Drawing Environment

Overview

This lesson describes the AutoCAD® Civil 3D® (AutoCAD®) software drawing environment. Whether refreshing students knowledge or learning for the first time, these exercises will help students develop familiarity with basic entity creation and modification, entity properties, layers, blocks, layouts, and template files. A strong knowledge of these basics will enable students to work with the AutoCAD Civil 3D lessons and software more efficiently.

This lesson is intended to help students become familiar with the basic drawing environment of Civil 3D, which is based on AutoCAD. Students who already have a strong working knowledge of this topic should proceed to Lesson 2, AutoCAD Civil 3D Interface.

Objectives

After completing this lesson, students will be able to:

- Navigate the Civil 3D drawing environment, zoom and pan to view objects, use the command window, use the Help system, and explore environment settings and function keys.
- Configure fundamental drawing settings and options such as Scale, Grid, Snap, Object Snap, file paths, and display colors.
- Create basic AutoCAD objects such as lines, polylines, circles, arcs, and polygons using menus, palettes, keyboard commands, mouse controls, coordinates, and object snaps.
- Modify AutoCAD objects using multiple techniques including grip editing and object properties
- Use layers to control object display.
- Navigate and view objects in 3D.
- Create reusable blocks.
- Use externally-referenced drawings in the current drawing.
- Draw objects in paper space (layouts) and configure one or more viewports in a layout.
- Create a properly formatted layout with required elements such as a title block, north arrow, border, and scale.
- Configure the page setup and plot layouts to an engineering scale.

Exercises

The following exercises are provided in a step-by-step format in this lesson:

1. Navigate the Civil 3D Drawing Environment
2. Review Options and Drawing Settings
3. Create Objects
4. Modify Objects
5. Navigate the 3D Drawing Environment
6. Create Blocks and Use External References
7. Work with Layouts and Viewports
8. Plot an Engineering Drawing to Scale

Civil 3D Drawing Environment

AutoCAD is the drawing environment used by AutoCAD Civil 3D design software. The software enables you to design in 3D, therefore, it is critical for students to learn the basics of the graphic environment prior to continuing through the rest of this curriculum. In the early years of CAD, design was performed separately from the drafting and production of final drawings. Civil 3D has changed this paradigm so that design and production are performed simultaneously. Understanding the drawing environment is crucial to design using the intelligent objects of Civil 3D. Feeling comfortable with creating and modifying objects, layers, viewing in 3D, using blocks, and being able to print to scale will help students be more productive as they learn the design tools of Civil 3D.

These exercises cover many basic concepts and the novice user is strongly encouraged to work through each one of the exercises to gain a full understanding of the graphic environment of Civil 3D.

A few key terms are:

Key Terms

Grips	Small squares and triangles that appear on selected objects. After selecting the grip, you edit the object by dragging it with the pointing device instead of entering commands.
UCS Icon	An icon that indicates the orientation of the UCS (User Coordinate System) axes. (UCSICON).
Grid and Snap	A grid is an area covered with regularly spaced dots or lines to aid drawing. The grid spacing is adjustable and the grid dots are never plotted. Snap settings relate to an invisible grid that locks the pointer into alignment with the grid points according to the spacing settings. Snap grid does not necessarily correspond to the visible grid.

Object Snap (Osnap)	Methods for selecting important geometric points on an object while you create or edit a drawing. Examples of object snaps include endpoint, midpoint, and center.
Layer	Layers are used to organize drawing data. Every drawing object is assigned to a layer. Objects can adopt the layer visibility settings, including on\off, freeze\thaw, color, and linetype.
Selection Window	A selection window is used to select one or more objects that a command can act upon at the same time. Implied windowing means using a right to left window to select items the window touches and a left to right window to select items entirely within the window.
Named View	A view, or graphical orientation, that can be saved and restored.
Block	A generic term for one or more objects that are combined to create a single object.
External Reference	A drawing file referenced by another drawing.
Layout	The environment in which you create and design paper space layout viewports to be plotted. Multiple layouts can be created within each drawing. Contract drawing borders are usually created on layouts.
Viewport	A bounded area that displays some portion of the model space of a drawing. A viewport is created on a layout.
Paper Space	One of two primary spaces in which objects reside. Paper space is used for creating a finished layout for printing or plotting, as opposed to doing design or drafting work that is performed in model space.
Model Space	One of the two primary spaces in which objects reside. Typically, a geometric model is created in a three-dimensional coordinate space called model space. A final layout of specific views and annotations of this model is placed in paper space.
Drawing Template Files	Drawing template files (DWT files) contain standard AutoCAD settings, layer definitions, linetypes, symbols, paper space layout definitions, dimension styles, and text style definitions. In addition, template files can include Civil 3D drawing information in either the Settings tree (including Civil 3D settings, object styles, label styles, tables, description keys, and point import\export formats), or the Prospector tree (including Civil 3D objects such as point group and surface definitions).

Exercise 1: Navigate the Civil 3D Drawing Environment

In this exercise, students navigate the Civil 3D drawing environment.

There are many tools available for viewing, creating, and modifying objects. Recognizing these tools and knowing how to use them quickly will help as students move into the later lessons. Customizing the drawing environment is frequently done to optimize your interaction.

No visible changes will be made to the drawing during this exercise.

For this exercise, start AutoCAD Civil 3D. A new drawing, *drawing1.dwg*, is opened.

Exercise 2: Review Options and Drawing Settings

In this exercise, students explore the various settings and options to customize AutoCAD Civil 3D.

No visible changes will be made to the drawing during this exercise.

Either continue from the previous exercise or start AutoCAD Civil 3D. A new drawing, *drawing1.dwg*, is opened.

Exercise 3: Create Objects

In this exercise, students create basic objects using menus, toolbars, cursor techniques, and keyboard shortcuts.

Either continue from the previous exercise or start AutoCAD Civil 3D. A new drawing, *drawing1.dwg*, is opened.

Exercise 4: Modify Objects

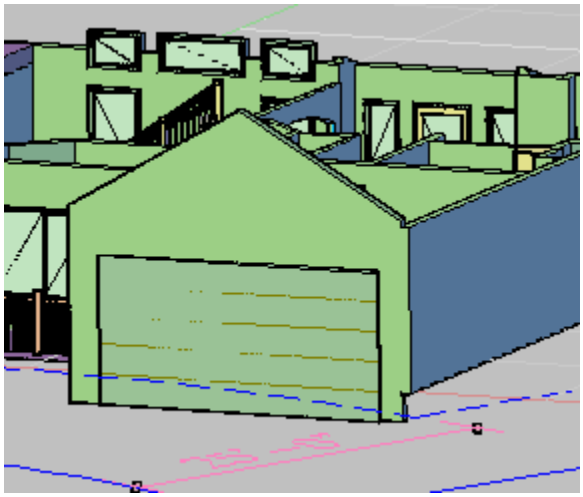
In this exercise, students modify basic objects using menus, toolbars, cursor techniques, and keyboard shortcuts.

No visible changes will be made to the drawing during this exercise.

Either continue from the previous exercise or start AutoCAD Civil 3D. A new drawing, *drawing1.dwg*, is opened.

Exercise 5: Navigate the 3D Drawing Environment

In this exercise, students learn the basic commands and views for interacting with Civil 3D in 3D.



For this exercise, open …*I_C3DDrawingEnvironment-EX5.dwg*.

Exercise 6: Create Blocks and Use External References

In this exercise, students create their own blocks and modify existing blocks. Students also use external references to help visualize background information.

Blocks are an efficient method used to group a set of objects together and can be reused within one or many drawings. It is convenient to create custom symbols by drafting objects to form the desired shape, and then create a block. Internal block definitions are stored in the DWG file in which they were created. The Writeblock (WBLOCK) command can be used to save a selection set to a separate DWG file.

Students start creating a block by drawing various objects. In this exercise, students use several drawings. Begin by opening the file …*FireHydrant.dwg*.

Exercise 7: Work with Layouts and Viewports

In this exercise, students work with model and layout tabs, add and modify viewports, and prepare a layout.

In general, model space (Model tab) is used for designing and working, while a paper space (Layout tab) is used for plotting. Although it is possible to plot from model space, it is most common to plot from a layout.

Viewports are a window into model space and are created in paper space on a Layout tab. You can control the number, size, and scale of the viewports on any layout.

For this exercise, open *…\I_C3DDrawingEnvironment-EX7.dwg.*

Exercise 8: Plot an Engineering Drawing to Scale

In this exercise, students use a template to create a new layout; create a scale bar; insert a north arrow; set the viewport scale; and preview and adjust the drawing and layout prior to plotting. While this exercise uses only one viewport, realize that you can use more than one viewport, and that each viewport can have its own scale and shape.

For this exercise, open *…\I_C3DDrawingEnvironment-EX8.dwg.*

Assessment

Challenge Exercise

Instructors provide a challenge exercise for students to do based on this lesson.

Questions

1. What is a selection set?
2. Where can you adjust the background color of the graphic screen?
3. What is an object snap?
4. What is the difference between relative and absolute coordinates?
5. How does a line differ from a polyline?
6. What are the five modes of a grip edit?
7. What is meant by exploding a block?
8. Is a zoom in paper space the same as a zoom in model space? Why or why not?
9. Can you have multiple viewports in a layout?
10. Should you place a title block in paper space or model space?

Answers

1. A selection set is a "selected" object or group of objects in a drawing. Once selected, the object(s) can have a command executed upon them in a noun/verb context.
2. The background color of the graphic screen can be adjusted by right-clicking the graphic screen and selecting Options, and then the Display tab.
3. An object snap specifies a precise location on an object. You can use an object snap whenever drawing to precisely locate a position such as the midpoint or endpoint of a line.
4. When drawing objects, you can use coordinates to enter a location. Absolute coordinates refer to the x, y, z coordinates of your active coordinate system. Relative coordinates are the coordinate *difference* from the current location.
5. A line is one object with a connected start and endpoint. A polyline is one object that contains a start and endpoint, but can also have multiple vertices in between, so it can appear to be multiple lines, but is actually only one object.
6. A grip edit is done when you select an object and highlight the grips and then select one particular grip to be “active.” The five modes include Stretch, Move, Rotate, Scale, and Mirror, which you can toggle through using ENTER or SPACEBAR.
7. A block is composed of objects that can be drawn on different layers with various colors, linetypes, and lineweight properties. Exploding a block reduces the block to its elementary objects.
8. No. A zoom command in paper space changes the view of the paper, not the model. If in model space while zooming, the scale of the model will change.
9. Yes, and the viewports can be a different size and shape.
10. Since the title block does not change with the scale of the drawing, it should be placed in paper space; that way, its size is constant.

Lesson Summary

This lesson focused on developing familiarity with the AutoCAD Civil 3D drawing environment. This included basic object creation and modification, entity properties, layers, blocks, layouts, and template files. A strong knowledge of these basics will enable students to work with the AutoCAD Civil 3D lessons and software more efficiently.