

Highway 4D



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HIGHWAY 4D TUTORIAL

HIGHWAY 4D OVERVIEW	1-1
DOCUMENT CONVENTIONS	1-1
KEYBOARD AND MOUSE INTERFACE	1-1
Keyboard	1-1
The Mouse	1-2
DATA ENTRY SEQUENCE	1-2
Cross Sections	1-2
Horizontal and Vertical COGO	1-2
Reports and Calculating Volumes	1-2
LESSON 1 — DIGITIZING CROSS SECTIONS	1-3
Import the PDF or TIF file	1-3
Start a New Job (Job Setup)	1-3
Enter the Plan Scale	1-4
Enter the Reference Point	1-7
Enter Cross Sections	1-7
Enter Existing Ground	1-8
Enter Design Points	1-9
Entering Stripping and Sectional Depths	1-12
Using Stripping Entry	1-12
Using Sectional Entry	1-13
LESSON 2 — ENTERING COGO	1-14
Start a New Job (Job Setup)	1-14
Enter Station Equations	1-15
Enter Horizontal COGO	1-17
Enter Vertical COGO	1-22
Editing COGO	1-25
Deleting Segments	1-25
LESSON 3 — REPORTS AND CALCULATING VOLUMES	1-26
Mass Diagram	1-26
The Mass Diagram Window	1-27
Interpreting the Mass Diagram	1-28
Printing the Mass Diagram	1-29
Printing the Haul Report	1-31
The Volumes Report	1-31
Printing the Volumes Report	1-33
Calculating Volumes in 3D View Mode	1-33
Other Volumes-Related Features	1-34
Compaction	1-34
Entering Borrow/Spoil Locations	1-35

Stopping and Starting Volumes	1-36
LESSON 4 — ADVANCED TOPICS - CAD DATA ENTRY	1-38
Creating 3D Models with COGO and Cross Sections	1-38
Import COGO	1-38
Import Cross Sections	1-39
Create the Model	1-41
Visual Verification with the 3D Window	1-43
Surfacing Multiple Alignments with Starts/Stops	1-44
Inspect the Job	1-46
Perfecting Models from Digitized Cross Sections	1-47
Enter Travelway Transitions	1-47
Surface the Job	1-52
Creating a Highway Job from Earthwork 4D	1-53
IMPORTING OTHER CROSS SECTION DATA FILES	1-55
Import the Cross Section	1-55
Edit the Cross Section	1-56

Highway 4D Overview

Highway 4D is a complete highway estimating and modeling tool that adds highway-specific entry techniques and reporting to the Earthwork 4D Suite of products. Highway 4D allows entry of cross sections from PDF or TIF files, survey notes, or electronic file formats as well as supporting coordinate geometry (COGO) entry. On-screen volume reporting and an interactive mass diagram combine to allow quick analysis.

By combining different data types from a variety of sources, you can use Highway 4D to create basic highway volumes and reports, surfaces for Earthwork 4D, and when accurate data types such as COGO and electronic sections are available for surfaces, field layout and modeling.

Document Conventions

This tutorial uses standard software documentation conventions to explain how the software works. These conventions are described below.

Click/Click on - Press the left button on the mouse (assuming the mouse buttons are set to the default setting).

Double-click - Press the left button on the mouse twice in rapid succession.

Right-click - Press the right button on the mouse.

Shift + Click - Press the Shift key then press the left button on the mouse.

Ctrl + (Key) - Press the Ctrl key then press the keyboard key noted in the step.

Press - Press a key on the keyboard.

Select - Use the mouse to pick an item on the screen or a menu command.

Menu Commands - Menu commands are described using the following format: **Menu > Command**. If there is more than one level to the menu, it appears as a Submenu, **Menu > Submenu > Command**. For example, **Options > Sound Preference > Sound Card**.

Data Entry/File Names - If a file is specified in a procedure, or if specific text needs to be entered into a field as part of a procedure, it will appear inside double quotation marks.

Keyboard and Mouse Interface

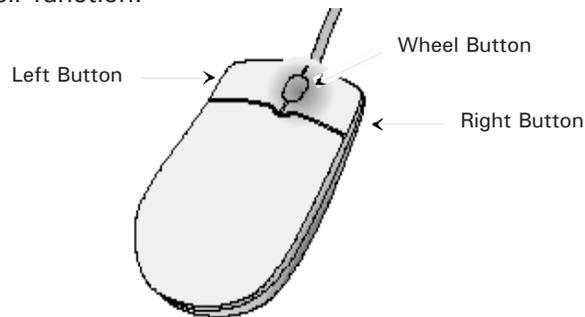
Highway 4D relies on the mouse for input and the keyboard for alphanumeric entry and keyboard shortcuts.

Keyboard

To effectively use Highway 4D you will use the mouse and the keyboard. Most tasks are available on menus and the toolbar at the top of the screen, but the tasks can also be accessed much faster through keyboard shortcuts. Keyboard shortcuts are listed in the Reference Section of this manual and are mentioned in the Tutorial Section where appropriate.

The Mouse

A two-button wheel mouse is used for non-digitized entry. Below is a description of the buttons and their function.



The **Left** button is used to select objects and choose menu items.

The **Right** button is used to display the Right Mouse Menu. This menu displays quick access to specific commands in each job surface.

The **Wheel Button** allows the user to zoom in or out over the location of the arrow (or a segment if selected) by rolling the wheel Up or Down respectively. Holding the button down and moving the mouse allows the user to pan the view on the screen.

Data Entry Sequence

Highway 4D is used for the entry of cross sections from PDF or TIF files. You may also enter Horizontal and Vertical COGO data. Below are the suggested data entry sequences.

Cross Sections

- Start a New Job.
- Import the PDF or TIF file.
- Enter the Plan Scale
- Enter the Reference Point
- Enter Existing Points
- Enter Design Points
- Enter Stripping and Sectional Depths
- View Volumes Report

Horizontal and Vertical COGO

- Start a New Job/Name Highway
- Enter Station Equations
- Enter Horizontal COGO
- Enter Vertical COGO
- Enter Offset Points

Reports and Calculating Volumes

- Mass Diagram and Haul Report
- Volumes Report
- Calculate Volumes in 4D Mode

Lesson 1 — Digitizing Cross Sections

Start a New Job

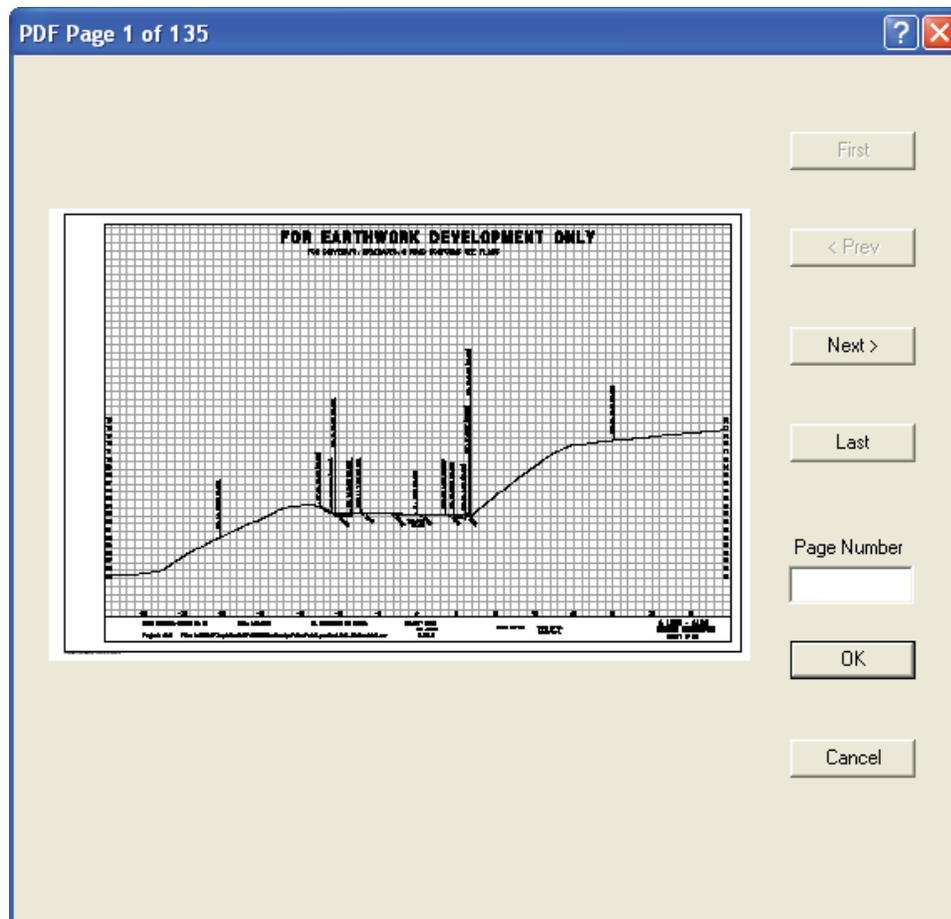
1. Double click the Earthwork 4D shortcut or select **Start > Programs > AGTEK > Earthwork 4D**. The Open dialog box is displayed.



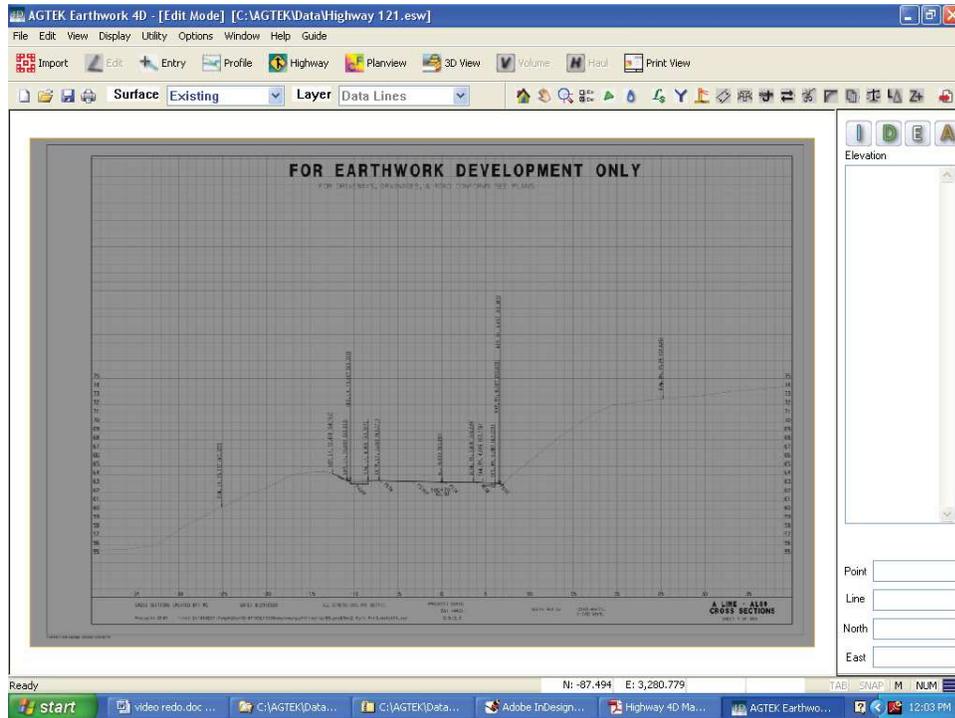
2. Click the **New** button. The Job Information dialog box is displayed.
3. Name the job, make sure Meters is selected as the Units and the Highway box is checked, then click **OK**. The Enter Alignment Name dialog box is displayed.
4. Name the alignment and click **OK**. Highway 4D opens in Cross Section Mode. **Import the Cross Section Data**

Import the Cross Section Data

1. Select **File > Import** then select the "Xsect Napa 121.pdf" file in the Import dialog box and click Open. The PDF Page dialog box is displayed.



2. Select the page of the PDF to open (the first page in our example) and click **OK**. The PDF opens in CAD Transfer Mode. Your screen should look similar to the illustration below.

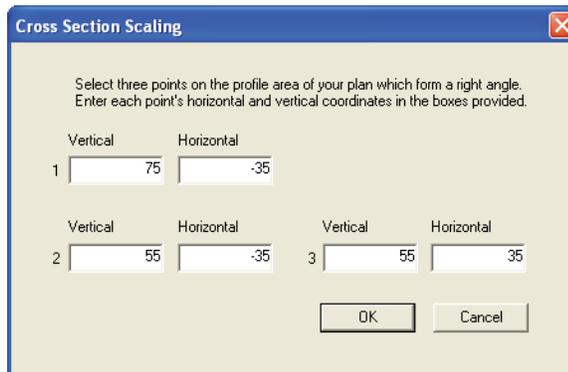


Note: Files that only contain bitmap data and cannot be vectorized are imported with a red bounding box. Files with at least some vector data are imported with a green bounding box. Our example has a green bounding box and has vector data, but will be digitized instead of vectorized.

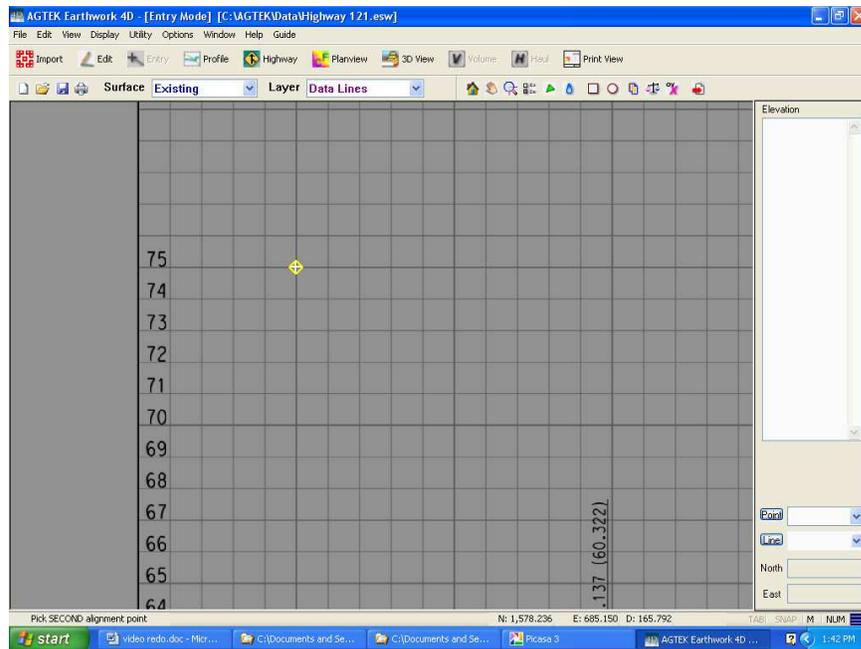
Scale the Electronic Data

Cross sections are typically drawn using the same scale for a job. If so, you will only need scale the cross sections one time. However, AGTEK recommends checking each cross section to make sure the scale is the same. If the scale is not the same you would perform the following steps each time the scale changes.

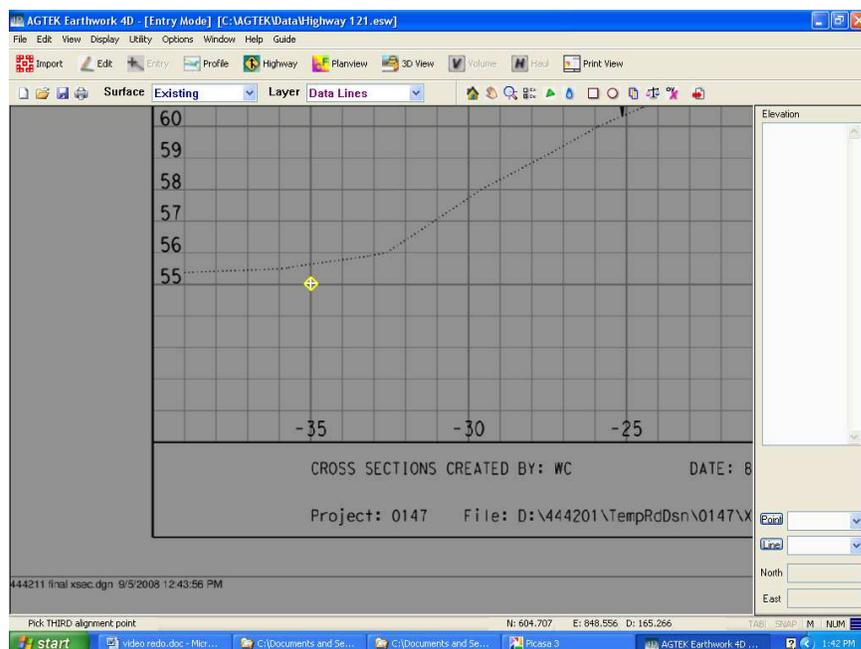
1. Switch to Entry Mode, then select **Utility > Trace Cross Section**. The Cross Section Scaling dialog box is displayed.



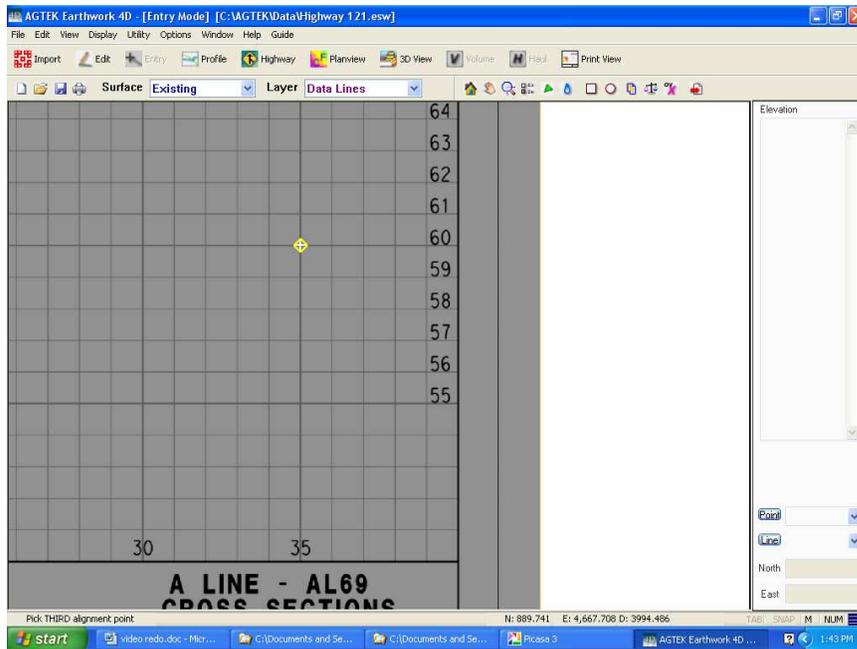
2. Type "75" in the Point 1 Vertical text box, then "-35" in the Horizontal box.
3. Enter "55" in the Point 2 Vertical text box, then "-35" in the Horizontal box
4. Enter "55" in the Point 3 Vertical text box, then "35" in the Horizontal box and click **OK**.
5. Zoom into the left part of the cross section, place the crosshairs over point 1 (75, -35) and click. Make sure you are as accurate as possible when clicking on the point.



6. Zoom into the bottom left part of the cross section, place the crosshairs over point 2 (55, -35) and click.



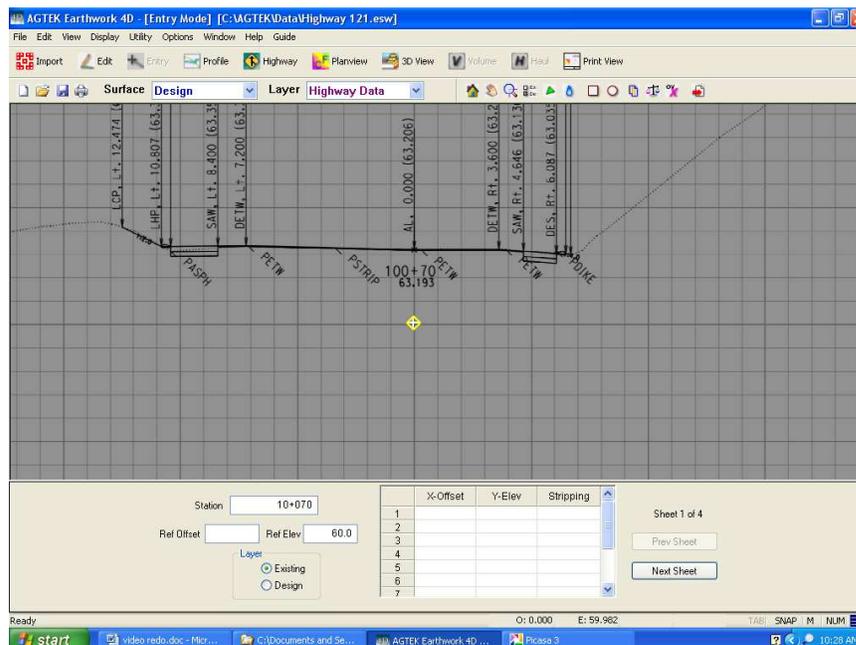
7. Zoom into the bottom right part of the cross section, place the crosshairs over point 3 (55, 35) and click.



8. Make sure the correct alignment is selected (the name you gave it if you created a new job or "A Line" if you opened the COGO file) in the Alignment Selection dialog box, and click **OK**.
9. Enter "10 +070" in the Station box at the bottom of the screen. This is the first station of the cross sections.

- Select a reference point for the cross section and enter the offset in the Ref Offset box and the elevation in the Ref Elev box, (use 0, 60) then click on that point in the cross section. The reference point is entered and the cursor changes to a Crosshair.

Note: Like the scaling points, the reference point should be common to all cross sections you are going to digitize to facilitate data entry.



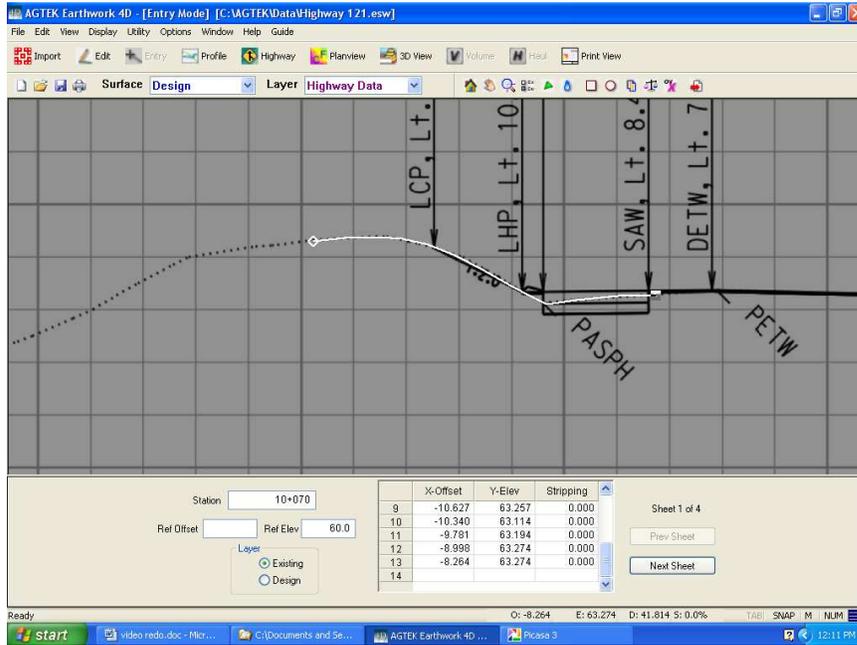
Digitize Cross Sections

Cross Sections are entered as existing ground, design, and daylight points. Daylight points are special design points that are automatically connected to the existing ground from the current horizontal position when entered.

Enter Cross Section 1 Existing Ground

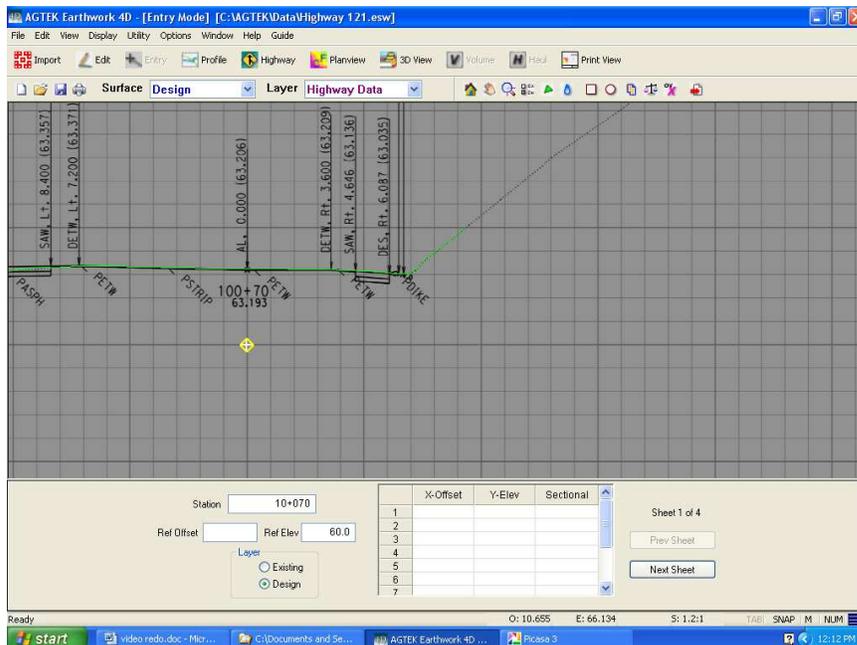
- Move the cursor to the beginning of the existing ground from left to right and click to create the first point.
- Move the crosshair to the next point you want to enter, typically a grade break and click to create a line connecting the points.

- Continue moving the cursor and entering points by clicking at the grade breaks until you reach the end of the cross section.



Note: If you make a mistake during entry, the error can be removed by pressing the **Backspace** key.

- Right-click to end the existing ground entry. The Layer selection changes to Design and the on-screen crosshair is no longer connected to the existing.



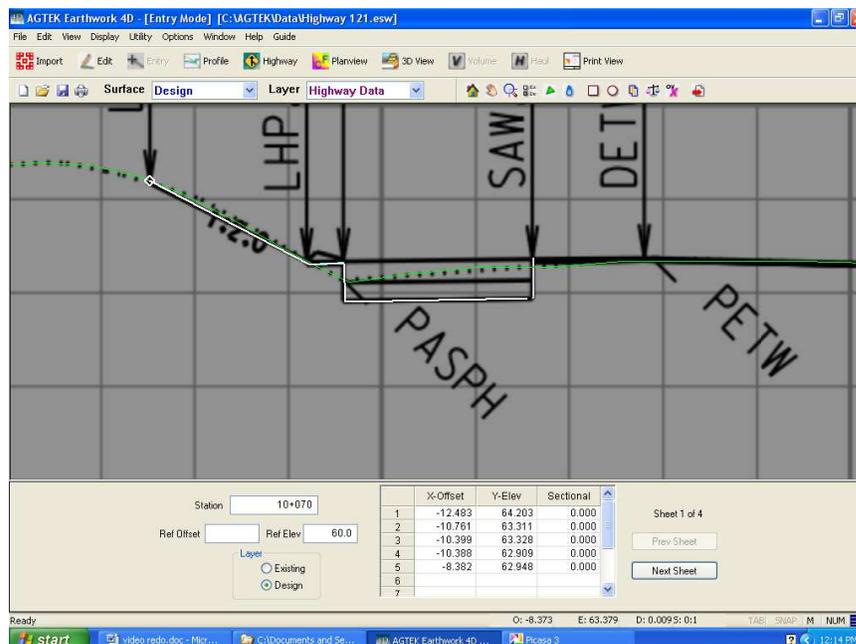
Enter Cross Section 1 Design Points

1. Move the cursor to the beginning of the design where it connects to existing ground.
2. Press the **Period (.)** key then click on the first design point as a daylight point.

Note: Because the first design point starts at existing ground, you should enter it as a daylight point. Pressing the Period key before clicking creates a daylight point.

3. Move the crosshair to the next point you want to enter, typically a grade break and click to create a line connecting the points.

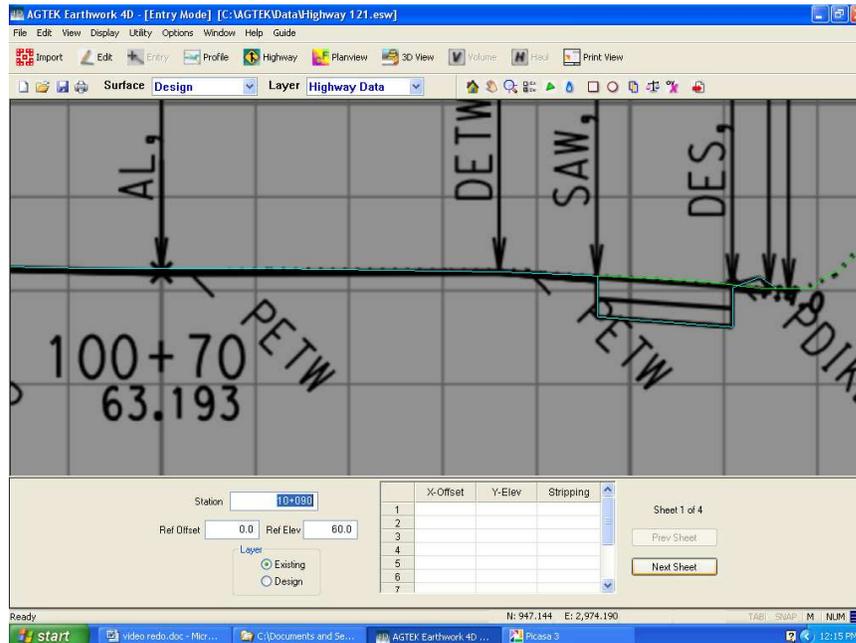
Note: The second point is not a daylight point, so you do not need to press the Period key before clicking.



4. Continue moving the cursor and entering points by clicking at all of the grade breaks until you reach the end of the design. If the design crosses existing ground, you should enter the point as a daylight point by pressing the Period key before clicking.

Note: If you make a mistake during entry, the error can be removed by pressing the **Backspace** key.

- Right-click to end the design entry. Highway 4D automatically enters a new station number in the Station box.



- Click the **Next Page** button.

Note: Make sure to digitize all cross sections from a page before moving onto the next page.

Enter Cross Section 2 Existing Ground

Highway 4D has features to facilitate electronic data entry. To demonstrate those features, we will enter another cross section. As mentioned, scaling is page-specific when digitizing from electronic data. However, if you chose scaling points that are common for all of the pages you are digitizing you do not need to re-scale each page. In this example, the page does not need to be re-scaled. In addition, because we selected a reference point that was common, we do not need to pick a new reference point, simply click on the point we chose earlier.

- Enter "10+080" in the Station box at the bottom of the screen.
 - Note:** Once you have entered two stations, Highway 4D automatically enters stations based on that interval.
- Zoom into the reference point (0, 60) and click on it. The reference point is entered and the cursor changes to a Crosshair.
- Move the cursor to the beginning of the existing ground from left to right and click on the first point.
- Move the crosshair to the next point you want to enter, typically a grade break and click to create a line connecting the points.
- Continue moving the cursor and entering points by clicking at the grade breaks until you reach the end of the cross section.

Note: If you make a mistake during entry, the error can be removed by pressing the **Backspace** key.

- Right-click to end the existing ground entry. The Layer selection changes to Design and the on-screen crosshair is no longer connected to the existing.

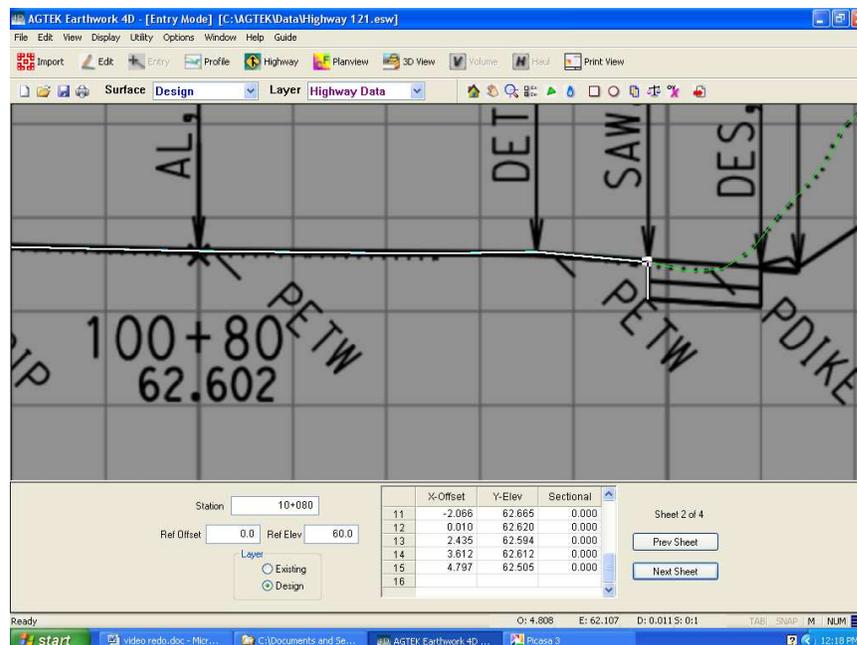
Enter Cross Section 2 Design Points

Notice how the existing and design lines overlap for part of this cross section. Highway 4D can “daylight snap” to the existing ground to ensure accurate cross sections.

- Move the cursor to the beginning of the design where it connects to existing ground.
- Press the Period key then click on the first design point as a daylight point.
- Move the crosshair to the next point you want to enter, typically a grade break and click to create a line connecting the points.

Note: The second point is not a daylight point, so do not press the Period key before clicking.

- Continue entering points until you notice the design line overlapping the existing ground. Press the Period key then click on the point where they overlap.
- Move the cursor to the right until the design line and existing ground do not overlap, press the period key twice and click at that point. The design line will follow exactly the existing ground to that point.



Note: If you make a mistake during entry, the error can be removed by pressing the Backspace key.

- Right-click to end the design entry. Highway 4D automatically enters a new station number in the Station box.
- Click the **Next Page** button.

Once the cross section has been digitized, you would continue the process of clicking the Next Sheet button, entering the Station number, selecting a reference point, then digitizing the data until all cross sections have been digitized.

Entering Stripping and Sectional Depths

When entering cross sections, you may enter stripping on the existing and sectional depth for the design.

Enter Stripping

1. When tracing the existing ground line, enter the depth you want to strip before entering the point. The value will display in the Stripping column. You may change the depth as you go.
2. Stripping will be added to the cross section in Highway Mode. Separate volumes will be calculated for stripping.

The screenshot displays a software interface for entering cross-section data. The top portion shows a grid-based diagram of a cross-section with a 'PDIKE' label. Below the diagram is a control panel with the following elements:

- Station: 10+080
- Ref Offset: 0.0
- Ref Elev: 60.0
- Layer: Existing (selected), Design
- A data table with columns: X-Offset, Y-Elev, Stripping
- Sheet 2 of 4
- Buttons: Prev Sheet, Next Sheet

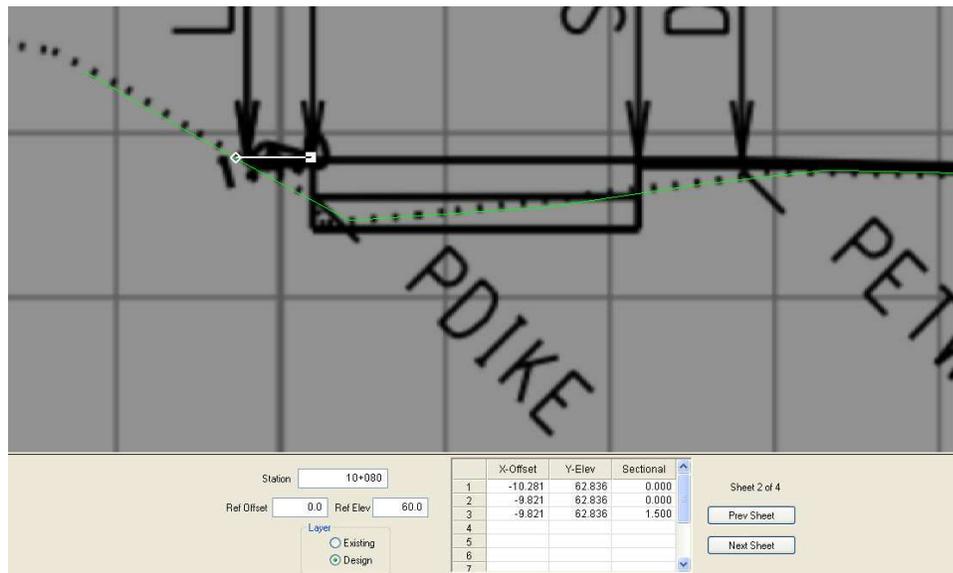
	X-Offset	Y-Elev	Stripping
1	-11.331	63.484	0.000
2	-10.689	63.150	0.000
3	-10.475	62.978	0.000
4	-10.235	62.879	0.000
5	-10.235	62.879	0.500
6			
7			

Entering Stripping and Sectional Depths

When entering cross sections, you may enter stripping on the existing and sectional depth for the design.

Enter Sectional Depths

1. When tracing the design ground line, enter the depth you want to deduct for subgrade before entering the point. The value will display in the Sectional column. Continue tracing the finished grade line. You may change the depth as you go.
2. The sectional depth will be deducted from the design elevations in Highway Mode. There are no volumes generated for the sectional areas.

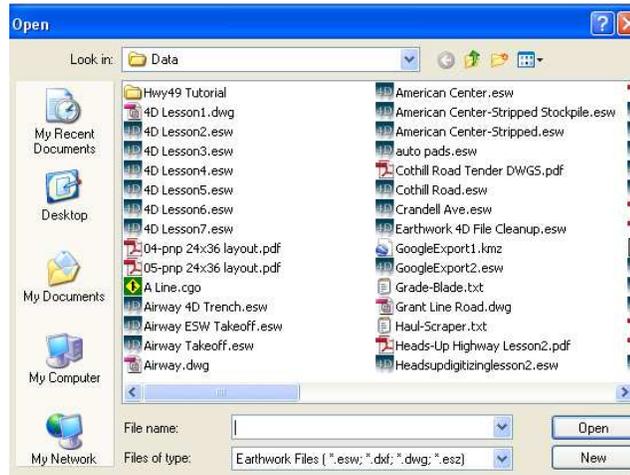


Lesson 2 – Entering COGO

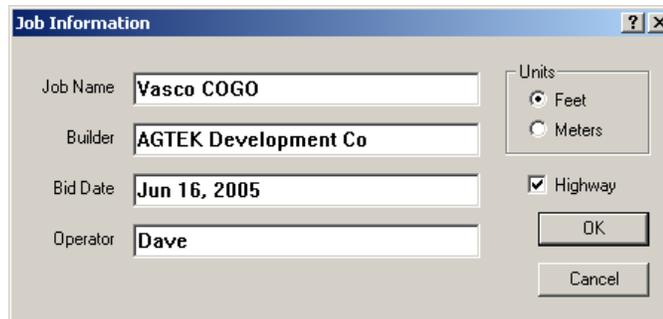
Coordinate Geometry (COGO) entry uses numeric values to specify road information both horizontally and vertically. For this example, you will enter a portion of the horizontal and vertical COGO for Vasco Road. Digital plans are not available, so all required entries have been added to the worksheets.

Start a New Job (Job Setup)

1. Double click the Earthwork 4D shortcut or select Start > Programs > AGTEK > Earthwork 4D. the Open dialog box is displayed.
2. Click the New button. The Job Information dialog box is displayed.

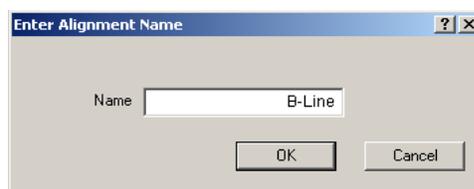


3. Type Vasco COGO for the Job Name, select the Highway checkbox, and click OK.



The Enter Alignment Name dialog box is displayed.

4. Type B-Line and click OK. Highway 4D supports multiple COGO lines (alignments) and the Alignment Name is used to distinguish between alignments.

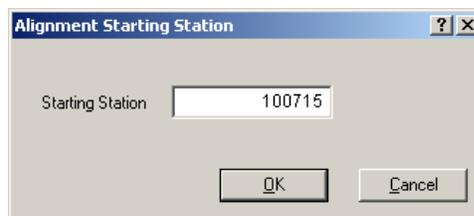


Enter Station Equations

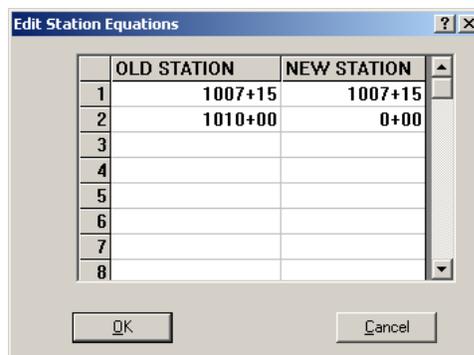
When entering a highway, the first task is to enter any station equations that may exist. This job has a station equation 285 feet from the beginning of the highway where station 1010+00 becomes station 0+00.

Note: Before entering Station Equations and COGO, go through the plans and write down all the information you'll need to enter. Worksheets are provided in the back of this manual and the Vasco COGO worksheet is on the next page.

1. Select **Edit > Station Equations**. The Alignment Starting Station dialog box is displayed.
2. Type "100715" and click OK. The Edit Station Equations window is displayed showing the Starting Station as the first equation and leaves room in the cells below for other equations



3. Click in the Old Station cell of the second row and type "101000" to represent the original station location where it transitions to the new stationing

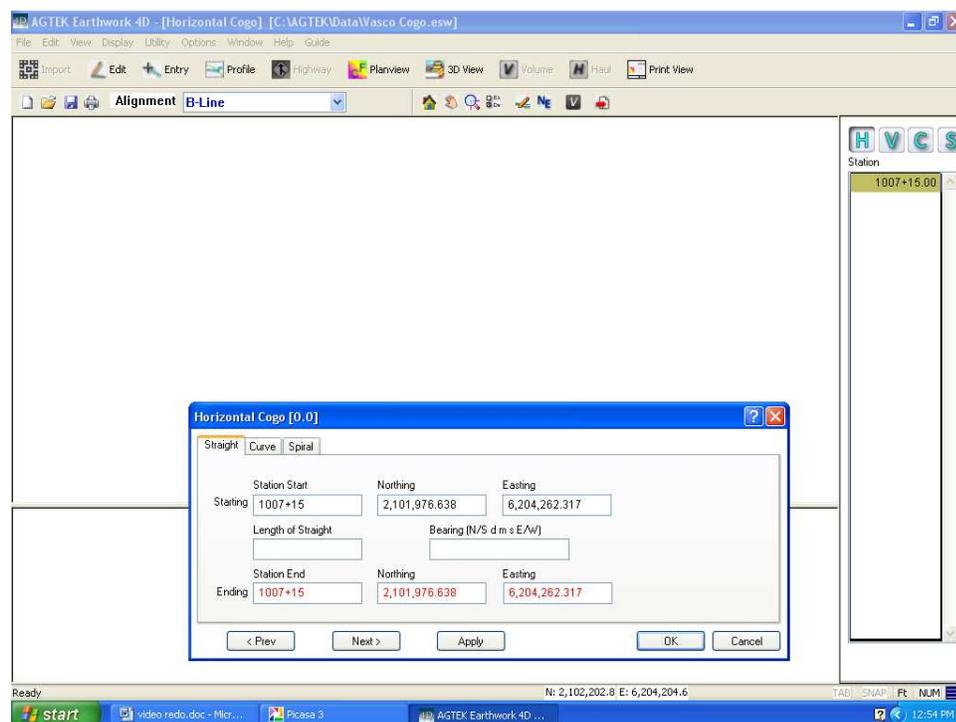


4. Press the Tab button to go to the New Station cell of the second row.
5. Type "0" to finish the first station equation. The equation as entered tells Highway 4D that at station 1010+00 you want to renumber the stationing to start at 0+00. Additional Station Equations may be entered by the same method.
6. Click OK to continue.

Enter Horizontal COGO

1. Change to the Horizontal COGO view by either selecting **Edit > Horizontal COGO** or by pressing the Horizontal COGO (H) button in the upper right corner of the window.
2. Click the Edit COGO button or select **Edit > Horizontal COGO**. The Horizontal COGO window displays the specifications for the first line segment, and in the Station List at the right, the starting Station specified earlier is highlighted.
3. Press the Tab button to accept this value and the cursor moves to the Northing cell.
4. The Northing and Easting for this first segment are N: 2101976.638 and E: 6204262.317. Enter these numbers into their respective cells and press Tab to move to the Length of Straight cell.

Note: The default Northing and Easting of the first segment is 0,0. If the Northing and Easting are known on a later segment, these values can be typed in later and all Northings and Eastings will be recalculated.



- On the L-1 plan sheet the first straight is 368.54 long. Enter this for the Length and press the Tab key. The cursor moves to the Bearing cell and displays the calculated Station End.

Note: The Station equation entered earlier is reflected in the Station End and the calculated values display in red.

- The bearing for the first straight is N 7 13 4.0 W. Type in "N <space> 7 <space> 13 <space> 4 <space> W" and press the Tab key. The Northing and Easting for the Station End calculate and the segment displays graphically on the screen above.

Note: Straight bearings are entered in a specific format using spaces as separators between the elements. The elements are:

N or S North or South is specified at the beginning of the Bearing

Degrees, Minutes Seconds Each separated by a space.

E or W East or West is entered at the end of the Bearing

Station Start	Northing	Easting
Starting 1007+15	2,101,976.181	6,204,262.317
Length of Straight 368.54	Bearing [N/S d m s E/W] N 7 13 13.4 W	
Station End	Northing	Easting
Ending 0+83.54	2,102,342.255	6,204,215.997

- Click Next to define the next segment.

Note: By default, the COGO entry alternates between straights and curves but can be overridden by pressing the desired tab at the top of the window. The Curve window defaults to entry of the Angle first.

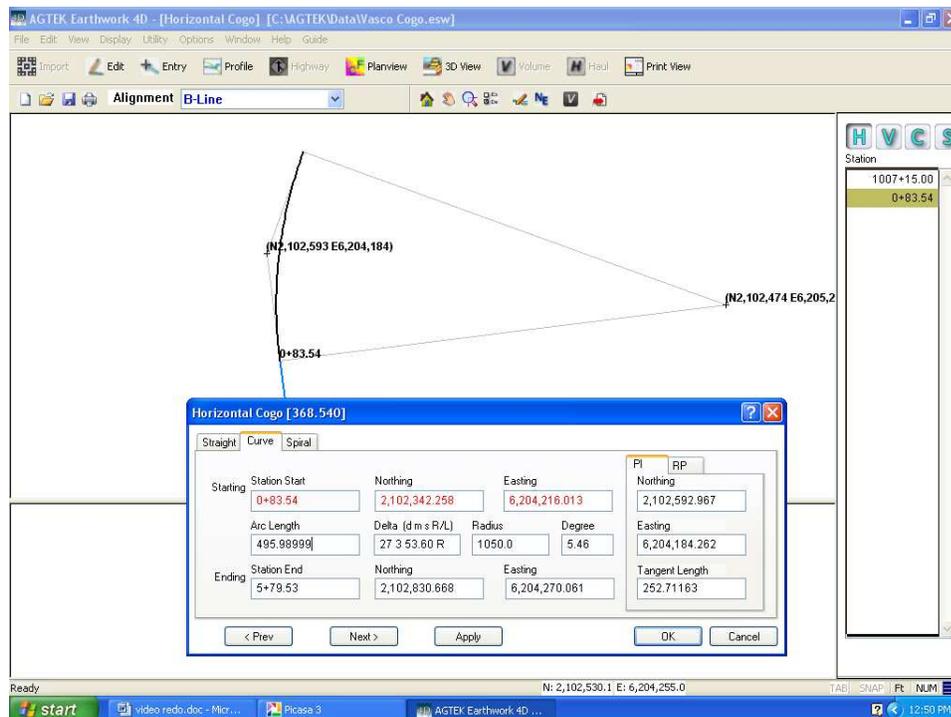
The Edit COGO window defaults to using the data from the lesson job but is flexible on what it can use to define the segments. Other data cells for each segment can have data entered as an alternative entry method.

- By looking at the table at the top of sheet L-1 you can see that the curve angle is 27°03'53.6" with a turn to the right. Type "27 <space> 3 <space> 53.6 <space> R" and press the Tab key. The cursor moves to the radius cell.

Note: Similar to straight bearings, curve angles use a specific format for entry. The format is Degrees, Minutes, Seconds and Right or Left for the curve direction. All values are separated by a space during entry.

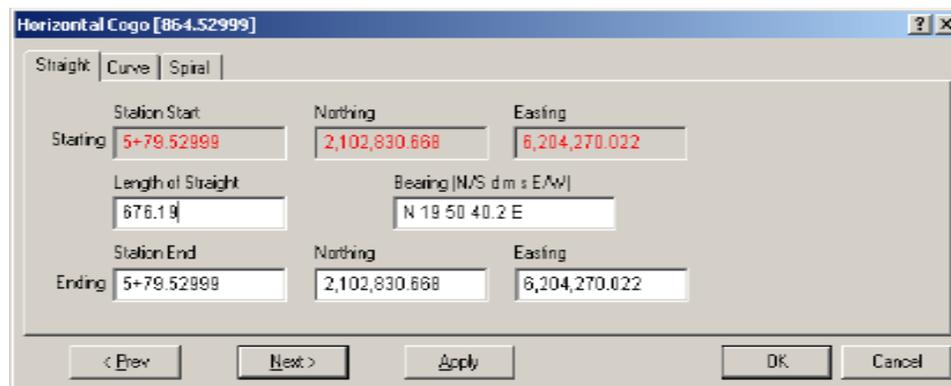
- Type "1050" as the radius and click Apply to see the results. Your screen should look like the illustration below.

The window shows the two COGO segments with the current segment highlighted and the arc controls visible. The Arc Controls and Arc Coordinates display is controlled by respective settings on the Display menu.



- Click Next to specify the next segment. The cursor is in the Length of Straight text box. Type "676.19" as the length and click Next.

Note: Bearing is already calculated and should match the plans.



11. The rest of the COGO data follows a similar pattern. Enter the remainder of the COGO up to station 86 + 05.2628 from the plans. Listed below are the entries required for the remaining four segments (bold denotes the entry values).

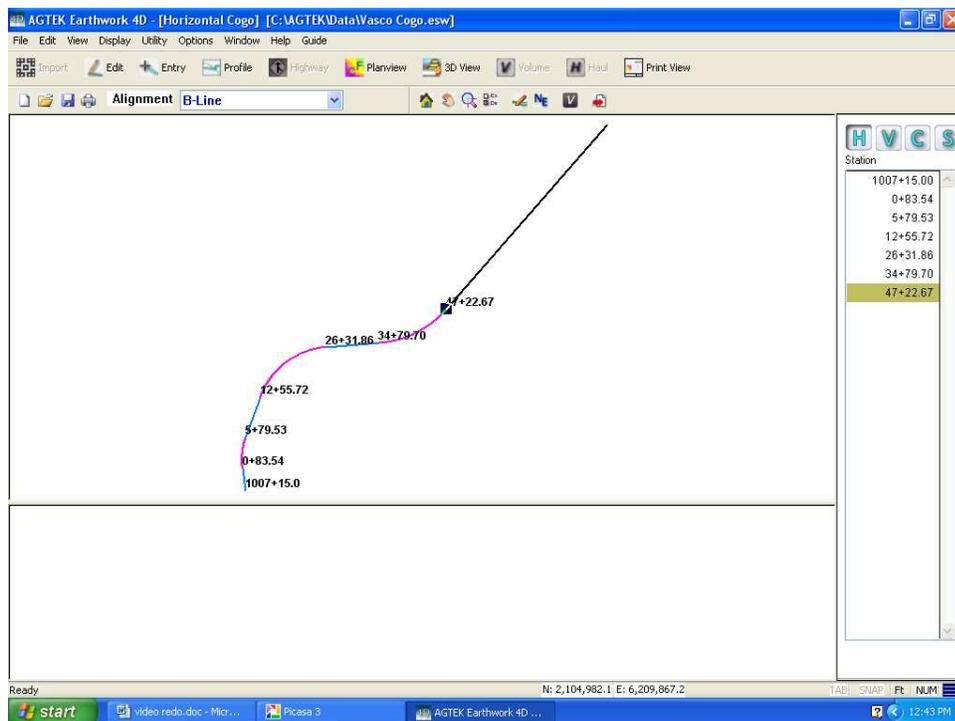
Station 12 + 55.71999
 Angle **65 42 22.6 R**
 Radius **1200**

Station 26 + 31.86906
 Length **847.84**
 Bearing N 85 33 12.2 E

Station 34 + 79.70906
 Angle **44 30 37.3 L**
 Radius **1600**

12. Click OK to complete the entry. Your screen should look like the illustration below. There are no cross sections attached yet, so the section of the window below the horizontal COGO is blank.

The curves display in magenta and the straights in blue. A segment can be selected by clicking on it or by selecting the starting station of the segment in the station list. The specifications for a segment can be viewed or edited by double-clicking the segment.



Enter Vertical COGO

The horizontal COGO just entered has no elevation. One way to assign elevation is to enter the vertical COGO. Vertical COGO entry is similar to the horizontal COGO just completed.

1. Select Edit > Vertical COGO. The Vertical COGO entry/edit window is displayed and the starting station defaults to 100715.

The screenshot shows the 'Vertical COGO [0.0]' dialog box with the 'Slope' tab active. The 'Starting' field contains '1007+15'. The 'Slope Length' field is empty. The 'Ending' field is empty. The 'Slope' and 'Elevation' fields are empty. At the bottom, there are buttons for '< Prev', 'Next >', 'Apply', 'OK', and 'Cancel'.

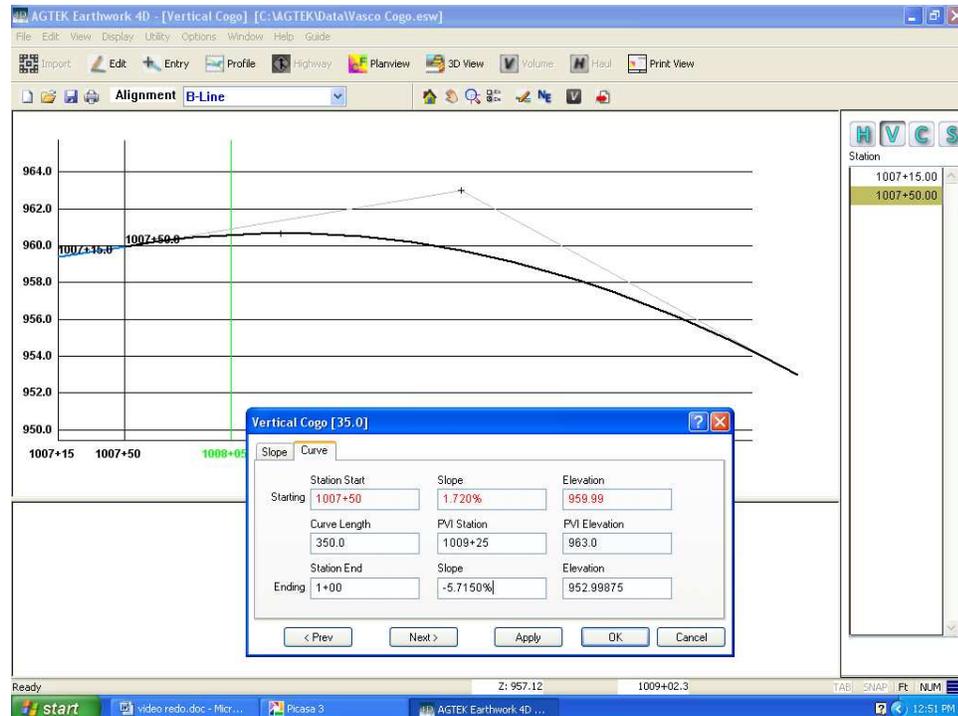
2. Press the Tab key to move to the slope cell and type "1.72" as shown on the plans.
3. Press Tab to bypass the Elevation box and go the Station End since you don't have an elevation for the beginning of the job.
4. Enter "1007 + 50" as the Station End and press the Tab key. The next curve begins there so it can be used as the Station End.
5. Enter "959.99" in the Elevation text box. The program back-calculates the starting elevation.

The screenshot shows the 'Vertical COGO [0.0]' dialog box with the 'Slope' tab active. The 'Starting' field contains '1007+15'. The 'Slope' field contains '1.720%'. The 'Elevation' field contains '959.388'. The 'Slope Length' field contains '35.0'. The 'Ending' field contains '1007+50'. The 'Elevation' field below 'Ending' contains '959.99'. At the bottom, there are buttons for '< Prev', 'Next >', 'Apply', 'OK', and 'Cancel'.

6. Click Next to finish this segment and move to the Curve.

Note: Similar to the Horizontal COGO, by default the vertical COGO alternates between Slope and Curve segments, although you can override this. The ending station is automatically highlighted and the starting station is derived from the previous segment.

7. Enter "100" as the Station End and press the Tab key to go to the slope field. The next slope begins there so it can be used as the Station End.
8. Enter "-5.714" in the Slope text box, as reflected on the plans. Your screen should look like the illustration on the next page.
9. Click Next to finish the segment and continue. As you enter segments, the amount of information that must be typed in for each segment is limited to the beginning and end of the vertical curves along with the slope for the curve segment.



10. You can use the information provided below to enter the remaining vertical COGO (entered values are in bold).

Station **4 + 90**
Length 390

Station **6 + 90**
Length 200
Slope **-6.32**

Station **7 + 40**
Length 50

Station **9 + 40**
Length 200
Slope **-5.924**

Station **16 + 25**
Length 685

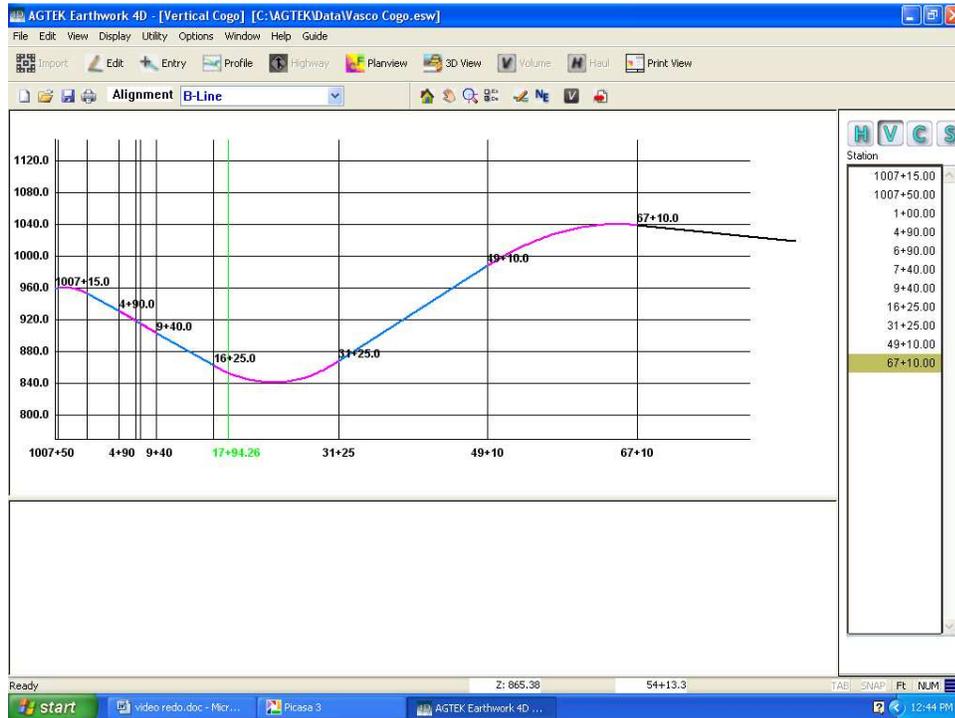
Station **31 + 25**
Length 1500
Slope **6.704**

Station **49 + 10**
Length 1785

Station **67 + 10**
Length 1800
Slope **-1.06**

Station **86 + 05.26**
Length 1985.26

11. When finished, click OK to close the vertical COGO entry window. The screen should look similar to that shown below.



Horizontal and Vertical COGO are not required for calculating volumes in Highway 4D. COGO is only required when creating a surface in Earthwork 4D. This exercise will be covered in Lesson 4 in this tutorial.

Editing COGO

COGO segments are interdependent—changing one segment affects the others. This is true of both horizontal and vertical COGO. In either view, the segment can be edited by double-clicking on the screen representation or on the Station List. Choosing the appropriate COGO type from the Edit menu also displays the selected segment.

The segment edit window is identical to the entry window. Values in white text cells can be edited by clicking in the cell and typing new numbers. Clicking Next or Prev moves forward or backward through the segments. Clicking Apply saves the changes to the values, but leaves the window open. Clicking OK saves the changes and closes the edit window. Clicking Cancel saves no changes made after Apply was used.

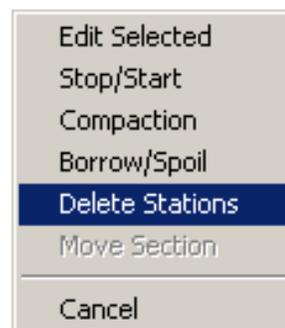
	Station Start	Slope	Elevation
Starting	7+40	-6.32%	915.5219
Curve Length	200		
	PVI Station	PVI Elevation	
	8+40	909.2019	
	Station End	Slope	Elevation
Ending	9+40	-5.924%	903.2779

Deleting Segments

Because COGO segments are interdependent, only the last segment of a COGO line may be deleted. To delete the last segment, select it on the cross-section or on the Station List. Pressing the Delete key displays a confirm dialog box. Click Yes to complete the deletion or No to cancel.



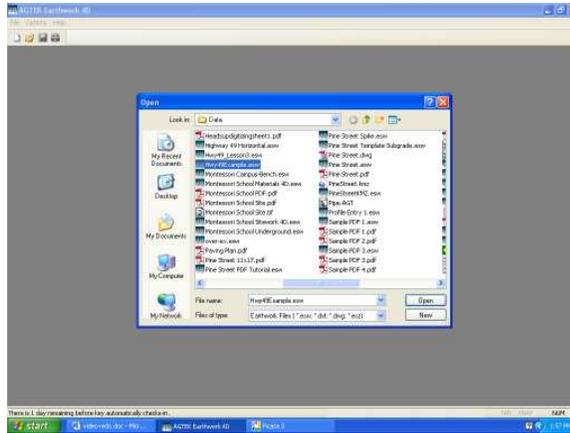
On the Station List, you can also select the ending station and right-click to display a menu, then select Delete Stations. This is the same as pressing the Delete key.



Lesson 3 – Reports and Calculating Volumes

Highway 4D provides three report types—Mass Diagram, Haul Report, and Volume Report. All are based on the simple average end-area calculation.

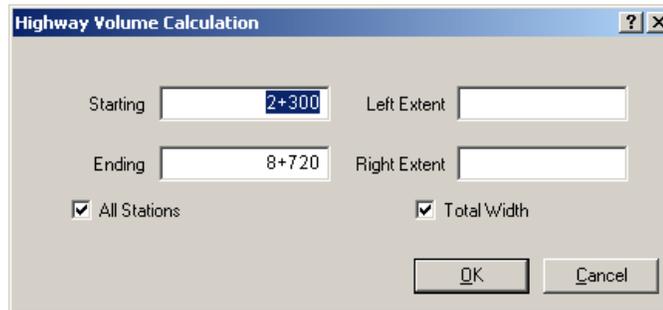
This lesson uses a finished job file located in the “AGTEK\Data” directory named “Highway49Example.esw”. Start Highway 4D and select “Highway49Example.esw” from the Open dialog box. The primary alignment is named CA_49. Make sure that this alignment is selected on the toolbar.



Mass Diagram



The Mass Diagram is a graphical report of the hauls for a specific alignment such as CA_49. Click the Volumes (V) button on the left side to display the Mass Diagram. The Highway Volume Calculation dialog box is displayed



The Volume Calculation dialog box controls what is included in the calculation. Choices include the entire alignment or split both lengthwise or across. The default Station range is all stations but can be limited by entering the starting and ending stations.

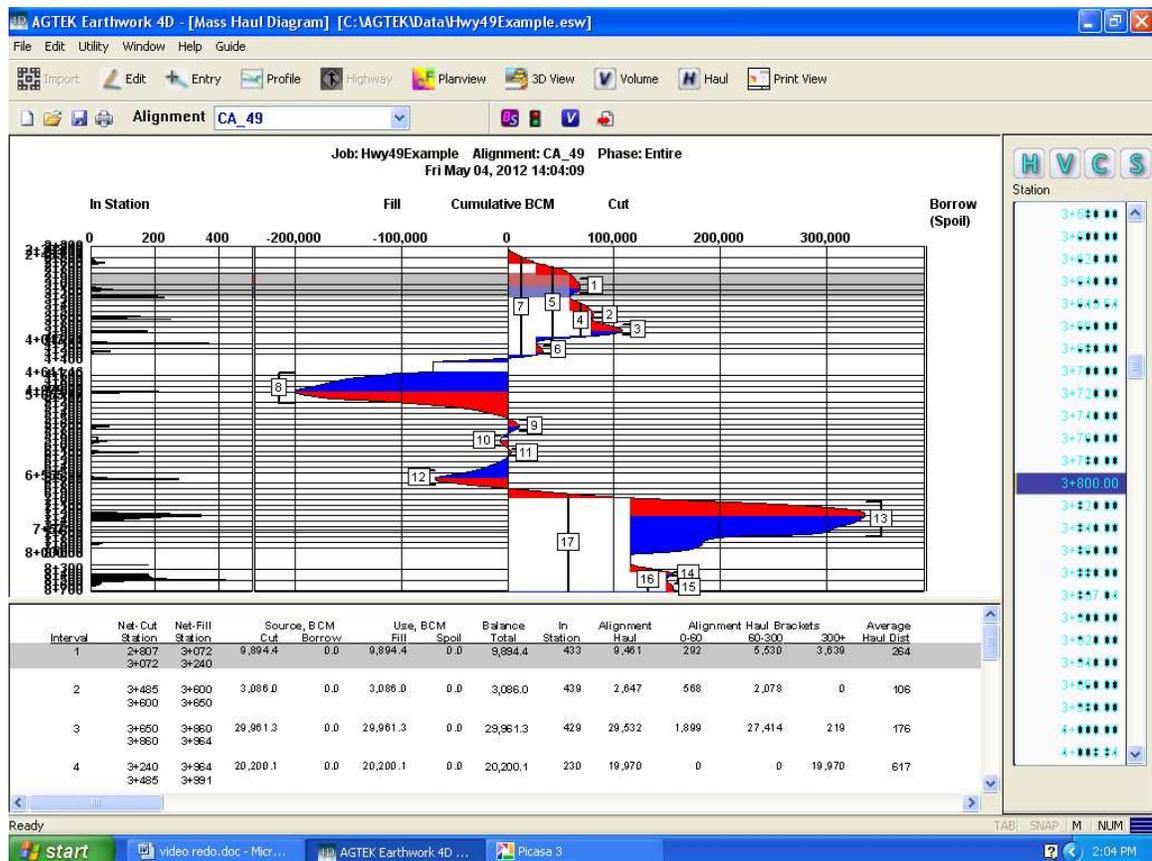
Volumes can be limited to a portion of each station by entering extent limits. Extent limits are measured from the reference point (0 horizontal) on the cross sections and are specified as negative for the left extent and positive for the right. For example, if you wanted the volumes for only the right side you could enter “0” for the left extent and a positive number for the right.

In this example, keep All Stations and Total Width checked and click OK. The Mass Diagram window is displayed.

The Mass Diagram Window

The different parts of the Mass Diagram window are described below.

- ① The Mass diagram itself shows the net cumulative volumes along the alignment by station. The **blue** represents a **net fill** and the **red** represents a **net cut**. Where the line crosses or is on the **center 0** line indicates where the **alignment balances**.
- ② The **Selected Haul** displays on the Mass Diagram and the Haul Report below as a **gray band**. Roll the mouse roller-button to move between the haul intervals.
- ③ The selected station location displays as a **blinking square** on the Mass Diagram and is highlighted on the **Station List**. Stations may be selected by clicking on the Mass Diagram or the Station List.
- ④ Haul Intervals are numbered on the Mass Diagram to correspond to the Haul report.
- ⑤ The **In Station Haul** volumes are graphed on the left side of the Mass Diagram. A separate legend of the volumes is shown at the top of report. In Station hauls are the amount of dirt being moved across the alignment instead of down.
- ⑥ The **Haul Report** shows the numbers that the Mass Diagram Graphic represents. The details of each Haul Interval Station numbered above display in this report.
- ⑦ Any user-entered borrow or spoil displays to the right of the Mass Diagram. Numbers in parentheses indicate a spoil.



Mass Diagram Window Controls

Mass Diagram screen controls differ from those on the other Highway 4D windows and are summarized below.

- Left Button** Clicking on the Mass Diagram selects the station nearest to the arrow. Clicking on the station list selects the station number nearest the arrow. Clicking on the Haul Report selects the haul interval nearest the arrow.
- Wheel-button** The wheel-button scrolls through the Haul Intervals if the Mass Diagram or Haul Report is selected. If the Station List is selected, the wheel-button scrolls through the stations.
- PageUp/PageDown** Zoom in and Zoom out respectively on the Mass Diagram.

Interpreting the Mass Diagram

Select Interval 3 on the Haul Report. It should look like the illustration shown below. From left to right, the Interval 3 fields are described below:

Balance Interval	Net-Cut Station	Net-Fill Station	Source, BCM		Use, BCM		Balance Total	In Station	Alignment Haul	Alignment Haul Brackets			Average Haul Dist
			Cut	Borrow	Fill	Spoil				0-60	60-300	300+	
3	3+650 3+860	3+860 3+970	29,961	0	29,961	0	29,961	394	29,567	1,767	27,179	620	181

- Balance Interval** The 3rd haul on the alignment. This identifies the haul. An (S) or (B) indicates a haul with excess volumes.
- Net Cut Station** The range of stations where the cut volumes are coming from. In this case, from station 3 + 650 to 3 + 860.
- Net Fill Station** The range of stations where the cut volumes will be used to fill. Station 3 + 860 to 3 + 970 in this example.
- Source Cut** The volume in cubic meters (or yards) being moved for this interval.
- Source Borrow** Any volumes introduced through borrow pits specified by the user.
- Use Fill** The volume in cubic meters (or yards) used as fill.
- Use Spoil** Any volumes introduced through spoils removal specified by the user.
- Balance Total** The yards moved for the haul interval. This number will always be equal to either the Source totals or the Use totals.
- In Station** The portion of the Balance Total quantities that is used across the alignment instead of being moved to the next station.
- Alignment Haul** Quantities to be moved down the alignment, or the difference between the Balance Total and the In Station volumes.
- Alignment Haul Brackets** Haul brackets are user specified distances that allocate the Alignment
- Brackets** Haul quantities in amounts per distance. These can be edited for different equipment spreads by selecting **Edit > Haul Brackets**.
- Average Haul Distance** The average measurement in meters or feet of the haul interval.

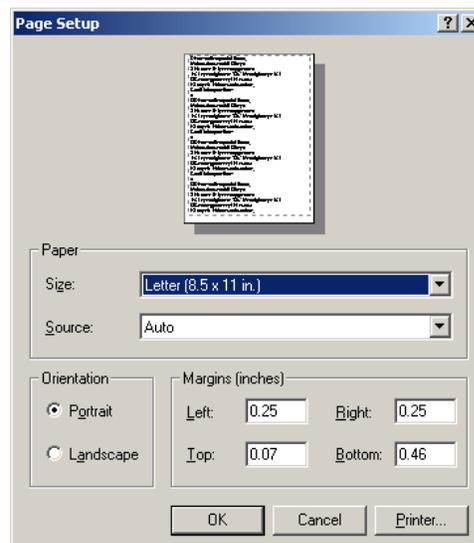
Printing the Mass Diagram

The Mass Diagram can be sent directly to the printer or sent to the print page for layout.

Note: The Haul Report displays with the Mass Diagram but is printed separately. Refer to “Printing the Haul Report” later in this tutorial for information about printing the Haul Report.

Configuring the Printer

The default printer settings determine the size of the direct printed output and the size of the Print Page. To change the printer and its setup, select File > Print Setup. Verify that the correct printer is selected, the Orientation is set to Portrait, and click OK



Printing Direct



Mass Diagrams sent directly to the printer are always sized to fit the paper width and automatically print to the next page if they require more than a single sheet. Selecting **File > Print** or clicking the **Print** button sends the Mass Diagram to the printer.

Sending to the Print Page

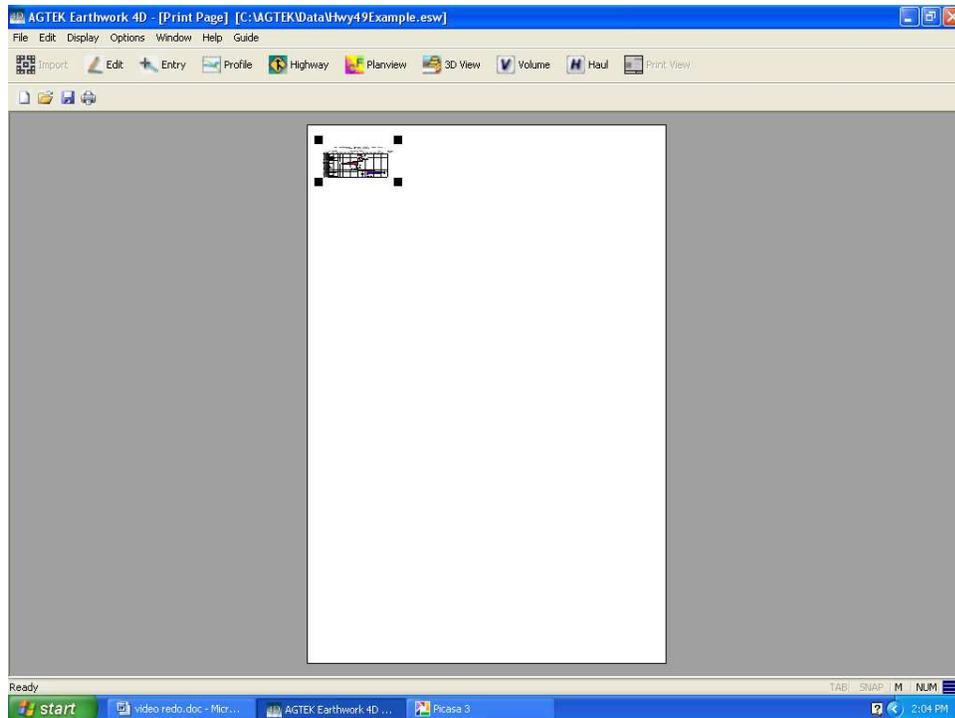
The Print Page allows for visual layout of different reports and views. Like direct printing, the Print Page relies on the selected printer for its size. For best results, verify that the correct printer, page orientation, and paper size are selected before sending information to the print page.

Unlike direct printing, Print Page does not size the Mass Diagram to fit the width of the page and it does not send the entire Mass Diagram. Instead, it prints only the Mass Diagram view as displayed on the screen.

PageUp and PageDown can be used to control the zoom level and pressing. Holding the mouse roller-button while moving the mouse controls panning.



Use the screen controls mentioned above to get the desired view. **Select File > Send to Print Page** or click the Send to Print Page button. The Print Page displays with the selected Mass Diagram positioned on it as shown in the following illustration.



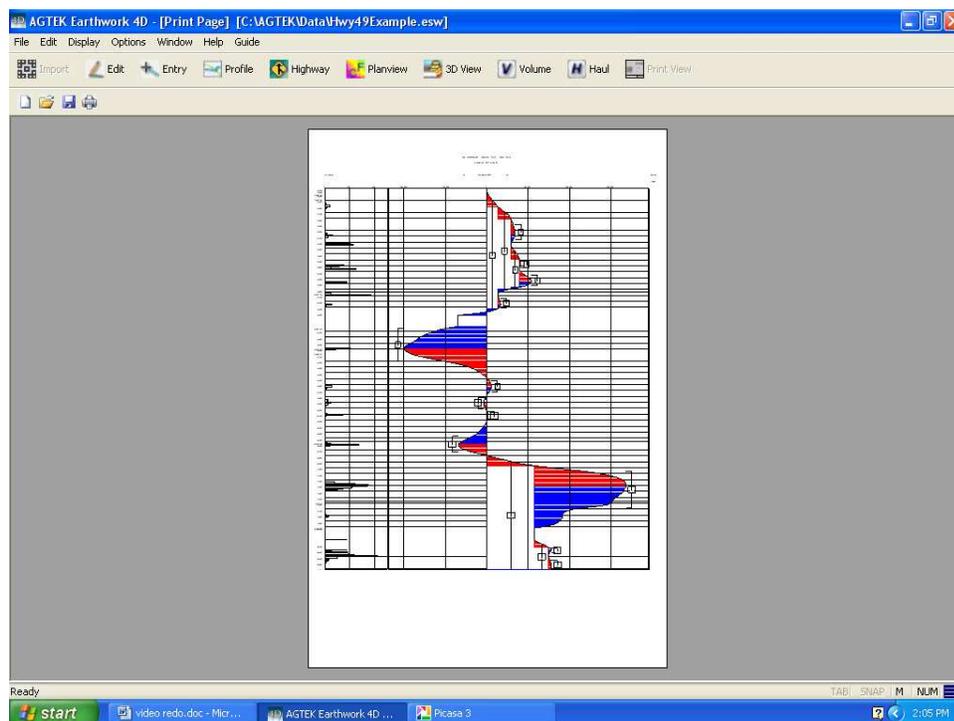
Resizing Graphics on Print Page

The size and position of the graphic may be smaller than desired and not positioned where you want it. To resize the graphic, move the arrow over the lower right selection block, then press and hold the left mouse button. The arrow changes to a double-headed arrow. By moving the cursor away from the graphic, you can resize it. Resize the Mass Diagram to the desired page width.

Moving Graphics on Print Page

The Mass Diagram is now bigger, but may not be positioned correctly on the page. To move the diagram, click and hold the diagram, then move it to the desired position on the print page.

When satisfied with the size and positioning, select File > Print or click the Print button on the toolbar. The Print Page can display multiple reports and views, so you can add more items to it before printing.



Printing the Haul Report



The Haul Report has been explained in the prior pages describing the Mass Diagram, as it shows the numbers that the Mass Diagram represents. It does not, however, print from the Mass Diagram screen. To display a separate Haul Report, click the Haul Report (H) button on the toolbar.

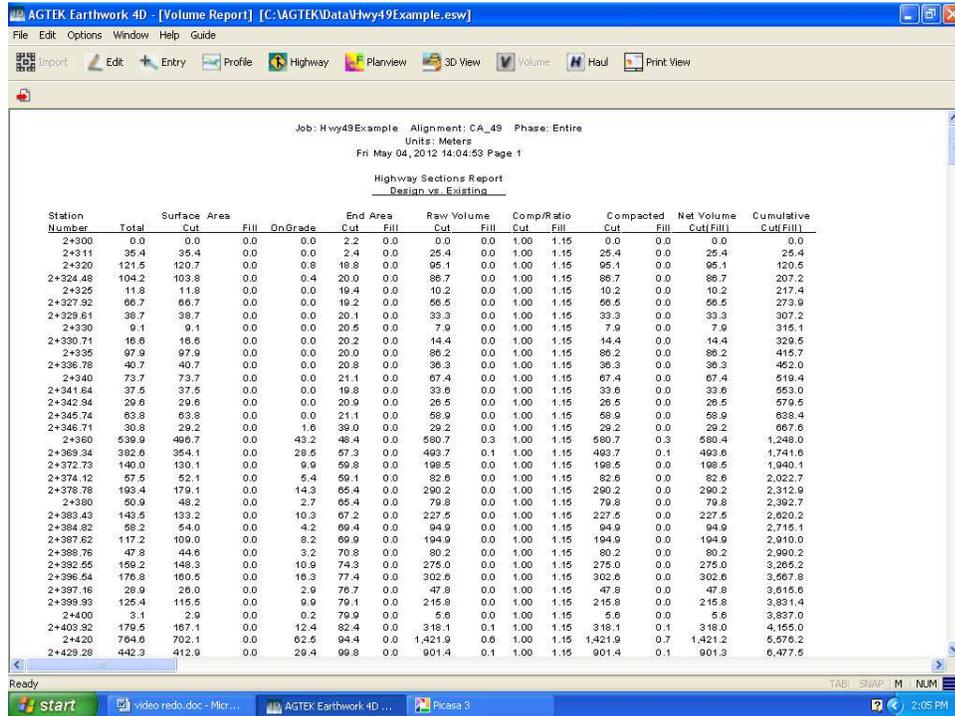
Like the Mass Diagram, the Haul Report can be printed directly or sent to the print page. However, the entire Haul Report is always sent to the Print Page instead of only what is currently displayed. Once on the Print Page, the report can be sized or moved as desired.

The Volumes Report



The Volumes Report breaks the volumes down by station and shows the accumulating volumes as you move down the alignment.

Display the Volumes Report by pressing the Volumes Report (white V) button after a Mass Diagram is calculated.



The volume report lists the surface areas, the numbers used to calculate the volumes and the net results along the selected alignment. For example, Stations 2 + 360 to 2 + 369.34 are shown and explained in the following figure.

Job: Hwy49Example Alignment: CA_49
Units: Meters
Wed Jun 09, 2004 14:59:19 Page 1

Highway Sections Report
Design vs. Existing

Station Number	Surface Area				End Area		Raw Volume		Comp/Ratio		Compacted		Net Volume	Cumulative Cut(Fill)
	Total	Cut	Fill	OnGrade	Cut	Fill	Cut	Fill	Cut	Fill	Cut	Fill	Cut(Fill)	
2+300	0	0	0	0	2.2	0.0	0.0	0.0	1.00	1.15	0.0	0.0	0.0	0.0
2+311	35.4	35.4	0.0	0.0	2.4	0.0	25.4	0.0	1.00	1.15	25.4	0.0	25.4	25.4
2+320	121.5	120.7	0.0	0.8	18.8	0.0	95.1	0.0	1.00	1.15	95.1	0.0	95.1	120.5
2+324.48	104.2	103.8	0.0	0.4	20.0	0.0	86.7	0.0	1.00	1.15	86.7	0.0	86.7	207.2
2+325	11.8	11.8	0.0	0.0	19.4	0.0	10.2	0.0	1.00	1.15	10.2	0.0	10.2	217.4
2+327.92	66.7	66.7	0.0	0.0	19.2	0.0	66.5	0.0	1.00	1.15	66.5	0.0	66.5	273.9
2+329.61	38.7	38.7	0.0	0.0	20.1	0.0	33.3	0.0	1.00	1.15	33.3	0.0	33.3	307.2
2+330	9.1	9.1	0.0	0.0	20.5	0.0	7.9	0.0	1.00	1.15	7.9	0.0	7.9	315.1
2+330.71	16.8	16.6	0.0	0.0	20.2	0.0	14.4	0.0	1.00	1.15	14.4	0.0	14.4	329.5
2+335	97.9	97.9	0.0	0.0	20.0	0.0	86.2	0.0	1.00	1.15	86.2	0.0	86.2	415.7
2+336.78	40.7	40.7	0.0	0.0	20.8	0.0	36.3	0.0	1.00	1.15	36.3	0.0	36.3	452.0
2+340	73.7	73.7	0.0	0.0	21.1	0.0	67.4	0.0	1.00	1.15	67.4	0.0	67.4	519.4
2+341.64	37.5	37.5	0.0	0.0	19.8	0.0	33.6	0.0	1.00	1.15	33.6	0.0	33.6	553.0
2+342.94	29.6	29.6	0.0	0.0	20.9	0.0	26.5	0.0	1.00	1.15	26.5	0.0	26.5	579.5
2+345.74	63.8	63.8	0.0	0.0	21.1	0.0	58.9	0.0	1.00	1.15	58.9	0.0	58.9	638.4
2+346.71	30.8	29.2	0.0	1.6	39.0	0.0	29.2	0.0	1.00	1.15	29.2	0.0	29.2	667.6
2+350	639.9	496.7	0.0	43.2	48.4	0.0	580.7	0.3	1.00	1.15	580.7	0.3	580.4	1,248.0
2+369.34	382.6	354.1	0.0	28.5	57.3	0.0	493.7	0.1	1.00	1.15	493.7	0.1	493.6	1,741.6
2+372.73	140.0	130.1	0.0	9.9	59.8	0.0	198.5	0.0	1.00	1.15	198.5	0.0	198.5	1,940.1
2+374.12	57.5	52.1	0.0	5.4	59.1	0.0	82.6	0.0	1.00	1.15	82.6	0.0	82.6	2,022.7
2+376.76	193.4	179.1	0.0	14.3	65.4	0.0	290.2	0.0	1.00	1.15	290.2	0.0	290.2	2,312.9
2+380	50.9	48.2	0.0	2.7	65.4	0.0	79.8	0.0	1.00	1.15	79.8	0.0	79.8	2,392.7
2+383.43	143.5	133.2	0.0	10.3	67.2	0.0	227.5	0.0	1.00	1.15	227.5	0.0	227.5	2,620.2
2+384.82	58.2	54.0	0.0	4.2	69.4	0.0	94.9	0.0	1.00	1.15	94.9	0.0	94.9	2,715.1
2+387.82	117.2	109.0	0.0	8.2	66.9	0.0	194.9	0.0	1.00	1.15	194.9	0.0	194.9	2,910.0
2+388.76	47.8	44.6	0.0	3.2	70.8	0.0	80.2	0.0	1.00	1.15	80.2	0.0	80.2	2,990.2
2+392.55	159.2	148.3	0.0	10.9	74.3	0.0	275.0	0.0	1.00	1.15	275.0	0.0	275.0	3,265.2
2+396.54	176.8	160.5	0.0	16.3	77.4	0.0	302.6	0.0	1.00	1.15	302.6	0.0	302.6	3,567.8
2+397.16	28.9	26.0	0.0	2.9	76.7	0.0	47.8	0.0	1.00	1.15	47.8	0.0	47.8	3,615.6
2+399.93	125.4	115.5	0.0	9.9	79.1	0.0	215.9	0.0	1.00	1.15	215.9	0.0	215.9	3,831.4
2+400	3.1	2.9	0.0	0.2	79.9	0.0	5.8	0.0	1.00	1.15	5.8	0.0	5.8	3,837.0
2+403.92	179.5	167.1	0.0	12.4	82.4	0.0	318.1	0.1	1.00	1.15	318.1	0.1	318.0	4,155.0
2+420	764.6	702.1	0.0	62.5	94.4	0.0	1,421.9	0.6	1.00	1.15	1,421.9	0.7	1,421.2	5,576.2
2+429.28	442.3	412.9	0.0	29.4	99.8	0.0	901.4	0.1	1.00	1.15	901.4	0.1	901.3	6,477.5

Unseen report data . . .

2+346.71	31	30	0	1	39.0	0.0	29	0	1.00	1.00	29	0	29	663
2+360	541	512	4	25	48.4	0.0	581	0	1.00	1.00	581	0	581	1,246
2+369.34	362	368	0	14	57.3	0.0	494	0	1.00	1.00	494	0	494	1,740

Unseen report data . . .

8+720	232	152	7	73	2.0	0.0	47	1	1.00	1.00	47	1	46	240,812
Totals	282,811	154,120	123,754	4,937			805,381	564,569			805,381	564,569	240,812	

Station Number Location for the values on the job. The volumes and areas represent the calculation between this station and the prior station.

Surface Area Plan view area calculated between the station and the prior station. Totals, Cut, and Fill are self-explanatory. On Grade areas are those areas that have less than 0.1 feet (or the metric equivalent) of Cut/Fill.

End Area Square meters or feet of cut and fill for the station. These numbers are also shown on the cross section. This area is used to calculate the cut/fill volumes.

Raw Volume	The volumes calculated before applying a compaction factor. The end area explanation above shows how this is calculated.
Compaction Ratio	Ratios entered by the user to adjust for compaction or expansion of Fill or Cut. Compaction is edited by right-clicking on the Station List.
Compacted Volumes	Volumes after any compaction ratios are applied. These volumes are used to calculate the Net Volume and Cumulative Volumes.
Net Volume	Difference between the compacted Cut/Fill volumes.
Cumulative Volumes	Volume that accumulates along the Alignment. The amount shown is the cumulative volume left over after the Net Volume is applied.

Printing the Volumes Report

Like the Mass Diagram and Haul Report, the Volumes Report can be printed directly or sent to the print page. The technique is the same as printing a Mass Diagram. However, unlike the Mass Diagram, the entire Volumes Report is always sent to the Print Page instead of only what is displayed on the screen. Once on the Print Page, the report can be sized or moved as desired.

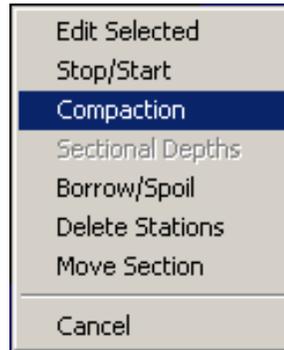
Other Volumes-Related Features

Although not directly related to the Report views, the following features affect the volumes.

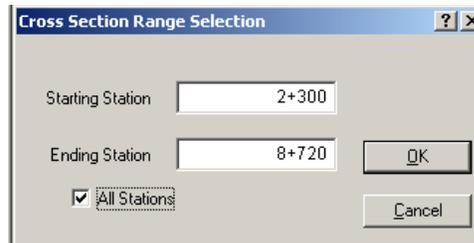
Compaction

Compaction ratios enable the program to compensate for shrink and swell. Compaction can be assigned for all stations or a range of stations.

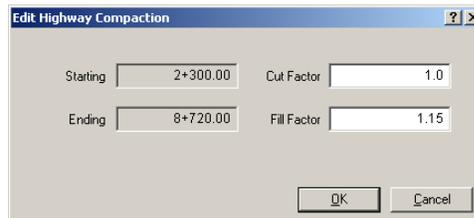
1. Selecting a Compaction Range
2. Click the Highway Mode button to change to Highway Mode.
3. Select a station from the Station list.
4. Right-click to display the menu and select Compaction. The Cross Section Range Selection dialog box is displayed and the selected station is automatically put in both the starting station and ending station.



5. Select the All Stations checkbox. The Stations change to the first (Starting Station) and last (Ending Station). Click OK. The Edit Highway Compaction dialog box is displayed.



6. Type "1.15" for the Fill Factor and click OK to apply the change. A 1.15 fill ratio increases the amount of fill required by 15% and the Mass Diagram changes to reflect that. Compactions ratios are multiplied with raw volumes to produce compacted volumes.



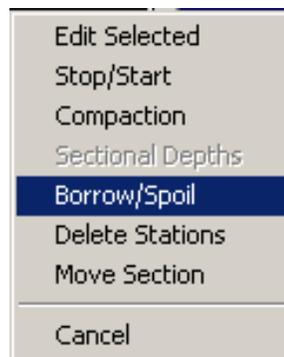
Entering Borrow/Spoil Locations

The default Mass Diagram and Haul Reports don't always reflect how the dirt has to move. Unbuilt bridges, haul roads, and sites for borrow and spoil can complicate choices on how the dirt moves. To accommodate these variables, Highway 4D allows Borrow and Spoil volumes to be inserted on stations. The reports then recalculate to reflect the change.

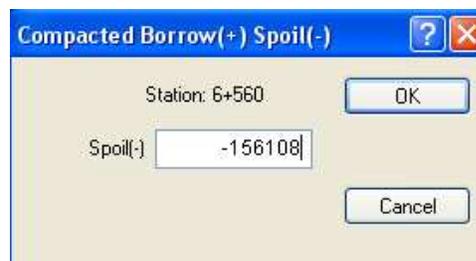
The first step identifies if there is too much dirt or not enough. At the end of the Haul Report, the spoil volume indicates that there is an excess of 156,108 cubic meters. This reflects a 1.15 fill compaction ratio.

The next step is to figure out where this dirt can be removed from the job. For this example, assume that the nearest location from which you can remove the dirt is at the Tonzi Road intersection at station 6 + 560. Entering a borrow/spoil location first requires picking the location on the Station List.

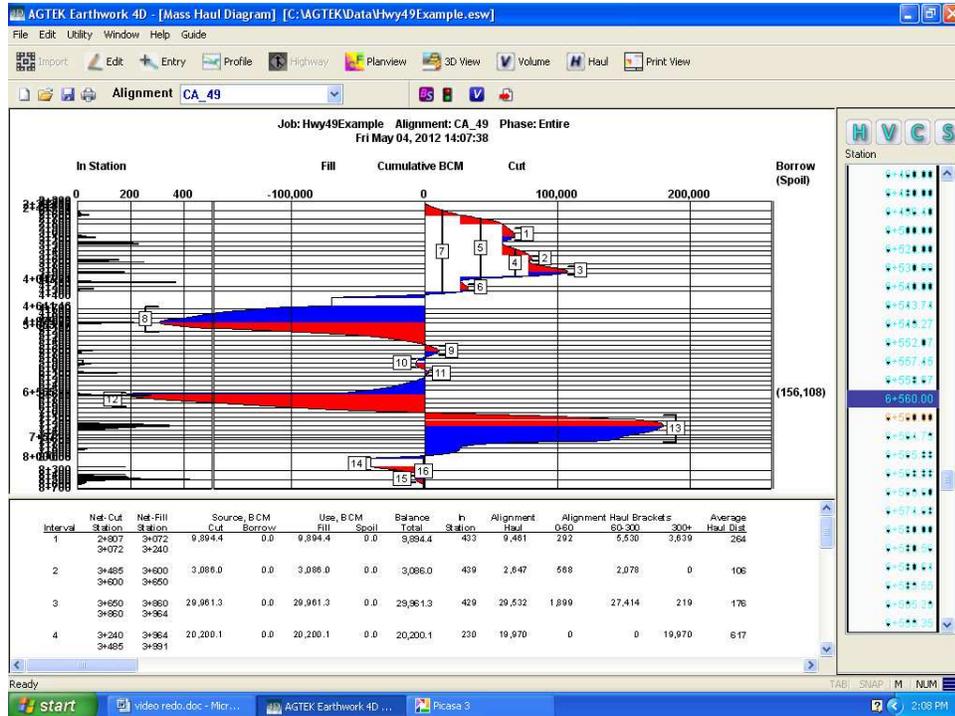
1. Select station 6 + 560 on the Station List.
2. Right-click to display the menu and select Borrow/Spoil. The Compacted Borrow/Spoil dialog box is displayed.



3. Type "-156108" and click OK. Spoils are entered as negative numbers. The mass diagram automatically recalculates to reflect the change and the Borrow/Spoil station on the station list changes color as an identifier and the spoil amount displays on the right side of the mass diagram as shown in the illustration on the next page.



Note: Highway 4D supports multiple borrow/spoil locations, but for this example, we want to remove all of the spoils of th job.



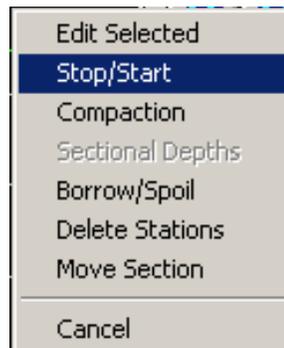
Stopping and Starting Volumes

Another common situation in highway jobs is station ranges where no volumes should be calculated. Highway 4D allows you to specify Starts and Stops through the Station List. In this example, an existing bridge is widened from station 4 + 435 to 4 + 620 and you don't want volumes to be calculated for that area.

1. Scroll through the Station List to display stations 4 + 435 to 4 + 620.

Note: Notice that both the stations are color coded red for stop and green for start to show that the stops and starts are entered. The program also duplicates the station when a start or stop is created.

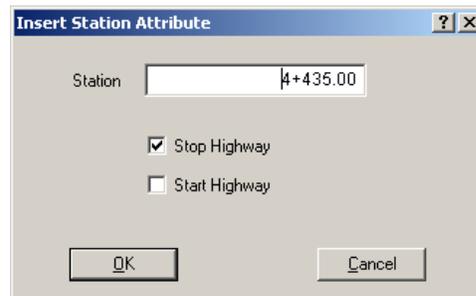
2. Select station 4 + 435 on the Station List.
3. Right-click to display the menu and select Stop/Start. The Insert Station Attribute dialog box is displayed for the selected station.



4. Leave the Stop Highway checkbox checked and click OK to continue.

Note: The dialog box opens with the Stop Highway checkbox checked to signify that volumes will stop being calculated from that station forward. The Stop can be removed by clicking the checkbox off.

The Start Station, 4 + 620 is green to show its status. If you selected it, the above window would show the Station Number with the Start Highway checkbox hecked.



Lesson 4 — Advanced Topics - Creating Surface Models

The previous lessons covered three basic tasks performed in Highway 4D to create a model and generate volume reports for your highway job. This lesson covers advanced topics for using existing CAD or Earthwork 4D data to create models, create typicals for fast highway entry, and generate 3D models of a Highway job. The following are covered in this lesson:

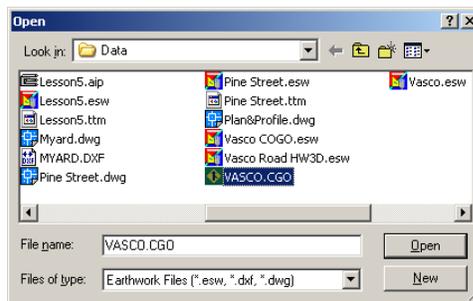
- Creating 3D Models with Imported COGO and Cross Sections
- Surfacing Multiple Alignments with Starts/Stops
- Perfecting Models from Digitized Cross Sections
- **Creating a Highway Job from Earthwork 4D**

Creating 3D Models with Imported COGO and Cross Sections

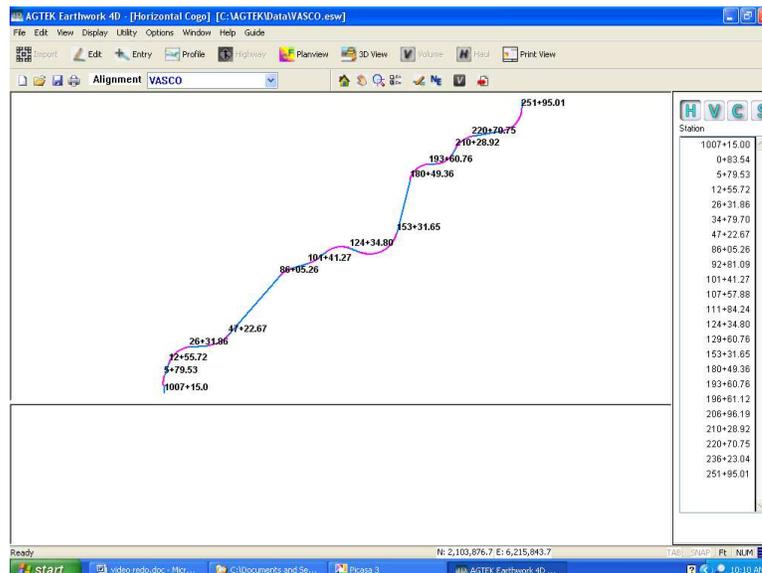
Using existing COGO and Cross Section data, you can create a 3D model of your highway job by importing COGO and Cross Section information, then generating the model.

Import COGO

- Open the "Vasco.CGO" file. The imported COGO is displayed in the main window.



The COGO includes the station equation entered in the previous tutorial and is the entire Vasco Road example.



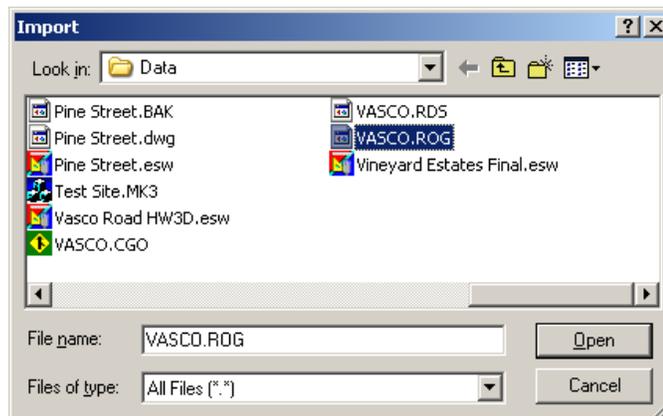
Import Cross Sections

Highway 4D can import a variety of electronic cross-section files. In this example, you will use the ROG/RDS format.

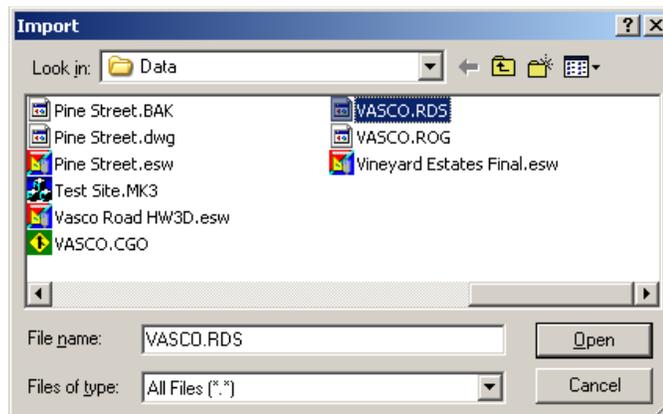


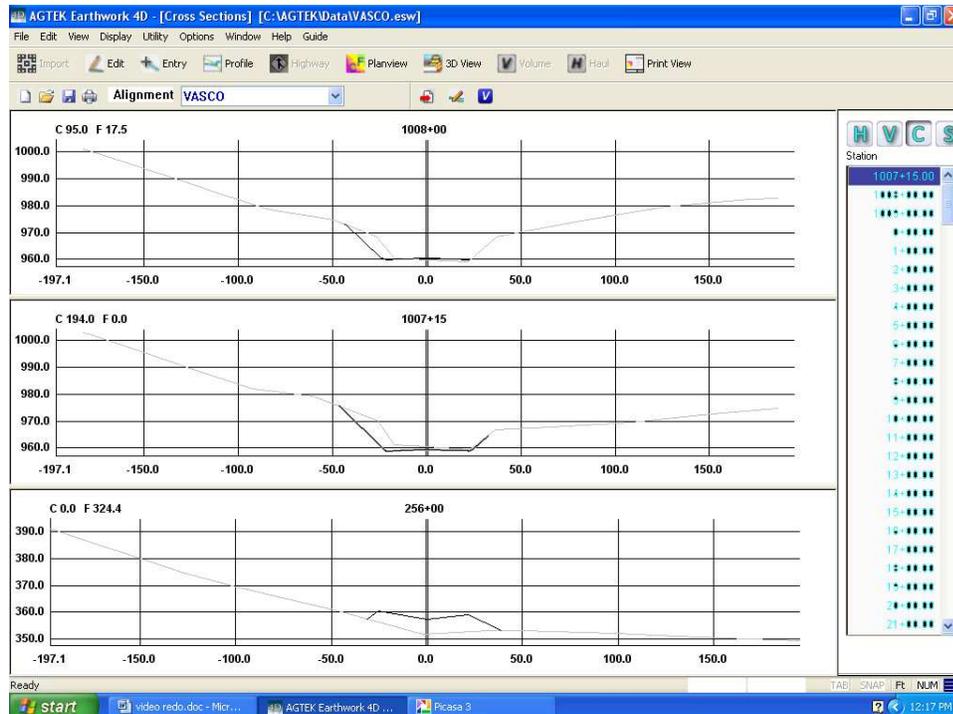
1. Click the Cross Sections (C) button to change to the **Cross Sections** mode.
2. Select **File > Import** then select "Vasco.ROG" and click Open to import the existing ground sections. The Cross Sections window displays only the Existing Ground lines.

Note: The Import window automatically displays all files to avoid missing readable data. If the extension is not recognized by the program, you'll be prompted to pick a type and layer destination.



3. Select **File > Import** again and select "Vasco.RDS" and click Open to import the Design. The Design section lines display and the station end areas calculate. Your screen should look like the illustration on the next page.





With what you have here, you can calculate volumes and create a model.

Create the Model

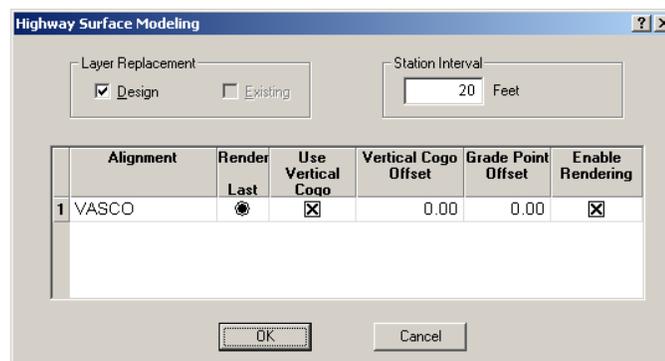


Highway surfacing takes the COGO and attaches the cross sections perpendicular to the COGO. Highway data surfaced into Earthwork 4D is no different than any other Earthwork 4D data. It may be edited, added to, or deleted as required.

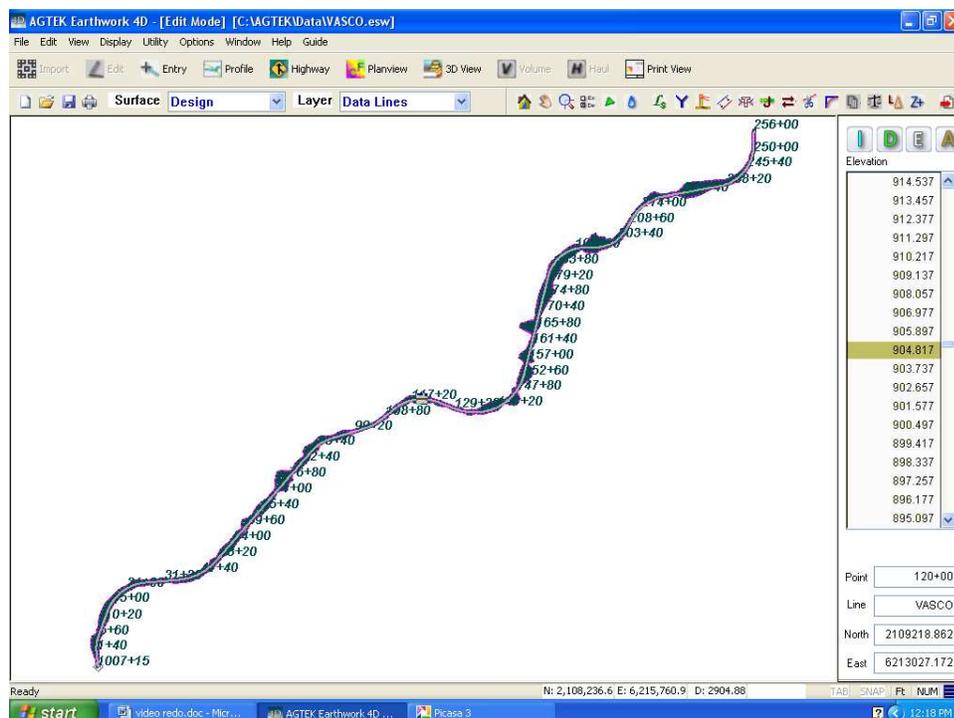
1. Click the Surface Creation (S) button over the Station List to start creating your model. The Highway Surface Modeling dialog box is displayed.

Moving left to right on the options, both the Design and Existing surfaces must be created from the cross sections. There is only one alignment present, so the Render Last is always on. The Use Vertical COGO option just means that the cross sections are moved, when required, to match the vertical COGO. Vertical COGO Offset is used when the cross sections are at subgrade and you must compensate for the difference from the finish grade COGO. Grade Point Offset is used only when the Vertical COGO is specified as an offset location from the Horizontal COGO.

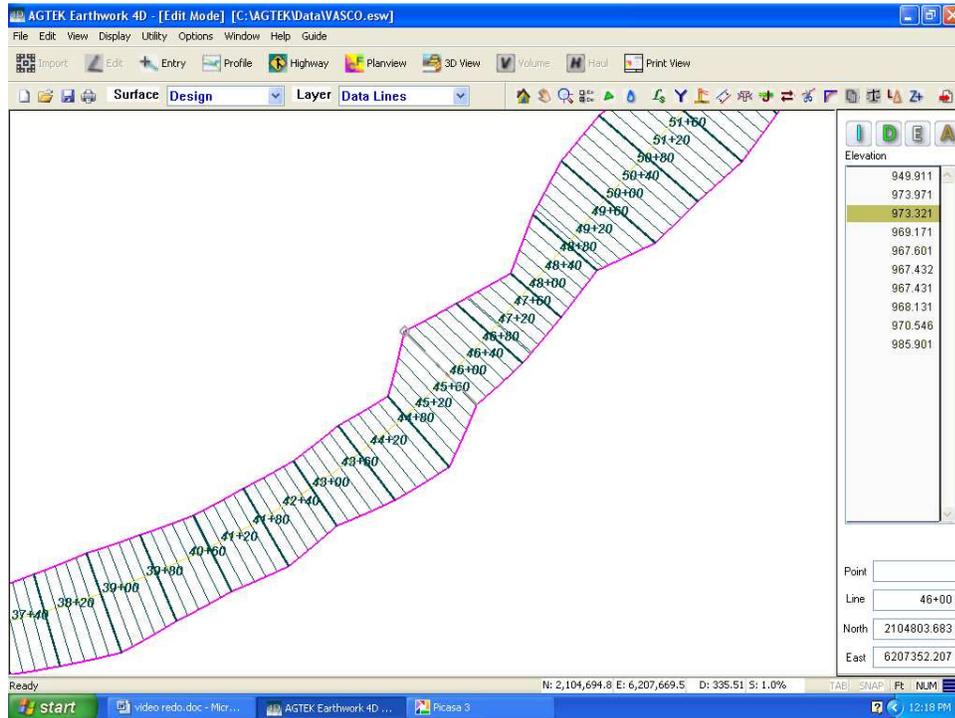
2. Click OK to start the surface creation



Your screen should look similar to the illustration below.



3. Select a point on the highway surface and zoom in to get a closer look. Your screen should look like the illustration below.



The given cross sections display as heavier light-blue lines while the intermediate interpolated sections are displayed as thinner lines. The thicker lines also have a line label that represents the station location. Highway 4D automatically generates a Design perimeter for the boundaries of the design sections and an existing perimeter to the limits of the existing sections.

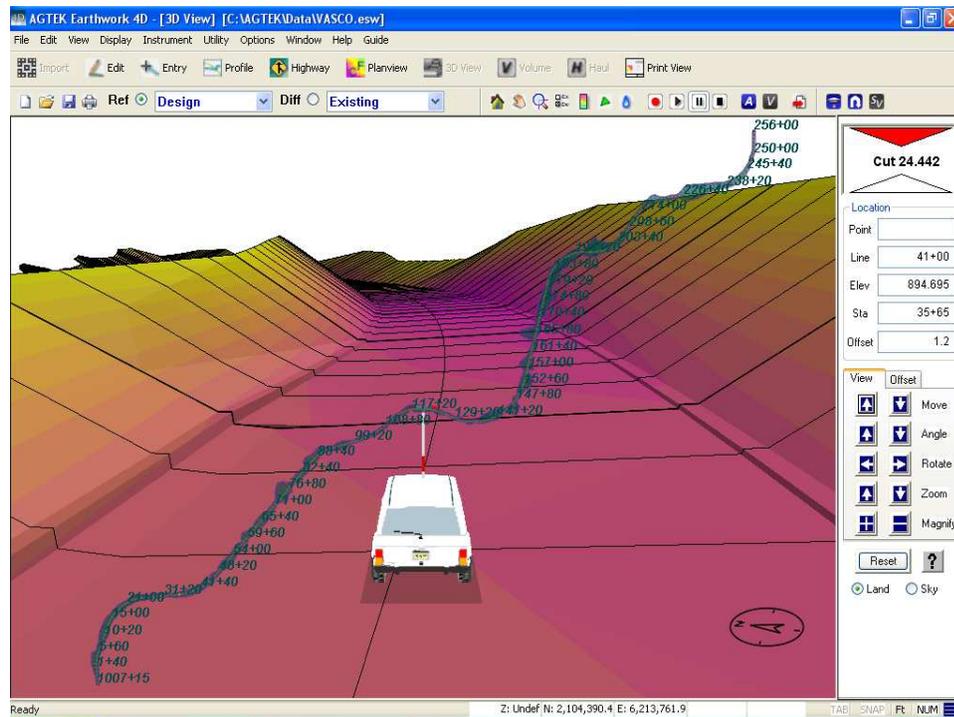
To see the three-dimensional terrain, press the T key or select **Display > Terrain**. Selecting any point on the plan view overlay moves the view to that point. The view may be rotated by pressing the R or L keys.

Visual Verification with the 3D Window



The Edit mode terrain view works for examining and editing but the 3D View is preferred for verification. Click the 3D View button to display the job in 3D and visually verify the model.

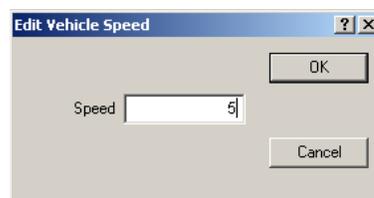
The 3D View displays a view similar to the Edit window with Terrain on. The difference is that the 3D window allows you to drive over the site with the arrow keys and more readily manipulate the view



When Highway data is present in the 3D view mode, you do not need to enter a drive path. An automatic drive-through feature, using the center line as the drive path, is automatically created from the COGO data.



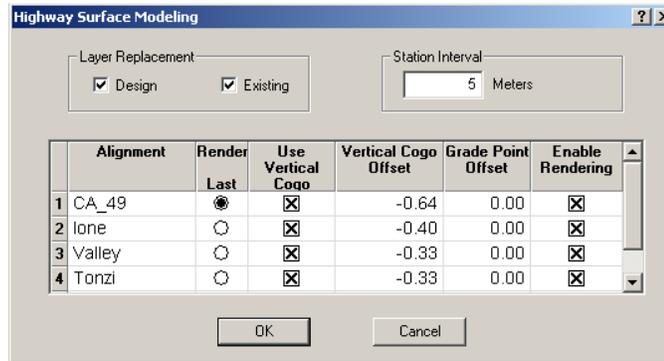
- Click the Play button and the program begins driving down the highway. Underneath the view controls, the current station displays as the vehicle passes over it.
- Click the Pause button to stop the drive without later having to restart at the beginning.
- Click Pause again to restart the drive.
- Click Stop to reset the drive to the beginning.
- The speed of the drive can be changed by selecting **Edit > Vehicle Arrow Rate** and increasing or decreasing the number to change the speed.



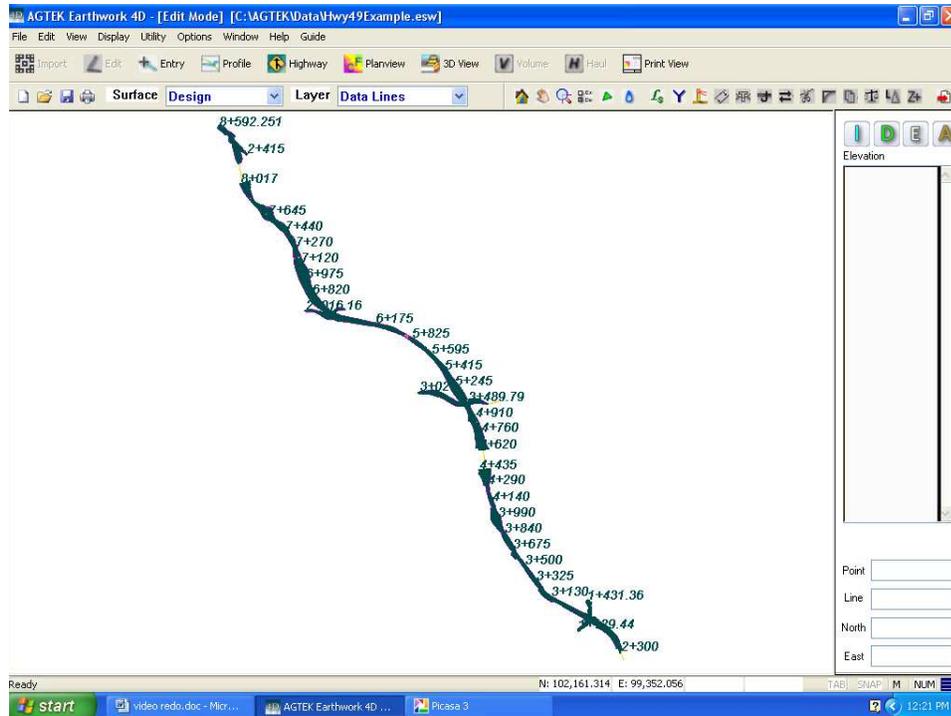
Surfacing Multiple Alignments with Starts/Stops

The CA_49 tutorial file contains multiple alignments and starts and stops. Highway 4D allows you to create a job with multiple starts and stops so you can generate accurate volume reports and create a 3D model of the job.

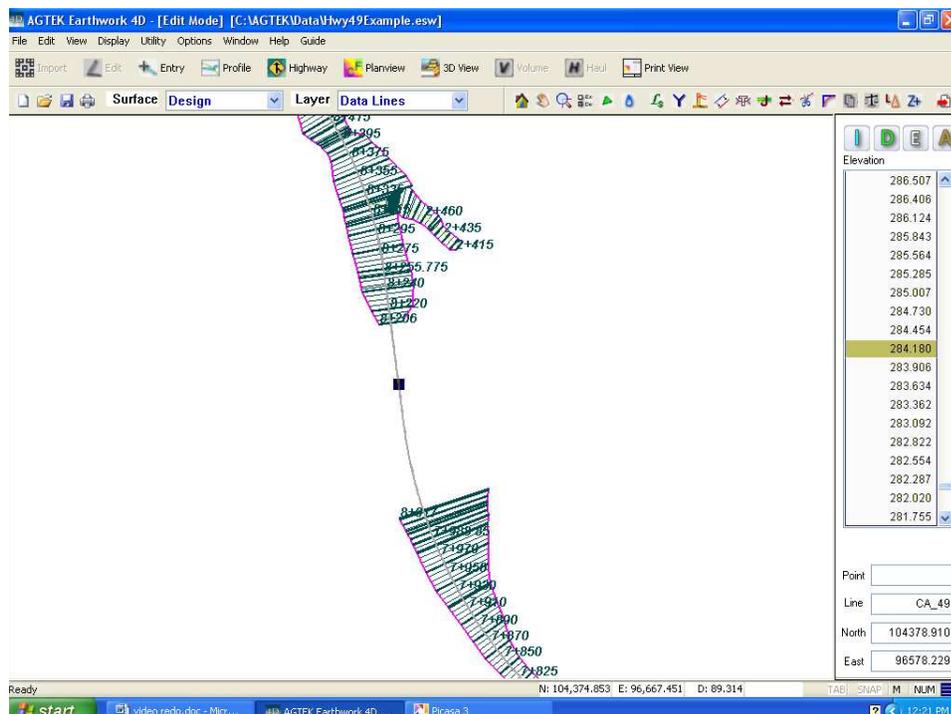
1. Click the Surface Creation (S) above the Station List to start the surfacing process. The Highway Surface Modeling dialog box is displayed. Note the following:
 - This job has five alignments and CA_49 has Render Last selected. CA_49 is the primary alignment and the others are crossing roads. When you select Render Last for this alignment, Highway 4D surfaces the crossings first. In doing this, the CA_49 surface takes precedence over the cross roads where they overlap.
 - Vertical COGO offset is not zero. The cross sections in this file are taken off at subgrade, but the vertical COGO is specified at finished grade. Entering the elevation difference between finished grade and subgrade allows Highway 4D to correct the cross-section centerline elevations without moving them too high to finished grade.
2. Leave the settings of the Surface modeling window unchanged and click OK to create the surface. The program calculates the surface and changes to edit mode. Your screen display should look similar to the illustration on the next page.



Notice that there are some areas where the highway stops and then begins again. When the Starts and Stops are specified in the Station list, the program will not create the surface for the specified station ranges. Pick something near the upper gap in the highway and zoom in.



While the COGO line continues through the gap, the program inserts Design Perimeters to surround only the used cross sections. This prevents volumes from being calculated outside the perimeters and from showing any Design in those areas in the Terrain view.



Inspect the Job

When multiple alignments are surfaced, duplicates of design perimeters can cause holes to display in the 3D Surface. To remove these holes:

1. Select the Design Surface and Perimeters Layer.



2. Zoom in to the planview and select the innermost design perimeter line.
3. Press the Delete key on the keyboard or select **Edit > Delete**.
4. Select **Options > Stage Design** to view how the design ties in with the existing ground data.
5. Click the 3D View button to switch to 3D View mode.
6. Click the Play button on the Utility Toolbar to play a recorded path down the centerline of the road to inspect the job.
7. Mistakes or design anomalies can be corrected by entering or editing the cross sections.



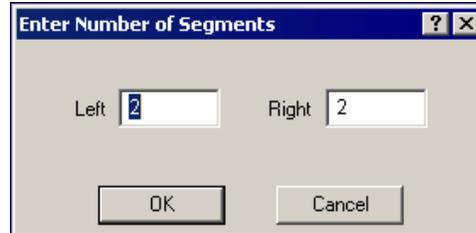
Perfecting Models from Digitized Cross Sections

There are two phases to highway jobs: bidding and building. While digitized cross sections are sufficient for estimating, building the job demands more precision from the model and requires COGO and precise sections for the best results. The process described below details a technique used to take the already entered COGO and cross sections to build an accurate model of the job, including and replacing the travelway portions of the roadway with precise typical-based sections.

Travelway Transitions are used to accurately calculate width and slope transitions when creating a highway model, such as lane widenings or superelevations. Generally there are typical cross sections that define the parameters of the roadway. Width transitions can be found on the plan sheets, while slope transitions are typically shown on the profile sheets. Horizontal and vertical COGO, as well as cross section data, are required to enter travelway transitions. This lesson uses the "Vasco Road HW4D.esw" file, which already has cross section and COGO information entered.

Enter Travelway Transitions

1. Open the "Vasco Road HW4D.esw" file. The job opens in the Cross Section window.
2. Select **Edit > Copy Alignment** and enter a name for the new alignment.
3. Select **Edit > Travelway Transitions** and enter the number of segments to the left and right side of the reference point, which is normally centerline of the travelway, then click OK to continue. For this example, there are two segments on each side of centerline.

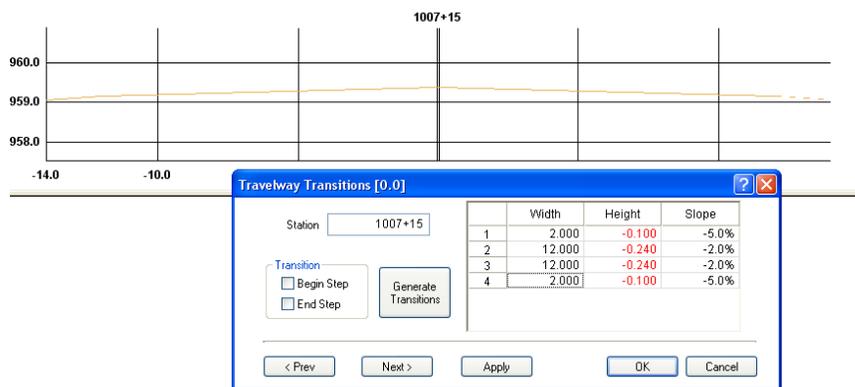


Typical Sections Worksheet

Name	Station	Segment 1		Segment 2		Segment 3		Segment 4	
		Width	Slope	Width	Slope	Width	Slope	Width	Slope
	1007 + 15	2	-5%	12	-2%	12	-2%	2	-5%
	1007 + 58	4		12		12		4	
Begin Step	1007 + 69		-5%		-2%		-2%		-5%
	1008 + 55	4		12		12		4	
	1009 + 80	8		12		12		8	
End Step	1 + 54		6%		6%		-6%		-6%
	2 + 13.67	8		12		12		8	
Begin Step	5 + 10		6%		6%		-6%		-6%
	8 + 13.37	8		24		12		8	
End Step	8 + 95		-5%		-2%		-2%		-5%
	9 + 40	8		24		12.62		8	
Begin Step	9 + 68.5		-5%		-2%		-2%		-5%
End Step	13 + 06		4%		4%		-4%		-5%
	15 + 13.4	8		24		24		8	
	23 + 08.06	8		24		24		8	
	25 + 75	8		12		24		8	
Begin Step	25 + 82		4%		4%		-4%		-5%
End Step	29 + 19.5		-5%		-2%		-2%		-5%
Begin Step	31 + 65		-5%		-2%		-2%		-5%
	33 + 07	8		12		24		8	
	33 + 32	8		12		24		6	
	35 + 50		-6%		-6%		6%		6%
	56 + 53		-6%		-6%		6%		6%
	50 + 38		-5%		-2%		-2%		-5%
	54 + 00	8		12		24		6	
	60 + 00	6		24		24		6	
	82 + 17.5		-5%		-2%		-2%		-5%
	86 + 05	6	-5%	24	-2%	24	-2%	6	-5%

- Press the Tab key to enter the first Travelway Transition then enter a width of "2" for segment 1, "12" for segment 2, "12" for segment 3, and "2" for segment 4.

The default values for slope are already correct. The numbers in black are fixed values, while the red numbers are interpolated. This is very important to remember when both width and slope transitions are occurring at the same time.

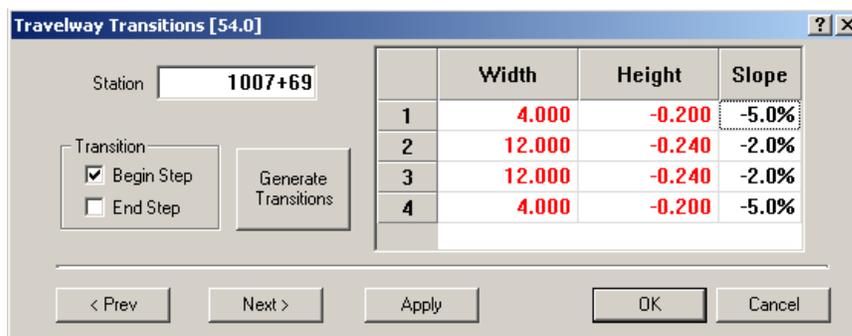


- Click Next and type "100758" to define the next travelway transition Station.
- Enter a width of "4" for segment 1 and "4" for segment 4. Click on segments 2 and 3 to keep them fixed at 12. The slope does not change, so the values can be left interpolated.

Note: When you click on the number it changes from red (interpolated) to black (entered).

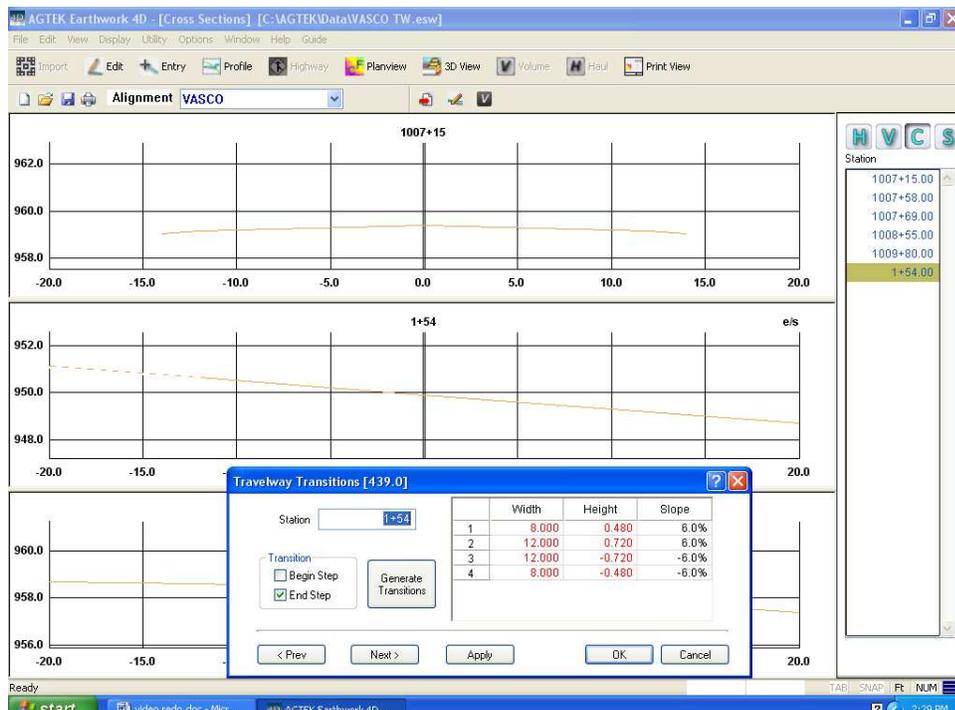
- Click Next and type "100769" to define the next travelway transition Station.
- Check the Begin Step box, then click on each of the slope fields to set the fix the values, leaving the width values interpolated.

Note: This station begins a Step Transition. When transitioning from a full crown section to a full superelevation section, the outermost segment will change until it matches the slope of the next segment. This continues until all segments are at the desired slope.

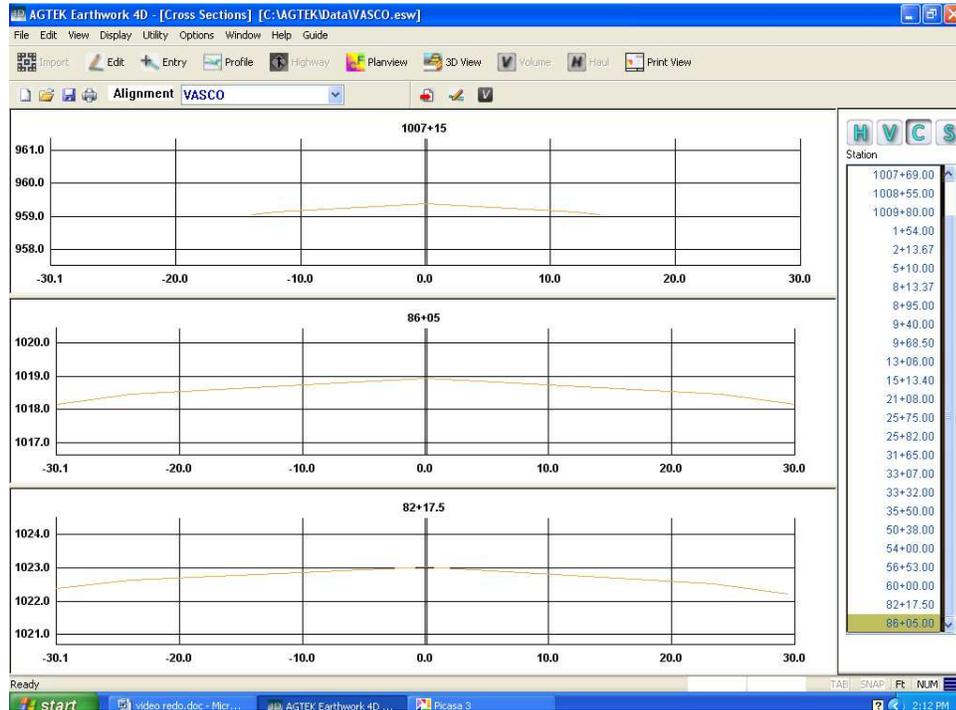


9. Click Next and type "100855" to define the next travelway transition Station.
10. Click on the width for each segment, making them fixed at their current values, leaving the slopes interpolated.
11. Click Next and type "100980" to define the next travelway transition Station.
12. Enter a width of "8" for segment 1 and 4, then click on the width for segments 2 and 3 to set them fixed at 12. Leave the slopes interpolated since we are still in a transition.
13. Click Next type "154" to define the next travelway transition Station.
14. Check the End Step box, then enter "6" for the slope of segment 1, "6" for segment 2, "-6" for segment 3 and "-6" for segment 4. The widths remain interpolated.

Note: This station represents the full superelevation, which will end the step transition.



- Click Next and continue entering Travelway Transitions from the Typical Sections worksheet. Your screen should look similar to the illustration below.



Surface the Job



- Click the Surface button to start the creation of the 3D Surface model. The Highway Surface Modeling dialog box is displayed.
- Select the renamed alignment to Render Last and click OK to create the 3D Surface. By selecting the travelway precise section to render last, you can substitute your precise roadway for that portion of the digitized sections.

Highway Surface Modeling

Layer Replacement: Design Existing

Station Interval: Feet

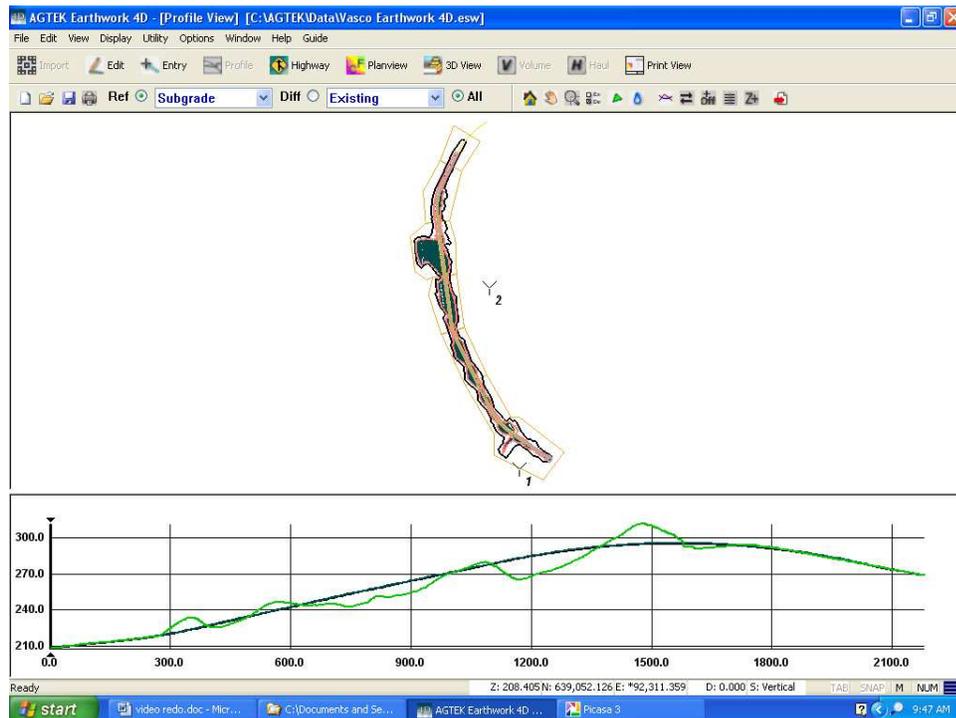
	Alignment	Render Last	Use Vertical Cogo	Vertical Cogo Offset	Grade Point Offset	Enable Rendering
1	VASCO-1	<input checked="" type="radio"/>	<input checked="" type="checkbox"/>	0.00	0.00	<input checked="" type="checkbox"/>
2	VASCO	<input type="radio"/>	<input checked="" type="checkbox"/>	0.00	0.00	<input checked="" type="checkbox"/>

OK Cancel

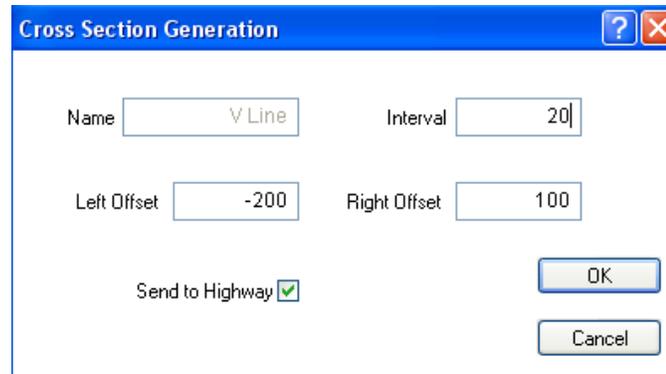
Creating a Highway Job from Earthwork 4D

In some situations you may want to create Highway Data from an Earthwork 4D file. In the following example, you will enter a profile and then generate Horizontal COGO and Cross Sections that create the highway data.

1. Double click the Earthwork 4D shortcut or select **Start > Programs > AGTEK > Earthwork 4D**. In the Open dialog box select the "Vasco Earthwork 4D.esw" file and click OK.
2. Choose the line you want to use for the reference line. The line may be a data line or an annotation. This line will be used to create the profile to generate cross sections and the horizontal COGO. You may also enter the horizontal cogo as described in Lesson 2.
3. Click the Profile View button on the Selection Toolbar to switch to Profile Mode.
4. Zoom in to the start of the chosen line in the direction of travel. You may want to select **Display > Plus Marks** to turn on plus marks if they do not display.
5. Click the Profile Entry button on the Utility Toolbar.
6. The profile line must be entered in the direction of travel for proper stationing. Place the cursor over the start of the line and press the F8 key to snap to this first point.
7. Use F8 to snap to points along this line, or Line Snap (F8 twice) over the same point to capture the entire length. Make sure the line is heading in the right direction. Select **Utility > Swap Ends** to change the line direction.
8. Press the Blank button twice to stop the line and end data entry. The entered profile line displays the change in elevation along the line in the panel below the planview.

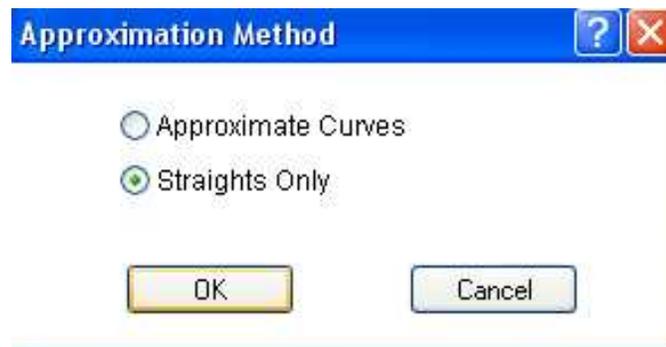


9. Click the Station Generator button. The Cross Section Generation dialog box is displayed.
10. Enter a name for the alignment.
11. Enter the station Interval and the Left and Right Offset distance. These are used to determine how far the cross section is drawn from the center line. In the example, a 300 foot cross section (200 meters left and 100 meters right of the centerline) will be drawn at stations every 20 meters. Check the Send to Highway checkbox and click OK to continue. The Enter Highway Name dialog box is displayed.



The image shows a dialog box titled "Cross Section Generation". It has a blue header bar with a question mark icon and a close button. The dialog contains four input fields: "Name" with the text "V Line", "Interval" with the value "20", "Left Offset" with the value "-200", and "Right Offset" with the value "100". Below these fields is a checkbox labeled "Send to Highway" which is checked. At the bottom right, there are two buttons: "OK" and "Cancel".

12. Choose the desired approximation method. For best results, choose Straights only.



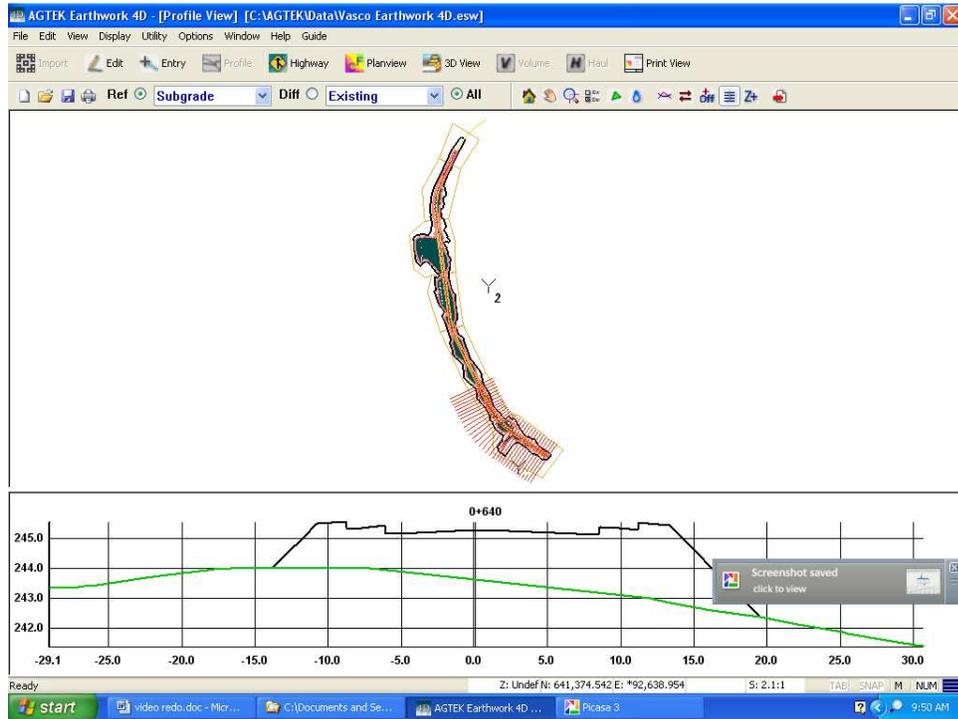
The image shows a dialog box titled "Approximation Method". It has a blue header bar with a question mark icon and a close button. The dialog contains two radio button options: "Approximate Curves" and "Straights Only". The "Straights Only" option is selected. At the bottom, there are two buttons: "OK" and "Cancel".

12. Enter the Starting Station value, or use the default "0 +000". Click OK to start generating the cross sections.

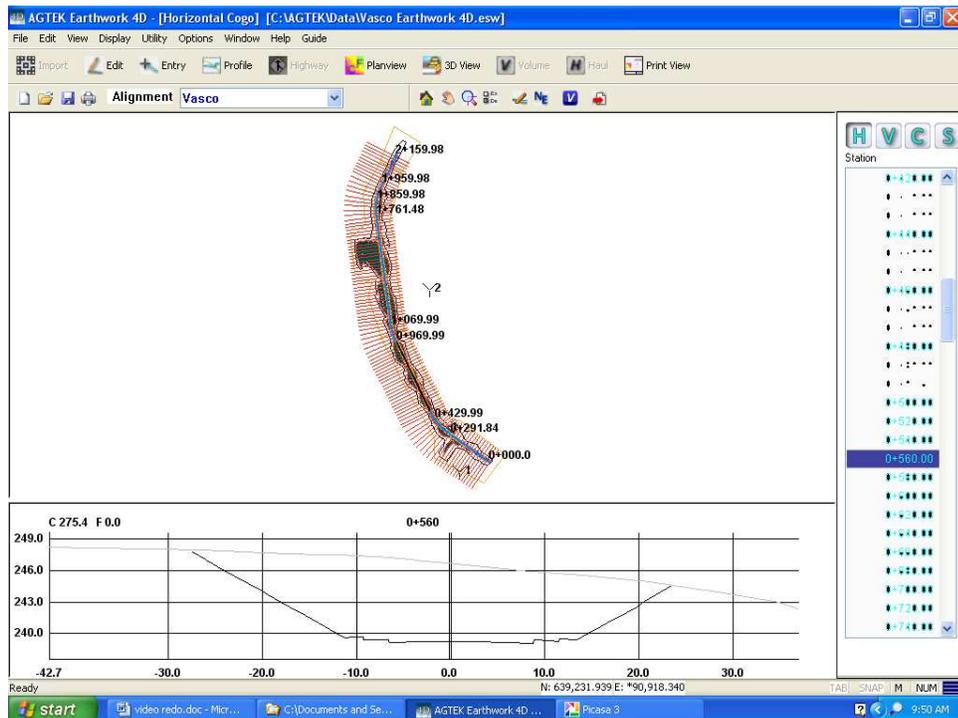


The image shows a dialog box titled "Alignment Starting Station". It has a blue header bar with a question mark icon and a close button. The dialog contains a single input field labeled "Station" with the value "0+000". At the bottom, there are two buttons: "OK" and "Cancel".

the cross sections draw along the profile line and then the screen switches to the Horizontal COGO screen in Highway Mode.



13. Select one of the cross sections. Below the planview the existing and design profile of the cross section displays.



Importing Other Cross Section Data Files

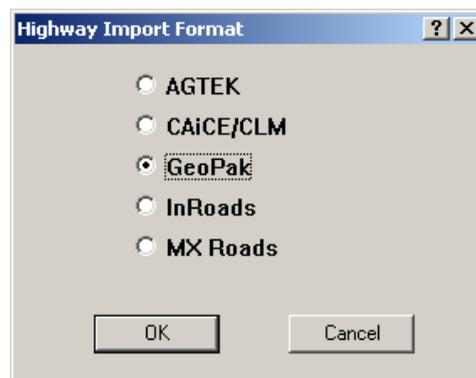
In addition to standard RGS and ROG cross section files, Highway 4D can import other formats, including AGTEK, CAiCE, GeoPak, InRoads, and MX Roads to create cross sections. This cross section data may need editing after it is imported. This section demonstrates how to import and edit the data.

Import the Cross Section

1. Double click the Highway 4D shortcut or select **Start > Programs > AGTEK > Highway 4D**. The Open dialog box is displayed.
2. Click the New button to create a new highway file. The Job Information dialog box is displayed.
3. Enter a Job Name, check the Highway checkbox, select the Units, and click OK to continue. The Enter Alignment Name window displays.
4. Select **File > Import**. The Import dialog box is displayed.
5. Find the file to import and click Open. The Highway Import Format dialog box is displayed.

Note: For some imported formats, you cannot determine whether the data is design or existing, so make sure you are importing the correct file. The name of the file can often be used to determine if the data is design or existing data.

6. Select the type of the imported file and click OK to continue. In this case, the file originated from a GEOPAK program. The Highway Layer dialog box is displayed.



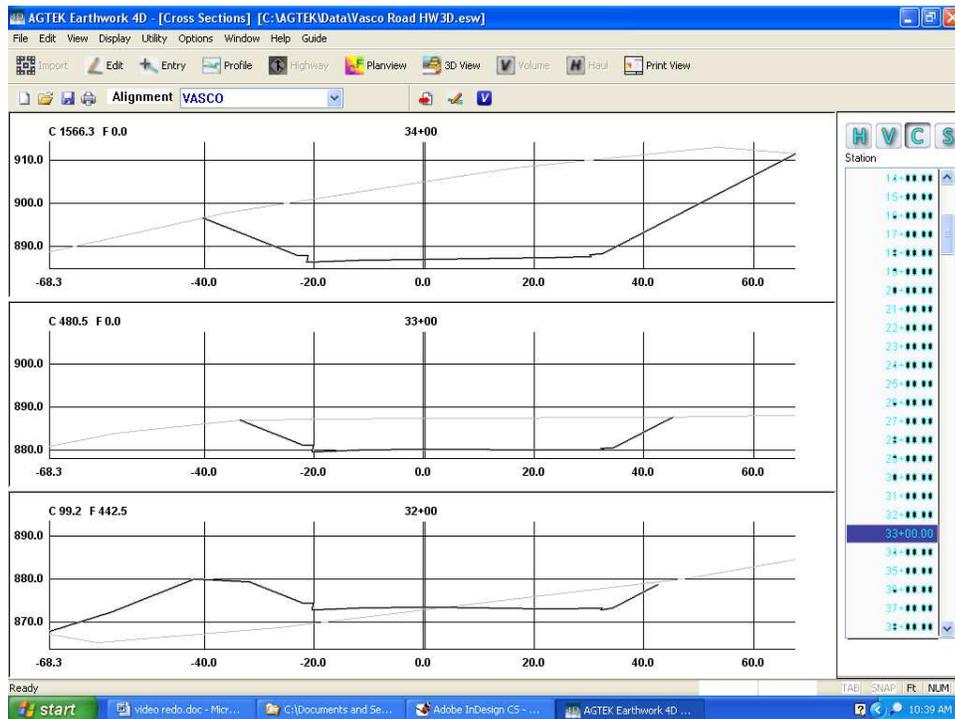
7. Select Existing or Design as the destination for the imported data and click OK. If the imported data was sent to the wrong layer, select **Edit > Undo**.



The program switches to the Cross Sections screen of Highway Mode and displays the imported data. In the example below, only the design data has been imported.

Notice how there are two lines represented in the cross section view. The thin blue line represents the original imported data. The bold blue line is the actual imported data after the data has been processed. The original data has points which switch back on themselves. Highway 4D uses this information and creates verticals based on the original data.

Review the cross sections to ensure that the imported data was interpreted correctly. Discrepancies typically occur in the design data.



Edit the Cross Section

If you find a cross section that appears incorrect, you can edit the cross section.

1. Double-click the cross section to edit.
2. Click No when prompted to enable the digitizer.
3. Select the Layer to edit and use the Arrow keys to move through the points on the line. Make any changes and click Apply to apply the change and OK to close the window.
4. Repeat this process for the existing data for any other incorrect cross sections.

Section 2

Reference

User Interface

To effectively use Highway 4D you will use the 16-button cursor for digitized input, the mouse for non-digitized entry, and the keyboard for alphanumeric entry and keyboard shortcuts.

Keyboard

Most tasks are available on menus and the toolbar at the top of the screen, but the tasks can also be accessed through keyboard shortcuts shown next to the command in the menus.

The Mouse

Highway 4D uses the mouse throughout the program. A roller-style center button mouse is recommended. The mouse can be substituted for the cursor for non-digitized entry.

The **Left** button is used to select objects and choose menu items.

The **Right** button is used to display the Right Mouse Menu. This menu displays quick access to specific commands in each job surface.

The **Wheel Button** allows the user to zoom in or out over the location of the arrow (or a segment if selected) by rolling the wheel Up or Down respectively. Clicking and holding and moving the mouse allows the user to pan the view on the screen.

Pull Down Menus

Menu commands are selected from pulldown menus by clicking on the menu then clicking on the command. A submenu is noted by an arrow to the right of the command name. Click on the command with the submenu to view available commands then click on the command in the submenu to select it. Menus and commands displayed in grey are not available.

Buttons



A button is selected by placing the cursor over the button and clicking it.

Check Boxes and Radio Buttons



Check Boxes and Radio Buttons are used to display whether an option is enabled or disabled. When filled, the option is on.

Checks



Checks indicate that a certain command option is enabled. These appear in menus and submenus in Highway 4D.

The Arrow



The Arrow is used for selecting items only.

The Crosshair



The Crosshair means the program is in data entry mode.

Selecting

Selecting is done by placing the arrow over the object and clicking the mouse. Multiple items can be selected by pressing and holding the Shift key while selecting the items.

Text Boxes

Text Boxes are used to input values. Select the Text box to add or modify the data. The text cursor can be moved with the TAB key or by selecting a new textbox.

Screen Modes

Highway 4D is a companion product to Earthwork 4D and operates in several modes, each with a different purpose and set of menus and commands to perform specific tasks associated with that mode. Only Modes specific to Highway 4D are documented in this manual. For information about other Modes, refer to your Earthwork 4D manual.

Horizontal and Vertical COGO Modes



The Horizontal and Vertical COGO Modes are used to enter COGO data from a plan into Highway 4D. COGO uses the coordinate geometry on the plans to describe the line (generally the centerline) from beginning to end. Horizontal COGO describes the X and Y values of the line. The Z value (elevation) is described by Vertical COGO. The Horizontal/Vertical COGO modes are used to enter this COGO information.



The Z value (elevation) is described by Vertical COGO. The Horizontal/Vertical COGO modes are used to enter this COGO information.

Cross Sections Mode



The Cross Sections Mode is used to enter cross sections from a plan into Highway 4D. The Cross-Section Window displays three sections at a time. The Station List on the right lists all of the stations.

- Click on the upper displayed section to scroll up through the stations.
- Click on the lower section to scroll down through the stations.
- Double-click on the center section or click the Edit/Enter button to edit that station.
- Click in the Station List and use the roller wheel on the mouse to scroll through the list. The keyboard arrows may also be used to move up and down through the list.

Haul Report Mode



The Haul Report Mode displays the mass haul diagram and the haul report on a split screen. In this mode, you can change the borrow/spoil for a station, determine the extent of the volume calculations, and edit the haul brackets.

Other Modes

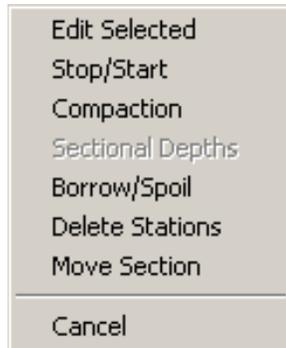
When the Surface Button is pressed, Highway 4D switches to Edit Mode in Earthwork 4D. All functionality for Edit, Enter, Profile View, Plan View, 3D View, Volume Report, and Print Preview Modes is described in your Earthwork 4D manual.

The Station List Interface

The Station list has its own interface and menu commands. From this menu you can edit, create gaps in station volumes, adjust the compaction, insert borrow or spoil volumes, delete stations, and move/copy cross sections. Select a station and right-click the mouse to display the Station List menu.

Right-Mouse Menu

The following commands are available when you right-click over the Station List



Edit Selected	Opens the Highway Sections dialog box to edit the selected cross sections.
Stop/Start	Enters a stop or start point along the length of the highway for volume calculations.
Compaction	Used to enter a compaction ratio for a range of cross sections to compensate for shrink or swell.
Borrow/Spoil	Used to enter borrow and spoil volumes on stations. Once entered, the Mass Diagram and Haul reports recalculate for these variables.
Delete Stations	Deletes the selected cross sections.
Move Section	Moves the selected cross section to a designated station.

Keyboard Shortcuts

Highway 4D contains many commands that can be accessed by both the menus and by keyboard shortcuts. The keyboard shortcuts of Earthwork 4D also function in Highway 4D. Below is a list of the commands and their shortcuts commonly used with a highway job. Refer to your Earthwork 4D manual for a description of the other commands.

Changing Modes

	Switches to Edit Mode from any other mode. Toggles between Edit and Entry Modes.
	Switches to 3D View Mode from any other mode.
	Switches to Print Preview Mode from any other mode.
	Switches to Highway Mode. Toggles between Highway Mode and Haul Report Mode.
	Switches to Plan View Mode from any other mode.
	Switches to Profile View Mode from any other mode.

Horizontal/Vertical COGO Modes

	Deletes the currently selected segment or highlighted text from a textbox.
	Zooms out to the extents of the job and centers the data on the screen.
	Moves the view in the direction of the key press. When the cursor is placed over the Station List, the arrows move up and down the list highlighting the segment on the screen and on the list.
	
 	Used to enter values for COGO. When the cursor is over the Station List, the number keys jump to the station that starts with that number.
	
 	Zooms in or Out over the location of the cursor or selected data (Sticky Zoom).
	Deletes one character at a time in a selected textbox.
	“Sticky Zoom” toggle. Allows zooming over a selected segment.
 	Sends the currently selected view to the Print Preview Page.
 	Undo the last edit.
 	Redo previously undone edit.

Cross Sections Mode

-  Zooms out to the extents of the job and centers the data on the screen.
-  
  When the cursor is placed over the Station List, the arrows move up and down the list highlighting the segment on the screen and on the list.
-  
 The Number and Period keys are used to enter values for Cross Section. When the cursor is over the Station List, the number keys jump to the station that starts with that number.
-   Scrolls Up and Down the Station List three at a time.
-  Deletes the currently selected cross section or highlighted text from a textbox.
-  Deletes one character at a time in a selected textbox.
-   Sends the currently selected cross section to the Print Preview Page.
-   Undo the last edit.
-   Redo previously undone edit.

Haul Report Mode

-  Resets the mass haul diagram vertical scale.
-  
  When the cursor is placed over the Station List, the arrows move up and down the list highlighting the segment on both the mass haul diagram and the list. Place the cursor over the diagram and pressing the Up/Down Arrows causes the different interval to highlight on both the report and the mass haul diagram.
-   Increases/decreases the vertical scale of the mass haul diagram.
-   Sends the currently selected view to the Print Preview Page.
-   Undo the last edit.
-   Redo previously undone edit.

Volume Report Mode

-   Sends the currently selected view to the Print Preview Page.

Tool Bars

Highway 4D utilizes the tool bar function for many of its commands for easy and quick access. There are two tool bars: Selection and Utility. Click on the button to activate the command. Below is a list of the commands available in Highway 4D. Buttons that are grey are not accessible. Refer to the Earthwork 4D manual for a description of the other tool bar commands.

Selection Tool Bar

The Selection Tool Bar is used for opening files, saving files, and printing as well as switching between the different Modes.



Highway Mode Switches to Highway Mode.



Haul Diagram Mode Switches to Haul Diagram Mode.

Utility Tool Bar

The Utility Tool Bar displays different options depending on which window is open. Below is a list of commands which may display in this tool bar.



Calc Volume Calculates the volume and displays the Mass Haul Diagram and Volume Report.



**Edit Cogo/
Cross Sections** Enters vertical and horizontal COGO or cross sections, depending on the current view.



Station North/East Displays the northing and easting coordinates of a station and to enter offset points and labels.



**Insert/Delete
Borrow/Spoil** Adjusts the volume at a given station.



Insert Stop/Start Inserts a point to stop or start the highway for calculating the volume.

Menus

Highway 4D is a companion product to Earthwork 4D program and has menu commands not described in the Earthwork 4D manual. In addition, some of the menu commands function differently in Highway 4D than in Earthwork 4D. Only commands that function differently or are specific to Highway 4D are documented in this manual. For information about other commands, refer to your Earthwork 4D manual.

File Menu

The File Menu is used to access files, import files, save job files, setup the printer and exit the program. Below is a description of the different/additional commands for the Highway 4D File Menu.

New

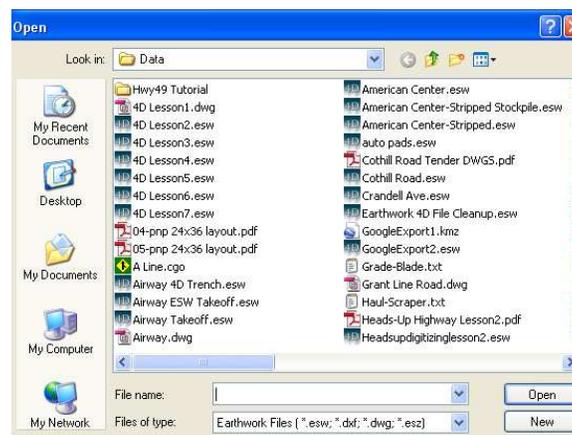
Used at the start a new job. When the command is selected, the Job Information dialog box is displayed



Highway 4D adds the Highway checkbox to specify that this is a new highway job. In addition to entering the other job data, make sure to check the box to create a highway job.

Open

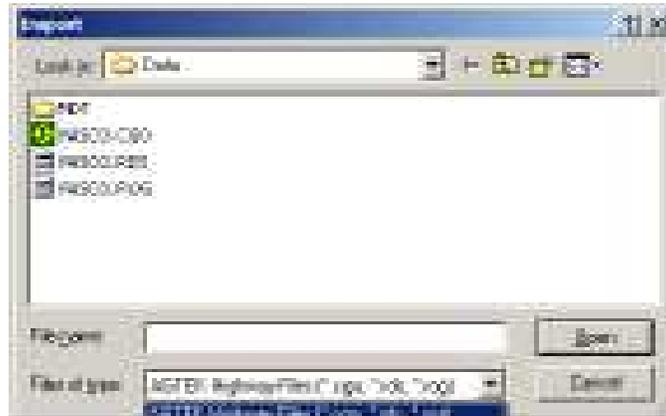
Used to open an existing job. When the command is selected, the Open dialog box is displayed.



Select the file from the list in the window. The name then displays in the File Name text box. Highway 4D adds the ability to open AGTEK Highway Files (*.esw, *.cgo, *.rds, *.rog). Click Open to get the file.

Import

Used to import CGO, RDS and ROG files. When the command is selected, the Import dialog box is displayed.



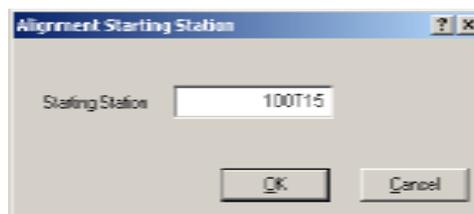
From the Files of type pulldown, select AGTEK Highway Files to display only highway files, then select the file from the list in the window. The name displays in the File Name text box. Click Open to get the file.

Edit Menu

The Edit Menu is used to undo/redo commands, change station equations, edit horizontal/vertical cogo, add/delete highways and change the elevation of the vertical cogo. Below is a description of the different/additional commands for the Highway 4D Edit Menu.

Station Equations

Station Equations are used where a project switches to a different stationing system part way through the job. The Station Equation should be entered before entering any stations. When the command is selected, the Alignment Starting Station dialog box is displayed



Enter the starting station for the job. A plus mark (+) does not need to be used. For example, if the starting station is 1007 + 15, you would enter "100715" and Highway 3D automatically inserts the "+".

After the starting station is entered, the Edit Station Equations dialog box is displayed



Line 1 represents the starting station alignment. Line 2 is where the first station equation is entered. A second station equation would be entered on Line 3, and so on. In this case, the station equation meets at 1010 +00 and 0 +00. These stations are at the same location on the job. To enter the location where the two station equations meet, click in OLD STATION on Line 2. Type a value of "101000". Press the Tab button, or click in NEW STATION on Line 2 and enter "0". Entering station equations tells the program where the two stationing systems meet on the job to maintain proper positioning to one another.

Horizontal Cogo

Used to enter and edit Horizontal COGO data. Much of the information in the dialog box is calculated and filled in automatically, such as northings and eastings. The line is drawn relative to the other segments based off the bearings, lengths, and radii. Clicking the Next button after entering a COGO switches tabs in the following order:

Straight - Curve - Straight - Curve

To enter a segment different from this pattern, use the tabs at the top of the screen to specify the next segment type.

When the command is selected, the Horizontal Cogo dialog box is displayed. There are three tabs for entering different types of Horizontal COGO data: Straight, Curve, and Spiral.

Straight

Enter the Station Start, Northing, Easting, Length and Bearing. The Ending station and coordinates are filled in automatically.



Curve

When entered after a Straight, much of the information in the window is already filled. The only thing needing to be filled in is the Angle and Radu.

Spiral

A Spiral is a special type of horizontal COGO. It is a type of curve and can be used as a transition between straight and curved segments. When entered after a straight, the Length, Angle, Radius, Degree and Curvature must be filled. When entered after a curve, only the Length and Curvature need to be specified.

The buttons along the bottom of the dialog box are the same in each tab and are explained below.

- Previous** Steps back to the previously entered COGO.
- Next** Advanced to the next COGO entered, or to enter a new COGO.
- Apply** Applies any changes to the COGO without closing the window.
- OK** Applies changes to the COGO and closes the window.
- Cancel** Aborts any changes made, unless Apply was clicked first.

Vertical Cogo

Used to enter elevation change along the length of the roadway. Like the Horizontal Cogo dialog box, much of the information is calculated and filled in automatically after the first segment is entered. Clicking the Next button after entering a COGO switches tabs in the following pattern:

Straight - Curve - Straight

To enter the next segment different from this pattern, use the tabs at the top of the screen to specify the next segment type.

When the command is selected, the Vertical Cogo dialog box is displayed. There are two tabs for entering different types of Vertical COGO data: Slope and Curve.

Slope

The Station Start from Horizontal COGO is used. If there is no Horizontal COGO entered, the default is 0+00. Enter the Slope, Elevation and Slope Length. The Ending Station and Elevation fill in automatically.

Curve

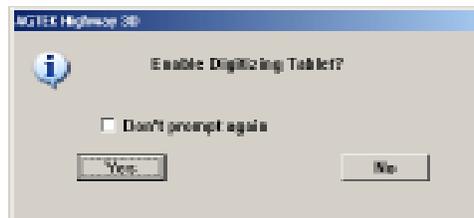
Enter the Curve Length, Slope and Elevation. Many of the entries fill automatically.

The buttons along the bottom of the dialog box are the same in both tabs and are explained below.

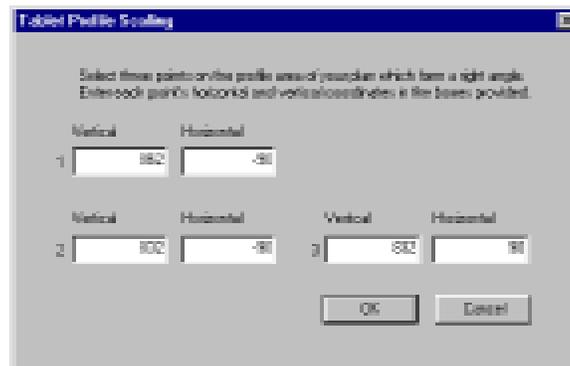
- Previous** Steps back to the previously entered COGO.
- Next** Advanced to the next COGO entered, or to enter a new COGO.
- Apply** Applies any changes to the COGO without closing the window.
- OK** Applies changes to the COGO and closes the window.
- Cancel** Aborts any changes made, unless Apply was clicked first.

Cross Sections

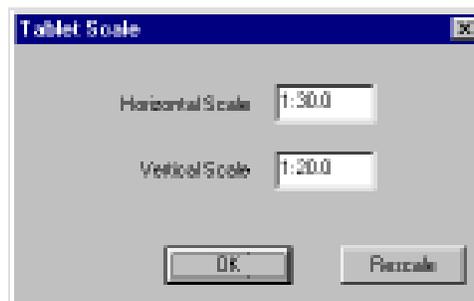
Used to enter digitized cross sections from a plan sheet. When the command is selected, a dialog box is displayed asking to enable the tablet.



Click No to not scale the digitizer or Yes to scale the digitizer. If Yes is clicked, the Tablet Profile Scaling dialog box is displayed.



Enter the Vertical and Horizontal coordinates for three points that form a right angle on one of the cross sections plan sheet. Click OK, then digitize each point in the order you entered them. Once all three points have been digitized, the Tablet Scale dialog box is displayed.



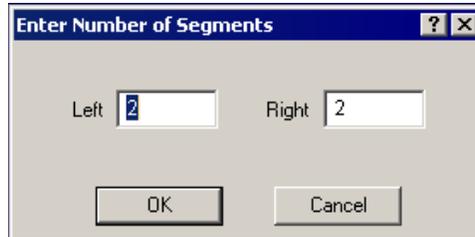
Click OK to accept or Rescale to repeat scaling. If OK is clicked, the Highway Sections dialog box is displayed.



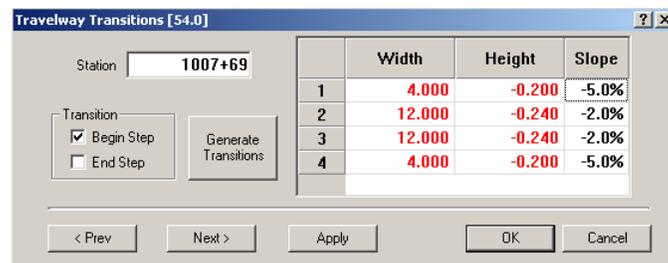
Edit/enter your cross sections using the Highway Sections dialog box.

Travelway Transitions

Used to accurately calculate width and slope transitions when creating a highway model, such as lane widenings or superelevations. Generally there are typical cross sections that define the parameters of the roadway. When the command is selected, the Enter Number of Segments dialog box is displayed.



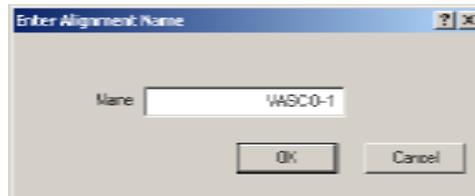
Enter the number of segments to the left and right of the reference point, typically the centerline of the travelway, then click OK. The Travelway Transitions dialog box is displayed.



Enter your travelway transition Station number, select whether it is a Begin or End Step transition, and enter the Width, Height, and/or slope of the transitions. Click OK to enter the transition and start a new transition or Apply to enter the transition and close the dialog box.

Add Alignment

Used to add a highway to the current job. When selected, the Enter Alignment Name dialog box is displayed.



Type in the name of the new highway and click OK to add the highway.

Copy Alignment

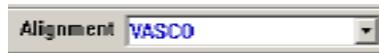
Copies the current alignment and opens the Enter Alignment Name dialog box to name it.

Rename Alignment

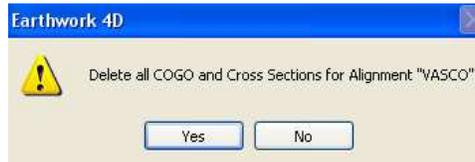
Opens the Enter Alignment Name dialog box to enter a new name for the current alignment.

Delete Alignment

Used to remove all COGO and Cross Sections for the current alignment. The current alignment is displayed in the Alignment pulldown menu.



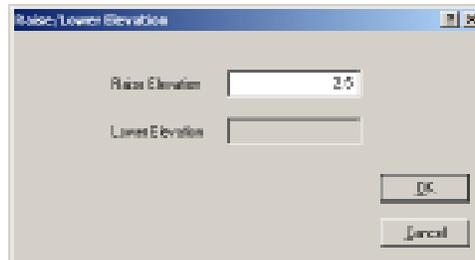
Select the alignment to delete from the Alignment pulldown menu and select **Edit > Delete Highway**. A confirmation dialog box is displayed.



Click Yes to delete all COGO and Cross Sections.

Raise/Lower

Used to change the elevation of the Vertical COGO. If there is no Vertical COGO, this command is not available. When selected, the Raise/Lower Elevation dialog box is displayed.



Type a value in either the Raise or Lower Elevation box. Once a value is entered, the other box become unavailable. Click OK to adjust the elevation.

Haul Brackets

Used to set the Alignment Haul Brackets on the Volume Report. When the command is selected the Edit Haul Brackets dialog box is displayed.



The Mass Haul Diagram report displays three columns for the Haul Brackets.

0-(Minimum) (Minimum)-(Maximum) (Maximum)+

Changing the Minimum or Maximum changes the report by moving quantities to different ranges accordingly. Type in the desired changes and click OK to change the values.

Display Menu

The Display Menu is used to adjust how screen data is displayed. A check next to the command indicates that it is enabled. Below is a description of the different/additional commands for the Highway 4D Display Menu.

Arc Controls

Displays arc control points and lines in Horizontal and Vertical COGO Modes.

Station Numbers

Displays the station labels in Horizontal and Vertical COGO Modes.

Arc Coordinates

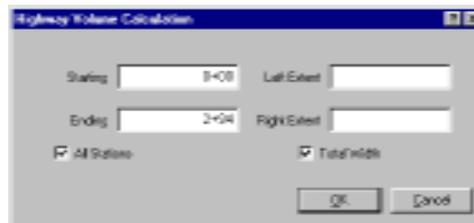
Displays the arc coordinates in Horizontal COGO Mode if Arc Controls is also selected.

Utility Menu

The Utility Menu is used to display specialized commands used to modify the entered data. Below is a description of the different/additional commands for the Highway 4D Utility Menu.

Calc Volume

Used to compute the volumes for the current alignment. When the command is selected, the Highway Volume Calculation dialog box is displayed



Enter the Starting and Ending stations and Left and Right Extent, or check the All Stations and Total Width boxes. Click OK to start volume calculation.

Calc Accum Volume

Used to generate a Volume Report with a column showing the total cut/fill volumes accumulated from station to station.

Delete Model(s)

Used to delete all previous 3D Models rendered for the job in Highway 4D.

Break Alignment

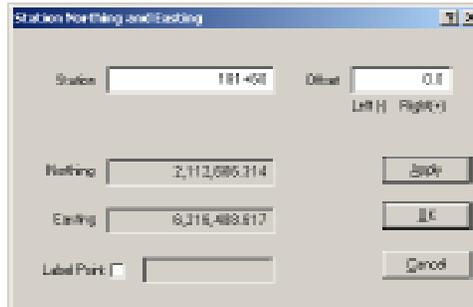
Used to break a highway at the end of the currently selected segment. When the command selected, the Enter Alignment Name dialog box is displayed.



The default name appends an incremental value after the current highway name. Change the name as desired and click OK to break the highway.

Station North/East

Used to display the northing and easting of the selected station, enter labels, and offset points. When selected, the Station Northing and Easting dialog box is displayed.



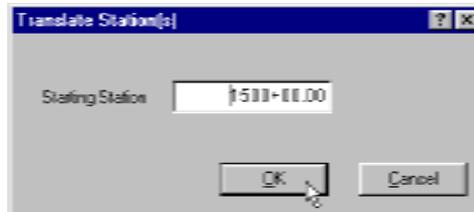
To create an offset point, enter a distance with a "-" for Left or "+" for Right. Check the Label Point box to add a label. Click Apply to enter the changes or OK to enter the changes and close the window.

Translate Stations

Used to move specified stations into a different station numbering sequence. When selected, the Cross Section Range Selection dialog box is displayed.



Enter the specified stations or check the **All Stations** box and click OK. All the stations in the specified range highlight on the right side of the screen and the Translate Station(s) dialog box is displayed.



Enter the new value for the station numbering and click OK to apply the change.

Insert Curve

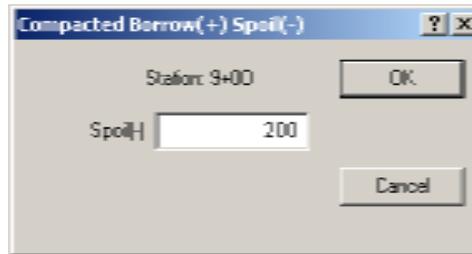
Used to insert a curve segment between two straight segments with a user defined radius. When the command is selected, the Edit Curve Radius dialog box is displayed.



Enter the desired radius of the curve and click OK.

Borrow/Spoil

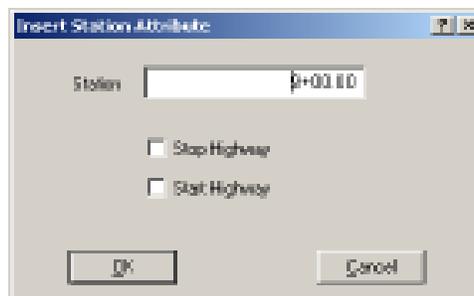
Used to set a borrow or spoil amount from a selected station. When the command is selected, the Compacted Borrow/Spoil dialog box is displayed.



Enter a Borrow/Spoil amount in the box below the currently selected Station. A Borrow value is entered as a positive number and a Spoil value is entered as a negative (-) value.

Stop/Start

Used to enter a stop or start point along the length of highway for use in volume calculation. A stop point tells the program to stop calculating at the selected station. A start point tells the program to resume, or start, calculating at the selected station. When the command is selected, the Insert Station Attribute dialog box is displayed.



Enter the Station where the start/stop should be and check Stop Highway or Start Highway to specify if it is a stop or start. Click OK to apply the attribute.

Surfacing



Surfacing creates a 3D surface by using the COGO and Cross Section data to generate 3D data lines for the existing and design surfaces and a displays a 3D model of the job. When



the Surface button is clicked, the Highway Surface Modeling dialog box is displayed.

- Layer Replacement** Choose Design and/or Existing to replace any existing layers created by previous surfacing. If you wish to only send one layer, check the appropriate layer to replace.
- Station Interval** Determines the distance between each data line that is created during rendering. Stations are automatically rendered, regardless of distance.
- Alignment** This is the list of all the alignments (highways) for the job.
- Render Last** This option allows you to choose the order in which multiple alignments are rendered to create the 3D Model. Selecting an alignment to render last uses all other alignments first then layers the selected alignment over the others.
- Use Vertical Cogo** When checked, this option use the elevations from the Vertical COGO to correct the cross section elevations to match.
- Vertical Cogo Offset** Changes the Vertical COGO offset if it is based on a location other than the 0 horizontal location (centerline). For example, to use a vertical COGO that is offset 7 feet to the left of the centerline, you would enter "-7". A negative number offsets to the left and a positive number offsets to the right.
- Grade Point Offset** Changes the vertical COGO offset if the cross sections are at subgrade, but the vertical COGO is at finished grade. Enter the depth of the section at the centerline to create a section at subgrade for the alignment.
- Enable Rendering** When checked, this option renders the specified alignment and over-writes any previous rendering of that alignment with the new options. If unchecked, the alignment is not rendered and any previous rendering of the alignment remains in the 3D model.

Index

Symbols	I
<i>no entries</i>	Import 2-9
A	Importing COGO 1-38
Add Alignment..... 2-14	Insert Stop/Start 2-19
Alignment 2-20	Insert/Delete Borrow/Spoil 2-19
Arc Coordinates 2-16	J
B	<i>no entries</i>
Borrow/Spoil..... 1-35, 2-19	K
Break Highway..... 2-17	Keyboard Equivalents..... 2-5
Buttons..... 2-1	L
C	Layer Replacement 2-20
Calc Volume 2-16	M
Changing Modes 2-5	Mass Haul Diagram 1-26
Check Boxes 2-1	Multiple Alignments..... 1-44
COGO..... 1-14	N
COGO Modes 2-3	New Job 2-8
Compaction..... 1-34	O
Creating Models 1-41	Open Job 2-8
Cross Section Sectional Entry 1-12	P
Cross Sections..... 2-6, 2-13	Print Page 1-30
Cursor 1-2, 2-1	Protection Key Installation 1-3
Curve Segments..... 2-11	Pull Down Menus 2-1
D	Q
Delete Alignment..... 2-15	<i>no entries</i>
Deleting COGO 1-25	R
E	Raise/Lower..... 2-15
Edit Menu 2-9	Reference Points 1-8
Entering	Render Last 2-20
Horizontal COGO..... 1-17	Reports..... 1-26
Export	Rescale Tablet 1-3
Highway from Earthwork..... 1-53	S
F	Sectionals 1-12
File Menu 2-8	Send to Highway 1-52
G	Spirals 2-11
Grade Point Offset..... 2-20	Stage Design 1-46
H	Starting Volumes 1-36
Horizontal COGO..... 1-17, 2-5, 2-10	
Horizontal COGO Worksheet..... 1-16	

Station Equations	1-15, 2-9
Station Generator	1-54
Station Labels	2-16
Station List Interface	2-4
Station North/East	2-17
Stop/Start	2-19
Stopping Volumes	1-36
Straight Segments	2-10
Surfacing	2-20

T

Tool Bars	2-7
Translate Stations	2-18

U

Use Vertical COGO	2-20
Utility Menu	2-16
Utility Tool Bar	2-7

V

Vehicle Speed	1-43
Vertical COGO	1-22, 2-12
Vertical COGO Offset	2-20
Vertical COGO Worksheet	1-21
Volumes	1-33
Volumes Report	1-31, 2-6

W

no entries

X

no entries

Y

no entries

Z

no entries
