Best of Both Worlds: Autodesk® Land Desktop and Autodesk® Civil 3D®

Anthony Governanti - Autodesk

CV13-3  This lecture will go through a subdivision design project from concept through final design, and to the creation of construction documentation using tools in both Civil 3D 2006 and Land Desktop. We will discuss how to leverage new interoperability tools to integrate project data from Civil 3D and Land Desktop, and vice versa. This class is designed for civil engineers and technicians who want to take advantage of the new Civil 3D technology while still maintaining a high level of efficiency and billable time in a familiar Land Desktop environment.

About the Speaker:
Anthony is currently the technical marketing manager at Autodesk specializing in civil engineering applications for the Infrastructure Solutions Division. This will be Anthony's third year presenting at Autodesk University. He has also taught technical classes and sessions for large Autodesk resellers and sales events. Anthony has close to 8 years of civil engineering experience, and worked in the industry as a CAD technician designing and producing production plans for subsurface and athletic field projects. During his 5 years at Autodesk, he has also served as an applications engineer and a product support analyst.

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Introduction

Autodesk Civil 3D 2006 is the latest offering from Autodesk for the Civil Engineering industry and offers a true model-based design application. When Civil 3D was released in 2005, it was the first Civil Engineering Design software that used the concept of a dynamic engineering model. This model allows the objects that represent design elements such as alignments, profiles, pipe networks, roadways and site grading to react with each other in a dynamic environment so that if a change is made to one of them; say the alignment, that change is “rippled” throughout the rest of the design.

The exploded diagram to the right demonstrates how the model based system in Civil 3D works. An original ground surface is built from point data representing the field conditions. Parcels, alignments, corridors, and pipe networks can then use the original ground as a reference for their design. When and if any of the data elements in the model change, all elements upstream of it will be updated, in most cases dynamically. For example, make a change to the alignment, and the corridor, pipe network and finish ground surface update as well.
With the release of Civil 3D 2006, a close to 1:1 feature parity was reached when compared to Land Desktop and Civil Design. The distinction that Civil Design be part of this comparison is worth noting, because civil engineers who use Land Desktop rarely do it without Civil Design installed as well. For the purpose of this paper, whenever Land Desktop is mentioned it is assumed that Civil Design is included with it.

When looking at Civil 3D and Land Desktop, it is beneficial to break out the major feature groups to get a better understanding of how they compare. The following table compares the major features of Land Desktop, Civil Design, and Survey with the two versions of Civil 3D that have been released so far. We can see that with Civil 3D 2006 the only functionality that is missing is Hydrology and Hydraulics. We can also see that it offers some basic Survey functionality as well. With this comparison we can begin to develop a set of workflows for Land Desktop and Civil 3D being used together to complete an entire project.

<table>
<thead>
<tr>
<th>Feature Group</th>
<th>LDT</th>
<th>LDT / Civil Design / Survey</th>
<th>Civil 3D 2005</th>
<th>Civil 3D 2006</th>
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<tbody>
<tr>
<td>Multi-user project environment</td>
<td>YES</td>
<td>YES</td>
<td>Limited</td>
<td>YES (DTM, Align, Profiles)</td>
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<tr>
<td>Points/COGO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Surfaces/Volumes</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Alignments</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Parcels</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Survey Analysis, Import, Drafting</td>
<td>No</td>
<td>YES</td>
<td>No</td>
<td>Limited – with partner apps</td>
</tr>
<tr>
<td>Grading</td>
<td>No</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<td>Profiles</td>
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<td>Road Modeling</td>
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<td>Pipes Layout and Drafting</td>
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<td>Hydrology and Hydraulics</td>
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<td>Limited</td>
<td>No</td>
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<td>Dynamic Engineering Model</td>
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<td>Style-Driven Environment</td>
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<td>Interactive Visualization</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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Sample Workflows

Below we have several workflows that outline how Land Desktop and Civil 3D could be integrated together from a process standpoint. We can use these workflows to help decide how and when we can begin to take advantage of Civil 3D in our current day-to-day processes. These workflows have been broken down into categories based on how much Civil 3D functionality is used to complete a typical civil engineering project.

Using all Civil 3D features on a project
The first workflow to look at is probably the one most Land Desktop users will eventually get to when they begin to adopt Civil 3D 2006 in a production environment.

We start by importing and analyzing field data using Land Desktop and Survey (as seen on the left side of the diagram). We then build the existing surfaces, as well as the base plan to work from for the design. Next we move the project data...
into Civil 3D, where with can do our preliminary design, iterate through that design, create our initial pipe networks, parcels, alignments, profiles, roadways (corridors) and cross sections. We can then move data back to Land Desktop or go to a 3rd party application when we need hydraulic and hydrology calculations. We finalize the project in Civil 3D and create construction documents there.

**Using just alignment and parcel layout tools in Civil 3D**

Depending on the level of comfort you have with Civil 3D, or the current state of your projects, you may not want to fully commit to using all of Civil 3D just yet. If this is the case, you do have the option to use certain features of Civil 3D for specific parts of the project and then come back to the Land Desktop environment to finish out the project. Below we have several alternative workflows that use specific features of Civil 3D with Land Desktop.
In this workflow, we’re using Civil 3D in a much more limited manner. Our base plan still starts in Land Desktop and Survey, but we are only doing our Preliminary Alignment and Parcel design in Civil 3D. Because the alignment and parcel features in Civil 3D are easy to use, and allow for multiple design iteration quickly and efficiently, we’ll use these tools as an alternative to the ones included in Civil 3D. We then take those designs back to Land Desktop to complete the project.

Using most of Civil 3D for design except for pipes

In this workflow, we use most of Civil 3D for the design but go back to Land Desktop to create the Pipe networks, and do the Hydraulic design and analysis. Again, like with alignments and parcels, the tools in Civil 3D for profiles, roadway design, and pipe networks allow for dynamic design iterations, and thus offer a distinct advantage to some of the more static tools in Land Desktop.
Using just Civil 3D for design

This last scenario cuts Land Desktop out of the workflow all together and uses features in Civil 3D to complete a project with the help of a 3rd party for hydraulics/hydrology calculations. Civil 3D has three Survey add-ons; Carlson Connect, Trimble Link, and Leica Exchange. These add-ons allow you to import field data directly from a wide range of devices in the form of points and breaklines from which surfaces can be created.

Civil 3D is built on components of Autodesk Map 3D 2006 which contain data import tools. The combination of the survey tools, and the data import tools allows Civil 3D to stand alone in the design process, where we can again take full advantage of the dynamic environment to iterate through multiple designs.
Integrating Civil 3D with Land Desktop

Now that we’ve reviewed several ways you can integrate the workflows of Land Desktop and Civil 3D together to complete projects, let’s take a hands on look at how this is done. There are two components to this integration; the ability to move project data between the two applications, and the ability to open drawings created in either application.

Importing data from Land Desktop

Civil 3D has simple tool that allows us to read a Land Desktop project database directly into a drawing, and extract the data we need from it.

1. In Civil 3D, open the “C:\Civil 3D Projects\CV11-2\dwg\LDT_Baseplan-C3D.dwg”

2. From the General menu, select Import Data from Land Desktop…

We’ll start by simply opening the LDT drawing in Civil 3D directly.

3. Select the Browse button for the Land Desktop Project Path

4. Browse to C:\Civil 3D Projects\CV11-2

5. Select “CV11-2” as the project

This dialog allows us to browse to any Land Desktop project and select the data contained in it to import into the Civil 3D drawing. We can import Description Keys, Surfaces, Alignments, Profiles, and Parcels. We not only get the data definitions, but we also get the new Civil 3D drawing objects that represent them.
6. Select OK

7. Select OK to the message that data was successfully migrated

As you can see we have two Surfaces, an Alignment, and a Parcel that were imported and converted directly from the Land Project database. This drawing also contains some cogo points that need to be converted as well. To do this, we'll use a conversion utility that Autodesk released right after both Civil 3D and Land Desktop 2006 were released.

8. Zoom into one of the LDT point objects

9. From the Points menu, select Utilities > Convert Land Points

Here we are presented with several options for how the Land points are converted to Civil 3D points. Note that we can define the default layer for all the points, as well as the Styles and naming the new Civil 3D points will use. Lastly we can choose to put the new points into a group for management purposes.

10. Select OK to accept defaults
We now have the entire base plan data from the project converted and imported to a Civil 3D drawing, and can start to use the tool included in Civil 3D to design the rest of our subdivision, or whatever project we’ve chosen to migrate to Civil 3D.

This importing of data directly from a Land project ensures that the data is accurate, and expedites the building of a base plan in Civil 3D from data we created in Land Desktop. It also allows us to continue to use the tools we are familiar with in Land and Survey to convert and analyze field data while taking advantage of the design tools in Civil 3D.
**Extract Civil 3D in LDT**

To complete the integration of Land Desktop and Civil 3D, it is necessary to be able to bring data from Civil 3D back into a Land Desktop project. This is facilitated with the Extract Civil 3D data tool in Land Desktop.

**Note:** The versions of Land Desktop and Civil 3D have to be the same in order for this tool to work. You can use LandXML to export the data to an older version of Land Desktop if you are working in a mixed version environment.

1. Open Land Desktop
2. When prompted for a drawing, select the Open… button
3. In the *Open Drawing: Drawing based* dialog select Browse
4. Browse to `C:\Civil 3D Projects\CV11-1\dwg\` and open *Civil 3D Design.dwg*
5. From the Projects menu, select Extract Civil 3D data

The Extract Civil 3D Data feature allows us to specify the data we want to extract from the drawing, and the destination project for that data. In a typical workflow, you would be extracting back to the same project you imported from in the previous section. Simply select the path and project name in the window, and then check or uncheck the data needed.

6. In this case, we will not re-import the same data from the baseplan, so uncheck the following items:
   a. Points
   b. Description Keys
   c. Existing Ground
   d. Ledge
   e. Cherrywood Drive – ET
7. Select OK
We have successfully extracted the new design data from the Civil 3D drawing into a Land Desktop Project.
Using Civil 3D

For the purpose of this class, we will not be going too in-depth with the tools and features of Civil 3D, but we have provided a set of hands-on exercises and a data set to use that will take us step-by-step through the design of a small subdivision. Please refer to the AU download site for this class to obtain the dataset; Civil3D2006TrialExercises.zip. Alternatively you can visit www.autodesk.com/civil3d-trial and download the exercises as well as view other important information to first time users of Civil 3D.

Conclusion

By now we hope you can see the value that Civil 3D 2006 can offer to civil engineers, designers, and technicians in their day-to-day operations, and that you can use Land Desktop and Civil 3D together as an integrated solution. We've reviewed several workflows for using the two applications together, as well as gone through the mechanics of imported and extracting data between the two.

We also hope you take away some key points from this class as well.

- Civil 3D is an exciting new technology from Autodesk, Inc.
- Land Desktop and Civil 3D can be used together to aid in the adoption of this new technology
- There are several workflows that can be applied to using LDT and Civil 3D together
- The tools included in LDT and Civil 3D for exchanging data are easy to use and ensure data accuracy