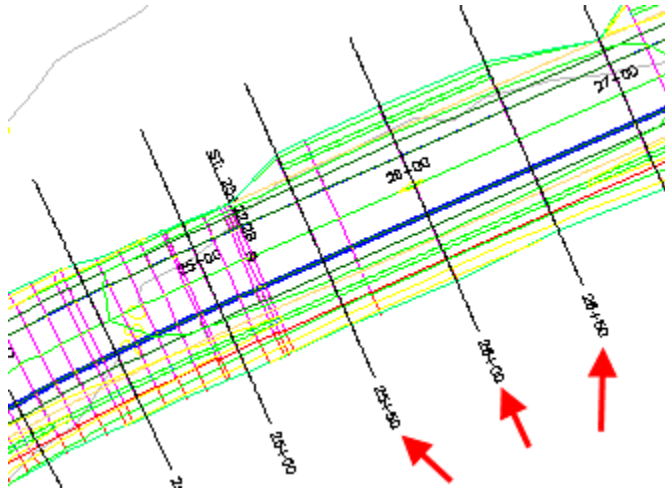# Cross Sections and Quantities

Overview

In this lesson, you work with cross sections, sample lines, corridor quantities, and quantity reports. Cross-section views are inserted at sample line locations along the alignment and illustrate the materials to be used at that particular location. Section views display surface, corridor surface, corridor, pipe network, and material section data at the sample line locations. Section data in the section views is automatically updated when the corridor recalculates or section data changes. A section view is shown in the following illustration.
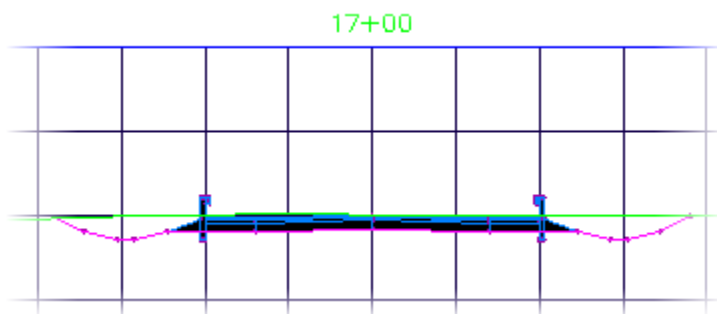
Sample lines are required to calculate quantities and to create section views that display section data. Sample lines are attached to an alignment, as shown in the following illustration.

Earth cut and fill, and pavement structure quantities, are calculated from data associated with cross sections at the sample lines in order to estimate the amount of earth to be moved and the required materials for construction. Earth cut and fill volumes are calculated by comparing the corridor datum surface section data with the existing ground surface section data. Pavement and base material volumes necessary to construct the roadway are calculated directly from the corridor section data.

The following illustration shows a material list for corridor quantities. The material list is assigned to a sample line group.

Quantity reports are created from a sample line group and can be inserted in a drawing as a table, or extracted to an external file. After a quantity report is created, if the corridor model

changes, the section data attached to the sample lines also updates. When the section data attached to the sample lines updates, the quantity table in the drawing also updates. This makes it very easy to quickly analyze quantities and adjust corridor models to balance earth cut and fill volumes.

The following illustration shows a portion of a quantity report in a table in a drawing area.

Station	Fill Area	Cut Area	Fill Volume	Cut Volume	Cumulative Fill Vol	Cumulative Cut Vol
22+00.00	22.49	132.73	31.34	325.98	125.78	3360.02
22+50.00	44.54	84.68	74.13	219.93	199.91	3579.96
23+00.00	89.36	54.86	147.60	140.70	347.50	3720.66
23+50.00	173.73	11.25	288.62	66.40	636.13	3787.06
24+00.00	196.97	0.00	402.83	11.36	1038.96	3798.41
24+50.00	190.12	0.00	416.84	0.00	1455.80	3798.41
25+00.00	100.86	17.09	311.71	17.90	1767.51	3816.31
25+50.00	46.68	38.46	157.09	59.15	1924.61	3875.46
26+00.00	14.99	60.49	65.66	105.36	1990.27	3980.83
26+50.00	1.18	95.42	17.22	166.02	2007.49	4146.85

Total Volume Table

Objectives

After completing this lesson, you will be able to:

- Describe sample lines and how they are used in cross sections.

- Create and edit sample lines.

- Modify the sample line group properties and add additional section data.

- Describe criteria used in quantity takeoff calculations.

- Calculate the earth cut and fill and pavement structure quantities for a corridor model.

- Create quantity reports that display quantity calculations.

- Create a quantity report in a table and a quantity report in a web browser.

- Create section views from sample lines.

- Create multiple section views.

Exercises

The following exercises are provided in a step by step format in this lesson:

1. Create and Edit Sample Lines
2. Modify Sample Line Group Properties
3. Calculate Corridor Quantities
4. Create Quantity Reports
5. Create Multiple Section Views

About Sample Lines

Sample lines are linear objects with a specific width that are used to cut sections at a specified interval along an alignment. Sample lines are created along the corridor baseline and are used to:

- Calculate earth cut/fill and pavement structure corridor quantities.
- Create section views.

Sample lines are created for an alignment and extract section data for surfaces, corridors, and pipe networks. They represent the locations where section data is generated.

Sample Line Groups

Sample lines are organized in sample line groups. Sample line groups contain the following elements:

- Sample line data.
- Section data.
- Section view groups.
- Mass haul lines and views.

You can perform the following tasks when you modify the properties of a sample line group:

- Edit the swath width and change the labels assigned to the sample lines.
- Add or remove section data from the sample lines.
- Modify properties of the section views.
- Modify the material list.

The last two functions are applicable only after you create section views and calculate the quantities for the corridor. The following illustration shows a single sample line placed on an alignment. The name SL-1 was generated automatically.
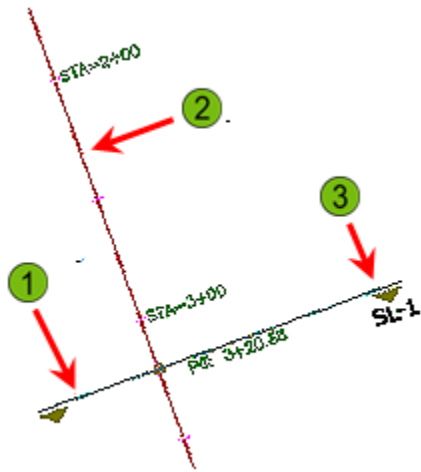
①   Sample line

②   Alignment

③   Sample line label

Sample Line Parameters

To create sample lines, you specify the data source and location parameters. The section data you attach to the sample lines is used to calculate quantities and can be displayed on section views. You can attach the following types of section data to sample lines:

Data source	Description
Surface Section Data	Existing ground or other surface data used for calculating earthworks volumes and displaying in section views.
Corridor Surface Section Data	A corridor datum surface that can be used for volume calculations and optionally displayed in section views.
Corridor Section Data	Use for calculating pavement structure quantities and for displaying in section views.
Pipe Network Section Data	Use for displaying pipe networks in section views.
Material Section Data	Created after volumes have been calculated and used to show material areas in section views.

Location

You create sample lines by specifying a range of stations and the width of the swath to the left and the right of the alignment. When you create sample lines, you can specify their location using the following methods.

| Location	Description
From corridor stations	Sample lines created at the locations where the assembly was inserted to create the corridor.
By range of stations	User-specified sample line increment, independent of the corridor assembly insertion frequency.
At a station	User-specified individual stations, such as driveways, entrances, and BC and EC of intersection curb returns.
Pick points on screen	Create skewed sample lines or multivertex sample lines.

Creating Sample Lines

You create sample lines to:

- Create design cross sections at intervals along an alignment.

- Calculate corridor earth cut and fill and pavement structure quantities.

To create sample lines, you first select an alignment. You then specify the data that is to be attached to the sample lines. You select the section data to attach to the sample lines based on data required for quantity calculations, and data you want to view in the section view objects. The next step is to determine where the sample lines are created along the alignment. Finally, you specify the width of the sample lines. The sample line width can either be a fixed value or can be determined from another alignment.

Moving Sample Lines

You can edit the locations of sample lines in plan view by using grips. The sample line grips are shown in the following illustration.
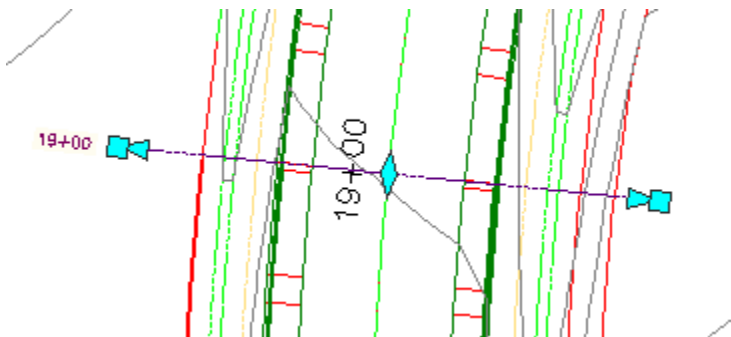
The grips are summarized as follows:

- Diamond grip repositions the sample line along the alignment.

- Triangle grips change the length (swath width) of the sample line.

- Square grips change the length and skew angle of the sample line.

When you change the location of a sample line, the data attached to the sample line is updated based on the new location. Quantities tables in the drawing and cross-section views also automatically update.

About Quantity Takeoff Criteria

Quantity takeoff criteria indicate precisely how the quantities are to be calculated. Quantity takeoff criteria are defined in the drawing template and can be modified to suit specific project requirements. You can specify the name of the material, the data used to calculate the material quantity, the condition, and the quantity type. For earth cut and fill quantities, you can also specify cut factors, fill factors, and refill factors.
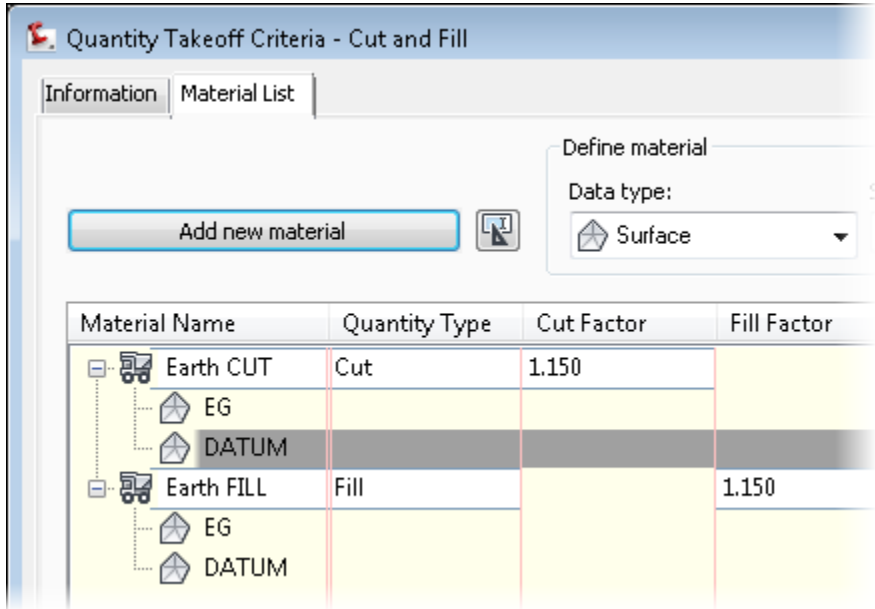
When you create quantity takeoff criteria, you specify the following information:

Item	Description
Material name	Name of the material to appear in the report.
Data type	Surface or pavement structure.
Condition	Above or below.
Quantity type	Cut, fill, cut and refill, earthworks, structures.
Cut factor	Earth cut material expansion factor.
Fill factor	Earth fill material compaction factor.
Refill factor	Percentage of earth cut material that is suitable for engineering fill material.
Shape style	Controls the display of the material in the cross section views.

Cut and Fill Factors

The cut factor is also referred to as an expansion factor. If you measure 100 cubic yards of excavation, then you actually excavate 115 (1.15 factor) cubic yards because the material expands after excavating. Conversely, a fill factor is also known as a compaction factor. If you measure 100 cubic yards of fill, you actually require 115 (1.15 factor) cubic yards of material because of compaction. The refill factor is the percentage of cut material suitable for engineering fill material.

The following illustration shows examples of quantity takeoff criteria used to calculate earth cut and fill quantities.

Calculating Corridor Quantities

To calculate corridor quantities, you first create quantity takeoff criteria. After you create the quantity takeoff criteria, you then compute the material volumes. Earth cut and fill volumes are calculated using the existing ground and corridor surface section data attached to sample lines. Pavement structure volumes are calculated using the corridor section data attached to sample lines.

Quantity takeoff criteria is created in your company/client drawing template, and can be used to calculate the quantities for most projects. You can also create new quantity takeoff criteria in the current drawing for projects that have unique quantity calculation requirements.

Quantity takeoff criteria for pavement structure is shown in the following illustration.
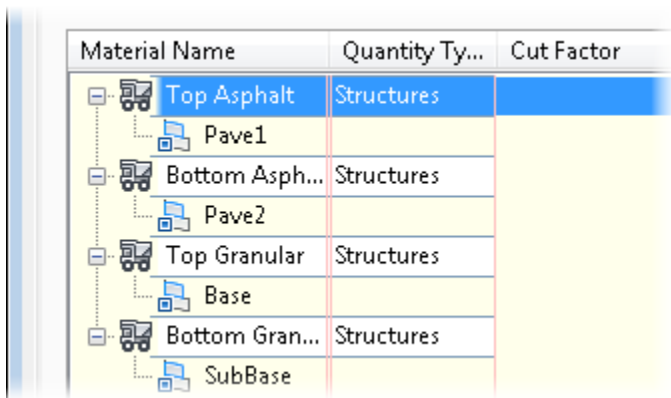
After you create or review the quantity takeoff criteria, you then compute the material quantities as a single step.

When you compute the material quantities, a material list is attached to the sample line group. This is shown in the following illustration. When the corridor model changes, the material list, and hence the volumes, automatically update.

Keep the following guidelines in mind when calculating corridor quantities:

- A common practice is to create individual quantity takeoff criteria that can be used for earth cut/fill volumes and for pavement structure volumes. This simplifies and organizes the reporting process.

- When you compute materials, no quantities are displayed. To view the quantities, you must generate a report.

About Quantity Reports

Quantity reports form the basis for construction contracts. For earth cut and fill quantity reports, an existing surface is compared to a corridor datum surface (which represents the subgrade of the corridor model), and the results are broken down by station in a report. Quantity reports display the total volume of material required to create a finished grade surface. The values displayed include area and volume for both cut and fill, or other specified criteria. There are default criteria and table styles for this kind of report.

Quantity reports are either static or dynamic. Dynamic quantity reports are created in the drawing area as quantity tables. Dynamic quantity reports are useful when you need to achieve a quantity balance, or generate a material excess or deficit. Static quantity reports are generated in a web browser. The format of the quantity report is controlled with a style sheet.

A portion of a static quantity report generated in a web browser is shown in the following illustration.
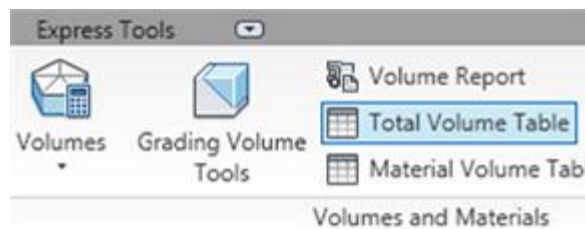
	Area Type	Area	Inc.Vol.	Cum.Vol.	MassHaul
		Sq.ft.	Cu.yd.	Cu.yd.	Cu.yd.
Station: 17+00.000					
	Adjusted Cut	141.33	227.16	303.82	
	Adjusted Usable	141.33	197.53	264.19	
	Adjusted Fill	0.00	0.00	0.00	
					303.82
Station: 17+50.000					
	Adjusted Cut	140.23	299.81	603.63	
	Adjusted Usable	140.23	260.71	524.90	
	Adjusted Fill	0.00	0.00	0.00	
					603.63

Creating Quantity Reports

You create quantity reports after the material quantities are calculated. You can create quantity reports in a web browser or as a table in the drawing. To generate quantity takeoff, you set criteria, associate surfaces with criteria, calculate volumes, and generate reports.

The following steps outline the process for generating a volume table.

1. Execute the appropriate command from the ribbon.

   - Total Volume Table creates a table in the drawing.

   - Volume Report creates a table in a web browser.

2. Pick a location in the drawing to create the table.

   - Select the material list.

   - Create the table.

Quantity reports are created for sample lines in a sample line group. You must create multiple sample line groups when cross sections change significantly (rural to urban and vice versa, either side of bridge abutments, and so on).

About Section Views

Section views are the grid objects that display section data. Section views are dynamic, and are updated automatically if the geometry or location of the sample lines change. The section view style controls the display of the section view. After you create sample lines, you create section views to show section data at the sample line locations.

The following illustration shows a section view with corridor section data, existing ground surface section data, and material section data.
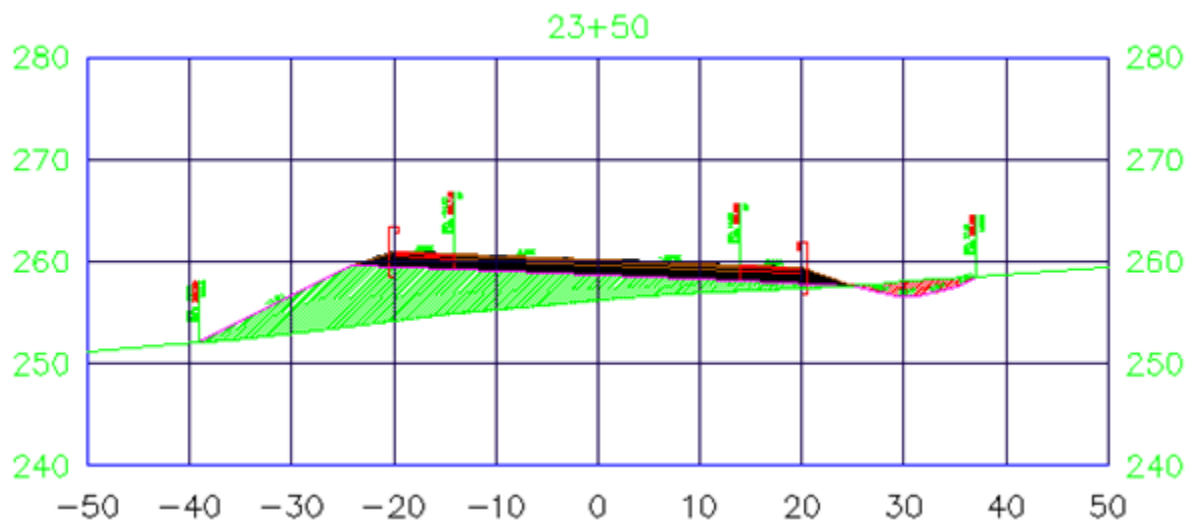

Section View Style and Groups

A section view style controls the display of section views. The section data that you display in a section view originates from the sample lines in the sample line group. Section views are organized in a section view group, which is shown as a collection under the sample line group in Prospector. You can modify the properties of a section view group to:

- Change the group plot style.

- Change the style assigned to section views.

- Change the volume tables attached to section views.

- Show profile grade lines for other alignments and profiles in section views.

The following illustration shows a section view created using a sample line extending 100 feet in each direction from the alignment centerline. The top label identifies the station where the sample line intersects the alignment. The section line has labels showing the offset and elevation values at 10 foot intervals. A data band marking the offset distance is included at the bottom of the graph.
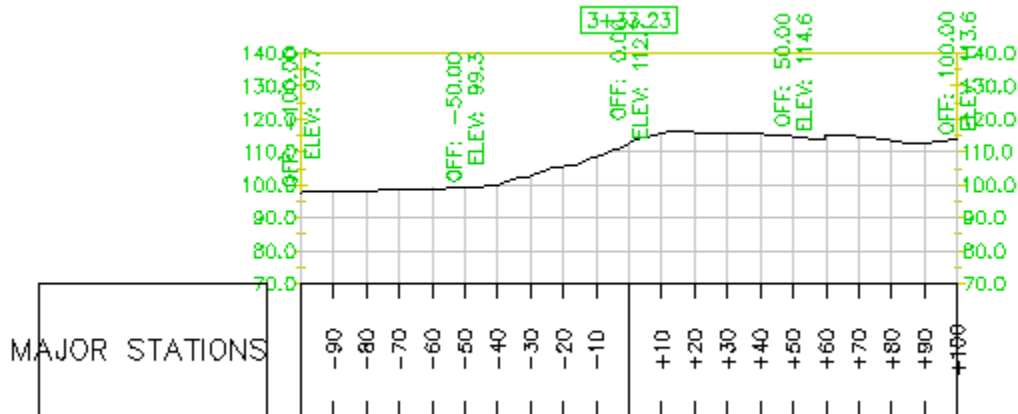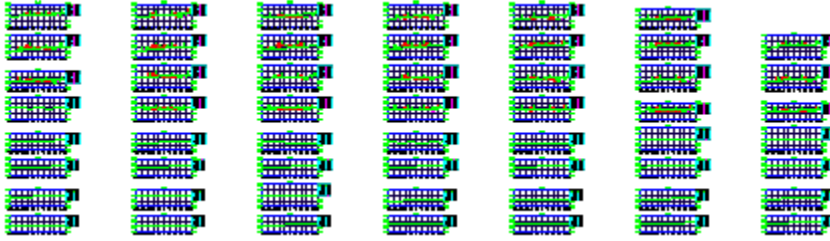

Creating Section Views

After you create sample lines, you can either create a single or multiple section views. To create multiple section views, select Sections - Create Multiple Section Views from the menu. When you create multiple section views, you specify the following in the Create Multiple Section View wizard:

- Alignment and sample line group.

- Station range for section views to create.

- Section view style.

- Group plot style.

- Offset and elevation ranges.

- The section data and associated styles to view in the section views.

- Material table details and placement relative to the section views.

The section views are then plotted in the drawing.

Section views are shown in the following illustration:

To erase section views, you delete the section view group in Prospector.

Key Terms

Code Set Style	Used to control the display of points, links, and shapes in an assembly, corridor, or corridor section data that is displayed in a section view. Can also be used to annotate corridor section data in section views and when you view/edit corridor sections.
Construction Staking Data	Data extracted from a Civil 3D design that can be used in the field for construction staking and layout.
Corridor Section Data	Corridor data attached to sample lines in a sample line group and used for viewing the corridor in the section views and calculating pavement structure volumes.
Corridor Surface Section Data	Corridor surface data attached to sample lines in a sample line group and used for viewing corridor surfaces in the section views and calculating earthwork volumes.
Group Plot Style	Controls the orientation and placement of section views in a drawing.
Material List	Attached to a sample line group after material volumes have been calculated. The material list indicates those materials that have had their volumes calculated. You can have several material lists as part of a sample line group.
Material Section Data	Material data attached to sample lines in a sample line group used for reporting volumes and displaying in section views.
Pipe Section Data	Pipe data attached to sample lines in a sample line group used for displaying pipe network data in section views.
Quantity Takeoff Criteria	Quantity takeoff criteria define the methods used to calculate cross-section quantities. For earthworks quantities, the criteria are based on a defined relationship between surfaces. Pavement structure quantities reference subassembly shapes in the criteria. Quantity takeoff criteria can be saved in a drawing template file (DWT).

Sample Line	Also known as cross-section lines. Lines created typically perpendicular to an alignment, with a specified width and at a specified interval along an alignment. Section data is attached to sample lines that can be used for viewing in section views and calculating quantities.
Sample Line Group	Sample lines are organized in a sample line group. The sample line group appears as a collection under the Alignments tree on the Prospector tab of the Toolspace window.
Section Data	Data attached to sample lines within a sample line group.
Section View	The "grid" that displays section data.

Exercise 1: Create and Edit Sample Lines

In this exercise, you create and edit sample lines.

The completed drawing is as shown.
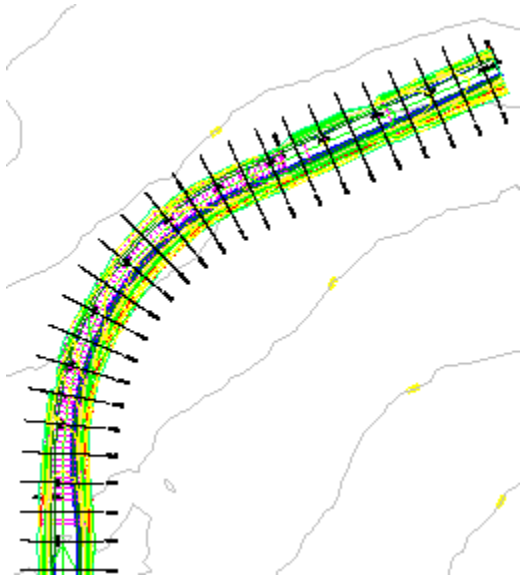
For this exercise, open
…\I_CrossSectionsandQuantities-EX1.dwg
(M_CrossSectionsandQuantities-EX1.dwg).

1. On the ribbon, Home tab, Profiles & Section Views panel, click Sample Lines.

2. When prompted to Select an Alignment, press ENTER.

3. In the Select Alignment dialog box, select 8th Avenue. Click OK.

4. In the Create Sample Line Group dialog box:

   ▪ Clear the 8th Avenue TOP check box.

   ▪ For 8th Avenue DATUM, select the row. Click in the Style column.

   ▪ In the Pick Section style dialog box, select Datum.

   ▪ Click OK twice.

5. On the Sample Line Tools toolbar, select By Range of Stations.
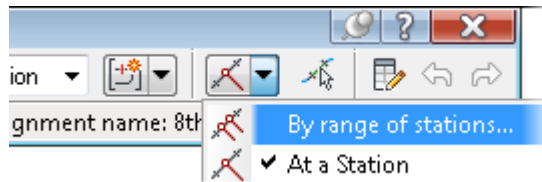
6. In the Create Sample Lines - By Station Range dialog box:

   ▪ Under Left Swath Width, for Width, enter **70'** (**25** m).

   ▪ Under Right Swath Width, for Width, enter **70'** (**25** m).

   ▪ Under Sampling Increments, for Increment Along Tangents, enter **50'** (**20** m).

   ▪ For Increment Along Curves, enter **50'** (**20** m).

   ▪ For Increment Along Spirals, enter **50'** (**20** m).

   ▪ Click OK.

7. Close the Sample Line Tools toolbar. The sample lines are created in the drawing area.
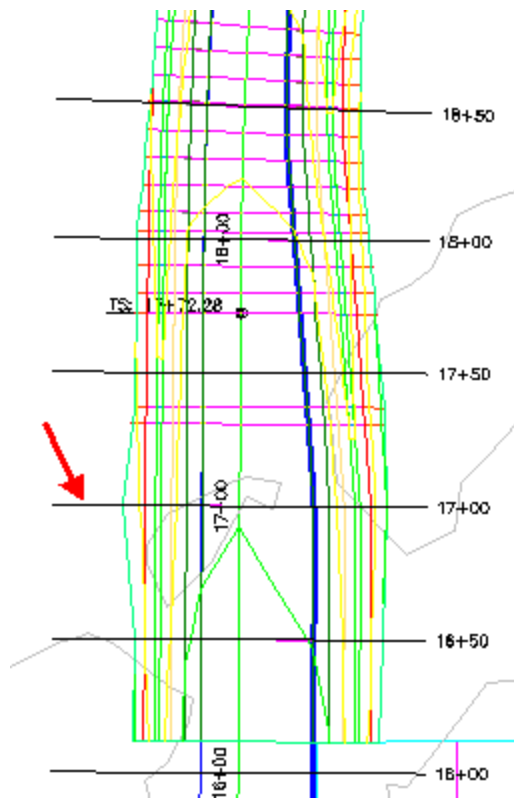
8. In Prospector:

   ▪ Expand Alignments, Centerline Alignments, 8th Avenue, Sample Line Groups, SL Collection - 1.
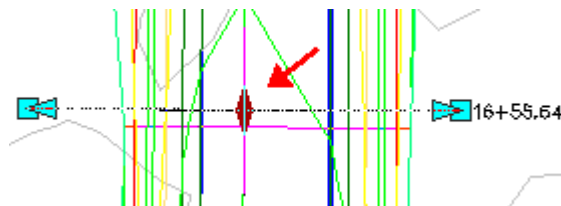
Notice that the sample line group can contain sample lines, sections, section view groups, mass haul lines, and mass haul views. Also notice that just the Sample Lines and Section collections are populated with data.
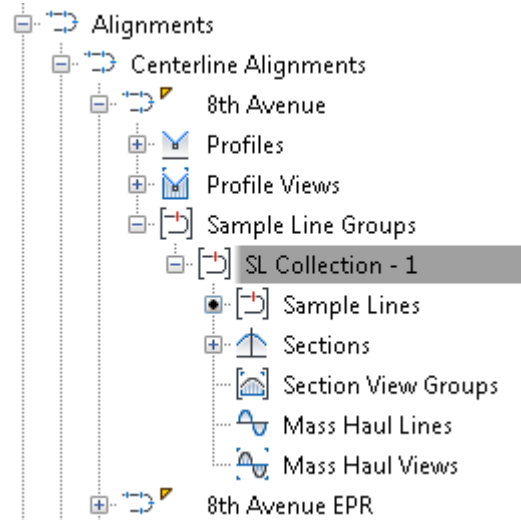
You can graphically modify the location of the sample lines.
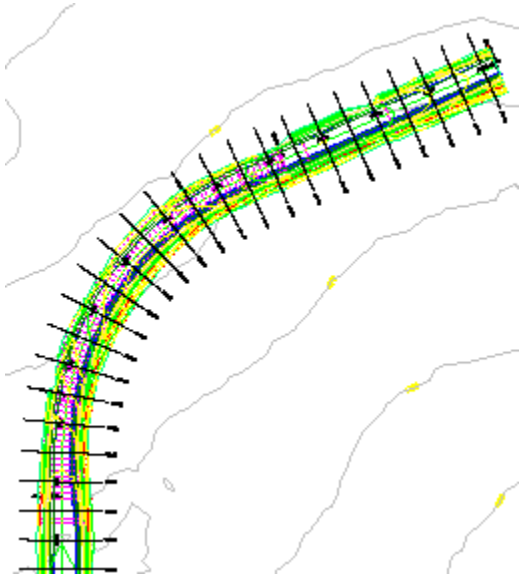
9. In the drawing area:

   ▪ Select any sample line.

   ▪ Click the diamond-shaped grip.

   ▪ Move your cursor along the alignment and click a new location.

The label on the sample line position changes and the sample line updates to reflect the new station location.
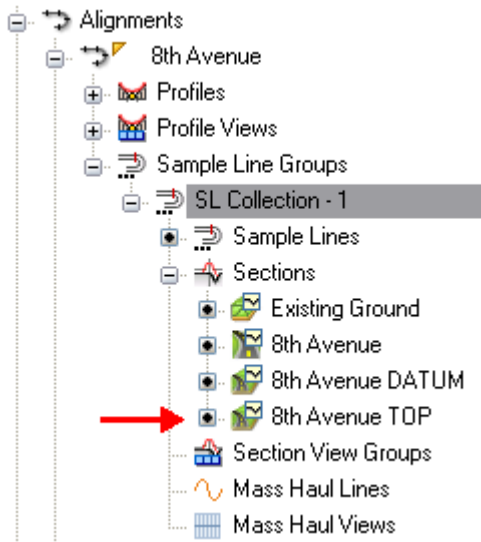
10. The completed exercise is as shown.

11. Close the drawing. Do not save the changes.

Exercise 2: Modify Sample Line Group Properties

In this exercise, you modify the sample line group properties and add additional section data.

The completed drawing is as shown.

For this exercise, open
…\I_CrossSectionsandQuantities-EX2.dwg
(M_CrossSectionsandQuantities-EX2.dwg).

1. In Prospector:

   ▪ Expand Alignments, Centerline Alignments, 8th Avenue, Sample Line Groups and SL Collection -1.

   ▪ Expand Sections.

   ▪ Note the Existing Ground surface, 8th Avenue corridor, and 8th Avenue DATUM corridor surface section data are attached to the sample lines. This data can be used for quantity calculation and displayed in the section views.

2. Right-click SL Collection - 1. Click Properties.

3. In the Sample Line Group Properties - SL Collection - 1 dialog box, click the Sample Lines tab.

Note that you can change the offsets and the labels for the sample lines.

4. Click the Sections tab and:

   ▪ Note the tools that enable you to add or remove section data to the sample lines. When you add section data to the sample lines, this data can be used for quantity calculations and displayed in the section views.

   ▪ Click Sample More Sources.

   ▪ On the left side of the Section Sources dialog box, click 8th Avenue TOP.

   ▪ Click Add to add the 8th Avenue TOP corridor surface to the sampled sources data list.

   ▪ For 8th Avenue TOP, change the Style to Finished Ground.

   ▪ Click OK twice.

The 8th Avenue TOP corridor surface is added to the sample lines with the Finished Ground style assigned.
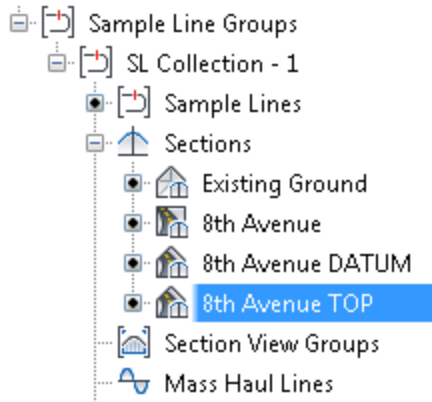

5. Click the Section Views tab. Click the Material List tab.

No data is displayed on these tabs. Section views have not been created and material quantities have not been computed.

6. Click OK to close the dialog box.

7. In Prospector, note that the section data
    has been updated to include the 8th
    Avenue TOP corridor surface section
    data.

You can also access sample line group
properties from the drawing area.

8. In the drawing area, select any sample
    line.

9. On the contextual ribbon, Modify panel,
    click Group Properties.

10. In the Sample Line Group Properties - SL
    Collection - 1 dialog box, review the
    settings. Click OK to close the dialog
    box.

11. Close the drawing. Do not save the
    changes.

Exercise 3: Calculate Corridor Quantities

In this exercise, you review the quantity takeoff criteria, and calculate the earth cut and fill and pavement structure quantities for a corridor model.

The completed drawing is as shown.

For this exercise, open
…\I_CrossSectionsandQuantities-EX3.dwg (M_CrossSectionsandQuantities-EX3.dwg).

1. In Toolspace, Settings tab:

    ▪ Expand Quantity Takeoff and Quantity Takeoff Criteria.

    ▪ Right-click Cut and Fill. Click Edit.

2. In the Quantity Takeoff Criteria - Cut and Fill dialog box, Material List tab:

    ▪ For Earth FILL, Fill Factor, enter **1.15**.

    ▪ For Earth CUT, Cut Factor, enter **1.15**.

    ▪ For Earth CUT, Refill Factor, enter **0.9**.

    ▪ Click OK.

Next, you review the quantity takeoff criteria for the pavement structure.

3. On the Settings tab, right-click Pavement Structure. Click Edit.

4. In the Quantity Takeoff Criteria - Pavement Structure dialog box, Material List tab:

    ▪ Expand the trees. Review the settings.

    ▪ Click OK.

Next, you compute the earth cut and fill volumes.

5. On the ribbon, Analyze tab, Volumes and Materials panel, click Compute Materials.

6. In the Select a Sample Line Group dialog box, verify that the 8th Avenue alignment and SL Collection – 1 sample line group are selected. Click OK.

The names of the Civil 3D objects required for quantity calculations do not match the names in the quantity takeoff criteria. Next, you assign the Civil 3D objects required for quantity calculation to the names in the criteria.

7. In the Compute Materials - SL Collection - 1 dialog box:

    ▪ For Quantity Takeoff Criteria, click Cut and Fill.

    ▪ For EG, click in the Object Name column where it says <Click here to set all>. Select Existing Ground from the list.

    ▪ For DATUM, click in the Object Name column where it says <Click here to set all>. Select 8th Avenue DATUM from the list.

- Click OK to compute the Earth Cut and Earth Fill materials.

Next, you compute the quantities for the pavement structure using the Pavement Structure quantity takeoff criteria.

8. On the ribbon, Analyze tab, Volumes and Materials panel, click Compute Materials.

9. In the Select a Sample Line Group dialog box, click OK.

10. In the Edit Material List dialog box, expand Material List - (1). Notice the Earth CUT and Earth FILL materials created for the sample line group.

Next, you use another criteria to compute quantities.

11. In the Edit Material List dialog box, click Import Another Criteria.

12. In the Select a Quantity Takeoff Criteria dialog box, select Pavement Structure. Click OK.

Next, you assign the object names in the drawing to the object names in the criteria.

13. In the Compute Materials - SL Collection - 1 dialog box:

- Under Corridor Shapes, For Pave1, click in the Object Name cell to select 8th Avenue Pave1.

- For Pave2, select 8th Avenue Pave2.

- For Base, select 8th Avenue Base.

- For SubBase, select 8th Avenue SubBase.

Standard names are assigned to subassembly shapes. For pavement structure, the convention is Pave 1, Pave 2, Base, and SubBase. The name in the criteria is a generic reference to the material name.

- Click OK to compute the materials.

Civil 3D computes the pavement structure quantities and creates a second material list.

Next, you rename the material lists.

14. In the Edit Material List - SL Collection - 1 dialog box:

- Rename Material List - (1) to **Earth Cut and Fill**.

- Rename Material List - (2) to **Pavement Structure**.

- Click OK.

Next, you review the Sample Line Group properties.

15. In the drawing area, select any sample line. Right-click, click Sample Line Group Properties.

16. In the Sample Line Group Properties - SL Collection - 1 dialog box, click the Sections tab.

Notice that material section data has been added to the Sections list. You can display the material section data in the section views.

17. On the Material List tab:

   ▪ Note that the material list is now attached to the sample line group.

   ▪ Scroll to the right and note the assignment of a shape style for the different materials.

   ▪ Click OK.

18. Close the drawing. Do not save the changes.

Exercise 4: Create and Edit Sample Lines

In this exercise, you create a quantity report in a table and a quantity report in a web browser.

The completed drawing is as shown.

Area Type	Area	Inc.	Cum.Vol
	Sq.ft.	Cu.yd	Cu.yd.
Top Asphalt	4.48	0.00	0.00
Bottom Asphalt	4.48	0.00	0.00
Top Granular	17.98	0.00	0.00
Bottom Granular	42.00	0.00	0.00
Top Asphalt	4.47	8.29	8.29
Bottom Asphalt	4.47	8.29	8.29
Top Granular	17.93	33.25	33.25
Bottom Granular	41.84	77.63	77.63

For this exercise, open …\I_CrossSectionsandQuantities-EX4.dwg (M_CrossSectionsandQuantities-EX4.dwg).

1. On the ribbon, Analyze tab, Volumes and Materials panel, click Total Volume Table.

2. In the Create Total Volume Table dialog box:

   - For Select Material List, select Earth CUT and FILL.

   - Review the remaining settings.

   - Click OK.

3. When prompted to Select Upper Left Corner, select a location in the drawing to create the table.

15+00.00	0.00	0.00	0.00
15+50.00	0.00	0.00	0.00
16+00.00	0.00	0.00	0.00
16+50.00	0.00	125.72	0.00
17+00.00	0.00	211.94	0.00
17+50.00	0.00	176.07	0.00
18+00.00	0.00	188.47	0.00

Notice that many of the values in the lower station ranges are 0. This is because sample lines were created beyond the limits of the corridor. Next, you delete the unnecessary sample lines.

4. In Prospector, expand Alignments, Centerline Alignments, 8th Avenue, Sample Line Groups, and SL Collection - 1. Click Sample Lines.

5. In the item view area of Prospector:

   - Press SHIFT+select row 2+00' (9+760) to row 16+00 (10+180).

   - With the stations selected, right-click. Click Delete.

6. In the confirmation dialog box, click Yes to confirm the deletion.

The sample lines are removed from the drawing and the table updates. Recall that the quantity table is dynamic.

Total Volume Table					
Station	Fil Area	Cut Area	Fil Volume	Cut Volume	Cumulativ
16+50.00	0.00	125.72	0.00	133.87	0.00
17+00.00	0.00	211.94	0.00	359.55	0.00
17+50.00	0.00	176.07	0.00	413.15	0.00
16+00.00	0.00	188.47	0.00	388.17	0.00
16+50.00	0.00	120.56	0.00	326.71	0.00
19+00.00	0.00	113.13	0.00	244.46	0.00
19+50.00	0.36	165.02	0.40	287.96	0.40
20+00.00	16.55	116.72	18.78	288.63	19.18
20+50.00	25.02	136.37	46.15	256.65	65.33
21+00.00	7.60	197.77	36.46	338.95	101.79
21+50.00	8.26	194.88	15.65	398.96	117.45
22+00.00	20.70	152.65	30.02	352.90	147.46

7. In Prospector:

   ▪ Collapse Alignments.

   ▪ Expand Corridors.

   ▪ Right-click 8th Avenue. Click Rebuild
     - Automatic.

8. On the command line, enter **VPORTS**.
   Press ENTER.

9. In the Viewports dialog box, click Two:
   Horizontal. Click OK.

10. Click in the top viewport.

11. In Prospector:

    ▪ Expand Alignments, Centerline
      Alignments, 8th Avenue, and Profile
      Views.

    ▪ Right-click 8th Avenue PV1. Click
      Zoom To.

12. Click in the bottom viewport. Zoom in to
    the last few rows and columns of the
    table.

Table

ne	Cumulative Fill Vol	Cumulative Cut Vol
	839.61	6006.97
	841.12	6321.79
	841.81	6697.05
	642.33	7156.60
	642.33	7656.07
	642.33	8142.08

13. In the top viewport:

    ▪ Select the layout profile.

    ▪ Select a PVI near the end of the
      profile view on the right (this is
      where the corridor is calculated).

    ▪ Move the cursor to a new location
      nearby and click.

The corridor rebuilds, and the quantity
table automatically updates.

Table

ne	Cumulative Fill Vol	Cumulative Cut Vol
	1100.47	4965.55
	1210.53	5046.10
	1296.52	5161.47
	1331.84	5403.77
	1335.40	5717.42
	1336.68	6110.89

Next, you create a static (nonreactive)
report in a web browser.

14. On the command line, enter **VPORTS**.
    Press ENTER.

15. In the Viewports dialog box, select
    Single. Click OK.

16. On the ribbon, Analyze tab, Volumes
    and Materials panel, click Volume
    Report.

17. In the Report Quantities dialog box:

    ▪ For Select Materials List, select
      Pavement Structure.

    ▪ For Select a Style Sheet, select File
      Folder.

    ▪ Click *Select Material.xsl*. Click Open.

    ▪ Click OK.

A web browser is launched.

18. If you are using Internet Explorer, click
   Yes.

A portion of the report is shown.

Area Type	Area	Inc.	Cum.Vol
	Sq.ft.	Cu.yd	Cu.yd.
Top Asphalt	4.48	0.00	0.00
Bottom Asphalt	4.48	0.00	0.00
Top Granular	17.98	0.00	0.00
Bottom Granular	42.00	0.00	0.00
Top Asphalt	4.47	8.29	8.29
Bottom Asphalt	4.47	8.29	8.29
Top Granular	17.93	33.25	33.25
Bottom Granular	41.84	77.63	77.63

19. Close the drawing. Do not save the changes.

Exercise 5: Create Multiple Section Views

In this exercise, you create multiple section views.

The completed drawing is as shown.
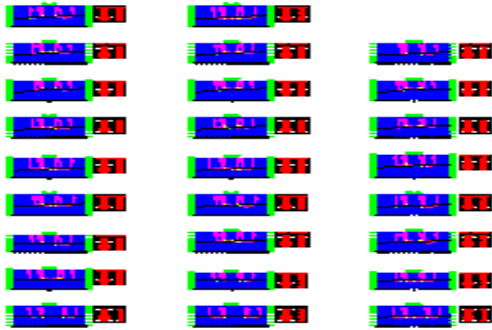
For this exercise, open
…\I_CrossSectionsandQuantities-EX5.dwg
(M_CrossSectionsandQuantities-EX5.dwg).

1. On the ribbon, Home tab, Profile and Section Views panel, click Section Views > Create Multiple Views.

2. In the Create Multiple Section Views wizard, General page, review all the settings. Click Next.

3. On the Offset Range page, review the settings. Click Next.

4. On the Elevation Range page, review the settings. Click Next.

5. On the Section Display Options page:

   ▪ Clear the following check boxes: Top Asphalt, Bottom Asphalt, Top Granular, and Bottom Granular.
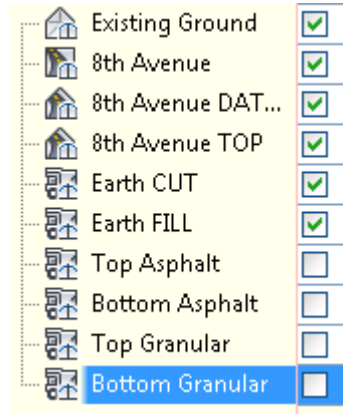

   ▪ Click Next.

6. On the Data Bands page, review the settings. Click Next.

7. On the Section View Tables page:

   ▪ For Type, select Total Volume.

   ▪ For Select Table Style, select Standard.

   ▪ Click Add.

   ▪ For X Offset, enter **0.5"** (**15 mm**).

   ▪ Click Create Section Views.

8. When prompted to Identify Section View Origin, select a location in the drawing above the 8th Avenue Profile View and click.
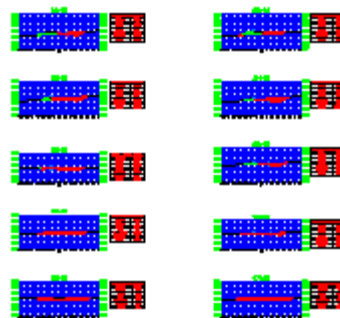
9. In Prospector, expand Alignments, Centerline Alignments, 8th Avenue, Sample Line Groups, SL Collection - 1, and Section View Groups. Click Section View Group - 1.

The section views are displayed in the Item View area.

10. In the Item View area, right-click 23+50.00 (10+420). Click Zoom To. The drawing area navigates to section view. Notice the cut and fill shapes.
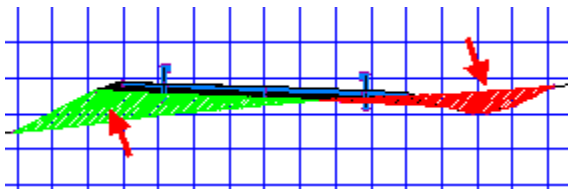

Next, you change the annotation on the cross sections. This is controlled with a code set style.

11. In Prospector:

   ▪ Expand Alignments, Centerline Alignments, 8th Avenue, Sample Line Groups, and SL Collection -1.

   ▪ Right-click SL Collection - 1. Click Properties.

12. In the Sample Line Group Properties - SL Collection - 1 dialog box, Sections tab:

   ▪ For 8th Avenue, click in the Style column.

   ▪ In the Code Set Style dialog box, select Codes with Labels.

   ▪ Click OK to close both dialog boxes.

Slope labels are applied to the corridor surface, and elevation and offset labels are applied to the corridor section points.
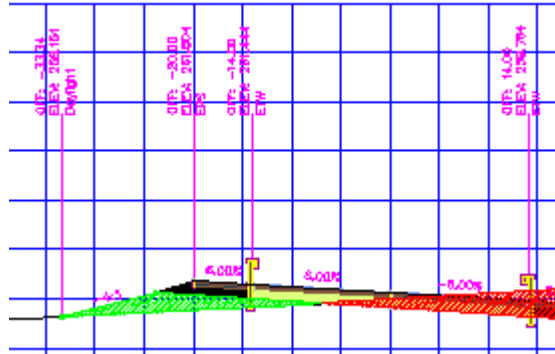
13. The multiple section views appear as follows:
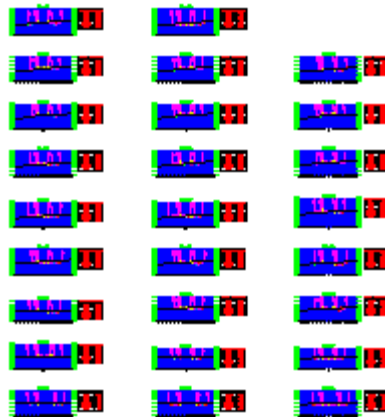
14. Close the drawing. Do not save the changes.

Assessment

Challenge Exercise

Instructors provide a master or challenge exercise for students to do based on this lesson.

Questions

1. What is a sample line?
2. How can you set the location of the sample lines?
3. What is section data?
4. What are the types of section data that can be attached to sample lines?
5. What controls the placement and orientation of section views?
6. When is a material list generated?
7. What is quantity takeoff criteria?
8. What object is used to display section data?

Answers

1. A sample line is also known as a cross-section line and indicates the location where a cross-section view will be created. The sample line is part of the sample line group created along an alignment. Section data is attached to sample lines and the data is displayed in section views and used for quantity calculations.

2. You can specify the location of sample lines by manually selecting locations, selecting existing lines/polylines, using Corridor Assembly insertion locations, or by specifying an interval.

3. Section data is attached to sample lines in a sample line group and is displayed in section views and used for quantity calculation. You can attach surface, corridor, corridor surface, material, and pipe network section data to sample lines.

4. You can attach surface, corridor surface, corridor, material, and pipe network section data to sample lines.

5. In Prospector Settings, click Section Views to find the group plot styles that control the placement and orientation of section views.

6. The material list is generated when volumes are computed. The material list becomes part of the sample line group.

7. Quantity takeoff criteria define the method used to calculate quantities.

8. The Section View object displays the section data. The display of the section view is controlled with a Section View style.

Lesson Summary

In this lesson, you learned how to generate roadway cross sections and calculate quantities. In order to perform these tasks, the first step was to create sample lines. Data required for display in section views and for calculating quantities was attached to the sample lines as section data. Sample lines with a defined width were generated at specific intervals along a horizontal alignment and were organized in a sample line group.

The next step was to calculate the volumes. The quantity takeoff criteria were reviewed and modified. Volumes were then calculated and attached as material lists to the sample line group. Reports for the volumes were generated in Internet Explorer and in the drawing as tables.

Section views were then created to display the section data that was attached to the sample lines. Section views were oriented and placed in the drawing with a group plot style.