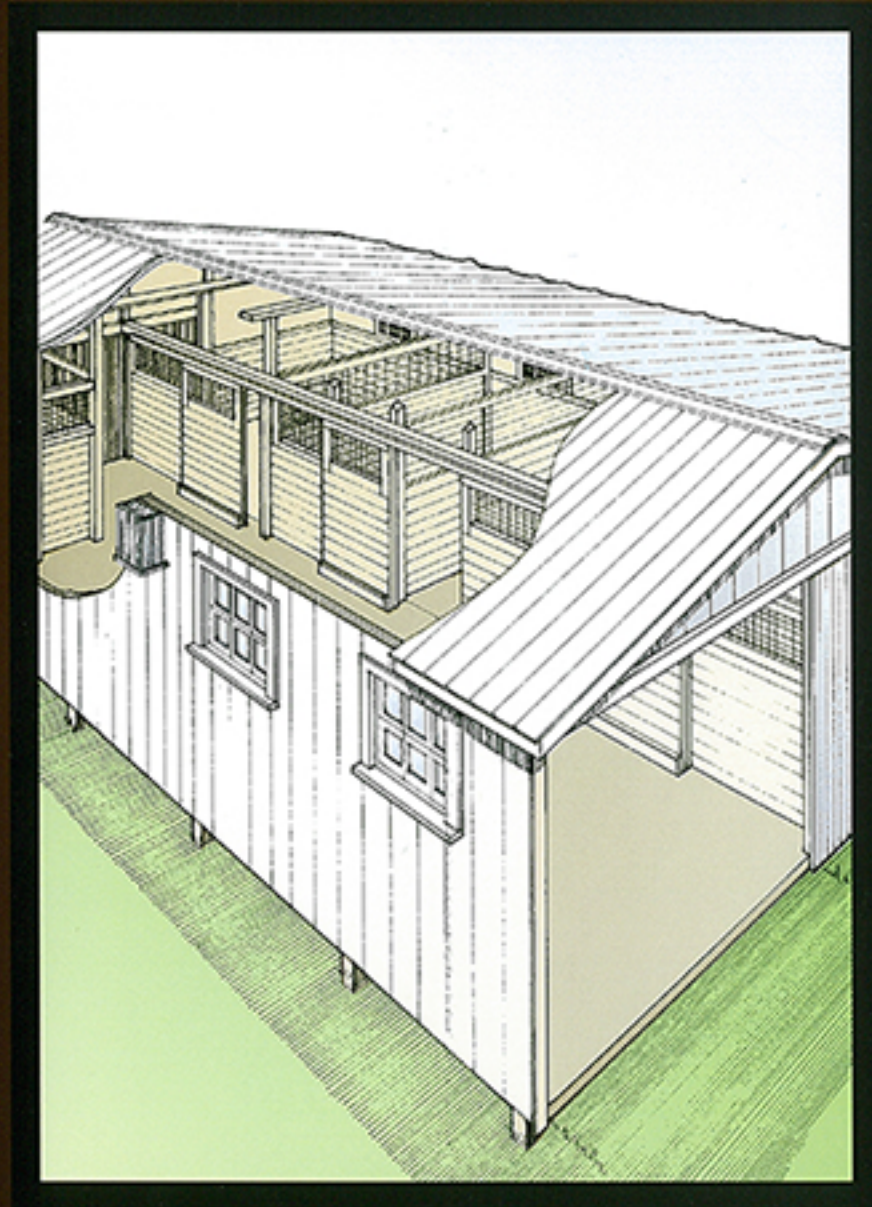


HORSE



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Alan Kidd

Wayne Winchell

Les Burwash

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Introduction

This publication presents information on horse barn designs and recommended methods of construction. It includes chapters on site planning, horse shelters, corral and fence construction, riding arenas and ancillary equipment.

The largest costs incurred in maintaining and managing a horse operation are feed and labor.

Therefore, all planning should aim at minimizing feed wastage and reducing labor.

NOTE: The information in this book does not cover PMU barns. They are tightly governed and regulated to comply to a stringent code of practice. Design and construction of PMU facilities are spelled out by buyers in specific contracts.

Table 1. Guidelines for Horse Housing

Requirements	Mature Horses
Stall Sizes:	
- regular (box)	10 ft. x 10 ft. to 12 ft. x 12 ft.
- foaling	10 ft. x 16 ft. to 12 ft. x 16 ft.
- tie (incl. manger)	4 - 5 ft. x 9 ft.
Watering Facilities:	
- space req.	1 bowl per 20 head
- water use (daily)	12 gallons
Grain Feeders: (Individual Grain Boxes)	
- length	12 - 24 inches
- width	12 - 16 inches
- depth	6 - 12 inches
- throat height	24 - 36 inches
Hay Feeders: (Individual Manger)	
- length	24 - 36 inches
- width	20 - 24 inches
- depth	24 - 30 inches
- throat height	24 - 42 inches
Barn Facility Alleys	10 ft. (minimum)
Pasture Gates	12 ft. (minimum)
Stall Doors	4 ft. or wider
Corrals:	
- for runs	1000 sq. ft. per horse (minimum)
- for working pens	250 sq. ft. per horse (minimum)
Open Front Sheds	80 to 100 sq. ft. per horse

Site Planning

Planning is the first and most important step in the construction of a horse facility. If you want to ensure that your venture is successful, put a lot of thought and attention into planning. By considering the following points, you can avoid future problems:

Location – Choose a location that is easily accessible and has good drainage. Consider the ease of water and electrical hookups. Place barns and corrals at least 300 feet away from residences. Allow ample parking and turning space for trucks and trailers.

Zoning – Check local regulations.

Flexibility – The possibility of expansion or conversion of the facility should be considered, not only in the building design, but in the choice of site.

Environment (Proximity to neighbors and pollution potential) – In intensive operations, high animal numbers on small sites, you must

protect against surface and ground water contamination by manure.

Appearance – The actual appearance of a stable is also important. An attractive and efficient building can significantly increase the property value of an operation.

Snow and Wind Control – Snow and wind are unquestionably part of Alberta's climate. There are few days when the temperature drops below a mature animal's comfort zone when the air is still. Wind, however, increases heat loss and animals react by increasing their feed intake. They also suffer from stress and discomfort in the cold. Therefore, windbreaks are essential.

Natural windbreaks provide an excellent means of wind protection. Where natural ones are not available, artificial windbreaks such as fences can be effective.

Figure 1 shows designs for solid or porous fences.

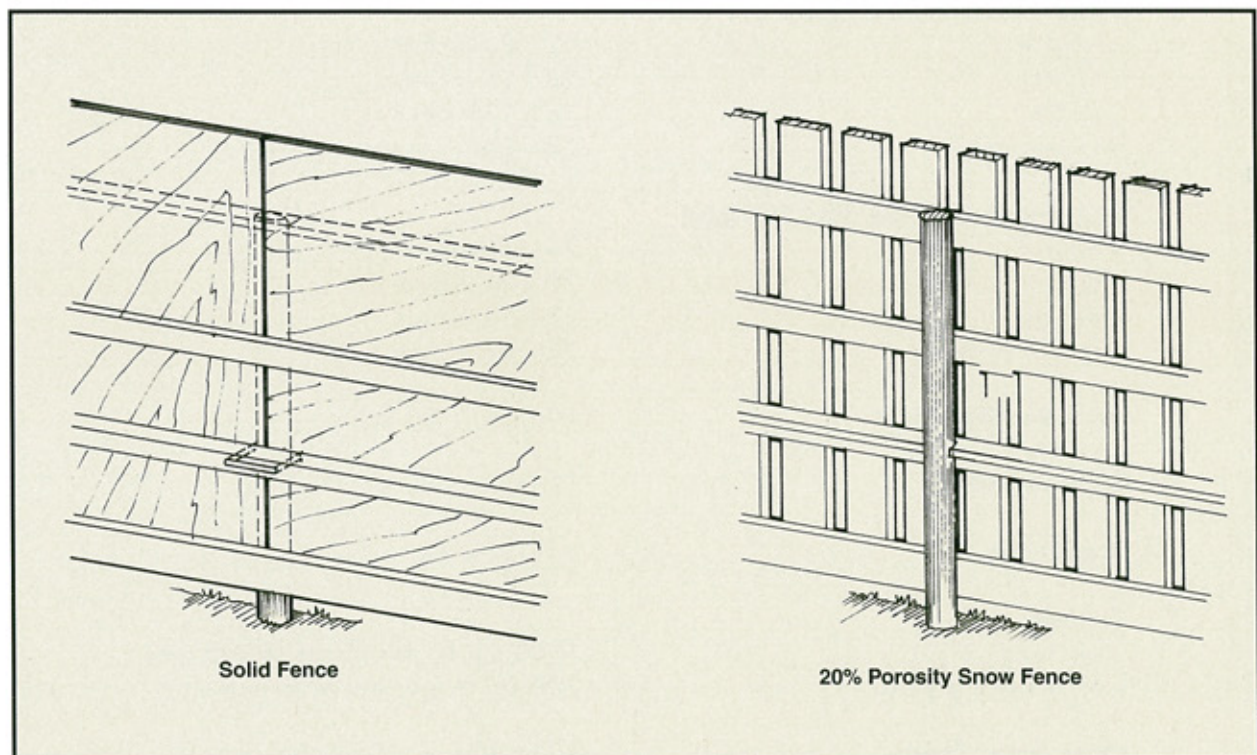


Figure 1. Construction of snow and windbreak fences

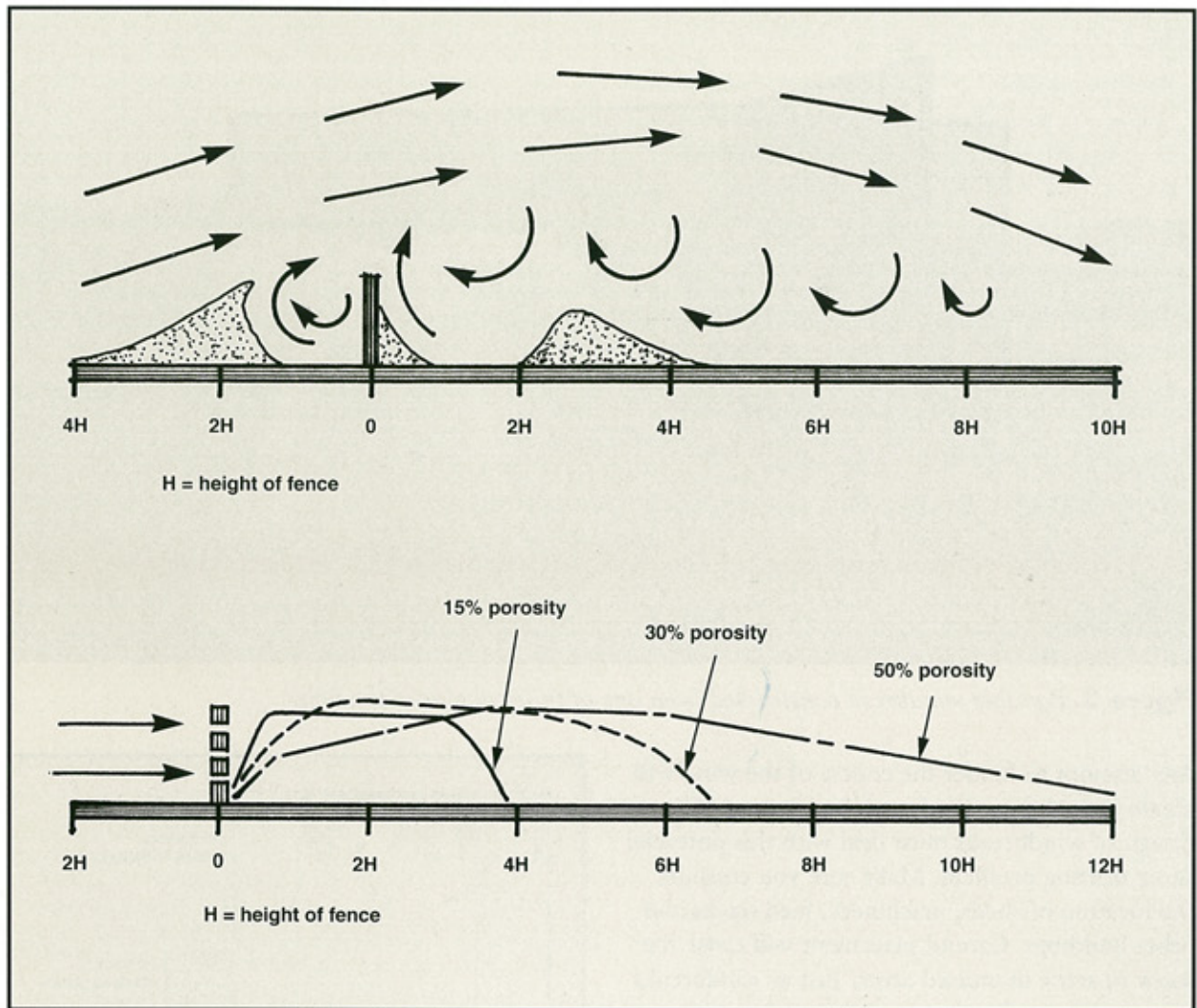


Figure 2. *The effect of fences on wind and snow*

Solid fences are effective for snow control over a limited area, but are ineffective for wind control because of high turbulence (Figure 2).

Figure 2 illustrates the wind patterns and snow drift patterns caused by solid and porous fences. Porous fences provide good wind protection for greater distances than solid fences. A fence 8 feet high with 20 per cent porosity will provide good wind protection for a distance of 80 to 100 feet. It makes no difference whether the spaces are placed vertically or horizontally, as long as they achieve the proper porosity.

If you use lumber, vertical board fences are the easiest to construct. Place boards above ground to prevent rotting. Suppliers currently sell several types of windbreaks made from plastic derivatives. These types of windbreaks are usually available by the roll. They are available in many heights and different porosities. To date, longevity of this material appears excellent as it does not rot or dry out. The biggest cause of breakdown of this type of windbreak is ultraviolet (UV) light – the better quality products incorporate UV inhibitors. You can easily build these windbreaks on metal or wooden frames. Construct all windbreaks to withstand the wind forces that a large surface area develops.



Figure 3. Portable windbreak constructed from one of the new plastic products

Any attempt to hinder the course of the wind will create snowdrifts, as indicated in Figure 4. The design of windbreaks must deal with this potential snow drifting problem. Make sure you consider the location of sheds, machinery, feed stacks and other buildings. Careful placement will cause the snow to settle in unused areas. Just as windbreaks have certain air flow characteristics, they also have peculiar snowdrift patterns which depend on the density of the windbreak.

You must allow space for snowdrifts and the resulting drainage. Poorly placed buildings and equipment will cause drifting in lanes and corrals and may cause a building to fill with snow.

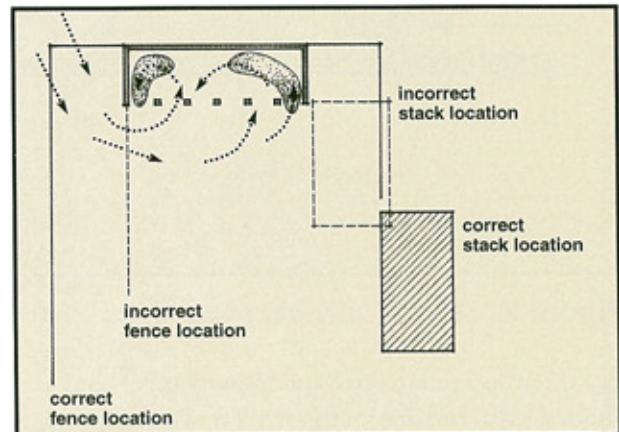


Figure 4. Snow accumulation in corrals

Figure 4 illustrates the snowdrift problems caused by incorrect stack and fence locations. Move the fences away from the shed to avoid abnormal drifting in sheltered areas.

Shelter Facilities

You should carefully plan shelters and attached corrals to ensure that the finished horse facility meets your needs. When planning horse housing, remember that mature horses only require adequate feed, water and protection from the wind.

One building option is a single-sloped, open-front shed. (Figure 5). This facility provides good wind and moisture protection at a low cost.

A shelter such as this should be on well-drained land allowing about 85 square feet per mature horse. Maximum depth of the shed should be 24 feet. Shallow sheds (12 feet) with an east or south exposure are usually preferred but you should face sheds away from the prevailing winds. If hay feeders are placed in the shed, put them at the back wall. This will prevent horses from loitering in the entry and blocking access to the feeder for

other horses. Treat all wood once a year with creosote or anti-chew paints to limit wood chewing.

A continuous slot left open under the rear eaves provides ventilation and helps control snow drifting. Sheds must be carefully placed to prevent them from filling with snow. For summer, one option is to have panels in the back wall that open to permit the free flow of air.

Figure 6 shows another open-front shed. This clear span, truss rafter building has the advantage of having no centre row of poles to interfere with manure clean-out. Also, you can close it in and insulate it later if you wish. Since the roof slopes to the front, you will need an eavestrough to avoid wet and muddy conditions at the front of the shed.

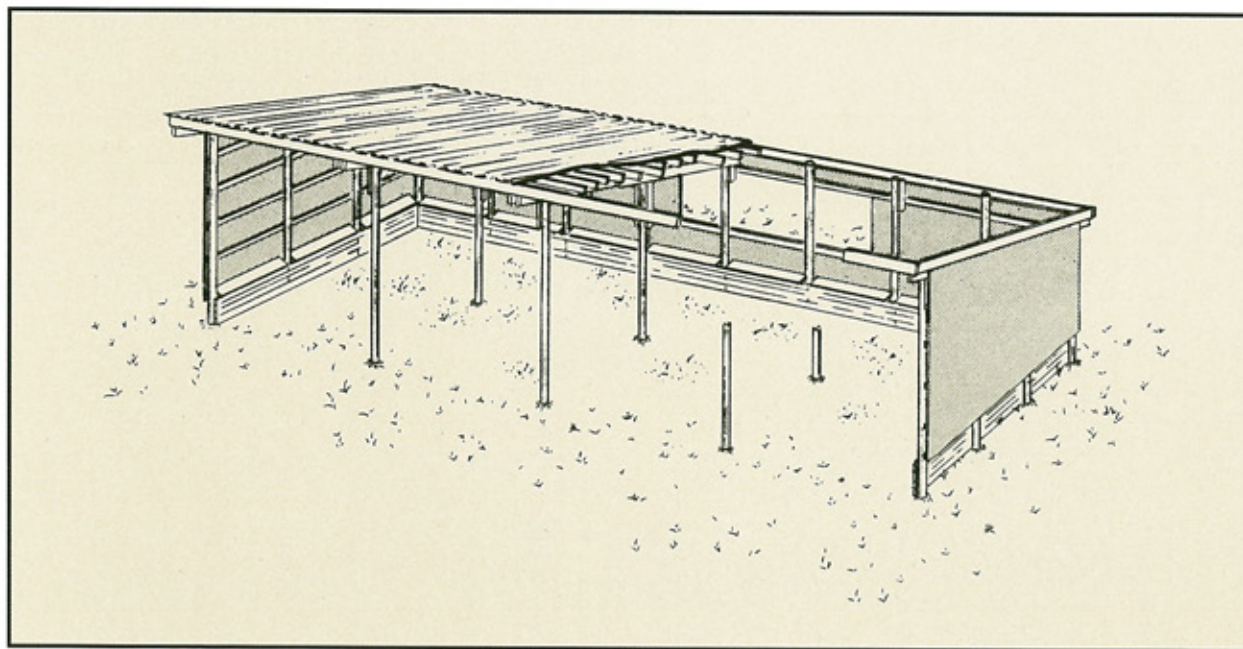


Figure 5. *Open-front pole shed CPS plan 8162*

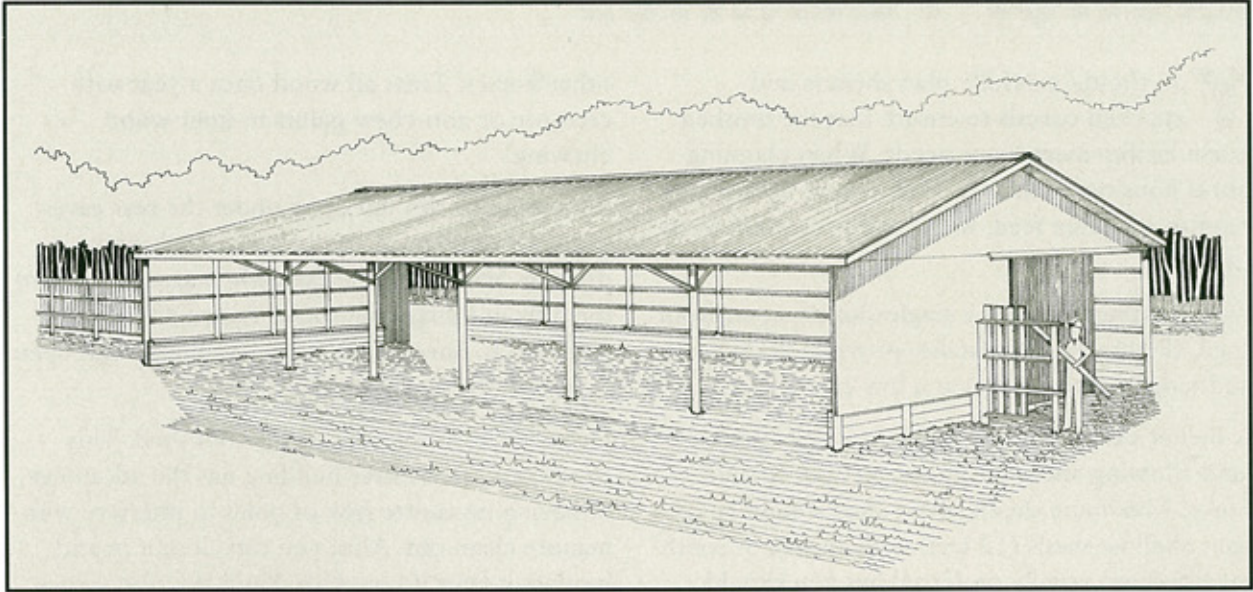


Figure 6. *Open-front clear span pole barn CPS plan 8163*

Planning Your Stable

Of the styles and types of stables presented here, one is particularly well suited for new construction. This stable is a single storey, gable-ended structure that represents maximum utility at minimum cost (see Figure 7). Floors of the stalls and alley can be either asphalt or concrete. Plan on providing ventilation of some type. The structure should be free of drafts and insulated, but heating is unnecessary.

Outside wall covering is not important, but inner walls and stall partitions should consist of 2 inch planking, or 3/4 inch plywood with adequate framing. Tie or box stalls are acceptable and should include mangers and grain feeders. Watering appliances are not necessary if the horse has access to water during the day. Box stalls should have doors at least 4 feet wide or fully opening fronts to simplify cleaning. Feed storage in the stable should be kept to a minimum to reduce the risk of fire. Remodelling older structures to fit this ideal is sometimes possible, but most often it is not.

Advance planning will make it easier to incorporate personal details. For instance, large establishments may require washrooms for employees and a stable office. For a large breeding operation, a permanent wash rack with optional open-sided restraining stocks is almost a necessity. Careful planning before building will ensure an efficient functional structure.

Practicality of the building itself is very important. Cleaning and maintenance should be easy. Remember that feeding and cleaning are chores, and a simple system can reduce labor requirements. Ample space for storage, and wide doors and alleys are important.

Large amounts of feed and dust in a stable increase the possibility of fire. Choose materials and designs that reduce risk and may aid in the control of fires.

Figures 7 to 9 show some stable and floor plan designs available from the Canada Plan Service (CPS).

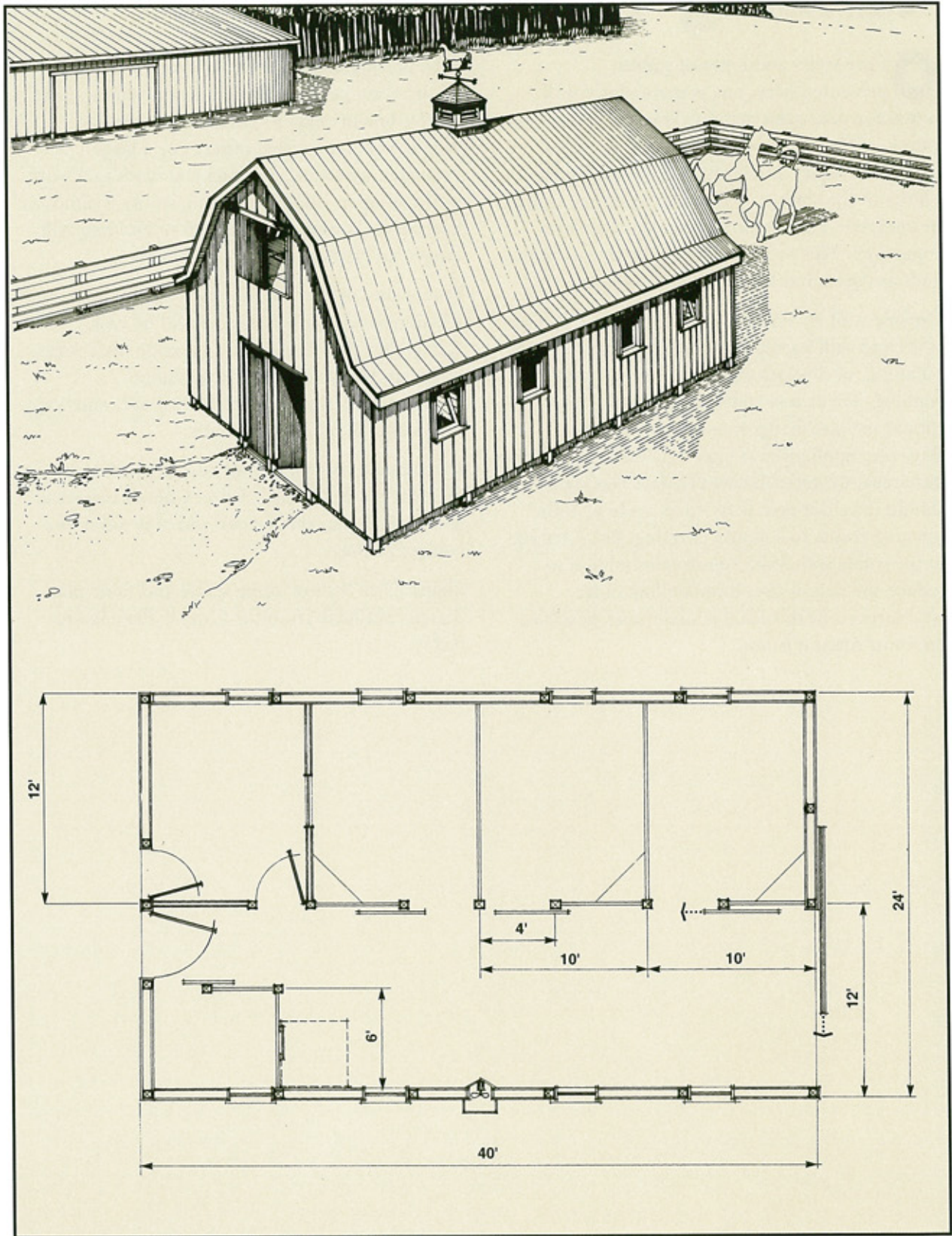


Figure 7. 1 1/2 storey horse barn CPS plan 8203

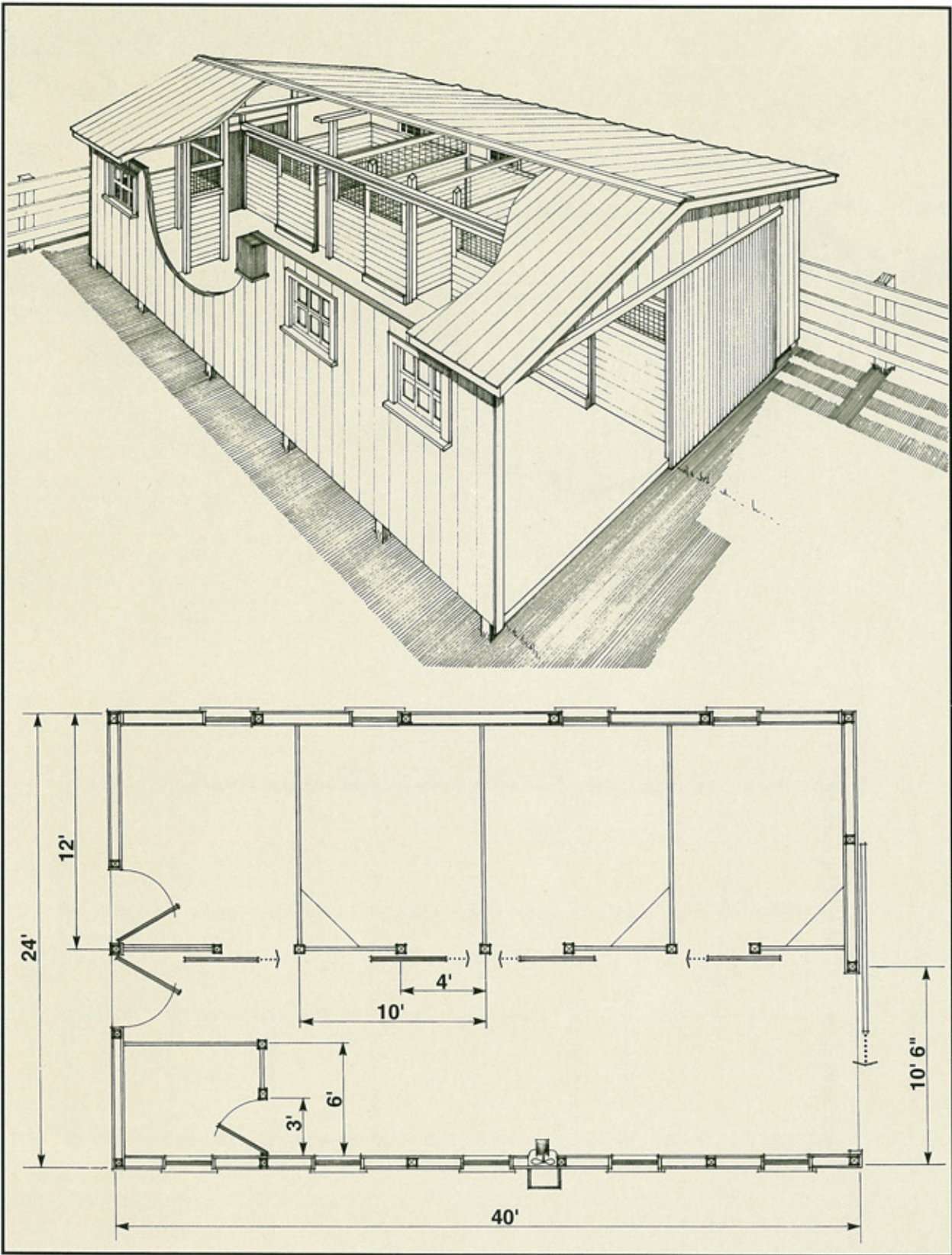


Figure 8. Horse barn CPS plan 8201

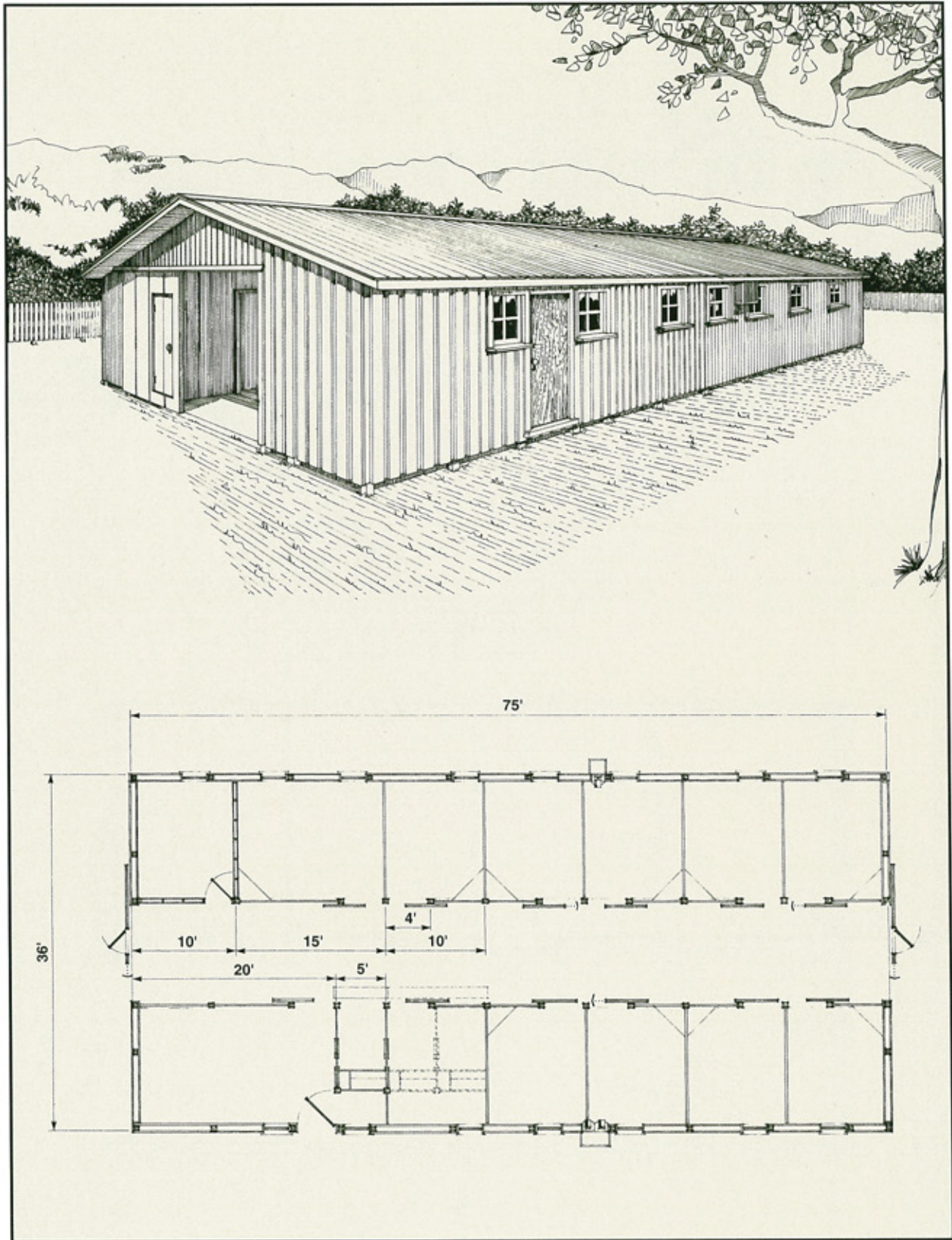


Figure 9. Horse barn CPS plan 8202

Building Types

Modern farm structures are commonly shaped either as gable-ended (with perpendicular walls), arch-type, or flat-roofed type (with slanted walls). Gable-ended structures are built mainly with wood framing. Arch buildings can be either wood or metal. The flat-roofed types usually have a two-hinged steel frame structure.

You can most readily adapt gable-ended structures for use as horse stables. They are easy to insulate, service and finish on both the interior and exterior. Doors and windows can be placed on side and end walls. The outside can be finished to match existing structures. You can use square pole (Figures 10 and 11) or traditional framing techniques (Figure 12). Wooden trusses up to 60 feet long are less expensive than steel trusses and provide a large range of possible sizes at reasonable cost. Gable-ended structures are usually the least expensive to build.

Another wooden-framed structure that is readily adaptable for livestock housing is the rigid frame (Figure 13). Such buildings are comparable in price to those of standard frame construction and are easy to insulate and sheath on the interior. Putting ventilation slots in the side walls and installing a baffle can be difficult depending on the design of the rigid frame.

Arch-type buildings (Figure 15) have some drawbacks when used as stables. The slanted walls will reduce the usable floor area in low buildings. This is especially true for outfacing tie stalls. If the building is tall enough to have a reasonable vertical wall height, you waste overhead space. You can install a loft, but this adds to labor and we do not recommend it. Putting doors and windows on side walls is possible, but it is not as easy as it is in a standard frame building. Building and attaching stalls can be difficult.

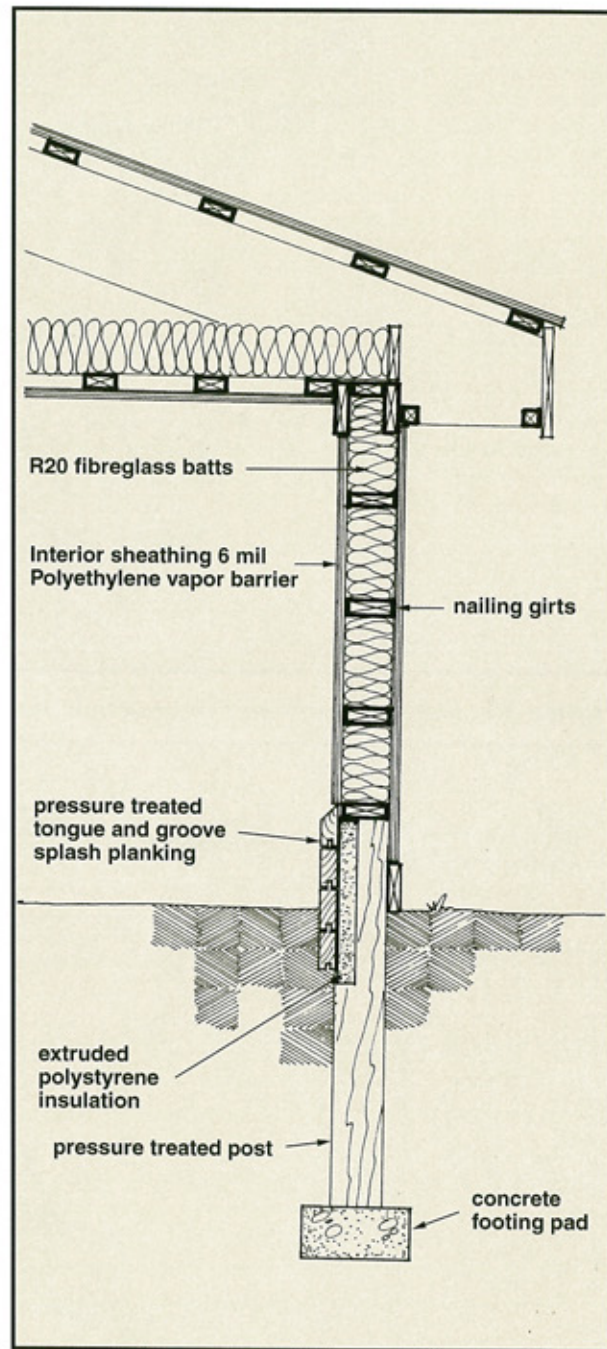


Figure 10. Insulated post frame construction (flat ceiling)

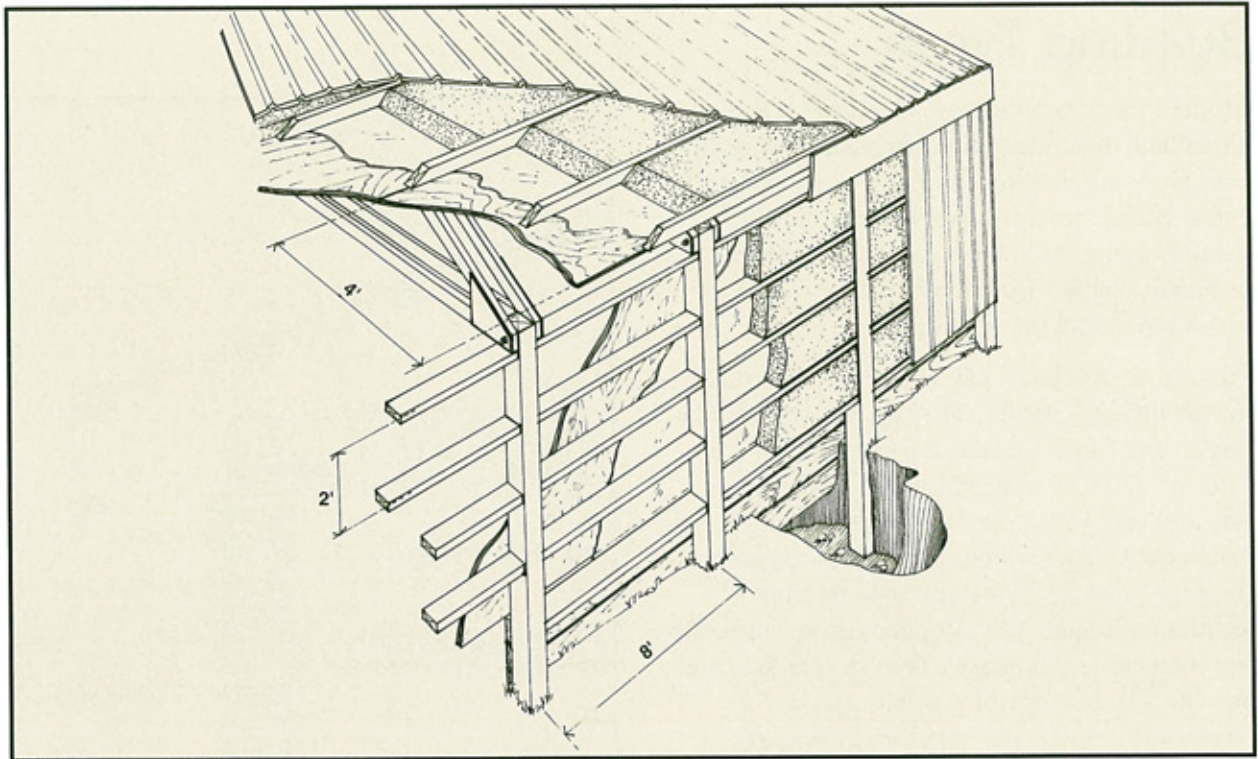


Figure 11. Insulated post frame construction (insulated roof deck)

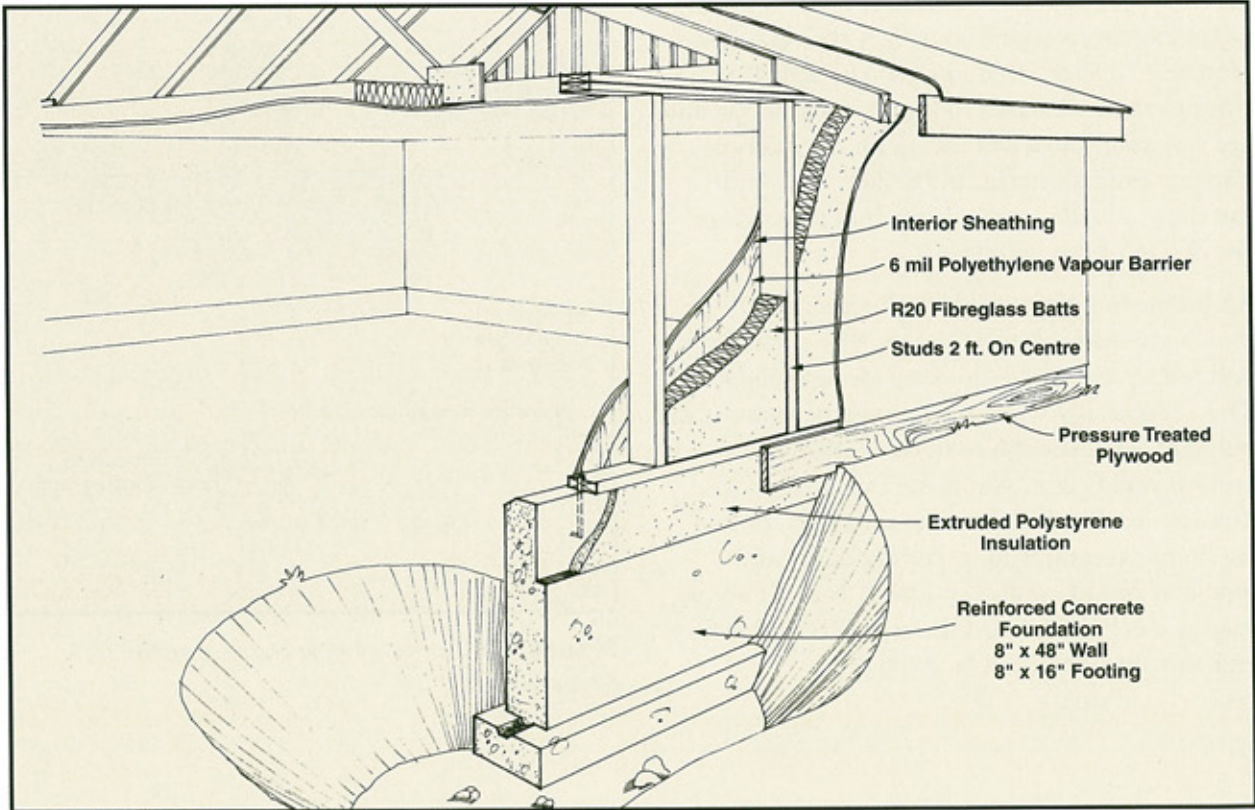


Figure 12. Insulated stud wall construction



Figure 13. *Straight wall metal clad stable*



Figure 14. *Metal clad Quonset style stable*

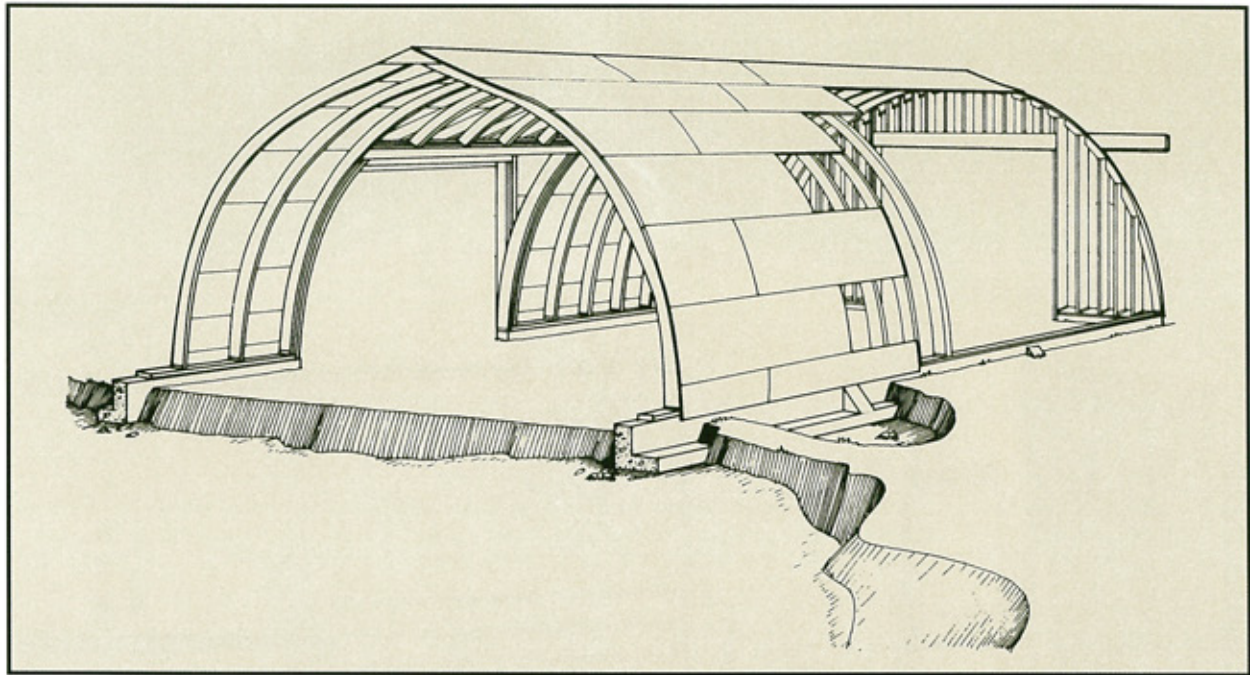


Figure 15. *Wooden arch construction*

Wooden arch-rib buildings are relatively easy to service and insulate. Metal ones are difficult and expensive to insulate. Horses will chew any sprayed-on insulation, so you must strap and sheet the inside of the structure to at least 8 feet. Most of the sprayed-on insulations are unsuitable for livestock buildings because they absorb moisture.

Two-hinge metal frame structures may have slanted side walls, which make side doors more difficult to install. You must strap the inside of the building to protect the insulation. Enclosed, uninsulated metal buildings lose excessive amounts of heat and will “sweat” badly in the winter, even when heated. Adding interior structures may be difficult. Metal Quonsets and metal-framed buildings generally cost more than wooden structures, especially those with shorter spans. These structures are generally not suitable as livestock housing.

Face inner walls and partitions with 2 inch lumber, or suitably framed 3/4 inch plywood. Dress outer surfaces to match existing structures. Horses may deface wooden siding and it may become necessary to restrict their access to it.

Aluminium siding is prone to dents and tears. Metal sheeting is more rugged, and reduces routine maintenance. Painted plywood or chipboard is subject to chewing. Usually you will need to protect the outer walls from the horses. Horses may chew at shingles used to clad arch rib buildings. Some paints contain toxic material so you should not use them on livestock facilities.

Wooden framed buildings are recommended for new construction – using either square-pole or conventional framing. This type of building has gable ends, with sufficient overhang to move run off water away from the building. It has a central alley between a double row of stalls or a side alley for a single row. The floor is concrete – rough enough not to be slippery and either level or with a slight slope to the middle of the alley. Doors at the end of the alley are tall enough and wide enough to allow for the passage of equipment. If you are going to house horses for extended lengths of time, you should insulate the structure with vapor barriers installed. Ceiling height should be at least 12 feet. This aids ventilation and lighting and allows more machinery use options. Line the inside to a height of 5 feet with

3/4 inch plywood or 2 inch lumber. Options for lining above 5 feet include metal sheeting, high density polyethylene “puck” board, or wooden sheeting at least 1/2 inch thick. A drawback to wooden sheeting is a tendency for bored horses to chew on it, so treat it with creosote. Metal sheeting or puck board require less maintenance and reflect more light. Windows are double paned and protected by heavy wire screens or bars anywhere a horse may reach. Metal cladding on the outside walls and roof reduce maintenance.

Flooring Materials

The ideal floor should be elastic and firm, smooth but not slippery. It should be absorbent, but not retain odors, and it should drain well. The ideal floor material has not yet been found.

You do not need to make a stable floor entirely of one material. A common plan is to have a concrete alley, with earth in the stalls. Alleys need to be able to support heavy equipment. You may vary asphalt mixes from stall to alley to provide a harder alley floor. To improve drainage, consider crowning alleys and sloping stall floors with a gutter installed. Maximum stall slope should be 1:50. Floor drains are a possibility but they plug easily, causing more problems than they are worth. Safety, comfort and utility are major considerations when choosing a floor.

Concrete, asphalt or brick floors in stalls will reduce maintenance and barn dust. These types of floors, however, may require more bedding than clay or dirt floors. This is particularly true for young horses that spend considerably more time lying down. Extra bedding will reduce the incidence of scraping of the hocks on rough flooring when getting up. It also reduces the loss of body heat from the foal when it is lying down.

Clay

Many people advocate clay or earth floors. They are inexpensive and not slippery when wet. However, these floors retain moisture and are dusty when dry. Horses can easily paw and pit

earth and clay floors so they need to be replaced frequently.

Sand

Sand has all the advantages of earth and clay but will not pack to a solid floor. It will drain more readily than dirt or clay. Unfortunately, it also has the same disadvantages in that it dries and becomes dusty. Stalls with dirt, clay or sand may get wet spots from urine.

Wood

Some horsemen prefer wood flooring because cleaning it is easy. It can, however, be extremely slippery when wet, and it retains odors. It will wear and rot, so you must replace it periodically. Wood floors can also harbor infestations of rodents. Wood flooring is expensive – using pressure-treated lumber can reduce the long-term cost.

Brick

The traditional material for stable floors in Europe is brick. Brick floors are expensive and may be damaged by heavy horses with caulked shoes. You can use interlocking or lay ordinary bricks on edge but ones specially made for stable floors may be available in some areas. Lay the bricks on an incline to increase drainage. Some are grooved for this purpose. They are easy to clean but can be very slippery when wet. If you lay them on sand, you may need to relevel them periodically.

Asphalt

Asphalt floors are inexpensive but they often cost as much as concrete. They can be laid on an incline, are easy to clean and have some elasticity. While asphalt is not usually slippery, you must take care when it is wet. When very cold, asphalt becomes hard and brittle, but in a heated barn this should pose no problem. When hot, asphalt may become sticky. Although it has a long life, it may need resurfacing after years of continuous hard use. Various mixtures of asphalt are available to provide different textures. A horse not used to asphalt flooring may scrape its hocks when getting up. Occasional applications of lime keep

asphalt odor-free. Deep bedding can overcome most of the disadvantages associated with this flooring.

Concrete

Concrete is very hard-wearing, easy to clean, and you can lay it on a slope. It is not slippery if finished with a rough surface, e.g., a wood float or broom finish. Avoid smoothly finished concrete as it is very slippery. Adequate bedding is essential to prevent urine from soaking into the concrete and to provide a cushion.

Rubber mats

You can use rubber mats with concrete, asphalt or wood to add traction to the floor. The mats have some insulating value and are very easy on horses' feet. Although expensive, the savings in stall cleaning, labor and bedding, plus the added comfort they provide to the horse may be worth it. Rubber mats laid over sand or dirt floors prevent pawing and reduce, but do not eliminate, the need to replace lost material. They may also aid in dust reduction. Mats should be at least 3/4 inch thick and should butt up against the walls for optimum use.

Red ash (coal slag)

Red ash is an alternative flooring material available in coal mining country. Its red color adds to the appearance of alleys and driveways. It drains well and retains little odor. Horses are less prone to paw or dig ash than earth. It does add some dust to the air, but it is firm and easier to clean than earth, sand or clay. It also has the advantage of not being slippery when wet.

Box Stalls

Box stalls are not intended to be a horse's permanent home even though they allow some freedom for the animal to move around and lie down. They provide a place of relaxation for horses in rigorous work or training sessions. However, horses maintained in box stalls may become bored and develop bad habits. Stall

weaving and cribbing are two habits that commonly arise. Box stalls require more space, more bedding and more labor to clean and maintain than tie stalls.

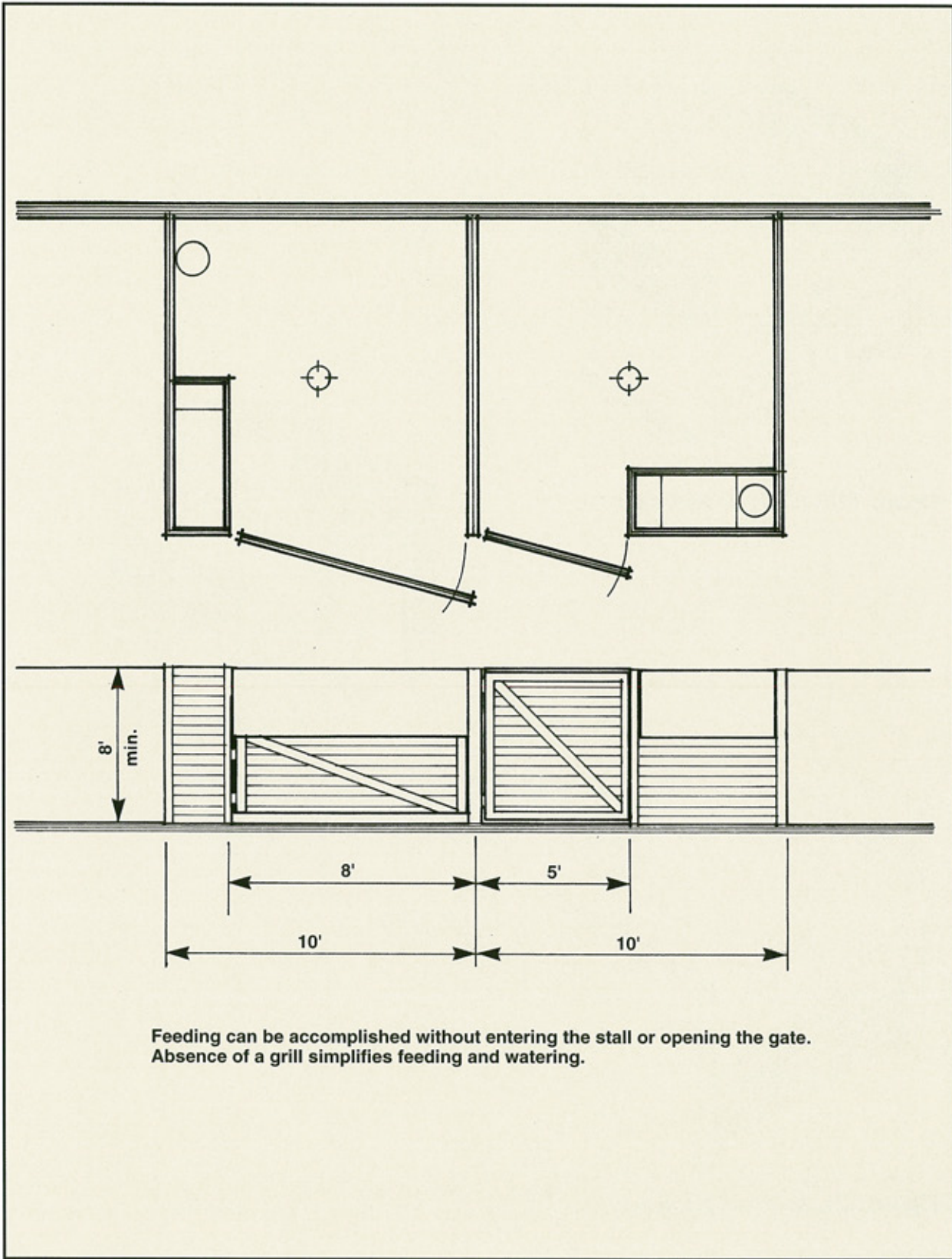
A well-planned box stall should have a smooth inner finish, with no projections to injure the horse. It should be well ventilated and have sufficient light. The minimum recommended size for a box stall is 100 square feet per 1000 pound horse. The ceiling should be at least 8 feet high. As indicated in the lighting and ventilation sections (page 23), the optimum height of ceilings is 12 feet. Make foaling and hospital stalls larger than average box stalls.

Box stall fittings can include a manger, grain trough, watering facility and cross-tie rings (Figure 16). Consider using an auxiliary overhead heater for supplementary heat in foaling stalls.

Make doors entering stalls at least 4 feet wide and build them solidly. Sliding and swinging doors are common. Swinging doors should open into the alley. Dutch doors or doors with open tops are traditional, but a full door is more practical. A horse may put its head into the alley and paw and strain against the door, especially at feeding time. If you want an opening, leaving the top part of the wall open is better. A wall is better able to take the strain of a horse leaning against it than a door.

For easy cleaning, having a system that allows the whole front of the stall to open is best. A metal panel is ideal for this. A wide door will permit machinery to enter and operate easily. This will cut down on the need for hand labor. A wide opening will also let in more air and light. The side walls can be solid to provide some seclusion. All door hardware should be solid with no sharp edges. Choose and place latches so horses cannot open them themselves.

Windows add light to the barn and give a feeling of openness. They are also a major source of heat loss in winter. For ventilation in hot weather, you can use windows that open. Any windows placed



Feeding can be accomplished without entering the stall or opening the gate.
 Absence of a grill simplifies feeding and watering.

Figure 16. *Alternative box stall layouts*

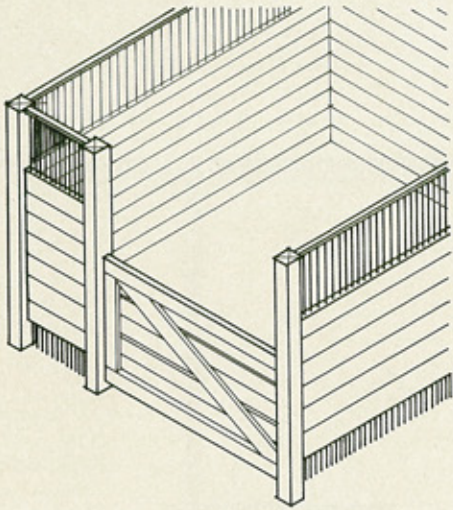


Figure 17a. *Plank and grate partition*

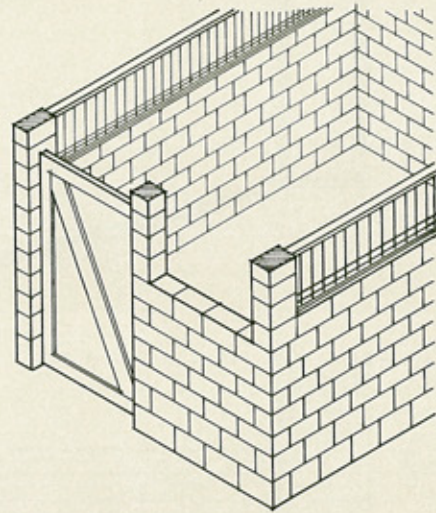


Figure 17b. *Masonry partition*

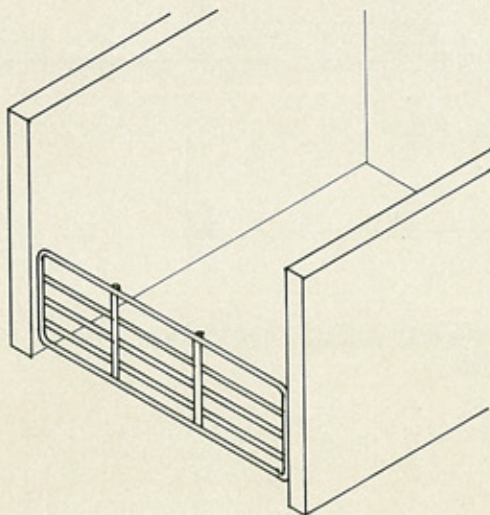


Figure 17c. *Solid wall partition*

Figure 17. *Box stall construction alternatives*

within a horse's reach require heavy screens or bars for protection.

Tense horses may gaze out the window instead of eating and relaxing. Foaling stalls should be especially secluded. A high window above a horse's line of vision may be better. Windows with solid shutters but no glass, which can be opened in the summer and on warm winter days, may be another choice. Consider using skylights instead. They are out of a horse's reach and cannot be broken. Skylights add natural light and do not require much cleaning. In a barn with good air mixing, heat loss is not any greater through skylights than through windows. Skylights or windows may add up to 2.5 Watts per 10 square feet per hour of heat when the sun is shining. To prevent condensation and possible moisture damage to frames and sills, windows should be double paned.

Stall partitions can be several different styles. If solid from floor to ceiling, they may impede ventilation. Walls should be solid to a height of at least 4 feet. Grates or screens to a height of at least 7 feet are an option if seclusion is not desired.

A recommended type of partition has a grate 6 inches high on the bottom of the kick wall to aid in ventilation (as shown in Figure 17a). Leaving 1 1/2 inch spaces between boards allows air movement. For horses that you would normally pasture together and hold no animosity for each other, metal panels 5 feet high make an open, airy, low maintenance facility. You can move panels to allow for different situations, e.g. remove a partition to make a double stall for foaling.

You can build partitions with various materials. Wood is the most common. If lumber is used, 2-inch planking is required. Plywood panels 3/4

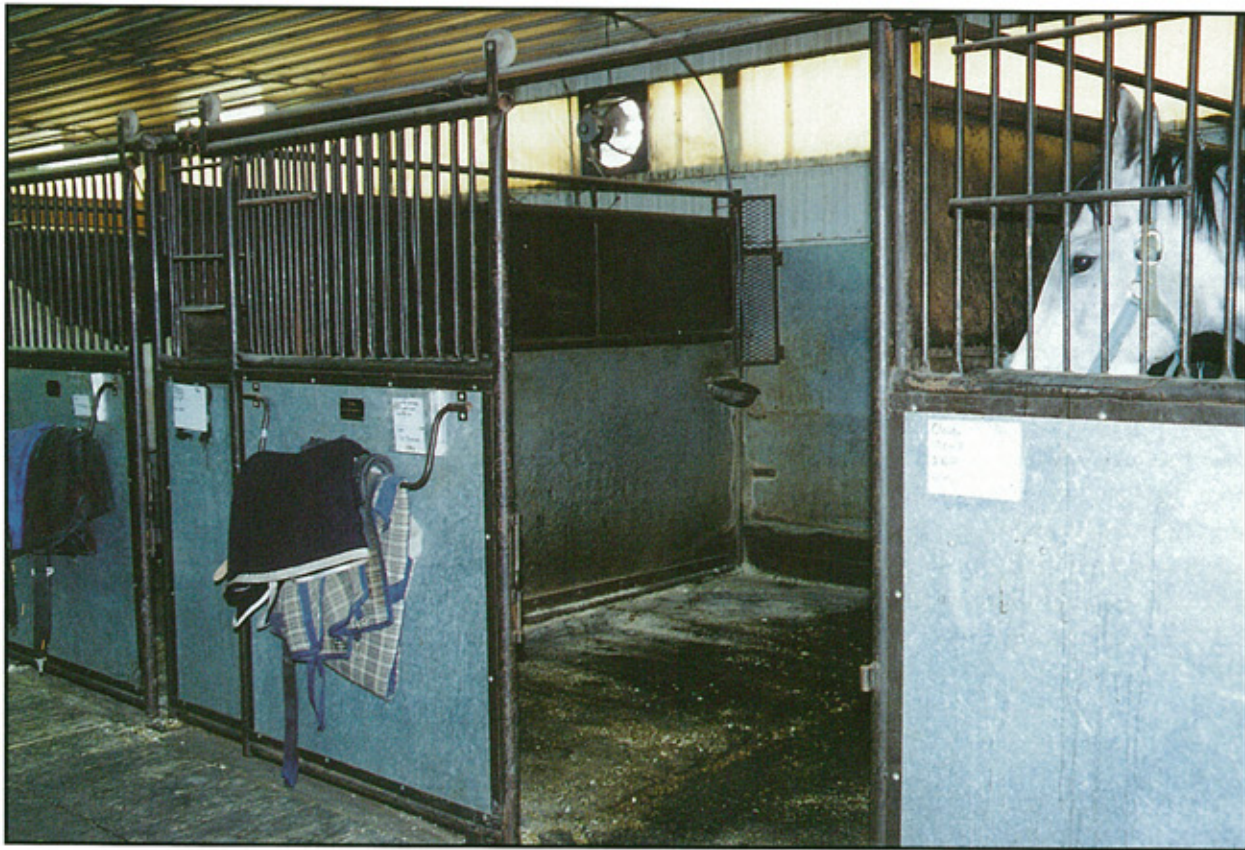


Figure 18. Commercial box stall partition – note the higher ceiling, light panels and ventilation fan

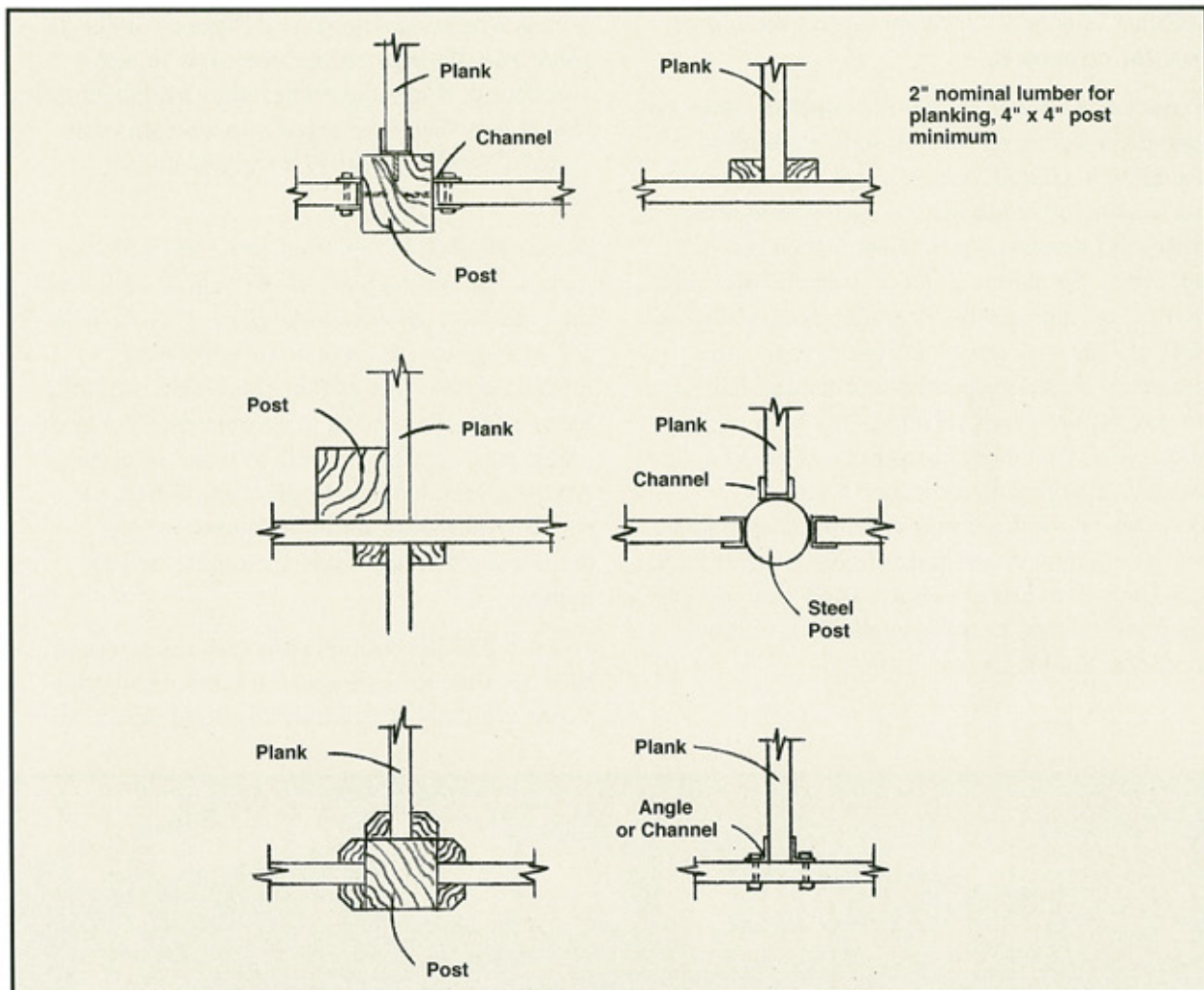


Figure 19. End anchors for stall partitions and walls

inch thick with metal reinforcing are available commercially. All exposed wooden edges should be metal covered to prevent chewing. Metal panels are strong and maintenance free. Hollow masonry brick partitions, as shown in Figure 17b, should be filled with sand or concrete to resist punctures from kicks. You can build solid stall partitions, similar to Figure 17c, of laminated 2 x 4 inch lumber especially when using this type of building wall construction. The main points to remember are to keep inner surfaces smooth and to make partitions strong.

Figure 19 shows some partition types and construction details. Those with open tops and bottoms help ventilation. Stalls with solid walls

and closed fronts can be difficult to ventilate adequately. Ventilation should be a major concern when planning your stable.

You should build mangers in box stalls solidly to the floor to prevent horses from being cast (trapped) under an overhang. They should be as solid as the stall walls and designed to reduce sharp corners. Provide water in manually filled buckets or automatic watering bowls. Plastic pipe is suitable in areas where horses cannot reach it but any piping within reach should be metal – preferably galvanized water pipe. Remember to keep valves out of the reach of stalled horses, as some horses may play with a tap until it turns on.

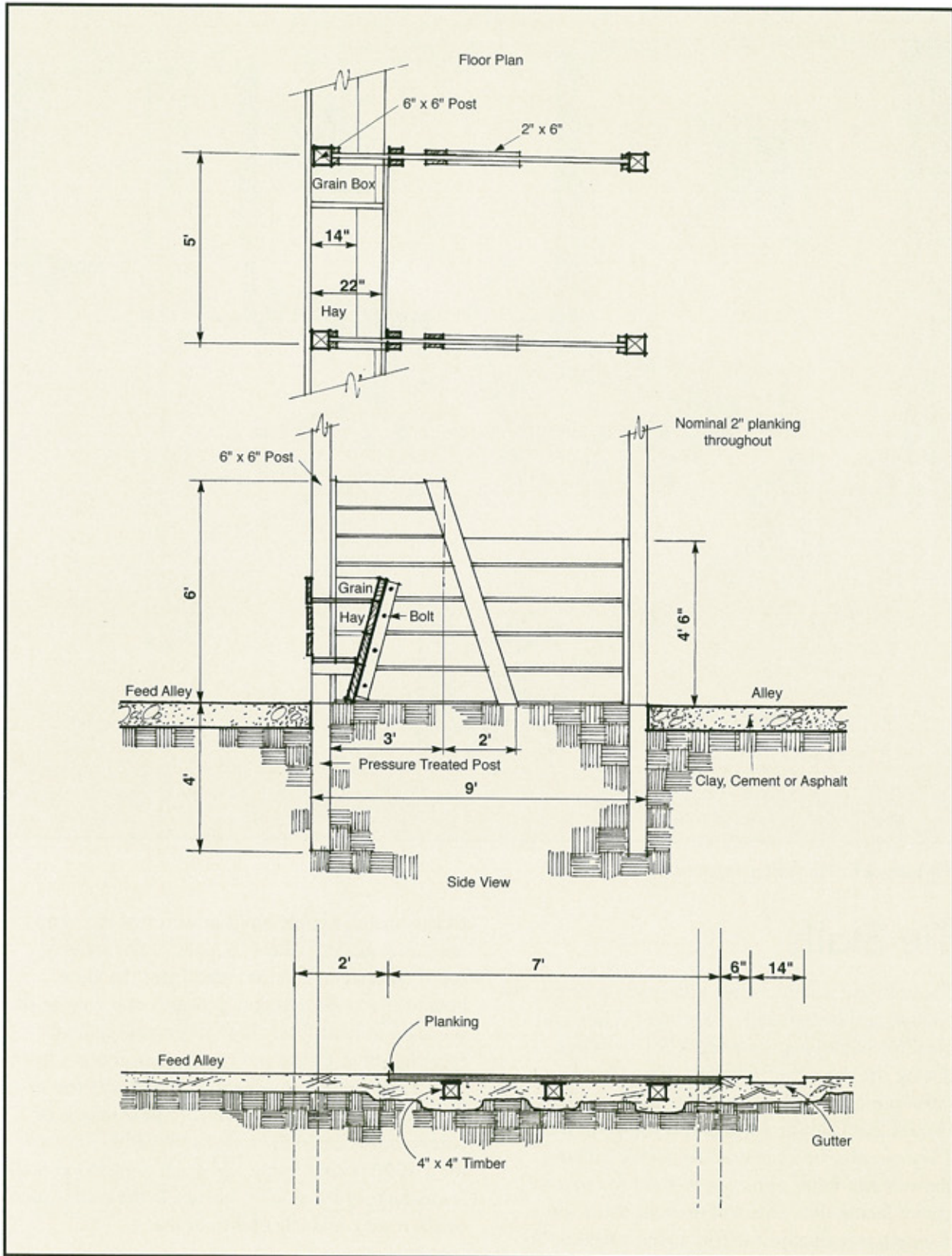


Figure 20. Tie stall construction

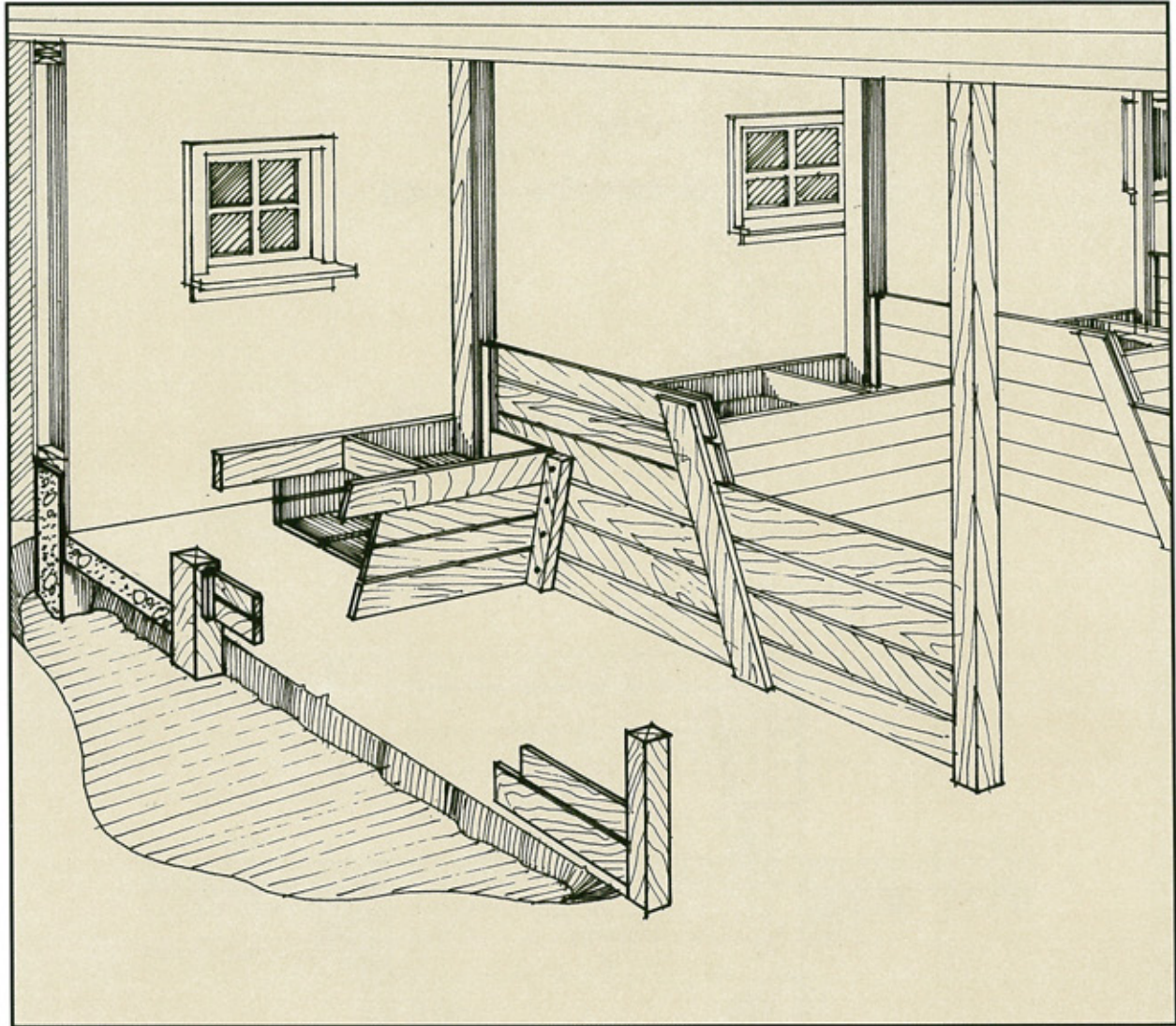


Figure 21. *Tie stall arrangement*

Tie Stalls

Tie stalls are suitable when you bring in horses for feeding and occasionally, overnight. They are ideal for horses kept in paddocks or worked during the day. They take less space than box stalls, use less bedding, and are easier to clean. Horses learn to stand still and relax in tie stalls. They can also become used to people moving about them. Pillar reins can be used to cross-tie horses facing out. This will prevent them from drinking or eating just before being worked. You can build mangers and grain boxes into tie stalls.

Occasionally, people build in waterers too. You can run your feed alleys in front of the stalls to supply service or you can feed from the alley behind the horses. Make partitions at the front of the stalls at least 7 feet high to prevent animals from fighting. Either run rear partition posts from floor to ceiling or cut them flush with the top of the partition. Figures 20 and 21 show details of construction. Recommended stall width is 5 feet for a 1000 pound horse, although a narrower stall is satisfactory for smaller horses. If the stall is too small, it may limit flexibility of use.

Lighting

Good lighting prevents accidents, speeds chores and aids livestock inspection.

When choosing a lighting system, factors to remember include duration and frequency of use, the cost of electricity, purchase price of lamps and lighting equipment, quantity and quality of light required and the labor involved in the installation and maintenance of the system.

In areas where you turn lights on and off frequently (more than three times per day) or turn them on for less than two hours, use incandescent lamps. If you turn them on for periods longer than two hours, consider other alternatives.

Modern fluorescent lamps have electronic ballasts and conform to the Energy Efficiency Act. In areas that will be colder than 10°C (50°F), use low temperature ballasts.

Use either incandescent or fluorescent lamps for stalls, feed storage, tack rooms and alleys. Fixtures should be gasketed and vapor or dust tight. Use watertight fixtures in wash racks.

Walls should be flat white or at least a light-toned, flat color. This increases light reflection and prevents dark corners.

If you run lights in rows down the edges of alleys, you can illuminate both stalls and alley. With completely enclosed stalls, place a light in each stall.

When choosing an option for illuminating a riding arena ask yourself these questions. How often and for what duration will the lamps burn? Do you need good color rendition? Will the arena be used for shows or competitions?

Metal halide (MH) lights provide light with the best color rendition. High pressure sodium (HPS) lights are less expensive and as efficient, but have poor color rendition. Some deluxe HPS lights provide good color rendition, but they cost more. Consult your lighting suppliers to compare pricing of light fixtures and lamps.

Outdoor lighting provides for safe movement and security. Low pressure sodium lights (LPS) provide adequate light in low use areas most efficiently. In high use areas – riding arenas or loading areas – consider using HPS or MH lights.

Regular cleaning (at least once a year) of light fixtures will help maintain light output and may extend the life of light fixture components.

Adequate lighting controls are essential. An ability to turn on lights in each section of the barn and in tack rooms, feed rooms and in wash racks as needed is a money-saving convenience. Plan arena light controls to allow a quarter or sixth of the

Table 2. Comparison of light types for efficiency and color rendition

Type	Efficiency* (lumens per Watt)	Color rendition (less than 50 poor/ more than 60 good)
Incandescent	10 - 35	95+
Fluorescent	40 - 100	60 - 85
Metal halide (MH)	50 - 110	60+
High pressure sodium (HPS)	50 - 120	20 - 25
Deluxe HPS	30 - 90	60+
Low pressure sodium (LPS)	100 - 180	undefined (poor)
Mercury vapor (not recommended)	20 - 63	15 - 50

* Based on lamp mean lumens.

**Table 3. Recommendations for lighting specific areas
(assuming 10-foot ceilings and reasonably reflective surfaces)**

Area	Recommended illumination level (foot candles)	Lighting options
Alleys	10	Incandescent – one 200 Watt lamp every 12 feet Fluorescent – one twin-tube 32 Watt T-8 lamp every 16 feet
<i>Note: It is reasonable to augment lighting in alley areas used for horse shoeing and veterinary examinations to 20+ foot candles</i>		
Box stalls	5	Incandescent – one 100 Watt lamp per stall Fluorescent – one twin-tube 32 Watt T-8 lamp situated to light two stalls if stall wall and ceiling design allows
Tie stalls	5	Incandescent – one 100 Watt lamp every other stall along a common wall or alley Fluorescent – one twin-tube 32 Watt T-8 lamp every other stall along a common wall or alley
Feed storage	10	Incandescent – one 200 W lamp per 120 sq. ft.
Tack room	15	Incandescent – one 200 Watt lamp per 60 sq.ft. Fluorescent – one twin-tube 32 Watt T-8 lamp per 120 sq. ft.
Foaling stall	15	Incandescent – one 200 Watt lamp per 60 sq.ft. Fluorescent – one twin-tube 32 Watt T-8 lamp per 120 sq. ft.
Wash rack	15	Incandescent – one 200 Watt lamp per 60 sq. ft. Fluorescent – one twin-tube 32 W T-8 lamp per 120 sq. ft. (watertight fixtures)
Office	30	Incandescent – one 250 Watt lamp per 40 sq. ft. Fluorescent – one twin-tube 32 Watt T-8 lamp per 60 sq. ft. Supplement with task lighting as required.
Riding arena (ceiling height of 14 ft. or more)		
Recreation	10	MH or HPS with a color rendition index above 70 – one 250 Watt lamp per 900 sq. ft. Deluxe HPS – one 250 Watt lamp per 1000 sq. ft. A spacing of one 250 Watt lamp per 625 sq. ft. will provide more even lighting at a level of 15 foot candles.
<i>Note: Observe recommended spacing for fixture type to avoid "spotlight" effects</i>		
Competitive	20 (up to 50 for professional competitions)	MH – one 250 Watt lamp per 400 sq.ft. Deluxe HPS – one 250 Watt lamp per 450 sq. ft.
Seating areas	5	Incandescent for low use – one 250 Watt per 250 sq. ft. Fluorescent for higher use – one 32 Watt T-8 fixture per 250 sq. ft.
<i>Note: Riding arenas with seating may be classified as a building for major occupancies. If so, the facility would have to comply with the Alberta Building Code which regulates all aspects of structure design.</i>		
Outdoor riding		
Recreational	10	Use HPS, deluxe HPS or MH
Competitive	20	
Other outdoor		
Entrances	1	LPS or HPS on photocell controls
Security	0.2-0.5	Halogen or incandescent spot or flood lights activated by motion detectors, where higher illumination levels are needed, but not continuously.

area to be turned on at a time. This lets you light only the portion being used.

Provide adequate power outlets in tack rooms, feed rooms and alley to meet your needs, e.g., consider use of clippers, radio, sound systems, power tools and so forth.

Watering Systems

Mature horses require 8 to 12 gallons of water per day. Several options are available to meet these needs. Many horse barns are equipped with manually filled plastic water buckets in each stall. If this is the only water source available, make sure you monitor and refill the buckets often enough to provide adequate amounts of water on a daily basis. You can reduce labor with individual automatic waterers. Make sure they have turn off valves. Automatic waterers are only an option in heated barns. Keep plastic pipe and valves out of the reach of horses.

If no natural water source is available in summer, water must be provided. Since the average horse needs 10 gallons per day, you can easily calculate trough sizes for different situations. In a slow recovery system, a tank that holds one day's supply for the horses it serves is adequate. A 100-gallon automatically refilling tank will easily accommodate 10 horses. If tanks must be refilled manually, allow enough capacity to meet the maximum daily needs between fillings and add at least 25 per cent for wastage and evaporation.

Under a pressurized system, one bowl for every 20 mature horses is adequate.

Provide horses with water in the winter even if clean snow is available. The following suggestions are the most practical options for providing water to horses kept outside:

- Automatic, electrically heated waterers (Figure 22) can be used for corral or paddock facilities. You can place these waterers on a fence line to serve two pens. Put them on a well-drained site surrounded by a concrete (25 MPa air

entrained) apron 6 to 10 feet wide to provide a dry area around the waterer and a solid base for the waterer itself. Energy efficient electrical waterers are available on the market and highly recommended. You will recover your additional cost in the first cold winter. Cattle drink approximately the same amount of water as horses of similar body weight. Following the manufacturer's recommendation for stocking numbers will provide adequate watering capacity. Stocking above the maximum rate is not a concern in average horse facilities.

- Even minute amounts of stray electricity are apparent to horses, and this will cause them to quit drinking. Electrically heated waterers **must** be properly grounded. Use two 10 foot long ground rods 10 feet apart, #6 stranded copper ground wire.
- Another option is to use waterers heated by natural gas. While the up-front installation cost is higher, power outages and the cheaper energy cost may make this a viable alternative. As each individual situation is different, making specific recommendations is difficult. You must measure the energy cost savings against specific installation costs to decide the best alternative.
- If you have a very large operation with many horses, you may want to consider zero energy waterers. These operate by super insulating the watering bowl to retain the ambient heat provided by incoming water. If enough water is not regularly drawn into the system, however, all will eventually freeze. Manufacturers of these waterers can provide minimum required stocking rates. The prospect of no energy cost can make these types of waterers very attractive if high enough usage is available.



Figure 22. *Electrically heated automatic waterer installed on a concrete pad and situated to allow access from two sides of the fence*

Heating and Ventilation

Ventilation is the most neglected, yet most important aspect of stabling. Horse urine may cause high levels of ammonia in the atmosphere. This condition can retard feed efficiency and may lead to respiratory problems. Dust can also cause respiratory problems. To test your facility, go into a stall in an average state of cleanliness, close the door, kneel down and smell the air about 15 inches off the floor. This is where a foal's head is when it is lying down with its head erect. You can avoid most health problems if you give horses safe, dry facilities with good feed and clean air.

Box stalls are extremely difficult to ventilate adequately. If the ceiling height is only 8 feet and

the stall walls are solid, providing adequate air flow is almost impossible. To allow for the free passage of air above the stalls, make the ceilings at least 10 feet high with a two foot opening over the wall. If an opening is left in the bottom of the front of the stall, air can be drawn down through the stall to expel moisture and contaminants. Good planning is required to provide adequate ventilation in a horse barn.

Ventilation not only provides clean air to breathe, it also removes moisture. Housed animals release significant amounts of water into the atmosphere through respiration. If not removed, this moisture will rapidly cause structure deterioration and failure and is a major cause of respiratory problems in horses.

As outside air is brought in and heated, its ability to carry moisture is increased. The colder the air is to start with, or the more the air is heated, the greater its moisture holding capacity. The amount of air required to remove the moisture produced determines the ventilation rate. The rates given in Table 4 were calculated on the assumption that a horse produces 527 to 703 Watts (1,800 to 2,400 BTU) of heat per hour, and 4,500 to 5,000 grams of moisture at -30°C (-22°F).

Cold housing provides shelter from the environment but does not provide supplemental heat. If horses are not in heavy training or usage, cold housing is recommended. You must provide adequate ventilation. Without supplemental heat, however, animals will need more feed to maintain body heat.

Warm housing requires an insulated building and a heating system. Effectively insulated buildings require less added heat and are less expensive to maintain. With the high humidity prevalent in livestock buildings, a vapor barrier becomes a

Table 4: Ventilation requirements

	Winter	Spring & Fall	Summer
Ventilation Rate	12 L/sec	75 L/sec	125 L/sec
Required per 1000 lb of horse	(25 cfm)	(150 cfm)	(250 cfm)

critical part of an insulation system. A vapor barrier must be placed on the warm side of the wall to prevent moisture from infiltrating into the insulation and building materials. This barrier protects against loss of insulating value, rotting and structure failure.

In winter, ventilation control is a critical factor. Enough air must pass through the structure to keep it dry, yet it must be kept to a minimum to prevent heat loss. More air movement is required in spring and fall when the temperature differential is less. In summertime, as much air movement as possible is desired to keep the inside cool. See Table 4 for recommended ventilation rates.

There are two kinds of ventilation systems – natural and forced air. Forced air is easier to control but will incur the expense of purchasing, maintaining and operating fans. You need to watch natural ventilation more closely, and you need to change vent openings frequently to maintain the desired inside conditions.

Natural ventilation

Natural ventilation is the ventilation of a livestock building without the aid of fans. It uses convection currents. Convection systems only work if there is a difference between the inside barn temperature and the outside temperature. Ventilation outlets should be at or near the highest point of the building. Place the air inlets as low on the wall as possible without causing drafts in the stalls. For ease of construction and adjustment, place the inlets near the top of the walls, or under the eaves and over the top plate.

A long narrow slot inlet with an adjustable baffle is the most satisfactory. This slot should be about 1 to 4 inches wide and should be continuous down both eaves of the barn. You will need a 6-inch wide opening to cool the barn in the summer. A maximum opening of 3 inches will be adequate for most other conditions.

Types of ventilation outlets are the continuous ridge opening type (Figure 23) or the cupola. The continuous ridge opening type is usually 4 inches

wide and runs the full length of the barn (except for 8 feet on either end). One or two cupolas of a comparable size can be used instead (Figure 24).

Forced air ventilation

Fans

Select fans for their certified rating, based on 3 mm static pressure. They should have enclosed motors to protect them from dust and moisture and sealed bearings to assure proper lubrication. Overload protection is necessary to prevent motor burnout. Install automatic shutters and wire mesh guards to prevent drafts and to keep birds out.

Place fans away from prevailing winds. Put them in a tight wall away from loose-fitting doors and windows. Inlet placement controls air flow in a building more than other factors. Fan location has very little influence on air flow patterns.

Inlets and outlets

Design inlets to prevent drafts. Long, narrow inlets promote air mixing in open truss systems. In a forced air system, allow one square foot of inlet for each 1,000 cubic feet per minute of fan capacity. You should install inlets where they will draw fresh air. Keep them well away from manure storage areas. In winter, tempered air can be drawn from the attic. In the summer, air should be drawn directly from outside. Be careful where you place inlets and outlets because these are the major factors in controlling air mixing.

A negative pressure ventilation system (exhaust fans creating a vacuum inside the barn, which causes air to be drawn into the barn) is practical in a stable. Inlets can then be placed above or in front of every stall to ensure good ventilation. Stall partitions can cause ventilation dead spots if this is not done. Inlets in unused stalls can be closed and others opened wider, to promote ventilation where needed.

Figures 25 and 26 show how to install negative pressure inlets and recirculating ducts either on the sides or in the centre of the ceiling.

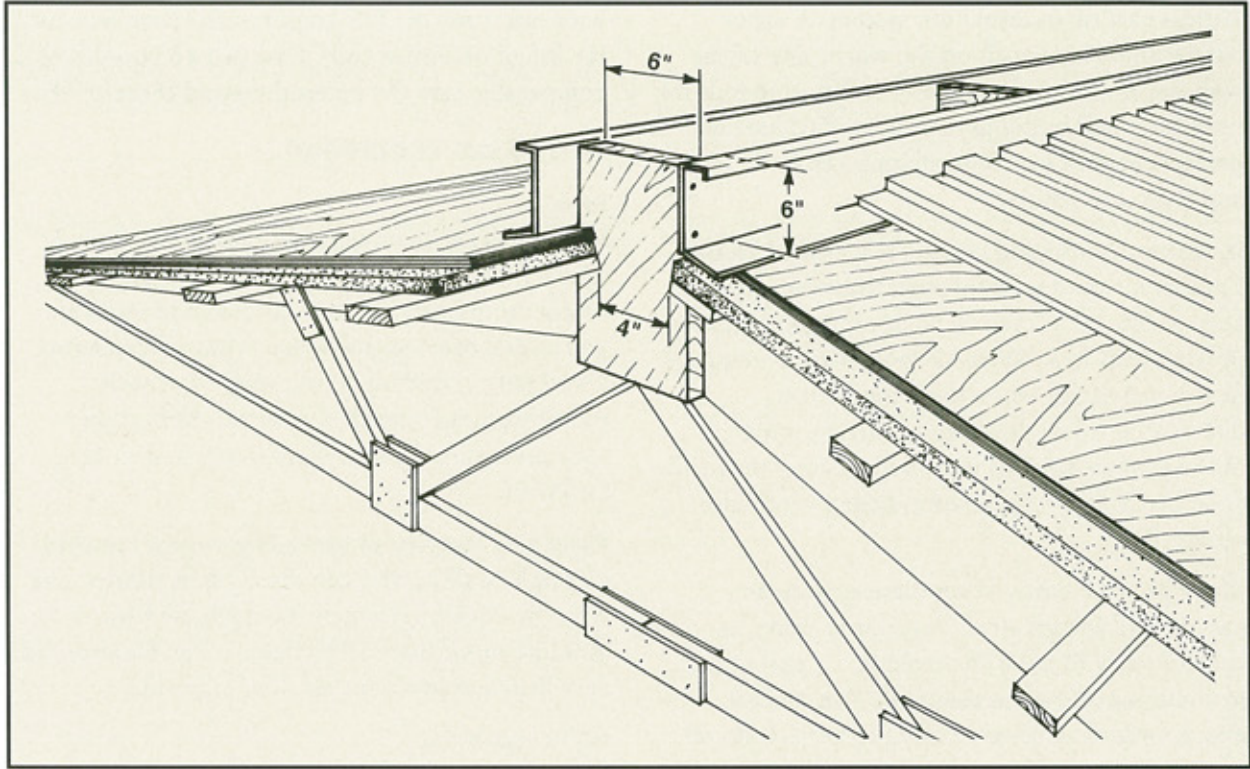


Figure 23. Continuous ridge ventilation opening

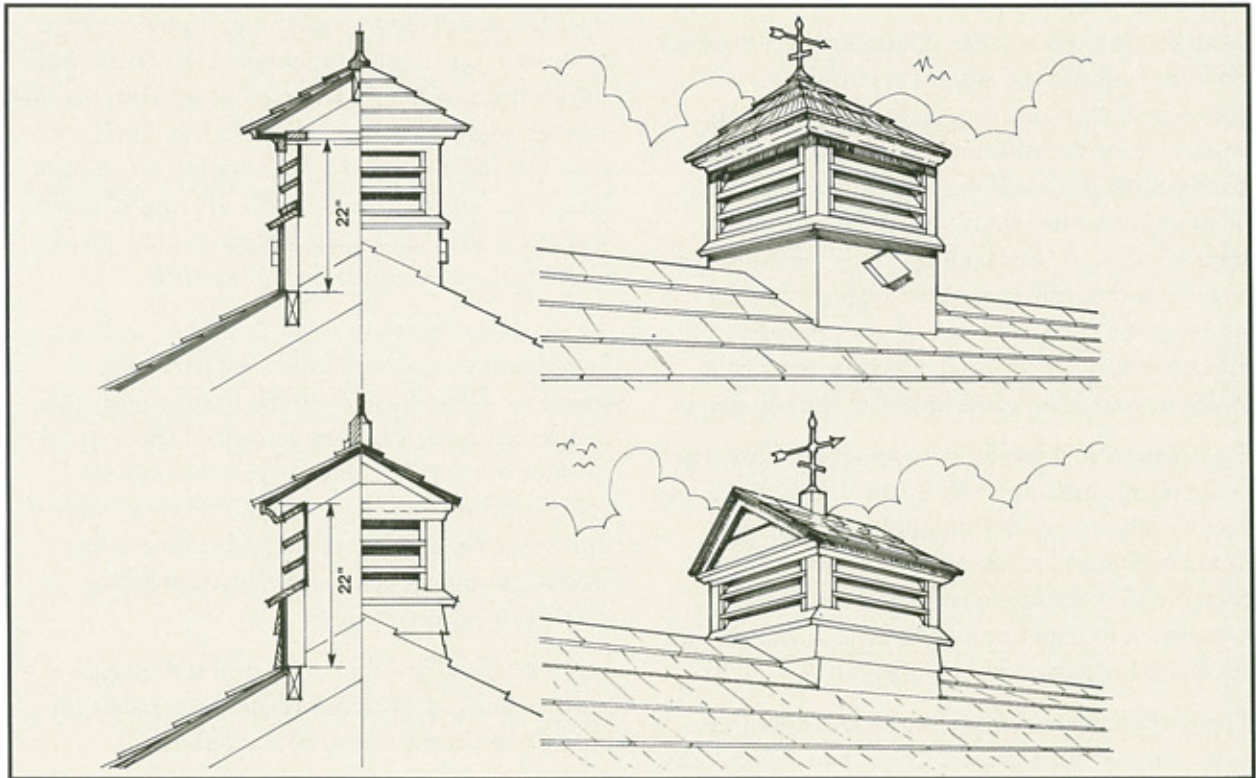


Figure 24. Ventilation cupolas

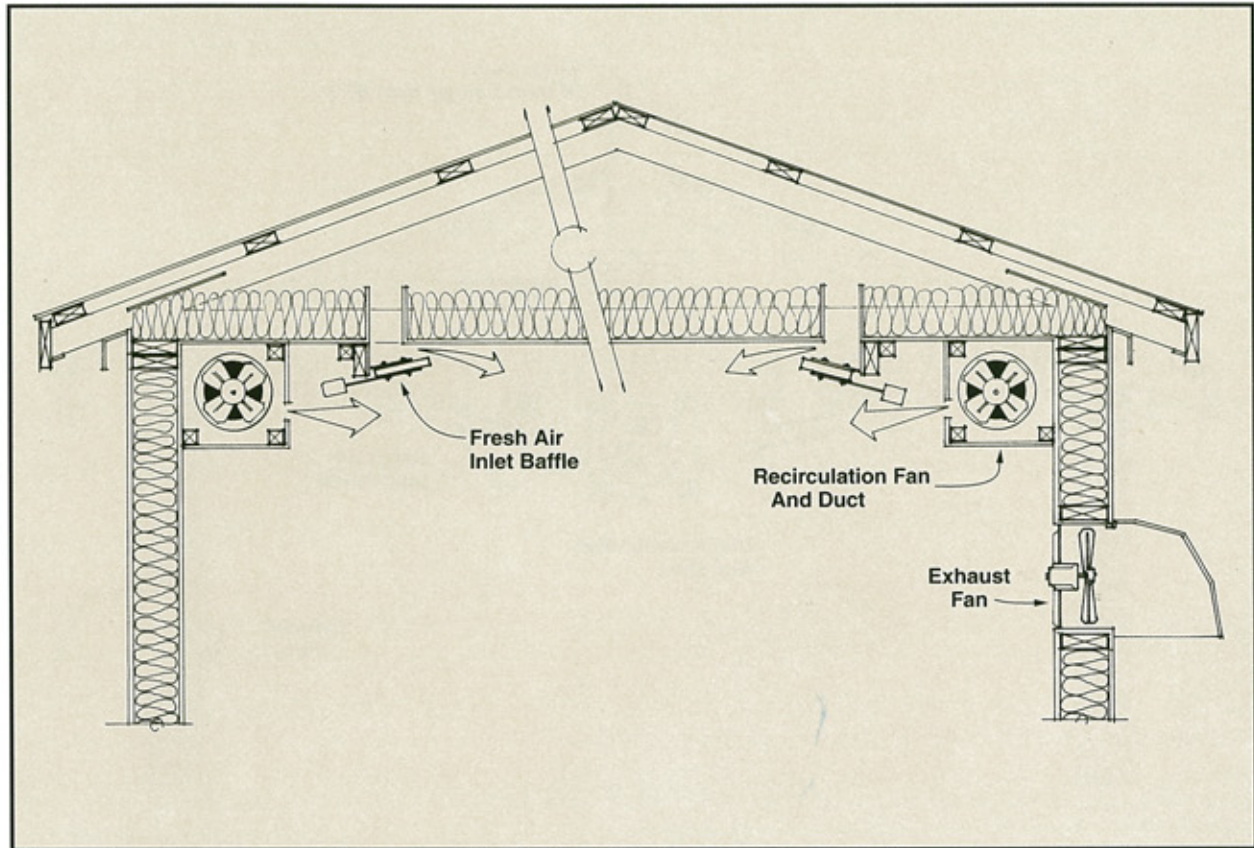


Figure 25. *Negative pressure ventilation system side air inlets and recirculation ducts*

You can also use a positive pressure ventilation system (fans forcing fresh air into the barn). Forced inlet systems require some duct work to ensure good air mixing, although in a small barn a square baffle below the fan will adequately distribute the air. Heat distribution can be optimized in a heated building with the use of forced air systems for ventilation. The main disadvantage of a positive pressure system occurs with an inadequate vapor barrier. This could result in moisture being forced into the walls and insulation by the positive pressure system.

Figure 27 shows a workable positive pressure ventilation system using a plastic tube for air distribution. This may be the most practical system in a long barn of box stalls.

Both negative and positive systems can work, but many attempts to combine them in a single structure have proven unsatisfactory. Take a great

deal of care to make sure that one system does not fight against the other.

To prevent drafts, incoming air should be directed across the ceiling by a baffle system. If inlets are placed high on a wall and are correctly adjusted, air mixing potential is optimized (Figure 28). Figure 29 summarizes the various ventilation alternatives and shows the various options of air inlet and outlet locations.

Consult an agricultural engineer when planning your ventilation system. The objective is to provide an **efficient** system that provides a healthy environment for the horses.

Heated facilities

Before heating any livestock facility, insulate and seal it against air leaks. You also have to decide how much heat you need. A cold barn that is dry and well ventilated is healthier than a humid, warm barn. The higher the desired temperature,

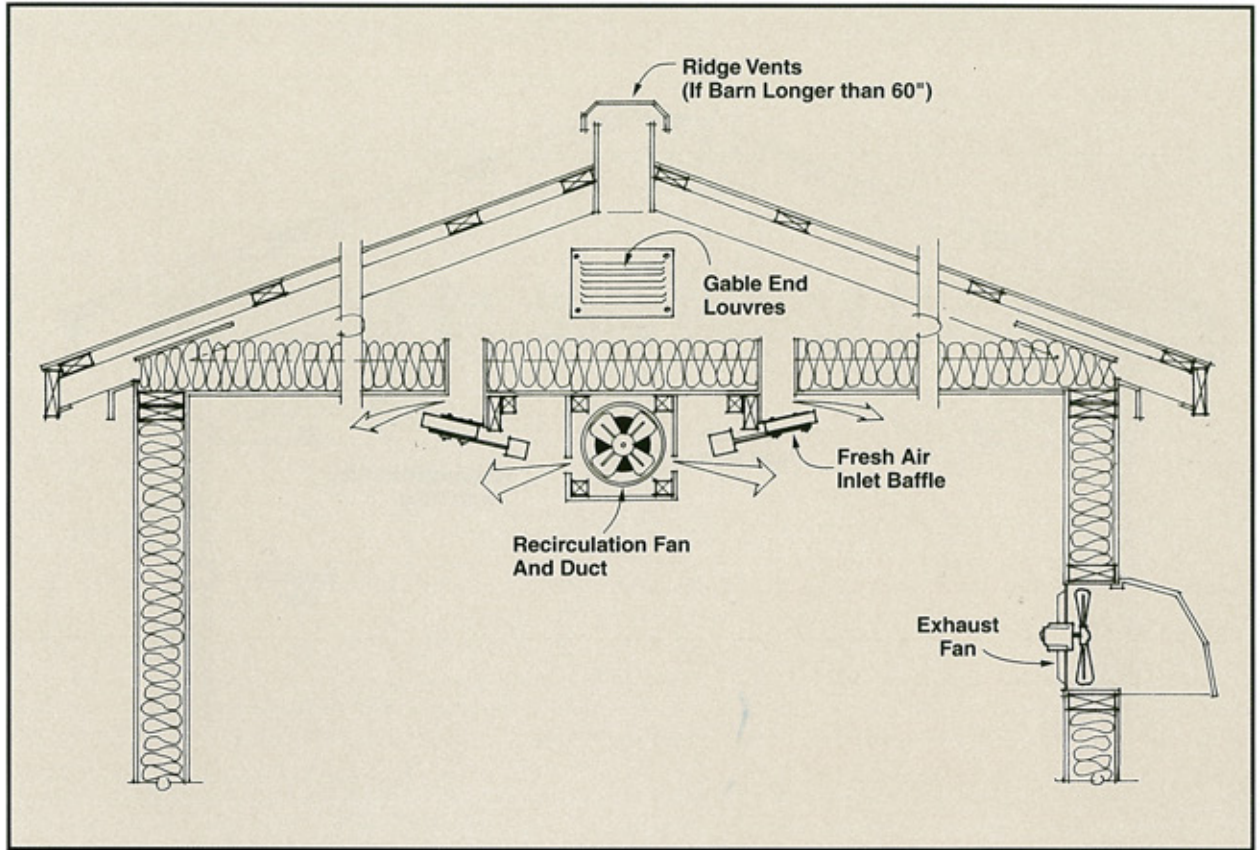


Figure 26. *Negative pressure ventilation system centre air inlets and recirculation ducts*

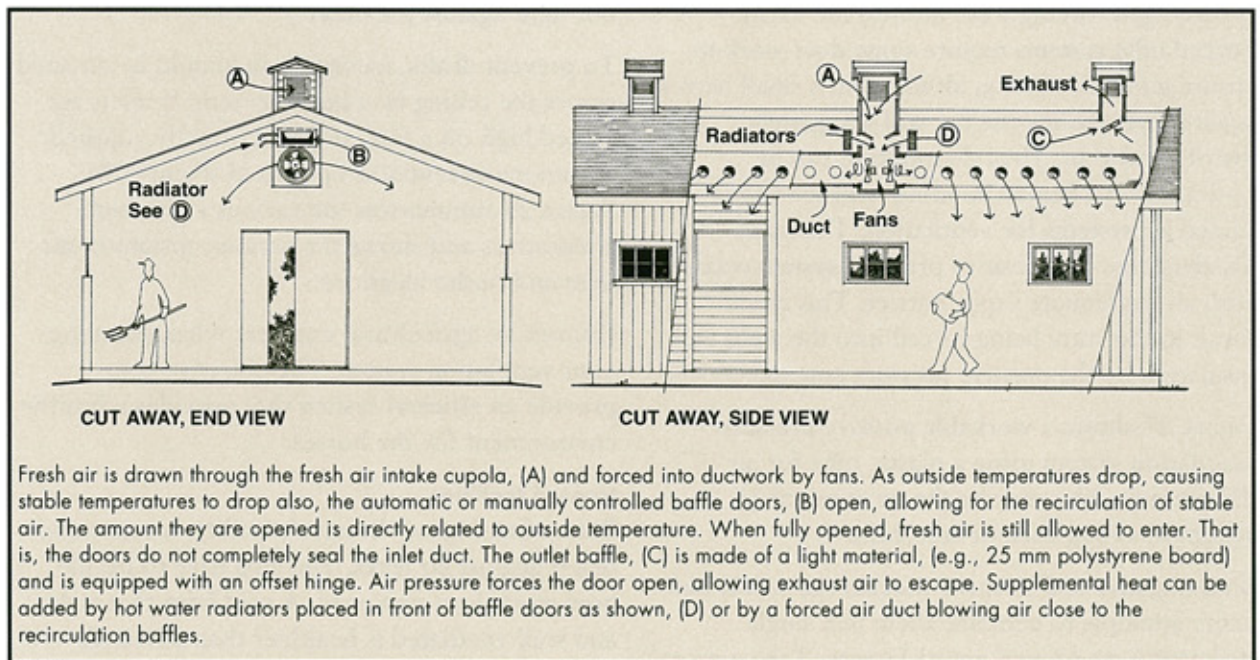


Figure 27. *Positive pressure ventilation system*

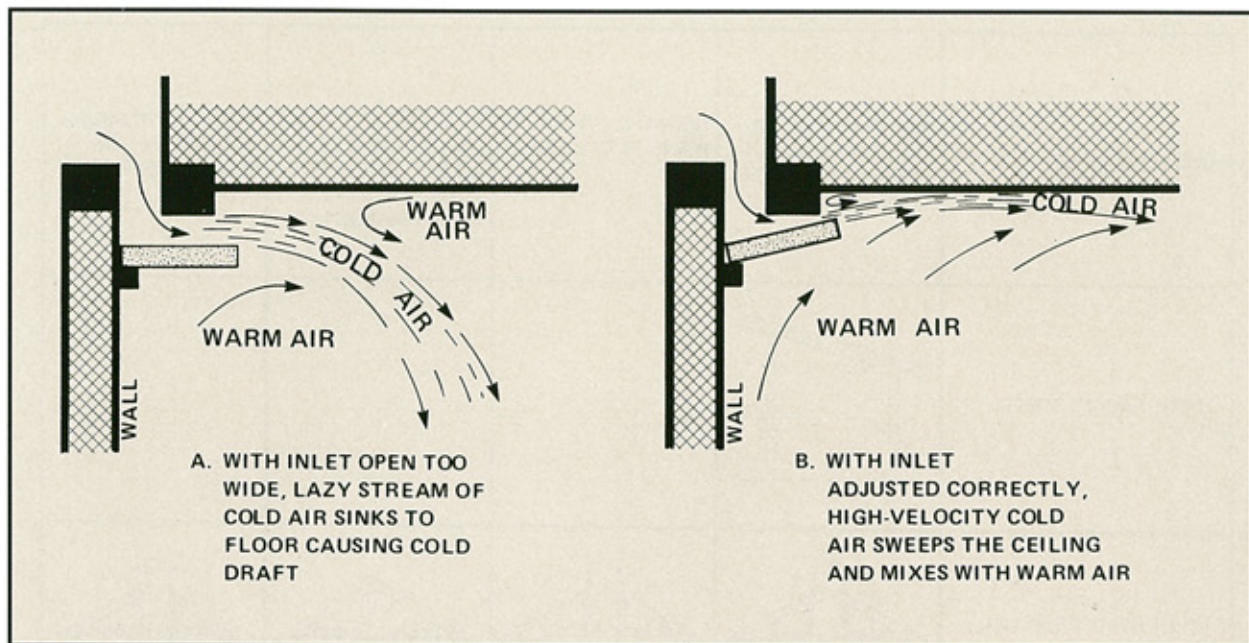


Figure 28. How the size of an inlet slot affects the jet of cold air

the higher the cost of running the facility. Sale, training and show barns are often heated to discourage winter coat growth or to encourage shedding of hair. The operator's comfort is often the deciding factor in determining stable temperatures. Keeping the temperature above freezing gives several advantages. It simplifies watering systems and allows intensive training since horses will have a short hair coat, and a reduced likelihood of overheating.

Heating rates in Table 5 were taken from a barn that housed horses in box stalls. The building was

of average construction with R20 insulation in the roof and R18 in the walls. Allowance was made for 5 square feet of window per horse. Treat these figures as a general guideline but actual heat requirements will vary depending on the type and construction of the facility.

Several common types of heating systems can be used for heating horse facilities: hot water boilers, forced air furnaces, gas-fired space heaters, electric radiant heaters, and gas-fired radiant heaters.

Table 5. Ventilation and supplemental heating requirements for horses

Temperature °C	Inside Barn Design Conditions		Supplemental Heat Required (BTU/hr per 1000 lb. horse) Outside Design Temperature °C					
	Relative Humidity %	Ventilation Rate cfm/1000 lb. horse	-35	-30	-25	-20	-15	-10
2	90	40	1900	1500	1000	560	0	0
4	80	35	2200	1700	1300	850	440	0
7	75	30	2300	1900	1500	1100	720	340
10	70	25	2800	2300	1800	1400	1000	680

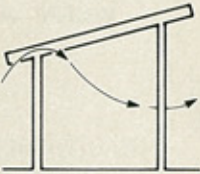
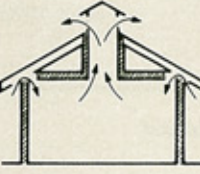
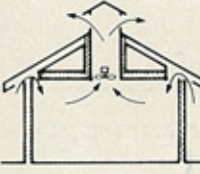
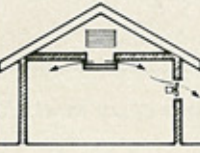
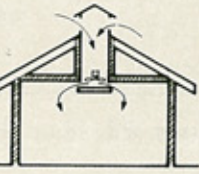
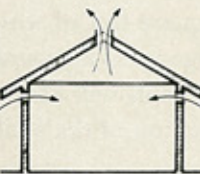
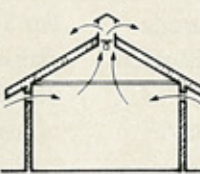
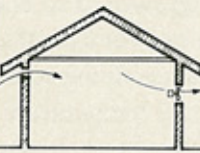
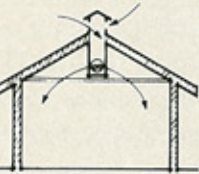
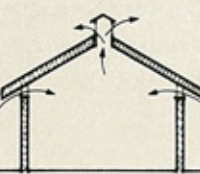
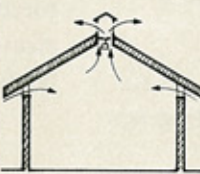
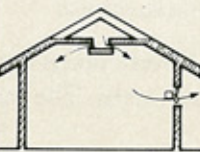
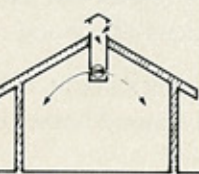
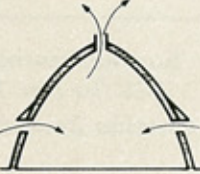
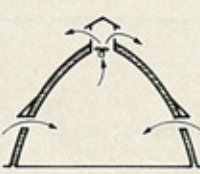
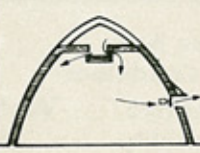
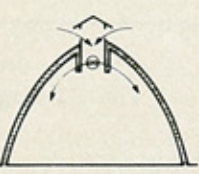
BUILDING TYPE	NATURAL-VENTILATION (CONTINUOUS RIDGE OPENING OR CUPOLAS)	NEGATIVE-PRESSURE (FANS IN CEILING)	NEGATIVE-PRESSURE (FANS IN WALLS) DO NOT INTERFERE WITH STALL ARRANGEMENT)	POSITIVE-PRESSURE (EITHER TUBE OR SQUARE BAFFLE)
OPEN-FRONT SHED				
INSULATED STUD-WALL OR POLE FRAME (FLAT CEILING)				
INSULATED STUD-WALL OR POLE FRAME (SLOPED CEILING)				
INSULATED RIGID FRAME				
INSULATED WOODEN ARCH-RIB				

Figure 29. *Ventilation alternatives*

Hot water heating

Hot water heating is very efficient and also clean and dry. Pipes for hot water heating require less space than forced air ductwork and little maintenance. This type of heating does not interfere with a ventilation system because there is no forced air movement and no drafts. In a pressure ventilation system, careful placement of radiators reduces piping. You can ensure even heat distribution if an element is placed where recirculation air enters the system. The main disadvantage to hot water heating is the initial high cost.

Forced air heating

A forced air furnace heating system has a lower cost initially. The least expensive installation uses an ordinary household furnace with normal aluminium heat exchangers. The furnace, like the hot water boiler, has to be placed in a separate room to prevent back-drafting of the flue gases. The main disadvantage of a normal installation of a furnace is that it circulates the air from the interior of the barn the same way it does in a house. However, barn air carries a lot of dust and moisture, so you need a large filter to avoid problems. This filter must be cleaned daily to allow for proper operation. If you remove the filter, rapid corrosion of the heat exchanger may occur, and the build-up of dust will create a potential fire hazard in the furnace.

An alternative method of installing a furnace is to only have a fresh air inlet into the furnace room for both combustion air and cold air return. This requires a heat register to dump heat back into the furnace room and no cold air returns from the barn. In this way, all of the air blown into the barn is tempered fresh air.

An alternative forced air heating unit with a stainless steel heat exchanger is a more expensive make-up air unit than a household furnace. This type of unit can heat outside cold winter air to about 20°C (68°F) which would be adequate to provide fresh air and enough heat to keep the barn above freezing. If you equip these furnaces with modulating flame control and a continuously

running fan, they will help provide a pressurized ventilation-heating system.

If a forced air heating system is used in conjunction with a recirculation duct of a negative pressure ventilation system or a positive pressure tube system, no additional heat ducting is required. The heat from the furnace is simply dumped into the barn near the recirculation fans and the heat is distributed through the barn with the recirculated air.

Space heaters

Another recent type of heating system being used in livestock barns is the gas-fired, hanging, flue-less space heaters. They are low cost and easy to install. The heat from these units is directed at the recirculation fans of the ventilation system.

Electric radiant heating

Electric radiant heaters are expensive to operate but are well-suited to areas, such as foaling stalls, that require localised heat. Figure 30 shows an example of a 1,750 Watt infrared heating unit. Table 6 gives approximate sizes of heated areas for various suspension heights. Take care to ensure that the horses cannot come in contact with the unit. You must maintain a minimum distance of 2 feet between the heater and any combustible material it may radiate onto.

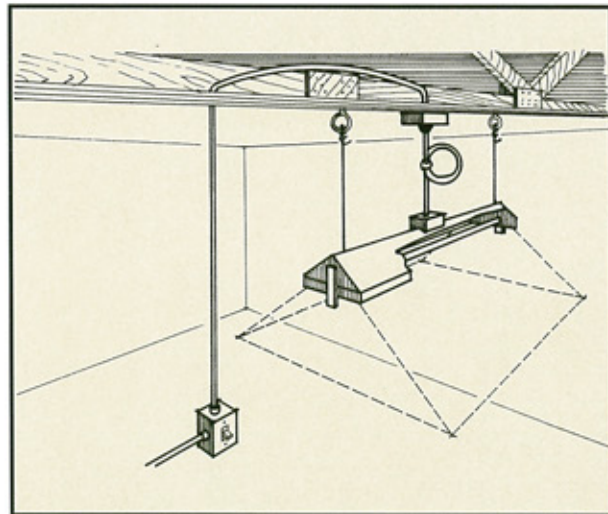


Figure 30. *Infrared heat unit installation*

Table 6. Influence of a 1750 watt infrared heater

Mounting Height	Area	Temperature Rise	
		°C	°F
2.1 m (7 ft)	2.4 x 3.3 m (8 x 11 ft)	8	(46)
1.8 m (6 ft)	2.1 x 3.0 m (7 x 10 ft)	14	(57)
1.5 m (5 ft)	1.8 x 2.4 m (6 x 8 ft)	19	(66)
1.2 m (4 ft)	1.5 x 2.1 m (5 x 7 ft)	28	(82)
0.9 m (3 ft)	1.2 x 1.8 m (4 x 6 ft)	44	(110)

Natural gas-fired infrared radiant heating

Infrared radiant heaters that burn natural gas or propane consist of a long radiant tube that can be placed over the centre of alleys using minimal head space. However, sufficient ceiling height must be available for safe operation. These heaters are simple to install and relatively inexpensive. They add heat to the barn by heating a solid surface that then re-radiates the heat into the air. A properly installed ventilation system is still required to circulate fresh air and this heat in order to pick up and exhaust the moisture and gases from the barn.

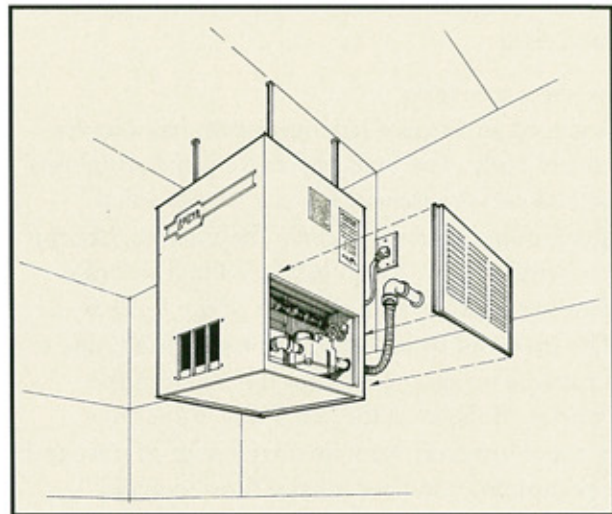


Figure 31. Unvented gas (or propane) fired space heater

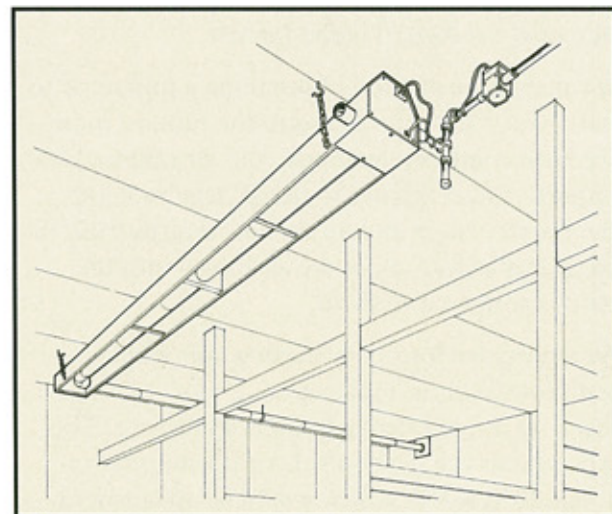


Figure 32. Gas-fired infrared radiant tube heater

Manure Handling

A mature horse will produce up to 10 tons of manure per year. The collection and disposal of this manure is a major problem for horse owners.

Save labor by making the alleys, doors, and gates wide enough for a truck or manure spreader to pass through. Manure can then be loaded directly onto the vehicle.

Storage areas must be situated where they will not contaminate water supplies – surface or ground water must both be considered. In rural areas, given a sufficient land base, spread manure on the land not being used as pasture.

Composting, using nitrogen pellets, may be necessary in crowded areas where odors from spreading manure may be objectionable. You can speed the breakdown process by supplying nitrogen as 46-0-0 or 34-0-0 fertilizer. When manure is piled it breaks down, reducing the odor. Less odor from the manure makes it more acceptable to the public when you spread it on the land.

Fresh manure and bedding require 2 cubic feet of storage space per animal per day. Composting will reduce this space by about half. Spreading composted manure is the most satisfactory solution. Horse manure has value both for its nutrients and its organic matter. Table 7 shows the chemical composition of horse manure.

Unless composted, horse manure should not be spread on horse pastures because it can contain large concentrations of internal parasite eggs. If heat during the composting process does not kill the eggs, parasitism problems can occur in horses pastured where you spread manure.

Always check local regulations before proceeding with any method.

Table 7. Composition (on a wet-weight basis) of fresh manure

Components of Manure	Proportions		Nitrogen (as N)		Phosphorous (as P ₂ O ₅)		Potassium (as K ₂ O)	
	%	lb/t of manure	%	lb	%	lb	%	lb
Horse Feces	60	1,200	.055	6.6	0.30	3.6	0.40	4.8
Urine	15	300	1.35	4.1	trace		1.25	3.8
Bedding (straw)	25	500	0.50	2.5	0.20	1.0	1.00	5.0
Total mixture 1 ton			0.66	13.2	0.23	4.6	0.68	13.6

Feed Storage and Handling

You can most efficiently store hay in a shed built specifically for this purpose. While hay traditionally has been stored in the stable loft, there are several reasons for not doing so. It is usually cheaper to build a hay shed (Figure 33) than to build a two-storey building and strengthen it to support a loft full of hay. Hay can be machine stacked or unloaded in a shed, while loft storage uses hand labor. The fire risk is lower when you do not store feed in the stable. Air circulation in a shed helps prevent heating and the danger of spontaneous combustion. With the increasing cost of construction and labor, hay lofts are becoming less common.

Store grain away from moisture in rodent-proof bins if possible, either outside the stable (Figure 35) or in grain storage bins incorporated into the barn. Figure 36 illustrates a hand dip storage bin that will hold a ton of grain. Commercially built metal hopper bottom bins are available in a wide range of sizes. They are both rodent proof and maintenance free. While initially more expensive than wooden bins, over their lifespan these bins are usually the most economical.

One tonne of hay takes 250 cubic feet of space and a ton of grain requires approximately 35 cubic feet. Plan storage facilities accordingly.

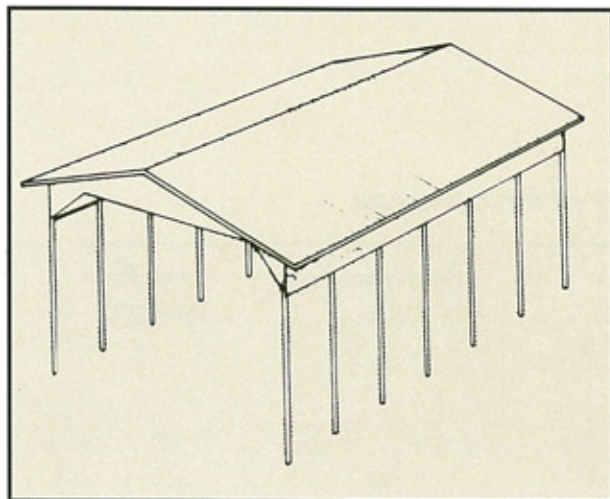


Figure 33. Hay storage CPS plan 7601



Figure 34. Pole hay shed with full walls of metal sheeting

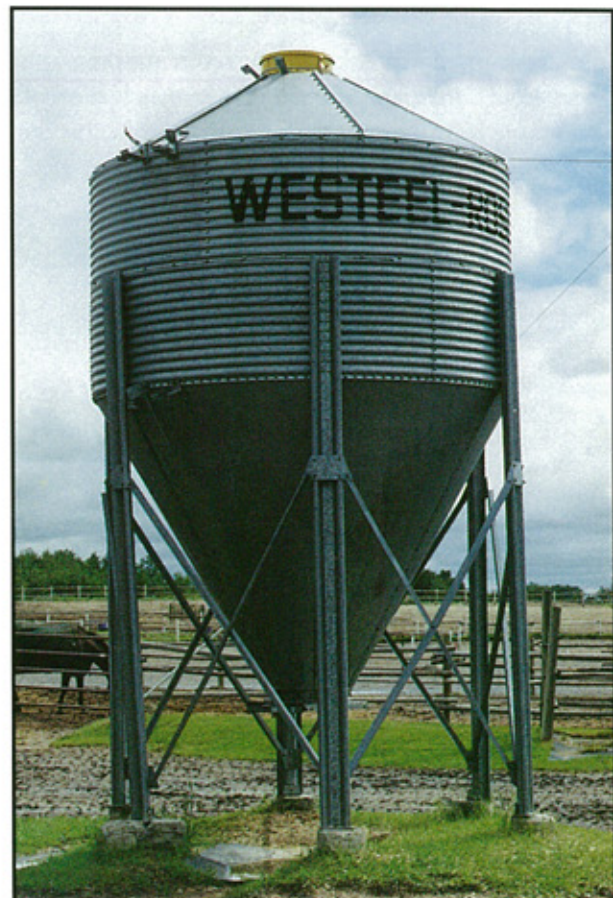


Figure 35. Commercial hopper bottom feed bin

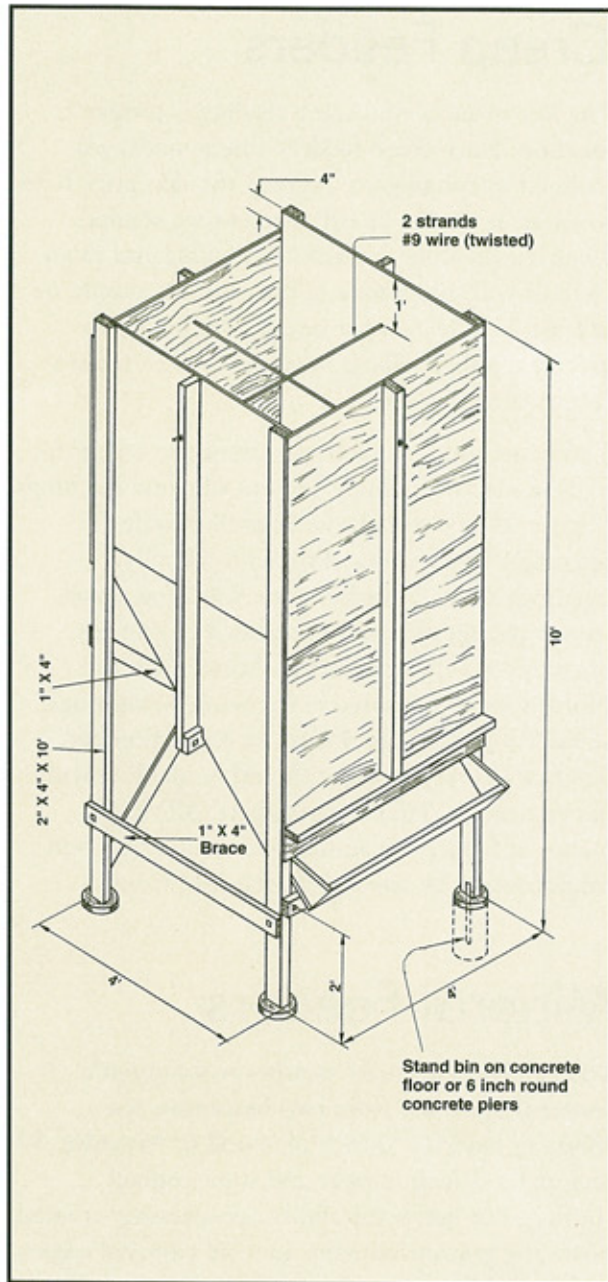


Figure 36. Hand dip bin

Hay Feeders

Pasture mangers should be sturdy and portable. Some types are available commercially, but most are built on the site. One of the most important dimensions to remember is to make the side wall of any hay feeder for horses 24 to 26 inches high.

If the side walls are lower, horses will flip valuable hay onto the ground and waste it, or walk into the feeder.

A practical hay feeder 4 feet x 6 feet x 2 feet high can be built from 3/4 inch plywood and 2 x 4 framing. To prevent horses from chewing the wood, line the edges of the manger with drywall corners. An alternative is to use angle iron framing, which also protects the edges of the plywood.

You can build another type with two 4 x 4 inch skids running the length of the manger, a 1-inch lumber floor and laminated 2 x 4 inch walls. Again, the feeder should be 4 feet wide and 2 feet deep. Lining the manger with tin will prevent horses from chewing and damaging it.

You can make a very practical, long-lasting manger from a used tractor tire. Cut the sidewall out of one side and bolt plywood to the other. This type of manger is inexpensive and inedible, and it reduces the chances of injury. Once built, it requires a minimum of upkeep. Another alternative is to have worn-out tractor tires turned inside out, which provides a safe, high-walled hay feeder. (Figure 37)

Commercial racks are available with pans in the bottom (Figure 38). Wooden edges are protected by pipe to prevent chewing. They withstand a lot of abuse and can be used in crowded conditions. The elevated head position required by this type of feeder may result in dust and hay particles falling into a horse's nose and eyes.

Fence line bunks (Figure 40) offer an efficient method of feeding large numbers of loose horses. You can reduce your labor by feeding from permanent stacks along bunks, or feeding with side-chute equipped vehicles. You can also feed pellets or grain in these bunks. Allow at least 5 feet of bunkspace for each mature horse and 3 feet for each young horse. Horses rubbing mane hair out on a rail placed too low above the bunk is one problem associated with bunk feeders.



Figure 37. *A tractor tire hay feeder*



Figure 38. *Commercial feeder with bottom pans*



Figure 39. *Farm built feeder with bottom pans*

Creep Feeders

The key to successful creep feeding is proper location. Place creep feeders where mares are inclined to congregate. A creep should entice foals to enter. It should be dry when rainy, shaded when the weather is warm, and be big and open so foals will spend time in the creep. It should be at least 10 x 16 feet for one or two foals. For greater numbers, allow an additional 25 square feet of creep per foal.

Three methods can restrict entrance to creeps to foals: a narrow opening (Figure 41), low openings (Figure 42), or troughs with small muzzle openings (Figures 43a, 43b, 43c). Usually, openings 20 to 24 inches wide will keep mares from entering the creep. To restrict by height, openings should be 6 inches shorter than the shortest mare measured at the withers, although some will learn to go under the restriction bar. Restrictive creep troughs should be shallow with bars spaced 3 ½ to 4 inches apart. Allow 18 inches of feeder per animal and ensure that rain cannot fall or be blown into the feed trough.

Mineral Feeders

You can build a sturdy weatherproof mineral feeder (Figure 44) from two fenceposts, two sheets of exterior ½ inch plywood or Aspenite, 32 feet of 1 x 1 inch lumber and some asphalt roofing. For better durability, use pressure-treated posts and galvanized nails. Line all exposed edges with metal to prevent horses from chewing the wood.

Do not paint the plywood and framing. A good, penetrating wood stain may look better over time and requires less maintenance. Put the feeder in the pasture where horses spend time. The opening of the feeder should face away from the direction of most rainstorms.

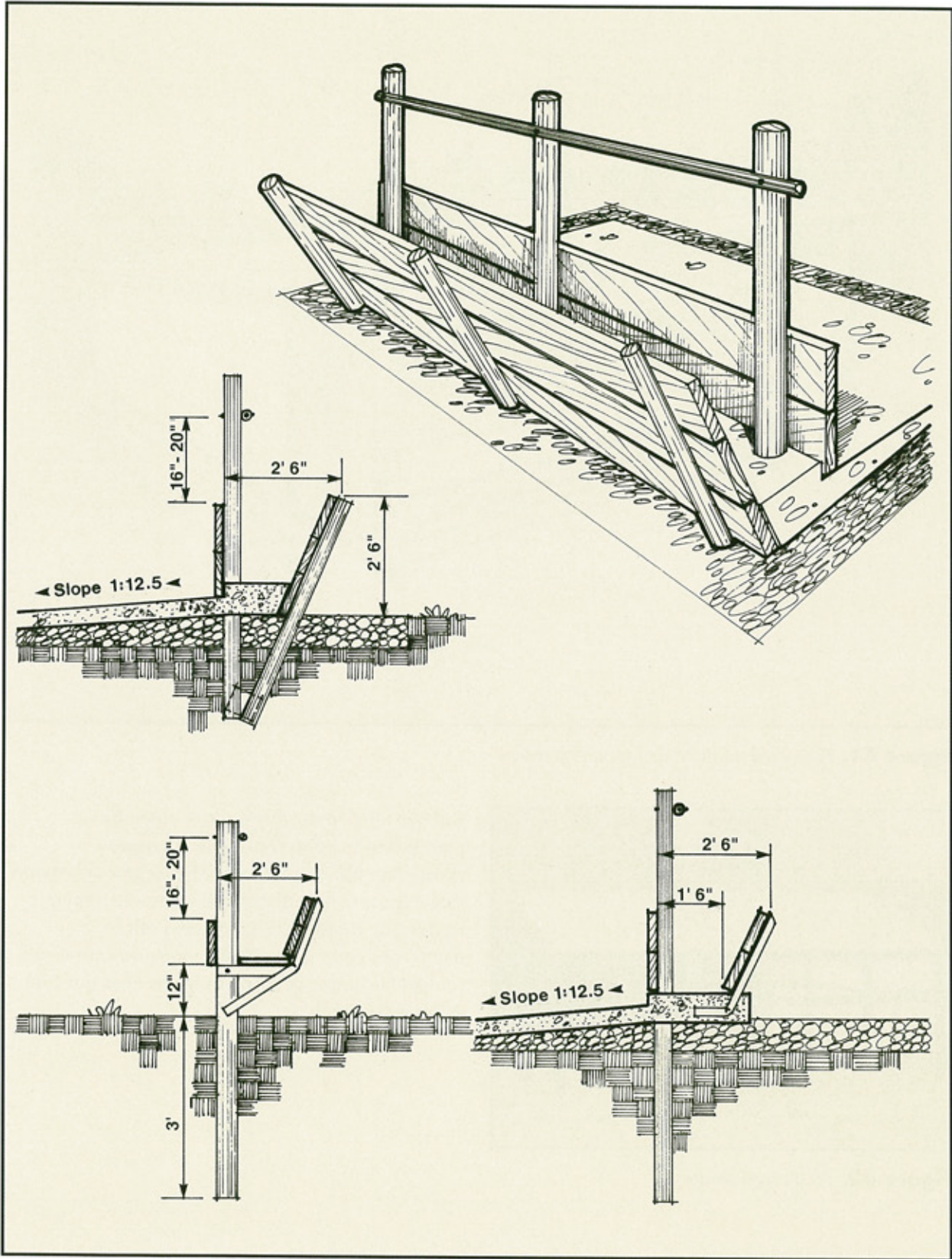


Figure 40. Fence line bunks

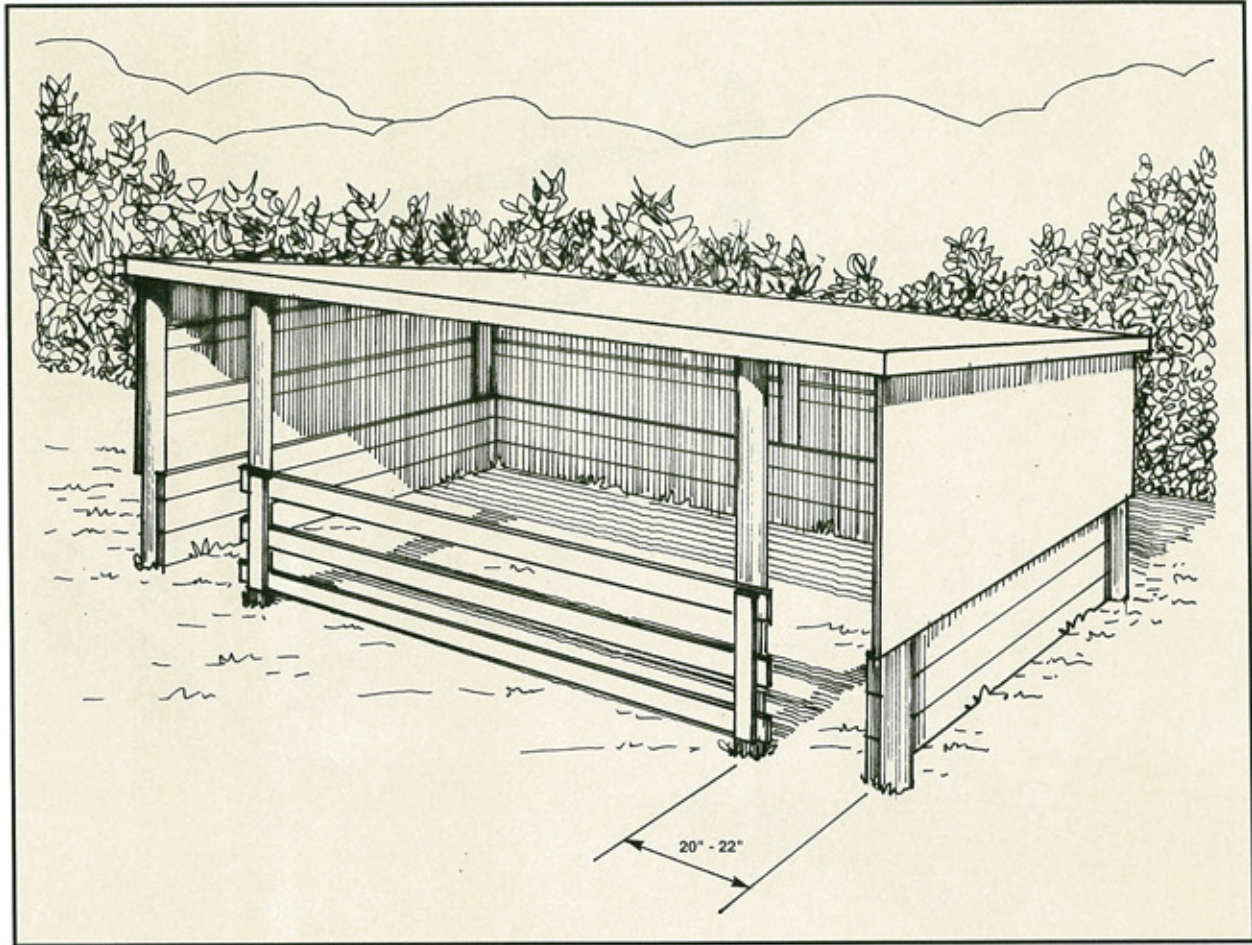


Figure 41. Pole shed adapted as foal creep feeder



Figure 42. Foal creep feeder

Rubber tubs or sturdily built wooden boxes placed on the ground provide adequate short-term mineral feeders. The biggest concern is that exposure to moisture causes many minerals to degrade rapidly. You may feed salt in uncovered containers. While moisture causes salt to dissolve and may speed usage, it does not lose its mineral value.

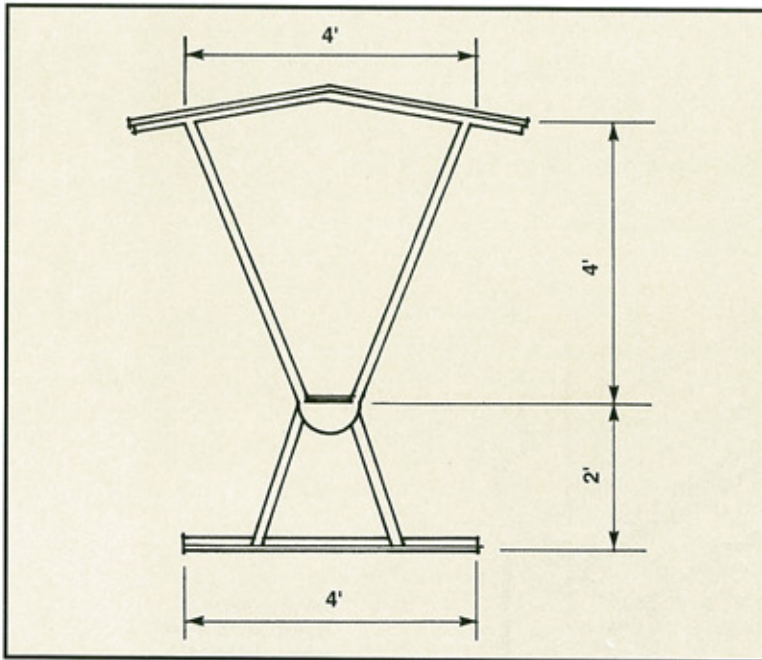


Figure 43a. Free standing creep feeder for foals

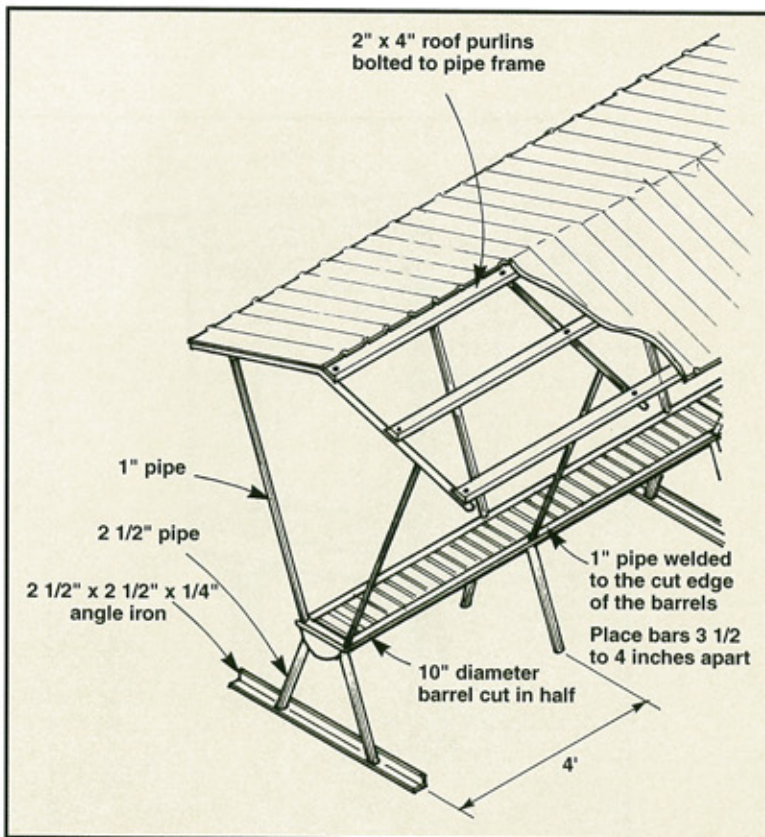


Figure 43b. Another view of the free standing creep feeder for foals

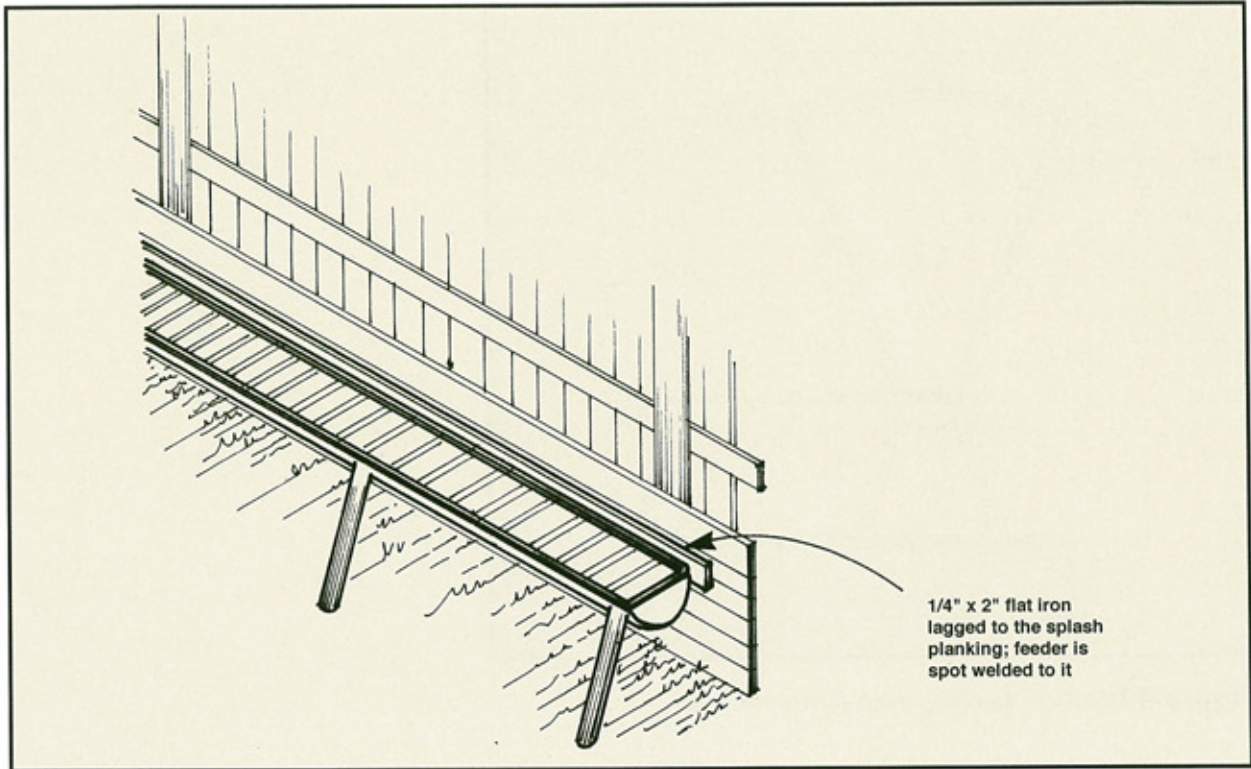


Figure 43c. Foal creep feeder for shed wall

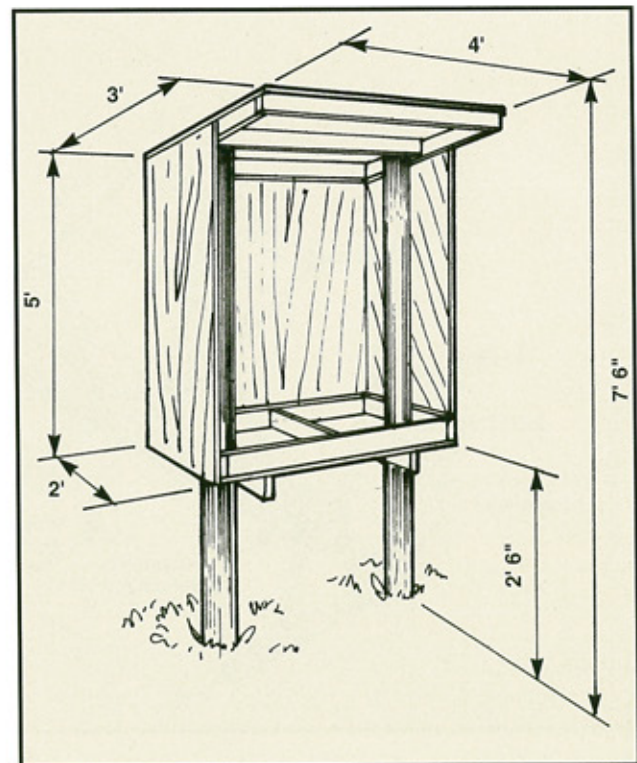


Figure 44. Mineral feeder for horses

Fencing

Use adequate construction techniques and materials to ensure your fences are effective. As the property owner, you may be liable for any damage to crops or accidents that your horses might cause if they escape. As the saying goes, “Good fences make good neighbors”.

Chain link fences

Chain link fencing is highly effective and long lasting and requires little maintenance if properly built. However, it is also very expensive. If a horse runs into a chain link fence, kicks or leans heavily against it, the fence may be permanently stretched.

Board fences

Board fences are strong and highly visible. If they are kept painted and in good repair, they can add to the appearance and value of your property. Board fences require a lot of maintenance. Horses may lean over them and loosen boards and posts. Setting the posts in concrete will help keep fences tight. Use larger posts in high-density, high-use areas such as corrals. Staining may be a longer lasting alternative to painting. Do not use lead-based paints on livestock facilities – they are poisonous. Some horses will chew lumber, especially if they are confined in small areas. Some paints contain a chewing preventative that may help eliminate this problem. Using creosote-treated lumber also reduces chewing.

You can make a sturdy fence with 2 inch planks with posts set at 8 foot intervals. Stagger the planks so that only some of the planks end on each post. You may have to drill the planks to prevent them from splitting when nailed. For a rail or plank fence, you need to space the posts carefully. This is not as critical for wire fences.

Pipe fences

Pipe fences with metal posts are expensive initially, but their endurance potential pays off over time. Pipe makes a strong, safe and attractive fence. If the posts are set in concrete, a pipe fence

will be there for life. No maintenance other than an occasional coat of paint is needed.

Wire mesh fences

Wire mesh fences are less expensive to construct than board fences. If a horse runs into or leans against a wire mesh fence, you may need to restretch the mesh. You may need to put boards or pipe on the top and bottom of the fence to keep horses from stretching and pushing it down. This will add substantially to the cost of the fence but will reduce maintenance. A well-tightened and stapled strand of barbed wire run along the top of the fence can be used to keep horses from leaning too heavily on the wire mesh.

Diamond mesh fences

Diamond mesh is more expensive than standard mesh. It has many more stay wires which are heavier than standard mesh. It is also resistant to curling and less stretchable than standard mesh. Horses cannot walk it down or put their feet through it. Usually, you do not need a top board or barbed wire for this type of fencing. This type of fence is aesthetically pleasing and requires little maintenance when properly installed.

Rubber rail fences

Rubber rail fences with wooden or metal posts are durable and easy to maintain. The rubber strapping is expensive but long lasting. It is strong and safe for horses. Some types have all their edges sealed and others do not. Seal raw edges with a rubber compound, or singe them to burn off the loose threads. If the edges are left raw, horses may pull the threads out and swallow them.

Polymer strand fences

This high strength strand material claims one major advantage over wire fencing – it will not cut. It is more expensive than wire and requires special connectors. It doesn't rust, and will not conduct electricity – an advantage in a lightning storm. To be effective it must be tightly stretched requiring strong end braces. Follow the manufacturer's recommendations when you build

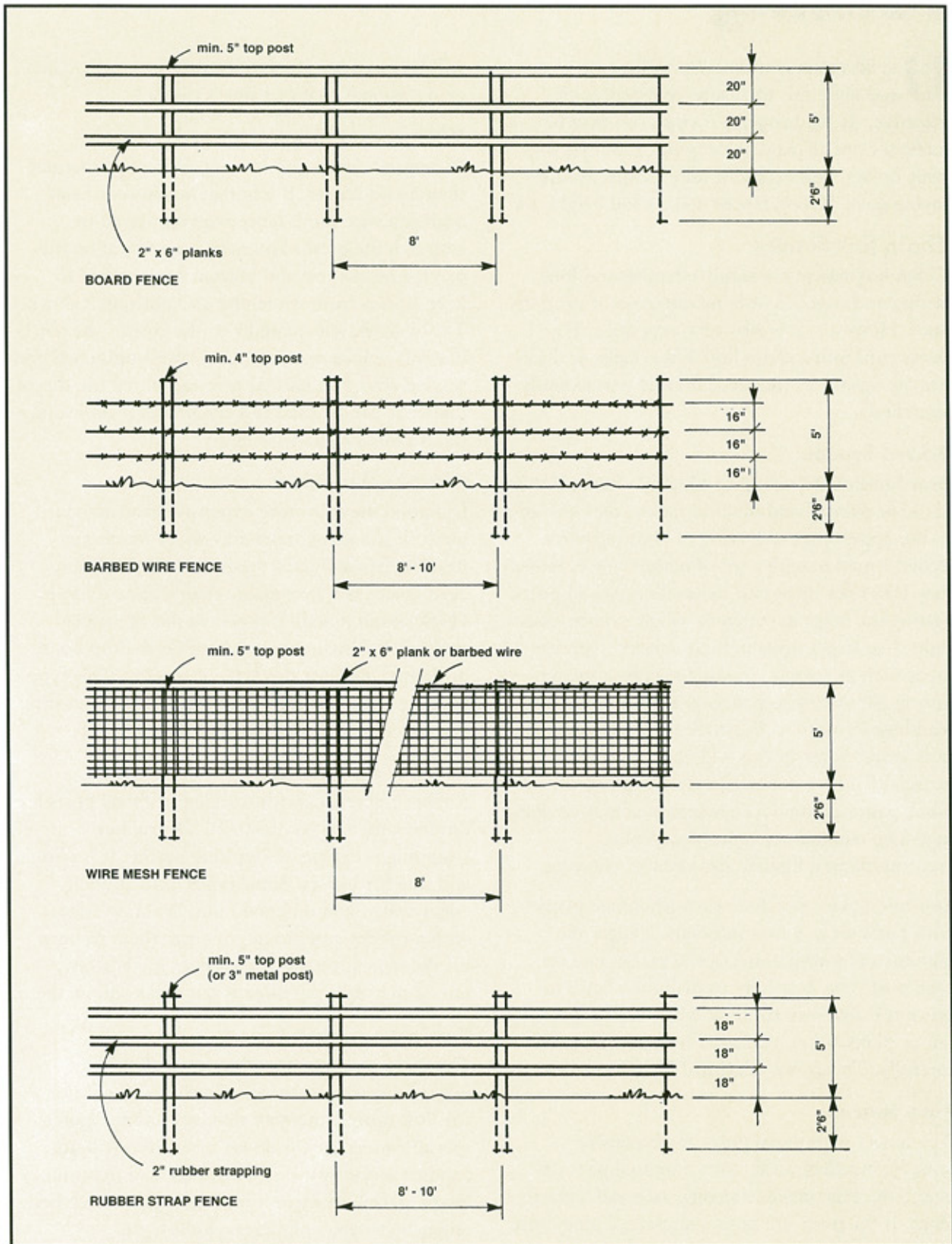


Figure 45. *Fencing alternatives*

a polymer strand fence. Because it is white and thicker than the average fence wire, it is more visible for part of the year. It has not been used in Alberta long enough to make recommendations on its long-term effectiveness.

Plastic and fibreglass planks

Several vinyl and fibreglass plank materials are available on the market. They require less maintenance because you do not need to paint them. These “boards” are stronger than wood planks of similar size and may provide resistance to chewing. The largest drawback is the purchase price. Most of these materials range in price from two to three times the price of wood. Build each specific fence type according to the manufacturer’s recommendations.

Electric fences

Electric fences are inexpensive and effective. Horses are especially sensitive to electricity. They will not touch an electric fence once they are used to it.

One hundred and ten (110) volt household current, solar panels, automotive batteries, or

smaller dry cell batteries can power the new types of electric fences. Better quality fences do not require insulators, but an insulated, weed-free fence will increase the range of the unit.

The key to successful electric fence use is proper grounding of the fence unit. You can usually attribute failure of electric fences to poor grounding. Large units may require up to three copper or galvanized ground rods. Use lightning arrestors to protect your fencing unit.

Alternating ground and “hot” wires assures a good ground if an animal reaches through the fence. Usually the top and bottom wires are “hot”.

Several different plastic-type fence wires or tapes, interwoven with stainless steel fibres, make excellent temporary fences. Once horses are aware that these tapes or wires are “hot,” one wire will contain horses for temporary grazing.

You can use electric fences in conjunction with board fences to prevent horses from chewing or leaning. You can buy special outriggers that carry

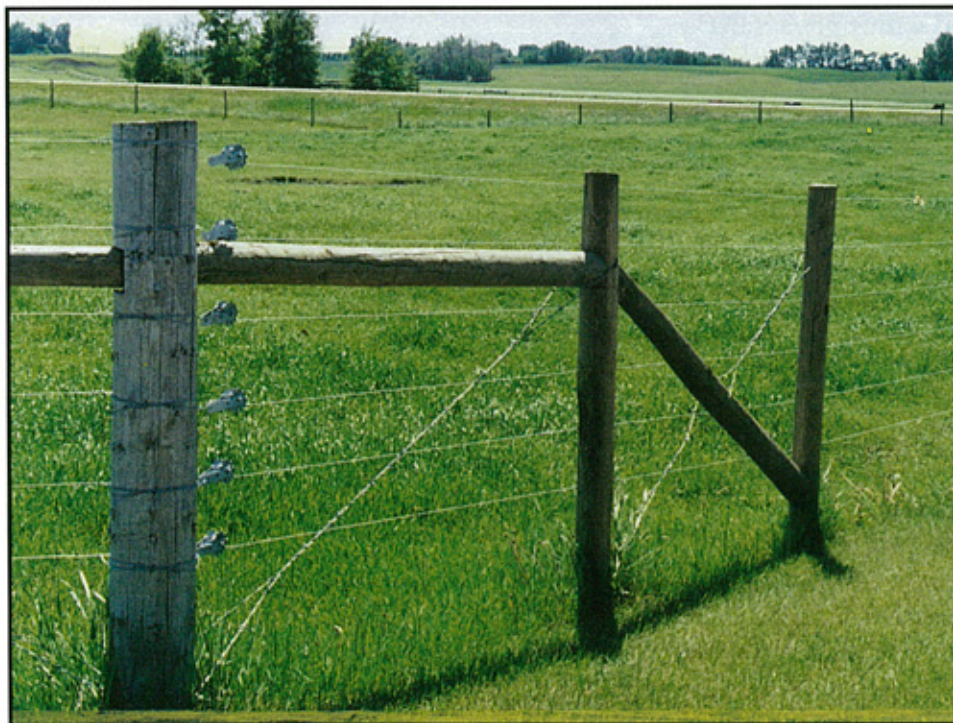


Figure 46. *High tensile wire fence*

the wire about 12 inches inside the fence. One strand is adequate in most situations.

Electric fences are currently the least expensive and most effective pasture fences available.

For more details on electric fencing, see *Fencing with Electricity*. Available from district offices of Alberta Food and Rural Development or the Publications Office, 7000 113 Street, Edmonton, AB, T6H 5T6 or call toll free (in Canada) 1-800 292-5697. Price is \$10 plus GST – add \$2 plus GST per order for shipping and handling.

Smooth wire

Permanent fences built with smooth wire are very safe. Construction techniques are similar to barbed wire fences described later.

High-tensile wire

High-tensile wire, stretched between adequate end braces, requires minimal posts to maintain wire height. While these fences may be adequate without being electrified, using a charging unit will greatly reduce stretching caused by animals leaning over the fence and reduce overall maintenance requirements.

The cost of purchasing and setting posts is the major part of fence construction. Good braces and well-tensioned wires reduce the number of line posts needed. Spacing depends greatly on terrain. Fencing costs are not greatly reduced when line post spacing exceeds 60 feet.

All of the brace and corner construction examples shown in Figure 47 provide adequate strength for high-tensile wire fences. Use 6 inch diameter corner posts and 4 inch diameter brace posts with both being 8 feet long. This allows the posts to be set or driven 4 feet into the ground, leaving 4 feet above the ground. Six-foot line posts are adequate for most situations. Soft, wet ground will require longer posts. On level ground the maximum practical spacing is 60 feet with droppers spaced 10 to 15 feet apart between posts. Droppers should not bend under normal use. Their function is to maintain wire spacing, and they should have a lifespan equal to the life of the rest of the fence. Undulating terrain will require closer post

Table 8. Wire spacings and specifications for common high-tensile fences

	5 Wire	8 Wire
Height of top wire	45"	46"
Wire spacing from ground up	12"	4"
	8"	5"
	8"	5"
	9"	6"
	6"	
	7"	
	8"	
End posts		
Length and diameter		8' x 6"
Driven depth		4'
Brace Posts		
Length and diameter		8' x 4"
Driven depth		4'
Line posts		
Length and diameter		6' x 3"
Driven depth		30"
Post spacings		up to 60 ft
Dropper spacing		
Light grazing pressure		15 ft
Medium to heavy grazing pressure		10 ft
You can obtain information on more detailed construction techniques in Agriculture Canada publication 1848/E <i>Wire Fences for Livestock Management</i> , Agdex no. 724-5.		

spacing. Table 8 shows wire spacing for various styles.

Barbed wire fences

Many horses spend their lives in pastures enclosed with barbed wire fences, although electric fencing is rapidly gaining popularity. The fact that barbed wire is inexpensive and quick to erect will keep it popular, especially if the farm also maintains cattle. A strong, tight barbed wire fence can be safely used on large pastures. To be safe, barbed wire fences must be kept tight. You can reduce

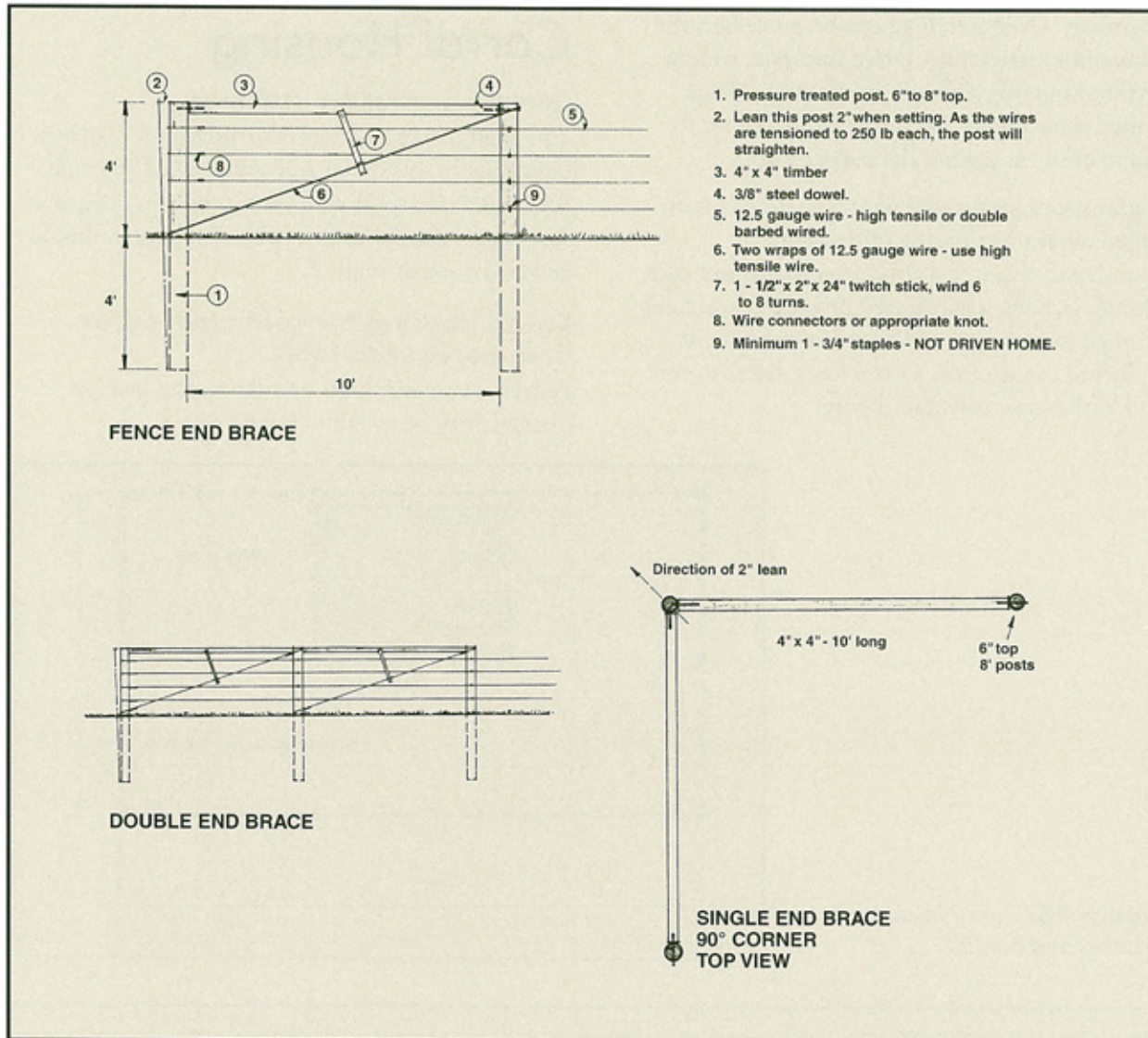


Figure 47. Construction details for fence end brace

routine maintenance with good construction. Do not use this type of fence to enclose stallions, or for corrals.

Starting with a well-built fence can simplify fence maintenance. A well-built fence starts with good brace posts, properly set in the ground. When one post along the length of a fence fails, you can replace it relatively simply. If a corner post fails on a barbed or woven wire fence, you will need to restretch the entire line.

Take special care in the setting and bracing of corner posts. Setting posts in concrete adds to the

stability of the fence but is not necessary. Broken posts set in concrete are difficult to replace. A good job of tamping will be adequate in most situations. Treated wooden posts are initially more expensive than untreated wooden posts but last longer, so long-term costs will be less.

Do not tighten any wire fencing (barbed, smooth, high-tensile or mesh) around a corner sharper than 45 degrees as it tends to pull the corner post into the enclosed area. It is better to tighten to a corner, cut the wire, and start stretching from that point. Woven wire should be rolled out, propped up and stretched evenly, then stapled to

the posts. Overstretching can be more harmful than under stretching. Drive staples in snugly without burying the wire in the post. When completing a fence line leave enough wire to complete a tie around the corner post.

Lightning carried along wire fences has often killed livestock. In areas of frequent thunderstorms, it is a good idea to ground such fences. Driving a galvanized or copper rod deep enough into the ground to reach permanent moisture can do this. Fasten fence wires to this rod with heavy galvanized wire.

Corral Housing

Corral housing for stallions

You need fences of stout construction 8 to 9 feet high (Figure 49) if you run stallions side by side. With only one stallion, a 6-foot fence is adequate. The fences should not be solid – the horse should be able to see through it.

Corral housing for geldings, mares, and mares with foals

Fences 5 to 6 feet high that the horses can see through will be suitable (Figure 48).

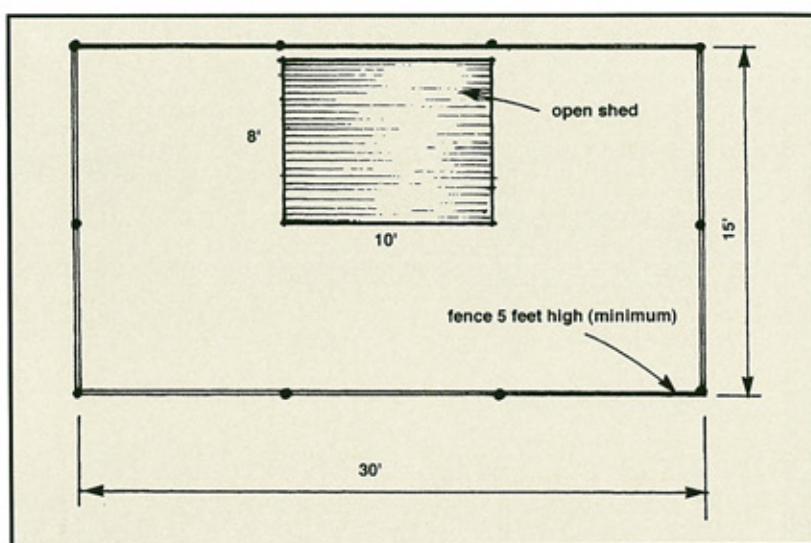


Figure 48. Corral housing for geldings and mares

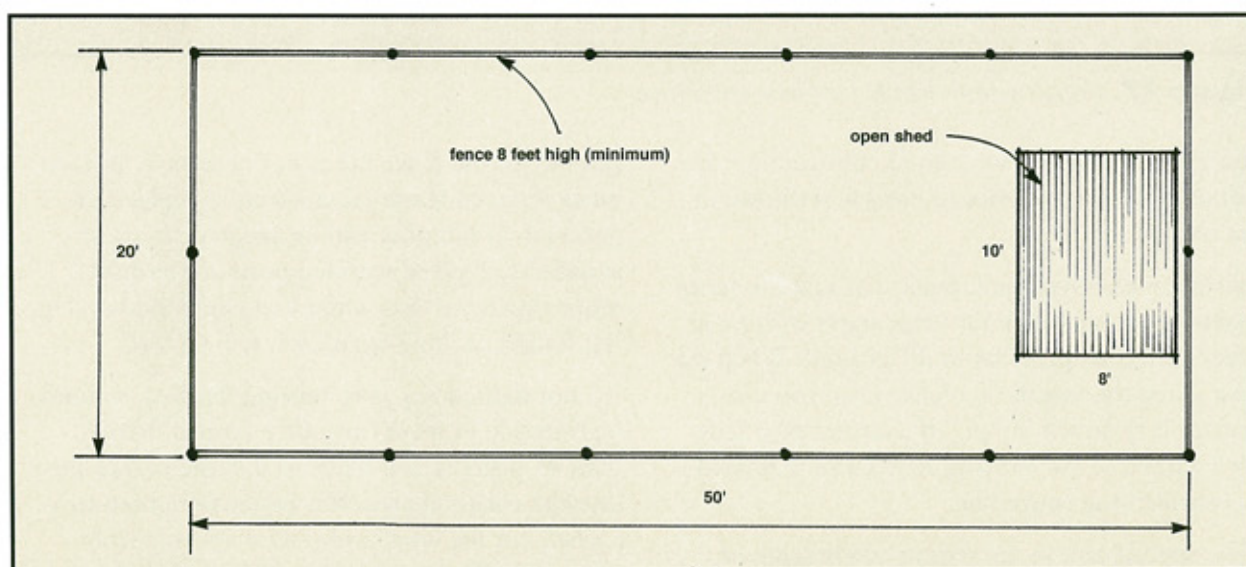


Figure 49. Corral housing for stallions

Horse runs

Horse runs provide a convenient way to house stock. They allow you to accomplish isolation easily if required. On a breeding establishment that has visiting mares, they offer a safe and efficient method of housing, especially if foals are at foot. Build runs on a base of compacted gravel to aid in drainage. In locations with very high rainfall or poor soil, flooring runs with asphalt or concrete may be necessary.

Handling corrals

Corrals used for training horses should have tall, strong fences. A height of about 6 feet will prevent the horse from escaping or being distracted. Heavy 2-inch planks or pipe will give fences adequate strength.

If you are going to use a corral regularly in all types of weather, it requires a good base. A compacted pit run with a sand or clay cover will provide good footing and drainage.

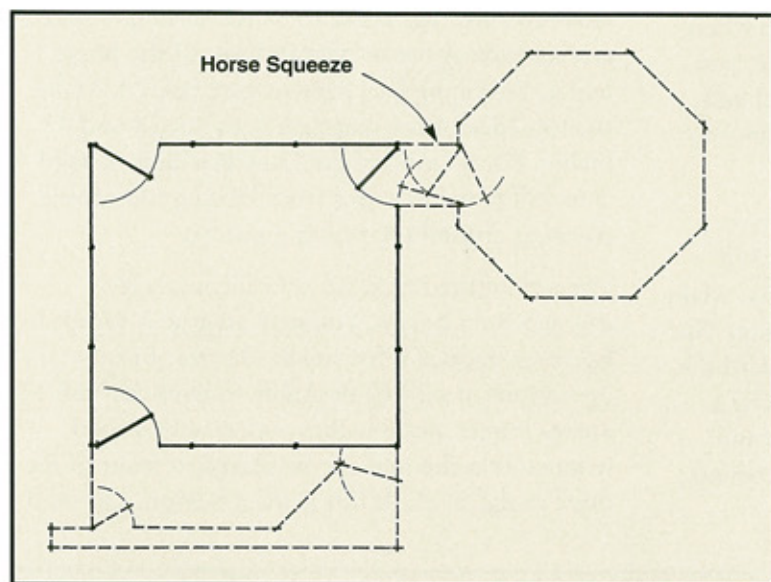


Figure 50. *Handling corrals*

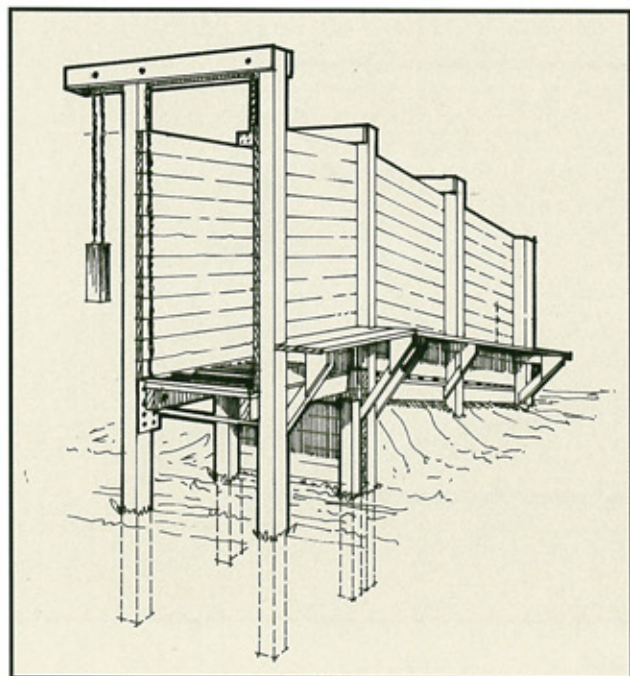


Figure 51. *Adjustable stationary loading chute*

Make water and salt available in the corral. If horses get into the habit of coming to the corral for these necessities, they will be easier to catch.

The solid lines in Figure 50 represent a minimum corral set up for working horses. It is small enough to make it possible to catch difficult horses, yet large enough to allow space for breaking and training. A loading chute set up with a cutout gate is shown in broken lines. When working and handling a large number of horses, a loading chute (Figure 51) may be necessary. When horses are unschooled to the point where ordinary restraining stocks are inadequate, you may need a horse squeeze. A round corral and horse squeeze are also shown in broken lines to make a complete set of working corrals.

Figure 52 shows details of the horse squeeze. Gate 1 and wall A can be the same thing, but figure 52 shows them separately for clarity. Make gates and walls with rails or heavy planking. The flat side of the gate should always go toward the horse. The height of the structure should be a minimum of 6 1/2 feet. Use heavy hinges and hardware throughout. Avoid projecting corners that may injure the horses.

When a horse is loaded into the squeeze, its head must always point toward the hinge end, as shown. Use a chain or rope tie to hold the squeeze shut.

Restraining Stocks

Restraining stocks are recommended for artificial insemination breeding programs or where veterinary services are often required. Size the stock to allow the horse to be led through. There is a restraining bar or gate in front of the horse and a restraining bar, rope or gate behind. Make the top edge of the rear gate between 28 and 32 inches, but no more than 35 inches high. A solid gate will prevent horses from kicking the people working around their hind quarters.

The size of the stock, 32 x 72 inches, is for average sized horses. You may enlarge it for draft horses or reduce it for smaller horses. In some operations, it may be desirable to have the stall 12 inches longer and 6 inches wider, with a solid front so that the foal can be placed in front of the mare in the stock. If this is the situation, use solid

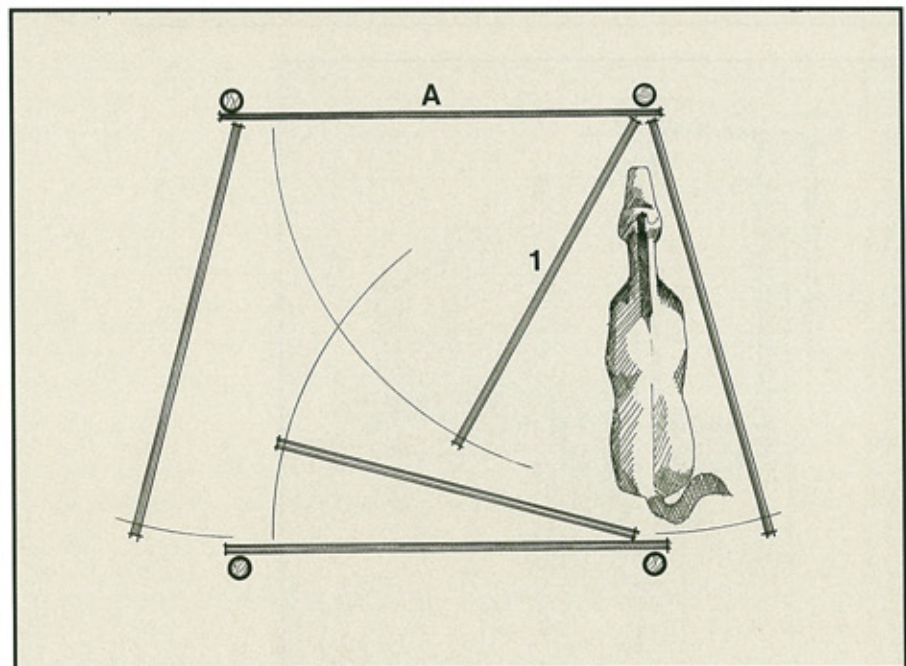


Figure 52. *Horse squeeze*

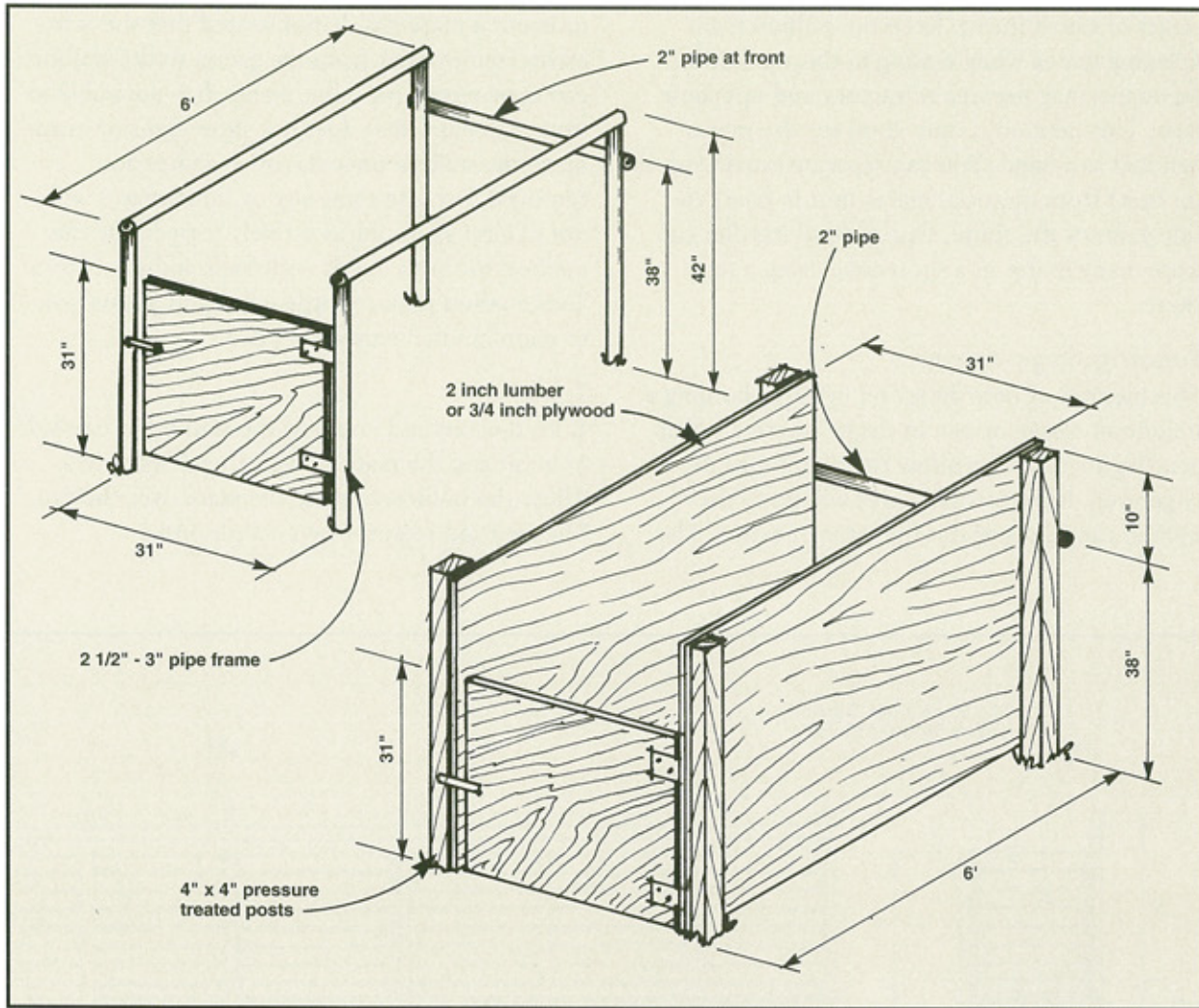


Figure 53. *Restraining stocks*

stock walls. It is advisable to have a small alley in front of the walk-through stocks so foals can move about without leaving the mares' view.

You can build stocks side by side so you can restrain a number of horses at one time for artificial insemination, pregnancy checks, de-worming and so forth.

Make the stocks with pipe or treated 4 x 4 inch posts, 2-inch lumber or 3/4 inch plywood. Secure the posts to the floor to prevent the stock from tipping or shifting. Figure 53 shows the dimensions and some construction details for a pipe frame, open-sided restraining stock, and a wood frame solid-sided stock.

Teasing and Breeding Facilities

Teasing chute

The tease chute in Figure 54 is a wooden alley 28 to 32 inches wide, 5 feet high on one side and 4 feet high on the other. The length of the chute can vary, allowing 16 feet per mare. If the chute accommodates nine mares, for instance, make it 144 feet long. Place a gate at each end with one or two gates in the side. Mares are placed in the chute and tied at 16-foot intervals. A stallion is led to the low side of the chute and allowed to tease each mare individually to determine their

stages of estrus (heat). Keep the stallion from savaging mares when teasing in this method or the mares may become refractory and not show heat. This method is only good for dry mares handled as a band. You can separate estrual mares (in heat) from diestrual mares (not in heat) via side gates of the chute. One stallion handler can tease many mares in a short time using a tease chute.

Teasing cage or pen

This method of heat detection involves holding a stallion in a cage or pen in the centre of a larger pen (Figure 55). You allow the mares into the larger pen. Most estrual mares will go to the stallion cage and exhibit the signs of estrus. The

moment a mare has demonstrated that she is in estrus, remove her from the group so the stallion can concentrate on other mares. It is advisable to lead each mare that does not show signs of estrus up to the stallion once the other mares are removed, because some shy or timid mares will not exhibit signs unless actively teased. Use this method for both mares with foals and dry mares. This method requires little labor and allows you to maintain the mares as a band.

T-bar

With this method you lead the stallion to one side of a rail and the mare to the other (Figure 56). Allow the stallion to tease the mare over the rail. This method requires two people and a

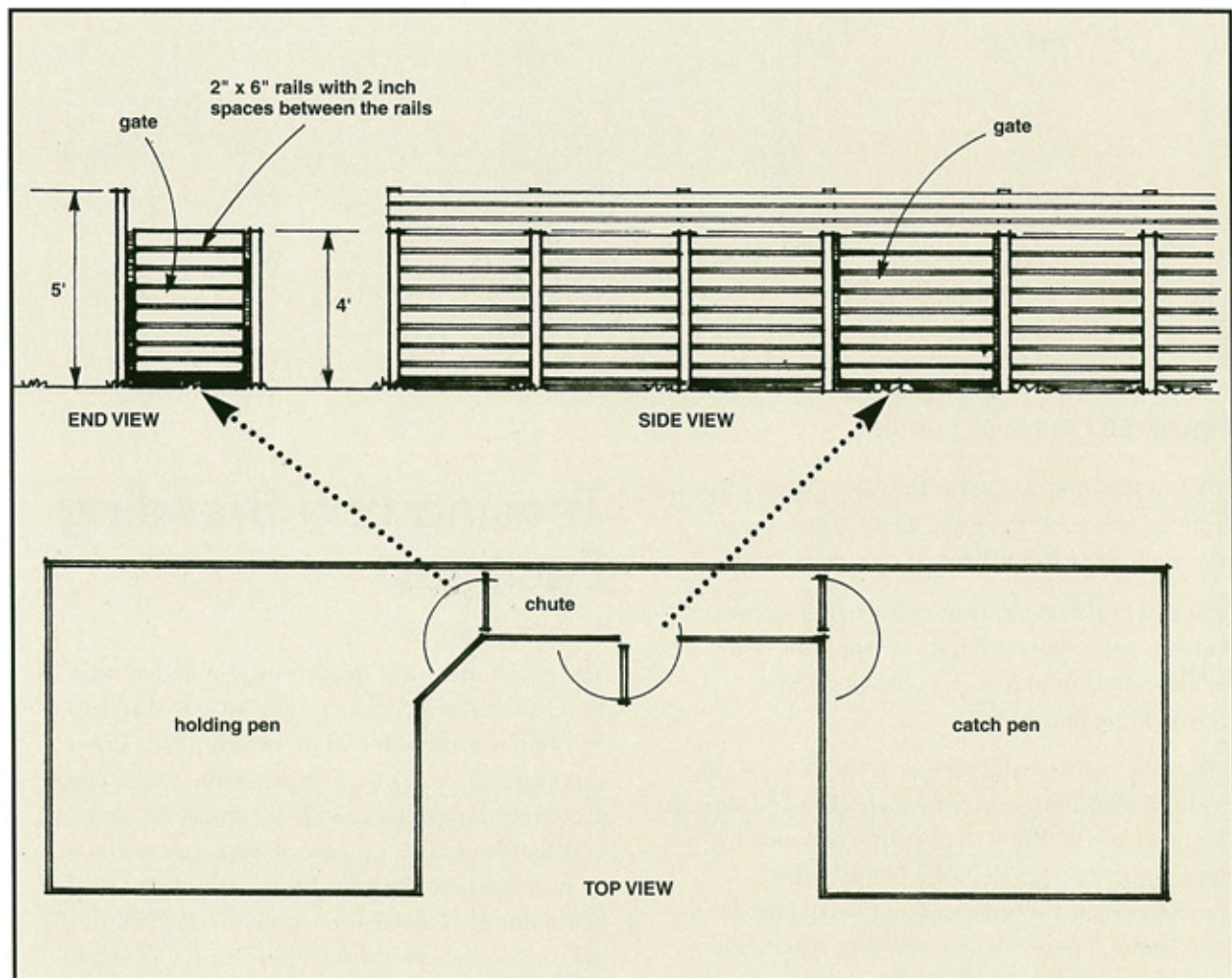


Figure 54. Tease chute

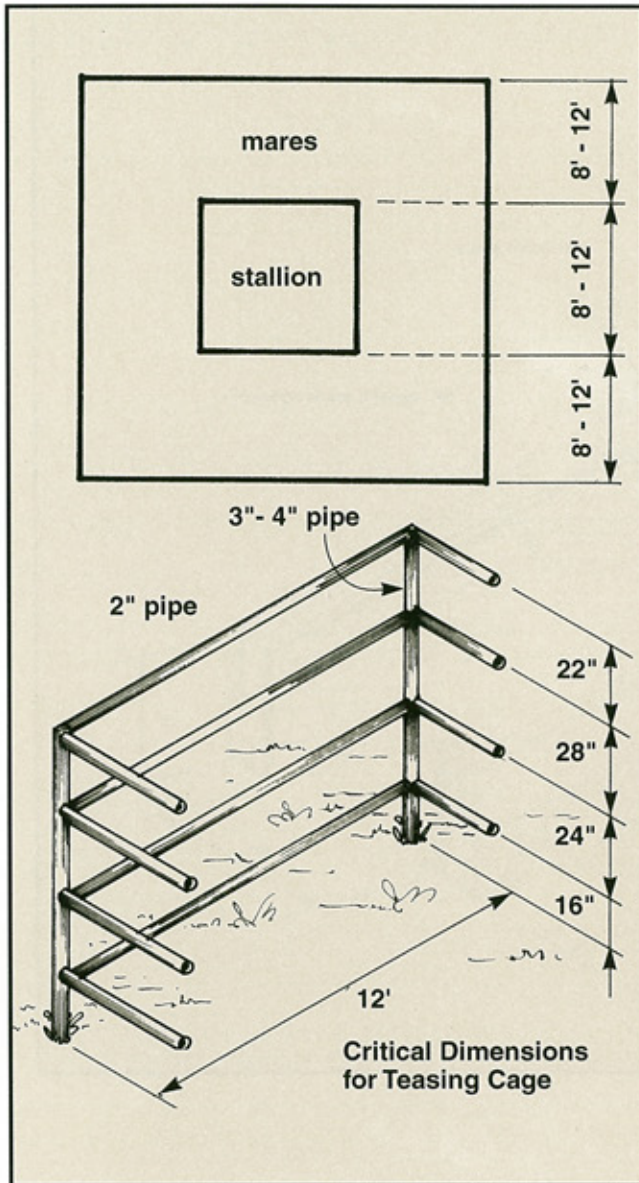


Figure 55. *Teasing cage*

considerable amount of time. It is a very effective means of detecting heat as each mare is individually teased. The method is very safe for the mare, stallion and the handlers, so it is ideal for most small breeders.

The "T" needs to be solidly constructed – strong enough to withstand kicks. Make the top of the "T" 10 to 14 feet long, and the leg 15 to 20 feet long. Make the leg of the "T" solid and 4 feet high. Make the top of the "T" 4 feet high, but it

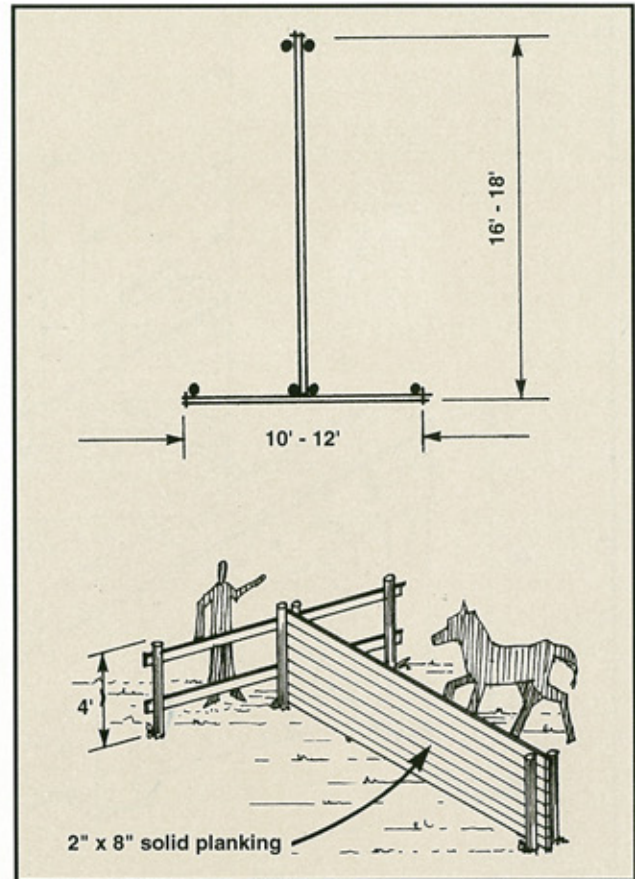


Figure 56. *T-Bar*

does not need to be solid. Figure 56 provides more detail.

Breeding stalls

Breeding stalls (Figure 57) serve to control the mare to a large extent. This allows one person to handle breeding in a safe manner.

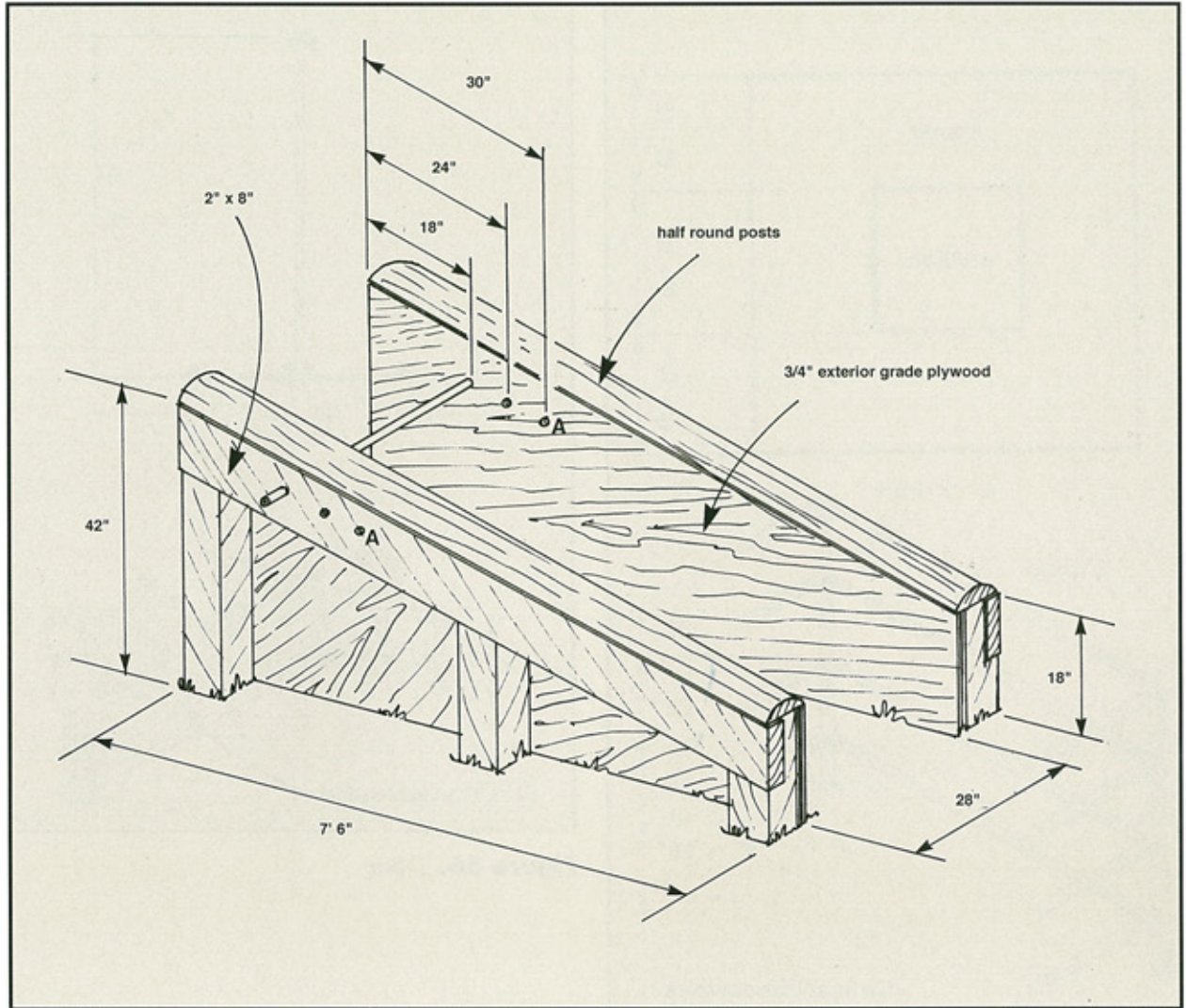


Figure 57. *Breeding stall*

Arena Construction

Outdoor Arenas

Footing is one of the most important aspects of arena construction. The usual practice is to rototill the existing soil. Figure 58 shows the construction of a good all-weather surface. This surface is good for dressage and jumping, but you may need a firmer surface for reining or working cows and horses. You can achieve this firmer surface by reducing the top layers of sand and shavings to one inch each. You may crown the surface slightly, but very little crown is desired. Only unwashed gravel should be used.

The minimum size recommended for an outdoor arena is 60 x 120 feet. The most common and more versatile size is 100 x 200 feet (Figure 59).

Having the entrance and exit at opposite ends of the arena makes it easy to move horses in and out of the ring. Extend the gates right from the floor to the full height of the fence. Openings under the fence might allow pets and small animals to enter or feet to protrude if a horse goes down, risking injury. Make the gates less distracting by matching them with the rest of the fence.

A vertical arena fence may be satisfactory, but riders may bump their feet and legs against the wall. An arena fence with an excessive slant away from the ring can be very dangerous. A horse travelling close to the wall may hit the wall with his feet, lose its balance, and fall into the wall, trapping the rider. A slight slope of the fence (away from the ring) offers some protection to

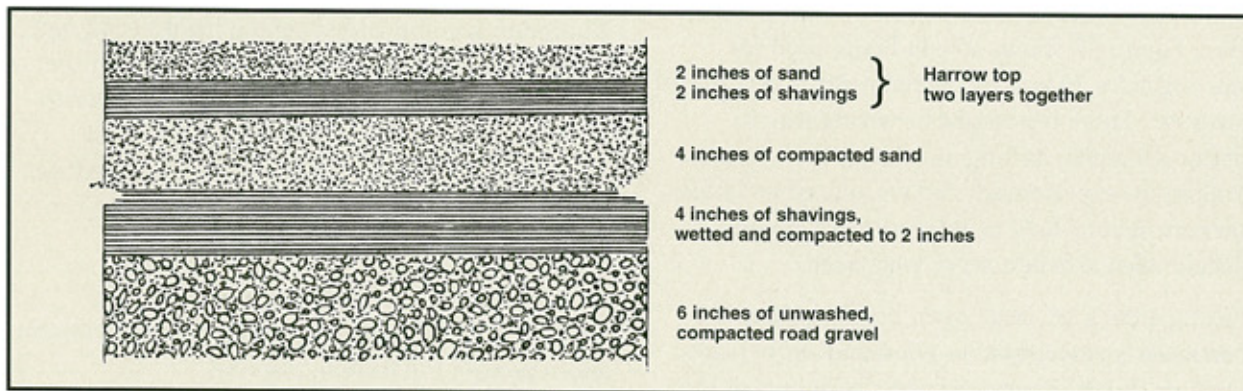


Figure 58. *Riding arena surface*

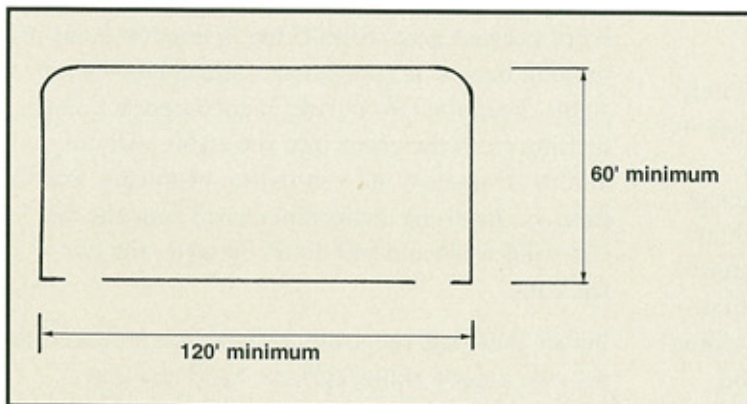


Figure 59. *Arena size and shape*

the rider. A fence with a slope of between 2:12 and 2.5:12, attached to a vertical support is best. It will allow a horse to travel against the wall safely without endangering the rider.

Indoor Arenas

Indoor arenas can be a good addition to any horse establishment. The key to a successful development is to analyze what the major purpose of the facility will actually be, and how much it will be used. There is a wide range of types of successful facilities in Alberta. The traditional, rectangular arenas are prevalent and they serve a purpose. Arenas built with the end use in mind are the most successful ones. There are some square arenas that cover large round pens for working cows or horse training. There are a few long, narrow arenas for calf roping – team roping requires more width. Dressage riders need an arena that is proportional to a standard dressage ring. Figure 62 shows a round pen, used for starting colts, that was covered to fill a very useful purpose. There is no right or wrong way to design an arena, as long as it meets your needs. Talking to experienced trainers and other facility owners in your field of interest will help you decide what will best serve your needs.

Riding arenas are large open buildings that are particularly susceptible to wind and snow loads. Owners should ensure that new buildings of this type are built with appropriate professional engineering design and supervision.

The Alberta Building Code provides for appropriate professional design and other safety aspects of buildings in Alberta. The code does not apply to “farm buildings” of low human occupancy; however, it applies to riding arenas that are used for commercial purposes, such as riding lessons, or where the site is clearly more than a farming operation. Also, if the building contains bleacher-style seating for viewing riding events, it is not “low human occupancy” and other provisions of the Alberta Building Code

may apply. Owners of such buildings outside Alberta should check with local authorities for information on building code requirements.

The key is to provide a **useful** covered area that lengthens your riding season by protecting you from the weather and keeping the ground from freezing.

Viable options for construction include square post or frame walls with truss rafters, wooden or metal Quonset-style buildings or flat-walled, steel-framed buildings. The stable construction section on page 8 presents arguments for each type of building. Remember ongoing maintenance requirements when planning your facility.

If the walls provide an outer perimeter, install kick plates to a height of at least 4 feet. Build this with 3/4 inch plywood with adequate framing or 2-inch lumber. Remember that anything protruding into the arena may catch and injure a horse’s shoulder or a rider’s knee.

Minimum recommended ceiling height is 12 feet but 14 feet is better. It will be easier to light the arena and the higher ceiling offers more options for varied uses. Higher walls allow room for windows high on the wall, reducing the need for electric lights, and offering less opportunity for leaks than skylights in the roof.

At least one door large enough to allow the entrance of equipment makes it easier to maintain and replenish the footing material.

Gate placement and design are similar to outdoor arenas. Put the gates close to the corners. This helps prevent gates from being opened in front of moving horses. If your arena is attached to your stable, keep the two environments separate. Dust drifting from the arena into the stable will only add to air quality and ventilation problems. Stable gases in the arena environment will sour the air. Use solid walls and full doors between the two facilities.

Before building, the ground should be prepared to provide a good riding surface. Sand and clay, well mixed and placed over a solid base should



Figure 60. *Metal clad arena with stalls attached to one side – note ventilation turbines and natural light strip*



Figure 61. *Innovative covered round pen for year-round training*

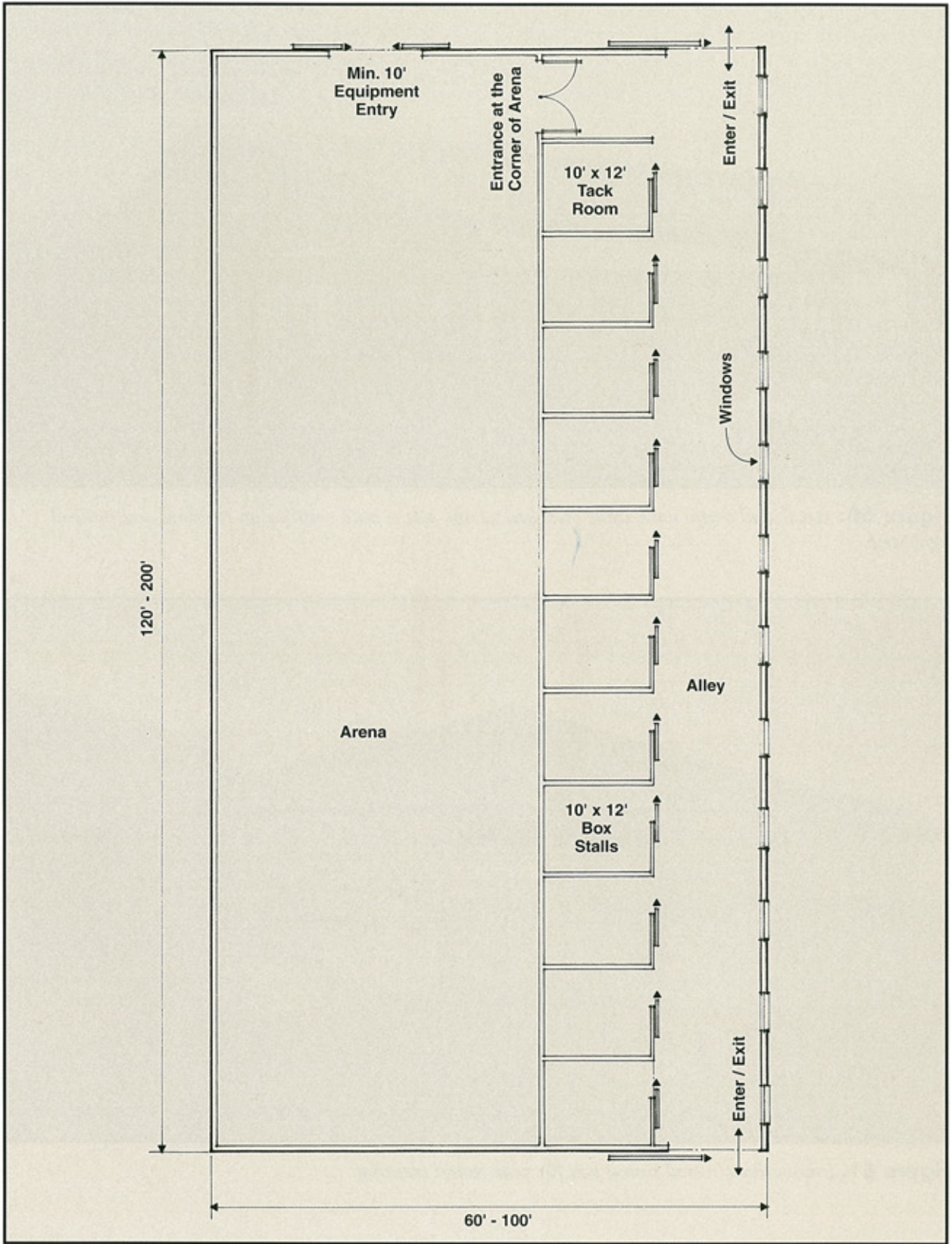


Figure 62. *Single row style arena*

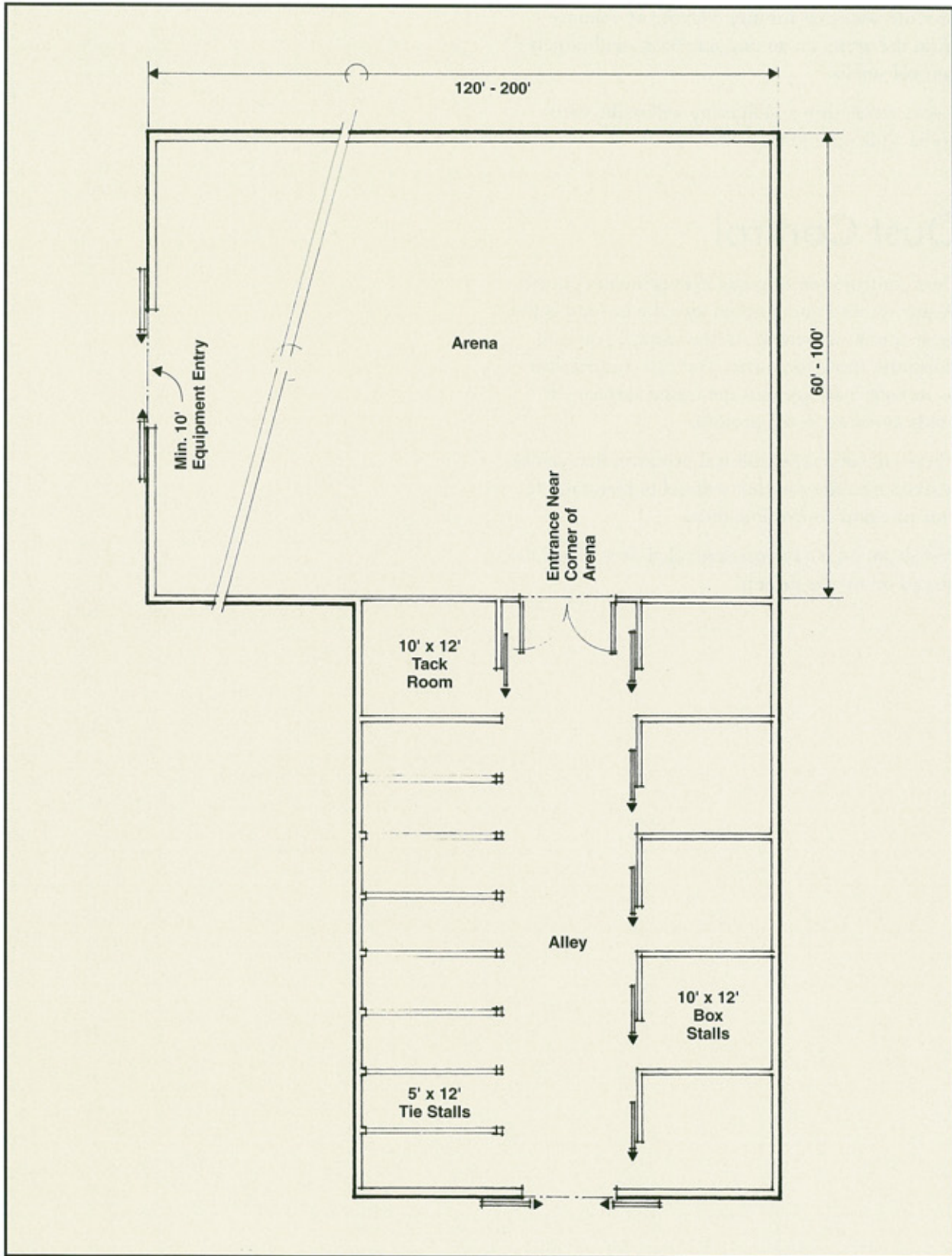


Figure 63. T-style arena

provide adequate footing. Picking up manure from the arena on an ongoing basis, will largely control smells.

Good ventilation and lighting will make your arena a pleasant place to be.

Dust Control

Dust control is an ongoing management concern. Water sprayed and worked into the ground is the most common method. In the winter, you can substitute snow for water. You can control dust by mixing road salt into the riding surface – it holds moisture in the ground.

There are some horticultural products that can be worked into the soil that will aid in maintaining moisture and controlling dust.

Petroleum oil is **not recommended**. It is illegal to spread oil on the ground.

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