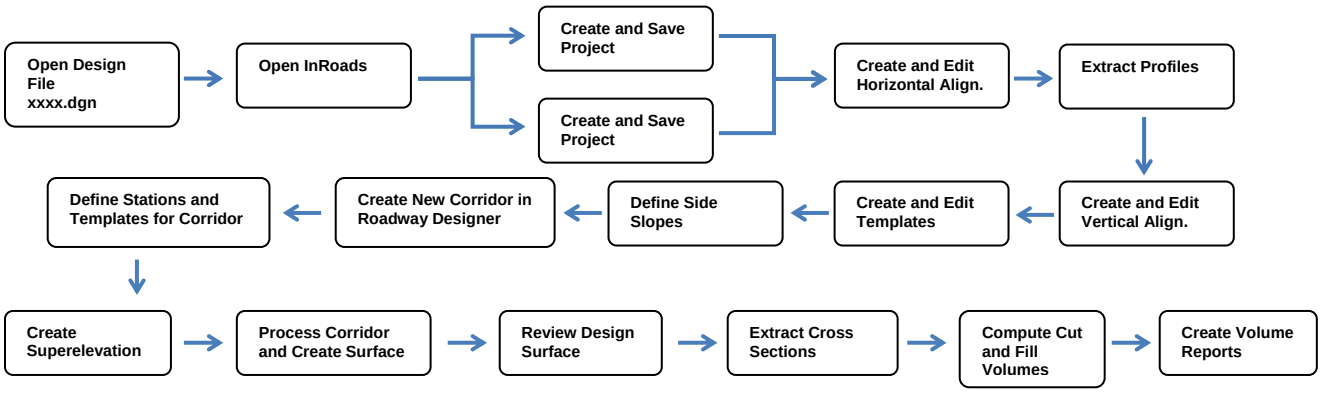
InRoads Master Workflow



Getting Started

- If the project folder has not already been created, create the folder as u:/rd/prj/COUNPCN# using Windows Explorer.
- Create a new Microstation 3D graphics file, saving it as ePCN#.dgn in the project folder. Close file
- Click and drag Microstation to the bottom of your left screen bar <Left click> on Microstation and pin [to this list (right side)] your ePCN#.dgn. Open file F1 key to start InRoads
- Attach the topography file as a reference file from the u:\regionXX\prj\COUNPCN# folder.
- Execute MicroStation's **File** > **Save Settings** command.
- Toggle on **Pencil/Pen** and the **Delete Ink** checked
- Urban Projects Select File<Project Options> Urban preference Load <Close> <Close>

For each specific project the preference for urban, suburban or rural will need to be set in order for the design to scale properly.

Open InRoads Files

See Appendix A for instructions on creating an InRoads Project file. An InRoads Project file allows the user to simultaneously open selected InRoads design files. This file can be created at any time.

Original Ground Surface

Open the original ground DTM from the REGION folder (u:\regionXX\prj\COUNPCN#\PCN#org.dtm).

Geometry Project

- **File > New.**
- Under the *Geometry* tab select Geometry Project as the geometry type and enter ePCN# as the project name. Add pertinent information in the *Description* field.
- Save the design geometry to the corresponding project folder as (ePCN#). The save process will default to "Geometry Projects (*.alg)".

Create and Edit Horizontal Alignments

Open the geometry project (ePCN#.alg) from the project folder.

- Create Horizontal Alignment **File > New.**
- Under the *Geometry* tab select *Horizontal Alignment* as the Geometry *Type*, enter mainline as the alignment *Name,* select mainline for the *Style* and the *Curve Definition* should be set to Arc. Add pertinent information in the description window.

See CADD procedures Section A regarding proper naming convention for non-mainline alignments.

Create PI's – There are three separate and independent methods for creating horizontal alignments:

- **Geometry > Horizontal Curve Set > Add PI –** Identify points for PI's using graphics and/or key-ins. (Example key-ins: ne = northing & easting coordinates; di = distance & direction). Note: This is the typical method that is used.
- **Geometry > Horizontal Elements**
- **Geometry > Utilities > Create/Edit Alignment by COGO Points –** The COGO point names must be numeric.
- The PI's can be displayed by using **Geometry > View Geometry > Horizontal Annotation**, and toggling on *Display Points* **/** *Off-Alignment***.**

Computations are planer even if the horizontal alignment includes several different elevations.

Add Horizontal Curves (Horizontal Curve Set method)

- **Geometry > Horizontal Curve Set >Define Curve**
- Move from PI to PI by selecting *Next* or *Previous* at the bottom of the dialog box until the desired curve set is highlighted. Fill in the *Horizontal Curve* portion of the dialog box. For simple curves, the *Curve Set Type* = SCS. Enter desired curve radius (*Radius 1*). The *Leading* & *Trailing* Radii for simple curves = 0.

To eliminate a short tangent between Horizontal Curves (two different options):

1. **Floating Curve**

- Turn off Accusnap
- Lay out Horizontal PI's as described above.
- **Geometry > Horizontal Element > Add Floating Curve**
- Set *Mode* to *Point & Direction*. Be sure the *Point* checkbox is toggled on.
- Create the 1st Horizontal Curve.
  - Select the *Point* target and snap to the PRC (midpoint of the ahead tangent is a good place to snap to, but any point along that tangent will work).
  - Select the *Direction* target and identify the direction of the ahead tangent of the 1st curve.
  - Select <Apply> and select the back tangent (somewhere near the PI) of the 1st curve. Data point to accept.
- Create the 2nd Horizontal Curve.
  Select the ahead tangent (somewhere near the PI) of the 2nd curve. Data point to accept.
- Delete the middle tangent.
  - **Geometry > Horizontal Element > Delete Element**
  - Set *Inclusion Mode* to *Selected Element Only*.
  - Select <Apply> and select the middle tangent. Data point to accept.

Note: The Middle Tangent Direction remains the same in this option. The horizontal curve radii are based upon the location of the PRC that is selected.

2. **Free Curve**

- Turn off Accusnap
- Lay out Horizontal PI's as described above.
- Select desired radius for 1st Horizontal Curve. (Geometry > Horizontal Curve Set >Define Curve)
- **Geometry > Horizontal Element > Add Free Curve**
- Select desired radius for 2nd Horizontal Curve. (Geometry > Horizontal Curve Set >Define Curve)
- Identify 1st Element (1st Horizontal Curve).
- Identify 2nd Element (Ahead Tangent of 2nd Horizontal Curve). Data point to accept.
- Delete the Middle Tangent.
    - **Geometry > Horizontal Element > Delete Element**
    - Set *Inclusion Mode* to *Selected Element Only*.
    - Select <Apply> and select the middle tangent. Data point to accept.

Note: The Middle Tangent Direction (prior to deletion) changes in this option. The horizontal curve radii remain as set above.

SAVE !! When the information is worth saving – Save It.

Review the Horizontal Alignment

- **Geometry > Review Horizontal**,

Annotating the Horizontal Alignment

- To annotate the Bearings, PC's, PT's and ends of the alignment:
    - **Geometry > View Geometry > Horizontal Annotation**
    - Set *Apply Style* to Assigned (as set when alignment was created) or Active (Style set will override the Style assigned to the alignment).
    - Select the appropriate *Preference* for the type of project being designed.
    - Enter the alignment to be annotated. Toggle on *Display Points / On-Alignment* and <Apply>.
- Stationing:
    - **Geometry > View Geometry > Stationing**
    - Select the appropriate *Preference* for the type of project being designed.
    - Under the *General Tab*, select the *Horizontal Alignment* to be stationed and <Apply>.
- PI curve data:
    - **Geometry > View Geometry > Curve Set Annotation**
    - Select the appropriate *Preference* for the type of project being designed.
    - Under the *General Tab*, Select the *Horizontal Alignment* to be annotated and <Apply>.

In general, for reconstruction projects the beginning station of horizontal alignments should be 0+00. The work should begin at 10+00 for all scales. This allows for work to begin previous to 10+00, if needed, without changing the stationing of the design data and notes.

Setting the beginning station to the necessary "begin station" can be accomplished by the following:

- **Geometry > Horizontal Curve Set > Stationing**
- Select the *Horizontal Alignment*
- Enter the desired starting station in the *Starting Station* and <Apply>.

Horizontal & Vertical Alignment Coordination

- **Geometry > Horizontal Curve Set > Stationing**
- Note – Prior to performing any of the following, save a copy of your current information.
- Within this dialog box there are choices under *Vertical and Superelevation Alignments*.
- *Do Not Update* – If you add 1,000' to the Horizontal Alignment Stationing, the Vertical Alignment Stationing will not change.
- *Synchronize Starting Stations* – If you add 1,000' to the Horizontal Alignment Stationing such that the Begin station is 110+00, the Begin Station of the Vertical Alignment will be changed to match the Horizontal at 110+00 regardless of what it was previously.
- *Maintain Station Difference* – If you add 1,000' to the Horizontal Alignment Stationing, 1,000' will be added to the Vertical Alignment Stationing. Typically, this is what we would utilize.

Horizontal Station Equations

- **Geometry > Horizontal Curve Set > Stationing**
- Select "New" at the bottom of the dialog box.
- Enter the Back and Ahead Stations for the equation and enter <Apply>.
- For "Overlap" equations, the Ahead Station will require an "a" in front of the station. For subsequent "Overlap" equations, you will need to continue with "b", etc.

Adding Horizontal Event Points (Pipe, Entrance, and other desired special cross sections)

- **Geometry > Horizontal Curve Set > Events**
- Define by: Single Station
- Add As: Station and Offset
- Locate By: Enter the desired Station (Offset = 0) and <Apply>.
- Event point stations can be edited within this dialog box.

Note – If the horizontal alignment stationing is changed, horizontal event points do not update. They remain at the Station that they were set at. They can be edited individually as noted above.

It is very important that all the points defining the Horizontal Alignment be at the same elevation (1500.00). If all the same elevations are not used, the plan sheets may be cut incorrectly. Review the horizontal alignment - **Geometry > Review Geometry Points >** *Report***.**

If the alignment points are on different elevations, they can all be moved to one elevation by choosing "All Points" under "Mode", typing the desired elevation and <Apply>.

Horizontal Alignment Reports. You can create reports to review your alignment.

- **Tools > XML Reports > Geometry**
- *S*elect *Horizontal Alignment* and <Apply> .
- Numerous .xsl Report options are generated. Some will be partially or completely blank due to a lack of input data. Select desired .xsl Report and Review.
- To save a hard copy of any report, highlight desired .xsl Report. **File > Save As >** Select Word Document format (.doc) and save to appropriate directory.

Alternatively, you can create a report by selecting **Geometry > Review Horizontal >** This report can be saved to a hard copy similar to that described above. **File Save As >** Select Notepad format (.txt) and save to appropriate directory.

Extract Profiles

The purpose of this process is to create a profile for displaying the existing ground profile, and from which the new grade line may be established.

- Open the geometry project file and set active the appropriate horizontal alignment.
- Open and set active the original ground dtm (PCN#org.dtm) from the respective region project folder.

Before creating the existing ground profile, verify the existing ground elevation limits (**Surface > Surface Properties**) and adjust the profile limits accordingly to allow for the display of design vertical PI's.

- Set **Station Lock** to ON.
- **Evaluation > Profile > Create Profile**
- Select the appropriate *Preference* for the type of project being designed (appr_pipe, Rural, Storm, Suburban, Urban).
- Under the *General* leaf/*Surfaces* toggle on the PCN#org surface.
- Under the *Source* leaf/*Alignment* select the active horizontal alignment (this will draw the original ground along the active horizontal alignment).
- Under the *Controls* leaf enter the minimum and maximum elevation limits as explained above. Likewise, *Station* Start and Stop limits should be entered at this time as necessary.
- <**Apply>** and then place a Data point to locate the lower left-hand corner of the profile. The profile grid will be generated with the execution of the **Create Profile** command.

Create and Edit Vertical Alignments

Open the geometry project (ePCN#.alg) from the project folder.

- Set the Horizontal Alignment to mainline.
- **File > New.**
- Under the *Geometry* tab select Vertical Alignment as the geometry type and enter mainline as the alignment name. Add pertinent information in the description window.
- Graphically lay out vertical alignment PI's
- **Geometry > Vertical Curve Set > Add PI**
- PI's can also be added by keying in station and elevation using **se=** (station and elevation)

View Alignment

Geometry > View Geometry > Active Vertical

Add vertical curves

- **Geometry > Vertical Curve Set > Define Curve**
- Identify the vertical PI by clicking <Next> until the desired PI is highlighted.
- Enter vertical curve length in **Length** field
- <Apply >

SAVE !! When the information is worth saving – Save It.

Before exporting/importing horizontal and vertical alignments, change all curve lengths to 0 feet. This will allow the alignment to be defined with PI's rather than components.

Vertical Alignment Reports

- **Tools > XML Reports > Geometry**
- Create the vertical alignment report following the same procedure as outlined above for horizontal alignments, substituting vertical for horizontal.

There are different methods to get the templates and roadway designed for your specific project.

Copy Templates

Create a new Template Library

- **Modeler>Create Template**
- In the **Create Template** box, select **File > New Template Library**
- In the **Save As** box, key in (PCN#.itl)
- Select **Save**

Copy Standard Typicals

- In the **Create template** box, select **Tools>Template Library Organizer**
- In the Organizer box's **Available In** section, select the **Browse (…)** button and browse to U:\rd\Bentley\V8i\Inroads\data\English\SDDOT.itl then select **Open**
- Expand the directory tree on the right side
- Drag and drop folders or individual templates as desired from the right side (…SDDOT.itl) to the left side (…PCN#.itl)copy from
- Select **OK**
- When prompted to save data, select **Yes**

The template will need to be adjusted to match the design summary. Make the necessary modifications to lane, shoulder, subgrade widths and undercut depths, etc. Refer to **Editing Templates.**

Editing Templates

- <Double Click> u:\rd\prj\COUNPCN#\PCN#.itl in the Create Template box, the tree view, select desired Roadway Templates or Typical Sections.

You can either select typical sections which already have the end conditions attached or select roadway templates and then add the desired end conditions.

- Notice the selected template is displayed in the view on the right
- To add end conditions to a roadway template in the Create Template box, the tree view, Template Library <Click> desired end condition drag (but before releasing it) right-mouse click to access the mirror option, then place on the desired roadway template.
- <Double Click> on each end condition Component Properties **Target Type** Surface **Surface** PCN#org

You may choose to delete end conditions, roadway templates or typical sections that do not pertain to your project. You may also choose to copy and paste the roadway templates with end conditions into the typical sections folder. There is no right way or wrong way to achieve the roadway typical section.

The software has options to edit templates. Refer below

Option

- Create Template box, data your roadway typical section and in the view on the right displays the components, (Horizontal, Vertical and Slope) parametric constraints, etc.
- Display Box <Constraints button on> and Display Point Names checked to help make the necessary changes.
- Increase your view and move cursor on the drawing in the cross section view and a box will indicate if it is a point or a component with other information. To edit lengths of constraints to match your design summary <double click> on red plus signs or move cursor to the red plus sign and <right click> and <click>**edit point** then change the desired parameters in the **Point Properties**
- Select previous or next to move within the template in the **Point Properties**
- You may need to delete, move or add constraints for your specific project.
- To add a finished surface in the urban design <right click> on your starting point add new component, constrained, move cursor in direction up from subgrade connect the area component with points <right click> and finish. Design Constraints from your subgrade line <double click>(new point) change horizontal value to 0.00 under constraint 1 and vertical value to surface thickness under constraint 2. Label as Lane, Surface Feature Style as Finish, Member of Finish. Complete constraints for all new points within the finish component
- Verify Template Origin is correct in relation to your vertical alignment
- For Surfaces **Finished** and **Undercut** In Component Properties check mark **Exclude from Triangulation**

Verify all point properties are designed correctly for your project with respect to parent names, slopes, values, constraints, components, etc.

- **When the creation of the Roadway Typical Section is complete, save the Template Library, File save as PCN#.itl.**

- Close

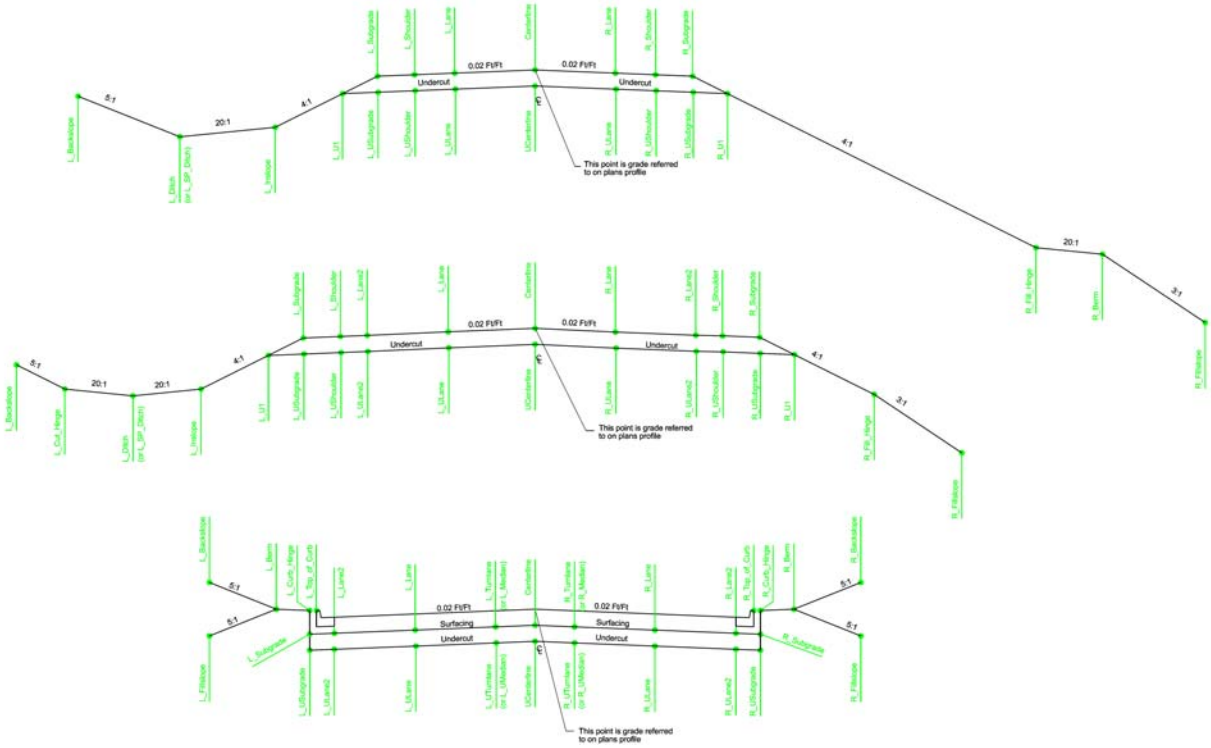
Option

- **Modeler > Roadway Designer**
- **Tools > Parametric Constraints** Constraint Label drop down box for lane, left shoulder, right shoulder, sidewalk, subgrade and undercut. For each label activate the start and stop

station with the start and stop value. <Add> [example: the constraint label **Lane** from station to station is 12' then all lanes left and right will be shown as 12').

- Close

- Each point in the template is named with a **Surface Feature Style**, **Constraints 1 & 2 with Parent** and **values**. Point Properties for Cut and Fill Slopes have additional **End Condition Properties.** (Example: the segment to the right of centerline on the rural template is "R_Lane" - See Example: rural that follows). These Point Properties are to be left as they are unless it is deemed necessary to change them.



- Point Property names should remain consistent for transitioning from one template to another.

- To edit lengths of components to match your design summary use Point Properties for defining the roadway section beyond the subgrade limits. This can define standard cut and fill sections as well as urban cut and fill sections. It is flexible in that any number of situations can be coded into a particular Template to define special criteria such as a special ditch or flatter than standard fill slope.

Create a Roadway

Create a Roadway as follows:

- **Modeler > Roadway Designer**
- **Corridor** > **Corridor Management**
- **Manage Corridors** Name *mainline*, Surface Symbology *mainline,* Type *alignment*, Horizontal alignment *mainline*, Vertical Alignment *mainline* Limits *Toggle Station start and stop* if desired < *Add*> A project must have one corridor to create a valid design from which a surface can be created. Notice you can add, copy, change or delete corridors from your design at any time.<Close>
- Save the Roadway Designer to the corresponding project folder as (PCN#). The file save as process will default to " Roadway Design (*.ird)".
- Notice that you can also directly open a PCN#.ird file using **File**>**Open** in Roadway Designer.
- The top-left window is the plan view and displays the alignment (mainline) of the active corridor in light blue. The active surface perimeter is shown as white (Lock Active Surface to PCN#org), the current station location is shown as the yellow line. The bottom–left window is the profile view. The large top-right window is the cross-section view.

Dropping Templates in the Corridor

- **Corridor > Template Drops**
- 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.
- *Library Templates* box <Browse>button to find u:\rd\prj\COUNPCN#\PCN#.itl. Select Corridor *mainline,* In the *Station* field, enter station where the desired template will begin. In the *Interval* field, input the interval by which InRoads will "drop" a template for modeling (*typically 50 feet for rural and/or urban projects).*
- <Double Click> u:\rd\prj\COUNPCN#\PCN#.itl in the Library Templates box, the tree view, select desired Roadway Templates or Typical Sections then <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 box.

If you did not complete templates as stated above, this is another option to make changes to the template, fix and design into the corridor.

- To add End Conditions to a Roadway Template <Double Click> in the Current Template Drops box, blue display. Editing Roadway Designer Template Drop box <Double Click> u:\rd\prj\COUNPCN#\PCN#.itl in the Template Library box, the tree view, <Click> desired end condition drag (but before releasing it) right-mouse click to access the mirror option, then place at roadway template. <OK>

In the current template drops box the template is red which indicates changes were made [example: end conditions added to a roadway template], these changes to the template are specific to this station only and have been modified and is different from what is stored in the library u:\rd\prj\COUNPCN#\PCN#.itl templates.

The template may need to be adjusted to match the design summary. Make the necessary modifications to lane, shoulder, subgrade widths and undercut depths. Refer to **Editing Templates.**

HINT: Before adding templates in the current template drops box to match your design make the necessary changes to avoid changing each template for each new station, therefore complete once and then copy. Notice you can add, copy, change or delete templates from your design at any time.

A mainline template may include the standard mainline components, finish, subgrade and undercut. See CADD procedures Section A regarding proper naming convention for non-mainline Layers.

Complete your Current Template Drops with each station, interval and template to match your design summary. Basically like the old Roadway Modeler run within the Roadway Library.

Once you have closed the template drops box. In the plan view, notice the visual cues (Brown Lines) that show the location of the each new template drop. In cross section the templates are displayed.

When the creation of the Roadway is complete, save the Roadway Corridor and File save as PCN#.ird.

Special Ditches

Special Ditches are ditches whose grade line does not parallel the roadway grade line. When special ditches are required, additional vertical alignments need to be created under the appropriate horizontal alignment. InRoads<Tools> Application add-ins <Click> Horizontal and Vertical Elements Add-In

- Create the vertical alignments **special ditch left** and/or **special ditch right** using the steps outlined above for creating vertical alignments.
- Set the newly created special ditch alignment active.
- **Geometry > Vertical Element > Add Fixed Line…**
- Set *Mode* to *By Two Points.*
- Toggle on each of the two *Station / Elevation* sets.
- Fill in the desired station and elevation for each segment, verifying that the stations are 0.1' before the desired beginning station and 0.1' after the desired ending station.
- <Apply> and data to accept.
- Repeat as necessary to complete the special ditch vertical alignment.
- **Geometry > Vertical Element > Check Integrity** must be executed to verify that any added vertical elements are in the correct order, by station.

The template library component has a special ditch to be searched. If a special ditch alignment is not found, the component will go to the next component entry, which is a standard or sloped ditch, followed by components for a fill section. In doing this, a special ditch can be created without changing the components each time. **Corridor > Template Drops** <Double click> on template in the current template drops box which opens up **Editing Roadway Designer Template Drop.** Template Library bottom tab make Active Template, in the network tree you can data on the components (Example: <Double Click> R_Special Ditch 1 which is the right special ditch and it will highlight **Component Properties**) Verify **End Condition Properties** as Target type *alignment elevation* Horizontal Alignment *mainline* Vertical Alignment *special ditch right* and offsets vertical *0.70*. Complete for left side L_Special Ditch 1.

- The special ditch vertical alignments must be fully created prior to creating a surface.

When the creation of the Roadway is complete, save the Roadway Corridor and File save as PCN#.ird.

Editing Between Transitions: From 2 to 4 Lane

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. 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.
- **Roadway Designer Corridor** Mainline **Active Surface** PCN#org 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. A brown bar appears at a template drop station. Notice a yellow shape between two template drops. This shape represents a transition region (shifting from 2 lane to 4 lanes). The yellow indicates that some, but not all, of the points have been connected and you have not yet reviewed the transition.
- **<Double Click>** anywhere on the yellow shape. In this 3D view of the backbone transition, notice that the thick red points symbols (+) are points that have not been connected to a point at the other end of the transition. Move the template 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. Notice how you can pause the mouse over a point to display the point name.
- To add a transition connection, left mouse click over the point (you must connect from the "unconnected" to the "connected"). Multiple points can connect to a single point. If you make a mistake or want to change connectivity, right click over the transition and select **Delete** Click **OK** on the Edit Transition dialog. Verify your connections. In the roadway Designer dialog, notice the yellow area in the transition is now dark blue. This indicates that all points of the transition are connected.
- **Roadway Designer Corridor** Mainline **Active Surface** PCN#org right bottom, select the **Process All** button. 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.

When the creation of the Roadway is complete, save the Roadway Designer and File save as PCN#.ird.

Roadway Designer Right click in the cross section box and select **Display Properties.** Select the settings you prefer and click **OK**

When working with templates and superelevation dialog boxes, it may be desirable to set the slope format to 0.50 so cross slopes read as 0.02 versus 50%.

- **File > Project Options**
- Select the *Units and Format* tab.
- Under *Format* Select the *Slope* drop down menu and select 0.50.
- <Apply> <Close>

Superelevation

Superelevation is used to control the cross slope of roadways in areas of horizontal curves. In roadway designer 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.

Modeler > Roadway Designer

- In the bottom right corner, toggle on **Superelevation** display mode. The superelevation diagram is synchronized to display the same station range as the profile view. The plan, profile, and cross section view now show cross slope values of the backbone of the template. (Hot) Colors from yellow to red indicate increasing slope from left to right. (Cold) Colors from green to blue indicate increasing slope from right to left. White indicates a cross slope at or near 0%. A typical normal crown section is Yellow / Orange on the Left and Green / Blue on the Right.

Superelevation > Create Superelevation Wizard > **Table**

- <Browse> from *Table Wizard* to find C:\rd\Bentley\V8i\Inroads\data\English\06sd__.sup. Open the *Rate Table* that corresponds with the design speed as defined in the scope document.
- Toggle on *Percent Total on Tangent* and set to 80%. Transition Lengths Are: Toggle *Total Transition.* Select *Load Values from Table* in Selected Curves Tab (Click on the box to load the values). *Select* **<Next>**
- In the *Superelevation Section Definitions* dialog box, Select *Add* under *Sections* to add a section to be superelevated.
- In the Add Superelevation Section dialog box, select Centerline for Crown Point, L_Subgrade for Left Range Point and R_Subgrade for Right Range Point. Pivot Direction: From Crown Point (for Two Lane Roadway). Number of lanes: Toggle Two. Runoff Length Multiplication Factor: 1. Station Limits can be left toggled off to cover the entire horizontal alignment. Select <OK>.
- In the Superelevation Section Definitions dialog box, to view the basic superelevation information for each curve, highlight the curve under Superelevation for Selected Section and Select Edit. Select <Close> to exit.
- Back in the Superelevation Section Definitions dialog box, Select <Next> to proceed.
- The Superelevation Controls dialog box shows the final superelevation controls that have been created. Select <Finish>
- The superelevation wizard completed the design task of creating control lines for each point to be superelevated.

If you need to model superelevation which does not follow the standard tables, keep in mind that creating your own table specific to your projects parameters is an option.

The superelevation process will need to be repeated if the horizontal alignment is modified or restationed after the completion of superelevation.

SAVE !! When the information is worth saving – Save It.

Import Superelevation from ASCII is another method available to model superelevation using the following steps. This method is simple and useful where the desired superelevation does not follow standard tables and needs to be input manually.

Create ASCII file

- Create *.txt file in Notepad with each line having the following format.
- Station (tab) Left Grade (tab) Right Grade
- Grades are in ft/ft with positive and negative values based on direction from the crown point.

Modeler > Roadway Designer > Superelevation > Import Superelevation from ASCII

- File: <Browse> to *.txt file created above.
- Section: Input “1” for the first curve, “2” for the second, etc.
- Select Crown Point, Left Range Point and Right Range Point (See Note below)
- Apply
- Note: It appears this method does not apply the superelevation to all the points between the crown and the range points, therefore, the *.txt file must be applied to all the points that need to be superelevated. For a typical rural 2 lane road the ASCII file needs to be imported 3 times by changing the range points to do the lanes, then shoulders, then subgrades.

Editing Superelevation

Modeler > Roadway Designer > Display Mode: Toggle on **Superelevation**

In the bottom right window of the Roadway Designer,

- Right click on point, Select Edit Point, Select Subgrade
- Superelevation Point Properties: Edit station and cross slope or others as needed.
- Repeat for all the points that need to be edited. May also need to change points at the same location as Subgrade, such as Lane and Shoulder, etc. Verify in the view.

OR

- Right click in bottom right window
- Select Edit Curve Set Stations
- Edit stations and cross slopes. Toggle off Constrained where needed to change items.
- This method of editing cannot do all the points so the above method needs to be used to finish the editing.

Deleting Superelevation

Modeler > Roadway Designer > Corridor > Point Controls

- Select the control(s) from the table
- Select Delete in the bottom right corner

Modeler > Roadway Designer > Display Mode: Toggle on **Superelevation**

In the bottom right window of the Roadway Designer,

- Right click control line, Delete Control Line
- Repeat for all control lines to delete.

Superelevation > Apply Shoulder Rollover Lock

This section is a work in progress. After one or more individuals has had a chance to work on a rural divided roadway with superelevation, the design process for this section will be updated and the template points will be updated with correct terminology. The process written below was written for a two lane roadway with the Range Points set at the edge of the driving lanes.

For Two Lane roadways, Shoulder Rollover Lock should typically not be necessary. For Four Lane roadways, it may be necessary to utilize this design tool so that the entire subgrade surface rotates as necessary in superelevated sections.

Shoulder Point: LOS Set Difference for both High Side and Low Side to 0. Toggle on Match Transition Slope. Leave the High Side Maximum Slope and Low Side Minimum Slope toggled off. <Apply> Repeat the process for Shoulder Point: ROS. <Apply> again. <Close> the dialog box.

- **Process All**

- **Modeler > Roadway Designer > Superelevation > Superelevation Report** Report At: Toggle All Processed Stations. Select All Available Superelevated Points (LEP, LOS, REP, ROS). <Apply> Review data to verify accuracy.

- Note: For the LOS & ROS, the high side shoulder begins rotating prior to the driving lane (from 4% to 2%) to match the slope of the driving lane. This rotation occurs prior to the calculated beginning station of the superelevation based upon the rate of change for the curve. For example: 70 mph design speed, 4.0% superelevation rate, transition length = 180'. The 2.0% shoulder change would occur over 60' = (.02 / .06) x 180'. This transition would occur within the 60' prior to the typical Begin Superelevation Station.

Note: For the LOS & ROS, the low side shoulder holds at 4.0% until the inside driving lane has rotated to a point where it is also 4.0%. For the example listed above, the low side shoulder would not rotate at all since the superelevation rate for the curve is 4.0%.

Defining End Condition Exceptions

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

- **Roadway Designer** bottom right corner toggle on **Normal** display mode**. Corridor< End Condition Exceptions**
- Select Station Range start and stop Apply to Override or Transitions **<Add>**
- Highlight the new entry, select **Edit** or <**Double Click>,** the Create Template command is activated to an Override box
- Move cursor to the point you want to override and right click to move point, delete, etc. however you want to change that point. <Click> **OK** in Override box & **Close** to End Condition Exceptions

SAVE !! When the information is worth saving – Save It.

Independent Transition Control

It appears that transitions for V8i are handled with Roadway Designer under point controls.

Independent control allows for the flexibility to model a roadway with varying geometry, without creating additional templates. In those locations where a turn lane, mailbox turnout, historical marker turnout or guardrail widening are called for, Independent Transition Control should be considered for the varying geometry.

The first step in setting up independent control is to modify the templates to allow the appropriate segments to vary to meet the needs of the required geometry.

- Open the template library (PCN#.tml) from the project folder.
- Follow the steps defined earlier in this document for a template editing session.
- Set the *Edit Mode* to *Global* and select the appropriate segment to be modified.
- Set the *Fixity* to *Variable Width*. Exercise caution when using the *Variable Slope* and *Variable Slope and Width* options. If the *Fixity* is set to *Fixed*, Horizontal transition control can still be applied, however the transition control will only be able to lengthen the segment. InRoads will not shorten a defined segment if its *Fixity* is set to *Fixed.*
- <Update>
- Repeat the process to modify the Fixity on other segments as needed.

InRoads will automatically adjust the location of those segments located outside a segment that varies with independent transition control.

SAVE !! When the information is worth saving – Save It.

- Set the appropriate horizontal and vertical alignments active.
- **Modeler>Define Roadway**
- Select the appropriate roadway definition and <Edit>.
- Select the *Horizontal and Vertical Controls* tab
- Select the appropriate *Transition Control Name* (the segment that is to vary to meet the needs of the geometry).
- Toggle *Use Horizontal Control* on.
- Toggle *User Vertical Control* off.
- Select the appropriate *Horizontal Alignment* (this will be other than the active horizontal alignment if a separate alignment has been created for the sole purpose of utilizing Horizontal Control).
- Input the appropriate *Station Limits / Start* and *Stop* stationing.
- Input the appropriate *Offsets / Start* and *Stop* distance from the horizontal alignment. Keep in mind that this distance is to be the true offset from the alignment, not the distance the Transition Control is to vary. Also, if a separate horizontal alignment is being used for Horizontal Control, the offset distances will be 0.00'.
- <New>
- Repeat the process as necessary for each additional entry.

SAVE !! When the information is worth saving – Save It.

Creating the New Surface

Typically, the end result in the Roadway Designer is the generation of a new design surface form which plan, profile, and cross section drawings are created. Using the **Corridor< Create Surface** command

- **Roadway Designer** **Corridor** *Mainline* **Active Surface** PCN#org
- **Create Surface** dialog box Create surface from *Mainline*
- Click **<Apply>** then **<Close>** Results dialog and the Create Surface <**Close**> Roadway Designer
- Save surface *Mainline* Review your surface *mainline*

If you need to save the display of triangles or contours, create a separate graphics file (cPCN#.dgn), which can then be attached as a reference file as needed.

- **Surface > View Surface > Contours**
- Select the appropriate *Surface*.
- For large projects, establish a fence and set *Fence Mode* to the appropriate setting. The fence must be established prior to executing the View Surface command.
- Set *Interval* and *Minors per Major* to the desired settings.
- Edit the <Preferences…> and *Symbology* as needed.
- <Apply>

And/or

Surface > View Surface > Triangles
Select the appropriate *Surface, Fence Mode, Symbology* and <Preferences…>.

If a surface is viewed temporarily in a file, delete contours or triangles when done and compress the graphics file.

The fence mode is useful for large projects because it can limit the contours or triangles to an area inside the fence.

Feature

The two most common uses for Features is for annotating cross sections and for attaching cells (such as the curb & gutter cells) to cross sections.

As directed earlier in the Create Cross Sections section of this document, toggle *Include Features* off when creating a cross section set. If it is desirable to include the features, generally only the subgrade features that represent the exterior boundary, special ditch elevations, and curb and gutter features need to be turned on. It is good practice to keep the number of features displayed in the cross sections to a minimum as displaying features can cause the file to become very large.

To attach cells to features

- **Tools > Symbology Manager**
- Select the appropriate feature code from the list displayed in the dialog box.
- <Edit>
- Select *Cross Section Point*.
- <Edit>
- Set *Display As* to *Cell*.
- Set *Level* to the appropriate level.
- Set *Cell Name* to the appropriate cell to be associated with the feature code.

The proper cell library must be attached to the MicroStation design file prior to executing the Symbology Manager command.

- Verify that *X Scale, Y Scale* and *Z Scale* are properly set. Some cells require that the *Y Scale* be set to 0.50, while the other scales remain at 1.00.
- <OK>
- <Apply> and <Close>
- <Close>

These cells will now be displayed with the corresponding feature code, when the feature codes are displayed in the cross section set.

Cells associated with feature codes will be removed or added from the display in the cross section set, as their parent feature code is removed or added.

Create Cross Sections

Cross sections will be drawn in a separate graphics file (xPCN#.dgn).

- **Surface > Surface Properties…**
- Select the *Advanced* tab.
  - Select the appropriate *Surface.*
  - Select the corresponding *Cross Sections Symbology.*
  - Select the corresponding *Profiles Symbology* (this will be useful when creating approach pipe sections).
- <Apply>

Two separate cross section sets will be created for two separate purposes:

1. The Plans Cross Section Set – This set will be created for plotting and will include annotation and a plans border. The Undercut surface will not be displayed in this set of cross sections unless requested by the Area Office.
2. The Volume Cross Section Set – This set must show the entire range of cross sections and all surfaces necessary for volume computations. The actual earthwork volumes are calculated from the elements created for each surface in the graphics file.

Open the original ground surface (PCN#org.dtm), the geometry (ePCN#.alg) and the appropriate design surface (Mainline)

- **Evaluation > Cross Section > Cross Sections…**
- Open the *Create Cross Section* Folder.
- <Preferences…>
  - Plans Cross Section Set – Set the appropriate preferences to 10_20_portrait, 20_40_portrait, 10_20_landscape or 20_40_landscape.
  - Volume Cross Sections Set – Set the preference to *volumes*
- Open the folder *Create Cross Section*.
  - Under General
    - *Set Name* will default to the horizontal alignment name, and will change by an increment of 1 (mainline_1, mainline_2, etc.) for each subsequent cross section set created. Modify this entry to (volume) for the Volume Cross Section Set.
    - Open the *Source* subfolder turn on *Alignment* and select the appropriate horizontal alignment.
  - Under Controls
    - Modify the *Limits* settings as needed. (The *Station* limits will be ignored if entries are created under the *Custom* tab).
- Select the *Spacing* tab. This step is required to compensate for an out of range error that occurs with the InRoads Civil version 8.04 (Service Pack 1) package. No settings need to be modified. The tab simply has to be selected.

- See Cross Section Reports later in this document for details on creating a cross section report during the Create Cross Sections process.

- Return to the *Main* tab.
- <Apply> and data point a position in the graphics file.

- **The cross section *Interval* must be at the same interval (or multiple of interval) that the template was dropped. If it is not, the design surface may not tie to the original ground on the cross sections. The cross section Interval shall be set to 100.00 feet for rural projects and to 50.00 feet for urban projects or mountainous terrain.**

Cross-Section Viewer

- **Evaluation > Cross Section > Cross Section Viewer**
- Select the appropriate *Cross Section Set.* A fence with the active MicroStation properties will display around the selected cross section set.
- Modify the *Zoom Factor* as needed.
- <Run> and data the appropriate view (*ESC* to stop the display while running).

Update Cross Sections

This command allows the user to update the surface graphical elements following the execution of the Roadway Modeler command, without having to recreate cross sections.

Features must first be removed from the cross section set before surfaces are refreshed. To remove features, follow the steps listed below, selecting *Display Off* instead of *Refresh* and the appropriate features listed in the *Object / Feature* window in conjunction with the appropriate surface.

- **Evaluation > Cross Section > Cross Sections**
- Select the appropriate *Cross Section Set.*
- Open the *Update Cross Section* Folder.
    - Under *General*
        - Toggle on *Refresh* to update the surface graphical elements.
        - Set *Limits / Station Range* as needed.
    - Under *Surfaces*
        - Select the appropriate surfaces.
- <Apply>

This command is also used to toggle on or off features for annotating the cross sections.

Annotating Cross Sections

- **Evaluation > Cross Section > Cross Sections…**
- Select the appropriate *Cross Section Set.*
- Open the Update Cross Section folder.
    - Under General
        - Toggle the Mode:/*Display On.*

    - Open the *Crossing Features* subfolder.
        - Select the appropriate *Surface* followed by the appropriate *Features.*
- <Apply>
- Open the *Annotate Cross Section* Folder.
    - Under *General* subfolder
        - Select the appropriate *Surfaces.*
- Open the *Features* subfolder
    - Under *Annotate* (In the Features subfolder).
        - Select all features by opening *Filter*… and toggle on *Start with:/All and press* <Ok>
- <Apply> and <Close>

Exterior Boundary, Left Subgrade and Right Subgrade are annotated using the 10_20_scale or 20_40_scale preferences. Special Ditches are annotated using the Left Special Ditch and Right Special Ditch preferences. Note that the Special Ditch preferences are configured for the 20_40 scale cross section sets.

Once the cross section set has been annotated return to the Update Cross Section command, Toggle *Mode: / Display Off* and follow the remainder of the steps for displaying features outlined above to "turn off" the features. This will remove the feature graphical elements from the dgn.

Plotting Cross Sections

To plot cross sections in .pdf format follow the steps in the link below.

http://www.sddot.com/pe/roaddesign/docs/Procedures/ElectronicPlans.pdf

Pipe Cross Sections

Mainline Pipe Cross Sections

Open the geometry project (ePCN#.alg) from the project folder, and set the appropriate horizontal alignment active.

- Place horizontal event points at all proposed mainline pipe locations.
    - **Geometry > Horizontal Curve Set > Events…**
    - Set *Define By:* to *Single Station.*
    - Toggle *Add As / Station and Offset*.
    - Enter the pipe station in the *Locate By / Station* field, leaving the *Offset* field set to 0.00.
    - <Apply>
    - Repeat until all pipe locations have been entered.
    - <Close>
- **Modeler > Roadway Designer…**
- Create a new surface under **Roadway Designer > Corridor > Create Surface**…
- Select the appropriate surfaces.
- <Apply>
- Create a new Microstation 3D graphics file, saving it as pPCN#.dgn in the project folder.
- **Evaluation>Cross Section>Cross Section…**
    - Set the *Preference* to 10_20_Landscape.

Create a separate pipe cross section set for the 20_40_Landscape preference as needed

- Open the *Create Cross Sections* folder followed by the *Custom* subfolder
- Select the *Custom* tab.
  - Select *Perpendicular* or *Skewed* as the *Type*.
- Enter the pipe *Station:* and *Skew Angle:* as appropriate as well as the *Left Offset:* and *Right Offset:* corresponding with the previously selected preference.

The *Skew Angle:* is positive for Left Hand Forward and negative for Right Hand Forward.

  - <Add>
  - Repeat until all pipe sections have been entered.
  - Save the custom pipe section set as pipe10_20.xsc (or pipe20_40), in the project folder**.**
- <Apply>

The custom pipe section set can be recreated at any time, by loading the .xsc file from the project folder (*Control File / File Name)*.

Following the creation of the pipe cross sections, load the XPIPE MDL application to draw each individual pipe. (MicroStation Utilities > MDL Applications).

Approach Pipe Cross Sections

- Open pPCN#.dgn.
- Load the XSECT cell library and place the cell ENTL or ENTP. If you are using the ENTL cell, the station range is 320 feet. If you are using the ENTP cell, the station range is 200 feet.

- **Evaluation > Profile > Create Profile…**
- Set *Preferences* to *appr_pipe.*
  - Under *General*
    - Select the appropriate *Surfaces*.
    - Toggle *Direction / Left to Right* on for entrances on the left and *Direction / Right to Left* for entrances on the right.
    - To Set Offset: Highlight the appropriate *Surface* and select properties:
      - Set the Profiles/Symbology:
        - <Surface Properties…>
          - Select the *Advanced* tab.
          - Set the appropriate *Surface*.
          - Set the appropriate *Profiles / Symbology* to Subgrade.
          - Set the pipe *Offset / Distance* from mainline (-) for left and (+) for right.
          - Set the *Offset / Symbology* to Appr_Pipe.
          - <Apply>
  - Under *Controls*
    - Toggle *Station* on and select a start station that is ½ the cross section limit ahead and a stop station that is ½ the cross section limit back of the entrance location.
  - Under *Offsets*
    - Check on the appropriate *Offsets:*
- <Apply>

- Data a green point on the left side of ENTL or ENTP for an approach pipe left of mainline or data a green point on the right side of ENTL or ENTP for an approach pipe right of mainline.

Following the creation of the pipe cross sections, load the XPIPE MDL application to draw each individual pipe. (MicroStation Utilities > MDL Applications).

Compute Cut and Fill Volumes using End Area Volumes

Open the cross section file (xPCN#.dgn), the appropriate geometry (*.alg) and surface (*.dtm) files.

- **Evaluation > Cross Section >Cross Sections > End-Area Volumes Folder**
- Select the appropriate *Cross Section Set.*
- Select **General Tab** >
  - Select the *Original Surface* (PCN#.org)
  - Select the appropriate subgrade *Design Surface.*
  - Toggle Imperial Units to *Cubic Yards*.
  - Toggle Method to *Correct for Curvature.*
  - Toggle *Plot Mass Haul Diagram*.
  - Toggle *Create XML Report*. (When an End Area Volume is run a XML Report will automatically open if this options is checked.)
- Select **Classifications Tab**>
  - Set the following for all the Undercut Components.
  - *Classification> MDC*
  - *Mass Ordinate> Include*
  - *Fill Factor> Shrink value* (Enter appropriate shrink value for each undercut based on specified station ranges. In order to have different shrinkage values for the undercut, the undercut component symbology will need to be changed for each shrink value and station range with symbology names such as UndercutA, UndercutB, etc.)
- Select **Compaction/Expansion Tab**>
  - *Settings> Start/Stop Stations> Station Cut/Fill Factors:* This option allows the user to input project specific shrinkage or swell.
- Select **Volume Exceptions Tab**>
  - *Settings> Start/Stop Stations>* This option allows the user to select a portion of the model, which will not be included in the volume quantity (grading exception). When using this option for excluding bridges, the start and stop stationing must be the toe of the fill slopes. *Volume Exceptions* are project specific.
- Select **Added Quantities Tab**>
  - *Settings> Start/Stop Stations> Toggle Type> Volumes & Factor>* This option must be selected to enter additional cut and fill quantities. Quantities such as borrow, muck and unstable, salvage and entrance volumes are entered here. Shrinkage values must also be entered with each added fill quantity entry. When entering quantities over a station range, enter the total quantity for the station range. Inroads adjusts this quantity per station. *Added Quantities* are project specific.
- Select **Annotation Tab**>
  - Toggle on the appropriate *Objects* as necessary to annotate the volume cross section set. This step is a user preference and is not required for calculating volumes.

Save the above end area volume settings by *File> Save As> Save in: Path to the project directory & File name: input based on the roadway alignment name*. The end area volume file should be saved as a type (*.eav) with a name that matches the alignment, such as mainline.eav or xr105.eav. This file will need to be opened to make changes to any added quantities or other settings by *File> Open*.

Added Quantities and other above settings can be edited/added by opening the (*.eav) file mentioned above in a text editing software program such as Notepad or Wordpad. Extreme caution should be taken when working with the Added Quantities in this manner, as the entries need to be in a specific order and numbered in a specific manner.

Mass Haul Diagram

- Select **Apply in the Cross Section Tab** Identify point to plot in Microstation file or Reject
- *Exaggeration / Horizontal:* should be set to 0.50 and *Exaggeration / Vertical:* should be set to 0.02.

Volume Reports

- Select **Apply in the Cross Section Tab**> Bentley Civil Report Browser>
- Select Evaluation</EarthworkQuantities.xsl

Volumes.xsl could be used to verify MDC quantities for a check

- File <Save As…> to save this report results to the project directory as u:\rd\prj\COUN\PCN#\endvol.html.

- **Save the Roadway Designer and File save as PCN#.ird.**

Appendix A

Developing an InRoads Project

An InRoads Project (*.rwk) file can be created, that can be opened at the beginning of each InRoads session. This file gives the user the ability to open each desirable component of the modeling process without having to open each component individually.

- Open the Surface files (*.dtm) for the project, beginning with PCN#org.dtm (from the REGION project folder), and then mainline.dtm files.
- Open the Geometry project file (ePCN#.alg).
- Open the Template Libraries file (PCN#.itl).
- Open the Roadway Design file (PCN#.ird).
- Open, if applicable, the Drainage file (PCN#.sdb).
- InRoads **File > Save As**
- <Options…>
  - Select the *Surfaces* tab.
    - ✓ Toggle *Add* for the PCN#org surface. (Road Design does not have access rights to the Region project folders, thus *Update* must not be toggled on for this surface, as Update also saves any modifications to the component file, when the InRoads session is ended or the Project file is saved).
    - ✓ Toggle *Add* and *Update* for the remainder of the surfaces.
  - Select the *Geometry Project* tab.
    - ✓ Toggle *Add* and *Update* for the Geometry Project.
  - Select the *Template Library* tab.
    - ✓ Toggle *Add* and *Update* for the Template Library.
  - Select the *Roadway Design* tab.
    - ✓ Toggle *Add* and *Update* for the Roadway Design.
  - Enter PCN# in the *File Name:* field.
- <OK>

The InRoads Project file can also be created by copying u:\rd\Bentley\Civil\data\English\rd.rwk to the appropriate project file. Once the copy has been completed utilize a text editor program to edit the path for each respective component of the file.

Appendix B - InRoads Storm & Sanitary Workflow, v8i

Reference Documents (Does not apply anymore. updated reference material?)

The following documents, provided by Intergraph, are useful tools for using the software.

u:\doc\ SelectCAD\Ver8.02_doc \Tutorials\
Working With Storm & Sanitary SelectCAD.pdf – contains information on getting started, common design workflows, and a tutorial and sample data set that provides step-by-step instructions for learning how to create a storm drainage system. **Chapter 5 of the above document provides a good workflow, which was followed to create this document.**

u:\doc\SelectCAD\Ver8.02_doc\Reference\

Storm & Sanitary Design Procedures.pdf - is a technical reference document that details the industry standards, computations, and methodologies that the software utilizes for hydraulic/hydrology calculations.

u:\doc\InRoads\Ver8.04.00.00\Product_suite_ref_guide\
DAA022620v2.pdf – Provides explainations of each command and input in InRoads. *Drainage* begins on page 1259, and *Tools>Drainage Options* begins on page 2324 (DAA022620v3.pdf)

Starting Inroads Storm & Sanitary

Need to contact the HELP desk to have BIT install the software on your computer.

Loading Inroads Storm & Sanitary after software installed

Inroads toolbar: **Tools > Product Add-Ins >** check **InRoads Storm & Sanitary** box**, OK**
This will add **Drainage** to the Inroads toolbar and also a Drainage under Tools.
Save settings to have this automatically load for this project, but should toggle off when not in use since it checks out a license every time it is loaded.

Create Drainage (.sdb) file when first beginning

File > New > Drainage Tab >
Name: **PCN#** (will automatically add the extension .sdb)

Save Drainage (.sdb) file when needed

Open Drainage (.sdb) file

File > Open >
set Files of type: to Drainage (*.sdb), then select **PCN#.sdb**
Can also open the PCN#.sdb by adding to the PCN#.rwk file and opening only that.

Be sure to have the project geometry and surface files loaded for InRoads Storm & Sanitary to reference from.

HINT: Be sure you have run **Bentley Config Utility (BCU.exe),** so your computer has the latest SDDOT standard drainage files loaded. Recommend checking that the correct i_structure.dat file is loaded everytime InRoads Storm & Sanitary is used by looking under **Tools > Drainage > Options > Inlet Tab**, and that Type B is an option under class: when the type: is set to combination.

Recommend creating **sPCN#.dgn** as a 3D graphics file in your PROJECT folder using microstation.
This file will be used to design the storm sewer system.