

Abstract:

This workflow will highlight the basic necessary steps of using the Roadway Designer: Creating corridors, creating/modifying templates, talk about styles and symbologies, define the difference between a component and a point, assigning templates to a corridor or template drop, defining transitions or other horizontal or vertical controls, test and refine our Roadway and finally create a surface.

This workflow is designed as a reference and to establish future workflows, to get you started. It is not a step by step show you everything approach. It hits the highlights.

This workflow does not address the creation or modification of horizontal and vertical alignments nor the evaluation of the surface created by this process – displaying contours, creating cut/fill maps, earthworks, etc.

Also, if this is your first venture using the new Roadway Designer it is highly recommend running through the basic InRoads Roadway Designer Tutorial. We will refer to this tutorial throughout this document.

The instructions and sample files are on your computer. Open the pdf file located:

C:\Program Files\Bentley\InRoads Group
8.8\Sample\Data\InRoadsRoadwayDesignerTutorialV88(Imperial).pdf

Run through pages 77-102, and 112(Applying Point Controls) - 126 of the Roadway Designer Tutorial. The skipped middle section is on Superelevation, if this is applicable to you please run through the entire tutorial.

It should take about 3.0 hours of uninterrupted time to complete the lesson (not including the superelevation portion).

Tools talked about during this workflow can be found under the Modeler menu item within InRoads.

Software Version: InRoads V8.8

Notes:

Vocabulary Lesson: Old terms -> New Terms

Typical Section -> Template

Roadway -> Corridor

*.rwd -> *.ird = Roadway Design File

*.tml -> *.itl = Template Library

Roadway Designer vs Express Modeler

Roadway Designer -- generates a 3-D corridor model, incorporating independent controls, following right-of-way restrictions, and applying superelevation.

Express Modeler -- Use this command as a simple and direct method to move a specific template along an alignment and create a surface from the results. The new design surfaces can represent a new roadway or other type of surface. Express Modeler is intended for models that do not require the depth of information provided by Roadway Designer. It does not have any mechanism to incorporate independent control, superelevation, or right-of-ways. For the generation of complex corridor models, use the Roadway Designer command. Use Express for berms, ditches, simple roadways, etc.

Instructions:

The Roadway Designer workflow consists of six main tasks

- 1) Create the Corridor/s
- 2) Create the Template/s
- 3) Template Drops
- 4) Special Conditions (a. Transitions, b. Point Controls or constraints, c. Superelevation)
- 5) Test and Refine
- 6) Create Surface/Display Features

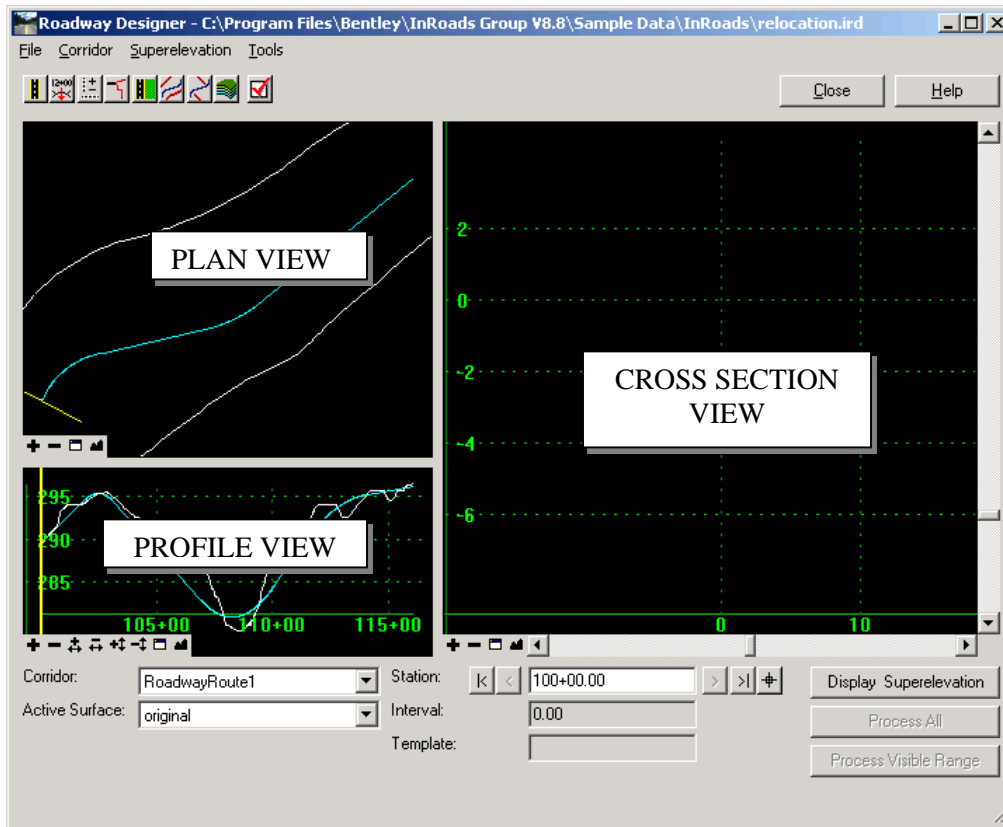
Create the Corridor/s

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.

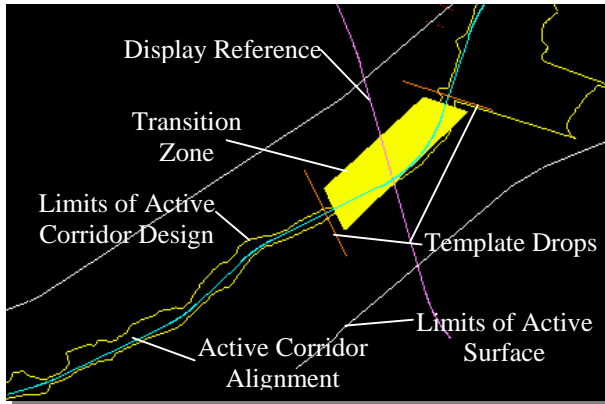
In the past we would create the template then the Roadway. We want to now reverse that mindset.

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

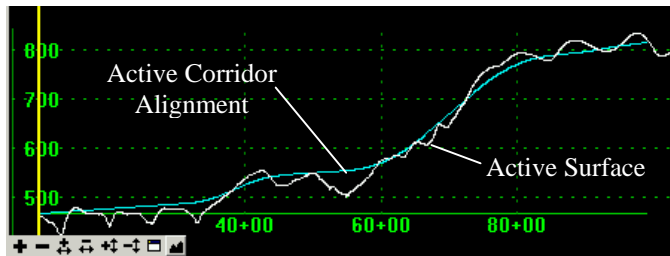
This opens the Roadway Designer dialog box. This is where you will manage, create and refine your corridors.




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.



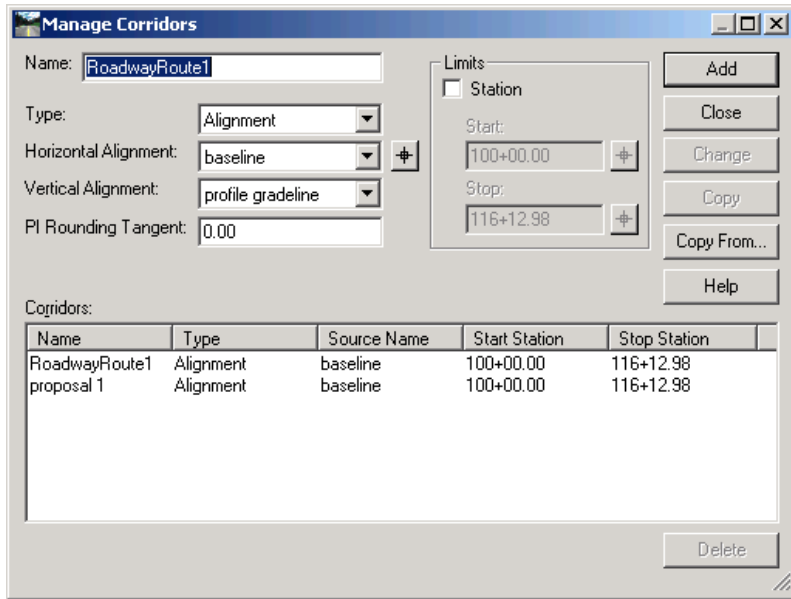
PLAN VIEW



PROFILE VIEW


2. Next, create the new corridor. Click the **Manage Corridors**  button. For **Name**, type the name of your corridor RoadwayRoute1 or Street A.

3. Click **Add**.



Notice the PI Rounding Tangent field. This field is used to define a tangent length to use when processing a feature or an alignment that does not have curves at the PI points. In those cases, a pseudo curve is created with the specified tangent length along each segment. Then, the roadway design processing is orthogonal to the curve instead of the alignment, although the centerline of the corridor remains unchanged.

Notice that you can add, edit, or delete corridors from your design at any time during the design session from this dialog. You can also copy corridors from other Roadway libraries (ird files).

4. Close the dialog.
5. Fit the view .

Create the Template/s


Within the InRoads Help type in *Create Template Overview* in the search tab for further detailed information.

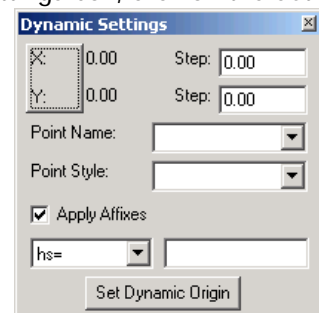
When attempting your first Template, please load InRoads, go to the Help, click on the contents tab, scroll down to Media Library and select *Creating a Simple Roadway Template*. This is a short video showing the basics of the Create Template dialog. There is no sound but very worthwhile to run through.

Getting started we will focus on Constrained components and End Conditions. See Appendix A for a complete description of Template Components.

Ok, a couple rules of thumb.

- a) If you are not sure where a command is, try right clicking
- b) The difference between a component and a point: A component is part of your typical section; for example the asphalt. The component is then comprised of points. For example Crown and Edge of Pavement are two points of our asphalt component. Points represent *the breaklines* when displayed in plan view. Breaklines are features in a surface. The display of the feature is controlled by a Style. When placing components and points, make sure you pick the correct style. This will ensure that when you display graphics they appear with the correct color and on the correct level. You can always change the style by double clicking on your component or point after you place them. Alternatively, try right clicking on a component or point. **It is important to select the appropriate style.** The settings of the style not only control color and level, but if the feature will even display. A style for example could be setup to only display in Profile View and as such wouldn't even show up on plan when trying to display.
- c) Dynamic Settings are your friend. **See Appendix B for additional Dynamic Settings info and a slightly more humorous lesson. Otherwise keep reading to get started.**

Find the  button. Click it and the Dynamic Settings box will appear. You can also use Ctrl+D. YOU WILL USE THIS A LOT!! Notice on your create template screen there is a small purple square. When you start it is probably at 0,0. With the dynamic settings box, click on the *Set Dynamic Origin*. You can now place the small purple square anywhere on your template. This is the Origin to move in the x,y direction or in the x, slope direction. Click on the X: Y: button and it will shift to X: Slope:. The step is just that. If you want a 12' wide section at 2% (signs don't matter!!) Positive/negative directions are based upon the location of your mouse cursor with respect to the origin (small purple box). While your mouse is moving, notice the dynamic settings, the X: Y: will update instantaneously only at the intervals of your steps.



This is mostly straightforward. You want to move 10' in the X and 2' in the Y; type those into your Step values. The only tricky part is if you want to move in a cardinal direction or at a flat slope. DO NOT ENTER A VALUE OF "0". Enter a larger value say like 5' or 5%, then when you are moving your cursor, one of the dynamic values(step values) will be 0 and it will lock in there. If

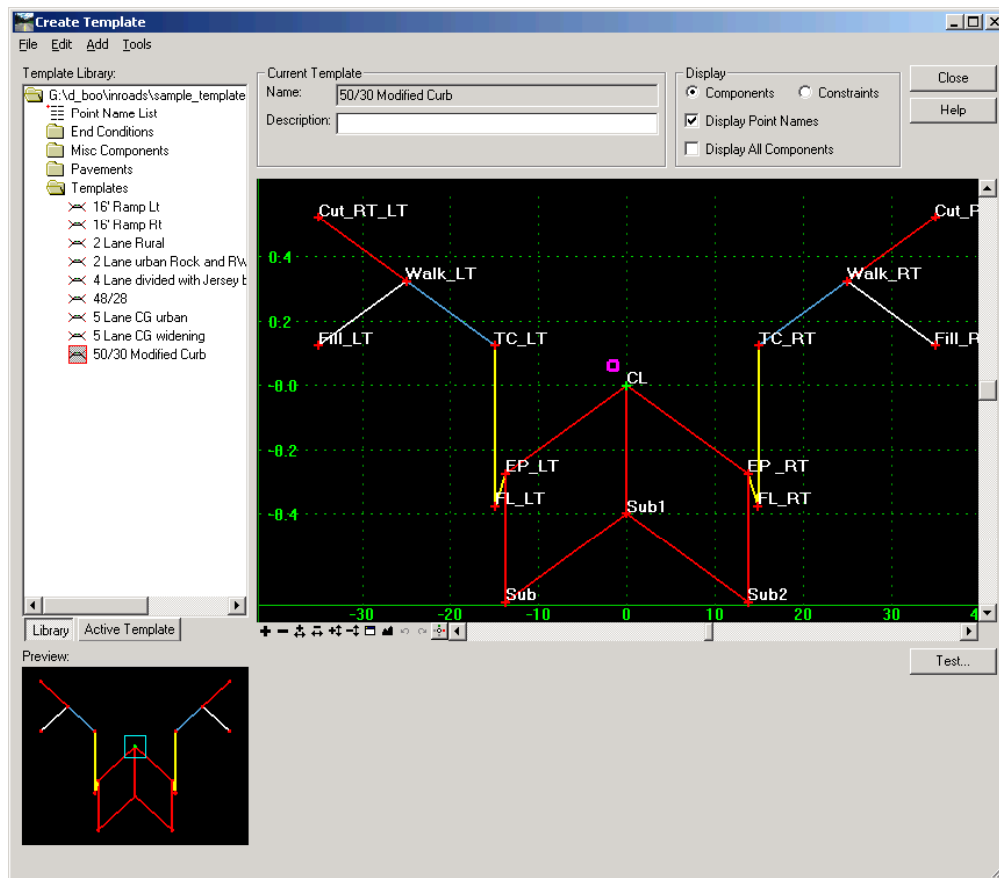
you set it to 0, then all values are valid dynamic values(step values) and it is difficult to get the exact value you are looking for.

- d) If you build it once, don't build it again!!! Templates are now very easy to use over and over again. Items such as curbs, medians, fill conditions and pavement sections can be used over and over again. For example you can build several different curb types as a template by themselves. Then when you need it, you can drag and drop it on your new template. You can also easily copy templates from other libraries into your active one by using the Tools -> Template Library Organizer. You can also organize your library in a similar fashion. Have individual folders for Curbs, End Conditions, Sections. Then have one library titled Templates that have your complete templates for your job. Think of templates as standards. There will be a seed template library in your newjob folder. Also, you can import *.tml files from older versions of InRoads to help start your new libraries on existing jobs.
- e) Name and set your Style of your components and points while you go.
 1. Right click and Add New Component
 2. Name\style your component at the bottom of the screen
 3. In the Dynamic Settings, Pick your Point Name or give a new one and set your style
 4. Place your point
- f) If using *Constrained* components do not string them together. What? Do not go from crown, to ep, to flowline, to tc with a single component, keep them separate. Go from crown to ep, right click Finish, then start a new component for ep to flowline. This is necessary for graphic purposes as well as if you intend to use variable width templates.

Ok enough rule of thumbs lets try this thing:

1. Modeler -> Create Template

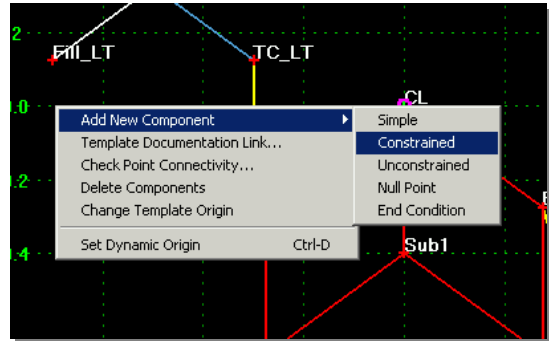
This opens the Create Template dialog box. This is where you will build each of your End Conditions, Misc Components (curbs), Pavement Sections and of course complete templates.



2. Open an existing library or create a new one. File > New > Template Library
3. Right-click, a dynamic menu will appear with options for New > Folder; name "templates".
4. Right-click on Templates to display an additional dynamic menu with options for **New > Template**.
5. Name the new template.
6. Since you have added a new template, save the library file.
7. Click **File > Save As**.
8. For Save as type, select Template Libraries (*.itl).
9. Type in name of your template library

Zooming Around

You can use the zoom in, zoom out, fit all or your center mouse wheel just as in Microstation to zoom around your template or roadway design. Notice the zoom controls at the lower left corner of the template window.

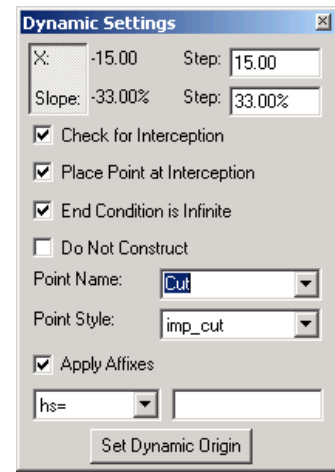


Undo/Redo

Next to the view commands, notice the Undo Redo commands. These are awesome.

To add new components


10. You can now drag and drop from existing already built templates or begin creating your own components.
11. Right click in the template window, select *Add New Component*, pick component type. See Appendix A for a complete list and description of component types. Using a "simple" component you will simply put in the width, slope and depth at the bottom on the template window. If you are placing the others you will typically use the Dynamic Settings to place it.
12. Click **Tools > Dynamic Settings**. The settings here allow you to specify precision input (step increments) from the dynamic origin of the new template. See using Dynamic Settings in Appendix B.
13. Repeat to finish your template.
14. **Add End Conditions**. We will add a simple cut and fill option on each side of the template. You can also construct complex bench/wall scenarios as well.
15. Right click in the template window, select *Add New Component*, pick *End Condition*. Set your component style; *imp_cut*. Right-click and select *Mirror*. Move your cursor over the end of your last template component where your cut will begin, left mouse click.
16. Now use your dynamic settings to set your slope and x direction, Cut as Point name and click the checkbox *End Condition is Infinite*. First, selection the *Set Dynamic Origin*. Relocate the origin to the beginning of your cut line (end of your template) and left click. Move your mouse cursor to where the slope should appear, watch your dynamic settings box when you hit your slope and direction criteria, left click in the window.
17. Finally, right-click and select finish. Notice that the cut line was drawn on both sides of your template.
18. Repeat for the fill line. When setting your component style to *imp_fill*, there is a priority box, set the fill priority to 2.
19. Click File > Save

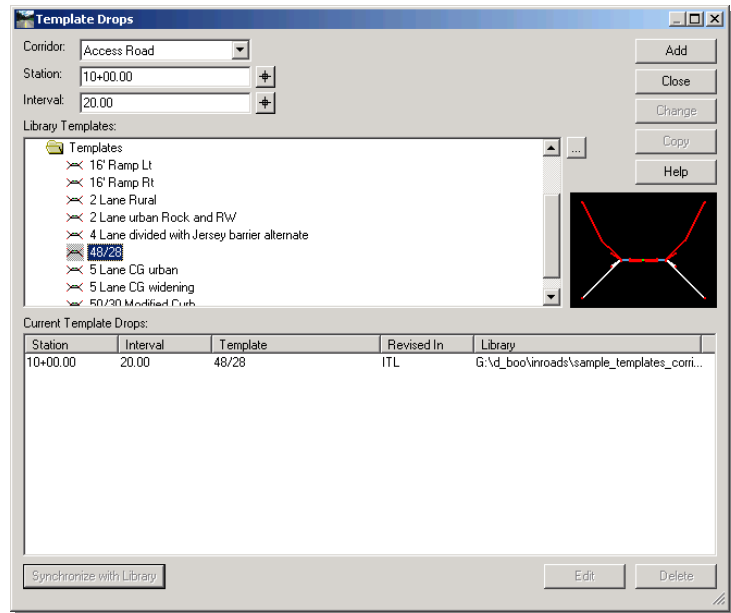


Template Drops

Now that we have our corridor and templates created we need to associate them. This is called "Template Drops."

Back in the Roadway Designer

1. Click the **Template Drops** button .
2. In the Library Templates tree view, select **Templates** > <select the desired template>
3. Make sure the correct corridor is selected. Watch this closely, as it appears as if the drop down box changes quite easily.
4. Set your initial station, the station shown is the beginning station of the alignment.
5. Set an interval of 10 (the template is placed every 10 feet). Consult your Project Engineer for proper setting.
6. Click Add.
7. Repeat if roadway is using another template that will incorporate a transition.
8. Place the same initial template at the start of where the transition is to begin. Place the other template at the station where the transition is to end.



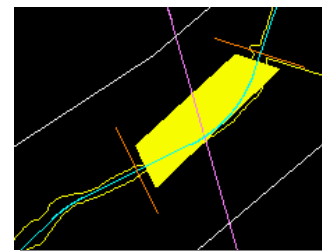
Lets take a moment here to discuss what is exactly happening when you add a template drop. When you select a template to associate with a roadway, it is actually copied to the Corridor or Roadway Design file (IRD). On the figure above notice the "Revised in" tab. It tells you where the template came from. ITL = template library. IRD = Roadway Design file. You can make modifications to a template in a specific roadway and it won't change the template library. The "Revised in" will show IRD. Conversely, you could change the template library and the Roadway will not reflect the changes unless you highlight the template drop and select "Synchronize with Library."

Special Conditions and Transition Editing

Our next step is to take care of any transitions and add any special conditions, other constraints and add any Superelevation. This part of the Workflow is for reference only and will not step through the necessary steps. If you care to have an example of how to use the Transition Editing, Horizontal and Vertical Point Controls, End Condition Exceptions, End Condition Exception Overrides or Superelevation please refer to the Roadway Designer Tutorial (info at the beginning of this document how to access the tutorial) and the online Help. Use keyword: Roadway Designer Overview.

A transition zone is created between templates of different names. The color of the transition zone indicates the state of the transition. This is display in the plan view of the Roadway Designer.

- Red – indicates that none of the backbone points of the first template connect to the backbone points of the second template.
- Yellow - indicates that some of the backbone points are connected (initially this is done attaching points that have the same name).



- Light Blue – indicates that not all of the points are connected, but you have reviewed and/or edited the transition at least once.
- Dark Blue – indicates that all of the points on both templates are connected.

A transition can be edited by double clicking on it; the Edit Transition dialog box is displayed:

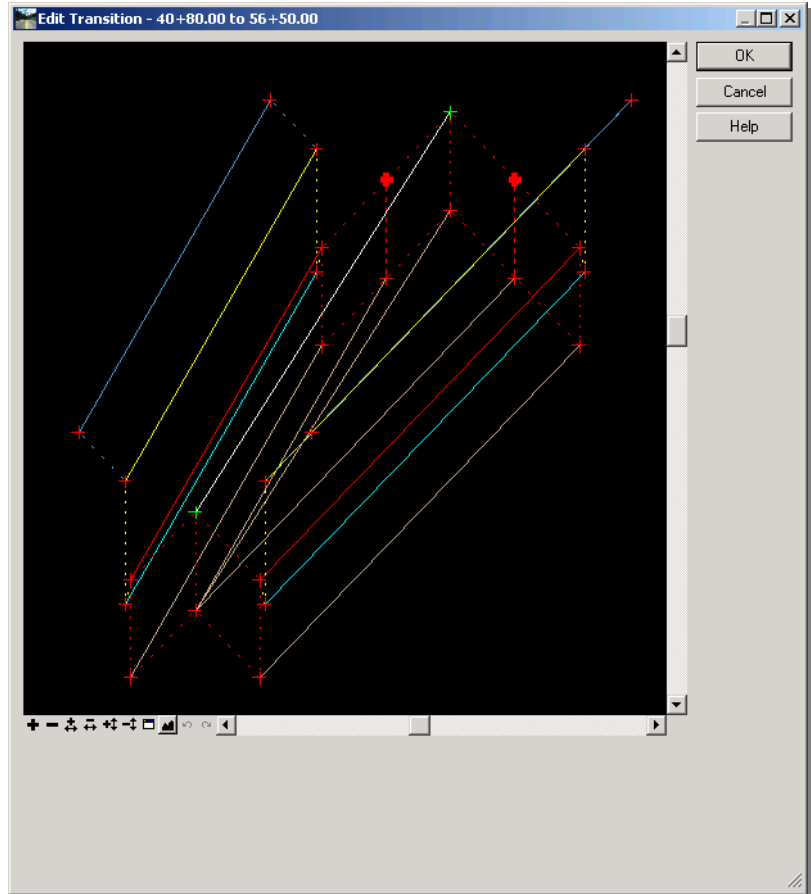
Transition Editing

Editing a transition is a two-step process. The first step is to connect the backbone points of the first template to the backbone points of the second template, as desired. Unconnected points are shown as thick + symbols; connected points are thin + symbols. Note that End conditions are not shown. End condition transitions are handled through end condition exceptions.

Connecting the points

There are several things to be aware of when connecting points. A connection is created by clicking on an unconnected point on one template then moving the mouse to a point on the other template; then, clicking again. The connection line will be shown dynamically. To abort a connect, press the right mouse button.

The order of point selection is important, because the feature style that will be used when this particular line is created in the surface will be the feature style of the first point selected.



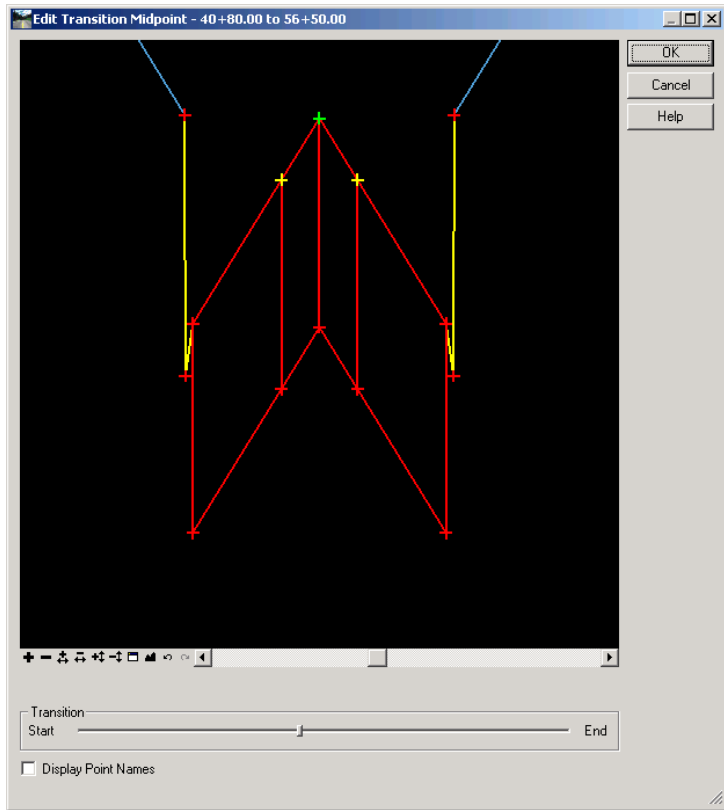
A connection can be deleted by right clicking on it and selecting the Delete command from the pop-up menu.

You can change the position of a template by right clicking on one of its points, selecting Move Template, and dragging the template to a new location on the screen. This, along with the windowing commands, allows you to get a better view of the connections. This is particularly useful for complex templates.

A template point can be connected to more than one point on the other template.

Editing the transition components

Once the points have been connected as desired and the OK button is selected, the command attempts to create the components for the transition based on the start and end templates. The results of this "best guess" is displayed in the window as shown below. You can modify the transition template as desired by clicking Cancel and returning to the Edit Transition dialog box.



The display shows a cross section of the transition half-way between the template drops that define the transition. The slider control at the bottom of the dialog box is used to adjust the location along the transition from beginning to end to make sure the transition is behaving properly. You can add a new component by right clicking anywhere in the view; then, you are prompted to select the points that define the component. Finish up the component by right clicking again and selecting Finish. When selecting points, you are limited to only the existing points, and cannot create new ones. A component can be deleted by right clicking on it and selecting delete.

When everything is correct, select OK again to dismiss the dialog box. If you select Cancel at this point, you are brought back to the connect points window.

Horizontal and Vertical Point Controls

Point controls are used to override the normal locations of one or more points and or components in a cross section. Examples of this include lane widening, staying within the right-of-way, maintaining a particular slope for a ditch, and superelevation. Click Corridor > Point Controls.

Using End Condition Exceptions

In many cases, it is desirable to keep the backbone of the road the same, but change what is happening where the new design is intersecting the surface. One way to do this is to create a new template with the same backbone components and new or different end condition components; then, drop this new template at the appropriate station. The problem with this approach is that 1) it creates template transitions that must be resolved, 2) the conditions on the left and right sides of the design are likely to change at different locations, possibly requiring extensive collection of slightly varying templates to meet all the possible combinations (also numerous template drops). The solution to this situation is End Condition Exceptions. End condition exceptions come in two classes: overrides and transitions. Click Corridor > End Condition Exceptions.

End Condition Exception Overrides

Overrides allow you to replace or override the template drop end conditions on the left or right of the backbone. When you choose this option, you must edit the override to set up the new end condition. When the override exception is edited, the Create Template command dialog box is displayed allowing you to edit the end-condition.

Superelevation

If required, please refer to the Roadway Design Tutorial and InRoads help for further information.

Test and Refine

Continue the process of setting transitions, adding point controls, end conditions, superelevation until results are what you desire. The corridor can be saved and returned to for future editing at any time.

Use the process all button to have the complete corridor run through each station.


On the cross section view of the Roadway Designer, click through the stations to watch your template run throughout the alignment. Notice how the cut/fill slopes are dynamically changing throughout the alignment.

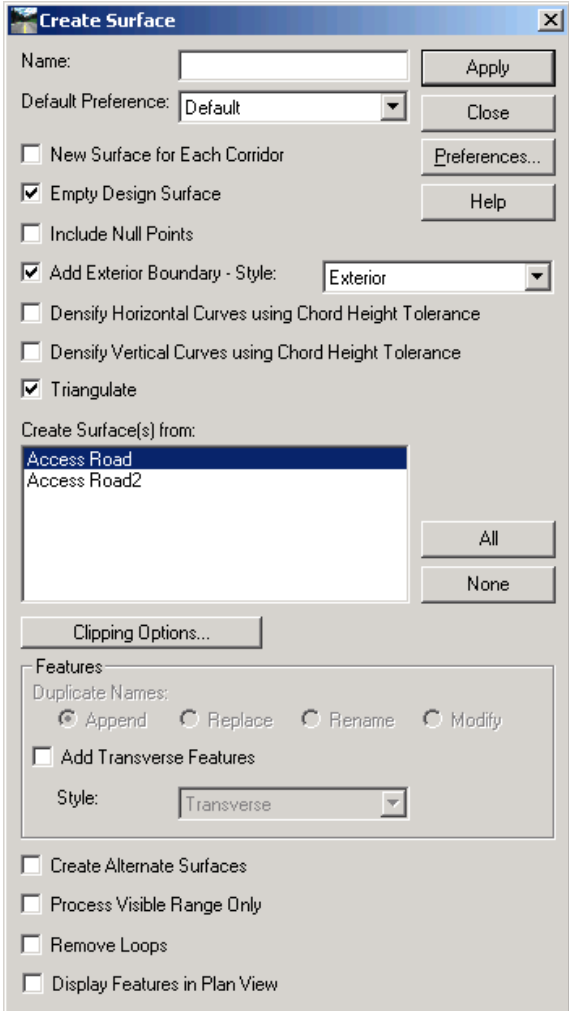
Use **Display References** to show any horizontal constraints on your roadway such as utility crossings, property boundaries or right of ways. When selecting a horizontal alignment as a Display Reference, make sure you mark it as right of way. This will show dashed purple lines in the cross-section view of the roadway designer. Go to Corridor -> Display Reference...

If you have a station that you wish to see a template run, meaning a station that falls between the station interval set for the corridor. You can set it as a **Key Station**. Go to Corridor -> Key Stations...

Create Surface/Display Features

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 
2. Select the settings as shown below:
 - If you wish features to display, the Breaklines of your road, check "Display Features in Plan View". Alternatively, you can create the surface then use the Surface -> View Surface -> Features command to selectively display individually selected features or groups of features based upon the feature style.
3. Click Apply; then, Close
4. Once processing is complete, save the roadway design file. Close the Results dialog and the Roadway Designer.
5. In the Explorer, locate the new design surface.
6. Review the surface.
7. Save the surface if desired. Refer to the Cadd Standards and Procedures manual for proper naming of dtm files. Section 3 - "Filenames".



Appendix A

Template 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 parallelogram (4 constrained points) that is defined by the slope and thickness.

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 point (parent) is moved, any constrained point (child) also moves. This restriction only affects the offset and elevation (x,y) of the restrained point and, the relationship is unidirectional (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.

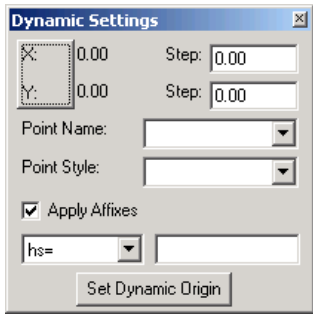
An **end condition** is a special open-shaped component that targets a surface, a feature of a surface, an elevation, or an alignment (it replaces the former Cut/Fill, Material, and Decision tables). The integrity of end conditions can now be routinely tested while the roadway template is being created.


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 multi-lane highways with superelevated curves and variable side slopes.


Appendix B

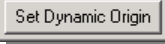
Dynamic Settings

Ok, most of the text below is straight out of the help file from InRoads. It is good for some simple definitions, but misses the whole "How do we use this?" concept. We want to emphasize a couple of concepts first and they should help your experience with the Dynamic Settings out. YOU WILL USE THIS A LOT!!!!



To open the box go to Tools->Dynamic Settings, or click on the  button, or use Ctrl+D. The first item to point out (it is the last in the help file) is the Dynamic Origin. Take a look at your Create Template window, do you see the

small purple box? No...it looks like this: . It is exactly what it says. It is the origin of the Dynamic Settings. Meaning if you tell a component of the template to be 12' in the X direction and 0.24' in the Y direction. It will be from this purple box!

The Dynamic part is just that as well, it can MOVE. You can place this purple box wherever you want it. So after you draw in your pavement section and want to place you next component that may be the curb, you will hit the *Set Dynamic Origin*, , relocate the little purple box to the end of the pavement section. It will automatically snap to the end of it when you get near, now you will tell InRoads the dimensions of the component.

You can give dimensions in two forms. With Step Values(deltas) or absolutes. We are only going to talk about deltas, the absolute functions are more straight forward and can be read about below. You may wish to print out the key-ins and tape on your monitor for reference.

OK... Delta X:Y or Delta X:Slope are your tools. First concept, don't worry about positive or negative. The direction will be from the location of your mouse pointer. Meaning if you are right/above of the origin the delta value will be positive, if you are left/below of the origin the delta value will be negative. You get the point. Same goes for slope. Above the origin > positive, below the origin > negative. So don't key in any negative slopes, it just isn't necessary.

Second concept: this is the weird one. When you want to move in a cardinal direction (north/south or east/west) or at a flat slope. DO NOT ENTER A VALUE OF "0". Enter a larger value say like 5' or 5% or even larger numbers. Then when you are moving your cursor, one of the dynamic values(step values) will be 0 and it will lock in there. If you set your step value to 0, then all values are valid dynamic values(step values) and it is difficult to get the exact value you are looking for. Actually it will drive you crazy, you think you are doing everything correctly but a slope is off or a section is one foot longer then it is supposed to be, not good.

Ok...try it out now. Try drawing a new component; select Constrained as the component type. Draw two new components. One that is 12' wide and .24 down from the beginning. Draw a second new component that is 12' wide and slopes down at 2%.

Below is the Inroads Help info...it is very useful for definitions and the such.

Use this dialog box to specify precision input. Step locks are overridden when snapping to an existing point or component.

X:Y/X:Slope

toggles between X,Y step lock and X/Slope step lock.

X Value

displays the current X distance **from the dynamic origin**.

X Step

specifies the step increment. If this value is non-zero, then the cursor moves to the horizontal increments of the specified value as measured **from the dynamic origin**.

Y value

displays the current Y distance **from the dynamic origin**.

Y Step

specifies the step increment. If this value is non-zero, then the cursor moves to the vertical increments of the specified value as measured **from the dynamic origin**.

Check for Interception

Place Point at Interception

applies to end condition points only. Specifies that when an interception is found along the preceding line segment, the line segment will be drawn to the interception. Otherwise, if the interception is found, the line segment will be drawn to its maximum width.

End Condition is Infinite

applies to end condition points only. Specifies the last segment will be considered to be of infinite length when attempting to intercept the target. This option is only applicable to the last point on the end condition.

Do Not Construct

applies to end condition points only. Specifies the point will be solved like all other points in the end-condition, but the point will be skipped when drawing the component segments.

Point Name

specifies the name of the point to be placed.

Point Style

allows you to set the style of the point to be placed.

Apply Affixes

specifies, when selected, that affixes are applied when placing points.

(key in)

specifies the type of key in to be performed.

- XY= key in absolute coordinates
- 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.

(key-in)

specifies a precision value. If the key-in value is prefaced with a key in type (e.g. "DL="), then the keyed in type overrides the current combo box setting. Press the Tab or Enter key to accept the value in the field and apply it to the current operation; then, the field will be cleared and focus will remain in the field. You can also use the up and down arrow keys to get to previous keyed in values.

Set Dynamic Origin

sets the location of the dynamic origin. Use the following short-cuts for this option: Ctrl+D.