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CHAPTER 1

Quick Reference

The daily activities on horse farms vary according to a farm's primary function, be it breeding, training, or public use. Though each farm requires specialized facilities, the basic goals of facility design and construction are similar. Facilities should promote safety as well as the efficient care and handling of horses. Well-planned facilities allow for lower operational costs and an overall increased efficiency of facilities. Poorly planned or improperly constructed facilities interfere with daily operations, increase costs such as labor and maintenance, and compromise the safety and health of both horses and people.

Influence of Horse Behavior on Design

To develop well planned facilities, a designer must understand horse psychology and behavior. When designing and constructing a facility, keep in mind that the expected behavior of horses will vary under different situations. It is also important to realize that horses have traits that differ from other livestock species. People who have little previous experience with horses and/or the planned activities of the farm should research horse behavior and training. Safe and sound designs respect horses' uniqueness and provide convenience and safety for both horse and handler.

A horse's natural defense mechanism is the *fight* or *flight* instinct. Horses are generally non-aggressive, but when threatened, excited, impatient, scared, or in pain they will typically first try to escape by running away. If escape is not possible, they will fight by kicking, striking, or biting. Those defenses explain the high-strung, excitable nature of the horse. The degree of excitability and nervousness varies between individuals and blood lines. Properly designed handling facilities allow for horse and handler safety while diminishing the horses' instinct or desire to escape by running through or jumping over barriers. Some classes of horses, such as breeding stallions, can be naturally aggressive and require specialized facility design to guard against horse or handler injury.

General horse traits include:

- Major preoccupation with food and security. A stable area typically represents an area for food and security. An excited horse may re-enter a burning barn because of this connection between food and security.
- Herd instinct with its security and the acceptance of discipline and a degree of submission. This instinct is a prime factor in training.
- Low pain tolerance. This low pain tolerance is sometimes used by people to control and train horses.
- Desire to stand to rest or doze while standing but will lie down for prolonged sleep. Sleeping patterns mean that horses need a comfortable area in which to stand and lie down.
- Highly developed senses of sight, smell, and hearing. Horses have an excellent range of vision. Their vision range is 340°, which makes them very sensitive to motion.

types of vehicles that will be on the site is needed.

Once the concepts of separation distances, work zones, and vehicular requirements are understood, placing buildings or activity areas on a map using information from a new or existing site can help one visualize how everything will fit together and identify problem areas. Even physically staking out the locations of buildings or activity areas will help to visualize the layout. When laying out the buildings or activity areas, be sure to plan for any landscaping that will help enhance the aesthetics of the site.

Separation Distances

When planning, assume that activities at the site will double in size over time. Provide space for new buildings, clearance between buildings, and expansion. Separate all buildings by at least 35 feet for access and snow storage. Naturally ventilated buildings require 50 feet or more clearance. Fire protection will require at least 75 feet of clearance. Consider space needs for vehicle access and parking. A good way to assure adequate space for future expansion is to develop a complete site plan that shows the location of all current facilities and area for future expansion.

Separation distances between buildings and neighboring features depend on management, operation size, pollution potential, and appearance.

- **Operation size.**
  Larger operations create more noise, odors, dust, and traffic requiring greater separation distances. For example, a bulk hay and grain storage area for a few horses has less impact on the living area than a site with many horses that requires frequent activity of tractors and large trucks.
- **Pollution hazards.**
  Odor, dust, noise, and manure disposal problems can be associated with larger sites with many horses. Odors from large-scale equine operations can often be detected one-half mile downwind.
- **Appearance.**
  A neat and attractive farmstead is very important. Consider landscaping that will enhance the site's appearance, especially near roadways, and locate less attractive facilities and activities farther away.
- **Management needs.**
  Locate horse facilities at least 200 feet from the family living area.

Zone Planning

Buildings are located in one of four specific areas or zones on the site, Figure 2-1. Zones are in about 100-foot increments. Zone 1 is for family living, lawn, recreation, gardens, office and visitor parking. Protect Zone 1 from odor, dust, insects, and unwanted visitors by locating other centers of activity outside Zone 1. The home should be closer to public roads than other buildings, especially large ones that tend to dominate or obscure the view of the house. A family living area at a separate site is a consideration for larger farms.

Zone 2 is for machinery storage, a repair shop, and related activities that are relatively quiet, dry and odor free. Zone 2 typically includes much of the driveway, service yard, and temporary parking space. Fuel storage and other more hazardous activities may be located to the far side of Zone 2—away from the family living area.

Zone 3 may contain a small stable, hay, grain, and bedding—activities that have frequent noise, dust, and traffic and that need daily labor. The electric power distribution pole, propane storage, and wagon parking may fit in either Zone 2 or 3.

Zone 4 is the major area for horse activities and other areas needing expansion space, access, feed, and manure management. Activities that produce noise, dust, odors, and traffic are located in Zone 4.

The location of the public road with respect to the site affects the Zone 1 living area location and overall site layout. For example, in the upper Midwest, it is usually preferable to have the driveway enter the farmstead from the south. This allows for an

undisturbed tree windbreak along the west and north to protect the farmstead from prevailing northwesterly winter winds—yet allow prevailing south winds in summer to reach into the farmstead. Figure 2-1 shows recommended farmstead area arrangements in relation to the driveway/public road access.

The direction of the site from the main road affects layout. Layout assumes prevailing winter winds are from the north and west, and prevailing summer winds are from the southwest, south, or east.

When a family living area does not or will not exist on a site, an office building, stable or arena may be the first building that is observed by people entering the site. Similar to zone planning for a family living area, the first building that is observed by people entering the site will become the focus area for the site and will be located in Zone 1. This

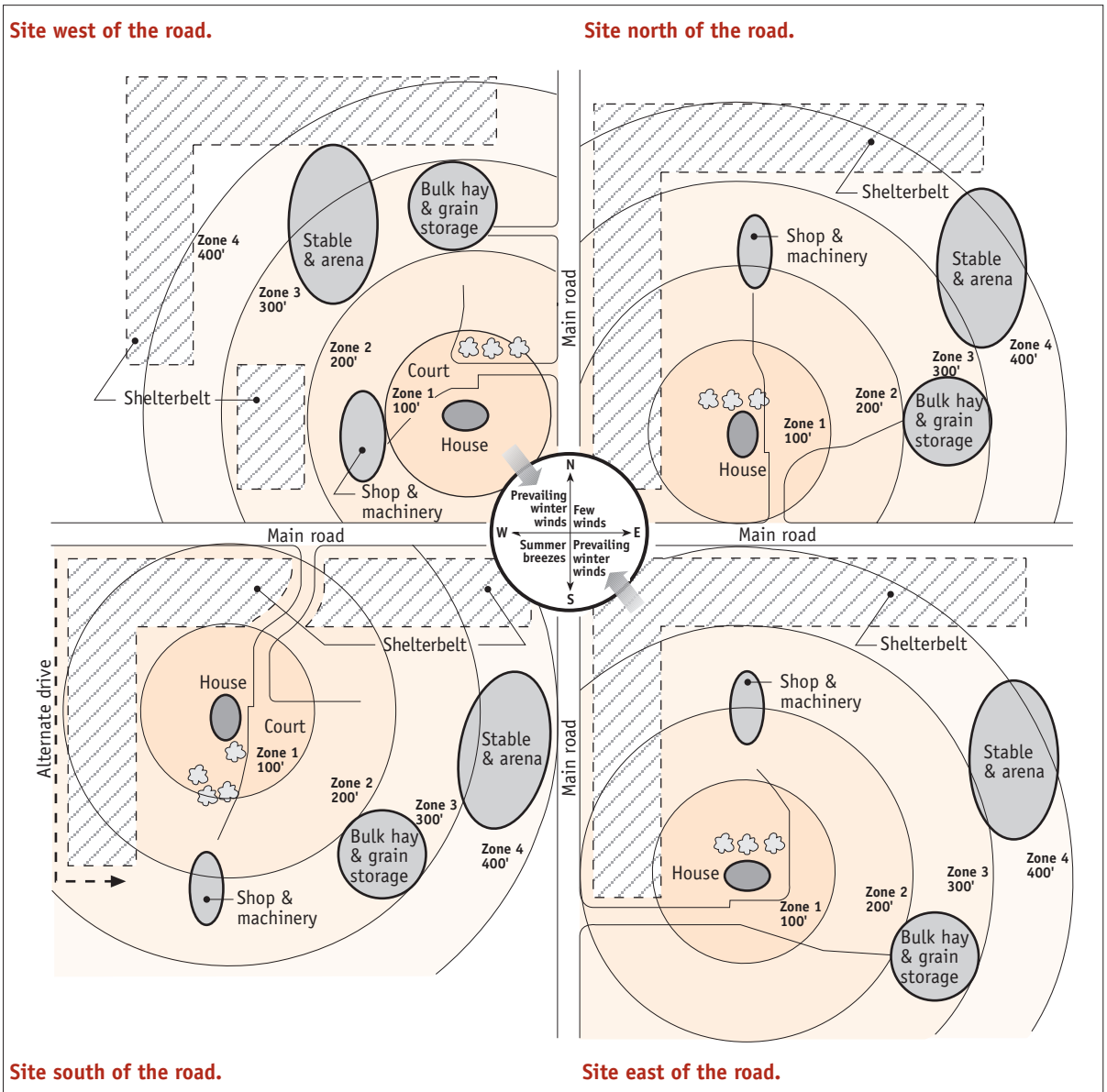

Figure 2-1 **Development of a site with respect to a main road and common wind conditions.** The direction of the site from the main road affects layout. Layout assumes prevailing winter winds are from the north and west and prevailing summer winds are from the southwest, south, or east.

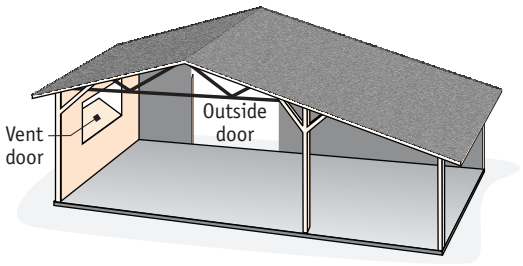

Figure 3-5 **Offset gable roof.**
Open front shed (truss-post and beam).

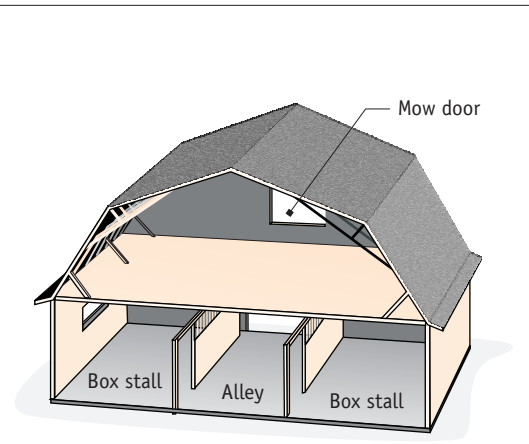

Figure 3-6 **Gambrel roof.**
Two rows of stalls serviced from center alley(clear span, braced rafter).

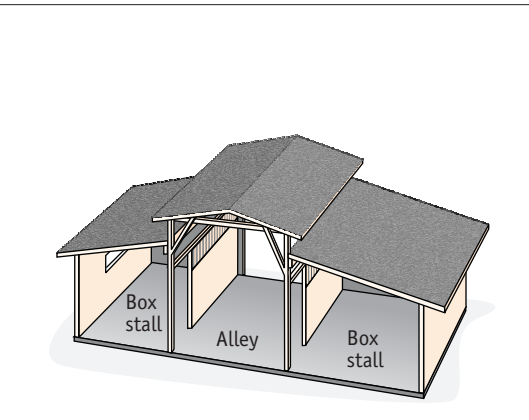

Figure 3-7 **Monitor roof.**
Two rows of stalls serviced from center alley. (post and beam).

mow, then be aware of the effect that this hay can have on ventilation and the fire hazard concerns. *Chapter 7. Environmental Control* and *Chapter 12. Fire Protection* address these issues.

The most common type of framing is light, clear-span braced rafters, supported on the barn wall and anchored to the mow floor joists to resist horizontal forces and uplift.

Monitor roof

The full monitor roof is made up of two shed sections and a gable section for the center portion of the roof. The vertical wall area separating the shed and gable roof provides natural light and ventilation. The monitor shape is seldom used for horse buildings less than 36 feet wide. The center section may be wider than the sheds or the reverse may be true. Its use matches that of clear-span buildings of similar size with side extensions. Framing is similar to that for shed and gable roofs.

Gothic roof

The Gothic roof is a pointed arch formed by two similar curved roof sections meeting at a center ridge. It is used on two-story barns and also for separate free-standing structures to provide shelter at ground level. It is adaptable to both narrow and wide structures. Similar to the gambrel style roof, this roof style has

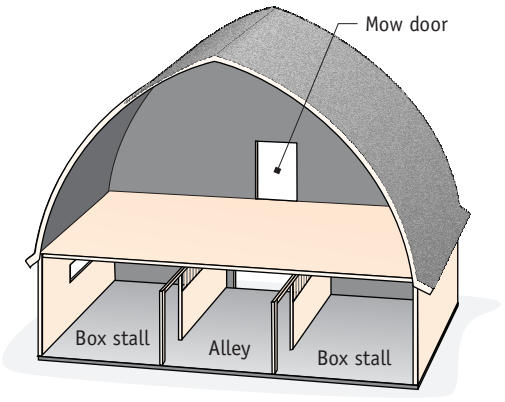

Figure 3-8 **Gothic roof.**
Two rows of stalls serviced from center alley. Mow over (clear span, laminated rafters).

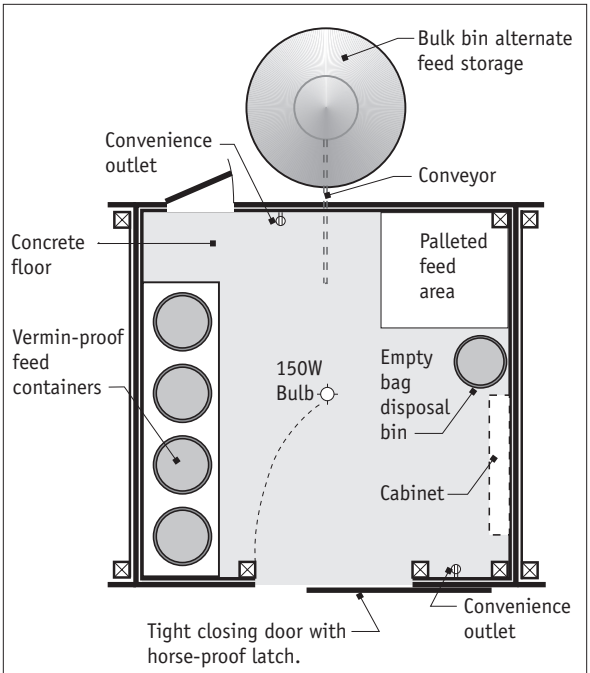

Figure 3-29 **Example feed room layout.**
The cabint can be used to store feed additives, carrots, and treats.

Figure 3-30 **Scale used to measure rations.**

space for storing supplements, salt blocks, medications, minerals, vitamins, grain crimper, feed carts, scales, and any other items that are pertinent to the feeding program. Keep feed storage areas free of batteries, petroleum products, chemicals, and other non-feed items. A set of small scales (10 pounds) and a scoop are necessary for accurate daily feeding of concentrates and medicated feeds. Large scales (30 pounds) can allow for accurate measuring of total rations, Figure 3-30. The feed room can be combined with the tack room if feed is stored in containers to promote a clean room.

Store bagged feed in a rodent- and bird-proof area. Store bags on pallets that leave an air space under the bags to prevent moisture migration from the floor to the bags. In order to maintain rodent proofing and allow for cleaning up spilled feed, a concrete floor is desirable. Once bags are opened, it is desirable to empty a whole bag into a plastic or metal container with a tight fitting lid rather than feeding directly from an open sack each day, Figure 3-31. Measuring feed from an open bag

Figure 3-31 **Container with lids used to keep rodents out of feed.**
Note the clipboards hanging above the containers. Putting clipboards with ration recording sheets near the grain bins is an easy and convenient method of recording and reviewing feed consumption for each horse.

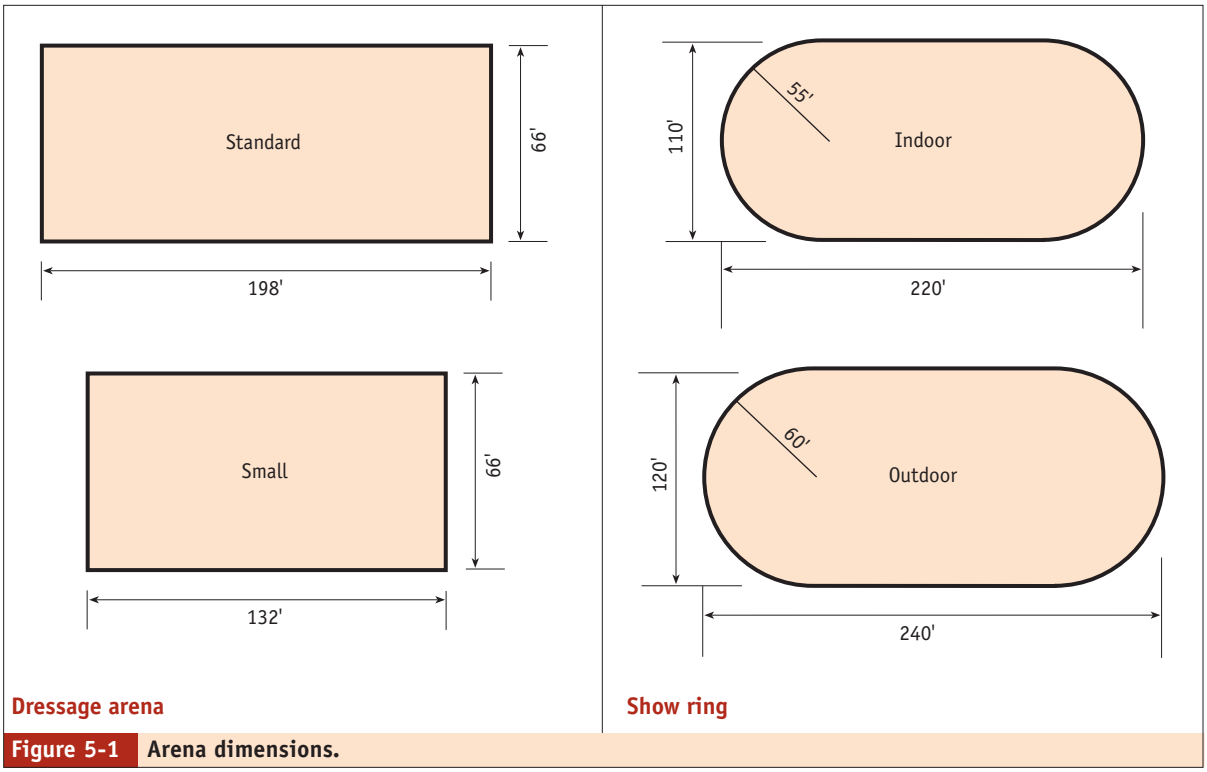

Figure 5-1 **Arena dimensions.**

arena sizes were used: 144 x 295 feet, 148 x 295 feet, 148 x 262 feet, and 148 x 312 feet.

For outdoor arenas, select a good site that has, or can be modified to obtain, proper drainage and surface conditions for the riding events, Figure 5-2. Having a few different site options is a good idea. Investigate the soil at each proposed site. Evaluate the cost to obtain the desired riding surface at each site in addition to its accessibility to other buildings and activities at the site. Sometimes a desirable location does not have good soil for constructing an arena. Making the site useful can be cost prohibitive.

Site grading, sub-base, and base materials for an outdoor arena should extend at least 10 feet beyond the perimeter of the planned final arena size. Because an outdoor arena needs to be able to shed water, sloping the base and top surface as shown in Figure 5-7c is important for good drainage. A 2% slope in the direction of the shortest dimension is the most cost effective, with options shown in Figure 5-7a and 5-7b.

Figure 5-2 **Outdoor arena with good drainage.** This arena is located at a higher elevation than the surrounding area. The ground is sloped away from the arena, which helps in drainage.

Indoor Arenas

Indoor arenas are basically clear span structures that are part of, attached to, or close to the main horse barn. When designing an indoor arena, a critical dimension to consider is ceiling height, which is the

CHAPTER 8

Manure Management

Proper design and management of the manure handling and containment system are essential to pollution control when operating any animal facility. Proper handling of manure is essential, especially as more horse facilities are located in suburban areas. Stables must be good neighbors. Failure to provide adequate manure collection, handling, and storage facilities in conjunction with adequate land area for proper application and utilization of manure nutrients could adversely affect air, water, and land resources. Also, degraded stream water quality and fish kills can result from manure and feed waste entering waterways from surface runoff. Improperly designed or constructed manure storage facilities, or over-application of nitrogen or phosphorus can lead to groundwater pollution. Many horse owners are conscious of manure's pollution potential and have taken steps to control it.

Independent of operation size or location, a proper manure management system and plan are essential.

A complete manure management system has the following goals:

- Avoid pollution of soil, groundwater, or surface water.
- Reduce odors and dust.
- Control insects, rodents, and other pests.
- Comply with appropriate state and local regulations pertaining to manure handling.
- Balance capital investment, cash-flow requirements, labor, and nutrient use.

A manure management system includes collecting, handling and transferring, storing, possibly treating, and marketing or land applying the manure. The collection of horse manure is pretty simple because it is almost always collected on the floor of a stall or inside an outdoor shed. Knowing the characteristics of horse manure is key to all the other aspects of the manure handling system.

Because horse manure is almost always in a solid form and most of the time with bedding, knowing common solid manure handling practices to handle and transfer the manure from the stall or shed floor to another location is essential. If manure is stored or treated by composting, then knowing the volume of manure is important. If the manure is marketed or applied directly to nearby land, knowing the nutrient content of the manure is key.

The remainder of this chapter will discuss:

- Basic manure characteristics.
- Bedding.
- Manure-handling systems.
- Locating, sizing, and designing a manure storage.
- Sizing, designing, and operating a composting treatment system and marketing tips to sell compost.
- Land application of manure.
- Overall system management to reduce odors, dust, and flies.