Creating Solids from Surfaces

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To Create AutoCAD Solids from AutoCAD Civil 3D TIN Surfaces

You can create an AutoCAD solid from a TIN surface. The solid that is generated is based on the surface triangles and the surface border.

1. In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Create AutoCAD 3D Solids**. Double-click **Create 3D Solid from Surface**.
2. In the Extract Solid From Surface (page 1) dialog box, select a TIN surface to use as the basis for the solid.
3. Specify the **Vertical Definition** and **Drawing Output** settings to use for the solid and then click **Create Solid**.

   The solid is created in the current drawing or in the specified new drawing.

   NOTE If the command cannot create a solid based on the specified options, a message is displayed. For example, sometimes the command is unable to create a solid when the **At A Surface** option is selected and the two surfaces that are specified intersect each other, such as when a surface created from a grading object intersects a target surface.

Extract Solid From Surface Dialog Box

Use this dialog box to specify options for extracting a solid from a TIN surface.

Surface
Specifies the TIN surface that is used as the basis for the solid. Select the surface from the drop-down list or click

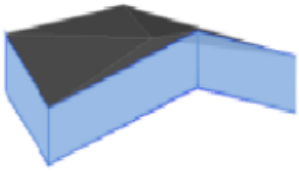


to select the surface from the drawing.

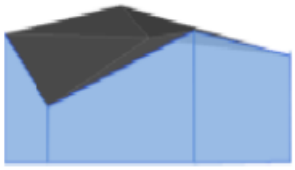
Vertical Definition

Specifies how the depth of the solid is defined.

Depth Specifies that the bottom of the solid is defined from a specified relative depth. Enter the depth as a positive or negative value. If you enter a positive value, the solid is extruded upward from the surface. If you enter a negative value, the solid is extruded downward from the surface. The depth is applied straight up or down relative to the surface.



At Fixed Elevation Specifies that the bottom of the solid is at a fixed elevation, which results in a solid with a flat bottom or top. This option is useful for creating solids that can be used in another application such as Autodesk® Revit® or if you want to create a 3D print of a surface.

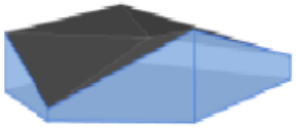


At a Surface Specifies that the bottom of the solid is defined from another surface. Select the surface from the drop-down list or click



to select the surface from the drawing. This option creates a solid that represents the mass between the two surfaces. For example, you can use this option to create a solid that represents the mass of the top surface down to the subgrade.

NOTE When using this option, any portion of the bottom surface that extends above the top surface is not included in the resulting solid.



Drawing Output

Insert Into Current Drawing Creates the solid in the current drawing.

Add To a New Drawing Creates the solid in another drawing. Click



to open the Specify New Drawing dialog box where you can specify the drawing name and location.

Layer Specifies the layer on which the solid is created. Click



to open the Object Layer dialog box where you can specify the layer.

Color Specifies the color for the solid. Click



to open the Select Color dialog box where you can select the color.

Using the COGO Editor

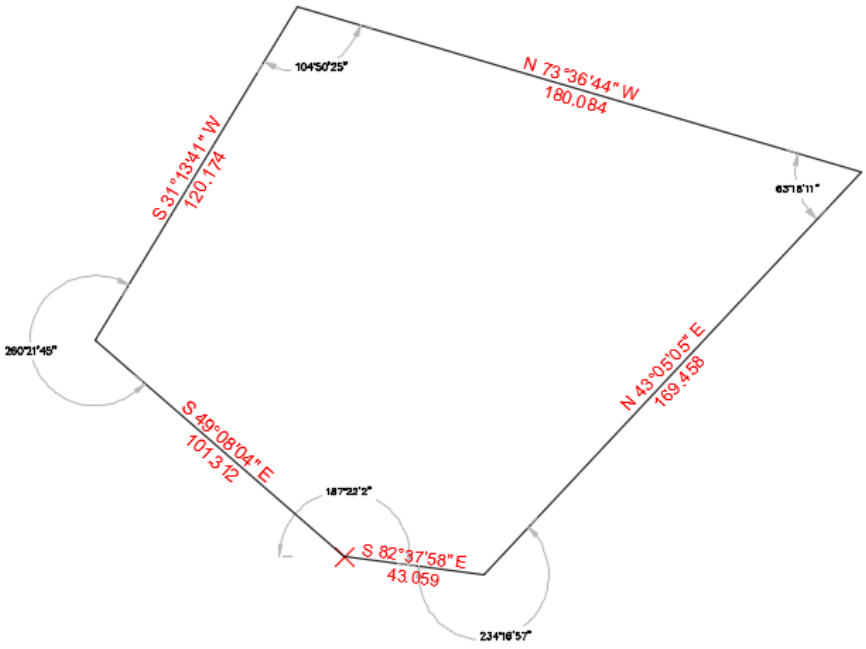
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About the COGO Editor

Use the COGO Editor to create and balance 2D traverses.

Graphical Preview and Object Insertion

Temporary graphics, as shown in the following example, are displayed in the drawing when you enter traverse data in the COGO Editor.



These graphics disappear when you close the COGO Editor. You can use the **Create Polyline From Traverse**

and **Add COGO Points to Drawing**



options to insert objects into the drawing that are based on the traverse data.

General Guidelines for Entering Data

You can load data into the COGO Editor by selecting an existing polyline in the drawing or by manually entering known data. You can use a variety of formats and mathematical equations to quickly enter traverse data.

- Use the Tab, Enter, or arrow keys to navigate between cells.
- The values you enter in the COGO Editor are not affected if the traverse is adjusted, scaled, or rotated.
- To use another unit of measure, enter either ' or **m**.

  For example, if you are working in a metric drawing and want to enter a value in feet, enter **200'**.

  NOTE The unit of measure calculation depends on the parameters specified on the Units and Zone tab of the Drawing Settings dialog box:

If Drawing Units is set to:	and Imperial to Metric Conversion is set to:	and the suffix is:	then the distance conversion is:
Feet	US Survey Foot	m	meters to US survey foot
Feet	International Foot	m	meters to international foot
Meters	US Survey Foot	'	US survey foot to meters
Meters	International Foot	'	international foot to meters

Using Mathematical Equations to Calculate Traverse Parameters

You can enter a variety of mathematical equations to calculate traverse parameter values. The equations enable you to enter known data, such as the relative location of COGO points, when you define a traverse.

The following operators are valid:

- +
- -
- /
- *
- ( )

The following equations are simple examples of how to enter data in the COGO Editor:

Equation	Result
(1 to 2)/2	Calculate the angle, direction, or distance between points 1 and 2, and then divide the result by 2.
100+200+150	Return the sum of multiple values. **NOTE** This type of equation is useful for calculating the total distance of several, contiguous lot lines.

To Create Traverse Data in the COGO Editor

To create traverse data manually

You can enter traverse data in the COGO Editor by creating traverse sides. Side types can be Point, Line, Arc, or Side Shot. The first side type of the traverse must be a point.

1. In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).
2. Ensure that the **Entry** tab is active.
3. If there is existing data in the COGO Editor, click 
   to create a new traverse.
4. Ensure that **Point** is specified as the first **Side** type.
5. Enter parameters in the first row of the COGO Editor for the point.

6 Specify subsequent **Side** types, and then specify the requisite parameters.

TIP You can right-click in the COGO Editor to access a context menu with commands you can use to delete a row, to insert a row between existing rows, and to reorder rows.

7 Click

to save the traverse to a TRV2 file.

To create traverse data by selecting a polyline in the drawing

You can generate traverse data by selecting an existing polyline in the drawing.

1 In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).

2 Ensure that the **Entry** tab is active.

3 If there is existing data in the COGO Editor, click

to create a new traverse.

4 Click

, and then select the polyline in the drawing.
The COGO Editor is populated with the information from the polyline.

TIP You can also right-click in the COGO Editor and select the Import Graphics command to create traverse data from a polyline.

5 Click

to save the traverse to a TRV2 file.

To Open and Edit a Traverse File in the COGO Editor

1. In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).
2. Ensure that the **Entry** tab is active.
3. In the **COGO Editor** dialog box, click
   
   .
4. Select the appropriate TRVX2 or TRVX file. Click **Open**.

   NOTE The COGO Editor saves files in TRV2 format.

   The **COGO Editor** dialog box is populated with the traverse data, and a preview of the traverse is displayed in the drawing.
5. In the **COGO Editor** dialog box, adjust the parameters as necessary.
6. Create additional sides as needed, and then specify the requisite parameters.
7. On the main toolbar, click
   
   .

To Balance a Traverse in the COGO Editor

1. In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).
2. Ensure that the **Entry** tab is active.
3. Create a traverse, or open an existing traverse.
4. Click the **Balance** tab.
5. Specify an adjustment type from the drop-down list.
6. Specify control points as needed.

7 On the main toolbar, click

.

To Create Objects from a Traverse in the COGO Editor

To create a polyline from a traverse

1 In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).

2 Ensure that the **Entry** tab is active.

3 Create a traverse, or open an existing traverse.

4 Click

. A vertex is placed at the beginning and end of each traverse side.

To create COGO points from a traverse

1 In the **Toolspace**, on the **Toolbox** tab, expand **Subscription Extension Manager ➤ Civil 3D Productivity Pack 1 ➤ Coordinate Geometry Editor**. Double-click **Launch Coordinate Geometry Editor** to display the COGO Editor (page 10).

2 Ensure that the **Entry** tab is active.

3 Create a traverse, or open an existing traverse.

4 Click

. COGO points are created at the beginning and end of each traverse side. If there is an existing COGO point that is used in the traverse at the beginning or end of a traverse side, an additional COGO point is not added at that location.

COGO Editor Dialog Box

Use this dialog box to enter and balance traverse data.

Icons

Create a New Traverse



Creates a new traverse in the dialog box.

Open an Existing Traverse File



Opens a traverse from a TRV2 file (created in the COGO Editor) or a TRVX file (an older format created in the Coordinate Geometry Editor). When the file is opened, the dialog box is populated with the traverse data, and a preview of the traverse is displayed in the drawing.

Load Traverse From Existing Graphics



Loads traverse data from a polyline, automatically creating traverse sides between each polyline vertex.

Save the Current Traverse



Saves the traverse to a TRV2 file.

Save a Copy of the Traverse



Saves a copy of the traverse to a TRV2 file.

Refresh



Refreshes the display of the traverse in the drawing.

Create Polyline From Traverse

Creates a polyline from the traverse. A vertex is placed at the beginning and end of each traverse side.

Add COGO Points to Drawing



Creates COGO points at the beginning and end of each traverse side. If there is an existing COGO point that is used in the traverse at the beginning or end of a traverse side, an additional COGO point is not added at that location.

Entry Tab

Use the Entry tab to enter traverse data.

TIP Right-click in the COGO Editor to access commands for inserting, deleting, or reordering the rows, entering bearing and distance data, and importing graphics.

Side Specifies the type of traverse side to create: **Point**, **Line**, **Arc**, or **Side Shot**. The first side type of the traverse must be a point.

Point - Line - Chord Use these columns to enter data for points, lines, and chords.

NOTE To enter chord data, select **Arc** as the **Side** type and enter chord data in the **Point - Line - Chord** section of the dialog box.

- **Angle**: Specifies the angle for the traverse side.

  You can enter angles using several methods. Letters in entries may be capitalized or lower case.

Angle Entry Types

Angle Entry Type	Example/Description
Directions	**NSE** or **W** **NOTE** **North**, **South**, **East**, and **West** can also be used.
Directions and angle	**N30W** (bearing) or **N45** (azimuth)
Quadrant and angle	**1..45**, where 1 is the quadrant and 45 is the angle.
Right or left turned angle	**R45** or **L45** **NOTE** This angle is turned from the foresight.
Degrees, minutes, and seconds	**63 51 25** or **63.5125** **NOTE** This angle is turned from the backsight.
The angle between two COGO points	**1 to 2** where 1 and 2 are the COGO point numbers or **PT1 to PT2** where PT1 and PT2 are COGO point names.

Angle Entry Type	Example/Description
Selected locations	Click  and select two points to define a direction in the drawing.
Mathematical equations	**(1 to 2)/2** **NOTE** The following operators are valid: ■ + ■ - ■ / ■ * ■ ( )

TIP You can also define the angle and distance for side by right-clicking a row in the COGO Editor and selecting Pick Bearing and Distance on the context menu. After selecting the command, define the bearing and distance by selecting two points in the drawing.

- **Direction**: Displays the direction of the traverse side (read-only).
- **Distance**: Specifies the distance of the traverse side.

  You can enter distances data using several methods.

Distance Entry Types

Distance Entry Type	Example/Description
Numeric	**100**, **100m**, or **100'** **NOTE** The unit of measure calculation depends on the parameters specified on the Units and Zone tab of the Drawing Settings dialog box. For more information, see About the COGO Editor (page 5).
COGO points	**1 to 2** where 1 and 2 are the COGO point numbers, or **PT1 to PT2** where PT1 and PT2 are COGO point names.

Distance Entry Type	Example/Description
Selected locations	Click  and select a two points to define a distance in the drawing.
Mathematical equations	**100 + 25** or **(1 to 2)/2** **NOTE** The following operators are valid: ■ + ■ - ■ / ■ * ■ ( )

- **Length**: Displays the length of the traverse side (read-only).
- **Location**: Specifies the location of point data.

  You can specify locations data using several methods.

Location Entry Types

Location Entry Type	Example/Description
COGO points	Enter **1** where 1 is a COGO point number, or **PT1** where PT1 is a COGO point name, or click  and select a COGO point in the drawing
Coordinates	Enter **200,200**, or click  , enter **X** at the Command line, and then and select a location in the drawing.

- **Reverse**: When selected, specifies that the direction of the traverse side is reversed.

Arc Use these columns to enter data for arcs.

- **Angle**: Specifies the angle of the arc. For information about methods for entering angles, see the Angle Entry Types table above.
- **Radius**: Specifies the radius of the arc. For information about methods for entering radius data, see the Distance Entry Types table above.
- Δ**Angle**: For a tangent curve or radial curve, specifies the central angle, measured from the center of the curve, from the beginning of the curve to the ending point of the curve. For information about methods for entering angles, see the Angle Entry Types table above.
- **Length**: Specifies the length of the arc. For information about methods for entering length data, see the Distance Entry Types table above.
- **Center**: Specifies the center point of the arc. For information about methods for entering center point data, see the Location Entry Types table above.
- **Flip**: When selected, flips the angle of the arc.

Context Menu You can right-click to access commands in a context menu.

- **Pick Bearing and Distance**: Defines the bearing and distance from two points you select in the drawing.
- **Insert Row Before**: Inserts a new row before the selected row.
- **Insert Row After**: Inserts a new row after the selected row.
- **Delete Row**: Deletes the selected row.
- **Move Up**: Moves the selected row up.
- **Move Down**: Moves the selected row down.
- **Import Graphics**: Loads traverse data from a polyline, automatically creating traverse sides between each polyline vertex. You can use the Offset command line option to offset a polyline and import the offset polyline into the traverse.

Balance Tab

Use this tab to select a balance type and to review the balance data.

Balance Selection Drop-Down Use these options to select the type of traverse adjustment to perform.

- **No Balance**: Does not perform an adjustment.
- **Compass Rule/Bowditch Adjustment**: A method of corrections where the closing errors are assumed to be as much due to errors in observed angles as by the errors in measured distances. The closing errors in latitude

and departure are distributed according to the ratio of the length of the line to the total length of the traverse.

- **Transit Rule**: A method of balancing a traverse where the closing errors are assumed to be caused less by the errors in the observed angles than by the errors in measured distance. Corrections are distributed according to the ratio of the latitude and departure of each leg of the traverse to the sums of the latitude and departures of the entire traverse.
- **Crandall Rule**: A method of balancing a traverse where all the angular error is distributed throughout the traverse and all adjustments to the traverse are due to modifying the traverse distances. The modification distance made to each leg is such that the sum of the squares is a minimum. Corrections corresponding to the closing errors assume that the closing errors are random and normally distributed, and that all the angular error has been adjusted prior to the adjustment routine.
- **Rotate and Scale to a Known Line**: A method of balancing a traverse where the line between the start and end of the traverse is scaled and rotated to match a known line that is defined between two control points. To use this option, the first and last sides of the traverse must have control points defined.

Side Displays the type of traverse side: **Point**, **Line**, **Arc**, or **Side Shot**.

Control Point Specifies whether certain points should be held as control points. Enter the COGO point number or name.

Side Displays the data for each traverse side. The data contains the adjustments if any are made.

Adjustment Displays the changes applied to each traverse side when the adjustments are applied. If no adjustments are made, the values are zero.