

**Forest Service Handbook
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Forest Service Handbook 2309.18 – Trails Management Handbook

Chapter 4 - Trail Operation and Maintenance

Amendment: 2309.18-1991-2

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Approved by: F. Dale Robertson, Chief

Date approved:

Responsible Staff:

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Digest: Following is an explanation of the changes throughout the directive by section.

This amendment is a reissuance of FSH 2309.18 to conform the format and structure of the Handbook to the requirements of electronic directive issuance.

This amendment makes no substantive changes to the text. The only changes made are those necessary to meet new format requirements or to correct spelling, punctuation, unit names or coding errors.

This Handbook is now available electronically in the National Information Center in the same format as the paper copy. Henceforth, amendments to this Handbook will be issued to Forest Service units electronically on a document basis.

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Trail management objectives establish the parameters for developing trail operations and maintenance strategies. Some of the key parameters are the trail type, difficulty level, the appropriate trail guide, and expected amount, type, and timing of use.

4.1 - Trail Operation

Trail operation involves management of the type, volume, and season of trail use to achieve the desired trail management objectives. Elements of trail operation include: monitoring the volume of use, the type of use, and the effects of use on the trail management objectives; implementing trail restrictions; and informing the user through guides and signs of the use that is intended for each trail.

4.11 - Monitoring Use

Monitor type and volume of trail use to determine if trail management objectives are met. Use the resulting data to direct trail maintenance planning.

The type and volume of use can be monitored in a number of ways.

1. Established Traffic Counter Stations. Photoelectric cell counters, photographic counters, inductive loops, compression counters, and visual counts are the types of trail counter stations presently in use.

2. Trail Registers. Ask trail users to sign a trail register. Although user compliance may vary widely at different locations, estimate the percentage of users who register using visual counts.

3. Records of Permits Issued. Study issued permits to gather information about the general use of an area.

4. Trailhead Use. Check the number and types of vehicles parked at trailhead to gather information about volume and type of traffic using the trail. Trailers used for hauling trail stock, trail bikes, and the like indicate the type of use.

5. Tread Wear. Study imprints and tread wear on trails to gather information about the volume and types of use.

4.12 - Managing Trail Use

Restrict traffic on trails to meet trail management objectives, where traffic exceeds safe use levels, when there is significant user conflict, when unacceptable resource

damage is occurring, or when excessive operation and maintenance costs are resulting from the volume, type, or season of use.

Develop restrictions to fit the situation. For example, seasonal closures during wet seasons may eliminate high tread maintenance costs. Other situations may warrant year-long restrictions.

Use advisory or regulatory techniques to impose needed restrictions. Advisory techniques are preferred because they are more likely to receive a positive reaction from the recreationists. However, they may not work and the regulatory restrictions must then be imposed.

4.12a - Advisory Restrictions

Advisory restrictions include such items as posting of notices to get user cooperation and strategic use of brushing, fallen trees, rocks, or other natural features to encourage the desired use pattern.

Signing should be positive and communicate a Good Host image. Avoid negative signing such as "Stay on Trail" or "Don't Crosscut Switchback."

4.12b - Regulatory Restrictions

Use 36 CFR 261.55 to regulate use. The requirements for writing orders and posting notices are in 36 CFR 261.50 and 36 CFR 261.51, respectively.

Public involvement prior to issuing a prohibition normally will aid in enforcement of the prohibition. Notices of restrictions are shown on maps as well as in news releases, recreation reports, and in other media. Use personal contacts to gain user understanding.

Closing a trail to a specific mode of travel is usually not enforceable unless the area surrounding the trail is also closed to that mode of travel. For example, if a trail is closed to motorized vehicles, the general area restrictions under 36 CFR 261.56 are most appropriate.

4.13 - Public Information

When appropriate, employ both offsite and onsite information techniques to aid proper trail management. When trail difficulty level is defined, describe it at the trailhead on bulletin boards and in trail guides, brochures, and travel management maps (FSM 1600). Public information techniques for trails should:

1. Convey the Host image when regulating use. Emphasize where to go instead where one should not go; what can be done rather than what cannot be done.
2. Display an array of recreation opportunities so the users may choose what they prefer.
3. Use public information techniques to assist users in understanding resource management objectives.
4. Provide simple, accurate, and current data about trails and appropriate activities.
5. Encourage private sector cooperation in guidebooks, the media, and educational systems.
6. Use unique and imaginative methods to encourage trail use. Examples include trail dedications, trail-of-the-month features, outfitter guides, and trailhead facility development.
7. Indicate all seasonal activities available in order to establish desired use patterns. Winter visitors may consider returning in the summer if a desired activity is recommended.
8. Use international symbols with Forest Service identification rather than regulatory signs.

4.14 - Signs

Signs should follow the general guides outlined in FSH 7109.11, chapters 30 and 50, and in the "Sign and Poster Catalog."

4.2 - Trail Maintenance

The purpose of maintenance is to preserve the trail and related facilities to meet established objectives.

4.21 - Maintenance Management Process

The Forest Service Trail Maintenance Management System is a method to plan, schedule, perform, and evaluate the maintenance activities necessary to ensure the safety, protection, proper administration, and appropriate use of the forest trail system (ex. 01).

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4.21 - Exhibit 01

**SEE THE PAPER COPY OF THE MASTER SET
FOR SECTION 4.21 - EXHIBIT 01**

4.22 - Recording Maintenance

Maintenance shall be recorded as standard when a trail is maintained in a manner adequate to serve established objectives. Maintenance shall be recorded as less than standard when some needed maintenance activities are not performed, resulting in a trail that does not fully serve established objectives. Refer to the trail guides (chapter 2) to determine whether maintenance is preserving the trail to a standard adequate to serve the established objectives.

4.23 - Maintenance Activity Groups

Five activity groups are described below, along with a list of each individual maintenance activity. These maintenance activities (or others as desired by the local units) should be used to maintain the trails to the current assigned and planned guide. These maintenance activities are only a suggested list; different lists may be developed at the Regional, Forest, or District level.

4.23a - Tread Maintenance

<u>Activity Code</u>	<u>Activity</u>	<u>Work Unit</u>
960	Loose Rock Removal	Linear Foot or Mile
961	Rock and Root Removal	Linear Foot or Mile
962	Slough and Berm Removal	Linear Foot
963	Slide Maintenance	Linear Foot
964	Cement Treated Surface Repair	Linear Foot
965	Bituminous Surface Repair	Linear Foot
966	Snow Trail Grooming	Linear Foot or Mile
967	Borrow	Cubic Foot

4.23b - Drainage Maintenance

<u>Activity Code</u>	<u>Activity</u>	<u>Work Unit</u>
970	Routine Drainage Maintenance	Mile
971	Maintain Water Bar	Each
972	Maintain Rock Culvert	Each
973	Maintain Stream Fords and Gully Crossings	Each
974	Maintain Drainage Dip	Each

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4.23c - Trailway Maintenance

<u>Activity Code</u>	<u>Activity</u>	<u>Work Unit</u>
980	Logging Out	Linear Foot, Mile, or Each
981	Brush Cutting	Linear Foot or Mile
982	Danger Tree Removal	Each
983	Litter Cleanup	Linear Foot
984	Slope Revegetation	Linear Foot

4.23d - Structures

<u>Activity Code</u>	<u>Activity</u>	<u>Work Unit</u>
990	Maintain Rock and Log Barrier	Linear Foot
991	Rock, Log, or Timber Retaining Wall	Facial Square Foot
992	Maintain Trail Turnpike	Linear Foot
993	Trail Puncheon Repair	Linear Foot
994	Fence and Gate Repair	Each
995	Bridge Maintenance	Each

4.23e - Traffic Services

<u>Activity Code</u>	<u>Activity</u>	<u>Work Unit</u>
997	Sign Repair (field)	Each Site
998	Sign Replacement	Each Site
999	Cairn Installation and Repair	Each

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4.24 - Trail Log

Prepare a trail log for each trail. The log is an inventory of physical features within or adjacent to the trails and is prepared to the level of detail necessary to make the required trail management decisions. The log is drawn up once and is usable until the inventoried features are modified, replaced, or removed. Inventoried items include:

Type of Terrain	Retaining Wall	Intersection	Fence
Ground Cover	Puncheon Section	Bridge	Sign
Side Slope Percent	Turnpike Section	Drainage Dip	Milepost
Trailbed Width	Rock Section	Water Bar	Cairn
Grade	Drainage Ditch	Culvert	Gate
Surfacing and Depth	Stone Barrier	Stream Ford	Vista
Switchback	Barricade	Underdrain	
Climbing Turn	Turnout	Gully Crossing	

An example of a trail log is shown on the left side of exhibit 01.

Data are usually recorded to the nearest foot by measuring with a cyclometer. Measurement starts from the beginning terminus of the trail, with the beginning and ending termini easily identified on the ground. Trail markers, such as milepost markers, and other prominent items aid in establishing the on-the-ground location of trail log information.

The trail log is the working tool for the condition survey. It becomes part of each individual trail folder and is used to update the trail inventory.

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4.24 - Exhibit 01

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4.24 - Exhibit 01--Continued

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SECTION 4.24 - EXHIBIT 01.**

4.25 - Condition and Prescription Surveys

The condition survey is the backbone of maintenance management. The person who performs the condition survey must be knowledgeable about the entire maintenance management process. The data gathered and the decisions made during the condition survey provide the information needed for subsequent decisions. The condition survey may also be used for scheduling and reporting work accomplishments.

The right side of exhibit 01, section 4.24, provides an example of a trail condition survey.

Review the management objectives for each trail prior to performing the condition surveys. These objectives are used in the development of the annual maintenance plan and generally include the following considerations:

1. Requirements to protect specific adjacent resources or improvements, such as streams, lakes, meadows, vegetation, scenic strips, view areas, experimental forests, facilities, and the like.
2. Planned use of the trail. The season of use, difficulty level, type and volume of use, and trail restrictions and regulations are examples of the type of information that must be known before conducting a condition survey. Use this information to determine whether a trail is adequately providing for the planned use.

Condition surveys are conducted to provide up-to-date information about the condition of all physical features that are of concern to the manager. Prior surveys provide information to forecast work requirements that are used in formulating the annual maintenance plan. Examples of possible deficiencies that should be noted in condition surveys include the following:

1. Inlets and outlets of culverts that are plugged.
2. Locations of hazard trees.
3. Brushing growth within cleared limits.
4. Sluffing backslope.
5. Missing or damaged signs.
6. Subgrade failures.

7. Stone retaining wall failures.
8. Slide encroachment on trailway.
9. Trail tread erosion.

These surveys also provide data to make an account of deficiencies and corrective measures that can be used in planning reconstruction projects.

The prescription survey identifies actions to correct the deficiencies noted on the ground. A qualified person can prescribe the action needed to correct the deficiency at the same time the condition survey is made. The prescription may be designated by referring to a specific maintenance activity and maintenance specification.

A detailed condition survey may not be needed during the springtime opening of trails. However, trail inspectors are needed to verify the type and extent of work needed before dispatching crews or awarding contracts. Opening trails in the spring normally involves logging out and drainage maintenance.

4.26 - Annual Trail Management Plan

The annual trail management plan is based on historical maintenance requirements, the most current condition survey, a knowledge of the projected use of the trail, and a continuing evaluation of the need for certain trails.

The proposed annual trail management plan lists the total requirements for maintaining the trail system to the desired standards. When the final budget and staffing advice is received, the proposed plan is finalized to reflect those allocations.

Where reductions are required, the priority criteria established in the condition survey provide valuable information about maintenance activities to defer.

The following criteria are normally used in establishing priorities for trail maintenance work.

1. Priority 1. Maintenance activities that would correct an unsafe condition relative to management objectives.
2. Priority 2. Maintenance activities that minimize unacceptable resource and trail damage.

3. Priority 3. Maintenance activities that fully restore the trail to the planned design standard.

In addition, a change in the method of accomplishment (contract, force account, volunteer, or contributed labor) may be necessary.

The annual trail management plan may contain the following items:

- a. A Trail System Operation Listing (ex. 01).
- b. A Project Trail Maintenance Listing (ex. 02).
- c. An Annual Trail Management Summary (ex. 03).

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4.26 - Exhibit 01

Trail System Operation Listing

___ Proposed Plan
X Financed
___ Accomplished

Sheet 1 of 1
Made by Jones
Date 10/79

District Park Forest Lake FY 79

Work Activity	Unit	Quantity	Unit Cost	Total
Traffic Management Plan	Each	1	300	\$ 300
Trail Logs	Mile	20	100	2,000
Condition Surveys	Mile	100	50	5,000
Maintenance Planning & Scheduling	Each	1	200	200
Maintenance Programming (2-3 yrs. in advance)	Each	1	200	200
Traffic Counting	Sites	2	300	600
Trail Inventory & Map	Each	1	200	200
Trail Sign Inventory	Each	1	200	200
Cost Accountability & Reporting	Each	1	200	200
Performance Review	Mile	20	20	400
Supervision	M.Y.	.25	30,000	7,500

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TOTAL COST	\$16,800
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4.26 - Exhibit 02

Project Trail Management Listing

___ Proposed Plan
X Financed
___ Accomplished

Sheet 1 of 1
Made by Jones
Date 10/9/79

District Park Forest Lake FY 79

Trail Name	Trail No.	Station	No. Mi	Total Cost	Method of Performance
Bear Creek	01W03	0-530	10	\$ 1,000	Force Account
Slide Canyon	13W16	0-630	12	1,200	Force Account
Burnt Creek	12W06	20-73	1	200	Volunteer
Bear Lake	11W12	0-100	2	400	Force Account
Gold Springs	01W16	0-106	2	4,300	Force Account
Tampa Pass	15W22	53-630	11	500	Volunteer
Spring Creek	09W18	0-1060	20	10,000	Contract
Lava Dunes	12W08	0-220	4	500	Fire Crew
Mill Falls	13W14	0-96	2	5,000	Contract
Logging Out	14W16		10	0	User
Jays Lake	12W36	0-40	1	300	Older American
TOTAL				\$25,700	

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4.26 - Exhibit 03

Annual Trail Management Summary

FY 85

Management Unit Park R.D.

 Proposed
 X Financed
 Accomplished

<u>MIH</u> <u>Code</u>	<u>Description</u>	<u>Miles</u>	<u>Average</u> <u>Cost/Mile</u>	<u>Total</u>
762	Operations	200	\$ 84	16,800
763	Adequate	104	100	10,400
764	Inadequate	96	160	15,300
	TOTAL	200	\$212	42,500

4.27 - Methods of Accomplishment

Normally, the manager has three basic means to accomplish the work: force account, contracting, and volunteers. Use the budget process to plan for accomplishing work regardless of the method utilized.

The following matrix (ex. 01) displays some factors to consider in deciding which type of work force to use in completing the project.

Volunteer programs like "adopt-a-trail" can lessen the financial dilemma faced by trail managers. Managers should also take advantage of contributed funding and other force account crews, such as fire crews. Individual users and user groups, such as outfitters and clubs, will often assist if they are aware of maintenance needs.

Use the same quality standards for all methods of accomplishment. However, be aware that the production rates may vary considerably between methods. Guidance and supervision by a qualified Forest Service employee or experienced volunteer supervisor will usually be required to achieve quality work. The guidebook "Working with U.S. Forest Service Volunteers" is a good reference for managers interested in working with volunteer groups.

Develop cooperative agreement opportunities to the fullest extent possible. Parties to agreements must meet periodically to insure a good working relationship is maintained under the agreement. Reference 2(c), 7h, and 11 of the National Trails System Act of 1968, as amended.

Contracting trail maintenance is a practical solution. However, contracting is not a cure-all for accomplishing trail objectives. Carefully analyze contracting advantages and disadvantages for each situation. Contract limitations should not be underemphasized, nor should contractor capabilities be overrated. Consider the Forest Service's ability to produce effective specifications and to provide the required contract administration.

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4.27 - Exhibit 01

Methods of Accomplishment

Factor	Contracting	Force Account	Individual Volunteer	Volunteer Organization
Cost	-	-	+	+
Training	-	0	-	-
Supervision and Contract Administration	0	+	-	-
Control (timing, adherence to standard, adjustment of standard)	+	+	-	-
Benefit to Government:	+ positive 0 benefits offset disadvantages - negative			

4.28 - Work Scheduling, Accomplishment Reporting, and Performance Review

4.28a - Work Scheduling

Scheduling is the process of working within given limits to determine the most effective and economical use of manpower, equipment, tools, supplies, and time to accomplish a goal.

Develop a schedule for the items listed in the financial trail system operation listing and the financial project trail maintenance listing. Plot the schedule on a time chart to obtain an overall view of the maintenance workload (ex. 01).

Prepare Forms FS-1900-3, Individual Annual Work Plan, for each project or aggregate of projects and use Form FS-1900-4, Project Work Plan, for management control purposes.

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4.28a - Exhibit 01

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4.28b - Accomplishment Reporting

Refer to section 4.22, "Recording Maintenance," for general information about reporting trail maintenance accomplishments.

1. Force Account. Accomplishment by force account crews may be recorded on the condition survey form. The force account crew should record actual time spent on each maintenance activity as compared to the time estimated by the person who made the condition survey. This type of procedure will provide valuable information for future programming and cost estimating.

2. Contract. Payment documents will provide the records for recording accomplishments by contract. Inspection while work is in progress and daily diaries will provide data useful for future programs and cost estimates.

3. Volunteer. Volunteer groups should use and record their accomplishments on condition surveys in the same manner as force account personnel.

At the end of the fiscal year an accomplishment report must be prepared on the annual trail management summary. A trail may be reported as maintained to standard even though no work was performed, provided the trail was maintained to the desired level.

4.28c - Performance Review

Maintenance and management personnel should review a sampling of trail maintenance work to evaluate performance. The condition survey, maintenance specifications, letters from users, and other sources of information should be assessed during the field inspection. The performance review may reveal some needed changes in the maintenance management process. The performance review is not considered complete until recommended changes have been implemented.

4.29 - Special Considerations

Some types of trails require special techniques of operation and maintenance.

4.29a - Wilderness Areas

Within wilderness areas, maintenance should complement management objectives and maintain or gradually improve/restore the quality of the natural environment.

Occasional logs or obstructions that will not cause detouring may be left in the trail to aid in creating a more natural appearance. Low-growing vegetation will be allowed to grow close to the trail.

4.29b - Pack and Saddle Trails

Pack and saddle animals can be injured by poorly maintained structures such as bridges, punchen, corrals, and hitchracks. Routine maintenance should include the removal of loose nails, telephone wire, barbed wire, jill pokes, and large splinters from these facilities.

Routine cleanup of the trailhead facility should include the removal and disposal of manure to prevent the pollution of surface water and minimize fly problems.

4.29c - Snow Trails

1. Cross-Country Ski Trails

a. Pre-Season. Once a good vegetative cover is established, trails used exclusively as snow trails will need very little maintenance to prevent erosion. Establish vegetation as soon as possible where severe cuts or leveling occur during trail construction.

b. Snow Season. Where the trails are groomed, packing is necessary early in the snow season to establish a firm base. On groomed trails, a snowfall of more than 2 inches may require reestablishment of the track. With heavy use, a trail will develop snow waves (moguls), ruts, and holes that will require grading, packing, and resetting of tracks. Thaw and freeze cycles may cause ski trails to become hazardous and require grading and resetting of the track.

Snowmobiles or snowpackers may be used to pack trails. A special ski trail tracksetter can be used to grade trails and establish the parallel tracks.

Restrict groomed ski trails to skier use only. Dogs, horses, and snowmobiles should not be allowed on groomed trails and should be discouraged from using other heavily used cross-country trails. The manager may want to consider some trails for dogsledders.

2. Snowmobile Trails

a. Traffic Management on Snow-Covered Roads. A variety of techniques, used singly or in combination, can be used to manage traffic on trails.

b. Shared Use of Roads. Some roads are designated snowmobile trails with a general management objective of allowing snowplowing and log haul use during weekdays and snowmobile use during the weekends. For effective management, timber sale contracts should reflect this situation. It may be necessary to erect snow gates.

c. Roads Designated as Snow Trails. Some roads are designated as snowmobile trails with a general management objective of prohibiting all wheeled vehicles during certain months. Snowplowing is also prohibited. These roads, which often are groomed trails, generally are located in heavy snow and heavy snowmobile use areas. Wheeled traffic is restricted through CFR/Federal regulation.

d. Roads Closed to Snowmobiles. Carefully locate, sign, and mark closure devices.

Use "Snowmobile Area Closed" signs on highway approaches to parking areas.

The point of physical closure should ideally be located along the entrance road to the parking lot (between highway and lot) and be visible to the driver prior to turning onto the entrance road.

A turnaround should be provided immediately before the gate. Determine the need for notices and other information at the gate and post according to Forest Service policy and public need.