

GEOPAK Drainage for the Roadway Designer

Presented by:

James Worley

james.worley@dot.state.fl.us

Florida Department of Transportation

Engineering/CADD Systems Office

www.dot.state.fl.us/ecso/

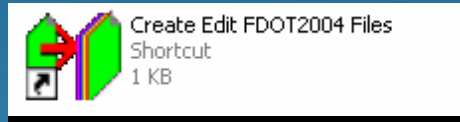
In the Beginning

Things you need to start using GEOPAK Drainage (in an FDOT project).

- Make sure you have MicroStation, GEOPAK, GEOPAK Drainage and the FDOT2004 software properly installed and working. (due in late July, MR4 will change numerous things in GEOPAK Drainage for FDOT projects)
- An existing FDOT roadway project with gpk, tin, dlb, ddb, cel and superelevation shapes.
- All pertinent information for the design of the drainage system from a drainage engineer. Including type, station, offset and elevation of the structures to be placed in the plan view.

Create Your New Drainage Project

- Use File Create/Edit

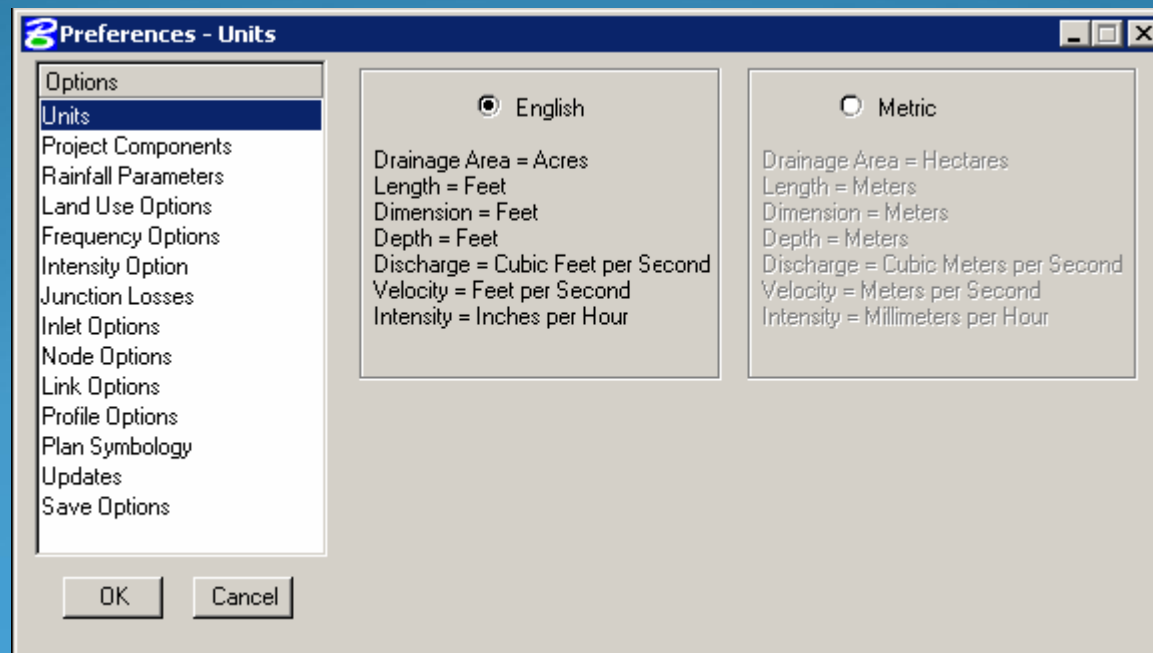


to create your proposed drainage file.

- Now open your DRPRRD01.dgn and set up your new drainage project by going to, *MS Menu: Applications > GEOPAK Drainage > Drainage* to access GEOPAK Drainage.
- Next you must create the new drainage project by going to, *Drainage Menu: Project > New* and typing in the name of you project.

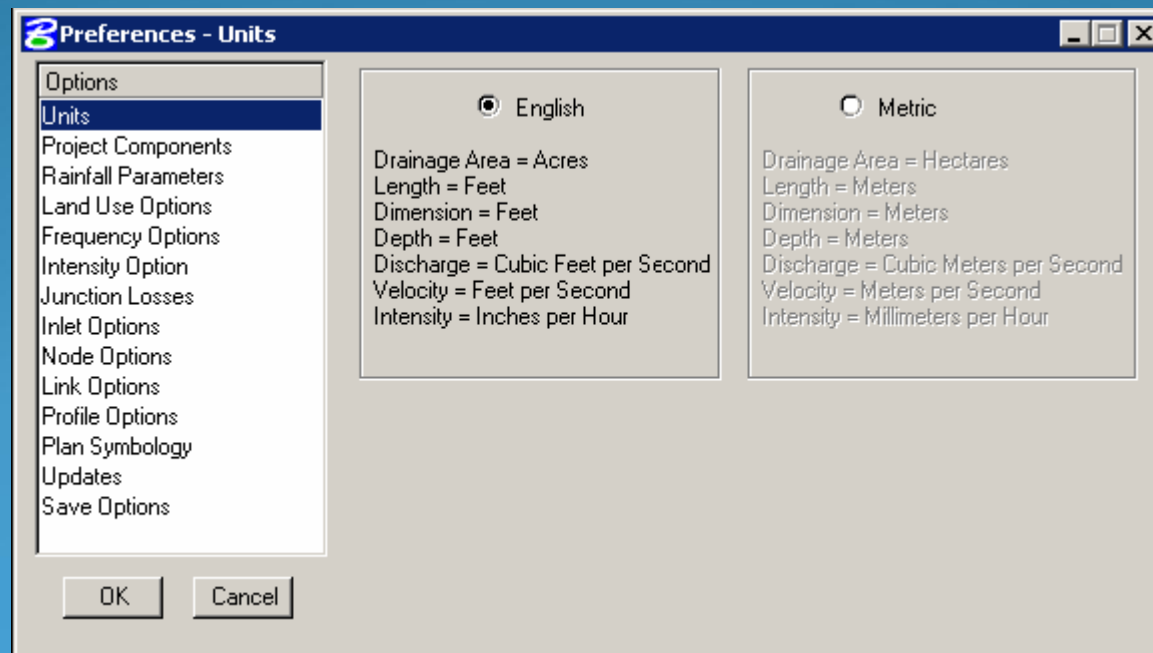
Project Preferences

- To set up Project Preferences go to *Drainage Menu: Project > Preferences* to open the Preferences dialog box.



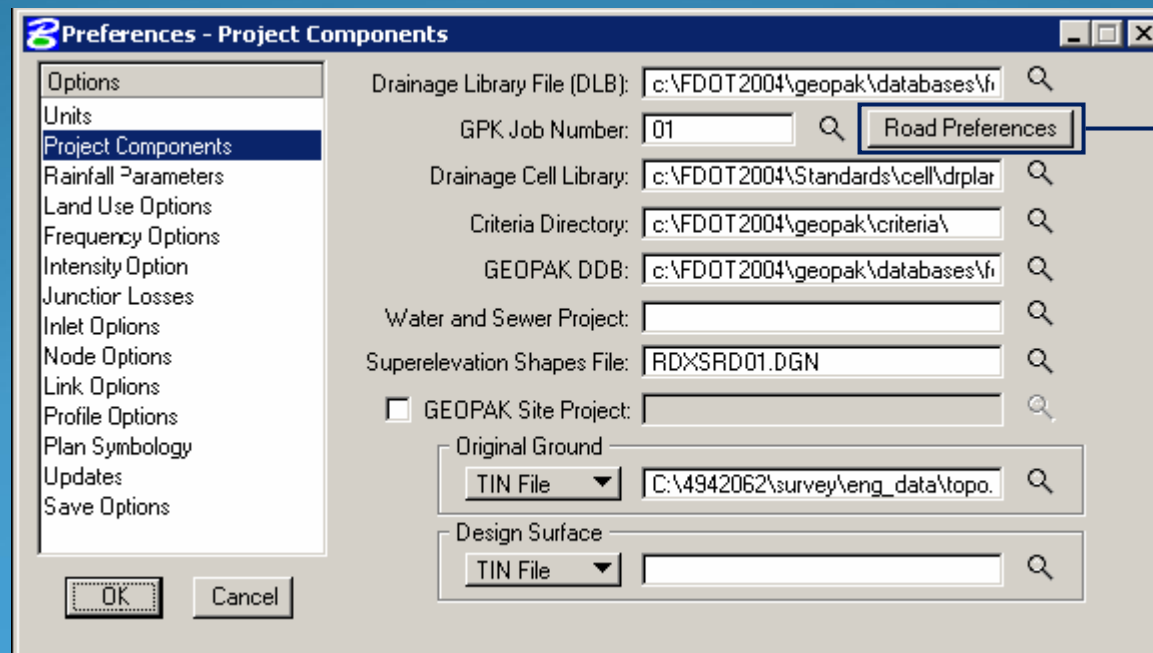
Project Preferences

- The first setting is for the Units to be used in this project. All FDOT projects will use English units.



Project Preferences

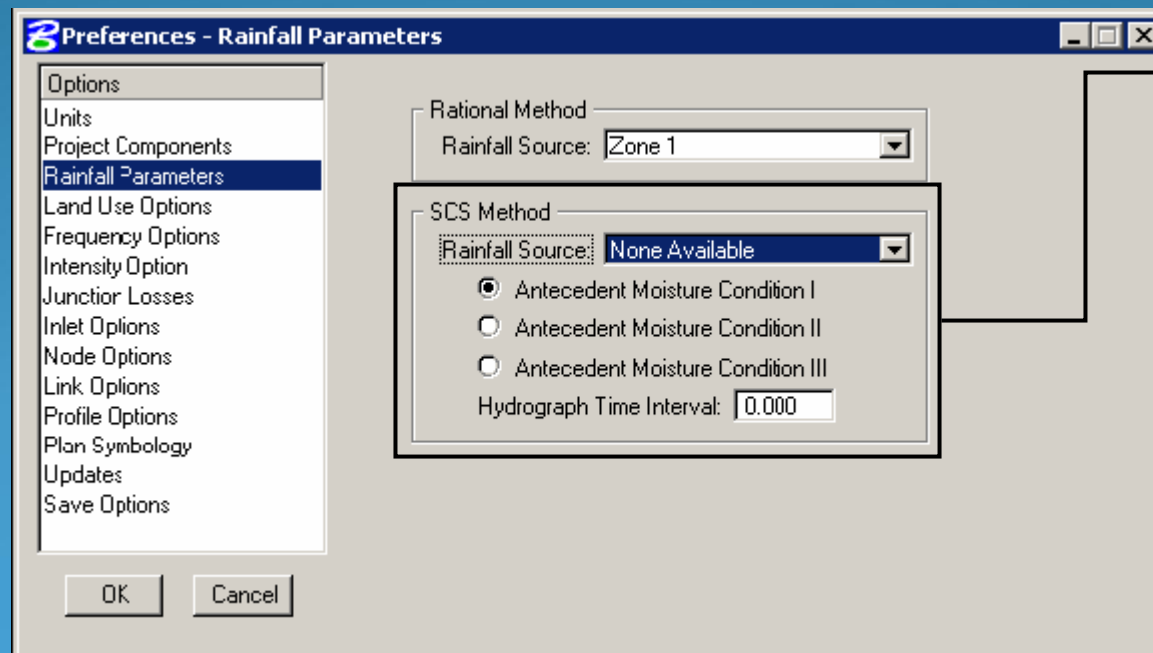
- Your next settings will be the Project Components. This is where the location of the files needed for the project are located (dlb, gpk, cel, x, ddb, tin and shapes).



Use Road Preferences to set the location of your gpk file.

Project Preferences

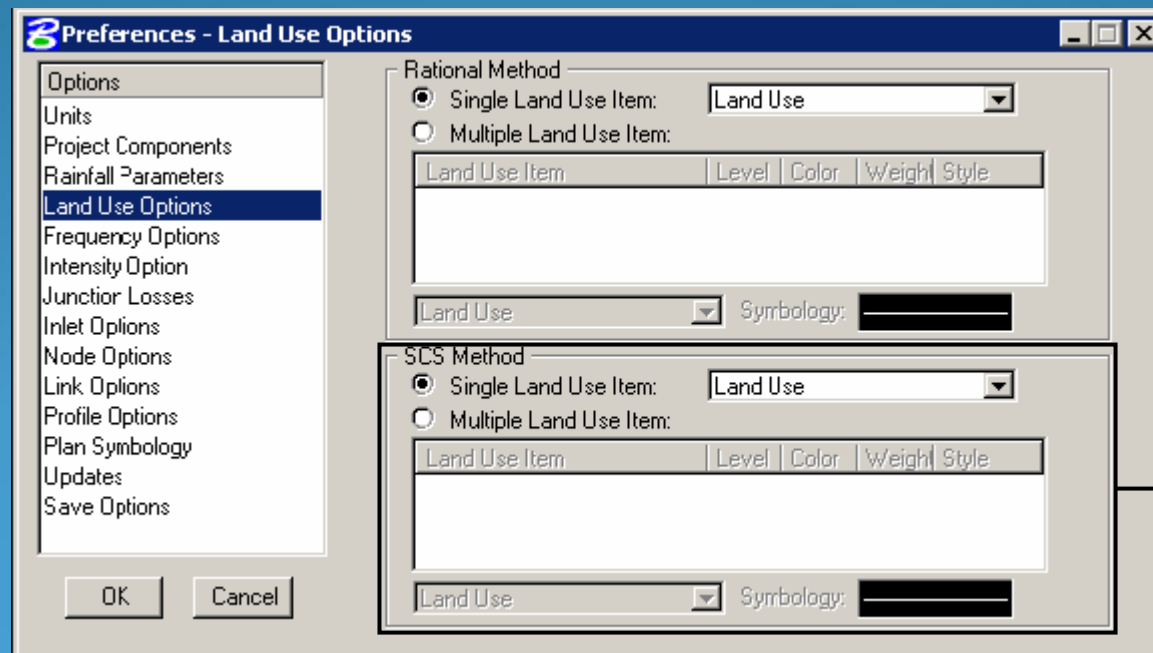
- Rainfall Parameters need to be set for the project. Choose the correct Zone for the project from the provided drop down list.



SCS Method is not used in this example.

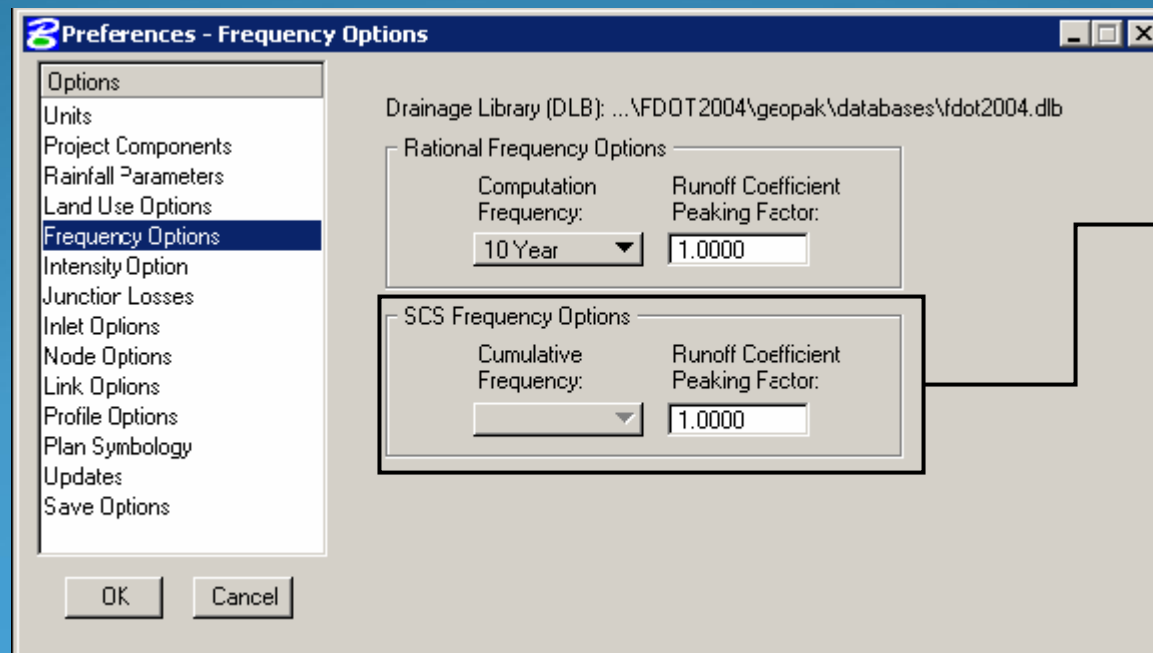
Project Preferences

- Land Use Options are next and there is only one option in the FDOT setup. Choose *Land Use* from the dropdown menu.



Project Preferences

- Now Frequency Options need to be set to a Computational Frequency of 10 Year and a Runoff Coefficient Peaking Factor of 1.



Project Preferences

- Set Intensity Options as shown in the dialog below.

Min. Time of Concentration 10.0 Minutes
Accumulate Pipe Flow Time by Iterative Velocity
Compute Intensity from Library Rainfall Data Source
Inlet Computation Only Absolute Intensity 4.0

Preferences - Intensity Option

Options
Units
Project Components
Rainfall Parameters
Land Use Options
Frequency Options
Intensity Option
Junction Losses
Inlet Options
Node Options
Link Options
Profile Options
Plan Symbolology
Updates
Save Options

Drainage Library (DLB): ... \FDOT2004\geopak\databases\fdot2004.dlb

Minimum Time of Concentration: 10.0000

Accumulate Pipe Flow Time by: Iterative Velocity

Intensity Options

Compute Intensity from Library Rainfall Data Source
 Absolute Intensity: 0.0000
 Weight Time of Concentration

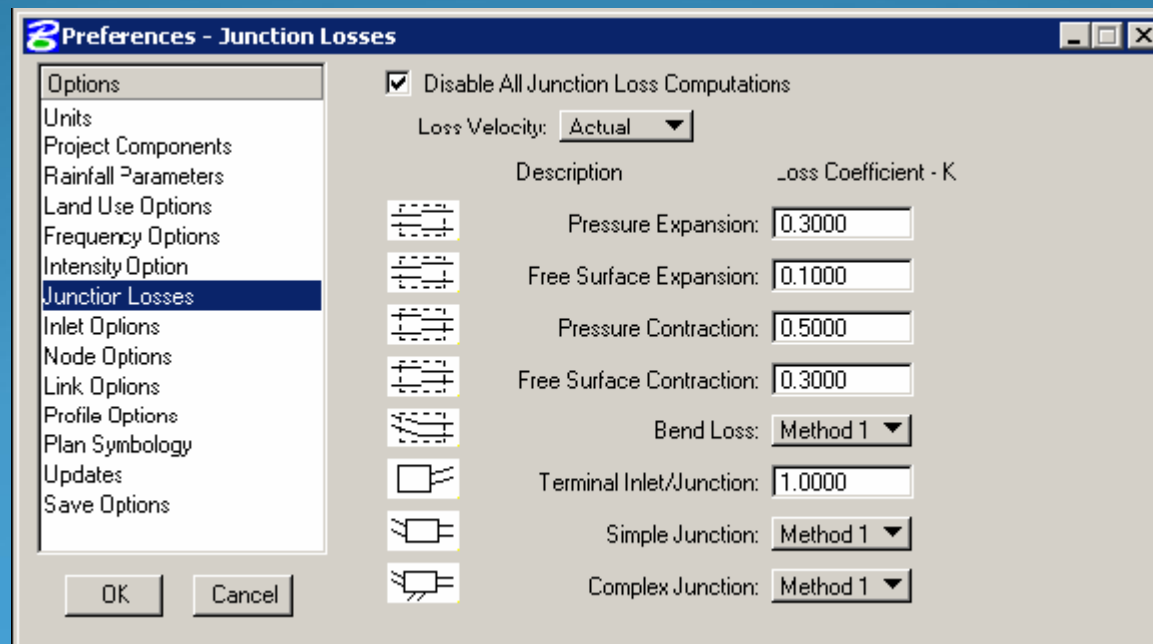
Inlet Computation Only

Absolute Intensity: 4.0000

OK Cancel

Project Preferences

- Set Junction Losses as shown in the dialog below.



Project Preferences

- Inlet options are next. Set them as follows.

Inlet By Pass Options

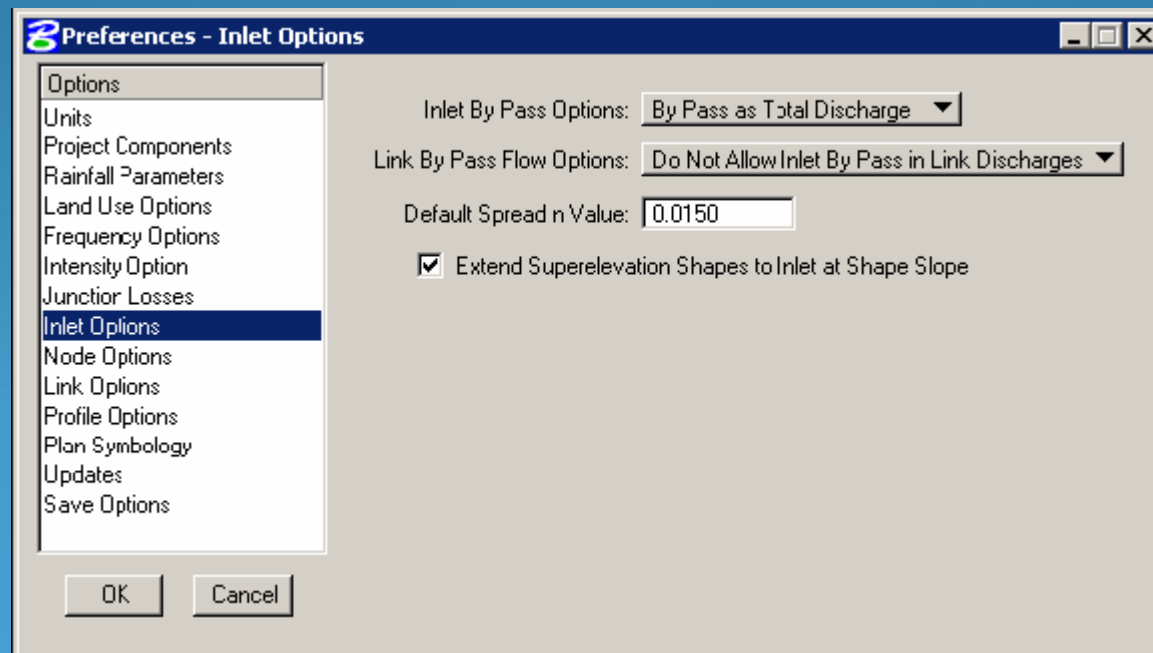
By Pass as Total Discharge

Link By Pass Flow Options Do Not Allow Inlet By Pass in Link Discharges

Default Spread n Value

0.0150

Extend Superelevation Shapes at Shape Slope



Project Preferences

- Set Node Options as shown in the dialog below.

Default Node ID Prefix

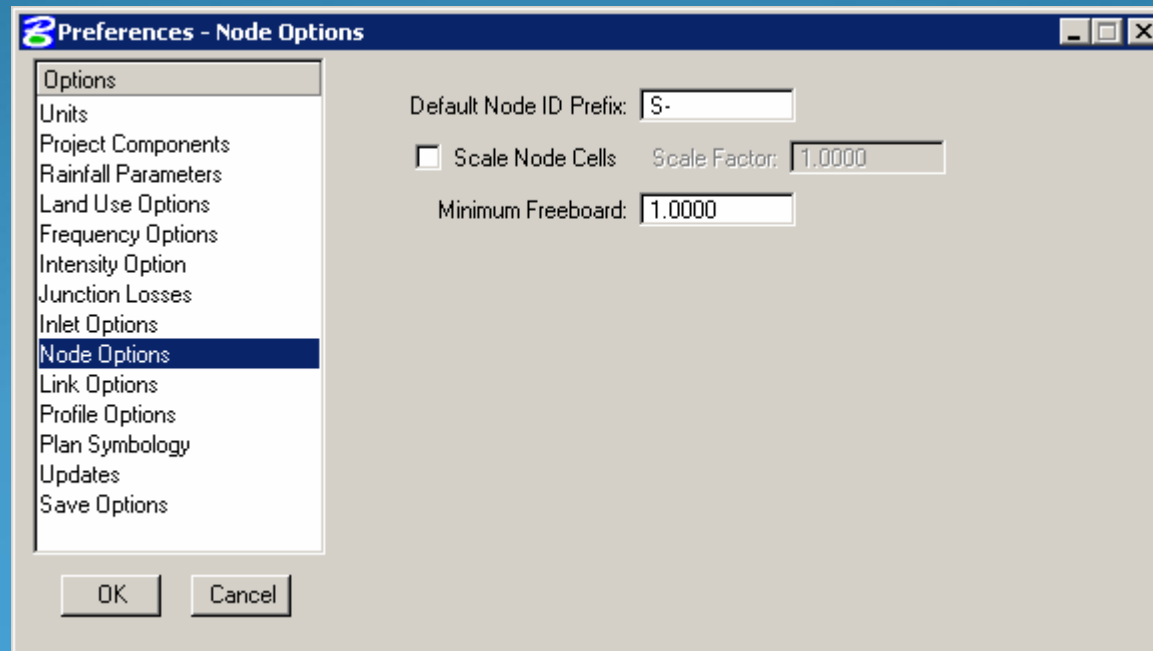
S-

Scale Node Cells

DO NOT CHECK THIS BOX

Minimum Freeboard

Currently 1.0 Foot



Project Preferences

- Set Link Options as shown in the dialog below.

Default Link ID Prefix	Pipe-
Design Optimization	Minimize Depth of Cover
Elevation Option	At Actual Link End
Design for Maximum Capacity	Checked ON
Link Criteria File	Pipe.x

The screenshot shows the 'Preferences - Link Options' dialog box with the following settings:

- Options: Link Options (selected)
- Default Link ID Prefix: pipe-
- Link Profile Options:
 - Design Optimization: Minimize Depth of Cover
 - Elevation Option: at Actual Link End
- Link Design Options:
 - Design for Maximum Capacity
 - Design for Full Capacity
 - Design Partial Capacity (d/D) Ratio: 1.0000
 - Design Partial Capacity (q/Q) Ratio: 1.0000
 - Link Slope Decimal: No Rounding
- Link Criteria File:
 - File Name: pipe.x
- Hydraulic GradeLine Options:
 - Hydraulic Gradeline Basis: Equal Hydraulic Gradeline

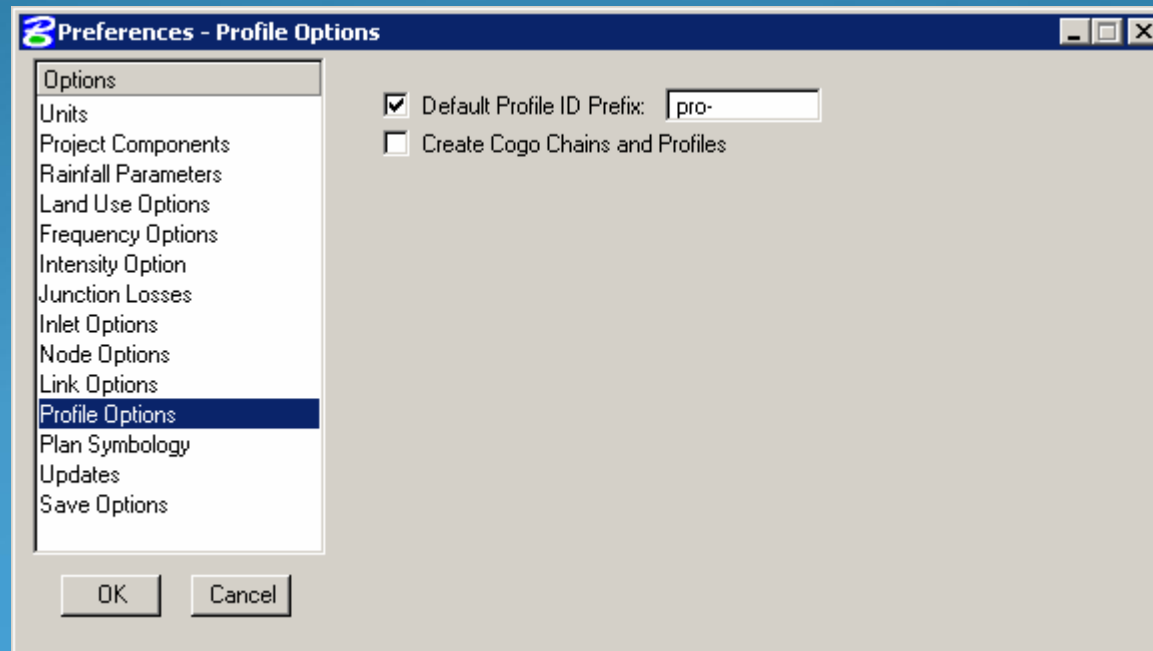
Buttons: OK, Cancel

Project Preferences

- Profile options are next. Set them as follows.

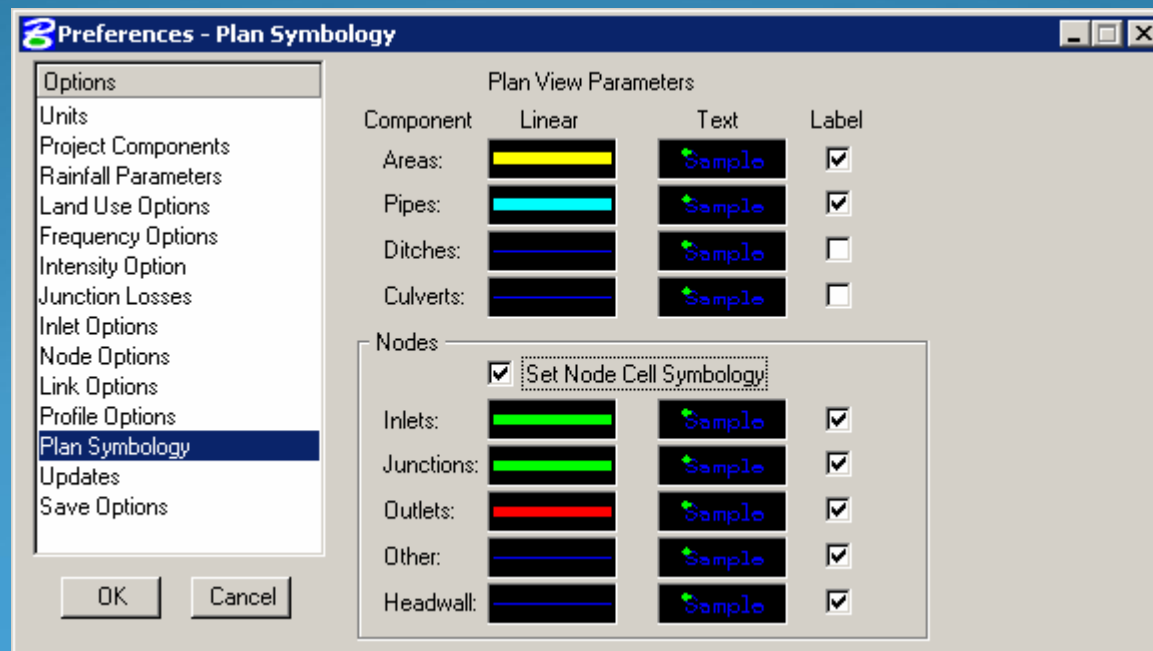
Default Profile ID Prefix
Create COGO Chains

Pro-
Not Checked



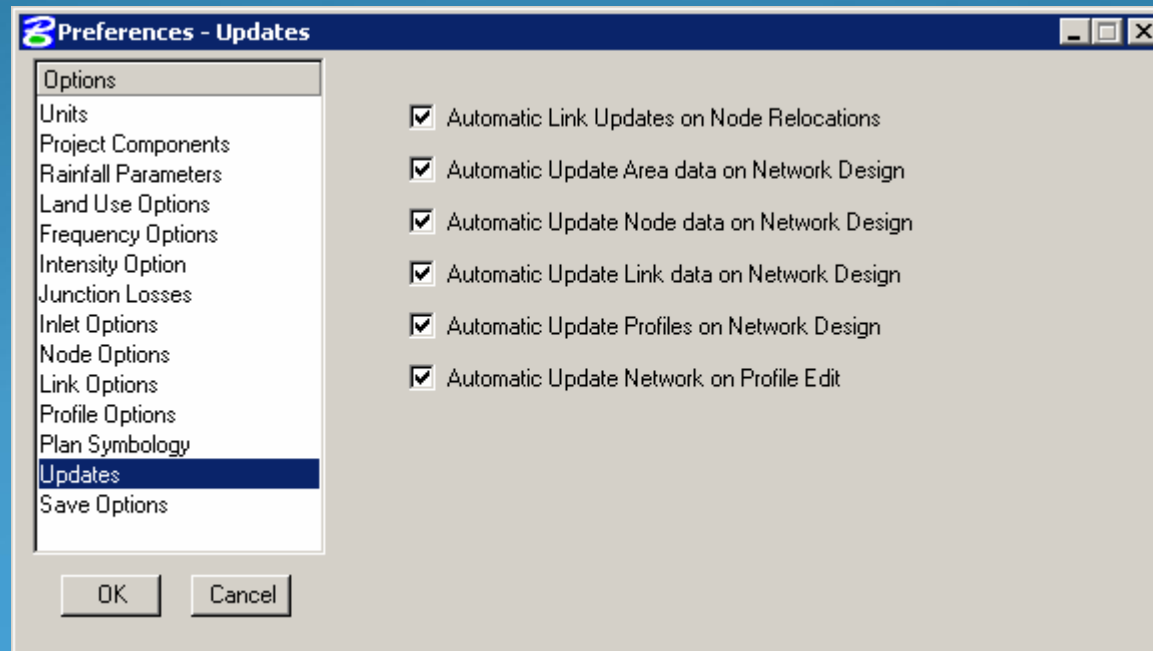
Project Preferences

- Plan Symbology is the next set of options you come to. They can be set to any symbology you are comfortable with to aid in the initial layout of the project.



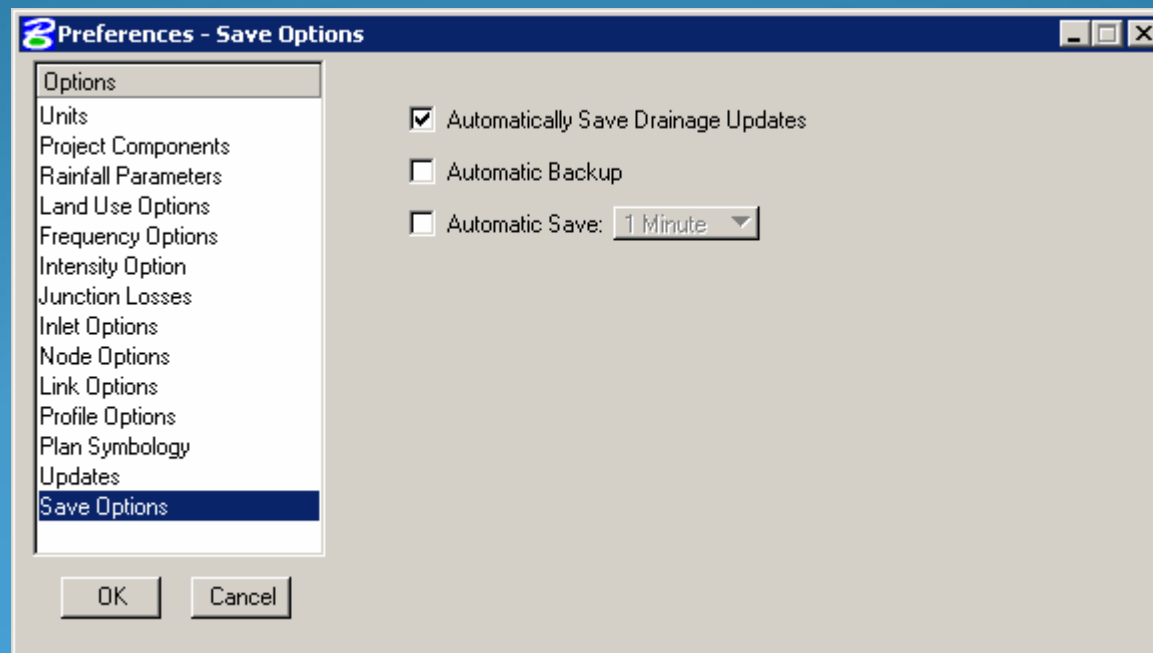
Project Preferences

- All of the check boxes on the Updates Options screen should be checked ON. This is to make sure everything updates as you Apply the changes you make.



Project Preferences

- On the Save Options screen you can set these as you feel comfortable. But it is recommended that you at least set Automatically Save Drainage Updates to ON.



Now Let's Get to Work

- First you need to place the Nodes (structures) in plan view. The placement of these will be based on the information you have received from the drainage engineer.

Now Let's Get to Work

- First you need to place the Nodes (structures) in plan view. The placement of these will be based on the information you have received from the drainage engineer.
- After the Nodes you must place the Links (pipes). These will connect your nodes for the system you are working on.

Now Let's Get to Work

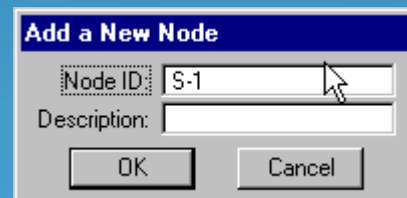
- First you need to place the Nodes (structures) in plan view. The placement of these will be based on the information you have received from the drainage engineer.
- After the Nodes you must place the Links (pipes). These will connect your nodes for the system you are working on.
- Next you will need to use the Nodes and Links you have placed to form the Networks for your project.

Now Let's Get to Work

- First you need to place the Nodes (structures) in plan view. The placement of these will be based on the information you have received from the drainage engineer.
- After the Nodes you must place the Links (pipes). These will connect your nodes for the system you are working on.
- Next you will need to use the Nodes and Links you have placed to form the Networks for your project.
- Now you can generate cross sections and profiles of your project.

Placing the Nodes

- To place a new Node go to *Drainage Menu > Component > Node > Add* and the pre-numbered Node ID should appear. You will be able to change this later or you can specify a different Node ID now. You can also Place a description with this node at this time. Once you have this done just click OK to procede.

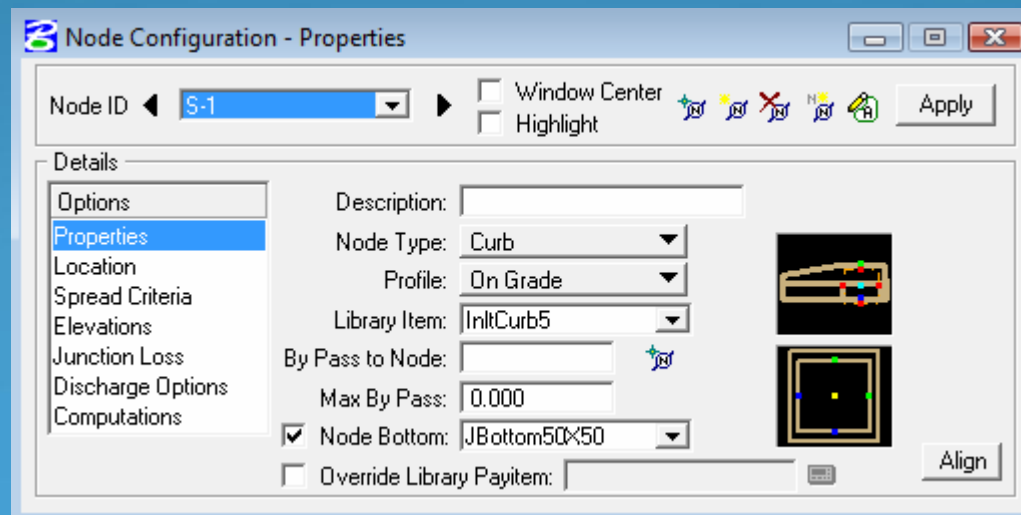


The image shows a dialog box titled "Add a New Node". It contains two input fields: "Node ID" with the value "S-1" and "Description" which is currently empty. At the bottom of the dialog are two buttons: "OK" and "Cancel". A mouse cursor is positioned over the "Node ID" field.

Placing the Nodes

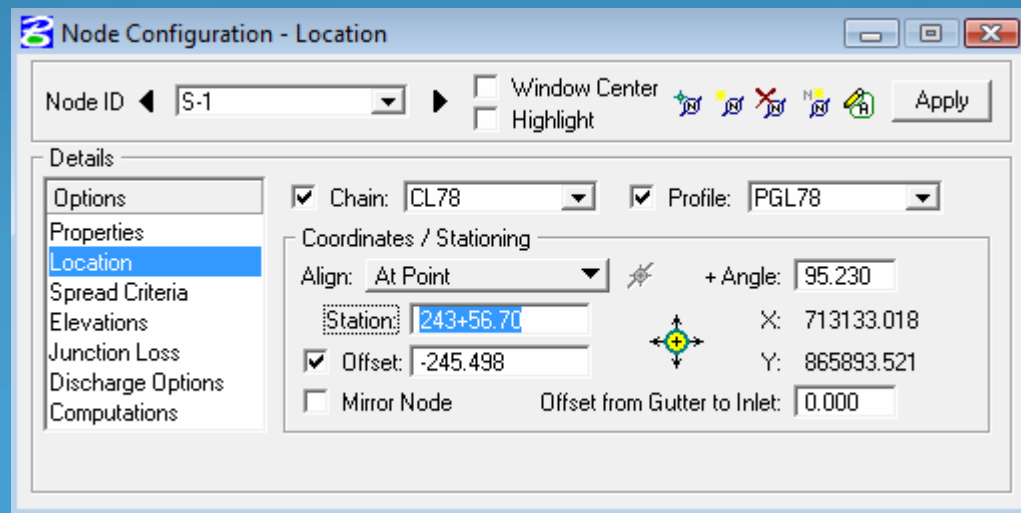
- Now you see the Node Configuration dialog box. It is here you will enter the information provided to you by the drainage engineer. The first area is the node Properties. This will be your Description, Type, Profile, Library Item and Bottom. (You can use the Override Payitem to prevent quantification of existing structures)

Attention:
Make sure you
have only one
Outlet on any
network of
Nodes.



Placing the Nodes

- Next you will define the Location of your node. To do this select the appropriate Chain and Profile. Then supply the Station Offset and Angle of the Node.



Placing the Nodes

- Next you will define the Elevation of your node. Select the User Supplied option for the Elevation Source. Then set the value to the provided elevation for the node and set Node Elevation Option to Same as Source. Use Match Soffit and set your Max. & Min. Depth to the desired amounts.

Node Configuration - Elevations

Node ID: S-1

Window Center

Highlight

Apply

Details

Options

Properties

Location

Spread Criteria

Elevations

Junction Loss

Discharge Options

Computations

Reference Surface: TIN File C:\4942062\survey\veg

Elevation Source: User Supplied 5.65

Node Elevation Option: Same as Source 0.000

Vertical Alignment: Match Soffit 0.000

Minimum Depth: 3.000

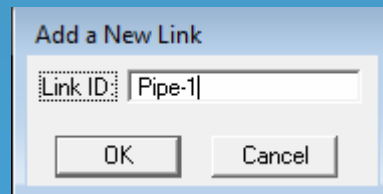
Maximum Depth: 20.000

Add Sump Depth: 0.000

Once you finish with each Node, be sure to hit the **Apply** button.

Placing the Links

- After you have placed all the Nodes in your project you can then begin to place your Links. Start by going to *Drainage: Component > Link > Add* and the pre-numbered Link ID should appear. You will be able to change this later or you can specify a different Link ID now. You can also give a description to this Link. Once you are done just click OK to procede.

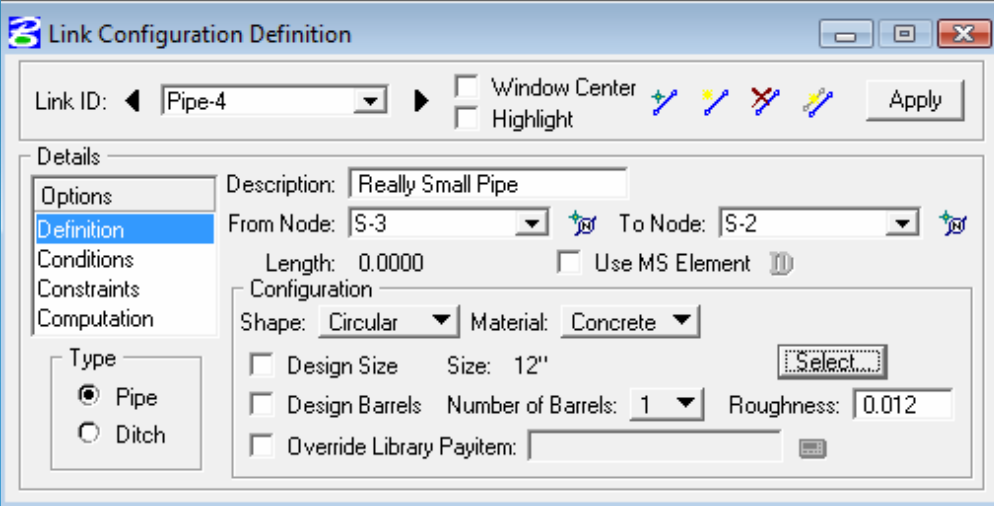


Placing the Links

- Now you can supply a Description and identify the From and To Nodes for this Link. The Configuration of the Link will consist of it's Shape, Material, Size, Number of Barrels, Roughness and Override Payitem (which is used to identify existing structures to prevent quantification).

Attention:

Some users have been seeing their links jump from one Node to another while making modifications. This is just a graphics glitch.



The screenshot shows the 'Link Configuration Definition' dialog box. It features a 'Link ID' dropdown set to 'Pipe-4', with 'Window Center' and 'Highlight' checkboxes and an 'Apply' button. The 'Details' section includes a 'Description' field with 'Really Small Pipe', 'From Node' (S-3) and 'To Node' (S-2) dropdowns, and a 'Length' of 0.0000. The 'Configuration' section has 'Shape' set to 'Circular' and 'Material' set to 'Concrete'. Under 'Type', 'Pipe' is selected. Other options include 'Design Size' (12"), 'Design Barrels' (1), 'Roughness' (0.012), and an 'Override Library Payitem' field.

Placing the Links

- At this point enter the Vertical Elevation information that the drainage engineer has given to you and hit the Apply button. FDOT usually calls out Invert Elevation.

Attention:

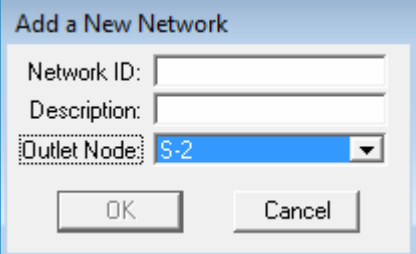
Some users have been seeing their links jump from one Node to another while making modifications. This is just a graphics glitch.

	From Node	Slope	To Node
Min Cover:	0.000	-0.739	2.650
Soffit:	0.000 <input type="checkbox"/>	0.000 <input type="checkbox"/>	0.000 <input type="checkbox"/>
Invert:	0.000 <input type="checkbox"/>		0.000 <input type="checkbox"/>
Max Depth:	0.000	4.000	-14.350

Once you finish with each Link, be sure to hit the **Apply** button.

Establishing Networks

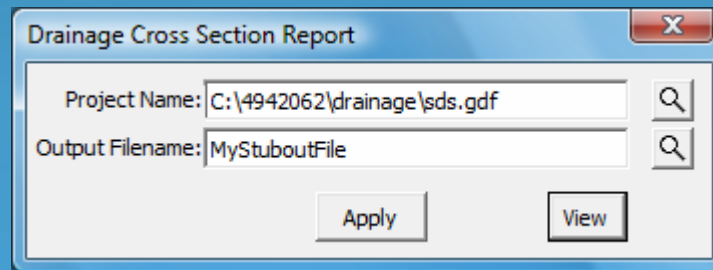
- To make the groupings of Nodes and their Links into a Network go to *Drainage Menu > Network > Add* to bring up the Add New Network dialog box. In this box you will specify the Network ID, Description (optional) and choose the Outlet Node from a dropdown Menu. Once you hit OK a new dialog will come up and can be dismissed.



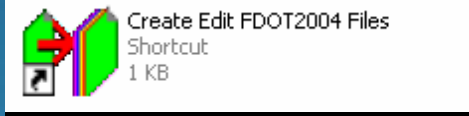
The screenshot shows a dialog box titled "Add a New Network". It contains three input fields: "Network ID:" (empty), "Description:" (empty), and "Outlet Node:" (dropdown menu). The dropdown menu is currently set to "S-2". At the bottom of the dialog box, there are two buttons: "OK" and "Cancel".

Drainage Cross Sections

- The first and sometimes forgotten step in generating drainage cross sections is making a Stub-out file. To do this go to the FDOT2004 Site Menu *Roadway > Drainage > Drainage VBAs > Drainage Stub-out Report for Xsections* and stat the VBA. It needs the current gdf (drainage project) file and the name you want it saved as. Hit Apply and you are done.

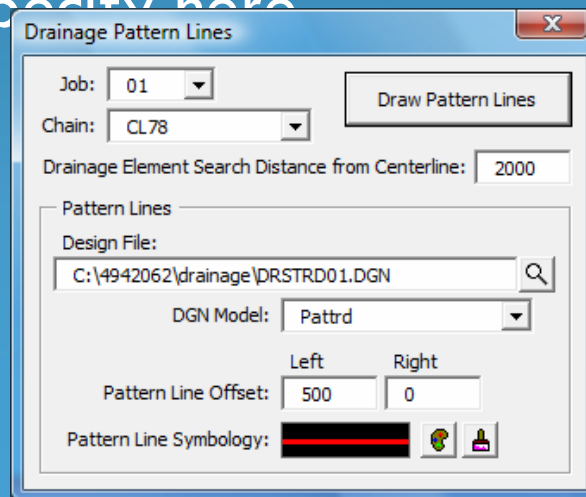


Drainage Cross Sections

- The next step is to use File Create Edit  to make the Proposed Drainage Cross Section file. This will be the DRXSRDxx.dgn. You will put your pattern lines, cross sections and superelevation shapes in it.
- Now make sure you are in the main drainage plan and go to *Roadway > Drainage > Drainage VBAs > Draw Drainage Pattern Lines*. This will bring up the Drainage Pattern Lines dialog box.

Drainage Cross Sections

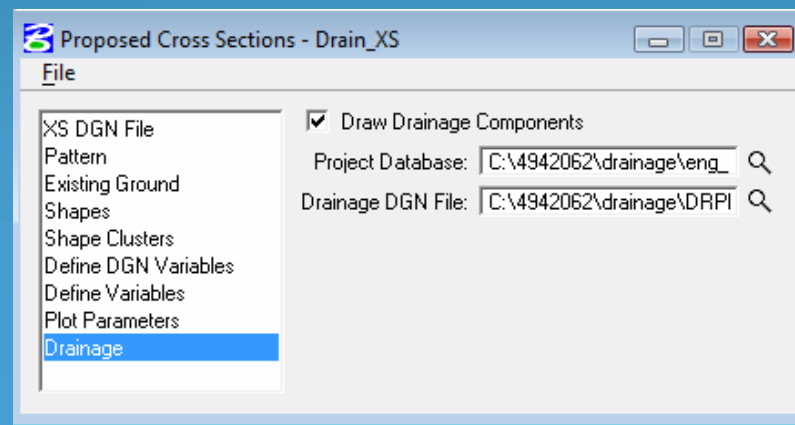
- In this dialog box you must supply the Job Number & Chain from the gpk. You will also determine the search distance from the centerline that the VBA will find structures. The pattern lines will be drawn according to the Design File, Model, Left Offset, Right Offset and Symbology you specify here.



Attention:
This VBA references the ddb so it will take a few seconds to come up.

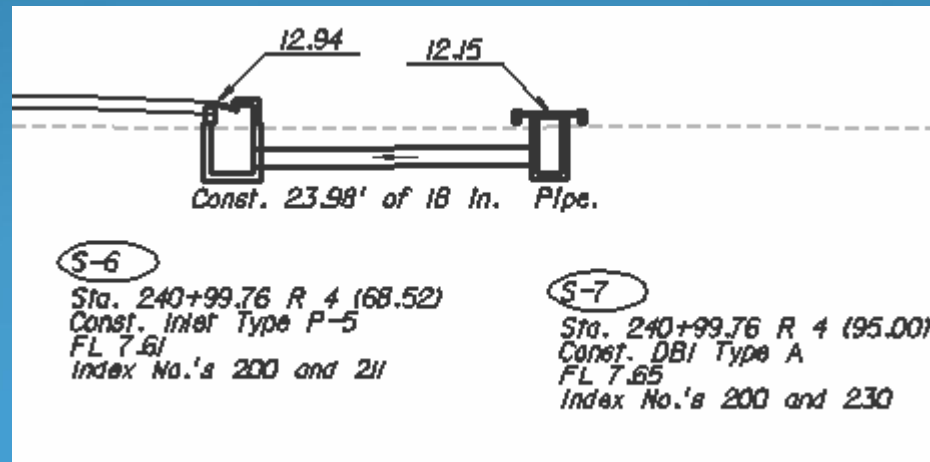
Drainage Cross Sections

- Once you have your pattern lines you can then generate your cross sections. The only difference in this run and the one you used to do your standard roadway cross sections is the information in the XS DGN File, Pattern settings and the Drainage Settings. They should all be set to point to the corresponding drainage files.



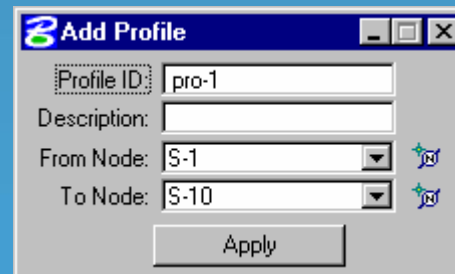
Drainage Cross Sections

- When you have all this set and activate the run it will ask you for the location of the stub-out file you created earlier. Browse to the location of the file and away you go.
- The output you get will be similar to the diagram below.



Drainage Profiles

- First we need to open the drainage plan to place the profile in.
- To create a Drainage Profile you start by going to *Drainage > Component > Profile > Add* bringing up the following dialog. The automatically generated Profile Id can be changed and a description added if you like. Now supply the From & To Nodes and hit the apply button.



Drainage Profiles

- Now you are presented with the Edit Drainage Profile dialog box. You need to supply the Scale at which the profile should be placed, Max. & Min, Elevations and then use the DP button to locate the profile on the plan.

Edit Drainage Profile - pro-1 - ...\drain_profile.ppf

File

Description: View Number: 1

Registration | Display | Drainage Information | Grid & Labels | Link Profile

Registration Point

X:

Y:

Projection

Project to Chain:

Chain:

Scale

Horizontal:

Vertical:

Grid Stationing and Elevations

Begin Station:

End Station:

Max. Elevation:

Min Elevation:

Node Information

From:

To:

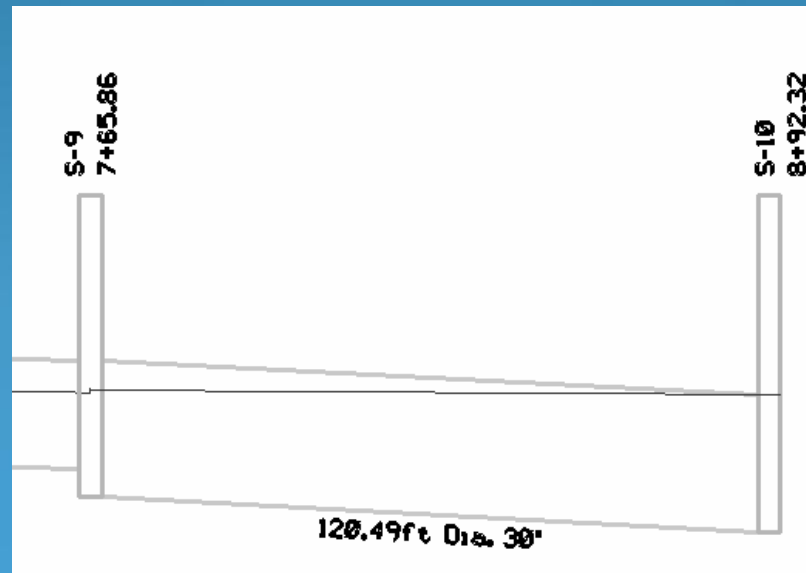
Reference Surface

Site Model

Vertical Offset:

Drainage Profiles

- Once you have placed this profile it can be moved by using the DP button and clicking Apply. Your output should look something like this.

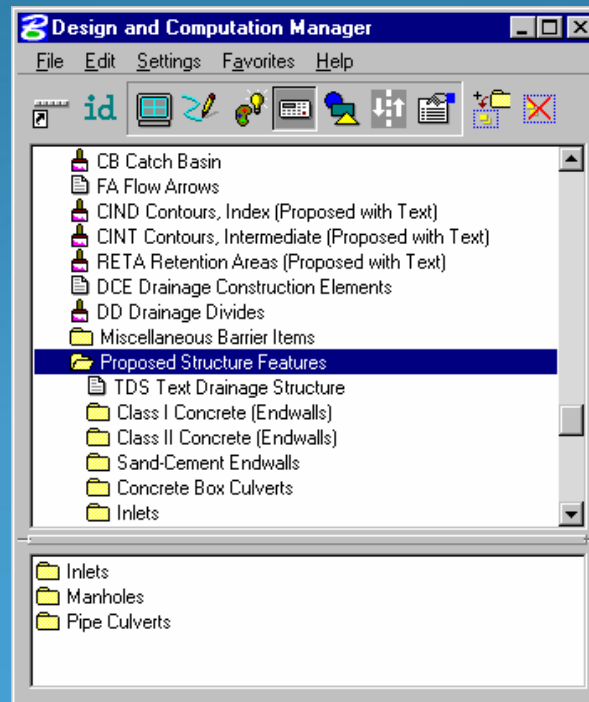


Automated Quantities

- GEOPAK Drainage places elements that in conjunction with the D&C Manager can be used to generate automated quantity reports.
- To begin this process you must be in the drainage plan view and have your drainage project open.
- Go to *Drainage > Project > Preferences*. Open the Plan Symbology options and turn all options off.
- Next you must do an Update with Payitems to the Nodes and Links within your project. You will notice a symbology change. This is due to the ddb symbology for them being used.

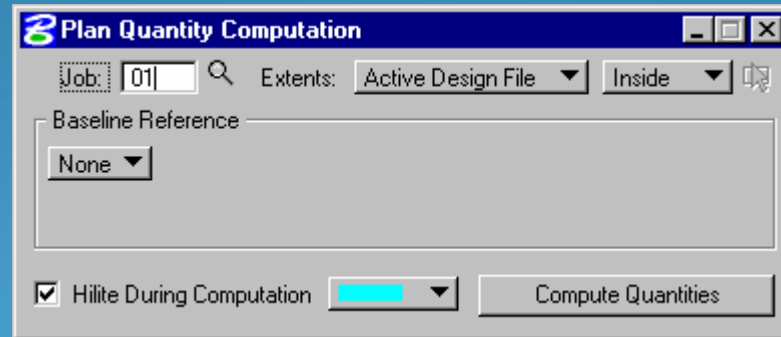
Automated Quantities

- Open the D&C Manager and set it to Compute mode. Now select the items to be quantified from the D&C Manager listing.



Automated Quantities

- In the Plan Quantity Computation dialog set it to Active Design File and Inside. Set the baseline Reference to None. Now click compute Quantities.



Automated Quantities

- Your output should look something like this. You can now deal with this information like any other quantity data.

Item	Description	Quantity	Unit	Export
0425 1351	Curb Inlet Type 5 (<10ft)	4.0000	EA=...	<input checked="" type="checkbox"/>
0425 1361	Curb Inlet Type 6 (<10ft)	2.0000	EA=...	<input checked="" type="checkbox"/>
0425 1501	DBI Type A (4 x 3) (<10ft)	1.0000	EA=...	<input checked="" type="checkbox"/>
0430171133	Storm Sewer Pipe Culvert Opt Mtrl (30")	122.0000	LF=...	<input checked="" type="checkbox"/>
0430171129	Storm Sewer Pipe Culvert Opt Mtrl (24")	794.0000	LF=...	<input checked="" type="checkbox"/>
0430171125	Storm Sewer Pipe Culvert Opt Mtrl (18")	618.0000	LF=...	<input checked="" type="checkbox"/>

Export Format:

Run: Phase:

Thank you for attending and
please feel free to send any
questions to me VIA e-mail.
james.worley@dot.state.fl.us