



# E6 - Modeling Utilities and Drainage Structures

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P.E.(FL)



# Ways to Evaluate your Design

View the data

- Plan
- Profile
- Cross Section
- 3D View>Drainage as Solids



# Ways to Evaluate your Design

Annotate the data

- Plan Annotation
- Profile Annotation
- Place Notes



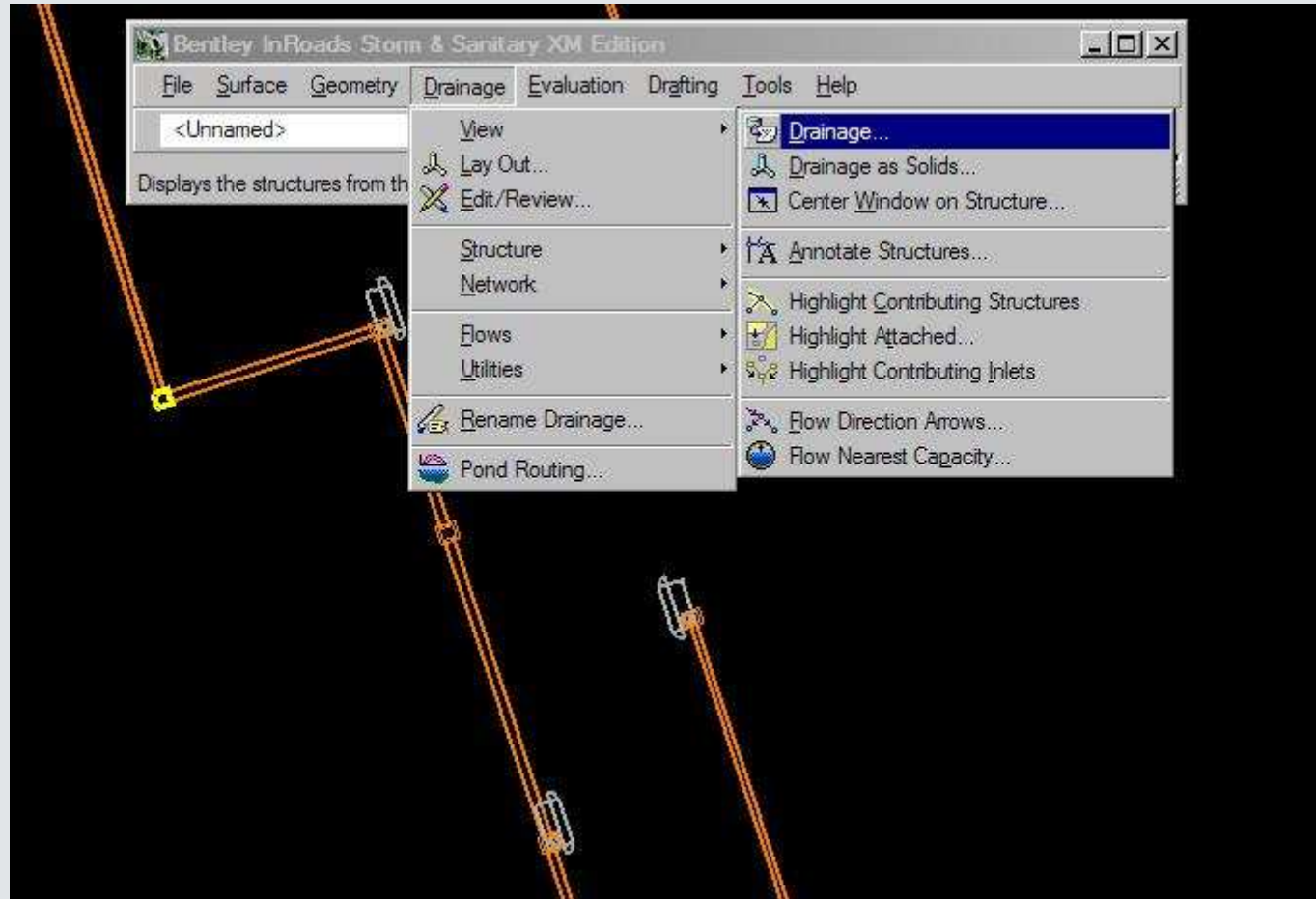
# Ways to Evaluate your Design

## Evaluate the data

- Reports
- Queries
- InRoads Explorer
- Edit/Review



# Plan



## Style Lock On or Off

- Tools>Locks>Style -  
**“On” = GOOD, “Off” = BAD**
- When “On” each structure’s styles control their display and therefore no dialog is required.
- When “Off” the display is controlled by the command’s settings.
- Many commands, Create Cross Section, and Update Cross Section ALWAYS operate as if Style Lock is “On”



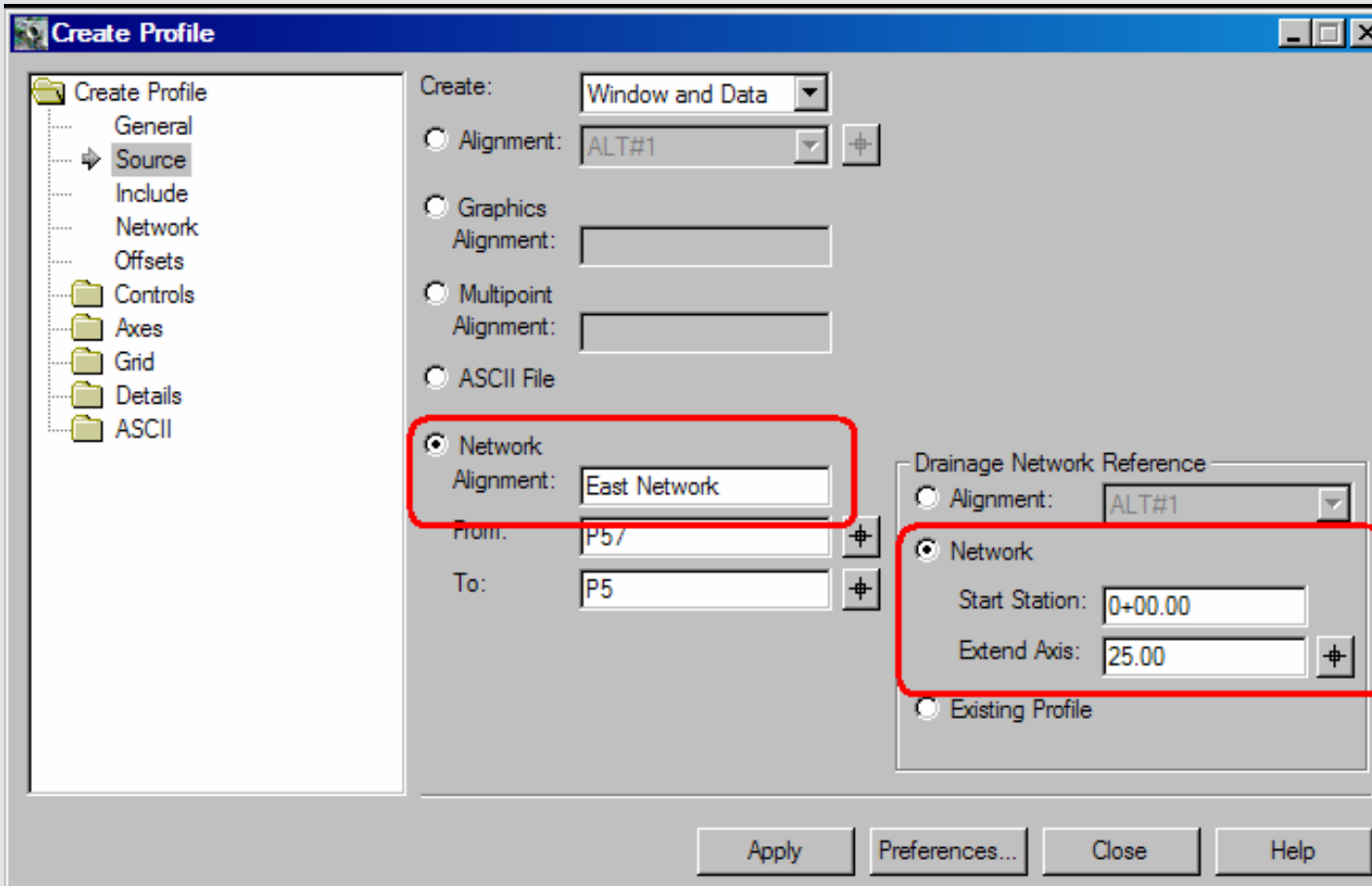
# Profile

The screenshot displays the Bentley InRoads Storm & Sanitary XM Edition software interface. The main window shows a profile view with a vertical axis on the left and a horizontal axis at the bottom. The vertical axis has red numerical labels: 30, 32, 34, 36, 38, 40. The horizontal axis has red numerical labels from 0+00 to 2+00 in increments of 10. A red line represents the ground surface, and an orange line represents the proposed profile. A context menu is open over the profile, listing the following options: Create Profile..., Annotate Profile..., Annotate Feature In Profile..., Annotate Drainage Profile..., Update Profile..., Update Drainage Profile..., Check Pipe Cover..., and Rename Profile Set... The software title bar reads 'Copy of SS\_solids.dgn (3D - V8 DGN) - MicroStation V8 XM Edition'. The menu bar includes File, Edit, Element, Settings, Tools, Utilities, Workspace, Window, and Help. The toolbar contains various icons for navigation and editing. A secondary window titled 'Bentley InRoads Storm & Sanitary XM Edition' is also visible, showing a menu with options like Profile, Hydrology and Hydraulics, and Drainage Structure Analyzer...



# Create Profile Alignment

- Create an alignment of the Network





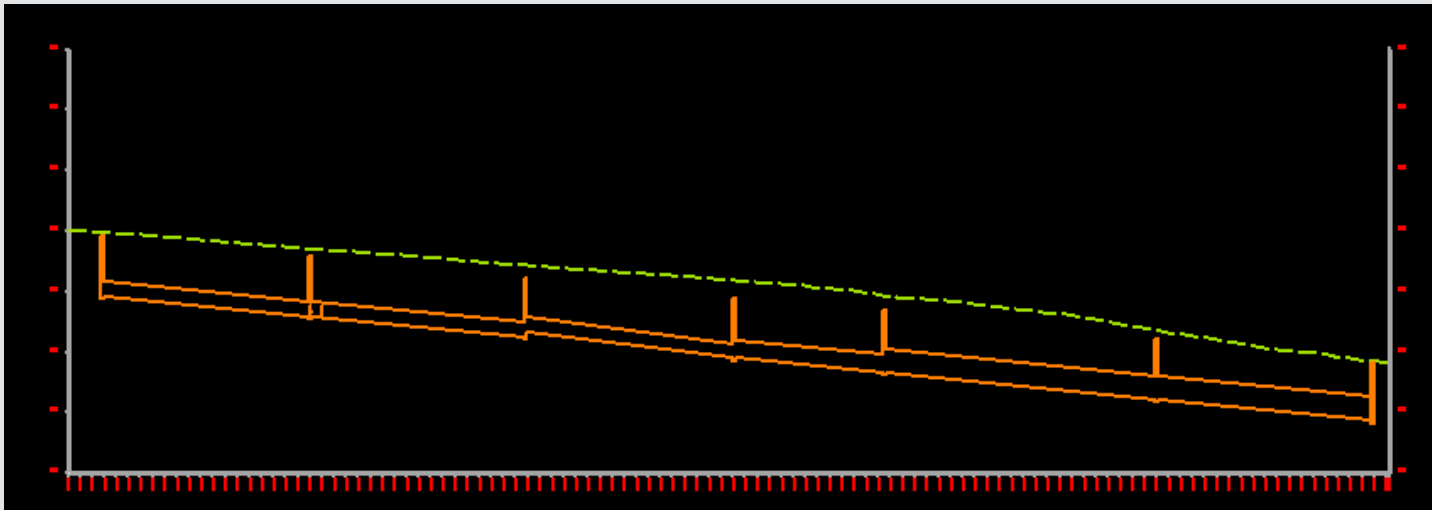
## 4 Types of Profiles

- Existing Alignment Profile
- Network Profile w/ Alignment Reference
- Network Profile w/ Network Reference
- Network Profile w/ Network Reference  
(Which Created a new Alignment)



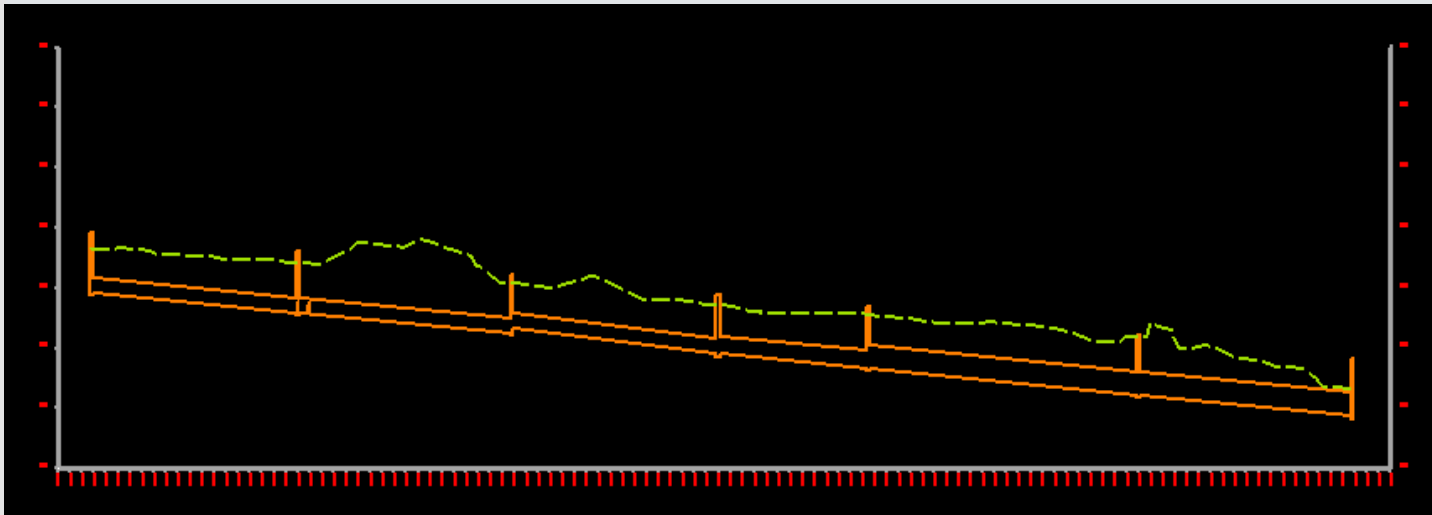
## Existing Alignment Profile

- Surfaces DO NOT **Update** with “UPDATE DRAINAGE PROFILE”.
- Surfaces **Update** Along the Alignment with “UPDATE PROFILE”.



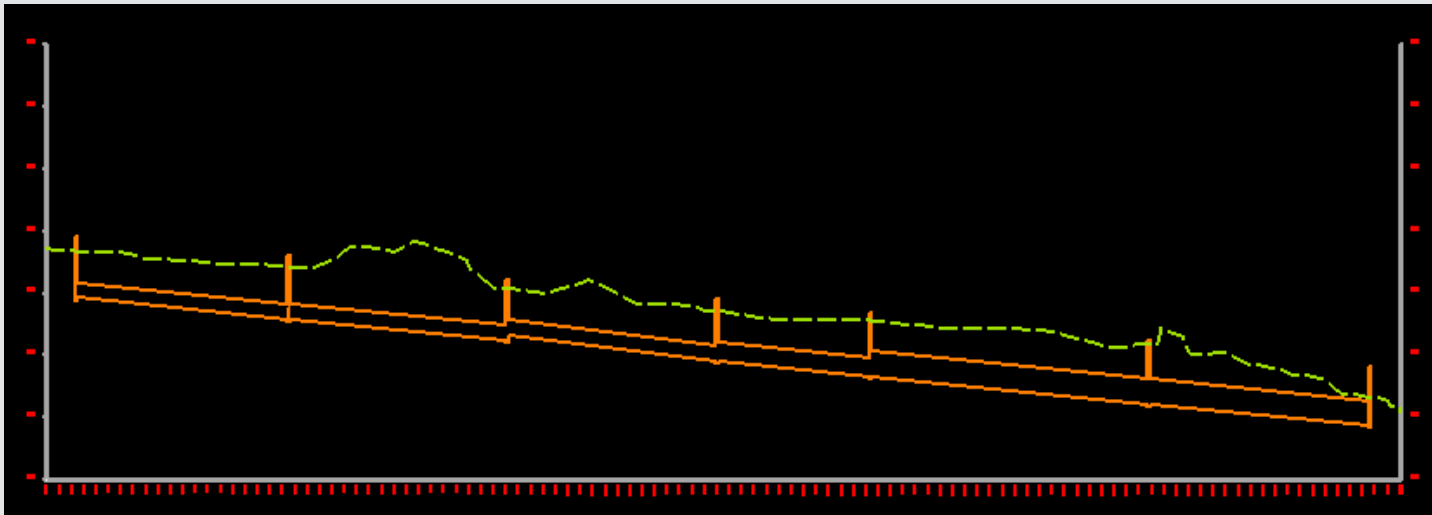
## Network Profile – With *ALIGNMENT* Reference

- Surfaces **Update** Along Network with “UPDATE DRAINAGE PROFILE”.
- Surfaces **Update** Along Alignment With “UPDATE PROFILE”.



## Network Profile – With *NETWORK* Reference

- Surfaces **Update** Along the Network with “UPDATE DRAINAGE PROFILE”.
- Surfaces **DO NOT Update** with “UPDATE PROFILE”.

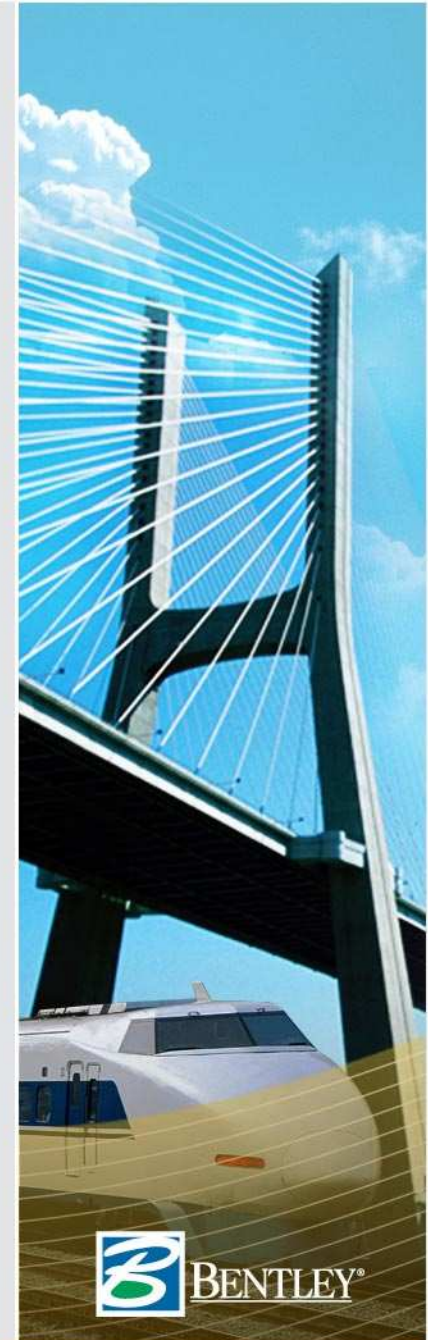


## Network Profile – With Network Reference (which created a **new alignment**)

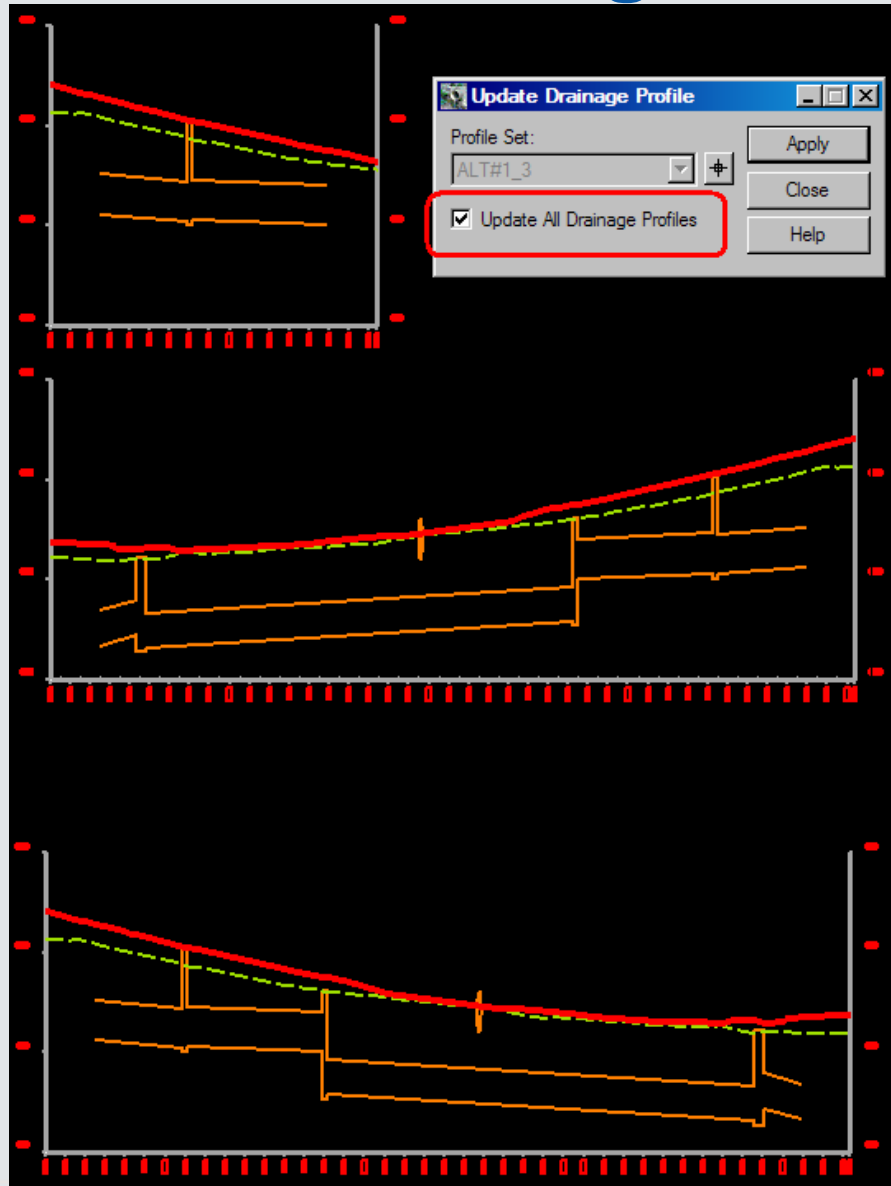
- Surfaces DO NOT **Update** with “UPDATE DRAINAGE PROFILE”.
- Surfaces **Update** Along Alignment With “UPDATE PROFILE”.

Which is Identical to the Network Path.

- Remember to Save the Newly Created Alignment!!!

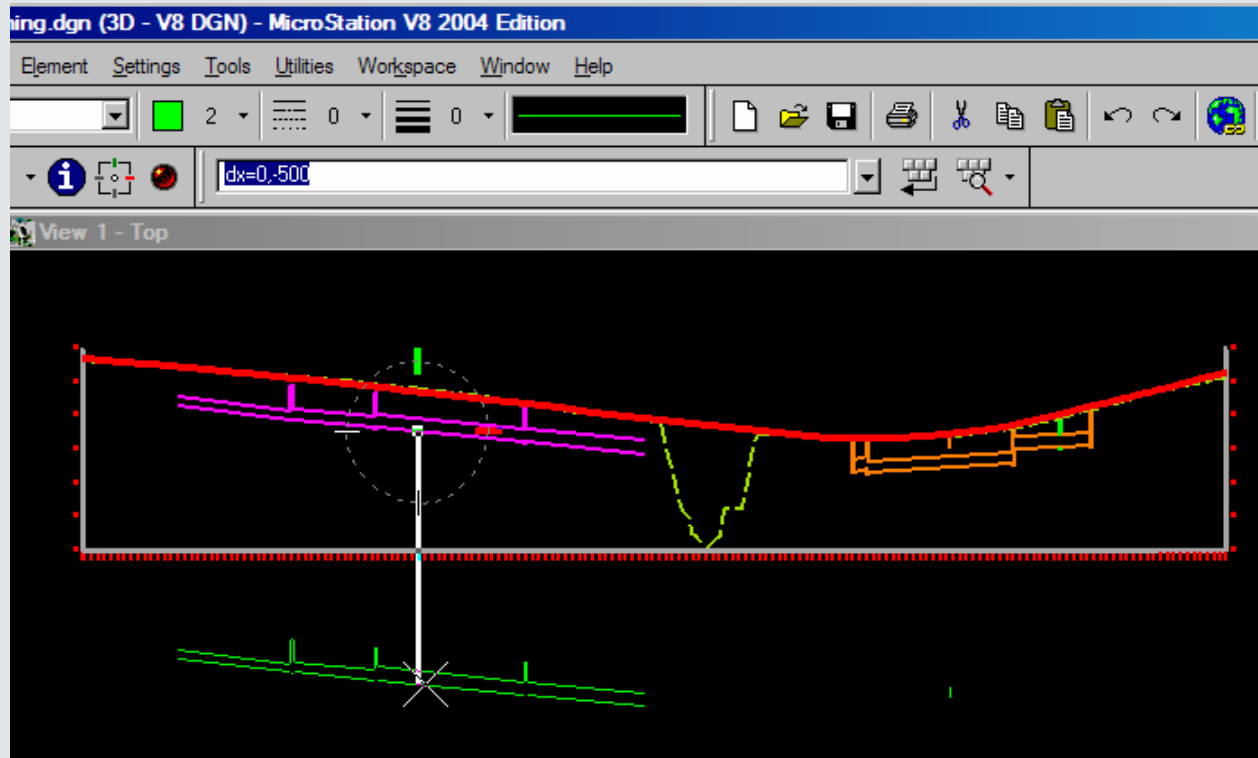


# Update All Drainage Profiles



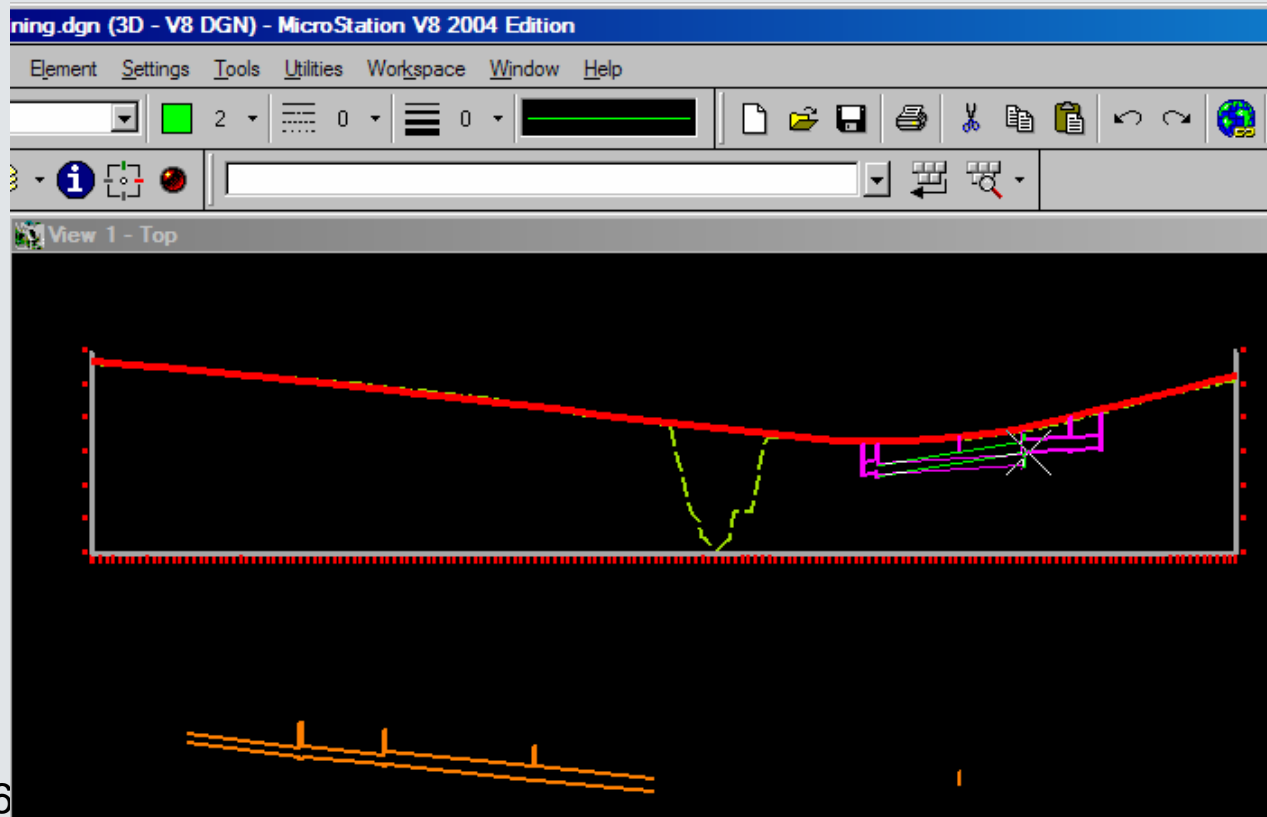
# Update or Modify Multiple Networks in an Alignment Profile

- Turn on Graphic Group.
- Use Mstation to Move ALL but one Network out of the Profile Window. (dx = 0,-500)



# Update or Modify Multiple Networks in an Alignment Profile

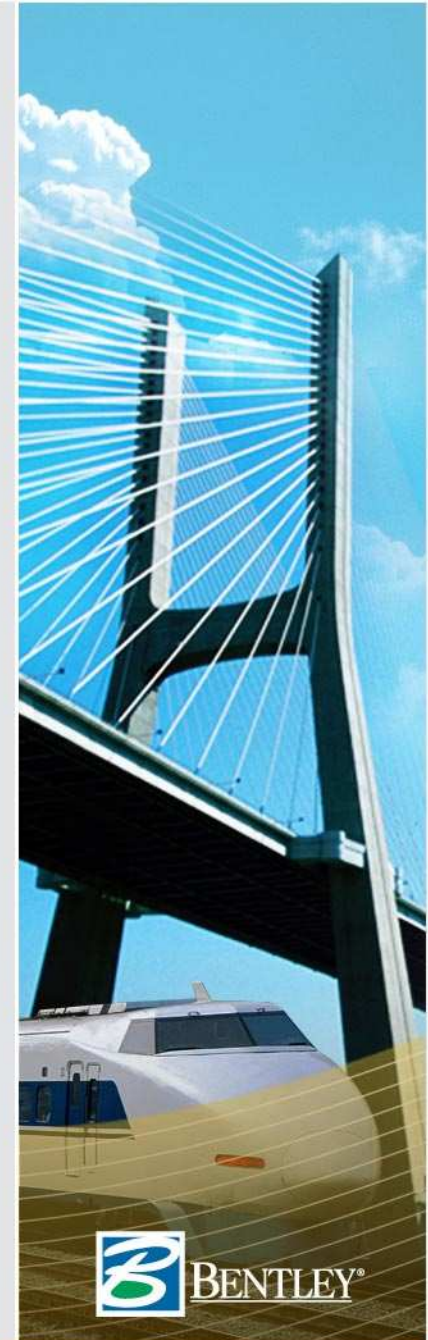
- Use Move in Profile or Edit/Review to make your modifications.
- Then use Update Drainage Profile if required.



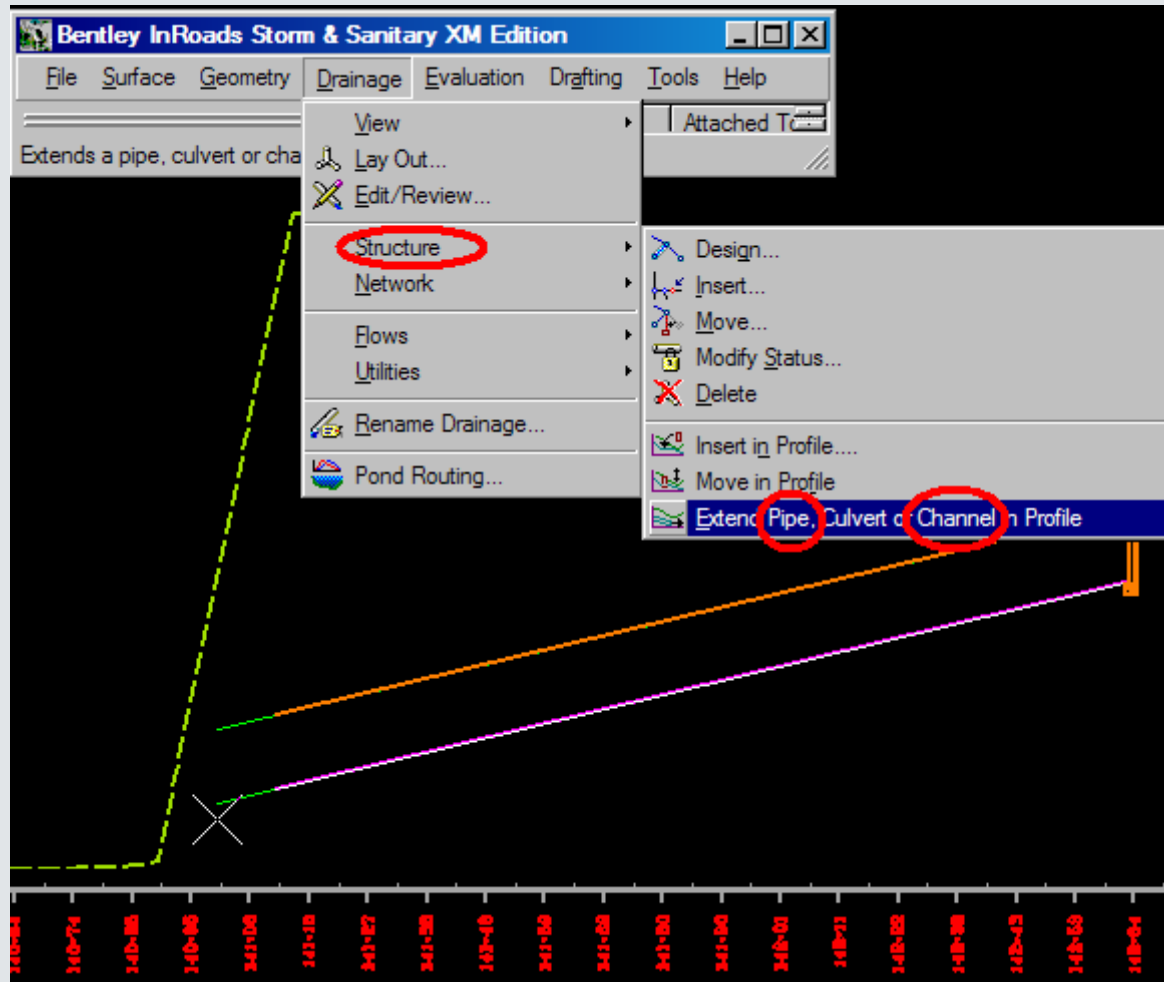


# Update or Modify Multiple Networks in an Alignment Profile

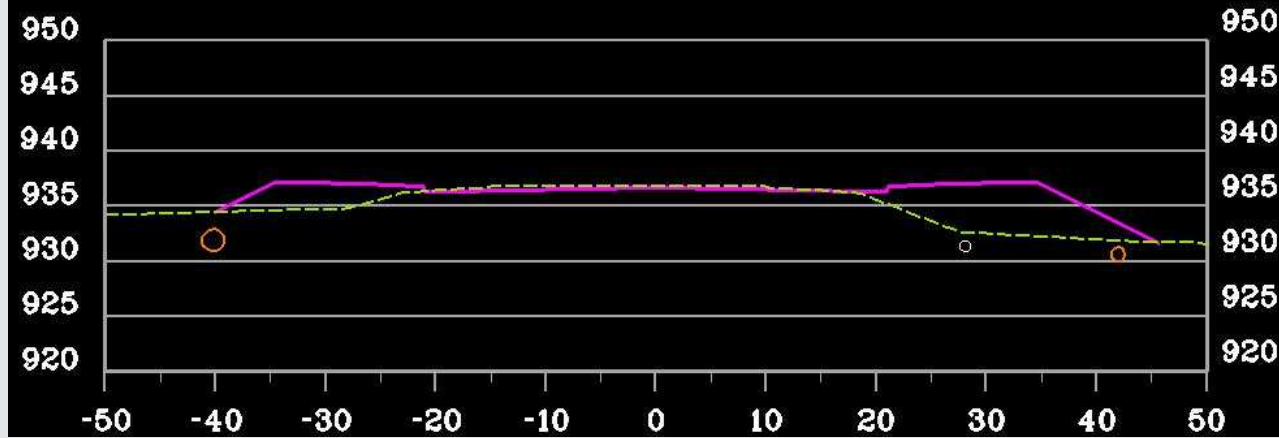
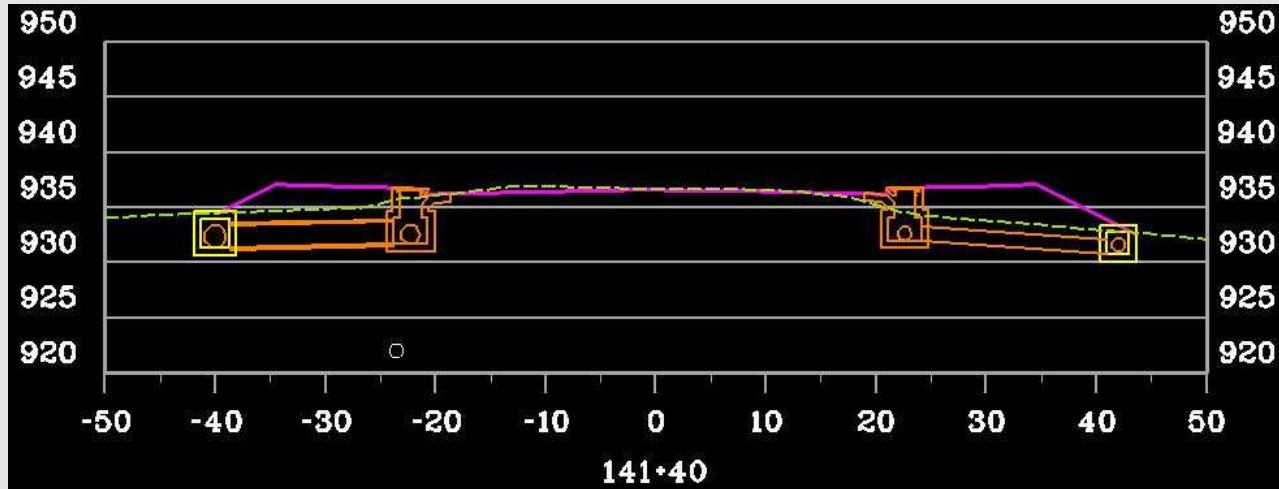
- Make sure to turn on Graphic Group.
- Use Mstation to Move the other Networks back into the Profile Window. (dx=0,500)



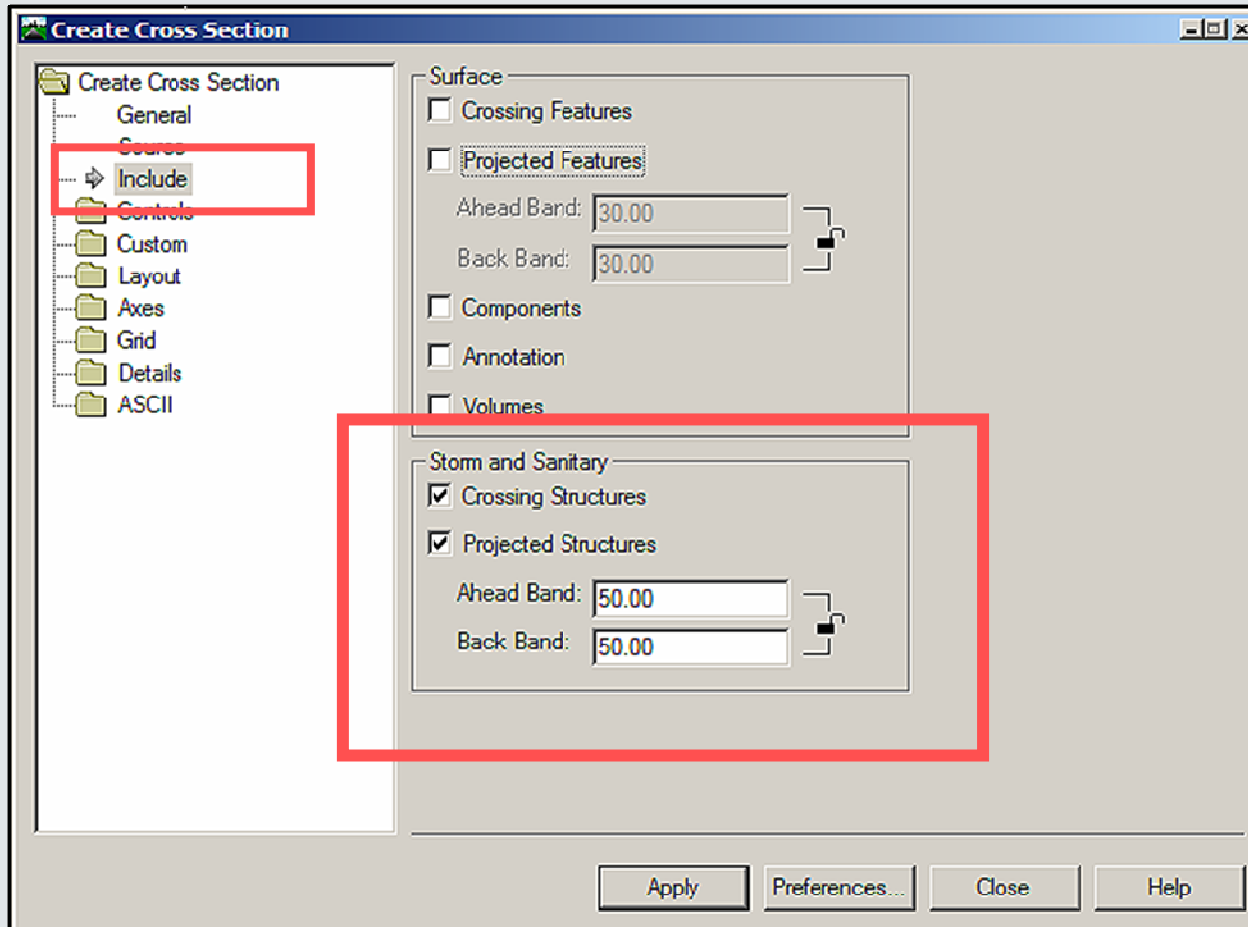
# Extend Free Entrance or Free Exit Pipes and Channels (v8.9)



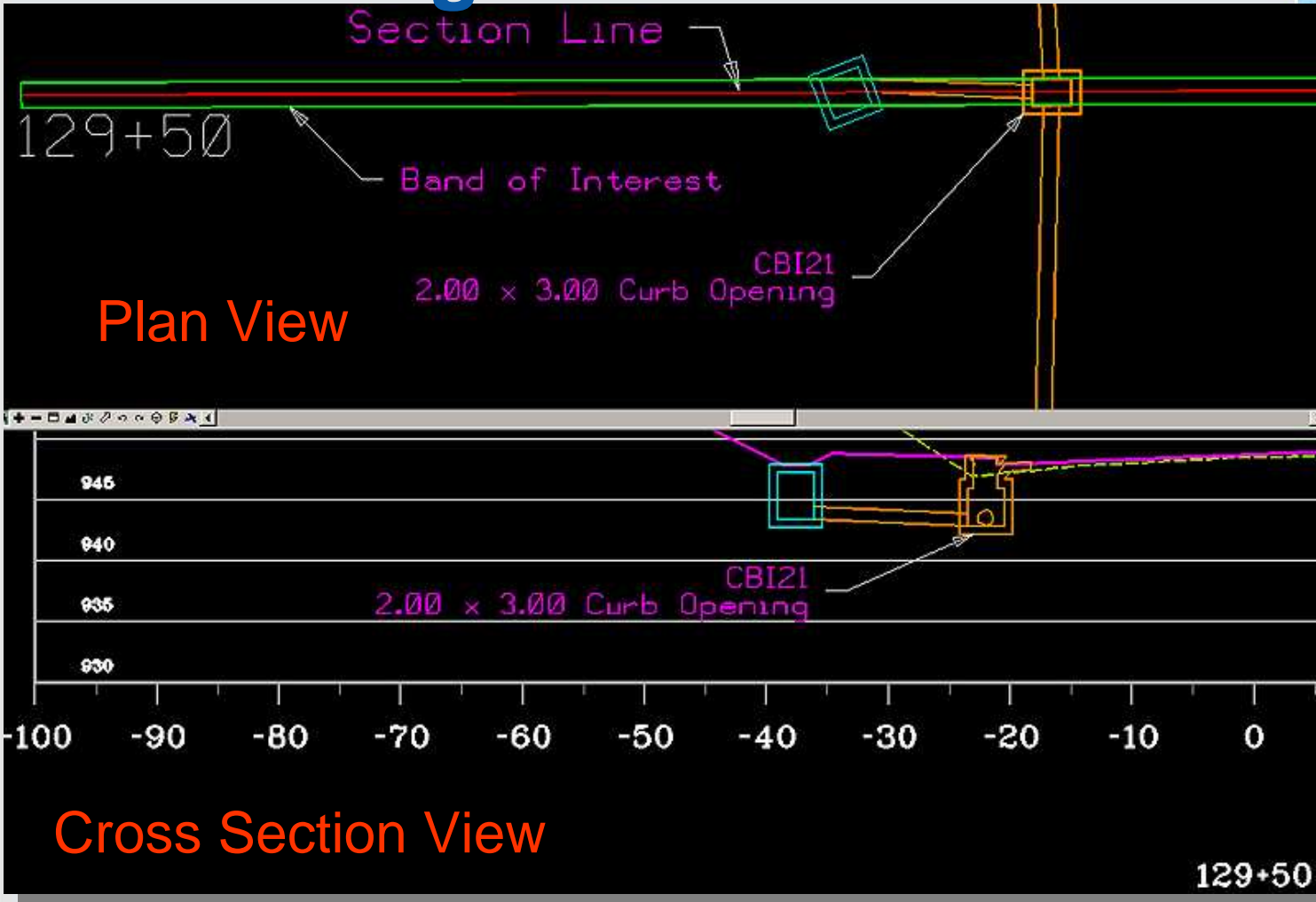
# Cross Section



# Drainage in Cross Section



# Drainage in Cross Section



Plan View

Cross Section View



# Drainage in Cross Section

**Create Cross Section**

- Create Cross Section
  - General
  - Source
  - Include
  - Controls
  - Custom
    - General
    - Layout
  - Layout
  - Axes
  - Grid
  - Details
  - ASCII

Station	Type
143+80.00	Perpendicular(St
144+16.19	Perpendicular(St
144+96.00	Perpendicular(St
146+06.79	Perpendicular(St
146+46.74	Perpendicular(St
147+57.90	Network
149+50.00	Perpendicular(St
149+73.24	Perpendicular(St
150+94.07	Network
152+55.14	Perpendicular(St
153+50.00	Perpendicular
154+67.56	Network

Type: Network

Details

Station: 150+94.07

Left Offset: -242.47

Right Offset: 55.26

From: DBI15

To: CBI27

Extend Axis (From): 11.00

Extend Axis (To): 26.00

Features

Crossing

Projected

Ahead Band: 0.00

Back Band: 0.00

Storm and Sanitary Structures

Crossing

Projected

Ahead Band: 0.00

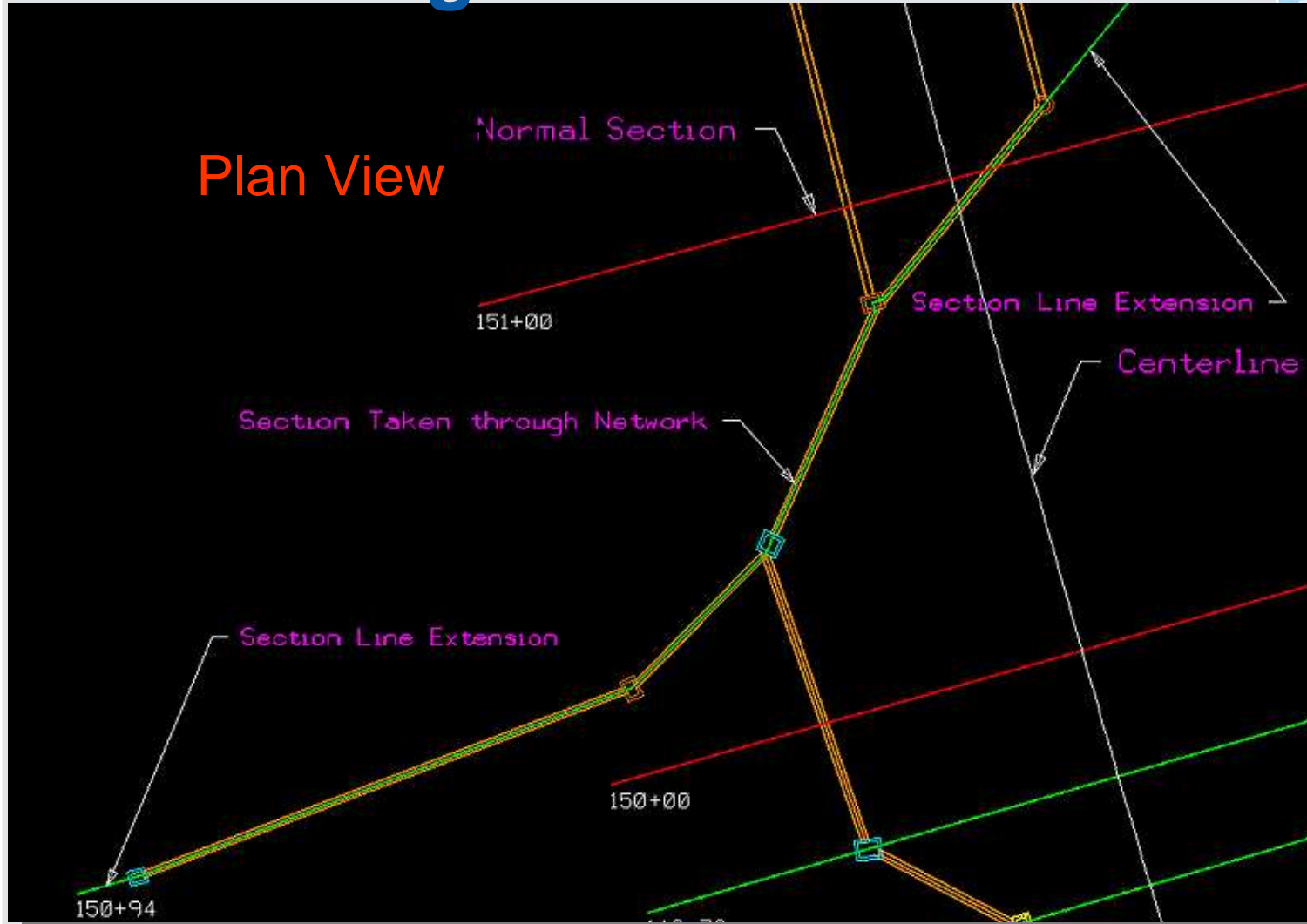
Back Band: 0.00

Buttons: Add, Update, Graphics, Import..., Save, Save As..., Apply, Preferences..., Close, Help

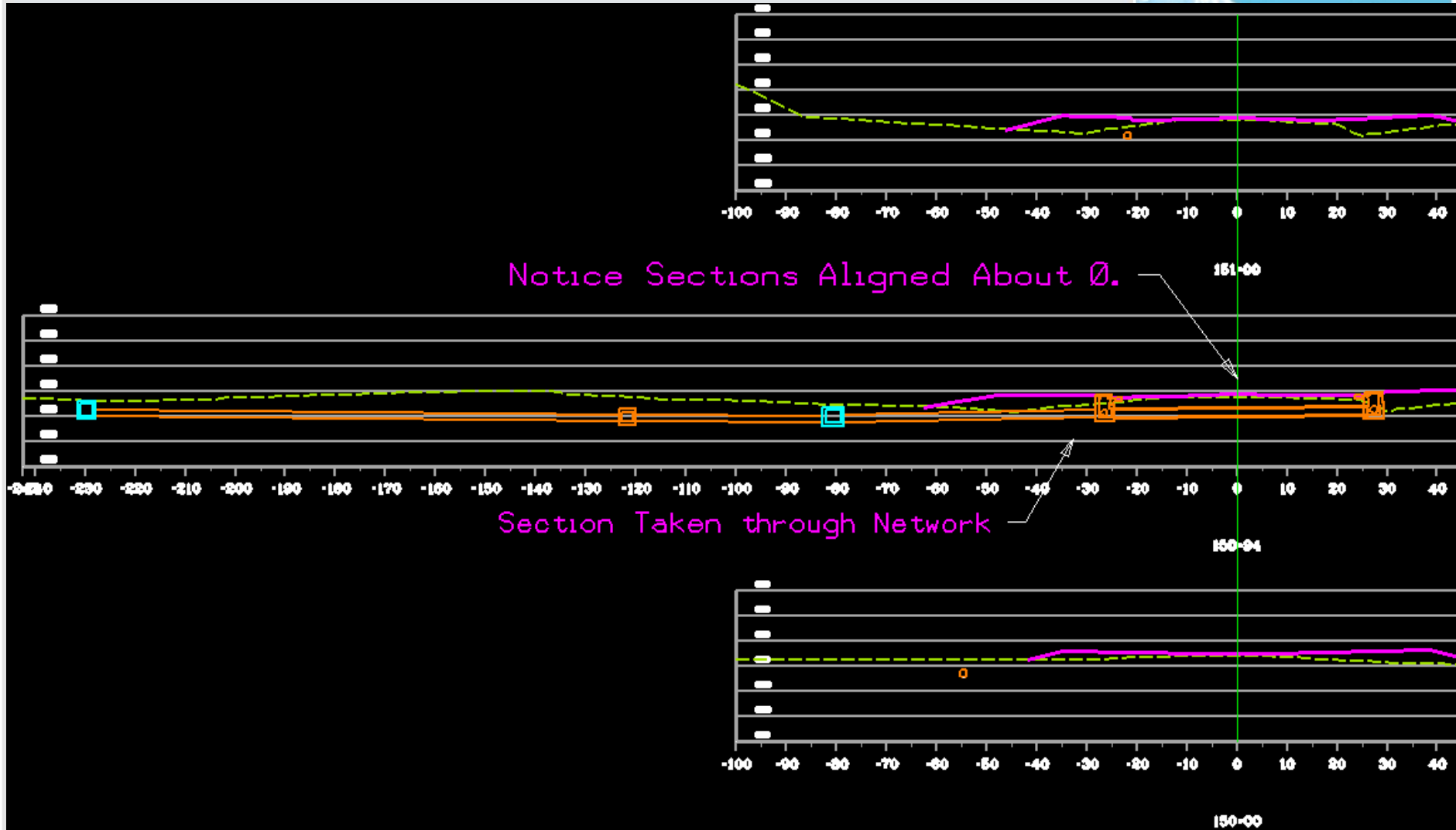


# Drainage in Cross Section

## Plan View



# Drainage in Cross Section



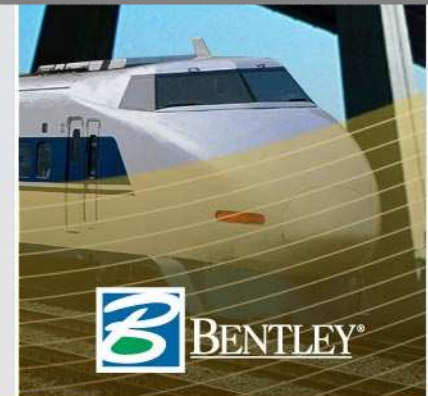


# Drainage in Cross Section

- Custom Cross Sections store the Structure IDs
- Custom file doesn't need to be re-created if structures are moved.

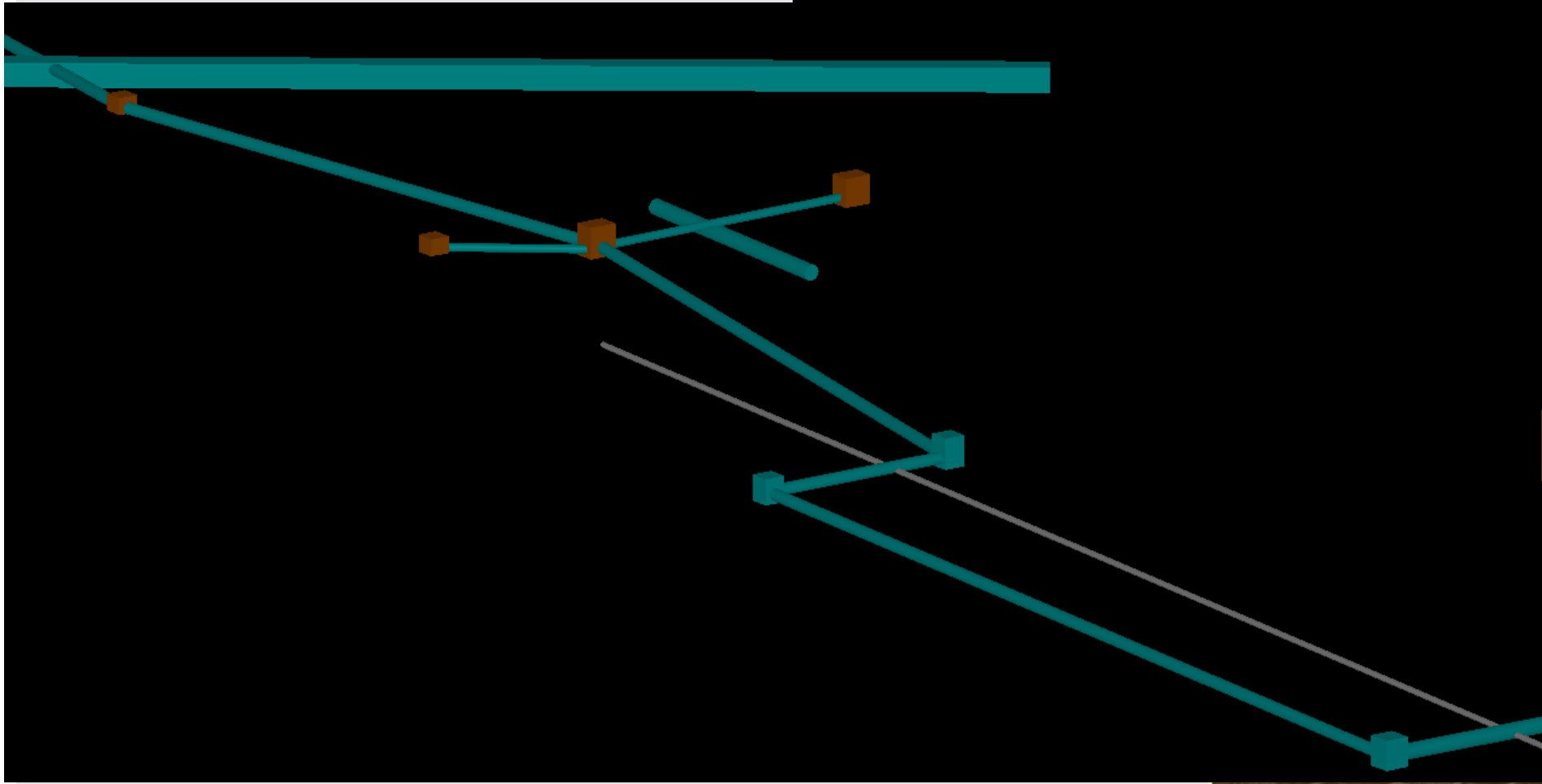
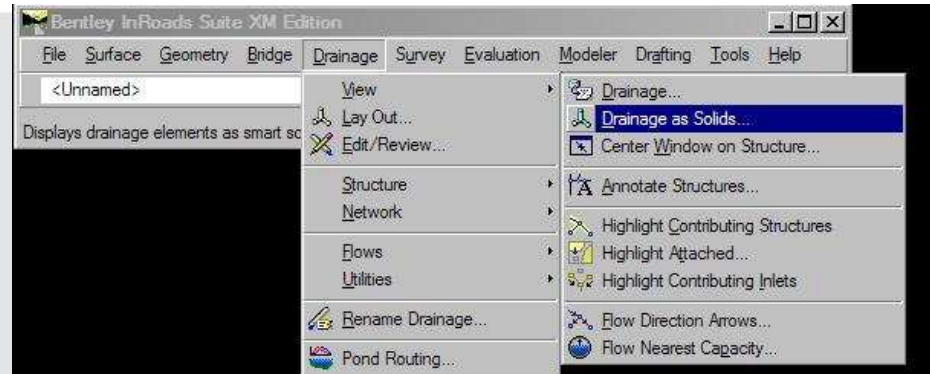
```

v87_training.csc - Notepad
File Edit Format View Help
:
:Custom Cross Sections
:
:Structure ID          Left Offset   Right Offset  Ahead Band    Back Band
"MH1"                 | -100.000000 | 100.000000   | 0.000000     | 0.000000
:Network XY Coordinates for reference only. Actual structure names are used to create
:
: X                    Y
:2052571.9834710      | 2027259.4098561
:2052763.7423814      | 2027316.2299257
:
:Cross Section Line Type Station At Alignment
:Network              147+57.8977005
:From                 To
"DBI TYPE 14"         | "CBI16"
:Network XY Coordinates for reference only. Actual structure names are used to create
:
: X                    Y
:2052581.3735056      | 2027391.2544128
:2052592.4529120      | 2027394.5373510
:2052593.8911038      | 2027394.9635015
:2052612.9705852      | 2027387.6277395
:2052615.0479743      | 2027388.2432873
:2052617.1253633      | 2027388.8588352
:2052656.5431411      | 2027400.2537697
:2052657.9813330      | 2027400.6799202
:2052684.0285850      | 2027408.3979796
:
:Cross Section Line Type Station At Alignment
:Perpendicular(Structure) 149+49.9999999
:Structure ID          Left Offset   Right Offset  Ahead Band    Back Band
"JBX11"                 | -100.000000 | 100.000000   | 0.000000     | 0.000000
:Network XY Coordinates for reference only. Actual structure names are used to create
:
: X                    Y
:2052485.8042417      | 2027550.2599441
:2052677.6138516      | 2027606.9086296
    
```



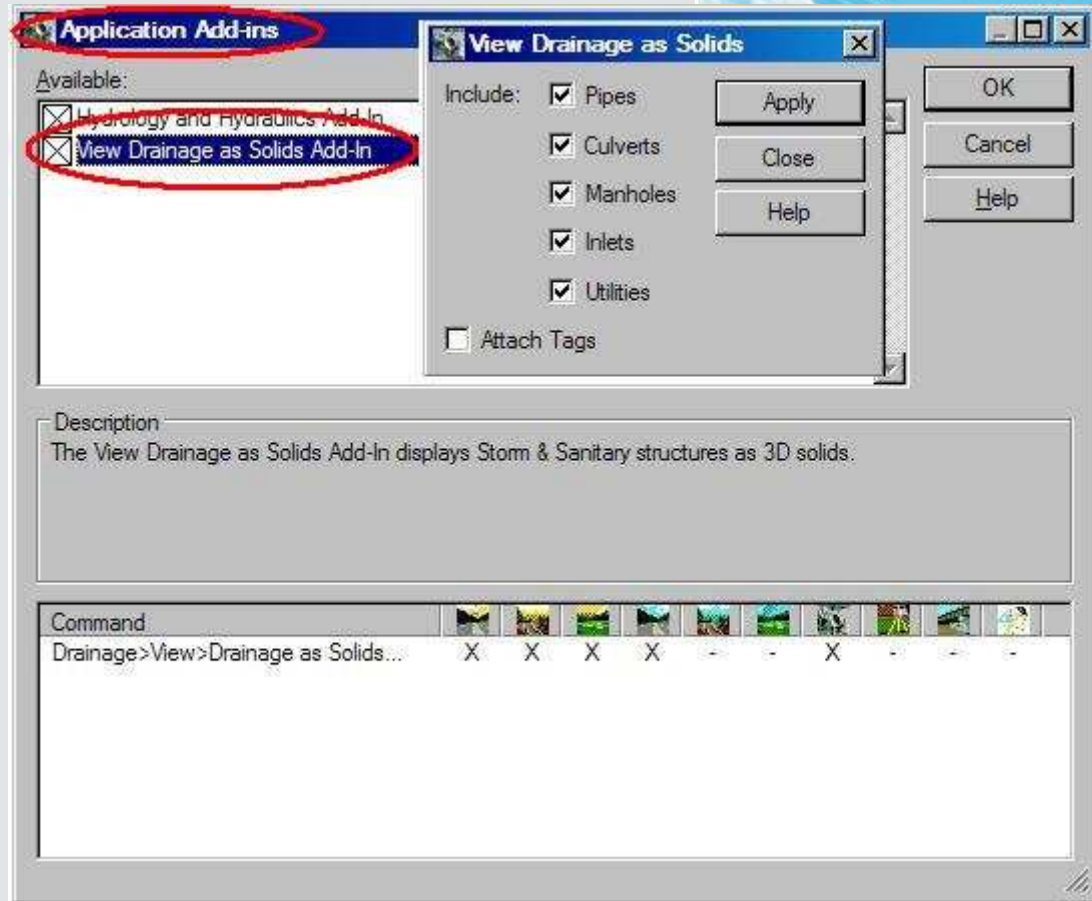
# 3D

- New in V 8.9 SP1

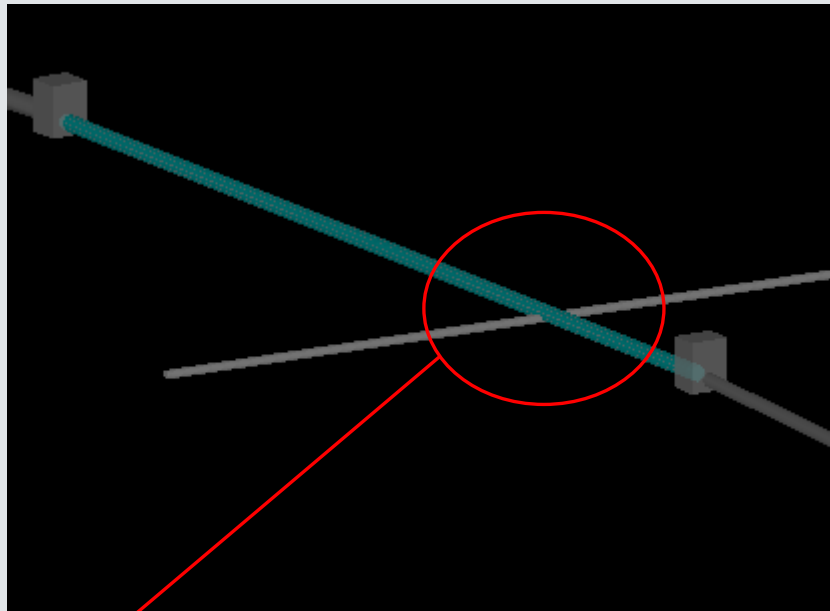


# View Drainage as Solids

- Displays Outside Walls.
- Uses Outside Style when Style Lock is on.
- Displays Smart Solids.



# ProjectWise Navigator – Interference Manager Engine



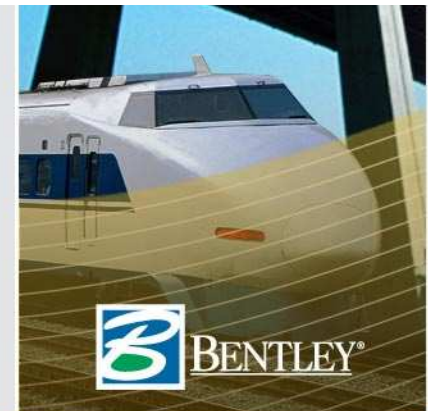
Detects Conflicts!



**PROJECTWISE® NAVIGATOR™ V8**  
XM edition



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# ProjectWise Navigator – Interference Reviewer

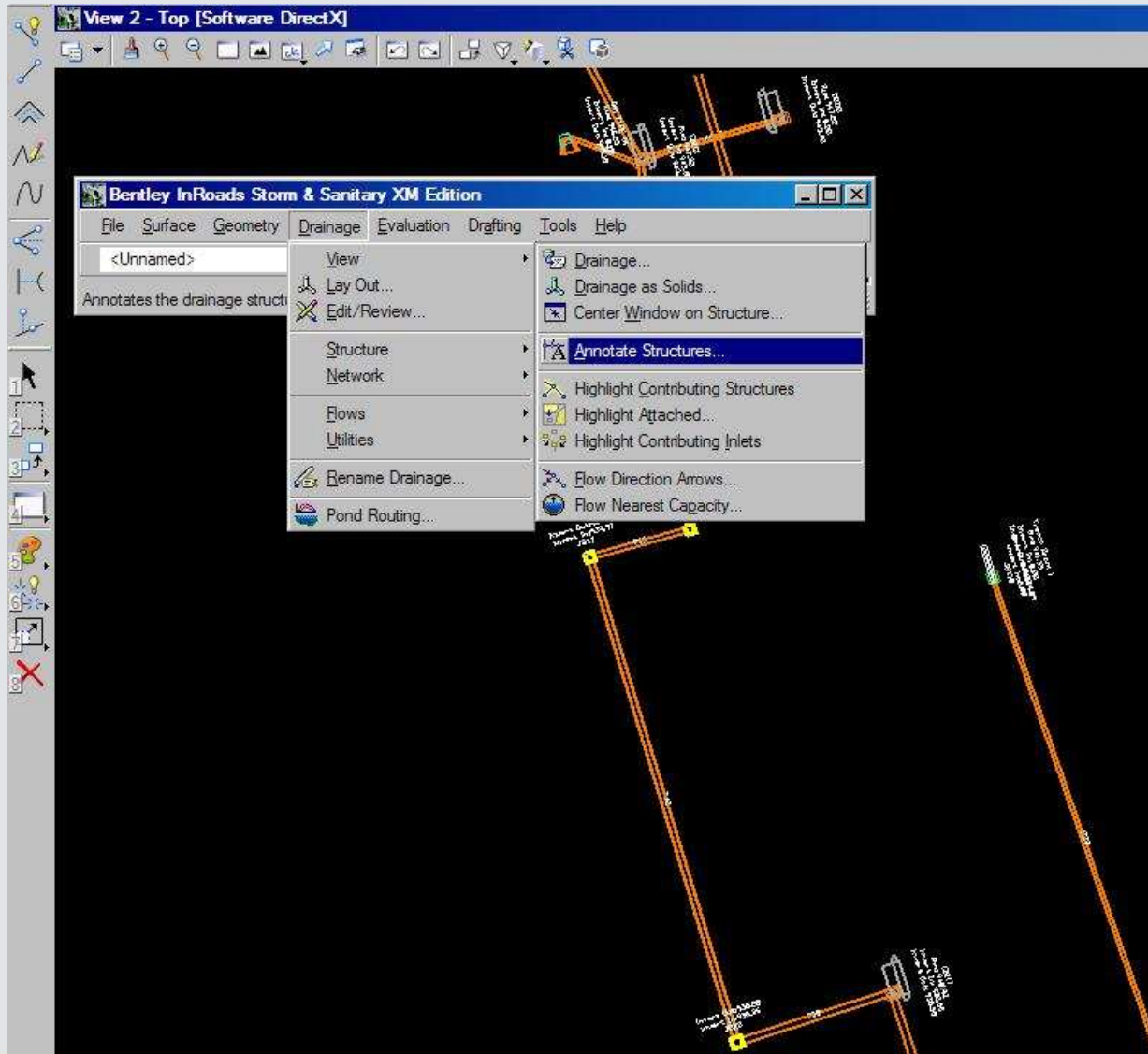
The screenshot displays the Bentley ProjectWise Navigator Interference Reviewer interface. On the left, a 3D model of a bridge structure is shown with a red line indicating a detected interference. The main window contains a table of interferences and a list of detected items.

ID	Type	Status	Reviewer	Comment
22	Hard	Reviewed	B. Mathews	Move P22 to avoid existing Box Culvert
23	Hard	Detected		
24	Hard	Detected		
25	Hard	Detected		
26	Hard	Detected		
27	Hard	Detected		
28	Hard	Reviewed	B. Mathews	Move P28 to avoid existing Utility
29	Hard	Detected		
30	Hard	Detected		
31	Hard	Detected		

Interference ID:  Total Interferences: 44



# Plan Annotation



# Annotate Structures

- Annotate ALL inverts at a structure.

The screenshot shows the 'Annotate Structures' dialog box with the 'Structure Type' set to 'Inlets'. The dialog includes a table for column settings, a 'Label Location' dropdown menu, and checkboxes for 'Annotate All Inverts at Structures' and 'Display Invert Direction Labels'. The 'Label Location' dropdown is open, showing 'After Suffix' as the selected option.

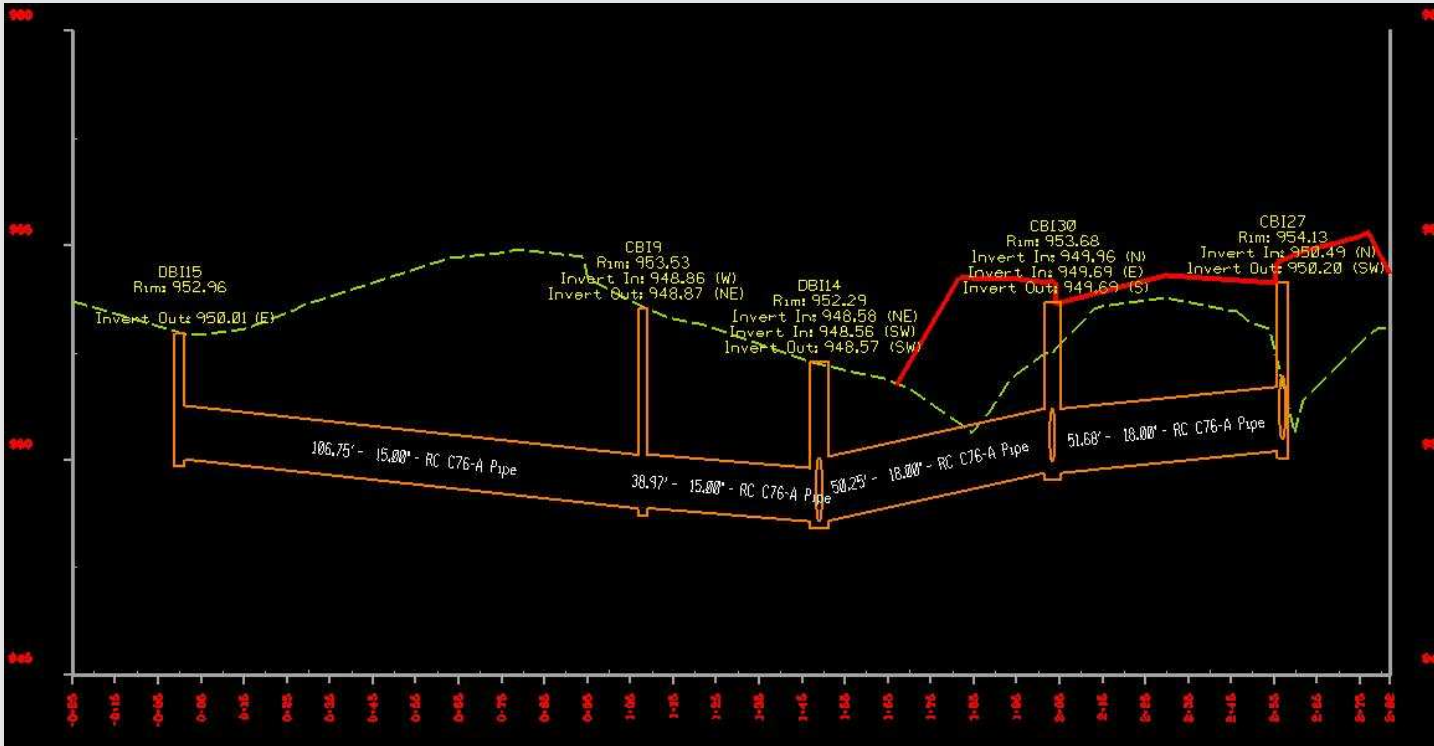
Show	Attribute	Prefix	Suffix	Position	Order	Precision	Location
X	Elevation	Rim:		1	0	2	Center
						-	Center
					2	2	Center
					2	2	Center
					2	2	Center
					2	2	Center
					2	2	Center
					2	2	Center

Position Inside  
 Annotate All Inverts at Structures  
 Display Invert Direction Labels  
 Label Location: **After Suffix**  
 Before Prefix  
 After Suffix

INØ  
 10.00' Curb Opening  
 Rim: 949.29  
 Invert In: 943.24 (N)  
 Invert In: 942.75 (E)  
 Invert In: 943.39 (S)  
 Invert Out: 943.00 (W)



# Profile Annotation





# Annotate Structures

- Annotate ALL inverts at a structure.

**Annotate Drainage Profile**

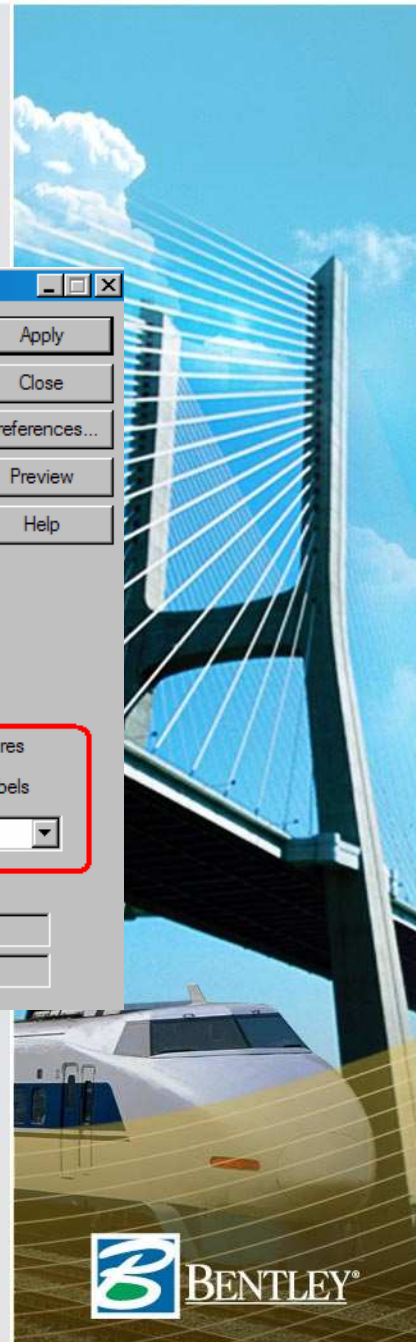
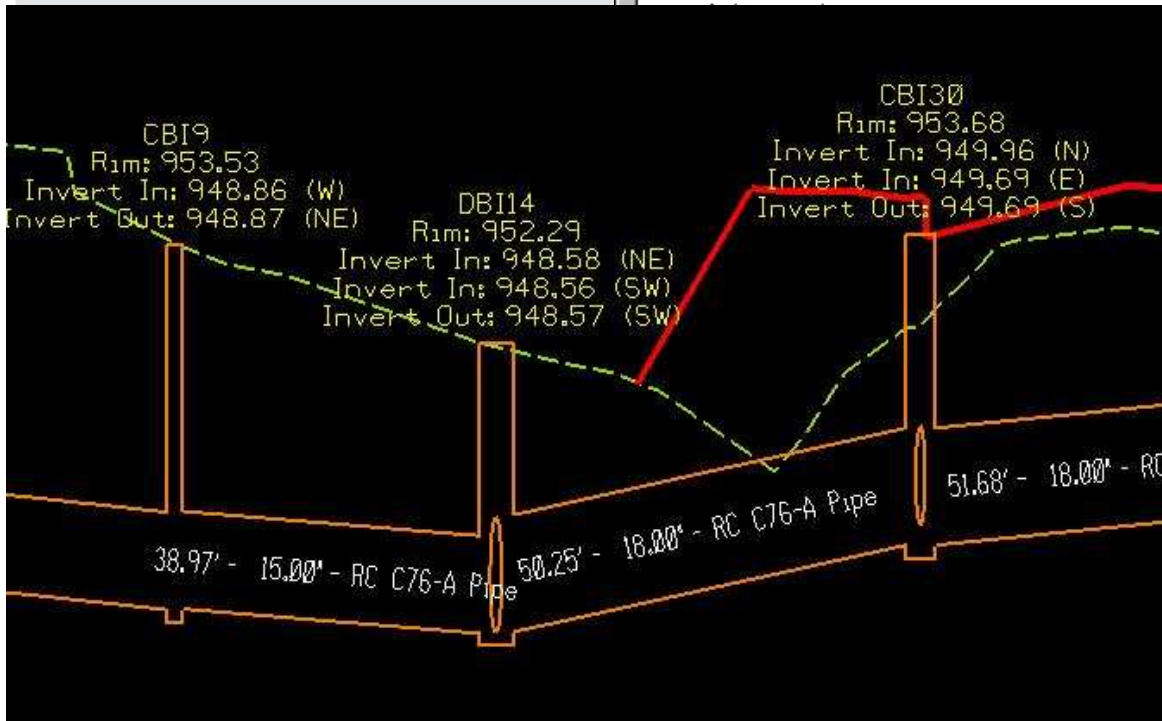
Structure Type: **Inlets** Set List: **ALT#1**

Show	Attribute	Prefix	Suffix	Position	Order	Precision	Location
X	Elevation	Rim:		3	0	2	Center
X	ID			4	0	-	Center
X	InvertIn	Invert I...		2	0	2	Center
X	InvertOut	Invert ...		1	0	2	Center
				2			Center
				2			Center
				2			Center

Buttons: Apply, Close, Preferences..., Preview, Help

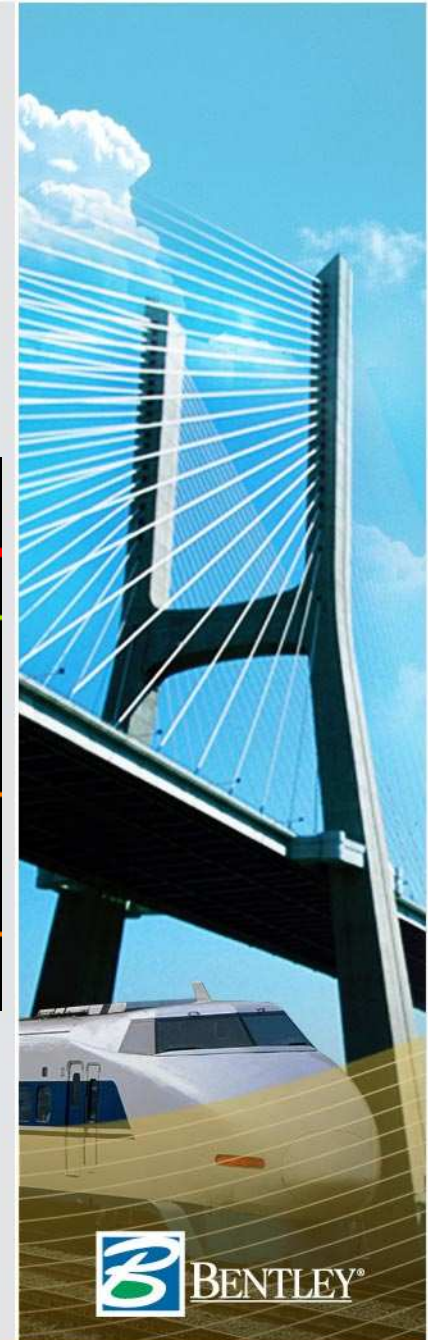
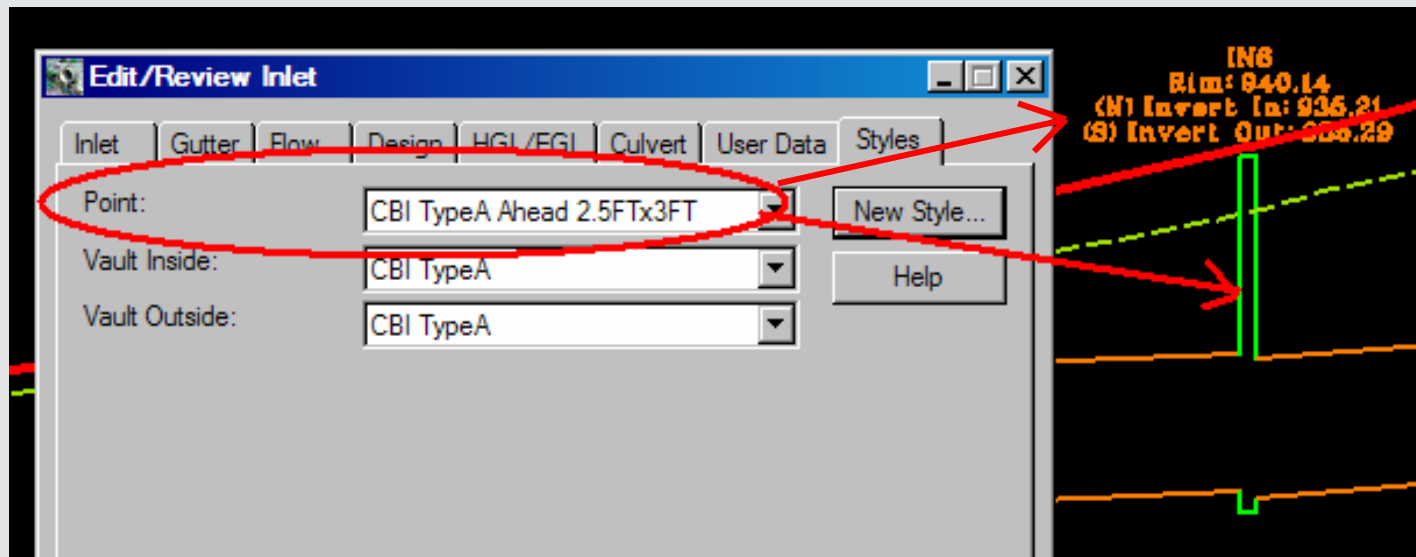
Options:

- Position Inside
- Annotate All Inverts at Structures
- Display Invert Direction Labels
- Label Location: **Before Prefix**
- Offset Annotation
- Offset: 0.00
- Height: 0.00

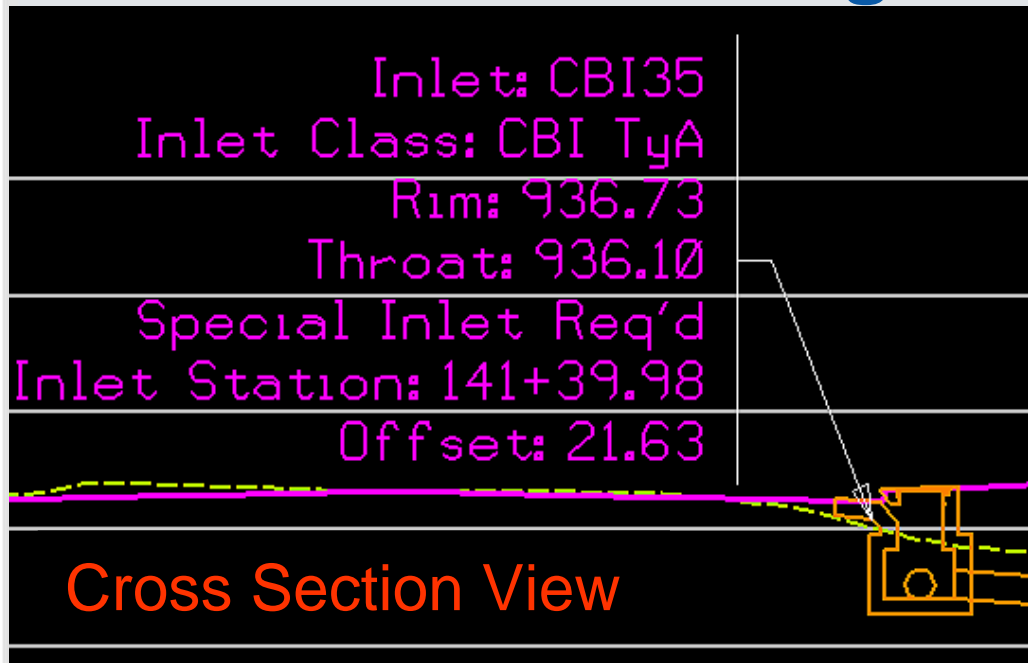


# Inlet Symbology in Profiles

- Inlet Vault AND Text comes from the Point Feature Style.
- Wall display depends on connection type



# Place Drafting Notes



Place Cross Section Note

File Edit

Note File:

- Proposed
  - All Sections - 2 Pts
  - All Sections - Element
  - All Sections - Pt
  - area
  - Channels
  - inlet-plain
  - inlets**
  - manholes
  - Pipes
  - Pipes - Crossing

Note:

Inlet: {ID}  
Inlet Class: {InletClass}  
**Rim: ({Elevation})+0.625**  
Throat: {Elevation}  
{newfield}  
Inlet Station: {STATION}  
Offset: {OFFSET}

Apply  
Close  
Settings...  
Help

Dynamics  
 Rotate  
 Omit Autoflip  
 Scale  
 Multiple Leaders

Sort User Text

Note:

Inlet: {ID}  
Inlet Class: {InletClass}  
**Rim: ({Elevation})+0.625**  
Throat: {Elevation}  
{newfield}  
Inlet Station: {STATION}  
Offset: {OFFSET}

Inserts:

# Reports

The screenshot displays the 'Results' window with a table of pipe data and the 'Drainage Reports' dialog box. The table lists pipe IDs (P0 to P48), shapes (Circular), materials (Concrete, RC C76-A), widths (12.00, 24.00), heights (12.00, 24.00), slopes (1.27, 2.22), and pipe slope lengths (24.29 to 38.87 ft). The 'Drainage Reports' dialog box is open, showing report settings for 'C:\2007 IUTC\P09-Evaluating Drainage\Design\Report.rpt'. It includes options for report structures (Outfall, Between, Structure Type) and format settings for various pipe components.

Pipe ID	Shape	Material	Width (in)	Height (in)	Slope (%)	PipeSlopeLength (ft)
P0	Circular	Concrete	24.00	24.00	2.22	38.87
P4	Circular	RC C76-A	12.00	12.00	1.27	7.16
P5						67.60
P6						671.02
P7						812.82
P8						19.10
P9						12.12
P10						11.20
P11						9.27
P29						164.67
P32						109.97
P33						29.31
P36						149.21
P37						24.34
P38						142.64
P39						50.43
P41						46.81
P42						150.80
P43						169.10
P44						172.75
P45						50.26
P46						62.43
P47						31.38
P48						24.29



# Report on All Pipes



Drainage Reports

Main | **Formats**

Report Library

Path: C:\2007 IUTC\PO9-Evaluating Drainage Design\Report.rpl

Name: Reports

Description: Delivered report formats

Browse...

New...

Structures for Report

Outfall:

Between:

And:

Structure Type: Inlets

Physical data

Physical data

Physical data

ABCPhys and Dgn data

Phys and Dgn data

Apply

Preferences...

Close

Results

Sunday, October 21, 2007 9:45:28 PM

Page Data File: Renfro Drainage

ID	Type	InletClass	GrateLen (ft)	VaultShape	VaultLength	VaultWidth	InvertIn (ft)	InvertOut (ft)
CBI4	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	0.00	936.25 (S)
CBI6	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	0.00	952.50 (S)
CBI8	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	953.98 (W)	953.98 (E)
CBI9	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	948.86 (W)	948.87 (NE)
CBI11	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	0.00	952.50 (S)
CBI12	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	943.11 (N) 943.05 (E) 943.10 (W)	943.07 (S)
CBI14	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	0.00	944.58 (N)
CBI15	Curb Opening	CBI TyA	10.00	Box	2.00	3.00	0.00	947.69 (S)



# Edit Reports

Format Name: Design data

Format Description: ID, Flow, Vel, Cap

Structure Type: Pipes

Lines per Page: 55

Report Data

Attribute: DepthOfFlow

Column Width: 12

Sum Column:  No  Yes

Header: DepthOfFlow

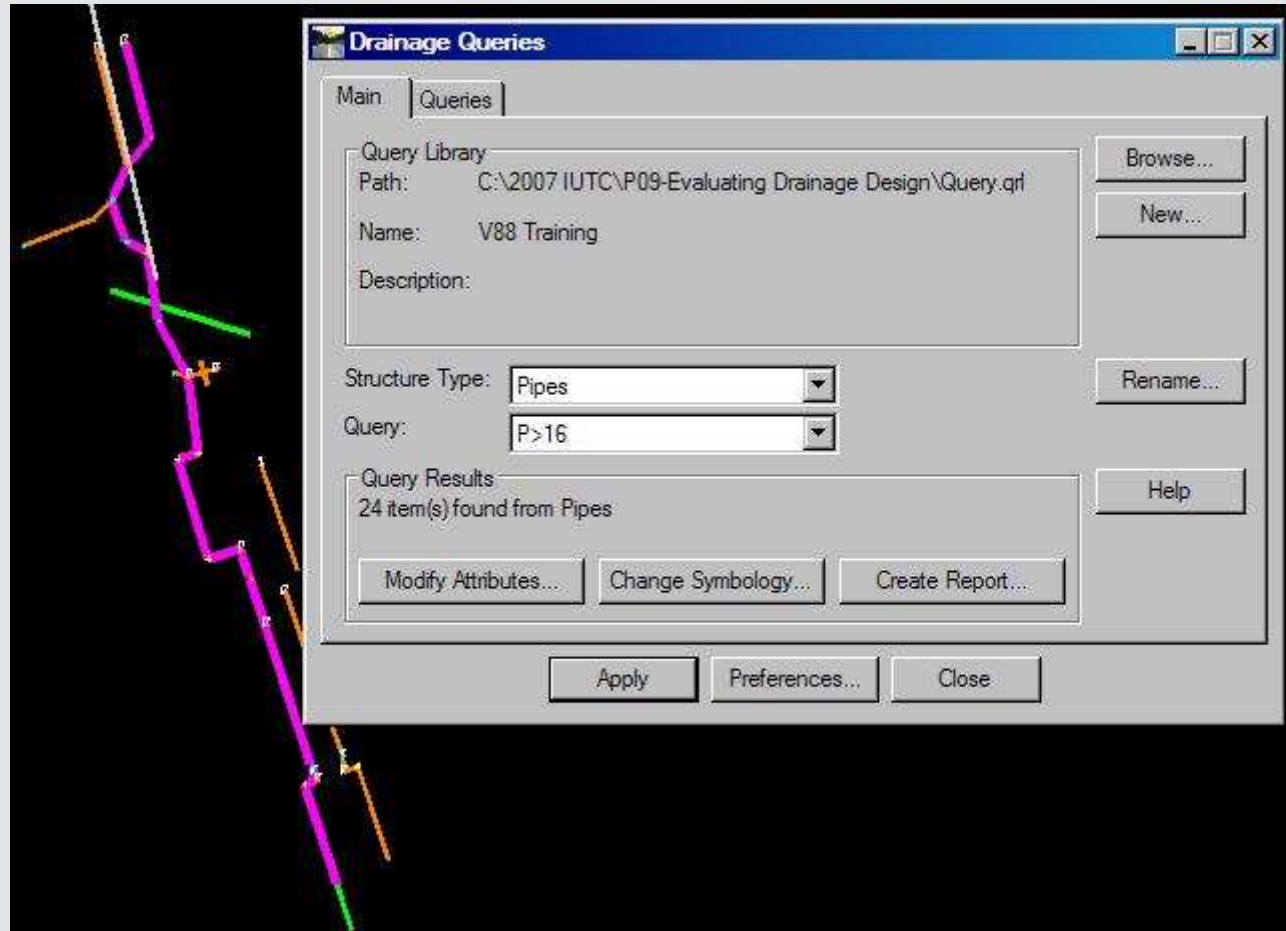
Precision: 0.12

Attribute	Header	Column Wi...	Precision	Sum
ID	Pipe ID	16	-	-
TotalFlow	TotalFlow	12	2	No
Capacity	Capacity	12	2	No
Velocity	Velocity	12	2	No
DepthOfFlow	DepthOfFlow	12	2	No
CriticalDepth	Crit. Depth	12	2	No
FlowStatus	FlowStatus	12	-	-
FlowRegime	FlowRegime	18	-	-

Buttons: Add, Insert, Modify, Sort..., Delete, Move Up, Move Down



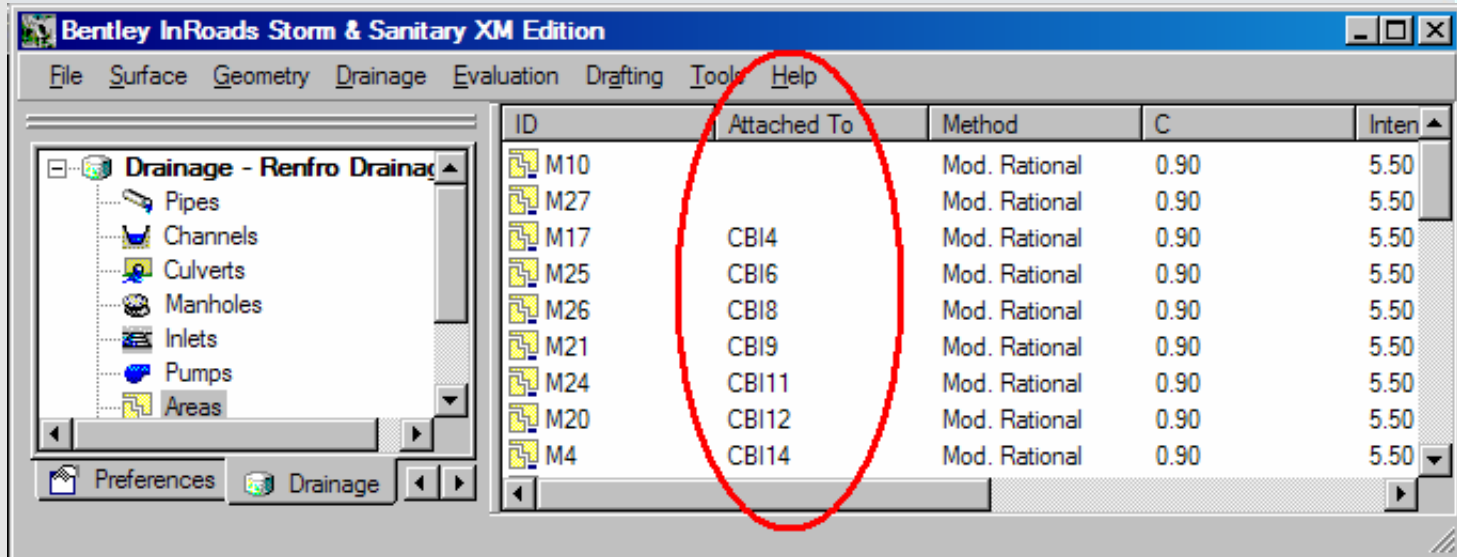
# Queries



# InRoads Explorer to Find Errors

(Contributed by: Karl Dauber of Parsons Brinckerhoff )

- Sort Areas by “Attached To”
- Check that all are attached to an Inlet

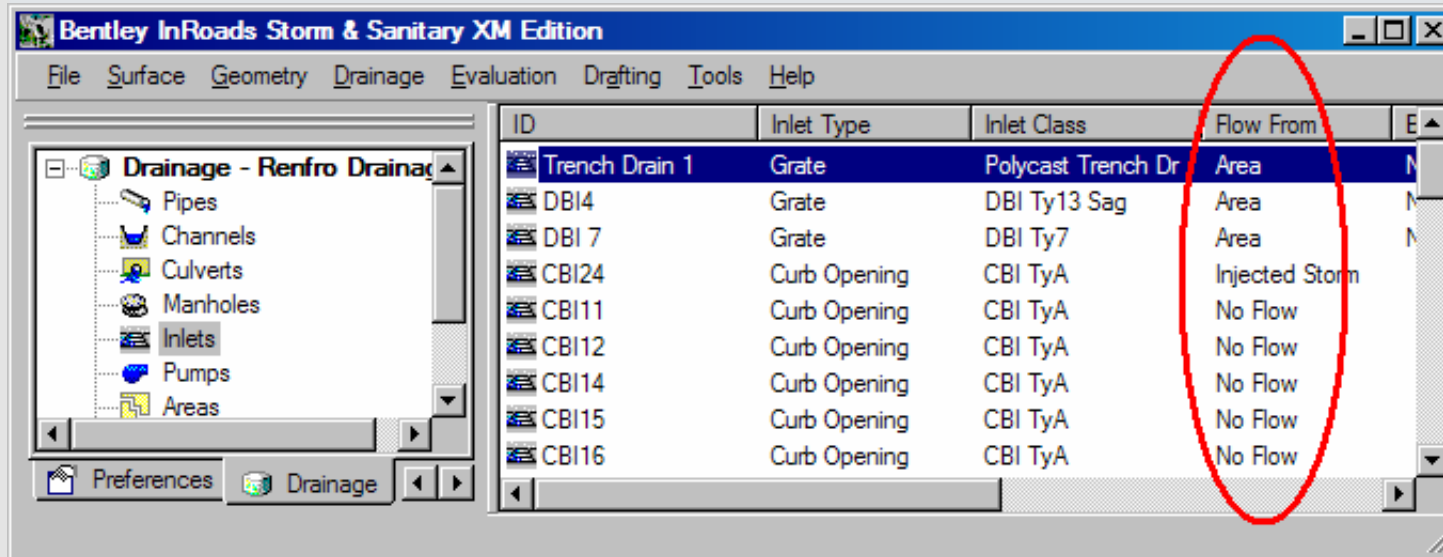




# InRoads Explorer to Find Errors

(Contributed by: Karl Dauber of Parsons Brinckerhoff )

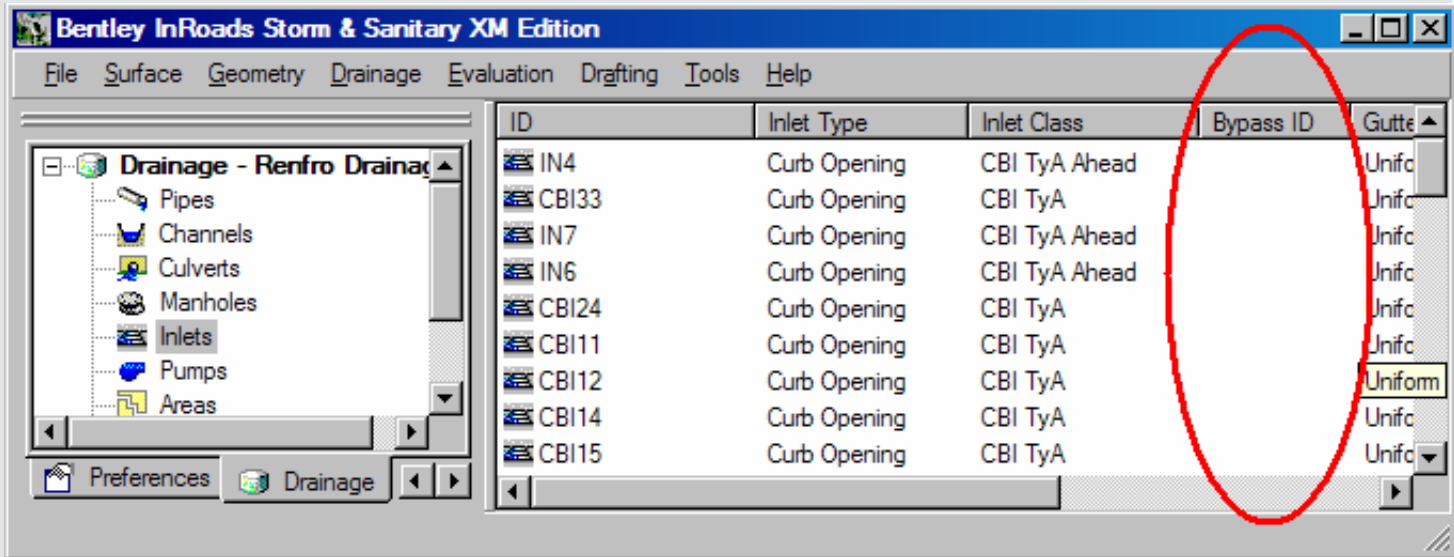
- Sort Inlets by “Flow From”
- Check that all have areas attached



# InRoads Explorer to Find Errors

(Contributed by: Karl Dauber of Parsons Brinckerhoff )

- Sort Inlets by “Bypass ID”
- Check that all on-grade inlets have an assigned bypass ID.



# InRoads Explorer to Find Errors

(Contributed by: Karl Dauber of Parsons Brinckerhoff )

- Sort Pipes by “Velocity”
- Check for pipes that don’t meet minimum velocity standards.

The screenshot shows the Bentley InRoads Storm & Sanitary XM Edition software interface. The 'Drainage - Re' tree on the left lists various components like Pipes, Channels, Culverts, Manholes, Inlets, Pumps, and Areas. The main window displays a table with the following data:

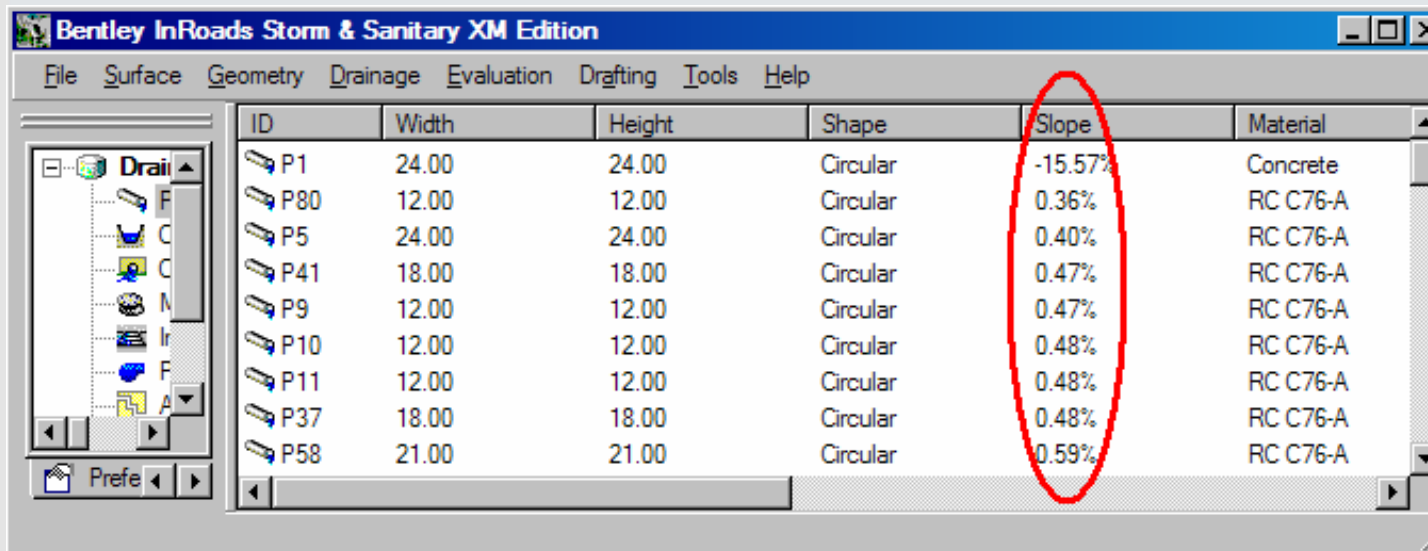
Upstream ID	Downstream ID	Design Flow Rate	d / D	Velocity
CBI31	JBX3	0.00	0.00	0.00
JBX4	CH0	0.01	0.03	0.81
JBX10	FREE_EXT	0.55	0.32	2.56
CBI17	IN6	1.34	0.20	3.07
JBX8	CBI17	1.34	0.18	3.36
CBI28	FREE_EXT	0.24	0.10	3.73
DBI4	DBI 7	1.18	0.29	3.94
MH1	JBX7	1.34	0.25	3.95
JBX1	CH2	1.34	0.16	4.17



# InRoads Explorer to Find Errors

(Contributed by: Karl Dauber of Parsons Brinckerhoff )

- Sort Pipes by “Slope”
- Find pipes with Zero or Negative slopes



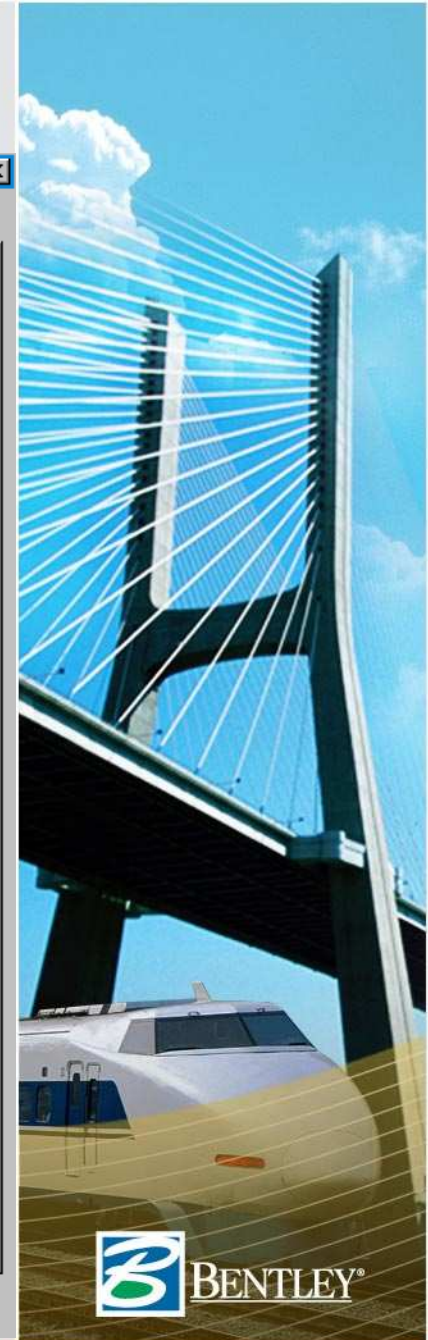
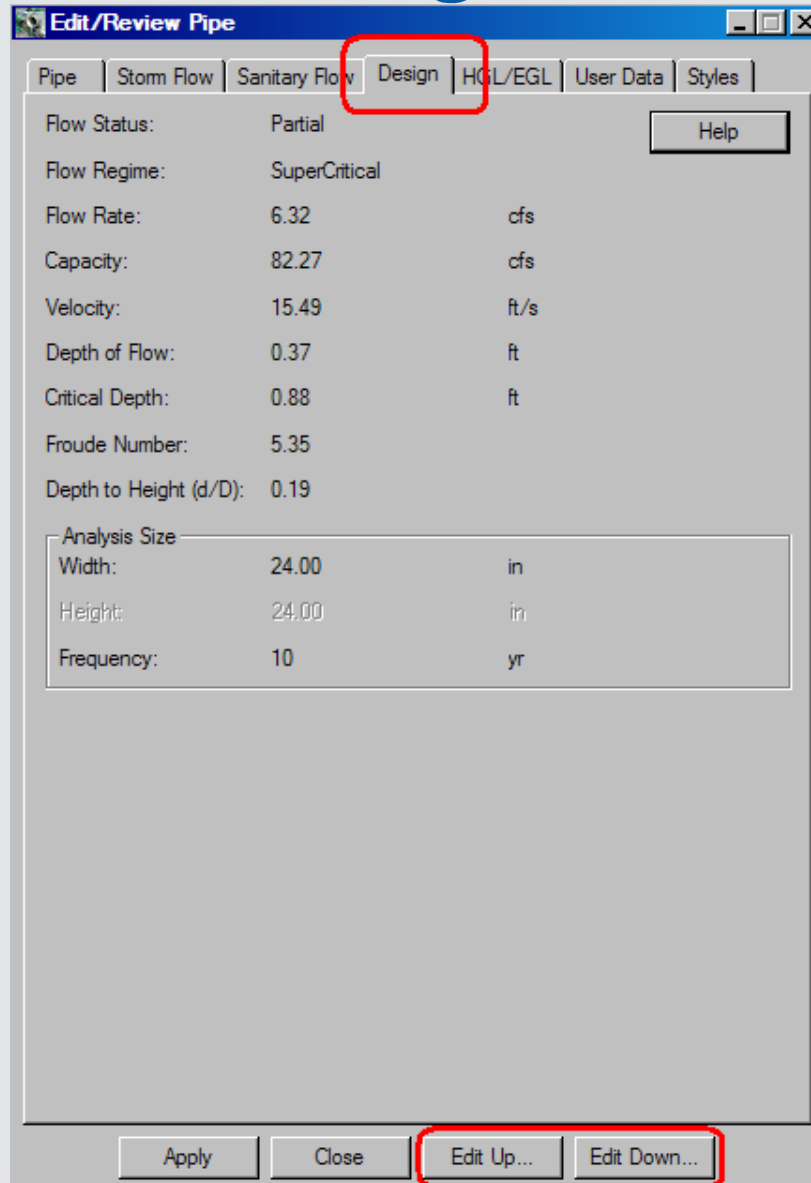
Bentley InRoads Storm & Sanitary XM Edition

File Surface Geometry Drainage Evaluation Drafting Tools Help

ID	Width	Height	Shape	Slope	Material
P1	24.00	24.00	Circular	-15.57%	Concrete
P80	12.00	12.00	Circular	0.36%	RC C76-A
P5	24.00	24.00	Circular	0.40%	RC C76-A
P41	18.00	18.00	Circular	0.47%	RC C76-A
P9	12.00	12.00	Circular	0.47%	RC C76-A
P10	12.00	12.00	Circular	0.48%	RC C76-A
P11	12.00	12.00	Circular	0.48%	RC C76-A
P37	18.00	18.00	Circular	0.48%	RC C76-A
P58	21.00	21.00	Circular	0.59%	RC C76-A

# Edit/Review Dialog

- Edit Up and Edit Down Buttons at the Bottom of the Dialog.



# Questions?

