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## Chapter 18: Cross Sections

### Overview

Proposed Cross Sections are used to determine the limits of construction, earthwork, construction staking reports, and 3D modeling. It is very important that they are drawn consistently and to the standards outlined in this chapter. Federal Lands Highway (FLH) has developed a new generation of criteria files known as the X30 criteria files. With the development of the X30 criteria, creating the proposed cross sections no longer requires the traditional input files and exception data files. With the X30 criteria files, proposed cross sections are created through the Project Manager using the Typical Section Generator. Proper setup and use of the Project Manager is crucial in using the Typical Section Generator to create the proposed cross sections.

Federal Lands Highway have developed **6 Typical Sections** for the use of developing cross sections. The 6 Typical Sections are **Divided New Pavement, Existing Features, Existing and Proposed Right of Way, Rehabilitation Typical Section (3R), Undivided New Pavement and Cross Section Labeling**.

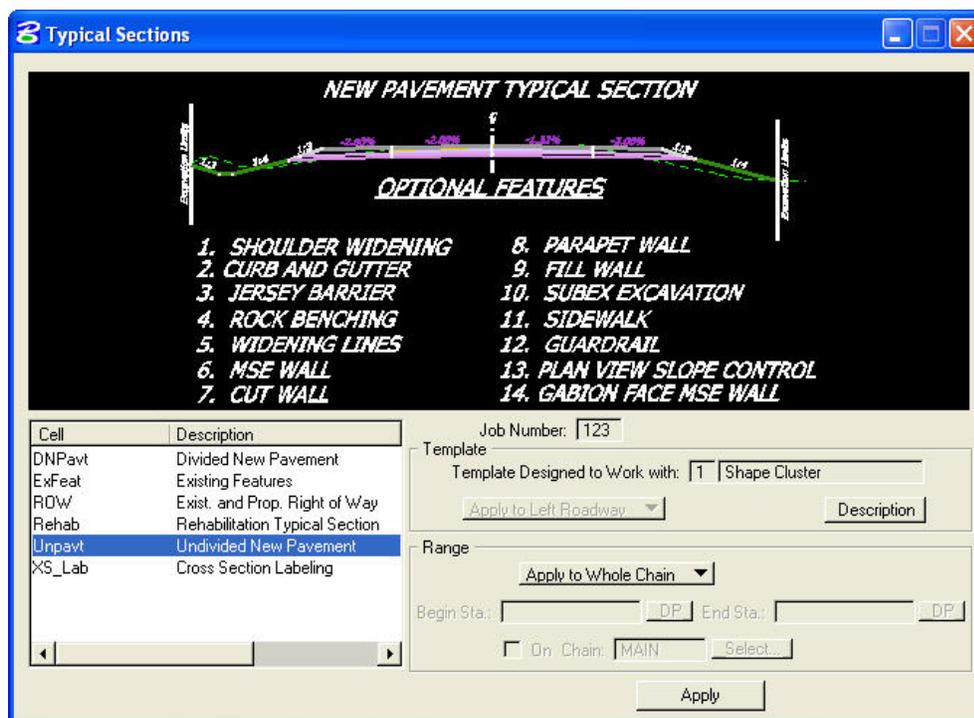


Figure 18-1: FLH Typical Sections

There are many optional features available with the Typical Sections. To use the optional features, Typical Sections looks for elements drawn in plan view that were drawn using Design and Computation Manager and Place Influence to act as a "horizontal" reference lines. Sometimes these elements drawn in plan view represent the exact offset for the corresponding cell to be placed in the cross section file and other times



these elements simply act as an "on/off switch" giving instructions to the criteria.

Prior to running proposed cross sections, the Project Manager needs to be setup as outlined in Chapter 13 of the Geopak 2004 - X30 CADD Standards Manual.

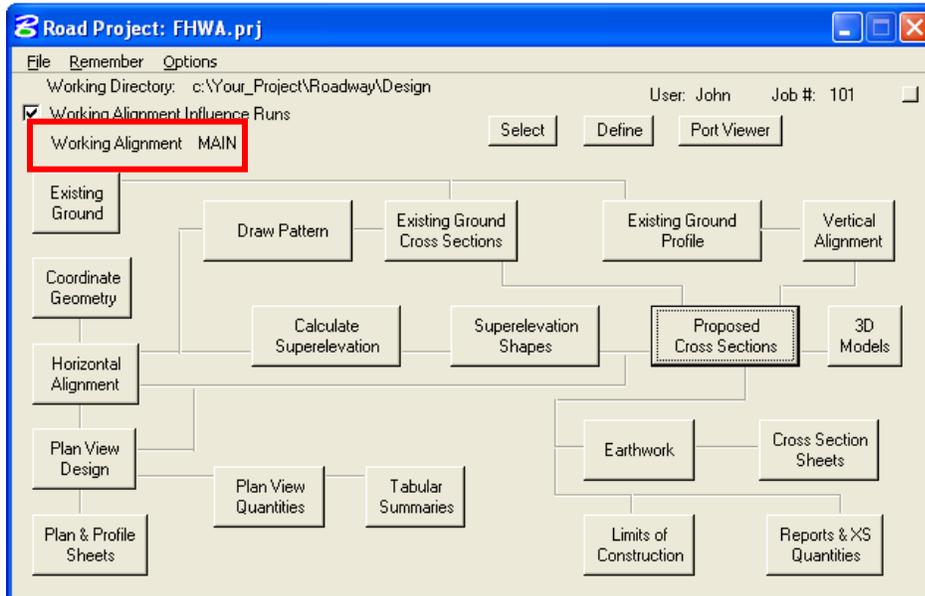


Figure 18-2: Project Manager Workflow Dialog

Once the working alignment has been selected and defined, Proposed Cross Sections can be run through the Project Manager Workflow Dialog Box. Follow Workflow 1 below to setup the Working Alignment Definition. An example Working Alignment called MAIN will be used to outline the Workflows in this Chapter.

## Workflow 1: Working Alignment Definition

1. Select Define button from the Project Manager Workflow Dialog as shown below.



Figure 18-3: Define Working Alignment

2. The Working Alignment Definition Dialog Box for the Chain MAIN will appear. For the Plan View select the proposed design file and select the Geopak alignment chain.

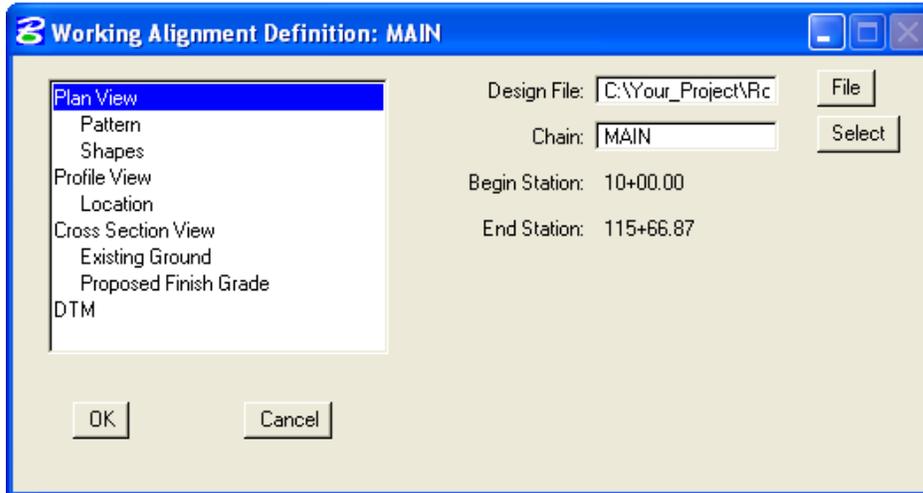


Figure 18-4: Plan View Definition

- For the Pattern populate the dialog *By Station* or *By Design File*. Use named levels *P\_GPK\_Pattern\_01* to *P\_GPK\_Pattern\_10* to place pattern lines in a design file. *Horizontal Scale* and *Vertical Scale* should be set to 1.

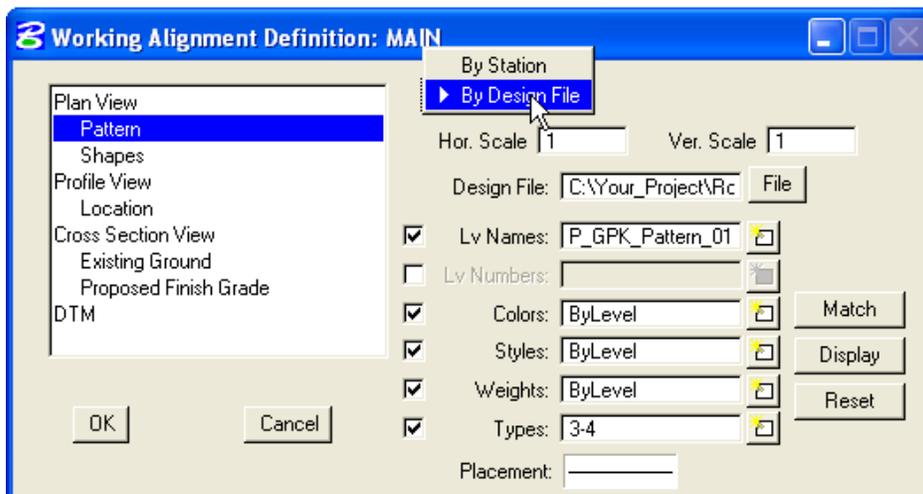


Figure 18-5: Pattern Definition

- For the Shapes populate the dialog *By Search Criteria* as shown below. Using the *Search Criteria* mode instead of the *All in DGN* mode will process the proposed cross sections faster. When drawing superelevation shapes, make sure to define your level symbology, use named level *P\_RDW\_Super\_Shapes* to draw superelevation shapes in the Shapes dgn file.

For CFL projects, Superelevation Files (preference files, e files and length files) are accessible from the V8\_RESOURCEX\_30\Standards\Bin\English or Metric Directory.

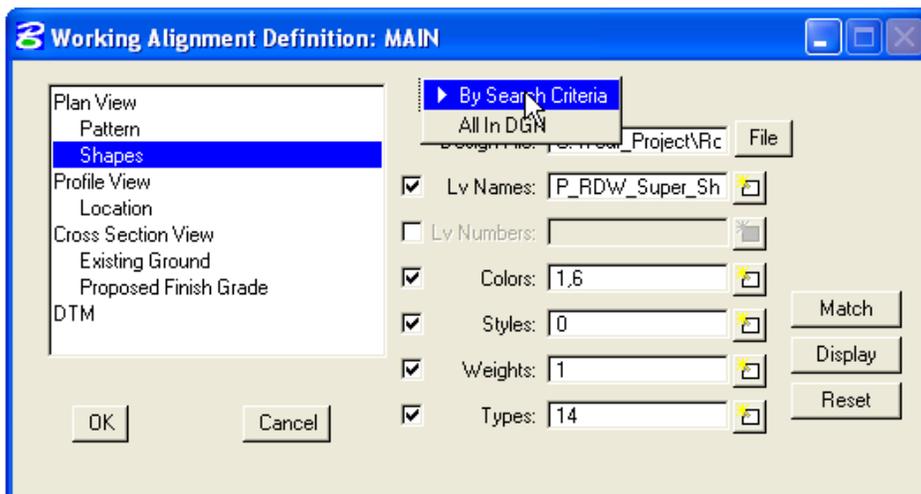


Figure 18-6: Shapes Definition

5. For the Profile View and Location populate the dialogs defining your design profile file, existing profile and proposed profiles. Profile Location can be populated by selecting the Identify Cell button and selecting the profile cell. Profile View and Location are not required to be populated to run proposed cross sections.
6. For the Cross Section View populate the dialogs defining your XS DGN file.

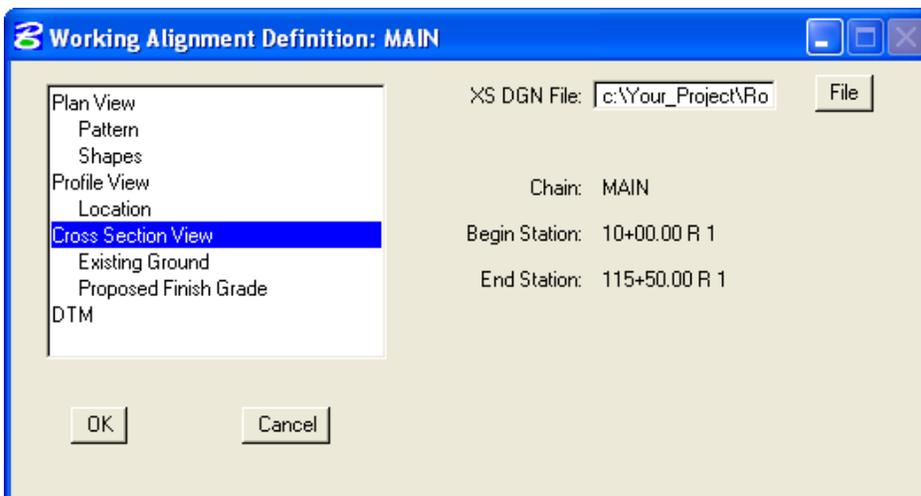
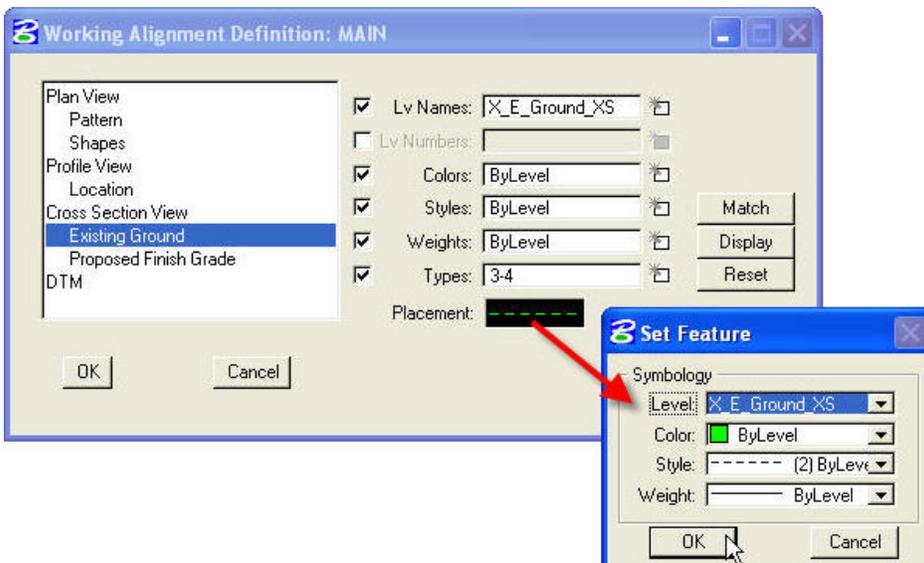


Figure 18-7: Cross Section Definition



- For the Existing Ground populate the dialogs defining the parameters of your existing ground as shown below. Double click on the Placement field and Set the Feature Symbology as shown.



**Figure 18-8: Existing Ground Definition**

- The Proposed Finished Grade and DTM should be completed, but they are not required to be populated to run Proposed Cross Sections. After completing all the categories in the dialog box, Select OK to save and close the Working Alignment Definition dialog box. In this example the working alignment definition for MAIN has been saved.

Once the working alignment definitions are set for a working alignment, Proposed Cross Sections can be selected from the Project Manager Dialog Box. Workflow 2 will outline the steps required to process the Proposed Cross Sections.



## Workflow 2: Proposed Cross Sections

1. *Select Proposed Cross Sections button from the Project Manager Workflow Dialog Box.*

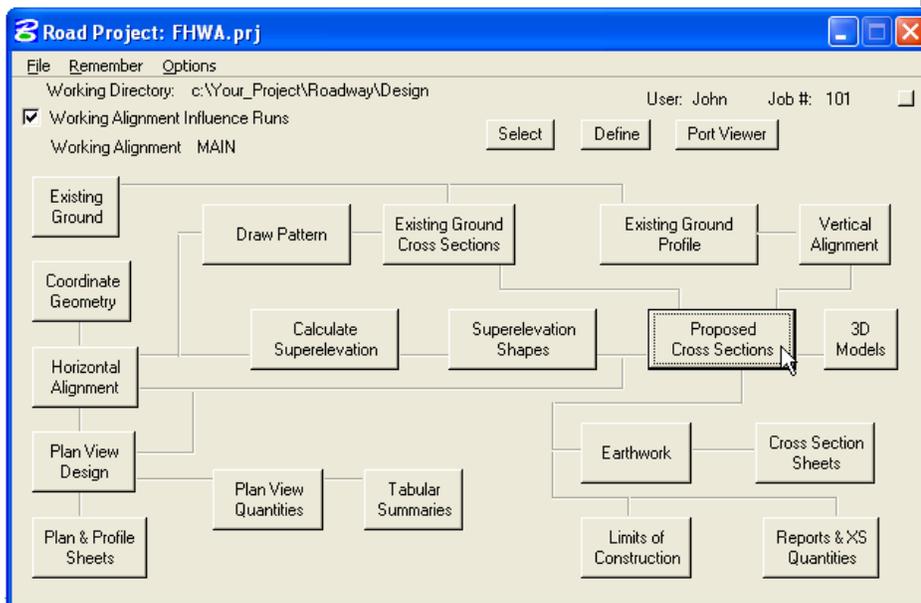


Figure 18-9: Accessing Proposed Cross Sections

2. *The following dialog will be activated, since no run exist for the example Select New to create a Run.*

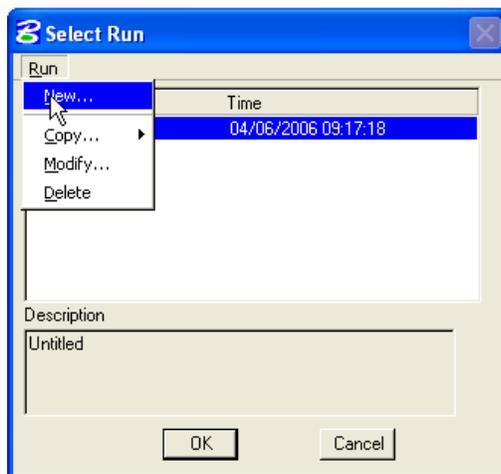
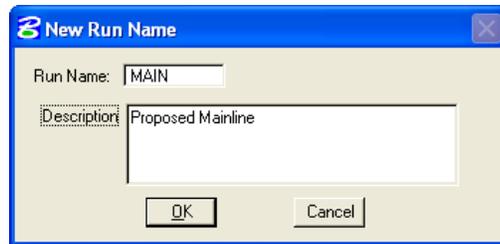


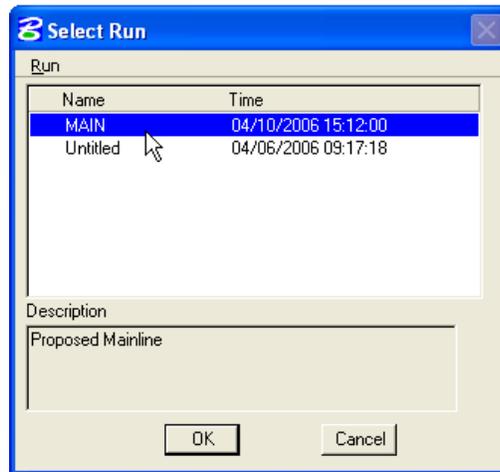
Figure 18-10: Create a New Run

3. *Create a New Run by entering the run name and description and select OK.*



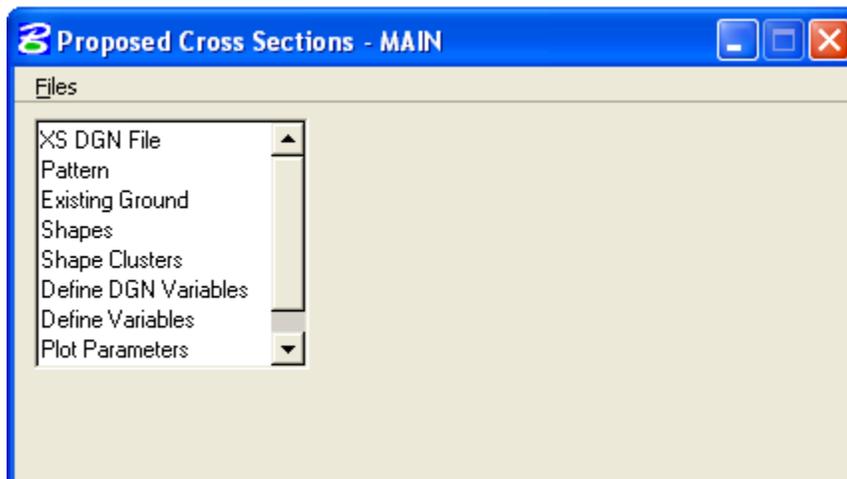
**Figure 18-11: New Run**

4. From the *Select Run* dialog, select the newly created run MAIN and select OK.



**Figure 18-12: Select New Run**

5. Selecting a Run will access the *Proposed Cross Section Dialog*.



**Figure 18-13: Proposed Cross Sections Dialog**

The Proposed Cross Section run shown in this workflow will be for an Undivided New Pavement Typical Section.



The proposed Cross section run holds the same information as the old Proposed Cross Section Input File and Exception Data File combined.

6. *Select the XS DGN File from the Proposed Cross Section dialog. Note that the dialog box is already filled in by the Working Alignment definition.*

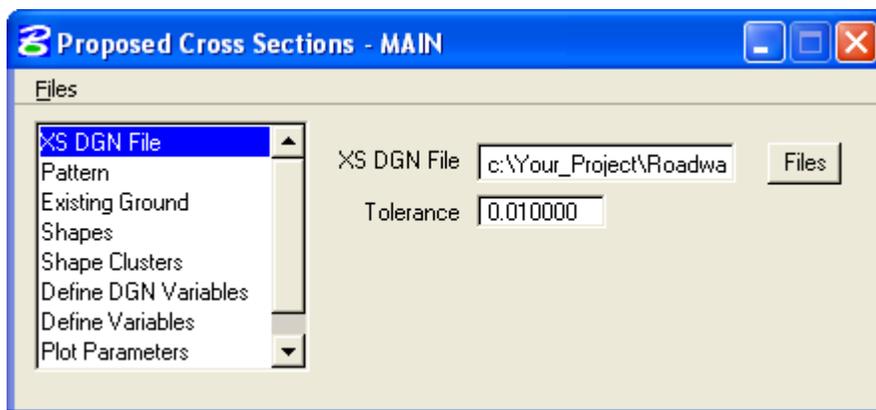


Figure 18-14: Selecting XS DGN File



The tolerance should always be set to 0.01 for English projects and 0.003 for Metric projects. The tolerance setting is very important and the proposed cross section will not process without setting this value.

7. *Select the Pattern and toggle on Use Working Alignment Definition.*

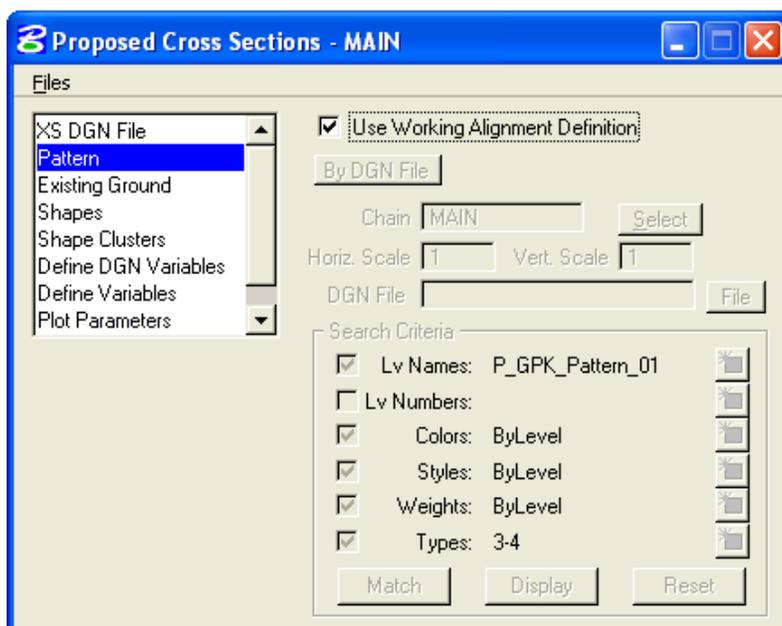
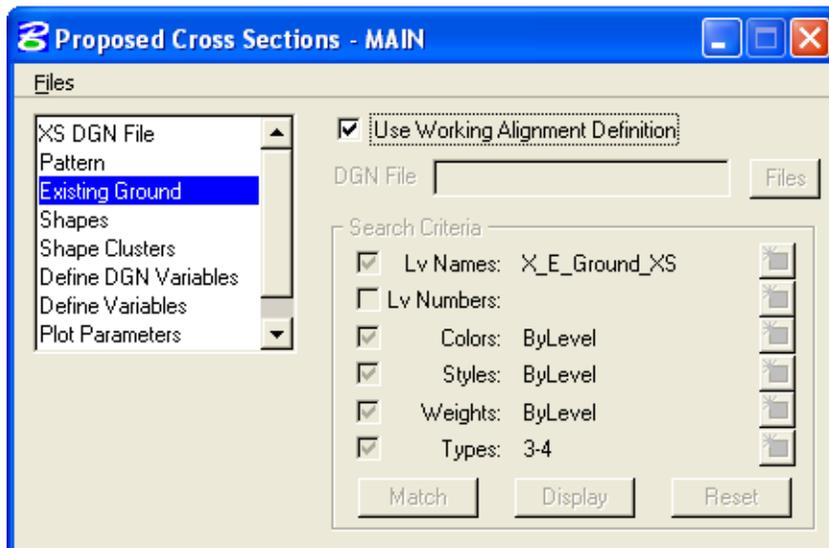


Figure 18-15 Selecting Pattern

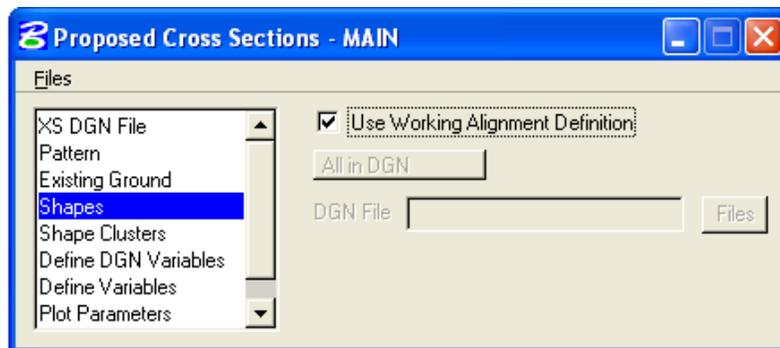


8. *Select the Existing Ground and toggle on Use Working Alignment Definition.*



**Figure 18-16 Selecting Existing Ground**

9. *Select the Shapes and toggle on Use Working Alignment Definition.*



**Figure 18-17: Selecting Shapes**

The Working Alignment Definition toggle can be used for Pattern, Existing Ground and Shapes; these were previously defined for this working alignment. Shapes can be selected using Working Alignment definition, All in DGN, By Search Criteria, or in Shapeless Mode. Proposed Cross Sections should be run in shapeless mode for Existing Features, Existing and Proposed Right of Way, and Cross Section Labeling Typical Sections.



10. Select Shape Clusters from the Proposed Cross Section dialog. The following dialog box will appear. Select Scan.

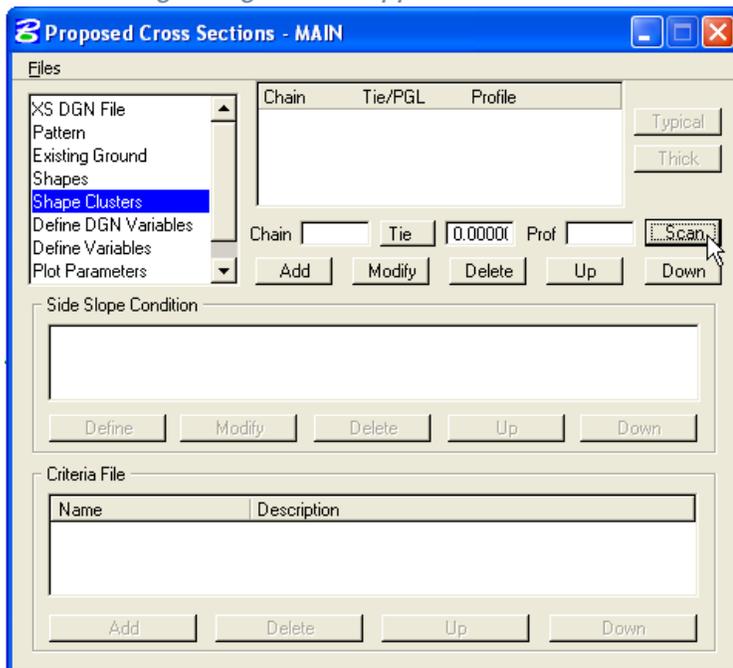


Figure 18-18: Selecting Shape Clusters

11. Selecting Scan button will access the List of Clusters dialog box as shown below. Select the shape cluster and close the dialog box.

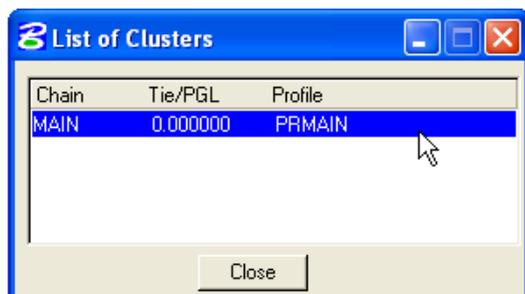


Figure 18-19: List of Clusters

12. Select the add button from the main shape cluster dialog box to add the shape cluster to the list box as shown.

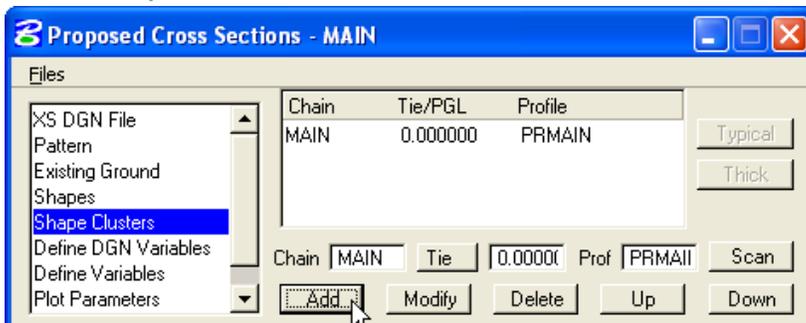


Figure 18-20: Add List of Clusters



13. Once the shape cluster is added to the list box, highlight the information in list box shown and the Typical button will become active. Select the Typical button to access the Typical Section Generator.



Figure 18-21: Select Typical Section

14. Through the Typical Sections Generator, 6 Typical Sections are available. Select UNPAVT for undivided new pavement. In the Range window, Select Apply to Whole Chain and then Select Apply button at the bottom of the dialog box.

If the proposed cross section need to be processed for a station range, select By Station Range and then define begin and end stations.

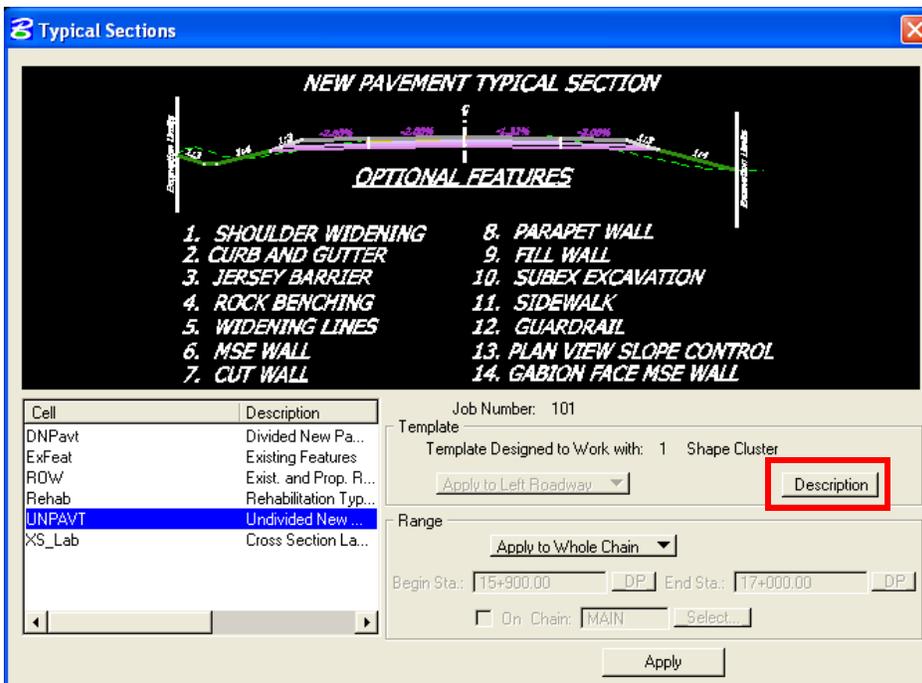


Figure 18-22: Choose Typical Section



Select the Description button in the Typical Section dialog box to access the online help for the highlighted Typical Section. Help document provides detailed drawings, descriptions and information on how each of the Typical Sections work.

The help files can also be accessed outside the Typical Sections Dialog Box. For Consultants, **Help** documentations are available through the **V8\_Resource.zip** download on CFLHD Website. Help files (\*.wri files) are available in the *V8\_Resource\X\_30\Typicals\English or Metric directory*.

The **Help** documentations can be found on the CFLHD network at: *N:\Standards\V8\_RESOURCE\X\_30\Typicals\English or Metric directory*.

15. *By selecting apply in the dialog box above, the criteria files associated with the selected Typical Section is populated into the main Proposed Cross Section dialog box.*

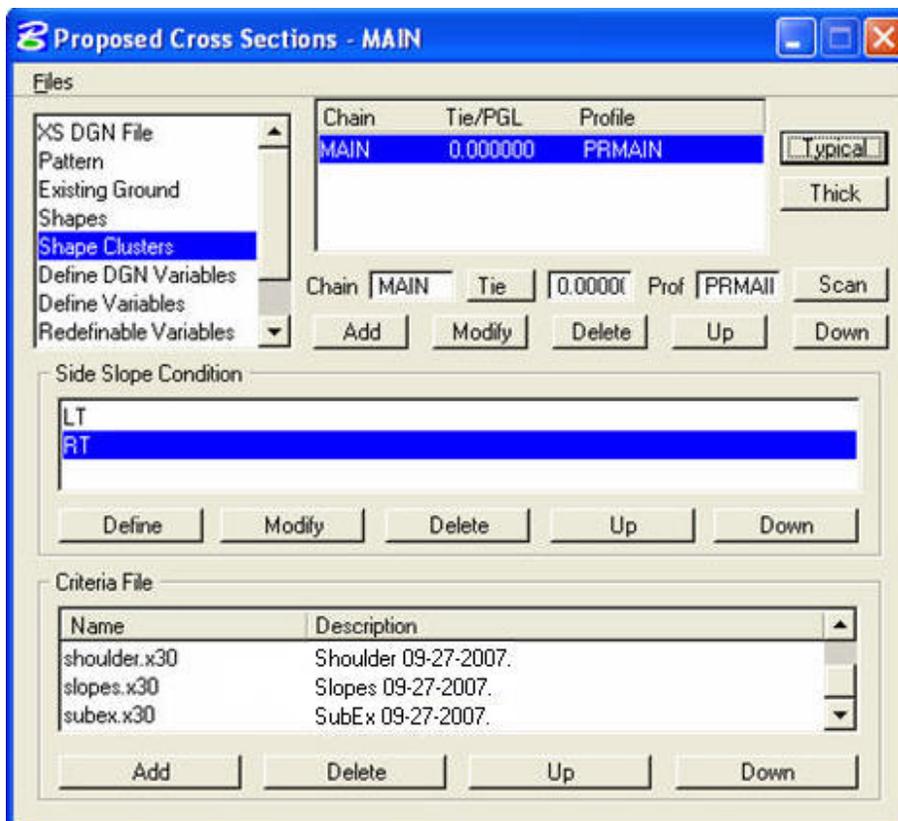


Figure 18-23: Populated Shape Cluster

16. *The Define DGN Variables is not applicable for Undivided New Pavement Typical and should be left blank. This variable is used only with Automated Cross Section Labeling Typical.*



17. Select Define Variables and edit Cross Section Dgn, Proposed Plan Dgn and Geopak Lines Dgn values. Edit the default value of the variable and select Modify to accept.

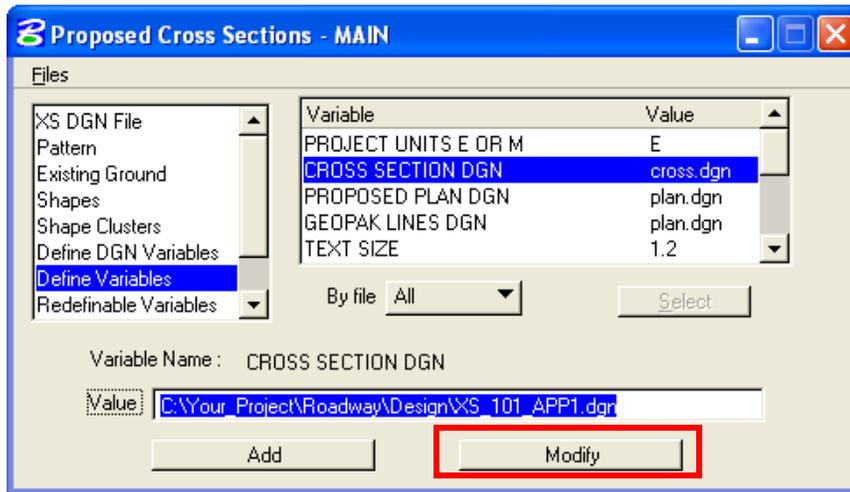


Figure 18-24: Populated Shape Cluster



If any of the dgn files are not in the working directory, the full file path must be specified. These dgn files are used by criteria to search for plan view elements.

18. Select Redefinable Variables as shown below. Select the Edit button to modify each of the default variables and to set project specific values.

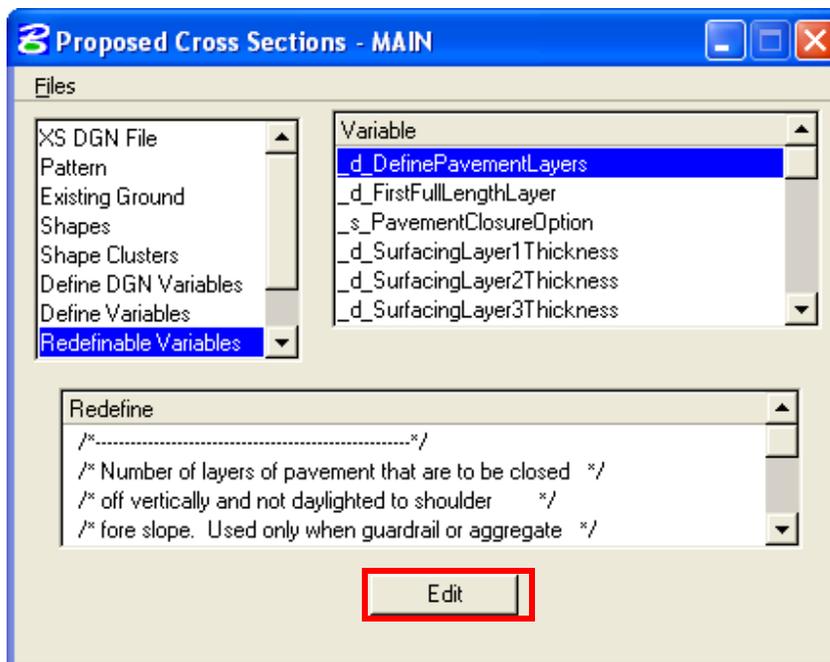


Figure 18-25: Redefinable Variables



Never remove the default syntax of “if (Sta>=0+00 R 1) then” from beginning of each of the redefinable variable statements. When editing the station ranges for the redefinable variables, make sure { and } are placed after every “if, then” statement. Station ranges should be defined in the order of the baseline stationing. “and”, “or” and “not” are all valid syntax to use when editing redefinable variables.

The changes made to the define variables and redefinable variables are stored in the proposed cross section run, criteria is not being modified. Every time a Typical Section is reapplied (shape clusters populated), the proposed cross section run will be overwritten, therefore your define variables and redefinable variables will go back to default. Prior to re-applying a Typical Section, makes sure to create an input file by selecting File>Export or make a copy of the pxsprj.inp file and save as a different name. The backed up input file can be used to copy and paste project specific values to your default proposed cross section run.

*19. Select Plot Parameters and toggle off all the plot options as shown below.*

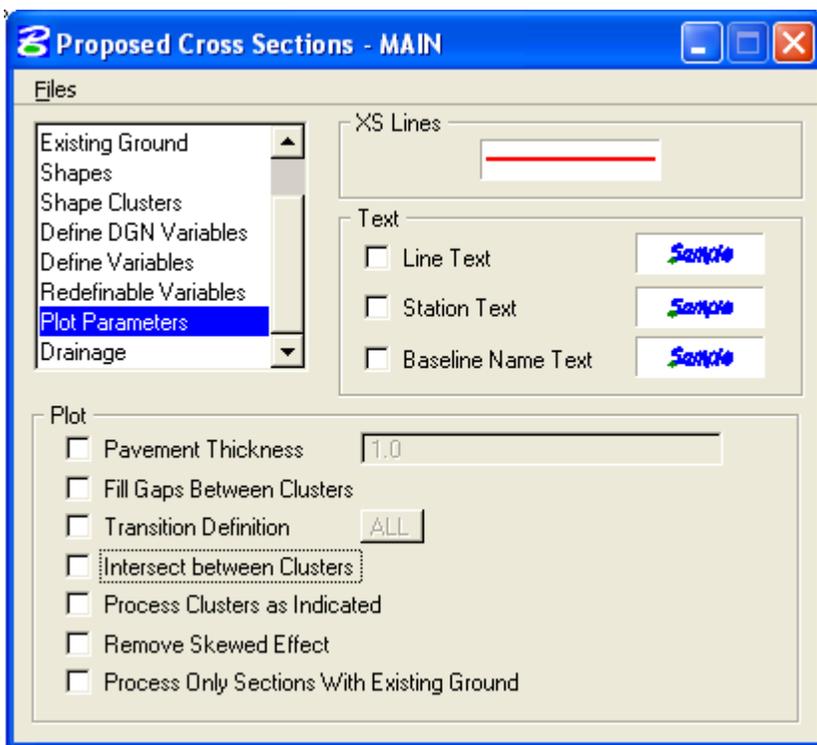


Figure 18-26: Plot options

*20. Select the drainage, this should be left blank. This will not apply to the 6 Typical Sections. Once the run has been modified for the working alignment, Select Files >Save Settings to save your run.*

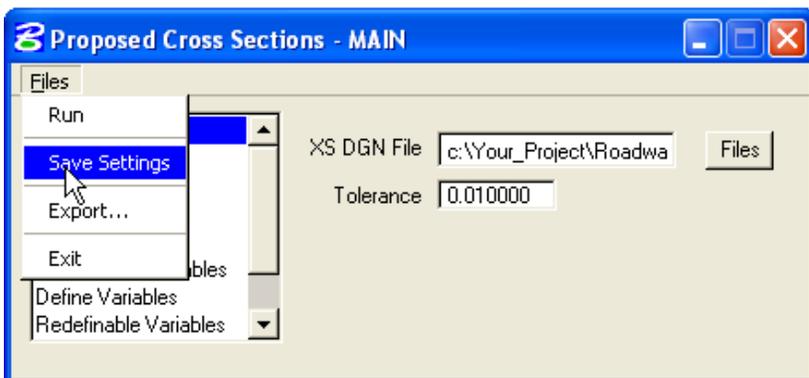


Figure 18-27: Save Settings

21. Select Files >Run to process your proposed cross sections.

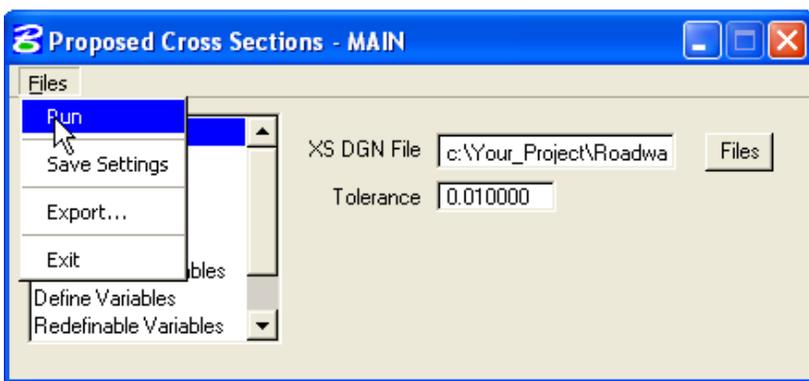


Figure 18-28: Run Proposed Cross Section

22. The following Proposed Cross Section Run dialog box will appear. Select the To Log File, change To Screen if no log file is desired. Select the Apply Button to process the proposed cross sections to your XSDGN file.

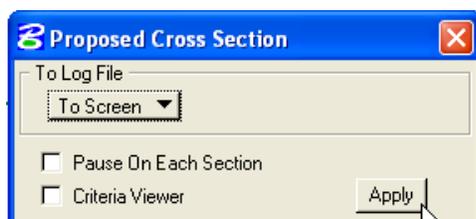


Figure 18-29: Process Proposed Cross Section



## Cross Section Navigator

Now that you have completed the proposed cross section run, you will want to view them. The cross section navigator is a tool that makes the viewing of cross sections much easier. Two types of Cross Section Navigators are available to review the cross sections. The Cross Section Navigator and the Super Cross Section Navigator which allows you to view your cross section based on your profile. The Super Cross Section Navigator prevents drifting of the cross sections and provides speed controlled cross section movie navigation. Workflow 3 and Workflow 4 will outline the two Cross Section Navigators.

### Workflow 3: Cross Section Navigator

1. *Select Applications>GEOPAK ROAD>Cross Sections>Navigator, or Select the Cross Section Navigator icon from the GEOPAK Road toolbar.*



Figure 18-30: Cross Section Navigator Icon

2. *The Cross Section Navigator dialog shown will appear.*



Figure 18-31: Cross Section Navigator

3. *Navigator will automatically center the first cross section found, using the station on the cross section cells.*

4. Use the arrows  to move up or down station through the cross sections. You can also use the station pull down menu to go to a specific cross section.



## Workflow 4: Super Cross Section Navigator

1. *Select Applications>GEOPAK ROAD>Design & Computation Manager, or Select the Design & Computation Manager icon from the GEOPAK Road toolbar.*



Figure 18-32: Design & Computation Manager Icon

2. *In Design and Computation Manager Dialog box, select MVBA Applications>Super Cross Section Navigator.*

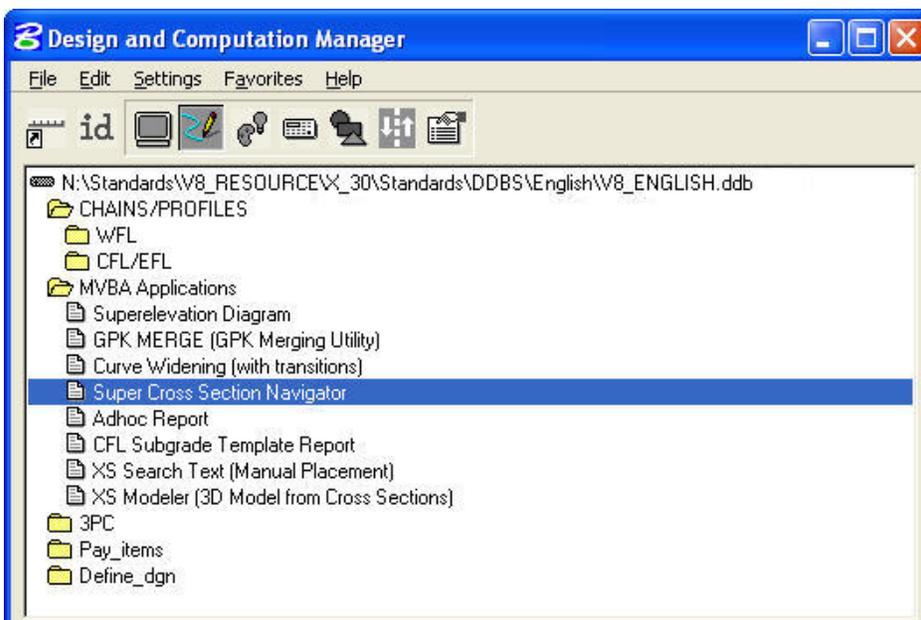


Figure 18-33: Design & Computation Manager



3. Double Click on Super Cross Section Navigator. The following dialog box will appear.

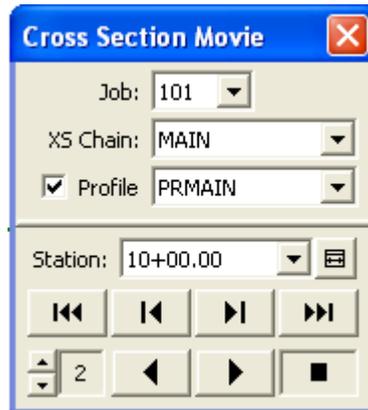


Figure 18-34: Super Cross Section Navigator

Selecting the profile and toggling on the profile will allow you to view cross section based on the profile, without drifting vertically. The speed of the cross section movie can be controlled by adjusting the number “2” shown above.

**Related links:** Setting up the Proposed Cross Section run for 5 typical sections using Knucklehead’s Guide for GEOPAK Road 2004 Edition.

[Existing Features](#)

[Right of Way](#)

[Rehabilitation \(3R\)](#)

[Undivided New Construction](#)

[Automated Cross Section Labeling](#)



## Cross Section Sheet Composition

This section will describe the method used to create cross section sheets. The following workflow will show the user how to set up sheets using GEOPAK Cross Section Sheet Composition tool. This application supports the following scales and layout options.

US Customary		Metric	
Sheet Name	Sheet Description	Sheet Name	Sheet Description
10 Scale, Single Stack, Landscape	Max. XS Width 145'	100 Scale, Single Stack, Landscape	100:1 Metric
20 Scale, Single Stack, Landscape	Max. XS Width 290'	200 Scale, Single Stack, Landscape	200:1 Metric
30 Scale, Single Stack, Landscape	Max. XS Width 425'	300 Scale, Single Stack, Landscape	300:1 Metric
10 Scale, Single Stack, Portrait	Max. XS Width 80'	100 Scale, Single Stack, Portrait	100:1 Metric
20 Scale, Single Stack, Portrait	Max. XS Width 160'	200 Scale, Single Stack, Portrait	200:1 Metric
30 Scale, Single Stack, Portrait	Max. XS Width 270'	300 Scale, Single Stack, Portrait	300:1 Metric
10 Scale, Double Stack, Landscape	Max. XS Width 60'	100 Scale, Double Stack, Landscape	100:1 Metric
20 Scale, Double Stack, Landscape	Max. XS Width 120'	200 Scale, Double Stack, Landscape	200:1 Metric
10 Scale, Double Stack, Portrait	Max. XS Width 40'	100 Scale, Double Stack, Portrait	100:1 Metric
20 Scale, Double Stack, Portrait	Max. XS Width 80'	200 Scale, Double Stack, Portrait	200:1 Metric

## Workflow 5: Cross Section Sheet Composition

1. *Create a new file to contain the cross section sheets and create a new file to contain the sheet border (the border will be referenced into the cross section sheets file).*



Note: When creating these files, it is important to use the correct seed file that matches the resolution of your cross section file (1000 or 10,000). For CFLHD employees, the seed files are located in:

N:\V8\_RESOURCE\X\_30\STANDARDS\SEED\ENGLISH OR METRIC

2. *Open the DGN file containing the proposed cross sections. Turn off any levels that are not wanted in the cross section sheets and save settings (File>Save Settings).*
3. *From the Cross Sections tool box, click on the last icon to open the Cross Section Sheet Composition dialog as shown below (or from Project Manager, click on Cross Section Sheets).*



Figure 18-35: Cross Section Sheet Composition Icon

4. *From the Cross Section Composition dialog box, select the desired cross section sheet layout option with the drop down arrow; browse to the DGN file containing the proposed cross sections*



with the magnifying glass and select the chain name with the drop down arrow.

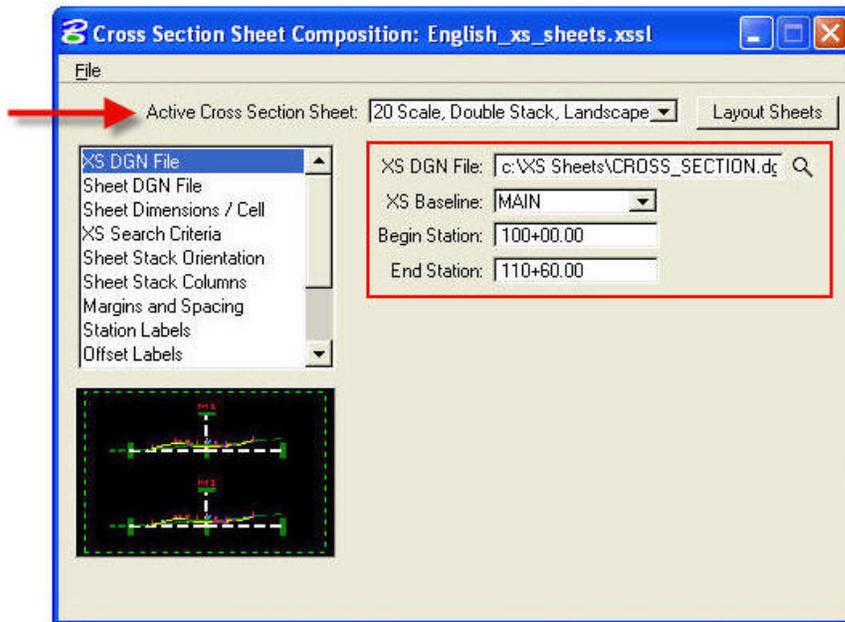


Figure 18-36: Cross Section Sheet Composition Dialog

5. Click on Sheet DGN File as shown below. Browse to the file where the cross section sheets are to be draw. The Sheet DGN File should be created before the cross section sheets are laid out.

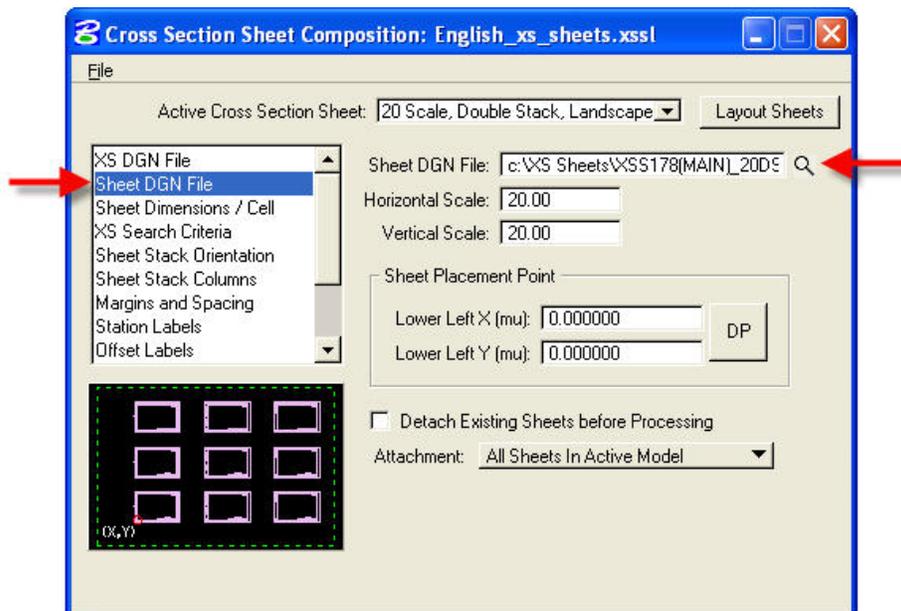


Figure 18-37: Sheet DGN File



- Click on *Sheet Dimensions/Cell* as shown below. Under *Sheet Cell Placement*, toggle to the option called *Place Sheet Cell Once in a Reference File*. Under *Sheet Cell Reference File*, browse to the file that will contain the sheet border. The *Sheet Cell Reference File* is an empty *Microstation* file which the border cell will be placed in during the layout process. Click on *Layout Sheets* and the cross section sheets will be created.

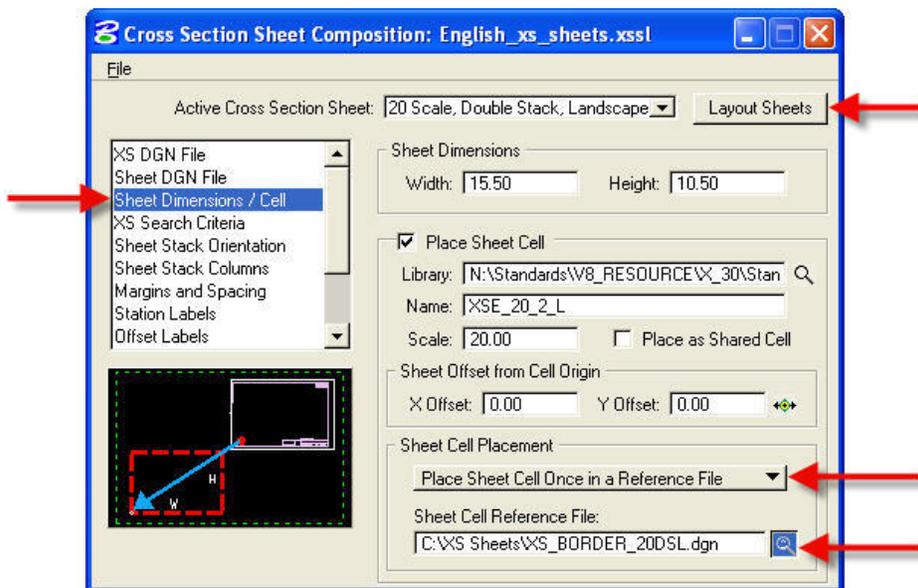


Figure 18-38: Sheet Dimensions/Cell

- To quickly number all the cross section sheets, place the first sheet number in the file containing the cross section sheet as shown below.

REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
			X1	

Figure 18-39: Sheet Numbering

- Click on *Copy/Increment Text* tool as shown below. Set the tag increment to 1.

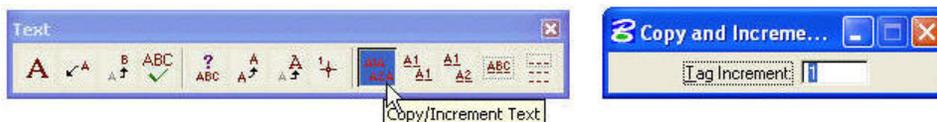
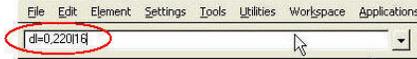
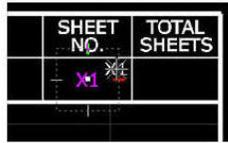


Figure 18-40: Copy/Increment Text



- Click on the sheet number and type the command as shown below, into the key-in field and hit Enter.



**dl=0,220;16**

total number of sheets  
Shift + backslash  
distance in the y direction  
distance in the x direction

10 Scale, Single Stack, Landscape	dl=0,110	10 Scale, Double Stack, Landscape	dl=0,110
20 Scale, Single Stack, Landscape	dl=0,220	20 Scale, Double Stack, Landscape	dl=0,220
30 Scale, Single Stack, Landscape	dl=0,330	10 Scale, Double Stack, Portrait	dl=0,170
10 Scale, Single Stack, Portrait	dl=0,170	20 Scale, Double Stack, Portrait	dl=0,340
20 Scale, Single Stack, Portrait	dl=0,340		
30 Scale, Single Stack, Portrait	dl=0,510		

Figure 18-41: Key-In Command Line

- Open the DGN file containing the sheet border and place the project information and the total number of cross section sheets.