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Workshop - X3

Beyond the Roadway Designer - Finishing the Model

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Finishing the Model

Module Overview

The focus of this workshop is to concentrate on design issues that occur during the final design process which need to be addressed in order to complete proposed grading for the project. The workshop will explore doing this with a variety of tools including the Roadway Designer, the Apply Template tool, and site tools.

Module Prerequisites

- Familiarity with the overall InRoads Product.
- A firm understanding of the Roadway Designer and template creation in InRoads 8.7 and higher.
- Knowledge of the InRoads' site tools.

Modules Objectives

After completing this module, you will be able to:

- Incorporate Partial Pavement Widening in an existing Corridor.
- Target features Styles to increase productivity in the Designer.
- Learn to use the Apply Template Tool.
- Use Site tools to complete your design.

Introductory Knowledge

Before you begin this module, let's define what you already know.

1. End Conditions can target the style of particular features in your DTM?
 - True
 - False
2. Site tools only found in InRoads Site?
 - True
 - False
3. Point Controls and Parametric Constraints are the only external influence on Template points.
 - True
 - False
4. Site tools are only productive for site development?
 - True
 - False
5. Feature Lock allows for only one feature to be designed at a time?
 - True
 - False

Answers

1. Can End Conditions target the style of particular features in your DTM?

True

InRoads' End conditions can target a style that is defined for multiple features in a surface. This prevents you from targeting each feature individually.

2. Site tools are only found in InRoads Site?

False

The Site tools are found also in InRoads & InRail.

3. Point Controls and Parametric Constraints are the only external influence on Template points.

False

Style & Project to Surface constraints can act as external control for points within a template. These constraints obtain values from surfaces and geometries as Point Controls do.

4. Site tools are only productive for site development?

False

Site tools are valuable assets in complementing your corridor design. This workshop will display this.

5. Feature Lock allows for only one feature to be designed at a time?

False

The Feature Lock allows InRoads to scan for Features in the active DTM, and ignore any MicroStation Graphics.

Before You Begin

Before beginning the exercises outlined in this workshop, you need to start InRoads and load the workshop files. To do so, follow these steps:

1. Start InRoads, then navigate to the workshop directory and select the *proposed.dgn* file from the *MicroStation Manager*. This design file has several reference files attached showing some of the existing topological features which are stored in the DTM and also displays proposed pavement markings. You may turn off the display of the reference files at any time, if you wish, by selecting *File > Reference* from the MicroStation menu and toggling off the checkmark in the *Display* column. We only use this data for visual references during the workshop.
2. From the *InRoads Explorer*, select *File > Project Defaults* and set the *Configuration Name* to **W25**. Close the *Project Defaults* dialog.



Hint If **W25** does not show up in your list, select the *Import* button from the *Project Defaults* dialog, navigate to the workshop directory, and open *W25.reg*.

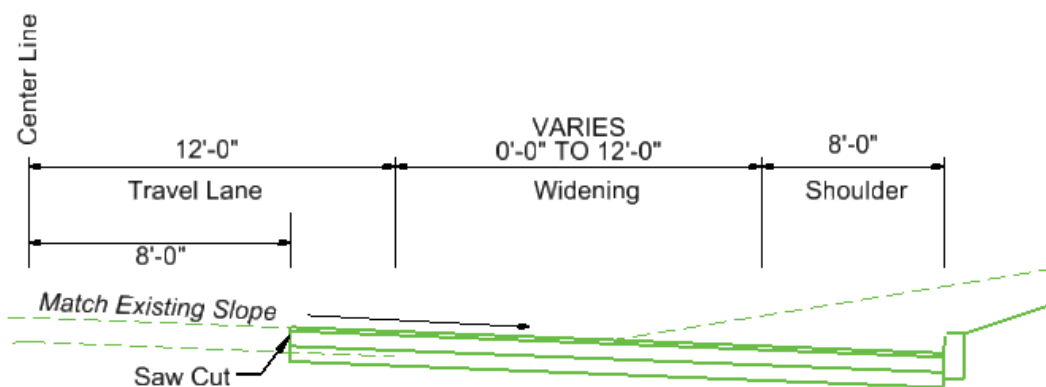
3. Select *File > Open* and load the workshop files by selecting the project file named *finishing.rwk*. This project file contains a geometry project, an existing surface, a template library and a roadway design file for use in the remainder of this workshop.
4. Select *Tools > Locks > Toolbar* to turn on the *Locks* toolbar, if it is not already on.

You are now ready to begin the exercises in this workshop. If, for any reason, you must exit the software before the end of the workshop, simply repeat the steps in this section.

If you are unable to complete an exercise as you proceed through this workshop, the completed files for that lesson are stored in *\Finished* subdirectory labeled with the exercise's topic. For example, if you cannot complete *Driveways*, you can open the completed files from the *\Finished\Driveways* subdirectory and continue with the exercise.

Partial Pavement Widening

This section of the workshop will give an overview on adding partial full depth pavement widening to an already existing corridor defined in the Roadway Designer. The partial width full depth pavement is being placed to address the tapers associated with adding a left turning lane and for wider travel lanes. The design has called for full width reconstruction in the areas where the travel lanes are fully established and has already been defined in the corridor. The purpose of this lab is to add the partial width reconstruction to the corridor and use the Designer to complete the model. A typical section below is showing the design criteria for the pavement widening:



Notice that the saw cut location in the typical. It is 8 feet from the centerline of the road. The original road is roughly 10 feet wide. It has been determined that the pavement near the end of the travel line has failed, thus around 2' of existing pavement will be removed. The existing elevations at the centerline and at the saw cut will be used to determine the existing cross slope. This cross slope will be projected through the partial full depth pavement travel lanes and widening in the proposed design.

This workshop will modify a template in an existing corridor to accommodate the above scenario. This will be done in the Designer, thus it allow one surface to be produced for both the full width and partial width sections of this design.

Note: This workshop displays a specific design scenario, however the techniques used in this workflow will accommodate a wide variety of Designs.

➔ **Exercise: This exercise will assume that you are familiar with Template Creation and the Roadway Designer.**

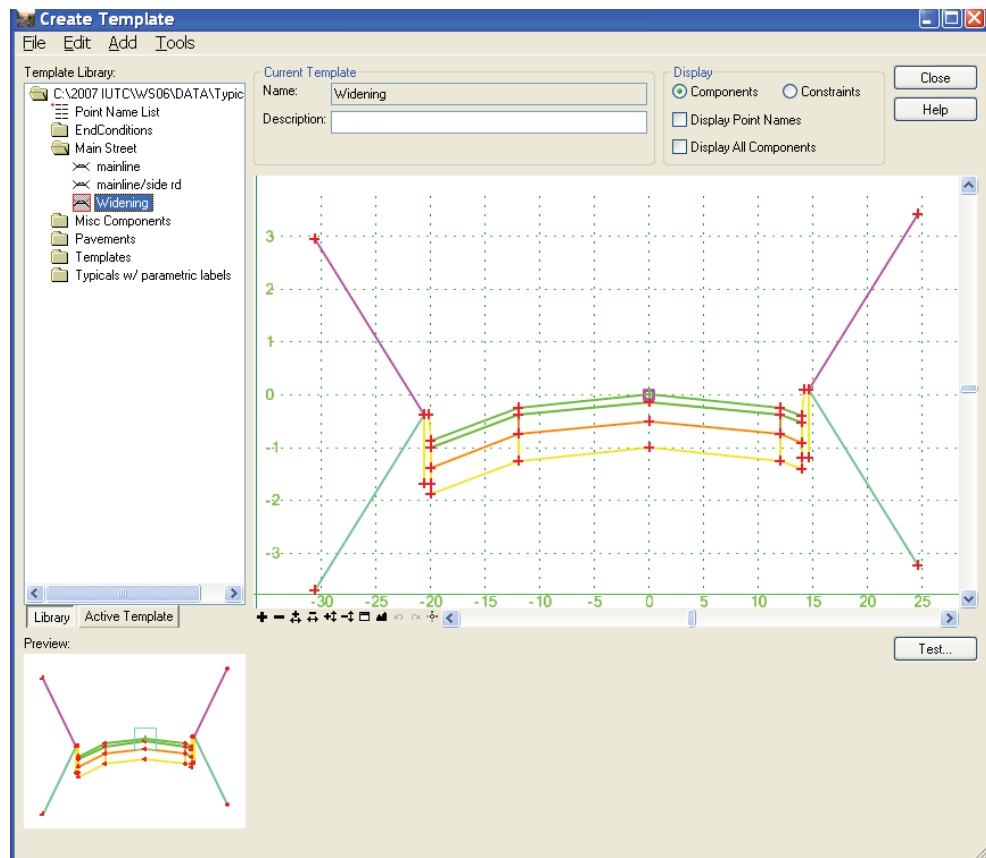
1. If you have not opened **proposed.dgn**, please do such. Examine the Proposed design, particularly at Sta. 200+63.63 until the end of the alignment for *Main St.*. Remember the topography, existing contours, and pavement markings are referenced.

Note: The instructor will provide a general review of the DGN files and InRoads' file supplied at this time.

2. Go to **Modeler>Roadway Designer** and observe the *Main Street* corridor that already exists, noting that the corridor stops at Sta. 200+63, which is at the beginning of the partial full depth pavement widening.
3. **Close** the Designer and go to **Modeler>Create Template**.

Note: We are making the new template for the widening in the ITL file. Remember this can be done in the IRD file also.

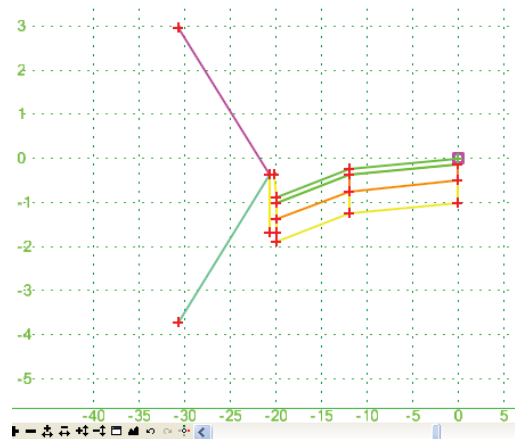
4. Navigate to the *Main Street* folder in the *Create Template* dialog. Copy the *Mainline* template and paste it in the same folder. Rename the template to **Widening**.



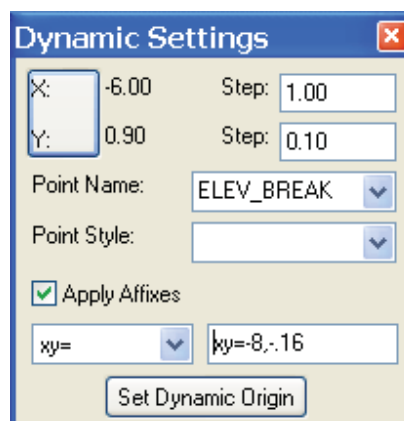
- Making sure the active template is *Widening*, delete the components that represent the right shoulder pavement courses, the right curb, and the right end conditions. This can be done by right clicking in the main dialog, and selecting **Delete Components** and then drawing a line through any unwanted components.

Warning: Do not delete the right travel lane component, named *Pavement*, it also includes the left travel lane which is still needed. Remember, to use the Undo button, to delete any unwanted changes.

- Next the right travel lane need to be removed. However since it is in the same component as the left we can not use the same method as in Step 5. We will accomplish this by deleting the points: **EP_R, EP1_R, EP2_R, & EP3_R**. Right click on these respective points and select **Delete Points**. Your template should appear as below once completed.

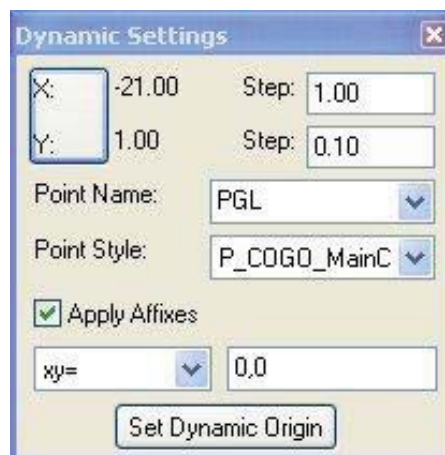


- Turn on your **Dynamic Settings**. Then right click on point **CL** and choose **Move Point**. Choose **xy=** in the Dynamic Settings dialog and key-in **-8, -.16**, then press enter.

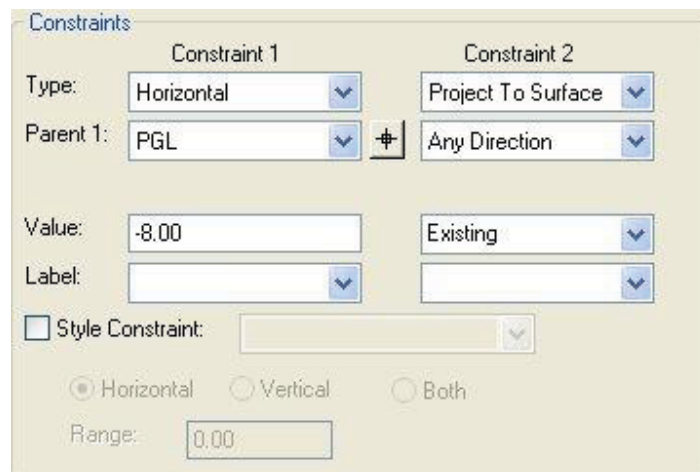


Note: The Template was moved to reflect the location of the saw cut, 8 feet from the center line.

- Next a new point needs to be created at the profile grade line. Right click in the display and then choose Add New Component>Null Point. In your Dynamic Settings key in **PGL** for the point name, **P_COGO_MainC** for the style, and **XY=0,0** and then click **Enter**.



- The point **CL** now needs to be constrained to the point **PGL** and vertically projected to the elevation of the existing surface. Add a Horizontal & Project to Surface Constraints. Right click on the point **CL** and choose **Edit Point**. Apply the constraints below:



- Next the template needs to be modified to allow the slope between point **CL** and **EP_L** to match existing cross slope. In order to accomplish this, the constraints for **EP_L** need to be modified. Double click on **EP_L** and then add the constraints as below:

Note: The Style Constraint will be used to control the varying width of **EP_L** from a horizontal geometry with the style **P_Road_LEP**. The Range is left at zero since we only have one **P_Road_LEP** defined in our project.

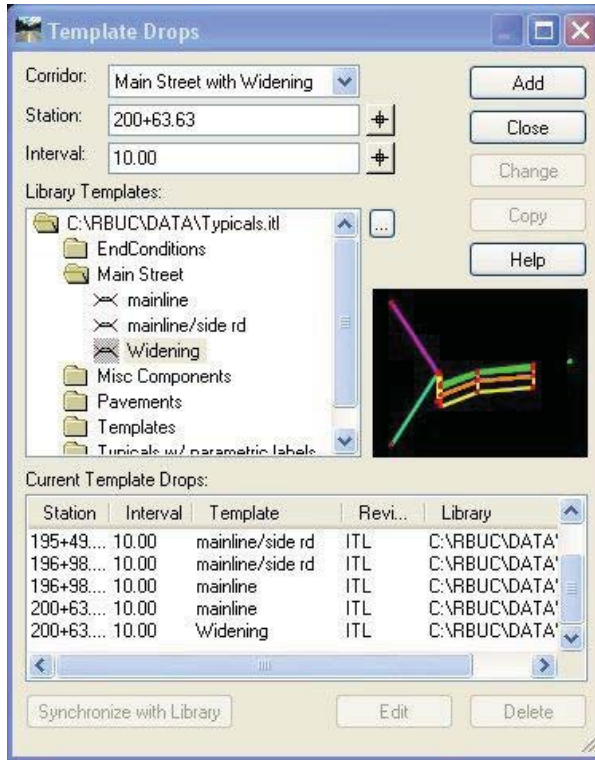
- Test the behavior of the template by moving point **PGL** with **Move Point** tool. Notice the behavior of the cross slope. Also use the Test button to verify the End Condition solutions.

Hint: Notice the additional Available Target, Existing-Surface, where did this target come from? How does this target affect the template?

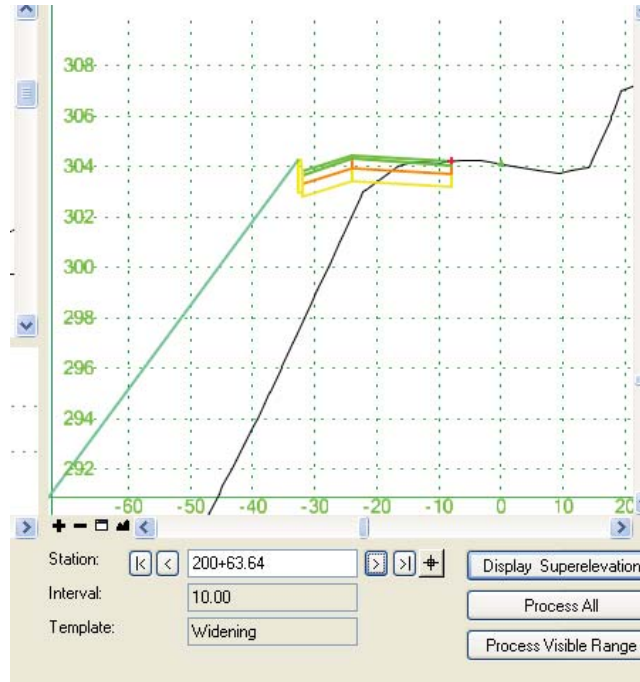
- Save the template by going to **File>Save** in the *Create Template* Tool.
- Close** the Create Template tool and return to the **Roadway Designer**.
- Copy the *Main Street* corridor. This is done by going to **Corridor>Manage Corridor**, highlight *Main Street* and the hit **Copy**. Key-in a new Corridor Name: **Main Street with Widening**. Then hit **<OK>**
- Highlight the **Main Street with Widening** Corridor and then key-in a new Stop Station: **203+17.88** and then hit **Change**. Close the Manage Corridor dialog.

Note: Navigate through the Stations in the Designer, notice that **EP_L** is only 12 feet wide from station 200+63.63 forward.

16. Add a new template drop for the partial pavement widening by going to **Corridor>Template Drops**. Choose the **Widening** template and key in Station **200+63.64**. Then press **<Add >** and then close the Template Drops Dialog.



17. Run through the Designer and observe the region where the widening occurs. Verify that the EP_L is correctly placed and then verify the cross slope in this area.



Note: The EP_L did not need a point control to control its varying width. The Horizontal Alignment named, Main LEP, has the style P_ROAD_LEP, thus the Style Constraint in the Widening template automatically adjusts to the horizontal value defined through this alignment.

Hint: Observe the cross slope between 200+63.63 and 200+63.64. The slope is the same. The superelevation was modified to match the existing roadway cross slope to provide a smooth transitions.

A surface is not created at this time since we are not done with the improvements to Main Street.

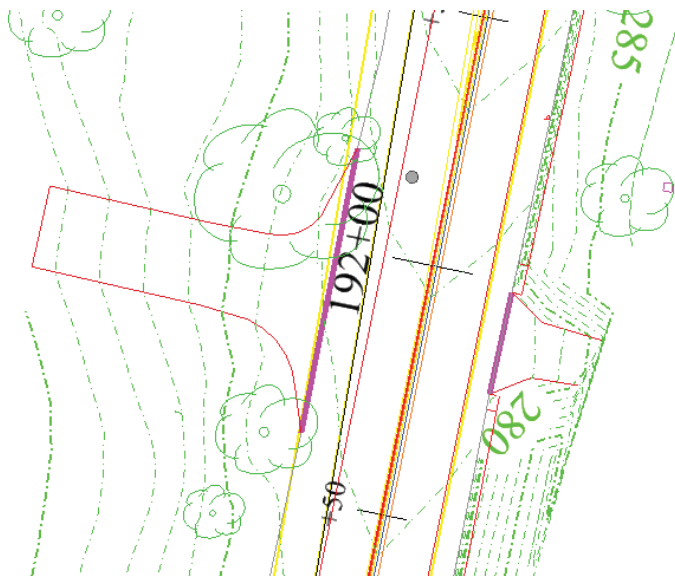
Driveways

This exercise will demonstrate a procedure that will allow End Conditions to determine where to place depressed curbing instead of full 6" curbing to accommodate for driveway entrances. After the depressed curbing is placed at a driveway location then the End Conditions can continue to test for different tie in situations that are relevant for only when a driveway is present. This method can be quite useful on large corridors, where many driveways exist. This is because this workflow's End Conditions target a Style of a feature and not just an individual feature. This eliminates the mapping of each individual driveway feature as a type of external control within the Roadway Designer.

Note: The main goal of this lab is to display the functionality of End Condition using a Style as a target. This Style can exist in an ALG or a DTM, but it must be active for it to operate correctly.

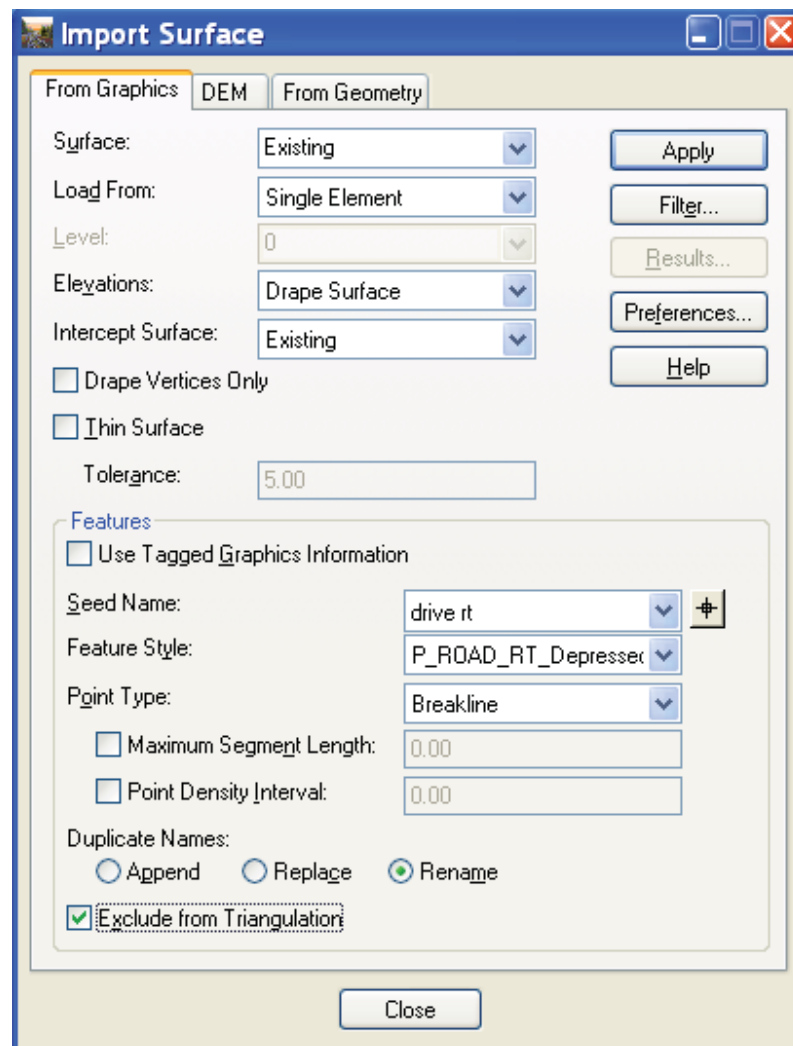
➔ **Exercise:** In this section we will modify the first template drop in our corridor to allow it to adjust the end condition solution if a driveway is found.

1. Window your view to the beginning of the *Main Street* alignment around Sta. 192+00. There are two driveways in the location, one on the left and the other to the right of the baseline, each labeled appropriately. The drive openings are marked with a purple line that resides in the *Proposed.dgn*.

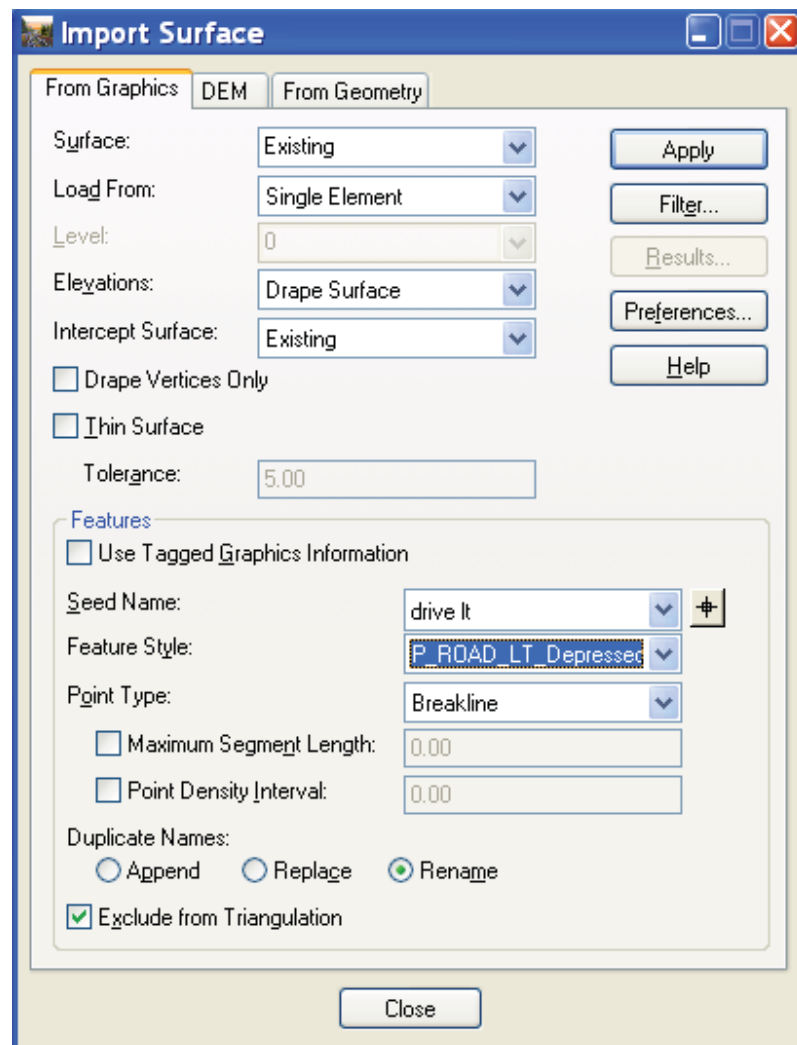


2. Go to **Reference Display** in MicroStation and shut off the references. This will make the following steps easier by isolating the graphics.
3. In InRoads go to **File>Import>Import Surface>From Graphics**.

4. Import the right driveway into the **Existing** Surface while draping the driveway onto **Existing** surface. Enter a Seed Name of **Drive Rt** with a feature style of **P_Road_RT_Depressedcurb** as a **Breakline**. Check the **Exclude from Triangulation** toggle.

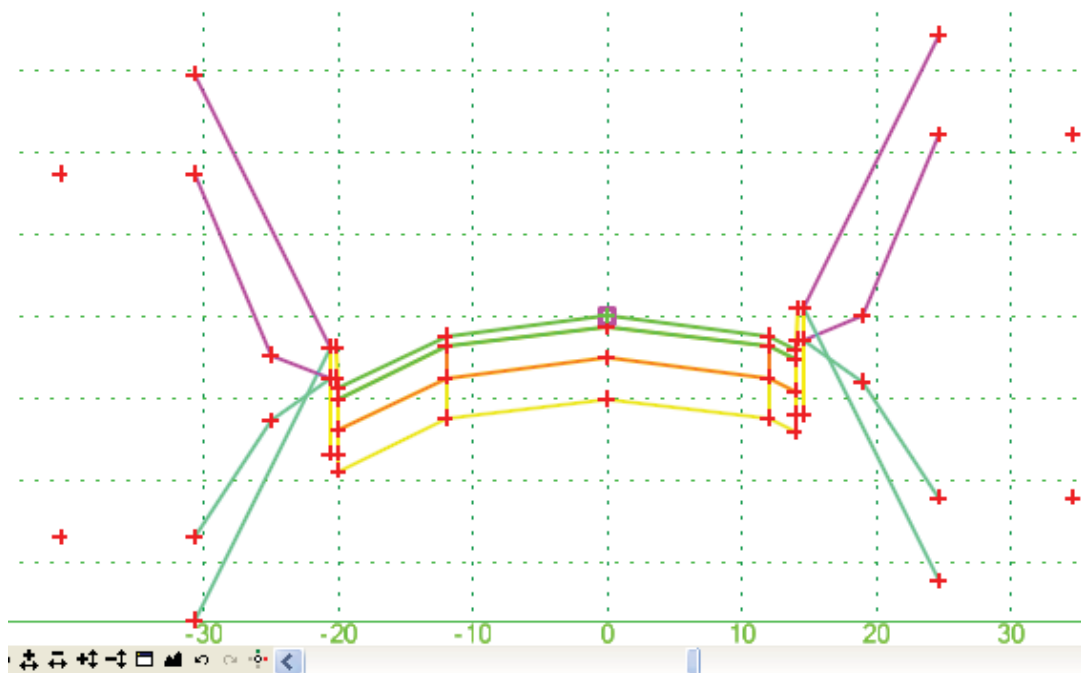


5. Repeat this process for the left driveway. Import it also into the **Existing** Surface while draping the driveway onto **Existing** surface. Enter a Seed Name of **Drive Lt** with a feature style of **P_Road_LT_Depressedcurb** as a **Breakline**. Check the **Exclude from Triangulation** toggle.



6. Next go to the **Modeler>Roadway Designer**. Make a copy of *Main St with Widening* corridor and rename it **Main St with Driveways**.
7. Go to the **Template Drop** dialog, highlight the first template at Sta.191+20.00, and then press <**Edit**>.
8. At this time we need to modify the template to include new End Conditions to determine when to use Depressed Curbing. Right click in the template dialog and <**Delete Components**>, draw a line through the existing End Conditions.
9. The End Condition will determine when to place the curbing so the current curbing components will need to be in the End Condition. **Delete** the right and left curb components from the template.

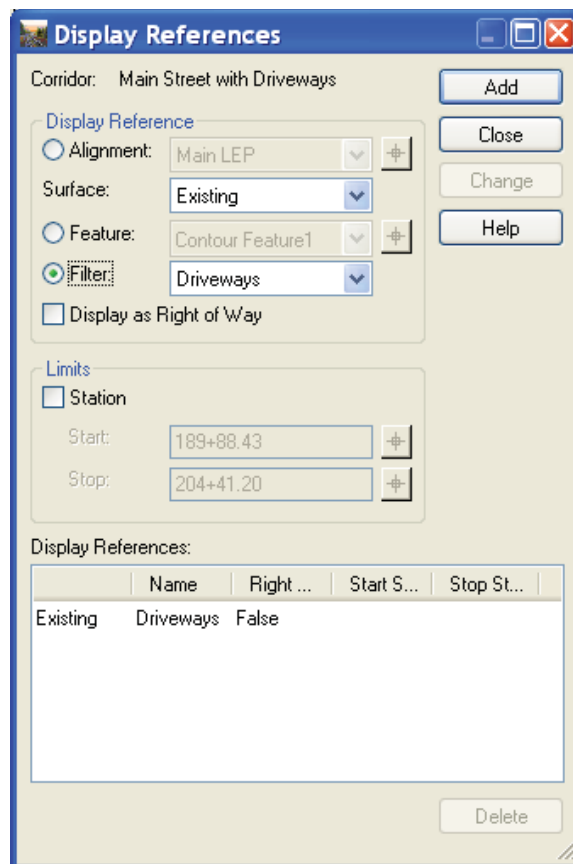
10. Bring in the new End conditions from the *End Condition* Folder on the left. You will notice two end conditions named **driveway end condition rt** and **driveway end condition lt**. Drag and drop the end conditions from the preview window into the template stored in the Roadway Designer. Both end conditions should be placed at the left and right shoulder points, *shldr_r* & *shldr_l*. Your template should appear as below.



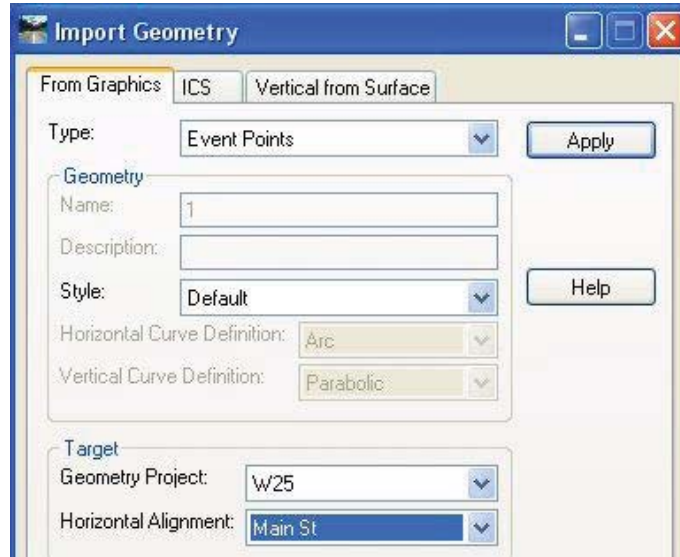
11. Press the Template <Test> button. Observe the behavior of the template when there depressed curb styles are defined and when they are not.

Hint: This workflow can easily modified to test to see if your proposed end condition is within the legal right of way.

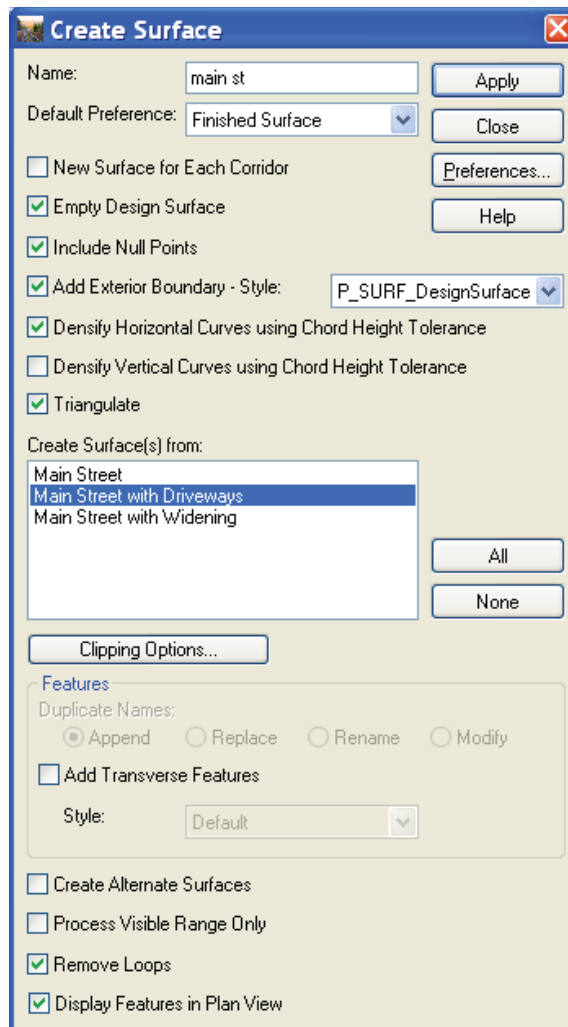
12. After observing the behavior of the template, press <OK>.
13. Next add the driveways to the Roadway Designer as a reference. Go to **Corridor>Display References**.
14. Typically, there is more than two driveways on a project, thus a filter would be a good idea to automate this process. A filter, named *Driveways*, has been created that seeks the styles, *P_Road_RT_Depressedcurb* & *P_Road_LT_Depressedcurb*. Select Surface **Existing**, the filter **Driveways**, and then click <Add> then dismiss the Display Reference dialog.



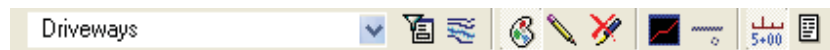
15. The Driveways now appear in Designer, this will aid in seeing if the Design is appropriate. Cycle through the stations by the driveways.
16. The template drop interval is set to 10 feet for this particular template drop, this may or may not satisfy the precision that is required to determine where our driveways are located. The design may call out that a template drop must occur at the beginning and end of each driveway location, increasing the accuracy of the model. First, go to **File>Save** in the *Roadway Designer*.
17. Proceed to **File>Import Geometry>From Graphics**. Change the type **Event Points** and verify that the geometry project is **W25** and the horizontal geometry is **Main St**.



18. Press <Apply> and select the two driveways graphically in the *proposed.dgn*. Remember to *Accept* your selection by clicking an additional data click. Right click to exit the operation and then **Close** the Import Geometry tool.
19. Return to the **Roadway Designer**. Verify the additional template drops at the beginning and end of each driveway location.
20. Next create the proposed Main St. surface by going to **Corridor>Create Surface**. Key in **Main St** for the surface name and select the corridor named **Main St with Driveways**, then <Apply>. Dismiss the *Create Surface* dialog and then save the Roadway Designer by going to **File>Save**. Then **Close** the Designer.



21. The features have been displayed in the *proposed.dgn*. Next display the proposed Main St. contours. First turn on your **Style Locks**, it is the icon that resembles the painter palette, next change your active surface to *Main St.* Then go to **Surface>View Surface>Contours**.



Apply Template Tool

In this section, the Apply template tool will be used to widen the Side Road. Again, the improvements do not call out for the total reconstruction of the roadway. However, there is no Roadway Designer corridor defined as there was for Pavement Widening Exercise. The widening includes a single face concrete barrier to accommodate the existing steep cut slope.

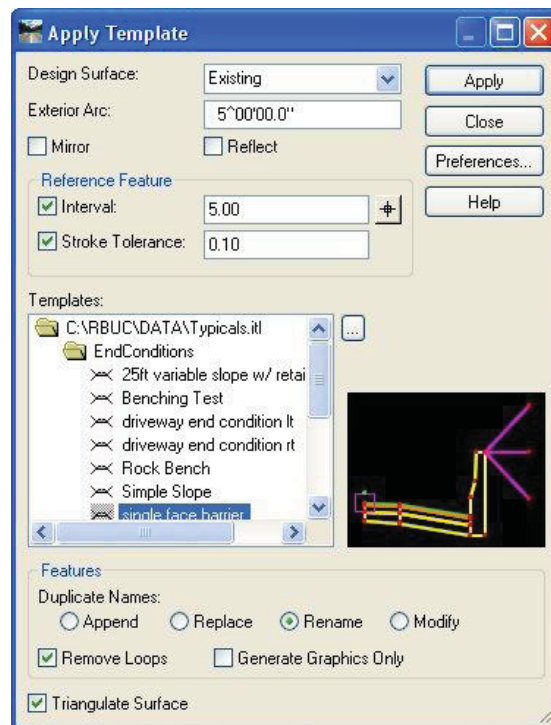


Single Face Barrier Template

Note: This exercise will display the use the Apply Template Tool, it will use a MicroStation graphic that does not exist as a feature or as geometry. This provides the ability to perform grading task quickly and easily.

1. Locate the *Sawcut* line on the Side Road in *proposed.dgn*. This line in MicroStation is currently at elevation of zero. However, this line needs to be at the elevation of existing ground surface. The Apply Template tool is going to accomplish this as it places the pavement coarses, the single face barrier, and solve for our end condition in one step.
2. First, examine the template, Single Face Barrier by going to the **Modeler>Create Template**. Inside the End Condition folder, locate and make active the *Single Face Barrier* template. Again, <Test> the template and note the targets.

3. **Close** the Create template dialog.
4. Since the proposed contours for the *Main St* were just displayed, it is still active. Change the active surface back to **Existing**.
5. Next, navigate to **Surface>Design Surface>Apply Template**.
6. Key in for the Design Surface: **Side Rd**
7. Open the EndConditions folder and select **Single Face Barrier**.
8. Verify the template appears in the preview window.



9. Press <**Apply**>

Warning: After applying, make sure to follow the prompts.

10. **Select** the Side Road **saw cut** for the *Primary* and *Reference* Elements. Making sure to *Accept* after each prompt.
11. The operation will be done on the entire length of the saw cut so when prompt for start and stop stations, just simply **right click** to Reset for entire length to be processed.
12. InRoads will ask if the location is correct. Give a **Data** button to accept.

Hint: If the widening was performed on wrong side of saw cut, simply reject the location and toggle the Reflect on in the Apply Template tool.

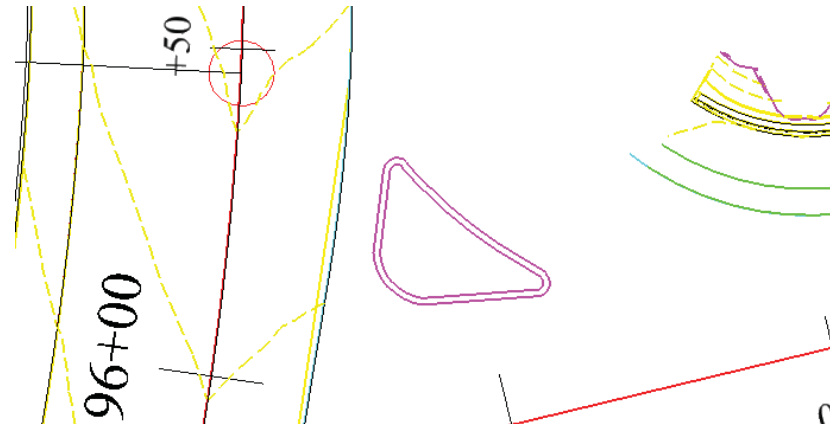
13. **Close** the *Apply Template* tool.
14. Next go to **Surface>Surface Properties**. Change the Surface to **Side Rd.** Then enter a Maximum triangle length of **10** and choose the preference, **Finish Surface**, and then **<Apply>** and **Close**.

Note: The Apply Template tool does not add an exterior boundary; the maximum triangle length provides an adequate accuracy for this example. However, an exterior boundary could be used instead of setting a Maximum Length.

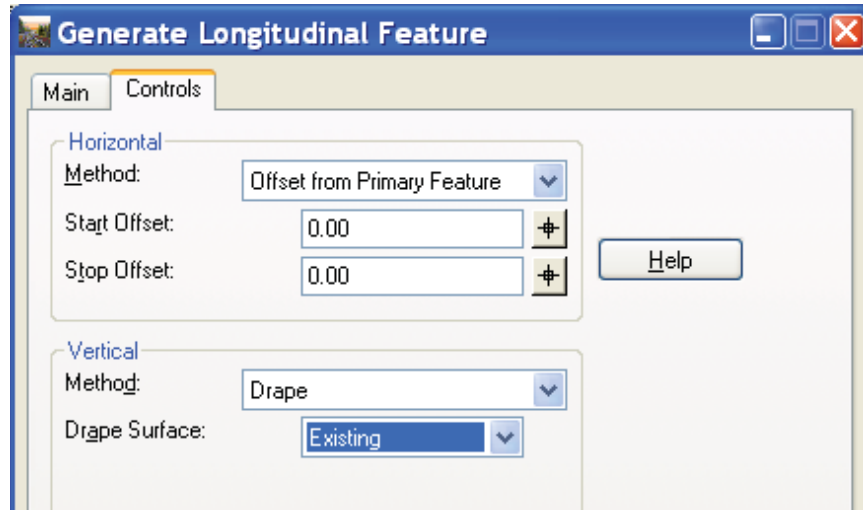
15. Display the Side Rd. contours, **Surface>View Surface>Contours**.

Mountable Curb Island

This exercise will perform the grading of a mountable curb section that is required at the intersection of Main Street and Side Road. The site tools will be used to accomplish this.

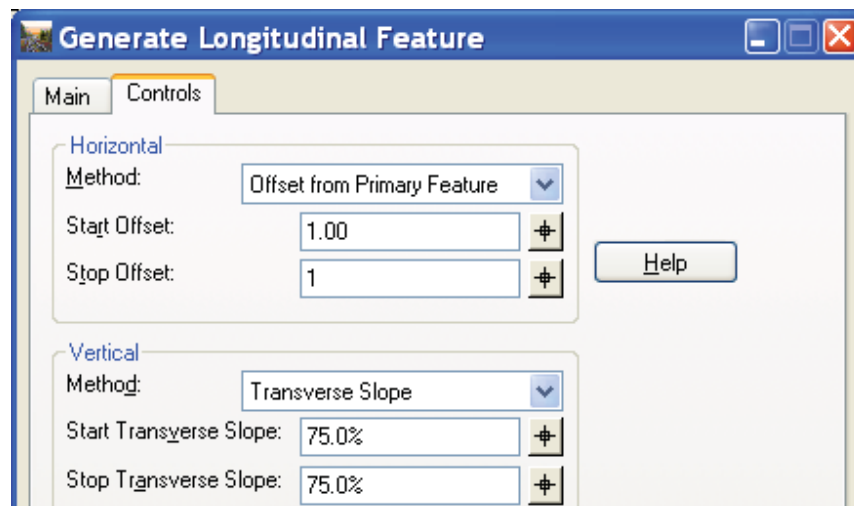


1. *Locate* the mountable curb island located at the intersection of the Main Street and Side Road.
2. The exterior portion, bottom of the Mountable Curb needs to tie into Existing Ground. While the top of mountable curb is a 1' offset from the bottom at a slope of 75%. The island is required to be graded to drain so no water ponds on the island.
3. Go to **Surface>Design>Generate Longitudinal Feature**.
4. Key in a Surface: **Island**
5. Enter the feature name of **BC** and a style of **P_Road_ConcreteCurb**.
6. Tag the advanced tab, verify the horizontal offsets are **0** and the vertical method is **Drape** and the surface is **Existing**.



7. Press <Apply>
8. **Select** the exterior line of the island for **Primary** and **Reference** Elements. Then **Accept** the location.

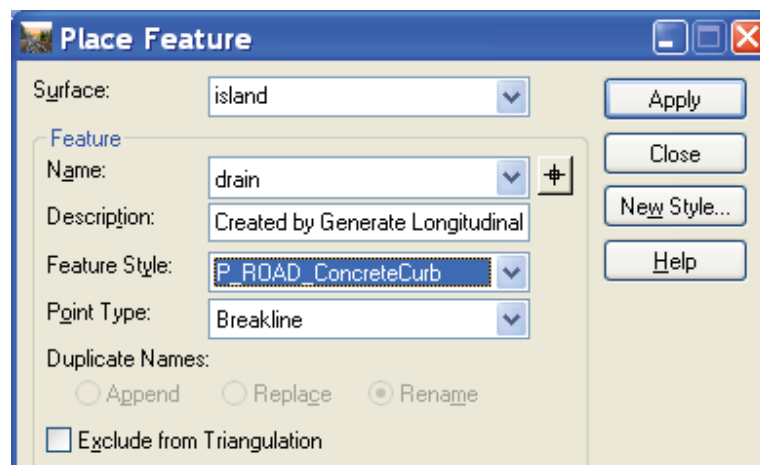
Note: The location is not relevant since the Horizontal Offsets define are 0.
9. A yellow line now appears at the location. This line is at the existing ground elevation and is feature named *BC* in the surface named *Island*.
10. Go to the *Main* tab, and enter a new feature name of **TC** and then go to the *Advance* tab and change the Horizontal *Start* and *Stop* offsets to **1.00** and then change the method for vertical to **Traverse Slope**. Enter a *Start* and *Stop* slope of **75.0%**



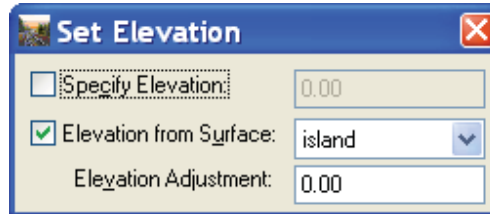
11. Turn on your **Feature** locks located on the Locks toolbar.

Note: Feature Locks will allow InRoads to scan for Features in the active surface when the Generate Longitudinal Feature tool is applied. This will allow the tool to select the Feature BC, which is at elevation and ignore the original 2D line in MicroStation. This functionality applies throughout the Site Tools.

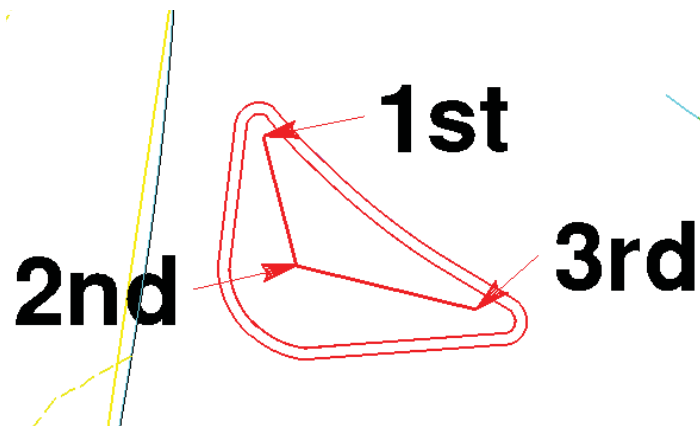
12. <**Apply**> the *Generate Longitudinal Feature* tool. **Select** the BC feature created previously for your **Primary** and **Reference** Elements, note that name of the feature, **BC**, is displayed when selected, this is because *Feature Lock* is toggled on.
13. The entire feature needs to be processed so **Right Click** for entire element.
14. The software now prompts you to *Accept* the location, notice if you move your cursor from inside to the outside the island the TC is dynamically moving 1 foot in either direction. Place your **cursor** to the **inside** of the Island and then **Accept** with a left mouse click. Your TC feature should be place directly on top of the purple MicroStation graphic.
15. **Close** the Generate Longitudinal Feature tool.
16. Go to **Surface>Design Surface>Place Feature** tool.
17. Verify the Surface is **Island**, enter the feature Name of **Drain**, with a Style of P_Road_ConcreteCurb and point type of **Breakline**. <**Apply**>.



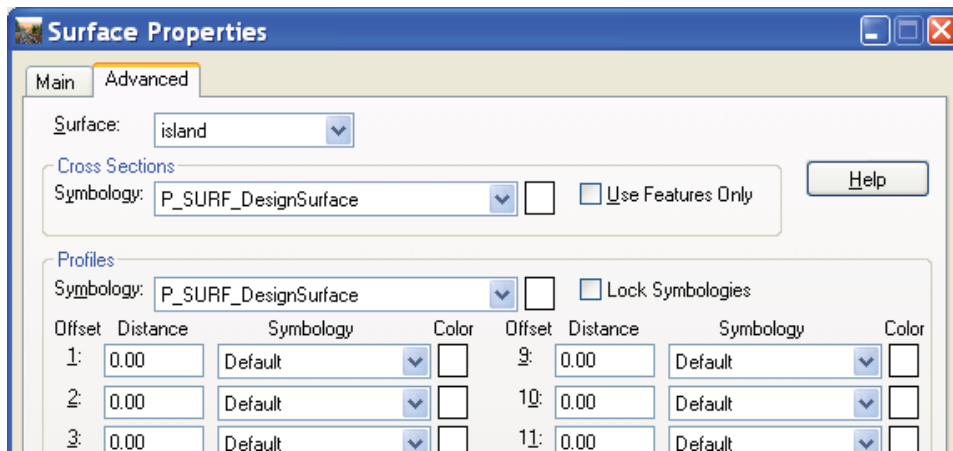
18. A *Set Elevation* Dialog appears; toggle on the Elevation from Surface with an Adjustment Value of zero.



19. Place 3 points, with this tool. The XY location or somewhat arbitrary but the *Elevation Adjustment* for 1st and 3rd points are **0.00** while the 2nd point has an elevation adjustment of **1.00**. This is achieved by simply placing the 1st point with the above settings and then change the Elevation Adjustment to **1.00** and then place the second point. Lastly, change the Elevation Adjustment back to **0.0** and then place the last point. This will track the elevations for the Island Surface and then add the Adjustment Value to that elevation for the *drain* feature. This will increase the elevation of the middle of the island ensuring that no ponding will occur.



20. Go to **Surface>Triangulate Surface**. Triangulate the *Island* surface, and then **Close** the dialog.
21. Go to **Surface Properties** and change the surface type to **Design** and the preference to **Finished Surface**. Select the advanced tab and change the Cross Section and Profile symbology to **P_Surf_DesignSurface**. Press **<Apply>**



22. View the contours for Island.dtm. **Surface>View Surface Contours.**

Module Summary

You are now able to:

- Use the power of constraints to accommodate partial pavement widening matching the existing cross slope in the same corridor with full pavement reconstruction.
- Place Depressed Curbing at driveway locations by targeting Styles within your End Conditions.
- Use of the Apply Template command can be used effectively to perform grading task, particularly when no geometry is needed.
- Use Site tools to complete a variety of design functions to finish your model.