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# Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds





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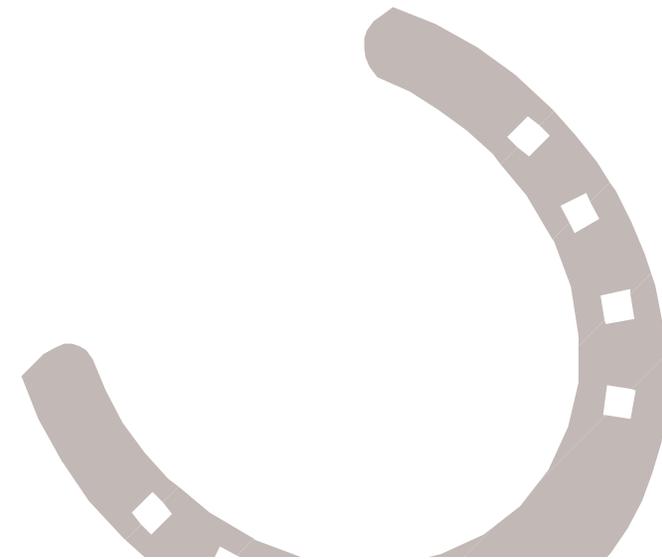
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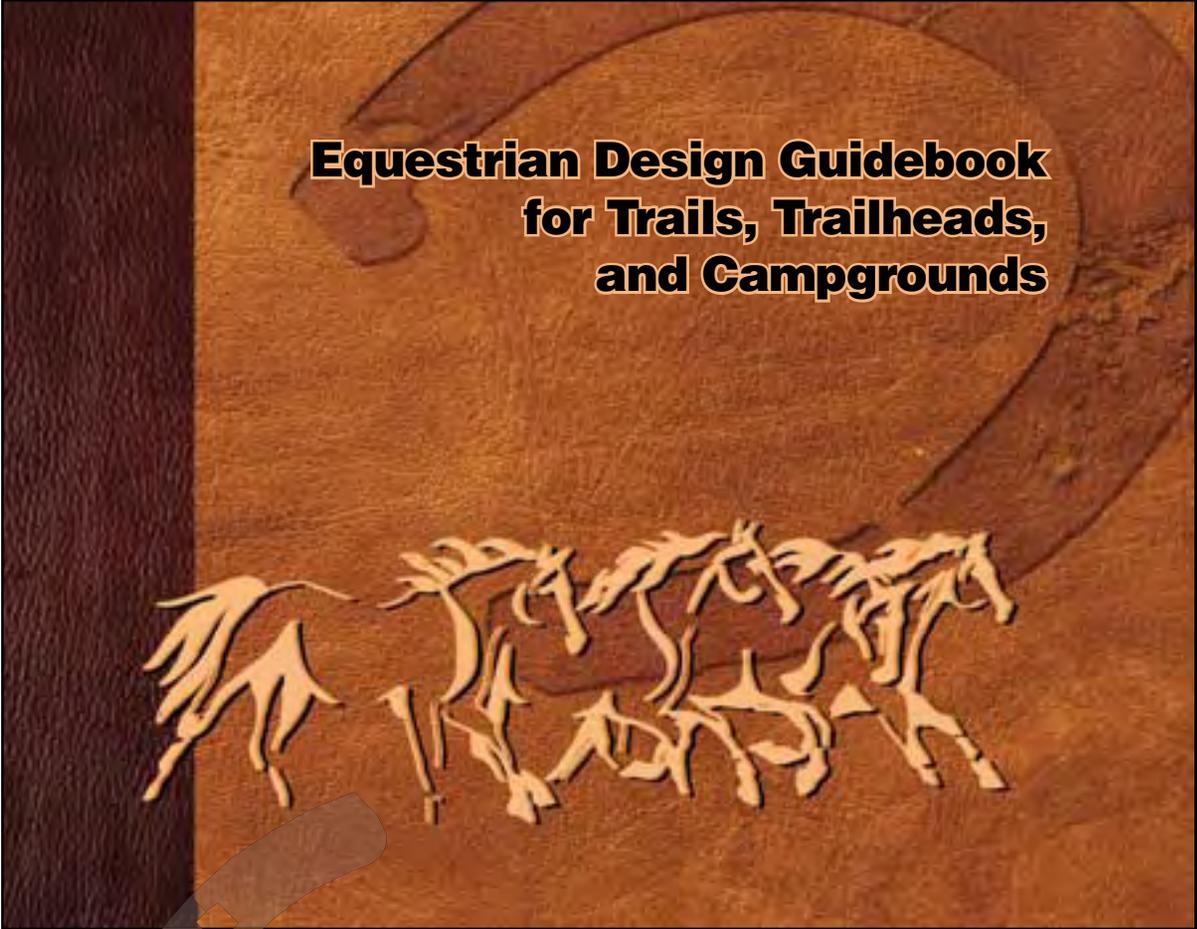
This guidebook provides information for developing trails, trailheads, and campgrounds that are sensitive to the needs of riders and their animals. The emphasis is on highly developed facilities and programs such as those in urban, rural, and some wildland areas. The information presented can be adapted for a variety of settings and levels of development, as well as jurisdictional requirements. Chapters include:

- ☆ Understanding Horses and Mules
- ☆ Planning Trail Systems
- ☆ Designing Horse Trails
- ☆ Designing Trail Elements
- ☆ Designing Trail Crossings and Structures
- ☆ Choosing Horse-Friendly Surface Materials
- ☆ Planning Recreation Sites
- ☆ Designing Roads and Parking Areas
- ☆ Designing Camp and Picnic Units
- ☆ Securing Horses and Mules
- ☆ Designing for Riders With Disabilities
- ☆ Providing Signs and Public Information
- ☆ Reducing Environmental and Health Concerns
- ☆ Considering Liability Issues
- ☆ Working With Funders and Volunteers
- ☆ Learning From Others

### Keywords:

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**Equestrian Design Guidebook  
for Trails, Trailheads,  
and Campgrounds**

**Jan Hancock**

*Hancock Resources LLC*

**Kim Jones Vander Hoek**

*Forest Service, Tonto National Forest*

**Sunni Bradshaw**

*Forest Service, Missoula Technology and  
Development Center*

**James D. Coffman**

*Coffman Studios*

**Jeffrey Engelmann**

*J2 Engineering and Environmental Design*

**USDA Forest Service  
Technology and Development Program  
Missoula, MT**

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 USDA Forest Service  
 Missoula Technology and Development Center  
 5785 Hwy. 10 West  
 Missoula, MT 59808  
 Phone: 406-329-3978  
 Fax: 406-329-3719  
 E-mail: [wo\\_mtdc\\_pubs@fs.fed.us](mailto:wo_mtdc_pubs@fs.fed.us)

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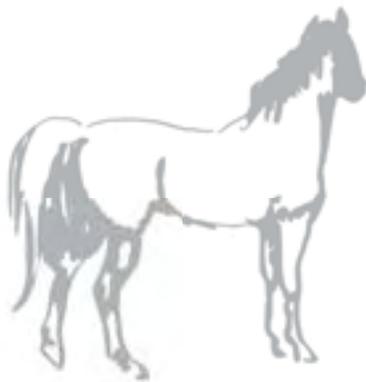


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- ☆ Mary Ann Davies—Mechanical engineer, U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center
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- ☆ Sara Lustgraaf—Visual information specialist (retired), U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center
- ☆ Heather Matusiak—Office automation assistant, U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center
- ☆ Shanna Robison—Office automation assistant, U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center
- ☆ Donna Sheehy—Transportation management engineer, U.S. Department of Agriculture Forest Service, Northern Region
- ☆ Kathleen Snodgrass—Project leader, U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center
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# Contents

**Introduction—Climbing Into the Saddle** ..... XI

**Chapter 1—Understanding Horses and Mules** ..... 1

- An Evolutionary Perspective ..... 1
- The Startle Factor ..... 2
- Physical Characteristics ..... 4
  - Size and Strength ..... 4
  - Hoofs ..... 6
  - Mouth and Teeth ..... 7
  - Basic Needs ..... 7
- Senses and Behavior ..... 8
  - Vision ..... 8
  - Hearing ..... 10
  - Smell ..... 11
  - Touch ..... 11
  - Curiosity ..... 11
  - The Herding Instinct ..... 11
  - Responses to Weather Conditions ..... 12

**Chapter 2—Planning Trail Systems** ..... 13

- Benefits of Trail System Planning ..... 13
- User Involvement in Trail Planning ..... 14
- Land Use and Regulatory Framework ..... 15
  - Federal, State, Regional, and Local Agency Environmental Requirements ..... 17
  - Federal Accessibility Requirements ..... 17
  - Smart Growth Plans ..... 17
  - General Plans ..... 18
  - Flood Control Plans ..... 18
  - Zoning Ordinances ..... 18
- Multijurisdictional Trail Planning ..... 18
- The Planning Process ..... 19
  - Phase 1—Initial Project Organization ..... 19
  - Phase 2—Inventory and Data Collection ..... 20
  - Phase 3—Analysis ..... 21
  - Phase 4—Conceptual Planning ..... 23
  - Phase 5—Plan Adoption ..... 24
  - Phase 6—Implementation ..... 24
- Trail System Operations and Maintenance Concerns ..... 24

**Chapter 3—Designing Horse Trails** ..... 27

- Trail Settings ..... 27
  - Wildland Settings ..... 27
  - Rural Settings ..... 28
  - Urban Settings ..... 28
- Appropriate Levels of Development ..... 29
- Riders' Needs ..... 29
- Conflicts ..... 30
- Trail Hierarchies ..... 31
- Trail Scenarios ..... 35
- Equestrian-Only Trails ..... 37
- Shared-Use Trails ..... 38
  - Shared-Use, Single-Tread Trails ..... 40
    - Shared-Use, Separate-Tread Trails ..... 41
  - Trail User Separation ..... 42
    - Multiple Treads Separated by Distance ..... 42
    - Multiple Treads Separated by Barriers ..... 45
- Trail Barriers, Walls, and Bollards ..... 46
  - Barriers and Walls ..... 46
  - Bollards ..... 48
- Trails Adjacent to Roads ..... 49
- Alternative Shared Corridors ..... 50

**Chapter 4—Designing Trail Elements** ..... 51

- Trail Terms ..... 51
- Trail Length ..... 52
- Trail Sight Distance ..... 54
- Trail Clearance ..... 56
  - Horizontal Clearance ..... 56
  - Vertical Clearance ..... 57
  - Vegetation Clearance ..... 57
- Trail Tread ..... 57
  - Tread Width ..... 57
  - Tread Surface ..... 60
  - Tread Obstacles ..... 60
- Alignment ..... 60
  - Grade ..... 60
  - Steps ..... 62
  - Outslopes ..... 63
    - Grades, Outslopes, and Drift ..... 63
    - Slopes With Hard Surfaces ..... 63
- Trailbed Construction ..... 63
  - Trail Drainage ..... 64



Crowned Tread.....	65	Below-Grade Clearance .....	92
Waterbars .....	65	Enclosed-Area Lighting .....	93
Grade Reversals, Knicks, and Rolling Grade Dips .....	66	Culverts That Carry Water .....	93
Culverts .....	66		
Grates .....	67	<b>Chapter 6—Choosing Horse-Friendly Surface Materials .....</b>	<b>95</b>
Curves, Turns, Passing Areas, and Switchbacks .....	68	Surface Options .....	95
Curves and Turns.....	68	Natural Materials .....	98
Passing Areas.....	68	Native Soils .....	98
Switchbacks .....	68	Wood Chips .....	98
Climbing Turns .....	70	Aggregate and Similar Surface Materials .....	99
<b>Chapter 5—Designing Trail Crossings and Structures .....</b>	<b>71</b>	Gravel .....	100
At-Grade Road Crossings .....	71	Crushed Gravel and Crushed Stone.....	100
Crossing Locations .....	71	Sand .....	101
Crossing Sight Triangles and Visibility .....	72	Decomposed Granite .....	101
Waiting Areas at Crossings .....	72	Cinders .....	101
Road Signs and Traffic Signals .....	74	Additives .....	101
Road Intersections .....	74	Pavement .....	101
Railway Corridors and Crossings .....	78	Asphalt .....	102
Water and Wet Area Crossings .....	80	Asphalt With Chip Seal .....	102
Shallow Stream Fords .....	80	Rough-Textured Concrete .....	102
Wet Area Trail Structures .....	82	Concrete With Washed Surface .....	102
Tumpikes .....	82	Pavers .....	103
Tumpikes Without Ditches .....	83	Specialty Products .....	103
Puncheon .....	83	Geosynthetic Materials .....	103
Boardwalks .....	83	Geotextiles .....	104
Retaining Curbs .....	83	Cellular Confinement .....	104
Above-Grade Crossings .....	84	<b>Chapter 7—Planning Recreation Sites .....</b>	<b>105</b>
Bridge and Overpass Design .....	84	User Needs .....	105
Bridge Site Selection .....	85	Site Conflicts .....	105
Bridge Grade .....	85	Appropriate Levels of Development .....	109
Bridge Width .....	86	Site Selection .....	109
Bridge Load Limits .....	86	Vegetation and Landscaping .....	111
Bridge and Overpass Structural Materials .....	86	Toxic Vegetation .....	111
Bridge and Overpass Surface Materials .....	87	Noxious Weeds .....	111
Bridge and Overpass Sides and Railings .....	88	Amenities and Facilities .....	112
Bridge Clearance .....	89	Trail Access Points .....	116
Bridge Sight Distance .....	90	Utilities .....	116
Trails on Bridges and Overpasses With Traffic .....	90	Storm Drainage Systems .....	116
Specialty Bridges .....	91	Water Sources .....	117
Below-Grade Crossings—Culverts and Underpasses .....	91	Water Hydrants and Troughs .....	117
Below-Grade Approaches .....	92	Accessible Hydrants and Handpumps .....	118
Below-Grade Tread Surfaces .....	92	Water Troughs .....	118



Wash Racks .....	121	Horse Areas .....	168
Drainage Overflow .....	122	Camp Units .....	168
Wet-Area Wearing Surfaces .....	122	Sizes of Camp Units .....	170
Power and Lighting .....	123	Single-Party Camp Units .....	170
Structures .....	124	Double-Party Camp Units .....	172
Toilet Buildings .....	125	Several-Party Camp Units .....	174
Shower Buildings .....	126	Group Camps .....	175
Shelters .....	126	Picnic Units .....	177
Structure Locations .....	127	Equestrian Site Furnishings .....	178
Manure Disposal .....	128	Picnic and Serving Tables .....	178
Mounting Blocks and Ramps .....	129	Fire Rings and Grills .....	179
Mounting Blocks .....	129	Lantern Hangers .....	179
Mounting and Loading Ramps .....	132	<b>Chapter 10—Securing Horses and Mules</b> .....	181
<b>Chapter 8—Designing Roads and Parking Areas</b> .....	139	Importance of Perimeter Fences .....	181
Road System Design .....	139	Fence Materials and Construction .....	181
Recreation Site Entrances .....	139	Post-and-Rail Construction .....	182
Design Vehicles .....	139	Steel Post-and-Rail Fences .....	183
Road Alignment .....	142	Wood Post-and-Rail Fences .....	183
Road Grade .....	145	Vinyl Post-and-Rail Fences .....	184
Road Profile .....	145	Premanufactured Tubular Panels .....	184
Road Drainage .....	145	Wire Fences .....	185
Parking Area Design .....	146	Wire Mesh Fences .....	186
Parking Area Grade .....	148	Cattle Guards, Gates, and Latches .....	187
Parking Area Layout .....	148	Cattle Guards .....	187
Staging Areas .....	148	Road Gates .....	188
Open Parking Areas .....	150	Stepover Gates .....	190
Small Parking Areas .....	152	Trail and Corral Gates .....	192
Parking Delineation .....	154	Gates for Arenas and Round Pens .....	192
Existing Vegetation .....	154	Gate Designs .....	192
Road and Parking Area Surfaces .....	155	Gate Materials .....	193
Traffic Control .....	157	Gate Safety .....	193
<b>Chapter 9—Designing Camp and Picnic Units</b> .....	159	Accessible Gates .....	194
Camp Parking Pads .....	159	Gate Latches .....	198
Placement of Camp Parking Pads .....	162	Accessible Latches .....	200
Grades for Camp Parking Pads .....	164	Tethering Devices and Enclosures .....	200
Living and Horse Areas .....	164	Hitch Rails .....	201
Sun and Wind .....	164	Hitching Posts .....	203
Site Vegetation .....	165	Trailer Ties .....	204
Slopes .....	165	Highline Ties .....	204
Distance Between Horse and Living Areas .....	165	Corrals .....	207
Surfaces .....	166	Related Facilities—Arenas and Round Pens .....	210
		Size and Location .....	210



Grade .....	210	Dangerous Creatures .....	241
Dust Prevention .....	211	Animal Diseases .....	242
Lighting .....	211	Manager and User Awareness .....	242
<b>Chapter 11—Designing for Riders With Disabilities</b> .....	213	<b>Chapter 14—Considering Liability Issues</b> .....	243
Site-Specific Accessibility .....	213	Equine Liability Acts and Recreational Use Statutes .....	243
Users .....	213	Risk Management Strategies .....	244
Funding Sources .....	213	Competitive and Group Trail Events .....	245
Pathway and Trail Designs .....	214	Private Insurance .....	245
Universal Design .....	215	<b>Chapter 15—Working With Funders and Volunteers</b> .....	247
Accessible Shared Trails .....	216	Funding and Partnership Opportunities .....	247
Accessible Equestrian Features .....	217	Funding Proposals .....	247
Therapeutic Riding Programs .....	217	Creative Fundraising Ideas .....	248
<b>Chapter 12—Providing Signs and Public Information</b> .....	219	Volunteer Opportunities .....	249
Sign Plans .....	219	The Three Rs of Volunteer Stewardship .....	249
Sign Design Factors .....	221	Recruit .....	249
Sign Types .....	221	Retain .....	249
Regulatory Signs .....	221	Reward .....	250
Warning Signs .....	222	<b>Chapter 16—Learning From Others</b> .....	251
Guide Signs .....	223	Trail System Master Plans .....	251
Road Guide Signs .....	223	Equestrian Trail Network Study—Pinellas Park, FL .....	251
Trail Guide Signs .....	225	Trails Master Plan—Scottsdale, AZ .....	252
Trail Sign Placement .....	226	West Valley Multimodal Transportation Corridor Master Plan—Phoenix, AZ .....	253
Shared-Route Signs .....	226	Trailheads and Campgrounds .....	253
Identification Signs .....	227	Equestrian Trailheads and Campgrounds With Low to Moderate Development ..	253
Visitor Information Stations .....	227	Horse Creek Campground—Siuslaw National Forest, Florence, OR .....	254
Visitor Information Stations at Recreation Sites .....	229	Picketpost Trailhead—Tonto National Forest, Superior, AZ .....	256
Visitor Information Stations at Trail Access Points .....	230	Blue Mountain Horse Trailhead—Lolo National Forest, Missoula, MT .....	258
Interpretive Signs .....	233	Houston Mesa Horse Camp—Tonto National Forest, Payson, AZ .....	261
Exhibit Structures .....	233	Waterfall Glen Forest Preserve—Forest Preserve District of DuPage County, IL ..	264
Viewing Areas .....	234	Equestrian Trailheads and Campgrounds With High Development .....	267
Accessibility Information .....	234	Frazier Recreation Site—Tonto National Forest, Roosevelt, AZ .....	267
Riders, Signs, and Safety .....	235	Stonegate Equestrian Park—Scottsdale, AZ .....	270
<b>Chapter 13—Reducing Environmental and Health Concerns</b> .....	237	Horseshoe Park and Equestrian Centre—Queen Creek, AZ .....	271
Water Quality .....	237	WestWorld and WestWorld Trailhead—Scottsdale, AZ .....	273
Horse Manure .....	238	<b>References</b> .....	277
Noxious and Invasive Weeds .....	239	<b>Appendix A—Acronyms</b> .....	283
Soil Erosion and Root Damage .....	240		
Vegetation and Facility Damage .....	240		
Toxic Vegetation .....	241		



**Appendix B—Trail Libraries, Trail Organizations, and Funding Resources** . . . . . 284

    Trail Libraries . . . . . 284

    Trail Organizations . . . . . 284

    Funding and Partnership Resources . . . . . 286

**Appendix C—Helpful Resources** . . . . . 287

    Accessibility . . . . . 287

    Animal Confinement . . . . . 287

    Case Studies . . . . . 288

    Engineering Standards and Building Codes . . . . . 288

    Fords, Bridges, and Overpasses . . . . . 288

    Laws, Liability, and Safety . . . . . 288

    Low Impacts . . . . . 289

    Parking, Roads, and Intersections . . . . . 289

    Planning and Design . . . . . 289

    Rails-to-Trails . . . . . 290

    Railways . . . . . 290

    Signs . . . . . 290

    Toilet and Shower Buildings . . . . . 290

    Trail Construction . . . . . 290

    Trail Management . . . . . 291

    Trail Terms . . . . . 291

    Weeds and Vegetation . . . . . 291

**Appendix D—Trail Proposal and Evaluation Process:**

**Open Space and Trails Program (Pitkin County, CO)** . . . . . 292

**Appendix E—Sample Evaluation Criteria for Trail Corridor Suitability Analysis** . . . . . 297

**Appendix F—Summary of Accessibility Legislation, Standards, and Guidelines** . . . . . 299

**Appendix G—Sample Requirements for Weed-Free Feed (BLM)** . . . . . 301

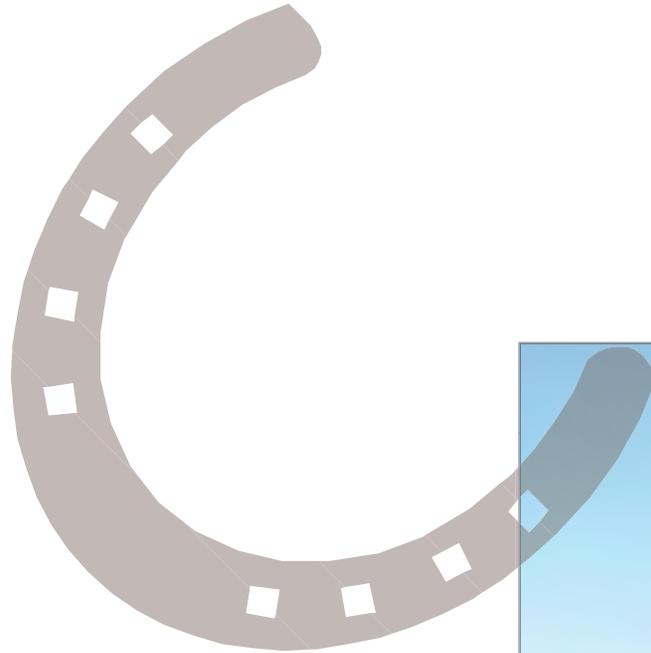
**Appendix H—Sample Requirements for Weed-Free Feed (Forest Service)** . . . . . 302

**Appendix I—Sample Equine Liability Act (New Mexico)** . . . . . 303

**Appendix J—Sample Recreational Use Statute (Kentucky)** . . . . . 305

**Appendix K—English and Metric Conversions** . . . . . 307







## Introduction— Climbing Into the Saddle

Why write another book on planning and designing trails, trailheads, and campgrounds? The answer is simple. Very few of the references now available address the needs of equestrians. This guidebook addresses their needs. It is written with a specific audience in mind—*planners, architects, engineers, landscape architects, land managers, equestrian advocates, and private developers who want to create successful recreation opportunities for riders.* The emphasis is on highly developed recreation facilities and programs, such as those in urban, rural, and some wildland areas.

This guidebook provides practical guidelines for developing recreation environments that are sensitive to the needs of riders and their stock. To keep the size and scope of this guidebook manageable, the focus is limited to equestrian elements—such as corrals, tread width, horse-friendly surfaces, and so forth—and a few closely related subjects. The information presented can be adapted to a variety of settings and levels of development, as well as to different jurisdictions. In many cases, the expertise of specialists—for example, engineers, landscape architects, and scientists—is required. Planners

and designers should consult other sources for basic planning and design criteria, including agency-specific guidelines, legal requirements, engineering and architectural standards, scientific expertise, and so forth. Consulting with area riders is an essential part of the planning process. Sound planning and design judgment are the keys to choosing the most appropriate elements, given local conditions. This guidebook is intended as a practical guide for trail work, not a policy manual—however, the authors believe the information is consistent with current U.S. Department of Agriculture (USDA) Forest Service policies and direction.

Useful resources, references, examples, and other points of view appear in sidebars that accompany the text. Sidebars include:

- ☆ *Lingo Lasso*—Useful terms
- ☆ *Resource Roundup*—Useful print and Web resources
- ☆ *Trail Talk*—Other points of view
- ☆ *Horse Sense*—Useful information not included in the text

Web site addresses given in the sidebars also are listed in *Appendix C—Helpful Resources*. Numerous drawings, tables, photographs, and examples supplement the text. The figures are not construction drawings, but can serve as guidelines that can be modified to suit local conditions. Both English and metric measures are given where applicable.



### Lingo Lasso

#### Why Equestrian?

Terms used to describe people who ride horses and the facilities they use vary around the country. In some circles, *equestrian* means a person who rides a horse or mule. Equestrian also can describe anything related to horses and mules, such as an *equestrian trail*. Some readers prefer simple expressions, for example, rider and horse trail. In an effort to include all readers, this guide uses all these terms as they seem appropriate.

For clarity, drawings and tables use English measurements only. For assistance with metric conversions, refer to *Appendix K—English and Metric Conversions*.

The authors attempted to present material applicable to many areas of the country and to include information from a variety of agencies and jurisdictions. The text presents many examples and concepts used by the Forest Service, which has a long history of planning recreation trails and facilities. Many of the concepts developed for national forests are useful models for other agencies. Because Arizona is home to several of the authors, readers may detect a southwestern influence in some discussions. Planners and designers are encouraged to adapt the information as necessary to fit local conditions.



Readers should review *Chapter 1—Understanding Horses and Mules* before turning to areas of specific interest. Chapter 1 is a horse and mule primer suitable for planners and designers who need to understand the needs and behavior of trail stock. The chapter also provides an overview of basic design considerations, such as animal size.

Although the *Equestrian Design Guidebook for Trails, Trailheads and Campgrounds* was printed in black and white to keep costs down, electronic color versions of the guidebook are available at

☆ <http://www.fhwa.dot.gov/environment/retrails/publications.htm>

☆ <http://www.fs.fed.us/t-d/pubs/htmlpubs/html/07232816>

The t-d site requires a username and password. (Username: t-d, Password: t-d)

The HTML files on these Web sites feature live links for the numerous references and helpful resources in this guidebook. High and low resolution pdf (Acrobat) files—the best choice for printing—also are provided.



Resource Roundup

What's That?

For help with terms and acronyms, visit these online sources:

☆ Glossary of horse terms (Gaited Horses 1998–2003) at <http://www.gaitedhorses.net/Articles/HorseGlossary.html>

☆ Glossary of planning and trail terms from *Designing Sidewalks and Trails for Access* (Beneficial Designs 1999) at <http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks2ag.htm>

☆ Glossary of trail terms (National Trails Training Partnership 2003) at <http://www.americantrails.org/glossary.html>

☆ Trail acronyms listing (Rails-to-Trails Conservancy 2007) at <http://www.railtrails.org/whatwedo/railtrailinfo/resources/acronyms.html>

☆ For assistance with acronyms used in this guidebook, refer to *Appendix A—Acronyms*.





## Chapter 1— Understanding Horses and Mules

In addition to the usual planning considerations, equestrian recreation trails and facilities require attention to the behavior and physical characteristics of horses and mules. The success of horse trails and recreation sites depends on how well planners and designers understand these animals.

### An Evolutionary Perspective

Essentially, horses and their kin are prey animals. They developed behavior patterns and physical characteristics over millions of years spent in wide open spaces. Flight is their primary defense. They use their strength, stamina, agility, and speed to escape predators, notably large cats—such as cougars—and wild dogs—such as dingos. Horses and mules constantly monitor their surroundings and are always aware of available escape routes. They may become nervous when routes are narrow or blocked. Horses and mules also prefer to see what they hear or smell.



### Horses and Their Kin

What is the difference between a *horse* and a *mule* (figure 1-1)? A mule is half horse and half donkey. When a female horse—a *mare*—mates with a male donkey—a *jack*—the resulting offspring is a mule. Mules are sterile and are generally unable to reproduce. Their adult size depends on the breeds of their parents. A rarely seen variation is a *hinny*—the offspring of a male horse and a female donkey.



Figure 1-1—The mule on the left and the horse on the right are closely related. The mule is a unique animal with a blend of characteristics inherited from its horse mother and donkey father.

### Lingo Lasso

What is the difference between a *donkey* and a *burro*? Burro is Spanish for donkey. Many people in the Southwest use the term to refer to feral donkeys on public lands. Burros (figure 1-2) are usually smaller than horses and mules. When this guide refers to horses, stock, or trail animals, it includes mules and donkeys as well.



Figure 1-2—Burros—also called donkeys—generally are smaller than horses and mules. These two are hard-working members of a trail crew.



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### The Startle Factor

What frightens horses and mules is not always obvious. Anything that moves suddenly or makes an unexpected noise can rouse an animal's survival instincts and prime it to bolt. This natural reaction—often referred to as a startle reflex—is the result of remarkably acute senses.



#### Lingo Lasso

##### Startling News

A horse or mule can be said to *startle*, to *shy*, to *spook*, or to be *skittish*. The terms have similar meanings—a horse is instinctively on alert, assessing the situation for danger. Horses and mules have much faster reflexes than humans and other domesticated animals (Miller 1999). When a horse or mule startles, its response varies according to the stimulus and the animal's personality.

*Startle* is a generic description for any aroused behavior. *Shy* and *spook* are often used interchangeably with *startle*, but they are not exactly the same. An animal that shies moves swiftly away from the disturbance—sometimes quickly enough to unseat the rider. *Spook* is a colloquial term for frighten. A *skittish* horse is one that is nervous or easily alarmed.

Horses and mules have excellent vision, hearing, and tactile senses. They are even capable of feeling vibrations through their hoofs, which often alert them to others long before the rider becomes aware. Horses and mules need a comfortable operating space. When they can see something suspicious from afar, they can more easily evaluate the danger and react accordingly. There is a fine line between what is comfortable for horses and mules and what seems dangerous.

In addition to confined spaces and predators, things that can startle a horse or mule include:

- ☆ Loud or unexpected noises—Buzzing model airplanes, exploding firecrackers, batting practice, or a falling tree
- ☆ Quick or unexpected movements—Fast-moving bicycles, inquisitive children, running animals, or birds rustling in the underbrush
- ☆ Things in unusual combinations—Hikers with large backpacks or vehicles with strange loads
- ☆ Highly contrasting or reflective surfaces—A light-colored tread near dark soil, freshly cut logs, black or white rocks, or a manmade object in a natural setting
- ☆ Unfamiliar situations—Activity at a golf driving range or a train nearby
- ☆ Wild or unfamiliar domestic animals—Mountain lions, moose, emus, pigs, or llamas (figure 1-3)
- ☆ Narrow or constricted spaces—Bridges, gates, or tight passages
- ☆ Unexpected trail obstacles—Litter, fallen trees, or boulders



Figure 1-3—Anything that appears suddenly, makes an unexpected noise, or is unfamiliar engages a horse's survival instincts. On the trail, horses and mules are particularly wary of llamas, hikers with bulky backpacks, and bicycles.



#### Equine View

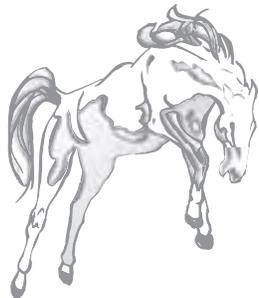
#### Trail Talk

*Designing Shared-use Trails to Include Equestrians* (O'Dell 2004) offers the following interpretations of scary things from a trail animal's perspective:

- ☆ Fishing rods look suspiciously like buggy whips.
- ☆ The ticking of bicycle gears sounds like an electric fence charger.
- ☆ Boisterous dogs look like wolves.
- ☆ People carrying canoes overhead may be horse-eating monsters!



So, what happens when horses and mules are startled? They have a range of responses, from remaining calm to becoming severely frightened. The more conditioned the animal is to uncomfortable situations, the more likely its response will be subdued. When something makes it nervous, an animal may dance around, inadvertently step on things, or balk. Horses or mules that are severely unnerved may run, jump, spin, or do a creative combination of all these things. When horses and mules feel the need to protect themselves, they may kick, bite, or strike. Experienced riders can hold a well-trained animal in check under most circumstances. There is a point, though, where a stimulus becomes so great that even the best conditioning will not override the animal's innate fight-or-flight instincts.



### Trail Manners

#### Trail Talk

Trail etiquette varies in different parts of the country and in different situations. According to IMBA, the International Mountain Bicycling Association (2007), "All animals are startled by unannounced approach, a sudden movement, or loud noise. This can be dangerous for you, others, and the animals. Give animals extra room and time to adjust to you. When passing horses always use special care and follow directions from the horseback riders (ask if uncertain). Running cattle and disturbing wildlife is a serious offense. Leave gates as you found them, or as marked."

Horses and mules are often uncomfortable around moving bicycles and may startle if they spot a bicyclist nearby. It is a good idea for bicyclists to make sure the stock have seen them from a distance. Hiding is not a good strategy, as the animal will probably sense the presence of something unknown and become agitated.

Trail stock—especially mules—have highly developed memories for pleasure, pain, fear, people, and places. Many trail animals recognize a previously visited location or trail route (figure 1–4). Once a horse or mule has had a particularly unpleasant or painful experience, the animal will try to avoid that location, condition, or object forever. Recreationists in many areas minimize potential conflicts by practicing trail etiquette that favors needs of horses and mules. *Chapter 12—Providing Signs and Public Information* lists ways to communicate a trail animal's needs to other trail users.



Figure 1–4—Horses and mules have excellent memories and can easily retrace routes they have traveled in the past. They avoid areas they associate with unpleasant experiences.



## Physical Characteristics

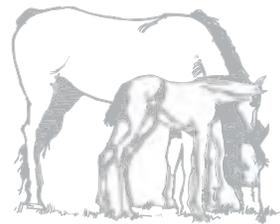
On nonmotorized recreation trails, the heaviest, widest, and tallest recreationists are riders on their mounts. Not only do trail designers need to take the dimensions of mounts and their riders into consideration, they have to provide for the needs, abilities, and heightened sensitivities of horses and mules.

## Size and Strength

Horses and mules come in all different sizes. For example, quarterhorses, used extensively in the American West, are generally shorter than thoroughbreds, commonly used in other areas. A horse or mule's height is measured in *hands*—or 4-inch (102-millimeter) increments. Measurements start at the bottom of the front hoof and end at the *withers*—the highest point on an animal's shoulder near its mane. The saddle rests just behind the withers, in a slight depression on the animal's back.

The size of horses and mules depends on their breed and age. Miniature breeds are about the size of a large dog. Small horses, such as ponies, are frequently about 14 and one-half hands—also referred to as 14.2 hands—or about 58 inches (1,473 millimeters) tall. Draft horses are often about 19 hands—76 inches (1,930 millimeters) tall. Many trail stock are about 15 to 16 hands—60 to 64 inches (1,524 to 1,626 millimeters) tall.

Trail stock usually weigh between 800 to 1,500 pounds (454 to 680 kilograms). They have exceptionally strong muscles that help them maintain their balance and allow them to carry heavy loads for long distances. The rule of thumb is that healthy, well-conditioned horses and mules can carry as much as 20 percent of their body weight.



## Horses by Design

### Horse Sense

Design measurements give recreation designers some guidance when they are designing and constructing recreation facilities and amenities. The American Institute of Architects (2000) considers a design horse as 16 hands—64 inches (1,626 millimeters) at the withers (figure 1–5), 92 inches (2,337 millimeters) from tail to nose, and 81 inches (2,057 millimeters) at the top of the ears. When a rider is seated in the saddle, the top of the rider's head is about 93 inches (2,362 millimeters) above the ground. Viewed from behind, the rider and horse span about 4 feet (1.2 meters) at the widest point. These measurements don't include maneuvering space.

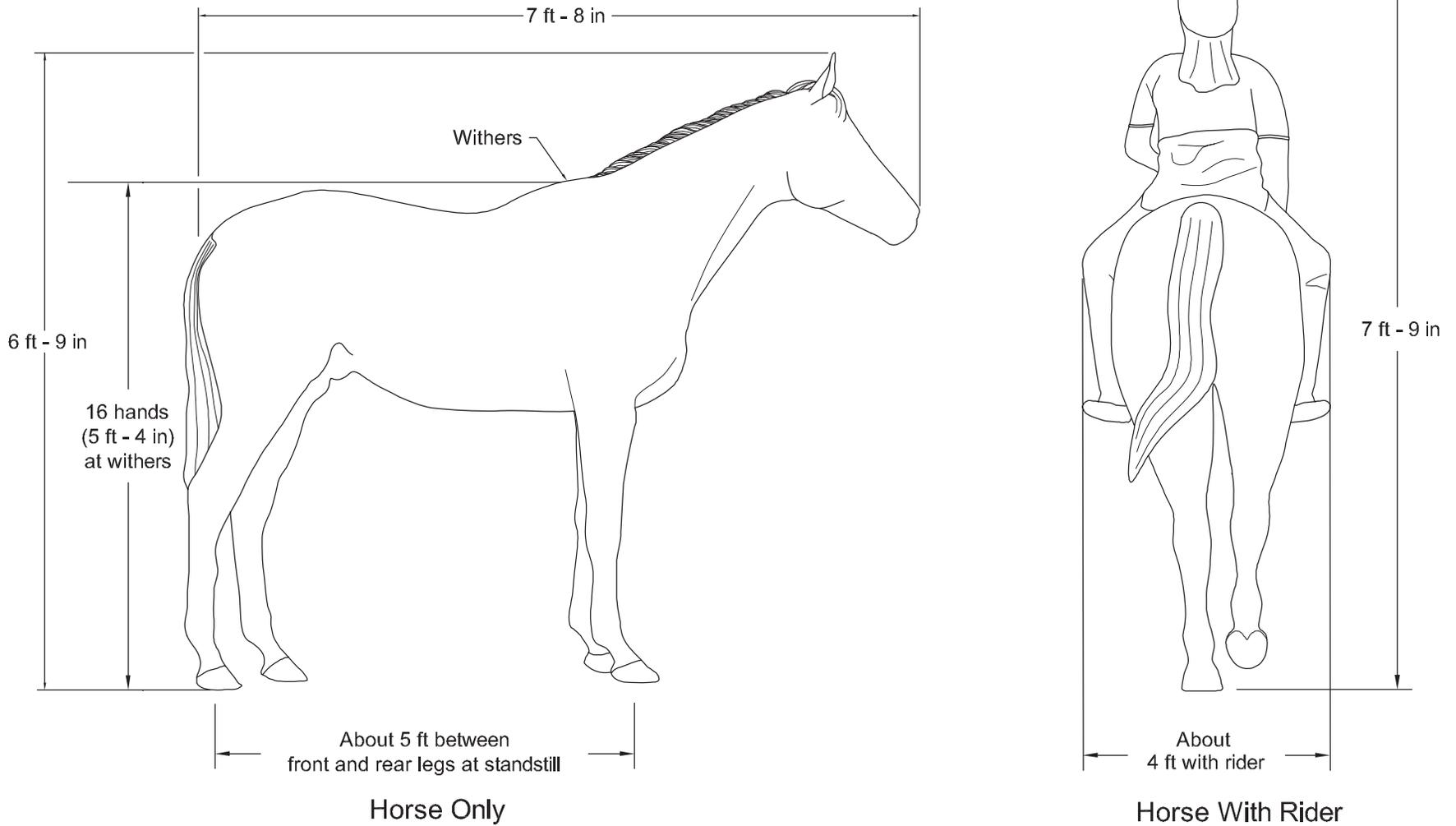


Figure 1-5—Industry standard design dimensions for a horse and rider from *Architectural Graphics Standards*. Standard design dimensions are representative dimensions for planning purposes. —Courtesy of Wiley Publishing. The original figure was edited for clarity.



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### Hoofs

With their well-adapted hoofs, horses and mules are sure-footed in many environments. Hoofs have a hard material outside—the *hoof wall*—and a triangular-shaped area of living tissue on the underside (figure 1–6). This tissue—the *frog*—is susceptible to injury from sharp objects, such as broken glass or sharp crushed gravel, and by very hot surfaces, such as melted asphalt. Horses and mules can bruise their hoofs with repeated exposure to hard surfaces. Mule hoofs are generally more elongated than those of horses.

Both horses and mules are particularly careful where they place their hoofs. Many stock avoid stepping

on slippery shale, smooth boulders, mud puddles, boggy areas, railroad crossings, bridge decks, or other unfamiliar surfaces, until they become more confident with their footing. They sometimes are reluctant to use human-sized steps on trails or in urban environments. Many riders are uncomfortable negotiating steps, too.

Because an animal’s hoof wall can crack, chip, or break, horseshoes are used to enhance the hoof wall’s strength. Special nails are tapped through the hoof wall and clinched over to hold the horseshoes in place. Horseshoes are made in different sizes and styles (figure 1–7). Some are smooth on the bottom, some have grooves, and others have raised heels



Figure 1–7—As far as horses and mules are concerned, one horseshoe doesn’t fit all. A draft horse wears the large, specialized horseshoe during winter logging operations. Its sizeable calks and built-up borium edges improve footing on ice. Saddle horses commonly use flat-plate horseshoes. The general-use shoe has built-up heels and toes for added traction.

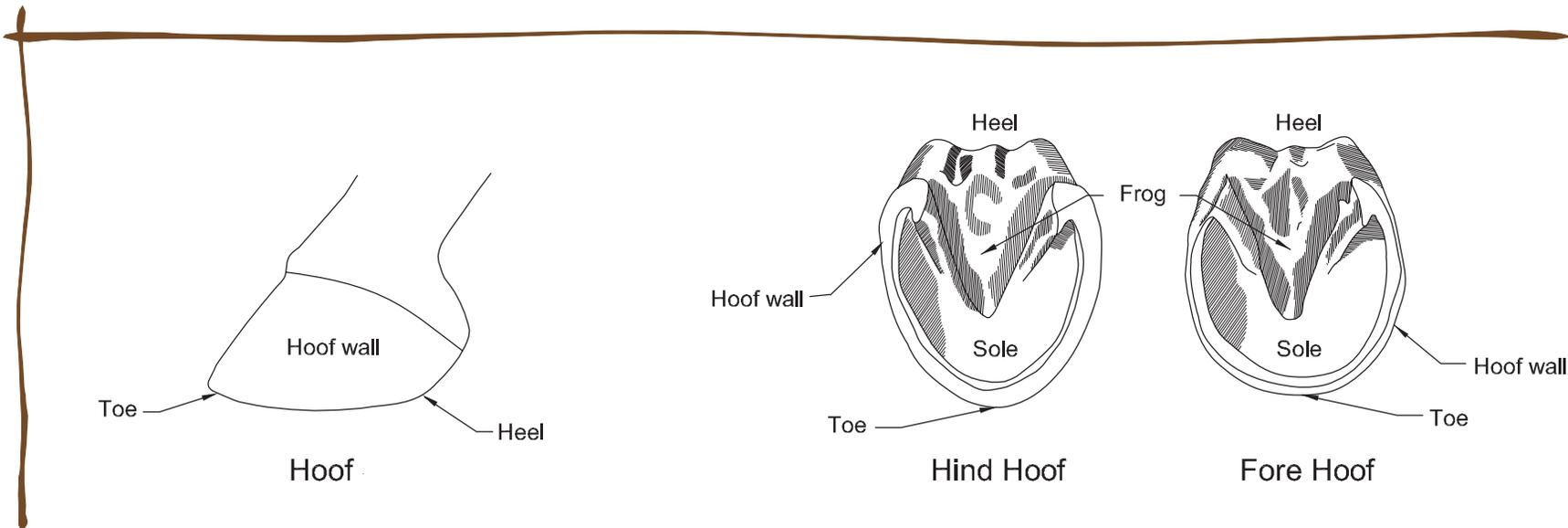


Figure 1–6—A horse hoof.



and toes for better wear and traction. A hoof that is protected by a horseshoe withstands rugged terrain and extended periods of use better than the natural hoof alone. However, horseshoes can be loosened or pulled off when they catch in wire, between boulders, in underground holes, under roots and waterbars, and in cattle guards. If this happens, stock may trip or suffer pain or injury.

Paved or hard surfaces—asphalt, concrete, metal, and stone—offer little or no traction and are quite dangerous for stock. The smooth face of horseshoes exacerbates the danger of slipping. While there are some horseshoe styles that increase traction in certain circumstances, they are not appropriate for all surfaces. Slick surfaces that compromise an animal's footing include shale, submerged rocks, wet wood surfaces, moist vegetation, and ice. Snow-packed hoofs, especially shod hoofs, also limit an animal's mobility.

Hard surfaces become much more dangerous on a slope. Once an animal has started to slip or skid, it has difficulty regaining its balance. In most cases, both animal and rider fall to the ground. Trails that have hard surfaces and slopes steeper than 5 percent need to be treated to increase traction. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for more information regarding suggested surface treatments.

## Mouth and Teeth

Horses and mules use their flexible lips and strong teeth much like people use their hands. They can untie a rope or release a pressure snap on a gate. Mules are especially adept escape artists. Even experienced riders have been surprised to return to a mount they thought was securely tied, only to find it wandering loose. Horses and mules also can lift or pull heavy objects by using their teeth and their body weight.

## Basic Needs

Horses and mules have the same basic needs as most living beings—healthy air, water, and food. They also have some specific and unique requirements.

Healthy horses and mules have excellent lung capacity and a high level of endurance. Smoke, dust, toxic fumes, and pollutants affect their ability to breathe. Many people are surprised to learn that horses and mules breathe air only through their nostrils. Some stock even hold their breath when they are listening intently or greatly stressed or alarmed. When this happens, they can become dizzy or faint from lack of oxygen. Horses and mules also hold their breath for short periods while eating underwater vegetation. They must be able to keep their nostrils above water when swimming. If *tack*—or riding equipment—restricts movement and forces a horse's nostrils underwater, the horse may drown. Horses and mules with canvas feedbags on their heads can drown if the bag fills with water when they try to drink.

According to the Cummings School of Veterinary Medicine at Tufts University (2006), an average horse needs at least a gallon of water daily for each 100 pounds of body weight. The amount of water a horse needs depends on many factors, including its physical size, how active it is, whether it is pregnant, how much it has eaten, and how long it's been since it last had a drink. A horse exercising in hot weather may need two to four times the minimum amount. Make sure that horses have frequent access to drinking water. On trails, provide horses and mules with access to drinking water at least every 10 miles (16.1 kilometers). Riders often take advantage of every watering opportunity. On the other hand, riders leading a long string of stock may not water stock as frequently to avoid the complications of stopping a string. The mules in figure 1–8 are taking advantage



Figure 1–8—Trail stock, such as these saddle mules, need regular access to clean water.



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of access to water during a work trek. In hot climates or when traveling through difficult terrain, additional watering may be advisable. During freezing weather, inexperienced horses and mules or stock from warm climates may not know how to break the ice that has formed on top of water containers. Dehydration can cause serious health complications that require immediate medical attention.

Horses and mules thrive when they have access to grazing 24 hours a day. Eating regularly keeps an animal's digestive action healthy. At a minimum, stock need to feed twice daily—usually 12 hours apart, morning and evening. Food requirements vary with the amount of work an animal has done, as well as its physical attributes, age, and condition.

The *Manitoba Agriculture, Food and Rural Initiative* (2006) lists a horse's daily feed requirement as between 1.5 and 3.5 percent of its body weight. That means a 1,000-pound (454-kilogram) horse will eat 15 to 35 pounds of hay, grass, or other feed each day.

The digestive system of horses and mules becomes accustomed to the particular food they're eating. If the type or quantity of food changes suddenly, horses are vulnerable to digestive disorders or serious health problems. In addition to food, stock require salt in

their diet to replace lost electrolytes. As outdoor temperature, sweating, and the horse's activity level increase, so does the required amount of salt. When an animal is dehydrated enough to have a low salt concentration in its blood, its thinking may be clouded.

At feeding time, horses and mules frequently become very nervous, aggressive, and display dominating behavior toward other horses. The horses in figure 1–9 display typical aggressive body language as they keep an eye on their neighbors and show their impatience for food. If facilities don't have adequate space to allow horses and mules to get away from a dominant animal, stock can injure themselves, their stablemates, people, and property. In such cases, stock may need to be separated from one other.



Figure 1–9—Aggressive behavior often emerges during feeding time. These horses are extremely wary of each other.

## Senses and Behavior

A key to understanding the instinctive behavior of horses and mules is to know how they see, hear, smell, and feel things. As prey animals, horses and mules are very perceptive—they had to be to survive in the wild. However, along with that acuity comes some limitations.

### Vision

Horses and mules move their eyes independently, allowing them to see objects in two different directions at once. Their eyes protrude slightly from the sides of the head, allowing panoramic vision with a visual field that measures about 350 degrees. This visual field is predominantly *monocular*—or seen with one eye at a time. The monocular portion of the field measures about 285 degrees. Monocular vision is relatively flat and is used for detecting distant motion. Horses and mules also have a *binocular* visual field—an area of about 65 degrees that is seen with both eyes at once. In contrast, the human field of vision, which measures less than 180 degrees, is mostly binocular. Binocular vision is three dimensional and contributes to depth perception.



Because their eyes are on the sides of their heads, horses and mules have blind spots in their binocular vision (figure 1–10). They cannot see the tips of their own noses or anything directly beneath their heads, limiting the ability to see anything directly in front. They cannot see objects closer than 4 feet (1.2 meters) with binocular vision. They also don't automatically see something behind that is narrower than their body. Horses and mules can't see forward and sideways at the same time.

In order to focus their vision, horses and mules must move their heads, and they can do so with amazing speed. They can focus their vision more quickly than

can humans. Usually when stock lift their heads, they are looking at something in the distance. They lower their heads to focus on low, close objects. This visual arrangement allows horses and mules to graze and watch for danger at the same time, but may affect their depth perception. Occasionally stock run into, fall over, or step on low-lying objects that they did not see or recognize as a hazard, such as posts, wires, holes, signs, rocks, and waterbars. Stepping into an animal's burrow can cause a horse or mule to trip, fall down, or break a leg. Common burrow dwellers include ground squirrels, badgers, and prairie dogs (figure 1–11).



Figure 1–11—The burrows of ground animals, such as prairie dogs, present tripping hazards for horses and mules.

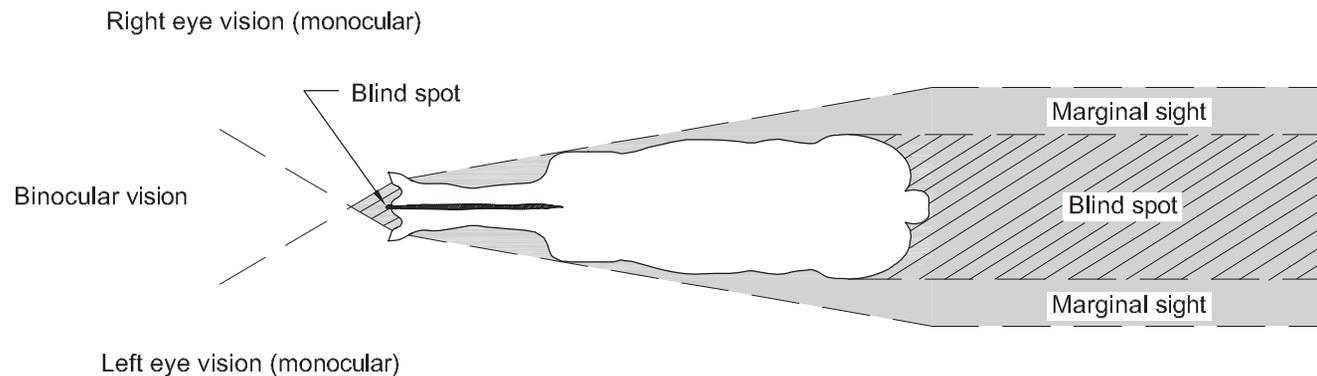


Figure 1–10—A horse's fields of vision. —*Courtesy of American Youth Horse Council. The original figure was edited for clarity.*



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Unfamiliar objects in the distance are suspect to horses and mules. For instance, a trail animal sometimes has trouble identifying a hiker with a bulky backpack (figures 1–12 and 1–13) as a person, unless the hiker speaks. The animal will be on alert until satisfied that a threat is not imminent. Because they are prey animals, horses and mules can become disoriented and nervous when they hear



Figure 1–12—Horses and people may have trouble identifying unusual objects they encounter on trails. What first appeared strange and possibly threatening...



Figure 1–13—...turned out to be a hiker with a plastic-covered backpack.

something, but are unable to see it. Hidden sources of activity—such as those behind solid walls or fences—cause some stock to become fearful. Horses and mules frequently rely on their wide peripheral vision to navigate in tightly restricted spaces and to pass through narrow areas, such as gates, trails, or bridges. In these situations, some stock feel trapped. In response, they may bolt quickly through the offending space, creating a potential safety hazard to themselves, riders, and others. Because of their exceptional sensitivity to side and rear movements, horses and mules that are harnessed to pull a cart often wear side blinders. The blinders reduce peripheral vision and reduce the chance that the animal might see something that alarms it, such as the motion of the cart’s wheels.

Research by J. Carroll and others (2001) suggests horses—mules were not studied—have *dichromatic* vision—they distinguish two main colors—while humans have *trichromatic* vision—they distinguish three main colors. Many of the colors horses do see are *desaturated*—or less intense. Colors that contrast with more subtle natural hues attract the animal’s attention. Examples include a large white rock against a dark background, a red shirt, or dappled shadows. Many experienced stock stop to make certain such objects are not potential hazards or predators. Similarly, when horses or mules see a surface change, such as shadows or roadway markings painted on asphalt, they hesitate or stop.

Reflective materials may confuse stock, especially if the material is used on signs that move in the wind or if lights ripple across reflective backgrounds. Any lighting that distorts natural colors, including some night lighting, affects an animal’s comfort, vision, and ability to function well.

Horses and mules see very well at night, probably a survival mechanism to escape nocturnal predators. Their large eyes admit substantial light, which is amplified by internal reflectors. The low-light vision of horses and mules is better than that of humans. However, their eyes adjust more slowly to light changes than human eyes. Lighting contrasts when entering or leaving enclosures, such as tunnels or horse trailers, can cause horses and mules to hesitate until their eyes can adjust to conditions.

### Hearing

Riding animals have excellent hearing, better than that of humans. Horse and mule ears rotate 180 degrees and generally face the direction the animal is looking. They can focus one eye and ear on the rider and one eye and ear on something else. When they hear something, horses and mules want to see the cause. Noise created by traffic, wind, and other distractions can greatly interfere with hearing, and cause many stock to become skittish. Stock ridden in more developed environments become accustomed to unsettling noises after repeated exposure to them. Vehicles backfiring, sonic booms, gunfire,



firecrackers, sirens, helicopters, public address systems, hot air balloons, trains, marching bands, mechanical equipment, echoes, and bridge or tunnel sounds are tolerated by stock that are accustomed to them. Horses and mules that spend time in rural areas get used to noises there, such as the sounds of farm animals or forest activities. However, all these sounds and many others can startle stock unfamiliar with them, making it difficult for riders to maintain control.

### Smell

Horses and mules also have an excellent sense of smell, much better than that of humans. Trail stock may use smell to find their way back. They readily smell other animals, and they can discern differences in the smell of water. Most horses and mules are happy to drink muddy water from a puddle because it has a natural odor, but they may refuse to drink from an unfamiliar source. Many riders travel with a familiar water bucket so their stock will welcome water in the campground.

### Touch

Horses and mules are so sensitive to touch that they can feel a fly land on a single hair. Slight pressure from a rider's legs can guide a horse or mule forward and anything touching its whiskers or body hair can alert the animal to trouble. If an animal brushes up against a narrow passage and feels trapped, its survival instincts kick in.

Sharp objects, such as barbed wire, easily cut or damage the relatively tender skin of a horse or mule. Painful or sharp impacts trigger the animal's instinct to run away from the offending object or lunge through it, potentially injuring itself or others. A frightened animal also can damage things nearby.

Horses and mules enjoy rubbing against protruding objects because they are handy scratching devices. Given the sensitivity of their skin, stock can easily injure themselves while scratching. Remove or flatten any sharp corners, nails, posts, curbing, or protruding objects that can catch an animal, rider, or equipment. Wire fences should be completely smooth and free from projections or barbs.

### Curiosity

Some horses—and many mules—are exceptionally bold. Their curiosity leads them to explore anything new in their environment. They smell, push, move, pick up, or play with new objects within their reach. They may pull things into a corral with their teeth or kneel to reach underneath fences for something they want. Depending on the design of the fence or barrier and the size of the animal, horses and mules may be able to reach 6 feet (1.9 meters) beyond its edge.

### The Herding Instinct

Horses and mules prefer being around others of their kind, where they find comfort and safety. In the wild, horses survived by staying with the herd. This innate

herding instinct strongly affects domesticated horses and mules today. If one animal becomes startled, many nearby animals also will become alarmed. When one horse runs, the others want to run as well.

The herding instinct can pose problems when new horses or mules are introduced to a group that has an established *herd structure*—or pecking order. Stock establish the herd structure by kicking and biting (figure 1–14). Horses usually dominate mules. The pecking order influences which stock have ready access to food, water, or space in a shared enclosure. Some equestrian facilities address this behavior by blocking views from one animal area to another, but not all riders agree with this approach. Until stock are familiar with each other, they should not be turned loose together in open, common enclosures.



Figure 1–14—Horses and mules kick and bite to establish herd structure—or pecking order. Herd structure determines who has first access to food.



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When unacquainted horses and mules are tied side by side or placed in shared areas, they need close supervision.

Kicking and biting are natural defense mechanisms for horses and mules. Their kick is amazingly quick, powerful, and potentially life threatening. An average animal can kick 6 feet (1.8 meters) backward without moving its front feet. They also strike and stomp with their front legs and can aim sideways. Mules in particular are adept at kicking forward with their hind feet, a practice sometimes described as a *cow kick*. Stock confined in relatively small enclosures often repeatedly kick the offending barriers. Horses and mules also may bite people, animals, vegetation, or other objects within range.

### Responses to Weather Conditions

Horses and mules sometimes respond to changes in weather more than humans. Why a weather change affects them is not fully understood. How they respond in different conditions is relatively well known.

Horses and mules can adjust to relatively high outdoor temperatures, although the combination of high heat and high humidity exhausts them and makes them quite uncomfortable. They frequently seek shelter—or *shade up*—by standing under

trees or overhead structures. However, if irritating insects invade the shaded areas, horses and mules may choose to stand in the sun. Horses and mules withstand cold weather and snow quite easily if they are conditioned. In cold weather, stock with shorn hair or stock accustomed to being stabled or blanketed may become chilled and susceptible to respiratory illnesses.

Rain, whether it is a light shower or a torrential downpour, does not noticeably affect stock. Most horses and mules turn their backsides into the rain during heavy showers and wait them out. Stock that stand in accumulations of rainwater or mud for 3 to 4 days may get *hoof thrush*—an ailment caused by an anaerobic bacterium that eats away at the frog.

Horses and mules are unusually sensitive to electrical current and highly susceptible to injury. Some horses and mules may tense up near high-voltage electrical lines.

Lightning is very hazardous. Some stock become nervous and difficult to control when lightning is flashing and thunder is cracking. Taking shelter under trees can be dangerous during electrical storms. An enclosed horse trailer with rubber tires may be one of the safest locations for stock. The riders probably will be safe inside the tow vehicle.

Horses and mules don't like wind in their faces. Whenever possible they turn their hindquarters upwind (figure 1–15). When the wind is blowing and much of the outdoors is moving, horses and mules may shy while mentally preparing to evade perceived threats, even the moving shadow of a billowing flag.



Figure 1–15—Horses turn their backsides to the wind.



## Chapter 2— Planning Trail Systems

In 2005, 3.9 million horses were used for recreation in the United States, more than a third of the country's 9.2 million horses. All but five States have 20,000 horses or more (American Horse Council 2005). Many of the country's 2 million horse owners seek community and backcountry trail riding opportunities. Recreationists with physical challenges also turn to horses and mules to enjoy outdoor activities that would otherwise be unavailable to them.

The goal of equestrian trail planning is to enable accessible, safe, and pleasurable trail riding opportunities with few environmental impacts. Many communities and agencies are exploring ways to combine trail uses to provide the greatest number of recreation opportunities. Successfully blending horse use with other nonmotorized recreation can maximize opportunities while conserving natural resources. Figure 2-1 shows an example of *blended use*—a seasonal trail successfully shared by different users. By incorporating *universal design principles*—those that include all people—planners ensure access for a greater number of users. *Chapter 11—Designing for Riders With Disabilities* has more information on universal design principles.



Figure 2-1—Unused roads have great potential as year-round or seasonal trails for compatible nonmotorized uses.

Many agencies and municipalities are developing trail system master plans that include and encourage nonmotorized trail use. Such plans provide a framework for the trail system and identify opportunities to improve or expand offerings. This chapter offers an overview of planning concepts used in some areas of the country. For one useful approach, refer to *Appendix D—Trail Proposal and Evaluation Process: Open Space and Trails Program (Pitkin County, CO)*. The appendix covers issues that must be addressed during the development, construction, or maintenance of most trails.



### Trail Planning Steps

Trail Talk

Mitchell Overend and Jeff Owenby (1998) look at horse trail planning as a series of steps. They include:

- ☆ Thorough analysis of the area
- ☆ Development of a trail master plan
- ☆ Predesign coordination with potential users
- ☆ Consideration of a unique set of design parameters associated with horses and riders
- ☆ Recognition of potential management and maintenance problems created by natural erosive forces

### Benefits of Trail System Planning

Trail systems may be a series of local and regional trails that link with existing or planned trails. Well-planned trail systems increase the quality of user experiences and offer benefits to the broader community. Well-planned trail systems:

- ☆ Conserve the natural environment, native species, and wildlife corridors
- ☆ Provide an alternative to motor vehicle travel by linking other trail systems, parks, open spaces, areas of concentrated activity, and trailheads
- ☆ Provide access to otherwise remote areas that may be difficult to access
- ☆ Provide increased opportunities for healthy physical activity and recreation for all ages



- ☆ Potentially increase land and property values, benefiting local and regional economies
- ☆ Conserve traditional equestrian use areas and neighborhoods, thereby preserving a distinctive lifestyle choice
- ☆ Provide opportunities for funding partnerships and resource sharing

Trail system master planning follows the same general principles used for roads, highways, and bicycle paths. All these routes are linear and link people with destinations. Some trail systems are *multimodal*, incorporating numerous forms of transportation. The best trail systems provide loops and links, avoid potential issues and conflicts, and offer the public the most travel and recreation choices.

Planning successful trail systems depends on identifying essential elements, including:

- ☆ Existing trail opportunities, issues, and constraints (multimodal, if appropriate)
- ☆ Existing and potential users (multimodal, if appropriate)
- ☆ Existing and potential right-of-way requirements
- ☆ Unsafe corridor conditions and potential solutions
- ☆ Design and user elements that appropriately enhance the corridor
- ☆ Optimal and minimal requirements to operate and maintain the system



### Forest Trail Fundamentals

The Forest Service uses five fundamental cornerstones for trail planning and management:

- ☆ *Trail Type*—Reflects the predominant trail surface and the general mode of travel accommodated by the trail. The three types of trails are standard/terra trails, snow trails, and water trails.
- ☆ *Trail Class*—Indicates the prescribed scale of trail development, representing the intended design and management standards of the trail. Trail classes range from minimal/undeveloped to fully developed. Trail classes are defined in terms of the trail tread and traffic flow, obstacles, constructed features and trail elements, signs, and typical recreation environs and experience.
- ☆ *Managed Use*—Indicates the modes of travel that are actively managed and appropriate on a

### Trail Talk

trail, considering the design and management of the trail. There may be more than one managed use per trail or trail segment. Managed uses include: hiker and pedestrian, bicycle, pack and saddle, all-terrain vehicle (ATV), motorcycle, cross-country ski, snowmobile, motorized watercraft, and nonmotorized watercraft.

- ☆ *Designed Use*—Reflects the intended use that controls the geometric design of the trail, and that determines the subsequent maintenance parameters for the trail. One managed use is identified as the designed use. There is only one designed use per trail or trail segment.
- ☆ *Design Parameters*—Include the technical guidelines for trail survey, design, construction, maintenance, and assessment, based on designed use and trail class. Design parameters include tread width, surface, grades, cross slope, clearing, and turns.

### User Involvement in Trail Planning

When urban trails are not available, riders may be forced to share roads with motorists. A similar situation can occur along rural roads or highways.

Review existing policies and programs early to determine whether riders can be included in the trail planning process. The planning and development of horse trails often require addressing a broad range of trail user needs.



**Resource Roundup**

**Transportation Planning**

*A Citizen's Guide to Transportation Decisionmaking* by the U.S. Department of Transportation Federal Highway Administration (FHWA 2001) provides additional information regarding transportation planning. It is available at <http://www.fhwa.dot.gov/planning/citizen>.

Thoughtful planning and communication with other trail users, agencies, land managers, developers, and members of the community are imperative. Many existing trails were formed over a long period through informal use and are highly valued by riders. In such cases, rights-of-way, ingress and egress rights, or special-use easements may not exist. Many of these trails are not contiguous because of physical barriers—private property, fences, roads, railroads, rivers, and canals (figure 2–2). Formalizing trail



**Resource Roundup**

**Trail Planning Assistance**

*Appendix B—Trail Libraries, Trail Organizations, and Funding Resources* contains contact information for some trail organizations that provide comprehensive resource information.

agreements and involving riders before planning and implementation can go a long way toward reducing problems later.



Figure 2–2—Utility maintenance roads are often used for recreation trails.

**Land Use and Regulatory Framework**

Trail planners need to know how regulatory measures will affect proposed projects. In general, State regulations create the framework for local planning through enabling legislation, and local governments guide the nature and character of development. Land use regulations foster excellent trail systems if public transportation and recreation issues are incorporated into local plans and ordinances. There are opportunities at all planning levels to involve riders.



**Horse Sense**

**Regulatory Measures**

Trail systems must comply with existing regulatory measures, which vary by jurisdiction. Common regulatory measures include:

- ☆ Federal, State, regional, and local agency environmental requirements
- ☆ Federal accessibility requirements
- ☆ State enabling legislation and requirements
- ☆ State land use laws—such as smart growth plans
- ☆ State or regional metropolitan area transportation plans
- ☆ County and regional plans
  - » General land use plans
  - » Transportation plans
  - » Flood control plans
  - » Open space plans
  - » Trail plans
- ☆ City, town, and municipal plans
  - » General plans
  - » Zoning ordinances
  - » Subdivision ordinances
  - » Transportation plans
  - » Parks, recreation, and open space plans
  - » Trail plans
  - » Pedestrian plans
  - » Bicycle plans
  - » Local area, specific area, and neighborhood plans
  - » Development or design standards and guidelines





### Easements and Setbacks

The legal right to build a trail—usually through outright ownership, easements, rights-of-way, or permits—affects how wide a trail can be built. Legal requirements may take long periods of negotiation, and can derail trail construction. In addition, many jurisdictions have specific requirements that may not be optimum for horse trails.

For example, Scottsdale, AZ, has trail easements based on the city’s trail classification system. In situations where a trail easement overlaps common tracts or easements dedicated for other purposes and it is deemed beneficial, the combined easement and tract width may be dedicated for public trails.

☆ Primary trails must be contained within a 15-foot (4.6-meter) easement. Primary trails provide transportation and recreation links between areas of significant community activity. For trails along streets, the minimum setback distance from the back of the curb to the edge of the trail is:

- » 25 feet (7.6 meters) along expressways and parkways
- » 15 feet (4.6 meters) along arterials
- » 10 feet (3 meters) along collectors
- » The maximum distance feasible in all other locations

☆ Secondary trails must be contained within an easement that is at least 25 feet (7.6 meters) wide. Secondary trails provide secondary transportation and recreation links between scenic and open space areas. Secondary trails must be as far as feasible from the edge of the street.

☆ Local trails must be contained within a 15-foot (4.6-meter) easement. Local trails often funnel into primary, secondary or regional trails. Local trails must be as far as feasible from the edge of the street.

☆ Preserve primary trails are usually located within large open spaces controlled by the city. In situations where preserve primary trails must be located within easements, the easement width must be a minimum of 100 feet (30.5 meters).

The Pitkin County, CO, Open Space and Trails Program builds its trails with two different surfaces—*asphalt (paved trail) and crushed stone (stone trail).* (See *Appendix D—Trail Proposal and Evaluation Process: Open Space and Trails Program (Pitkin County, CO)* for more information.) The trails are used for recreation and as an alternative transportation system. In some cases, two parallel but separate treads are used to accommodate different user groups. During shared-use trail planning and land acquisitions, the Open Space and Trails Program bases final

### Trail Talk

and construction easement widths on the trail type. The minimum easement width is based on the paved trail (whether or not there is an adjacent stone trail), the cross slope of the site, and whether cut- and fill- or full-bench construction is used. The final easement widths vary from 12 to 46 feet (3.7 to 14 meters). Corridor widths also depend on whether or not there is an adjacent stone trail. The optimum tread separation is 15 to 150 feet (4.6 to 45.7 meters). The recommended corridor width varies from 50 to 100 feet (15.2 to 30.5 meters). Narrow widths are allowed in certain circumstances. Widths of more than 150 feet (45.7 meters) may be preferred to preserve desired features or open space.

Other communities are looking at acceptable building heights and building setbacks alongside trails. One perspective is to make building setbacks as far from the trail boundary as possible to prevent forming an urban trail canyon. Another perspective is that a setback means less building space and might mean fewer businesses that can serve trail users or enhance their experience.





## Federal, State, Regional, and Local Agency Environmental Requirements

Trail construction on Federal lands, or lands where Federal funds are involved, must conform to laws such as the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and the Endangered Species Act (ESA). Specialists should review proposed trail routes to determine potential adverse effects. When Federal funds are not involved, professional ethics suggest voluntary compliance with the intent of the NEPA and NHPA regulations.

The U.S. Army Corps of Engineers regulates construction in navigable waterways and wetland areas of the United States. The agency's primary concern in wetland areas is to limit the volume of fill and to avoid placing fill where it would interfere with normal runoff entering the wetland. Getting approval for a wetland trail generally involves sending a letter to the local Corps of Engineers district headquarters, perhaps a site visit by a Corps representative, and the issuance of a Clean Water Act Section 402 or 404 permit.

Trails that cross land or water under the jurisdiction of Native American or Alaskan Native tribal governments, U.S. Department of the Interior Bureau of Reclamation (BOR), U.S. Department of the Interior Fish and Wildlife Service, or similar agencies, may be subject to additional regulations.



### Environmental Analysis

#### Horse Sense

On Federal lands or when Federal funds are involved, agencies are required to conduct an environmental analysis. This analysis often includes an impact assessment. The assessment process alerts businesses, residents, transportation planners, trail planners, interested parties, and decisionmakers to the potential effects of a trail project. Federal land management agencies have processes for conducting an environmental analysis. The processes range from simple to complex, depending on the agency, project size, and potential environmental effects.

Many States and some counties, municipalities, and local agencies also have environmental regulations covering recreation development, including trails. Project managers need to be aware of other laws and regulations that might apply. Occasionally, large areas have been established to coordinate regulations among many towns and counties. The Adirondack Park Agency is a good example. This agency's regulations apply to 6 million acres of New York State's Adirondack Mountains, including all or parts of 12 counties and more than 100 towns and villages. Roughly 45 percent of the land is owned by the State—the rest is privately owned.

Early in the planning stage, determine the regulations that govern development in the area being considered. When many agencies have jurisdiction, the agency with the most stringent regulations usually governs.

## Federal Accessibility Requirements

Trails need to be accessible to people with differing physical abilities. All trails don't have to be accessible to all people, but accessibility must be considered for new trail construction and major reconstruction. This is a legal requirement under Section 504 of the Rehabilitation Act of 1973. Accessibility requirements apply to all sites, facilities, or activities under the jurisdiction or ownership of Federal agencies, and to many State, local, and private sites, facilities, and activities. For more information read *Chapter 11—Designing for Riders With Disabilities* and *Appendix F—Summary of Accessibility Legislation, Standards, and Guidelines*.

## Smart Growth Plans

Many States, counties, cities, land management agencies, and regional coalitions recognize the impacts of uncontrolled urban growth and are implementing plans that attempt to direct the nature of this growth. Open space provisions and *multimodal transportation systems*—those involving different types of motorized and nonmotorized travel—are common topics addressed in these plans. Riders must be involved during the preparation of smart growth plans if they want the plans to include nonmotorized trails that meet their needs.





### General Plans

The overall blueprint for community planning is in the city, town, or municipal comprehensive general plan. Trail planning is frequently one part of the general plan, along with other broad considerations such as transportation, water, and open space provisions.

### Flood Control Plans

Flood control agencies recognize the economic and public relations benefits of including recreation and green space in projects and programs. There may be opportunities to integrate trails into shared use plans. Trails can sometimes take advantage of maintenance roads and open space in flood plains.

### Zoning Ordinances

Zoning ordinances guide the character of urban, suburban, and rural areas by dictating allowable uses and densities. Zoning ordinances that assume motor vehicles are the primary mode of transportation may make it difficult to establish a safe and usable trail system. In addition, many zoning ordinances do not require enough rights-of-way to accommodate trail systems. A community's general plan often includes provisions for trail systems, which are implemented through zoning ordinances. Horse-friendly zoning ordinances are necessary to keep equestrian trail-based communities viable.

A rezoning request and the subsequent review by local planners and the community are key times for comprehensive evaluation of transportation needs. Figure 2–3 shows one way of announcing a public meeting to discuss zoning issues. Transportation improvements—and impacts—for horse trails or vehicle routes can best be coordinated during this detailed review. Ordinances often address linking amenities and destinations with separate corridors for trails and motor vehicles. Subdivision regulations may require land developers to build trails or plan for future trails. These regulations can help riders maintain access to public lands and recreation opportunities that may otherwise be blocked by private developments.



Figure 2–3—Zoning reviews offer prime opportunities for planners and the public to evaluate transportation and recreation needs.

### Resource Roundup



### Zoning for Horses

The Equestrian Land Conservation Resource (ELCR) offers information of interest to riders regarding zoning, legislation, partnerships, planning, trail reports, studies, funding resources, and related topics on the ELCR *Library of Resources* Web page at [http://elcr.org/index\\_resources.php](http://elcr.org/index_resources.php).

### Multijurisdictional Trail Planning

Trail system planning frequently involves more than one land-management jurisdiction. Multijurisdictional and regional planning efforts that encourage links between trail systems can increase recreation opportunities. Trail systems that span the boundaries of land management agencies or communities require interaction and communication between the many stakeholders. Decisions on trail standards, locations, names, maintenance, amenities, resources, and liability can become complex. The earlier these issues are addressed in the planning process, the better. Broad-based trail organizations play an important role. They can contribute a comprehensive vision—helpful when promoting regional trail systems to planning agencies.



Planning multijurisdictional trail systems is a relatively new concept. The lack of clearly defined procedures, processes, laws, requirements, and responses to liability concerns are potential deterrents. Reviewing successful case studies of projects with many partners can help planners understand the process. Raising public and agency awareness of the benefits that come from a well-planned trail system can provide an excellent foundation for support. When the framework for a trail system clearly defines the increased benefits, the plan is more likely to garner approval. *Chapter 16—Learning From Others* includes an overview of several trail system master plans.

Often State and local legislation limits the liability of public or private landowners who make areas publicly available for recreation or education. Consult *Chapter 14—Considering Liability Issues* for more information regarding liability concerns.

A formal agreement ensures a successful, long-term, multijurisdictional trail system. The formal agreement can define important design standards, trail user guidelines, funding opportunities, management and maintenance responsibilities, liability, and stewardship, and can include a schedule for future trail enhancements. Agreements address financial resources, the overall integrity of the project, and long-term commitments.



**Trail Talk**

**Working Across Boundaries**

Forest Service District Ranger Ron Archuleta (2006) suggests some ingredients of a successful multiple-partner project:

- ☆ Mutual benefits and mutual understanding of the benefits
- ☆ Open communication and dialogue
- ☆ Discussion centered around interests, not positions
- ☆ Desired conditions that are established and understood
- ☆ A strategic plan that defines the work and who is accountable for it

**The Planning Process**

A planning process can be simple or complex. It also can be intuitive or highly rational and procedural. Local conditions and politics determine the most appropriate process. The following example uses a complex, rational model that assumes a need for documenting and defending all decisions. The model includes six phases an agency or organization could follow to develop a comprehensive trail plan.

- ☆ Phase 1—Initial project organization
- ☆ Phase 2—Inventory and data collection
- ☆ Phase 3—Analysis
- ☆ Phase 4—Conceptual planning
- ☆ Phase 5—Plan adoption
- ☆ Phase 6—Implementation

**Phase 1—Initial Project Organization**

During initial project organization, planners identify the need for an equestrian trail system, develop a public involvement plan, and identify and engage partners—for example, agency representatives, trail user representatives, and landowners.

Federal, State, and local governments should involve the public in planning for trail systems. Public involvement adds a unique local and personal perspective. Local residents and visitors are often best-equipped to identify trail network and access opportunities, as well as potential problem areas.



**Horse Sense**

**The Benefits of Early Community**

**Involvement**

Early community involvement during trail system planning ensures that:

- ☆ Plans are more responsive to community needs.
- ☆ Projects receive increased community support.
- ☆ Public opposition can be detected early.
- ☆ Potential conflicts can be mitigated through enhancements or compromises.
- ☆ Competing interest groups are better able to understand and resolve differences.
- ☆ Closer ties are forged between agencies and communities.
- ☆ Litigation threats are minimized.



Provide participation opportunities for all segments of the community. Make efforts to contact trail user groups through a variety of outlets. Be sure to provide plenty of advance notice to community organizations, retailers who offer products or services for trail users, the media, publications serving trail users, and advocacy groups. Post notices on public bulletin boards at places such as local tack and feed stores, restaurants, and gas stations near horse facilities.



**Horse Sense**

**Public Outreach Techniques**

Use a combination of public outreach techniques to encourage more representation and broad-based opinion.

- ☆ Public meetings
- ☆ Open house meetings
- ☆ Statistically valid written or verbal surveys
- ☆ Informal Web-based surveys
- ☆ Stakeholder interviews
- ☆ A collaborative task force or small focus groups
- ☆ A public advisory committee of interested riders and agency liaisons
- ☆ Site tours, hikes, and rides within an equestrian area or along a trail corridor
- ☆ Newsletters, Web sites, and publications

**Phase 2—Inventory and Data Collection**

During inventory and data collection, planners research and map existing trails or potential routes, including relevant jurisdictions, neighborhoods, stables, arenas, destinations, and trailheads. They conduct a public needs assessment, identify desired trail and trail system criteria, and conduct a comprehensive inventory of existing trails and conditions. The inventory contributes to finding the best opportunities for planned trail networks within rights-of-way. Field reviews verify the existing trail conditions and identify the opportunities for equestrian and multimodal trails. Field reviews also identify issues and constraints. Field measurements and photographs support the inventory.

The site-condition data serve as the inventory’s foundation. When planning the inventory, identify the potential information source, such as map or onsite reconnaissance. For instance, aerial and general planning maps may provide helpful information regarding major land uses, physical barriers, and drainage patterns. In areas that use the Public Land Survey System, section maps often provide detailed information regarding size and width of rights-of-way, parcels, and easements. Soil maps may be available from the local soil and water conservation district, U.S. Department of Agriculture Natural Resources Conservation Service, county extension office, or Web sites. A site reconnaissance visit can help identify specific conditions that affect the nature and quality of a trail corridor.



**Resource Roundup**

**Earth Images**

*Google Earth* has links to satellite imagery, maps, and other geographic information at <http://earth.google.com>.

A geographic information system (GIS) database can help organize and manipulate data collected for a trail inventory. If GIS data already exists, the inventory is verified and existing trails and corridors are mapped. If no GIS data is available, record existing trail locations using global positioning system (GPS) data to produce accurate maps.



**Resource Roundup**

**Aerial Views**

Aerial photographs of all areas in the United States are available from the National Aerial Photography Program. Aerial photographs provide a standardized set of cloud-free images taken over 5- to 7-year cycles. Each photo centers on a quarter section of a 7.5-minute (1:24,000 scale) U.S. Geological Survey quadrangle map, and covers a square area of about 5.5 miles (8.6 kilometers) on a side. Additional information about the National Aerial Photography Program’s map and photo resources can be found at <http://edc.usgs.gov/products/aerial/napp.html>.



Field photographs, with location and orientation coded to a map, support field data collected for the mapping process. It is possible to link them to a GIS database. Photographs also can document structures, vegetation, fences, trenches, or other obstructions that block trail corridors or render trail segments impassable. The value of a trail inventory increases when it is updated and maintained on a regular basis.

Whether or not a trail goes through a master trail system planning process, eventually the proposed or modified route is scouted and mapped. Many of the tools employed during trail system planning also are used for locating individual trails. GIS studies, topographical maps, and aerial photos help identify factors and physical conditions that affect the placement of the trail. Factors include legal and social concerns—ownership boundaries, traffic crossings, and similar considerations. Physical conditions include topography, hydrology, soils, vegetation, wildlife habitat, slopes, and grades. By plotting the relevant factors and physical conditions on the map, control points are established. Once the control points are plotted, on-the-ground surveys will help determine the location and configuration of the trail.

Control points the trail must connect or avoid may include:

- ☆ Topographical features—for example, gaps, passes, outcrops, and water bodies
- ☆ Stream or road crossings
- ☆ Other trails or transportation systems
- ☆ Densely populated areas
- ☆ Points to avoid—for example, hazardous areas, habitat for protected or dangerous species, poor soils, cultural resources, undesirable distractions, or sensitive areas
- ☆ Points to connect—for example, scenic overlooks, waterfalls, and popular recreation areas

### Phase 3—Analysis

During the analysis phase, planners develop a vision and goals for the trail system. They search for and evaluate potential project partnerships, and make maps of potential trail corridors, rights-of-way, destinations, and trailheads. Permits are researched and specialists are engaged to evaluate environmental factors, historical and cultural concerns, engineering or construction considerations, and so forth. Opportunities, constraints, and liability issues are determined and a suitability analysis of all potential corridors is conducted. The corridor and the trail alignment depend on each other and must be considered before the land is obtained. The trail corridor is chosen partly because it can contain the trail and the trail alignment is chosen partly to take optimum advantage of the corridor.



### Resource Roundup

#### Interagency Trail Data Standards

The Interagency Trail Data Standards (ITDS) are a core set of 34 standardized trail data attributes with corresponding definitions and values.

The ITDS provide a terminology that trail managers and the public can use for recording, retrieving, and applying spatial and tabular information. This makes it easier for trail information to be accessed, exchanged, and used by more than one individual, agency, or group.

Ease in sharing data increases the capability for enhanced and consistent mapping, inventory, monitoring, condition assessment, cost control, budget development, information retrieval, and reporting.

The ITDS apply to all Forest Service, U.S. Department of the Interior National Park Service, Bureau of Land Management (BLM), and U.S. Fish and Wildlife Service managed trails, including National Scenic Trails and National Historic Trails. The ITDS can also be applied to trails managed by State or local governments and other entities.

Access the ITDS and find out more at <http://home.nps.gov/gis/trails>.





Resource Roundup

**Trails in Densely Populated Areas**

In the *Trails Design and Management Handbook* (Parker 1994), the Pitkin County, CO, Open Space and Trails Program outlines information on corridor selection in densely developed areas. The handbook lists scenarios ranging from the best case (using a long-established route or boundary that is attractive in itself) to the worst case (squeezing a trail between a major highway and a commercial or developed area). Also addressed are routes between areas with two very different uses, routes in a highway right-of-way, and routes hemmed-in by development or fences. The handbook has detailed information on the trail design process, trail specifications for shared-use trails with hard or unpaved surfaces, and the trail proposal and evaluation process.

A suitability analysis can be used to rate how trail corridors could accommodate horse trails. This is a critical step that bridges the identification of issues, opportunities, constraints, and the selection of the best plan. Use public and professional input to create a list of attributes that will be evaluated. The list could include access to a trailhead, location of stock water, identification of potential trail loops, or inclusion of scenic trails. Local riders can help determine the importance of corridor attributes during public meetings.



**Suitable or Not?**

The following questions examine important factors in any trail system. The answers affect the trail's rank in a suitability analysis for horse trails. Not all questions are applicable to all situations.

- ☆ Does the trail provide links to local destinations, such as neighborhoods, stables, equestrian centers, trailheads, and open spaces?
- ☆ Does the trail provide links to regional destinations, such as regional parks, open spaces, major equestrian centers, and major trail systems?
- ☆ Does the trail provide loop opportunities or incorporate local or regional trails to create a continuous route back to the trailhead?
- ☆ Does the trail infringe on privacy concerns of adjacent property owners? For example, can mounted riders see into outdoor living areas in residential neighborhoods?
- ☆ Does the land use adjacent to the trail create a negative or unsafe experience for the rider? For example, does the trail pass near a shooting range, golf driving range, model airplane field, railway corridor, overhead transmission line, deep ruts and water drainages, or an unattractive site such as a landfill?

Horse Sense

- ☆ Is the trail corridor wide enough to accommodate many trail users, including stock and their riders? Is the anticipated trail appropriate for equestrian use?
- ☆ Does the trail have access points appropriate for equestrian use? For example, do trailheads have adequate parking for horse trailers?
- ☆ Is the trail corridor free of hazards or potential safety problems that would affect riders? Do trail conditions, such as separate treads for different nonmotorized users, promote a sense of safety?
- ☆ Does the trail provide relatively little conflict between motorized traffic and riders through such accommodations as a comfortable setback from streets and appropriate crossings?
- ☆ Is legal access to the trail corridor available or potentially available? Is the trail corridor under public control of Federal, State, county, or municipal land-management agencies?

During the evaluation, each attribute receives a score of 0, 1, or 2, based on how well it satisfies the criteria. *Appendix E—Sample Evaluation Criteria for Trail Corridor Suitability Analysis* shows this suggested scoring method.



Trail Talk

### Suitable Steps

During the development of the *Scottsdale Trails Master Plan: On the Right Trail* (Todd & Associates, Inc., and others 2003), planners developed six steps for a trail corridor suitability analysis:

- ☆ Identify several attributes that define the most suitable trail corridor.
- ☆ Assign weights to attributes—public input is critical at this step.
- ☆ Identify trail corridors to be analyzed.
- ☆ Analyze each trail corridor using trail attributes and assign an appropriate score.
- ☆ Analyze the numerical scores and divide them into suitability levels.
- ☆ Map all trail corridors by suitability level.

### Phase 4—Conceptual Planning

During the conceptual phase, planners identify all feasible alternatives and choose the best overall plan. They set priorities for projects needed to complete the system plan based on criteria, goals, and objectives. Planners identify funding and determine project action and implementation plans. This also is the time to develop design guidelines for the trail system.



### Prioritizing Trail Projects

Scottsdale, AZ, prioritized projects during its trail system planning process by examining the project criteria and attributes listed below.

- ☆ Safety—The project corrects an issue on an existing trail.
- ☆ Completion—The project completes an unfinished undertaking along a primary trail corridor.
- ☆ Connection—The project provides a critical connection opportunity. It is the only route available.
- ☆ Suitability—The project is along a corridor with the highest trail suitability.
- ☆ Gap—The project completes a gap, providing a significant usable and continuous trail corridor.
- ☆ Use—The project is along a corridor with heavy existing or potential use.
- ☆ Destination—The project greatly improves access to a neighborhood, community, or regional destination.
- ☆ Priority—The project enhances a primary trail.
- ☆ Most miles—The project completes more than a specified number of trail miles using the funding and resources available.

Trail Talk

Using this method, planners applied the criteria to potential projects and assigned a score of 0, 1, or 2. Higher numbers indicated a higher positive value. For example, an initial score of 2 for the priority criterion indicated the project enhanced a primary trail. Assigning an initial score of zero to safety indicated the project did not correct an existing trail safety problem. Some criteria were assigned weighting factors of 1, 1.5, or 2, which increased their overall score.

Additional factors include sensitivity to budgets and community support. For example:

- ☆ Are there constraints that would require expensive or inappropriate trail construction techniques to accommodate trail users?
- ☆ Would the trail require above-average maintenance to accommodate riders?
- ☆ Is there reasonable support by the public to include stock and riders in the trail corridor, or is there strong, organized opposition that would be difficult to mitigate?

The answers to these questions may break scoring ties or more evenly distribute projects if scores are very close. See *Chapter 16—Learning From Others* for more information about the Scottsdale trail system master plan.





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### Phase 5—Plan Adoption

During the plan adoption phase, plans are submitted for approval or adoption by appropriate jurisdictional authorities. Examples of jurisdictional authorities include county boards of supervisors, city councils, and parks and recreation commissions.

### Phase 6—Implementation

During the implementation phase, marketing continues and funding alternatives are promoted. As funds become available, project priorities are integrated into annual capital improvement programs and operations budgets. Project managers work to standardize design guidelines across jurisdictional boundaries. If necessary, they develop a process to incorporate trails into the public review process for private development.

The implementation phase also is a time to review, update, and revise the master plan. A master plan provides an agency with a vision and specific direction for a limited period, often 5 years. Changes are inevitable. It is important to adjust the plan according to the local development climate and pace, available budget, and public need. Certain corridors may need to be relocated or modified based on site-specific constraints or as levels and types of use become apparent.

Many communities rely on private development funds or funding partnerships for equestrian trail

projects and programs. It is important to integrate horse trails into private developments according to approved trail plans and ordinances. Coordination is essential between all agency departments that develop trail projects and those that review the proposals. Reviewers evaluate development proposals for compliance with zoning and subdivision requirements, ordinance provisions, and the goals and objectives of the comprehensive general plan.

A helpful tool for private trail developers is a checklist of agency submittal requirements. Include general requirements for plan submittal, specific trail requirements, and specific language required for trails. Give the checklist to developers at the earliest stages of a proposal.

### Trail System Operations and Maintenance Concerns

A successful trail system requires an ongoing operation and maintenance (O & M) program to ensure that the recreation experience encourages trail use and provides appropriate user safety. O & M programs identify items to be maintained and specify maintenance levels, funding resources, and work responsibility. Successful trail system maintenance may involve partnerships between a managing agency and community organizations, homeowners associations, private landowners, public utility companies, railroad companies, or volunteer recreation groups.

The initial research and documentation during planning forms the basis for subsequent actions. Information about land ownership, maintenance responsibility, and the site become part of the project database and form the baseline for future maintenance programs. Include other relevant management information—prescriptions for vegetation management, hazard corrections, waste treatment and disposal, inspection requirements, maintenance schedules, fire prevention, and so forth. Consider whether separate O & M plans are appropriate for individual sites, or if one plan should cover an entire trail system and related sites. Incorporate procedures to notify user groups and community associations of work responsibilities. Make the program ongoing and cyclical to ensure safe, high-quality recreation opportunities. The steps in this ongoing program include the following:

- ☆ Evaluation—What is the existing condition of the trail and related facilities?
- ☆ Maintenance program—What is required to keep facilities safe?
- ☆ Maintenance schedule—How often is maintenance needed?
- ☆ Response to special situations—What components need repair from damages caused by weather events, accidents, vandalism, or other events?

In some areas, trail classifications and their related components—such as signs, tread surface, and trail width—guide the maintenance program. Some



agencies base the frequency of trail evaluations on trail classifications and use levels. For example, high-use trails in highly developed areas may need more frequent monitoring and evaluation than low-use trails in areas with low development.

Manage maintenance frequency for specific trail segments or facilities based on the maintenance plan or unique conditions. The land manager is responsible for overseeing or maintaining all public trail facilities on private land and establishing a consistent level of maintenance and care.

An annual operating budget is needed to fund an ongoing trail operation and maintenance program. Often, operating budgets reflect the development and use levels of trails and facilities. Annual maintenance budgets can be averaged by cost per designated distance, such as a mile (or kilometer), work units, or recreation sites. The average costs are then multiplied across an entire trail system. This approach works best when most trail segments have similar requirements. Other budgetary approaches may look at trail maintenance needs of specific locations.



### Management Aids

Trail planners and managers may find the following management tools helpful:

- ☆The National Trails Training Partnership offers numerous resources regarding trail maintenance and operations, including a maintenance checklist for urban trails, maintenance management systems, a cost example, and other useful materials. The information is available at <http://www.americantrails.org/resources/ManageMaintain>.
- ☆*Rail-Trail Maintenance and Operation: Ensuring the Future of Your Trail—A Survey of 100 Rail-Trails* by Tim Poole (2005) discusses trail maintenance responsibility, cost, practices, and related issues. It is available at <http://atfiles.org/files/pdf/railtrailmaint.pdf>.
- ☆The Forest Service's Recreation & Heritage Resources Integrated Business Systems offers reports and management tools that help identify program inventory, develop measurable quality standards, determine management costs,

### Resource Roundup

prioritize work programs, develop and allocate budgets, and monitor and measure resources.

The tools are available at <http://www.fs.fed.us/r3/measures>.

- ☆Trails Management Handbook FSH 2309.18, (U.S. Department of Agriculture Forest Service 1991) gives practical information regarding the Forest Service Trail Maintenance Management System. Subjects include operations, maintenance activities, and cost planning. *Chapter 4—Trail Operations and Maintenance* is available at <http://www.fs.fed.us/im/directives/fsh/2309.18/2309.18,4.txt>.
- ☆TRACS (Trail Assessment and Condition Surveys) is a system developed by the Forest Service to collect and maintain trail data consistently. By incorporating a common set of terminology, business rules, data fields, and standard trail specifications and drawings, TRACS helps maximize efficiency, while providing flexibility. More information is available at <http://www.fs.fed.us/r3/measures>.







## Chapter 3— Designing Horse Trails

Once trail analysis and planning are completed, planners know how the trail relates to existing transportation systems and recreation opportunities. The next step is trail layout and design. The design should protect the setting, use an appropriate level of development, meet the needs of trail users, and minimize trail user conflicts.

### Trail Settings

The setting is the overall environment of the trail. Three commonly used settings are wildlands, rural, and urban. The terms and definitions may vary from area to area and between organizations. The definition of the setting helps planners and designers make decisions on matters such as the suitability of particular construction methods or maintenance levels. Settings also affect esthetic decisions.

### Wildland Settings

Riders place a high value on riding in *wildland settings* (figure 3–1). These areas are generally minimally developed or dispersed multiple-use areas, such as forests, swamps, deserts, or alpine areas. Many National Forest System lands have



### Best Practices

#### Resource Roundup

What constitutes best practices for designing trails? *The National Bicycling and Walking Study* (1994) published by the FHWA, defines best practices as those that “...offer exemplary or model planning guidelines, design standards, development strategies, and management programs that lead to successful bicycle and pedestrian programs.” Riders often use the same trails as pedestrians and bicycles. The study lists numerous examples of State and local plans that address individual topics. Some also clarify existing national standards and incorporate regional considerations. The update, *Ten Year Status Report* (FHWA 2004), is available at <http://www.fhwa.dot.gov/environment/bikeped/study>.

wildland settings. In some cases, rural road rights-of-way are used for wildland trails. Wildland settings often present the most design challenges because of topography, distance from services, and hazards. When trails are not accessible by motor vehicles, tools and materials may need to be packed in—a significant challenge. In this guidebook, the wildland settings category does not include recreation opportunities in designated wilderness.



Figure 3–1—Trails in wildland settings generally have minimal development and offer the most challenge for trail users.



### Trails, Naturally

#### Resource Roundup

*Natural Surface Trails by Design: Physical and Human Essentials of Sustainable, Enjoyable Trails* (Troy Scott Parker 2004) has a flexible design system that covers:

- ☆ Basic physical forces and relationships
- ☆ Trail shaping techniques
- ☆ Trail purpose and management

Parker provides an evaluation form that looks at human perception, human feelings, physical forces, tread materials, and tread watershed. This technique helps designers and visitors understand new or complex situations quickly.





### Horse Power

#### Resource Roundup

When trail segments are difficult to reach with mechanized equipment, construction and maintenance crews turn to horse power. *Stock-Drawn Equipment for Trail Work* (Didier and Herzberg 1996) describes the advantages and disadvantages of different types of plows and grading equipment, including photos and sources. The document is available at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm96232802>. This Web site requires a username and password. (Username: t-d, Password: t-d)

### Rural Settings

*Rural settings* often incorporate some combination of rivers, creeks, unimproved drainages, hillsides, undisturbed open space, and other natural features. They often include open spaces and preserves near highly populated areas or in moderately developed rural regions (figure 3–2). Unusual—but often viable—resources in some areas include contributed rights-of-way and fence setbacks by cooperating neighbors. Safety concerns for riders in rural settings include visibility, interaction with other recreationists, and natural hazards. Rural trails may cross or run at grade parallel to roads with vehicular traffic, a significant safety concern.



Figure 3–2—Trails in rural settings often take advantage of public rights-of-way, such as canals or utility corridors. —Courtesy of Kandee Haertel.



### Trails on Small Properties

#### Resource Roundup

*Trail Design for Small Properties* (Baughman and Serres 2006) provides “...simple, and inexpensive solutions for designing, building and maintaining sustainable trails—trails for hiking, horseback riding, bicycling, cross-country skiing, snowmobiling, off-highway motorcycles, and all-terrain vehicles.” Subjects covered include: determining trail uses, selecting a corridor, establishing design standards, marking the trail location, clearing and constructing the trail, installing structures and facilities, and signing. Copies are available from University of Minnesota Extension at <http://shop.extension.umn.edu>.

### Urban Settings

*Urban settings* usually are highly developed or congested areas. Trails in urban settings (figure 3–3) often accommodate many different user groups and frequently require many facilities. Urban trails may share routes with other modes of transportation and often take advantage of roads, utility corridors, developed drainage corridors, and similar rights-of-way. Safety is a significant consideration when animals must mix with motorized traffic and adjust to other aspects of city travel.



Figure 3–3—Shared-use paths in urban settings serve many different user groups.



### Appropriate Levels of Development

The appropriate level of trail development is based on local needs and conditions. This guidebook uses the terms *low*, *moderate*, and *high development* as subjective classifications to describe the degree of development. Specific definitions aren't assigned to the terms, because level of development is relative. For example, high development in a wildland setting may be considered moderate development in a rural area, or low development in a busy urban area. On the other hand, a simple neighborhood trail in an urban area could be similar to a low development trail in a wildland area. Levels of development also may vary on different trail segments within the same trail corridor. Planners usually generate their own definitions based on local conditions and input. This guidebook focuses on development with modest to substantial improvements.

### Riders' Needs

Equestrians include youngsters, elders, leisure riders, professional riders, organized groups, novices, people with disabilities, and working ranchers (figures 3-4 through 3-8). Riders recreate singly or in groups, and for many reasons—including pleasure, exercise, or challenge. Popular group trail events include social trips, competitive trail rides, and endurance races. Riders ferry loads or camping gear using *packstrings* or *packtrains*—a group of packhorses or packmules tied together single file and led by one rider. Less common are the drivers of stock that pull carts or

### Equestrians include



Figure 3-4—Children...



Figure 3-5—...leisure riders...



Figure 3-6—...organized groups...



Figure 3-7—...people with disabilities...



Figure 3-8—...and the working rancher.

—Figures 3-4, 3-5, and 3-6 courtesy of the Forest District of DuPage County, IL.





carriages. Well-designed horse trails consider the setting of the trail system, the needs of all user groups, and the specific needs of stock and their riders.

Some riders prefer gentle, wide trails, and easy trail access. Others prefer technically challenging situations. The designer uses local guidelines when determining the opportunities to offer trail users.

3



**Horse Sense**

**Counting on Experience**

Planners, designers, and land management agencies expect riders and their stock to be prepared for the riding environment. This includes being comfortable when encountering other trail users and common activities on the trail, at trailheads and campgrounds, and near vehicles. Public trails and recreation sites are not the place for stock or riders that are *green*—or that don't have the skills to handle common situations.

**Conflicts**

Stock, hikers, runners, and bicyclists sometimes share trail corridors that are modified to meet each user group's requirements. However when conflicts seem likely, land managers may separate trail users on different trails or on different treads separated by buffers. The *Trail Scenarios* section in this chapter has more information about separating trail users.

Motorized traffic is one of the most dangerous hazards to stock. Collisions or conflicts can cause serious injury or death to people and stock. Design that considers the needs of all users is vital.



**Resource Roundup**

**Conflicting User Groups**

To learn more about interactions between trail users, see *Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice* (Moore 1994). The report is available at <http://www.fhwa.dot.gov/environment/conflicts>.



**Trail Information Libraries**

An abundance of information is available online regarding design and construction of recreation trails. *Appendix B—Trail Libraries, Trail Organizations, and Funding Resources* lists some national organizations that offer sizable online databases or comprehensive links to many other trail resources. Because designing trails is a complex field that requires different areas of expertise, jurisdictions rely on experienced trail designers and specialists.



Lingo Lasso

### Shared-Use Trails

Some agencies or groups use the terms *multiple use* or *multiuse* instead of *shared use* when referring to trails and paths. Many of these groups ascribe exact meanings to each term. Others don't distinguish between the terms and use them interchangeably. This guidebook calls paths that accommodate a variety of user groups *shared-use trails*. In this context, a shared-use path or trail is "...a trail that permits more than one type of user and that has a transportation and recreation function." (Beneficial Designs 1999). Figure 3-9 shows pedestrians and horses on a shared-use trail.



Figure 3-9—Hikers and riders often share trails.

### Trail Hierarchies

Some agencies and municipalities find it useful to assign a hierarchy to trails, ranging from trails with a major regional significance to trails that access neighborhoods or areas with sparse traffic. Trail classifications can reflect the functions the trails serve, their scale of development, their level of use, and their location in a larger trail system. The Forest Service, MetroGreen, and Scottsdale trail classification systems are discussed in this section.

The Forest Service considers specific trail uses when designing, constructing, and maintaining a trail. Forest Service Trail Classes are basic categories that reflect the desired management of each trail, taking

into account other management activities in the area, user preferences, settings, and protection of sensitive resources.

Trail classes also help determine the cost of meeting the national quality standards. The five trail classes range from minimal development to full development as shown in table 3-1. Most of the trails discussed in this guidebook would fall into Forest Service Trail Classes 3 and above (more developed trails).

The Forest Service also uses Recreation Opportunity Spectrum (ROS) and Wilderness Recreation Opportunity Spectrum (WROS) classifications (see *Chapter 7—Planning Recreation Sites*).





Trail Classes Vary—Examples of Trail Classification Systems

Table 3-1—Forest Service trail classes with trail attributes. The general criteria apply to all Forest Service system trails. Most of the trails discussed in this guidebook would fall into Forest Service Trail Classes 3 and above. ROS and WROS classifications are discussed in Chapter 7—Planning Recreation Sites.

Trail Attributes	Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
<b>General Criteria: Physical characteristics to be applied to all National Forest System trails</b>					
<b>Tread &amp; traffic flow</b>	<ul style="list-style-type: none"> <li>☆ Tread intermittent and often indistinct</li> <li>☆ May require route finding</li> <li>☆ Native materials only</li> </ul>	<ul style="list-style-type: none"> <li>☆ Tread discernible and continuous and rough</li> <li>☆ Few or no allowances for passing</li> <li>☆ Native materials</li> </ul>	<ul style="list-style-type: none"> <li>☆ Tread obvious and continuous</li> <li>☆ Width accommodates unhindered one-lane travel (occasional allowances constructed for passing)</li> <li>☆ Typically native materials</li> </ul>	<ul style="list-style-type: none"> <li>☆ Tread wide and relatively smooth with few irregularities</li> <li>☆ Width may consistently accommodate two-lane travel</li> <li>☆ Native or imported materials</li> <li>☆ May be hardened</li> </ul>	<ul style="list-style-type: none"> <li>☆ Width generally accommodates two-lane travel, or provides frequent passing turnouts</li> <li>☆ Commonly hardened with asphalt or other imported material</li> </ul>
<b>Obstacles</b>	<ul style="list-style-type: none"> <li>☆ Obstacles common</li> <li>☆ Narrow passages; brush, steep grades, rocks and logs present</li> </ul>	<ul style="list-style-type: none"> <li>☆ Obstacles occasionally present</li> <li>☆ Blockages cleared to define route and protect resources</li> <li>☆ Vegetation may encroach into trailway</li> </ul>	<ul style="list-style-type: none"> <li>☆ Obstacles infrequent</li> <li>☆ Vegetation cleared outside of trailway</li> </ul>	<ul style="list-style-type: none"> <li>☆ Few or no obstacles exist</li> <li>☆ Grades typically &lt;12%</li> <li>☆ Vegetation cleared outside of trailway</li> </ul>	<ul style="list-style-type: none"> <li>☆ No obstacles</li> <li>☆ Grades typically &lt;8%</li> </ul>
<b>Constructed features &amp; trail elements</b>	<ul style="list-style-type: none"> <li>☆ Minimal to non-existent</li> <li>☆ Drainage is functional</li> <li>☆ No constructed bridges or foot crossings</li> </ul>	<ul style="list-style-type: none"> <li>☆ Structures are of limited size, scale, and number</li> <li>☆ Drainage functional</li> <li>☆ Structures adequate to protect trail infrastructure and resources</li> <li>☆ Primitive foot crossings and fords</li> </ul>	<ul style="list-style-type: none"> <li>☆ Trail structures (walls, steps, drainage, raised trail) may be common and substantial</li> <li>☆ Trail bridges as needed for resource protection and appropriate access</li> <li>☆ Generally native materials used in Wilderness</li> </ul>	<ul style="list-style-type: none"> <li>☆ Structures frequent and substantial</li> <li>☆ Substantial trail bridges are appropriate at water crossings</li> <li>☆ Trailside amenities may be present</li> </ul>	<ul style="list-style-type: none"> <li>☆ Structures frequent or continuous; may include curbs, handrails, trailside amenities, and boardwalks</li> <li>☆ Drainage structures frequent; may include culverts and road-like designs</li> </ul>
<b>Signs</b>	<ul style="list-style-type: none"> <li>☆ Minimum required</li> <li>☆ Generally limited to regulation and resource protection</li> <li>☆ No destination signs present</li> </ul>	<ul style="list-style-type: none"> <li>☆ Minimum required for basic direction</li> <li>☆ Generally limited to regulation and resource protection</li> <li>☆ Typically very few or no destination signs present</li> </ul>	<ul style="list-style-type: none"> <li>☆ Regulation, resource protection, user reassurance</li> <li>☆ Directional signs at junctions, or when confusion is likely</li> <li>☆ Destination signs typically present</li> <li>☆ Informational and interpretive signs may be present outside Wilderness</li> </ul>	<ul style="list-style-type: none"> <li>☆ Wide variety of signs likely present</li> <li>☆ Informational signs likely (outside of Wilderness)</li> <li>☆ Trail Universal Access information likely displayed at trailhead</li> </ul>	<ul style="list-style-type: none"> <li>☆ Wide variety of signage is present</li> <li>☆ Information and interpretive signs likely</li> <li>☆ Trail Universal Access information is typically displayed at trailhead</li> </ul>
<b>Typical recreation environs &amp; experience</b>	<ul style="list-style-type: none"> <li>☆ Natural, unmodified</li> <li>☆ ROS: Often Primitive setting, but may occur in other ROS settings</li> <li>☆ WROS: Primitive</li> </ul>	<ul style="list-style-type: none"> <li>☆ Natural, essentially unmodified</li> <li>☆ ROS: Typically Primitive to Semi-Primitive setting</li> <li>☆ WROS: Primitive to Semi-Primitive</li> </ul>	<ul style="list-style-type: none"> <li>☆ Natural, primarily unmodified</li> <li>☆ ROS: Typically Semi-Primitive to Roded Natural setting</li> <li>☆ WROS: Semi-Primitive to Transition</li> </ul>	<ul style="list-style-type: none"> <li>☆ May be modified</li> <li>☆ ROS: Typically Roded Natural to Rural setting</li> <li>☆ WROS: Transition (rarely present in Wilderness)</li> </ul>	<ul style="list-style-type: none"> <li>☆ Can be highly modified</li> <li>☆ ROS: Typically Rural to Urban setting</li> <li>☆ Commonly associated with Visitor Centers or high-use recreation sites</li> <li>☆ Not present in Wilderness</li> </ul>

—Adapted from Trail Class Matrix (U.S. Department of Agriculture Forest Service 2005b) at <http://www.fs.fed.us/r3/measures>.



The Metro Green Alliance—seven counties in the Kansas City area—uses a different approach. *Design Guidelines for MetroGreen* (Mid-America Regional Council and others 2001) incorporates five trail classes that address different levels of development, amount of use, and user type, as shown in table 3–2. The trail system used in Scottsdale, AZ, consists of primary, secondary, local, and neighborhood trails in natural and built environments (table 3–3).

**Trail Classes Vary—Examples of Trail Classification Systems (continued)**

Table 3–2—MetroGreen Alliance trail types with trail user characteristics. The MetroGreen Alliance has more than 1,400 miles (2,253 kilometers) of trail, classified into five major categories. MetroGreen Type 3 trails are the only ones designated for riders and may be restricted to equestrians only. When riders share Type 3 trails with other users, a separate horse tread is provided. Type 3 trails provide riding opportunities along multiuse trail corridors within greenways and accommodate a steady flow of two-way horse traffic during peak use. MetroGreen Type 3 trails would have moderate to high levels of development, based on the information in this guidebook.

Trail Type 1	Trail Type 2	Trail Type 3	Trail Type 4	Trail Type 5
<b>No facility development</b>	<b>Limited development, low-impact uses</b>	<b>Multiple-use, unpaved trail development</b>	<b>Multiple-use paved trail development</b>	<b>Bicycle and pedestrian facilities with the right of way</b>
<ul style="list-style-type: none"> <li>☆ Very low volume of use is expected.</li> <li>☆ Hikers.</li> <li>☆ Bicycle use should be restricted in most cases.</li> </ul>	<ul style="list-style-type: none"> <li>☆ Generally a very low volume of users is expected.</li> <li>☆ Hikers, joggers, and perhaps cross-country skiers.</li> <li>☆ This trail type is not intended for cyclists or other wheeled users.</li> </ul>	<ul style="list-style-type: none"> <li>☆ Low-to-moderate volume of users is expected.</li> <li>☆ These trails are restricted to pedestrians, bicycles, and equestrians. Equestrian users require a separate trail so that horses do not damage the trail surface.</li> <li>☆ Wheelchair users and persons with strollers can use unpaved trails if they are designed to ADA [Americans with Disabilities Act] standards and surfaced with compacted crushed stone or other firm surface.</li> </ul>	<ul style="list-style-type: none"> <li>☆ Moderate-to-very high use is expected.</li> <li>☆ Several users groups can enjoy the trails, including bicyclists, joggers, wheelchair users and rollerbladers.</li> </ul>	<ul style="list-style-type: none"> <li>☆ Moderate-to-high use is expected.</li> <li>☆ Depending on the specific facility, this trail type serves pedestrians, bicyclists, rollerbladers, etc.</li> </ul>

—Adapted from *Design Guidelines for MetroGreen* (Mid-America Regional Council and others 2001).





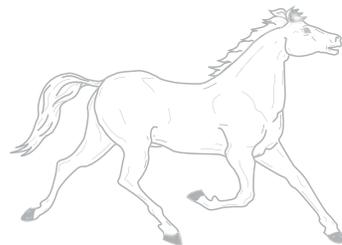
**Trail Classes Vary—Examples of Trail Classification Systems (continued)**

Table 3-3—Scottsdale, AZ, trail classes and environments. Scottsdale trails are part of a large, multimodal trail system, including 100 miles (161 kilometers) of trail in the McDowell Sonoran Preserve and 224 miles (360.5 kilometers) elsewhere in the city. Scottsdale trails would be considered moderately to highly developed, based on the information in this guidebook.

Environment	Primary Trails	Secondary Trails	Local and Neighborhood Trails
<b>Built environment</b>	<ul style="list-style-type: none"> <li>☆ Canal banks</li> <li>☆ Powerline corridors</li> <li>☆ Scenic corridors</li> <li>☆ Standard corridors</li> <li>☆ Drainage corridors</li> <li>☆ Built open space</li> </ul>	<ul style="list-style-type: none"> <li>☆ Roadside</li> <li>☆ Nonstreet easements</li> <li>☆ Drainage corridors</li> <li>☆ Built open space</li> </ul>	<ul style="list-style-type: none"> <li>☆ Roadside</li> <li>☆ Alleyways/nonstreet easements</li> <li>☆ Drainage corridors</li> <li>☆ Built open space</li> </ul>
<b>Natural environment</b>	<ul style="list-style-type: none"> <li>☆ Washes</li> <li>☆ Natural open space</li> </ul>	<ul style="list-style-type: none"> <li>☆ Washes</li> <li>☆ Natural open space</li> </ul>	<ul style="list-style-type: none"> <li>☆ Washes</li> <li>☆ Natural open space</li> <li>☆ Roadside with adjacent natural environment</li> </ul>

—Adapted from Scottsdale Trails Master Plan (Todd & Associates, Inc., and others 2003).

A trail’s degree of challenge depends on the user. Defining trail challenge—or *trail difficulty*—requires a subjective look at an average trail user’s physical ability and skill. Difficulty takes into consideration trail condition and trail elements such as alignment, steepness, elevation gain and loss, and the number and kinds of barriers that must be crossed. Trail length is not considered a difficulty factor, although it is an important consideration. Snow, ice, rain, and other weather conditions may increase the level of difficulty. Because of their subjectivity, trail ratings are not recommended. Instead, provide appropriate information at the trailhead or trail junction so trail users may make informed choices. Visitor information stations can include a map and trail length, maximum grade, sustained grade, elevation change, obstacles along the way, and other relevant information. See *Chapter 12—Providing Signs and Public Information* for further discussion on this topic.





## Trail Scenarios

The trail scenarios presented in this section are design approaches that commonly work for riders. These are not the only possible solutions—designers are encouraged to learn about stock and rider needs, and then mix and match trail elements to best fit local conditions and requirements.

From the rider's perspective, trails must have enough room so their mount feels at ease. Stock tend to stay a comfortable distance away from other trail users and from walls or fences they cannot see through or over, sometimes even moving to the far side of the trail to avoid them. Accommodate this behavior by widening the trail, routing it away from disturbing objects or activity, locating the horse tread on the far side of the trail corridor, providing a physical separation or visual screen, installing barriers, or increasing the horizontal distance—also called the *shy distance*—from the discomfort. Shy distance is in addition to tread width.



### On the Edge

Horses and mules are most comfortable in the track that other stock have trod. They favor the outer edge of a tread, especially if this ground is less densely packed. Having a 2-foot shoulder (0.6-meter) of nontread material or a downslope defines the edge to the animal and rider.

In areas with low development, stock tend to travel about 18 inches (457 millimeters) from the edge of the tread surface (figure 3–10, A). Riders often guide their animals farther away from fences or other obstacles because the riders are more comfortable there. The trod area frequently lies 2 feet (0.6 meter) or more away from obstacles (figure 3–10, B). In areas with a high level of development, for example between tall structures, stock tend to walk about a foot (0.3 meter) from the tread edge of a single-lane trail. If there is a 2-foot (0.6-meter) shoulder, this means they travel about 3 feet (0.9 meter) from the wall or building.

### Trail Talk

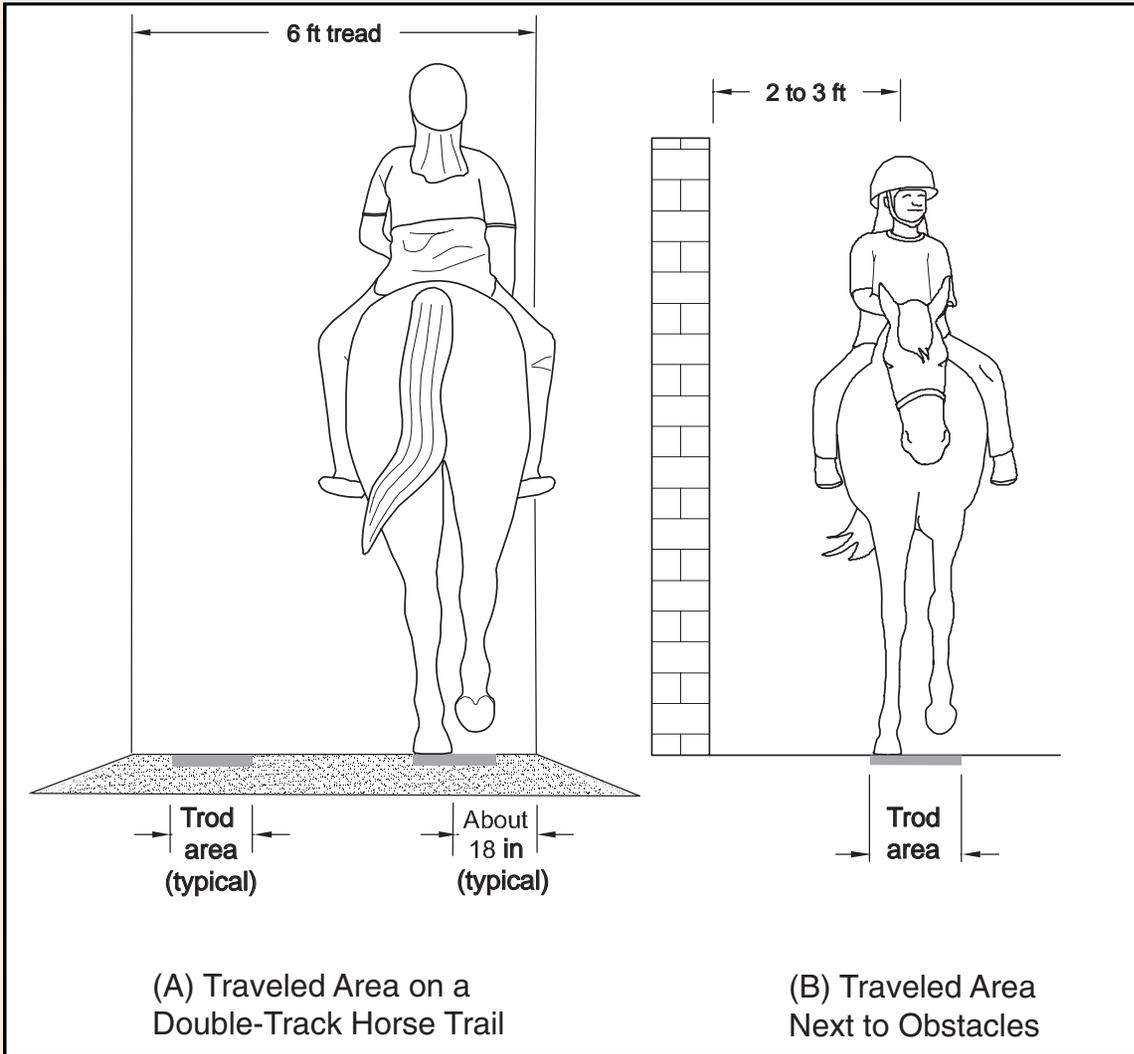
The amount of horizontal shy distance an animal needs in addition to tread width depends on the trail design. Bill Archibald (personal communication) of the Canadian Equestrian Federation suggests using reasonable design parameters, based on what is appropriate for average riders. Too much shy distance may be counterproductive, because a startled animal that wants to bolt may take advantage of the available space. Experienced stock, under the control of experienced riders, often get by with 3 to 4 feet (0.9 to 1.2 meters) of horizontal shy distance. They usually keep within the normal 5- to 6-foot (1.5- to 1.8-meter) tread width on many horse trails, provided there is adequate clearance on both sides of the tread.





On the Edge (continued)

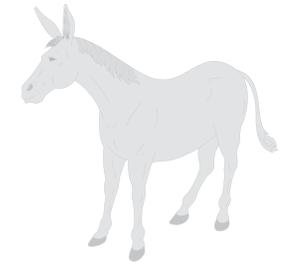
Trail Talk



(A) Traveled Area on a Double-Track Horse Trail

(B) Traveled Area Next to Obstacles

Figure 3-10—Traveled area on horse trails. In rural or suburban areas, stock tend to walk 18 inches from the edge of the tread (A) except when passing. Riders, on the other hand, tend to guide horses and mules 2 to 3 feet away from buildings and obstacles (B). —Adapted with permission from sketches by Bill Archibald.



Resource Roundup

Trail Planning

*Trails for the Twenty-first Century: Planning, Design, and Management Manual for Multi-use Trails, 2d Edition* (Flink and others 2001) is a popular reference for trail developers. The detailed guide addresses developing trails in former railroad corridors, but the concepts apply to all shared-use trails.



Designing Shared Use Trails

*Designing Shared Use Trails to Include Equestrians* (O'Dell 2004) is an equestrian overview of trail design. More information is available at <http://www.aiusa.com/anneodel/ODell-Designing%20Shared-Use%20Trails.pdf>.



### Equestrian-Only Trails

Single-tread trails reserved exclusively for horses and mules—also called *bridle trails*, *bridle paths*,

or *bridleways* in urban settings—are uncommon in the United States. Figure 3–11 shows a trail that could be designated for equestrians only or for shared use. Most public trails are designated for shared

use, although there may be instances where a trail is not appropriate or safe for all users—for example, a narrow and winding recreation trail with a steep dropoff.

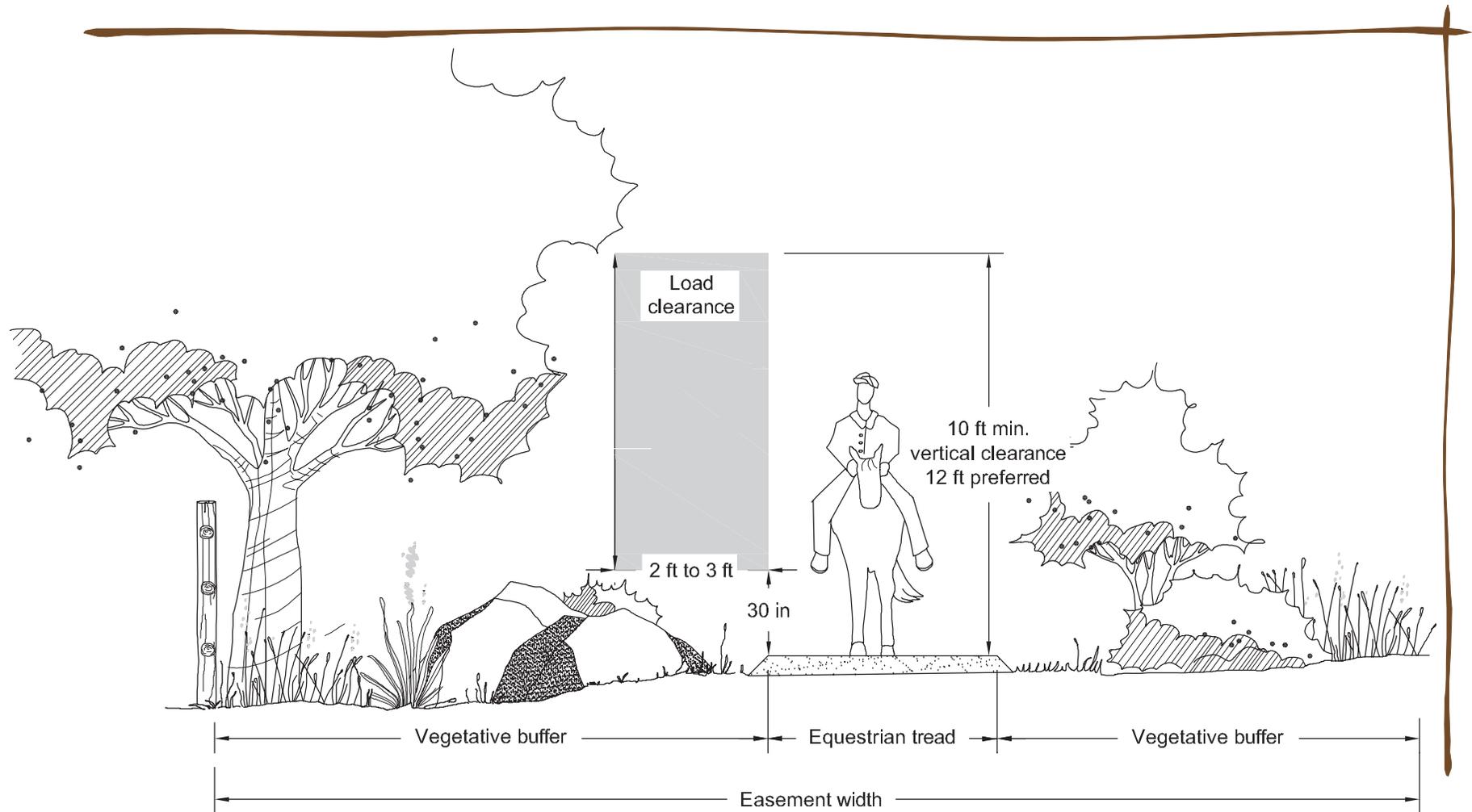


Figure 3–11—An equestrian-only trail for riders and their horses and mules. Such trails may be called bridle trails, bridle paths, or bridleways.



### Mixing Bicycle and Horse Use

Whether or not riders and bicyclists can share a trail without conflict depends on local circumstances and customs. It also may reflect the local cycling style—mountain bikers have different needs than road cyclists. While there are situations where bicyclists and stock don't coexist well, in other situations they may be very compatible. Here are three approaches:

- ☆ The American Association of State Highway and Transportation Officials (AASHTO) generally finds it undesirable to mix stock and bicyclists on paved shared-use trails. Paved shared-use trails are common in areas with high and moderate levels of development. *The Guide for the Development of Bicycle Facilities* (AASHTO 1999) recommends a separate bridle trail in such cases. The reasoning is that many bicyclists are ill-informed about the need to slow down and make room for stock, and stock may be unpredictable if they think a bicyclist poses a danger.
- ☆ The Pedestrian and Bicycle Information Center (PBIC) notes that some rural trails with hard surfaces already include a soft shoulder for joggers (*Rails and Trails: Design of Trails* 2005). The PBIC recommends providing a parallel trail with suitable surface for stock where there is adequate space.
- ☆ Michael Kelley, in a 1998 address at the *National Symposium on Horse Trails in Forest Ecosystems* held at South Carolina's Clemson University, made a case for trails shared by

### Trail Talk

mountain bikers and riders. "My basic thesis is that horses and bikes can, and must, share trails together with all other nonmotorized users. I hope to show that problems are often matters of perception rather than reality, and those that are real can almost always be solved with a proactive approach..."

"Trail width necessary to accommodate both uses is subject to controversy. Some jurisdictions, particularly those that formed regulations during the early days of mountain bikes, require road sized-trails in order to accommodate both uses. Nowadays, more information and experience indicates that significantly smaller trails are better for multiple-use. Narrow trails tend to slow users down, and in that respect, are less dangerous. The narrower the trail, and the more features such as turns, rises and falls, obstructed views, and occasional protruding rocks or roots, the slower mountain bikers will go. Most experienced mountain bikers would rather ride these challenging trails than smooth, wide open trails that encourage high speeds.

"Width of trails can depend upon proximity to urban areas. In the San Francisco Bay Area, China Camp State Park is very close to large population centers. Its multiple-use trails are 4- to 5-feet (1.2- to 1.5-meters) wide, become narrower as vegetation fills in, and accommodate horses and bikes very well. In the backcountry, a trail wide and tall enough for a horse can accommodate a hiker."

### Shared-Use Trails

Unless designated otherwise, recreation trails are shared-use trails. The two basic types of nonmotorized shared-use trails are:

- ☆ Trails with a single tread for all users
- ☆ Trails with multiple treads to accommodate specific user groups

Single-tread, shared-use trails work well when all user groups are compatible. Trail and tread requirements vary by jurisdiction or area of the country. Figure 3-12 shows a typical section of a single tread trail in DuPage County, IL. Multiple treads in a single trail corridor allow separation of uses that might conflict. In areas where stock may encounter motor vehicles, other considerations apply.

Riders and their stock, hikers, runners, bicyclists, people with disabilities, and other users can safely share the same well-designed trails. For example, joggers and riders are usually compatible. Both groups appreciate unpaved tread and slow trail traffic. Bicyclists and horses or mules may have conflicts. Road bicyclists—as opposed to mountain bikers—usually appreciate pavement, a surface that is not best for stock. Because the sudden appearance of bicyclists may unnerve stock, many people recommend separating bicycles and stock. This is not the only solution. Different communities and organizations resolve conflicts differently. Some put all trail users on one path, others provide separate treads or separate routes.



No matter which approach is selected, involving all user groups is imperative. If separate treads are

chosen, beware of the *someday syndrome*—building one tread and putting off development of other treads

until *someday*—when more funds are available. This practice can alienate whole groups of trail users.



### That's Typical

When engineers and landscape architects use the term *typical*, they generally are referring to:

- ☆ A typical section—A drawing or description, often of a road or trail, that defines the parts, such as right-of-way limits, pavement widths, shoulder widths, ditches, medians, and so forth. The builder uses the typical section as a construction guide for the entire project unless otherwise directed. Figure 3-12 is a typical cross section for a trail.
- ☆ Items that are identical—An item on a drawing or plan that is used to represent all like items on the page. The dimensions are followed by the word *typical* or *typ.*, often in parentheses. Measurements and descriptions for the individual item apply to all the others. By labeling only a single item, the page is easier to read. The vertical clear zone in figure 3-12 is the same on both sides of the trail, but only one is labeled: *12 ft clear zone (typical)*.

Lingo Lasso

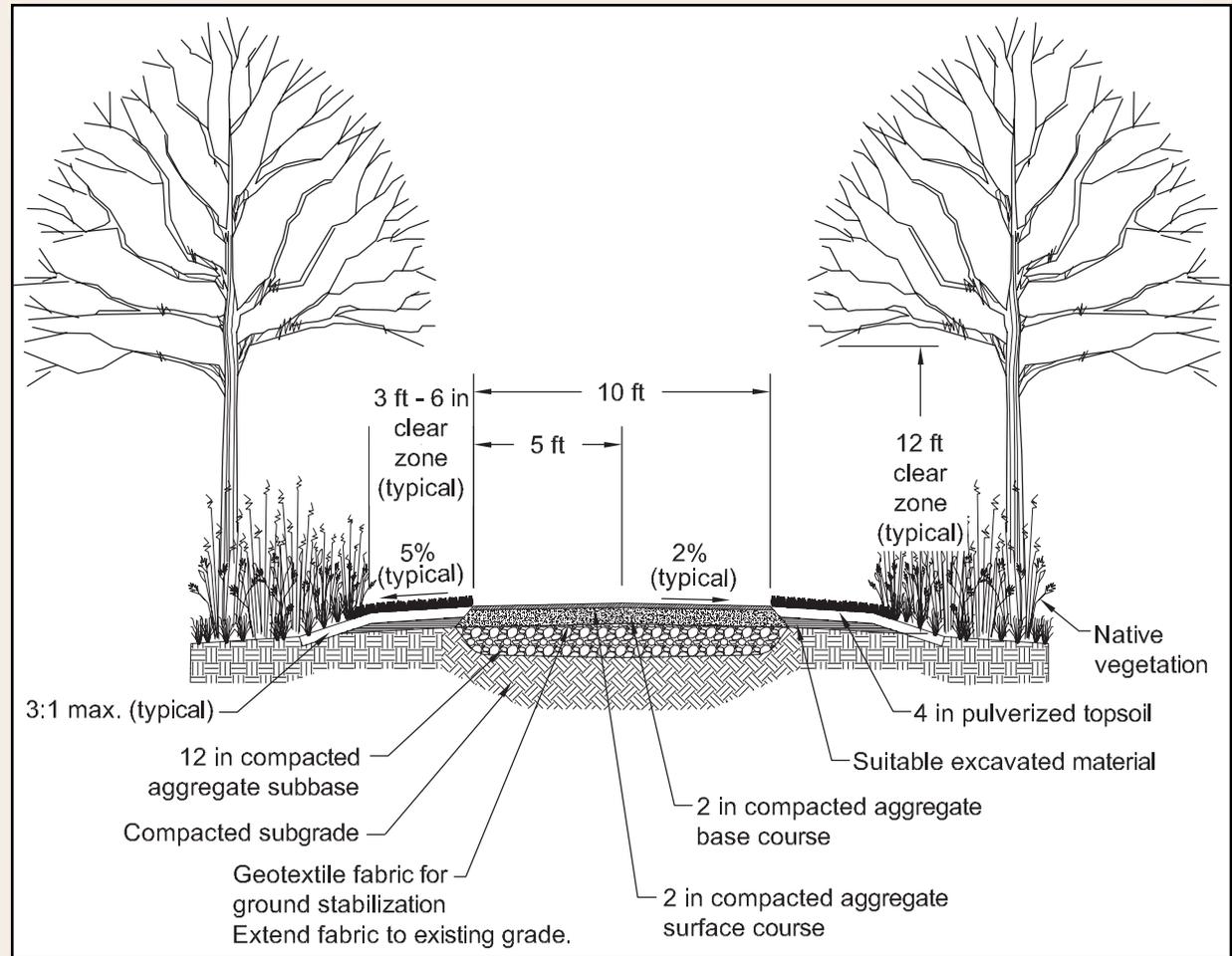


Figure 3-12—A typical trail section used by the Forest Preserve of DuPage County, IL. —Courtesy of Forest Preserve District of DuPage County, IL. The original figure was edited for clarity.



### Shared-Use, Single-Tread Trails

Single-tread trails are generally restricted to areas where the potential conflict between trail users is low. Riders and pedestrians are user groups that generally

are compatible on single-tread trails. Single-tread trails can have single or double lanes—or *tracks*. On single-track tread, trail users walk single file. On

double-track tread, two trail users can walk side-by-side or in opposite directions. Figure 3–13 shows a single-tread trail with a double track and shoulders.

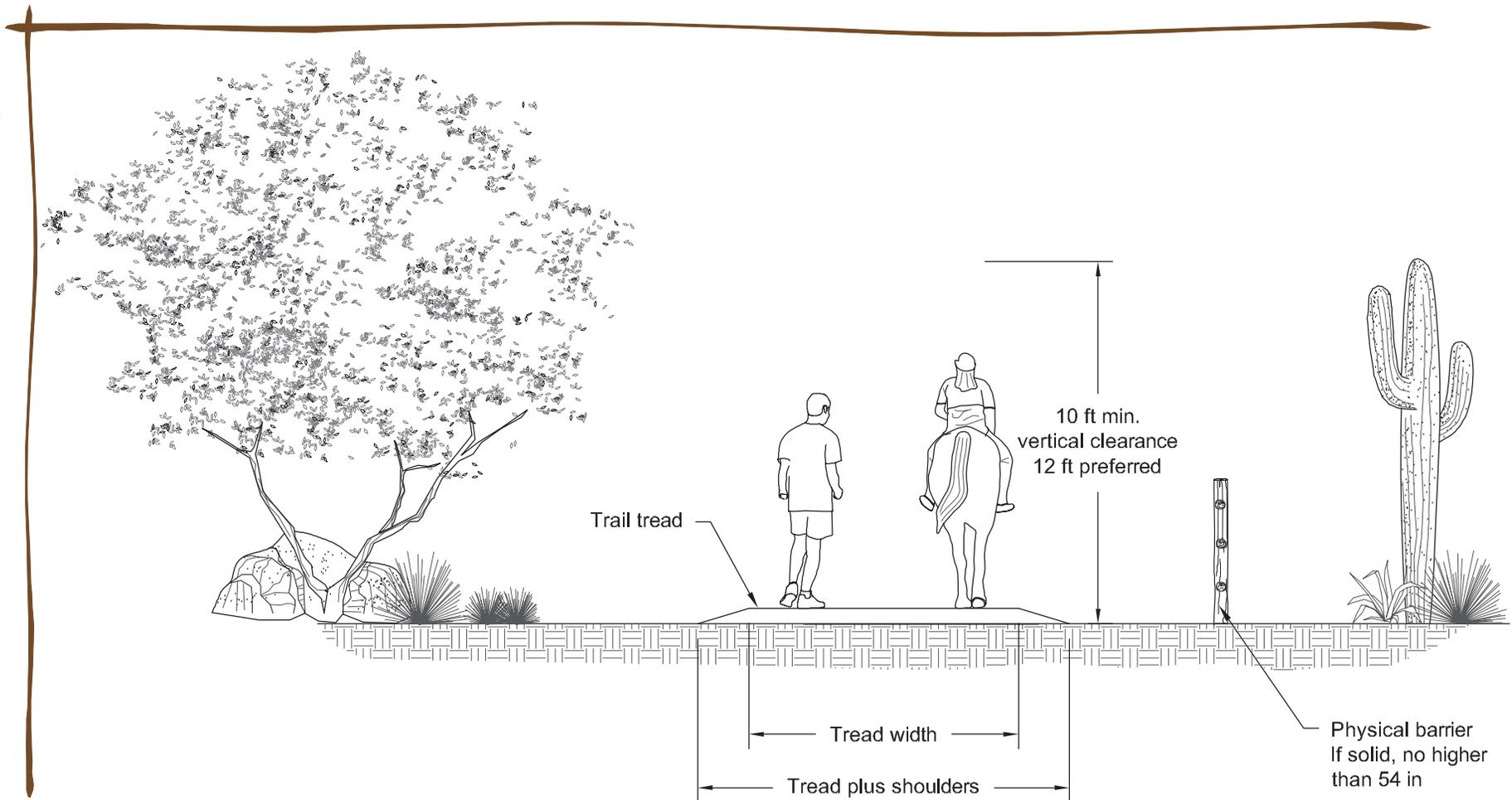


Figure 3–13—A shared-use, single-tread trail with double track (two lanes).



### Shared-Use, Separate-Tread Trails

As the number and frequency of trail users increases, so does the demand for two separate treads to reduce conflicts. Part of the appeal is that an unpaved tread offers a different trail experience than a paved tread. Another factor is that riders, joggers, people with disabilities, and other recreationists who travel at low-to-moderate speeds often prefer separation from faster trail users, such as bicyclists. An example of separate treads is a paved path for bicyclists and other wheeled users and an unpaved tread nearby for equestrians and joggers (figure 3–14). It is possible to designate each tread for single use, if the conditions warrant. For example, if the trail has two unpaved treads, one tread could be designated for riders, and the other tread could be designated for pedestrians.

The most highly used trails require trail users to pass each other. Treads can be separated by distance and by visual screens. High- and moderate-use trails sharing highly developed trail corridors often have separate treads divided by at least a 6-foot- (1.8-meter-) wide vegetation buffer or barrier. In some areas, the treads are separated by an elevation change.

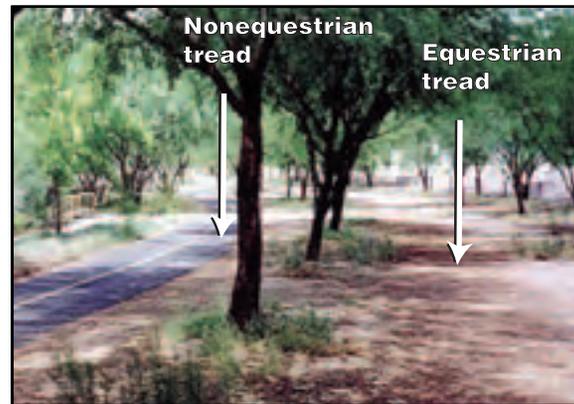


Figure 3–14—Trail corridors with paved and unpaved treads accommodate multiple users, such as riders with horses, pedestrians, joggers, and bicyclists. Vegetation and distance help separate users and minimize conflicts.

The alignment of separate treads can be different—each tread following its own optimum route for grades, curves, sight lines, obstacles, attractions, and so forth. When the trail corridor width is constrained and trail use is moderate, a less desirable—but workable—approach is to locate hard and natural treads side by side with little—2 to 3 feet (0.6 to 0.9 meter)—or no buffer area between them. Unpaved cross trails can connect separate trails or treads at convenient locations. Unpaved spur trails can access points of interest. Occasionally, separate unpaved treads merge into a single tread at road or bridge crossings, separating again on the other side of the constriction.



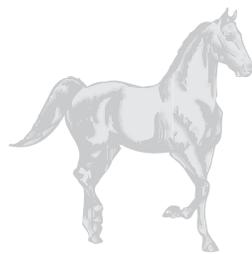


### Trail User Separation

There are many methods of separating trail users, including time, distance, screening, barriers, or some combination of these factors. An example of time separation is a trail used by cross-country skiers in winter and by riders in summer. Trails also can be used by different groups on alternating days. A variation would be alternating groups during the week and on weekends.

### Multiple Treads Separated by Distance

When riders must be separated from other trail users, the preferred method is by physically separating the trail treads. In areas where there is adequate space, include vegetation in the separation (figure 3–15). Preserve existing plants or use new landscape materials to visually separate the two treads. When landscaping, don't plant trees and shrubs so densely that stock cannot see what is on the other tread. Well-spaced vegetation will provide some visibility, and stock will be more comfortable.



### Parting of the Ways

#### Trail Talk

To facilitate consistently designed trails and trailheads, the town of Gilbert, AZ, established *Trail Design Guidelines* (DFD CornoyerHedrick 2001). The guidelines specify a minimum width of 10 feet (3 meters) and a preferred width of 12 feet (3.6 meters) for horse trails. The minimum easement width for horse trails adjacent to a public right-of-way is 25 feet (7.6 meters). The town requires a buffer that is 6 feet (1.8 meters) or wider separating horse treads from shared-use treads. The town prohibits horse trails that parallel an active railroad track. Except at bridge crossings, horse trails don't encroach within 6 feet (1.8 meters) of canals or irrigation ditches.

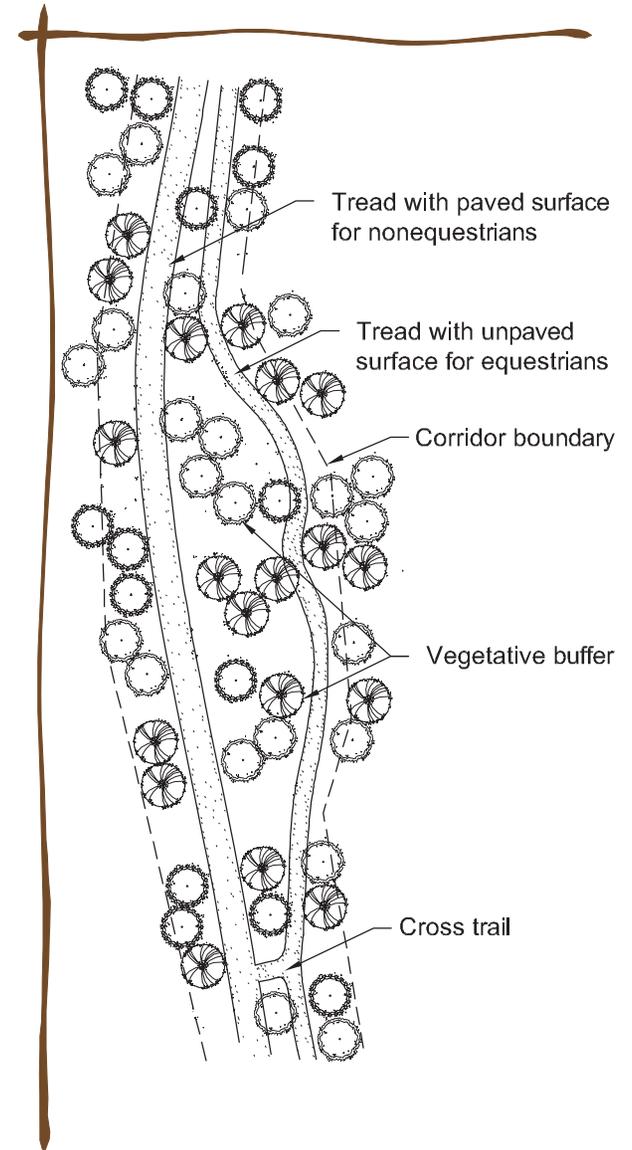


Figure 3–15—A shared-use trail with multiple treads—an unpaved tread for riders with animals and a paved tread for other users.



### Making Do

Trail corridors—especially in urban areas—are often not as wide as would be ideal for multiple treads. Planners and designers resort to working with the space that is available, designing compact trails with multiple treads. Bill Archibald (personal communication) sketched shared-use trails that fit within converted urban corridors and residential lanes. The tread widths are shown in figure 3–16. These trail widths only apply in tight corridors and represent the minimum for shared-use situations—additional width and more separation between treads would be better. The widths shown assume that riders and their mounts have at least average trail experience, and are comfortable in the setting. The recommended minimum width is 8 feet (2.4 meters) for double-track horse trails and 6 feet (1.8 meters) for single-track horse trails.

In urban canyons, short trail segments through narrow corridors may be unavoidable (figure 3–16, A). When riders are passing or meeting other trail users in narrow segments, they must use extra care. While not ideal, these trails are workable. Avoid long stretches with narrow trail corridors, and be sure to consider air exchange, light, and adjacent activities, among other factors. For more information on air exchange in urban canyons, see the *Modifications of Highway Air Pollution Models for Complex Site Geometries*, an FHWA TechBrief (no date) available at <http://www.tfhrc.gov/structure/pubs/02036/02036.htm>.

Some older urban areas have former dray lanes that can be used as recreation trails. The dray lanes, which usually measure 26 to 33 feet (7.9 to 10 meters), originally accommodated horse-drawn freight wagons and trucks that backed in at right angles. A 26-foot lane between walls or buildings (figure 3–16, C) accommodates five compact treads for recreation use as follows:

### Trail Talk

- ☆ Down the trail corridor center is a single, 6-foot (1.8-meter), packed-aggregate bikeway.
- ☆ On each side of the bikeway is a 4-foot (1.2-meter), unpaved walkway for pedestrians and joggers.
- ☆ On the outside of each walkway is a 6-foot (1.8-meter), single-track tread for equestrians that accommodates one-way travel. Each equestrian tread includes a 2-foot (0.6-meter) shoulder, which often has underground drainage.

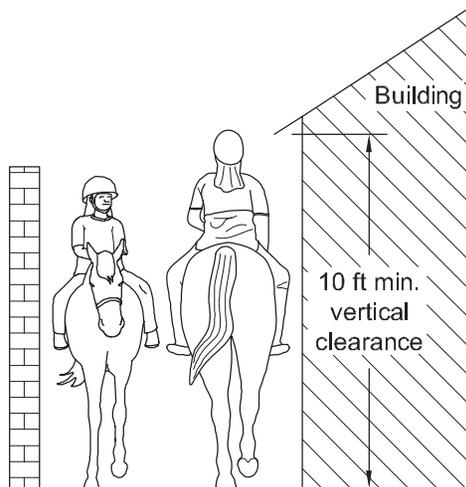
Many residential lanes are 20 to 22 feet (6.1 to 6.7 meters) wide with fences or walls on either side. A 20-foot lane can be tightly configured with an 8-foot (2.4-meter) paved bikeway in the middle, a 5-foot (1.5-meter) pedestrian walkway on one side, and a 7-foot (2.1-meter) equestrian tread on the other side (figure 3–16, B). While not ideal, the 7-foot equestrian tread allows stock to pass each other on occasion. This configuration works when converting lanes to greenways.



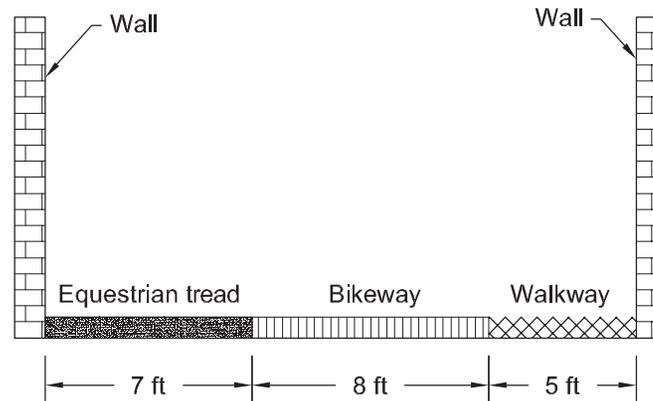


Making Do (continued)

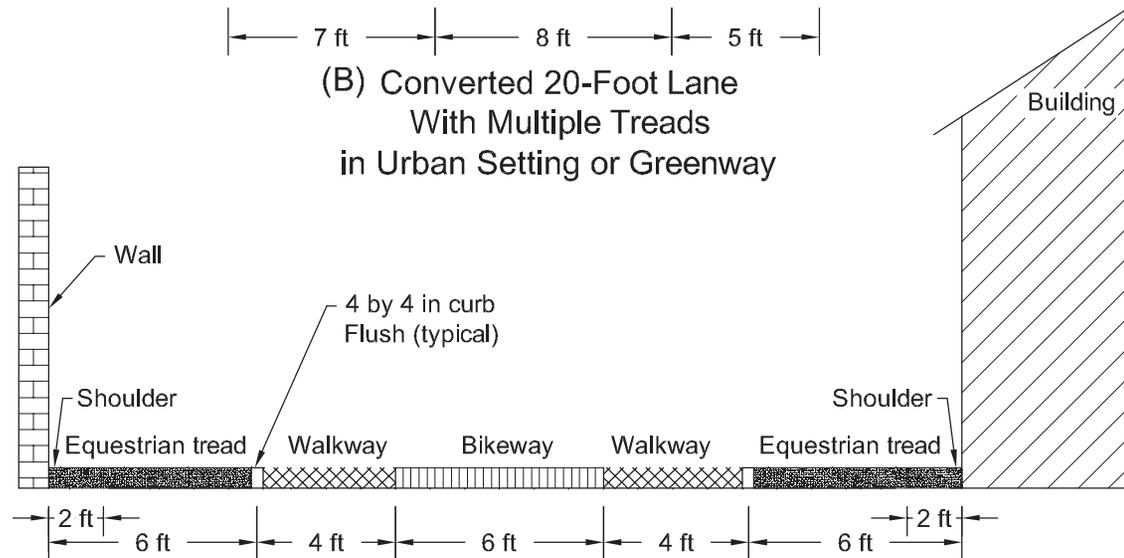
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(A) Narrow Double-Track Horse Trail in Urban Canyon



(B) Converted 20-Foot Lane With Multiple Treads in Urban Setting or Greenway



(C) Converted 26-Foot Lane With Multiple Treads in Urban Canyon

Figure 3-16—Shared-use trails in constricted urban spaces. Riders must use extra caution when meeting or passing in narrow corridors (A). Long stretches with narrow corridors are inadvisable. The 7-foot equestrian treads in a 20-foot converted lane can accommodate one-way travel with occasional passing or infrequent two-way travel (B). Caution: solid barriers higher than 54 inches severely limit a trail animal’s peripheral vision and sense of security. The 6-foot wide equestrian treads in a converted 26-foot dray lane each accommodate one-way travel (C). —Adapted with permission from sketches by Bill Archibald.



### Multiple Treads Separated by Barriers

When other types of separation are not appropriate, a barrier between treads may help prevent conflicts

or reduce hazards (figure 3–17). When considering barriers, consult governing land agency requirements. Barriers also must meet applicable safety requirements.

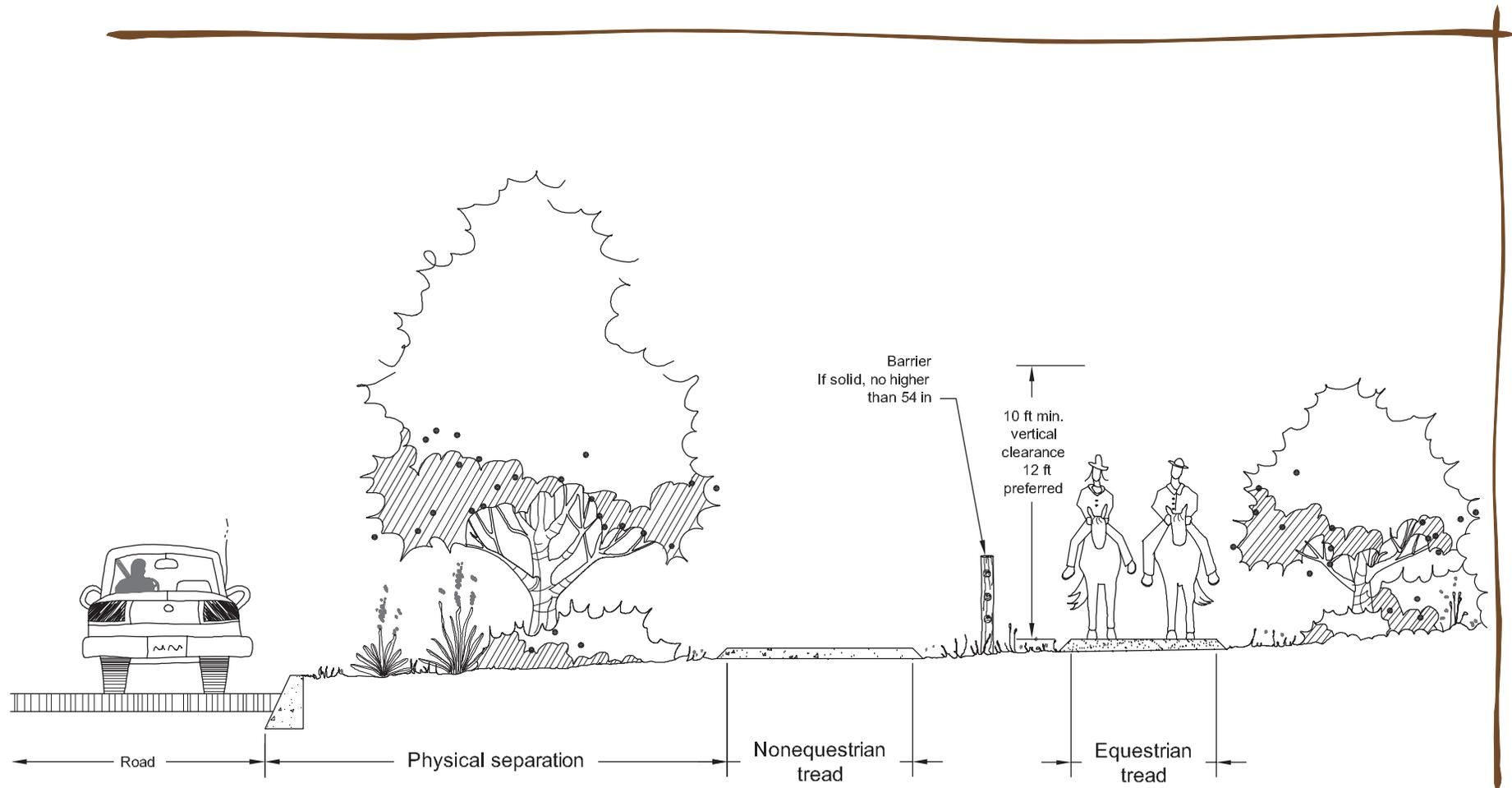


Figure 3–17—A shared-use, multiple-tread trail using physical separation and a barrier as separators.



### Trail Barriers, Walls, and Bollards

Barriers improve safety for all trail users—they can prevent a scared animal from running into the path of others. A substantial barrier between trail users also reduces the risk that people unfamiliar with horses and mules will frighten them. The barrier must be sturdy and tall enough to gain a horse’s respect or the animal may attempt to run through or jump over it. Chain link or split rail fences are not adequate, and may even be dangerous. When designing barriers, avoid sharp edges, protruding fasteners, or vertical supports that could hurt riders or stock.

### Barriers and Walls

When barriers (figure 3–18) are necessary, options include low walls, fences, and railings. The accepted height for most equestrian barriers is 54 inches (1,372 millimeters), similar to the AASHTO (1996) requirements for railings on equestrian bridges. Solid barriers higher than 54 inches severely limit a trail animal’s peripheral vision and sense of security. High trestle bridges, overpasses, or other potentially dangerous situations may require higher barriers. Consider adding railings to low walls if more height is needed. Consider adaptations when solid walls end abruptly. One method is to taper the wall height gradually, allowing the animal to get adjusted to the view.

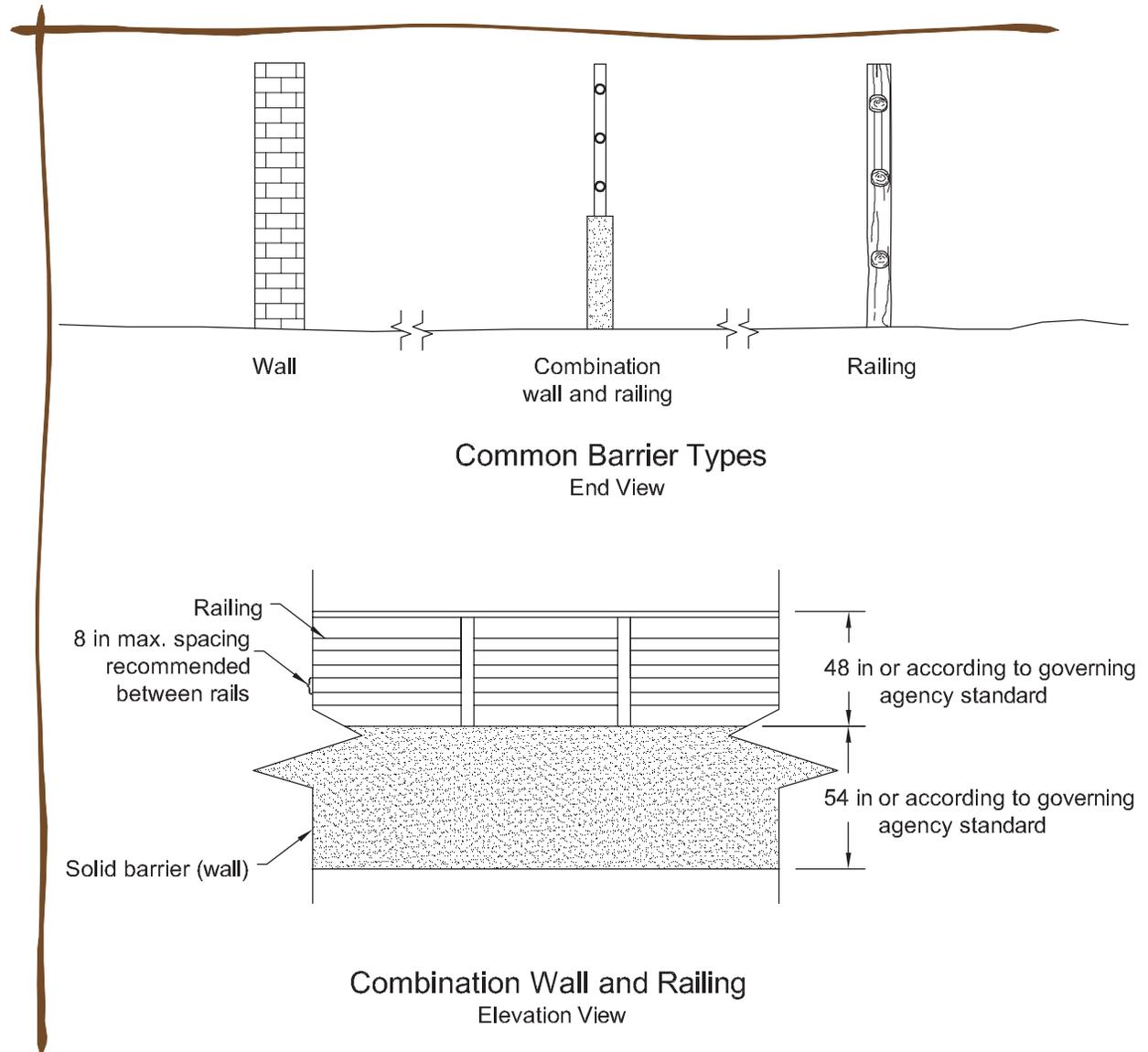


Figure 3–18—Common styles for horse-friendly barriers. The barrier must be sturdy and tall enough to gain a horse’s respect or the animal may attempt to run through or jump over it. Caution: solid barriers higher than 54 inches severely limit a trail animal’s peripheral vision and sense of security.



When solid walls are used, vegetation on the side facing the trail can soften the structure's appearance. Figure 3–19 shows treads separated by a railing that has vegetation. Near urban areas where crime may be a concern, trim adjacent trail vegetation to less than 3 or 4 feet (0.9 or 1.2 meters) high to minimize hiding places.

Barriers that separate trails from a pasture or livestock enclosure may pose challenges for riders. Pastured horses and mules frequently run to meet approaching trail users, causing some inexperienced stock to run away. Many horses and mules fear aggressive dogs and unfamiliar livestock, including

llamas, cattle, goats, sheep, and pigs. Keep the trail away from potential conflicts with farm and exotic animals, if possible.

Barriers also are useful for keeping riders and other trail users away from hazards. For example,

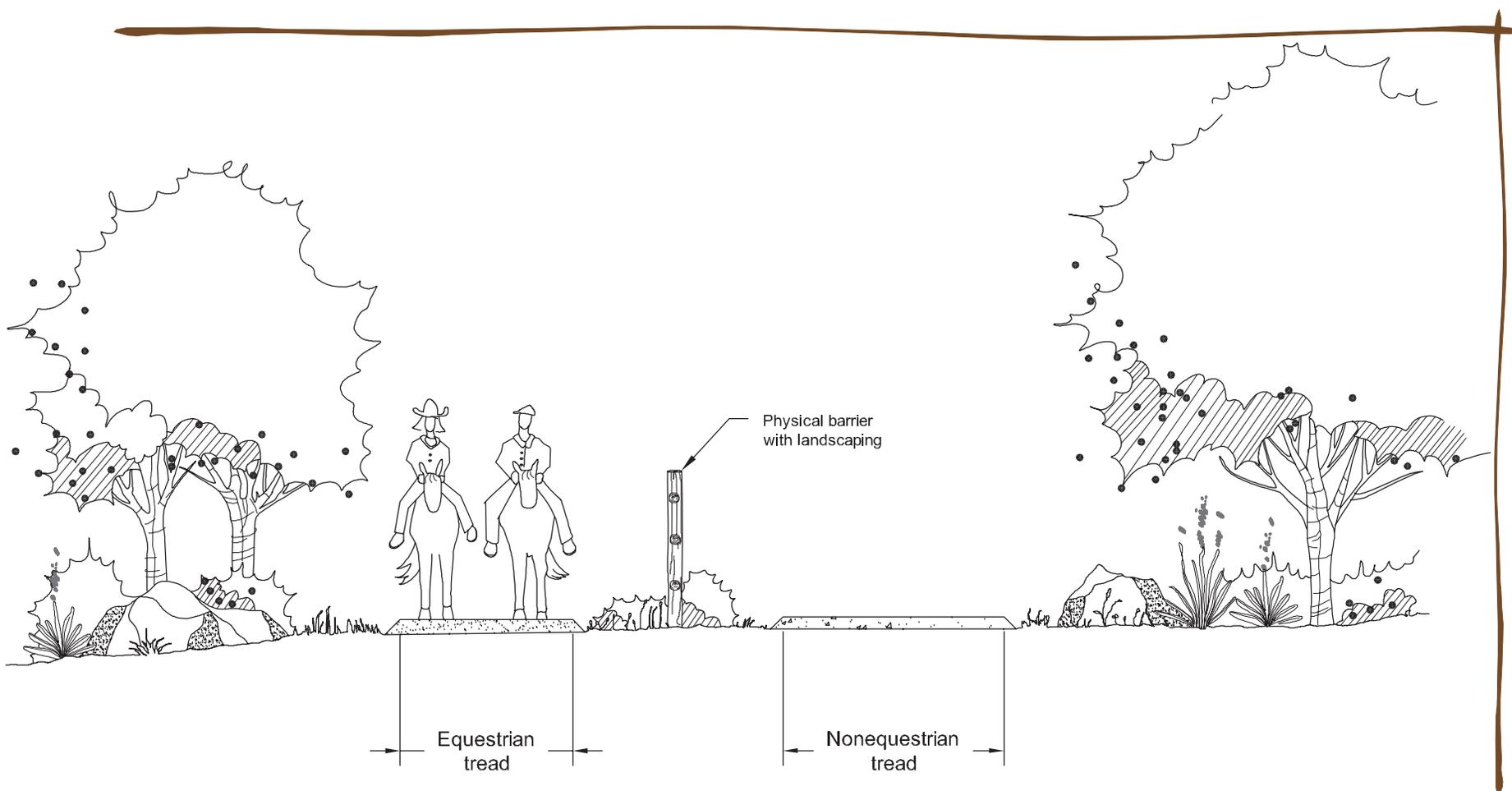


Figure 3–19—A trail with multiple treads separated by a barrier with landscaping.



### Transparent Barriers

Trail Talk

See-through barriers, such as chain link or picket fences, may confuse stock because the slats or wires break up the view. The driving range on the Point Grey Golf Course in Vancouver, BC is bordered by a chain link fence. When stock approach or walk alongside it, sometimes they are uncomfortable with the distorted view of the activity. In addition, when stock glimpse movement at their sides and low to the ground, such as sailing golf balls, their survival instinct may kick in.

Mitigation measures can make stock more comfortable. Driving range employees installed a dark green strip of fabric on the fence to screen the view. Because the view from the trail to the range is clear for quite some distance, stock have time to view the activity and become accustomed to it.

stock may be more comfortable along steep drops and precipices than their riders. From a horse's perspective, the edge is a safe place to be—predators are not likely to come from below. Design barriers in such areas with smooth, continuous surfaces that cannot catch the load, a rider's foot, or the stirrups.



### Slippery Slope

Trail Talk

*Design Guidelines for MetroGreen* (Mid-America Council and others 2001) recommends railings or safety barriers where the trail is adjacent to ditches or steep slopes that rise more than 1 foot (0.3 meter) in 3 feet (0.9 meter) and also have a dropoff of more than 2½ feet (0.8 meter). They also specify railings when slopes this steep are within 6 feet (1.8 meters) of the trail edge. Railings begin at least 8 feet (2.4 meters) before the vertical hazard and extend at least 8 feet beyond the hazard. Rail height is 54 inches (1,372 millimeters) with a maximum opening of 4 inches (102 millimeters). The guidelines stipulate using flanged ends on rails to reduce the risk of injury if trail users collide with them. The guidelines also suggest a minimum 3-foot (0.9-meter) shoulder from the trail edge to the rail.

### Bollards

Barrier posts—or *bollards*—frequently are installed on nonmotorized trails to block motorized use (figure 3–20). One bollard is usually enough to let motorists know the trail is not open to them. If more than one bollard is needed, install an odd number. Two bollards may confuse riders, possibly channeling them into the center of the trail or contributing to conflicts with other trail users. Three bollards send a clearer message. Placing bollards 5 feet (1.5 meters) apart allows mounted riders to pass between them

with relative ease, but may not keep out all-terrain vehicles (ATVs). Because most ATVs for adults are at least 4 feet (1.2 meters) wide, bollards would have to be spaced 3 to 4 feet (0.9 to 1.2 meters) apart to restrict motorized access. This spacing is too narrow for a trail animal to go through comfortably, unless the bollards are no taller than 3 feet (0.9 meter). Bollards that high won't catch in stirrups and are tall enough that they won't become tripping hazards. Bollards at vehicle intersections must meet applicable regulations, such as AASHTO requirements. Bollards should be placed where they will not interfere with sight or stopping distances. Bollards may have lights to guide trail users after dark, and they may be lockable, removable, or recline to allow authorized vehicle access.



Figure 3–20—An uneven number of bollards is less confusing to trail users than an even number.



### Trails Adjacent to Roads

When trails are next to busy roads, there is always a chance that a trail animal will become excited and run into traffic. In areas with low or moderate development, or in places where traffic speeds are

relatively low, a comfortable distance between road and trail may suffice (figure 3–21). Places where traffic moves more quickly require greater physical separation. It may be best to provide a sturdy barrier. Trails with barriers along streets and highways must

not only meet the needs of stock, but also the safety requirements for motorized traffic. The barriers can be costly and they need regular maintenance.

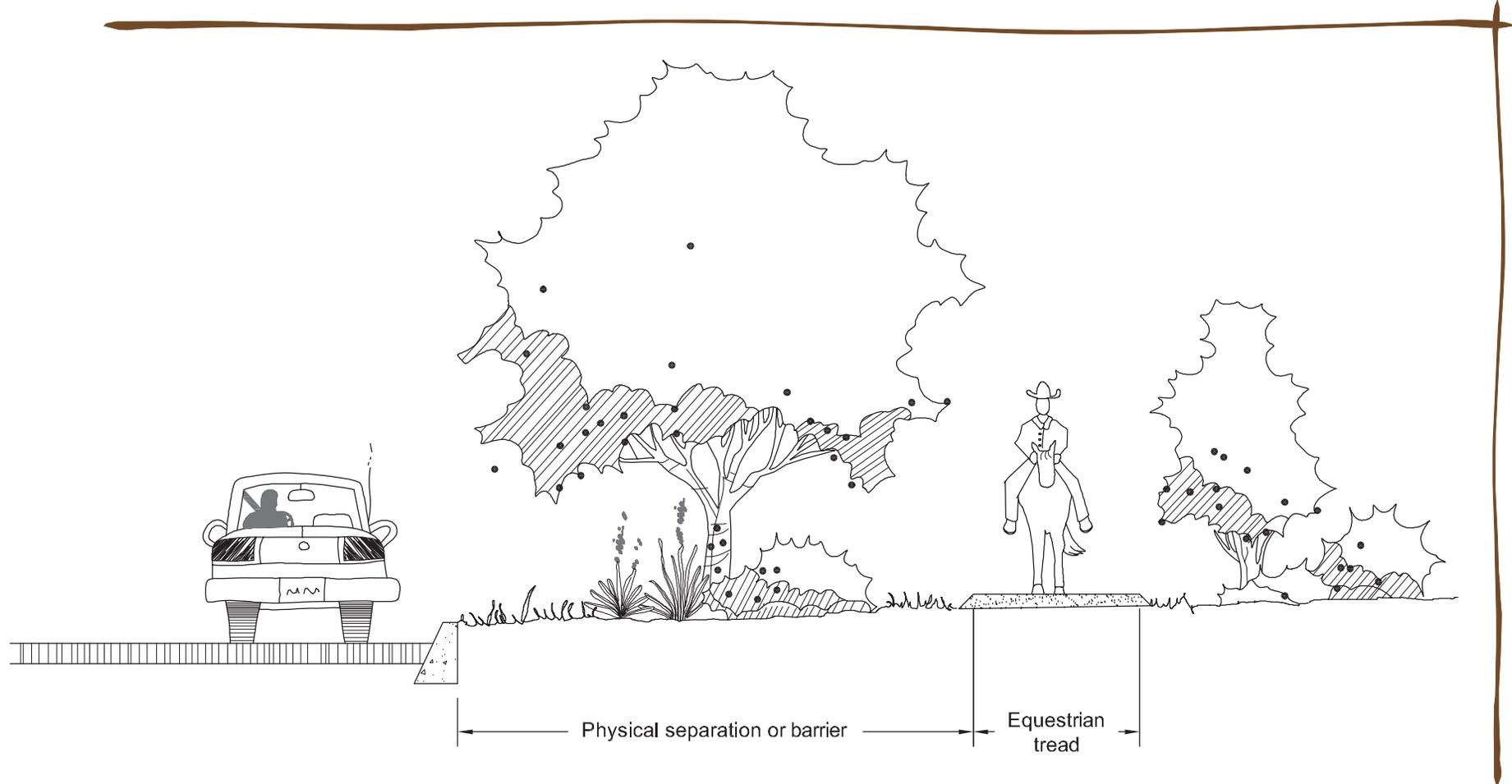


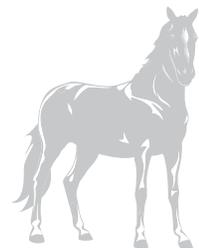
Figure 3–21—Distance separates a horse trail from an adjacent road. A safety barrier could be used instead of distance. Roadside barriers must meet the safety requirements for motorized traffic.



3

The accepted height of most equestrian barriers is 54 inches (1,372 millimeters). To reduce the risk that a horse might jump the barrier, make it at least 60 inches (1,524 millimeters) tall. Choose barriers that can withstand the force of a trail animal attempting to run through them. An example of an acceptable barrier is a steel railing. If a railing is used, include vegetation at the bottom to screen traffic from the horse's view. Avoid railings with posts or edges that can injure a trail animal or rider.

Occasionally, it may be necessary to completely block the horse's ability to see the source of noise. An example would be a trail that is immediately adjacent to high-speed roads where the sight of oncoming traffic would probably alarm the horse more than just traffic sounds alone.



### Alternative Shared Corridors

In many areas of the country, existing corridors could serve more than one purpose. Consider incorporating horse trails into alleys, utility rights-of-way, and public or private roads with private access. These corridors serve as alternatives for horse trails if they are wide enough, don't have pavement, and the governing authority approves their use. Other potential trail routes include abandoned roads and inactive railroad corridors.

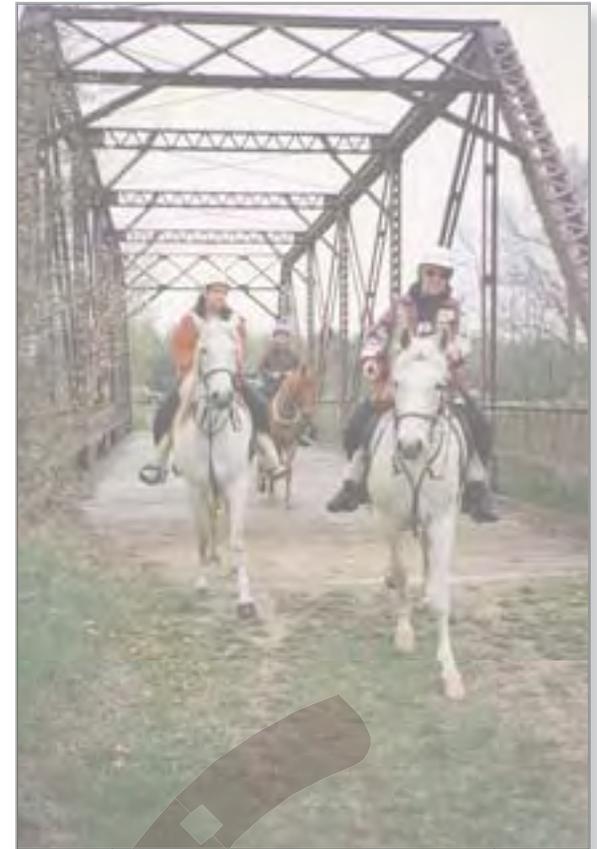


#### Resource Roundup

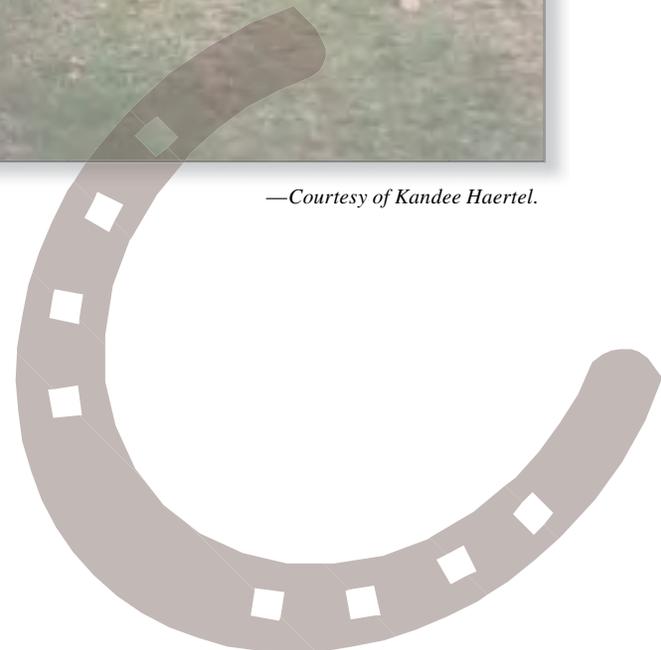
##### Converted Rail Trails

These organizations offer online information regarding conversion of former rail lines into recreation trails:

- ☆ Rails-to-Trails Conservancy (RTC) at <http://www.railtrails.org>
- ☆ National Trails Training Partnership (NTTP) at <http://www.americantrails.org/resources/railtrails>
- ☆ Pedestrian and Bicycle Information Center (PBIC) at <http://www.bicyclinginfo.org/rt>



—Courtesy of Kandee Haertel.





# Chapter 4— Designing Trail Elements

Safe shared-use trails follow engineering principles that are similar to those used for highways, including adequate sight distance and alignment. With careful design, safe trails don't have to be minihighways—they can adhere to professional standards and still be esthetically pleasing. A single trail corridor can include many design considerations, requiring flexibility on the part of designers. Because each situation is unique, appropriate solutions require sound judgment by the designer, adherence to applicable legal requirements, and sensitivity to local conditions, preferences, and needs.

## Trail Terms

It is helpful to understand trail structure and the terms that describe it. Figure 4-1 illustrates some common trail corridor terms.



### Building Lightly

#### Resource Roundup

The Student Conservation Association (SCA) uses *Lightly on the Land: The SCA Trail Building and Maintenance Manual* (Birkby 2006) as a field guide for trail construction. The manual covers basic techniques, from building with timbers to rock construction and environmental reconstruction.

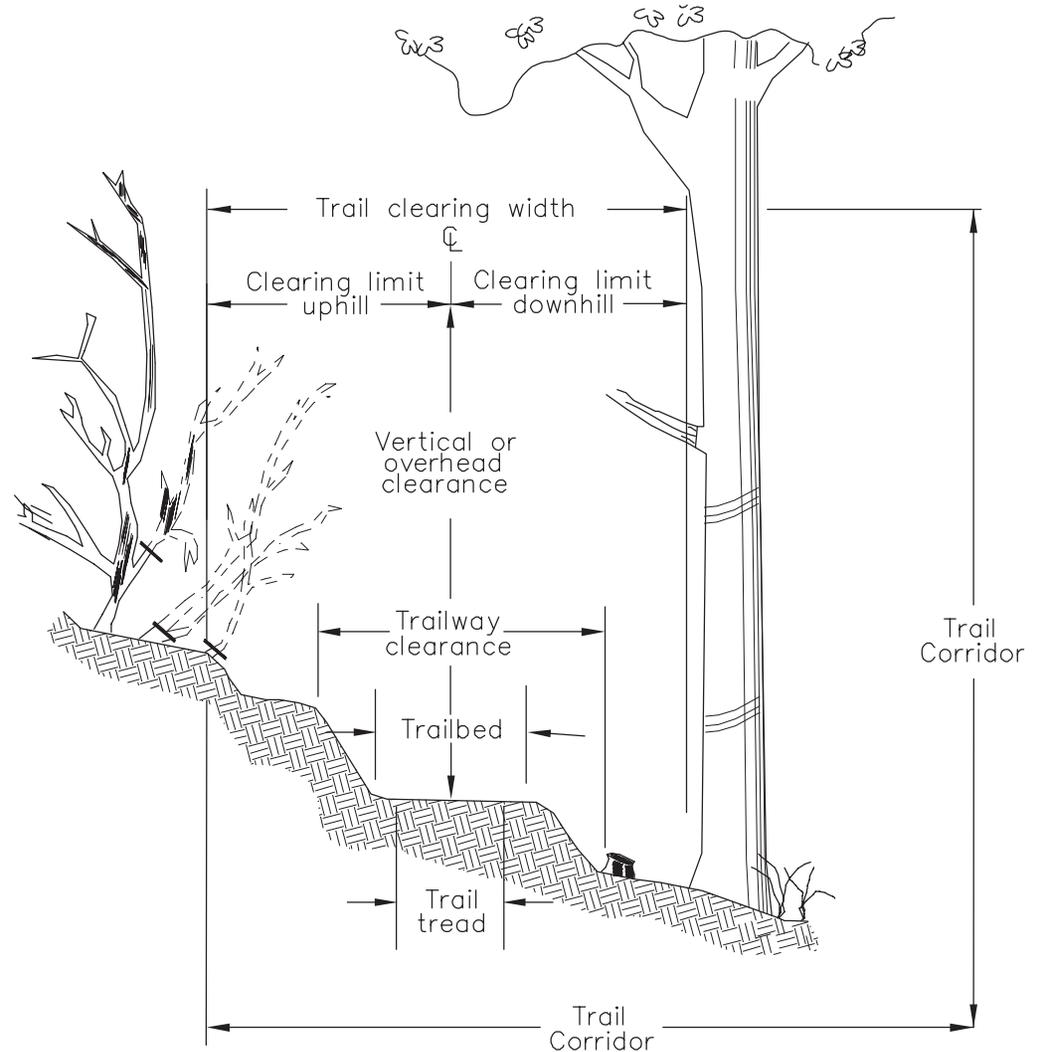


Figure 4-1—Common trail terms. Agency specifications may vary.





### Trail Words

When speaking about trails, it is helpful to use common terminology. This guidebook uses the following definitions:

- ☆ *Transportation corridor*—The larger alignment of a trail, which may include other modes of transportation; for example, a multimodal transportation corridor between two attractions that has separate trails for stock and bicycles and a road for motor vehicles.
- ☆ *Trail corridor*—The zone that includes the trail tread and areas immediately above and to each side. The edges of single-tread trail corridors generally are the same as the trail’s clearing width plus its vertical clearance. Multiple-tread trail corridors include the trail clearing width and vertical clearance for all the treads. Sometimes trail corridors include more land than is needed to accommodate the trail tread and clearance.

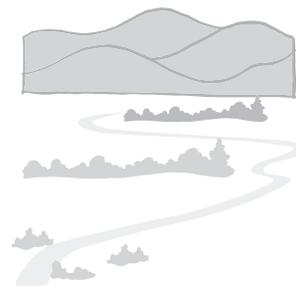
### Lingo Lasso

- ☆ *Trail tread or tread*—The travel surface of the trail.
- ☆ *Trailbed*—The tread plus base materials.
- ☆ *Trail clearing width*—The space to each side of the trail tread that is cleared for trail users. Usually, there is an uphill and a downhill clearing width.
- ☆ *Trail vertical or trail overhead clearance*—The space over the trail tread that is clear of obstructions. For riders, this clearance is sometimes referred to as vertical shy distance.
- ☆ *Trail clearing limit*—The area over and beside a trail tread that is cleared of trees, limbs, and other obstructions; often the edges of the trail corridor.
- ☆ *Trailway clearance*—The trailbed plus the area to either side that is needed to accommodate construction cuts and fills.

### Trail Length

A single trail system can give trail users choices, including scenic variety, different trail lengths, or more than one challenge level. Trails with loops let trail users travel new ground the entire way.

Loop trails allow more miles of trail in smaller areas and avoid the extra traffic of out-and-back—or *linear*—trails. Elongated loops with cross trails (figure 4–2) allow trail users to select their own trails. An interesting variation contains stacked loop trails, which resemble the links in a chain. A common approach is designing the closest loop to appeal to the greatest number of trail users and to be the easiest to travel. Succeeding loops provide additional length or more challenge.





Trail users' travel speeds differ, and it is important to vary the trail length. Design horse trails no shorter than 5 miles (8 kilometers)—preferably longer. It takes 1 to 2 hours for most equestrians to ride an average 5-mile trail. The length of many day-use trails ranges from 5 to 25 miles (8 to 40.2 kilometers). The best trail systems include a variety of routes that allow rides of 2 to 3 hours, a half-day,

and a full day or more. Provide reasonable access to stock water. When practical, the Forest Service (1991) recommends providing water at intervals of no more than 10 miles (16.1 kilometers) and informing visitors if water is not available within this distance. In areas that experience very hot weather, consider locating water sources at 5- to 6-mile (8- to 9.7-kilometer) intervals.



Trail Talk

**Making the Loop**

The Pennsylvania Trails Program (1980) suggests day-use loop trails of 15 to 20 miles (24.1 to 32.2 kilometers) for riders, with an inner loop of 7 to 10 miles (11.3 to 16.1 kilometers) for half-day trips. They recommend providing vehicle access points with adequate parking near overnight stops to allow riders to bring in food and water for stock. The authors note that pedestrians may find all-day equestrian loop trails too long.

Baughman and Serres (2006) recommend horse trails with multiple or single loops that include a variety of scenery and terrain, and an open gathering area. They also recommend trail lengths of 5 to 25 miles (8 to 40.2 kilometers).

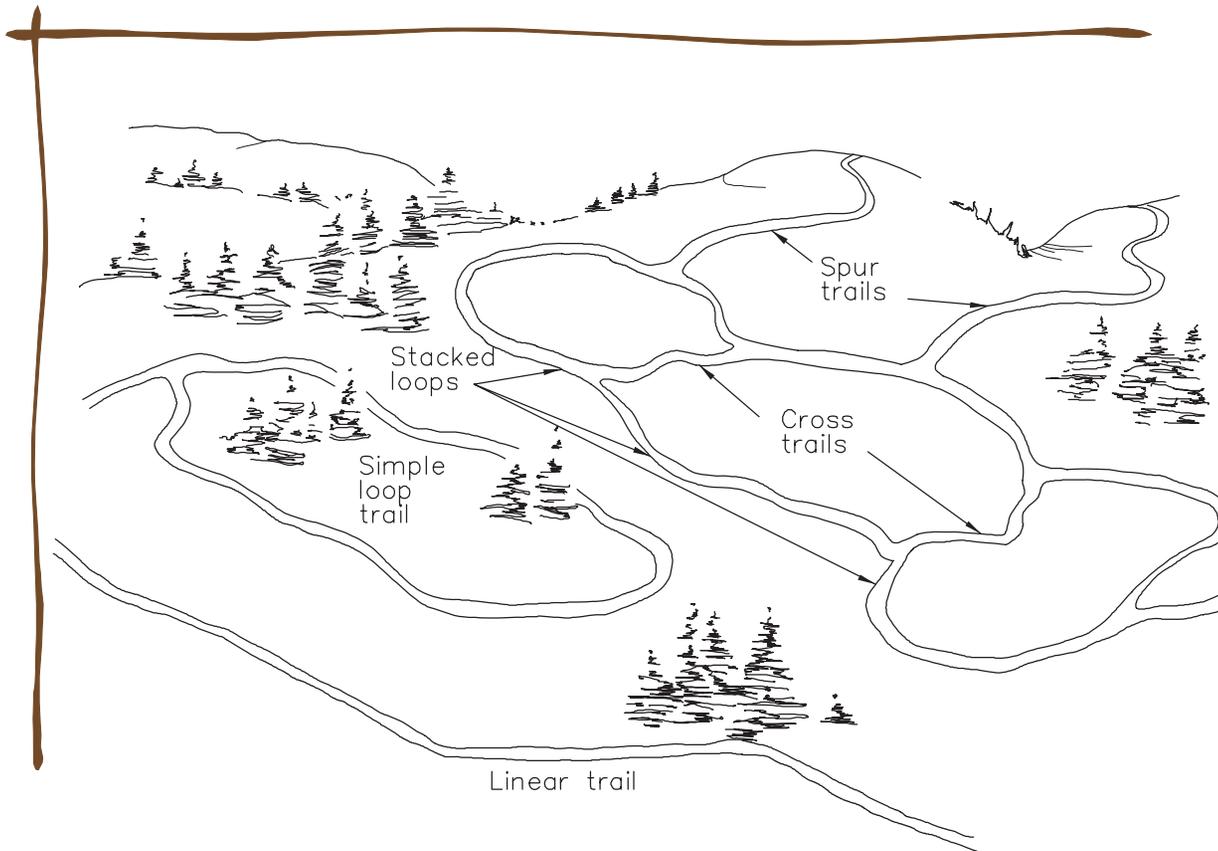


Figure 4-2—Linear, loop, spur, and cross trails. —Adapted with permission of University of Minnesota Extension.



Calculating trail distances and trip times is easier if you know the average speed of a trail animal. Horses and mules have different gaits and speeds, depending on breed, training, and physical condition. The speed also depends on the animal's size, trail conditions, topography, size of the riding group, and experience level of the rider.

Most recreation trail users ride their animals at a walk on trails, or combine a walking gait with periods of trotting or cantering, averaging between 4 and 6 miles per hour (6.4 and 9.7 kilometers per hour). Keep in mind that many riders stop along the trail to socialize or enjoy the setting, slowing their average time. Some riders train for *endurance rides* (figure 4-3)—fast athletic events that cover 50 or 100 miles (80.5 or 161 kilometers).

### Trail Sight Distance

Mounted riders can see farther than trail users on the ground. This added height helps others see the rider. Near the crest of a hill, a trail user should see the head of another trail user on the other side of the hill before reaching the hill's crest. Riders training for endurance races and other trail users that travel at increased speeds require plenty of sight distance to avoid collisions. Downhill travelers need more stopping distance than uphill travelers. Curves in the trail reduce the sight distance; in such cases, trim vegetation along the curve. Design trail curves for appropriate speeds and sight distance to prevent conflicts, considering individual site conditions. The large group of riders shown in figure 4-4 requires a long sight distance to give them time to react.



#### Horse Sense

##### Speeding By

The average speeds of the most common horse gaits on relatively flat ground are:

- ☆ Walk—About 2.5 to 4 miles per hour (4 to 6.4 kilometers per hour), about as fast as a person walks
- ☆ Trot—About 8 miles per hour (12.9 kilometers per hour)
- ☆ Canter or Lope—About 12 miles per hour (19.3 kilometers per hour)
- ☆ Full Gallop—About 20 to 30 miles per hour (32.2 to 48.2 kilometers per hour)



Figure 4-3—Endurance races are long-distance rides with strict veterinary controls.



Figure 4-4—A large equestrian group needs a relatively long sight distance to avoid conflicts with other trail users.





**Lingo Lasso**

**Sight Distance**

People sometimes confuse the terms *sight distance*, *sight line distance*, and *sight stopping distance*. Sight distance and sight line distance—or *sight line*—usually refer to how far a person can see along an unobstructed line of sight. Sight stopping distance usually takes into consideration the time it takes a traveler to see something, react to it, and stop safely.

Sight distance in areas with low development is most critical when trail users encounter approaching bicyclists or riders (figure 4–5). It is often customary for other trail users to yield to horses and mules. To do so, trail users need adequate warning and space. When two horses meet, passing is difficult.



Figure 4–5—Horses and mules need more maneuvering space than people. Usually other trail users yield to riders, and individual riders yield to packstrings.

Frequently, horses heading uphill take precedence. In some areas, time is used to separate trail users. For example, on the Holland Lake Trail to the Bob Marshall Wilderness in Montana, incoming traffic

has the right-of-way until noon, when the preference switches to outbound trail users. Local custom often determines who has the right-of-way. There are no fixed rules that apply nationwide.



**View from the Saddle**

**Trail Talk**

There are different ways to determine sight distance on trails.

- ☆ For trails on small properties, Melvin Baughman and Terry Serres (2006) recommend a minimum sight distance of 50 feet (15.2 meters) with 100 feet (30.5 meters) preferred. Provide 100 feet of sight distance at road crossings.
- ☆ On horse trails in Pinellas Park, FL, Orth-Rodgers and Associates (2002) recommend sight distance of 100 feet (30.5 meters) forward and backward.
- ☆ On roads and some trails, especially trails that intersect with motorized traffic, sight and stopping sight distances are subject to guidelines established by AASHTO. Many

agencies incorporate AASHTO guidelines into their own standards, sometimes by reference. AASHTO publishes numerous guidebooks that cover highways, roads, roadsides, bridges, bicycle and pedestrian trails, and other related subjects. Some AASHTO publications are listed in *Appendix C—Helpful Resources*.

- ☆ In the United Kingdom, The Highways Agency (2005b) calculates stopping sight distance using rider eye heights, 4.9 to 8.9 feet (1.5 to 2.7 meters) off the ground. This range allows children on ponies as well as adults on larger stock to see, react, and stop in time. Distance calculations must include additional traffic factors, such as the speed of other trail users.





## Trail Clearance

Vegetation that encroaches on tread width and overhead clearance is more than a nuisance for trail users—it can entangle users and gear. Trim or remove vegetation and other obstacles—such as boulders—from this area (see figure 4–1) so trail users can more easily avoid plants that have prickly seeds, thorns, and pointed branches. Periodically providing larger cleared areas for turnouts gives trail users room to move off the tread for breaks or to allow others to pass. Keep in mind that the weight of leaves can cause deciduous tree branches to bend 1 to 2 feet (0.3 to 0.6 meter) in summer and snow can cause evergreen trees to bend in winter, reducing the overhead clearance (Baughman and Serres 2006).

## Horizontal Clearance

Trail clearance varies by trail use and setting. Table 4–1 shows a general range for clearing widths and overhead clearance on single-track horse trails. Tread width is discussed later in this chapter. Appropriate clearing width depends on the site. For example, on shared-use bicycle/pedestrian trails, AASHTO (1999) recommends at least 2 feet (0.6 meter) of graded width on each side of the tread. A distance of 3 feet (0.9 meter) is preferred from trees, poles, walls, fences, guardrails, and other obstructions. On Forest Service pack and saddle trails in the Northern Rockies, the trail clearing width is 8 feet (2.4 meters) and the trail vertical clearance is 10 feet (3 meters).

Table 4–1—Suggested widths and clearance for a standard, single-track horse trail. Agency specifications may vary.

Trail element	Low development (feet)	Moderate development (feet)	High development (feet)
Tread width	1.5 to 2	3 to 6	8 to 12
Clearing width (horizontal)	5.5 to 8 (Tread plus 2 to 3 feet to each side)	9 to 12 (Tread plus 3 feet to each side)	14 to 18 (Tread plus 3 feet to each side)
Overhead clearance (vertical)	10	10 to 12	10 to 12

Baughman and Serres (2006) of the University of Minnesota Extension recommend a clearing width of 8 feet (2.4 meters) on one-way trails or trails with light use. They recommend a clearing width of 12 feet (3.6 meters) on two-way trails or trails with heavy use.

On level terrain, trails are cleared an equal distance on either side of the tread centerline. Using the previous Forest Service trail example with a 2-foot (0.6-meter) tread, the clearing width would be 3 feet (0.9 meter) on either side of the tread, for a total cleared width of 8 feet (2.4 meters). It is unnecessary to remove all the vegetation from the side of the trail. Instead, consider leaving vegetation or objects less than 30 inches (762 millimeters) tall. The cleared area—also called *load clearance* (see figure 3–11)—accommodates items tied to saddles, such as picnic

articles, sporting gear, or very full saddlebags, but it's also useful when two trail users must pass on a narrow trail. The concept applies to urban and rural areas if the trail does not already have substantial shoulders or horizontal clearance. Consult the land management agency's guidelines.

On moderate to steep side slopes, extensive travel along the lower—or *outer*—edge of the tread can cause the tread to fail. A log cut nearly flush with the trail's downhill trail edge will encourage travelers to move toward the center of the tread. Rocks, limbed trees, and other natural materials near the lower edge of the tread also help guide traffic back to the center. Obstacles left as guide material on either side of a trail can interfere with loads and can catch a rider's legs or stirrups. Be sure to leave load clearance as described previously. Experienced trail stock may adjust their position on a trail tread to avoid contact with encroaching objects—less experienced stock may not.

To compensate for guide material left near the downhill edge of the trail, cut and remove material



for a greater distance from the centerline on the uphill side. When slopes are steeper than 50 percent, consider providing additional horizontal clearance for logs or protruding branches. For example, on the 2-foot (0.6-meter) wide Forest Service trail cited earlier, extend the clearance 6.5 feet (2 meters) from the centerline. This would mean clearing 5.5 feet (1.7 meters) beyond the edge of the tread. This added clearance is particularly necessary for packstock because a horse may shy away from any object near its head. Widen trails cut through solid rock on steep hillsides to provide load clearance. Also, widen the trail base along a precipice or other hazardous area. Using a 2-foot (0.6-meter) Forest Service trail as an example, hazardous trail segments would be widened to 4 or 5 feet (1.2 or 1.5 meters) for safety. Wider treads also provide safe passing areas. Planning this flexible clearance takes some thought and may be difficult for inexperienced trail construction crews. Meander the clearing edges so the trail looks natural.

### Vertical Clearance

Low vertical clearance is a potential safety hazard for riders when stock need maneuvering space. Vertical clearance for physical barriers, including bridges, underpasses, and vegetation, should extend at least 10 feet (3 meters) above the tread. Vertical clearance of 12 feet (3.6 meters) is recommended. Increasing the vertical clearance, especially on engineered structures, can be quite costly, and designers must exercise good engineering judgment.

### Vegetation Clearance

Cut tree and shrub branches back to the tree trunk or to the vegetation's stem. Don't cut all vegetation back exactly the same distance. In some cases, some slightly encroaching vegetation may help slow trail users down. During construction of new trails, minimize plant disturbance. Using the least obtrusive tool to do the job helps accomplish this goal. When highly valued or rare plants cannot be trimmed and must be removed, consider relocating them. On public lands, follow guidelines for sensitive plant species that require extra protection.

It is important to know which vegetation is toxic to stock to avoid routing trails nearby. If toxic plants can't be avoided, the next best choice is to remove them. If toxic plants can't be removed, use signs that identify toxic plants adjacent to trails, especially in highly developed or high-use areas.



#### Native Plants

#### Resource Roundup

*Roadside Use of Native Plants* (Kartesz and others 2000) addresses preserving and restoring native plants. The State-by-State section lists native, endangered, and noxious plants. Additional resources also are included. The document is available at <http://www.fhwa.dot.gov/environment/rdsduse>.

### Trail Tread

Tread is the actual travel surface of the trail, where the hoof meets the surface. Tread is constructed and maintained to support the designed trail use and may or may not be paved. Most trail construction involves establishing solid, obstacle-free tread that stays in place. A good job of locating, constructing, and maintaining tread discourages trail users from creating their own paths.

### Tread Width

No national standards establish the width of shared-use trails. Determining the best trail width is site-specific and depends on many factors, including the types of trail users and their needs, the level of development, the setting, land availability, jurisdictional requirements, safety, potential conflicts, local expectations, and maintenance concerns.

To accommodate their natural stride, horses and mules require a tread that's at least 1.5 to 2 feet (0.5 to 0.6 meter) wide. The trail animal and rider require about 4 feet (1.2 meters) of unobstructed width, and packstock with loads require a minimum unobstructed width of 5 feet (1.5 meters). If stock frequently carry bulky items, the suggested minimum clearing width is 6 feet (1.8 meters).





Tread width also varies by the number of incorporated lanes—or *tracks*. A single-track tread forces trail users to travel single file. They must move off or to the side of the trail when meeting or passing others. A double-track tread allows trail users to travel two abreast or easily accommodates passing. Single-track treads vary from 1.5 feet (0.5 meter) wide in wildland areas to 8 feet (2.4 meters) or wider in urban areas. Double-track treads are often 5 to 6 feet (1.5 to 1.8 meters) wide if there is plenty of clearance on each side to allow passing. This is a common configuration for moderately developed trails in rural settings. In highly developed areas, double-track treads frequently are 8 to 12 feet (2.4 to 3.6 meters) wide to meet the needs of all trail users. Trails should be wider in areas with heavy shared use.

4



Trail Talk

**Flexible Tread Width**

On single-track trails with low, but steady use, the Pennsylvania Trails Program (1980) recommends a minimum tread width of 2 feet (0.6 meter) for stable soils and 3 feet (0.9 meter) for poorer soils. Where there are frequent encounters between stock and other trail users coming from opposite directions, the minimum suggested tread width is 6 feet (1.8 meters). In areas with steep dropoffs or other hazards, the recommended width is 8 feet (2.4 meters), which allows stock to pass each other safely.

In areas with low development, trail users usually have fewer encounters with other users, and the trail tread can be narrower. To allow proper use and to reduce animal impacts, horse trails with low levels of development require at least 1.5 to 2 feet (0.5 to 0.6 meter) of tread width. Narrower trails force stock, particularly packstock, to step off the tread. The outer edges of a wildland trail generally receive the greatest impacts from packstock and wildlife. The suggested tread width for horse trails is summarized in Table 4–2. Narrow single-track treads require trail users to move to the side when others pass. Design cleared areas or wide spots to accommodate this practice. Double-track treads may need additional width near walls, fences, or other obstacles. Highly developed trails often have to be wider to accommodate higher traffic volumes and multiple trail user groups. The preferred tread width on shared-use trails depends on who is doing the sharing. The guidelines in table 4–2 apply to most nonmotorized shared-use situations

except those involving bicycles—which require additional considerations.

Not all equestrians are found in the saddle—some drive single animals or teams pulling carriages, wagons, carts, sleighs, or other conveyances. Stock that pull carts require tread width that accommodates the vehicles. Single-horse runabout carts (figure 4–6) require a tread width of 4 to 5 feet (1.2 to 1.5 meters), and those pulled by teams of two or more animals require even more. Figure 4–7 shows common dimensions for a runabout cart pulled by a single, standard-sized driving horse. Four-wheeled conveyances pulled by a team of animals are longer and wider than single-horse runabout carts. Other trail users passing in either direction require adequate space to go around. The minimum preferred tread width for a team of animals is 12 feet (3.6 meters). Consult carriage manufacturers or local equestrians for more details.

Table 4–2—Suggested tread width on shared-use horse trails with no bicyclists. Agency specifications may vary.

Number of tracks	Low development (feet)	Moderate development (feet)	High development (feet)
Single-track tread	1.5 to 2	3 to 4	6 to 8
Double-track tread	Usually is a converted vehicle trail	5 to 6	8 to 12

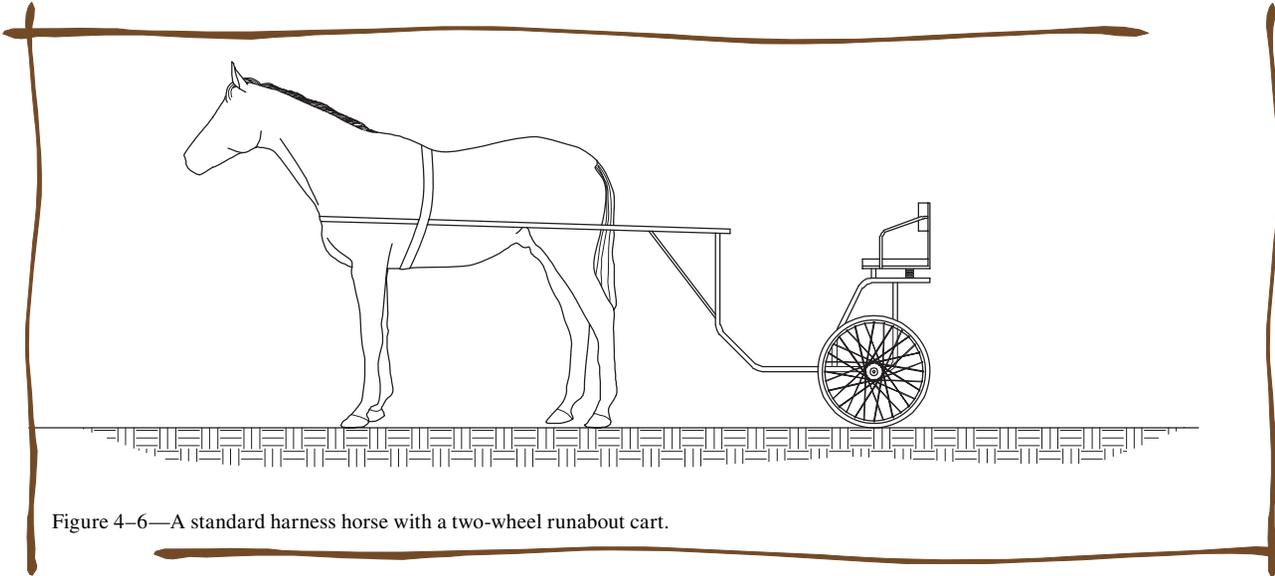


Figure 4-6—A standard harness horse with a two-wheel runabout cart.

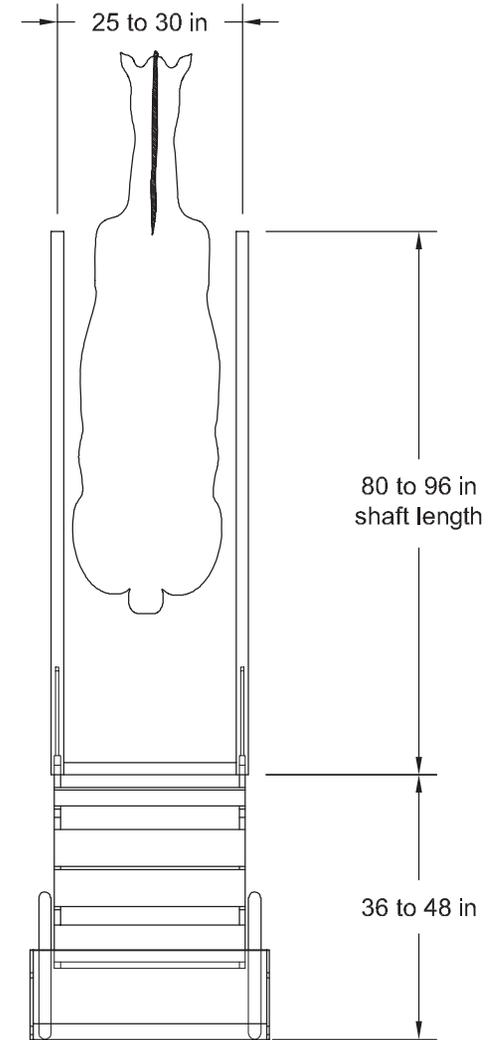
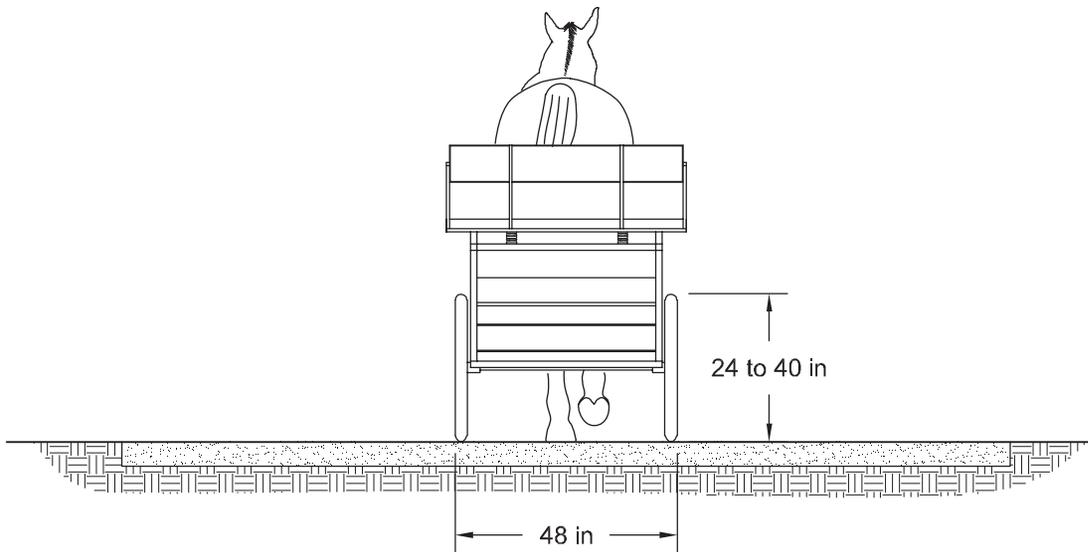


Figure 4-7—Some common dimensions for a single-horse runabout cart.



## Tread Surface

The choice of tread surface treatment affects the speed at which horses and mules can travel. For example, fine aggregate and dry woodchips provide relatively good traction and are conducive to safe cantering. Hard surfaces, such as large flat rocks, offer poor traction, and for safety reasons, limit travel to a walk. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for more information.

## Tread Obstacles

Tread obstacles, including tree roots, waterbars, holes, or projecting objects, present tripping hazards and should be removed. Whenever possible, construct edges flush on either side of the trail tread without rocks, curbs, or other delineating materials. Stock may encounter curbs and other low objects, especially in highly developed areas. Most horses and mules navigate them successfully, but it is better to avoid them when possible. If curb cuts and grades are designed to meet accessibility guidelines and are at least as wide as the trail tread, the curbs usually are passable.

## Alignment

Alignment is a major consideration when locating trails. Alignment—horizontal and vertical—affects trail users' satisfaction and the trail's longevity. Alignment also affects sight distance and the speed at which trail users travel. The ideal trail matches the route to the ground, following the contours of the land

and providing the best view (figure 4–8). The most enjoyable trails take advantage of natural features, such as drainages, winding around trees and rocks.



Figure 4–8—Elevation on contour trails remains relatively constant. Trail users appreciate contour trails because they are easier to travel and frequently offer great views.

*Horizontal alignment* is the way the trail looks from above, as on a map. The best horizontal alignment includes simple curves rather than straight sections with sharp turns. *Vertical alignment* is the way the trail climbs and descends slopes. The vertical alignment determines not only how steep the trail is, but also how it channels water. Erosion from runoff is one of the most destructive forces affecting a trail. For information regarding trail alignment, refer to *Appendix B—Trail Libraries, Trail Organizations, and Funding Resources* and *Appendix C—Helpful Resources*.

## Grade

Steepness—or *grade*—determines how challenging a trail is. In the English measurement system, grade is the amount of rise in 100 feet (30.5 meters) expressed as a percentage. A trail that climbs 5 feet (1.5 meters) over a distance of 100 feet has a 5-percent grade. Grade directly affects how a trail needs to be designed, constructed, and maintained to establish and retain solid tread.

Generally it is easier for stock to maintain their balance when they are traveling uphill rather than downhill. This is because most of their weight is over the forelegs. Descents require stock to shift more weight to their forelegs. Table 4–3 shows suggested design grades for horse trails. Surface water runoff can be controlled on all of the grades listed in the table. On grades nearing 50 percent, erosion cannot be controlled.

The best contour trails have grades, slopes, and turns that are comfortable for all trail users, not just horses and mules. Following contours helps reduce erosion and minimize trail maintenance. Keep trail segments between slope breaks—or *running grades*—as short as possible. Do so by following land contours, as opposed to cutting across or going straight up and down contours. Incorporate periodic short grade reversals as needed to remove surface water from the trail. Because water gains speed as it runs downhill, the potential for erosion increases greatly as the running grade becomes longer.



Table 4-3—Suggested design grades for horse trails. Agency specifications may vary.

Length of pitch	Low level of development**	Moderate level of development**	High level of development**
<b>Target range* (Over at least 90 percent of trail)</b>	Less than or equal to 12-percent grade	Less than or equal to 10-percent grade	Less than or equal to 5-percent grade
<b>Steep exceptions*</b>	20-percent grade for no more than 200 feet	15-percent grade for no more than 200 feet	5- to 8-percent grade for 800 to 1,500 feet  8- to 10-percent grade for 500 to 800 feet  10-percent grade for no more than 500 feet

\* May not meet accessibility requirements.

\*\* Base any grade variances on soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential.

Horses and mules easily can master steady grades steeper than 10 percent—even 20 percent. However, as the grade increases, so does the potential for runoff to harm the trail’s surface. In areas where grades are steeper than 10 percent, consider using one or more switchbacks to gain elevation (figure 4-9). Refer to *Trail Switchbacks* in this chapter for more information.

On running grades steeper than 5 percent, add 6 to 12 inches (152 to 305 millimeters) of extra tread width as a safety margin where possible. This helps a trail animal regain its footing if it accidentally steps off the downhill side of the trail. Benches or trail sections that are at least 100 feet (30.5 meters) long without a running grade can serve as resting areas for stock that are out of condition, large groups, and packstock. The larger, relatively flat area means an entire group can rest together at one time.



### Making the Grade

#### Trail Talk

In the United Kingdom, equestrian routes are available to bicyclists, and are subject to bicycle grade recommendations of 3 to 5 percent, with occasional steeper pitches. The preferred maximum grade on routes limited to equestrian use is 20 percent (The Highways Agency 2005b). The British Horse Society (2005b), an advocacy group, recommends a maximum grade of 8.3 percent for routes that include equestrians.

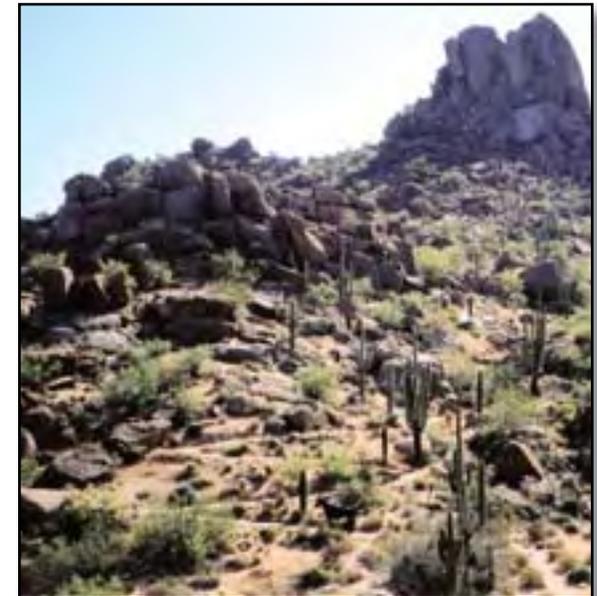


Figure 4-9—A trail with segments separated by switchbacks is easier to travel than a single, steep trail.



### Steps

In areas where grades exceed 10 percent, trail steps are common (figure 4–10). Most horses and mules navigate steps successfully, but steps sized for humans may present difficulties for stock. Some stock hesitate at steps, and some riders don't like the jostling that occurs when they're forced to navigate steps on horseback. Figure 4–11 shows a ford that incorporates a step up to the trail. The landing is too small, causing some stock to balk. Soils at the approach and landing areas of steps or staircases may erode quickly, leaving a gap that can catch an animal's hoof. Stock can negotiate steps with risers that are 16 inches (406 millimeters) high or higher, but many riders prefer steps with risers that are no higher than 12 inches (305 millimeters).

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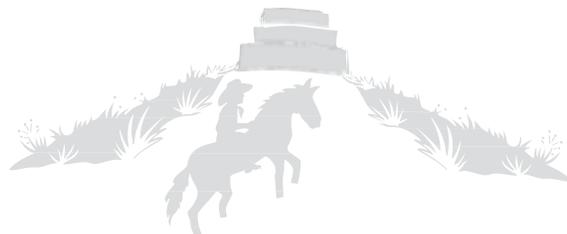


Figure 4–10—Experienced trail stock readily travel these steps to a bridge crossing. The risers are 8 to 12 inches tall, and the landings are 6 to 8 feet deep. The trail tread is about 3 feet wide. Trees and rocks along the sides direct stock onto the bridge.

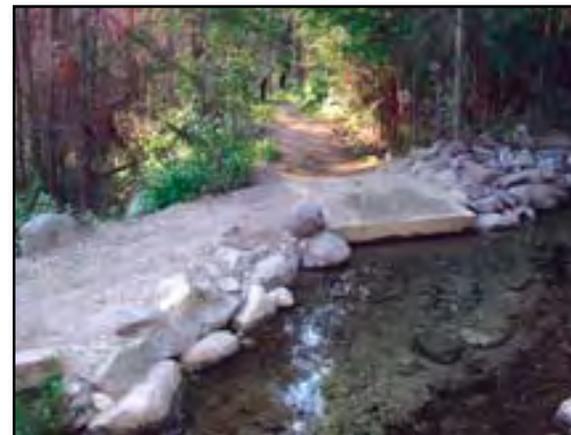


Figure 4–11—After fording the irrigation ditch, stock must step up about 12 inches. Because the landing is only 4 feet square, some untrained stock balk at the step.



### Stepping Up

#### Trail Talk

Steps on horse trails should be used with caution.

☆ In the United Kingdom, neither The Highways Agency (2005b) nor the British Horse Society (2005b) recommends steps for equestrian routes. In cases where steps are unavoidable, the British Horse Society recommends a step length of 9.5 feet (2.9 meters) to allow stock to stand with all four feet on a single step. The recommended height for risers is 5.9 inches (150 millimeters). The step may slope slightly downward to make use of limited space.

☆ The Student Conservation Association avoids building steps on trails used by stock (Birkby 2006). When there is no alternative, they require landings at least 4 feet (1.2 meters) deep, but prefer them to be 5 feet (1.5 meters) deep. Stones form the front and sides of the step—the *crib*. For crib fill, SCA uses crushed rock or other durable material that is not easily kicked loose or eroded by hoofs. SCA also recommends using visual barriers alongside steps to encourage stock to stay on the tread. Sometimes, rocks placed randomly alongside the trail serve this purpose.



### Outslopes

Flowing water follows the path of least resistance, which may be directly down a poorly constructed trail. An *outslope*—also known as a cross slope—helps shed water from the trail (figure 4–12). Grading with an outslope leaves the outside edges of a hillside trail slightly lower than the inside edge. Table 4–4 shows suggested slope ranges for outslopes for horse trails.

Table 4–4—Suggested slope range for outslopes on horse trails. Agency specifications may vary.

Low development (percent)	Moderate development (percent)	High development (percent)
5 to 10	5	2 to 5

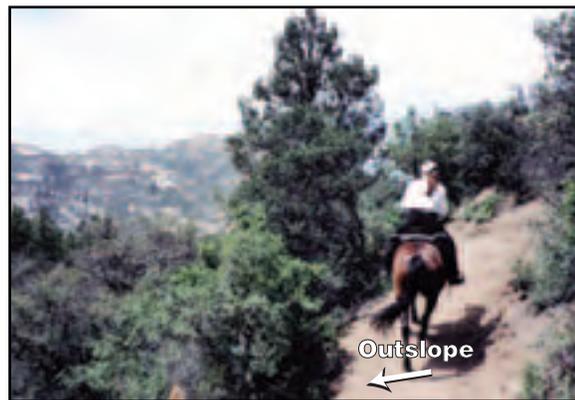


Figure 4–12—An outsloped section of trail directs water off the tread, reducing erosion damage.

### Grades, Outslopes, and Drift

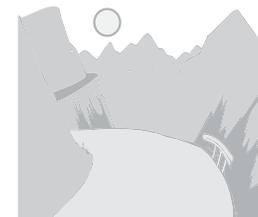
Over time, trails tend to drift downhill as trail users step to the tread’s outside edge and wear it away. As running grades increase and outslopes become extreme, stock may find it difficult to maintain their balance and stay in the center of the tread. To protect the edges of the trail, make trails wider as the outslope becomes steeper. When trails have outslopes of 4 to 5 percent, widening the trail an additional 6 to 12 inches (152 to 305 millimeters) helps stock stay in the center. An alternative is to create wide spots where obstacles might force riders and packstock to the outer edge of a trail. Berms sometimes build up on the edges of trails, preventing water from flowing off the tread. Proper maintenance removes these berms, preventing erosion.

### Slopes With Hard Surfaces

Trail animals can slip on smooth, hard surfaces, especially if they are outsloped. Where trails intersect solid rock ledges, asphalt, concrete, or other hard surfaces, keep the outslope to 5 percent or less to reduce the possibility of slipping. Add texture to hard surfaces at trail crossings. Evaluate surface treatments carefully where trails make a transition to pavement—loose material may end up on the hard surface and reduce traction further. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for additional information.

### Trailbed Construction

On hillsides, excavate the trailbed into the hill to provide a slightly outsloped travel path. Figure 4–13 shows cross sections of a trail with a relatively flat trailbed, full-bench construction, ¾-bench construction, and a balanced section. Full-bench construction is preferred because it produces a more durable trail that requires less maintenance. During full-bench construction, excavated soil from the hill is cast as far as possible from the trail since it is not needed for fill (figure 4–14). Partial-bench construction incorporates part of the cut material in a process known as *sliver fill*. Because it is difficult to compact the fill evenly, the trail may be prone to failure, especially on the downhill side. If a slope needs to be filled, reinforce it with retaining walls or use step cuts and fills (see figure 4–13) to key the fill material into the slope.



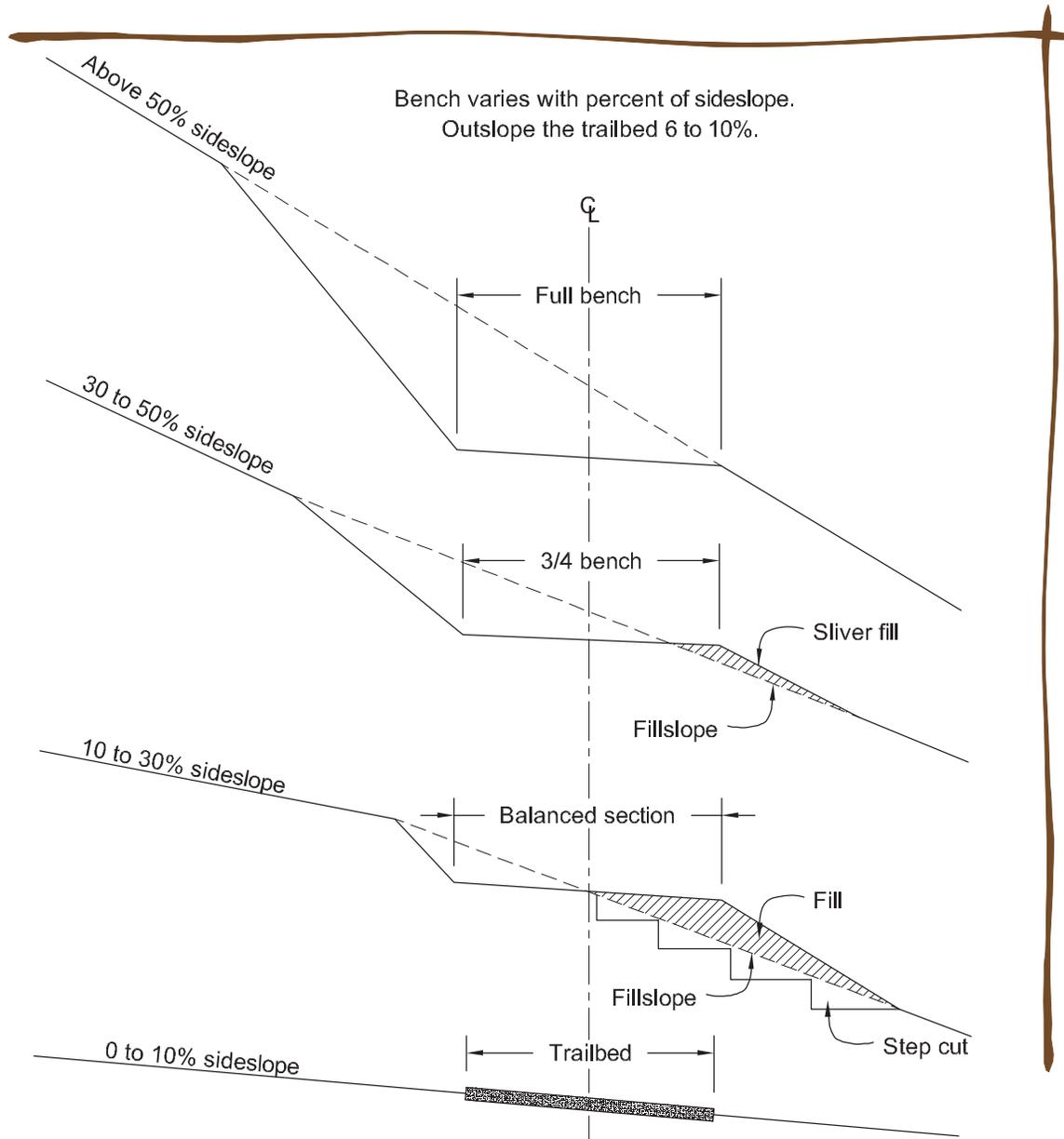


Figure 4-14—When constructing hillside trails in steep terrain, excavated soil is cast downhill.

### Trail Drainage

Proper drainage is vital trails because it reduces erosion from runoff and boggy conditions from water pooling in flat areas. Poor drainage increases tread damage by all trail users. Figure 4-15 shows an advanced case of poor trail drainage on a popular shared-use trail. For further information on trail drainage, refer to *Appendix B—Trail Libraries, Trail Organizations, and Funding Resources*.



Figure 4-15—Running or standing water can cause extensive damage.

Figure 4-13—Trail typical cross sections. Full bench construction gives the fewest problems, especially on steep slopes.



### Crowned Tread

One way to avoid water damage on relatively flat or level ground is to *crown* the tread—keep it higher in the center than on the edges. Usually, treads are crowned 2 to 5 percent. Soil composition, texture, type, and the trail’s use determine how often crowned tread needs to be maintained. Tread quickly becomes trenched on trails that are not maintained or that have significant traffic. Turnpikes are structures with a crowned tread that are sometimes used when trails cross boggy areas. Don’t crown short sections of trail paved with asphalt or cement.

### Waterbars

Although waterbars are common on trails, they often work poorly and require substantial maintenance. In theory, water running down the trail is deflected by the waterbar and runs off the trail’s lower edge. In reality, waterbars fill in with soil, wash out, dislodge, or deteriorate over time. In the process, the anchors holding waterbars in place may become exposed, creating a significant tripping hazard. Wildlife often go around waterbars, which also is the natural inclination for horses and mules. These unwelcome detours widen treads. When waterbars on horse trails are unavoidable, construct them of rock or wood.

Rock—or *armored*—waterbars are occasionally used where the trail grade is less than 5 percent (figure 4–16). On steeper grades—15 to 20 percent—waterbars are likely to clog if the waterbar is set at an angle of

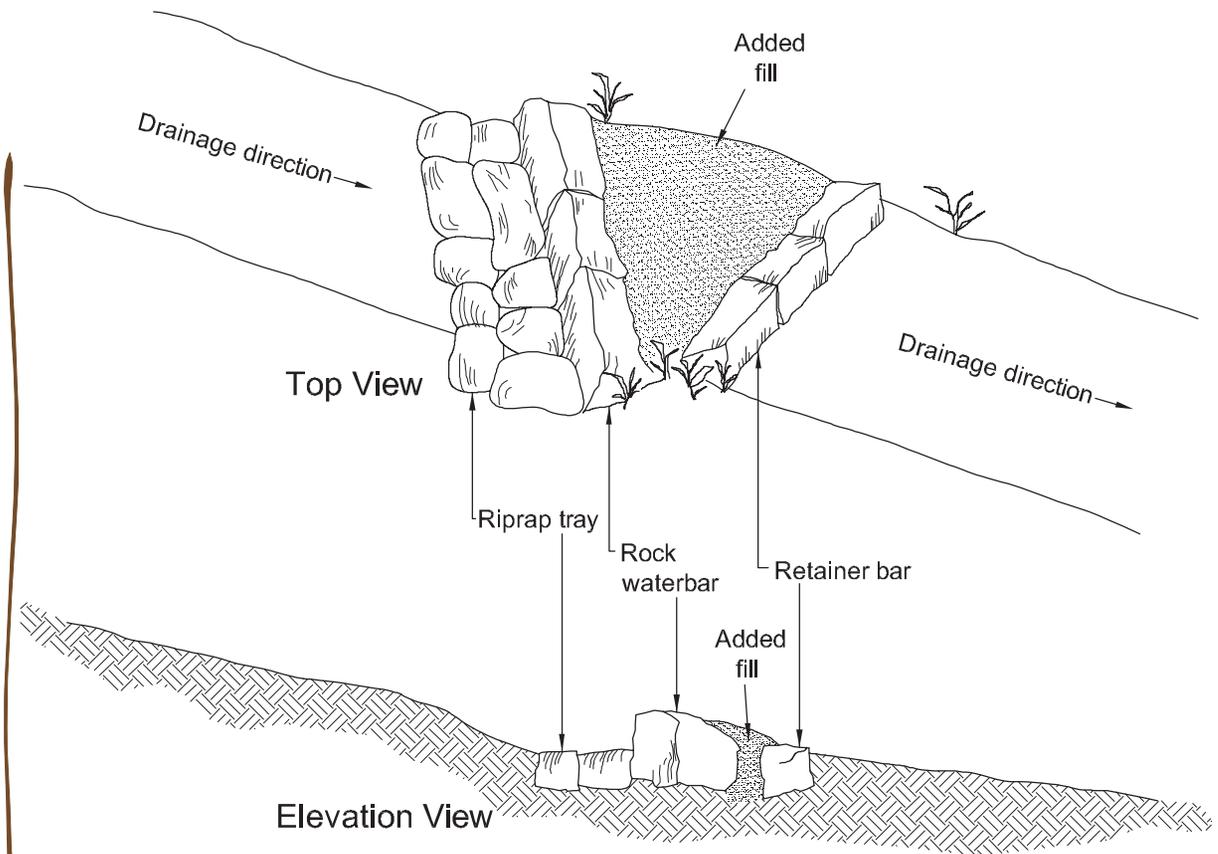


Figure 4–16—A reinforced or armored waterbar.

less than 45 degrees to the trail. When grades are steeper than 20 percent, waterbars are ineffective.

At such steep grades, there is a fine line between clogging the waterbar and eroding it away.



### Grade Reversals, Knicks, and Rolling Grade Dips

Grade reversals are used on new outsloped trails to shed water from the tread. In a grade reversal, the vertical tread alignment levels out and then drops subtly for 10 to 50 linear feet (3 to 15.2 meters) before rising again. Water flows down the drop, running off at the low spot before the water gains significant momentum or volume. Contour trails with grade reversals are often referred to as rolling contour trails. Retrofitting trails generally incorporate knicks or rolling grade dips. A knick is appropriate for draining puddles on relatively flat ground. A knick (figure 4-17) consists of a subtle, semicircular depression in the trail, about 5 to 10 feet (1.5 to 3 meters) long. The depression is angled about 15 percent so water runs off the edge of the trail. A rolling grade dip (figure 4-18) is similar to a knick. A rolling grade dip has an outsloped depression with a ramp built from the removed soil. The ramp is outsloped like normal tread, up to 5 percent. Rolling grade dips are 15 to 30 feet (4.6 to 9.1 meters) long and are more suitable than knicks for relatively steep trails. Stock tolerate grade reversals, knicks, and rolling grade dips well. Grade reversals, knicks, and rolling grade dips are preferred over waterbars in nearly all situations.

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Figure 4-17—A trail knick directs water off relatively flat areas.

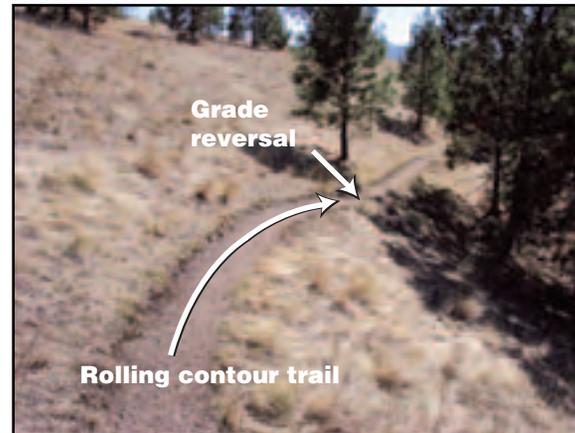


Figure 4-18—A trail with a grade reversal handles water more effectively than a trail with a waterbar. A grade reversal also requires less maintenance.



#### Trail Talk

#### Grade Dip or Waterbar?

For existing trails with water issues, Woody Hesselbarth, Brian Vachowski, and Mary Ann Davies (2007) encourage the use of rolling grade dips or knicks instead of waterbars. This is “...because by design, water hits the waterbar and is turned. The water slows down and sediment drops in the drain. Waterbars commonly fail when sediment fills the drain. Water tops the waterbar and continues down the tread. The waterbar becomes useless. You can build a rolling grade dip quicker than you can install a waterbar, and a rolling grade dip works better.”

#### Culverts

Where running water crosses the trail, culverts may be needed. Construct culverts of rock (figure 4-19), treated timbers, plastic, concrete, or metal, and surface them with at least 6 inches (152 millimeters) of suitable tread material. Bare culverts are slippery and have other undesirable features. The hollow sound of horseshoes hitting a bare culvert and the metal’s bright reflections or odd contrast can spook stock. Consider using tapered end sections (figure 4-20), painting the culvert ends, or screening the edges with rock or timber for safety and esthetics. The tread surface over culverts has a tendency to erode and needs to be replaced regularly.

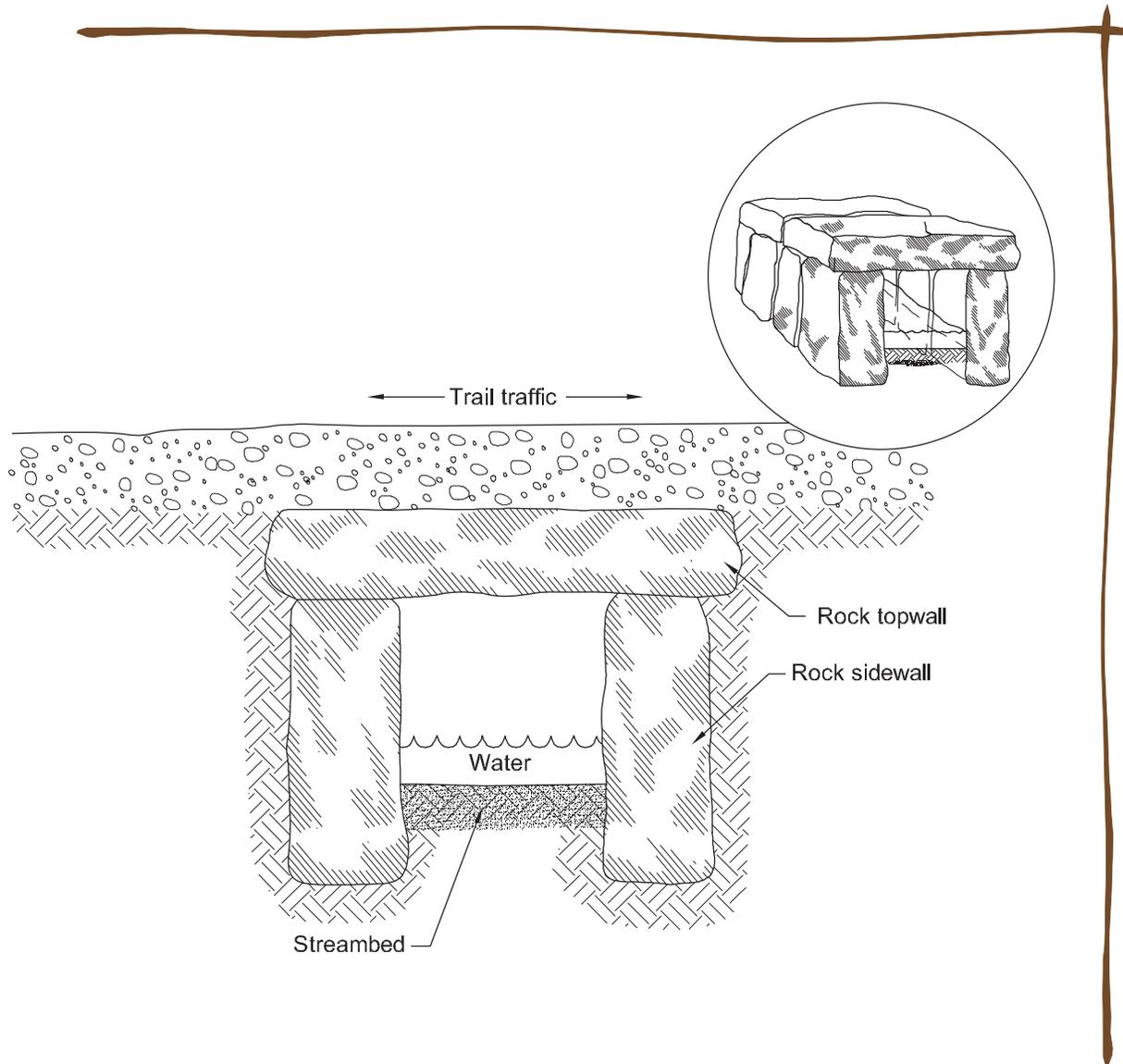


Figure 4-20—This trail culvert has a flared end piece that is partially concealed with rock. It is attractive, durable, conforms to the slope, and improves waterflow. Culverts with flared or covered ends are more horse-friendly than exposed culverts because they look more natural and there is no exposed metal to make noise when a horse steps on it. —*Courtesy of Kandee Haertel.*

### Grates

Any grates should be strong enough to support the weight of stock safely. Grate patterns should not catch horseshoes. Small grates placed to the side of the tread are better than grates that encroach on the center of the trail. Long, narrow grates are more likely to be accepted by stock than large square ones. Horses and mules often avoid grates because their surface does not appear solid and they make noise when stock step on them.

Figure 4-19—A rock culvert. Stones may also be laid along the bottom of the culvert.



### Curves, Turns, Passing Areas, and Switchbacks

The large size of stock and their loads requires plenty of maneuvering space. While curves and switchbacks designed to accommodate riders are usable by many recreationists, the design parameters are slightly different than those for other users, such as bicyclists. Refer to *Chapter 1—Understanding Horses and Mules* for the design dimensions of horses.

#### Curves and Turns

On trail curves and turns, the minimum comfortable radius is 5 feet (1.5 meters). When turns are any tighter, stock may stumble over their own legs. Turns with a radius of 6 to 8 feet (1.8 to 2.4 meters) are more comfortable for both animal and rider.

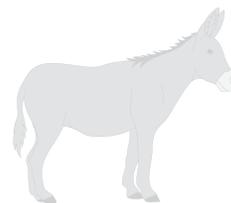
Table 4–5 shows the minimum suggested turning radius on horse trails with different levels of development. Wider turns are preferred. In addition to handling increased traffic volume and being more comfortable, wider turns may better suit tread width, site conditions, and trail users' experience levels. Allow additional clearance for packstock equipped with side panniers or for stock that are pulling carts.

Table 4–5—Minimum suggested turning radius for horse trails, depending on site conditions. Agency specifications may vary.

Low development (feet)	Moderate development (feet)	High development (feet)
5 to 6	6 to 8	8 to 10

#### Passing Areas

When trails are in steep terrain, other trail users can find it challenging to move aside for stock. Incorporate passing areas on narrow trails, particularly those on steep hillsides. A space 5 feet (1.5 meters) wide by 10 feet (3 meters) long will allow a single trail animal to pull off the tread. Locate passing areas in natural openings if possible. Larger passing areas, where large groups or packstrings may move off the trail while another group goes by, are sometimes needed. Plan these areas to handle the expected traffic volume and group sizes.



#### Switchbacks

Switchbacks reduce the grade on a trail by incorporating sharp turns on one or more trail segments. Several switchbacks may be needed to traverse a steep area effectively. Switchbacks consist of an upper and lower approach, guide structures, a landing—or turn platform—and a drain for the upper approach and landing. Figure 4–21 illustrates suggested guidelines for trail switchbacks on horse trails.

#### Trail Talk



#### Rounding the Curve

The Pennsylvania Trail Program (1980) recommends switchback landings no narrower than 8 feet (2.4 meters) on its trails. On horse trails, the Pitkin County, CO, Open Space and Trails Program (Parker 1994) specifies a minimum switchback radius of 10 feet (3 meters) and a minimum trail curve radius of 12 feet (3.6 meters) elsewhere.

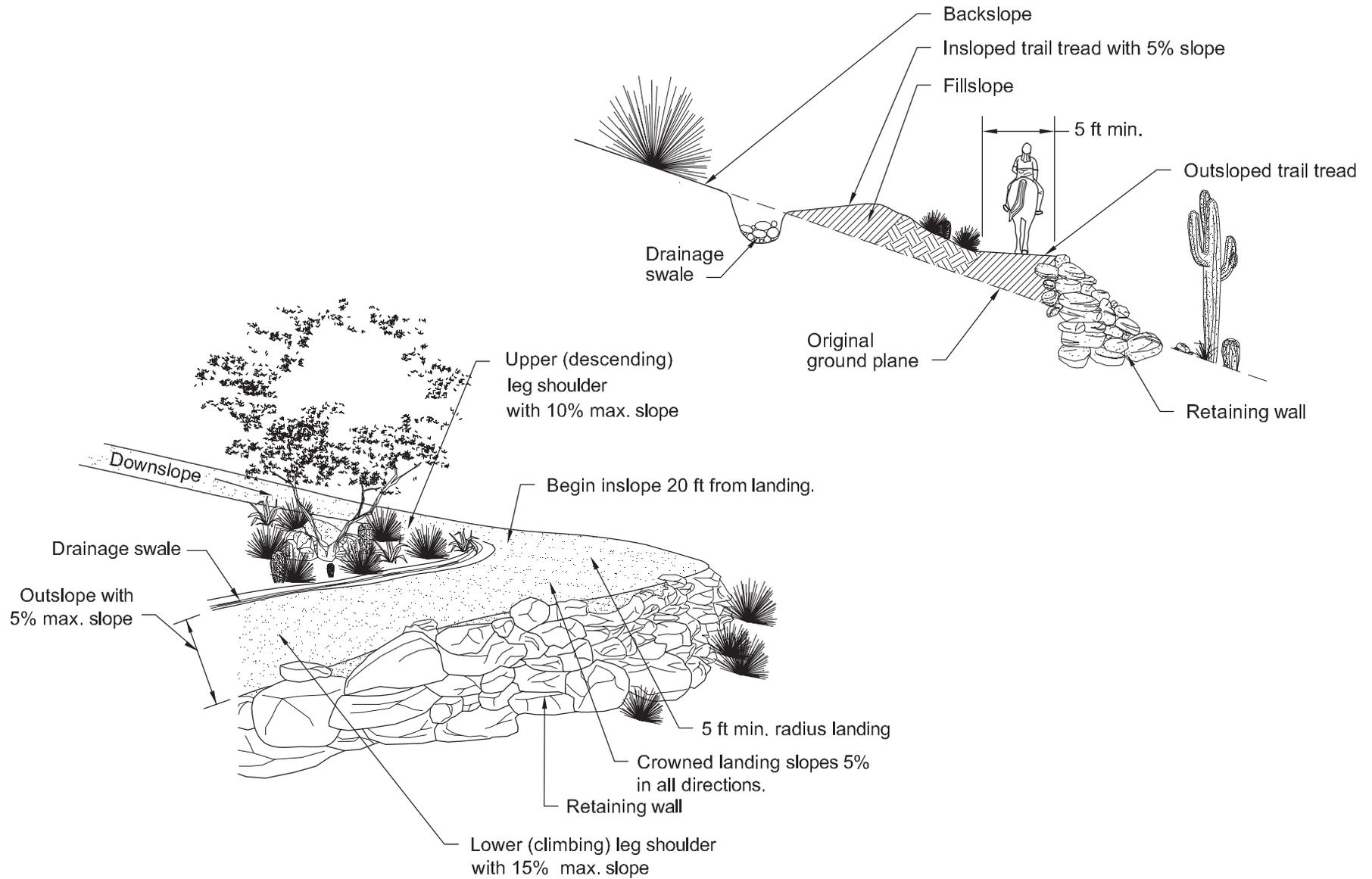


Figure 4-21—A switchback with a retaining wall.



### Shortcuts

Inexperienced or inattentive riders frequently cut across switchbacks. Packstock do too, but for a different reason. As the lead horse or mule completes its turn, the towrope tightens and prevents the following animal from making a wide turn. The effect continues down the line as each animal follows the one ahead. If the packstring is traveling too fast, stock cut the curve of the switchback.

Design trail switchbacks with as long a curve radius as possible, generally with a radius of at least 5 feet (1.5 meters). To discourage shortcutting, design grades of 10 percent or steeper for 100 feet (30.5 meters) leading to and away from switchbacks. Consider using a boulder or log barrier for 15 to 30 feet (4.6 to 9.1 meters) back

### Trail Talk

from the turning point, on the inside of the curve. Placing natural barriers at the inside of the curve is another approach to prevent shortcutting (figure 4-22).

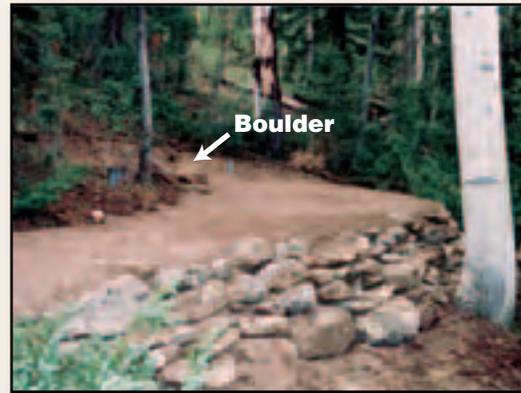


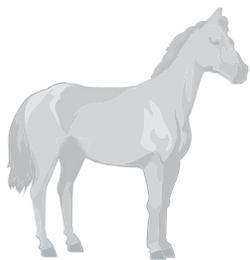
Figure 4-22—This newly reconstructed switchback includes a landing reinforced with a retaining wall. A boulder placed at the inside of the turn prevents shortcutting.

### Climbing Turns

Where appropriate, climbing turns are an alternative to switchbacks and are easier for packstock to negotiate. A climbing turn (figure 4-23) follows the natural slope. When the tread turns, it climbs at the same rate as the slope. The advantage of climbing turns is that a larger radius turn is easier to construct. Construction is much less expensive because less excavation is required and fill is not needed. The minimum suggested radius for a climbing turn is 20 feet (6.1 meters). Climbing turns work best when built on slopes of 15 percent or less. In steeper areas, switchbacks are a better choice.



Figure 4-23—Several stumps discourage trail users from cutting across this climbing turn.



**Chapter 5—****D**esigning Trail Crossings and Structures

Some of the most complex elements on trails are crossings and structures. Trails intercept roads, highways, railroad rights-of-way, wetlands, and waterways. Trails can pass over, under, or across such obstacles. Constructing even the simplest at-grade road or stream crossing means evaluating safety issues, trail user needs, design parameters, environmental concerns, and cost. Solutions range from simple to complex, and they require input from engineers and scientists representing many disciplines, as well as trail designers, legal experts, and local riders. This guidebook provides only a basic overview for trail crossings and structures. Consult governing authorities and qualified professionals for requirements, laws, standards, and guidelines.

**At-Grade Road Crossings**

Horse trails often cross roads or highways *at grade*—on the same elevation as the road. Ideally, the amount of motorized traffic in such areas is low, or the intersection has a traffic light with a push-button signal actuator that the rider can easily reach. Push-button signal actuators allow users to control the traffic light. When horse trails intersect

with roads, safety is the most important factor. Road crossings must conform to legal requirements, and they require the expertise of transportation engineers. When designing trail crossings, it is wise to consult a designer familiar with the special requirements of riders and stock.

**Crossing Locations**

Where trails cross roads, the trail should be perpendicular to the road. The crossing generally should be on a straight segment of road. Locations where motorists might expect an intersection are good sites for trail crossings. Consistency in the placement and design of intersections allows all users to identify them more readily. Federal, State, or local regulations usually affect trails that intersect roads.

Appropriate tread surfaces at road crossings are critical to rider safety. Most asphalt and concrete road surfaces don't provide enough texture or traction for a horse or mule. These surfaces can be as slippery to stock as compacted snow and ice are to pedestrians. For more information, see *Chapter 6—Choosing Horse-Friendly Surface Materials*.

**Dogleg Approaches**

## Trail Talk

The Haney Horsemen in British Columbia, Canada, sometimes advocate the use of T- or L-shaped trail jogs just before intersections with roads (Archibald, personal communication). The jog allows riders to slow down before they reach the road. When nearby vegetation is cleared appropriately, the added turns allow trail users and drivers to see each other in advance. Trails that approach an intersection by an S-shaped or zigzag path also allow trail users to see vehicles in several directions as they approach the road. Circuitous routes have another benefit—they can force stock to observe traffic, instead of blindly following the animal in front. When using dogleg approaches, provide adequate sight distance for both road and trail users, and make sure the immediate approach and crossing are perpendicular to the road.

The use of warning signs, decreased speed limits, road markings, narrowed travel lanes, and other traffic control devices can enhance the safety of riders and other users at road crossings. On public roads, signs and other traffic control devices must conform to the *Manual on Uniform Traffic Control Devices* (MUTCD).



Resource Roundup

**Intersection and Road Crossing Guides**

Shared-use trails may intersect with roads or have segments that need to meet Federal, State, or local requirements. Many agencies adopt the standard references listed below as part of their own requirements. The references listed are updated frequently—consult the latest edition.

- ☆ *A Policy on Geometric Design of Highways and Streets* (AASHTO 2001a) can be ordered from the AASHTO online bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=110](https://bookstore.transportation.org/item_details.aspx?ID=110).
- ☆ *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400)* (AASHTO 2001b) can be ordered from the AASHTO online bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=157](https://bookstore.transportation.org/item_details.aspx?ID=157).
- ☆ *Roadside Design Guide* (AASHTO 2002) can be ordered from the AASHTO online bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=148](https://bookstore.transportation.org/item_details.aspx?ID=148)
- ☆ *Manual on Uniform Traffic Control Devices* (FHWA 2004a) is available at <http://mutcd.fhwa.dot.gov>.
- ☆ *MUTCD Standard Highway Signs* (FHWA 2004b), a companion document to the MUTCD, is available at [http://mutcd.fhwa.dot.gov/ser-shs\\_millennium.htm](http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm).

**Crossing Sight Triangles and Visibility**

Riders need to see the road before they approach an intersection or a crossing that has rapidly moving traffic. To each side of the trail, vehicles need to see the approaching stock. These sight distances, sometimes called the *sight triangle*, allow sufficient time for everyone to stop safely once they have seen each other.

The required sight distances vary with the speed of the traffic involved and the eye height of the travelers. Refer to the appropriate AASHTO geometric design guidelines when calculating sight triangles for bicyclists and motorists on roads that intersect horse trails. Refer to the *Trail Sight Distance* discussion in *Chapter 4—Designing Trail Elements* for more information regarding riders’ needs.

Many riders recreate after sundown and during evening hours, particularly in warmer climates. While lighting at rural or wildland crossings generally is not feasible, in areas with high levels of development, crossing lights may be advisable.



Trail Talk

**Trails Crossing Roads**

Where shared-use trails approach road crossings, Baughman and Serres (2006) recommend adding “...a tight turn, ridges and dips in the tread, and/or narrowing the clearing width to slow down trail users. On the final approach the trail must be at a right angle (90 degrees) to the road, nearly level, and have a sight distance adequate for trail users to see the oncoming road in time to stop.” They also recommend expanding the clearing width or thinning forest trees to provide good visibility from the trail to the road.

**Waiting Areas at Crossings**

Riders generally ride in pairs or groups. When a trail group comes to a road crossing, riders may have difficulty keeping stock off the road. Solutions include trimming vegetation to provide a clear view farther from the road or providing a waiting area that allows stock to stand back from traffic until it is safe to cross. Consider expanding the width of the trail surface before it meets the road, forming a rectangular or fan-shaped waiting area.



### Waiting to Go

In the United Kingdom, rider waiting areas—also called *refuges*—are required where equestrian routes cross roads at grade (figure 5-1). *The Geometric Design of Pedestrian, Cycle and Equestrian Routes* (The Highways Agency 2005b) specifies a grassy area measuring 16.4 by 32.8 feet (5 meters by 10 meters). Two L-shaped fences or barriers are set opposite each other to create a dogleg in the bridle path, slowing trail traffic before it reaches the waiting area. Fence segments guide riders and their stock and make the refuge more noticeable to other users. When reviewing this design, keep in mind that traffic in the United Kingdom travels on the left-hand side of the road. U-turns are usually prohibited near rider refuge areas. When refuges are necessary in medians between multiple lanes of traffic, the designated size is 16.4 feet wide by 9.8 feet long (5 by 3 meters). Structures associated with equestrian routes, such as bridle gates or horse stiles, must be placed at least 13.1 feet (4 meters) from the road.

### Trail Talk

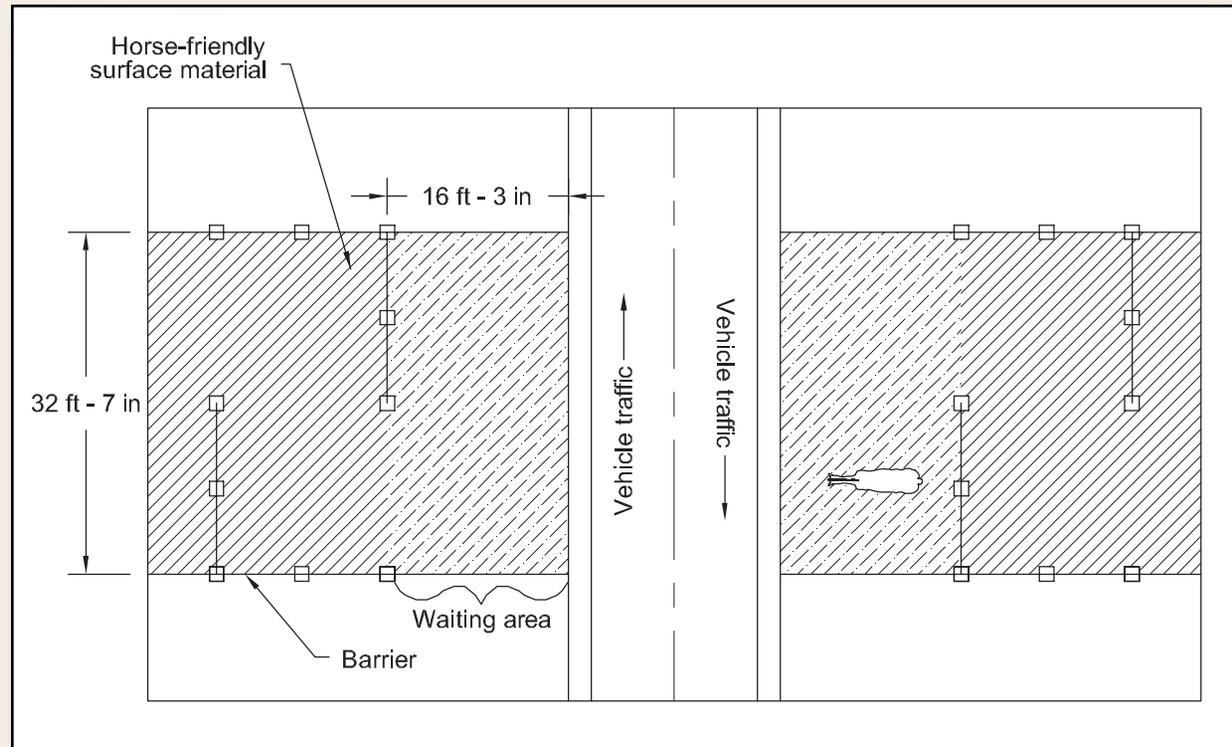


Figure 5-1—A bridleway crossing with waiting area in the United Kingdom. —Courtesy of The Highways Agency. The original figure was edited for clarity.





## Road Signs and Traffic Signals

Road signs are critical for the safety of riders and other trail users where trails cross roads. Consider standard equestrian crossing signs for all at-grade road crossings used by horses and mules. *Chapter 12—Providing Signs and Public Information* has more information regarding road signs.

Most push-button signal actuators are installed too low for riders to reach without dismounting. To solve the problem, install a second push button for riders. Most seated riders can operate a push button that is between 5 and 6 feet (1.5 and 1.8 meters) above the ground (figure 5-2). Set the post far enough back from the road to keep stock out of the traffic lane.

5



### Trail Talk

#### Push-Button Signal Actuators

*Equestrian Crossings* (The Highways Agency 2003) discusses crossings with and without traffic signals in the United Kingdom. The Highways Agency places push-button signal actuators in a position that encourages riders to first check the nearest approaching traffic. They also recommend placing push buttons at least 6.6 feet (2 meters) from the road edge so the animal's head does not encroach on traffic. The leaflet is available at <http://www.dft.gov.uk/pgr/roads/tpm/tal/signsandsignals/equestriancrossings>.

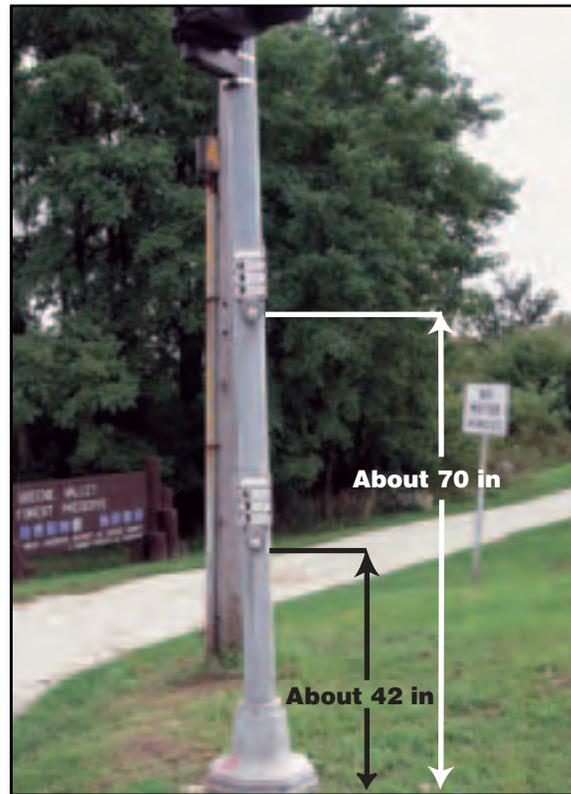


Figure 5-2—Two push-button signal actuators serve pedestrians and riders. The push button for equestrians is about 70 inches above the trail's surface. —Courtesy of Forest Preserve District of DuPage County, IL.

## Road Intersections

Trail intersections with roads require site-specific engineering studies and must comply with the MUTCD standards, AASHTO guidelines, and other applicable requirements for signs, push-button

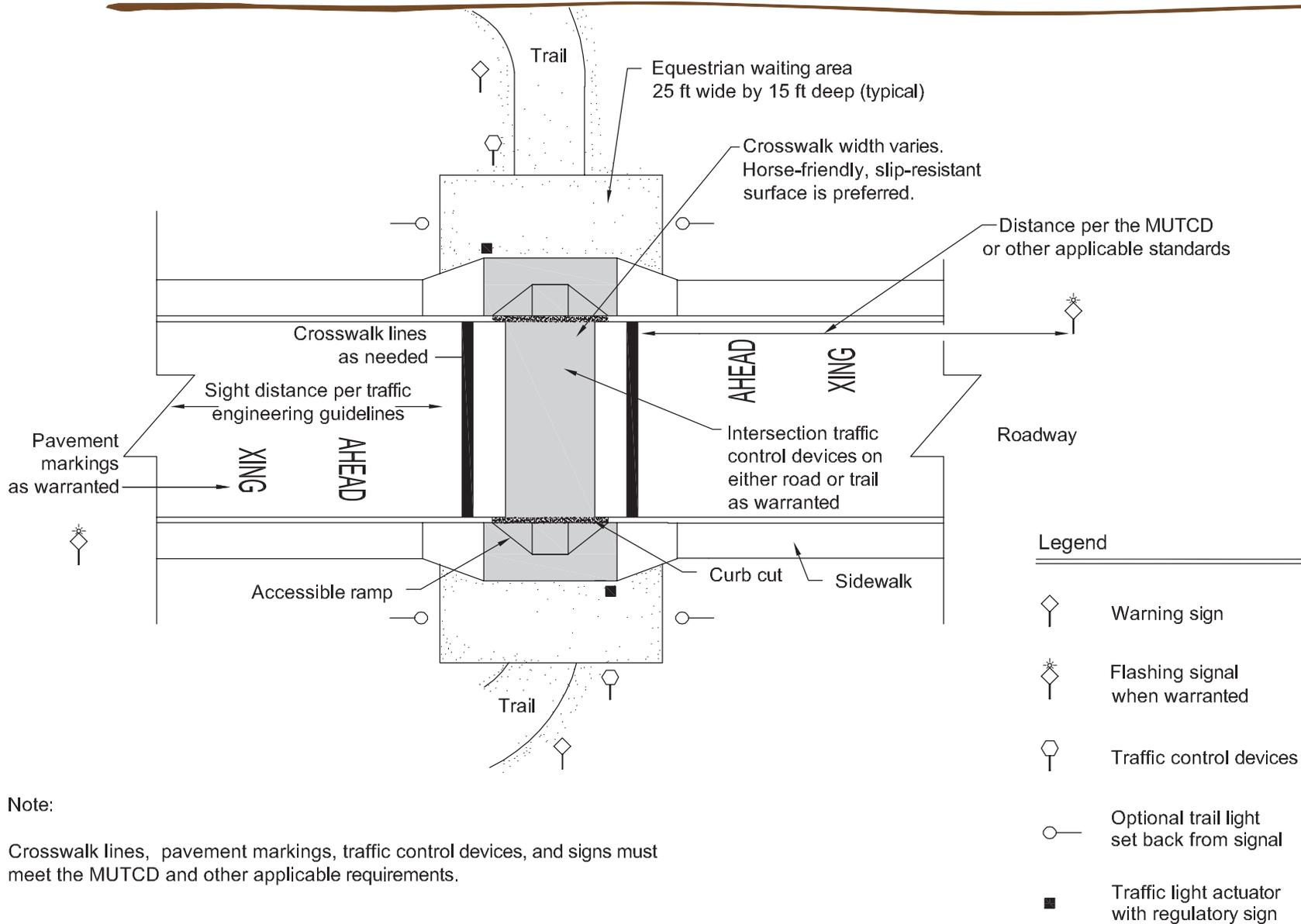
signal actuators, and related elements. Figures 5-3 and 5-4 illustrate two concepts for shared-use trails that intersect with roads. Figure 5-3 illustrates a concept for an at-grade road crossing with traffic signals, curbs, and sidewalks. Figure 5-4 illustrates a concept for an at-grade trail crossing without signals. According to the MUTCD (2003), nonvehicular signs with symbols may be used to alert road users in advance of locations where unexpected entries may occur.



### Resource Roundup

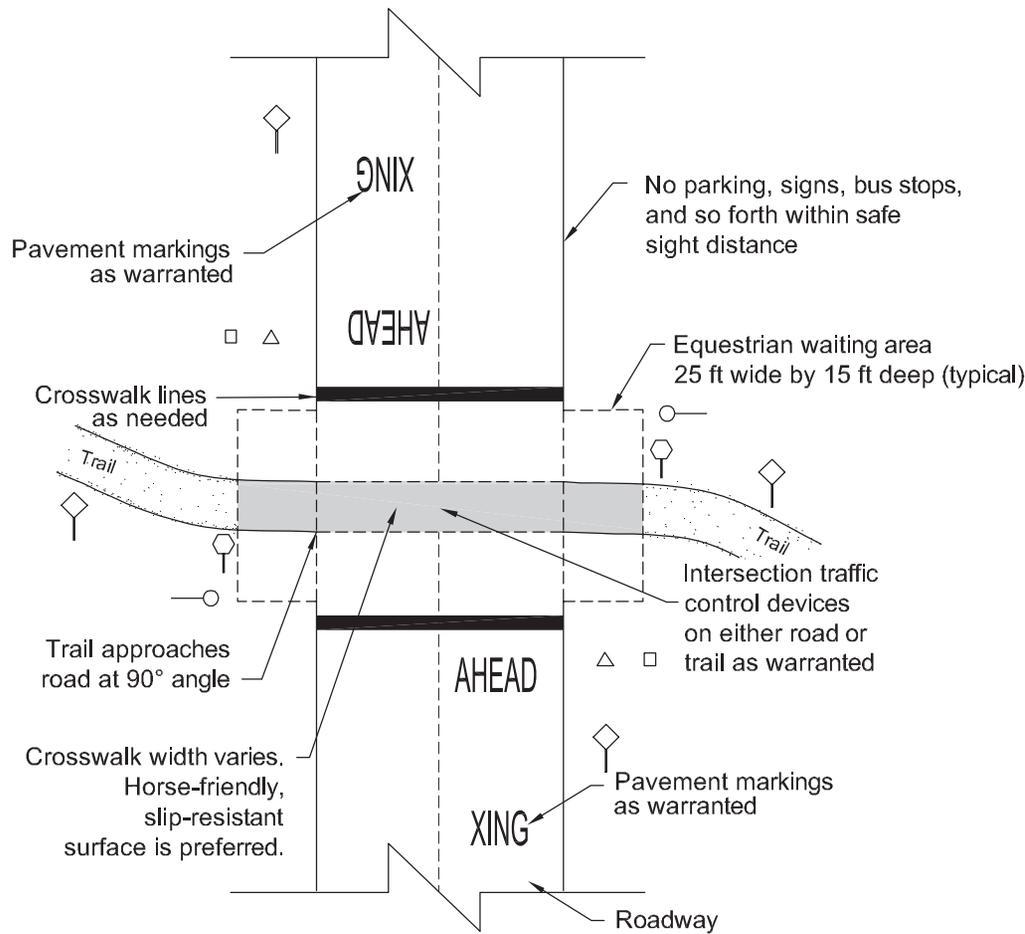
#### Early Warning

Usually, when there is no electricity, traffic warning lights can't be used. This presents problems when recreation trails cross roads or when crossing sight distance is poor. One solution is the Cross Alert System, a motion-activated, solar-powered, warning light. Activity on the trail triggers a radio-controlled amber warning beacon, alerting motorized traffic that trail users are at or near the intersection. The self-contained system handles rough conditions and senses many users, including pedestrians, bicyclists, and equestrians. A wide detection zone can be set up to monitor dual parallel treads, and early warning signs can be placed as far away as 500 feet (152.4 meters). Options include an integrated counter. More information is available at <http://measur>.



Note:  
 Crosswalk lines, pavement markings, traffic control devices, and signs must meet the MUTCD and other applicable requirements.

Figure 5-3—An at-grade trail crossing (with signals) for equestrians. —Adapted from the *Manual on Uniform Traffic Control Devices (FHWA 2003)*.



Note:

Crosswalk lines, pavement markings, traffic control devices, and signs must meet the MUTCD and other applicable requirements.

Legend

-  Warning sign
-  Trail crossing warning sign distance is determined by vehicle speeds, sight lines, and so forth.
-  Traffic control devices
-  Optional trail light set back from signal
-  Optional street light set back from sight lines

Figure 5-4—An at-grade trail crossing (without signals) for equestrians. —Adapted from the Manual on Uniform Traffic Control Devices (FHWA 2003).



In highly developed areas, horse trails sometimes cross driveways leading into private property, or intersect with road entrances into commercial areas. Two scenarios are common when an unpaved trail crosses a driveway—the unpaved tread continues across the drive, or the unpaved drive continues across the tread. If a paved surface is required, roughen it to improve traction, or choose material that is horse-friendly. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for information regarding options. Figure 5–5 is an example of an unpaved trail that crosses a private driveway.



Figure 5–5—Unpaved trails that continue across driveways are more comfortable for riders than trails that are interrupted with pavement. The Murphy Bridle Path in North Central Phoenix, AZ, was established in 1895 and preserved as an unpaved trail in the heart of a modern community. Unpaved trail sections across driveways may not be suitable in all regions of the country.



### Crossing the Street

*Town of Queen Creek Parks, Trails and Open Space Master Plan* (HDR and others 2005) lists the following design considerations for shared-use, enhanced at-grade crossings in Queen Creek, AZ.

- ☆ Crosswalks and curb ramps at right angles to moving traffic, ladder crosswalk markings, curb extensions with landscaping, detectable warnings, and accessible pedestrian signals. Where the trail crosses, surface the crosswalk with washed concrete or incise grooves in the concrete perpendicular to the direction of trail travel.
- ☆ Adequate sight distances that consider time, visibility, amenities, warning signs, and lighting.
- ☆ Gathering spaces [*waiting areas*], large enough for riders, at each crossing corner.
- ☆ Push-button signal actuators where trails cross. Locate one button at 6 feet (1.8 meters) above

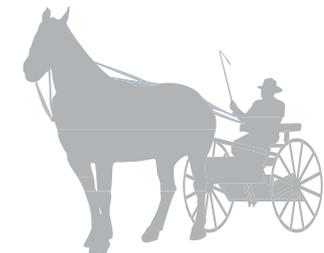
### Trail Talk

the tread for riders and another push button at pedestrian height. Allow maneuvering space around actuator posts.

- ☆ A crossing island or median (raised or flush) safe zone with curb ramps or cut-throughs the same width or greater than the trail or path.
- ☆ Traffic calming techniques.
- ☆ Fences or barriers to separate the trail from paths, adjoining property, and similar situations.
- ☆ Optional lighting scaled for pedestrians and riders.

The elements are variable at corners and crosswalks, depending on how trails converge at the site. Complex intersections require engineering to meet safety and legal requirements. Consult the MUTCD and AASHTO publications for more information.

Continuing an unpaved tread across a driveway in snow country frequently is impractical because winter plowing can disturb the surface materials. Consult governing authorities for requirements regarding construction, signs, traffic patterns, and applicable accessibility requirements.





## Railway Corridors and Crossings

Routing horse trails along active railroad corridors generally is ill-advised. Most riders don't want to ride on a trail adjacent to active rail tracks. Train speeds, sounds, vibrations, and size are threatening to stock that are not familiar with them. Controlled crossings with crossing bells, sirens, horns, lights, or traffic gates can frighten stock and cause them to become uncontrollable. However, in limited circumstances horse trails or crossings in railroad corridors may be unavoidable (figure 5–6).



Figure 5–6—The sights and sounds of a moving train frequently frighten animals. Trails in rail corridors are subject to many safety and legal requirements. —*Courtesy of Anne M. O'Dell.*

For safety reasons, most railroad companies are reluctant to allow other uses within their rights-of-way. Railroad rights-of-way are private property—walking or riding there without explicit authorization from the railroad company is trespassing.

Arrangements to use railroad corridors or crossings require extensive negotiation between trail developers, governing jurisdictions, and property owners. Safety arrangements have to be negotiated in areas where proposed equestrian trails will be close to railroads.

Locating horse trails or crossings in active railroad corridors is a lengthy and costly process. Permits, easements, or rights-of-way are an absolute necessity. In addition, stringent safety and liability issues must be addressed. When at-grade railroad crossings intersect highways, they also are subject to the governing highway authority. Frequently, the highway authority pays to install crossing signs and signals on highways, and the railroad maintains them.



### Lingo Lasso

#### Rails, Tracks, Railways, and Railroads

Operation Lifesaver (Hall, personal communication) explains easily confused railroad terms:

- ☆ *Rails*—The steel strips
- ☆ *Tracks*—The pair of rails with ties holding them together
- ☆ *Railways and railroads*—Generally, the companies that own the tracks
- ☆ *Highway-rail grade crossings*—The intersections where roads and railroad tracks meet

Trails parallel to *active* railroad tracks are called *rails-with-trails* (RWTs). Don't mistake RWTs for *rails-to-trails*, which follow former—or *inactive*—rail lines. Safety is the most important factor when designing RWTs that include riders. According to *Rails-with-Trails: Lessons Learned* (Alta Planning and Design 2002): “Trail width is an overriding design issue when considering equestrian use on RWTs. RWTs designed to accommodate equestrian use should provide separate treads for multiple users. Narrow rights-of-way that afford width for only a single paved trail, or that provide inadequate shy distance for a horse frightened by near or oncoming trains are not appropriate candidates for accommodation of equestrian use. Trestles and bridges require additional considerations. Many horses are frightened by bridges and other elevated environments, particularly lattice or perforated bridges and trestles that allow the animal a view of the ground substantially below the bridge deck. Most horses are not accustomed to this environment and will respond unpredictably with potentially negative consequences.”

Because there are no national planning standards or guidelines for trail setback distances parallel to active railroads, guidance must be pieced together from relevant standards for shared-use trails, pedestrian facilities, railroad facilities, and/or railroad crossings or railroad rights-of-way. Consider these factors (Alta



Planning and Design 2002) during trail feasibility studies:

- ☆ Type, speed, and frequency of trains in the trail corridor
- ☆ Maintenance needs
- ☆ Applicable State standards
- ☆ Separation techniques
- ☆ Historical problems
- ☆ Track curvature
- ☆ Topography
- ☆ Engineering judgment

Because every case is different, determine the setback distance and other considerations on a case-by-case basis after engineering analysis and consideration of liability concerns.

Generally, horses and mules can maneuver over railroad tracks that intersect trails when the crossing is wide enough and has solid, level footing—at the approach, between the rails, and on the opposite side of the railroad track. Trails, roads, or sidewalks should approach a railroad crossing perpendicular to the direction of train travel. Build the tread surface level with the top rail flange, filling in the gap (figure 5–7) as specified by railroad regulations. Materials commonly used to fill the gap include concrete, asphalt, hardened rubber, wood planks, gravel, or other durable materials. Rubber or concrete lasts longer than wood or asphalt and requires less maintenance. When trails cross abandoned tracks, consider removing the rails and ties.



Figure 5–7—Building a horse trail in an active railroad corridor requires extensive negotiation to address safety and liability concerns for trail users and railroad personnel. If trails must cross tracks, the tread should be level and the gaps filled according to railroad requirements. Trails also must approach tracks at a 90-degree angle.

Railcars overhang the tracks by 3 feet (0.9 meter) on each side, and trains need a dynamic operating space for loose loads or straps and thrown debris. To reduce the hazards associated with stock waiting for a train to pass through a crossing, a waiting area may be appropriate. Locate waiting areas back and away from rails as required at each site to meet the needs of trail users and railroad personnel.



Resource Roundup

**Rail and Trail Information**

Visit these online resources for more information regarding railway crossings:

- ☆ Federal Railroad Administration at <http://www.fra.dot.gov>.
- ☆ Operation Lifesaver at <http://www.oli.org>.



Resource Roundup

**Train and Trail Laws**

*Rails-with-Trails: Lessons Learned* (Alta Planning and Design 2002) has valuable information regarding setbacks, separation distance, and other considerations dealing with trails and rail corridors, including sample legal agreements and a useful matrix of State laws regarding railroads and trails.

- ☆ The entire document is available at <http://www.fhwa.dot.gov/environment/rectrails/rwt>.
- ☆ *Appendix B: State-by-State Matrix of Applicable Laws and Statutes* is available at <http://www.fhwa.dot.gov/environment/rectrails/rwt/appendixb.htm>.





### Water and Wet Area Crossings

Recreation trails generally cross water at grade or above. Constructing a crossing over or through water generally requires authorization from the governing authority and may require special construction techniques or environmental considerations. Horse trails may incorporate bridges or culverts to maximize habitat protection and reduce trail maintenance. Sometimes fording a stream is the best option.

### Shallow Stream Fords

Locate fords in an area where the stream is straight and shallow, avoiding areas that are deeper than 2 feet (0.6 meter) during most of the use season. Avoid locations where the stream turns, because water undercuts the outside bank. Routing the trail to a good natural ford is better than building a new ford. When constructing a ford across a shallow stream, stabilize banks to prevent sedimentation, if necessary. Figure 5-8 shows a ford that crosses a fish ladder. Where suitable, angle trail approaches upstream to protect the bank from erosion caused by rising water. To block rising water from running down the main trail, construct approaches so they climb a short distance above the usual high water line (figure 5-9). Options for stabilizing banks include the use of geotextiles in combination with riprap. Figure 5-10 shows installation of soil-filled geocell layers to stabilize a bridge approach. Articulating



Figure 5-8—This fish ladder includes a ford for trail users while still allowing trout to move up the creek. The steps have big landings—about 8 to 10 feet long—and stock tolerate them. The rocks alongside the ford keep stock on the desired path.

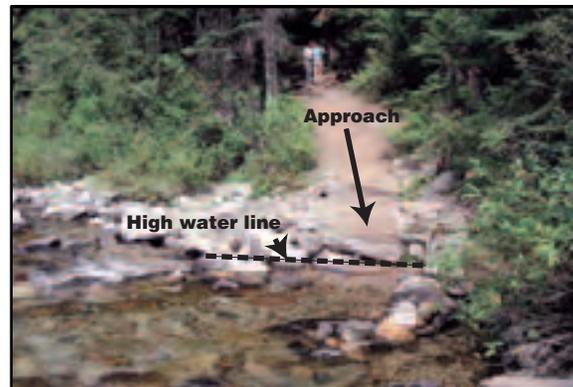


Figure 5-9—This ford has a rock step up to a landing. The trail approach rises to keep the stream from flowing down the tread. Rocks on the side of the ford guide stock to the step. *Caution:* large, wet rocks can be hazardous for all trail users.

and interlocking concrete pavers are other options for stabilizing streambeds. Pavers with voids for soil or plant material are less likely to be a slip hazard. Figure 5-11 shows interlocking hard pavers used to stabilize a bridge approach.



Figure 5-10—Workers have compacted soil into layers of geocell to provide stability at a bridge approach. The top layer will bring the tread level even with the deck level.

Provide solid footing, such as medium-sized gravel or a stabilized surface. Place it at a consistent depth from one bank to the other (figure 5-12). Choose the surface materials carefully—hardened surfaces reduce sedimentation and stream erosion, but can be slippery when wet.

Curbs that run across treads and smooth, hardened tread edges at water crossings are trip hazards and are not appropriate for horse trails. Natural rocks and



Figure 5-11—The approach to this trail bridge is reinforced with interlocking pavers to withstand wear from off-highway vehicle use. The pavers may not offer enough traction for horses and mules. A similar approach using horse-friendly pavers could be used on equestrian bridges.

crushed gravel can help sustain the edges of stream crossings when stabilization is necessary (figure 5-13). Do not include fines that will wash away. To prevent steep dropoffs, gradually transition from the tread to stream bottom. The underwater portion of the tread may need to be wider than the rest of the trail to accommodate stock that step to the side. On Forest Service horse trails, fords have a trail base that is at least 3 feet (0.9 meter) wide. Consult an engineer or hydrologist for additional techniques to stabilize fords and areas nearby. Figure 5-14 shows a concept for an urban channel crossing at grade. Geosynthetics stabilize the banks.



Figure 5-12—A stable tread surface is essential for shallow stream crossings. Stepping stones for pedestrians should be placed on the upstream side of the tread.



Figure 5-13—Rocks and gravel can be used to reduce erosion along waterways, but medium and large rocks can be slippery when wet. These riders chose the side of the tread with the best horse footing—small rocks and gravel.

Fords get the most use when flows are low to moderate and are not intended for use during high runoff. Where fords traverse water with a strong current, the downstream side should be free of dangerous objects. Place pedestrian bridges or stepping stones on the upstream side of the equestrian bridge to prevent fallen stock from being swept into other trail users or pinned against structures.



### Treading Water

#### Resource Roundup

These Forest Service references provide trail construction information regarding fords and wetlands:

- ☆ *Trail Construction and Maintenance Notebook: 2007 Edition* (Hesselbarth, Vachowski, and Davies 2007) is available at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232806>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ *Wetland Trail Design and Construction* (Steinholz and Vachowski 2007) available at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232804>. This Web site requires a username and password. (Username: t-d, Password: t-d)



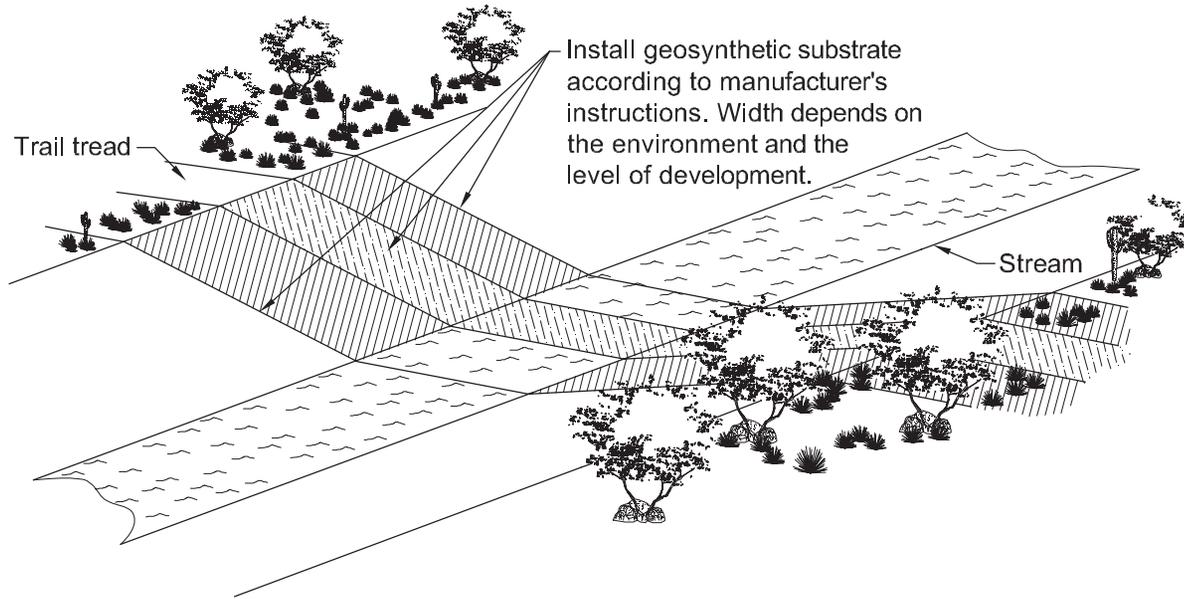


Figure 5-14—A channel crossing using geosynthetics to stabilize the banks. This example is suitable for areas with high levels of development.

To build a turnpike, ditch both sides of the trail to lower the water table. Next, install geotextile, or other geosynthetic materials, and retainer logs or rocks. Place the geotextile under any retainers. Lay the geotextile over the ground with no excavation, and then add high-quality fill.

The two most important considerations when constructing a turnpike are lowering the water level below the trail base and carrying the water under and away from the trail at frequent intervals. Turnpikes require some degree of drainage. A turnpike is easier and cheaper to build than puncheon and may last longer. Use puncheon when the ground is so wet that drainage is impossible and grading is precluded.

5

### Wet Area Trail Structures

In areas where at-grade stream crossings are not suitable, consider elevating the tread. Causeways, turnpikes, boardwalks, and puncheon bridges are construction methods that minimize damage to wet areas. These techniques often are used in combination with rock, fill, and geosynthetics, where permitted. Determine the type of support and drainage systems that will safely withstand the weight of stock on elevated trail treads.

### Turnpikes

Turnpikes incorporate fill material taken from parallel side ditches and from offsite to build the trail base higher than the surrounding water table on wet or boggy ground (figure 5-15). Turnpikes are practical in areas with a trail grade up to 10 percent and in flat areas with 0- to 20-percent sideslopes. Use turnpike construction to provide a stable trail base in areas with a high water table and fair- to well-drained soils.



Figure 5-15—A turnpike elevates the trail in boggy or wet areas. Ditches provide drainage. This turnpike has log stringers filled with coarse, well-drained rock.



### Turnpikes Without Ditches

A more environmentally friendly relative of the turnpike is one without side ditches. Sometimes turnpikes without ditches are called causeways. In the Sierra Nevada, causeways filled with crushed rock create elevated, hardened treads across seasonally wet alpine meadows. A single causeway often replaces multiple, unwanted parallel treads. These causeways create less environmental impact than turnpikes, because they lack ditches and don't lower the water table. The risk is that turnpikes without ditches could sink into highly saturated soils, a problem mitigated by geotextiles. The encapsulation technique sometimes works well on causeways.



#### Horse Sense

##### Encapsulation: The Sand Sausage

Encapsulation, an alternative method of building tread in a turnpike, provides separation between good fill and clay and keeps a layer of soil drier than the muck beneath. To *encapsulate*—or create a sand sausage—excavate 10 to 12 inches (254 to 305 millimeters) of muck from the middle of the turnpike. Lay a roll of geotextile the length of the turnpike, wide enough to fold back over the top with a 12-inch (305-millimeter) overlap. Place 6 inches (152 millimeters) of crushed stone, gravel, or broken stone on top of the single layer of geotextile, then fold the geotextile back over the top and continue to fill the turnpike with tread material.

### Puncheon

Puncheon is a wood walkway used to cross bogs or deep muskeg, to bridge boulder fields, or to cross small streams (figure 5–16). Puncheon can be constructed where uneven terrain or inadequate tread material makes turnpike construction impractical. It is easier to support puncheon on muddy surfaces than to construct a turnpike.

Puncheon resembles a short log-stringer trail bridge that has a deck made of native logs or sawn, treated timber. The deck of surface puncheon is placed on stringers to elevate the trail across wet, difficult-to-drain areas. The Student Conservation Association (Birkby 2006) constructs puncheon for horse trails using log stringers that are at least 10 inches (254 millimeters) in diameter and decking that is at least 4 inches (102 millimeters) thick. The puncheon is 48 inches (1,219 millimeters) wide.

Subsurface puncheon is placed flush with the wetland surface. Creating subsurface puncheon involves constructing mudsills, stringers, and decking under the surface. This design depends on continual water saturation for preservation. To improve traction, cover the surface between the curb logs with a layer of gravel, wood chips, or soil.

In areas with deep mud, sometimes trail users find it difficult to see and follow the trail on subsurface



Figure 5–16—Puncheon walkways can be level with the surface or lie below it. Log stringers support this deck.

puncheon. Once an animal steps off the tread, it can severely damage the area when attempting to regain solid footing. If the animal becomes trapped in muck, it may be very difficult or impossible to get it out alive.

### Boardwalks

Boardwalks have multiple pilings, and are essentially a series of connected bridges. Horse trails rarely have boardwalks.

### Retaining Curbs

Install longitudinal edging—*retaining curbs*—to delineate the edges on elevated treads or puncheon (see figures 5–15 and 5–16). Treat elevated treads, such as boardwalks, as if they were a bridge and use the guidelines for equestrian bridge designs.



### Above-Grade Crossings

The design of *above-grade crossings*—bridges and overpasses—is complex and beyond the scope of this guide. Designing an appropriate above-grade crossing that meets the special needs of riders requires qualified and knowledgeable engineers, as well as other key resource specialists, who may include hydrologists, soil scientists, bridge and geotechnical engineers, and landscape architects. Design must comply with regulations established by the authorizing agency and Federal and State laws. Bridges require regular certified inspection according to governing regulations. Bridges on Forest Service lands, for example, must undergo inspection every 5 years.

### Bridge and Overpass Design

Bridges and overpasses on horse trails require careful design to accommodate animal behavior. Horses and mules may hesitate if a bridge or overpass is narrow, sways, swings, vibrates, or is constructed of unfamiliar materials. Stock also are uncomfortable if the structure creates or amplifies noise. Even well-trained stock may balk at ramp approaches to bridges, especially where there are no approach rails. If a structure or tread appears dangerous, horses and mules usually refuse to go any farther. Incorporate skid-resistant surfaces and avoid designing steps on equestrian overpasses and bridges.

In general, there are six types of trail bridges:

- ☆ Cable bridges
- ☆ Deck girder/truss bridges
- ☆ Side girder/truss bridges—pony-truss bridges
- ☆ Arch bridges—deck or suspended bridges
- ☆ Miscellaneous single-unit bridges
- ☆ Covered bridges

Each bridge type and construction material has different span limitations that must be matched to site conditions. Longer crossings may have a very limited selection of suitable bridge types or materials. Prefabricated bridges, shipped in sections for reassembly on the site, may be appropriate for some situations. For example, the remote bridge shown in figure 5–17 consists of sections that were

packed in and bolted into place. Engineering analysis is required for these products, along with strict adherence to the manufacturer’s installation and maintenance instructions.

A simple bridge (figure 5–18) is adequate for many stream crossings. Horse and pedestrian trails frequently cross suspension bridges (figure 5–19). Long or swaying suspension bridges (figure 5–20) can be daunting to stock and riders that are not accustomed to crossing them.

5



Figure 5–17—This packable bridge comes in 6-foot sections that are bolted together at the site. Nearby cliffs encourage stock to stay on the tread, so approach rails are unnecessary.



Figure 5–18—The weathered steel and wood of this sturdy stock bridge fit the setting.



Figure 5-19—This wood suspension bridge is designed for packstock use in a wildland setting. The design would be appropriate for other users in other settings.



Figure 5-20—Inexperienced stock—and some people—may hesitate before crossing this suspension bridge over the Colorado River.



### Resource Roundup

#### Crossing the Bridge

For more information regarding bridges and overpasses:

- ☆ *A Guide to Fiber-Reinforced Polymer Trail Bridges* (Groenier and others 2006) is available at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232824>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ *Guide Specifications for Design of Pedestrian Bridges, 1st Edition* (AASHTO 1997) is available from the bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=37](https://bookstore.transportation.org/item_details.aspx?ID=37).
- ☆ *Guide for the Development of Bicycle Facilities* (AASHTO 1999) is available at <http://www.communitymobility.org/pdf/aashto.pdf>.
- ☆ *Standard Specifications for Highway Bridges* (AASHTO 1996) is available from the bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=51](https://bookstore.transportation.org/item_details.aspx?ID=51).
- ☆ *Transportation Structures Handbook* FSH 7709.56b (U.S. Department of Agriculture Forest Service 2005c) is available at [http://www.fs.fed.us/cgi-bin/Directives/get\\_dirs/fsh?7709.56b](http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?7709.56b).
- ☆ *Trail Bridge Catalog* (Eriksson 2000) is available at <http://www.fs.fed.us/t-d/bridges>. This Web site requires a username and password. (Username: t-d, Password: t-d)

#### Bridge Site Selection

Bridges with the horizontal alignment perpendicular to the stream are the shortest and usually the least costly to build. Avoid sharp and blind curves on the immediate approaches to bridges, because curves adversely affect sight distance. The vertical alignment—or *grade*—of bridges also affects sight distance, drainage, and footing. Adjusting the trail alignment to address these issues usually costs less than modifying the bridge.

#### Bridge Grade

Bridges with a slight grade or camber shed water better than flat bridges. However, grades that are too steep can cause footing problems. Bridge grades on trails should not be greater than any part of the trail itself and when possible, should not exceed 5 percent. Camber on arch bridges also should not exceed 5 percent. Figure 5-21 shows a trail bridge with camber.



Figure 5-21—For safety, the camber on equestrian bridges should not exceed 5 percent.





### Bridge Width

The minimum suggested bridge width on horse trails in areas with low levels of development is 5 feet (1.5 meters). In areas with high levels of development, 12 feet (3.6 meters) is preferred. Bridges in areas with moderate levels of development often range between 5 and 8 feet (1.5 and 2.4 meters) wide. Bridges that are wider than 6 feet (1.8 meters) and narrower than 10 feet (3 meters) are only suitable for riding single file, but riders may be tempted to pass or ride two abreast, a potential source of conflict. For facilities subject to the AASHTO guidelines, match the clear bridge width to the width of the shared-use trails that lead up to them. Then add an additional 2 feet (0.6 meter) on each side (AASHTO 1999). This extra width gives all trail users the minimum horizontal shy distance from the railing or barrier. It also provides maneuvering space when trail users encounter others who have stopped.

5



#### Trail Talk

### Bridging Streams and Ditches

The British Horse Society (2005b) prefers bridges that are 6.6 feet (2 meters) wide for streams and ditches in the United Kingdom. The organization recommends a bridge width of 13.1 feet (4 meters) when the river measures at least 26.2 feet (8 meters) across. They also advise consulting with highway engineers for site-specific requirements.

### Bridge Load Limits

Bridges, causeways, and boardwalks on horse trails must meet engineering specifications to support the weight of a large group of stock. Structures designed primarily for pedestrians and bicycles are not strong enough for horses and mules, because the decking cannot withstand the force of horseshoes or the point load per hoof. In addition, bridges must be engineered to withstand the vibration caused by single or multiple animals. Stock, including their riders or loads, usually weigh from 1,000 to 1,700 pounds (454 to 771 kilograms).



#### Trail Talk

### Mule Maneuvers

*Suspension Bridges for Mountain Warfare* (U.S. War Department 1944) provided specifications for suspension bridges with spans of up to 400 feet (122 meters). These bridges were used to carry light loads over long gaps. The War Department required standard military suspension footbridges to carry three packmules, each with a handler, spaced one-third of the span length apart. Light equipment bridges were designed to carry seven mules and handlers, spaced at intervals of one-seventh the span length. Intervals are crucial for figuring a structure's load capacity and fundamental frequency.

Design bridge beams and stringers for the anticipated maximum loading or load combinations, including live loads, snow, wind, snow groomers, earthquakes, and light vehicles. Covered bridges in snow country have additional load considerations.



### Live Loads

#### Resource Roundup

Live loads for hikers, ATVs, motorcycles, bicycles, snowmobiles, and stock or packstrings are grouped together as pedestrian live loads. When designing bridges, consult the live load, deflection, and small load criteria outlined in the *Guide Specifications for Design of Pedestrian Bridges, 1st Edition* (AASHTO 1997), or other applicable sources. The guide is available from the bookstore at [https://bookstore.transportation.org/item\\_details.aspx?ID=37](https://bookstore.transportation.org/item_details.aspx?ID=37).

### Bridge and Overpass Structural Materials

Select materials for bridges and overpasses based on durability as well as for strength, esthetics, cost, and appropriate level of development. Common bridge materials include timber, steel, concrete, and fiberglass. Many companies have engineered plans for standard bridge lengths of wood, steel, and fiberglass. Table 5-1 shows suggested structural materials suitable for different levels of trail development. Esthetics and the setting—wildland, rural, urban—also affect choices.



Table 5-1—Suggested structural materials for bridges on horse trails.

Material	Low development	Moderate development	High development
Sawn timber or engineered wood	X	X	X
Concrete		X	X
Steel	X	X	X
Fiberglass	X	X	

### Bridge and Overpass Surface Materials

Select surface treatments for bridges and wetland structures carefully. Most stock will hesitate to step from the tread to the bridge unless the transition between tread and bridge is as smooth and uninterrupted as possible. The surface of the tread and bridge should be flush and have similar colors. A step up or down to the bridge draws the trail animal's attention to the change in material.

Common bridge decking materials include wood, concrete, steel grates, fiberglass, and composites made from plastic and wood. Wood decking can be planks or glue-laminated panels. Because wood surfaces may be slippery when wet, they work best in areas that don't get a lot of rain. Concrete bridges surfaced with appropriate natural soils, sand, crushed rock, or a rough surface generally are horse friendly. Avoid steel grates because stock may be frightened when they look through the grate or hear

a horseshoe striking it. Fiberglass decks must have a wearing surface that can withstand the impact of horseshoes. The surface of plastic laminates can be slick, requiring that they be manufactured with a roughened surface. Avoid decks that sound hollow when stock travel across them.

*Bridge wearing surface* refers to a temporary layer of decking that is easily replaced when worn. Often less expensive, untreated wood is used for this purpose. The wearing surface frequently is the same width as the trail on each end and tapers to a narrower width toward the center (figure 5-22). This gradual reduction in width serves to funnel trail traffic to the center of the bridge tread. This pattern is less costly than providing a wearing surface that extends the full bridge width for the entire span length.

In areas with low levels of development, the Forest Service often constructs decking from wood planks

that are 3 inches (76 millimeters) thick if no wearing surface is included. When used along with wearing surfaces, the decking consists of transverse wood planks 2 inches thick by at least 8 inches (51 by 203 millimeters) wide, placed on the bridge stringers. The wearing surface consists of longitudinal planks 2 inches thick by 12 inches (51 by 305 millimeters) wide. Horse loads normally are concentrated loads. Horse loads determine the thickness of bridge decking and wearing surfaces. Pedestrian live loads are uniform loads over the entire deck. Pedestrian live loads determine the size of bridge stringers.

Select tread surface materials that don't become slick from use, particularly if the bridge has any slope. Timber cleats, rubber matting, or other wearing surfaces can be installed to improve traction.



Figure 5-22—Wearing surfaces are a relatively easy and economical way to prolong the life of bridge decking. The tapered pattern guides stock to the wearing surface in the center of the bridge.





### Bridge and Overpass Sides and Railings

Trail bridges require railings, except in certain circumstances. Trail bridges that don't have railings must have longitudinal edging, commonly called *curbing* or *curbs*. Before constructing bridge curbs instead of railings, agencies may require documentation that substantiates the decision. For example, if an analysis shows that the potential hazards along the trail are the same or greater than the hazards of a bridge without a railing, curbs may be used in place of railings. The Forest Service requires an engineering analysis to determine whether the hazards along the trail are the same or greater than those on a bridge without a railing. In general, trail users in rural and urban settings are more likely to be small children or less experienced adults who will need a railing. In wildland settings, trail users normally are more experienced and railings may be unnecessary.

The first consideration in selecting railings must be safety. According to the *Trail Bridge Catalog* (Eriksson 2000), guidelines for rail systems fall under the following:

☆ **Building Code**—Railings on trail bridges in urban settings must meet building code requirements, such as the International Building Code (IBC). These railings are designed for pedestrians, not riders, and must have vertical balusters that are not easy to climb. The code requires a handrail at least 42 inches (1.067 meters) high that does not allow a 4-inch (101.6-millimeter) sphere to pass through.

- ☆ **AASHTO Code**—Horizontal railings on trail bridges frequently used by children must meet AASHTO Standard Specifications for Highway Bridges. A 6-inch (152.4-millimeter) sphere must not pass through the railing in the bottom 27 inches (685.8 millimeters), and an 8-inch (203.2-millimeter) sphere must not pass through the area higher than 27 inches (685.8 millimeters). The code also requires a handrail at least 54 inches (1,372 millimeters) high for equestrian traffic.
- ☆ **Remote Areas**—Railings on remote trail bridges must be at least 54 inches (1,372 millimeters) high for equestrian traffic. The handrail system also must have one or more intermediate rails so that the vertical distance between rails does not exceed 15 inches (381 millimeters). The Forest Service requires handrail systems on bridges to have at least two horizontal rails above the tread level.

Table 5–2 gives selected design criteria for Forest Service bridges on horse trails. Live load pressures for hikers, ATVs, motorcycles, bicycles, snowmobiles, stock, or packstrings are grouped together under pedestrian live loads.

Other considerations may justify railings or barriers. For example, horses and mules may become frightened if they can see high-speed vehicles or other distractions passing beneath or near the bridge. Provide a solid barrier or panel topped with an open-view railing (see figures 3–18 and 5–23). Use a similar design on the bridge approach to ease the transition from the trail onto the bridge deck. Such panels on approaches guide a reluctant trail animal onto the bridge. Construct the panels on one or both sides to extend a distance appropriate to site conditions. Angle the extensions outward from the bridge structure to form approach rails (figure 5–24).

Table 5–2—Selected Forest Service trail bridge criteria for pack and saddle trails.

Trail use	Clear width*	Live load**	Railing height***
Tread width	5 feet without railing 6 feet with railing****	Pedestrian load or snow load	54 inches

\* Widths shown are recommended minimum clear widths between railings or curbs. Use design parameters developed for each particular trail, which may recommend narrower bridge width. If groomers are to be used on the trail, check the specific snow groomer machines for necessary width.

\*\* See [FSH 7709.56b] section 7.62 for a description and minimum requirements of pedestrian live load.

\*\*\* Railing height is the minimum if railing is required. Provide analysis to determine whether railings may be eliminated.

\*\*\*\* For trail bridges that require access for light administrative vehicles, a minimum width of 8 feet [2.4 meters] is required. The design live load shall be AASHTO H-5 (10,000 pounds [4,535 kilograms]) vehicle loading.

—Excerpted from *Transportation Structures Handbook FSH 7709.56b* (U.S. Department of Agriculture Forest Service 2005c).



Figure 5-23—A solid barrier topped with an open view railing is often more acceptable to horses and mules than an open view fence alone. This open view railing is on the Marjorie Harris Carr Cross Florida Greenway Land Bridge. Figures 5-27 and 5-28 show additional views of the land bridge.



Figure 5-24—Approach rails guide stock onto a bridge. Large rocks or other natural objects sometimes are used to block alternate routes.

Railings should be free of protrusions that can catch on legs, feet, stirrups, or tack. Install all connecting hardware with the smooth side toward the trail user.



**Horse Sense**

**Rubbing the Right Way**

Some shared-use bridges incorporate an optional *rub rail*—a smooth, flat panel that is attached to the inside of the railing (figure 5-25). Rub rails keep bridge users or their gear from catching bridge members. Make sure the rails have no edges or gaps that can snag reins, ropes, people, or stock.



Figure 5-25—Wood rub rails are frequently used on bridges to keep saddles, backpacks, bicycle handlebars, and other equipment from snagging on posts.

**Bridge Clearance**

Safety is compromised when riders are forced into areas with narrow or low clearance. Construct bridges with a minimum overhead clearance of 10 feet (3 meters) in the equestrian trail corridor. The preferred overhead clearance is 12 feet (3.6 meters). Pedestrian and bicycle bridges over freeways frequently have vertical curved fences or roofs to prevent anything being thrown from the bridge. Tread location and inadequate trail clearance (horizontal or overhead) should not force riders to the center of the corridor or make it difficult for riders to pass stopped users safely. Loud traffic noises on these bridges may make them questionable for equestrian use.



**Low Down**

**Trail Talk**

The British Horse Society (2005b) advises building new road underpasses that have a vertical clearance of 12 feet (3.6 meters). If that is not possible, the minimum clearance is 11 feet (3.4 meters). The preferred width is 16.5 feet (5 meters) and the minimum width is 10 feet (3 meters).





Figure 5–26 illustrates a shared-use bridge for nonmotorized travel over a freeway. It has a separate, 12-foot- (3.6-meter-) wide equestrian tread in the center of the bridge where the vertical clearance is greatest. Pedestrians, bicyclists and other nonmotorized users use the separate treads on either side of the horse tread.

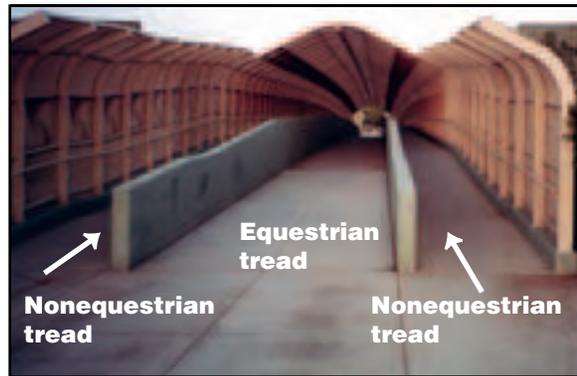


Figure 5–26—Separation barriers on this shared-use bridge are short enough for horses and mules to see over, so stock are more comfortable. The roof over the equestrian tread (center) has a high overhead clearance to accommodate equestrians.



### To Dismount or Not?

#### Horse Sense

Asking riders to dismount for trails or structures with low or narrow clearance is not recommended. Dismounting can lead to dangerous situations because riders have less control of a nervous or aggressive trail animal from the ground than when they're in the saddle. Dismounted riders risk being run over by a spooked animal. Occasionally, low clearance, narrow passages, or trail obstacles are unavoidable. In all cases, safety is the determining factor when deciding whether to require riders to dismount. Some riders are not able to dismount or remount on a trail without stepping up on something. If passages don't have adequate vertical or horizontal clearance for mounted riders, or if other considerations warrant leading an animal, warn riders with signs and provide mounting blocks at both ends of the obstacle. Consult *Chapter 7—Planning Recreation Sites* for more information regarding mounting blocks and ramps.

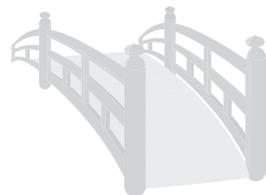
### Bridge Sight Distance

Sight distance can be restricted by a bridge's arc or because approaches are placed at a poor angle. A long sight distance on bridges allows riders to see problems in advance, preferably the entire length of the bridge, plus approaches. When sight distance or visibility on bridges is limited, work with bridge and traffic engineers to determine proper remedial action. In urban and rural areas, this may include installing signs and signals.

### Trails on Bridges and Overpasses With Traffic

Many stock are unfamiliar with bridges that also have vehicle traffic. The speed of the traffic on the bridge, noise level, and vibrations can make some stock nervous. Occasionally, managers designate a bridge for equestrians only. For bridges where motorized use is very low, if budgets and bridge conditions permit, separate riders from vehicles and other trail users. Where feasible, bridge design can incorporate barriers between two or more treads to separate riders and slow motorized traffic. The barrier would be subject to careful analysis and regulatory approval.

It is best if bridges over high-speed roads separate stock and traffic. Some shared bridges route traffic on one level and trail users on a different—usually lower—level. The traffic is not visible to the animal, and the sound of traffic is contained in the separate corridor.





### Specialty Bridges

Several specialty land bridges over major roads in the United States have grass and shrubs planted in a soil-covered deck. Many user groups appreciate this design, which is costly. Figures 5-27 and 5-28 show the Marjorie Harris Carr Cross Florida Greenway Land Bridge over Interstate 75 just south of Ocala, FL.



Figure 5-27—The Marjorie Harris Carr Cross Florida Greenway Land Bridge across Interstate Highway 75 south of Ocala allows riders, hikers, and bicyclists to cross six lanes of traffic. The bridge is 52.5 feet wide and 200 feet long.



Figure 5-28—Native vegetation in irrigated planters on the land bridge buffer users from the sight of traffic below. Natural surfaces enhance the trail experience.

### Below-Grade Crossings—Culverts and Underpasses

In some cases, underpasses—or *below-grade* crossings—are more suitable than at-grade crossings or bridges. Large-diameter structures—culverts and underpasses—generally serve riders well. Prefabricated underpasses are available in aluminum, steel, and concrete. They can be round, elliptical, arched, or box-shaped. Examples of underpasses are shown in figures 5-29 and 5-30. Trails with below-grade crossings must meet design regulations or

guidance such as AASHTO specifications, and they require the expertise of engineers. The advantage to recreationists and wildlife can sometimes justify the higher cost of below-grade crossings rather than at-grade crossings. When designing below-grade crossings, carefully consider the safety of approaches, drainage structures, the tread surface, clearance, sight distance, and lighting. Figure 5-31 shows separate, adjacent underpasses for motorized traffic and trail users.



Figure 5-29—Underpasses can have different configurations, such as this one with approach wings. —*Courtesy of Bridgetek.*



Figure 5-30—Make horizontal trail clearance in underpasses the same width as the trail or wider. —*Courtesy of Bridgetek.*



Figure 5-31—For safety, provide separate underpass routes for motorized users and trail users. —*Courtesy of Bridgetek.*





### Below-Grade Approaches

It is often difficult to provide the necessary overhead clearance required by riders when approaches slope down into below-grade passages. Design new structures so approaches are level with the trail tread. If drainage or site conditions require a slight slope, make it constant from one end of the passage to the other. Retrofitted below-grade trail approaches sometimes slope downward at both ends, reducing clearance and making drainage difficult. Avoid this situation wherever possible. When sloped approaches to retrofitted culverts or underpasses are unavoidable, design them with no more than a 5-percent grade. Avoid hard, smooth tread treatments for approaches.

### Below-Grade Tread Surfaces

Relatively level, natural tread surfaces leading into underpasses generally require no additional treatment. The exception is a tread surface that is frequently wet or muddy. Sloping trails that are frequently wet may benefit from geosynthetic materials. If culverts don't drain adequately, they are unsuitable for horse trails. Design the approach and surfaces of the underpass to prevent water, snow, sand, soil, or other materials from collecting where they will hamper traction or interfere with clearance. Use horse-friendly surface materials. Make sure that the below-grade crossings are large enough for the equipment needed to maintain them. See *Chapter 6—Choosing Horse-Friendly Surface Materials* for more information.

### Below-Grade Clearance

If a trail animal startles while in an underpass or below-grade culvert, the animal, rider, and other trail users may be injured. This is especially true in narrow underpasses or those with low, curved ceilings. For safety, design culverts and underpasses on horse trails so the vertical clearance is no lower than 10 feet (3 meters) across the entire width of the tread. The preferred height is 12 feet (3.6 meters). Horizontal clearance often extends 2 to 3 feet (0.6 to 0.9 meter) beyond the tread edge on both sides of the trail. Horizontal and vertical clearance in passages should be no less than the clearing limits on the rest of the trail.

When figuring horizontal and vertical clearance in underpasses, allow space for maneuvering and passing. Box-shaped structures should meet the standard height guidelines and be no less than 8 feet (2.4 meters) wide. A preferred width of 12 feet (3.6 meters) allows space for trail users to pass. The culvert in figure 5–32 appears wide enough for riders, but the vertical clearance is suspect. Culverts that curve near the top must provide 10 to 12 feet (3 to 3.6 meters) of overhead clearance without forcing riders to the center of the trail. Riders can suffer severe injuries if they hit their heads. The horizontal clearance at head height should be at least as wide as the trail itself and no narrower than 5 feet (1.5 meters) wide. This may be difficult to achieve with tapered culverts (figure 5–33).



Figure 5–32—When selecting equestrian underpasses, such as this common box culvert, carefully consider overhead and horizontal clearance.



Figure 5–33—Riders need more lateral clearance near the top of underpasses than other users. Provide 12 feet of overhead clearance that is the entire width of the trail. Avoid sloping roofs that force riders to the center of the tread.



### Enclosed-Area Lighting

Adequate lighting and sight distance are important inside, outside, and at approaches to enclosed trail corridors. The eyes of stock don't adjust quickly to lighting changes, and many animals stop or hesitate when they can't see well.

In highly developed areas, artificial lights may be helpful, especially if the corridor approach is sloped. If possible, install fixtures flush with the approach walls. In trail corridors, locate fixtures at least 10 feet (3 meters) above the trail surface where they will not encroach on clearance. Keep the scale appropriate to trail users, and vary the light intensity for trail conditions or location. Consult a professional lighting designer or engineer for a site-specific plan.

Some divided highways provide a *light well*—or opening—in the median to allow sunlight into the passage below and enhance visibility during the day.



#### Trail Talk

##### Light on the Subject

Night travel often occurs on shared-use trails, which may suggest the need for lights. The *Guide for the Development of Bicycle Facilities* (AASHTO 1999) suggests maintaining average horizontal illumination levels of between 5 and 22 lux for trails, highway intersections, and in underpasses or tunnels. Higher levels may be advisable if security is an issue.

### Culverts That Carry Water

With careful design, some culverts that carry water can include a separate trail tread (figure 5–34).

Successful designs prevent trail tread material from being eroded at either end of the culvert.

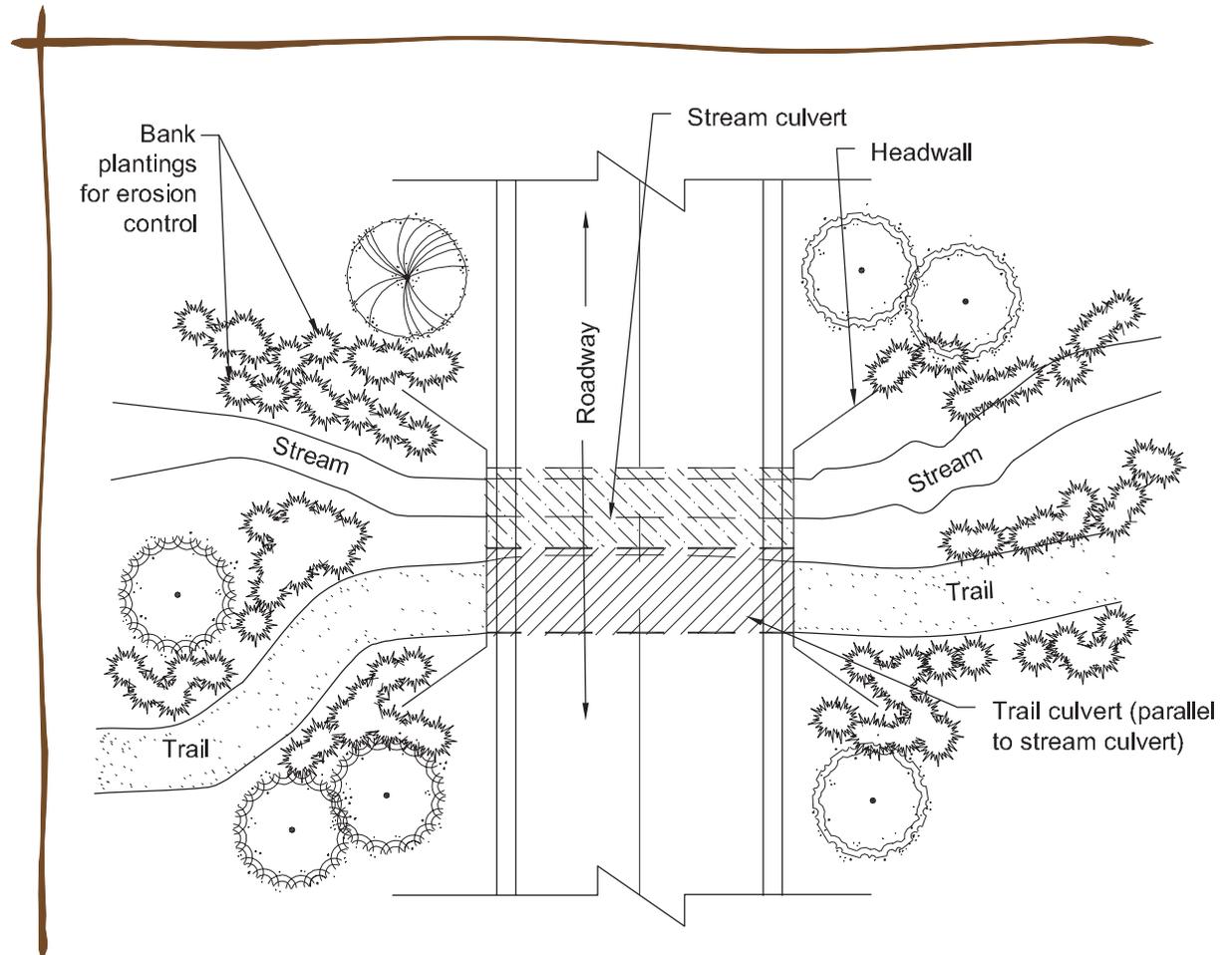


Figure 5–34—A culvert shared by a stream and the trail. When flooding occurs, both courses channel floodwater.



Figure 5–35 illustrates a culvert that carries water and also includes a trail. Inside the culvert, a channel along the outer edge of the trail carries water out of the culvert. Abutments direct the water to a catchment pond below the trail tread.

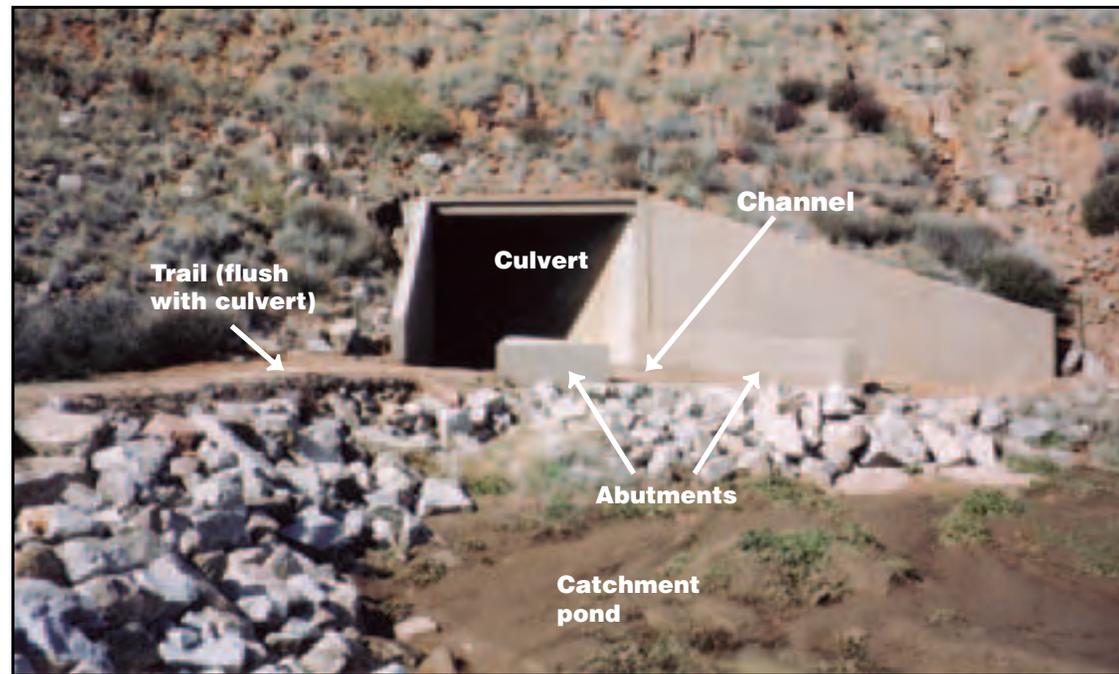


Figure 5–35—A trail and a water channel share this specially designed culvert. The channel keeps water off the trail and abutments direct the runoff into a catchment pond.

**Chapter 6—****C**hoosing Horse-Friendly Surface Materials

Although horses and mules are sure-footed in the wild, surfaces need to be considered when developing trails and recreation sites. How well stock can walk on a surface depends on the degree of slope and traction, the horseshoes they are wearing, the distance they must travel, and the surface material itself.

**Surface Options**

When choosing surface materials, consider how comfortable and safe the surface is for the users and how well the material will stand up to the major forces that affect the surface's life:

- ☆ **Compaction**—the force pressing the material down, usually human, animal, and motorized users
- ☆ **Displacement**—the force moving material sideways
- ☆ **Erosion**—the forces of wind and water

All surface materials have advantages and disadvantages. For example, many materials present slipping hazards, especially when they are wet, snowy, or icy.

Whatever the choice, make sure the materials are appropriate for the regional climate and the level of development. For equestrian use, materials should compact to a firm, slip-resistant surface that can withstand the impact of horseshoes. Paved surfaces provide little traction for horseshoes, and are rarely suitable. If possible, choose a surface material that produces minimal dust and whose color blends with the native soil. Sometimes making the surfaces a slightly different color helps users distinguish between areas, such as recreation site roads and parking spaces or parking pads.

Table 6–1 summarizes relative characteristics of common surface materials and table 6–2 identifies their relative suitability for horse trails and recreation sites. For discussion purposes, this guidebook categorizes surface materials as natural materials, aggregate, additives, and pavement. Specialty products and geosynthetic materials are listed separately.

**Lingo Lasso****Course Outline**

This guidebook uses the following terms to describe construction elements for trails and recreation sites:

- ☆ **Surface course**—The top layer of applied materials. The surface course carries the traffic load, provides a finished surface, is slip-resistant, and resists traffic wear and water damage.
- ☆ **Base course**—A support layer of applied materials. The base course provides the immediate support for the surface course. The base course may be built directly on the subgrade (existing material) if no subbase is required.
- ☆ **Subbase**—A foundation layer used on engineered travelways. Recreation site roads and parking areas may require a subbase. Such construction must comply with the requirements of the AASHTO and ASTM International (formerly the American Society for Testing and Materials). The subbase consists of compacted granular material or soil that helps protect the base and surface courses from intrusion of fine-grained roadbed soils, damage from frost, and the accumulation of free water in or below paved surfaces.
- ☆ **Subgrade**—The material in place; usually the natural soil. The subgrade is the base for succeeding layers of applied materials.



Table 6-1—Relative characteristics of common surface materials for horse trails, trailheads, and campgrounds. Specialty materials are not included. Agency specifications may vary.

	Surface material	Traction or slip-resistance*	Durability	Natural appearance**	Dust free	Horse comfort	Cost of material	Maintenance	Susceptibility to displacement
Natural materials	Native soil***	Variable	Variable	Excellent	Variable	Good to excellent	Low	Variable	Variable
	Wood chips	Fair to good	Poor	Good	Good	Excellent	Low	Moderate	High
Aggregate	Crushed rock with fines	Excellent	Excellent	Good	Good to excellent	Good	Moderate	Low	Low
	Crushed rock without fines	Good	Excellent	Good	Good	Fair	Moderate	Low to moderate	High
	Rounded gravel without fines	Poor	Excellent	Fair to good	Good	Poor to good (varies with particle size)	Moderate	Moderate	High
	Sand	Good	Good	Excellent	Poor	Good	Low	Moderate	High
	Cinders	Good	Poor to fair	Fair	Good	Poor	Low	Moderate	High
Additives	Soil additives****	Good	Good	Good	Good to excellent	Good	High	Moderate	Moderate
Pavement*****	Asphalt	Poor	Good	Poor	Excellent	Poor	High	Moderate	Low
	Asphalt with chip seal	Fair	Good	Fair	Excellent	Poor	High	Moderate	Low
	Rough-textured concrete	Good	Excellent	Poor	Excellent	Poor	High	Low	Low
	Concrete with washed surface	Poor to fair	Excellent	Fair	Excellent	Poor	High	Low	Low
	Hard, traction-friendly pavers	Good	Good	Poor to fair	Excellent	Poor	High	Moderate	Low

\* Wet surfaces may have reduced traction.

\*\* How natural a product appears varies by location.

\*\*\* Native soils are quite variable. Consult local geotechnical engineers or soil scientists for more information.

\*\*\*\* Characteristics of soil additives vary according to the manufacturer and the method of installation.

\*\*\*\*\* Coatings and surface washes may change the characteristics of paved surfaces, including traction and appearance.



Table 6–2—Suitability of common surface materials for equestrian trailheads and campgrounds. Specialty materials are not included. Agency specifications may vary. Note: Appropriate surface materials for arenas and round pens depend on the activities they’re being used for. Consult other references for more details.

	Surface material	Roads, parking areas, and parking pads used by horses	Living area (camp or picnic area)	Horse area (tying area, corral, or pen)	Wearing surfaces around water hydrants, troughs, and wash racks*
<b>Natural materials</b>	Native soil**		X	X	
	Wood chips			X	
<b>Aggregate</b>	Crushed rock with fines	X***	X		
	Crushed rock without fines		X	X	X
	Rounded gravel without fines		X	X	X
	Sand				X
	Cinders	X	X		X
	Soil additives***	X	X****		
<b>Pavement*****</b>	Asphalt				
	Asphalt with chip seal				X
	Rough-textured concrete		X		X
	Concrete with washed surface		X		X
	Hard, traction-friendly pavers				X

- \* To reduce slipping hazards, use rubber mats in wash racks.
- \*\* Native soils are quite variable. Consult local geotechnical engineers or soil scientists for more information.
- \*\*\* The surface must be compacted.
- \*\*\*\* Soils treated with additives should not be used for tent pads.
- \*\*\*\*\* Coatings and surface washes may change the characteristics of paved surfaces, including traction and appearance.





### Natural Materials

As with all surface options, natural materials have advantages and disadvantages. Horse-friendly unpaved surfaces are attractive and well received by users. On the other hand, these surfaces may be damaged by rain or snow, and some, such as loose shale, round tree needles, damp moss, or moist vegetation, offer poor traction, posing slipping hazards for all recreationists.

### Native Soils

Native soils vary, even within a single trail corridor or recreation site. Soils that are coarsely textured with high percentages of gravel and sand can be very good surface materials for trails and *living areas*—camp and picnic areas. Finely textured soils, those with a higher percentage of organic matter, silt, and clay, tend to be poor surface materials. Roads, parking areas, and parking pads surfaced with native soils are generally difficult to maintain and can become muddy. Hoofs, boots, and wheels can damage the tread in wet or boggy areas (figure 6–1). When these areas dry out, the ruts may make the trail difficult to use. Some native soils also produce a lot of dust, an issue of special concern in urban areas and near residences. Unhealthy dust conditions may require abatement measures. Native soils may be economical, but they may require frequent maintenance, reducing their overall cost effectiveness.



Figure 6–1—As trail surfaces become worn or muddy, trail users frequently walk to the outside. This results in wider or multiple treads that are often called *braided trails*.

### Wood Chips

Wood chips cushion the impact of hoofs on soils, and most stock are comfortable walking or lying on them. Consider using wood chips about 2 by 2 by ½ inches (51 by 51 by 13 millimeters) on low development trails in drier climates. In areas where horses are confined, smaller chips or sawdust are suitable in many climates. Hardwood chips may last longer than chips from conifers.

Wood chips require more maintenance than other treatments. They absorb water and eventually decompose and become embedded in the soil surface. Heavy rainfall can wash the chips away unless they are contained with edging. Wet wood chips can be slick, making them less desirable in regions that have steep grades or heavy use. Wood chips also can harbor insects, retain unwanted moisture, and reduce accessibility. Chips with protruding knots can injure the horse’s frog if the animal is not wearing horseshoes. Don’t use chips from trees that are toxic to horses and mules, such as black walnut or yew.



#### Resource Roundup Soil Treatments for Accessible Trails

*Soil Stabilizers On Universally Accessible Trails* (Bergmann 2000) reviews several products that claim to stabilize native materials used for trail surfaces while maintaining a natural appearance. Results varied from very poor to satisfactory stabilization. The report is available at <http://www.fhwa.dot.gov/environment/fspubs/00231202> or <http://www.fs.fed.us/t-d/pubs/pdf/00231202.pdf>. This Web site requires a username and password. (Username: t-d, Password: t-d)



#### Resource Roundup Accessible Surface Study

The National Center on Accessibility is conducting a study to determine which trail surface materials are accessible as well as environmentally friendly. The *National Trails Surface Study* is available at <http://www.ncaonline.org/trails/research>.



## Aggregate and Similar Surface Materials

The term *aggregate* generally refers to materials that started out as bedrock. Aggregate is commonly used for base and surface courses at recreation sites and on trails. Aggregate includes combinations of crushed stone, gravel, crushed gravel, sand, or other mineral materials. Aggregate is produced using crushing, screening, pit-run, or grid-rolling methods. Crushing and screening are the most commonly used methods. Pit-run and grid-rolling methods generally produce lower quality aggregate.

- ☆ *Crushing* breaks stone and gravel into smaller particles. Crushing equipment also blends the various sizes together for the proper gradation.
- ☆ *Screening* separates raw material into uniform sizes. The material is moved or shaken on sorting screens. Adjusting the relative proportion of particle sizes produces the proper gradation.
- ☆ *Processing* is not required for pit-run aggregate, because aggregate in its natural state has the proper gradation of particle sizes. Sometimes, oversized stones are sorted out using a grizzly—a screen with large openings.
- ☆ *Grid-rolling* means crushing rock in place. Rock sources include native materials or aggregate hauled from pits. A heavy steel roller with a waffle pattern rolls the material, crushing and compacting it at the same time.

Aggregate can be graded for base and surface courses. Gradation refers to aggregate particle sizes and the relative distribution of those particle sizes in the material. *Well-graded soils*—those with many particle sizes—compact well. Gradation is determined by screening—or *sieving*. A sample of the test material is dried, weighed, and then passed through a series of sieves. The contents of each sieve are weighed.

Well-graded aggregate has different particle sizes that fit snugly together to form a tight, dense mass. Water is added for lubrication, allowing the particles to be thoroughly compacted so they form a relatively stable surface. The suitable depth for an aggregate surface course varies depending on soil conditions and the depth of the base course.

Other materials that occasionally are used in aggregate base and surface courses include fillers or binders and chemical additives. Fillers are mineral materials, such as crushed limestone, that improve the gradation of the aggregate. Binders increase the cohesiveness or binding quality of the aggregate. Clay is a common binder. For example, a base of sand and clay is often used in areas with abundant sand. The sand alone is too loose to form a well-compacted stable material. Adding small amounts of clay to aggregate may improve resistance to washboarding and raveling. Fillers and binders generally are not used alone but are blended uniformly with the aggregate. Added materials should be blended at the plant when the aggregate is processed.



### Lingo Lasso

#### Screens and Sieves

The terms *screen* and *sieve* are often used interchangeably. A sieve is a pan with a square woven wire mesh—the screen—at the bottom. The size of a sieve depends on the size of the mesh openings. The most commonly used soil classification system is the Unified Soil Classification Systems (USCS). The USCS labels sieves with large openings as 4-inch, 3-inch, 2-inch,  $\frac{3}{4}$ -inch,  $\frac{3}{8}$ -inch and so forth. Metric equivalents are about 101.6-millimeter, 76.2-millimeter, 50.8 millimeter, 19-millimeter, and 9.5-millimeter sieves. USCS uses the U.S. Standard Sieve Numbers for sieves with smaller openings:

- ☆ No. 4 U.S. Standard Sieve—4.750 millimeters (about 0.187 inch)
- ☆ No. 10 U.S. Standard Sieve—2.000 millimeters (about 0.079 inch)
- ☆ No. 20 U.S. Standard Sieve—0.850 millimeter (about 0.033 inch)
- ☆ No. 40 U.S. Standard Sieve—0.425 millimeter (about 0.017 inch)
- ☆ No. 60 U.S. Standard Sieve—0.250 millimeter (about 0.010 inch)
- ☆ No. 100 U.S. Standard Sieve—0.150 millimeter (about 0.006 inch)
- ☆ No. 140 U.S. Standard Sieve—0.106 millimeter (about 0.004 inch)
- ☆ No. 200 U.S. Standard Sieve—0.075 millimeter (about 0.003 inch)



### Gravel

Gravel is a coarse, granular material produced by the natural weathering and erosion of rock. The USCS distinguishes gravel as particles that pass through a 3-inch (76.2-millimeter) sieve but remain on a No. 4, 0.187-inch (4.750-millimeter) sieve. Particles larger than 3 inches (76.2 millimeters) are considered cobbles and boulders. Round gravel usually comes from alluvial deposits. Sometimes round gravel is used in wildland settings or areas with low development where it is readily available. Round gravel is a poor choice for trails, roads, parking areas, and parking pads because it doesn't compact well. The rocks roll against each other, making it difficult for people and stock to walk. Vehicles pulling a trailer also have difficulty getting traction, especially if the gravel is deep. As the gravel particles roll, the vehicle sinks and may become stuck. Round gravel with very small rocks sometimes is called pea gravel. Pea gravel is appropriate for surfaces in horse areas and around hydrants, water troughs, and wash racks.

### Crushed Gravel and Crushed Stone

Crushing natural gravel produces crushed gravel. The number of fractured faces depends on the original gradation of the natural gravel—the coarser the gradation, the higher the percentage of fractured faces.

Crushed stone is produced by crushing bedrock. Nearly all the faces of the fragments are fractured. Examples of materials used for crushed stone include limestone and granite.

Many people refer to crushed gravel and crushed stone, either separately or in combination, as *crushed rock*. Crushed rock, with its angular faces, compacts relatively well. Crushed rock is suitable for trail areas where water collects or where there is heavy use. It is also suitable for subbases on roads, parking areas, parking pads, and trails. Crushed rock can be used in horse areas. Small rocks  $\frac{3}{8}$  inch (about 9.5 millimeters) or smaller are less likely to get caught in rakes during manure cleanup. Larger rocks can lodge in an animal's hoofs, causing pain or injury. Crushed rock is suitable near water, for example on wearing surfaces around water hydrants, water troughs, and wash racks.

Crushed rock, when combined with fines and well compacted, generally is preferred for surface courses on trails, roads, parking areas, and parking pads. This material fits together tightly, offering a stable surface for stock and vehicles. Compacted crushed rock with fines withstands high use and requires little maintenance. The material provides good traction and drainage. If it is well compacted and the surface

hardens well, it is not dusty. The standard size for crushed material is  $\frac{3}{4}$ -inch-minus (less than about 19.1 millimeters), which includes rocks about  $\frac{3}{4}$  inch in diameter and smaller. Some agencies prefer crushed materials that are  $\frac{1}{2}$ -inch-minus (about 12.7 millimeters or less) for trail building, but this material may be more expensive.



### Crusher Fines

#### Horse Sense

Fines—sometimes called *crusher fines*—are small particles of crushed rock that include a mix of sizes, from a fine dust up to  $\frac{3}{8}$  inch (about 9.5 millimeters) in diameter. Often, crusher fines are leftovers from crushing operations, but they can be custom produced. Using crusher fines alone contributes to dusty conditions. Well-graded crusher fines mixed with a clay binder can form a good surface for trails or living areas in campgrounds. Crusher fines frequently are added to crushed rock to make the mixture compact more completely. The recommended combination of crusher fines and crushed rock contains enough small particles to completely fill the voids between larger rocks.



## Sand

Sand is fine granular material produced by the natural disintegration of rock. The USCS says that sand is material that passes a No. 4 (4.750-millimeter) sieve, but is retained on a No. 200 (0.075-millimeter) sieve. Sand drains well and creates a soft trail tread for stock. When used alone, sand is easily eroded or replaced by other materials and can be dusty. Often, sand is combined with clay and gravel or other materials to improve its drainage or prevent too much compaction. If sand is applied more than 3 inches (76.2 millimeters) deep, it can strain an animal's tendons and ligaments. Over time, horses that eat or breathe sand can contract sand colic, a serious illness. Sand should not be used in areas where horses and mules eat or where they spend a lot of time.

## Decomposed Granite

Decomposed granite resembles crushed stone, although it erodes into angular pieces through natural processes. Decomposed granite, with or without fines, compacts relatively well. When combined with fines and compacted, decomposed granite is a popular surface choice for trails, parking areas, parking pads, and living areas in campgrounds. Some designers group crushed stone, crushed gravel, and decomposed granite under the single term *angular rock* because these materials have many characteristics in common. All are excellent for many surfaces used by horses and mules.

## Cinders

Cinders are pulverized pieces of volcanic lava about ½ inch (13 millimeters) in diameter or smaller. They are an alternative treatment for high-use areas that are subject to trenching or soil displacement caused by water, snow, or ice. The rough surface provides improved traction but requires periodic maintenance to replace displaced or buried materials. Cinders form an unpleasant walking surface for long-distance trails.

## Additives

Soil additives reinforce or augment existing soil structure to improve the soil's engineering characteristics. They can be used to improve some native soils and leave them looking natural. Some additives also may be used with well-graded aggregate. Several commercial companies market additives described as environmentally friendly that produce firm surfaces.

*Chemical additives*—calcium chloride, sodium chloride, lignin sulfonate, magnesium chloride, or hydrated lime—may be added to aggregate to control dust, to adjust moisture levels, or to act as a binder. Sometimes, a small amount of portland cement is mixed with soil or aggregate to slightly harden the surface. *Soil stabilizers*—a form of additive—act as a binding agent. After a rainfall, some stabilized materials may fail to adequately support the weight of stock. AASHTO or ASTM International specifications establish standards for many additives.

## Pavement

This guidebook uses the term *pavement* to refer to hardened materials such as asphalt, concrete, and hard pavers. Although they are durable, hardened materials frequently are not horse friendly.

Pavement usually is smooth, offering poor traction for horseshoes. Most equestrians are uncomfortable riding, unloading, or tying their stock on pavement. For example, a horse stepping out of a trailer may slip once its weight hits the smooth surface. Some stock balk at the trailer door when they are being loaded. As the handler works to get the animal inside, a smooth surface makes a difficult situation dangerous.

There are other reasons for avoiding pavement in areas used by riders. When horses and mules are comfortable, they are more likely to stay quiet. Stock may spend many hours tied to trailers or confined in corrals, and they are more comfortable standing on softer surfaces.

Pavement is inherently dangerous for stock. If pavement in a stock area is absolutely unavoidable, minimize the paved area. Horses and mules can successfully navigate short sections of smooth surface if they are accustomed to doing so. However, many stock are reluctant to step on unfamiliar or uncomfortable surfaces.



Because pavement does not absorb liquids well, urine and rainwater can form puddles. Standing puddles of horse urine are unattractive, inconvenient for pedestrians, and may make the surface slippery.

### Asphalt

Asphalt surfaces generally are not recommended for horse trails, roads, parking areas, or parking pads because they provide little grip for horseshoes. However, trails may have to cross sections of asphalt. Roughen the surface in such areas. Some uncoated asphalt surfaces are somewhat rough, providing a degree of traction that is better than coated asphalt. *Rubberized asphalt*—regular asphalt mixed with finely ground used tires—has been used with some success in Arizona. Caution: asphalt heats up and softens in hot climates. The softened material sticks to hoofs and can burn the living tissue under some circumstances.

6



### Sticking to It

#### Trail Talk

Horses and mules need traction even when they're not on the trail. For example, when the Northern Region Pack Train participated in the Rose Bowl Parade, the horses and mules each wore special horseshoes. Welded to the gripping surface of each shoe was a slip-resistant borium coating. Many sponsors of large events require the use of borium-treated horseshoes to reduce risk.

### Asphalt With Chip Seal

Asphalt with a chip-seal finish slightly improves traction on asphalt road surfaces. This option is suitable for limited use at trail crossings, bridges, and bridge approaches. Type III asphaltic emulsion slurry seal may be an option.



#### Resource Roundup

### Slip-Resistant Slurry

To reduce the potential for slipping by humans and stock, the Forest Preserve District of DuPage County, IL, surfaced the equestrian parking lot at Waterfall Glen Forest Preserve with a Type III asphaltic emulsion slurry seal. The seal uses larger aggregate and is applied in a thick layer. The result is a coarse surface texture that improves traction for all users. In other areas of the country, the treatment is commonly referred to as slurry seal or slurry surfacing.

Slurry seal emulsion is comprised of well-graded fine aggregate, mineral filling (if needed), emulsified asphalt, and water. Type III slurry seal is usually used as the first of many coatings, to correct surface conditions, or to improve skid resistance. Technical information is given in *Supplemental Specifications and Recurring Special Provisions* (Illinois Department of Transportation 2005) at <http://www.dot.il.gov/desenv/07supp.pdf>.

### Rough-Textured Concrete

Concrete is one of the slipperiest surfaces a horse or mule may encounter, and many riders do not recommend it. Nonetheless, stock manage to cross concrete surfaces without incident. This doesn't make concrete any safer. A heavy, rough-broom finish, applied perpendicular to the direction of travel, is one mitigation measure used successfully in some places. A rough finish may increase traction, but does not eliminate the danger that a horse or mule might slip and fall on the hard surface.

### Concrete With Washed Surface

Concrete, with exposed 1- to 1½-inch (about 25- to 38-millimeter) crushed aggregate and a ½- to ¾-inch (about 13- to 19-millimeter) water wash finish, provides more traction than smooth concrete (figure 6–2). Riders do not agree on the advisability of using



Figure 6–2—Some agencies use concrete surfaces with a water wash finish to improve horse traction. This treatment may not be suitable in all areas.



this finish. Local weather, site conditions, or top coatings can reduce surface traction. For example, the surface may be slippery when wet, especially if a sealer coat has been applied. Before choosing this surface treatment, consult with local trail users.

## Pavers

Generally, hard pavers are not horse-friendly surfaces. However, interlocking or articulating pavers that facilitate traction can be good choices for equestrian water crossings where stream erosion is a problem. Interlocking pavers fit into each other, holding them in place. Some styles allow vegetation to grow through, others have voids that can be filled with soil, gravel, or other suitable material. Articulating concrete pavers form a mat with spaces that are filled with soil. In highly erodible soils, pavers combined with geotextiles are an option. These materials provide a horse-friendly choice for durable surfaces, but they are costly.

Interlocking synthetic or rubberized pavers are relatively softer than other pavers and may be suitable for horse trails. They are costly. Possible locations for rubberized pavers include approaches to bridges, culverts, and on roads with grades steeper than 5 percent. They also may be suitable in urban and rural areas on unpaved treads that are dusty or drain poorly. Some areas have had problems keeping the pavers in place.



## In the Groove

It is dangerous for stock to travel on smooth, hard surfaces. Some people suggest *grooving*—or *tining*—concrete to provide more traction. According to *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-03)* (FHWA 2003), grooves in textured concrete are spaced about 0.4 to 0.8 inch (10.2 to 20.3 millimeters) on center, are about 0.08 to 0.20 inch (2 to 5.1 millimeters) wide, and about 0.12 to 0.20 inch (3 to 5.1 millimeters) deep. Grooves should be perpendicular to the direction of travel. Form grooves using a float with tines or a concrete saw. Grooves on horse trails should not be larger than specified because:

## Specialty Products

Antiskid planking and sheeting made from recycled tires and plastics are used in marine environments and may be useful for equestrian bridge applications. The materials originally were designed for horse trailer ramps, floors, and walls.

Heavy-duty stall mats or rubber matting made from recycled tires may be suitable for wash racks or other wet areas where theft or vandalism is not a problem. There are many commercial manufacturers of these products.

## Trail Talk

- ☆ Some horseshoes with built-up heels and toes can catch in large grooves.
- ☆ Large grooves reduce the amount of surface that contacts the hoof, giving less traction.
- ☆ Surfaces with grooves deeper than 0.5 inch (12.7 millimeters) don't meet accessibility requirements.
- ☆ Roads with grooved areas, rumble strips, and similar treatments must comply with applicable requirements, such as AASHTO standards. Rumble strips are not recommended for areas used by stock.

Grooved surfaces may require frequent maintenance to keep the grooves free of debris. When the grooves are filled, they won't provide traction.

## Geosynthetic Materials

*Geosynthetics* are synthetic materials, usually made from hydrocarbons. Geosynthetics in combination with soil or rock can increase tread stability.

Geosynthetics perform three major functions: separation, reinforcement, and drainage. Materials of this type include geotextiles and cellular confinement products, such as geocells. These materials become a permanent part of the trail. They are covered with about 6 inches (152 millimeters) of soil or rock to prevent damage by ultraviolet light or users.



### Geotextiles

Geotextiles, also known as *construction fabrics* or *filter cloth*, are widely used in roads, drains, and embankments. They consist of long-lasting synthetic fibers bonded by weaving, heat, extrusion, or molding. Geotextiles stabilize surfaces when they are used with other materials or vegetation. They are not suitable for use alone as tread. Figure 6-3 shows construction of a trail tread using geotextile covered with several layers of gravel.



Figure 6-3—Geotextile is sandwiched between a substandard soil base and an aggregate cap to prevent soil migration. Logs hold the edges of the fabric in place.

### Cellular Confinement

*Cellular confinement systems* (CCS) are three-dimensional, web-like materials that provide structural integrity for materials compacted within the cell. The engineered cell walls limit the transfer of shear forces within the soil. CCS consists of a surface-aggregate wearing surface, the cell membrane, and fill—usually imported gravel or suitable onsite material. Depending on site characteristics, construction may incorporate an optional separation fabric. Installation of the system is labor intensive. The smallest cell system commercially available is 4 inches (102 millimeters) deep. At least 6 inches (152 millimeters) of fill is required to plug the cells and provide a 2-inch (51-millimeter) wearing surface. For a 6-foot- (1.8-meter-) wide trail, this amounts to about 1 cubic yard (0.76 cubic meter) of loose material per 6 linear feet

(1.8 meters) of trail. Figure 6-4 shows a trail bridge approach that is being reinforced with CCS and soil. Figure 6-5 shows the finished job.



Figure 6-4—Workers are preparing the third layer of geocells at a trail bridge approach. The cells provide structure for soil that forms the tread.



Figure 6-5—When installation is completed, the approach blends into the surrounding landscape.



#### Resource Roundup

#### Geosynthetics in Wet Areas

For more information regarding the use of geosynthetic materials in wetlands, refer to *Geosynthetics for Trails in Wet Areas* (Monlux and Vachowski 2000). View the report at <http://www.fhwa.dot.gov/environment/fspubs/00232838> or <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm00232838>. This Web site requires a username and password. (Username: t-d, Password: t-d)



## Chapter 7— Planning Recreation Sites

The prerequisite for developing any recreation site is access and permission to use the area. Other factors that come into play include: user preferences, safety, budgets, legal requirements, site limitations, and climate. A good recreation site meets the needs of users, minimizes conflicts, and has an appropriate level of development, while protecting the natural environment. Careful planning is the key to a successful equestrian recreation site, whether it is a trailhead, single-party campground, group camp, or a combination of the three.

### User Needs

The needs of equestrians are similar to the needs of other users. For example, all recreationists need water. Riders not only need a water source, they need one that accommodates their stock.

Because riders' preferences vary greatly across the country, when planning recreation sites for equestrians, arrange a public meeting to gather input. Invite representatives from a wide range of equestrian organizations. If equestrian trailheads and

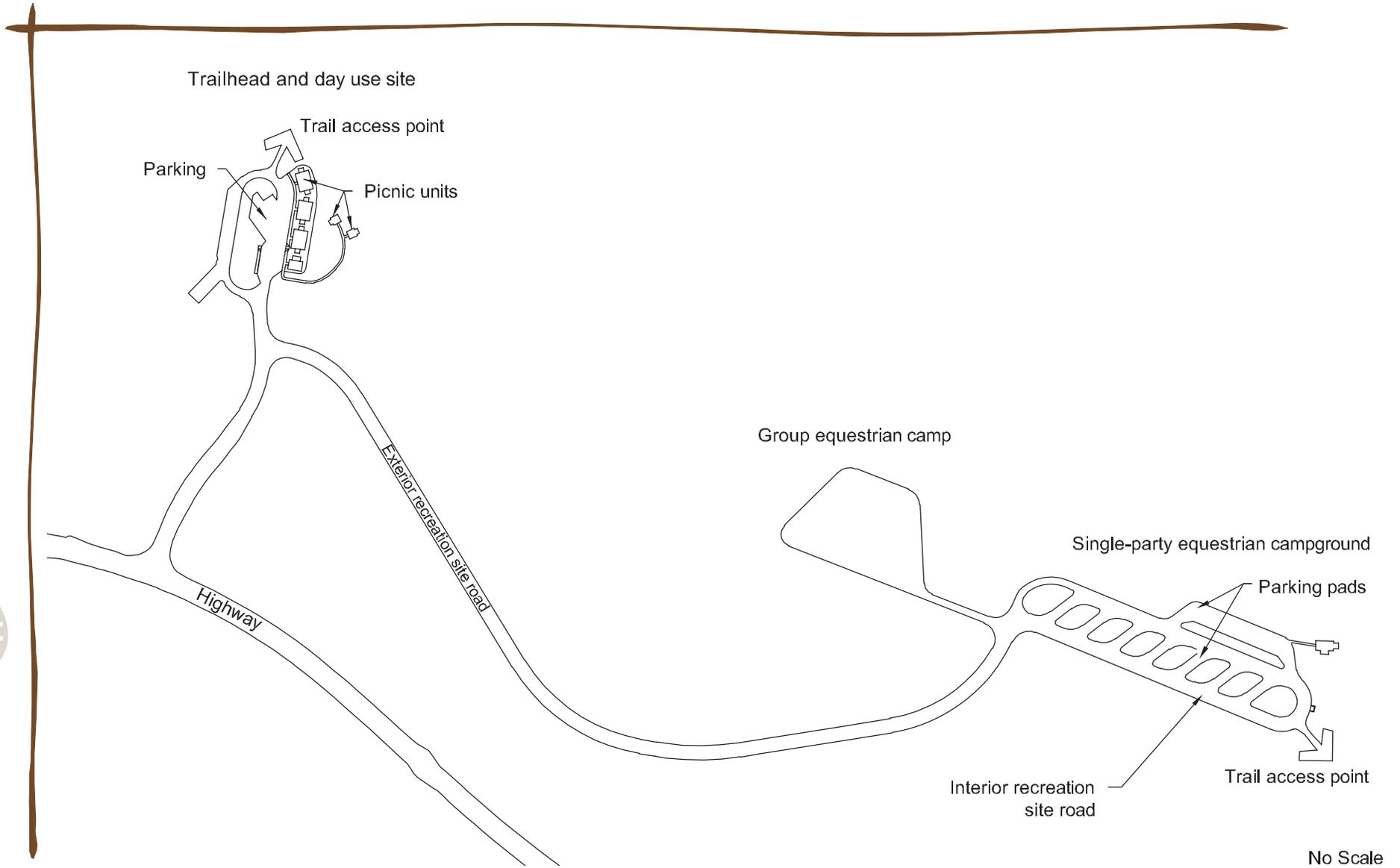
campgrounds are nearby, visit them. While there, ask riders what they like about the facilities and what they would like to improve.

### Site Conflicts

If recreation user groups are not fully compatible, safety may become an issue. For example, many children are not horsewise. They may play in ways that startle horses and mules. Adults who are not familiar with stock might unintentionally create problems as well. People, stock, and facilities could be harmed in such situations. Riders appreciate separation from other users in campgrounds, at trailheads, and at trail access points. Landforms, roads, streams, drainages, and vegetation can be used for separation. Suggested separation strategies include:

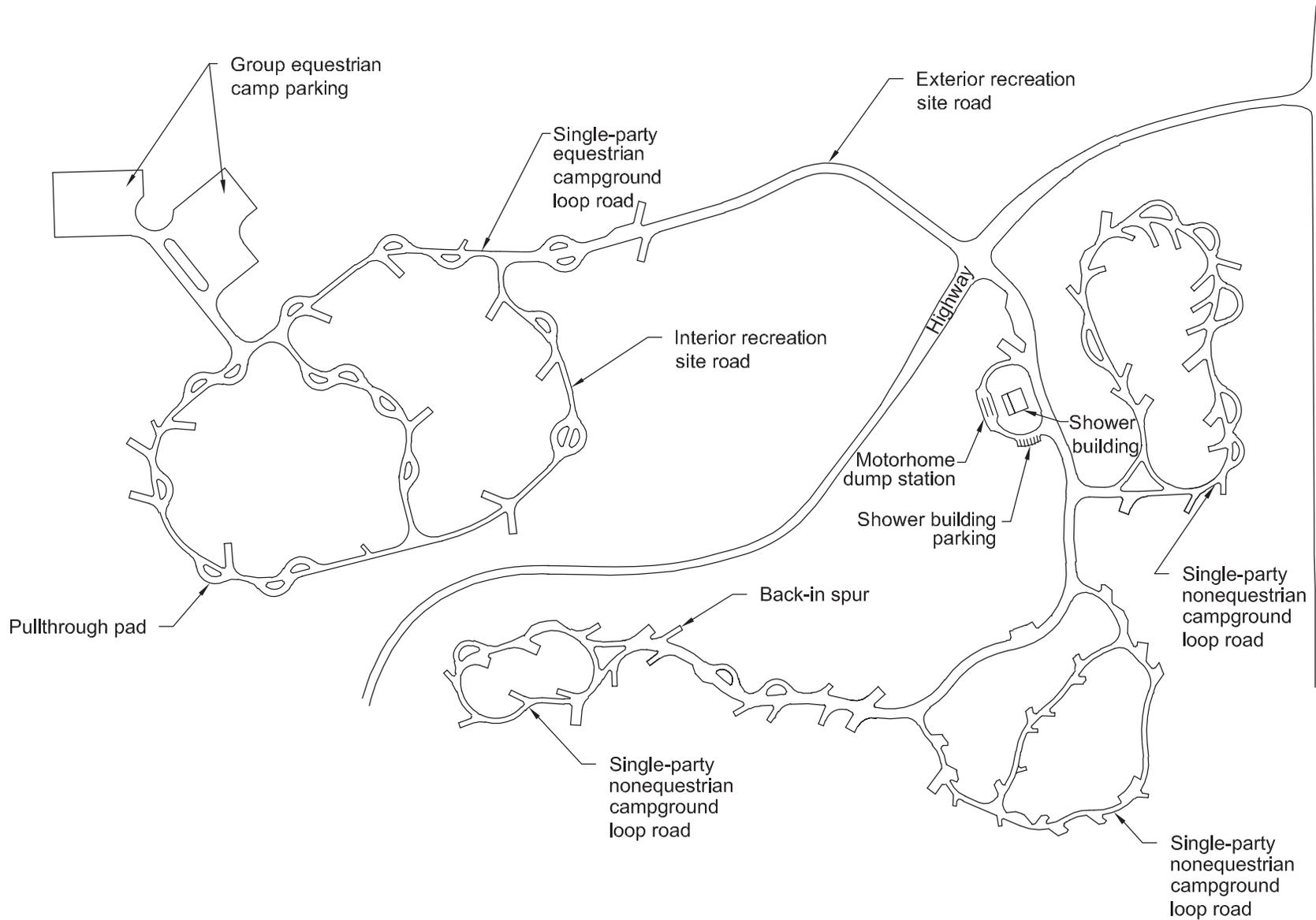
☆ Trailheads and campgrounds—Design sites to avoid disturbances between trailhead visitors and equestrian campers. Figure 7-1 shows a site where distance separates vehicles traveling to the campground from trailhead users.

- ☆ Equestrian and nonequestrian campgrounds—Restrict equestrian campgrounds to campers who have stock. Provide substantial separation between equestrian and nonequestrian campgrounds. Keep nonequestrian users away to reduce the potential for inadvertent injury. Figure 7-2 shows a site where equestrian and nonequestrian campgrounds are separated by distance and a highway.
- ☆ Single-party equestrian camping and group equestrian camping—Separate the single-party equestrian sites from those designed for groups. Single-party campers appreciate a buffer, because large groups may be loud.
- ☆ Equestrian and nonequestrian trailhead parking—Separate equestrians and other users at trailhead parking areas. Post signs indicating where users should park. The separation does not need to be extensive, because visitors don't stay in trailhead parking areas very long, making conflicts less likely. Figure 7-3 shows a trailhead with facilities and vegetation that separate conflicting user groups. Some agencies also provide separate trail access points for conflicting user groups. Signs should identify access points for different types of users and educate users about appropriate behavior around stock.



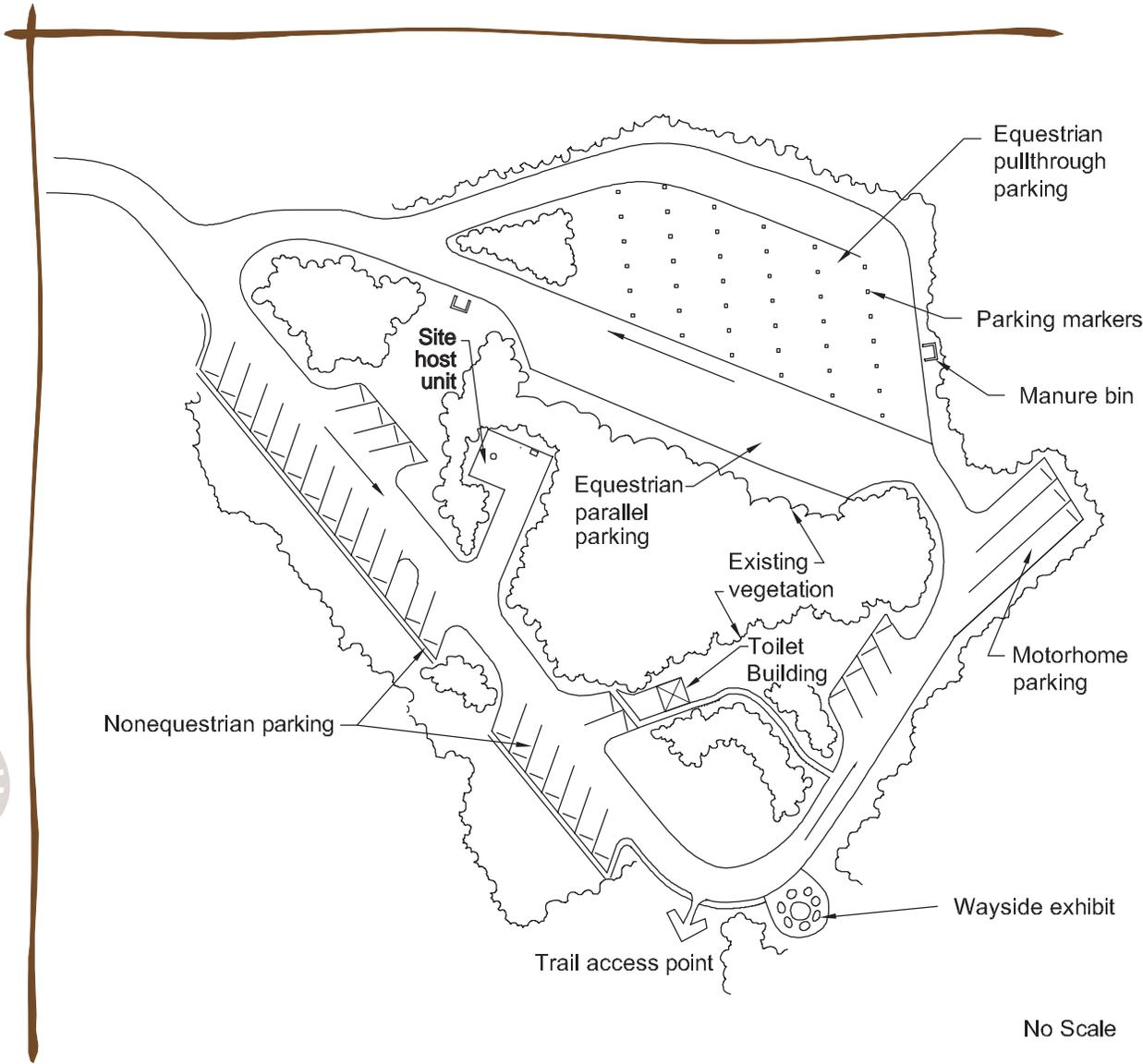
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Figure 7-1—A recreation site where distance separates vehicles traveling to the equestrian campground from the trailhead.



No Scale

Figure 7-2—A recreation site where distance and a highway separate the equestrian and nonequestrian campgrounds.



No Scale



### The Army Way

#### Trail Talk

The U.S. Army Corps of Engineers (2004) follows these guiding principles when designing recreation sites:

- ☆ Consider functional use, creative design, environmental harmony, and economy of construction.
- ☆ Maintain health, safety, security, and comfort of the users in all aspects.
- ☆ Meet local and regional recreation needs.
- ☆ Consider the present requirements as well as recreation trends and future needs.
- ☆ Create user-friendly areas and facilities to serve all populations. Universal design principles help ensure accessibility and user diversity.
- ☆ Consider economy of scale and life-cycle costs.
- ☆ Enhance revenue generation.
- ☆ Base the design of facilities on an area's anticipated average weekend day visitation during the peak season of operation.
- ☆ Protect resources from physical and esthetic degradation.
- ☆ Incorporate off-the-shelf products wherever practical.
- ☆ Correct existing design problems.
- ☆ Provide for ease and economy in cleanup and maintenance.
- ☆ Meet stated management and sustainable development goals.

Figure 7-3—A trailhead where facilities and vegetation separate conflicting user groups.



## Appropriate Levels of Development

Will a trailhead or campground have minimal equestrian facilities and offer an opportunity to get away from it all, or will there be extensive modern conveniences? The answer to this question describes the site's level of development. A recreation site's level of development accommodates the land management agency's master plan and the setting. This guidebook uses the terms *low*, *moderate*, and *high development* as subjective classifications describing the degree of manmade change in developed recreation sites. The levels of development for recreation sites roughly correspond with the *roaded natural*, *rural*, and *urban* recreation classifications of the *Recreation Opportunity Spectrum (ROS) Users Guide* (U.S. Department of Agriculture Forest Service 1982). The Wilderness Recreation Opportunity Spectrum (WROS) is beyond the scope of this guidebook. Normal development for ROS classes is defined as:

- ☆ **Roaded natural areas**—Rustic facilities provide some comfort for users as well as site protection. Contemporary rustic design is usually based on native materials, and synthetic materials are not evident. Site modification is moderate.
- ☆ **Rural areas**—Some facilities are designed primarily for user comfort and convenience. Synthetic but harmonious materials may be incorporated. The design may be more complex and refined. Site modification for facilities is moderate to heavy.

- ☆ **Urban areas**—Facilities are designed mostly for user comfort and convenience. Synthetic materials are commonly used. Facility design may be highly complex and refined, but is in harmony with or complements the site. Site modification for facilities is extensive.

## Site Selection

The ultimate site for equestrian trailheads and campgrounds has the following:

- ☆ **Convenient driving access**—The site has access roads that accommodate vehicles towing horse trailers. Many trail users prefer a site that is within 5 miles (8 kilometers) of a paved road.
- ☆ **Trail access**—The site accesses a trail system. Riders staying in a campground for several nights generally prefer to travel a different loop trail each day.
- ☆ **Mild terrain**—The site has somewhat level ground. As long as portions of the site are suitable for building, some existing natural drainages and landforms may serve as buffers between conflicting uses.
- ☆ **Good soil conditions**—The site has soils that percolate water quickly to avoid wet or muddy conditions. Such soils also withstand traffic without excessive compaction or erosion.
- ☆ **Areas of existing vegetation**—The site's tree canopy provides at least partial shade. An understory serves as a natural visual buffer. Vegetation serves to separate conflicting uses.

- ☆ **Areas of minimal vegetation**—The site has a natural opening surrounded by trees and shrubs that is suitable for parking areas, eliminating the need to remove existing vegetation.
- ☆ **Adequate size**—The site has sufficient area for the project. If the site is not large enough for the planned facilities, resource damage is likely.
- ☆ **Suitable landscape**—The site allows facilities to blend with the natural topography. Avoid a site that would make the recreation facilities prominent features when viewed from surrounding roads, trails, recreation sites, residences, or commercial properties.



### Gentle Slopes

#### Horse Sense

Choosing trailhead and campground sites with steep terrain has its pitfalls. Steep terrain has design limitations and results in unsightly cuts and fills. The most desirable natural slope is about 1 to 3 percent, and the maximum is 4 percent. These gentle slopes allow construction of roads, parking areas, structures, camp units, and picnic units without extensive earthwork.

A thorough site analysis is invaluable. When archeological or cultural resources are present, or if plants or wildlife are classified as threatened or endangered, the complexity of planning and design can increase significantly. Deciding to build on flood plains may increase construction and maintenance costs.



### Designing Choices: ROS

The *Recreation Opportunity Spectrum (ROS) Users Guide* is an inventory and management tool used extensively on lands managed by the Forest Service. The ROS provides a framework for understanding environmental settings as they relate to recreation experiences, recognizing that the user's goal is to have satisfying experiences. Users achieve satisfaction by participating in their preferred activities in preferred environmental settings. For example, camping in an undeveloped setting offers some users a sense of solitude, challenge, and self-reliance. In contrast, camping in a setting with easy access and highly developed facilities offers some users more security, comfort, and social opportunities.

### Resource Roundup

The ROS framework is set up on a continuum—the spectrum—that helps managers provide broad recreation choices. The continuum encompasses six classes that range from primitive to urban (figure 7–4). The combination of activities, settings, and experience opportunities in each class determines management and development strategies. For example, a facility intended to create a safe, controlled environment for large numbers of people would be highly developed using modern materials and would offer ample conveniences. A more primitive area would have far fewer constructed features than an urban area, and the features would be smaller and made of natural materials. *The Recreation Opportunity Spectrum Users Guide* is available at <http://roadless.fs.fed.us/bgdocuments2>.



### Resource Roundup

#### Protecting Views: SMS and VRM

The Forest Service uses the Scenery Management System (SMS) to protect landscape views. The SMS presumes that land management activities—including construction of recreation sites—should not contrast with the existing natural appearance of the landscape. Regional character types are used as a basis for design. Form, line, color, and texture that blend with the landscape can be incorporated into the regional character type to minimize the visual impact of structures. This approach reinforces the concept that recreation sites should be visually subordinate to the landscape. The SMS is included in *The Built Environment Image Guide* (U.S. Department of Agriculture Forest Service 2001). The guide is available at <http://www.fs.fed.us/recreation/programs/beig>.

The Bureau of Land Management uses a similar concept, the Visual Resource Management (VRM) system, to maintain scenic values on public lands. The VRM system is a method of identifying and evaluating scenic values to determine appropriate levels of management. Managers can analyze potential visual impacts and apply visual design techniques so development is in harmony with the surroundings. More information is available at <http://www.blm.gov/nstc/VRM>.

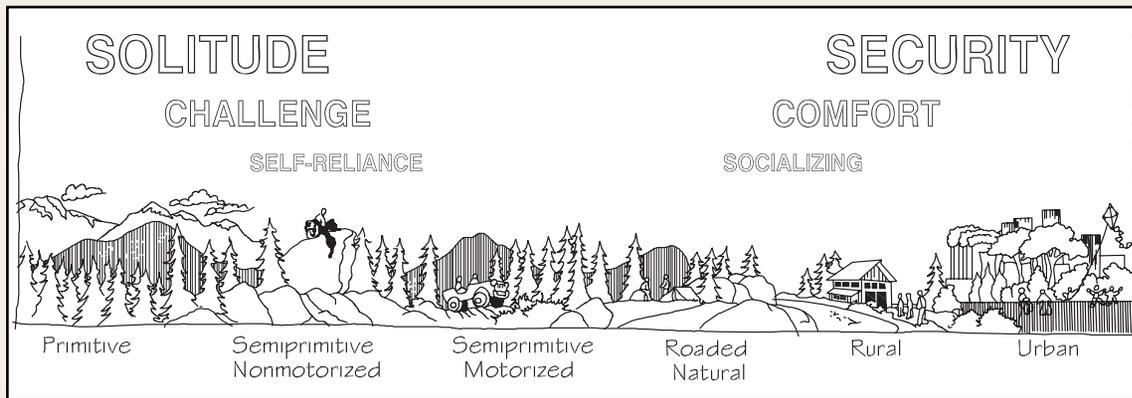


Figure 7–4—The Recreation Opportunity Spectrum provides inventory and management tools for recreation settings. The levels of trail development used in this guidebook roughly correspond with nonmotorized portions of the roaded natural, rural, and urban recreation classifications.



## Vegetation and Landscaping

A vegetation management plan usually is part of the recreation site master plan. Silviculturists, botanists, or other specialists evaluate existing conditions and species for health, hardiness, age, longevity, and similar factors that influence proposed landscape changes. Subsequent recommendations will vary by climate and region of the country. For example, in heavily forested sites it may be desirable to remove some vegetation, providing clear areas open to the sun. In hot climates, priorities may include saving existing vegetation and preserving shade.

## Toxic Vegetation

When planing equestrian amenities and facilities, avoid any vegetation that is toxic to horses and mules. If there's just a little toxic vegetation, remove it. Otherwise, consider moving the amenity away from the toxic vegetation. If it is impractical to avoid a large patch of toxic vegetation, post notices at information stations to alert riders about the hazards.

## Noxious Weeds

Noxious weeds affect the health of the recreation site. Seeds often arrive inadvertently in hay and straw, on vehicles and clothing, and in hair and manure. The seeds germinate and proliferate quickly. Address the issue with handouts, notices, and signs, as appropriate. Consult *Chapter 13—Reducing Environmental and Health Concerns* for more information regarding toxic and noxious vegetation.



### Tasty but Toxic

There are hundreds of toxic plants in North America, and many of them are common. *Ten Most Poisonous Plants for Horses* (EQUUS June 2004) ranks the ones of most concern to equestrians:

- ☆ Bracken fern (*Pteridium aquilinum*)
- ☆ Hemlock (*Conium maculatum*)
- ☆ Tansy ragwort (*Senecio* spp.)
- ☆ Johnsongrass and Sudan grass (*Sorghum* spp.)
- ☆ Locoweed (*Astragalus* spp. or *Oxytropis* spp.)
- ☆ Oleander (*Nerium oleander*)
- ☆ Red maple (*Acer rubrum*)
- ☆ Water hemlock (*Cicuta* spp.)
- ☆ Yellow star thistle and Russian knapweed (*Centaurea* spp.)
- ☆ Yew (*Taxus* spp.)

The article is available at [http://www.equisearch.com/horses\\_care/feeding/feed/poisonousplants\\_041105](http://www.equisearch.com/horses_care/feeding/feed/poisonousplants_041105).



### Toxic Plants Field Guide

Another popular reference is *Horse Owner's Field Guide to Toxic Plants* (Burger 1996). The guide describes well-known plants in the United States that are poisonous or otherwise dangerous to stock.

## Resource Roundup



### Toxic Plants Web Guides

- Several Web sites provide additional information about plants that are toxic to horses and mules:
- ☆ Cornell University provides the *Poisonous Plant Informational Database* (2006) with pictures of plants and affected animals, and information about the botany, chemistry, toxicology, diagnosis, and prevention of animal poisoning by natural flora. The information is available at <http://www.ansci.cornell.edu/plants>.
  - ☆ Manes & Tails Organization has *Poisonous Range Plants of Temperate North America* based on the *Merck Veterinary Manual* (2003). The Web site lists the vegetation's dangerous season, scientific name, common name, habitat and distribution, important characteristics, toxic effects, and includes remarks. The information is available at <http://www.manesandtailsorganization.org/toxic.html>.





### Amenities and Facilities

Equestrian facilities and amenities—trail access, water sources, toilets, corrals, and so forth—help determine the value of a site (figure 7-5). The most important elements at trailheads and campgrounds are trail access, convenient toilet buildings, and a sturdy place to secure stock. Potable water is highly desirable, although in some areas recreationists bring their own water. Table 7-1 summarizes the relative desirability of selected facilities and amenities at recreation sites. Figures 7-6, 7-7, and 7-8 show suggested placement of facilities and amenities at a trailhead, a single-party campground, and a group camp. Consult *Chapter 10—Securing Horses and Mules*, for more information about confinement options.

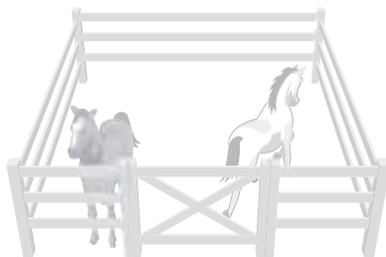


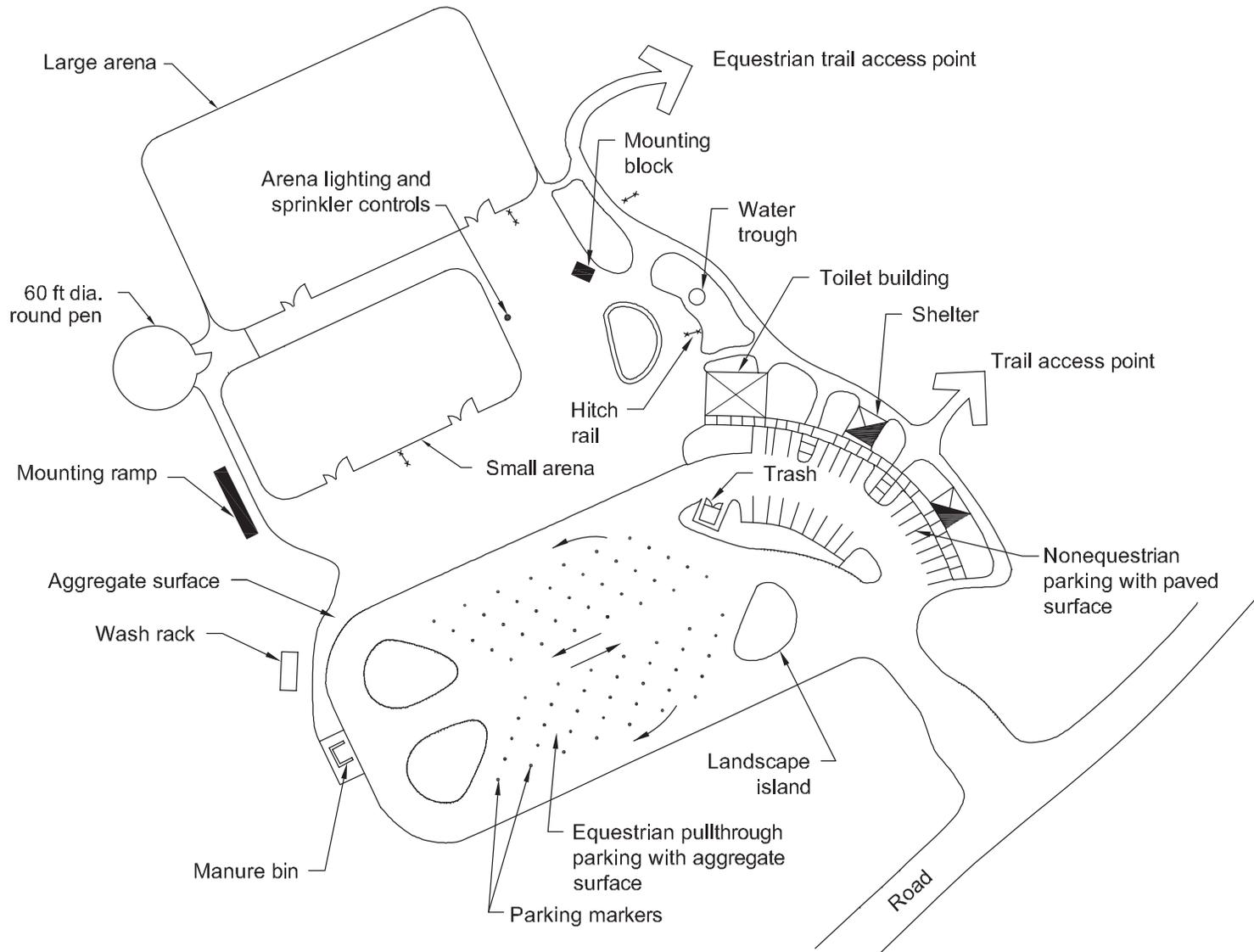
Figure 7-5—This open camp unit has parking, an area for setting up a tent, a fire surface, and a picnic table. Other campground facilities include a manure bin, toilet buildings, and common water hydrants. In the region where it is located, this campground is considered high development. In other areas, this campground would be considered low to moderate development. —*Courtesy of Kande Haertel.*

Table 7-1—Suggested recreation facilities at equestrian trailheads and campgrounds.

Facility	Basic	Often provided	Optional
Trail access	X		
Water sources*		X	
Toilet building	X		
Shower building (campground only)			X
Wash rack			X
Mounting ramp**			X
Loading ramp			X
Mounting block		X	
Manure disposal***		X	
Highline or corral		X	
Hitch rail	X		
Arena or round pen			X

\* In some areas, recreationists bring their own water.  
\*\* Mounting ramps must be accessible, if they are provided.  
\*\*\* Manure disposal is not required in all areas of the country.





No Scale

Figure 7-6—Suggested locations for facilities at an equestrian trailhead with a high level of development.

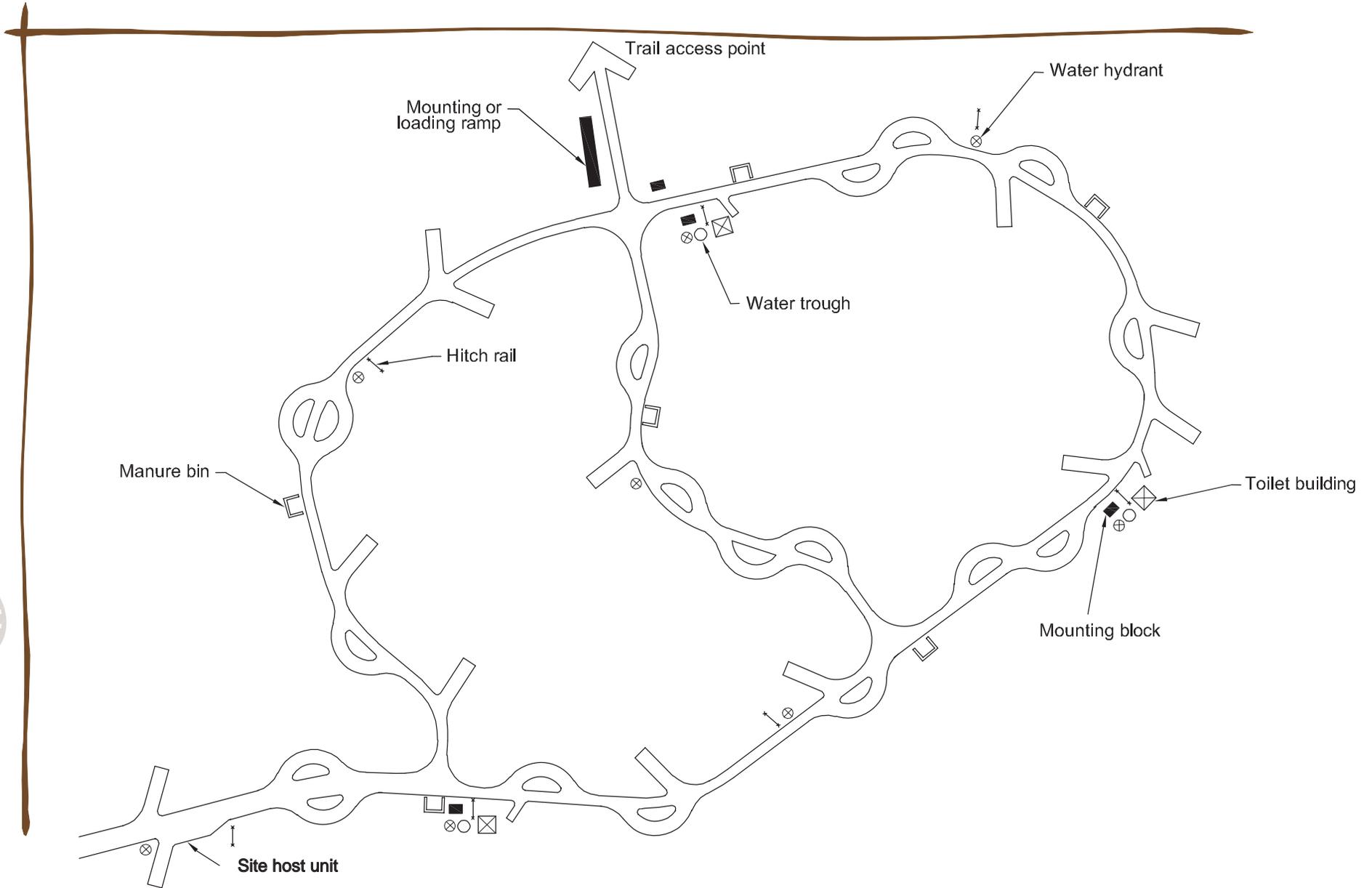


Figure 7-7—Suggested locations for facilities at a single-party equestrian camp unit with a moderate level of development.

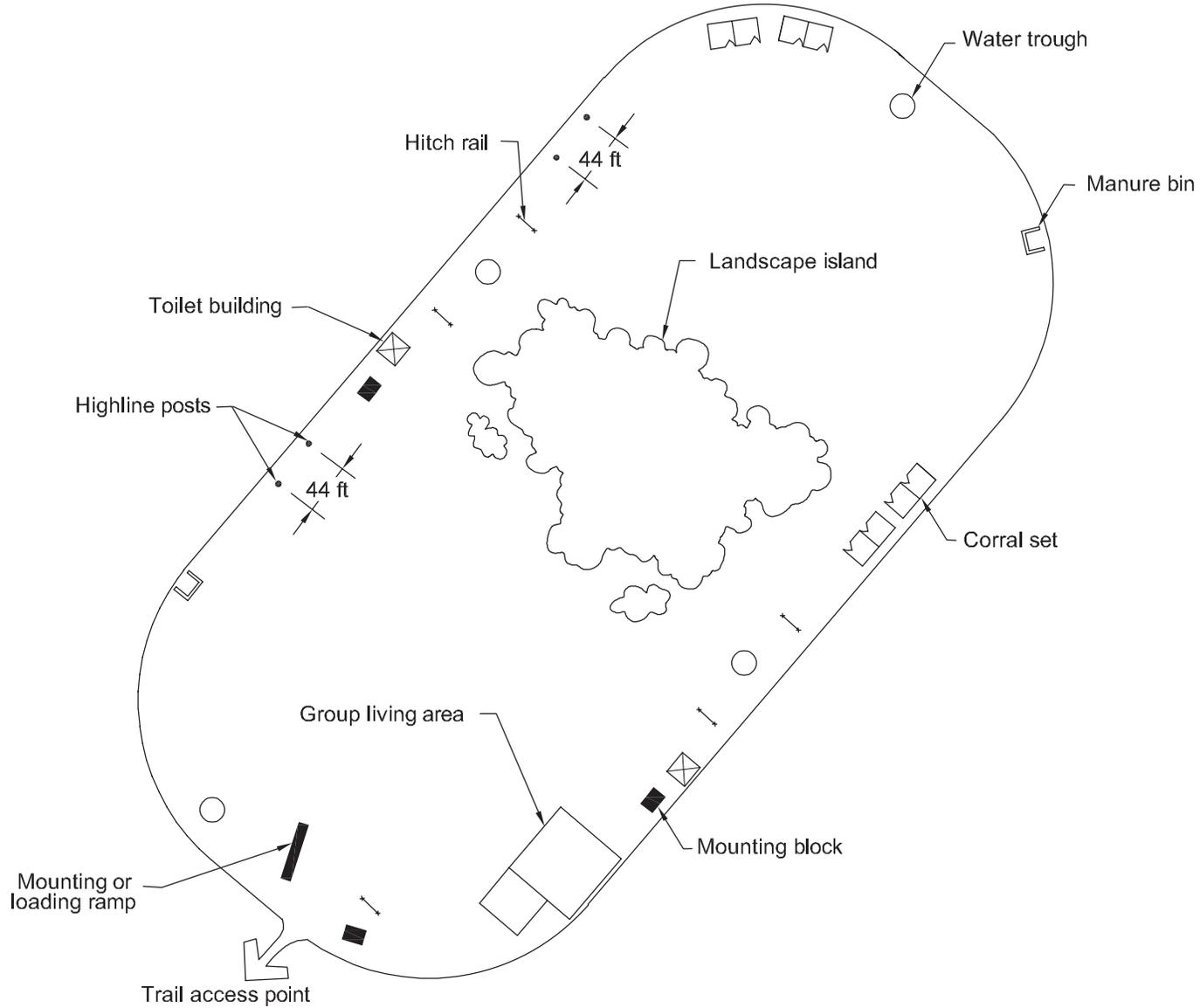


Figure 7-8—Suggested locations for facilities at an equestrian group camp with a moderate level of development.



## Trail Access Points

The primary feature of a successful equestrian trailhead and campground is a well-planned trail system. Once riders have established their camp, they don't like to transport stock to another location. Provide access to numerous loop trails directly from horse camps and trailheads. *Consult Chapter 4—Designing Trail Elements* for more information regarding loop trails.

Trail access points should be in places that are convenient, easy to find, and avoid user conflicts. If a recreation site has both a trailhead and a campground, provide separate trail access points leading from each facility and merge them some distance away. Because stock tend to defecate in the first half mile (0.8 kilometer) of a ride, separating trail access points for riders and other recreationists also reduces the manure on trails used by others.

7 Locate campground trail access in a public area that minimizes disturbance to visitors in single-party camp units. Trail access is best located at the end of a loop road or road intersection. These locations encourage riders to use the road instead of riding through someone else's camp unit. In group camps or trailhead parking areas, locate trail access points at the end of parking areas (see figures 7-6, 7-7, and 7-8).

## Utilities

Recreation site utilities may include storm drainage, water, waste disposal, and power systems. The main factors that determine which utilities to provide at a recreation site are the site's proximity to existing utilities, the budget, and the level of development.

Sewer-, water-, and power-system design varies by geographic region. For example, water conservation is important in arid regions. Urban areas have access to existing water systems that may be sophisticated, while some northern regions use wells that require frost-free hydrants. Electrical systems may access a power grid or use solar power. No matter what system is chosen, utility design must be completed by qualified engineers and adhere to applicable local, State, and Federal building and regulatory codes

Installing utility lines in a recreation site can affect vegetation and esthetics, often leaving a bare corridor the width of a road. Sensitive design minimizes these impacts by placing utility lines parallel and adjacent to the edges of new roads, along abandoned roads, or on a route that is already devoid of vegetation. If this is impractical, use the newly cleared area for pedestrian routes or structures. Where feasible, bury powerlines.



### Resource Roundup

#### According to Code

The International Code Council (ICC) Web site lists the most widely adopted series of building codes in the United States. The ICC develops the codes used to construct residential and public buildings and is dedicated to fire prevention and structure safety. More information is available at <http://www.iccsafe.org/cs>.

## Storm Drainage Systems

Storm drainage systems should carry off surface water without affecting site esthetics. Grades must direct surface waterflow away from living areas, toilet buildings, and hardened surfaces. Recreation site roads, parking areas, and pathways also must be sloped slightly to drain. Wherever possible, concentrate and collect surface flows in areas that are not visible. It may be possible to minimize impact on the land by using several small inlet structures close to one another instead of one large inlet. Regardless of the complexity of the system, proper design must follow State law and will require an interdisciplinary team that includes an engineer, hydrologist, and landscape architect.



### Water Sources

Provide convenient stock water access—an average 1,500-pound (6,680-kilogram) animal needs about 15 gallons of water daily—more if the animal is active. Fifteen gallons of water weighs about 125 pounds (56.7 kilograms), quite a load to haul in buckets. Suitable water sources include water hydrants and water troughs.

### Water Hydrants and Troughs

When stock share water sources, there is a potential for disease transmission. Because of this, many riders bring their own water and don't permit their horses and mules to use a shared source. Some riders prefer filling their own bucket at a hydrant, and then they take the bucket to the animal (figure 7-9) or bring the animal to the bucket. Other riders prefer the convenience of having a water trough. To meet the needs of all riders, provide both water hydrants and troughs. At a minimum, provide a water trough and hydrant at each toilet building and at trail access points. Riders also appreciate hydrants at group gathering areas. For user convenience, consider installing hydrants as suggested in table 7-2.

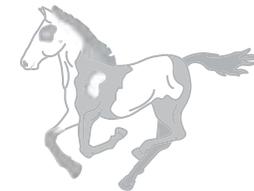


Figure 7-9— An average horse requires about 1 gallon of water daily for each 100 pounds of body weight. Trail stock generally weigh between 750 and 1,500 pounds. Draft horses, such as these Percherons, can weigh 2,000 pounds or more. —*Courtesy of the Forest Preserve of DuPage County, IL.*

Locate hydrants and troughs along the outside edges of loop roads, at intersections, or along the perimeter of parking areas. These locations encourage users to travel the road instead of cutting through camp units (see figures 7-6, 7-7, and 7-8). In highly developed areas where one hydrant serves two campsites, designers may want to incorporate split faucets and controls. Split faucets are not commonly available, but can be custom fabricated. Local health and safety codes may require backflow prevention systems or other considerations for custom configurations.

Table 7-2—Suggested placement guidelines for water sources in recreation sites.

Facility	Maximum distance from camp unit, picnic unit, or horse trailer (feet)
Water hydrant	150
Water trough	300





### Accessible Hydrants and Handpumps

In areas with existing water lines, water access for riders with disabilities usually is not a problem. Many hydrant models are commercially available to meet needs at these sites. The *Americans with Disabilities/Architectural Barriers Act Accessibility Guidelines* (ADA/ABAAG) require that the controls can be operated with one hand without tight grasping, pinching, or wrist twisting. The force required to operate the control can't be more than 5 pounds (2.3 kilograms), and control heights must be between 15 and 48 inches (about 381 to 1,220 millimeters) above the ground. To be accessible, the handpump (figure 7-10) must be on a firm and stable surface that is clear of any obstructions for at least 60 by 60 inches (1,524 by 1,524 millimeters). This design allows someone in a wheelchair to approach the hydrant from the front or side, turn around, and leave. If the hydrant is an unusual design with the handle and spout on different sides of the post, be sure that people can access both sides.

Because available options for stand-alone handpumps that meet accessibility requirements are limited, MTDC designed the accessible handpump shown in figure 7-11. The pump complies with the grasping, turning, and operating force restrictions for people with disabilities. The design works with wells that are about 50 feet (15.2 meters) deep. No commonly available handpumps meet accessibility requirements for wells deeper than 50 feet.



Figure 7-10—This accessible hydrant has easy-to-use controls, a drain, and a firm and stable surface for wheelchairs.

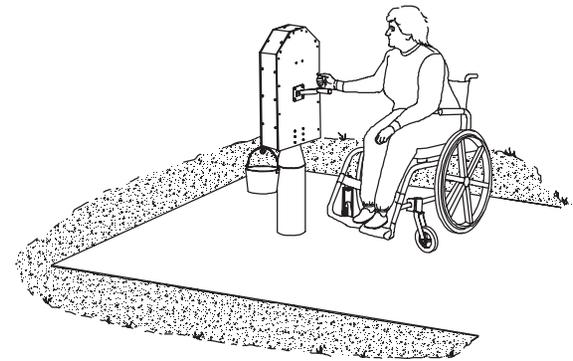


Figure 7-11—An accessible handpump for shallow wells.

### Water Troughs

Most horses and mules are comfortable using traditional, economical metal or plastic stock tanks—also called *troughs*. Avoid using low troughs—1-foot (0.3-meter) high or less—that sit on the ground. Curious stock may paw at them and get their hoofs caught or flip the trough. Figure 7-12 shows a trough that is 2 feet (0.6 meter) high and suitable for an area with a low to moderate level of development. The trough features a convenient automatic fill device with a protective screen that prevents curious stock from damaging it. Cold climates require frost-free hydrants. Figure 7-13 shows a trough suitable for a high level of development. Many riders prefer watering their stock in clean, freshly filled water troughs.

#### Resource Roundup



#### Accessible Handpump

For information regarding the accessible shallow-well handpump, see *New Accessible Handpump for Campgrounds* (Kuhn and Beckley 2005) at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm05712311>.

This Web site requires a username and password. (Username: t-d, Password: t-d)

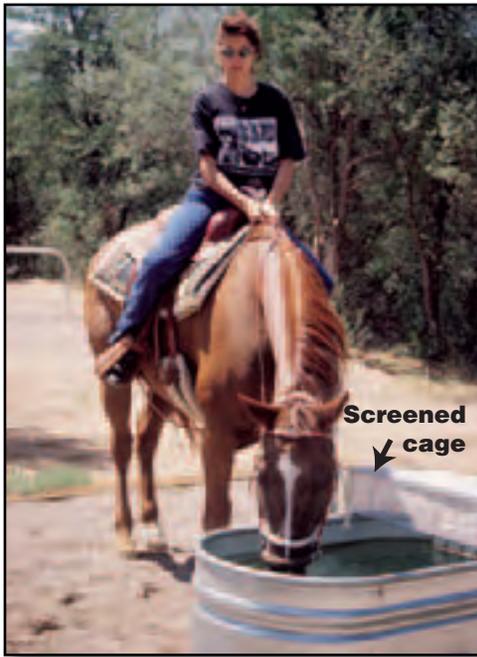


Figure 7-12—Stock can paw at a short trough and flip it. A tall trough, such as this one, is a better choice. A screened cage protects the automatic fill device from curious stock or other animals.



Figure 7-13—This attractive water trough is convenient, but costly.

Horses and mules suck water into their mouths through lips that they keep mostly closed. They can get a hearty drink from a water source that is only a few inches deep. Some innovative shallow troughs fill for a single animal's use. After the animal has finished, the remaining water flushes into the drainage system. The raised shallow basin permits stock to see in all directions while drinking (figure 7-14). These troughs are appropriate only in



Figure 7-14—A raised water basin allows stock to see in all directions when drinking. This style is suitable for areas with a high level of development.

highly developed sites. Table 7-3 shows the relative characteristics of water troughs and indicates the suitable level of development for each type.



**Horse Sense**

**Watering Holes**

You can lead a horse to a public water source, but it may not drink. A dehydrated horse may not drink because its judgment is clouded by lack of salt. A healthy horse may refuse water that smells or tastes differently than the water it is used to drinking. Many riders prefer watering their animals in clean, freshly filled water troughs.

Table 7-3—Characteristics and suitability of stock water troughs.

Water trough material	Rust-resistant	Economical	Suitable level of development
Concrete	X		High
Metal		X	Low, moderate, and high
Plastic	X	X	Low, moderate, and high





Horses and mules are not the only animals that use water troughs in recreation sites. Small wildlife in search of water may jump up on the edge, or reach into, stock water troughs. If they lose their balance, they can fall in and drown. A wildlife ramp (figure 7–15) supplies an escape route for small, trapped animals. Contact the appropriate wildlife and conservation agency for applicable regulations and design guidelines.

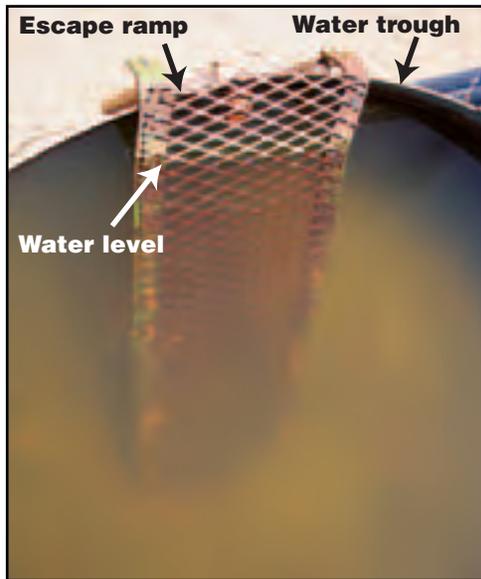


Figure 7–15—Water troughs with an escape ramp are lifesavers for small, thirsty wildlife that otherwise might have drowned after falling in.

Water troughs require a surrounding area that is clear of vegetation, signs, and other obstructions. When surroundings are clear, stock can drink from either side and avoid conflicts. The size of the wearing surface will vary according to the size of the water trough. Figure 7–16 illustrates a 4-foot water trough that has an adequate clear area with an aggregate

wearing surface. Water troughs also require regular maintenance. To prevent them from getting plugged, drain debris and standing water regularly. Mosquitoes that carry serious stock diseases, such as West Nile virus, breed in standing water. In some areas of the country, water troughs must be scrubbed frequently to remove scum, algae, or mineral deposits.

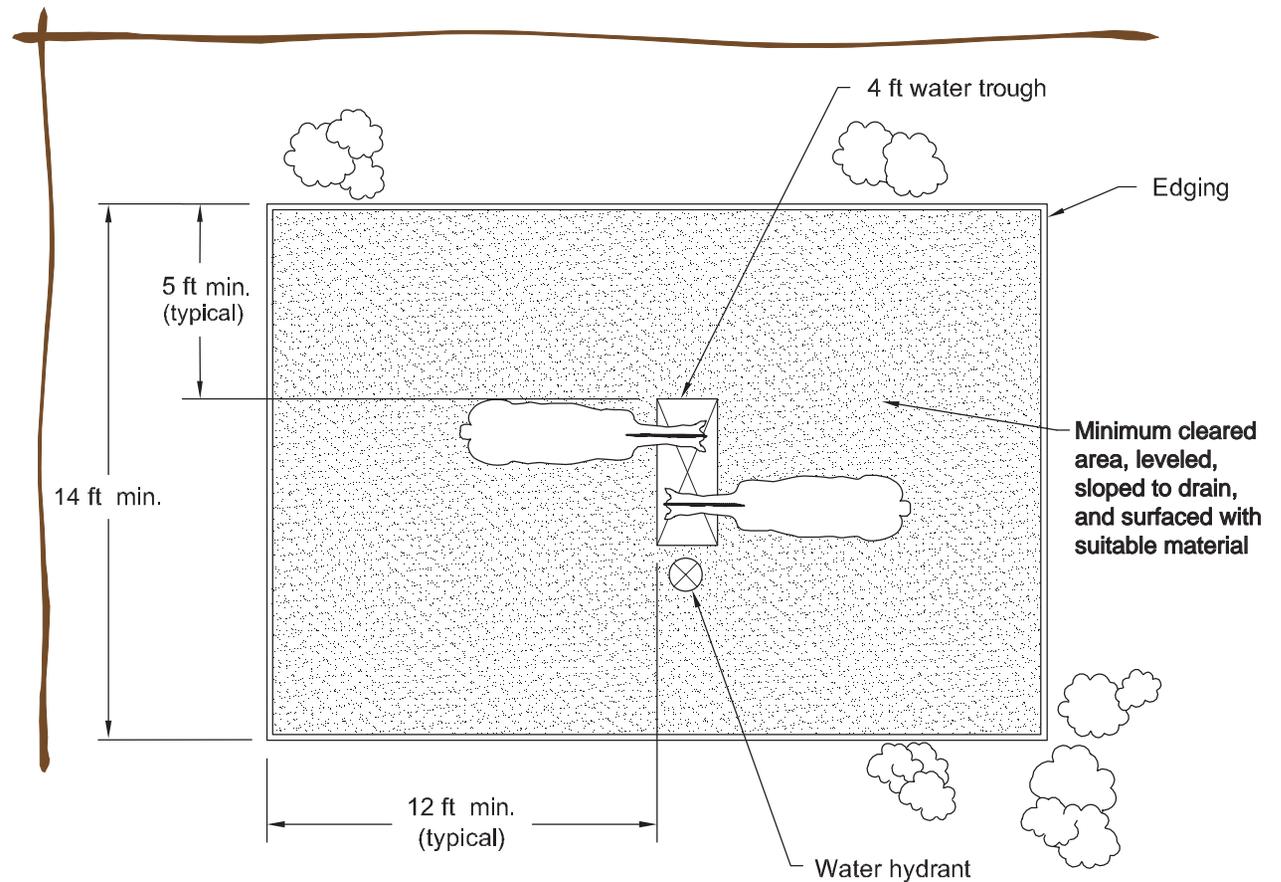


Figure 7–16—A 4-foot water trough installed on a wearing surface.



### Wash Racks

Wash racks are optional amenities appreciated by riders to clean and cool their stock after a ride. Figure 7-17 shows a wash rack that accommodates four tethered trail animals. Some premanufactured wash racks have a chain that latches behind the animal to prevent it from backing out. A clear, somewhat level area at the entrance to the rack allows the handler to maneuver the animal (figure 7-18). Wash racks can be purchased prefabricated, or they can be custom built. When providing wash racks, locate them around the perimeter of parking areas, in landscape islands, or along the outside edge of loop roads (see figure 7-6).



Figure 7-17—Metal rails separate four stalls in this wash rack. A single hydrant and hose in the center serve all four stalls.

Regardless of the wash rack configuration, the water source must be installed in a clear area that has a *wearing surface*—material, such as crushed gravel, that reduces mud. Some agencies provide a hose at

the wash rack. If hoses are stolen frequently, they can be stored in a secure location accessible only by the camp or site host. Riders sometimes carry hoses in their horse trailers.

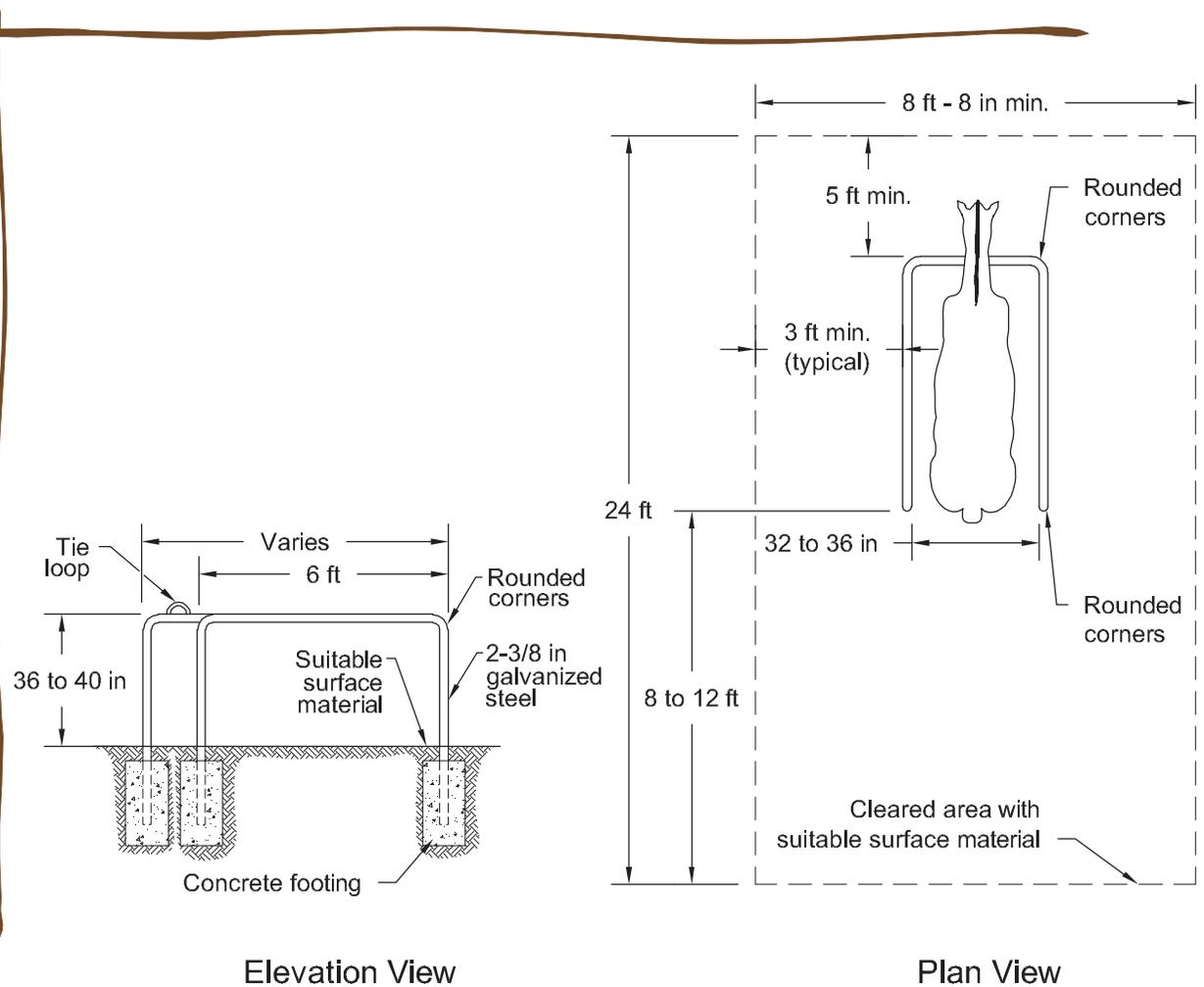


Figure 7-18—A single-horse wash rack.





**Drainage Overflow**

Provide proper drainage for overflow and spills at water hydrants, water troughs, and wash racks to minimize maintenance and avoid problems. Standing water quickly becomes a muddy mess. If the water is stagnant, it can attract insects, such as mosquitoes. Design drainage systems to prevent runoff into nearby waterways, particularly with wash racks, because they produce lots of runoff that often contains soap.

**Wet-Area Wearing Surfaces**

Surfacing the area around water hydrants, troughs, and wash racks reduces maintenance. Suitable materials include pea gravel, crushed rock without fines, sand, or a combination of aggregate and sand. Sand is generally not recommended for horse areas because horses and mules will get sick if they eat sand and it builds up in their digestive system. Horses and mules rarely are fed or left unattended near water devices, so sand can be used for drainage there. Use edging to contain loose surface materials. Suitable edging materials include concrete curbs, steel, wood timbers, or recycled plastic. An example of edging is shown in figure 7-19.

Concrete forms a durable wearing surface that is firm and stable. However, smooth concrete gets slippery when wet. Apply a heavy, rough-broom finish when installing concrete. This safety precaution is especially important at wash racks. In areas where vandalism is not an issue, heavy rubber mats placed on top of the concrete may be suitable.

Regardless of the material used, the wearing surface must be sloped away from the water source to handle runoff. Include a drain if the wearing surface is concrete.

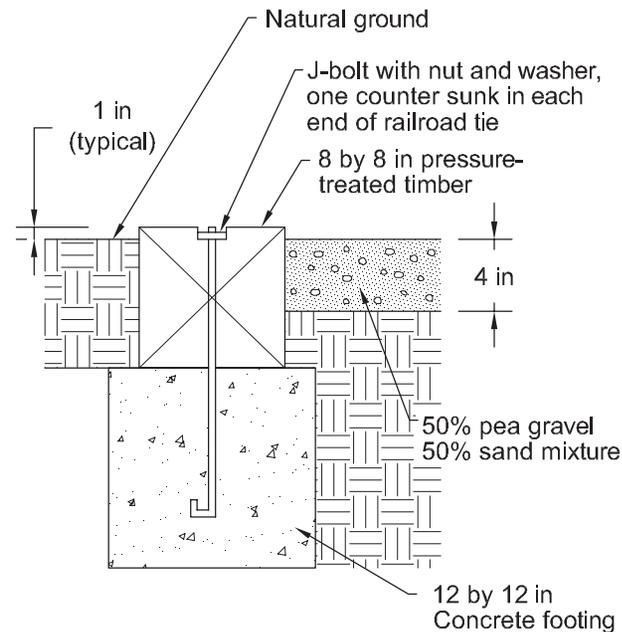


Figure 7-19—Timber edging detail for a hydrant or trough.



## Power and Lighting

Before installing exterior lighting, consider the drawbacks of artificial light in a natural setting. Exterior and interior safety lighting should be provided at toilet and shower buildings, if lighting is suitable for the level of development. Reserve additional area lighting strictly for recreation sites with a high level of development. Lights may be helpful at information stations and group gathering areas. If trailhead facilities—such as arenas or round pens—are open at night, site lights are an option. User-activated or timed lighting controls (figure 7–20) reduce the overall effect of light at the site. Figure 7–21 shows one recommended lighting fixture for trailhead parking areas, arenas, and round pens. Follow applicable local and State regulations for lighting systems.

Added utility options for equestrian campgrounds include access to electricity, full-service hookups, and a sanitary dump station. Many recreationists appreciate electrical outlets near the serving table in a group gathering area. These options are only appropriate in a large campground with a high level of development.



Figure 7–20—Timing mechanisms are convenient and reduce light pollution.

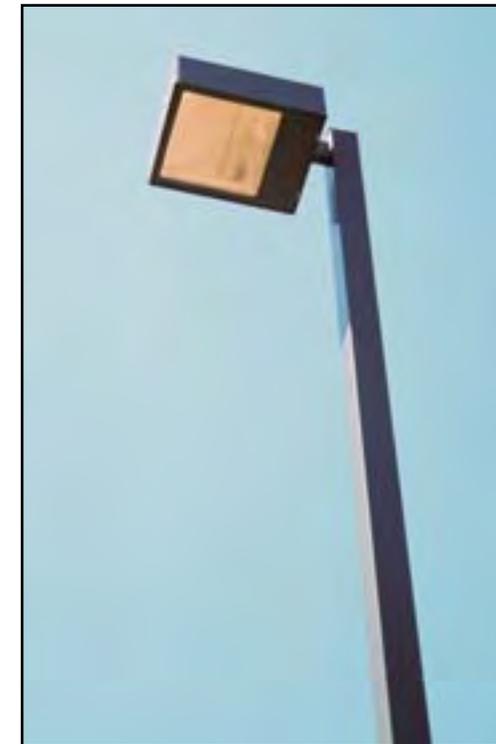


Figure 7–21—Fixtures that direct light downward reduce light pollution.



### Night Light

### Resource Roundup

The mission of the International Dark-Sky Association is to preserve and protect the nighttime environment and our heritage of dark skies through quality outdoor lighting. Information regarding the effects of light pollution and possible solutions is available at <http://www.darksky.org>.



## Structures

An architectural theme is highly desirable for structures at a recreation site. Match form, materials, textures, colors, and finishes of toilet buildings, shower buildings, and shelters. In general, avoid bright colors and select materials and finishes that blend with the setting and climate, such as earth-toned hues.

The services of a qualified engineer or architect are required if toilets, shower buildings, or shelters are custom designed. Structure design must comply with applicable Federal, State, and local building regulations and codes. All buildings constructed or altered by a Federal agency since 1968, or by a State or local government since 1991, also must comply with applicable accessibility guidelines.

When designing structures, keep the safety of horses and mules in mind. Even where equestrian routes and human facilities are separated, escaped stock may find their way to areas with structures. Avoid sharp corners, projections, or tight spaces, and don't design small openings that attract bees and wasps. Horses and mules are very susceptible to bee stings. They may react violently when stung.

7



### By Design: BEIG

Although developed for use on Forest Service lands, the *Built Environment Image Guide for the National Forests and Grasslands* (U.S. Department of Agriculture Forest Service 2001) may be a useful model for other locations. Known as the BEIG, the guide provides design guidance for toilet buildings, site furnishings, wayside structures, and signs—or the built environment. Eight architectural character types are defined by geographic location. The designs project the overall Forest Service image while echoing local values, heritage, and culture. Following the BEIG facilitates an integrated approach to planning and design, including early collaboration among planners, designers, specialists, managers, and maintenance personnel. It ensures that facilities fit their natural and cultural settings. Buildings and other constructed features should incorporate the principles of sustainability and accessibility as an integral part of their architectural character. The text of the BEIG is available at <http://www.fs.fed.us/recreation/programs/beig>.



### Resource Roundup

#### Eye for Color: VRM

The BLM's Visual Resource Management system addresses more than location issues and surface disturbance. VRM also looks at design elements—form, line, color, and texture. Strategies include color selection, earthwork, vegetative manipulation, and reclamation and restoration. These techniques are used in conjunction with a visual resource contrast rating process. More information about BLM design techniques is available at <http://www.blm.gov/nstc/VRM/destech.html>.



#### Material Standards

ASTM International is one of the largest voluntary standards development organizations in the world, producing technical standards for materials, products, systems, and services. More information is available at <http://www.astm.org>.





### Toilet Buildings

Prefabricated toilet buildings are commonly available and generally cost less than a customized structure. Designs appropriate for recreation sites generally accommodate one, two, or four people. If pressurized water is available at the site, provide riders with a washbasin where they can clean up after a ride. Toilet buildings may include storage areas for maintenance equipment, wheelbarrows, rakes, and shovels used for manure disposal.

The three most common toilet systems available for recreation sites are vault, composting, and flush. The proper system for a particular site depends on the level of development and the availability of water. Proper sanitation requires strict compliance with all applicable laws, ordinances, and regulatory provisions.



#### Resource Roundup

##### Sweet Smelling Toilets

The Forest Service’s Technology and Development Program has produced several practical reports for designing, choosing, constructing, and locating toilet and shower buildings. The reports are available at <http://www.fs.fed.us/t-d/pubs>. Search the site using the keywords toilet and shower. This site requires a password. (Username: t-d, Password: t-d)

Louisiana State University Ag Center and Research Extension has construction plans for a Campground Comfort Station (1969). The structure is constructed of concrete block and has toilets, showers, and washbasins. The electronic document is available at [http://www.lsuagcenter.com/en/our\\_offices/departments/Biological\\_Ag\\_Engineering/Building\\_Plans/recreation/equipment/Campground+Comfort+Station.htm](http://www.lsuagcenter.com/en/our_offices/departments/Biological_Ag_Engineering/Building_Plans/recreation/equipment/Campground+Comfort+Station.htm)

A vault toilet has a belowground storage chamber that requires regular pumping, usually performed by a commercial operator. When placed properly, built correctly, and maintained regularly, vault toilets do not smell. Fans may be needed for ventilation—solar fans are an option in areas with no electricity. Composting systems are environmentally friendly and odorless, but require substantial maintenance. Because many users prefer flush toilets, they may be the best option where water is available and the level of development is suitable. Table 7–4 summarizes toilet system characteristics. Figures 7–22, 7–23, and 7–24 show toilet buildings appropriate for low, moderate, and high levels of development. Figure 7–22 is a premanufactured building commonly used at Federal recreation sites.



Table 7–4—Characteristics of toilet systems for recreation sites.

Toilet system	Appropriate level of development	Water is required	High maintenance	Easily vandalized	Economical	Preferred by visitors	Preferred by maintenance staff
Vault	Low and moderate				X		X
Composting	Low and moderate		X	X		X	
Flush	High	X	X	X		X	



Figure 7-22—This prefabricated toilet building is a style commonly used at Federal recreation sites. It is suitable for areas with low to moderate levels of development.



Figure 7-24—This combination toilet and shower building is suitable for some recreation sites with high levels of development.

### Shower Buildings

Although showers are not a necessity, riders appreciate the convenience of a shower building at the campground after long rides. Shower buildings require maintenance, water, heat, and grey water disposal. Before planning shower buildings at recreation sites, consider whether they are appropriate for the level of development. Thoroughly evaluate and weigh the drawbacks against the benefits. If providing a shower building is economically feasible, include one—the campground will be popular with riders.

Shower buildings usually are custom designed and follow two basic layouts. The first layout has individual shower stalls, each with its own exterior door. The stalls may be unisex or gender specific. The second layout has a single large room with numerous stalls and is gender specific. A shared shower room is more cost effective than individual stalls, but offers less privacy.

### Shelters

Shelters provide protection from the elements, offer convenience, and can add an attractive touch to a recreation site. Incorporate shelters in heavily used areas—camp units, picnic units, group gathering areas, and information stations. The size of shelters for camping or picnicking depends on the number of tables that are needed. Table 7-5 shows recommended shelter sizes for one to six picnic tables. Often, it's less expensive to purchase a premanufactured shelter than to construct a custom shelter. Figure 7-25 shows a camp or picnic unit shelter. Figure 7-26 shows an information station with a shelter.

Table 7-5—Recommended shelter sizes to accommodate picnic tables.

Number of picnic tables*	Shelter size (feet)
1	16 by 16
2	16 by 24
3	16 by 39
4	24 by 34
6	34 by 39

\* One picnic table seats about six people comfortably.



Figure 7-23—This toilet building is suitable for recreation sites with moderate levels of development.





Figure 7-25—An effective shelter can have a simple design.



Figure 7-26—Information stations often incorporate a shelter. Install a hitch rail nearby for equestrians.

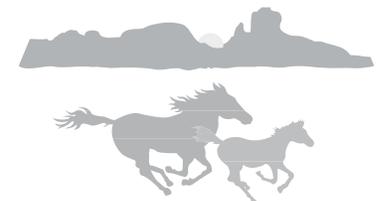
### Structure Locations

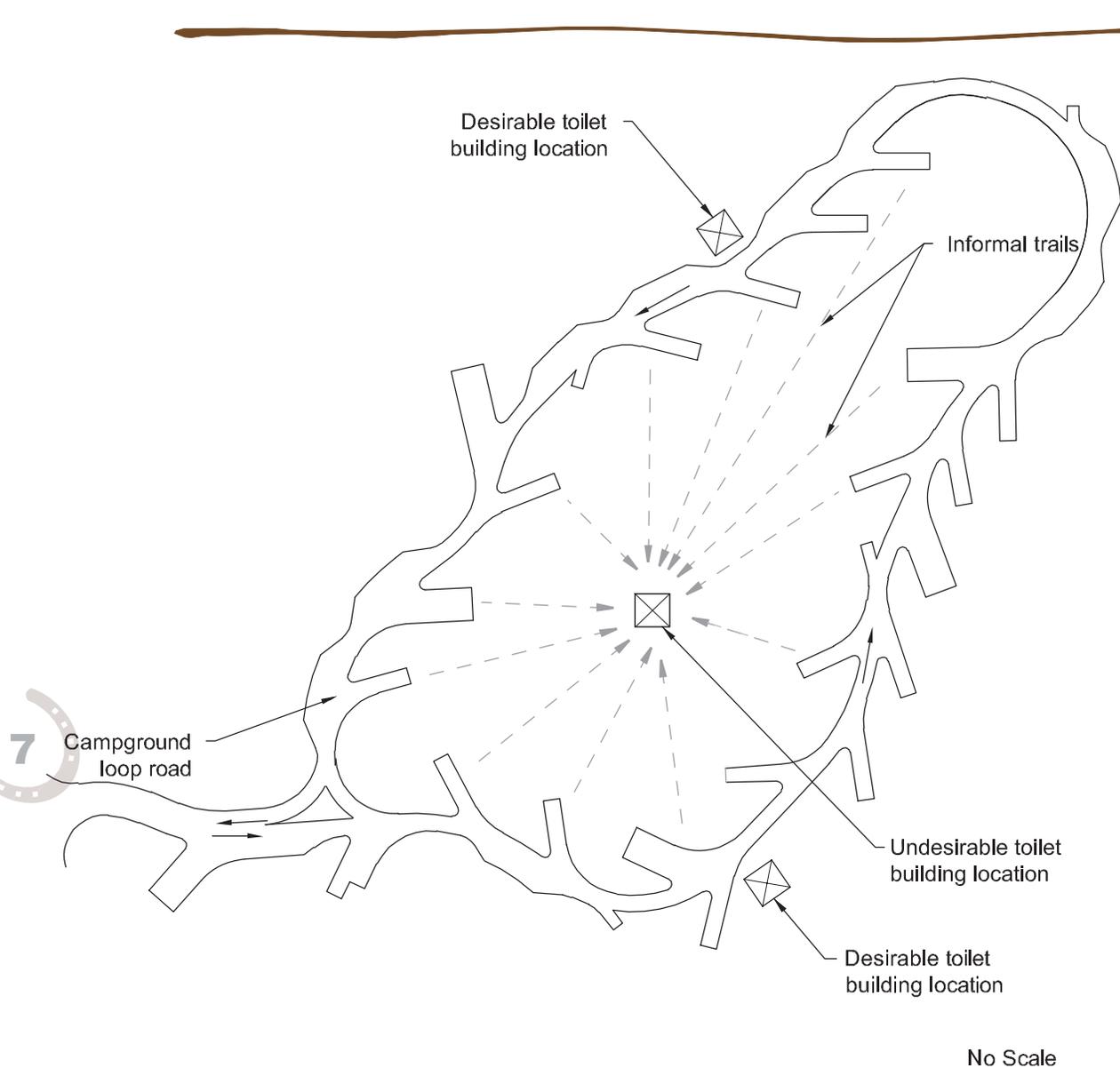
For ease of construction and maintenance, locate toilet, shower, and shelter structures in an area with well-drained soil and little hard rock. Pick open areas to reduce the vegetation that must be removed. Make sure that structures are a safe distance from dropoffs and water bodies. Solar collectors should be placed where they will not be shaded during the day.

Although it may seem logical to locate toilets and shower buildings in the center of a loop road, this arrangement has problems. A toilet building located in the loop center does reduce the travel distance from camp units, but it also requires many trails for users (figure 7-27). Campers will make their own routes if there are no trails—to the detriment of vegetation along the way. A centrally located

building also means campers are disturbed when others walk past or through their parking pad. This is especially true if the passerby is on a horse or mule.

The preferred location for a toilet or shower building is along the outside edge of a loop road or at a road intersection. The road serves as a pedestrian passageway. It also helps preserve the vegetation buffer in the center of the loop. Locate toilet buildings near trail access points so riders can use facilities before and after a ride. Place toilet and shower buildings around the perimeter of trailhead and group camp parking areas or in landscape islands (see figures 7-6, 7-7, and 7-8). For user satisfaction, place toilet buildings at least 75 feet (22.9 meters) from camp units, picnic units, and horse trailers, and no more than 500 feet (152.4 meters) away.





### Manure Disposal

Horses and mules produce lots of manure. The manure can attract insects and it's probably smelly. The appropriate manure disposal system for a recreation site depends on the site's proximity to solid waste disposal facilities, the costs of disposal, and applicable health regulations. In some areas of the country, especially in remote areas, manure cleanup may not be customary. Some land managers suggest scattering manure in vegetation around the recreation site. Many places prohibit this practice because it encourages the growth and spread of weeds.

In recreation sites where it is not feasible to arrange for manure disposal, land managers often institute a pack it in, pack it out policy—requiring riders to pick up the manure and take it home with them, a practice that can be difficult to enforce. To encourage compliance, site hosts, entry station personnel, or a self-service dispenser could supply plastic garbage bags.

Hauling manure may be the best option for sites near a community that will dispose of solid waste or when the managing agency has its own garbage truck. A temporary manure storage bin is used by some agencies (figure 7–28). The bin has walls on three sides, and the fourth side has an opening that is wide enough for maintenance equipment. A concrete bottom makes it easy to remove manure. Proper

Figure 7–27—Campers create informal paths when toilet buildings are in the center of a campground loop. Placing toilet buildings along the outside of campground loop roads reduces problems caused by shortcuts.



Figure 7-28—When manure disposal units are convenient, riders are more likely to clean up after their stock. Proper drainage is essential.

drainage is critical to prevent rainwater or snowmelt from pooling in the bin or flowing out of the manure disposal bin into nearby waterways.

Some agencies provide dumpsters with lids to minimize flies and odors. A concrete dumpster pad provides a sturdy surface for garbage trucks. See figures 7-6, 7-7, and 7-8 for suggested placement of manure bins. For user satisfaction, place manure disposal units at least 75 feet (22.9 meters) from camp units, picnic units, and horse trailers, and no farther than 300 feet (91.4 meters) away.

The easier it is for riders to dispose of manure, the more likely they will do so. To make cleanup easy, provide tools—wheelbarrows, manure rakes, and shovels (figure 7-29). If the site is prone to vandalism, have the site host store the tools. If this is not feasible, encourage recreationists to carry rakes

and shovels in their horse trailers. Determine whether manure and other waste may be mixed. If manure must be disposed of in different containers than other waste, install signs that explain the rules. Figure 7-30 shows a simple sign for manure disposal. See *Chapter 13—Reducing Environmental and Health Concerns* for more information.



Figure 7-29—Riders are more likely to clean up after their stock when tools and containers are provided.



Figure 7-30—Signs encourage riders to dispose of manure properly.

## Mounting Blocks and Ramps

Other convenient—and greatly appreciated—equestrian amenities include mounting blocks, mounting ramps, and in some areas, stock loading ramps for trucks or trailers with elevated beds. These amenities serve a broad range of riders.

Installing mounting blocks or ramps in areas where riders normally dismount and mount can increase usage of trails, trailheads, or campgrounds. Many riders have difficulty getting on and off a horse or mule. Young children, small or older riders, and people who are not athletic may find it a long reach to get a foot in a stirrup without assistance. Many riders in this situation search out large rocks, stumps, or mounds to give themselves a boost. Such objects can be unstable or slippery. Provide a mounting block or ramp instead.

## Mounting Blocks

Riders of all abilities and ages can use mounting blocks. A mounting block resembles a short staircase that ends in midair (figure 7-31). The rider climbs the stairs to reach the saddled animal standing at the elevated end. Mounting blocks may be made of wood, steel, concrete, plastic, fiberglass, or a combination of these materials (table 7-6). Structures that are more permanent, for example those made of concrete or steel, are most suitable at trailheads or campgrounds that have easy access for construction equipment. Permanent structures also discourage



Figure 7-31—Riders may have trouble using this mounting block, because the handrails limit the maneuvering space. Options include removable or foldable handrails and rails that don't extend all the way to the end of the platform.

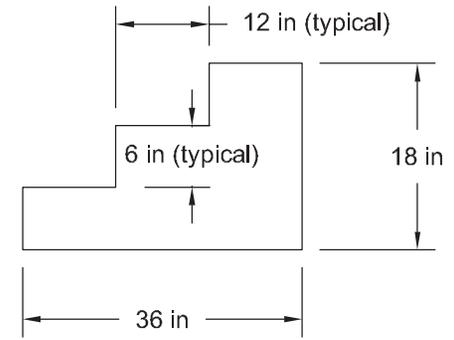
Table 7-6—Characteristics of construction materials for equestrian mounting blocks.

Material	Relative cost	Vandalism potential	Construction difficulty
Plastic or fiberglass	Low	High	Low
Wood	Low	Moderate	Moderate
Steel	Moderate	Moderate	High
Concrete	Moderate to high	Low	High

theft. Structures made from wood, fiberglass, or plastic are easier to transport, install, and place along trails.

To meet accessibility requirements, the treads on mounting blocks must be at least 11 inches (about 279 millimeters) deep and 36 inches (about 914 millimeters) wide (figure 7-32). Risers should be uniform and measure between 4 and 7 inches (about 102 and 178 millimeters) high. Mounting blocks with an overall height of 16 to 28 inches (about 406 to 711 millimeters) are common. The need for handrails is under debate. While handrails keep users from falling off platforms, the animal, rider, assistants, or equipment can be caught or squeezed against the handrails.

Riders usually mount from the left side of the animal, passing their right leg over the horse's back. Handrails on the right-hand side of the stair may interfere with the rider's leg movement. This makes a compelling case for leaving handrails off mounting blocks, or for installing handrails that stop before the top step. To meet the ADA/ABAAG requirements, when handrails are used they must have extensions—also called *returns*—at the top and bottom. In this case, returns extending into the animal's space are not appropriate.



Elevation View

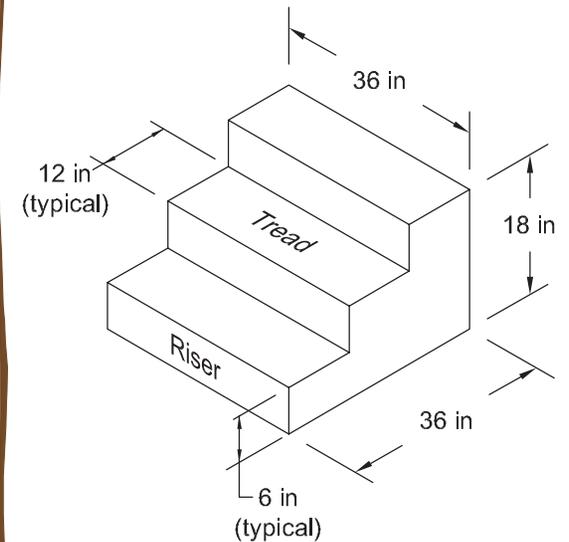


Figure 7-32—An equestrian mounting block that meets guidelines.



### A Leg Up

### Horse Sense

Mounting a horse or mule successfully requires considerable coordination. The rider must grasp the saddle, reins, and sometimes a riding whip; step into the stirrup; raise up; lift a leg over the animal's back; sit down; get the loose foot in the stirrup; and find balance—all while maintaining control of the animal. Problems or serious injuries can occur if the animal moves before the rider is settled solidly in the saddle (figure 7-33).

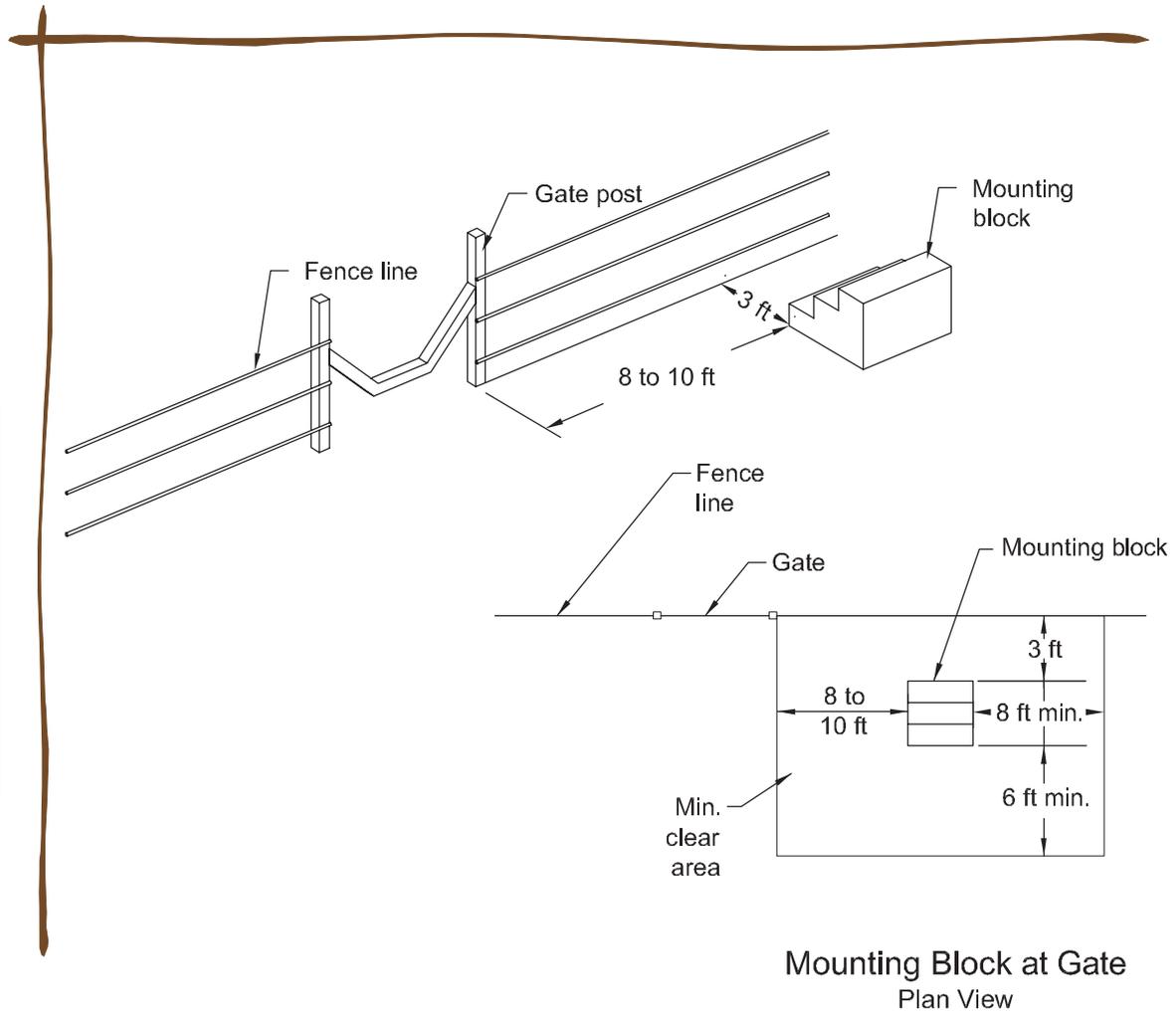


Figure 7-33—Riders are not safely seated until both feet are firmly planted in the stirrups and the animal is under control.

Locate mounting blocks 8 to 10 feet (2.4 to 3 meters) from trail treads and fence gates (figure 7-34). Farther may be better in heavily used areas. Position mounting blocks at least 3 feet (0.9 meter)

away from fences—completely avoiding fences with barbed wire. Situate the mounting block parallel to

the trail tread or fence line, with the steps facing the fence. This arrangement provides the most space



Mounting Block at Gate  
Plan View

Figure 7-34—Suggested placement for equestrian mounting blocks. The trail gate shown is not accessible to people with disabilities if the bar across the opening is higher than 2 inches from the ground.

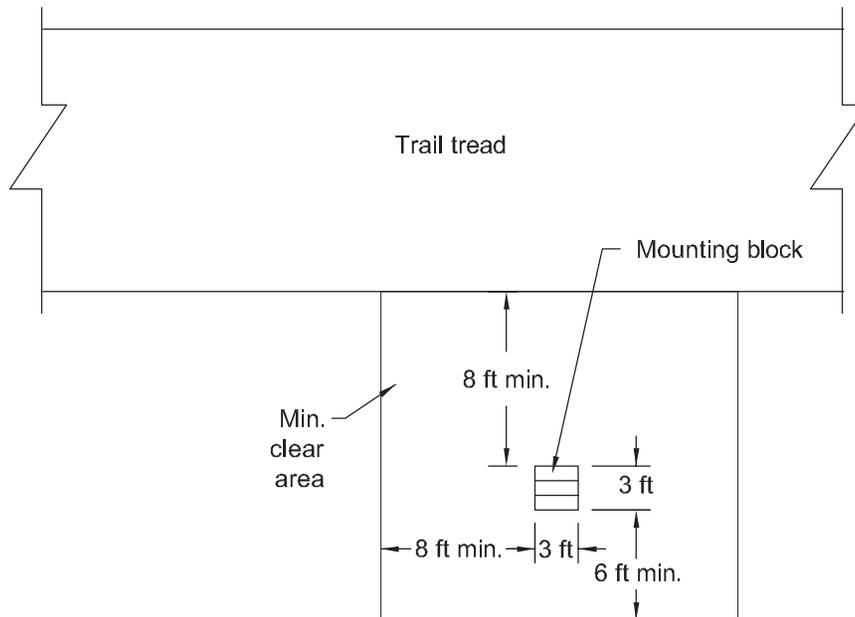


for maneuvering horses and mules. The space on both sides of the animal must be free of obstacles.

See figures 7-6, 7-7, and 7-8 for some suggested locations for mounting blocks in recreation sites.

### Mounting and Loading Ramps

Some riders require more assistance than afforded by a mounting block. They appreciate mounting ramps—gradual inclines leading to an elevated platform. Mounting ramps elevate the rider to the height of a saddled animal or waiting carriage. Some riders using mounting ramps also require the help of assistants (figure 7-35).



Mounting Block Along Trail  
Plan View



Figure 7-35—This mounting ramp has offside steps and a horse chute in the middle. Assistants can stand on both sides and in front of the horse and rider. Caution: at this site, handrails and railings were not included to leave space for assistants. Safety must be the overriding factor when deciding how to place railings on mounting ramps.

A variety of types, sizes, and inclines are suitable for mounting ramps, depending on the space available, natural grade, and potential use. Wood and grass-covered slopes are often used for ramps in low



Figure 7-36—Access to this mounting ramp is from an accessible path behind and to the left of the grassy surface. The horse stands in the chute at the right. When the ramp is not in use, removable rails block the open end.

development areas with sloped terrain (figure 7-36). Mounting ramps in flat terrain that has moderate to high development often are constructed with manmade materials, such as concrete or steel. No matter what the setting or level of site development, the approach to the ramp must have a firm and stable surface to meet accessibility requirements.

When access routes are steeper than 5 percent, the routes must meet accessibility guidelines for ramps. Ramps that rise more than 6 inches (152 millimeters) above the ground require handrails and an *edge protector*—a curb or other barrier that extends at

least 4 inches (102 millimeters) above the ramp edge. Ramps with a rise of more than 6 inches must have handrails with extensions. Accessible ramps must be at least 36 inches (914.4 millimeters) wide between the handrails, with space at the bottom and the elevated end for a 60-inch (1,524-millimeter) turning radius. At any change of ramp direction, there must be a level landing with a 60-inch turning radius. Figure 7-37 shows a sturdy mounting ramp. Although this mounting ramp gives access for all users, to meet accessibility guidelines for ramps, handrails with extensions and curbs would be required. Building codes and safety standards require intermediate rails.



Figure 7-37—Although this mounting ramp allows access for all users, to meet accessibility guidelines it needs curbs, handrails with extensions, and closely spaced rails. Ramps must meet accessibility requirements if they are part of a travel route that is required to be accessible by Section 206 of the *ADA/ABA Accessibility Guidelines*.

Ramps with a dropoff that is more than 30 inches (762 millimeters) must have a guardrail that is 42 inches (1,067 millimeters) high with intermediate rails or fence material that won't allow passage of a 4-inch (101-millimeter) sphere through the openings in the railing. Guardrails are required for a simple and obvious reason—to keep people from falling off the platform. Make the rails removable on the side facing the animal. Figure 7-38 shows an accessible mounting ramp with a platform where an assistant could stand. Figures 7-39 and 7-40 show a simple mounting ramp on sloped terrain in the Hoosier National Forest.

Mounting ramps can serve dual purposes—to help riders mount and to unload animals from stock trucks (figure 7-41). Figure 7-42 shows a combination ramp that serves people with disabilities and stock.

A startled animal can bolt or hurt a rider who is not in position to fully control the situation. Loading ramps should be in areas that are quiet, away from areas with high activity, such as arenas or popular round pens (see figures 7-6, 7-7, and 7-8). Provide enough space around the mounting ramp for several people to stand and move while assisting the rider.

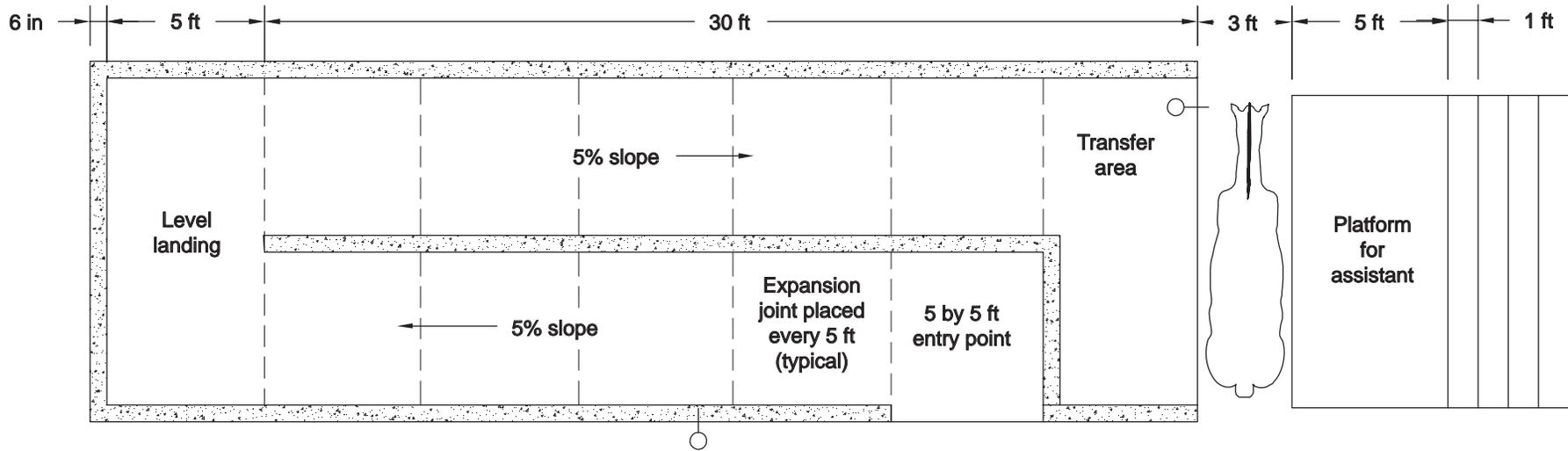


Figure 7-38—An accessible mounting ramp with a platform where an assistant could stand.



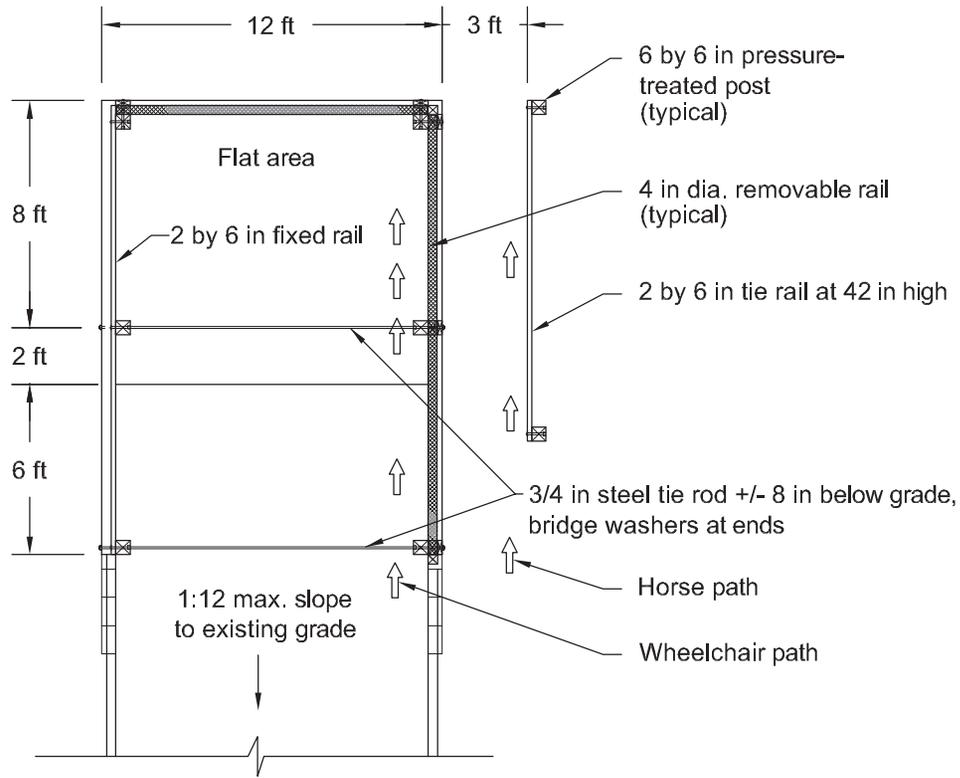
Figure 7-39—This ramp has a firm and stable surface on the mounting side, allowing access by people who use wheelchairs. The chain serves as a safety device that can be unhooked before mounting the horse or mule.



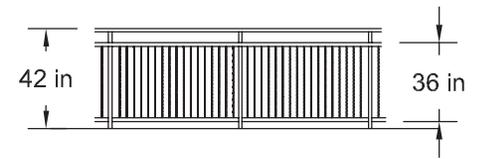
Figure 7-40—The horse stands between the ramp and the trees on the left, facing the viewer.



Figure 7-41—Stock trucks usually have a drop-down panel or slide-out deck for unloading. If a stock ramp is not available, the truck can be backed up to a slope and the drop-down panel can bridge the gap between the tailgate and the ground.



Plan View



Note:

To meet accessibility requirements there must be a 42 in guardrail with intermediate rails that do not allow a 4 in sphere to pass through or there must be fencing that will not allow a 4 in sphere to pass through.

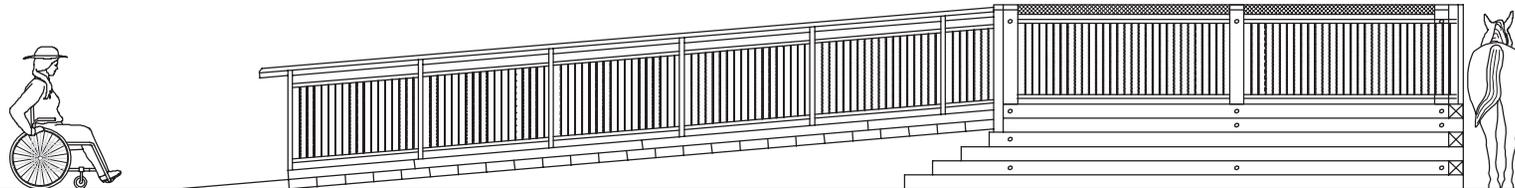
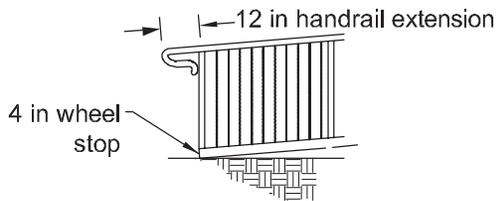


Figure 7-42—A combination ramp with wheelchair and stock-loading access.



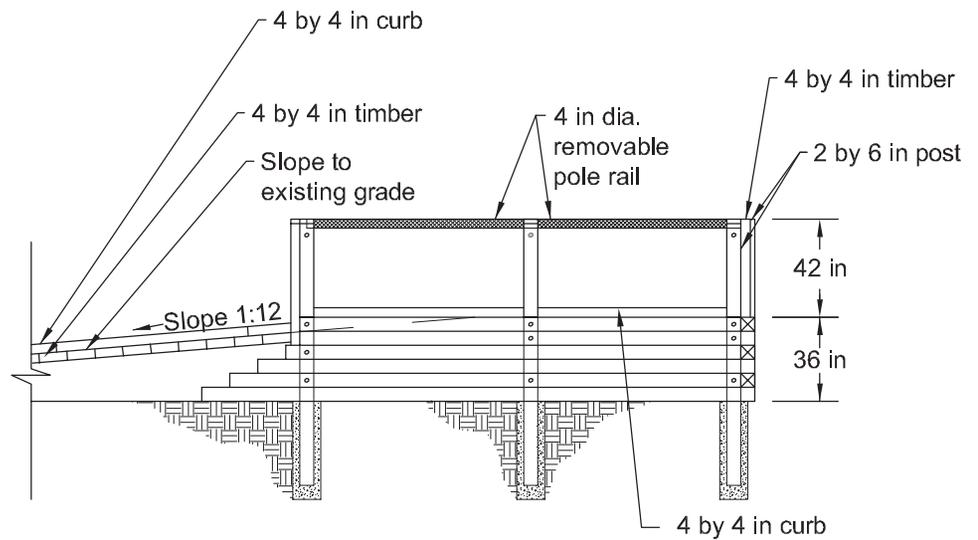
Notes:

1. All posts have beveled tops.
2. Removable rails sit loose in pockets.
3. All nuts and washers facing users are countersunk.
4. A firm and stable surface is required for wheelchairs.
5. All wood is pressure-treated.



Note:

To meet accessibility requirements there must be a 1 1/4 to 2 in dia. handrail with extension.



Elevation View

Figure 7-42—(continued)



Figure 7-43 shows a mounting ramp at Hidden Horse Campground in the Klamath National Forest. Designers evaluated accessibility requirements and safety. The design considers the needs of riders with a range of disabilities, as well as stock of many sizes.

The important features of the ramp are:

- ☆ A wheelchair-accessible platform that is tall enough to allow mounting without the use of stirrups.
- ☆ Firm and stable surfaces on the platform and path—in this case, hard rubber mats.
- ☆ A multipurpose platform for assistants that
  - » Keeps the animal straight and in position.
  - » Can be used by assistants.
  - » Serves as a mounting block for more able riders.

- ☆ Steps on two sides of the assistant's platform and the wheelchair-accessible platform allow assistants to walk alongside as the animal departs.
- ☆ Access to the chute from both sides so the animal can be mounted from either direction.
- ☆ Beveled edges to avoid injuries to animal and rider or snagged stirrups.
- ☆ No railings, gates, walls, or fences near the chute to spook the animal or injure people.

Some designers would make a case for having handrails on the steps and platform, on the side away from the horse chute. This would prevent an assistant from accidentally falling off.

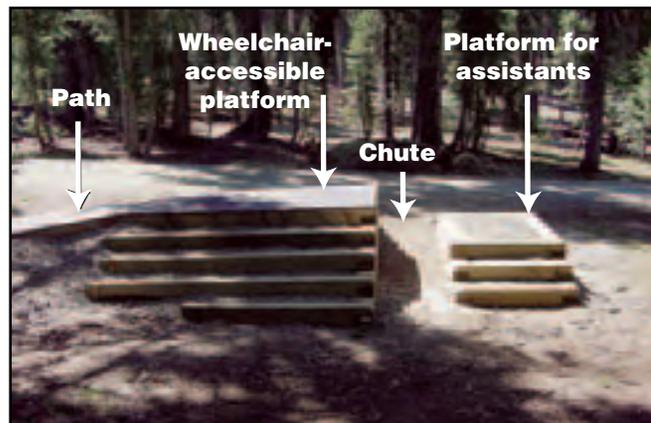
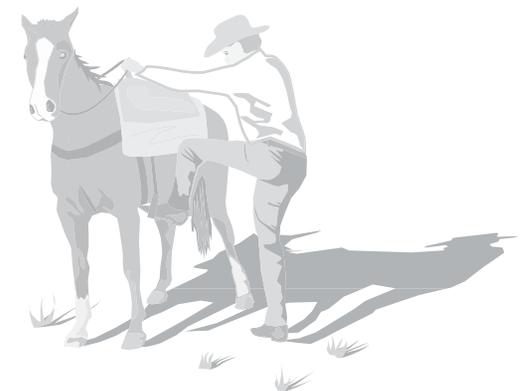


Figure 7-43—The horse stands in the chute between the wheelchair-accessible platform and the platform for assistants. Users approach from the path on the left. Assistants can stand on either platform. Caution: At this site, handrails and railings were not included to leave space for assistants. Safety must be the overriding factor when deciding how to place railings on mounting ramps.





7



## 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)
<b>Passenger vehicle with trailer</b> 19-foot vehicle plus 30 feet total trailer length (including tongue)—49 feet combined length	17.5	34.5
<b>Motorhome with trailer</b> 30-foot vehicle plus 23 feet total trailer length (including tongue)—53 feet combined length	35	51.5
<b>Garbage truck**</b> 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](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

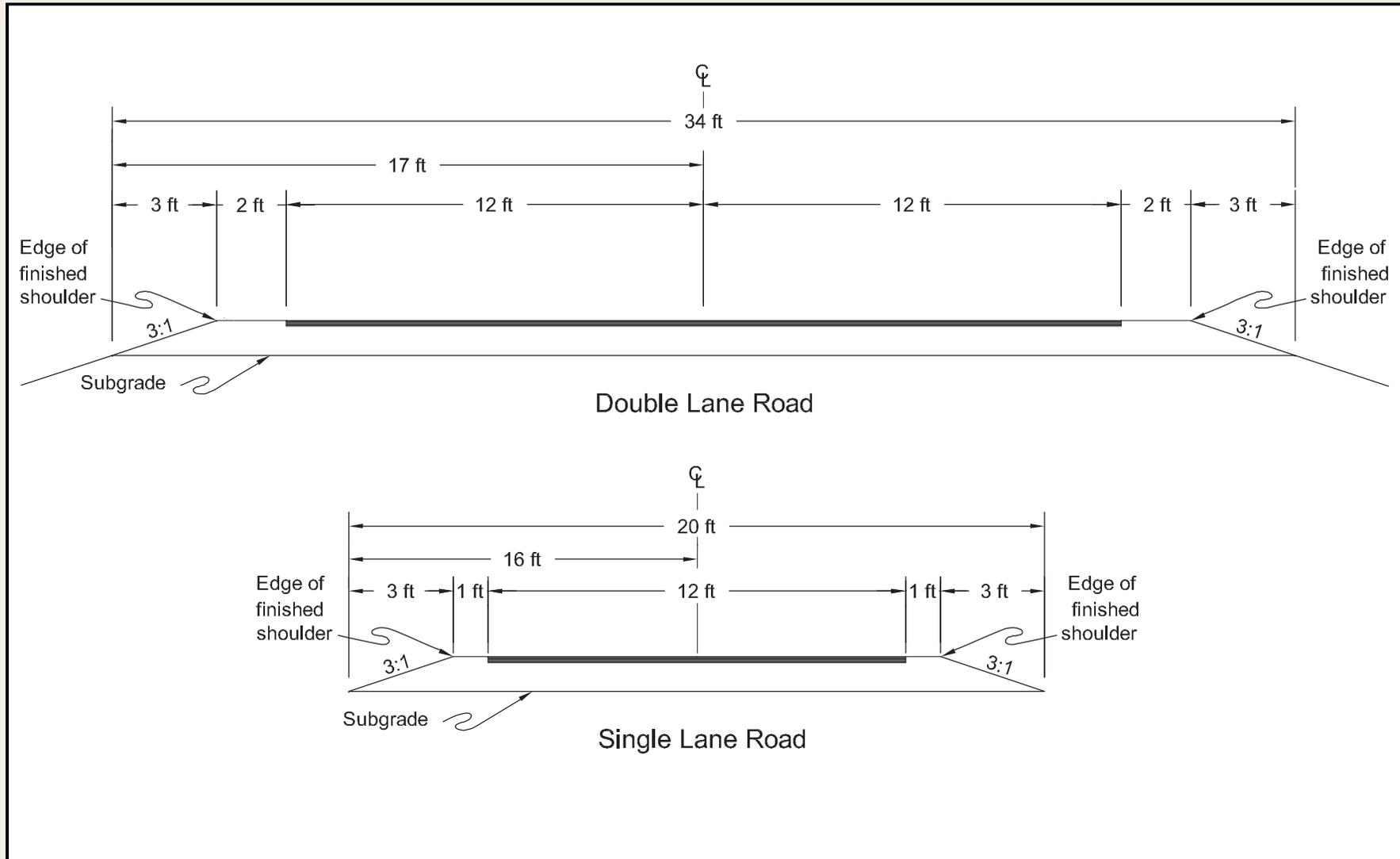


Figure 8-1—Typical cross sections for roads at recreation sites.



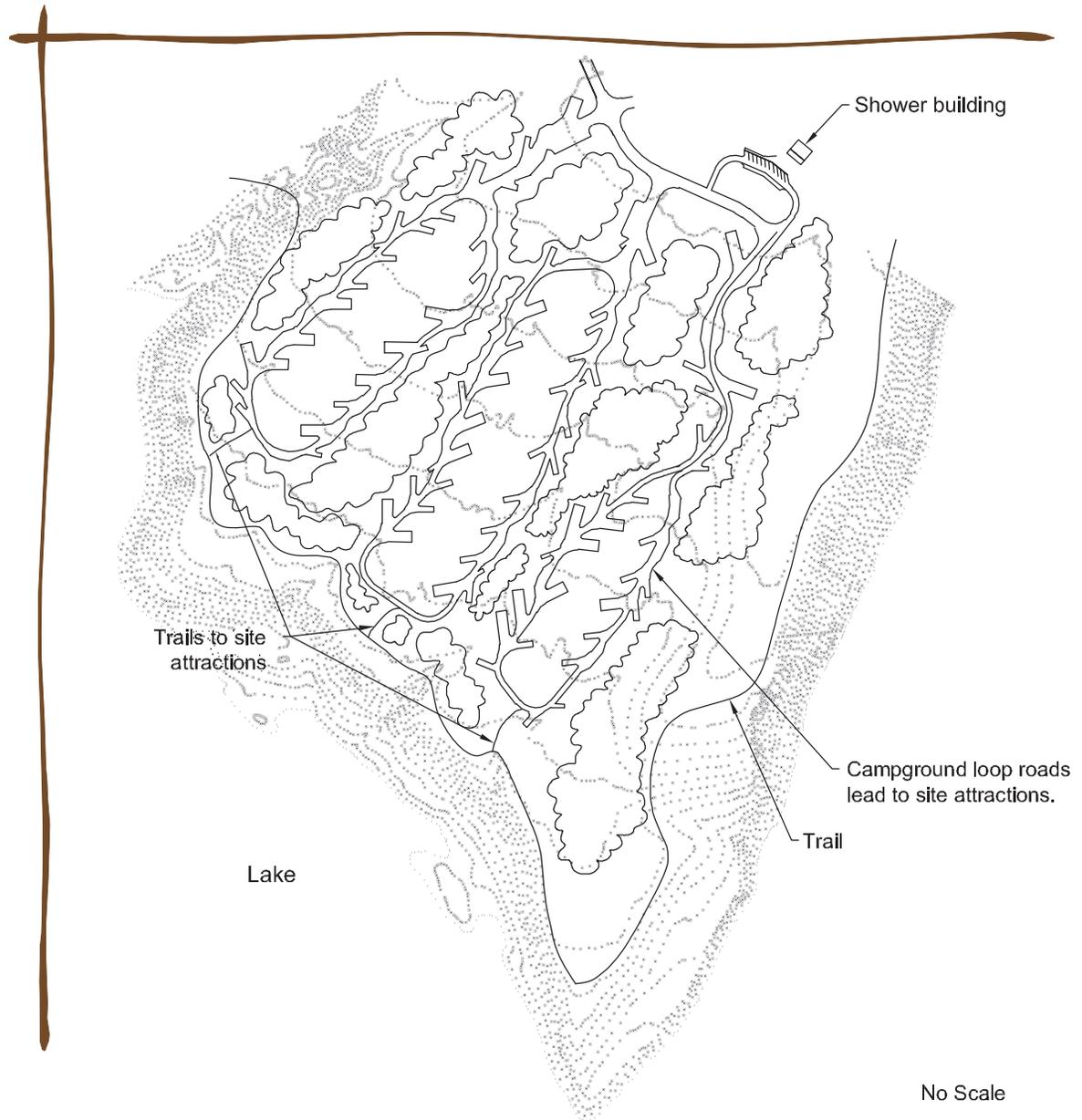


### Road Alignment

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.

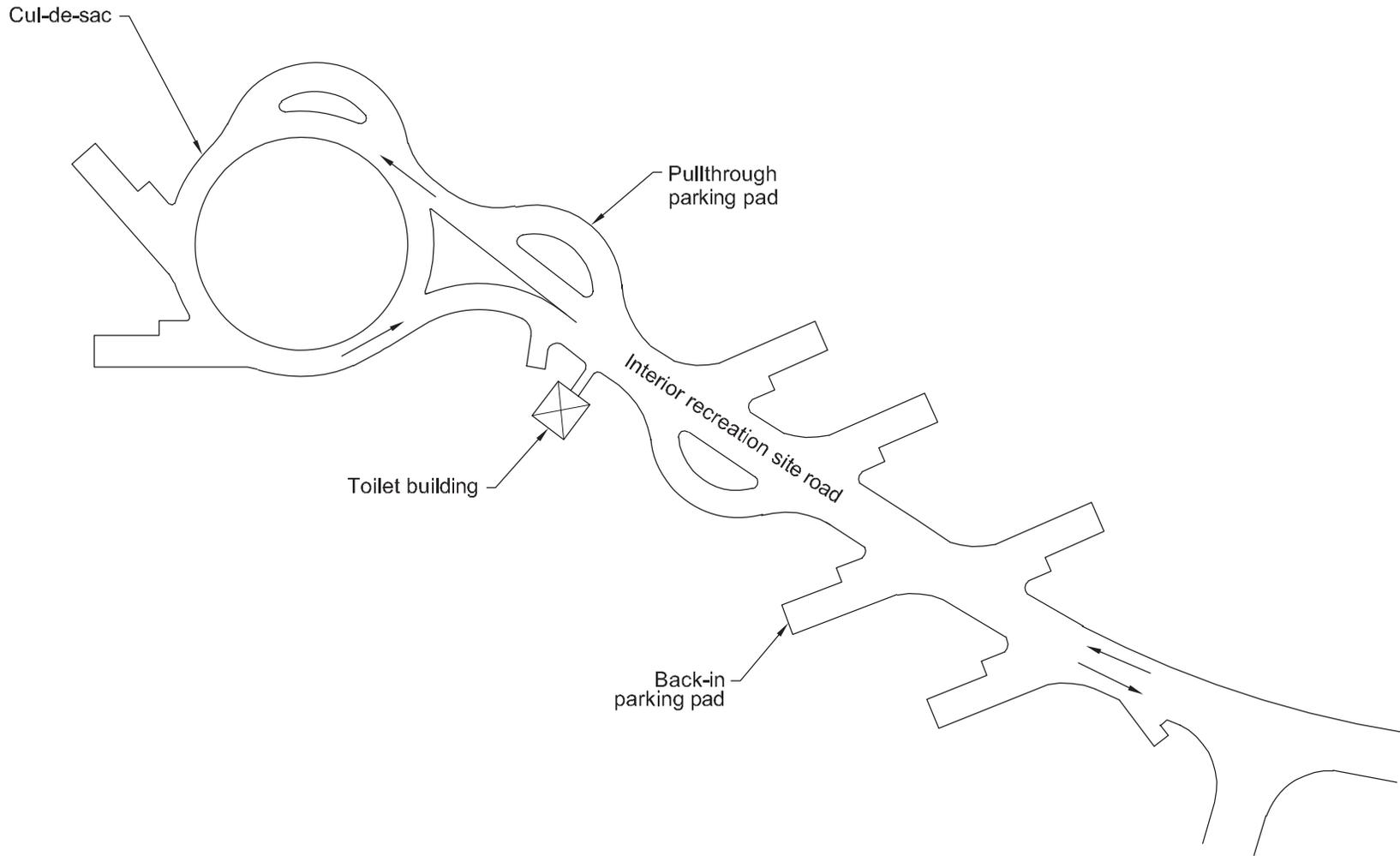
Single-lane, one-way loop roads are best for single-party campgrounds or group sites with individual camp units. Loop roads make it easy for visitors to get oriented. Managers like loops because they can be closed as needed. Fit the loops between landforms, dense stands of vegetation, streams, or drainages. 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.

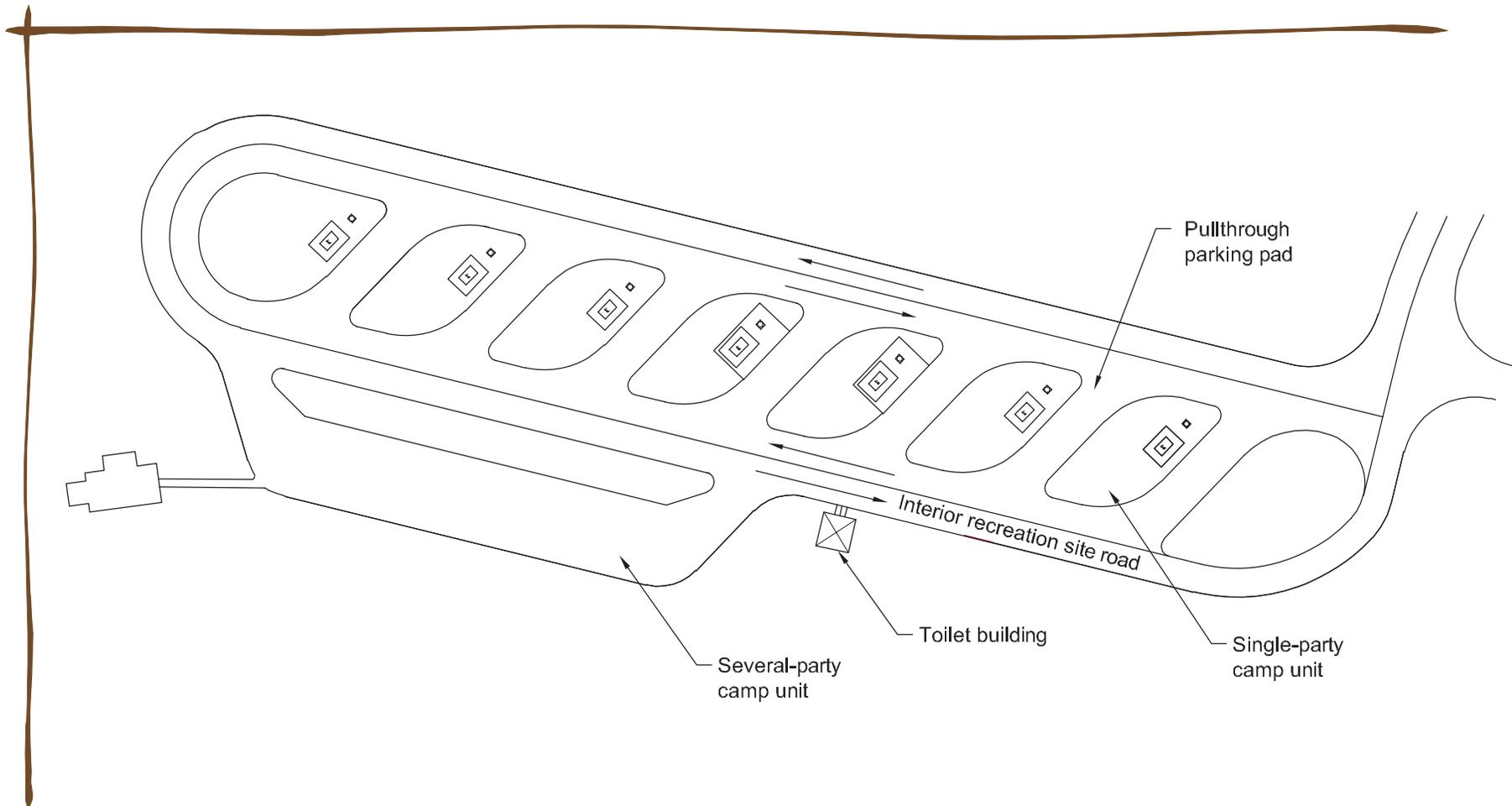


Figure 8-4—A campground loop road in a restricted space with a high level of development.

No Scale



### 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](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.

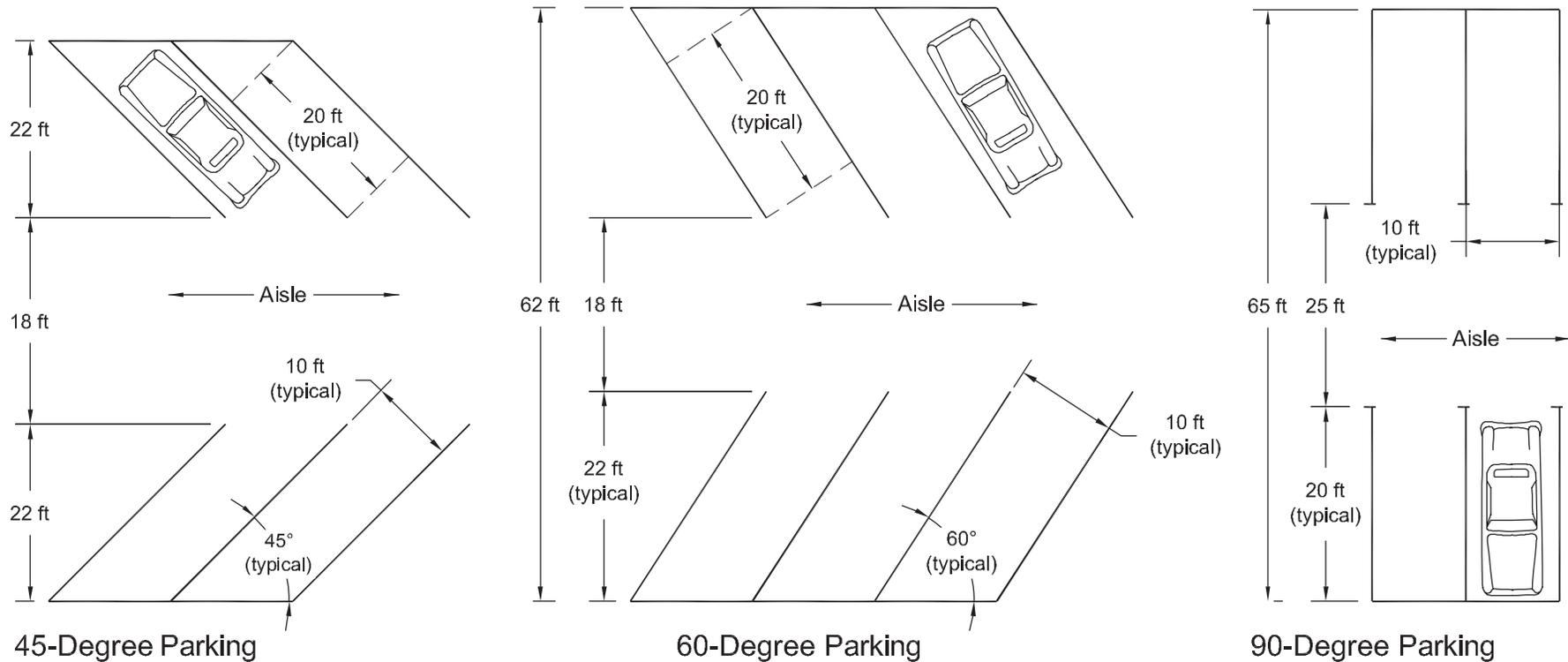


Figure 8-5—Parking dimensions and patterns for standard passenger vehicles. Increase the length of parking spaces if they will be used by pickup trucks with extended cabs and long beds. Forest Service parking areas must comply with the FSORAG.



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.

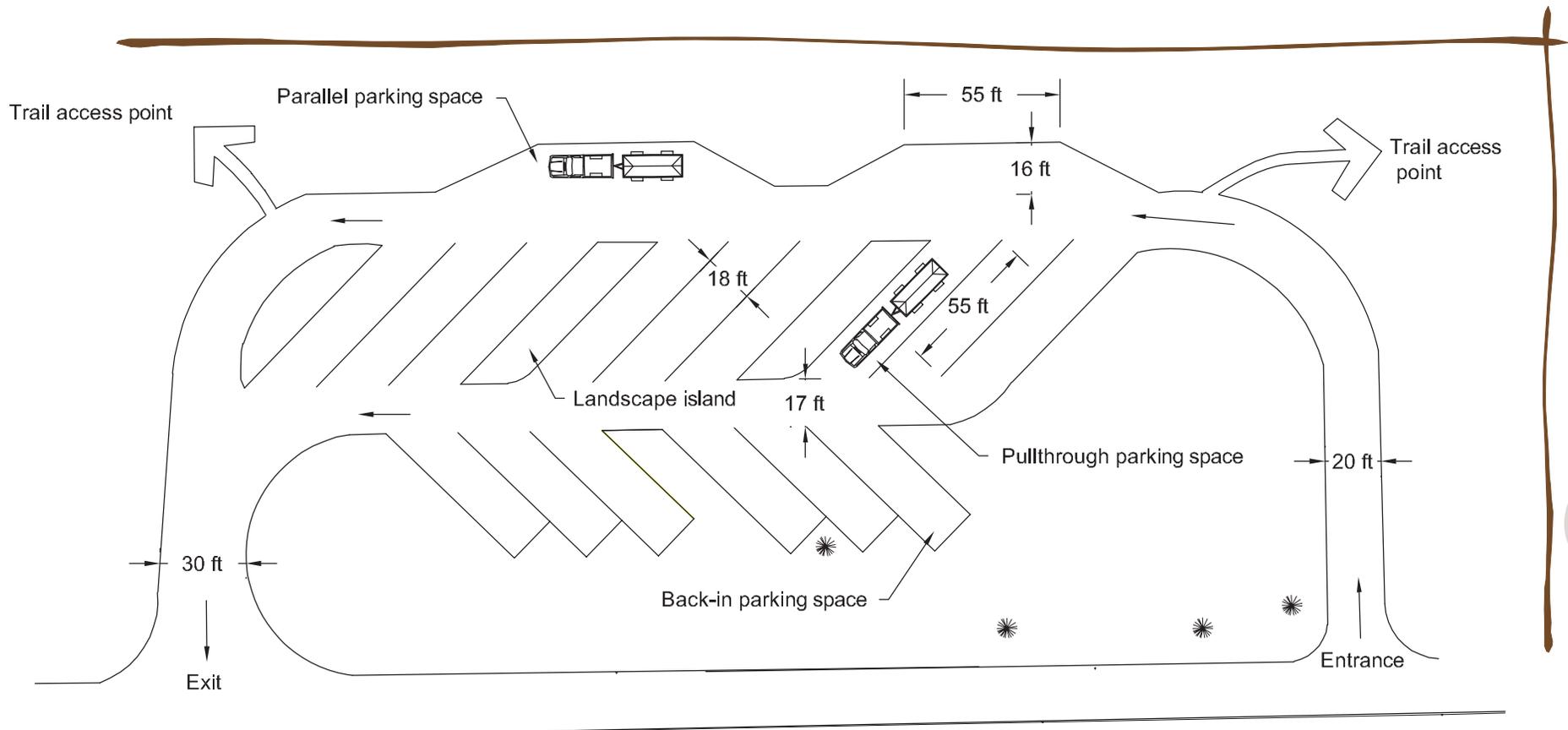


Figure 8-6—Equestrian parking in restricted spaces.

No Scale



### 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.

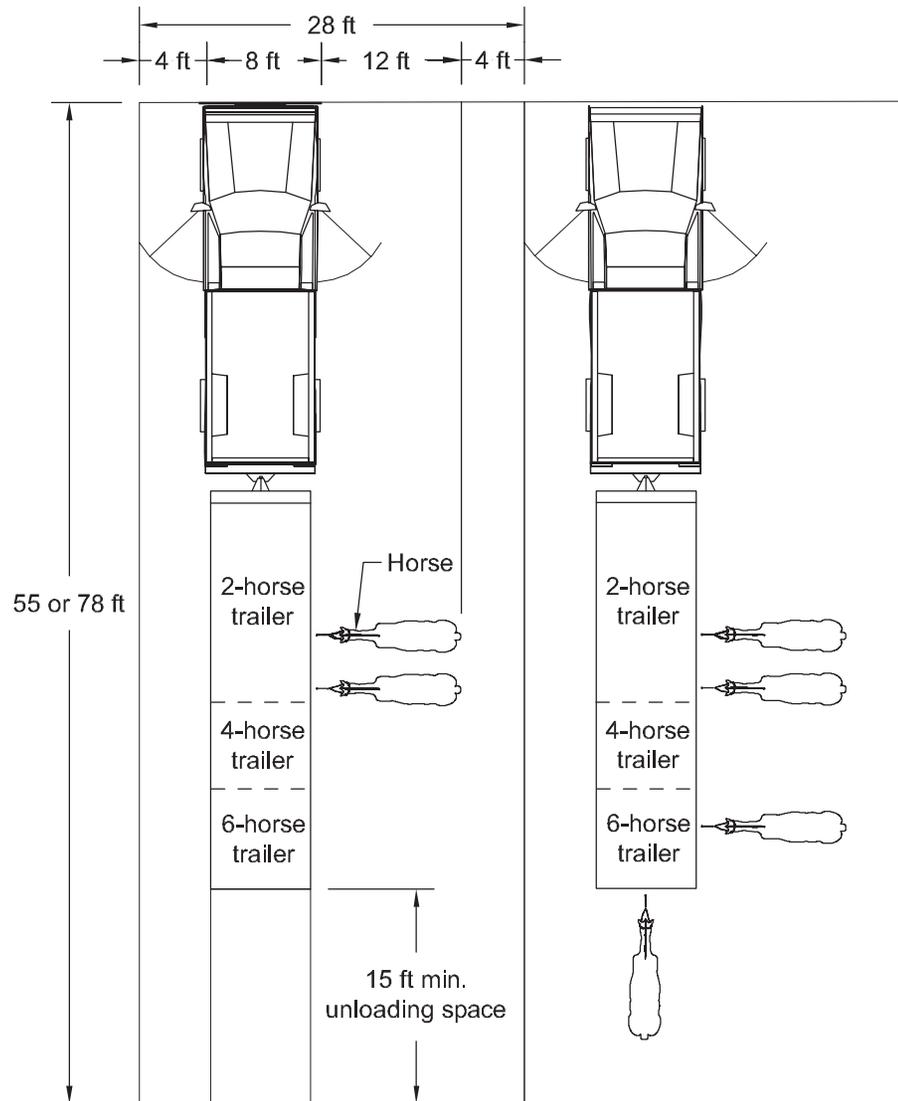


Table 8-3—Lengths of vehicles, trailers, and a standard garbage truck. All trailers are slant loading.

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

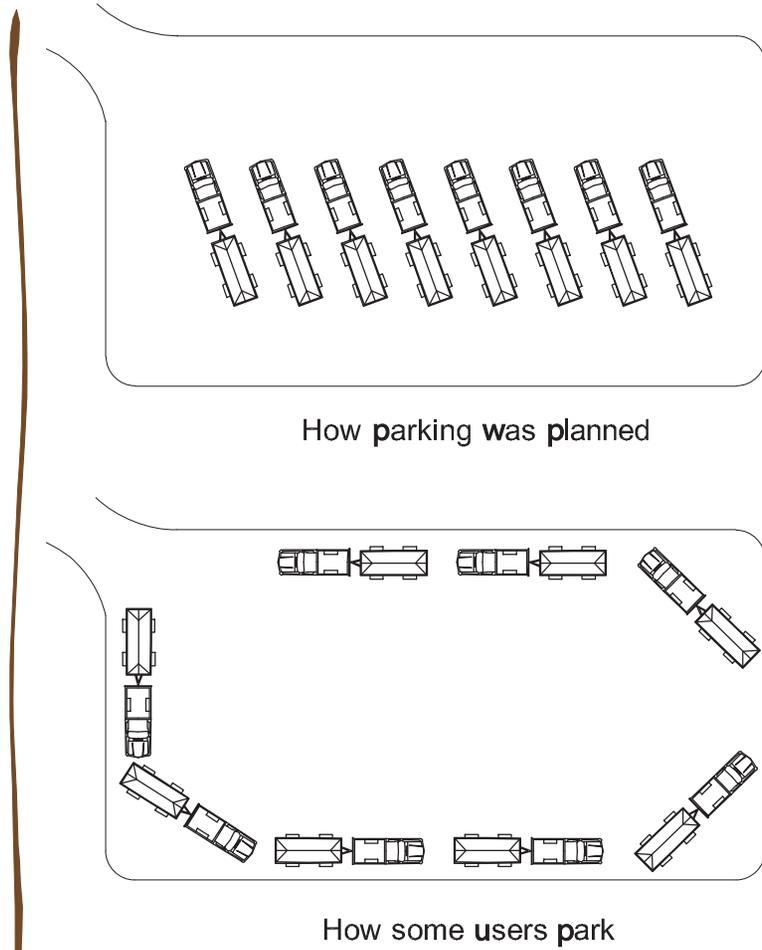
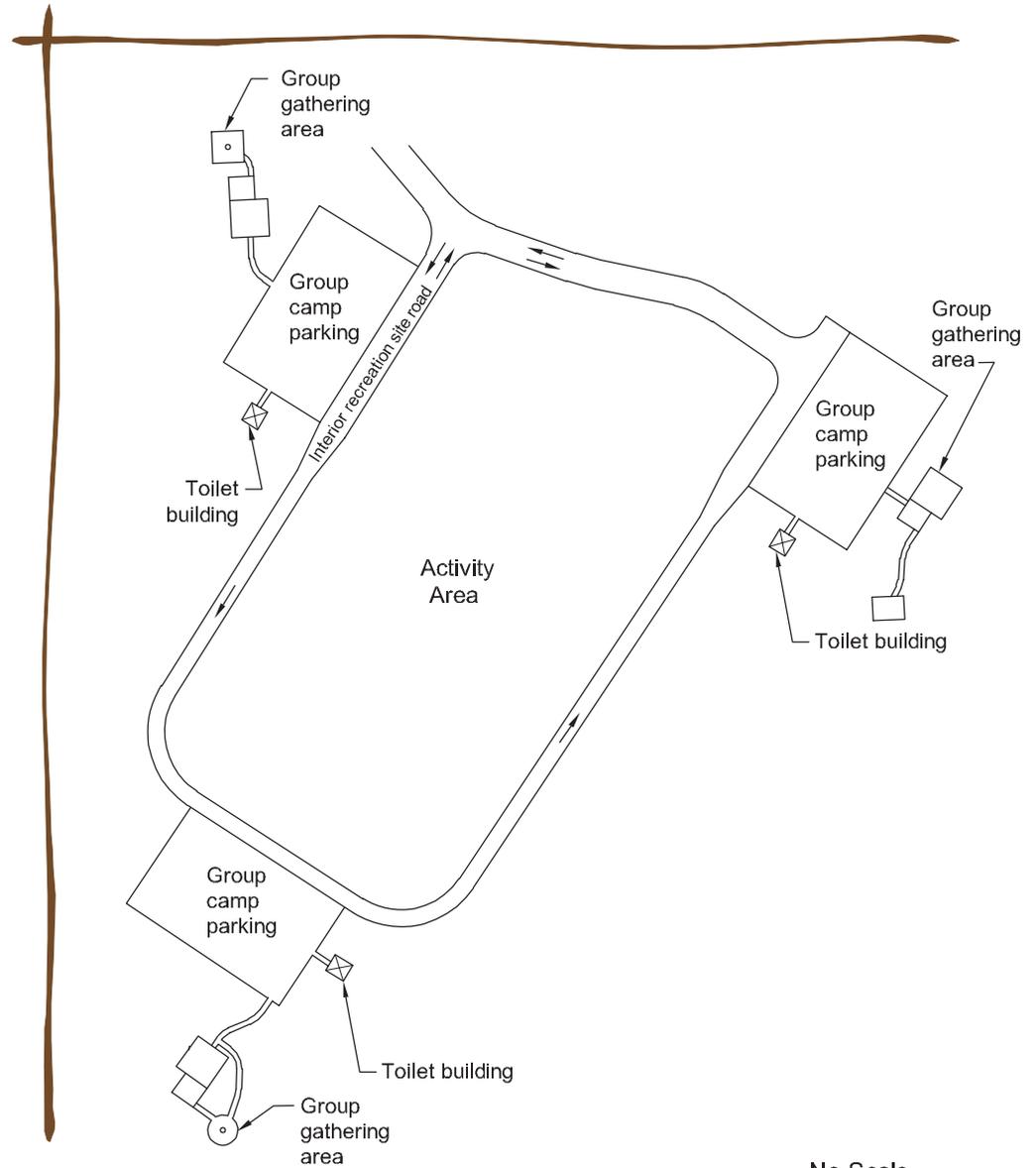
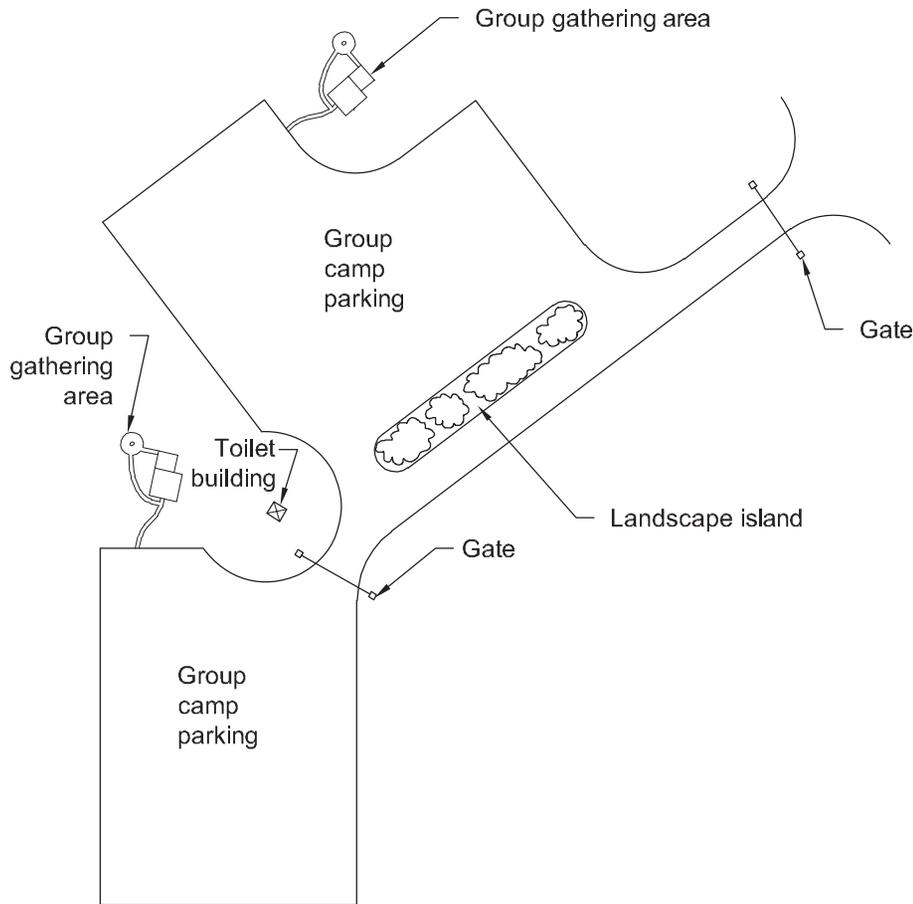


Figure 8-12—Designed parking compared to actual parking patterns.



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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.



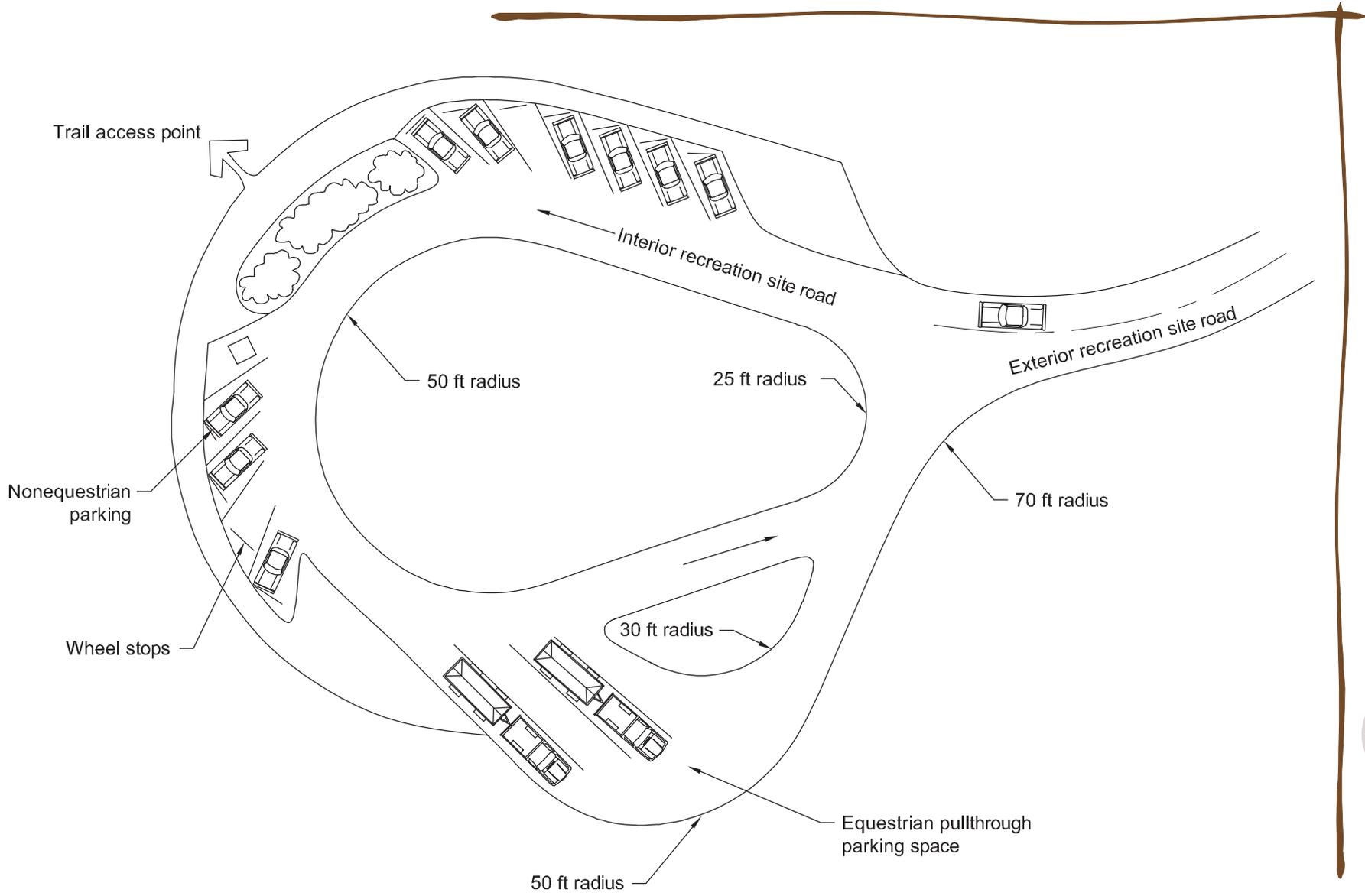
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### Small Parking Areas

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.

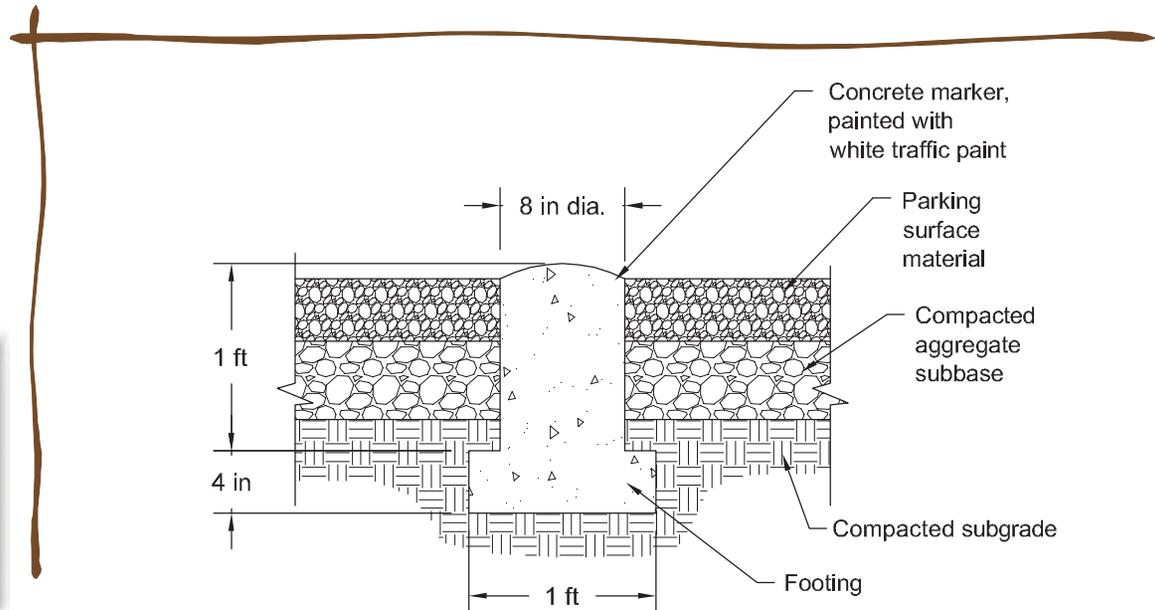


Figure 8–17—A concrete parking marker.



## 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.

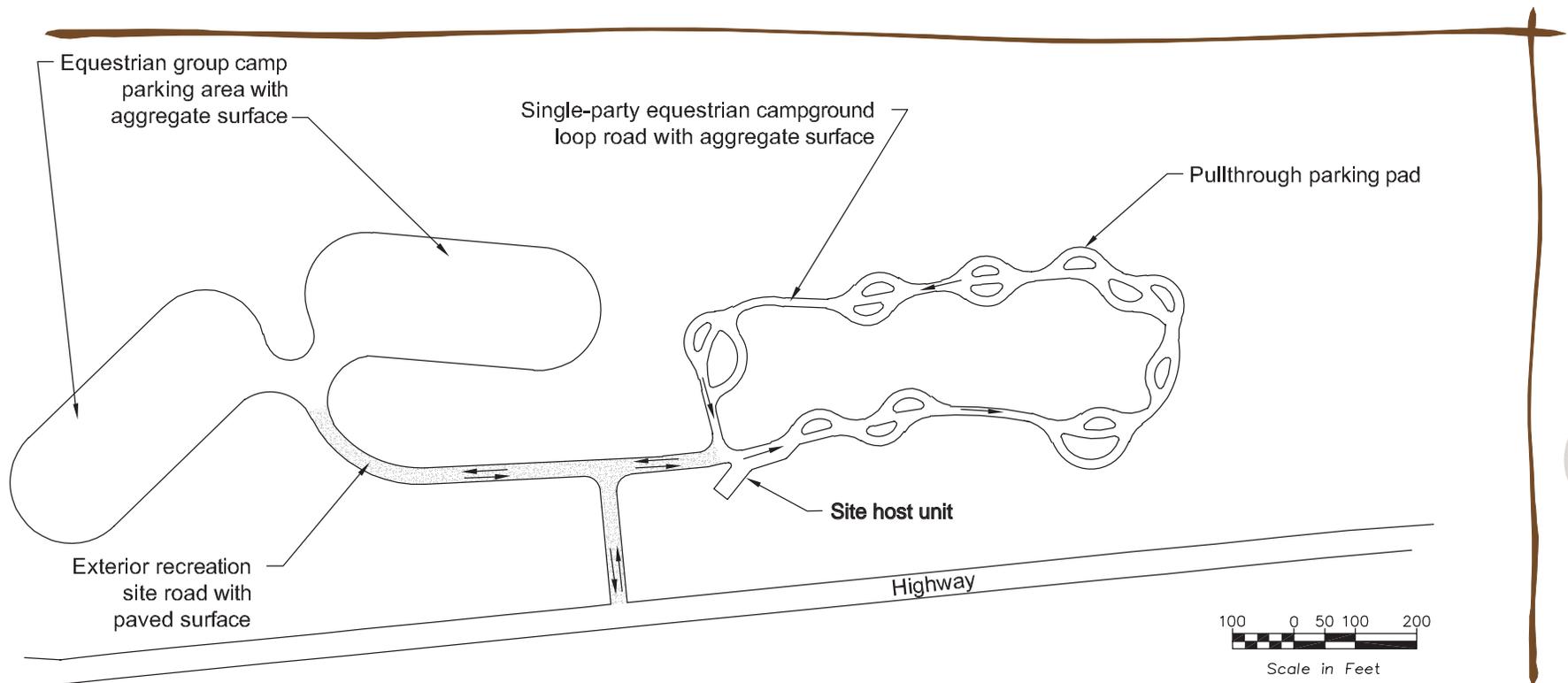
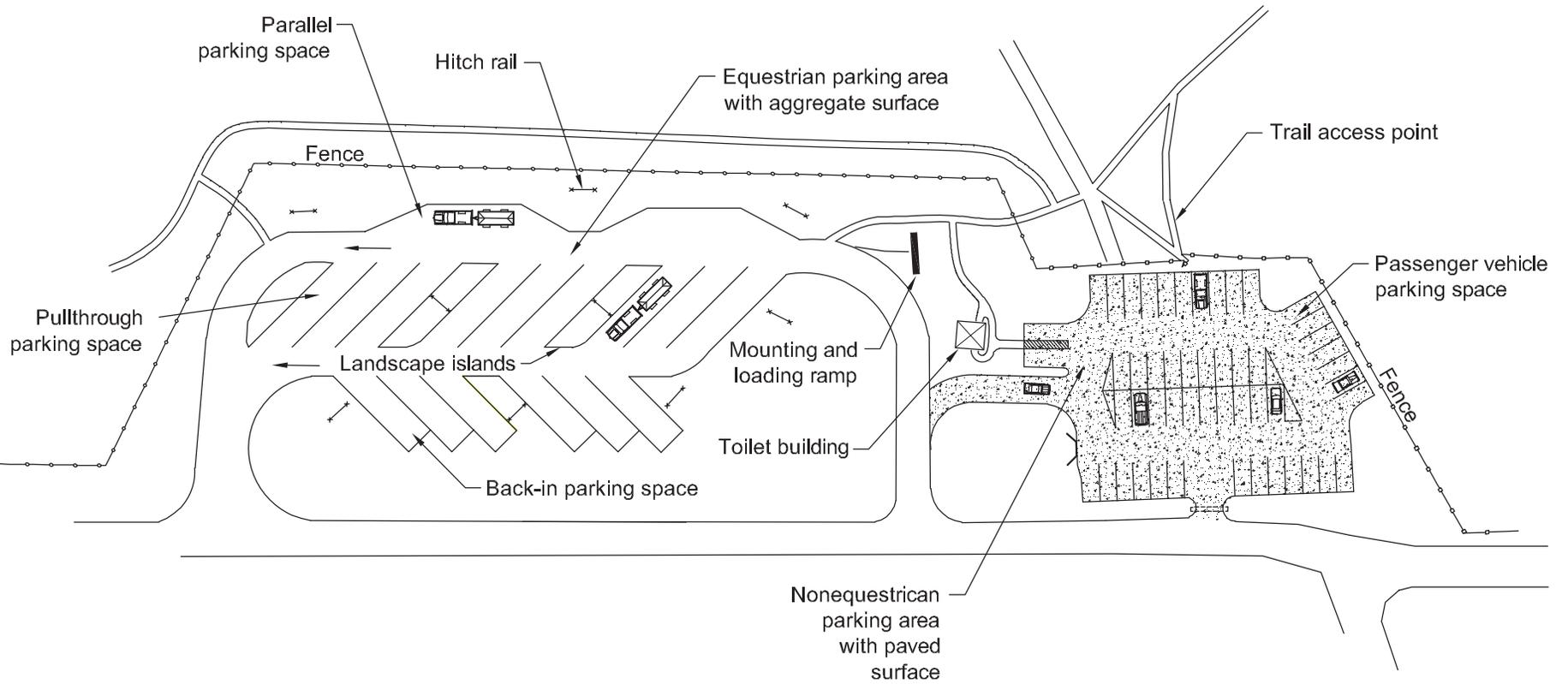


Figure 8–18—Pavement should not be used in equestrian areas. Paving the exterior recreation site road is an exception to this rule because stock seldom travel there.



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.

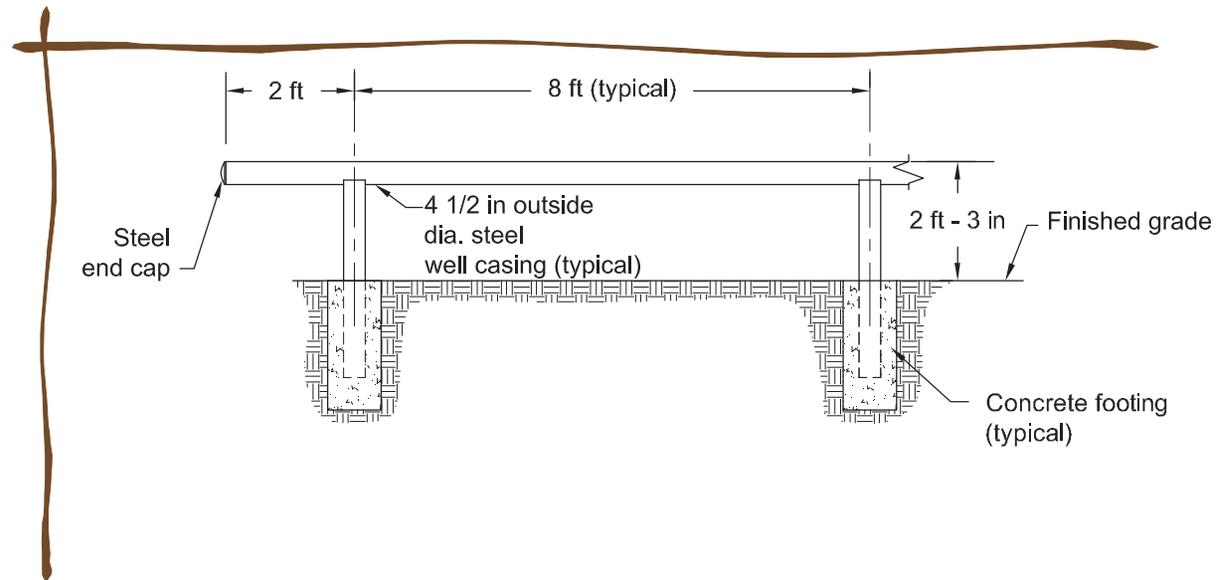


Figure 8–20—A horse-friendly steel barrier.





**Chapter 9—****D**esigning Camp and Picnic Units

Camp units are designed for overnight use and may include a parking pad. Picnic units generally are for day use only. Equestrian camp and picnic units do not have to be elaborate to be comfortable and convenient for both riders and their stock.

**Camp Parking Pads**

Two common parking configurations used in equestrian campgrounds are back-in (figure 9-1) and pullthrough parking pads (figure 9-2). Drivers often prefer pullthrough parking pads, because they are easier to navigate with a horse trailer in tow. Pullthrough parking pads include an island, which serves as a buffer to keep stock away from the road when they are tied to a horse trailer. Preserve existing vegetation in islands to increase campers' privacy.

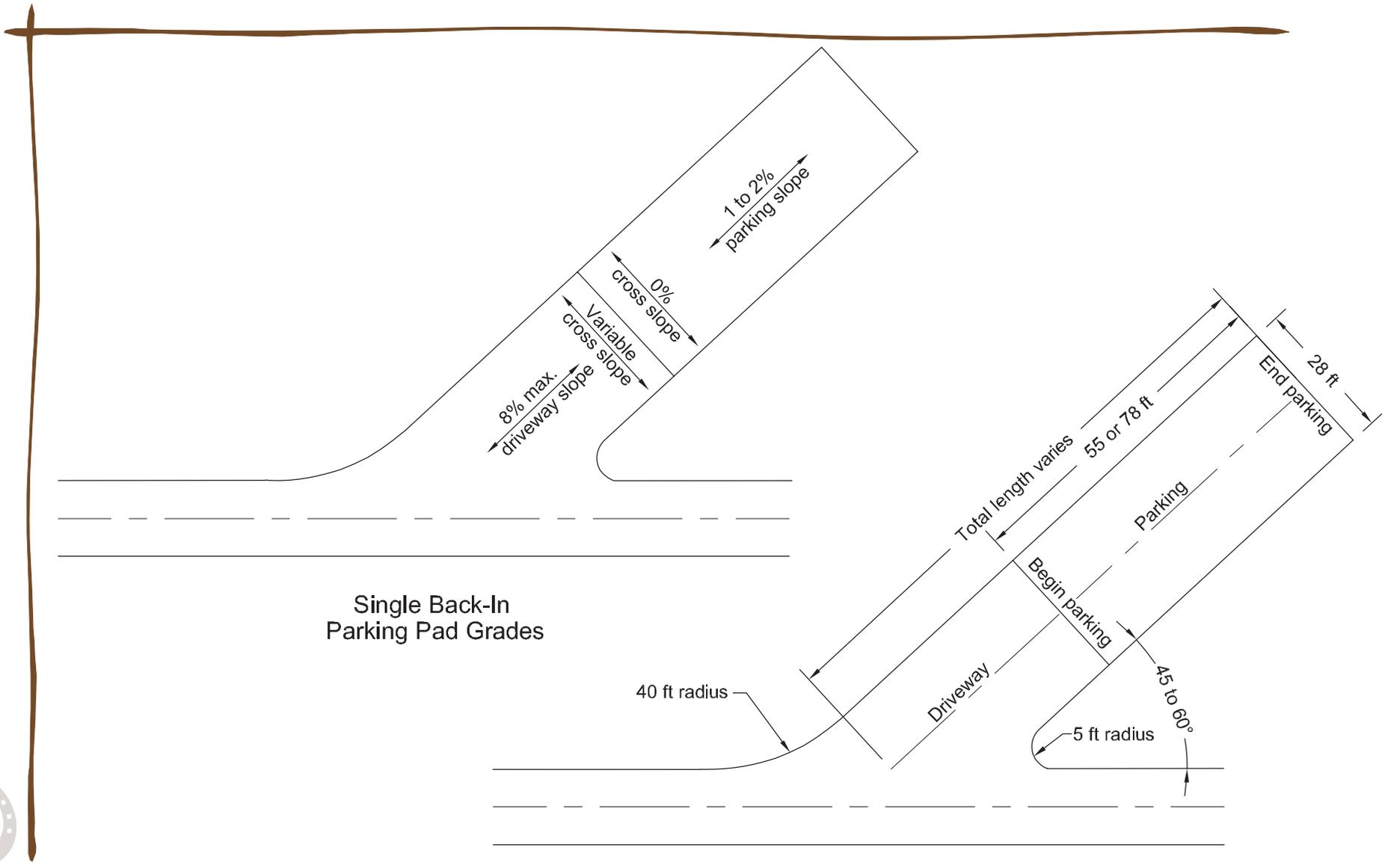
Even though backing a horse trailer can be awkward, some drivers prefer back-in parking pads, because the trailer ends up farther from the road. Provide both pullthrough and back-in parking pads, and include a variety of parking pad sizes to accommodate single-party, double-party, and several-party groups. Allow the topography and vegetation to determine the size and type of parking pad at individual locations. The recommended surface material for parking pads is aggregate (see *Chapter 6—Choosing Horse-Friendly Surface Materials*).

Some equestrian parties travel in more than one vehicle when they camp. Several people may arrive in the vehicle towing the horse trailer, and others may be in a passenger vehicle. When planning camp units, visit with local riders. If users often travel in more than one vehicle, design some back-in parking pads with an added parking space for a passenger vehicle. Plan some pullthrough parking pads with enough extra length to accommodate a second vehicle. When the transition between the pullthrough parking pad and the road has a mild slope, extra vehicles can park there. If there is enough demand, include a few extra parking spaces in the campground.

**Lingo Lasso****Outdoor Living**

This guidebook uses the following terms to describe areas in equestrian recreation sites:

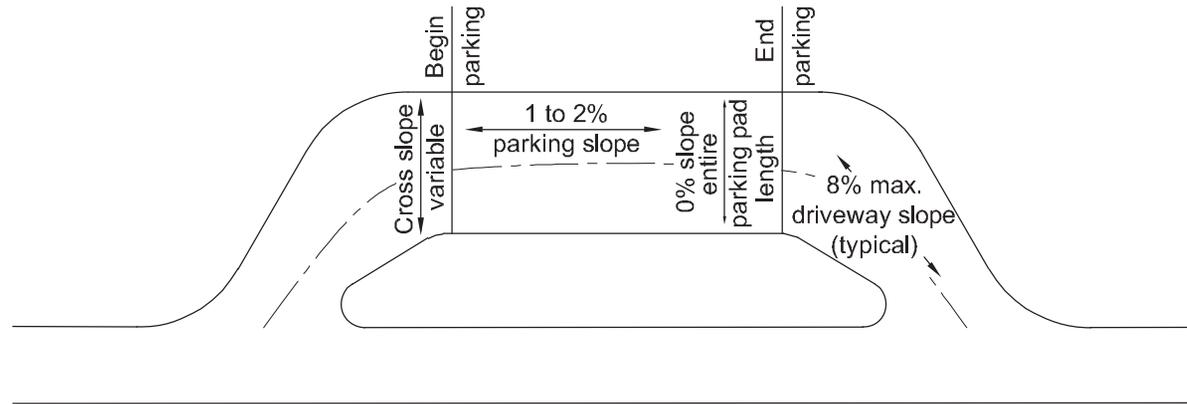
- ☆ *Living area*—A defined space for campers or picnickers. Furnishings, such as picnic tables, are included in a living area.
- ☆ *Horse area*—A defined space for horses and mules while their riders are camping or picnicking. A horse area has a way to confine stock, such as a corral or highline.
- ☆ *Parking pad*—A defined space in a camp unit where a towing vehicle and a horse trailer can be parked. Parking pads can be configured for pulling through or backing in.
- ☆ *Parking space*—A defined space for a vehicle in a day use area or at a trailhead. Parking spaces can be configured for pulling in, pulling through, or backing in.
- ☆ *Tent pad*—A defined area for a tent.
- ☆ *Camp unit*—A defined area that includes a parking pad, living area, tent pad, and horse area.



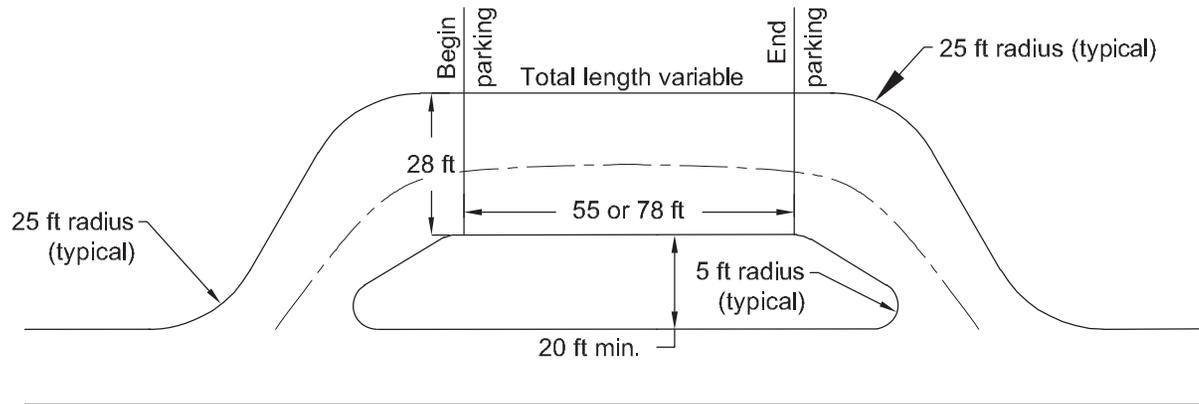
Single Back-In  
Parking Pad Grades

Single Back-In  
Parking Pad Dimensions

Figure 9-1—A parking pad in a single back-in spur—dimensions and grades.



### Single Pullthrough Parking Pad Grades



### Single Pullthrough Parking Pad Dimensions

Figure 9-2—A parking pad in a single pullthrough space—dimensions and grades.



### Placement of Camp Parking Pads

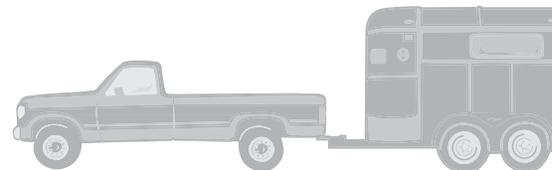
The general guide in campground design is to locate parking pads on the passenger side of the road and living areas on the passenger side of parked vehicles. This is because doors to tack storage, living quarters, and dressing rooms frequently are on the passenger side of horse trailers and the vehicles block the view from the road. This layout works well on a two-way road where drivers can park with the passenger side of their vehicle next to the living area (figure 9–3, parking pads A, B, C, and D). To make the best use of space along one-way roads, parking pads are placed on both sides of the road. When back-in parking pads are on the driver’s side of the road, living areas end up between the parking pad and

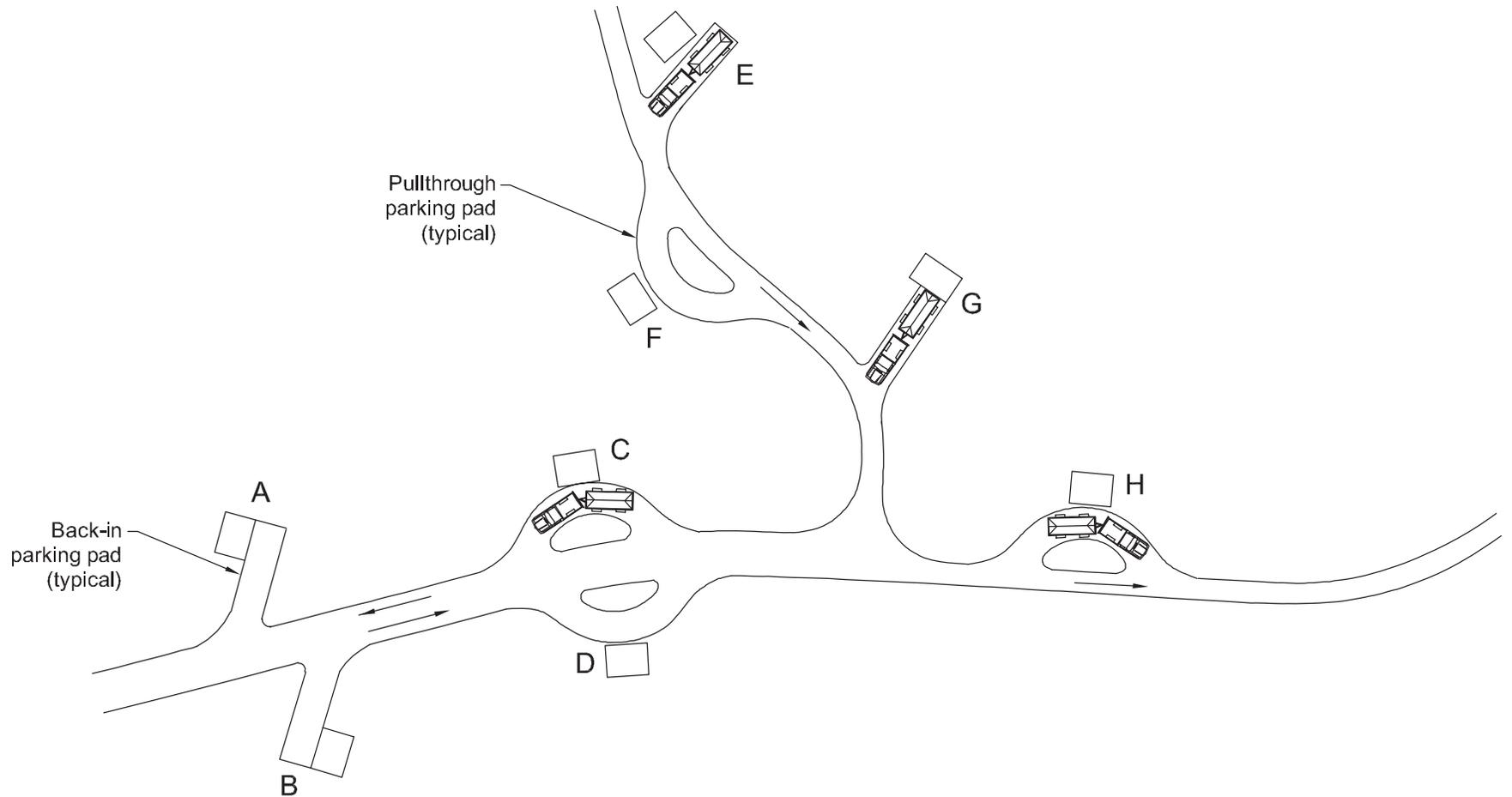
the road, close to the road (figure 9–3, parking pad E). These camp units are fully functional, but not as desirable. To make them more appealing, place the living area at the end of the pad, farther from traffic (figure 9–3, parking pad G). The living area is on the passenger side of the vehicle in pullthrough parking pads placed on the passenger side of a one-way road (figure 9–3, parking pad F). This is ideal. In figure 9–3, parking pad H has a pullthrough parking pad on the driver’s side of the road with a living area on the driver’s side of the vehicle. This configuration is less desirable because the doors to storage and living quarters are on the far side of the trailer, close to the road.

Topography, vegetation, and level of development affect placement of the parking pad. Avoid drainages and low spots. The sparser the vegetation, the wider the ideal separation between parking pads. In an area with a low level of development, riders expect some privacy while camping. In an area with a high level of development, they expect interaction with neighboring campers. Table 9–1 shows the suggested minimum spacing distance between parking pads.

Table 9–1—Suggested minimum spacing between parking pads.

Level of development	Back-in parking pad (Centerline to centerline in feet)	Pullthrough parking pad (Centerline to centerline in feet)
Low	100 to 150	160 to 210
Moderate	70 to 100	130 to 160
High	40 to 70	100 to 130





No Scale

Figure 9-3—On two-way roads, all parking pads and living areas can be located on the passenger side, as shown in A, B, C and D. Some living areas on one-way roads end up between the parking pad and the road, as seen in E. This configuration offers less privacy. A better option is to locate the living area at the end of the parking pad, as shown in G. The living area in F is attractive because the vehicle blocks the living area from the road. The living area in H is on the driver's side of the vehicle, where it is less convenient for unloading items.



### Grades for Camp Parking Pads

For improved safety and comfort, an equestrian parking pad should be somewhat level. The recommended grade for parking pads is 1 to 2 percent, the same as in a parking area. At sites with steep slopes, it may be difficult to construct level parking pads without a great deal of cut or fill. In such situations, the driveway between the road and parking pad can have a steeper grade. Wayne Iverson (1985) suggests a maximum grade of 8 percent for driveways to parking pads (see figures 9-1 and 9-2). In steeper terrain, the slope can be up to 10 percent. This flexibility makes it easier to join the driveway slope to the road grade without a significant amount of earthwork. The cross slopes on parking driveways must not exceed 2 percent. Accessibility guidelines also require grades within this range.

### Living and Horse Areas

When planning living and horse areas, considerations include the physical characteristics of the site and the preferred distance between riders and their stock. The distance between living and horse areas takes safety into consideration.

### Sun and Wind

Place the living and horse areas to take advantage of morning sun and afternoon shade. Canopy trees should cast shade into these areas during the heat of the day, especially if no shelters are provided. Keep

local weather patterns and prevailing winds in mind. Locate horse areas downwind of living areas. Situate fire rings and grills so smoke doesn't blow across picnic tables, tent pads, and horse areas (figure 9-4).

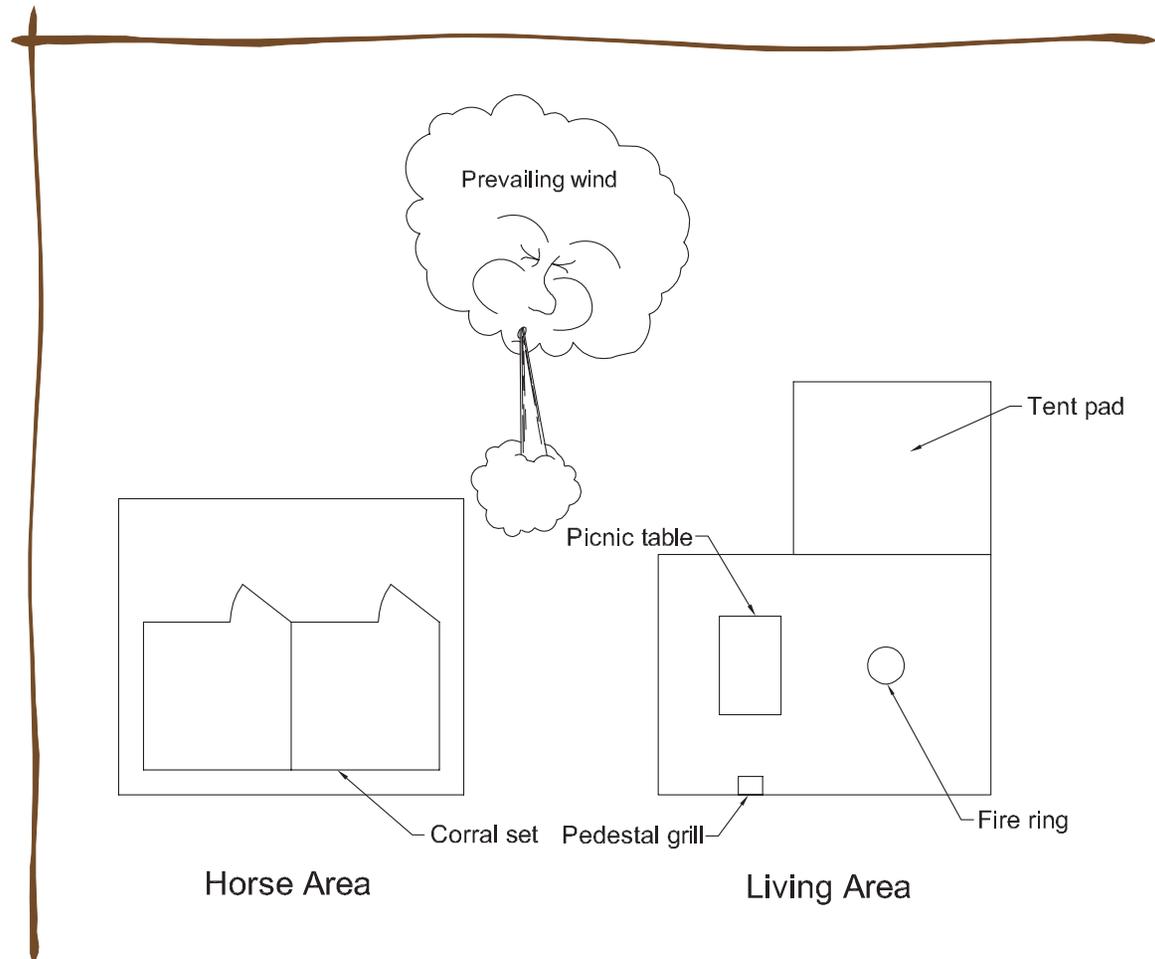


Figure 9-4—A suggested layout for living and horse areas. Placing the areas as shown avoids problems with windblown smoke and odors.



## Site Vegetation

If existing vegetation is sparse, minimize plant removal by locating living areas and tent pads in natural openings. If the design includes new landscaping, incorporate indigenous species. Preserve existing trees and understory plants as visual barriers between adjoining living areas.

To avoid damage to vegetation, don't locate horse areas close to desirable plants. Horses may eat plants within reach. Provide vegetation-free zones around horse areas. The zone should be at least 7 feet (2.1 meters) on all sides and 12 feet (3.6 meters) high. Base the distance on the mature size of plants.

## Slopes

Living and horse areas need to be somewhat level. Slope horse areas so they drain away from living areas. The recommended slope for living areas is 1 to 2 percent. Slopes in this range allow rainwater and horse urine to drain. Accessibility guidelines for many features also require grades in this range, in addition to other considerations. When living areas and tent pads are placed on a slope steeper than 2 percent, they may need to have retaining walls (figure 9–5). Select wall materials that are appropriate for the setting and the level of development.



Figure 9–5—Retaining walls may be necessary for living areas in sloped terrain.

## Distance Between Horse Areas and Living Areas

Many riders want to be as close as possible to their stock; others prefer some distance between living and horse areas. Most riders want to see and monitor their stock from the living area, tent pad, or horse trailer. Figure 9–6 shows a popular campground unit with a horse area that is 5 feet (1.5 meters) from the living area. To some riders, that would be too close—keeping the horse area up to 50 feet (15.2 meters) away would be preferable. Visit with local user groups to determine their preferences. Provide a range of distances in the campground so campers can choose a campsite that meets their needs. Highly developed sites with many visitors usually have tighter spacing than less developed sites.



Figure 9–6—When horse areas are close to living areas, riders can easily monitor their stock. —*Courtesy of Janet Grove.*

The appropriate distance between a horse area and a living area also varies with the amount of existing vegetation. For visibility, the denser the vegetative screening, the closer stock need to be to the living area.

In camp units, locate the horse areas close to parking pads for convenient access to feed and supplies (figure 9–7). In group camps, riders generally tie their stock to trailers, but they also appreciate horse areas. If horse areas are provided, they should be located around the perimeter of the parking area. The corrals shown previously (see figure 7–7) are in the parking area because the slopes around its perimeter are too steep. When using this approach, make the parking area large enough to handle the added use.



In day-use sites, most riders tie their horses to the trailer for short periods. Horse areas may be unnecessary. If the day-use site has a picnic area,

horse areas may be desirable. Visit with local riders to discuss their preferences.



Figure 9-7—Horse trailers, such as this slant-load model, often have tack storage that is accessed through side or rear doors.

## Surfaces

In areas where native soils don't drain well, apply suitable surface materials to horse areas and living areas. Surface materials help define these areas, enhance wear, reduce dust, and are easier to maintain in high-traffic areas. Where there is grass, additional surface materials may be unnecessary. However, if the living areas receive heavy use, grass will wear quickly.

The surfaces in horse areas should be relatively soft so stock can roll comfortably after a ride, lie down to sleep, or stand comfortably for long periods. Generally, the finer the surface material, the easier horse manure can be removed. Suitable materials include wood chips and shavings, loose aggregate, pea gravel, and soil. If aggregate is used, compaction is not appropriate—the surface would be too hard. Avoid using concrete or asphalt because these materials are slippery when wet, don't absorb urine or rainwater, and are too hard. Avoid using sand because horses and mules can become ill if they eat it.



Usually the most economical and effective surface material for living areas is compacted crushed aggregate with fines. With good compaction, crushed aggregate with fines produces a firm and stable surface—one of the requirements for accessibility. In highly developed recreation sites, it may be more feasible to pave the accessible living area. Concrete,

asphalt, or a surface material mixed with a stabilizer will be easier to maintain. It may be necessary to pave a heavily used group gathering area.

Edging around the perimeter of the living and horse areas contains loose surface materials, defines the areas, and protects them. Suitable edge materials

include steel, wood, recycled materials, or concrete curbs—choose whichever is appropriate for the climate and level of development. Regardless of the material, install edging somewhat flush (figure 9–8) with the living area so it does not pose a tripping hazard for stock or riders.

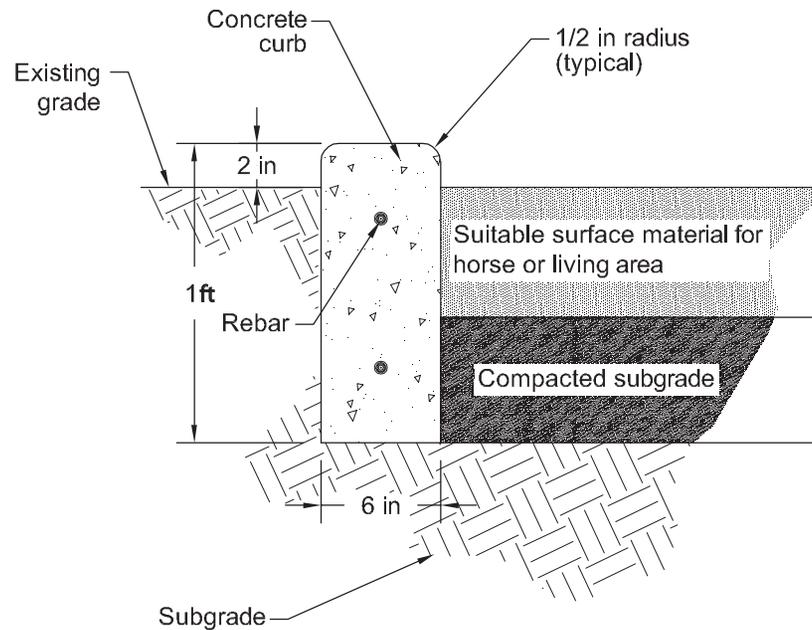


Figure 9–8—Concrete edging for a living area. To prevent tripping, install the edging so it is reasonably flush with surrounding surfaces.



### Horse Areas

A horse area must provide a way to confine horses and mules. At camp units with vehicle access, the three main options for securing an animal overnight are to:

- ☆ Tie it to the horse trailer.
- ☆ Tie it to a highline.
- ☆ Place it in a corral.

Meet with local riders and determine their preferences. If opinions are mixed, provide options—corrals in some units and highlines in others. Accommodate stock tied to trailers in all units because stock usually have to be tied to a trailer when preparing for a ride. If corrals are made of portable panels with temporary posts, install a hitch rail nearby where stock can be tied (figure 9–9). Hitch rails are much sturdier and safer for tying stock than portable corral panels.

Stock generally are not tied to hitch rails for very long. Arenas and round pens are used for exercising and training stock, not for confining them. For more information about confinement and staging areas, see *Chapter 10—Securing Horses and Mules* and *Chapter 8—Designing Roads and Parking Areas*.



Figure 9–9—Unless they have permanent posts, portable corrals are not strong enough to be used for tying stock. A separate hitch rail is much sturdier and safer.



Figure 9–10—This camp unit has an attached living area adjacent to the parking pad.

### Camp Units

The best camp units are designed in the field to take advantage of the individual site’s conditions.

Place living areas, horse areas, and tent pads in natural openings to minimize removal of vegetation and make each camp unit unique. Locate the living area adjacent to the back-in or pullthrough parking pad (figure 9–10), or detach the living area from the parking pad (figure 9–11). If the living area is detached, a 3- to 4-foot- (0.9- to 1.2-meter-) wide pathway can connect the living area to the parking pad. Ideally, the horse area is adjacent to the parking pad, making it easy for equestrians to reach their trailer, where they store feed and equipment.



Figure 9–11—This detached living area is a short distance from the parking pad.



Most camp units include site furnishings, such as a picnic table, a grill, and a fire ring. Place these amenities at least 4 feet (1.2 meters) away from the edge of living areas and from each other. If space allows, place them 5 to 7 feet (1.5 to 2.1 meters) from the edge and from each other. Pedestal grills that rotate require at least 4 feet (1.2 meters) of clearance on all four sides, and 5 feet (1.5 meters) of clearance is preferred. Stationary grills require 4 feet of clearance in front, and 5 to 7 feet (1.5 to 2.1 meters) is preferred. Separate picnic tables by 5 to 7 feet also. Figure 9–12 shows a living area layout. Figure 9–13 shows a camp unit with a low level of development, and figure 9–14 shows a camp unit with a high level of development.

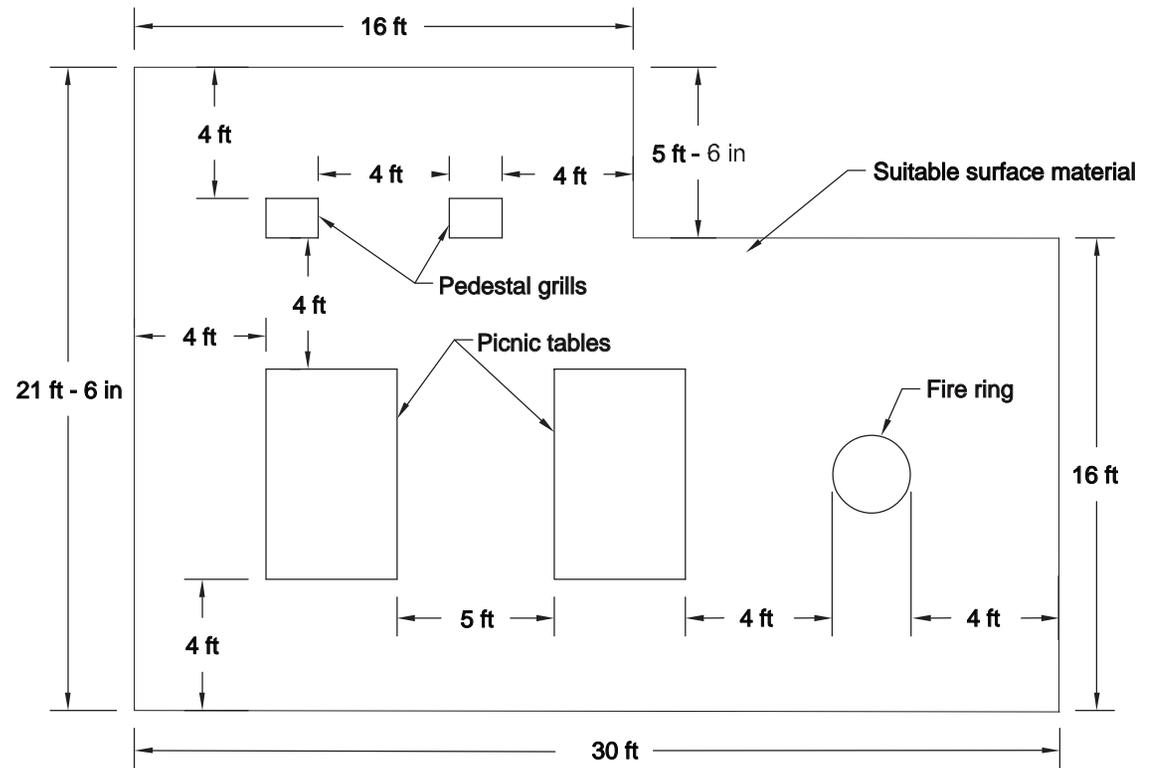


Figure 9–12—The living area for a double-party camp unit. The suggested dimensions are minimums. In some situations, space may allow a larger living area.





Figure 9–13—This camp unit has a low level of development that meets the basic needs of campers and their stock. Water for stock is located a short distance away.



Figure 9–14—This camp unit features many conveniences suitable for a recreation site with a high level of development. —Courtesy of Janet Grove.

Provide tent pads that are at least 14 by 16 feet (4.3 by 4.9 meters). Tent pads consist of a separate unit that may be attached to a living area. Place tent pads near the camp living area in a single-party camp unit. In a group camp, locate them around the parking area perimeter. This placement makes it easier for riders to monitor stock tied to trailers.

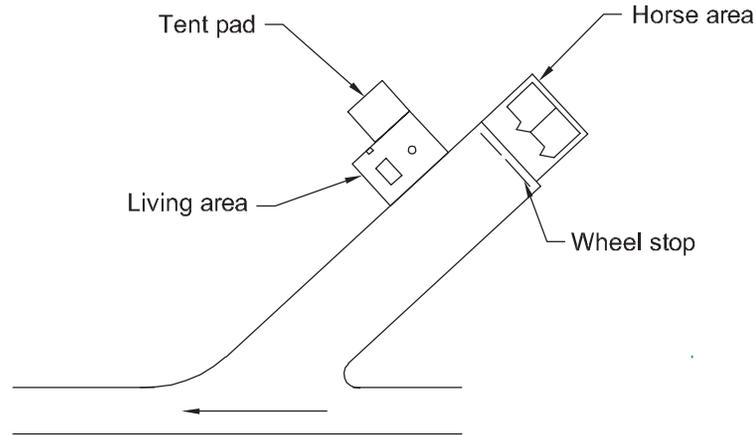


### Sizes of Camp Units

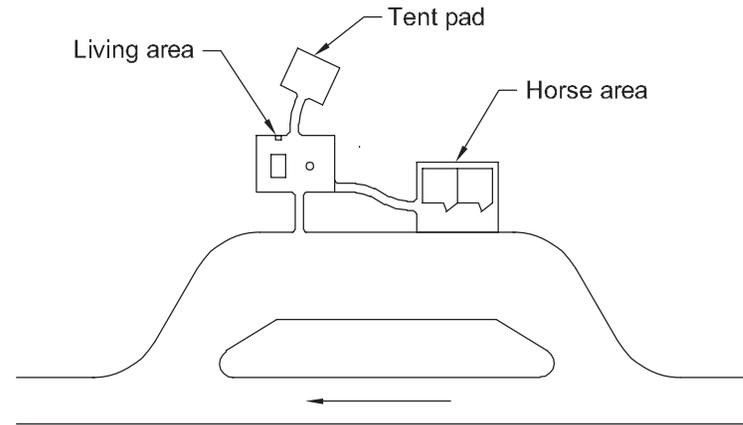
The most common camp unit for riders is the *single-party camp unit*; other options include *double-party camp units*, *several-party camp units*, and *group camps*. Visit with riders to determine the types they prefer. Provide a variety of camp units to meet varying needs.

### Single-Party Camp Units

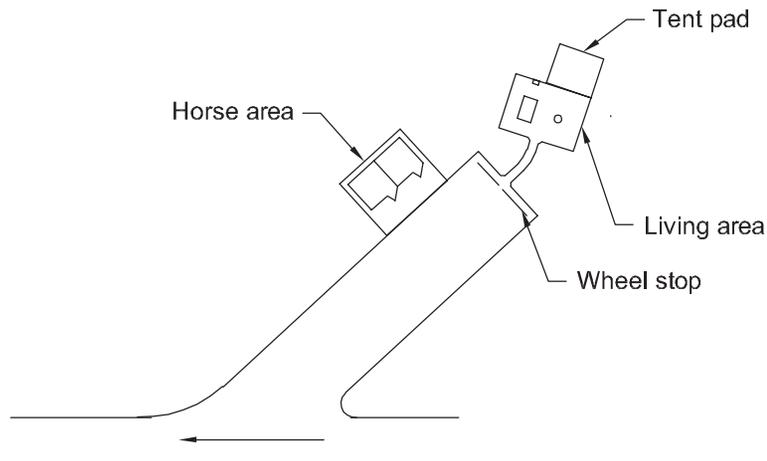
Many equestrian campers prefer a single-party camp unit. Generally, a single-party camp unit accommodates no more than five people, a towing vehicle, and a four-horse trailer. Provide a living area that is about 550 square feet (51 square meters), a tent pad, and a horse area for two animals. If campers have four animals, two animals will have to be tied to the trailer. Figure 9–15 shows concepts for single-party units.



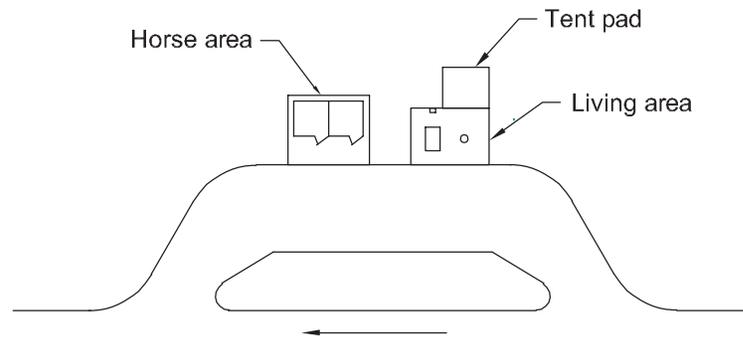
(A) Back-In Parking Pad



(B) Pullthrough Parking Pad



(C) Back-In Parking Pad



(D) Pullthrough Parking Pad

Figure 9-15—Single-party camp units.



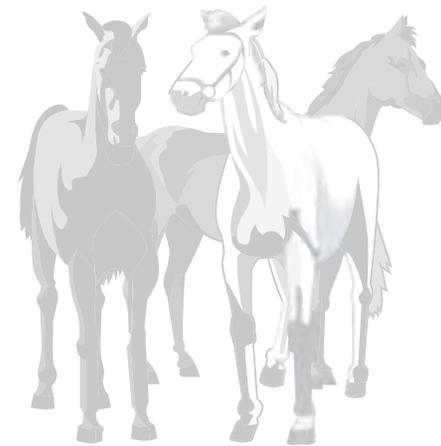


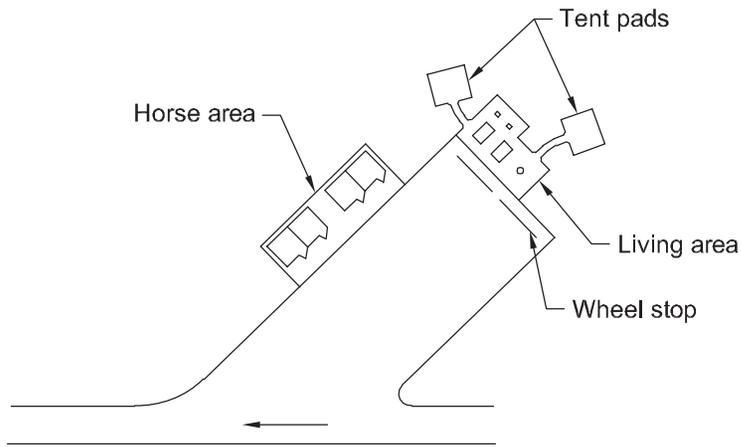
### ***Double-Party Camp Units***

Riders who want to camp with fellow riders appreciate double-party camp units. Back-in or pullthrough parking pads can be adapted for use in double-unit parking pads. One concept merges two back-in parking pads with a total width of 56 feet (17.1 meters). A pullthrough parking pad will need to be extended 55 or 78 feet (16.8 or 23.8 meters). Extended pullthrough parking pads have a disadvantage—the towing vehicle parked in the

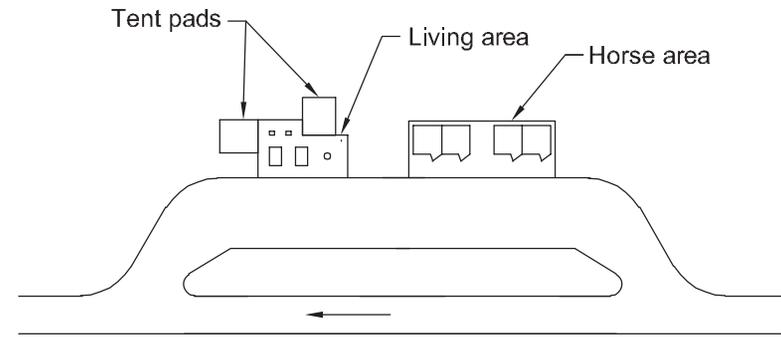
rear cannot be moved forward until the front trailer is moved. Backing the rear vehicle is an option, but some drivers are not comfortable doing so. A widened pullthrough parking pad allows the rear vehicle to be driven around the other parked vehicle. To widen the parking pad, add 10 feet (3 meters), for a total width of 38 feet (11.6 meters). Provide a living area of about 700 square feet (65 square meters), two tent pads, and areas for four animals. Figure 9–16 shows concepts for double-party equestrian camp units.

Consider having attendants or hosts who can monitor the operation of the campground. The most effective attendants are those familiar with the special needs of stock and riders. Attendants and their stock should be provided a double-party camp unit with a horse area.

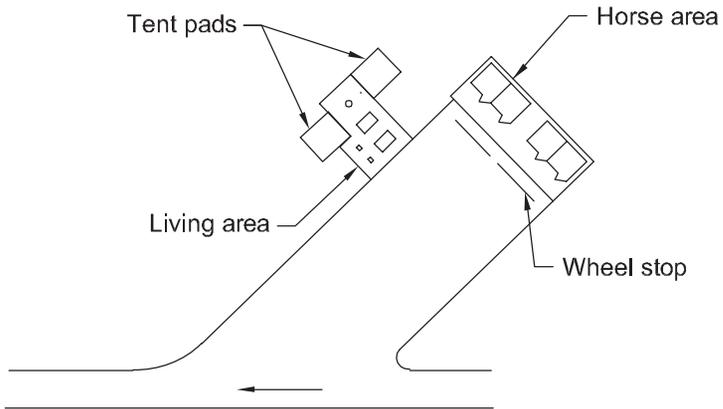




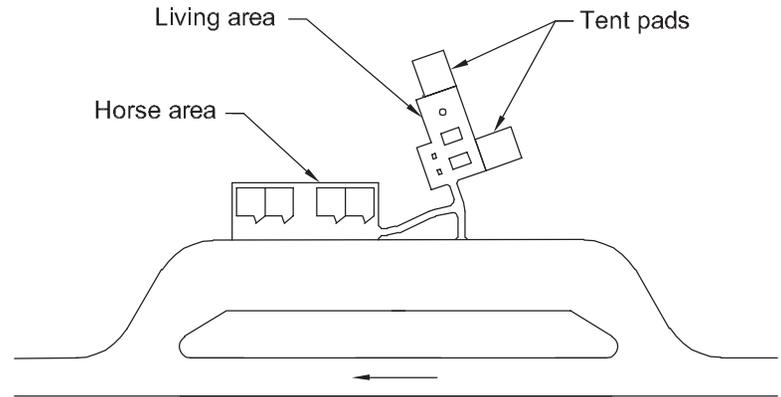
(A) Double Back-In Parking Pad



(B) Double Pullthrough Parking Pad



(C) Double Back-In Parking Pad



(D) Double Pullthrough Parking Pad

Figure 9-16—Double-party camp units.



### Several-Party Camp Units

Campsites designed for three to four parties are highly favored by riders. Parking options include extra-long or extra-wide pullthrough parking pads (figure 9–17A and B). The extra length—55 or 78 feet (16.8 to 23.8 meters) per vehicle—allows three to four vehicles to park one behind the other. Widen pullthrough parking pads to 38 feet (11.6 meters) to accommodate parking on the outside, and leave the inside open as a travel lane. The landscape island insulates tied stock from dangers on the main road. Install a sign at each unit clarifying that it is for several parties.

Another several-party concept has a *terminal loop* with three to four back-in parking pads (figure 9–17C). A terminal loop is used only by the campers in the several-party campsite. Make the loop oval rather than a perfect circle. An oval loop allows campers to more easily pull forward and back into parking spaces. Another concept uses three or four back-in parking pads adjacent to each other. The space needs to be 84 feet (25.6 meters) wide for three parking pads and 112 feet (34.1 meters) wide for four. The parking layout may not be clear to drivers. Wheel stops placed 2 feet (0.6 meter) from the end of each parking pad can help mark the spaces.

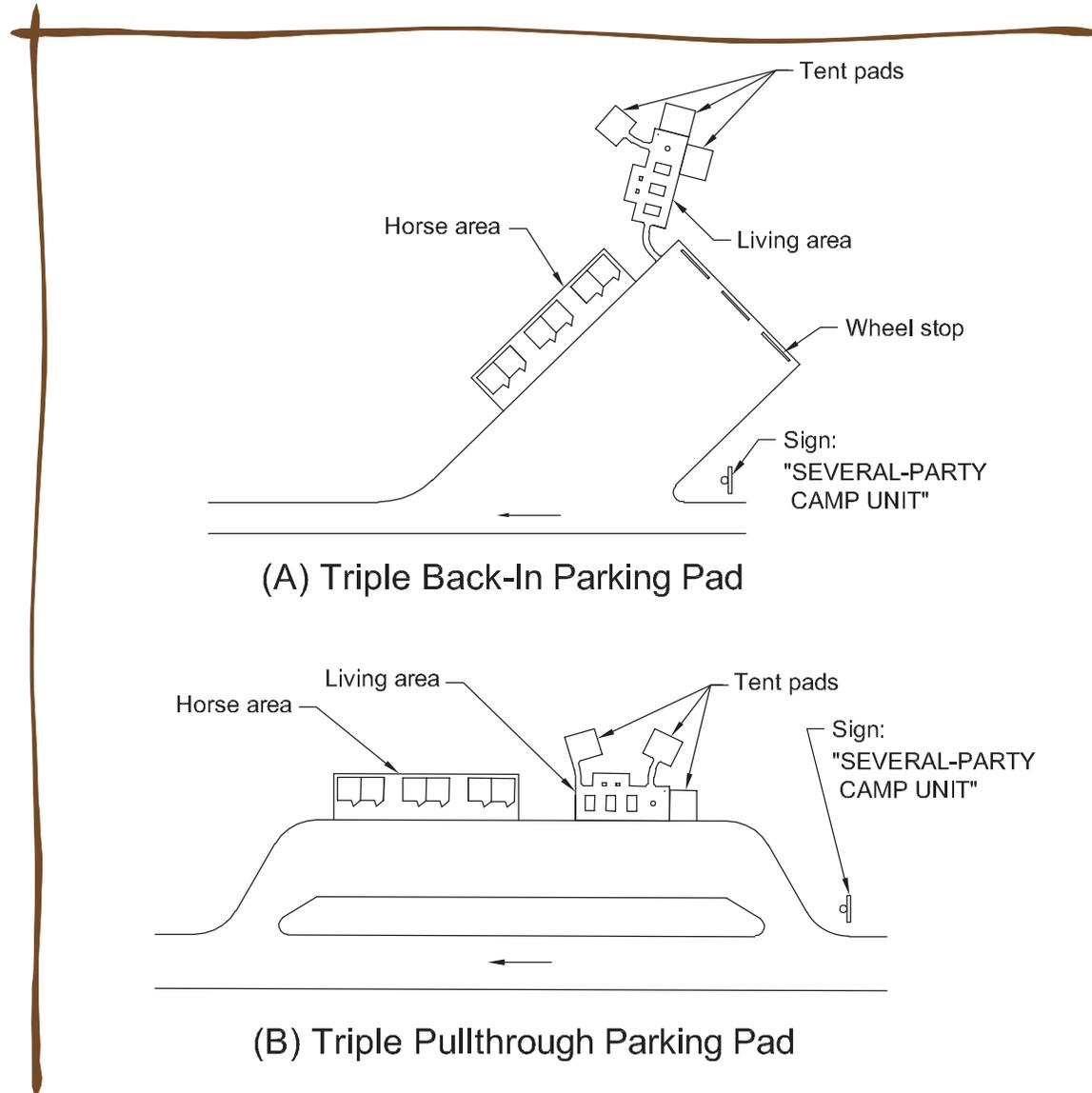
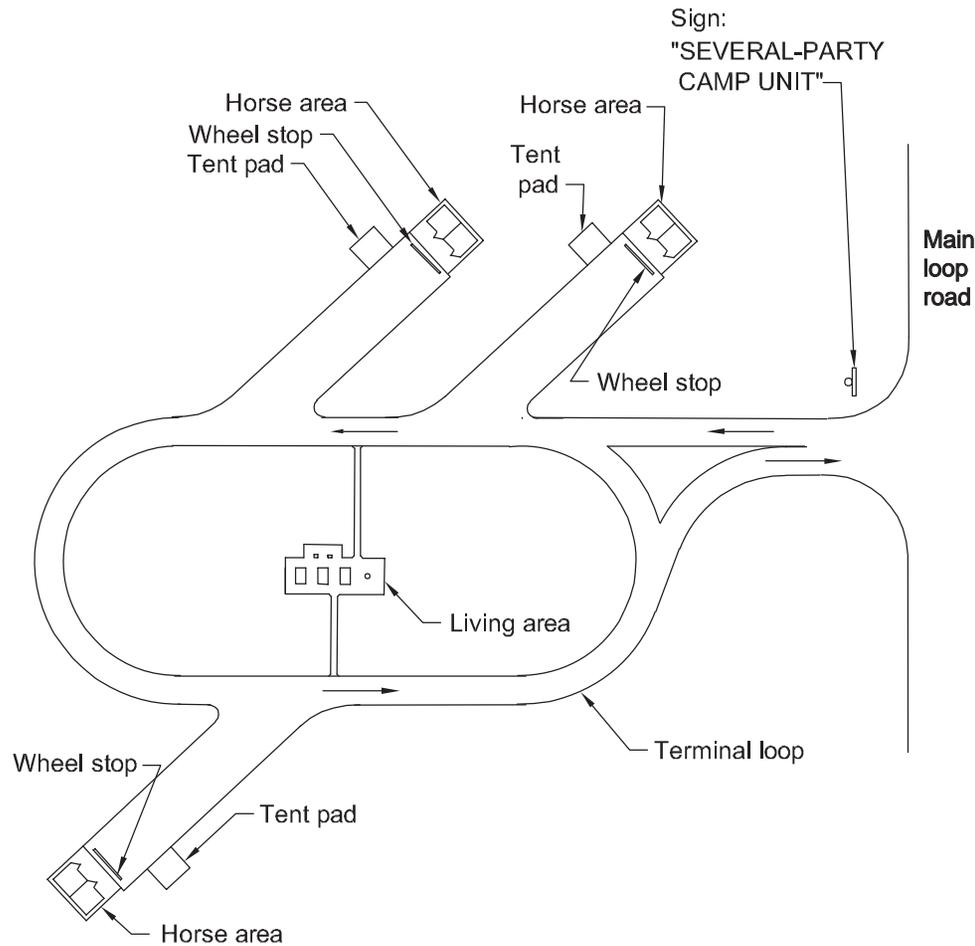


Figure 9–17—Several-party camp units. Each example is sized for three vehicles with horse trailers.





(C) Separate Back-In Parking Pads

An appropriate living area for several parties includes a shared space of about 950 square feet (88.3 square meters) where the campers gather to prepare meals and socialize. Living areas for several parties should be centrally located in the camp unit (figure 9–17C). Provide a separate tent pad and horse area for each party. This allows privacy for sleeping and separates the stock.

### Group Camps

At group camps, include a group gathering area for eating and socializing. Furnishings at group gathering areas may include picnic tables, group-sized pedestal grills, group-sized fire rings, serving tables, and lantern hangers. Equestrians also appreciate a shelter, trash receptacles, and a water hydrant. Group gathering areas may include one large structure (figure 9–18) or several smaller structures (figure 9–19). For more information on sizing structures, see *Chapter 7—Planning Recreation Sites*. Because the areas may receive heavy traffic, paving may be necessary. The suitability of pavement depends on the level of development.



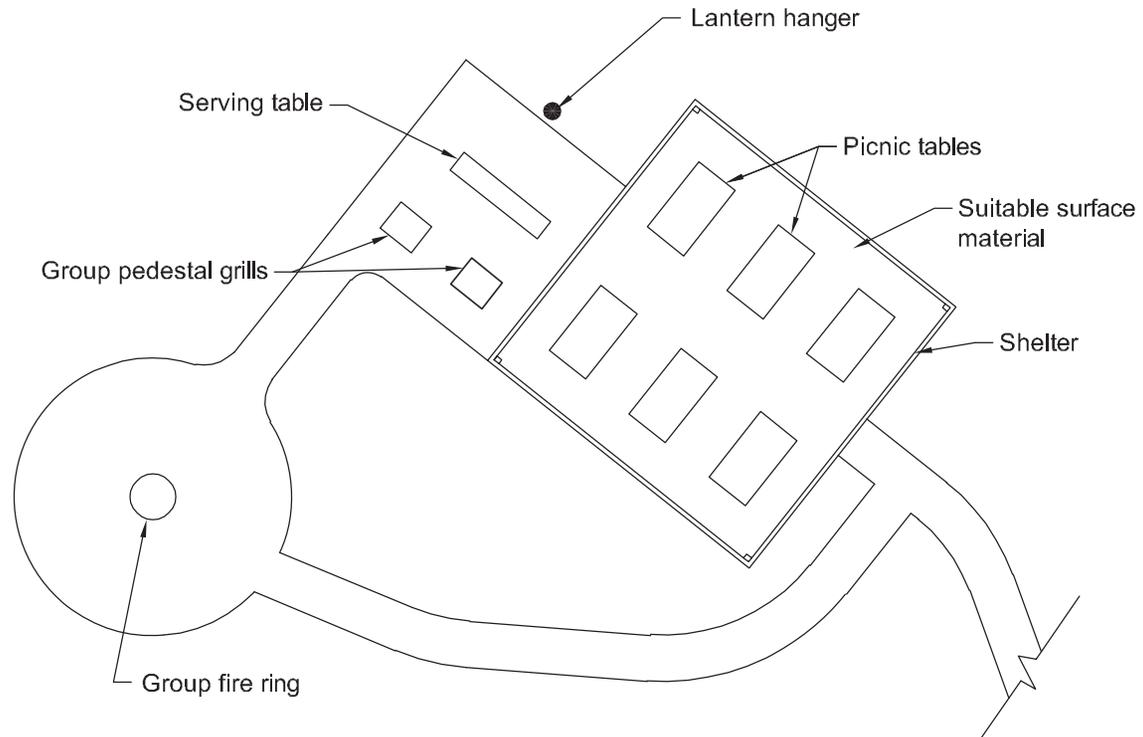


Figure 9-18—A group gathering area for a recreation site with a moderate to high level of development.



### Picnic Units

When planning picnic units at trailheads, provide different sizes of living areas because the number of riders traveling together varies. The best approach is to incorporate single-party (figure 9–20), double-party, and several-party living areas. Because living areas in picnic units also receive heavy foot traffic, consider paving them.

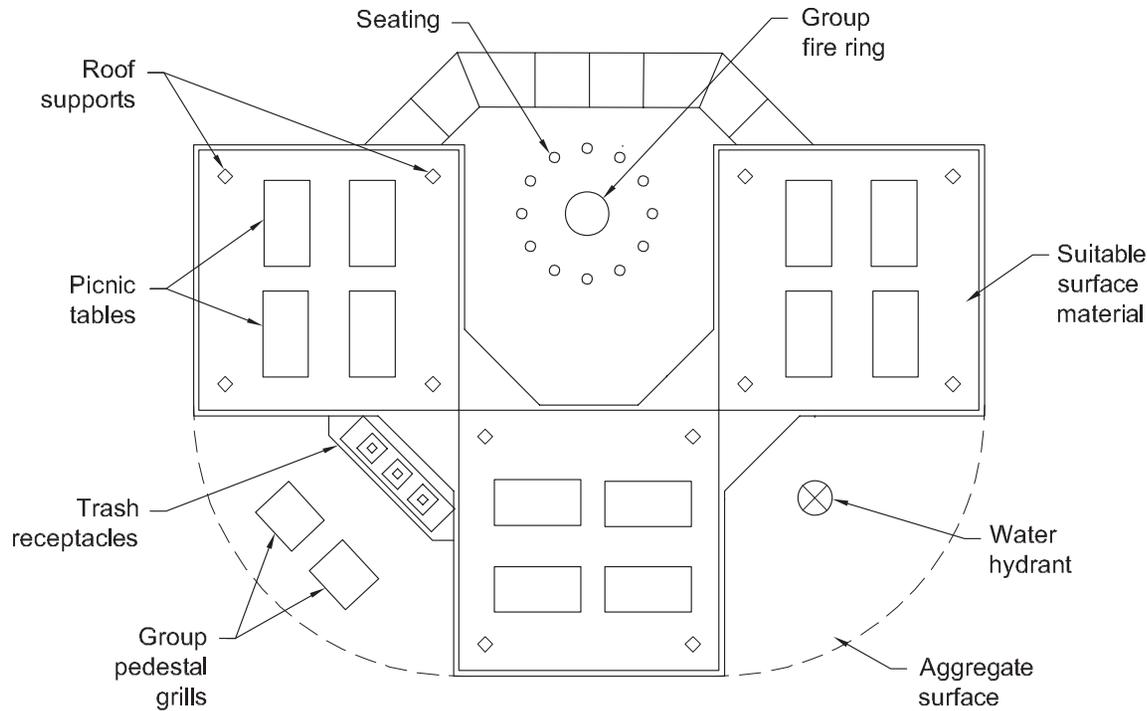


Figure 9–19—A group gathering area under three roofs for a recreation site with a high level of development.

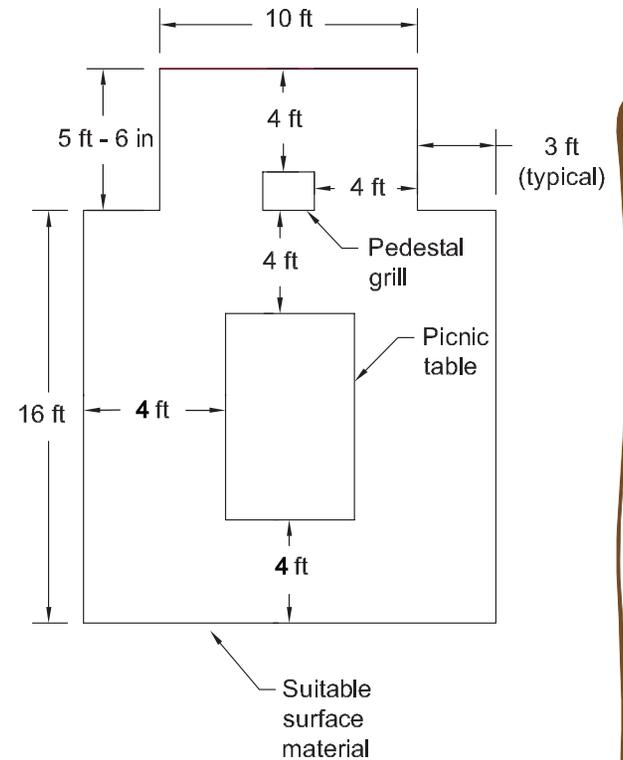


Figure 9–20—A single-party living area in a picnic unit. The dimensions are minimums.





### Equestrian Site Furnishings

Common recreation site furnishings include picnic tables, fire rings, grills, lantern hangers—and in group sites, serving tables. The best furnishings require little maintenance, have a long lifespan, are easy to clean, and are difficult for vandals to damage. Furnishings also must be convenient, easy to use, and safe. Avoid items with protruding objects or sharp corners that could injure users. Table 9–2 lists the suitability of site furnishings for living areas.

Table 9–2—Suggested suitability of recreation site furnishings.

Facility	Single-, double-, and several-party camp units	Single-, double-, and several-party picnic units	Group camp gathering areas
Picnic table	Usually provided	Usually provided	Usually provided
Fire ring	Usually provided	Not usually provided	Usually provided
Grill	Usually provided	Often provided	Usually provided
Lantern hanger	Often provided	Not usually provided	Often provided
Serving table	Not usually provided	Not usually provided	Often provided



#### Trail Talk

##### Accessible Furnishings

The Architectural Barriers Act (ABA) requires most agencies to include accessible furnishings when constructing new facilities, even if the route or living area does not meet the accessibility requirements. For example, at campgrounds cooking surfaces should be raised above the ground and grill grates should be easy to lift. Furnishings that are accessible are more convenient and comfortable for most users. For more information, refer to *Appendix F—Summary of Accessibility Legislation, Standards, and Guidelines* and *Chapter 11—Designing for Riders With Disabilities*.

### Picnic and Serving Tables

Many users bring their own grill or stove, but few carry a picnic table. Provide picnic tables in campgrounds and at trailheads where day use is encouraged. Tables are available commercially in wood, metal, concrete, recycled plastic, and plastic-coated expanded metal. Select the table material based on the level of development, climate, and amount of vandalism expected at the site. Serving tables are not a necessity, but groups appreciate the extra space for preparing and serving food (figure 9–21).



Figure 9–21—A serving table is a convenient amenity at a group camp.



## Fire Rings and Grills

Fire rings are essential at camp units because they reduce fire hazards and make maintenance easier. Because evening use is not encouraged at picnic units, fire rings are unnecessary there. Preferred fire ring styles have a hinged base so the cooking grate can be tipped back to clean out the ashes. Many accessible fire rings have an expanded metal barrier around the perimeter to keep campers from leaning against the hot surface.

Grills are needed in campgrounds and may be installed at day-use trailheads. Pedestal varieties are designed at a level comfortable for most users, and are the most common. The best models have a cooking grate that is hinged and can be raised and lowered. Some models include lids to reduce cooking time and to keep food warm. Rotating grills and shelves for utensils are other options.

It is a good idea to equip each equestrian camp unit with both a fire ring and a grill to meet all cooking and campfire needs. If funding does not allow both, fire ring and grill combinations (figure 9–22) are available. Combination models with hinged and adjustable cooking grates are best for cooking and are easy to clean.



Figure 9–22—This combination fire ring and grill has multiple cooking levels and a surface for fires. This accessible style works well for most users.

## Lantern Hangers

Some campers appreciate lantern hangers—they are convenient and protect trees from damage. The recommended distance from the ground to the lantern hanger is about 80 inches (2,032 millimeters). Because an 80-inch hanger, such as the one shown in figure 9–23, is not accessible, a second hook can be mounted where people in wheelchairs can use it.



Figure 9–23—For lantern hangers to be accessible, they should not be more than 48 inches from the ground. This style of lantern hanger could be adapted by adding a second, lower hook.



**Chapter 10—****S**ecuring Horses and Mules

After riders unload their stock at a recreation site, keeping them there can be a challenge. Stock may escape when a handler accidentally leaves a corral gate open, when a mule opens a gate or unties itself, or when a rider falls off and the horse runs away. A combination of continuous perimeter fences, road barriers, and trail barriers is vital. Inside the recreation site additional confinement methods are used. Corrals and highlines secure stock at camp units, especially overnight. Hitch rails serve short-term needs. Arenas and round pens provide space for exercising and training horses and mules.

**Importance of Perimeter Fences**

When a horse or mule gets loose, it may remain calm or it may run wildly about. Other stock nearby may get nervous if they see or hear a loose animal running because they assume it is running from a predator. Powerful instincts kick in, and the stock nearby may try to join the freed animal and flee the perceived threat. An unbroken barrier around the recreation site makes it easier to catch escaped stock and prevents them from running headlong onto a busy road. Perimeter fences also keep large wildlife

or domestic animals, such as cattle, out of the site. These uninvited animals are nuisances and can hurt recreationists. Combine perimeter fences with a barrier at the site entrance.

If the terrain is varied, locate perimeter fences on the highest point of the landscape. Horses and mules watch the horizon and are more likely to see the fences there. They may not notice fences in drainages or hollows.

**Fence Materials and Construction**

The materials used to build perimeter fences and horse enclosures, such as corrals, arenas, and round pens, are often the same. Slight variations exist in construction details. For maximum security, perimeter fences should not be one side of a corral, arena, or round pen. When choosing materials for perimeter fences and horse enclosures, the primary consideration is safety. Materials must be durable, suitable for the application, and appropriate for the level of development. The goal is to choose horse-friendly, nontoxic materials that discourage chewing and scratching.

The cornerposts of perimeter fences need to be larger diameter than the lineposts, because cornerposts receive more stress. The recommended distance between perimeter fenceposts is 8 to 12 feet (2.4 to

**Scratching an Itch****Horse Sense**

Horses and mules like to rub against fences, structures, and trees to relieve the discomfort caused by insect bites, dried sweat, or shedding hair. They can cause substantial damage when scratching their itch.

3.6 meters). Set all posts in concrete and bury them an appropriate depth for local soil conditions. The higher the fence, the deeper the posts must be buried. Set cornerposts and gateposts deeper than lineposts. Regardless of the fence style selected, the bottom rail or strand should be no less than 1 foot (0.3 meter) from the ground, high enough to allow mowing or raking, yet low enough to prevent small stock from rolling under the fence. Corrals, arenas, and round pens should be 5 to 6 feet (1.5 to 1.8 meters) high. The recommended height for perimeter fences is between 4.5 and 5 feet (54 and 60 inches or 1,372 and 1,524 millimeters).

Avoid making square or rectangular enclosures that hold more than one animal, because they can be unsafe. Horses and mules that are being pursued are less likely to be trapped by more aggressive stock when enclosures are oval or have angled sections instead of 90-degree corners.





### Post-and-Rail Construction

Post-and-rail construction is suitable for perimeter fences and horse enclosures. One style places the rails in line with the posts, and the other mounts the rails on the sides of posts. Of the two styles, inline construction generally is stronger, cleaner, and looks more professional (figure 10–1). Placing steel rails in line requires more welding and is more costly. Saddle-welded joints are preferred because they are stronger than surface- or butt-welded joints. Mounting steel rails on the sides of posts usually is more economical because it requires less labor. However, the fence appears bulky and may have weak joints at the cornerposts (figure 10–2). Rails on the inside don't pop off as easily if an animal runs into or pushes against them.

Some post-and-rail fences made of wood and vinyl have inline rails. The rails measure up to 16 feet (4.9 meters) long and are set in holes drilled through the posts (figure 10–3). Many traditional wood fences have rails attached securely to the sides of the posts on the inside of the horse enclosure.

Post-and-rail perimeter fences and horse enclosures may have three to five rails. Riders debate the required number of rails needed in corral fences. Some feel that the more rails in a corral fence, the better it is. They recommend using four or five rails, saying that the fence appears more solid to a horse

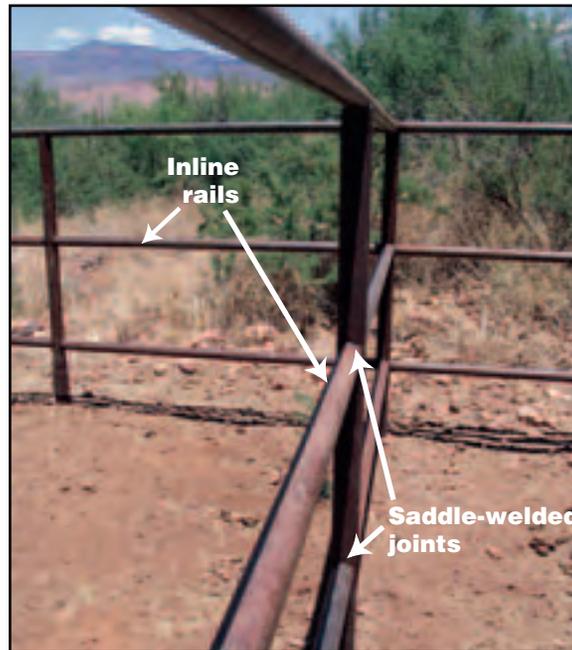


Figure 10–1—Welded inline rails generally are stronger than side-mounted rails. Saddle-welded joints are preferred.

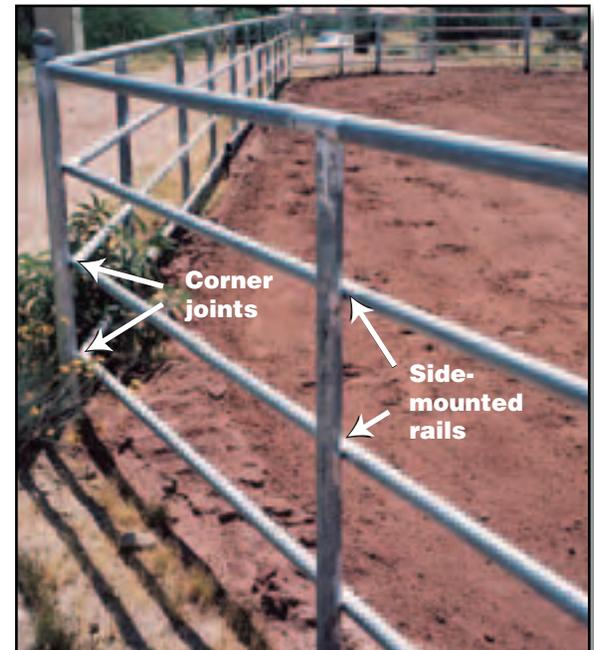


Figure 10–2—Steel fence rails mounted on the sides of posts are more economical, but they may have weak corner joints.

or mule, reducing any temptation to run through it. Other riders say the more rails, the easier it is for an animal to trap a leg or hoof. These riders prefer three rails. When deciding how many rails are needed, seek input from riders who will use the enclosures. Regardless of the number of rails, fences must be free from sharp corners or protruding hardware. This is critical—horses, mules, and people get hurt when they rub against sharp objects.



Figure 10–3—Some rustic wood fences have inline rails that pass through holes in the posts.



### Steel Post-and-Rail Fences

Fences made of steel posts and steel rails are suitable for most perimeter fences and horse enclosures. While steel post-and-rail fences cost more initially than fences made from other materials, steel fences are the most durable and will please riders. The horizontal rails usually are made from schedule 40 pipe that is at least 1 $\frac{7}{8}$  inches (about 47.6 millimeters) in diameter. Posts usually are schedule 40 pipe that is 2 $\frac{3}{8}$  inches (about 60.3 millimeters) in diameter.

Galvanized finishes reduce maintenance, but they may be too shiny for some settings. Black pipe is sometimes used because it rusts, allowing it to blend with less developed settings. However, rusted pipe tends to leave red particles behind when stock rub against it, something riders don't appreciate. If steel fences are painted, use an earth-toned enamel product that blends with the environment. Some stock chew on anything, including steel rails. If the steel rail is painted, chewing can make it unsightly.

Caps on posts keep rainwater from settling at the bottom and rusting through or weakening the posts. Caps on exposed pipe ends keep out bees and wasps.

### Wood Post-and-Rail Fences

Wood post-and-rail fences blend well with the natural environment. However, most stock chew on wood fences (figure 10–4). Not only do chewed rails have to be replaced or maintained frequently, ingested wood slivers may be hazardous to stock. Wood rails can be treated with a solution that discourages chewing, but the solution is costly. Stock can easily damage wood fences or panels when they kick, especially if the rails are weak (figure 10–5). Wood post-and-rail fences need to be checked frequently for damage and decay.



Figure 10–4—Hungry or bored stock often chew on inappropriate items, causing considerable damage.



Figure 10–5—Riders repair corrals with whatever materials are available—in this case, baling twine and wire. Schedule regular inspections and maintenance so riders don't have to make repairs themselves.



### Preserving Wood

#### Resource Roundup

For an overview of wood preservatives, treatment processes, alternatives, and guidelines, refer to *Preservative-Treated Wood and Alternative Products in the Forest Service* (Groenier and Lebow 2006) at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06772809>. This site requires a username and password. (Username: t-d, Password: t-d)



The American Youth Horse Council (1993) lists decay-resistant woods that are suitable for horse enclosures. Osage orange, western red cedar, western juniper, and black locust make good post materials without pressure treatments. Painting or staining wood fences may help them last longer. Waterborne treatments usually are safer for stock than oil-based treatments. Surface treatments require regular reapplication and are not as effective as pressure treatments. Although pressure-treated posts and rails last longer than untreated posts, avoid posts and rails treated with chromated copper arsenate (CCA), pentachlorophenol (penta), and creosote, because these substances may be harmful or toxic to stock.



Figure 10-6—Sizable rails, attached to the inside of posts, define a classic wood corral.

Wood is most appropriate for perimeter fences, arenas, and round pens where horses and mules don't spend a lot of time. Stock spend more time in corrals and have more opportunity to chew or damage wood. Wood is still the most popular material for corrals in some areas of the country. Figure 10-6 shows a sturdy wood corral with round rails.

### ***Vinyl Post-and-Rail Fences***

Molded vinyl materials (figure 10-7) are suitable for perimeter fences, arenas, and round pens because they are durable. Some synthetic fence materials that have a steel wire bonded inside are light, but are still strong enough for gates. When correctly installed, vinyl fences generally need little maintenance. Most synthetic materials have ultraviolet stabilizers and antifungicidal agents that aren't toxic to stock and stock don't find vinyl appealing to chew on. Vinyl has no sharp edges, so most stock don't get satisfaction from rubbing against it. Synthetic fence materials are available in many colors, including colors that harmonize with the surrounding environment—dark green, brown, and black. Vinyl and similar synthetic materials don't blend well in areas with a low level of development—they are more suited to highly developed areas. A disadvantage of vinyl fence panels is their high initial cost.



Figure 10-7—When they are installed correctly, vinyl post-and-rail fences are strong, durable, require little maintenance, and have no sharp edges to injure stock.

### **Premanufactured Tubular Panels**

Equestrians commonly use premanufactured metal panels to construct horse enclosures at home. The lightweight, inexpensive panels are a popular substitute for steel pipe in corrals, arenas, and round pens. It is easy to construct temporary enclosures like the one shown in figure 10-8. An advantage of these panels is their somewhat forgiving nature. Horses and mules are less likely to be injured if they kick or collide with a panel than with a permanent fence.

The safest tubular fence panels are connected with hinged rods, but these panels are difficult to install on uneven terrain. Panels with loose pin connectors



are easier to install on uneven surfaces, but stock may be able to catch a leg or tail in the gap between panels (see figure 10–62). Panels with rounded corners may appear safer for stock but they are actually more dangerous. If an animal rears higher than the rail, the rounded corner can funnel the animal's hoof or head into the gap between panels. A square corner with edges that have been ground smooth is better. Other fasteners include bolt clamps and rubber connectors to secure the panels solidly. Stock can rub on the protruding fasteners, which may give way, releasing the panel and freeing the horses.

If the recreation site budget does not cover steel pipe, vinyl, or wood for enclosures, consider using tubular fence panels—but use them with caution. Occasionally an agitated animal will knock the panels down and escape. Sometimes riders tie stock to panels when preparing for a ride. The unsecured panel



Figure 10–8—Building a corral is quick and easy with premanufactured metal panels.

may move if something spooks the tied animal and it pulls back. Frightened by the panel's unexpected movement, the animal may run off, dragging the panel behind it. There are several solutions:

- ☆ Install permanent posts in corrals, arenas, and round pens.
- ☆ Place hitch rails near horse areas, arenas, or round pens.

### Wire Fences

A horse or mule is more likely to challenge materials it can lean over or push through. Because wire fence materials stretch, they are not suitable for corrals, arenas, round pens, or gates. Horses also can get their feet or heads caught in the wires. If they are constructed properly, wire fences may be used to secure a site perimeter. Smooth wire fences with four strands are generally adequate to discourage fleeing stock. Fences with five or six strands are even more secure.

A leaning or running animal can loosen wire fences—install materials on the inside of the posts for maximum strength. Avoid using T-posts for wire and wire-mesh fences, because stock may impale themselves on the posts. Pressure-treated wood is a sturdier—and safer—solution.

High-tensile, smooth wire of at least 12.5 gauge can be used instead of barbed wire. High-tensile wire coated with vinyl or plastic is safer—although it

costs more than uncoated high-tensile wire. Coated, smooth wire costs less than post-and-rail construction and does not rust, stretch, or fade. When installed properly, coated wire provides an effective perimeter fence. Coated smooth wire is strong, somewhat flexible, and easier for stock to see than uncoated smooth wire. If stock do run into coated wire, they have less chance of injury than with barbed wire. When using smooth wire for a perimeter fence, consider adding a steel, wood, or vinyl top rail so that stock can see it easily. Using smooth wire instead of barbed wire doesn't eliminate the possibility that stock might get tangled in the strands.



### Barbed Response

#### Horse Sense

In some areas, perimeter fences keep cattle out of the recreation site while keeping stock inside. The traditional cattle fence incorporates multiple strands of barbed wire, an unsafe practice for horse fences. When horses and mules catch a leg or hoof in fences, they often struggle vigorously to free themselves and sustain serious injuries. Barbed wire is generally not recommended for horse fences—many alternatives are safer. When barbed wire must be used, a compromise is to use smooth wire or wire mesh for the bottom of the fence, and a single strand of barbed wire at the top (figure 10–9). Do not use barbed wire for interior fences.

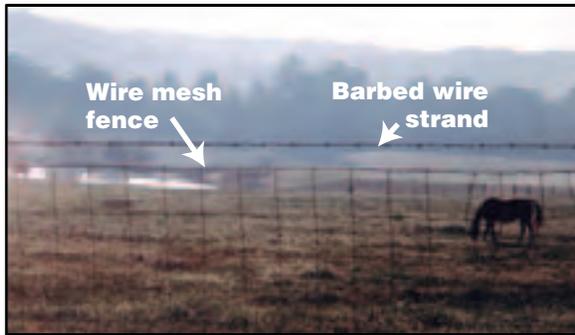


Figure 10-9—Barbed wire discourages cattle from leaning over and breaking down a fence, but can be dangerous for horses and mules. Choose an alternative fencing material in recreation sites.

Wire mesh stretches when a horse hits it, distributing the impact over a wide area and reducing injuries and damage. The mesh should be attached to a post-and-rail fence made of wood or steel (figure 10-10). As with all enclosures, secure the boards and wire to the inside of posts. For horse fences, V-mesh woven wire, a more costly variation, generally is safer than rectangular woven wire. Table 10-1 lists suggested materials for horse fences and gates. Table 10-2 compares characteristics of materials suitable for fences in equestrian recreation sites.



Figure 10-10—Attaching wire mesh to post-and-rail fences makes the fence more resilient. Stock also can see it better.

### Wire Mesh Fences

Wire mesh is made of woven wire or welded wire and is commonly used for horse fences. The bottom portion of the pasture fence in figure 10-9 is constructed of wire mesh. Woven wire is a better choice than welded wire, because aging welds can burst, resulting in sharp projecting ends. Although wire mesh is the least expensive fence material, it is not safe for use on horse corrals. When some horses and mules are kept in wire mesh enclosures, they try to climb or step on the wire grids. They can easily catch a hoof or horseshoe in the wire. Wire mesh is suitable for perimeter fences, arenas, and round pens because horses are not loose there for long.

Table 10-1—Suggested materials for horse fences, enclosures, and gates.

Material	Perimeter fences	Corrals	Arenas and round pens	Gates	Appropriate level of development
Steel post and rail	X	X	X	X	Low, moderate, high
Vinyl post and rail	X		X	X	High
Wood post and rail	X	X	X		Low, moderate, high
Square, woven wire mesh	X		X	X	Low, moderate, high
Tubular panels		X	X	X	Low, moderate, high
Coated, smooth wire	X				Low, moderate, high



Table 10–2—Characteristics of fence and panel materials for equestrian recreation sites.

Material	Sturdy	Economical	Safe for horses	Low maintenance	Long lifespan
Steel (unpainted)	Excellent	Poor	Excellent	Excellent	Excellent
Wood	Fair	Good	Poor	Poor	Poor
Vinyl	Excellent	Poor	Excellent	Excellent	Excellent
Portable panels	Poor	Excellent	Poor	Good	Poor
Square, woven wire mesh	Fair	Excellent	Poor	Fair	Fair
Coated, smooth wire	Fair	Good to excellent	Fair to good	Fair	Fair to good

## Cattle Guards, Gates, and Latches

Perimeter fencing by itself is not enough. To complete the continuous barrier around the recreation site, install gates at trail access points and roads. Within the recreation site, provide appropriate gates and latches for corrals, arenas, and round pens. Often a cattle guard is required by land management agencies, but most riders do not like them.

### Cattle Guards

Many agencies require cattle guards on access roads to keep cattle out of recreation sites. Cattle guards are dangerous for horses and mules—whether they are loose or under saddle. They may try to walk or jump over the cattle guard or walk around its ends. They can trap a hoof or leg in the cattle guard, severely injuring themselves. Figure 10–11 shows a cattle guard that has objects and barbed wire in the angled side wings, creating hazards for all users. If a cattle guard is required, install a vehicle gate between the recreation site and the cattle guard to contain loose stock. If a gate is not feasible, consider painting bold, white parallel stripes on the pavement between the recreation site and the cattle guard. Some horses and mules are reluctant to cross these highly visible markings, and the sight may temporarily distract a fleeing animal. Cattle guards generally are subject to the MUTCD or the governing agency’s sign requirements.



### Electric Solutions

Many riders travel with portable electric corral kits that include posts, fasteners, stakes, a gate, synthetic wire, a tester, and a battery-operated fence charger. Horses and mules are very sensitive to small electrical shocks. One shock is usually enough to convince stock to stay away. When stock have been conditioned to electric fences, they generally don’t test or challenge them, but

### Horse Sense

if a horse or mule perceives a real or imagined predator, an electric fence will do little to deter the animal’s flight. Animals, people, or property can be hurt. Other domesticated animals and wildlife may not respect electric fences, whether they are set up with single or double strands. This guidebook recommends using other fence options for equestrian recreation sites.



Figure 10-11—Some stock attempt to go around cattle guards. Pieces of wood stuck in the wings of this cattle guard discourage passage, but are safety hazards for all users. Find another solution. Cattle guards must be marked according to the MUTCD standards.

### Road Gates

A gate provides a safe barrier that will be respected by loose stock. Provide gates at entrances to campgrounds and trailheads and at each loop road. Even though the loops may not be fenced, gates can help if access must be restricted for any reason, including maintenance and renovation. Entrance

road gates should remain closed except when a rider opens and closes them for vehicle access. Plan for turnaround areas when placing gates, so gate closures do not create dead ends. Figure 10-12 shows the perimeter fence and gates in a campground with loops and turnarounds.

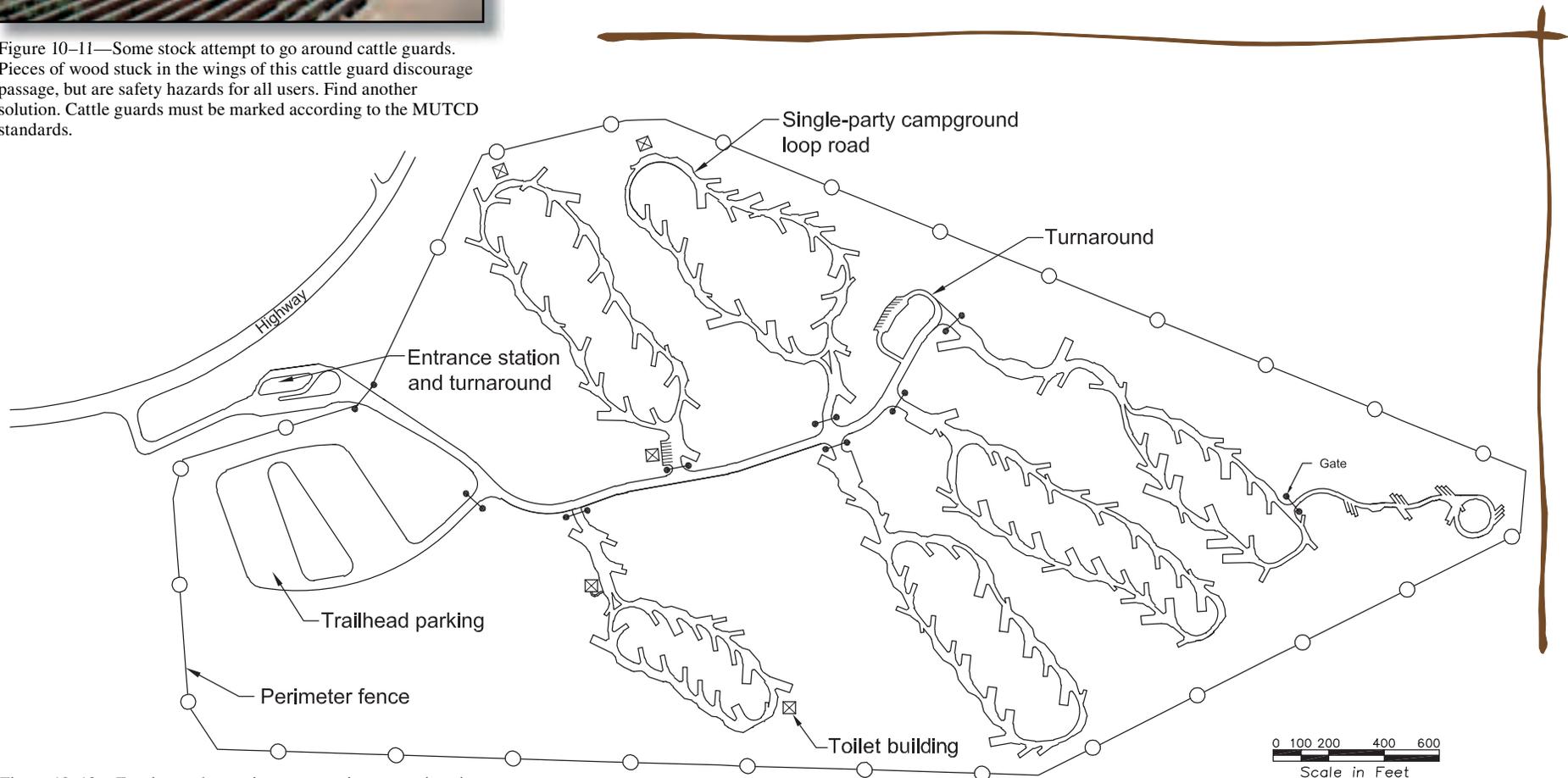


Figure 10-12—Fencing and gates in an equestrian recreation site.

0 100 200 400 600  
Scale in Feet



Road gates commonly range from 16 to 20 feet (4.9 to 6.1 meters) wide. Two-lane roads normally have two gates. Figure 10–13 shows a gate suitable for an area with a high level of development. A standard gate is preferred in areas with low to moderate development (figure 10–14). A farm gate is more appropriate for areas with low development (figure 10–15).

When trails or attractions are outside the recreation site, provide a smaller trail gate beside the road gate. The additional gate is necessary when a cattle guard blocks the exit (figure 10–16). Trail gates are easier for riders to open and close than large road gates.



Figure 10–14—A gate commonly used by the Forest Service in recreation sites.



Figure 10–15—Farm gates are used in some areas for horse trails.



Figure 10–13—This pair of gates is suitable for a recreation site with a high level of development.

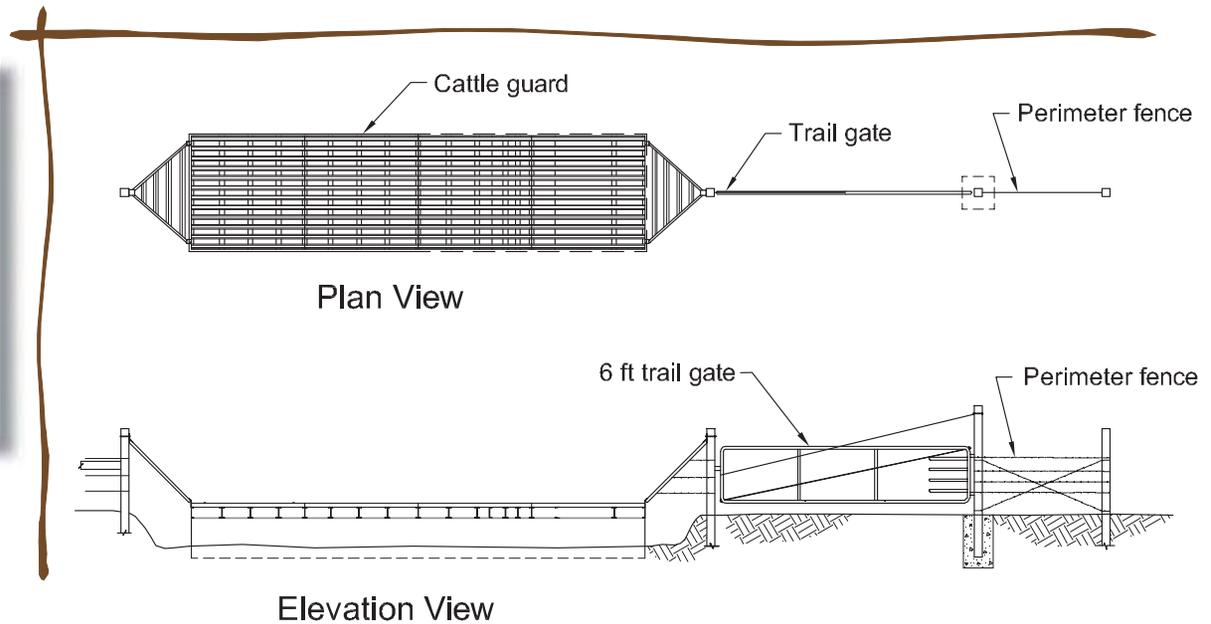


Figure 10–16—A cattle guard with an adjacent trail gate.

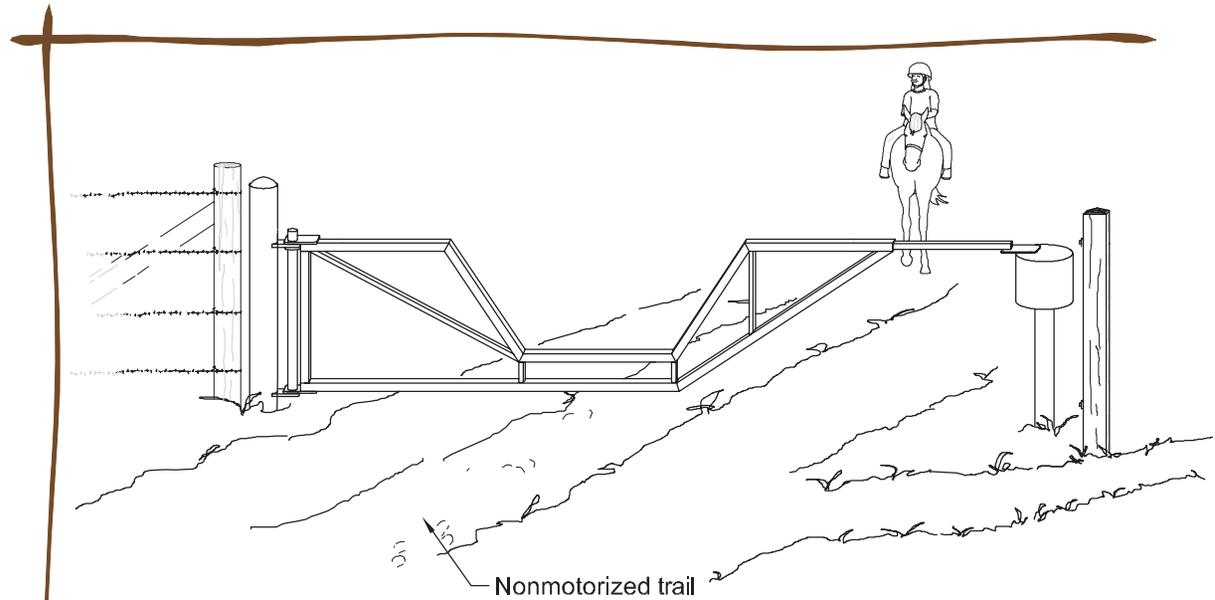


### Stepover Gates

A road gate can have a low section—or stepover—that keeps wheeled vehicles out, but allows pedestrians and equestrians to pass (figure 10–17). Gates with stepover bars are not effective perimeter closures because a loose horse or mule may walk or jump over the bars, as might wildlife or cattle.

Trail stepover gates have a horizontal bar or other device placed across the tread to deter unauthorized use. Figure 10–18 shows a rural trail with a narrow V-gate and a stepover bar. Land managers commonly use stepover gates to discourage motor vehicles on nonmotorized trails. Stepover gates are not foolproof. While it is difficult to get an off-highway vehicle (OHV) across them, it is easy to lift motorbikes over them. Recreationists sometimes fill the gap between the ground and the bar with soil, creating a ramp for motor vehicles. One challenge facing land management agencies is designing a stepover gate that allows a person with disabilities to pass through the barrier while excluding OHVs.

Many horses and mules routinely use stepover gates; others are hesitant to do so. Wrapping the bar with cushioning material will dampen the noise when an animal’s hoofs contact the bar. The preferred height for the stepover bar is 12 inches (305 millimeters). The maximum is 16 inches (406 millimeters). When a bar is too high, stock may jump over it, unseating inexperienced riders. On horse trails where riders



**Note:**

1. When a need has been appropriately determined, use standard object markers (Type II and III) to mark hazards, such as gates, within or adjacent to the trail.
2. When a need has been appropriately determined, traffic control devices, such as retroreflective signs, may be used on roads and trails open to motorized or mechanized traffic.
3. Retroreflective signs may be considered for added emphasis on trails that are closed to motorized and mechanized traffic.
4. All traffic control devices must meet the MUTCD or governing agency standards.
5. Signs are not shown for clarity.

Figure 10–17—This prototype road closure gate allows trail stock and pedestrians to pass, while restricting many motor vehicles. This trail gate is not accessible to people with disabilities because the bar across the opening is higher than 2 inches. See *Chapter 12—Providing Signs and Public Information* for sign details.



Figure 10-18—Riders, pedestrians, and mountain bikers can pass through this relatively narrow V-gate on a rural trail, but ATVs are restricted. The gate is not accessible to people with disabilities because it is narrower than the minimum width required for passage of a wheelchair—32 inches—and the bar across the opening is higher than 2 inches.

have limited experience, a bar lower than 12 inches (305 millimeters) may be appropriate. Tread surfaces on both sides of stepover gates wear down or become compacted over time, leaving the bar higher from the ground (figure 10-19). Short stepover bars



Figure 10-19—As heavy traffic wears the tread down, negotiating stepovers may become more difficult for all users. This trail gate is not accessible to people with disabilities because the bar across the opening is higher than 2 inches.

accommodate trail compaction, but may allow unauthorized trail users to pass. Higher stepover bars may require frequent maintenance because of tread

wear. To reduce tread wear at a stepover gate, install a concrete pad below grade and cover it with tread surface material (figure 10-20).

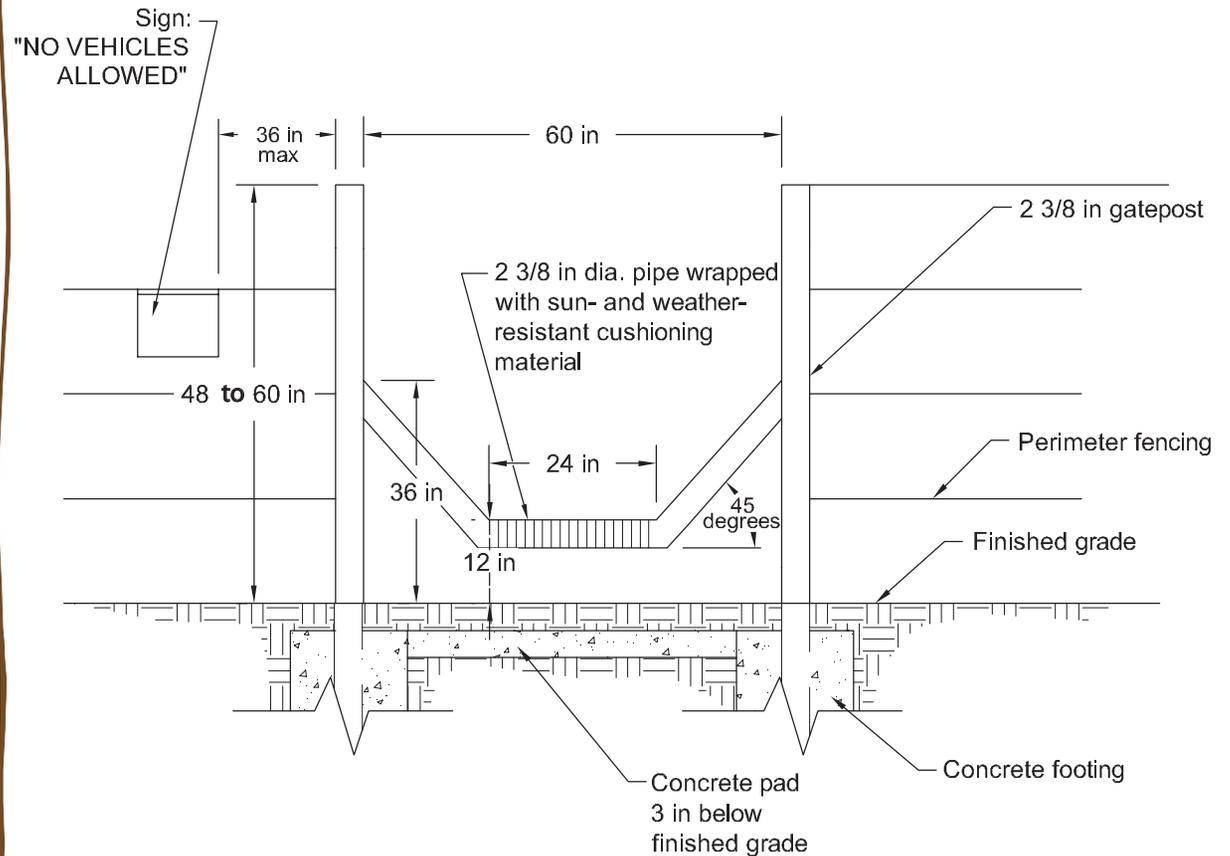


Figure 10-20—A stepover gate for nonmotorized trail users. This trail gate is not accessible to people with disabilities because the bar across the opening is higher than 2 inches.



10

### Trail and Corral Gates

Gates must be wide enough to allow riders, stock, and loads to pass through without rubbing. The minimum width for trail gates is 5 feet (1.5 meters), and the minimum width for corral gates is 4 feet (1.2 meters). A 6-foot- (1.8-meter-) wide gate is easier to use when riders are leading stock (figure 10–21). Standard, prefabricated gates are available in 4 and 6 feet widths, while 5-foot gates generally must be custom built. Trails often have standard 6-foot prefabricated gates because they cost less than 5-foot custom gates.



Figure 10–21—The bulky loads carried by packstock require relatively wide gate openings.

### Gates for Arenas and Round Pens

The minimum recommended gate width for arenas and round pens is 12 feet (3.6 meters) to allow access by maintenance vehicles. Large gates may be awkward for riders to open and close when they are leading an animal. To avoid installing a single, heavy gate consider installing two, 6-foot (1.8-meter) gates, or a 12-foot gate for vehicles with an adjacent 6-foot gate for riders (figure 10–22).



Figure 10–22—This arena can be accessed through a large or a small gate.

### Gate Designs

Stock perceive narrow gates, or those that don't swing completely open, as tight spaces and may move too quickly through them for safe passage. Gates that swing freely in and out of the enclosure are the best. Gates should be easy to open and close with one hand—riders should not have to pick up a gate end and carry it. Once opened, gates should stay open long enough to lead an animal through them. A gate that unexpectedly swings closed against an animal can startle it. Self-closing gates that close too quickly can snag packs, loads, and reins in the closing device. Many riders dismount, hold the self-closing gate open with one hand, and awkwardly maneuver the animal through with the other hand. Sometimes, another rider dismounts and holds the gate open as others pass. To remedy such problems, install a large hook and an eye bolt to hold the gate open.





### Gate Materials

Construct gates from smooth fence materials, such as steel, to discourage stock from rubbing against them and straining the hinges. The ideal gate is strong and lightweight—heavy gates frequently sag (figure 10–23) over time. Gates made of wood rails or lumber are heavy, especially if they span more than 5 feet (1.5 meters). Wood gates longer than 5 feet will require frequent maintenance. A premanufactured gate made of steel tubing is a sturdier option that will require less maintenance (figure 10–24). Prefabricated farm gates made with formed flat steel or standard aluminum livestock gates are not safe for horses and mules. When a horse gets a leg caught in a gate made with these materials, the rolled edges can open, injuring the animal as it tries to pull free. The lightest gate material is chain (figure 10–25). When gates are made of wire mesh, a structural frame of steel or vinyl is recommended for stability and ease of use.



Figure 10–23—Wood corral gates are heavy and can sag over time. This corral has rails attached to the outside of posts. A horse could pop the rails loose by leaning against them.



Figure 10–24—Premanufactured tubular steel gates are lighter and less likely to sag than wood gates.



Figure 10–25—Chain gates are simple and effective. Some riders do not like them because a horse or mule may get its head or hoof caught in the large openings.

### Gate Safety

A safe gate doesn't have sharp edges or protrusions that can cut stock. Figure 10–26 shows an attempt to repair a damaged gate with baling twine, unacceptable for recreation sites. Grind smooth or round all gate corners. Otherwise, curious or playful stock may hurt themselves. Although most tubular steel gates have safe, rounded bottom corners, some have sharp ends on the vertical tubes that can cause serious injury if an animal catches a hoof or leg under the gate. Maintain gates regularly.



Figure 10–26—Baling twine provides a temporary—and possibly unsafe—field fix for a broken gate. Schedule regular inspection and maintenance for gates and fences in recreation sites.





Gateposts can support a heavy swinging gate if the posts are set in concrete. Minimize the gaps between the gate and the gateposts, so swished tails won't get caught. Gates should fit closely to the posts, with clearance only for hinges. Make sure the upper hinge pin on horse gates made from pipe or tube is placed correctly. If the pin is set too low, stock can rear up and catch a front leg or hoof between the gate and the gatepost. Minimize the hazard by placing the upper hinge pin as high as possible on the gatepost. Avoid gates made from portable fence panels that have a bottom rail at ground level. When the ground erodes away from the base of the rail, stock can trip or wedge a hoof between the tube and the ground. If these gates must be used, they require regular maintenance.

### Accessible Gates

Accessible shared-use trails must have gates that meet ADA/ABAAG requirements. Because gates that can be opened from horseback may not meet pedestrian accessibility requirements, consider installing two separate gates, one for riders and one for other trail users, including people in wheelchairs. Figure 10–27 shows a horse-friendly road gate

combined with an accessible kissing gate. This gate and the gates in the following examples don't have latches. These gates would be suitable for trail installations, perimeter fences, and places where stock don't spend a lot of time. Gates without latches are not suitable for areas where horses and mules are confined, because they would figure out how to escape. The tread through accessible gates must meet the requirements for firmness and stability.

In 2006, MTDC developed a prototype equestrian kissing gate without a latch that is accessible to people in wheelchairs. Kissing gates, a half-round or V-shaped fence with a hinged gate, are used in the United Kingdom to confine livestock while allowing people to pass. The gate opens by pushing from either side, and closes when it hits the fence on either side. When the gate is pushed partially open, a gap allows a single person to pass through. The prototype MTDC gate combines a horse stile with a traditional kissing gate design (figure 10–28). This gate is appropriate where motor vehicle use is not allowed, because the gate combination restricts the passage of most OHVs and motorcycles.

In Utah, the Bureau of Land Management and the Forest Service use a dual-purpose V-gate (figure 10–29) that has an opening at the bottom wide enough to allow wheelchair access. The opening flares at the top to allow loaded packstock to pass. The gate blocks use by OHVs with four wheels, but doesn't restrict smaller vehicles, such as bicycles or motorcycles.

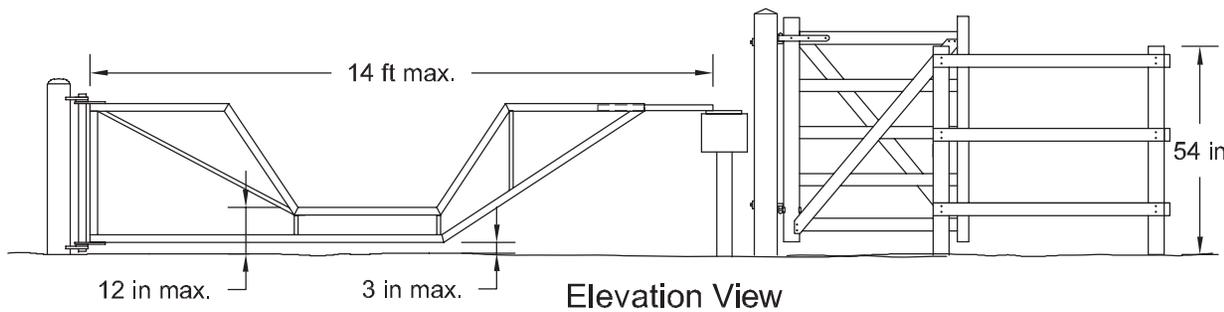
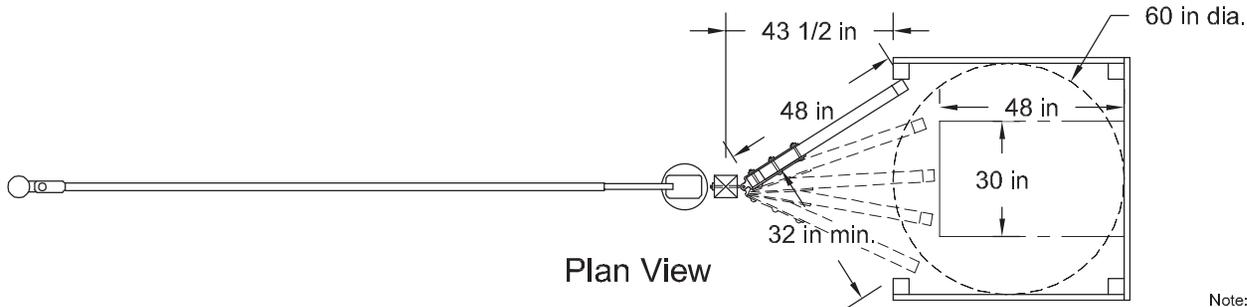
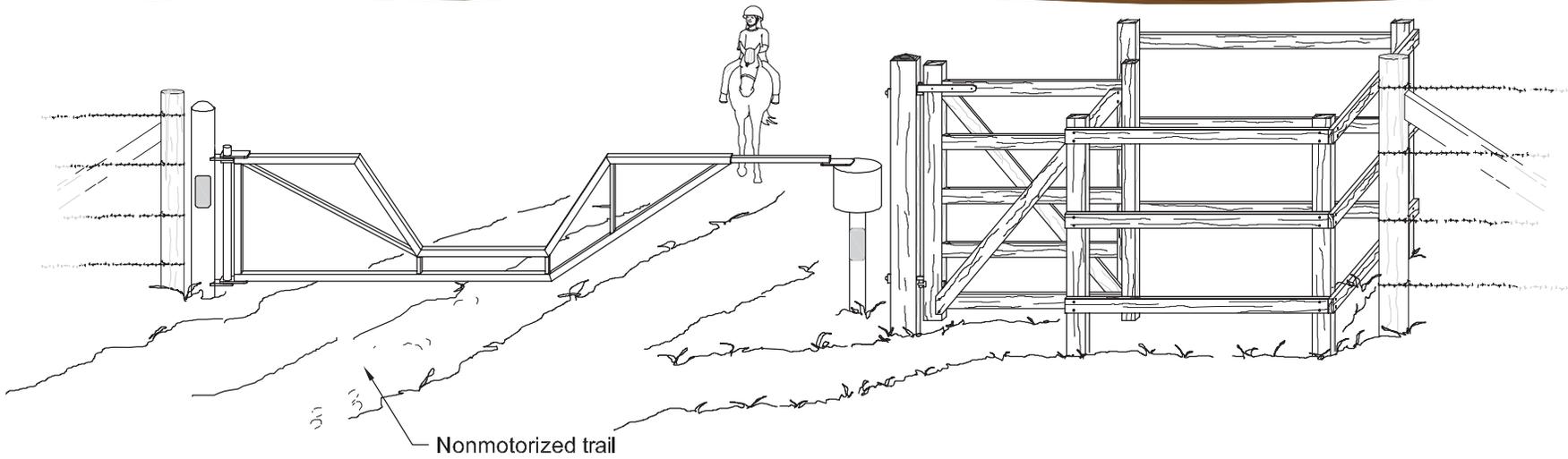
Figures 10–30 and 10–31 show another gate that discourages motor vehicles while allowing access for stock and wheelchairs. It is a modified *chicane*—double bend—design that incorporates an L-shaped leg off the main rail fence. To be accessible, the dimensions at the right turn must allow a 60-inch (1524-millimeter) turning radius for a wheelchair, which may permit passage by some small OHVs.



#### Resource Roundup

##### Accessible Horse Gates

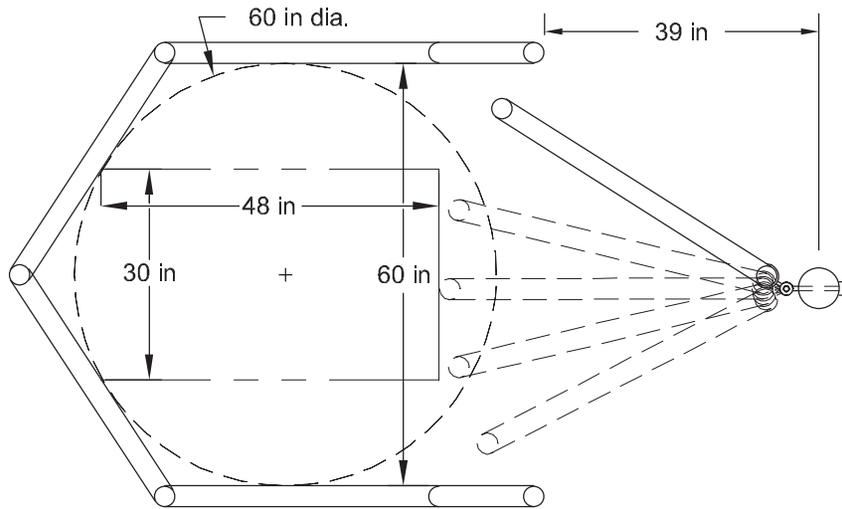
For more information on the accessible gates developed by MTDC, refer to *Accessible Gates for Trails and Roads* (Groenier 2006) at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232340>. This site requires a username and password. (Username: t-d, Password: t-d)



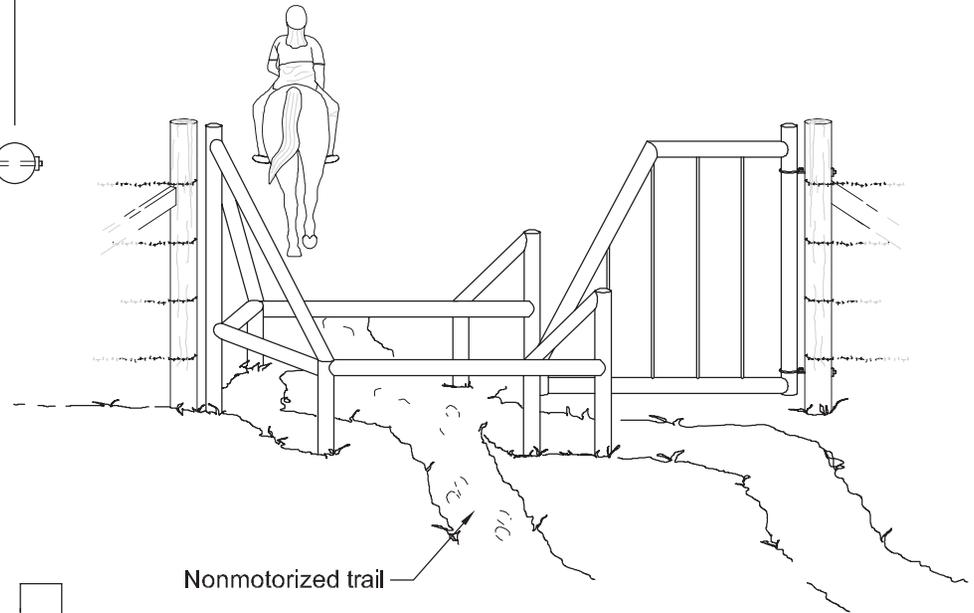
Note:

1. When a need has been appropriately determined, use standard object markers (Type II and III) to mark hazards, such as gates, within or adjacent to the trail.
2. When a need has been appropriately determined, traffic control devices, such as retroreflective signs, may be used on roads and trails open to motorized or mechanized traffic.
3. Retroreflective signs may be considered for added emphasis on trails that are closed to motorized and mechanized traffic.
4. All traffic control devices must meet the MUTCD or governing agency standards.
5. Signs are not shown for clarity.

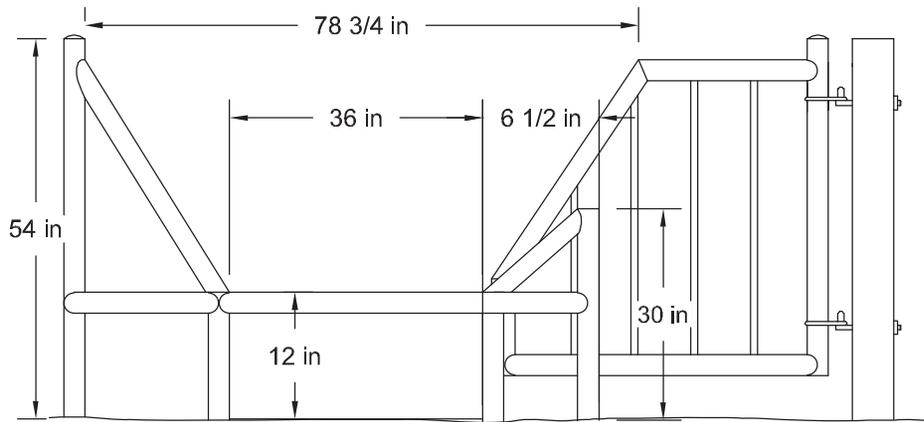
Figure 10-27—This prototype road closure gate has a kissing gate alongside. The combination would allow stock, pedestrians, and people who use wheelchairs to pass, while still restricting many motor vehicles.



Plan View



Nonmotorized trail

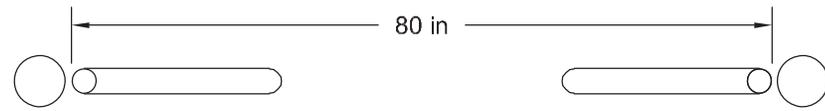


Elevation View

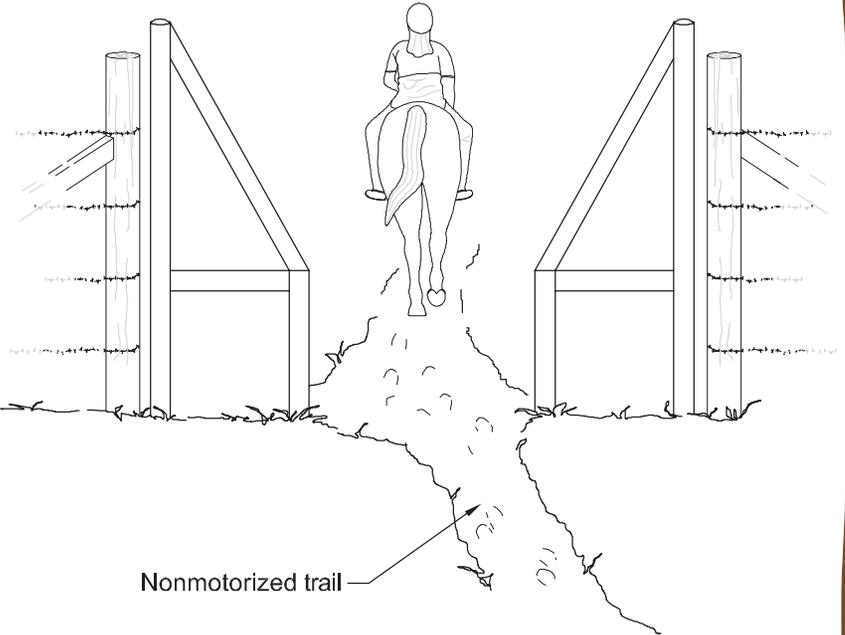
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Figure 10-28—A combination horse stile and accessible kissing gate.



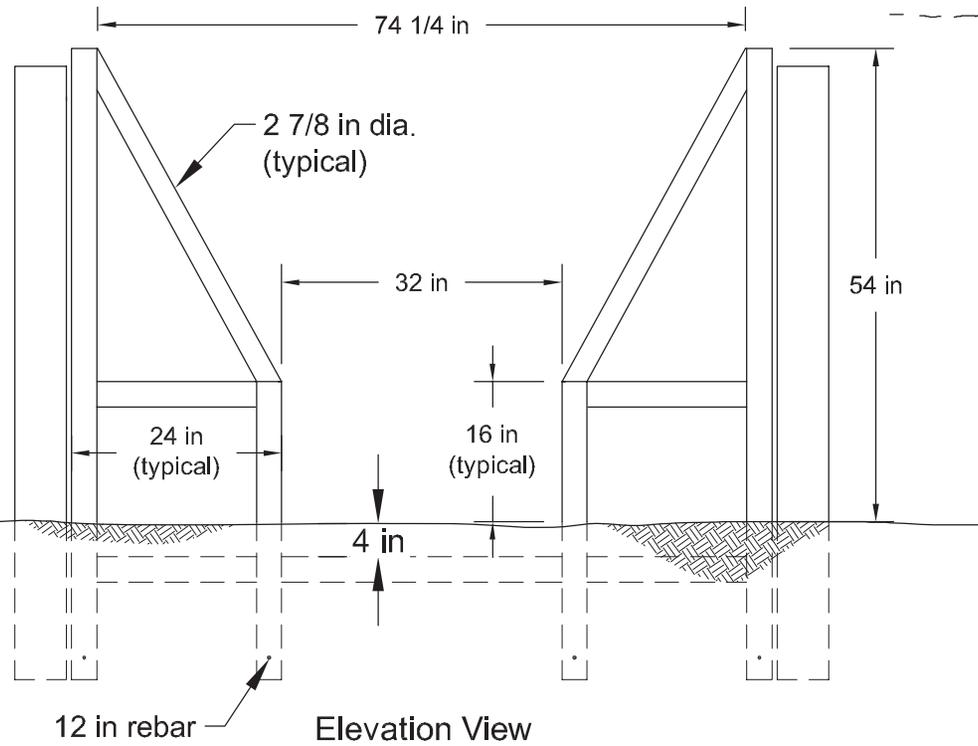
Plan View



Nonmotorized trail

Note:

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4. All traffic control devices must meet the MUTCD or governing agency standards.
5. Signs are not shown for clarity.



Elevation View

Figure 10-29—A V-gate for stock and pedestrians.



Figure 10-30—Chicanes use tight turns to prevent unauthorized use. The entrance to this modified chicane is immediately left of the signs.



Figure 10-31—The dogleg design of a chicane restricts some trail users.



### Gate Latches

When it comes to latches and gates, one size does not fit all equestrian situations. Gates along trails should have latches that can be opened from horseback. Corral gates and latches should open easily from ground level because riders generally dismount before leading stock into corrals. Arena gates are a slightly different situation. Many riders prefer to ride into arenas, and they appreciate latches that can be opened from horseback.

Suitable equestrian gate latches must be *horseproof*—strong enough to give an equestrian peace of mind and complex enough to withstand exploration by a mule’s prehensile lips. The latch and gate should be easy to operate with one hand because riders need the other hand to control their mount. A bored or lonesome animal may spend hours methodically moving a latch back and forth with its teeth or lips until the device breaks or releases. If a 2-year-old child can open a latch, a determined horse or mule probably can open it. To deter curious stock, choose horseproof hardware or shield the latch with an overhanging cover. Horseproof latches are optional on gates where stock are not confined for long periods, such as a trail gate designed to restrict motor vehicles while allowing pedestrians and riders to pass.

Premanufactured metal gates commonly include a slotted steel plate and a length of chain welded on the gate panel. The chain wraps around the gatepost and

slips into the slot (figure 10-32). Opening the gate is relatively easy with one hand, but closing it requires two hands to wrap the chain around the gatepost. This style is common in ranch country, but many horses and mules can open such gates. To prevent stock from escaping, wrap the chain around the post and use a strong snap to secure the chain.

The most secure latches generally are made of metal, and many are lockable. Horse-resistant latches may employ a sliding male hook or bar that fits into a female opening or sleeve. Some include a metal chain secured with a pressure snap that stock can’t operate.

Mounted riders generally can open gates equipped with double-piston, pull-rod, or spring-lever latches without dismounting. Place latches used by mounted riders about 5 to 6 feet (1.5 to 1.8 meters) above the tread.

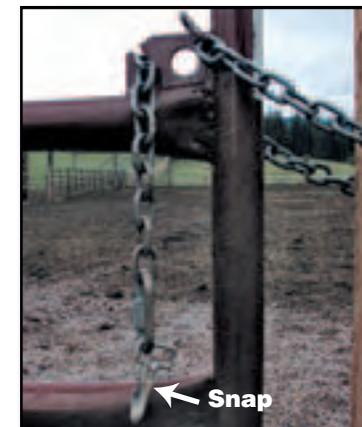


Figure 10-32—Premanufactured gates often come with a slot latch and chain to wrap around the gatepost. Attaching a sturdy snap that can be hooked back into the wrapped chain prevents most curious horses and mules from letting themselves out.



### Latching the Gate

Some effective and easy-to-use latches for horse gates include:

- ☆ Figure 10-33 is a lockable latch that comes with a self-latching strike plate. It is almost impossible for a horse or mule to open this latch.
- ☆ Figure 10-34 is a latch that opens easily with one hand from horseback or from the ground. It is rustproof, frostproof, and is difficult for stock to open.
- ☆ Figure 10-35 is a latch that opens with one hand from horseback or from the ground. When the latch is open, it allows the gate to swing both ways. When the latch is closed, it supports the gate. This latch is designed for gates with tubes that have an outside diameter of 1 $\frac{5}{8}$  to 2 inches (about 42 to 51 millimeters).
- ☆ Figure 10-36 is a self-latching unit that mounts on the post rather than on the gate. It is operated from horseback or from the ground. The gate can be pulled or pushed open by pressing down on the rod. Lifting the rod up and giving it a half turn locks the latch in place, foiling curious stock.
- ☆ Figures 10-37, 10-38, and 10-39 show some handmade latches that can be operated from horseback.



Figure 10-33— This galvanized latch is horse resistant.



Figure 10-34— This galvanized latch is easy to open with one hand, even from horseback. —*Courtesy of Ramm Fence Systems, Inc.*



Figure 10-35— This latch allows the gate to swing both ways, can be opened from horseback, and supports the closed gate. —*Courtesy of Co-Line Welding, Inc.*



Figure 10-36— Pushing down on this adjustable latch while pushing or pulling opens the gate. —*Courtesy of HiQual Manufacturing.*



Figure 10-37— This rustic wood gate opener has a lever that can be operated from horseback.



Figure 10-38— Pull-rod latches allow riders to open gates without dismounting.



Figure 10-39— A spring-lever latch must be placed appropriately to be used from horseback.



### Accessible Latches

Gates and latches designed to accommodate all riders, including riders who have disabilities, add tremendously to overall trail accessibility. To be accessible, latches must

comply with the ADA/ABAAG requirements—operating mechanisms must be operable with one hand without pinching, tight grasping, or twisting the wrist and cannot require more than 5 pounds (2.3 kilograms) of force to operate.



### Prototype Latch

In 2006, Hamilton Hinge Co. worked with MTDC to develop a prototype gate latch that keeps stock in and also provides access for people with disabilities (figure 10–40). The gate swings both directions and can be reached from a wheelchair. Dexterous riders can open the gate from horseback with their foot. Figure 10–41 shows a guard ring that can be added to discourage animal exploration. Because some clever mules and horses may be able to open this latch, avoid using it on corrals or other areas where stock are confined for long periods. This latch is best suited to trail or perimeter gates where stock have little opportunity to investigate the mechanism. For more information, refer to *Accessible Gate Latch* (Groenier 2006) at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232331>. This site requires a username and password. (Username: t-d, Password: t-d)

### Resource Roundup



Figure 10–40—Depressing the plate while pushing the gate releases this prototype accessible latch. Some riders can open the gate from horseback using their foot to depress the plate.



Figure 10–41—Adding guard rings on the gate frame confounds most escape attempts by stock. Because some clever horses and mules still may be able to open this latch, it is best suited for gates inside an area that also has a perimeter fence.

### Tethering Devices and Enclosures

The most common methods for securing stock within a facility and at camp units are tying them to something solid or placing them in an enclosure. The most suitable method depends on the length of time the horse or mule is confined and the individual animal’s personality. Preferences vary widely among riders.

Riders use the terms *hitching* or *tethering* to describe tying their stock. Preferred tether anchors in recreation sites include highlines, tie loops on horse trailers, and hitch rails. The most common horse enclosure in a developed recreation site is a corral, which is suitable for overnight use. Two other enclosures—arenas and round pens—are used for exercising or training horses. Generally, they are not used for confining stock at recreation sites.



No method of tethering or confining a horse or mule is absolutely secure. Anytime an animal is tied to something or confined, there is risk of escape or injury. Inadequately anchored objects may be pulled out of the ground or broken. An animal may work a knot loose, or it may get a leg or head caught in a rope and injure itself. When a horse or mule is confined, it may push through a barrier, worry a latch and open the gate, or get a leg caught in the rails or wires. All confinement options have advantages and disadvantages. To minimize problems and hazards, design facilities so stock can be monitored easily.

### Hitch Rails

*Hitch rails*—also called *hitching rails* or *tethering rails*—allow riders to secure horses or mules for relatively short periods. Riders tie the lead rope around the hitch rail to restrain the animal. Riders appreciate hitch rails near toilet buildings and information stations. Another good place to install hitch rails is near water hydrants. Doing so minimizes the distance handlers have to carry water buckets for stock. Allow at least 25 feet (7.6 meters) between the hitch rail and the hydrant to keep animal waste away from the water source.

Install hitch rails at trail access points so riders can tie their stock up before and after outings. Hitch rails midway on trails longer than 8 miles (12.9 kilometers) allow riders to secure their stock during short breaks.

Hitch rails are not needed:

- ☆ In trailhead parking areas if parking spaces are large enough to accommodate stock tied to trailers
- ☆ At camp units with permanent corrals

Provide hitch rails if portable panels are used for enclosures, because portable panels are not strong enough for tethering stock.

Hitch rails commonly are constructed of wood or steel. Wood rails are suitable for low and moderate levels of development—however, stock may chew on them, causing damage (figure 10–42). Common steel hitch rails range from 4 to 10 feet (1.2 to 3 meters) long. A hitch rail that is 4 feet long generally has space for one animal tied on each side. A hitch rail that is 10 feet long accommodates three



Figure 10–42—Because stock chew on wood hitch rails, the crossmembers eventually weaken.

animals—two animals on one side (one animal near each end of the rail) and the third animal tied to the opposite side in the middle of the rail. This allows a comfortable distance between the three animals. However, because stock can touch noses, it is best that the animals know each other and get along well. The extra-long hitch rail shown in figure 10–43 is frequently full during hunting season.

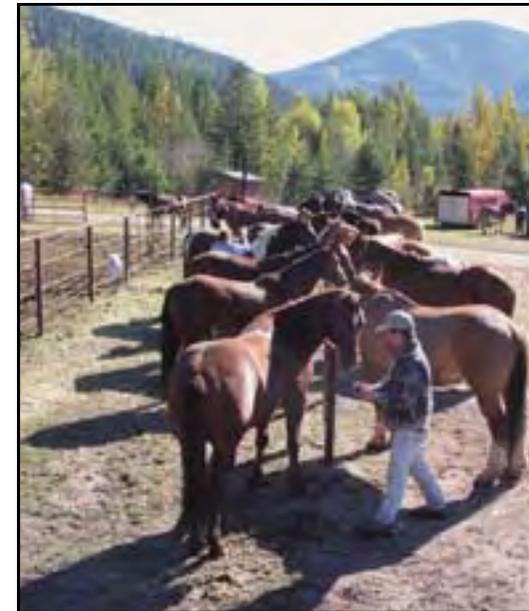


Figure 10–43—Hitch rails come in a variety of lengths to accommodate the number of stock expected. This unusually long hitch rail is at a trailhead that is heavily used during hunting season.



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The recommended height for hitch rails is 42 inches (1,067 millimeters). This height is good for both riders and stock when lead ropes are tied properly. To avoid injuries, round the corners of hitch rails (figures 10–44 and 10–45). Properly designed hitch rails don't allow a lead rope to slide from the horizontal rail down the upright posts. If this happens, the animal could easily step over the rope and tangle its front legs, a setup for panic and injuries. Crossmembers may be installed at each end of the rail (figure 10–46) to keep the rope from sliding down or tie rings could be installed on the rail. When lead ropes are tied to the rings, they can't slide along the length of the rail. Lead ropes tied to the long, overhanging ends of the hitch rail shown in figure 10–47 may slide off, releasing the stock.

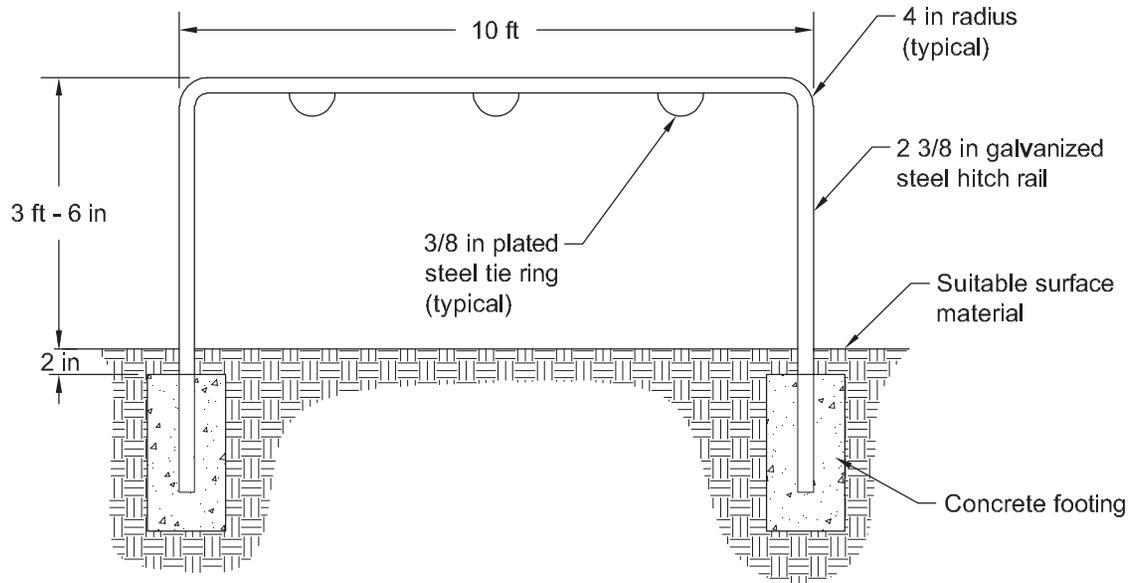


Figure 10–44—A hitch rail.

For safety, provide a level area around hitch rails that is free of vegetation or other obstacles (figure 10–48). See figure 10–46 for an example of a well-designed hitch rail that is not popular because a raised curb, large rocks, and encroaching vegetation prevent stock from being tethered on one side. Riders do not use the hitch rail shown in figure 10–49 because the ground is uneven, and the signs, bollards, and rocks nearby are dangerous for horses and mules. Figure 10–50 shows a hitch rail with a suitable cleared area. Because hitch rails may be in high traffic areas, it is wise to add suitable surface material such as aggregate.



Figure 10–45—Welded steel loops prevent lead ropes from sliding along this hitch rail.



Figure 10–46—The braces in the corners of this hitch rail confine lead ropes to the horizontal bar and make it a good design choice. However, this site would be more horse friendly without the raised curb, large loose rocks, and encroaching vegetation.

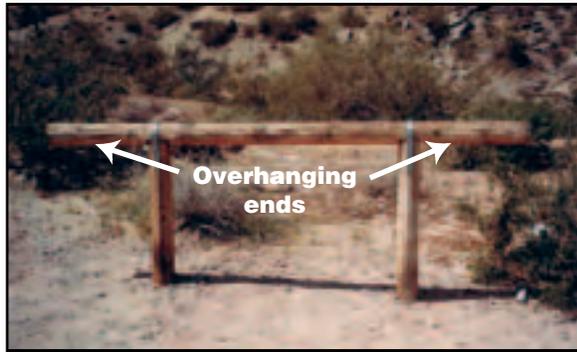


Figure 10-47—Because the overhanging ends on this hitchrail are so long, some riders may tie stock there. Lead ropes could slide off the open ends, leaving stock loose.



Figure 10-49—Signs, bollards, and an uneven surface would make these hitch rails unpopular with many riders.



Figure 10-50—Areas near toilet buildings are excellent places to install hitch rails. Provide plenty of clear space around the hitch rails. This rest area also includes a horse trough nearby, a welcome amenity.

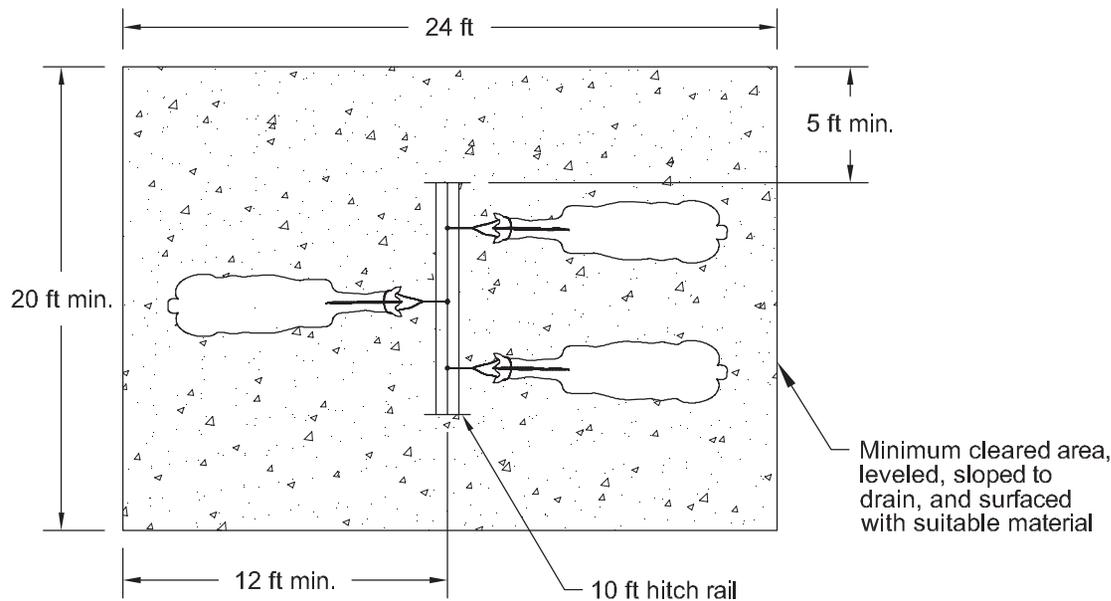


Figure 10-48—The minimum wearing surface recommended at a hitch rail.

### Hitching Posts

A *hitching post* is a variation of a hitch rail that has a single, solid upright with a ring attached near the top (figure 10-51). Riders tie the lead rope to the ring. While hitching posts save space, they have several drawbacks—they only accommodate one horse or mule at a time, and the animal can circle the post, wrapping the lead rope. Use other tethering devices in recreation sites.



Figure 10-51—Stock tied to hitching posts tend to move in circles, wrapping the lead rope, restricting their movement, and possibly injuring themselves.



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### Trailer Ties

Some riders prefer tying stock to the side or end of a horse trailer in such a way that the animals can eat, drink, and lie down (figure 10–52). When animals are nearby, riders who sleep in the horse trailer or towing vehicle can keep an eye on their stock. Access to equipment, feed, and supplies is also convenient. To allow riders to tie their stock to trailers, design extra length and width into parking pads and parking spaces. Consult *Chapter 8—Designing Roads and Parking Areas* and *Chapter 9—Designing Camp and Picnic Units* for more information.

Stock tied to a trailer can only move sideways 180 or 270 degrees. They can untie themselves, catch their heads or a leg in the lead rope or under the trailer, or injure themselves on sharp, protruding objects. Stock tied to trailers require close monitoring.



Figure 10–52—Riders frequently anchor highlines to their horse trailers. —*Courtesy of Kandee Haertel.*

### Highline Ties

Some riders prefer tethering stock to a *highline*, also called a *tethering line* or *picket line*. A highline is a rope stretched taut between two secure uprights above the animal’s head. The stretched rope has tie loops spaced for securing stock with lead ropes. Sturdy trees often are used as anchors for highlines (figure 10–53). When trees are not available, posts



Figure 10–53—A highline allows stock substantial freedom of movement. Care must be taken to protect surrounding vegetation and ground surfaces. —*Courtesy of Kandee Haertel.*

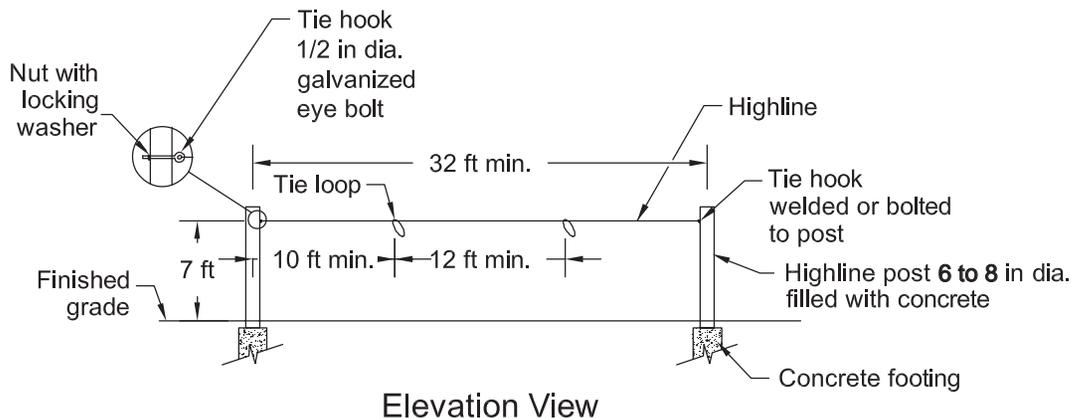
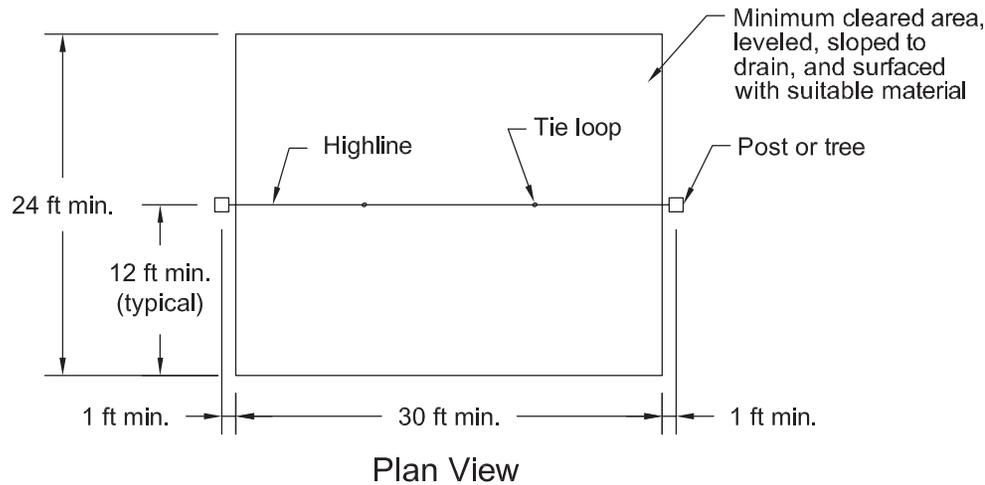
set in concrete may serve as uprights (figure 10–54). Riders sometimes park their horse trailers parallel to each other and stretch a rope between them. This is feasible only in locations with double-party or several-party parking pads or group parking areas. Many riders prefer highlines because their stock can move 360 degrees. Highlines are easy to carry and



Figure 10–54—To be effective, highlines must be stretched taut. A hand winch helps to apply enough tension.

install, and they are an option for stock that shouldn’t be confined in corrals.

Highlines require a cleared area of at least 32 feet (9.8 meters) wide by 24 feet (7.3 meters) deep to accommodate two animals (figure 10–55). Plan the location of the cleared areas to avoid sensitive soils. Refer to *Chapter 13—Reducing Environmental and Health Concerns* for more information on soils. Protect the vegetation, too—hungry or curious stock may devour edibles within 12 feet (3.7 meters) above the cleared space and within 7 feet (2.1 meters) to the side. Trees or branches anchoring highlines should be at least 1 foot (0.3 meter) in diameter. Permanent posts with sturdy tie hooks can be installed for highlines. Securely weld or bolt the tie hooks to the posts.



In areas that are not prone to vandalism, managers may provide ropes for highlines. However, most riders prefer to bring their own ropes. Install a highline by stretching a suitable rope tightly between the trees or posts, about 7 feet (2.1 meters) above the ground (figure 10–56). Suitable ropes include a 1/2-inch (12.7-millimeter) multifilament polyester-plus-hemp rope or 3/8-inch (9.5-millimeter) poly Dacron rope. Using 2-inch- (51-millimeter-) wide, flat tree-saver straps (figure 10–57), or an equally wide padded rope, helps prevent damage to trees. Fixed tie loops should be at least 12 feet (3.6 meters) apart. The outside loops should be at least 10 feet (3 meters) from trees or posts. At this distance, the animal’s heavy front quarters are away from the tree, minimizing soil compaction on tree roots. Do not use metal cables and connectors with metal uprights, as they can be targets for lightning strikes.



Resource Roundup

Don't Fence Me In

Learn more about tree-saver straps, animal hobbles, pickets, and other time-honored equipment in *Techniques and Equipment for Wilderness Travel with Stock* (Stoner and others 1993), available at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm93232839>. This Web site requires a username and password. (Username: t-d, Password: t-d)

Figure 10–55—A horse area with a highline suitable for two animals.



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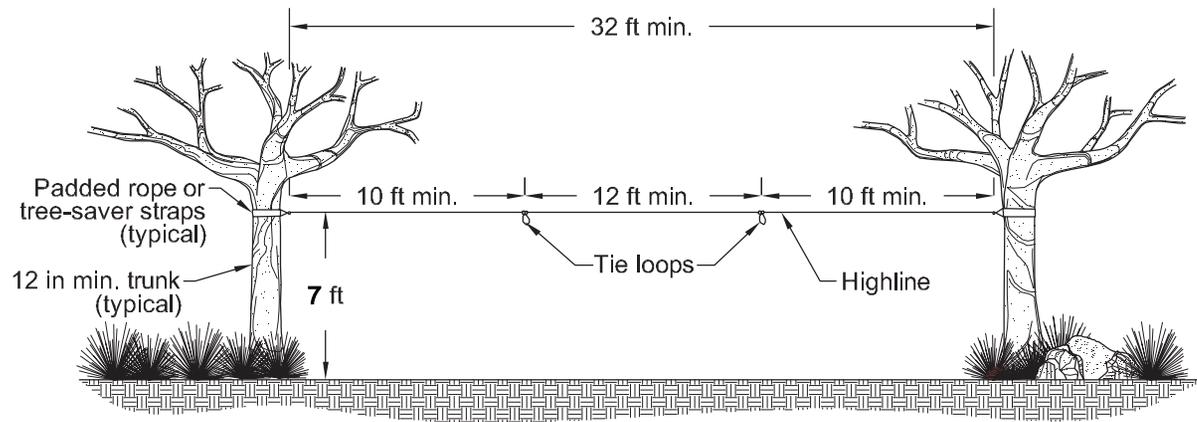
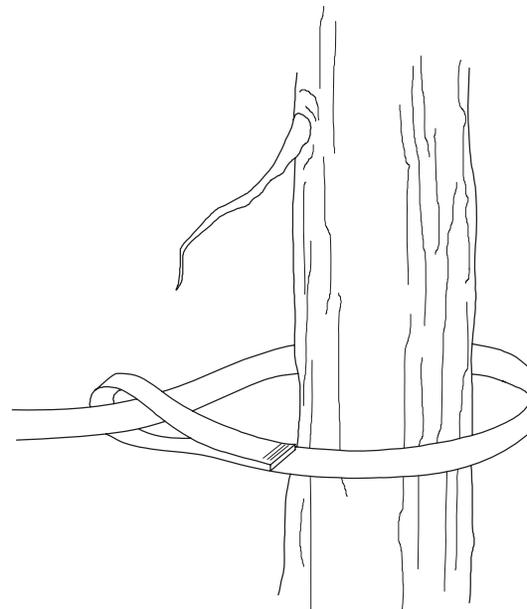
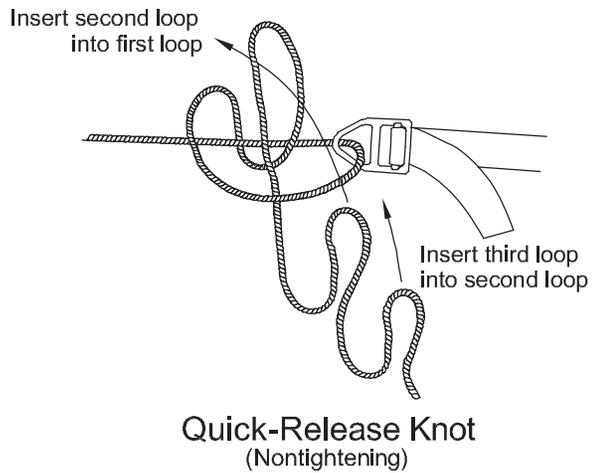


Figure 10-56—A highline attached to trees.



Flat Strap

Figure 10-57—Highlines can be quickly set up using tree-saver straps and a rope.



## Corrals

Some campers like the security of keeping their stock in corrals, especially riders who have a corral at home. Stock have maximum freedom of movement in corrals, and riders don't have to monitor their stock as frequently. Of all the options presented in this chapter, well-designed corrals that include suitable gates and latches are usually the best choice for recreation sites,

Most stock want to roll on their backs after a workout. If they don't have adequate space to roll in corrals, they can *cast* a leg or hoof—get it stuck—in the rails. A 12- by 12-foot (3.6- by 3.6-meter) corral is the minimum a larger animal needs to roll, move, and turn around. It also provides enough space for a horse or mule to escape an aggressive animal in an adjoining corral. Where space allows, a 12- by 16-foot (3.6- by 4.9-meter) corral is preferred. Locate corral posts at every corner and midway on each side (figure 10–58). Place posts every 6 feet (1.8 meters) in 12-foot corrals, and every 8 feet (2.4 meters) in 16-foot corrals.

The greatest cost and space efficiencies are achieved when two 12- by 12-foot (3.6- by 3.6-meter) or two 12- by 16-foot (3.6- by 4.9-meter) corrals share a side, forming a *corral set* (figures 10–59 and 10–60). A drawback to corral sets is that the adjoining enclosures can only be used for compatible stock. Horses or mules that fight, kick, and bite should not

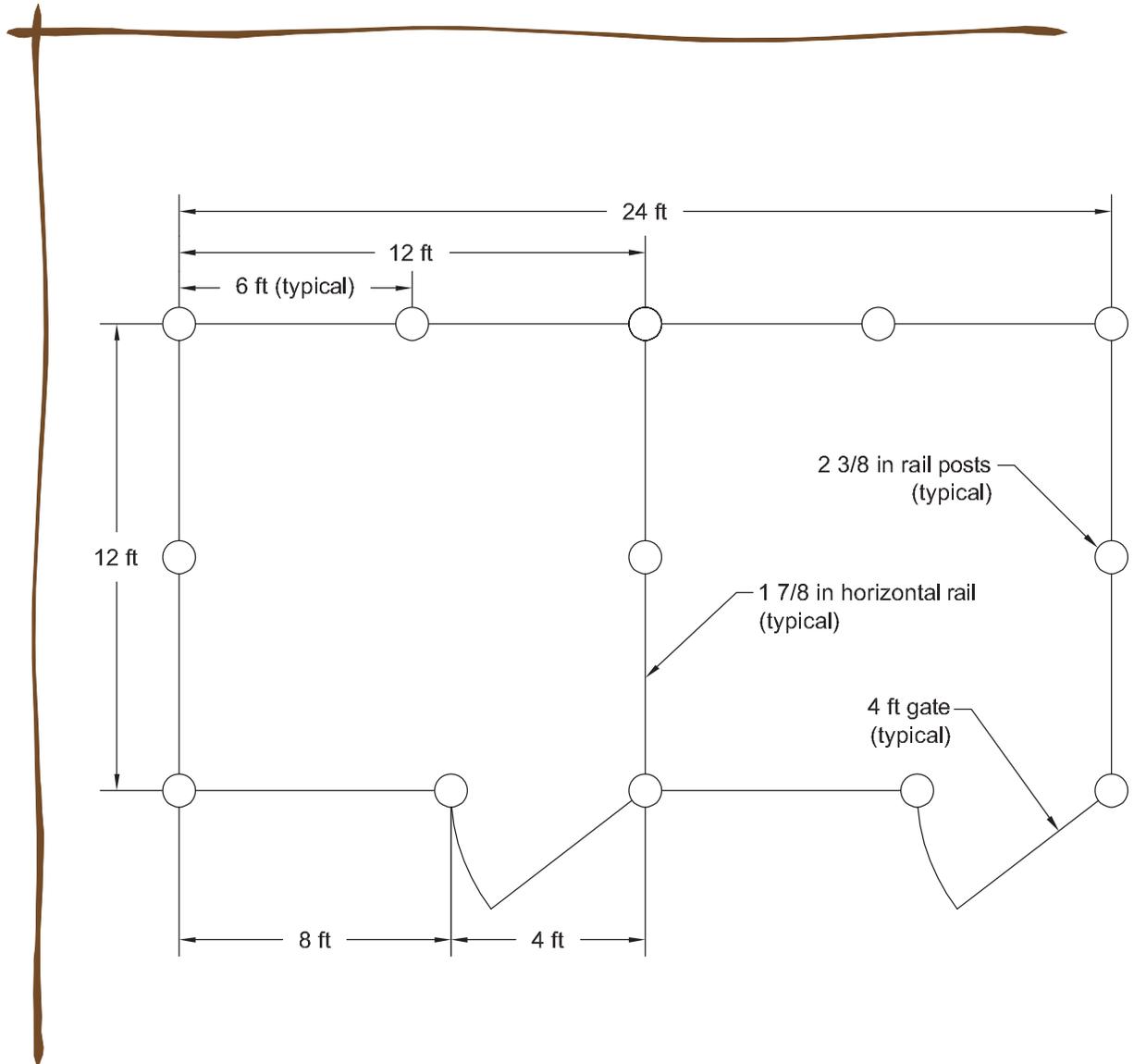


Figure 10–58—Dimensions for a single corral set. A single corral set holds two animals.

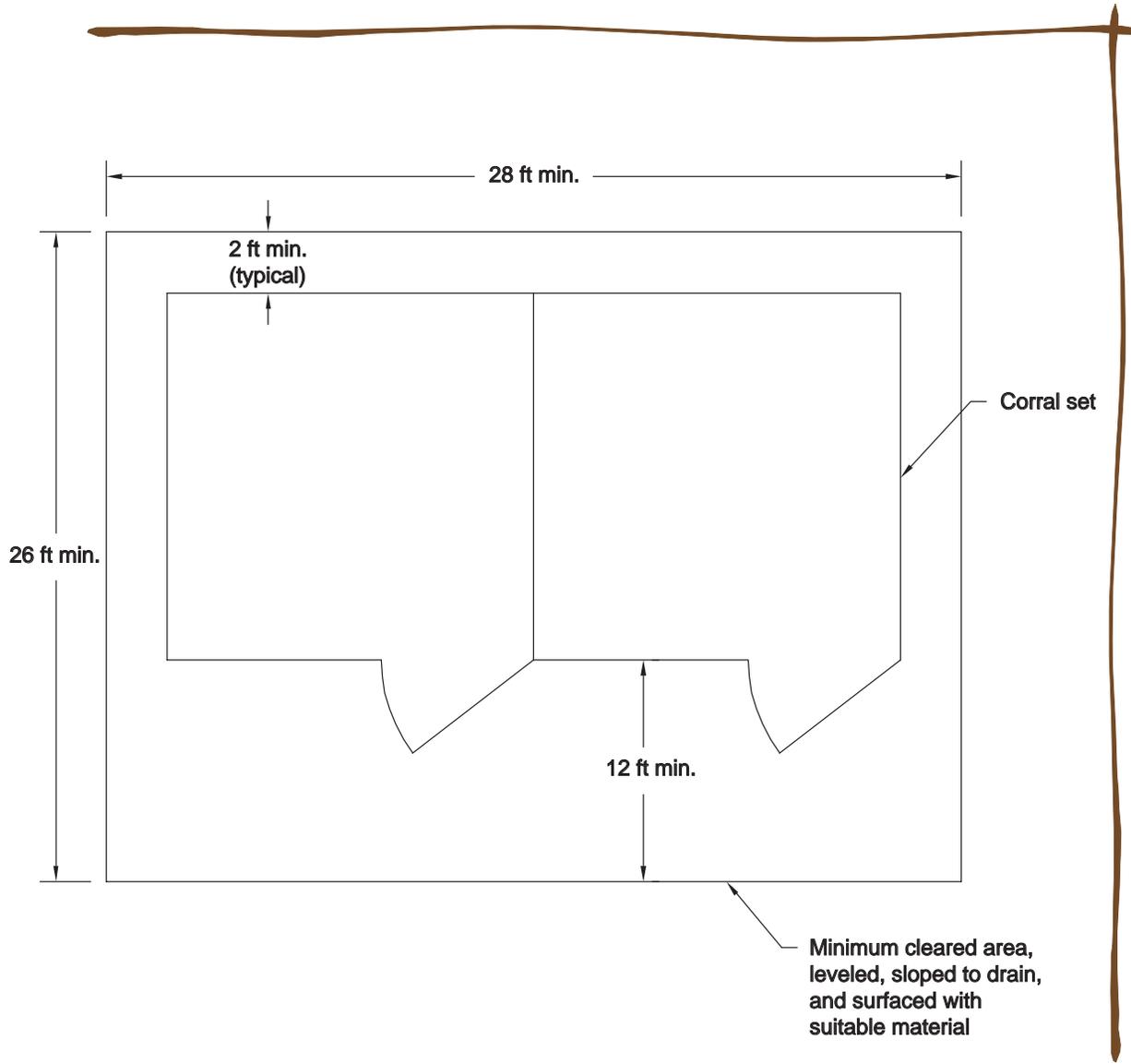


Figure 10-60—Two horses relax in a single corral set. Water buckets are tied to the lower rail. —*Courtesy of Janet Grove.*

be confined adjacent to other stock. It is the rider's responsibility to minimize aggression between stock. This may mean segregating aggressive horses or mules by tying some to the horse trailer. To avoid aggressive horse behavior, build no more than two adjoining corrals in a set. Construct multiple corral sets instead of additional adjoining corrals. Corral sets should be located far enough apart that penned stock can't reach each other.

Figure 10-59—The area required for a single corral set.



A single-party camp unit usually includes one corral set. Two corral sets are installed for a double-party camp unit, and three to four are supplied for a several-party camp unit. The number of corrals to include in a group unit depends on the anticipated use and the available space. If there are more than two corral sets, arrange them in a row. Separate corral sets by 10 to 12 feet (3 to 3.6 meters). If space is not available for multiple corral sets in a row, arrange them as shown in figure 10–61. Stock may be uncomfortable walking down the center aisle when there are unfamiliar stock on both sides, so don't install corral gates facing the aisle.

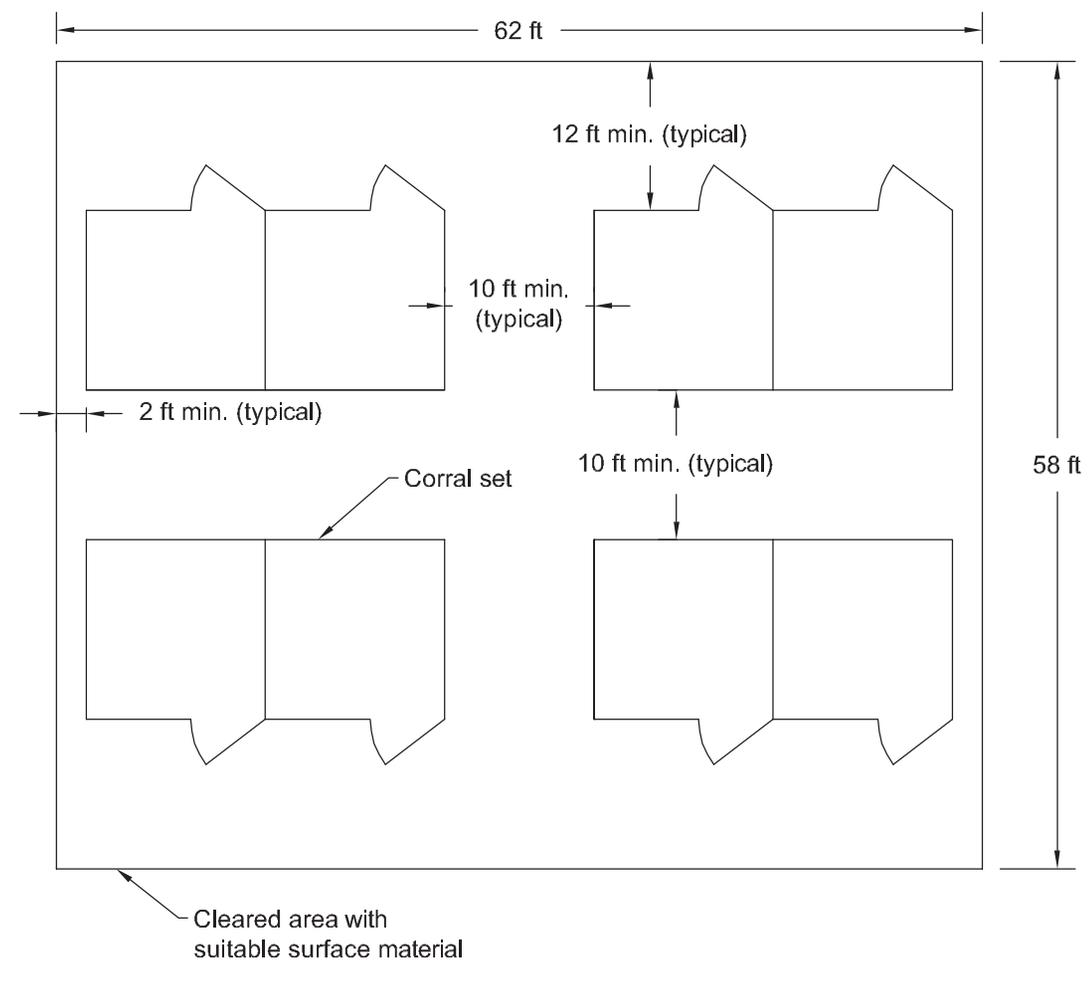


Figure 10–61—Corral placement for a horse area with four corral sets that are not placed in a row. Four corral sets hold eight animals.



### Related Facilities—Arenas and Round Pens

Riders frequently use round pens (figure 10–62) to exercise a high-strung animal before a ride, and to cool an animal down afterward. Round pens also offer a safe place for stock to roll. Round pens are appropriate for areas with high levels of development but are not essential at trailheads or in campgrounds.

Arenas are spacious fenced areas that provide a comfortable setting to train or exercise stock, teach riding lessons, or hold group events (figure 10–63). In many cities, recreationists use a trailhead much like a community park, and an arena may be appropriate.

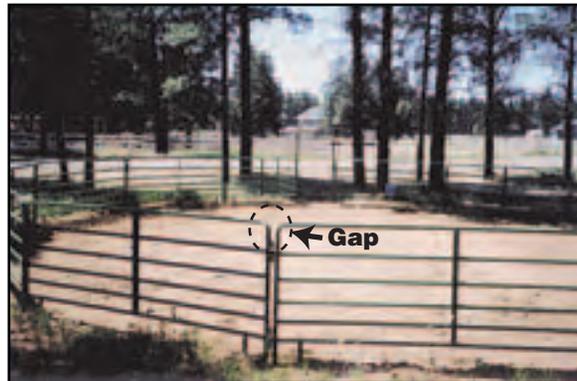


Figure 10–62—A round pen is convenient for exercising stock before and after a ride. When setting up portable panels, connectors need to hold the panels close together. Install the connectors carefully—a large gap could trap a horse’s leg.



Figure 10–63—Group events and equestrian training sessions often are held in outdoor arenas.



Figure 10–64—It is more comfortable to exercise an animal in a round enclosure.

#### Size and Location

The minimum diameter for round pens that allow riding is 60 feet (18.2 meters). If the pen is smaller, it impedes the natural movements of a horse or mule moving faster than a walk. Suggested dimensions for a multipurpose arena are 100 by 200 feet (30.5 by 61 meters). Round all arena corners (figure 10–64). This allows smooth riding when riders are working their stock, and just as with perimeter fences, prevents stock from being trapped in corners. Because activities in arenas and round pens are likely to excite nearby stock, locate these facilities in isolated but convenient locations. Choose sites with dry, well-drained soil.

#### Grade

Arenas and round pens must be reasonably level with enough slope to allow drainage. Crown the subgrade in the center and incorporate a 1-percent slope from the centerline to all sides. If the surface is not crowned, slope it 2 percent from one side to the other. For an arena or round pen to be functional year-round, regular maintenance is required. The surface needs to be dragged weekly, monthly, or quarterly, depending on frequency of use. The surface—or *footing material*—should be replaced every 5 to 10 years.



### Dust Prevention

Activity in arenas and round pens can create dust that is unhealthy for stock, riders, and other people in the area. When water is available, a sprinkler system can effectively control dust. Install sprinkler heads that meet plumbing pressure requirements and provide complete and even coverage (figure 10–65). For the safety of arena users, install sprinkler heads where arena users or stock won't trip over or run into them. Common placements include the top rail or ground level adjacent to posts. For convenience and efficiency, allow users to control the sprinklers with a timer. Alternatives to plumbed sprinklers include portable water sprayers and dust abatement products.



### Resource Roundup

#### Best Hoof Forward

The ideal surface for arenas and round pens provides a cushion, is dust-free, and doesn't abrade horses' hoofs. Existing soil and slope characteristics should be evaluated, and a mix of footing materials applied over a base. The most suitable base and footing materials depend on the planned activities—for example, rodeo or jumping activities require different materials than cart driving or miniature horse activities. The *Equine Arena Handbook* (Malmgren 1999) applies soil science to footing materials. *Underfoot* (United States Dressage Federation 2007) addresses construction and maintenance of arenas.

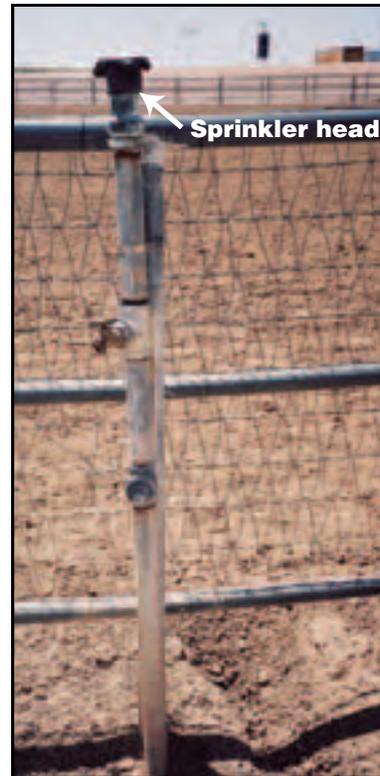


Figure 10–65—Sprinkler heads can be placed on the top fence rail. Another popular location is at ground level. Regardless of the location, the sprinkler heads should be placed so they are not hazardous to riders or stock.

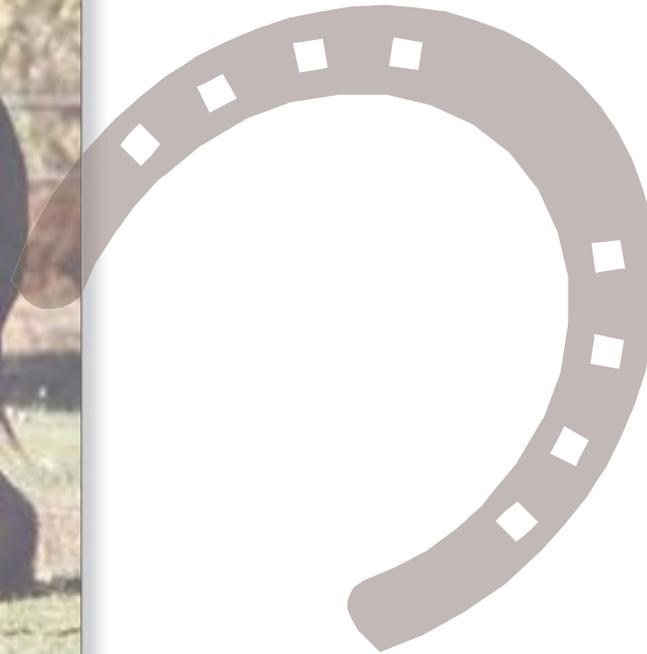
### Lighting

In areas with high levels of development, lighting may be appropriate for arenas and round pens. To minimize light pollution and maximize energy efficiency, install a timer that allows users to control the lights when needed. Properly selected fixtures reduce environmental impacts and minimize the spread of light into surrounding areas. For best results, have a lighting consultant or engineer design the system.





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## Chapter 11— Designing for Riders With Disabilities

In the United States 54 million people have disabilities. That number will increase as the country's population ages. By 2030, over 110 million people will be older than 55, and many will develop functional disabilities. People who have disabilities recreate with families and friends, increasing the need to provide facilities and programs where everyone can participate. Accessibility requirements need to be considered when designing horse trails, trailheads, or campgrounds.

Numerous laws and guidelines govern this topic, and the acronyms—ABA, 504, ADA, ADA/ABAAG, and so forth—can be a bit daunting. It is beyond the scope of this guidebook to define and interpret accessibility requirements in detail, although a brief look at the issues may be helpful. In summary, with very few exceptions, all people are to be provided an equal opportunity to participate in programs that are offered, and new or renovated facilities are to be accessible. Refer to *Appendix F—Summary of Accessibility Legislation, Standards, and Guidelines* for an overview of accessibility laws, related guidelines, and standards. Sites, facilities, and programs are accessible or they are not—there is no middle ground. The only

way to determine accessibility is to evaluate the site or facility to determine whether it complies with the accessibility standards in effect when it was constructed or renovated.

### Site-Specific Accessibility

Determining which accessibility requirements apply to a situation may be confusing. For each site:

- ☆ Identify users
- ☆ Know the funding source
- ☆ Separate trail design from trailhead and campground design

### Users

If the public has access, the project must meet accessibility requirements. The ownership or jurisdiction of the site, facilities, or activities helps determine the requirements that apply. The basic categories are:

- ☆ Federal agencies—the National Forest System, National Park Service, Bureau of Land Management, and so forth
- ☆ State, local, and private entities

If the recreation opportunity is solely for private or religious use, and the public will never have access—not even once a year at a fundraiser—and the opportunity takes place entirely on privately owned land, the trail or facility may not have to meet accessibility requirements. This guidebook doesn't address such situations.

### Funding Sources

Certain laws and guidelines apply if funding is provided by government sources, whether as direct payment or as grants, or if the program is operating under a permit from a Federal agency. Projects paid for with community or State money are subject to the Americans with Disabilities Act (ADA). Those funded with Federal dollars or operating under a permit issued by a Federal agency fall under the Architectural Barriers Act (ABA) and Section 504 of the ADA. Both the ABA and ADA are laws. Accessibility guidelines were developed to guide construction of facilities that would comply with the laws. The current accessibility guidelines are the *Americans with Disabilities Act/Architectural Barriers Act Accessibility Guidelines* (ADA/ABAAG).

The ADA/ABAAG focuses on facilities in highly developed areas such as cities, towns, and major tourist attractions. With the exception of boating facilities and fishing piers and platforms, the ADA/ABAAG doesn't provide direction for construction or renovation of outdoor developed recreation areas or trails designed for hikers and pedestrians.

Because there were no accessibility guidelines for outdoor recreation areas, the Forest Service developed its own guidelines. The *Forest Service Outdoor Recreation Accessibility Guidelines* (FSORAG) and the *Forest Service Trail Accessibility*



*Guidelines* (FSTAG) are detailed accessibility guidelines that apply to developed recreation sites and hiker and pedestrian trails within the National Forest System. Both the FSORAG and the FSTAG are based on draft accessibility guidelines for outdoor recreation areas created by a committee of the Architectural and Transportation Barriers Compliance Board (Access Board). The Forest Service guidelines recognize the realities of the outdoors and allow exceptions for certain circumstances. While the FSORAG and FSTAG only have to be followed within National Forest System boundaries, the guidelines may prove useful for others who are planning and designing outdoor recreation projects.

### Pathway and Trail Designs

Facilities at **trailheads** and **campgrounds**, including toilet buildings and parking areas, must be accessible. **Pathways within such areas** and those that lead to trailheads and interpretive sites also must be accessible. The FSORAG addresses the accessibility of camp and picnic units, picnic tables, grills, and so forth at Forest Service recreation sites. The FSORAG also covers pedestrian routes from camp units to toilet buildings and parking areas as well as the pathways or *outdoor recreation access routes* (ORARs) that connect these outdoor recreation facilities. Table 11–1 is a quick reference for applying accessibility standards and guidelines to facilities.

Table 11–1—Quick guide for applying accessibility standards and guidelines to facilities.

ABA Accessibility Standard	FSORAG (Apply only within National Forest System boundaries)	FSTAG (Apply only within National Forest System boundaries)
<b>Buildings, boating, and fishing</b>	<b>Recreation site features</b>	<b>Hiker/pedestrian trails</b>
<p><i>All buildings, including:</i></p> <ul style="list-style-type: none"> <li>☆ Administrative offices</li> <li>☆ Residences</li> <li>☆ Crew quarters</li> <li>☆ Visitor centers</li> <li>☆ Entrance stations</li> <li>☆ Parking lots</li> </ul> <p><i>And including components, such as:</i></p> <ul style="list-style-type: none"> <li>☆ Restrooms with and without water</li> <li>☆ Workstations</li> <li>☆ Doors</li> <li>☆ Operating controls (door handles, faucet controls, thermostats, and so forth)</li> </ul> <p><i>Boating and fishing facilities, including:</i></p> <ul style="list-style-type: none"> <li>☆ Boating facilities</li> <li>☆ Docks</li> <li>☆ Fishing piers and platforms</li> </ul>	<p><i>New or reconstructed:</i></p> <ul style="list-style-type: none"> <li>☆ Picnic areas</li> <li>☆ Fire rings</li> <li>☆ Grills</li> <li>☆ Wood stoves</li> <li>☆ Benches</li> <li>☆ Picnic tables</li> <li>☆ Cooking surfaces</li> <li>☆ Pedestal grills</li> <li>☆ Fireplaces</li> <li>☆ Beach access</li> <li>☆ Outdoor recreation access routes</li> <li>☆ Camping units (eating and cooking areas, parking spurs, platforms, tent pads)</li> <li>☆ Campground utility connections</li> <li>☆ Water hydrants and drinking fountains</li> <li>☆ Outdoor rinsing showers</li> <li>☆ Remote-area pit toilets</li> <li>☆ Trash/recycling containers</li> <li>☆ Viewing areas and overlooks</li> <li>☆ Telescopes and periscopes</li> <li>☆ Mobility device storage</li> <li>☆ Warming huts</li> </ul>	<p><i>New or altered trails that are:</i></p> <ul style="list-style-type: none"> <li>☆ Designed for hiker/pedestrian use</li> </ul> <p><i>and</i></p> <ul style="list-style-type: none"> <li>☆ That connect either directly to a trailhead</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>☆ Connect to a currently accessible trail</li> </ul>

—Accessibility Guidebook for Outdoor Recreation and Trails (Zeller and others 2006).



Accessibility of **trails that are not in developed recreation sites** needs closer examination. Trails are designed to address the use for which the trail is designated, the trail's *designed use*. For example, trails designed for trail stock and riders have higher and wider clearance and softer tread surfaces than bicycle trails. While trails may be managed for multiple uses, each trail only has one designed use. The FSTAG, which addresses recreation trails, only applies to trails that meet all three of the following conditions:

- ☆ The trail has a designed use of hiker and pedestrian, in accordance with the Interagency Trail Data Standards, **and**
- ☆ The trail is new or being altered because of a change in the original trail purpose, **and**
- ☆ The trail connects either directly to a trailhead or to a currently accessible trail.

Federal accessibility legislation does not apply to trails exclusively designed for horse use.

## Universal Design

The best way to integrate accessibility is to use the principles of universal design. Universal design focuses on building for everyone while conforming to accessibility standards. Simply put, universal design means designing programs and facilities to include all people to the greatest extent possible, without separate or segregated access for people with disabilities. The classic example of universal design is constructing a single at-grade entrance to a structure rather than steps and accessible ramps.

A well-designed, universally accessible recreation facility does not stand out as being different from other sites. It also has more opportunities that are available for a broader range of public use.

The Forest Service's policy of universal design requires complete integration of accessibility within Forest Service facilities. Because the Forest Service has had an accessibility policy since the early 1990s, its facilities, programs, and associated elements often exceed the minimum requirements of Federal accessibility guidelines.



### Firm and Stable Surfaces

To be accessible, facilities must have a firm and stable surface. What sort of surface is firm and stable? In general, if the answer to both of the following questions is yes, the surface is probably firm and stable.

- ☆ Could a person ride a narrow-tired bicycle across the surface easily without making ruts? (The bicycle tires are similar to large rear wheels of a wheelchair.)
- ☆ Could a folding stroller with small, narrow plastic wheels containing a 3-year-old be pushed easily across the surface without making ruts? (The stroller's wheels are similar to the front wheels of a wheelchair.)

### Resource Roundup

While this method for determining firmness and stability is not scientifically accurate, it has proven to be effective.

In the late 1990s, the Access Board funded an Accessible Exterior Surfaces research project conducted by Beneficial Designs, Inc., of Minden, NV. Results of the study are available from the Access Board at <http://www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm> or from Beneficial Designs at <http://www.beneficialdesigns.com/surfaces/surface.html>. The project developed a scientific method for determining firm and stable exterior surfaces and a rotational penetrometer tool that can be used to evaluate surfaces.



### Designing for Accessibility

Useful sources of information for designing accessible recreation facilities include:

- ☆ *Accessibility Guidebook for Outdoor Recreation and Trails* (Zeller and others 2006) describes the history of accessibility guidelines, discusses tools for planning accessible recreation opportunities, and provides practical information for applying the FSORAG and FSTAG to recreation features. The information is available at <http://www.fs.fed.us/recreation/programs/accessibility/htmlpubs/htm06232801> or <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232801>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ *ADA and ABA Accessibility Guidelines Homepage* provides links to the guidelines and related information. The information is available at <http://www.access-board.gov/ada-aba>.
- ☆ *Americans with Disabilities Act Accessibility Guidelines: Checklist for Buildings and Facilities* Web site helps individuals and entities apply the requirements of ADAAG. The information is available at <http://www.access-board.gov/adaag/checklist/a16.html>.
- ☆ AgrAbility Project promotes success in agriculture for individuals with disabilities and their families through onsite assistance and educational resources, including an online database of assistive technology.

### Resource Roundup

The information is available at <http://www.agrabilityproject.org/assistivetech>.

- ☆ National Center on Accessibility provides links to information for designing accessible trails, including the status of regulatory guidelines, research, publications, and other resources. The information is available at *National Center on Accessibility*: <http://ncaonline.org/trails>.
- ☆ *Universal Trail Assessment Process* (Beneficial Designs, Inc. 2001) identifies trail features desired by a specific user group. It focuses on width, surface, grade, slope, obstacles, and other related trail elements. The information is available at <http://www.beneficialdesigns.com/trails/utap.html>.
- ☆ USDA Forest Service *Recreation, Heritage and Wilderness Programs* Web site provides links to accessibility information, news, notices in the Federal Register, and related information about recreation and accessibility. The information is available at <http://www.fs.fed.us/recreation/programs/accessibility>.
- ☆ *Wilderness Access Decision Tool* (Lais and others 1995) is a resource for personnel in the National Wilderness Preservation System that helps managers make appropriate, objective, and consistent decisions that include people with disabilities. The information is available at [http://carhart.wilderness.net/docs/wild\\_access\\_decision\\_tool.pdf](http://carhart.wilderness.net/docs/wild_access_decision_tool.pdf).

### Accessible Shared Trails

Trail stock can share accessible trails where the design accommodates the needs of the stock and the riders, even though differences may arise among user groups. Examples of differences that can be resolved include:

- ☆ Higher railings are required on equestrian bridges than on pedestrian bridges.
- ☆ Larger pulloff areas are required by trail stock and riders.
- ☆ High walls—those over 54 inches (1,372 millimeters) tall—may interfere with an animal's vision.
- ☆ Paved treads can pose problems for trail stock.

In such cases, careful examination of the issues can lead to workable accommodations. In the paved tread example above, an option is to provide a separate, adjacent tread with a horse-friendly surface. The solution always comes back to ensuring safety, abiding by the regulations, and doing so in a manner that includes all people. In addition to accessibility requirements, many recreation features are subject to engineering standards, building codes, and other regulations.



## Accessible Equestrian Features

This guidebook only addresses accessible features that are specific to equestrian use. While many products on the market are advertised as being accessible, the buyer must know the specific requirements within the ADA/ABAAG. For example, a picnic table may be advertised as accessible, but not meet requirements. The buyer needs to check the table's dimensions to be sure. Don't rely on the manufacturer's claim of accessibility compliance. Some features that can meet accessibility and equestrian requirements include mounting blocks, mounting ramps, and an accessible handpump. For more information, consult *Chapter 7—Planning Recreation Sites* and *Chapter 10—Securing Horses and Mules*.



### Unlisted Features

#### Horse Sense

What if a designer wants to provide an accessible constructed feature that is not addressed in the FSORAG? While not specifically related to equestrian use, lantern hangers are an interesting example that shows the principles involved.

*The Accessibility Guidebook for Outdoor Recreation and Trails* (Zeller and others 2006) suggests designers go back to the basic building blocks of accessible design found in the ADA/ABAAG—the reach ranges, clear space, and maneuvering space that accommodate standard wheelchair dimensions. Using that information and the principles of universal design, designers would know that to be usable by the greatest number of campers of all ages, with and without disabilities, lantern hangers need to be placed within the reach range of someone in seated and standing positions. Solutions include using a simple device to raise the hanger or attaching two hangers at different levels. A firm and stable surface and sufficient clear space are needed around the lantern hanger to allow it to be approached from the front or side by someone using a wheelchair. The clear space should not block the main path of travel through the camp unit.

## Therapeutic Riding Programs

Some riders with disabilities engage in trail riding as part of therapeutic programs. For safety, assistants may accompany these riders on foot. One horse and an individual walking on each side require a trail that is at least 8 feet (2.4 meters) wide, with an additional 3 feet (0.9 meter) of clearance on either side of the trail. All riders need at least 10 feet (3 meters) of overhead clearance, and 12 feet (3.6 meters) of clearance is preferred. Walkers must be able to navigate the trail fully between destination points. Trails with streams, narrow openings, or other physical barriers are not appropriate for riders requiring this additional on-the-ground assistance.

On trails crossing open areas, such as beaches or sparsely vegetated areas, two riders usually accompany the rider with disabilities (figure 11-1).



Figure 11-1—In open areas, assistants generally keep to the left front and right rear of a rider with disabilities.



One rider travels at the left front and one at the right rear, providing assistance if problems arise. To accommodate the extra stock, consider widening trails in open landscapes to at least 12 feet (3.6 meters). Areas that have dense vegetation bordering the tread allow better control if a problem occurs. The lead rider simply turns his horse or mule sideways on the trail and blocks the wayward animal. The existing vegetation restricts lateral movement.

On trails with moderate-to-heavy use that include riders with disabilities, increase the size of pulloff areas to 12 feet deep by 15 feet long (3.6 by 4.6 meters). These wide spots allow trail users to pass or reverse direction when necessary. The level of trail traffic dictates the appropriate number of pulloff areas. On curves, turns, and switchbacks, provide a wide tread and large-radius turns.

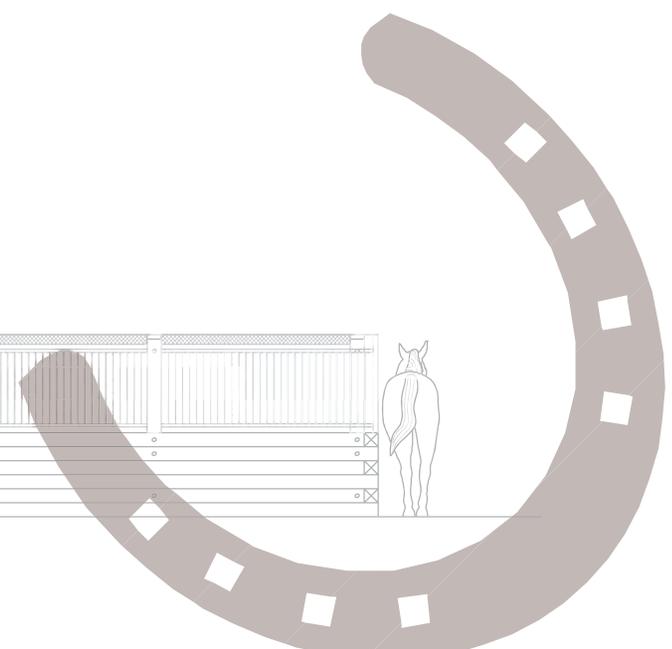
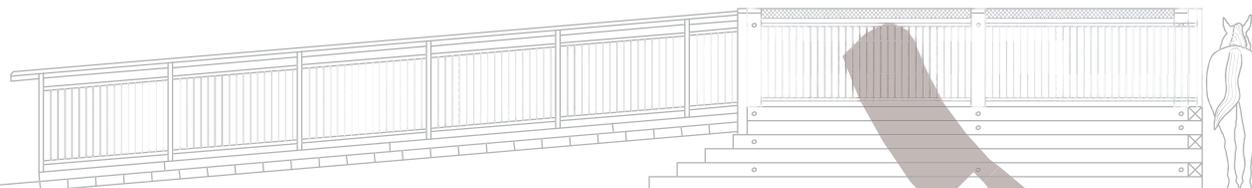


Resource Roundup

**Assisting Riders With Disabilities**

Recreation opportunities for people with disabilities are increasing rapidly as awareness of their value grows. Equestrian therapeutic organizations, programs, equipment, and training opportunities are available worldwide.

- ☆ The North American Riding for the Handicapped Association, Inc., is a national organization that fosters safe, professional, ethical, and therapeutic horse and mule activities for people with and without disabilities. For more information, visit the association's Web site at <http://www.narha.org>.
- ☆ The Adaptive Riding Institute has information regarding adaptive equestrian programs and riding equipment for people with disabilities. For more information, visit the institute's Web site at <http://www.open.org/~horses88>.
- ☆ Many communities have therapeutic riding facilities and organizations that can help identify the special needs of people with disabilities.





## Chapter 12—

# Providing Signs and Public Information

Trail and recreation site signs inform, warn, guide, and educate users. For best compliance, provide just enough signs to convey the required messages. Too many signs clutter the landscape and prevent signs with critical messages from receiving the attention they deserve. Design, install, position, and maintain signs and posters so they:

- ☆ Fulfill a legal requirement or an important need
- ☆ Command attention
- ☆ Convey a clear, positive, friendly, simple message
- ☆ Look professional
- ☆ Allow users enough time to follow the instructions

Most agencies and jurisdictions have their own guidelines regarding signs, or they follow national standards. This chapter provides a basic overview of sign requirements for recreation sites.

## Sign Plans

A sign plan provides the framework for an effective sign program. Planning is essential for accomplishing signing objectives in an orderly, consistent, and cost-effective manner. Develop sign plans to meet the requirements of governing agencies and the specific conditions of the site, road, or trail.

Recreation sign considerations may include:

- ☆ Safety
- ☆ User information needs
- ☆ Resource protection
- ☆ Liability considerations
- ☆ Law enforcement
- ☆ Vandalism

Engineers and landscape architects should collaborate to determine how best to sign roads, campgrounds, trailheads, and in many cases, trails. When roads are involved, engineers must conduct an analysis or exercise engineering judgment to determine appropriate signs. Emphasize the needs of first-time recreationists when making a sign plan, and analyze travel in both directions to determine the minimum number of signs required. Figure 12–1 illustrates a thorough sign plan for a campground.

Reevaluate existing and planned signs annually and compare them against applicable standards and guidelines. The results form the basis for an action plan. Action plans address:

- ☆ Ordering and installing new or replacement signs
- ☆ Removing obsolete signs

- ☆ Maintaining signs
- ☆ Planned actions
- ☆ Schedules
- ☆ Responsibilities
- ☆ Estimated costs
- ☆ Available funding and workforce



### Resource Roundup

#### Signs for the Times

Sources for recreation sign information include:

- ☆ *Sign and Poster Guidelines for the Forest Service, EM–7100–15* (U.S. Department of Agriculture Forest Service 2005a). This information is not available on the World Wide Web; request electronic copies from Forest Service regional sign coordinators.
- ☆ *Signs and Posters Toolbox* (Wilderness.net 2005). This information is available at <http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=signsPosters>.
- ☆ *Manual on Uniform Traffic Control Devices* (FHWA 2004a). Chapter 2H addresses signs for recreational and cultural interest areas as they apply to road users. The manual is available at <http://mutcd.fhwa.dot.gov/HTM/2003r1/part2/part2h.htm>.
- ☆ *Standard Highway Signs* (FHWA 2004b). This document contains some frequently used signs that are not found in the MUTCD. It is available at [http://mutcd.fhwa.dot.gov/ser-shs\\_millennium.htm](http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm).

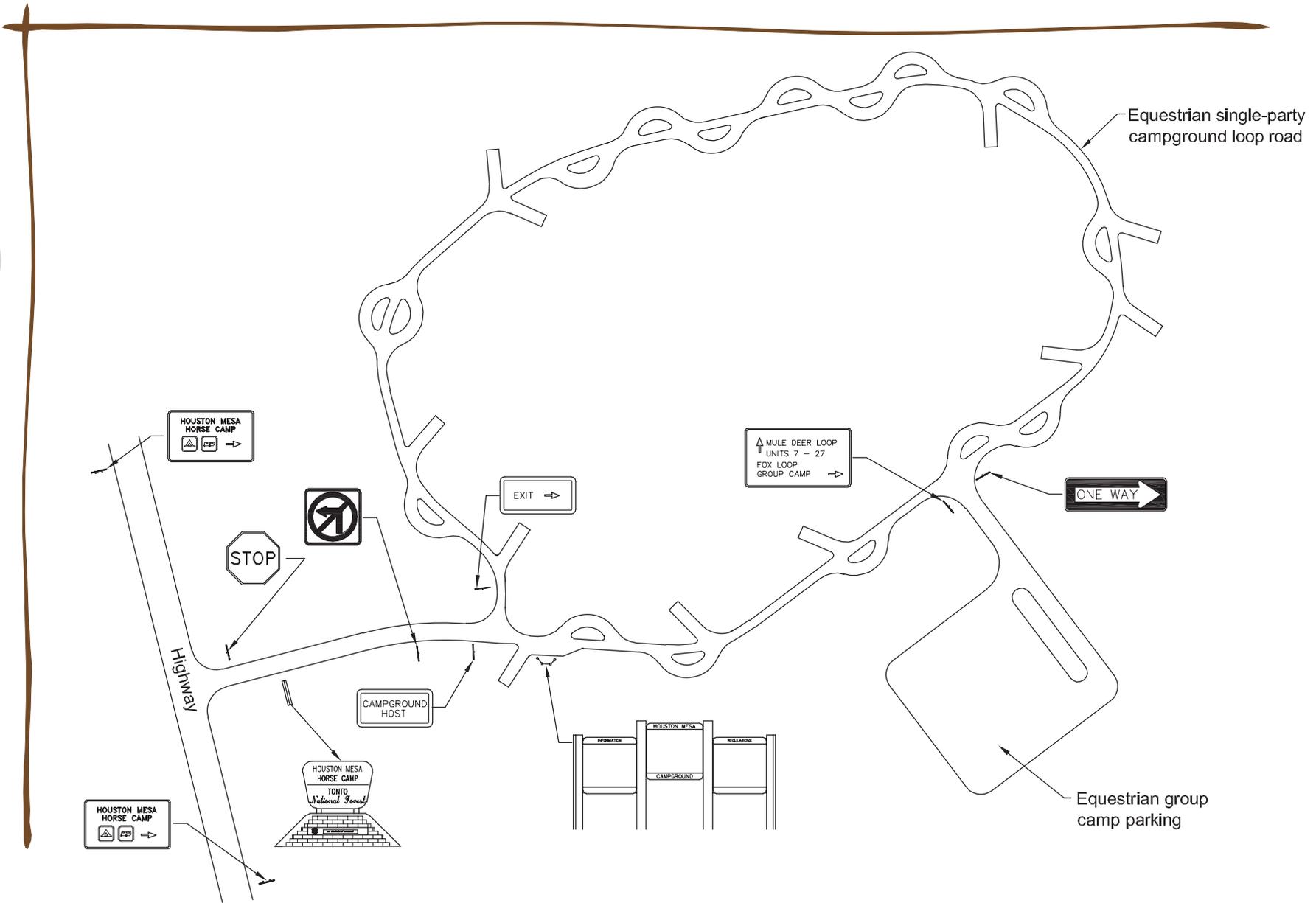


Figure 12-1—A sign plan for a campground.



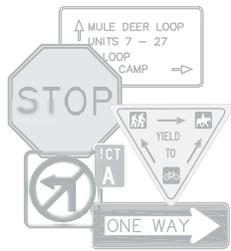
## Sign Design Factors

When designing signs consider size, contrast, color, shape, retroreflectivity, and the use of standard Federal recreation symbols. The MUTCD standardizes most design specifications for road signs, including signs for recreational interest areas. Many land management agencies establish their own guidelines or standards for signs that are not regulated by another authority.

## Sign Types

Signs of particular interest to riders include those used at:

- ☆ Highways or roads, including recreation site roads—Regulatory, warning, and guide signs
- ☆ Recreation sites (nonroad signs)—Site identification signs, interpretive signs, and signs at visitor information stations
- ☆ Trails—Regulatory, warning, and guide signs; site identification signs, interpretive signs, and signs at visitor information stations



Regulatory signs, warning signs, and guide signs that govern traffic on roads are known as *traffic control devices* (TCDs). All TCDs on roads open to public travel must conform to the standards in the MUTCD. Many agencies also have their own requirements that supplement the MUTCD standards. For example, Forest Service TCDs must meet the MUTCD standards and follow the *Sign and Poster Guidelines for the Forest Service, EM-7100-15* (U.S. Department of Agriculture Forest Service 2005a). Paved bicycle trails with shared use fall under AASHTO guidelines and the MUTCD standards. Visitor information stations and site identification signs are subject to governing agency guidelines.



### Lingo Lasso

#### Traffic Control Devices

Traffic control devices include all signs, signals, and markings used to regulate, warn, or guide traffic. The agency having jurisdiction authorizes placement of the signs on, over, or adjacent to a street, road, highway, pedestrian facility, or bikeway. The purpose of TCDs is to promote road safety through orderly and predictable movement of motorized traffic.

## Regulatory Signs

Regulatory signs inform users of traffic laws or regulations and indicate legal requirements that are not readily apparent. Stop signs, yield signs, and speed limit signs are regulatory signs. These signs also inform users of nontraffic regulations that protect resources and ensure user safety and enjoyment. Signs stipulating weed-free hay use, food storage requirements, or shooting regulations fit in this category. Limit regulatory signs to the minimum needed to:

- ☆ Ensure consistent protection of trails, recreation sites, and adjacent resources
- ☆ Enhance user safety and enjoyment
- ☆ Provide a basis for enforcing regulations

Regulatory signs also may be used to direct equestrian parking at trailheads, especially shared-use trailheads. Figure 12-2 shows a regulatory sign for a trailhead parking area.



Figure 12-2—Regulatory signs have black type on a white background. They inform travelers of nontraffic regulations.



### Warning Signs

Riders are especially interested in warning signs regarding motorized traffic on the route or other hazards. Figure 12-3 is a road warning sign for an equestrian crossing. On horse trails, warning signs often indicate road intersections and shared uses. When trails intersect roads, sight and stopping distances may be limited for all users. It is critical to incorporate road signs that warn vehicles of an upcoming horse crossing. Consult *Chapter 4—Designing Trail Elements* in this guidebook for more information regarding rider sight distance requirements and speeds. AASHTO (1999) addresses distance requirements on shared-use trails that also include bicyclists.



Figure 12-3—Road warning signs have black type on a yellow background. Equestrian crossing signs use symbol RL110 from the MUTCD.

Paved roads and trails—especially in urban areas—often have pavement markings to reinforce sign messages. The MUTCD and AASHTO (1999) address these situations. If trails are not paved, flashing lights may be appropriate, but only in urban or highly developed areas. Because flashing lights may alarm stock, use low-glare light fixtures. An option for highly developed areas is placing the lights in a wall. Lights also may be incorporated into a bollard. Follow the appropriate land management agency’s lighting standards.

12



#### Lingo Lasso

##### Advanced Warning

Warning signs give drivers and recreationists advanced notice of unexpected conditions on or adjacent to a road or trail, and of situations that might not be readily apparent. Warning signs indicate the need for caution. They may call for a reduction in speed or a maneuver that is not consistent with user expectations. Before using a warning sign on a trail, consider changing trail grade, alignment, or location, or take other measures to mitigate the hazard.

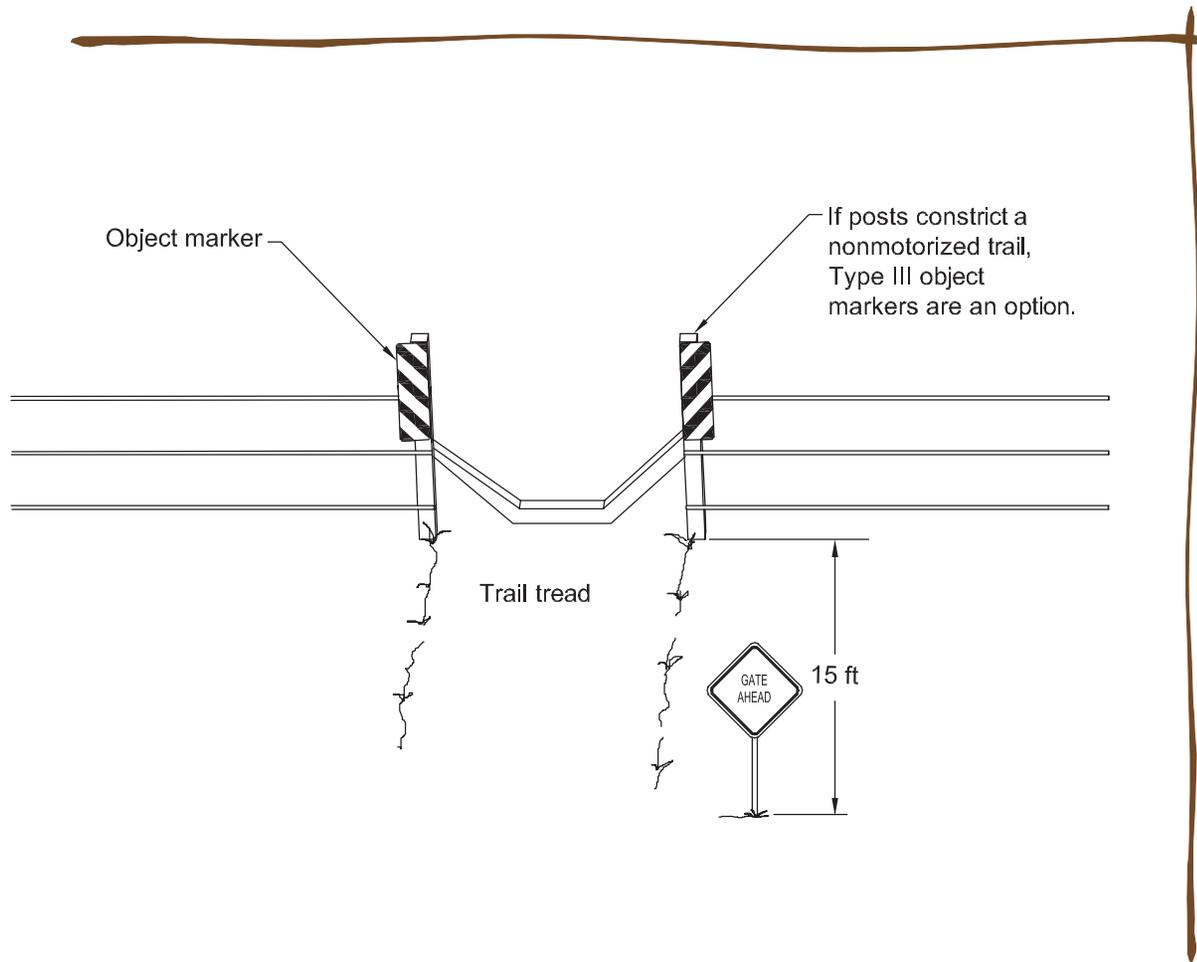
Carefully place advance warning signs for gates, cattle guards, bridges, or underpasses. Because these passages may be new to horses or mules, they could balk. If the animal rears, a nearby sign mounted on a post may pose a danger. Locate advance warning signs at least 15 feet (4.6 meters) ahead of these constricted passageways (figure 12-4). The MUTCD addresses warning signs for cattle guards across roads, but has little guidance regarding warning signs for gates. Consult agency guidelines and directives for more information regarding gate signs.



#### Lingo Lasso

##### Markings

Markings are special types of warning signs that include object markers (figure 12-4), barricade markers, end-of-roadway markers, delineators, and pavement markings. For example, object markers warn of cattle guards that constrict roads. Object markers are used on trails that are shared with motorized traffic or bicyclists. They are an option for shared-use nonmotorized trails. However, some stock are wary of object markers and may shy away or refuse to walk past them. Markings can supplement regulations or other TCDs, such as pavement arrow markings that provide guidance in campgrounds and parking areas.



### Guide Signs

Guide signs convey essential travel information—such as direction or distance—allowing travelers to easily reach their destinations. Some agencies refer to guide signs as *destination signs*. Use guide signs on highways near the approaches to recreation sites, in recreation sites, and on trails.



#### Reliable Signs

#### Horse Sense

Guide signs help guide road and trail users to and from destinations, such as campgrounds, trailheads, trails, and other points of interest. Guide signs include route markers, destination signs, and reference location signs. Up-to-date recreation, visitor, and travel management maps also are important. Information on maps and signs should be consistent.

#### Road Guide Signs

Road guide signs inform drivers about recreation sites. Destination and approach guide signs help prepare drivers for the slowing, braking, and turning maneuvers necessary for safe entry to recreation sites. Equestrian vehicles frequently tow large trailers, and their drivers need plenty of clear, advance notice of intersections. Figure 12–5 shows some site destination and approach signs. Road guide signs must be compatible with vehicle speed, traffic pattern, and the driver’s response time.

Figure 12–4—Preferred sign placement for advance warning of gates or constricted areas. This trail gate is not accessible to people with disabilities if the bar across the opening is higher than 2 inches.

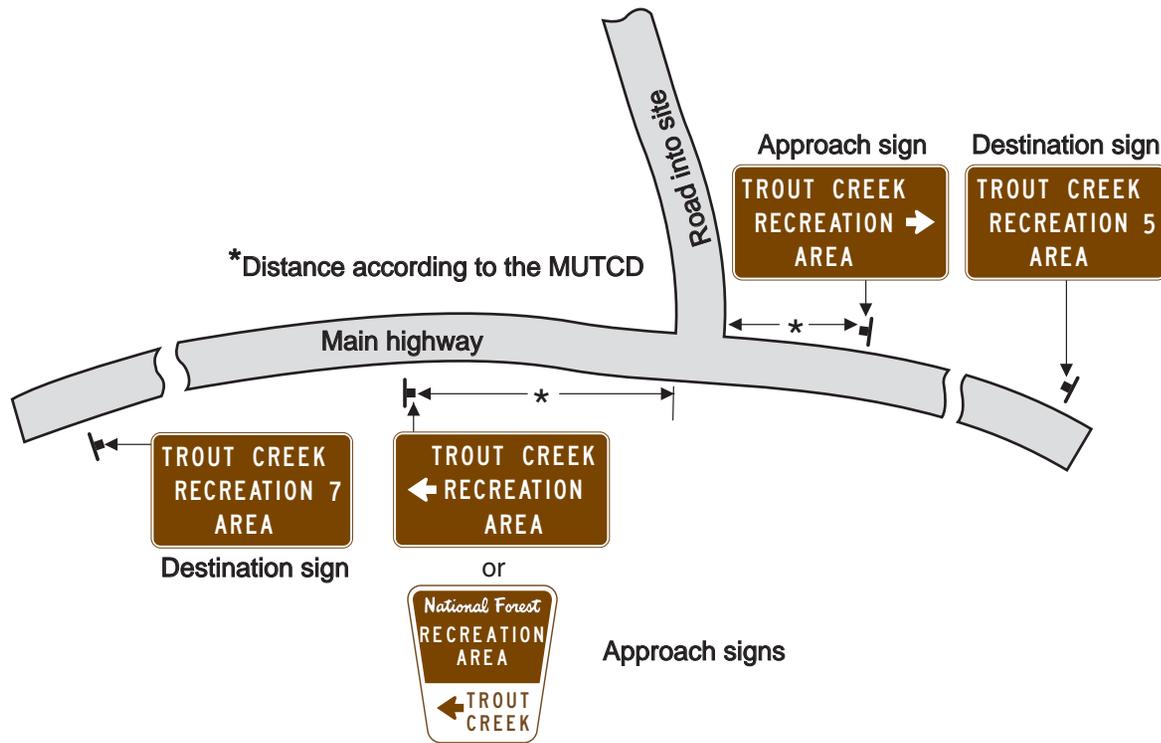


Figure 12-5—Examples of site destination and site approach signs.

In recreation sites, road guide signs direct travelers to trailheads, campgrounds, single-party camp units, and group camps (figure 12-6). Road guide signs, and sometimes trail guide signs, mark individual camp units. Place signs for individual camp units in a consistent manner, using small, retroreflective signs, posts, or markers with the unit number. It may be beneficial to include a horse symbol on the marker to reinforce the rule that campers must have stock. Mark several-party units so others know they are for more than one party. Camp units accessed from a trail, rather than from a road, don't need retroreflective camp unit signs. Figure 12-7 shows a routed wood guide sign at a camp unit accessed from a trail.



Figure 12-6—Road guide signs give basic directions.



Figure 12-7—Nonretroreflective guide signs, such as this camp unit marker, can be used when sites are accessed from trails. Sites accessed from roads must have retroreflective signs.



### Lingo Lasso

#### Retroreflective Signs

Signs that must be seen by motorists at night should be *retroreflective*, or they must be illuminated to show the same shape and color by day and night. Retroreflective signs reflect light directly back, no matter what angle the light comes from, unlike a mirror which must be exactly perpendicular to the light to reflect it directly back. For more information, consult the MUTCD and managing agency sign manuals. Although some horses and mules may be leery of retroreflective surfaces, the MUTCD requirements were established to ensure motorist and pedestrian safety.

#### Trail Guide Signs

On trails, guide signs:

- ☆ Give directions—*Directional guide signs* identify the trail, show the trail’s direction, or guide trail users to destinations (figure 12-8). Directional signs usually include the trail name, trail number, and direction arrows.
- ☆ Identify junctions—In a trail system where junctions are designated with numbers or letters, a *junction identity sign* (figure 12-9, top) may be used. Provide trail maps or *You are here* signs (figure 12-9, bottom) at trail access points or along the trail. Place the junction identity signs so they can be seen at or before the junction. Junction identity signs are often used with other trail guide signs at trail junctions.
- ☆ Offer reassurance—*Reassurance* or *confidence markers* reconfirm the identity, location, or route of the trail. Trail markers, guide poles, blazers, and cairns are reassurance markers. Figure 12-10 shows a reassurance marker that also identifies the trail. Use reassurance markers in areas where travelers may be unsure whether they are still on the trail. Place a minimum number of reassurance markers along the trail, at road crossings, and past trail junctions.

Select a marker that is appropriate for the level of development, as shown in table 12-1. Don’t use reassurance markers in areas where the trail is well defined, except when needed at openings and



Figure 12-8—Trail guide signs direct trail users. An arrow clarifies this sign.



Figure 12-9—Trail guide sign with a junction identity sign and a *You are here* sign.

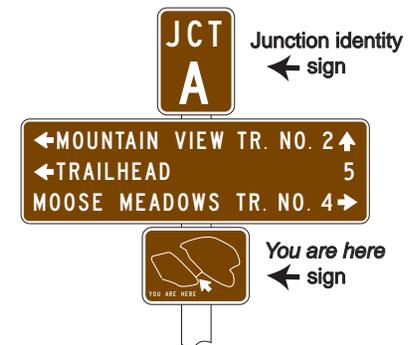


Figure 12-10—The reflector on the top of this reassurance marker facilitates night rescue operations. This photo has been digitally altered for clarity.



road or trail crossings. On trails that are poorly defined, reassurance markers need to be *intervisible*—within sight of each other— during normal use conditions. Baughman and Serres (2006) recommend placing reassurance markers at least every ¼ mile (0.4 kilometer) in open country.



### Multipurpose Markers

#### Trail Talk

Trail markers may serve more than one function. The simple reassurance marker shown previously (see figure 12–10) also provides trail identification and serves as a ground reference point. The marker consists of a square metal post with a trail label on each side and a reflector on the top. The reflector is visible to search and rescue groups at night. To facilitate emergency operations, the marker locations are entered in a GPS database. Emergency responders in helicopters or aircraft flying overhead can see the reflectors and identify the precise location of the trail marker.

### Shared-Route Signs

Occasionally, trails and roads share the same route. Place signs along such routes before shared use occurs, based on engineering judgment or an engineering study. The optional *Share the Road* sign shown in figure 12–11 warns motorists about shared use on a road. Agencies or jurisdictions may have specific sign and management standards and guidelines for shared routes. More information is available in the MUTCD.

12

Table 12–1—Appropriate trail reassurance markers based on the level of development.

Level of development	Route marker	Guide pole	Blazer	Rock cairn
Low			X	X
Moderate	X	X	X	X
High	X	X		

### Trail Sign Placement

Place signs high enough so that they are visible without posing safety hazards for riders and stock. Table 12–2 shows recommended installation distances and heights for signs on horse trails.

Table 12–2—Recommended installation for signs on horse trails.

Sign placement*	Low and moderate development (feet)	High development (feet)
Vertical Distance (from tread level to sign bottom)	5 (minimum)	5
Horizontal Distance (from nearest sign edge to tread edge)	3	3 to 6

\* Also refer to agency guidelines.

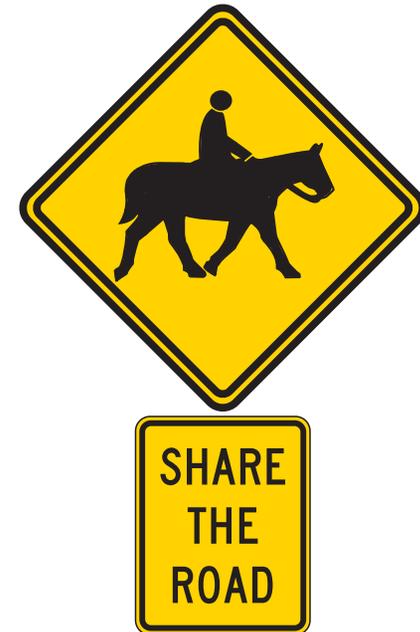


Figure 12–11—Combining an equestrian trail warning sign with a *Share the Road* message alerts motorists and riders that they are sharing the road. A *Share the Trail* message can be used for trails.



## Identification Signs

Identification signs assure recreationists they are in the right place or on the right trail (figures 12–12 and 12–13). Generally, install identification signs at site entrance roads, host sites, and trails with special designations. Identification signs at the entrance to a campground or trailhead confirm the destination as the driver turns off the main road. These signs are not traffic control devices and are inappropriate for use as destination and site approach guide signs. Designs for entrance signs vary with the setting, level of development, and agency requirements. Install site identification signs up to 30 feet (9.1 meters) outside the *clear zone*—the safety area for vehicles straying beyond the edge of the road.



Figure 12–12—When identification signs for recreation sites are along roads, the signs must be placed outside the clear zone, be shielded by a barrier such as a guard rail, or meet MUTCD breakaway standards.



Figure 12–13—Recreation sites with a high level of development often incorporate more elaborate identification signs than areas with a low level of development.

## Visitor Information Stations

Visitor information stations—sometimes called *information kiosks*—are useful at campgrounds and trailheads. They contain information that:

- ☆ Familiarizes recreationists with the site or trail
- ☆ Discusses facility use, trail conditions, and safety
- ☆ Provides instructions regarding rules, regulations, and etiquette

Information station design must be appropriate for the level of development and the amount of information provided. Permanent sign panels or bulletin boards with one to three panels usually are adequate. If the information changes frequently, bulletin boards allow the land manager to post new items easily. Figure 12–14 shows an information

station suitable for a campground with a moderate level of development. It would not be safe for riders to lead or ride their stock under a roof. If there is a roof over the information station, provide a hitch rail nearby so riders can dismount and tie their stock to the hitch rail while viewing signs.



Figure 12–14—This information station is appropriate for an area with a moderate to high level of development. The information is displayed in an attractive, uncluttered manner.

Write sign text clearly and concisely, because riders may have to keep their stock on the move. Mounted riders may just take a quick glance. Make important messages obvious, and communicate more detailed information in brochures or printed handouts. Brochure boxes (figure 12–15) can provide such material at the site. Visitor information stations often provide safety information and display instructions regarding recreation site fees and trail registration.



Figure 12-15—Detailed information, such as maps or regulations, can be provided in weather-resistant brochure boxes.

On visitor information stations without a roof, mount posters so they can be read from horseback by placing the poster's center about 5 feet (1.5 meters) above the ground. To increase readability, size the text according to the distance between the viewer and the poster. Add 1 inch (25.4 millimeters) of letter height for every 10 feet (3 meters) of viewing distance. For example, use letters that are at least 1

inch (25.4 millimeters) high on a poster that is 1 to 10 feet (0.3 to 3 meters) from the reader. Make sure posters are made from weather-resistant materials.

Maps posted at visitor information stations familiarize recreationists with the site's facilities so they can select a camp unit or find a trail access point. Figure 12-16 shows a simple and effective recreation site map. Similarly, maps posted at trail access points familiarize riders with the trail routes. Consider having printed handouts with more specific details. Figure 12-17 is a trail map handout that has clear and concise information. Table 12-3 lists suggested locations for visitor information stations. Locate information stations a safe distance from vehicle and horse traffic.



Figure 12-16—A simple site map is easy to understand.



Figure 12-17—Trail map handouts provide specific information that can help trail users before and during a recreation visit. —Courtesy of the Arizona Trail Association.

Table 12-3—Suggested locations for information stations.

Type of information station	Station location
Trail	Trail access points
Recreation site	Recreation site entrance, toilet or shower buildings, group gathering areas, group camp parking areas, campground host sites, and water troughs



## Visitor Information Stations at Recreation Sites

Some information is useful to recreationists before their arrival at a recreation site, and some information is beneficial once they are onsite. For information relevant to all users, refer to the land agency’s sign guidelines. Table 12–4 lists information beneficial to riders recreating at trailheads or campgrounds.

Along with the standard recreation site rules, provide riders with the rules pertaining to horses and mules. Two important subjects are the disposal of animal manure and the use of weed-free feed. For more information and resources on these topics, consult *Chapter 13—Reducing Environmental and Health Concerns*.



Table 12–4—Information that could be provided at equestrian recreation sites.

	Equestrian recreation site sign and handout information	Signs	Handouts	Critical	Desirable
General information	Location of equestrian facilities (parking, camp and picnic units, group camps, accessible units, water sources, hitching and confinement areas, manure disposal, wash racks, accessible mounting ramp, stock loading ramp, and so forth)	X	X		X
	Camp unit restrictions (riders with horses and mules only)	X	X	X	
	Number of horses allowed in the camp unit	X	X	X	
	Number of vehicles and trailers allowed in the camp unit	X	X	X	
	Number of riders allowed in the camp unit	X	X	X	
	Size restrictions for horse trailers	X	X	X	
	Method of manure disposal	X	X	X	
Regulations	Regulations regarding weed-free feed	X	X	X	
	Horse use restrictions (designated roads, parking pads, horse areas, and trails)	X	X	X	
	Stock speed restrictions in the recreation site	X	X	X	
	Vehicle speed restrictions in the recreation site	X	X	X	
	Tethering restrictions (types of gear, number of stock)	X	X	X	
	Prohibitions (excessive noise, barking dogs, or other annoying behavior)	X	X	X	
Facilities	Road conditions (suitability for horse trailers)	X*	X		X
	Parking area description (space for turning horse trailers around)	X*	X		X
Safety	Presence of dangerous predators or creatures	X	X	X	
	Presence of vegetation toxic to stock	X	X	X	

\* The use of road signs must be determined on a case-by-case basis using an engineering study or application of engineering judgment.



### By the Rules

Rules appropriate for an equestrian recreation site vary by location. The following rider-oriented information appeared on a handout provided by the Prescott National Forest:

### Welcome to Groom Creek Horse Camp and the Prescott National Forest

*Notice:* This campground was built for the exclusive use of the equestrian camper. Camping without a horse is prohibited.

This campground is serviced in part by citizen volunteers. Your help is needed to keep this camp clean. Your campground host will help you find a camp unit or provide information regarding camping rules and local recreation opportunities.

#### ☆ Horses

- » No horses or gear will be tied to trees or other places not designated.
- » Tether lines are provided for two horses only. Two horses may be tied to horse trailer for a total of four horses per site. Portable corrals may be used under tether line or behind trailers.
- » Please remove all manure. Manure may be deposited in the campground dumpsters or hauled to a sanitary landfill.

#### Trail Talk

- » Restore all areas where horses are tied to as natural appearance as possible. Contact host for rakes, shovels, etc. as needed.
- » Hitching rails are provided at convenient locations for watering horses. Do not water horses at faucets.
- » All horses must be under physical control at all times.
- » Keep horses on roadways. No cross country travel will be allowed in campground as this destroys the vegetation and causes erosion.
- » Horses will be ridden at a walk at all times in campground.

#### ☆ Pets (other than horses)

- » Pets are welcome, but must be under physical restrictive control at all times. This means being caged or on a leash no longer than six feet.

#### ☆ Vehicles

- » Each site is intended to accommodate one vehicle with horse trailer and one other vehicle, if needed for carrying people.
- » Sites are designed for 5 people; a maximum of 10 people is allowed only to accommodate a single large family.
- » Trailers longer than 35 feet are prohibited in campgrounds.

### Visitor Information Stations at Trail Access Points

Visitor information stations at trail access points are similar to those in recreation sites. These information stations (figure 12–18) familiarize riders with trail conditions, etiquette, and hazards. Table 12–5 lists suggested information to display at trail information stations and in trail handouts. Riders want to know trail conditions because the conditions determine the kind of ride they can expect. Provide updated information to help them make informed decisions. Figure 12–19 is an example of trail information suitable for a printed handout.



Figure 12–18—This trail information station is near a wilderness entrance.



Table 12–5—Information that could be included on trail signs and in handouts.

	Trail sign and handout information for riders	Signs	Handouts	Critical	Desirable
<b>Trail conditions</b>	Trail length	X	X	X	
	Typical and maximum trail grade	X	X	X	
	Typical and minimum tread width	X	X		X
	Trail surface materials	X	X	X	
<b>Obstructions</b>	Location of water crossings	X	X		X
	Location of stepover gates	X	X		X
	Location and type of gates (operated from ground or horseback)	X	X		X
	Locations where the vertical clearance is less than 10 feet		X		X
	Locations of above-grade crossings (bridges and so forth)	X	X	X	
	Locations of below-grade crossings (culverts, tunnels, and so forth)	X	X	X	
<b>Facilities</b>	Locations of stock watering sources along the route	X	X	X*	
	Location of toilets along the route	X	X		X
<b>Safety</b>	Presence of vegetation toxic to stock	X	X	X	
	Areas impassable by stock	X	X	X	
	Presence of poisonous or dangerous creatures	X	X	X	
<b>Etiquette</b>	Intended trail users	X	X	X	
	Trail user with right-of-way (stock, bicyclist, or hiker)	X	X	X	
	Bicyclist instructions for approaching stock	X	X	X	
	Hiker instructions for approaching stock	X	X	X	

\* This is important in dry climates or when water access is limited.



**Horse Sense**

**Post It Here**

Many riders appreciate a message board for posting notes and activity announcements. This can be a simple bulletin board at the visitor information station or in a group gathering area. Notes left on a message board can guide late arrivals to the appropriate camp unit or trail location and can let them know whether their friends arrived earlier.





2004 Update

## 3\_Canelo Hills - West

### Canelo Pass to Patagonia

**General Information**

This passage provides scenic views of rolling grass hills, oak savannas, mesquite groves and riparian canyons. The east side of this passage links with the Canelo Hills East Passage at the Canelo Pass trailhead. The west side of this passage ends in the town of Patagonia where it links with the Tompauk Gulch Passage.

**Location:** Southern Arizona on the Coronado National Forest between Parker Canyon Lake and Canelo Pass.

**Length:** 17.4 miles

**Difficulty Rating:** Moderate

**Recommended Seasons of Use:** Fall, Winter, Spring

**Access:**

To reach the Canelo Pass trailhead, turn south on FR 799 from Highway 83 near Canelo, and go four miles to the signed trailhead on the west side of the road. The northern trailhead for this passage is located east and south of the town of Patagonia. Take FR 58 (which begins in front of the US Post Office) from Hwy 82. Travel three miles on FR 58 until you reach the trailhead on the southwest side of the road.

**Trail Route Description:**

From the Canelo Pass trailhead the route continues southwest and switchbacks up a ridge overlooking Canelo Hills. From here the trail descends into the scenic Meadow Valley and heads west along four wheel drive roads in Redrock Canyon to Red Bank Well. Along this section of trail there are a few enclosures where there are sensitive plant and animal species. These enclosures are fenced and/or signposted and camping is prohibited in these areas. From Red Bank the trail continues northwest and crosses several washes as it winds north and then west of Red Rock Ranch. The trail crosses Redrock Road and begins climbing and descending various ridges with scenic views of Kado Mountain. The trail terminates 3.3 miles from Redrock ranch road at the trailhead at Harshaw (FR 58), east and south of Patagonia. This passage, named Canelo Hills West (TR113) is 17.4 miles from the Canelo Pass trailhead to Harshaw on FR 58.

**NOTES:** Water is intermittent and scarce. Plan to bring your own water. Stock water may be available at Downs Under Tank, La Plata Tank, and Red Bank Well.

- Trail is designed for hiking and horsetruck riding. Mountain bikes are permitted.
- Cattle grazing occurs along the route of the trail. Please close all gates.
- Please use low impact camping-hiking techniques.
- Gently rolling trail, with few climbs in elevation ranges from 4050' to 5980'.
- Mines are located near some of the trail routes and are marked. Please remain on the trail.
- There are areas closed to overnight camping and stock. These areas are to protect sensitive wildlife and plant species and are signposted and/or fenced.

**Resources**

**Maps:** This map, more detailed maps available in the future, USGS Quads: Mt. Hughes, T'Donner Canyon, Canelo Pass, Huachuca Peak.  
(The trail is not marked on these quads.)

**For more information, contact:**  
Sierra Vista Ranger District, Coronado National Forest, 7990 S. Hwy 92, Hereford, Arizona 85015  
(520) 378-0311

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Figure 12-19—Effective trail handouts contain just enough information to be useful. —Courtesy of the Arizona Trail Association.

One of the most important messages to convey to users on shared-use trails is who has the right-of-way. The philosophy varies across the country and with land management agencies. In many regions, hikers and mountain bikers yield to riders, and mountain bikers yield to hikers (figure 12-20). Yielding the right-of-way is a courtesy—generally it is not enforceable by law. No matter who has the right-of-way, all users need to know who is expected to yield. Post right-of-way information at the trail access point and along the trail. To be effective, the sign and the information on it must be large enough to be seen at a distance, and the message must be easy to understand. Follow the guidelines established by the land management agency.



Figure 12-20—Trail right-of-way etiquette is usually based on courtesy—not regulation—and varies from region to region.



### Critical Call

#### Horse Sense

It helps if mountain bikers call out as they approach a horse or mule. If bicyclists approach quietly at a rapid speed, stock may be surprised and become frightened. If an area is heavily traveled by mountain bikers, signs explaining mountain bike etiquette (figure 12–21) are critical.

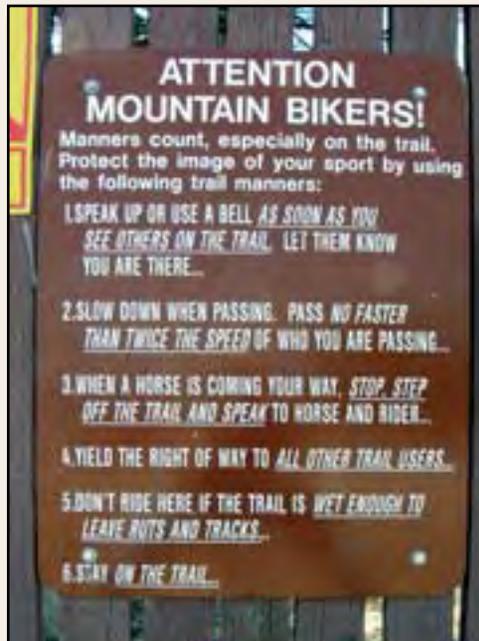


Figure 12–21—Post local etiquette rules where many visitors will see them. This list is posted at a shared-use trailhead.

### Interpretive Signs

Interpretive signs communicate messages that can change behavior, educate, or evoke emotion (figure 12–22). These signs may be used for self-guiding trails or wayside exhibits at cultural, natural, or geographical points of interest. Seek assistance from specialists when planning interpretive signs at trail access points, in a campground, or along a trail. In addition to conveying information effectively, interpretive signs must meet accessibility guidelines. (See the *Accessible Signs* Resource Roundup on page 234.)



Figure 12–22—Interpretive signs communicate a variety of messages. This artistic sign educates riders about appropriate recreation behavior.

### Exhibit Structures

Shelters often protect viewers, printed literature, or interpretive signs from the weather and they can be inviting. Because it is dangerous to lead or ride a trail animal under a shelter, design the structure to discourage entry while on horseback. Install a hitch rail nearby to encourage riders to dismount and tether stock before reading the information.



### Exhibit It

#### Resource Roundup

*Signs, Trails, and Wayside Exhibits: Connecting People and Places, Third Edition* (Trapp and others 1996) has more information regarding interpretive signs. The book and several related publications can be ordered from the University of Wisconsin at <http://www.uwsp.edu/cnr/schmeckle/Handbooks/Signs>.



### Viewing Areas

To help users read signs with detailed text, include a viewing area at visitor information stations or interpretive signs. A viewing area is an open, cleared space in front of the sign for up to three riders on horseback. The extra space allows riders to read the information while trail traffic keeps moving a safe distance away from stock. If visitor information stations are near roads in a recreation site, the viewing area provides separation from motor vehicles.

A clear space of 24 feet (7.3 meters) wide by 16 feet (4.9 meters) long accommodates three animals. One or two animals need an area 16 feet (4.9 meters) square (figure 12–23). If substantial vegetation or restrictive slopes make it impossible to provide a large enough cleared space for stock, place a hitch rail in a clearing near the sign.

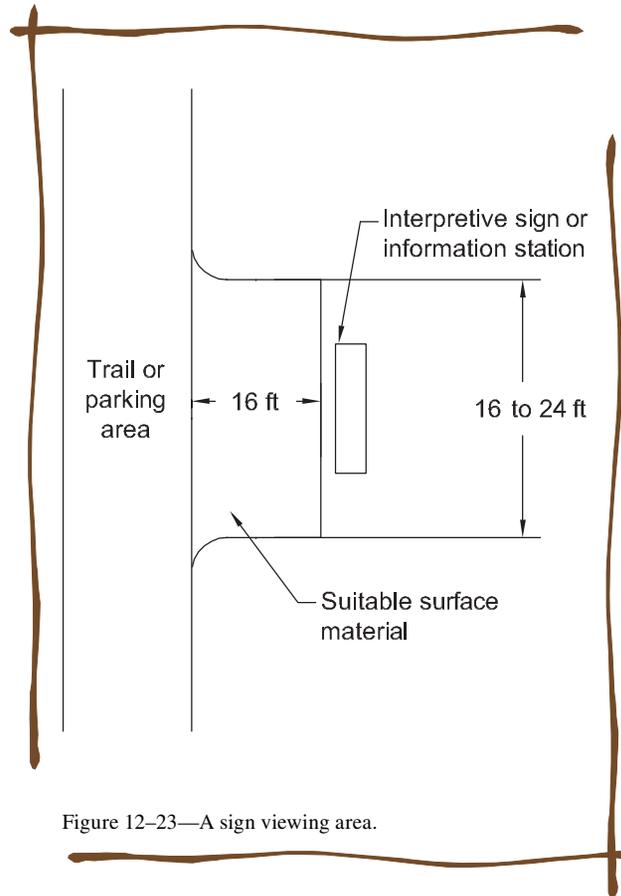


Figure 12–23—A sign viewing area.

### Accessibility Information

Some riders have difficulty using trails that require dismounting for obstacles or negotiating steep or uneven terrain. Provide maps, signs, or handouts to help trail users make informed choices. Standard posted messages include the trail name, number, destination, and distance. If pedestrian trails have been evaluated for accessibility, post the following additional information:

- ☆ Typical and maximum trail grade
- ☆ Minimum trail width
- ☆ Typical and maximum cross slope
- ☆ Trail surface—type and firmness of surface
- ☆ Any major obstacle—such as boulders in the trail tread



#### Accessible Signs

#### Resource Roundup

Many signs must comply with ADA/ABAAG Section 703, which contains requirements for print lettering, raised lettering, Braille, mounting heights and locations, and other considerations. Raised lettering and Braille are only required at buildings. The ADA/ABAAG Section 216 (Section F216 for Federal facilities) lists sites where compliant signs must be posted.

Forest Service employees should consult the FSTAG and FSORAG regarding signs for recreation sites and trails. The *Accessibility Guidebook for Outdoor Recreation and Trails* (Zeller and others 2006) summarizes the information.





At a campground, let campers know which equestrian camp units and related facilities are accessible and provide information concerning barriers to facilities or trails. Show accessible camp units on the site map with wording such as:

Sites 2, 4, 6, and 10 are accessible. If no one in your group needs accessible facilities, please do not use these sites unless all other sites are filled.

Don't place signs indicating accessibility at the individual camp units. Such signs tend to draw needless attention to campers with a disability.

Accessible camp units are generally available to all on a *fill last* basis if they are a small portion of total units. If all or most units are accessible, they're generally available with no restrictions.

### Riders, Signs, and Safety

If riders must dismount to read a sign or use facilities, provide a hitch rail nearby. The hitch rail should be located where riders can monitor their stock. It is a good idea to provide a mounting block as well.

Try to leave more than enough room for stock to pass safely when installing signs. It is easy for a sign or post to catch a leg, stirrup, or tack. A horse or mule can scrape its side. Besides causing injuries, such encounters may startle stock, especially if part of the saddle catches. Reduce the possibility of injury by rounding all sign corners and removing sharp objects from posts.

Vehicles towing horse trailers are relatively large and drivers can have difficulties maneuvering them at trailheads and campgrounds. Avoid placing signs near areas where towing vehicles travel, turn, or back, or near entries to back-in or pullthrough parking pads. To avoid damage by bored stock, install signs at least 7 feet (2.1 meters) from areas where stock are confined.



#### The Accessibility Symbol

Signs provide key information concerning the accessibility of facilities and programs. The International Symbol of Accessibility (ISA)—the familiar person-seated-in-a-wheelchair logo (figure 12–24)—indicates the facility is in compliance with applicable State or Federal accessibility requirements. According to the ADA/ABAAG, the ISA must be posted in only four outdoor places:



Figure 12–24—When the international symbol of accessibility (ISA) is posted on a facility, it designates compliance with all applicable State or Federal accessibility requirements. Therefore, this symbol must be used with caution.

#### Horse Sense

- ☆ Accessible parking spaces, where there are five or more parking spaces.
- ☆ Accessible rest rooms and bathing facilities.
- ☆ Accessible loading zones.
- ☆ Accessible entrances to a building. If the main entrance is not accessible, an arrow is posted to direct users to the closest accessible entrance.

Accessibility requirements call for the ISA to have high contrast colors. In areas where State or local law enforcement officers will be enforcing parking restrictions, the familiar blue and white combination must be used. In other outdoor settings, colors such as brown and white would be better choices.



12



## Chapter 13—

# Reducing Environmental and Health Concerns



## Trail Talk

**Trail Talk—Impact Study**

David Newsome and others (2004) reviewed research in the United States and Australia in their report, *Environmental Impacts Associated with Recreational Horse-Riding*.

They remind riders that: “Because of the impact potential, it needs to be emphasized to horse-riders that, for continued access, management is critical. Only with ‘best practice’ management should horse-riding be allowed in national parks and similar areas. With sustained horse traffic, management may have to include some or all aspects of the following: trail location and design; trail construction (drainage and control); trail hardening, such as the use of gravel, geotextiles or geoblock; trail maintenance; visitor regulation (confinement, amount of use, timing of use); education (user behavior, codes of conduct); policing and enforcement.”

All users create impacts on the environment. Project planners reduce adverse impacts through sensitive planning of trails and recreation sites. Designers should carefully consider the needs of riders and mounts, the limits of the site, and project limitations. Consult applicable Federal, State, and local environmental regulations when dealing with environmental concerns.

It is beyond the scope of this guidebook to offer scientific data about the environmental effects and health concerns of horse use, or to provide detailed information regarding mitigation. This chapter contains general background information and suggested approaches.

**Water Quality**

Equestrian trails, trailheads, and campgrounds that are poorly located or improperly designed can cause erosion that deposits sediment in streams, harming fish habitat and waterflow. Sedimentation occurs every time an animal steps in a stream (figure 13–1). Prolonged sedimentation can reduce roughness along the stream bottom and decrease water depth.



Figure 13–1—Riding off the trail in streambeds can disturb aquatic life and soils.

*Planning and Design Considerations*

- ☆ Consult soil scientists, hydrologists, or engineers to locate water crossings.
- ☆ Use bridges or stabilized water crossings.
- ☆ Construct approaches to stream crossings so overland water does not flow on the trail or road surface, and rising streams don’t run down the approaching tread. Where suitable, reinforce approaches with gravel, rock armoring, or other materials that resist water damage.
- ☆ Locate trails and roads so topography and grades restrict destructive runoff. Use appropriate construction and drainage techniques.
- ☆ Choose suitable surface treatments—such as soil hardeners or geotextiles—for trail treads across boggy areas.
- ☆ Plan trails so users will go slower in sensitive areas. For example, incorporate trail curves in such areas instead of long straight segments.
- ☆ Use a trail design that constricts trail users to a designated tread to minimize the tendency of stock to create *braided*—or multiple—trail treads.



## Horse Manure

The beneficial uses of manure as fertilizer are well-known—ask any gardener or farmer. However, in recreation areas and on trails manure may be unwelcome. Users may wonder whether horse or mule manure poses significant health risks to humans. There are no definitive answers, but studies are proposed or underway to examine manure’s role in water pollution, insect breeding, pathogen transfer, and distribution of weed seeds.

A lot of the manure produced by stock is concentrated at predictable places, including trailers, confinement areas, and trailheads. Because horses and mules often defecate in the first one-half mile (0.8 kilometer) of a trail ride, consider providing two short trail segments from the campground to the main trail—one for riders and one for other users.

Some equestrian groups foster a stewardship attitude by cleaning up after their stock where signs (figure 13–2) are posted and convenient containers are provided. In other places, such as wildland areas where use is low, cleaning up is not customary. Posting signs asking riders to clean up after their stock may not be effective, especially on trails. Programs that involve planners, managers, and all trail users—not just riders—may be useful

for finding effective solutions and changing local attitudes. Enforcement efforts may be considered until riders become familiar with the policies. Some jurisdictions classify manure as a solid waste and have regulations regarding disposal.

### Planning and Design Considerations

- ☆ Involve riders when planning manure management in recreation sites.
- ☆ Plan separate trails or treads for riders in areas where manure might cause problems for other users.
- ☆ Provide separate equestrian-only parking so others won’t have to park near animal waste.
- ☆ Locate corrals and tethering areas away from water sources.
- ☆ Provide convenient structures for sanitary manure disposal. Onsite *composting*—or controlled decomposition—may be subject to local health regulations. Locate receptacles on level ground and provide positive drainage to prevent puddles from forming and waterways from being contaminated. Manure containers with lids minimize odors and flies. Receptacles must be easy to use.
- ☆ Design containers so waste can be removed easily.
- ☆ Consider providing wheelbarrows, rakes, bags for manure cleanup, and a place to store them.

### Trail Talk



#### Manure and Human Health

Adda Quinn investigated current literature to write *Does Horse Manure Pose a Significant Risk to Human Health?* (2001). She states: “Horse guts do not contain significant levels of the two waterborne pathogens of greatest concern to human health risk, *Cryptosporidium* or *Giardia*, neither do they contain significant amounts of *E. coli* 0157:H7 or *Salmonella*. Fungus, viruses, bacteria and worms found in horses have never been shown to infect humans, and are unlikely to be zoonotic [*transmittable from animals to humans*].” Quinn cites numerous scientific studies and resources to support her conclusions.



Figure 13–2—Signing encourages trail users to be responsible for their animals.



### Manure on Trails

#### Trail Talk

Horses and mules leave significant amounts of manure on trails each year, some of which washes into streams. Few studies have looked at whether horse or mule manure can transmit pathogens to humans. A study conducted at the University of California, Davis, Medical Center by Robert Wayne Derlet, M.D., and James Carson, Ph.D., (2004) looked at the prevalence of human pathogens in horse and mule manure along the John Muir Trail. According to the researchers, “Pack animal manure commonly encountered by backpackers on Sierra Nevada trails contains large numbers of...bacteria normally found in animals. Human pathogens with potential medical importance are present but have a low prevalence.”

### Noxious and Invasive Weeds

Seeds of noxious plants and invasive species may remain viable after passing through a horse or mule’s digestive tract. Weed management efforts focus on:

- ☆ Stopping weed introduction
- ☆ Redirecting traffic around existing vegetation
- ☆ Removing noxious and invasive plants

As a precautionary measure, some land managers restrict trail use unless trail stock are fed certified weed-free feed for several days before and during trail use. Figure 13–3 shows a sign that informs trail users about feed regulations. Also see *Appendix G—Sample Requirements for Weed-Free Feed (BLM)* and *Appendix H—Sample Requirements for Weed-Free Feed (Forest Service)*.

#### Planning and Design Considerations

- ☆ Avoid areas with known noxious or invasive species when locating recreation facilities.
- ☆ Search literature for current best planning and management practices.
- ☆ Install signs informing recreationists about noxious weeds, invasive species, and agency requirements.



Figure 13–3—Many public agencies have regulations regarding stock feed.



### Spreading Nonnative Seeds

#### Trail Talk

Horses and mules are often thought to be an important source of weed and nonnative seed introduction along trails, but the evidence is largely anecdotal. The American Endurance Riding Conference funded a study to examine the issue. Stilt T. Gower, Ph.D., of the Department of Forest Ecology and Management at the University of Wisconsin-Madison determined that “while there are seeds from weeds and nonnative species in horse manure and hay, the plants that result don’t survive or spread on trails. Therefore, horses do not appear to be a major source for the introduction of nonnative species...native and nonnative plant species rarely become established on horse trails because of the adverse effects of harsh environmental conditions and frequent disturbance on seedling establishment.” The article, *Do Horses Spread Non-Native Plants on Trails?*, is available at <http://www.thehorse.com/ViewArticle.aspx?ID=8846>. The site requires free registration.



Resource Roundup

Weeds and Seeds

Many electronic sources offer helpful information regarding weed management.

☆ *Backcountry Road Maintenance and Weed Management* (Ferguson and others 2003) at <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm03712811>. This Web site requires a user-name and password. (Username: t-d, Password: t-d)

☆ *Federal Interagency Committee for the Management of Noxious and Exotic Weeds* (FICMNEW) Web site at <http://www.fws.gov/ficmnew>.

☆ *Invasive Species Management* (National Park Service) at <http://www.nature.nps.gov/biology/invasivespecies>.

☆ *Weed Free Feed: Horsemen Protecting Public Lands from Invasive Weeds* at <http://www.extendinc.com/weedfreefeed>.

☆ *Weeds Website* (Bureau of Land Management) at <http://www.blm.gov/weeds>.

Soil Erosion and Root Damage

Trail stock generate many pounds of pressure on the ground under each hoof. Stock tied to highlines, trees, and shrubs for prolonged periods will compact the soil, possibly damaging root systems (figure 13–4). Horses and mules may circle repetitively

when they are bored or anxious, creating a doughnut-shaped area of disturbed soil. Other nervous stock paw trenches. Post signs with educational information about stock tethering. When riders are well informed, they can minimize impacts. A regular maintenance program may be able to address problems before they become serious.

Planning and Design Considerations

- ☆ Choose locations for concentrated stock use carefully, evaluating soils and vegetation for vulnerability to damage or disruption.
- ☆ Locate hitch rails, horse areas, pulloffs, and viewing areas away from fragile soils and vegetation.



Figure 13–4—Stock can cause soil or root damage when they are tied to trees. Signs at visitor information stations can discourage this practice.

Vegetation and Facility Damage

Horses and mules graze whenever they have the opportunity—unless their riders stop them. Stock consume more than just grass. They will nibble on most of the trees, shrubs, and plants within their reach. Sometimes, grazing is prohibited to achieve management objectives. When tethered or contained stock are bored, hungry, uncomfortable, fearful, or just need attention, they sometimes chew on things they would normally leave alone. Sometimes they engage in *cribbing*—biting and swallowing air at the same time. Chewing, cribbing, gnawing, and similar behaviors damage fences, hitch rails, and recreation site furnishings.

Planning and Design Considerations

- ☆ Locate areas of concentrated horse use away from sensitive vegetation. Trim vegetation back at least 7 feet (2.1 meters) from trailheads, horse areas, hitch rails, and water troughs. When planting young trees and shrubs, consider how large they will be when they are mature. Trim tree canopies at least 12 feet (3.6 meters) above horse areas, parking pads, or parking spaces.
- ☆ Locate trail and campground furnishings at least 7 feet (2.1 meters) from places where stock are confined so the stock can't chew on them.



### Toxic Vegetation

Many plants are toxic to stock and may damage their digestive systems or kill them. The animal's weight, age, and general health affect how intense the reaction will be. Most horses and mules avoid toxic plants that taste bad. The horses in figure 13-5 are feeding on grass and deliberately avoiding the potentially toxic shoots in between. However, some toxic plants—such as water hemlock—have tender, young sprouts or roots that appeal to horses and mules.

#### Planning and Design Considerations

- ☆ Avoid locating trails or facilities in areas known to have plants toxic to stock. Remove the toxic plants where possible.
- ☆ Post signs noting the presence and location of plants that are toxic to stock.



Figure 13-5—Most adult horses and mules avoid toxic species because they are unpalatable, but some toxic plants have young tender shoots that taste good to stock.

### Dangerous Creatures

Attacks by aggressive bees, disease-carrying mosquitoes, biting horseflies, toxic spiders or scorpions, poisonous reptiles, and large predators (figure 13-6) can seriously injure or kill horses and mules. Post warnings for users explaining local dangers (figure 13-7). Educate visitors by offering campground talks, informative brochures, and so forth. Land managers can address some problems through maintenance programs. For example, a bee control program can include inspecting facilities where bees might nest and following up on reports of ground-dwelling colonies.

#### Planning and Design Considerations

- ☆ Design sites and facilities in a manner that does not hinder animal emergency care or rescue.
- ☆ Avoid building structures, fences, hitch rails, and corrals with openings that might harbor insects, snakes, or other animals that might harm stock.



Figure 13-6—Horses and mules are vulnerable to reptiles, predators, and poisonous or disease-carrying insects,

**West Nile Virus Information**  
July – September, 2006

**Protect Yourself:**

- Wear protective clothing (long sleeves, pants, socks) at dawn and dusk.
- Use insect repellents containing DEET or Picardin (30-50% concentration for adults, less than 10% for children).
- Reapply repellent according to label directions.

**What You Need to Know:**

- There is no cure or vaccine for West Nile Virus in humans.
- People who are over 50 years old are at greatest risk for serious illness; in rare cases it is deadly.
- Three days to 2 weeks after exposure, milder symptoms may include fever, headache, body aches, rash, and/or swollen glands; less than 1% have more severe symptoms.
- Most people (80%) who are infected with the virus do not get sick.
- To date, Missoula County has been low risk for West Nile Virus.

**For More Information:**

- Contact the Missoula City-County Health Dept., 258-3896.
- The Centers for Disease Control, [www.cdc.gov](http://www.cdc.gov), provides up-to-date information on the virus and its spread nationally.

Public Health

Figure 13-7—Visitors appreciate current information about dangers in an area. —Courtesy of City-County Health Department, Missoula, MT.



## Animal Diseases

Horses and mules contract communicable diseases from bedding, fence materials, water troughs, or other items they share with infected stock. Direct contact between healthy and infected stock can spread many diseases. Strangles, ringworm, rabies, encephalitis, and respiratory illnesses are common examples. Communicable diseases often occur cyclically. Posting current information during outbreaks is a good practice.

### Planning and Design Considerations

- ☆ Provide easy-to-clean water troughs that drain between uses.
- ☆ Provide a convenient disposal method for used bedding material.

## Manager and User Awareness

Riders can anticipate many situations and minimize unwanted effects of horse use through responsible behavior. Some uninformed riders create unintentional environmental impacts. Occasionally, users ignore regulations that don't make sense to them or that seem unreasonable.

Land managers should learn and incorporate current best management practices that address environmental and health issues, encourage input from all users, and adapt to changing needs. An example is a bee control program. Managers also can foster awareness and understanding by providing signs and handouts (see *Chapter 12—Providing Signs and Public Information*). Other activities include developing user guides or sponsoring educational programs about outdoor ethics. Monitoring maintenance, posting current conditions, and providing necessary tools—for example, manure rakes, shovels, bags, and wheelbarrows—are other ways managers can help riders. Agencies can hold events that unite different user groups for a common cause, such as trail cleanup days, and have the added bonus of fostering better relationships between user groups. Many areas have recreation land stewardship groups that assist managers in their efforts. See *Appendix B—Trail Libraries, Trail Organizations, and Funding Resources*.

### Resource Roundup



#### Low Impact Recreation Use

The Leave No Trace Center for Outdoor Ethics is a national nonprofit organization that promotes responsible outdoor recreation through education, research, and partnerships. The center's *Leave No Trace* message consists of seven major points:

- ☆ Plan ahead and prepare.
- ☆ Travel and camp on durable surfaces.
- ☆ Dispose of waste properly.
- ☆ Leave what you find.
- ☆ Minimize campfire impacts.
- ☆ Respect wildlife.
- ☆ Be considerate of other visitors.

More information about *Leave No Trace* principles is available at <http://www.lnt.org>.



#### Low Impact Stock Use

The *Leave No Trace Stock Master* course covers Leave No Trace principles as they apply to stock users and packers. Students learn hands-on methods and techniques for teaching outdoor ethics to diverse audiences in a train-the-trainer format. The course is offered by the Forest Service's Ninemile Wildlands Training Center near Missoula, MT. More information is available at <http://www.fs.fed.us/r1/lolo/resources-cultural/nwtc/descriptions.pdf>.



## Chapter 14— Considering Liability Issues

Liability issues concern riders, landowners and managers, outfitters, concessionaires, event coordinators and sponsors, and anyone else who is involved in equestrian recreation. Accidents with horses and mules happen.

A frequent question is, “Can I be sued?” The answer is, “Yes.” Little can be done to prevent an aggrieved party or plaintiff from filing a lawsuit. Landowners are better prepared to deal with lawsuits if they:

- ☆ Know the State statutes that reduce liability for landowners who open their lands to free public use. The statutes include, but are not limited to, equine liability acts and recreational use statutes.
- ☆ Work with legal advisors to develop a risk management plan. It is important to keep facilities in good condition and free of hazards. Use good judgment about activities allowed on the property.
- ☆ Purchase liability insurance that covers equestrian activities.

This guidebook can only provide basic information about liability. Laws and their interpretation vary widely by jurisdiction, and the best advice is to seek

professional legal counsel. Citations in this chapter provide resources that give additional background. Be aware that statutes and rulings change or are amended frequently, and that Web site information may become outdated or be invalid.

### Equine Liability Acts and Recreational Use Statutes

In the 1990s, lawsuit costs and rising liability insurance rates contributed to an economic downturn for equestrian businesses and activities. Since then,

many States have adopted equine liability acts to address these concerns. For an example of such an act, see *Appendix I—Sample Equine Liability Act (New Mexico)*. Because these acts are relatively new, the courts have heard few cases. Certain liability considerations are common to a number of equestrian activities. Equestrians and landowners should become familiar with the equine liability acts that apply to lands they own, visit, or manage. Figure 14–1 shows one approach to presenting information regarding risk.



#### Recreation Liability Law

These sources provide additional information regarding liability law as it pertains to recreation or horses and mules:

- ☆ The Animal Legal & Historical Center has a searchable database of cases, statutes, and articles relating to stock in the United States and other countries at <http://www.animallaw.info>.
- ☆ The Equestrian Land Conservation Resource has links to equine activity statutes on the *Information by State* Web page at [http://elcr.org/index\\_info.php](http://elcr.org/index_info.php).
- ☆ The University of Vermont offers information regarding equine law, statutes for horsemen, law cases for horsemen, and safety articles on the *Equine Law and Horsemanship Safety* Web page at <http://asci.uvm.edu/equine/law>.

#### Resource Roundup

- ☆ The International Mountain Bicycling Association offers a table of State recreational use statutes that lists the year the law was passed and indicates whether the law addresses such topics as: duty to keep safe, duty to warn, assurance of safety, misconduct and similar issues, and whether protection is lost if a fee is charged. View the table at [http://imba.com/resources/trail\\_issues/liability\\_chart.html](http://imba.com/resources/trail_issues/liability_chart.html).
- ☆ The National Park Service’s Rivers, Trails, and Conservation Assistance Program has brochures about limited liability recreation laws for all 50 states on its *Recreational Use Statutes and the Private Landowner* Web page at <http://www.nps.gov/ncrc/programs/rtca/helpfultools/recusebrochures>.



Figure 14-1—Liability laws vary around the country.

Every State has recreational use statutes that address a landowner’s liability for injuries that occur to an individual recreating on the landowner’s property if a fee is not charged. These statutes help protect private landowners, reduce the threat of lawsuits, and encourage landowners to open their lands to recreational use. Refer to *Appendix J—Sample Recreational Use Statute (Kentucky)* for an example of a State recreational use statute. Some landowners worry that by opening their lands to the public for such use, they risk losing the land through adverse possession. Some recreational use statutes address this issue, and some State recreational use statutes

define recreation user responsibilities. Local jurisdictional guidelines and statutes define required precautions when horses or mules are involved in any recreational pursuit. These guidelines also differ widely from one jurisdiction to another. It is the equestrian’s responsibility to know the applicable statutes and regulations.

Land management agencies have their own concerns about lawsuits resulting from equestrian activities. Government immunity acts or tort claims acts generally address Federal and State liability. Some also address recreation concerns. In some cases, State recreational use statutes apply to public lands. The statutes differ by State, as do their interpretations by State courts.

### Risk Management Strategies

Sound risk management strategies use common sense to incorporate facility standards that reduce the risk of injury. It’s common sense to anticipate, identify, and address hazards in a timely manner. Having a perimeter fence around the campground to contain stock that get loose makes sense. Fences or latches designed for cattle may not be adequate for riding animals and packstock. Gates and fences should comply with minimum standards for the type, strength, height, latch closures, and anchoring techniques reasonably expected to contain horses and mules.

Prudent risk management incorporates good safety and emergency access plans. Safe processes and procedures for accessing or leaving public land during emergencies should be identified and implemented. Most public land managers establish routes and practices for use in equestrian-related emergencies. The sheer size and weight of a horse or mule can complicate emergency procedures. For example, lifting an injured or dead horse off a pinned rider can be very difficult, especially in remote areas. Plan ahead.



#### Resource Roundup

##### Liability and Lawsuits

The International Mountain Bicycling Association has numerous articles addressing recreation liability subjects, including risk management, landowner liability, insurance, and other relevant topics on its *Liability and Lawsuits* Web page at [http://www.imba.com/resources/trail\\_issues](http://www.imba.com/resources/trail_issues).



## Resource Roundup

**Safety Trails Forum**

The *Safe Trails Forum* offers articles contributed by National Trails Training Partnership members on safety, crime, liability, and related issues.

Access the forum at <http://americantrails.org/resources/safety>.

Public land management agencies can develop rescue procedures that minimize rider safety risks and reduce emergency response times. The U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA), many State emergency response teams, and universities with equine veterinarian programs can provide helpful planning guidelines and large-animal rescue training for emergency responders.



## Resource Roundup

**Emergency Response**

Large animal response teams help rescue or relocate stock during disasters, such as floods and fires. Examples include:

- ☆ Clemson Extension Large Animal Emergency Rescue at <http://www.clemson.edu/ep/LART>.
- ☆ UC Davis Veterinary Emergency Response Team at <http://www.vmeth.ucdavis.edu/home/VERT>.

**Competitive and Group Trail Events**

Equestrian events held on public or private lands, including group trail rides, endurance races, competitive trail rides, instructional lessons, arena activities, and spectator events, usually have special requirements designed to limit liability. Public land management agencies may require special permits for certain recreation uses, such as group or competitive events. Insurance certification often is a requirement for the permit. Liability insurance coverage should protect the event managers and the land managers, while covering other concerns.

Event participants should sign a liability release form. By themselves, release forms don't provide immunity from liability—they are one factor among many risk management strategies. Structure the release-form language to meet requirements of local jurisdictions and State law. Have an attorney review any liability release form.

Other equestrian activities also can cause injuries to spectators, bystanders, and other recreationists. To reduce the risk of accidents, injuries, or recreation user conflicts, post appropriate signs and public information.



## Resource Roundup

**Mandatory Wording**

For information on mandatory language for event contracts, entry forms, and waivers, consult *The Equine Activity Liability Act: How It Affects Associations & Sponsors* (Farris 2005) at <http://www.farrislawfirm.com/Default.aspx?PageID=31>.

**Private Insurance**

Many owners insure their horses and mules, as well as their horse trailers, tack, carts, and related equipment. Remember:

- ☆ Special insurance and a written description of the equestrian activity generally are required for competitions, events, and instructional training.
- ☆ If any monetary exchange or agreement is made for riding, caring for, transporting, competing, or training horses or mules, or if any other compensation is paid to an individual using stock, the pursuit could be considered a business activity. Most homeowner insurance policies don't normally cover business activities.
- ☆ Some policies don't provide coverage when a horse or mule leaves the landowner's property. Know the limits and exclusions in any equestrian-oriented insurance policy.





## Chapter 15— Working With Funders and Volunteers

Sometimes, projects can be planned and constructed more quickly with outside help, such as volunteer assistance, funding, and partnership agreements. Researching such opportunities increases the likelihood of success and often builds support for the project. *Chapter 16—Learning From Others* includes several case studies that illustrate successful projects involving interagency cooperation, volunteer labor or materials, and grants.

### Funding and Partnership Opportunities

Funds for trails, recreation sites, and bridges are available from government agencies and the private sector. Developers, associations, foundations, corporations, organizations, private companies, and individuals often fund trail systems or segments.

Sometimes, land developers build and dedicate recreation amenities—such as trail segments—on their developed lands. To do so, the developer or owner submits detailed improvement plans for approval to a land management agency, such as a municipality or county planning department. After

completion, some developers dedicate trails and other improvements to the managing agency. These types of projects generally require a legally binding agreement that secures the easement of the trail route, access, and connections with other facilities.

### Funding Proposals

Securing funds for well-planned projects or programs requires some form of proposal, application, or written request. Successful funding applications clearly state program goals, effectively substantiate need, and include reasonable budgets.

Identify potential funding sources for all or parts of the project. A coalition of partners can diversify and disperse funding responsibilities. Many private grants come from individuals as direct gifts or bequests. Many large corporations also have grant or assistance programs for projects that relate to their interests or geographic areas. In addition, government funding is often available from Federal, State, or local agencies.

Search the Internet, public libraries, and grant libraries for funding opportunities and possible

partnerships. Focus the search to match resource eligibility requirements with project qualifications and needs. Prioritize funding sources by degree of match and the chance of success.

Each funding source has its own grant application process with a set of instructions and accountability requirements. Federal and State funds usually require a matching revenue source and have strict guidelines. Many grant applications require detailed supporting documents—budgets, timelines, monitoring plans, project justification reports, and anticipated outcome statements. Many funding agencies or organizations require a specific document format, completion of standardized forms, or a prescribed set of materials. Many funders provide guidelines and directions to help applicants complete the paperwork.



#### Write That Grant

#### Resource Roundup

The Grants Information Collection at the University of Wisconsin has a Web page devoted to *Proposal Writing: Internet Sources*: <http://grants.library.wisc.edu/organizations/proposalwebsites.html> with links to nongovernmental and governmental online resources, research articles, cooperating collections throughout the United States, and a list of printed materials.



Before beginning a grant request, verify that the grantor is still interested in funding trail or recreation site projects. Determine the current fiscal cycles and required submittal dates and get the latest application requirements. Grant and funding information changes constantly—contact the agency or visit the Web site for the most current information.



Resource Roundup

Online Funding Resources

Appendix B—Trail Libraries, Trail Organizations, and Funding Resources lists some organizations and agencies that offer databases or links to funding and partnership resources.

Creative Fundraising Ideas

When matching funds are required, organizations may have to supply 50 percent or more of the project’s total cost. Read the funding source’s definition of allowable matching funds carefully. Sometimes contributed labor and materials count as matching funds at specified rates. Many private groups hold fundraising events to augment financial resources and to build project support and awareness. In many cases, sponsorships offset fundraising expenses or underwrite specific portions of projects. Only imagination limits the possible fundraising activities. Choose a variety of events that will energize the entire community to support the project.



Fun With Fundraising

Many organizers of fundraising events charge an entry fee or admission price, offer sponsorships, or do both. Possible sponsors include local media, retailers, equipment manufacturers, recreation or health organizations, schools, and private individuals. Here are some fundraising ideas:

- ☆ Hoofs, heels, and wheels—Arrange a relay race between teams of riders, mountain bikers, and hikers. This event has the added benefit of building positive relationships.
- ☆ Benefit trail rides—Arrange events around a theme, such as riding with a celebrity, or plan a ride to follow a special route, such as an endurance course or historic trail.
- ☆ Fund-a-foot or trail catalog sales—Offer sponsorships for proposed sections of trail. Sponsors purchase, for example, a portion of the tread or a trail gate. Offer various cost levels to encourage broad support.

Resource Roundup

- ☆ Equine Expo—Showcase the world of horses and their kin through public demonstrations, exhibits, and educational offerings. An equestrian art exposition is a variation of this idea.
- ☆ Limited edition or specialty sales—Raise money with royalty programs for specialty license plates (figure 15–1), trail products, or services. These approaches may be a good way to help pay for recurring expenses such as trail maintenance.

For even more ideas that can be adapted to local or regional projects and funding, refer to *Eighty-five Creative Funding Ideas for Trails and Greenways* (Macdonald 2003). The information, along with other fundraising articles, is available at <http://www.americantrails.org/resources/funding>.



Figure 15–1—Specialty license plates appeal to many people who otherwise might not participate in a fundraising activity.



## Volunteer Opportunities

Many equestrian clubs arrange special events that foster partnerships with agencies, landowners, developers, and others that can help create trails, trailheads, and campgrounds.

Volunteer equestrians generally have a great sense of stewardship and respect for the natural environment—a reflection of their desire to preserve riding habitats for themselves and future generations. Riders and their stock are particularly well suited to help on trail and recreation site projects, in part because the stock can haul heavy items (figure 15–2). Volunteers also assist with funding, construction, cleanup, and similar efforts. Such contributions supplement the resources of land management agencies and increase public awareness of volunteer stewardship projects.



Figure 15–2—Equestrian volunteers and their stock can contribute significantly to the success of a trail project.

## The Three Rs of Volunteer Stewardship

One approach to an equestrian volunteer program includes a three-part, continuous cycle of activity—recruiting, retaining, and rewarding volunteerism. Each of these activities enhances the ongoing availability of well-informed, trained volunteers and stewards.

### Recruit

The first phase of any volunteer program is to recruit groups or individuals who are willing to work. A volunteer recruitment campaign might:

- ☆ Distribute fliers, posters, and announcements to public land management offices, equestrian businesses and facilities, outdoor retailers, and equestrian publications.
- ☆ Announce volunteer opportunities through Web sites and e-mail notices.
- ☆ Post volunteer signup forms at equestrian events and distribute the forms to community organizations.
- ☆ Distribute videos to public schools, libraries, and community organizations.
- ☆ Distribute announcements to youth groups—4-H clubs, Scout programs, pony clubs, youth corps, junior equestrian organizations, and so forth.

### Retain

Successful volunteer programs provide activities that keep volunteers interested and increase their skills and knowledge. They might:

- ☆ Provide information about available levels of volunteer activities.
- ☆ Provide a stewardship orientation program for new volunteers.
- ☆ Ask volunteers to sign a stewardship agreement formalizing their commitment.
- ☆ Establish a mentoring program that encourages an experienced volunteer to work with a new volunteer.
- ☆ Conduct construction, maintenance, and safety workshops to educate volunteers about proper techniques.
- ☆ Establish a program to train trainers and reach more volunteers.
- ☆ Provide fun rides and events to sustain volunteer interest.
- ☆ Record volunteer hours accurately and offer incentive rewards or acknowledgement.
- ☆ Inform volunteers about changes that affect communication.



### **Reward**

Volunteers enjoy recognition for their efforts—particularly by their peers or the media. There are many ways to recognize a volunteer's contribution:

- ☆ Provide a signature item that designates a level of accomplishment, such as a special pin, badge, bandanna, hat, saddle pad, saddlebag, bridle ornament, or jacket.
- ☆ Provide written recognition using newsletter articles, media releases, Web site articles, and magazine interviews.
- ☆ Provide certificates of appreciation or recognize a volunteer at regular community or organizational meeting.
- ☆ Arrange an interview between a local radio personality and the volunteer to promote an event or to recognize a successful volunteer effort.
- ☆ Post volunteers' hours in newsletters, at meetings, and at other locations that provide opportunity for recognition.
- ☆ Establish award levels, such as the *Most Outstanding Volunteer Work Event* or *Volunteer of the Year*.
- ☆ Install a recognition plaque along the trail or in the recreation site.





## Chapter 16— Learning From Others

Case studies provide insight and better understanding when planning and designing trails and recreation sites. The trail system master plans for communities in Florida and Arizona and the recreation sites in Oregon, Montana, Arizona, and Illinois incorporate equestrian design concepts appropriate to the sites' climate, soils, topography, and vegetation. These projects take the needs of users and land managers into consideration as well as budget limitations. Some projects are completed and others were in progress when this guidebook was published.

### Trail System Master Plans

A comprehensive trail system can improve quality of life, particularly when trails provide more than recreation opportunities. Some areas adopt healthy community initiatives that support nonmotorized access to local schools, shopping districts, and workplaces. Public trail systems can be far from roads or they can supplement the roadway system. Trail systems can be designed with low, moderate, or high levels of development, connecting trails in wildland, rural, urban, or a combination of settings.

It is expensive to create corridors for walkways, bikeways, and trails after transportation, recreation, residential, or commercial infrastructure has been established. Master plans reduce redundancy, streamline funding, and give communities a way to communicate their needs. Master plans can provide the framework for a cohesive, linked trail network that serves the greatest number of people in the broadest geographic areas of a community. Although it takes time and lots of cooperation to develop trail master plans, the effort can produce many benefits. The master plans in this section are from areas with a high level of development.

### Equestrian Trail Network Study— Pinellas Park, FL

Within the city of Pinellas Park, FL, large land tracts are owned by active equestrians. When the *Equestrian Trail Network Study* began, there were roughly 750 horses and 45 property owners with public and private stables scattered over about 200 acres (80.9 hectares). Horse trails meandered through the area, taking advantage of local parks and roads. There were about 9.6 miles (15.4 kilometers) of horse trails within city parks and rights-of-way. Many of these trails were not contiguous because of barriers, roadway crossings, large drainage channels, and private property boundaries.

Growth and development within the surrounding neighborhoods brought schools, parks, and other public facilities. As development encroached on areas enjoyed by riders, increasing traffic spurred the equestrian community to request an improved, safe, and dedicated trail network. As a result, the Pinellas Park planning department established a nine-member Equestrian Trails Study Commission. In 2000, the commission recommended establishing an equestrian trail network for Pinellas Park.

The Orth-Rodgers and Associates consulting firm, in cooperation with the Pinellas Park Planning Department and the Pinellas Park Equestrian Trail Study Commission, produced the *Equestrian Trail Network Study* (2002). They collected data based on field reconnaissance, aerial photography, existing rights-of-way and land-use maps, local history, trail user needs, and input from the general public and professionals. They reviewed the history of the equestrian community in the area, conducted an inventory of existing conditions, and identified existing recreation facilities. Common themes included:

- ☆ Physical activity and exercise opportunities
- ☆ General design considerations and network connections
- ☆ Conservation and management provisions
- ☆ Improved access to special features and locations
- ☆ Improved safety and access at roadway crossings



After completing these activities, the consultants developed planning guidelines and proposed design objectives. They addressed:

- ☆ Design criteria—Rights-of-way limits, adjacent property ownerships, clear zones, sight distances, trail crossings with at-grade road intersections, controlled trail access, typical trail sections, and information kiosks
- ☆ Trail foundation and tread—Drainage, trailbed, tread, vegetation, and obstructions
- ☆ Trail safety—Signs and trail markings, pavement markings, horse-friendly lighting, and general equestrian safety
- ☆ Trail maintenance and management criteria
- ☆ Trail etiquette

Subsequent phases of this project will include design and construction of trail network improvements. The *Equestrian Trail Network Study* is not available online.

### Trails Master Plan—Scottsdale, AZ

Before approval of a trail master plan in 2003, Scottsdale, AZ, had not addressed trail planning since 1991. During that period, the city experienced significant growth that affected about 300 miles (483 kilometers) of unpaved, shared-use trails. Many trails that once were nonmotorized transportation routes became fragmented.

During the planning process Scottsdale used many of the concepts found in *Chapter 2—Planning Master Trail Systems*. The resulting trail master plan classified existing and proposed trails and links using seven different categories:

- ☆ Primary or signature trails—Trails that have regional significance by providing linkages to major destinations
- ☆ Secondary trails—Trails that provide links between primary trails and more localized neighborhood trails
- ☆ Local trails—Trails that are usually feeder trails
- ☆ Neighborhood trails—Trails that are very limited in range, serving a localized area
- ☆ Trailheads—Entry points to the trail system
- ☆ Trail crossings—Crossings designed to minimize safety risks
- ☆ Paved links—Paved sections where new, unpaved trails are not possible

The plan considered the environment when classifying primary, secondary, local, and neighborhood trails:

- ☆ Built environment trails—Trails that occur in more constructed environments and have a decomposed granite trail surface
- ☆ Natural environment trails—Trails that occur in more natural or undisturbed open space and have native surface materials

Standards were assigned to each trail class to describe the minimum acceptable tread width, surface type, signs, and whether additional amenities would be provided.



#### Resource Roundup

### City of Scottsdale Trails System

#### Master Plan

The *City of Scottsdale Trails System Master Plan* (Todd and Associates and others 2003) examines existing trail infrastructure from physical characteristics to policies and procedures. A detailed executive summary and plan documents are available at <http://www.scottsdaleaz.gov/trails/plan.asp>.





## West Valley Multimodal Transportation Corridor Master Plan—Phoenix, AZ

The Maricopa Association of Governments and the Flood Control District of Maricopa County jointly developed a multiphase, multipurpose flood control facility that also provides opportunities for recreation trails and alternative transportation trails.

The West Valley is northwest of Phoenix, AZ, along the New and Agua Fria Rivers. It encompasses a riparian ecosystem common to the Sonoran Desert region, along with diverse plant and animal habitats as well as cultural resources. The transportation corridor links many communities in the greater Phoenix area.

The general topography of the West Valley includes low undulating hillsides, mountains, open space, major washes, and innumerable deep arroyos. The northern reach is rugged and remains largely undeveloped. The flat topography in the central and southern reaches favors urban development.

The *West Valley Multimodal Transportation Corridor Master Plan* is the regional framework for a 42-mile (67.6-meter) trail network that connects existing trails and major public land areas, serving pedestrians, riders, bicyclists, and other trail users. The nonmotorized trails take advantage of locations that offer multiple benefits—alternative transportation routes, recreation opportunities, wildlife habitat preservation, open space protection, and flood control.

The master plan acknowledged the natural character along the rivers and considered ways to minimize environmental degradation. To facilitate planning, the corridor was divided into three landscape management zones—conservation, passive, and active. Planners considered the amount of use appropriate for each zone, restricted access to sensitive areas, and identified potential conflicts, safety issues, and challenges to trail design. Five types of trails were identified:

- ☆ Primary
- ☆ Secondary
- ☆ Neighborhood-transit-connector
- ☆ Conservation-interpretive
- ☆ Equestrian

To accommodate the needs of anticipated trail users, trails vary in location, design, and amenities. The plan attempts to create a sense of place, maximize safety, and establish a regional multimodal transportation system that links residential areas, bus routes, parks, commercial buildings, schools, and other facilities.



### Resource Roundup

#### **West Valley Multimodal**

#### **Transportation Corridor Master Plan**

The *West Valley Multimodal Transportation Corridor Master Plan* (Entranco and others 2002) is a multifaceted master plan covering two river corridors. A detailed summary is available at <http://www.mag.maricopa.gov/archive/wvtrails/publications/master%20plan.pdf>.

## Trailheads and Campgrounds

Whether a recreation site is in the country or in the city, the goal of equestrians is the same—to have a safe and enjoyable visit. The following case studies describe popular equestrian recreation sites in a variety of settings. The examples are arranged in order of complexity, beginning with the lowest level of development. Levels of recreation site development may be different than levels of trail development.

### Equestrian Trailheads and Campgrounds With Low to Moderate Development

Recreation opportunities in areas with low and moderate levels of development strongly appeal to riders. These trailhead and camping opportunities, usually found in rural or wildland settings, bring a level of enjoyment that is difficult to duplicate in highly developed or urban areas.





**Horse Creek Campground—  
Siuslaw National Forest, Florence, OR**

The Horse Creek Campground, in the Mapleton Ranger District of the Siuslaw National Forest, is shaded by tall pines that also provide shelter from the wind. The campground has two access points to the adjacent trail system, which offers scenic views of the Pacific Ocean and nearby mountains (figure 16–1). The trail system has looped trails and road segments that offer many options for day trips.

When designing the Horse Creek Campground, Siuslaw National Forest personnel worked closely with volunteers from Oregon Equestrian Trails, a nonprofit service organization. The campground has 11 camp units furnished with tables and fire rings (figure 16–2). The visitor information station is near a vault toilet (figure 16–3) built by Job Corps members. Water for stock is available on nearby trails (figure 16–4). Each rustic camp unit has access to a post-and-rail corral in one of two sizes. The larger corrals are 15 feet (4.6 meters) by 30 feet (9.1 meters) and have wood divider rails down the middle. The smaller corrals (figure 16–5) are 15 feet (4.6 meters) by 20 feet (6.1 meters) and have ropes or chains for gates.

Drivers enter the campground on a single-lane gravel road with a cul-de-sac at the end. Some camp units with graveled pullthrough and back-in parking pads

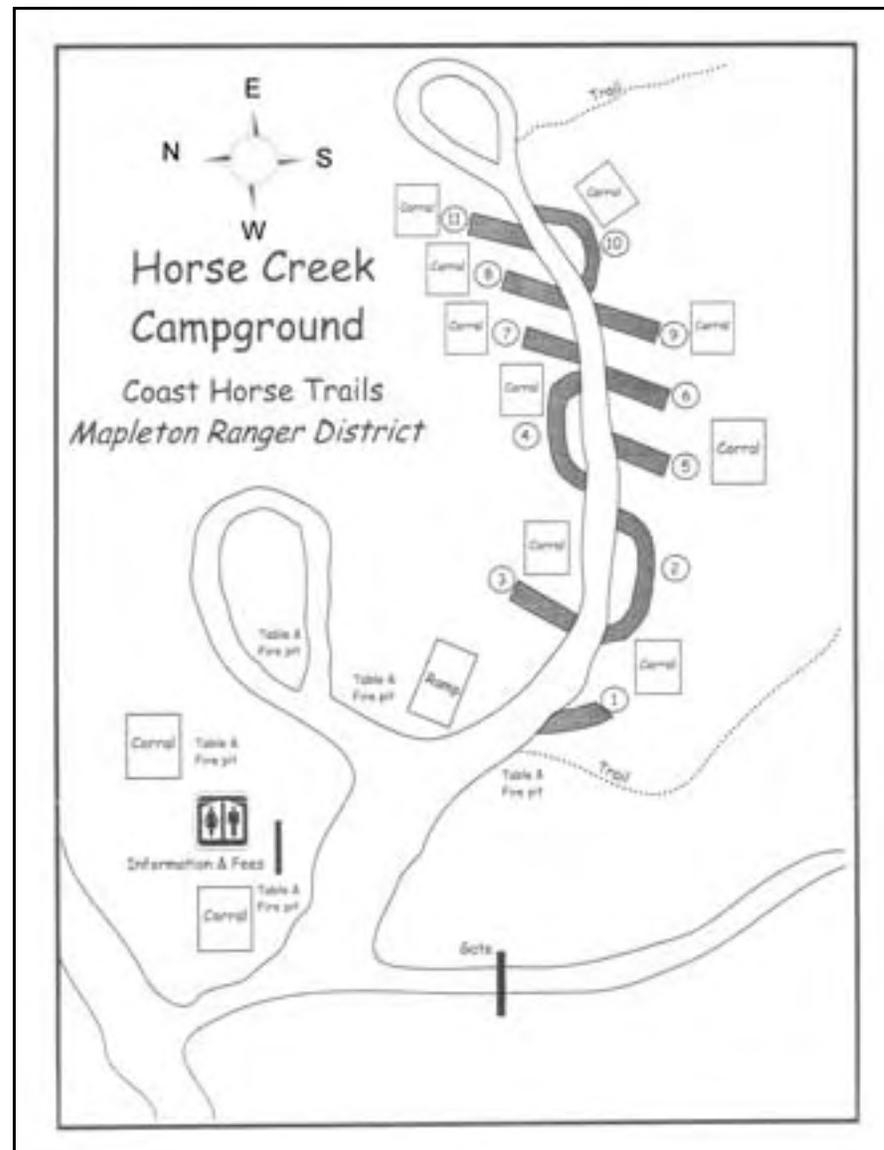


Figure 16–1—Horse Creek Campground in the Siuslaw National Forest.



accommodate vehicles with trailers. A combination mounting and loading ramp (figure 16-6) serves stock trucks and people in wheelchairs. Figure 16-7 shows the removable rails that allow access for riders with disabilities.



Figure 16-2—The Horse Creek Campground has 11 camp units.



Figure 16-3—Members of the Job Corps built the sturdy vault toilet.



Figure 16-4—Stock water is available a short distance down the trail.



Figure 16-6—A combination mounting and loading ramp is provided for people who use mobility devices and for trail stock.



Figure 16-5—Some of the campsites have corrals. This one measures 15 by 20 feet.



Figure 16-7—A removable rail provides access for people with disabilities.



**Resource Roundup**

**Horse Creek Campground**

For more information, visit <http://www.fs.fed.us/r6/siuslaw/recreation/triplanning/newpflor/camp/horsecreek.shtml>.



**Picketpost Trailhead—**

**Tonto National Forest, Superior, AZ**

Picketpost Trailhead, near Superior, AZ, takes its name from the feature it accesses—Picketpost Mountain (figure 16–8). This simple recreation site in the Sonoran Desert is an excellent example of a shared-use trailhead built by volunteers. The site (figure 16–9) has parking for equestrians and other visitors, a toilet building, and a wayside exhibit. Figure 16–10 shows the toilet building, and figure 16–11 shows the equestrian parking area. To successfully complete the project, Tonto National Forest personnel coordinated numerous volunteer events. A grant funded the toilet building, directional signs, a hitch rail, and a bike rack. Tonto National Forest employees and volunteers installed these amenities.

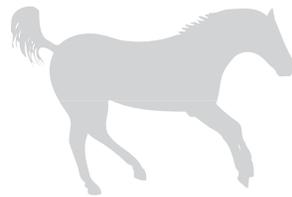
The new parking area took advantage of an abandoned loop road, minimizing removal of vegetation. The Arizona Department of Transportation provided remilled asphalt to surface the interior recreation site road and supplied construction equipment and labor to spread the materials. The finished design includes 30 parking spaces for nonequestrian passenger vehicles clustered between shade trees. Two pullthrough parking spaces serve motorhomes and trailers. An area



Figure 16–8—Recreationists access the Arizona Trail, an 800-mile (1,287-kilometer) nonmotorized trail, from the Picketpost Trailhead in the Sonoran Desert.

without vegetation accommodates nine pullthrough parking spaces for equestrians. It is separated from the nonequestrian parking area by about 100 feet (30.5 meters) and a buffer of native desert vegetation. The parking areas are surfaced with compacted decomposed granite, which contrasts with the remilled asphalt on the road, helping to define parking areas. The addition of wheel stops at the front of nonequestrian parking spaces helps distinguish visitor parking. Raised lane markers—also called *highway bumpers*—designate angled equestrian parking spaces.

Volunteers from the neighboring Boyce Thompson Arboretum removed all vegetation that would be disturbed during trailhead construction. They placed the plants in pots and transported them to the arboretum for care. At the completion of the project, arboretum representatives and Boy Scouts replanted the salvaged plants during a workday at the new trailhead site. Volunteers also installed the hitch rail and bicycle rack. As a final touch, they constructed a wayside memorial exhibit. Hikers, family members, and Forest Service employees spent a day building a stone bench, installing an interpretive sign, and planting a shade tree. The recreation site is very popular with riders and other nonmotorized trail users.



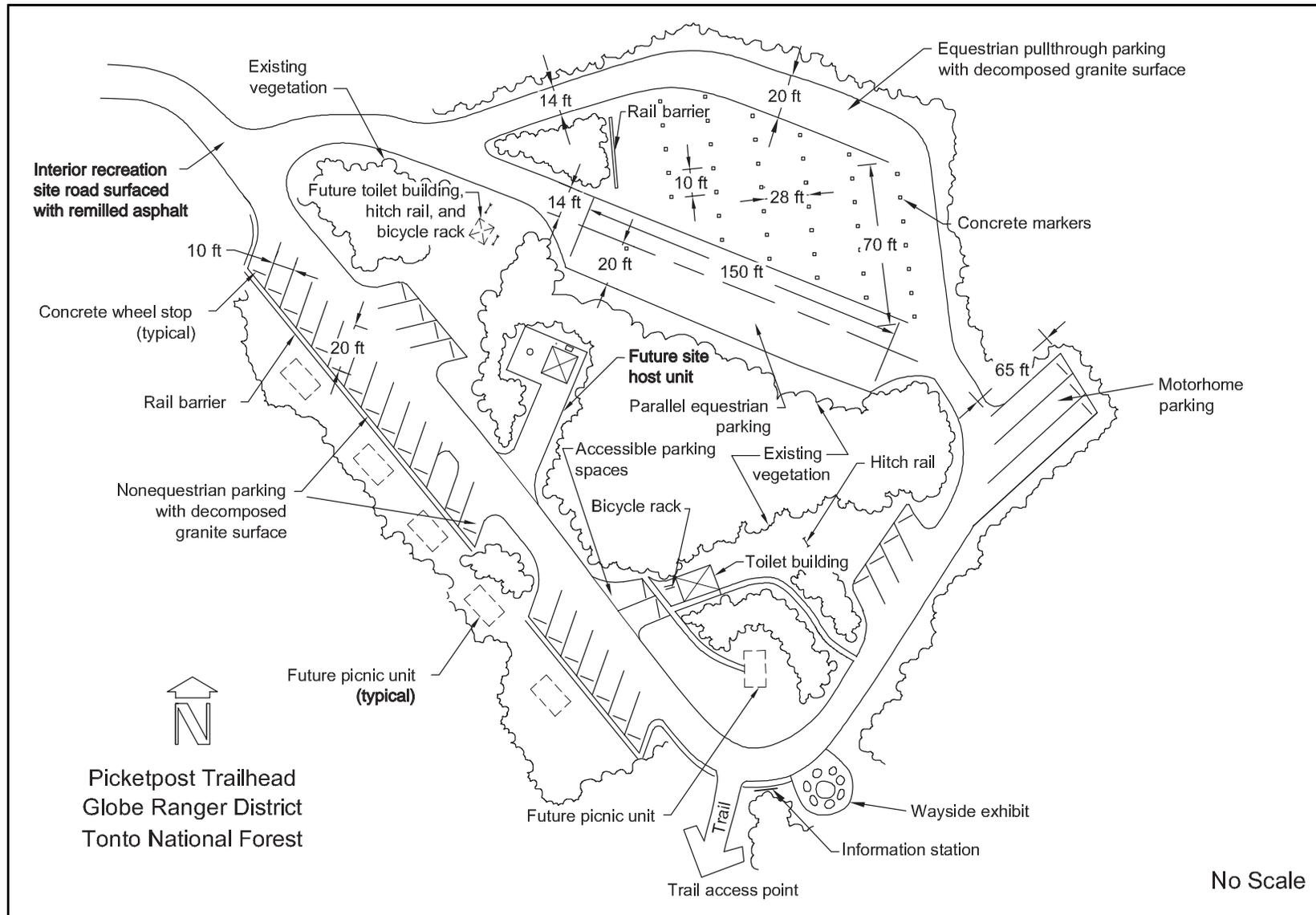


Figure 16-9—Picketpost Trailhead in the Tonto National Forest. Future plans include construction of a site host unit, picnic units, and another toilet building.



Figure 16-10—The toilet building at the Picketpost Trailhead has two accessible parking spaces.



Figure 16-11—The campground at the Picketpost Trailhead has nine pullthrough equestrian parking spaces.



**Blue Mountain Horse Trailhead—  
Lolo National Forest, Missoula, MT**

The Blue Mountain Recreation Area is one of three Lolo National Forest recreation areas in the rural-urban interface near Missoula, MT. At Blue Mountain, about 2 miles (3.2 kilometers) southwest of Missoula, riders, hikers, runners, mountain bikers, dog walkers, *folfers* (Frisbee golfers), motorcyclists and OHV riders share all or part of the recreation area. This variety, combined with great scenery and the proximity to town, makes the Blue Mountain Horse (or Main) Trailhead very popular, especially in the evenings and on weekends.

The population of Missoula County—about 101,000 in 2005—is rapidly growing. The trailhead parking area (figure 16-12) accommodates 25 to 30 vehicles, including 5 or 6 horse trailers. Facilities include a toilet building, a horse unloading ramp, and a visitor information station (figures 16-13 and 16-14). The parking area is fenced to prevent offroad, motorized vehicles from leaving the trailhead. The parking area, which has little delineation, is full on busy days.

The Forest Service had planned to expand and improve the trailhead for several years. Early in 2004, the Backcountry Horsemen of Missoula offered to help with the work and to submit a National Recreation Trails grant request. Managers viewed the expansion as an opportunity to accommodate



Figure 16-12—The parking lot at the Blue Mountain Horse (or Main) Trailhead does not have delineated parking spaces.



Figure 16-13—Facilities at the Blue Mountain Horse Trailhead include a single-user toilet building and a loading ramp for stock and dogs.



Figure 16-14—The visitor information station provides maps, signs, and information brochures.



increased use, reduce parking congestion, and provide spatial separation between parking for horse trailers and stock trucks and parking for pedestrians and mountain bikers. This project may be completed in stages over several years as funding, partnerships, and volunteer opportunities allow. The acting district ranger issued a memo of decision in May 2004, which is summarized below. Figure 16–15 shows the proposed trailhead expansion plan.

*Issue 1: Capacity*—How large should the parking area be?

*Decision:*

- ☆ Expand the parking lot to provide 10 to 14 horse trailer parking spaces. Design the horse trailer parking area with pullthrough spaces. Maximize the distance between spaces and install hitch rails.
- ☆ Restrict pavement at the horse parking area. The pedestrian and mountain biker parking area may be paved in the future.
- ☆ Improve the pedestrian and mountain biker parking area for better parking delineation, use patterns, and traffic flow.
- ☆ Restrict the equestrian parking area to vehicles towing and hauling stock. Vehicles towing horse trailers will be prohibited from parking in the pedestrian and mountain biker parking area.

*Rationale for this decision:* Blue Mountain is the most popular national forest horseback riding area

in the Missoula Valley. Having 10 to 14 horse trailer parking spaces would accommodate current use and allow additional use. Expanding beyond 14 spaces may cause the horse parking area to dominate the landscape. Expansion predominantly to the south minimizes the visual effect and maintains the scenic view of Blue Mountain from the county road and trailhead entrance.

Expanding the trailhead will reduce congestion and conflicts between different types of users while improving public safety. Stock and dogs unaccustomed to each other may be a safety concern, so separating equestrian and nonequestrian parking areas reduces the chance of injury to dogs, horses, riders, and others.

*Issue 2: Horse Unloading Ramp*—Should the Forest Service continue to maintain an unloading ramp?

*Decision:*

- ☆ Provide two separate or one shared ramp for stock and dog unloading, depending on how the final trailhead functions.
- ☆ Separate or sign the dog and stock ramps.

*Rationale for this decision:* When developing the initial proposal, it was assumed that the stock ramp received little or no use, since most people use horse trailers. Additional space could be made available by removing the ramp. However, public comments

indicated many people use the ramp for unloading stock or dogs and some people use it to mount their animals, so one or two ramps are planned. The dog ramp may be modified to prevent stock unloading at the pedestrian and mountain biker parking area. Dog unloading will be prohibited in the equestrian parking area. There is a possibility of developing a shared ramp between the equestrian and nonequestrian parking areas. If that isn't feasible, there may be one ramp in the equestrian area and a second ramp in the pedestrian and mountain biker parking area.

*Issue 3: Weeds*—Can the Forest Service design the trailhead to reduce the spread of invasive plants?

*Decision:*

- ☆ Revegetate soil disturbed during expansion.
- ☆ Continue the present mowing, herbicide, weed prevention, and education activities.

*Rationale for this decision:* There were no public comments, so the present program is maintained.

*Issue 4: Design and visual quality*—Could the trailhead be designed to be more esthetically pleasing? Could shade be provided during the summer?

*Decision:*

- ☆ Revegetate disturbed soil with weed-resistant grasses.
- ☆ Plant a few native conifers.

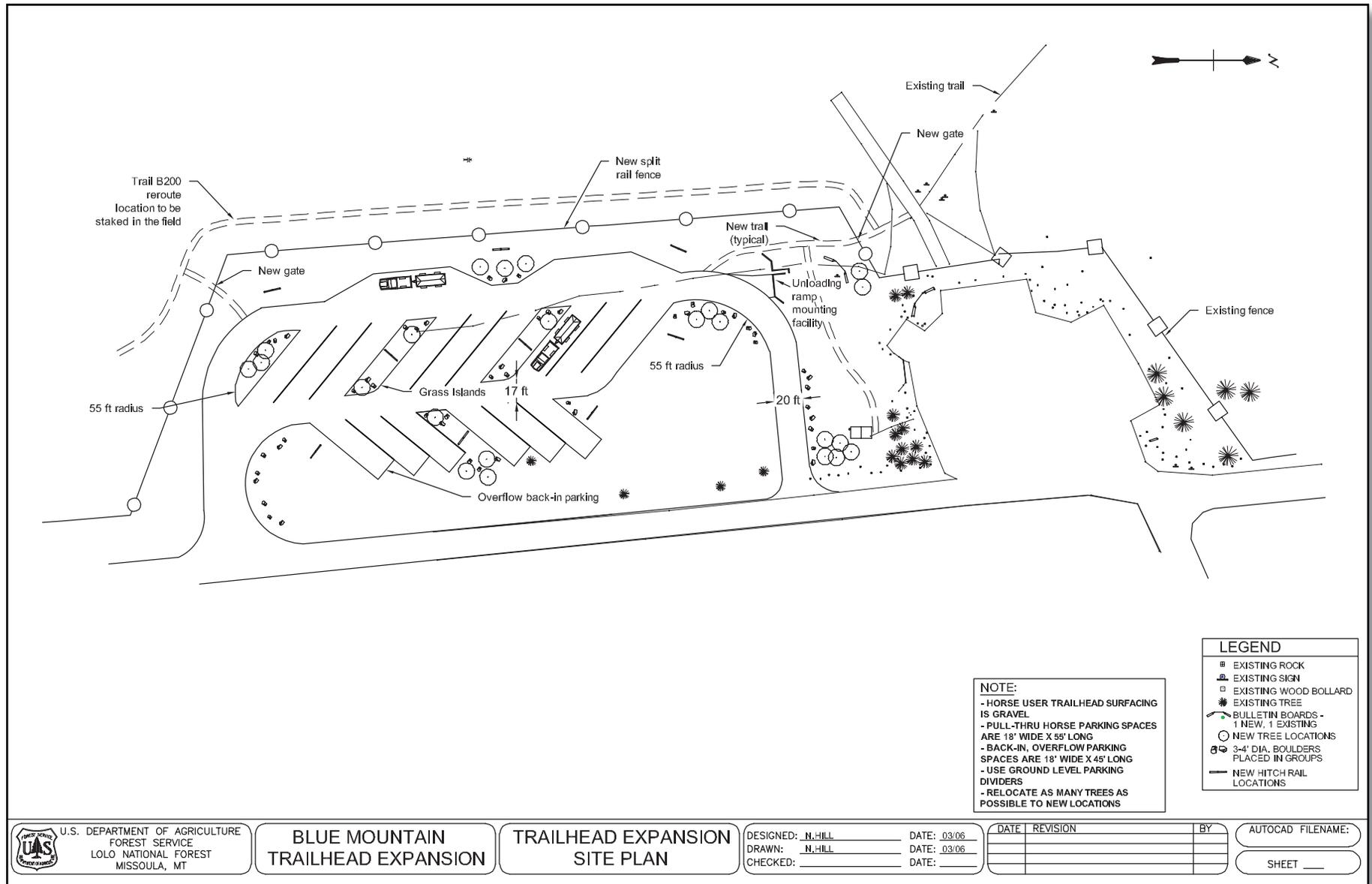


Figure 16-15—The Blue Mountain Trailhead proposed expansion in the Lolo National Forest. Equestrians park in the lot on the left. Pedestrians and mountain bikers park in the lot on the right.



*Rationale for this decision:* By keeping the site simple, trail access is limited and the site will not become a picnic area. Minimizing landscaping lowers water consumption, reduces costs, and discourages loitering. It also means there is less vegetation to vandalize.

*Issue 5: Security*—Can the Forest Service do anything to improve personal and vehicle security at the site?

*Decision:*

- ☆ Keep the site relatively open and visible to motorists on the county road.
- ☆ Continue the cooperative patrol agreement between the national forest and the Missoula County sheriff.

*Rationale for this decision:* Maintaining an open area reduces the chance for theft and vandalism. The county sheriff, Forest Service law enforcement officers, and Forest Service project staff will patrol the trailhead.



#### Resource Roundup

##### **Blue Mountain Trailhead**

For more information, visit <http://www.fs.fed.us/r1/lolo/recreation-brochures/blue-mtn-rec-area.pdf>.

#### **Houston Mesa Horse Camp— Tonto National Forest, Payson, AZ**

The Houston Mesa Horse Camp is in the pine and oak forests of the Tonto National Forest at an elevation of 5,000 feet (1,524 meters). The site is on a major highway near Payson, AZ, a community of 28,000.

The uneven topography at this location posed interesting design challenges. The design team had never designed an equestrian campground, so the first step was learning about the subject. The landscape architect, a horse owner, organized a camping trip for team members and their horses. The group spent the night at Little Elden Horse Camp on the Apache-Sitgreaves National Forest. During the stay, the team met with the site's designer, maintenance personnel, and campground hosts. They gathered information from these sources, including learning how important it is for campground hosts to be knowledgeable riders. Some members of the team also rode the trails and visited with other campers, who suggested their ideas on the proposed equestrian recreation site at Houston Mesa. Campers commonly requested water troughs and a shower building.

The Houston Mesa Horse Camp includes single-party camp units for nonequestrians and equestrians, and group camps for equestrians. The horse camp is fenced to prevent horses from escaping. The

nonequestrian campground has 48 trailer and motorhome units and 29 tent sites, all carefully located to avoid numerous drainages. Facilities include: flush toilets, a shower building, water hydrants, and a dump station. The campground also includes a 50-person amphitheater and an interpretive trail, made possible with funding from a State heritage grant.

The designers selected the area farthest from the highway for the horse camp to avoid noise and conflicts with motorized traffic. The highway splits the two areas, separating riders and other visitors. Once a preliminary design was completed, it was presented to members of the Arizona State Horseman's Association, an equine advocacy organization. Based on feedback, designers modified the equestrian group camp to include a large open parking area (figure 16–16), where equestrian groups could park according to their needs. Figure 16–17 shows the modified site plan.



Figure 16–16—The layout of the group camp parking area at the Houston Mesa Horse Camp reflects existing topography.

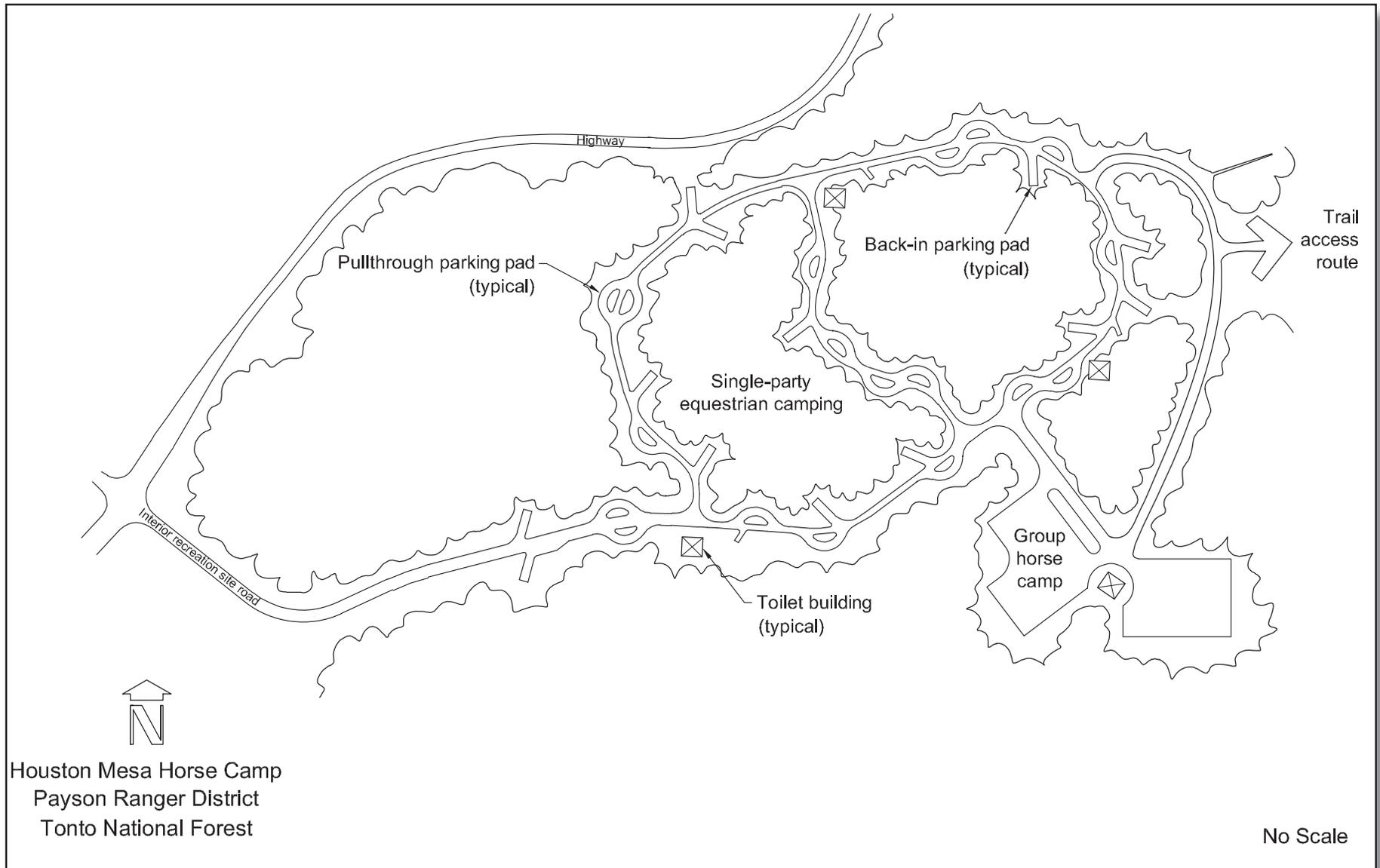


Figure 16-17—Houston Mesa Horse Camp in the Tonto National Forest.



Significant drainages in the area defined the unusual shapes of the group camp parking areas. Together, two adjacent equestrian group camps accommodate up to 65 people. An accessible equestrian group gathering area includes a shelter, a serving table, a fire ring that is 6 feet (1.8 meters) in diameter, and group-sized pedestal grills (figure 16–18).



Figure 16–18—The accessible group gathering area has a shelter, group-sized pedestal grills, a serving table, and a large fire ring.

It was not feasible to provide pullthrough parking pads at all single-party camp units. Some back-in parking pads were included because they were easier

to fit between the existing washes and hills than pullthrough parking pads. The horse camp has 30 single-party equestrian camp units, each furnished with a combination fire ring and grill, a picnic table, and a single corral set (figure 16–19). Because project funds were insufficient to purchase corrals, riders donated materials and installed them. The finished corrals use portable panels attached to posts set in concrete. Equestrian camp units have access to water hydrants, water troughs, and flush toilets. Showers are available in the nonequestrian campground.



Figure 16–19—Furnishings at the single-party equestrian camp units include a single corral set, a picnic table, and a combination fire ring and grill.

The Houston Mesa Horse Camp quickly became the most popular horse camp in Arizona, regularly filling on the weekends. Shortly thereafter, a problem became apparent. The trail system included 6- and 9-mile (9.7- and 14.5-kilometer) loop trails, but the trails were not enough to keep overnight riders occupied for long. More trails or longer trails would have been better. When many riders quit using the facilities, the Forest Service began allowing access to other users. When safety concerns arose, equestrian use dropped even further. If the trail system is expanded and the horse camp reverts to rider-only use, the Houston Mesa Horse Camp may appeal to riders again.



#### Resource Roundup

#### **Houston Mesa Horse Camp**

For more information, visit <http://www.fs.fed.us/r3/tonto/recreation/rogs/camping/Payson/HoustonMesaHorseCamp.pdf>.





**Waterfall Glen Forest Preserve—  
Forest Preserve District of DuPage County, IL**

Long before the arrival of European settlers, Native Americans camped on limestone bluffs overlooking the Des Plaines River—a convenient vantage point. Today this scenic area is home to the Forest Preserve District of DuPage County, IL. The district, which is just southwest of Chicago, has 60 preserves covering 25,000 acres (10,117 hectares) that include 140 miles (about 225 kilometers) of trails.

Waterfall Glen Forest Preserve (figure 16–20), which encompasses 2,487 acres (1,006 hectares), is in the southeast corner of the district. The preserve includes diverse topography, geology, and soils, formed by the Wisconsin Glacier. This diversity underlies multiple habitats—prairies, savannas, barrens, marshes, sedge meadows, fens, oak-maple woodlands, as well as planted pine groves. Numerous native plants, fish, amphibians, reptiles, mammals, and resident and migrant birds make their homes there.

The area's modern recreation history began in 1907, when 107 acres were purchased from a local landowner so its topsoil could be used to build Lincoln Park. The Forest Preserve District purchased property from private owners in 1925, trading parcels to create a contiguous piece of land. In 1973, the district received 2,222 acres of Federal surplus land from the National Park Service's Lands to Parks Program. The doughnut-shaped parcel surrounded

the Argonne National Laboratory Reserve and came with numerous easements, rights-of-way, access roads, and conditions. To accommodate the restrictions, preserve planners developed a master plan oriented to outdoor recreation rather than large group gatherings—trails and related opportunities are emphasized over picnic and camping activities. While there are no picnic areas, visitors are welcome to enjoy a picnic in the mowed grass. Fires are not allowed except at the trailhead fire ring.

Today, Waterfall Glen Forest Preserve is popular with hikers, cyclists, riders, cross-country skiers, and wildlife watchers. Fishing and orienteering are also popular activities. Amenities include toilet buildings, observation benches, drinking water sources, an outdoor education camp, and several parking areas. A model-aircraft field near the trail is easily visible. Conflicts between stock and planes are rare. The Northgate Road Trailhead is very popular with equestrians and other trail users, and a pattern of courteous use also has evolved there (figure 16–21). Visitors with horse trailers use spaces designated for them and other users park elsewhere in the loop (figure 16–22). The parking area is paved with slip-resistant slurry, improving traction for all. For more information regarding the slurry, refer to *Chapter 6—Choosing Horse-Friendly Surface Materials*. Signs indicate traffic direction and equestrian parking spaces. Where riders must travel in paved areas, a parallel path—similar to a shoulder—is

surfaced with limestone screenings. The equestrian trail access point includes a mounting and hitching area.

The preserve's three marked trails are from 0.2 miles (0.3 kilometer) to 9.5 miles (15.3 kilometers) long and meander through scenic areas. The main trail loop follows existing service roads, while other trail routes are limited by topography and soil conditions. The 8-foot- (2.4-meter-) wide main trail is surfaced with crushed limestone, accommodating shared use. Numerous unmarked footpaths dissect the preserve. Many trails are suitable for horseback riders. In winter, when cross-country skiers share the trails, etiquette information signs are installed temporarily. Winter trails are groomed about 9 feet (2.7 meters) wide, with ski tracks on the outside edges. Riders and pedestrians use the center tread. To date, few conflicts have been reported.

The preserve attempted to prohibit riders from traveling offtrail and degrading sensitive areas. A local equestrian group advocated the use of education over formal restrictions. The group began educating other riders, and preserve managers mailed an informative newsletter to previously registered trail users. These efforts, coupled with ranger patrols, effectively accomplished the task.

Inside the preserve's southern boundary is an active Burlington Northern Santa Fe Railway right-of-way. Trains travel the route daily. Where the main trail



Figure 16-20—Waterfall Glen Forest Preserve near Chicago, IL. —Courtesy of the Forest District of DuPage County, IL.



Figure 16–21—A slip-resistant finish on the surface of this parking area improves traction for pedestrians and equestrians. —Courtesy of Kande Haertel.

crosses Sawmill Creek, the rails and main trail are as close as 250 feet (76.2 meters) for about 225 feet (68.6 meters), although the trail is outside the rail corridor. In the southwest corner of the preserve, an infrequently used railroad spur line lies within 30 feet (9.1 meters) of the trail for about 500 feet (152.4 meters). There are no formal crossings of the railway corridor, nor are there any fences separating the preserve or trail from the rails. The public is not encouraged to travel there, and approaching trains issue warning blasts on their horns. Trail users informally adjust to the rail use, and so far, planners have received no reports of conflicts between riders and trains.

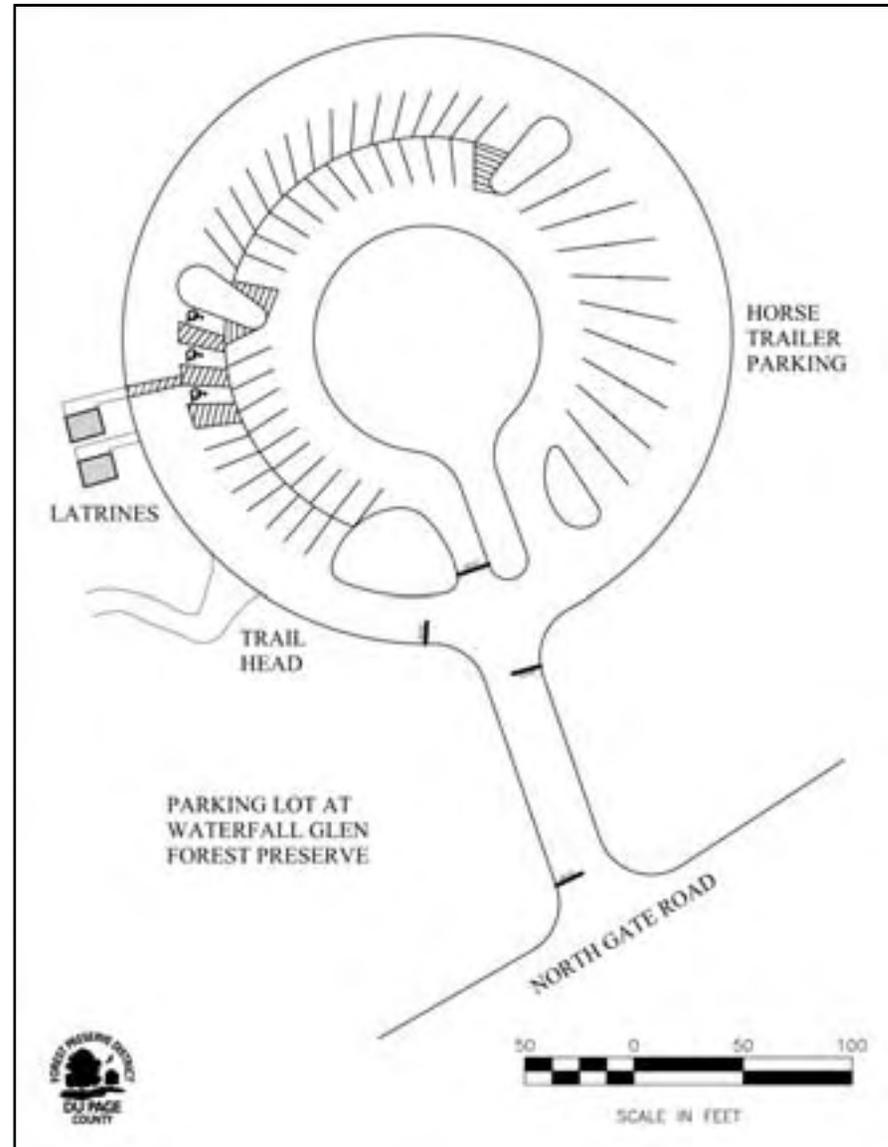


Figure 16–22—The parking lot at Waterfall Glen Forest Preserve. —Courtesy of the Forest District of DuPage County, IL.



Resource Roundup

**Waterfall Glen Forest Preserve**

For more information, visit <http://www.dupageforest.com/PRESERVES/waterfallglen.html>.



## Equestrian Trailheads and Campgrounds With High Development

Highly developed trailheads and campgrounds often are close to urban areas or in frequently visited recreation sites. They also may serve large trail networks. Each of the following examples provides maximum recreation opportunities for riders as well as shared-use opportunities for other recreationists.

### ***Frazier Recreation Site—Tonto National Forest, Roosevelt, AZ***

The Frazier Recreation Site (figure 16–23) nestles in the Sonoran Desert at Roosevelt Lake, one of Arizona’s most outstanding water-based recreation areas. The lake is the largest of four reservoirs within a 2-hour drive of Phoenix and Tucson. The facility has the first lakeside horse camp built in the Southwestern Region of the Forest Service. From the recreation site, trail users access the Arizona Trail, an 800-mile (1,287-kilometer), nonmotorized trail.

When developing the recreation site, the landscape architect and engineers faced these design challenges:

- ☆ Site vegetation must remain undisturbed, by agreement with the Arizona Game and Fish Department.
- ☆ All permanent facilities, such as toilet buildings, must be located above the high water level.
- ☆ The recreation site must include picnicking opportunities for visitors who don’t ride stock.
- ☆ Equestrian amenities must be purchased with nonproject funds.

New facilities were built on a 3-acre abandoned administrative site with a large asphalt parking area and several building foundations. The facilities included an interpretive site, a nonequestrian day-use area, and a horse camp that accommodates single parties and groups.

The single-party camping area was constricted and required a unique layout. Working with the Arizona State Horseman’s Association, designers created a high-density layout (figure 16–24). Association members said lake views outweighed density concerns in this case.

The popular equestrian area has eight single-party camp units, two of which are accessible. The camp units (figure 16–25) have pullthrough parking pads with compacted aggregate surfaces. Each camp unit has a shelter, a picnic table, a combination fire ring and grill, and a single corral set. A several-party camp unit (figure 16–26) accommodates three equestrian parties. Steep terrain restricts the installation of horse corral sets there, but the pullthrough parking pads have enough space for portable corrals or for tying stock to trailers. The horse and living areas are surfaced with decomposed granite that is compacted only in the living areas. The accessible camp units have firm and stable surfaces in the living areas. A map at the visitor information station notes the locations of the accessible camp units.

A natural drainage, thick desert vegetation, and 200 feet (61 meters) separate the equestrian group camp from the equestrian single-party camp units. The 50-person equestrian group camp (figure 16–27) is about 200 by 250 feet (61 by 76.2 meters). The site’s topography determined the shape of the compacted decomposed granite parking area, which has no designated parking spaces. The paved and accessible equestrian group gathering area has six picnic tables under a shelter, two group pedestal grills, a serving table, and a fire ring that is 6 feet (1.8 meters) in diameter (figure 16–28).

The nonequestrian day-use area includes 26 picnic units that accommodate single parties, double parties, and groups. The picnic units have picnic tables and access to a single or group pedestal grill. Most have a shelter, although two of the picnic units are under large canopy trees, eliminating the need for shelters. A cove in the lake separates the nonequestrian and equestrian areas.

Desert trees were planted for shade in both the day-use area and campground. Flush toilets and dumpsters are available in both areas. Dumpsters in the equestrian area accommodate trash and manure. Visitor information stations are at the day-use area, the single-party campground, and the group gathering area. The day-use area also has an interpretive plaza.

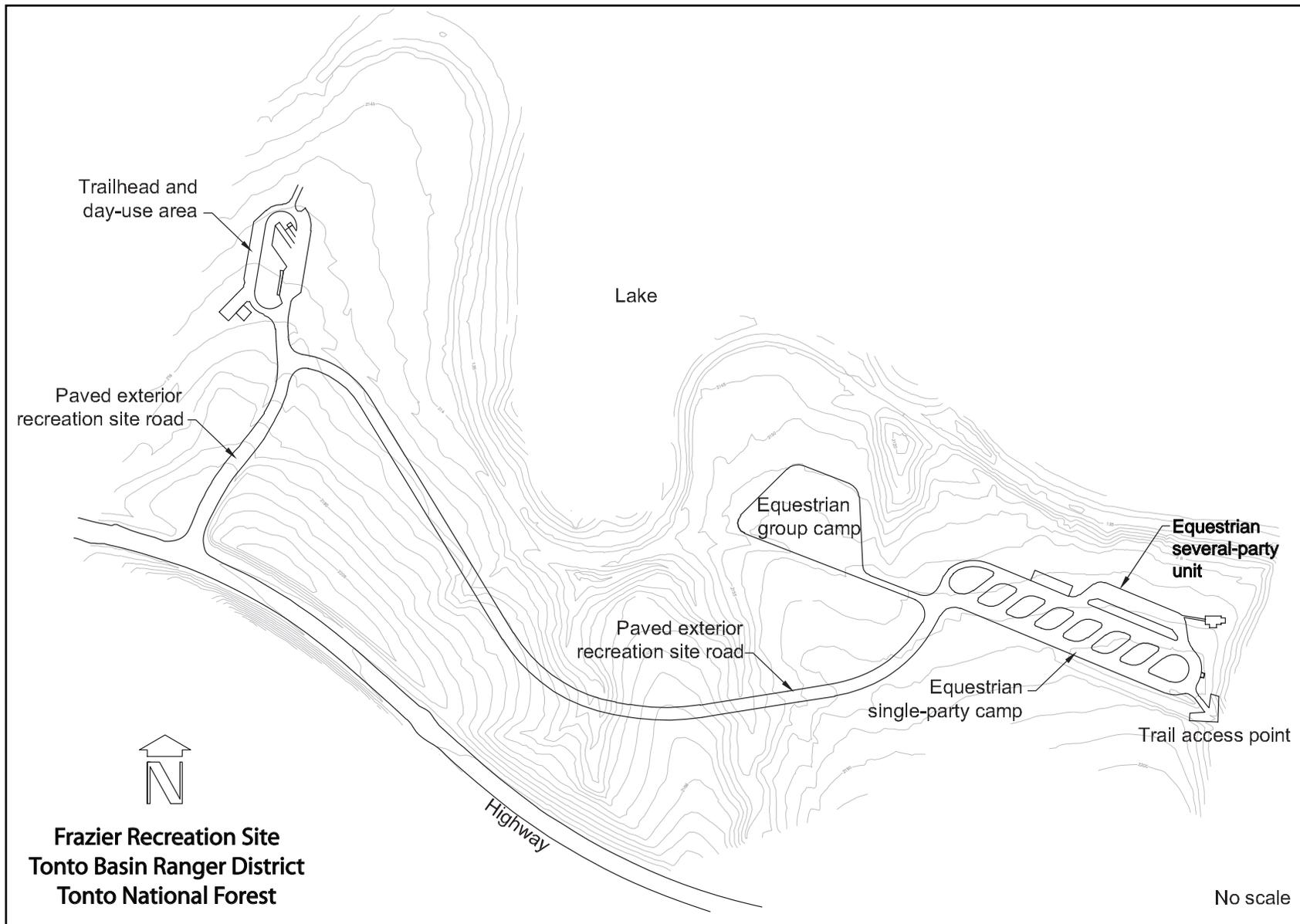


Figure 16-23—The Frazier Recreation Site in the Tonto National Forest.



Figure 16-24—This high-density site accommodates many riders at a time and is very popular.



Figure 16-27—The equestrian group site accommodates 50 people.

The Bureau of Reclamation provided funding for facilities such as roads, gates, signs, toilet buildings, water hydrants, an interpretive plaza, shelters, and site amenities. Volunteers donated materials and labor to build steel pipe corrals (figure 16-29). The Forest Service donated water troughs, and members of the Backcountry Horsemen of America donated materials and labor for hitch rails. This recreation site is an example of successful cooperation between public agencies and volunteers.



Figure 16-25—Camp units have excellent lake views. Each site has a pullthrough parking pad, a shelter, a picnic table, a combination fire ring/grill, and a set of single corrals.



Figure 16-28—The accessible group site has a shelter, six picnic tables, two group pedestal grills, a serving table, a lantern hanger, and a large fire ring.



Figure 16-29—Volunteers donated materials and built the corrals.



Figure 16-26—A several-party camp unit accommodates up to three equestrian parties. Space limitations preclude corrals.



**Resource Roundup**

**Frazier Recreation Site**

For more information, visit <http://www.fs.fed.us/r3/tonto/recreation/rogs/camping/Tonto%20Basin/Frazier.pdf>.



**Stonegate Equestrian Park—  
Scottsdale, AZ**

Stonegate Equestrian Park (figure 16–30) is a 23-acre facility in northeastern Scottsdale, AZ. Many commercial and residential horse owners live in the area. The park has two horse arenas, a round pen, nature trail, playground, picnic area, shelters, and a multiuse room. The trailhead is designated for day use and accesses several popular trail systems.

The parking area has space for vehicles pulling horse trailers. The decomposed granite surface is compacted and has parking markers. Curbs that are level and almost flush with the adjacent surface alleviate tripping as stock leave the area. Light fixtures in the parking area comply with city light pollution guidelines.

The park has a gated entrance and perimeter fence. Both arenas have sprinkler systems that users can turn on as needed. One arena has lights that users operate with a timer. The park provides water troughs (figures 16–31 and 16–32), hitch rails, and manure bins.

A shelter houses two restrooms and the multiuse room. The structure includes large overhangs covering a patio with picnic tables and benches (figure 16–33). A small children’s park with playground equipment is nearby.

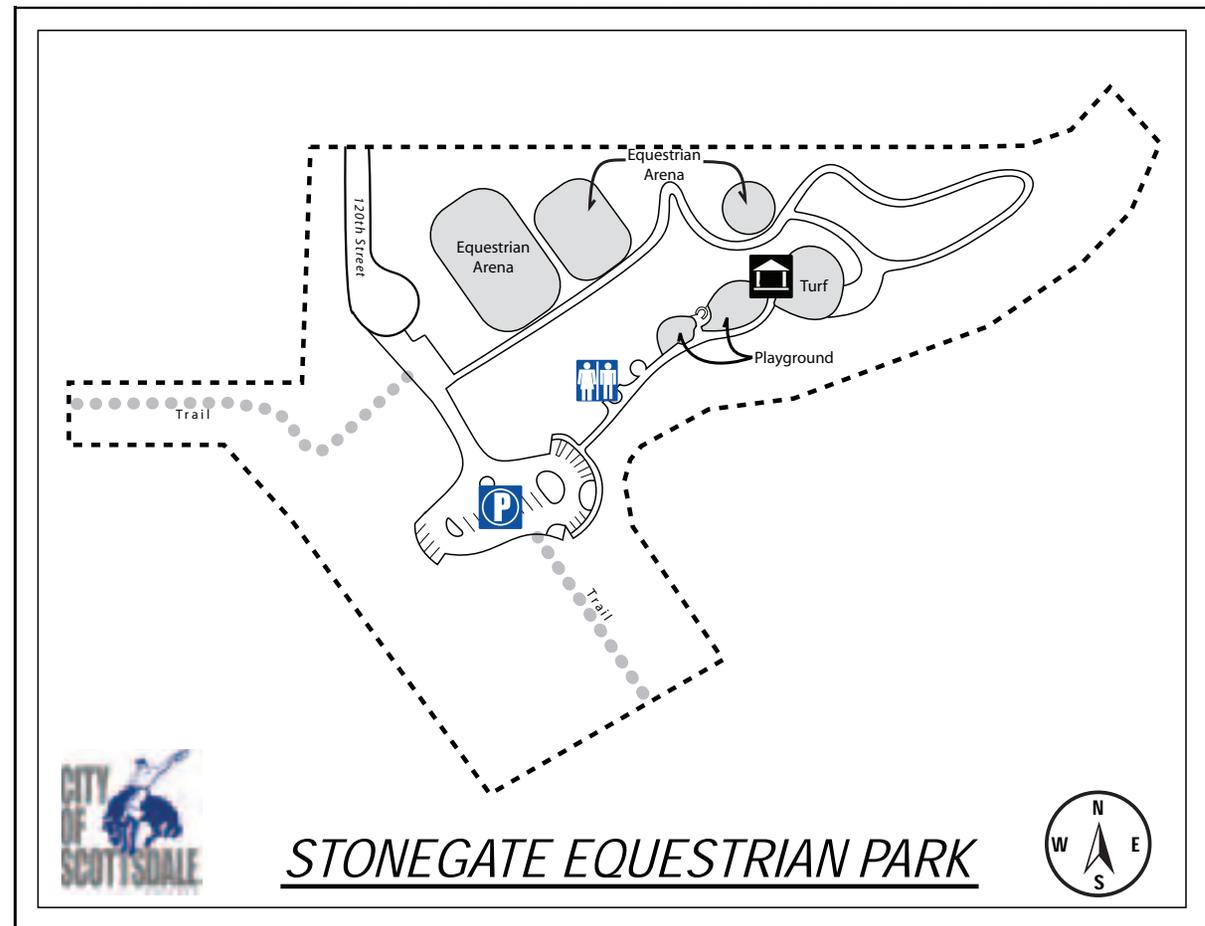


Figure 16–30—The Stonegate Equestrian Park in Scottsdale, AZ. —Courtesy of City of Scottsdale, AZ.



Figure 16–31—Stonegate Equestrian Park features a raised water trough with hand-operated fill and drain controls.

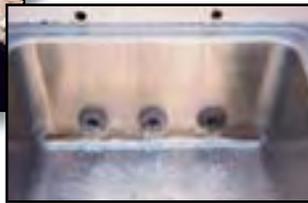


Figure 16–32—The shallow basin fills quickly and is easy to clean.



Figure 16–33—The shelter at Stonegate Equestrian Park includes two restrooms and a multiuse room. Picnic tables and benches fit under the large overhang.



#### Resource Roundup

### Stonegate Equestrian Park

For more information, visit <http://www.scottsdale.az.gov/parks/neighborhood/stonegate.asp>.

### Horseshoe Park and Equestrian Centre—Queen Creek, AZ

Queen Creek, AZ, has traditionally been a rural community with large agricultural acreages. The area has a high concentration of horse properties, and many youth activities center on farming and livestock, particularly horses and ponies.

As commercial growth and planned residential development increased, the community developed a master plan for the Horseshoe Park and Equestrian Centre. The proposed park site is a landfill area slated for closure, near San Tan Mountain Park, a large open space with recreation trails for riders and other nonmotorized users. Eventually, shared-use trails will connect to Horseshoe Park and Equestrian Centre, many equestrian residential properties, and San Tan Mountain Park.

The *Parks, Trails, and Open Space Master Plan* is notable because of public involvement during the planning process. After touring area sites, a citizen subcommittee of the Parks, Trails, and Open Space Committee developed a public involvement plan, a vision statement, and a list of high-priority amenities. A landscape architectural firm created a set of conceptual plans. Three public open houses were held. After changes were made, the town council unanimously approved the final master plan and a tentative completion date was set. The town is using the construction manager at-risk process, which binds the design team

and the contractor to work together before and during construction for faster, more cost-efficient completion.

The final master plan for the park includes an equestrian event area, a community park, and trails. The master plan design (figure 16–34) accommodates different types of community events, such as dog shows, livestock shows and auctions, concerts, and youth-oriented programs that attract up to 3,000 spectators. The facility plan reflects year-round day and evening use. The proposed equestrian event area includes four lighted arenas (one is covered). It also contains livestock pens and chutes, stalls, motorhome hookups, trailer parking, wash racks, a restroom and concession building, vendor areas, an administration building, spectator seating, and a maintenance facility. The community park has a playground, a group picnic area, a toilet building, an arena for community use, a round pen, an open turf area, and an amphitheater. The area has 1.5 miles (2.4 kilometers) of shared-use trails with a scenic overlook at the highest point of the landfill. The unpaved trails are designed for nonmotorized users and meet accessibility guidelines.

The project has two phases: The first phase will develop 33 acres containing the equestrian center and amenities, motorhome hookups, trailer parking, vendor areas, concessions, showers, restrooms, offices, and maintenance facilities. Trails, a small park and amphitheater, picnic shelters, and a mountaintop gazebo will be constructed during the second phase.



Figure 16-34—The Horseshoe Park and Equestrian Centre in Queen Creek, AZ. —Courtesy of Town of Queen Creek, AZ.



Resource Roundup

**Queen Creek Parks, Trails, and Open Space Master Plan**

The Parks, Trails, and Open Space Master Plan (HDR and others 2005) is available at <http://www.queencreek.org/Index.aspx?page=198>. For more information about Horseshoe Park and Equestrian Centre, visit: <http://www.queencreek.org/Index.aspx?page=196>.



### ***WestWorld and WestWorld Trailhead— Scottsdale, AZ***

WestWorld is a very large equestrian facility where some of the nation's largest horse shows are held, including the Arabian Horse Show and the American Quarter Horse Association's Sun Circuit Show. WestWorld facilities include many arenas, barns, and exhibit facilities that can accommodate shows with over 1,000 horses (figure 16–35). Two 100-foot (30.5-meter) arenas with sprinkling systems accommodate horse activities (figure 16–36).

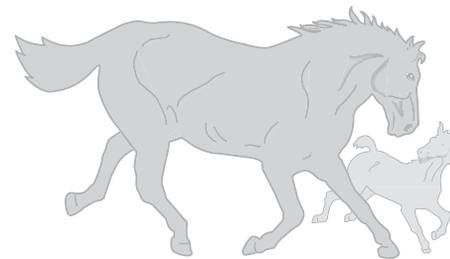
WestWorld is an example of Government interagency cooperation—Scottsdale operates the facility under a license from the U.S. Department of the Interior Bureau of Reclamation. WestWorld sits in a massive retention basin on lands managed by the Bureau of Reclamation just north of the Central Arizona Project Canal. The canal carries water from the Colorado

River to central portions of Arizona. The basin is designed to hold stormwater runoff. Flooding is a recognized—and distinct—possibility.

Scottsdale's recreation trail system skirts WestWorld and can be accessed from the WestWorld Trailhead, a large public facility that accommodates pedestrians, bicyclists, and riders. Partly because of its proximity to WestWorld's other equestrian facilities, the trailhead receives substantial use from riders. The road and parking areas at the trailhead are constructed of decomposed granite with a stabilizer. This treatment reduces dust and creates a firm and stable surface that is accessible. Accessible parking spaces are adjacent to a shade structure with picnic tables and restrooms. Concrete edge curbs are flush with adjacent surfaces to hold surface material in place without presenting a tripping hazard. An accessible route leads from the parking area to the shade structure.

Equestrian parking spaces are 70 feet (21.3 meters) long and 24 feet (7.3 meters) wide (figure 16–37). Concrete markers delineate pullthrough spaces arranged in a fishbone pattern. Additional parking spaces along the perimeter of the trailhead are for extra-long horse trailers. All trail users have immediate access to the nonmotorized trail system. Well-positioned bollards prevent motor vehicles from accessing trails.

The trailhead includes separate parking areas for equestrians and other trail users. Amenities include a water trough and lighting. Riders must fill the water trough. A simple automatic drain empties the water after each use (figure 16–38). There is a large dumpster for manure (figure 16–39). WestWorld Trailhead lighting fixtures adhere to city light pollution guidelines.



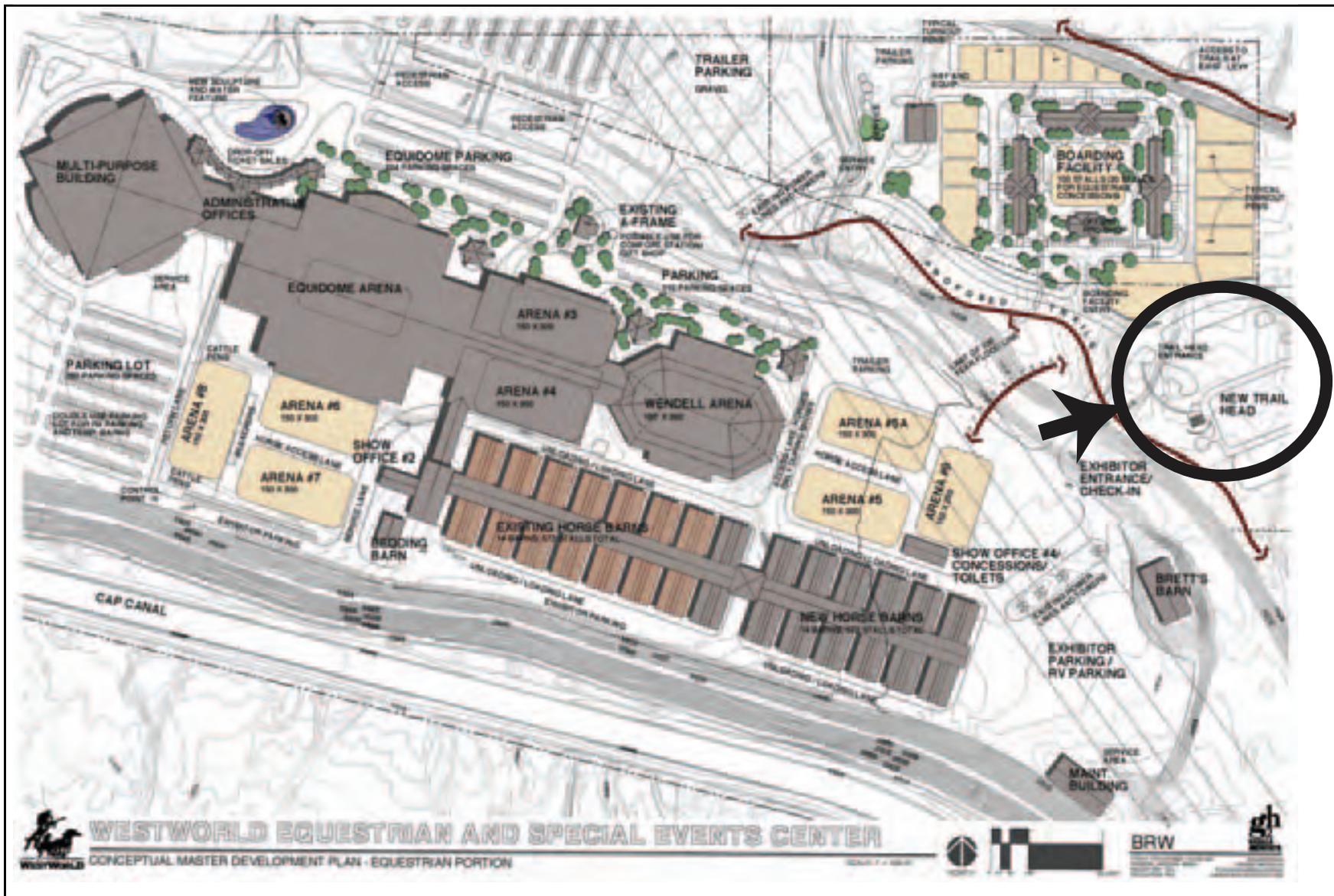


Figure 16-35—The WestWorld Equestrian and Special Events Center in Scottsdale, AZ. The horse trails are accessed from the new trailhead (circle). —Courtesy of City of Scottsdale, AZ.



Figure 16-36—The center has two 100-foot arenas.



Figure 16-38— A shallow water trough is convenient for riders and allows stock to keep an eye out while they drink.



Figure 16-37—Equestrian parking spaces are 70 feet long and 24 feet wide. The spaces are arranged in a fishbone pattern and delineated with concrete markers.



Figure 16-39— A dumpster is provided for convenient manure disposal.



### WestWorld

### Resource Roundup

For more information, visit <http://www.scottsdaleaz.gov/westworld>.







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## Appendix A— Acronyms

AASHTO	American Association of State Highway and Transportation Officials	FSTAG	Forest Service Trail Accessibility Guidelines
ABA	Architectural Barriers Act	GIS	Geographic information system
ABAAS	Architectural Barriers Act Accessibility Standard	GPS	Global positioning system
ADA	Americans with Disabilities Act	GSA	General Services Administration
ADA/ABAAG	Americans with Disabilities Act/Architectural Barriers Act Accessibility Guidelines	HUD	Department of Housing and Urban Development
AHC	American Horse Council	IBC	International Building Code
ASTM	American Society for Testing and Materials	ICC	International Code Council
ATV	All-terrain vehicle	IMBA	International Mountain Bicycling Association
BMP	Best management practices	ISA	International Symbol of Accessibility
BOR	Bureau of Reclamation	MTDC	Missoula Technology and Development Center
CCA	Chromated copper arsenate	MUTCD	Manual on Uniform Traffic Control Devices
CCS	Cellular confinement systems (geotextiles)	NEPA	National Environmental Policy Act
DOD	Department of Defense	NHPA	National Historic Preservation Act
DOJ	Department of Justice	NTTP	National Trails Training Partnership
DOT	Department of Transportation	O & M	Operations and maintenance
ESA	Endangered Species Act	OHV	Off-highway vehicle
FEMA	Federal Emergency Management Agency	ORAR	Outdoor recreation access route
FHWA	Federal Highway Administration	PBIC	Pedestrian and Bicycle Information Center
FICMNEW	Federal Interagency Committee for the Management of Noxious and Exotic Weeds	ROS	Recreation Opportunity Spectrum
FSH	Forest Service Handbook	RWT	Rails-with-trails
FSM	Forest Service Manual	SCA	Student Conservation Association
FSORAG	Forest Service Outdoor Recreation Accessibility Guidelines	SMS	Scenery Management System
		SDTDC	San Dimas Technology and Development Center
		TCD	Traffic control device
		UFAS	Uniform Federal Accessibility Standards
		USCS	Unified Soil Classification System
		USDA	United States Department of Agriculture
		USDI	United States Department of the Interior
		USPS	United States Postal Service
		VRM	Visual Resource Management



Appendix B—

# Trail Libraries, Trail Organizations, and Funding Resources

## Trail Libraries

- ☆ **Federal Highway Administration**—*Recreational Trails Program*  
Publications: <http://www.fhwa.dot.gov/environment/rectrails/publications.htm>
- ☆ **Federal Highway Administration**—*Recreational Trails Program Related*  
Links: <http://www.fhwa.dot.gov/environment/rectrails/links.htm>
- ☆ **Federal Highway Administration**—*USDA Forest Service Publications List*:  
<http://www.fhwa.dot.gov/environment/fspubs>
- ☆ **National Transportation Library**: <http://ntl.bts.gov>
- ☆ **National Trails Training Partnership**—*Resources Library*:  
<http://www.nttp.net/resources>
- ☆ **Professional Trail Builders Association**—*Resource Library*:  
<http://www.trailbuilders.org/resources>
- ☆ **USDA Forest Service**—*Directives*: <http://www.fs.fed.us/im/directives>
- ☆ **USDA Forest Service**—*Technology and Development Publications*:  
<http://www.fs.fed.us/t-d/pubs> (Username: t-d, Password: t-d)
- ☆ **University of Minnesota Trail Library**—*Trail Planning, Construction, and Maintenance*: <http://forestry.lib.umn.edu/bib/trls.phtml>

## Trail Organizations

- ☆ **American Hiking Society (AHS)** provides more than hiking information. The AHS Web site has links to information regarding trail-based policy initiatives, funding resources, trail news, and volunteer opportunities, as well as a trail finder service at <http://www.americanhiking.org>.
- ☆ **American Horse Council (AHC)** is a national trade association representing the horse industry before Congress. The AHC monitors Federal legislation and regulations that affect the horse industry. Its Recreation Committee provides recommendations to the AHC regarding Federal recreation issues and works with local horse councils. A listing of related sites—including State horse councils—is available under the *About Us* menu at <http://www.horsecouncil.org>.
- ☆ **American Trails** is a nonprofit organization that promotes the creation, conservation, and broad enjoyment of quality trails and greenways. American Trails promotes common ground and cooperation among all trail interests and offers hundreds of articles, studies, contacts, links, and other Web resources at <http://www.americantrails.org>.
- ☆ **Back Country Horsemen of America (BCHA)** is a service club with many local chapters that strives to protect the equestrian use of, and access to, wilderness and backcountry areas. Volunteer members assist government and private agencies with trail maintenance and management. The BCHA strives to educate, encourage, and solicit active participation in the wise and sustainable use of backcountry resources by equestrians and the general public. More information is available at <http://www.backcountryhorse.com>.
- ☆ **Equestrian Land Conservation Resource (ELCR)** is a nationwide organization dedicated to assisting equestrians with access and land issues. The ELCR raises awareness among equestrians about stewardship and land conservation. It also assists grassroots efforts in communities nationwide,





- encourages collaboration with other conservation and user groups, and provides equestrians with specific how-to information at <http://www.elcr.org>.
- ☆ **International Mountain Bicycling Association (IMBA)** provides services that include planning, designing, building, and maintaining trails. Technical resources are available on the Resources page at <http://www.imba.com>.
  - ☆ **Land Trust Alliance (LTA)** promotes voluntary land conservation and provides training, publications, a digital library, grants, liability insurance for land trusts, and other services. More information is available at <http://www.lta.org>.
  - ☆ **National Center for Bicycling and Walking (NCBW)** provides useful resources regarding land use, transportation, and planning for pedestrians and bicyclists at <http://www.bikewalk.org>.
  - ☆ **National Trails Training Partnership (NTTP)**, managed and promoted by American Trails, is an alliance of Federal agencies, training providers, nationwide supporters, and providers of products and services. The NTTP focuses on training opportunities. A wide variety of informative trail resources and links are available at <http://www.nttp.net>.
  - ☆ **Pedestrian and Bicycle Information Center (PBIC)** maintains an online planning resources list for shared-use trails. The PBIC is a clearinghouse for information about health and safety, engineering, advocacy, education, enforcement, access, and mobility. The resources are available at <http://www.pedbikeinfo.org>.
  - ☆ **Professional Trailbuilders Association (PTBA)** is an organization for private trail specialists and professional trail contractors, designers, and consultants. The PTBA promotes quality trail design, construction, and maintenance. More information is available at <http://www.trailbuilders.org>.
  - ☆ **Recreational Trails Program (RTP)** is an assistance program of the Department of Transportation Federal Highway Administration (FHWA). The RTP provides funding to develop and maintain recreation trails and trail-related facilities for both nonmotorized and motorized recreation trail uses. Access RTP's Web page at <http://www.fhwa.dot.gov/environment/rectrails>. Some useful features include:
    - » Trail references and links to Federal and State agencies, trail organizations, and trail information resources, available at <http://www.fhwa.dot.gov/environment/rectrails/links.htm>.
    - » Links to Recreational Trails Program State administrators, available at <http://www.fhwa.dot.gov/environment/rectrails/rtpstate.htm>.
  - ☆ **Rails-to-Trails Conservancy (RTC)** is a nonprofit organization that works to create a nationwide network of trails from former rail lines. The RTC promotes conditions to make trail building possible; works to protect the Transportation Enhancements Program; defends the Federal railbanking statute in Congress; and provides information, technical assistance, and training at local levels. More information is available at <http://www.railtrails.org>. Some useful features include:
    - » **Trails and Greenway Clearinghouse** is a service of the Rails-to-Trails Conservancy. Technical assistance, information resources, and referrals to trail and greenway advocates and developers across the country can be found at <http://www.trailsandgreenways.org>.
    - » **Trail-Building Toolbox** is a trail development resource center developed by the Rails-to-Trails Conservancy for first-time citizen advocates to more experienced planners and trail managers. Access the Trail-Building Toolbox at <http://www.railstotrails.org/whatwedo/trailbuilding/index.html> or [http://www.railstotrails.org/whatwedo/trailbuilding/technicalassistance/toolbox/toolbox\\_index.html](http://www.railstotrails.org/whatwedo/trailbuilding/technicalassistance/toolbox/toolbox_index.html).
  - ☆ **Rivers, Trails, and Conservation Assistance Program (RTCA)**, also known as the Rivers and Trails Program) is a community resource of the National Park Service. The RTCA provides collaborative technical assistance to community groups and government agencies developing trails, greenways, open space areas, and other projects. The program focuses on organization building, planning, and coordination for conservation and outdoor recreation, but does not offer grants. More information is available at <http://www.nps.gov/ncrc/programs/rtca>.





## Funding and Partnership Resources

- ☆ *Ninety-five Creative Funding Ideas for Trails and Greenways* (Macdonald 2003) is available at <http://www.americantrails.org/resources/funding>.
- ☆ **Foundation Center** Web site provides advice on how to write and seek grants, along with an extensive list of funding sources at <http://www.fdncenter.org>.
- ☆ **National Association of Service and Conservation Corps** (NASCC) is a direct descendant of the Civilian Conservation Corps of the Depression era. Information regarding methods to involve youth or conservation corps in projects is available at <http://www.nascc.org>.
- ☆ **National Trails Training Partnership** (NTTP) has many resources for trail planners. The Funding and Resources Web page provides links for fundraising ideas, volunteer programs, grants, and grant-writing resources. More information is available at <http://www.americantrails.org/resources/funding>.
- ☆ **National Transportation Enhancement Clearinghouse** (NTEC) Web site is a collaboration between the Federal Highway Administration and the Rails-to-Trails Conservancy. Some useful NTEC Web pages include:
  - » *Transportation Enhancements* Web page, which provides links to basic information for using Federal Transportation Enhancement funds, State-specific information, and Federal legislation at <http://www.enhancements.org>. This Web page is an introduction—it is not the Transportation Enhancements Web site.
  - » *Rails-to-Trails Conservancy Trail and Greenway Funding Guide*, which has a searchable database for many Federal, State, and private funding sources at <http://www.enhancements.org/trailfunding.htm>.
- ☆ **Red Lodge Clearinghouse** provides a searchable database of private, foundation, Federal, and State funding sources for trail and greenway projects in 11 Western States at <http://www.redlodgeclearinghouse.org/resources/search.cfm>.
- ☆ **Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users** (SAFETEA–LU) authorizes the Federal surface transportation programs for highways, highway safety, and transit from 2005 to 2009. More information is available at <http://www.fhwa.dot.gov/safetealu>.
- ☆ **Transportation Enhancements** is a Web resource for States sponsored by the Federal Highway Administration, which provides official legislation and guidance documents regarding Transportation Enhancement Activities. This Web site is not the same as the Transportation Enhancements page on the NTEC Web site. Access FHWA's Transportation Enhancements Web site at <http://www.fhwa.dot.gov/environment/te>.
- ☆ **Trust for Public Land** (TPL) helps agencies and communities define conservation priorities, identify lands to be protected, plan networks, raise funds, negotiate land transactions, and share knowledge. The trust also has information regarding regional, State, and Federal programs at <http://www.tpl.org>.
- ☆ **University of Wisconsin Grants Information Collection** has a Web page devoted to *Proposal Writing: Internet Sources*: <http://grants.library.wisc.edu/organizations/proposalwebsites.html>.



## Appendix C— Helpful Resources

The resources cited in the text are compiled alphabetically here, by topic. For information on funding resources, see *Appendix B—Trail Libraries, Trail Organizations, and Funding Resources*.

### Accessibility

- ☆ **Accessible Exterior Surfaces Technical Article** (Axelson and others 1999): <http://www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm> or <http://www.beneficialdesigns.com/surfaces/surface.html>
- ☆ **Accessibility Guidebook for Outdoor Recreation and Trails** (Zeller and others 2006): <http://www.fs.fed.us/recreation/programs/accessibility/htmlpubs/htm06232801> or <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232801>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Accessible Gate Latch** (Groenier 2006): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232331>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Accessible Gates for Trails and Roads** (Groenier 2006): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232340>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **ADA and ABA Accessibility Guidelines**: <http://www.access-board.gov/ada-aba>
- ☆ **Adaptive Riding Institute**: <http://www.open.org/~horses88>
- ☆ **AgrAbility Project**: <http://www.agrabilityproject.org/assistivetech>
- ☆ **Americans with Disabilities Act Accessibility Guidelines (ADAAG): Checklist for Buildings and Facilities**: <http://www.access-board.gov/adaag/checklist/a16.html>
- ☆ **National Center on Accessibility**: <http://ncaonline.org/trails>

- ☆ **National Trails Surface Study** (National Center on Accessibility): <http://www.ncaonline.org/trails/research>
- ☆ **New Accessible Handpump for Campgrounds** (Kuhn and Beckley 2005): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm05712311>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **North American Riding for the Handicapped Association, Inc.**: <http://www.narha.org>
- ☆ **Soil Stabilizers On Universally Accessible Trails** (Bergmann 2000): <http://www.fhwa.dot.gov/environment/fspubs/00231202> or <http://www.fs.fed.us/t-d/pubs/pdf/00231202.pdf>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Universal Trail Assessment Process** (Beneficial Designs, Inc. 1994–2001): <http://www.beneficialdesigns.com/trails/utap.html>
- ☆ **USDA Forest Service Recreation, Heritage and Wilderness Programs**: <http://www.fs.fed.us/recreation/programs/accessibility>
- ☆ **Wilderness Access Decision Tool** (Lais and others [n.d.]): [http://carhart.wilderness.net/docs/wild\\_access\\_decision\\_tool.pdf](http://carhart.wilderness.net/docs/wild_access_decision_tool.pdf)

### Animal Confinement

- ☆ **Preservative-Treated Wood and Alternative Products in the Forest Service** (Groenier and Lebow 2006): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06772809>. This site requires a username and password. (Username: t-d, Password: t-d).
- ☆ **Techniques and Equipment for Wilderness Travel with Stock** (Stoner and others 1993): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm93232839>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **The Equine Arena Handbook: Developing a User-Friendly Facility** (Malmgren 1999): Available at book outlets.
- ☆ **Underfoot** (United States Dressage Federation 2007): <http://www.usdf.org/Store/UnderfootOrder.pdf>



## Case Studies

- ☆ **Blue Mountain Recreation Area:** <http://www.fs.fed.us/r1/lolo/recreation-brochures/blue-mtn-rec-area.pdf>
- ☆ **City of Scottsdale Trails System Master Plan** (Todd & Associates, Inc. and others 2003): <http://www.scottsdaleaz.gov/trails/plan.asp>
- ☆ **Frazier Recreation Site:** <http://www.fs.fed.us/r3/tonto/recreation/rogs/camping/Tonto%20Basin/Frazier.pdf>
- ☆ **Horseshoe Park and Equestrian Centre:** <http://www.queencreek.org/Index.aspx?page=196>
- ☆ **Horse Creek Campground:** <http://www.fs.fed.us/r6/siuslaw/recreation/tripplanning/newpflor/camp/horsecreek.shtml>
- ☆ **Houston Mesa Horse Camp:** <http://www.fs.fed.us/r3/tonto/recreation/rogs/camping/Payson/HoustonMesaHorseCamp.pdf>
- ☆ **Stonegate Equestrian Park:** <http://www.scottsdaleaz.gov/parks/neighborhood/stonegate.asp>
- ☆ **Town of Queen Creek Parks, Trails, and Open Space Master Plan** (HDR and others 2005): <http://www.queencreek.org/Index.aspx?page=198>
- ☆ **Waterfall Glen Forest Preserve:** <http://www.dupageforest.com/PRESERVES/waterfallglen.html>
- ☆ **WestWorld:** <http://www.scottsdaleaz.gov/westworld>
- ☆ **West Valley Multi-modal Transportation Corridor Master Plan** (Maricopa Association of Governments 2001): <http://www.mag.maricopa.gov/archive/wvtrails/publications/master%20plan.pdf>

## Engineering Standards and Building Codes

- ☆ **ASTM International** (originally known as the American Society for Testing and Materials): <http://www.astm.org>
- ☆ **International Code Council (ICC):** <http://www.iccsafe.org/cs>

## Fords, Bridges, and Overpasses

- ☆ **A Guide to Fiber-Reinforced Polymer Trail Bridges** (Groenier and others 2006): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm06232824>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Geosynthetics for Trails in Wet Areas** (Monlux and Vachowski 2000): <http://www.fhwa.dot.gov/environment/fspubs/00232838> or <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm00232838>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Guide for the Development of Bicycle Facilities** (AASHTO 1999): <http://www.communitymobility.org/pdf/aashto.pdf>
- ☆ **Guide Specifications for Design of Pedestrian Bridges, 1st Edition** (AASHTO 1997): [https://bookstore.transportation.org/item\\_details.aspx?ID=37](https://bookstore.transportation.org/item_details.aspx?ID=37)
- ☆ **Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400)** (AASHTO 2001b): [https://bookstore.transportation.org/item\\_details.aspx?ID=157](https://bookstore.transportation.org/item_details.aspx?ID=157)
- ☆ **Standard Specifications for Highway Bridges** (AASHTO 1996): [https://bookstore.transportation.org/item\\_details.aspx?ID=51](https://bookstore.transportation.org/item_details.aspx?ID=51)
- ☆ **Trail Bridge Catalog** (Eriksson 2000): <http://www.fs.fed.us/t-d/bridges>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Transportation Structures Handbook FSH 7709.56b** (U.S. Department of Agriculture Forest Service 2005): [http://www.fs.fed.us/cgi-bin/Directives/get\\_dirs/fsh?7709.56b](http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?7709.56b)
- ☆ **Wetland Trail Design and Construction** (Steinholtz and Vachowski 2007): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232804>. This Web site requires a username and password. (Username: t-d, Password: t-d)

## Laws, Liability, and Safety

- ☆ **Animal Legal & Historical Center:** <http://www.animallaw.info>
- ☆ **Clemson Extension Large Animal Emergency Rescue:** <http://www.clemson.edu/ep/LART>



- ☆ **ELCR Library of Resources** (Equestrian Land Conservation Resource 2000–2007): [http://elcr.org/index\\_resources.php](http://elcr.org/index_resources.php)
- ☆ **Equine Law and Horsemanship Safety**: <http://asci.uvm.edu/equine/law>
- ☆ **Information by State** (Equestrian Land Conservation Resource 2000–2007): [http://elcr.org/index\\_info.php](http://elcr.org/index_info.php)
- ☆ **Liability and Lawsuits** (International Mountain Bicycling Association 2006): [http://www.imba.com/resources/trail\\_issues](http://www.imba.com/resources/trail_issues)
- ☆ **Recreational Use Statutes and the Private Landowner** (Rivers, Trails, and Conservation Assistance Program 2007): <http://www.nps.gov/ncrc/programs/rtca/helpfultools/recusebrochures>
- ☆ **Safe Trails Forum** (National Trails Training Partnership 2007): <http://www.americantrails.org/resources/safety>
- ☆ **Table of State Liability Laws** (International Mountain Bicycling Association [n.d.]): [http://imba.com/resources/trail\\_issues/liability\\_chart.html](http://imba.com/resources/trail_issues/liability_chart.html)
- ☆ **The Equine Activity Liability Act: How It Affects Associations & Sponsors** (Farris 2005): <http://www.farrislawfirm.com/Default.aspx?PageID=31>
- ☆ **UC Davis Veterinary Emergency Response Team**: <http://www.vmeth.ucdavis.edu/home/VERT>

## Low Impacts

- ☆ **International Dark-Sky Association**: <http://www.darksky.org>
- ☆ **Leave No Trace Center for Outdoor Ethics**: <http://www.lnt.org>
- ☆ **Leave No Trace Stock Master** course: <http://www.fs.fed.us/r1/lolo/resources-cultural/nwtc/descriptions.pdf>

## Parking, Roads, and Intersections

- ☆ **A Policy on Geometric Design of Highways and Streets** (AASHTO 2001a): [https://bookstore.transportation.org/item\\_details.aspx?ID=110](https://bookstore.transportation.org/item_details.aspx?ID=110)
- ☆ **Cross Alert Systems**: <http://www.crossalert.com>
- ☆ **Designating Parking Areas on Unpaved Surfaces** (U.S. Department of Agriculture Forest Service, San Dimas Technology and Development Center

- 2002): <http://www.fs.fed.us/eng/pubs/html/02231314/02231314>
- ☆ **Equestrian Crossings** (The Highways Agency 2003): <http://www.dft.gov.uk/pgr/roads/tpm/tal/signsandsignals/equestriancrossings>
- ☆ **Road Preconstruction Handbook FSH 7709.56** (U.S. Department of Agriculture Forest Service 1987): [http://www.fs.fed.us/cgi-bin/Directives/get\\_dirs/fsh?7709.56](http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?7709.56)
- ☆ **Roadside Design Guide** (AASHTO 2002): [https://bookstore.transportation.org/item\\_details.aspx?ID=148](https://bookstore.transportation.org/item_details.aspx?ID=148)
- ☆ **Supplemental Specifications and Recurring Special Provisions** (Illinois Department of Transportation 2007): <http://www.dot.il.gov/desenv/07supp.pdf>

## Planning and Design

- ☆ **A Citizen's Guide to Transportation Decisionmaking** (U.S. Department of Transportation Federal Highway Administration 2001): <http://www.fhwa.dot.gov/planning/citizen>
- ☆ **Designing Shared-Use Trails to Include Equestrians** (O'Dell 2004): <http://www.aiusa.com/anneodel/ODell-Designing%20Shared-Use%20Trails.pdf>
- ☆ **Google Earth**: <http://earth.google.com>
- ☆ **Lightly on the Land: The SCA Trail Building and Maintenance Manual** (Birkby 2006): Available at book outlets.
- ☆ **Modifications of Highway Air Pollution Models for Complex Site Geometries** in: *FHWA TechBrief* [n.d.]: <http://www.tfhr.gov/structur/pubs/02036/02036.htm>
- ☆ **National Aerial Photography Program**: <http://edc.usgs.gov/products/aerial/napp.html>
- ☆ **National Bicycling and Walking Study Ten Year Status Report** (U.S. Department of Transportation Federal Highway Administration 2004): <http://www.fhwa.dot.gov/environment/bikeped/study>
- ☆ **Natural Surface Trails by Design: Physical and Human Essentials of Sustainable, Enjoyable Trails** (Parker 2004): <http://www.natureshape.com>
- ☆ **Recreation Opportunity System (ROS)** (U.S. Department of Agriculture Forest Service 1982): <http://roadless.fs.fed.us/bgddocuments2>



- ☆ **The Built Environment Image Guide** (U.S. Department of Agriculture Forest Service 2001): <http://www.fs.fed.us/recreation/programs/beig>
- ☆ **Trail Design for Small Properties** (Baughman and Serres 2006): <http://shop.extension.umn.edu>
- ☆ **Trails Design and Management Handbook** (Parker 1994): <http://www.natureshape.com>
- ☆ **Trails for the Twenty-first Century: Planning, Design, and Management Manual for Multi-Use Trails, 2d Edition** (Flink and others 2001): Available at book outlets.
- ☆ **Visual Resource Management (VRM)** (U.S. Department of the Interior Bureau of Land Management 2003): <http://www.blm.gov/nstc/VRM>
- ☆ **VRM Design Techniques** (U.S. Department of the Interior Bureau of Land Management 2003): <http://www.blm.gov/nstc/VRM/destech.html>

## Rails-to-Trails

- ☆ **National Trails Training Partnership:** <http://www.americantrails.org/resources/railtrails>
- ☆ **Pedestrian and Bicycle Information Center:** <http://www.bicyclinginfo.org/rt>
- ☆ **Rails-to-Trails Conservancy:** <http://www.railtrails.org>

## Railways

- ☆ **Federal Railroad Administration:** <http://www.fra.dot.gov>
- ☆ **Operation Lifesaver Rail Safety Education:** <http://www.oli.org>
- ☆ **Rails-with-Trails: Lessons Learned** (Alta Planning and Design 2002): <http://www.fhwa.dot.gov/environment/rectrails/rwt>
- ☆ **Rails-with-Trails: Lessons Learned Appendix B: State-by-State Matrix of Applicable Laws and Statutes** (Alta Planning and Design 2002): <http://www.fhwa.dot.gov/environment/rectrails/rwt/appendixb.htm>

## Signs

- ☆ **Manual on Uniform Traffic Control Devices (MUTCD)** (U.S. Department of Transportation Federal Highway Administration 2004a): <http://mutcd.fhwa.dot.gov>

- ☆ **MUTCD Chapter 2H Recreational and Cultural Interest Area Signs** (U.S. Department of Transportation Federal Highway Administration 2004): <http://mutcd.fhwa.dot.gov/HTM/2003r1/part2/part2h.htm>
- ☆ **MUTCD Standard Highway Signs** (U.S. Department of Transportation Federal Highway Administration 2004b): [http://mutcd.fhwa.dot.gov/ser-shs\\_millennium.htm](http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm)
- ☆ **Sign and Poster Guidelines for the Forest Service, EM-7100-15** (U.S. Department of Agriculture Forest Service 2005): Forest Service employees can request electronic copies from Forest Service regional sign coordinators.
- ☆ **Signs and Posters Toolbox** (Wilderness.net 2005): <http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=signsPosters>
- ☆ **Signs, Trails, and Wayside Exhibits: Connecting People and Places, Third Edition** (Trapp and others 1996): <http://www.uwsp.edu/cnr/schmeeckle/Handbooks/Signs>

## Toilet and Shower Buildings

- ☆ **Technical articles on toilets** (U.S. Department of Agriculture Forest Service, Technology and Development Program): <http://www.fs.fed.us/t-d/pubs>. This Web site requires a username and password. Search the Web site using the keywords *toilet* and *shower*. (Username: t-d, Password: t-d)
- ☆ **Campground Comfort Station construction plans** (Louisiana State University Agricultural Center 1969): [http://www.lsuagcenter.com/en/our\\_offices/departments/Biological\\_Ag\\_Engineering/Building\\_Plans/recreation/equipment/Campground+Comfort+Station.htm](http://www.lsuagcenter.com/en/our_offices/departments/Biological_Ag_Engineering/Building_Plans/recreation/equipment/Campground+Comfort+Station.htm)

## Trail Construction

- ☆ **Stock-Drawn Equipment for Trail Work** (Didier and Herzberg 1996): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm96232802>. (Username: t-d, Password: t-d)
- ☆ **Trail Construction and Maintenance Notebook: 2007 Edition** (Hesselbarth, Vachowski, and Davies 2007): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232806>. This Web site requires a username and password. (Username: t-d, Password: t-d)



## Trail Management

- ☆ **Trails Management Handbook FSH 2309.18, Chapter 4—Trail Operation and Maintenance** (U.S. Department of Agriculture Forest Service 1991): <http://www.fs.fed.us/im/directives/fsh/2309.18/2309.18,4.txt>
- ☆ **Conflicts on Multiple-Use Trails: Synthesis of Literature and State of the Practice** (Moore 1994): <http://www.fhwa.dot.gov/environment/conflicts>
- ☆ **Interagency Trail Data Standards** (U.S. Department of the Interior Bureau of Land Management, National Park Service and Fish and Wildlife Service; U.S. Department of Agriculture Forest Service 2004): <http://www.nps.gov/gis/trails>
- ☆ **Rail-Trail Maintenance and Operation: Ensuring the Future of Your Trail—A Survey of 100 Rail-Trails** (Poole 2005): <http://atfiles.org/files/pdf/railtrailmaint.pdf>
- ☆ **Recreation & Heritage Resources Integrated Business Systems** (U.S. Department of Agriculture Forest Service): <http://www.fs.fed.us/r3/measures>
- ☆ **Trail Maintenance and Management** (National Trails Training Partnership): <http://www.americantrails.org/resources/ManageMaintain>
- ☆ **Trail Assessment and Condition Surveys (TRACS)** (U.S. Department of Agriculture Forest Service): <http://www.fs.fed.us/r3/measures>

## Trail Terms

- ☆ **Designing Sidewalks and Trails for Access—Glossary** (U.S. Department of Transportation Federal Highway Administration 2001): <http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks2ag.htm>
- ☆ **Glossary of Terms** (National Trails Training Partnership 2003): <http://www.americantrails.org/glossary.html>
- ☆ **Helpful and Interesting Acronyms** (Rails-to-Trails Conservancy 2007): <http://www.railtrails.org/whatwedo/railtrailinfo/resources/acronyms.html>
- ☆ **Horse Glossary** (Gaited Horses 1998–2003): <http://www.gaitedhorses.net/Articles/HorseGlossary.html>

## Weeds and Vegetation

- ☆ **Backcountry Road Maintenance and Weed Management** (Ferguson and others 2003): <http://www.fs.fed.us/t-d/pubs/htmlpubs/htm03712811>. This Web site requires a username and password. (Username: t-d, Password: t-d)
- ☆ **Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW)**: <http://www.fws.gov/ficmnew>
- ☆ **Invasive Species Management** (National Park Service): <http://www.nature.nps.gov/biology/invasivespecies>
- ☆ **Cornell University Poisonous Plants Informational Database** (Cornell University 2006): <http://www.ansci.cornell.edu/plants>
- ☆ **Do Horses Spread Non-Native Plants on Trails?** (Gower 2007): <http://www.thehorse.com/ViewArticle.aspx?ID=8846> This site requires free registration.
- ☆ **Horse Owner's Field Guide to Toxic Plants** (Burger 1996): Available at book outlets.
- ☆ **Roadside Use of Native Plants** (Kartesz and others 2000): <http://www.fhwa.dot.gov/environment/rdsduse>
- ☆ **Poisonous Range Plants of Temperate North America** (Merck & Co., Inc. 2003): <http://www.manesandtailsorganization.org/toxic.html>
- ☆ **Ten Most Poisonous Plants for Horses** (EQUUS June 2004): [http://www.equisearch.com/horses\\_care/feeding/feed/poisonousplants\\_041105](http://www.equisearch.com/horses_care/feeding/feed/poisonousplants_041105)
- ☆ **Weed Free Feed: Horsemen Protecting Public Lands from Invasive Weeds** (Davis and Bay Area Equestrian Network 2000–2007): <http://www.extendinc.com/weedfreefeed>
- ☆ **Weeds Website** (U.S. Department of the Interior Bureau of Land Management 2005): <http://www.blm.gov/weeds>



Appendix D—

# Trail Proposal and Evaluation Process: Open Space and Trails Program (Pitkin County, CO)

D

Trails are not as simple as they may appear. Every trail, as a long-term community resource, must be well designed, planned, and constructed in order to best serve the public and meet the goals of the Pitkin County Open Space and Trails Program. Because the County wants each trail to be unique and as well fitted to its site, users, purpose, and goals as possible, the County has created a dynamic trail design and management approval process.

This approval process works with you. It walks you through the design of your trail, reminds you of things you didn't think of, and actually helps you to design good trails. Taking the site, the trail, the users, the purpose of the trail, and the County's goals into account, the process helps you develop a unique trail which is very well suited to all of these. The process helps guide the design and improve the quality of trails while they are still in the conceptual stage—use it as a learning tool and work with it (and the County) to generate high-quality trails. The rewards are excellent community trails which will be used and enjoyed for decades.

## How to Propose a New Trail

The Pitkin County Open Space and Trails Board will apply the outline on the following pages as they examine a trail proposal, prepare specific design (and acquisition, when applicable) recommendations, and adopt a long-term management plan for a proposed new trail. The County will also use this outline as it periodically reviews the management of trails which pre-date the Open Space and Trails Program. If you are proposing a trail project, you need to address all the issues in this outline. The outline exists to help you design your trail

and to help the County gather as much information about your trail as needed. By the time you complete the outline, you will know a great deal about how to create a good trail. The outline also makes it easier for you and the County to optimize opportunities whenever possible and to spot and correct problems in the conceptual stage. Every proposed trail will likely have less than optimal factors, and the presence of these will not necessarily affect the approval of your trail. Keep in mind that all of the outline issues have to be considered at some stage in the birth and life of a trail—completing the outline now helps you to think in advance of what you would have to address eventually.

The outline is keyed to the Trail Design Process and Guidelines in Section 1 of this Handbook [*Trails Design and Management Handbook*]. You should read and apply the contents of Section 1 to the proposed trail before attempting to complete your proposal outline. In order to respond to the questions, you should be familiar with the proposed site of the trail as well as with the basic design and construction techniques presented in Sections 2 and 3 of this Handbook.

In your written proposal, you may use any format you choose as long as you address all the issues in this outline.

The items below are keyed to the Trail Design Process and Guidelines in Section 1. Please refer to that section for the full meaning behind the following questions, then prepare a response for each of these topics (and any other relevant issues) for presentation and adoption by the Open Space and Trails Board and the Pitkin County Commissioners.



In completing your proposal:

- ☆ Be familiar with the site of the trail and with your proposed trail alignment in that site.
- Review the County’s goals for the Open Space and Trails Program given in the Introduction of this Handbook.
- Refer to Section 1 for trail design guidelines which pertain to the trail. The trail should meet as many of these guidelines as possible.
- Refer to Sections 2 and 3 to get a working knowledge of the construction techniques needed to build and maintain the trail.

Your responses to the questions posed in the outline can and should refer back to specific sections of this Handbook when appropriate.

## A. General Information

1. Briefly describe the location of the trail and why a trail is desirable here. Include the purpose of the trail (destination trail, recreational trail, connector trail). If the trail has more than one purpose, explain each in the order of importance. (See Section 1 Parts A and B).
2. Who are the expected users? In broad terms, how much use from each user type can be expected now and in the future? (See Section 1 Part C).
3. Is the trail clearly suited for some users at the exclusion of others (and if so, who)? Can use of this trail be provided for the physically challenged? (See Section 1 Part C).
4. What user conflicts can be expected and how does the trail design work to mitigate or avoid them? What trail user groups are interested in this trail? (See Section 1 Part C).
5. Which trail type should this trail be (hard surface multiple use, crusher fines, or natural surface), and why is this the best choice? (See Section 1 Part D).

## B. Mapping

*A site map is required for all trails:*

1. Prepare a 24” x 36” site map, using a USGS 1:24,000 series topographic map or a superior topographic map as the base, enlarged to at least 1”=300’ scale, that approximately depicts the “parent” property parcel as well as the surrounding 200–300’ perimeter of adjoining lands, and the location of the present or proposed trail. If necessary, use multiple 24” x 36” sheets. Also indicate the approximate property lines of all adjoining property parcels within that 200–300’ perimeter, and prepare a listing of their owners’ names and addresses, keyed to the map.
2. Transcribe to the site map, and prepare a map key of the applicable “Areas & Activities of Local and State Interest” (more commonly known as the “1041 Hazards”) from the following list (note in the map key those Hazards or Areas which are not applicable to the site):
  - Geologic Hazards
    - Soils
    - Avalanche Hazard
    - Debris Flows
    - Rockfall
  - Slopes
  - Wildfire Hazard
  - Wildlife Habitat
  - Floodplain
  - Scenic Overlay
  - Historic & Archaeological Resources
  - Areas Around Key Facilities
3. On the mapped trail alignment, note the locations of major structures such as bridges, underpasses, large cuts or fills, large retaining walls, trailheads, etc. Also (if known), locate any easements, utilities, or agricultural parcels that are in or adjoin the alignment.



## C. Trail Corridor Guidelines

Items in this part are keyed to Section 1 Part E:

1. Briefly describe the desirable and undesirable features of the proposed trail corridor. Explain what can be done to mitigate any undesirable features and why any undesirable features should be deemed acceptable. (See Section 1 Part E).
2. Does the proposed corridor use, preserve, or enhance a natural corridor or one with many desirable open space values? (See Section 1 Part E).
3. What present or future linkages or access would this trail create or preserve? If this is an urban or suburban trail, would it function as a part of an alternate transportation web? What factors will contribute to increased or decreased use of the trail?
4. Are any spur trails proposed that would increase access, and if so, where? Does the proposed trail create possibilities for loops and varied trips?
5. What are the potential impacts of the projected levels of trail use (both now and in the future) on adjoining private property owners, agricultural operations, public lands, and communities?
6. If the proposed alignment follows property lines, highway rights-of-way, utility corridors, or other man-made corridors, what are the positive and negative features of this alignment? In accordance with the guidelines in Section 1 Part F, describe how alignments, trailside improvements, and design solutions can improve the users' trail and open space experience in a less than optimal corridor.
7. If land has not already been obtained, is it or will it be possible to follow the corridor selection process as described in Section 1 Part G? If not, what corridor planning measures can be taken to ensure that the best possible corridor is obtained? (See Section 1 Part G).

## D. Existing Trail Conditions Audit

If this is an entirely new trail, the questions in this part can be skipped. Otherwise, respond to each of the following questions:

1. What are the present modes of trail use (whether authorized or not)?
2. What is the present intensity of trail use?
3. What, if any, are the safety concerns associated with present use?
4. Does this trail provide a linkage with existing trails, or provide access to public lands? Does this trail form a loop by itself or by linking other trails?
5. Is present trail use considered unauthorized trespass by the owner?
6. Is the present owner flexible about relocating the trail on the property?
7. What are the present impacts on adjoining property owners?
8. Describe the impacts of present trail use on the following features of this property:
  - Ecological/Wildlife
  - Cultural/Historical
  - Agricultural
  - Scenic

## E. General Trail and Corridor Design

Items in this part are keyed to Section 1 Part H:

1. What design features are planned that will help the trail achieve the “fit” and economy of design described in Section 1 Part H? Please include specifics on how the trail will achieve “fit”, respect and appreciation of land, freedom from design contradictions, simple but effective solutions, a sense of belonging on its site, and a fresh user experience each time.
2. Briefly describe some of the ways in which a “limited unpredictability” will be built into the trail (see Section 1 Part H). Also describe some design solutions by which “the master-planned feel” will be lessened without being inconsistent in design or adding contrived features or treatments.
3. What aspects of the trail will make it enjoyable and fun to use?



## F. Relationship Between Trail and Site

Items in this part are keyed to Section 1 Part I:

1. Is the site inherently interesting? If so, briefly describe why. If not, how can the trail still create the best experience from it, and would another alignment create a more interesting site?
2. Describe the sequence of ecosystems and environments the trail will pass through and how this will create an interesting experience for the user.
3. Will the trail follow landforms and traverse fall lines in such a way that the trail seems to belong there? If not, why? How will the trail be designed and constructed in an unobtrusive way such that the trail seems like it has always been there?
4. How will trail structures blend with the landscape?
5. Describe the site preservation and revegetation techniques that will be used to keep and maintain trailside vegetation.
6. What site features will be highlighted, and how will this be done?
7. What “1041” hazards are present and how will they be handled? (see list of “1041” hazards in Section 1 Part I).
8. Could the alignment disturb sensitive environments such as wetlands, migration routes, and critical wildlife habitat? Are there any endangered plants or animals which might be disturbed by the trail or its users? If so, how? If the trail could disturb these features, explain why this disturbance is acceptable. Could any problems identified above be resolved through mitigation measures on the present or applicant-proposed alignment? Also indicate any other possible alignments which could avoid the sensitive areas.
9. What are the impacts of the trail and trail corridor on adjacent landowners?
10. If the trail passes through an agricultural parcel, how might agricultural uses be impacted? How will any impacts be minimized or mitigated?
11. What are the possible impacts of adjacent landowners and agricultural operations on trail users and open space values?
12. If site repair is to be used in any part of the trail corridor, explain what will be done and how this will blend with the remainder of the site and trail.

13. Describe the width of the trail corridor and how the width changes to accommodate various features. Where the corridor is narrow, explain how the trail can fit in the corridor. Where on the map is the recommended final easement location?
14. Are there alternate alignments which could eliminate or mitigate any problems revealed elsewhere in this proposal? If so, describe how and map them, naming and keying the alternate alignments. If the alternate alignments create other problems, please discuss why the proposed alignment is the best option.

## G. Safety and Human Aspects

Items in this part are keyed to Section 1 Part J:

1. In what ways will safety be designed into the trail?
2. What are the widths of the trail and other design features for accommodating the expected number of users?
3. Are there any expected violations of County standards on curve radii, grades, sight lines, and other safety features? If so, can these situations be eliminated with another alignment? If not, how can unavoidable situations be made as safe as possible?
4. If the trail crosses any driveways, streets, roads, highways, or other trafficways, how will the crossing be handled? If the crossing is not grade-separated, can another alignment be found or created which is grade-separated (see Section 1 Part J).
5. How will the privacy of neighbors along the trail corridor be preserved?
6. If this trail is to be used in the winter, what features will be incorporated for winter use?



## H. Construction

Items in this part are keyed to Section 1 Part K:

1. Who will build the trail? Who should have maintenance responsibility for this project? (See Section 1 Part K).
2. Of the construction standards given in Sections 2 and 3 for your trail type (trailheads, signs, fencing, bridges, underpasses, intersections, retaining walls, railings, revegetation, site restoration, special features for particular user groups, drainage issues, and the like), list by name all that are applicable to this trail. For major, labor intensive, expensive, or unusual construction items, please give additional information which can be used as the basis for rough cost analysis—for example, give the number of and approximate lengths of bridges, approximate lengths and heights of retaining walls, trailhead requirements, etc. Please give as much detail as you can.
3. Given snow, snowmelt, wildlife zones, revegetation requirements, and other site conditions, during what months of the year could the trail be constructed?
4. Are any parts of the trail difficult to build because of a fragile or difficult site, access problems, low clearance, buried and overhead utilities, and the like? If so, how can these parts of the trail be built?
5. Will construction of the trail require a special short-term construction easement that is wider than the final trail easement? If so, what is the recommended construction easement location?
6. What features will give the trail the maximum lifespan as described in the guidelines for this trail type?

## I. Maintenance

Items in this part are keyed to Section 1 Part L:

1. Who should have maintenance responsibility for this project?
2. What aspects of the design give the trail minimum maintenance requirements?
3. Estimate the expected maintenance requirements for the trail at 4–6 months, 1 year, 5 years, and 20 years.
4. Will arrangements be made with the trail contractors, maintenance group, management group, and other involved groups for required formal design and maintenance reviews at 4–6 months and one year after completion?
5. What is the proposed schedule for maintenance inspections (see Section 1 Part L)

## J. Stewardship

Items in this part are keyed to Section 1 Part M:

1. Should the trail fall under County jurisdiction and enforcement of Open Space and Trails Rules? If so, should any special rules or exceptions apply to this trail? If not, who will have jurisdiction, and what rules will apply?
2. Describe the trail management plan which should be adopted. If there are any difficult management issues (issues which are likely to be a serious problem or an area of serious dispute), what are they and how might the issues be addressed?
3. Who should be accountable for implementation of the management plan? Are there potential partners, such as organized user groups, or other governmental agencies, who can assist in the management of this trail and, if so, in what ways?
4. If the trail passes through sensitive wildlife zones, will seasonal trail closure be necessary to protect wildlife? If so, how should this closure be handled?
5. How should this trail be promoted, if at all, and by whom?
6. Do all aspects of the proposed trail and trail corridor work within the Open Space and Trails Program General Objectives and Policies? If not, describe how it doesn't and why an exception should be made.

—Excerpted from *Trails Design and Management Handbook* (Parker 1994). Courtesy of the author. Used with permission of Pitkin County, CO, Open Space and Trails Program.



## Appendix E— Sample Evaluation Criteria for Trail Corridor Suitability Analysis

Weight	Attribute	Point range
1	<b>Local link</b> —Neighborhood park, equestrian center, neighborhood school, local open space corridor, neighborhood commercial center, and so forth 0 No, the trail does not link to local destinations. 1 Yes, the trail links indirectly to local destinations. 2 Yes, the trail links directly to local destinations or no other route exists.	0 to 2
1.5	<b>Regional link</b> —Regional park, regional trail, regional open space, major equestrian center, place of commerce or employment concentration, high school, community college, university, and so forth 0 No, the trail does not link to regional destinations. 1 Yes, the trail links indirectly to major regional destinations (links to other trail or trails that directly connect) or; yes, links directly to minor destination. 2 Yes, the trail links directly to major regional destination, such as a potential Signature Trail or; yes, the trail is a critical link in regional trail.	0 to 3
1	<b>Loop link</b> 0 The trail completes no loop. 1 The trail completes a portion of existing or potential loop. 2 The trail completes a portion of more than one existing or potential loops.	0 to 2
1	<b>Equestrian impact on adjacent land use</b> 0 Equestrian use of the corridor infringes on privacy of adjacent property. 1 Equestrian use of the corridor has a negligible impact on adjacent land use. 2 Equestrian use of the corridor complements the adjacent land use.	0 to 2

Weight	Attribute	Point range
1.5	<b>Adjacent land-use impact on equestrian experience</b> 0 Adjacent land use creates a negative experience to the equestrian corridor user. The corridor is defined by its adjacent negative or unsafe features to the equestrian user (loud noises, shooting range, golf driving range, model airplane area, unattractive site, railway corridors, and so forth). 1 Adjacent land use has some features negative to the equestrian user, but is not defined by it; or the corridor has primarily positive features but the corridor is not the experience in itself and is rather the means to accessing primary feature. 2 The corridor itself is defined by its positive equestrian features (scenic vistas, proximity to historic, cultural or natural sites, proximity to equestrian destinations, such as arenas and stables) and its lack of negative features.	0 to 3
1.5	<b>Most suitable trail type</b> 0 A paved pathway would better serve existing or potential use of corridor. 1 There is some or moderate existing or potential use or demand by equestrians. 2 There is heavy existing or potential use or demand by equestrians.	0 to 3
1.5	<b>Access/usability</b> 0 The trail corridor has few or minimal available access points and/or the corridor is convoluted and/or the corridor itself is confusing, or the corridor connection to other corridors is confusing. 1 The corridor has limited available access points and/or some confusing aspects. 2 The corridor has numerous available access points and/or flows easily along logical corridors.	0 to 3





Weight	Attribute	Point range
2	<p><b>Safety</b></p> <p>0 The corridor includes numerous hazards that create a sense of danger to horses and riders (overly-constricted corridor for shared-use and so forth).</p> <p>1 The corridor has existing or potential safety problems that could be mitigated with reasonable effort.</p> <p>2 The corridor is free of hazards and fosters a sense of safety and security.</p>	0 to 4
1.5	<p><b>Trail/traffic relationship</b></p> <p>0 There is significant existing or potential conflict resulting from trail proximity to high-speed traffic or forced at-grade crossing without a signal.</p> <p>1 There is some existing or potential conflict resulting from relative trail proximity to some traffic or at-grade crossing with signal or stop sign.</p> <p>2 There is minimal existing or potential conflict (comfortable set-back from street and connections through grade-separated crossings or low risk at-grade crossings).</p>	0 to 3
1.5	<p><b>Land availability</b></p> <p>0 The corridor is not currently or likely not available for use as equestrian corridor.</p> <p>1 The corridor is not currently secured for public use, but public use is possible.</p> <p>2 The corridor is currently under public control or is otherwise legally available for public access.</p>	0 to 3





## Appendix F—

# Summary of Accessibility Legislation, Standards, and Guidelines

## Some Laws Governing Accessibility in the United States

### Laws for Federal Agencies

A 1968 law—the Architectural Barriers Act (ABA)—requires that facilities built, bought, rented, or leased by or on behalf of a Federal agency must be accessible. A 1973 law—Section 504 of the Rehabilitation Act—requires provision of equal opportunity for individuals with disabilities to participate in all Federal or federally funded programs and activities. A 1990 law—the Americans with Disabilities Act (ADA)—does not apply to Federal agency programs and facilities, except for Title V Section 507, which pertains to federally designated wilderness areas.

The 1994 U.S. Department of Agriculture (USDA) regulation—7 CFR 15b and 15e—is the USDA’s implementation of Section 504. It specifies requirements for ensuring the accessibility of programs and activities conducted by or for USDA agencies. Other agencies have similar specific requirements. More information is available at:

- ABA—<http://www.access-board.gov/about/laws/ABA.htm>
- Section 504—<http://www.access-board.gov/enforcement/Rehab-Act-text/intro.htm>
- ADA Title V—<http://www.access-board.gov/about/laws/ADA.htm#TITLE%20V%20-%20MISCELLANEOUS%20PROVISIONS>
- CFR15b—[http://www.access.gpo.gov/nara/cfr/waisidx\\_03/7cfr15b\\_03.html](http://www.access.gpo.gov/nara/cfr/waisidx_03/7cfr15b_03.html)
- CFR15e—[http://www.access.gpo.gov/nara/cfr/waisidx\\_03/7cfr15e\\_03.html](http://www.access.gpo.gov/nara/cfr/waisidx_03/7cfr15e_03.html)

### Laws for the Private Sector and State and Local Governments

The Americans with Disabilities Act (ADA) prohibits discrimination based on disability in public accommodations, businesses open to the public, and commercial transportation in the private sector and in State and local government. This law includes requirements for accessible programs, new construction, renovation, transportation, and telecommunications, as well as reasonable accommodation for employment. The ADA is modeled on the 1968 Architectural Barriers Act and Section 504 of the Rehabilitation Act of 1973. Information about the ADA is available at <http://www.access-board.gov/about/laws/ADA.htm>.

### Guidelines and Standards Resulting From These Laws

The Architectural and Transportation Barriers Compliance Board (also known as the U.S. Access Board or Access Board) is responsible for establishing and maintaining guidelines to ensure that new or altered buildings and facilities covered by the ABA and ADA are accessible to people with disabilities. On July 23, 2004, the Access Board updated the ABA and ADA guidelines to make them more consistent and easier to understand.

The ADA guidelines are the basis for standards adopted by the Department of Justice (DOJ) and the Department of Transportation (DOT). The ABA guidelines are the basis for enforceable standards issued by four standard-setting Federal agencies—the Department of Defense (DOD), the General Services Administration (GSA), the Department of Housing and Urban Development (HUD), and the U.S. Postal Service (USPS). The USDA, including the Forest Service, follows standards set by the GSA.





On November 8, 2005, the GSA adopted portions of the ABA guidelines as the Architectural Barriers Act Accessibility Standard (ABAAS). For construction or alteration of federally-owned facilities addressed by the ABAAS, compliance depends on the date construction or alteration began.

If construction or alteration began after May 8, 2006, compliance with the ABAAS is required. If construction or alteration began on or before May 8, 2006, compliance with the Uniform Federal Accessibility Standards (UFAS) is required.

Information about the ADA and ABA guidelines is available at <http://www.access-board.gov/ada-aba>.

## Other Relevant Guidelines

The *Forest Service Outdoor Recreation Accessibility Guidelines* (FSORAG) provide guidance for campsites, tent pads and platforms, viewing overlooks, outdoor showers, picnic tables, fire rings and grills, and toilets as well as other facilities in the National Forest System. The *Forest Service Trail Accessibility Guidelines* (FSTAG) provide the specific information needed to maximize accessibility, while protecting the resource on newly constructed or altered pathways or trails that are designed for pedestrian or hiker use. The FSORAG and FSTAG provide guidance for maximizing accessibility while recognizing and protecting the unique characteristics of the natural setting and the resources. Information about the FSORAG and FSTAG is available at <http://www.fs.fed.us/recreation/programs/accessibility>.





## Appendix G— Sample Requirements for Weed-Free Feed (BLM)

### Weed-Free Hay Required on Utah Public Lands

The Bureau of Land Management announced that users of BLM administered land in Utah will be required to use only certified noxious weed-free hay, straw or mulch. Approved products for livestock feed on public lands include pellets, hay cubes, processed and certified hay available at some feed stores in Utah. As a reminder, the guideline for supplemental feeding livestock on BLM land in Utah states, “feeding of hay and other harvested forage (which does not refer to miscellaneous salt, protein, and other supplements) for the purpose of substituting for inadequate natural forage *will not be conducted* on BLM lands other than in (a) emergency situations where no other resource exists and animal survival is in jeopardy, or (b) situations where the Authorized Officer determines such a practice will assist in meeting a Standard or attaining a management objective.”

Noxious weeds are a serious problem in the Western United States and are rapidly spreading at an estimated rate of 14 percent each year. Species like Leafy Spurge, Squarrose Knapweed, Russian Knapweed, Musk Thistle, Dalmatian Toadflax, Purple Loosestrife, and many others are alien to the United States and have no natural enemies to keep the population in balance.

“Among other things, widespread infestations can lead to soil erosion and stream sedimentation.” Noxious weeds impact revegetation efforts by out-competing desirable species, they reduce wild and domestic grazing capacities, can occasionally irritate public land users by aggravating allergies, and certainly threaten our federally protected plants and animals.

Utah State Department of Agriculture has developed a crop field inspection and certification process which will allow participants to have their hay certified as noxious weed-free. Certification requirements will comply with the Utah Department of Agriculture. Producers can obtain bale identification tags from the Department.

Region Four, of the United States Forest Service, has required noxious weed-free hay, straw and mulch on Utah National Forests since January 1994.

Anyone who knowingly and willfully violates the noxious weed-free certification requirement on BLM and Forest lands may be subject to a fine of no more than \$1,000 or imprisonment of not more than 12 months, or both, as defined in *43 U.S. Code 1733(a)*.

—This document is available at  
[http://www.ut.blm.gov/stgeorge\\_fo/sgfoweed\\_free\\_hay.html](http://www.ut.blm.gov/stgeorge_fo/sgfoweed_free_hay.html).



# Appendix H— Sample Requirements for Weed-Free Feed (Forest Service)

## Special Order Occupancy and Use on National Forest System Lands in the State of Montana

Pursuant to the Regulations of the Secretary of Agriculture, Title 36 CFR 261.50 (a) and (b), the following acts are prohibited within all National Forest System lands within the State of Montana.

These restrictions are in addition to those enumerated in Subpart A, part 261, Title 36 of the Code of Federal Regulations and will remain in effect from October 6, 1997, until rescinded or revoked.

1. The possession or storage of hay, grain, straw, cubes, pelletized feed or mulch that is not certified as being noxious weed free or noxious weed seed free by an authorized State Department of Agriculture official or designated county official; each individual bale or container must be tagged or marked as weed free and reference the written certification (36 CFR 261.58 (t))

Pursuant to 36 CFR 261.50 (e), the following are exempt from this Order:

- A. Persons with a permit specifically authorizing the action or omission.
- B. Transporting feeds, straw, or hay on Federal, State, and county roads that are not Forest Development Roads or Trails.

The above restrictions are necessary to prevent the spread of noxious weeds on National Forest System lands (16 USC 551). Upon issuance of this order, all previous orders requiring the use of certified noxious weed free or noxious seed free forage on NFS lands in Montana shall be superseded.

Violation is punishable by a fine of up to \$5,000 and /or up to six months imprisonment (16 U.S.C. 551 and 18 U.S.C. 3571 (b) (6)).

(Signed) Kathleen A. McAllister 10-08-97  
for: Hal Salwasser  
Regional Forester  
Northern Region

—This document was supplied by the Lolo National Forest, Missoula, MT.



## Appendix I— Sample Equine Liability Act (New Mexico)

The Legislature of the State of New Mexico, 41st. Legislature, 1st. Session, Laws 1993, chapter 117: Senate Judiciary Committee Substitute for Senate Bill 268, as amended, introduced by Senator Virgil Rhodes.

AN ACT, RELATING TO TORT LIABILITY; ENACTING THE EQUINE LIABILITY ACT.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF NEW MEXICO:

Section 1. SHORT TITLE. This act may be cited as the “Equine Liability Act”.

Section 2. LEGISLATIVE PURPOSE AND FINDINGS. The legislature recognizes that persons who participate in or observe equine activities may incur injuries as a result of the numerous inherent risks involved in such activities. The legislature also finds that the state and its citizens derive numerous personal and economic benefits from such activities. It is the purpose of the legislature to encourage owners, trainers, operators and promoters to sponsor or engage in equine activities by providing that no person shall recover for injuries resulting from the risks related to the behavior of equine animals while engaged in any equine activities.

Section 3. DEFINITIONS. As used in the Equine Liability Act,  
A. “equine” means a horse, pony, mule, donkey or hinny;

“B. “equine activities” means:

1. equine shows, fairs, competitions, rodeos, gymkhana, performances or parades that involve any or all breeds of equines and any of the equine disciplines; 2. training or teaching activities; 3. boarding equines; 4. riding an equine belonging to another whether or not the owner has received some monetary consideration or other thing of equivalent value for the use of the equine or is permitting a prospective purchaser of the equine to ride, inspect or evaluate the equine; 5. rides, shows, clinics, trips, hunts or other equine occasions of any type, however informal or impromptu, connected with any equine or nonequine group or club; 6. equine racing;

C. “behavior of equine animals” means the propensity of an equine animal to kick, bite, shy, buck, stumble, bolt, rear, trample, be unpredictable or collide with other animals, objects or persons, and

D. “rider” means a person, whether amateur or professional, who is engaged in an equine activity.

Section 4. LIMITATION ON LIABILITY.

A. No person, corporation or partnership is liable for personal injuries to or for the death of a rider that may occur as a result of the behavior of equine animals while engaged in any equine activities.

B. No person, corporation or partnership shall make any claim against, maintain any action against or recover from a rider, operator, owner, trainer or promoter for injury, loss or damage resulting from equine behavior unless the acts or omissions of the rider, owner, operator, trainer or promoter constitute negligence.



C. Nothing in the Equine Liability Act shall be construed to prevent or limit the liability of the operator, owner, trainer or promoter of an equine activity who:

1. provided the equipment or tack, and knew or should have known that the equipment or tack was faulty and an injury was the proximate result of the faulty condition of the equipment or tack; 2. provided the equine and failed to make reasonable and prudent efforts to determine the ability of the rider to: a. engage safely in the equine activity; b. safely manage the particular equine based on the rider's representations of his ability; 3. owns, leases, rents or otherwise is in lawful possession and control of the land or facilities upon which a rider sustained injuries because of a dangerous condition that was known to the operator, owner, trainer or promoter of the equine activity; 4. committed an act or omission that constitutes conscious or reckless disregard for the safety of a rider and an injury was the proximate result of that act or omission; or 5. intentionally injures a rider.

Section 5. POSTING OF NOTICE. Operators, owners, trainers and promoters of equine activities or equine facilities, including but not limited to stables, club-houses, ponyride strings, fairs and arenas, and persons engaged in instructing or renting equine animals shall post clearly visible signs at one or more prominent locations that shall include a warning regarding the inherent risks of the equine activity and the limitations on liability of the operator, owner, trainer or promoter.

RELEASE STATEMENT – A release statement used by an operator, equine animal owner, property owner, trainer or promoter of equine activities should include the warning that there are inherent risks to participants and observers involved in all activities with equine animals due to the propensity of an equine animal to kick, bite, shy, buck, stumble, bolt, rear, trample, be unpredictable or collide with other animals, objects or persons. The statement should also include a warning that New Mexico state law provides that no person, corporation or partnership is liable for personal injuries to or for the death of a rider (or other participant) that may occur as a result of the behavior of equine animals while engaged in any equine activities, and that the rider (or other participant) agrees to engage in the equine activity at his own risk.

—This document is available at [http://www.nmhorsecouncil.org/NMHC\\_Liability.html](http://www.nmhorsecouncil.org/NMHC_Liability.html).



**Appendix J—**  
**S**ample Recreational Use  
Statute (Kentucky)

**Kentucky Recreational Use Statute**

KENTUCKY REVISED STATUTES ANNOTATED TITLE XXXVI:  
STATUTORY ACTIONS AND LIMITATIONS CHAPTER 411: RIGHTS OF  
ACTION AND SURVIVAL OF ACTIONS

**411.190. Obligations of owner to persons using land for recreation**

(1) As used in this section:

(a) “Land” means land, roads, water, watercourses, private ways and buildings, structures, and machinery or equipment when attached to the realty.

(b) “Owner” means the possessor of a fee interest, a tenant, lessee, occupant or person in control of the premises.

(c) “Recreational purpose” includes, but is not limited to, any of the following, or any combination thereof: hunting, fishing, swimming, boating, camping, picnicking, hiking, bicycling, horseback riding, pleasure driving, nature study, water skiing, winter sports, and viewing or enjoying historical, archaeological, scenic, or scientific sites.

(d) “Charge” means the admission price or fee asked in return for invitation or permission to enter or go upon the land but does not include fees for general use permits issued by a government agency for access to public lands if the permits are valid for a period of not less than (30) days.

(2) The purpose of this section is to encourage owners of land to make land and water areas available to the public for recreational purposes by limiting their liability toward persons entering thereon for such purposes.

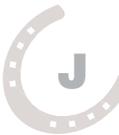
(3) Except as specifically recognized by or provided in subsection (6) of this section, an owner of land owes no duty of care to keep the premises safe for entry or use by others for recreational purposes, or to give any warning of a dangerous condition, use, structure, or activity on such premises to persons entering for such purposes.

(4) Except as specifically recognized by or provided in subsection (6) of this section, an owner of land who either directly or indirectly invites or permits without charge any person to use such property for recreational purposes does not thereby:

(a) Extend any assurance that the premises are safe for any purpose.

(b) Confer upon the person the legal status of an invitee or licensee to whom a duty of care is owed.

(c) Assume responsibility for or incur liability for any injury to person or property caused by an act or omission of those persons.





(5) Unless otherwise agreed in writing, the provisions of subsections (3) and (4) of this section shall be deemed applicable to the duties and liability of an owner of land leased to the state or any subdivision thereof for recreational purposes.

(6) Nothing in this section limits in any way any liability which otherwise exists:

(a) For willful or malicious failure to guard or warn against a dangerous condition, use, structure, or activity.

(b) For injury suffered in any case where the owner of land charges the person or persons who enter or go on the land for recreational use thereof, except that in the case of land leased to the state or a subdivision thereof, any consideration received by the owner for the lease shall not be deemed a charge within the meaning of this section.

(7) Nothing in this section shall be construed to:

(a) Create a duty of care or ground of liability for injury to persons or property.

(b) Relieve any person using the land of another for recreational purposes from any obligation which he may have in the absence of this section to exercise care in his use of the land and in his activities thereon, or from the legal consequences of failure to employ such care.

EFFECTIVE: July 14, 2000

HISTORY: Amended 2000 KY. Acts Ch. 338, Sec. 12, effective July 14, 2000.  
—Amended 1998 KY. Acts Ch. 275, Sec. 12, effective July 15, 1998. —Created 1966 Ky. Acts Ch. 252, Secs. 1 to 7.

*—This document is available at*  
[http://www.americanwhitewater.org/resources/repository/Kentucky\\_Recreational\\_Use\\_Statute.htm](http://www.americanwhitewater.org/resources/repository/Kentucky_Recreational_Use_Statute.htm).



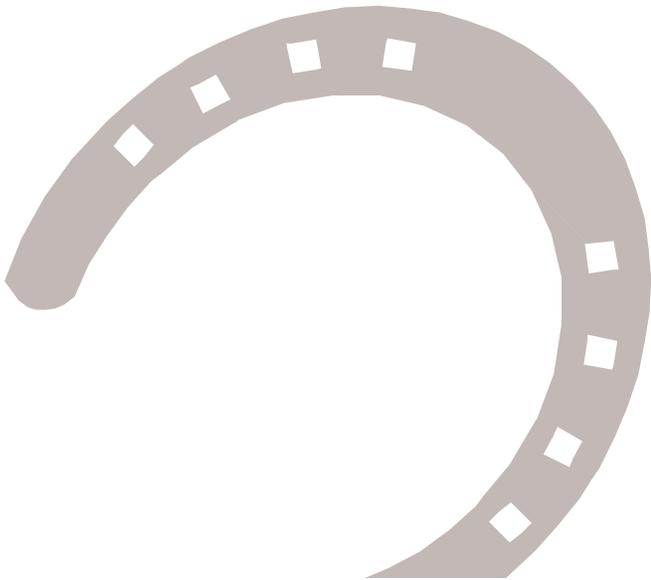
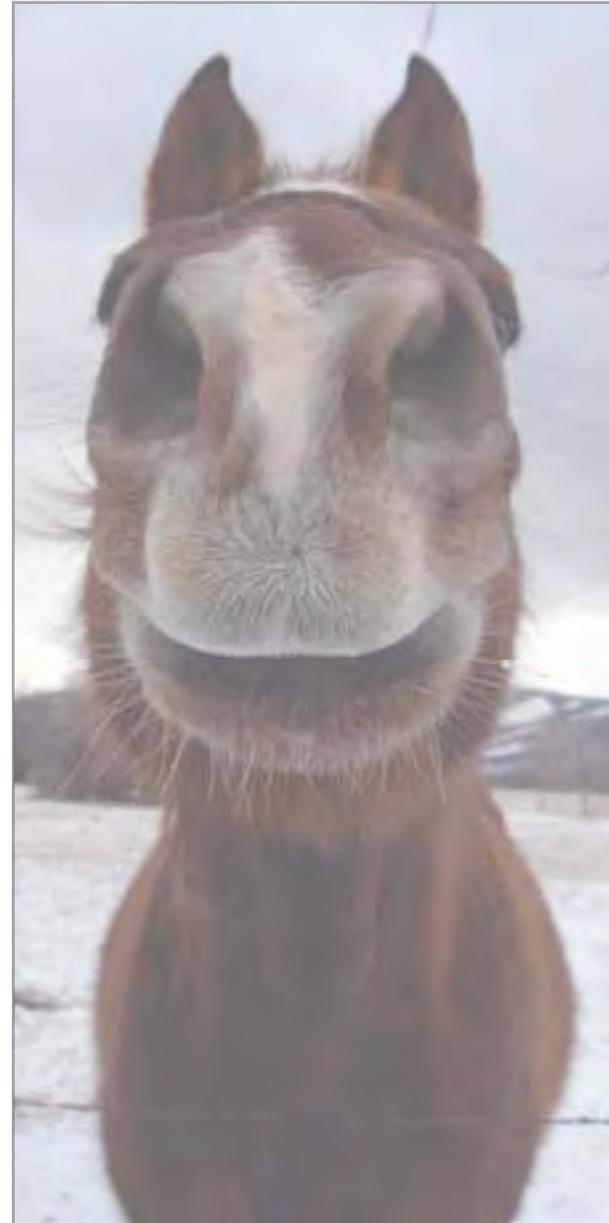


## Appendix K— English and Metric Conversions

	To convert from this unit	To this unit	Multiply by
From English to metric units	Inch	Millimeter	25.4*
	Inch	Centimeter	2.54*
	Foot	Meter	0.3048
	Square foot	Square meter	0.093
	Mile	Kilometer	1.6
	Square mile	Square kilometer	2.59
	Acre	Hectare (sq. hectometer)	0.405
	Pound	Kilogram	0.454
	Gallon	Liter	3.785
From metric to English units	Millimeter	Inch	0.039
	Centimeter	Foot	0.0328
	Kilometer	Mile	0.62
	Square kilometer	Square mile	0.386*
	Hectare	Acre	2.47
	Kilogram	Pound	2.202
	Liter	Gallon	0.264

\* These items are exact conversion factors for the units—the others give approximate conversions.







## About the Authors

### **Jan Hancock—Hancock Resources LLC**

Jan Hancock is an equestrian and author in private practice at Phoenix, AZ. She specializes in the design of equestrian trails, trailheads, and campgrounds, serving as a consultant for landscape architects, planners, land managers, and civil engineers. She has a bachelor's degree in education from Northern Arizona University and a master's degree in community education from Arizona State University. She has 12 years of experience as a college instructor in design and 15 years of management experience in marketing. Jan serves on numerous national, regional, State, and local boards for open space, parks, and trails organizations. She has served as the equestrian representative on the board of directors for American Trails. Jan is a member of the State of Arizona Governor's Council on Growing Smarter and the Phoenix Parks and Recreation board. She is a founding board member of the Arizona Trail Association, an organization developing the 800-mile Arizona Trail. Jan is the author of *Horse Trails in Arizona*. She credits her bay gelding, Partner, for always making the work of writing books about horses incredibly fun. Contact Jan at:

Hancock Resources LLC

805 North 4th Ave., Suite 703

Phoenix, AZ 85003

Daytime direct phone: 602-417-1216

Home office phone: 602-252-8387

Toll-free voice mail: 877-727-7117

Fax: 602-253-2789

E-mail: [HANCOCKJAN@aol.com](mailto:HANCOCKJAN@aol.com)

Web site: <http://www.HancockResources.com>

### **Kim Jones Vander Hoek, RLA—USDA Forest Service, Tonto National Forest**

Kim Jones Vander Hoek is a registered landscape architect. She has a bachelor's degree in landscape architecture from Iowa State University, 5 years of experience with engineering and landscape architectural firms, and 18 years of experience with the Forest Service. The American Society of Landscape Architects, Arizona Chapter, honored Kim for her accomplishments during her tenure as association president. She currently serves as the forest landscape architect for the Tonto National Forest in Phoenix, AZ, designing recreation sites, transportation corridors, and scenery management projects. She has designed 12 recreation sites, including 3 campgrounds and 2 trailheads for equestrians and the largest Forest Service campground built to date. Kim learned sensitivity to the needs of horses thanks to her charming Arabian gelding, Flask. Contact Kim at:

USDA Forest Service

Tonto National Forest

2324 McDowell Road

Phoenix, AZ 85006

Phone: 602-225-5236

Fax: 602-225-5295

E-mail: [kvanderhoek@fs.fed.us](mailto:kvanderhoek@fs.fed.us)



### **Sunni Bradshaw—USDA Forest Service, Missoula Technology and Development Center**

Sunni Bradshaw is a project assistant at Missoula Technology and Development Center. She is a graduate of the Rocky Mountain School of Photography and has a bachelor's degree in recreation program management from the University of Montana. While attending college, Sunni cofounded several regional recreation organizations, drafted a comprehensive trail management plan for a National Recreation Trail, wrote a preservation grant for an historic ghost town, and worked at numerous guest ranches and outfitting camps. She and her husband helped manage several guest ranches, farmed with draft horses, and owned Montana Horse Logging. Sunni and Emmy Lou, a winsome sorrel mule, traveled extensively through wilderness settings in the Rocky Mountains. Before joining the Missoula Technology and Development Center, Sunni was a technical writer, photographer, and award-winning journalist. Her work—including articles, photography, layout, and design—has appeared in many local, regional, and national publications. Contact Sunni at:

USDA Forest Service

Missoula Technology and Development Center

5785 Hwy. 10 West

Missoula, MT 59808

Phone: 406-829-6765

Fax: 406-829-6745

E-mail: [srbradshaw@fs.fed.us](mailto:srbradshaw@fs.fed.us)

### **James D. Coffman, RLA, ASLA—Coffman Studios, LLC**

Jim Coffman is a registered landscape architect in private practice in Phoenix, AZ. He has a bachelor's degree in business management and administration from Indiana University and a master's degree in landscape architecture from Ball State University. He has 19 years professional experience focused on open space, parks, and multimodal planning and design. Jim managed parks and trails planning for the cities of Scottsdale and Phoenix for 12 years. He was the project manager for design and implementation of master trail systems covering more than 600 miles. Jim is a regional and national presenter at open space, parks, and trails conferences; serves as a lecturer on pedestrian audits for people with physical challenges and on xeriscape principles; and has a special interest in designing natural environments for the elderly. He is the president of the Arizona Chapter of the American Society of Landscape Architects. Contact Jim at:

Coffman Studio, LLC

2126 S. La Rosa Drive

Tempe, AZ 85282

Cell phone: 602-790-8311

Phone: 480-966-3822

Fax: 480-966-3885

E-mail: [jim@coffmanstudio.com](mailto:jim@coffmanstudio.com)



## **Jeffrey Engelmann, RLA, ASLA—J2 Engineering and Environmental Design, LLC**

Jeff Engelmann is a registered landscape architect. He has a bachelor's degree in landscape architecture from Iowa State University and is cofounder and vice president of J2 Engineering and Environmental Design, a 25-person engineering and landscape architectural firm in Phoenix, AZ. He has 24 years of professional experience with an emphasis on major public park, open space, trail, and transportation projects in the West and Midwest, specializing in public recreational projects for State, county, and municipal agencies. These projects include recreation master plans, multimodal trail corridor planning, streetscapes, sports complexes, bridge design and esthetics, entry monuments, pedestrian/bicycle/equestrian trail design, revegetation projects, urban revitalization, and urban plaza projects. Contact Jeff at:

J2 Engineering & Environmental Design, LLC

4649 East Cotton Gin Loop, Suite B2

Phoenix, AZ 85040

Phone: 602-438-2221

Fax: 602-438-2225

E-mail: [jengelmann@j2design.us](mailto:jengelmann@j2design.us)

Web site: <http://www.j2design.us>





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# Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds





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