Use of Layers In A CAD Drawing

Concept of Layers

Before you can effectively use layers in a CAD drawing, you have to understand conceptually what a layer is and why we even need them. If we could relate layers to drawing with pencil and paper, we might think back to our childhood when we would tear a picture from a magazine and press it up to a window so the light could partially shine through it. On top of the picture, we would place a thin piece of tracing paper, and using a pencil, begin to trace the outline of the image from the magazine—the thin piece of tracing paper became a layer on which we would draw.

Well, using a CAD system effectively, whether it is AutoCAD, MicroStation or any other popular piece of CAD software, relies heavily on the use of layers to control the visibility of the elements that we place into a drawing. These elements (lines, circles, arcs, text, etc.) are all related to one another, yet very different. For example, a centerline has a very different pattern to it than a hidden line, which itself has an appearance very different than that of a visible line. When we draw architectural floor plans manually on paper, we almost always show walls, dimensions, notes, plumbing fixtures, etc. all on the same sheet of paper. Using a CAD system on the other hand, experienced CAD operators will draw each of these different yet related items on a separate layer, with each layer becoming a sort of drawing within a drawing. As the drawing becomes more and more complex, we develop a need to control not only the appearance of these separate yet related items, but also their visibility.

Consider we were making a simple floor plan of a one-room out building that was comprised of four walls. Additionally, we might complicate our design by adding a single door and one window. Drawing this type of plan using a CAD system doesn't require anything extraordinary. It's a relatively simple structure, and if all of the drawing elements appeared in the same color, we'd still have a fairly easy time of distinguishing one building element from another. Now imagine you were drawing the floor plan of a large commercial building. The complexity of such a plan requires us to draw a whole host of other items similar to what we mentioned earlier—including doors and windows of varying configuration, dimensions that are both on the interior and exterior portions of the floor plan, a wide variety of plumbing fixtures. And don't forget that we have to display all of these different yet related items on the same computer screen. If they were all the same color, we'd have a difficult time of distinguishing one element from another—that's where layers become a critical if not essential component of our drawing activities. Being able to draw plumbing fixtures on a layer separate from the interior or exterior walls gives us the opportunity to tell the CAD program that all of the exterior walls will be one color, say green, while the interior walls might be cyan. A layer on which the doors are drawn could be red, while the layer on which the windows appear could be magenta. The advantage of being able to create layers (drawings within drawings) is that we can more easily see what elements are doors, and which are windows. In drawings that are of great complexity, we may even find it necessary to make some layers visible (on), while others are invisible (off).

In short, being able to use layers in a drawing allows us to easily manage the contents of the drawing and more efficiently complete our drawing activities. Use of layers requires the CAD operator to be disciplined to the point that he or she is aware of what layer they're drawing on at
any given time, and to make certain that elements of the drawing are always drawn on their assigned layer, regardless of how few elements there may be on a particular layer.

Layering Standards
AutoCAD gives us the ability to assign names to layers, and different industries have different standards by which they name those layers. Layering standards make it easier to be consistent with the naming schemes we create for drawing projects, and become critically important in professional offices regardless of the number of CAD operators in that environment. To illustrate this point, I’d like you to consider how work is performed in professional offices. Most often, several people will be working on a project collectively and no single person or office for that matter is responsible for preparing the drawings necessary to construct a building. Additionally, the structural engineer who designs the framework to support the building also uses the work that is performed in an architect's office. The same is true of the civil, electrical and mechanical engineers. All the people within your office have an expectation that certain elements of a drawing will be found on specific layers, just as the people in offices other than your own. Naming and symbology standards must be maintained for the sake of allowing other operators to quickly edit and maintain the drawings initiated by some other CAD operator.

The standards used for layers and layer symbologies are often times specific to a particular industry and sometimes are dictated by a client. Sometimes layering standards are established for a single project. Under any circumstances, the use of layering standards allow CAD operators to control the following:

- Consistency in drawing practices and locating objects
- Various linetypes
- Drawing organization
- Streamlined display and overlay of objects
- Simplifying selection sets for various commands
- Protection of objects when you freeze or lock layers
- Control of object screen colors for clarity
- Controlling pen widths for plotting
- Layer management for external references
- Compatibility with custom automation
- Assign rendering materials

A couple of points to consider when developing a standard of your own are listed below

- Layer names should never be cryptic. They should always adequately describe what elements are contained on a specific layer.
- Use a prefix for dialog box and Layer Control window sorting. In other words, if you have a drawing where you want to distinguish between exterior and interior walls, you might provide names like “walls-int” and “walls-ext.”

Information necessary to write this paper came from AutoCAD R14 Fundamentals, Autodesk Press, ITP, 1998.