

Lesson 2: Building Designs

Agricultural structures use many different types of styles and designs because of the vast diversity of agricultural enterprises. This lesson describes some common building designs and factors that should be considered when designing and constructing agricultural structures.

Designs for Agricultural Structures

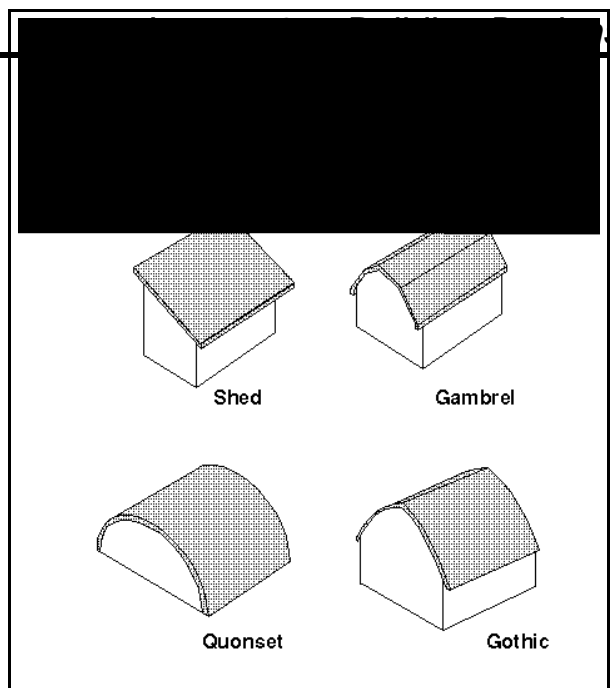
Although any conceivable design or combination of designs may be used for agricultural structures, certain basic shapes and roof styles are most commonly used. Structures are generally square, rectangular, round, or oval in shape; they may also be some combination of these shapes. Roof styles also are a significant factor in design; many structures are commonly referred to by the roof style used. Seven roof styles--gable, hip, mansard, gambrel, shed, Quonset, and Gothic/arched--meet most agricultural needs. A gable roof has two sloping sides that meet at the peak of the building, while a hip roof slopes on all four sides from the peak.

A mansard roof is similar to a hip roof in that it slopes on all four sides, but the upper part of the roof is flat. In the gambrel roof style, the sides slope slightly from the ridge to about halfway down the roof and then slope more steeply. A shed roof is sloping, with no ridge. A Quonset building is basically a half circle, with a rounded roof and walls. A Gothic or arched roof has two continuous curves that come to a peak to form the roof. Figure 2.1 shows these different styles.

Methods of construction vary with the types of materials selected for the structure. Several common methods of construction are used when building agricultural structures. Agricultural structures may also make use of aspects of all four of these basic methods of construction.

Wood frame - Wood frame construction involves the use of weight-bearing upright wooden members for the walls of a building. An example of this type of construction is a shed with stud walls.

Pole - In pole buildings, often called post frame buildings, large wooden timbers are placed in the ground and serve as the weight-bearing skeleton



of the building. This type of design is often used for hay barns and shelters for farm machinery. **Metal** - Metal construction refers to any structure where metal is used as a primary component of the building. Because of its strength and stability, metal is sometimes used in place of wood in pole-type construction. Structures are built by welding and bolting the materials together. This type of construction is often used for machine storage sheds.

Masonry - In masonry construction, concrete or masonry blocks are the primary building material.

Buildings are constructed by pouring concrete in forms or laying blocks. The use of masonry is very common for some types of agricultural structures, such as manure handling, because it produces a durable surface that can be cleaned and disinfected easily.

Advantages and Disadvantages of Different Designs

The advantages or disadvantages of each type of structure must be evaluated while keeping in mind its intended uses, the builder's options, and site restrictions. One type of structure cannot successfully meet the needs of every possible situation. To evaluate the suitability of a structure for a project, the following questions should be considered.

Building Construction

- Will the structure serve its intended purpose? Is it efficient?
- Are the construction and operating costs reasonable? Will using a particular design or material save money?
- Can the building be heated or cooled if required?
- Are the building materials durable enough to last for the life of the structure?
- Can the building be partitioned off or expanded if necessary?

Wood frame structures are often more economical than the other types. They are usually relatively easy to partition or expand. However, wood frame buildings will likely require more maintenance and may not be durable under conditions of abusive use. They also pose an inherent fire hazard because of the use of wood in their construction.

Pole buildings can be constructed rapidly and economically. With good maintenance and repair, the buildings can have a long life span. Partitioning or expansion of the existing structure is usually easily accomplished. However, they may provide inferior weather protection, because they often do not have solid sides. They generally cannot be heated or cooled without modifications being made to the structure.

Metal buildings often are serviceable for a long time; they are also fire resistant. Disadvantages of metal structures are that they may be expensive and require special equipment and considerable skill to build. They also may be short-lived around manure.

Since masonry can be cleaned and disinfected easily, as discussed above, it is often the best choice for structures that require frequent cleaning with water. Masonry is also fire resistant. The life span of masonry or concrete structures is generally very long, and they require minimal maintenance. Building with masonry may be more costly, however. The use of concrete may also require extensive excavation, depending on the topography. While masonry structures may be expanded or partitioned, tearing down masonry for expansion is a labor intensive process.

Factors to Consider For Design or Construction

A structure's intended uses must be specifically identified before the style of the design or the materials used are determined. The activities that will take place in a building may determine the best type of design. For example, a pole building will generally not be appropriate for swine nurseries.

A second factor to consider is whether the cost of construction is reasonable enough to allow successful operation or use. The building's use must justify its construction cost. An example would be to borrow money to erect a hay storage facility at a cost of \$100,000 and only produce enough hay to average \$5,000 per year in returns, which would likely not pay the interest on the loan or produce any profit.

The builder must determine whether the proposed structure is appropriate for local environmental conditions. Different designs and building materials affect a building's ability to function in its environment. Before making any decisions about design and the materials used, determining the amount of weather protection needed is important. The steepness of the roof will affect the structure's ability to deflect rain, snow, or ice. The type of wall construction and the materials used will determine how much weather protection is provided by the walls. Foundation designs vary from bare earth to raised floors of metal, concrete, or wood products that meet the requirements of the environment and the structure's intended use. The tremendous diversity of building materials, designs, and environmental conditions makes it impossible to give specific recommendations. However, tables and charts that detail specifics for weather and load, which is the weight carried by a part of a structure, recommendations are available from sources such as University Extension services, libraries, and manufacturers of building materials.

Since some structures may be unacceptable according to the regulations for a particular area, codes and regulations for construction must be consulted when choosing a design for a structure.

A county planning and zoning office can supply specific information about required wiring, plumbing, structural specifications, and permits. They may also suggest additional sources of information.

Finally, the efficient use of materials must be considered. The efficient use of materials is often a compromise because using them efficiently to provide the most space does not always yield the most functional design. Even though a square, rectangle, and circle have the same perimeter, they do not contain the same amount of interior space. Rectangular buildings are the most inefficient use of materials; however, they are frequently the most functional in use because the flow of activities typically follows a horizontal line. Square designs are more efficient and are suitable for many applications, although they are not as popular in the construction industry. Circles are very efficient in the use of materials but are usually not efficient in use or ease of construction.

Summary

When choosing a design for an agricultural structure, the intended use of the structure is perhaps the most significant factor, although other factors that may affect the design and its advantages and disadvantages must also be considered. Information is readily available to provide help in identifying options. Anyone considering constructing a large structure should seek appropriate help, which is often very inexpensive or free from government sources. Professionally prepared plans generally are designed to take many factors into account and may be an excellent choice for use in constructing a structure.

Credits

Burch, Monte. *How to Build Small Barns and Outbuildings*. Pownal, Vt.: Garden Way Publishing, 1992.

Huth, Mark W. *Construction Technology*. Albany, N.Y.: Delmar Publishers, 1989.

Lindley, James A., and James H. Whitaker. *Agricultural Buildings and Structures*. Rev. ed. St. Joseph, Mich.: American Society of Agricultural Engineers, 1996.

