AutoCAD Civil 3D Survey Essentials

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Working with Points in AutoCAD® Civil 3D®

Working with Points

Any discussion of points in Civil 3D must begin with a working definition of points - within our context points are simply stored coordinates.

Points in Civil 3D are stored coordinates to which point numbers are assigned. The point numbers are an absolute index on the stored points; a point number cannot be duplicated in a Civil 3D drawing. In addition to stored northing, easting and point number, a point in Civil 3D may also have an elevation and a description. As Civil 3D stores these data, there may also be additional information stored, including latitude and longitude, grid coordinates, short and long descriptions and more, but the basic stored information consists of point number, northing, easting, optional elevation and optional description.

The means by which points are "stored" is unique in Civil 3D, and quite different from other civil products. While programs like Land Desktop or Carlson store their points in external data files, Civil 3D stores its points within the drawing, displayed and listed in the Prospector. There are exceptions to this statement, and under some circumstances, points in Civil 3D do behave exactly like those from Land Desktop, displayed in a drawing from an external database, but certain conditions in Civil 3D must be met to enable this - so the basic statement made is true: Civil 3D "stores" its points within the drawing.

Points can serve many roles in the Civil 3D drawing, some obvious, many overlooked. Most operators are familiar with points as the primary interface for bringing field information in from a survey, and this certainly accounts for the majority of point data seen in Civil 3D. Points are an extremely powerful tool for grading however, and there are excellent point-based grading tools that most operators overlook. The data management applications for points are also powerful, yet untapped, and the crossover line into what would traditionally be viewed as GIS can become very blurry indeed.

Points, Objects and Styles

Points in Civil 3D represent an evolution in the complexity of Civil 3D data management as compared with surfaces. Points in Civil 3D continue to be objects, with display and editing behavior unlike those of basic AutoCAD objects. The display of points in Civil 3D involves the interaction of two styles, while surfaces required only one: a Point Object Style which controls the display of the point "symbol" itself, and a Point Label Style which configures the fields of stored data labeled on each visible point in the drawing. Point display management is actually contingent on other optional tools, including the use of Description Keys and default point Feature Settings, so the topic ratchets up the complexity somewhat over the refreshingly simple surfaces already examined...
Exploring Points in Civil 3D

The best way to begin an examination of points in Civil 3D will be to create a point and look at its characteristics, rather than talking about points in the abstract.

The drawing being used is the Existing Base drawing in which the surface was previously produced. The surface is set to a _No Display style, and the contours seen are actually the original aerial contours from which the surface was produced. A new layer has been set current, V-MISC-P, following the layers standards in use in the drawing (the V prefix indicating Survey information, and the P suffix indicating that the layer contains points as opposed to lines or text on L or T layers, respectively).

There is a concrete monument that forms the primary control point for all of the survey work in the Chestnut Ridge Estates project. The control is a NY DOT monument with known northing, easting and elevation. The monument falls at the intersection of the east-west county road (Weybridge Road) and the north-south town road (Chestnut Ridge Road), in an area as shown in Figure 1.01. A photo of the monument itself is seen in Figure 1.02.

![Figure 1.01 – Intersection Where Monument is Located](image1)

![Figure 1.02 – Concrete Monument](image2)

Tools in Map can be used to link the photo to the point created in Civil 3D, so that clicking on the point will display the photo.

The coordinate data for the monument can be found in the \Received\From Surveyor folder in the project, in a text file named Concrete Monument Weybridge at Chestnut Ridge. The full information on the monument is as follows:

Northing = 1044008.2320
Easting = 668237.1924
Elevation = 229.8
Latitude: N 41° 41' 51.28"
Longitude: W 73° 51' 18.29"
To set the point in the Existing Base drawing a command will be used from the HOME tab of the Civil 3D ribbon. On the CREATE GROUND DATA panel, opening the POINTS dropdown opens a menu, from which CREATE POINTS - MISCELLANEOUS → NORTHING/EASTING is selected.

The command prompts:

>>>>Enter northing <0.00>: 1044008.232 type northing value, press ENTER.

>>>>Enter easting <0.00>: 668237.1924 type easting value, press ENTER.

Enter a point description <.>: MON type desired point description, press ENTER.

Specify a point elevation <.>: 229.8 type elevation value, press ENTER.

The point is placed in the drawing, the coordinate echoed back to the screen in the current decimal precision of the drawing, and the command prompts for the next coordinate value:

N: 1044008.2320' E: 668237.1924'

Please specify a location for the new point:

Please specify a location for the new point: Press ESCAPE at this prompt to end the Northing/Easting mode.

A dialog is left on the screen as the command ends, as seen in Figure 1.04 on the next page. CLOSE the dialog box for now with the X in its upper right corner.

We’ll talk more about that dialog bar in a little while. There’s actually quite a bit we’re not discussing yet, including the description typed and why we recommended terminating a command with Escape - usually a no-no. Trust us - we just need to get the horse before the cart here.
The point has appeared in the drawing as seen in Figure 1.04. Looking in the Prospector, and clicking on the Points collection, point information is displayed in the bottom pane of the Prospector. The information displayed in the Prospector is effectively the point database; at the moment, the point can be edited by changing the information displayed there. If the point is erased from the drawing with an AutoCAD erase command, it disappears from the Prospector as well.

Focusing on the object in the drawing, the Properties Palette reveals more information about what is present and how it is being displayed. Properties lists the object as a Cogo Point; its Style is listed as SV_MON, and its Point Label Style as EX L80 Description. Together, these three pieces of information explain much of what is in the drawing.
The Cogo Point is a custom Civil 3D object, not unlike the surface. This is a unique entity created by Civil 3D to represent civil engineering and surveying data: the point, as generically defined above.

To get more specific, the point in the drawing at the moment is a Civil 3D Point, also referred to as a Drawing Point. This is contrasted with something we'll show later: a Survey Point. A Civil 3D Point or Drawing Point exists only in the current drawing. It may or may not be visible in the drawing based on settings we'll explore, but a Civil 3D Point or Drawing Point exists within the Prospector of the drawing in which it is placed - the Prospector serves as the "database" once again. Civil 3D Points or Drawing Points exist only in a single drawing; if the same point is needed in another drawing, it must be created in that drawing, as there is no way to expose Civil 3D Points or Drawing Points from drawing to drawing. Throughout this manual, we'll use the terms Civil 3D Points or Drawing Points interchangeably from here.

The Survey Point is something entirely different. A Survey Point is actually a record in a point database external to the Civil 3D drawing, very similar to the point database in Land Desktop or Carlson. Survey Points may be inserted into a drawing, and they are represented in that drawing by Civil 3D Points, albeit with special locking and editing characteristics as we'll see. The same Survey Points can be inserted in any number of drawings within the Civil 3D project, much like in Land Desktop. We'll examine Survey Points to some extent in this chapter and in the following chapter.

The use of the Survey Point Database as the central location for all point data is very desirable, even when not using traditional "Survey" functionality. Using the Survey Point Database adds tremendous security to point data, and simplifies the sharing of points between drawings.

Returning to the information displayed in the Properties Palette, the Cogo Point was displayed using a Point Object Style, SV_MON, and a Point Label Style, EX L80 Description. The Point Object Style selection configures the display of the point as the monument symbol, and the Point Label Style selection configures the display of the labeled information as an existing label (slanted text), Leroy 80 size (0.08" plotted height) and Description field only. These settings were totally dependent on the operator (or more likely the CAD Manager), and were settings created in the drawing and passed on through Point Feature settings. All of these will be examined here in due course.

Looking a little further in the drawing, the point created sits on the layer V-BOUNDARY-P, in spite of the current layer being set to V-MISC-P. The layer on which the point is inserted is under the control of another tool in Civil 3D, Description Keys. Description Keys also stepped in to assign the Point Object Style and Point Label Style if needed, and they are part of a hierarchy of control of point display that we'll examine, involving Layers, Point Object Styles, Point Label Styles and Point Groups. This will all seem very complicated at first glance, but the point display management in Civil 3D is incredibly powerful once one gets used to its nuances; it is actually much more flexible than point display control in Land Desktop or even Carlson.

The point display strategy, which is presented here, is admittedly only one of several that could be used in Civil 3D. Relying primarily on control by Point Groups, this strategy has the advantage of very fluid control over point display. While one could elect to use a point display scenario based more traditionally on layers, we feel that this strategy offers significant benefits in drawing size and performance, as well as operational advantages.
Point Feature Settings

As we've already discussed, each Feature in Civil 3D has its own settings which control the display of its objects, as well as other settings that fine-tune the way the program operates. There are a number of Point Feature Settings which can be important. While some of these should at least be checked before working with points, many of the settings can be adjusted on the fly, often in the Create Points dialog which we'll examine.

Point Feature Settings are again controlled from the **Toolspace's Settings** tab, at the parent level of the collection (*Point*), and the Commands level for the operation to be used (CreatePoints).

Feature Settings

To begin examining Point Feature Settings, **Right-Click** on **Point** on the **Settings** tab, and pick **Edit Feature Settings**.

Once again, our focus here will be to discuss only the settings that are really important for each operation we'll perform. While there are three levels of Point Feature Settings in the *Edit Feature Settings - Point* dialog, as evidenced by the **glyphs, only one is really important at this time: **Default Styles**. Expanding the **Default Styles** level in the dialog, notice the selections made in this drawing: *<none>*.

![Figure 1.07 - Point Default Styles](image)

The selection of a default Point Object Style and Point Label Style of *<none>* may seem strange, and could lead one to believe that the point would be neither visible nor labeled in the drawing based on this selection. In fact, however, this setting means that the assigned Point Object Style and Point Label Style are **not fixed** by this setting, but instead are **variable**, and **under the control of another element downstream in the process - Point Groups**. This setting, strange though it seems, is a critical component of the point display strategy supported by Civil 3D, which passes primary control of point display to Point Groups.

Leaving the Point Object Style and Point Label Style setting as *<none>*, press **OK** to exit the *Edit Feature Settings - Point* dialog.

Command Settings

There are several individual levels of Command Settings that influence point creation. Many of these directly resemble the point settings in Land Desktop, and most can be adjusted on the fly later. To access the settings, **Right-click** on **CREATEPOINTS** under **Commands** below the **Point** collection on the **Settings** tab, and pick **Edit Command Settings**. The new settings levels
should be announced by the new \textcircled{9} glyph at this level, but one new level has inherited the \textcircled{9} glyph from the parent Feature Settings level.

\footnote{Can you say “Overly complicated user interface?”}

**Default Layer Settings**

The first of three levels of important Point Command Settings are found by expanding the \textbf{Default Layer} level in the \textit{Edit Command Settings - CreatePoints} dialog.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{default_layer_command_settings.png}
\caption{Default Layer Command Settings}
\end{figure}

The \textbf{Default Layer} for the placement of a point is set to \textit{<use current>}; clearly the monument point placed earlier did not go to the current layer, so something else was in play.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{points_creation_command_settings.png}
\caption{Points Creation Command Settings}
\end{figure}

**Points Creation Settings**

The second level of important Point Command Settings is found by expanding the \textbf{Points Creation} level in the \textit{Edit Command Settings - CreatePoints} dialog.

Several of these settings control the prompting for default values on point placement: \textbf{Prompt for Elevations}, \textbf{Prompt for Descriptions} and \textbf{Prompt for Point Names}; the selection for each can be \textbf{Manual}, \textbf{Automatic} or \textbf{None}.

\footnote{As in Land Desktop, Point Names are alphanumeric point numbers, actually aliases for integer point numbers.}
The **Default Elevation**, **Default Description** and **Default Point Name** entries supply the command line default when each corresponding attribute is set to *Manual*, or the attribute placed when *Automatic* is enabled.

The **Disable Description Keys** setting seems somewhat strange. When this setting is *False*, the use of Description Keys is *On*. This seems like a double negative, but the way the interface works. Description Keys are being used in this example, so the value is set to false.

The **Match on Description Parameter** ($1, $2, etc.) setting allows the use of replaceable parameters in point descriptions, separated by spaces.

**Point Identity Settings**

The other level in the *Edit Command Settings - CreatePoints* dialog which is important is **Point Identity**. Click to expand the **POINT IDENTITY** level.

The **Next Point Number** setting establishes the current point number; **Use Sequential Numbering** can then be turned off or on as desired.

Most of the remaining settings affect the processing of point numbers when points are imported from external files. The difference between **Point Number Offset** and **Sequence Point Numbers From** can be confusing; **Point Number Offset** can be used to "bump" point numbers by adding an offset value such as 10000 to numbers already on points, whereas **Sequence Point Numbers From** always renumbers imported points.

Most of the Point Identity settings will need to be adjusted on the fly, so we'll return to these settings later when cross section points for the two roads in the example project need to be imported.

Press **OK** to close the *Edit Command Settings - CreatePoints* dialog.
**Point Description Keys**

Description Keys are an optional tool in managing point display in Civil 3D, but really should be considered an essential tool. Description Keys automate the control of Point Object Styles and Point Label Styles as points are placed, by matching point descriptions entered and assigning styles accordingly. Description Keys also handle the layer management of points, which really is of less importance than it was in Land Desktop due to the use of Point Groups.

Point Description Keys are also found on the Toolspaces's **Settings Tab**. Expand the **Description Key Sets** level under the **POINT collection**, and two Description Key sets are found, inherited from the CivilTraining.dwt template file.

The CivilTraining Alpha description key set is intended for use with alpha point descriptions, typical of most field work. The CivilTraining Alpha description key set worked in the example thus far, found, and matched on the typed description MON as will be seen momentarily.

The CivilTraining Numeric description key set is intended for use with numeric point descriptions, less common in field work. The CivilTraining Numeric description key in this example would have expected a description of 85 for the monument, and would have found and matched on that typed description. Either set could be used and one set deleted from the prototype, if desired. Multiple Description Key sets can be used in a drawing, but all sets in the drawing are active; they cannot be selectively turned on and off.

To examine the Description Keys in use in this example, **RIGHT-CLICK** on the CivilTraining Alpha description key set, and pick **EDIT KEYS** from the menu.

The Description Key set opens in the **DescKey Editor**, which is a tab in the Panorama.

The **CODE** column in each Description Key specifies the point description entry that will be matched; the use of the " * " wildcard permits matching on a string that begins with the desired characters but continues with other values.
The **STYLE** column assigns a particular Point Object Style to be used when a match is found. There are a number of different styles in the drawing, and more information on these styles follows later in this chapter.

The **Point Label Style** column assigns a particular label style when a match is found; different label composition can be used for different points as seen in the dialog. Again, more information on the Point Label Styles will follow shortly.

The **Format** column handles the processing of point descriptions entered, and configures the amount and content of the data that will show up in a point label. Point descriptions in Civil 3D can consist of up to ten (10) attributes, separated by spaces. The first attribute is the one on which the description key itself is matched; the program assigns this attribute the number $Ø$. Each succeeding attribute, separated again by a space, is assigned a number: $1$, $2$, $3$, etc. The use of $1$ $2$ in the description key formats shown above are placeholders. If a point has a value in the $1$ or $2$ attribute, that attribute label will show up in the point label. The point set earlier had a description typed of MON; had it been typed as MON NY DOT it would have been labeled as such: NY would have been in the $1$ variable, DOT in the $2$ variable, and the MON$*$ description key shown in the dialog box is set to label the point as MON $1$ $2$. Had the point been entered as MON NY DOT CONC it still would have labeled as MON NY DOT, because the format column does not include $3$. The full MON NY DOT CONC description would still display in the Point List in the Prospector, however.

The use of the value $*$ in the **Format** column means that the full description as entered will be used in the point label, without any restrictions.

The **Layer** column assigns the layer on which the point itself will reside; this setting overrides the Default Layer point command setting when a match is found.

The remaining columns affect the scaling and rotation of Point Objects.

The **DescKey Editor** can be closed by clicking on the button in the Panorama.

For sake of comparison, **Right-click** on the CivilTraining Numeric Description Key set under the Description Key Sets collection on the Settings tab, and pick **Edit Keys** from the menu.

The format of the CivilTraining Numeric Description Key set is slightly different, but the operation is the same. No entries in the **Format** column are set to $*$ in this Description Key set; instead, each numeric description is replaced with a different alpha value. $1$ $2$ continues to be used in some descriptions, and a mix of numeric and alpha entry is actually employed in the field with this particular set.

Again, close the **DescKey Editor** by clicking on the button in the Panorama.
Description Key Set Search Order

When more than one Description Key set is present in the drawing, as is the case here, the order in which they are to be evaluated for matches is specified through a Search Order function.

To set the Search Order, RIGHT-CLICK on Description Key Sets on the Settings tab, and click Properties from the menu.

The order in which matches are processed from the multiple Description Key Sets is established by their relative position in the Description Key Sets Search Order dialog. The program will look for matches in the first Description Key Set found in the dialog. If a match is not found, the program moves down through the list through any additional files. The search order is set in the dialog box by HIGHLIGHTING a Description Key Set and moving it up or down in the list with the or buttons.

Curiously, there is no function to turn off the processing of a Description Key Set. The only way to accomplish this is to delete the set from the drawing. If the same Description Key Set is in another drawing, this is safe. A Description Key Set can be dragged and dropped from one drawing to another. A set can be dragged into another drawing temporarily, and then deleted in the current drawing. When needed back in the current drawing, it can be dragged back, accomplishing the same function as turning it off.

Point Groups

Point Groups are a critical component of Civil 3D, and an essential tool in point display management.

Point Groups reside on the Prospector; clicking back to the Prospector tab and expanding the Point Groups level reveals a number of Point Groups already in this drawing, and a potential surprise.

The glyph in front of the _No Display point group indicates that the group may not be up to date, and needs to be updated. This situation results whenever a point group is in place in the drawing before
points are added to the drawing, and indicates that the new points may not be correctly reflected in the point groups without an update.

To update the point groups, **Right-click** on **Point Groups** in the Prospector, and click **Update** from the menu.

Most of the point groups shown in the example are in the template drawing at the discretion of the operator; one shown is always present, and one *should* always be present.

The **_All Points** point group is always present in Civil 3D, and, by default, every point placed in a Civil 3D drawing is a member of this group. Although *Civil 3D establishes no clear direction as to how this group should be used*, it should serve one purpose: **the _All Points point group should be used to provide the default appearance of points with respect to their Point Object Style and Point Label Style, either by specifying the two styles explicitly or by enabling the display as configured by Description Keys.**

The **_No Display** point group is not always present in Civil 3D, but it should be. Like the **_All Points** group, every point placed in a Civil 3D drawing is a member of this group (the mechanics of this follow). This group likewise has one purpose: **the _No Display point group should be used to suppress the appearance of points by overriding their Point Object Style and Point Label Style with a selection of <none>, regardless of whether the point acquired its Point Object Style and Point Label Style from another group or from Description Keys.**

If these two groups are created and used as described, and if all other display management of points is likewise handled by point groups, the display management of points in Civil 3D is very easy and very efficient.

**Using Point Groups to Manage Point Display**

With display management configured through point groups, controlling point display in Civil 3D becomes easy and reliable: **point display is controlled by a Display Order function built into Point Group Properties.**

**Using the _No Display Group**

The purpose of the _No Display point group is to suppress the display of points within it.
**Right-click** on Point Groups on the Prospector, and click **Properties** from the menu. In the Point Groups dialog, highlight the _No Display group, and shift it to the top of the list, above all other groups, using the button. The list in the Point Groups dialog establishes a display order for the group contents. If a point is a member of one or more point groups, it will be displayed using the properties of the topmost group of which it is a member in the dialog. Since all points are members of the _No Display group, and this group suppresses the Point Object Style and Point Label Style of all of its member points with a selection of <none>, points will disappear or vanish from the drawing when this group is at the top of the list.

Pressing OK and checking the drawing, the monument point has disappeared, as seen in Figure 1.21.

 Erotse  If the point does not immediately disappear, regen the drawing. Trust us, it was there....

**Mechanics of the _No Display Group**

Some explanation of exactly how the _No Display group works will be helpful, and will expand our exploration of point management.

In the Prospector, right-click on the _No Display group, and click Properties from the menu.

*Point Group Properties* is a tabbed dialog, and three of the tabs are important here. Begin by clicking to the **Information** tab.
On the Information tab, the Point Style and Point Label style are both set to <none>. This means that a point displayed through the configuration established here would not be visible. This setting alone would be enough to control the display of a point if it did not match a Description Key or if no Description Key Set were in use. There’s a display hierarchy for points, and **Description Keys trump point groups.**

Click next to the second important tab in *Point Group Properties*, the **INCLUDE** tab.

The *Include* tab specifies what points will be members of the point group. In this case, the option used is **INCLUDE ALL POINTS**. It should be mentioned that using this option is dangerous in most other cases, as *every point placed in the drawing will be included in this group*. Usually group membership is better specified using the other options in the dialog, but this is one of the rare cases where every point should be part of this group.

**⚠️**: Do not use Include all points when creating point groups for building surfaces, as all points ever added to the drawing will be added to the surface.

The last of the three important tabs in *Point Group Properties* is the **OVERRIDES** tab.

As stated above, the styles configured on the Information tab cannot affect a point that has different styles assigned through description keys, based on a hierarchy of display settings. The top of this hierarchy, and **the setting that can trump a Description Key, is a Point Group Override.**

Clicking **on** the **STYLE** override and the **POINT LABEL STYLE** Override means that their two styles as configured on the Information tab will Override any style assigned by a Description Key. In a conflict between a Point Group and a Description Key, having an override means the point group wins.

Press **OK** to close the *Point Group Properties* dialog.
Using the _All Points Group

To return the display of points to their configuration as set by description keys, the _All Points group is moved to the top of the Point Group Display Order. If a point does not match a description key, or if description keys are not in use, the Point Style and Point Label Style specified in the _All Points group directly controls the point display parameters.

**Right-click** on **Point Groups** on the **Prospector**, and click **Properties** from the menu. In the **Point Groups** dialog, highlight the _All Points group and shift it to the top of the list, above all other groups, using the **button. Press OK to close the dialog.

The original point display mode is restored, seen in Figure 1.27.

If the point does not immediately disappear, regen the drawing.

**Mechanics of the _All Points Group**

Again, a spin through the three pertinent tabs of Point Group Properties for the _All Points group will help to explain exactly what is happening and why.

In the **Prospector**, **right-click** on the _All Points group, and click **Properties** from the menu.

The **Information** tab for the _All Points group specifies a **Point Style** of 0.10 X 3D. This will set the point style to an X shaped marker, 0.10" in size, displayed in 3D, *if no match is made to a Description Key*. More information on the Point Styles in a little while.

The **Point Label Style** is set to **EX L80 Elevation-Description**; based on the settings in the drawing, this will label the point with both its elevation and description using slanted text, 0.08" in size, *if no match is made to a Description Key*. More information on the Point Label Styles follows in a little while.
The **INCLUDE** tab for the **_All Points** group has no surprises; like the **_No Display** group, all points added to the drawing will end up in this group. The one difference, however, is that this option cannot be changed, as the **_All Points** group is automatically created by Civil 3D.

There is a difference on the **OVERRIDES** tab for the **_All Points** group; no overrides are turned on. This setting means that the **_All Points** group enables the display of points as specified in Description Keys when the group is at the top of display order, or specifies the Point Style and Point Label Style to use if no match to Description Keys is found.

**Creating a New Group to Alter Display**

The effect of point groups on display management becomes more apparent as more groups are added to the mix. Here a new Control group will be created with different display parameters. The effect of this group will be apparent now, with a single point in the drawing, and more so later, as other points are imported.

To create a new point group, **RIGHT-CLICK** on **POINT GROUPS** in the **PROSPECTOR** and click **NEW** from the menu.

Click to the **INFORMATION** tab in the **Point Group Properties** dialog.
Supply a **Name**, **Control** in this case, and a **Description**.

Select a desired **Point Style**. Remember that this style will be applied if a point does *not* match a Description Key, and only as an **Override** if a point *does* match a description key.

Select a desired **Point Label Style**. Again, remember that this label style will be applied if a point does *not* match a Description Key, and only as an **Override** if a point *does* match a Description Key. The style selected will label five attributes on a point, including its latitude and longitude.

Click to the **Include** tab in the **Point Group Properties** dialog.

The strategy used to specify the points to include in the **Control** group built here is based on the overall point number management in use in the project. In this project, point numbers 1-100 are reserved for control. Traverse points begin at number 101, and other fixed ranges are specified for different functions. Accordingly, the entry in **Include** tab is with numbers matching, and the range 1-100 is entered in the field as shown.

The concept of overall project-wide point number management hopefully is not new. Managing point numbers for different functions is essential in any software package, and will be even more important as points are shared between drawings from the Survey Database in Civil 3D.

Click to the **Overrides** tab in the **Point Group Properties** dialog.

In this case, only an **Override** for the **Point Label Style** is clicked **On**. This setting means that the display of a point through this point group will *not* override the Point Style as specified by Description Keys; the Point Style set in description keys will still be used. If no match to a Description Key is found, then the Point Style specified in this group will be used. The Point Label Style will always be displayed as specified by this group, however, regardless of what might be assigned by a Description Key.
Press **OK** to close the *Point Group Properties* dialog. The newly created point group shuffles to the top of the Point Group Display Order automatically, and point number 1 in the drawing takes on the new appearance.

> If the point does not immediately disappear, regen the drawing.

![Figure 1.35 - Drawing with Newly Created Control Group at Top of Display Order](image)

With the various point groups created in Civil 3D, controlling the desired display is easy:

- **To restore the default point display**, as set in Description Keys or the `_All Points` point group, *shift the `_All Points` group to the top of the display order list in Point Group Properties, or above any other group that would otherwise control the desired points.*

- **To set different point display options for points**, create new groups as required assigning new Point Styles and/or Point Label Styles. Remember to turn on Point Group Overrides for the Point Styles and/or Point Label Styles if they are to override Description Keys. *Shift the new group(s) to the top of the display order list in Point Group Properties, or above any other group that would otherwise control the desired points.*

- **To suppress the display of points**, seemingly "removing them" from the drawing, use a `_No Display` group, and *shift the `_No Display` group to the top of the display order list in Point Group Properties, or above any other group that would otherwise control the desired points.*

It is important to understand the impact of using a `_No Display` group as specified here versus freezing point layers. The use of Description Keys does an excellent job of routing points to different layers in the drawing; why not simply control point display by freezing layers. The answer lies in the overhead of points in the drawing.

Each point in the drawing has the rough overhead of a block with multiple attributes. Since attributes are effectively text, keeping a lot of points on frozen layers will increase the drawing size substantially. Setting the points to a `_No Display` style on the other hand means their overhead is nil - they're not there from a drawing overhead standpoint. A drawing saved with point set to `_No Display` will be considerably smaller than one where the points are frozen.

It’s still desirable to have points on a number of different layers, however, and the layers can be turned off temporarily to make working with some point data easier. When done with points, however, don’t freeze their layers - use a `_No Display` group as described here. It takes some getting used to, but this point display scheme in Civil 3D works very well.
The Point Display Hierarchy

Using the point display management scheme described here, all point display control is governed by Point Groups. Setting the display management in this manner makes it consistent, and easy to use.

Summarizing, certain critical settings were made:

- The default Point Style and Point Label Style set in Point Feature Settings was <none>. This allows a downstream feature, point groups, to exercise control.

- The _All Points group, built into Civil 3D by default, is set up with a desired Point Style and Point Label Style, but without any point Overrides. This group, therefore, enables the Point Style and Point Label Style in Description Keys when a point matches a key, or specifies the styles to use when description keys are not in use or a point does not match a Description Key.

- Point group Overrides are used to set any display modes other than those established by Description Keys or the _All Points group. This includes suppressing the display of points with the _No Display group, where Point Style and Point Label Style Overrides of <none> are used.

These three rules really are the key to point display management in Civil 3D.

Point Creation Tools

It will be helpful at this stage to bring some additional points into the Existing Base drawing. Doing so will allow examination of some of the point creation commands, show further interaction with point groups and display management, and additional points in the project will be required for later processing of surfaces from field work and some outbound parcel information. The \Received\From Surveyor\From Field Crews\Alpha folder in the project contains six ASCII files of point data that will need to be imported; the Parcel 1-3 Outbound.txt file contains an outbound survey of the three parcels comprising the Chestnut Ridge Estates property, while the remaining five are cross sections shot along Chestnut Ridge Road and Weybridge Road for more surface preparation. Not all of these files are optimal for use in Civil 3D, as will be seen shortly.

The files in the \Numeric folder have the same point data, with descriptions that will work with the Numeric Description Key Set.

Point creation in Civil 3D, and the use of the Point Creation Tools, can be triggered from the HOME tab of the CIVIL 3D ribbon, CREATE GROUND DATA panel, opening the POINTS dropdown as
described earlier; the **Point Creation Tools** selection from the top of the menu opens the basic dialog.

Optionally, the process of point creation can be invoked by **Right-clicking** on **Points** in the **Prospector**, and clicking **Create** from the menu.

Either operation will display the Create Points dialog, seen in Figure 1.37. The Create Points dialog is an example of an unusual dialog type in AutoCAD, but a dialog type used extensively in Civil 3D: a **Dialog Bar**. Dialog Bar is actually a term that was introduced in Land Desktop, then seems to have been forgotten moving forward, but we've resurrected the term in this manual. There was one dialog bar in Land Desktop (LDT), though most seasoned LDT operators would be hard pressed to tell you where it was. A dialog bar is a unique combination of a dialog box and toolbar, usually with its own combination of dropdown menus and/or tabs. The Create Points dialog bar has several dropdown menus, plus another unique setting that affects its visibility.

Located in the upper right corner of the Create Points dialog bar is a small or pushpin glyph. Since the Create Points dialog bar is technically a modeless dialog in AutoCAD, it can remain on-screen, even after the command(s) that invoked it are done. Pressing the glyph minimizes, or auto-hides the dialog bar when the cursor leaves it. Returning the cursor over the dialog bar expands it back to its previous size. This behavior is shared by other dialog bars in Civil 3D, including those in the parcel, alignment and profile parts of the program.

Clicking the pushpin glyph (which now looks like it has been "stuck" into something:) again will return the dialog bar to its original configuration.

Did you ever wonder who gets paid to come up with these glyphs? We want that job.

The individual dropdown menus in the Create Points dialog bar reveal the various point creation tools in Civil 3D; some are obvious, some are obscure, and many are underutilized. Some of the better but less well-known point grading commands are shown in Figure 1.39.
The other major feature in the Create Points dialog bar is revealed when the chevron glyph near its right end is pressed. Pressing it opens a lower level in the dialog bar, consisting of Point Feature Settings Overrides.

The purpose of the Point Feature Settings Overrides is to allow manipulation of point settings on the fly, while point commands from the dialog bar are in use. By default, settings changed here do not affect the global Point Feature Settings described earlier on the Settings tab; they are simply temporary overrides in place while the dialog bar is displayed. Closing the dialog bar, and then redisplaying it for later use, the Point Feature Settings would be as established on the Settings tab, not as overridden.

This behavior can be changed from a setting on the Ambient Settings tab of Drawing Settings on the Settings tab.

One of the functions that can be accomplished through the Create Points dialog bar is importing ASCII files of point data such as we have in this project. Before we do, however, it is always important to examine the files, determining their organization and content, and determining if any point settings will need to be changed as they are imported.

The first point file that will be imported is the outbound survey information for the three parcels, Parcel 1-3 Outbound.txt. Opening this file in a text editor to examine its contents, the file is basically ready to use.

The file is comma delimited as seen in Figure 1.41; the file consists of point numbers, NYS East NAD 83 Northings, NYS East NAD 83 Eastings, elevation values of -99999, and descriptions. The -99999 elevation values are assigned by some survey programs when elevations are not being run in the field, and are not unusual. The field crew did a good job of beginning the shots at point number 101, the start of the range assigned to traverse work in the overall point management scheme, and the numbers jump to 201 and 301 at the beginning of the second and third parcels, respectively. This file is ready, and easy, to use.

Some of the parcel 1 points are not shown in Figure 1.41, but are present in the file.
With this good result for the first point file, continue to check the remaining five files. The other files were cross sectional topo survey work of the two roads in the project, and were shot by a different crew.

Looking at these five files, the viewer is struck by one fact: this crew used 101 as their starting point number for each of the five days’ work! The crews did a (presumably) great job of running linework codes, as evidenced by the CL1, GRVL1, GRVL2 and other descriptions, but there will be substantial point number conflicts if these files are all imported without adjusting Point Feature Settings on the fly. This is far more common than it should be with work coming in from the field. It’s also not a big deal to deal with on an ASCII import in Civil 3D, but don’t tell the field crews that.

It would be a big deal if the import method was Field Books rather than ASCII files.

Since the ASCII files contain point numbers, and the point numbers in the Parcel 1-3 Outbound.txt file can be used without modification, it is only necessary to check the setting that insures the point numbers will be maintained on import.

Under the **Point Identity** level in the bottom of the Create Points dialog bar, check the setting for **If Point Numbers Are Supplied** - it should be **Use** as seen in Figure 1.44.

To begin the import, press the glyph in the top of the Create Points dialog bar.

In the **Import Points** dialog, select the **Format** from the formats available in the dropdown list. The format that corresponds to the files used in this example is PNEZD (comma delimited): Point Number, Northing, Easting, Elevation, Description with a comma separator. If needed, a new format can be created and added to the list using the **button to the right of the dropdown.
For the **Source File**, use the button, and browse to and select the **Parcel 1-3 Outbound.txt** file. Note that the Select Source File dialog allows the selection of multiple ASCII files; care must be taken when using the selection of multiple files when their point numbers are to be used, as will be described in a moment.

Click on the **Add Points to Point Group** option. Use the button to create a new point group, supplying a new group name in the **Point File Formats - Create Group** dialog that displays.

Always put imported points into a group as they are brought in - it makes dealing with them easier later, especially if they need to be changed.

The **Advanced options** at the bottom of the **Import Points** dialog should remain **OFF**; these could be used to do metric to imperial conversion within the import, but are not needed here. Press **OK**.

The imported points are displayed, and form the outbound perimeters of the three parcels. One of the points sits right on top of the control point already in the drawing as seen in Figure 1.46; we’ll deal with the duplication of labels in a moment.

Before importing the remaining files, it is necessary to deal with the duplicate point numbers. Remember that each of the five ASCII files started at point number 101. One other important piece of information about the files - none of them contains 1000 points (no surprise there). Since each file begins at 101 and contains less than 1000 points, each can be renumbered on import by adding a point number offset to each file. The first file will be renumbered by adding an offset of 1000, the second by adding an offset of 2000, and so on. This method preserves the base point numbers of each original file; if it is necessary to return to point number 231 of the fourth day's work, its new number is known - 4231.

To enable the offset, use the **Point Identity** level in the bottom of the **Create Points** dialog bar. Change the **If Point Numbers Are Supplied** setting to **Add an Offset**. Change the **Point Number Offset** value to 1000 for the first file.
To import the first of five road sections ASCII files, use the glyph again from the top of the *Create Points* dialog bar.

Although there are five files to be selected for import, they must be processed one at a time. The **Point Number Offset** value will need to be changed for each import, so the ability to select multiple files is not that useful here. Select the first file by field work date, *Weybridge Rd 2009-09-16.txt*.

Click on the **Add Points to Point Group** Option, and again create a new group for these points - *Weybridge Road Sections*.

Press **OK** to import the first of five files.

Before proceeding to the next file, return to the **Point Identity** level in the bottom of the *Create Points* dialog bar. Change the **Point Number Offset** value to 2000 for the second file, then 3000 for the third, etc.

On import, the second and third files can be added to the *Weybridge Road Sections* point group, clicking on the **Add Points to Point Group** option, and picking the group from the dropdown list. Switching to the fourth file, use the button in the *Import Points* dialog again to create a new point group for the other road - *Chestnut Ridge Road Sections*, and place both of the Chestnut Ridge Road files in that group.

When all five files have been imported, close the *Create Points* dialog bar with the glyph in its corner.

With all of the points imported, the drawing and Prospector appear as shown in Figure 1.50. The drawing is something of an illegible mess, and that's going to be improved by some point groups shortly.

The Prospector displays a glyph in front of the *No Display* point group again, indicating again that the group is not up to date, and needs to be **updated**. The situation again results because points have been added to

**Figure 1.48 - Import Points Dialog for First Sections File**

**Figure 1.49 - Point Identity Settings for Second of Five Imports**

**Figure 1.50 - Drawing and Prospector after Import**
the drawing after the group was created, and indicates that the new points may not be correctly reflected in the point groups without an update.

To update the point groups, **Right-click** on **Point Groups** in the Prospector, and click **Update** from the menu.

**SAVE** the drawing, as the points exist only in the drawing!

**Using Styles and Overrides to Change Point Display**

As we’ve left the drawing thus far, the road section points are displayed, but with far too much information to be usable. To make the display of these more workable in preparing breaklines, further on we’ll create some new point groups, assigning different Point Styles and Point Label Styles with Overrides.

Zooming back in around the intersection of the two roads, there’s clearly too much displayed to do any linework connectivity between the shots.

In the Prospector, start the creation of a new point group by **right-clicking** on **Point groups** and clicking **NEW** from the menu.

In the **Point Group Properties** dialog, supply a **NAME** for the first new point group - **Centerline**. Also add a **DESCRIPTION**.

**Selecting Point Styles**

The **POINT style**, currently set to **0.10 X 3D** in both the point group defaults and in the Description Key for the centerline shots, is simply too big. Select a different one which is smaller, **0.05 X 3D**, from the dropdown list.
To look at some of the parameters in this Point Style, click the glyph adjacent to the Point Style selection as shown, and click **Edit Current Selection** from the menu.

There are a lot of components to an object style in Civil 3D, and they will be covered in much more detail later in this chapter.

To look at the pertinent components of the Point Style, begin on the **Marker** tab.

The **Marker** selection in this style is a **Custom Marker**, X shaped, as opposed to an AutoCAD block. This accounts for part of the style name, 0.05 X 3D. Many of the styles in use in the description keys utilize blocks, rather than markers. To be used, the blocks must reside in the drawing, and cannot be obtained from an outside location.

Land Desktop could pull in Description Key blocks from an external location, usually the Symbol Manager files. Civil 3D cannot.

The **Size** option for this style is set to **Use drawing scale**, and the size is set to 0.05" plotted height. The point styles have annotative behavior as the drawing scale is changed, so this establishes the size in plotted units regardless of drawing scale. This also explains another part of the style name, 0.05 X 3D.

Click over to the **3D Geometry** tab in the **Point Style** dialog.

On the **3D Geometry** tab, the **Point Display Mode** is set to **Use Point Elevation**. This means that the point will sit in the drawing in 3D, at an actual Z value corresponding to the elevation value on the point. This means that any AutoCAD objects drawn by snapping to the points will be in 3D, essential for breakline construction. This also explains the other element of the style name, 0.05 X 3D.
In some instances, it is desirable to have points displayed in the drawing in 2D rather than 3D; an example would be traverse points where a quick inverse is desired by snapping from point to point. For an application such as this, the **Point Display Mode** would be set to Flatten Points to Elevation, and the **Point Elevation** value would be set to 0. The 0.05 X 2D and 0.10 X 2D styles behave this way, as do a number of other styles in use with Description Keys.

We'll turn you lose to explore the styles used in the Description Keys shortly.

Press **OK** to exit the Point Style dialog, returning to the Point Group Properties dialog.

In editing styles from within settings’ dialogs in Civil 3D, it's possible to get about six levels deep in dialogs. If LISP stands for Lost In Stupid Parentheses, Civil 3D should be characterized by LIED - Lost In Endless Dialogs.

### Selecting Point Label Styles

The Point Label Style in use in the drawing is also too big. The style being used is not the PR L50 Point#-Elevation-Description style shown in the Point Group Properties dialog, but is an EX L80 Description style assigned by the Description Keys. It's too big, and it would be helpful to see the point numbers for connectivity in drawing breaklines.

From the dropdown, select a different **Point Label Style**, EX L50 Point#-Description.

As we did with the Point Style, examine some of the Point Label Style parameters by clicking the glyph adjacent to the Point Label Style selection and clicking **Edit Current Selection** from the menu.

Begin on the **General** tab in the **Label Style Composer** dialog. The **Text Style** used by this Label Style is romansR__00; this is a variation of AutoCAD’s RomanS, set with an obliquing angle for existing conditions rather than vertical for proposed, and set with a 0 height in the AutoCAD style - the height is added by the Label Style definition. This explains the EX L50 Point#-Description component of the label style name.
The **layer** set is **V-PNTS-TEXT**; this is actually the Color Control Layer for the existing Point Label Styles. Changing the color of this layer in the drawing will change the color of all existing points - the proposed styles use a different Color Control Layer.

Click over to the **layout** tab.

The **Layout** tab formats the text used in the label in its default position. There are three **Components** in the Point Label style, but the **Visibility** setting is only set to True for two: Point Number and Point Elevation. That explains a little more of the style naming convention, **EX L50 Point#-Description**.

For each of the two text components, the Text Height is set to 0.05", Leroy 50, explaining the last part of the name, **EX L50 Point#-Description**. There's a lot more happening on this tab, but we're not going to go there today - that's for another day.

Before leaving the **Label Style Composer** dialog, click over to the **Dragged State** tab.

The **Dragged State** tab configures the behavior of the label when dragged to a new location. The settings on this tab supply the style, size and visibility of the arrow head and leader, the size of the text when dragged, and the composition of the dragged label.

» It's important, and challenging, to match the display parameters of the Dragged States of Label Styles to the Default appearance so that they behave as expected when dragged with grips.

Press **OK** to exit the **Point Label Style** dialog, returning to the **Point Group Properties** dialog.
To continue with the point group definition, click to the **INCLUDE** tab in the *Point Group Properties* dialog. The Raw, or field-entered description for the centerline shots, is known from the ASCII file, but it could be exposed by clicking on one of the points and looking in the Properties Palette as well - CL. Click on the **WITH RAW DESCRIPTIONS MATCHING** option. Since linework numbers followed this description on the points, type CL* in the field, remembering that the entry is case sensitive.

Finally, click to the **OVERRIDES** tab in the *Point Group Properties* dialog. Since this point group needs to override both, click **ON** the **POINT STYLE** and **POINT LABEL STYLE OVERRIDES**.

Press **OK** to create the new point group.

The centerline points immediately assume the new display characteristics, and are much easier to use.

To continue adjusting the display of the road points, and in support of some point management that will be required for breaklines, additional point groups need to be created for the edge of pavement, shoulder and bottom of bank shots. The groups can use these same entries as their names. Each should be set with the same 0.05 X 3D Point Style and EX L50 Point#-Description Point Label Style. The raw description entries for each are:

- **Edge of Pavement**: EP*
- **Shoulder**: GRVL*
- **Bottom of Bank**: BB*

![Image of Point Group Properties](image-url)
With each of the new point groups built, the drawing appearance changes:

![Figure 1.63 - Drawing Display with New Road Groups Created with Overrides](image1)

Returning to Point Group Properties and shuffling the Point Group Display Order, as shown in Figure 1.64, should suppress the display of the shoulder and bottom of bank points, leaving the centerline and edges of pavement displayed...

![Figure 1.64 - Point Group Display Order in Point Group Properties](image2)

...which works very nicely.

![Figure 1.65 - Drawing with Only Centerline and Edge of Pavement Points Displayed](image3)

**Save** the drawing.
Survey Workflow in AutoCAD® Civil 3D®

With SmartDraft

This document summarizes the workflow through a typical Civil 3D Survey drawing and project, including assignment to a Civil 3D Data Shortcuts project that would receive surface data from topo and the Civil 3D Survey project with its Survey database. This example illustrates the import of Fieldbook data typical of most data collection systems and the processing of traverse data using Compass Rule and Length Weighted Vertical adjustment. Other adjustment and analysis options could be substituted in this process, or simple sideshot or topographic data could be used without adjustment following the same process. Optional workflow steps utilizing SmartDraft® are shown in Times New Roman italics, like this.

Verify Drawing Settings and Units

In a drawing started from the desired template, use **Edit Drawing Settings** from the **Settings** tab of the Toolspace. On the **Units and Zone** tab of the **Drawing Settings** dialog, verify that the **Imperial to Metric Conversion** and **Coordinate** settings are correct. On the **Ambient Settings** tab of the **Drawing Settings** dialog, verify that the **Angle** and **Direction Formats** are set to **Decimal DMS**.

Create or Select Civil 3D Data Shortcuts Project Folder and Associate Drawing

On the Toolspace’s **Prospector** tab, **Right-Click** on **Data Shortcuts** and use **Set Working Folder**, browsing to the top level job folder below which the Data Shortcuts folder will reside. If the data shortcuts project displays the project is already created; if not, **Right-Click** on **Data Shortcuts** and use **New Data Shortcuts Project Folder** to create it. **Right-Click** again on **Data Shortcuts** and use **Associate Project to Current Drawing**, associating Civil 3D project to the drawing. **Save** the drawing.

Set Survey Working Folder

On the Toolspace’s **Survey** tab, **Right-Click** on **Survey Databases** and use **Set Working Folder**. Browse to and select the desired Civil 3D project level for the job, below which the Survey database(s) for the project will reside, pressing **OK** from the dialog. If a survey database displays in the top of the Survey tab upon pressing OK, the Survey database for the project has already been created and needs to be opened. If no Survey database is displayed upon pressing **OK** from the dialog, a new survey database needs to be created.
• If the Survey Database Displays – To Open the Survey Database

To open a Survey database that already exists in a Survey project, **RIGHT-CLICK** on the desired Survey Database and use **OPEN FOR EDIT**.

![Figure 2.01 – Open for Edit on Survey Tab](image)

⚠️ Only one person can have the Survey database open for edit at a time.

• If No Survey Database Displays – To Create the Survey Database

To create a new Survey database in a Survey project, **RIGHT-CLICK** on **SURVEY DATABASES** and use **NEW LOCAL SURVEY DATABASE**. Enter the desired Survey database name in the **New Local Survey Database** dialog, and press **OK**.

![Figure 2.02 – Survey Database Name](image)

⚠️ It is recommended that the name of the Survey database include a reference to the job number or name, as well as the coordinate system in use.

**Edit Survey Database Settings**

The newly-created Survey database will default to International Feet, and must be changed to correct units and settings.

**RIGHT-CLICK** on the Survey database, and use **EDIT SURVEY DATABASE SETTINGS**.

In the **Survey Database Settings** dialog, adjust settings as desired, paying particular attention to **UNITS, COORDINATE ZONE and DISTANCE, ERROR TOLERANCE and CHANGE REPORTING**.

![Figure 2.03 – Edit Survey Database Settings](image)
The Distance settings must be set to **US Feet** to avoid inadvertently converting to International Feet. The Coordinate Zone can be used to transform data from one zone and projection to another if other enabling settings are made in Civil 3D. The Error Tolerance settings are used to display notifications when observations fall outside user-defined criteria as set. The Change Reporting setting enables a change log for the Survey project which records everything done within it.

/embed video

*Do not overlook the Units settings!*

*When available, preset Survey Database settings can be imported from a file using the icon at the top of the Survey Database Settings dialog. These settings should still be checked, however, as some imported settings, such as error tolerances, are not reliably imported.*

### Associate the Drawing to the Survey Working Folder

Civil 3D provides the ability to associate the drawing to the Data Shortcuts project, insuring that the current project is changed when opening drawings in different projects; unfortunately this capability is not provided by Civil 3D for the Survey project. This can entail substantial risk when working with different survey projects in Civil 3D. SmartDraft overcomes this limitation by providing the same ability to reset the Survey Working Folder when changing between drawings.

To associate the drawing to the current Survey Working Folder, use the icon from the Points Panel on the SmartDraft tab of the ribbon, or type SVF. In the Associate Civil 3D Survey Working Folder dialog verify the current Survey Working Folder and press the Associate button. Save the drawing.
Set Auto-Update on Survey Points

Civil 3D Survey uses a strategy similar to the one used in Land Desktop for years; points are stored in an external database and can optionally be inserted into the current drawing. By default, edits to survey data in Civil 3D update the database information, but these changes may not automatically update points in the drawing. To insure that points in the drawing will be updated, **Right-Click** on the **Survey Points** level. From the menu displayed, **Left-Click** on **Automatic Update**, toggling it on and placing a check before the setting on the menu.

Create a Survey Network

Civil 3D Survey uses the concept of a **network**, a group of related coordinate and observation data. In order to be available for traverse or closure analysis, observations and data must be contained within one network. **Right-Click** on **Networks** under the Survey project and use **New**. Supply a meaningful network name which characterizes the work to be included.

Set Auto-Update on Network

Civil 3D also uses a toggle on the Survey Network to determine whether or not the network will be updated with changes made to setups, prism heights, etc. Usually toggling this auto-update setting on is also desirable. **Right-Click** on the network level. From the menu displayed, **Left-Click** on **Automatic Update**, toggling it on and placing a check before the setting on the menu.
Edit Fieldbook – Check Fieldbook Settings

Autodesk-Softdesk Fieldbook files can be produced directly from current generation data collection systems, such as the Leica Viva® collectors, from conversion programs, such as Leica Exchange®, or from the TDS Survey Link® program which installs with Civil 3D.

Fieldbooks produced from older data collectors will typically not include the unit information required for Civil 3D, as older equipment and software did not distinguish between US Survey and International Feet. This setting should be checked and edited in the fieldbook before importing. Additionally, it is often desirable to comment-out coordinates which are set in or uploaded to the fieldbook to prevent duplicate coordinates on import.

To edit the fieldbook, **Right-Click** on the network into which it will be imported, and use **Edit Fieldbook**. Browse to the fieldbook file, and it will open in the configured text editor.

In the fieldbook editor, look for a line at the top of the fieldbook beginning with `UNIT`. If this line reads `UNIT FOOT DMS`, edit it to read `UNIT USFOOT DMS`. This instruction is necessary to tell Civil 3D that the fieldbook is in US Survey Feet; if this instruction is not made, Civil 3D assumes the fieldbook is in International Feet and will perform a conversion on its units when imported. Any other edits needed, including prism height changes noted in the fieldbook but not entered correctly, should be made at this time. **SAVE** and **EXIT** from the fieldbook editor.

*Do not overlook the Units settings in the fieldbook either!*
Import Fieldbook

Civil 3D organizes data imports into the Survey project using *Import Events*. Each import event captures the data brought into the project and provides an easy mechanism by which to remove, edit and re-import data.

Capturing points imported by a fieldbook in a Civil 3D Point Group is facilitated if no points are displayed in the drawing when the fieldbook is imported. If points are presently in the drawing, use Point Group Properties in Civil 3D to hide them before importing, using a _No Display group.

To import the fieldbook, **Right-Click** on Import Events at the top of the Survey tab, and use **IMPORT SURVEY DATA**. The program triggers a wizard which steps through the process of importing data from fieldbooks, LandXML files, ASCII files or data from the drawing. Step through the pages of the wizard, selecting the fieldbook file and network into which to import. On the last page of the wizard, supply an **IMPORT EVENT NAME**. Make sure **INSERT NETWORK OBJECT** is **on**, **INSERT SURVEY POINTS** is **on** and **DISPLAY TOLERANCE ERRORS IN EVENT VIEWER** is **on**.

As the import completes, the points are displayed in the drawing, and any tolerance errors are displayed in the Event Viewer. The tolerance error information is recorded with the network and can be redisplayed using an option from the right-click menu on the network, so the Event Viewer can be cleared and closed.
Assign Imported Points to a Point Group

Capturing points imported by a fieldbook in a Civil 3D Point Group is very desirable, but selecting the points to be included is difficult. An anomaly of Point Group management in Civil 3D makes this easier. Points imported into Civil 3D are not automatically added to point groups within the drawing; point groups must be updated to include them. Since the points in the drawing were hidden by making a _No Display group current before importing the fieldbook, the only points currently displayed and selectable are those from the fieldbook import itself. Additionally, the Point Groups collection in the Prospector displays warning shields, indicating that the groups have to be updated. This is the one instance where the groups should not be updated, as doing so will hide the new points from the drawing as well. There is a one-time opportunity to add these new points to their own group before updating the present groups.

Create a new point group in the Prospector, adding the imported points by using the Selection Set in Drawing option on the Include tab. Once this new group is created, Right-Click on the Point Groups level in the Prospector, and use Update to update all groups and clear the warnings. The new points will then be included in all Civil 3D Point groups in the drawing, and their display can be controlled by the groups with their settings and overrides.

Examining Survey Network Data in the Drawing

Once Civil 3D Survey data are imported, they can be examined and checked for errors by exploring the survey network in 3D. If the network topology is not displayed automatically, Right-Click on the network in the Prospector, use Properties, and change the network Object Style on the Information tab.

The network object shows the data and spatial connectivity of setups and side shots. Errors can often be identified by detecting sideshot vectors too high or too low, often identifying rod height errors. In Figure 2.14, two viewports are utilized, examining the same setup in plan and elevation view.
Editing Observed Data

An examination of the network data will often reveal setup and observation details that need to be corrected. These edits can be performed at several levels: editing and correcting the fieldbook, editing individual setups or editing individual observations or shots.

- **Editing the Fieldbook**

Making edits and corrections within the fieldbook itself is simplified in Civil 3D by the Import Event that captured its import. To edit the fieldbook, use the **Edit Fieldbook** option from the menu below the network, as described above. **Save** the fieldbook, and **Exit** from the editor. To import the changes, return to the Import Event created when it was first imported, **Right-Click** on the **IMPORT EVENT**, and use **RE-IMPORT** from the menu. All points and observations associated with the event are removed, and the edited fieldbook is reimported into the database and drawing.

- **Editing an Individual Setup**

Civil 3D survey captures and organizes each setup transferred from the fieldbook, including observations recorded from it. Editing an individual setup exposes the instrument height, which can be changed, but the Setups Editor also serves as a vehicle to get to all observations turned from the setup. To access the Setups Editor, **DOUBLE-CLICK** on the **SETUPS** level under the network on the Survey tab. As the Setups Editor opens in the Panorama, scroll to the desired setup. **RIGHT-CLICK** on the setup and use **ZOOM TO** to shift the display in the current viewport (occupying 10, backsighting 11 in Figure 2.16).

![Figure 2.15 – Re-Import Import Event](image)

Most fields in the setup are not editable, but the instrument height can be changed.
After making changes in the Setups Editor, save the changes with the icon in the upper right corner. Since both the network and survey points are set to update automatically, the survey database and drawing will update to reflect the change.

⚠️ If the automatic updates are not turned on, be sure to update the network and survey points levels manually.

- **Editing Individual Observations – From Setups Editor**

To edit observations from the Setups Editor, **RIGHT-CLICK** on the desired setup, and use **EDIT OBSERVATIONS** from the menu. Civil 3D opens a second tab in the Panorama for the Observation Editor, and highlights all observations from the setup in the current viewport. Clicking on an individual observation highlights its data in the drawing, and individual elements of the observation can be edited, including the prism height.

As with the Setups Editor, save the changes in the observation editor with the icon in the upper right corner. Since both the network and survey points are set to update automatically, the survey database and drawing will update to reflect the change.

⚠️ If the automatic updates are not turned on, be sure to update the network and survey points levels manually.

- **Editing Individual Observations – From Drawing**

An alternative method for accessing the observation data for an individual point is to **RIGHT-CLICK** on the point in the drawing, and use **BROWSE TO SURVEY DATA** from the menu. This method opens the Observation Editor as described above, and highlights the current observation in the drawing in the same fashion. The observation data for the selected point will be made current in the Observation Editor automatically. Use the same procedure described above for saving changes in the Observation Editor.
Civil 3D Traverse Concepts

Civil 3D manages data for traverse analysis by storing observation information on each point. Shots returning to a previously stored point, either as a check shot or to close a traverse, should use the same point number as originally stored. Civil 3D uses the coordinate of the first shot to set the point temporarily in the drawing, but all setup data are captured and can be seen in the survey network object. In Figure 2.18, point 11 is represented in the drawing by the traverse symbol shown (set by description keys). In addition, two red circles can be seen. The first circle, concentric with the insertion point of the symbol, represents the coordinate of the first observation to point 11. The second red circle represents the coordinate of the second observation to point 11, taken later. The distance between the two is 14 hundredths, which resulted in one of the tolerance errors displayed earlier in the Event Viewer. When traverse analysis is complete in Civil 3D, the final coordinate of point 11 will be determined by the method chosen, and the coordinate of point 11 will be updated in the Survey Database. At that time, it is critical that Survey Points be set to Update Automatically as described above to insure that the drawing updates as well.

Operators using Civil 3D Survey must always consider the definition of a closed traverse in the program, which requires establishing a closing angle (or angle to known data).

In the example in Figure 2.19, 1001 represents the first occupied station in a traverse. An azimuth is established through 1002, and 1002 is shot and recorded establishing distance. Traverse setups then advance traditionally through a setup on 1004, backsighting 1003 and shooting 1001. If the field crew packs up at this point, the traverse cannot be analyzed by Civil 3D. The required final setup is on 1001, backsighting 1004 and turning into 1002 to establish closing angle.

Defining a Traverse

To define a traverse, **RIGHT-CLICK** on **TRAVERSES** under the network level, and use **NEW**. In the **New Traverse** dialog, enter a **NAME**, the **INITIAL OCCUPIED STATION** point number, **INITIAL BACKSIGHT**, remaining **OCCUPIED STATIONS** and **FINAL FORESIGHT**. Press **OK**.
Performing Traverse Analysis

To perform traverse analysis in Civil 3D, **Right-Click** on the **Traverse** in the Traverse list in the bottom pane of the Survey tab, and use **Traverse Analysis**.

In the Traverse Analysis dialog, turn **Traverse Analysis** and **Balance Angles** **on**. Select the desired **Horizontal Adjustment Method** and **Vertical Adjustment Method**. Check the **closure limits** passed in from the Survey database settings, adjusting them if desired. Turn **Update Survey Database** **on**. Press **OK**.

Four text files are created by the traverse analysis process, displayed automatically by Civil 3D. These reports are stored by default in the network folder under the survey project folder, below the Survey Working Folder.

The **Raw Closure report** contains closure information for the traverse prior to adjustment:

Angular error      = 0-00-15.04
Angular error/set  = 0-00-01.07 Over
Elevation error : -0.0715
Error North       : 0.0721
Error East        : -0.0225
Absolute error    : 0.0755
Error Direction   : N 17-19-41.98 W
Perimeter         : 3104.8427
Precision         : 1 in 41097.1331
Number of sides  : 14
Area              : 609309.9 sq. ft., 13.9878 Acres

Closure at other Traverse Points -----  
Attention is called to maxima-minima separations

<table>
<thead>
<tr>
<th>Point</th>
<th>Separation Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.0755</td>
</tr>
<tr>
<td>3</td>
<td>0.0644</td>
</tr>
<tr>
<td>4</td>
<td>0.0554</td>
</tr>
<tr>
<td>5</td>
<td>0.0477</td>
</tr>
<tr>
<td>6</td>
<td>0.0433</td>
</tr>
<tr>
<td>7</td>
<td>0.0346</td>
</tr>
<tr>
<td>8</td>
<td>0.0086</td>
</tr>
<tr>
<td>9</td>
<td>0.0049</td>
</tr>
<tr>
<td>10</td>
<td>0.0127</td>
</tr>
<tr>
<td>11</td>
<td>0.0305</td>
</tr>
<tr>
<td>12</td>
<td>0.0414</td>
</tr>
<tr>
<td>13</td>
<td>0.0572</td>
</tr>
<tr>
<td>14</td>
<td>0.0691</td>
</tr>
<tr>
<td>1</td>
<td>0.0674</td>
</tr>
<tr>
<td>2</td>
<td>0.0755</td>
</tr>
</tbody>
</table>

Possible distance error in leg : 9 - 10
Angular error (if any) most probable at point 9
The **Balanced Angles report** contains closure information for the traverse with balance angles adjustment only:

<table>
<thead>
<tr>
<th>Point</th>
<th>RAW Coordinates</th>
<th>TRAVERSE</th>
<th>No RULE - Balanced Angles Coordinates</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>N 5000.0000</td>
<td>E 5000.0000</td>
<td>N 5000.0000 E 5000.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>N 77-58-27.07 W</td>
<td>Dist:180.6502</td>
<td>N 5037.6398 E 4823.3145</td>
<td>N 5037.6389 E 4823.3143</td>
<td>0.0009</td>
</tr>
<tr>
<td>N 85-08-05.16 W</td>
<td>Dist:143.0982</td>
<td>N 5049.7778 E 4680.7321</td>
<td>N 5049.7754 E 4680.7317</td>
<td>0.0024</td>
</tr>
<tr>
<td>N 71-04-34.23 W</td>
<td>Dist:173.2896</td>
<td>N 5105.9801 E 4516.8095</td>
<td>N 5105.9751 E 4516.8083</td>
<td>0.0051</td>
</tr>
<tr>
<td>N 78-36-41.31 W</td>
<td>Dist:103.3959</td>
<td>N 5126.3988 E 4415.4498</td>
<td>N 5126.3917 E 4415.4482</td>
<td>0.0073</td>
</tr>
<tr>
<td>N 87-12-48.39 W</td>
<td>Dist:244.5185</td>
<td>N 5138.2926 E 4171.2208</td>
<td>N 5138.2791 E 4171.2189</td>
<td>0.0136</td>
</tr>
<tr>
<td>S 18-13-26.54 W</td>
<td>Dist:357.2116</td>
<td>N 4799.0018 E 4059.4982</td>
<td>N 4798.9849 E 4059.5068</td>
<td>0.0190</td>
</tr>
<tr>
<td>S 20-00-12.46 W</td>
<td>Dist:183.9537</td>
<td>N 4626.1479 E 3996.5655</td>
<td>N 4626.1287 E 3996.5805</td>
<td>0.0244</td>
</tr>
<tr>
<td>S 13-08-24.60 E</td>
<td>Dist:111.6234</td>
<td>N 4517.4461 E 4021.9368</td>
<td>N 4517.4279 E 4021.9563</td>
<td>0.0267</td>
</tr>
<tr>
<td>S 64-36-25.69 E</td>
<td>Dist:304.9377</td>
<td>N 4386.6690 E 4297.4079</td>
<td>N 4386.6638 E 4297.4335</td>
<td>0.0262</td>
</tr>
<tr>
<td>S 72-52-01.75 E</td>
<td>Dist:164.8099</td>
<td>N 4338.1098 E 4454.9018</td>
<td>N 4338.1127 E 4454.9299</td>
<td>0.0283</td>
</tr>
<tr>
<td>N 88-30-39.16 E</td>
<td>Dist:259.5104</td>
<td>N 4344.8388 E 4714.3249</td>
<td>N 4344.8566 E 4714.3527</td>
<td>0.0330</td>
</tr>
<tr>
<td>S 81-07-19.92 E</td>
<td>Dist:170.2861</td>
<td>N 4318.5485 E 4882.5693</td>
<td>N 4318.5768 E 4882.5988</td>
<td>0.0408</td>
</tr>
<tr>
<td>N 03-29-34.01 E</td>
<td>Dist:556.2378</td>
<td>N 4873.7507 E 4916.4945</td>
<td>N 4873.7813 E 4916.4863</td>
<td>0.0317</td>
</tr>
<tr>
<td>N 33-29-59.94 E</td>
<td>Dist:151.3195</td>
<td>N 4999.9279 E 5000.0225</td>
<td>N 4999.9646 E 5000.0051</td>
<td>0.0406</td>
</tr>
</tbody>
</table>

Angular error = 0-00-00.00
Angular error/set = 0-00-00.00 Over
Elevation error = -0.0715
Error North = 0.0354
Error East = -0.0051
Absolute error = 0.0358
Error Direction: N 08-13-56.14 W
Perimeter = 3104.8427
Precision = 1 in 86796.3070
Number of sides = 14
Area = 609290.8 sq. ft., 13.9874 Acres
The Loop report contains closure information for the traverse with selected adjustment:

<table>
<thead>
<tr>
<th>Point</th>
<th>RAW TRAVERSE Coordinates</th>
<th>COMPASS RULE - Balanced Angles Coordinates</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>N 5000.0000 E 5000.0000</td>
<td>N 5000.0000 E 5000.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>N 77-58-24.84 W 3</td>
<td>Dist:180.6510</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>N 5037.6398 E 4823.3145</td>
<td>N 5037.6410 E 4823.3140</td>
<td>0.0012</td>
</tr>
<tr>
<td>N 85-08-02.85 W 4</td>
<td>Dist:143.0986</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N 5049.7778 E 4680.7321</td>
<td>N 5049.7791 E 4680.7312</td>
<td>0.0015</td>
</tr>
<tr>
<td>N 71-04-32.12 W 5</td>
<td>Dist:173.2905</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>N 5105.9801 E 4516.8095</td>
<td>N 5105.9808 E 4516.8075</td>
<td>0.0021</td>
</tr>
<tr>
<td>N 78-36-39.07 W 6</td>
<td>Dist:103.3963</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>N 5126.3988 E 4415.4498</td>
<td>N 5126.3986 E 4415.4472</td>
<td>0.0026</td>
</tr>
<tr>
<td>N 87-12-46.06 W 7</td>
<td>Dist:244.5190</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>N 5138.2926 E 4171.2208</td>
<td>N 5138.2888 E 4171.2175</td>
<td>0.0051</td>
</tr>
<tr>
<td>S 18-13-27.60 W 8</td>
<td>Dist:357.2080</td>
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</tr>
<tr>
<td>8</td>
<td>N 4799.0018 E 4059.4982</td>
<td>N 4798.9986 E 4059.5048</td>
<td>0.0074</td>
</tr>
<tr>
<td>S 20-00-13.58 W 9</td>
<td>Dist:183.9519</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>N 4626.1479 E 3996.5655</td>
<td>N 4626.1445 E 3996.5782</td>
<td>0.0131</td>
</tr>
<tr>
<td>S 13-08-24.81 E 10</td>
<td>Dist:111.6222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>N 4517.4461 E 4021.9368</td>
<td>N 4517.4450 E 4021.9538</td>
<td>0.0171</td>
</tr>
<tr>
<td>S 64-36-27.67 E 11</td>
<td>Dist:304.9357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>N 4386.6690 E 4297.4079</td>
<td>N 4386.6843 E 4297.4306</td>
<td>0.0273</td>
</tr>
<tr>
<td>S 72-52-03.90 E 12</td>
<td>Dist:164.8091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>N 4338.1098 E 4454.9018</td>
<td>N 4338.1351 E 4454.9267</td>
<td>0.0356</td>
</tr>
<tr>
<td>N 88-30-36.80 E 13</td>
<td>Dist:259.5101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>N 4344.8388 E 4714.3249</td>
<td>N 4344.8820 E 4714.3490</td>
<td>0.0495</td>
</tr>
<tr>
<td>S 81-07-22.20 E 14</td>
<td>Dist:170.2855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>N 4318.5485 E 4882.5693</td>
<td>N 4318.6041 E 4882.5948</td>
<td>0.0612</td>
</tr>
<tr>
<td>N 03-29-33.53 E 1</td>
<td>Dist:556.2440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>N 4873.7507 E 4916.4945</td>
<td>N 4873.8150 E 4916.4814</td>
<td>0.0656</td>
</tr>
<tr>
<td>N 33-29-58.36 E 2</td>
<td>Dist:151.3208</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>N 4999.9279 E 5000.0225</td>
<td>N 5000.0000 E 5000.0000</td>
<td>0.0755</td>
</tr>
</tbody>
</table>

Area: 609272.1 sq. ft., 13.9870 Acres
The **Vertical Adjustment report** contains adjustment information for the traverse with selected vertical adjustment:

<table>
<thead>
<tr>
<th>Point</th>
<th>Raw Elevation</th>
<th>Length Weighted Distribution</th>
<th>Raw Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1000.0000</td>
<td>1000.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>3</td>
<td>990.6025</td>
<td>990.5984</td>
<td>-0.0042</td>
</tr>
<tr>
<td>4</td>
<td>979.0493</td>
<td>979.0419</td>
<td>-0.0075</td>
</tr>
<tr>
<td>5</td>
<td>960.9368</td>
<td>960.9254</td>
<td>-0.0115</td>
</tr>
<tr>
<td>6</td>
<td>954.3999</td>
<td>954.3861</td>
<td>-0.0138</td>
</tr>
<tr>
<td>7</td>
<td>952.9086</td>
<td>952.8892</td>
<td>-0.0195</td>
</tr>
<tr>
<td>8</td>
<td>962.9272</td>
<td>962.8995</td>
<td>-0.0277</td>
</tr>
<tr>
<td>9</td>
<td>965.1329</td>
<td>965.1010</td>
<td>-0.0319</td>
</tr>
<tr>
<td>10</td>
<td>966.3297</td>
<td>966.2952</td>
<td>-0.0345</td>
</tr>
<tr>
<td>11</td>
<td>971.4943</td>
<td>971.4527</td>
<td>-0.0415</td>
</tr>
<tr>
<td>12</td>
<td>974.5624</td>
<td>974.5171</td>
<td>-0.0453</td>
</tr>
<tr>
<td>13</td>
<td>983.3547</td>
<td>983.3034</td>
<td>-0.0513</td>
</tr>
<tr>
<td>14</td>
<td>987.2983</td>
<td>987.2430</td>
<td>-0.0552</td>
</tr>
<tr>
<td>1</td>
<td>995.3320</td>
<td>995.2639</td>
<td>-0.0681</td>
</tr>
<tr>
<td>2</td>
<td>1000.0715</td>
<td>1000.0000</td>
<td>-0.0715</td>
</tr>
</tbody>
</table>

The drawing will display a warning dialog if user specified tolerances have not been met. Pressing **OK** from this dialog (if present) advances through the process and the survey database is updated. Since both the network and survey points are set to update automatically the survey network object and points in the drawing will update to reflect the change.

Verify that the Survey Points in the drawing are set to update automatically by checking the **Automatic Update** setting made earlier. If the check mark seen in Figure 2.22 is not present, force an update of the Survey points by using **Points → Update** as seen in Figure 2.22.

Verify that the points in the drawing have updated to the change in the network object as seen by the concentric circles on point 11 seen in Figure 2.23.