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FSH 2309.18 – TRAILS MANAGEMENT HANDBOOK

CHAPTER 20 – TRAIL DEVELOPMENT

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Posting Instructions: Amendments are numbered consecutively by handbook number and calendar year. Post by document; remove the entire document and replace it with this amendment. Retain this transmittal as the first page(s) of this document. The last amendment to this handbook was 2309.18-2016-1 to 2309.18_zero_code.

New Document	2309.18_20	48 Pages
Superseded Document(s) by Issuance Number and Effective Date	2309.18_20 (Amendment 2309.18-2008-4, 10/16/2008)	48 Pages

Digest:

20 - Incorporates new regulations to require designation of roads, trails, and areas on NFS lands to provide for over-snow vehicle (OSV) use. The direction is amended to require the Responsible Official to designate NFS roads, NFS trails, and areas on NFS lands where OSV use is allowed in administrative units or Ranger Districts, or parts of administrative units or Ranger Districts, where snowfall is adequate for OSV use to occur at Title 36, Code of Federal Regulations, part 212, Subpart C. Notice of final rule was published in the Federal Register on January 28, 2015 (80 FR 4500).

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20.2 - Objectives

1. Provide trails that meet their Trail Management Objectives (TMOs), are consistent with the applicable land management plan, provide opportunities for satisfying recreation experiences, harmonize with and provide opportunities for enjoyment of the National Forest or Grassland setting, and minimize maintenance costs.

2. Design, construct, and maintain sustainable trails, that is, trails that withstand the wear and tear of normal traffic and reasonable user behavior during the managed season of use and that have minimal negative effects on adjacent resources.

21 - PLANNING, PREPARATION, AND IMPLEMENTATION OF TRAIL PROJECTS

21.1 - Chart

The following chart displays the phases of planning, preparing, and implementing trail projects.

21 - Exhibit 01

PLANNING, PREPARATION, AND IMPLEMENTATION OF TRAIL PROJECTS

Phases[1]	Components	Average Lead Time (In Years)
1. Programing	Planning	5
	Design Elements Selection	
2. Reconnaissance	Preconstruction[1]	4
	Route Investigation	
	Placement of Preliminary Flag Lines	
	Environmental Analysis	
	Final Route Selection	
	Right-of-Way Acquisition (if needed)	
3. Location Survey	Survey[2]	2
	Placement of Preliminary Flag Lines	
	Trail Classification Data	
	Project Cost Estimate	
	Final Design	
4. Project or Contract Preparation	Drawings and Specifications	1
	Review of Plans	
5. Construction	Contract Award	0
	Contract Administration	

[1] These phases do not occur independently. The most notable overlap occurs in design. Design begins during the programming phase, is further refined during the reconnaissance and location survey phases, and is completed prior to development of drawings and specifications during project or contract preparation.

[2] The survey work should not start until the requisite environmental analysis has been completed.

21.2 - NFS Road to NFS Trail Conversions

The following process must be followed and documented in converting any unneeded NFS road to an NFS trail (36 CFR 212.5(b)(2)).

1. General Considerations. Before converting an NFS road to an NFS trail, carefully consider the positive and negative effects of conversion, including but not limited to effects on the unit's trail system, user preferences and demands, NFS resources, and availability of funds to perform work needed to convert the NFS roads to NFS trails and maintain the NFS trails. When multiple NFS roads are being considered for conversion, consider the routes individually, rather than collectively. If an NFS road is identified for potential conversion to an NFS trail during travel analysis, consult FSM 2353.28, 7715.5 and 7703.27. See FSM 7731.11 for further direction on traffic management strategies.

2. Criteria for NFS Road to NFS Trail Conversion. Based on a travel analysis report (FSM 7712), landscape scale analysis, or other analysis, as appropriate, a recommendation should be made to the responsible official regarding whether a particular NFS road should be converted to an NFS trail. To support a recommendation for conversion, the following three criteria should be met:

a. The converted route would meet its Trail Management Objectives (TMOs) and provide the desired recreation experience;

b. Adequate funding would be available to cover the work to convert and maintain the route; and

c. The environmental effects and mitigations of the converted route would be acceptable to the Responsible Official and would meet applicable requirements, including 36 CFR 212.55.

3. Application of Conversion Criteria. To determine whether these criteria are met, the following steps should be followed:

a. During the travel analysis process (FSM 7712) actively engage trails managers.

b. Develop draft TMOs for the potential trail so that it is clear how it would be managed (FSM 2353.12 and 2353.13; FSH 2309.18, sec. 14).

c. Describe the recreation experience to be offered by the potential trail based on the following considerations:

(1) Whether the conversion would be consistent with the standards and guidelines in the applicable land management plan; and

(2) Whether the conversion would provide quality recreation opportunities, such as enhancing trail connectivity, creating trail loops, or otherwise improving the quality of trail opportunities.

d. Identify the work needed for route conversion and maintenance and the short-term and long-term costs of conversion. The characteristics of the NFS road to be converted are an important factor. For example, the cost of converting and maintaining a two-track NFS road across flat terrain would likely be substantially less than the cost of converting and maintaining a full-bench NFS road with large fills and culverts.

4. Implementation of NFS Road to NFS Trail Conversions. After a decision has been made to convert an NFS road to an NFS trail:

a. Carefully review or revise trail-specific design parameters to accommodate the Managed Uses and the Designed Use for the potential NFS trail. Adjustments may be needed in the design tread width and grade, clearing limits, turning radii, and other factors. For example, a trail prescription may identify narrowing of the tread width and clearing limit to meet the intended Design Parameters and provide the desired trail experience. These types of adjustments may occur naturally over time or may be designed and implemented through on-site field work. See FSH 2309.18, section 23, for Design Parameters for motorcycles, all-terrain vehicles, and four-wheel-drive vehicles.

b. Consider minor or major realignment of trail segments as needed to provide the desired trail experience.

c. Assess existing and needed route structures, including drainage and crossing structures. This assessment may include consideration of opportunities to modify existing structures or to construct new structures that are more appropriate for trail vehicles.

d. Assess existing signs, and make appropriate adjustments before the route is managed as a trail.

e. Follow the environmental analysis process in Forest Service regulations and directives (36 CFR Part 220; FSH 1909.15).

f. Identify the funding source and its availability to cover the costs associated with the work required to convert the NFS road to an NFS trail and maintain the NFS trail.

22 - GENERAL DESIGN CONSIDERATIONS

The following direction applies to the reconnaissance phase of project-level trail planning.

22.1 - Trail Management Objectives (TMOs)

Incorporate applicable TMOs in the design and development of each National Forest System (NFS) trail (FSM 2353.12).

22.2 - Recreation Opportunity Spectrum

1. The Recreation Opportunity Spectrum (ROS) identifies experience levels and management prescriptions to provide a diversity of recreation experiences.

2. Trail development and uses must reflect trail direction in the applicable land management plan, including the ROS classes identified in the plan (FSM 2311.1).

22.3 - Trail Class and Level of Challenge

1. Trail Classes generally reflect the level of recreational challenge provided by a trail, including the corresponding level of user skill and experience needed to negotiate the trail. For example, a trail in Trail Class 2 normally is constructed and maintained to a lower standard than a trail in Trail Class 4. Therefore, a trail in Trail Class 2 is usually more challenging and generally requires more user skill and experience than a trail in Trail Class 4 to traverse.

2. The degree of challenge presented by a trail depends on a combination of trail characteristics, including trail grade, alignment, clearing width, tread conditions, gain or loss of elevation, and other criteria outlined in the Design Parameters (sec. 23.1, ex. 01, through 23.3, ex. 01).

22.4 - Trailheads

22.41 - Trailhead Location

1. Where appropriate, situate trailheads so as to allow access to the greatest number and diversity of trails. Depending on the circumstances, the greatest diversity of trails may include trails with the same Managed Use or with multiple Managed Uses, depending on the combination of uses, relative use levels, and potential for use conflicts. Match the development scale and size of the trailhead facility to the carrying capacity of the area and to the Trail Classes of the trails to be served.

2. In locating trailheads, consider snow use as well as non-snow use where appropriate, along with opportunities for using existing facilities. Other pertinent considerations include the ability to provide pull-through parking for vehicles with trailers and space for unloading trailers and stock trucks and safety of unattended vehicles.

3. Use visual resource management principles to minimize the visual impacts of the trailhead on trail users (see FSM 2380 and Landscape Aesthetics: A Handbook for Scenery Management, USDA Agriculture Handbook 701).

4. All constructed features must comply with the applicable technical provisions of the Architectural Barriers Act Accessibility Standards (ABAAS) or the Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG). The routes connecting constructed features at trailheads must comply with the technical provisions for outdoor recreation access routes in the FSORAG. The FSORAG is available electronically at *http://www.fs.fed.us/recreation/programs/accessibility*.

22.42 - Trailhead Parking

1. When space is available, consider separate parking facilities for certain uses, such as horseback riding and hiking. Provide separate facilities within walking distance of areas of concentrated public use, such as campgrounds. Locate the trailhead next to a trail so that non-highway-legal vehicles are not forced to travel on roads that may be used only by highway-legal vehicles.

2. When 5 or more designated parking spaces are provided at a trailhead, they must comply with the technical provisions in ABAAS for accessible parking spaces.

22.43 - Pack and Saddle Trailheads

1. The trailhead needs of pack and saddle animal users vary with the type of vehicles used for transportation, the number of animals being handled, and the length of stay at the trailhead.

2. Many animals are transported in trailers or trucks equipped with portable ramps. Therefore, unloading ramps are not needed at every trailhead. As an alternative, consider designing an earthen bank for unloading.

3. Trailheads used primarily for day trips require less development than those used for overnight trips.

4. Trailheads with a full range of facilities, such as a loading ramp, a corral, a water source, hitching racks, and feed bunks, may be justified if the objective is to have users bring pack and saddle animals out of the backcountry for the night. Fully developed trailheads may be especially desirable in areas with scarce forage or fragile soils. Provide toilets and fire rings where needed.

5. Corrals are expensive to construct and maintain and should be considered only when animals need to be held for more than one or two nights. Many owners are reluctant to place their animals in a corral with other animals with which they are not familiar.

6. A watering source for livestock is an important consideration. A trail to a nearby stream may suffice, but for heavy-use sites, consider piping in water to a watering tank.

22.44 - Snow Removal at Trailheads

Coordinate plowing at trailheads with the local public road authority. If rotary plows will be used, pave the surface of the road or parking lot. The size of the plowed parking area will provide an upper limit for trail use. Consider the following when providing winter parking at trailheads:

1. Snow Removal.

   a. Adequate surface for snowplowed lots.

   b. Adequate slope for drainage and operation of appropriate equipment.

   c. Proximity to buildings and surface obstructions.

2. Size and Shape of Parking Lot.

   a. Design that allows for efficient snow removal and use. A compromise between the visual resource and efficiency of snow removal may be necessary.

   b. Maneuverability of necessary equipment.

3. Adequate Snow Storage.

   a. Sufficient room for snow storage to prevent removal of the same snow multiple times.

   b. Protection of adjacent vegetation from mechanical or chemical damage incidental to snow clearing.

4. Access Road.

   a. Adequate width.

   b. Availability of proper storage for snow removed from the road.

   c. Situated at a reasonable distance from major access points.

   d. Minimal curvature.

   e. Grade of less than 3 percent.

   f. Adequate visibility at parking area or access road entrances.

22.45 - Application of Forest Service Trail Accessibility Guidelines (FSTAG) at Trailheads

Ensure that all new or altered trails with a Designed Use of Hiker/Pedestrian that connect directly to a trailhead or to a currently accessible trail comply with the FSTAG. The FSTAG is available electronically at *http://www.fs.fed.us/recreation/programs/accessibility*.

22.5 - Facilities and Associated Constructed Features Along Trails

1. Facilities and associated constructed features along trails include shelters, toilets, and other structures that provide support for trail users. These facilities and associated constructed features must comply with the FSORAG under the Forest Service's universal design policy.

2. Facilities and associated constructed features along trails must be designed appropriately for the setting and in compliance with the FSORAG to ensure that the facilities can be used for their primary purpose by all hikers, including hikers with disabilities. See the FSORAG for specific technical provisions. This requirement applies but is not limited to:

   a. Pit Toilets With No Walls. The total height of the toilet seat and the riser it sits on must be 17 to 19 inches above the ground or floor. A clear floor or ground space complying with section 6.6.6 of the FSORAG must be provided adjacent to the riser. Since walls are not provided, grab bars are not required.

   b. Trail Shelters or Lean-Tos With Three Walls. Where the constructed finished floor elevation is above the ground, a shelter or lean-to must be located so that at least one section of the floor on the open side of the shelter or lean-to is 17 to 19 inches above ground to facilitate transfer from a wheelchair.

22.6 - Wilderness Considerations

1. The applicable land management plan establishes specific objectives for wilderness management, including appropriate levels and types of use. Plan and manage the trail system serving a wilderness area in accordance with these objectives (FSM 2323).

2. The criteria for locating, constructing, and maintaining trails in a wilderness area are based on the management objectives outlined in the applicable wilderness plan. At a minimum, locate, construct, and maintain trails in a wilderness area so as to achieve the following goals:

   a. To give the appearance of being a part of the wilderness area, rather than an intrusion upon it.

   b. To meet and maintain the levels of acceptable use established for specific locations in the wilderness area.

   c. To meet the setting requirements for the Recreation Opportunity Spectrum (ROS) class established for specific locations in the wilderness area.

   d. To meet the scenic integrity objectives established for specific locations in the wilderness area.

   e. To protect the safety of users consistent with the normal degree of difficulty they would likely encounter during the primary season of public use.

   f. To protect and perpetuate the wilderness character of the area.

   g. To construct and maintain trails with non-motorized equipment.

   h. To provide trail treads that do not exceed 24 inches in width.

23 - DESIGN PARAMETERS

Identify Design Parameters for each NFS trail or trail segment based on the guidance in section 14.5 and the corresponding set of Design Parameters in sections 23.1 through 23.3.

The following sets of Design Parameters are included as exhibits in sections 23.1 through 23.3:

1. Section 23.1 - Standard Terra Trails: Non-Motorized.

   a. Hiker/Pedestrian.

b. Pack and Saddle.

c. Bicycle.

2. Section 23.2 - Standard Terra Trails: Motorized.

   a. Motorcycle.

   b. All-Terrain Vehicle (ATV).

   c. Four-Wheel Drive Vehicle Greater Than 50 Inches in Width.

3. Section 23.3 - Snow Trails.

   a. Cross-Country Ski.

   b. Snowshoe.

   c. Snowmobile.

4. Section 23.4 - Water Trails [Reserved].

Besides the Designed Uses included in the Design Parameters, there are a variety of other Managed Uses, such as dog sledding. Regional sets of Design Parameters may be developed for these Managed Uses, if needed. If these Managed Uses become common, a national set of Design Parameters may be developed for those uses.

For definitions of the design attributes in each set of Design Parameters (including Design Tread Width, Design Surface, Design Grade, Design Cross Slope, Design Clearing, and Design Turns), refer to section 05.

23.1 - Standard Terra Trails - Non-Motorized

23.11 - Hiker/Pedestrian Design Parameters

The next page displays the Hiker/Pedestrian Design Parameters, followed by considerations regarding their application.

23.11 - Exhibit 01

HIKER/PEDESTRIAN DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use HIKER/PEDESTRIAN		**Trail Class 1**	**Trail Class 2**	**Trail Class 3** [2]	**Trail Class 4** [2]	**Trail Class 5** [2]
Design Tread Width	**Wilderness** (Single Lane)	0” – 12”	6” – 18”	12” – 24” Exception: may be 36” – 48” at steep side slopes	18” – 24” Exception: may be 36” – 48” at steep side slopes	Not applicable
	Non-Wilderness (Single Lane)	0” – 12”	6” – 18”	18” – 36”	24” – 60”	36” – 72”
	Non-Wilderness (Double Lane)	36”	36”	36” – 60”	48” – 72”	72” – 120”
	Structures (Minimum Width)	18”	18”	18”	36”	36”
Design Surface[3]	**Type**	Native, ungraded May be continuously rough	Native, limited grading May be continuously rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native with improved sections of borrow or imported material, and routine grading Minor roughness	Likely imported material, and routine grading Uniform, firm, and stable
	Protrusions	≤ 24” Likely common and continuous	≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3 ” Uncommon, not continuous	No protrusions
	Obstacles (Maximum Height)	24”	14”	10”	8”	No obstacles

23.11 – Exhibit 01--Continued

Designed Use HIKER/PEDESTRIAN		Trail Class 1	Trail Class 2	Trail Class 3 [2]	Trail Class 4 [2]	Trail Class 5 [2]
Design Grade [3]	**Target Grade**	5% – 25%	5% – 18%	3% – 12%	2% – 10%	2% – 5%
	Short Pitch Maximum	40%	35%	25%	15%	5% FSTAG: 5% – 12%[2]
	Maximum Pitch Density	20% – 40% of trail	20% – 30% of trail	10% – 20% of trail	5% – 20% of trail	0% – 5% of trail
Design Cross Slope	**Target Cross Slope**	Natural side slope	5% – 20%	5% – 10%	3% – 7%	2% – 3% (or crowned)
	Maximum Cross Slope	Natural side slope	25%	15%	10%	3%
Design Clearing	**Height**	6’	6’ – 7’	7’ – 8’	8’ – 10’	8’ – 10’
	Width	≥ 24” Some vegetation may encroach into clearing area	24” – 48” Some light vegetation may encroach into clearing area	36” – 60”	48” – 72”	60” – 72”
	Shoulder Clearance	3” – 6”	6” – 12”	12” – 18”	12” – 18”	12” – 24”
Design Turn	**Radius**	No minimum	2’ – 3’	3’ – 6’	4’ – 8’	6’ – 8’

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] Trail Classes 3, 4, and 5, in particular, have the potential to be accessible. If assessing or designing trails for accessibility, refer to the Forest Service Trail Accessibility Guidelines (FSTAG) for more specific technical provisions and tolerances (FSM 2350).

[3] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Hiker/Pedestrian Design Parameters:

1. Trails with a Designed Use of Hiker/Pedestrian generally require less development than trails with another Designed Use, thereby offering the greatest opportunity to bring users close to nature. Tread width, clearing width and height, alignment, and structures for crossing streams normally are at a smaller scale.

2. On trails with a Designed Use of Hiker/Pedestrian, grades leading to and from switchbacks should not be less than 10 percent. Within the turn, reduce the grade to less than 10 percent for a distance of 5 or 6 feet. When needed, reduce or eliminate creation of switchbacks by trail users by installing rocks, logs, native vegetation, or other material.

3. When trails with a Designed Use of Hiker/Pedestrian cross wet areas or streams, select routes that require the fewest structures. When designing structures to cross wet areas, follow the guidance in the Design Parameters regarding the minimum tread width for trail structures. Stepping stones generally should be at least 12 to 18 inches wide, depending on the Trail Class of the trail and its management intent, and should be set no more than 24 inches apart.

4. Design bridges on trails with a Designed Use of Hiker/Pedestrian to prevent overloading, especially if they are located in areas used by pack and saddle stock.

5. The maximum grade for trails in Trail Class 1 with a Designed Use of Hiker/Pedestrian matches the grade for trails in the lowest class of mountaineering routes. However, mountaineering routes, which require the use of unconstructed hand and toe holes or ropes, are not covered by the Hiker/Pedestrian Design Parameters.

23.12 - Pack and Saddle Design Parameters

The next page displays the Pack and Saddle Design Parameters, followed by considerations regarding their application.

23.12 - Exhibit 01

PACK AND SADDLE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use **PACK AND SADDLE**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Wilderness** (Single Lane)	Typically not designed or actively managed for equestrians, although use may be allowed	12” – 18” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	18” – 24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	Typically not designed or actively managed for equestrians, although use may be allowed
	Non-Wilderness (Single Lane)		12” – 24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	18” – 48” 48” – 60” or greater along precipices	24” – 96” 48” – 60” or greater along precipices	
	Non-Wilderness (Double Lane)		60”	60” – 84”	84” – 120”	
	Structures (Minimum Width)		Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	
Design Surface[2]	**Type**		Native, with limited grading May be frequently rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native, with improved sections of borrow or imported material and routine grading Minor roughness	

23.12 – Exhibit 01--Continued

Designed Use PACK AND SADDLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Surface (continued)	**Protrusions**		≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3” Uncommon, not continuous	
	Obstacles (Maximum Height)		12”	6”	3”	
Design Grade [2]	**Target Grade**		5% – 20%	3% – 12%	2% – 10%	
	Short Pitch Maximum		30%	20%	15%	
	Maximum Pitch Density		15% – 20% of trail	5% – 15% of trail	5% – 10% of trail	
Design Cross Slope	**Target Cross Slope**		5% – 10%	3% – 5%	0% – 5%	
	Maximum Cross Slope		10%	8%	5%	
Design Clearing	**Height**		8’ – 10’	10’	10’ – 12’	
	Width		72” Some light vegetation may encroach into clearing area	72” – 96”	96”	
	Shoulder Clearance		6” – 12” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	
Design Turn	**Radius**		4’ – 5’	5’ – 8’	6’ – 10’	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Pack and Saddle Design Parameters:

1. Trails with a Designed Use of Pack and Saddle are designed and maintained to accommodate a wide variety of pack and saddle animals, including horses, mules, donkeys, and burros. Some of these trails are simple day-use bridle paths, and others are built to accommodate long strings of pack animals on journeys lasting many days. The combination of shorter and longer trails affords opportunities for natural experiences with the greatest range in user ability and knowledge.

2. When locating trails with a Designed Use of Pack and Saddle, give special consideration to the care and safety of livestock and riders. If practical, provide reasonable access to streams or lakes for stock watering at intervals of no more than 10 miles. To the extent practicable, notify equestrians if intervals between water sources are excessive. Avoid locations near campgrounds or other areas of concentrated use, where dogs or loud noises could startle pack and saddle animals. If the trail must cross highways or railroads, select sites with adequate visibility at the crossing point.

3. Consider the use of climbing turns if the terrain permits, incorporating a curve radius of 4 feet or greater, depending on the Trail Class and site-specific conditions. Design switchbacks with a curve radius as long as possible and a radius of 5 feet or greater, depending on the Trail Class and site-specific conditions. To discourage shortcutting between switchbacks by trail users, design grades of at least 10 to 15 percent for a distance of 100 feet leading to and from switchbacks. Consider using a rock or log barrier for a distance of 15 to 30 feet from the turning point.

4. Clearing needs for trails with a Designed Use of Pack and Saddle may vary depending on whether the trails are designed for day rides or pack animals.

5. Additional widening is needed to accommodate pack clearance on trails cut through solid rock on steep side hills. Along a precipice or other hazardous area, the trail base should be at least 48 to 60 inches wide to be safe for both animals and riders.

6. Pack and saddle animals can cause severe wear and tear on trail tread, especially when soils are wet. When possible, locate trails on stable soil types or on side slopes, where water is drained away. Gravel surfacing, turnpike, or puncheons may be needed on wet sections.

7. Fords are preferred over bridges for stream crossings, provided the velocity and depth of the water are acceptable for fording during the normal season of use. Generally, streams can be forded safely if they are less than 24 inches deep and the current is moderate. Where feasible, route trails to natural fords, rather than building fords.

8. Construction of a ford requires widening the trail base to at least 36 inches, removing large rocks, and flattening the stream bottom to make a relatively smooth and level crossing. If necessary to make the ford viable, widen the streambed to reduce depth and velocity. Ice buildup during late fall may be an important factor to consider in determining whether to construct a ford.

9. If a decision is made to build a bridge for pack and saddle animals, select a site with an adequate foundation for abutments and stream piers. The bridge must have a load-carrying capacity equal to the weight of the maximum number of loaded animals that can occupy the bridge at one time or the maximum anticipated snow load, whichever is greater. Design railings to prevent packs from getting caught. For minimum bridge widths and railing heights, see FSH 7709.56b, section 7.69, exhibit 01, Trail Bridge Design Criteria.

23.13 - Bicycle Design Parameters

The next page displays the Bicycle Design Parameters.

23.13 – Exhibit 01

BICYCLE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use **BICYCLE**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	6” – 12”	12” – 24”	18” – 36”	24” – 48”	36” – 60”
	Double Lane	36” – 48”	36” – 48”	36” – 48”	48” – 84”	72” – 120”
	Structures (Minimum Width)	18”	18”	36”	48”	60”
Design Surface[2]	**Type**	Native, ungraded May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present, but not common	Native, with improved sections of borrow or imported materials and routine grading Stable, with minor roughness	Likely imported material and routine grading Uniform, firm, and stable
	Protrusions	≤ 24” Likely common and continuous	≤ 6” May be common and continuous	≤ 3” May be common, but not continuous	≤ 3” Uncommon and not continuous	No protrusions
	Obstacles (Maximum Height)	24”	12”	10”	8”	No obstacles

23.13 – Exhibit 01--Continued

Designed Use BICYCLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade [2]	**Target Grade**	5% – 20%	5% – 12%	3% – 10%	2% – 8%	2% – 5%
	Short Pitch Maximum	30% 50% on downhill segments only	25% 35% on downhill segments only	15%	10%	8%
	Maximum Pitch Density	20% – 30% of trail	10% – 30% of trail	10% – 20% of trail	5% – 10% of trail	0% – 5% of trail
Design Cross Slope	**Target Cross Slope**	5% – 10%	5% – 8%	3% – 8%	3% – 5%	2% – 3%
	Maximum Cross Slope	10%	10%	8%	5%	5%
Design Clearing	**Height**	6’	6’ – 8’	8’	8’ - 9’	8’ - 9’
	Width	24” – 36” Some vegetation may encroach into clearing area	36” – 48” Some light vegetation may encroach into clearing area	60” – 72”	72” – 96”	72” – 96”
	Shoulder Clearance	0’ – 12”	6” – 12”	6” – 12”	6” – 18”	12” – 18”
Design Turn	**Radius**	2’ – 3’	3’ – 6’	4’ – 8’	8’ – 10’	8’ - 12’

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Bicycle Design Parameters may be developed as determined necessary.

23.2 - Standard Terra Trails - Motorized

23.21 - Motorcycle Design Parameters

The next page displays the Motorcycle Design Parameters, followed by considerations regarding their application.

23.21 – Exhibit 01

MOTORCYCLE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use MOTORCYCLE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for motorcycles, although use may be allowed	8" – 24"	18" – 36"	24" – 48"	Typically not designed or actively managed for motorcycles, although use may be allowed
	Double Lane		48"	48 " – 60"	60" – 72"	
	Structures (Minimum Width)		36"	48"	48"	
Design Surface[2]	**Type**		Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present	Native, with imported materials for tread stabilization likely and routine grading Minor roughness Sections of soft tread not common	
	Protrusions		≤ 6" May be common and continuous	≤ 3" May be common, but not continuous	≤ 3" Uncommon and not continuous	
	Obstacles (Maximum Height)		18" May be common or placed for increased challenge	12" Common and left for increased challenge	3" Uncommon	

23.21 – Exhibit 01--Continued

Designed Use MOTORCYCLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade [2]	**Target Grade**		10% – 25%	5% – 20%	3% – 10%	
	Short Pitch Maximum		40%	25%	15%	
	Maximum Pitch Density		20% – 40% of trail	15% – 30% of trail	10% – 20% of trail	
Design Cross Slope	**Target Cross Slope**		5% – 10%	5% – 8%	3% – 5%	
	Maximum Cross Slope		15%	10%	10%	
Design Clearing	**Height**		6’ – 7’	6’ - 8’	8’ - 10’	
	Width (On steep side hills, increase clearing on uphill side by 6” – 12”)		36” – 48” Some light vegetation may encroach into clearing area	48” – 60”	60” - 72”	
	Shoulder Clearance		6” – 12”	12” – 18”	12” – 24”	
Design Turn	**Radius**		3’ – 4’	4’ – 6’	5’ – 8’	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grades, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall trail sustainability.

Application considerations for Motorcycle Design Parameters:

1. NFS trails that allow motorcycle use must be designated for that vehicle class pursuant to 36 CFR 212.51 and displayed on a motor vehicle use map (FSM 7703.1).

2. For NFS trails that have been designated for motorcycle use and that have a Designed Use of Motorcycle, apply the Motorcycle Design Parameters and the following guidance.

a. A variety of distances and recreation experiences may be provided by designing cutoffs for less experienced riders within a system of loop trails. An experienced rider can ride approximately 50 miles in an average day. Some riders can cover over 100 miles in a day.

b. Trail alignment should exhibit decreasing randomness between Trail Class 2 and Trail Class 4.

c. Favor drainage dips over water bars.

d. On trails in Trail Class 4, the alignment is generally moderate, with no sharp curves combined with steep grades. Novice riders may be subjected to sharp curves, but generally not in combination with rough surfaces or steep grades (see sec. 23.21, ex. 01).

e. Favor climbing turns over switchbacks, within the applicable Design Parameter grade tolerances, as deemed appropriate, considering the use and direction of travel. Modify the level of challenge of a curve by increasing or decreasing its turning radius.

f. For trails in Trail Class 4, locate turns on level ground or on slopes of less than 6 percent. On trails designed for novice and intermediate riders, consider providing a 4-to-6-foot barrier on the downhill side of a switchback.

g. The speed of a motorcycle entering a turn varies depending on the radius of the turn. A trail designer can slow the speed of a motorcycle entering a turn by decreasing its turning radius. A trail designer may increase the length of a trail in a limited area by increasing the number of turns.

h. Hardening of switchbacks and climbing turns in sensitive soils is recommended. Suggested hardening materials include concrete blocks, soil, and cement.

i. For minimum bridge widths and railing heights, refer to FSH 7709.56b, section 7.69, exhibit 01, Trail Bridge Design Criteria. Bridges should have a straight approach and should not change directions. Special decking may be necessary to accommodate wheeled vehicles.

j. To minimize confusion, consider locating trail junctions so that no more than two trails intersect at one point.

23.22 - All-Terrain Vehicle (ATV) Design Parameters

The next page displays the All-Terrain Vehicle (ATV) Design Parameters, followed by considerations regarding their application.

23.22 – Exhibit 01

ALL-TERRAIN VEHICLE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use **ALL-TERRAIN VEHICLE**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for ATVs, although use may be allowed	48” – 60”	60”	60” – 72”	Typically not designed or actively managed for ATVs, although use may be allowed
	Double Lane		96”	96” – 108”	96” – 120”	
	Structures (Minimum Width)		60”	60”	60”	
Design Surface[2]	**Type**		Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present	Native, with imported materials for tread stabilization likely and routine grading Minor roughness Sections of soft tread uncommon	
	Protrusions		≤ 6” May be common and continuous	≤ 3” May be common, but not continuous	≤ 3” Uncommon and not continuous	
	Obstacles (Maximum Height)		12” May be common or placed for increased challenge	6” May be common and left for increased challenge	3” Uncommon	

23.22 – Exhibit 01--Continued

Designed Use ALL-TERRAIN VEHICLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade [2]	**Target Grade**		10% – 25%	5% – 15%	3% – 10%	
	Short Pitch Maximum		35%	25%	15%	
	Maximum Pitch Density		20% – 40% of trail	15% – 30% of trail	10% – 20% of trail	
Design Cross Slope	**Target Cross Slope**		5% – 10%	3% – 8%	3% – 5%	
	Maximum Cross Slope		15%	10%	8%	
Design Clearing	**Height**		6’ – 7’	6’ – 8’	8’ – 10’	
	Width (On steep side hills, increase clearing on uphill side by 6” – 12”)		60” Some light vegetation may encroach into clearing area	60” – 72”	72” - 96”	
	Shoulder Clearance		0” – 6”	6” – 12”	12” – 18”	
Design Turn	**Radius**		6’ – 8’	8’ – 10’	8’ – 12’	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for All-Terrain Vehicle Design Parameters:

1. NFS trails that allow ATV use must be designated for that vehicle class pursuant to 36 CFR 212.51 and displayed on a motor vehicle use map (FSM 7703.1).

2. For NFS trails designated for ATV use and that have a Designed Use of ATV, apply the ATV Design Parameters and the following guidance.

a. A variety of distances and recreation experiences may be provided by designing cutoffs for less experienced riders within a system of loop trails.

b. Trail alignment should exhibit decreasing randomness between Trail Class 2 and Trail Class 4.

c. Include frequent elevation changes and turns appropriate for each skill level. These design features can be incorporated as appropriate to slow vehicle speeds, increase safety, and provide more riding time per mile (see sec. 23.22, ex. 01).

d. Favor drainage dips over water bars.

e. Favor climbing turns over switchbacks, within the applicable Design Parameter grade tolerances, as deemed appropriate, considering the use and direction of travel. Modify the level of challenge of a curve by increasing or decreasing its turning radius.

f. On trails in Trail Class 4, the alignment generally should be moderate, with no sharp curves combined with steep grades. Novice riders may be subjected to sharp curves, but generally not in combination with rough surfaces or steep grades. If possible, incorporate climbing turns with a wide radius for ascending hills. Use switchbacks on steep slopes only for more challenging trails.

g. Hardening of switchbacks and climbing turns in areas with sensitive soils is recommended. Suggested hardening materials include concrete blocks, soil, and cement.

h. For minimum bridge widths and railing heights, refer to FSH 7709.56b, section 7.69, exhibit 01, Trail Bridge Design Criteria. Bridges should have a straight approach and should not change directions. Special decking may be necessary to accommodate wheeled vehicles.

i. To minimize confusion, consider locating trail junctions so that no more than two trails intersect at one point.

23.23 - Design Parameters for Four-Wheel Drive Vehicles Greater Than 50 Inches in Width

The next page displays the Design Parameters for Four-Wheel Drive Vehicles Greater Than 50 Inches in Width, followed by considerations regarding their application.

23.23 – Exhibit 01

DESIGN PARAMETERS FOR FOUR-WHEEL DRIVE VEHICLES GREATER THAN 50 INCHES IN WIDTH

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use FOUR-WHEEL DRIVE VEHICLE > 50"		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for 4WD Vehicles > 50", although use may be allowed	72" – 84"	72" – 96"	96" – 120"	Typically not designed or actively managed for 4WD Vehicles > 50", although use may be allowed
	Double Lane		16'	16'	16'	
	Structures (Minimum Width)		96"	96"	96"	
Design Surface[2]	**Type**		Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present	Native, with imported materials for tread stabilization likely and routine grading Minor roughness Sections of soft tread uncommon	
	Protrusions		≤ 12" May be common and continuous	≤ 8" May be common and continuous	≤ 4" May be common and continuous	
	Obstacles (Maximum Height)		36" May be common or placed for increased challenge	24" Common and left for increased challenge	12" Uncommon	

23.23 – Exhibit 01--Continued

Designed Use FOUR WHEEL DRIVE VEHICLE < 50"		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade[2]	Target Grade		10% – 21%	5% – 18%	5% – 12%	
	Short Pitch Maximum		25%	20%	15%	
	Maximum Pitch Density		20% – 30% of trail	10% – 20% of trail	5% – 10% of trail	
Design Cross Slope	Target Cross Slope		8% – 15%	5% – 12%	5% – 8%	
	Maximum Cross Slope		15%	12%	8%	
Design Clearing	Height		6’ – 8’	6’ – 8’	8’ – 10’	
	Width		72” – 84” Some light vegetation may encroach into clearing area	72” – 96”	96” - 144”	
	Shoulder Clearance		0” – 6”	6” – 12”	12” – 18”	
Design Turn	Radius		10’ – 15’	15’ – 20’	20’ – 30’	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Four-Wheel Drive Vehicles > 50” In Width Design Parameters:

1. NFS trails that allow four-wheel drive vehicle use must be designated for that vehicle class pursuant to 36 CFR 212.51 and displayed on a motor vehicle use map (FSM 7703.1).

2. For NFS trails designated for four-wheel drive vehicles over 50 inches in width and that have a Designed Use for that type of vehicle, apply the appropriate Design Parameters and the guidance below, as applicable.

a. The level of challenge provided by a trail increases with the size of the vehicle. For example, a trail that is challenging for a vehicle with a short wheelbase (less than 100 inches) is likely to be even more challenging for a vehicle with a long wheelbase (greater than 100 inches).

b. Trails designed for four-wheel drive vehicles greater than 50 inches in width have varying degrees of horizontal and vertical alignments, with safe tread for an average speed of 2 to 4 miles per hour.

c. A variety of distances and recreation experiences may be provided for less experienced riders by designing cutoffs within a system of loop trails.

d. Favor drainage dips over water bars.

e. Favor climbing turns over switchbacks, within the applicable Design Parameter grade tolerances, as deemed appropriate, considering the use and direction of travel. Modify the level of challenge of a curve by increasing or decreasing its turning radius.

f. Alignment on trails with grades of 4 percent or less should provide 5 lock-to-lock turns (five changes of direction of the steering wheel, from far right to far left) in the first 150 feet of the trail to restrict use of the trail to smaller vehicles. The rest of the trail should have 2 to 5 lock-to-lock turns, depending on vegetation, topography, and planned challenge level (see sec. 23.23, ex. 01).

g. Trails with grades of 4 to 10 percent should have wider turning radii and dips and bumps, as topography allows. Depending on topography, locate 10 percent or more of the trail on a relatively straight alignment, with a maximum side slope of 30 percent.

23.3 - Snow Trails

23.31 - Cross-Country Ski Design Parameters

The next page displays the Cross-Country Ski Design Parameters, followed by considerations regarding their application.

23.31 – Exhibit 01

CROSS-COUNTRY SKI DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use **CROSS-COUNTRY SKI**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Groomed Width	**Single Lane**	Typically not designed or actively managed for cross-country skiing, allow use may be allowed	2’ – 4’ Typically not groomed	6’ – 8’ Or width of grooming equipment	8’– 10” Or width of grooming equipment	Typically not designed or actively managed for cross-country skiing, although use may be allowed
	Double Lane		6’ – 8’	8’ – 12’	12’ – 16’	
	Structures (Minimum Width)		36”	36”	36”	
Design Grooming and Surface[2]	**Type**		Generally no machine grooming	May receive occasional machine grooming for snow compaction and track setting	Regular machine grooming for snow compaction and track setting	
	Protrusions		No protrusions	No protrusions	No protrusions	
	Obstacles (Maximum Height)		12” Uncommon	8” Uncommon (no obstacles if machine groomed)	No obstacles	

23.31 – Exhibit 01--Continued

Designed Use CROSS-COUNTRY SKI		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade [2]	**Target Grade**		5% – 15%	2% – 10%	0% – 8%	
	Short Pitch Maximum		25%	20%	12%	
	Maximum Pitch Density		10% – 20% of trail	5% – 15% of trail	0% – 10% of trail	
Design Cross Slope	**Target Cross Slope**		0% – 10%	0% – 5%	0% – 5%	
	Maximum Cross Slope (For up to 50')		20%	15%	10%	
Design Clearing	**Height** (Above normal maximum snow level)		6' – 8'	8' Or height of grooming equipment	8' – 10'	
	Width		24" – 60" Light vegetation may encroach into clearing area	72" – 20"' Light vegetation may encroach into clearing area	96"' – 168" Widen clearing at turns or if increased sight distance needed	
	Shoulder Clearance		0" – 6"	0" - 12"	0" – 24"	
Design Turn	**Radius**		8' – 10'	15' – 20' Or to accommodate grooming equipment	≥ 25'	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential and other factors contributing to surface stability and overall sustainability of the trail

Application considerations for Cross-Country Ski Design Parameters:

1. Trails with a Designed Use of Cross-Country Ski are Snow Trails that are designed and managed for travel during the snow season. They may, however, overlap a Standard Terra Trail that is managed for use when there is no snow. When this overlap occurs, identification of the applicable Design Parameters should be based on consideration of both the Designed Use for the Standard Terra Trail and the Designed Use for the Snow Trail. From the two Designed Uses, select the Design Parameters with the most demanding design, construction, and maintenance requirements (sec. 14.4).

2. Locate or review potential locations for cross-country ski trails during the winter months.

3. Locate cross-country ski trails where reliable snow conditions exist for 2 to 3 months annually. Utilize topography to extend the period of snow cover. Consider the direction the slope faces, prevailing wind direction, shade, and microclimate when locating cross-country ski trails.

4. Avoid avalanche hazards. Consult with those knowledgeable of local avalanche hazards before developing cross-country ski trails.

5. Avoid hazardous stream and lake crossings. Normally, 6 inches of hard blue ice is considered safe for cross-country ski trail crossings.

6. Avoid locating trails under dense canopies, especially in tall, old-growth stands. Canopies intercept much of the snowfall, and when the air temperature rises, large chunks of snow fall on the trails.

7. Similar to downhill ski runs, cross-country ski trails are rated as easiest, more difficult, and most difficult. Always design trails rated as easiest for novice skiers under normal snow conditions. Design trails rated as most difficult to provide challenges, but no unusual difficulties, for experienced skiers. Design more difficult trails to fall between these two extremes.

8. Provide only sweeping curves, rather than sharp turns, on downhill sections. Locate sufficient distance at the base of downhill runs to permit the user to slow down before turning. A place to stop adjacent to the trail mid-slope is desirable on long downhill runs.

a. Trail Width. Widths of trails with a Designed Use of Cross-Country Ski vary depending on the terrain, steepness of the trail, sharpness of curves, amount of use, and number of tracks. On flat or gently rolling terrain (with grades of up to 3 percent), clear single-track groomed trails to a width of 6 to 8 feet and double-track groomed trails to a width of 10 to 12 feet. Steeper, uphill sections should include extra clearing width where herringbone or sidestep skiing techniques might be used. The extra clearing width should be one-half times the normal width, up to 14 feet. Downhill sections require extra widening commensurate with the speed allowed by the hill. The lower portions and runout require the most widening, while the upper portions require the least. Normally, a downhill run is cleared to 1.5 times the normal

width from approximately one-third to two-thirds of the way down the hill. From two-thirds down to the bottom and through the runout, clear the trail to twice the normal width.

b. Trail Length. Accommodate user needs for different distances and degrees of challenge by providing cutoffs for less experienced users on a system of loop trails, as follows:

Recommended Lengths	Half Day	Full Day
Easiest Trail	3.2 miles	6.4 miles
Most Difficult Trail	6.4 miles	9.5 miles

c. Bridges. For minimum bridge widths and railing heights, see FSH 7709.56b, section 7.69, exhibit 01, Trail Bridge Design Criteria.

d. Intersections. Approaches to intersections should have grades of 5 percent or less to allow for speed control. Clear intersections to a diameter of twice the trail width.

e. Marking Standards. Cross-country ski trails should be marked so that travelers unfamiliar with the trails can follow them during poor weather conditions, when there are with no tracks to follow and relatively poor lighting. See the Sign and Poster Guidelines for the Forest Service (EM 7100-15) for guidance on marking trails.

23.32 - Snowshoe Design Parameters

The next page displays the Snowshoe Design Parameters.

23.32 – Exhibit 01

SNOWSHOE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use SNOWSHOE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for snowshoe, although use may be allowed	36”	36” – 48”	36’ – 60’	Typically not designed or actively managed for snowshoe, although use may be allowed
	Double Lane		60”	72”	72” – 96”	
	Structures (Minimum Width)		36”	48”	48”	
Design Surface[2]	**Type**		Generally no machine grooming	May receive occasional machine grooming for snow compaction	Likely to receive occasional machine grooming for snow compaction	
	Protrusions		No protrusions	No protrusions	No protrusions	
	Obstacles (Maximum Height)		12” Uncommon	8” Uncommon (no obstacles if machine groomed)	No obstacles	
Design Grade [2]	**Target Grade**		10% – 20%	5% – 15%	0% – 10%	
	Short Pitch Maximum		30%	20%	15%	
	Maximum Pitch Density		5% – 20% of trail	5% – 25% of trail	0% – 10% of trail	

23.32 – Exhibit 01--Continued

Designed Use SNOWSHOE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Cross Slope	**Target Cross Slope**		0% – - 10%	0% – 5%	0% – 5%	
	Maximum Cross Slope		20%	15%	10%	
Design Clearing	**Height** (Above normal maximum snow level)		6' – 8'	8'	8' – 10'	
	Width		48" Some light vegetation may encroach into clearing area	72" Light vegetation may encroach into clearing area	72" – 96"	
	Shoulder Clearance		0"	12"	12" – 24"	
Design Turn	**Radius**		3' – 4'	3' – 6'	4' – 8' Or to accommodate grooming equipment	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18, section 05.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Snowshoe Design Parameters may be developed as determined necessary.

23.33 - Snowmobile Design Parameters

The next page displays the Snowmobile Design Parameters, followed by considerations regarding their application.

23.33 – Exhibit 01

SNOWMOBILE DESIGN PARAMETERS

Design Parameters are technical guidelines for the survey, design, construction, maintenance, and assessment of National Forest System trails, based on their Designed Use and Trail Class and consistent with their management intent[1]. Local deviations from any Design Parameter may be established based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable Trail Class.

Designed Use SNOWMOBILE		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for snowmobiles, although use may be allowed	4’ – 6’ Typically not groomed	6’ – 8’ Or width of grooming equipment On turns with tight radius, increase groomed width to ≥ 10’	8’ – 10’ Or width of grooming equipment On turns with tight radius, increase groomed width to ≥ 12’	Typically not designed or actively managed for snowmobiles, although use may be allowed
	Double Lane		10’ Typically not groomed	10’ – 12’	12’ – 20’	
	Structures (Minimum Width)		6’	12’	18’	
Design Surface[1]	**Type**		Generally no machine grooming Commonly rough and bumpy	May receive occasional machine grooming for snow compaction and conditioning Frequently rough and bumpy	Regular machine grooming for snow compaction and conditioning Commonly smooth	
	Protrusions		No protrusions	No protrusions	No protrusions	
	Obstacles (Maximum Height)		12” Uncommon	6” Uncommon (no obstacles if machine groomed)	No obstacles	

23.33 – Exhibit 01--Continued

Designed Use SNOWMOBILE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Grade [2]	Target Grade		0% – 12%	0% – 10%	0% – 8%	
	Short Pitch Maximum		35%	25%	20%	
	Maximum Pitch Density		15% – 30% of trail	10% – 20% of trail	5% – 10% of trail	
Design Cross Slope	Target Cross Slope		0% – 10%	0% – 5%	0%	
	Maximum Cross Slope		15%	10%	5%	
Design Clearing	Height (Above normal maximum snow level)		6’	6’ – 8’ Provide sufficient clearance for grooming equipment	8’ – 12’ Provide sufficient clearance for grooming equipment	
	Width		6’ – 12’ Some light vegetation may encroach into clearing area	8’ – 14’ Light vegetation may encroach into clearing area	10’ – 22’ Widen clearing at turns or if increased sight distance needed	
	Shoulder Clearance		6” – 12”	12” – 18”	12” – 24”	
Design Turn	Radius		8’ – 10’	15’ – 20’ Or to accommodate grooming equipment	25’ – 50’	

[1] For definitions of Design Parameter attributes (e.g., Design Tread Width and Short Pitch Maximum), see FSH 2309.18.

[2] The determination of the trail-specific Design Grade, Design Surface, and other Design Parameters should be based upon soils, hydrological conditions, use levels, erosion potential, and other factors contributing to surface stability and overall sustainability of the trail.

Application considerations for Snowmobile Design Parameters:

1. Trails with a Designed Use of Snowmobile are Snow Trails that are designed and managed for travel during the snow season. They may, however, overlap with Standard/Terra Trails. When this occurs, identify the applicable Design Parameters based on consideration of both the Designed Use identified for the Standard/Terra Trail and the Designed Use for the Snow Trail. Select the Design Parameters with the most demanding design, construction, and maintenance requirements.

2. Locate or review potential locations for snowmobile trails during the winter months.

3. Snowmobiling is often conducted in large groups. Where possible, the needs of large numbers of trail users should be considered in the design and location of snowmobile facilities. Incorporate opportunities for picnicking, off-trail facilities (for example, overlooks and places along the trail where users can congregate without blocking the trail), and trail segments of varying difficulty into the trail system.

4. Snowmobile trails should lead to a destination of scenic or other natural interest or other destinations, such as recreation sites and communities.

5. Snow depth, natural lighting, and nighttime operation add hazards to snowmobiling. To the extent appropriate and practicable, address trail hazards, for example, consider posting signs. Consult with those knowledgeable of local avalanche hazards before locating snowmobile trails.

6. Where possible, avoid development of one-way snowmobile trails.

7. A loop trail system should provide a half-day of snowmobiling without repeating a trail experience. Trails within the system should be at least 5 to 10 miles long, with a median length of 15 to 30 miles. Provide alternate, shorter routes in the trail system.

8. Variety in vertical alignment contributes to user enjoyment. Based on the applicable Trail Class, use vertical alignment in proper combination with horizontal alignment to control operating speeds for safety while enhancing the experience. For example, intersperse segments of relatively steeper and generally straighter trail with segments of relatively flatter and curvier trail along the route.

9. When a trail or trail segment has a Short Pitch Maximum of over 25 percent, provide straight approaches to the steeper portions (which may also include grades of less than 25 percent), with a gradual increase in grade.

10. As the season progresses, drifting snow may alter the grade of some portions of a trail. Therefore, during the trail location phase, identify areas where drifting is probable, and try to avoid them in aligning trails for snowmobile use. Where rerouting is not possible, limit grades to accommodate the most adverse conditions anticipated.

11. When a planned snowmobile trail will cross a public road or railroad right-of-way, contact the responsible authority at the earliest possible stage to coordinate planning. Coordinate on the final selection of the crossing point, approval of approach alignment and visibility at the crossing point, and sign plans for both the public road or railroad right-of-way and the trail, and agree on respective responsibilities.

12. Snowmobile trails frequently use existing roads and are thus constrained by the physical characteristics of those roads. However, where possible, lay out trail junctions so that only two trails intersect at one point. Crossings should be at right angles, with a level grade approaching the junction to allow users to control their approach speed.

23.4 - Water Trails [Reserved]

23.5 - Special Trails

23.51 - Accessible Trails

1. The FSTAG provides guidance for maximizing accessibility of trails in the NFS, while recognizing and protecting the unique characteristics of their natural setting. Appropriate application of the FSTAG will ensure that the full range of trail opportunities continues to be provided, from primitive long-distance trails to highly developed trails and popular scenic overlooks. Application of the FSTAG is not intended to change the Trail Class or Designed Use prescribed for a trail. The FSTAG is available electronically at *www.fs.fed.us/reacreation/programs/accessibility*.

2. Refer to the FSTAG for direction on assessment, development, and management of trails that are subject to the FSTAG.

3. To support integration between this handbook and the FSTAG, an overview of the FSTAG follows. See the FSTAG for further direction on its application.

4. The FSTAG applies to NFS trails that meet all three of the following criteria:

   a. The trail or trail segment is new or altered (an alteration is a change in the original purpose, intent, or design of a trail);

b. The trail has a Designed Use of Hiker/Pedestrian; and

c. The trail connects directly to an accessible trail or to a trailhead.

5. While trail designers and managers are encouraged to look for opportunities where accessibility may be improved beyond those trails where it is required, the uniqueness of each trail must be preserved. The FSTAG contains conditions for departure and exceptions that apply when application of a technical provision would cause a change in a trail's setting or the purpose or function for which a trail was designed.

6. The FSTAG may not apply to most portions of existing primitive, long-distance trails. However, the FSTAG may apply to some segments of those trails, such as where they pass through a more developed area. The FSTAG contains exceptions that will prevent accessibility from being pointlessly applied in a piecemeal fashion along a trail when access between trail segments is not possible. The FSTAG also contains requirements to provide accessibility to special features where possible.

7. If materials need to be obtained from or manipulated on a sign or kiosk, the sign or kiosk must be designed to meet the reach ranges in section 308 of the Architectural Barrier Act Accessibility Standards (ABAAS).

8. In accordance with the Forest Service policy of universal design, trail information must be provided in a manner that will permit users to evaluate the appropriateness of a trail for their ability, resources, and the type of trail experience they are seeking.

9. Signs must be posted at the trailhead of new or altered trails and trail segments that fall into Trail Class 4 or Trail Class 5, as well as at the trailhead of trails that have been evaluated for accessibility. At a minimum, in addition to the standard information including the name and length of the trail, these signs must include the typical and maximum trail grade, typical and maximum cross slope, typical and minimum tread width, surface type and firmness, and obstacles. These signs also should state that the posted information reflects the condition of the trail when it was constructed or assessed and should include the date of the construction or assessment.

10. Where more extensive trail information is provided (for example, an aerial map of the trail and related facilities), the location of specific trail features and obstacles that do not comply with the FSTAG's technical provisions should be identified and a profile of the trail grade should be included.

11. Do not use the international symbol of accessibility, the wheelchair symbol, in trail signage.

12. Local managers have the discretion to decide whether to post FSTAG signage on newly constructed or altered trails that fall into Trail Class 1, Trail Class 2, or Trail Class 3.

23.52 - Interpretive Trails

1. While interpretive trails may be managed for a variety of uses, they most often fall into Trail Class 4 or Trail Class 5, with a Designed Use of Hiker/Pedestrian, although they sometimes fall into Trail Class 3.

2. Interpretive trails offer access to areas with natural, geological, historical, or cultural significance. Interpretive trails provide a recreation experience that enriches visitors' understanding of the environment, fosters a stewardship ethic, and furthers sustainable resource management objectives. Consider providing interpretive trails in a wide range of settings that maximize interaction between users and the environment.

3. An interpretive plan is recommended for development of most interpretive trails. Interpretive plans vary in complexity and scope, depending on the trail being developed. In developing an interpretive plan, at a minimum:

a. Determine the specific audience to be reached. Invite user participation in the development of the trail.

b. Determine the specific objectives of the interpretive message.

c. Determine the appropriate media (for example, trail signing, audio stations, and brochures) that are best suited to the message and the audience.

d. Evaluate all sites that provide the intended message and theme. Consider population proximity, amount of expected use, adjacent facilities and services, and quality of the setting.

e. Evaluate what the area has to offer and what visitors want. Develop the trail message to expand visitors' knowledge.

f. Inventory the selected site to identify its limitations, interpretive opportunities, and fragile areas. The inventory may be conducted by developing a grid with parallel strips representing every 50 to 100 feet. On each strip, the surveyor notes items of interest. These rudimentary maps are then refined into a more detailed map.

g. Use a multidisciplinary approach in planning an interpretive plan. Depending on the interpretive theme of the trail or sites along the trail, specialists my include wildlife biologists, botanists, and geologists.

4. Avoid critical wildlife habitats and other fragile, unusual, and sensitive areas unless they can be adequately protected or only guided walks are conducted through these areas.

5. The standard interpretive trail is usually less than 1 mile long. Additional shorter loops can be a part of the longer segment. Interpretation of special areas can be provided on any trail.

6. Locate interpretive trails near population centers or heavily used developed sites. Strive to locate interpretive trails away from noise and distracting activities. Some distracting conditions can be mitigated by a vegetation screen.

7. Select a route with a wide range of special features or one that illustrates a single purpose (sometimes known as a theme trail). The latter approach is preferred.

8. The following design criteria apply to most interpretive trails:

a. Design the message or theme of the trail to achieve its management intent, develop user awareness, and promote enjoyment of the area.

b. Space stops to allow users to absorb ideas. Plan for approximately 10 to 15 signs or stops per trail, with stops at least 200 feet apart. If more than 15 stops are planned, consider providing brochures.

c. Design entry and other signs, registration stations, and brochure distribution boxes to present a positive image and a pleasant entrance experience.

d. Write the text of the message at the anticipated educational and social level of users. Indicate in the message why the item is important. Test stops and text on representatives of the intended audience before final development. Redesign as necessary.

e. Do not interpret all items of interest along the trail. Items of interest that are not interpreted can be added later to create a changing message. Consider a seasonal approach, if possible.

f. Call attention to items between stops, such as birds and animals, by noting them on signs or in brochures.