



Chapter 8— Designing Roads and Parking Areas

Proper road and parking area design is critical in recreation sites, especially for vehicles towing trailers. Traffic circulation should be simple, functional, and avoid dead ends.

Road System Design

Designing roads is a complex process that is beyond the scope of this guidebook. Road geometry and components, including turning radii, sight distances, horizontal and vertical alignments, and intersections, must conform to AASHTO requirements and any other applicable standards. Consult with a qualified transportation engineer. Designers need to know not only engineering essentials, but also basic equestrian needs when designing recreation site roads.

Recreation Site Entrances

The access to most recreation sites is from a State or county highway. Any work performed within the rights-of-way of Federal, State, or county roads requires applicable permits. The road agencies also may require acceleration, deceleration, or turning lanes. During design, carefully analyze the location of intersections. Use only one site entrance to minimize conflicts with highway traffic. One entrance also

simplifies incoming traffic flow and makes site management easier. Safe exits avoid steep grades and have adequate clear sight distance for approaches and departures. Vehicles towing heavy horse trailers need a lot of time to merge with highway traffic, so make sure merge lanes are long enough.

Avoid locating intersections on sharp curves or at areas with awkward grade combinations. Carry the grade of the main road through the intersection and adjust the grade of the access road to it. The grade of the access road should be 6 percent or less where it approaches the main road. A maximum grade of 5 percent at intersections allows vehicles pulling horse trailers to accelerate more quickly so they can merge safely into highway traffic. The preferred grade is 1 to 2 percent.

For roads where snow and ice may create poor driving conditions, AASHTO (2001a) lists the preferred grade on the approach leg as 0.5 percent to no more than 2 percent, as practical. Avoid intersections that are slightly offset from each other on opposite sides of the main road. More than two roads intersecting at one location may cause traffic management problems.

Design Vehicles

Road design is based on vehicle dimensions and operating characteristics. Transportation engineers must know which design vehicle is used at the site. In an equestrian recreation site, this is a passenger vehicle—a pickup truck—pulling a horse trailer. The standard design length for passenger vehicles is 19 feet (5.8 meters). Newer model pickup trucks range from about 15 feet (4.6 meters) long for a standard pickup to about 22.5 feet (6.8 meters) long for a pickup with an extended cab and long bed. Common horse trailers vary from 16 feet (4.9 meters) long for a two-horse, bumper-pull trailer, to about 49 feet (15 meters) long for a six-horse, gooseneck trailer with living quarters. Roads also may need to accommodate 32- to 46.5-foot (9.7- to 14.2-meter) motorhomes towing horse trailers. If a commercial waste management company services a facility, garbage trucks may be traveling through the site. Visit with the land management agency to determine the size of the expected vehicles and whether the site needs to accommodate maintenance equipment. The *Parking Area Layout* section in this chapter has more information on lengths of common vehicles and slant-load trailers.

Some turning radii guidelines are summarized in table 8–1. Tight curves may have to be widened more than indicated—consult current AASHTO requirements for exact figures.



Table 8-1—Turning radii of some common design vehicles, rounded to the nearest 6 inches.

Vehicle type	Minimum inside turning radius (feet)	Minimum outside turning radius (feet)
Passenger vehicle with trailer 19-foot vehicle plus 30 feet total trailer length (including tongue)—49 feet combined length	17.5	34.5
Motorhome with trailer 30-foot vehicle plus 23 feet total trailer length (including tongue)—53 feet combined length	35	51.5
Garbage truck** Gross vehicle weight (GVW) 20,000 pounds with 25-foot 5-inch wheelbase	21	33.5

* A Policy on Geometric Design of Highways and Streets (AASHTO 2001)

** Architectural Graphic Standards (American Institute of Architects 2000).



Forest Lanes

The number of constructed lanes appropriate for recreation site roads depends on safety concerns and the amount of traffic. Forest Service recreation site roads generally are narrow enough to minimize landscape impacts but wide enough for safe travel at up to 30 miles per hour (48.2 kilometers per hour).

The Forest Service requires single-lane roads to be at least 10 feet (3 meters) wide if they serve passenger vehicles moving no faster than 25 miles per hour (40.2 kilometers per hour). Riders often drive pickup trucks or motorhomes towing horse trailers. Because these vehicles require more maneuvering space than passenger vehicles, many Forest Service recreation site roads are wider than 10 feet (3 meters). Single-lane recreation site roads

are often 12 feet (3.6 meters) wide, and double-lane recreation site roads are often 24 feet (7.3 meters) wide (figure 8-1). Shoulder width depends on available space—1 to 2 feet (0.3 to 0.6 meter) usually is adequate. Curves need to be widened on single-lane roads to accommodate trailers. In most cases, single-lane roads are constructed no wider than 14 feet (4.3 meters). If they are wider, drivers may mistake them for narrow two-lane roads.

In a few situations, two-way traffic may be routed along a single-lane recreation site road. Appropriate situations include recreation sites where traffic volume is very low, where the distance is short, or where minimal environmental impact is desired. When routing two-way traffic along a single-lane road, the Forest Service constructs turnouts. The dimensions and locations of turnouts must follow

Trail Talk

established guidelines. Chapter 4 of the Road Preconstruction Handbook FSH 7709.56 (U.S. Department of Agriculture Forest Service 1987) has more information on Forest Service design and standards. The handbook is available at http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?7709.56.

Recreation roads on public lands are subject to the AASHTO guidelines for local roads with very low traffic volume. On low-volume two-lane roads where the maximum speed is 30 miles per hour (48.3 kilometers per hour), AASHTO (2001b) recommends a width of 18 feet (5.5 meters). Single-lane roads with two-way traffic often range from 11.5 to 13 feet (3.5 to 4 meters) wide.



Forest Lanes (continued)

Trail Talk

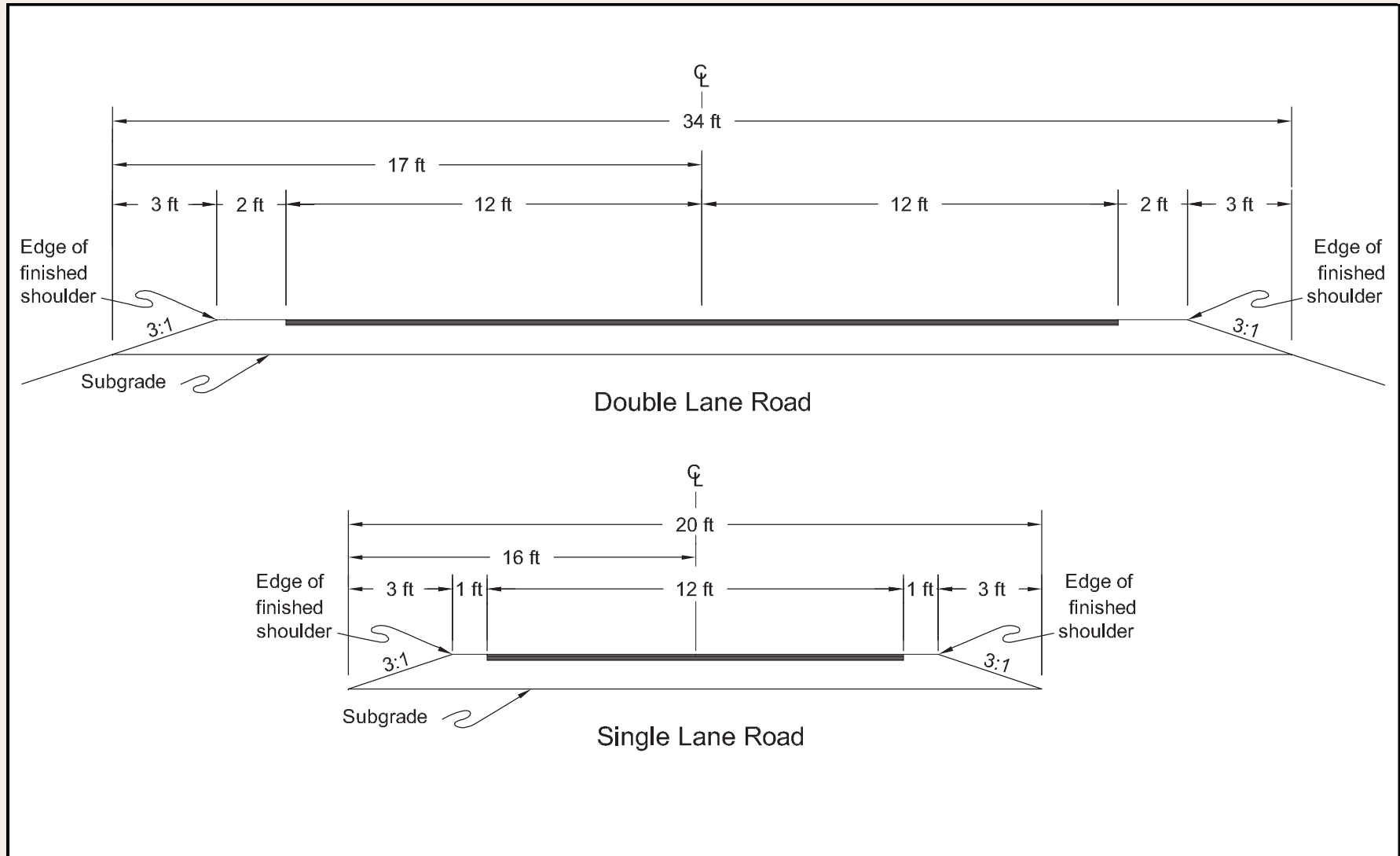


Figure 8-1—Typical cross sections for roads at recreation sites.



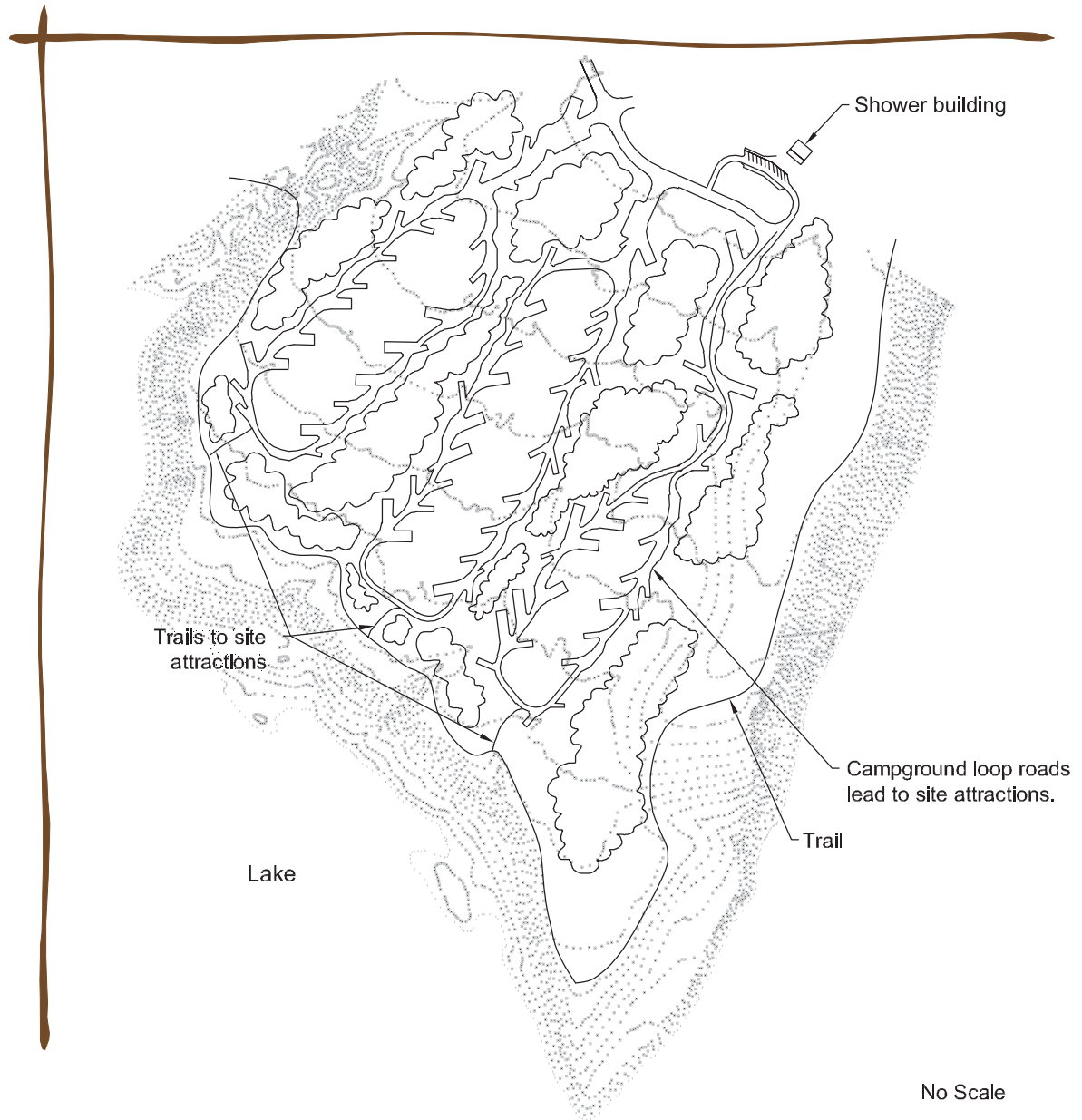


Road Alignment

Minimize landscape alterations by allowing recreation site roads to complement the site's natural landforms. Visitors prefer curves to long straight stretches when they are driving through a recreation site. However, roads with curves must provide adequate stopping sight distance. Where feasible, roads should follow the contour, avoiding areas of steep terrain. Try not to disturb appealing vegetation or significant natural features. In some places, new road alignments can take advantage of abandoned roads.

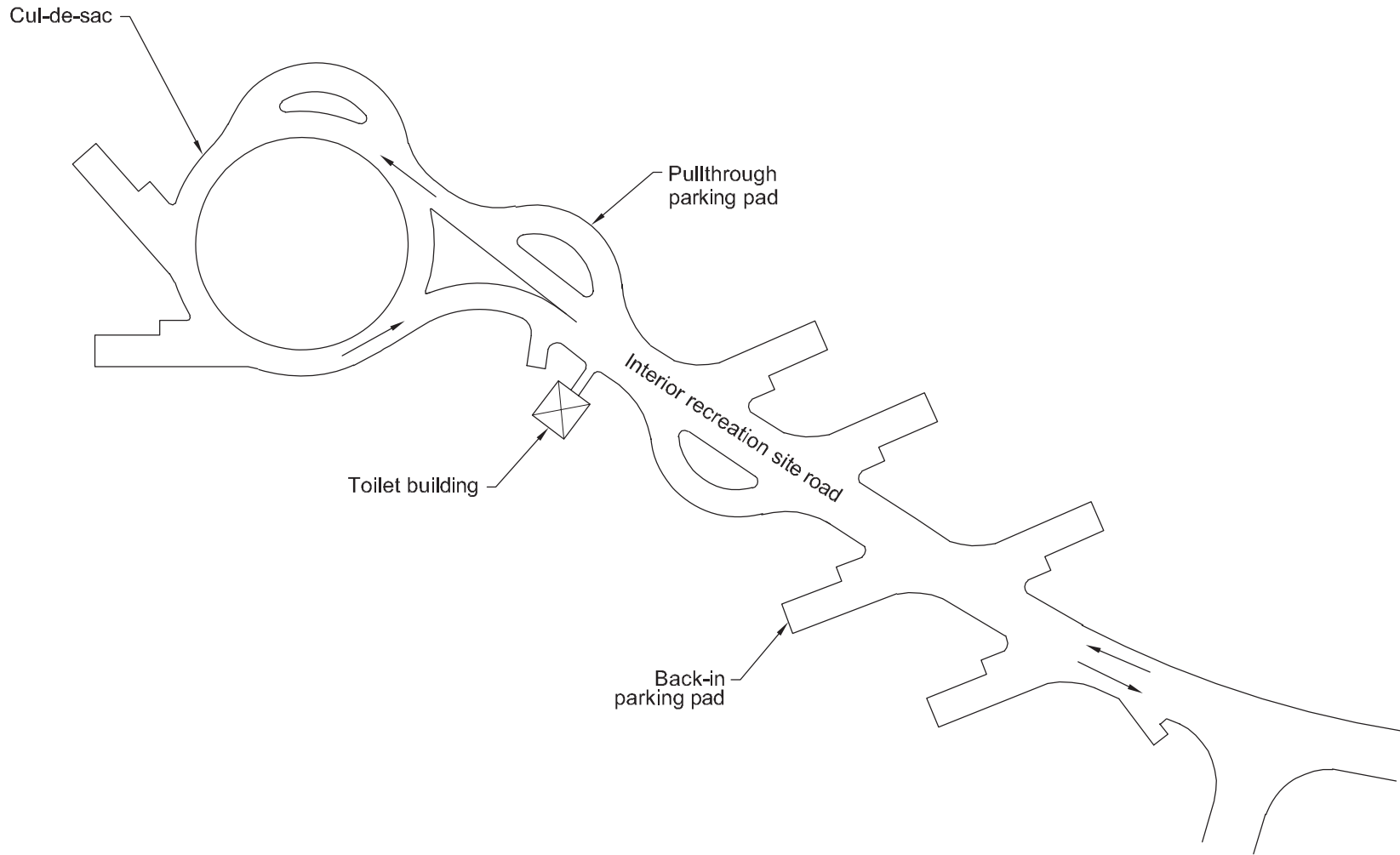
Single-lane, one-way loop roads are best for single-party campgrounds or group sites with individual camp units. Loop roads make it easy for visitors to get oriented. Managers like loops because they can be closed as needed. Fit the loops between landforms, dense stands of vegetation, streams, or drainages. These barriers will screen noise and provide privacy. Reduce road and trail duplication by aligning loop roads so they lead to site attractions, such as trail access points or a lake (figure 8-2). Field experience shows that to provide an adequate buffer for camp units, the loop road should enclose an area that is at least 300 feet (91.4 meters) across. If vegetation is sparse, allow more distance between the roads.

In areas with restricted space, consider incorporating a double-lane road with a loop turnaround—a *cul-de-sac*—at the end (figure 8-3). Make sure the cul-de-sac's



No Scale

Figure 8-2—Loop roads lead to the lake. The campground loop roads fit between existing vegetation and drainages.



No Scale

Figure 8-3—This cul-de-sac is large enough to accommodate parking pads.



turning radius accommodates the expected sizes of vehicles. Unless the cul-de-sac is large enough, avoid locating parking pads on the turnaround,

because it is difficult to maneuver vehicles with trailers in and out of such areas. An oval-shaped cul-de-sac accommodates parking pads well. Consult

Chapter 9—Designing Camp and Picnic Units for more information on parking pads. Another concept suitable for tight spaces is shown in figure 8-4.

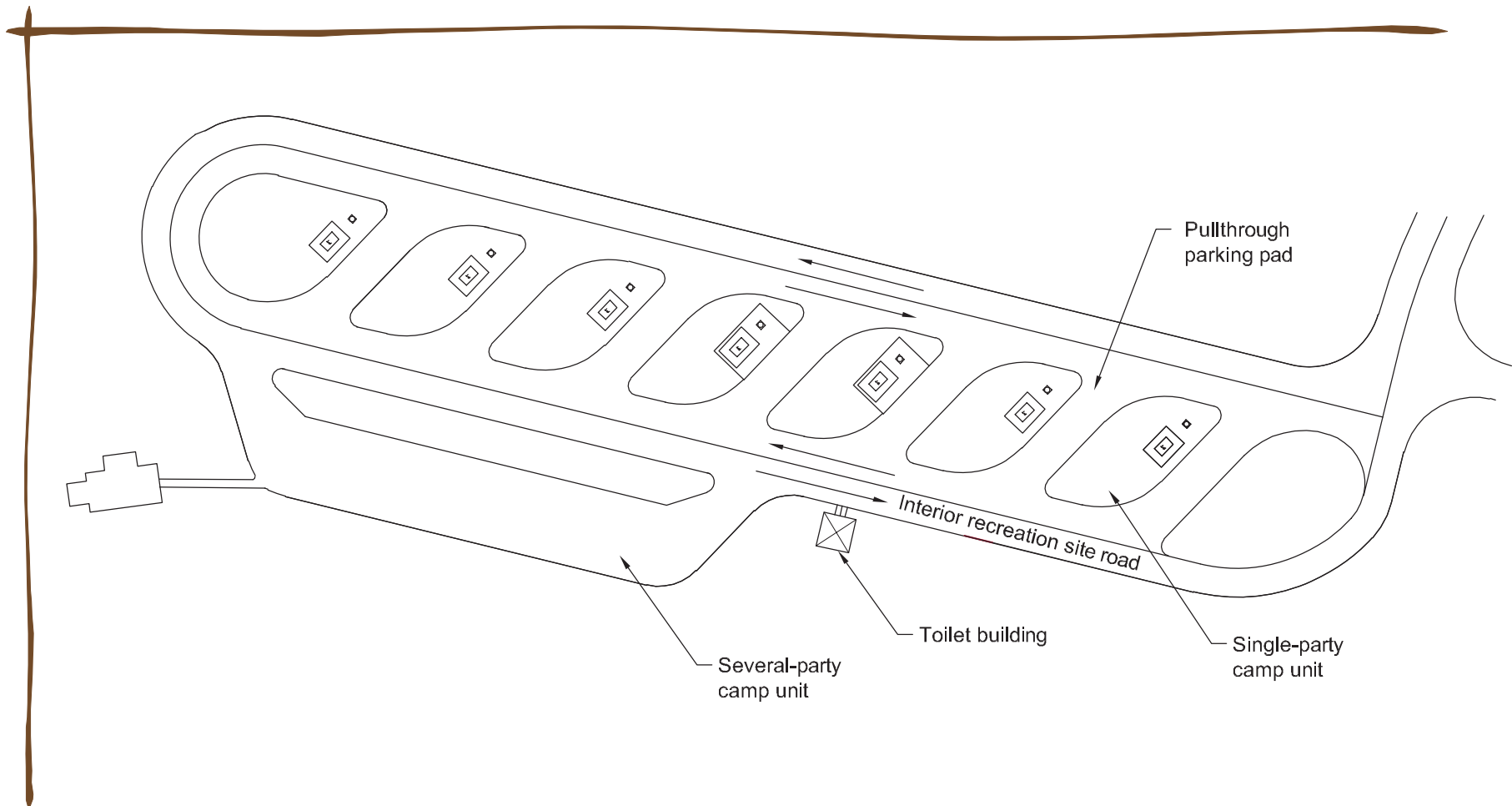


Figure 8-4—A campground loop road in a restricted space with a high level of development.

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Road Grade

Design recreation site roads with minimal grades. Wayne Iverson (1985) suggests that the maximum road grade be 10 percent. A grade up to 12 percent may be allowed for no more than 100 feet (30.5 meters). When the route is considered a pedestrian access route, accessibility requirements apply. The *Forest Service Outdoor Recreation Accessibility Guidelines* (FSORAG) define an *outdoor recreation access route* (ORAR) as a continuous, unobstructed path intended for pedestrian use that connects constructed features within a picnic area, campground, or trailhead. The running slope on ORARs should be 5 percent or less. On steeper terrain, running slopes up to 8.3 percent are permitted for as long as 50 feet (15.2 meters). Running slopes up to 10 percent are permitted for as long as 30 feet (9.1 meters). Additional accessibility requirements apply and are detailed in the FSORAG. The suggested road grades are summarized in table 8–2.

Road Profile

Maintain landscape character by fitting recreation site roads to the natural terrain. The objectives are to keep cuts and fills to a minimum, ease pedestrian flow to facilities, and reduce construction costs. Keep cuts and fills less than 3 feet (0.9 meter). Wayne Iverson (1985) indicates it is usually possible to raise the finished grade about 6 to 12 inches (152 to 305 millimeters) above the natural grade to provide drainage in areas with gentle terrain.

Road Drainage

Avoid site damage by incorporating unobtrusive drainage structures to carry surface water off recreation site roads. Use culverts, drop inlets, dips, dikes, curbs, paved or unpaved ditches, and similar structures where needed. Low-profile culverts and drainage structures reduce fill requirements. After evaluating potential adverse environmental impacts, consider using a ford as a low-water crossing.



The Green Book

Resource Roundup

Recreation site roads are subject to guidelines published and regularly updated by AASHTO. Be sure to use the most recent editions. *A Policy on Geometric Design of Streets and Highways* addresses special-purpose roads that serve recreation sites. This comprehensive volume, sometimes called The Green Book, covers design speed, design vehicle, sight distance, grades, alignments, lane width, cross slopes, barriers, and related subjects.

A companion volume, *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400)*, addresses design philosophy and guidelines. It also shows examples of unpaved roads and two-way single-lane roads. These AASHTO publications are available from the bookstore at https://bookstore.transportation.org/item_details.aspx?ID=157.

Table 8–2—Suggested road grades for equestrian recreation site roads.

Road element	Minimum grade (percent)	Maximum grade (percent)	Preferred grade (percent)
Interior recreation site roads	0	10	2 to 5
Site entrance or exit	0	5	1 to 2
Road cross slope (to allow adequate drainage)	1	2	1 to 2





Parking Area Design

Design parking areas to provide smoothly flowing traffic circulation for vehicles pulling trailers. Avoid dead ends and allow the site's terrain and vegetation to guide the shape of parking areas. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for information regarding surface options. The difference between equestrian parking areas and standard parking is the size of the parking spaces.

Because riders share most trailheads with many users, prevent conflicts by separating equestrian parking areas from other parking areas. Consult *Chapter 7—Planning Recreation Sites* for more information regarding separation. If the trailhead accommodates hikers, mountain bikers, or picnickers, provide passenger-vehicle parking spaces. According to Wayne Iverson (1985), the minimum size for passenger-vehicle parking spaces in recreation sites is 10 feet (3 meters)

wide by 20 feet (6.1 meters) long. Make some parking spaces longer to accommodate longer pickup trucks. Provide accessible parking spaces. Forest Service parking areas must comply with the FSORAG. Figure 8-5 shows parking area dimensions for standard passenger vehicles. If nonequestrians in motorhomes frequent the area, provide spaces for them. While motorhomes fit into equestrian parking spaces, it is better to separate the conflicting uses.

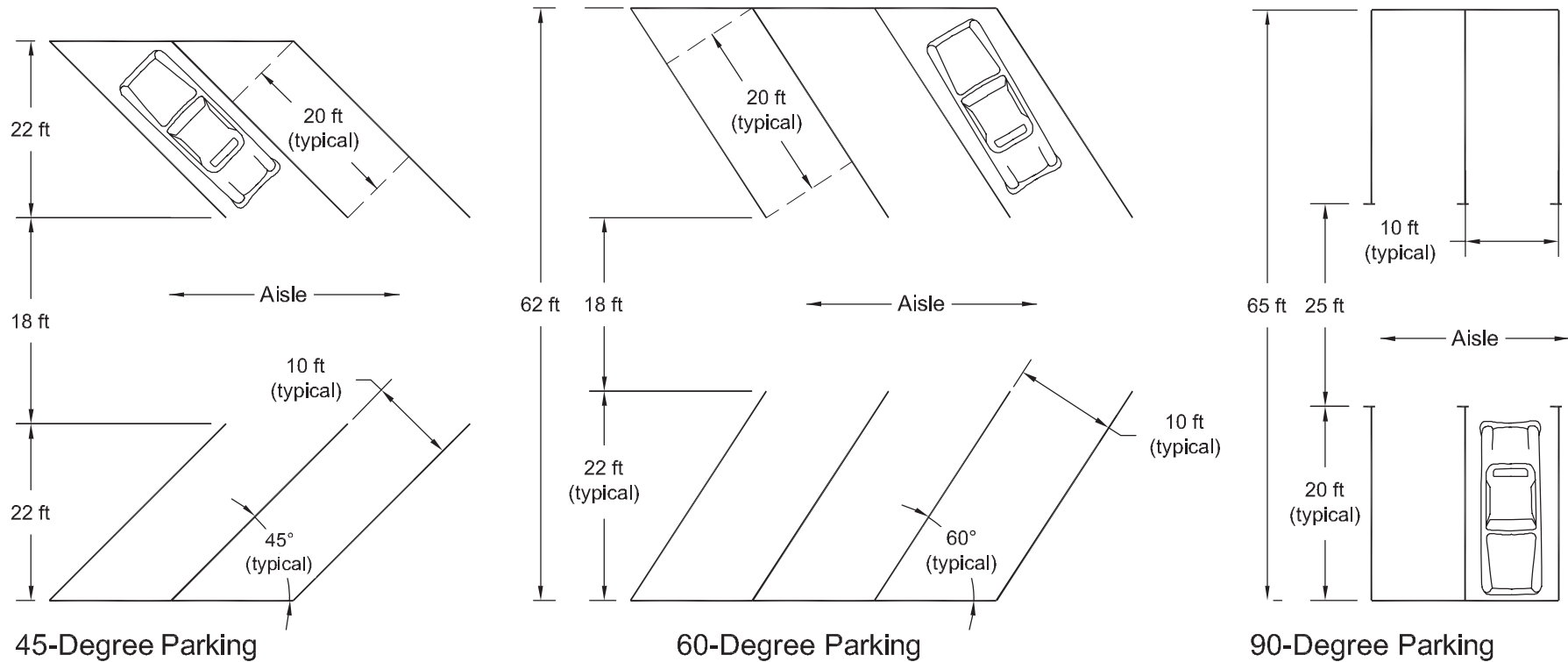


Figure 8-5—Parking dimensions and patterns for standard passenger vehicles. Increase the length of parking spaces if they will be used by pickup trucks with extended cabs and long beds. Forest Service parking areas must comply with the FSORAG.



Most drivers prefer pullthrough parking spaces that are angled 45 or 60 degrees, because the angled space is easier to navigate. Experience shows that this is true for both equestrian and nonequestrian drivers. Consider parking spaces angled at 90-degrees only for nonequestrian parking.

If space is limited, consider incorporating back-in parking spaces angled at 45 or 60 degrees. If angled back-in spaces are used on single-lane roads, locate the spaces on the driver's side of the road. As drivers back into the spaces, they can see obstacles on the inside of the turn more easily. The parking configuration is more obvious when back-in parking spaces contain wheel stops. Install the wheelstops in

the parking space, 2 feet (0.6 meter) from the end. Parallel parking spaces, while less desirable than pullthrough spaces, also may be incorporated. Figure 8-6 shows an equestrian parking area where space restrictions dictated the use of back-in and parallel parking spaces. A separate entrance and exit make the most efficient use of space. Landscape islands and exit and entrance signs guide parking.

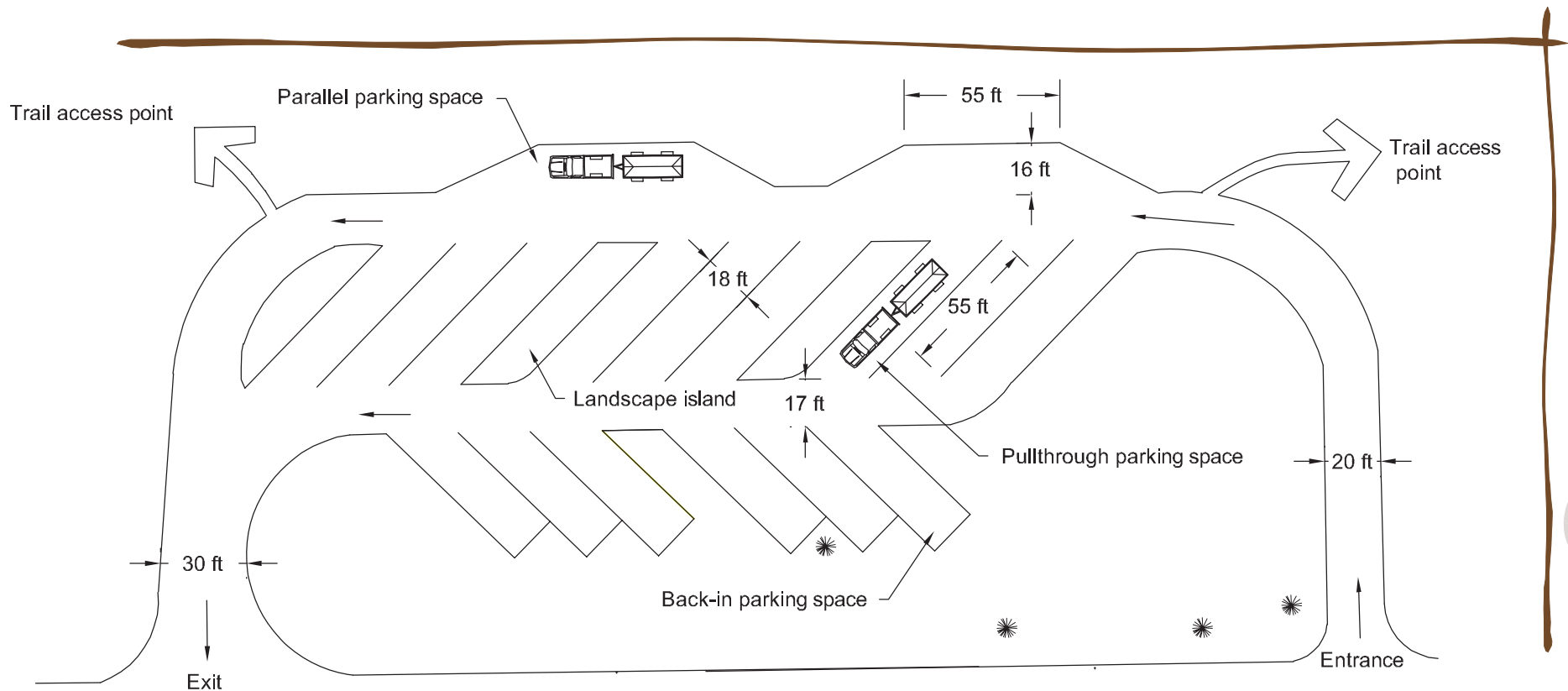


Figure 8-6—Equestrian parking in restricted spaces.

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Parking Area Grade

For the safety and comfort of riders and their stock, equestrian parking areas need to be somewhat level. This makes it easier to unload stock and gear, to saddle an animal, or to spend time in mobile living quarters. Horses or mules tied to trailers are much happier standing for an extended period in a level area. The recommended grade for a parking area is 1 to 2 percent, a comfortable range that allows proper drainage of rainwater and animal urine. Accessibility requirements also stipulate grades within this range.

Parking Area Layout

The appropriate parking configuration depends on drivers' parking preferences, the number of parking spaces desired, and the size of the site. In a group camp, some riders are satisfied with an open area where they can park as they wish. Others prefer to have individual camp units, each with its own parking pad. Because preferences vary, visit with local horse organizations to discover their members' preferred configuration for group parking.

Staging Areas

Popular equestrian sites need staging areas where it is easy and safe to unload, groom, and saddle stock. This means providing extra length and width in parking spaces. Extra length allows riders to unload stock and tie them at the rear of the trailer. Extra width allows stock to be tied at the trailer's side. Figure 8-7 shows a rider saddling a horse in an area

with inadequate space. The horse must stand close to the trailer, making it difficult to saddle the animal properly and safely. Figure 8-8 shows horses tied to a trailer with adequate staging area.



Figure 8-7—Saddling a horse or mule requires access to all sides of the animal, and tight quarters make the job difficult. Note the difference in the horse trailers. The trailer on the left has parallel horse stalls, and the trailer on the right has *slant-load*—or angled—stalls with a storage area behind the partially closed door.



Figure 8-8—Adequate space in parking areas makes it easier and safer to saddle and care for horses and mules. They are more comfortable and are more apt to wait quietly.

To determine the optimum width for parking spaces, consider the trailer width, stock requirements, and space needed for walking behind the stock. Generally, trailers are 8 feet (2.4 meters) wide. Stock tied to the side of the trailer need about 12 feet (3.6 meters) at the side of the trailer, if they stand perpendicular to the trailer. Another 4 feet (1.2 meters) is needed for a person to safely walk or lead an animal behind tied stock. Where space allows, add an extra 4 feet for open doors on neighboring vehicles, for a parking space that is 28 feet (8.5 meters) wide. Figure 8-9 illustrates parking and staging dimensions for several vehicle and horse trailer combinations.

Determining the length of a parking space with staging area is similar to figuring its width. The minimum length required for safely unloading a horse or mule from the rear of a horse trailer with an open door or ramp is 15 feet (4.6 meters). Table 8-3 gives lengths of common vehicles and slant-load trailers, as provided by several horse trailer manufacturers. A slant-load trailer allows stock to stand diagonal to the sidewall instead of parallel (see figure 8-7). A gooseneck trailer is similar to a fifth-wheel trailer. An extension (the gooseneck) extends over the pickup bed and is attached to a ball hitch in the truck bed. Vehicle lengths range from a standard pickup truck pulling a two-horse trailer to a 44-foot (13.4-meter) motorhome towing a six-horse trailer with living quarters and tack room. Because many campgrounds use a garbage service, the length of a standard garbage truck is provided.

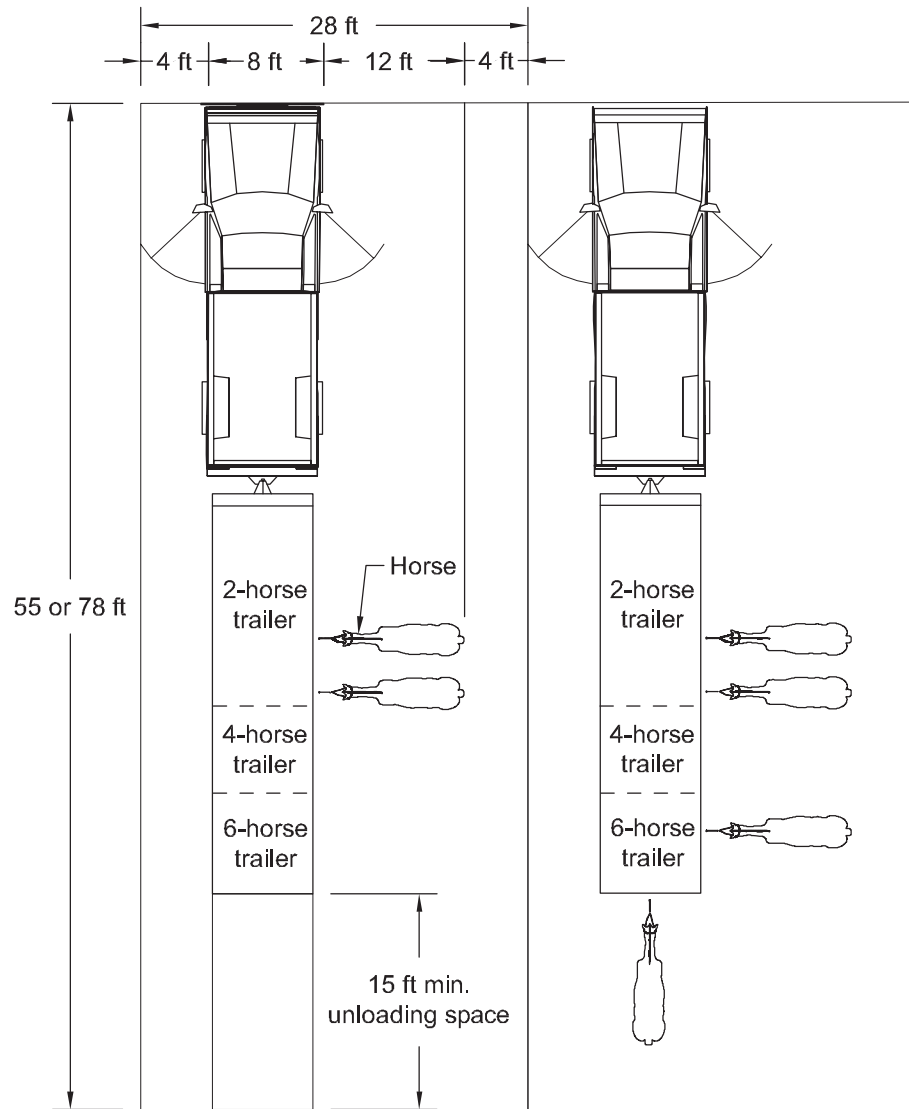


Table 8-3—Lengths of vehicles, trailers, and a standard garbage truck. All trailers are slant loading.

Vehicle	Length (feet)
2-horse bumper-pull trailer	16*
3-horse bumper-pull trailer	19*
4-horse bumper-pull trailer	23*
6-horse bumper-pull trailer	32*
2-horse gooseneck trailer	26 to 33**
3-horse gooseneck trailer	28 to 35**
4-horse gooseneck trailer	32 to 39**
6-horse gooseneck trailer	42 to 49**
Pickup truck	15 to 22.5
Motorhome	32 to 46.5
Garbage truck	28

* Measurements for bumper-pull trailers include the length of the hitch.

** Measurements for gooseneck trailers do not include the overhang above the truck bed.

Figure 8-9—Optimum parking and staging dimensions for vehicles towing horse trailers.





A 19-foot (5.8-meter) pickup truck towing a bumper-pull, two-horse trailer would need a total length of 55 feet (16.8 meters) to park and unload safely. This includes a 15-foot (4.6-meter) unloading area plus walking space at both ends of the vehicle. A four-horse gooseneck trailer drawn by a 19-foot pickup truck would need 78 feet (23.8 meters) for parking and loading. A 78-foot-long parking space covers most parking and loading needs. Forty-two-foot (12.8-meter) motorhomes pulling six-horse trailers with interior living quarters may need a space 110 feet (33.5 meters) long (figures 8–10 and 8–11). If these long trailers are common or expected in the facility, provide several longer spaces for them. If local riders commonly use two-horse trailers, provide some 55-foot- (16.8-meter-) long spaces for them.



Figure 8–10—Horse trailers come in many different sizes and configurations. Common slant-load gooseneck trailers range from about 26 to 49 feet long.



Figure 8–11—Some vehicles carry up to eight horses, contain living quarters, and include storage space.

flexibility, an open parking area is appropriate for a group camp or trailhead. Where possible, locate open parking areas in a large, sparsely vegetated area with a slope no steeper than 4 percent.

Riders want to park facing the exit as they arrive, orienting their vehicles for an easy departure. The parking area should be large enough for undefined parking spaces 28 feet by 78 feet (8.5 meters by 23.8 meters) and aisles that are 15 feet (4.6 meters) wide per lane. The generously sized parking area will allow many parking configurations. Designers may plan one parking configuration and riders may park in a very different way. Figure 8–12 illustrates the planned configuration for a group camp and how horse groups, such as 4-H clubs, often park in the allotted space. The impromptu arrangement opens the center area for the club’s activities.

A variation of the open parking area concept incorporates several small parking areas (figures 8–13 and 8–14). The small areas help break up the expanse of a large parking area and may be more attractive. In a group camp, having more than one parking area provides flexibility. A few different groups could use the site simultaneously or one large group could occupy all the parking areas.



Trail Talk

Spatially Challenged

Designers laying out the Blue Mountain Horse Trailhead near Missoula, MT, had very little space to provide rider, pedestrian, and bicyclist facilities. Local riders wanted parking areas that were 30 feet (9.1 meters) wide to accommodate stock tied to the sides of trailers. Doing so would have greatly reduced the number of equestrian parking spaces. To resolve the problem, planners chose 18-foot- (5.5-meter-) wide parking spaces and provided ample hitch rails nearby. For more information about this trailhead, see *Chapter 16—Learning From Others*.

Open Parking Areas

Some riders prefer a parking area that does not have defined parking spaces. This allows drivers to arrange vehicles in a manner that best suits their needs. When space is plentiful and riders want

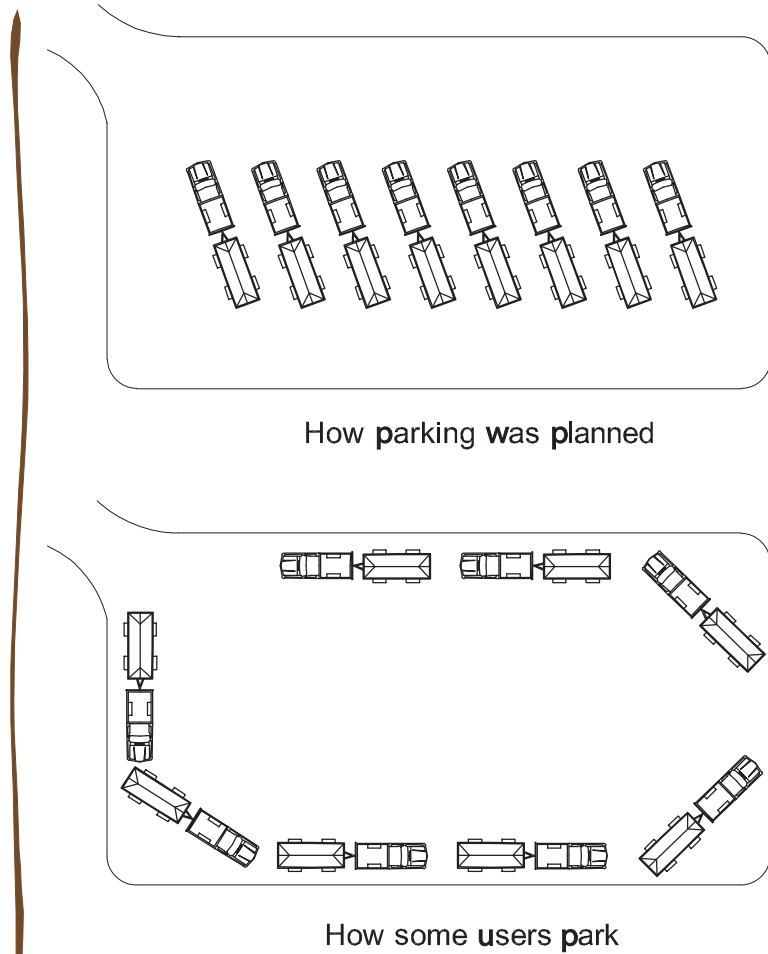
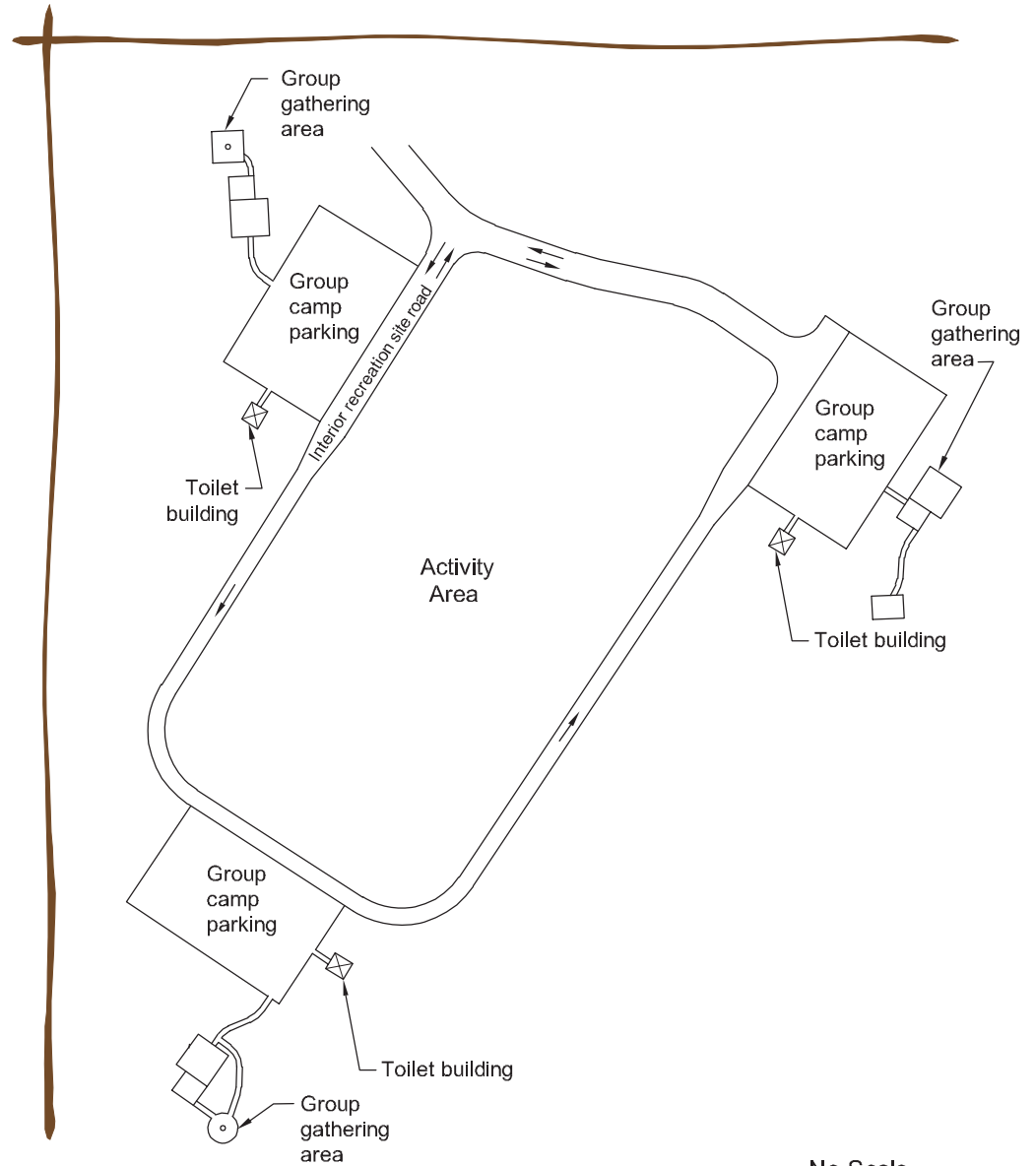
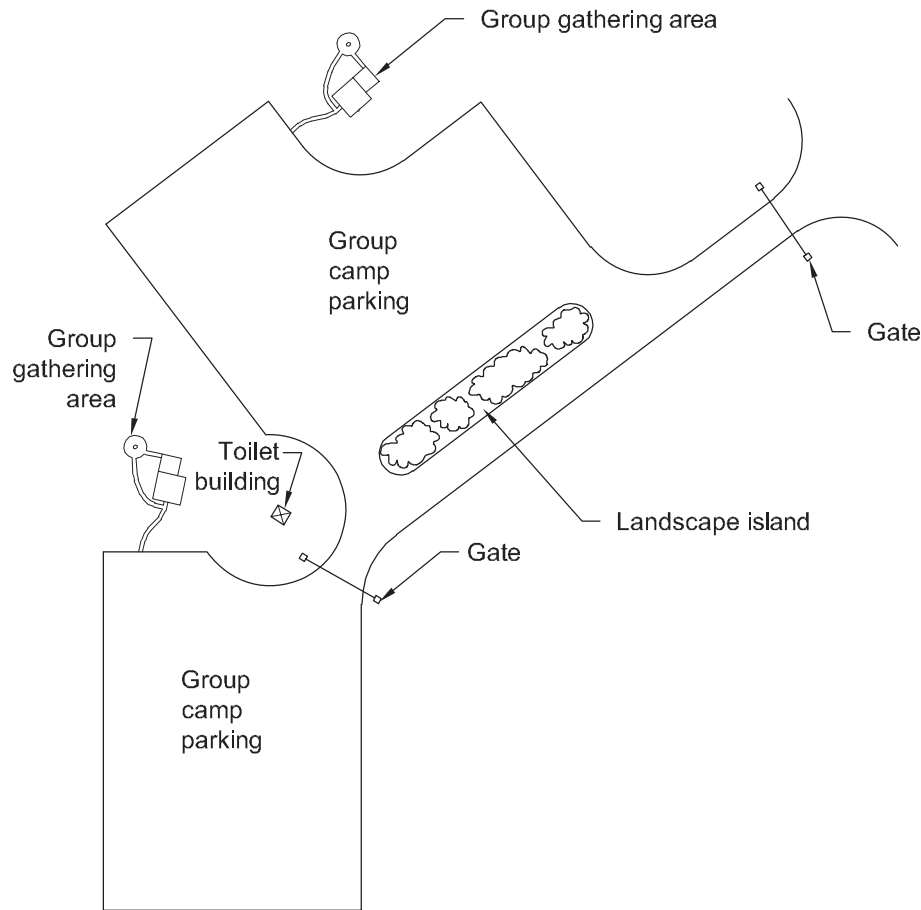


Figure 8-12—Designed parking compared to actual parking patterns.



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Figure 8-13—A recreation site for three small groups or one large group. An activity area is located in the center.



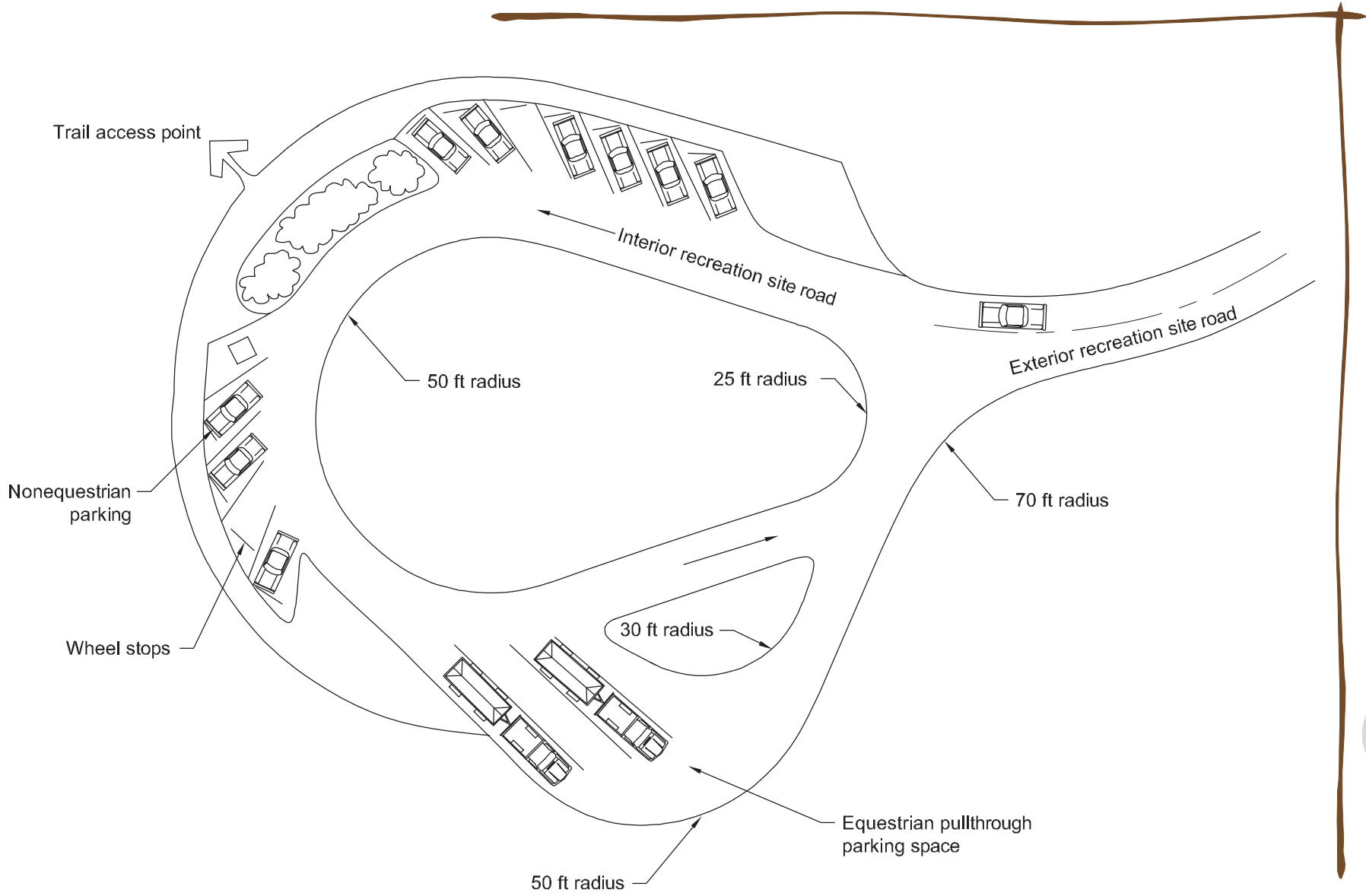
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Small Parking Areas

Figure 8–15 shows a parking concept appropriate for small trailheads. The circulation pattern includes a loop turnaround to prevent vehicles from becoming trapped when all parking spaces are full. Because the parking area is not paved, arrows cannot mark the direction of traffic flow. In the United States, designers can use a counter-clockwise traffic flow that takes advantage of the familiar right-hand driving pattern. Landscape islands guide vehicle traffic and determine parking orientation. Directional signs may be a helpful addition, along with wheel stops.



Figure 8–14—A group camp parking area that can be used by two small groups or one large group.



No Scale

Figure 8-15—Loop parking at a trailhead.



Parking Delineation

Because paved equestrian parking areas are not recommended, delineating the parking spaces becomes a challenge. Many agencies don't delineate parking spaces. Where delineation is necessary, striping is just one of several alternatives.



Trail Talk

Delineating With Concrete

In the Southwest, where plowing and grading are uncommon, some land management agencies use concrete delineators (figure 8–16). The delineators are durable enough to resist chipping or breaking when an animal steps on them. Because they are buried in the ground, they will be damaged if areas are graded. To reduce tripping, they are maintained flush with the road or parking surface (figure 8–17). When painted with white reflective traffic paint, the markers are easily visible.



Figure 8–16—Concrete markers are used to delineate unpaved parking spaces in some areas of the country.



Resource Roundup

Marking the Spot

In 2002, the San Dimas Technology and Development Center (SDTDC) conducted a search for ways to designate parking on unpaved and gravel parking areas. The ideal solution would reduce traffic and eliminate confusion and other parking problems. The study investigated wheel stops, striping, construction whiskers, and a soil stabilizer. *Designating Parking Areas on Unpaved Surfaces* describes the results of the study and is available at <http://www.fs.fed.us/eng/pubs/html/02231314/02231314.html>.

Existing Vegetation

If there is natural vegetation in a planned parking area, consider preserving it and turning the surrounding area into a landscape island (see figures 8–14 and 8–15). The vegetation visually breaks up the parking area, and the landscape island can guide motorized traffic and provide a spot for drainage basins. Where vegetation is sparse, preserve or plant trees and shrubs along parking area perimeters and in islands. The plantings relieve visual monotony, and the shade is invaluable in hot weather.

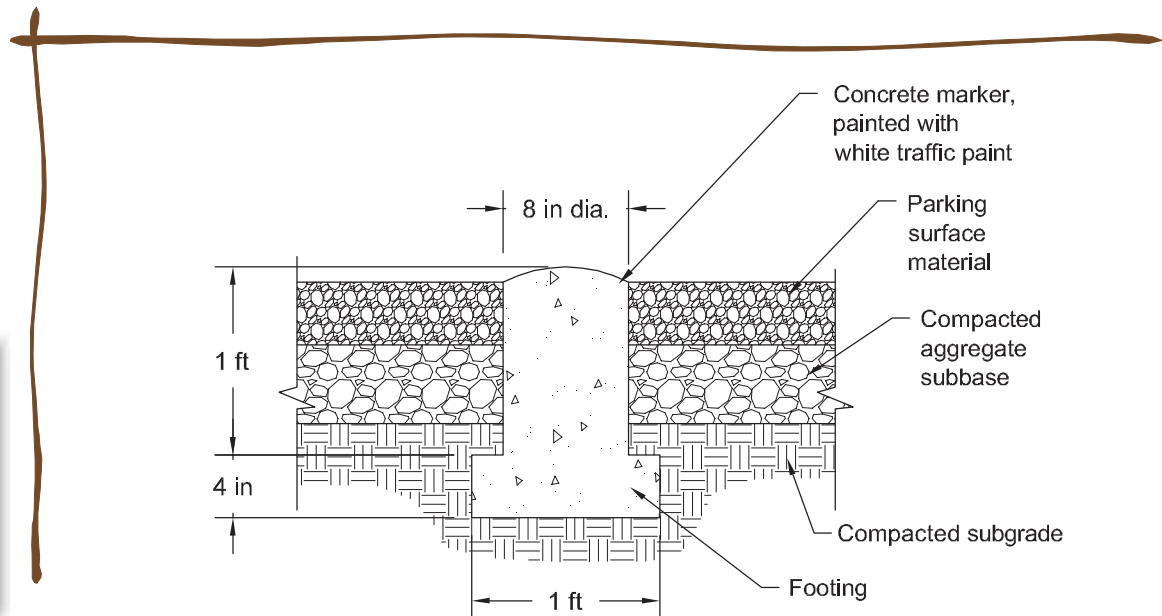


Figure 8–17—A concrete parking marker.



Road and Parking Area Surfaces

Equestrians frequently ride or stand on interior recreation site roads, in parking areas, and on parking pads. Many times these areas are paved with asphalt, chip seal, or concrete—surfaces that are not recommended for equestrian use. Pavement and stock don't mix well because the hard surface provides poor traction for metal horseshoes. Aggregate is the recommended surface for equestrian recreation areas,

because it is slip-resistant, doesn't allow water to pool, and is comfortable to stand or walk on.

Pavement can be used for exterior recreation site roads, which often receive more traffic than interior roads (figure 8-18). Major benefits to paving exterior roads include minimizing dust and reducing maintenance requirements. Because horses usually don't use exterior recreation site roads, pavement

there generally doesn't pose a hazard. If paved exterior roads lead to trail access points, construct an adjacent, unpaved trail for horses and mules.

At a trailhead intended for shared use, apply aggregate only in the section where riders unload and saddle stock before a ride. Pave the remaining nonequestrian sections of the parking area (figure 8-19). Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for more information regarding surfaces.

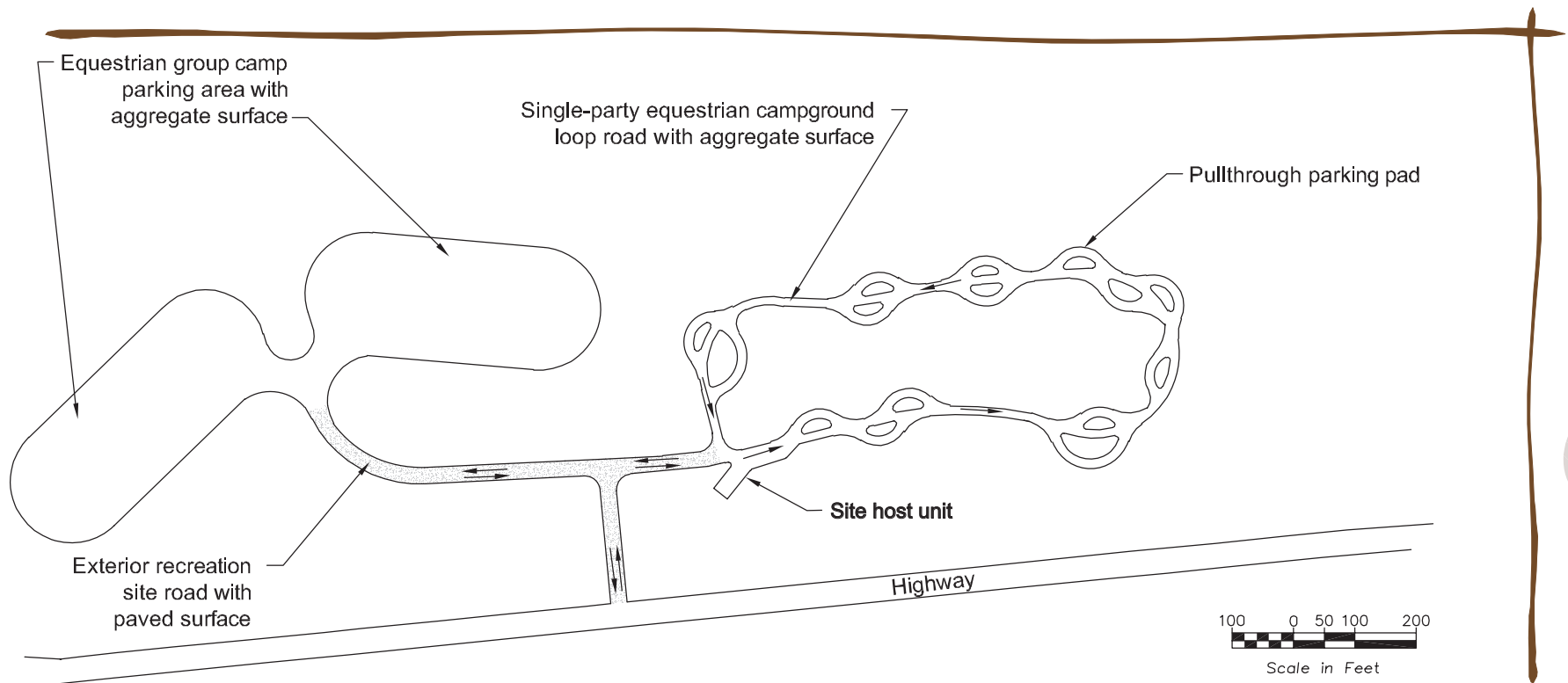
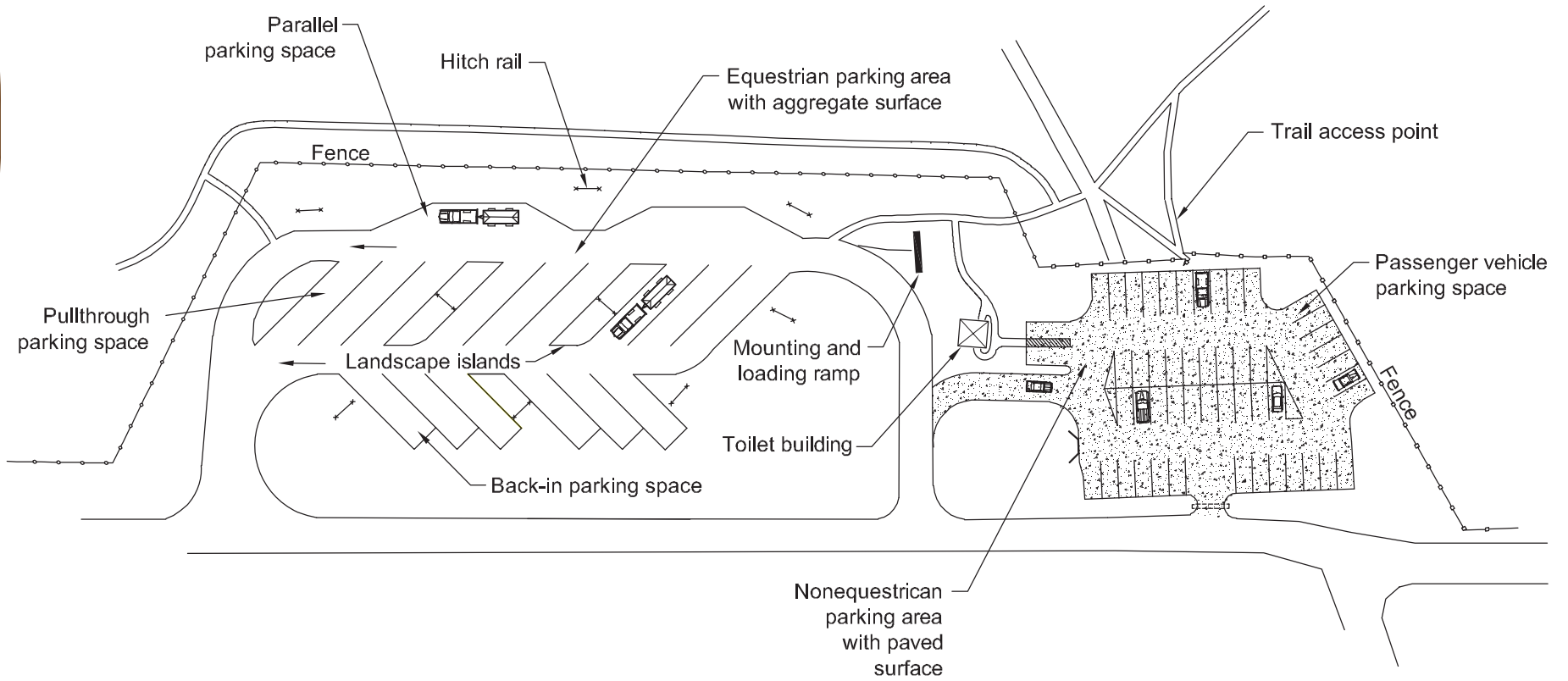


Figure 8-18—Pavement should not be used in equestrian areas. Paving the exterior recreation site road is an exception to this rule because stock seldom travel there.



No Scale

Figure 8-19—When user groups are separated, surface materials can match the needs of different groups. In this illustration, the equestrian parking area is surfaced with aggregate and the nonequestrian parking area is paved.



Traffic Control

Avoid placing barriers that restrict vehicles along the perimeters of site roads and parking areas that are traveled by stock. Barriers in these areas can be dangerous for stock and riders. Some stock may become nervous around barriers, such as wood bollards. This is especially true if the passageway between the bollards is constricted. Attempts to ride or lead a nervous animal through the barrier may produce a rodeo. While there are no completely horse-safe barriers, a wood or steel railing is suitable (figure 8–20). Make sure barriers have no sharp edges or other potential hazards. Large boulders appear more natural to a horse or mule and may be an alternative to bollards.

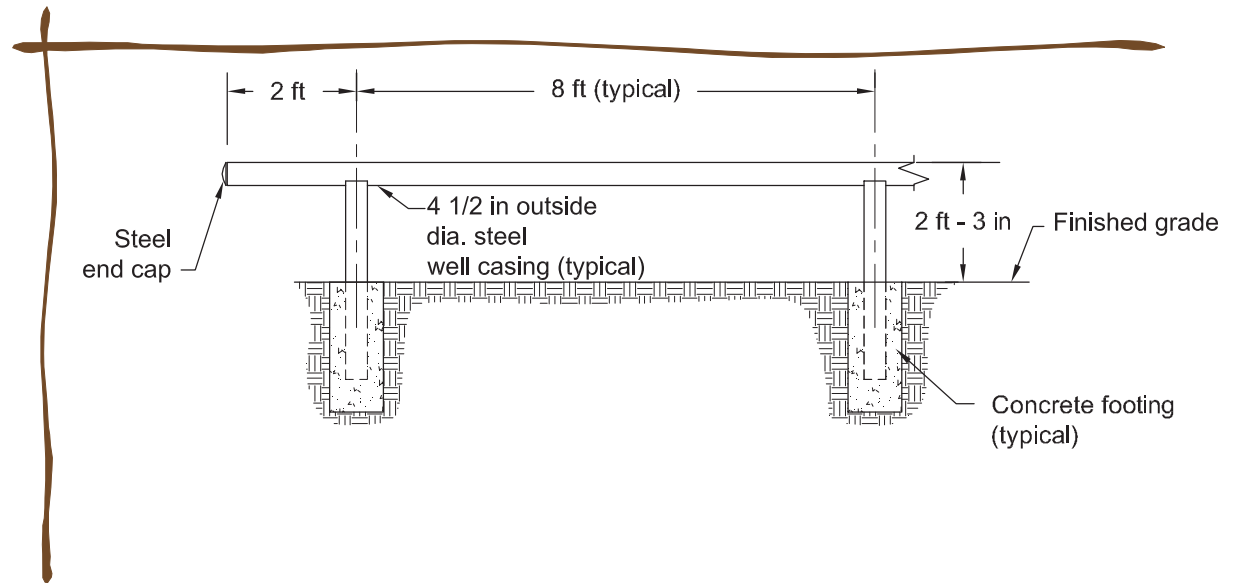


Figure 8–20—A horse-friendly steel barrier.



