



# ***Bentleyuser.dk Årsmøde 2008***

## ***Nordic Civil 2008***

**10.-12. November 2008, Munkebjerg Hotel, Vejle**

### **Workshop - X7**

### **Cross Sections with Drainage Structures**

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## **Workshop Description**

This workshop will cover the tools available in InRoads for the creation of cross sections that contain drainage structures created with the InRoads Storm & Sanitary product. Some of the topics covered in this workshop include: display of drainage structures on cross sections, and labeling of drainage structures on cross sections using Drafting Notes.

## **Target Audience**

This workshop is intended for Drainage/Highway Engineers, Designers, and Drafters.

## **Prerequisites**

- MicroStation knowledge is helpful.
- Basic InRoads knowledge is recommended.

## **Course Objectives**

- Create a custom set of cross sections showing drainage structures.
- Display realistic inlets using a cell.
- Label the drainage structures using Drafting Notes.
- Create a Drafting Note and use that note to label an inlet.

## **Modules Included**

- Creating Cross Sections and Drainage Structures.
- Drafting Notes and Drainage Structures.

## Introductory Knowledge

The purpose of the following questions is to gauge the learner's pre-requisite knowledge prior to completing this course. At the completion of the course the learner will be asked to complete a review to measure the skills learned.

### Introductory Questions

1. How many surfaces can be displayed on a cross section?
2. Can linear surface features be projected to profiles and cross sections?
3. Can InRoads files be stored on a network drive?

**Hint** Answers can be found at the end of the manual.



## **Cross Sections and Drainage Structures**

### **Module Overview**

InRoads can now open a Storm & Sanitary database without having a license for Storm & Sanitary.

An InRoads user can open Storm & Sanitary data and display the data in plan view and on cross sections. To design and layout a storm and/or sanitary system, Storm & Sanitary needs to be licensed, but InRoads alone can display Storm & Sanitary data.

### **Module Objectives**

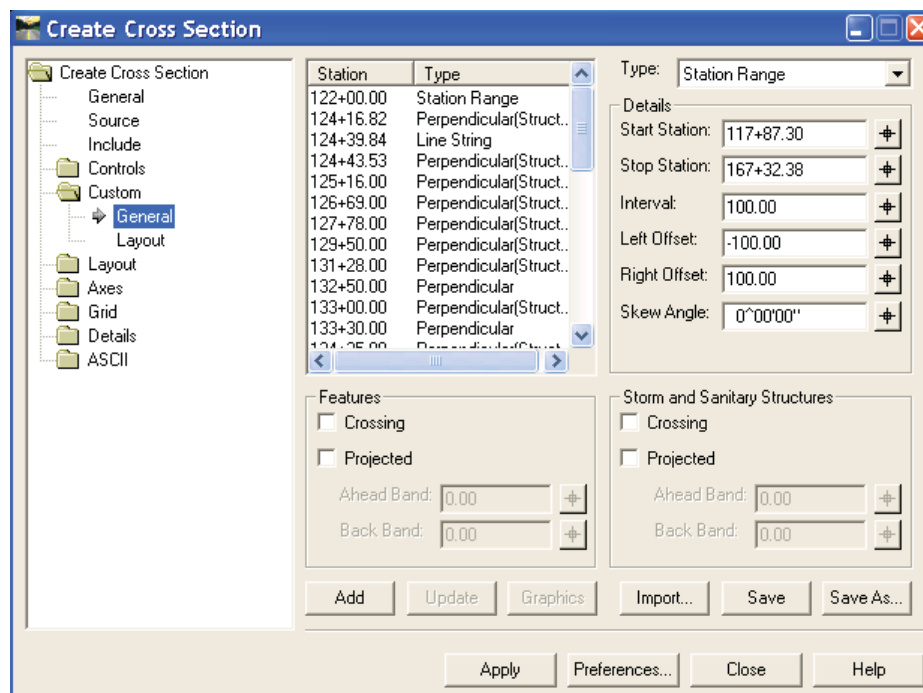
- Create custom cross sections with drainage structures.
- Display realistic inlets using a cell.

## InRoads Storm & Sanitary

The latest versions of InRoads can read Storm & Sanitary database files directly, without Storm&Sanitary running. Drainage structures are now fully integrated into InRoads cross section capabilities.

Surface features and drainage structures selected by the user and within a user specified bandwidth show up in cross sections. The *Ahead Band* defines how far up-station and the *Back Band* defines how far back-station. If both numbers are positive (for example: ahead 10, back 15), and a cross section is created at station 100+25, the band starts at 100+10 and ends at 100+35. The band will be perpendicular to the alignment used for the cross section. For cross sections generated on arcs, the band is not rectangular but wedge shaped.

Creating a custom cross section set can be very helpful to visualize the drainage structures. Custom cross sections allow you to specify skewed cross sections at any location along an alignment. Cross section locations can also be specified at drainage structures and will automatically create a cross section perpendicular to that structure. Projected and crossing drainage structures can be projected to specific cross sections and varying bandwidths can be applied. Custom cross section set parameters can be saved to a text file and imported for future use.



## Let's Get Started

> *Exercise: Start InRoads and Open the Project Data.*

1. Select **Start**> **Programs** > **Bentley** > **InRoads Group XM** > **InRoads**.
2. From the MicroStation Manager, select the file  
*C:\2008 RBUC\W11 Cross Sections with Drainage Structures\Data\StormAndSanitaryCrossSections.dgn* and click **OK**.
3. From the InRoads Menu, select **File** > **Open**.
4. Select the Project *C:\2008 RBUC\W11 Cross Sections with Drainage Structures\Data\RBUC\_training.rwk* and click **Open**.

This Project file opens the following files:

Existing Ground Surface	Existing.dtm
Proposed Surface	Design.dtm
Geometry Project	Drainage Geometry.alg
Drainage	Drainage Design.sdb
Preferences	RBUC_training.xin

5. Click the **Cancel** button.

## Drainage Tools in InRoads

InRoads now provides you several drainage tools that were previously only included in InRoads Storm & Sanitary. In the last exercise, a Drainage Database was opened and can now be used by InRoads alone. The Drainage tab in the InRoads Workspace Bar can be used to review the drainage data. There is a Drainage menu which provides access to the View Drainage and Edit/Review tools.



### The Style Lock

Each drainage structure has a Style associated with the different parts of the structure. During the placement of the structures, the Style is assigned to the structures. The Edit/Review dialog contains a Styles tab which can be used to change or review the structure's Styles. With the Style Lock in the On position, the drainage structures will be displayed using the Styles associated with each structure. This allows you to individually control the display of different structure types and sizes.

## Viewing the Drainage Structures in Plan View

> *Exercise: View Drainage Structures in Plan View.*

1. Verify that the **Style Lock** is in the **On** position.



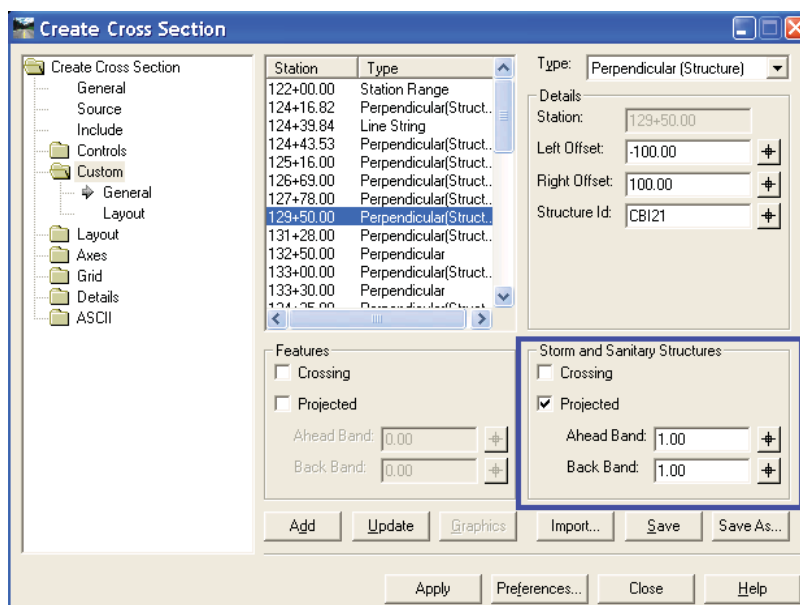
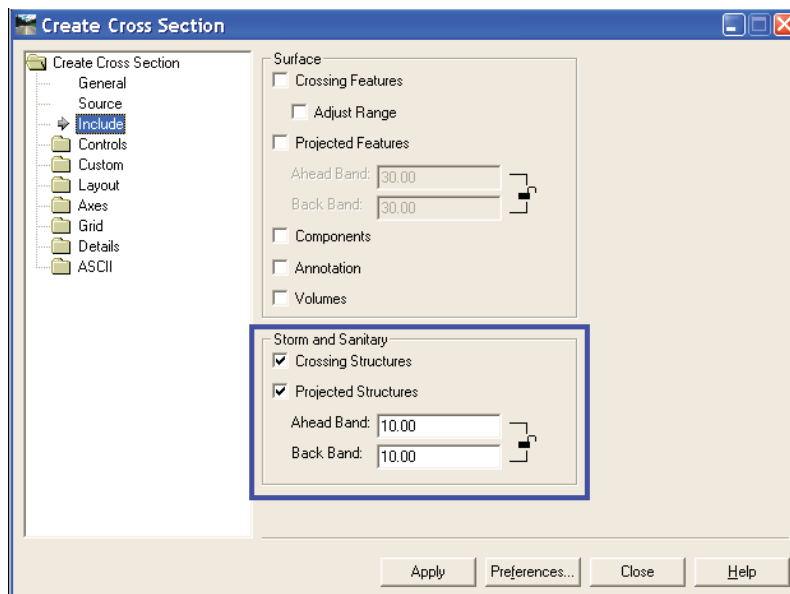
**Hint** If the Locks toolbar is not displayed, select Tools > Locks > Toolbar to display the toolbar.

2. Select **Drainage > View > Drainage**.
3. Review the graphics of the drainage structures in Plan View.



## Create Cross Sections

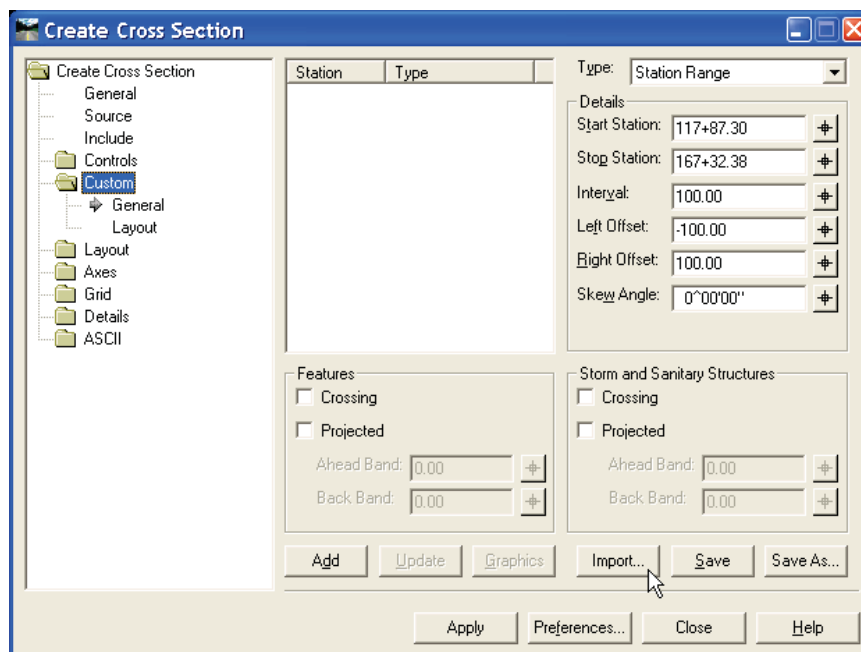
The InRoads' Create Cross Section command has been updated to be able to view projected and crossing drainage structures in cross sections. The Include and the Custom leafs of the Create Cross Section dialog allow you to display crossing and/or projected Storm & Sanitary Structures. Like in the Plan View, the display of the structures is controlled by the Styles assigned to the structures. The Style Lock must be in the On position to assure the graphical display of the structures produces the desired results. When displaying Projected structures, the bandwidth must be specified to display the desired structures within an area of interest.



## Create Cross Sections

> **Exercise: Create Custom Cross Sections with Drainage Structures.**

1. Select **Evaluation > Cross Section > Create Cross Section**.
2. Select the **Create Cross Section > Custom > General** leaf.



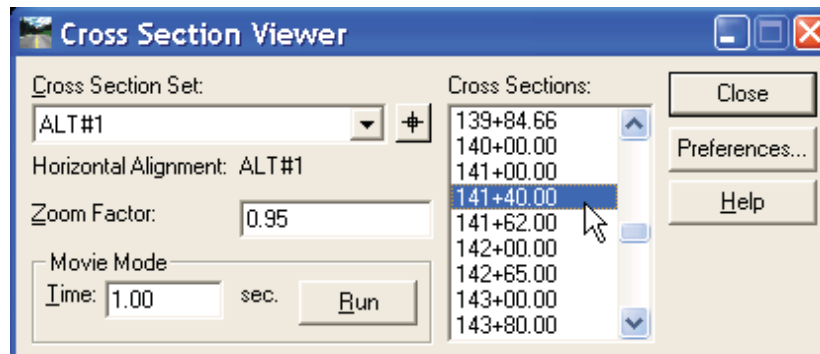
3. Click the **Import** button.
4. Select the **C:\2008 RBUC\W11 Cross Sections with Drainage Structures\Data\Custom Drainage Sections.xsc** and click **Open**.
5. Click the **Apply** button and click in the MicroStation View to create the cross sections.

The click location specifies the lower left hand corner of the cross section set.

6. Close the Create Cross Section dialog.

### Review the Cross Sections

1. Select **Evaluation > Cross Section > Cross Section Viewer**.



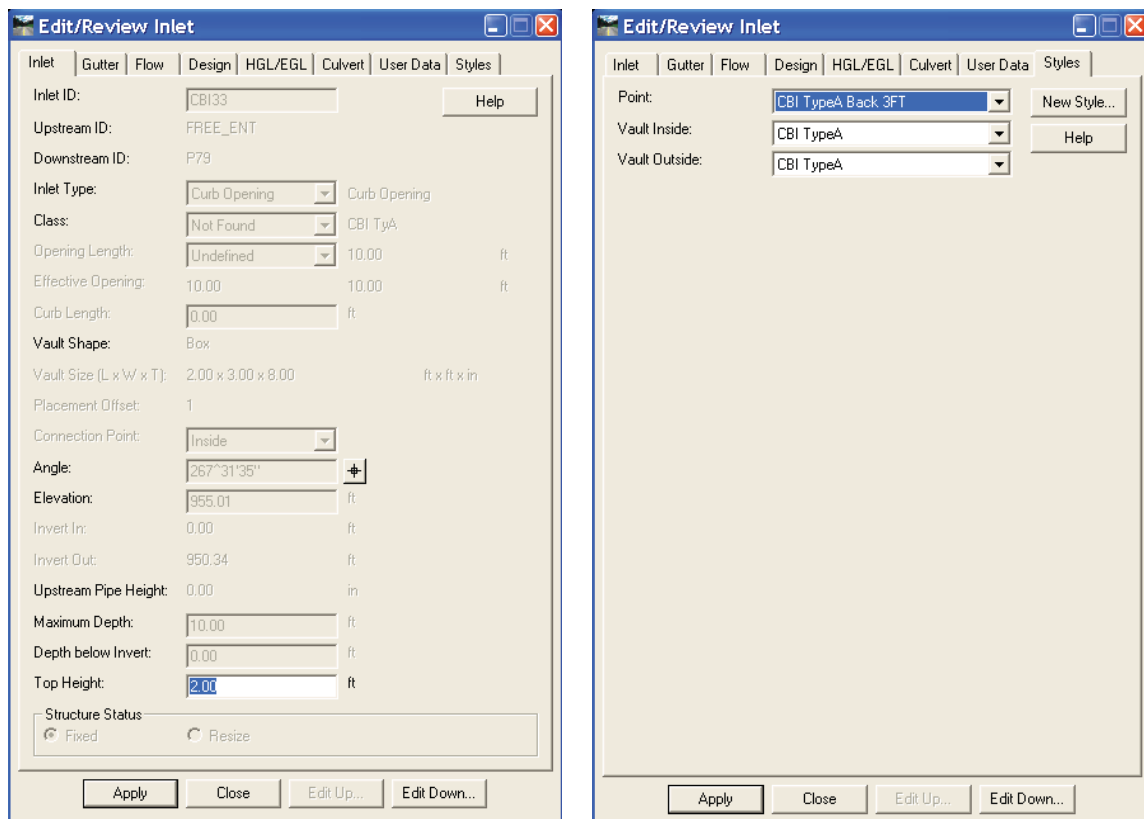
2. Step through several of the cross sections and review the drainage structures that are displayed.
3. Select station *141+40* from the *Cross Sections:* list.
4. Review the right and left inlets.
5. Close the Cross Section Viewer dialog.

## Displaying Drainage Structures Using Cells

Several drainage structure types have the option to select a Style for points. Manholes, inlets, pumps and utilities use Point Styles. The Style used by a drainage structure is specified in the Structures file. The Structure file assigns the Styles used when the drainage structure is being added to the database using the InRoads Storm & Sanitary's Layout command. Individual structure Styles can also be reviewed and modified using the Drainage > Edit/Review command.

The Styles used are configured using the Tools > Style Manager command. The drainage structure Styles are linked to Named Symbology through the Edit Style > Surface Features > Symbology leaf when editing a Style using the Style Manager. The Named Symbology can specify a cell to use when a drainage structure is being displayed as a point.

Cells used for inlets may be oriented differently depending on which side of road the inlet is located. Different Styles can be used to specify left and right cells, which reflect the differences in the orientation.



## Adding a Cell to the Style

> *Exercise: Add a Cell to the Left and Right Inlets at station 141+40.*

### Add a Cell to the Left Inlet

1. Select **Drainage > Edit/Review**.
2. At the “Key in ID or identify structure” prompt select the inlet on the left side (CBI34) of the cross section.
3. Accept your selection by clicking on the View.
4. Select the **Styles Tab** on the Edit/Review Inlet dialog.

Notice the Style of the *Point*: is *CBI TypeA Back 3FT*.

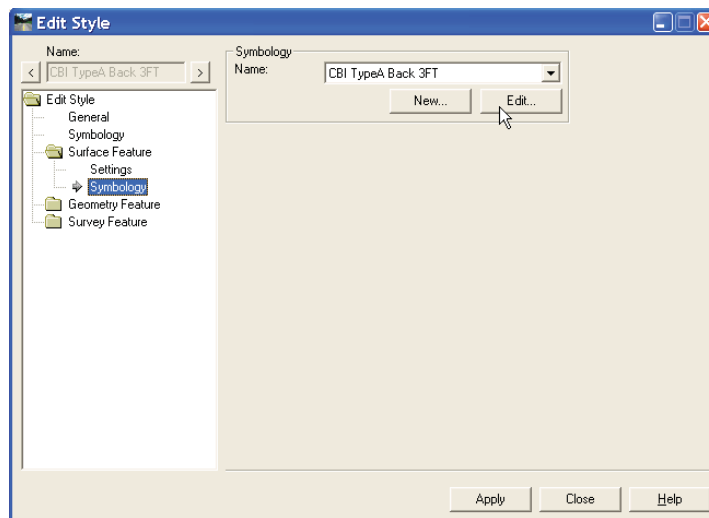
5. Select the **New Style** button.

This is a shortcut to the **Tools > Style Manager** command.

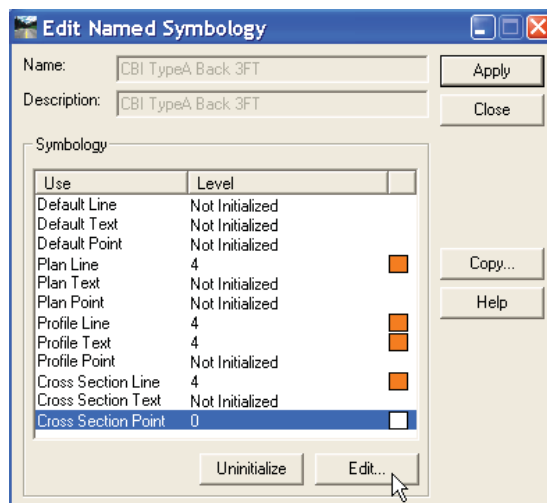
6. Select the *Style* named *CBI TypeA Back 3FT* and click the **Edit** button.

7. Select the **Edit Style > Surface Feature > Symbology** leaf.

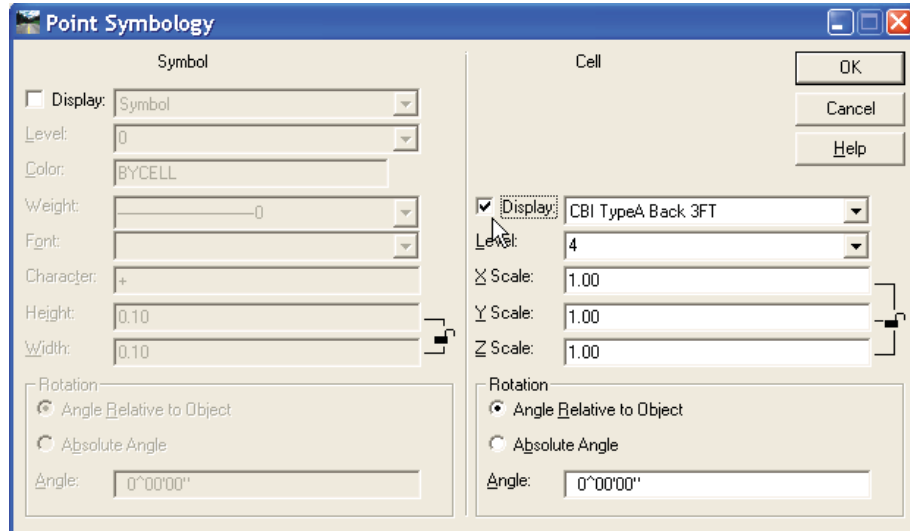
This Style uses the *Named Symbology* called *CBI TypeA Back 3FT*.



8. Click the **Edit** button.
9. This is a shortcut to the **Tools > Named Symbology** command.
10. Select the *Cross Section Point* symbology and click the **Edit** button.



11. Enable the *Cell Display* option and select the cell named *CBI TypeA Back 3FT* and click **OK**.



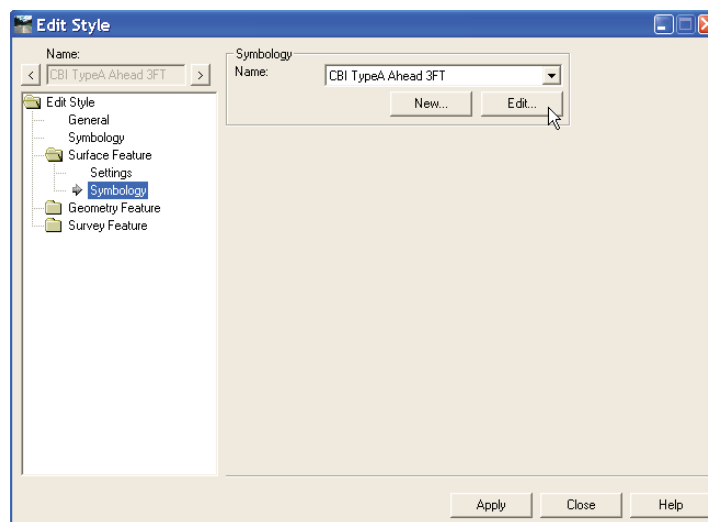
12. Click **Apply** and **Close** on the Edit Named Symbology dialog.
13. Click **Apply** and **Close** on the Edit Style dialog.

## Add a Cell to the Right Inlet

The right inlet uses a Style named *CBI TypeA Ahead 3FT*. We can change that Style while the Style Manager dialog is open.

1. Select the *Style* named *CBI TypeA Ahead 3FT* and click the **Edit** button.
2. Select the **Edit Style > Surface Feature > Symbology** leaf.

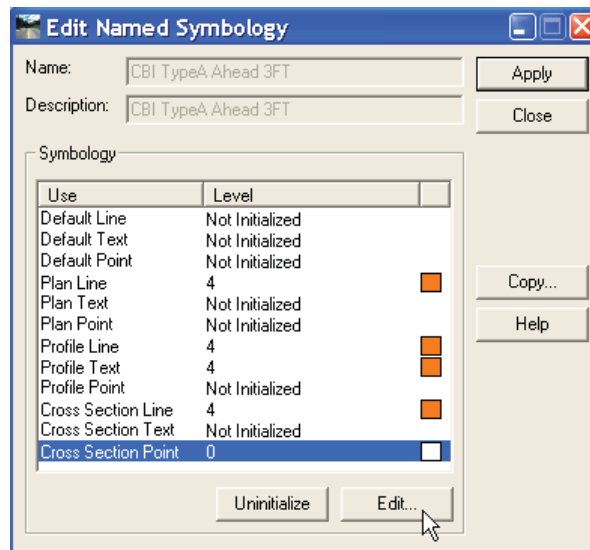
This Style uses the *Named Symbology* called *CBI TypeA Ahead 3FT*.



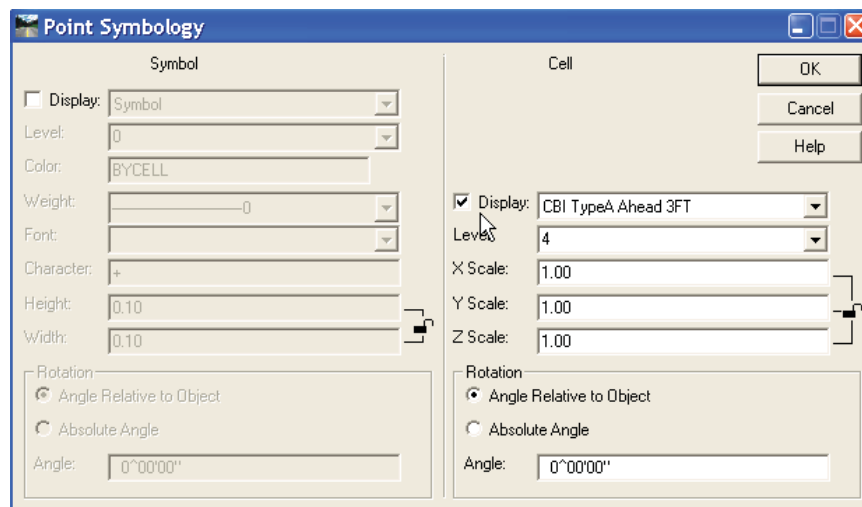
3. Click the **Edit** button.
4. This is a shortcut to the **Tools > Named Symbology** command.



5. Select the *Cross Section Point* symbology and click the **Edit** button.



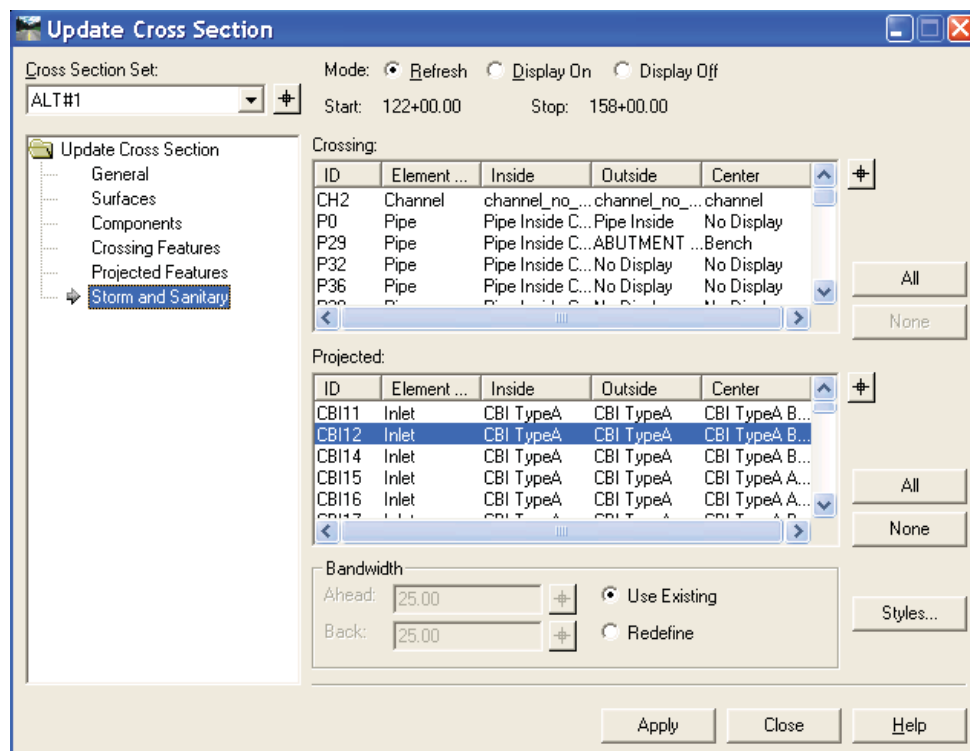
6. Enable the *Cell Display* option and select the cell named *CBI TypeA Ahead 3FT* and click **OK**.



7. Click **Apply** and **Close** on the Edit Named Symbology dialog.
8. Click **Apply** and **Close** on the Edit Style dialog.
9. **Close** the Style Manager dialog.

## Updating Cross Section Drainage Structures

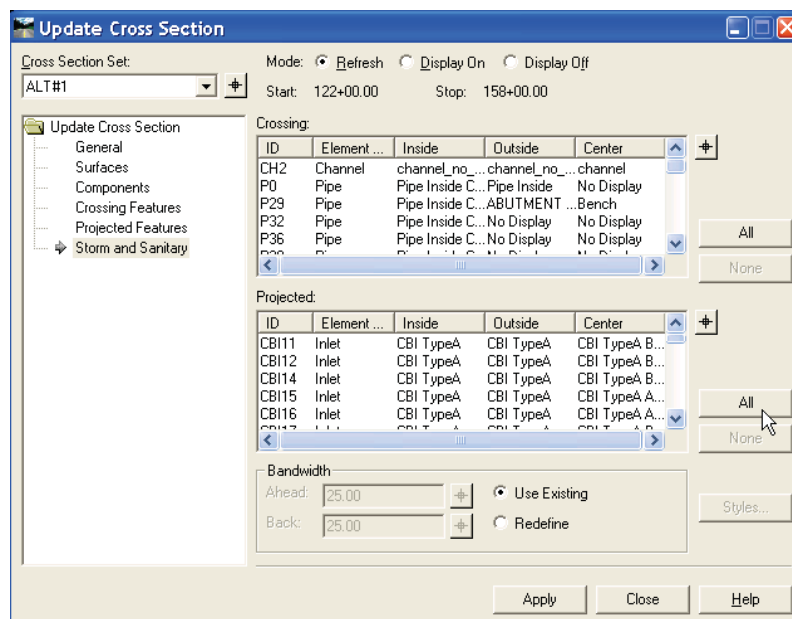
The Update Cross Section command allows you to update the drainage structures graphics on cross sections. One option is to Refresh or synchronize the graphics with changes made to the drainage database. This refresh also includes any changes made to the Styles associated with the drainage structures. Drainage structures can be added or removed using the Display On or Display Off options. Select the Update Cross Section > Storm and Sanitary leaf from the Update Cross Section dialog and select the drainage structures to update. The bandwidth may also be redefined during the update. If you need to change the Styles, there is a Styles button on this leaf that opens the Style Manager dialog.



## Update Cross Section

> **Exercise: Update Drainage Structures in the Cross Sections.**

1. Select **Evaluation > Cross Section > Update Cross Section.**
2. Select the **Update Cross Section > Storm and Sanitary** leaf.



3. Click the **All** button next to the *Projected*: structures.
4. Click the **Apply** and **Close** button.
5. Review the inlet graphics.

Notice the original inlet graphics overlap the cell graphics.

## Top Height Parameter

In the last exercise, the inlet cell was displayed on top of the normal inlet structure graphics. The normal graphic can include the Inside and Outside Vaults, which are shown as concentric rectangles. Using a cell can better represent more complicated structures. To create an opening in the top of the normal vault graphics, the Top Height parameter can be used. The Top Height is the amount of the vault graphic that is clipped from the vault's top. This is measured down from the structure's stored elevation. If the inlet's center style has a cell specified in its cross section point symbology and the inlet or manhole has a top height greater than 0.0, the top of the vault is clipped the top height amount. The specified cell's origin will be placed at a location that is horizontally centered on the vault and vertically located at the structure's stored elevation. The Top Height parameter applies to both inlets and manholes.

**Edit/Review Inlet**

Inlet | Gutter | Flow | Design | HGL/EGL | Culvert | User Data | Styles

Inlet ID: CBI33 Help

Upstream ID: FREE\_ENT

Downstream ID: P79

Inlet Type: Curb Opening Curb Opening

Class: Not Found CBI TyA

Opening Length: Undefined 10.00 ft

Effective Opening: 10.00 10.00 ft

Curb Length: 0.00 ft

Vault Shape: Box

Vault Size (L x W x T): 2.00 x 3.00 x 8.00 ft x ft x in

Placement Offset: 1

Connection Point: Inside

Angle: 267°31'35" +

Elevation: 955.01 ft

Invert In: 0.00 ft

Invert Out: 950.34 ft

Upstream Pipe Height: 0.00 in

Maximum Depth: 10.00 ft

Depth below Invert: 0.00 ft

Top Height: 2.00 ft

Structure Status

Fixed  Resize

Apply Close Edit Up... Edit Down...

## Changing the Top Height

> *Exercise: Clip the Inlet Graphics Using the Top Height.*

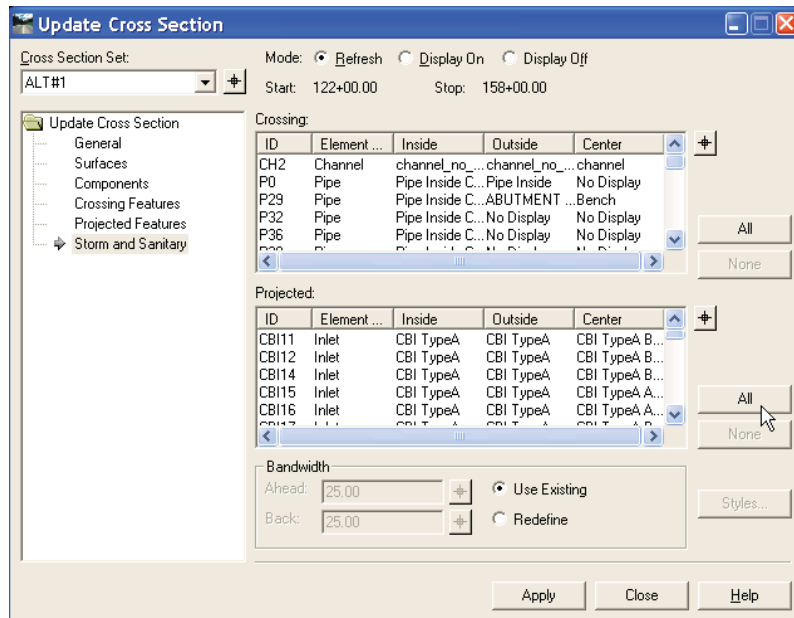
1. Select **Drainage > Edit/Review**.
2. Select the left inlet (CBI34).
3. Change the *Top Height:* to 2.0.
4. Click **Apply** and then **Close**.
5. Select **Drainage > Edit/Review** again.
6. Select the right inlet (CBI35).
7. Change the *Top Height:* to 2.0.
8. Click **Apply** and then **Close**.

**Warning** The Top Height parameter is stored in the Drainage file (.sdb). InRoads Storm & Sanitary must be used to save the Drainage file (.sdb).

### Update the Cross Sections Again

1. Select **Evaluation > Cross Section > Update Cross Section**.

2. Select the **Update Cross Section > Storm and Sanitary** leaf.



3. Click the **All** button next to the *Projected*: structures area.
4. Click the **Apply** button and then **Close**.
5. Review the inlet graphics.

Notice the original inlet graphics are now clipped and no longer overlap the cell graphics.



## **Drafting Notes and Drainage Structures**

### **Module Overview**

The InRoads Drafting Notes now include Storm & Sanitary variables. This module will step you through placing existing notes on drainage structures in cross sections. You will also create a new note and place that note on a drainage structure.

### **Module Objectives**

- Place several existing notes on drainage structures in cross section.
- Create a new cross section note and place that note.

## Drafting Tools

Drafting tools are used to place intelligent notes in plan, profile, and cross section views. Intelligence refers to the notes ability to extract computed values from InRoads elements and include the computed values in the note. For example, when labeling a surface feature, the note can include the feature's name, description, style, length, etc. Computed values can be extracted from InRoads surfaces, geometry, and InRoads Storm & Sanitary drainage elements. Drafting notes can also be used on MicroStation elements which are not related to InRoads.

Drafting tools are located in the Drafting drop-down menu. Drafting note tools are separated into which view the note is being placed. There are three views: plan, profile, and cross section. For example, to place or create a cross section note, you would use **Drafting > Place Cross Section Note**.

Notes can be easily created and saved to be reused in different projects.

Other drafting tool benefits include the ability to dynamically scale and rotate the note when placing the notes. After the notes are placed, there are tools to update and move notes. If the note applies to more than one item, you can place a note with multiple leader lines. Various terminator types are available for use, which include Filled, Hollow, Open, and Cell. Notes can be created using various text frame shapes, which include Circle, Ellipse, Polygon, Box , Capsule, and Bar.

## Place Cross Section Note

**Place Cross Section Note** is used to place notes in the cross section views. Select **Drafting > Place Cross Section Note**. This will bring up the Place Cross Section Note dialog.

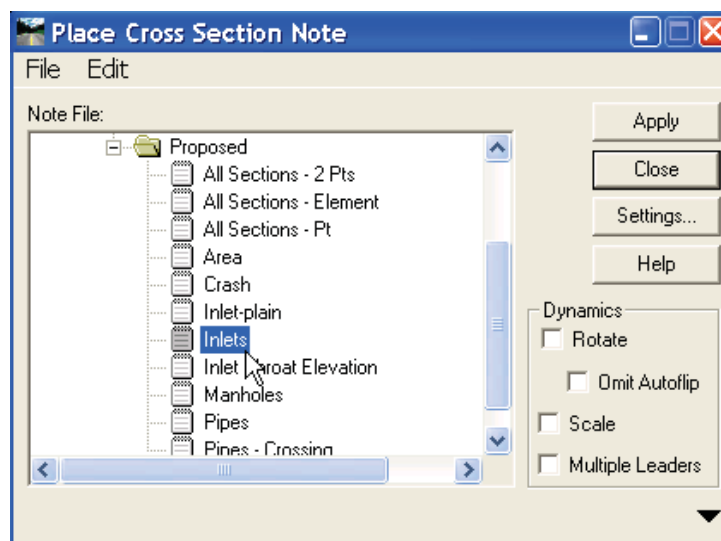
The basic workflow for placing cross section notes is to first enable any dynamics options if needed. Then navigate and select the cross section note you want to place. Click **Apply** and follow the prompts located in the MicroStation status bar.



## Place Cross Section Notes on Structures

> *Exercise: Use the Place Cross Section Note command to Label Drainage Structures.*

1. Select **Drafting > Place Cross Section Note**.
2. Select **File > Open** from the Place Cross Section Note dialog menu.
3. Select the Note file *C:\2008 RBUC\W11 Cross Sections with Drainage Structures\Data\notes.dft* and click **Open**.
4. Navigate and select the *Sections > Proposed > Inlets* note.



5. Click the **Apply** button and select one of the inlets on the cross section. Follow the prompts in the MicroStation status bar.
6. Right-click to return to the Place Cross Section Note dialog.
7. Navigate and select the *Sections > Proposed > Inlet Throat Elevation* note.

8. Click the **Apply** button and select one of the inlets on the cross section. Follow the prompts in the MicroStation status bar.
9. Right-click to return to the Place Cross Section Note dialog
10. Navigate and select the *Sections > Proposed > Pipes* note.
11. Click the **Apply** button and select one of the pipes on the cross section. Follow the prompts in the MicroStation status bar.
12. Select the other pipe on the cross section. Follow the prompts in the MicroStation status bar.
13. Right-click to return to the Place Cross Section Note dialog.

## Creating Notes

To create a note, you must use the appropriate command. To create plan notes, use **Place Plan Note**. Likewise, to create profile notes, use **Place Profile Note**. Cross section and alignment intersection notes are also created using their respective placement commands.

The note file folder structure is completely customizable and is defined by the user. You can build the folder structure and notes to fit your needs. It is recommended that plan, profile, and cross section notes be separated into different folders because the notes are created specifically for each view type.

## Creating Note Names

To create a new note name, select an existing folder. Then, use **File > New > Note** from the Place Note pull-down menus. Note names can be created using any of the Place Note tools. Instead of using the File menu commands, you can right-click on any folder and access the File menu commands through pop-up menus. Finally, key-in the name of the newly created note. To rename a note, right-click on the folder and select the Rename command.

## Note Content

The content of any note consists of text and computed values. To reveal the note creation and editing portion of the Place Note dialogs, click the **Expand** arrow located directly below the Dynamics portion of the dialog.

## Text

Any text can be included in a note. Key-in any text that you want to appear in a note in the Note area of the dialog. The Note area works like Notepad. You can right-click in this area and select common commands like Copy, Paste, Cut and Delete. Windows hot-keys may also be used in this area. For example, using the CTRL-Z combo invokes the Undo command. There are numerous icons adjacent to the Note area to assist you in creating notes.

## Computed Values

Computed values are used to display extracted data from InRoads graphics or pure MicroStation graphic elements. Computed values can be selected from the Inserts area of the Place Notes dialogs. Computed values are organized into a folder structure. There are three main categories: General, Geometry, and Surface. Under each category there are related computed values to be used for creating notes. To include a computed value in a note, navigate to the appropriate computed value and double-click it. The computed value will then appear in the Note area.

Computed values use a very specific naming convention and format. When used, they appear in the Note area as text inside curved brackets. For example, the “Offset” computed value has the format {OFFSET}. Computed values can be combined with regular text in the Note area. If the computed value is not found when creating the note, the computed value will appear in the note text as text inside curved brackets. For example, if you use a note that is looking for surface feature information and you identify an element that is not a surface feature, then the computed value will not be calculated.

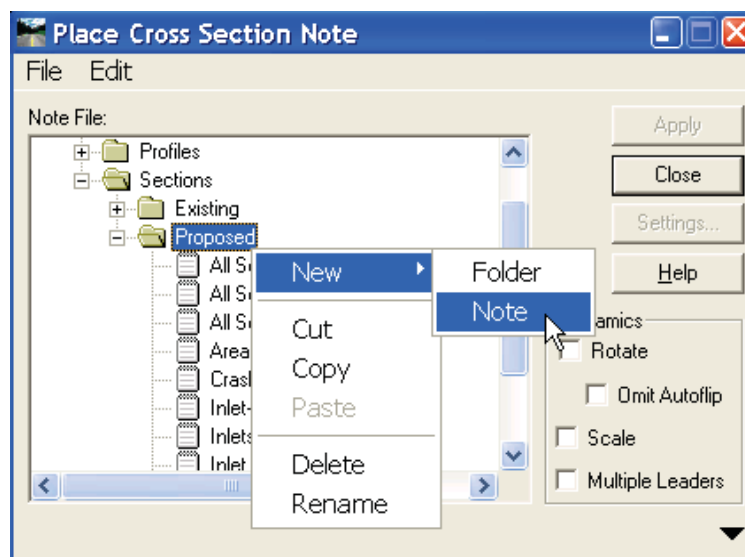
The Storm and Sanitary Structures computed values allows you create notes used to label drainage elements created using the InRoads Storm & Sanitary software. When a drainage database has been opened, the list of available computed values is displayed.

## Create a Drainage Note

> > *Exercise: Create and Place a Cross Section Note.*

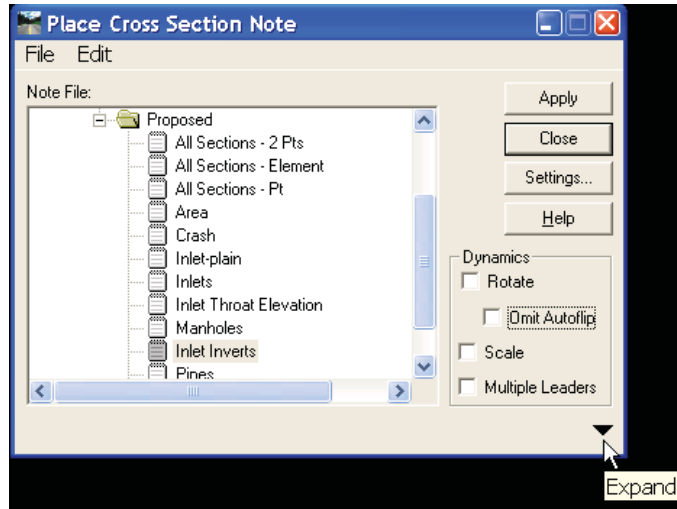
>

1. In the Place Cross Section Note command, navigate and select the **Sections > Proposed** folder.

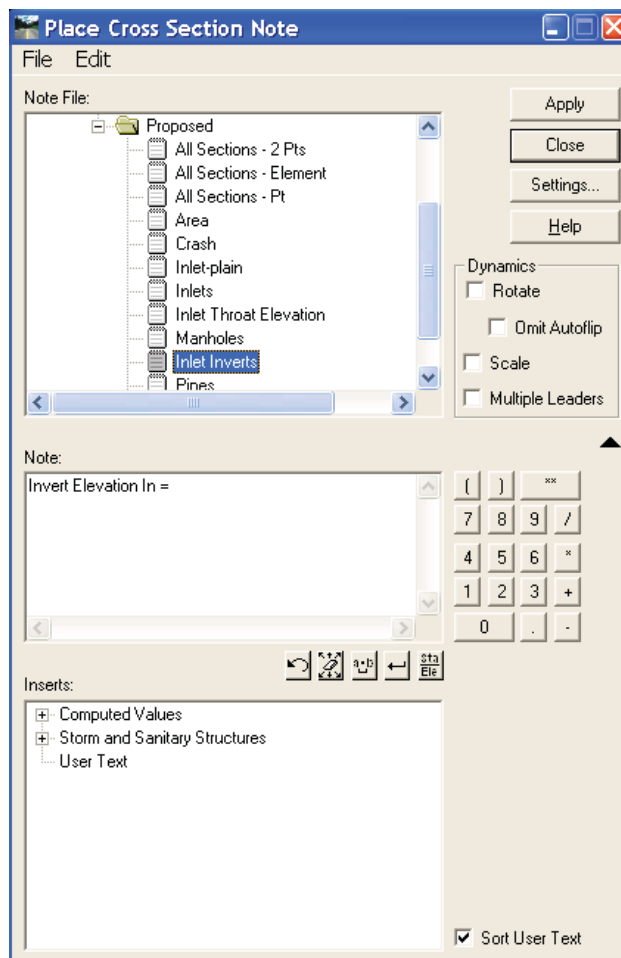


2. Right-click the **Proposed** folder and select **New > Note**.
3. Key-in the Note name as *Inlet Inverts*.

- Click the **Expand** button located at the bottom right of the dialog.

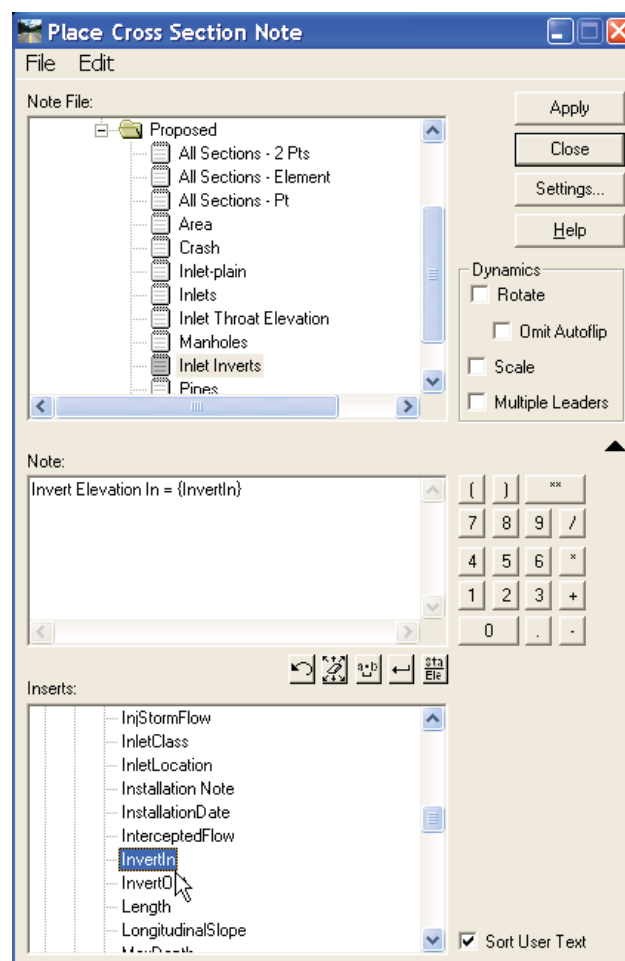


- Key-in *Invert Elevation In =* in the *Note:* area of the dialog.



6. Click the + sign next to the **Storm and Sanitary Structures** in the *Inserts:* area of the dialog.
7. Navigate to the **Storm and Sanitary Structures > Inlets > InvertIn** insert.
8. Double-click the *InvertIn* insert.

This will insert the *{InvertIn}* variable in the *Note:* area of the dialog.

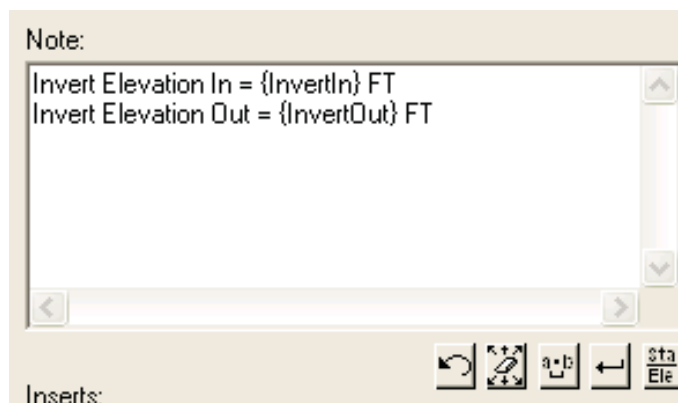


9. Put your cursor next to *{InvertIn}* variable in the *Note:* area and press the Space bar on your keyboard. Key-in *FT* and press Enter on your keyboard.

10. Key-in *Invert Elevation Out =* in the *Note:* area of the dialog.
11. Navigate to the **Storm and Sanitary Structures > Inlets > InvertOut** insert.
12. Double-click the *InvertOut* insert.

This will insert the *{InvertOut}* variable in the *Note:* area of the dialog.

13. Put your cursor next to *{InvertOut}* variable in the *Note:* area and press the Space bar on your keyboard. Key-in *FT* and press Enter on your keyboard.
14. The *Note:* area should look like this now.



15. Select **File > Save** from the Place Cross Section Note dialog menu.



## Note Settings

When creating a note, click **Settings** to configure the setting of that note. Each note can have its own settings defined. If you copy a note, the settings are also copied. Using the Copy command could save you time creating new notes if the settings are similar. The Settings dialog is where the placement mode is specified. Select one of the three placement modes: Data Point, Two Data Points, or Element. Drainage notes generally use the Element placement mode, since the information about the drainage database is contained in the drainage structure graphics.

The symbology of the note is specified here using the Named Symbology portion of the dialog. You can use different symbology for each part of the note or use the Lock icon to select one named symbology for all the different parts of the note.

The text frame is also specified in the Settings dialog. The shape can be a Box, Circle, Ellipse, Polygon, Bar, Capsule, or None.

The leader type and terminator are specified here. The leader type can be 2 Point, 3 Point, or none. The terminator can be Filled, Hollow, Open, Cell, Named Symbology, or None.

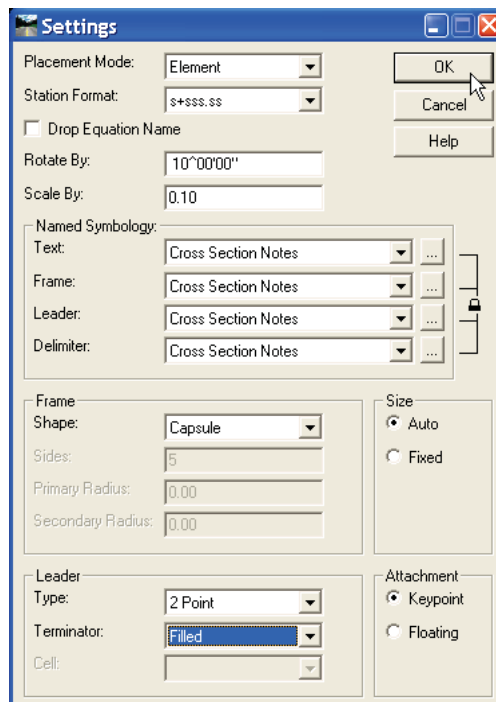
## Configure the Note Settings

> > *Exercise: Setup the Display Setting of the New Note.*

1. Select the **Settings** button from the Place Cross Section Note dialog.
2. Change the *Placement Mode:* to *Element*.
3. Change the Named Symbology *Text:* to *Cross Section Notes*.

The Lock next to the *Named Symbology:* area will use the same Named Symbology for all the note graphics, if enabled.

4. Change the *Frame Shape:* to *Capsule*.
5. Change the *Leader Terminator:* to *Filled*.
6. The Settings dialog should look like this now:



7. Click the **OK** button.
8. Select **File > Save** from the Place Cross Section Note dialog menu.

### **Place the Inlet Inverts Note**

1. Click the **Apply** button and select one of the inlets on the cross section. Follow the prompts in the MicroStation status bar.
2. Right-click to return to the Place Cross Section Note dialog.
3. Close the Place Cross Section Note dialog.

## Workshop Review

InRoads now includes Storm & Sanitary tools which allow InRoads users to display drainage structures in plan and cross section views. The Drafting Notes can now be used to label drainage structures in plan, profile and cross section views.

The drainage structure Styles are now defined in the Structures file and are assigned to the structures when the drainage is placed using the Storm & Sanitary Layout tool. Enabling the Style Lock will use the drainage Styles to control the symbology of the drainage structures in plan, profile, and cross section. Individual drainage structure Styles can be modified using the Drainage > Edit/Review tool. The drainage Styles are linked to the Named Symbology and is associated with the Style's Surface Feature Symbology.

Cross Sections can include drainage structures and will show crossing and/or projected features on the cross sections. The projected drainage is based on a bandwidth, which is defined when creating the cross sections. The Update Cross Section command allows you to refresh the drainage structures and modify the bandwidth.

Custom cross sections are very useful for displaying drainage structures in cross section. Custom cross sections allow you to automatically create cross sections which are perpendicular to drainage structures and vary the bandwidth from station to station. Skewed and Linestring cross sections can be used to help visualize the drainage structures in custom cross sections. A custom cross section set can be saved and then later imported if needed for future use.

Several structure types allow for the use of Point Styles. This allows you to use cells to represent more complex structures. Inlets and manholes are displayed as concentric rectangles in cross sections. The Top Height parameter can be used to clip the top of the vault graphics when a cell is being used.

## Review Questions

1. Can projected and crossing drainage structures be added to a cross section set after the cross section set is created?
2. When using a cell to display a drainage structures, does the Top Height parameter change the display if it is set to zero?
3. Can a single Drafting Note include information about drainage structures and also include surface and geometry data?

## Answers to Questions

### Introductory Answers

1. Unlimited.
2. Yes. Point features may also be projected to both cross sections and profiles.
3. Yes. A mapped drive or UNC path can be used.

### Review Answers

1. Yes. Use the Display On option in the Update Cross Section command.
2. No. Only Top Height values larger than zero will result in vault top clipping.
3. Yes. Also, any general text may be included in any note.