1.1 Introduction

This document is a supplement to the <u>ODOT GEOPAK Road 2 training guide, Chapter 10 – Cross Section Sheets</u>. The training guide is available on the ODOT website at the following address:

http://www.dot.state.oh.us/Divisions/Engineering/CADDMapping/CADD/Pages/GPKManual.aspx

The following ODOT Visual Basic Applications are detailed in this document:

Application Name:	ODOT_XSCombineQuantities.mvba
Current version:	v10.10.15
Required MicroStation Version:	NA
Required GEOPAK Version:	GEOPAK V8i
Description:	This application is used to read GEOPAK Earthworks and Seeding quantity output files to combine the quantities in one text file that can be used to place the earthwork and seeding quantities on the cross sections.

Application Name:	ODOT_XSBoundary.mvba
Current version:	v11.07.15
Required MicroStation Version:	MicroStation V8i
Required GEOPAK Version:	GEOPAK V8i
Description:	This application is used to draw a boundary element on the GEOPAK Cross Section cells. The boundary element is useful to define the clipping limits of each cross section when clipping the cross section sheets using GEPOPAK. Additionally, the boundary element contains insertion points for cross section quantities.

Application Name:	ODOT_XSQuantities.mvba
Current version:	v11.04.15
Required MicroStation Version:	MicroStation V8i
Required GEOPAK Version:	GEOPAK V8i
Description:	This application is used place earthwork and seeding quantities in a cross section boundary element created using the ODOT_XSBoundary.mvba application. The quantities are read from the file created using the CombineSeedine.exe application.

Each application is described in detail on the following pages.

1.2 ODOT_XSCombineQuantities.exe

The ODOT GEOPAK Road 2 training guide, Chapter 7 – Earthwork Quantities details the process to generate cut and fill quantities for the cross sections. The resulting quantities are output to an ASCII text file that can be used to place the quantities on the cross section sheets when the sheets are clipped. The first 10 lines of an earthwork quantity file are shown in the example below:

```
000000000000 1111111111 2222222222 3333333333 4444444444

53+00.00/1           73          33           0           0
53+50.00/1           44          33         108          61
54+00.00/1           29          42          67          69
54+50.00/1           31          34          56          71
55+00.00/1           49          17          75          48
55+50.00/1           68           5         108          21
56+00.00/1           92           0         148           5
56+50.00/1          118           0         195           0
```

This file is formatted for importing the cross section quantities onto the cross section sheets when the sheets are clipped.

GEOPAK also provides the capability to generate seeding quantities as detailed in the ODOT GEOPAK Road 2 training guide, Chapter 8 – Seeding Quantities. A partial example of the seeding report is shown below:

```
Page# 1
SEEDING REPORT

NUMBER OF LEFT  CUT  SLOPES TO BE BYPASSED        = 0
NUMBER OF LEFT  FILL SLOPES TO BE BYPASSED        = 0
NUMBER OF RIGHT CUT  SLOPES TO BE BYPASSED        = 0
NUMBER OF RIGHT FILL SLOPES TO BE BYPASSED        = 0
ROUNDING DISTANCE FROM CUT SLOPE STAKE            = 0.00        Ft
MAXIMUM ALLOWABLE SLOPE FOR SEEDING/SODDING       = ****
ADDITIONAL SEEDING    LEFT   SIDE                 = 0.00        Ft
ADDITIONAL SEEDING    RIGHT  SIDE                 = 0.00        Ft
ADDITIONAL SEEDING IN CUT                         = 10.00       Ft
ADDITIONAL SEEDING IN FILL                        = 10.00       Ft
SUBTOTALS EVERY    500.0000 Ft BEGINNING AT STATION 52+00.00 R 1 METHOD INCR
SCALING FACTOR                     =      0.11111              WITH LABEL               [ SY ]


STATION             SLOPE DISTANCE   AVERAGE SLOPE DIST    A R E A    SY    SUBTOTAL  A R E A   SY
LT      RT     LT       RT        LT      RT     BOTH    LT      RT    BOTH
(TOTAL)

53+00.00 R 1      34.7     42.2                                          0        0        0
(    76.9)        34.0     42.0     189     233     422
53+50.00 R 1      33.2     41.7
(    74.9)        32.5     42.0     181     233     414
54+00.00 R 1      31.7     42.3
(    74.0)        31.6     40.8     176     227     403
```

ODOT_XSCombineQuantities.mvba is used to read the seeding quantity output file and append these quantities to the earthworks text file. The combined quantities can be included on the GEOPAK Cross Section sheets as detailed in the ODOT GEOPAK Road 2 training guide, Chapter 10 – Cross Section Sheets, or the combined quantities can be drawn in a border placed in the original cross section cell design file and referenced to the completed sheets using the procedures defined in this document.

The application can be accessed from the MicroStation pull down menu by selecting **ODOT > XS Utilities > XS Combine Quantities**. The dialog shown below is opened.
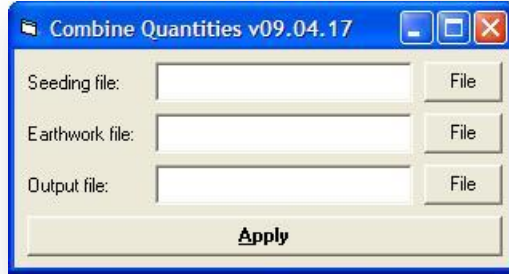
Select the GEOPAK **Seeding File** and the **Earthwork File** to combine. Key-in the name of the **Output file** to be created by the application. Select **Apply** to append the seeding quantities to the earthwork quantities and generate the new output file. An example of the combined quantities is shown below:

```
000000000000 1111111111 2222222222 3333333333 4444444444 5555555555 6666666666
53+00.00/1          73         33          0          0       76.9          0
53+50.00/1          44         33        108         61       74.9        422
54+00.00/1          29         42         67         69       74.0        414
54+50.00/1          31         34         56         71       70.6        403
55+00.00/1          49         17         75         48       66.0        380
55+50.00/1          68          5        108         21       61.3        354
56+00.00/1          92          0        148          5       59.4        335
56+50.00/1         118          0        195          0       61.9        337
57+00.00/1         137          0        236          0       63.1        348
57+50.00/1         164          0        278          0       65.1        356
```

The seeding quantities are appended in column 5 and 6 as shown above.

Notes:
- The contents of the first four columns are set when you extract the earthwork quantities using GEOPAK.

- When the program processes the files, it reads the station from the Earthworks file and looks for a corresponding station match in the seeding file. The comparison is a literal string comparison; therefore, the program expects an exact match when comparing strings. Be sure to run both reports with the GEOPAK User Preferences set to the same number of decimal places for the Station. "50+00.000" does not match "50+00.00".

- Columns 5 and 6 are extracted from the seeding report.
  - Column 5 represents the End Width for the station listed in Column 0.
  - Column 6 represents the seeding area for the station in Column 0 back to the previous station. For example, the value of 0 in Column 6 represents the seeding area between station 53+00 and the proceeding station. The value of 422 for station 53+50 represents the seeding area between station 53+50 and the previous station, 53+00.

1.3 ODOT_XSBoundary.mvba

The **ODOT_XSBoundary.mvba** application is used to draw a boundary around a GEOPAK Cross Section similar to the one show in the example below.
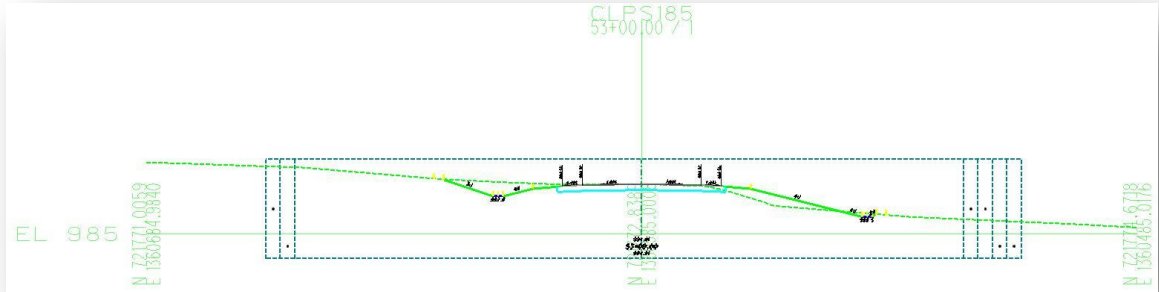
The boundary element is drawn at the width of a standard ODOT Cross section sheet cell and includes columns for the cross section quantities. The bounding element is intended to be used when clipping cross section sheets to set the **XS Search Criteria** as shown in the example below.
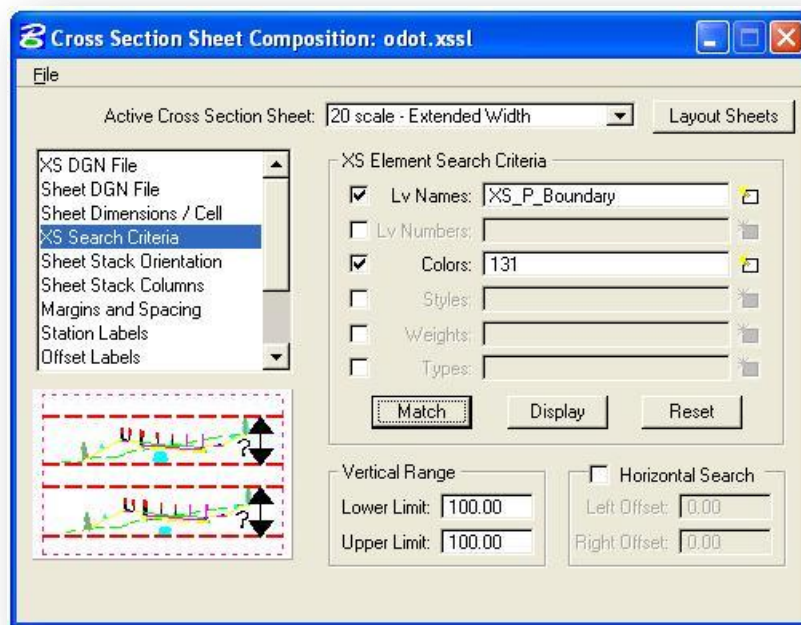
When clipping cross section sheets with GEOPAK, the **XS Search Criteria** item is used to select the level symbology for the MicroStation graphics that will be used to define the vertical limits of each cross section. There are several advantages to using a bounding element to define the **XS Search Criteria**:

- Using a bounding element allows you to define the **XS Search Criteria** symbology for only one element rather than selecting each element that is drawn on the cross sections.

- Any cross section that does not have a bounding element will not be included on the final cross section sheets. This allows you to easily control which sections actually appear on the completed sheets without deleting cross section or cross section cells.

- The boundary element is beneficial when drawing and labeling graphics in the cross section cell design file to ensure that your new graphics will fit within the reference file clipping limits of the cross sections on the completed sheets.

- Cross section quantities can be imported into the cross section cell design file using the **ODOT_XSQuantities.mvba** application, and subsequently referenced to the cross section sheets. This allows users to easily update earthworks and seeding quantities without re-clipping the cross section sheets.

To run **ODOT_XSBoundary.mvba**, select **ODOT > XS Utilities > XS Boundary** from the MicroStation pull doen menu, or key in the following command in MicroStation:

```
vba load ODOT_XSBoundary.mvba;vba run xsBoundaryMain
```

The dialog shown below will appear.
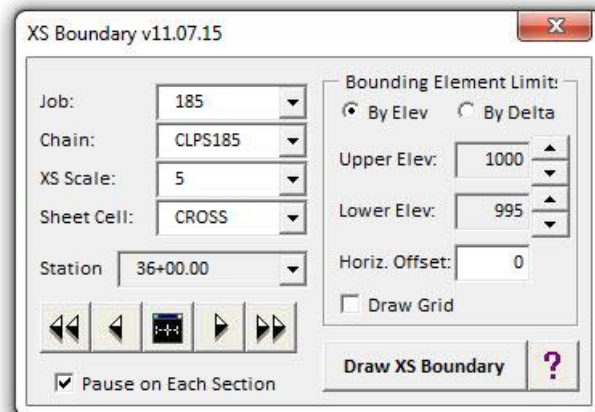
Job
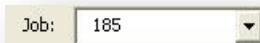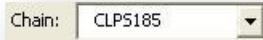
The **Job** menu will list all of the .gpk files found in the current GEOPAK Working directory.
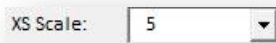
Chain

The **Chain** drop down menu contains a list of all the chains in the currently selected **Job**. When a **Chain** is selected, the application will scan the design file for cross sections matching the selected chain. If cross sections are found for the **Chain**, the application will automatically window-in on the first cross section.
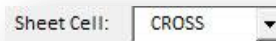
Scale

The cross section boundary can be placed for 5, 10, or 20 scale sheets by selecting the desired scale from the menu.

Sheet Cell

The cross section boundary can be placed for compatibility with three different ODOT Cross section sheet cells:
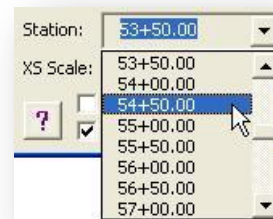
- CROSS
- CROSS_SPLIT
- CROSSV

XS Navigation

The station for each cross section in the design file is displayed in the **Station** drop down menu as shown at right. Select the desired **Station** from the drop down list to display the station on screen. Use the navigation buttons directly above the **Station** list to scroll through the cross sections.

Bounding Element Limits

The **Bounding Element Limits** values are used to set the upper and lower limits of the bounding element. The limits can be defined **By Elevation** or **By Delta**. Each mode of operation is detailed below.
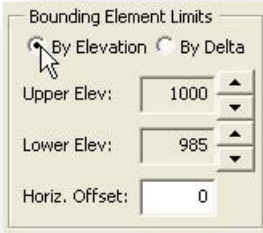

When **By Elevation** is selected, the **Upper Elev** and **Lower Elev** values are used to set the upper and lower elevation limits of the boundary element. Selecting the up and down arrows to the right of each field will increase or decrease by the **XS Scale** value.
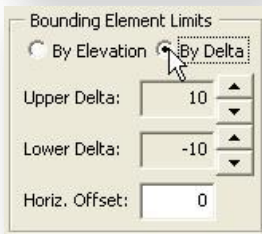
When **By Delta** is selected, the **Upper Delta** and **Lower Delta** values are used to set the upper and lower elevation limits of the boundary element. Selecting the up and down arrows to the right of each field will increase or decrease the value by the **XS Scale** value.

The delta is measured from the cross section cell reference elevation. If the reference elevation is evenly divisible by the **XS Scale**, the **Upper Delta** and **Lower Delta** values are measured directly from the cell's reference elevation as shown below.

If the reference elevation is not evenly divisible by the **XS Scale**, a horizontal grid line is inserted about the reference elevation and the **Upper Delta** and **Lower Delta** values are measured from the extra grid line as shown in the example below. This is necessary to ensure that the grid interval matches the **XS Scale** value.
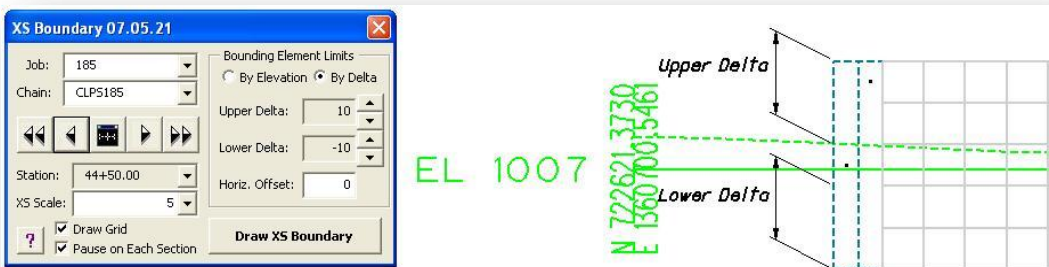
The **Horiz. Offset** key-in field is used to enter an offset value to shift the XS Boundary to the left or right as shown in the example below. Use this option to align the boundary with the cross section sheet layout when the completed cross sections will be shifted off center on the completed sheets. The value of the **Horiz. Offset** is multiplied by the **XS Scale** to determine the offset in the design file.
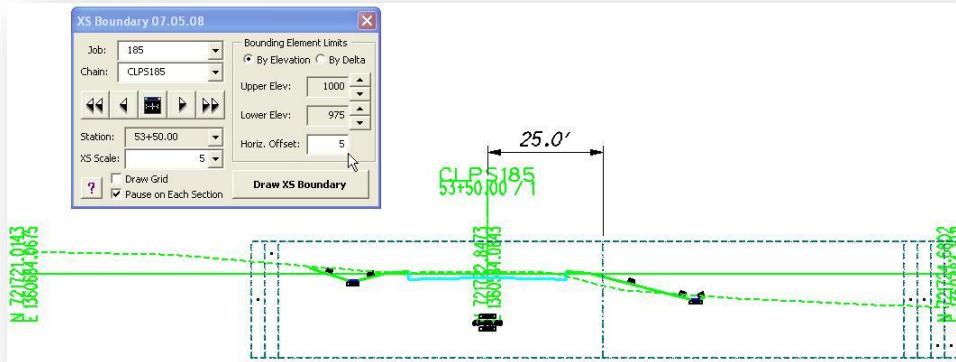
Draw Grid

Optionally, a grid can be drawn on the cross sections as shown below.
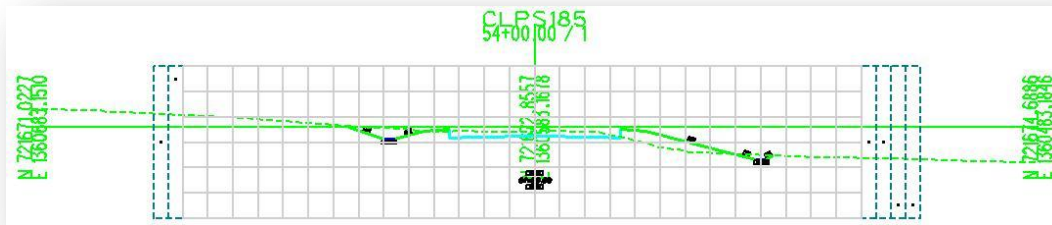
The grid is drawn on the level SH_Major_Grid_Line and is not normally needed on the cross sections. This option is provided for the rare occasions where a user may wish to display a grid in the cross section design file. The level should be turned off before clipping the cross section sheets.

Pause on Each Section

If **Pause on Each Section** is toggled on when the **Draw XS Boundary** button is selected, the program will draw the boundary element for the current cross section and will automatically advance to the next cross section. The user has the option to adjust the **Bounding Element Limits** before drawing the boundary element on the section.

If **Pause on Each Section** is toggled off when the **Draw XS Boundary** button is selected, the program will use the current **Bounding Element Limits** to draw the boundary element on each cross section, starting from the currently selected cross section, to the last cross section.

For the best results placing the boundary elements, we recommend using the **By Elevation** option with **Pause on Each Section** toggled on. This allows the user to uniquely control the bounding elevation range for each cross section and will produce the best results when generating the cross section sheets with GEOPAK.

Draw XS Boundary

The XS Boundary element is initially displayed as temporary graphics using a weight zero dotted line. When the **Draw XS Boundary** button is selected, the boundary is drawn in the file as shown below, using the following symbology:

Level Name = XS_P_Boundary
Color = 131
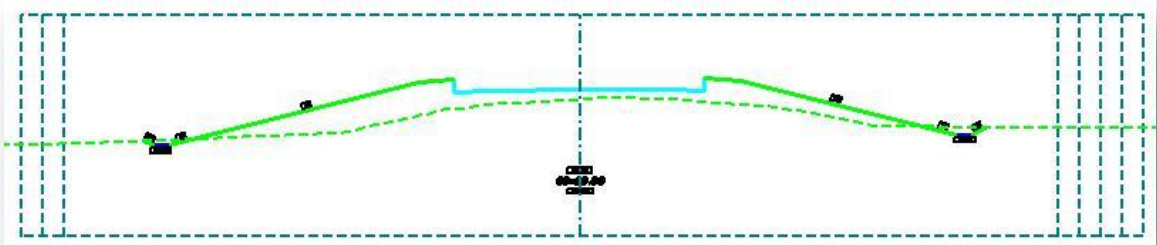
Processing Notes

In most cases, it is more desirable to use the **By Elevation** option with **Pause on Each Section** toggled on to individually place each bounding element. This allows the designer to control the elevation range uniquely for each cross section. This option will also ensure that the bounding element elevation range will match the major grid line interval on the completed cross section sheets. This allows for better control of the spacing between the cross section on the completed sheets.

In some cases, the user may wish to quickly draw boundary elements on all the cross sections with the **Pause on Each Section** option toggled off. In this case, using the **By Elevation** option may result in some of the cross sections falling outside the initial elevation limits. The following elevation values were set for the initial cross section:

>   **Upper Elev** = 1000
>   **Lower Elev** = 980

While these values were sufficient for the first cross section, subsequent cross sections may not fall within those elevation limits as show below.
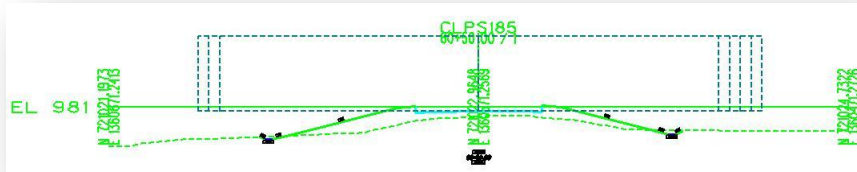
The **By Delta** option is a better choice for processing with **Pause on Each Section** toggled off since the boundary element will be placed relative to each individual cross section cell's reference elevation, not by a specific elevation range. In the example below, the following values were used:

Upper Delta = 15
Lower Delta = -15
XS Scale = 5

The resulting bounding element, shown with the optional grid in the example above, is placed relative to the cross section cell's reference elevation rounded to the nearest increment of the **XS Scale** value. In the example above, the reference elevation is 987 which results in a boundary element with an upper elevation of 1005 and a lower elevation of 970.

In summary, using **By Elevation** with **Pause on Each Section** toggled on will yield the best results for placing boundary elements for generating the cross section sheets.

1.4 ODOT_XSQuantities.mvba

This application is used place earthwork and seeding quantities within the limits of the cross section boundary elements created using the **ODOT_XSBoundary.mvba** application. The quantities are read from an ASCII text file created using the GEOPAK Earthwork computation process, or created by combining GEOPAK Earthwork and Seeding quantity files by use of the CombineSeeding.exe application.
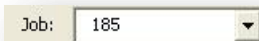
To run **ODOT_XSQuantities.mvba**, select **ODOT > XS Utilities > XS Quantities** from the MicroStation pull doen menu, or key in the following command in MicroStation:

```
vba load ODOT_XSQuantity.mvba;vba run xsQuantityMain
```

The dialog shown below will open.
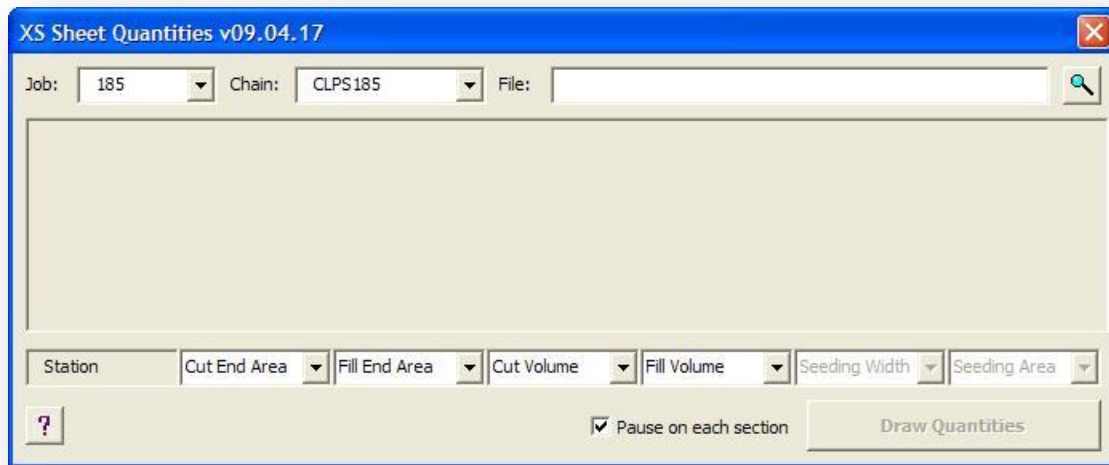
Job

The **Job** menu will list all of the .gpk files found in the current GEOPAK Working directory.
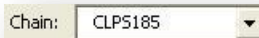
Chain

The **Chain** drop down menu contains a list of all the chains in the currently selected **Job**. When a **Chain** is selected, the application will scan the design file for cross sections matching the selected chain. If cross sections are found for the **Chain**, the application will automatically window-in on the first cross section.
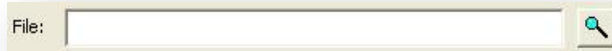
File

Select the ASCII text file containing the quantities. The file assumed to be in the same format as a GEOPAK Earthworks ASCII file as shown in the example below:

```
000000000000  1111111111  2222222222  3333333333  4444444444

53+50.00/1              66          33           0           0
54+00.00/1              50          41         108          69
54+50.00/1              53          34          96          69
55+00.00/1              72          17         116          47
55+50.00/1              90           5         150          21
56+00.00/1             115           0         190           5
56+50.00/1             141           0         237           0
57+00.00/1             159           0         278           0
```

The first row is assumed to be the header row and contains the column id information. The remaining rows are assumed to contain the cross section quantities.

Column zero is assumed to contain the station and region as shown in the example above.

The ASCII file can contain either 4 or 6 columns containing the cross section quantities. The contents of each column are user definable, but it is recommended that you follow the guidelines shown in the <u>ODOT GEOPAK Road 2 training guide, Chapter 7 – Earthwork Quantities</u>.

If an ASCII file is opened containing 4 columns of quantities, the dialog will appear similar to the example shown below.
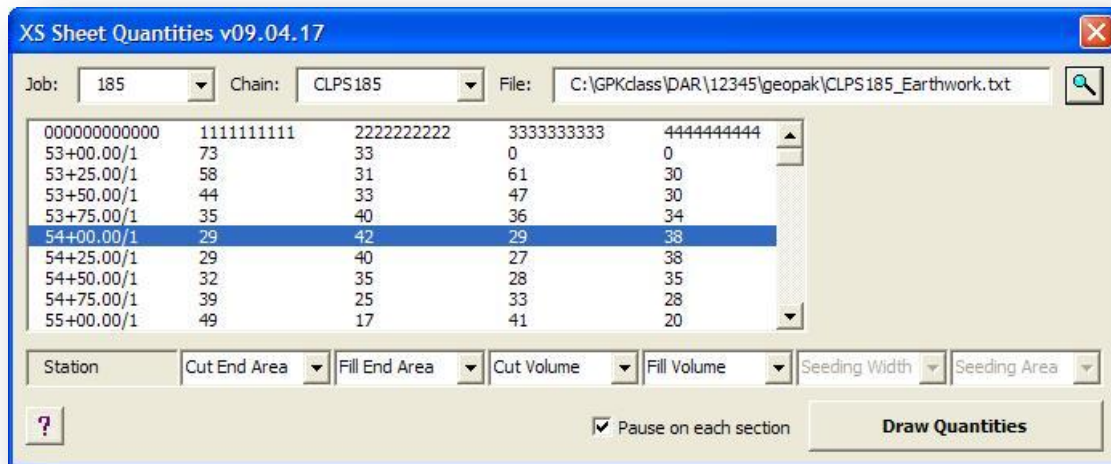
If an ASCII file is opened containing 6 columns of quantities, the dialog will appear as shown in the example on the following page.
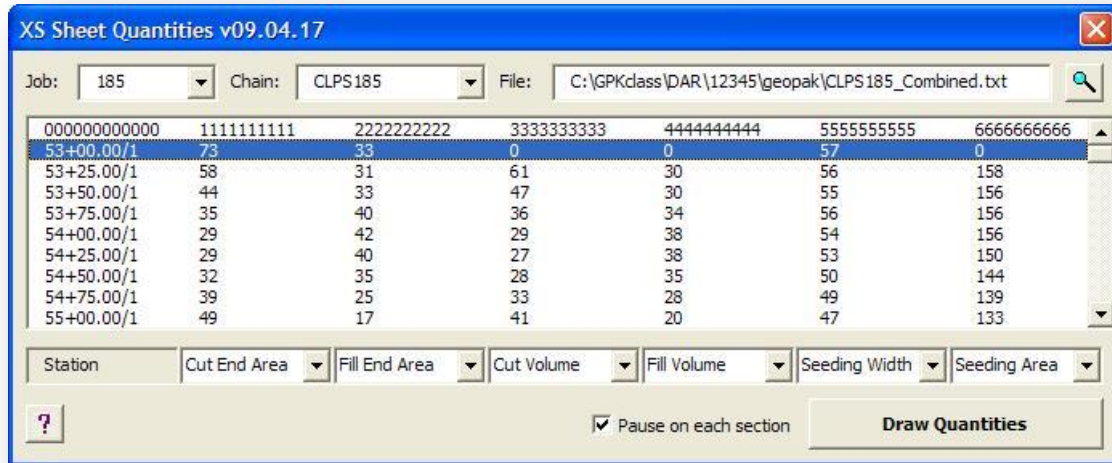
The quantity values contained in columns 1, 2, 3, and 4 are user definable when the original earthworks quantity file is generated with GEOPAK. The <u>ODOT GEOPAK Road 2</u> training guide recommends defining the columns in the following order:

> Column 1 = Cut End Area
> Column 2 = Fill End Area
> Column 3 = Cut Volume
> Column 4 = Fill Volume

Columns 5 and 6 were generated using the **ODOT_CombineQuantities.exe** application and contain the following values:

> Column 5 = Seeding End Width
> Column 6 = Seeding Area

If the order of the quantities contained in the columns does not match the values listed above, the user has the option to define the contents of each column using the drop down menu below each column as shown at right.

Pause on each section

If **Pause on Each Section** is toggled on when the **Draw Quantities** button is selected, the program will draw the quantities for the current cross section and will automatically advance to the next cross section.

If **Pause on Each Section** is toggled off when the **Draw Quantities** button is selected, the program will draw the quantities for the selected **Chain** on each cross section in the design file.

Draw Quantities

When the **Draw Quantities** option is selected, the quantities are drawn on the currently selected cross section. The points placed with the cross section boundary are used as the insert points for the quantities as shown in the example below.
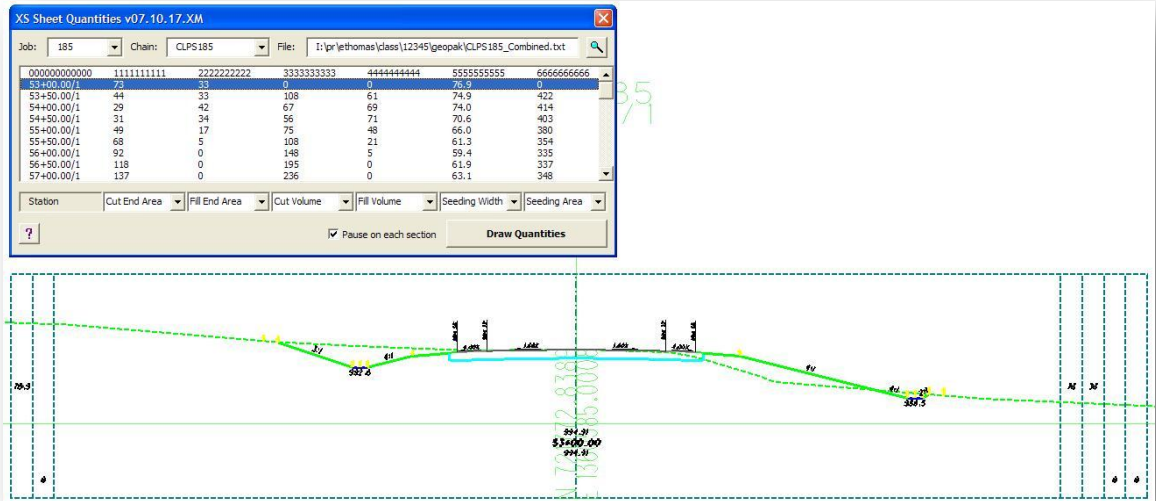
If a set of quantities has been previously placed for the cross section(s) using this application, the previously placed quantities will be automatically deleted from the cross section(s).

The text is placed using the active Text Style and the active Model Annotation Scale.

1.5 Tips for Clipping XS Sheets using Boundary Elements

Three new clipping options have been added to ODOT.xssl for clipping cross section sheets using the boundary elements:

5 scale – Extended Width
10 scale – Extended Width
20 scale – Extended Width

These options can be selected in a cross section sheet run as shown below:
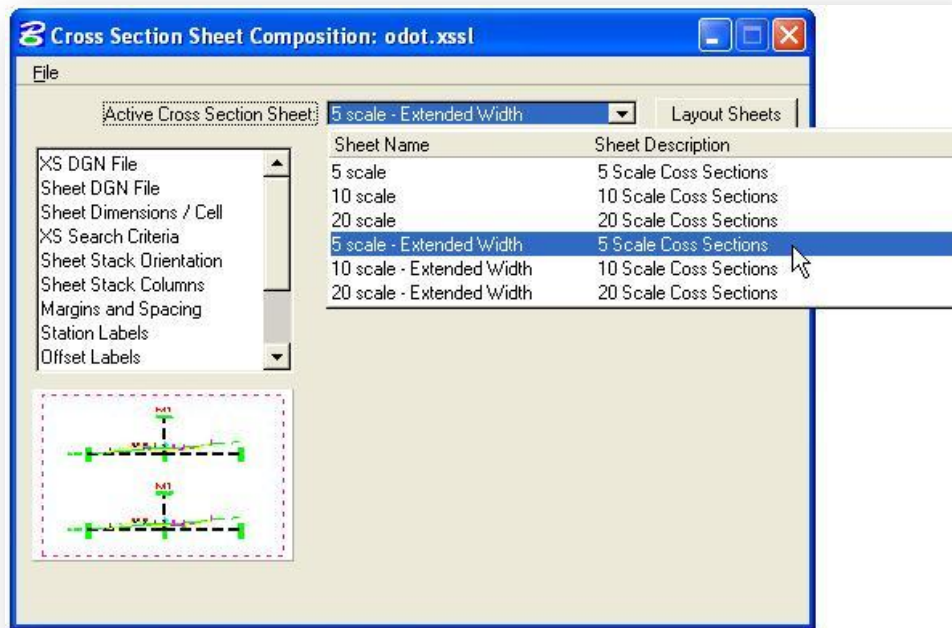
For each of these three options, the width of the clipping area has been extended to include the seeding and earthworks quantity columns within the reference boundaries for each cross section.

The **XS Search Criteria** item has been changed to specify the level and color for the boundary element as shown below.
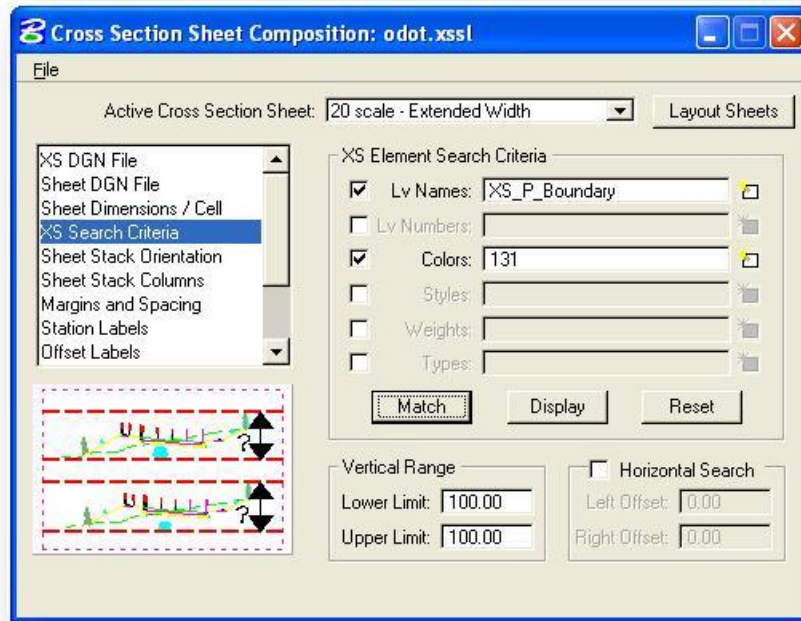
Note that the **XS Search Criteria** is only used to set the vertical extents of each cross section on the completed sheets. The horizontal limits are set in the **Margins and Spacing** item shown below.
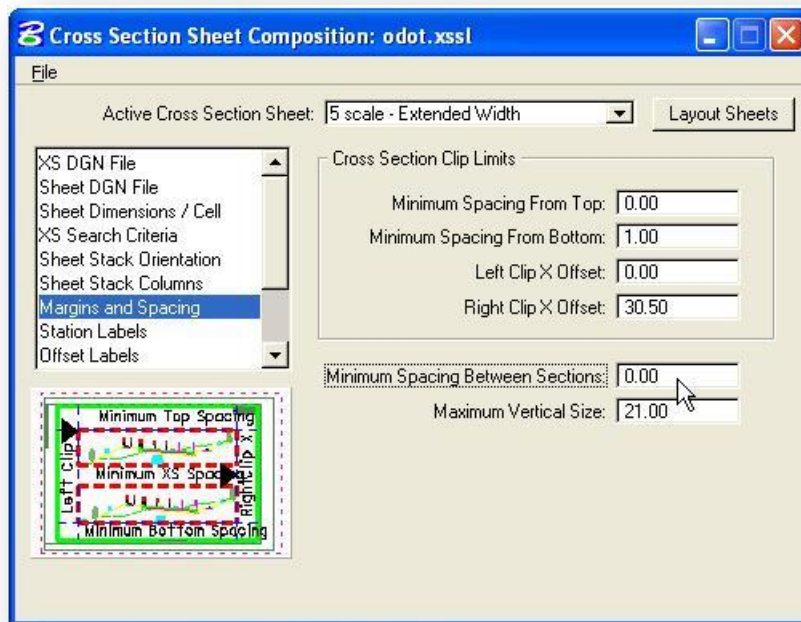

The **Left Clip X Offset** and **Right Clip X Offset** values have been adjusted in ODOT.xssl to include the width of the quantity columns.

The **Minimum Spacing Between Sections** value has been set to zero. Users may wish to set this option to a value of one depending on the vertical extent of the cross sections.

Since the cross section quantities will be referenced into the sheets, there is no need to configure the **Earthwork Quantity Labels** item, shown below.
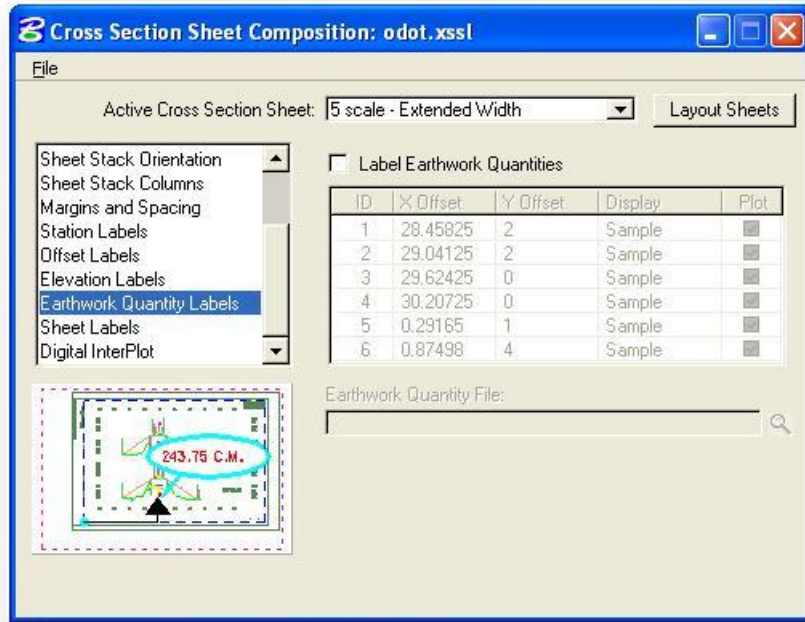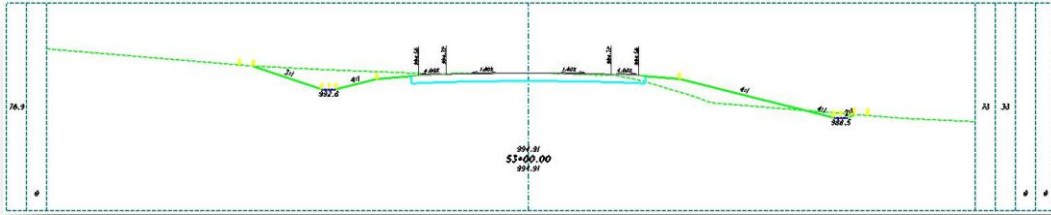

An example of a completed sheet is shown below.
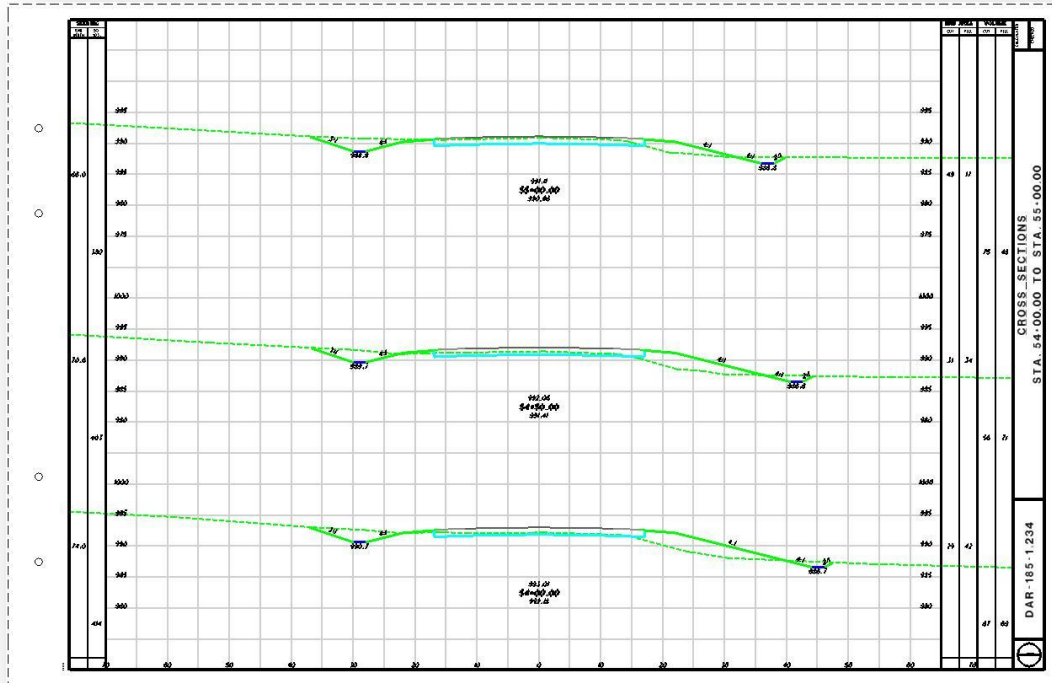
Notice that the existing ground line extends through the quantity columns on the completed sheets. Users may wish to partial delete the ground line in the original cross section cell file so that it falls within the limits of the boarder element as shown in the example below.


Since the horizontal clipping limits of the sheets has been extended to include the quantity columns, and extra Offset Label is drawn on the lower left and lower right of each cross section sheet. These labels should be deleted. The extra label to the right of the sheet is shown in the example at right.
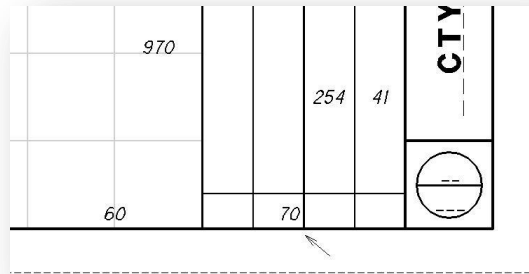

1.6 Match Lines and Cross Sections

When clipping cross section sheets, GEOPAK does not provide the capability to automate match lining cross sections that extend beyond the width of the cross section sheet. Users can manually create match lines for specific cross sections as needed and use the boundary element to control the vertical limits of each cross section as it is referenced into the cross section sheets.

In the example below, the cross section will extend into the quantity columns on the right side of the cross section sheets.
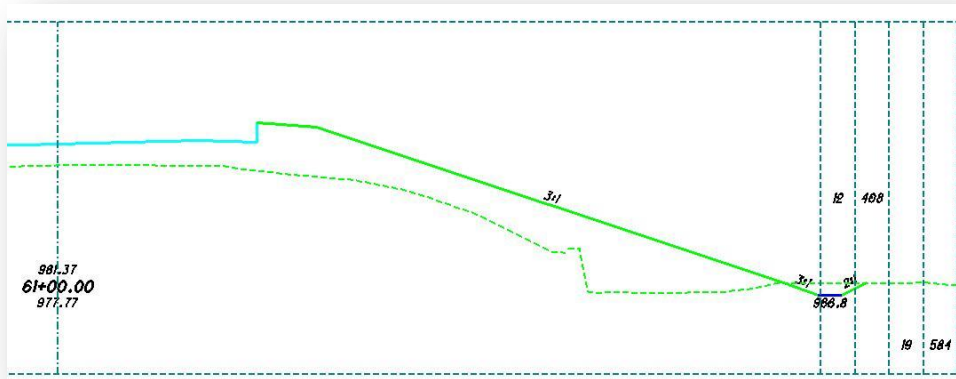
Use the boundary element with a grid to facilitate breaking up the cross section into a match line segment as shown in the example below.
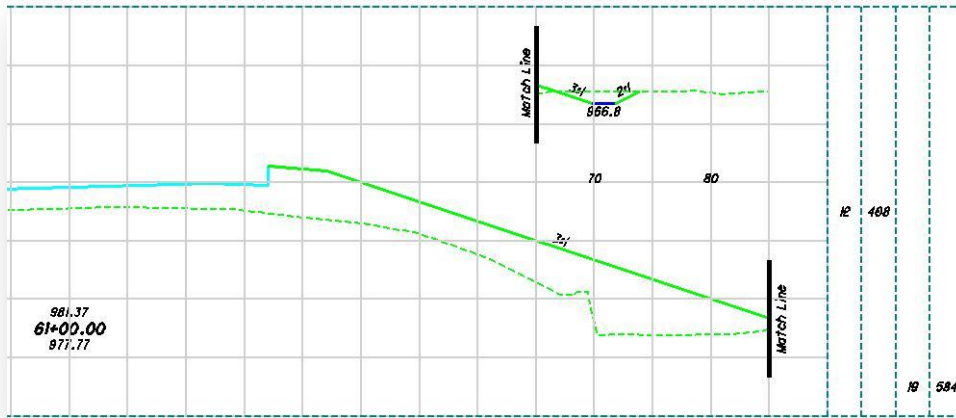
The boundary element is used to define the vertical extents of the cross section on the completed sheet. The example on the following page shows the cross section on the completed sheet.
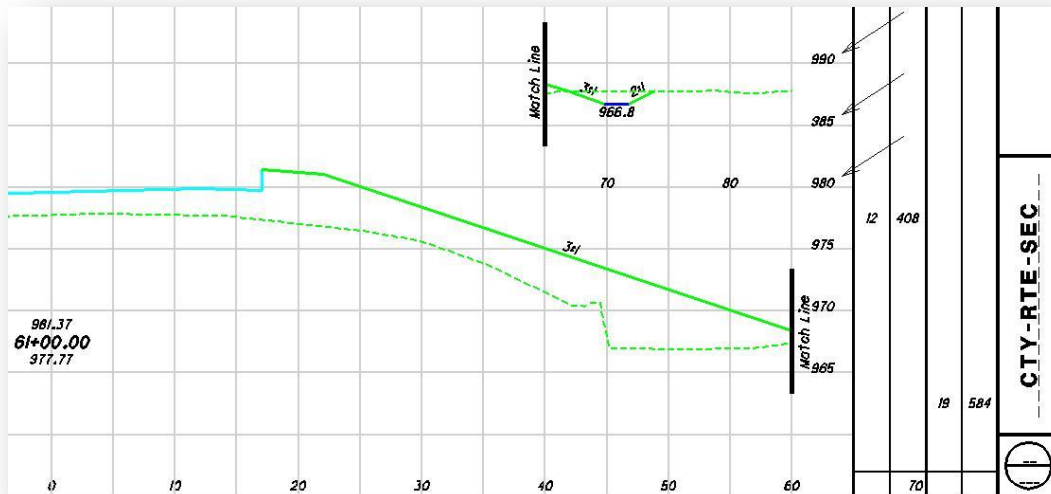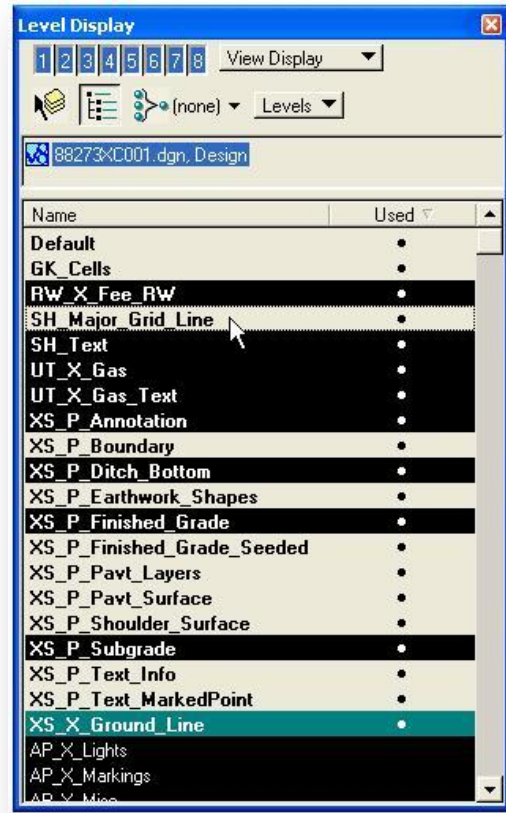

Note: The elevations on the side of the cross section sheet are placed by GEOPAK for the vertical extent of the boundary element. In the case where match lines are included within the clipping limits of these elevations must be manually edited to reflect the correct elevation values of the match line segment.

1.7 Reference Levels

The **ODOT_XSBoundary.mvba** application places boundary elements, and optionally grid lines, in the cross section cell design file that should not be displayed on the cross section sheets. Before clipping the cross section sheets with GEOPAK, be sure to turn off the following levels and Save Settings:

>
> SH_Major_Grid_Line
>
> XS_P_Boundary

Note: ODOT's cross section criteria files place elements on several other levels in the cross section cell design file that should not be displayed on the completed cross section sheets. Some of these levels are shown in the example at right. It is up to the user to review the levels shown in the cross sections to turn on/off the appropriate levels for the cross section sheets.

Contacts