Lesson 1: Preparing a Plan

When building an agricultural structure, developing and understanding a simple construction drawing is the first step in actually producing the structure. The following lesson will outline the importance of developing a useable plan and explain how to develop a simple plan.

The Importance of Having a Good Plan

A plan is a drawing of a proposed structure containing a pictorial representation of the structure and information about it, such as the various dimensions of the structure and the placement of any doors or windows. Having and following a good plan will provide a useable structure that serves its intended purpose. A good plan will be well thought out before the actual building of the structure begins, thus providing an opportunity to design the structure to meet specific needs. Following a good plan saves time and money and allows an individual to avoid the difficulties associated with situations caused by a lack of careful forethought. A good plan is the builder's instruction sheet!

The Steps in Making a Good Plan

The first step in making a good plan is determining and defining needs. Being as specific as possible is important to avoid problems with the plan later. The person planning the structure should ask himself or herself, "What are the intended uses of the structure?" As she or he considers the uses of the structure, this information should be written down and reviewed carefully. For example, suppose storage space was needed for lawn and garden equipment, so a storage shed was to be built. The person putting together the plan would need to make the storage shed as usable as possible. A good place to start would be to write down a list of the items that would be stored there.

The next step is to determine the size of the structure. The designer should consider what size the structure needs to be to fulfill its intended purpose. Forethought is required at this point in the plan. Defining the needs is first evaluated by determining what the building is to be used for and considering any needs that might be designated in the future. Also, consideration must be given in order to have enough room in the structure for access and maneuvering. For this project, a storage shed with floor dimensions of 10 feet by 14 feet, equaling 140 square feet of floor space, should be sufficient for storing a riding lawn mower with a width of 42 inches, a wheelbarrow, and many hand tools and supplies. A door 48 inches wide and 80 inches tall centered in the front of the building would allow good entry for the equipment. Walls should be 8 feet in height with an overall building height of 18 feet from the ridge of the roof to the bottom of the structure.

The third step is to choose the style of the structure. Different styles and combinations of styles allow for a wide selection of structures. Structures are often referred to by their shape or roof style. Some examples of basic shapes are round, dome, A-frame, square, or rectangular. Common roof styles are gambrel, gable, or a shed roof. These roof types will be discussed in more detail in later lessons. For the storage shed described in the preceding paragraphs, a gambrel roof would be a good choice. This style will allow for considerable overhead room that can be used for storage if needed.

While other factors to think about at this point in the planning process will not affect all structures, they may be considerations in certain circumstances. An individual planning a building may need to consider the following factors:

- Material resources available - Some materials may be more cost efficient or easier to work with in construction but are simply not available or would take too long to find and purchase. An excellent example is very long pieces of dimensional lumber. Sixteen-foot lengths are not available in all dimensions on a regular basis; longer lengths may be very hard to obtain.
- Cost factors and constraints - Cost is usually a limiting factor in construction. Projects must be constructed at a cost that will allow for their completion and use.
- Building and fire codes - These codes provide a list of rules and regulations that must be followed when planning and constructing a building. The

regulations do not just apply to residential buildings, but to most structures. Compliance with any code or regulation in effect for a structure makes good sense. They are designed to ensure structures are safe. Insurance companies may also reject insurance applications or certain claims on buildings that are not in compliance.

- Zoning laws - Zoning laws are a set of local restrictions and requirements that determine what type of building may be done in a particular area. These laws regulate the type of building permitted, the size of a structure, the permits required, the style of construction, and other characteristics.
- Insurance and/or financial stipulations - These stipulations can affect the style and size of building that a lending institution will approve for financing. If commercial financing by a bank or other lending agency is required for the project, insurance is commonly required also.
- Safety considerations for specific structures - Structures may have very specific safety concerns, which generally depend on the enterprise in question. Ventilation could be a serious safety consideration, as a repair shop where engine exhaust or fumes might build up to dangerous levels. Milking parlors that are washed down daily may have slick floors if special measures are not included in the plan before construction begins. Hay and grain storage facilities have specific fire precautions that need to be addressed before construction.
- Utility and service access - Any enterprise will need some level of utility and service access to structures, and some need very reliable access. A good example is dairies where milk must be picked up on a regular basis.
- Cleaning requirements - For some enterprises, such as dairies and pig nurseries, cleaning is an everyday practice. Drains and sufficient water supplies must be planned to operate efficiently.
- Heating and cooling requirements - These requirements are critical to some enterprises, such as greenhouses or livestock and poultry facilities. They must be planned before beginning to build a structure.

Notice how quickly details accumulate when putting together a plan. Even a simple drawing must convey a large amount of information. A simple construction drawing for the storage building described could be put together from the information given above. However, before the plan could actually be drawn, an understanding of scale and the symbols used on plans is necessary.

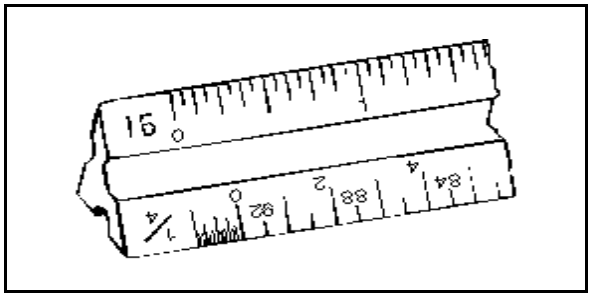
Scale

According to Webster's Dictionary, scale means "a proportion between two sets of dimensions." For plans, scale indicates an adjustment in the size of a drawing that reflects the size of the object being drawn. Drawing structures to their actual size on paper would not be practical. A system of reducing the actual size mathematically has been devised to compensate and allow for easy drawing and interpretation. An example would be to draw a construction project to 1/48 of the actual size, with one foot of the actual project being represented by ¼ inch on the drawing. This scale would be indicated on the drawing by including the following label: Scale ¼ inch = 1 foot.

Some common scales are used to represent projects of different sizes. Although many different scales can be used, the chart in Table 1.1 shows several of the most common scales. They are found on a triangular architect's scale (see Figure 1.1), a tool used by professionals who do many construction drawings. The architect's scale combines the eleven commonly used scales on one tool. Two scales are found on each face. The

Table 1.1 - Common Scales

Full Scale



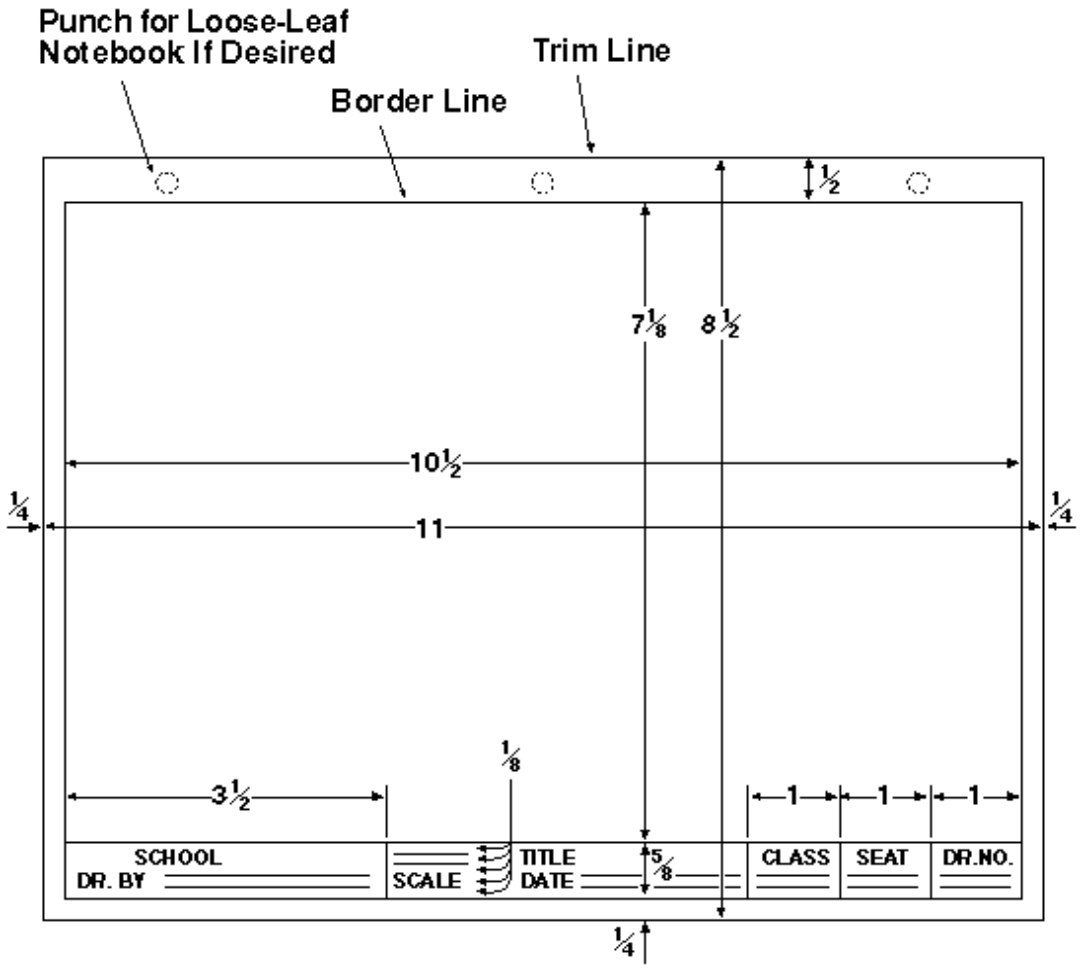
3/32" = 1'	_" = 1'
3/16" = 1'	¼" = 1'
_" = 1'	½" = 1'

¾" = 1'	1" = 1'
1½" = 1'	3" = 1'

main units of the scales are undivided with a fully subdivided extra unit at the zero end; the only exception is the full size scale, which is divided into sixteenths. The numbers listed at the zero end represent the length in inches that will represent one foot of the actual structure being drawn. This tool is very convenient for anyone drawing by hand. However, a regular ruler may also be used to draw a simple plan to scale.

When using a regular ruler, consider the maximum amount of space available for drawing. If standard drawing paper is used, as shown in Figure 1.2, approximately 10 inches by 7 inches is available for the drawing. Then consider the size of the actual structure. The storage building described in the earlier example has a 10 foot by 14-foot floor. To draw this structure on a standard sheet of drawing paper, the scale must fit a length of 10 inches and a width of 7 inches. The scale must fit within 7 inches, since this measurement is the limiting dimension for the drawing. What is needed is a scale that represents 14 feet in no more than 7 inches of drawing space. Keep the math simple and estimate a scale that might work. If the scale ½ inch = 1 foot is used, 7 inches on the drawing will represent 14 feet of the actual structure.

Common Symbols and Elements of a



Plan

Elements are the different parts of a construction drawing that convey information or enhance the information displayed on the drawing. Examples of elements would be all the information in the blocks provided in the title box, such as the name

of the person drawing the plan, title of the project, date, and scale (see Figure 1.2), as well as the symbols found on the drawing. The lines used for the drawing are also elements of a plan.

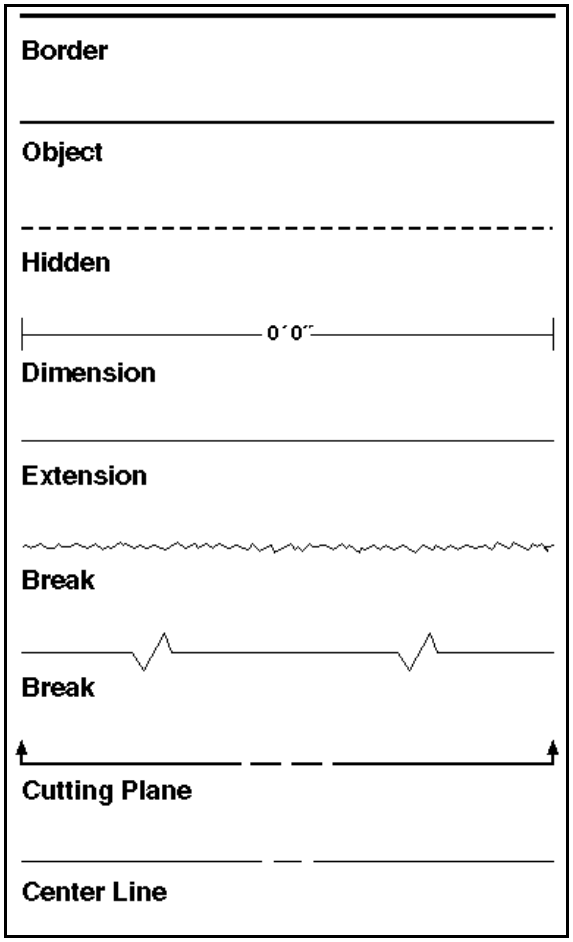
Symbols are pictorial representations of information that are included on the actual drawing. Some symbols, such as those for doors and windows, may be subject to the same scale as the rest of the drawing. They show the location of these parts of the structure. Other symbols, such as those used for plumbing and electricity, show where these devices or appliances are to be located. Symbols may also indicate the type or grade of materials used, such as concrete, steel, or wood.

The symbols that can be included on a plan cover a large number of pictorial representations of items that should be shown but are not practical to draw. As the illustration of symbols shown in Figure 1.3 indicates, they can be broken into categories, such as electrical symbols, plumbing symbols, symbols for metals, and symbols for lumber.

Symbols are most often used on plans to represent specific types of materials, doors, windows, and electrical or plumbing apparatuses. They need to appear on the plan where the specific information they convey is important. The appearance of symbols may vary between different sources, but they generally are like the examples in the illustration or are similar enough to be recognizable. Symbols are a great convenience for displaying information. The information conveyed by most symbols is more often of use on detailed plans. These symbols may appear on simple construction drawings if they are needed to represent specific information related to a particular plan.

Several different types of lines (Figure 1.4) may be used on a plan. As with the symbols, using all these lines on a single project is unlikely, but each may convey information needed for a specific project.

- Border line - A border line is the heavy dark line around the perimeter of the drawing paper, usually ¼ inch from the paper's edge. The drawing and all other information are inside the border line.
- Object line - This line is a very distinct line used to draw the object.
- Hidden line - A hidden line is a dashed line that represents material in a drawing that is under other material from the view being displayed.
- Extension line - This type of line is used for placing dimensions on drawings. It extends from objects without touching them to indicate their length, width, and height.
- Dimension line - This line shows the size of an object. It spans the space from one extension line to the next and has arrows at each end; a numerical notation of the length is displayed in a broken area in the middle of the line.
- Break line - A break line represents an area in a structure where a section has been removed.

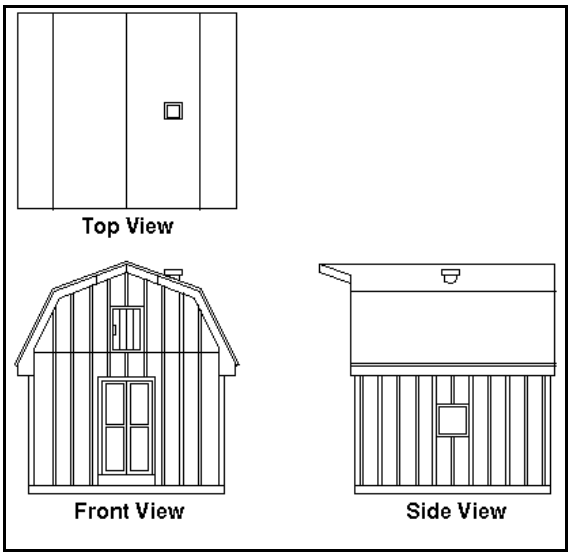


- Cutting plane - A cutting plane shows an area where a section has been removed.

Arrows on the end show the direction from which the section was taken.

- Center line - A center line shows the centers of holes and round shapes, such as drains.

Elevation drawing is a term used by drafters to refer to orthographic projections of a structure as viewed from different perspectives, most commonly the top, front, and one or both sides. Drawing only one view simply does not provide enough information to be able to visualize the structure completely. To convey the necessary basic information about a structure, a minimum of three elevation drawings must be produced either by hand or with a CAD system. These drawings show the exterior features of the building. Figure 1.5 shows different elevation drawings for a particular structure.



Computer-Aided Drafting

Computer-aided drafting or design, called CAD, is a system consisting of a computer and specially designed software that does the actual drawing of plans. CAD software programs are offered in different levels of complexity as well as in home versions that are inexpensive and produce excellent results. CAD is now the industry standard for drafting. The four main benefits of CAD over conventional hand drafting are speed, quality, ease of making changes, and communication (since CAD drawings can be transferred electronically). Drafting complex plans was once very labor intensive but can now be done with less effort. Changes can be made and viewed easily before printing. However, the CAD operator must still have the skill and talent to develop a functional plan. Many schools now teach the use of CAD.

Summary

As demonstrated throughout the lesson, the plan affects how the structure ultimately looks. To formulate and produce a good plan, the structure's intended purpose must be carefully considered. Decisions on style and size are determined by evaluating all known facts concerning the proposed structure. Each structure will likely have its own unique circumstances and considerations that factor into the plan. To convey the necessary information, a minimum of three elevation drawings of the structure must be produced either by hand or with a CAD system.

Credits

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