates.
  - Create Template > Apply Feature Name Overrides. Now displays points that have an override in red in the list box.
  - Create Template. Provided a mechanism to select the components to merge when there are multiple coincident components.
  - Create Template. Provided a mechanism to select the point to merge when there are multiple coincident points.
  - Create surface > Alternate Surface option. Implemented an exterior boundary for these surfaces.
  - Roadway Designer. Added a status bar indicating Template change.
  - Create Template. Added an option to delete the constraint on all points in a template.
  - Roadway Designer. Added the display of horizontal and vertical cardinal points on plan and profile views. Hovering cursor shows point names and stationing.
  - Create Template. Added the ability to break a component into two components.
  
- **Drafting Menu**
  - Place Coordinate Grid. Added this option for the creation of a plan coordinate grid for drawings.
  - Place Notes. Added Keywords for Pay Item Name, Pay Item Code, Pay Item Description, Pay Item Unit. Also added Keywords for Pay Item Block and Pay Item Endblock so that multiple pay items on a single feature can be annotated. For example: {PAYITEM\_BLOCK} {PAYITEM\_UNIT} {PAYITEM\_CODE} {PAYITEM\_ENDBLOCK}
  
- **Tools Menu**
  - Named Symbology > Points. Cell levels can now be maintained or overridden with a setting in Variable Manager. Previous versions of InRoads placed cells

on the level defined in the Point Symbology and ignored the levels defined in the cells. Now if the setting is set to Retain Cell Levels, the level field in Point Symbology is grayed out.

- Survey Options > General > Chord Height. Option has changed to disallow the value of zero, and to show all significant figures. Previous preferences with less than zero are set to 0.0001.
- Options > Tolerances. Option has changed to disallow the value of zero, and to show all significant figures. Previous preferences with less than zero are set to 0.0001.
- Style Manager > New Style. Modified the command so that after clicking Apply on the dialog, the name is cleared for another new style to be created.
- Tracking > Tracking. Change the Symbology button name to Settings.
- Tracking > Symbology > Settings. Rearranged the settings for Point and Text Named Symbology.
- Added the ability for Horizontal Tracking to also track in the profile and for Vertical Tracking to track in the horizontal. This is enabled with a setting in the Tools > Variable Manager.

Experienced users will continue to find advanced programming features such as the Run Macro command that allows software customization for specialized environments.

## About Your Documentation

To assist the beginning through advanced user, InRoads provides three complementary forms of documentation:

- Tutorial. This introductory material provides step-by-step instructions for learning how to create a new roadway design surface. The tutorial is delivered with the product in PDF format.
- Bentley InRoads Help. Delivered with the product in HTML format, this comprehensive online reference material consists of help topics that detail each command and dialog box parameter within the product.
- Bentley InRoads Group XM Reference Guide. Available, by free download (for SELECTservices customers), in PDF format. This document contains all InRoads help topics. It is available to all customers in printed form by purchase only.

## Product Training: Learn It Your Way

In addition to the documentation provided with your software, the Bentley Civil InRoads Group, in conjunction with Bentley Institute, offer various levels and methods of product training. For training facility information or a complete listing of training courses, visit the Bentley Systems website at <http://bentleyinstitute.bentley.com/>.

## Typeface Conventions Used in InRoads Documentation

### ALL CAPS

Keyboard keys

If keys are separated by a comma, press them in sequence. For example: ALT,F5. If they are joined by a plus sign, press them at the same time.

For example: CTRL+z.

### **Bold Unserifed Type**

An item in the graphical interface, such as the title of a dialog box or a tool. Paths through menus use right angle brackets between items you click.

For example: Click **File > Open** to load a file.

### Courier Type

Information you type.

For example: Type `breaklines.dat` in the dialog box field.

### *Italic type*

A document or section title, the first occurrence of a new or special term, directory and file names, or information about what the software is doing.

For example: The *civil.xin file* contains preference settings.

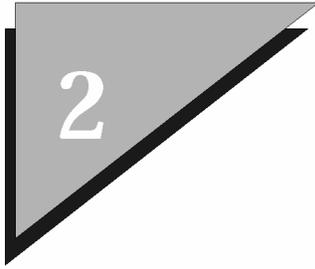
## What You Need to Know Before Working with InRoads

While InRoads is a comprehensive design package, it is also an intuitive product in which a new user could become productive in a short time with some assistance.

The documentation and tutorial in InRoads assume that you have:

- A basic understanding of the computer operating system
- The ability to move around in the Windows environment
- Working understanding of your CAD system
- General knowledge of engineering concepts and terms





## Getting Started

InRoads can be installed on Intel-based hardware using the Windows 2000 Professional or Windows XP Professional operating system. The following instructions assume that you have already installed one of these operating systems on your machine. You must also have installed CAD software on your machine. InRoads will run on AutoCAD 2004/2005/2006 and MicroStation V8 2004 Edition or XM Edition. See the *CAD Package Requirements* section that matches your operating system for a list of software tools.

### In Windows 2000 and Windows XP

This section details what you need to efficiently run InRoads.

#### CAD Package Requirements

- CAD software (one of the following): AutoCAD versions 2004/2005/2006, and MicroStation V8 2004 Edition or XM Edition.
- Pentium 200 Mhz minimum, 400 Mhz or more recommended
- 512MB memory or more recommended
- 310MB free disk space or more recommended
- VGA or better
- Access to a CD-ROM drive
- Mouse or compatible digitizer for input
- Compatible plotter or printer for output (optional)

#### Downloading from the CD

Prior to installing InRoads, make sure you have exited all other civil engineering software. In Windows 2000, the setup program automatically starts when the CD is loaded. If Autoplay is not enabled on your system, follow the steps below.

1. Insert the CD in your CD-ROM drive.
2. From the Start menu, click Run.
3. In the Run dialog box, type d:\install.html, where d: is the letter assigned to your CD-ROM drive.
4. Click OK and follow the instructions on the screen.

## Downloading Across the Network

If you are downloading InRoads across a local area network, mount the shared network CD drive and double-click on *install.html* from the InRoads Explorer or File Manager. Or, navigate to the product directory and run *Setup.exe*.

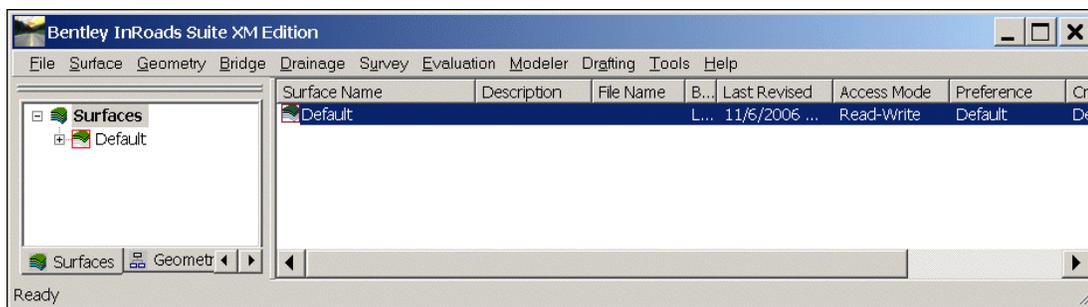
## Starting InRoads

Once you have successfully downloaded the software, you are ready to start the product.

1. From the Start menu, click **Start > Programs > Bentley > InRoads Group XM > InRoads**.
2. MicroStation users must first select a design file. Navigate to a design file or demonstration directory and select a file or create a new one.

AutoCAD automatically opens with a default drawing file at startup.

The InRoads menu is displayed.

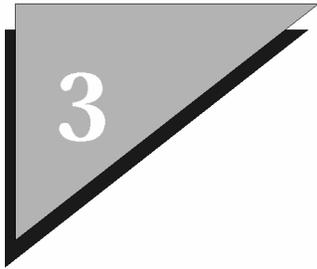


You have successfully installed InRoads, selected your CAD platform, and opened a drawing/design file.

## Exiting InRoads

To exit InRoads and leave the CAD software running, select **File > Exit** from the InRoads menu.

To exit InRoads and the CAD software, select **File > Exit** from the CAD main menu. If you exit the CAD software prior to exiting InRoads, the product will also exit. You are prompted to save any open files.



# Using InRoads

## An Overview

From project definition to plan and profile sheet creation, InRoads provides the tools you need to create highways, roads, and other construction and transportation engineering projects. In addition, several add-in applications are available to assist you in completing specific civil engineering production tasks. The advanced programming tools offer ways to customize your work environment to accomplish unique tasks or meet customer deliverables.

Starting with geometric, alignment, and surface point data, you can do the following:

- Graphically represent the base map ground surface, topographic features, and property boundaries. Display and analyze surface contours, slope vectors, and other terrain data.
- Review existing or legacy plans to identify new controls. Through an iterative process, generate preliminary plan sheets, create new horizontal and vertical alignments, specify roadway templates and design file criteria. You can also compute volumes and generate reports.
- Generate a 3-D model of the design. Generate cross-sections, compute triangle volumes, calculate end-area volumes, make modifications, and redesign as needed to meet specifications.
- Prepare and plot plan and profile drawings. Generate final reports for production requirements or customer deliverables.

The results of your project can be stored for future use and integrated with other Bentley Systems civil engineering and GIS industry solutions.

## Basic Concepts in InRoads

There are a few concepts to review prior to using InRoads. Some of these concepts concern tools that provide more flexibility in the way you work, such as customized toolbars. Others are simply ways of thinking about features, preferences and symbology: how they interact with each other and how they function within the DTM. The next several topics discuss basic concepts in InRoads.

## Digital Terrain Model

A computerized model of a 3-D ground surface is a visual representation of triangle and point data. This data, in x,y,z numerical coordinates, defines the Digital Terrain Model (DTM), also commonly referred to as a surface.

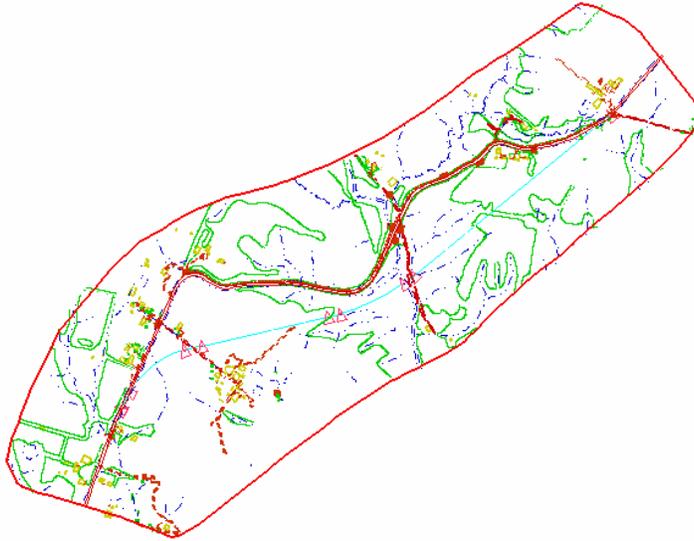


In InRoads, the DTM remains an integral and important part of your project. Feature data resides in the DTM and profiles, cross-sections, volumes and other design analysis and computations are performed on the data in the DTM. This functionality allows you to place features, execute commands, view surface properties, make design modifications all in the design surface. The DTM requires fewer interactions with graphical menus and dialog boxes while expanding the function and definition of the traditional design feature.

### Types of DTM Display

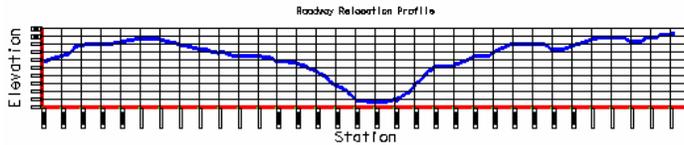
In the InRoads project, surface representation and features can be displayed in three different views or modes: 3-D Planimetric, Profile, and Cross Section.

- 3-D planimetric view, commonly referred to as plan, is a top-level aerial view of the entire surface.

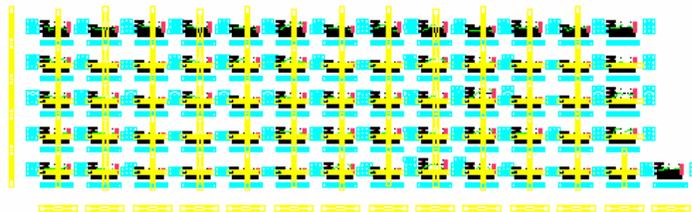


This view allows you to see any of the point types (random, breakline, contour, and so on) in the digital terrain model.

- Profile is an extracted side view of the vertical elevation of a surface along an entire active horizontal alignment (or just a portion of it). A legend, correlating surface line symbology, surface name and the scale used on the profile, can also be displayed.



- Cross Section is a portion of the roadway model at a specified location. Displayed in individual graphic windows, each section shows surface configurations perpendicular or at a skew angle to a linear feature, such as the horizontal alignment (often the centerline of the roadway). Cross sections differ from profiles in that they show detailed sections of the surfaces, from one station to the next transverse to an alignment; profiles show surface elevations longitudinally along an entire alignment.



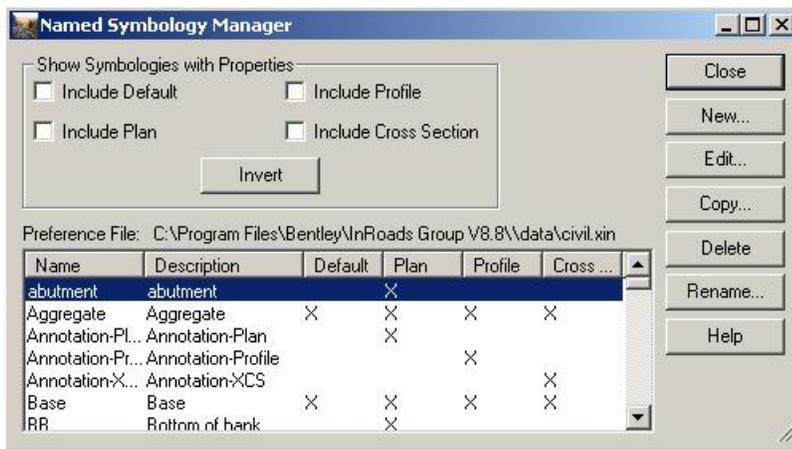
Together, these display modes allow you to view, evaluate, and design your project from various important perspectives. Objects in the DTM can be represented in one view or all of these views.

## Symbology

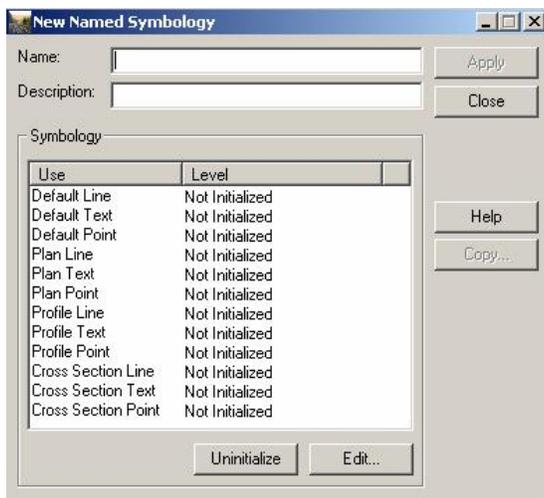
Symbology (line style, weight, color and so on) can be defined for any surface object or feature. Uniquely specifying symbology for objects or features allows for quick identification within the model as well as uniformity across the project. In InRoads, symbology can be set in three ways: named symbology using the Name Symbology Manager, Named Symbology Tools, and basic command-level symbology.

## Named Symbology Manager

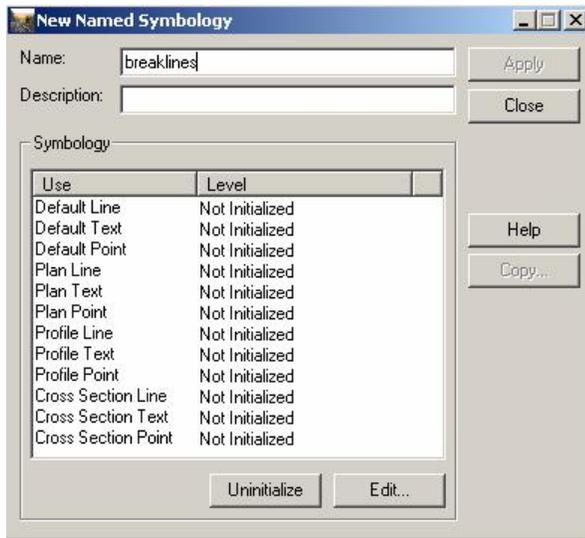
The **Tools > Named Symbology Manager** allows you to define and name symbology settings for surface objects and features. These settings, along with many other preference settings, are stored in the \*.xin preference file. This customizable file contains basic default settings, including predefined symbology, and is delivered when you install InRoads. These predefined symbology settings are displayed when you access **Named Symbology Manager**.



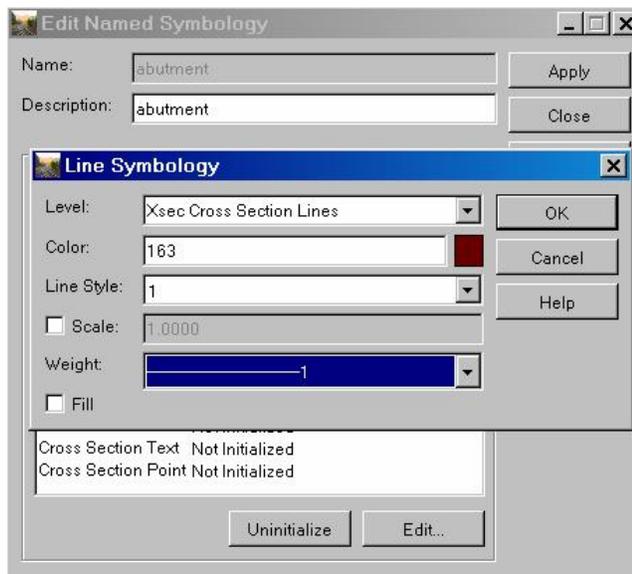
By clicking **New**, you can define additional symbology.



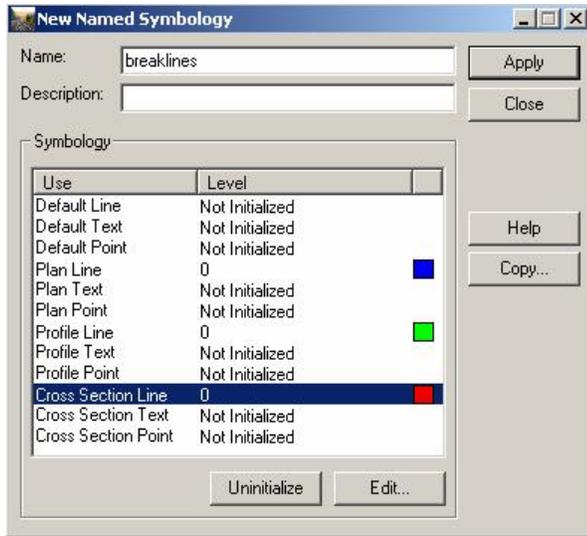
New symbology is first given a name. Providing a name allows you to associate the symbology with a feature or object and later reference the symbology by this name.



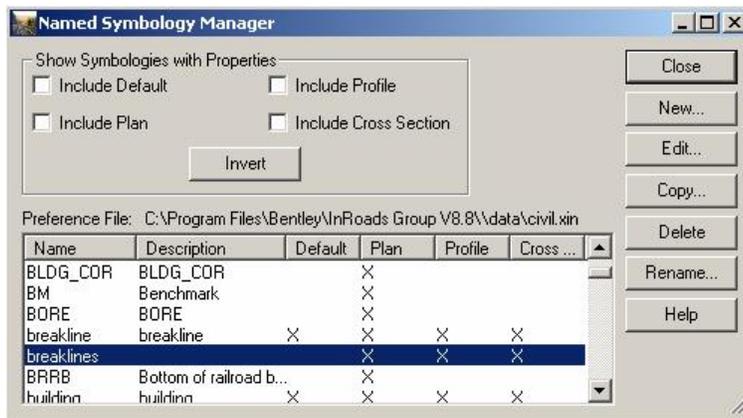
By double-clicking on an item or selecting the item and clicking the **Edit** button, you can set symbology for lines, text, and points in one or all three of the views.



Once you have defined symbology for more than one representation (line, point or text) or for more than one view (plan, profile or cross section), you actually have a set of symbology. In **Named Symbology Manager**, you create named symbology sets.



Defined symbology is considered initialized after you click **Apply**. Default symbology applies when specific symbology for plan, profile or cross section is not defined. If default symbology is not defined, the system settings delivered with InRoads apply.



For more details about this command, see the **Named Symbology Manager** online help topic.

## Named Symbology Tools

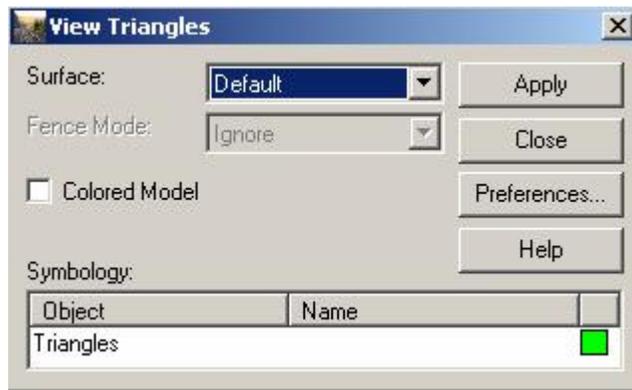
- The **Tools > Named Symbology Tools** provides various methods of managing existing named symbologies. The following commands are not available when running AutoCAD.
- **Verify Named Symbology.** Use this command to verify the existence of fonts, text styles, line styles, levels and/or cells defined in named symbologies. When you click OK, this command prints a report showing you the named symbologies that have levels and/or cells not found.
- **Global Named Symbology Edit.** Use this command to change all occurrences of a particular value in the .xin file. An example is text height and width.
- **Export Named Symbology to CSV.** Use this command to export named symbologies to a file (or files) you designate. Recall that a named symbology stores a large set of parameters that define exactly how a point, line, or piece of text will appear in plan view, in profiles, and in cross sections.

- **Import Named Symbology from CSV.** Use this command to import named symbologies into the Named Symbology table in the .xin file from separate line, text, and point files, or from one file. A named symbology stores a large set of parameters that define exactly how a point, line, or piece of text will appear in plan view, in profiles, and in cross sections.

For a more detailed description of these commands, see the associated topics in online help.

## Command-level Symbology

While InRoads provides the opportunity to name symbology, you are not required to do so. You can continue to select local symbology at any time. You can also use the **Preferences** button that appears on most dialog boxes to create or modify basic preferences at any time. For example, **Surface > View Surface > Triangles**.



## Features in the DTM

In InRoads, features are key to the design process. A feature is a unique instance of an item or 3-D entity that is represented in the DTM by lines, points, or text. A line is actually a linear segment. Points can be represented as symbols or cells. Annotation is considered text. The following are examples of common road design features:

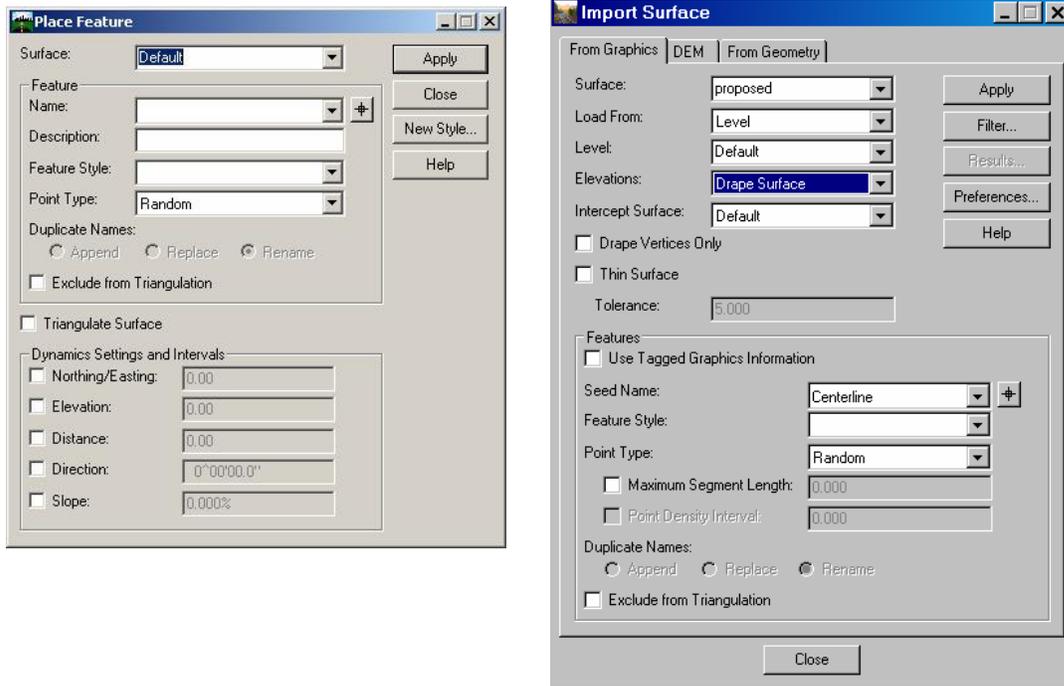
- A single random point
- A single interior boundary
- A flowline
- A single curb line
- A single utility (pipe, pole, manhole)
- A collection of utilities (poles, manholes)

A feature then is any single component that is part of the DTM. Further, for features such as random points, you can store more than one random point feature type in a DTM. This flexibility allows you to control the display of the random points in the surface separately from other features, such as manholes.

In InRoads, features can be created or imported into the DTM with a level of “intelligence”; that is, they know what they are and how they are to display.

## Intelligent Features

Whether you begin your design by using **Surface > Design Surface > Place Feature** or **File > Import > Surface**, you can indicate what a feature is before it becomes a part of the active surface. You can provide a feature name and description, select a feature style, indicate the point type, and specify whether or not it is to be triangulated.



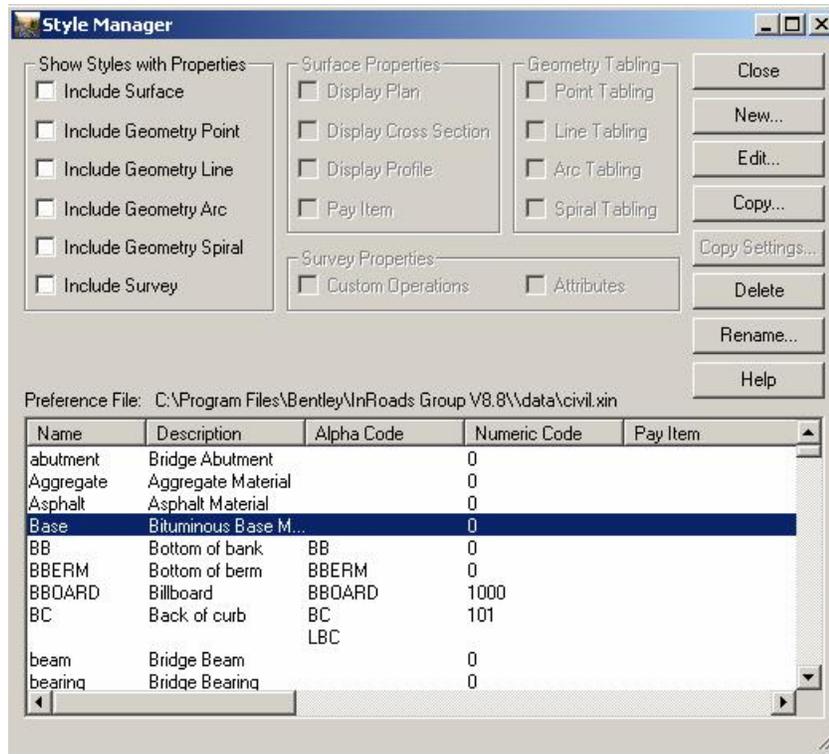
All of this information is associated with the feature and available for quick reference once it becomes a part of the surface.

The key to working with features in the surface is determining how the features will display. *How* a feature is represented and *where* it displays can be specified by a *style*. Feature styles are created and organized by the **Style Manager**.

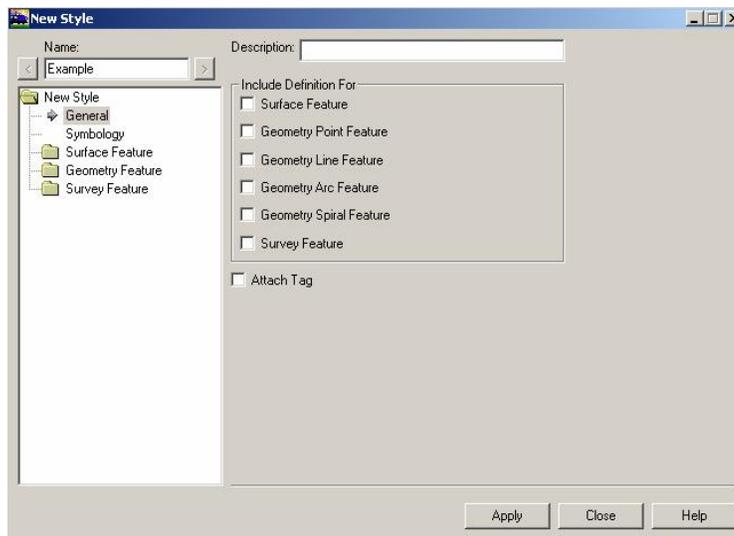
## Style Manager

A style uniquely defines how a feature is represented and determines the symbology for its display. Once defined, the style is one-to-many; meaning any one style can be used to display many features. For example, a style for centerline could be used for both the roadway centerline as well as for any other secondary road centerline. Once styles are created, they can be used by all areas of the product: Surfaces, Geometry, and Survey.

When you select **Tools > Style Manager**, any predefined styles currently in the .xin preference file are displayed.

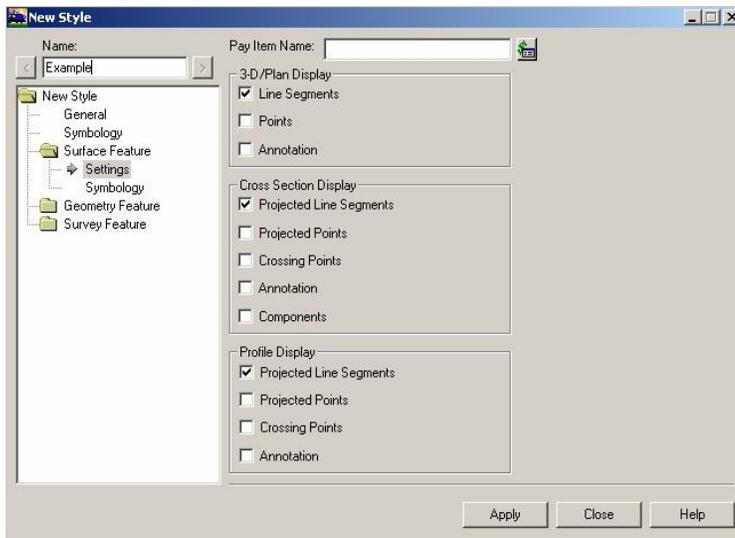


Click **New** to create additional styles.

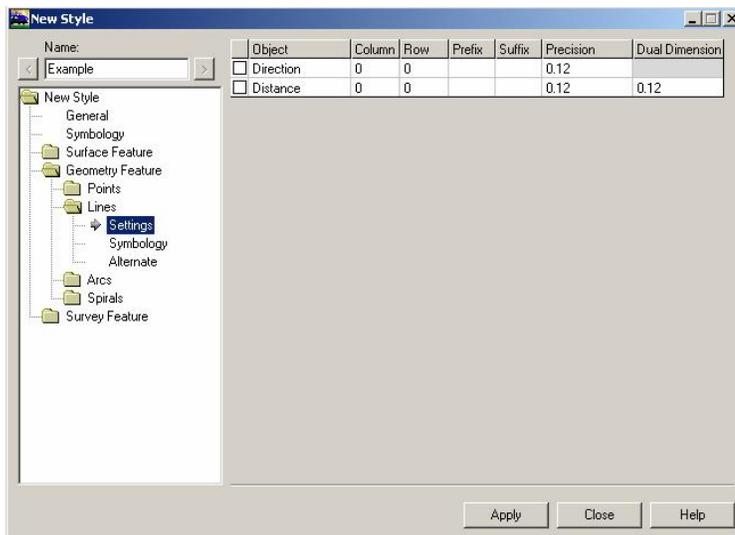


A style includes a unique name and description (optional). The New/Edit Style is a dual view dialog box (tree view on the navigation or left pane and a list view on the contents or right pane). This gives you the ability to organize styles in different folders, called categories in the .xin file. The user-defined organization of the styles is stored in the .xin file along with the styles themselves.

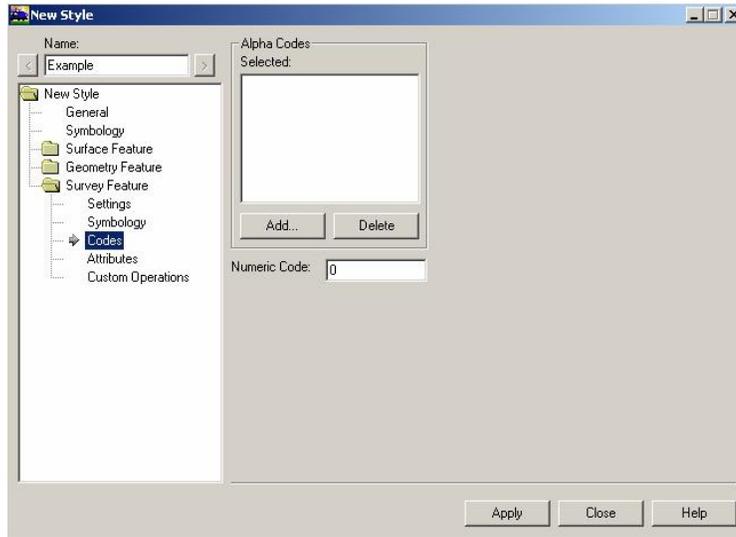
Next, provide more details about how the features that use this style will be displayed in graphic view (as a line segment, point annotation, or attached tag). For example, to see the features using this style displayed in Plan, Cross-Section, and Profile, check the following options:



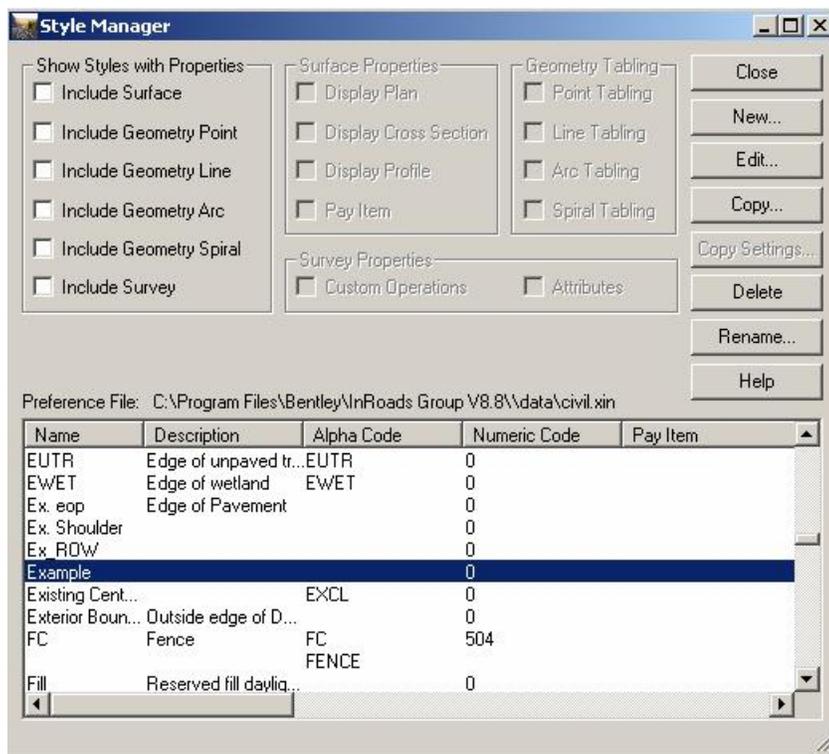
You can also modify the named symbology associated with the style. For geometry features, settings for points, lines, arcs, and spirals are also defined.



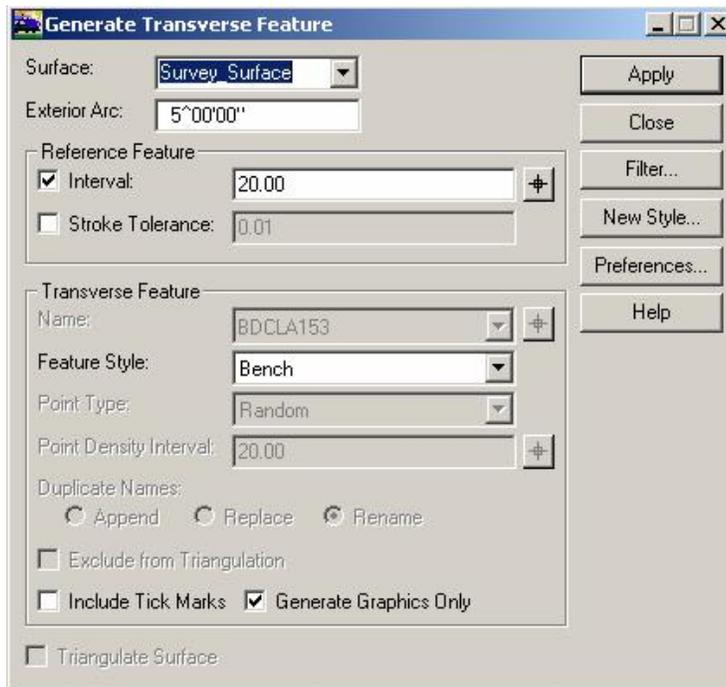
For survey features, codes, attributes, and custom operations can also be specified.



Once all style settings and options are selected and you click **Apply**, the new style is added to the preference file.



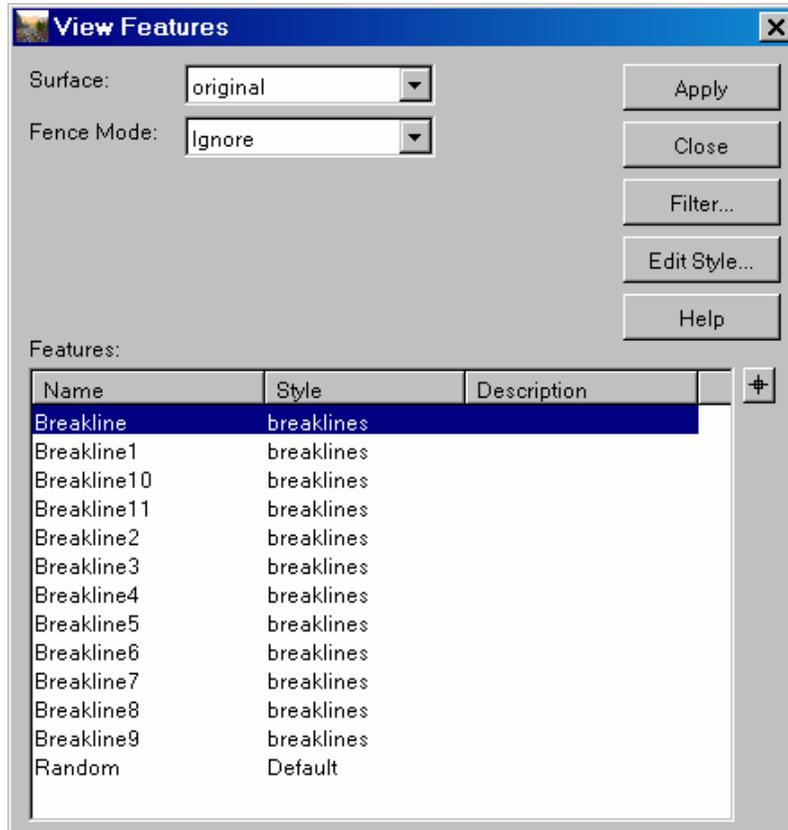
Feature styles can also be created or modified from the **New Style** button that appears on many **Surface > Design Surface** commands.



For more detailed information about style settings and options, see the *Style Manager* online help topic.

## View Surface Features

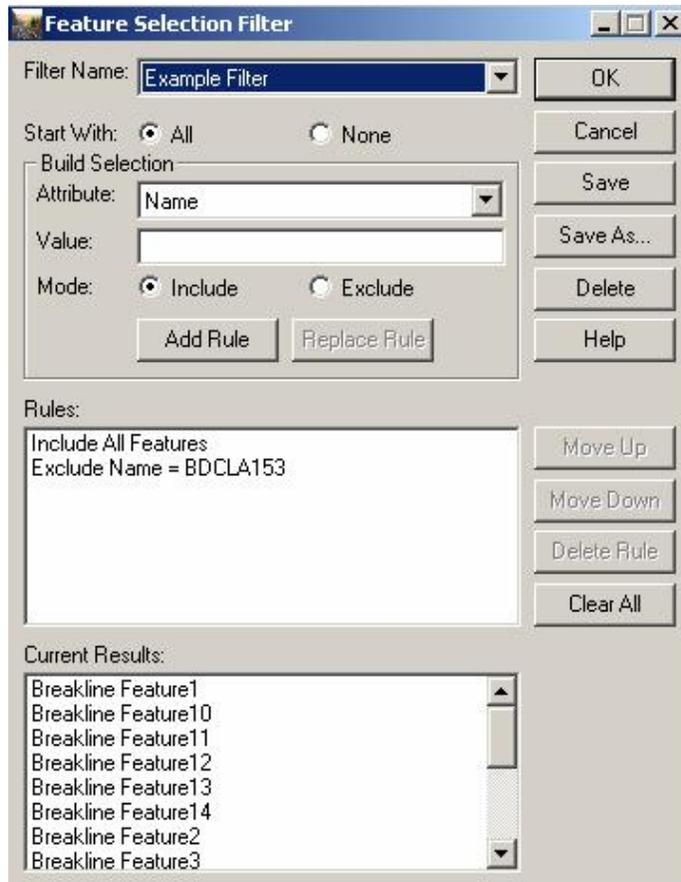
Features that are a part of the active surface can be displayed for review. To see the features, use the **Surface > View Surface > Features** command.



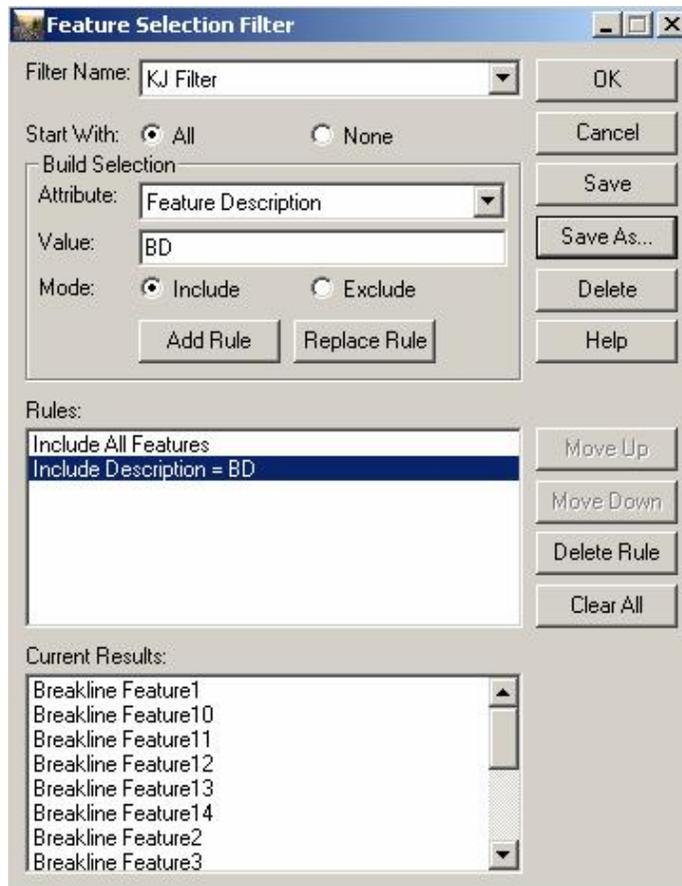
After choosing a surface, you can select individual features from the list, select all of the features or click **Filter** to build a feature selection set to view.

## Viewing Surface Features Using the Feature Selection Filter

The **Filter** option on the **View Features** dialog box is a shortcut to the **Surface > Feature > Feature Selection Filter** command. This command allows you to quickly specify a feature selection set.



By clicking **Save As**, the filtered selection set can be saved and associated with a *name* for future reference.



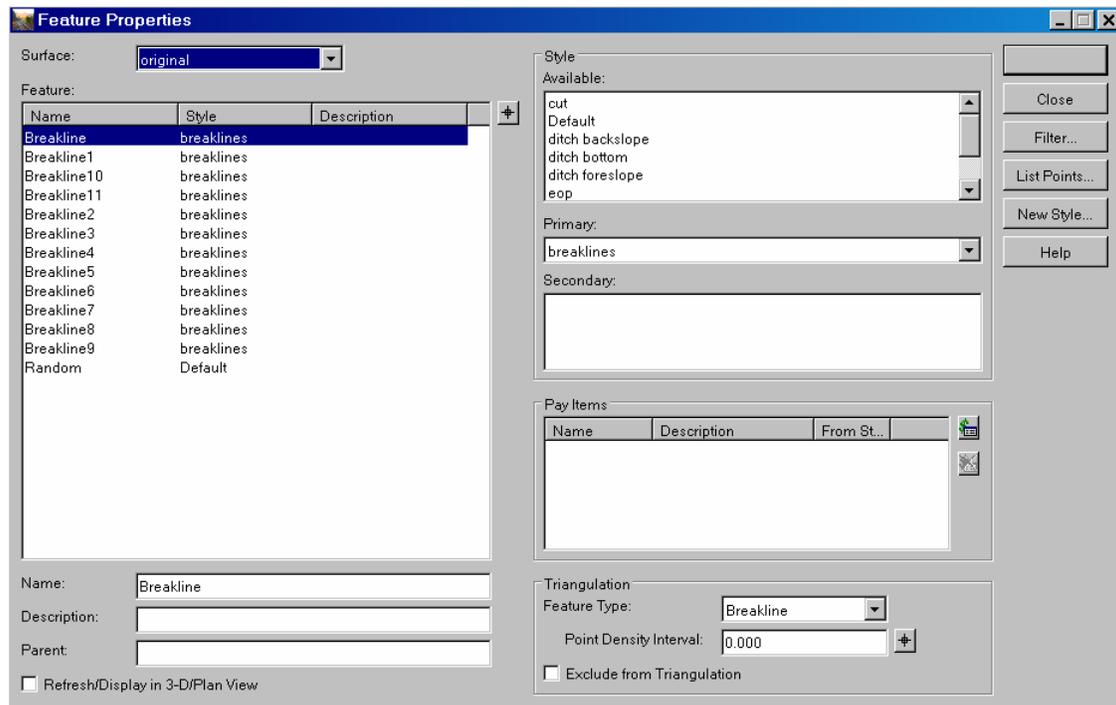
 Before clicking **OK**, make sure the **Feature Filter Lock** is on. If the filter lock is *not* on, filters are not applied. Turn on this lock by clicking **Tools > Locks > Feature Filter Lock**.

When you click **OK**, selected features are listed in the **View Features** dialog box. When you click **Apply**, these features are displayed.

Once features are in the surface, you can display and modify feature properties.

## Feature Properties

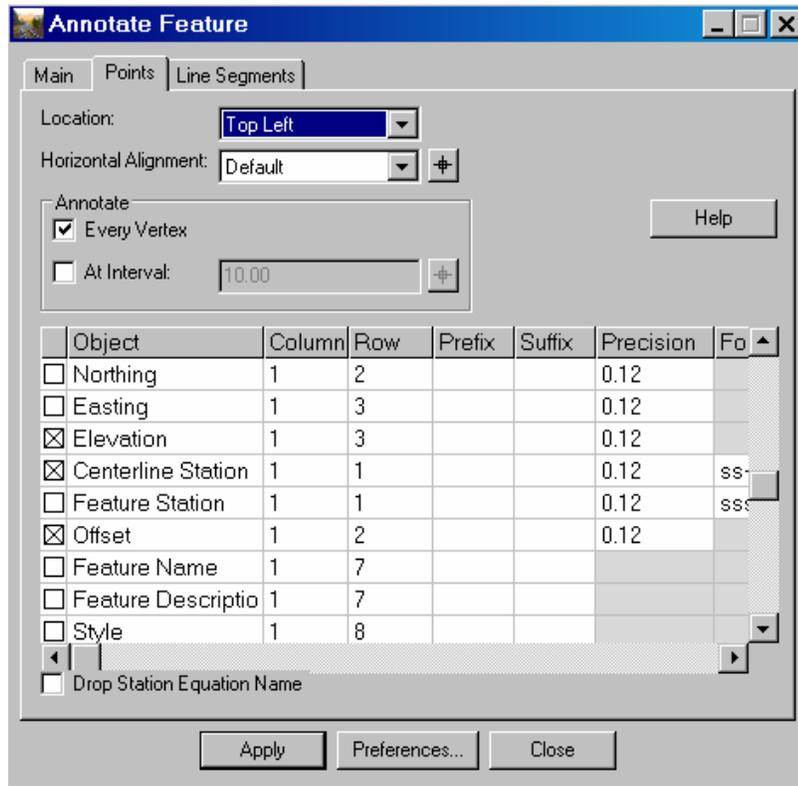
The **Surface > Feature > Feature Properties** command allows you to edit feature properties. Use this command to change the feature name, modify the description or style, and set the criteria for triangulation. You can take action against all features in the surface, against a filtered feature-selection set, or against selected features.



Once features are defined or modified and displayed, you can annotate them within the design file.

## Annotating Features

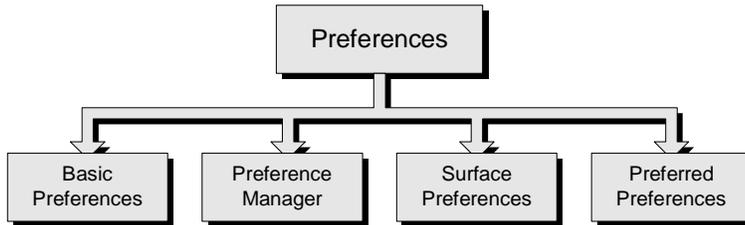
The **Surface > View Surface > Annotate Feature** command allows you to annotate features within the DTM.



Click **Apply** to display the annotation.

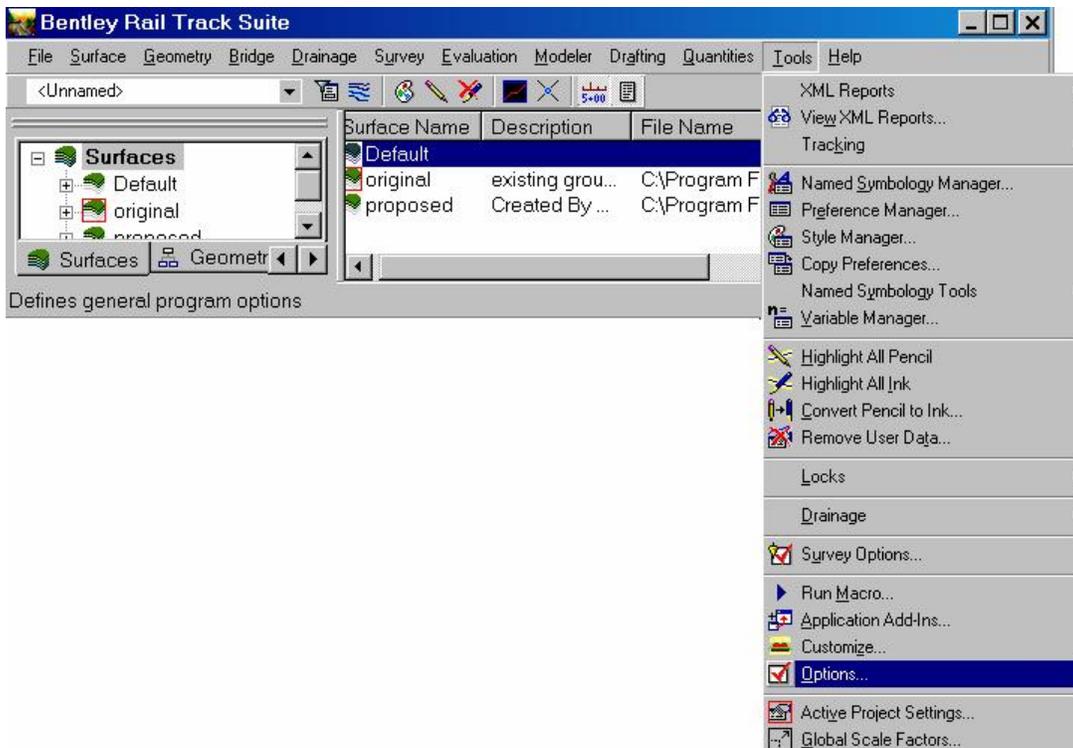
## Preferences

Preferences allow you to define everything from general operating parameters (like units of measure, decimal places to display, stationing format, and symbology) to specific instructions as to which settings apply to a particular design surface. In InRoads, preferences are a flexible system that can be considered as a single group of information that is simply defined in four different ways:



## Basic Preferences

Basic preferences are settings that are defined at the command level. These values are set on the individual command dialog box located on most InRoads menus.

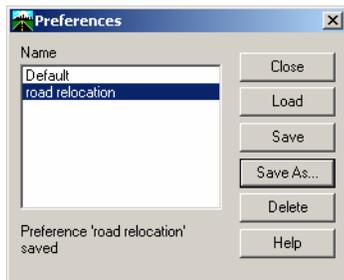


Basic preferences govern general operating parameters such as units of measure, stationing format, decimal places, local symbology, and so on.



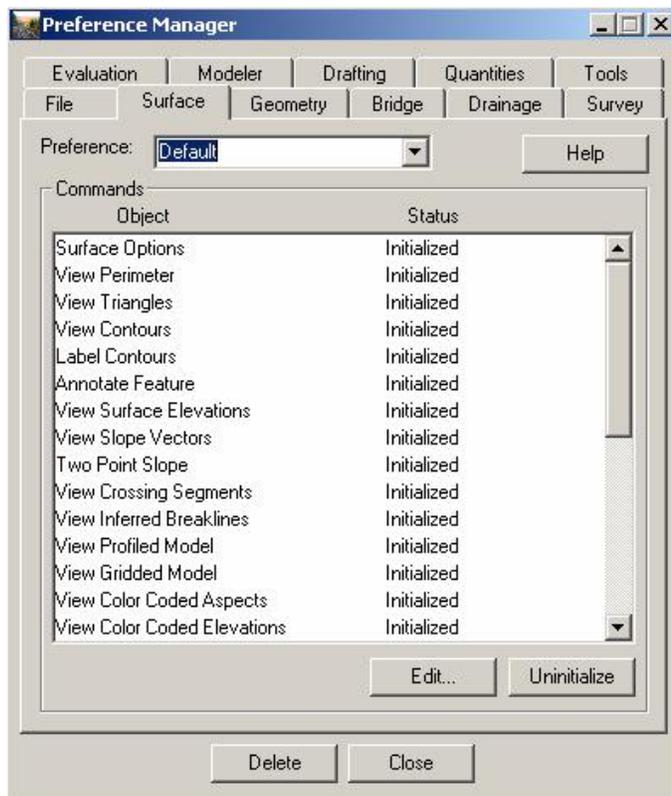
Settings that have been selected across the various tab options can all be saved to a preference set. Preferences are stored in the *civil.xin* file. When you want these configured settings for a particular design session, you can load the saved file from the **Preferences** dialog box. At start up, all available preference files currently in the *civil.xin* are listed in the Preferences dialog box.

You can create or modify basic preferences at any time from the **Preferences** dialog box.



## Preference Manager

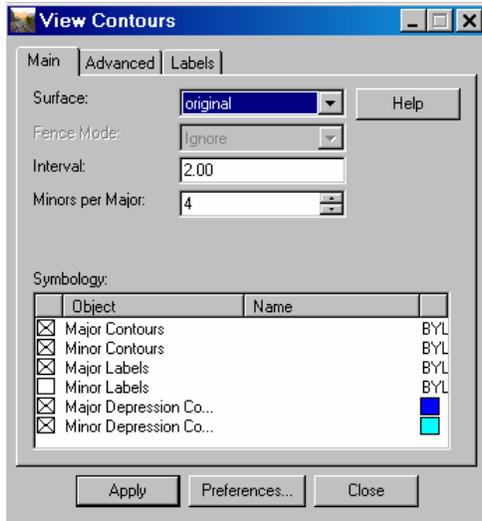
You can set basic preferences for every command under each InRoads menu, as previously described, or you can globally set all of these values (in addition to other detailed settings required by some commands) in one place at one time, using the **Tools > Preference Manager** command. **Preference Manager** acts as a global editor that allows you to specify preferences across all functional areas of InRoads.



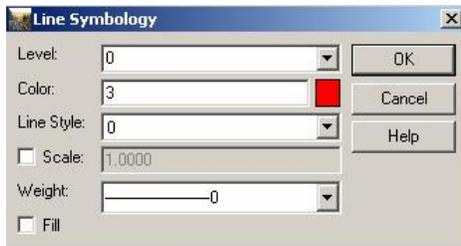
In **Preference Manager**, begin by selecting an area of InRoads for which you want to specify preferences. Second, type a unique name for a new preference set, or you could select an existing preference set from the list (any setting change will modify the set).

Notice that in the **Status** field, it is indicated whether or not a preference object has already been defined for this preference set (either at the command dialog box or in **Named Symbology Manager**). If *initialized* is displayed, preferences for the object have already been defined; however, you can modify the settings here and associate them with the new preference set. This is helpful if you want to standardize preferences across a design session or meet a specialized customer deliverable.

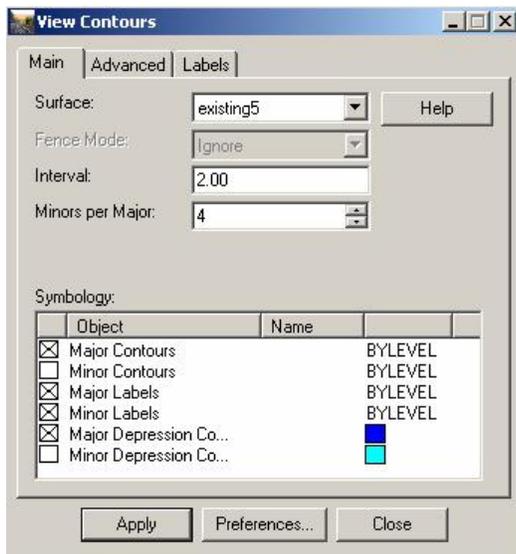
To set preferences, double-click on an object (or select it and click **Edit**).



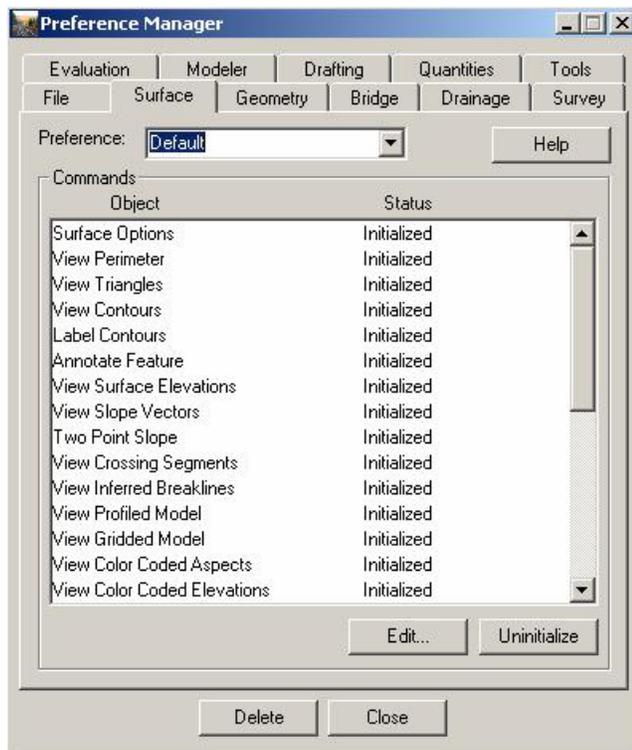
Individually set each value for an object. Or you can select a named symbology. If you choose a named symbology, the values previously defined in **Named Symbology Manager** populate the dialog box:



You must individually save each object preference.



When you have selected and saved all of the preferences, click **Close** to dismiss **Preference Manager**:



Named preferences are saved and stored in the *civil.xin* file.

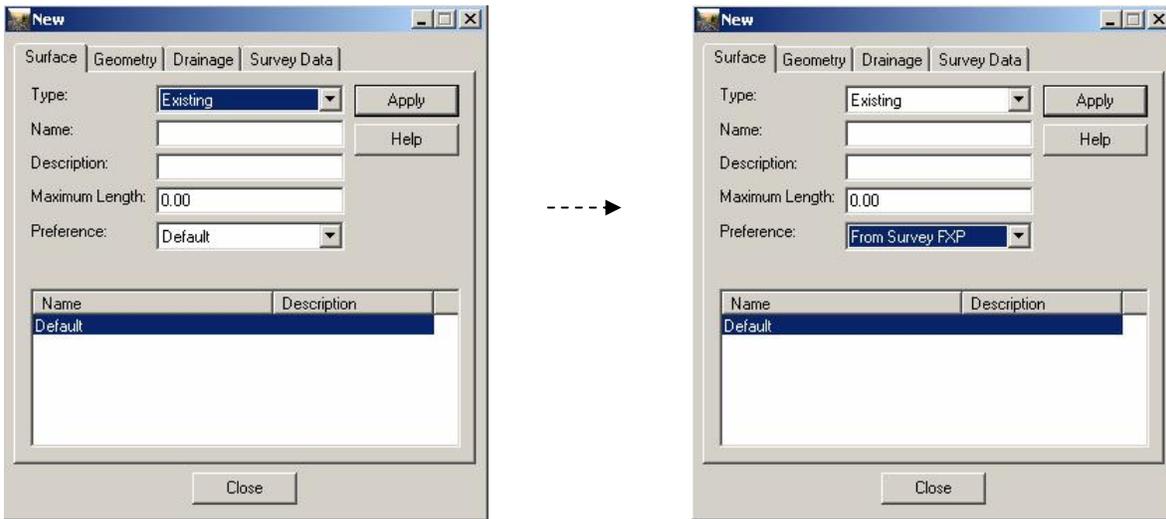
## Surface Preference

A surface preference is a named preference that you want to associate with a surface. When a preference is associated with a surface, all of the settings and display characteristics that were previously defined will be active for the surface.

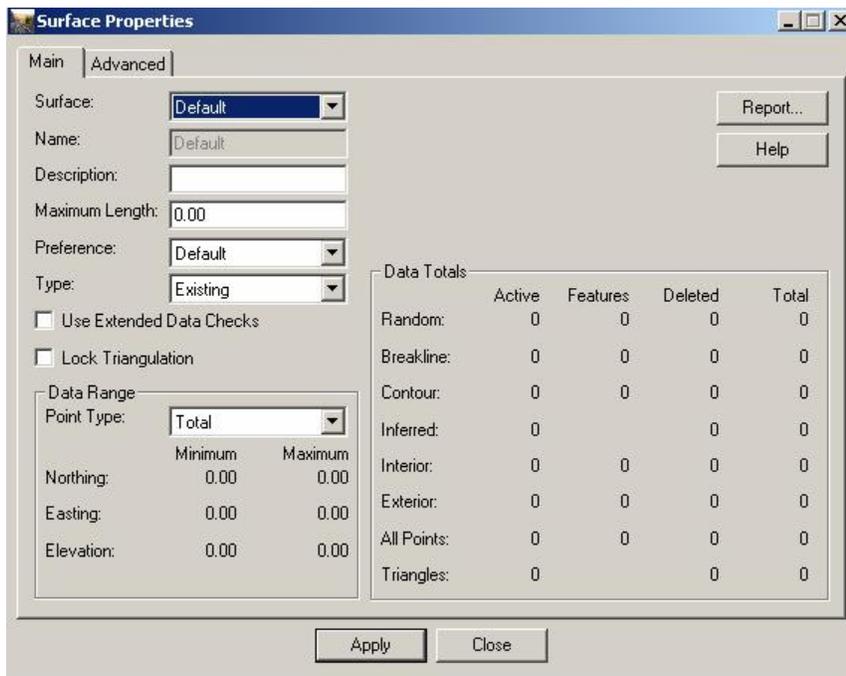


The **Tools > Locks > Style** command must be on. If **Style Lock** is not on, the basic preferences from the command dialog box apply.

A surface preference can be specified when creating a surface with the **File > New > Surface** command.



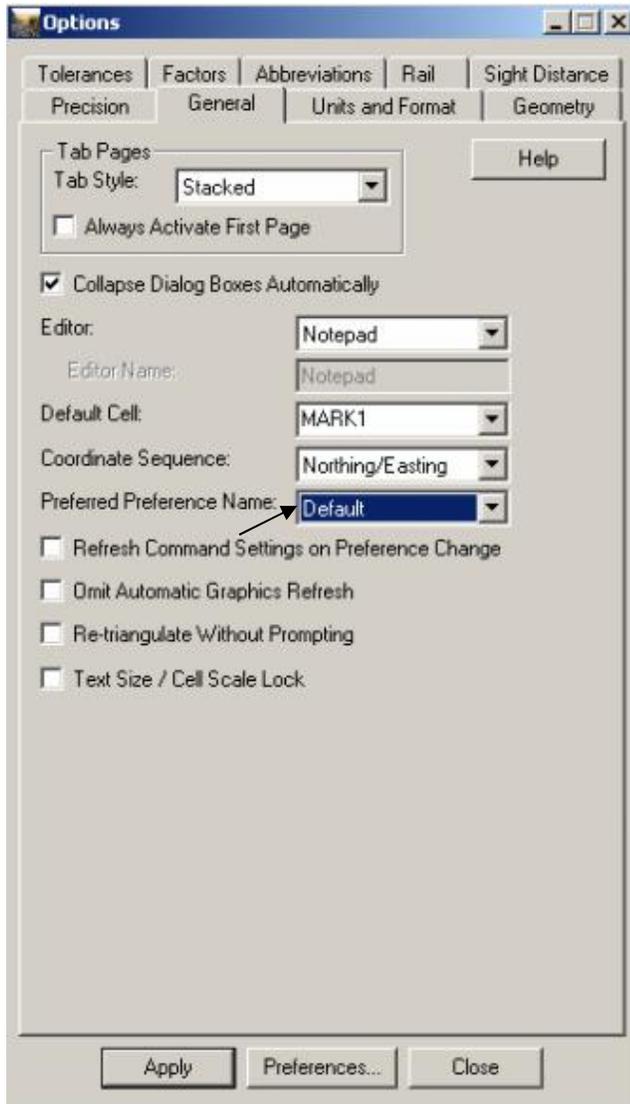
In addition, you can change surface preferences at any time during a design session using the **Surface > Surface Properties** command.



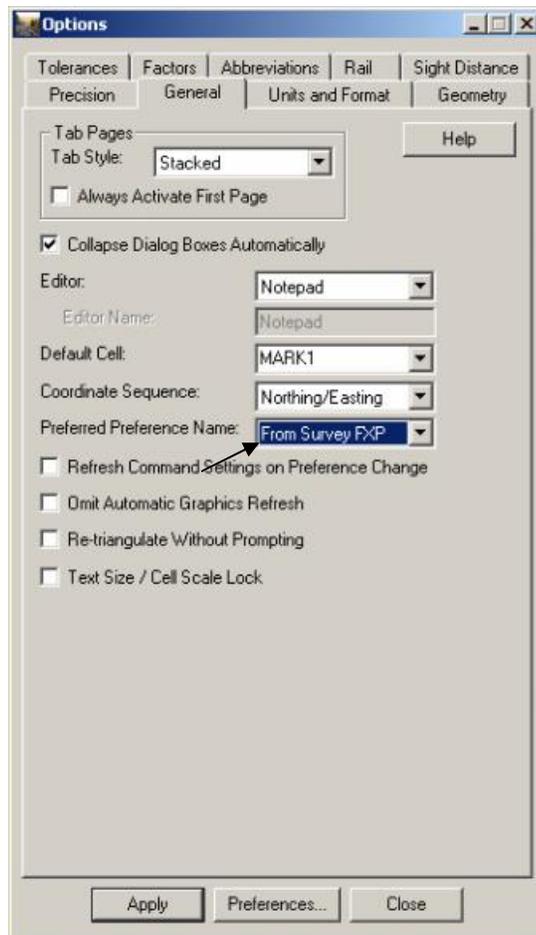
If, during a design session, you choose a different surface preference, use the **Surface > Update 3-D/Plan Surface Display** command to refresh the graphic display with the new preferences.

## Preferred Preference

The *preferred* preference is the default global preference set. At start up, the preferred preference is the system **Default** (these are selected settings delivered with InRoads). If you have created a named preference set and desire to have it as the default, access the **Tools > Options > General** tab. For **Category**, select **Settings**.



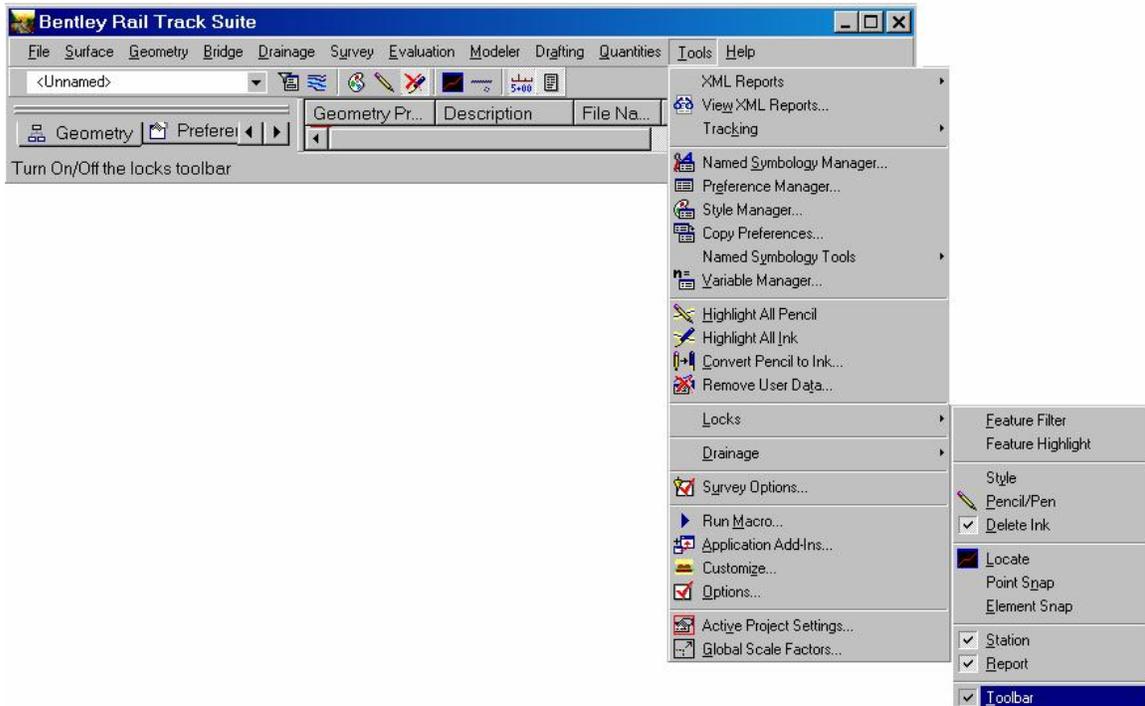
When specifying a preferred preference, if the **Refresh Command Settings on Preference Change** toggle is on, all of the InRoads commands that are affected by the preference change are updated to reflect the new preference settings. If a command dialog box does not have a named preference corresponding to the preferred preference, the system defaults continue to apply for that dialog box.



Click **Apply** to activate the preferred preference.

## Locks

In InRoads, there are several *lock* features that work together with **Named Symbology Manager**, **Preference Manager**, and **Style Manager** to streamline your required interaction with the software.

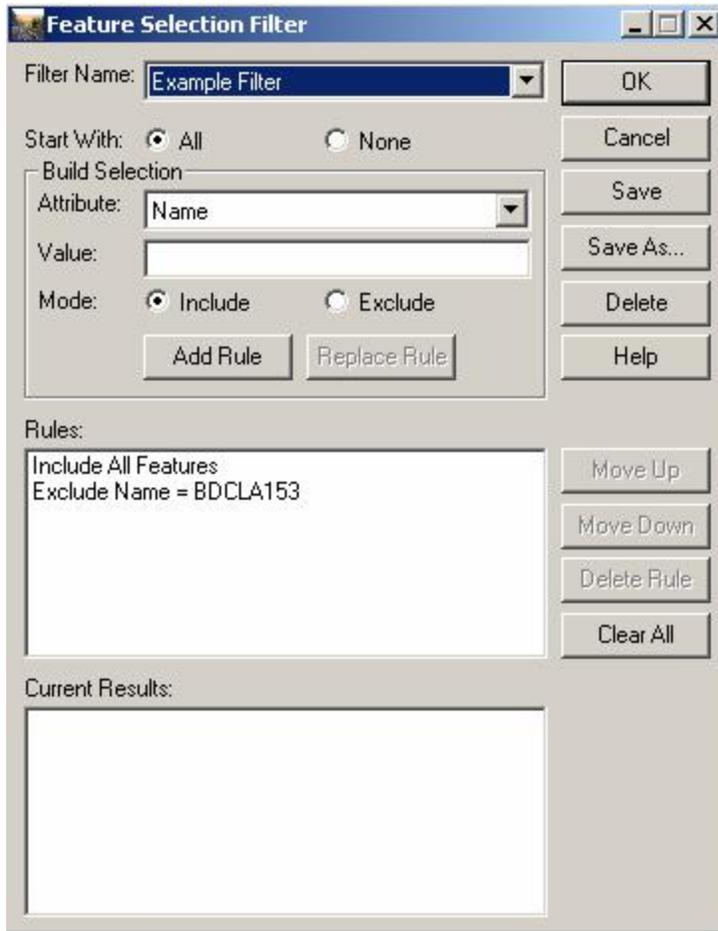


For quick access to the lock commands, select **Tools > Locks > Toolbar**.

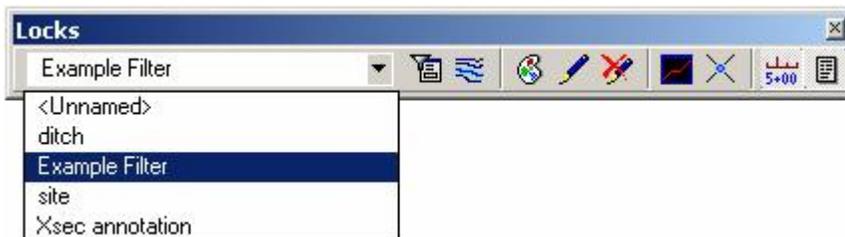


## Feature Filter Lock

The **Feature Filter** lock works in conjunction with the **Surface > Feature > Feature Selection Filter** command to automatically make available a filtered feature-selection set. When you create a selection set using the **Feature Selection Filter** command, it is assigned the name <Unnamed> if you do not use the **Save As** button to provide a name.

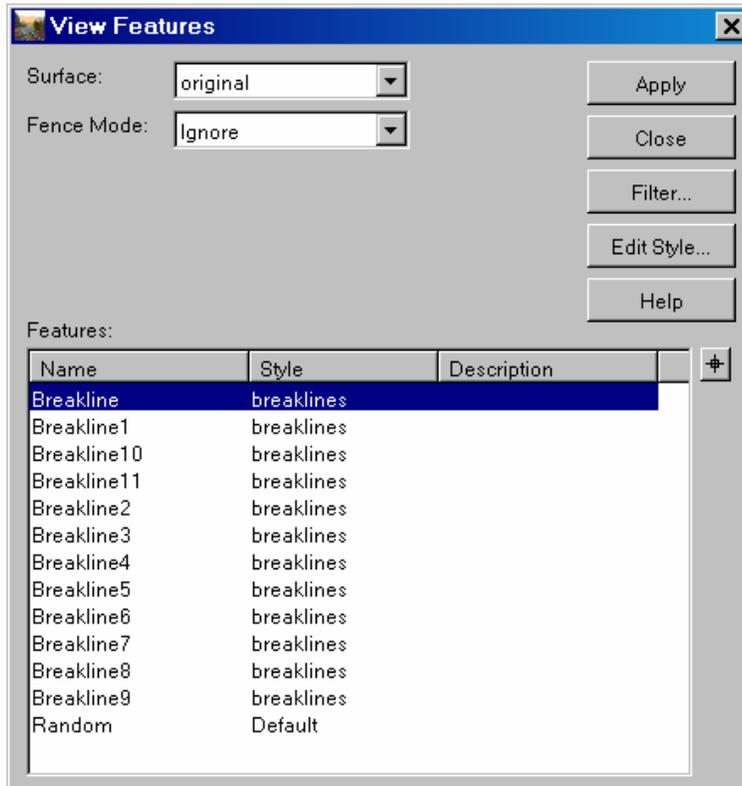


Not only is the feature-selection set saved to the *civil.xin* file, the name assigned to the set is listed in the **Feature Filter List** located on the **Locks** toolbar.



When the **Feature Filter** toggle is turned on, these selection sets are now available for display without any further interaction with the **Feature Selection Filter** dialog box.

Subsequently, when the **Surface > View Surface > Features** command is selected, only those feature types specified in the selection set are available for display.



Click **Apply** to display the features in the surface. Or, you could use the **Locate** button to identify features (of the filtered type) by datapoint in the surface.



When the **Feature Filter** lock is off, defined feature selection sets are not available or applied.

## Feature Highlight Lock



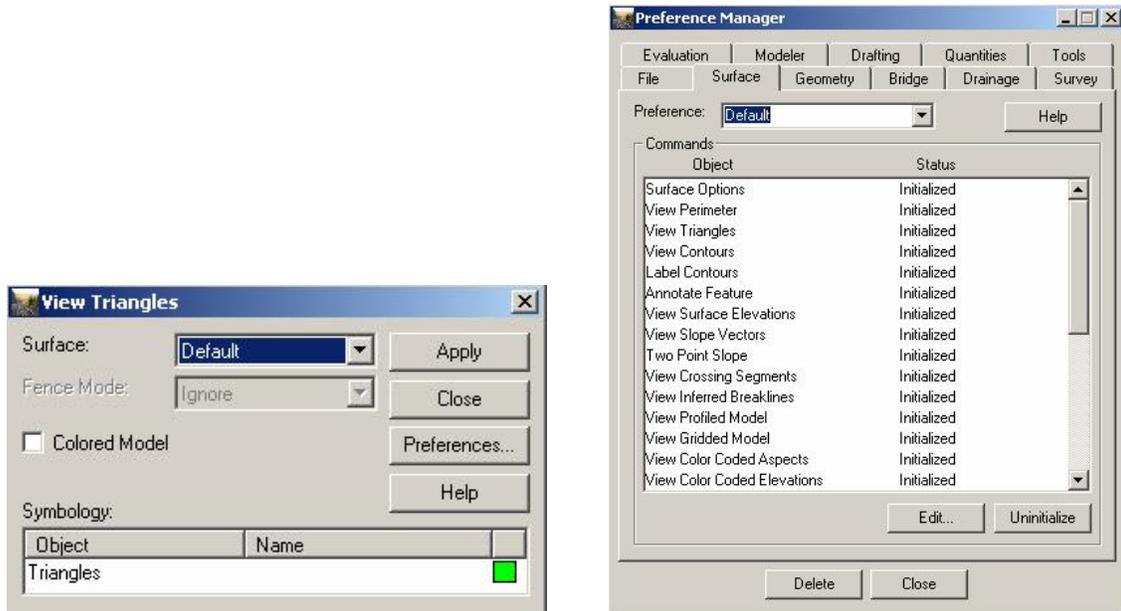
The Feature Highlight lock turns on or off the Feature Highlight lock. Use this command to highlight selected features in plan view.

When the lock is on, any commands that include a feature list field highlights the feature in plan view when it is selected in the list. While this primarily affects Surface commands, it also applies to Evaluation commands that include feature lists.

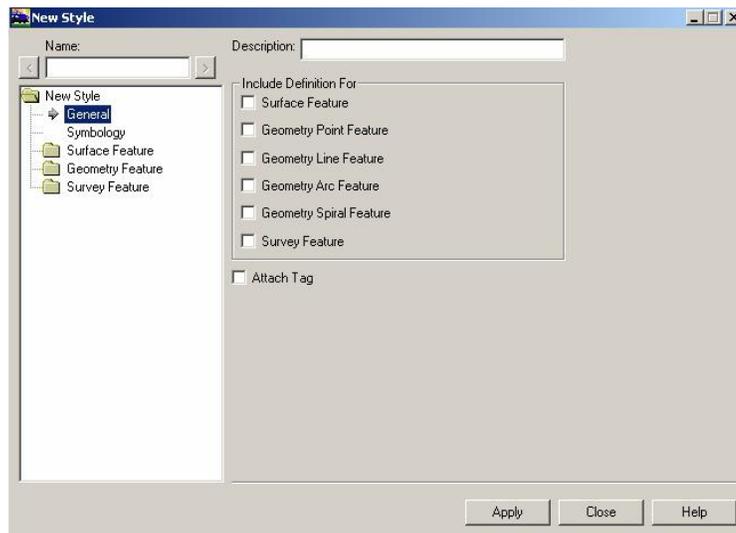
## Style Lock



The **Style** lock works together with **Preferences**, **Preference Manager** and **Style Manager** to automatically display global preference settings and defined features styles. As previously detailed, preference settings are defined at the local command dialog box or globally in the **Preference Manager**.



Styles are created and named using the **Tools > Style Manager > New** command.



Once preferences and feature styles have been defined, you can turn on the **Style** lock toggle to have these settings automatically display during the design session, without any further interaction with command dialog boxes.



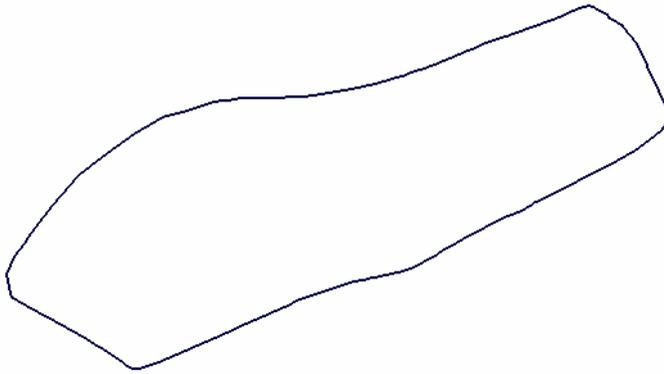
When the **Style** lock is on and a command is selected, data preferences are active and displayed; no dialog box is presented. When **Style** lock is off, each time a command is selected a dialog box is presented allowing you to define display preference and style.

This command allows you to reduce required interaction with InRoads commands.

## Pencil/Pen Mode

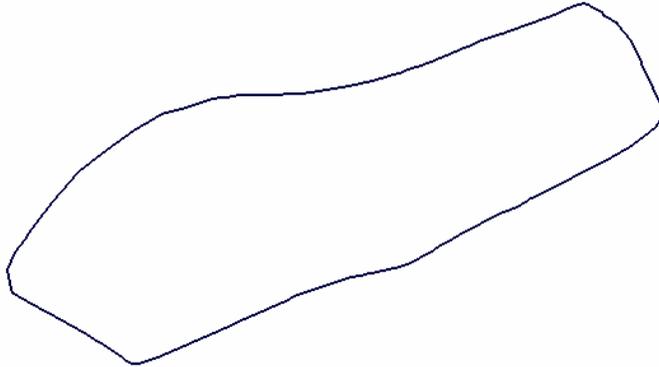
When graphics are generated and written to the design/drawing file, the **Pencil/Pen** mode is available. These modes allow you to write to the design/drawing file in either temporary or permanent form. This idea is similar to drawing on a sheet of paper with pen or pencil. When writing in pencil, you can quickly erase a drawing to remove it. In contrast, writing in ink (pen) is a more permanent form that must be deleted to be removed. Similarly, in InRoads graphics written in pencil are not retained between iterations of display, and graphics written in ink are retained each time the object is displayed.

For example, if you turn on **Pencil** mode and select the InRoads **Surface > View Surface > Perimeter** command, the graphic is displayed and written to the CAD design/drawing file.



Then, using a CAD manipulation command such as **Move**, relocate the graphic. Next, select **Surface > View Surface > Perimeter** to display it again. The previous graphic is “erased” and only the most recent graphic appears.

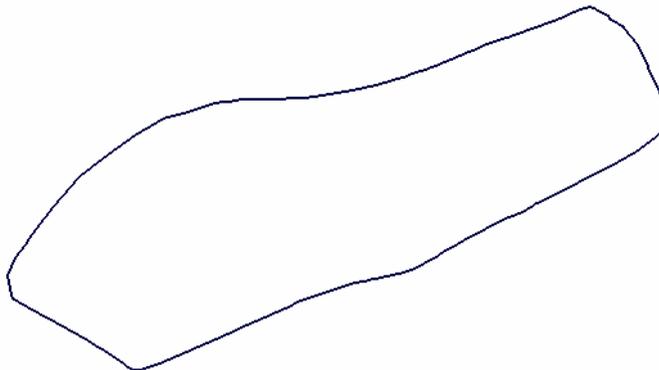
 The **Pencil/Pen** mode that is active when the graphic is initially displayed determines whether or not it is erased when it is redisplayed.



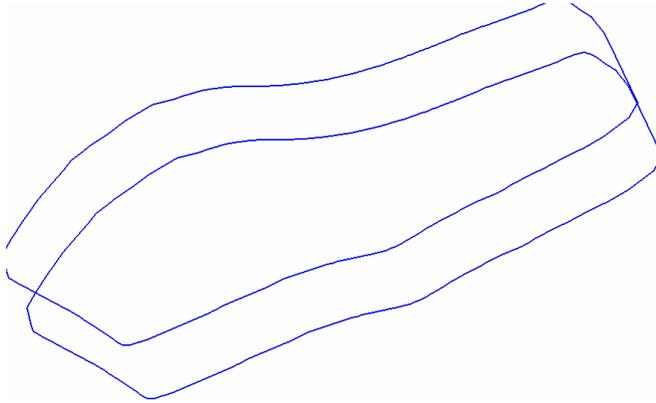
Graphics written in **Pencil** mode are retained only until the next time the same graphic is selected for display.

 During a design session in **Pencil** mode, there may be an occasion where you do not want pencil graphics to automatically be erased. To override this action, select the **Tools > Options > General** tab. For **Category**, select **Settings** and turn on the **Omit Automatic Graphics Refresh** toggle. All graphics, written in pencil or ink, will be retained until you manually delete them.

In contrast, if in **Pen** mode you select **Surface > View Perimeter**, the graphic is displayed and written to the design/drawing file.



Then, using the CAD **Move** command, you relocate the graphic. Next, select **Surface > View Surface > Perimeter** again. Both graphics appear. The first is retained because it was written in ink, the second appears because it is the most recent.



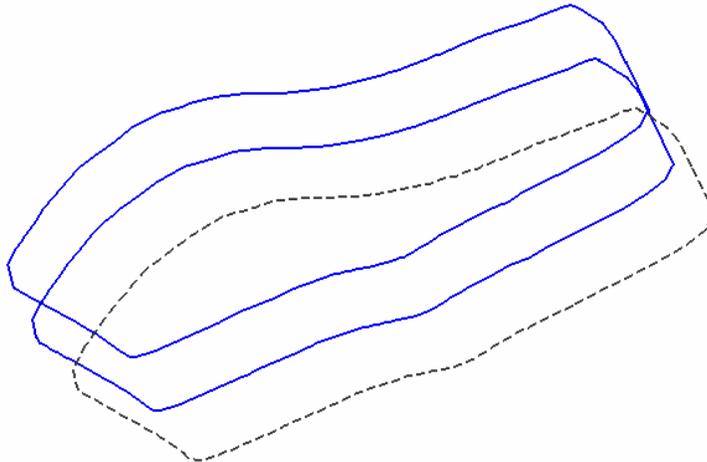
All graphics written in **Pen** mode are retained until they are deleted. Graphics can be manually removed using the CAD **Delete** command or by activating the InRoads **Delete Ink** lock.

## Delete Ink Lock

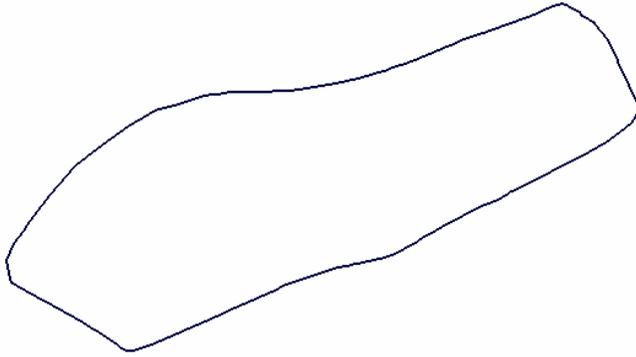


Turn on this toggle to quickly remove all graphics that were previously written in ink.

For example, if you have three iterations of a graphic that was written in ink, all three graphics appear in the design/drawing file.



Then, if you turn on the **Delete Ink** lock and select the command again, only the current graphic is displayed.



All of the previously displayed graphics are deleted. To override the **Delete Ink** lock, select the **Tools > Options > General** tab. For **Category**, select **Settings** and turn on the **Omit Automatic Graphics Refresh** toggle. All graphics, written in pencil or ink, will be retained until you manually delete them.

## Locate Graphics/Features

During an InRoads design session, you create, edit and manipulate objects in two different environments: the CAD design/drawing file and the DTM model surface. Objects located in the CAD design/drawing file are referred to as *graphics*. Objects located in the DTM model (design surface) are referred to as *features*. The **Locate Graphics/Locate Features** mode lets you quickly specify the environment from which to select objects.



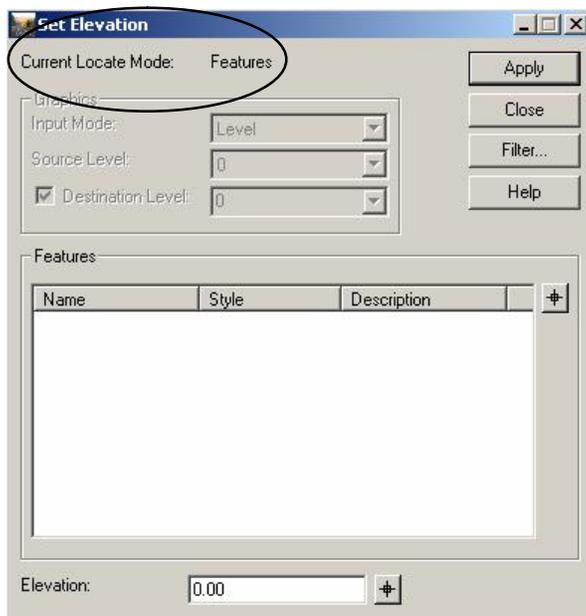
For example, if you toggle to **Locate Graphics** and select the **Surface > Design Surface > Set Elevation** command for a **Single** graphic element, you are prompted to identify an element within the CAD design/drawing file.



While remaining in the same command dialog box, you can toggle the mode to **Locate Features**.



The dialog box options dynamically change. You can now identify *features* in the surface.



Identify and locate individual features or select all available features in the surface.

-  While an alignment (\*.alg) is another way to manipulate objects during a design session, the *geometry* data in the alignment is not accessible from the **Locate Graphics/Locate Features** command.

## Point/Element/No Snap Lock



This lock is a three-way toggle that allows you to specify the snap mode when working with feature and geometry data.

- **Point Snap.** This lock allows you to snap onto any point contained in the geometry project. This mode is helpful when placing geometry elements. For example, if you want to input point data into a dialog box, toggle this lock on and place a data point in the design file. InRoads will find the closest point and display the point data in the dialog box.
- **Element Snap.** This lock allows you to snap or lock onto any geometry element (any object that would require multiple data points to define) in the geometry project. This mode is helpful when using the direction, distance, length, radius, and/or angle of an existing geometry element to design a new element. When this lock is on, InRoads snaps to the element nearest the data point you place in the design file
- **No Snap.** This mode disables both point and element snap.

## Station Lock



This on/off lock is applicable only when the first station specified on the horizontal alignment is an odd-numbered station (for example, 2+39) and you are generating cross sections, executing the roadway designer, or generating station type reports. When this lock is turned on, InRoads applies a given command action to the first station, and then forces all subsequent actions to even-numbered stations. For example, if the first station 2+39 and the station interval is defined as 50, InRoads performs the command action at stations 2+39, 2+50, 3+00, and so on. When the **Station** lock is turned off and the first station is odd-numbered, InRoads applies the command action to odd-numbered stations only (for example, 2+39, 2+89, 3+39) and so on.

## Report Lock



This on/off lock is used by several commands to control whether or not the output displays in a dialog box as the command calculations are performed. If this lock is off, the command processes and stores results without displaying them in an output dialog box.

---

## General InRoads Review

InRoads includes a wide-range of functionality, features, and commands that are accessible to several areas of the product.

### Comprehensive Data Structure

The data structure for InRoads accommodates the intelligence needed to perform sophisticated 3-D design operations such as earthwork analysis, profile generation, and superelevation. Its ability to maintain double-precision numbers is not dependent upon the CAD platform. As you place or locate design elements or coordinate geometry points, InRoads tools accommodate double-precision input. Even graphical selection tools automatically snap to points and elements in your geometry project with double-precision accuracy.

### Horizontal and Vertical Alignments

Alignments continue to represent longitudinal features, such as centerlines, lanes, access ramps, and ditch grade lines. The horizontal and vertical geometry of an alignment is designed separately, with the vertical being a child of the horizontal. There are no restrictions on how many vertical alignments you can attach to a horizontal alignment. Alignments are designed using the geometry component of InRoads, which has an array of features for locating points and designing the curvilinear geometry through them.

InRoads automates the creation of horizontal and vertical geometry. In the initial design phase, you can use a backdrop of graphics such as a DTM, aerial photo, MicroStation graphics, and so on. You can define curve and tangents, in any order, with or without automatic spiral placement, and if you need to add spirals, you can do so as you define the circular curves.

When the rough geometry is complete, you can begin to refine the alignment. You can dynamically manipulate elements or use precision key-ins. The software provides immediate visual feedback and automatically adjusts the geometry throughout the alignment, maintaining coincidence and colinearity between all the elements where appropriate.

### Roadway Templates

Templates are among the most powerful features of InRoads' corridor design capabilities. Contrasted with alignments, which represent longitudinal geometry, roadway templates represent transverse geometry. Templates, which are the backbone of road design, are made up of *points* and *components*.

#### Points

The points of a template represent *breakline* features that will be created when the template is processed using Roadway Designer. Points have a name and feature style; there is no limit to the number of points in a template. Once processed in Designer as features, they are saved to the design surface.

#### Components

A component is a set of points that define an open or closed shape. Each component, whether open or closed, can represent a different material or area of interest. Components are named and have

an assigned feature style. There are 5 *types* of components created in InRoads: *Simple*, *Constrained*, *Unconstrained*, *Null Point*, and *End Condition*.

A simple component typically represents a section of pavement. It's a closed shape (4 constrained points) that can define the slope and thickness of the component. A constrained component consists of points that are all restricted to the movement of the first point. A constrained point is typically used to manage the behavior of other points in the template. When a constrained point (parent) is moved, any related point (child) also moves. This restriction only affects the offset and elevation (x,y) of related point and, the relationship is uni-directional (movement of child point does *not* move the parent point). An unconstrained component is open or closed-shaped with no movement restrictions. A null point is a template point that is purposely not related to any particular component. It's most often used as a reference for controlling other points. An end condition is a special open-shaped component that targets a surface, a feature of a surface, an elevation, a surface with a specific material, or an alignment (it replaces the former Cut/Fill, Material, and Decision tables). The integrity of end conditions can now be routinely tested while the roadway template is being created.

Once created, components can be modified as desired. There is no limit to the number of points or components in a template.

When templates are paired with horizontal and vertical alignments and superelevation, they define the surface of a corridor. Templates are flexible design components that allow you to model simple constructs such as ditches and sidewalks to the more complex multilane highways with superelevated curves and variable side slopes.

## Evaluation

InRoads provides tools to make preliminary evaluation of your model quick and simple. In addition to the dynamic display in Create Template that allows you to evaluate the roadway as it is being designed, the following tools allow you to evaluate various aspects of the design:

Display triangles and slope vectors and view them from any angle.

- Produce contours, cross sections, and profiles to compare original surfaces with design surfaces.
- Compute volumes using the triangle, grid, or end-area method.
- Produce Mass-Haul diagrams.

## Superelevation

Superelevation refers to the banking applied to offset the lateral acceleration that vehicles experience when going around curves. More specifically, it is the transverse slope between the inner and outer edges of a banked curve. InRoads accommodates all commonly used methods of calculating superelevation rates, including the five AASHTO methods and numerous international methods. Plus, InRoads gives you control over how superelevation is achieved longitudinally along an alignment, with parametric control over transition lengths and methods of transition.

## The Roadway Model

Roadway Designer pulls together all of your design data to create the corridor model. The designer uses a roadway definition to place appropriate templates and side slopes at intervals and at critical design points along the alignment. In addition, it applies superelevation and adjusts the templates to the longitudinal features as necessary, as well as checks right-of-way limits. The end result of

this is a DTM for each of the layers in the proposed corridor surface. These layers are comprised of 3-D linear features and xyz random points, providing a full 3-D model of the proposed roadway. The model features can then be displayed in the CAD design/drawing file.

For simple projects, InRoads provides Express Modeler, which produces a model quickly, with only minimal information. You need only to provide an existing surface, a horizontal alignment, and a single template. You can also provide a vertical alignment, but InRoads will use elevations derived from a horizontal alignment if no vertical alignment is provided.

## Drawing Production

Plan and profile drawings are easily generated from InRoads graphics. You can create construction documents, such as plan/profile, cross sections, and detail sheets.

## Reports

Reporting in InRoads is flexible and comprehensive. You can produce reports on any data that you have created or manipulated in the course of a project. Reports include listings of coordinate geometry points, alignment clearances, and earthwork data. InRoads also allows you to track your design activities. You can save your activities as report files or append them to other report files; they are invaluable for project documentation. All reports are generated in ASCII format for easy manipulation in a text editor or word processing program.

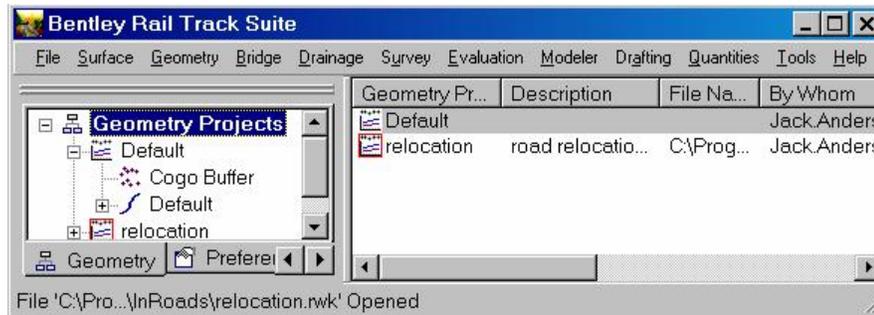
## Visualization

Designs produced with InRoads can be used with visualization software to create photo-realistic images, which help your project team or client better visualize the design. Bentley Systems also complements InRoads with a range of applications for editing and manipulating images to create photomontages or video presentations. These capabilities help you prepare presentations for non-technical audiences.

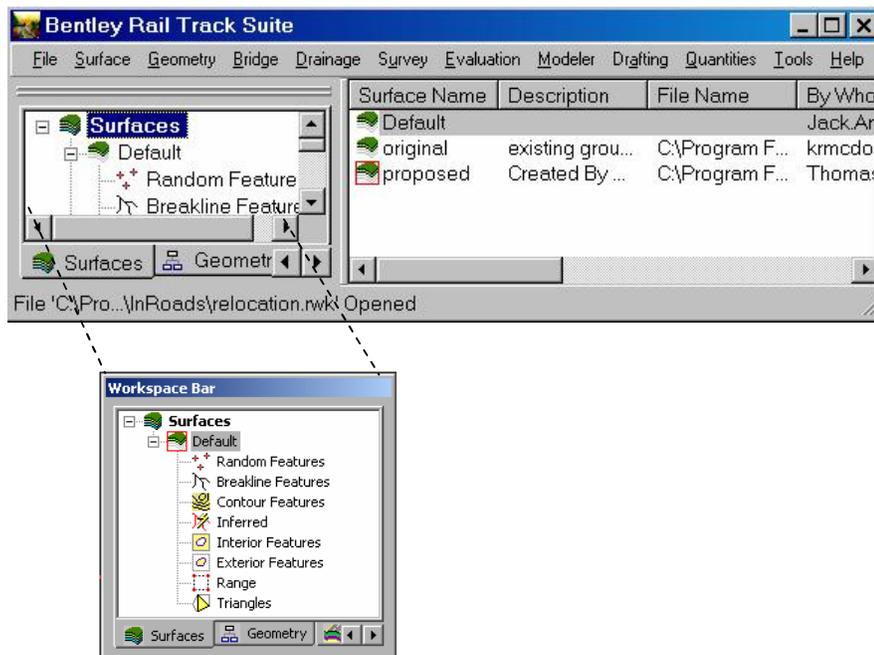
## Getting Around in InRoads

### Using the Interface

InRoads utilizes the Windows *Explorer* environment for file management. It works like the Explorer in the Microsoft Windows environment. By either clicking the plus sign (+) in the square next to an item or double-clicking on the name, a subgroup of items displays just like a directory tree. The InRoads Explorer provides a quick view of files that have been loaded and are available in a working session.



From the InRoads Explorer, you can “tear away” the left-pane Explorer tree, now referred to as the Workspace Bar:

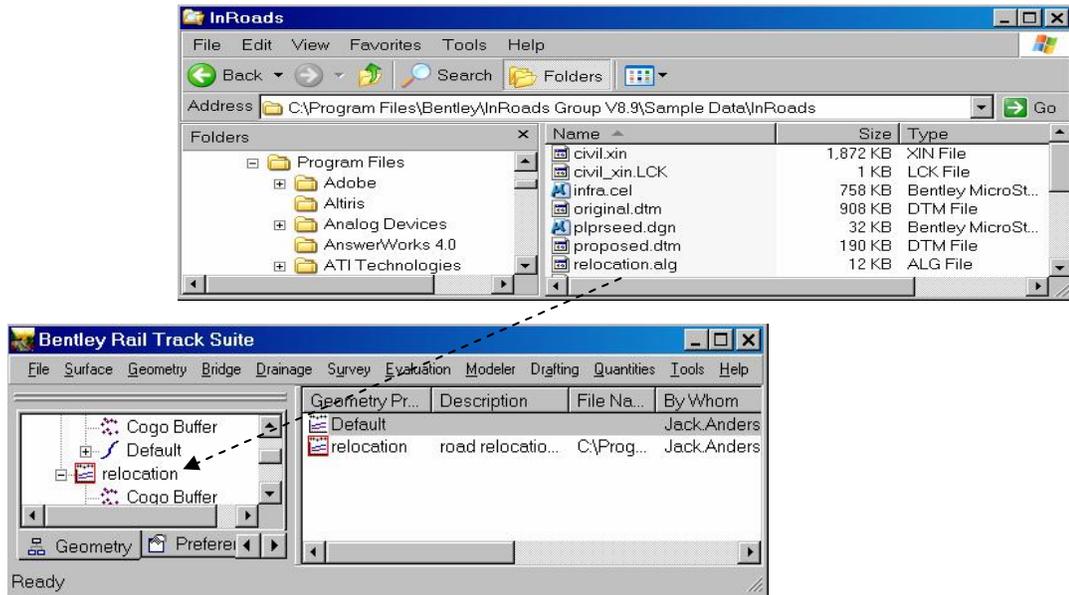


There are several unique advantages of the Workspace Bar. First, major objects are represented by tabs at the bottom of the view. Each tab corresponds to a particular view of the overall Explorer hierarchy. Second, by clicking a tab, such as the Surfaces, you’ll see all (and only) the surface objects in the project.

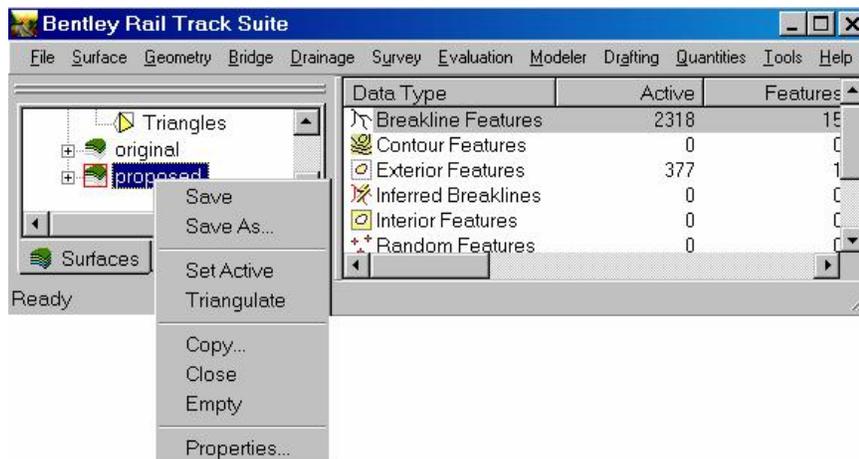
Workspace Bars can be docked anywhere on the screen for easy access.

To return the Workspace Bar back to the Explorer, click and drag the box to the desired location:

When you are in the Windows Explorer, you can drag and drop your InRoads data directly to the InRoads Explorer. The status of the data is displayed in the bottom portion of The Explorer window.

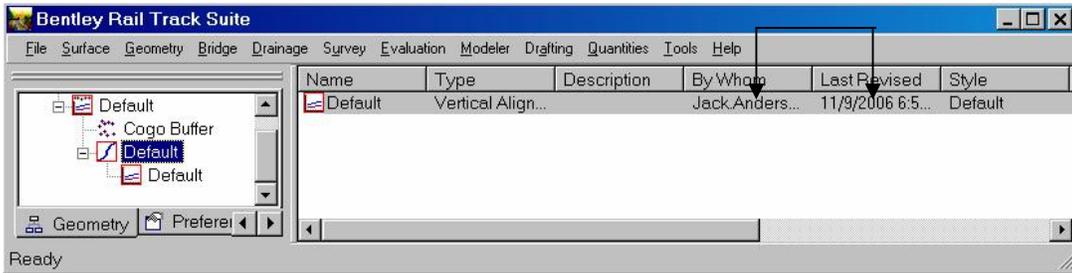


In the Explorer, you can access additional options that are available for an entity. For example, if you select (highlight) a surface and right-mouse click, a pop-up menu appears with additional options for surfaces.

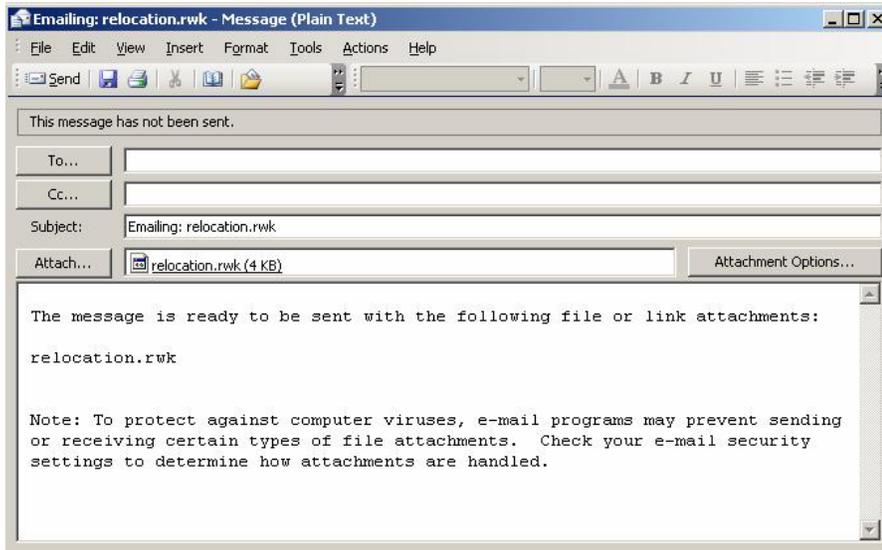
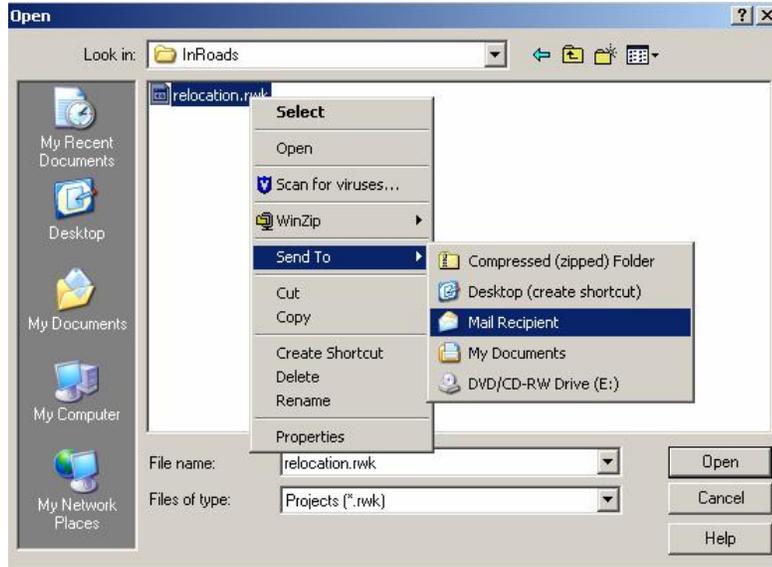


The additional options that are available depend on the entity that you select. In the Explorer, you can also access the following shortcuts:

- Review file revision data.



- Click **File > Open**, then right-click to access additional file and mailing options. For example, to email an InRoads project file:



The Explorer can be moved to a convenient location on the screen to make common tasks faster and easier.

## Accepting/Rejecting Solutions

If MicroStation is your CAD platform and you are using the default mouse configuration, you accept an InRoads solution by clicking the left mouse button. You reject an InRoads solution by clicking the right mouse button.

If AutoCAD or is your CAD platform, you accept an InRoads solution by clicking the right mouse button, by typing `accept` or `a`, or by pressing **Enter**. You reject an InRoads solution by typing `reject` or `r`.

On both CAD platforms, you exit an InRoads command by pressing **Esc**.

## Using Access Control

Access control allows you to share files among multiple users while controlling read-write access to the data. Using access control, you can essentially “lock” your data so that another user cannot overwrite it while you are working on it. The other user can open the data (read-only access) but cannot make changes to it while you have it opened with read-write access. Likewise, if another user has some data opened with read-write access, your only option is to open the data with read-only access.

Access control works with individual horizontal alignments, the cogo buffer, and preference files. However, with preference files, you lock the entire file! not individual preferences. When you have read-write access to a horizontal alignment, you also have read-write access to all data associated with the horizontal alignment: vertical alignments, superelevations, vertical event buffers, and horizontal event buffers.

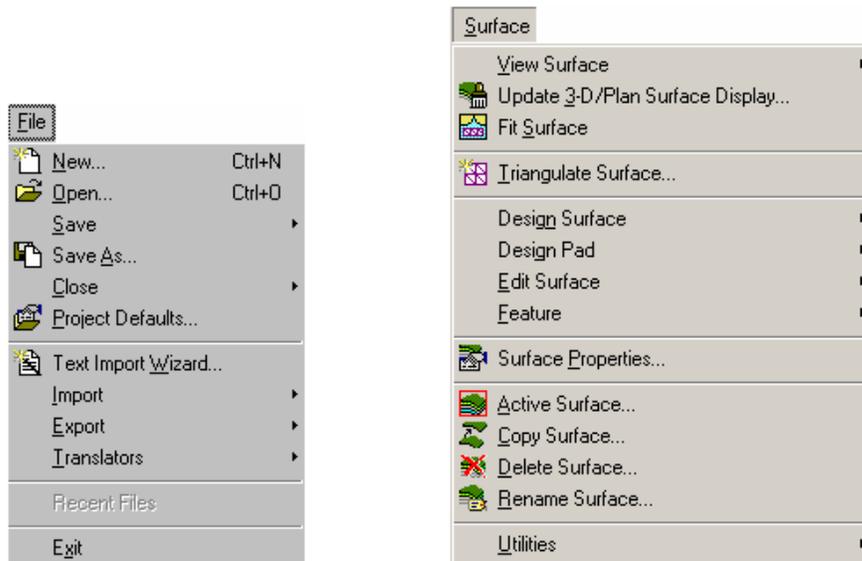
To set the access status, right-mouse click the horizontal alignment, cogo buffer, or preference file in the Explorer. When the menu appears, select either **Read-Write** or **Read-Only**. The status is reflected in the Explorer.

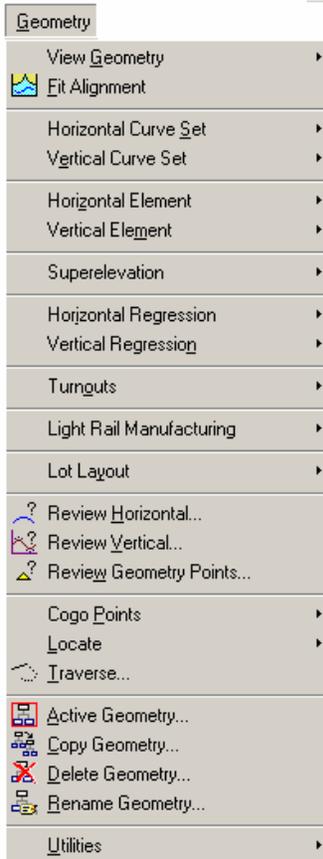
For more information about access control, see the *Bentley InRoads Group XM Help*.

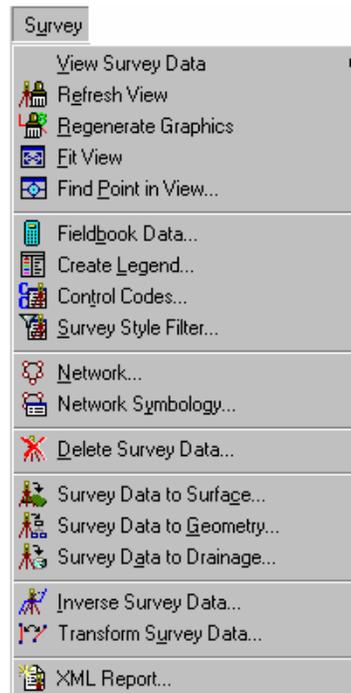
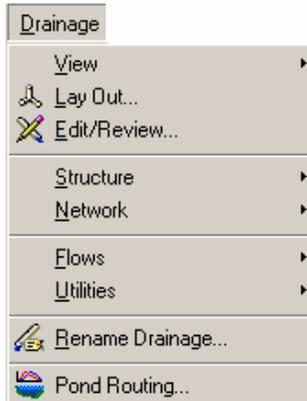
## Menus

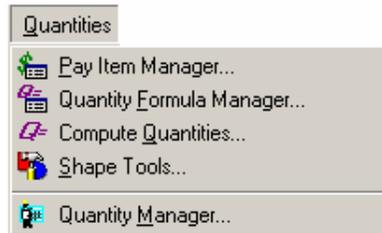
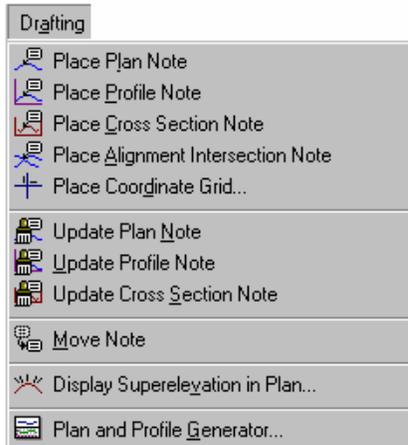
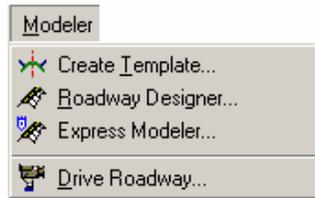
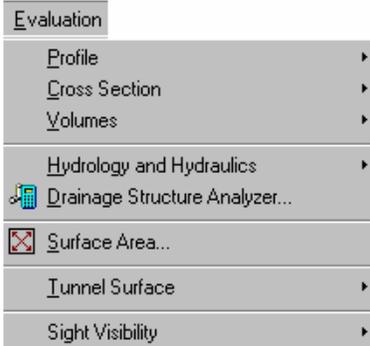
The Explorer contains menus that are the primary source of interaction with InRoads.

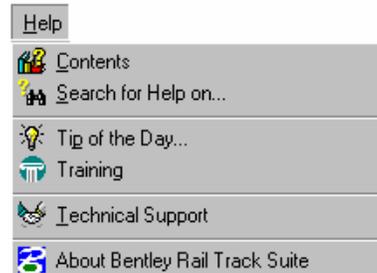
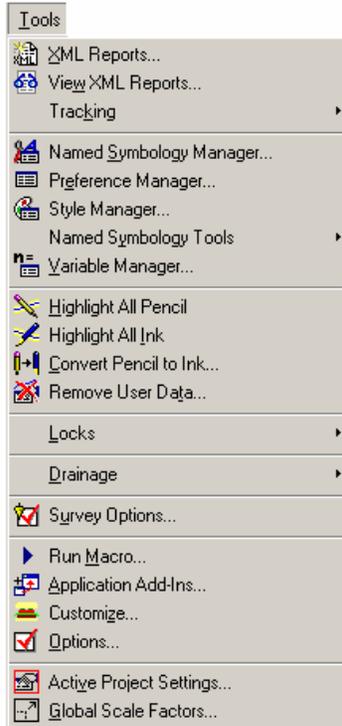
The menu titles reflect the functions used during the design process. They help you navigate to groups of commands used for a specific task. A small right arrow by a command indicates an additional menu with commands.





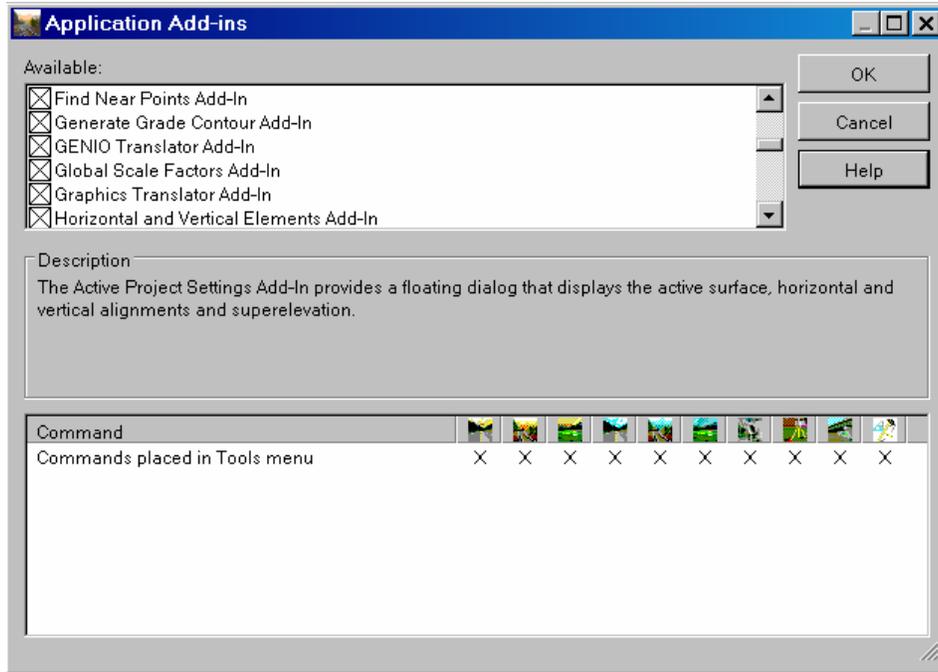




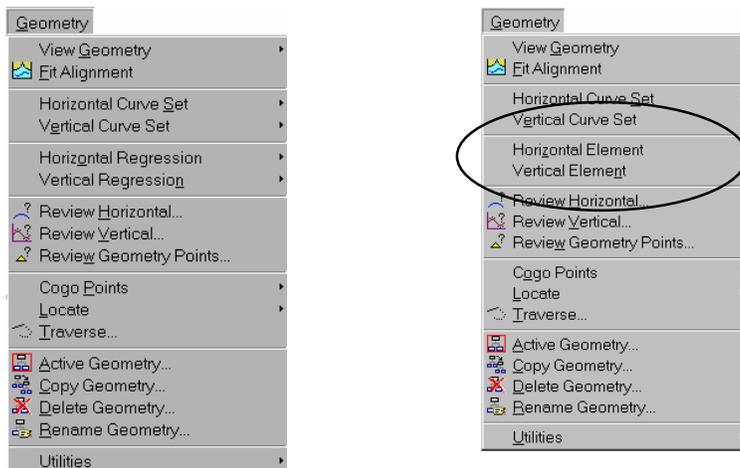


## Menus and Application Add-Ins

InRoads is delivered with several additional software modules that allow you to complete specialized or advanced tasks, including data translation. To access these features, select **Tools > Application Add Ins**.



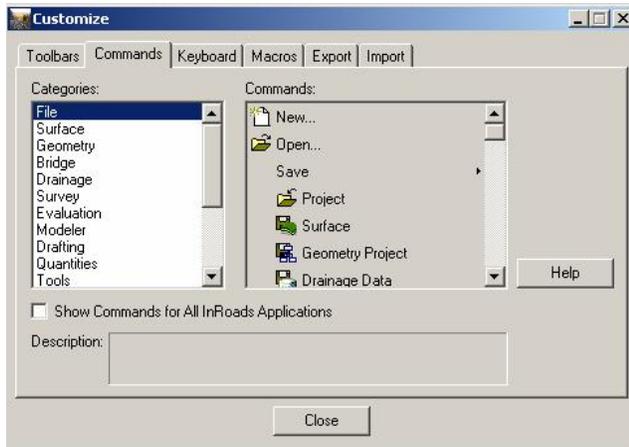
By default, these additional commands do not appear on InRoads menus because they are “turned off”. However, when you select add-in applications, menus are dynamically updated and the commands are listed on the appropriate menu. For example, by default the **Geometry** menu does not include the **Horizontal and Vertical Elements Add-In**. If you select it to turn it on and click **OK**, the command is dynamically added to the menu.



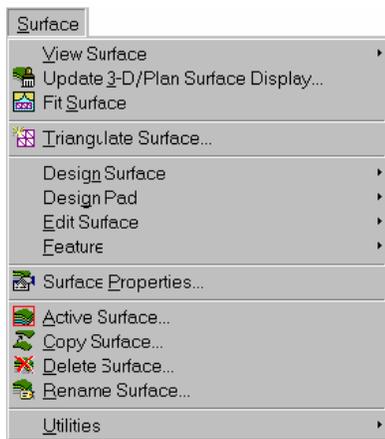
Add-in applications can be turned on and off at anytime during a design session.

## Customize Menus

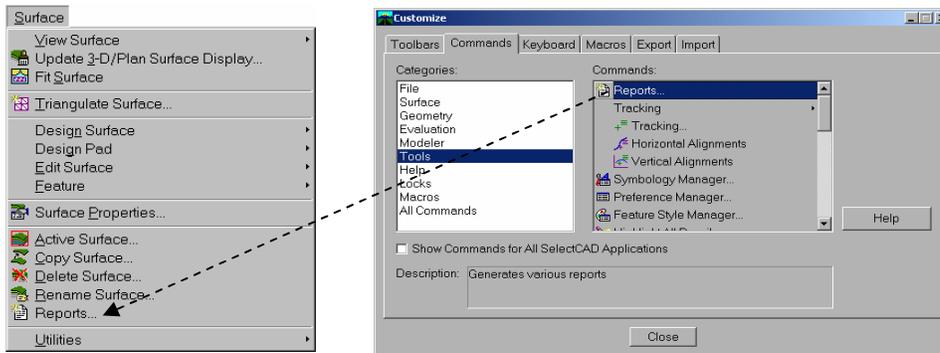
You can also create customized InRoads menus using the **Tools > Customize > Command** tab.



This command allows you to group specific commands together on a menu. First, select the menu on which to place the commands.



Then, drop and drag the selected command onto the menu.



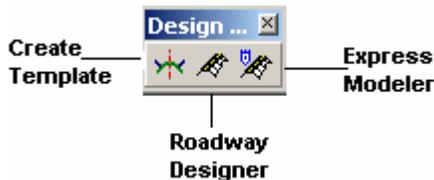
The command is added to the menu.

## Customize Toolbars

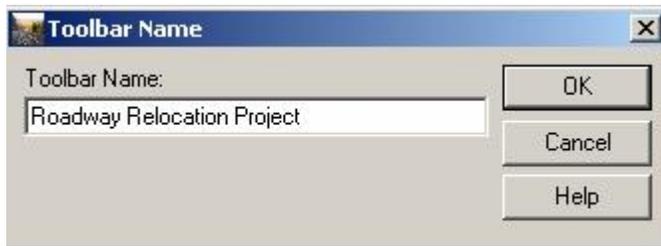
With the **Tools > Customize > Toolbars** command, you can select predefined toolbars to display that provide quick access to frequently used commands. There are toolbars for specific groups of menu commands, such as **View Surface**.



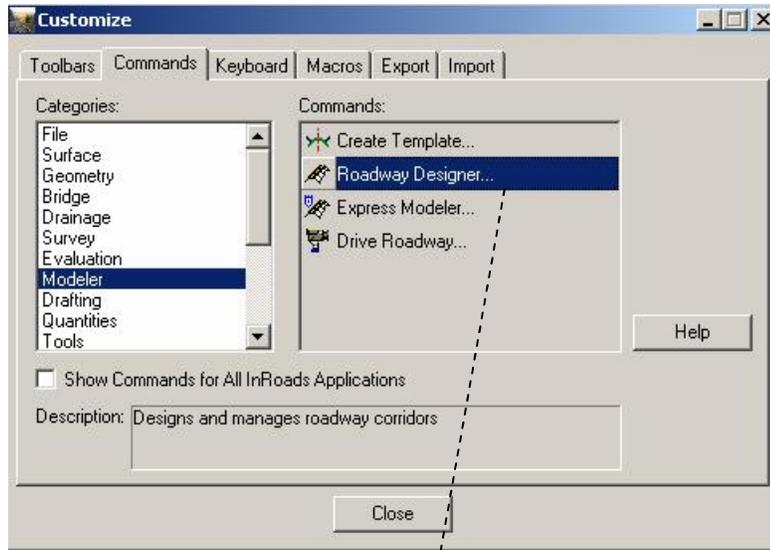
There are also predefined toolbars for common design workflows. The commands on the workflow toolbars may not appear together on any one menu or all of the available commands may not appear, but some are grouped together on the toolbar for a specific function. For example, **Design Roadway**.



If a predefined toolbar does not meet your design needs, you can create customized toolbars for unique workflows. Select **Tools > Customize > Toolbars > New**. Enter a toolbar name and click **OK**.

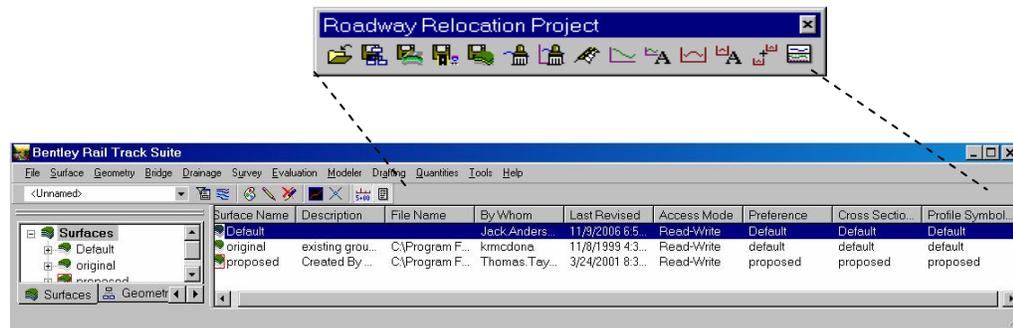


Click the **Commands** tab. Select commands from the list to drag and drop onto the toolbar.



With customized toolbars, you can step through the design process from surface creation to plan and profile sheet generation using a single toolbar.

Once toolbars are displayed, they can be moved to a convenient location on the screen or they can be “docked” onto the Explorer. To dock a toolbar, click and hold on the toolbar, drag it to the Explorer and release it.

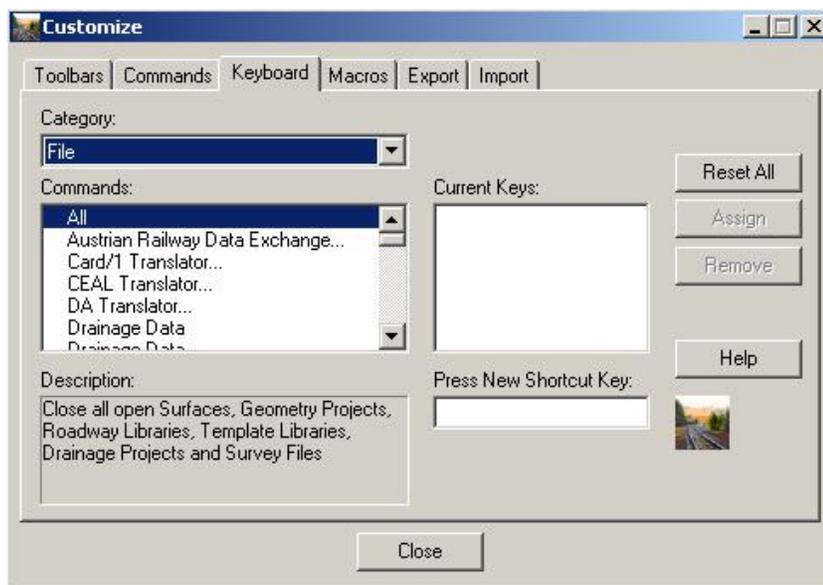


Docked toolbars remain in the Explorer until you delete them.

To remove a docked toolbar, click on it and drag it away from the Explorer and click the **X** button. Or, to remove *all* customized toolbars and menus, click **Tools > Customize > Toolbars > Reset All**.

## Customize Commands

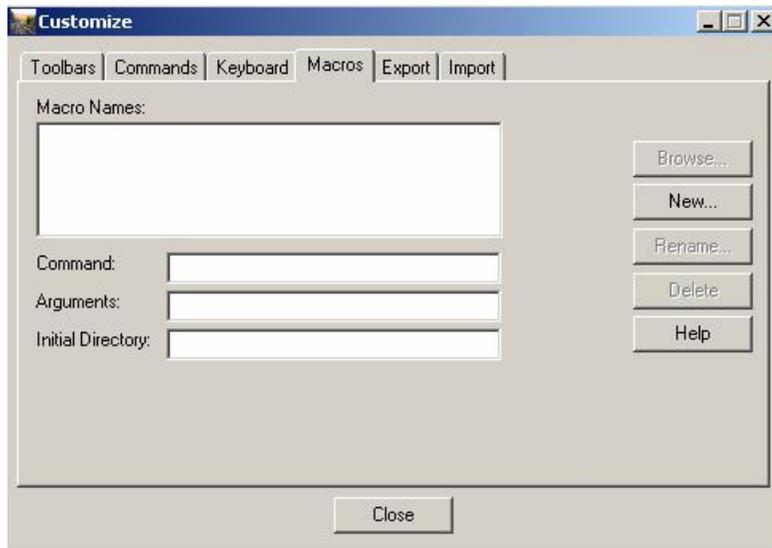
Use the **Tools > Customize > Keyboard** tab to create new keystrokes to activate InRoads commands.



You can create new shortcut keys or modify existing ones.

## Customize Macros

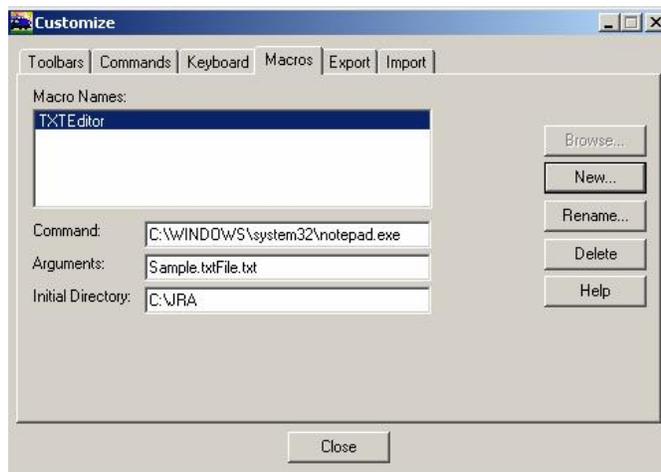
Use the **Tools > Customize > Macros** tab to provide access to external software programs that can be run within InRoads.



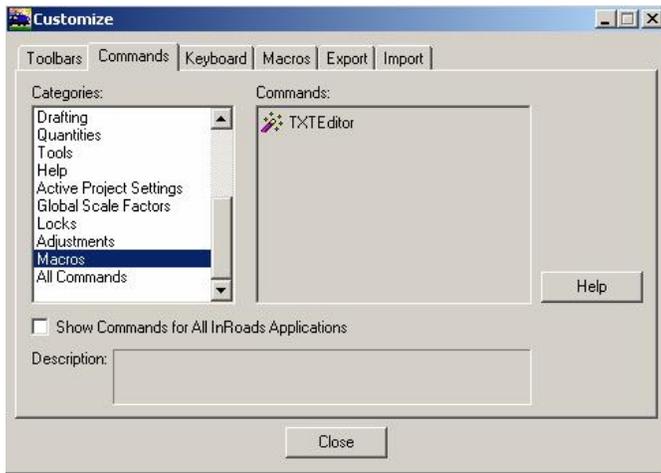
For example, click **New** to create a macro to run Notepad®, a Microsoft text editor, in a specific directory.



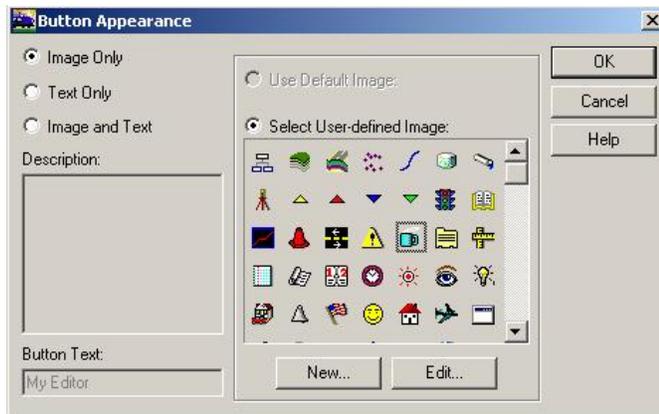
Enter a macro name and click **OK**. Then click **Browse** on the **Macros** tab dialog to locate and identify the Notepad executable. This automatically populates the command field. Then specify the Argument (file on which to run the editor) and the initial directory (where the file is located).



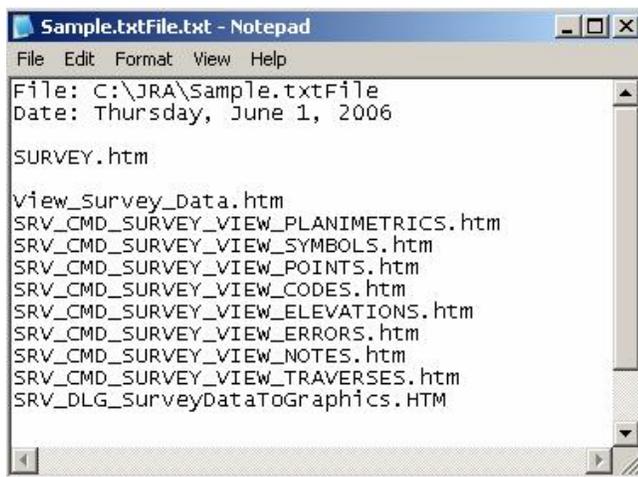
Click **Close**. The name of the new macro appears in the **Commands** list. Drag and drop the new command onto a toolbar or menu.



The **Button Appearance** dialog box appears. Select an icon to represent the command.



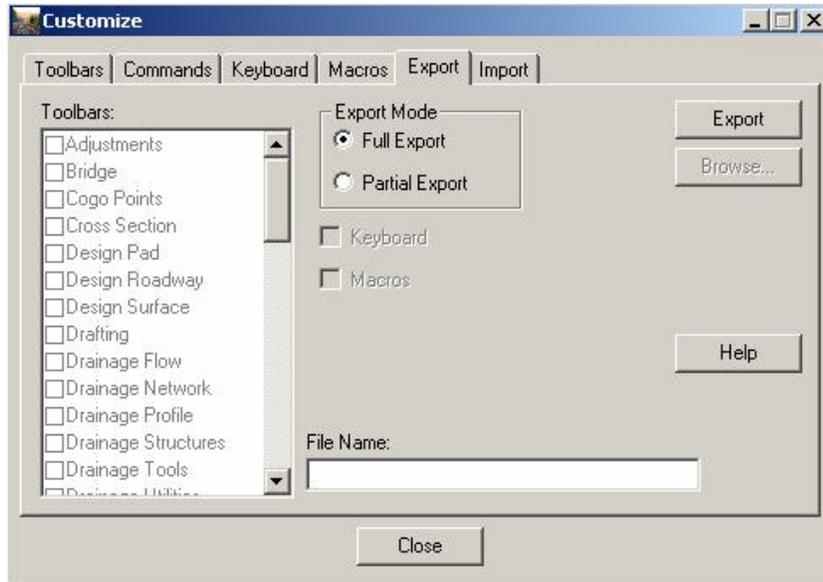
The icon appears on the toolbar or menu where you dragged and dropped it. Double-click the icon to start the command.



You can also use the **Tools > Customize > Macros** command to run advanced software programs created with InRoads Suite SDK. InRoads Suite SDK allows you to call InRoads Group functions from your own programs written in Visual Basic, Visual C++, or MDL. Refer to Program Files\Bentley\InRoads Group V8.9\SDK\Help\SDK.HLP for more information about customizing InRoads using SDK.

## Exporting Custom Settings

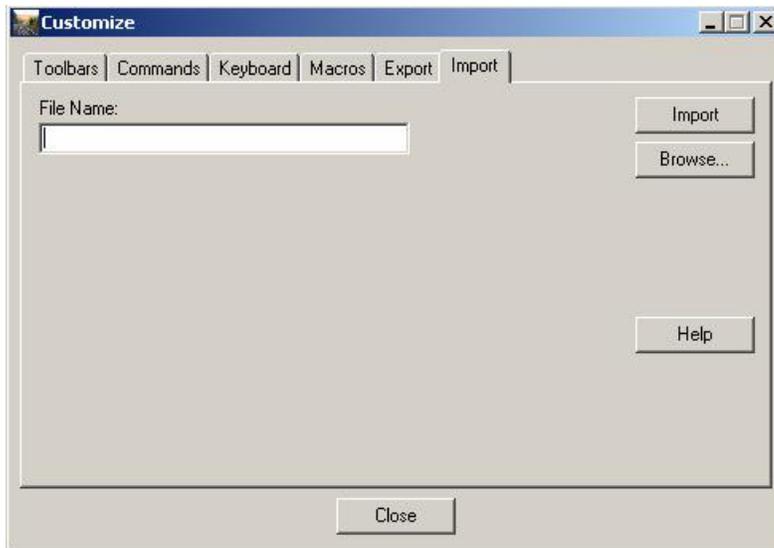
Once custom menus, toolbars and command-shortcut keys have been created, you can save all of the settings to a file for use in future design sessions. To access this command, select **Tools > Customize > Export**.



- **Full Export** – Use this option to save all custom settings.
- **Partial Export** – Turn on this option to individually choose which toolbars to save. You can also specify shortcut keys, macros, or both.

## Importing Custom Settings

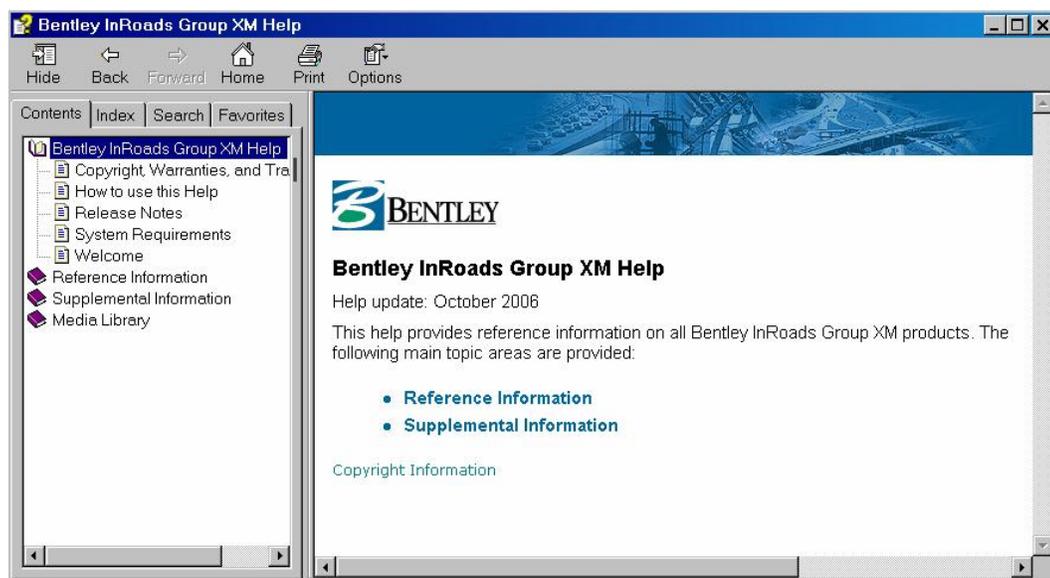
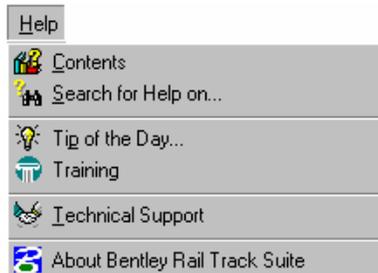
Previously defined settings can be imported for a current design session. To access these settings, select **Tools > Customize > Import**.



Click **Browse** to locate the settings file.

## Using the Online Help System

To display help when InRoads is active, click **Help > Contents** from the main menu.



## Bentley InRoads Group XM Help Topics

InRoads is delivered with comprehensive online reference information for each command. This information is available through the InRoads Group XM help system. Help topics include brief overviews of the commands, detailed descriptions of dialog box options, and workflows that show how to use the command.

InRoads allows you to design while integrated with other Bentley Civil applications. In this environment, you can access the online help topics for these applications in addition to InRoads help.

 If help was not installed on your hard drive during setup, you must have the InRoads CD in the CD-ROM drive or be connected to the network node containing the help files.

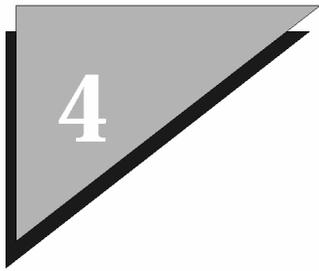
- Click the **Contents** tab to display the Contents page for InRoads Group XM help. This page is similar to a table of contents in that it lists everything that is available in the help files. Double-

click a file to display it. After reviewing a topic, you can close it or print it.

- Click the **Index** tab to enter a command name, phrase, or word for which to search. This page is similar to a book index with items listed in alphabetical order. As you type a word, the list dynamically updates as the sorting feature narrows the search. Double-click the topic when it appears in the list, or click the **Display** button.
- Click the **Search** tab to access a full-text retrieval search. Full-text retrieval allows you to search for specific words instead of alphabetized categories. First, the software builds a database of words from all available help files. Once the database is compiled, you can search it for any key word. A workflow wizard steps you through this brief process. Double-click a located word or click the **Display** button to display the search results.

To display Bentley Civil InRoads help outside of the product, from the **Start** menu, click **All Programs > Bentley > InRoads Group XM > InRoads Group XM Help**.

InRoads Group XM help is context sensitive, which means that you can press F1 to display help for the active command or dialog box. You can also click the **Help** button on each dialog box.



# Learning the Roadway Designer

## Overview

Welcome to the InRoads Roadway Designer tutorial. In this chapter, you will complete a basic roadway designer session using Metric units. See the *Roadway Designer Tutorial (Imperial)*, for completing a workflow using Imperial units. You can also use this tutorial if you are currently running AutoCAD.

In this project, you will create a road design surface, beginning with two lanes along the centerline alignment *baseline*, from station 10+000.000 to 10+550.000, using the vertical alignment *profile gradeline*. Then, you will transition to four lanes, using the Superelevation Wizard to generate the vertical point controls for curve elevation. You'll complete the design with a transition back to two lanes using horizontal and vertical controls. This process is interactive, meaning you can design, test conditions, create superelevation as desired before finalizing the new design surface.

When the design surface is completed, you will create and review profile and cross sections.

## About the Tutorial Data

The data required for this tutorial is delivered with InRoads Group version 8.9. The data resides at two locations:

1. *C:\Program Files\Bentley\InRoads Group V8.9\Sample Data\InRoads.*
2. *C:\Program Files\Bentley\InRoads Group V8.9\data\metric.*

Be aware that there are several types of data located in these directories (\*.xin, \*.cel, \*.tiw, and so on); you will not use all of this data. You will be instructed to load specific data files for the tutorial.

Once you have located the data files, you will store them in a working tutorial directory. This will allow you to repeatedly practice learning the Roadway Designer without overwriting the original delivered sample data.

## Before Getting Started

Create a tutorial directory on your local machine to store data files. For example, *C:\Tutorials8.9\data.*

### ➤ Loading Data Files

1. Start InRoads.

2. From *C:\Program Files\Bentley\InRoads Group V8.9\Sample Data\InRoads* open the *road.dgn* or *road.dwg* file.



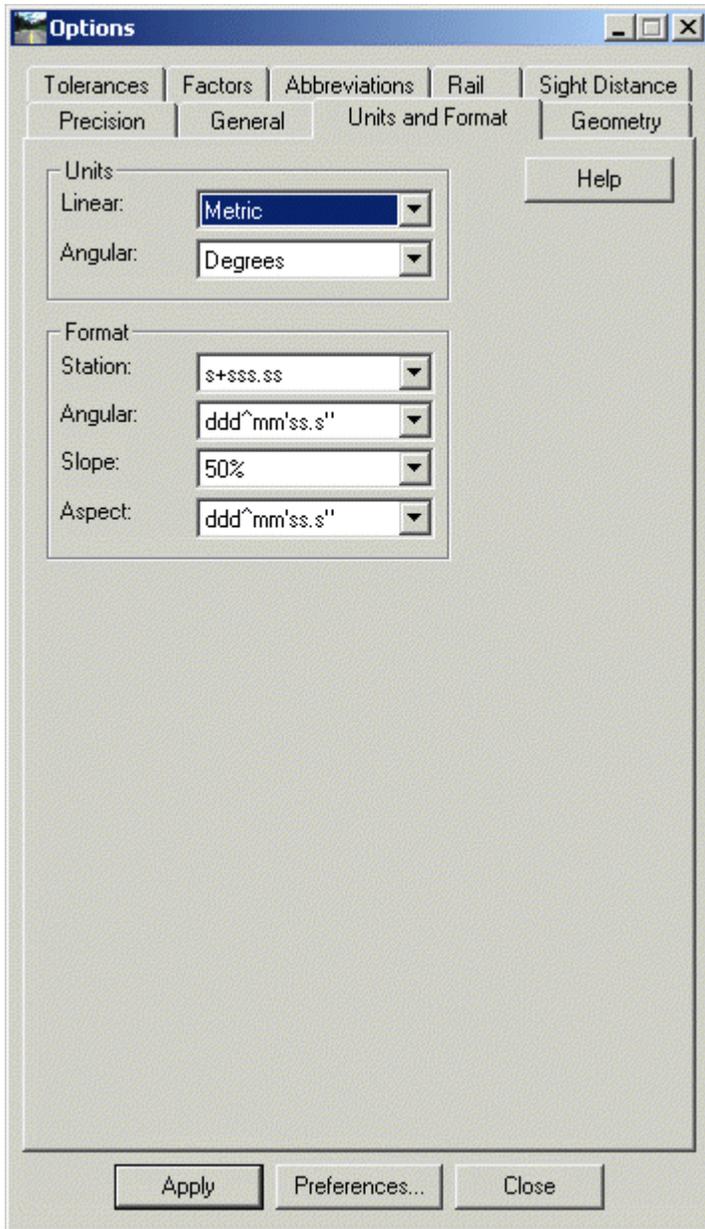
Delete any graphics in the *road.dgn* or *road.dwg* file.

3. Click **File > Open**. Load the following data files from *Sample Data/InRoads*:
  - *original.dtm* (surface)
  - *relocation.alg* (geometry project)
  - *relocation.ird* (roadway design)
4. Change directories. From *C:\Program Files\Bentley\InRoads Group V8.9\data\metric* open the following data files:
  - *civil\_dgn.xin* or *civil\_dwg.xin* (preferences)
  - *DefaultTemplates.itl* (template library)

Next, select the working units for the project.

### ➤ **Setting Working Units**

1. Click **Tools > Options > Units and Format**.
2. Ensure the following settings are selected:



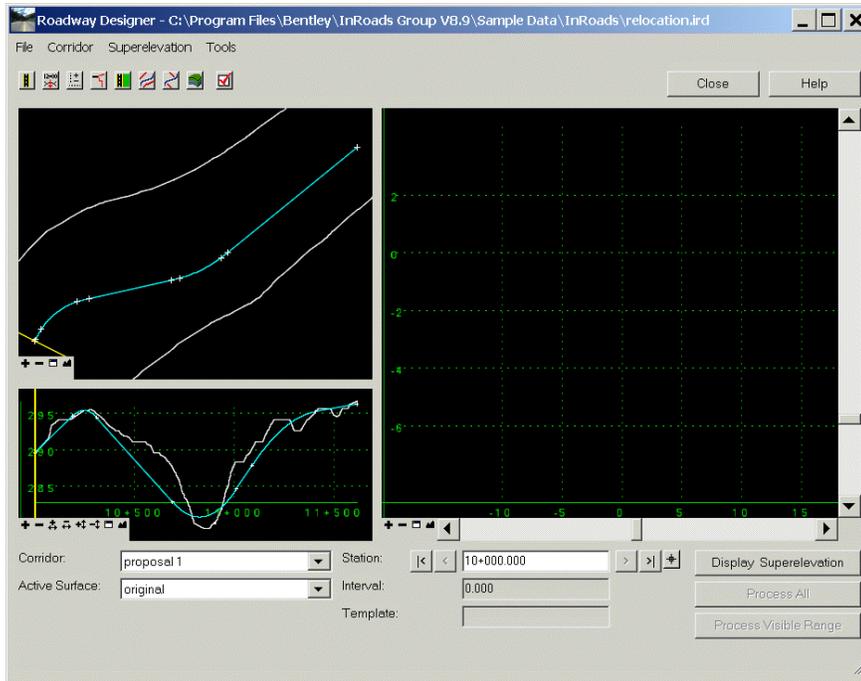
3. Apply; then, close the Options dialog.

Once data files are loaded, begin the roadway design session.

## Creating a Corridor

Road design begins with creating the roadway corridor. A project must have one or more corridors to create a valid design from which a surface can be created.

1. Click **Modeler > Roadway Designer**.

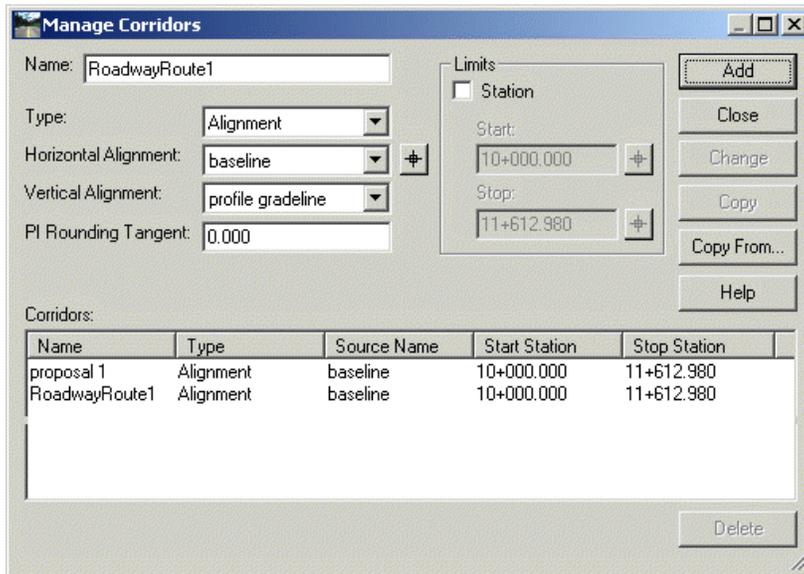


Notice that you can also directly open an .ird file using **File > Open** on this dialog box.



Throughout this tutorial, while command icons are primarily used, be aware that all commands can be accessed from the top-level menus in the main Roadway Designer dialog.

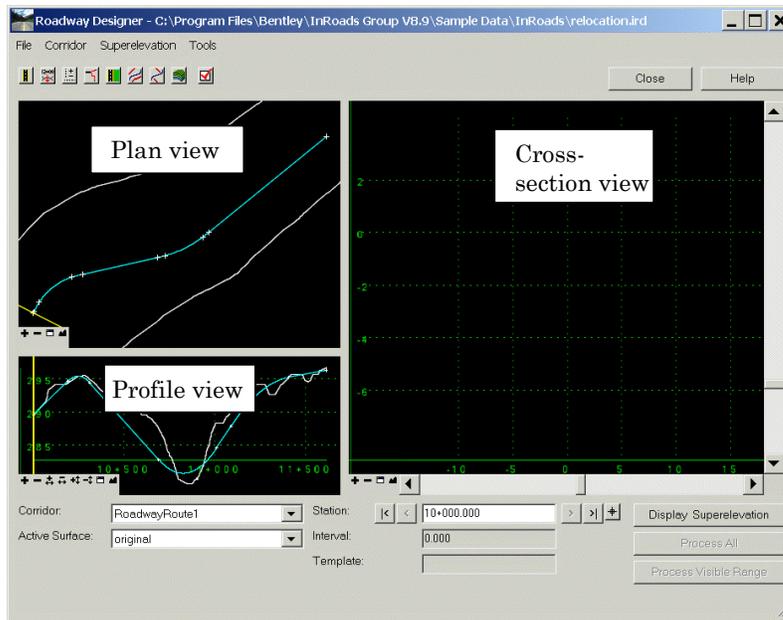
2. Next, create the new corridor. Click the **Manage Corridors**  button. For **Name**, type RoadwayRoute1.
3. Click **Add**.



Notice that you can add, edit, or delete corridors from your design at any time during the design session from this dialog.

## 4. Close the dialog.

The top-left window is the plan view and displays the alignment (*baseline*) of the active corridor in light blue. The active surface perimeter is shown in white; the current station location is shown as a yellow line. The bottom-left window is the profile view. The large, top-right window is the cross-section view.

5. Click **File > Save As**.6. Change locations to the local tutorial directory (*Tutorials8.9\data*).

7. For Save As type, select Roadway Design (\*.ird).

8. For File name, type *RoadwayRoute1*.

9. Save and close the Save As dialog.

Now that an active corridor for this project is in place, add the template drops.

## Creating and Dropping Templates in the Corridor

Template drops are used similarly to the previous **typical sections** functionality in InRoads (that is, the command was used to control the cross-sectional geometry of the corridor, roadway side slopes, roadside ditches, additional shoulders, retaining walls, berms, and so on).

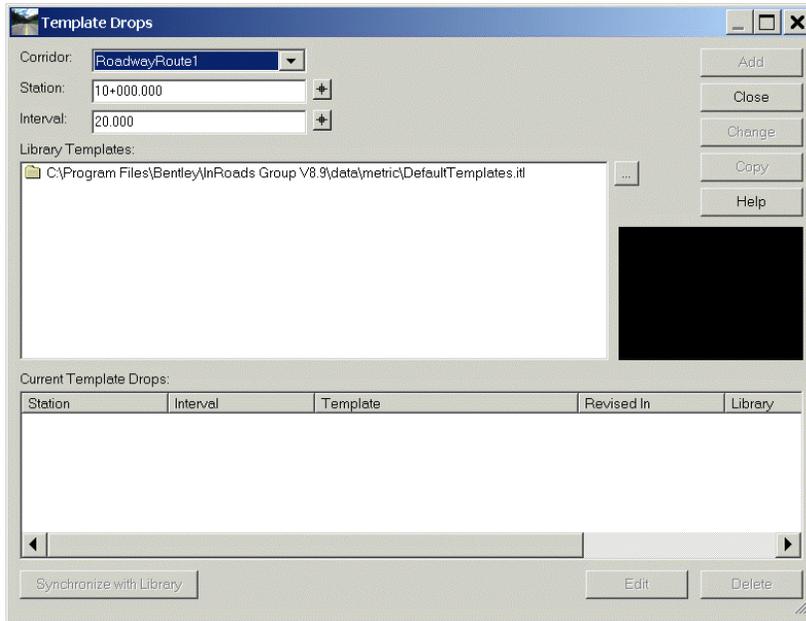
In version 8.7 and later, template drops comprise a series of points and components that represent breakline features that are processed using the Roadway Designer command. A component is a set of points that define an open or closed shape. Each component, whether open or closed, can represent a different material or area of interest. Components are named and have an assigned style. There are 5 types of components created in InRoads: *Simple*, *Constrained*, *Unconstrained*, *Null Point*, and *End Condition*. For more specific details on components, see the **Create Template Overview** help topic.

Once stored in a template library (\*.itl), templates can be copied from the template library into the roadway design file (Roadway Designer command). This means that changes to the template in the InRoads Roadway Designer file will not affect the templates in the library.

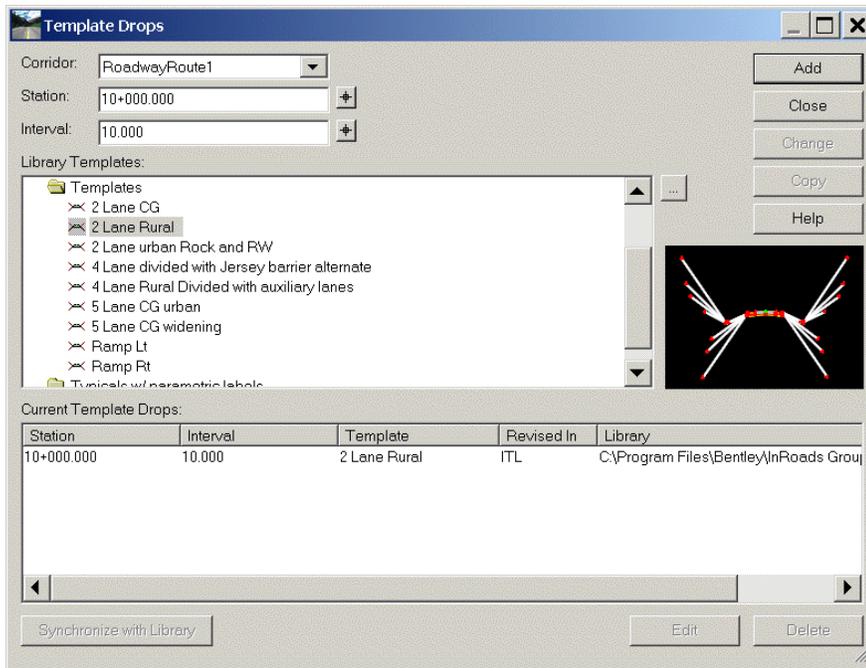
In this task, add two existing *two-lane* templates and create a single *four-lane* template to the new roadway corridor

## ➤ Adding An Existing Template

1. Click the **Template Drops** button 

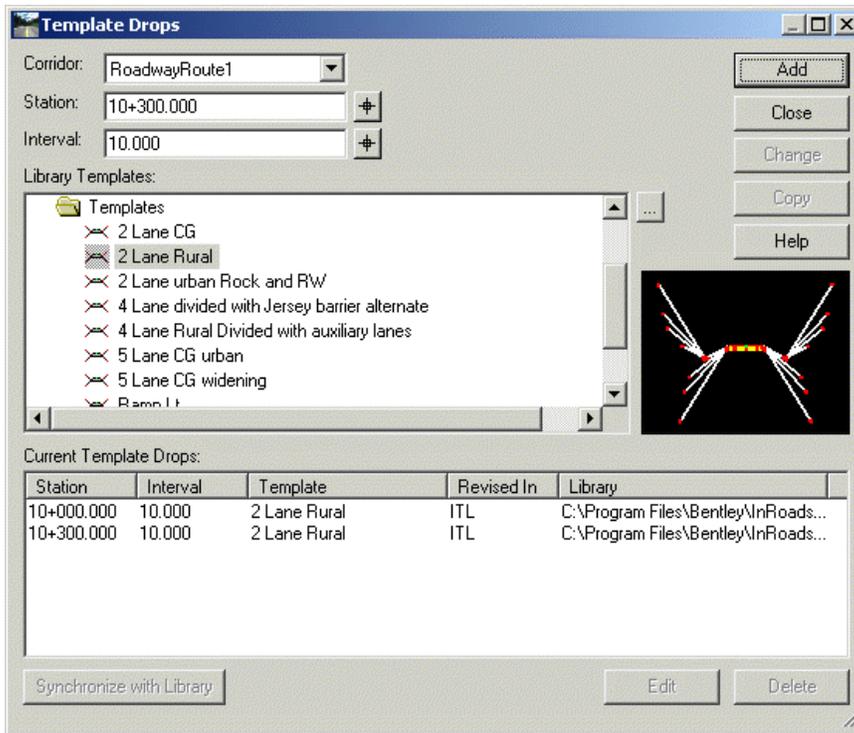


2. In the Library Templates tree view, select **Templates > 2 Lane Rural**.
3. Change the interval to 10 (the template is placed every 10 meters). Add the first of two 2 Lane Rural templates at station 10+000.000.
4. Click Add.

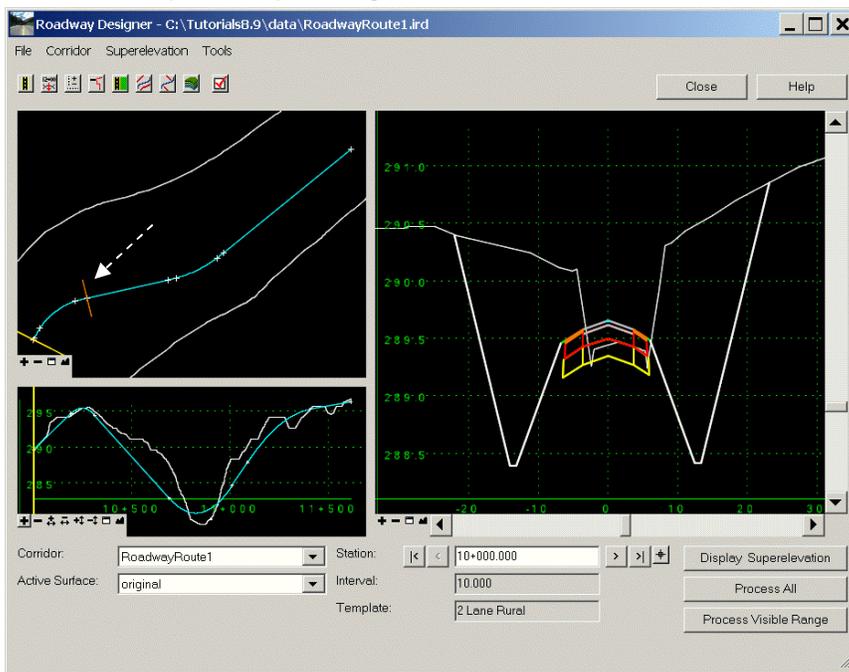


Notice the selected template is displayed in the view on the right, and is added to the Current Template Drops list at the bottom of the dialog.

5. Similarly, add the second 2 Lane Rural template at station 10+300.000.



6. Close the Template Drops dialog.

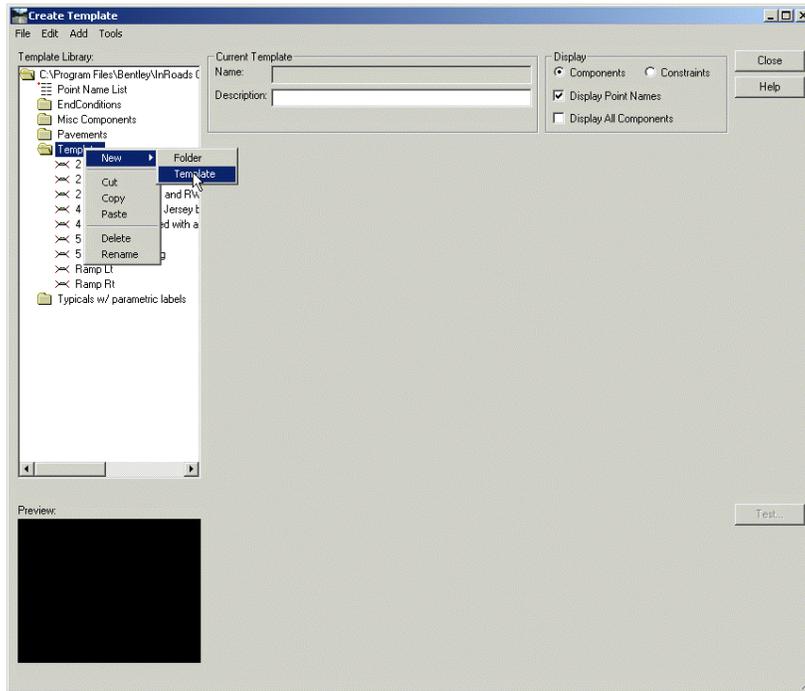


In plan view, notice the visual cues (brown lines) that show the location of the two new templates. In cross section the templates are displayed.

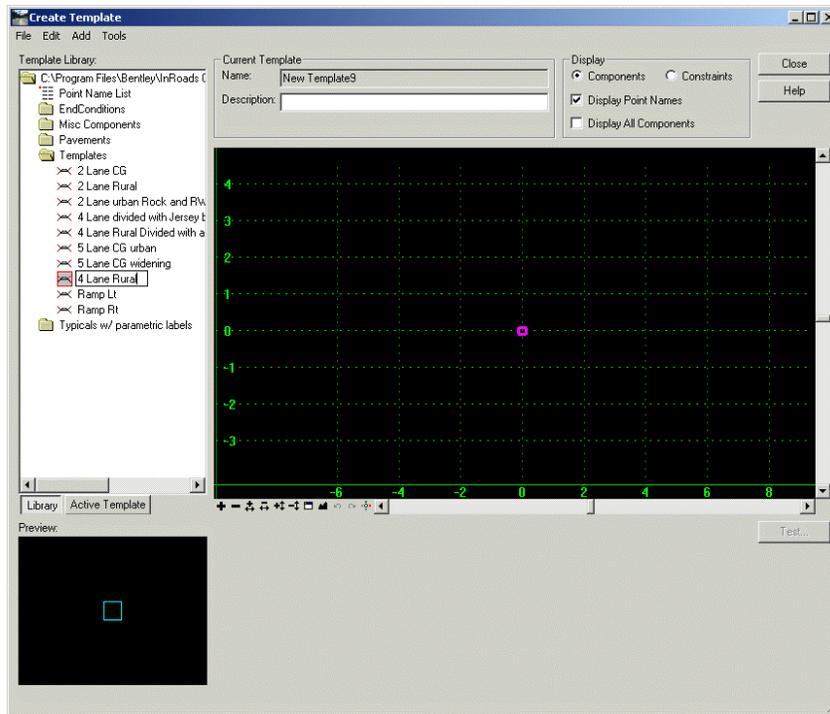
Next, create a 4 Lane Rural template for the new corridor.

## ➤ Creating a Four-Lane Template

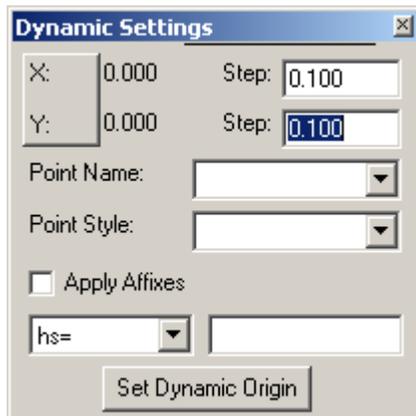
1. Do not close the Roadway Designer command. Click **Modeler > Create Template**. In the Template Library tree view, select Templates.
2. In the Template Library tree view, select Templates.
3. Right-click on Templates folder to display an additional context sensitive menu with options for **New > Template**.



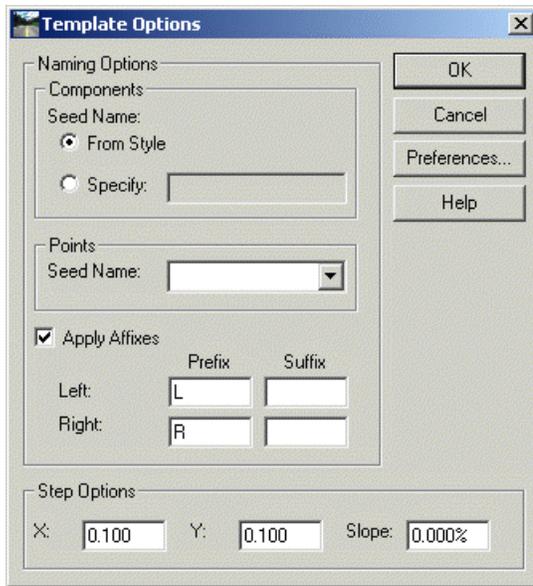
4. Name the new template. Type 4 Lane Rural.



5. Click **Tools > Dynamic Settings**. The settings here allow you to specify precision input (step increments) from the dynamic origin of the new template. Select the settings as shown below:



6. Close the Dynamic Settings dialog.
7. Since you have added a new template to the default library, save the library file to the tutorial directory.
8. Click **File > Save As**.
9. For Save as type, select Template Libraries (\*.itl).
10. For File name, type RoadwayRoute1. Save then close the dialog.
11. Before placing the components, specify the identifying prefixes for each lane. Click **Tools > Options**. Select the following settings:



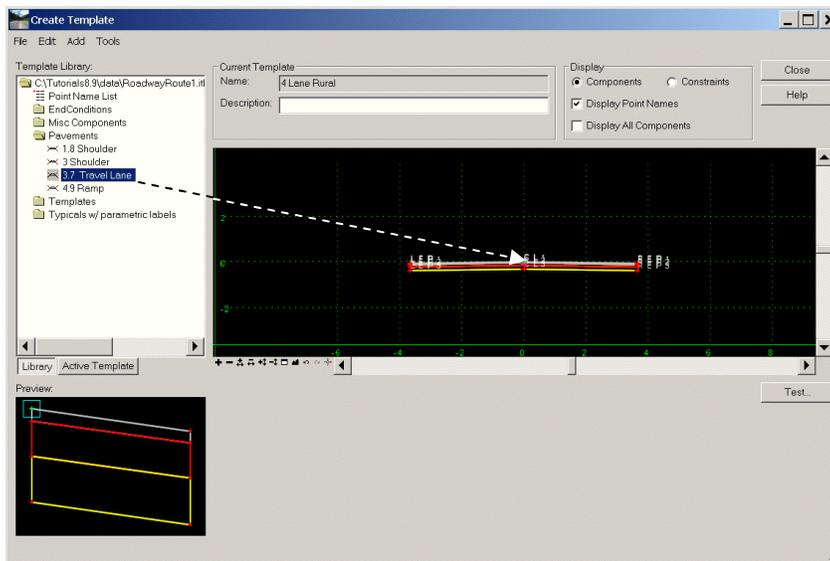
12. Click OK to close the Template Options dialog.
13. Next, drag and drop the first of two 3.7 meter lanes. From the tree view, select **Pavements > 3.7 Travel Lane**. With a single click, drag the lane to the center of origin for 4 Lane Rural.



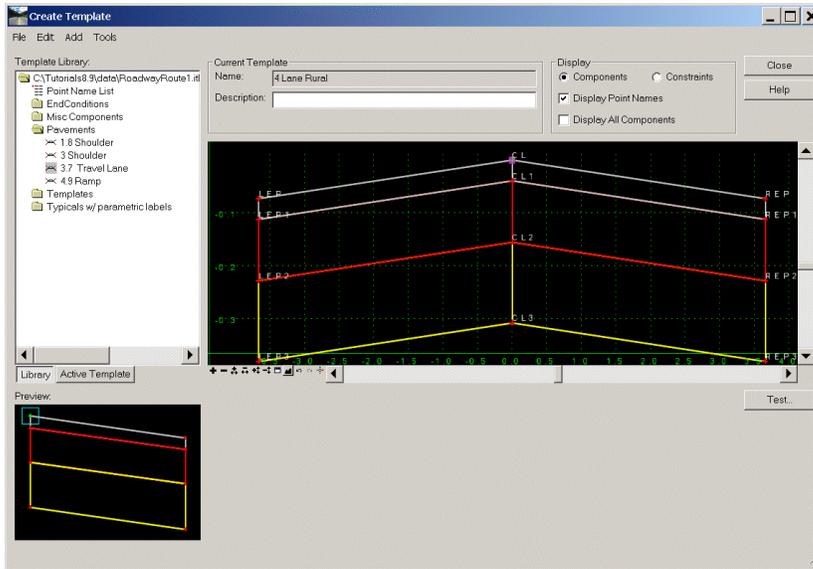
While dragging (but before releasing it), right-mouse click to access the Mirror option.

Mirror	Ctrl-M
Reflect	Ctrl-R
Cancel	ESC
Set Dynamic Origin Ctrl-D	

Turn on the option to simultaneously place the Left and Right lanes as shown below:

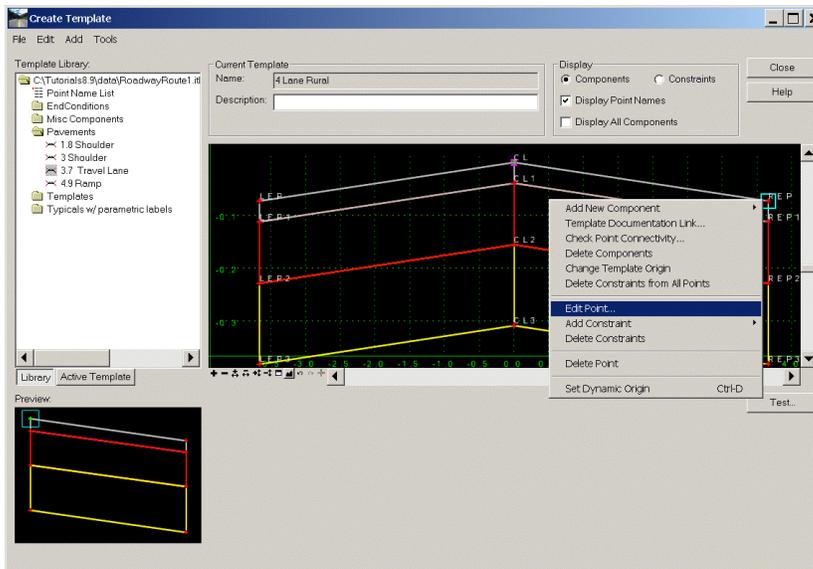


14. Fit the view.

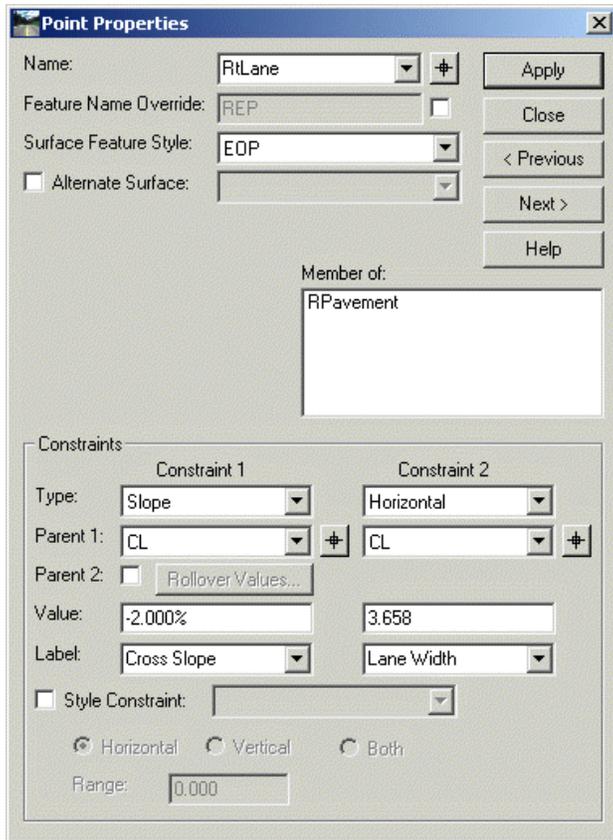


15. Next, rename the REP (right edge of pavement) to RtLane (right lane) prior to adding the second lane.

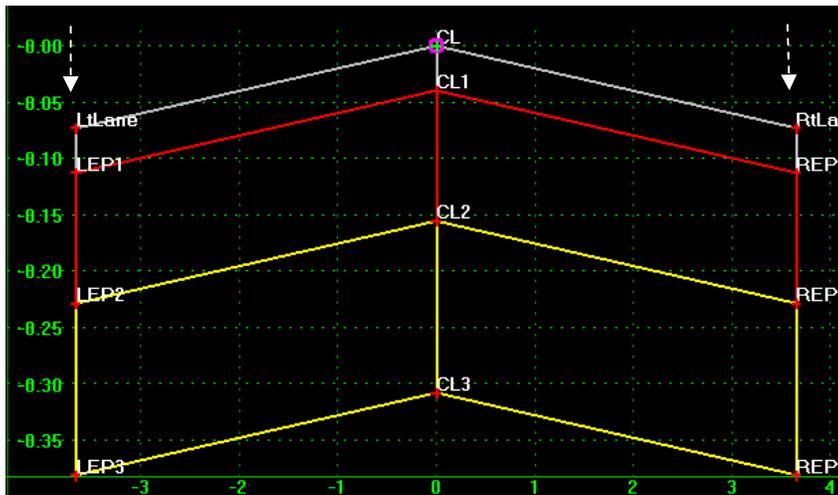
16. Right click on REP and select Edit Point.



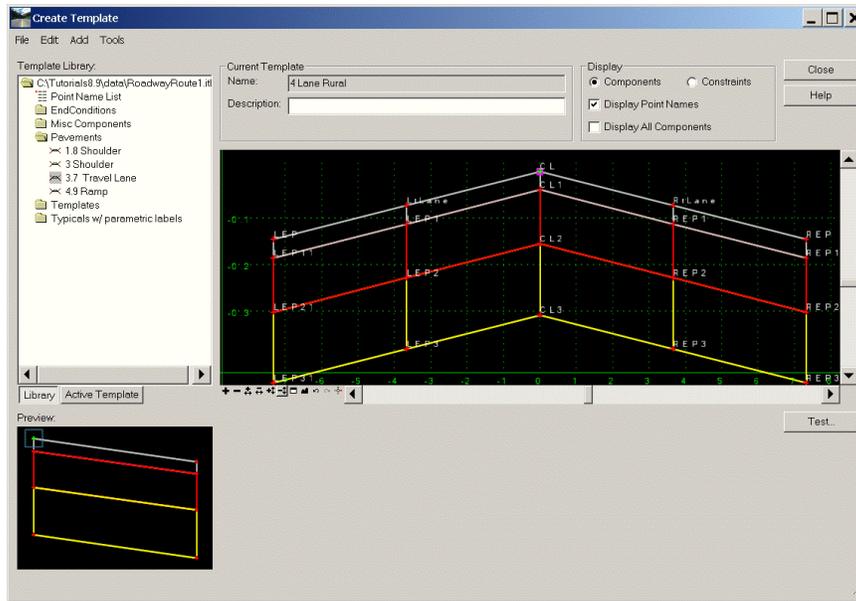
17. Change the name to RtLane.



- 18. Click Apply; then, Close.
- 19. Repeat this process for LEP (LtLane).



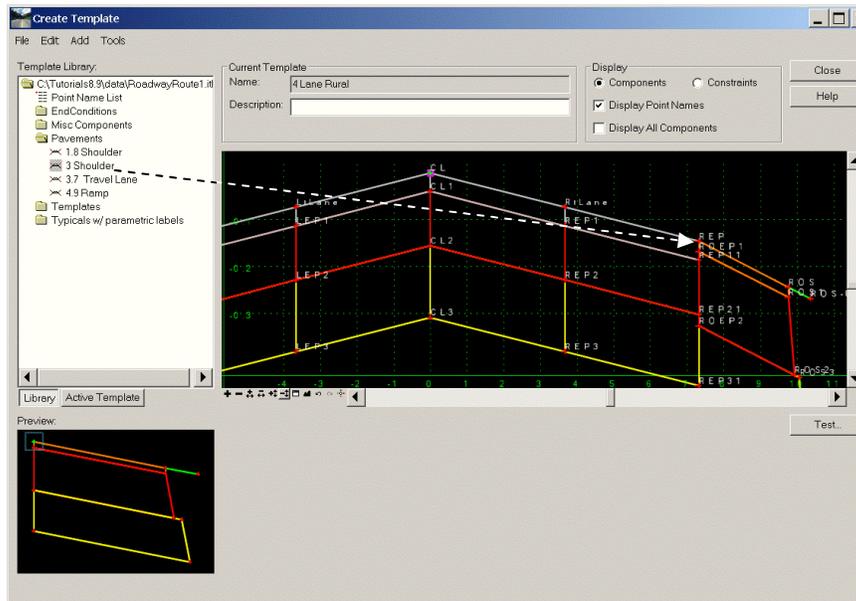
- 20. Now, drag and drop the second 3.7 meter Travel Lane at RtLane.
- 21. Fit the view.
- 22. Because Mirror is on, all 4 lanes should appear as shown:



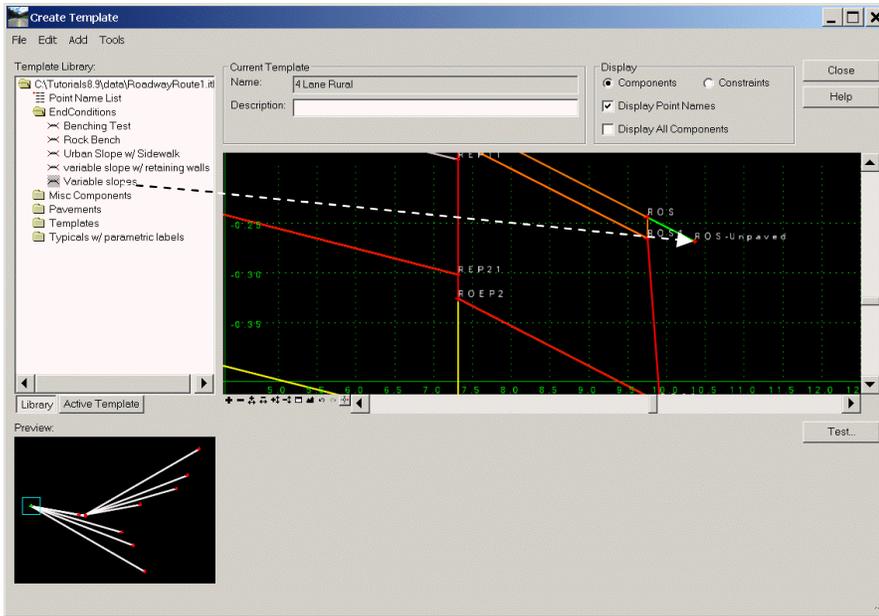
23. Now would be a good time to save the new template. **File > Save.**

24. Typically, a 4 lane design will have a Shoulder for the outside edge of the roadway. Add shoulders at both REP (right edge of pavement) and LEP (left edge of pavement). In the tree view, select **Pavements > 3 Shoulder**.

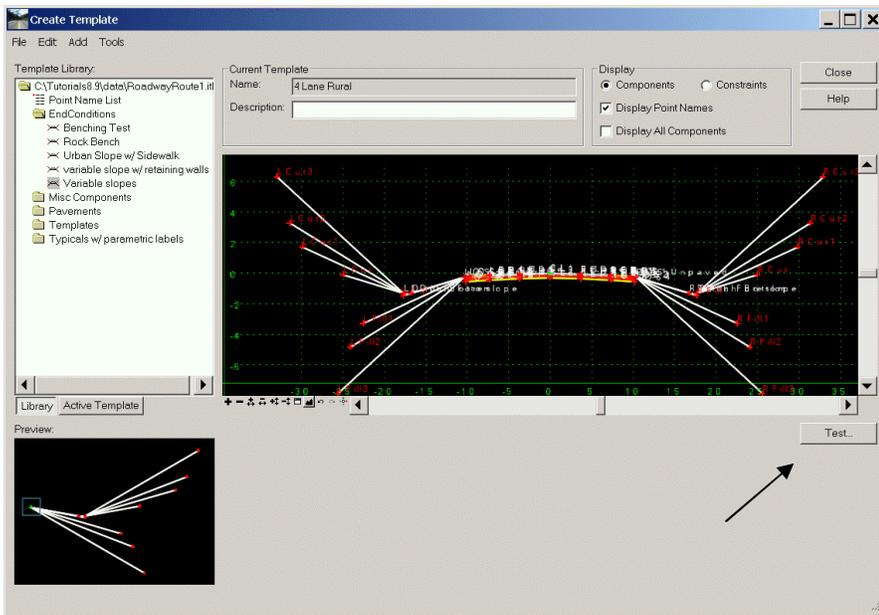
25. Drag and drop a 3-meter Shoulder onto REP. Notice the names ROEP (right outside edge of pavement) and ROS (right outside shoulder) are automatically given.



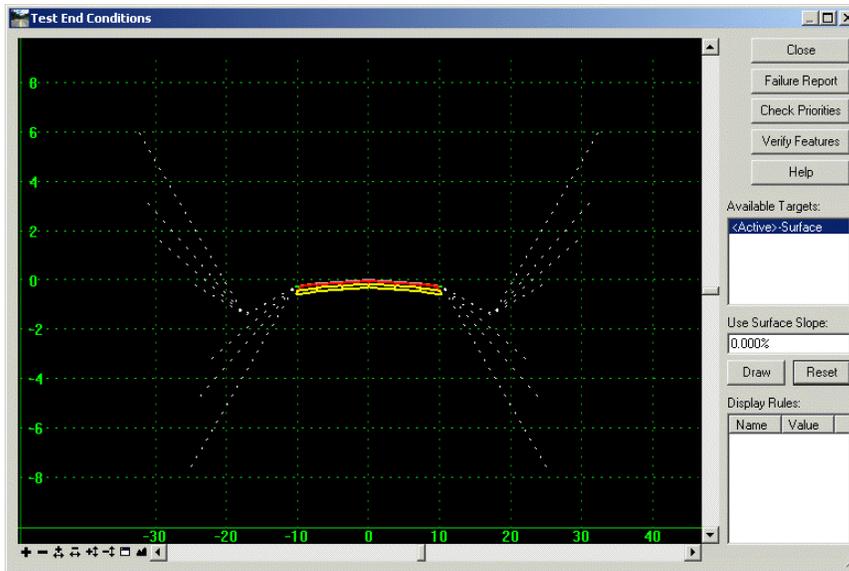
26. Finally, add the end conditions to the outer shoulder of the roadway (ROS Unpaved). Recall that end conditions allow you to define how the design will match up with the existing surface. Drag and drop **End Conditions > Variable slopes**.



27. Fit the view.



28. Click the Test button to test the end condition for template 4 Lane Rural.

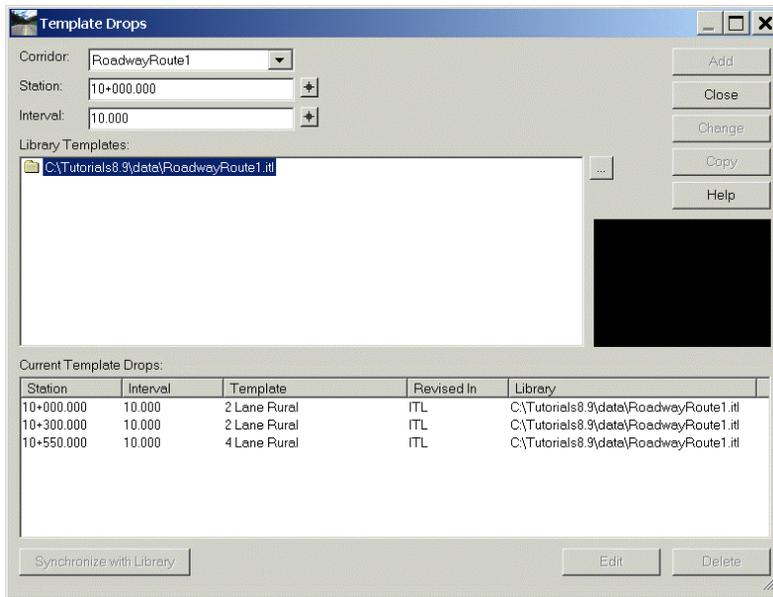


29. Click Draw then move the cursor over the display to dynamically test the condition. Recall that non-solved end conditions, and their child components, display as *dashed* lines. Solved end conditions will display as *solid* lines. Reset to finish.
30. Close the Test End Conditions dialog.
31. Save the template and close the Create Template dialog.

### ➤ Adding Templates to Template Drops

32. Now, add the new template to *RoadwayRoute1* corridor in the Roadway Designer. In the designer, click **Corridor > Template Drops**.
33. In the tree view, select **Templates > 4 Lane Rural**.
34. For Station, type 10+550.000.
35. Set the Interval to 10.
36. Click Add.
 

Notice that the two 2 Lane Rural templates ITL indicators appear in red. This occurs because these template drops were placed from a library that is now in a different location (see the Library column). You can remove this indicator in the next two steps
37. Select (highlight) one of the template drops and select the Change button.
38. Repeat this for the second template drop. The templates have been “reloaded” from the current library.



39. Close the Template Drops dialog. Do not close the Roadway Designer.

40. Save the roadway design file. **File > Save.**

Next, review and edit the transition between template drops.

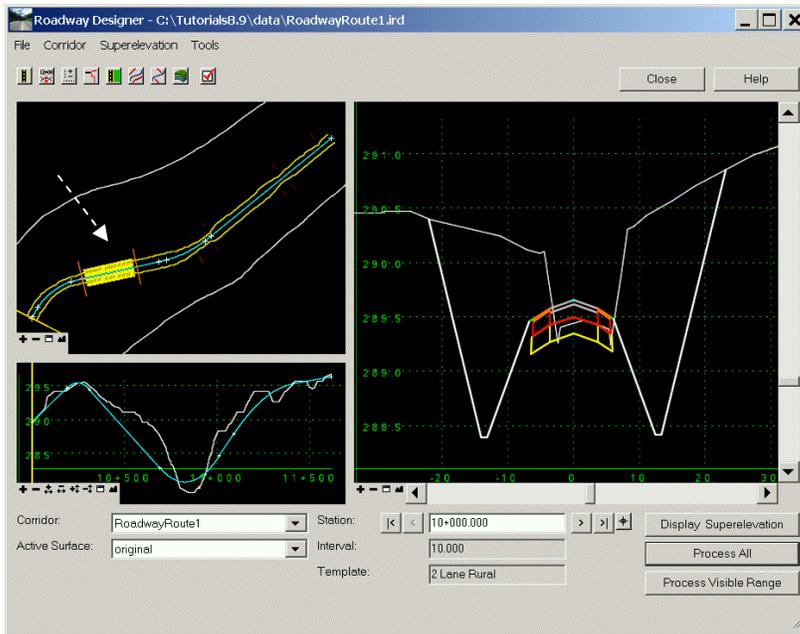
## Editing Between Transitions: From 2 to 4 Lanes

The Edit Transition command allows you to interactively modify existing backbone transitions between two template drops. The backbone is considered to be the component of the template that is not an End Condition or child component. In previous versions of InRoads, transition connectivity was determined by the software. Now, the Roadway Designer makes connections based on matching point names between transition templates, and then allows you to adjust it as desired.



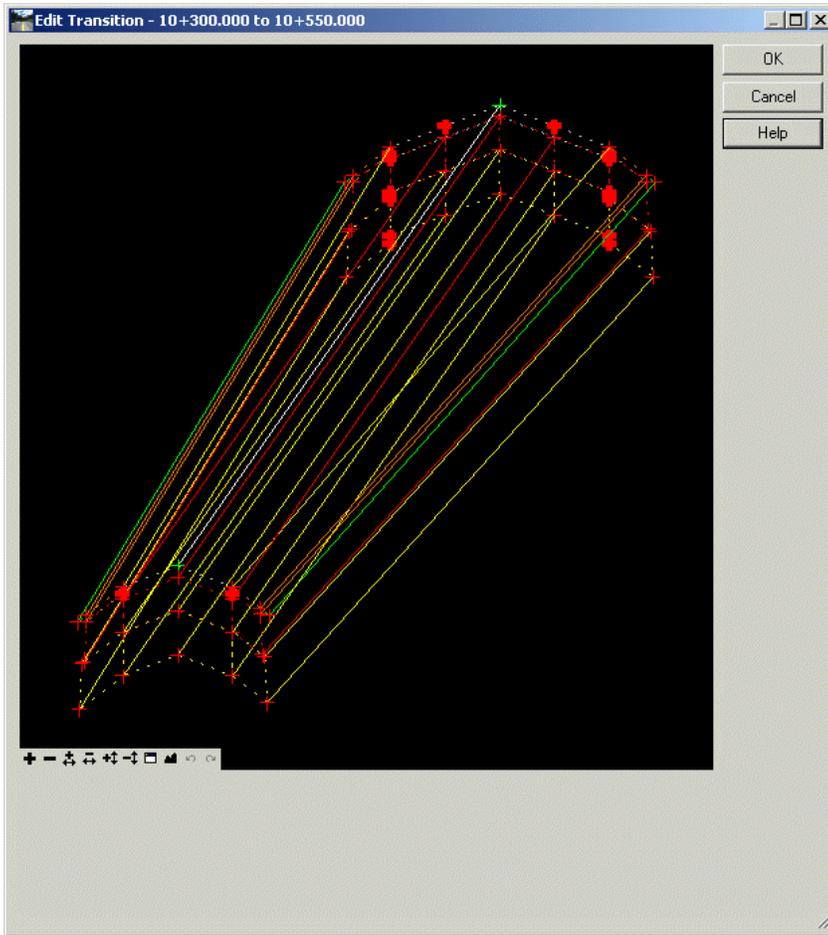
The **Roadway Designer > Tools > Options > Display Transition Graphics** option must be turned on to view transition graphics.

1. In the Roadway Designer main dialog (right bottom), select the Process All button. This action processes all stations of the corridor and updates all the display windows with the results. Close the Results dialog box.

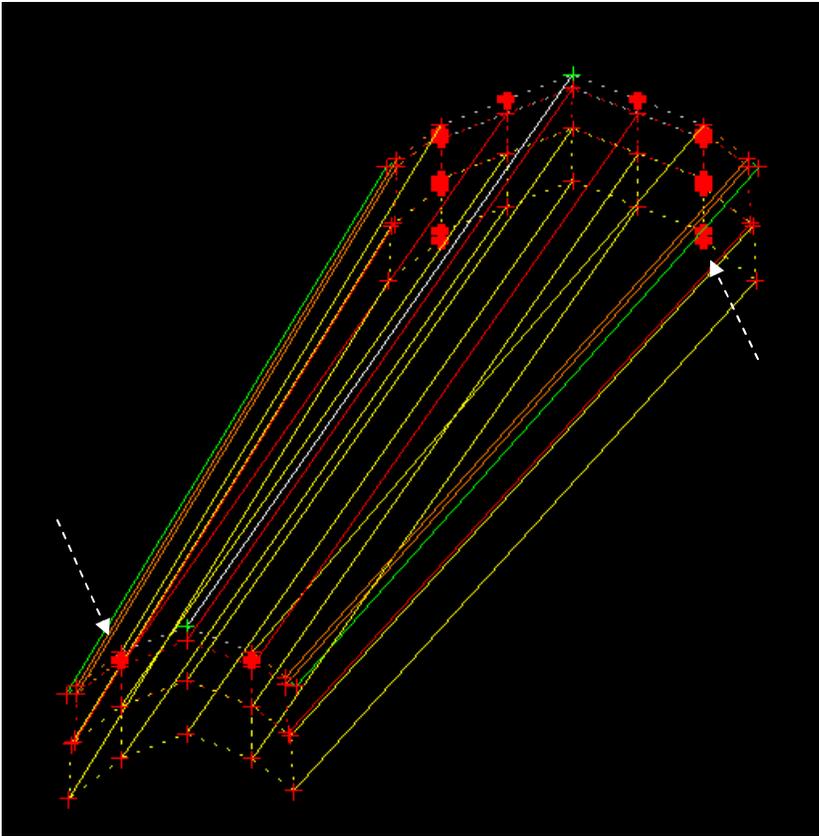


Recall that brown bars appear at template drop stations. Notice a yellow shape between the last two template drops. This shape represents a transition region (shifting from 2 lanes to 4 lanes). The yellow color indicates that some, but not all, of the points have been connected and you have not yet reviewed the transition.

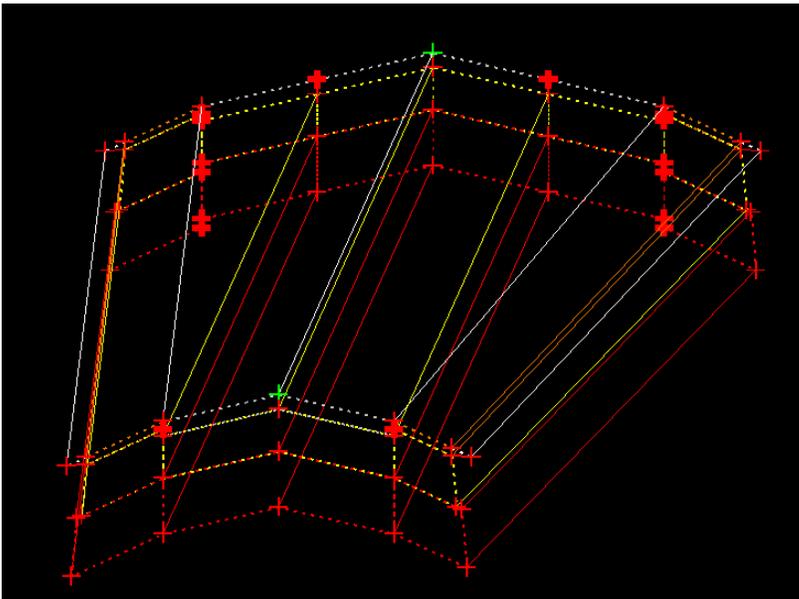
2. Double-click anywhere on the yellow shape.



In this 3D view of the backbone transition, notice that the thick red point symbols (+) are points that have not been connected to a point at the other end of the transition.

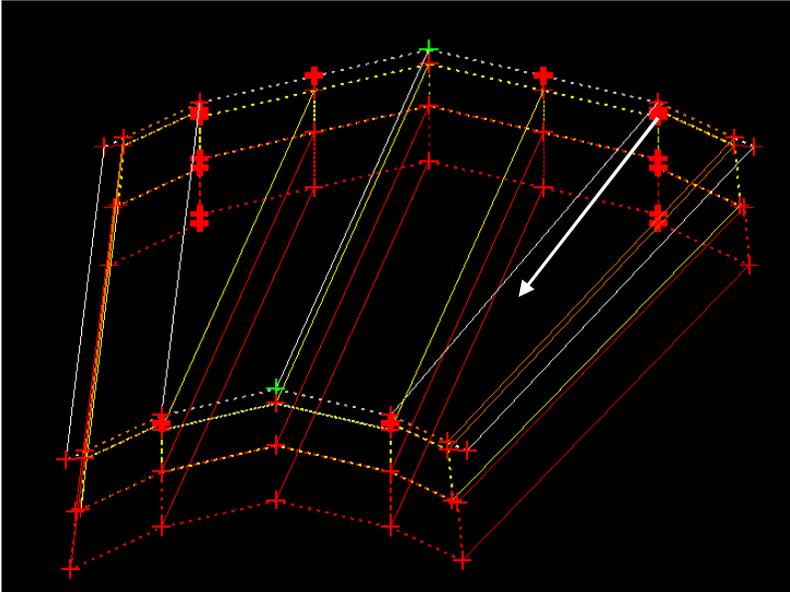


3. You can move the templates to get a better view of how the points are connected. To move a template, right click over one of the template points and select the **Move Template** command. Move the template so that it looks similar to template below; then, fit the view.

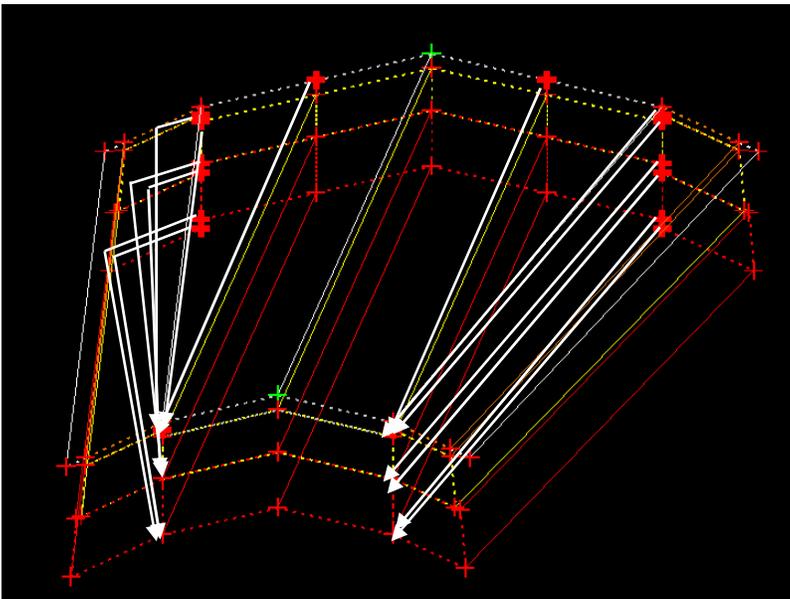


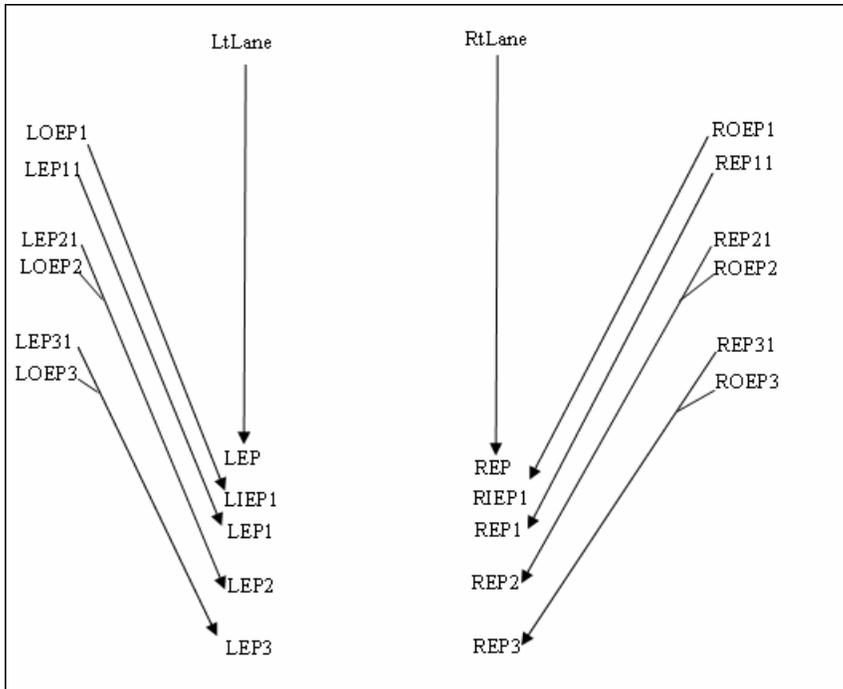
Notice that you can pause the mouse over a point to display the point name.

4. To add a transition connection, left mouse click over the point (you must connect from the “unconnected” to the “connected”, that is, you must start in the 4 Lane Rural template bold points and connect backward towards the 2 Lane Rural template normal points).

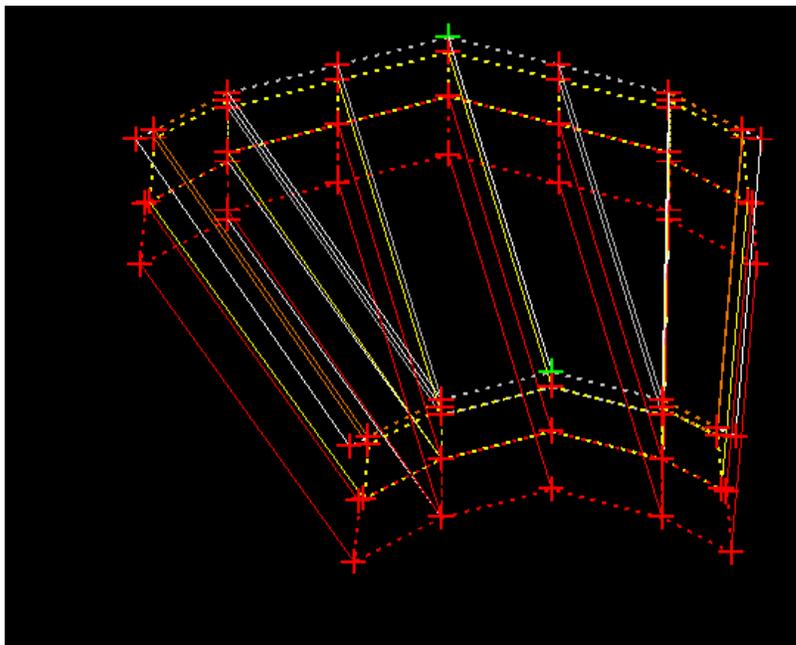


5. Make the following connections in the template. Notice that there may be several points in close proximity. Also, multiple points can connect to a single point. If you make a mistake or want to change connectivity, right click over the transition line and select **Delete**. Review the illustration below (by point names) to verify the correct connections.

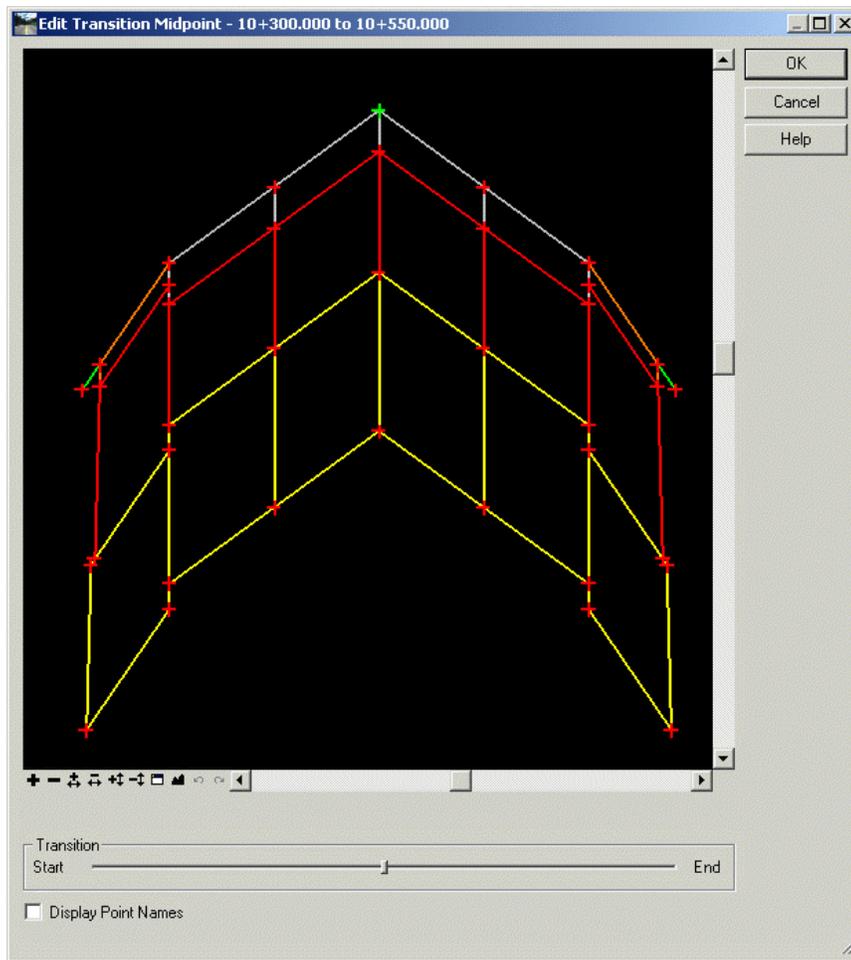




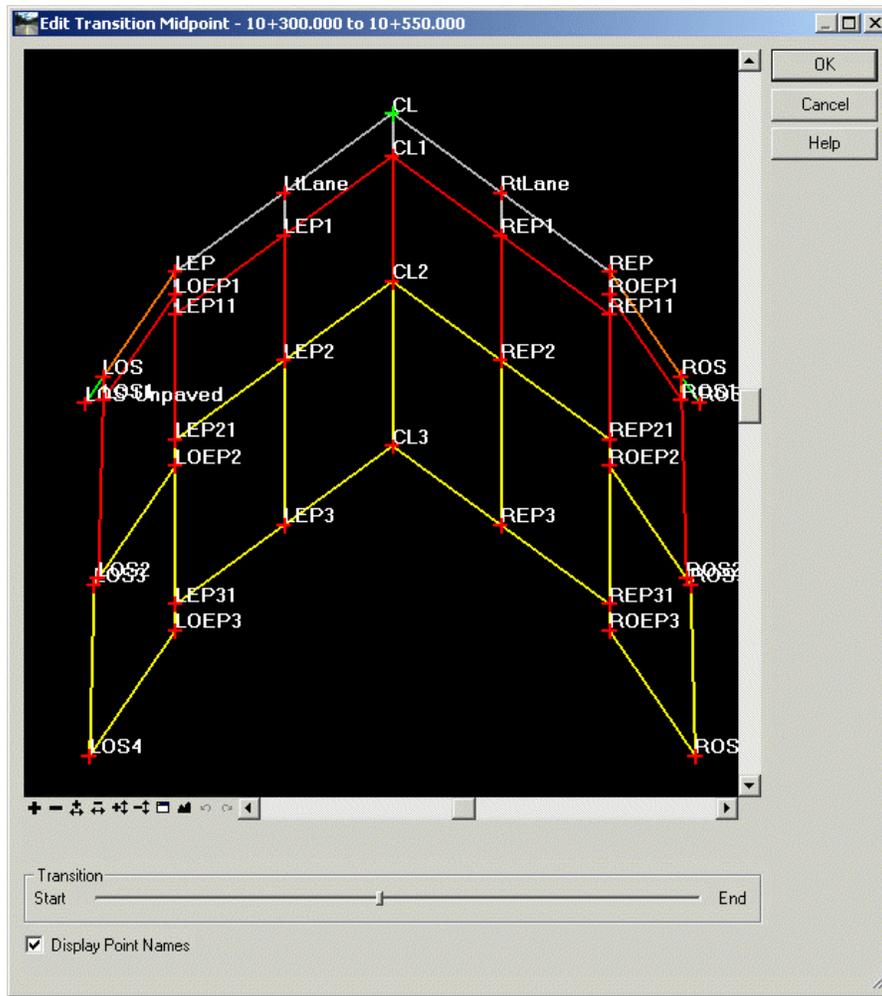
The final connections should appear as shown:



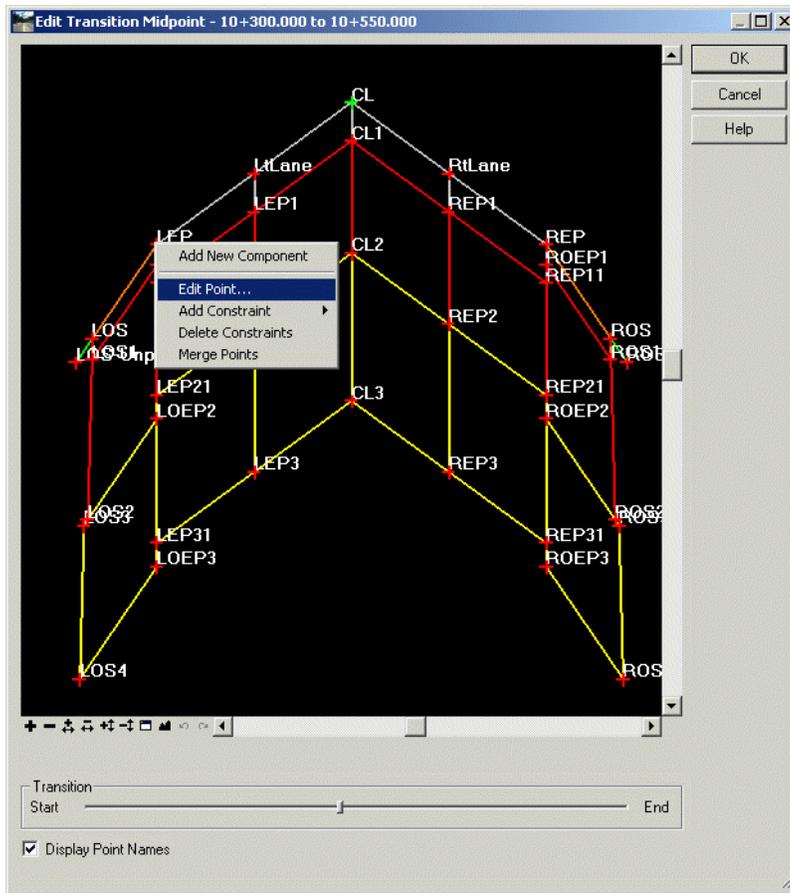
- Now, test the connections. Click OK on the Edit Transition dialog. A second dialog displays revealing what the transition components and points will look like at the midpoint of the transition. If you need to make any connection correction, simply Cancel here and return to the Edit Transition dialog for more connections. When done, ensure that your connections appear as shown:



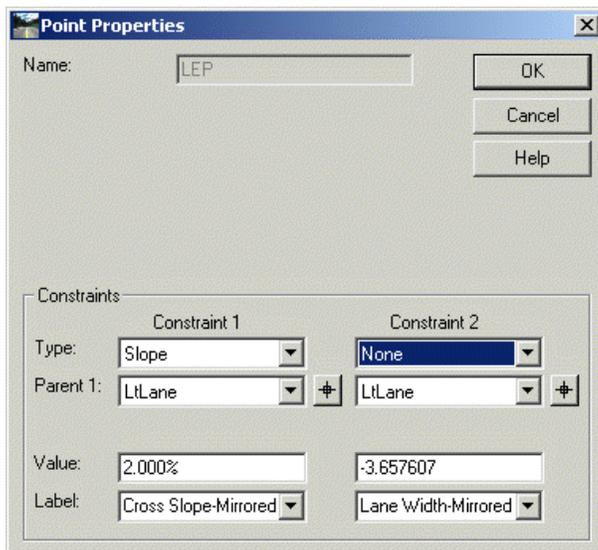
7. Although it appears that the software made a good “best guess” resulting in correct connections, recall that points also have constraints (that can restrict their movement). In the transition from 2 to 4 lanes, the outside lanes need to vary in width as you move along the transition. Test this movement using the slider bar in the bottom of the dialog. Move along the transition from beginning to end. *Nothing happened.* You will need to remove any horizontal constraints from the REP and LEP points so that they can vary linearly along the transition.
8. Turn on the Display Point Names option in the bottom left corner of the dialog.



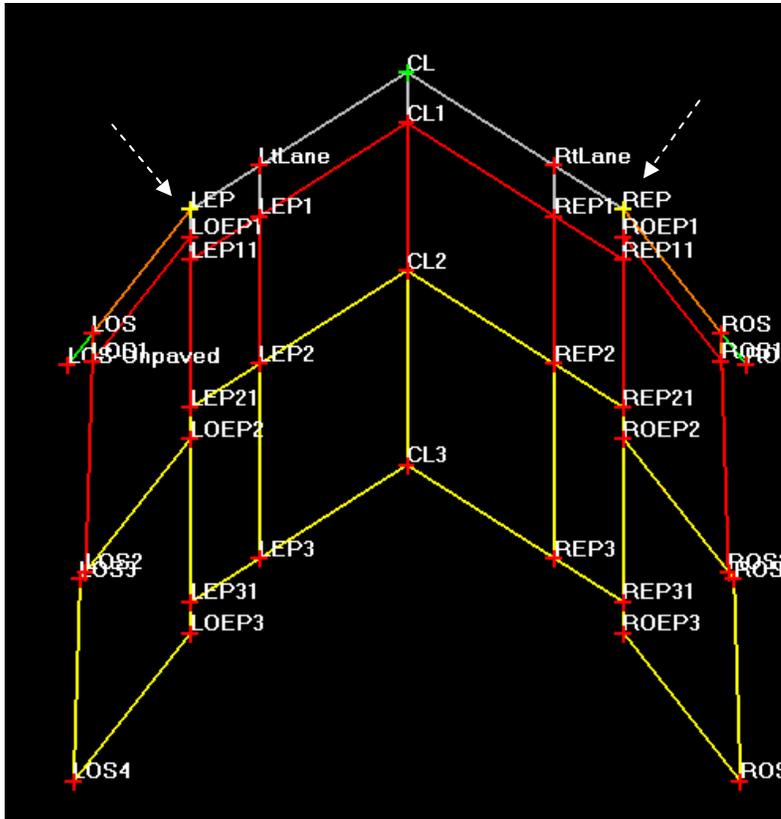
9. At LEP (left edge of pavement), right click and select Edit Point.



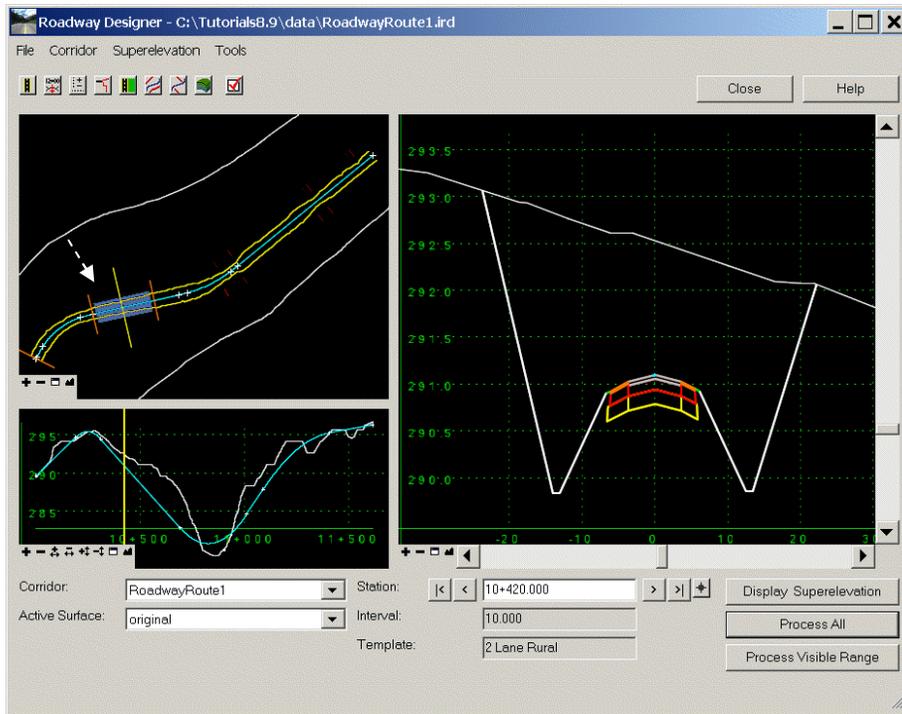
10. Under Constraints, for Constraint 2, select None; then, OK.



11. Repeat this process for REP. Fit the view. Notice the symbols for these points changed from red to yellow. This indicates they are no longer fully constrained (2 constraints); they are partially constrained (containing only 1 constraint: maintaining the slope).

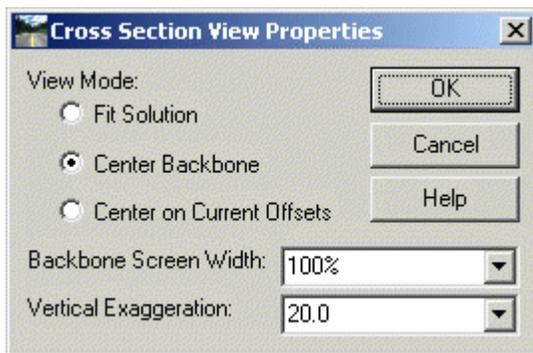


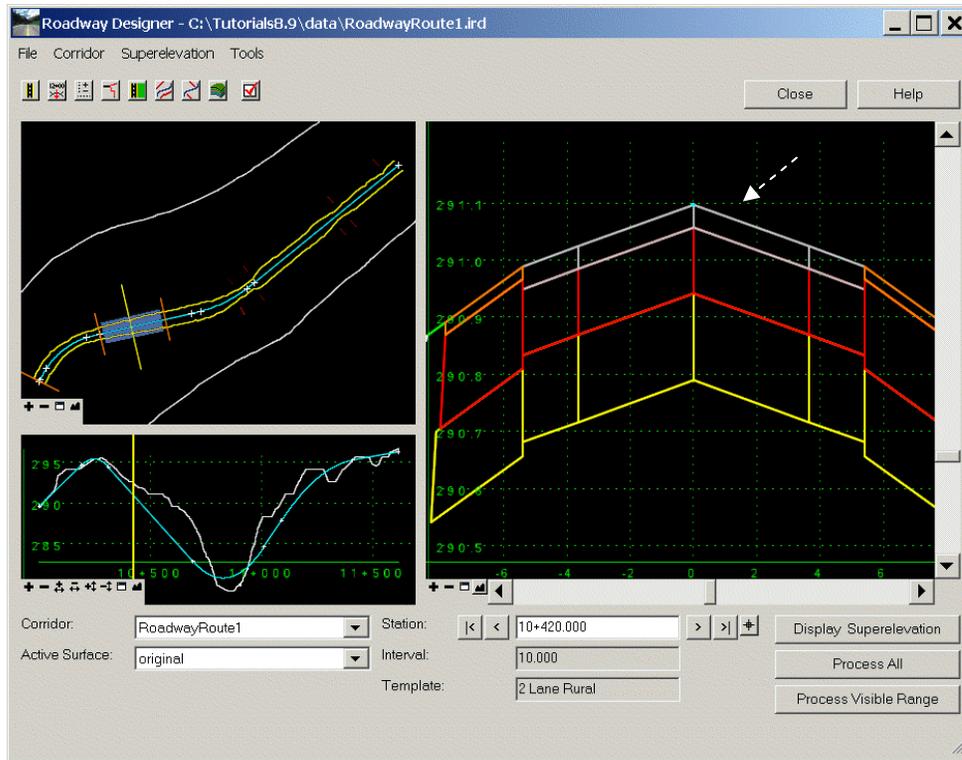
12. Use the slider to test the transition again. Movement at the lanes indicates the transition is correct. Click OK to close the Edit Transition Midpoint dialog.
13. In the Roadway Designer dialog, select Process All. Close the Results dialog box.
14. Notice the yellow area in the transition is now dark blue. This indicates that all points of the transition are connected.



Other visual cues for transitions are Red, indicating none of the points are connected; Light Blue, indicating the transition has been reviewed or edited, however, one or more points remain unconnected.

15. Move the station location back and forth along the transition region. Notice how the transition appears; in both plan and cross section.
16. To get a better view, right click in the cross section view and select Display Properties. Select the following settings; then, click OK to dismiss the dialog





17. Save the roadway design file.

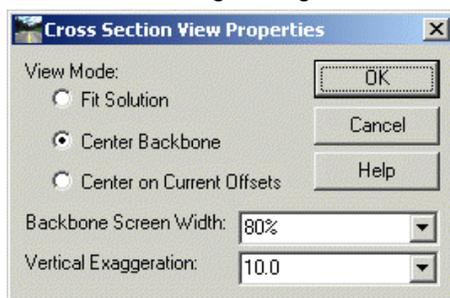
Next, add superelevation to the model.

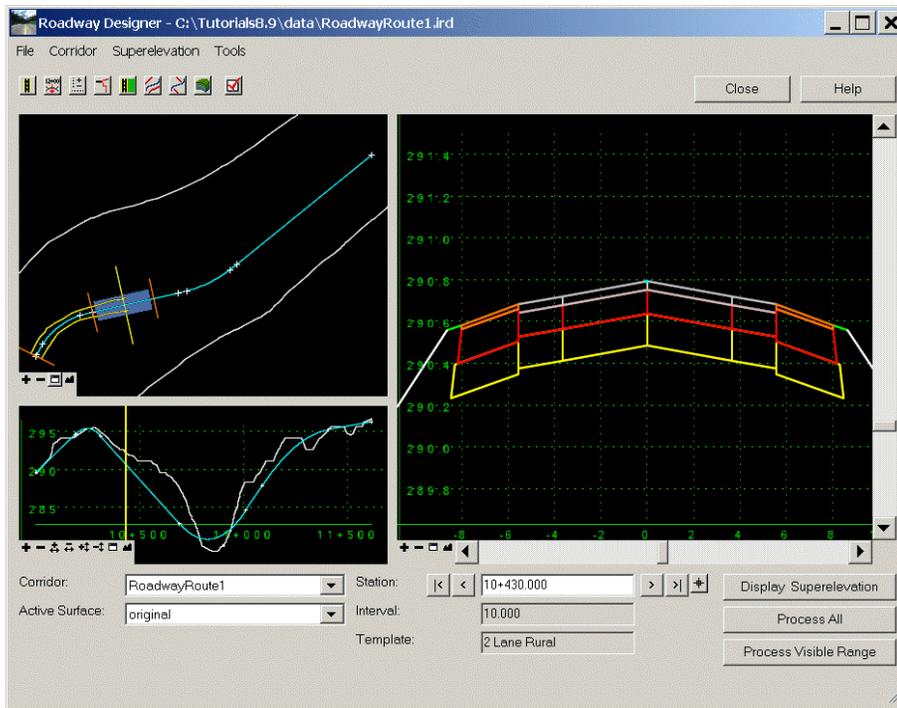
## Creating Superelevation

Superelevation is used to control the cross slope of roadways in areas of horizontal curves and spirals. In the Roadway Designer command, superelevation control lines can be created and then used as vertical point controls to control the elevation of a point relative to another point in the cross section.

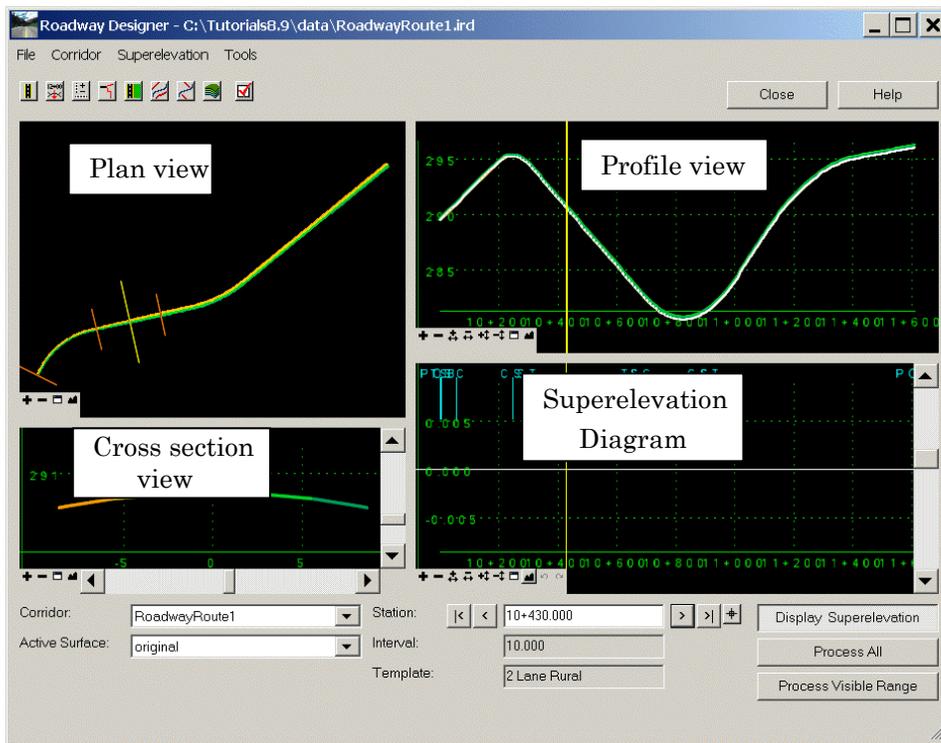
For a typical two lane road, there are generally two super control lines; one for the left edge of pavement, and one for the right with the pivot point being the crown point of the road. However, with the Roadway Designer superelevation functionality, there is no limitation on the number of control lines or pivot points. In this task, add superelevation for both curves in the model.

1. Change the cross section display. In the view, right click and select Display Properties.
2. Select the following settings; then, click OK.



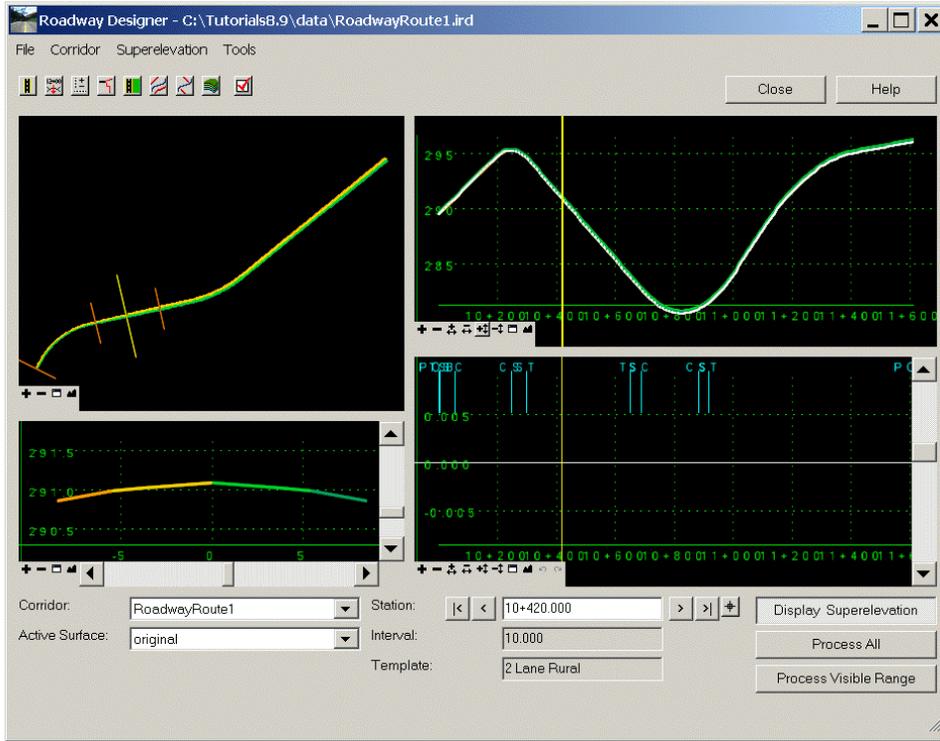


3. Select the Display Superelevation button. In superelevation mode, the views are displayed as shown below:

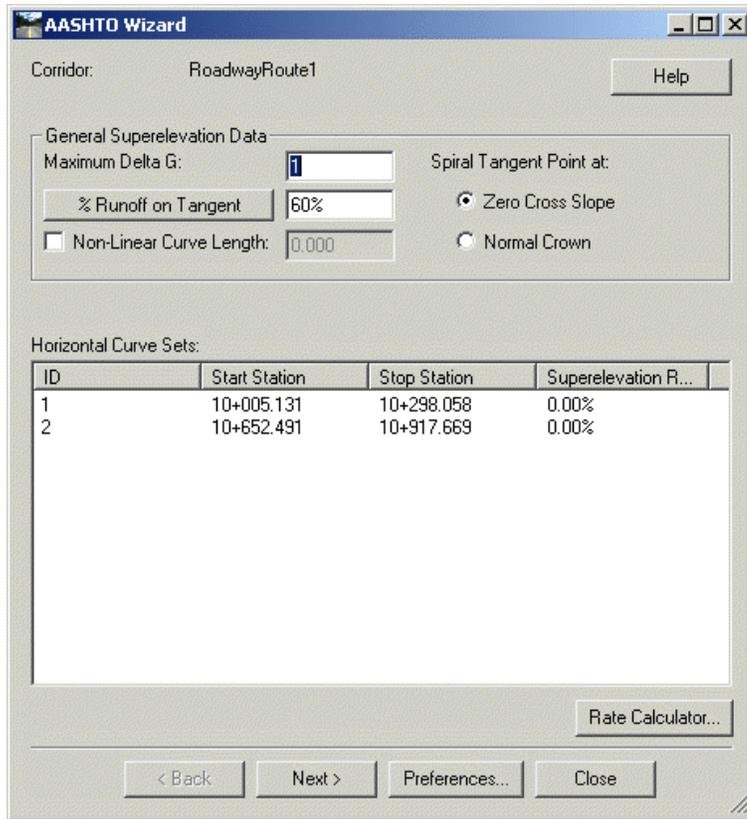


The superelevation diagram is synchronized to display the same station range as the profile view. The plan, profile, and cross section views now show cross slope values of the backbone of the template. Colors from yellow to red indicate increasing slopes to the left. Colors from

green to blue indicate increasing slopes to the right. White indicates a cross slope at or near 0%.



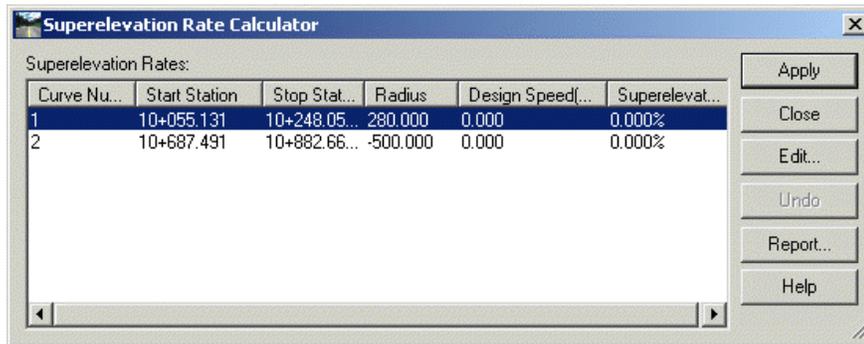
4. Right click in the superelevation display. Select **Create Superelevation Wizard > AASHTO**.



5. Next, redefine the maximum rates for the curves. Select Rate Calculator.

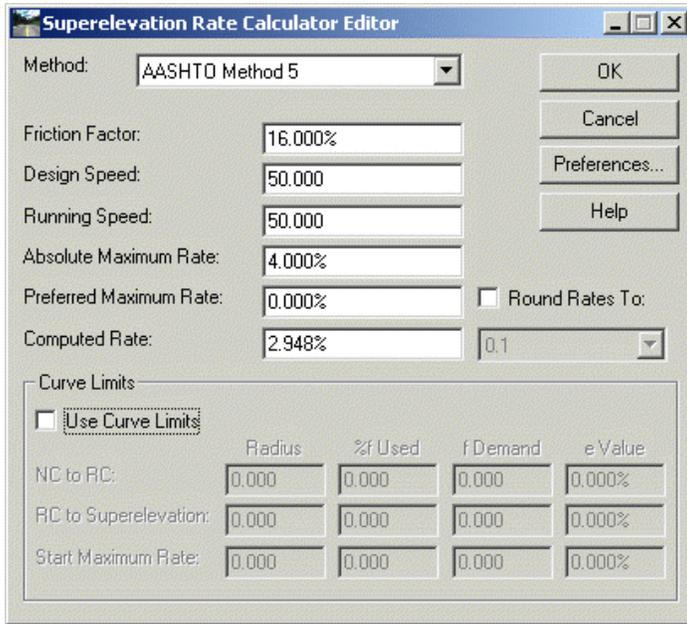


You can also access the Rate Calculator from **Geometry > Superelevation**.

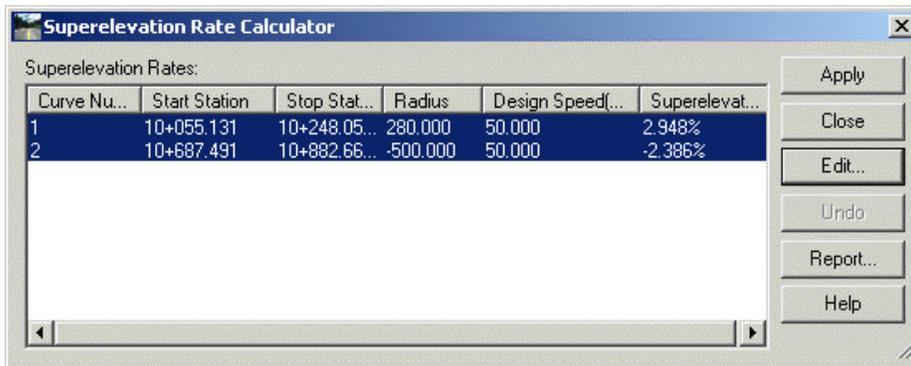


6. Select (highlight) both curves. Click Edit

7. In the Superelevation Rate Calculator Editor, select the settings shown below.



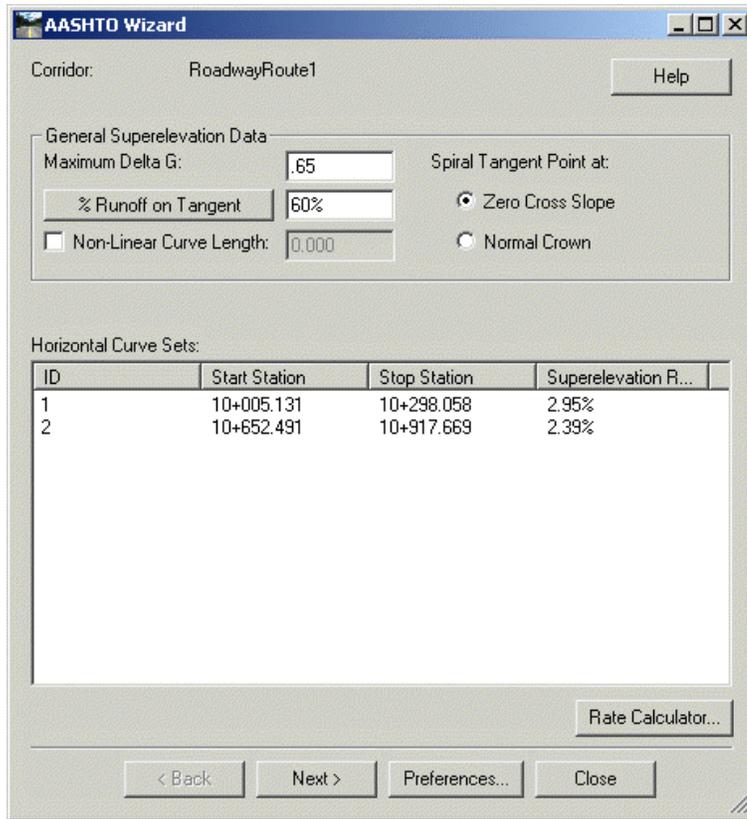
8. Click OK.



Notice the speed and superelevation change.

9. Click Apply; then, Close.

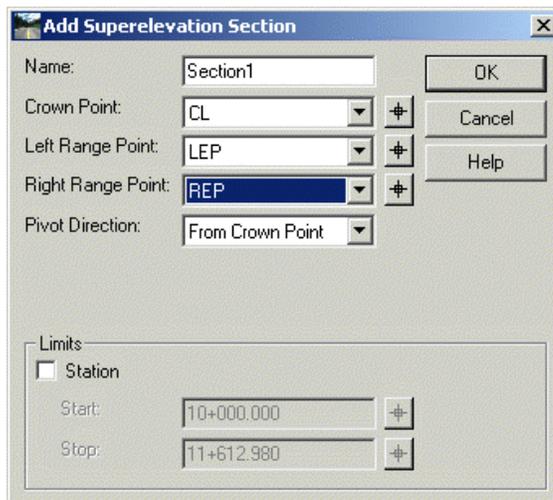
10. Now, modify the Maximum Delta G to .65. Recall that the Delta G is defined in the AASHTO design manual. A lower Delta G results in longer runoff lengths.



11. Click Next.

12. Under Sections, select Add.

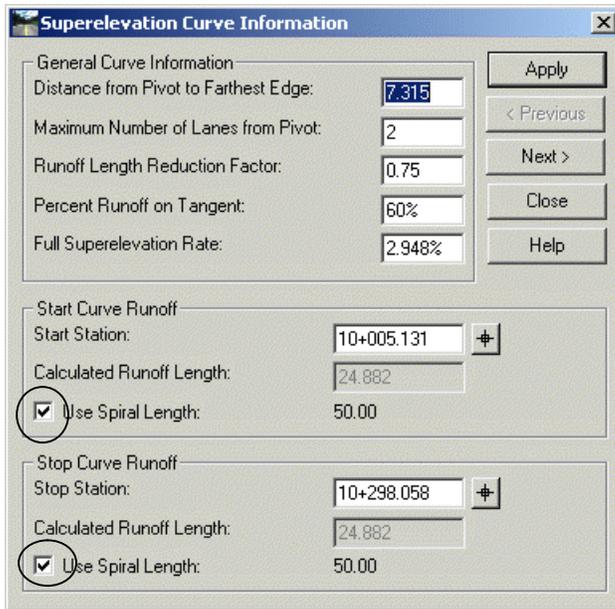
13. Here, define the superelevation section. Select the settings as shown below:



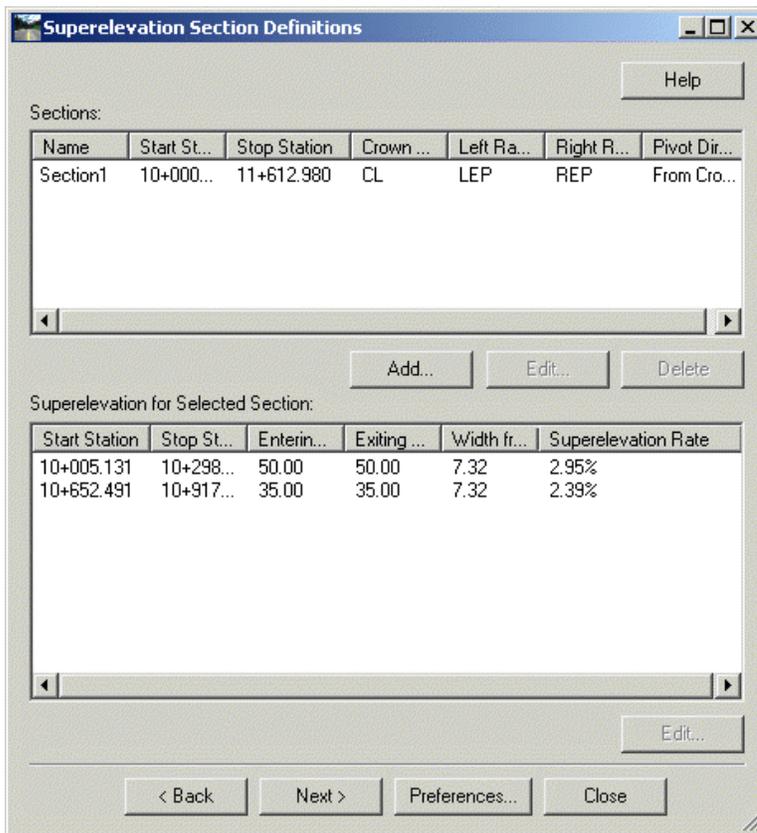
14. Click OK

15. Under Superelevation for Selected Section, double-click on the first curve.

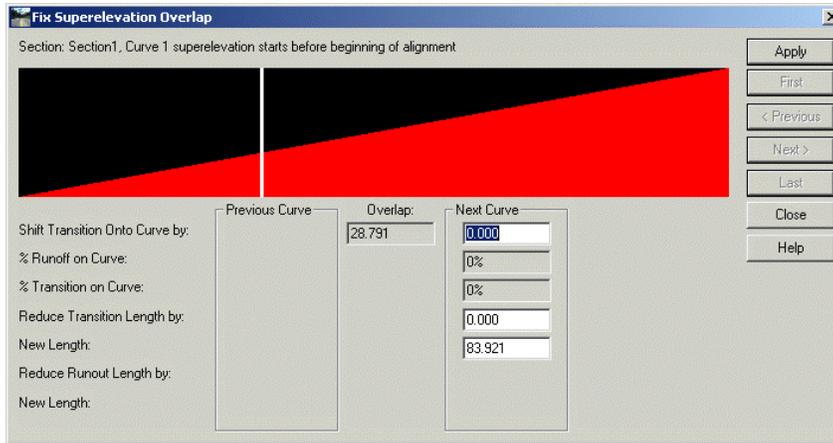
16. The General Curve Information values are those calculated from the input provided in the newly created section. For this section, use the spiral length (50.00) to calculate runoff.



17. Click Apply; then, Close.

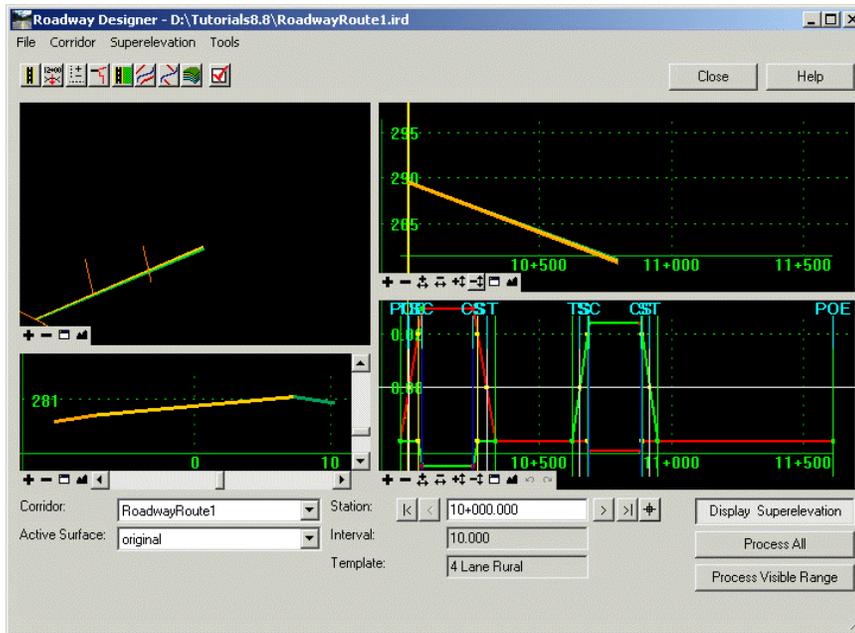


18. Click Next; then, Finish.



Notice that the Fix Superelevation Overlap dialog is displayed. This occurs because there is only approximately 5 meters of tangent prior to the incoming spiral (Review the alignment at **Geometry > Review Horizontal** with Mode set to Alignment). This is an insufficient length to achieve the superelevation runoff. You do not need to modify this overlap.

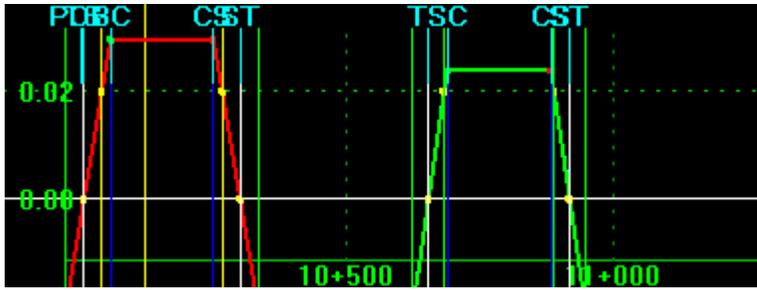
19. Click Apply; then, Close.



A control line is created for each point of the template that is superelevated. For this alignment 4 lines are created: Left Lane LEP, Right Lane LEP, Centerline Left Lane, and Centerline Right Lane, due to the template transition from 2 to 4 lanes.

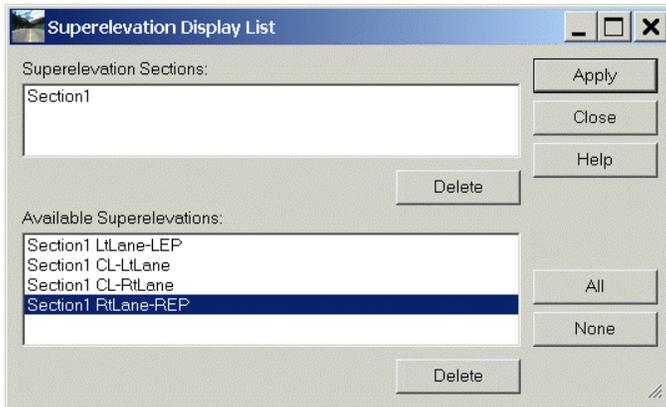
Notice in the first curve that runoff uses the spiral length of 50.00.

20. Zoom in the superelevation display to view the control lines.

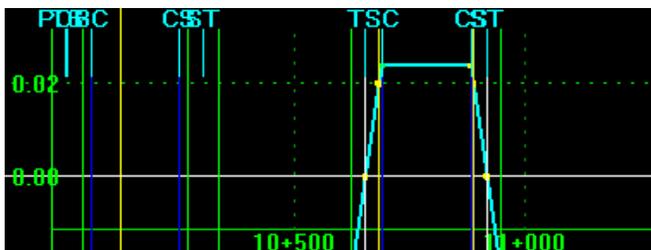


Notice that superelevation in the first curve failed (Delta G at 0.00 throughout). This is due to the transition: the connection process referenced points in the template that do not exist. You will fix this error later in the workflow.

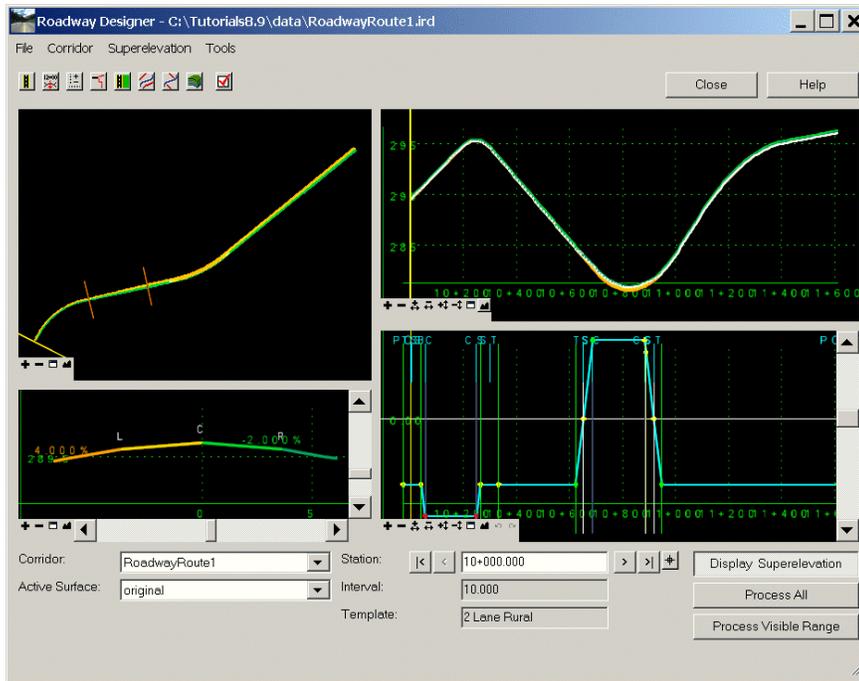
- To display lines individually, right click in the display and select **Superelevation Display List**. The multi-color lines are to only visually assist you in identifying the controls. For example, to see the Right Lane REP only:



Click **Apply**; then, **Close**. Select the **Process All** button (to update all views) in the main dialog.



- Close the Results dialog. Fit the view.



So, the superelevation wizard completed two design tasks. First, it calculated the runoff lengths for the curve. Second, it created control lines for each point to be superelevated.

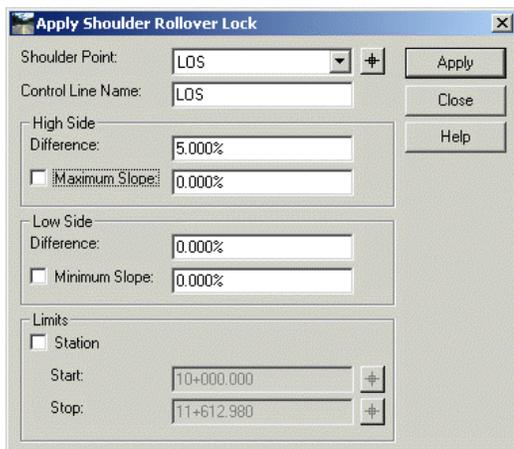
23. Save the roadway design file.

Now that you have accomplished a transition from 2 to 4 lanes, apply roadway shoulder rollover locks.

## Applying Shoulder Rollover Lock

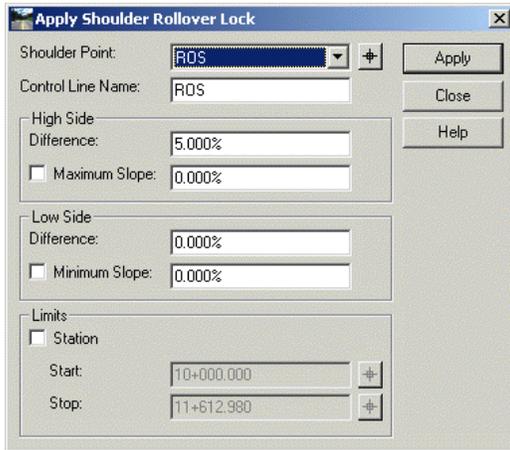
Once you have created Superelevation for lanes in the alignment, you are ready define and apply control lines to handle shoulder rollover.

1. In the Superelevation Display, right click and select Apply Shoulder Rollover Lock.
2. For Shoulder Point, select LOS (Left Outside Shoulder).
3. Under High Side, for Difference, type .05 and press Tab.

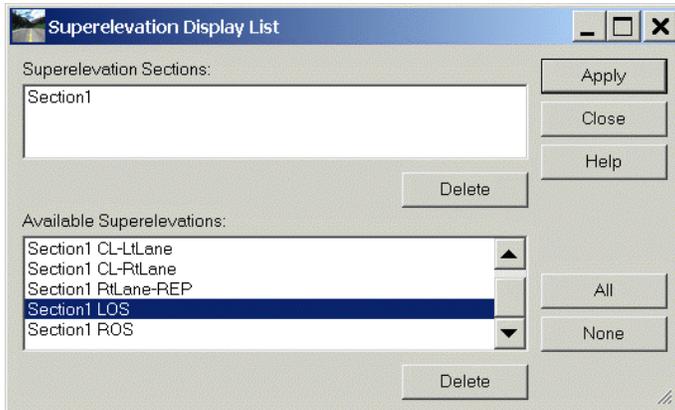


4. Click Apply.

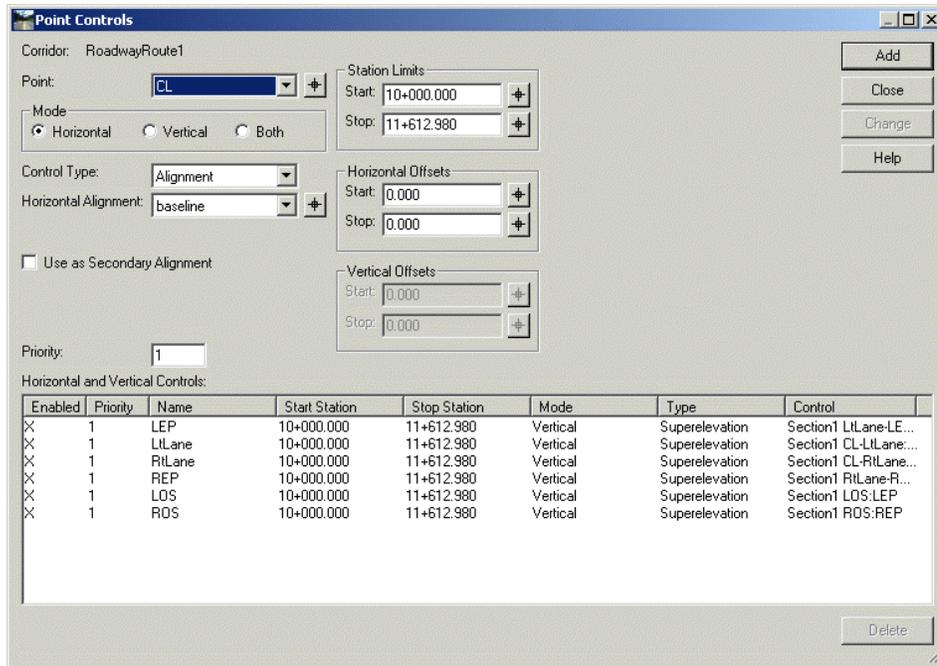
5. Repeat this process for ROS



6. Click Apply, then Close.
7. Now, view the control lines in the Superelevation Display. Select Process All to update the view. Close the Results dialog.
8. Right click and select Superelevation Display List.
9. Select a shoulder control line and Apply. For example, LOS:



10. Close the dialog.
11. Click **Corridor > Point Controls** to review the control points.
12. Notice that the Superelevation Wizard assigned horizontal and vertical control names. The point controls should appear as shown:



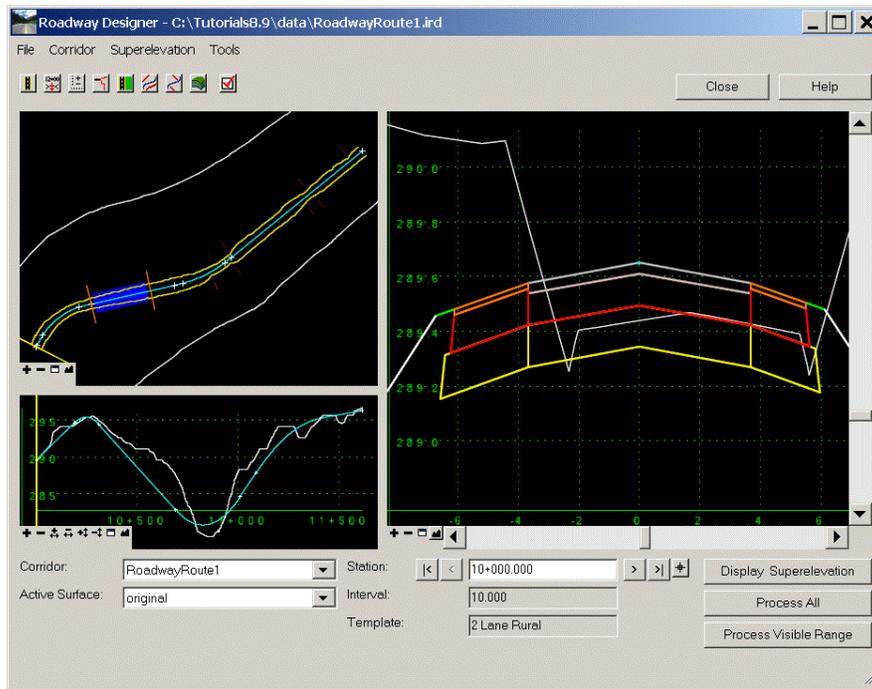
13. Close the dialog

At this point in the project, you have created a corridor, a new template with transition from 2 to 4 lanes, created superelevation, and applied point controls for shoulder rollover. Next, continue using the Point Controls command to re-transition back to 2 lanes (7.4 meters to 3.7 meters) to complete the end of horizontal alignment in this project.

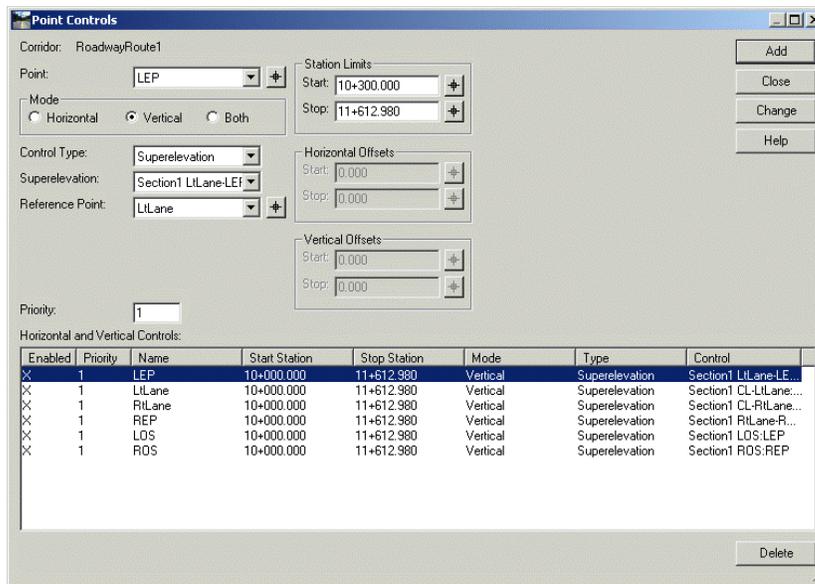
## Applying Point Controls

In this task, resolve the superelevation error in the first curve; then, add new horizontal and vertical controls to transition back to 2 lanes.

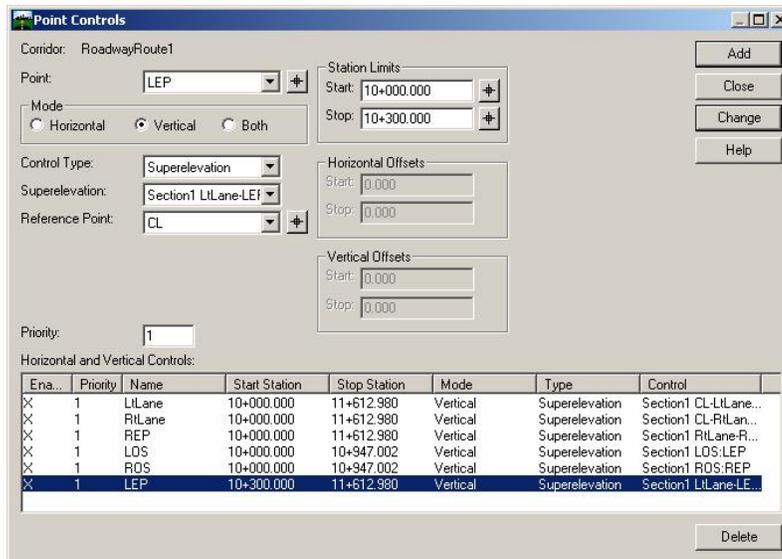
1. Turn off the Superelevation Display.



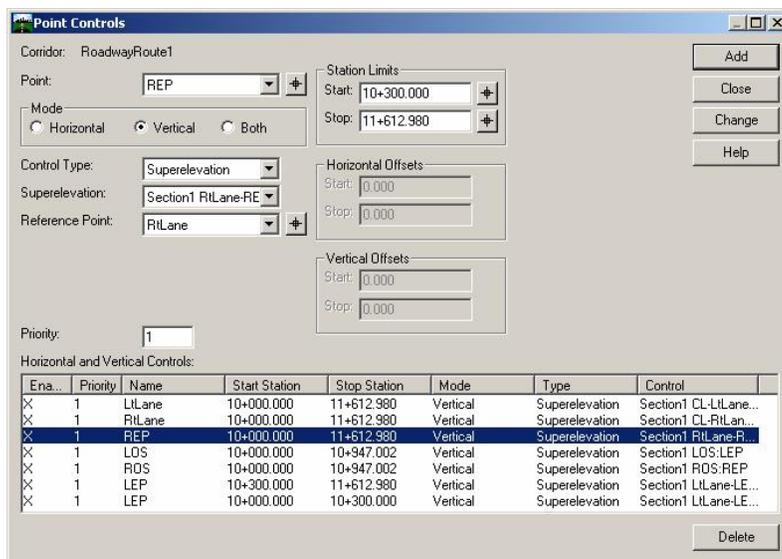
2. Select **Corridor > Point Controls**.
3. In the next few steps, you will modify points in the 2-Lane portion of the alignment to correct the superelevation error in the first curve. Select LEP.
4. For Start station, type 10+300.000. Ensure that all other settings are as shown:



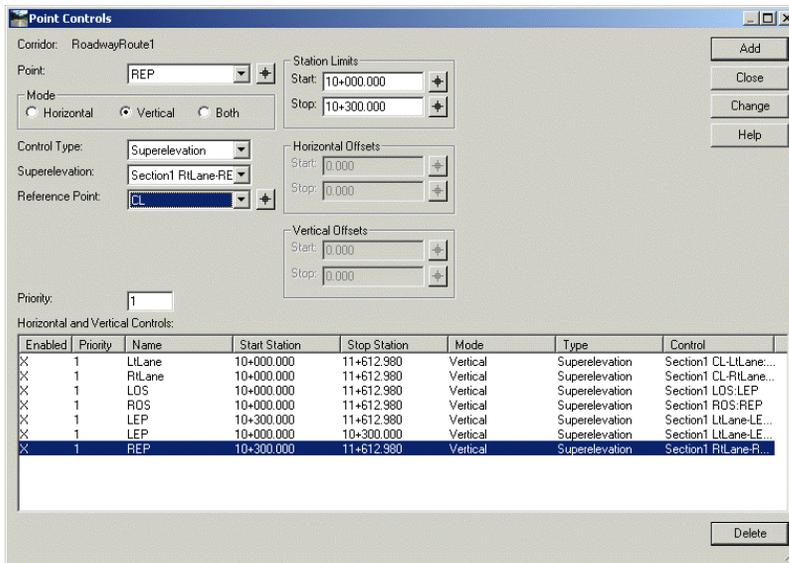
5. Click Change.
6. Next, for Reference Point (for LEP), choose CL (Centerline).
7. For Start station, type 10+000.000; for Stop station 10+300.000. The settings for LEP should appear as shown below:



8. Click Add
9. Now, repeat this process for REP.
10. For Start station, type 10+300.000.

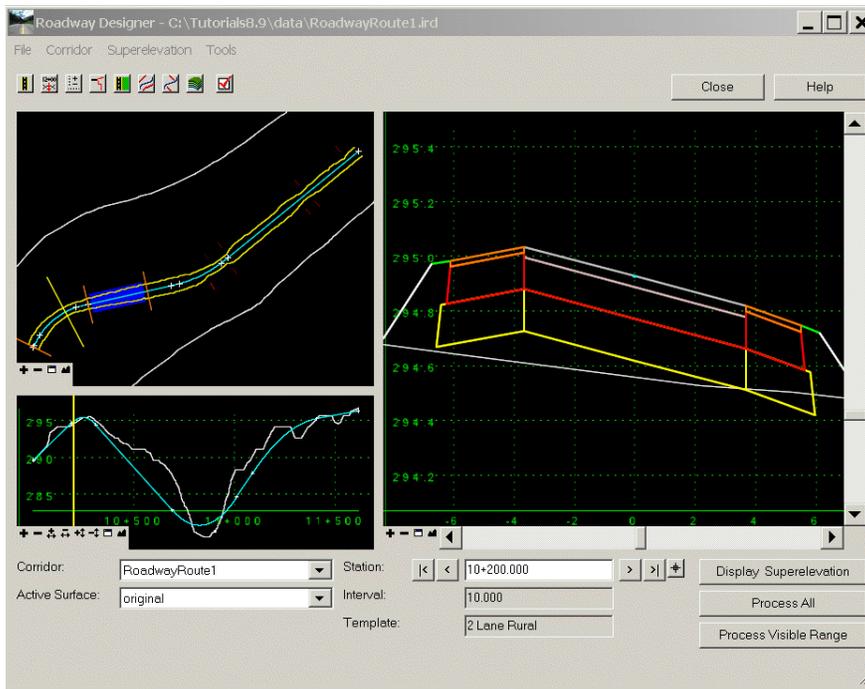


11. Click Change.
12. Next, for Reference Point (for REP), choose CL (Centerline).
13. For Start station, type 10+000.000; for Stop station 10+300.000. The settings for REP should appear as shown below:

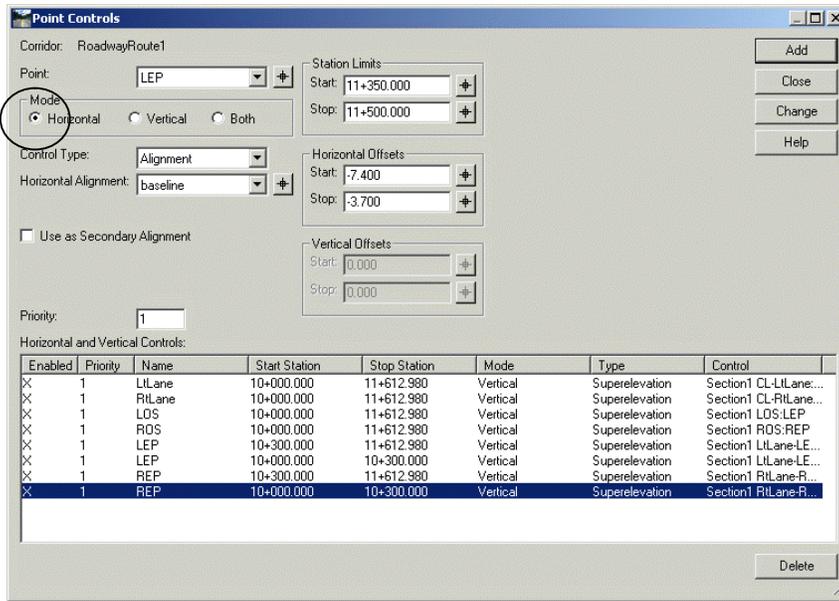


14. Click Add. Do not close the Point Controls dialog box.

15. Click on the 2-lane portion in Plan view. Notice the superelevation in the first curve:



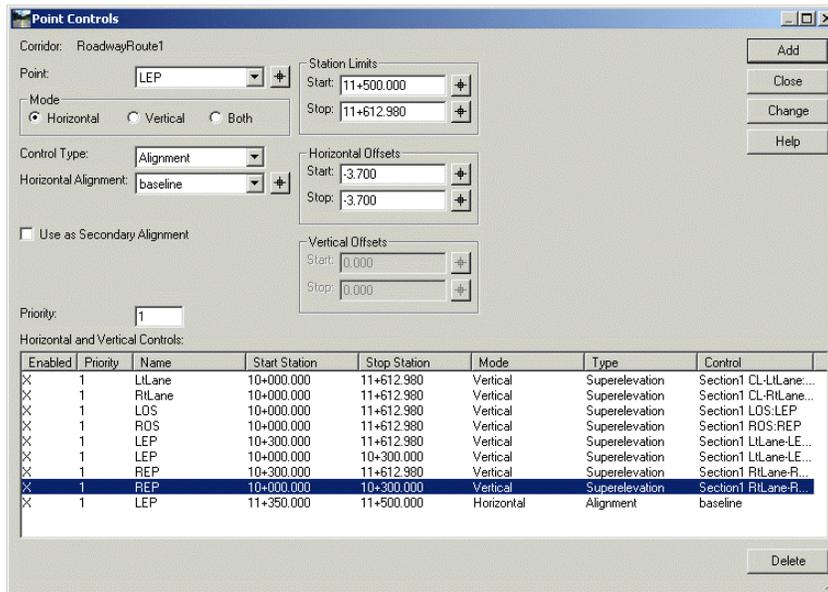
16. Finally, add new controls for the end of the alignment. In the Point field, select LEP. Select or key-in the additional settings as shown below:



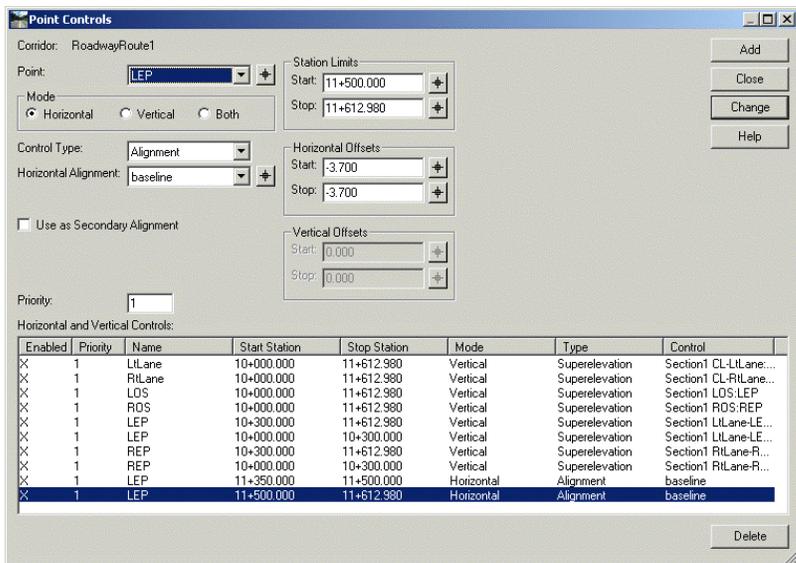
This left edge of pavement point will control the lane width change from 7.4 to 3.7 meters.

17. Click Add.

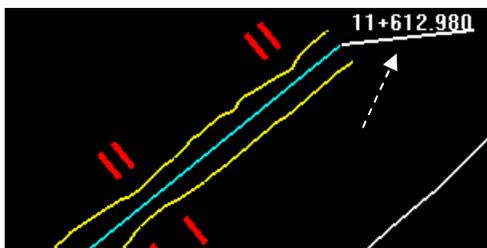
18. Next, add a control that maintains the 3.7 meter width to the end of the alignment. Select the settings as shown below:



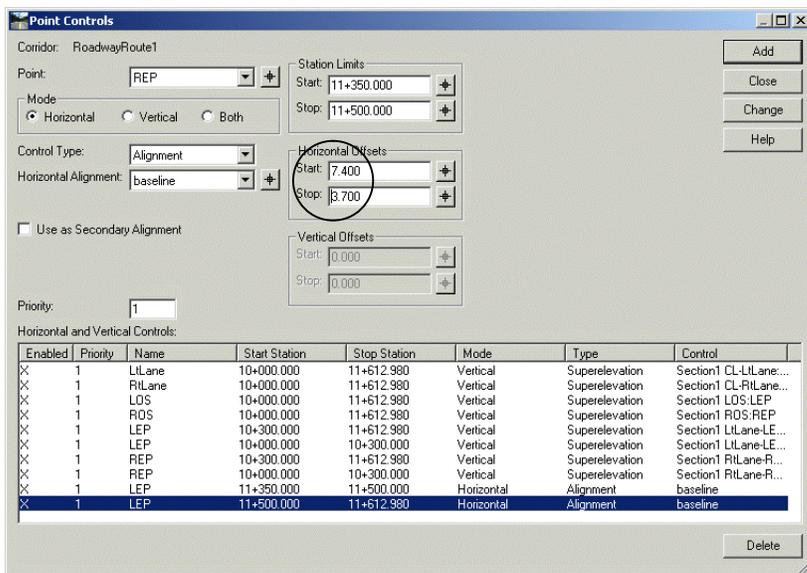
19. Click Add.

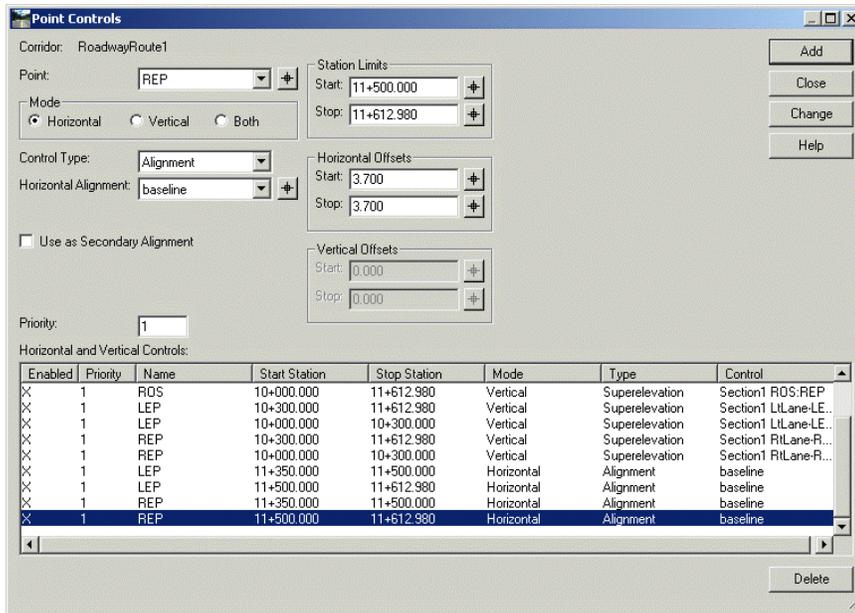


Do not be concerned if the stop station appears in red. Zoom into the view and use the locate button to click precisely on the end of the alignment then; click the Change button.



Repeat this process of adding controls for REP. This right edge of pavement point will control the lane width change from 7.4 to 3.7 meters. Notice that these are positive values.





20. Close the Points Control dialog box.

21. Save the roadway design file. **File > Save.**

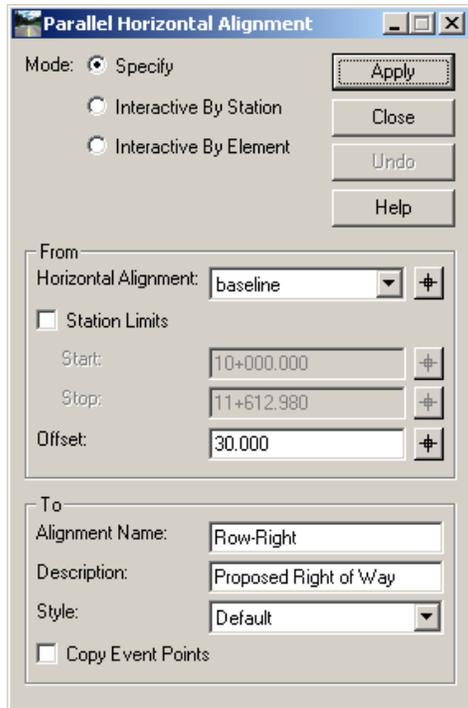
Next, take a look at how display references are used in the Roadway Designer.

## Using Display References

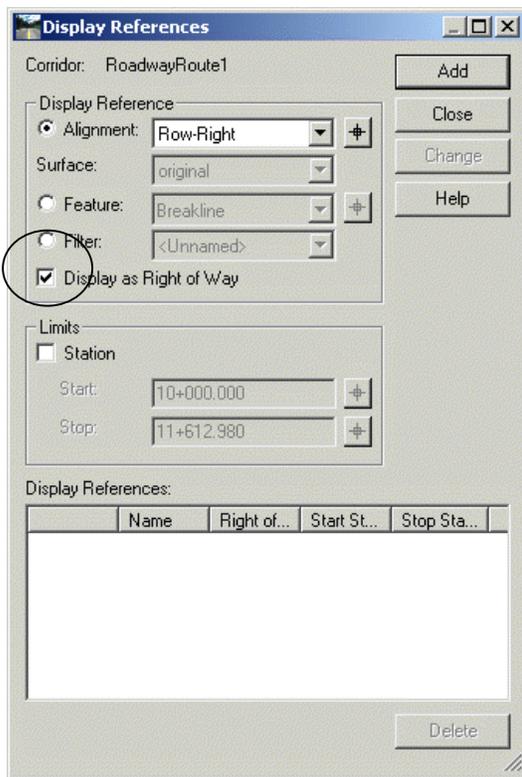
In prior versions of InRoads, right-of-ways (ROWs) were managed with *rules* to instruct the modeler how to handle a solution that extended beyond the ROW. In the Roadway Designer, ROWs are now simply added as display references that you can interactively inspect and adjust using various tools during the design session.

In this task, first create an alignment; then, display it as a reference in Roadway Designer.

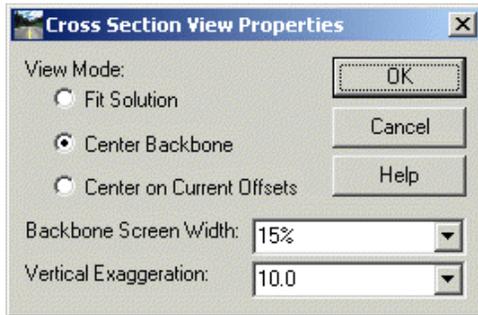
1. Collapse but do not close Roadway Designer.
2. Click **Geometry > Utilities > Parallel Horizontal Alignment.**
3. Select the settings as shown below:



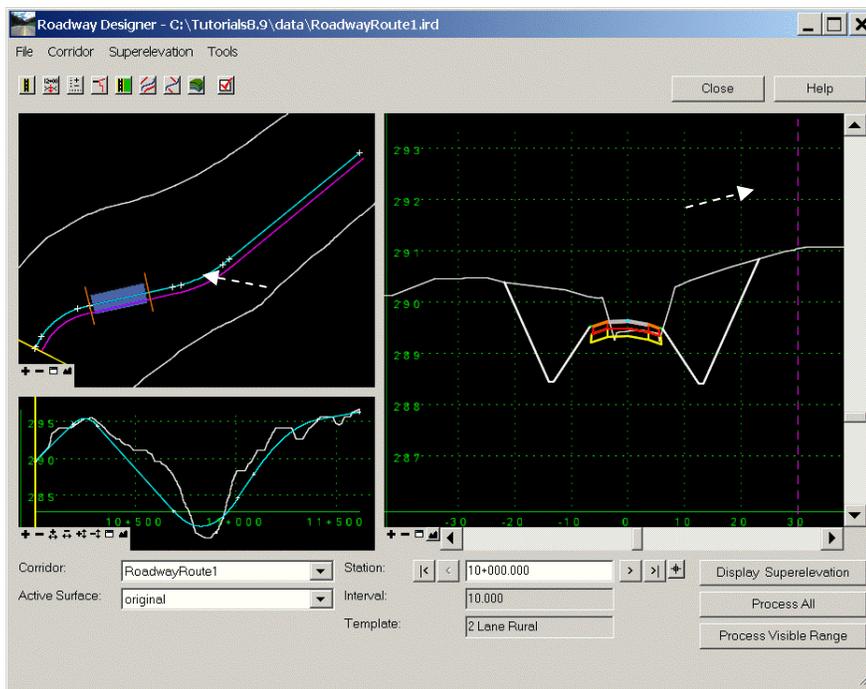
4. Click Apply; then, Close.
5. Return to the Roadway Designer
6. Now, display the new alignment as a display reference. Click **Corridor > Display References**.
7. Select the settings as shown below:



8. Click Add; then, Close.
9. In the cross-section view, right click and select Display Properties.
10. Select the settings as shown below:



11. Click OK
12. Fit all views.



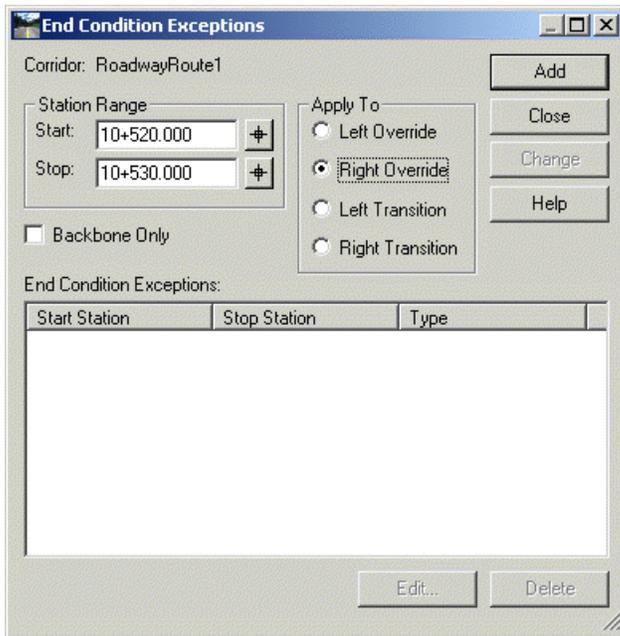
13. Notice the reference (alignment) appears as a solid purple line in plan view; as a dashed purple line in cross-section.
14. Step through the stationing to view the solutions relation to the right ROW. Notice that from station 10+520.000 to 10+530.000 as well as from 10+540.000 to 10+730.000 the right side slightly exceeds the ROW. There are several methods to fix this, from adjusting the alignment to adding a retaining wall. In the next task, fix it with an end condition exception.

## Defining End Condition Exceptions

An end condition exception is an efficient method of modifying the behavior of an end condition solution without making additional template drops.

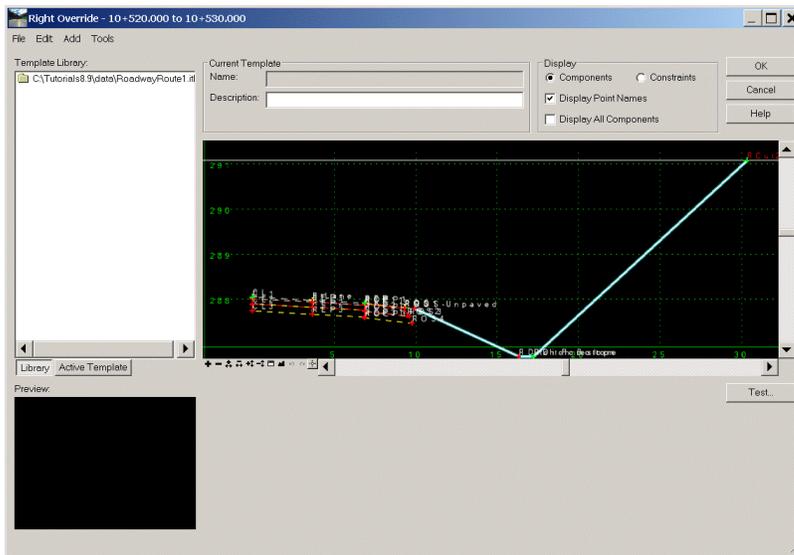
1. Select .

2. Select the settings as shown below:

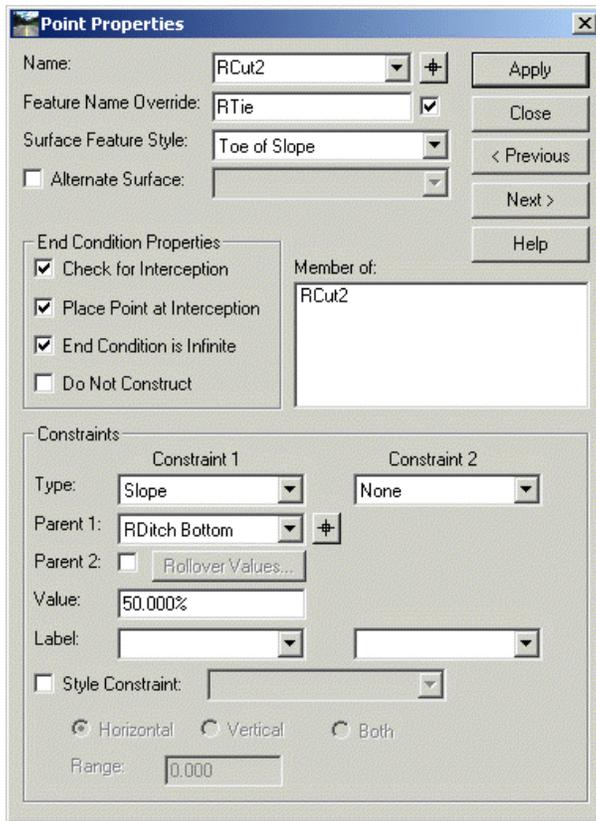


3. Click Add.
4. Select (highlight) the entry, and select Edit.

The Create Template command is activated.

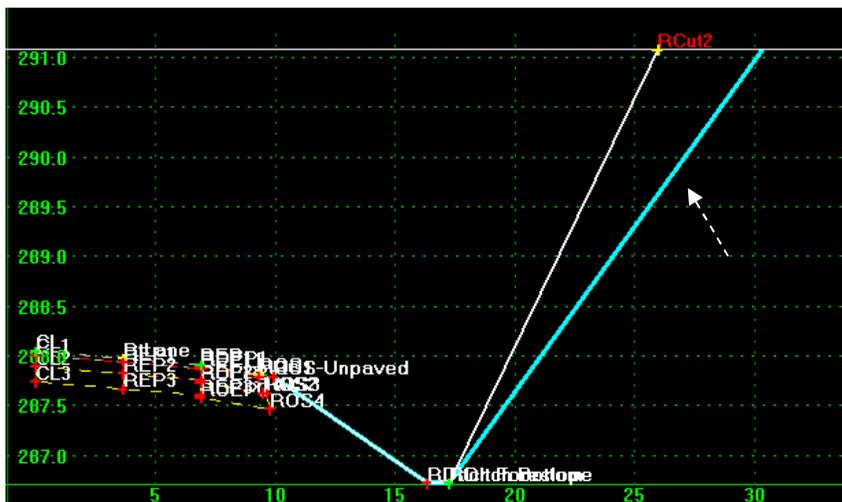


5. At the point: RCut2, right click and select Edit Point.
6. Select the settings as shown below:



7. Click Apply; then, Close.

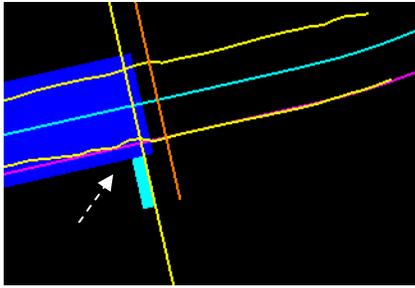
To resolve the solution problem, notice that you have modified the slope constraint at the point.



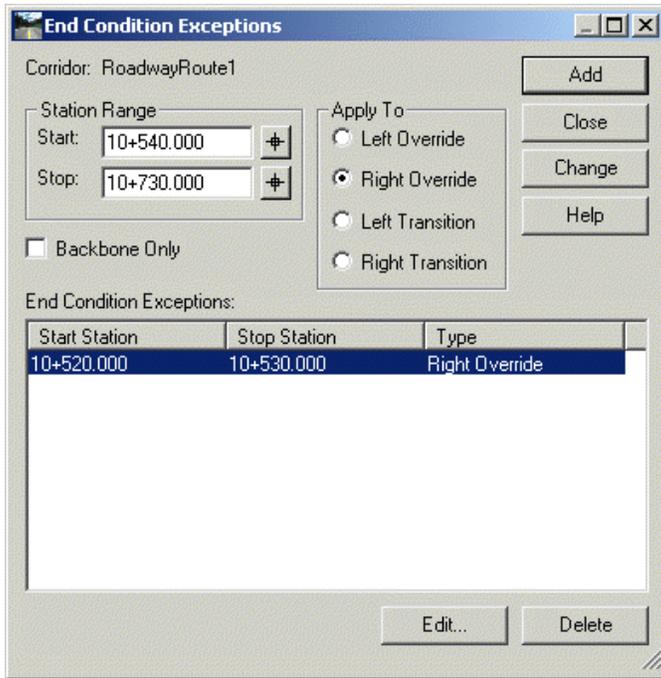
8. Click OK to close the Create Template dialog.

9. Close the End Condition Exceptions dialog.

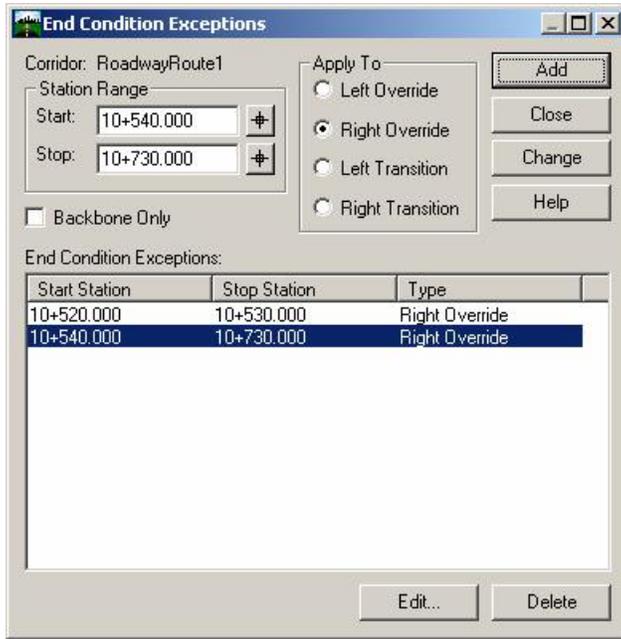
Step through the stationing from 10+520 to 10+530. The right side solution no longer exceeds the right ROW. Also notice in plan view (zoom) that a light blue visual indicator appears in the station range to inform you that the transition has been edited.



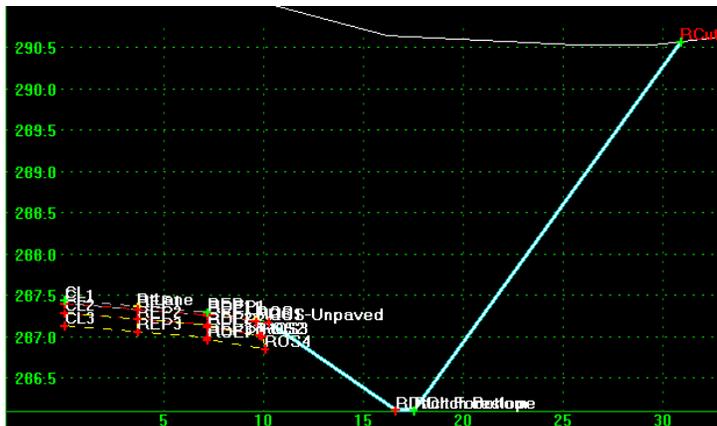
- 10. Now, repeat the end condition process for station range 10+540.000 to 10+730+000. Select .
- 11. Modify the station range as shown below:



- 12. Click Add.

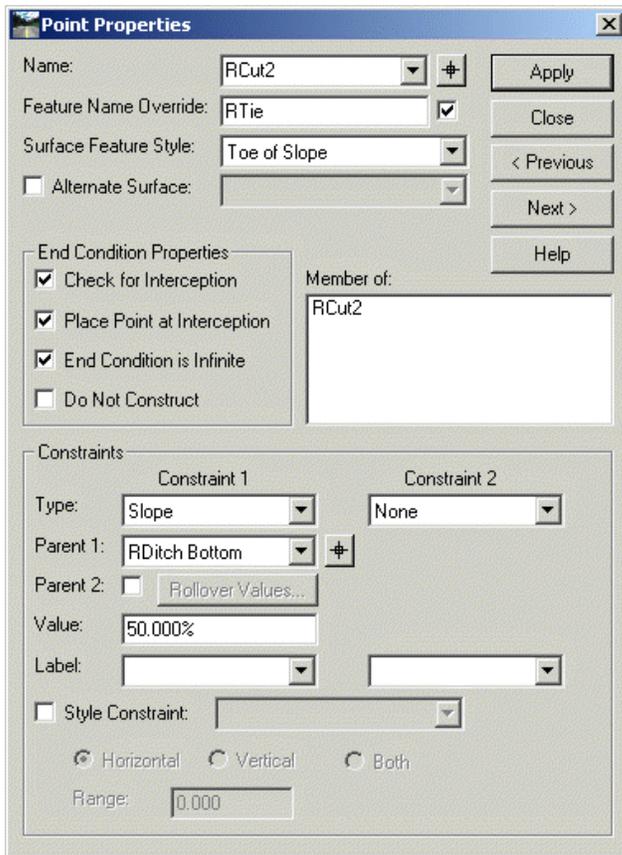


13. Click Edit.



14. Edit point R Cut2.

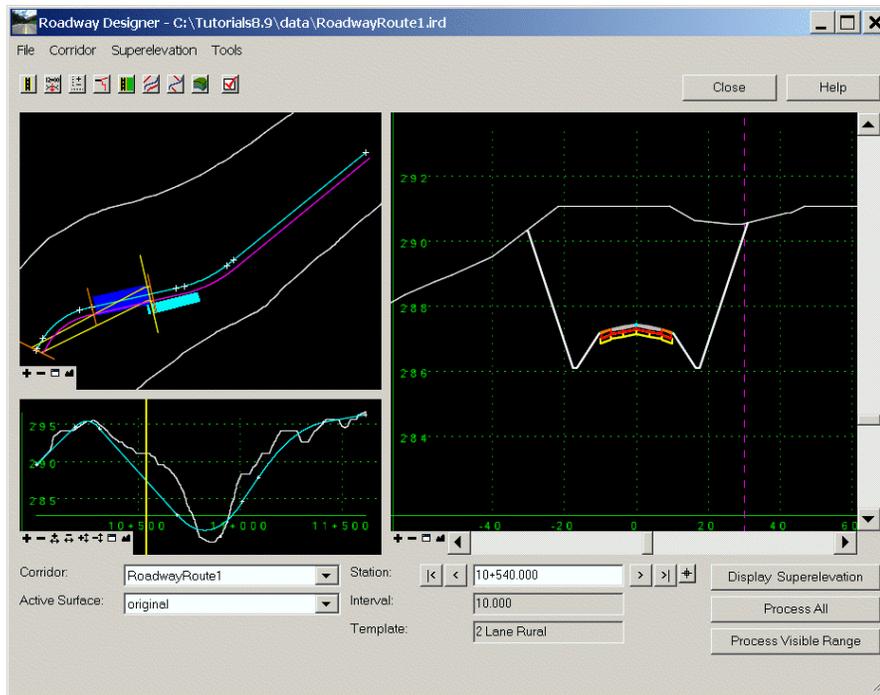
15. Select the settings as shown:



16. Click Apply; then, Close.



17. Click OK on the Create Template dialog and Close on the End Condition Exceptions dialog.



18. Review the stationing across the alignment; the right of the solution does not exceed the ROW.

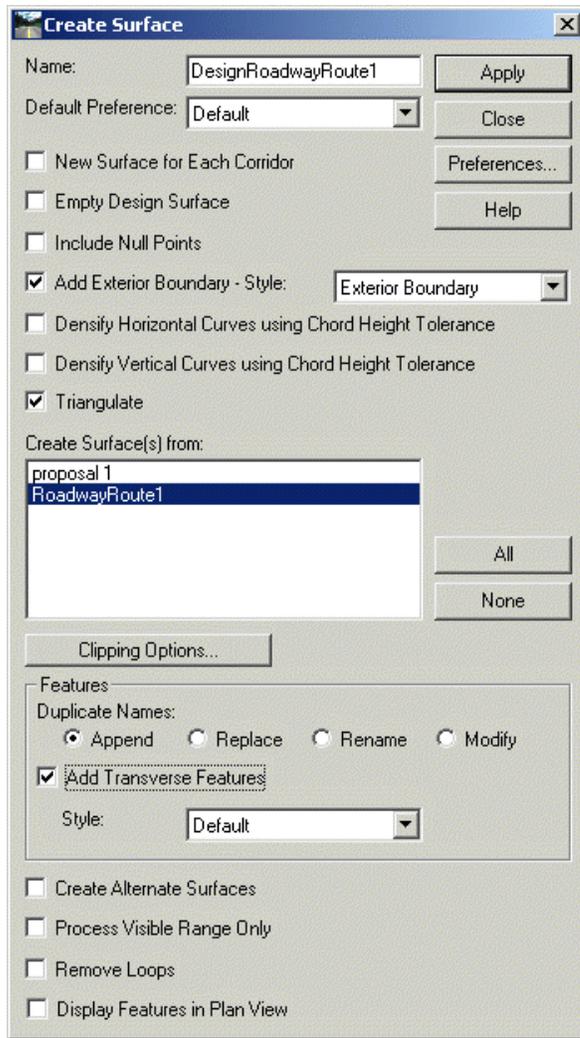
19. Save the roadway design file.

You have created a new corridor, created and edited a new template, transitioned the roadway from 2 to 4 lanes, created superelevation, applied shoulder rollover locks, transitioned the roadway back to 2 lanes using horizontal and vertical controls, displayed a ROW reference, and corrected the solution using end condition exceptions. In the final task, create the new design surface.

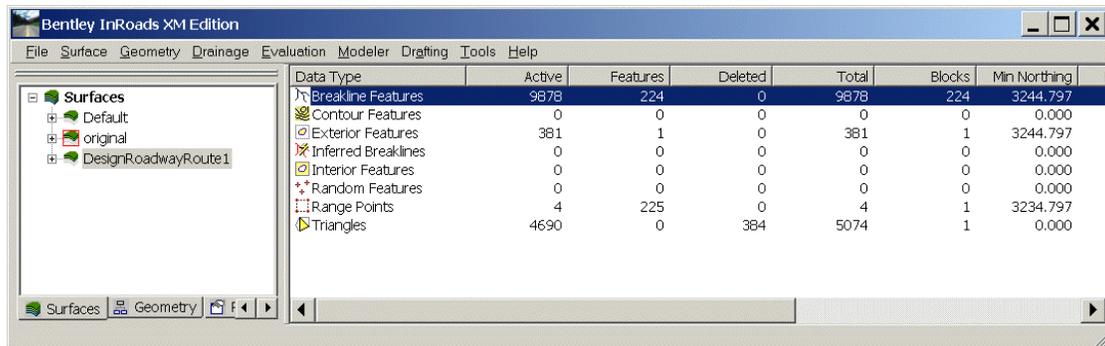
## Creating the New Surface

Typically, the end result of a session in the Roadway Designer is the generation of a new design surface from which plan, profile, and cross section drawings are created. Using the Create Surface command, you can either create a unified or merged surface from all corridors in a design, or create a separate surface for each corridor, which you will complete in this task.

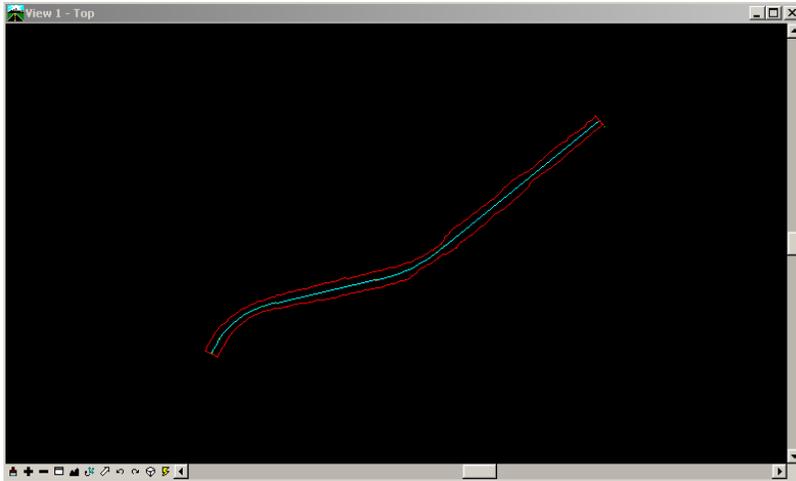
1. Click Create Surfaces .
2. Select the settings as shown below:



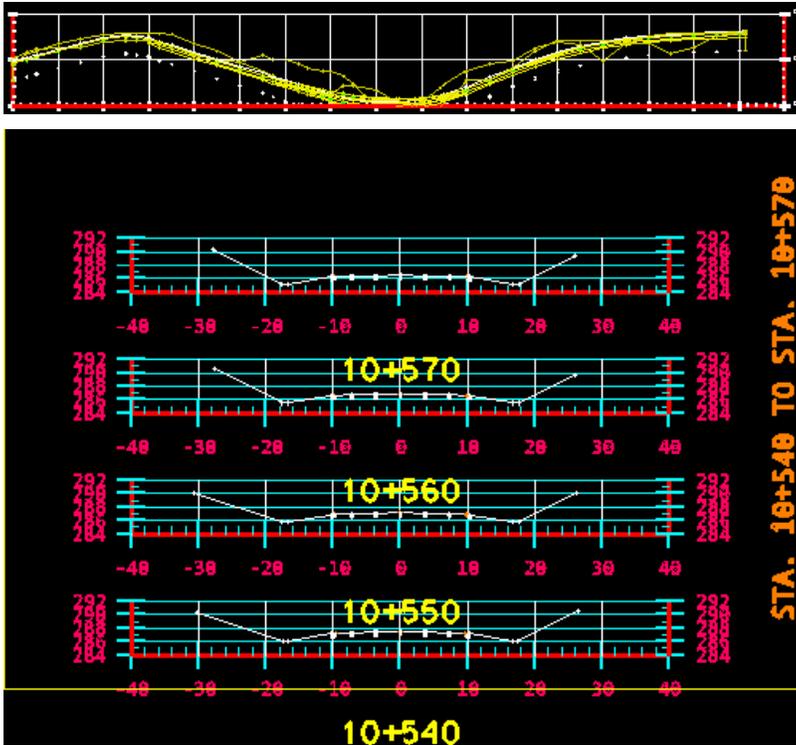
3. Click Apply; then, Close
4. Once processing is complete, close the Results dialog.
5. Save the roadway design file. Close Roadway Designer.
6. In the Explorer, locate the new design surface.



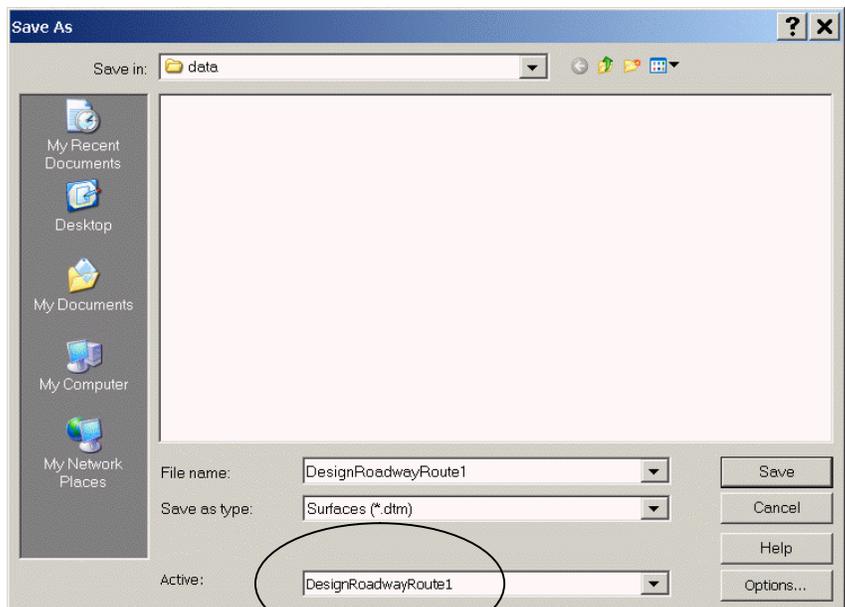
7. Review the surface.



8. Generate cross sections and profiles:



9. Save the surface. Click **File > Save As > DesignRoadwayRoute1.dtm**.



10. Close all dialogs.