hat are GIS Skills?

Many engineers are familiar with the powerful set of editing tools provided by AutoCAD®, but have little experience with GIS applications and little time to learn them. If you have opened this book, you are probably an engineer or skilled drafter who knows AutoCAD very well. You may also know something about AutoCAD® Map 3D from previous releases. However, you may be less familiar with tasks that come under the heading of "GIS." The goal of this book is to help you take your GIS skills to another level.

Many engineers are being asked to take on more GIS tasks, often because of changes in departmental processes or because there are too few specialists who have been trained in GIS applications. So what are GIS skills? How are they different from the engineering and drafting skills that you already have?

GIS skills or tasks are primarily data-oriented, being concerned with tasks such as data preparation and cleanup, data management, and data sharing. These tasks also tend to be feature-oriented, dealing with real-world objects such as roads and parcels rather than geometric entities such as polylines and polygons. They may deal specifically with feature data that is kept in a central data store, such as an Oracle® database or SDF files. They may deal with geo-referenced data that is stored in DWG format. Or they may involve working with both feature data and DWG data.

This book collects together the most common and/or most important of these skills, and groups them together so that they are easy to learn.



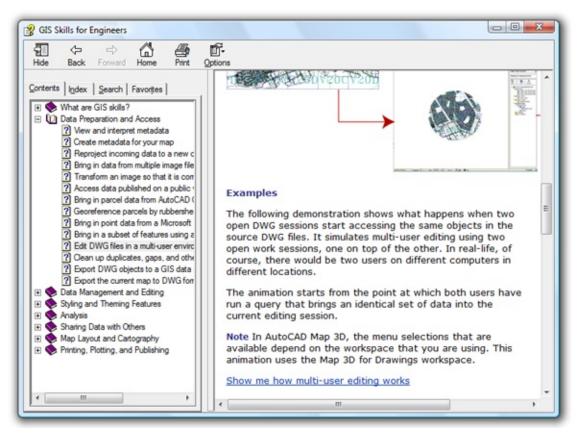
Topics in this section

- <u>How to use this book</u>
- <u>Understanding DWG objects and GIS features</u>
- <u>Other learning resources</u>
- <u>Complete list of animations</u>



low to use this book

This book introduces each skill with some conceptual information that will help you to understand why you would want to learn that particular skill. It also explains the circumstances in which you would use it. Each skill is accompanied by one or more "Show me" animations that demonstrate how to do that task. The links to the animations look like standard web-page links, as shown in the illustration below.



When you click a link, the animation starts in the same window. Each animation has its own set of controls to stop, pause, rewind, and so on. Make sure that the sound on your computer is turned on so that you can hear the "clicks." When you have finished viewing the animation, click the Back button at the top of the Help window to return to where you were.

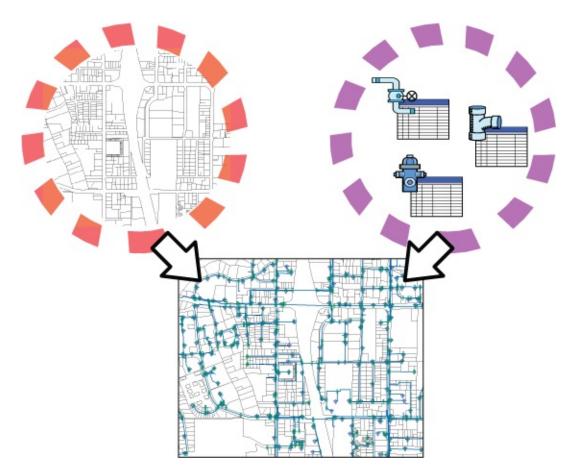
Note In AutoCAD Map 3D, the menu selections that are available depend on the workspace that you are using. All animations use the Map 3D for Geospatial workspace, unless otherwise specified.

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nderstanding DWG objects and GIS features

Throughout this book, you will see a distinction between "DWG objects" and "features." For example, you may see sentences like "import SDF features to DWG objects" or "create new features from existing DWG objects." It is very important to understand this distinction. AutoCAD Map 3D works with both DWG objects and with GIS features. GIS features look like DWG objects, in the sense that they are displayed on the screen as lines, polygons, and points, but they are completely different in the way that they are stored, accessed, and managed. Here are some of the most important differences.

- DWG objects (such as the parcel geometry on the left in the illustration below) are physically stored in the DWG file as geometric entities: lines, polylines, etc. Features are stored in a database or a database-like file and are only referenced in the DWG file.
- DWG objects are added to the map by drafting or by importing geometry from other files. Features are added by drafting or by connecting to a data store.
- DWG objects such as polylines or points can represent anything. Features always represent a specific class of objects in the real-world, such as the pipes, valves, or hydrants shown in the illustration.
- DWG objects are organized by layers which are listed in the Layer Properties Manager. Features are organized by layers which are shown in the Display Manager task pane.
- DWG objects have properties that define their styling, such as color, linewidth, and so on. Features have no inherent styling. Instead they are styled after they are brought into the DWG.



The reason it is important to understand these differences is that there are commands in AutoCAD Map 3D that work on features but not on DWG objects (and vice-versa). For example, most of the skills in this book apply only to features, because the assumption is that you are already familiar with DWG objects. However, we have included some skills that deal with DWG objects, partly for the sake of completeness, and partly to provide you with essential AutoCAD Map 3D skills if you are a new user or if you are making the transition from AutoCAD.

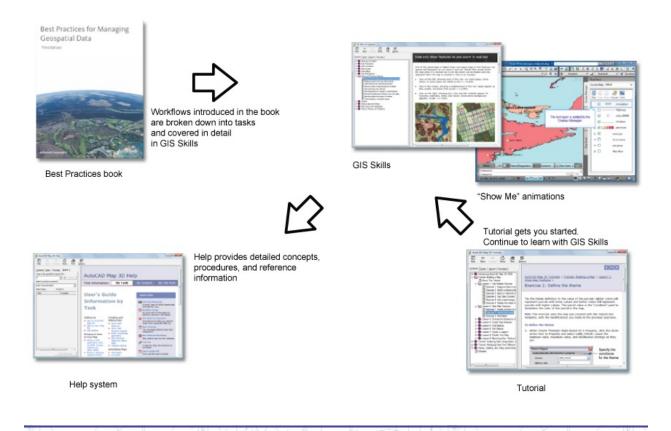


ther learning resources

For concepts and workflows, for example, for the answer to questions such as "What is a feature class?" or "What is FDO?" refer to the book *Best Practices for Managing Geospatial Data*. The Best Practices book is available as a printed book and in PDF format (from the Help menu in AutoCAD Map 3D).

To learn the most important features of the program using realistic sample data, work through one or more of the tutorials, which you can also access from the Help menu.

For answers to questions while you work, use the search feature of InfoCenter, which references all available documentation. Or open the separate Help files for AutoCAD Map 3D and AutoCAD.



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omplete list of animations

This page lists all of the animations from all of the skills in the book, so that you can browse through them easily.

Data Preparation

Show me how to view and interpret metadata Show me how to create and edit metadata Show me how to set a map to the coordinate system of the data Show me how to assign a coordinate system to my map Show me how to bring in data and reproject it Show me how to georeference parcels by rubbersheeting Show me how to clean up errors in my data

Data Conversion

Show me how to export DWG objects to SDF

Show me how to import SDF features to DWG objects

Show me how to export styled DWG objects

Show me how to view the contents of the SDF file

Show me how to export the current map to DWG format

Show me how the map looks after conversion to DWG format

Data Access

Show me how to bring multiple image files onto a single layer Show me how to insert an image using a guide Show me how to transform an image

Show me how to bring in data from a web server using WMS Show me how to convert a parcel to simple geometry Show me how to bring in data from Autdodesk Civil 3D Show me how to bring in point data from an ODBC database Show me how to run a query on a set of attached DWG files Show me how to run a query on a feature class

Data Editing

Show me how multi-user editing works Show me how to draft a new feature for an existing feature class Show me how to edit features stored in a database or data store Show me how to edit features using automatic check-out Show me how to split a parcel feature Show me how to create new features from existing AutoCAD objects Show me how to check out features for editing in the field Show me how to check in features after editing in the field Show me how to make the Data Table transparent Show me how automatic zoom works Show me how automatic scroll works Show me how to export records for selected features

Data Management

Show me how to create a new SDF file and import a schema Show me how to copy data from one data store to another Show me how to append a feature class to an SDF file Show me how to delete properties in the Schema Editor

Show me how to limit what can be entered in a field

Show me how to join attribute data to features

Show me how to manage joins

Show me how to create a calculated field

Styling and Theming Features

Show me how to make a layer visible only at a certain scale range

Show me how to create a second scale range for a road layer

Show me how to replace points with symbols

Show me how label features

Show me how to label features with automatic resizing

Show me how to set the number of decimal places for labels

Show me how to create a text layer and add text

Show me how to edit text

Show me how to rotate text

Show me how to make the features on a layer semi-transparent

Show me how to theme a parcels layer

Show me how to manually adjust the ranges of a theme

Show me how to exclude zero values and change colors for the ranges

Show me how to theme based on individual values

Analysis

Show me how to color surfaces based on elevation

Show me how to adjust the settings for hillshading

Show me how to delete elevation ranges and change the color of a range

Show me how to add a new elevation range

Show me how to view and navigate in 3D

Show me how to exaggerate the vertical dimension of a surface

Show me how to drape layers on a surface

Show me how to perform a slope analysis of a surface

Show me how to create a contour layer from a surface

Show me how to create a network topology

Show me how to load a topology

Show me how to find the shortest path between two points

Show me how to do an overlay analysis using two topologies

Show me how to create a buffer zone around a parcel

Show me how to use a buffer zone to select parcels

Show me how to create overlapping buffer zones

Show me how to use a location query with multiple buffers

Sharing Data with Others

Show me how to export a layer to SDF Show me how to import a layer from SDF Show me how to save a layer to a .layer file

Show me how to drag .layer files into an existing map

Map Layout and Cartography

Show me how to manage layers with draw order and folders Show me how to include an AutoCAD layer in the Display Manager Show me how to place a legend in the map and specify its contents Show me how to edit the table style for the legend Show me how to remove rows and border lines from the legend

Printing, Plotting, and Publishing

Show me how to publish a map to a MapGuide server

Show me how to create a map book

Show me how to publish a map book with attributes to a DWF file

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ata Preparation

This chapter shows you how to collect the data you need for a project, assign a coordinate system, and make sure that the data is clean and accurate.

Topics in this section

- <u>View and interpret metadata</u>
- <u>Create metadata for your map</u>
- <u>Reproject incoming data to a new coordinate system</u>
- <u>Georeference parcels by rubbersheeting</u>
- <u>Clean up duplicates, gaps, and other accuracy problems in DWG files</u>



The first phase of many GIS projects is data acquisition. In this phase, you collect the data that you need for your project from various sources. For example, you may need to begin with a parcel map from a central database or a set of files containing infrastructure such as pipes or roads. Sometimes, you may need to browse for data that has been posted by government departments on the Internet. When you acquire data from different sources and share data between different departments, it becomes important to have good descriptions of that data. In the GIS context, information that describes geospatial data sets is called metadata.

Metadata is usually stored in a separate "read-me" text file or xml file that accompanies the data source. Often you will want to look at the metadata to see whether that data is appropriate for your purposes or not. Metadata is divided into several categories. A metadata file will typically contain some or all of the following:

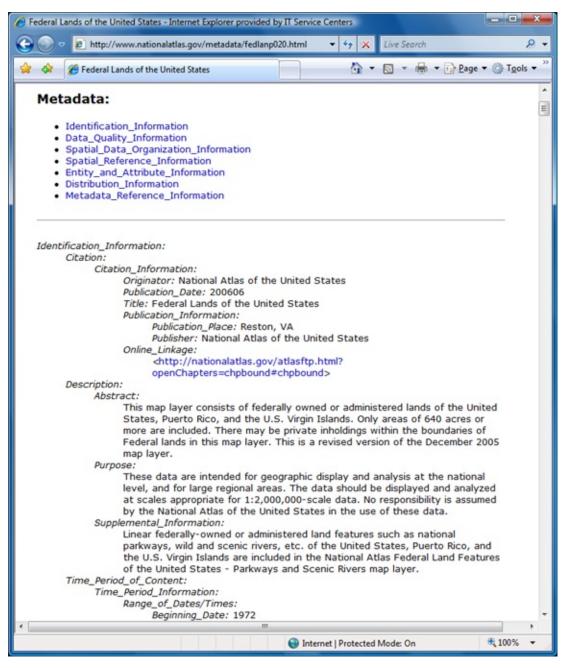
- A brief description of the data set (called an abstract)
- The area covered by the data set
- The data structure and file format
- The coordinate system or projection of the data
- The time that the data was collected and method of collection
- The quality or accuracy of the data

Metadata, when it is complete and up-to-date, can be extremely useful. If you receive a dataset from a colleague or from a local government department, look for a metadata file that describes the data. If there is none, ask your contact person to provide some basic information. You should at least find out what coordinate system the data is in, because you will need to know what it is if you need to reproject the data to bring it into an existing map (see <u>Reproject incoming data to a new coordinate system</u>).

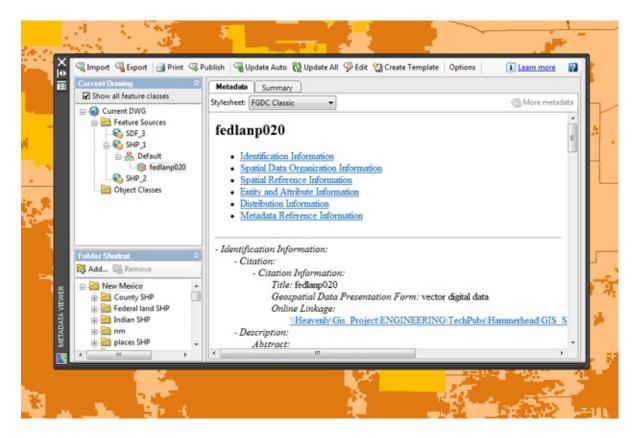
If you are downloading publicly-available data from a government agency, a link to the metadata is usually available from the download page.

There is no single worldwide standard for metadata. However, different government agencies are at work implementing standards within their particular geographical areas. For example, the Federal government in the United States requires the GIS data used in its various departments to comply with the FGDC standard (FGDC stands for Federal Geographic Data Committee). In other countries, the ISO 19139 metadata standard has been widely adopted.

The illustration below shows FGDC-compliant metadata as it appears on a web page.



In AutoCAD Map 3D, you can view metadata for any data source that complies with the FGDC or ISO 19139 standard. You do not have to add the data to your map to view the metadata. You only need to connect to the data source. You can then open the Metadata Viewer from the Map Explorer or Display Manager. The illustration below shows the same metadata as in the previous illustration, as it appears in the Metadata Viewer in AutoCAD Map 3D. (The data to which it refers has been brought into the map and can be seen in the background.)



Examples

The following animation shows how to view the metadata for a data source that is connected to the current map. The data in this example comes from a U.S. government source and is therefore in FGDC format. Very often, one of the first things you want to know is the coordinatate system of the data, so the animation demonstrates how to find that information.

Show me how to view and interpret metadata



reate metadata for your map

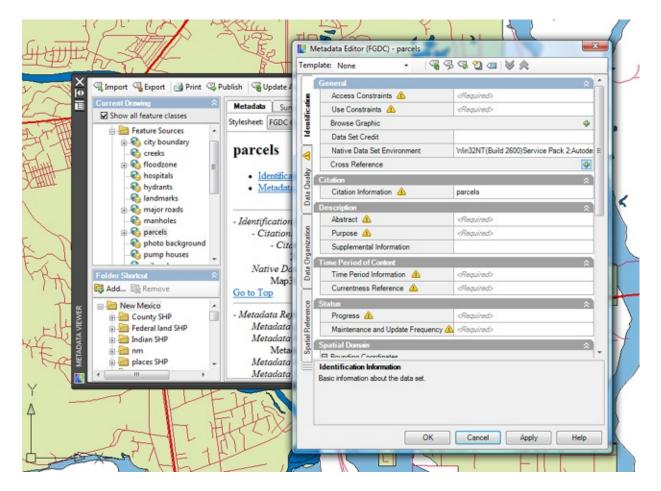
If you need to pass your map onto other people, you can create a metadata file to describe it. (If you are submitting maps and GIS data to a federal agency in the United States, FGDC-compliant metadata is a requirement.) There are over 300 fields in the FGDC or ISO 19139 standard for metadata. You don't have to fill in all of them to create a valid metadata file, but you do have to complete many of them. Working with metadata is therefore a matter of finding methods to create the required content in the most efficient way. AutoCAD Map 3D provides some shortcuts to help with this task:

- Automatic generation of metadata for the current DWG. This includes the coordinate system and paths to the connected data stores.
- Creation of templates from existing metadata. Once you have completed a valid metadata file with all the required fields, you can use it as a starting point for other DWGs.
- Checking for completeness. You can run a command that checks that all required fields have been completed and flags any that you might have missed.
- Copy and paste sections of metadata from one DWG to another. You can attach different folders of DWG files and edit the metadata for each file. For example, you may have the same contact information for a series of files, in which case you can just paste it in without having to open the file.

If you use these methods, you have a lot of flexibility when working with metadata. Generally, you only need to have one or two complete metadata templates. You can then use one of your templates as a basis for all your maps. When you import a template to get started with a new map, the information in that template will not overwrite the metadata that has been automatically generated for that specific map, for example, the coordinate system information. Once you have the standard information that comes from the template, plus the map-specific data, you can then proceed to check for completeness and use copy

and paste to fill in any required sections that are still blank.

The illustration below shows the Metadata Editor checking for completeness. The yellow icons indicate fields that are required but which are still empty.



Examples

This animation demonstrates the sequence of events when completing a metadata file for a new map. First, information is filled in from a template. The metadata is then checked for completeness and additional data is written into the fields. Finally, the metadata is saved (published) to a separate xml file.

Show me how to create and edit metadata



eproject incoming data to a new coordinate system

The earth is round but maps are flat. In order to display the earth on the flat surface of a map, we have to *project* it. A map projection, or coordinate system, is the way that a geographical area is stretched, shrunk, or otherwise distorted to make it appear flat. There are hundreds of different coordinate systems, which serve different purposes. Some are optimized for displaying small scale maps. such as maps of entire countries, while others are intended for large-scale maps of smaller areas, such as maps of a town or city. Some coordinate systems tend to preserve area at the expense of shape, and some tend to preserve shape at the expense of area, but they all make some compromises with reality. The trick is to choose the coordinate system that is best suited for the map you are going to create.

Here is a comparison of two coordinate systems, using a map of the United States as an example.



The first map (above) uses the LL84 coordinate system, which is a latitudelongitude system based on a datum (or reference point) established in 1984. You can see how the areas of the states are stretched horizontally. Distance and direction are not realistic either, as you can see from the straight line along the border with Canada at the top of the map. This coordinate system is not a good choice for a map like this one, which shows only the 48 states of the USA (not including the outlying states of Alaska and Hawaii).



The second map (above) does a much better job of showing the 48 states with minimum distortion. The coordinate system used in this map is the Albers Equal Area (code=US48), which is specifically designed to display this kind of map of the United States. Equal-area means that one square unit in one part of the map covers the same area of the actual Earth as a square unit in any other part. So this is a more accurate representation of the area.

Examples

Sometimes you will receive data with an unknown coordinate system, or a coordinate system that is different from your current map. In these cases, you have two choices:

• If the data has a coordinate system defined for it, but you don't know what it is, you can bring it into a new, empty map. In this case the empty map will be set to the coordinate system assigned to the data.

Show me how to set a map to the coordinate system of the data

• If you know what coordinate system the data is in, but you want to change it, you can start a new, empty map and assign a coordinate system to it, or you can open an existing map in a known coordinate system. Then, when you bring in data, the data will be reprojected to the coordinate system assigned to the map.

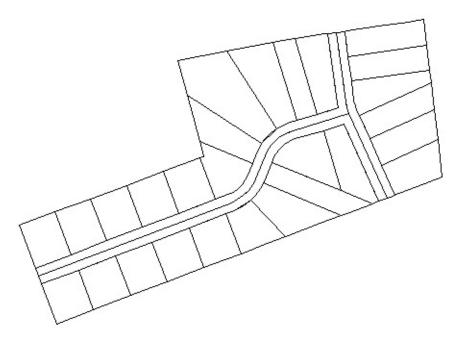
Show me how to assign a coordinate system to my map

Show me how to bring in data and reproject it



eoreference parcels by rubbersheeting

Another situation that you may encounter is that you receive maps, plans, or other data that has been created by contractors, but which does not have any geoferencing information at all. For example, a map of a new subdivision that has been drafted in AutoCAD will not contain any georeferencing. You may know where the subdivision has to go in your map, but the DWG that you have received consists of a set of simple polylines, or other DWG objects without any coordinate system.



In a case like this, you can place the subdivision in your map using a process called *rubbersheeting*. What the Rubber Sheet command does is to move, rotate, and scale the selected DWG objects as required to fit them into the map. You select a series of points in pairs—first a start, or source, point, then a destination, or displacement, point. The process is very similar to the standard Move command in AutoCAD, only you use more than one pair of points. The more pairs you enter, the more accurate and precise the result.

The illustration below shows how you might use four pairs of points to fit the subdivision into the target location. If you have ever tried using simple Move

and Scale commands to fit DWG objects precisely, you will find that the Rubber Sheet command in AutoCAD Map 3D is much easier to use and is more accurate.



Examples

For the sake of speed and simplicity, this demonstration uses only two pairs of points to rubbersheet the subdivision. However, when you use this command, you would want to use at least four pairs to get a good result. You would also want to use OSNAP judiciously to make sure that you snap to the right points.

In this animation, the set of parcels has been defined as a block so that it can be copied and pasted as a single object.

Show me how to georeference parcels by rubbersheeting

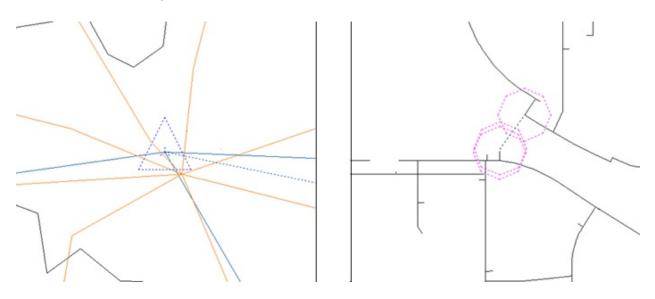


lean up duplicates, gaps, and other accuracy problems in WG files

If you receive DWG data from many sources, you don't always know how well that data has been prepared. Errors may have crept in during the processes of digitizing, scanning, or surveying. There may be inaccuracies, such as lines which don't exactly meet (overshoots or undershoots), duplicate lines where only one is needed, or lines which are too short to have any meaning.

Naturally, you want to make sure that the data that you use in your projects is free from these kinds of errors. If you had to do your error checking manually, you would certainly have to spend a lot of time on it, and some errors would probably go undetected. Fortunately, you can check for errors and fix them using an automated process called *drawing cleanup*.

The cleanup process goes through your drawing and checks for errors in the categories that you select. Typically, you will get the best results by checking one category at a time. Drawing cleanup can fix the errors it finds automatically, or it can operate interactively, that is, by marking the errors it finds with a colored symbol so that you can easily see where they are. You then decide in each case whether you want to fix that error or not.



Examples

This example demonstrates how cleanup works on a DWG layer that contains polylines. It shows the interactive process of locating and fixing duplicate-line errors.

Delete Duplicate Objects is usually the last of the cleanup actions that you would perform because many duplicates do not appear until all geometry conversion and changes from the previous operations are in effect. It is recommended that you select the cleanup operations in the order listed below:

- 1. Break Crossing Objects
- 2. Extend Undershoots
- 3. Erase Dangling Objects
- 4. Erase Short Objects, Snap Clustered Nodes
- 5. Dissolve Pseudo Nodes
- 6. Delete Duplicate Objects

Note In AutoCAD Map 3D, the menu selections that are available depend on the workspace that you are using. This animation uses the Map 3D for Drawings workspace.

Show me how to clean up errors in my data



ata Conversion

This chapter shows you how to convert data from DWG objects to GIS features and vice-versa.

Topics in this section

- Export DWG objects to a GIS data store (SDF)
- <u>Convert styled DWG objects to features</u>
- <u>Save the current map in DWG format with visual fidelity</u>



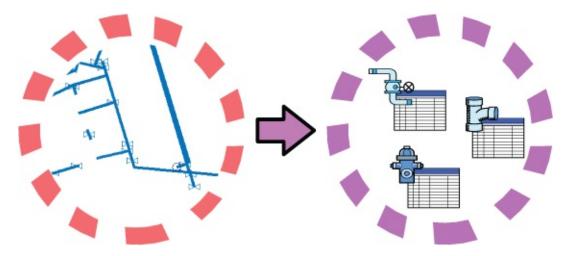
xport DWG objects to a GIS data store (SDF)

You may have read by now about the benefits of storing data as feature classes rather than DWG objects. You may already have used FDO data access technology to bring data into your map. But what if the vast majority of your data is still stored in DWG files, as raw geometry? How do you start migrating that data to a GIS data store?

Fortunately, migrating large numbers of DWG objects to SDF format is now a simple process. You can use a standard export command to get your DWG data into SDF, exporting the objects by layer. Each layer becomes a feature class in the SDF data store.

For example, if your DWG file has a layer that contains polylines representing pipes, a feature class "Pipes" is created in the SDF file and each line on that layer becomes a pipe feature. The same transformation happens for any other layers that you select, for example, the hydrants and valves in the illustration below. If your DWG has object data defined for the objects, the object data is copied to the SDF file and stored as properties of the features.

Note If you have already created feature classes for your DWG (using the process called classification), each feature class you select is simply transferred to the SDF file.



If the final destination of your data is Oracle, you can use the Export to Oracle command in AutoCAD Map 3D to copy the data directly into the database. All you need to do is make a connection to the Oracle database. If the final destination is some other data store, for example Microsoft® SQL Server[™], you can export to SDF and then use bulk copy to transfer the data from SDF format to the SQL Server database (see <u>Bulk copy data from a SHP file to an SDF file</u>).

Examples

The first demonstration starts with a DWG file with many layers. We want to export the objects on three of the layers, convert those objects to features, and then store the features in SDF format. We also want to make sure that the object data associated with the objects is exported at the same time.

Note Data from the city of Kawasaki, Japan, used by permission (Digital map 2500, approval No.136 issued by The City of Kawasaki).

Show me how to export DWG objects to SDF

You can also go the other way, that is, import features from an SDF file and convert them into DWG objects. This process is useful if you keep your data in DWG files but need to receive data from engineers or contractors who are using SDF or some other FDO-based data store.

Importing features is different from simply connecting to an SDF data source and adding feature classes to the map. In the latter case, the features are displayed in the map but the original data stays in the SDF file. (The DWG stays more or less the same size.) When you import, the data is copied from the SDF file and objects are created in the DWG. (The DWG gets bigger.)

Show me how to import SDF features to DWG objects



onvert styled DWG objects to features

Another way to get your DWG objects into a GIS data store such as SDF is to convert the objects to features based on existing properties such as color or linetype. For example, suppose you have a standard in your workgroup in which a blue polyline always represents a pipe that is 4 inches in diameter and a red polyline represents a pipe that is 6 inches in diameter.

A common situation is to receive drawings from external contractors in DWG format. You may already have a process in place that specifies the layers, colors, and linetypes/lineweights that contractors must use. As long as the DWG objects that you receive follow these standards, you can easily convert those objects into features in your central database.

The illustration below shows the water mains in a city. The color property has been used to show the different diameters of the water mains.

- red = 6" diameter
- magenta = 8" diameter
- cyan = 10" diameter



Examples

This animation shows how to convert the drawing of water mains, shown in the illustration, into features stored in an SDF file, based on the color property of each polyline.

If you typically receive DWG data from contractors, you probably already have your database set up and simply append new features to it. This is what we do in this demonstration.

Show me how to export styled DWG objects

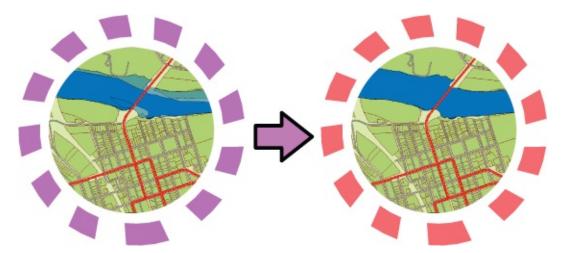
After the export operation, the SDF file contains one feature class: WATERMAIN, with three different values for the property DIAMETER. This animation shows how to bring the SDF data into AutoCAD Map 3D and view its contents using the Data Table.

Show me how to view the contents of the SDF file



ave the current map in DWG format with visual fidelity

AutoCAD Map 3D 2008 also provides a way to export all of the current map layers to plain AutoCAD format. For example, suppose you have created a map with many different layers. Some of them come from feature classes in an Oracle database, and some of them come from SDF. You want to send the map to a contractor who only has AutoCAD. You have styled the layers in Display Manager, as shown in the image on the left in the illustration below.



You use the Save Current Map as DWG command to convert the Display Manager layers to AutoCAD layers. When AutoCAD Map 3D converts the layers, it will preserve the existing styles as far as possible. In this example, the polygon features will be saved as closed polylines and given the same solid fill color as they have in the original map. However, because AutoCAD does not support transparent objects, the polygons on the floodzone layer, which are semitransparent in the original, are rendered as filled polylines as well.

Tip The exported map is optimized for the current zoom level. In this example, the style of the street center lines, which are displayed as thick lines when the map is zoomed in, is preserved by setting a heavy line weight in the converted DWG. If you wanted to capture the streets as thin lines, you would zoom out first and then export the map. See <u>Hide and show features as you zoom in and out</u>.

Examples

The first demonstration shows how to export the current map. This particular map is a simple one with three layers, all polygons.

Show me how to export the current map to DWG format

The second demonstration shows what the DWG looks like when it is opened. The three layers have been converted into AutoCAD layers and the styling has been preserved. The appearance of the converted DWG is very close to the original.

Show me how the map looks after conversion to DWG format



ata Access

This chapter shows you how to bring data from different sources into your map.

Topics in this section

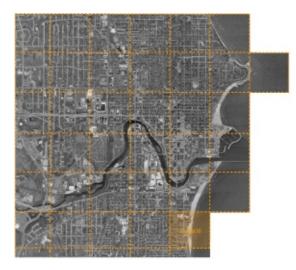
- Bring in data from multiple image files to a single layer
- Transform an image so that it is correctly aligned
- Access data published on a public web server
- Bring in parcel data from AutoCAD Civil 3D
- Bring in point data from a Microsoft Access database
- Bring in a subset of features using a query



ring in data from multiple image files to a single layer

Raster (or image) files are pixel-based data, such as digital photographs, that you can use as backgrounds for feature and drawing data. For example, you can display an aerial photograph of a city under a layer of streets.

Image files can be very large, especially if they cover extensive areas in detail. To make them easier to handle, images are often broken down into "tiles," which cover smaller areas. Each individual image file can be georeferenced, that is, it has an associated file (for example, TFW for TIFF files) that specifies the location of the image within the coordinate system used in the map.



Examples

In AutoCAD Map 3D, you have two ways of bringing tiled images into your map when you use the Raster Provider in Data Connect:

- Bring each image onto its own layer. You can easily turn each individual tile on or off. If you place them in a single folder in Display Manager, you can turn them all on or off at the same time.
- Bring multiple image tiles onto the same layer. This is useful if you want to make a single photo background from a mosaic of individual image

tiles.

Show me how to bring multiple image files onto a single layer

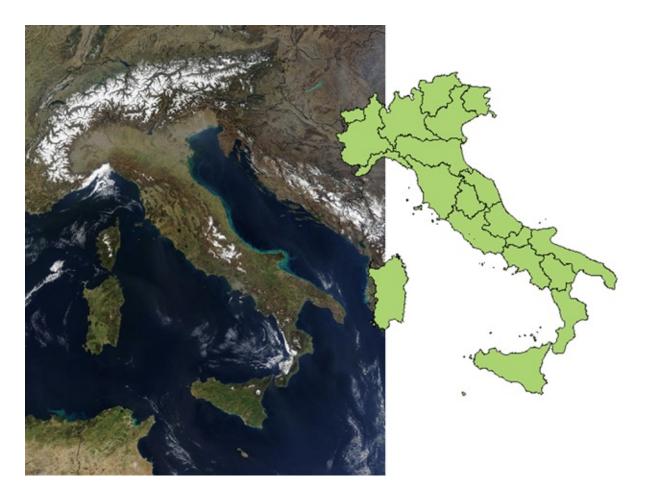
Note You can also bring images into the map using the Insert Image command. See <u>Transform an image so that it is correctly aligned</u>.

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ransform an image so that it is correctly aligned

What happens when you want to use an image that does not have any georeferencing information? You do not know the coordinates of the image relative to the coordinate system of the map, so the image will not be aligned with the data that you already have in your map.

This is not an ideal situation. However, you can still use the image, especially if you only need to use it as a background and as long as you do not need to have it align extremely precisely with existing features. For example, the illustration below shows a map of Italy. This is a small-scale map, in which the coastline and boundaries of the regions have been generalized. They are not precise and so, in this case, we can use the image on the left as a background for the map and it will be close enough.



Examples

This example assumes that you have assigned an appropriate coordinate system to your map and that you already have at least one layer of features that you can align the image to.

In this case, you can use the Insert Image command (instead of the Raster Provider in Data Connect). You use this command to bring the image into the map so that it is more or less in the correct position, and at roughly the correct size. A simple way to do this is to draw a rectangle on the map as a guide. You then insert the image, snapping the image to the corners of the rectangle.

Show me how to insert an image using a guide

Once you have the image in the map, you can use the ADETRANSFORM command to align it with the features in the map. This command moves, rotates, and scales the image all at the same time. You pick two source points and two destination points to specify how the image should be transformed. You may get it right first time, but more likely you will need to repeat the command to get a satisfactory result.

Show me how to transform an image



ccess data published on a public web server

You can incorporate data in your maps from layers that have been published to a public web server. Web-based data is published using one of two open standards developed by the OpenGIS Consortium (OGC):

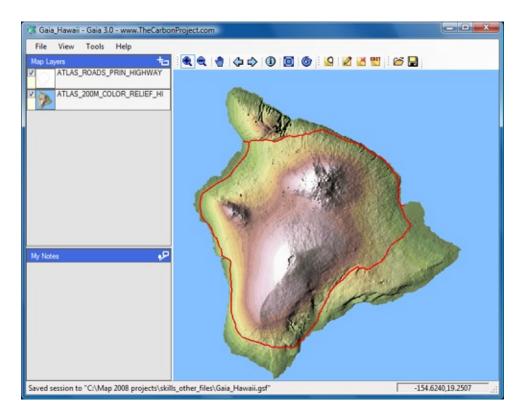
- WMS (Web Map Service), which consists of raster data such as satellite photographs
- WFS (Web Feature Service), which consists of layers of features in vector format

The number of Web Map Services (WMS) and Web Feature Services (WFS) that implement OpenGIS interfaces on the Internet is increasing all the time, as more organizations adopt the open standards. At the moment, there is a lot more data available in WMS format than in WFS.

Data from WMS web services can be used to provide background layers for your map. Attribute data may be available for WFS layers.

If you find a server that provides WMS or WFS data that interests you, you can browse the content of the published layers using viewer software, such as the Gaia viewer shown in the illustration below.

Note Websites that host web services appear and disappear or are under construction. Not all sites that you find will work perfectly (or at all).



Examples

Once you have located some WFS or WMS data, you need to get the URL of the page that serves the published layers. Often, this is not a standard web page that you can open in a browser, but a page that has been programmed using a scripting language such as CGI, PHP, or ASP. A typical web server address looks like this: http://wms.jpl.nasa.gov/wms.cgi

You can then paste the address into the Data Connect dialog box in AutoCAD Map 3D. The following example shows a WMS connection, but you connect to a WFS in exactly the same way.

Show me how to bring in data from a web server using WMS



ring in parcel data from AutoCAD Civil 3D

Splitting polygons that represent parcels is a very common task, but it can become a fairly complex one, due to the number of people who may be involved and the use of different software programs.



It is common practice to store parcel data as features in a central database while new subdivisions are created in a DWG file, using AutoCAD, AutoCAD Map 3D, or AutoCAD Civil 3D. What is the best way to handle this kind of workflow?

Ideally, you want to minimize the number of times that the data changes format and also minimize the total number of steps that need to be performed. Here is one solution:

- 1. Save the parcel or parcels to be subdivided as a DWG file using AutoCAD Map 3D.
- 2. Do the subdivision work in AutoCAD Civil 3D, to take advantage of its ability to automate parcel-creation and attribute assignment.
- 3. Export the subdivided parcels to SDF format.

- 4. Import the subdivided parcels back into AutoCAD Map 3D.
- 5. Update the parcels database.

This method uses only two formats: SDF and DWG, and only two programs: AutoCAD Map 3D and AutoCAD Civil 3D. (This is assuming that you have your parcel fabric stored in an SDF database. However, the process would be the same if the parcels were in Oracle or any other supported data store.) If you store your parcel data in DWG files, the effort involved to convert them to SDF is relatively trivial, using Export from DWG to SDF (see <u>Migrate data from the</u> <u>current DWG to a GIS data store (SDF)</u>).

Examples

The first step is to extract the parcel or parcels that you need to edit from the database, convert it to simple geometric objects, and save the objects as a DWG file. You can then give the DWG to the engineer who will create the subdivision design.

Show me how to convert a parcel to simple geometry

When the design is complete, the engineer saves the parcels for the subdivision as an SDF file. The SDF file may also contain other features such as pipes and road alignments. You can easily bring this data into AutoCAD Map 3D with a standard Data Connect operation. Because the data has retained its georeferencing information throughout the process, you can be sure that it will come in at exactly the right location.

Show me how to bring in data from AutoCAD Civil 3D

Note When you want to update the central database with the new parcel information, you can use a bulk-copy operation to add the parcels (see <u>Bulk copy</u> <u>data from a SHP file to an SDF file</u>).



ring in point data from a Microsoft Access database

Point data is often used in engineering projects. X, Y, and Z coordinates of assets and structures such as inlets, outlets, and manholes can be captured directly in digital format using a GPS or other data-collection device. Other attributes of the various structures, such as type, condition, and age may be noted manually by survey crews in their field books. The coodinates are stored as columns in a database table. The attributes of the various structures can be entered into the database as well.

Point data is brought into your map as raw coordinates and stylized afterwards, usually by assigning symbols (blocks) to the different point features.



Microsoft® Access (.mdb) is a common format for storing this kind of point data. However, spreadsheets in formats such as Microsoft Excel (.xls) are widely used as well. You bring this data into AutoCAD Map 3D in the same way, using the provider for ODBC. (ODBC stands for Open DataBase Connectivity.)

Examples

The simplest way to connect to an ODBC database is through a system DSN (Data Source Name) that you have already defined. It is very easy to define a DSN using the Windows Control Panel/Administrative Tools/Data Sources

(ODBC).

Once you have connected to the database using your DSN, you can select the feature classes that you want. You need to specify two other things when you bring in point data:

- The original coordinate system of the point data. The Microsoft Access database doesn't store any coordinate system information. You need to specify it so that the data can be correctly projected.
- The columns in the database table that contain the coordinate information. For example, a table may have two columns, LON and LAT, which contain the X and Y coordinates for the points (LON=X, LAT=Y).

Show me how to bring in point data from an ODBC database



ring in a subset of features using a query

Querying data is a fundamental GIS skill. There is usually an enormous amount of source data available, whether it is in a set of attached DWG files, or in a database. Typically, you want to work with only a small subset of it. You limit the data that you have to work on by running a query. The query finds the data you specify and brings it into the current drawing.

Sometimes you may want to bring in all the data in a certain geographic area by drawing a rectangle or a circle on your base map. This is called a location-based query (shown in the center of the illustration below).

For other tasks, the data you want is a single feature class, such as all parcels, and sometimes it is a more specific subset, such as all parcels with value greater than a certain amount. These are called property-based queries (shown on the right in the illustration below).



Examples

In AutoCAD Map 3D, you can run queries to bring in data from a set of attached DWG files, or from virtually any FDO-accessed data store:

• For DWG files, the query functionality is available on the Map Explorer task pane. As well as creating and running the current query, you can store any number of named queries in the DWG file, save queries for reuse, and load queries stored in external files.

The following example shows a location-based query. It uses a rectangle

to bring in all the data inside a specific area of the source DWGs. **Note** In AutoCAD Map 3D, the menu selections that are available depend on the workspace that you are using. This animation uses the Map 3D for Drawings workspace.

Show me how to run a query on a set of attached DWG files

• When you connect to a data store using an FDO provider, the query dialog box appears when you click Add to Map with Query to bring the feature class into your map. You can then specify the subset of features that you want to work with.

The following example shows a property-based query. It brings in all of the parcels that have a land value greater than 100,000.

Show me how to run a query on a feature class



ata Editing

This chapter shows you how to edit DWG objects and features using CAD tools.

Topics in this section

- Edit DWG files in a multi-user environment
- Draft new features for an existing feature class
- Edit feature geometry directly in a SHP file using CAD tools
- Edit features as polylines using PEDIT
- <u>Split a parcel in two and divide attributes</u>
- <u>Create new features from existing AutoCAD objects</u>
- <u>Check out features to edit in the field and update the database later</u>
- Zoom to features by selecting rows in the Data Table (and vice-versa)
- <u>Generate a report by exporting records to a spreadsheet</u>



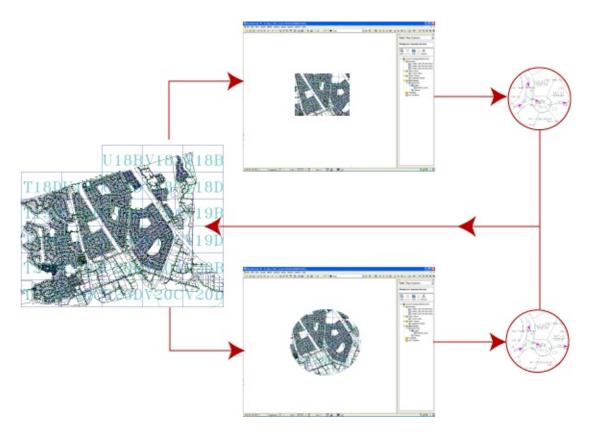
dit DWG files in a multi-user environment

If you are using multiple DWG files to store your data for a particular geographical area such as a city, you probably have your files organized in one of two ways:

- Stacked—each DWG file contains data for a single system or network, such as sewer, waste water, roads, or parcels. The DWG files overlay one another.
- Tiled—each DWG file contains data for a specific area of the city. The DWG files are adjacent to one another, according to an indexed grid.

AutoCAD Map 3D supports multiple users accessing and editing the same set of source DWG files at the same time over a network. The source DWG files essentially function as a database for the workgroup. Each user starts an editing session by opening a template drawing. He or she then runs a query to bring in a subset of the source data for editing. (For a demonstration of how queries work, see <u>Bring in a subset of features using a query</u>).

Of course, in a multi-user environment, there has to be a mechanism to prevent the engineers who are editing the data from overwriting one-another's work. AutoCAD Map 3D handles this by placing objects selected for editing in a *save set* (the red circle in the illustration below). These objects are then locked so that other users cannot edit them at the same time.



Examples

The following demonstration shows what happens when two open DWG sessions start accessing the same objects in the source DWG files. It simulates multi-user editing using two open work sessions, one on top of the other. In real-life, of course, there would be two users on different computers in different locations.

The animation starts from the point at which both users have run a query that brings an identical set of data into the current editing session.

Note In AutoCAD Map 3D, the menu selections that are available depend on the workspace that you are using. This animation uses the Map 3D for Drawings workspace.

Show me how multi-user editing works



raft new features for an existing feature class

A common requirement is to add new features, such as water pipes or parcels, to an existing water network or parcel fabric. In AutoCAD Map 3D, all you need to do is to make a connection to the appropriate data store and bring the feature class that you want to work with into your current map. You can then draft the new features using the CAD tools that you are already familiar with. Typically, as well as drafting the geometry for the new features, you will want to add attribute data for them.

The illustration below shows a new pipe feature being drafted for a water system.



Examples

In this example, we start with the network of water pipes that we copied in the previous skill and add a new pipe feature to it.

Layers for a photo background and for the city parcels have been added to the map so that we can see exactly where to place the pipe.

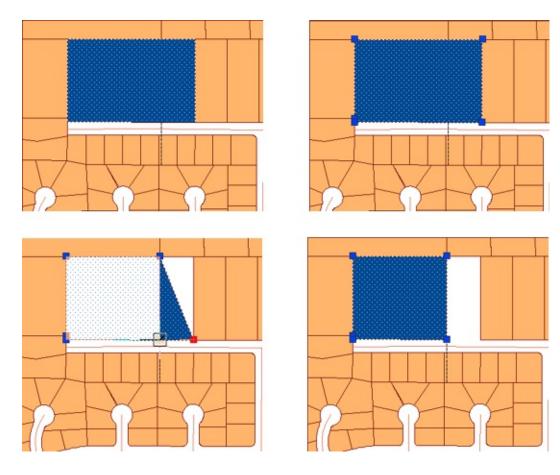
Show me how to draft a new feature for an existing feature class



dit feature geometry directly in a SHP file using CAD too

The ability to create, edit, and maintain geospatial data using the CAD tools that you already know can save you a lot of time. When you edit geometry in a DWG file using standard AutoCAD tools, you can move and stretch vertices using grips, delete the objects, or change their shape exactly as you like. In AutoCAD Map 3D, you can use these same tools to edit feature data that is stored in a database, such as Oracle or Microsoft SQL Server, or a file-based data store, such as SHP, without having to import it and export it again. For example, if you receive a folder of SHP files containing parcel and road data for a city, you can simply connect to those SHP files and edit them directly.

The illustration below shows parcel editing using grips.



In AutoCAD Map 3D 2009, you can choose how you want to edit features in the data store. You make your choice in the Feature Editing Options dialog box, shown in the following illustration.

Checkout and update features	
To edit features, they must be checked out	
Automatically check out features when e	edited
Automatically update data resources with	h edits
Editing tools	
Use the following editing tools:	
AutoCAD geometry editing tools (PEDIT,	, BREAK, TRIM, etc. and split and merge tools)
(Convert features to objects similar to Au	toCAD polylines.)
Geospatial specific geometry editing tool	Is (split and merge tools, BREAK, TRIM, etc.)
(Retain geospatial specific properties, su	uch as M and Z values.)
(Retain geospatial specific properties, su	uch as M and Z values.)
(Retain geospatial specific properties, su	uch as M and Z values.)
(Retain geospatial specific properties, su	uch as M and Z values.)
(Retain geospatial specific properties, su	uch as M and Z values.)
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	uch as M and Z values.)
Other options	uch as M and Z values.)
Other options	uch as M and Z values.)

By default the options are set as follows:

- Automatically Check Out Features When Edited
- Check Out Features As AutoCAD Drawing Objects

Checking out the features makes them available for editing and also locks them in the database. This is similar to what happens when you edit DWG files in a multiuser environment.

Keep these default options if you want editing to be as "CAD-like" as possible. If you do this, you do not have to specifically check out features before editing. You can use familiar CAD tools on the features just as you can on DWG geometry. For an example of this mode of editing, see <u>Edit features as polylines</u> <u>using PEDIT</u>.

If you are used to editing features in a database, you may want to deselect Automatically Check Out Features When Edited. Editing feature data in this way involves one extra step. When you have selected the features you want to edit, you explicitly "check out" those features using the Check Out Features command. By default, AutoCAD Map 3D will not update edits automatically. This means that edits are not written to the database until you check them in. If you want to commit your changes to the database as you make them, select Automatically Update Feature Source With Edits.

Whether you choose to use automatic check-out or not, when you have finished making your edits, you still need to "check in" the features. This step writes the features back into the database or data store and releases the locks.

Examples

This example shows simple parcel editing using grips. Features are checked out, edited, then checked in. The demonstration starts with the parcels and road layers already added to the map.

Show me how to edit features stored in a database or data store



dit features as polylines using PEDIT

When you are editing polylines, you use various AutoCAD tools, such as TRIM, BREAK, and of course, PEDIT. If your map includes features such as pipes or roads, which are represented by polylines, you can use the same tools to edit them. If you use the default editing options, you can edit DWG objects and GIS features seamlessly. (These options are described in Edit feature geometry directly in a SHP file using CAD tools.)

Basically, there are two ways to edit features in AutoCAD Map 3D:

- Treat all line and polygon features as though they were simple lines and edit them with AutoCAD tools.
- Treat polygon features as polygons and edit them using geospatial tools.

It is recommended to use the first option and edit using AutoCAD tools unless your organization is accustomed to using geospatial tools to edit areas such as parcels. Geospatial tools take into account the specific properties of polygons. This allows these tools to split and merge polygons and automatically calculate the new areas. For an example of this automatic calculation, see <u>Split a parcel in two and divide attributes</u>.

The illustration below shows a network of water pipes. The image on the left shows what happens when you select one of the pipe features. It is immediately available for editing. This is because the default option is selected (Automatically Check Out Features When Edited).

The image on the right shows what happens when this option is not selected. In this case, you have to check out the feature with the Check Out Features command before you can edit it.





Examples

The previous skill introduced the options available for editing features and explained when you would use them. It also included an animation to show you how to edit features using check-in and check-out. The following demonstration shows how to edit features using PEDIT without check-out.

Show me how to edit features using automatic check-out

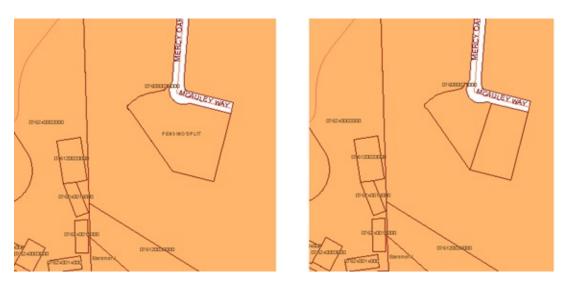


plit a parcel in two and divide attributes

It is often necessary to divide a feature into two or more parts. One of the most common examples is subdividing a parcel. How do you do this if your parcel map is stored as feature data in a database?

If you are receiving the data for the subdivided parcel from an engineer who is using AutoCAD Civil 3D, you can ask him or her to save the parcel data in SDF format. You can then easily bring that data into AutoCAD Map 3D (see <u>Bring in parcel data from AutoCAD Civil 3D</u>).

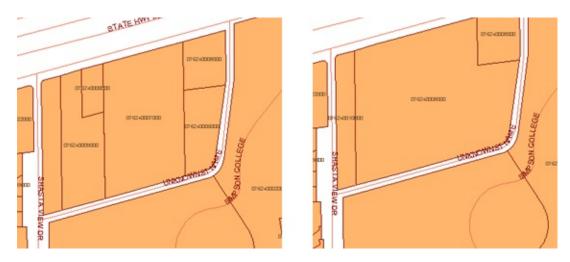
When you have the parcel map in AutoCAD Map 3D, you can use the Split command to divide a parcel into two or more smaller parcels, as shown in the following illustration.



What happens to the attribute data associated with the parcel when you split it? The attributes are divided according to the "rules" which are set in advance for each property of the parcels layer. For example, a common rule is to reset the AREA properties of the new parcels in a simple proportion. If you split a parcel with an area of 1000 square meters exactly in half, each new parcel will be 500 square meters in area. You could use a similar rule for the LAND_VALUE property, or you may want to leave it blank, pending assessment. Defining these rules is usually the responsibility of the data manager in an organization. Once

they have been set up, they are applied automatically, so you don't have to think about them every time you split a parcel.

You can also use the Merge command to combine two or more features, as shown below.



Examples

The following animation demonstrates how to subdivide a parcel feature using the Split command. When the Split command is complete, the Data Table opens to show the attributes assigned to each new parcel.

Show me how to split a parcel feature



reate new features from existing AutoCAD objects

The previous skill showed how to split a parcel that is defined as a polygon feature. However, you may also want to split parcels that are drafted as closed polylines.

For example, you might receive a design for a new subdivision already drawn as raw geometry with lines or polylines. In this case, you need to edit the parcel data, delete the old, undivided parcel feature, and replace it with the subdivided parcel geometry. In this process, you convert the raw geometry into features in the database.

The illustration below shows the division of a polygon feature on a different scale from editing a parcel, but the principle is the same.

In November 2000, the Government of India created the new state of Chhattisgarh out of the eastern part of the state of Madhya Pradesh. Countless maps became out-of-date overnight. The map on the left shows the pre-2000 conditions, while the map on the right shows the state boundaries as they were redrawn in the year 2000.

A Contraction of the contraction

Examples

In this example, the state boundaries are stored in a database (thick black lines

on the map). The boundaries for the new states have been drafted as closed polylines on separate layers (thick blue and green lines). They are not visible when the animation starts. The procedure goes like this:

- 1. Check out the old polygon feature and delete it.
- 2. Turn on the layers with new polyline geometry.
- 3. Create a polygon feature from the first new polyline.
- 4. Update the attribute data in the Data Table.
- 5. Check in the new feature.
- 6. Repeat steps 3 to 5 to create the other new polygon and add it to the database.

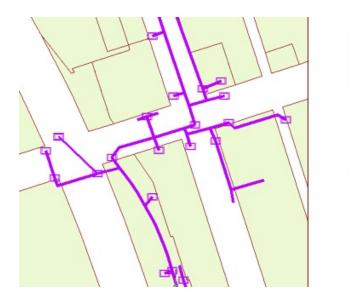
Show me how to create new features from existing AutoCAD objects

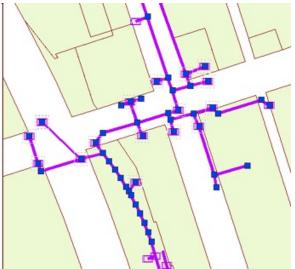


heck out features to edit in the field and update the atabase later

You may want to edit data in the field, at the actual work site, and then update the central database with your changes when you return to the office. If you have a copy of AutoCAD Map 3D on a laptop computer, you can work "offline" in this way. The central database can be a relational database such as Oracle or Microsoft SQL Server, or it can be a file-based data store, such as SDF or SHP. The process works in exactly the same way for all data that you access using the FDO providers in the Data Connect dialog box.

To work offline, you first check out the features you want to work on. AutoCAD Map 3D makes a local copy of the features. You can then disconnect from your network and make your edits at the work site. Later, when you reconnect to the network with your edits, you can synchronize those changes with the central database.





Examples

The first demonstration shows how you prepare to edit a set of features (in this case, storm-drain pipes) in the field. You check out the features and then go

offline.

Show me how to check out features for editing in the field

The second demonstration shows how you return those pipe features to the database after editing. You go online and then check in the features.

Show me how to check in features after editing in the field

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oom to features by selecting rows in the Data Table (and ice-versa)

In AutoCAD Map 3D, the attribute data for the features in the map is displayed in the *Data Table*, which is a separate window that floats on top of the work area. All features have attribute data stored in table format, even if the only attribute is a unique identification number (ID).

When you are working with parcels, they all look very similar in your map. Often it is difficult to know exactly where you are. Therefore, it is very useful to be able to quickly zoom into a particular parcel by selecting its record in the Data Table. The quickest way to select a particular parcel record is usually by typing in its ID number. Another way would be to search for all parcels on a particular street.

Using the Find/Search feature in this way, you select a row, or multiple rows in the Data Table. The map will zoom automatically to highlight just the selected parcel feature or features (as in the illustration in the center below). If the parcels are apart from one another, the map will zoom to show the smallest view that contains all of them (as in the illustration on the right below).

You can also do this the other way. You can select features in the map and the Data Table will scroll to highlight only the records for those features (illustration on the left below).

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Examples

Notice how, in the illustration above, the Data Table is partially transparent so

that you can see what is happening behind it. The first demonstration shows how to set this transparency.

Note Most computers will display transparency correctly. However, in a few cases, the graphics card in the computer will not support transparency.

Show me how to make the Data Table transparent

The second demonstration shows how to set automatic zoom so that the map zooms to the features selected in the Data Table.

Show me how automatic zoom works

The third demonstration shows how to set automatic scrolling so that the Data Table highlights only the features selected in the map.

Show me how automatic scroll works

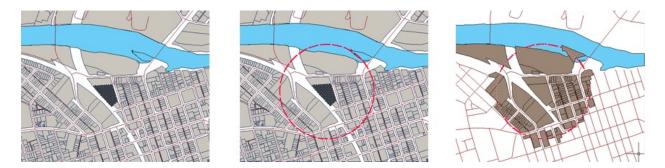


enerate a report by exporting records to a spreadsheet

One of the reasons for selecting a set of parcels is to use the attribute data for those parcels in another application. For example, you might want to send a letter to all the owners of property within a certain distance of a particular parcel. Perhaps construction work is about to begin and the neighboring owners must be notified.

The first thing you need to do is to identify the parcels that are affected. If you have accessed your data through an FDO provider, you can use a *buffer zone* to quickly select the parcels. (See <u>Select features by location using a buffer</u>.) If your data consists of DWG objects, you can create a buffer zone based on a topology (see AutoCAD Map 3D Help for more information).

To select the parcels, you use the polygon or circle created by the buffer zone in a location query. The illustration below shows the result of a query that selects parcels within, or crossed by, the buffer zone.



Examples

Once you have isolated the parcels in this way, it is very easy to export them from the Data Table. The records are exported in CSV (comma-separated values) format. CSV is a data format for tables that consists of fields separated by the comma character and records separated by newline characters. Any commonly used spreadsheet program, such as Microsoft Excel, will read this format.

Show me how to export records for selected features

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ata Management

This chapter shows you how to work with data in a central data store and how to move data from one data store to another.

Topics in this section

- <u>Create a GIS data store (SDF) to be populated from various sources</u>
- Bulk copy data from a SHP file to an SDF file
- Edit an existing schema (SDF)
- Limit what can be entered in a field
- Join attribute data to features
- <u>Calculate fields in the Data Table</u>



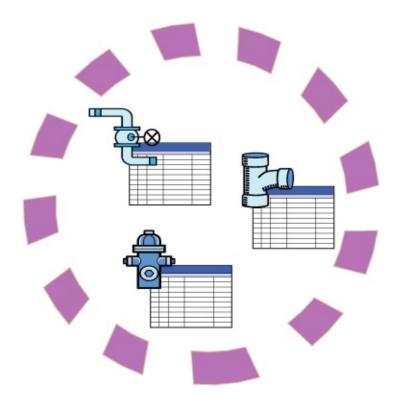
reate a GIS data store (SDF) to be populated from various ources

Suppose you want to create a spatial database so that you can store all of the water, wastewater, and sewer data for a city in one convenient location. However, no one on your staff is trained in Oracle or any other database applications. One solution is to create a spatial data file (SDF) and copy your data into it. As well as providing standard data query and access functions, SDF allows you to organize your data in an open, industry-standard database format today so that you will be ready if you need to move to a full relational database system later.

Creating an SDF file is easy. All you need to know is that the data stored in the file is organized according to a *schema*. The schema defines the structure of the database: which feature classes are stored in it, what are the properties of the different feature classes, and so on.

For example, in the illustration below, the circle represents the SDF file. It has a single schema, which defines three feature classes: valves, pipes, and hydrants. The feature classes are exactly like database tables, or object data tables. Of course, the SDF file also stores the geometry for the pipes, valves, and hydrants, so that the features will always be correctly associated with their properties, that is, their attribute data.

Each column in the table is a property (attribute), for example, type or installation date, and each row in the table stores the database record for a single feature, for example pipe number 501 or hydrant number 22.



Examples

An SDF file has a single schema. It can contain multiple feature classes or it can contain just one. You can begin with an empty file and then add as many feature classes to it as you like. The following demonstration shows how to create a new SDF file and add a feature class to it by importing a pre-defined schema.

The import method is useful if your organization has standardized on a *data model*. A data model is a diagram that specifies the names of the feature classes, the relationships between them, and their properties. The schema implements the data model. In this example, the schema is imported as an xml file.

Show me how to create a new SDF file and import a schema



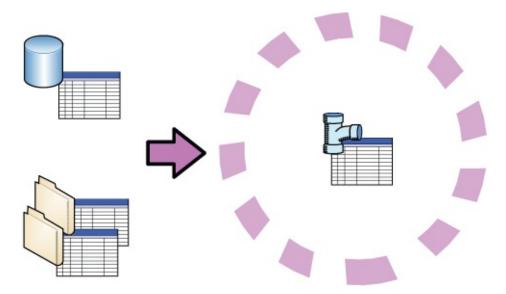
ulk copy data from a SHP file to an SDF file

All data that you access through the Data Connect window in AutoCAD Map 3D has a schema. This means that you can copy data from one data store to another simply by mapping the properties of one schema to another. As long as you can connect to it, you can copy it. For example, you could copy the data for water pipes from an SDF file to an Oracle database. Or you could copy the data for hydrants from an ESRI SHP® file to an SDF file.

In this scenario, you are not importing data into the current drawing and then exporting it, but you are using AutoCAD Map 3D as a bridge between two data stores. On one side, you are connected to a source data store and, on the other side, you are connected to the target data store. The data is transferred using bulk copy.

Examples

In the illustration below, the database on the upper left has a schema and the files on the lower left also have schemas. The circle on the right represents the SDF file that we defined in the last skill. It has a schema with a single feature class for water pipes. However, the feature class is empty and there are no water pipes in the SDF file yet.



In the following demonstration, we will see how to populate the SDF file by copying the water pipes from a SHP file. You can use the same procedure to copy data from any data store accessed through an FDO provider.

Show me how to copy data from one data store to another



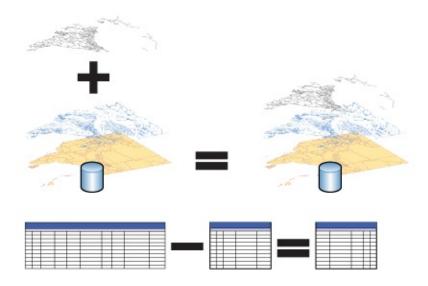
dit an existing schema (SDF)

If you are using SDF files to store your data, you will sometimes want to add data to an existing file. The SDF format can store multiple feature classes, so this is not a problem. One way is to use bulk copy to transfer the data (see <u>Bulk copy</u> <u>data from a SHP file to an SDF file</u>). Another way is simply to write the data directly from a DWG with the Export to SDF command (see <u>Export DWG</u> <u>objects to a GIS data store (SDF)</u>).

The schema for the SDF format is editable, that is, you can add feature classes and properties or overwrite existing ones. When you export DWG objects or features to an existing SDF file, you will be asked if you want to append (add) the data to the file or to replace the file. If you want to keep the existing feature classes, you would choose to append the new data.

You can also use the Schema Editor to add, edit, or delete feature classes and properties for any SDF file that is connected to your map. For example, if you receive data that has more properties than you need, you can remove them in the Schema Editor.

The illustration below shows the concept of appending a new feature class (layer) to an existing SDF data store. A single layer is exported to an existing SDF file, which already contains two feature classes. The illustration also shows how deleting properties from a feature class results in a table with fewer columns.



Examples

The first animation shows what happens when you export a DWG layer to an existing SDF file. By responding with a "Yes" to the "Append or overwrite?" question, we add the layer as a new feature class.

Show me how to append a feature class to an SDF file

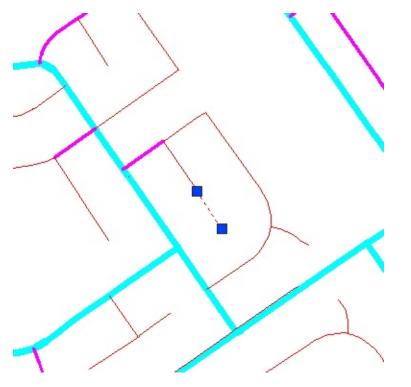
In the second animation, we edit the SDF schema and delete unwanted attributes from the newly-created feature class.

Show me how to delete properties in the Schema Editor



imit what can be entered in a field

Suppose you are responsible for a group of drafting technicians who each have access to the same data, for example, the network of water mains shown below. You want to make sure that everyone in your group enters one of the standard values for the DIAMETER field when drafting new pipes. 6", 8", or 10" are the only values allowed. In AutoCAD Map 3D, you can do this by setting a *constraint* for that field.



To set a constraint, you edit the schema for the data source. After you have done this for a particular property, for example for DIAMETER, the following things will happen:

- When one of your team uses the Data Table to add attribute data for a new pipe feature, the DIAMETER field will contain a pop-up list of acceptable values for the diameter.
- If he or she does not see the list and enters some other value, an error

message will appear that lists the acceptable values.

Examples

The following demonstration shows how to set a constraint for a field, using the DIAMETER property as an example.

Show me how to limit what can be entered in a field

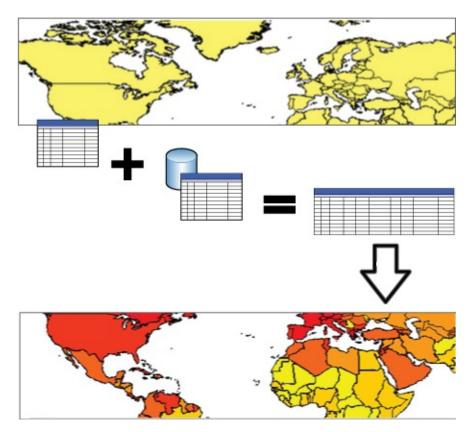


oin attribute data to features

Join is a term that comes from the world of relational databases. It refers to the action of joining one database table to another. The result of a join operation is an extended database table with more columns than it had before.

For example, consider a situation in which you need to create a map showing the property values of land parcels. You already have the parcels layer in your map, but the property value is not one of the attributes of the parcels, That data is in a separate Tax Assessment database in Microsoft Access format. In this case, you can simply join the Tax database to the parcel features. The attributes in the database then become available to the parcels layer and you can make a thematic map from the property values. (For more about theming, see <u>Choose the right type of theme to suit your data</u>.)

In the illustration below, a database containing economic and demographic data is joined to a feature class containing country boundaries. Once the new data has been added (joined) to the feature class, the attributes from the database table become available for theming. In this example, the countries have been themed to show life expectancy.



You have a number of advanced options when making a join. In order to use these options effectively, you need to know your data and what you want to do with it. (You should at least be comfortable working with tables, columns, and other characteristics of relational databases.)

For example, when you make a join, you can choose to keep only the features that exist in the original table and in the table you are joining. If you were joining a database table listing parcels within a flood zone to a parcel map, you could create a map to show only those parcels in the flood zone. Because the map will only display features that have a record in the data table, the parcels that are not in the floodzone would not be displayed in the map, as shown on the right in the illustration below.



Examples

The first demonstration shows how to create a basic join, using a map of countries of the world. In this example, we join a table of demographic data that is stored in a Microsoft Access database. The animation shows what the data table looks like before and after the join. It also shows the result of theming using one of the newly added properties.

Show me how to join attribute data to features

The second demonstration shows how to manage a join in your map after it has been created. You will see how to open the Manage Joins dialog box, and how to add another data table to the join that has already been created.

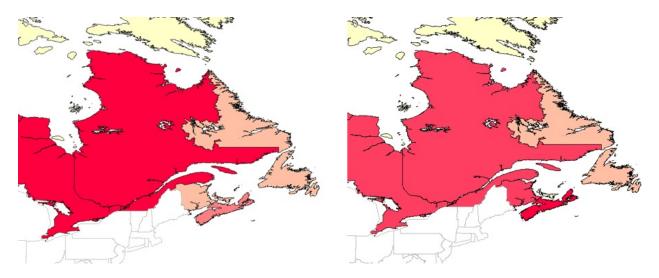
Show me how to manage joins



alculate fields in the Data Table

Another way to extend the number of properties available to you is to create a *calculated field*. Like joins, calculated fields result in extra columns in the data table. You can then use the new property to theme the data. A common example is the addition of a property for population density. This is a simple calculation, which you can do if you have data for population and for area. You simply divide area by population to get the population density.

The picture below shows provinces in Canada themed by population (on the left) and population density (on the right). The provinces of Ontario and Quebec, which appear in red in the population map, are in fact less densely populated than the province of Nova Scotia, which appears in red in the population-density map. This example shows how you can extract additional information from the data that you already have by adding calculated fields.



Examples

In this animation, we use the data for Canadian Provinces. The AREA property is in square kilometers. This animation shows how to use the Expression Builder dialog box to create a new calculated field that shows the area in square miles (using the formula SQKM * 0.386102159).

Show me how to create a calculated field

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tyling and Theming Features

This chapter shows you how to create a great-looking map by setting visibility, choosing line, point, and polygon styles, labeling, and theming based on attribute values.

Topics in this section

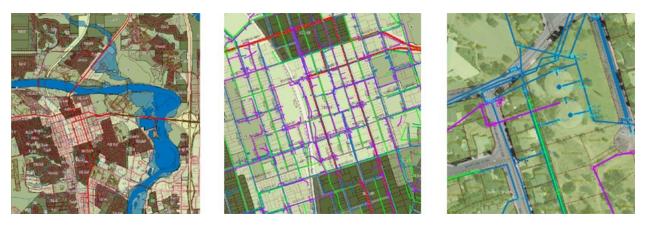
- <u>Hide and show features as you zoom in and out</u>
- <u>Replace points in the map with symbols</u>
- Label features and optimize placement
- <u>Set the number of decimal places for labels</u>
- Add a text layer and edit text
- <u>Set transparency for parcels or other features</u>
- Choose the right type of theme to suit your data
- <u>Manually adjust the ranges of a theme</u>
- <u>Theme based on individual values</u>



ide and show features as you zoom in and out

One of the advantages of digital maps over paper maps is that features can appear and disappear as you zoom in and out. Details that would clutter the map when it is zoomed out to its full extent can be hidden and only displayed when the map is zoomed in. Here is an example

- View on the left, showing most of the city—no water pipes, storm drains, or sewer pipes are visible (scale = 1:20,000).
- View in the center, showing a neighborhood in the city—pipes appear as blue, purple, and green lines (scale = 1:5,000).
- View on the right, showing just a few parcels—symbols appear for hydrants, manholes, tanks, and valves. Aerial photo background appears. (scale = 1:1,500)



Or the features can change their appearance as the scale changes. Here is an example.

- View on the left, showing the entire country—no roads are visible (scale = 1:10,000,000).
- View in the center, showing a district—roads appear as red lines (scale = 1:1,000,000).
- View on the right, showing a city—roads appear as thick yellow lines

with red edges (scale = 1:100,000)



In AutoCAD Map 3D, the mechanism for showing and hiding, or restyling, features at different scales is called a *scale range*. To use scale ranges effectively, you need to get a sense for the different scales at which it becomes useful to turn features on and off. It usually makes sense to display city infrastructure, such as pipes and cables, at scales of between 1:5,000 to 1:10,000. Individual objects, such as hydrants or traffic signals, can appear at a still larger scale, maybe 1:1000 or 1:2,000.

Of course, you can also decide to show or hide *labels* for the features at different scales. You can make the labels as well as the symbols that represent the features a different size to show that one feature is bigger than another. (See <u>Label</u> <u>features and optimize placement</u>) A common example is to represent large cities with large circles and smaller cities with smaller ones. (See <u>Replace points in the map with symbols</u>.)

Examples

By default, all layers have a single scale range, with a lower bound of 0 and an upper bound of Infinity, which means that the layer is always visible. The first demonstration shows how to change the default scale range for a parcels layer so that the parcels only appear at scales from 0 to 1:20,000.

Show me how to make a layer visible only at a certain scale range

You can add as many scale ranges as you like, to control the appearance of the layer at different scales. You might want to add symbols for points such as hydrants on a map of a city's water system, and display these symbols when the map is zoomed in. Or you can create composite lines for features such as roads to show detail such as multiple lanes.

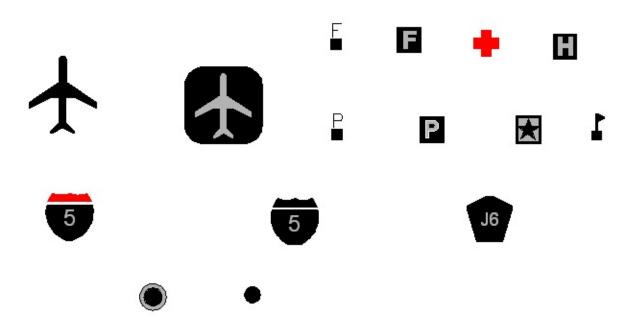
Show me how to create a second scale range for a road layer



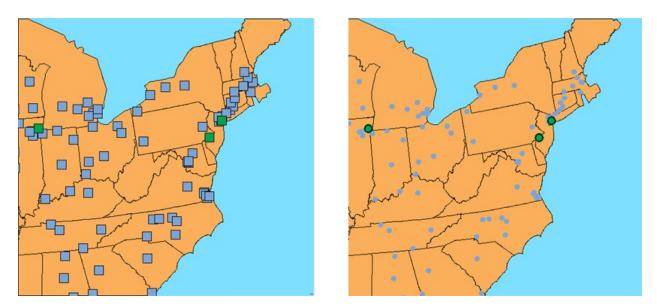
eplace points in the map with symbols

When you are drafting with AutoCAD, it is common to use a block to represent an object that repeats multiple times. You are probably already familiar with using blocks to show objects such as manholes or utility poles. In GIS terminology, a block used in this way is called a *symbol*.

In AutoCAD Map 3D, you can attach symbols to the current map from a symbol library, which is essentially a drawing with blocks in it. Here is an example of a symbol library, showing some symbols which are commonly used in maps in the USA.



In AutoCAD Map 3D, the default symbol for a point is a square like the ones on the left in the illustration below. The map on the right shows the result of replacing the default symbol with circles of different sizes. The map in this illustration has two point layers: one for cities with a population of over one million (green), and the other for cities with a population of over 100,000 (blue). In this case, our city data table contained an attribute/property for population. It was therefore possible to create separate layers for cities of different population ranges using simple property queries (see <u>Bring in a subset of features using a</u> query).



Examples

The following demonstration starts with two layers: for larger cities and smaller cities, already added to the map. It shows how to load a symbol library and then shows how to use a symbol from that library to replace the default square symbol.

Show me how to replace points with symbols



Labels are the names that mark each feature on the map, for example the parcel numbers or the street names on a city map. All feature classes, such as parcels or roads, have a data table that contains properties, stored as columns in the table. Typical properties are the ID and the number in the case of parcels, or size and material in the case of water pipes. There may be many other property columns in the data table as well, which can also appear in the label. Generating labels for features is simply a matter of selecting the property or properties you want to use.

							SNOW IN		_	SNOW LN	
1125-0201000	9123-0228020 1122-0228020	10208239380 102288398385	1.00000000	102020-020 1222220022	9120-0021000	102-00000000000000000000000000000000000	1020002900 10200034000	+1200034000	56	100000-000	+ (20009000
+125+00+0000	102480000		1100000-000	1-12100	1102-021020	105400000 10054	1-200	112228224020	LAKE REDONG C	1520000000	00 YOMOO
1120-0017000	1(2)421428	+-20800000		+canonicanan +CERDI	1123-429-11200	11254E1-4EE		+1200000000		1122000000	20 102000
1122-0214808	1122-021-9820	1020020402	1 CELEBRATE	+-2200 +-220	112040214000	+ CERTER ER	1-2238231028	**2230828000		100000000	-
						HARLAN DR	HARLA	N DR	_	HARLAN DR	
112200204205	112060001000	1120000000	ramoam	+-2000027-000 +-122020	+ CENTROLOGIE	+CONTRACTOR	+0280028000	+cmm-cmm	WI	1 common co	z +12800

AutoCAD Map 3D centers the label on the feature. It uses a method called *dynamic labeling*, which means that the placement of the labels is optimized so that labels on the same layer do not overlay one another.

Tip You can define multi-line labels. In the Style Label dialog box, for Property To Display, select Expression. You can then use an expression to specify how you want the labels to appear. Use the constant \n to separate each line. For example: owner\naddress

You will also want to consider the size of the labels relative to the features. There are two ways to manage this:

• Create a series of scale ranges with larger labels for closer zoom levels

(larger scales).

• Specify that you want the labels to change size automatically as you zoom in and out.

The first method takes a little time and experimentation to set up, but gives you greater control over the size and placement of the labels. The second method can be convenient as it takes almost no time to set up. It also gives good results. The map on the left below shows the labels before zooming. The map on the right shows how the labels get bigger and rearrange themselves after zooming.

If you want to do advanced cartography for printed maps, you will probably want to create your feature labels manually, using standard AutoCAD text tools. You can then place the labels precisely, so that the map is easy to read.



Examples

The first demonstration show how to label parcels with their parcel numbers. This animation shows the basic process for labeling any features. It applies equally well to line features (such as roads or rivers) and point features (such as cities or manholes).

Show me how to label features

The second demonstration labels cities with their names. It is similar to the first procedure, but adds a step to specify automatic resizing for the labels.

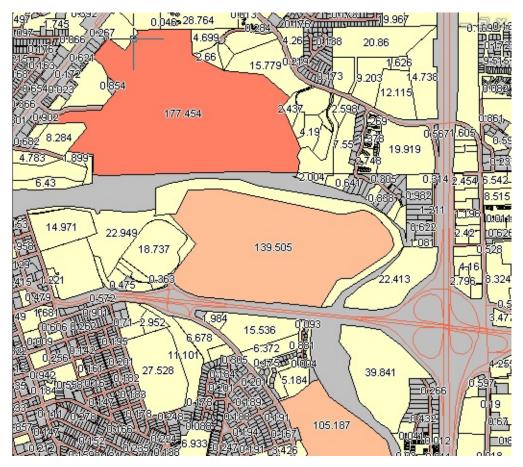
Show me how to label features with automatic resizing

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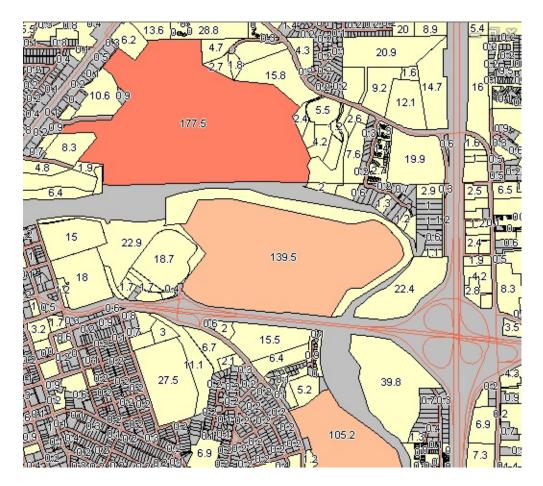
et the number of decimal places for labels

By default, AutoCAD Map 3D will label features with the property you select without changing the values for that property in any way. For example, if the value for the AREA property is set to 0 it simply means that it is not known or has not been specified. You can easily filter out these zeros and prevent them appearing on your map by using an *expression*. (For an example see the second animation in the skill <u>Manually adjust the ranges of a theme</u>.)

Another example of the use of an expression to change the appearance of labels is shown in the illustrations below. The labels show the area of the parcels to an accuracy of three decimal places. It is good to have this kind of accuracy in the data, but we don't necessarily want to display all three decimal places on the map—we don't need to show that level of precision and the extra numbers make the map look cluttered.



The illustration below shows the result of editing the labels to display only one decimal place.



Examples

Tip It is often a good idea to create a separate layer for the labels. Simply go to the Data Connect dialog box and add the parcels to the map a second time. Define your labels on this layer. This practice has two advantages: changing the style for the parcels does not affect the labels, and you can adjust the draw order of the labels separately from the parcels.

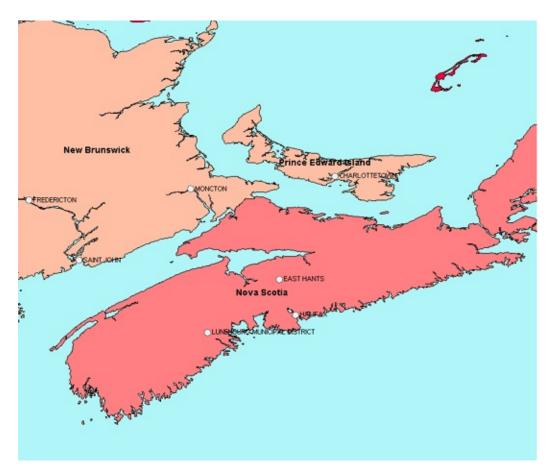
The following animation uses the parcel map shown above. It shows how to create an expression that includes the mathematical function ROUND. IN this case, we use the ROUND function to reduce the number of decimal places from three to one. (The expression looks like this: ROUND / area, 1)

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Show me how to set the number of decimal places for labels

dd a text layer and edit text

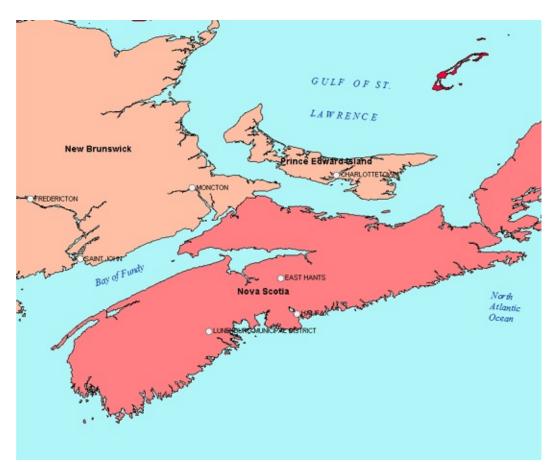
If you are creating maps with AutoCAD Map 3D, you may want to add text to your map and control the placement and appearance of the text very precisely. The labels that are generated automatically for features on the map may not always appear exactly where you want them. Take for example, the map in the illustration below. The labels for the provinces and cities are placed dynamically and will shift position as you zoom in and out. This is exactly what you want for maps that are intended for viewing on the Web using MapGuide. However, for plotted or printed map sheets, you need more control over the position of the labels.



You can use standard AutoCAD Mtext to place text anywhere you want on the

map, but you cannot save this text to your database with the rest of the feature data that makes up your map. If you want both precise control over your text *and* the ability to store the text in a database, you can add a special kind of point layer called an *annotation layer*.

This is what we have done in the illustration below. The blue text showing the main bodies of water has been added on its own anotation layer. The text is stored in the database, in this case an SDF file, but it retains the styling applied to the individual text strings.



Examples

The following animation shows how to create an annotation layer and add the first text item to it, using the map of Canada shown in the illustration above. The text is added using the default values for style and rotation.

Show me how to create a text layer and add text

The second animation edits the text string inserted in the previous animation. Because the text string is on the annotation layer, it has its own set of style properties. It can easily be adjusted to change the font, the color, and so on.

Show me how to edit text

To change the rotation of the text, you edit the ORIENTATION column in the Data Table, as shown in the final animation.

Show me how to rotate text



et transparency for parcels or other features

Using aerial photographs or satellite photographs as a background is a good way to provide a context for your map. For example, if you are drafting new services such as pipes or cables, a photograph will show you where the buildings are located, as well as the location of potential obstacles such as trees. If you add a parcel layer on top of the photograph, you get an excellent picture of the existing conditions.

It is especially useful to be able to make the parcels layer partially transparent, so that you can see both the parcel boundaries and the photo background, as in the illustration below.



Another useful application of transparency is to create a overlay of one feature layer on top of another, for example, to show the parcels that fall within a flood zone.

In the illustration below, the river is shown without its flood zone on the left and with the flood zone on the right. The layer showing the extent of the flooded area has been made partially transparent to show which parcels are affected.



Examples

The following animation uses the flood zone as an example. The floodzone layer overlays the river layer but it is opaque (which is the default for all polygon layers). In this demonstration, we change the style to make the fill color 50% transparent. This gives the effect shown in the illustration.

Show me how to make the features on a layer semi-transparent



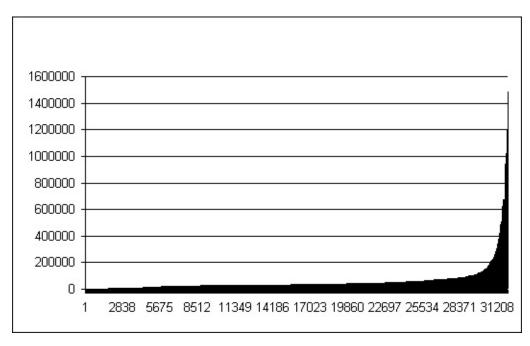
hoose the right type of theme to suit your data

You've almost certainly seen many thematic maps. These kind of maps are common nowadays in newspapers or on the internet, whenever the intention is to make some quantitative comparison of data. For example, a map of a country that shows election results is a thematic map. A map of the world showing GDP (gross domestic product) for each country is a thematic map.

A common use of thematic maps in local government is to show assessed property values. Other examples would be a zoning map or a map showing school districts.

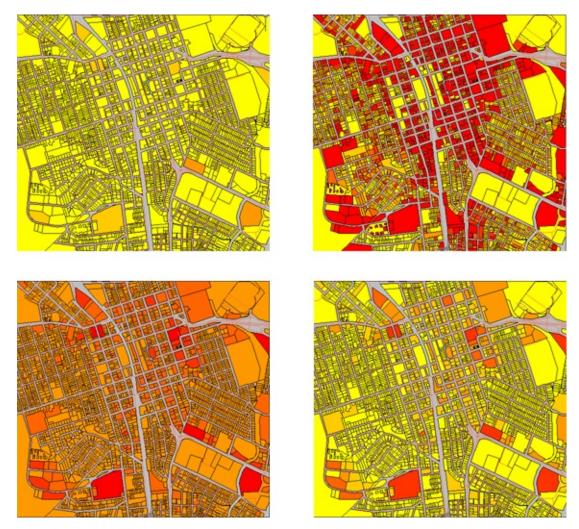
In AutoCAD Map 3D, you theme a layer based on a particular property or attribute. For example, you could theme a layer containing parcels according to the LAND_VALUE property of each parcel, or you could theme the same features by the AREA property. In this way, you can have multiple thematic layers in the same map, all based on the same features. Normally, of course, you only display one theme at a time (although you can create some useful maps by overlaying one semi-transparent theme over another—for example, a zoning layer on top of a parcels layer).

Equally important is the way that you stratify your data when you create a theme. You can get very different results depending on how you categorize and divide up your data. For this reason, it is a good idea to take a look at your data by making a chart of it. This will help you make a better decision about what kind of theme is most appropriate. You can generate a simple chart in a spreadsheet program, such as Microsoft Excel. The chart in the illustration below shows the distribution of values in the LAND_VALUE column of a parcels database.



Tip To get your data into a spreadsheet, you can export it in .CSV format. See <u>Generate a report by exporting records to a spreadsheet</u>.

The illustration below shows four maps of the same set of parcels. Each theme is based on the same LAND_VALUE property, and each one divides the data into six classes or ranges. However, each map uses a different method of separating the data into those six ranges.



These are the four methods:

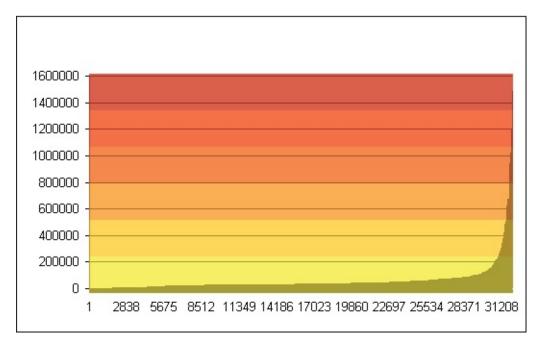
• Equal (upper left)—Creates ranges for the data at equal intervals. For example, if the parcels range in value from 0 to 1,200,000, this method will make six classes each one starting 200,000 higher than the one before.

Pros: Easy to interpret as data ranges are all equal. Useful for comparing a series of maps using the same data ranges. Works best with continuously distributed data, such as temperatures or precipitation amounts.

Cons: Does not consider how the data is actually distributed. Almost all data values may fall into one class, or there may be classes with no values in them. This is in fact what we see in the map above (upper left). Almost all the parcels are the same yellow color.

The chart below shows how the six equal classes relate to the data in our

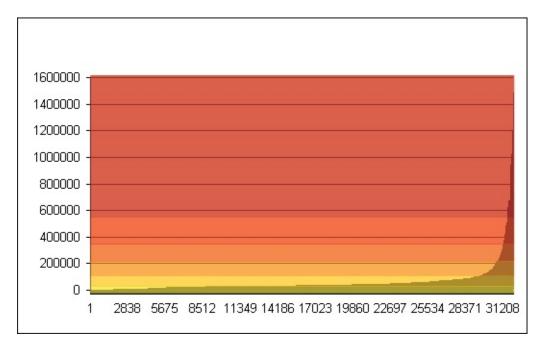
chart. As you can see, the vast majority of the values fall into the first class, with values between 0 and 200,000.



• Quantile (upper right)—Each range has the same number of features. For example, if there are 36,000 features, each range will have 6000 features assigned to it.

Pros: Always produces a good-looking map with even dispersal of colors, as no class has too few or too many values in it.

Cons: Can force similar values into different classes, or lump together dissimilar values into the same class. Implies that similar colors have similar values, when in fact this may not be the case. The chart below shows the parcel data distributed according to the quantile method.



• Standard deviation (lower left)—Finds the mean value, then places class breaks above and below the mean at equal intervals. All normally distributed data show the same "bell curve" shape with the majority of values clustered around the mean value. Standard deviation tells you how spread out the values are from the mean value.

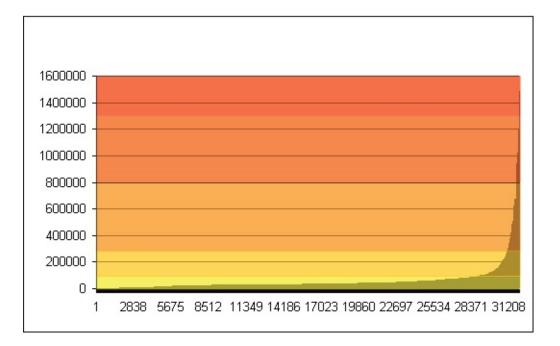
Pros: Brings out the contrast in the data values by using the mean as a dividing point. Assuming an even number of classes is used, the mean of the data serves as the dividing point between an even number of classes above and below the mean.

Cons: Requires a basic understanding of statistical concepts. May be difficult for users of the map to interpret. Only works on data that has a normal distribution (this is why it doesn't work for our parcel data, which is heavily weighted towards one end of the range).

• Natural breaks (lower right)—Ranges are determined based on statistically significant groupings in the data. Classes start and end where there are jumps in the data values.

Pros: Closely reflects the actual distribution of the data values. Features having similar values are placed in the same class. Good for showing uneven distribution.

Cons: The concept on which this classification is based may not be easily understood by all users of the map. The legend values for the class breaks, that is, the data ranges, may not be obvious as they are not even. Does not work well with data that is heavily weighted toward one end of the distribution.



Examples

Having analyzed our data according to the discussion above, we come to the conclusion that, of the four methods, Quantile will probably give us the best map for our data. Which method we choose in the end depends on what we want to examine or emphasize in our data, in other words, what is the purpose of the map and who is the intended audience?

Whichever method we choose, the procedure for theming the layer is the same, as shown in the following demonstration.

Show me how to theme a parcels layer



Ianually adjust the ranges of a theme

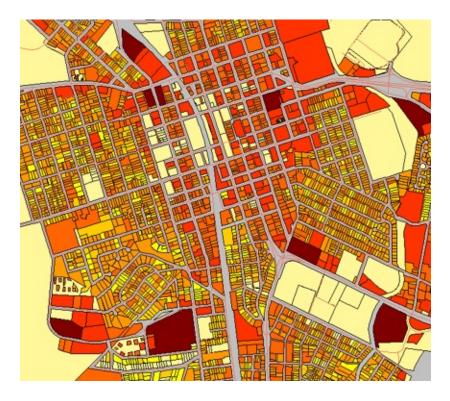
You may examine the distribution of values in your data and decide that none of the four distribution types: Equal, Quantile, Standard Deviation, and Natural Breaks, is exactly right. In this case, you can create your theme based on any distribution type, and then adjust the ranges individually. For example, with the parcels data, we have already found that most of the values are clustered at the low end of the range. We might therefore decide to make our own set of six ranges to best reflect the fact that most of the land values in our city fall between 0 and 100,000.

Analysis of the parcels data suggests that the following ranges would give the best results, that is, produce a map that is easy to read and in which the distribution of colors most accurately reflects the actual conditions.

- 1. 1 10,000
- 2. 10,000 20,000
- 3. 20,000 50,000
- 4. 50,000 200,000
- 5. 200,000 1,000,000
- 6. Greater than 1,000,000

Another characteristic of our data is that there are many parcels with LAND_VALUE = 0. We can exclude these parcels from the theme ranges so that they do not distort the distribution of the color values.

The illustration below shows the map that is produced when we theme the parcels using the new ranges. Compare it with the four maps in <u>Choose the right</u> type of theme to suit your data. The colors in this new map give a much better view of the real distribution of land values.



Examples

The first demonstration shows the procedure for manually editing the conditions for each range of values. For example, we change the first range so that it includes the values that are < (less than) 10,000. The second range includes values > (greater than) 10,000 and < 20,000, and so on.

Show me how to manually adjust the ranges of a theme

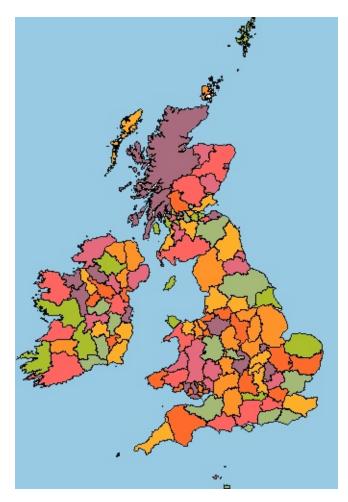
Manually adjusting the ranges gets us a long way towards a final map, but we forgot one thing—there are still many parcels with LAND-VALUE = 0 included in the first range. The second demonstration shows how to exclude those parcels. Also, the red colors for the two highest ranges seem too similar to one another, so we change one of them to a darker red.

Show me how to exclude zero values and change colors for the ranges



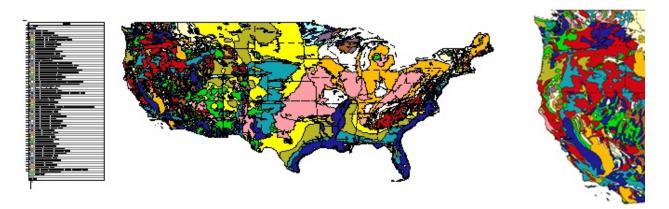
heme based on individual values

You may have noticed, if you worked through the previous theming skills, that there is a fifth distribution type for theming—Individual Values. You make a theme based on individual values when you don't want a range of values, for example, when you simply want to differenciate adjacent areas. A classic example is a country map in which the states or regions are assigned different colors:



A more complex example is a map showing soil types or geology, in which each category is assigned a color from a predefined palette. It is usual to use a palette for this kind of theme, rather than the graduated color ramp which is commonly

used for a theme based on ranges.



In a map like this one, with many different categories, the colors in the palette may repeat. In this case, you would want to examine the map to make sure that adjacent areas, which indicate different types of geology, have not been assigned the same color. If necessary, you can change the colors assigned to the individual values using the method described in <u>Manually adjust the ranges of a theme</u>.

Examples

The following demonstration shows how to create a geological map like the one in the illustration above. The layer for the geology has already been added to the map. There is also a layer for the outlines of the US states.

This theme uses one of the predefined palettes provided with AutoCAD Map 3D, which contains 14 colors.

Show me how to theme based on individual values



nalysis

This chapter shows you how to navigate and analyze surfaces, work with topologies, and isolate a subset of features using a buffer zone.

Topics in this section

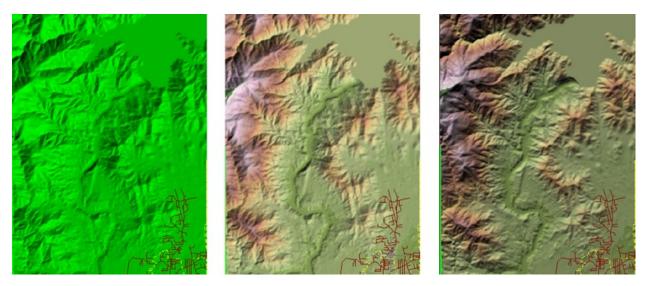
- <u>Color a surface by elevation and adjust hillshading</u>
- <u>Change the elevation ranges for a surface</u>
- <u>View a site in 3D</u>
- Drape vector and raster layers over a surface
- Analyze the slope and aspect of a site
- <u>Create a contour layer from a surface</u>
- Create a network topology to show how lines are connected
- Find the shortest path through a network
- <u>Find which lines are within a particular polygon (overlay analysis)</u>
- <u>Select features by location using a buffer</u>
- <u>Create overlapping buffer zones around points</u>



olor a surface by elevation and adjust hillshading

AutoCAD Map 3D supports grid-based surfaces such as DEM (Digital Elevation Model) files. Grid-based surfaces are raster images in which each pixel is assigned an elevation. You can theme the surface using elevation ranges, just as you theme features based on ranges of values. (If you have multiple surfaces, for example, a set of adjacent DEM files, you can bring them all into the map as a single layer, as described in Bring in data from multiple image files to a single layer.)

By default, a surface appears in the map colored in shades of green, as shown on the left below. The middle image shows the surface after it has been themed according to its elevation values.



By default, the surface also has *hillshading* applied to it. Hillshading gives the effect that the terrain is lit by the sun, with accurate shadows and highlights for a particular time of day and latitude/longitude.

You can adjust the direction and height (angle) of the sun to give the best results for your map. For example, because the middle image is fairly even in tonality—the shades of light and dark are similar—some people will see it "in reverse," with the mountain ridges appearing as valleys and the lake appearing to rise

above its shores. This optical illusion can be eliminated by changing the sun's angle and direction, as shown in the image on the right.

Examples

In this example, we have already brought two adjacent DEM files into our map. Now we want to color them to show the elevation of the terrain and provide a realistic background for the other layers. Because they are on the same layer, we can theme them together. This demonstration shows how to theme the surfaces using a pre-defined color palette.

Show me how to color surfaces based on elevation

The second demonstration shows how to adjust the direction and angle of the sun to give a stronger impression of light and shade. This makes the map less ambiguous and easier to read.

Show me how to adjust the settings for hillshading



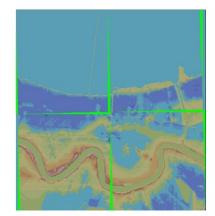
hange the elevation ranges for a surface

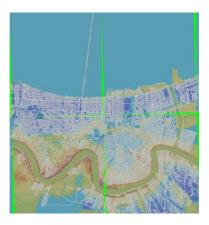
In an earlier skill, you saw how to edit the ranges of a theme that you have already applied to a layer to get exactly the effect you want (see <u>Manually adjust</u> the ranges of a theme). You can do the same thing with the elevation ranges of a surface. First, you apply a theme using one of the pre-defined color palettes. You then use the Style Editor to modify the elevations individually to control the appearance of the surface.

One useful application of this skill is to ensure that bodies of water are rendered with a blue color. When you apply a color palette, the colors are assigned to elevations in an arbitrary way. You can't guarantee that sea level will be blue, for example. Some palettes which are commonly used to render elevations, such as the USGS (United States Geological Survey) land cover palette used on the left in the illustration below, do not contain any blue colors. You can correct this with a little manual editing.

The illustration below shows three views of a map of the city of New Orleans. The map is one of a series depicting the flooding that occurred in the city following Hurricane Katrina in 2005. The view on the left shows four DEM files which have been brought into the map as a single layer and then themed by elevation. The view in the center shows the elevation ranges after editing. The land at or below sea level is now rendered in shades of blue—the darker the blue, the lower the elevation. The view on the right shows the street network on top of the elevation layer to show which areas of the city are affected.







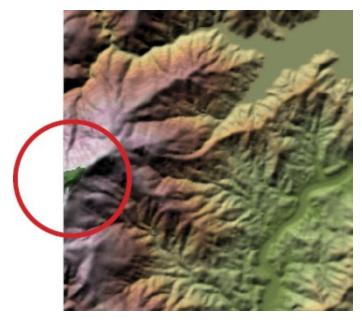
Tip The bright green strips in the illustration indicate areas around the edges of the four DEM files where there is no elevation data. You can remove these edges in a raster-editing program such as AutoCAD Raster Design.

Examples

In the first demonstration, we return to the map we were working with in the previous skill. At that point, we had rendered the surface elevation and adjusted the hillshading to give a realistic effect. The following animation takes over from that point. It demonstrates two techniques: how to delete unwanted ranges, and how to change the color for a particular range.

Why would we want to delete an elevation range? Suppose we know that the area covered by the surface in our map has no pixels with an elevation lower than a certain value. We can determine this, for example, by starting at the lowest elevation and changing the color for each range to something very obvious, like bright yellow or red, and then seeing if any areas of the surface are affected. In this way, we have found out that in our map there are no pixels with an elevation lower than 162. Therefore we can delete those ranges.

One problem that we have noticed with the surface is that the very highest elevation has been rendered with a green color, whereas it should be white. So we will change the color so that it renders correctly.



Show me how to delete elevation ranges and change the color of a range

The map shows a large lake or reservoir behind a dam. The next thing we want to do is to render the water surface of the lake in blue. A topographic map of the area would typically show the elevation of the lake. However, if we do not have such a map, we can also determine the elevation of the lake using the trial and error method described above. Either way, we know that the elevation of the lake surface is 325. We can now add an elevation range (or *rule*) specifically for the lake and then make its color blue.

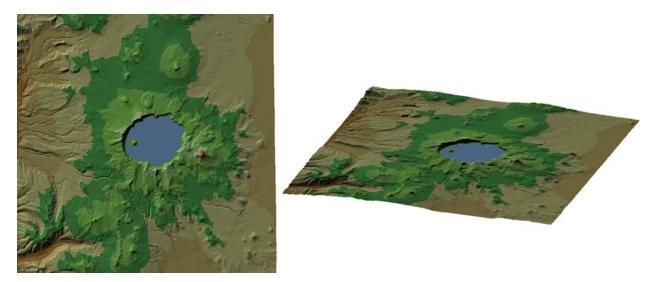
Show me how to add a new elevation range



iew a site in 3D

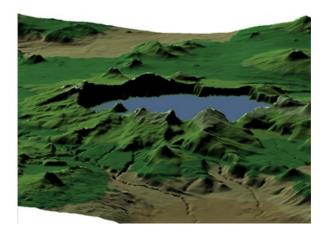
One of the most exciting aspects of the increase in computer processing power in the last ten years or so is the ability to create and view accurate 3D terrain models. Today, you can interact with 3D surfaces almost as easily as you can with a 2D map. As well as being a lot of fun to navigate, 3D models can show you aspects of a site or landscape that you can't visualize from an ordinary map. However well you can read contours or other cartographic conventions, there is no substitute for being able to see the relative heights and positions of landmarks in three dimensions. This is especially useful for the site analysis phases of engineering projects.

The illustration below shows a model of Crater Lake, in the state of Oregon, USA, rendered from two surfaces in ArcGrid format.



It can be useful to enhance your view of a surface by exaggerating the vertical dimension, especially for terrain that is mostly flat, or which varies only slightly in elevation. The following illustration shows a view of Crater Lake with the normal horizontal-vertical ratio on the left. The view on the right exaggerates the vertical dimension to 2, that is, a vertical distance is equal to twice the horizontal distance. This exaggeration emphasises the differences between elevation values and gives a more dramatic effect.





Examples

When you switch to 3D mode in AutoCAD Map 3D, a new 3D toolbar becomes available. You can use these tools to change your viewpoint, move in and out, rotate the surface, and so on.

Show me how to view and navigate in 3D

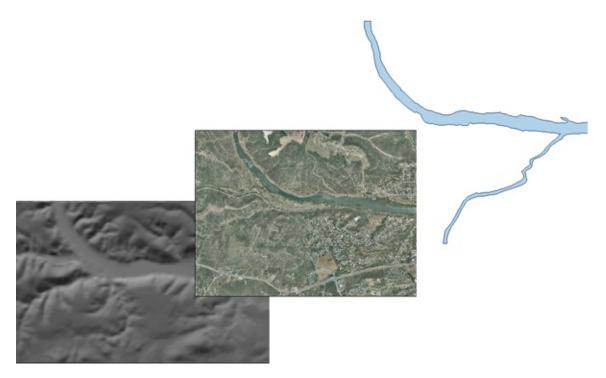
The second animation shows how to move your viewpoint close to the surface to obtain a view like the one in the second illustration above. It also demonstrates how to adjust the setting for vertical exaggeration.

Show me how to exaggerate the vertical dimension of a surface



rape vector and raster layers over a surface

Vector layers are layers that contain features, which can be lines, points, or polygons. Raster layers contain images such as photographs or scanned topographic maps. *Draping* means overlaying layers on a surface so that they follow the terrain. Of course, you only see this effect in a 3D view. The illustration below shows a DEM surface on the left. The photo, in the center, is a raster layer and the flood zone feature, on the right, is a vector layer. You can drape both these types of layers on top of the surface.



In AutoCAD Map 3D, draping happens automatically when you switch to 3D mode. Any layers that are visible and which are above a surface in the draw order are draped on the surface. You don't have to do anything to make the layers conform to the terrain. It is assumed that when you switch to 3D, you want to see everything in 3D. The layers which are draped are also trimmed to the edges of the surface. Again, the assumption is that when you go to a 3D view, you do not want to see any features that are not supported by an underlying surface.



Tip Draping applies to layers that have been created from data accessed through an FDO provider. You can also place DWG objects, but you will have to adjust their elevation properties manually to have them display on the surface correctly. For example, you could place 3D blocks representing trees, buildings and so on.

Examples

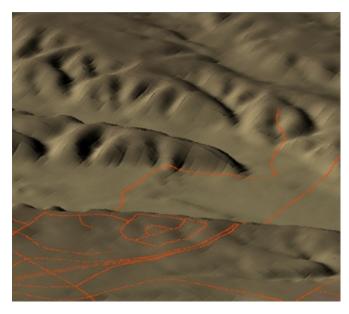
This animation shows the result of draping a vector and a raster layer on a surface. In the demonstration, we use named views to go quickly to a 3D view that has already been defined. However, you would normally use the 3D navigation tools first to set your 3D view. (See <u>View a site in 3D</u> for a demonstration of some of these tools.)

Show me how to drape layers on a surface

Tip You can get an excellent 3D effect by making the photograph semitransparent so that the DEM shows through. See "Making a Layer Transparent" in the AutoCAD Map 3D Help. (This effect is for display only. You cannot plot a transparent layer.)

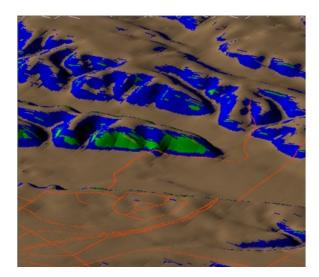
nalyze the slope and aspect of a site

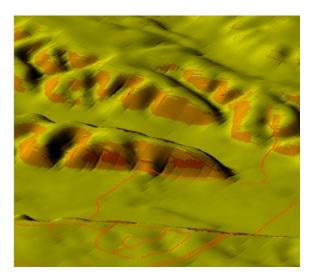
An important part of site analysis is to consider the slope and aspect of the different areas of the terrain. Suppose you are working on a development of the area along the road that winds into the hills in the view below.



One of the first things you might like to identify are the areas that are too steep to build on. In other words, perform a slope analysis. You have already seen how you can theme the surface to show its elevation (see <u>Color a surface by elevation</u> and adjust hillshading). You can theme the surface to show the slopes of the various landforms in just the same way. Of course, you can also adjust the ranges for the theme and make other changes to get the result that you want (using the techniques demonstrated in <u>Change the elevation ranges for a surface</u>).

The view on the left below shows a slope analysis using the default ranges and the pre-defined Slope palette. The view on the right shows a slope analysis using four rules, distributed equally, and a color ramp from yellow to red. The same slopes have been identified as steep in both analyses, but the colors and ranges are different.

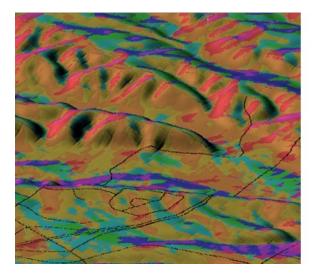


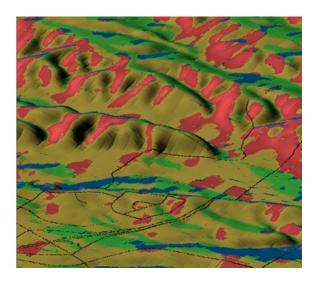


It can also be very useful to visualize the aspect of the different areas of the site. Aspect means the direction in which the land is facing: north, south, east, or west. The purpose of the analysis is usually to find out how much sun hits your site. Is part of the site on a hill facing north or south? Which areas receive full sun all day and which are shady part of the day? When during the day, morning or afternoon, does your site have sun? These are the kind of questions that you can answer with an aspect analysis.

Tip AutoCAD provides a dialog box in which you can specify the latitude and longitude of your site. You can then be sure that the sun settings that you use are accurate for your location. For more information, look up "geographic location" in the AutoCAD Help (Help Menu > AutoCAD Help).

The illustration below shows two aspect analyses of the same site. The view on the left uses the default ranges and the pre-defined Circular Palette for Aspect. This palette divides the 360 degree circle into 16 colors (of 22.5 degrees each). The view on the right removes most of the ranges and simplifies the analysis into four quadrants of 90 degrees each.





Examples

This demonstration shows how to analyze a surface using the Slope palette. There are five ranges in the Slope palette. For example, the first range is 0 to 18 and the second range is 18 to 36. (Slope is defined here as a range of numbers that represent the angle of slope rather than as a percentage of slope or a grade ratio.)

Show me how to perform a slope analysis of a surface



reate a contour layer from a surface

Contours are imaginary lines on the map which join points on the earth's surface at the same elevation. Contour lines are measured from a base datum, which is usually sea level, You can also have lines measured down from the datum to show the contours of the ocean floor or other bodies of water. Contour lines have become a familiar convention for representing elevations on large-scale maps, such as topographic maps, where accuracy and readability are more important than visual effect.

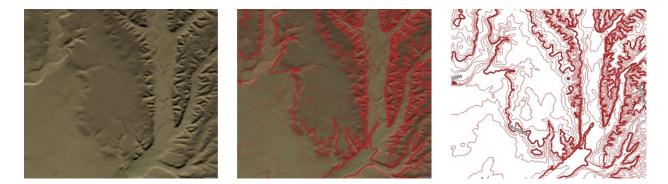
In AutoCAD Map 3D, you can create contours from surfaces such as DEM files. The contours are created on a separate layer and saved in SDF format so that they can be easily reused in other maps.

The difference in elevation between contour lines is called the contour interval. Usually there are minor contour lines, for example, every ten meters, and major contour lines, perhaps every 100 meters. Small scale maps of regions will have a larger contour interval, and will be less accurate, and large scale maps, suitable for engineering and planning, will have a small contour interval, and be very accurate.

When you choose the contour interval for your map, you will want to generate enough contours to accurately represent the terrain, but not make the contours so dense that they obscure the other features of the map. The illustration below shows a small area of a city with a surface in the background. What would be an appropriate contour interval for this map?



To find out, we can look at the elevation ranges for the surface, which has already been themed by elevation. (For more information, see <u>Change the elevation ranges for a surface</u>.) This tells us that the elevation in the area covered by the map ranges from about 400 meters to just over 700 meters. An interval of one meter would be too dense to be readable, while an interval of 10 meters would be too sparse to be accurate. A little calculation and experimentation shows us that a minor interval of 5 meters and a major interval of 10 meters would give us a good result for this map (see the view on the right in the illustration below).



Examples

The following animation shows how to generate the contours shown in the illustration above, with major and minor contour lines and default labeling.

Show me how to create a contour layer from a surface

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reate a network topology to show how lines are connected

A topology is an intelligent definition that specifies how lines, points, and polygons are connected. The topology records the relationships that the objects have with one another. Because of this intelligence, a topology can be used to perform useful calculations such as finding the shortest route between two locations, or determining which customers are downstream from a faulty pump or an offline substation.

Tip You can create topologies from DWG objects but not from features accessed through an FDO provider. If you need to create a topology from FDO features, extract the geometry first. See the first animation in <u>Bring in parcel data from AutoCAD Civil 3D</u>.

There are three kinds of topology: polygon, network (lines), and node (points). The illustration below shows the three types as they apply to an entire country: the division of land into districts, the network of railway lines, and the distribution of cities.



The following illustration gives further examples of the three types of topology on the scale of a single city: the parcel fabric, the street network, and the distribution of hydrants (blue circles).



It's fairly obvious that a street network or a railway network can be a topology, but how can a collection of points be regarded as a topology? The answer to this question is that topological relationships are not confined to connectivity, but also include adjacency and relative position. In simple terms, the topology knows where the points are, which means that you can use a node topology, together with a polygon topology, to find out which cities are within a particular district, or which hydrants are within a particular parcel.

Before you create a topology, it is a good idea to make sure that your data is "clean," that is, free from duplicate nodes, overlapping and intersecting line segments, and so on. The process of creating a topology may not work if these kind of errors are found. For more information, see <u>Clean up duplicates, gaps</u>, and other accuracy problems in DWG files.

Examples

You will see how to use topologies to make an overlay analysis in a later skill (see <u>Find which lines are within a particular polygon (overlay analysis</u>)). Before you can do any analysis, however, you need to create your topologies. This demonstration shows how to create a network topology of the Indian railway system. The process for creating a polygon or node topology is very similar and uses the same sequence of dialog boxes.

Note In AutoCAD Map 3D, the menu selections that are available depend on the workspace that you are using. This animation uses the Map 3D for Drawings workspace.

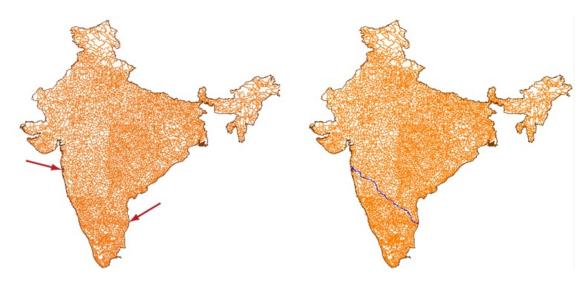
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Show me how to create a network topology

ind the shortest path through a network

Once you have defined a network topology in your map, you can use it to perform different types of analyses:

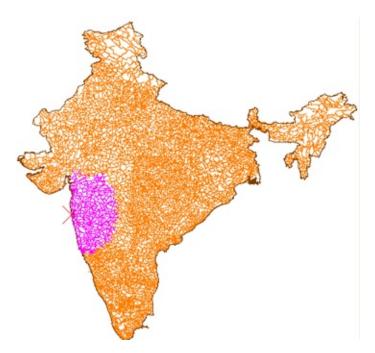
• Shortest path—Find the shortest distance between any two points in the network. Typical applications: dispatching emergency vehicles, getting driving directions. The illustration shows the shortest distance by road from the city of Mumbai, on the West coast of India, to Chennai, on the East coast.



• Best route—Find the optimal route from a start point to one or more intermediate points and back to the start point. Typical applications: optimizing truck delivery rounds, planning public transport. The illustration shows the route from Mumbai to Chennai and back, passing through three other cities on the way.



• Flood trace—Find all the possible routes from a given point. Typical applications: determining the reach of a water pump, finding the effective coverage of a customer-service center. The illustration shows all the road segments within 500 kilometers of Mumbai.



In most cases, when you perform these kinds of analyses, you will want to take into account the resistance to travel along certain line segments, such as road speed limits, as well as physical limitations, such as pipe width. For example, the shortest distance by road between two cities may not always have the fastest journey time. There may be a freeway, which takes a longer route, but which has a much higher speed limit. (These are the kind of calculations that are made when you get driving directions from a web-based mapping service.) Another example would be the resistance to crossing a particular point, such as a valve in a water network. In AutoCAD Map 3D, you can specify link resistance and node resistance across your entire network using expressions and object-data tables.

Examples

When you open a map that has a topology defined in it, the topology is not loaded. Before you can use it, you must load it. This step also audits the topology to make sure that it is correct and complete.

Show me how to load a topology

There is a lot of functionality that you can use when performing a network analysis, particularly to help you specify resistance factors. However, the following demonstration keeps things simple and shows how to find the shortest path between two points in the network, without calculating any resistance. The other kinds of analysis: Best Route and Flood Trace are very similar. (If you want to learn more about the different kinds of network analysis, there is a detailed description in the AutoCAD Map 3D Help.)

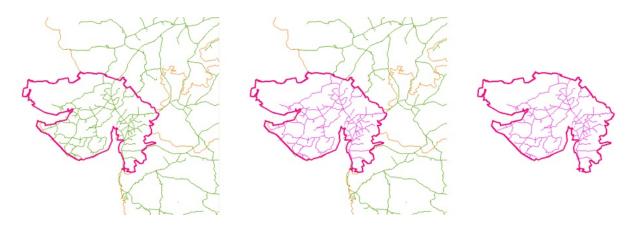
Show me how to find the shortest path between two points



ind which lines are within a particular polygon (overlay nalysis)

Suppose you want to find which railway lines are inside a state boundary or which pipes fall within a certain tax district. You can get the answer you want with an overlay analysis, which involves two topologies: the source topology, for example, the rail network, and the overlay topology, for example, the state boundary polygon. The result of this analysis is similar to what you would get if you used an AutoCAD command to trim the railway lines at the state boundary. This kind of trim or "clip" is one of the most common types of analysis that you can do by overlaying topologies, but it is by no means the only one. Another example would be to find the parcels that fall within a flood zone (called an "intersect"). A third example would be to find all the hydrants in a particular service district that are also within a specific residential zone ("union").

The illustration below shows the result of an overlay analysis in which the railway lines inside the state of Gujarat, India, are identified. The railway lines are saved to a new topology, which can then be used for further analysis.



Examples

The following demonstration starts with two topologies already loaded: "Indian_railways," which is the source topology, and "State_of_Gujarat," which is the overlay topology. The result of the analysis is a new topology, "Gujarat_railways," which contains only those railway lines that are inside the state boundary.

Show me how to do an overlay analysis using two topologies



elect features by location using a buffer

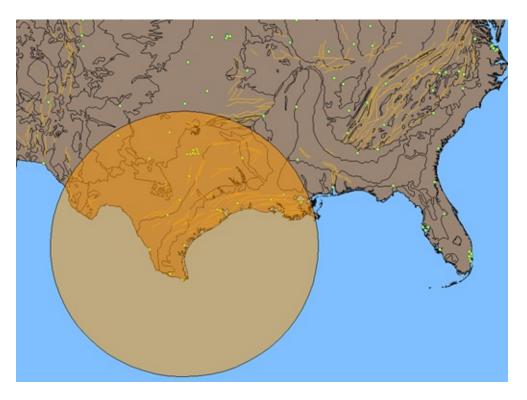
A buffer zone is a polygon that is drawn at a specific distance around a selected feature. It is typically used as a way to select features in the map for further analysis. For example, you may want to select parcels within a certain radius of a construction site. Once you have identified the parcels that you want, you can copy them to a separate layer, export the list of records to a speadsheet, and so on (see <u>Generate a report by exporting records to a spreadsheet</u>).

You can create buffers around polygons, points, or lines. In the Buffer Features dialog box, you specify the distance for the buffer zone. The distance becomes the radius of a circle if the selected feature is a point. If it is a polygon or a line, as in the examples shown below, the buffer zone will be irregular in shape. Buffers can overlap (you will learn more about the uses of overlapping buffers in the next skill).



The buffer zone is created as a polygon on its own layer. By default, it is styled to be semi-transparent. The polygon is also saved as a separate SDF file. When you want to select the parcels inside (or touched by) the buffer zone, all you need to do is make a location query, with the location defined by the buffer polygon (see the Examples section of this skill and the next skill for animated demonstrations of how to do this).

This illustration shows the result of a buffer operation around a city point, using a distance of 500 miles.



Examples

The first animation shows a simple, but common, case, in which we create a buffer around a parcel at a distance of 200 meters. Because this is a single parcel polygon, there is no overlapping or merging.

Show me how to create a buffer zone around a parcel

Beginning with the buffer zone created in the first animation, we use it as the basis of a location query. The goal is to identify only those parcels crossed by the buffer zone. The result is a set of parcel records, which we can view and manipulate in the Data Table.

Tip Before you begin this kind of query on an existing layer, it is a good idea to make a copy of the layer. Performing a query on a layer does not affect the data in the connected data store, but it does change the number of features visible in the map.

Show me how to use a buffer zone to select parcels

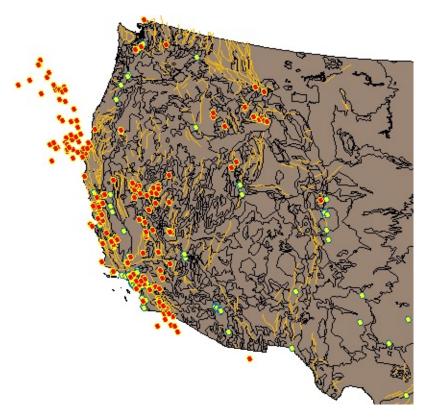


reate overlapping buffer zones around points

In the last skill, we saw how to create a simple buffer zone and use it to select a set of parcels. Now let's look at a more complex example, using multiple buffers around both points and lines.

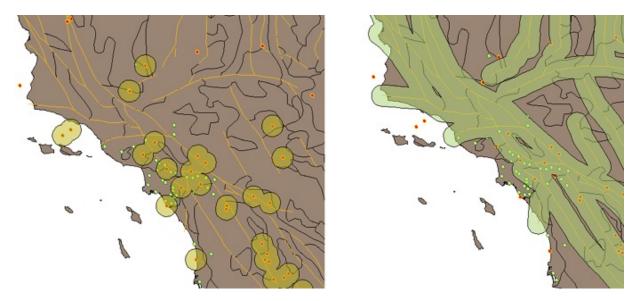
Suppose you are researching seismic activity in the Western USA. You have already put togther a map (shown in the illustration below) that shows all the earthquakes of a magnitude of 6 or more (the red circles), all the cities with a population of 100,000 or more (the yellow circles), and the major fault lines. To produce this map, you combined property and location queries to bring in the data from various sources (see <u>Bring in a subset of features using a query</u>).

Now you want to show which cities in the Los Angeles area are at greatest risk, based on past earthquake activity and the proximity of the cities to fault lines.



The first thing you need to do is to create a buffer layer to show the areas within

a specific distance of a past earthquake, say 10 miles. You can make the buffers around the individual earthquake points overlap to form continuous zones, as shown on the left in the illustration below. Next, you do the same with the fault lines to create another buffer layer (shown on the right).



Once you have created your buffer zones, you can use a multiple-location query on the cities layer to isolate those cities that are within one or more of the buffer zones, that is, they are within 10 miles of a past epicenter or within 10 miles of a major fault line.

Examples

The first demonstration shows how to build continuous buffer zones from multiple overlapping buffers. This example creates the buffer zones for the points. However, to create buffer zones around lines, you follow exactly the same steps

Show me how to create overlapping buffer zones

The second demonstration sets up a complex query for the cities layer by selecting some of the buffer zones in the area of study. The result is a new cities layer, containing only those cities within the buffer zones.

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Show me how to use a location query with multiple buffers

haring Data with Others

This chapter shows you how export data to a GIS format in order to share it with others, and to share the styles you have applied to the features in your map.

Topics in this section

- Exchange data with other users by exporting to SDF format
- <u>Share styles with other users of AutoCAD Map 3D using .layer files</u>



xchange data with other users by exporting to SDF format

In a workgroup there may be some engineers or drafting technicians who work directly with features stored in central databases. However, there may be many others who do not have access to the data store or who do not need it. In this situation, it is useful to have a method of exchanging data between the different users. For example, suppose you have most of your feature data and attribute data in an Oracle database. You may want to extract some of that data and pass it on to another user who does not have access to the source.

The SDF format is ideal for this purpose, as it preserves the schema of the original source, all of the attribute data, and the geo-referencing information (coordinate system). You can export a layer, or multiple layers, to an SDF file and post them in some convenient location for your colleagues to access.

The Export to SDF command extracts the source features but not the styling that you applied to them. If you want others to be able to recreate the map with exactly the same styling and theming, you can export the style information as well (see <u>Share styles with other users of AutoCAD Map 3D using .layer files</u>).



Examples

For the purposes of demonstration, we will assume that the geology polygons shown in the illustration above, have been brought into AutoCAD Map 3D from a database and then themed. You now want to share that data with another user who does not have access to the database.

Show me how to export a layer to SDF

Let's further assume that your colleague has started her map of the USA in a different coordinate system (shown in the center above). What happens to the geology data when she brings it into the new map? (For the answer, see <u>Reproject incoming data to a new coordinate system</u>.) The view on the right above shows the layer incorporated into the map—the features are correctly positioned, but there is no styling yet.

Show me how to import a layer from SDF



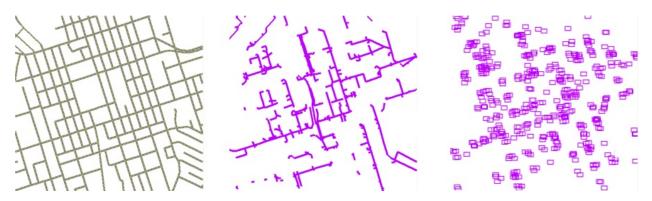
hare styles with other users of AutoCAD Map 3D using ayer files

There are various ways that you can share the maps you create with other users, depending on whether the other person has AutoCAD Map 3D and has access to the source data store.

- Case 1: The other person has AutoCAD Map 3D and has the same access to the source data that you do—Share styles by saving layers to .layer files. (The recipient may need to reset the path to the source data.)
- Case 2: The other person has AutoCAD Map 3D but does not have access to the source data—Share the data by saving as SDF (see <u>Exchange data with other users by exporting to SDF format</u>). The data needs to be restyled.
- Case 3: The other person does not have AutoCAD Map 3D and does not have access to the source data—Export the map to DWG (see Export the current map to DWG format with visual fidelity). The features in the map are converted to DWG objects and styles are converted. The map can be viewed in AutoCAD with good visual fidelity.

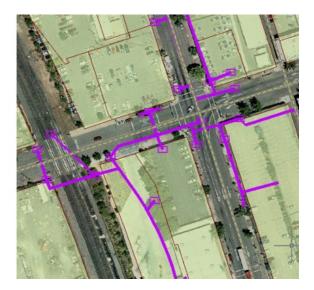
Case 1 is the best in terms of the time needed to rebuild the map. Layers are saved to .layer files, which can then be dragged into an empty map or into a map that already has some layers in it. This is a good way to enforce common styles within a workgroup. The .layer file records the styling for the features and also records the path to the source data. If everyone in the workgroup has the same drive mappings to the data store, then the transfer of .layer files will work seamlessly. If you send a .layer file to someone who has different drive mappings, then he or she will have to paste in the correct path (this is very easy to do in the Data Connect dialog box).

The illustration below shows three layers: for roads, storm drains, and drainage inlets. Engineer A has been working on these layers and now wants to pass them on to Engineer B. He saves them as three separate .layer files.



Engineer B has been working on the parcels in conjunction with an aerial photograph of the properties in the neighborhood, as shown in the view on the left below. She receives the .layer files from Engineer A and drags them into the map. The result is shown in the view on the right. The process is extremely quick and easy.





Examples

The first animation shows how to save a layer for sharing with other users of AutoCAD Map 3D. A .layer file stores the styling and path information for a single layer, so you need to save them one at a time.

Show me how to save a layer to a .layer file

The second animation shows how to use .layer files to build a map by dragging them from Windows Explorer. You can drag the files singly or you can drag several at the same time, as demonstrated here.

Show me how to drag .layer files into an existing map

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Iap Layout and Cartography

This chapter shows you how to work with the layers and draw-order of your map, and how to create and edit a legend.

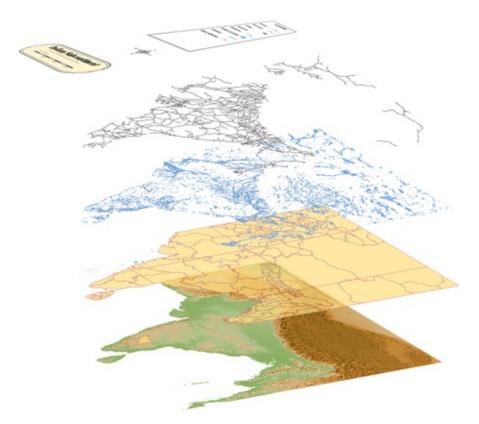
Topics in this section

- Manage layers with draw order and folders
- Include AutoCAD layers in the Display Manager
- <u>Create and edit a legend</u>



Ianage layers with draw order and folders

In digital cartography, a map is made up of layers which overlay one another. You need to arrange these layers in the correct order, so that every feature in the map is in its proper place in the vertical arrangement. Features should not obscure other features, and in turn should not be obscured by them. Typically, images, such as satellite photographs, go on the lower layers, that is, at the bottom of the *draw order*. Above them come polygon layers, such as state and city boundaries, and then the layers of line features and point features. Finally, elements such as the map legend, scales, and North arrows come on top.



Tip Transparency is a useful tool for working with draw order. For example, you can make some polygon layers semi-transparent so that they overlay other layers without completely obscuring them. See <u>Set transparency for parcels or other</u> <u>features</u>.

In AutoCAD Map 3D, layers are stacked in the Display Manager task pane. They do not have any connection to the AutoCAD layers in the Layer Properties Manager dialog box. If you want to include AutoCAD layers in the Display Manager, can do so by creating a Display Manager layer to contain them. Layers that you create from DWG objects participate in the draw order in the same way that layers made from features do. See <u>Include AutoCAD layers in the Display</u> <u>Manager</u>.

The illustration below shows a map with an incorrect draw order (on the left). The center view shows the result of moving the floodzone layer on top of the river layer. The view on the right shows the final map with the parcels layer also moved to a higher position in the draw order.



Folders are another way that you can manage feature layers. You can place related layers in the same folder. Folders are very useful when you have many layers in your map. Folders have their own visibility control, so you can turn all the layers in a folder on and off at the same time.

Examples

The map used in the following demonstration has seven layers in three folders: Transport, City, and Hydrology. These folders are visible in the default Display Manager view, which is called the Layers By Groups view. However, when we switch to the other view: Draw Order view, the folders are not visible and the layers appear in a single list. This makes it easier to move the layers up and down the draw order.

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Show me how to manage layers with draw order and folders

clude AutoCAD layers in the Display Manager

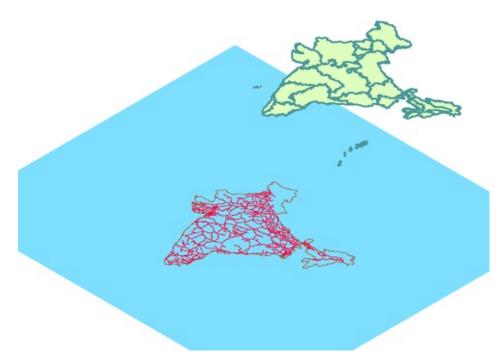
The different kinds of layers in AutoCAD Map 3D can be a little confusing at first. The generic term "layer," by itself, refers to the layers in the Display Manager. "AutoCAD layers" refers to the classic layers of DWG objects which appear in the Layer Properties Manager. You may also see the term "drawing layers." These are layers which appear in the Display Manager, but which have been created from AutoCAD layers, or from other elements in the DWG, such as queries or topologies. There are several good reasons why you might want to create drawing layers from the objects in your DWG:

- Control all layers in the map directly from the Display Manager.
- Style the DWG objects using the Display Manager.
- Set scale ranges for the DWG objects so they are visible only when you zoom in.
- Create themes from the DWG objects.

Take, for example, the map in the illustration below. This map is composed of layers made from features and from AutoCAD layers.

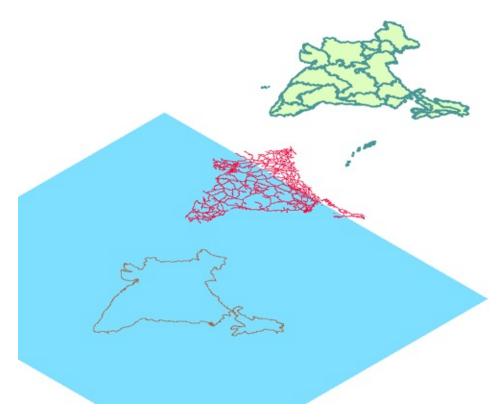


At the bottom of the Display Manager, whenever you start AutoCAD Map 3D, you see a default layer labeled "Map Base." What does this layer do? Its purpose is to serve as a container for all the visible AutoCAD layers. Therefore, if you turn it off, none of the AutoCAD layers in the Layer Properties Manager will be displayed. This does not affect the AutoCAD layers in any way, that is, it does not turn the light bulb off or freeze them, it simply means that they are not displayed in the map. However, if you make a drawing layer from one of the AutoCAD layers, it gets its own layer in the Display Manager and is no longer included in the Map Base layer. This will be clearer if we look at an example.



In the illustration above, the Map Base displays three AutoCAD layers: the blue rectangle, the coastline (brown polyline), and the railway network (red polylines). The green state boundaries are in a feature layer.

If we now create a drawing layer for the railway network, the structure of the map looks like this:



The railway lines have been placed on their own layer and are no longer under the control of the Map Base layer. The visibility and styling of these polylines can now be handled separately in the Display Manager.

Examples

The animation below demonstrates the main points of the preceding discussion. It starts with a review of the visible AutoCAD layers in the Layer Properties Manager, then shows how to create a drawing layer for one of them (the railway lines). It concludes by showing the effect of creating the drawing layer in the Display Manager.

Show me how to include an AutoCAD layer in the Display Manager



reate and edit a legend

If you are creating an engineering design, you will often distribute your plans in a standard format with a title bar and various other layout elements. If you are creating a map, you will usually want to add a *legend*. The legend is the key that explains the symbols, theme ranges, linework, and other conventions of the map.

The illustration below shows two legends which contain themes. The map on the left shows land values for the parcels in a city. The map on the right shows elevation values for a surface.

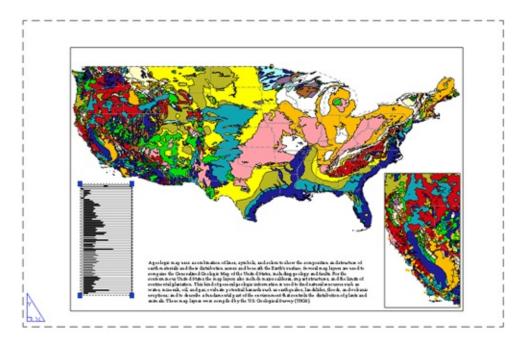


The following illustration shows a legend that includes two symbols for cities of different sizes. Note in this picture that the legend is actually a table with a heading and two columns.



In AutoCAD Map 3D, the legend is a direct reflection of what is visible in the Display Manager. When you create the legend, what you get by default is a table that includes all the layers in the Display Manager that are currently turned on. If you want to show the ranges for a theme, which you usually do, you need to make sure that the layer with the theme is expanded so that the ranges are visible.

The legend is always placed in the model view. When you want to include your legend in a layout view for plotting or publishing, you simply create a viewport for the legend and place it at the appropriate location in your layout, as shown below.



Examples

The following demonstration shows the interaction between the legend and the layers in the Display Manager. First, we create the legend. We then modify its contents by turning off the layers that we don't want to see and expanding the theme layer, because we do want to see the detail. Two of the tools in the Display Manager are used: Create Legend and Update Legend.

Show me how to place a legend in the map and specify its contents

The legend is displayed in a table. Therefore, to change the appearance of the legend, you can simply edit the table style "Legend," which is applied by default to the legend, or you can define and apply a different table style. The Table Style Editor is the standard AutoCAD dialog box, which links to the Text Style Editor.

Show me how to edit the table style for the legend

The Legend table style has borders all around it and also has lines to separate the rows. You may want to remove these lines. To do this, you explode the table and erase the lines manually. (Once you explode the table, it will not be updated automatically with the Update Legend tool.)

Show me how to remove rows and border lines from the legend



rinting, Plotting, and Publishing

This chapter shows you how to publish a map to the Web, create a map book, and publish a map to DWF format for viewing and plotting.

Topics in this section

- Publish a completed map to a MapGuide server
- <u>Create a map book with appropriate-scale tiling for a city</u>
- <u>Produce a multi-sheet DWF file for a map book</u>



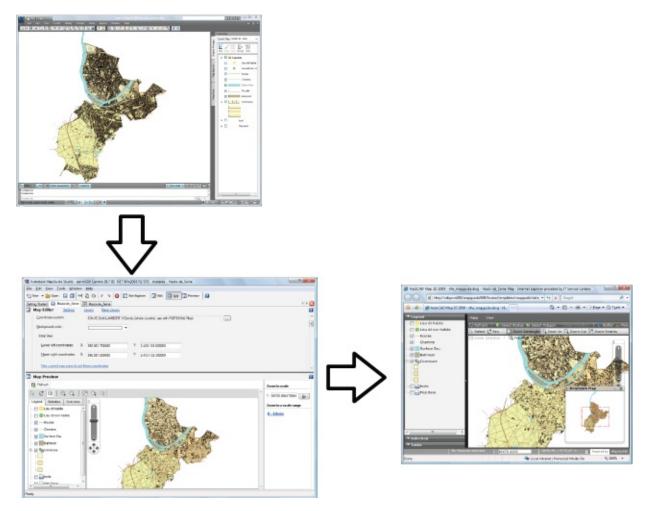
ublish a completed map to a MapGuide server

Distributing your maps to a wider audience on the Internet has never been easier. Once you have completed a map in AutoCAD Map 3D, you can publish it directly to Autodesk MapGuide® Enterprise. Autodesk MapGuide Enterprise is the quickest and simplest way to get maps from AutoCAD Map 3D onto the Web. The two applications work together seamlessly—all the styles, themes, scale ranges, and other characteristics of the map and its layers are preserved throughout the process.

Publishing to a web page involves just three steps:

- 1. In AutoCAD Map 3D, copy the map and its source data to a MapGuide server using the Publish to MapGuide command.
- 2. In Autodesk MapGuide Studio, open the published map and create a new web layout that references the map.
- 3. View and test the Web-ready map in a web browser.

In the illustration below, the original map in AutoCAD Map 3D is shown at the top. The application on the lower left is Autodesk MapGuide Studio. On the right, the map, in its web layout, is being displayed in a web browser.



The Web layout that is created by this three-step process displays the map either in the Autodesk DWFTM viewer, which is a free plug-in for Microsoft's Internet Explorer browser, or in the AJAX viewer, which does not require a plug-in and which runs in all other popular browsers. The Web layout provides all the essential navigation tools: zoom in and out, pan and select, plus layer visibility, property display, and interactive maptips. Usually, your web development team will add further functionality to the Web layout using the MapGuide API (application programming interface).

Autodesk MapGuide Enterprise is a commercial software product supported by Autodesk. The MapGuide server is also available as MapGuide Open Source, which is free software, supported by the open-source community. Both versions of MapGuide run on the Linux operating system, as well as on Microsoft Windows, which make it the most cost-effective Web-publishing solution, as well as the easiest. For more information about MapGuide Open Source, and for software downloads, see http://mapguide.osgeo.org/. For more about Autodesk MapGuide Enterprise, see www.mapguide.com.

Examples

The demonstration shows how to publish a city map with multiple layers to a MapGuide server. Before you publish your map, you need to know the internet address of the MapGuide server, either with a server name, for example \\srv12356272\mapguide or with an IP address, for example \\144.122.334.555\mapguide. You also need to have a user name and password to access the server.

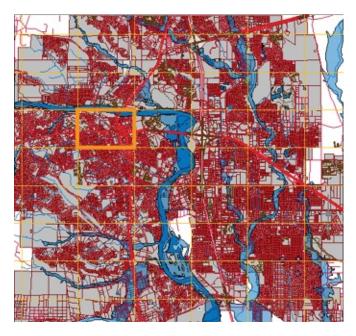
Show me how to publish a map to a MapGuide server



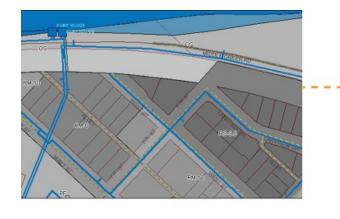
reate a map book with appropriate-scale tiling for a city

Map books are sets of plans that show infrastructure and property details, for example, for a municipality or utility company. Each page in a map book shows a tiled area linked to a key map that shows the position of each tile in the larger framework. Map books are often used by mobile work crews in the field. The convenience of having a book of easy-to-manage sheets that covers the entire work area helps crews to complete their work orders in a timely fashion. This system works best when the map book can be automatically refreshed on a regular basis from the most up-to-date data.

The important factors in creating a really useful map book are choosing the right scale and careful preparation of a layout sheet. You need to divide your coverage area into tiles that are the right size for the pages of a map book. The city map shown below has been divided into tiles which are useful as areas for querying and editing source data, but which are too big to serve as map book tiles.



However, you can use one of the larger tiles as a starting point for the Map Book tool in AutoCAD Map 3D. You can then subdivide the larger area (shown on the right in the illustration below) into smaller tiles (like the one on the left).





You can save time by creating a template (.dwt) file and a sheet set (.dst) file to define the pages of your map book. The template defines borders and title blocks, plus navigation aids such as a key map and the arrows which point to adjacent sheets. The sheet set specifies the content of each numbered tile. The illustration below shows a blank template (on the left) and the same template when it has a tile of data assigned to it by the sheet set.



Once you create a Map Book, you can publish it to a plotter or to an Autodesk DWF file. If you publish to a DWF file, the map book will be interactive, for example, you can click the adjacent arrows to go from one page to another. See <u>Produce a multi-sheet DWF file for a map book</u>.

Examples

The following animation condenses the process of creating a map book by using a pre-defined file for the map book settings. This fills in some of the values in advance, such as the numbering scheme for the tiles. We also use a pre-defined sheet template to set up the map book pages for publishing. The map book created in this example is not large—it only covers one of the large tiles in the first illustration on this page. However, the steps are the same for a map book of any size.

Show me how to create a map book



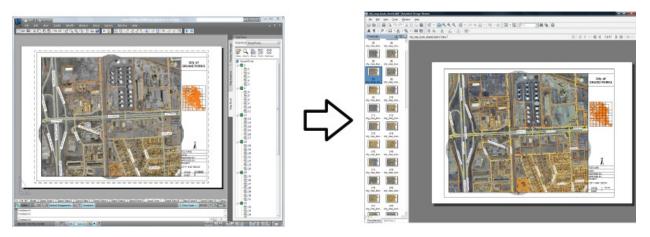
roduce a multi-sheet DWF file for a map book

A DWF file is a container for a design package. As well as the print-ready sheet set, it can contain other information about the map, such as the properties for each feature. AutoCAD Map 3D can publish maps as georeferenced DWF files with coordinate information. The published maps can then be viewed in Autodesk® Design Review, which is a free viewer and editor for the DWF format.

The person viewing the DWF file can interact with the map and view the attribute data simply by selecting any of the features. Publishing a DWF file directly from a map book is a good way to share information about infrastructure with other departments or with contractors. The DWF file contains all the sheets in the map book, exactly as they were in the original DWG.

For example, the illustration below shows a tile from a map of a city street network. The view at the lower left shows how the tile appears as a page of a map book generated in AutoCAD Map 3D. The view at the lower right shows the same page as it appears in Autodesk Design Review.





Autodesk Design Review is a plug-in for the Microsoft Internet Explorer web browser. It includes a viewer for DWF files and a set of DWF editing tools. Autodesk Design Review allows you, or your field crews, to add redlining to the DWF-based map or plan, enter field notes, or make any other kind of markup. The georeferencing information in the maps allows field workers to perform two very useful tasks:

- "Interact with GPS devices to display the current location on the map.
- "Navigate automatically to a specific location by entering coordinates.

After editing, the updated DWF file can then be read back into the original DWG file for incorporation into a central data store. In this way, it is possible to "round-trip" data from the original source, to the field for as-built edits, and then back again.

For more information and download of Autodesk Design Review, see www.autodesk.com/dwf.

Examples

This demonstration shows how to specify the properties or attributes to include in the published DWF file. In this example, we use a simplified map of a city water system with waterlines, valves, and hydrants. In the publishing options, we specify that we want to include the valve type and valve number properties in the output.

Show me how to publish a map book with attributes to a DWF file

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