Chapter 2

Roadway Designer Overview

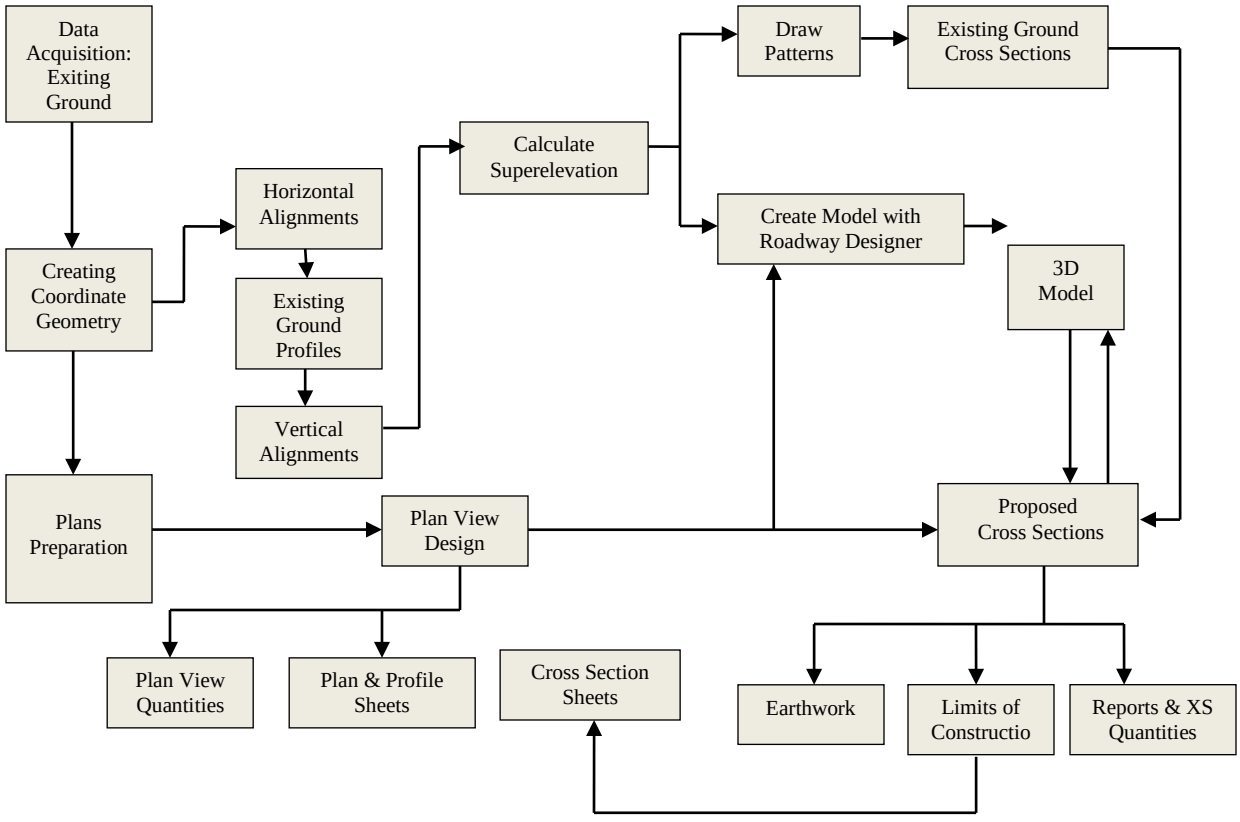
2.1 Objectives

The objective of this chapter is to give the user an overview of the Roadway Designer Tool and the design workflow using this tool. The user will learn how to access the tool, set preferences, navigate through the create template and roadway designer dialog boxes.

2.2 Roadway Designer Workflow

Roadway Designer is one of many tools designers can use to design highway corridors. This concept utilizes a model-centric approach. Consequently, the user must create the model before creating cross sections, which is the opposite of the traditional GEOPAK highway design cross section design approach.

The flowchart below shows a design workflow for preparing highway construction contract plans using GEOPAK. Please note the addition of the model-centric design workflow.



Once all alignments, profiles and superelevation are designed, the designer can start using the Roadway Designer tool to create the roadway(s) model(s).

2.3 Create Template Dialog

The first step to creating a 3D model is to create templates for the roadway design. Templates are dynamic typical sections used in Roadway Designer that use transverse geometry to create 3D models. Each template contains a series of points and components that represent breaklines,

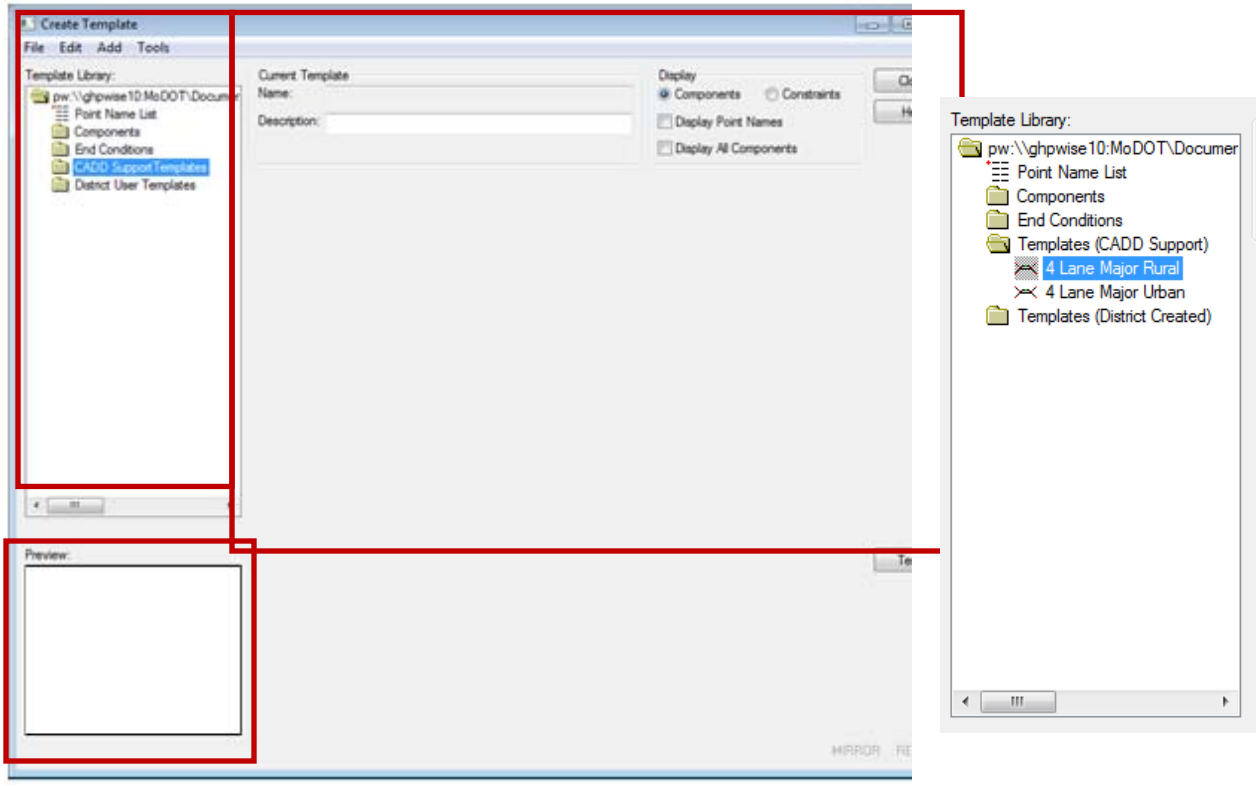
which are used to create the roadway surfaces. All these points, components, and templates are stored in the template library (itl).

CADD Support has created a default template library. This library contains most used components and end conditions at MoDOT. A limited number of templates are available through this template library. The intent is for the user to assemble his/her own templates giving the districts more flexibility in their design; therefore, the default MoDOT library is copied the user's working directory using the Start Job routine when creating new projects.

The user accesses all templates available in the standard MoDOT template library. In addition, this is the tool to use to create new components and templates to be used within Roadway Designer.

To access the Create Template Dialog, select the icon through the Corridor Modeler dialog.

The Create Template Dialog is composed of three major areas: Folder Tree Window, Current Template Window, and the Template Preview Window, which are shown below.



2.3.1 Folder Tree Window

This view allows the user to navigate through the template library selected. The folder tree structure begins with the template library. Underneath, the user will find the following categories: Point Name List, Components Folder, End Conditions Folder, CADD Support Templates, and District User Templates. This window is completely user definable, and it has all windows capabilities like right click functions, copy, paste, drag and drop.

2.3.1.1 POINT NAME LIST

This list contains previously created names to be utilized in the creation of new points for creating components for templates. Each point on a template must be unique, so no point can have the same name. CADD Support has created a point name list for standardization.

2.3.1.2 COMPONENTS

A component is a set of points defining an open or closed shape that represent different portions of the template. For example, pavement structure, curbs, gutters, shoulders, medians, retaining walls, etc. MoDOT default library has many components from which to choose to create templates. These components are organized in categories according to functionality. These components do not include side slope conditions.

2.3.1.3 END CONDITIONS

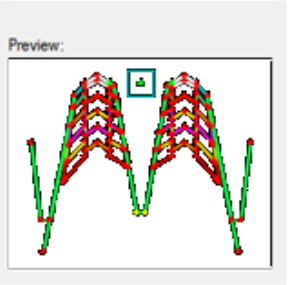
End conditions are simply side slope condition components that tie to existing ground. These include fill slope, cut slopes, ditches and/or combination thereof.

2.3.1.4 CADD SUPPORT TEMPLATES

The MoDOT standard template library will contain a limited number of templates. Only these templates will be housed in this folder.

2.3.1.5 DISTRICT USER TEMPLATES

The user will save the template library in his/her working directory and will be able to modify the library by adding new templates or components. Any templates created by a district user should be stored in this folder.

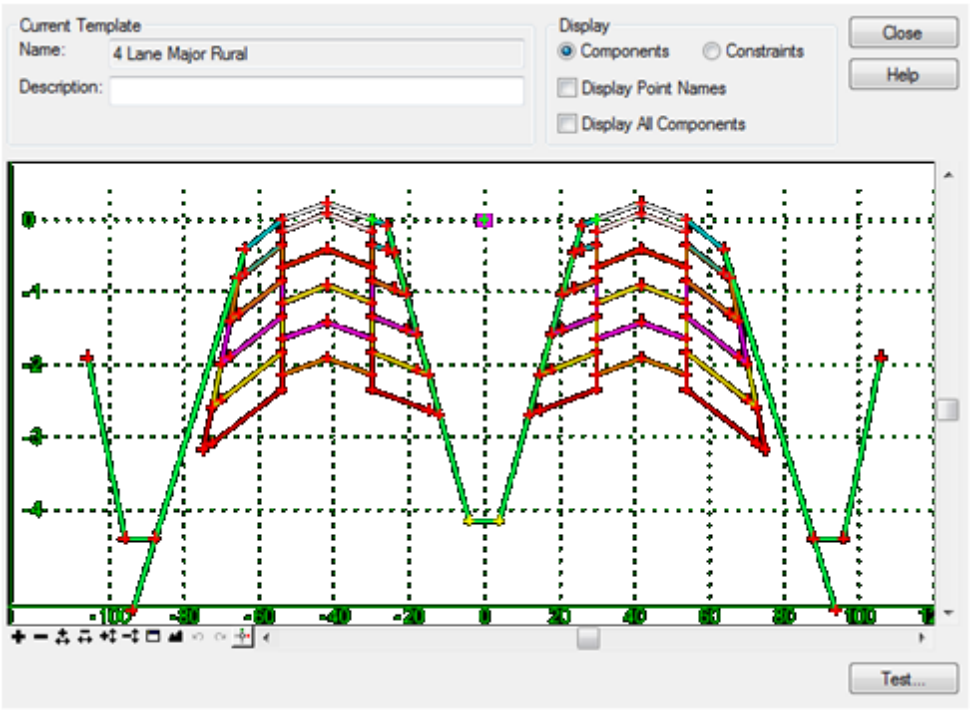


2.4 Preview Template Window

The template preview window shows the template that is highlighted in the folder tree view. A Cyan color box denotes the placement location for that template. Usually this is at the origin of the template, but the user can click on any point to move the placement point location. The user can drag and drop from the preview are to the current template window.

2.5 Current Template Window

This is the large window on the right hand side of the Create Template Dialog where templates are assembled and edited. The current template window shows the user the name, description and design of the template currently being edited, reviewed or assembled.



2.5.1 Display Options

The two radio buttons allow the user to choose what to display in the center window. The components option shows the typical section component/template picture. The constraints option show how each point in the component/template is constrained to each other. Constraints will be covered in another section.

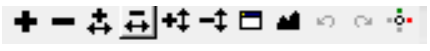
There are two check boxes the user can select for displaying various portions of the template. When the Display Point Names option is checked on, all the point names in the current template are displayed. Point names are long and when displayed the window can be too cluttered. Sometimes templates have hidden components controlled by certain design design situations. This concept will be discussed in a later chapter. When the Display All Components option is selected, these hidden components are displayed.

2.5.2 Center Window

The center window is the main graph for creating/modifying templates. This window has its own graphics engine and so it is not a MicroStation window. The scale of the graph is dynamic and changes as you zoom in and out.

The center point of the window is marked by the dynamic origin, which is a magenta-colored box. The dynamic origin is used as a reference point and can be moved to any location in the graph.

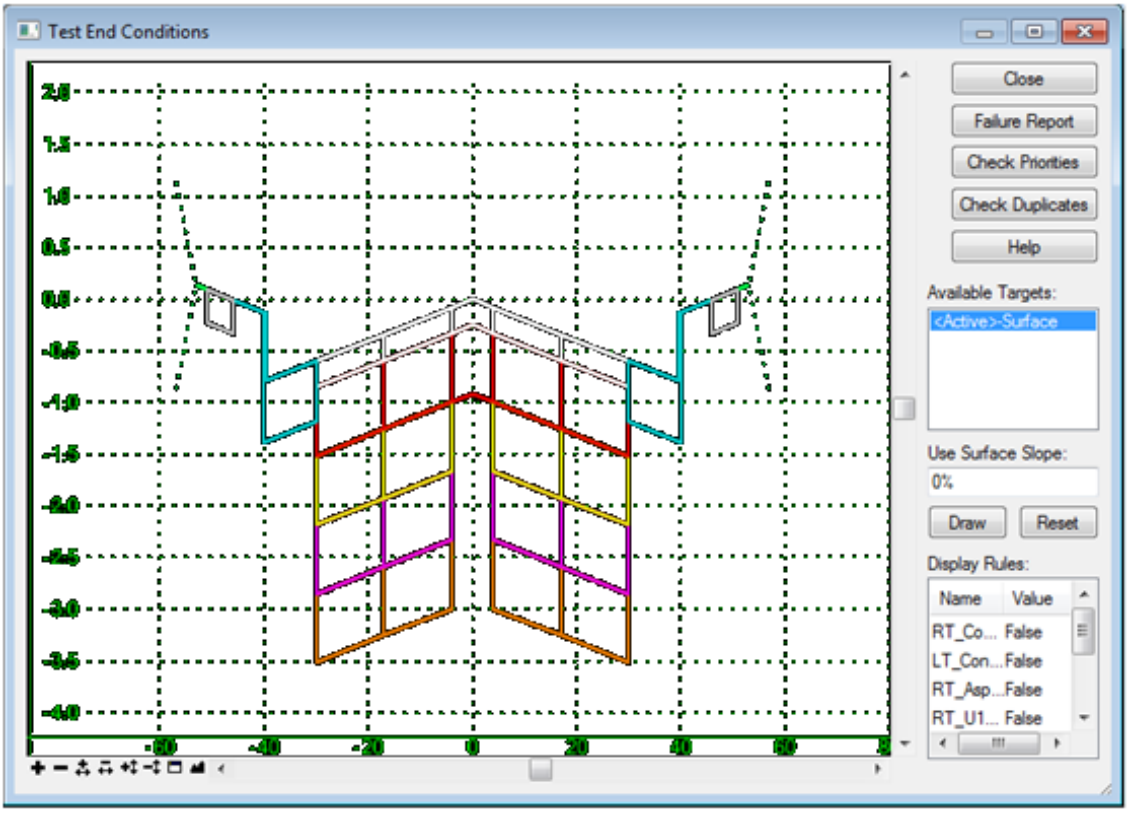
2.5.3 View Commands



These commands are similar to the MicroStation view commands. They allow the user to perform the standard zoom in/out, zoom in/out in the X direction, zoom in/out in the Y direction; window in an area, and fit the view, undo, redo, and set dynamic settings.

2.5.4 Testing End Conditions

Test – Opens the Test End Conditions dialog box. This tool allows the user to test the end condition solutions.



This tool displays the current template; the non-solved end conditions and their child components are displayed in dashed lines. The normal components and solved end conditions are displayed as solid lines.

The **Available Targets** area lists all of the targets available whether they are surfaces or specific styles. The user simply selects the desired target, sets the **Surface Slope**, and then clicks on **Draw** to test. The Surface Slope is the slope of the surface that is being placed. The **Reset** button clears all the drawn targets.

Display Rules - list the display rules for the current template. Left-click over a value to toggle between True and False. Press the Reset button to restore the original Display Rules values.

Failure Report – activates the Results dialog. When a template fails to get a solution on one or both sides, the results show which components failed and which end condition start points were not solved.

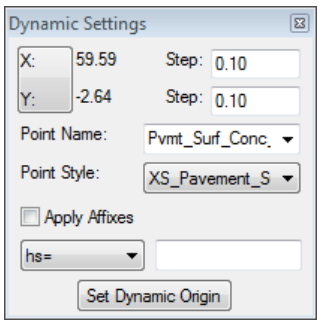
Check Priorities – tests the template for priority conflicts. Each end conditions starting at the same point has a priority assigned, and must be unique. When a conflict exists, a message is displayed indicating there are end conditions starting at the same point having the same priority assigned. If there are no conflicts, a message box indicating no conflicts is displayed.

Check Duplicates – checks for duplicate feature and component names for the given solution. If duplicate feature or component names are found, the Duplicate Feature Name List dialog is displayed. If no duplicates are found, a message to this effect is displayed.

Close – dismisses the dialog.

Help – displays the help for this dialog.

2.6 Dynamic Settings



Similarly to the MicroStation Accudraw tool, the Dynamic Settings are used for precision input of the template components and to assign point names and styles when creating components.

It also serves as a compass for the cursor location with respect to the dynamic origin. The dynamic origin can be modified by using the "**Set Dynamic Origin**" at the bottom of the dialog box.

2.6.1 Accessing the Dynamic Settings

The Dynamic Settings can be accessed by selecting Tools>Dynamic Settings or by using the view control icon . The dynamics settings should be set to x = 0.1, y = 0.1 before creating templates.

2.6.2 Precision Key-In Commands

XY = Key-in absolute coordinates (x, y)
DL = Key-in delta coordinates from last point placed (defaults to the dynamic origin if it is the first point of a component
HS = Key-in horizontal delta distance and slope from last point placed
VS = Key-in vertical delta distance and slope from last point placed
OL = Key-in delta coordinates from dynamic origin
OS = Key-in horizontal delta distance and slope from dynamic origin

2.7 Creating Templates from Components

Templates can be assembled by dragging and dropping components and end conditions into the Current Template window one at a time.

Each point on a component has a unique point name. These point names are created without being specific to "left" or "right" side of the roadway. The user assigns a prefix or suffix to determine "left" or "right" when creating the template via the Dynamic Settings.

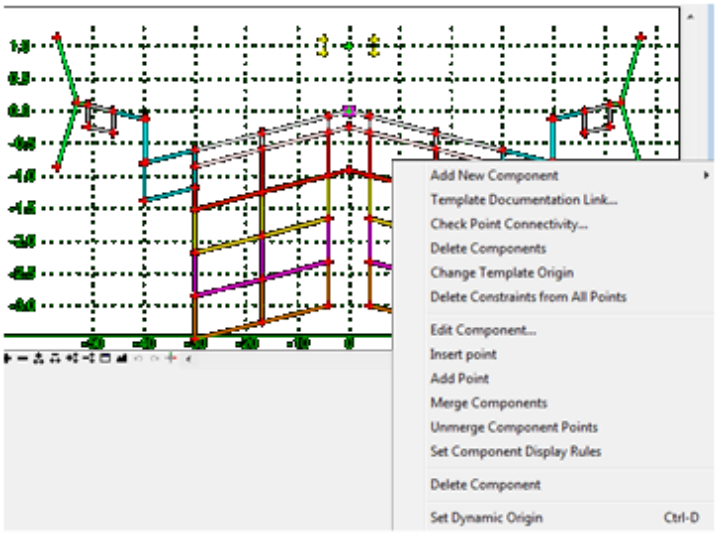
Creating components will be covered in a later chapter.

2.7.1 Dragging and Dropping Components

When two points coincide, a heavy white plus sign will appear. When connecting two components together, the existing connection point name will override the dropped point name. Dynamic Settings should be set before starting to drag and drop components to create a template.

Once a component is created, it can be modified by editing any property, inserting new points, or creating display rules. Once two or more components have been combined, they can also be merged.

To edit components, simply right-click between the components to access the editing commands.



2.7.2 Basic Template Creation Workflow

- Open Template Library
- From the folder tree view, right-click and select **Create > New Template**
- "Drag and drop" template components
- Merge Components
- Verify Point Names
- Save the Template Library

2.8 Pull Down Menus

File – allows the user to create a new template library, new folder, or new template; open another library, save the current library, or import a template from another library.

Edit – has the common Windows commands undo, redo, cut, copy, paste, clear, delete, and rename.

Add – has all the options for developing new components. Components are covered in a later chapter.

The Tools menu offers several tools to manage the template library, but the only two tools pertaining to the MoDOT template library are the Dynamic Settings covered in section 2.6 and the **Template Library Organizer,** which allows the user to copy components and templates from one library to another.

2.9 Roadway Designer Dialog

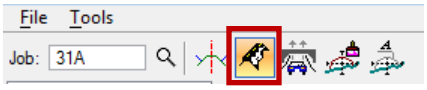
2.9.1 Roadway Designer Fundamentals

Roadway Designer combines all alignments, surfaces and templates to create a proposed roadway model. It also applies superelevation to the design, and all of this design data is stored in "the Roadway Design file" known as an *.ird file.

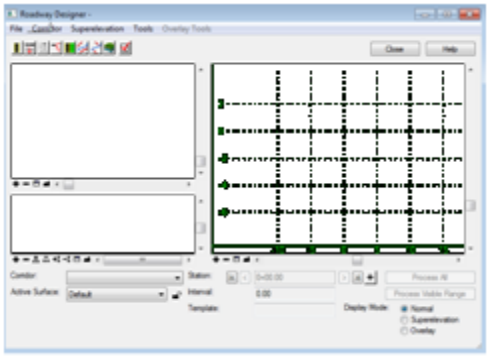
This tool is used for managing and designing corridors and producing surface models in 3D. In order to use the Roadway Designer tool, the user must have the following:

- Existing Surface (from photogrammetry, survey, or both)
- Horizontal and Vertical Alignments
- Detailed Typical Section(s) for the corridor(s)
- Superelevation information
- Plan view geometry of the corridor such as EOP's, EOS, sidewalks, C&G, entrances, etc.

Once all the design information is entered in Roadway Designer, the user saves it to a Roadway Designer File (.ird extension).



The Roadway Design tool can be selected from the Corridor Modeler dialog.



The main dialog is occupied by 3 views (4 views when superelevation or overlay is displayed). The main three views are Plan, Profile, and Cross-Section view at the current station.

The bottom portion of the dialog displays the name of the current corridor, active surface, current station, cross section interval, and the template being used at that particular section. The user can navigate through the corridor by using the navigation buttons.

For each view there are three display modes: normal, superelevation and overlay. Depending which one of the modes is selected, the threw windows will display different contents.
The **Process All** button processes all the cross sections in the corridor using the specified criteria, and updates all the display windows with the results. **Process Visible Range** processes only within the visible range of the windows.

2.9.2 Plan View Window

This window shows the corridor's centerline alignment, cut-fill lines, and original ground surface perimeter. It also shows civil design data and associated stationing, but not Microstation graphics.

2.9.2.1 NORMAL MODE

In this view, it displays the plan view of the current corridor design. The outlines of other corridors that have already been processed can also be shown.

Transition zones are displayed in yellow. A transition happens when there is a change in template from one station to the next.

2.9.2.2 SUPERELEVATION OR OVERLAY MODE

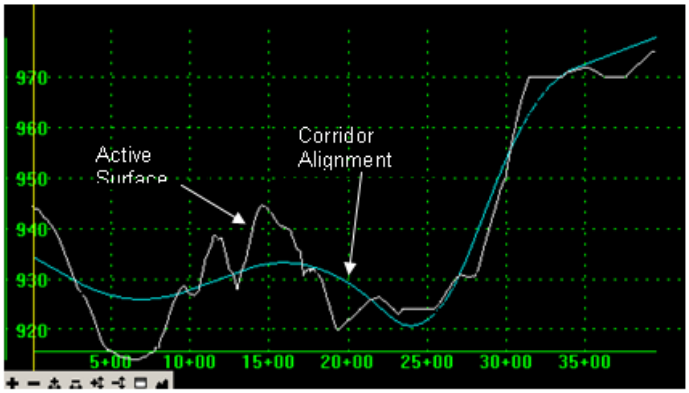
The plan view displays the top of the back bone (center of template with no end conditions) in various colors that represent the cross-slopes.

White:	cross-slopes with values less than 0.5%
Green-blue:	cross-slopes with values 0.5% to 10% to the right
Dark Blue:	cross-slopes with values greater than 10% to the right
Yellow-Red:	cross-slopes with values 0.5% to 10% to the left
Dark Red:	cross-slopes with values greater than 10% to the left

2.9.3 Profile View Window

This window shows the profile view of the current corridor design.

Normal mode



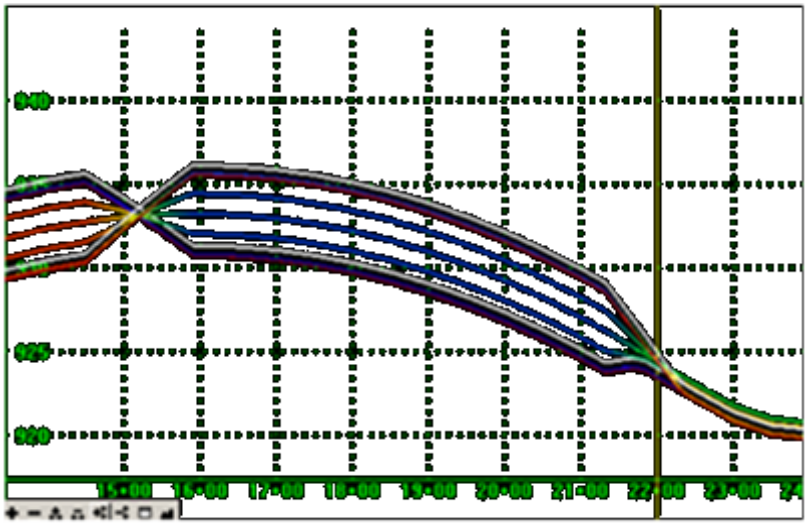
2.9.3.1 NORMAL MODE

In this mode, the active corridor vertical alignment and the existing ground profile from the active surface are displayed. The vertical points appear as white "+" symbols. Hovering over the point displays the point type and station.

2.9.3.2 SUPERELEVATION MODE

In this mode, the profile diagram displays the profile grade line of all the top of backbone points in the design. To control which points are displayed, right click in the view to bring up the point display list and select or de-select the appropriate points. The color of the lines represents the cross-slope color to the right of the line. The rightmost line is always white.

Super mode



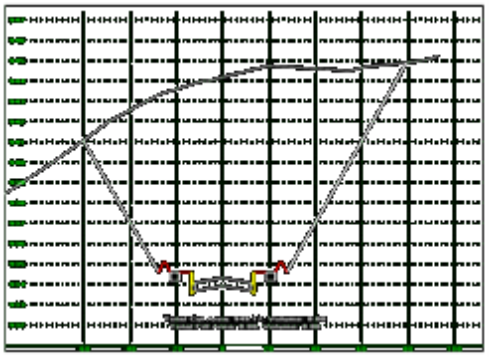
2.9.3.3 OVERLAY MODE

In this mode, the profile grade is displayed as defined in the Corridor management dialog, and the adjusted profile grade is displayed.

2.9.4 Cross Section View Window

This window displays the cross-section design solution at the current station. The view shows original ground for the active surface selected as well as the proposed template solution.

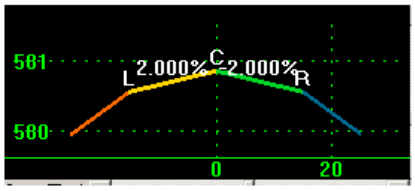
2.9.4.1 NORMAL MODE



In this mode, the entire cross section is shown. Hover over any line to display information about that line and about the component it belongs to. Hover over a vertex to display information about that point.

Right click on a point in the cross-section view to directly edit the point control(s) and/or parametric constraints affecting a point. This applies only to points that have a point control or parametric constraint affecting it.

2.9.4.2 SUPERELEVATION MODE

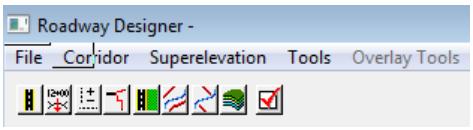


In this mode, only the top of the backbone is displayed. The line segments are color-coded based on their cross-slope using the same color values as described under superelevation mode for the plan display.

2.9.4.3 OVERLAY MODE

In this mode, the overlay adjustment value is displayed. The overlay adjustment value is the difference between the profile defined in profile management and the adjusted profile.

2.9.5 Pull Down Menus and Icons



Pull down menus and icons corresponding to the menus are located at the top of the dialog.

These tools will be covered in full detail in later chapters.

2.9.5.1 FILE MENU

This menu contains the common Windows file commands: Open, Save, Save as, and Close

2.9.5.2 CORRIDOR MENU

The corridor menu contains all the commands to create or set up the corridor design. These commands can be accessed via pull down menu or via icons across the top, and they include: Corridor Management, Template Drops, Point Controls, end Condition Exceptions, Display References, Secondary Alignments, Key Stations, and Create Surface.

2.9.5.3 SUPERELEVATION MENU

As the name indicates, this menu provides all the tools to input the superelevation design for the corridor. Even though Roadway Designer reads GEOPAK shape input files, the tool offers a variety of options for superelevation input.

2.9.5.4 TOOLS MENU

This menu offers another set of tools to add design features and options to maximize the design. A design corridor must exist in order to utilize these tools.

2.9.5.5 OVERLAY TOOLS

This menu provides tools to optimize the design for overlay projects such as cross-slope optimization, making vertical overlay adjustments, etc. This pull-down menu is only activated when the overlay mode is selected from the cross sectional view.

2.9.6 Corridor Management Command

This tool is used to specify the horizontal and vertical alignment to be used for the design corridor. Each corridor must be entered individually. This information is then saved to the IRD file.

2.9.7 Template Drops Command

This tool is used to specify what template(s) to use for the corridor. There can be multiple template drop locations.

2.9.8 Create Surface Command

This command is the last to use in the workflow of a Roadway Design project. It combines the alignment created through the Corridor Management command and the templates specified in the through the Template Drop command to create a 3D model (an InRoads DTM) of the proposed Roadway Design corridor. This surface consists of the top surface of the roadway design and the subgrade components, which are "Excluded from Triangulation" points and children of the top surface. Components can be displayed in cross sections and used for volume calculations.

2.10 Roadway Designer Basic Workflow

Once the existing TIN and the alignments and profiles are created in GEOPAK, and the typical sections are determined for the project, the following workflow should be followed:

- Launch corridor modeler from the GEOPAK 3D tools
- Create the RDP file and set up the preferences, import the geometry and original ground TIN, and select the template library
- Load the template library
- Load Roadway Design and create the IRD file
- Create new corridor
- Assign template drops
- Create surfaces
- Save IRD file