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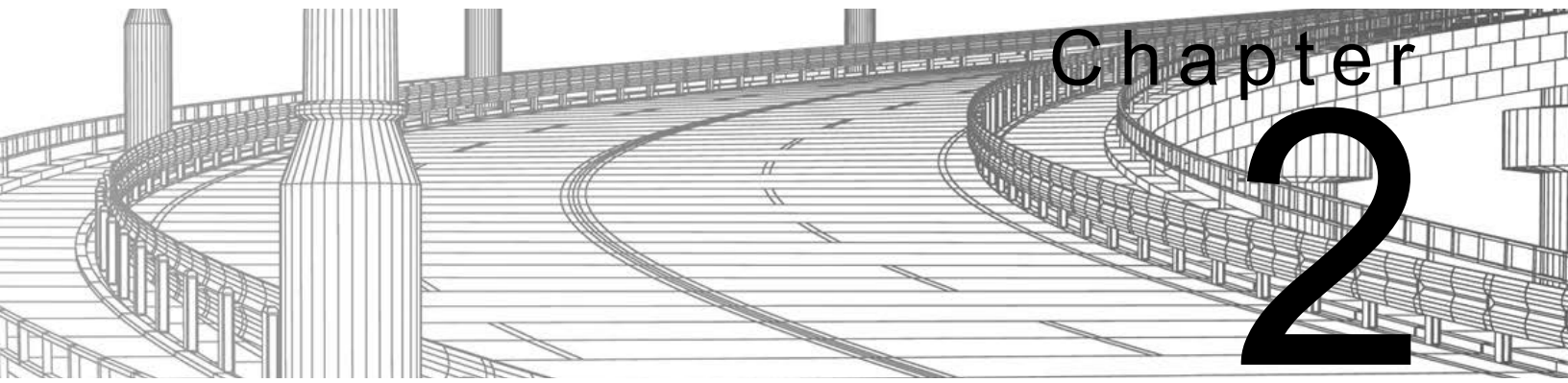
# Civil 3D® 2022 Fundamentals



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# Survey, Points, and Linework

This chapter focuses on automated Field to Finish tools that aid in drafting an accurate and efficient Existing Conditions Plan. These tools create a correct existing topography, property lines, right-of-ways, and center line locations based on survey data collected in the field. You will learn how to create parcels from a legal description using the Autodesk® Civil 3D® Lines and Curves commands and the transparent commands. The chapter also covers the important topic of Civil 3D Styles and how they are managed. Styles will be modified and new styles will be created.

## Learning Objectives in This Chapter

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- List the steps used to create linework from coordinate files, in a typical survey workflow.
- Create a figure database for stylizing linework automatically.
- Create point marker and label styles to annotate points.
- Set the appropriate point creation settings and the next available point number.
- Create points manually using the Create Points toolbar.
- Assign point symbols, labels, layers, etc., automatically when importing points by setting up Description Key Sets.
- Import points from ASCII files created from the field survey.
- Group points together using common properties, such as name, elevation, description, etc.
- Review and edit points using the Panorama window to ensure accuracy.
- Share information about points used for error checking or stake out points using predefined reports.
- Draw parcels from a legal description.

## Workflow

# 2.1 Survey Workflow Overview

To create linework from coordinate files, use the following survey workflow:

1. Data needs to be entered into the data collector. The correct language, methodology, and basic rules regarding data entry into the data collector begin with an understanding of Figure Commands and Field Codes (raw descriptions).
2. Data can be transferred from the data collector to the computer using an ASCII file or an electronic field book. An ASCII file can be opened in Notepad and data can be separated or delineated by spaces or commas. The most popular transfer format is Comma Delimited Point Number, Northing, Easting, Elevation, Description (PNEZD) format. This material focuses on the different types of Descriptions that can be entered into a data collector so that the user obtains the required automated symbology and linework.
3. If using an electronic field book file (a type of ASCII file), data needs to be converted from the raw coordinate file to a field book (\*.FBK) using Survey Link or other methods of the Autodesk® Civil 3D® software. Autodesk has collaborated with major survey equipment vendors to develop API and drivers that interface their specific survey equipment (Trimble Link, TDS Survey Link, Leica X-Change, TOPCON Link, etc.) with the Autodesk Civil 3D software.

If following the **Linework Code Set** command format, you do not need to convert the coordinate file to a field book. The Autodesk Civil 3D software needs to have all of the necessary Styles, Settings, and Figure Prefixes to create, sort, and place points and linework on the required layers.

## 2.2 Survey Figures

Survey figures consist of linework generated by coding and placed in a file that is imported into a Survey Database. A figure represents linear features (edge-of-pavement, toe-of-slopes, etc.).

A figure has many functions, which include:

- Acting as linework in a drawing.
- Acting as breaklines for a surface definition.
- Acting as parcel lines.
- Acting as a pipe run.
- Acting as targets for *Width* or *Offset Targets* in a Corridor.
- Acting as targets for *Slope* or *Elevation Targets* in a Corridor (e.g., limits of construction for a road rehab project might be to the face of walk, which exists in the drawing as a Survey Figure, hence a target).

The Figure Prefix database should be set up before importing any survey data to obtain the required entities in a drawing. As point and label styles and the Description Key Set need to exist before importing points, figure styles and entries in the Figure Prefix database need to exist before importing survey data.

### Figure Styles

Figure styles (found in the Toolspace, *Settings* tab, under Survey>Figures>Figure Styles) affect how the survey linework displays in a drawing. They should be part of your template file. These styles are not critical. However, to make figures work more efficiently, you should define the layers they use in the drawing.

- Figure styles are tied to the Figure Prefix database. The Figure Prefix database assigns a figure style to a figure that is imported into a drawing.
- A figure style includes the layers for its linework and markers.
- A marker is a symbol placed on the figure's segment midpoints and end points. They call attention to the figure's geometry. Although a figure style includes marker definitions, they typically do not display.
- In the Figure Style dialog box, the *Information* tab assigns a name to a style. The *Profile*, and *Section* tabs define how the marker displays in various views.

- The *Display* tab defines which figure’s components display and which layers they use for plan, model, profile, and section views, as shown in Figure 2–1.

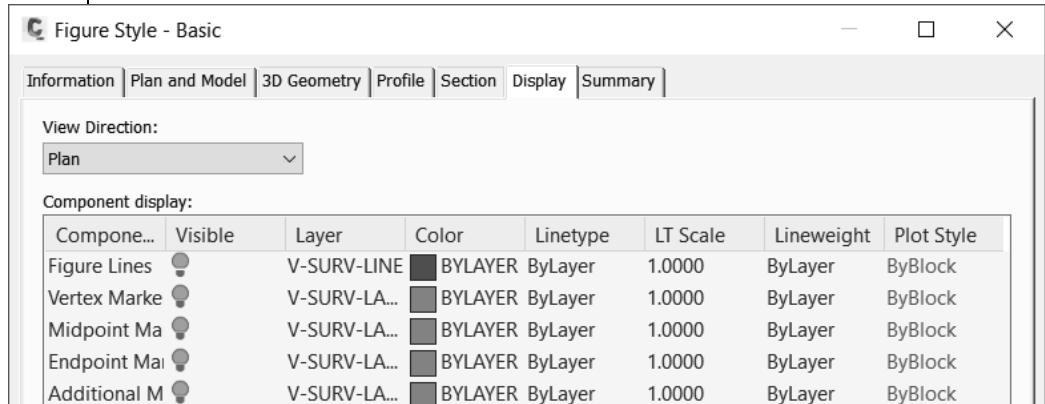


Figure 2–1

## Figure Prefix Database

The Figure Prefix database (found in the Toolspace, *Survey* tab) assigns the figure a style, a layer, and defines whether the figure is a surface breakline and/or lot line (parcel segment). If you did not define any figure styles, you should at least assign a layer to correctly place the figure in the drawing. Toggling on the *Breakline* property, as shown in Figure 2–2, enables you select all of the tagged survey figures and assign them to a surface without having to insert or select from a drawing. Toggling on the *Lot Line* property creates a parcel segment from the figure in the drawing and, if there is a closed polygon or intersecting lines to form an enclosure, assigns a parcel label and creates a parcel in the designated site.

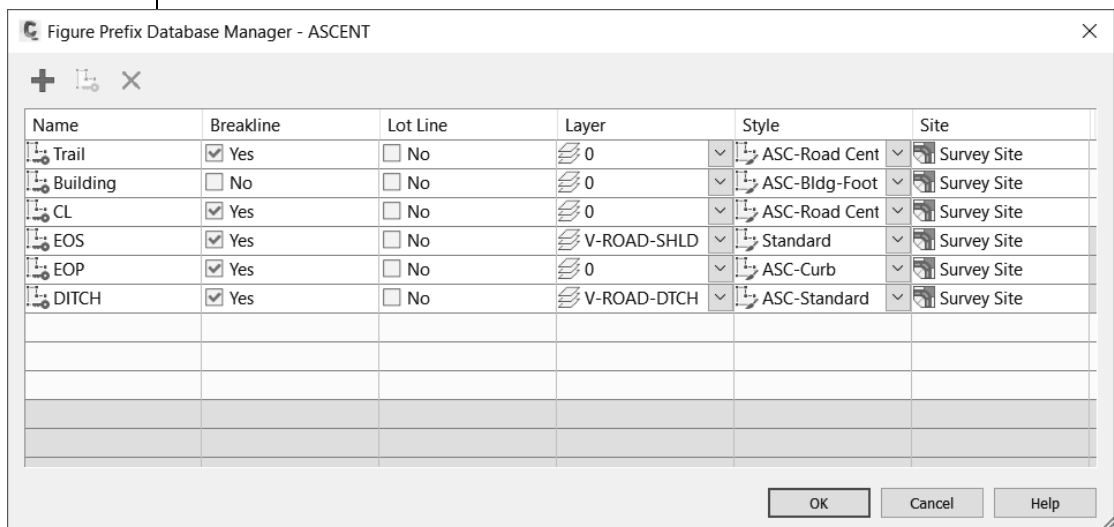


Figure 2–2

If the *Name* is **EOP** (as shown in Figure 2–2), any figure starting with EOP uses these settings. This is similar to using a Description Key Set, except that the entry in the Figure Prefix database does not need an asterisk (\*). The entry Name matches EOP-R or EOP-West or EOP-Main-East. When inserting survey figures in the drawing, Survey checks the Figure Prefix database for style or layer values.

## Practice 2a

You might have to change the draw order of the image to be able to view other objects. In Model Space, select the image, right-click, and select **Display Order>Send to Back**.

## Creating Figure Prefixes

### Practice Objective

- Create a figure database for automatically stylizing linework when importing field book or ASCII files.
1. Open **SUV1-A.dwg** from the *C:\Civil 3D Projects\Working\Survey* folder.
  2. In the Toolspace, select the *Survey* tab. Right-click on *Figure Prefix Databases*, and select **New....** Type **ASCENT** for the name.
  3. Right-click on the newly created ASCENT Figure Prefix database, and select **Make Current**.
  4. Right-click on the ASCENT Figure Prefix database again, and select **Manage Figure Prefix Database....**
  5. Click **+** to create a new Figure definition. Set the following options, as shown in Figure 2–3:
    - Change the *Name* to **TRAIL**.
    - Select *Breakline*.
    - Set *Style* to **ASC-Road Centerline**.

Any figure starting with **TRAIL** will now be selectable for a surface breakline and will use the style **ASC-Road Centerline**. As noted earlier, unlike the Description Key Set, an asterisk (\*) is not necessary to match Trail1, Trail2, etc.

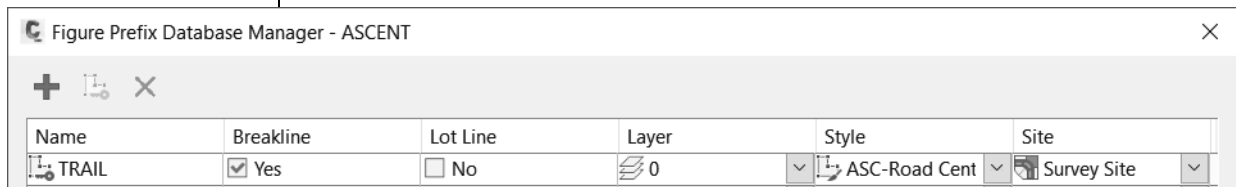


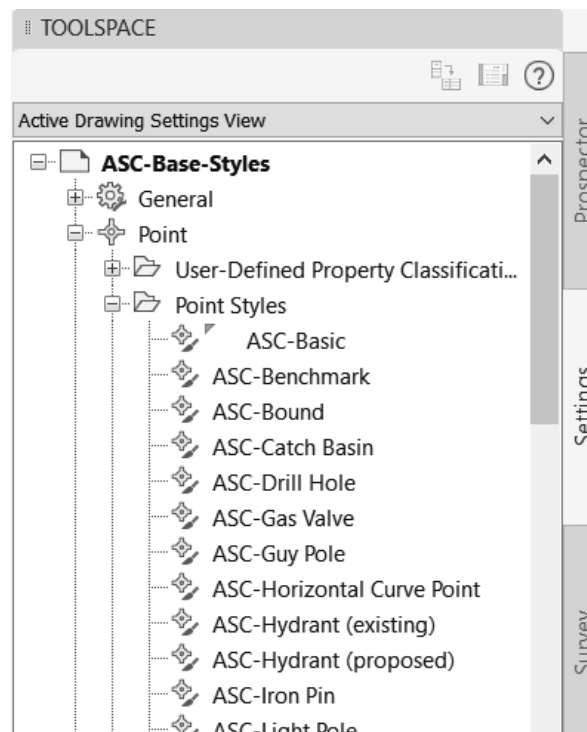
Figure 2–3

6. Click **+** to create a new Figure definition.
  - Change the name to **BLDG**.
  - Set the *Breakline* to **No**.
  - Set the *Style* to **ASC-Buildings**.
7. Click **OK** to exit the dialog box.
8. Save the drawing.



## 2.3 Styles

Styles are preconfigured groups of settings (specific to an individual object type or label) that make the objects display and print the way you want them to. For example, in the list of surface styles shown in Figure 2–4, each surface style is configured differently to display different features, such as contours at different intervals and on the correct layers. The display of a terrain model could be changed by swapping one surface style for another. Styles enable an organization to standardize the look of their graphics by providing preconfigured groupings of display settings.



**Figure 2–4**

The two categories of styles you work with most often are Object Styles and Label Styles. Some objects have table styles as well. Object styles control how Autodesk Civil 3D objects (points, surfaces, alignments, etc.) display, what combination of components the object displays, which layers they display on, and many other settings. Label Styles are similar except that they control the text and other annotations associated with the objects.

For example, an alignment object style specifies many settings including the layers on which to draw tangents and curve segments (which might be different) and the symbols to add at certain points as required (such as a triangle at the PI point). Alignment label styles include major and minor station labels, the display of station equations, design speeds, and similar annotation. By separating object and label styles, you can mix and match the right combination for a specific object.

Styles are the lowest items in the Toolspace, *Settings* tree and are typically dependent on other settings above them. If a style is given a unique setting, different from feature settings or label style defaults (such as a different text height), then that style is considered to have an override.

## Label Styles

Label styles produce annotation of values from existing conditions or a design solution. A label annotates a contour's elevations, a parcel's number and area, a horizontal geometry point's station on an alignment, etc.

A label style can have text, vectors, AutoCAD blocks, and reference text. The content of a label depends on the selected object's components or properties. For instance, a Line label can annotate bearing, distance, and coordinates, and use a direction arrow. A Parcel Area label can contain a parcel's area, perimeter, address, and other pertinent values. A surface label can include a spot elevation, reference for an alignment's station and offset, or other pertinent surface information.

- To access the values of a label style, in the Toolspace, *Settings* tab, select the style, right-click on its name, and select **Edit**.
- A style's initial values come from Edit Label Style Defaults and the style's definition.
- All labels use the same interface.
- The object properties available for each label vary by object type.

Each label style uses the same tabbed dialog box. The *Information* tab describes the style as well as who defined and last modified its contents. The values of the *General* tab affect all occurrences of the label in a drawing. For example, if *Visibility* is set to *False*, all labels of this style are hidden in the drawing. Other settings affect the label's text style, initial orientation, and reaction to a rotated view.

The *Layout* tab lists all of a label's components. A label component can be text, line, block, or tick. The Component name drop-down list (shown in Figure 2–5), contains all of the defined components for the style. When selecting a component name in the drop-down list, the panel displays information about the component's anchoring, justification, format, and border.

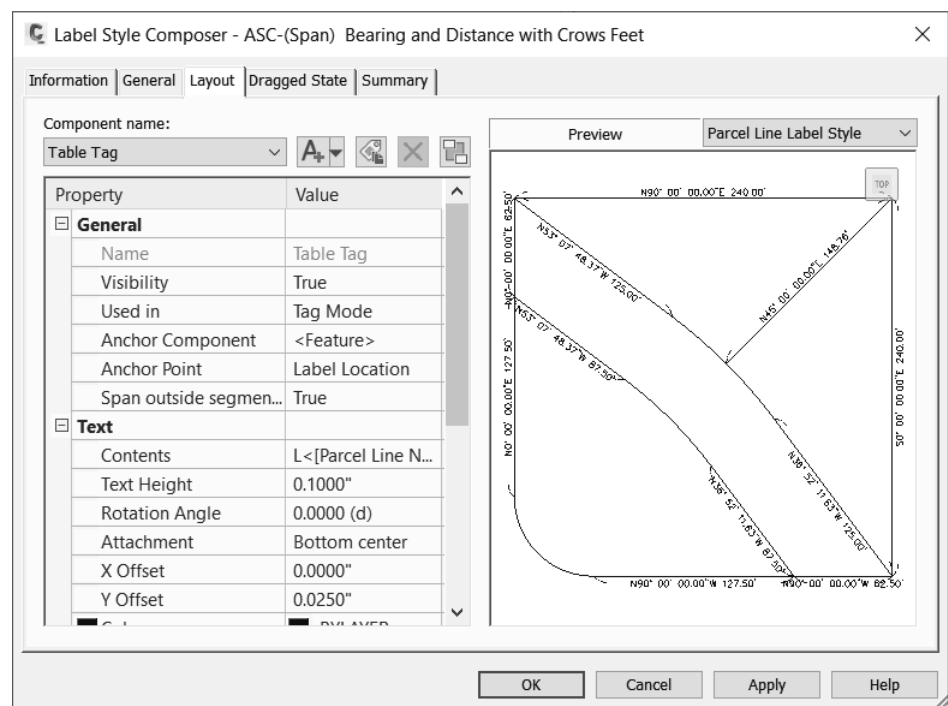




Figure 2–5

When defining a new text component, you assign it an object property by clicking  (Browse) for Contents. This opens the Text Component Editor dialog box, as shown in Figure 2–6. The Properties drop-down list displays the available object properties. The number and types of properties varies by object type. For example, a parcel area label has more and different properties than a line label does. Once a property has been selected, units, precision, and other settings can be set to display the property correctly in the label. Click  next to Properties to place the property in the label layout area to the right.

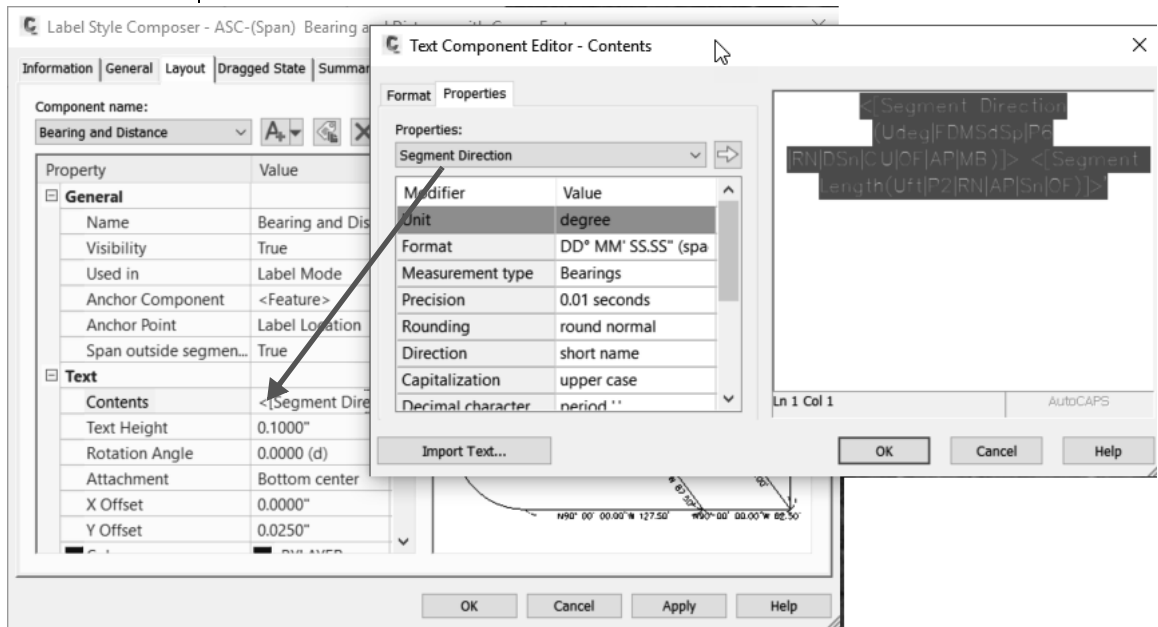
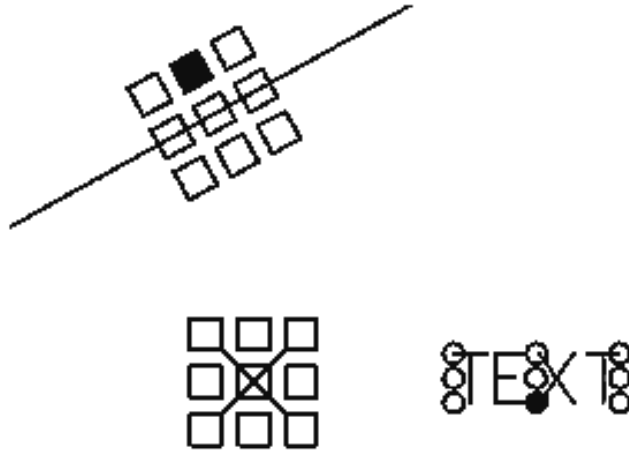


Figure 2–6

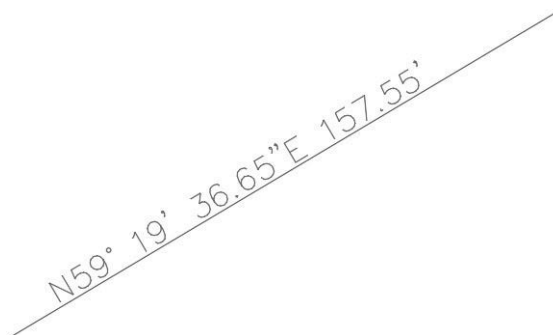
The values in the *Dragged State* tab define a label's behavior when it is dragged to a new location in the drawing.

The key to having the label display correctly when it is not in the dragged state, is to line up the Anchor Point of the component with the **Attachment** option for the text. Each has nine options from which to select. The options are shown in Figure 2–7.



**Figure 2–7**

Lining up the square hatched Anchor Point with the circular hatched attachment option results in the text centered above the object similar to the bearing distance label shown in Figure 2–8.



**Figure 2–8**

## 2.4 Points Overview

Survey Points are often used at the beginning of a project and COGO Points (for stakeout) at the end of a project. Surveyors collect data about existing site conditions (elevations, utilities, ownership, etc.) for the project. Their world is coordinates, which are represented by points. Each point has a unique number (or name) and a label containing additional information (usually the elevation of the coordinate and a short coded description).

There are no national standards for point descriptions in the Surveying industry. Each company or survey crew needs to work out its own conventions. There are no standards for symbols either. Each firm can have its own set of symbols. The symbols used in a submission set can be specified by the firm contracting the services.

Autodesk Civil 3D cogo / survey points are a single object with two elements: a point style and a point label style. A cogo / survey point definition is shown in Figure 2–9.

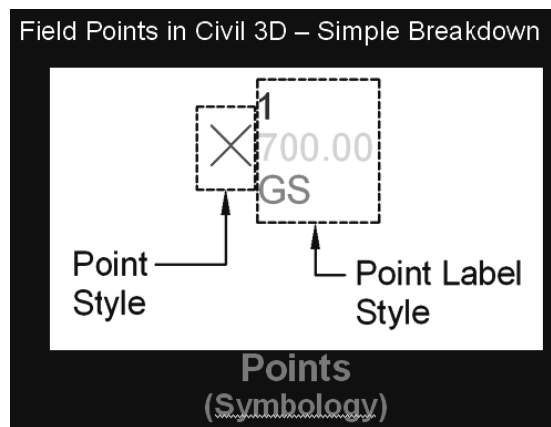


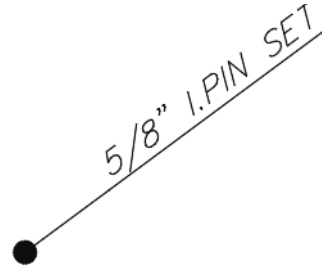
Figure 2–9

The following is important point information:

- A point style (no matter what it displays), an AutoCAD node, a custom marker, or a block is selectable with an AutoCAD **Node** object snap.

A point label is not limited to the point's number, elevation, and description. A point label can contain lines, blocks, and other point properties. One can set up User-Defined point properties as well. For example, point labels might only display an elevation or description. This text can be manually overridden (as shown in Figure 2–10) or it can consist of intelligent variables that represent point characteristics (such as its convergence angle).

In assigned coordinate systems, the convergence angle is the difference between a geodetic azimuth and the projection of that azimuth onto a grid (grid azimuth) of a given point.



**Figure 2-10**

## Point Marker Styles

A surveyor interacts with points daily. To easily use Autodesk Civil 3D points, you need to have a basic understanding of their related styles.

The Autodesk Civil 3D software provides metric and imperial template files that contain several point styles: *Autodesk Civil 3D Imperial (NCS)* and *Autodesk Civil 3D Metric (NCS)*. These two templates use the National CAD standards for their layers and provide examples of styles that you can use in a project. To customize these styles, you need to modify and expand the list of point styles.

Customizing styles needs to be managed carefully. Consult with your BIM Manager as to the standards and procedures for such customization. If you do modify an existing style or create a new one, be sure to put your name or initials in the *Created by:* field for easy identification, as shown Figure 2-11.

**Figure 2-11**

When installing the Autodesk Civil 3D software, the first thing you should do is set one of these two templates as your default template. Alternatively, your BIM Manager can develop styles to be used in your organization's drawing template file.

A point style defines a point's display, its 3D elevation, and its coordinate marker size. In the example shown in Figure 2–12, the point style is an X for a ground shot.

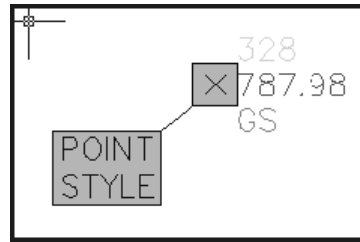


Figure 2–12

The Point Style dialog box has five tabs: *Information*, *Marker*, *3D Geometry*, *Display*, and *Summary*.

The *Information* tab sets the point style's name and description, as shown in Figure 2–13.

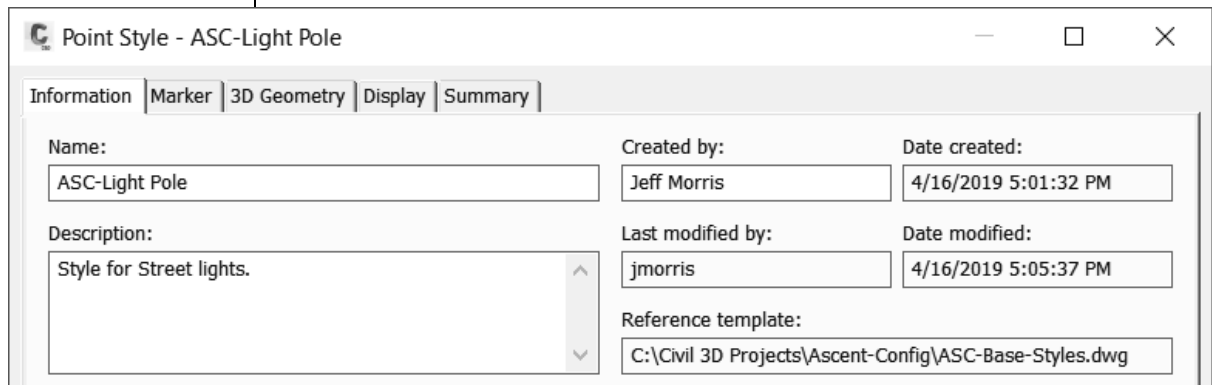


Figure 2–13

The *Marker* tab supports three marker definition methods, as shown in Figure 2–14.



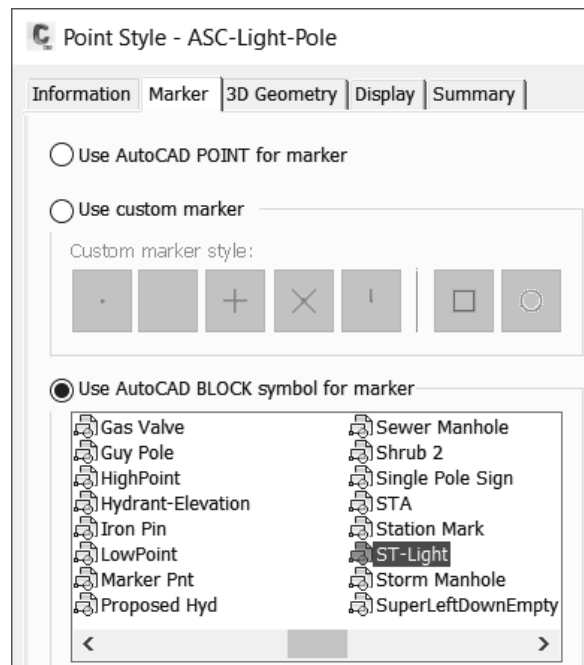
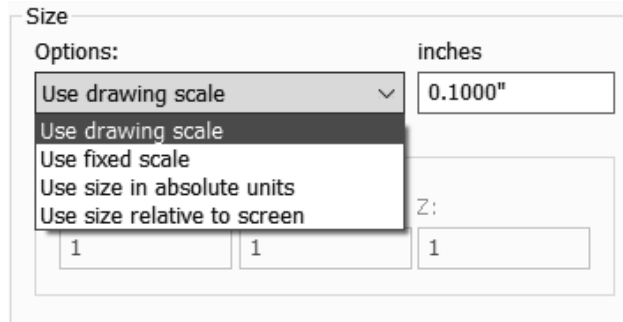


Figure 2–14

- **Use AutoCAD POINT [node] for marker:** All points in the drawing follow AutoCAD's **PDMODE** and **PDSIZE** system variables. You do not have independent control over points using this option. (This option is seldom used.)
- **Use custom marker:** This option creates markers similar to an AutoCAD point (node). However, the marker is under the Autodesk Civil 3D software's control, and each point style can display a different combination of marker styles. When using this option, select the components of the style from the list of Custom marker style shapes. A custom marker can have shapes from the left and right sides. The first comes from one of the five icons on the style's left side, and you can optionally add none, one, or both shapes from the right.
- **Use AutoCAD BLOCK symbol for marker:** This option defines the marker using a block (symbol). The blocks listed represent definitions in the drawing. When the cursor is in this area and you right-click, you can browse to a location containing drawings that you want to include as point markers.

Options for scaling the marker display in the marker panel's top right corner. The most common option is **Use drawing scale** (as shown in Figure 2–15), which takes the marker size (0.1000") and multiplies it by the current drawing's annotation scale, resulting in the final marker size. When the annotation scale changes, the Autodesk Civil 3D software automatically resizes the markers and their labels to be the appropriate size for the scale.

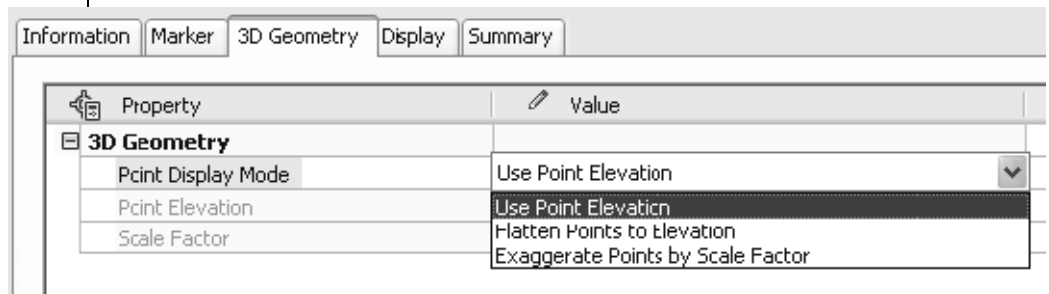


**Figure 2–15**

The other options are described as follows:

<b>Use fixed scale</b>	Specifies user-defined X, Y, and Z scale values.
<b>Use size in absolute units</b>	Specifies a user-defined size.
<b>Use size relative to screen</b>	Specifies a user-defined percentage of the screen.

The *3D Geometry* tab affects the point's elevation. The default option is **Use Point Elevation** (as shown in Figure 2–16), which displays the point at its actual elevation value.



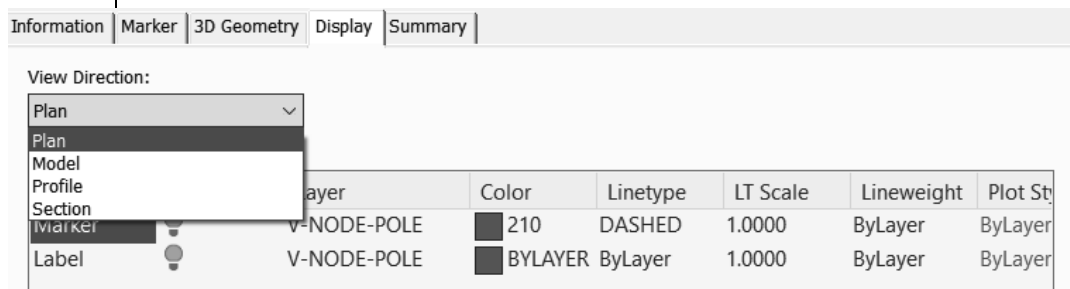
**Figure 2–16**

The other options are described as follows:

<b>Flatten Points to Elevation</b>	Specifies the elevation to which the point is projected (flattened). The Point Elevation cell highlights if this option is selected and is 0 elevation by default. When using an AutoCAD object snap to select a marker using this option, the resulting entity's elevation is the default elevation of 0. If selecting by point number or point object, the resulting entity is the point's actual elevation.
<b>Exaggerate Points by Scale Factor</b>	Exaggerates the point's elevation by a specified scale factor. When selecting this option, the Scale Factor cell highlights.

The *Display* tab assigns the marker and label layers, and sets their visibility and properties. Setting the property to **ByLayer** uses the layer's properties. Alternatively, you can override the original layer properties by setting a specific color, linetype, or lineweight.

A style's view direction value affects how the point and label components display in the plan, model, profile, and section views, as shown in Figure 2–17.

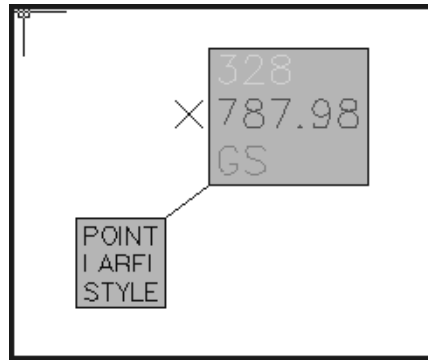


**Figure 2–17**

The *Summary* tab is a report of all of the style's settings. Controlling a leader arrow from a label in the dragged state, points to the boundary of the marker (yes) or the center of the marker (no). It is also changed under **Marker>Leader** and stops at marker. You can also edit style variables in this tab.

## Point Label Style

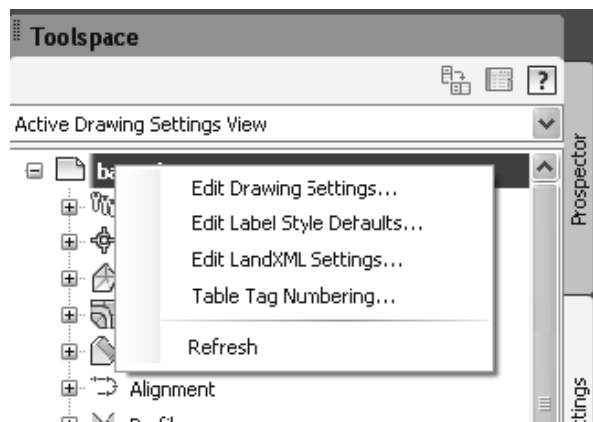
The Autodesk Civil 3D point label style annotates point properties beyond the typical point number, elevation and description. A typical point label style is shown in Figure 2–18.



**Figure 2–18**

All Autodesk Civil 3D label style dialog boxes are the same. The basic behaviors for a label are in the settings in the Edit Label Style Defaults dialog box. The values in this dialog box define the label layer, text style, orientation, plan readability, size, dragged state behaviors, etc.

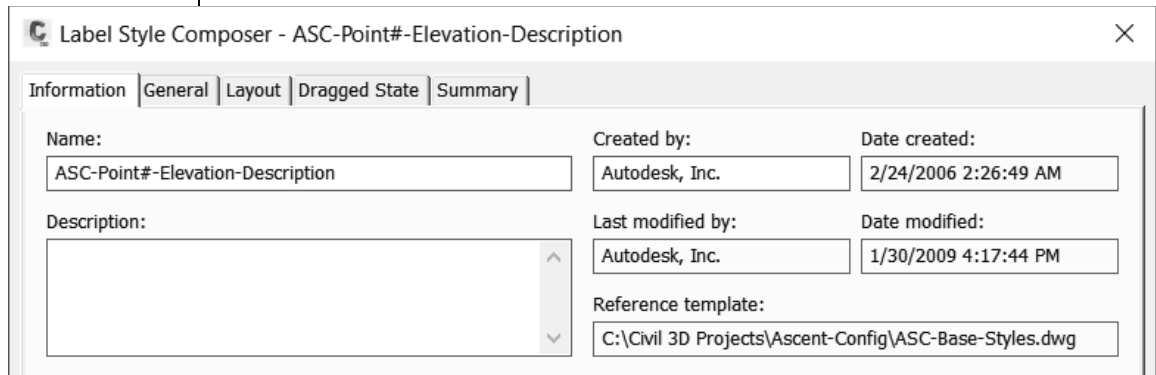
In the Toolspace, *Settings* tab, the drawing name and object collections control these values for the entire drawing (at the drawing name level) or for the selected collection (*Surface*, *Alignment*, *Point*, etc.) To open the Edit Label Style Defaults dialog box, select the drawing name or a heading, right-click, and select **Edit Label Style Defaults...**, as shown in Figure 2–19.



**Figure 2–19**

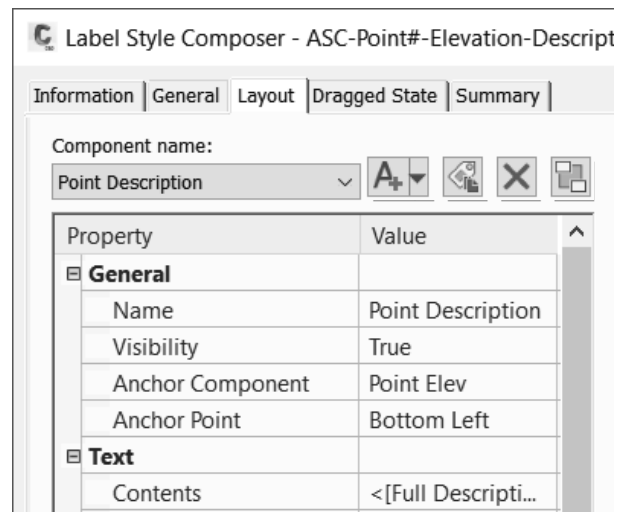
The Label Style Composer dialog box contains five tabs, each defining specific label behaviors: *Information*, *General*, *Layout*, *Dragged State*, and *Summary*.

The *Information* tab names the style, as shown in Figure 2–20.



**Figure 2–20**

The *General* tab contains three properties: *Label* (text style and layer), *Behavior* (orientation), and *Plan Readability* (amount of view rotation before flipping text to read from the bottom or the right side of the sheet), as shown in Figure 2–21.



**Figure 2–21**

The *Label* property sets the *Text Style*, *Label Visibility*, *Layer*. Select the *Value* cell next to the *Text Style* and *Layer* to open browsers and change their values. Selecting the *Label Visibility* cell displays a drop-down list containing the options **true** and **false**.

The *Behavior* property sets two variables that control the label's location. The *Orientation Reference* variable contains the three label orientation options.

<b>Object</b>	Rotates labels relative to the object's zero direction. The object's zero direction is based on its start to end vector. If the vector changes at the label's anchor point, the orientation updates automatically. This is the default setting.
<b>View</b>	Forces labels to realign relative to a screen-view orientation in both model and layout views. This method assumes that the zero angle is horizontal, regardless of the UCS or Dview twist. If the view changes, the label orientation updates as well.
<b>World Coordinate System</b>	Labels read left to right using the WCS X-axis. Changing the view or current UCS does not affect label rotation. The label always references the world coordinate system.

Under the *Behavior* property, the **Forced Insertion** variable has three optional values that specify the label's position relative to an object. This setting only applies when the *Orientation Reference* is set to **Object** and the objects are lines, arcs, or spline segments.

<b>None</b>	Maintains label position as composed relative to the object.
<b>Top</b>	Adjusts label position to be above an object.
<b>Bottom</b>	Adjusts label position to be below an object.

- **Note:** If you select **Top** or **Bottom**, set the value of *Plan Readable* to **True**.

The *Plan Readability* property has three variables that affect how text flips when rotating a drawing view.

Under the *Plan Readability* property, the *Plan Readable* variable has two options.

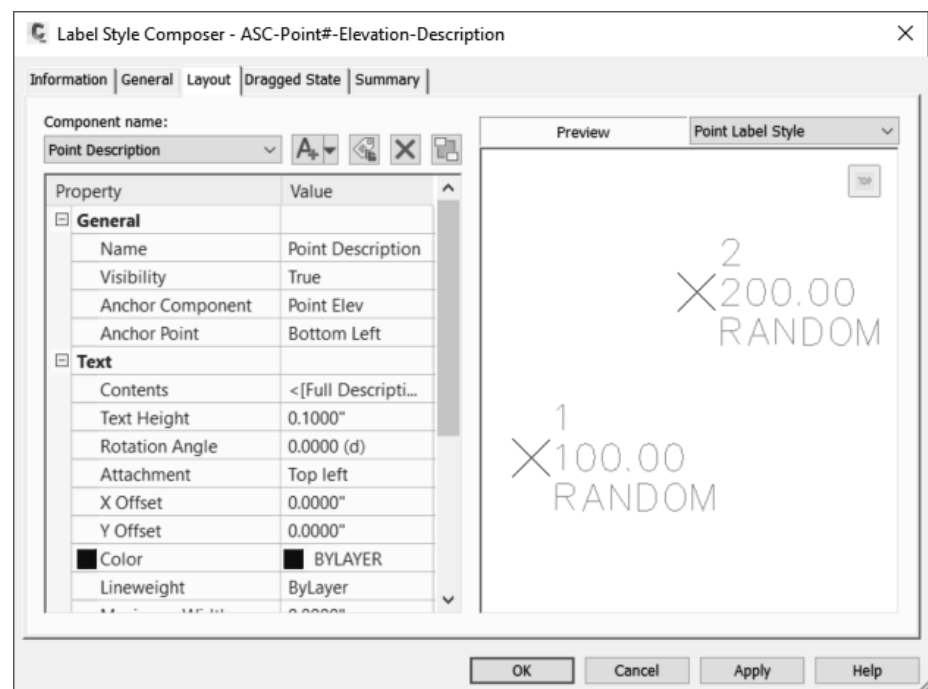
<b>True</b>	Enables text to rotate to maintain left to right readability from the bottom or right side of the drawing.
<b>False</b>	Does not permit text to flip. The resulting text might be upside down or read from right to left.

The *Readability Bias* variable is the amount of rotation required to flip a label to become left to right readable. The angle is measured counter-clockwise from the WCS 0 (zero) direction.

The *Flip Anchors with Text* variable has two options:

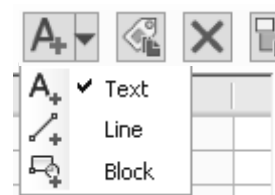
<b>True</b>	If the text flips, the text anchor point also flips.
<b>False</b>	The label flips, but maintains the original anchor point. The behavior is similar to mirroring the original text.

The *Layout* tab defines the label contents, as shown in Figure 2–22. A label component is an object property that it labels. Point properties include northing, easting, raw description, etc. If User Defined properties are in use, they will also be available. A label might have one component with several properties or several components each containing an object property, as well as regular text (such as Northing:).






**Figure 2–22**

A point style label component can be text, lines, or blocks. Other object type label styles can include additional components, such as reference text, ticks, directional arrows, etc. To add a component, expand the drop-down list (as shown in Figure 2–23) and select the component type.





**Figure 2–23**

The remaining icons in the *Layout* tab are described as follows:


	Copies the current component and its properties.
	Deletes the current component.
	Changes the display order of a label's components. For example, use this icon to change the draw order of the label's component such as text above a mask.

Depending on the label component type, it might have any combination of three areas: *General*, *Text*, and *Border*. *General* defines how the label attaches to the object or other label components, its visibility, and its anchor point.

If the label component is text, the *Text* property values affect how it displays its object property. To set or modify a label's text value, select the cell next to *Contents* to display  (shown in Figure 2–24). Click  to open the Text Component Editor dialog box.



**Figure 2–24**

The Text Component Editor dialog box (shown in Figure 2–25), defines the properties that the label annotates. When creating a label component, double-click on the text in the right pane to highlight it. In the left pane, select the property that you want to add, set the property's format values, and then click  to add the new property to the label component.



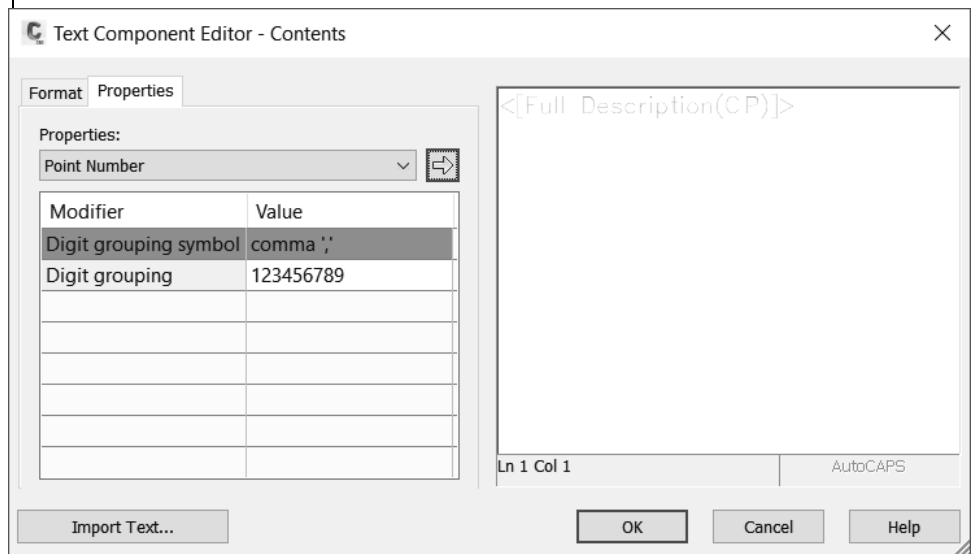


Figure 2–25

It is important to maintain the process order and to remember that the text on the right in brackets needs to be highlighted before you can revise its format values on the left.

The *Dragged State* tab has two properties: *Leader* and *Dragged State Components*. This tab defines how a label behaves when you are dragging a label from its original insertion point.

The *Leader* property defines whether a leader displays and what properties it displays. You can use the label's layer properties in the *General* tab (**ByLayer**) or override them by specifying a color, as shown in Figure 2–26.

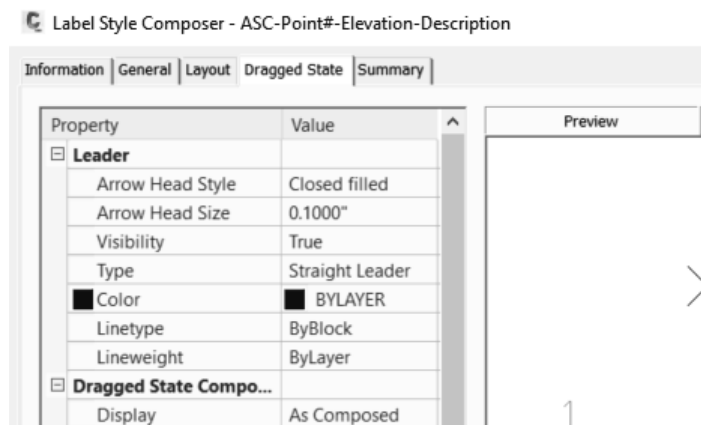


Figure 2–26

The *Dragged State Components* property defines the label component's display after it has been dragged from its original position. Select the cell next to *Display* to view the two display options, as shown in Figure 2–27.

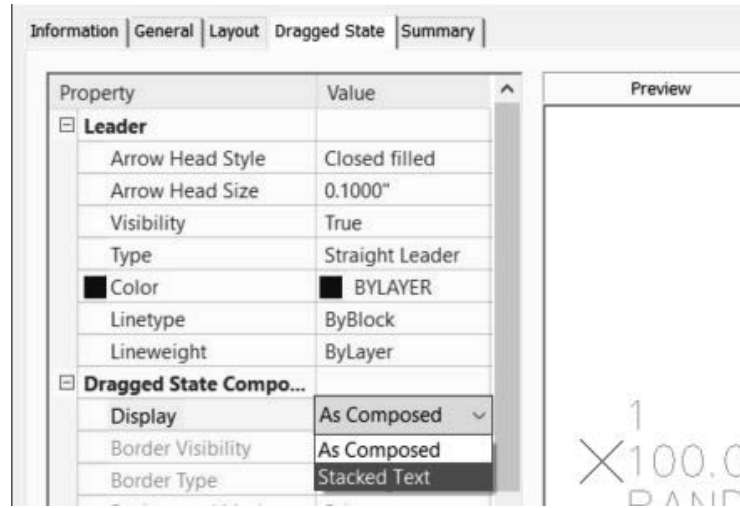


Figure 2–27

**As Composed**

The label maintains its original definition and orientation from the settings in the Layout panel. When you select **As Composed**, all of the other values become unavailable for editing.

**Stacked Text**

The label text becomes left justified and label components are stacked in the order listed in Layout's Component Name list. When you select **Stacked Text**, all of the blocks, lines, ticks, and direction arrows are removed.

The *Summary* tab lists the label component, general, and dragged state values for the label style. The label components are listed numerically in the order in which they were defined and report all of the current values.

## Practice 2b


# Point Marker Styles

### Practice Objective

- Create a point marker and label style to ensure that the correct symbol is assigned to specific points.

In this practice, you will create a new point style and apply it to an existing group of points.

### Task 1 - Add a block symbol.

1. Continue working on the drawing from the previous practice or open **SUV1-B1-Survey-.dwg** from the *C:\Civil 3D Projects\Working\Survey* folder.
2. To toggle off the aerial image, in the *Home* tab>*Palettes* panel, click  (Map Task Pane). When prompted, select **ON**.
3. In the Task pane>*Display Manager* tab, clear the **Main Site Imperial** layer, as shown in Figure 2–28. Select *Map Base* again to clear the *Raster Layer* contextual tab. Close the map Task Pane.

The aerial image used in this chapter was attached using the AutoCAD® Map 3D FDO connection.

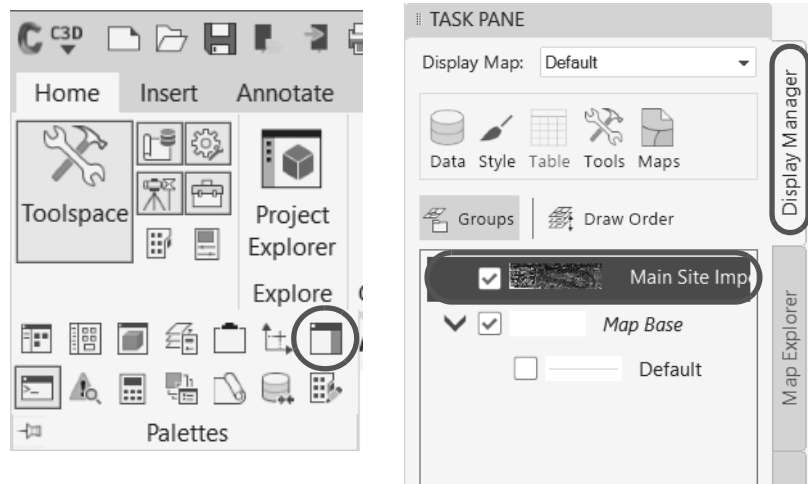
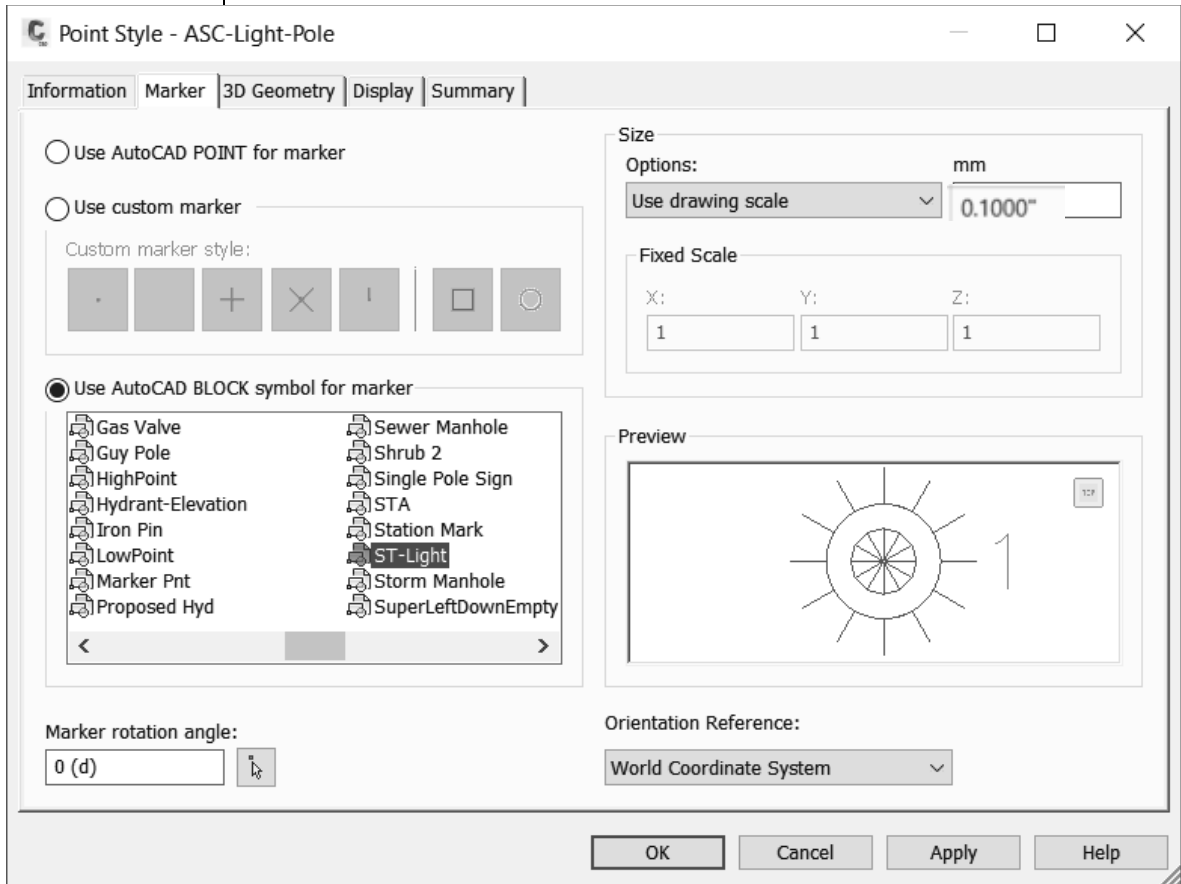


Figure 2–28

4. In the Toolspace, *Settings* tab, expand the *Point* collection until *Point Styles* displays. Expand the *Point Styles* collection.
5. In the *Point Styles* list, select the **ASC-Guy pole** style, right-click, and select **Copy....**

Review the *Point Styles* list and note that there is no light pole style.

6. In the *Information* tab, change the point style's name to **ASC-Light Pole** and enter your name or initials in the *Created by:* field.
7. Select the *Marker* tab. Select the **Use AutoCAD BLOCK** symbol for marker option. In the block list, scroll across as required and select the AutoCAD block **ST-Light**, as shown in Figure 2–29.



**Figure 2–29**

8. Select the *Display* tab and note that the layer settings are from the Guy Pole point style.
9. You can reassign the marker and/or label layer by selecting the layer name. Select the layer name to display the drawing layer list.

10. Click **New** in the top right corner of the Layer Selection dialog box. The Create Layer dialog box opens (as shown in Figure 2–30), enabling you to create new layers without having to use the Layer Manager.

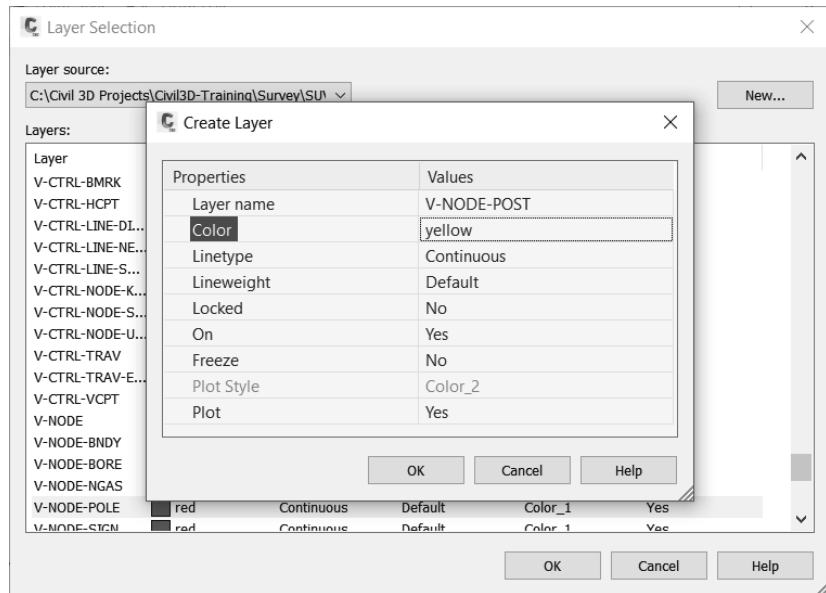


Figure 2–30

11. For the *Layer name*, type **V-NODE-POST**, and then set the *Color* to **yellow**, as shown in Figure 2–30. Click **OK** to exit the Create Layer dialog box. Click **OK** to exit the Layer Selection dialog box.
12. Click **OK** to create the point style.
13. Review the *Point Styles* list and note that **ASC-Light Pole** is now a point style, as shown in Figure 2–31.

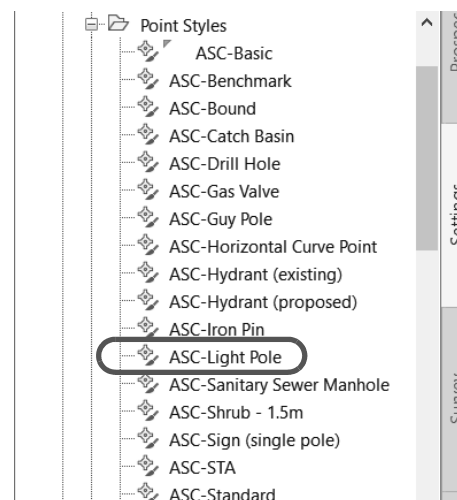


Figure 2–31

14. Save the drawing.

## Task 2 - Create a point label style's components.

1. Continue working with the drawing from the previous task or open **SUV1-B2.dwg**.
2. In the Toolspace, *Settings* tab, expand the *Point* collection until the *Point Label Styles* list displays.
3. From the list of point label styles, select **ASC-Point#-Elevation-Description**, right-click, and select **Copy**.
4. In the *Information* tab, change the name to **ASC-Point#-Description-N-E** and enter your name or initials in the *Created by:* field.
5. Select the *Layout* tab and do the following (as shown in Figure 2–32):
  - Select **Point Number** in the *Component name* drop-down list.
  - Set the *Anchor Component* to **<Feature>**.
  - Set the *Anchor Point* to **Top Right**.
  - Set the *Attachment* to **Bottom left**.

*These settings attach the bottom left of the label to the top right of the point object.*

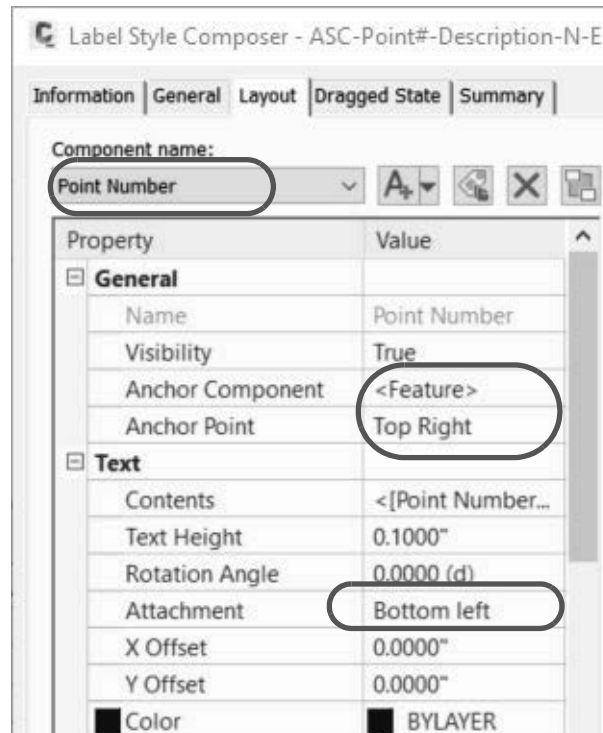



Figure 2–32

Since the elevation label is not required, you can delete it.

6. Select **Point Elev** in the Component name drop-down list and click , as shown in Figure 2–33. At the *Do you want to delete it?* prompt, click **Yes**.

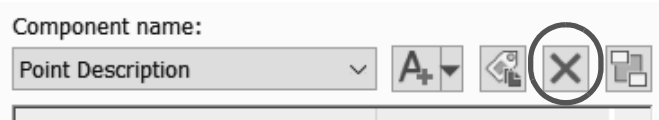


Figure 2–33

7. Select **Point Description** in the Component name drop-down list and do the following (shown in Figure 2–34):
  - Set the *Anchor Component* to **Point Number**.
  - Set the *Anchor Point* to **Bottom Left**.
  - Set the *Attachment* to **Top Left**.

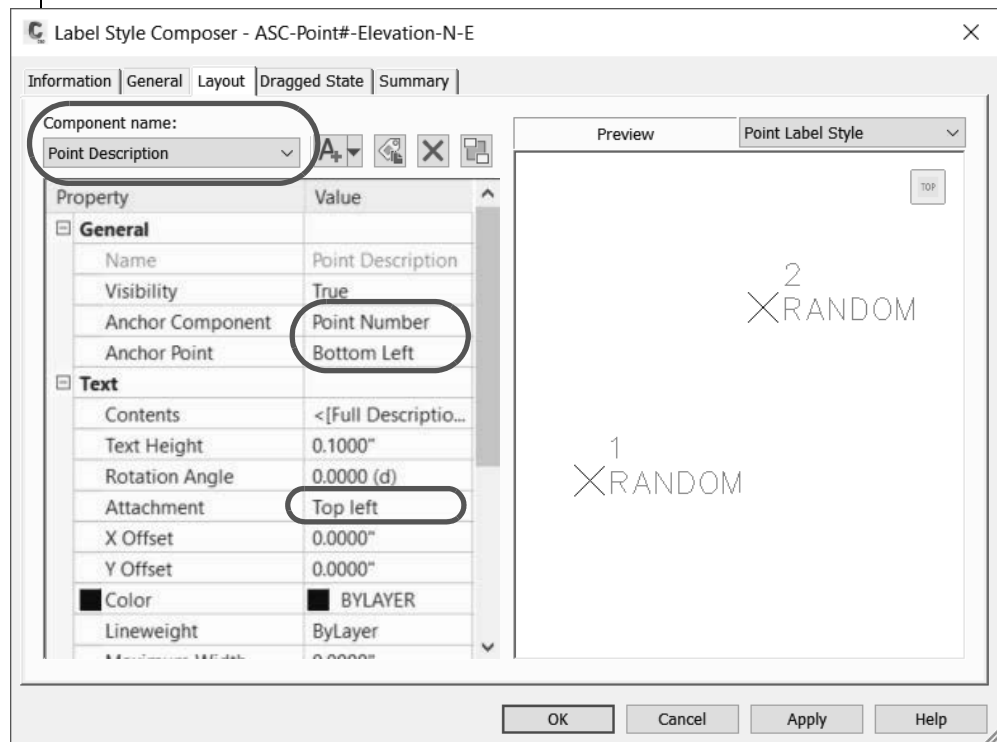


Figure 2–34

You will now add a new text component to display the Northing and Easting.

8. Expand the **Create Text Component** flyout (shown in Figure 2–35) and select **Text** to create a text component.

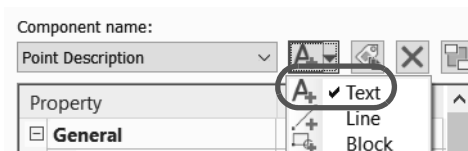



Figure 2–35

You will now change the contents from the default label set by the Autodesk Civil 3D software to display the coordinates.

9. Change the default *Name* **text.1** to **Coordinates**, and then do the following:
  - Set the *Anchor Component* to **Point Description**.
  - Set the *Anchor Point* to **Bottom Left**.
  - Set the *Attachment* to **Top Left**.
10. Click  in the *Contents* cell, next to *Label Text*, as shown in Figure 2–36.

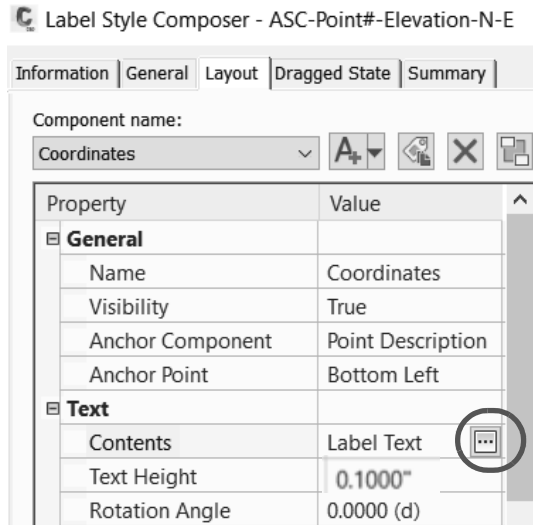



Figure 2–36

11. In the Text Component Editor dialog box, double-click on the text in the right side panel to highlight it and type **N:**.
12. Select **Northing** in the Properties drop-down list. Change the *Precision* to **0.001** and click , as shown in Figure 2–37, to add the code to display the northing.

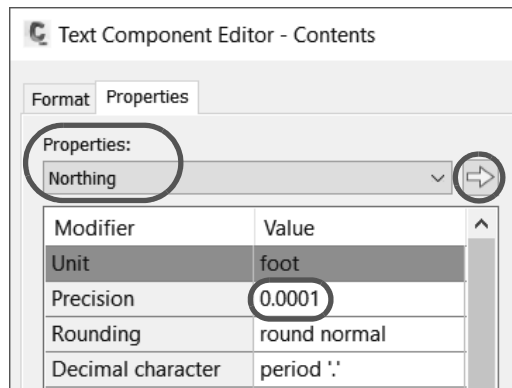



Figure 2–37



*In the easting, the value will be displayed to the 4th decimal, P4. Change it so that it matches the northing.*

13. Click at the end of the code. Press **<Enter>** to insert a new line followed by the letter **E** and a colon. Then select **Easting** in the Properties drop-down list and add it to post the code in the right side panel. The following should be displayed:

- N:<[Northing(Uft|P3|RN|AP|GC|UN|Sn|OF)]>
- E:<[Easting(Uft|P4|RN|AP|GC|UN|Sn|OF)]>

14. Select all of the code for the easting. Change the *Precision* to **0.001** and click  to revise the easting code.

15. Select the *Format* tab and verify that *Justification* is set to **Left**. Click **OK** to accept the changes in the Text Component Editor dialog box, and click **OK** again to accept the changes in the Label Style Composer.

16. Save the drawing.

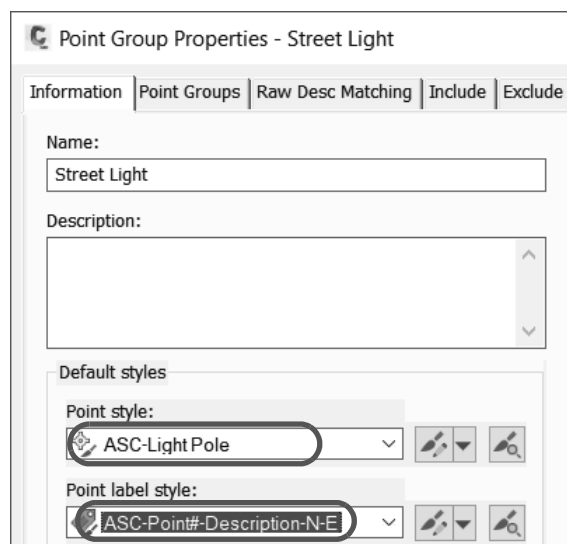
---

### Task 3 - Apply style components.

---

*Point Groups will be covered in detail later in this chapter.*

1. Continue working with the drawing from the previous task or open **SUV1-B3.dwg**.
2. In the Toolspace, select the Toolspace, *Prospector* tab and expand the *Point Groups* collection until the *StreetLights* point group displays. Select the **StreetLights** group, right-click, and select **Properties**.
3. In the *Information* tab, expand the Point Style drop-down list and select **ASC-Light Pole**. Then expand the Point label style drop-down list and select **ASC-Point#-Description-N-E**, as shown in Figure 2–38.



**Figure 2–38**

*If the symbol and label do not change, in the Toolspace, Prospector tab, right-click on the StreetLights point group and select **Update**.*


4. Click **OK** to accept the changes and close the dialog box.
5. The symbols for the Light pole points have now been changed. Additionally, both the point symbols and point labels are annotative. In the Status Bar, expand the Annotation Scale drop-down list and change the scale of the drawing from 1"=80' to **1"=40'**, as shown in Figure 2–39. The size of the labels and point symbols change.



**Figure 2–39**

6. Save the drawing.

## 2.5 Point Settings

When creating new points, you must determine the next point number, and which elevations and descriptions to assign and how to assign them. To set the current point number, default elevations, descriptions, and other similar settings, you can use the expanded Create Points toolbar. Click  in the Create Points toolbar to display the *Points Creation* and *Point Identity* categories (shown in Figure 2–40), which contain the most commonly used values.

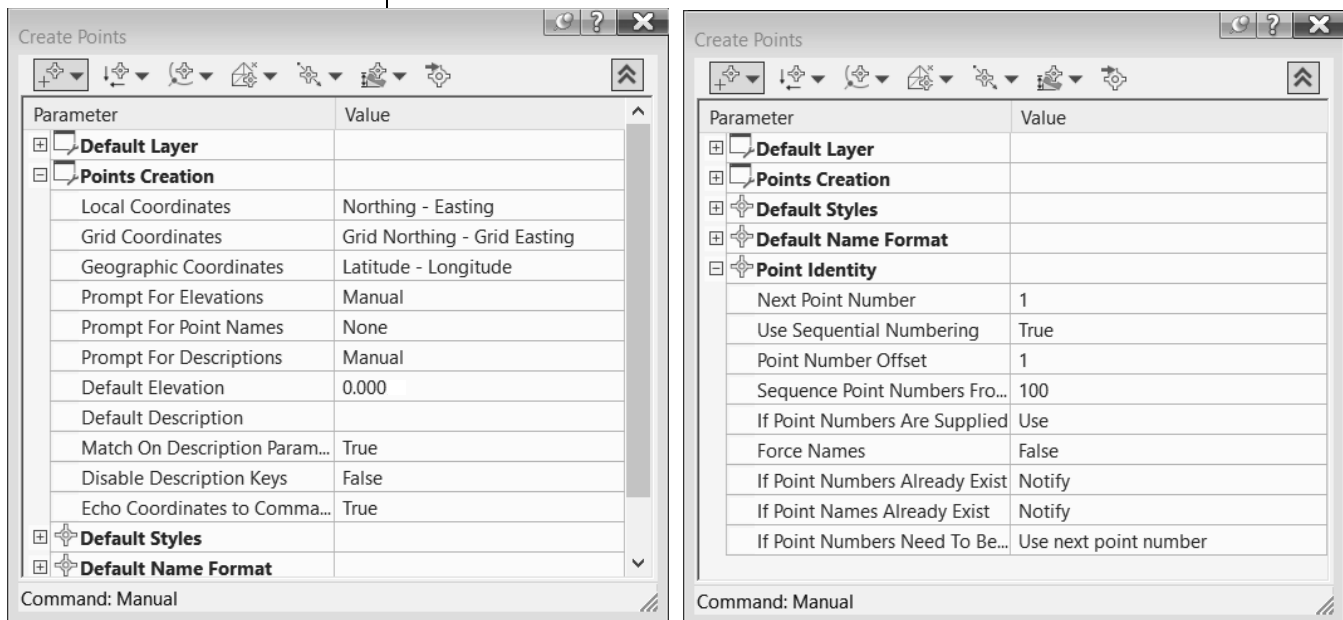


Figure 2–40

### Points Creation Values

The *Points Creation* area affects prompting for elevations and/or descriptions. The two properties in this area are *Prompt For Elevations* and *Prompt For Descriptions*. These properties can be set as follows:

<b>None</b>	Does not prompt for an elevation or description.
<b>Manual</b>	Prompts for an elevation or description.
<b>Automatic</b>	Uses the <b>Default Elevation</b> or <b>Default Description</b> value when creating a point.
<b>Automatic -Object</b>	Creates points along an alignment whose description consists of the <b>Alignment name</b> and <b>Station</b> . This description is not dynamic and does not update if the alignment changes or the point is moved.

## Point Identity Values

The *Point Identity* area sets the default method of handling duplicate point numbers. If there are duplicate point numbers, there are three ways to resolve the duplication:

1. Overwrite the existing point data.
2. Ignore the new point.
3. Assign it a new number.

This area’s critical property is *Next Point Number*. It is set to the first available number in the point list. If a file of imported point data uses point numbers 1-131 and 152-264, the current point number is 132 after importing the file. This value should be set manually to the next required point number before creating new points with the Create Points toolbar.

You can also change these point settings by selecting the Toolspace, *Settings* tab and expanding the *Commands* collection under the *Point* collection. Right-click on **CreatePoints** and select **Edit Command Settings...**, as shown on the left in Figure 2–41. In the Edit Command Settings dialog box, you can set the defaults for Point Creation, as shown on the right. **Note:** Ideally, this will be preset for you by your BIM Manager, according to your organization’s standards.

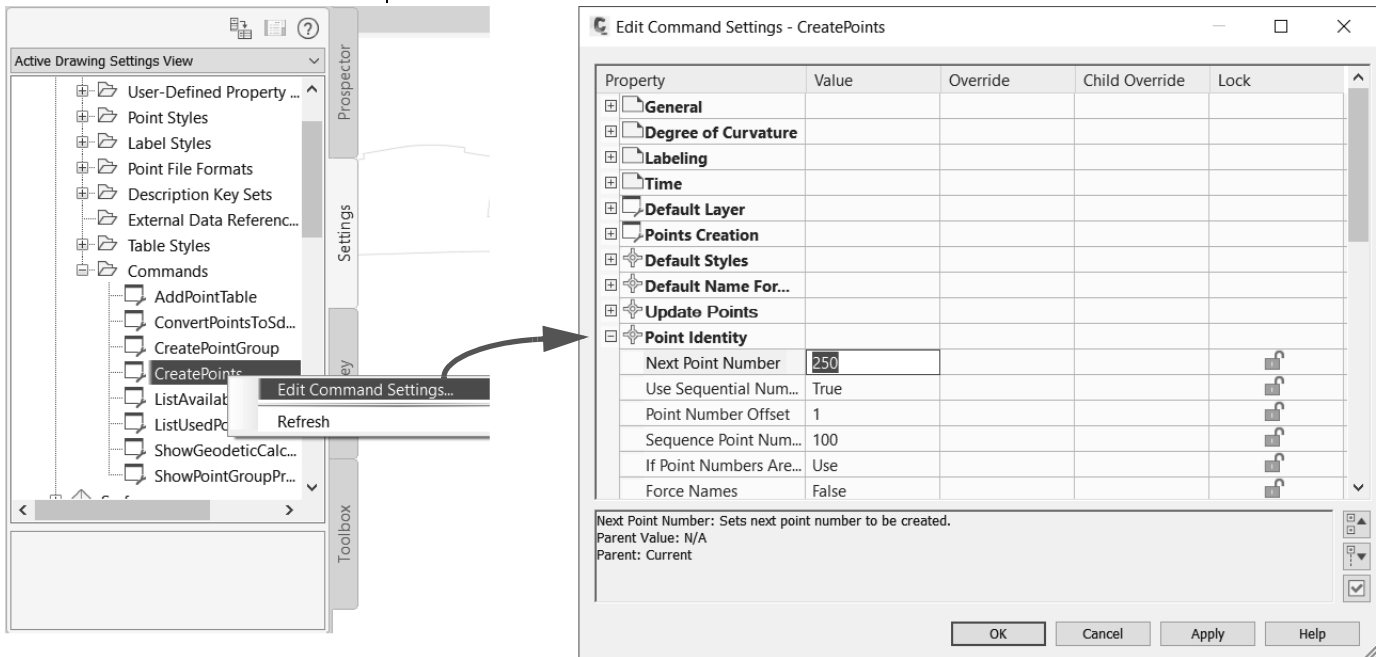


Figure 2–41

## 2.6 Creating Points

You can create points using the commands in the Create Points toolbar. These commands include:

- **Miscellaneous - Manual:** Creates a new point at specified coordinates.
- **Alignments - Station/Offset:** Creates a point at an alignment's specific station and offset. These points and their descriptions do not update if the alignment is modified or the point is moved. If you prefer a dynamic station and offset labels, consider using an Alignment label instead.
- **Alignments - Measure Alignment:** Creates point objects at a set interval, which is useful for construction staking. Again, these points do not update if the alignment changes.
- **Surface - Random Points:** Creates points whose elevation is from a specified surface. These points can update, but only if you manually force the update. If you prefer a dynamic spot label which will always be up to date, consider a Surface label instead.

Each icon in the Create Points toolbar has a drop-down list. If you expand it, you can select a command from the list to run, as shown in Figure 2–42.

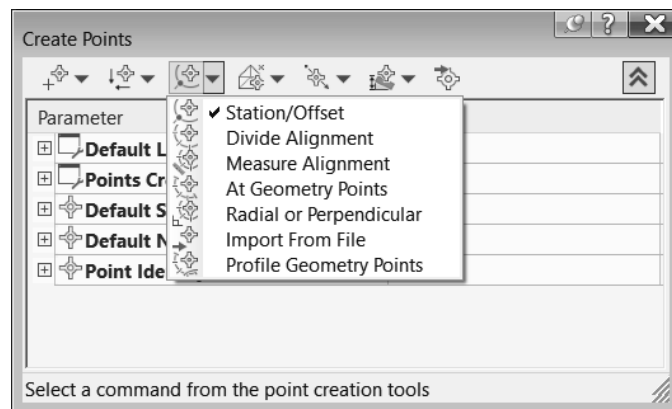


Figure 2–42



## Practice 2c

# Creating Autodesk Civil 3D Points

### Practice Objective

- Create a point manually then zoom to it using transparent commands.

In this practice, a fire hydrant was located by GPS. You will add a point object to locate it manually.

1. Continue working with the drawing from the previous practice or open **SUV1-C.dwg**.
2. In the *Home* tab>Create Ground Data panel, select **Points>Point Creation Tools** to display the Create Points toolbar. Expand the toolbar by clicking .
3. In the *Point Identity* area in the dialog box, set the *Next Point Number* to **260** and collapse the toolbar, by clicking .
4. Select the **Manual** option in the miscellaneous group in the toolbar as shown in Figure 2–43.

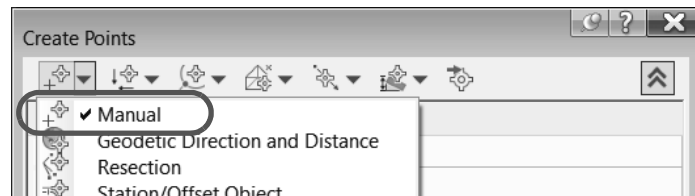



Figure 2–43

5. When prompted for a location, enter **6256069.30,2036634.25** and press <Enter>.
  - When prompted for a description, type **HYD** and press <Enter>.
  - When prompted for an elevation, press <Enter> to accept the default value of <.> (period), because it is unknown.
  - Press <Enter> again to finish the command and select **X** in the Create Points dialog box to close it.
  - In the Transparent Command toolbar, click  (Zoom to Point), and type **260**.
6. Save the drawing.

*The period is a placeholder for the elevation field. Typing zero is not correct because 0 is a valid elevation.*

## 2.7 Description Key Sets

Description Keys categorize points by their field descriptions (raw description). If a point matches a Description Key entry, the point is assigned a point and label style, and a full description (a translation of the raw description). Description Key Sets can also scale and rotate points.

The Description Key's first five columns are the commonly used entries, as shown in Figure 2–44.

Code	Style	Point Label Style	Format	Layer	Scale Parameter	Fixed Scale Fact...	Use drawing sc...
STA*	<input checked="" type="checkbox"/> STA	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-CT	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No
SWMH*	<input checked="" type="checkbox"/> Storm Se	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-NC	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No
TR*	<input checked="" type="checkbox"/> Tree	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-NC	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No

Figure 2–44

- To create a new Description Key row, select an existing code, right-click, and select **New**. To edit a code, double-click in the cell.

### Code, Point, and Label Style

Description code is a significant part of data collection. Codes assigned to a raw description trigger action by the Description Key Set. Each entry in the set represents all of the possible descriptions that a field crew would use while surveying a job. When a raw description matches a code entry, the Key Set assigns all of the row's values to the matching point, including point style, label style, translates the raw description, and possibly assigns a layer. Codes are case-sensitive and must match the field collector's entered raw description.

A code might contain wild cards to match raw descriptions that contain numbering or additional material beyond the point's description. For example, MH? would match MH1, MH2, etc., but not MH12, since the ? (question mark) symbol matches only single characters, whereas UP\* would match UP 2245 14.4Kv Verizon, since the \* (asterisk) matches any string characters. Common wild keys are described as follows:

# (pound)	Matches any single numeric digit. (T# matches T1 through T9.)
@ (at)	Matches any alphabetic character. (1@ matches 1A through 1Z.)
. (period)	Matches any non-alphanumeric character. (T. matches T- or T+.)
* (asterisk)	Matches any string of characters. (T* matches TREE, TR-Aspen, Topo, or Trench.)
? (question mark)	Matches any single character. (?BC matches TBC or 3BC.)

Matching a Key Set entry for the code assigns a Point Style at the point's coordinates. If the *Point Style* is set to **Default**, the *Settings* tab's Point feature *Point Style* is used (set in the Edit Feature Settings dialog box), as shown in Figure 2–45.

Matching a Key Set entry for the code assigns a point label style to annotate important point values. This is usually a number, elevation, and description. If the *Point Style* is set to **Default**, the *Settings* tab's Point feature *Point Label Style* is used (set in the Edit Feature Settings dialog box), as shown in Figure 2–45.

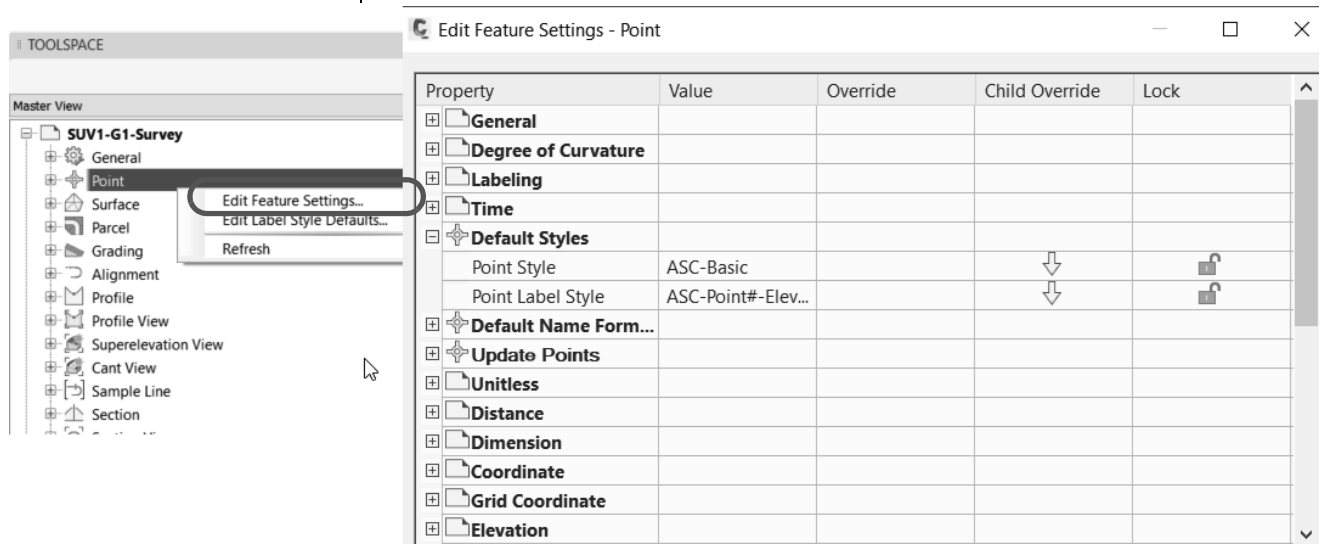


Figure 2–45



## Format

The *Format* column translates the raw description (what the surveyor typed) into a full description (what you want it to read). When including spaces in a raw description, the Autodesk Civil 3D software assigns parameter numbers to each description element. Parameters are represented by a \$ sign, followed by a number. For example, the description *PINE 6* has two elements: PINE and 6, with PINE as parameter 0 (\$0) and 6 as parameter 1 (\$1). When the *Format* column contains \$\*, it indicates that the software should use the raw description as the full description. The *Format* column can reorder the parameters and add characters to create a full description. For example, the raw description *PINE 6* can be translated to 6' PINE by entering **\$1' \$0**.

A complex raw description is as follows:

TREE D MAPLE 9

For the raw description to match the Description Key Set entry, the entry **TREE** must have an asterisk (\*) after TREE (as shown in Figure 2–46). The raw description elements and their parameters are TREE (\$0), D (\$1), MAPLE (\$2), and 9 (\$3). The *Format* column entry of **\$3' \$2 \$0** creates a full description of **9' MAPLE TREE**.

Code	Style	Point Label Style	Format	Layer	Scale Parameter	Fixed Scale Fact...	Use drawing sc...
STA*	<input checked="" type="checkbox"/> STA	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-CT	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No
SWMH*	<input checked="" type="checkbox"/> Storm Se	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-NK	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No
TR*	<input checked="" type="checkbox"/> Tree	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-NK	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000	<input type="checkbox"/> No

**Figure 2–46**

*If a point does not match any Description Key Set entry, it receives the default styles assigned by the \_All Points group.*

The *Layer* column assigns a layer to the matching point. If the Point Style already has a marker and label layer, this entry should be toggled off. The Description Key Set also contains the *Scale* and *Rotate Parameter* columns. In the example in Figure 2–46, the 3 for the trunk diameter can also be a tree symbol scaling factor when applied to the symbol's X-Y.

The most common parameter is the **Scale** parameter. With this parameter, a surveyor will enter the size of a tree as part of the description and the description key file will insert a symbol scaled to the value provided by the surveyor.

The **Rotate** parameter is used less frequently, but it can be useful. For example, you can edit the point file in the office (not in the field) once you have determined the bearing of a roadside curb. Then, you can append that rotation value as a parameter to the description of each hydrant, street sign, light standard, etc. along the road to have them inserted with the proper rotation so the symbols will be inserted with the proper angle to be perpendicular to the curb.

## Practice 2d

# Creating a Description Key Set

### Practice Objective

- Assign point symbols, labels, layers, etc., on import by setting up Description Key Sets.

In this practice, you will learn to create a new Description Key Set entry and apply it to an existing point. In addition, you will update the Description Key Set to use parameters.

### Task 1 - Create a new Description Key Set entry.

- Continue working with the drawing from the previous practice, or open **SUV1-D.dwg**.
- In the Toolspace, *Settings* tab, expand the *Point* collection until the *Description Key Set* collection and its list display.
- Select **Civil 3D**, right-click, and select **Edit Keys...**
- Right-click in any *Code* cell and select **New...**, as shown in Figure 2–47.

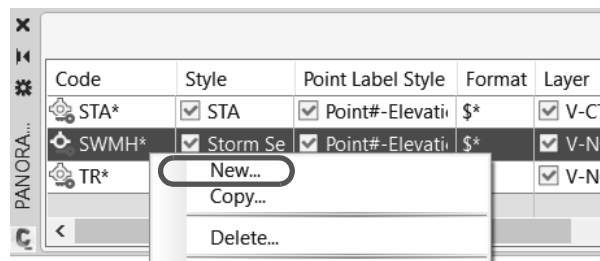


Figure 2–47

- Double-click in the *Code* cell in the newly created row and type **HYD**, as shown in Figure 2–48.

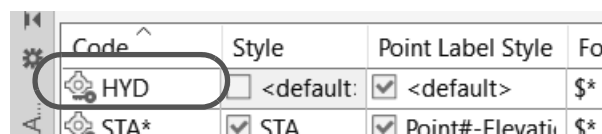


Figure 2–48

- In the *Style* cell, toggle on the Point Style and select the **Style** cell to open the Point Style dialog box, as shown in Figure 2–49. Select **ASC-Hydrant (existing)** in the drop-down list and click **OK** to assign the style to the code.

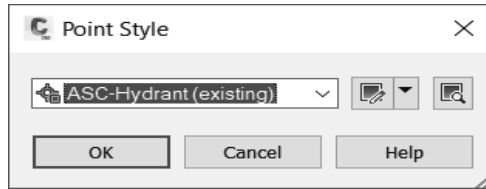


Figure 2–49

- Leave **<default>** selected as the *Point Label Style* and **\$\*** as the *Format*. This means the label will be the same as the one entered by the surveyor.
- Leave the check box toggled off in the *Layer* column.
- Select the **Yes** option in the *Use drawing scale* column, and clear the check box for the **Scale Parameter**, as shown in Figure 2–50.


You do not have a scale parameter and will not be using a fixed scale.

Code	Style	Point Label ...	For...	Layer	Scale Para...	Fixed Scale ...	Use drawin...	Apply to X-Y
STA*	<input checked="" type="checkbox"/> STA	<input checked="" type="checkbox"/> Point#-Elev	\$*	<input checked="" type="checkbox"/> V-C	<input checked="" type="checkbox"/> Parameter	<input type="checkbox"/> 1.000	<input type="checkbox"/> No	<input type="checkbox"/> No
SWMH*	<input checked="" type="checkbox"/> Storm Sewer Manhole	<input checked="" type="checkbox"/> Point#-Elev	\$*	<input checked="" type="checkbox"/> V-N	<input checked="" type="checkbox"/> Parameter	<input type="checkbox"/> 1.000	<input type="checkbox"/> No	<input type="checkbox"/> No
TR*	<input checked="" type="checkbox"/> Tree	<input checked="" type="checkbox"/> Point#-Elev	\$*	<input checked="" type="checkbox"/> V-N	<input checked="" type="checkbox"/> Parameter	<input type="checkbox"/> 1.000	<input type="checkbox"/> No	<input type="checkbox"/> No
HYD	<input checked="" type="checkbox"/> ASC-Hydrant (existing)	<input checked="" type="checkbox"/> <default>	\$*	<input type="checkbox"/>	<input type="checkbox"/> Parameter	<input type="checkbox"/> 1.000	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

Figure 2–50

- Close the DescKey Editor vista by clicking  in the top right corner of the palette.

### Task 2 - Apply the new Description Key Set to an existing point.

- If not already zoomed into the new point, in the *Transparent* tab, click  (Zoom to Point), and then type **260**.

The point updates to display the Hydrant symbol and its new description.

- In the Toolspace, *Prospector* tab, select the **\_All Points** group, right-click, and select **Apply Description Keys**, as shown in Figure 2–51.

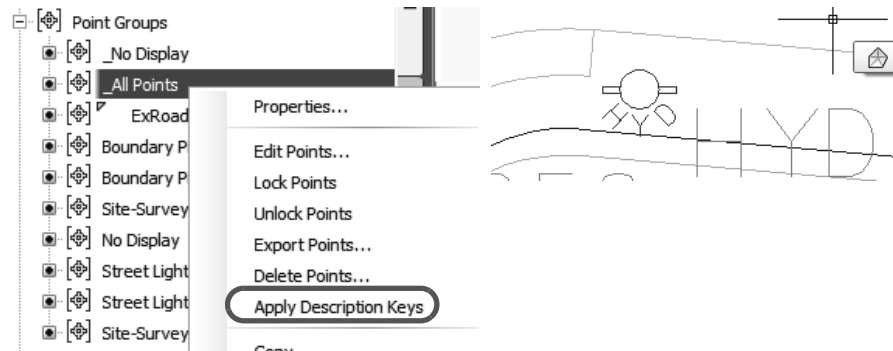


Figure 2–51

- Save the drawing.

### Task 3 - Update the Description Key Set to use parameters.

In this task, you will use the Parameters feature to control the display properties of symbols in your drawings.

In this case, you will use the **Rotate** parameter, so that the pumpers on the hydrant display correctly (i.e., running parallel to the road).

- In the Toolspace, *Settings* tab, expand *Point>Description Key Sets*. Select **Civil 3D**, right-click, and select **Edit Keys...**, as shown in Figure 2–52.

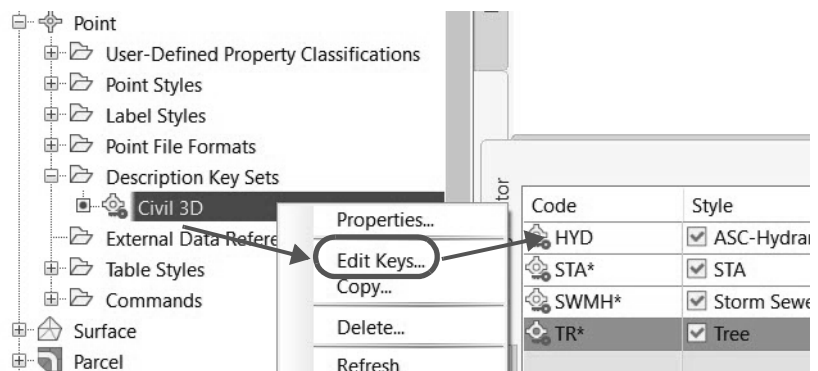


Figure 2–52

- In the HYD row, *Code* column, type **HYD\***. The asterisk symbolizes a wildcard, (i.e., any character after the letters HYD).

- In the HYD row, select the check box in the *Marker Rotate* column (as shown in Figure 2–53), select the cell, and then select **Parameter1** in the drop-down list.

Code	Style	Point La...	Fo...	Layer	Scale Para...	Fixed Scale Fact...	Use dr...	Apply t...	Apply to Z	Marker Rotate ...	Ma
HYD	ASC-Hydrant (existing)	<defaul	\$*		Paramete	1.000	No	No	No	Parameter 2	
STA*	STA	Point#-	\$*	V-C1	Paramete	1.000	No	No	No	Parameter 1	
SWMH*	Storm Sewer Manhole	Point#-	\$*	V-N	Paramete	1.000	No	No	No	Parameter 2	
TR*	Tree	Point#-	\$*	V-N	Paramete	1.000	No	No	No	Parameter 3	
										Parameter 4	
										Parameter 5	

Figure 2–53

- Click  in the top right corner of the dialog box to close the Panorama view.
- Using the AutoCAD **Distance** inquiry, you will note that the bearing of the curb is 5 degrees clockwise, as shown in Figure 2–54.

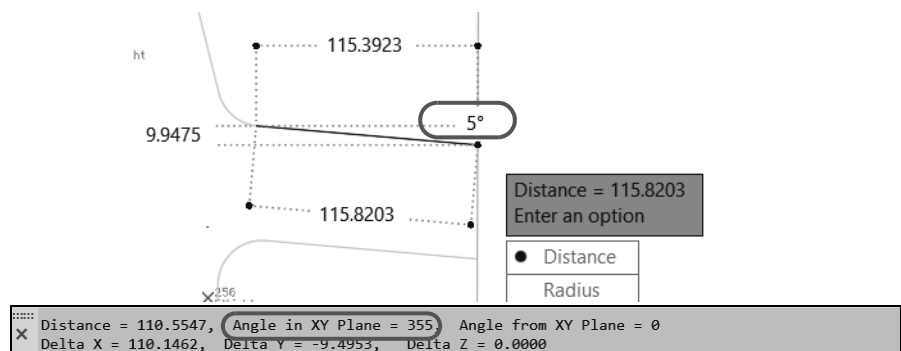


Figure 2–54

The -5 indicates the required rotation.

- In Model Space, select the Hydrant point object, right-click, and select **Edit Points**.
- Set the *Raw Description* from HYD to **HYD -5**. Ensure that you put a space after **HYD**.
- Select the row, right-click, and select **Apply Description Keys**, as shown in Figure 2–55.

Point Nu...	Easting	Northing	P...	N.	Raw Description	Full Descript...	Description For...	Grid E
260	5852.1285m	0768.5612m			HYD -5			16852

Figure 2–55

The curb line is accentuated in the figure for clarity. The rotation is slight and may be difficult to discern.

9. Click  in the top right corner of the dialog box to close the Panorama view.

The hydrant has now been rotated to display the hydrant pumpers following the bearing of the curb, as shown in Figure 2–56.

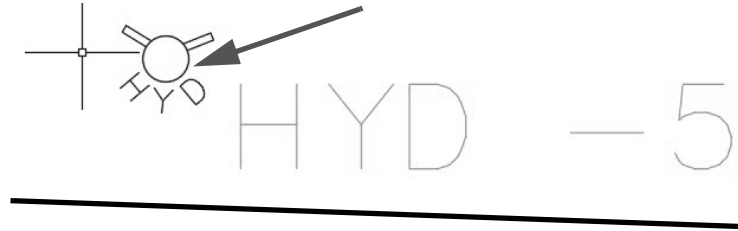


Figure 2–56

10. The label also displays the rotation angle text -5, which you do not want. In the Toolspace, *Settings* tab, expand the *Point* and *Description Key Sets* collections. Select **Civil 3D**, right-click, and select **Edit Keys...**
11. In the HYD row, change the *Format* from \$\* to **Hydrant**, as shown in Figure 2–57.

Code	Style	Point Label Style	Format	Layer	Scale Parameter	Marker Rotate ...	Ma
HYD*	<input checked="" type="checkbox"/> ASC-Hydrant (existing)	<input checked="" type="checkbox"/> <default>	Hydrant	<input type="checkbox"/>	<input checked="" type="checkbox"/> Parameter 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
STA*	<input checked="" type="checkbox"/> STA	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-CI	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/>	<input type="checkbox"/>
SWMH*	<input checked="" type="checkbox"/> Storm Sewer Manhole	<input checked="" type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-N	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/>	<input type="checkbox"/>
TR*	<input checked="" type="checkbox"/> Tree	<input type="checkbox"/> Point#-Elevati	\$*	<input checked="" type="checkbox"/> V-N	<input checked="" type="checkbox"/> Parameter 1	<input type="checkbox"/>	<input type="checkbox"/>

Figure 2–57

12. Click  in the top right corner of the dialog box to close the Panorama view.
13. In Model Space, select the Hydrant point object, right-click, and select **Apply Description Keys**. The changes are now applied, as shown in Figure 2–58.

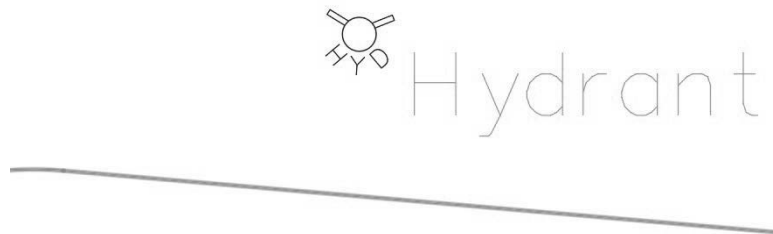



Figure 2–58

14. Save the drawing.

## 2.8 Importing Survey Data


The Autodesk Civil 3D software has methods to import point data from ASCII text files to Autodesk LandXML files, as well as methods to convert AutoCAD points to Autodesk Civil 3D points. The Toolspace, *Survey* tab also inserts points from a survey to a drawing.

### Import Points Only

Alternatively, you can click  (Import Points) in the Create Points toolbar.

There are two methods of launching the import point feature, one is by using the *Insert* tab and the other is using the **Points** creation tool in the *Home* tab, Create Ground Data panel or the Toolspace, *Prospector* tab.

#### How To: Use the *Insert* Tab Method

1. In the *Insert* tab, click  (Points from File). This opens the Import Points dialog box.
2. In the Import Points dialog box, set the file format, select the files to import, set any advanced options, and click **OK** to import the points.

#### How To: Use the Point Creation Tools Method

1. Open the Create Points dialog box by expanding Points in the *Home* tab, expanding the drop-down list and selecting a **Create Points** option, as shown on the left in Figure 2–59. Alternatively, in the Toolspace, *Prospector* tab, select **Points**, right-click and select **Create...**, as shown on the right.

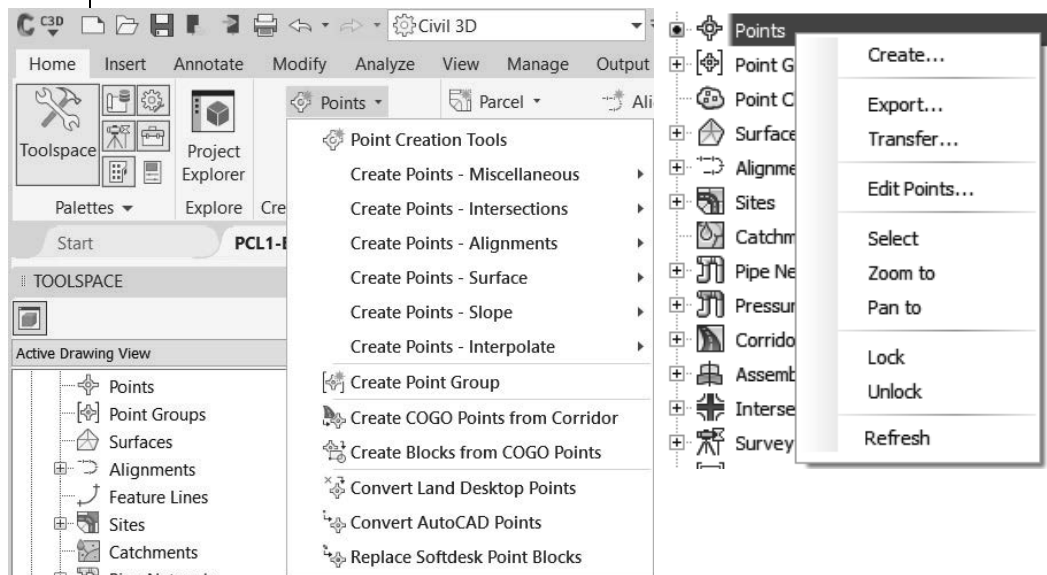
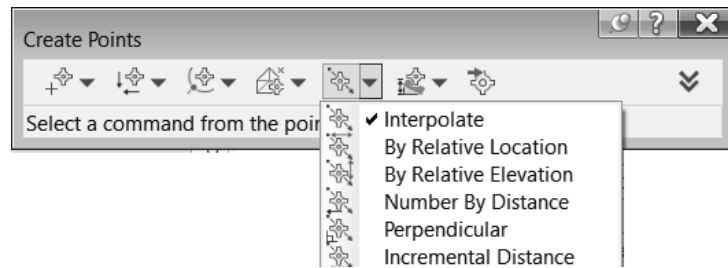



Figure 2–59

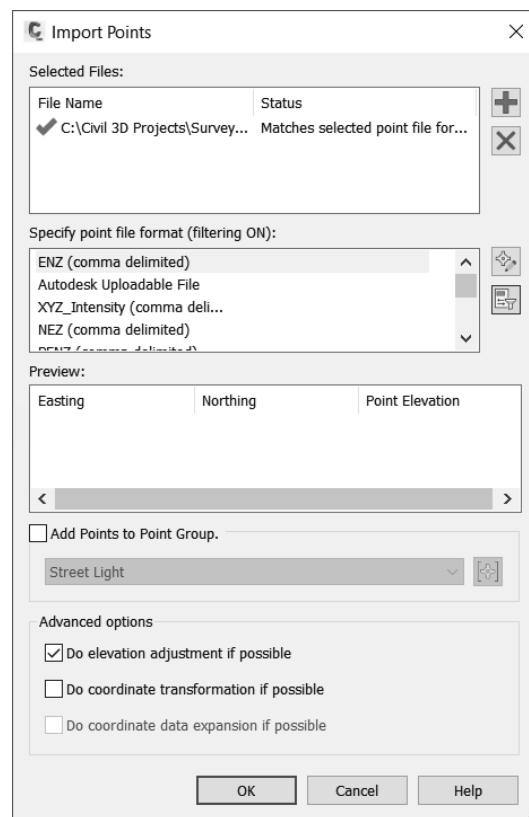


All commands in the Points drop-down list can also be accessed in the Create Points toolbar, as shown in Figure 2–60.




**Figure 2–60**

2. Click  (Import Points) to open the Import Points dialog box (shown in Figure 2–61).



**Figure 2–61**

3. In the Import Points dialog box, under the *Specify point file format* area, select the required format.
4. After setting the format, click  on the right to open the Select Source File dialog box.
5. In the Select Source File dialog box, browse to the import point file, select it, and select **Open**. Assign the imported points to a new or existing point group by selecting the **Add Points to Point Group** option and selecting the point group in the drop-down list. Select **Advanced options** as required.

*You can select multiple files if they have the same file format.*

## Duplicate Point Numbers

If an imported file creates duplicate point numbers, the Autodesk Civil 3D software overwrites, merges, or reassigns them during the import process. When encountering duplicate point numbers, the Autodesk Civil 3D software can assign the next available number, add an offset value (add 5000 to each point number that conflicts), overwrite points (replaces the current point values with the file's values), or merge points (add the file's values to an existing point's values). If using the offset method, the new point numbers are kept unique in the drawing. If using the next available number method, the new points blend into the original points and are difficult to identify.

The offset method is preferred when resolving duplicate point numbers. When importing points that will potentially duplicate point numbers, the Create Points toolbar's *Point Identity* settings, as shown in Figure 2–62, is the default when handling duplicate point numbers.

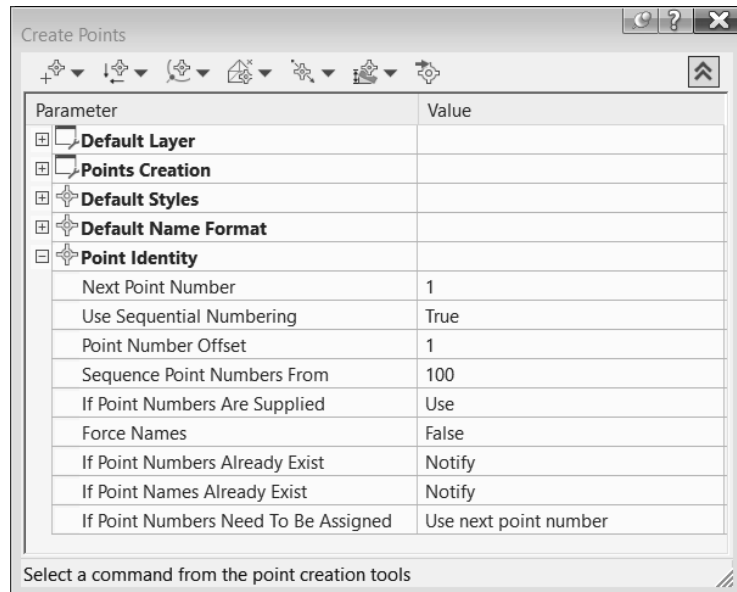


Figure 2–62

In the *Point Identity* settings, set the duplicate point resolution method for the *If Point Numbers Already Exist* variable. The four methods are **Renumber**, **Merge**, **Overwrite**, and **Notify**, as shown in Figure 2–63. The import process never overwrites point data unless you specify that it should do so.

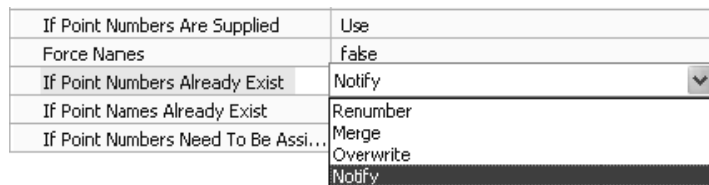


Figure 2–63

## Survey Toolspace

When encountering a duplicate point, the Duplicate Point Number dialog box opens. After you define a resolution, it can be assigned to the current duplicate point or to all encountered duplicate points.

The Toolspace, *Survey* tab displays a panel through which all surveys are processed. Survey uses graphics to display field book imports, figure and network previews, and points. If you toggle off these graphics, you can process a survey without a drawing being open. If you want to display these graphics, you need to have a drawing open. Survey prompts you to open a drawing if you do not have one open.

The Toolspace, *Survey* tab contains Survey settings, Equipment defaults, Figure Prefixes, and Linework Code Sets. Survey's settings can be on a local or network folder. It is preferred to use a network folder in larger offices because all users can then standardize the file values.

### How To: Display the Toolspace, *Survey* Tab

If your Toolspace does not display the *Survey* tab, click



(Survey) in the *Home* tab>Palettes panel, as shown in Figure 2–64.

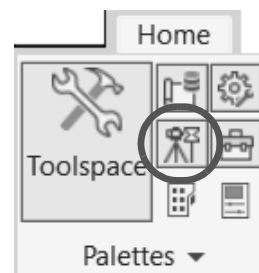


Figure 2–64

## Import Points and Figures Using the Survey Database

After collecting and coding the data, and then downloading and converting it, the next step in Survey is to import the survey data, review it, and place the survey points and figures into a drawing. A working folder defines where the local Survey Database is located. The preferred location is a network folder, in which you place the local Survey Databases. The Survey User Settings dialog box sets the defaults for all new Survey Databases. You should set these before starting Survey. The Survey Working Folder is the location for all of the Survey Databases and can be local or on the network. The default working folder is *C:\Users\Public\Documents\Autodesk\Civil 3D Projects*.

## How To: Set the Working Folder for the Survey Database

1. In the Toolspace, *Survey* tab, select **Survey Databases**.
2. Right-click and select **Set working folder...**, as shown in Figure 2–65.

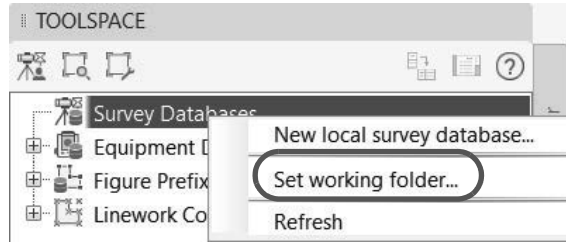


Figure 2–65

## Survey Database

*Survey Database Folders cannot be deleted in Autodesk Civil 3D Survey. If you want to delete the working folder, this process must be done through the Windows File Explorer, external to the Autodesk Civil 3D software.*

A Survey Database is a subfolder in the working folder. The Survey Working Folder contains the Survey's settings and observation database. This database contains the Survey's Networks, Figures, and Survey Points.

To import a field book, you use the Survey's *Import Events* collection. *Import Events* provides access to an Import wizard, which guides you through the steps of importing a file.

1. To open the Import wizard, select **Import Events** in the Survey, right-click, and select **Import survey data....**
2. The Specify Database page is shown in Figure 2–66. It sets the survey, creates a new survey, and edits the Survey's settings.

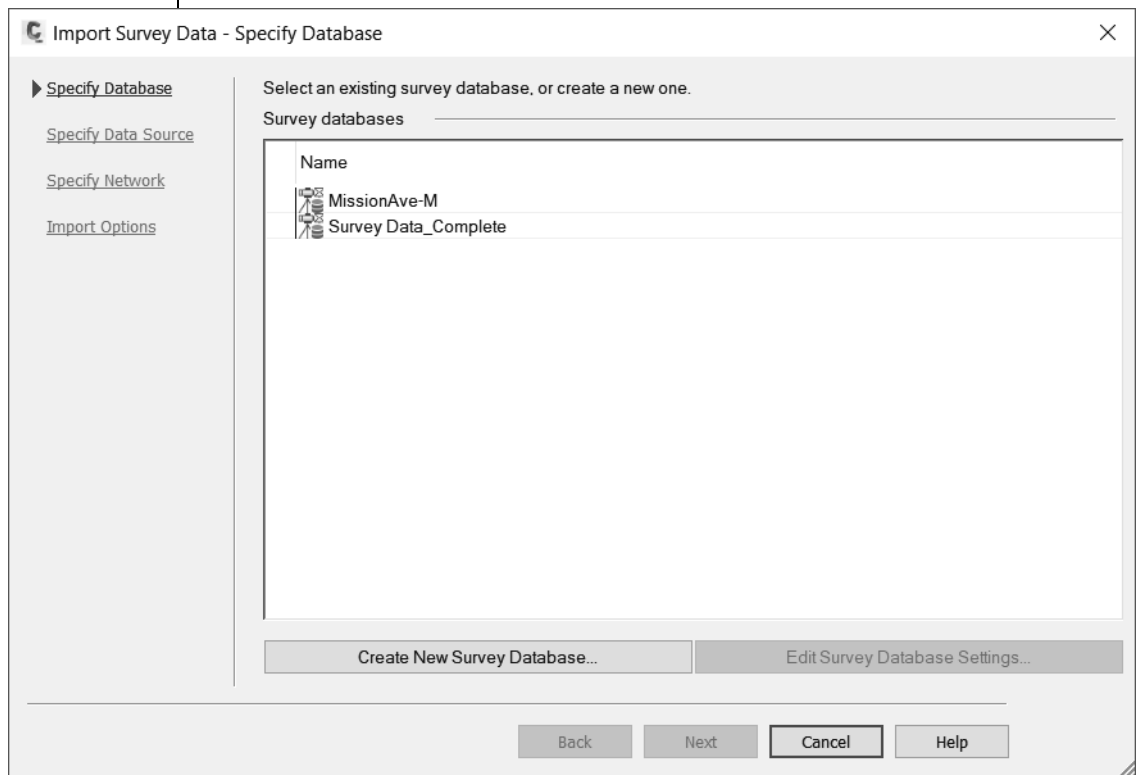


Figure 2–66

3. Click **Next**. The *Specify Data Source* page (shown in Figure 2–67), defines the file import type, the file's path, and its format (if it is a coordinate file).

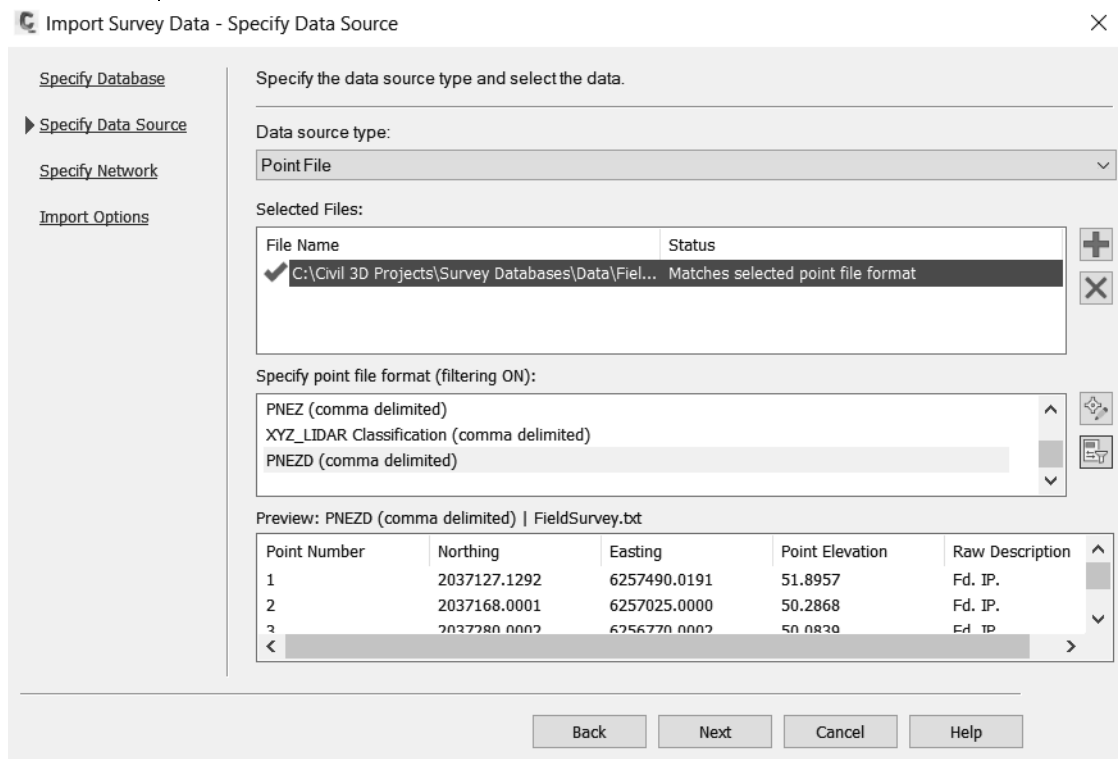


Figure 2–67

- Click **Next**. The *Specify Network* page (shown in Figure 2–68) enables you to change the network or create a new one. If importing a Field Book, a *Network* must be assigned. If Importing a Point File, a *Network* is optional.

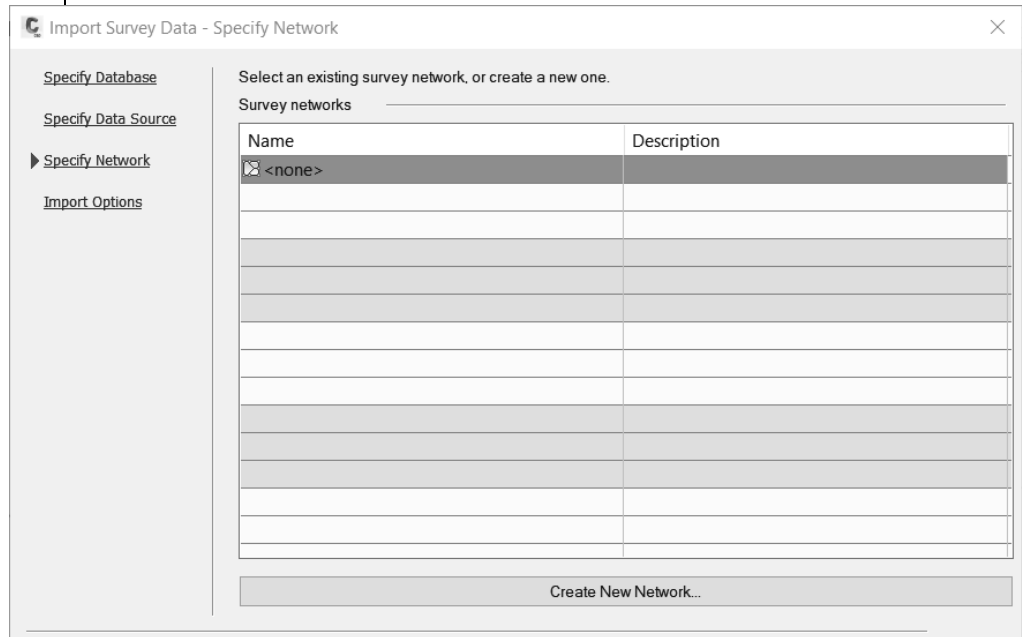


Figure 2–68

- Click **Next**.
- The *Import Options* page (shown in Figure 2–69) sets the values for the import. These settings affect what the import does and which support files it uses.

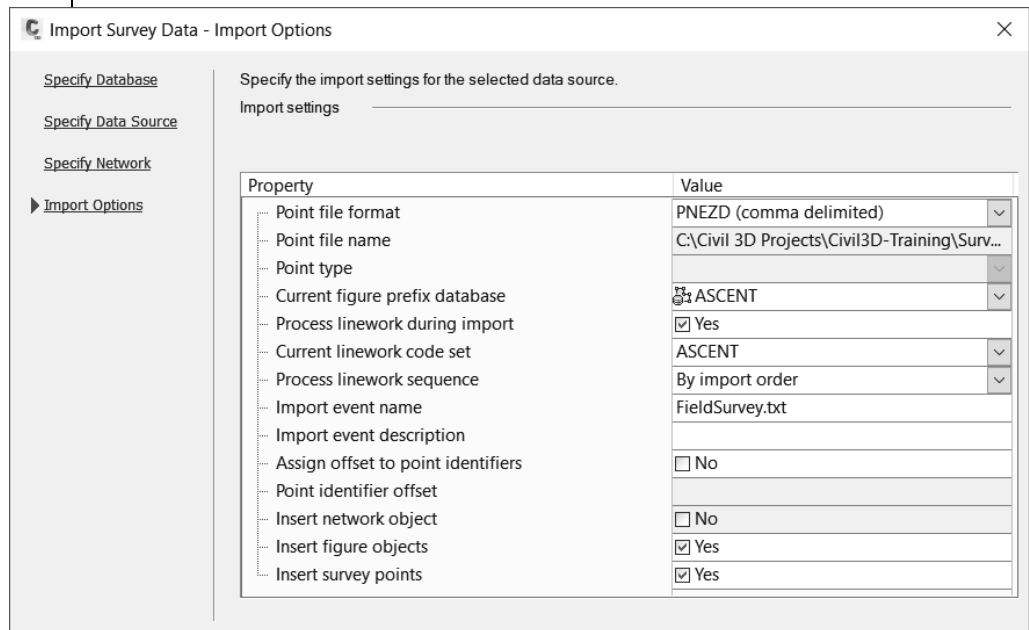


Figure 2–69

If the field book has figure coding from a conversion, you do not need to toggle on the *Process linework during import* property. This is for Point files other than field books that have **Linework Code Set** commands included in the point's description.

Inserting figures requires entries to be in the Figure Prefix database and figure styles to be in the drawing. This is required to point the figure and linework to the correct drawing layers and to specify whether the figure is also a breakline in a surface.

When inserting points, it is necessary to have a Description Key Set defined to assign points, point label styles, and layers, and to translate raw descriptions to full descriptions.

## Open a Survey Database for Editing

Only one Survey Database can be edited at a time. When opened for editing, this prepares the survey for reading and writing. There are options to set the path or location for the Survey Database project files, and for all of the settings. When you create a new Survey Database, a Windows folder is created with the same name. If you close a drawing with a survey open, the Survey Database closes automatically. You must start a new drawing or open an existing drawing and then open the required Survey Database. You can only have one Survey Database open at a time.

## How To: Open a Survey Database

1. In the Toolspace, *Survey* tab, expand the *Survey Database* collection.
2. Select the survey database that you want to open, right-click, and select **Open for edit** or **Open for read-only**, depending on your requirements, as shown in Figure 2–70. Contrary to most Civil 3D functions, where double-clicking invokes an edit function, double-clicking on a Survey Database will open it as read-only.

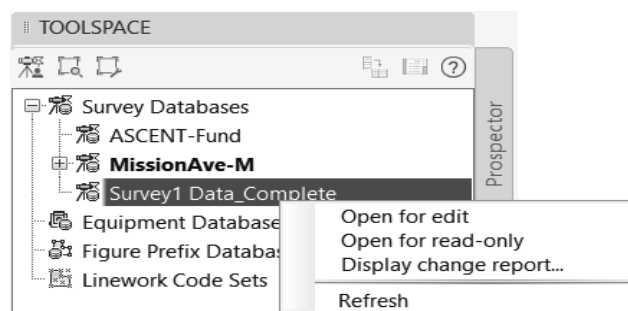


Figure 2–70

### Hint: Survey Database Migration to 2020 and Above

The Survey Database format has changed in the 2020 Release. If you have existing Survey Databases created in an earlier format, they will be marked and must be migrated, Right-click on the Survey Database and pick *Migrate*.... You will need to select a new location for the updated Survey Database, as shown in Figure 2–71.

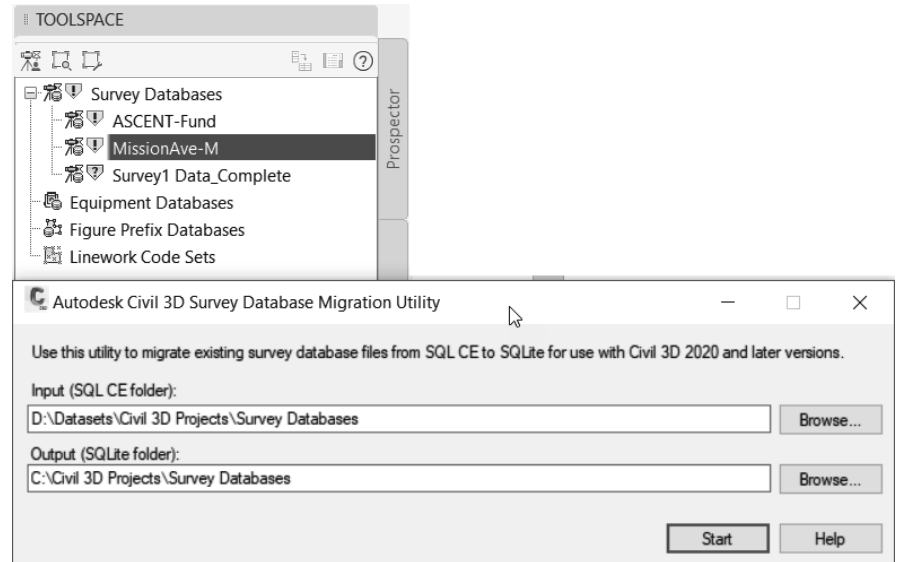


Figure 2–71



## Practice 2e

# Importing Survey Data

### Practice Objective

- Import points from an ASCII file created from the field survey.

In this practice, you will import an ASCII file created in the field.

1. Continue working with the drawing from the previous practice or open **SUV1-E.dwg** from the *C:\Civil 3D Projects\Working\Survey* folder.
2. On the *Survey* tab, right-click on **Survey Databases** and select **Set working folder**, as shown in Figure 2–72.

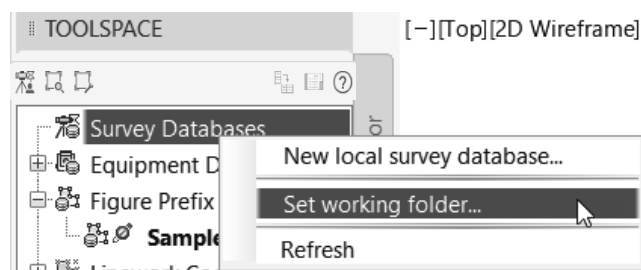



Figure 2–72

3. Browse to *C:\Civil 3D Projects\Survey Databases* and click the **Select Folder** button in the lower right corner.
4. In the *Home* tab>expanded Create Ground Data panel, click  (Import Survey Data).
5. On the Specify Database page, click **Create New Survey Database...**, as shown in Figure 2–73.

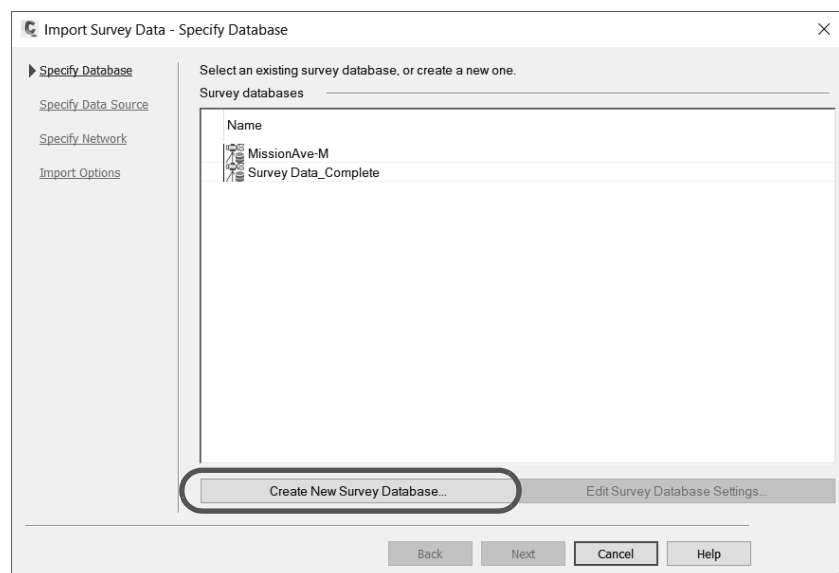


Figure 2–73

- 6. Type **ASCENT-Fund** for the name and click **OK**.
- 7. Click **Edit Survey Database Settings...** as shown in Figure 2–74.

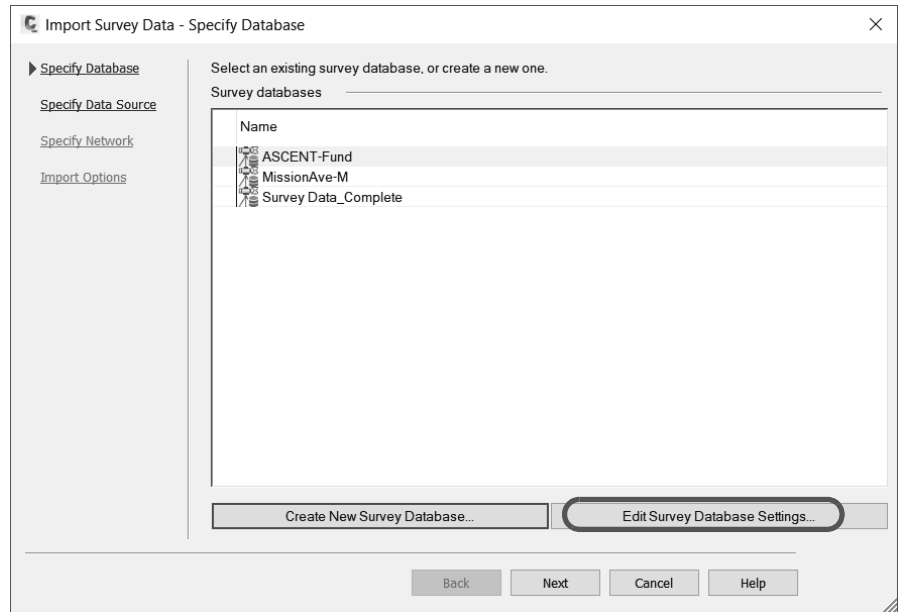


Figure 2–74

- 8. Under *Units* in the Survey Database Settings dialog box, for the *Coordinate Zone*, click the **Browse** icon. In the Select Coordinate Zone dialog box, select **NSRS 2007 California State Planes, Zone VI, US Foot** (as shown in Figure 2–75). Click **OK** twice and then click **Next**.

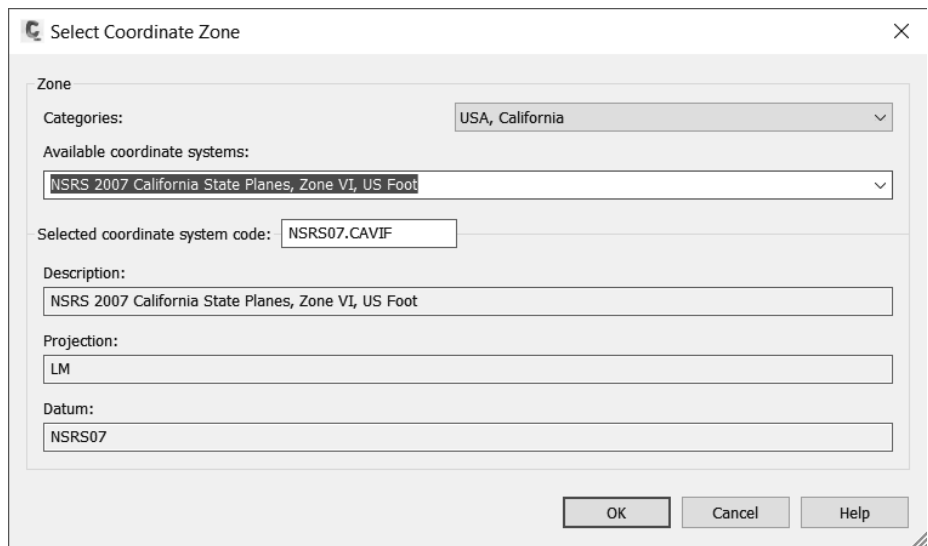
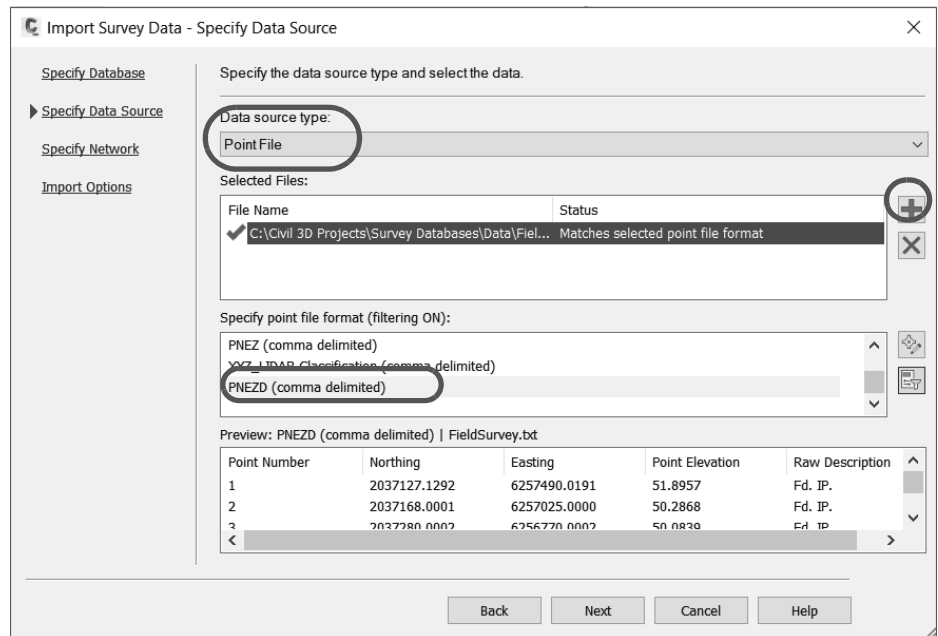


Figure 2–75

9. On the Specify Data Sources page, do the following, as shown in Figure 2–76:

- Expand the Data source type drop-down list and select **Point File**.
- Click **+** (Add file) and browse to *C:\Civil 3D Projects\Survey Databases\Data*. Select **Field Survey.txt** and open it.
- For the file format, select **PNEZD (comma delimited)**.
- Click **Next**.



**Figure 2–76**

10. On the Survey Network page, click **Next**.

11. On the Import Options page, select **Process linework during import**, **Insert figure objects**, and **Insert survey points**, as shown in Figure 2–77. Click **Finish**.

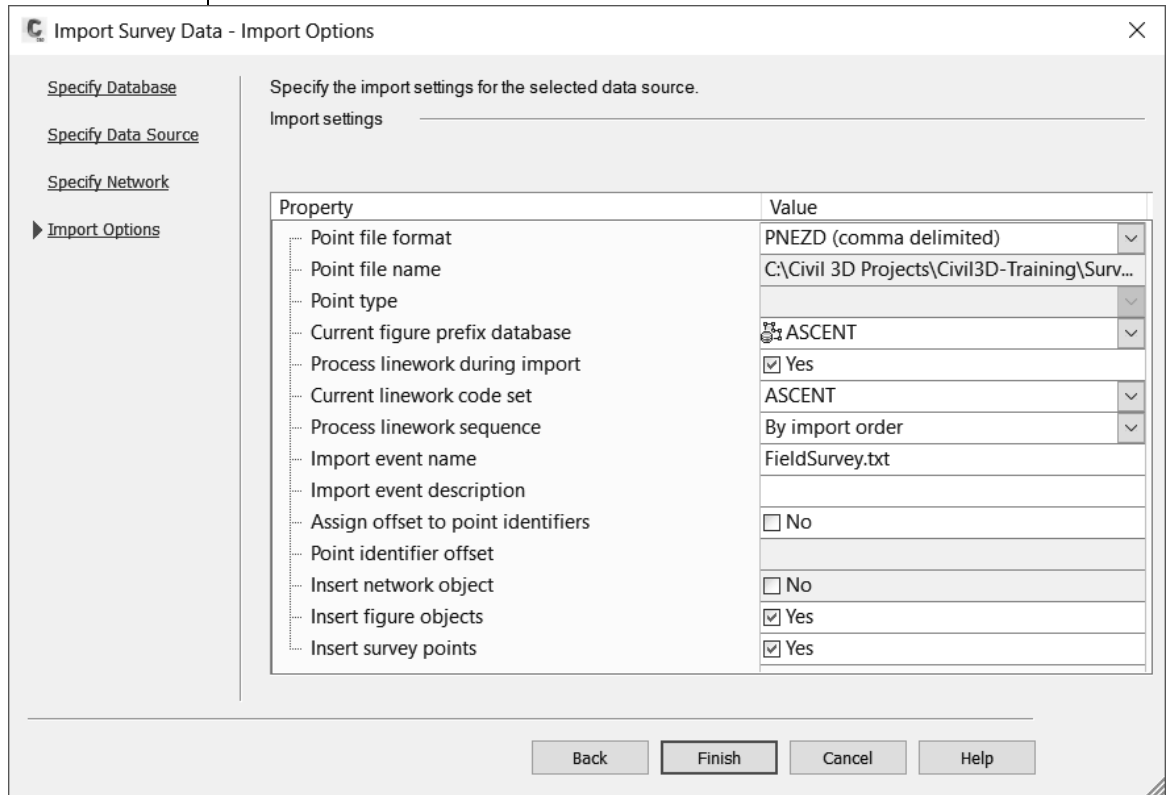


Figure 2–77

12. Save the drawing.

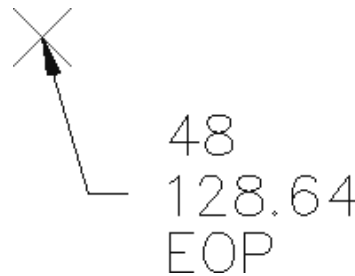
## 2.9 Reviewing and Editing Points

Reviewing and editing point data occurs throughout the Autodesk Civil 3D environment. It is as simple as selecting a point in the drawing, right-clicking, and selecting **Edit Points....** You can also edit points using the shortcut menu in the *Points* heading in the Toolspace, *Prospector* tab. Alternatively, you can select a point entry in the Toolspace, *Prospector's* preview area.

### Repositioning Point Labels

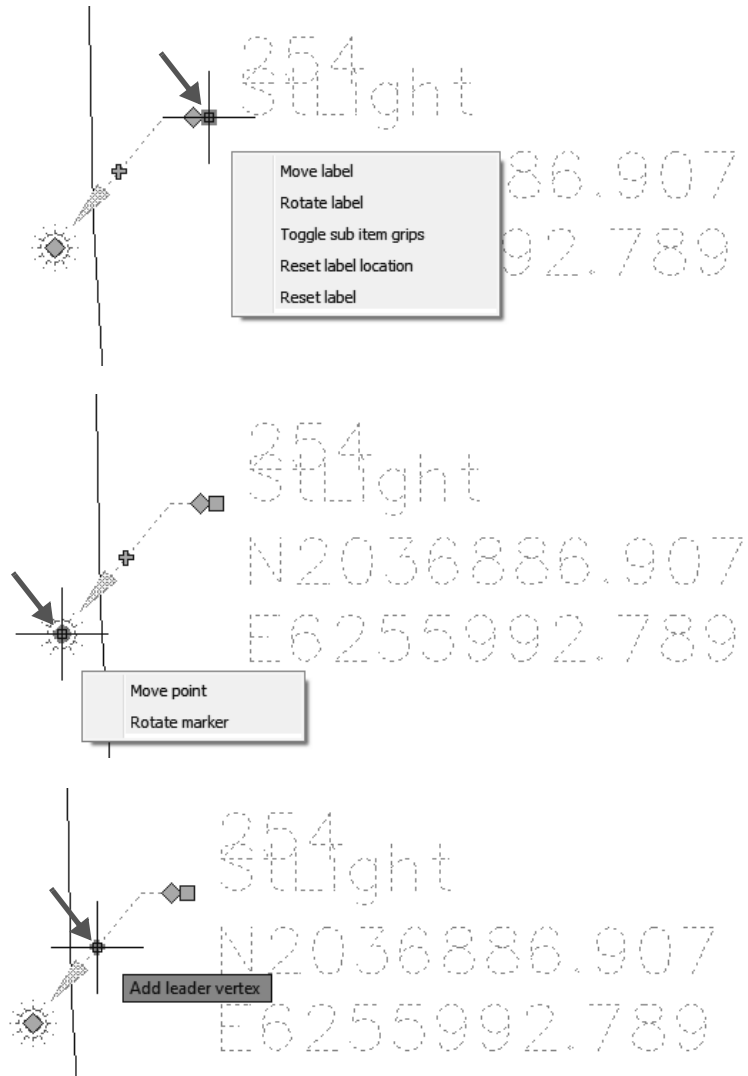
Each point label style has **Dragged State** parameters. These parameters affect the label's behavior when moving the label from its original label position. Depending on the **Dragged State** parameters, a label can change completely (Stacked text) or display as it was originally defined (As composed). An example of a label is shown in Figure 2–78.

*When selecting a point, it displays multiple grips. Click the move grip when you want to relocate the label.*



**Figure 2–78**

A point displays three grips when selected. Use the **Rectangle** label grip to Move, Rotate, and Toggle sub item grips and Reset the label. Use the Diamond point object grip to Move and Rotate both the label and marker, Rotate just the marker, reset marker rotation, and Reset all. The third grip is a plus symbol that enables you to add vertices to the leader, as shown in Figure 2–79.



**Figure 2–79**

- Each label component can be modified and the change is only for that point.
- Point objects can be set to automatically rotate to match the current view using style settings. If this is not preferred, they can have a rotation assigned directly through the AutoCAD Properties dialog box.
- You can reset a label to its original position by selecting the point, right-clicking, and selecting **Reset Label**.

## 2.10 Point Reports

The surveyor needs to produce point reports. These can include a record list for the project, a checklist to find errors, reference for field crews, stakeout, etc. Incorporating survey data with an Autodesk Civil 3D engineering project is unique in that it relies on connection and communication with third party survey equipment and software. Autodesk has collaborated with the major survey equipment vendors (TDS Survey Link, TOPCON Link, Trimble Link, Carlson Connect, and Leica X-Change) and they have developed applications that interface their equipment with the Autodesk Civil 3D software.

Autodesk Civil 3D points can be exported and then uploaded to the survey equipment without relying on manually created lists. However, a documented point list might be required. There are several ways to create reports about points.

### Point Reports - Reports Manager

The Autodesk Civil 3D Reports Manager produces several point reports. To create reports from the Reports Manager, the Toolspace, *Toolbox* tab must be available. To display the Toolspace, *Toolbox* tab, go to the *Home* tab>Palettes panel, and select **Toolbox**. Then select the Toolspace, *Toolbox* tab and expand the *Reports Manager* collection to display a list of object type reports, as shown in Figure 2–80.

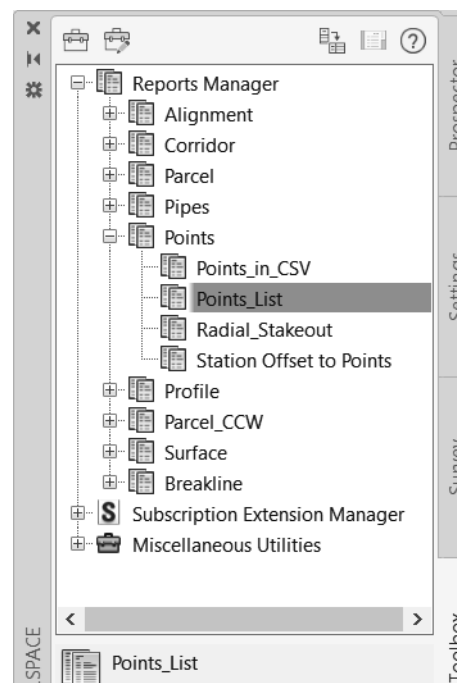


Figure 2–80

Points are easily organized into a convenient, legible list that displays the point number, northing, easting, elevation, and description (as shown in Figure 2–81). Another point report lists the points' station and offset values relative to an alignment. Another report calculates distances and angles from an occupied and a backsight. You can transfer points to Microsoft Excel spreadsheets using a CSV report. To create these reports, select the report's name, right-click, and select **Execute...**

Number	Northing	Easting	Elevation	Description
1	632055.919	2208068.041	900.655	MON
2	631396.467	2207989.483	900.171	MON
3	630834.659	2207979.534	898.369	MON
4	631382.131	2207989.229	900.174	MON

Figure 2–81

### Point Editor Reports

Another report method is to use the Point Editor vista. In the Toolspace, *Prospector* tab, select **Points**, right-click, and select **Edit...** to display the Point Editor vista, as shown in Figure 2–82.

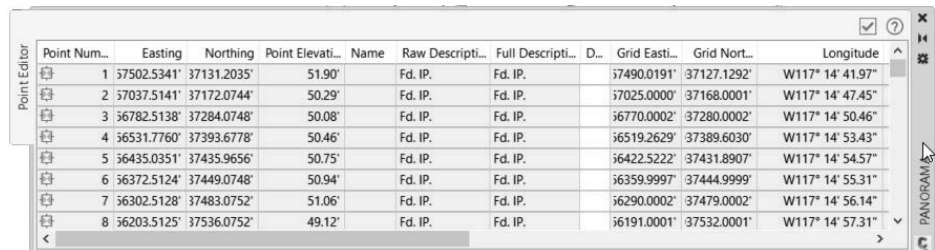


Figure 2–82

In the vista, you can select individual points using <Ctrl> or select blocks of points using <Shift>. When done selecting points, right-click and select **Copy to clipboard**. You can then paste the copied points into Microsoft Excel, Notepad, or any application that accepts the points, as shown in Figure 2–83.

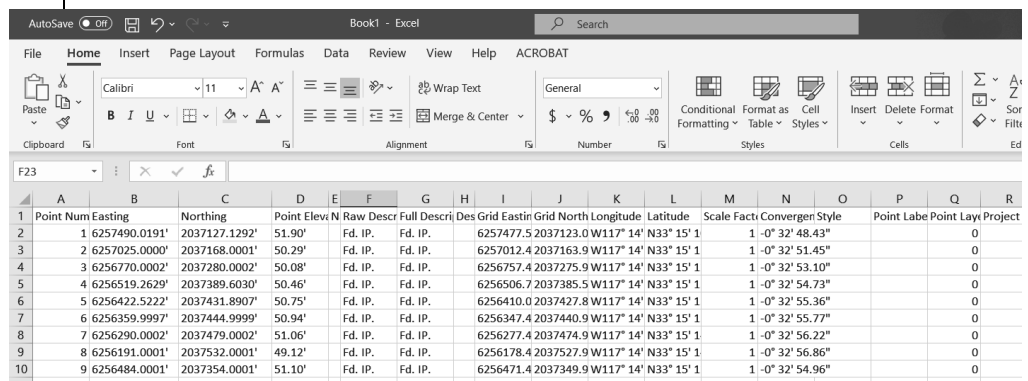


Figure 2–83



## Practice 2f

# Manipulating Points and Point Reports

### Practice Objectives

- Modify the label position for points to ensure that the plan is readable.
- Share information about points used for error checking or staking out points using predefined reports.

### Task 1 - Modify the position of the labels.

1. Continue working with the drawing from the previous practice or open **SUV1-F.dwg**.
2. In the preview point list, scroll down until the point number **260** displays. Select it, right-click, and select **Zoom to**, as shown in Figure 2–84.

*This positions the point at the center of the screen.*

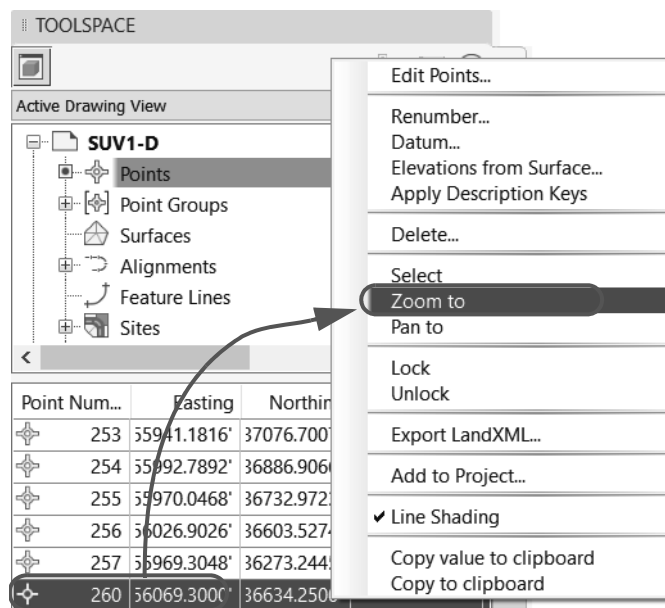


Figure 2–84

3. In a typical drafting workflow, points can overlap, making them illegible. Since the Point Style's text height is a function of the drawing scale, changing the *Annotation Scale* changes the text size. If need be, on the Status Bar, set the *Annotation Scale* to **1"=40'**, as shown in Figure 2–85, to change the point size in the drawing.



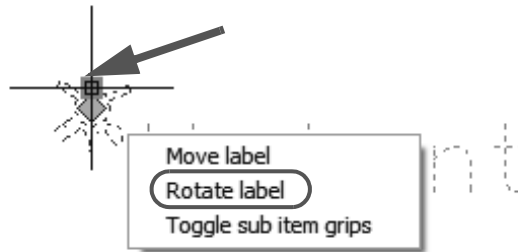
Figure 2–85

4. Select point 260 to display its grips. Select the Drag Label grip, as shown in Figure 2–86, to relocate the label.



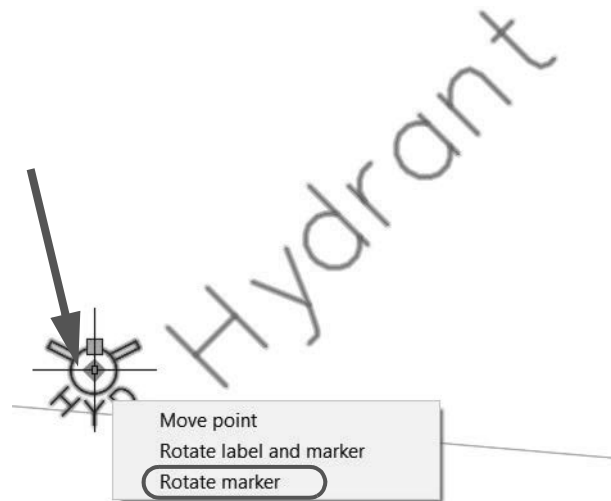
**Figure 2–86**

5. With the label still displaying grips, hover on the Rectangle grip and select **Reset Label**.
6. With the label still displaying grips, hover over the Square label grip to display the options for moving, rotating, and additional sub item grips, as shown in Figure 2–87. Select **Rotate label** and rotate the label. Type **45** to rotate the label 45 degrees counter-clockwise.



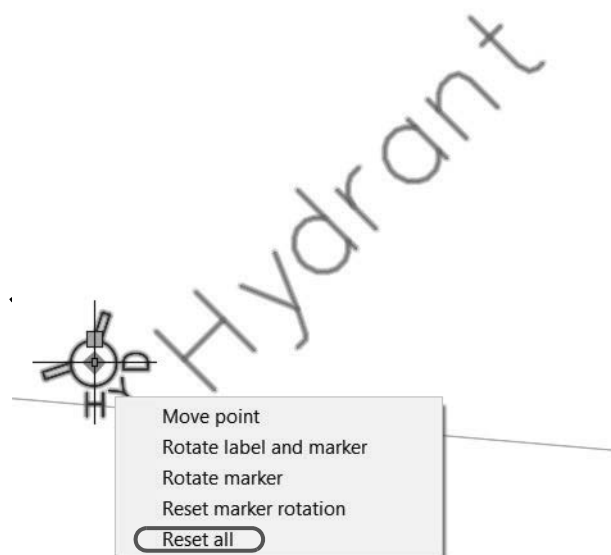
**Figure 2–87**

7. With the label still displaying grips, hover over the diamond point grip to display the options to move, rotate label and marker, and Rotate marker, as shown in Figure 2–88. Select **Rotate marker** and rotate the marker. Type **45** to rotate the marker 45 degrees counter-clockwise.



**Figure 2–88**


8. With the label still displaying grips, hover over the diamond point grip again and select **Reset all**, as shown in Figure 2–89.



**Figure 2–89**

9. Save the drawing.

## Task 2 - Create point reports.

1. If the Toolspace, *Toolbox* tab is not displayed in the Toolspace, select the *Home* tab and click  (Toolbox), to display the Toolspace, *Toolbox* tab.
2. Select the Toolspace, *Toolbox* tab and expand the *Reports Manager* collection to display the list of object type reports. Expand the *Points* collection, as shown in Figure 2–90.

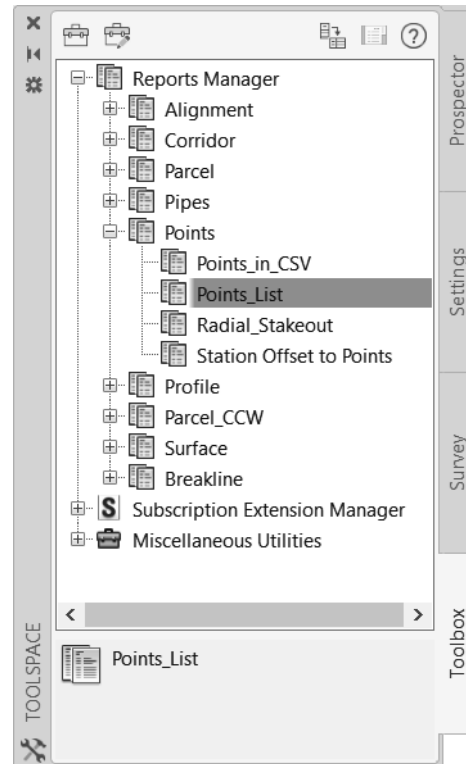


Figure 2–90

3. Select **Point List**, right-click, and select **Execute**.
4. In the Export to LandXML dialog box, click **OK** to generate the report. In the Save As dialog box, browse to the *C:\Civil 3D Projects\Documents\Reports* folder and type **<Your Initials>-Points.html**, and save the file.
5. The point list displays in Internet Explorer. Review the report and when done, close it.
6. Save the drawing

## 2.11 Point Groups

Point groups organize points that share common descriptions and characteristics (such as existing storm, gas lines, building corners, etc.). If you consider the points in the project to be a database, then Point Groups can be considered a means of querying the point database.

Point groups also enable points to display different point or label styles. For example, a Landscape Architect needs to display different symbols for each tree species, while an Engineer only needs to display a generic tree symbol. The Description Key Set enables you to assign the tree species symbols for the Landscape Architect, and a point group enables generic tree symbols to override the symbols for the Engineer. Another function of a point group is to hide all of the points.

In the Autodesk Civil 3D software, point groups can be defined in the template along with a Description Key Set. When you create a new drawing from this template and import points, they are assigned their symbols and can be sorted into point groups.

All points in a drawing belong to the **\_All Points** point group. Consider this point group as the point database. It cannot be deleted and initially is not in a drawing until you add points. All new point groups include all drawing points or a subset of drawing points (referenced points from the **\_All Points** point group).

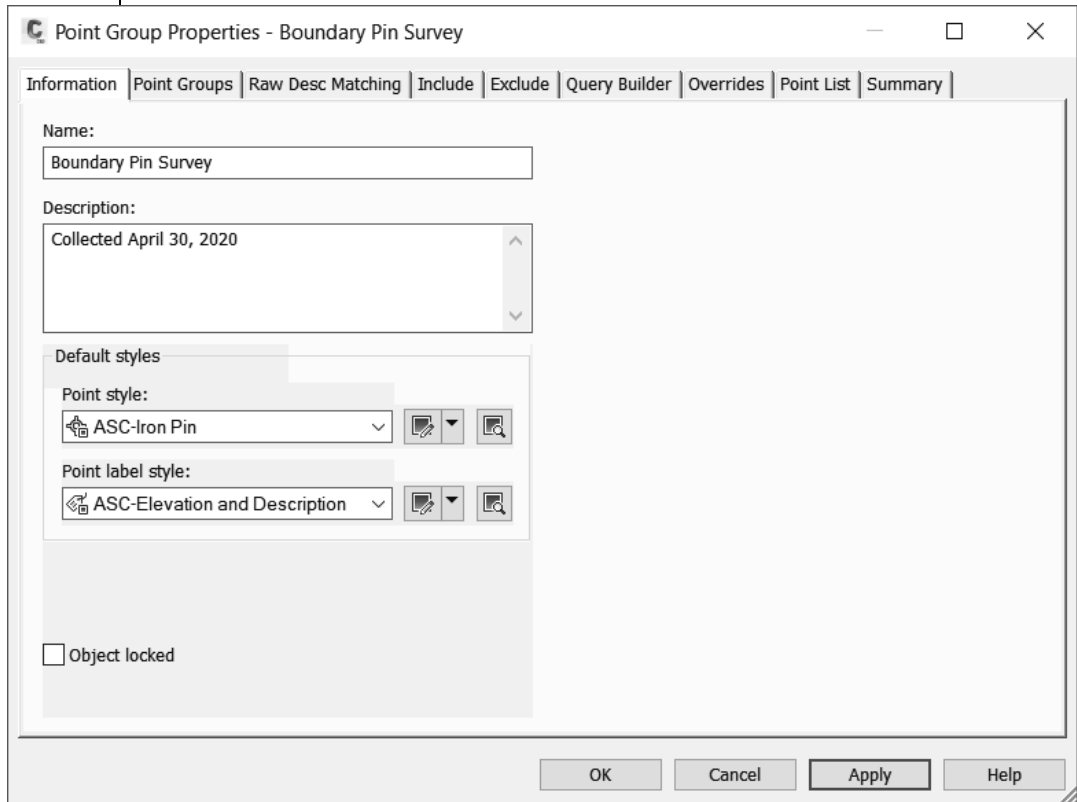
### Defining Point Groups

To create a new point group, select the Toolspace, *Prospector* tab, right-click on the *Point Groups* collection and select **New....** Alternatively, in the *Home* tab, expand *Points* and select **Create Point Group**.

When you select **New...** or **Create Point Group**, the Point Group Properties dialog box opens. It has nine tabs, each affecting the point group's definition.

The *Point Groups*, *Raw Desc Matching*, *Include*, and *Query Builder* tabs add points to the point group. The *Exclude* tab removes points from a point group.

The *Information* tab defines the point group's name. The *Point style* and *Point label style* should remain at their defaults, unless you want to use either style to override the assigned styles of the points in the point group. The points in the point group display their originally assigned styles until you toggle on the override. A point group can be locked by toggling on the **Object locked** option to prevent any changes to the group. The Point Group Properties dialog box is shown in Figure 2–91.



**Figure 2–91**

The *Point Groups* tab lists the drawing's groups. A point group can be created from other point groups, thereby creating a hierarchy of Point Groups. When you select a point group name, the group and its points become members of the new point group. For example, the point group **Trees** is created from the point groups *Maple*, *Walnut*, *Oak*, etc.

The *Raw Desc Matching* tab lists codes from the Description Key Code set. When you toggle on the code, any point matching the code becomes part of the point group.

If you cannot select a point with the previous two methods, the *Include* tab enables you to include points by specifically entering in the selection criteria. The criteria include the point number (point number list or by selection), elevation, name, raw description, full description, and all points.

- **With numbers matching:** Selects points by a point number range or list. When creating a list, sequential point numbers are hyphenated (1-20) and individual numbers are in a comma delimited list. A point list can include sequential and individual points (1-20, 14, 44, 50-60). Select **Selection Set in Drawing** to select the points in the drawing and list their point numbers at the top of the *Include* tab. If using the **Selection Set in Drawing** method, keep in mind that a Point Group defined by exact numbers will not be dynamic since it is fixed on individual point numbers.
- **With elevations matching:** Enables you to select points by entering a specific elevation or by specifying a minimum and/or maximum elevation. For example, valid entries include >100,<400, and >100. The first entry only includes points whose elevation is above 100, but less than 400. The second entry only includes points whose elevation is greater than 100. A point without an elevation cannot be selected using this method. An elevation range, defined by separating the start and end numbers with a hyphen, includes points whose elevation falls in the range (1-100). This can be combined with greater or less than symbols.
- **With names matching:** Selects points based on matching their point names. Enter one or more point names separated by commas.
- **With raw/full descriptions matching:** Selects points based on matching an entered raw or full description. Enter one or more descriptions separated by commas. You can use the same wildcards as the Description Key Set. Generally, this method uses the asterisk (\*) as the wildcard after the description (e.g., PINE\*, CTV\*, CL\*, etc.). By default, this is not case-sensitive.
- **Include all points:** Assigns all points in the drawing to the point group. When this option is toggled on, all other **Include** options are disabled.

The *Exclude* tab has the same options as the *Include* tab, except for the **Include All Points** option.

The *Query Builder* tab creates one or more expressions to select points. Each query is a row selecting points. As with all SQL queries, you combine expressions using the operators AND, OR, and NOT. You can also use parentheses to group expressions. It is here where you can make the criteria case-sensitive.

The *Overrides* tab overrides the points in the point group's raw description, elevation, point style, and/or point label style. For example, you can override specific tree species symbols with a generic tree symbol, override a label style when displaying this group, or override the point and label style with none (to hide all points).

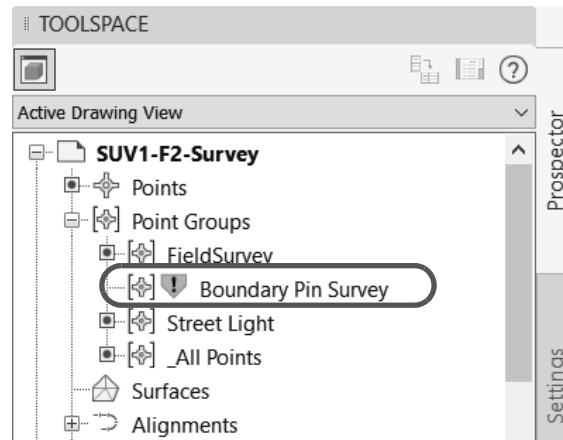
The point group display order affects points and their overrides. To change how the point groups display, modify the Point Group display order.

The *Point List* tab displays the point group's points. This tab enables you to review points that are currently in the point group.

The *Summary* tab displays the point group's settings. You can print this tab as a report by cutting and pasting it into a document.

## Updating Out-of-Date Point Groups

After defining point groups and adding points to a drawing, the group becomes out of date before assigning the points to the group. The point group will have an Alert symbol (🚩) next to it for easy recognition in the Prospector, as shown in Figure 2–92.



**Figure 2–92**

This enables you to verify that the point(s) should become part of the group. To review why a group is out of date, select the group, right-click, and select **Show Changes...** If the changes are correct, select **Update** to add the points to the group. If you know that all of the groups displaying as out of date should be updated, right-click on the *Point Groups* collection and select **Update**. At this level, the command updates all of the point groups.



Unlike other Civil 3D objects (such as Surfaces and Corridors), you cannot set Point Groups to be *Rebuilt Automatically*.

## Overriding Point Group Properties

When working with points, you might want them to display different labels, not be displayed, or display different symbols. Each required change is a function of a point group override. A point group that contains all of the points and overrides their symbols and labels with none does not display any points. This is similar to freezing all of the layers involved with points. A point group that changes the symbols that a group displays overrides the label styles assigned to the point in the point group. To display a different symbol, the point group overrides the assigned point styles. To set the style and override the assigned styles, toggle on the point group in the *Overrides* tab and set the styles in the *Override* column of the point group, as shown in Figure 2–93.

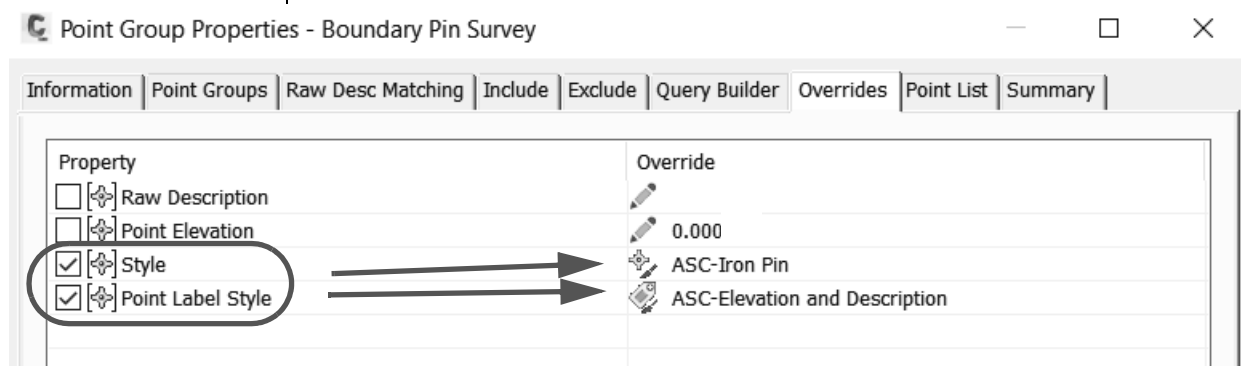


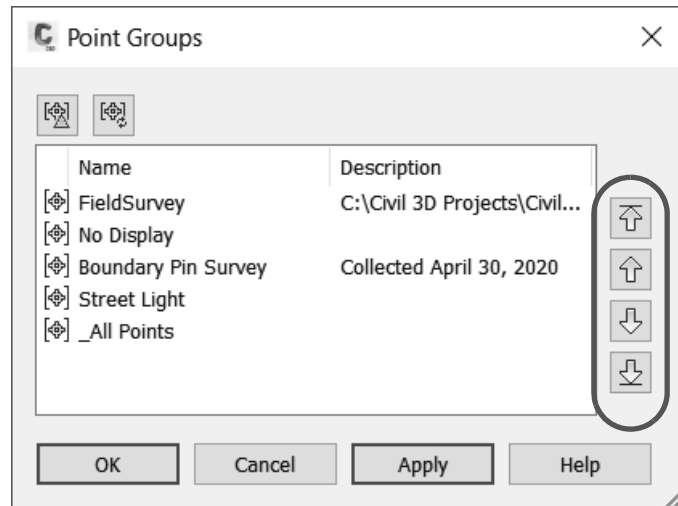
Figure 2–93

## Point Groups Display Properties



When creating a point group, it is placed at the top of the point group list. The point group list is more than a list of point groups; it is also the Autodesk Civil 3D's point draw order. The Autodesk Civil 3D software draws the point groups starting from the bottom of the list to the top. If **\_All Points** is the first drawn point group and the remaining point groups are subsets of all points, the individual point group does not display, but all of the points display.

To display point groups that are a subset of all points, you must create a point group whose purpose is to hide all points. This popular point group is commonly called *No Display*. With this group, any point group drawn after it displays its members without *seeing* the other points.

The Autodesk Civil 3D software draws point groups from the bottom to the top of the list. To manipulate the display order, right-click on the *Point Groups* collection in the Toolspace, *Prospector* tab and select **Properties**. The Point Groups dialog box opens, enabling you to modify the point group display order using the arrows on the right, as shown in Figure 2–94.



**Figure 2–94**

These arrows enable you to select the required point group and move it up or down in the list (or all of the way to the top or bottom of the list with one click, /) in the hierarchy for display purposes. The Point Groups dialog box has two additional icons at the top. The first icon displays the changes that need to occur in the point groups and the second icon updates them.

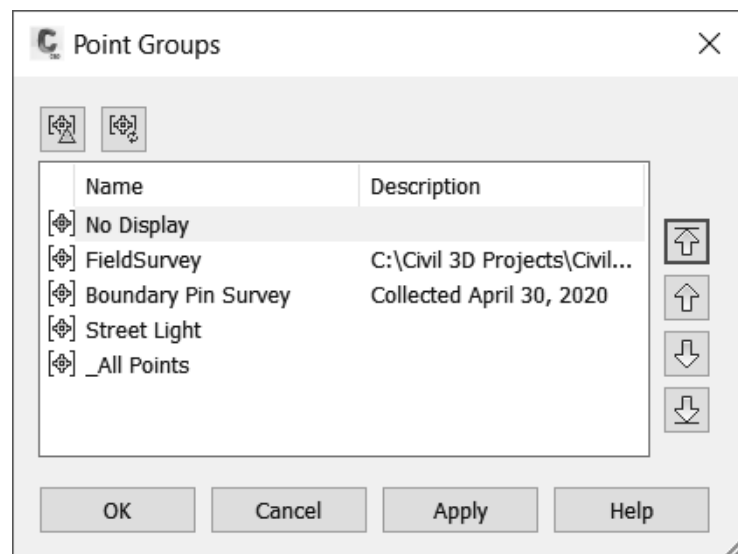
If you use Description Key Sets, a point displays the assigned point and label style when it is part of any point group. The only time the point displays another style is when you override the style (in the Point Group Properties dialog box, in the *Overrides* tab).

With the Description Key Set and display order shown in Figure 2–95, the points display their originally assigned point label styles.

Code ▲	Style	Point Label Style	Format	Layer	Scale Param
BLDG	<input checked="" type="checkbox"/> Building corner	<input checked="" type="checkbox"/> Building corner	\$*	<input checked="" type="checkbox"/> X-Building	<input checked="" type="checkbox"/> Parameter
CB	<input checked="" type="checkbox"/> Catch Basin	<input checked="" type="checkbox"/> Ex. Catch Basin label	\$*	<input checked="" type="checkbox"/> X-Storm	<input checked="" type="checkbox"/> Parameter
FH	<input checked="" type="checkbox"/> Hydrant	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Water	<input checked="" type="checkbox"/> Parameter
GV	<input checked="" type="checkbox"/> Gas Valve	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Gas	<input checked="" type="checkbox"/> Parameter
IPF	<input checked="" type="checkbox"/> I Pin Found	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Survey Control	<input checked="" type="checkbox"/> Parameter
LP	<input checked="" type="checkbox"/> Light Pole	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X Poles	<input checked="" type="checkbox"/> Parameter
MON	<input checked="" type="checkbox"/> Mon Box	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Survey Control	<input checked="" type="checkbox"/> Parameter
SMH	<input checked="" type="checkbox"/> San Mh	<input checked="" type="checkbox"/> Ex. San	SAN. MH.	<input checked="" type="checkbox"/> X-Sanitary	<input checked="" type="checkbox"/> Parameter
STMMH	<input checked="" type="checkbox"/> Stm Mh	<input checked="" type="checkbox"/> Ex. Stm	STM. MH.	<input checked="" type="checkbox"/> X-Storm	<input checked="" type="checkbox"/> Parameter
TREE	<input checked="" type="checkbox"/> Tree	<input checked="" type="checkbox"/> Tree label	\$*	<input checked="" type="checkbox"/> X-Vegetation	<input checked="" type="checkbox"/> Parameter
UP	<input checked="" type="checkbox"/> Utility Pole	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Poles	<input checked="" type="checkbox"/> Parameter
WV	<input checked="" type="checkbox"/> Water Valve	<input checked="" type="checkbox"/> <default>	\$*	<input checked="" type="checkbox"/> X-Water	<input checked="" type="checkbox"/> Parameter

**Figure 2–95**

The *No Display* point group includes all of the points, but overrides the originally assigned point style and point label styles with <none>. When *No Display* is moved to the list's top, no points display. The Point Groups dialog box is shown in Figure 2–96.



**Figure 2–96**

# Practice 2g

# Creating Point Groups

## Practice Objective

- Create point groups and control the visibility of the points within the groups.

In this practice, you will create point groups.

## Task 1 - Create point groups (Boundary Pin Survey).

1. Continue working with the drawing from the previous practice or open **SUV1-FG.dwg**.
2. In the Toolspace, *Prospector* tab, select **Point Groups**, right-click, and select **New...**, as shown in Figure 2–97.

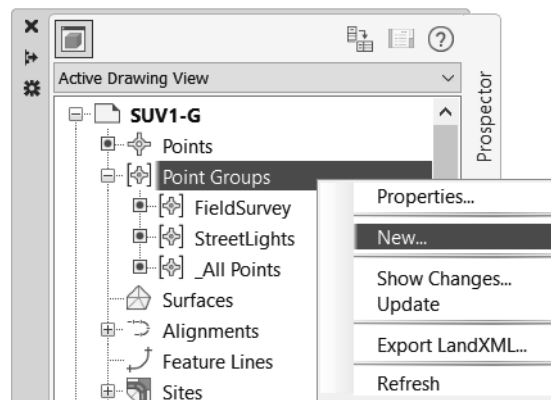


Figure 2–97

3. In the Point Group Properties dialog box, in the *Information* tab, type **Boundary Pin Survey** in the *Name* field, set the *Point style* to **ASC-Iron Pin**, and set the *Point label style* to **ASC-Elevation and Description**, as shown in Figure 2–98.

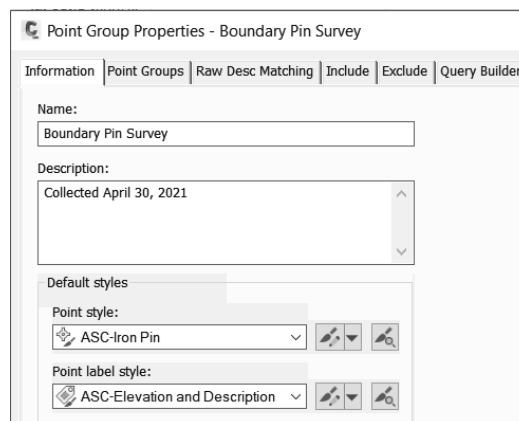
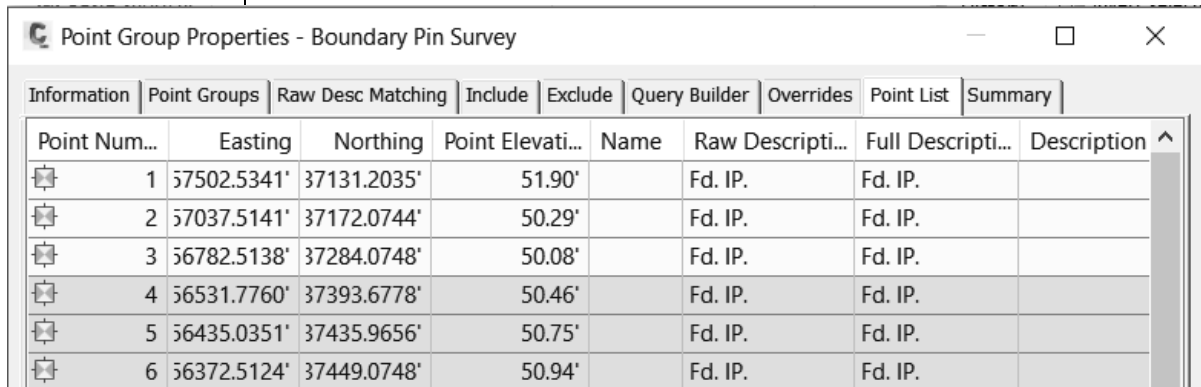


Figure 2–98

This will also select other Iron Pin descriptions beyond the "Found" ones, which the surveyor may use to determine Iron Pins.

4. Select the *Include* tab. Select the **With raw description matching** option. Type **\*IP.** in the field to select all of the points that have the last three characters *IP.* (iron pin). (Verify that a period follows IP. By default, this is NOT case sensitive.) You can confirm this in the *Point List* tab, as shown in Figure 2–99.



Point Num...	Easting	Northing	Point Elevati...	Name	Raw Descripti...	Full Descripti...	Description
1	57502.5341'	37131.2035'	51.90'		Fd. IP.	Fd. IP.	
2	57037.5141'	37172.0744'	50.29'		Fd. IP.	Fd. IP.	
3	56782.5138'	37284.0748'	50.08'		Fd. IP.	Fd. IP.	
4	56531.7760'	37393.6778'	50.46'		Fd. IP.	Fd. IP.	
5	56435.0351'	37435.9656'	50.75'		Fd. IP.	Fd. IP.	
6	56372.5124'	37449.0748'	50.94'		Fd. IP.	Fd. IP.	

Figure 2–99

5. Click **OK** to close the dialog box and apply the changes.

## Task 2 - Create point groups (No display).

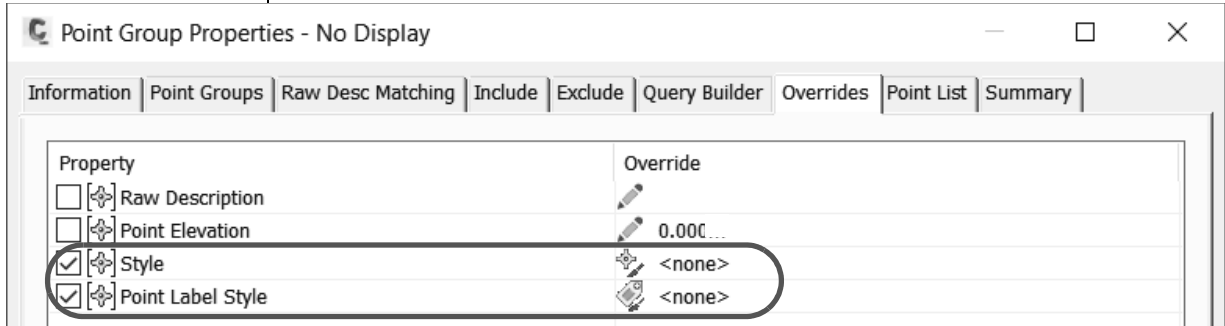
Continue working with the drawing from the previous task. In this task, you will use the point group to control the points display. Not only will you be able to display the same point differently, but you will also be able to control the visibility of the points. This eliminates needing to use the Layer command to thaw and freeze layers.

1. In the *View* tab>Named Views panel, select the preset view **Suv Main**.
2. As in Task 1, select **Point Groups**, right-click, and select **New...** to create a new point group. In the *Information* tab, type **No display** for the *Name*.
3. Select **<none>** for both the *Point style* and the *Point label style*, as shown in Figure 2–100.




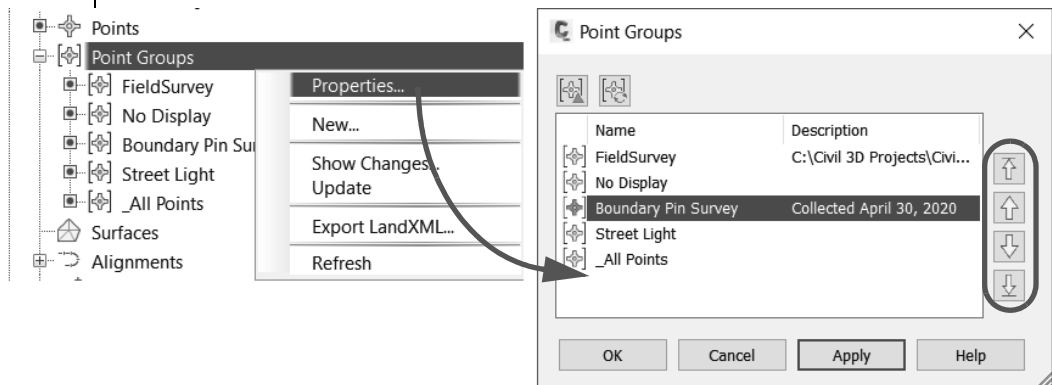
Figure 2–100

4. Select the *Include* tab, select **Include all points** to set it to **True**. Select the *Point List* tab to confirm that all of the points have been included.
5. Select the *Overrides* tab and select **Style** and **Point Label Style**, as shown in Figure 2–101.



**Figure 2–101**

6. Click **OK** to create the point group. Note that the points have disappeared.
7. To control the hierarchy and the display of the point group style, select the Toolspace, *Prospector* tab, select **Point Groups**, right-click, and select **Properties**.
8. In the Point Groups dialog box, select the **Boundary Pin Survey** point group and move it to the top of the list by clicking , as shown in Figure 2–102.

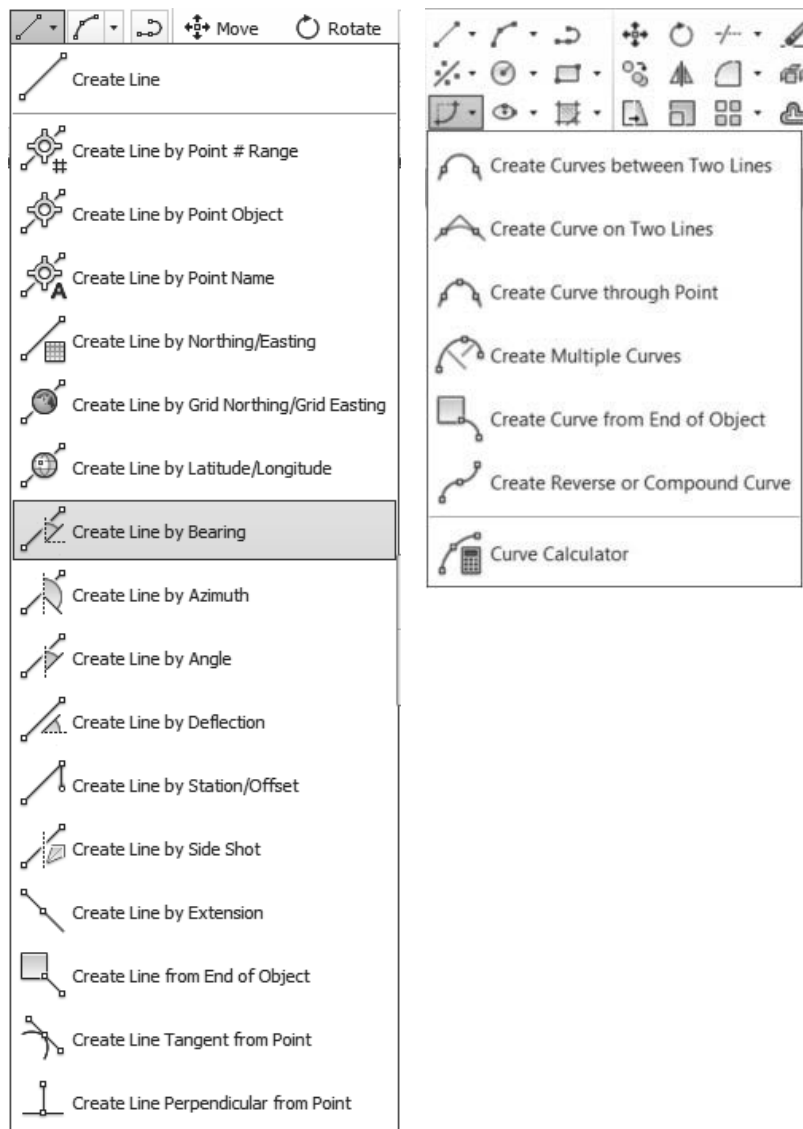


**Figure 2–102**

9. Click **OK** to apply the changes. Only the points in the **Boundary Pin** point group display. If the property pins are not displayed you might need to **regen** the drawing (type **RE**, and press <Enter>).
10. Experiment with moving point groups up and down the list to control the display of points.
11. Save the drawing.

## 2.12 Lines and Curves

A typical land development project commences with plotting out the property being subdivided, based on the legal description. Planners need to enter lines and curves representing the property boundaries into the computer from legal text description. The Autodesk Civil 3D software makes this task easy with the many options under the **Lines** and **Curves** commands in the *Home* tab>Draw panel. Expanding the Lines or Curves commands displays several options that are not found in the ordinary AutoCAD® software, as shown in Figure 2–103.













**Figure 2–103**















A second option is to use transparent commands. These are similar to Object Snaps in that they are only accessible while in another command that is searching for a point.

Once the required command has been started, you can select the transparent commands as follows:

- From the Transparent Command toolbar
- From the *Transparent Command* ribbon tab
- By typing an apostrophe letter combination in the Command Line
- From the right-click menu>**Transparent Commands**

Icon	Command Line	Description
	'AD	<b>Angle Distance:</b> Specifies a point location at an angle and distance from a known point and direction.
	'BD	<b>Bearing Distance:</b> Specifies a point location at a bearing and distance from a known point (or the last point occupied).
	'ZD	<b>Azimuth Distance:</b> Specifies a point location at an azimuth and distance from a known point (or the last point occupied).
	'DD	<b>Deflection Distance:</b> Specifies a point location at an angle and distance from a known point and previous direction.
	'NE	<b>Northing Easting:</b> Specifies a point location using northing and easting coordinates.
	'GN	<b>Grid Northing Grid Easting:</b> Specifies a point location using a grid northing and grid easting. (Note: You must have the drawing zone, coordinate system and transformations set for grids.)
	'LL	<b>Latitude Longitude:</b> Specifies a point location using latitude and longitude. (Note: You must have the drawing zone, coordinate system, and transformations set.)
	'PN	<b>Point Number:</b> Specifies a point location using a point number found in the drawing or active project.
	'PA	<b>Point Name:</b> Specifies a point location using a point name found in the drawing or active project.
	'PO	<b>Point Object:</b> Specifies a point location by picking any part of an existing COGO point in the drawing.



	'ZTP	<b>Zoom to Point:</b> Zooms to a point in the drawing or active project by specifying the point number or name.
	'SS	<b>Side Shot:</b> Specifies a point location at an angle and distance from a known point and direction (uses the last two entered points to set the reference line).
	'SO	<b>Station Offset:</b> Specifies a point location at a station and an offset from an alignment in the current drawing.
	.g	<b>Point Object Filter:</b> Specifies a point location by picking any part of an existing COGO point in the drawing.
	'STAE	<b>Profile Station from Plan:</b> Specifies a profile view point location by specifying an alignment station in plan and an elevation.
	'SSE	<b>Profile Station and Elevation from Plan:</b> Specifies a profile view point location by specifying a surface, an alignment station, and a point in plan view.
	'SPE	<b>Profile Station and Elevation from COGO Point:</b> Specifies a profile view point location by specifying a COGO point and an alignment station in plan view.
	'PSE	<b>Profile Station Elevation:</b> Specifies a profile view point location by specifying a station and an elevation.
	'PGS	<b>Profile Grade Station:</b> Specifies a profile view point location using grade and station values from a known point.
	'PGE	<b>Profile Grade Elevation:</b> Specifies a profile view point location using grade and elevation values from a known point.
	'PGL	<b>Profile Grade Length:</b> Specifies a profile view point location using grade and length values from a known point (or the last point occupied).
	'MR	<b>Match Radius:</b> Specifies a radius equal to that of an existing object.
	'ML	<b>Match Length:</b> Specifies a length equal to that of an existing object.
	'CCALC	<b>Curve Calculator:</b> Calculates curve parameters based on input.

The benefit to using these transparent commands to draw parcels over the **Lines** and **Curves** options (shown previously in Figure 2–103) is that a **Polyline** command can be used to create one entity rather than many individual lines that would need to be joined later.

## Practice 2h

# Beginning a Subdivision Project

### Practice Objective

- Draw a parcel from a legal description.

In this practice, you will use the following legal description below to draw a parcel. Later, you will create a parcel from the linework.

*From the **POINT OF BEGINNING**; thence, S 00° 26' 42.2" W for a distance of 922.4138 feet to a point on a line. Thence, S 00° 24' 20.8" W for a distance of 508.3493 feet to a point on a line. Thence, S 66° 03' 35.8" W for a distance of 92.1845 feet to the beginning of a curve.*

*Said curve turning to the right through 42° 35' 49.2", having a radius of 627.1788 feet, and whose long chord bears S 87° 21' 30.4" W for a distance of 455.6165 feet to the beginning of another curve.*

*Said curve turning to the left through an angle of 19° 13' 40.4", having a radius of 154.4828 feet, and whose long chord bears N 80° 57' 25.2" W for a distance of 51.6000 feet.*

*Thence, S 89° 25' 44.6" W for a distance of 724.9442 feet to a point on a line. Thence, N 00° 11' 09.9" E for a distance of 1904.2647 feet to a point on a line. Thence, S 61° 50' 15.3" E for a distance of 135.9034 feet to a point on a line. Thence, S 64° 05' 35.8" E for a distance of 77.8201 feet to a point on a line. Thence, S 78° 09' 29.2" E for a distance of 63.8821 feet to a point on a line. Thence, S 66° 23' 19.5" E for a distance of 379.2248 feet to a point on a line. Thence, S 66° 17' 17.4" E for a distance of 278.5122 feet to a point on a line. Thence, S 84° 58' 37.7" E a distance of 466.8116 feet to the **POINT OF BEGINNING**.*

1. Continue working on the drawing from the previous practice or open **SUV1-H-Survey-.dwg** from the C:\Civil 3D Projects\Working\Survey folder.

- In effect, you will be tracing over the green perimeter in the drawing, using the legal information provided, as shown in Figure 2–104.

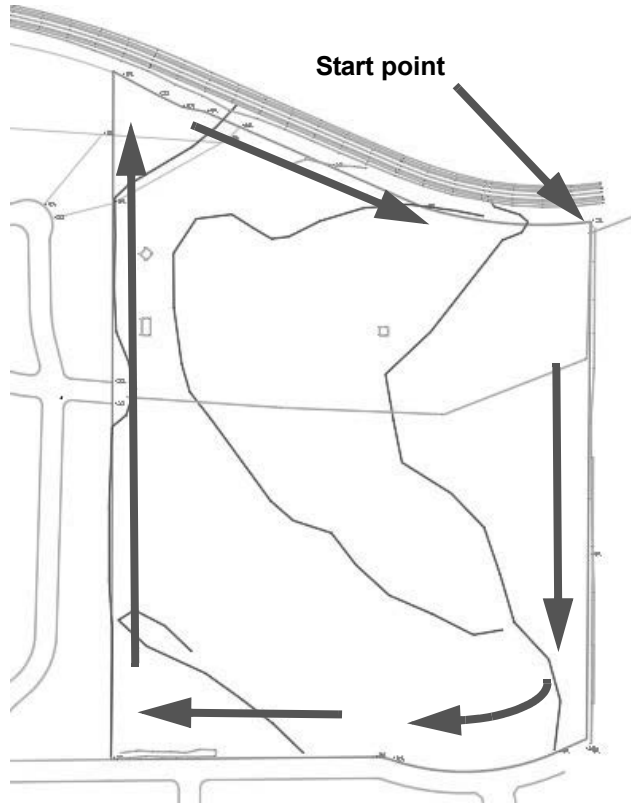



Figure 2–104




- Start the **Line** command. For the starting point, type **6257490.0191,2037127.1292** and press <Enter>.
- In the ribbon, in the *Transparent Commands* tab, click  (Bearing Distance).
- For the first line, type the following:
  - Quadrant:* **3** (for the southwest quadrant)
  - Bearing:* **0.26422**
  - Distance:* **922.4138**

Stay in the **Line** command with the **Bearing Distance** transparent command running for the next few lines.

- For the next two line segments, use the following values:

Quadrant	Bearing	Distance
3	0.24208	508.3493
3	66.03358	92.1845

*Remember to press <Enter> after you input a value.*

7. Press <Esc> twice to end the command.
8. In the *Home* tab>Draw panel, click  (Create Curve from End of Object). Select the last line that was drawn using the Bearing Distance command.
9. From the command options, select **Radius**. Set the radius to **627.1788**.
10. From the command options, select **Chord**. Set the chord length to **455.6165**.
11. In the *Home* tab>Draw panel, click  (Create Reverse or Compound Curve). Select the last curve drawn.
12. From the command options, select **Reverse**. Set the radius to **154.4828**.
13. From the command options, select **Chord**. Set the chord length to **51.6**.
14. Start the **Line** command. For the starting point, pick the endpoint of the last arc drawn.
15. In the Transparent Command toolbar, click  (Bearing Distance).
16. For the remaining line segments, use the following values:

Quadrant	Bearing	Distance
3	89.25446	724.9442
1	0.11099	1904.2647
2	61.50153	135.9034
2	64.05358	77.8201
2	78.09292	63.8821
2	66.23195	379.2248
2	66.17174	278.5122

*The legal description at the beginning of this practice was used to find the bearings and distances to type.*

17. Press <Esc> once to exit the **Bearing Distance** transparent command. Hold <Ctrl> as you right-click and select **Endpoint**, then select the starting point of the parcel to close on the point of beginning.

*This prevents closure errors from occurring later.*

18. Start the **Polyline Edit** command by typing **PE**. In the model, select one of the lines or curves you just created and press <Enter> to turn it into a polyline.
19. Select the **Join** option and then select all of the lines and curves you just created. Press <Enter> to create one closed polyline. Press <Esc> to end the command.
20. Save the drawing.
21. (Optional) Save the drawing as **<Your Initials>-Survey-Complete.dwg** in the *C:\Civil 3D Projects\References\DWG\Survey* folder.
22. Update the relative paths of the referenced drawings in the alert box.









## Chapter Review Questions

1. If you need linework, which method should you use to import survey data?
  - a. Import survey data using the Survey Database.
  - b. Import survey data using the **Import Points** command.
  - c. Import survey data using the Map Explorer.
  - d. Create points using the Toolspace, *Prospector* tab.
2. If you need to analyze the field data using the analysis tools available in the Survey Database, you must use a field book file rather than a text file.
  - a. True
  - b. False
3. Which of these is not a type of point object within the Autodesk Civil 3D software?
  - a. COGO Point
  - b. North Point
  - c. Survey Point
  - d. AutoCAD Point
4. Which of these is NOT an option within the Description Key manager?
  - a. Rotating the Point
  - b. Changing the Point Full Description
  - c. Deleting the Point
  - d. Assigning a Point Label
5. Which tab in the Point Label Style Composer dialog box controls the appearance of a point label when the point label grip is selected in the drawing and moved away from the point itself?
  - a. *General* tab
  - b. *Layout* tab
  - c. *Dragged State* tab
  - d. *Summary* tab

6. How do you control the next point number to be used in a drawing?
  - a. The **Point Identity** parameters located in the expanded area in the Create Points toolbar.
  - b. Under Label Styles in the Toolspace, *Settings* tab.
  - c. In the Toolspace, *Survey* tab, right-click on Survey Points.
  - d. In the Toolspace, *Prospector* tab, right-click on Survey Points.
7. Can the **\_All Points** point group be deleted?
  - a. Yes
  - b. No
8. Can a point group be made out of point groups?
  - a. Yes
  - b. No
9. How do you draw a parcel boundary from a legal description in the most efficient way possible?
  - a. Calculate the Cartesian coordinate angle for each bearing or azimuth within the legal description and type (distance)<(angle) for each line or curve.
  - b. Calculate the Cartesian coordinate angle for each bearing or azimuth within the legal description, place the cursor in that direction, and type the distance.
  - c. Use the extended **Lines** and **Curves** options in the *Home* tab>Draw panel or **Transparent** commands in the **Line** or **Polyline** command.
  - d. There is no fast way to do this.



# Command Summary

Button	Command	Location
	<b>Create Points</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Home</i> tab&gt;Create Ground Data panel</li> </ul>
	<b>Import Points from File</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Import panel</li> <li>• <b>Toolbar:</b> Create Points</li> <li>• <b>Command Prompt:</b> ImportPoints</li> </ul>
	<b>Bearing Distance</b>	<ul style="list-style-type: none"> <li>• <b>Toolbar:</b> Transparent Commands</li> <li>• <b>Command Prompt:</b> 'bd</li> </ul>
	<b>Create Curve from End of Object</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Home</i> tab&gt;Draw panel</li> <li>• <b>Command Prompt:</b> CurveFromEndOfObject</li> </ul>
	<b>Import Survey Data</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Home</i> tab&gt;Create Ground Data panel</li> <li>• <b>Command Prompt:</b> ImportSurveyData</li> </ul>
	<b>Survey</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Home</i> tab&gt;Palettes panel</li> </ul>
	<b>Survey User Settings</b>	<ul style="list-style-type: none"> <li>• <b>Toolspace:</b> <i>Survey</i> tab</li> </ul>
	<b>Zoom To Points</b>	<ul style="list-style-type: none"> <li>• <b>Toolbar:</b> Transparent Commands</li> <li>• <b>Command Prompt:</b> 'ZTP</li> </ul>

