

Contents

Surfaces Tutorials	2
Tutorial: Creating and Adding Data to a Surface.....	3
Exercise 1: Creating a TIN Surface	7
Exercise 2: Adding Point Data to a Surface.....	8
Exercise 3: Adding Breaklines to a Surface.....	11
Exercise 4: Adding an Outer Boundary to a Surface	16
Tutorial: Working with Large Surfaces	19
Exercise 1: Limiting Imported Surface Data	20
Exercise 2: Simplifying a Surface.....	26
Tutorial: Changing the Surface Style and Display.....	31
Exercise 1: Editing the Surface Style.....	32
Exercise 2: Using a Different Style for a Surface	34
Exercise 3: Labeling a Surface.....	36
Tutorial: Editing Surface Data	38
Exercise 1: Adding a Hide Boundary	41
Exercise 2: Smoothing a Surface	43
Tutorial: Visualizing Surface Data	44
Exercise 1: Moving Multi-View Blocks to a Surface	45
Exercise 2: Rendering a Surface	47

Surfaces Tutorials

These tutorials will get you started **working with land surfaces**. A surface is a central object for AutoCAD Civil 3D, and can be referenced by alignments, parcels, and other objects throughout the design process.

Note:

All drawings used in these tutorials are available in the [tutorials drawings folder on the course website](#). If you want to save your work from these tutorials, save the drawings to the [My Tutorial Data folder on your computer or thumb drive](#).

Topics in this section

Tutorial: Creating and Adding Data to a Surface

This tutorial demonstrates how to create a TIN surface, and then add contour, breakline, and boundary data to the surface.

Tutorial: Working with Large Surfaces

This tutorial demonstrates several features that can help you manage large surfaces efficiently in AutoCAD Civil 3D.

Tutorial: Changing the Surface Style and Display

This tutorial demonstrates how to change and constrain the surface styles and display.

Tutorial: Editing Surface Data

This tutorial demonstrates some common surface editing tasks, including edge swapping, TIN line deletion, and surface smoothing. You will also hide part of the surface using a hide boundary.

Tutorial: Visualizing Surface Data

This tutorial demonstrates how to add multi-view blocks to a surface and render it using a sample of the visualization techniques included with AutoCAD Civil 3D.

Additional Information

Tutorial: Creating and Adding Data to a Surface

This tutorial demonstrates how to create a TIN surface, and then add contour, breakline, and boundary data to the surface.

When you create a surface, its name is displayed in the Surfaces collection in Toolspace on the Prospector tab. From this location, you can perform other operations, such as adding data and editing the surface. When first created, the surface is empty, so it is not visible in the drawing.

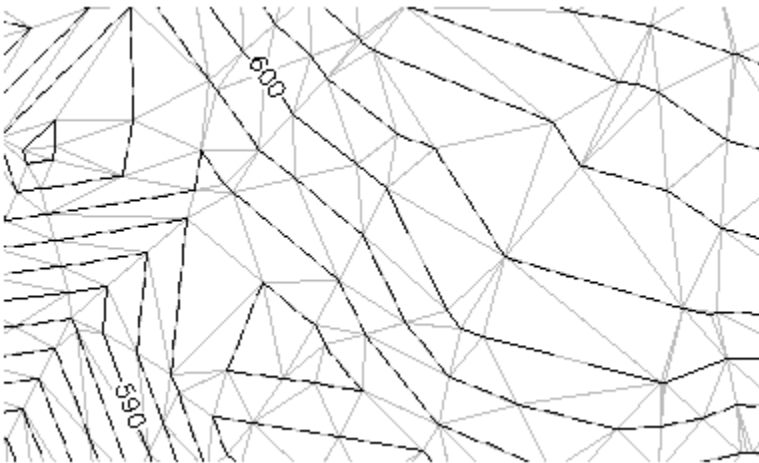
After data has been added to a surface, it becomes visible in the drawing in accordance with the display settings specified in the referenced surface style.

TIN Surfaces

A TIN surface is composed of the triangles that form a triangulated irregular network. A TIN line is one of the lines that makes up the surface triangulation.

To create TIN lines, AutoCAD Civil 3D connects the surface points that are closest together. The TIN lines form triangles. The elevation of any point in the surface is defined by interpolating the elevations of the vertices of the triangles that the point lies in.

TIN surface with contour lines displayed



Contour Data

Contours are graphical illustrations of surface elevation changes. You can create a surface from contours drawn as 2D or 3D polylines that have x, y, and z coordinate data.

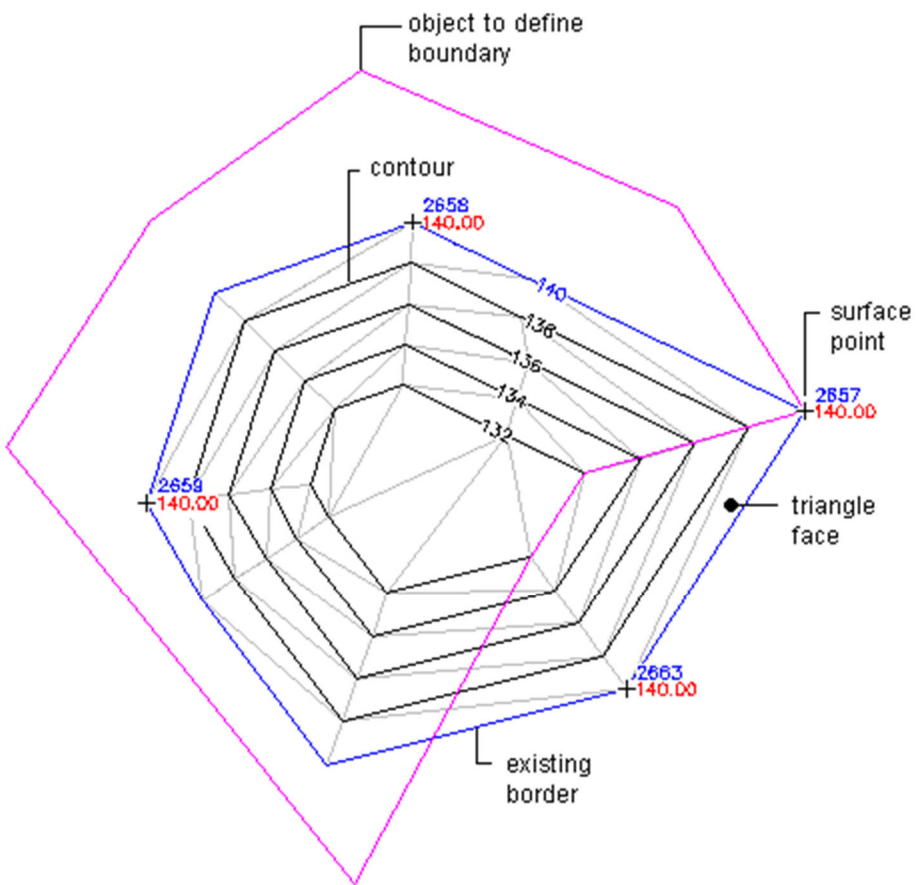
Boundaries

Boundaries are closed polylines that affect the visibility of the triangles either inside or outside the polylines. An outer boundary defines the extents of the surface. All triangles inside the boundary are visible, and all triangles that are outside the boundary are invisible.

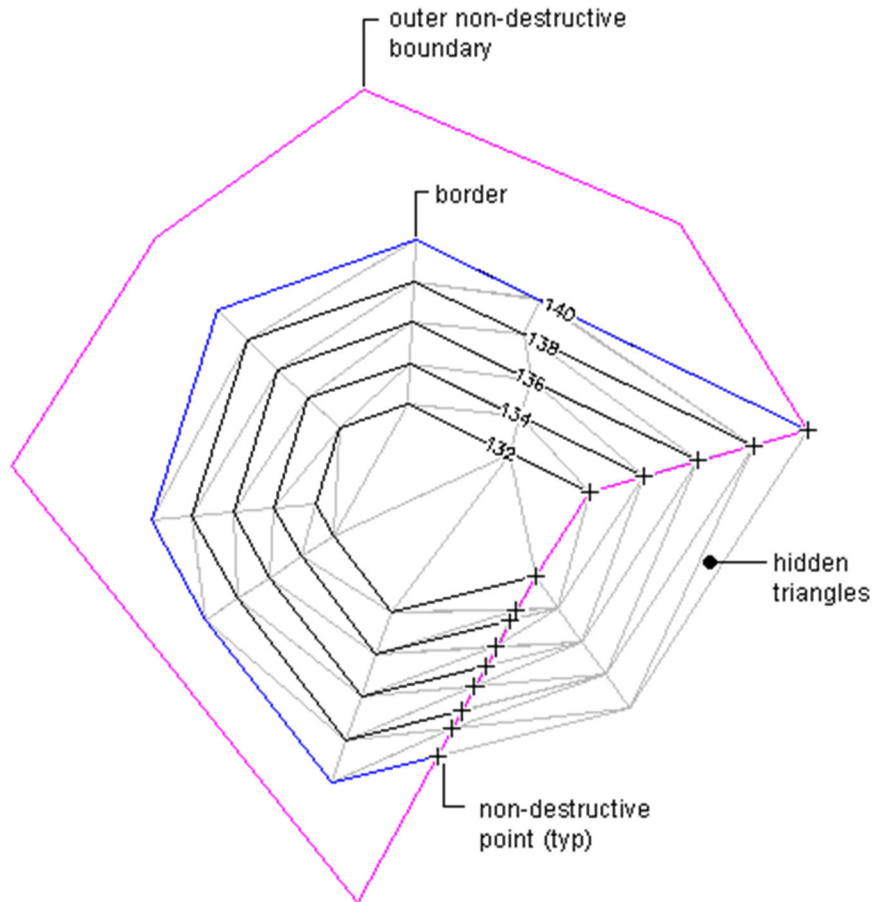
Areas hidden by boundaries are not included in calculations, such as total area and volume.

Surface boundaries are defined by selecting existing polygons in the drawing. The surface definition displays the numerical ID and a list of vertices for each boundary.

A surface before adding a non-destructive outer boundary



The effects of a non-destructive outer boundary



Breaklines

Breaklines define linear surface features, such as retaining walls, curbs, tops of ridges, and streams. Breaklines force surface triangulation to run along the breakline; triangles do not cross a breakline.

Breaklines are critical to creating an accurate surface model. Breaklines are important because it is the interpolation of the data, not just the data itself, that determines the shape of the model.

You can use 3D lines or 3D polylines as breaklines. Each vertex on the polyline is converted to a TIN point with the same XYZ coordinates. For 3D lines, each line that you select is defined as a two-point breakline.

Topics in this section

Exercise 1: Creating a TIN Surface

In this exercise, you will create an empty TIN surface in a new drawing.

Exercise 2: Adding Point Data to a Surface

In this exercise, you will import point data from a text file into the current drawing.

Exercise 3: Adding Breaklines to a Surface

In this exercise, you will cause the surface to triangulate along a linear feature.

Exercise 4: Adding an Outer Boundary to a Surface

In this exercise, you will create an outer surface boundary from a polyline.

Exercise 1: Creating a TIN Surface

In this exercise, you will create an empty TIN surface in a new drawing.

Create a TIN surface in a new drawing




In the Select Template dialog box, browse to the [tutorial folder](#). [Select Surface.dwt](#). Click Open.

Click [Home tab](#) > [Create Ground Data panel](#) > [Surfaces drop-down](#) > [Create Surface](#) .

In the Create Surface dialog box, for Type, select [TIN surface](#).

Note:

By default, a new Surface Layer will be created named C-TOPO- followed by the name you enter in the Name cell. You can also click  to specify an existing layer for the surface.


In the [Properties table](#), specify the following parameters:

Name: [EG](#)

Description: [Existing Ground surface from imported point data](#)

Style: [Points and Border](#)


Tip:

To select the style, click the Value cell, and then click  to display the Select Surface Style dialog box.

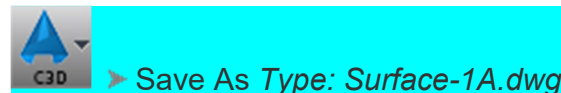
Render Material: [ByLayer](#)

Click [OK](#).

In Toolspace, on the [Prospector tab](#), expand the [Surfaces collection](#).

The [new surface name is displayed](#) in the  Surfaces collection in Toolspace on the Prospector tab, but this [surface does not contain any data](#).

Save this file with a new name



To continue this tutorial, go to [Exercise 2: Adding Point Data to a Surface](#).

Parent topic: [Tutorial: Creating and Adding Data to a Surface](#)

Exercise 2: Adding Point Data to a Surface

In this exercise, you will import point data from a text file into the current drawing.

This exercise continues from [Exercise 1: Creating a New TIN Surface](#).

Import point data into the current drawing

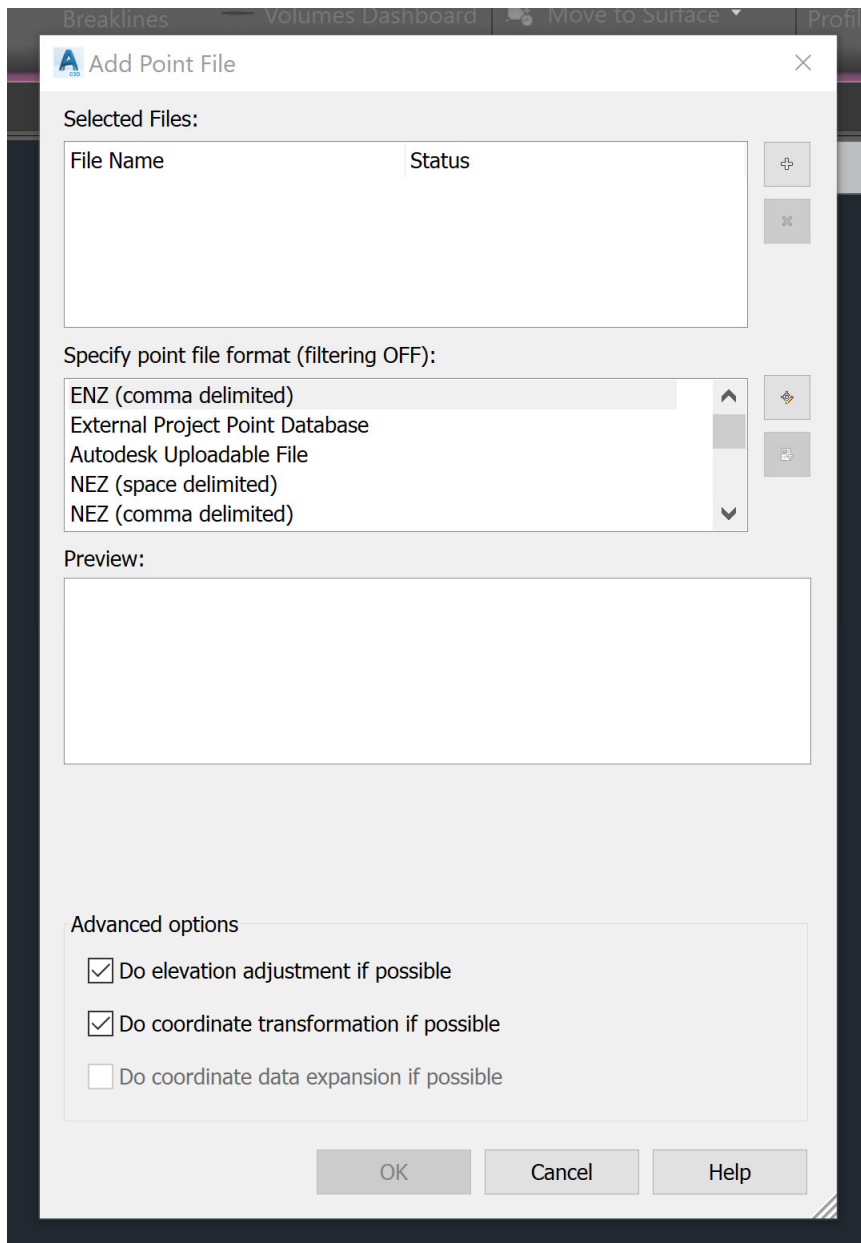
Open drawing *Surface-1A.dwg*.

This drawing contains an empty surface definition, which is named EG.

Click **Modify** tab from the top menu ➤ **Ground Data** panel ➤ **Surface** .

Click **Surface** tab ➤ **Modify** panel ➤  **Add Data** ➤ **Point Files** .

You should see the following Add Point File display.



Under Selected Files, click .

In the Select Files dialog box, click the browse to file location. Select **Surface-1A-PENZD (space delimited).txt**. Click Open.

In this box, under Specify Point File Format, select **PENZD** (Space Delimited).

In the Add Point File dialog box, click **OK**.

At the command line, enter **ZE**.

The surface, which contains the imported point data, is displayed in the drawing.

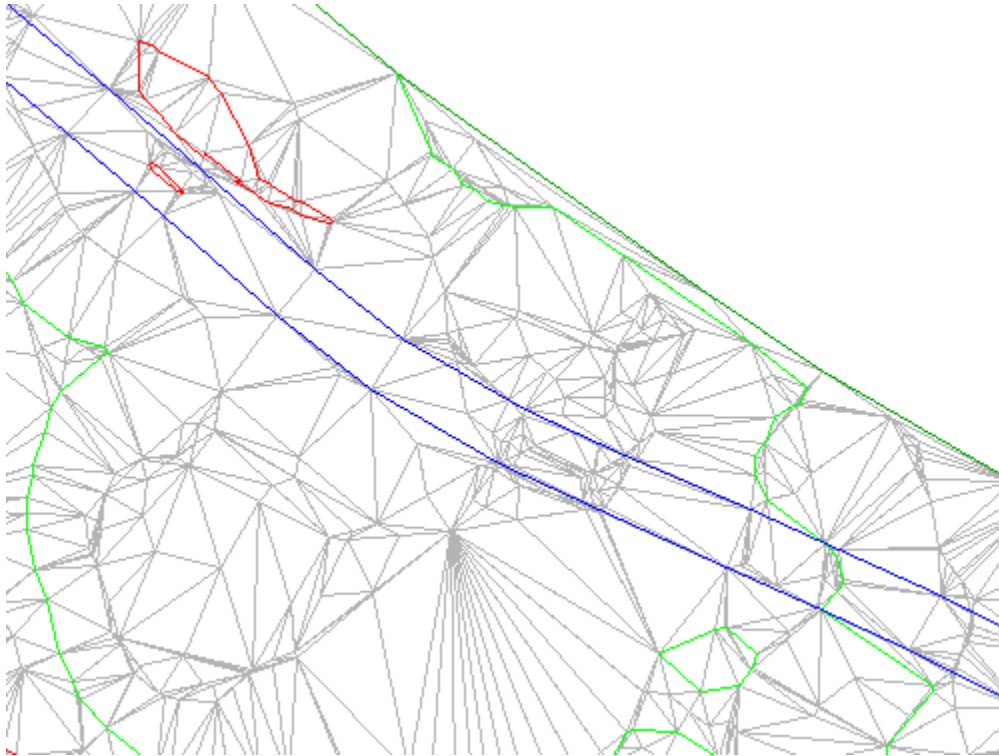


Exercise 3: Adding Breaklines to a Surface

In this exercise, you will cause the surface to triangulate along a linear feature.

Breaklines are used to define surface features and to force triangulation along the breakline. Surfaces do not triangulate across breaklines, creating more accurate TIN surface models.

In this exercise, you will create breaklines along the edge of pavement for an existing road. Breaking the surface along features produces a more accurate surface rendering.




This exercise continues from [Exercise 2: Adding Point Data to a Surface](#).

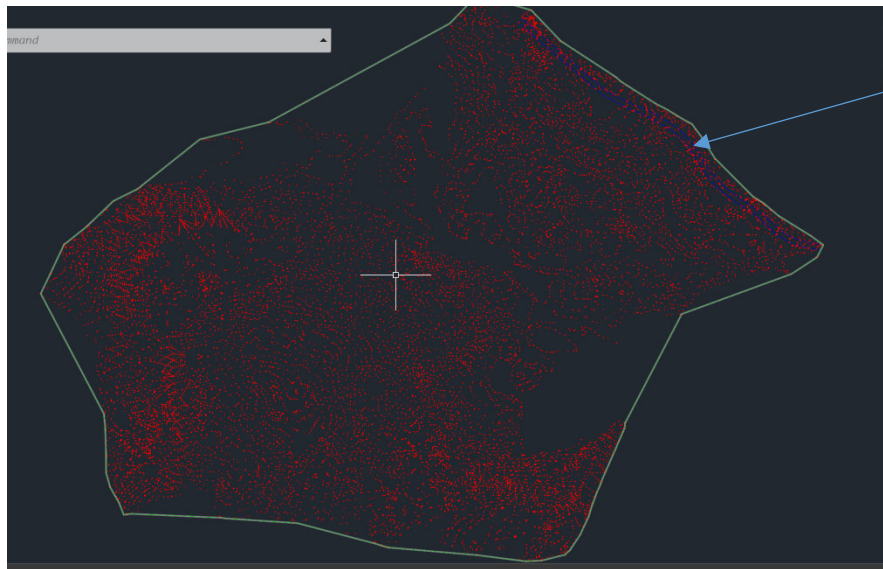
Display the source polylines and change the surface style

Note:

This exercise uses the drawing you created in the previous exercises.

Click **Home tab** > **Layers properties panel** > **Layer drop-down**. Next to the **EG_BREAKLINES** layer, click .

The **3D polylines** that represent the **edge of pavement (EP)** of an existing road are displayed on the east side of the site.



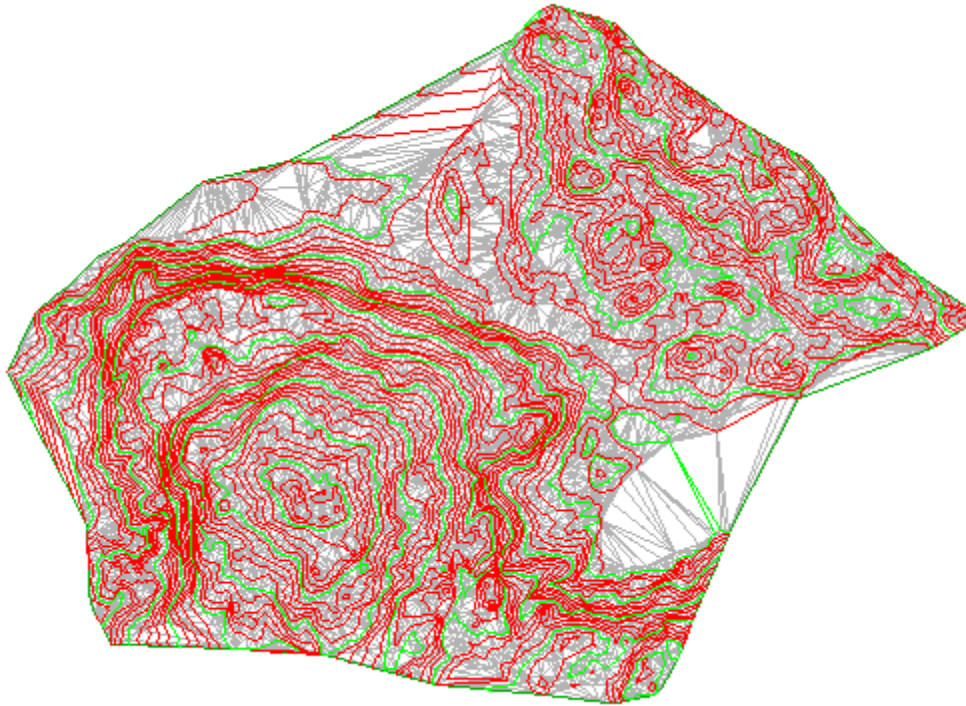
Note:

The EP polylines were included in the drawing template you used in [Exercise 1: Creating a TIN Surface](#).

Select the **Surfaces** from the Prospector menu. Select the surface **EG** and **Right-click**. Then **Click Surface Properties**.

In the Surface Properties dialog box, on the **Information tab**, for Surface Style, select **Contours and Triangles**. Click **Apply** Click **OK**.

The surface now shows contours and triangles that illustrate the EG surface triangulation.



Create breaklines from the polylines

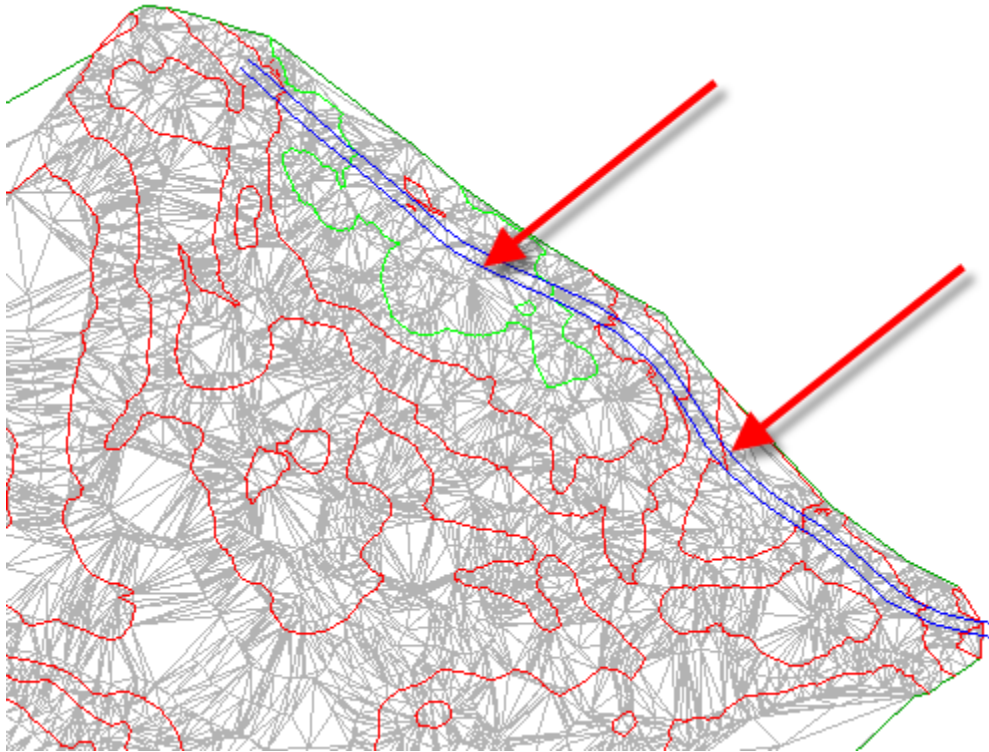
In **Toolspace**, on the **Prospector tab**, expand the **Surfaces** > **EG** > **+**

Definition collections. Then **Right-click** **Breaklines**. Click **Add**.

In the Add Breaklines dialog box, for Description, enter **Edge of pavement - existing road**. Use the default values for the other fields. Click **OK**.

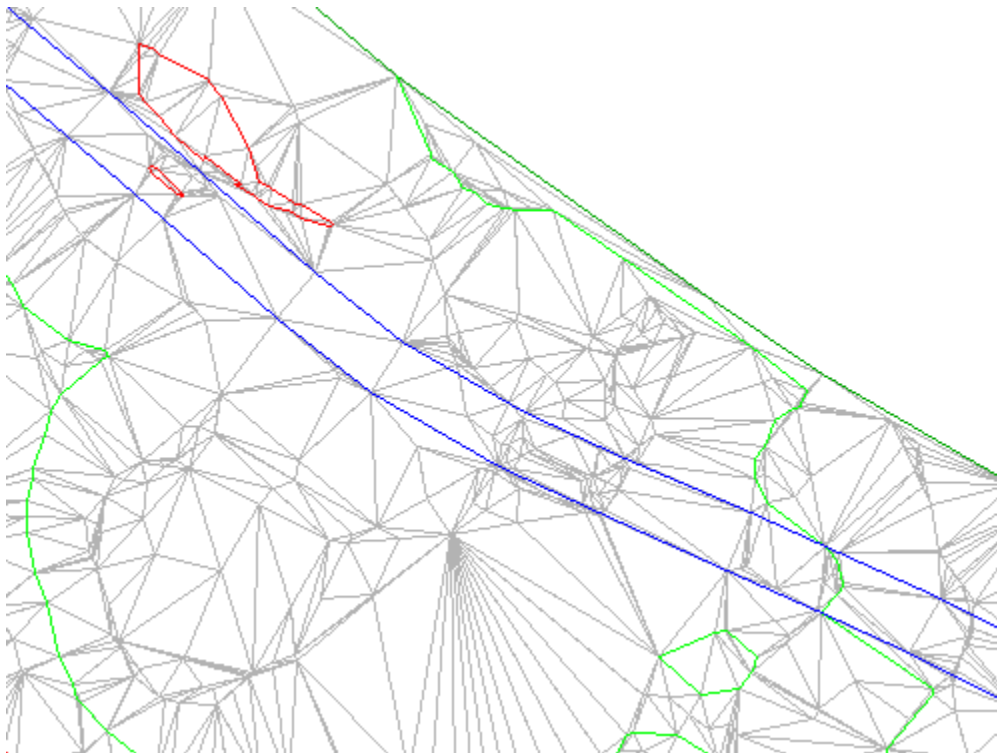
The **Select Objects** prompt becomes active. While in this command, use the Zoom and Pan commands to locate the two blue 3D polylines on the east side of the site.

Zoom in close so you can see that the triangles cross over the polylines.



Select the polylines. Press Enter.

The surface triangulation is now automatically modified. The edge of pavement breaklines are applied, and the TIN surface is adjusted along the breakline edges, modifying the surface triangulation.



Click View tab ➤ Navigate 2D panel ➤ Extents.

The drawing window zooms to the extents of the surface. With the breakline data added, the layer that contained the source data for the breaklines can be frozen.

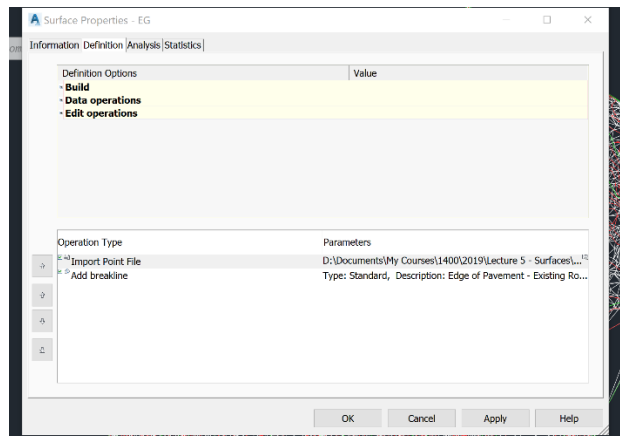
Click Home tab ➤ Layers properties panel ➤ Layer drop-down. Next to the **EG_BREAKLINES** layer, click ☀. This will change to frozen ❄.

Further exploration: Notice that, along some portions of the polylines, the surface triangulation incorrectly crosses the breakline. This happened because the surface contours also act as breaklines. The new breaklines are not added because the contours are already acting as breaklines, and the current surface setting does not allow more than one breakline to affect the surface at a given point. To override this behavior, you can perform any of the following tasks listed below. I recommend for this case that you use the Build the Surface with Contours and Breaklines as described below.

Build the surface with contours and breaklines: On the main menu bar

select the Surface Tab.

In this menu, select the drop down menu for Surface properties and from the drop down menu select Surface Properties and the follow drop down menu appears.



Expand the Build Definitions Options. Set Allow Crossing Breaklines to Yes. In the same menu select Elevation To Use and change this option to Last Breakline Elevation at Intersection by Double Clicking on the description box. Select the Apply button. Select Rebuild the surface when prompted. Click Apply. Click OK.

Modify the surface: Use the DeleteSurfacePoint command to delete surface points that are located exactly on the polylines. Not needed for this example.

Modify the polylines: Add a vertex to the polylines at each location where it crosses a surface contour. Not needed for this example.

Exercise 4: Adding an Outer Boundary to a Surface

In this exercise, you will create an outer surface boundary from a polyline.




This exercise continues from [Exercise 3: Adding Breaklines to a Surface](#).





Create an outer boundary from a polyline

Note:

This exercise uses *Surface-1A.dwg* with the modifications you made in the previous exercise.

Click **Home tab** > **Layers Properties** > **Select the _EG-BNDY** layer, click  to unfreeze this layer. Click the **X** in this menu to exit the Layer Properties list.

A blue polyline, which represents the extents of the site, is displayed. This polyline was imported with the original surface contours.

In Toolspace, on the **Prospector tab**, expand the  **Surfaces** >  **EG** >  **Definition**. Right-click  **Boundaries**. Click **Add**.

In the Add Boundaries dialog box, type the following.

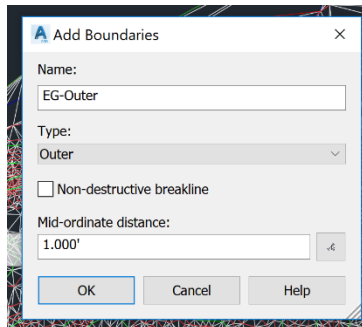
Name: **EG - Outer**

Select the Type: **Outer**

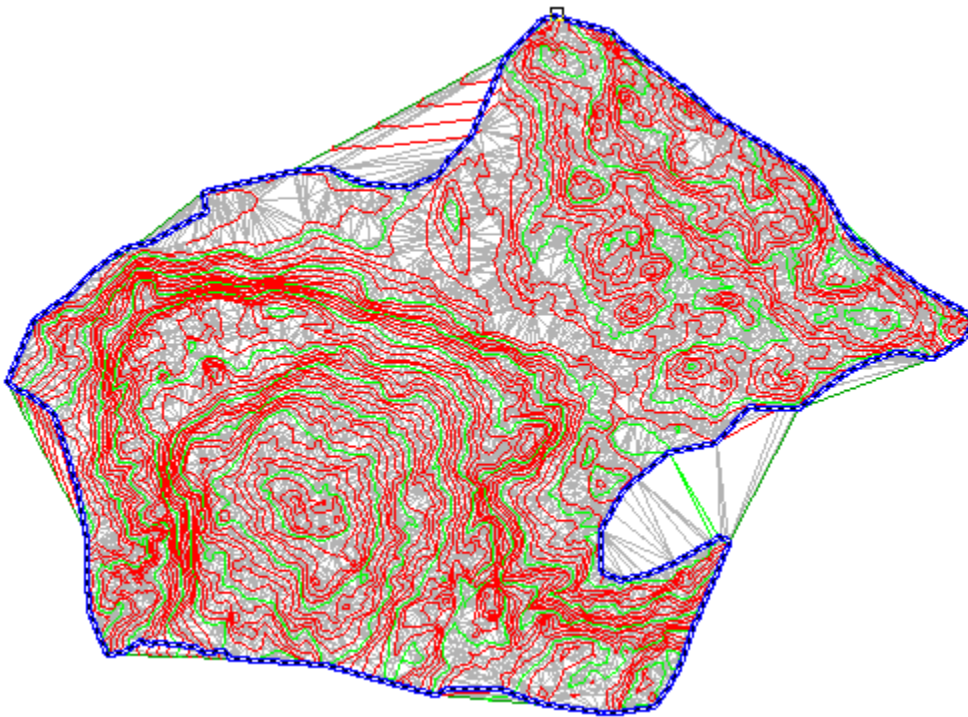
Clear the Non-Destructive Breakline box:

Mid-Ordinate Distance: **1.000**

Click OK.




Select the blue polyline.



The boundary is added to the surface definition, and the surface display in the drawing is clipped to the area that is defined by the new outer boundary.

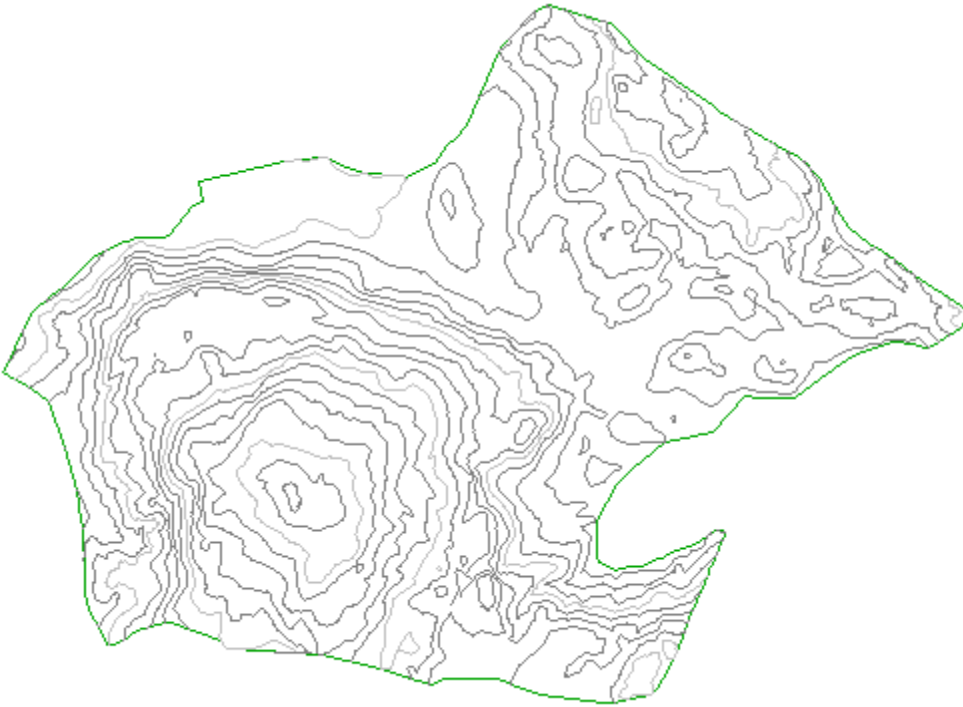
Hide the polyline and change the surface style

Click **Home** tab > **Layers Properties** > Layer drop-down. Next to the **_EG-BNDY** layer, click  to freeze this layer. Close the layer properties menu **X**.

From the **Prospector Menu** under **Surfaces** select the **EG** surface. Right-click and select **Surface Properties**.

In the Surface Properties dialog box select the **Information** tab, for Surface Style, select **Contours 5' and 25' (Background)**. Click **Apply** and then **OK**.

In the selected surface style, contours are displayed in muted colors at broad intervals. This display allows the major surface features to remain visible while you focus on other aspects of the site design.



To continue to the next tutorial, go to [Working with Large Surfaces](#).

Tutorial: Working with Large Surfaces

This tutorial demonstrates several features that can help you manage large surfaces efficiently in AutoCAD Civil 3D.

Because surfaces can contain large amounts of data, it is important to use only as much data is necessary for the current task. For example, when building a surface from LIDAR data, the corresponding point file can contain millions of points. If all of those points are included in the surface definition, it can take a considerable amount of time to rebuild the surface. If you restrict the points that the surface uses to a given area, the surface rebuilds faster and the drawing size is smaller.

The exercises in this tutorial demonstrate how to insert a relatively dense LIDAR point file into a surface, but restrict the amount of data that is actually used.

Topics in this section

Exercise 1: Limiting Imported Surface Data

In this exercise, you will use a data clip boundary to restrict the quantity of points that is referenced by a surface.

Exercise 2: Simplifying a Surface

In this exercise, you will reduce the number of points that are used to define a surface.

Exercise 1: Limiting Imported Surface Data

In this exercise, you will use a data clip boundary to restrict the quantity of points that is referenced by a surface.

Points that are in the point file, but outside the specified data clip boundary, will be ignored when the surface is built and during any subsequent surface editing operations.

Add a data clip boundary to a surface

Open **Surface-2.dwg**, which is located in the [tutorials drawings folder](#). All drawings used in these tutorials are available in the [tutorials drawings folder C:\Autodesk\WI\Autodesk Civil 3D 2019\x64\en-US\C3D\C3DLP\PF\Root\C3D\Help\Civil Tutorials](#)

In **Toolspace**, on the Prospector tab, expand the **Surfaces** collection. Expand the **EG surface**.

The **EG surface** is currently empty. In the following steps, you will use the red polyline in the drawing to create a *Data Clip* boundary, which will restrict imported surface data to the extents of the boundary. Then, you will import a relatively dense LIDAR point file and examine the results.

Expand the **EG surface** ► **Definition**. Right-click **Boundaries**. Click **Add**.

In the Add Boundaries dialog box, specify the following parameters:


Name: **Site**

Type: **Data Clip**

Mid-Ordinate Distance: **1.000'**

Click **OK**.

In the drawing window, click the red polyline.

The polyline is added to the **EG surface** definition as a boundary. The presence of a boundary in the surface definition is indicated by the  marker next to the **Boundaries** item on the Prospector tab. When the **Boundaries** collection is selected, the boundaries that have been added to the surface appear in the Prospector list view at the bottom of the screen.

In the following steps, you will add a relatively dense LIDAR point file to the surface definition. The point file will be added only within the extents of the data clip boundary that you just added.

Import surface data from a point file

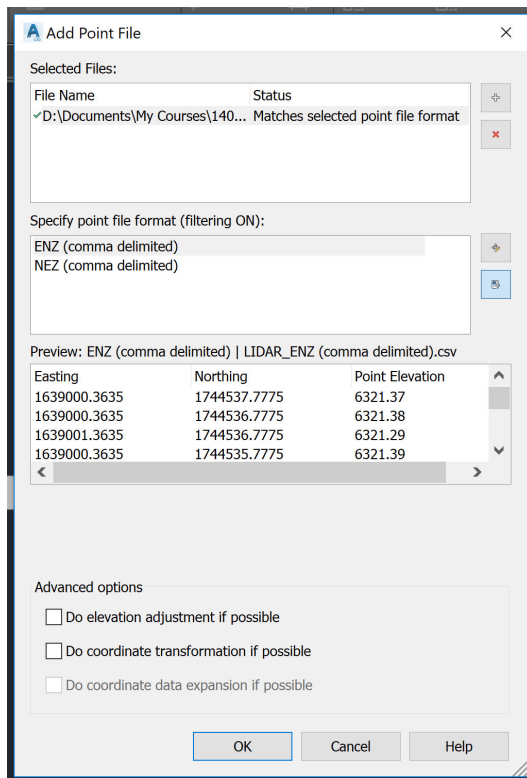
Expand the **EG surface** ► **Definition**. Right-click **Point Files**. Click **Add**.

In the **Add Point File** dialog box, under **Selected Files**, click .


Navigate to the [tutorial folder](#). Select **LIDAR_ENZ (comma delimited).csv**. Click **Open**.

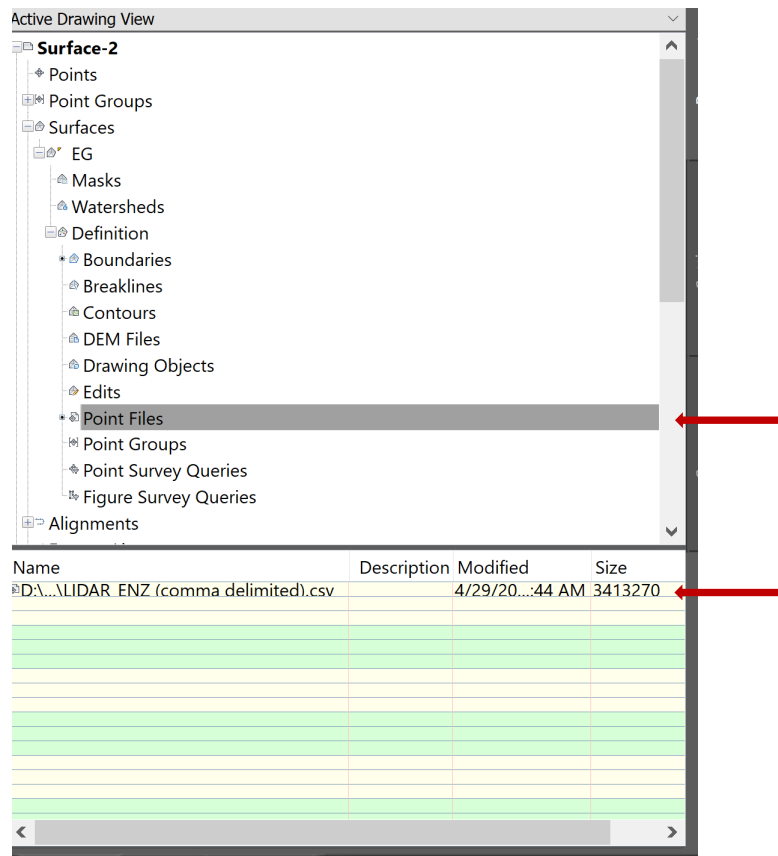
In the **Select Point File Format dialog box**, ensure that the Files Of Type field is set to **ENZ comma delimited (*.csv)**.

In the Add Point File dialog box, **clear both the Do Elevation Adjustment If Possible and Do Coordinate Transformation If Possible** check boxes. Click **OK**.



The point data is added to the drawing.

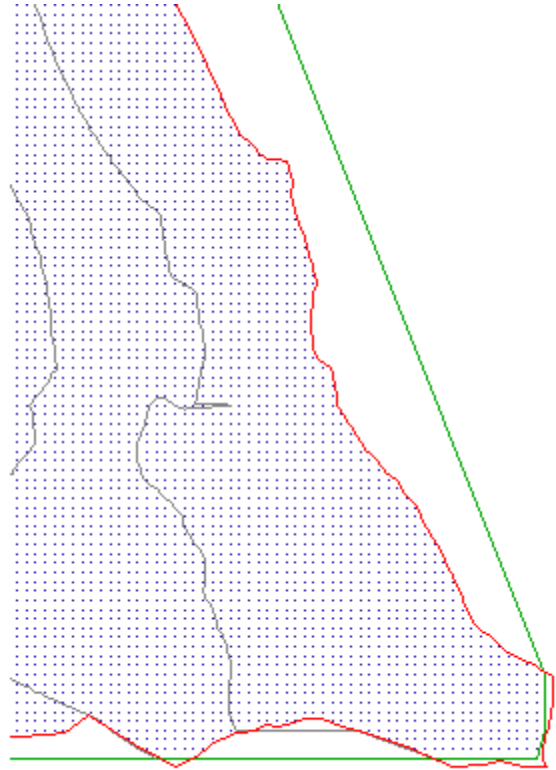
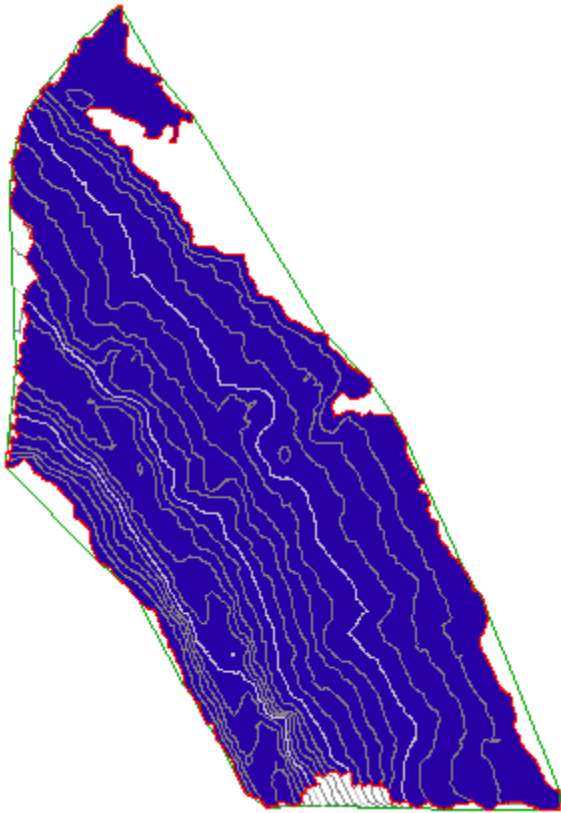
A reference to the point file is added to the EG surface definition. The presence of point data in the surface definition is indicated by the  marker next to the Point Files item on the Prospector tab.

[illegible]

Zoom in to the lower right corner of the surface.

Notice that only points that are inside the data clip boundary have been imported, and that a green border was created from the imported data.

The border is outside the red data clip boundary in some areas, and inside the data clip boundary in other areas. This happened because points in the point file that are outside the data clip boundary were excluded during the import operation. The green border is formed by the points at the outermost extents of the points that were imported.



Surface with points imported within a data clip boundary (left) and detail of the surface (right)

On the command line, enter **ZE** to zoom to the extents of the drawing.

Restrict the surface data to a smaller area

Click **Home** tab ► **Layers Properties** ► Layer drop-down. Next to the **C-TOPO-BNDY-CORR** layer, click .

This layer contains an orange polyline that you will use to create a second data clip boundary.

X to **Close** Layer Properties

Expand the **Surfaces** ► **EG** surface ► **Definition**. **Right-click Boundaries**. Click **Add**.

In the Add Boundaries dialog box, specify the following parameters:

Name: **Corridor**

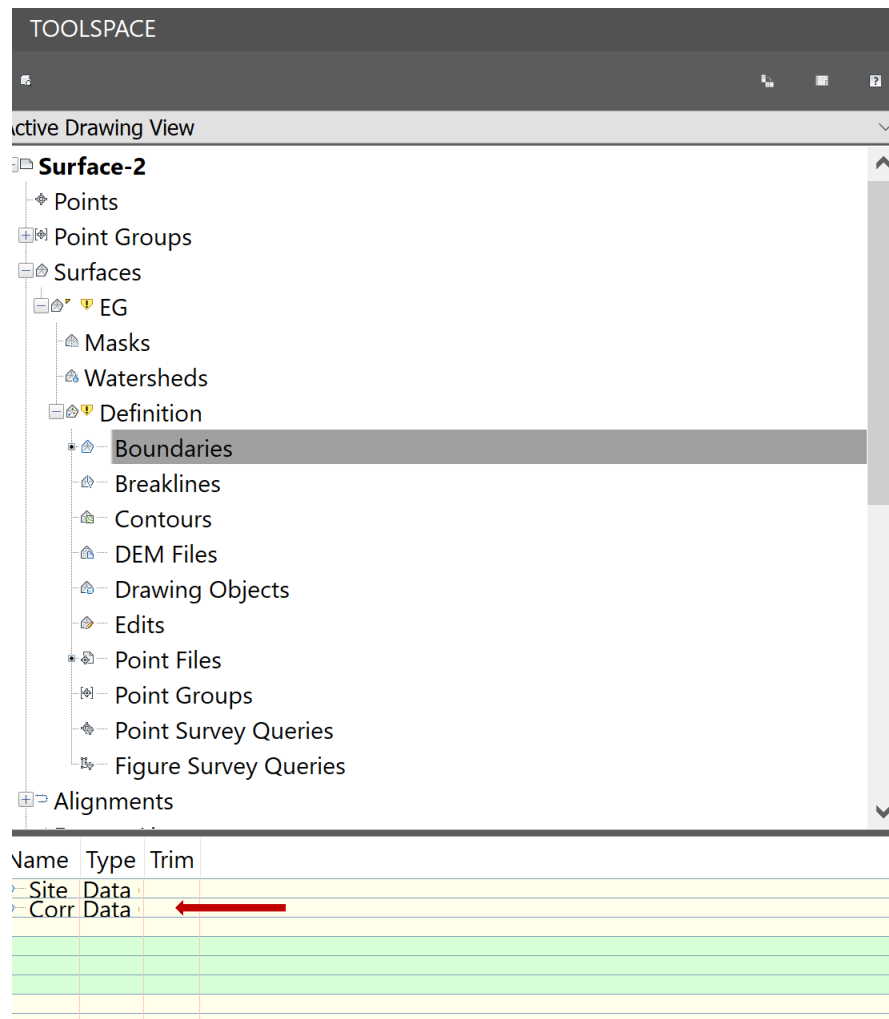
Type: **Data Clip**

Mid-Ordinate Distance: **1.000'**

Click **OK**.

In the drawing window, **click the orange polyline**.

The polyline is added to the EG surface definition as a boundary.




The point data has not changed. Data clip boundaries only affect surface editing operations that are performed after the data clip boundary has been added. Because the points were added to the surface before the Corridor boundary, the boundary currently does not affect the point data.


In the following steps, you will rearrange the surface definition operations so that the points will be restricted to the extents of the new Corridor data clip boundary.

In **Toolspace**, on the **Prospector tab**, right-click the **EG** surface. Click **Surface Properties**.

In the Surface Properties dialog box, on the **Definition** tab, in the **Operation Type** (bottom of screen) examine the order of the operations.

The operations you performed in this exercise are listed in the order in which they were performed. The Site data clip boundary was added first, and it affects the operations that follow it. The Corridor data clip boundary was added last, so it currently does not affect any other operations.

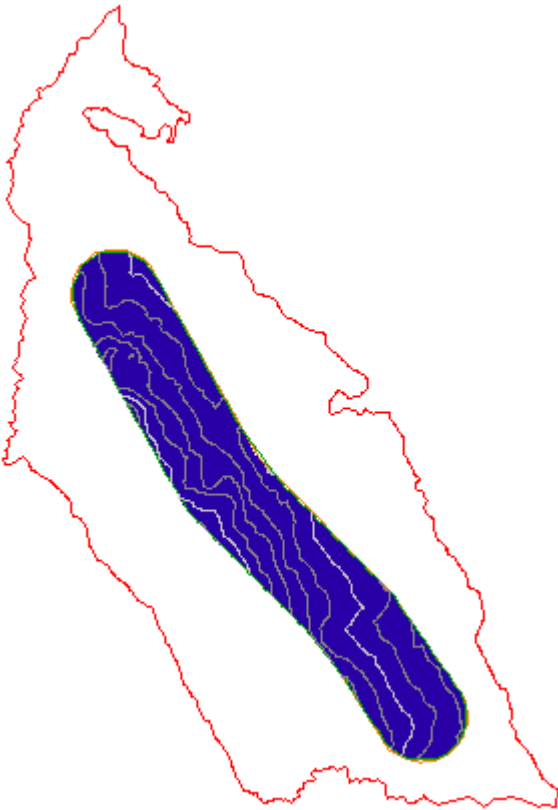
Select the last Add Boundary operation in the list. Click  (2 times) to move the Add Boundary operation (last on list) to the top of the list.

Select the other Add Boundary operation (Description Site). Click  to move the Add Boundary operation to the bottom of the list.

Click **OK**.

In the Surface Properties - **Rebuild Surface** dialog box, click **Rebuild the Surface**.

When the surface rebuilds, the points outside the orange Corridor data clip boundary are excluded from the surface.



Surface with Corridor data clip boundary applied

Further exploration: **Rearrange the surface definition operations** and observe the results. Before you continue to the next exercise, make sure that the Operation Type table is in the following order:

Add Boundary: **Corridor**

Import Point File

Add Boundary: **Site**

Exercise 2: Simplifying a Surface

In this exercise, **you will reduce the number of points that are used to define a surface.**

A surface can be simplified by **removing either TIN edges or points.** When the simplify surface command is complete, new points and TIN edges are calculated based on specified parameters. The original surface points are still contained in the referenced point file, but are not used in the surface triangulation.

In this exercise, you will use the **Point Removal method** of simplifying a surface. This method randomly selects points from the surface, and removes them based on the point density at different areas of the surface. More points are removed from areas in which the concentration of points is very dense than from areas that contain fewer points.

Note:

You cannot specify which points to remove. Points that are used to define surface borders and breaklines are not removed with the Simplify Surface command.

This exercise continues from [Exercise 1: Limiting Imported Surface Data](#).

Simplify a surface

Note:

This exercise uses **Surface-2.dwg** with the modifications you made in the previous exercise.

Click **Home tab** > **Layers Properties** panel > Layer drop-down. Next to the **C-TOPO-CONT-MAJR-ORIG** and **C-TOPO-CONT-MINR-ORIG** layers, click .

These layers contains polylines that represent the original major and minor contours. These polylines will enable you to observe the results of the Simplify Surface command.

 Close the Layer Properties Menu

Click **Modify tab** > **Ground Data panel** > **Surface** .

Click **Surface Properties** tab > **Modify panel** > **Edit Surface drop-down** > **Simplify Surface** .

In the Simplify Surface wizard, on the Simplify Methods page, **select the Point Removal** option.

Click **Next**.

On the Region Options page, specify the following parameters:

Select Objects: **Selected**

Mid-Ordinate Distance: **1.000'**

Click Pick In Drawing.

Click Next

In the drawing, **click the orange corridor boundary**.

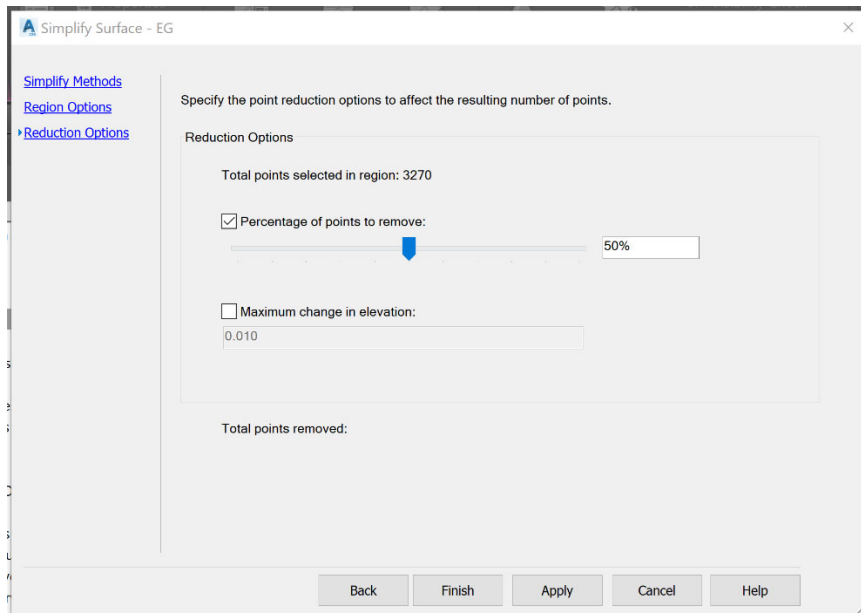
In the Simplify Surface wizard, notice the value for Total Points Selected In Region. This is the current number of points in the selected region.

Click Next.

On the Reduction Options page, specify the following parameters:

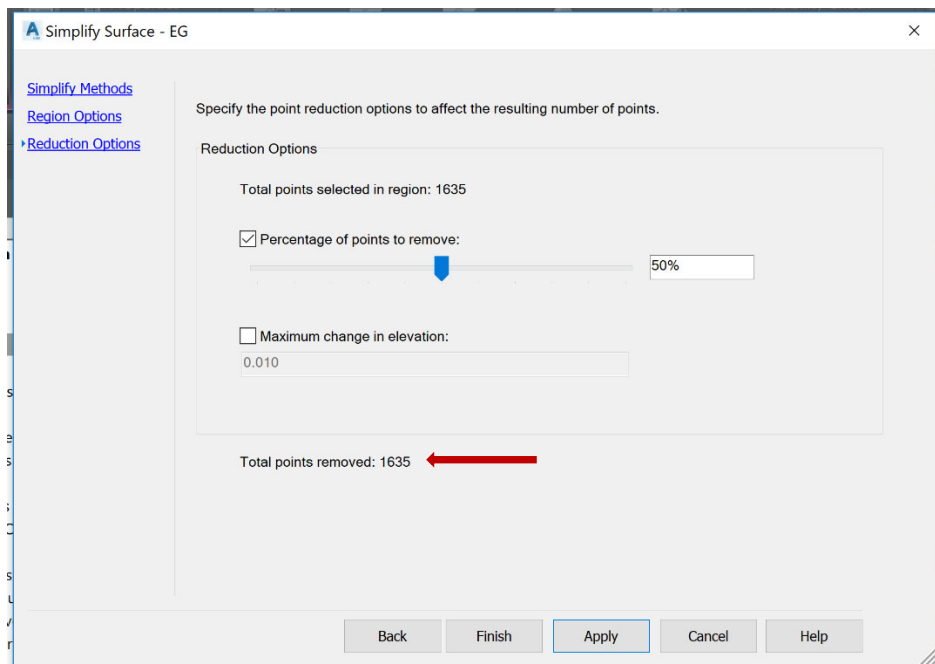
Percentage Of Points To Remove: **Selected, 50%**

Maximum Change In Elevation: **Cleared**



Click **Apply**.

At the bottom of the wizard, notice the **Total Points Removed value**. This value is the number of points that the simplify surface command removed within the selected boundary.



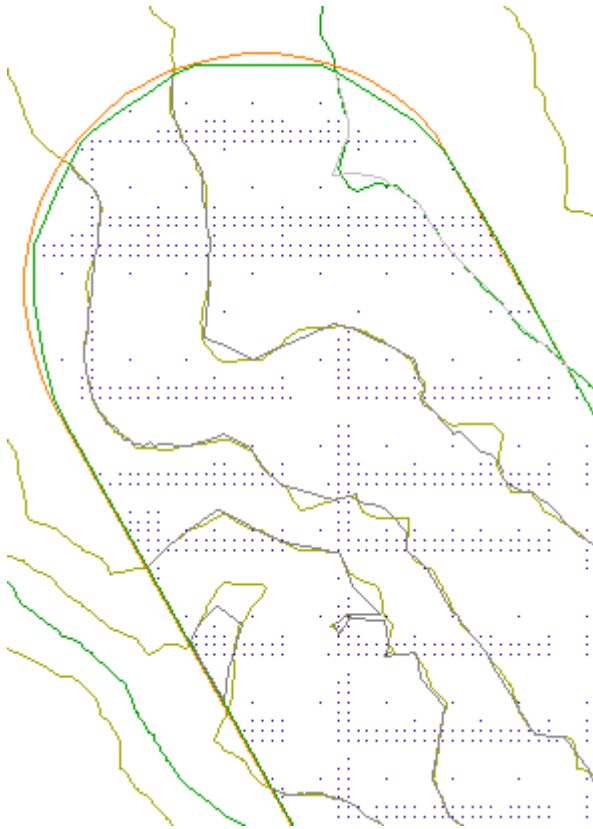
Note:

You can click Apply again to repeat the Simplify Surface command and keep the wizard open. If you **click Finish**, the Simplify Surface command is repeated and the wizard is closed.

Click Cancel.

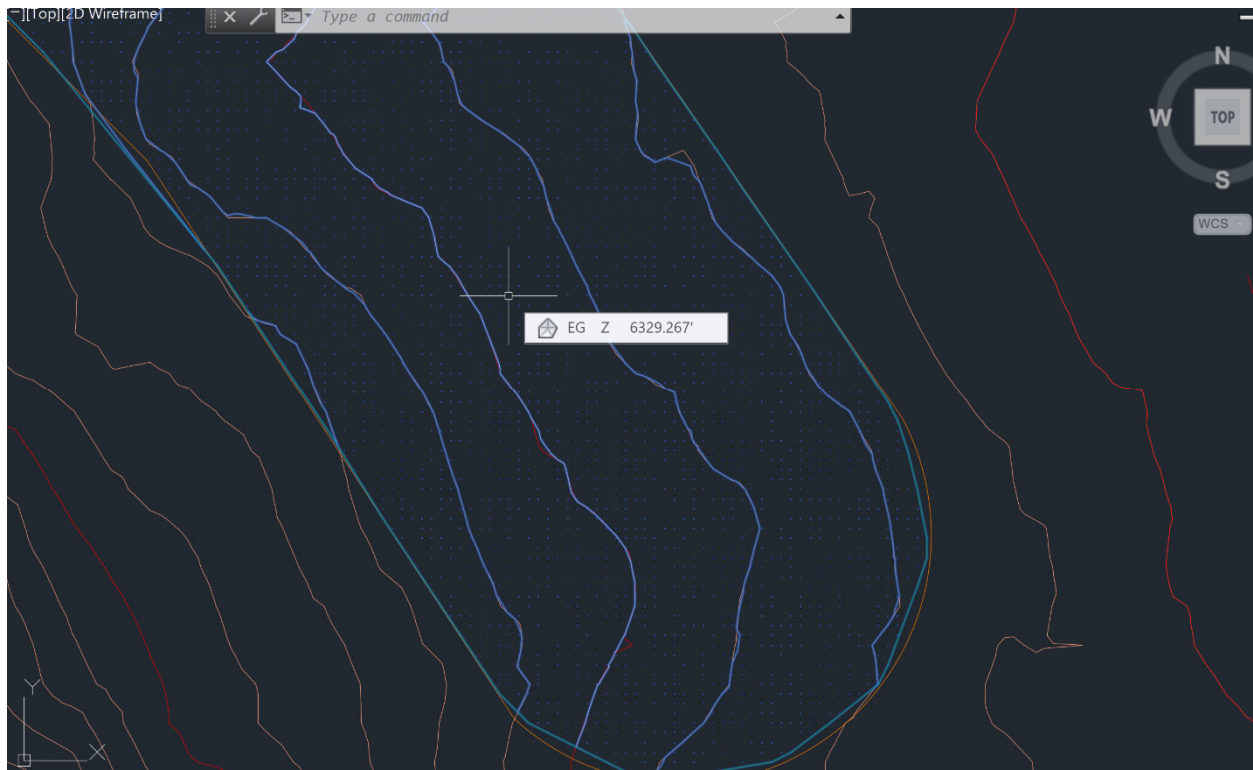
Zoom in to the surface.

Notice that the points are not as dense as they were at the beginning of the exercise, and the new, gray surface contours are very similar to the original contours. The Simplify Surface command reduced the amount of data that the surface uses without sacrificing much surface accuracy.



Simplified surface

If you cannot see the points, do the following. From the Prospector menu, Select **Surfaces**, **EG**, right click, select **Surface Properties**. In the **Surface Style Box**, Select **Contours 2'** and **10' Background**. Strike **Apply**, then **OK**.



To continue to the next tutorial, go to [Changing the Surface Style and Display](#).

Tutorial: Changing the Surface Style and Display

This tutorial demonstrates how to change and constrain the surface styles and display.

Using styles is an efficient way to control surface display. Rather than answering prompts for numerous variables every time you create a surface, you can reference a predefined style that sets all the variables as required.

Surface styles are managed the way all object styles are managed in AutoCAD Civil 3D, by using the Toolspace Settings tree. All objects have a standard object style grouping on the Settings tree, called an object style collection. You can create, edit, copy, and delete the styles for an object.

Surface styles define how the surface components are displayed in the drawing. If you want to change the appearance of a component, either apply a different style or edit the style.

The surface styles contain the following component parameters and component display settings for the creation of surface data objects:

Borders — Interior and exterior border and datum display

Contours — Minor, major, depression, and user-defined contour lines display

Grid — Primary and secondary grid display

Points — All surface points for the TIN or Grid surfaces

Triangles — TIN face information

Watersheds — Watershed analysis display

Analysis — Directions, elevations, slopes, and slope arrows

Topics in this section

Exercise 1: Editing the Surface Style

In this exercise, you will hide the display of the points on the surface and turn on the display of depression contours.

Exercise 2: Using a Different Style for a Surface

In this exercise, you will change the surface style, which the surface is referencing, to display different views of the surface.

Exercise 3: Labeling a Surface

In this exercise, you will add labels across surface contours. You will place individual labels manually and a series of labels automatically, using AutoCAD polylines as a guide.

Exercise 1: Editing the Surface Style

In this exercise, you will hide the display of the points on the surface and turn on the display of depression contours.

Depression contours form closed loops around areas of descending elevation. These are areas where lakes or can form if the rainfall and soil conditions are right.

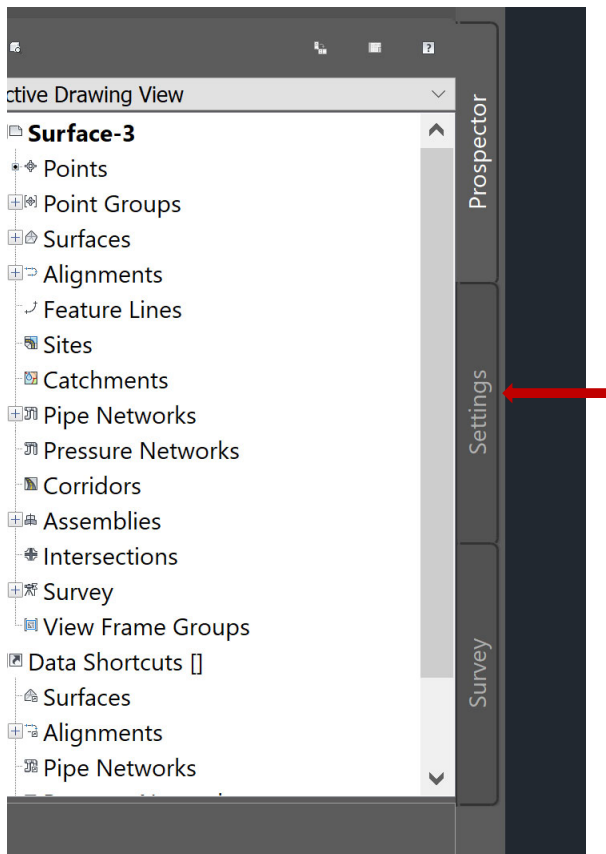
Edit the surface style

Open **Surface-3.dwg**, which is located in the [tutorials drawings folder](#).


<https://www.civil.utah.edu/~bartlett/CVEEN%201400/Tutorial%20Files/Drawings/>

I have put this file on the course website

In **Toolspace**, on the **Settings** tab (see figure below), expand the **Surface-3** ► **Surface** ► **Styles** collection.




This collection contains the existing surface styles in the drawing.

The style (**Standard**) that is being referenced by a surface in the drawing is designated with an orange marker: .

Right-click the **Standard** surface style. Click **Edit**.

In the Surface Style dialog box, click the **Display** tab.

In the **Component Display** table, turn off the visibility of Points in the surface. To do this, click  in the **Visible** column. Click **Apply**.

Click the **Contours** tab.

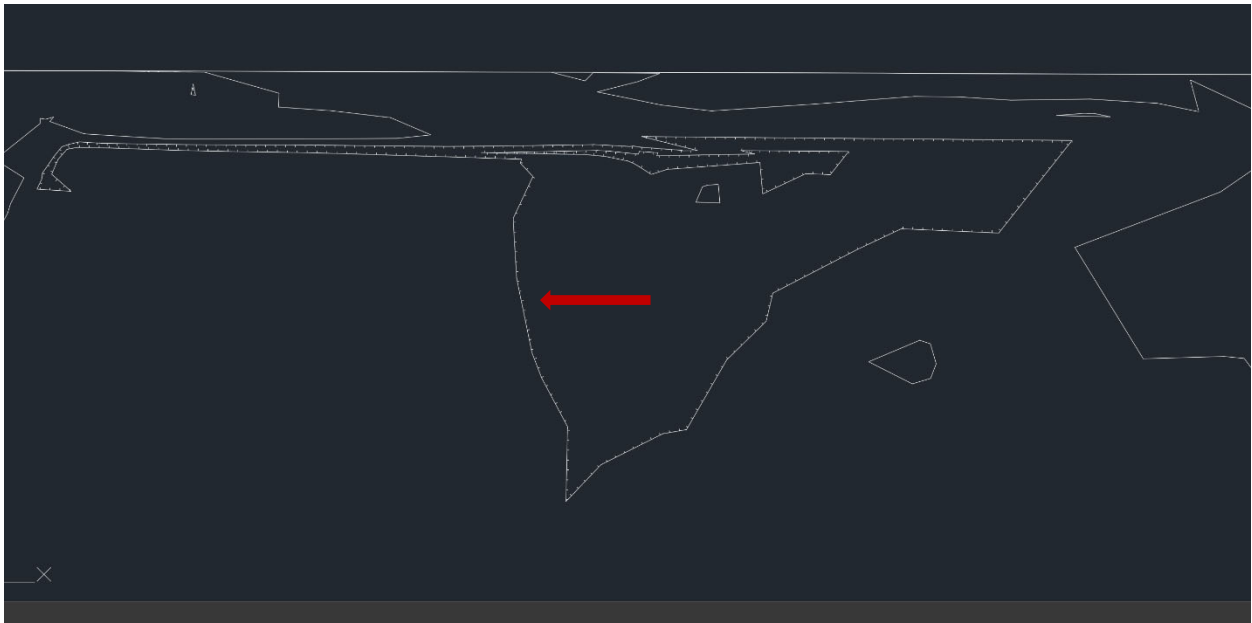
Expand the **Contour Depressions** property group. Specify the following parameters:

Display Depression Contours: **True**

Tick Mark Length: **5**

Click **OK**.

Depression contours are now visible in the drawing, with tick marks along their length.



To continue this tutorial, go to [Exercise 2: Using a Different Style for a Surface](#).

Exercise 2: Using a Different Style for a Surface

In this exercise, you will change the surface style, which the surface is referencing, to display different views of the surface.

This exercise continues from [Exercise 1: Editing the Surface Style](#).

Change the surface style

Note:

This exercise uses *Surface-3.dwg* with the modifications you made in the previous exercise.

In **Toolspace**, on the **Prospector tab**, expand the **Surfaces** collection. Right-click the **XGND** surface. Click **Surface Properties**.

In the Surface Properties dialog box, on the **Information tab**, in the **Surface Style** list, select **Border & Triangles & Points**.

This style is set to display the borders and the TIN faces with 3x vertical exaggeration. These display settings make it easier to see the vertical relief of the surface.

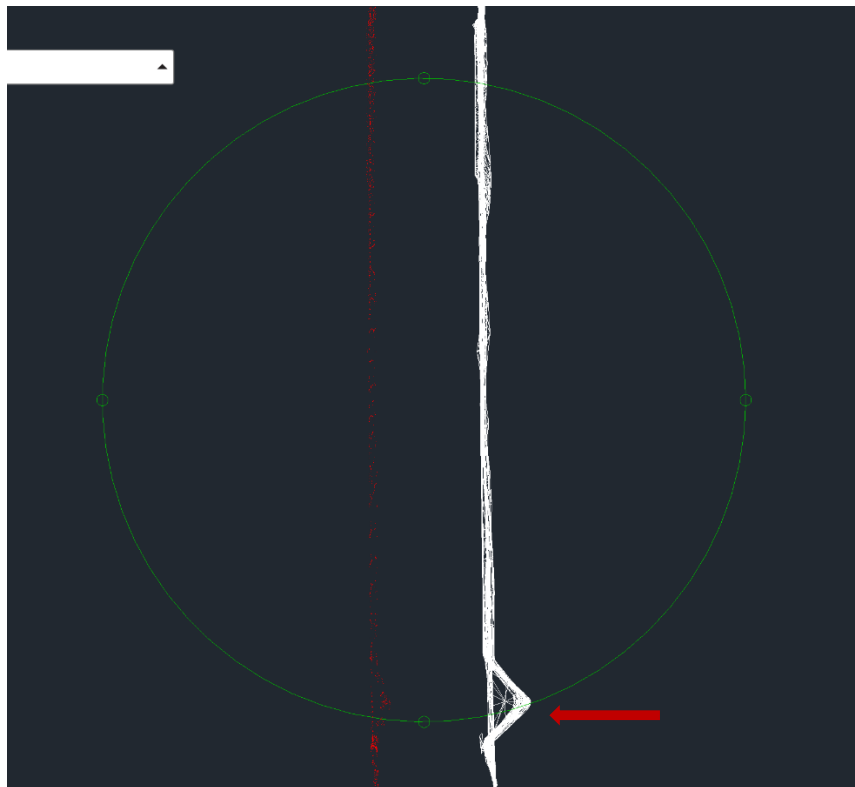
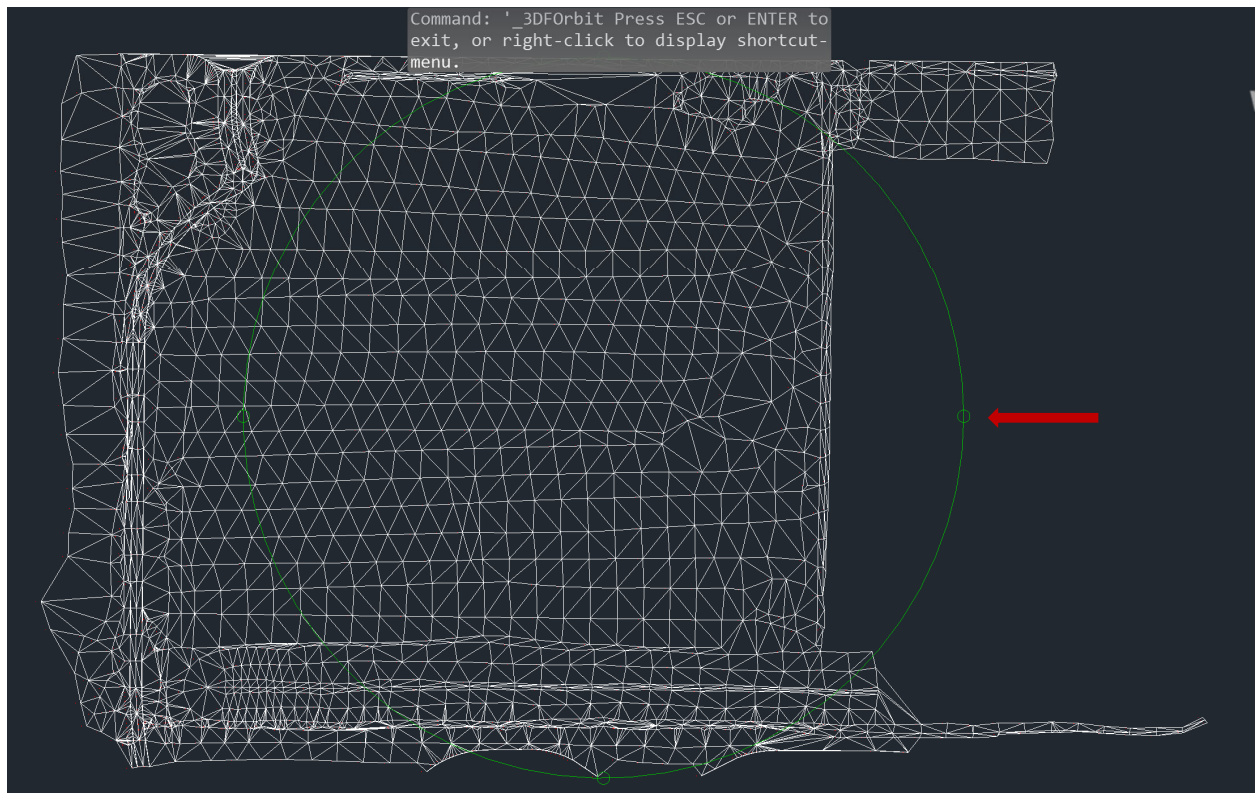
Click **APPLY**.

Click **OK**.

The surface representation updates to display the TIN triangles and border.

Click **View tab** > **Navigate 2D panel** > **Orbit** drop-down > **Free Orbit**.

Using the Free Orbit tool (select the left green point on the green circle and drag to the right), rotate the surface in the drawing to display the **exaggerated elevations**. These elevations are most evident along the bottom of the surface where a prominent ridge appears.



To return to the regular plan view of the surface, click **View tab** > **Unsaved Views** panel > **Unsaved Views drop-down** > **Top**.

Follow steps below to return the surface style to **Standard**.

In **Toolspace**, on the **Prospector tab**, expand the **Surfaces** collection. **Right-click** the **XGND** surface. Click **Surface Properties**.

In the Surface Properties dialog box, on the **Information tab**, in the **Surface Style** list, select **Standard**.

Click **APPLY**.

Click **OK**.

Exercise 3: Labeling a Surface

In this exercise, you will add labels across surface contours. You will place individual labels manually and a series of labels automatically, using AutoCAD polylines as a guide.

This exercise continues from [Exercise 2: Using a Different Style for a Surface](#).

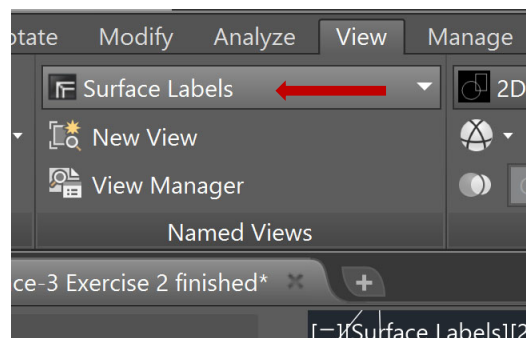
Draw a polyline to use as a guide

Note:

This exercise uses *Surface-3.dwg* with the modifications you made in the previous exercise.

To start this exercise, you must have your contours displayed! On the prospector menu, open **Surfaces**, Select **XGND**, right click and select **Surface Properties**, In the Surface Style Menu select **Borders and Contours**, then strike **Apply**, **OK**.

Click **View tab** > **Named Views** panel > **views list** > **Surface Labels**.



On the **command line**, type **PLine** and followed by the **Enter** key.

When prompted for a start point, **click in the green circle** in the **upper left corner of the view**.

Click in the middle circle, then the **lower right circle**. Press **Enter** to end the PLine command.

Label surface contours along the polyline


Click **Annotate** tab in the top menu ➤ **Labels & Tables panel** ➤ **Add Labels menu** ➤ **Surface** ➤ In the Add Labels dialog box, set the **Label Type** to **Contour - Multiple**. Leave the other settings at their defaults. Click **Add**.

On the **command line**, enter **O** then **Enter** key

to specify that you will select an object to use as a guide.

On the command line, enter **Y** to delete the polyline after the labels have been created.

You will be prompted to Select Objects in the command line. In the drawing window, **select the polyline you just made**. (It should turn blue) Press **Enter** to end the selection command.

The labels are created along the path you specified with the polyline. This method of surface labeling is useful when you want to lay out the path of surface contour labels before you create the labels. If you wanted to create the path and labels simultaneously without first drawing a polyline, you would click **Annotate** tab ➤ **Labels & Tables panel** ➤ **Add Labels menu** ➤ **Surface** ➤ **Contour - Multiple** , then draw the path.

In the drawing window, click the line on which the surface labels were drawn. Grips appear on the line.

Select the grip in the circle at the upper left. It turns red, indicating that it is active.

Drag the grip to a new location and click. Notice that the labels update automatically to reflect their new position.

Add spot elevation labels

Do do this specify the following parameters:

Annotate, **Add Label**, **Surface** Type: **Spot Elevation**

Spot Elevation Label Style: **Standard**

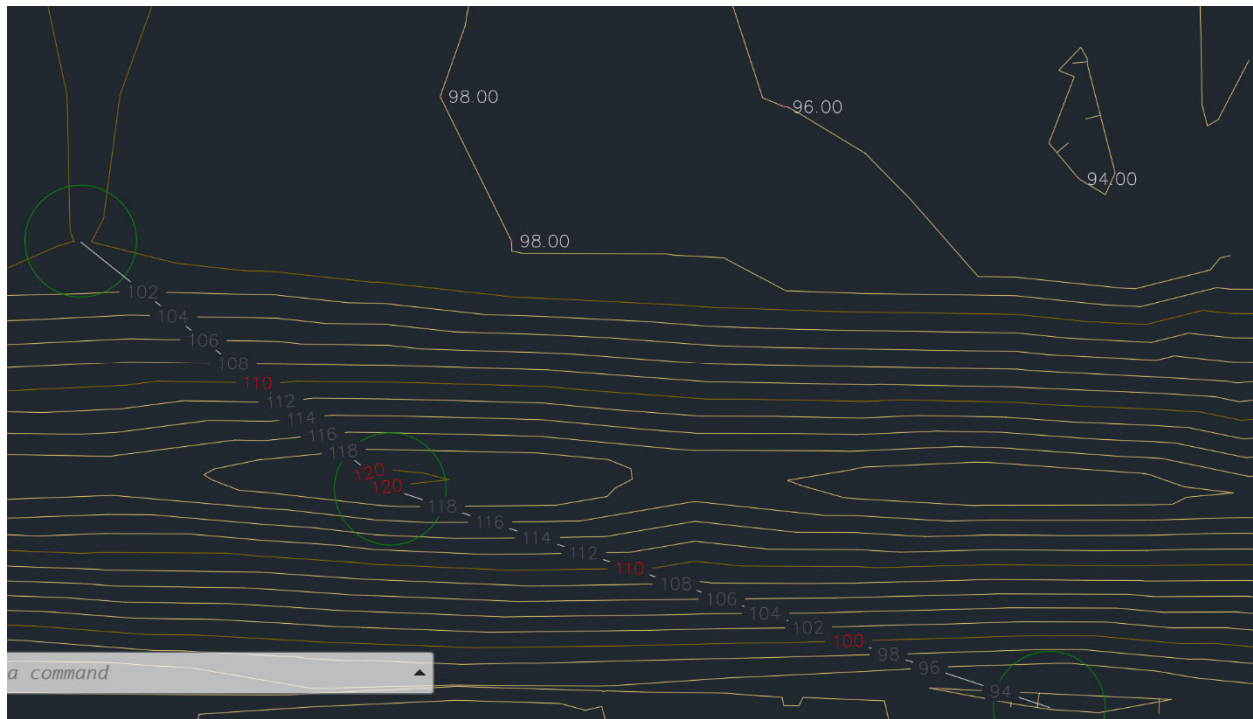
Click **Add**. When prompted, **click a point** along the ridge to place a label.

In the Add Labels dialog box, set the Spot Elevation Label Style to **Foot Meter**.

Click a point along the ridge to place a label.

Using the Add Labels dialog box, you can change label properties as needed while you create surface labels.

To close, strike **Enter**.



Tutorial: Editing Surface Data

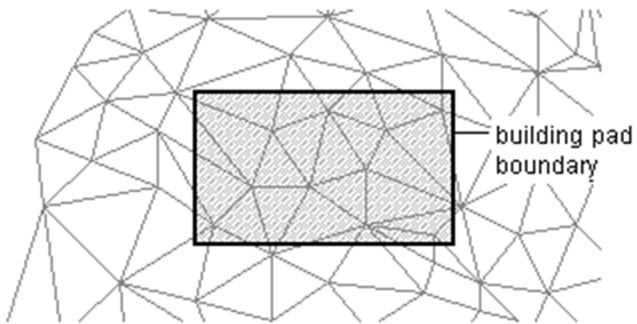
This tutorial demonstrates some common surface editing tasks, including edge swapping, TIN line deletion, and surface smoothing. You will also hide part of the surface using a hide boundary.

Hide Boundaries

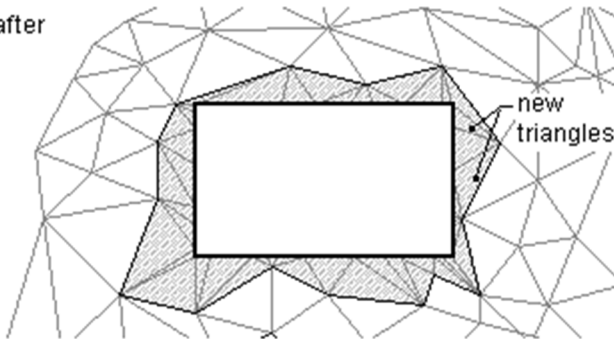
Hide boundaries mask areas of the surface so triangulation, and therefore contours, are not visible in the area. Use hide boundaries to create holes in a surface, for example, to mark a building footprint.

Click to view the effects of a hide surface boundary.

before



after



Note:

When you use a hide boundary, the surface is not deleted. The full surface remains intact. If there are surface TIN lines that you want to permanently remove from the surface, use the Delete Line command.

Surface Smoothing

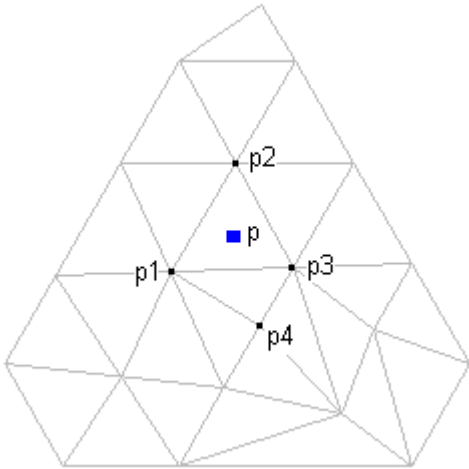
Surface smoothing is an operation that adds points at system-determined elevations using Natural Neighbor Interpolation (NNI) or Kriging methods. The result is smoothed contours, with no overlap.

You perform smoothing as an edit operation on a surface. You can specify smoothing properties and then turn them on or off. When the smoothing is turned off, the surface reverts back to its original state. However, the smoothing operation remains in the surface operation list, and it can be turned on again.

NNI is a method used to estimate the elevation (Z) of an arbitrary point (P) from a set of points with known elevations.

This method uses information in the triangulation of the known points to compute a weighted average of the elevations of the natural neighbors of a point.

Click to view the nearest neighbors of an arbitrary point (p).



To use NNI, specify only the output locations of the interpolated points. The elevations of the interpolated points are always based on the weighted average of the elevations of the existing neighboring points. NNI interpolates only within the surface.

Topics in this section

Exercise 1: Adding a Hide Boundary

In this exercise, you will create a hide boundary on the surface, which will mask unwanted triangulation.

Exercise 2: Smoothing a Surface

In this exercise, you will smooth a surface using the Natural Neighbor Interpolation (NNI) method.

Exercise 1: Adding a Hide Boundary

In this exercise, you will create a hide boundary on the surface, which will mask unwanted triangulation.

A boundary can be created from any polygon or polyline, but in this exercise you will use an existing breakline.

This exercise continues from Exercise 2: Deleting TIN Lines.

Add a hide boundary

Open *Surface-4C.dwg*, which is located in the tutorials drawings folder.

Note:

This drawing is similar to *Surface-3.dwg* with the addition of the C-TOPO-BRKL layer, which displays breaklines.

In Toolspace, on the Prospector tab, under the Surfaces collection, expand the **XGND** surface.

Under the **XGND** surface, expand the Definition collection. Right-click  Boundaries. Click Add.

In the Add Boundaries dialog box, specify the following parameters:

Name: **XGND-Pond Hide**

Type: **Hide**

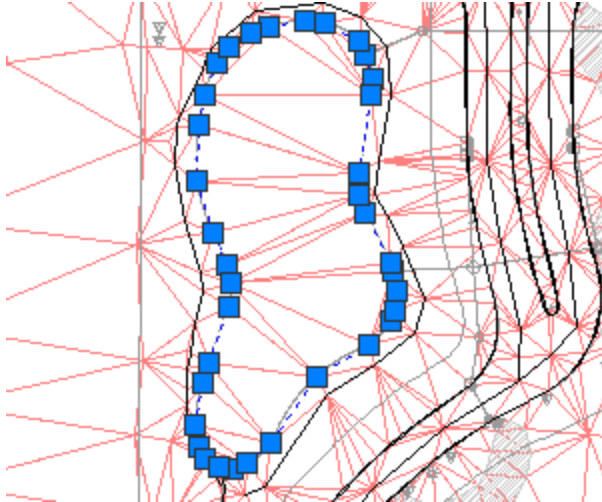
Non-Destructive Breakline: **Selected**

Mid-Ordinate Distance: **1.0000**

Click OK.

In the drawing, select the polyline object that matches the perimeter of the pond.

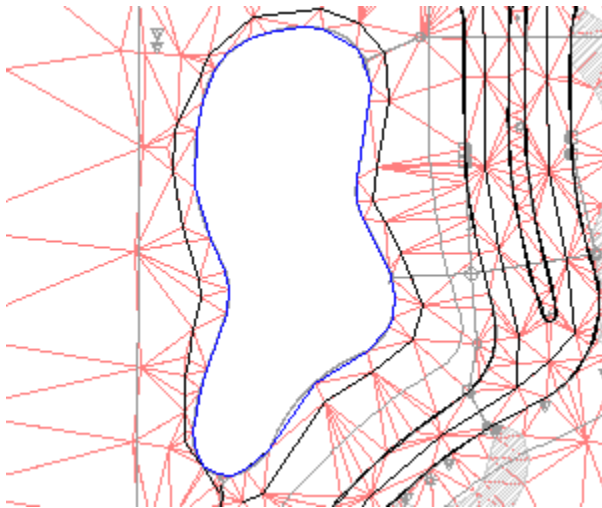
The polyline that matches the pond perimeter



Press Enter.

The hide boundary is added to the surface definition. The surface displayed in the drawing is modified to display the pond as a 'hole' in the surface.

How the surface should appear with the hide boundary





Exercise 2: Smoothing a Surface

In this exercise, you will smooth a surface using the Natural Neighbor Interpolation (NNI) method.

This exercise continues from [Exercise 3: Adding a Hide Boundary](#).

Smooth a surface using NNI

This exercise continues using *Surface-4C.dwg* with modification you made.

In Toolspace, on the Prospector tab, expand the **XGND** surface  Definition collection and right-click  Edits.

Click Smooth Surface.

In the Smooth Surface dialog box, specify the following parameters:

Select Method: **Natural Neighbor Interpolation**

Output Locations: **Grid Based**

The Grid Based output location interpolates surface points on a grid defined within specified polygon areas selected in the drawing. After the areas are defined, you can specify the grid X and Y spacing and orientation properties.

For the Select Output Region parameter, click the Value column. Click .

On the command line, enter **Surface** for the output region. This option will smooth the whole surface, rather than just the area within a specified rectangle or polygon.

In the Smooth Surface dialog box, specify the following parameters:

Grid X-Spacing: **10**

Grid Y-Spacing: **10**

In the drawing window, notice where some of the contour lines are especially angular. Click OK to smooth the surface.

The display of the surface is smoothed; contours are less angular. A Smooth Surface item is added to the Edits list view on the Prospector tab.

Note:

The Description column in the list view displays the type of surface smoothing that was used (Natural Neighbor Smoothing). You can delete the Smooth Surface edit from the list, but this does not reverse the smoothing operation until you rebuild the surface. You can also reverse the smoothing operation by using the **U** (undo) command.

Tutorial: Visualizing Surface Data

This tutorial demonstrates how to add multi-view blocks to a surface and render it using a sample of the visualization techniques included with AutoCAD Civil 3D.

AutoCAD Civil 3D uses the same rendering functionality as standard AutoCAD. At a basic level, you can use the Render command to render your model without applying any materials, adding any lights, or setting up a scene. In this tutorial, you will create a basic rendering by applying a render material to a surface. You will explore some of the basic render settings that are available.

Topics in this section

Exercise 1: Moving Multi-View Blocks to a Surface

In this exercise, you will insert multi-view blocks into a drawing, and then place them at the appropriate elevation on a surface.

Exercise 2: Rendering a Surface

In this exercise, you will use some of the visualization features in AutoCAD Civil 3D to render a surface.

Exercise 1: Moving Multi-View Blocks to a Surface

In this exercise, you will insert multi-view blocks into a drawing, and then place them at the appropriate elevation on a surface.

A multi-view block is an AutoCAD Civil 3D object that can have different representations in different view directions.

Predefined multi-view blocks supplied with AutoCAD Civil 3D are available in DesignCenter. These blocks represent various items, such as signs, building footprints, trees, and shrubs. In DesignCenter, predefined multi-view blocks are located in the [Data folder](#) \Symbols\Mvblocks. C:\ProgramData\Autodesk\C3D 2019\enu\Data

Insert multi-view blocks into the drawing

Open *Surface-7.dwg*, which is located in the [tutorials drawings folder](#).

Click View tab ➤ Views panel ➤ views list ➤ **Plan Detail**.

The drawing view shows a two-way road with a median separating the lanes.

Click View tab ➤ Palettes panel ➤ Design Center .

In DesignCenter, navigate to the [Data folder](#) \Symbols\Mvblocks. Select the Mvblocks folder in the left pane.

In the right pane, examine the blocks that are available.

Note:

Before continuing with this exercise, either dock the DesignCenter palette or click  to autohide it.

In the right pane, select *R4-7a Keep Right.dwg*. Right-click. Click Insert As Block.

In the Insert dialog box, specify the following parameters:

Insertion Point - Specify On Screen: **Selected**

Scale - Specify On Screen: **Selected**


Scale - Uniform Scale: **Selected**

Rotation - Specify On Screen: **Selected**

Explode: **Cleared**

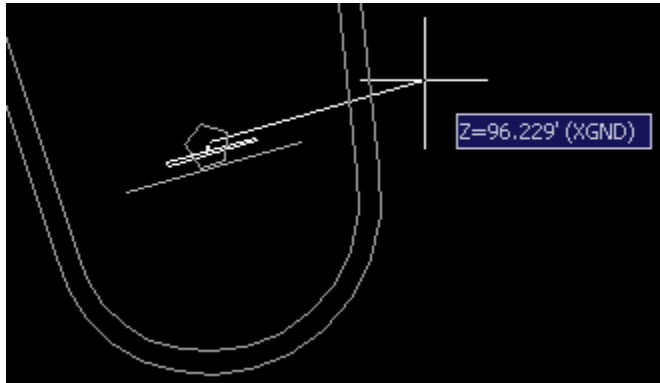
Click OK.

When prompted to specify an insertion point in the drawing window, click


the  symbol at the bottom of the median.

Press Enter to accept the default scale factor of 1.

When prompted to specify the rotation angle, zoom in to the insertion point and rotate the block until the sign is parallel with the symbol. Click to set the angle of rotation.




Repeat steps 6 and 7 to insert the *Light Pole 01.dwg* block.


When prompted to specify an insertion point in the drawing window, click the  symbol near the middle of the median. Press Enter to accept the default scale factor and rotation angle.

Move multi-view blocks to the surface

Click View tab ➤ Views panel ➤ views list ➤ **3D Detail**.

In the 3D view, notice that the street light block appears at the lower portion of the drawing and is not at the appropriate surface elevation. In the following steps, you will move both blocks onto the surface.

Click Modify tab ➤ Ground Data panel ➤ Surface .

Click Surface tab ➤ Surface Tools panel ➤ Move to Surface drop-down Move Blocks To Surface .

In the Move Blocks To Surface dialog box, in the Select Block Reference Names field, select **Light Pole 01** and **R4-7a Keep Right**.

Click OK. Each selected block moves from its current elevation to the surface elevation at the block's insertion point.

Exercise 2: Rendering a Surface

In this exercise, you will use some of the visualization features in AutoCAD Civil 3D to render a surface.

Like other AutoCAD Civil 3D objects, you must apply a render material to the surface using the Surface Properties dialog box.

This exercise continues from [Exercise 1: Moving Blocks to a Surface](#).

Apply a render material to the surface

Note:

This exercise uses *Surface-7.dwg* with the modifications you made in the previous exercise.

In Toolspace, on the Prospector tab, expand the Surfaces collection.

Right-click the **XGND** surface. Click Surface Properties.

In the Surface Properties dialog box, on the Information tab, specify the following parameters:

Render Material: **Sitework.Planting.Sand**

This render material displays contrast in the surface elevations.

Surface Style: **Standard**

Click OK.

Apply a visual style to the surface

Visual Styles give a fast, basic visualization of the surface that is useful for on-screen presentation in AutoCAD Civil 3D.

Click View tab ➤ Visual Styles panel ➤ Visual Styles drop-down ➤ Realistic.


This visual style shades the surface and smooths the edges between polygon faces. The render material that you applied to the surface is displayed.

Click View tab ➤ Visual Styles panel ➤ Visual Styles drop-down ➤ Conceptual.

This visual style shades the surface and smooths the edges between polygon faces. The shading in this style uses the Gooch face style, a transition between cool and warm colors rather than dark to light. The effect is less realistic, but it can make the details of the model easier to see.

Render the surface

On the command line, enter **RPREF**.

Examine the many render settings that are available, including variations in image quality and output size. If you wanted to save the rendered image to a file, you would click  and use the Output File Name control to specify a file name and destination.

Click .

The surface and blocks are rendered in the Render window. The effects of rendering are more apparent in a drawing that has different render materials applied to several surfaces and objects.

