

Section 3

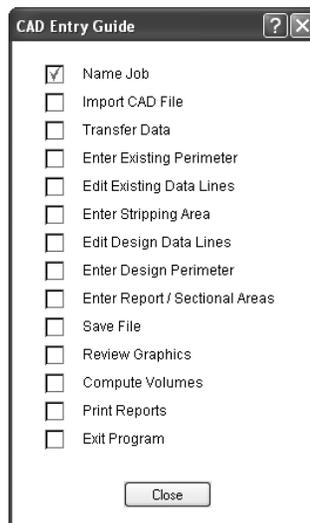
CAD Tutorial

3D Modeling Overview

Sitework 4D can be used to convert CAD files into takeoffs and accurate 3D models. This tutorial covers the steps to perform the conversion and creating the model.

CAD Entry Guide

In the Guide menu, Sitework 4D contains guides for PDF, CAD, Tablet and Haul Plan entry. These guides aid the entry of a complete job. This tutorial focuses on CAD entry. The CAD Entry Guide can be accessed by selecting **Guide > CAD** or by pressing the **G** key. When a procedure is selected from the Guide, Sitework 4D will change to the proper mode, surface, and layer necessary for that procedure. The Guide displays a check mark in the corresponding box when an operation has been completed.



Data Entry Sequence

Sitework 4D is used for data entry and editing to create 3D models from CAD data. Below is the suggested data entry sequence for the 3D modeling.

CAD Data Transfer

- Start a New Job
- Transfer CAD Data

Existing Ground Data

- Enter Existing Perimeter
- Edit Existing Ground
- Enter Stripping Areas

Design Ground

- Edit Design Data Lines
- Enter Design Perimeter
- Enter Sectional Areas

Calculate Volumes

- Visual Verification with the 3D Window
- Calculate Volumes
- Print Reports

Lesson 1 - CAD Data Transfer

Sitework 4D is a tool for creating takeoffs from PDF files, digitized plan sheets, and CAD files. Both DWG and DXF files are read and can be quickly transformed into a precise 3D model suitable for use in the field. When a DXF or DWG file is selected, the data from that file is opened in CAD Transfer Mode displaying all layers in the file including frozen, or locked, layers. Training videos discussing CAD modeling are available at <http://www.agtek.com/trainingvideos.asp>. It is recommended that you watch the training videos first.

Start a New Job (Job Setup)

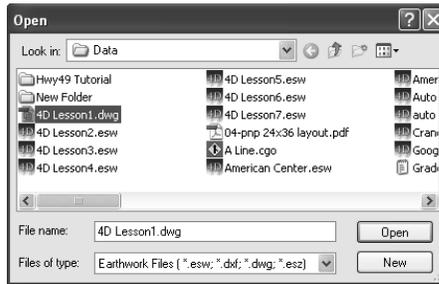
1. Double-click on the **Sitework 4D** shortcut, or select **Start > Programs > AGTEK > Sitework 4D**. The Open Dialog box is displayed.

This Open dialog box defaults to display three file types: ESW, DXF, and DWG. ESW is the native file type of Sitework 4D.



Earthwork 4D

2. Select the "4D Lesson1.dwg" file, and click **Open**.

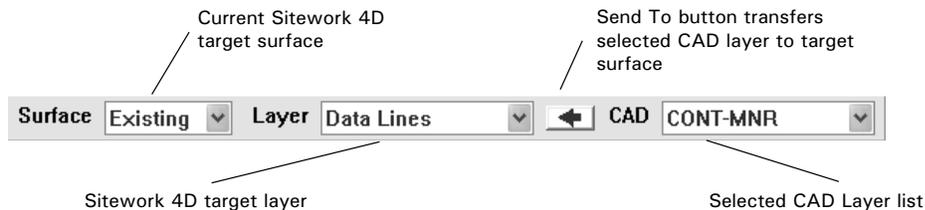


3. Select **Data Transfer > Crop Rectangle** to remove unnecessary data.
4. Click and draw a box around the relevant data, then click again to end.
5. Click **Yes** when asked to remove everything outside the rectangle.
6. Select **Data Transfer > Import Transfer Units**, and make sure Feet is selected as the units of measure, then click **OK**.

Import Transfer Units: The Import Transfer Units designate what unit of measurement the job is created in. It must be set to the same units as the CAD file being transferred: feet, metric, or architectural. User defined is used when the CAD file is created using a unique unit of measurement.

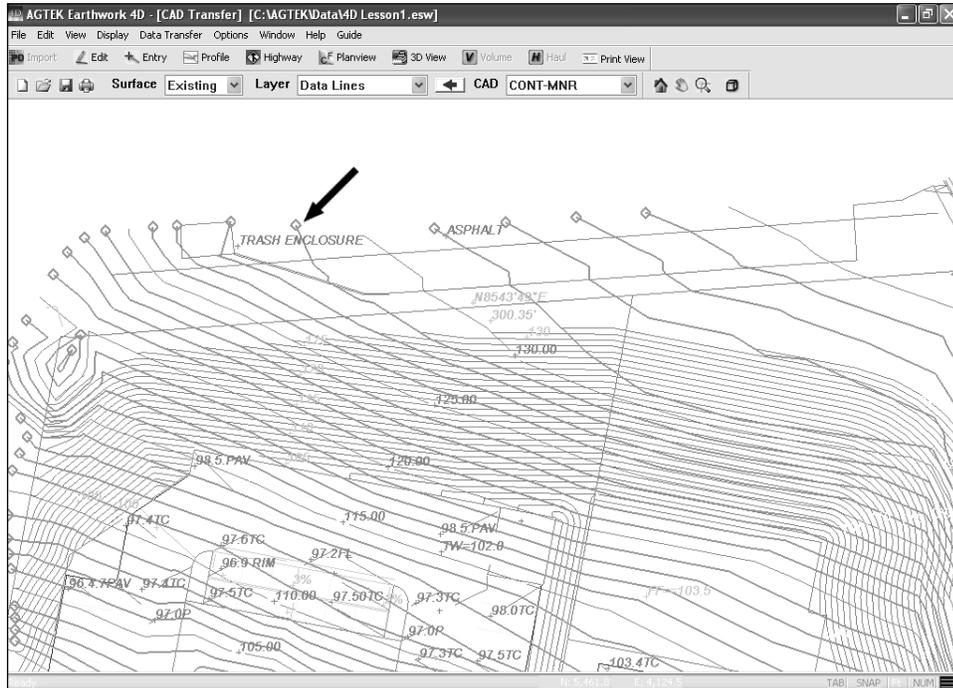
Transfer Existing Ground Data

When a line is selected in CAD Transfer Mode, all lines in the same CAD layer are highlighted. The tool bar shows the name of selected layer along with the controls used to send that layer to a Sitework 4D surface. Transfer mode can also be found by pressing the **G** key, and choosing **Transfer Data**.

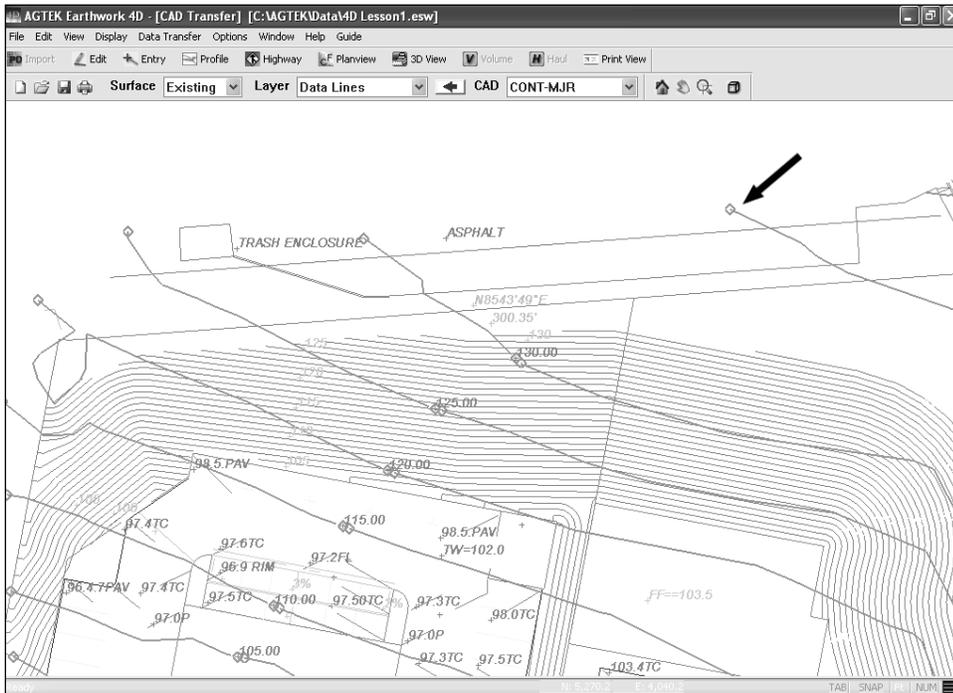




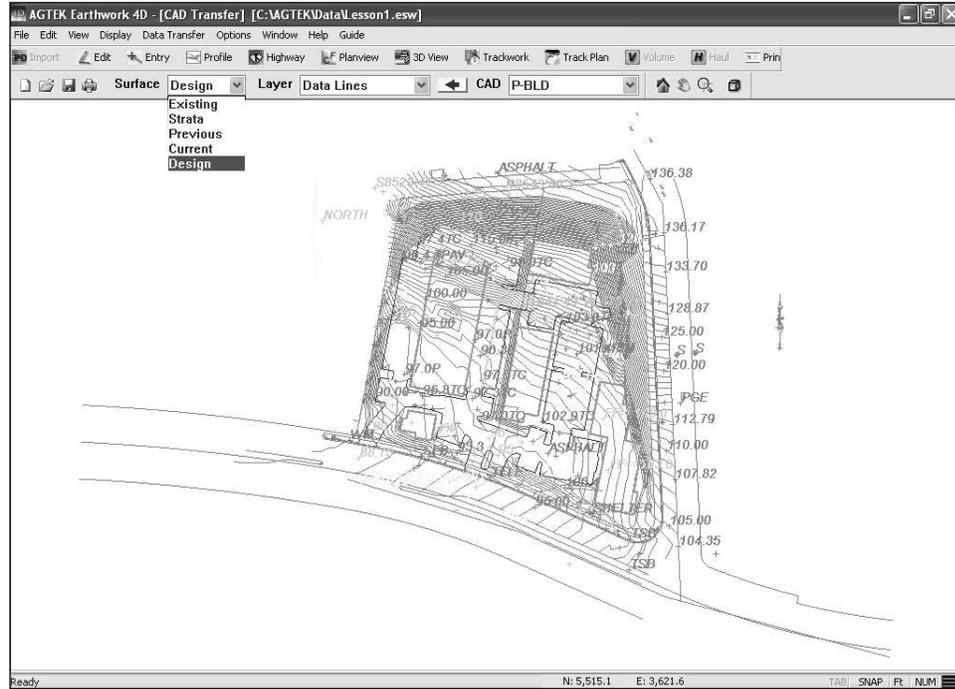
1. Change to the **Existing Surface** and **Data Line** Layer, then click the “CONT-MNR” layer, or use the toolbar to select it in the CAD pulldown, then click the **Send To** button to transfer the layer to the Existing surface.



2. Select the “CONT-MJR” layer with the mouse or by using the layer pulldown menu and send it to the Existing Surface and Data Lines Layer.



3. Change to the **Design Surface** and **Data Line Layer**, then select the “P-BLD” (building pad) layer and click the **Send To** button.



Other CAD Transfer Methods

In addition to the previous example, there are other methods of transferring CAD data.

Right-Click

Right-clicking a layer displays the Right-Mouse menu, which allows you to select the target surface.

- Select the “DSN-CNTR” layer, right-click, then select **Send to Design** to transfer the layer.

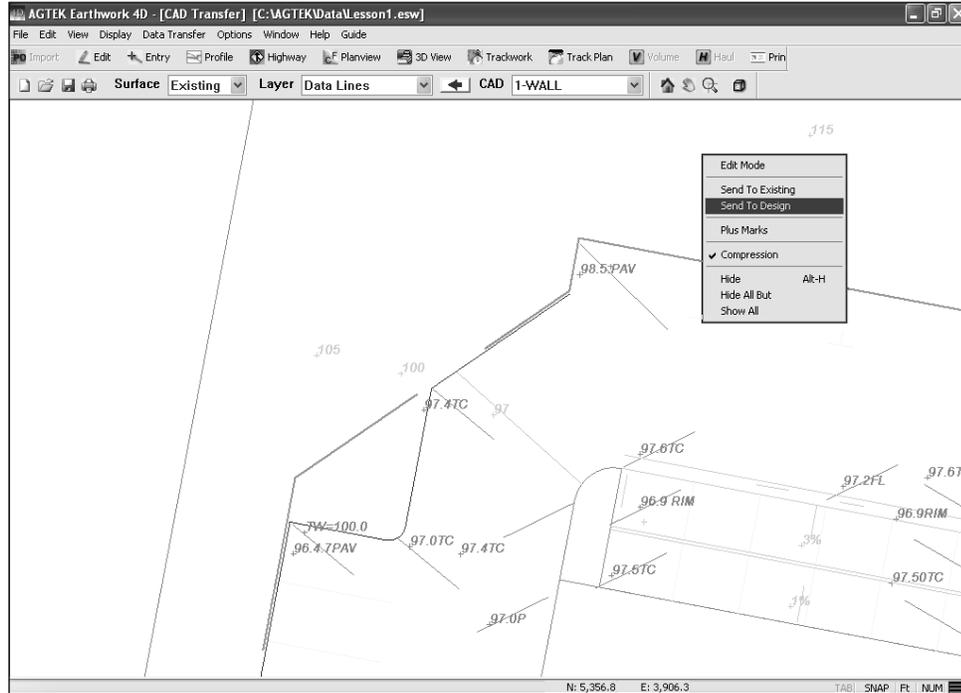


Transferring Multiple Layers

CAD Transfer also supports the transfer of multiple layers simultaneously.

1. Click on the top of curb “Des-TC” near the upper-left corner of the site.
2. Ctrl+click on the storm drain detail “1-SD”.
3. Ctrl+click on the grade text “TXT”.
4. Ctrl+click on the retaining wall “1-WALL”.

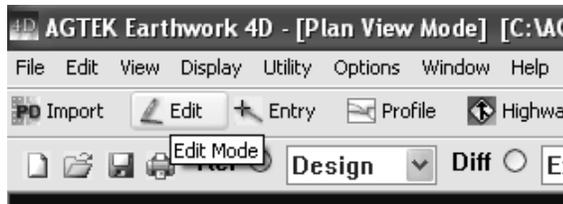
5. Right-click, then select **Send to Design** to move the layers to the Design surface.



Complete CAD Data Transfer

A few layers are left to transfer at this point. Use any of the transfer techniques to send the layers listed below to the Design surface.

- "Walk"
- "TEXT-GRADES"
- "1-DES-CURB"



Selecting **File > Save** will give you the opportunity to save a copy of your current file using a different name, leaving the original file unchanged.

When finished, click the **Edit Mode** button on the toolbar to leave CAD Transfer Mode.

 6. Select **File > Save**, or click the **Save** button.

Other CAD Transfer Features

The CAD Transfer window has additional features that are not needed in this tutorial but are useful for future files.

Hide, Show All, and Delete

In some CAD files the amount of data displayed makes it difficult to identify the desired layers. The Hide command removes the selected data from the screen. It can be activated from the right-click menu, the Edit menu, or by pressing **Alt + H**.

The reverse of Hide is the Show All command. Show All is selected from the right-click menu or the View menu.

The **Delete** command removes the selected data from the screen permanently. Delete is activated by pressing the **Delete** key or through the Edit menu. It does not affect the original CAD file.

Undo and Redo

Sitework 4D supports up to eight levels of undo for those occasional mistakes that you wish you could start over. The Undo command is activated by pressing **CTRL-Z** or through the Edit menu. The Redo command is usually used when Undo was used one too many times. It also supports eight levels and is activated by pressing **CTRL-Y** or through the Edit menu.

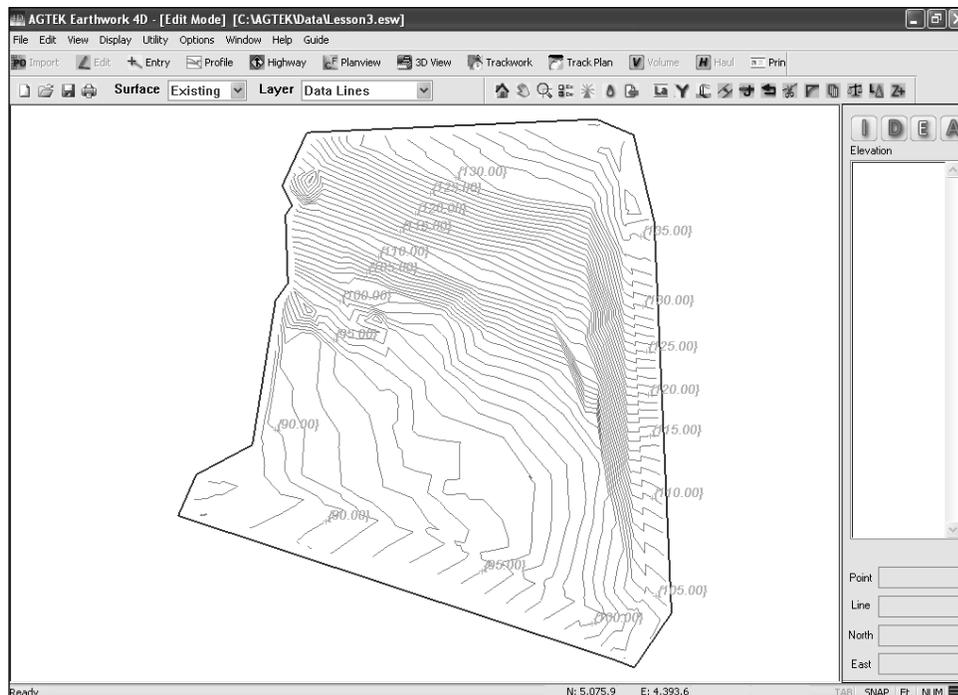
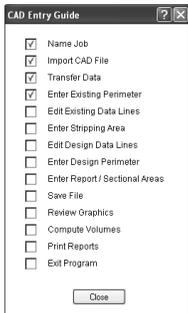
Lesson 2 - Existing Ground

The Existing Ground represents the current conditions of the job site. In addition to the existing conditions, we add the Existing Perimeter and Stripping Areas so the existing surface can be used in volume calculations.

Enter the Existing Perimeter

The Existing Perimeter defines the job limits of your existing ground and is used to speed 3D rendering by ignoring information outside of the boundary. Use the following steps to enter the Existing Perimeter.

1. Select **File > Open** and open "4D Lesson2.esw".
2. Switch to Entry mode, then select **Existing** from the Surface pulldown and **Perimeter** from the Layer pulldown, or press the **G** key, and choose **Enter Existing Perimeter** from the CAD Entry Guide.
3. Using the mouse, draw a perimeter around your site boundary. Right-click to close and end the site boundary entry. Right-click again to get your arrow back.



Edit Existing Data Lines

The 3D surface is created by converting the two-dimensional CAD data into a three-dimensional surface. Much of this work consists of cleaning up the data that has been transferred, including assigning elevations to points and contours, and joining lines. In this example all existing lines transfer with elevations already assigned to them. All techniques used to edit design data lines found in Lesson 3 of this tutorial can be used to edit existing data lines as well. To see what information is assigned to an individual existing data line:



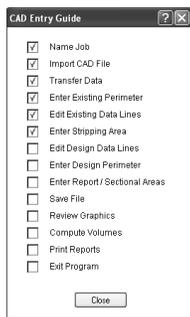
1. Switch to the Edit mode by clicking the **Edit Mode** button and select **Data Lines** in the Layer drop down, or press the **G** key, and select **Edit Existing Data Lines** from the CAD Entry Guide.
2. Click on an existing data line to select it.
3. Right-click and choose **Line Editor** from the right-click menu. The Line Editor box is displays.

4. Click **Cancel** to close the Line Editor box.

Enter Stripping Areas

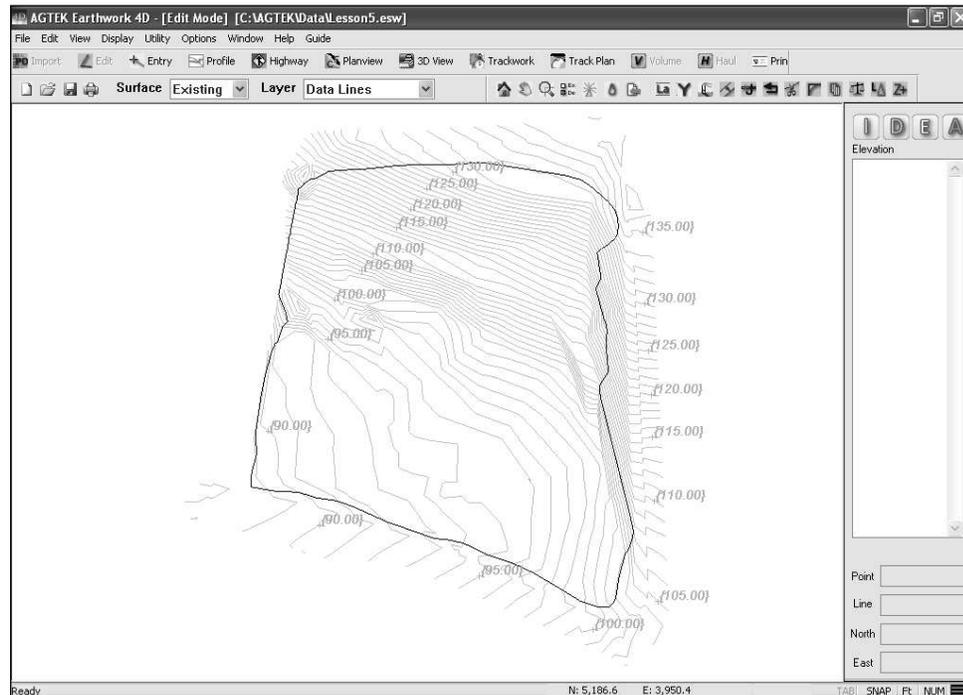
The depth specified for Stripping Areas is deducted from the Existing surface to create a Stripped surface. Stripping Areas are not additive, you may exclude areas from being stripped by entering a stripping area with a depth of "0".

In this sample we also display the design data lines and design annotation behind the existing data lines. This aids in the Stripping Area entry.



1. Switch to Entry mode, and select **Existing** from the Surface pulldown and **Stripping Areas** from the Layer pulldown, or press the **G** key and select **Enter Stripping Area** from the CAD Entry Guide.
2. If the Stripping Areas box is not displayed, click the **Add Regions** button.
3. Enter "Stripping 1" for the Area Name, "0.5" for the Stripping Depth, and click **OK**.

4. Right-click on the existing ground and select **Display > Design Layer**.
5. Right-click on the existing ground and select **Display > Design Annotation**.
6. Using your mouse, enter the Stripping Area around the area you plan to strip.
7. Right-click to close the Stripping area and end the entry. Be sure to keep the Stripping Area within the Existing Perimeter.
8. Right-click twice on the existing ground and select **Display > Design Layer** to turn the layer off.
9. Right-click on the existing ground and select **Display > Design Annotation** to turn the layer off.

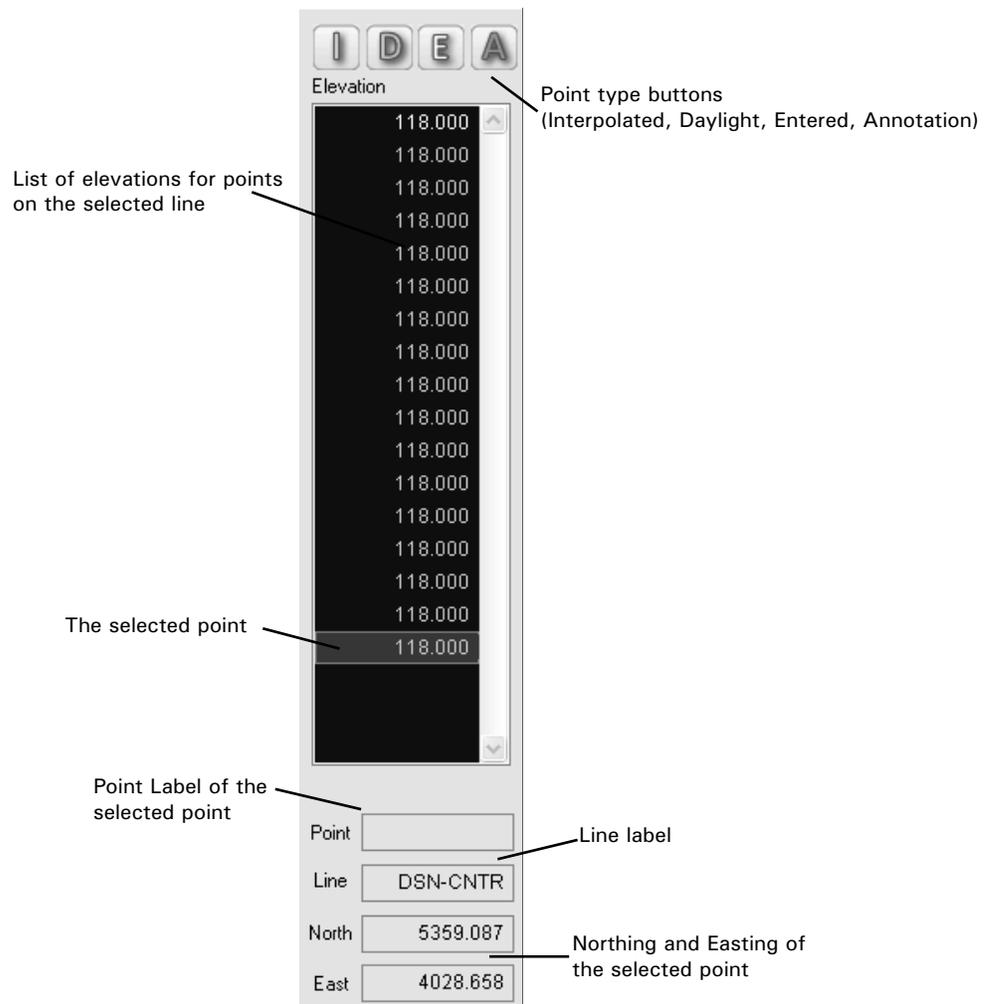


10. Select **File > Save**, or click the **Save** button.

Elevation List

The Elevation List shows information on the selected line (see the illustration below). Points listed in the elevation window are color-coded by type. Sitework 4D has five point types: Interpolated, Daylight, Entered, Snapped and Annotation.

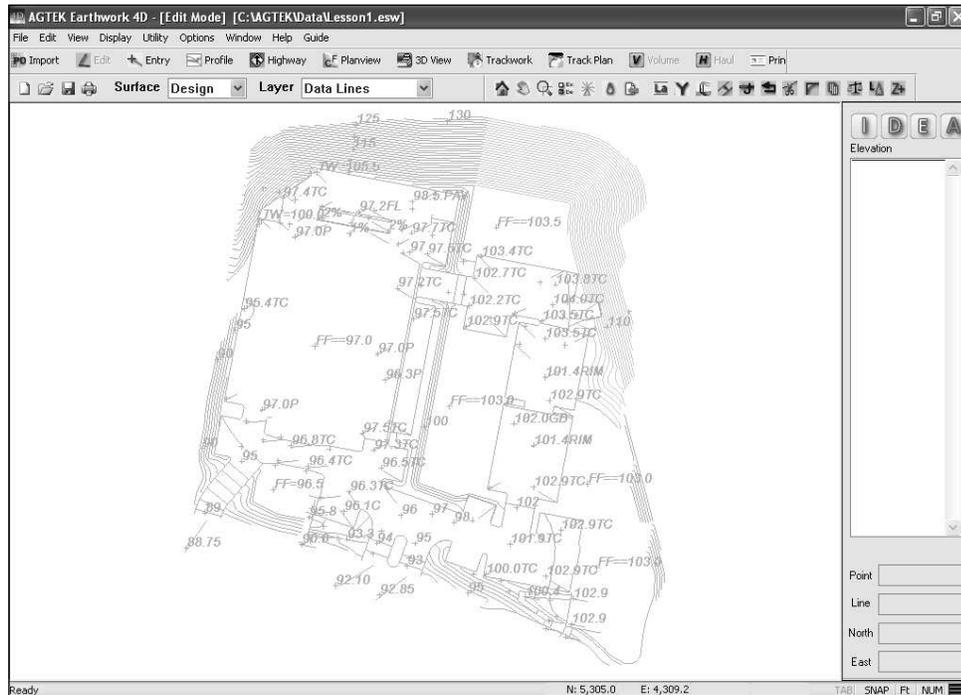
- **Interpolated** points (light blue) derive their elevation from the slope between the Entered elevations that surround them. If the elevation of the points that are used for interpolation change, the interpolated point elevation is recalculated as well.
- **Daylight** points (green) are assigned elevation from the Existing surface.
- **Entered** points (white) are points where the user has assigned an elevation to by editing or entry. These points do not change elevation unless the user specifically changes them.
- **Snapped** points (red) are created when a point on a data line is snapped (F6 or F8) to another existing data line. These become Entered points after the job is saved and reopened.
- **Annotation** points (brown) are not used by the program to create the 3D surface. The presence of an Annotation point on a line changes all points on the line to Annotation. Lines transferred through the CAD transfer with an elevation of zero are automatically assigned as Annotation.



Assign Elevations

Annotation lines are lines with no elevation. Assigning elevations to annotation lines essentially converts them to data lines. Elevations can be assigned to these lines by using the Snap techniques described in this tutorial. We'll go over several different snap techniques in the exercises that follow.

Before you begin, switch to the Design Surface in Edit mode. Notice how the contour lines on the upper right side on the screen are blue, while the ones on the left are brown. The blue contours have elevations assigned. We need to assign the remaining elevations to the brown (annotation) contours.



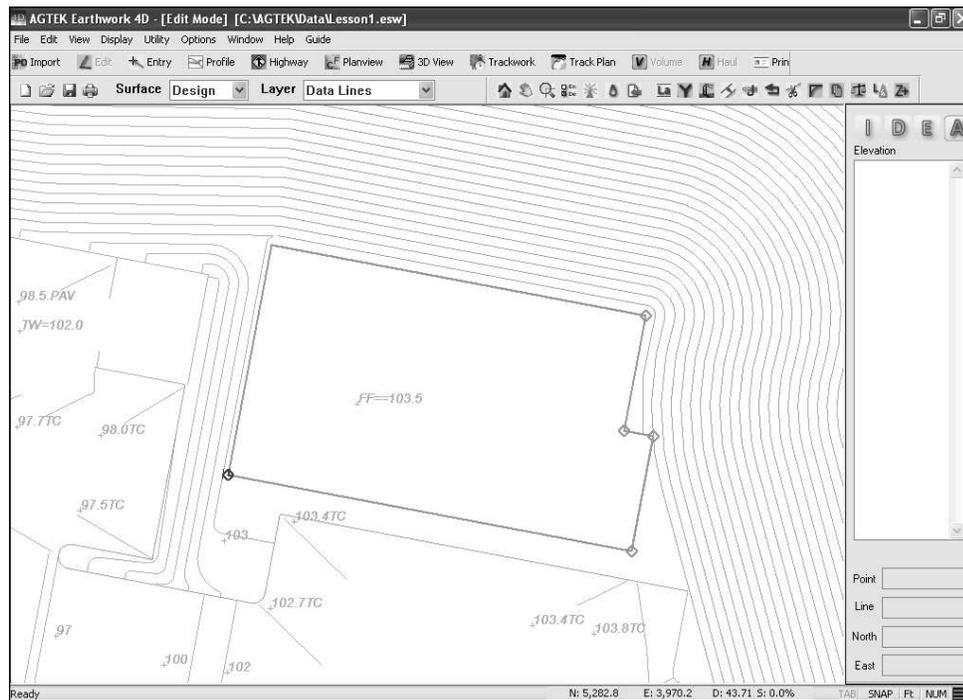
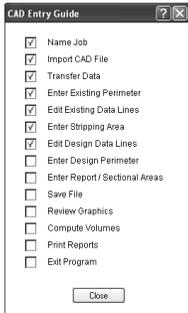
Join Lines/Assign Spot Elevations using Elevation Snap

CAD file lines are often “broken” and should be joined to ease elevation assignment. Before you can join lines, you should make sure to set your Bridge Gap Distance to the appropriate amount.

The Bridge Gap Distance indicates how far apart lines can be and still be joined. The space between the endpoints must be less than the Bridge Gap Distance for the lines to be joined.

Joining Lines

1. Select **File > Open** and open “4D Lesson3.esw”. Make the Surface is set to **Design** and the Layer is set to **Data Lines**, or select **Guide > CAD** and select **Edit Design Data Lines** from the CAD Entry Guide
2. Select one of the pad lines at the base of the slope.
3. Click the **Label Select** button. All the pad lines are selected.



4. Select **Options > Bridge Gap Distance**, and enter the desired distance in the Edit Bridge Gap Distance dialog box. The distance is measured in feet. For this example, use the default distance of “0.1”.

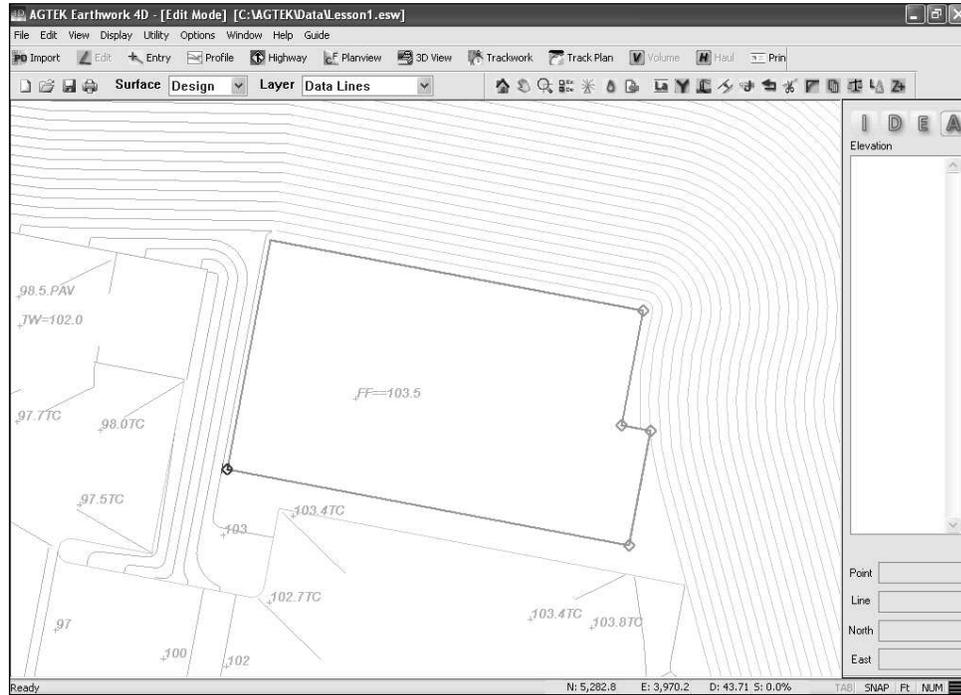


5. Click **Join** button to join the lines. After the line is joined, it is selected.

Assign Elevations using Elevation Snap

Once the lines for the pad are joined, you can use Elevation Snap to assign an elevation to the line from a label.

1. Select the pad again and verify that it is now a single line.
2. Move the cursor over the text in the center (FF = 103.5) and press **F9** to assign that elevation to the pad.

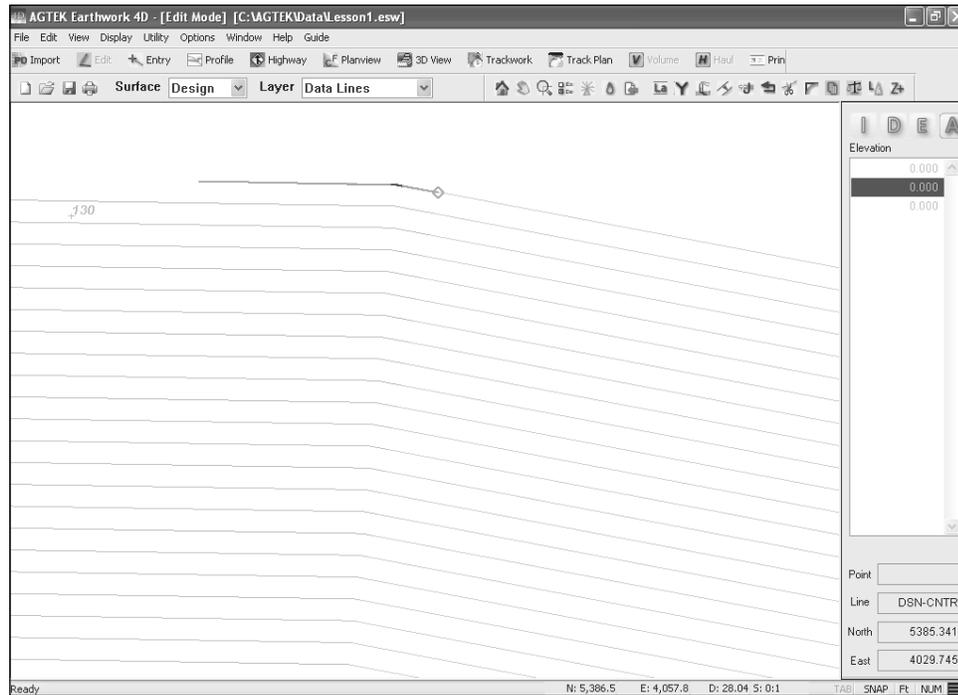


3. Continue using this technique to assign elevations to the remaining pads.

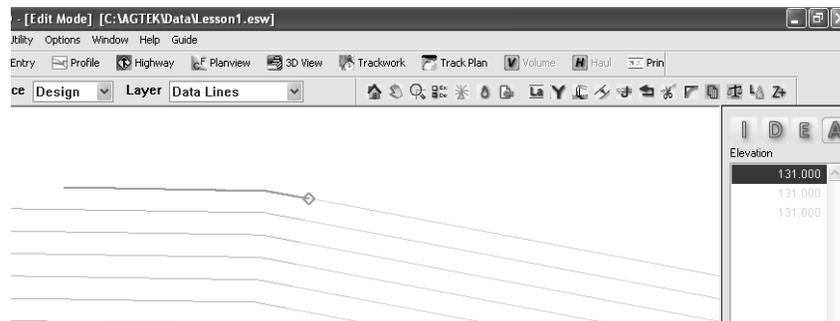
All of the snap techniques shown can be used for existing ground data as well as design data.

Elevation Snap (F9) grabs the elevation data from a label, or data line, and assigns it to a selected line.

4. Select **File > Open** and open "4D Lesson3.esw".
5. Zoom in to the contours at the top of the screen, and click on the first brown (annotation) contour on the left. Notice the elevation is 0.000 in the Elevation list.



3. Place the cursor over the light blue line to the right, and press the **F9** key. The elevation assigned to the line is displayed in the Elevation list.

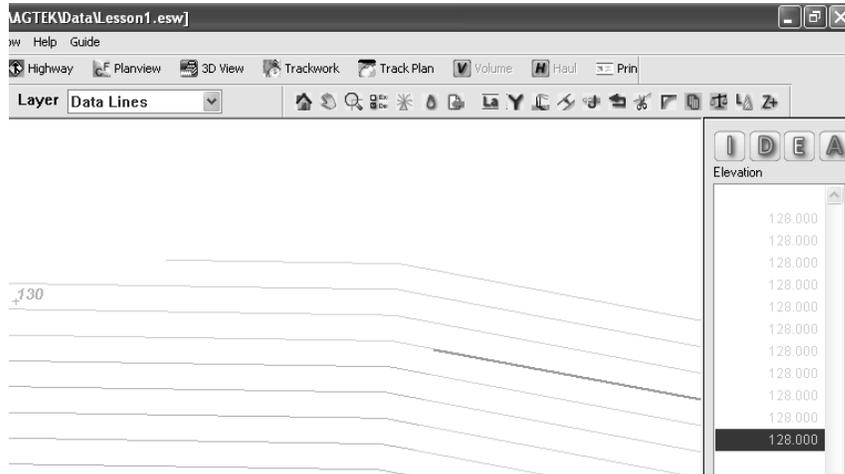


4. Repeat this process for the next contour to practice the technique. Use the Elevation list to verify that an elevation has been assigned.

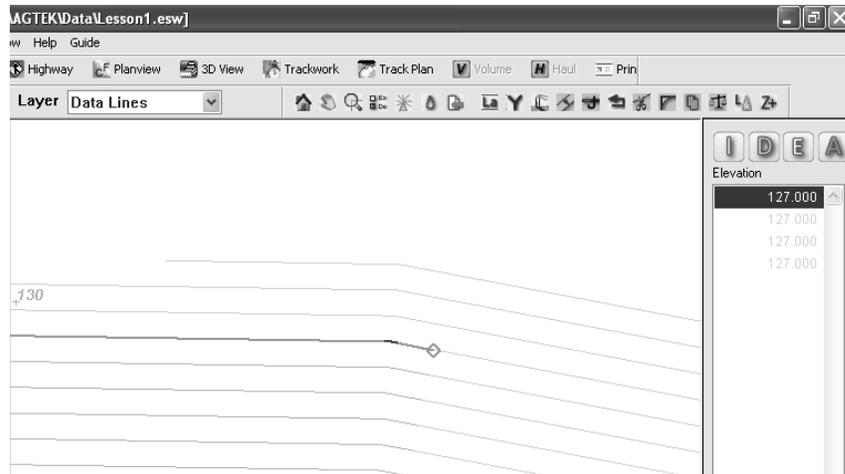
Assigning Elevation Using Increment Snap

Increment Snap creates an elevation increment and direction, then applies it to lines.

1. Press the **Esc** key to deselect any selected lines.
2. Place the cursor over the light blue contour with an elevation of 131, and press **F8**.
3. Move to the next contour below (130), and press **F8** again. The triple-beep indicates that the program is now in Increment Snap Mode.



4. Move to the next brown contour below, and press **F8** again. It automatically assigns the next incremental elevation, 127, to the line.

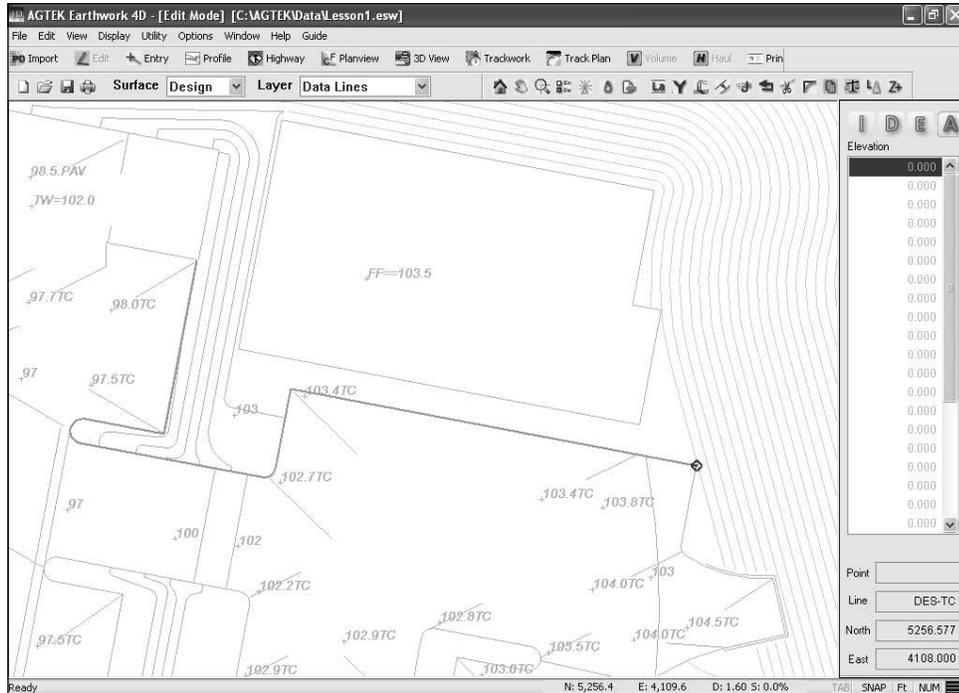


5. Repeat this process for three more contours to practice the technique.

Assigning Varied Elevations to a Line

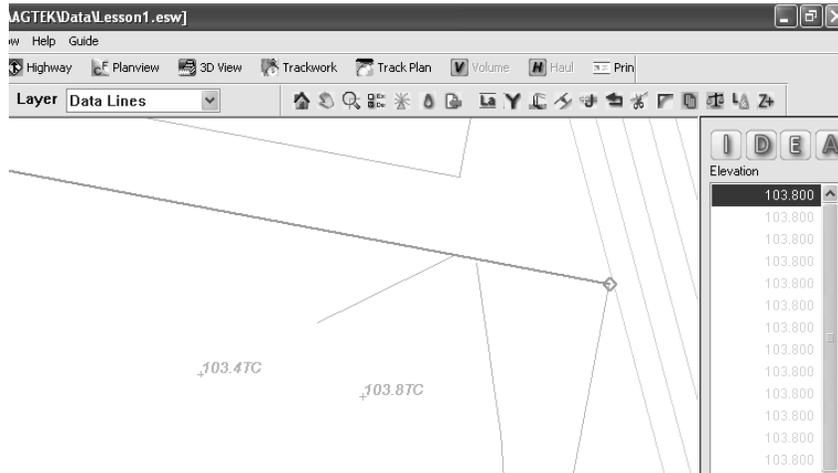
Up to this point we have snapped a single elevation to entire lines. However, you can also snap multiple elevations to a line.

1. Click on the top of curb line on the top, right side of the job. Notice that the first point on the line is marked with a diamond.
2. Click on the diamond or select the first point in the Elevation list to Select the first point.

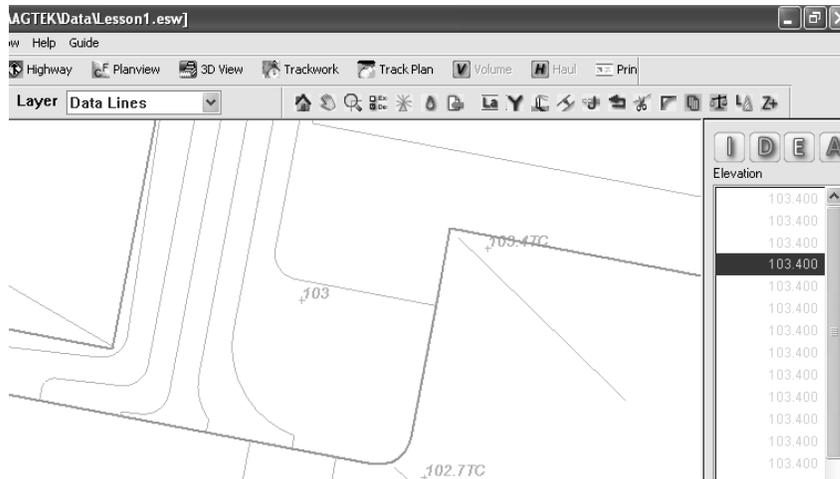


3. Move the cursor to the 103.8TC label, and press **F9** to assign that elevation to the curb.

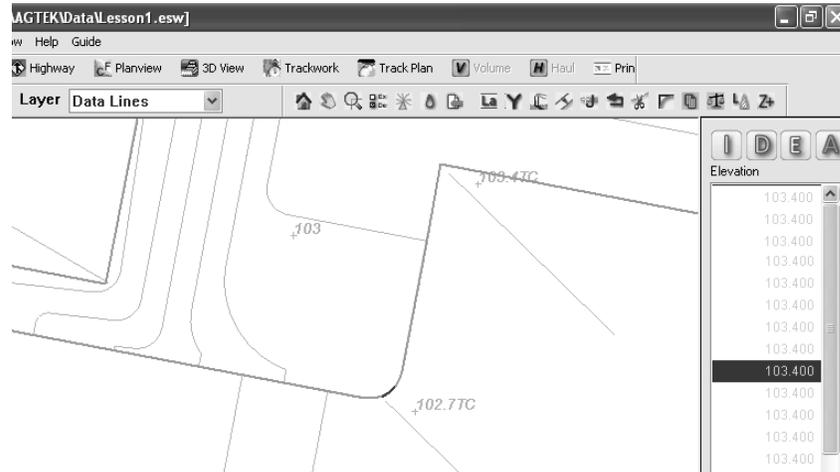
4. Move the cursor to the intersection of the 103.4 leader line, and press **F6** to add a point on the curb line. The new point is automatically selected.



5. Move the cursor over the 103.4TC label, and press **F9** to assign that elevation to the point.
6. Select the next point (corner point) on the line, and use **F9** to snap to the 103.4TC elevation label.
7. Continue down the line using **F6** key to add a point, and the contour label (103) for the elevation where the 103 contour meets the curb. Then use the **F9** key to assign the 103 elevation to the new point.



8. Bypass the first points on the corner until you reach the center of the arc and assign that point using the 102.7TC elevation label. Notice that the bypassed points on the corner are automatically interpolated between the entered elevations.

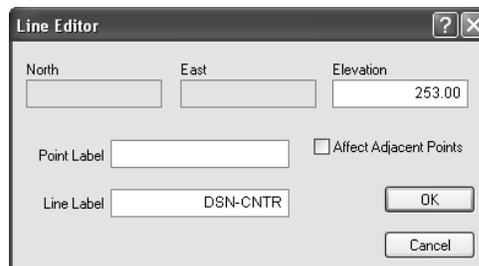


9. Continue down the line assigning grades as needed. You can use **F9** to snap elevations from some of the contours, and use the point editor to enter grades where the annotation contours intersect the curb (the 102 through 98).

Assigning Elevations Using the Line Editor

The Line Editor can also be used to assign elevations to annotation lines or change existing elevations. To use the Line Editor:

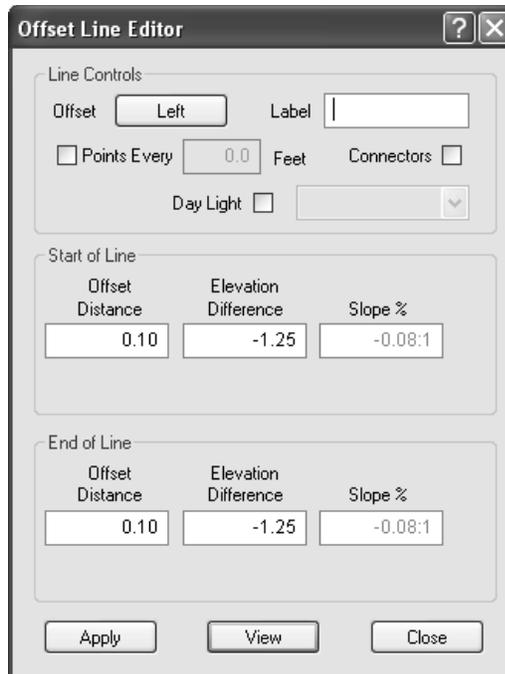
1. Click on a data line, then right-click to display the Right-Mouse menu and select **Line Editor**. The Line Editor dialog box is displayed.
2. Type in an elevation or label and click **OK**. The changes are displayed in the Elevation list.



For extra practice, you can continue to the assign elevations to the remaining annotation lines using the techniques previously discussed.

Offset Line Editor

Offset Lines are a powerful method of creating lines based upon numeric distances and elevations from a specified reference line (such as creating the bottom of curb from the top of curb line). This tutorial uses the "4D Lesson 4.esw" file, with all of the CAD data converted. For more information regarding offset lines, see page 8-92.



Creating Offset Lines

The job now has all of the top of curb, pad, and contour elevations assigned. To refine it further we need to create the bottom of curb lines.

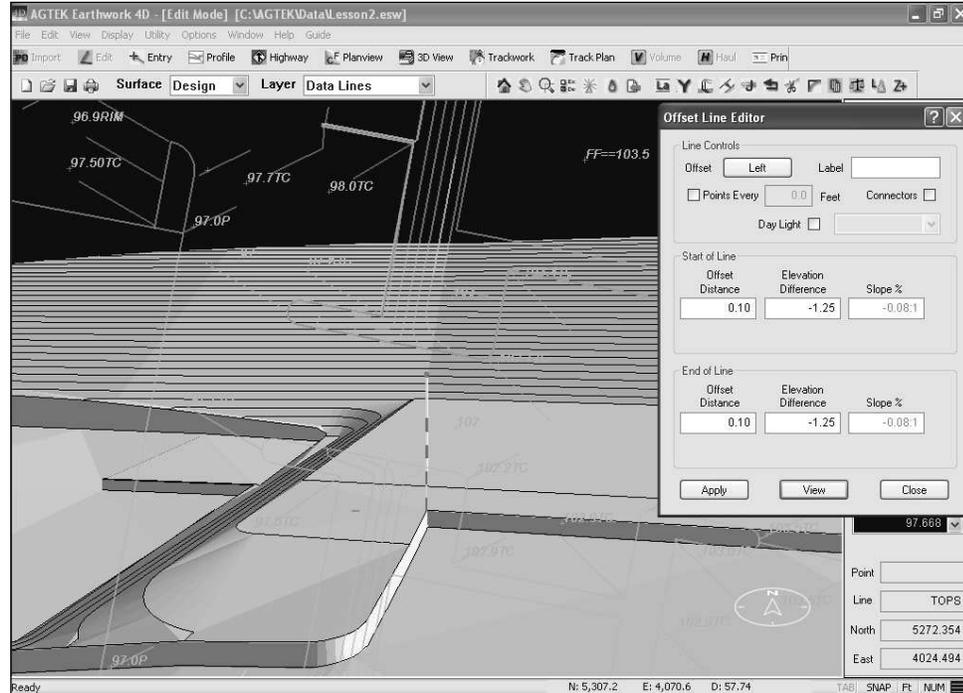
In this example, to reach light duty pavement subgrade the new line needs to be offset down 1.25 feet (.5 for curb height, .75 paving materials). We'll use an offset distance of .1 because you should never create two lines exactly on top of each other with differing elevations.

1. Select **File > Open** and open the "4D Lesson4.esw" file.
2. Switch to Edit Mode, then select **Design** from the Surface pulldown and **Data Lines** from the Layer pulldown, or select **Guide > CAD**, and select **Edit Design Data Lines** from the CAD Entry Guide.

3. Press the **T** key to turn on the Terrain View.



4. Click on the top of curb line to which elevations were first assigned in the previous lesson (below the 103.5 pad), then select **Utility > Offset Line**. The Offset Line Editor is displayed.



5. Enter "CURB SUB" in the Label box. AGTEK recommends that you label lines whenever possible. Labels are helpful for making changes to the model later if needed; such as raising the elevation of all lines with a common label.
6. Type ".1" in the Start of Line Offset Distance box, and "-1.25" in the Elevation Difference box. The Slope calculates automatically. Make sure the Offset button shows "Left" (click the button to change it if necessary).

Click **Apply** and notice that the bottom of curb line is showing and the curb face has been created using the two lines. Click **Close**.

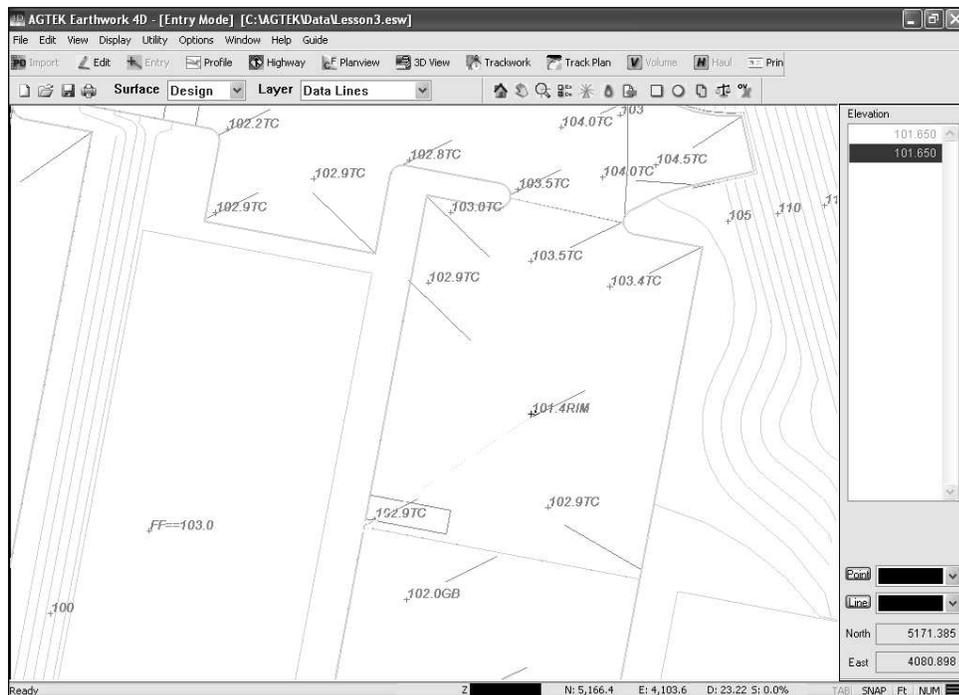
At this point you can select and offset the remaining top of curb lines on the job. The Offset Line Editor remembers the last settings used so the only changes you should need to make is changing the direction of the offset using the Offset button.

Add Grade Breaks

Grade breaks are another method to refine the model for accurate takeoffs and volume calculations. This section uses the "4D Lesson5.esw" file, which has all of the bottom of curb (BC) lines offset.

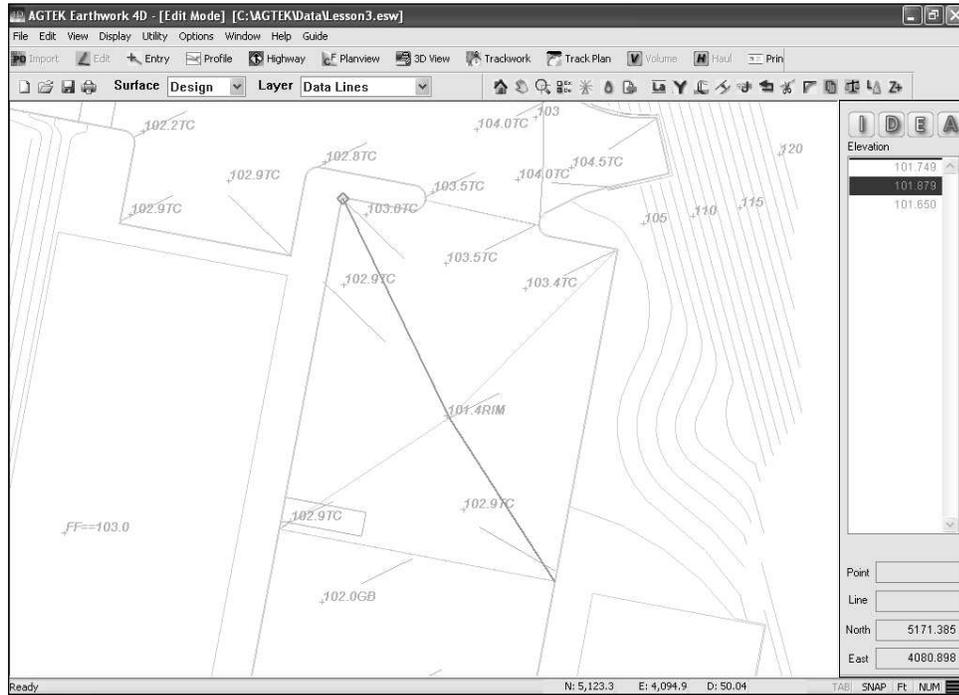
The parking areas include grade breaks and rim elevations for drainage. To refine it further we'll enter the grade breaks including the drains for the parking lot on the right (between the 103 pads).

1. Select **File > Open** and open the "4D Lesson5.esw" file.
2. Switch to Entry Mode, select **Design** from the Surface pulldown and **Data Lines** from the Layer pulldown, then zoom in to the parking lot on the right side of the job.
3. Move the cursor to the bottom left curb at grade break and press **F8**. The first point is entered at the curb and a tether line connects it to the cursor.
4. Move the cursor near the drain point in the center of the lot (101.4RIM), type "100.65", and press **F8**. If the drain was at subgrade we could use **F9** to grab the elevation from the label, but we need to subtract an additional .75 from this grade.



5. Continue diagonally to opposite corner, and press **F8** to snap to the bottom of curb.
6. Right-click to end the line, and move the crosshair across to the opposite corner.

- Press **F8** to snap the top left corner, snap again to the point you previously entered near the drain rim, and finish the line in the opposite corner.

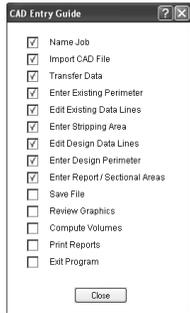


- Enter the remaining grade breaks on the job.

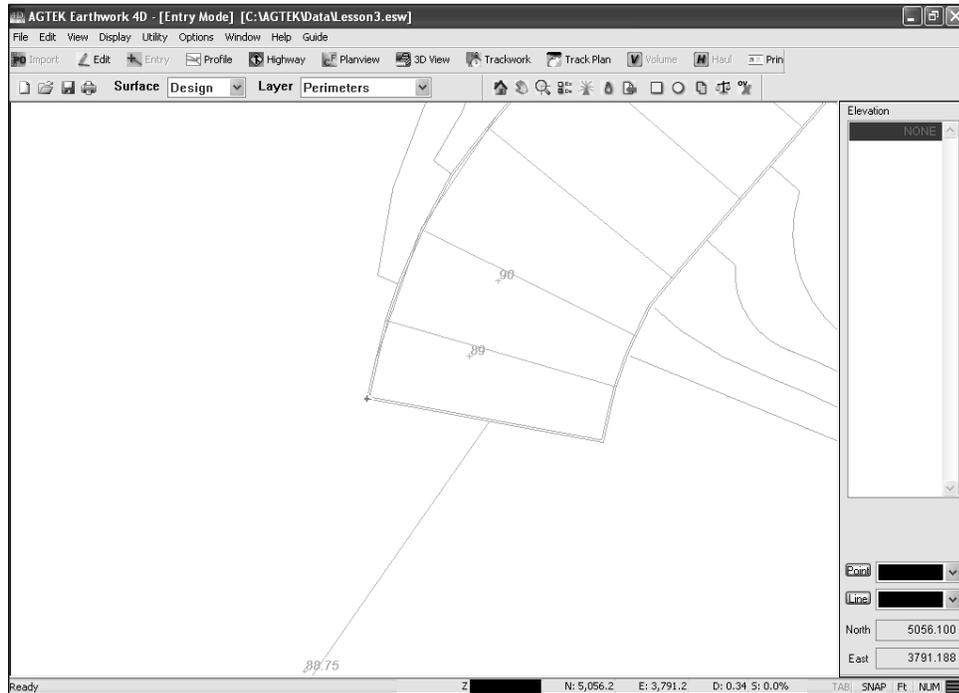
Enter Sectional Areas

Sectional Areas are closed areas that modify the Design Surface by their specified depth. When we used the Offset Editor to create the bottom of the curb, we subtracted both the curb height and the light duty pavement section. This means that the only area needing a section is the heavy duty paving and the pads. The first sectional we'll enter is the heavy duty paving area. This section starts with all data lines entered and uses "4D Lesson6.esw".

1. Select **File > Open** and open the "4D Lesson6.esw" file.
2. Switch to Entry Mode, select **Design** from the Surface pulldown and **Sectional Areas** from the Layer pulldown, or Press the **G** key and select **Report/Sectional Areas**. Then, zoom to the driveway in the lower-left of the design.

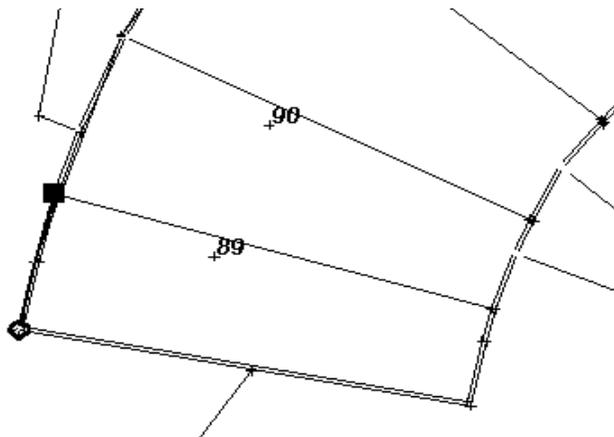


Once a Sectional Area has been entered, it can also be used as a report region by selecting the area in Edit Mode, selecting **Edit > Report Region**, and naming the region.

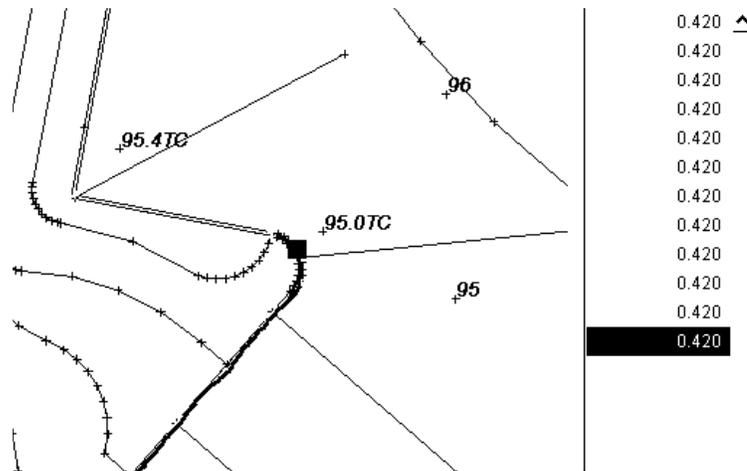


3. If the Report Regions box is not displayed, click the **Report Regions** button. Enter "HD Paving" as the Region Name, ".42" (42/100 of a foot) as the Sectional Depth (this is the difference between the heavy duty and light duty section). Clear the Report Region checkbox and click **Enter**.

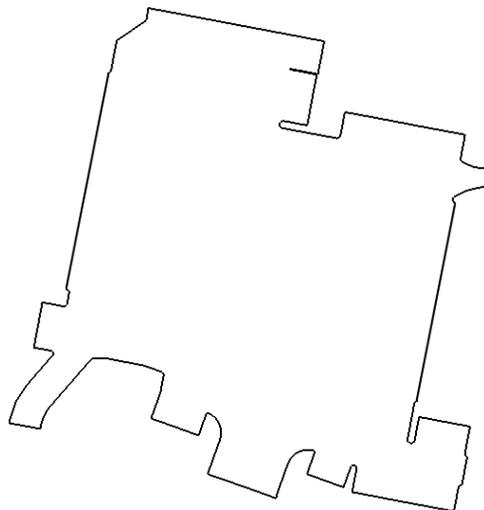
On a metric job the same ".42" would represent .42m , or 420mm.



4. Move the cross hair down to the lower-left edge of the driveway, and press **F8** to snap to the bottom of the curb line.
5. Move the crosshair to the next point up the driveway and press **F8** twice (Line Snap). The entire line is selected and changes the cursor to the line snap cursor.
6. Press the **Spacebar** to display the entire job. The selected line goes all the way to the retaining wall at the top of the parking lot. We want to follow only the portion of the line that borders the heavy duty paving area.



7. Move the cursor to the top of the driveway where the parking stalls start and press the Spacebar again to toggle back to the zoomed view, then press **F8** to limit the amount of line entered to just that section.
8. Move the cursor across the end of parking stalls, and press **F8** twice to snap to the end of the peninsula and then line snap around the tip.
9. Continue down the end of the parking stalls to the retaining wall using snap and line snap as necessary.
10. Trace around the outer edges of the parking while avoiding the light duty areas until you reach the starting point (see the illustration below).

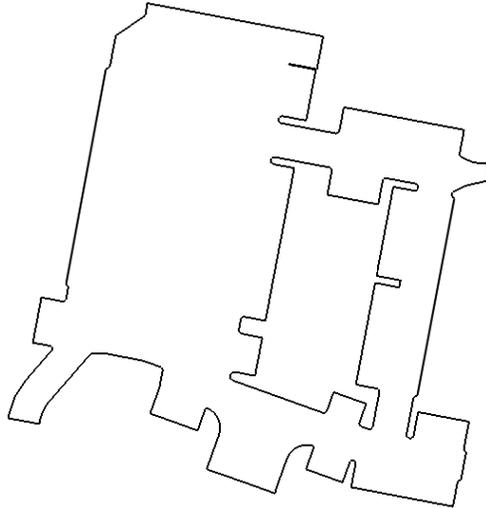


11. At the starting point (marked with a diamond) right-click to end and close the area.

Sectional Areas within Sectional Areas

The sectional area entered would drop the entire area within it by .42 feet. Since we want this to affect the heavy duty parking lot only, new sectional areas need to be entered within the first to represent different depths. Sectional Areas within other sections are not additive. We can specify a 0 depth and remove the portions from the surrounding section.

1. Switch to Entry Mode, select **Design** from the Surface pulldown and **Sectional Areas** from the Layer pulldown.
2. Type "0" to set the new depth to no sectional.
3. Move the crosshair to the center pad and surrounding curb (shown in the illustration below).
4. Use the **F8** key to snap and line snap around the CURB SUB line, and light parking areas (see the illustration below).

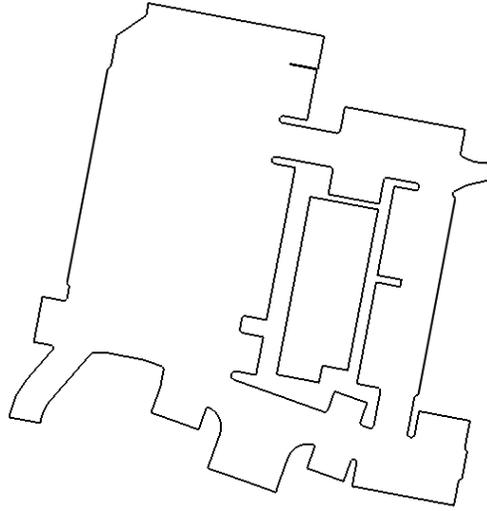


5. Right-click to finish and close the area.

The pad in the center of the 0 section has a .67 section. We need to add another sectional area to represent this.

1. Type ".67" for the section and move the crosshair over one of the pad corners, then press **F8** twice to change to line snap mode. The entire pad line highlights.

2. Right-click to snap to the entire area. This is a variation of Line Snap, called Area Snap, which assigns the elevation to the entire enclosed area.



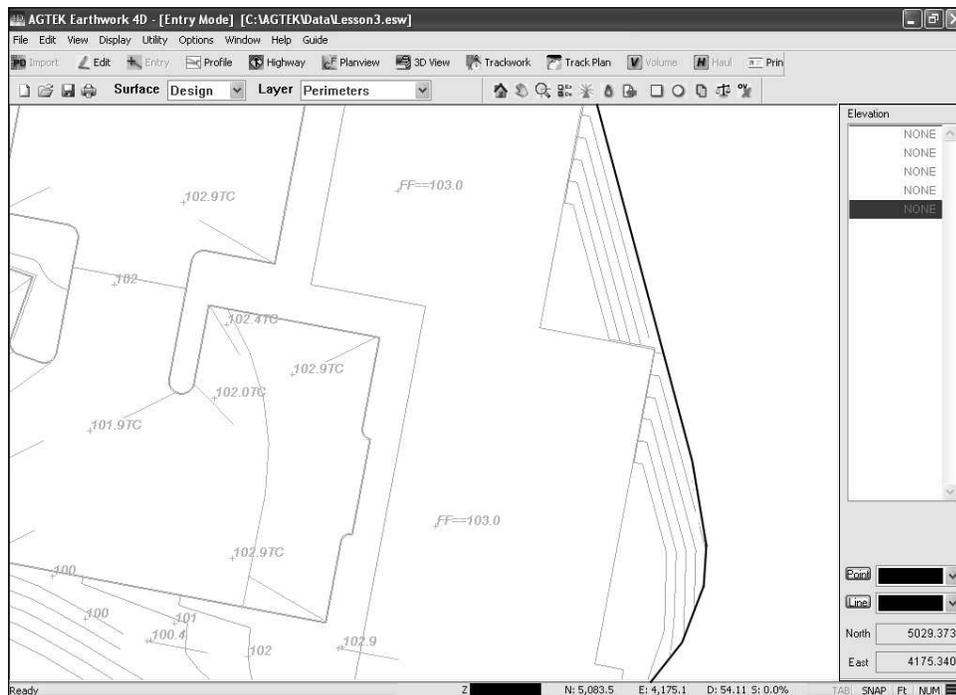
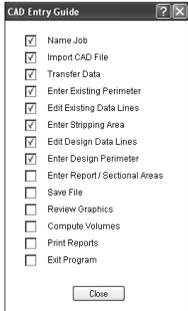
3. Continue the process to enter the rest of the sectional areas.

Enter Design Perimeter

Design Perimeters define where the Design stops and the Existing surface begins. They are also useful as a ready-made boundary when defining the volume calculation area.

Our goal with the perimeter is to trace around the edges of the design where it meets the existing ground. The Design Perimeter does not need any elevations to be entered because it automatically daylight to the Existing surface after exiting Entry mode.

1. Switch to Entry Mode and select **Design** from the Surface pulldown and **Perimeters** from the Layer pulldown, or select **Guide > PDF** and then select **Enter Design Perimeter** from the CAD Entry Guide.
2. Right-click, select **Display > Stripping Areas**.



3. Position the cursor over the Stripping Areas line and press the **F8** twice to line snap to the Stripping Areas line.
4. Right-click to end then entry. Right-click again and the Apply Drape Line dialog box displays. Click **Yes**.
5. Right-click to return to an arrow. Return to Edit Mode.



The program calculates the daylight elevations of the perimeter and creates a data line in the Design surface. If the 3D Terrain is turned on and the **Options > Staged Design** is checked, you'll see the Existing Ground shown outside of the Perimeter.

Lesson 4 – Verify the 3D Model

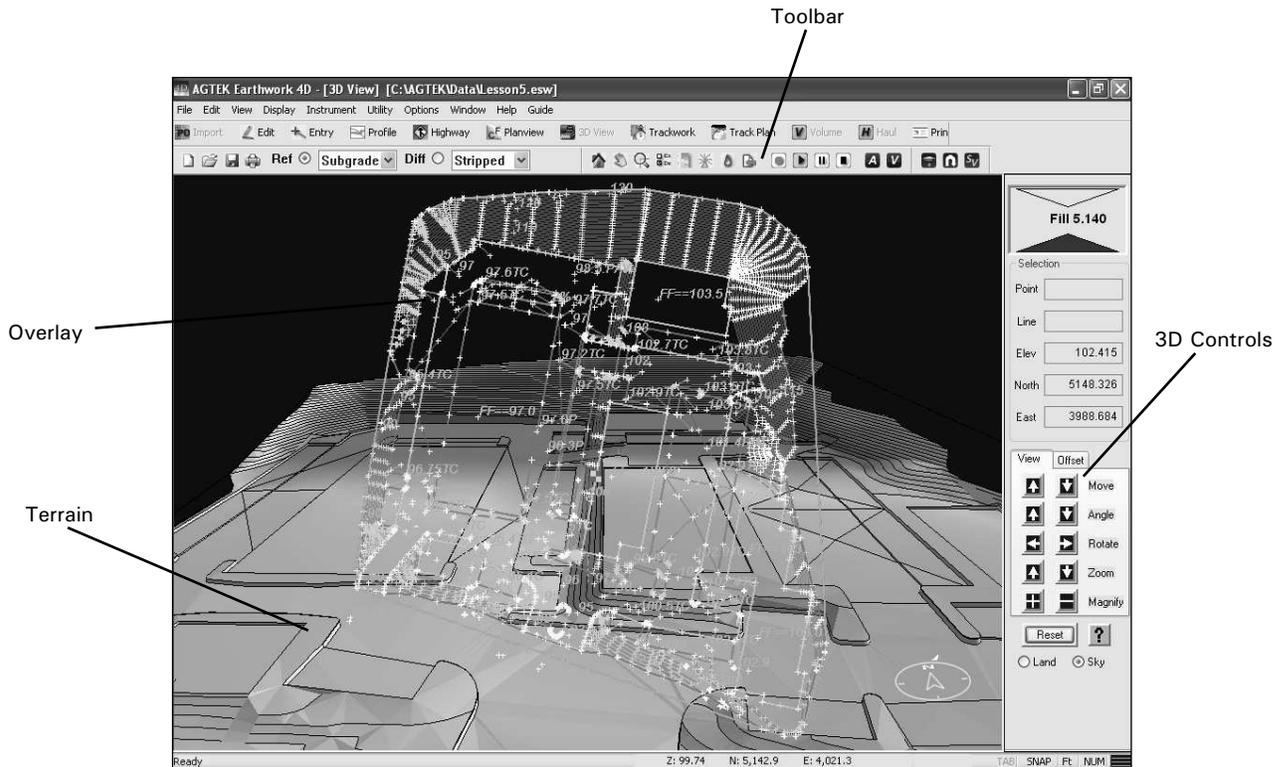
The creation of 3D surfaces allows comparison of the surfaces for volumes. This lesson shows how to verify the job with the 3D view and specify the area to calculate and generate the volumes. This lesson uses “4D Lesson7.esw”, which is the finished model.

Visual Verification with the 3D View Window

Sitework 4D can display the 3D terrain as it is entered in the Edit window. The 3D View Window adds greater flexibility to viewing and verifying the 3D surfaces.

While we were editing, the 3D terrain showed how the program interpreted the data lines to form the surfaces. The 3D Window is a much more flexible version of the 3D terrain which allows greater control over the view.

1. Select **File > Open** and open the “4D Lesson7.esw” file.
2. Click the 3D View button on the tool bar or choose **Window > 3D View**. The 3D window calculates the cut-fill colors and surfaces before displaying.



- Toolbar** Use the Toolbar to change the reference (Ref) and difference (Diff) surface to compare different surfaces in 3D View.
- Overlay** The Overlay is the two-dimensional plan view of the job. Clicking on the Overlay moves the view to that position.
- Terrain** The Terrain is the three-dimensional representation of the job. Use the Arrow keys to move around the Terrain View.
- 3D Controls** Use the 3D controls to inspect the terrain for any errors and to see how all of the data we have entered displays on the job.

Driving

Driving the 3D View is the easiest way to double check your work and the surface quality. It also can display the Subgrade and Stripping surfaces and calculate volumes.

Use the Arrow keys on the keyboard to drive through the site. The **Up** and **Down** arrows move forward and back. The **Right** and **Left** arrows turn. For additional clarity, you may want to turn the Overlay off by pressing the **O** key or by selecting **Display > Overlay**. The speed of the drive is based on the Arrow Rate setting, which is located on the **Edit** menu. Each arrow key press has a distance that the Arrow Rate controls. The speed of your computer and video adaptor can also affect screen speed.

Try using the 3D controls to change the views and get a feel for what they do. Also try changing the Reference and Difference surfaces to see the different views and comparisons.

The diagram illustrates the 3D driving controls interface, divided into two main panels: a vertical control panel on the left and a horizontal control panel on the right.

Vertical Control Panel:

- Fill 1.937:** A gauge showing the cut or fill amount at the current location.
- Selection:** A dropdown menu currently set to "Point".
- Point:** A text field for the Point Label of the selected point.
- Elev:** A text field showing the Elevation of the selected point (398.750).
- North:** A text field showing the Northing of the selected point (180.776).
- East:** A text field showing the Easting of the selected point (237.125).
- View / Offset:** A tabbed interface with "View" selected.
- Horz:** A text field showing the Horizontal distance between the selected point and current location (222.40).
- Vert:** A text field showing the Vertical distance between the selected point and current location (3.42).
- Slope:** A text field showing the Slope between the selected point and current location (1.5%).
- Buttons:** "Reset" and "?" (Launches Help) buttons.
- View Modes:** Radio buttons for "Land" (selected) and "Sky".

Horizontal Control Panel:

- View / Offset:** A tabbed interface with "View" selected.
- Move:** Up and Down arrow buttons. Label: "Drives forward and back".
- Angle:** Up and Down arrow buttons. Label: "Changes the viewing angle".
- Rotate:** Left and Right arrow buttons. Label: "Turns the view left and right".
- Zoom:** Up and Down arrow buttons. Label: "Increases/decreases the viewing distance behind the vehicle".
- Magnify:** Plus and Minus sign buttons. Label: "Increases and decreases the elevation skew".
- Buttons:** "Reset" and "?" (Launches Help) buttons.
- View Modes:** Radio buttons for "Land" (selected) and "Sky". Label: "Toggles between ground and aerial view".

Lesson 5 - Calculating Volumes

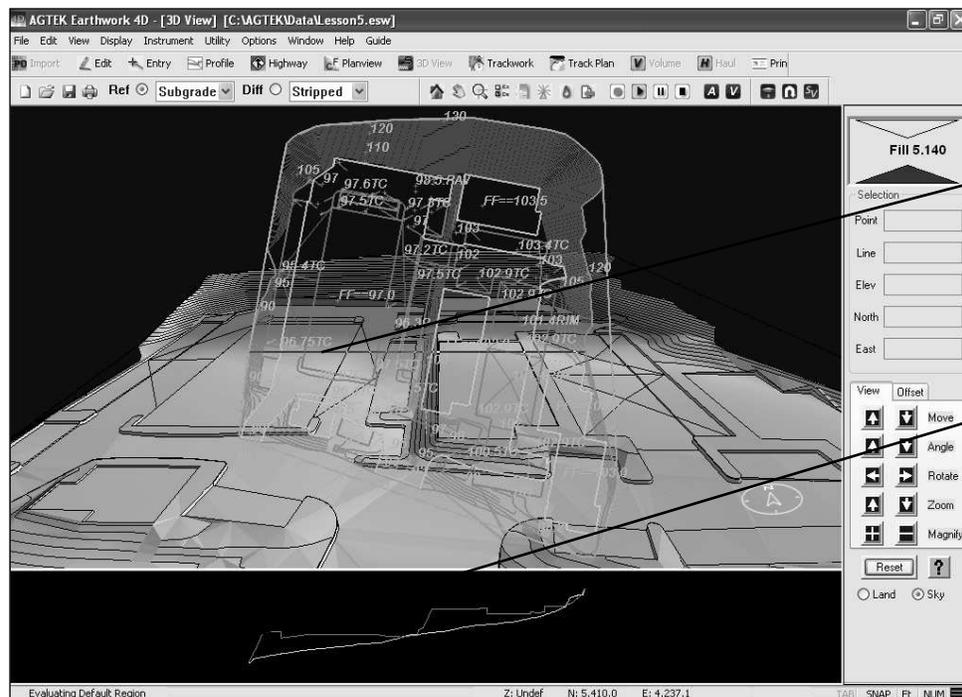
Once the model has been verified, and any changes have been made, you can calculate volumes and compare surfaces. This lesson uses the file "4D Lesson7.esw", which is the finished model.

1. Select **File > Open** and open the "4D Lesson7.esw" file.
2. Click the 3D View button on the tool bar or choose **Window > 3D View**. The 3D window calculates the cut-fill colors and surfaces before displaying.
3. Define the Volume Area. Click the **A** button on the Utility Tool Bar to create a bounding box (using the Design Perimeter) around the entire job. This determines the limits of the volume calculation.
4. Specify the Surfaces. Before calculating the volumes, verify that the correct surfaces are selected. For our example, set the Reference surface to Subgrade and the Difference surface to Stripped.
5. Calculate the Volume. The Volume Calculation is started by clicking the Calc Volume button on the tool bar or by selecting **Utility > Calc Volume**.

During the volume calculation the cross sections display at the bottom of the screen with blue representing the Reference and Green the Difference. A line displays on the overlay showing the corresponding location of the cross section. The calculation can be paused by pressing the Spacebar or aborted by pressing **Esc**. When paused, the **I** key on the keyboard will move across the site incrementally. Pressing the **Spacebar** again will resume the volume calculation.

When the calculation finishes, the Volume Calculation Results are displayed.

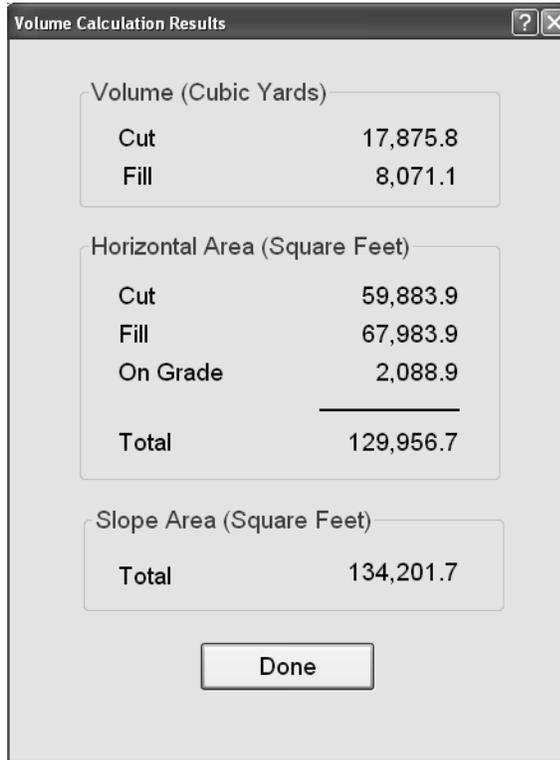
Be sure the finished surface (the surface you are calculating to) is on the left, and the beginning surface (the one you are calculating from) is on the right.



Cross Section Location

Cross Section Display

These numbers represent uncompacted cut and fill between the two surfaces. The Horizontal Area represents plan view areas with no slope adjustment and is broken down into Cut, Fill, and On-grade square footage. Slope Area represents a slope adjusted square footage. It is the total surface area, excluding vertical surfaces like curb faces. Click **Done** to close the dialog box. These volume numbers can be recalled by clicking the Volume Report button on the tool bar.



The Volume Report

Once you click **Done** in the Volume Calculations Results dialog box, the Volume Report displays. You can also access the report after volumes have been calculated by selecting **Window > Volume Report** or by clicking the Volume Report button.

The Volume Report displays area, volume, and depth for stripping and sectional areas. The total area, cut/fill, strata, and on grade area for each report region and sectional area are displayed, if created. The report also displays the Cut-Fill volumes, compaction ratios and their impact on the volumes, import/export data, and volume change per 0.1 foot of elevation change, which is useful for balancing the site. The data in the volume report should be similar to the illustration below.

| Job: Lesson5 | | | | | | | | | | | | | |
|----------------------------------|---------------|---------------|-------------|--------------|---------------|------------|---------|--------|---------|-----------|-------|-----|--|
| Units: Ft-CY | | | | | | | | | | | | | |
| Thu Mar 03, 2011 11:21:01 Page 1 | | | | | | | | | | | | | |
| Volume Report | | | | | | | | | | | | | |
| Subgrade vs. Stripped | | | | | | | | | | | | | |
| | Total | Cut | Area | OnGrade | Volume | Comp/Ratio | Compact | Export | Change | | | | |
| | | | Fill | | Cut | Fill | Cut | Fill | -Import | Per .1 Ft | | | |
| Job Site | 129,957 | 59,884 | 67,984 | 2,089 | 17,876 | 8,071 | 1.00 | 1.00 | 17,876 | 8,071 | 9,805 | 481 | |
| Stripping Qtys | | | | | | | | | | | | | |
| | <u>Plane</u> | <u>Slope</u> | <u>Area</u> | <u>Depth</u> | <u>Volume</u> | | | | | | | | |
| | <u>Area</u> | <u>Area</u> | | | | | | | | | | | |
| Stripping 1 | 129,971 | 131,704 | 0.500 | 2,439 | | | | | | | | | |
| Sectional Qtys | | | | | | | | | | | | | |
| | <u>Plane</u> | <u>Slope</u> | <u>Area</u> | <u>Depth</u> | <u>Volume</u> | | | | | | | | |
| | <u>Area</u> | <u>Area</u> | | | | | | | | | | | |
| HD Paving | 39,699 | 39,810 | 0.420 | 619 | | | | | | | | | |
| Landscape | 509 | 511 | 0.000 | 0 | | | | | | | | | |
| Landscape | 108 | 109 | 0.000 | 0 | | | | | | | | | |
| Landscape | 108 | 108 | 0.000 | 0 | | | | | | | | | |
| Landscape | 5,804 | 6,186 | 0.000 | 0 | | | | | | | | | |
| Landscape Sub: | 6,529 | 6,914 | | 0 | | | | | | | | | |
| Pad | 5,833 | 5,868 | 0.670 | 146 | | | | | | | | | |
| Pad | 1,292 | 1,296 | 0.670 | 32 | | | | | | | | | |
| Pad | 7,809 | 7,845 | 0.670 | 195 | | | | | | | | | |
| Pad | 3,887 | 3,905 | 0.670 | 97 | | | | | | | | | |
| Pad | 12,370 | 12,376 | 0.670 | 307 | | | | | | | | | |
| Pad Sub: | 31,191 | 31,290 | | 777 | | | | | | | | | |
| Sectional Total | 77,419 | 78,014 | | 1,396 | | | | | | | | | |

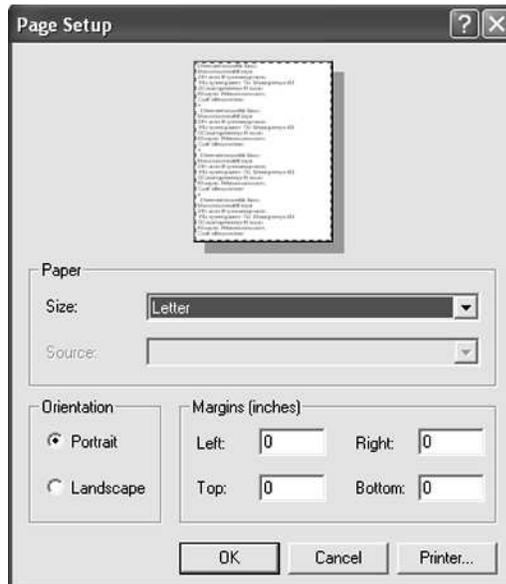
Lesson 6 – Printing Reports

Sitework 4D can print the Overlay and Terrain graphics along with Volumes and Profiles. The Print Preview Window allows the user to import graphics and resize, move, and add text. The lesson continues to use the file “4D Lesson7.esw”

Set up the Printer

Before printing, the printer should be configured. Sitework 4D uses the printer specified to size the screen and margins.

1. Select **File > Print Setup** to configure the printer.



2. Verify your printer and its settings and click **OK**.

Send Graphics to the Print Page

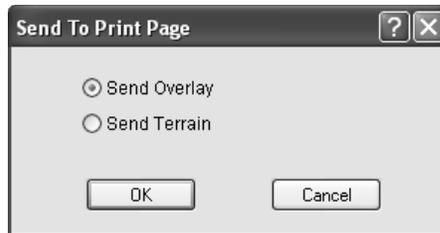
Selecting **File > Send to Print Page** sends the current screen view to the Print Page.



1. Click the **3D View** button on the tool bar. The job is shown in 3D View mode.



2. Use the keyboard arrows and the 3D Controls to show a Terrain view you want to print, then select **File > Send to Print Page**, or click the **Send to Print Page** button.
3. If both the Overlay and Terrain are visible, the program asks which you want send. Select Send Terrain and click **OK**.



The Print Preview Window

The Print Preview window displays a representation of the page with the Terrain as an object on the page. The white area is the printable area on the page. The gray area represents the printer's margins.

Selecting Objects

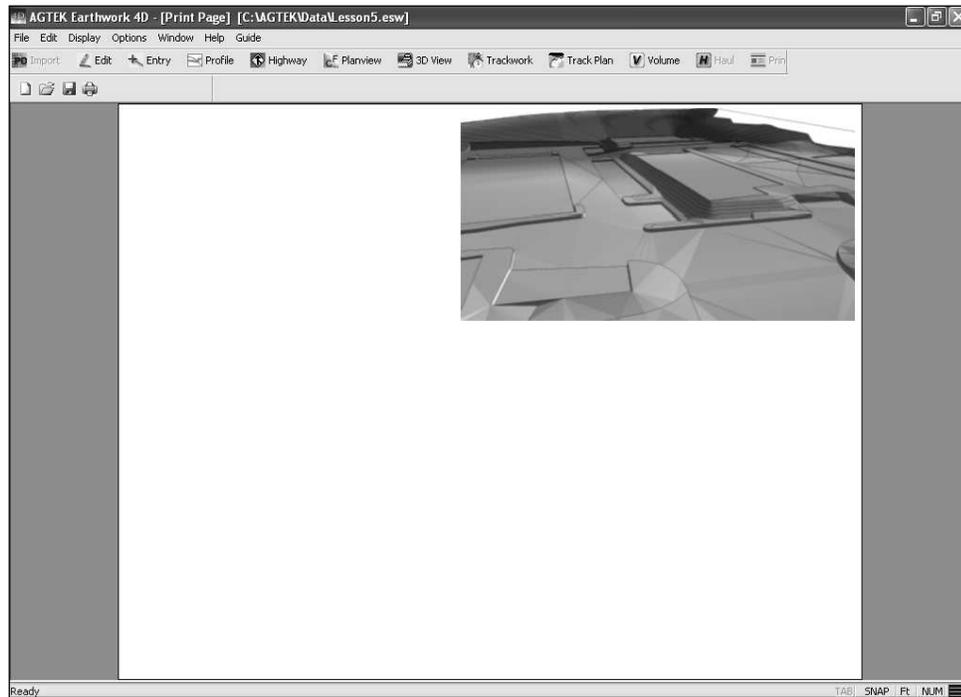
The Terrain object can be picked by clicking on it. A picked object displays four blocks around the object. In case of multiple overlapping objects, Shift + click cycles between objects.

Moving and Sizing Objects

To move an object, click and hold the object then drag it to the desired location.

To resize an object, click on an item, then click and hold the lower right selection block. The arrow changes to a double-headed arrow. By moving the cursor away from, or closer to, the object, you can resize it.

- Select the Terrain object, drag it to the left side of the page, and increase the size to similar to the illustration below.

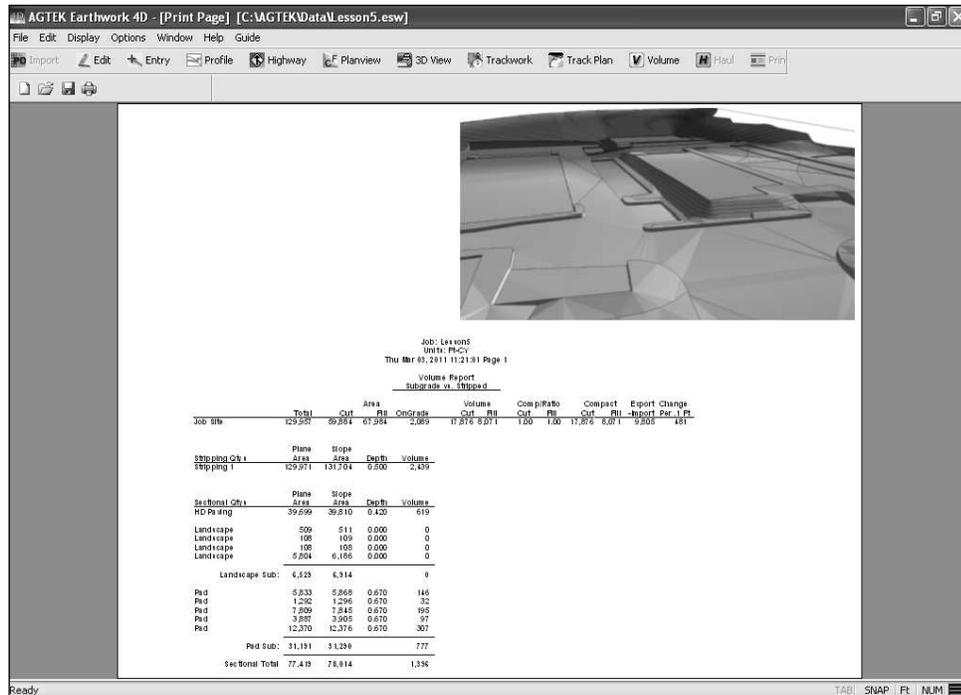


Adding Other Objects

The Print Preview window supports multiple objects. Next we'll add the Volumes Report to the page.

1. Click the Volumes Report button on the tool bar or select **Window > Volumes Report**. The Volumes Report shows the volumes and areas calculated earlier.
2. Select **File > Send to Print Page** and the report transfers to the Print Preview window.

The Volumes Report can be moved and resized using the same methods as the Terrain object. Move and size the report until the page looks similar to the illustration below.



Print The Report



1. Click the **Plan View** button on the tool bar or select **Window > Plan View**.
2. Send the image to the Print Page and switch back to the Print Page to resize and view the results. Your Print Page should look similar to the illustration below.
3. When you are satisfied with the results, click the Print button from the Selection Tool Bar or choose **File > Print**.

AGTEK Earthwork 4D - [Print Page] [C:\MGTEK\data\Lesson5.esw]

File Edit Display Options Window Help Guide

Import Edit Entry Profile Highway Planview 3D View Trackwork Track Plan Volume Haul Print

Job: Lesson5
Units: Feet
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Volume Report
Subgrade on Sloped

| Job Site | Total | Area | | Volume | Comp/Fill | | Compact | | Export | Change | | |
|----------|---------|--------|--------|--------|-----------|-------|---------|------|--------|--------|--------|-----|
| | | Cut | Fill | | Cut | Fill | Cut | Fill | | | Report | Pct |
| | 129,951 | 59,884 | 67,984 | 2,089 | 17,276 | 8,071 | 1.00 | 1.00 | 11,386 | 8,071 | 9,805 | 481 |

| Striping CV's | Plane | | Slope | Depth | Volume |
|---------------|---------|---------|-------|-------|--------|
| | Area | Area | | | |
| Striping T | 129,911 | 137,704 | 0.500 | | 2,439 |

| Subtotal CV's | Plane | | Slope | Depth | Volume |
|----------------|--------|--------|-------|-------|--------|
| | Area | Area | | | |
| MC Paving | 39,696 | 39,810 | 0.430 | | 915 |
| Landscape | 509 | 511 | 0.000 | | 0 |
| Landscape | 108 | 109 | 0.000 | | 0 |
| Landscape | 108 | 108 | 0.000 | | 0 |
| Landscape | 5,204 | 6,186 | 0.000 | | 0 |
| Landscape Sub: | 6,329 | 6,314 | | | 0 |
| Pd | 5,833 | 5,968 | 0.670 | | 146 |
| Pd | 1,232 | 1,296 | 0.670 | | 32 |
| Pd | 7,850 | 7,245 | 0.670 | | 105 |
| Pd | 3,887 | 3,905 | 0.670 | | 97 |
| Pd | 12,370 | 12,376 | 0.670 | | 307 |
| Pd Sub: | 31,191 | 31,239 | | | 777 |
| Subtotal Total | 77,419 | 78,614 | | | 1,336 |

Ready TAB | SNAP | FT | NUM

