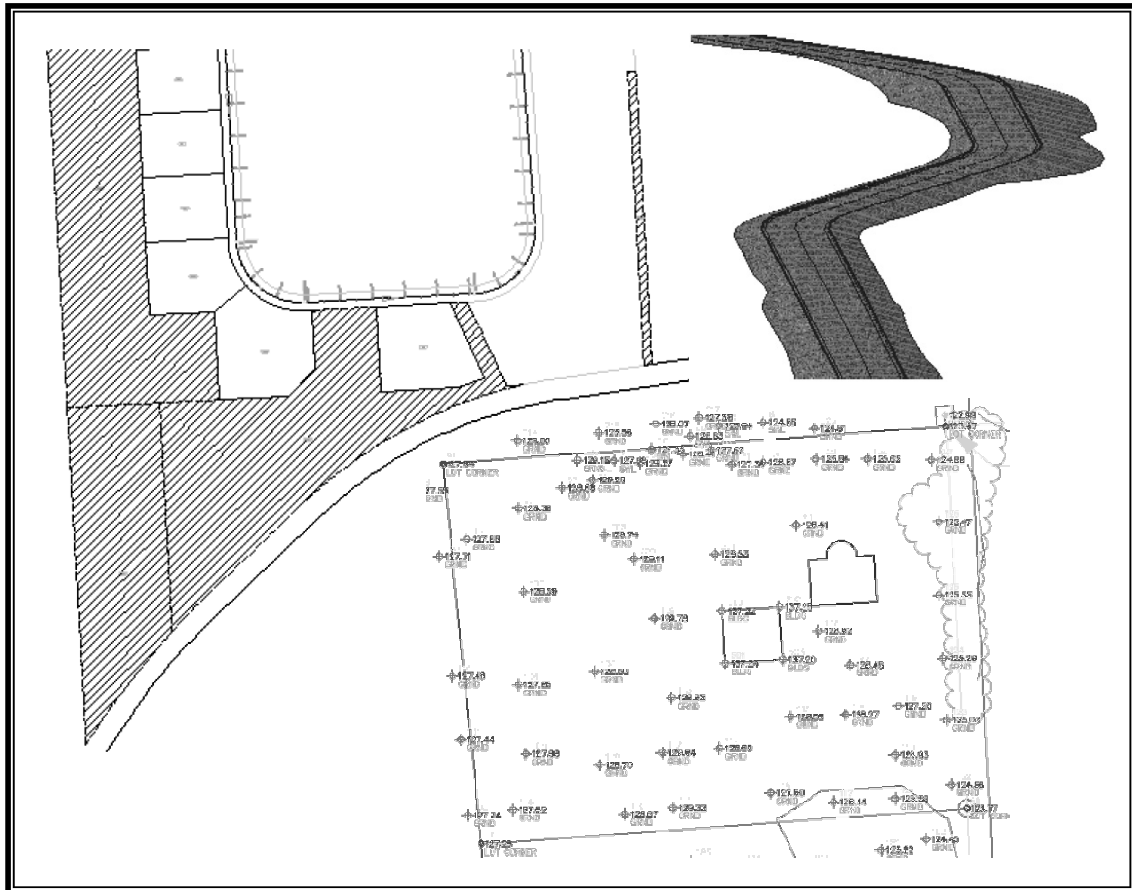


AutoCAD Civil 3D 2009 ESSENTIALS



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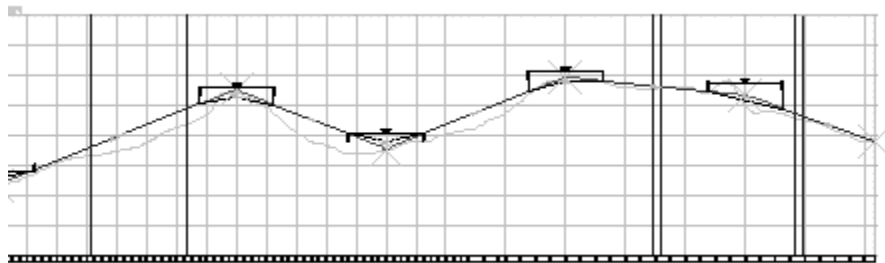
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Section 2: Profiles

In this section you learn how to:

- Create and manage Profile Views
- Create a Profile from a surface and by layout
- Work with Profile Transparent Commands
- Display existing and proposed Elevations correctly in Profile Bands

Profiles Overview



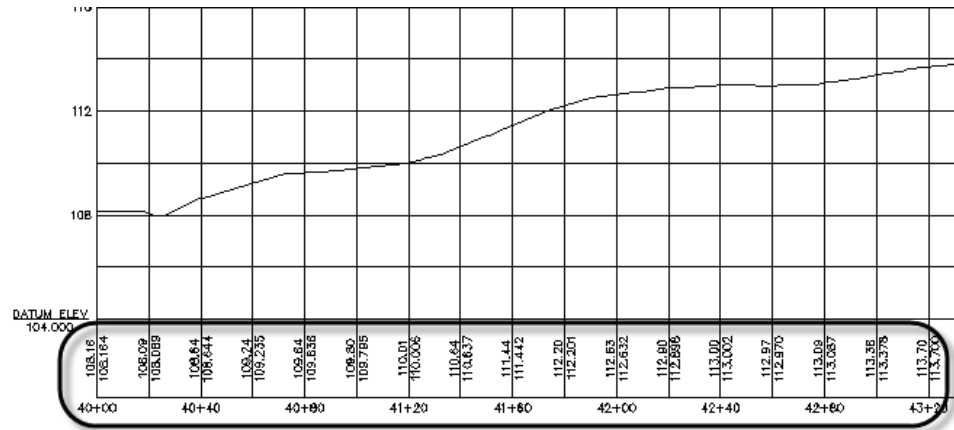
A profile is the second plane of a roadway design. It is a view of the alignment from one side of the centerline showing elevations along the alignment. An AutoCAD Civil 3D profile is a combination of a *profile view* and any number of *profiles* displayed in the view.

- A *profile view* consists of a profile grid and its annotation. The view's vertical lines represent alignment stationing and the horizontal lines represent elevations.
- A *profile* represents a surface or roadway vertical design. A typical road design profile view contains two profiles: the existing ground and a proposed vertical design. The existing ground profile represents elevations along the path of the alignment, usually from a sampled surface. The proposed vertical defines elevations along the path of the proposed roadway. You can have any number of existing and proposed vertical alignments displayed in the same profile view at the same time.

AutoCAD Civil 3D Profiles are managed by:

- **Profile View Properties:** Settings specific to individual profiles, such as datum elevation and maximum height.
- **Profile View Styles:** Affect how the grid and its annotation are displayed.
- **Profile Styles:** Control how the profile linework is displayed.

- Bands:** Control optional, additional annotation that can be displayed across the top or bottom of a profile view. Bands are grouped into Band Sets to make it easier to apply multiple, related bands at once. An example of a profile band is the elevation and station data shown in the profile below.

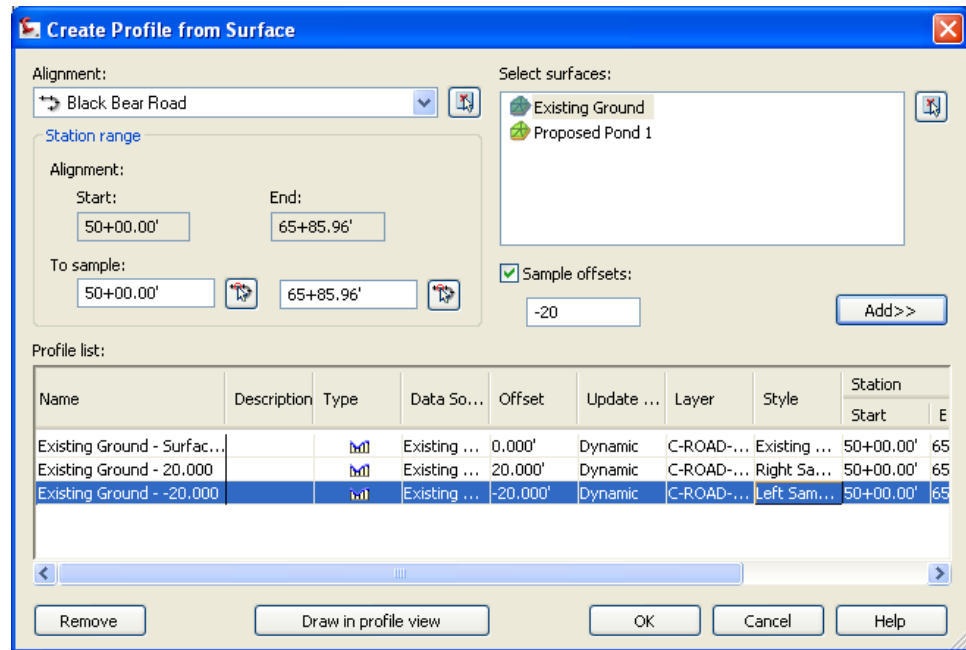


Repositioning and Deleting Profile Views

AutoCAD Civil 3D Profile Views are safe to reposition as needed with the AutoCAD **Move** command, and copy with the AutoCAD **Copy** command. They can also be erased with the AutoCAD **Erase** command. Erasing a profile view also erases the profiles inside it if there are no other views showing that profile.

Create Profiles from Surface

Most profile views display at least one profile based on a surface, such as from an existing ground terrain model. To do so select **Profiles>Create Profiles from Surface**. In the Create Profile from Surface dialog box select the desired Alignment and Surface (or Surfaces if you want to sample more than one). Then enter a desired station range. Click the **Add** button to sample each surface based on these settings.



The above creates a profile along the alignment itself. If you want to sample at an offset from the alignment, select the **Sample Offsets** checkbox and enter an offset value (negative for left), and click the **Add** button. You can sample multiple offsets by entering values one at a time and clicking the **Add** button after each.

There are two ways to exit this dialog box (other than the **Cancel** button):

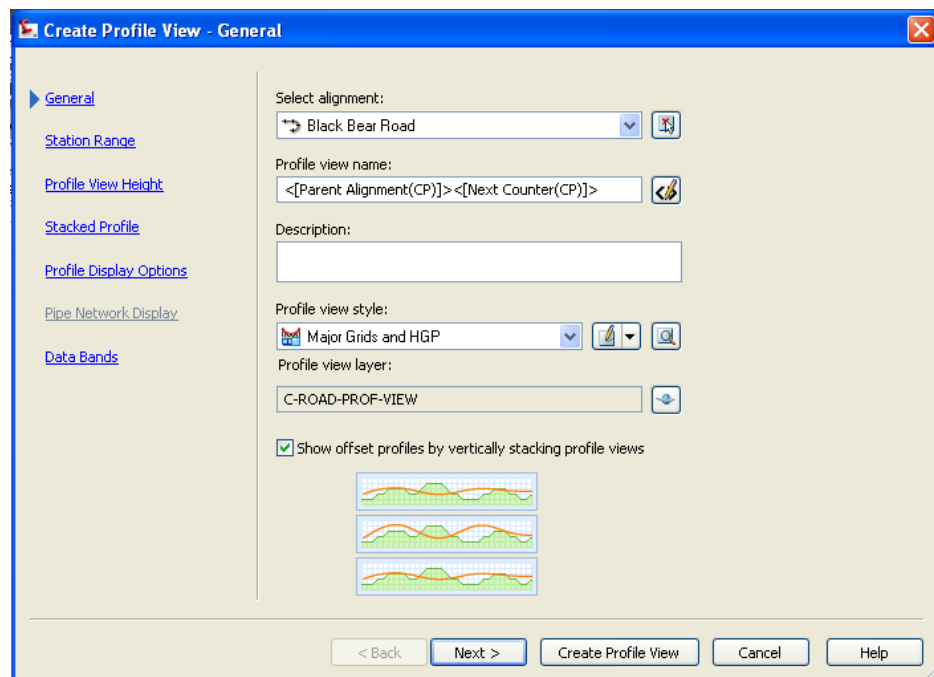
- If you do not have a profile view of this alignment in the drawing click the **Draw in Profile View** button. This launches the Create Profile View dialog box.
- If you already have a profile view of this alignment click **OK** and any new profiles are added to the existing view. If you clicked **OK** accidentally without having a view in which to display the profile, select **Profiles>Create Profile View**.

Create Profile View Wizard

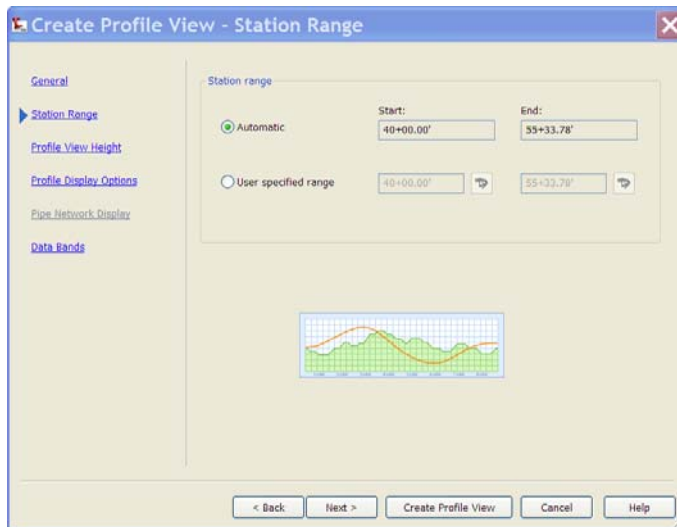
You can create a profile view at any time using the **Profiles>Create Profile View** command. Clicking the **Draw in Profile View** button in the Create Profile from Surface dialog box takes you to the same wizard. All of the settings selected in the wizard can be reassigned later through Profile View Properties (except for the alignment they are based on).

The General window in the Create Profile View Wizard enables you to select the alignment you want to work with and assign the profile view a name, description, view style, and layer. The **Show offset profiles by vertically stacking profile views** checkbox option enables you to display offset profiles in the same view as the centerline profile without overlapping.

NEW IN 2009!



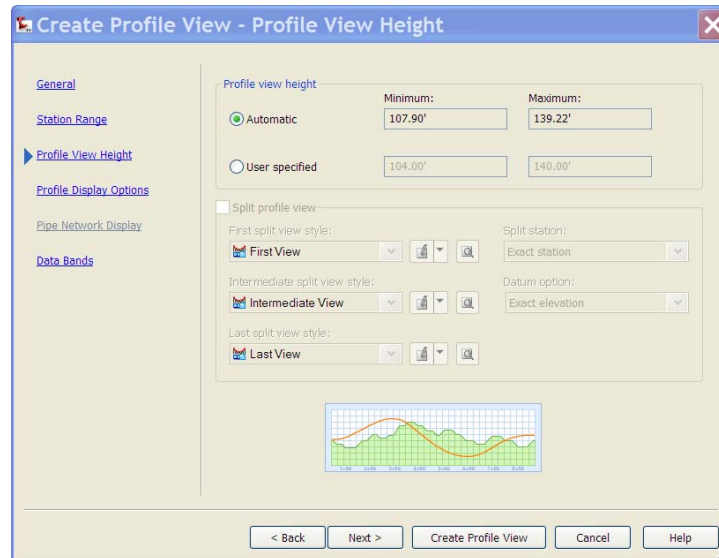
The *Station Range* second window enables you to select the station range you want to work with. Automatic includes the entire alignment's length.



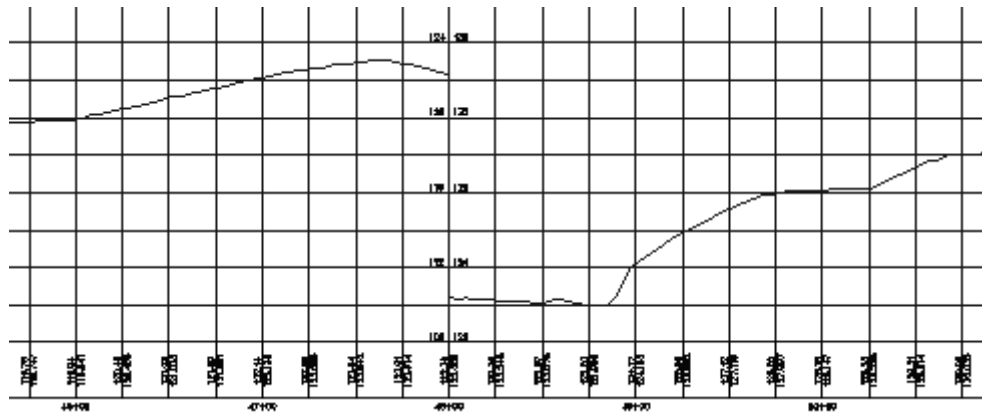
The *Profile View Height* window enables you to select the desired height of the profile grid.

- The **Automatic** option creates a profile view that is sized to avoid having to be split.

- The **User Specified** option enables you to assign specific minimum and maximum heights to the profile view. If a profile in one of these views had an elevation below or above the specified values the profile view is split to accommodate it. If a profile needs to be split you can assign different styles to control the different portions of the split profile.

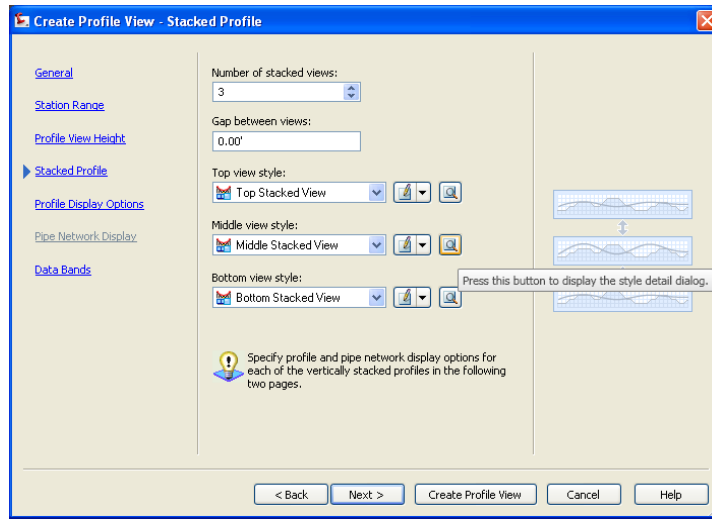


Below is a profile view that has been split.



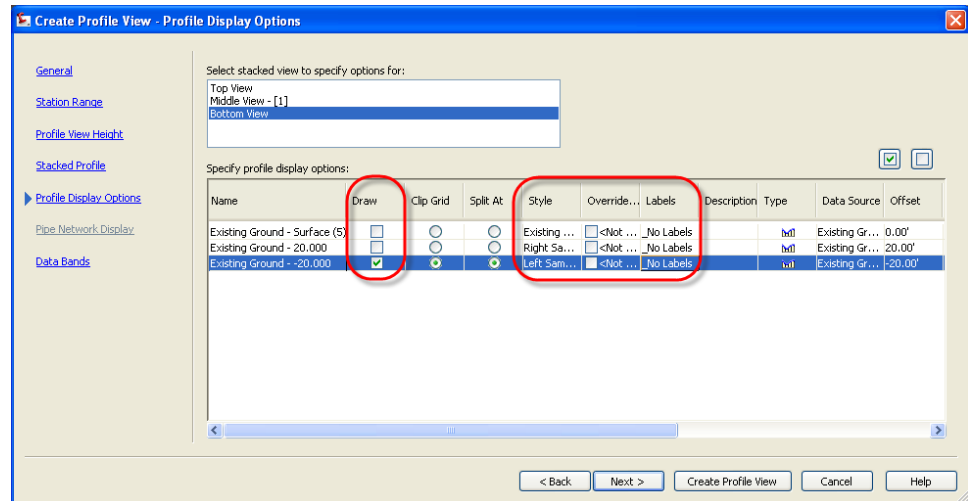
NEW IN 2009!

The Stacked Profile window enables you to set the number of stacked views, the gap between those views, and the styles for each one.



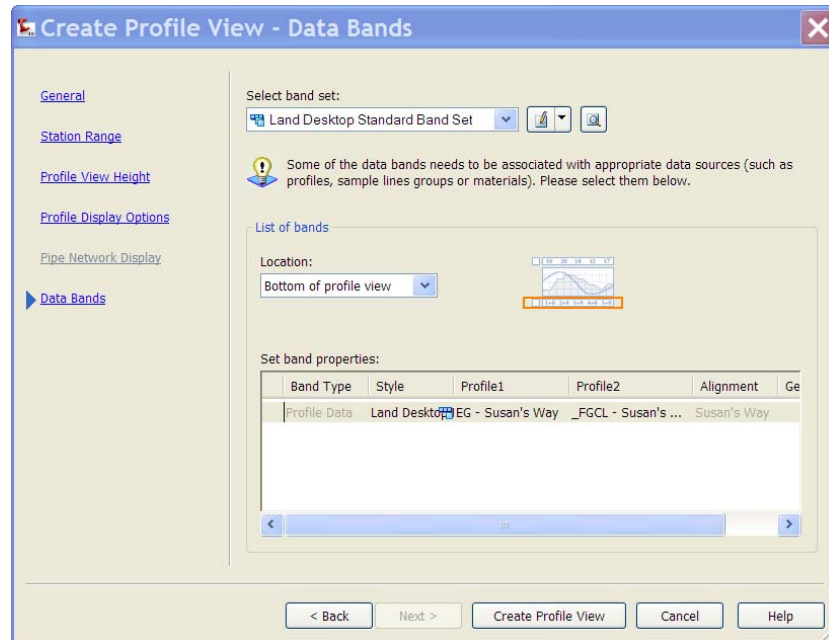
The *Profile Display Options* window enables you to apply specific controls to profiles that are displayed in the views. Some of the most important options include:

- **Draw checkbox:** Disabling this prevents the profile from being displayed in the view.
- **Style:** The profile style to show in the profile.
- **Labels:** Which profile label set should be displayed on the profile.



The *Pipe Network Display* window is considered later in the Student Guide.

The *Data Bands* window in the wizard enables you to select the bands you want to include. Bands are additional profile information that can be included along the top or bottom of a profile. Bands are applied in this dialog box through selecting a Band Set.



When satisfied, click the **Create Profile View** button to create the profile view. After the profile view is created these settings can be reviewed and adjusted through Profile View Properties. One way to open this dialog box is to select the profile view, right-click and select **Profile View Properties**.



Practice - Working with Profiles, Part I

Task 1 - Create Surface Profiles

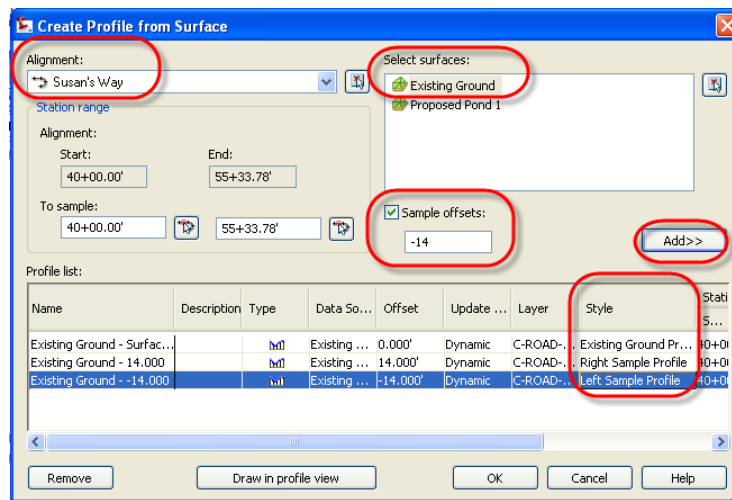
1. Continue working with the drawing from the previous practice or open **Site Design - Mod 4.3.dwg** from the following folder:

C:\<Installation Files>\Backup

If used, after opening this file save it as **Site Design.dwg** in folder listed below. Overwrite a previous drawing of the same name as needed.

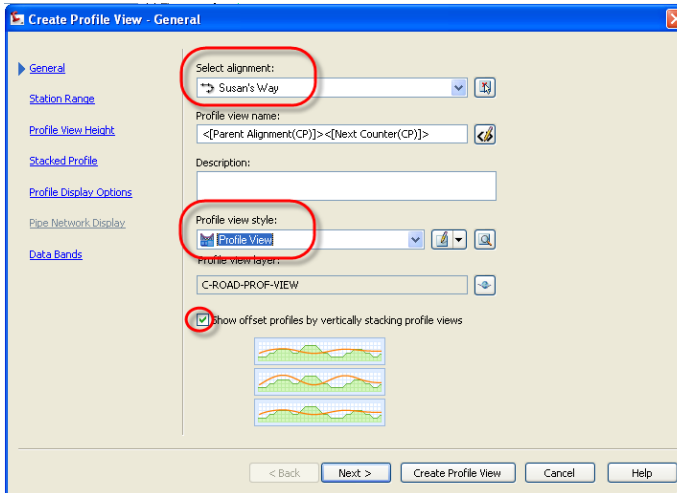
C:\<Installation Files>

2. **Zoom Extents** and **Pan** the drawing so that you have some open drawing area in which to create profiles.
3. Select **Profiles>Create Profile from Surface**. In the dialog box select the **Susan's Way** alignment, highlight the **Existing Ground** surface and press the **Add** button. This samples an existing ground profile along the centerline, the entire length of Susan's Way. Select the **Sample offsets** checkbox and type **14** in the Sample offsets box. Click the **Add>>** button, and set the style below to **Right Sample Profile** for the right TBC. In the *Sample offsets* box, type **-14**, click the **Add>>** button, and set the style below to **Left Sample Profile** for the left TBC.



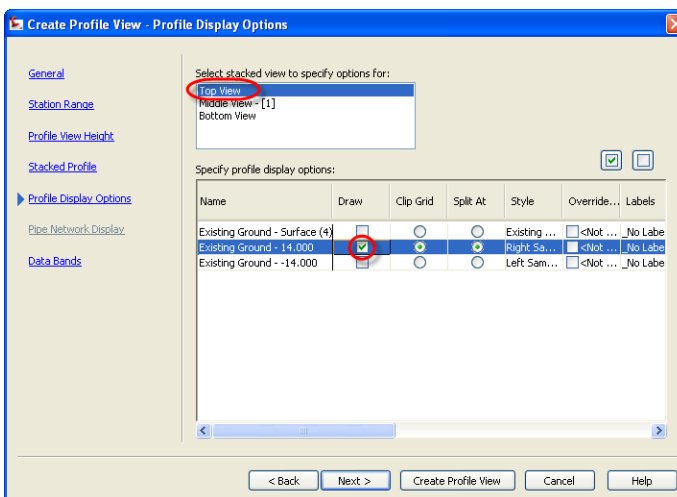
4. Click the **Draw in Profile View** button. (If you clicked **OK** instead, select **Profiles>Create Profile View**).

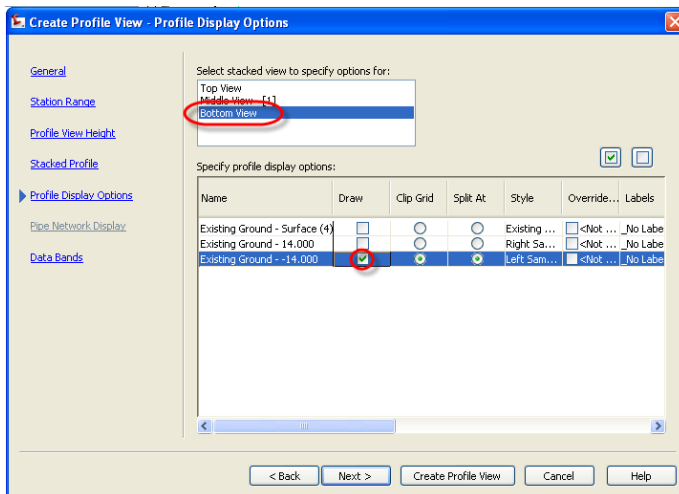
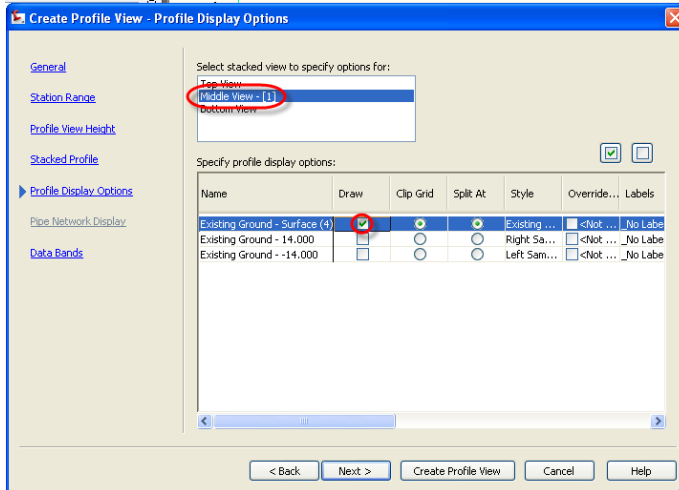
- In the **Create Profile View** wizard, select **Susan's Way** as the desired alignment and use the Profile View style. Select the **Show offset profiles by vertically stacking profile views** checkbox and click the **Next** button.



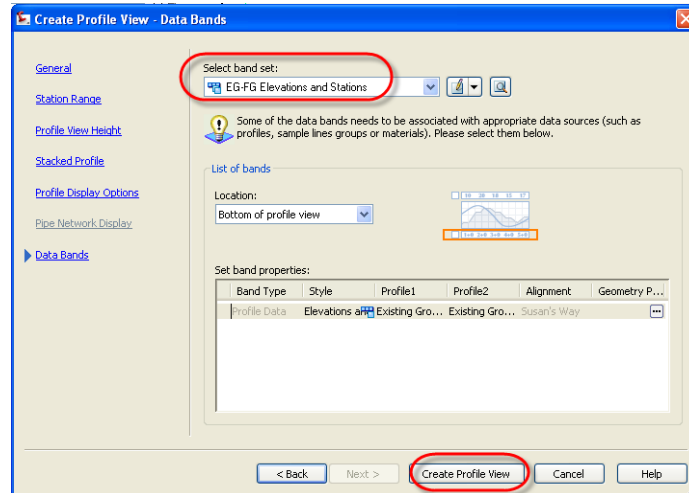
- Accept the defaults in the Station Range, Profile View Height, and Stacked Profile windows and click the **Next** button in each. In the Profile Display Options window, select **Top View**, and select the **Existing Ground – 14.000** checkbox in the Draw column for the right TBC. Select **Middle View – [1]**, and select the **Existing Ground – Surface** checkbox in the Draw column for the centerline. Select **Bottom View**, and select the **Existing Ground - - 14.000** checkbox in the Draw column for the left TBC. Click the **Next** button.

NEW IN 2009!

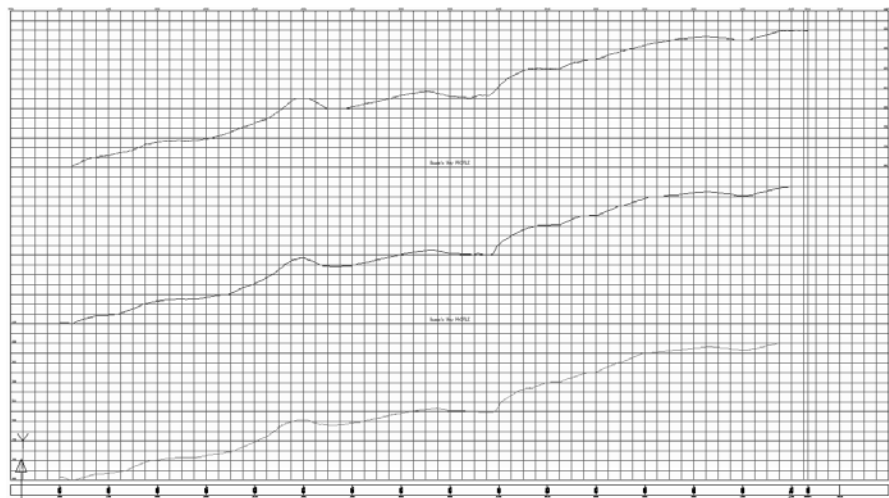


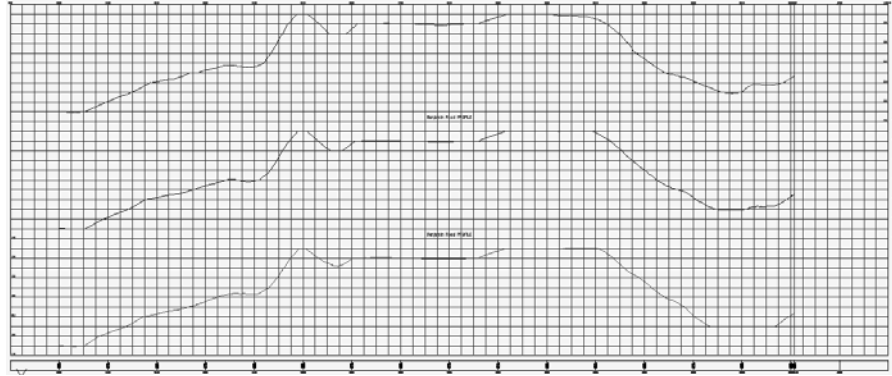


7. In the Data Bands window accept the default **EG-FG Elevations and Stations** and click the **Create Profile View** button.

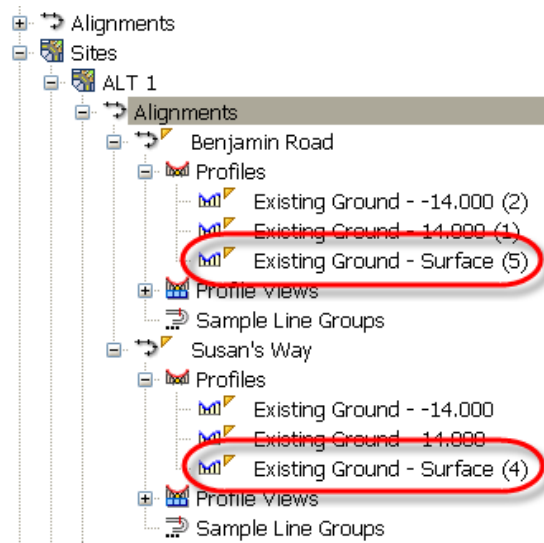


8. When prompted, click a point to define the lower left corner of the Profile View.
9. Repeat the same steps (same options as above) for Benjamin Road and create a profile for it as well, making sure the profile views do not overlap.





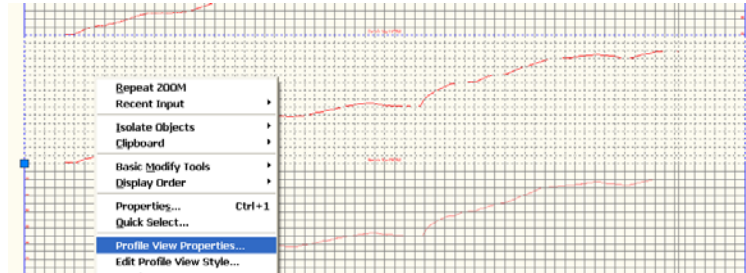
10. Locate the two profiles in the *Prospector* tab under their respective alignments. To help tell these profiles apart, rename them as something more obvious.



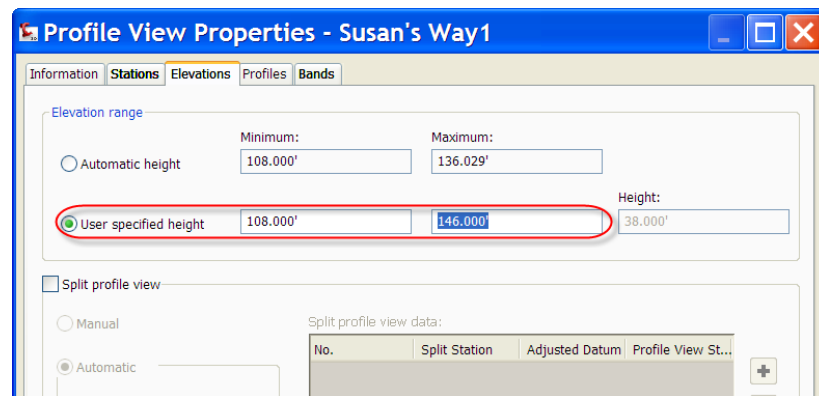
11. Right-click on Benjamin Road's Existing Ground profile and select **Properties**. In the *Profile Properties* tab rename it as **EG – Benjamin Road**.
12. Right-click on the Susan's Way Existing Ground profile and select **Properties**. In the *Profile Properties* tab rename it as **EG – Susan's Way**.
13. Save the drawing.

Task 2 - Adjust the Profile View

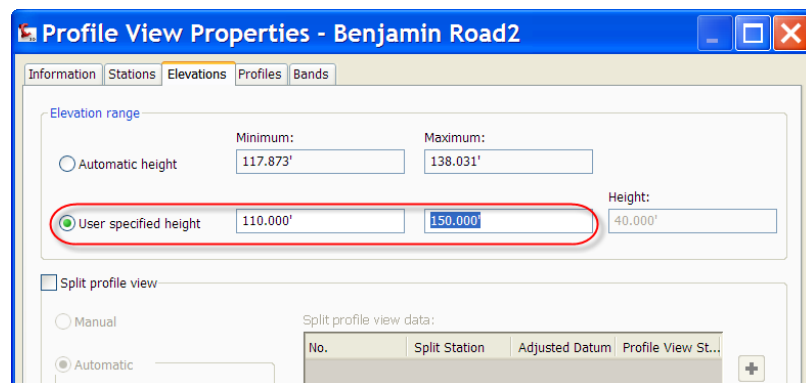
1. Select the Susan's Way centerline profile view, right-click and select **Profile View Properties**.



2. In the *Elevations* tab select the settings shown in the following figure, and click **OK**.



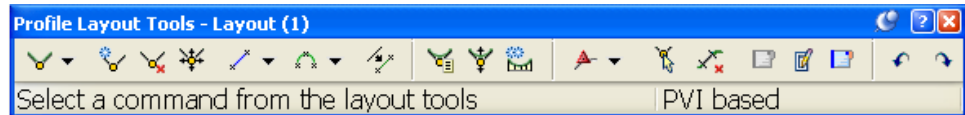
3. Repeat for the Benjamin Road centerline profile view with the following settings:



4. Save the drawing.

Finished Ground Profiles

Finished ground profiles (also referred to as proposed profiles or proposed vertical alignments) often are created interactively through the Profile Layout toolbar, similar to how alignments are created by layout. The toolbar can be opened using **Profiles>Create by Layout** and **Profiles>Edit Profile Geometry**.



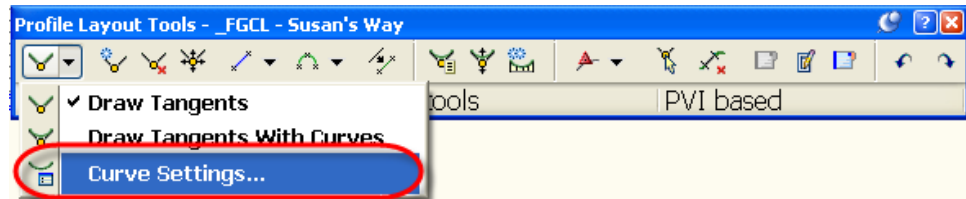
- Vertical curves transition a vehicle from one tangent grade to another and occur in two situations: *Crest* (top of a hill) and *Sag* (valley).
- There are four types of vertical curves to transition between changing the tangent grades of a crest or sag: **Circular**, **Parabolic**, **Asymmetric Parabolic**, and **Best Fit**. Roadways almost always use parabolic (equal length) curves. Asymmetric parabolic curves are usually only used if layout constraints do not permit an equal-length curve. True circular curves are used in some parts of the world for low-speed rail design and generally should *never* be used for roadways (which otherwise could lead to vehicle vaulting or bottoming out). Best fit curves follow the most likely path through a series of points.
- In the *Settings* tab, in the Profile heading, the Edit Features Settings sets the default curve type, styles, and command settings.

Most vertical designs have regulations affecting the minimum and maximum values for tangent slopes, distances along tangents between vertical curves, and safety design parameters for passing sight and stopping sight distances. Refer to local design manuals for more information on these design constraints.

The points connecting tangents in a finished ground profile are referred to as a **Point of Vertical Intersection (PVI)**.

Creating and Editing Profiles

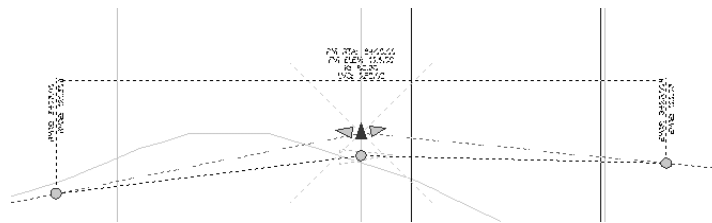
Similar to the Alignments Layout toolbar, the Profile Layout toolbar contains an overall vista (Profile Grid View) and Profile Layout Parameters (segment data viewer). These vistas enable you to review and edit the vertical design. The settings used when creating a finished ground profile can be selected through the **Draw Tangents** flyout menu in the toolbar. This toolbar is used to edit any kind of profile, including profiles created from surfaces.



Other toolbar commands **Add**, **Delete**, or **Move** individual tangent, PVI, or vertical curve segments.

- When editing a profile in the layout parameters or grid view, editable parameters appear in black.
- You can graphically edit a design profile using grips.

When graphically editing a vertical alignment, the tangents, PVI, and vertical curves display grips that represent specific editing functions.



- The red triangular grip moves the PVI to a new station and/or elevation.
- The cyan triangles extend the selected tangent, hold its grade, and modify the grade of the opposite tangent to relocate the PVI.
- The middle or end circular grips lengthen or shorten the vertical curve without affecting the location of the PVI.

- When you move the cursor to the original location of the grip, the cursor snaps to that location.

Transparent Commands

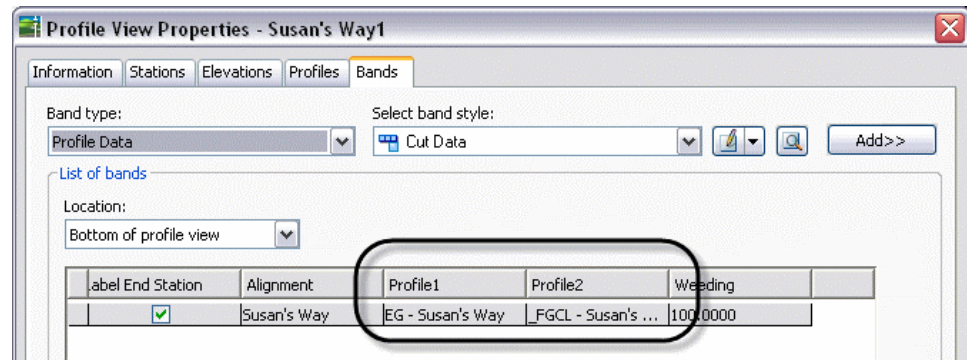


AutoCAD Civil 3D has several transparent commands that can be extremely helpful when creating or editing a finished ground profile. They are listed below in the order shown in the Transparent Commands toolbar (from left to right):

- **Profile Station from Plan:** When creating or adjusting a PVI, this transparent command enables you to pick a point in plan view next to the base alignment. AutoCAD Civil 3D then calculates the station value automatically and prompts you for the elevation to use at that station.
- **Profile Station and (surface) Elevation from Plan:** This command is similar except that it enables you to determine elevation from a surface.
- **Profile Station and Elevation from COGO Point:** Enables you to determine station and elevation values for a PVI based on the location of a point object.
- **Profile Station Elevation:** By default, when adding a PVI you are prompted for a drawing X-,Y-location. If you would rather enter a station value and elevation, use this transparent command.
- **Profile Grade Station:** Enables you to locate a PVI based on a grade and an ending station value.
- **Profile Grade Length:** Enables you to locate a PVI based on a grade and tangent length.

Assigning Profile Band Elevations

Profile band elevations, such as those shown in a previous example, are assigned through Profile View Properties, *Bands* tab. When you create a profile view you should review the band settings and make sure each is assigned the correct profile in the *Profile1* and *Profile2* fields. AutoCAD Civil 3D does not make any assumptions about which profile to use in either field.



Using the styles supplied with the AutoCAD Civil 3D templates, the existing ground surface would be assigned the *Profile1* field, and the finished ground profile would be assigned the *Profile2* field.

Profile Segment Types

Profile segments created by layout (tangent lines, parabolas, and circular curves) can be created as fixed, free, or floating.

Profile Labels

Profiles have dynamic labels that are organized into two categories:

- *Profile* labels include labels for Major and Minor Stations, Horizontal Geometry Points, Profile Grade Breaks, Lines, Crest and Sag curves. These can be selected when the profile is created and managed later through right-clicking on a profile and selecting **Edit Labels**.
- *Profile View* labels include a Station & Elevation label type, and a Depth label type. These are created through **Profiles>Add Profile View Labels>Add Profile View Labels...** and can be removed with the AutoCAD **Erase** command.



Practice - Working with Profiles, Part II

Task 1 - Create FG Profile

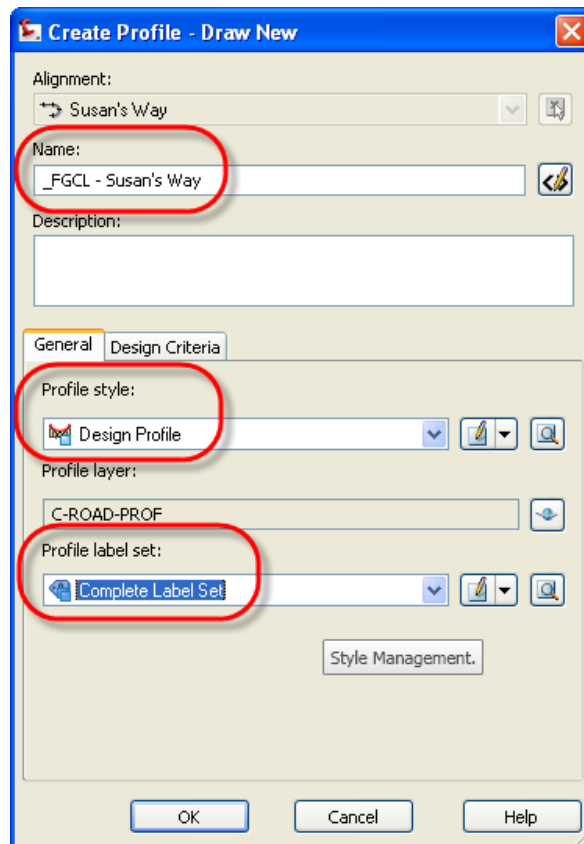
1. Continue working with the drawing from the previous practice or open **Site Design - Mod 3.4.dwg** from the following folder:

C:\<Installation Files>\Backup

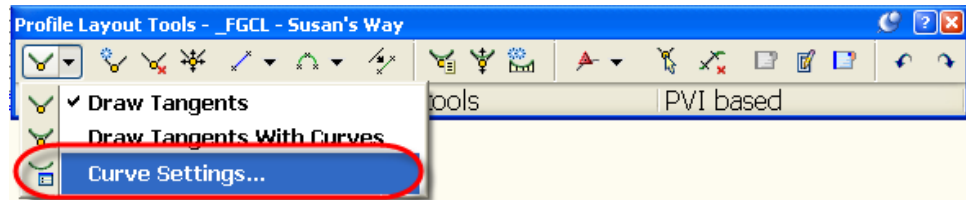
If used, after opening this file save it as **Site Design.dwg** in the folder listed below. Overwrite a previous drawing of the same name as needed.

C:\<Installation Files>

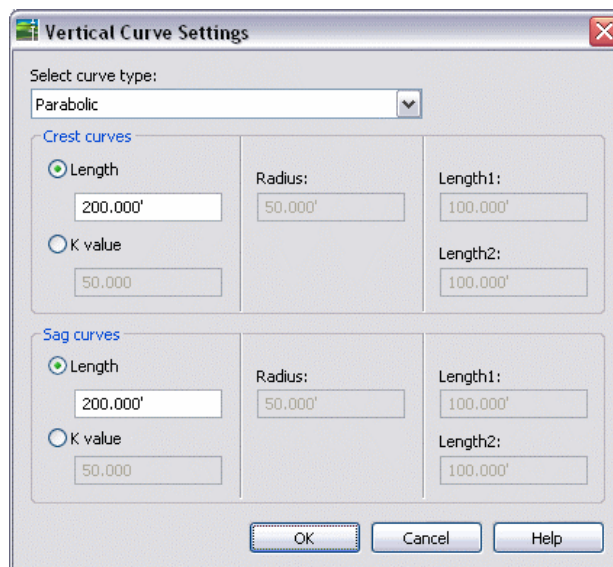
2. Zoom to the Susan's Way profile view. Select **Profiles>Create by Layout**. When prompted to select a profile view select the Susan's Way view.
3. In the Create Profile dialog box that follows, enter the following and click **OK**.



4. In the Profile Layout toolbar select **Curve Settings** as shown below.



5. In the Vertical Curve Settings dialog box verify that the *curve type* is **Parabolic**, and enter the *default curve length* of **200'** for the Crest and Sag curves. Click **OK**.

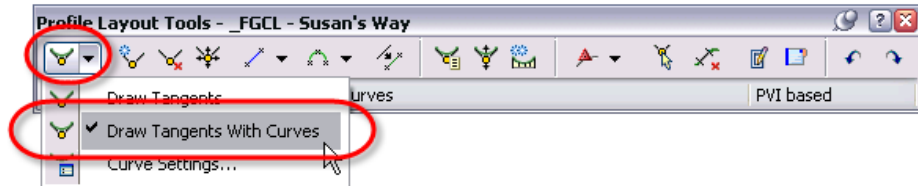




6. Locate the Transparent Commands toolbar.

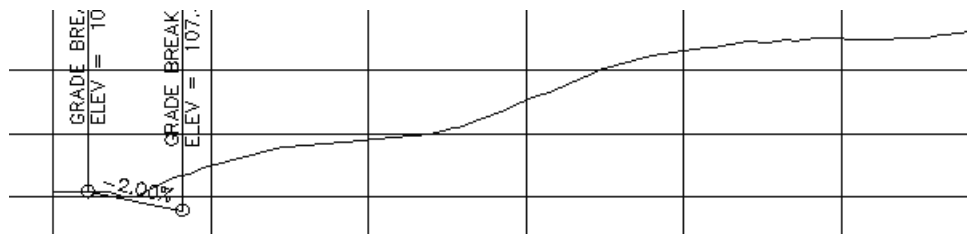


Task 2 - Create PVI by Layout

1. In the drop-down menu in the Layout toolbar, select **Draw Tangents with Curves**. AutoCAD Civil 3D prompts you for a start point – the location of the road’s first PVI.

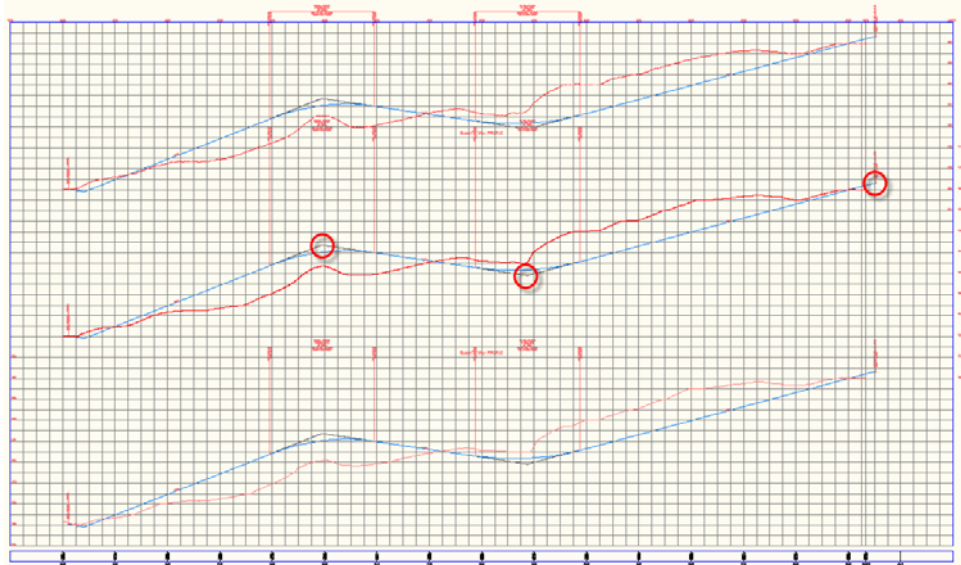


2. In the Transparent Commands toolbar click  (Profile Station Elevation).
3. When prompted select any part of the Susan’s Way profile view, then enter the starting station of **4011** and starting elevation of **108.17**.
4. The routine then prompts you for another station and elevation value. If you would rather use another means of layout, such as setting a grade over a certain distance, press <Esc> once, then click  (Profile Grade Length).
5. When prompted enter **-2** for slope (for -2%) and **30** for length. Press <Esc> twice to end the layout command.



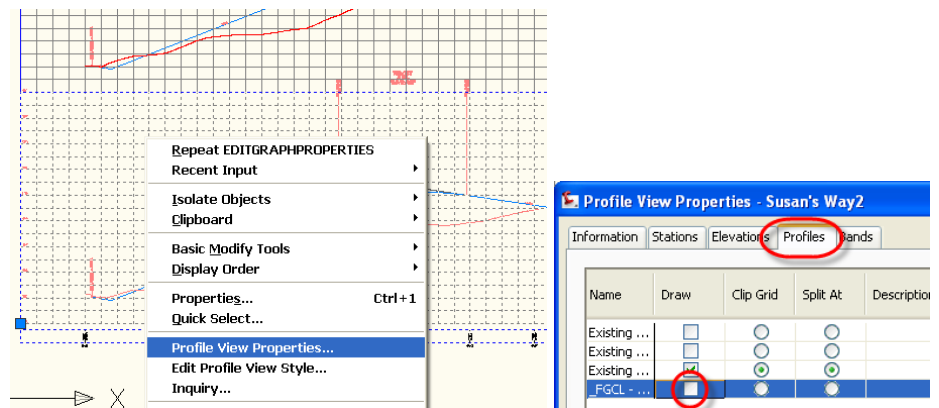
6. At any time you can continue to edit a profile by selecting it, right-clicking and selecting **Edit Profile Geometry**. Select the Susan’s Way FGCL profile and select to edit it now.
7. To continue adding PVI, return to the Profile Layout toolbar and again select **Draw Tangents with Curves**. Start by snapping to the endpoint of the last segment you drew.

8. Sketch in three other PVIs by left-clicking in the approximate positions of the circles shown below. When done press <Enter> to finish the command.



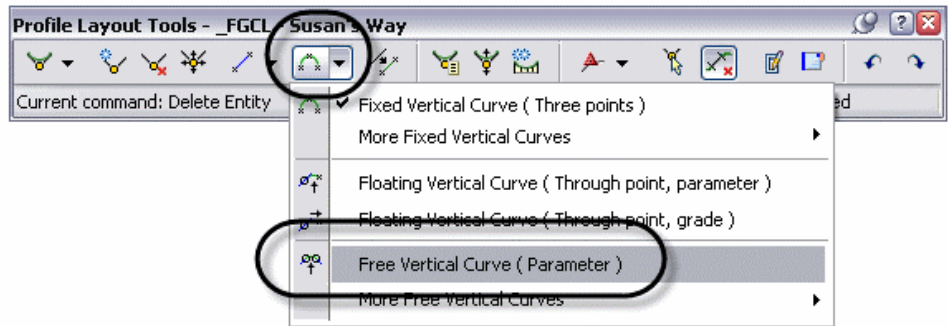
Note: The finish ground centerline was drawn in all three views for Susan's Way.

9. Select the **Top View**, right-click and pick **Profile View Properties**. In the *Profiles* tab, clear the draw box for **_FGCL**. Do the same for the bottom view.

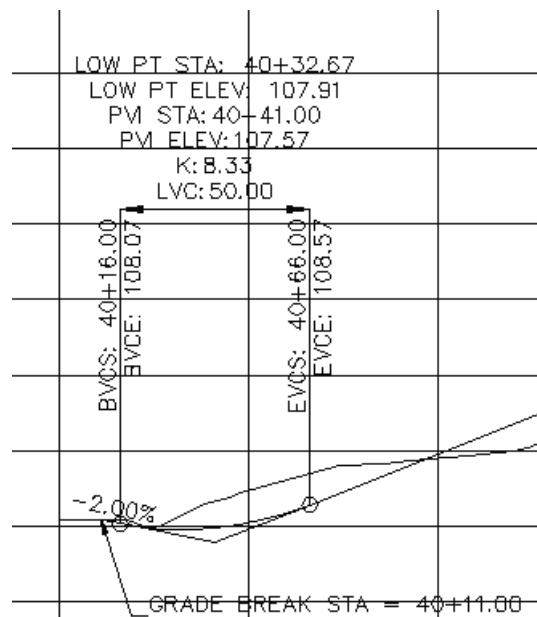



Task 3 - Adjust the Vertical Alignment

1. Select the profile you just drew and notice the grips that appear. Experiment with repositioning the PVI and changing the curve length through the grips.
2. PVI 2 at the start of the profile does not yet have a vertical curve. In the Profile Layout Toolbar Draw Curves drop-down list, select **Free Vertical Curve (parameter)**.



3. When prompted, pick the first and then second tangent in the profile, and enter a *curve length* of **50'**. Finish the command by pressing <Enter>.
4. Select the grips of the Grade Break and Curve label at the start of the profile and reposition them as shown below.




- In the Profile Layout toolbar click  (Grid View) and the Profile Entities Vista should appear in the Panorama.
- In Profile Entities Vista, edit the PVI stations, elevations, and curve lengths to match those shown below. (Tip: Fix PVI stations first, set Grades Out to match, and set final PVI elevations and curve lengths.)

No.	PVI Station	PVI Elevation	Grade In	Grade Out	A ...	P...	K..	Su...	Profile Curve Length
1	40+11.00'	108.170'		-2.00%					
2	40+41.00'	107.570'	-2.00%	4.00%	6.0...				
3	45+00.00'	125.930'	4.00%	-1.75%	5.7...	Crest	3...	Sym...	200.000'
4	49+00.00'	118.930'	-1.75%	3.20%	4.9...	Sag	4...	Sym...	200.000'
5	55+33.50'	139.202'	3.20%						

- Pan to the curve at station 45+00. Work with *Entity Based* data in the Profile Layout toolbar by selecting the following:



- Click  (Select Entity) and select the curve at station 45+00. The Profile Layout Parameters window should be open and the curve's current length should be 200.

The image shows the "Profile Layout Parameters" window. It contains a table with two columns: "Parameter" and "Value". The parameters are grouped into "General" and "Geometry".

Parameter	Value
General	
Number	4
Type	Symmetric P...
Curve Type	Crest
Constraint Type Desc	Curve Length
Passing Sight Distance	368.933'
Stopping Sight Dista...	215.578'
HeadLight Distance	
Geometry	
PVI Station	45+00.00'
PVI Elevation	125.933'
Grade In	4.00%
Grade Out	-1.75%
A (Grade Change)	-5.75%
K Value	34.783
Curve Radius	3478.261'
Length	200.000'
High/Low Point Station	45+39.13'
High/Low Point Elev	124.715'

9. In the Profile Layout Parameters window assign the curve to have a *K Value* of **30**. The curve length might not update automatically in the parameters window. Click on the curve again to see the new parameters based on the K value. (You can design curves based on sight distances through this dialog box as well).
10. Change the Layout toolbar to PVI Based mode as shown below and **save your drawing**.



Task 4 - Key in a Finished Ground Profile



Often profiles are defined on paper by other team members. The following is a simple and quick way to key one in from known PVI information.

1. You will next create a finished ground profile for Benjamin Road. Select **Profiles>Create Profile by Layout**.
2. When prompted for a profile view select **Benjamin Road's** profile view, not Susan's Way.

3. In the Create Profile dialog box enter the following and click **OK**.

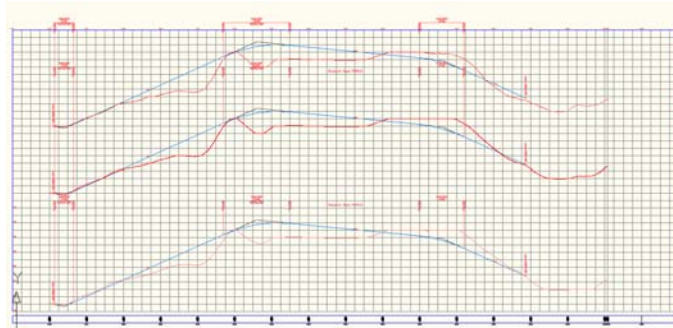
The screenshot shows the 'Create Profile - Draw New' dialog box with the following settings:

- Alignment: Benjamin Road
- Name: **_FGCL - Benjamin Road**
- Description: (empty)
- General tab selected
- Profile style: **Design Profile**
- Profile layer: C-ROAD-PROF
- Profile label set: **Complete Label Set**

4. In the Profile Layout toolbar click  (Insert PVIs Tabular). For this command to be active you must be in PVI-based data mode (.
5. In the Insert PVIs dialog box select the **Parabolic** curve type and enter the following values starting at station 10+11.

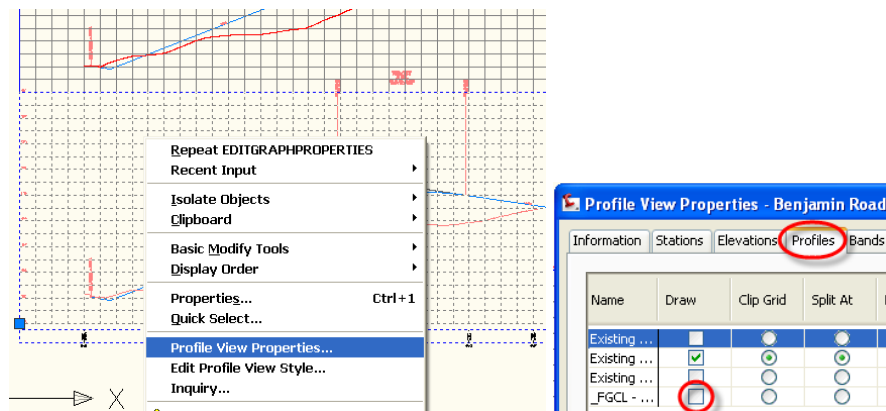
Station	Elevation	Curve Len
10+11.00'	118.000'	0.000'
10+40.00'	117.420'	50.000'
15+60.00'	140.820'	180.000'
20+60.00'	135.820'	120.000'
22+87.00'	125.500'	0.000'

- When done, click **OK** and the profile should resemble the following:



Note: The finish ground centerline was drawn in all three views for Benjamin Road.

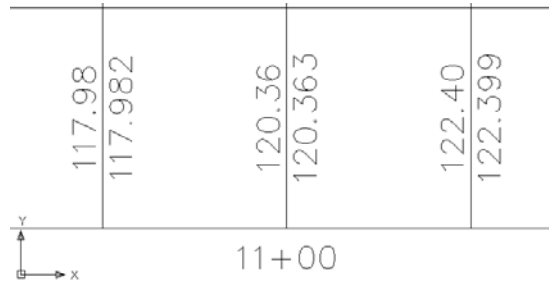
- Select the **Top View**, right-click and select **Profile View Properties**. In the *Profiles* tab, clear the **FGCL** checkbox in the Draw column. Do the same for the bottom view.



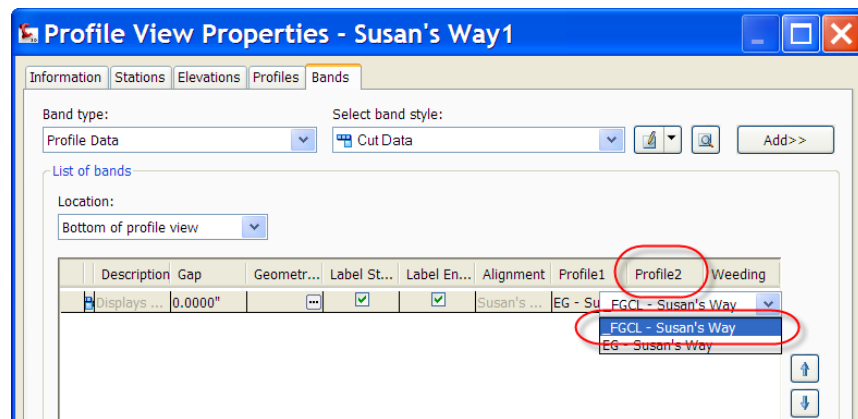
- Save your drawing.

Task 5 - Update Profile Bands

- The profile views are showing existing ground elevations in both the existing and proposed slots in the profile bands.



- To update, select the Susan's Way profile view, right-click and select **Profile View Properties**. In the *Bands* tab, assign **Profile2** to reference **_FGCL – Susan's Way**. Click **OK** to close.



- Repeat for the Benjamin Road profile view.



- Save your drawing.

Self Check: Profiles

1. Can you safely relocate profile views in AutoCAD Civil 3D using the AutoCAD **Move** command?
2. Name the three types of vertical curves.
3. Which grip do you use to move the PVI to a new station and/or elevation?
4. What do Profiles 1 and 2 annotate in profile bands?