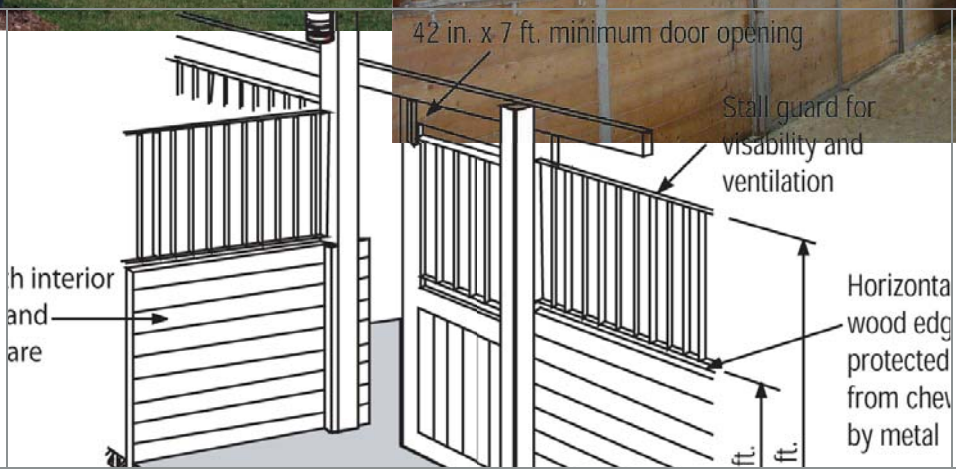
Horse Stable and Riding Arena Design

Eileen Fabian Wheeler



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Eileen Fabian Wheeler

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Preface

This book has been more than a few years in the making. Picture a child drawing horse stable layouts on the back of a restaurant's paper placemat while waiting for the family meal to be delivered. More recently, this book has been a multiyear project to get some solid engineering-based design information to those advising stable managers and builders of horse facilities. In between placemat drawings and my current faculty position, this "child" was educated in animal science and agricultural engineering to better understand the depth and breadth of topics that influence horse stable design. My lifelong interest in horses sparked the desire to become educated, and now to help others to understand the underlying principals influencing function and design of horse stabling.

Pleasant are my memories of entering horse stables containing the mingling smells of hay, horse, and leather. What peace from the satisfied sound of forage being chewed by the horses! Stable spaces that were light and airy felt welcoming. We all seem to know when we have entered a nicely designed and managed stable whether it is plush or spare in its design. I hope this book can aid in the design of such facilities.

One of my motivations in creating this book is to reemphasize the need to provide adequate ventilation for good air quality in stables, because a developing trend is to copy residential construction practices that severely compromise the air quality in horse stable and riding arena environments. I have spent many years working in ventilation of various livestock buildings, and as those systems have made tremendous improvements in providing comfortable conditions and improved air quality, many newly constructed horse facilities have worse environments than the old traditional stables.

My interest is in providing readers with enough background information to make good decisions in horse facility design. Most "nuts and bolts" of construction are available elsewhere. Detailed design and plans can be obtained from builders and professional engineers working in horse stable construction. Through the use of this book, detailed building plans can be checked for features that you have learned are important for horse well-being and human convenience.

Eileen Fabian Wheeler

Acknowledgments

It is hard for me to know how to organize the recognition of people who have contributed so much to the successful completion of this book. Being the sole author of this book implies that this is the work of an individual. True, this book's content comes from my knowledge gained through dedicated education and years of experience that honed that knowledge. Yet, I can't even begin to express my thanks that I owe to myriad individuals who have contributed in concrete ways to this book and the knowledge behind it. In random order, perhaps in the amount of recent time they dedicated directly to the project, let me begin.

As you enjoy this book and the amount of information that it conveys (remember that a "picture" is worth a thousand words), I want you to realize the yeoman's job that William Moyer has done in his capacity as the technical illustrator of this text. Bill has detailed hundreds and hundreds of drawings for me throughout the 10 years that I have been at Penn State University. More than 150 of those drawings are included in this book. Thanks to Bill for such friendly, quick, and dedicated turnaround of the various projects that have meant so much to me. You have built a career on making others look good.

Jennifer Zajaczkowski is another individual deserving extra special attention in the development of this book. Several of the chapters in this book were cowritten with Jennifer Smith, now Zajaczkowski, originally as Extension bulletins on horse housing topics. These were topics not well covered within other available information on horse housing, and Jenn did a great job of fleshing out my draft manuscripts with her own capable horsewoman experiences and information gathered from other animal scientists. Jenn has been an invaluable addition to the applied research in horse housing and riding arena environment that we have conducted over the past several years. Some findings from these studies are incorporated into this book. Jenn is the primary author of the chapter on fire safety, which extends her expertise and interests as an emergency medical technician.

Within my department of Agricultural and Biological Engineering at Penn State, there are three other colleagues who have made this book project a successful effort. Staff assistants Marsha Hull and Amy Maney have contributed in so many big and detailed ways to getting this book done in a professional manner. Marsha is the patient and creative publication artist for the original set of department fact sheets that turned into college bulletins, and now into several chapters of this book. Without her good work the original set of information would not have been so widely noticed, thus setting the stage for development of the information into a book-scale project. Marsha's organization has helped at numerous times in assembling this book from many years' worth of accumulated information. Amy has been so helpful in many detailed aspects of the current tasks of completing this book-writing project while I also maintained other professorial duties. I much appreciate Amy's dedicated professional efforts in timely turnaround of assignments and particularly her attention to detail. Having small and large tasks completed with high quality makes pulling this book together so much easier.

The third department colleague who deserves special thanks is Roy Young, department head of Agricultural and Biological Engineering at Penn State. I appreciate his approval to my spending more time working "out of the office" this past year for concentrated writing effort. I have the type of brain that needs full concentration on technical writing activity. Without that release, this book could not have been completed. Nor could two other books have been completed over the past year, with one being in print and the other going into final layout with its publisher. (By the way, I don't recommend working on three books at once.)

And yes, the family. Who needs a dining room? Work on this (and the other two) book has overtaken the available surface area in my home office, so expansion into what my older son, Ben, now calls my "second office" has crippled the normally clutter-free dining room aura. What a good group of guys I have with husband, Tim, son Ben, and younger son Tucker, putting up with a normally active "mom" stuck at the writing table and computer. My family members, near and far, have been real troopers. The troop brings real joy and laughter to my life and I love them dearly for being them, individually, and appreciate the support they have lent to this book project.

I got into the habit of having my technical writing reviewed long ago because of a career within the research and Extension communities. Having other knowledgeable people look over materials before they go to print is invaluable. It takes additional time; my time and theirs. I welcomed and incorporated their input for the wisdom they have beyond mine in so many nuances of the topics covered in this book. For their efforts this book is greatly strengthened.

The book chapters have benefited from technical review by both agricultural engineers and horse specialists. To make sure that explanations made sense to those without an engineering background, I enlisted the advice of equine scientists or practicing businesspeople with extensive equine experience. This book is not meant to be an engineering text, but the engineer reviewers validated the conceptual framework of the technical discussions.

I've been lucky to have some wonderful reviewers. My heartfelt thanks are extended to each chapter reviewer for taking the time to educate me with even more good information. These reviewers' comments and advice have contributed many thoughtful changes and clarifications. It seemed very important that each chapter provided sensible content that satisfied equine enthusiasts while containing enough engineering technical content to be of use in decision making.

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Last, alphabetically, but certainly not least:

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Jennifer was reviewer of chapters 4, 6, and 15 and coauthor on previous versions of five chapters that were first published as Extension bulletins through Penn State's College of Agricultural Sciences: "Stall Design," "Flooring Materials and Drainage," "Manure Management," "Fence Planning," and "Riding Arena Surface Materials." She was also primary author of bulletin, now Chapter 9, titled "Fire Safety."

The photographic figures in this book are from my collection taken over a couple decades of visits to horse stabling facilities. Many horse people have kindly made their farms available for photographs and offered their experiences about horses in relation to housing. A few companies and individuals have shared their photos when I had no suitable photos of my own to use. The following list contains facilities that have photos included in this book. It is

in no ways a comprehensive list (see next paragraph). Some farms are more recently visited sites whose owners will likely remember my visit. Other site photographs are from my files and were taken in the 1980s and 1990s.

Some photographed farms are not listed by name. A few photos in this book are curbside "drive-by" photos taken during my other travels and an official farm visit was not involved, so I can offer no farm name. In other cases, farms have changed ownership and name since my visit, so names may no longer match. I have included names of builders and construction companies with whom I traveled for troubleshooting or research project reasons. I don't necessarily list the names of those farms visited during our sometimes whirlwind tour of sites. My apologies if you recognize your facility and do not find your name on the credit list (send me a note to fix this situation!).

Tudane Farm, NY
Cornell University Horse Farms, NY
PenMor Thoroughbreds, NY
Stoned Acres, NY
University of Connecticut Horse Farm, CT
BOCES Horse Program, NY
Saratoga Organic, NY
Champaign Run, KY
Brookdale Farm, KY
Gainesway Farm, KY
Lakeside Arena, KY
McComsey Builders, PA
Red Bridge Farm, PA
Smucker Construction, PA
Greystone Stable, PA
Jodon's Stable, PA
Slab Cabin Stable, PA
Maryland State Fairgrounds, MD
Green Mountain Farm, VT
Tresslor and Fedor Excavating, PA
RigidPly Rafters, PA
Waterloo Farm, PA
Ryerrs Farm, PA
Rigbie Farm, MD
Sinking Creek Stable, PA
Turner Stable, PA
Restless Winds Farm, PA
R&R Fencing, PA
Ev-R-Green, PA
Greystone Farm, PA
Three Queens Farm, PA
Carousel Farm, PA
Detroit Radiant Products Co., MI
Coverall Building Systems, Ontario, Canada
Kalglo Electronics

Introduction

When one thinks of keeping horses, a vision centers on the stable. Horses are housed in stables for many reasons, but they seem to fall into three general categories that include human convenience, providing a less severe environment than that experienced outdoors, and tradition. The first two reasons are related to providing an environment where the handler is comfortable working and the horses are efficiently cared for. The environment and management of the stable is designed to be an improvement over outdoor conditions, or the horse will be disadvantaged by being in a stable. The third reason, tradition, has received little discussion.

Horses have traditionally been kept in stables. Horses as the precursors to "cars" or "trucks," or more appropriately "sport-utility vehicles," were kept in a stable behind the home or business like our cars. In this tradition, horses were used all day, virtually every day, and stored for the night in a stable until they were needed the next day. Compare this with the current Amish expectation where horses are consistently expected to drive dozens of miles each day and auction horses change hands with the ability to drive 20 miles each way to a work site. Now we use our cars every day to move dozens of miles and use most of our horses for recreation with movement restricted to a few miles per day. It may be all right to close our cars in a garage and to let them be idle most of the day, but a living, breathing horse is better suited to being outdoors or in an open airy environment if confined.

The "traditional" use of the horse has dramatically changed, but not our horse housing. Most horses are kept in suburban settings for recreation use rather than for any type of "work." This is fine, but perhaps our thinking about horse stabling needs to change to match the change in how we use horses. Modern horses are often inactive most of the day and confined to a stall where they originally were only expected to rest and sleep for work the next day.

Throughout this book there are several references made to horse housing design in relation to livestock housing design. This upsets some horsemen and horsewomen because they don't think of horses as livestock. Indeed, within our American culture we do not eat or derive food products from horses as we do from hogs, cattle, and poultry. Horses are our companions and treated as family, in many cases, but horses are livestock when it comes to housing. Horses are large, strong animals with instincts and habits that require they be housed in facilities that recognize their needs. As livestock, horses will drop feces and urine on the floor -- large amounts of feces and urine. Companion pets, such as dogs and cats, are trained not to do this throughout our human living environment. As livestock, horses are fed and bedded with relatively dusty materials compared with the food and flooring we find in our own homes. Horses respire large amounts of water into the stable air compared with the moisture we find in our own homes. Horse stables have more moisture, dust, and odor than found in human-occupied environments and, hence, require ventilation rates typical of livestock facilities. In fact, horse stables should have very good air quality to maintain horse health and athletic ability.

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. There are many breeds and types of horses and several riding and driving styles. The fundamentals of horse housing remain essentially the same, though. This book is written to house a typical 1000-pound horse. Clearly, scale up proportionally for larger animals. We don't often scale down for smaller equine but in the case of significantly smaller ponies and horses, accommodate their needs with fencing and stall panels that allow them similar safety and ability to

see neighbors, respectively, as provided for the typical 1000-pound horse.

One of the biggest challenges in conveying the information contained in this book is that there is such a wide range of suitable horse-housing designs. Designs vary from the simple, low-cost backyard facilities that can be thoughtfully planned and constructed for fully functional horse care to facilities that incorporate expensive and beautifully detailed construction. Stables large and small can be successful with informal features or may incorporate every available convenience. Within large horse enterprises, there is wide variation from "high-end" facilities to average construction. Some readers will be picturing their stable with chandeliers and impressive architectural features, while others want advice on how to most economically achieve horse housing goals. This book has been written to provide recommended practices for an average, well-built stable that will be attractive and with features that others will recognize as thoughtful, functional design. There is an emphasis on labor-saving functional planning. Surely, special features and finishes may be added to enhance visual appeal of the facility once fundamentals of housing the horse in a suitable environment are provided.

This book includes important information on topics that are often not carefully considered in initial stable planning. These topics include environmental control (ventilation), manure management, and fire protection systems. Additional chapters cover recommendations for stall design, flooring, drainage, fencing, utilities, and riding arena features. Individuals using the technical information from this book will be able to more effectively plan and design a facility that best meets operational goals.

Horse Stable and Riding Arena Design

1
Horse Behavior Influence on Design

A designer must understand basic horse behavior for proper design and construction of horse facilities. For designers familiar with farm construction practices, horses have traits that differ from other livestock species. People who have little previous experience with horses or the planned activities of the farm should become familiar with basic horse behavior and functional activities that are expected at the site. Safe and sound designs respect horses' uniqueness and provide convenience and safety for both horse and handler. This short chapter serves to provide an overview of basic horse behavior traits that relate to horse facility construction.

FLIGHT OR FIGHT

Horses have highly developed senses of sight, smell, and hearing. They have a 340° range of vision that makes them very sensitive to motion from almost any direction.

A horse's natural defense mechanism is the *fight-or-flight* instinct. Horses are generally nonaggressive, but when threatened, excited, impatient, scared, or in pain they will typically first try "flight" to escape by running away. Facilities that contain horses need to be sturdy and free of projections that would impale a panicked horse. If escape is not possible, then horses might "fight" by kicking, striking, or biting. A horse's reaction to a threat, real or perceived, is rapid and imparts high force on contact, so construction materials need to be sturdy and handler safety becomes important. Horses are well known for their apparently frantic behavior when entangled in fencing materials or caught with a foot between bars of the stall. Some horses patiently wait to be freed, but unfortunately most seem to struggle in an attempt at flight from the confining situation.

This flight-or-fight defense explains the excitable nature of the horse. The degree of excitability and nervousness varies among individuals and breeding 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.

SOCIAL NEEDS

Horses are social creatures so most will try to join other horses if they can (Fig. 1.1). Isolated horses lack the security of a group and often develop undesirable and possibly health-endangering behaviors not found when a number of horses live together. Horses in stalls quickly become bored, which leads to stable stereotypies (often called "vices," but this implies that these behaviors can be affected by training, which they cannot).

Stereotypies include the following:

- Wood chewing
- Pawing or striking the ground or stall walls with a front foot or repeated kicking out with a back foot
- Weaving nervously by repeatedly shifting weight from one front leg to the other
- Pacing and circling the stall, headshaking
- Placing the upper incisors on a solid object and expanding the larynx, which results in the gulping of air behavior known as *cribbing* (Fig. 1.2)

Horses housed individually are calmer if they can maintain visual contact with other horses. If possible, horses should be allowed to see other horses and outside activities to decrease these stereotypies and to reduce anxiety from being isolated (Fig. 1.3).

DOMINANCE ORDER

Horses kept in groups develop a dominance order. Each horse uses a combination of aggressive and submissive behaviors to place itself in the dominance order within the herd. Pastures and paddocks with corners and other small-enclosed areas that

Figure 1.1. Horses on pasture setting exhibit more natural behavior of social contact and time spent eating forages.

allow a dominant horse to trap a submissive one increase the frequency of injury.

In addition, feed, water, and shelter represent limiting resources and access to these are affected by the dominance order.

A good horseman is observant of horse behavior and temperament and can use these to advantage in training and even housing. Grouping horses according to observed relationships at pasture can make turnout, stabling, and trailering safer. Both people and horses can affect another horse's movement by use of the flight zone, much like a person's "personal space." Once a person enters the flight zone, the horse will move away. With training, the flight zone normally decreases. The flight zone is used every day when a person attempts to catch a horse in the field or work the horse in a round pen. A dominant horse may need only enter another horse's flight

Figure 1.2. Stereotypic behaviors (cribbing shown here) can develop in horses that are kept in situations that deny normal horse behavior.

Figure 1.3. Horses kept in stable for prolonged periods seem to benefit from being able to see other horses and activities around them.

zone, without making apparent threats, to make the more submissive individual move away from food, water, or even a grazing spot.

STABLES AS A PLACE FOR FOOD, SECURITY, AND REST

Horses have a major preoccupation with food and security. In a natural setting horses spend a considerable portion of their day grazing than when in confinement where feeding may be a short, regularly scheduled event leaving considerable time to fill with other activities. A stable area typically represents an area for food and security. An excited horse may reenter a burning barn because of this connection between food and security.

Horses often rest or doze standing but will lie down for prolonged sleep. Sleeping patterns mean that horses need a comfortable area to stand and lie down. Horses prefer bedding versus hard, bare flooring. Horses need to get into lateral recumbency in order to get their required daily REM sleep, or at least be able to lie in sternal recumbency and lean against something to mimic lateral recumbency. This is pertinent to horses kept in tie stalls.

Designing facilities to account for horse behavior does not have to be complicated or expensive. Horses have flourished for ages on open grassy plains. Excellent horse husbandry can be achieved with a paddock and simple shelter (the simple "shelter" may include natural things like dense bush or tree stands). Facilities should promote safety as well as the efficient care and handling of horses. Well-planned facilities allow for lower operational costs. 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.

2
Horse Stable Layout and Planning

A well-designed stable protects horses from weather extremes and keeps them dry while providing fresh air and light and protection from injury. Stables need ample space for the well-being of the horses, chore efficiency, material storage, convenience and safety of handlers, and the enjoyment of riders (Fig. 2.1). Many horses are successfully kept on pasture with a simple shelter (Fig. 2.2). Stables are a popular feature for horse housing irrespective of whether the horse is confined most of the day or only during certain periods.

ADVANTAGES AND DISADVANTAGES OF STABLES VERSUS PASTURE SHELTER

The advantages of a stable are that it

- provides shelter for horse care and handling;
- allows closer observation and individual care of confined horses;
- provides a better opportunity to regulate feed intake with training or exercising programs;
- provides shelter for a horse to maintain condition while clipped for winter working and showing;
- confines horses off pastures during wet, muddy conditions, so that
- they can be kept cleaner; and
- improves security.

The disadvantages of stables are as follows:

- More manual labor and attention to horses is required for such things as cleaning stalls, bedding, feeding at least twice a day, watering, and exercising.
- Improper care and exercise lead to poor health and/or stereotypies.
- Stables are much more expensive to build and maintain than pasture shelters.
- A poorly designed or managed stable can be an unhealthy environment—excess moisture, high ammonia level, stressed horses, hazardous construction, and so forth.

STALL LAYOUT OPTIONS

On the basis of stall and work aisle locations, horse stable floor plans are usually identified as single row, center aisle, or island design (Fig. 2.3). The single-row option is more common in mild climates where the exterior work aisle is comfortable for the human caretakers (Fig. 2.4). The single row is also used where horses are outdoors most of the time with free access to the stall area. The center aisle design is common in the United States for private boarding and showing facilities where the enclosed work aisle is central to horse care functions (Fig. 2.5). The island design is more common with horses that are in intensive training, such as racehorses, where the covered "ring" of aisles is used to cool down or exercise horses (Fig. 2.6).

Single-Row Configuration

- A single-row stable is a one-story structure with side-by-side stalls.
- Horses have access to outside air and sight of activities from the front or rear of stall.
- Stall door(s) opens into the stable yard, individual runs, or communal paddock.
- The work aisle is under a roof overhang or, less typically, is enclosed.

The single-row configuration is attractive and minimizes enclosed space compared with the other two options. Horses are closer to their natural environment, so each horse can have a desirable position within the stable. The handler has less protection from weather unless the aisle is partially enclosed.

Central Aisle Configuration

- The stalls are side by side along opposite stable walls and are separated by a wide alley.
- The alley can be used for tying, grooming, saddling up, and cooling out animals and for cleaning stalls.

Figure 2.1. Housing the horse in a stable offers many conveniences as long as management of interior environment and horse exercise is sufficient.

This floor plan makes efficient use of interior space, with one work aisle serving two rows of stalls. It provides occupants protection from the outside elements. The central aisle configuration can also be designed to provide each stall with a door to the outside.

Island Design

- An "island" is two rows of side-by-side and back-to-back stalls. An aisle encircles the entire island of stalls.
- Stall doors open into the aisle that encircles all the stalls.
- Another option encloses a central aisle stable as the island with stall doors open to the central work aisle.

In the island floor plan, the aisle can be used to cool horses or, if the ceilings are high enough, to exercise animals. If alleys are used to exercise animals, then dust suppression is important. Sunlight usually cannot reach stalls. This design has the most covered area per horse housed; so unless the extra alleys are frequently used, it is an inefficient design.

Clearly, other stall and work aisle arrangements are successfully used as stables. Particularly with buildings remodeled from other uses, stall and aisle

Figure 2.2. A simple pasture shelter with contiguous exercise area is sufficient for most horses, but handlers often desire more amenities in commercial facilities.

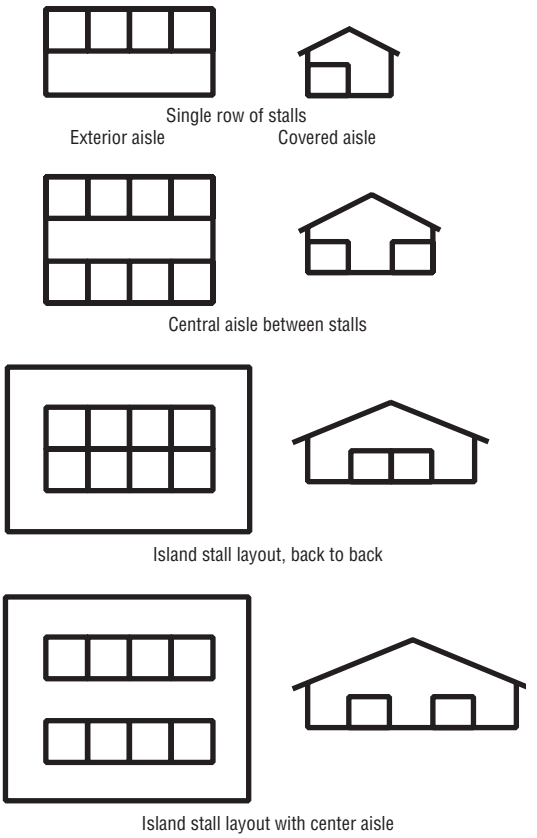

Figure 2.3. Common stable floor plan and cross-section configurations.

Figure 2.4. Single-row stall options are typically open to outside work aisle and are a good option in mild climates.

Figure 2.5. Center aisle design, with its enclosed, weather-protected work aisle with stalls on either side, is very common in the United States. This stable features hay storage over the center aisle with no ceiling over the horse stalls.

Figure 2.6. Island design puts stalls in the center of the structure with an exercise walkway around the entire perimeter. Shown is a portion of a racehorse stable with a center aisle stable surrounded by an exercise hallway with enough height so that horses can be ridden.

arrangements can be quite variable. Generally, straight, wide aisles are used in stable layout to allow safe and efficient movement of horses with handler, bulky bedding and forage materials, and stall waste removal. Stalls are positioned with direct access to fresh-air openings and to allow a confined horse to see activities within the stable and/or outdoors to decrease boredom. Developing a comfortable area to house horses is the main objective of a good stable design. In addition to comfortable stalls, it is important to design the building to be functional.

PLANNING HORSE STABLES

A stable, large or small, private or commercial, should be well planned, durable, and attractive. Its basic purpose is to provide an environment that protects horses from weather extremes, maintains fresh and dry air during all seasons, and protects horses from injury. A stable is a convenience for handlers and serves a social and recreational function for both private and commercial facilities. Consider safety in features that minimize sharp projections, eliminate fire hazards, and are sturdy enough for horse abuse. Provide enough space for safe passage of horses and handlers through doors, gates, and alleyways. Provide enough dedicated storage space for the tools, tack, and equipment needed for horsekeeping. Additional large storages will be needed for bedding, hay, and manure. Stall barns typically allow animal access to paddocks or riding areas but house individual horses, or mares with foals, in individual stalls.

The type of structure selected depends on size of the operation, climate, amount of capital available, and the owner's preference. Consider general attractiveness and keep facilities well maintained. Locate buildings to take advantage of existing conditions and provide economical use of labor in feeding, cleaning, and maintenance. For all stables and other horse buildings, evaluate the following features. For additional information on a topic, please refer to the suggested chapters.

Flexibility: Assume that remodeling will take place in the future to meet changing needs. The ability to cheaply and easily remodel a stable into another useful function (cabin, garage, storage building) will typically increase the property's resale value (see Chapters 3 and 4).

Attractiveness: Aesthetic value is achieved by a structure with good proportions in harmony with its surroundings and fulfilling its function. Good design enhances value. Landscaping enhances attractiveness (Fig. 2.7).

Space: Both horses and handlers need enough space, but too much of it unnecessarily increases expenses. Provide roofed space for stalls, indoor alleys, tack, and equipment and for storage of hay, bedding, and feed (Fig. 2.8). Some of this roofed space may be in separate buildings (see Chapters 5 and 13).

Safety: Protect both humans and horses from unnecessary risk with good design and construction. Eliminate sharp projections. Provide enough space to allow safe passage of horse and handler through

Figure 2.7. Landscaping and buildings in scale with their surroundings contribute to attractiveness and property value.

Figure 2.8. Space is needed for storage of tools (shown here) and plenty of equipment, tack, feed, and bedding in addition to the space needed for horse stalls and work aisles.

doors, gates, and alleys. Understand horse behavior in relation to building design features (see Chapter 1).

Floor-to-ceiling height: Low ceilings interfere with ventilation, make the barn dark, and are a safety hazard for people and horses. Common ceiling heights are 10 to 12 feet for stall barns and 16 to 18 feet for riding areas.

Minimized fire risk: Prohibit smoking. Follow a fire prevention program, and prepare to contain and extinguish a fire (Fig. 2.9). Precautions can prevent losses and may reduce insurance premiums. Use fire-resistant materials and fire-retarding paints and sprays where practical. (see Chapter 9).

Interior environment: Barns minimize stress on horses and humans by protecting against rain, snow, sun, and wind. Summer wind cools, but winter wind chills and can drive snow and rain into the building. Get data on prevailing wind direction and velocity to help properly orient buildings. Sunlight entry into a building can provide natural winter heat (Fig. 2.10). Trees are practical windbreaks, summer wind "funnels," screens to obstruct undesirable views, and shades. Some stables will benefit from having critical areas heated for human comfort, moisture control in tack storage, and horse drying in wash stall area. (see Chapters 4 and 12).

Good ventilation: Poor moisture, temperature, and odor control can be major problems in horse stables. Ventilation minimizes moisture buildup during cold

Figure 2.9. Horse facilities are built so as to ensure safety and minimize fire risk. Horse-proof hardware and construction is essential. Provide fire suppression tools as a backup to efforts to prevent fire ignition.

weather and aids in odor removal. The option to provide large openings (Fig. 2.10) on a stable or riding arena will aid heat removal during hot weather (see Chapter 6).

Suitable exercise area: Corrals and paddocks need safe, durable, and attractive fence material on sturdy posts (Fig. 2.11). Provide adequate space in paddocks and access lanes. An efficient traffic plan reduces labor for turning out and bringing in horses. Consider fencing the entire farmstead so loose horses cannot leave the property in conditions where loose horses are particularly undesirable (see Chapters 14 and 15).

Water and feed: Sufficient quantity of good-quality water must be available all year round in stable and turnout areas. Provide feed storage in a rodent-proof and horse-inaccessible location. A storage area for large quantities of hay is best located in a separate building, with a several-day supply (Fig. 2.12) convenient within the stable (see Chapters 10 and 13).

Special features: Special features may include grooming area or wash rack, trailer storage, breeding area, exercise area, office, lounge, and living quarters (Fig. 2.13). These facilities and others can be in one or several buildings. Indoor riding arenas are a popular feature on horse farms (see Chapters 13 and 16).

Labor saving: Three quarters of horse chores are manual, so labor saving is desirable for any sized operation. Labor-saving mechanization is available for large operations (Fig. 2.14). Design to minimize drudgery with a bright and airy interior, compact

Figure 2.10. Maintaining a good interior environment of stables and arenas is very important. The interior environment should have adequate light level, which may be provided with translucent panels shown here. Admitting fresh air to arenas and stables is essential for horses and human handlers. Having panels like those shown here, which open for warm weather air exchange, is beneficial.

Figure 2.11. A suitable area is needed for daily turnout or exercise of horses.

Figure 2.12. Each stable will need at least short-term storage of hay, bedding, various tools, and cleaning equipment.

Figure 2.13. Many special features are often included in stables, such as this grooming station. Other features are specific to the main function of the horse facility, such as breeding area or lounge for lesson spectators.

facilities, and efficient chore routines. Put highest priorities on daily chores that consume most time: feeding, watering, cleaning and bedding stalls, grooming, exercising, and turning out and bringing in. Teasing, breeding, worming, veterinary procedures, foot care, halter breaking, and so forth are secondary chores (see Chapters 4, 8, and 11).

Manure management: Plan ahead for storage and disposal of the tons of manure and stall waste that each horse generates (Fig. 2.15). Prioritize convenience in chores associated with stall waste handling. Assure that manure storage locations protect the environment from pollution, such as pile leachate flow into nearby waterways, and from odor and insect nuisances (see Chapter 8).

Drainage: Build on high ground for adequate drainage year round. Proper drainage considers both surface flow and groundwater influences. Poor drainage causes serious problems in the ability to successfully use an otherwise well-planned facility. Fix small drainage problems with grading or subsurface drains (see Chapters 4 and 7).

Construction and maintenance cost: Select materials and construction type for durability, ease of maintenance, cost, advertising value, and intangible values such as pride and satisfaction. Top quality may be most economical in the long run. The primary types of structure construction for horse facilities include post and beam or clear span. Each type has advantages and disadvantages (see Chapter 3).

Figure 2.14. Labor-saving features and efficient routines are important because of the high labor demands of horse housing. This stall features a labor-saving overhead water line that supplies the bucket with water after a valve is manually activated.

Figure 2.15. Plan for efficiently handling the large quantities of manure and stall waste generated from horse housing.

3
Construction Style and Materials

This chapter provides an overview of common construction styles used in horse stables and indoor riding arenas. Basic construction materials useful in horse facilities are briefly reviewed. Stables and indoor riding arenas are built to provide protection from weather, so there will be regional variation in desirable construction attributes. For example, in a hot, arid climate a more open structure is desirable for cooling breezes while providing protection from sunlight. In climates with cold, snowy winters a more enclosed facility is desirable. Regardless of the type of weather protection sought, the interior climate conditions should be an improvement over outside conditions, with provision of plenty of ventilation to maintain good air quality. Poor interior air quality will compromise building materials with increased absorption of moisture, mold formation, and eventual deterioration of materials. Choose materials that will withstand the higher humidity and dust levels found in horse stabling and riding arena environments.

BUILDING FRAMING STYLES

Building framing styles relate to the structural means of supporting the building shell and influence interior features. The two primary framing styles used in horse stables are "post-and-beam" and "clear-span" construction. Only the latter is used for indoor arena construction. Hoop structures are a variation of clear-span construction, using lighter framing and covering materials than more traditional construction. Post-and-beam and clear-span construction can be designed for natural light entry and ventilation via eave and ridge ventilation openings (see Chapters 6 and 11 for additional detail).

Post and Beam

Post-and-beam construction is common in horse stables because posts support both the structure and the stall partitions (Fig. 3.1). It is an economical construction in many cases, but the drawback of this construction is sacrifice of flexibility as compared with a clear-span barn if remodeling becomes necessary. Post-and-beam construction is the traditional barn construction technique and offers an aesthetically pleasing structure suitable for horse housing.

Clear Span

A clear-span barn is a popular type of structure for stall barns and arenas because there are no interior posts to inhibit movement. Without posts, remodeling is easier than when interior posts and walls need to be moved. Stall walls will need posts for support, but these will not be expected to also support the overall structure. The interior clear span is provided by either truss (Fig. 3.2) or rigid frame (Fig. 3.3) structural support of the roof. Trusses and rigid frames are purchased as engineered products and may be constructed from wood or steel. Trusses are often used in pole buildings. Post or pole construction, with poles embedded in the ground, replaces concrete foundations. Rigid frames and arches are economical when spanning wide distances. The rigid frame or arch is securely attached to concrete foundation supports. Wooden arches are often considered an attractive architectural feature of the building (Fig. 3.4). Rigid frames of either wood or metal material offer a more open appearance to the interior than trusses. Rigid frames offer unobstructed space to the roofline. Trusses offer support for a ceiling, if used.

Hoop Structures

Hoop structures are a newer introduction to horse stabling and riding arena construction. Because of lighter and low-cost construction materials, they offer a lower cost per area enclosed than the more traditional construction approaches discussed earlier. Hoop structures for horse stables and riding arenas provide clear-span attributes that developed from livestock housing and greenhouse construction

Figure 3.1. Post-and-beam construction that uses stall posts to support roof rafters.

Figure 3.3. Rigid frame clear-span construction is more common in wide indoor arenas than in stables.

practices. The hoop frame construction is of tubular metal design covered with a flexible material similar to a high-quality reinforced plastic tarp (Fig. 3.5). Many hoop structures have translucent coverings over a simple arched metal frame. Any material that admits sunlight will warm the building interior with trapped radiation, which is a benefit in cold weather but a liability in hot weather. Consider the seasonal use of the building if translucent materials are used. Hoop structures can be covered with an opaque material to decrease sunlight penetration. Provide sidewall protection against horse contact, both interior and exterior, because the flexible

Figure 3.2. Clear-span construction uses trusses that provide an open interior. Stall corner posts attach to the lower chord of some trusses but are not supporting the roof weight.

Figure 3.4. Wooden arches of glu-lam construction offer an attractive framing in simple rigid frame style or the more complex formation shown here.