

# Using Autodesk Civil 3D in a Multiuser Environment

When adopting new software there are many things to consider, such as interoperability with other software applications and the ability to share data. Longtime Softdesk/Autodesk® Land Desktop software users have been accustomed to the project structure in those products, which made it easy to share design data with other users. Land Desktop provided the flexibility to work in a multiuser environment.

## Introducing Autodesk Civil 3D

In Autodesk® Civil 3D® software, gone are the project structures of old, causing some users to wonder how they are going to share design data. Not to worry. Civil 3D provides the ability to store and share design data by using projects and shortcuts. These methods are completely different from the way Autodesk Land Desktop projects handled design data, and because of that Civil 3D is able to address problems that Land Desktop could not.

## Process Problems That Autodesk Civil 3D Addresses

Autodesk Civil 3D 2006 addresses the following process problems:

- Multiple users need to be able to reference project data simultaneously. For example, an alignment may be used by designers focusing on profile, pipe, and parcel elements in a design.
- Users should need to maintain only one master version of core project data. This master version of a surface, alignment, profile, or point file should then be referenced in other drawings.
- Users need the ability to graphically represent data differently based on production requirements. For example, a proposed grading plan needs to display contours differently than the utilities or parking sheets in a plan set.
- Users need to be able to work in a dynamic environment. In other words, if the master alignment changes, any drawings that reference this alignment should update automatically.

Although it's true that Autodesk Land Desktop has always provided a solid solution for the first three process issues, it never provided a dynamic approach. In other words, if the alignment changes in Land Desktop, there is nothing in the system that automates the updating of any other drawings that use that alignment.

In contrast, Autodesk Civil 3D addresses all the preceding process issues. If the master alignment changes, any references to that alignment are also updated. In the Civil 3D environment, all labeling and downstream design elements in the project update automatically.

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Autodesk Civil 3D addresses these problems through *projects* and *shortcuts*. Projects are where users store design data that they want to share with other users. Shortcuts are how the design data is stored in the project. A shortcut is simply an XML file that references the original drawing along with the design data in the drawing. Other users create a reference to this shortcut to access the data.

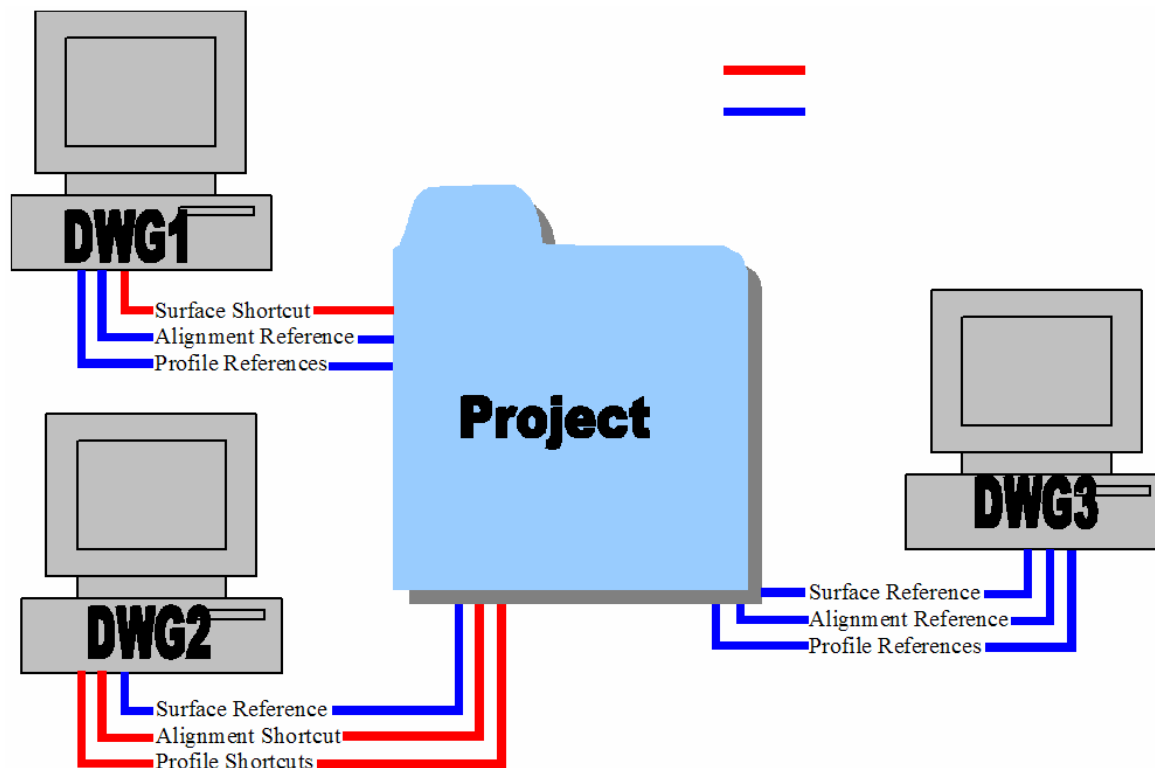
### Autodesk Civil 3D Shortcuts: The Basics

Whether designers are working as a member of a large project team or as a single user creating multiple drawings on a project, they need to be able to share core data across multiple drawings and with other users. The ability to share core project data is now possible in Autodesk Civil 3D 2006.

Through shortcuts, users can add surfaces, alignments, and profiles (both existing ground and finished ground) to a project and then share them with other users. Surfaces can also be managed using projects, a methodology first introduced in Autodesk® Civil 3D® 2005. This concept is covered later in this document.

### How Shortcuts Work

Shortcuts are like xrefs in that users have a master drawing of each data object. For example, after a surface is created, the user can create a shortcut that is accessible to anyone else working on that project. Another user can now create an alignment and a profile based on a reference of the surface shortcut. This alignment and profile, which exist in a different drawing, can then be added to the project by creating a shortcut to each object. A third user can then create references to all three design objects and design a corridor. Whenever the design data is altered in the master drawing, a popup message appears in every drawing that references that object. Edits can be made only in the master drawing. In the following diagram User 1 is the only user who can edit the surface, and User 2 is the only user who can edit the alignment and profiles. In drawings that references the shortcut, users can change the object's appearance or run reports but cannot edit the object.



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Here is an example of how shortcuts are used:

1. User 1 creates a new drawing, saves it, and then attaches it to a project. After attaching it to a project, the user builds a surface. The user then saves the drawing and creates a shortcut of the surface.
2. User 2 creates a new drawing, saves it, and attaches it to the same project as User 1. Once the drawing has been attached, the user can see that there is a surface shortcut in the project. User 2 creates a reference to this surface in the new drawing. After creating a reference to the surface, User 2 creates an alignment. An existing ground surface profile and then design (layout) profile can then be created from the new alignment and the referenced surface. At this point, the user can create shortcuts for the new alignment and profiles so that others can share this design data.

**Note:** The project now contains a surface shortcut, an alignment shortcut, and profile shortcuts that anyone working on the project can use.

3. User 3 creates a new drawing, saves it, and then attaches it to the same project. Once the drawing has been attached, the user sees that there is a surface, an alignment, and Existing and Proposed profile shortcuts. User 3 creates references for all shortcuts in their current drawing. At this point, User 3 can see all these objects in the drawing (using any style) and can begin designing a corridor model and a pipe network. Note that because these objects are referenced, the user cannot edit the surface, alignment, or profile objects.
4. User 1 refreshes the project in the drawing and sees that there are now shortcuts for an alignment and surface and design profiles. User 1 can choose to reference these objects if they are needed in the original ground surface drawing. For this example, assume that the user has done this to double-check the surface model by looking at the existing ground profile.

At this point, assume that some part of the design changes. Either the surveyor determines that the surface needed to update, or the designer needs to make a change to the alignment.

5. User 2 determines that the design alignment needs to change based on some new design constraint. To do this, User 2 loads the source alignment drawing to make these edits. As part of the process of editing the alignment the existing and proposed profiles also change. Once the edits are made, User 2 saves the drawing.
6. As soon as User 2 saves that drawing, anyone who is referencing objects that have changed will be notified that they are out of sync. In this case, User 1 and User 3 are both referencing the alignment created by User 2. Since the alignment has been edited, each user sees a message box stating that the alignment has changed and is prompted to update the current drawing. By choosing to synchronize to the project, the alignment updates. This means both users see updated alignments and profiles. In the case of User 3 (designing the corridor model and pipe network), the corridor design dynamically reacts to the changed alignment and profile.

Because the annotation is derived directly from the objects, all annotations update automatically.

### Storing Shortcuts

Shortcuts are stored in an XML file in the project directory (under the data type). For example, an alignment shortcut is located under the alignment folder in the project. This XML file contains information used to link references to the source object. This information includes the drawing name and path, object name and type, and limited display property information from the source. The following graphic shows a sample XML file with shortcuts.

<Shortcuts>

```
= <Shortcut name="C:\Civil 3D Drawings\project test
2.dwg:Alignment - (1)">
```

```
= <Criteria>
```

```
<File name="C:\Civil 3D Drawings\project test
2.dwg" />
```

```
<Object type="AeccDbAlignment" useType="-1"
name="Alignment - (1)" useName="0"
version="0" useVersion="0" handleLow="5552"
handleHigh="0" useHandle="-1" />
```

```
<DisplayProperties layer="C-ROAD" useLayer="0"
color="1" useColor="0" lineType="ByLayer"
useLineType="0" lineWeight="-1"
useLineWeight="0" />
```

```
</Criteria>
```

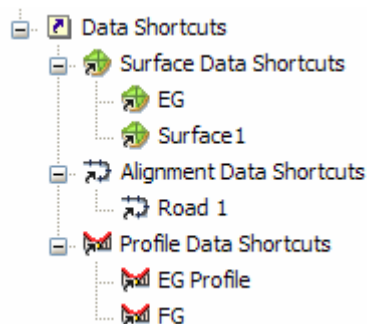
```
</Shortcut>
```

```
</Shortcuts>
```

**Note:** Autodesk recommends that only the CAD manager or an experienced team member manually edit the shortcut XML file. One situation that requires manually editing the shortcut XML is if the source drawing location has changed. In this case, the path must be edited manually to reflect the new drawing path.

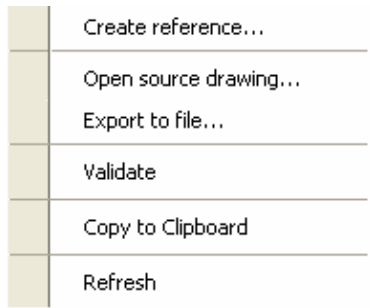
## Managing Shortcuts

Users do not need to open the shortcut XML file to find the name of the source drawing or verify the integrity of a shortcut or reference. This information is accessible in the interface, accessed by choosing Data Shortcuts>Edit Data Shortcuts from the General menu. The Data Shortcuts tab is displayed in the Autodesk Civil 3D Panorama window. This interface displays key information about the shortcut.




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To open the source drawing so that you can edit the source object directly, right-click the desired shortcut and choose Open Source Drawing from the context-sensitive menu.



Once the source drawing is open, you can edit and save the objects.

### Resolving Invalid Shortcuts

An icon  next to a shortcut indicates an invalid shortcut. Generally, a shortcut is invalid for one of the following reasons:

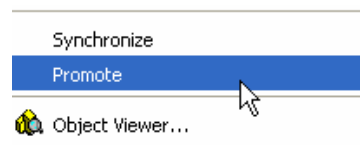
- The source drawing cannot be found.
- The source object cannot be found in the source drawing.
- The XML file cannot be found.

Choosing Validate from the popup window helps resolve this situation.

**Note:** If the source drawing has moved, you need to either manually edit the shortcut XML file to show the new location or move the drawing back to the original path. If the shortcut object no longer exists, you will need to re-create the shortcut object (with the designated drawing name and path).

### Editing an Object Without Updating All Reference Drawings

There are instances when you may want to create a permanent, nonlinked, fully editable copy of the reference in your drawing. Because you lose the dynamic link between source and reference objects once this is done, you should carefully consider whether this is the correct approach. If you determine this is needed, you can promote the object, which breaks the link with the source drawing and creates an editable version of the object in the current drawing. To promote an object, right-click the object in the current drawing and choose Promote from the context-sensitive menu. A new, editable object is created in the current drawing.



### Limitations of Data Shortcuts

Alignment and profile shortcuts need to exist in the same drawing in Civil 3D 2006 to make full use of these data types downstream in a project. You will need to consider this as you begin breaking up your project effort. For example, if you want to create a new drawing where you will be developing a corridor model, the alignment and profile will need to have been created and then referenced in a single drawing. However, if the profile data is not going to be referenced, then it is acceptable to have the profile in a separate drawing.

There are currently no shortcuts available to add corridor models, sections, parcels, grading objects, or pipe networks to a project. However, several workarounds address this limitation. First, users can insert xrefs, which gives them the ability to see the data but not edit it. Second, if users need to access the properties of objects that cannot be added to a project,

they can open a drawing in read-only mode. They can view the properties of any object but not save changes. Last, they can insert another drawing into their own drawing and the objects will come across with the drawing.

Limiting data shortcuts to two per drawing can help avoid problems down the road. In other words, having one drawing serve as the source for all surfaces can cause problems because only one person can edit the surfaces at any given time. However, if each surface is in a different drawing, then multiple users can edit different surfaces. The same is true for alignments. Keep the alignment and its associated profiles in the same drawing, but try to create different drawings for different alignments if possible. Shortcuts give the user the ability to view all the other alignments and profiles if necessary.

### **Autodesk Civil 3D Projects: The Basics**

As mentioned earlier in this paper, Civil 3D 2006 includes additional project support for Points and Surfaces. Surfaces can be shared using the Shortcut mechanism discussed earlier in this piece, which results in two separate multi-user options that you can choose to use. The Project support listed in this section provides far more control over the use, protection and management of surfaces. You will also find that this expanded control results in a more complex set of steps needed to run the program. This should be considered when determining the way that you will implement Civil 3D in production work. Conversely, points are not currently supported with Shortcuts, so the project support described in this next section should be used.

### **Autodesk Land Desktop Projects Versus Autodesk Civil 3D Projects**

Autodesk Land Desktop software has always created a large directory structure that worked well for the average user but could cause problems for larger firms. In contrast, Autodesk Civil 3D creates only a couple of directories and stores the data in individual files. A Land Desktop surface could have eight or more files that belong to one surface. In Civil 3D that surface is stored in one file. It is also easier to define the project location in Civil 3D than in Land Desktop.

In Autodesk Land Desktop adding design data to a project is automatic. In Autodesk Civil 3D, however, the new project structure requires that you add data to the project manually. This shift in methodology requires a subsequent shift in the way users think about structure, but the benefits quickly become clear.

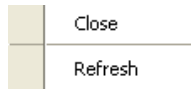
For example when working on a large project in Land Desktop users may have 20 or more surfaces in one project. Many of those surfaces are just building blocks that are useless to most other users on the project team. But because all 20 surfaces are in the project, other users working on the project see all 20 surfaces. The Civil 3D concept enables users to add only the surfaces that other users need. This in itself eliminates some of the guesswork of working in a multiuser environment. In Autodesk Civil 3D 2004 and 2005 you could use this concept with surfaces, points, and point groups.

Many users have had the experience of creating points just for building a surface or setting something out. In Autodesk Civil 3D users add only the points they think other team members will need and keep the others in their current drawing. They can always add them later if needed.

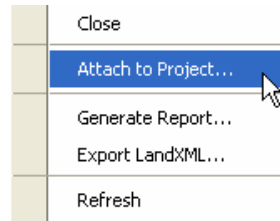
### **Getting Started Using Autodesk Civil 3D Projects**

Autodesk Civil 3D does not automatically create a project. You can use the software without ever creating a project, but doing so makes it difficult to share data with other users. To work with Civil 3D projects, users must first create a project in the Toolspace. Once a project has been created, every drawing that needs to add or access project data must be attached to the project. Note that before a drawing can be added to a project, it must be saved. The Attach to Project option is not available if the drawing hasn't been saved.

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Pop-up without saving a drawing



Pop-up after saving a drawing

After attaching a drawing to a project, users can then add individual items to a project. These items are limited to points, point groups, and surfaces in the 2004 and 2005 versions.

### Project Data Security

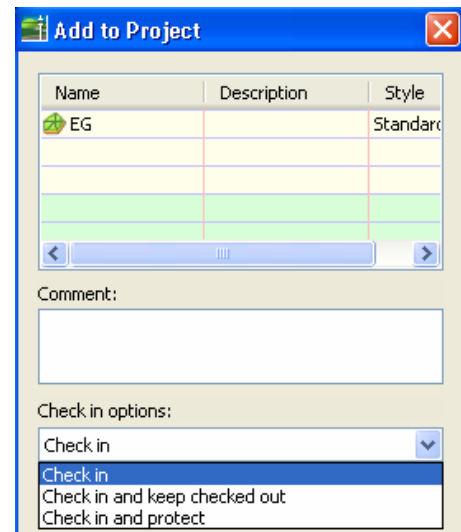
The subject of security is where Autodesk Civil 3D leaves Autodesk Land Desktop behind. In Land Desktop users could lock points, but any user familiar with the software could always unlock them. Also in Land Desktop a user could not edit a surface if another user was accessing it, but this wasn't an effective security mechanism. As soon as the user was no longer accessing a surface, someone else could edit it. Civil 3D offers a much better solution.

Users have three options for adding data to a project. Just right-click the project data you want to add, and choose Attach to Project. A dialog box displays several check-in options.

**Option 1: "Check In"**—Enables the user to add data to the project. Adding data to a project creates a *project object*. By choosing this option, the user relinquishes rights to the object and enables other users check it out and edit it. In addition, it locks the object in the current drawing.

**Option 2: "Check In and Keep Checked Out"**—Enables the user to add the data to the project but keeps the object checked out. Other users can now access the object in their own drawings but cannot edit it. The object can only be displayed or queried.






**Option 3: "Check In and Protect"**—Updates the project object but protects the object from being edited by other users. Any user can view the object but must unprotect it before any edits can be made.






All three options work on a first-come first-served basis.

After data has been added to a project, icons appear next to the item in both the drawing tree and the project tree. These icons indicate the current status of each data object.

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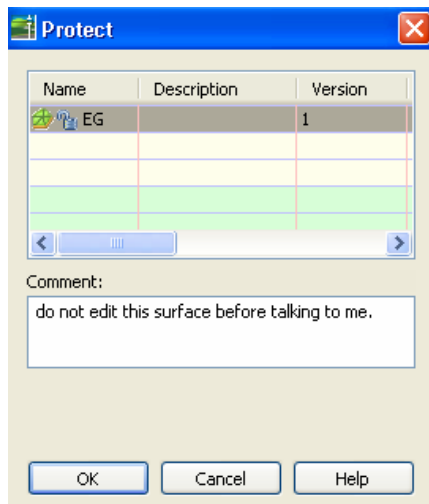
-  Object is checked in.
-  Object is checked out.
-  Object is checked out to a drawing other than the active drawing.
-  Object is protected and cannot be changed.
-  Object belongs to a project that could not be found

In addition, the software includes drawing icons, as follows:

-  Object is locked.
-  Object is being referenced by another object.
-  Object is referenced to another object in another drawing.

Depending on the icons displayed by each object, users have different options on what they can do to the data. If another user or drawing has an object checked out, then the current user or drawing can display the object but can't edit it. The user can, however, use the data to perform different tasks. For instance, if a user brings in points from a project that were already checked out to another user, this user could still build a new surface using the points. An individual object can be edited only if it is checked out.

Even if an object is not checked out it still can be protected so other users cannot inadvertently make edits. When checking in objects or protecting them, users can attach notes to the object. If other users get that object from the project, they can look at the object properties to see these notes along with the user who created them. This in itself is a major improvement over Autodesk Land Desktop. Users can track changes to a surface. For instance, if a user edits an existing surface and then checks it back into the project, the user can add a note explaining the changes.



Project item history:

| Status    | User   | Date         | Comment                  |
|-----------|--------|--------------|--------------------------|
| Protected | robert | 4/23/2005... | do not edit this surface |
| Created   | robert | 4/23/2005... |                          |

## Conclusion

Autodesk Civil 3D 2006 offers a very powerful set of tools that enables production sharing of project data between multiple users and multiple drawings. Customers should pay close attention to the Shortcut and Project functionality included in the product so that they can begin sharing the dynamic Civil 3D model throughout the project team. As not all data types are supported (points, surfaces, alignments and profiles), there are processes that you will want to consider such as use of xrefs that you will also need to integrate into your production design and drafting process. Understanding the basic concepts of shortcuts will help you define a process of data sharing that suits your company's workflow. Therefore, we strongly recommend that you invest learning and training energy on this subject.



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