Appendix D

The Clemson 4-Horse Tie Stall

Introduction

It is not unusual to find a horse camp that would have served very well as a family campground, but in its current use, it is poor at best and a disaster at worst. Concerns for accommodating horses at a camp are at least equal to, and may exceed, those for accommodating people. Standard camp designs will usually provide a way for people to make themselves reasonably comfortable and secure. However, it is often the case that provisions for appropriate confinement and care of the horses are inadequate.

If the functional and environmental integrity and aesthetic quality of a camp are to be maintained at high levels, the problems inherent to accommodating horses confined in small spaces must be resolved. Provisions for security, safety, and comfort (opportunity for physical and psychological rest) of the horse must be made. Protection of the camp environment involves prevention of damage that results from normal behaviors of a horse when confined to a small space, such as: a) moving around with quick movements or pawing when anxious or hungry, b) trampling waste hay and manure into the soil, c) chewing on things (usually out of boredom), d) developing and maintaining a pecking order with the animals it can reach or that can reach it, e) reacting in fright to violent storms or unusual human or other animal activities, f) becoming upset when separated from its herd-mates, and a host of other things that a horse might do that result in problems for humans and human values.

The purpose of the Clemson 4-Horse Tie Stall (Figure D.1) is to remedy the problems of horse care and environmental protection in horse camps where space for accommodating horses is inadequate for highlines, corrals, or covered stalls of appropriate size. This facility, while initially expensive, should have only minor structural maintenance requirements over an estimated 30-year period of use.

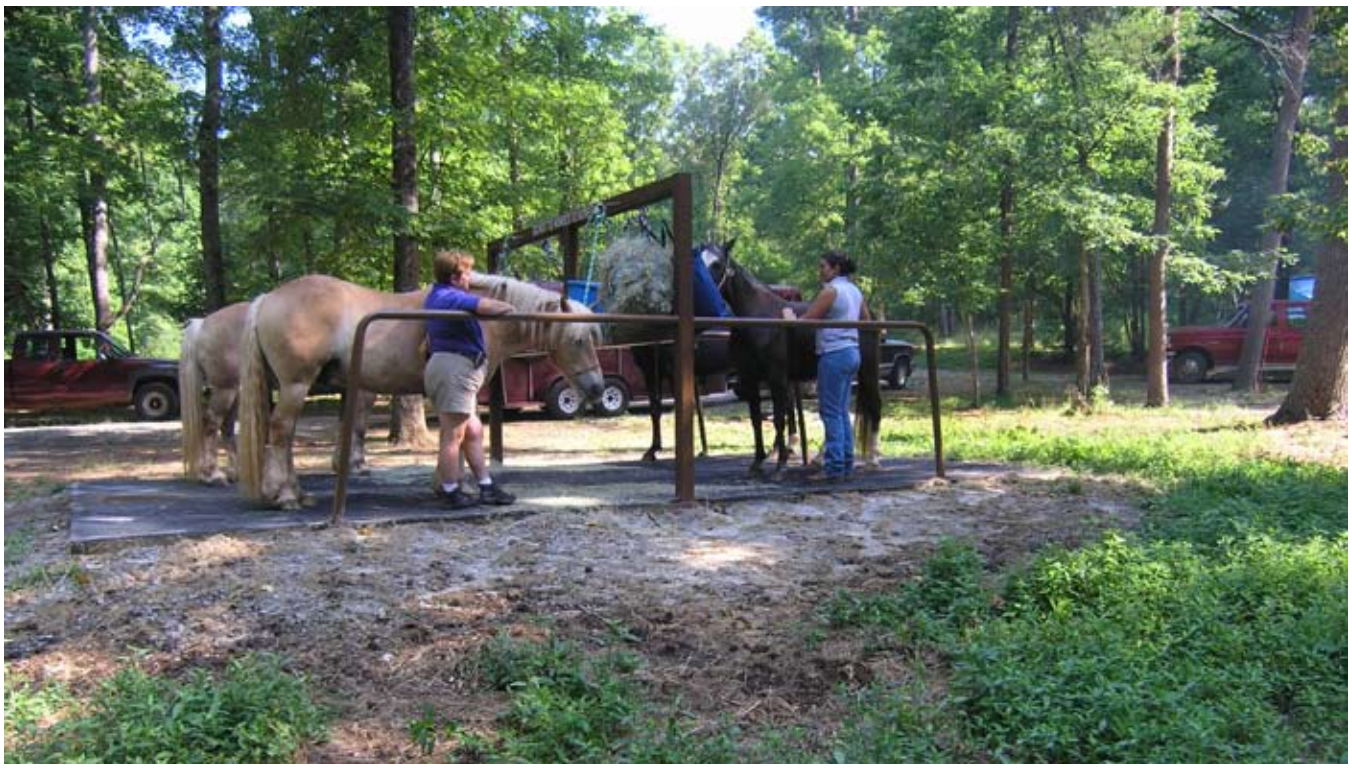

Figure D.1. Horses properly secured in the Clemson 4-Horse Tie Stall. (Photo by G. W. Wood)

Figure D.2. The Clemson 4-Horse Tie Stall design. (Photo by G. W. Wood.)

Clemson 4-Horse Tie Stall

An Alternative

Chapter 9 shows an array of photos of various facilities for confining recreational camp horses. Most of these designs have either horse care or site protection shortcomings, and some have both. The design offered here eliminates site and camp amenity damages that result from chewing and pawing while simultaneously providing a station comfortable to the horse and where the animal is easily cared for. A campground manure management program is required for this design to be maximally effective. Minor maintenance costs over several decades of use should make this design economically comparable to other designs that have significant periodic maintenance costs when the facility structures are adequately maintained.

General Description

The Clemson 4-Horse Tie Stall (Figure D.2) floor is 12 ft. wide by 24 ft. long. The floor is framed with 4x6 pressure-treated southern pine timbers sitting on edge on a foundation of crush-and-run gravel. The interior space of the floor is filled with either quarry screenings, gravel up to 4-6 mm in size, or recycled concrete that has 60-70% fines with ½-in. aggregates. The floor surface is covered with perforated stall mats.

The main structural feature of the design is the central divider which is framed with square tubing and has a screen on its upper half to separate horses on opposite sides and to provide a surface for hanging hay bags and feed and water buckets. A U-shaped tie-bolt is welded to the top horizontal bar of the divider in the center of each stall. Three rails (right side, center, and left side) located on each side of the central divider define the limits for horizontal movement of the horse in each stall.

Description of Components

Central Divider: The central divider is 72 in. high (stall floor to top of upper horizontal member) and 144 in. wide (outside to outside). The bottom of the lower horizontal member is 30 in. above the stall floor. The framing is made of 3½ -in. square tubing with ¼-in. walls

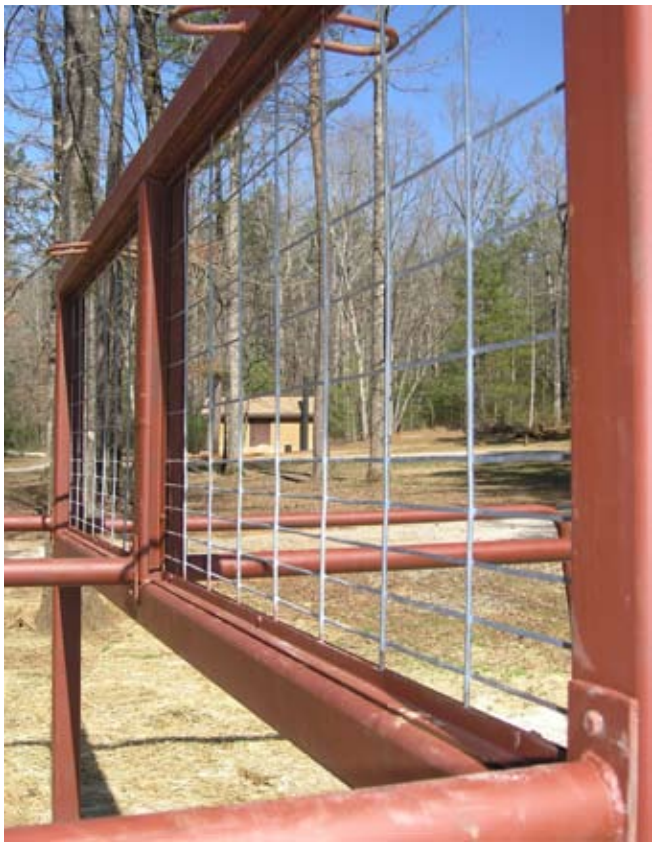

Figure D.3. The central divider separates four horses into two pairs on each side of the screen. The pairs are then separated by the stall rails. Each horse has 6 ft. of space for side-to-side movement. (Photo by G. W. Wood.)

(Figure D.3). All joints are welded. The upright at each end of the divider is welded to the center of a 3-sided, 12-in. long sleeve made of ¼-in. steel strap. The sleeve is 3½-in. wide inside and 6 in. deep outside. The sleeve attaches the uprights to 4x6 timbers that frame the stall floor (Figure D.4).

The divider screen (figures D.3 and D.5) is made from 34-in. hog panel that is framed and held in place with 1-in. angle iron. On one side of the screen the angle iron is welded to the square tubing along all four edges. On the opposite side, the two pieces forming the upper right corner are welded while the two pieces forming the lower left corner are bolted to the angle iron on the opposite side of the screen with ¼ x 1-in. galvanized hex-head bolts. This facilitates removal of the screen should it ever be damaged. The narrowest spacings between the horizontal rods of the screen are placed at the bottom to prevent a horse from hanging a leg in the divider.

Tie-bolts are 5/8-in., U-shaped rods welded to the top horizontal bar of the divider and at the center of each stall (Figure D.6). The tie-bolt is 6 in. long and 6 in. wide (inside measurement) at the base.

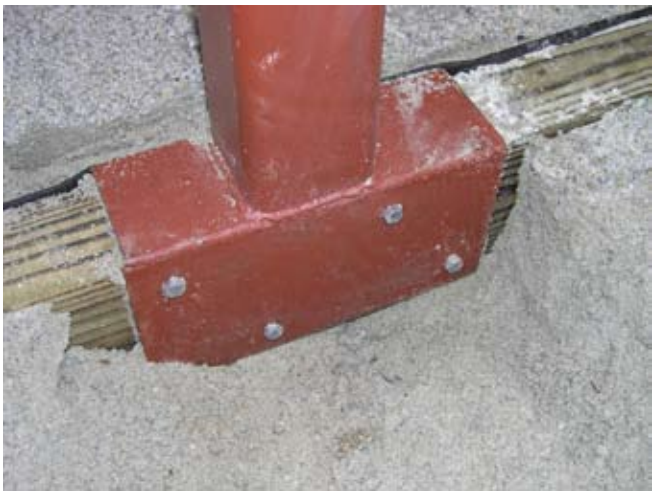

Figure D.4. The 3½- x 12-in., three-sided sleeve at the bottom of the central divider upright attaching the central divider to the framing timbers. Fasteners are ⅜- x 2½-in., galvanized lag bolts (GHD if available) located both inside and outside of the framing timbers. (Photo by G. W. Wood.)

Points for attachment of the stall rails to the central divider each have two pre-drilled and tapped ⅜-in. holes spaced to match holes in the rail flanges (figures D.3 and D.7). (Note: In these figures the central divider is 78 in. high with a 36-in. clearance for the bottom horizontal bar. When using the currently recommended

Figure D.5. Angle iron framing to secure the divider screen. (Photo by G. W. Wood.)

Figure D.6. The ⅝-in steel rod tie-bolt welded on the top horizontal member of the central divider. (Photo by G. W. Wood.)

72-in. high divider with a 30-in. bottom clearance, the 42-in. high stall rails will be positioned higher on the divider.)

The central divider should be prefabricated by a welder, primed for painting, and transported to the installation site in one piece.

Stall Rails: Stall rails are formed from 2-in. diameter, schedule 40 iron pipe (Figure D.8). The pipe is bent instead of being welded or joined with an elbow fitting to prevent the exposure of the horse to sharp edges. The stall rails extend 72 in. (floor measurement) from the central divider and they are 42 in. high (top line of the rail). Flanges on the bottom ends of the stall rails are attached to the floor framing with ⅜ x 3-in. galvanized lag bolts (GHD if available) (Figure D.9).

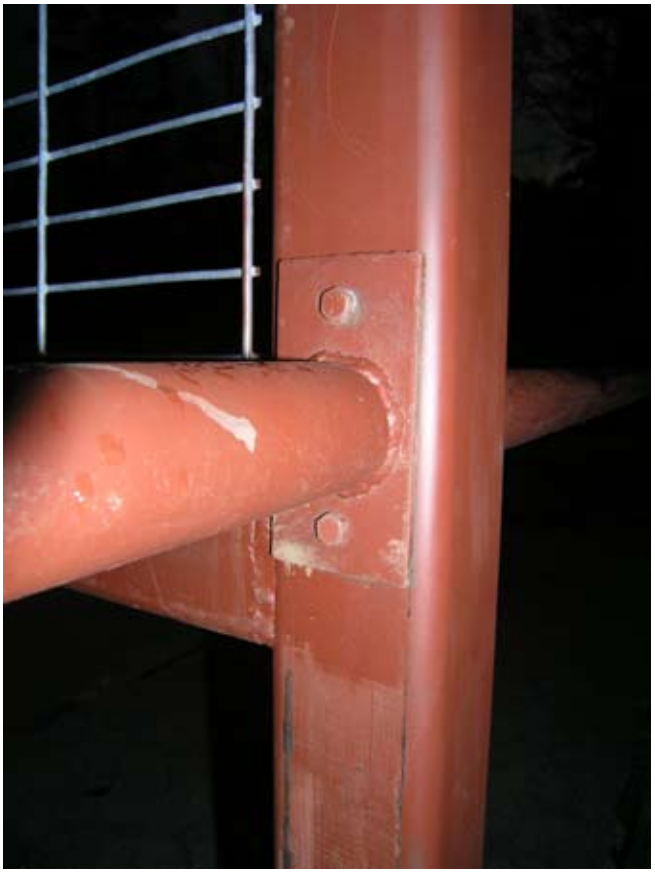

Figure D.7. Attachment of the stall rail to the central divider with ⅜- x 1-in. hexhead bolts. (Photo by G. W. Wood.)

Grounding: As a safety precaution against electrical storms, the metal portion of the tie stall is grounded by running a #4 copper ground wire from the central divider screen to a ⅝-in. diameter, copper ground rod driven 8 ft. into the ground (Figure D.10). The ground rod is located beneath the stall mat to eliminate potential for a hoof injury.

Figure D.8. Stall bars shaped by bending a 2-in diameter, schedule 40, iron pipe. The bars are 42 in. at the top line and extend 72 in. along the stall floor. (photo by G. W. Wood.)

Figure D.9. Attachment of stall bars to the floor framing and center support beam timbers with ⅜- x3-in., galvanized lag bolts (GHD if available). (Photo by G. W. Wood.)

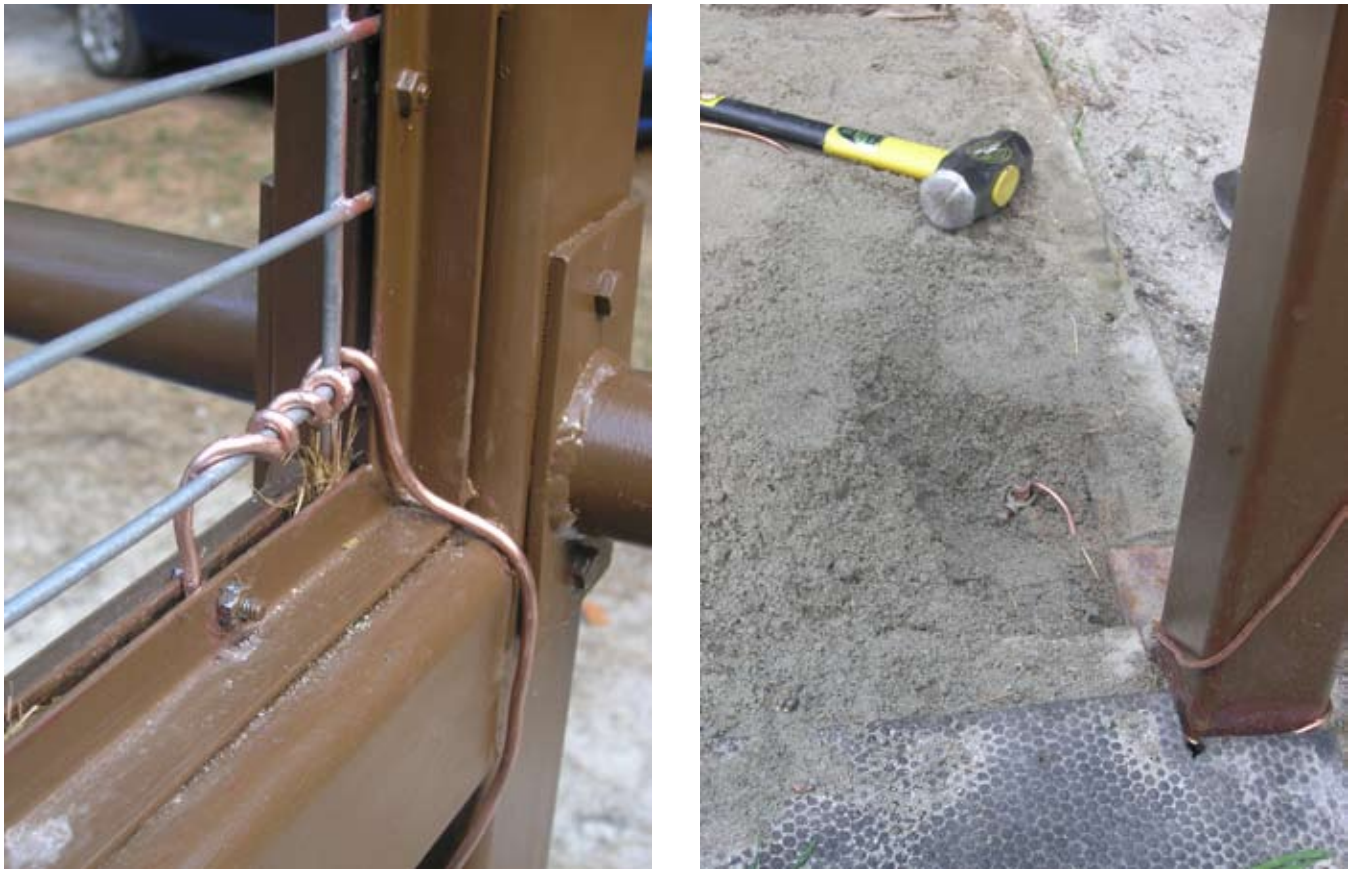

Figure D.10. Ground wire wrapped to central divider screen (left) and grounded to ⅝-in. diameter copper ground rod driven 8 ft. into the ground (right). (Photo by G. W. Wood.)

Stall Floor: The floor is framed with pressure-treated 4x6 timbers (Figure D.11). Outside dimensions are 12 ft. x 24 ft. Each end timber is 12 ft. long. Each side is composed of two 12-ft. timbers that join at the center point of the central divider sleeve. The four corners of the frame are formed by cutting the ends of the adjoining timber at a 45° angle and fastening them to each other with a ¼-in. steel strap that is 6 in. wide, 24 in. long, and bent at the length midpoint into a 90° angle (Figure D.12). Six ⅜- x 3-in. galvanized lag bolts (GHD if available) are used to attach each strap to the adjoining timbers.

The center of the floor has a center support beam composed of two 4x6, pressure-treated timbers, each 11 ft.

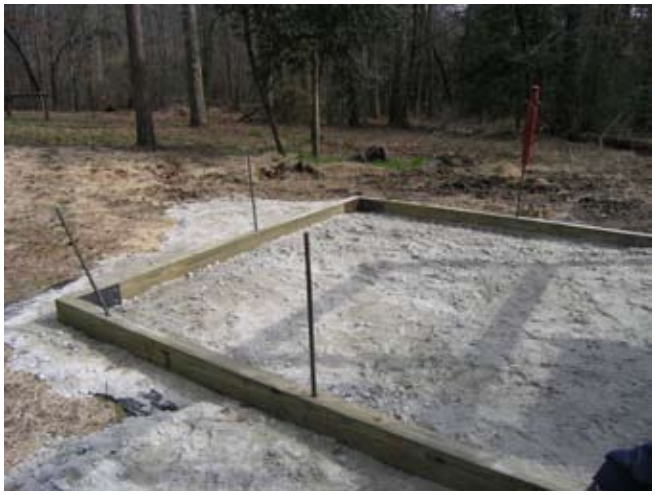

Figure D.11. Anchoring rods (⅝-in. rebar, 5 ft. long) ready for driving in framing timbers. The two slanted anchoring rods for the end timber are not shown here. (Photo by G. W. Wood.)

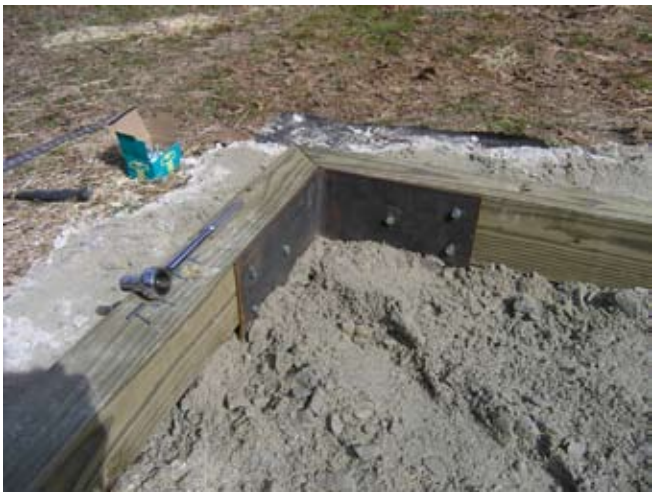

Figure D.12. Joining the floor framing corners with steel strap (¼x6x24 in.) bent to 90° and fastened with ⅜- x 2½-in., galvanized lag bolts (GHD if available). (Photo by G. W. Wood.)

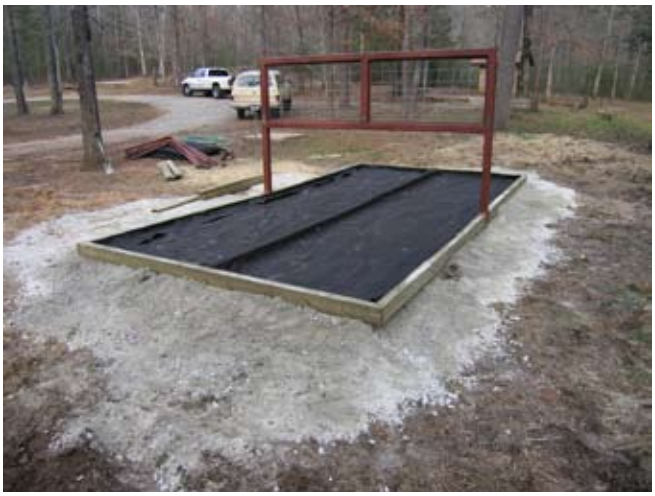

Figure D.13. A 5-oz. geotextile liner separating the floor fill material from the crush-and-run gravel foundation. (Photo by G. W. Wood.)

6½ in. long, that are set on edge and run the length of the floor to offer a surface for attachment of the floor surface covering and bottom flanges of the center stall rails. The center support beam timbers are joined with a ¼-in. thick steel strap that is 24 in. long and 6 in. wide, and fastened to the end timbers of the frame as described above for frame corners.

Each side framing timber and center support beam timber is anchored with one ⅝-in. diameter, 5 ft. long rebar that is driven through a pre-drilled ¾-in. hole angled at 45° to 60° with the linear axis of the timber and one driven vertically through the timber (Figure D.11). The end timbers each have three anchoring rod holes. One is for the vertical rod in the middle. The slanted rods are each 48 in. from the end of the timber.

The stall floor sets on a foundation of crush-and-run class gravel (Chapter 5). A 5 oz., non-woven geotexile liner is tacked into the floor framing using 1½-in. aluminum roofing nails to separate the quarry screenings (or other fill material) that will be used to fill the floor space from the foundation gravel (Figure D.13).

Flooring floaters are 2x6 pressure-treated timbers cut in 64½-in. lengths and laid flat on 48-in. centers perpendicular to the sides of the floor framing. They are set in the packed fill material with the floater surface even with that of the fill material and the framing timber surface (Figure D.14). The floaters are not fastened to the floor framing or center beam.

The floor surface is perforated stall mats that are 48 in. wide, 72 in. long, and ¾ in. thick. These mats are the same as those recommended for bridge surfaces in Chapter 7 (Figure 7.9). Perforations are ¾-in. holes

Figure D.14. Floaters (2x6 pressure-treated timbers) placed on 48-in. centers and even with surface of floor fill material, floor framing, and center support beam. (Photo by G. W. Wood.)

on 4-in. centers. The stall mat surface offers a non-skid surface and a comfortable footing that will provide for good leg rest. In addition, this surface is easy to clean, and should have a service life that exceeds that of the pressure-treated timbers (expected to be around 30 years) (Figure D.15).

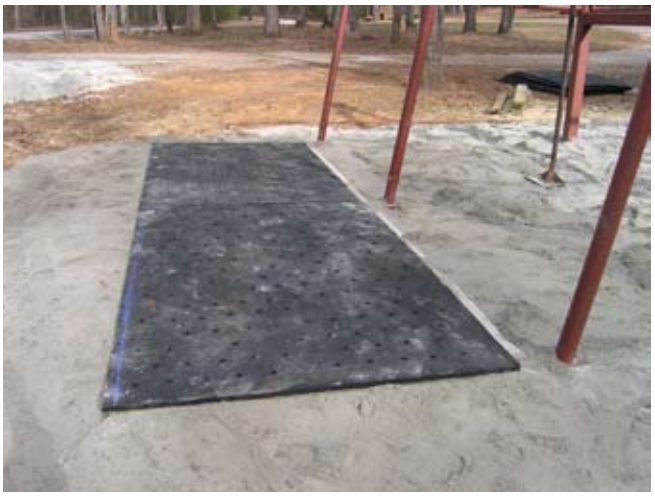

Figure D.15. Placement of perforated stall mats fastened to floor framing and center support beam timbers with 1½-in. deck screws. (Photo by G. W. Wood.)

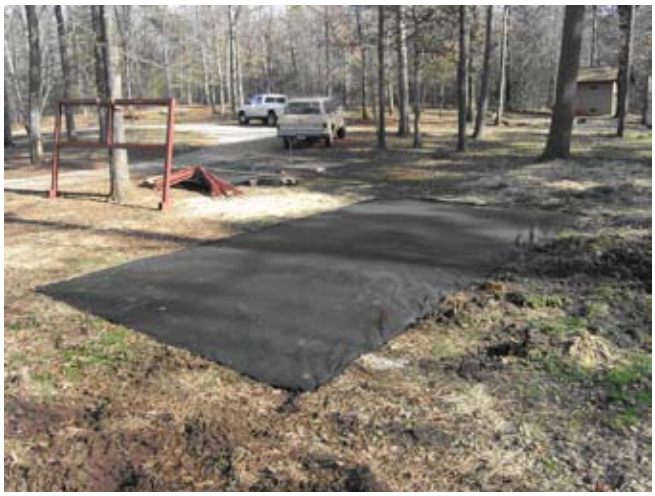

Figure D.16. The 5-oz., non-woven geotextile ground liner fastened around the perimeter with 6-in. wire staples. (Photo by G. W. Wood.)

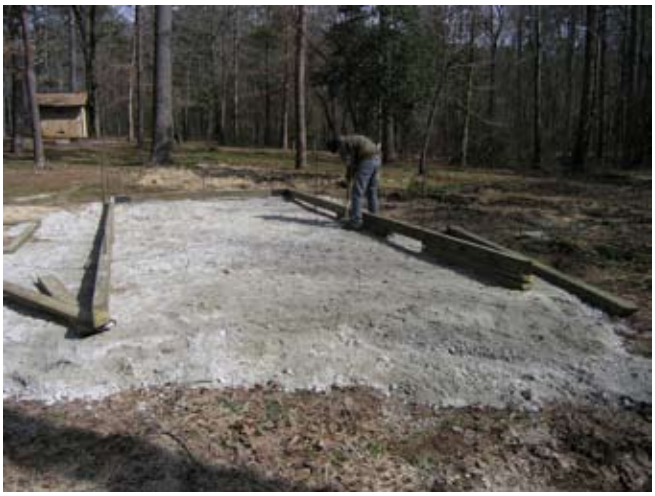

Figure D.17. Crush-and-run gravel placed on top of the ground liner to create the foundation for the stall floor. (Photo by G. W. Wood.)

Foundation: The foundation is crush-and-run gravel set on a 5-oz., non-woven geotextile that separates the gravel layer from bare soil (Figure D.16). A foundation gravel depth of 3-4 in. is ample for drainage. Greater depths may be required for: a) leveling the stall floor, and b) keeping the surface of the stall floor above surrounding terrain so that surface waters do not flow on to the floor in storm events (Figure D.17).

Installation of the Tie Stall

Step 1

To the extent practical, position the site for the tie stall so that it is near a water spigot and such that water draining from the stall will not be into the human-occupied portion of the campsite. Also, to the extent practical, position the tie stall so that the stall length runs parallel to the contour of the landscape. This will minimize the amount of drop from the floor surface to ground level on the low side of the site.

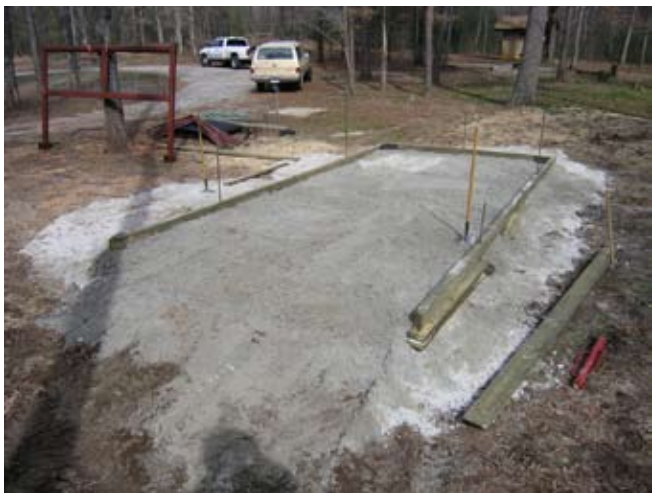

Figure D.18. Pressure-treated 4x6 timbers in the floor framing on three sides with one end left open to allow equipment to set the central divider in place. (Photo by G. W. Wood.)

Step 2

Clear the site of stones and organic debris. Excavate the site to the dimensions of the stall floor, but do not excavate the high side of the site to a depth that water will drain on to the floor surface once it is installed.

Step 3

Install the geotextile ground liner that will separate the crush-and-run gravel foundation from bare soil (Figure D.16). Use 6-in. wire stables (see Chapter 5, Figure 5.16) spaced 12 in. apart along the outer edge of the liner to hold it in place. Cover the liner with foundation gravel sufficiently to: a) provide for drainage from beneath the floor, b) provide for leveling of the floor framing timbers (Figure D.17), and c) keep the floor surface at least 4 in. above the surrounding terrain.

Step 4

Set and square, but do not anchor with rebar, the framing timbers on three sides leaving one end open for a machine to enter the site and set the central divider in place (Figure D.18). The center vertical rod in each side timber is only partially driven in as the opposing side timbers are set at exactly 144 in. (outside-to-outside) from each other. These rods will act as pivots for the squaring process.

Step 5

Set the central divider in place (Figure D.19). Check the framing timbers for square, install corner straps, and anchor all framing timbers with vertical and slanted rebar rods.

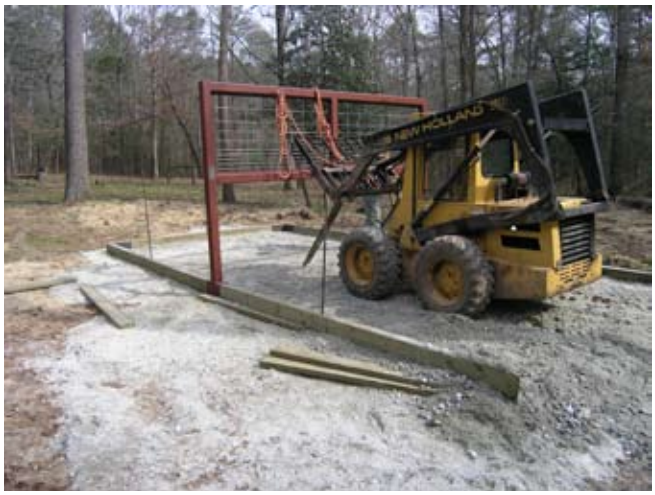

Figure D.19. Use of a skid steer to set the central divider into place. (Note that the divider is secured to the skid steer forks with a rope for personnel safety reasons.) (Photo by G. W. Wood.)

Figure D.20. Quarry screenings fill the stall floor area and embank its perimeter to eliminate sharp drop-offs. (Photo by G. W. Wood.)

Step 6

Install the geotextile liner that will separate the floor fill material from the foundation gravel (Figure D.13) and fill the floor space with either quarry screenings, 4-6mm gravel, or recycled concrete with 60-70% fines (Figure D.20). Also embank the perimeter of the stall floor with this material to eliminate sharp drop-offs.

Step 7

Pack and level the fill material. Install the floaters (Figure D.14).

Step 8

Install the stall rails fastening the top ends to the central divider first and then fastening the bottom end to the floor framing using ⅜- x 3-in. galvanized lag bolts

Figure D.21. Tie stall with hay bags and water buckets appropriately attached to the central divider and ready for use. (Photo by G. W. Wood.)

(GHD). (Note: The rails can be installed so that the flanges are beneath or on top of the stall mats. The process described here has them beneath the mats. If they are to set on top of the mats, the attachment points on the central divider will need to be set ¾-in. higher than if they are to be bolted directly to the framing timbers.)

Step 9

Install the mats using 1½-in. deck screws. Place three screws spaced 6 in. apart in the center and parallel to the outer edge of each mat only on the outer edge of the stall floor. Leave a ½-in. space between all mat edges. This will allow for shrinkage of the framing timbers without buckling the mats. After several months of use, the fill and foundation material may settle somewhat and leave depressions in the mat surface. Periodically lift the mats, and add additional fill until the settling is complete. Any edges that may buckle during the curing period of several months of use and exposure to site elements can be fastened down with deck screws as is deemed necessary.

The tie stall is now ready for use (Figure D.21).

Cost

The materials and prefabrication contract work done on the Clemson 4-Horse Tie Stall was approximately $1800 in 2006 at Clemson, SC.

Evaluations

Dr. Mylon Filkins, DVM, owner of Bakersfield Veterinary Clinic, Bakersfield, Calif., and Chairman of the Recreation Committee, American Horse Council was asked to evaluate the Clemson 4-Horse Tie Stall design in terms of concerns for horse health. He made the following comments: "The stall design should not be a factor in myositis [tying up] or exercise induced muscular disorders of recreational riding horses. Recurrent exertional myopathy is the result of a number of factors including genetic predisposition, nutrition, and exercise. I assume that these tie stalls are for overnight or day use only. I see nothing in the stall design which would be any different than the trailer ride to the location. Horses which are not accustomed to being tied may have some behavioral issues such as pawing or annoyance with neighbors."

Horse trainer Tinker Moffitt (Tinker Moffitt Quarter Horses, Seneca, South Carolina) has used the prototype of the tie stall shown here for over a year. He regularly ties colts that he is training on trails for several hours each day and overnight for three-day periods. He highly recommends the design as safe, effective, and efficient for secure, comfortable confinement of trail horses while in camp.