Tongass National Forest

Forest-Level Roads Analysis

Prepared for
Tongass National Forest
Region 10
USDA Forest Service

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Executive Summary

This roads analysis is prepared at the Forest-level scale for the Tongass National Forest (Tongass or the Forest). It is focused mainly on maintenance level (ML) 3, 4, and 5 roads, which are designed for travel by passenger vehicles, and other roads of high public interest. The Tongass manages approximately 5,000 miles of road, of which about 1,200 (24 percent) are ML 3, 4, or 5 roads. The objective of roads analysis is to provide decision-makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions.

The specific objectives of the analysis include the following:

- Identify the appropriate long-term road system for ML 3, 4, and 5 roads;
- Utilize Tongass Land and Resource Management Plan (TLMP) and other Forest-wide decision documents for guidance;
- Optimize Alaska Marine Highway and recreation access;
- Meet community needs for connectivity and subsistence uses;
- Identify appropriate road upgrading opportunities leading to incorporation in the State Highway System or operated as system public roads; and
- Identify opportunities to reduce management costs.

The total annual maintenance costs for National Forest System (NFS) roads on the Tongass were $11.9 million for 2001. ML 3, 4, and 5 roads accounted for $8.6 million or 73 percent of this total, with ML 3 roads alone accounting for 69 percent of the total. Noncritical maintenance costs comprised 87 percent of total maintenance costs for ML 3, 4, and 5 roads in 2001, with the non-critical Forest Service mission category accounting for 72 percent of the total.

The interdisciplinary team (IDT) identified key issues concerning ML 3, 4, and 5 roads based upon the 1997 TLMP, the draft Supplemental Environmental Impact Statement (SEIS) for the Forest Plan Roadless Area Evaluation for Wilderness Recommendations, and project-level National Environmental Policy Act (NEPA) documents and analyses completed since 1997. These issues were relevant to seven broad areas of concern, including:

- Funding for road maintenance;
- Jurisdiction of ML 3, 4, and 5 roads;
- ML 3, 4, and 5 road use for subsistence;

- Social and economic use of the ML 3, 4, and 5 road system;
- Road use for recreation and tourism;
- Fish passage, fish habitat, and water quality; and
- Wildlife and threatened, endangered, or sensitive species.

To assess the benefits, problems, and risks posed by the current road system, the IDT evaluated the management scheme for the current road system with a number of tools, including road system mapping; road management objectives developed from a geographic information system and databases; capital investment and road maintenance budget projections; Forest cost guides; an extensive number of photos of road features; and the road conditions survey (RCS) database.

The key findings of this analysis include the following:

- The availability of ML 3, 4, and 5 roads in Southeast Alaska is sufficient to satisfy local demand for roaded recreation, subsistence, and community connectivity needs and demands in most districts.
- There is a need to expand the access to roaded recreation by visitors from cruise ships via marine access points.
- There is a need to upgrade ML 3 roads that serve as community connectors and major recreation and subsistence routes to public road status.
- The RCS database upgrade needs include a more robust software platform, a change in the database structure, a QA/QC process, and a link to the budget estimation process.
- Deferred maintenance costs appear to be substantially underestimated in the 2001 deferred maintenance costs report, primarily due to costs for fixing fish passage problems at road-stream crossings.
- The fish passage and sedimentation maintenance costs should be considered part of the critical categories of the deferred maintenance cost schedule.
- There is also a need for project or area-level road analyses to effectively manage the ML 1 and 2 roads in combination with ML 3, 4, and 5 roads.

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ACRONYMNS AND ABBREVIATIONS

ANILCA	Alaska National Interest Lands Conservation Act
BMPs	Best Management Practices
EA	Environmental Assessment
EIS	Environmental Impact Statement
FH	Forest Highway
Foster Wheeler	Foster Wheeler Environmental Corporation
FSM	Forest Service Manual
IDT	Interdisciplinary Team
INFRA	Infrastructure Application
MAP	Marine Access Point
ML	Maintenance Level
NEPA	National Environmental Policy Act
NFS	National Forest System
RA	Roads Analysis
RCS	Road Condition Survey
ROS	Recreation Opportunity Spectrum
SEIS	Supplemental Environmental Impact Statement
SO	Supervisor's Office
SR	State Route (Highway)
TLMP	Tongass National Forest Land and Resource Management Plan
TSL	Traffic Service Level

Introduction

This roads analysis is prepared at the Forest-level scale for the Tongass National Forest (Tongass or the Forest). It is focused on maintenance level (ML) 3, 4, and 5 roads, which are roads designed for travel by passenger vehicles. In August 1999, the Washington Office of the USDA Forest Service published Miscellaneous Report FS-643, *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System.* The objective of roads analysis is to provide decision-makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions.

In October 1999, the agency published Interim Directive 7710-99-1 authorizing units to use, as appropriate, the roads analysis procedure embodied in FS-643 to assist land managers in making major road management decisions.

On January 12, 2001, the Forest Service issued the final policy (66 CFR 3219, Forest Transportation System) and rule (66 CFR 3206, Administration of the Forest Development Transportation System; Prohibitions; Use of Motor Vehicles Off Forest Service Roads) that govern the national forest transportation system and its administration. The rule and policy revise regulations concerning the management, use, and maintenance of the national forest transportation system. The final rule and policy are intended to help ensure that additions to the National Forest System (NFS) road network are essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental effects; and that unneeded roads are decommissioned and restoration of ecological processes are initiated. (A list of the laws and regulations governing road operations is located in Appendix A.)

The new forest transportation system policy direction, which was issued in Amendment No. 7700-2001-2 to Forest Service Manual (FSM) 7700 (Transportation System) and also became effective on January 12, 2001, helps guide the implementation of the new roads policy. Included in the amendment is a requirement that decisions on the addition of new roads be informed by roads analysis and that Forest-scale road analyses primarily covering ML 3, 4, and 5 roads be completed by January 13, 2003 (Sections 7712.14 and 7712.15). It also requires that roads analysis be used to evaluate opportunities and priorities for reconstruction and decommissioning of roads. Further, it requires that decisions on changes in access or road-related actions that may have adverse effects on soil and water resources, ecological processes, or biological communities, be informed by roads analysis.

FSM 7712.1 provides the following information for the Roads Analysis process:

The Responsible Official shall incorporate an interdisciplinary science-based roads analysis into multi-forest, forest-scale, and watershed or area-scale analyses and assessments to inform planners and decisionmakers of road system opportunities, needs, and priorities that support land and resource management objectives. Conducted by an interdisciplinary team (IDT), the science-based roads analysis process provides Responsible Officials with critical information needed to identify and manage a minimum road system that is safe and responsive to public needs and desires; is affordable and efficient; has minimal adverse effects on ecological processes and ecosystem health, diversity, and productivity of the land; and is in balance with available funding for needed management actions.

Units are to use an authorized science-based roads analysis process, such as that described in the report *Roads Analysis: Informing Decisions About Managing the National Forest Transportation System* (USDA Forest Service 1999, Misc. Report FS-643). Pursuant to FSM 7710.41, the Deputy Chief, National Forest Systems, may approve other science-based analysis methods for field use through amendments to this chapter. Although completion of an initial roads analysis is important, additional iterations of analysis may be needed to address changes in conditions, such as available funding, inventory and monitoring results, severe disturbance events, or new regulatory requirements.

FSM 7712.13b, Roads Analysis at the Forest or Area Scale, further provides guidance for this Roads Analysis:

Roads analysis at the forest scale is critically important, as it provides a context for road management in the broader framework of managing all forest resources. Close coordination with broader scale ecosystem assessments and analyses is essential. Area-scale assessments may be appropriate on forests with assessment areas composed of islands or groups of islands, on forests with widely separated units, or in areas where watershed boundaries do not make logical or effective assessment boundaries. Examples include forests with large physically or ecologically discrete subdivisions, such as the large islands in Southeast Alaska, or widely separated units of National Forests, including National Forests in Texas, Mississippi, Florida, Missouri, and Louisiana, or on forests where watershed boundaries do not make logical or effective assessment boundaries (i.e., the coastal plains of the eastern United States).

1. Consider the following at this scale:

    a. Environmental issues potentially affected by road management proposals, such as soil and water resources, ecological processes, and invasive species spread and biological communities.

    b. Social issues potentially affected by road management proposals, such as socio-economic impacts, public access, and accessibility for handicapped persons.

    c. An evaluation of the transportation rights-of-way acquisition needs.

    d. The interrelationship of state, county, tribal, and other federal agency transportation facility effects on land and resource management plans and resource management programs.

    e. Transportation investments necessary for meeting resource management plans and programs.

    f. Current and likely funding levels available to support road construction, reconstruction, maintenance, and decommissioning.

2. Prepare a report with accompanying map(s) that documents the information and analysis methods used to identify access and environmental priorities, issues, and guidelines for future road management and the key findings. At a minimum, the report will include the following:

   a. Inventory and map all classified roads, and display how these roads are intended to be managed.

   b. Provide guidelines for addressing road management issues and priorities related to construction, reconstruction, maintenance, and decommissioning.

   c. Identify significant social and environmental issues, concerns, and opportunities to be addressed in project level decisions.

   d. Document coordination efforts with other government agencies and jurisdictions.

This roads analysis follows the six-step process prescribed by FSM 7712 and Forest Service Miscellaneous Report FS-643. The document is divided into five steps:

1) Setting up the Analysis
2) Describing the Situation
3) Identifying Issues
4) Assessing Benefits, Problems, and Risks
5) Describing Opportunities and Setting Priorities

The sixth step of the process is this publication, which describes the results of the analysis.

Project Area Description

The 16.8-million acre Tongass National Forest occupies about 7 percent of the area of Alaska. The Tongass is located in Southeast Alaska, the area commonly called the panhandle of Alaska, and extends from Dixon Entrance in the south to Yakutat in the north; it is bordered on the east by Canada and on the west by the Gulf of Alaska. The Tongass National Forest extends approximately 500 miles north to south, and approximately 120 miles east to west at its widest point. Figure 1 is a vicinity map of the Tongass National Forest.

The Tongass includes a narrow mainland strip of steep, rugged mountains and icefields, and more than 1,000 offshore islands known as the Alexander Archipelago. Together, the islands and mainland have nearly 11,000 miles of meandering shoreline, with numerous bays and coves. A system of seaways separates the many islands and provides a protected waterway called the Inside Passage. Federal lands comprise about

Figure 1 Tongass National Forest

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95 percent of Southeast Alaska, with about 80 percent in the Tongass National Forest (and most of the rest in Glacier Bay National Park and Preserve). The remaining land is held in State, Native corporation, and other private ownerships.

Most of the area of the Tongass is wild and undeveloped. Approximately 73,000 people inhabit Southeast Alaska, most living in 32 communities located on island or mainland coasts. Only eight of the communities have populations greater than 1,000 persons. Most of these communities are surrounded by, or adjacent to, National Forest System land. Only three towns are connected to other parts of the mainland by road: Haines and Skagway to the north, and Hyder to the south.

The economies of Southeast Alaska's communities are largely dependent on the Tongass National Forest to provide natural resources for uses, such as fishing, timber harvest, recreation, tourism, mining, and subsistence. Maintaining the abundant natural resources of the Forest, while also providing opportunities for their use, is a major concern of Southeast Alaska residents.

Ranger District offices on the Tongass National Forest are located in Yakutat, Juneau, Hoonah, Sitka, Petersburg, Wrangell, Thorne Bay, Craig, and Ketchikan. There are also two National Monuments (Admiralty Island and Misty Fiords) with offices in Juneau and Ketchikan (see Figure 1).

The Tongass manages approximately 5,000 miles of road, of which about 1,200 (24 percent) are ML 3, 4, or 5 roads. These roads are designed and maintained for passenger vehicles. A more complete description of MLs is provided under Step 2 – Describing the Situation and in Appendix B. Under the Tongass National Forest Land and Resource Management Plan (TLMP) of 1997, land is allocated into 18 land use designations (LUDs) for management purposes. TLMP provides management direction on the acceptability of roads in each of the LUDs (Table 1). On a mile per square mile basis, the Modified Landscape and Recreational River LUDs have the highest density of ML 3, 4, and 5 roads with 0.18 mile per square mile. The Timber Production LUD and Scenic Viewshed LUD have the next highest ML 3, 4, and 5 road density with 0.16 and 0.14 mile per square mile, respectively.

Table 1. Land Use Designation Area, Road Acceptability under TLMP, and Miles of Maintenance Level 3, 4, and 5 Roads.

LUD	Acreage	Road Acceptability	Miles of ML 3, 4, 5 Roads
Wilderness	2,622,913	No, except ANILCA Access	0.0
Wilderness National Monument	3,098,820	No, except ANILCA Access	0.0
Non-wilderness National Monument	163,654	No, except ANILCA Access	5.8
Research Natural Area	59,545	No	0.0
Special Interest Area	297,173	Yes, as related to the needs of the special interest	6.0
Remote Recreation	2,129,169	No, except ANILCA Access	0.3
Enacted Municipal Watershed	45,776	Yes, if associated with Municipal Watershed administration or salvage logging	0.0
Old-growth Habitat	1,131,059	Generally no, unless no other alternative route	128.6
Semi-remote Recreation	2,941,350	Yes, but generally low standard roads, except to link existing roads or access adjacent LUDS	25.3
Land Use Designation II	719,000	Yes, but only to provide linkages between adjacent LUDs for vital transportation needs	0.0
Wild River	129,650	No, except ANILCA Access	2.8
Scenic River	36,460	Yes, but must be compatible with Scenic River classification	1.1
Recreational River	36,470	Yes, but must be compatible with Recreational River classification	10.0
Experimental Forest	17,260	Yes	0.0
Scenic Viewshed	496,613	Yes	104.8
Modified Landscape	622,387	Yes	175.7
Timber production	2,580,821	Yes	632.7
Minerals[1/]	166,215	Yes	
Non-National Forest			115.0
Total ML 3, 4, or 5 Road Miles[2/]			1,208.1

[1/] The Mineral LUD is applied to the same area as other LUD designations. Consequently, no road miles were accounted for under this LUD.
[2/] In some locations, more than one LUD may be applied to the same area. Consequently, total area is not calculated.
ANILCA – Alaska National Interest Lands Conservation Act

STEP 1 - SETTING UP THE ANALYSIS

Purpose of Analysis

The main purpose of this analysis is to provide road management information to support Forest-wide road management decisions, and to provide long-term road management direction for the Forest relative to the ML 3, 4, and 5 road system.

Objectives of Analysis

This roads analysis is being conducted at the Forest-scale for the Tongass National Forest. The specific objectives of the analysis include the following:

- Identify the appropriate long-term road system for ML 3, 4, and 5 roads;
- Utilize TLMP and other Forest-wide decision documents for guidance;
- Optimize Alaska Marine Highway and recreation access;
- Meet community needs for connectivity and subsistence uses;
- Identify appropriate road upgrading opportunities leading to incorporation in State Highway System or operated as system public roads; and
- Identify opportunities to reduce management costs.

Typical ML 3 arterial road surfaced with aggregate.

Table 2. Interdisciplinary Team Members.

Name	Responsibility
Alan Olson	IDT Leader/Aquatic/Riparian/Geology
Walt Weaver	Road Engineering
John Ostendorff	Forestry/Road Engineering
Steve Negri	Wildlife
Mike Hall	Wetlands/Wildlife
Matt Dadswell	Socioeconomics/Recreation

Information Sources

This analysis is based on existing information, including:

- Tongass Land Management Plan (1997);
- Geographic Information System (GIS) data;
- Infrastructure Application (INFRA) data on road dispositions and management objectives;
- Road Condition Survey data;
- Maintenance plan and budgeting information;
- Recreation master planning documents;
- Forest Service manuals and handbooks outlining requirements of the Roads Analysis process (FSM-7710, Misc. Report FS 643);
- Input and other information previously gathered from the public through collaborative stewardship efforts;
- Existing decision documents (Environmental Impact Statement [EISs] and Environmental Assessments [EAs]);
- Existing Road Analyses conducted at smaller scales; and
- Draft SEIS on Roadless Area Evaluation and appendices addressing values and projects, including roads under consideration in roadless areas.

Plan for Analysis

The general tasks required for this roads analysis include the following:

- Collect and review existing data, surveys, and reports;
- Identify issues and alternatives;

- Conduct analysis of issues and identify road-related resource effects;
- Identify management opportunities; and
- Develop final report.

Step 2 – DESCRIBING THE SITUATION

This section includes a summary of the commonly used terms and definitions in this report, a description of the TLMP guidance for the Forest, a description of the existing road system, and a description of road management in the Forest. Maps of the Forest showing the road system are presented in Figure 2 through Figure 12. A summary of road length by ranger district and maintenance level is presented in Table 3.

Terms and Definitions

The following commonly used terms are found throughout this report and are defined below.

Road: As used in this document, a road is a motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary.

Classified Roads: Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access, such as State roads, County roads, privately-owned roads, National Forest System roads, and roads authorized by the Forest Service that are intended for long-term use.

Public road: A road open to public travel under the jurisdiction of and maintained by a public authority, such as states, counties, and local communities.

Private road: A road under private ownership authorized by an easement to a private party, or a road that provides access pursuant to a reserved or private right.

National Forest System Road: A classified forest road under jurisdiction of the Forest System. The term "National Forest System road" is synonymous with the term "Forest development road," as used in 23 U.S.C. 205.

Unclassified Roads: Roads on National Forest System lands that are not needed for, and not managed as part of, the forest transportation system, such as unplanned roads, abandoned travelways, off-road vehicle tracks that have not been designated and managed as a trail, and those roads no longer under permit or authorization.

Temporary road: Roads authorized by contract, permit, lease, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management.

Maintenance Levels:

- Level 1 – Closed more than 1 year
- Level 2 – High-clearance vehicles

- ♦ Level 3 – Passenger vehicles; surface not smooth
- ♦ Level 4 – Passenger vehicles; surface smooth
- ♦ Level 5 – Passenger vehicles; dust free; possibly paved

The Forest assigns roads both an operational and objective maintenance level. Operational levels represent the current status of the road. The objective level represents the intention to upgrade or downgrade the road at a future time.

Traffic Service Levels:

- ♦ A: Free flowing, mixed traffic; stable; smooth surface; provides safe service to all traffic
- ♦ B: Congested during heavy traffic, slower speeds, and periodic dust; accommodates any legal-size load or vehicle
- ♦ C: Interrupted traffic flow; limited passing facilities; may not accommodate some vehicles; low design speeds; unstable surface under certain traffic or weather
- ♦ D: Traffic flow is slow and may be blocked by management activities; two-way traffic is difficult; backing may be required; rough and irregular surface; accommodates high clearance vehicles; single purpose facility

Further detail regarding MLs and traffic service levels (TSLs) may be found in Appendix B and C, respectively.

Marine Access Points (MAPs): MAPs are shoreline locations where the public commonly accesses the Forest. Many MAPs were, or are, log transfer facilities when timber harvest activities occur in the area and are associated with a local road system. Some MAPs may not have any associated structures, but they still receive regular public use.

Table 3. Maintenance Level 3, 4, and 5 (Operational) Road Miles in the Tongass National Forest.

Administering Ranger District	Maintenance Level			Total
	3	4	5	
Admiralty National Monument	14.3	0.0	0.0	14.3
Craig	75.0	0.0	0.0	75.0
Hoonah	113.1	0.0	0.0	113.1
Juneau	15.8	2.2	0.4	18.4
Petersburg	347.5	0.0	0.1	347.6
Sitka	42.6	4.1	0.0	46.7
Thorne Bay	410.8	8.3	0.0	419.1
Wrangell	157.8	0.0	0.0	157.8
Yakutat	13.3	0.0	0.0	13.3
Ketchikan	0.8	2.0	0.0	2.8
Grand Total	1,191.0	16.6	0.5	1,208.1

Land Management Plan Guidance

The 1997 TLMP assigned management prescriptions to 18 different LUDs, which included the goals, objectives, and desired conditions within each LUD. The transportation standards and guidelines for each LUD are summarized below.

Wilderness: New roads are not permitted, except to access surrounding state and private land and valid mining claims or for access authorized under the Alaska National Interest Lands Conservation Act (ANILCA). Existing roads are to be closed unless authorized under ANILCA.

Wilderness National Monument: New roads are not permitted, except to access surrounding state and private land and valid mining claims or for access authorized under ANILCA. Existing roads are to be closed to public use unless authorized under ANILCA.

Nonwilderness National Monument: New roads are not permitted, except to access surrounding state and private land and valid mining claims or for access authorized under ANILCA. Existing roads are to be closed to public use unless authorized under ANILCA.

Remote Recreation: New Roads are not permitted except to access valid mining claims. Existing roads are to be closed to public use unless authorized under ANILCA.

Research Natural Area: Unless otherwise provided by law, roads are not permitted unless they contribute to the objectives or protection of the area.

LUD II: Existing roads are generally closed to highway vehicular use. Proposed roads should provide vital Forest transportation system linkage, or should serve authorized activities, such as mining, power, and water developments; aquaculture developments; or transportation needs determined by the State of Alaska.

Wild River: New Roads are not permitted, except to access valid mining claims and for transportation corridors authorized under ANILCA. Existing roads are to be closed to public use unless authorized under ANILCA.

Scenic River: Roads are allowed that provide access to the river, but must be compatible with the Scenic River classification. Roads should usually be built to Traffic Service Levels C or D.

Experimental Forest: Roads allowed as needed to accomplish the experimental forest objectives or to access other LUDs.

Minerals: The mineral LUD is generally applied on areas in conjunction with another LUD. Roads are allowed, but must be consistent with other resource values, to allow for the exploration and development of mineral resources.

Modified Landscape: Develop and manage cost-effective transportation systems, give special consideration to minimizing apparent landform modification, give special emphasis to fish and wildlife habitat values, and provide recreation access where appropriate.

Enacted Municipal Watershed: Allow roads needed for the routine operation, maintenance, and improvement of the municipal water system and watershed, or if consistent with legislation, establishing the watershed.

Old-Growth Habitat: New road construction is generally inconsistent with this LUD, but new roads may be constructed if no feasible alternative is available. Manage the existing roads to the Old-Growth Habitat objectives.

Special Interest Area: Provide and manage a transportation system compatible with, or which will improve the interpretation of, the unique values of the Special Interest Area. Access to valid mining claims is permitted.

Semi-Remote Recreation: Existing low standard roads are generally managed for use by high clearance or off-highway vehicles. Generally, new roads are not constructed in this area, except to link existing roads or provide access to adjacent LUDs.

Scenic Viewshed: Develop and manage cost-effective transportation systems that integrate resource requirements consistent with LUD direction. Give special consideration to minimizing apparent landform modification, and give special emphasis to maintaining fish and wildlife habitat values. Provide recreation access where appropriate.

Timber Production: Develop and manage cost-effective transportation systems that integrate resource requirements consistent with LUD direction. Consider future recreational access in location and design of roads.

Recreation River: Allow the construction of roads. The river may be readily accessible by road. Roads may parallel the riverbank and be conspicuous in places when viewed from the river.

The Forest has Standards and Guidelines for 22 Resource Areas, including:

- Air
- Beach and Estuary Fringe
- Facilities
- Fire
- Fish
- Forest Health
- Heritage Resources
- Karst and Caves
- Lands
- Minerals and Geology
- Recreation and Tourism
- Riparian
- Rural Community Assistance
- Scenery
- Soil and Water
- Subsistence
- Threatened, Endangered, and Sensitive Species
- Timber
- Trails
- Transportation
- Wetlands
- Wildlife

Many of these Resource Areas have specific guidance related to the transportation system. Forest-wide transportation standards and guidelines, as well as standards and guidelines for each LUD, are located in TLMP.

Generally, most NFS ML 2, 3, 4, and 5 roads on the Forest are considered open for public use. At times, during active log haul, for example, some roads may be closed to public traffic for safety reasons, but these occurrences are occasional and infrequent. All roads are continuously open to non-motorized and foot traffic.

The Standards and Guidelines for recreation in TLMP designate the entire Forest open to off-highway vehicle (OHV) use, unless designated closed in site-specific locations. Because the local terrain and dense vegetation often limit off-road vehicle use, typical OHVs, such as motorcycles, three and four wheelers, and all-terrain vehicles (ATVs), use forest roads (including the ML 3, 4, and 5 road system) for recreation and travel purposes. However, some effects of the OHV use in the Forest is being observed in some locations (see Roaded and Unroaded Recreation in Step 4).

Existing Road System Description

Because of the abundant waterways in Southeastern Alaska and vast areas of undeveloped land, travel by air and water continues to be the primary methods of travel between islands in the region. Historically, marine transportation has been the major method of moving commodities and passengers. During the last three decades, air services have satisfied the growing need for rapid transportation between communities and connections to the contiguous United States and Canada. An extensive roaded transportation system has evolved on the Tongass. Originally built for management of the timber resource, many of these roads have been converted to public use roads, state highways, and forest highways, which is decreasing the demand for air services and increasing demand for ferry transportation between islands.

The approximate 5,000-mile road system is diverse and vital for public use and resource management. The primary use of Forest roads in Southeast Alaska is to provide basic transportation. Most of the roads "out of town" started out as logging roads and were either taken over by the State of Alaska and improved to meet general transportation standards or improved by the Forest Service and remain forest roads. As communities have spread and new communities have developed, the forest roads have often become "main highways" (wide, single-lane, gravel roads). The objective is to work with members of the public to meet their access needs by providing a road system that is safe, stable, and affordable with minimal impact.

The need for Sitka Spruce for aircraft construction during WWII was an early commercial timber use in Southeast Alaska. After WWII, the advent of 50-year timber sale contracts for pulp and paper production resulted in timber harvesting and associated load building in localized areas of the Forest. Increased visitation and scenic viewing from passing ferries and ships dictated the development of more inland routes.

Although constructed to access timber resources, roads are useful for recreation, hunting, and subsistence use by residents. Driving for pleasure is a popular outdoor recreation activity for Southeast Alaska residents. Approximately 76 percent of the entire road system (all MLs) remains open to motorized vehicles and are maintained for multiple use. Over 1,000 miles of the road system connect communities with other communities directly or by access to the Alaska Marine Highway System. Only three communities, including Haines, Skagway, and Hyder, are connected to other parts of the mainland. There are proposals for building roads to connect communities within

Southeast Alaska and to connect Alaska with other cities in Canada (Alaska DOT & PF 1999).

The ML 3, 4, and 5 road system is essentially single lane. The roads and bridges are designed for off-highway loads. Collector and Local roads are approximately 14-feet wide with rough aggregate surfacing. Arterial roads are wide (16-feet), single-lane roads with smoother aggregate surfacing and designed for 30 mile per hour (mph) speeds. Approximately 18 percent (219.5 miles) of ML 3, 4, and 5 roads are surfaced in some manner, including aggregate, asphaltic concrete, bituminous surface treatment, native surfacing, and pavement. The majority of roads do not have a surfacing and are constructed with pit-run crushed rock, but they may have occasional improvements with the use of aggregates.

Fish habitat protection is a primary concern of forest managers because of the high potential of adverse effects from roads and the high importance of the resource to the commercial, recreational, and subsistence fishing stakeholders, and to the public in general. Current Best Management Practices (BMPs) direct that bridges be designed to accommodate a 50 to 75-year storm, and culverts at Class I, II, or III streams for at least a 50-year storm (FSH 2509.22, BMP 14.17). However, new stream crossings are usually designed to accommodate a 100-year storm using stream simulation methods. Designated wetlands are avoided whenever possible.

Whenever a forest road provides a connection between communities and serves local needs such as mail delivery or a school bus route, it can be designated a Forest Highway. Forest Highways are usually upgraded to State highway standards, and jurisdiction may be given to the State. Currently, the State has operation and maintenance responsibility for 181 miles, or about half of the total Forest Highway road miles.

Primary Road functions

Most roads in the Tongass were originally constructed to access areas for timber harvest. However, roads currently have a variety of functions and individual roads may serve multiple functions. The IDT identified the following seven primary functions for roads in the Tongass:

Mainline (Arterial): Roads essential for maintaining access to a roaded portion of the forest. These roads are the main timber haul and commodity routes within the area served, but not community connectors.

Marine Access: Roads associated with state routes leading to and from an Alaska Marine Highway terminal, and roads leading to a Marine Access Point (formerly known as Log Transfer Facilities) with recreation or other public interest.

Community Connectivity: Roads not designated as state routes, regularly used to connect communities, and frequently used for commodities in and out of the forest, but not otherwise defined as “mainline.”

Subsistence – Dispersed Recreation: Forest roads that may have been built for other purposes, but provide general access to areas frequented by subsistence and recreational hunters, anglers, etc. Locals may use these roads simply for driving pleasure.

Administration and Destination Recreation: Access and parking for significant campgrounds, points of interest, and other popular tourist destinations.

Timber Access: Roads built for timber access, not meeting any of the other definitions.

Easement (Special Use, etc.): Roads serving other interests whose access rights are maintained by permit or easement.

Area Road Descriptions

This section of the report briefly describes the ML 3, 4, and 5 road system present on the Tongass. An inventory of roads on the Forest is located in Appendix C. The road system descriptions are grouped primarily by ranger district, but some systems are also grouped according to the island or area in which they occur. These groupings are primarily to provide geographic context for discussion purposes.

Yakutat Ranger District

Yakutat

The Forest road system on the Yakutat Ranger District is located on the mainland. It includes 13.4 miles of ML 3 roads (Figure 2). These roads are accessed via state and city roads, which link the Forest road system to the City of Yakutat, the MAP, and the airport. These roads are primarily used for subsistence and recreation by local residents. Sport fishing by non-residents results in a significant increase in road use between August and October.

Juneau Ranger District

The Forest road system on the Juneau Ranger District is located primarily on the mainland. It includes roads near Berners Bay, Juneau, Homeshore, and Hobart Bay (Figures 3a and 3b). Berners Bay and the Juneau area contain 18.4 miles of ML 3, 4, and 5 roads (Table 3 and 1 MAP [Homeshore]).

Berners Bay

There are two ML 3 roads located on Berners Bay that were constructed for mine access. The Kensington Mine is not active, but the road receives occasional mine-related use.

Juneau Area

The Jualin Mine is no longer active, but the associated access road receives occasional use by hikers and bikers. Other ML 3, 4, and 5 roads closer to Juneau are heavily used for recreation by residents and tourists. These include the driveway and parking lot near the Mendenhall Glacier.

Admiralty National Monument

The Forest road system on Admiralty National Monument is located on Admiralty Island. It includes two ML 3 roads totaling 14.3 miles (Figure 4).

Greens Creek Mine

The Greens Creek Mine Road on the north shore of the Island provides access to the Greens Creek Mine. This road receives little other use.

Angoon Work Center

An ML 3 road provides access to the Angoon Work Center, and it does not serve other functions.

Hoonah Ranger District

The Forest road system on the Hoonah Ranger District is located on Chicagof Island (Figure 5). It includes 113.1 miles of ML 3 roads and 6 MAPs.

Hoonah

A fairly extensive network of ML 3 roads connects Hoonah with MAPs at Whitestone Harbor, False Bay, and Freshwater Bay. These roads are primarily used for subsistence and recreation by residents of Hoonah and the Whitestone Logging Camp, although some Juneau recreationists use the roads to hunt in the Fall. Outfitter/guide use is increasing. The majority of recreation on the Hoonah District occurs on these road systems. These roads are also used for timber management.

Eight Fathom Bight

ML 3 roads connect the MAP in West Port Frederick with the interior of the island. This road system is used primarily for subsistence hunting. The roads are also being kept in the system to maintain future logging options.

Salt Lake Bay

Two ML 3 roads extend southeast and west from the MAP in Salt Lake Bay. These roads are used primarily for subsistence hunting; these roads are also being kept in the system to maintain future logging options.

Sitka Ranger District

The Forest road system on the Sitka Ranger District is located on Chichagof and Baranof Islands (Figure 6). It includes 46.7 miles of ML 3 and 4 roads (Table 3) and 25 MAPs.

Corner Bay

Most use of the road system extending southeast from Corner Bay on Chichagof Island is for timber or silvicultural management and other administrative purposes. These roads also receive some subsistence and recreation use. Most public use of the Corner Bay system comes from Tenakee Springs.

False Island/Chatham

The ML 3 roads in this road system connect MAPs in Sitkoh Bay and Peril Strait on Chichagof Island and also access the interior of the Peninsula. Currently, recreation and subsistence are the most common uses of these roads, but ongoing access for timber and silvicultural management by the Forest Service is also an important function of the road system. There is a new lodge at the False Island MAP, and there is also frequent administrative use of the False Island road system to access a Forest Service field camp. The majority of vehicles used are ATVs, although some pickup trucks are also used. Most users come from Sitka.

Sitka

Two short lengths of ML 3 and ML 4 road adjacent to Sitka on Baranof Island lead to Harbor Mountain and the Blue Lake Campground, respectively. These roads are primarily used by Sitka residents and visitors to the area for recreation, though there is also some subsistence use.

Petersburg Ranger District

The Forest road system on the Petersburg Ranger District is located on Mitkof, Kupreanof, Kuiu Islands (Figure 7). There is also a small road system at Thomas Bay on the mainland. It includes 347.5 miles of ML 3 roads and 0.1 mile of ML 5 road and 8 MAPs.

Kuiu Island

An extensive road system links MAPs at Saginaw Bay and Rowan Bay with Port Camden and the Bay of Pillars. These roads are used for timber management, as well as a considerable amount of recreation and subsistence use. Between 1985 and 1994, more black bears were harvested from the northern (roaded) portion of the island than from anywhere else on the Tongass National Forest. Data indicates that this was primarily recreational hunting.

Kake

Several ML 3 roads link the community of Kake, which includes a ferry terminal, to the interior of Kupreanof Island. The road system also accesses the MAP at Hamilton Bay. The road system is used for timber management, subsistence, and recreation. Most road-based subsistence and recreation users on Kupreanof Island come from Kake. Some local residents have proposed connecting Kake with Petersburg via the Portage Bay roads.

Portage Bay

Several ML 3 roads link the MAP at Portage Bay with the area on both sides of the Bay. The road system is used primarily for timber harvest, but it also receives occasional subsistence and recreation use.

Tonka

ML 3 roads link the east and west sides of the Lindenberg Peninsula with the MAP at Tonka on the Wrangell Narrows, which can be accessed by boat from Petersburg.

While the primary use of these roads is for timber harvest, they are also used for subsistence hunting.

Mitkof Island

Mitkof Island contains an extensive network of ML 3 roads that link MAPs at Blind Slough and Woodpecker Cove with non-Forest roads near Petersburg. The road system is used by residents and tourists for recreation and subsistence. Winter recreation use by the people of Petersburg is an important use.

Thomas Bay

Three ML 3 roads extend south from the MAP at Thomas Bay. Similar to most NFS roads in Southeast Alaska, these roads were originally constructed for timber management; however, for the last 20 years, these roads have been primarily used for recreation and moose hunting.

Wrangell Ranger District

The Forest road system on the Wrangell Ranger District is located on Zarembo, Wrangell, and Elotin Islands (Figure 8). It includes 157.8 miles of ML 3 roads and 10 MAPs.

Zarembo Island

ML 3 roads link the interior and southern coast of Zarembo Island with MAPs at Roosevelt/Deep Bay in the east and St. Johns in the west. Most use of the road system on Zarembo Island is for subsistence, recreation, and timber management. The Roosevelt and St. Johns MAPs are used heavily for subsistence hunting access by residents of Wrangell and, to a lesser extent, Petersburg.

Wrangell Island

Wrangell Island contains an extensive network of ML 3 roads that link MAPs at Earl West Cove on the east side of the island and Pat's Creek on the west with non-Forest roads near the City of Wrangell. The road system also extends to the southern part of the island. The ML 3 road system is used for subsistence and recreation, although the road system may be used for timber management on proposed sales. A loop road is being considered for this area. The heaviest recreation use on the district occurs on the Nemo Loop. Several developed recreation sites occur along this loop, as well as a trail with saltwater access. The loop is popular with residents interested in driving for pleasure. The Southeast Alaska Transportation Plan includes a proposal for a fast ferry terminal at the head of Fools Inlet in the southern part of the island.

Etolin Island

This road system extends from two MAPs on Anita Bay to the western portion of the island. The road system receives some use from subsistence hunters who transport ATVs from Wrangell. A new road system, King George, and MAP have recently been constructed on the island, but they have not yet been added to the GIS layers and INFRA database used in this analysis.

Thorne Bay Ranger District

The Forest road system on the Thorne Bay Ranger District is located on the northern half of Prince of Wales Island (Figure 9). It is the most extensive road system on the Forest and includes 419.1 miles of ML 3 and 4 roads (Table 3) and 14 MAPs. The road system, together with non-Forest roads, link most of the communities on the north half of the island, as well as Klawock and Craig; however, they do not connect with the communities of Port Baker and Port Protection.

An extensive network of ML 3 roads extends throughout the Thorne Bay RD. In addition, a section of ML 4 road extends the State-owned Thorne Bay Road to Naukati Bay, connecting communities in the northern portion of the island with those further south. Forest roads connect most communities on the island with the ferry terminal at Hollis (Craig Ranger District). In addition to the Alaska Marine Highway System, daily service is also provided between Ketchikan and Hollis by the Inter-Island Ferry Authority. A proposed ferry terminal is under consideration at Coffman.

The majority of use on most roads is recreation and subsistence, with some timber management. There are a number of timber sales presently under contract on the Thorne Bay Ranger District that would be accessed via the existing road system. Most people using the road system are residents of the island, but there is a growing component of users from outside the area. The island is especially attractive to visitors because it has an extensive transportation system accessing many recreation areas and because it has regular ferry access.

Craig Ranger District

The Forest road system on the Craig Ranger District is located in the central portion of Prince of Wales Island (Figure 10). It includes 75.0 miles of ML 3 roads and 6 MAPs. The Forest road system connects with the non-Forest road system linking Craig, Klawock, Hollis, and Hydaburg. The ML 3 roads are primarily used for subsistence and recreation by island residents, but the number of out-of-area users is growing steadily. Hunters bring their pickup trucks and ATVs to the island from Ketchikan. Polk Inlet and Twelvemile Arm, both of which were heavily used logging camps less than a decade ago, are now destinations for recreation.

Ketchikan-Misty Fiords Ranger District

Revillagigedo Island

The Forest road system on the Ketchikan-Misty Fiords Ranger District is located on Revillagigedo Island (Figure 11) and on the mainland (Figure 12). It includes 2.8 miles of ML 3 and 4 roads (Table 3) and 10 MAPs, all of which are on Revillagigedo Island. There are no ML 3, 4, or 5 roads on the mainland. The ML 3 and 4 roads are located on the south side of Revilla Road. A short section of a ML 3 road near White River links two sections of non-Forest Service roads. The majority of the roads in the Ketchikan-Misty Fiords Ranger District are ML 1 and ML 2 NSF roads, while the majority of roads accessible from Ketchikan are non-Forest Service roads.

Road Maintenance

Road maintenance costs for the Forest are categorized as annual, deferred, and capital improvement. Within each of these categories, costs are further categorized as critical or noncritical and related to either the Forest Service mission, health and safety, or resource protection. These terms are defined by the Department of Interior's Deferred Maintenance Working Group in "Financial Health - Common Definitions for Maintenance and Construction Terms" (USDI 1998).

> **Annual Maintenance**. Work performed to maintain serviceability, or to repair failures during the year in which they occur. Includes preventive and/or cyclic maintenance performed in the year in which it is scheduled to occur.
>
> **Deferred Maintenance**. Maintenance that was not performed when it should have been or when it was scheduled and which was, therefore, put off or delayed for a future period. When allowed to accumulate without limits or consideration of useful life, deferred maintenance leads to deterioration of performance, an increase in the costs to repair, and a decrease in asset value.
>
> **Capital Improvement**. The construction, installation, or assembly of a new fixed asset, or the significant alteration, expansion, or extension of an existing fixed asset to accommodate a change of purpose.
>
> **Critical Need**. A requirement that addresses a serious threat to public health or safety, a natural resource, or the ability to carry out the mission of the organization.
>
> **Noncritical Need**. A requirement that addresses potential risk to public or employee safety or health, compliance with codes, standards, regulations etc., or needs that address potential adverse consequences to natural resources or mission accomplishment.
>
> **Mission Need**. A requirement that addresses a threat or risk to carrying out the mission of the organization. Needs related to administration and providing services (transportation, recreation, grazing, etc.). Needs not covered by health and safety or natural resource protection.
>
> **Resource Protection Need**. A requirement that addresses a threat or risk of damage, obstruction, or negative impact to a natural resource.
>
> **Health and Safety Need**. A requirement that addresses a threat to human safety and health (e.g., violations of National Fire Protection Association 101 Life Safety Code or appropriate Health Code) that requires immediate interim abatement and/or long-term permanent abatement.

Deferred and capital improvement costs will be discussed in more detail during Step 5 of this analysis. Annual maintenance costs for ML 3, 4, and 5 roads consist of four main cost categories, including drainage, signs and traffic control, vegetation, surface/roadway, and road condition survey activities. Drainage-related activities include cleaning of drainage ditches and culverts. Signs and traffic control activities primarily include replacement of vandalized and deteriorated signage.

Vegetation-related activities include dry seeding and brushing on a 3- or 4-year cycle, depending on whether the road is considered a local, arterial and collector, or paved road. Surface/roadway costs include base course replacement, blading, and repairing paved surfaces, depending on the type of ML 3, 4, or 5 road.

Base maintenance costs for NFS roads on the Tongass are presented in Table 4. These base costs are adjusted by a locality factor and a use factor to obtain maintenance costs for specific roads. The locality factor accounts for increased costs due to items such as availability of equipment and mobilization. The use factor accounts for differences in maintenance needs based on the amount and type of use on a given road.

The total annual maintenance costs for NFS roads on the Tongass were $11.9 million for 2001 (Table 5). ML 3, 4, and 5 roads accounted for $8.6 million or 73 percent of this total. ML 3 roads alone accounting for 69 percent of the total. Noncritical maintenance costs comprised 87 percent of total maintenance costs for ML 3, 4, and 5 roads in 2001, with the non-critical Forest Service mission category alone accounting for 72 percent of the total.

Table 4. Base Annual Maintenance Costs.

Maintenance Level[/1]	Base Cost ($/Mile)[/2]
1	169
2	806
3	1,138
3+ Arterials and Collectors	2,051

[1/] The difference between a ML 3 Local and a ML 3+ Arterial and Collector is determined by the type of surfacing and the way the road is managed.
[2/] These costs exclude the costs for base course replacement and surface rock replacement.

Table 5. Tongass National Forest Annual Maintenance Report, 2001.

	Critical Costs ($)				Non-critical Costs ($)				
ML	Mission	Health & Safety	Resource Protection	Critical Subtotal	Mission	Health & Safety	Resource Protection	Non Critical Subtotal	Total
1		1,260	34,071	35,330	229,683		26,054	255,737	291,068
2		3,032	465,765	468,797	1,972,200		484,473	2,456,672	2,925,470
3		106,149	969,172	1,075,321	5,908,141	7,150	1,204,298	7,119,589	8,194,910
4		5,873	73,584	79,457	321,238	270	44,567	366,075	445,532
5		136	678	813	4,119		733	4,852	5,665
Subtotal ML 3, 4, and 5		112,158	1,043,433	1,155,591	6,233,498	7,420	1,249,598	7,490,516	8,646,107
Total		116,450	1,543,269	1,659,719	8,435,381	7,420	1,760,125	10,202,925	11,862,644
Percent ML 3, 4, and 5 w/in Category		96%	68%	70%	74%	100%	71%	73%	73%
Percent ML 3, 4, and 5 of ML 3, 4, and 5 Total		1.3%	12.1%	13.4%	72.1%	0.1%	14.5%	86.6%	100.0%

Pages 25 through 39 include the following map inserts:

STEP 3 – IDENTIFYING ISSUES

Public Involvement

Substantial public involvement has occurred in recent years regarding roads. Public involvement was conducted for the 1997 revision of TLMP and the 2002 Road Rule. More recently, public involvement was conducted for the draft SEIS for the Forest Plan related to roadless area evaluations and wilderness recommendations. Public involvement has also occurred for numerous project-level decisions that included some aspect of road management. Because of the ample public involvement for these decisions, it was determined that no additional public involvement would be necessary to identify key issues for this roads analysis.

Key Issues

Interdisciplinary team members reviewed TLMP, the draft SEIS, and project-level NEPA documents and analyses completed since 1997 to identify road-related issues. The following road-related issues were identified in these documents:

- The effect of roads on communities (some favored new roads to connect communities, while others did not want improved access).
- The effect of roads on subsistence (improved access was considered a benefit to some and a detriment to others).
- The need for roads to maintain an economic timber program to support the local economy.
- The effect of roads on fish (fish passage and water quality).
- The effect of roads on recreation and tourism (some favored access for roaded recreation, while others favored maintaining areas for undeveloped recreation).
- The effect of roads on wildlife (improved access may cause some populations to decline due to increased hunting, both legal and illegal).
- The effect of new roads on unroaded areas and roadless values.

The interdisciplinary team discussed potential road-related issues during a meeting on August 12, 2002. Specialists subsequently refined the issues related to their resource area. These draft issues were modified based on comments from Forest staff. The order of the presentation of the issues does not reflect any priority for the importance of the issue to the public, Forest Service, or the IDT.

Issue: How does the existing ML 3, 4, and 5 portion of the road system affect the social and economic well being of the communities of Southeast Alaska? How should this portion of the road system be managed to provide for the social and economic well being of these communities? How should this portion of the road system be managed to meet State and Tribal needs? How should this portion of the road system be managed to provide public access to the National Forest?

The road system in Southeast Alaska evolved almost entirely to access timber management sites. Today, some of the Forest roads linking communities have been upgraded and incorporated into the State Highway System. In some areas, such as Prince of Wales Island, transportation networks have been developed between marine access points and existing communities.

The existing road system provides access for timber management, mining, and recreation and tourism activities, which together accounted for approximately 14 percent of total employment in Southeast Alaska in 2001. The marine waters are a major component of the transportation infrastructure. The road system provides access to marine access points and connects some communities with one another. The majority of residents in some communities favor being connected to other communities and transportation systems, while the majority of residents in other communities are against additional roads or marine access points and do not want to be connected to other communities or transportation systems.

Issue: How does the existing ML 3, 4, and 5 portion of the road system affect recreation and tourism, including scenic values? How should this portion of the road system be managed to provide for recreation and tourism, including scenic values?

Outdoor recreation opportunities offered by the Tongass National Forest play an important role in the quality of life for most Southeast Alaska residents. The recreation and tourism industry in Southeast Alaska has grown significantly over the past decade, with visitor-related employment accounting for approximately 11 percent of Southeast Alaska employment in 1999.

Some organizations and individuals believe that there is a need for more roaded recreation opportunities, including access from the marine waters transportation system for tourists. Interest has been expressed in road development at existing marine access points to provide greater access for visitors traveling via the Alaska Marine Highway or by cruise ship. Others believe that roadless areas should remain unroaded. Many families have favorite places where they fish, hunt, beachcomb, hike, or just go to get away. Many value the unique recreation experience offered by the lack of roads and necessity for boat access.

Issue: How does the ML 3, 4, and 5 portion of the existing road system affect the opportunity for subsistence uses by rural residents of Alaska? How should the road system be managed to continue to provide subsistence opportunities?

For many rural Alaskans, subsistence hunting, fishing, trapping, and gathering natural resources provides needed food and supplements rural incomes. Subsistence is also viewed by many, especially Southeast Alaska's Native Americans, as a lifestyle that preserves cultural customs and traditions, reflecting deeply held attitudes, values, and beliefs. Subsistence use varies greatly across the Forest, depending on proximity to subsistence users and the quality of subsistence resources in an area.

Under ANILCA, the Forest Service is required to maintain reasonable access to National Forest System lands for rural residents who depend upon subsistence. Increased road access can result in greater opportunities for subsistence hunting, but it may also lead to greater competition and decreases in the populations of the species on which rural residents depend.

Issue: What are the jurisdictional problems and solutions associated with the ML 3, 4, and 5 portion of the road system?

Approximately 115 miles of ML 3, 4, and 5 roads have been identified as "non-National Forest." In addition, some roads are in an interim "Forest Highway" status, these are roads that may be suitable to become State Highways. The jurisdiction of roads needs to be determined. Some roads are no longer needed for the purposes for which they were constructed. These roads need to be identified.

Issue: Is sufficient funding available to operate the ML 3, 4, and 5 portion of the Forest Road System as a "public road" system?

ML 3, 4, and 5 roads must be safe, properly signed, and maintained for sedan use. Is funding available to properly maintain these roads? Can the maintenance backlog be eliminated?

Issue: How do existing ML 3, 4, and 5 roads affect wildlife populations, including populations of Threatened, Endangered, or Sensitive (TES) species? How can this portion of the road system be managed to better protect wildlife resources?

Existing road use may have direct, indirect, or cumulative effects on wildlife. Direct effects are primarily a concern for large mammals and can include vehicle collisions, increased hunting or poaching, or disturbance during critical life stages (e.g., fawning periods for deer, late-summer feeding periods for bear). Indirect effects include habitat fragmentation, as well as habitat loss secondary to activities that are facilitated by vehicular access (e.g., timber harvest, mining, residential development). Cumulative effects include the extent to which ML 3, 4, and 5 roads allow access to areas served by ML 1 and 2 roads. Such effects are of less immediate concern in the Tongass, where localized habitat degradation may be offset by the widespread availability of unroaded habitat.

Issue: How do the ML 3, 4, and 5 roads affect fish habitat and water quality? How can this portion of the road system be managed to ensure fish passage and better protect fish habitat and water quality?

Freshwater and anadromous fish, and fish habitat, are important to the public, sport and subsistence fishermen, and commercial fishing interests. Roads have the potential to adversely affect fish populations by creating passage barriers and reducing habitat quality through sedimentation, loss of riparian function, and reduced water quality. In order to protect fish populations and habitat, maintenance of roads at stream crossings and in areas of high erosion potential is an important factor affecting maintenance budgets and backlog.

STEP 4 – ASSESSING BENEFITS, PROBLEMS, AND RISKS

This section reports the results of the interdisciplinary evaluation of the major uses and effects of the ML 3, 4, and 5 road system. It addresses the various benefits, problems, and risks of the road system and whether the objectives of the road system are being met. These benefits, problems, and risks were identified through an IDT process that included answering questions in Forest Service publication FS-643, interviews with Forest Service staff, and IDT meetings to discuss these answers. Complete answers to these questions are presented in Appendix E of this Roads Analysis. A synthesis of the major findings of this IDT process is presented below.

Ecosystem Function

The ML 3, 4, and 5 road system provides some problems and risks to the ecosystem function in the Tongass. In general, these problems and risks are not severe and Forest plan standards and guidelines provide a high level of protection. Also, the Tongass is a relatively pristine area exhibiting a healthy ecosystem function. Roads are a primary indicator of human disturbance because they are the focus of initial interaction between humans and the forest. ML 3, 4, and 5 roads, and associated MAPs, are the principle means by which humans access the forest. However, human disturbance in the form of urbanization at the Forest edge, including hunting, fishing, recreation, timber harvest, mining, and other activities, occurs on a relatively small portion of Southeast Alaska. Over half the Forest's area is in LUDs where roads are prohibited or strongly discouraged.

The Tongass National Forest includes several contiguous roadless areas that exceed one million acres and represent large, unfragmented blocks of undeveloped land and waterways. However, the dominant forested ecosystem in the region is naturally fragmented by freshwater and marine waterways, muskegs, and mountains. Many of the Tongass roadless areas represent wildlife habitats, ecosystems, and visual character that are rare or exist nowhere else in the NFS, such as coastal islands facing the open Pacific, extensive beaches on inland saltwater, old-growth temperate rain forests, ice fields, and glaciers.

The ecosystem most at risk by resource management on the Tongass is the old-growth forest ecosystem. ML 3, 4, and 5 roads are an important factor to consider as part of the cumulative effects of human activities on the old-growth forest ecosystem. However, the level of risk should be considered well below any critical thresholds. Road construction in unroaded areas affects old-growth forests by contributing to forest fragmentation, direct removal of forest habitat, and ongoing disturbance to old-growth dependent wildlife (e.g., marten, goshawk, and marbled murrelet) because of increased access by humans. LUDs and standards and guidelines are designed to protect old-growth forest values and overall ecosystem function in the forest. Currently, the Tongass has approximately 130 miles of ML 3 road in the Old-growth Habitat LUD. Many of these roads were built prior to the development of the old-growth LUDs and are needed to provide access to other LUDs.

Natural forest disturbance in the Tongass results primarily from high winds during winter storms. ML 3, 4, and 5 roads may have a minor effect when long, straight road segments have a similar direction as the wind, which might result in a funneling effect that increases localized wind speed and the potential for blowdown.

Currently, invasive plants have not become a widespread problem on the Tongass. Several invasive species have become established in some areas, however. These species include the following:

- Japanese knotweed, in the road systems near Kake, Petersburg, and Sitka.
- Tansy ragwort on the Ketchikan and Prince of Wales Island road systems.
- Garlic mustard—a very aggressive species that can lead to major changes in understory vegetation—has appeared in the Juneau area.
- Canada thistle has appeared in the region, possibly brought in through horticultural stock
- Reed canarygrass was seeded for erosion control, and is now spreading into wetlands in the Petersburg Ranger District and into the vicinity of Twin Lakes in the Wrangell Ranger District.

The Forest is in a unique position (relative to other National Forests) to control the road-based spread of invasive plants before they become widespread. Implementation of contractual clauses designed to prevent the introduction or spread of noxious weeds by contractors and permittees would be a necessary element of any control program.

Proposals to develop additional road access from Canada may increase the risk of exotic insect species coming into the region. Some insects have already been observed (e.g., woolly aphid, spruce aphid); however, none have become established and no control efforts are underway.

Noise that results from road use is more likely to have adverse effects to wildlife on roads that connect communities, or that extend from the larger communities, because the frequency of road use is expected to be higher in these areas. Consequently, ML 3, 4, and 5 road systems with a higher risk of noise effects to wildlife include the systems on Prince of Wales Island, Wrangell Island, and Mitkof Island.

Aquatic, Riparian Zone, and Water Quality

The ML 3, 4, and 5 road system provides some problems and risks to the aquatic ecosystem, riparian zone, and water quality. The primary benefits of the road system are related to access for monitoring streams and implementing enhancement projects, such as fish passage structures at natural barriers. In general, ML 3, 4, and 5 roads are beneficial relative to ML 2 roads because of the higher standards of construction, and because levels of maintenance may result in a lower risk of adverse effects. These benefits are partially offset by the higher levels of use on ML 3, 4, and 5 roads. Problems and risks include adverse effects to fish passage, hydrology, coarse and fine sediment delivery to streams, loss of riparian function, and water quality. Many of these problems are related to inadequate culverts at road-stream crossings for older roads constructed to a lower standard than currently required.

Fish passage at road-stream crossings is perhaps the most important fish habitat issue on the Tongass that receives substantial attention by newspapers, environmental and timber industry groups, and the State legislature. Forest-wide, 715 culverts (or about 0.55 culverts per mile; 67 percent of surveyed culverts with complete assessments) are considered to have passage problems on ML 3, 4, and 5 roads. The Forest Service uses a conservative hydraulic modeling methodology when identifying fish barriers at culverts. Many culverts initially identified as having problems are secondary high flow culverts, or are at locations where little or no fish habitat is present upstream. Consequently, this rate of culvert problems is an over-estimate. Nevertheless, these results suggest that fish passage is a significant problem in the Forest. The Forest has recognized this issue and is addressing it through the development of the Road Condition Survey (RCS) database and through the implementation of a program to upgrade problem culverts. Currently, the Forest is developing a methodology for prioritizing the effort that includes an understanding of the amount of fish habitat affected by culverts with passage problems. The need for culvert upgrades is an important high priority component to road maintenance funding.

Roads can affect the hydrology of watersheds in several ways. Roads create strips of non-vegetated compacted soil across the landscape. Roads constructed through wetland areas may block or reroute flow patterns through the wetland. Precipitation that falls on road surfaces will collect in drainage systems (primarily ditches and culverts) and flow into streams and wetlands more quickly as runoff instead of infiltrating into soils. Road drainage systems can also act as an extension of the stream network, increasing the density of concentrated surface flow, which can result in changes to the natural hydrologic regime.

Running Water on Road Surface

Beginning in 1994, the Forest, in collaboration with the Alaska Department of Fish and Game and the Alaska Department of Environmental Conservation, began development of the RCS database (Flanders and Cariello 2000). The RCS database is a tremendous asset to the Forest that allows road engineers, fish biologists, and water resource specialists to monitor the environmental effects of roads and identify and prioritize road maintenance needs. Selected attributes in the database were summarized as part of this analysis. Overall, it was found that drainage structures, stream crossings, and cut and fill problems have the most potential to affect fish and water resources.

A query of the RCS database indicated that cut-slope or fill-slope erosion problems occurred more frequently than road surface erosion. Instances of surface erosion occurred on ML 3, 4, and 5 roads at a frequency of 0.16 per mile of road surveyed with an average length of road affected of 61 feet (maximum of 1,100 feet). In contrast, cut-slope or fill-slope erosion occurred at a frequency of 0.72 instances per mile of road surveyed with an average length of 98 feet (maximum 3,800 feet).

Road-stream crossings influence local stream channels and water quality by contributing coarse road fill material, fine sediment, chemical pollutants, and changes in stream hydrology. Existing roads may have road-stream crossings that were designed before current standards and may be at risk during flood events. Problems may include under-sized and too few drainage structures. Road-stream crossings can become major sources of coarse and fine sediment to stream systems if culvert failures occur during a flood event. Any time a road is built within the floodplain of a stream (e.g. at road-stream crossings), it will affect the ability of the channel to migrate, isolate portions of the floodplain, and constrict flow through that location. Stream crossings can also limit the movement of woody debris, which is an important component to fish habitat.

Location where a larger culvert is needed

A query of the RCS database indicates that road-stream crossing problems occurred at a rate of 0.29 problems per mile of the ML 3, 4, and 5, road system. The types of problems considered in this analysis included inadequate hydraulic capacity, fill slump or slide, improper culvert installation, stream in ditch, and sediment accumulation. The database also suggests that ML 3, 4, and 5 road-stream crossings at palustrine (PA) channel types have a relatively high frequency of problems. Palustrine channels have a low gradient and high retention of fine sediment, but they are often prime fish habitat in low elevation areas. Nearly a third (32.7 percent) of road-stream crossings of this channel type had a problem associated with it, often as a result of beaver activity. Moderate Gradient Mixed Control (MM) and Moderate Gradient Contained (MC) also had problem rates (14.5 percent and 14.3 percent, respectively) that were slightly higher than the Forest-wide problem rate of 13.7 percent. The highest number of ML 3, 4, and 5 road-stream crossings occurred at High Gradient Contained (HC) channel types (1,995 of 6,853 crossings), but the problems occurred at a rate (12.8 percent of that channel type) slightly lower than the Forest-wide rate. The latter three channel types are typically sources of fine and coarse sediment, which is transported to lower gradient channel types.

Sediment retention in palustrine channel type

Road-stream crossings are also locations where riparian function is lost. About 74.3 miles of Class 1 and 2 (fish-bearing) streams are within 100 feet of ML 3, 4, and 5 roads. The majority of this is at road-stream crossings. However, this represents a very small portion (approximately one-third of one percent) of the fish-bearing stream length (over 25,000 miles) in the Forest. Consequently, the risk of adverse effects is low.

The presence of exotic fish species has historically not been an important issue, but should be recognized as a risk, albeit relatively low at present. Exotic species have the potential to severely upset aquatic ecosystems in the Forest. The one known incident involves the recent introduction of northern pike to the Post Office Ponds in Yakutat, presumably human caused, from a small lake system in the Yakutat Ranger District. These lakes were previously the only known location for northern pike in Southeast Alaska. Roads, including the ML 3, 4, and 5 system, provide an efficient method to transport exotic species and introduce them to lakes and streams within the Forest.

Beaver activity affecting road drainage.

Frequently, access to areas used for recreation, hunting, or gathering in Southeast Alaska occurs through use of the NFS road system. Consequently, road derived pollutants, such as fine sediment, oil, and grease, are likely to increase and decrease in parallel with demand for access to the Forest. Areas with higher traffic levels have a higher risk of having road-derived pollutants.

Waterbodies listed as water quality limited under Section 303(d) of the Clean Water Act are categorized by the State of Alaska using a four-tier system. The highest tier, Tier 1 waterbodies, have assessments that verify that pollution is present and that controls are in-place or needed. Of the 21 Tier 1 sites, 11 were for debris in marine waters at marine access points (MAPs, formerly known as log transfer facilities), and two were related to timber harvest activities (including roads). Consequently, MAPs are one of the major transportation infrastructure issues related to water quality limited waterbodies. Roads (including the ML 3, 4, and 5 roads) appear to be a contributory factor in some watersheds with impaired waterbodies.

New road construction on the Tongass National Forest avoids wetland areas to the extent practicable. However, some older roads do cross substantial lengths of wetland. The Watershed Conservation Practices Handbook (FSH 2509.25) provides measures to protect wetlands. During project-level analyses, opportunities to reduce the effects of the road system on wetlands include the following:

- Relocate the roads out of wetland areas.
- Where relocation is not an option, use measures to restore the hydrology of the wetland. Examples include raised prisms with diffuse drainage, such as French drains.
- Set the road-stream crossing bottoms at natural levels of wet meadow surfaces.

Terrestrial Wildlife

The ML 3, 4, and 5 road system provides some problems and risks to terrestrial wildlife in the Tongass. In general, these problems and risks are not severe and Forest-wide the Tongass has relatively robust wildlife populations and habitat. However, project-level road analysis will likely identify localized problems and additional opportunities to minimize adverse effects. Relative to ML 1 and 2 roads, the ML 3, 4, and 5 roads receive more use. Consequently, the likelihood of human/wildlife interactions (including road-kills) is higher for ML 3, 4, and 5 roads.

The approximately 1,210 miles of ML 3, 4, and 5 roads on the Tongass National Forest equate to more than 2,500 acres of direct habitat loss. The effects of this loss are distributed over a vast area, however, and comprise less than 1/100 of 1 percent of the total area of the Forest. Forest habitat in the Tongass is naturally fragmented by muskegs, mountains, and waterbodies. Nevertheless, large areas of undeveloped landscape exists in the Tongass, including large blocks of temperate rainforest. The proportion of wildlife habitat that has been affected by added fragmentation due to roads is relatively small, and is offset by the availability of large blocks of undeveloped habitat throughout the Forest.

Moose and newborn calf on roadway

One possible source of concern is the amount of road that occurs in LUDs where road construction is discouraged. Approximately 130 miles (10 percent) of ML 3, 4, and 5 roads on the Forest occur in areas that have been designated as Old-Growth Reserves, where TLMP standards and guidelines allow road construction only where no other options are available. Many of these roads were built prior to these LUDs being designated, and all roads built following passage of the 1969 National Environmental Policy Act had the required environmental review prior to construction. A review of these roads in this analysis suggests that none are currently suitable for consideration for decommissioning (see Step 5). More than half of the roads in Old-Growth Reserves occur on the Thorne Bay and Petersburg Ranger Districts.

The primary concern with roads and wildlife on the Tongass National Forest is one of accessibility. A high road density allows a greater number of people into an area with fewer places for animals to hide, increasing the risk of overexploitation through hunting or trapping. Indeed, this has already occurred in few places on Prince of Wales Island, where the road system is relatively dense. An example is in the Staney Creek area where extensive logging and road system development have affected local wolf populations. Biologists with the ADF&G have documented the obliteration of wolf packs from this watershed, with subsequent recolonization from populations in an adjacent Old-Growth Reserve. Thus, the Staney Creek area appears to represent a population sink for wolves.

Deer, bear, marten, and mountain goats are also vulnerable to overharvesting and disturbance in areas of extensive road development. Increased hunter access can lead to unsustainable rates of deer harvest (and, potentially, illegal harvest) and may increase the potential for overtrapping of marten. Mountain goats and black bears can be over-hunted in areas where an extensive road system facilitates human access into the habitats (particularly old-growth forest) with which they are associated. Management direction for brown bear emphasizes the establishment of roadless refugia, where human disturbance would be minimal. Another key element for brown bears is the minimization of disturbance at key feeding areas (low-elevation valley bottoms and salmon streams) during the critical late-summer season. These are often the same areas of highest human use and most intense resource development activities.

Roads play an essential yet paradoxical role in subsistence hunting. Roads provide access to hunting and fishing areas, an attribute that is highly valued by residents. Proposals to close or decommission roads in some areas may run afoul of certain subsistence access provisions of ANILCA. At the same time, roads into rural areas can improve access for non-local sport hunters, which may reduce the availability of the animals on which subsistence hunters rely.

Economics

It is not possible to perform a financial efficiency analysis on the existing ML 3, 4, and 5 road system to determine whether revenues exceed costs because data on revenues are not collected in a way that allows them to be assigned to specific roads (i.e., just the ML 3, 4, and 5 roads) with any degree of accuracy. This absence of data on revenues also means that it is not possible to assess the changes in net revenue that would be associated with changes in the existing ML 3, 4, and 5 road system. Consequently, from a quantitative economic perspective, this roads analysis focuses more on road costs, such as annual and deferred maintenance, rather than a complete economic picture. However, other economic issues are examined on a qualitative basis.

Base annual maintenance costs for local ML 3 roads are approximately $1,138 per mile, while costs for arterial and collector ML 3 roads and ML 4 and 5 roads are approximately $2,051 per mile. Different localities in the Forest have somewhat higher costs than these base levels due to items such as availability of equipment and mobilization. Deferred maintenance costs are discussed in more detail in Step 5 of this roads analysis.

In terms of direct use, the majority of ML 3, 4, and 5 roads tend to be used for recreation and subsistence with use primarily by local residents or visitors from other parts of the region. Use of the ML 3 roads on the Thorne Bay Ranger District, for example, is thought to be primarily by local residents with about half the non-local users thought to come from Ketchikan. Local communities are, however, promoting tourism on Prince of Wales Island and the road system may prove attractive to visitors. The majority of the remaining sawmills in Southeast Alaska are located in the south portion of the Forest.

Wood products, recreation and tourism, and mining are the main economic sectors affected by the road system. The wood products sector is affected to the extent that the existing road system facilitates timber harvest. Although it is difficult to project where the employment associated with a particular timber sale will be concentrated, wood products employment tends to be concentrated in the communities located in the southern part of the forest, with the region's major operators located in Ketchikan, Wrangell, and Craig/Klawock. Other smaller operators tend to be concentrated on Prince of Wales Island. One exception to this is the Whitestone Southeast Logging Co. located in Hoonah (USDA Forest Service 2002).

Much of the growth in recreation and tourism-related employment in recent years has been associated with increases in cruise ship visitors. Data compiled at the Borough/Census Area level for 1999 suggests that lodging, restaurant, and recreation services employment (a common indicator of recreation and tourism employment) accounted for 11 percent of total employment in Southeast Alaska. Cruise ship operators have expressed concerns about the availability of locations to take visitors on day trips, including trips from MAPs and using the ML 3, 4, and 5 road system. It has been expressed that some of the available sites are currently over-utilized. Expansion of the ML 3, 4, and 5 road system in areas of interest by cruise ship operators, either through new construction or upgrades of ML 1 or 2 roads, could benefit the tourism-related component of the economy.

Two ML 3 roads located in the Berners Bay area north of Juneau were constructed for mine access. The Kensington mine is active on an exploratory basis and the road receives daily mine-related use. Approximately 318 workers were directly employed by the mining industry in 1999.

Commodity

Timber

Generally, ML 3, 4, and 5 roads do not directly affect road spacing and location or logging system feasibility on the Forest. Logging feasibility is directly affected by the presence or absence of roads. A road does not need to be maintained as a ML 3 road in order to provide adequate access for feasible logging systems. ML 3 roads do, however, provide more economical haul to MAPs compared to ML 1 and 2 roads, and provide a higher level of safety for both operators and others using the road. Relative to ML 1 and 2 roads, ML 3, 4, and 5 roads may also increase the operating season to some degree and reduce maintenance costs for trucks. On the other hand, ML 3, 4, and 5 roads also have higher maintenance costs for both the government and operators. Because ML 1 and 2 roads have a greater effect on logging system feasibility, the watershed or finer scale is most appropriate for addressing this road issue.

Thorne Bay log transfer facility and marine access point

Minerals

The Tongass National Forest has substantial mineral deposits including gold, silver, molybdenum, zinc, lead, and limestone. ML 3, 4, and 5 roads can provide safer and better access to these deposits than a ML 2 road. They can also provide more efficient transportation of ore. However, maintenance of ML 3, 4, and 5 roads costs more than ML 2 roads. Currently, two major mines are active: the Greens Creek Mine, and the Calder Mine. The Kensington Gold Mine obtained needed permits in 1997, but economic factors resulted in the need to substantially change the approach to processing the ore and treating waste products. Consequently, the mine is not currently active, but it may begin production in the near future if all needed permits or permit modifications are obtained. The Quartz Hill Mine is estimated to have about 12 percent of the world's molybdenum supplies, but the mine has not been found to be economically feasible under the current market. Access to the Quartz Hill Mine is by a private road reached from a MAP. Access to the Greens Creek, Calder, and Kensington Mines is primarily by barge or boat to a MAP that services a local road system. The ML 3 road from the MAPs at Hawk Inlet and Young Bay, which access the Greens Creek Mine, is under NFS jurisdiction.

The ML 3, 4, and 5 road system also provides access by mineral collectors and small-scale commercial miners to existing borrow pits. The roads and associated barrow pits are beneficial for these activities, which would likely not occur without the existing road system. Upgrading of ML 2 roads to ML 3, 4, and 5 roads could expand the areas accessible to mineral collectors that do not have a high clearance vehicle or prefer to avoid using lower standard roads.

Range management

There are no range allotments in the Tongass National Forest.

Water Production

Many of the larger communities (Ketchikan, Juneau, Petersburg, etc.) have municipal watersheds that are protected in order to maintain high water quality for domestic water supplies. There are no ML 3, 4, or 5 roads in these municipal watersheds. Smaller communities or areas not serviced by municipal watersheds may draw water from a variety of sources. ML 3 roads could affect these water sources (including improved access to facilities), but should be evaluated at a project level analysis. Relative to ML 1 and 2 roads, ML 3, 4, and 5 roads may have a lower risk of some adverse water quality effects (e.g., sediment) because of higher maintenance levels. However, higher use of ML 3, 4, and 5 roads could also increase the risk of contaminants (both chemical and fecal).

Special Forest Products

Special Forest Products are defined as products derived from non-timber biological resources that are used for subsistence, personal, spiritual, educational, commercial, and scientific use. These resources include, but are not limited to mushrooms, boughs, Christmas trees, bark, ferns, moss, burls, berries, cones, conks, herbs, roots, and wildflowers. Forest roads allow broader access to people gathering these resources. In particular, the ML 3, 4, and 5 roads allow people to travel farther distances to gather resources at prime locations. Traveling to these locations may result in higher competition for these resources (and possible conflict between local and visiting users), but may also allow some people to utilize resources they would be less likely or unable to gather near their community. The ability to gather at more distant locations may reduce over-harvest of products near communities, but may also result in adverse effects to resources not previously used or collected.

Special-Use Permits

Concessionaires (both for existing sites and future development or expansion) may require that an existing road be built, maintained at, or upgraded to a ML 3 or higher standard to safely accommodate passenger vehicle travel to these sites. Most existing recreation special use areas are based on access via salt water. There may be a need for ML 3, 4, and 5 roads to provide adequate access to recreation sites and resorts in the future, as tourism plays a greater role in the Southeast Alaskan economy.

General Public Transportation

Public transportation is a major benefit of the ML 3, 4, and 5 road system. All roads outside of communities were initially forest roads. Higher use roads, especially those connecting communities to Alaska Marine Highway terminals, became state routes. Local residents use roads for driving for pleasure, hunting access, and dispersed recreation and subsistence uses. There are no shared ownership roads, but a few private roads have Federal Land Policy and Management Act easements across federal lands (to private cabins, resorts, etc.)

ML 3, 4, and 5 roads, regardless of their primary function (e.g., timber, minerals, etc.), provide for faster and safer travel relative to ML 2 roads. Consequently, upgrades of ML 2 roads or new construction at ML 3, 4, and 5 standards benefits general public transportation and expands the amount of the Forest accessible to the public with highway vehicles. However, construction and maintenance costs are also higher.

All-terrain vehicle use of NFS roads

Motor vehicle accidents can be largely attributed to alcohol use and/or overdriving for conditions or designed use. Mixed traffic/underage driver/non-street legal vehicle issues are growing. Very few accidents occur because of the condition of the road and/or lack of traffic safety items (e.g. guardrails, approach rails, etc.).

Administrative Use

The Forest Service has responsibility for managing fish and game habitat on NFS lands, while the State manages the populations for sport fishing and hunting, including setting open seasons, bag limits, and other regulations. However, the Forest Service does have responsibility for managing subsistence harvests by rural residents where customary and traditional use determinations have been made. The road system is necessary for this administration, providing primary access for investigation and enforcement of timber theft, fish and game related activities, occupancy and abandonment of facilities, and vandalism. Relative to ML 2 roads, the ML 3, 4, and 5 road system is a benefit to more efficient administration by increasing the area that can be covered by patrols with a higher level of safety and lower maintenance costs for government vehicles. However, higher levels of ML 3, 4, and 5 roads may also increase unwanted or unlawful activities, and a public demand for increased enforcement. Law enforcement vehicles are frequently ferried among islands for enforcement work. Other activities include access to remote field camps, timber management planning and administration, fisheries improvement and maintenance projects, and maintenance of Forest Service cabins, recreation sites, and trails.

Protection

Similar to several other ecological, social, and economics aspects that could be affected, ML 3, 4, and 5 roads are a double-edged sword in terms of fire protection. ML 3, 4, and 5 roads provide quicker and safer access for suppressing fires, but they also increase the risk of human-caused fires. Although fire has been cited as a major factor in shaping vegetative conditions in other forests, it is not a primary factor within the Tongass National Forest due largely to the high annual rainfall in Southeast Alaska. Most fires within this region tend to spread very slowly and burn deeply. Many fires are the result of marine or shoreline recreation activities, primarily escaped campfires. Ninety-two percent of the fires recorded from 1958 to 1988 started from unattended recreational fires, with the average size of all fires comprising less than 7 acres (USDA Forest Service 1997b). Most fires are reported by passing boats or ships, but suppression equipment is mostly road based.

Roaded and Unroaded Recreation

Many residents of Southeast Alaska place a high value on the quality and availability of outdoor recreation opportunities in the region. This is evidenced by the fact that the proportion of Alaskan residents who participate in outdoor activities is generally much higher than elsewhere in the United States (Bowker 2001). Many local residents engage in dispersed recreation activities on NFS lands and adjacent saltwater.

The Tongass National Forest has the potential to provide a wide variety of recreation settings. The Recreation Opportunity Spectrum (ROS) has been developed to help identify, quantify, and describe these settings. The ROS system portrays the appropriate combination of activities, settings, and experience expectations along a continuum that ranges from highly modified to primitive environments. Seven classifications are identified along this continuum:

- Urban (U)
- Rural (R)
- Roaded Natural (RN)
- Roaded Modified (RM)
- Semi-primitive Motorized (SPM)
- Semi-primitive Non-motorized (SPNM)
- Primitive (P)

Figure 13 displays the recreation opportunities available on the Tongass by ROS class. The U and R settings account for a very small amount of the Forest Area and are not depicted on the graph.

The supply of unroaded recreation opportunities is expected to continue to exceed demand over the next decade (USDA Forest Service 2002; Table 3.4-16). All forms of access and travel may occur in RN settings, with access typically via passenger vehicle. RM settings are accessed by Forest roads maintained to MLs 2, 3, and 4 and available for public use. Access to R settings is primarily by passenger vehicle, while access to U settings is motorized, often with mass transit supplements.

Access to SPM settings is via motorized and non-motorized trails and Traffic Service Level (TSL) D roads, although some TSL C roads provide access to and through the area (see Appendix C for descriptions of TSLs). Access into SPM settings is provided via ML 1 or 2 roads, not ML 3, 4, or 5 roads. However, ML 3, 4, or 5 roads may be needed to reach these in the vicinity of an SPM setting.

ML 3 and 4 roads have the potential to affect the wilderness attributes of roadless areas by generating noise and dust, providing access, and affecting the natural integrity of the general area. The Draft SEIS for Roadless Area Evaluations for Wilderness Recommendations (USDA Forest Service 2002) identified 115 roadless areas that totaled approximately 9.7 million acres. Close proximity to a road may affect the eligibility of a roadless area for consideration for wilderness designation.

Off-road vehicle use is becoming more widespread in the Forest and has the potential to cause localized adverse environmental effects in areas of heavy use. These effects could include disturbance of wildlife, soil erosion, and associated water quality effects. Problems should be identified and addressed during project-level or district-level round analyses.

Regarding recreation, upgrading a road from ML 2 to ML 3 may result in more and different users using an area as access is improved. This could change the character of the area for existing users and affect their sense of place. Downgrading the maintenance level of a road may have the opposite effect by restricting the use of an area or road system for particular groups (i.e., those who only have highway vehicles).

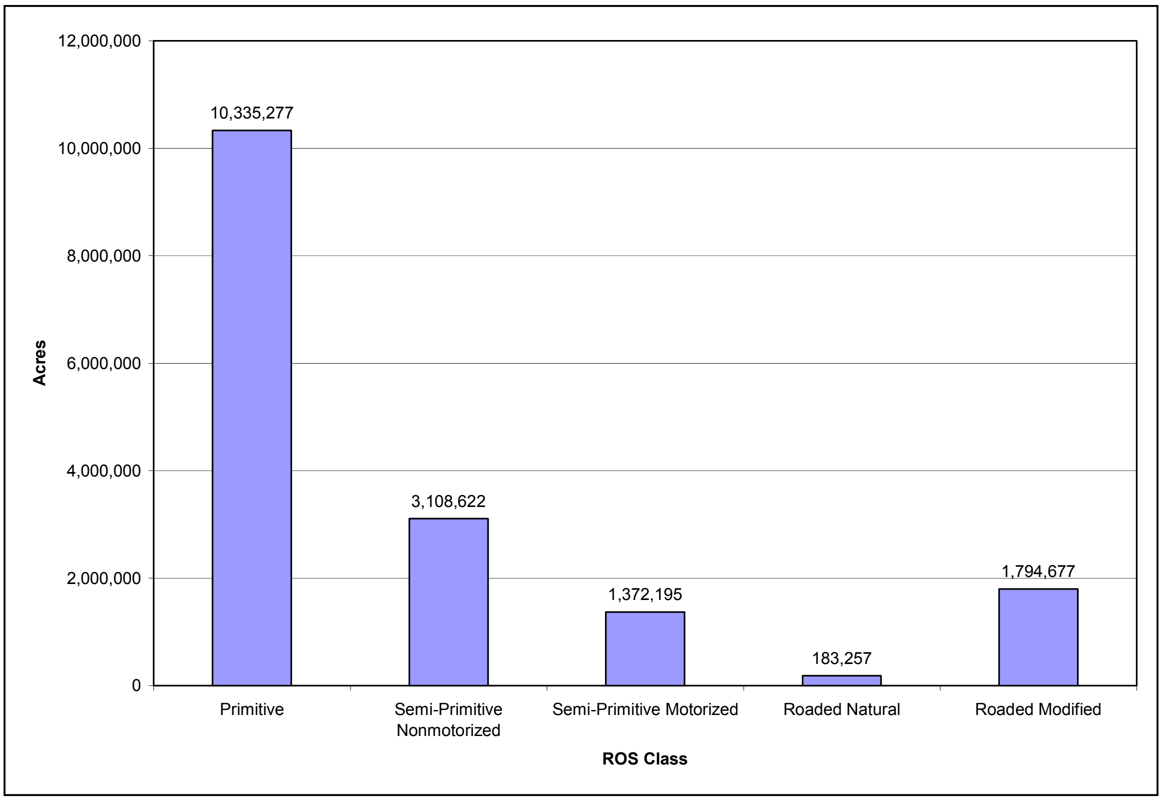


Figure 13. ROS Classes on the Tongass National Forest

Community road systems are limited, but they are heavily used for access to recreation sites, dispersed recreation, and attractions near local communities. Existing community road systems that include ML 3, 4, or 5 roads are primarily located near the larger communities of Juneau, Sitka, Petersburg, and Wrangell. The majority of the roads surrounding Ketchikan are non-Forest Service roads. There is an extensive road system connecting the small communities on Prince of Wales Island, and systems are developing near the communities of Hoonah and Kake. ML 3 roads comprise a large share of these roads. There is no interconnecting highway system between islands or between communities on the mainland.

Roads exist in other locations where timber harvest has taken place. Independent tourists and users from other parts of Southeast Alaska, as well as local residents, use road systems that are accessible from the Alaska Marine Highway System (ferries) or from a community for recreational purposes. Roads in locations where there are no communities or interconnecting access to the Alaska Marine Highway System receive relatively low levels of recreation use, primarily by local residents. However, recreation-related vehicle use has been growing on some remote islands, including Zarembo, Chichagof, and Etolin Islands, and isolated road systems on Kuiu and Kupreanof Islands. While the total amount of recreation use on these islands is low, it can be heavy at times, such as during hunting seasons.

The number of visitors to Southeast Alaska has increased significantly over the past decade with the number of cruise ship passengers visiting Juneau more than doubling, increasing from approximately 237,000 in 1990 to 632,000 in 2000. Other ports in Southeast Alaska, including Ketchikan, Skagway, and Haines, also experienced net increases in passenger volumes over this period. Sitka and Wrangell were exceptions to this general trend with decreases in passenger volumes during the latter half of the 1990s. Shore excursions have become an integral part of the cruise ship experience, providing increased revenues for ship operators and opportunities for local entrepreneurs. Despite a decline in the number of passengers since 1996, Sitka still received approximately 160,650 cruise ship visitors in 2000. Much of this activity has been concentrated at major ports of call (such as Ketchikan, Juneau, or Skagway). Several small and mid-size cruise operators are, however, now active in the region, often taking their customers to places, such as Hoonah, Metlakatla, and Petersburg, that are bypassed by the larger ships.

There has also been a significant increase in the number of outfitter/guide clients on the Tongass. In the Draft Shoreline Outfitter/Guide EIS, outfitter/guide use information compiled for the shoreline areas on the north part of the Tongass from 1994 to 1999 shows a dramatic increase in outfitter/guide use in shoreline areas, with the number of outfitter/guide clients increasing from approximately 1,550 in 1994 to 14,096 in 1999 (USDA Forest Service, 2001c). A survey of commercial recreation businesses conducted throughout Southeast Alaska in 2000 found that 73 percent of the businesses surveyed had experienced an increase in the number of clients they serve since 1995 (Alaska Division of Community & Business Development 2001). Cruise ship passengers accounted for 41 percent of total clients for all of the surveyed businesses, ranging from 22 percent of clients for businesses with fewer than 200 clients a year to 91 percent of clients for businesses with more than 10,000 clients a year.

A review of locations used by outfitter/guides between 1995 and 2001 identified just 12 locations that appeared to be located in the immediate vicinity of ML 3, 4, or 5 roads. Eleven of these areas received low levels of outfitter/guide use in 2001 (30 or fewer clients. The exception was Woodpecker Cove on Mitkof Island, which was visited by 137 clients for nature viewing. Woodpecker Cove was used as a Marine Access Point by the National Outdoor Leadership School (NOLS) for seakayaking expeditions. NOLS accessed the cove via the ML 3 road from Petersburg. While the database reviewed may not be entirely inclusive, it does provide some indication of the overall level of use of ML 3 roads by outfitter/guides. The majority of outfitter/guide locations identified on the Tongass are located along, or adjacent to, shorelines. There is also a concentration of locations on the Juneau Icefield.

Passive-Use Value

The development of the existing ML 3, 4, and 5 road system likely led to a reduction in the overall passive-use value held for the Tongass. This would be likely to occur because road construction, and especially road construction to facilitate timber harvest, results in a loss of undeveloped and wild areas. It is, however, important to note that the Forest-wide standards and guidelines outlined in the 1997 Forest Plan minimize the potential adverse effects of new roads on fish, wildlife, and cultural resources. Passive-use values are typically associated with natural resources, such as endangered and threatened species, pristine wilderness, unusual geological or natural conditions, or unique cultural heritage resources. They are rarely associated with developed areas or infrastructure elements, such as roads. While it is possible that some individuals may value the existence of roads on the Tongass independent of their use, it is reasonable to assume that these values, if they exist, would be lower than those associated with natural resources.

Social Issues

The Tongass National Forest encompasses an island archipelago that extends almost 500 miles south to north. The surrounding marine waters are a major component of the transportation infrastructure. Facilities that provide water to land to water access are a key component of all existing road systems and the overall transportation infrastructure in Southeast Alaska communities.

The majority of the ML 3, 4, and 5 roads on the Tongass were originally constructed for timber harvest, and the majority of the existing miles do not directly link communities with one another. There are some exceptions to this. These include the road on east Prince of Wales Island that connects Thorne Bay with Coffman Cove and the north Prince of Wales road that connects Naukati, Whale Pass, and other communities to Thorne Bay, Klawock, and others via Highway 929.

ML 3 road connecting communities on Prince of Wales Island

Access to paleontological, archaeological, and historical sites via ML 3, 4, or 5 roads provides opportunities for protection and interpretation for public education and enjoyment. It also increases the potential risk of detrimental effects associated with public use. In cases where active educational and interpretive programs are established, it is also necessary to implement measures to protect against vandalism.

The existing road system provides access to cultural resources sites in some locations. Auke Bay on the Juneau Ranger District, Petroglyph Beach by downtown Wrangell, and Sandy Beach in Petersburg are all areas where access to cultural sites is a concern. However, these areas are not accessed by Forest Service roads. Access problems elsewhere on the Forest include old canneries and mining sites on Prince of Wales Island where people go looking for historic artifacts. ML 3 roads provide access to these areas.

For many rural Alaskans, subsistence hunting, fishing, trapping, and gathering natural resources provides needed food and supplements rural incomes. Subsistence is also viewed by many, especially Southeast Alaska's Native communities, as a lifestyle that preserves cultural customs and traditions, reflecting deeply held attitudes, values, and beliefs. Eighty-five percent of rural Southeast Alaska households harvest subsistence food, with almost one-third of households obtaining at least half of their food from their own harvest activities.

The availability of subsistence resources is not uniform across the Forest and subsistence use varies by community. Edna Bay subsistence resource hunters gathered the most resources, measured in pounds per capita, while Skagway residents gathered the least (USDA Forest Service 1997b). Subsistence use historically occurred where access to the resources cost less in energy than the resources gathered provided, with the majority of gathering activities occurring in easily-accessed areas. Development of road systems allowed a movement out into new resource areas that had been relatively difficult to access.

It is often difficult to distinguish between recreation and subsistence use from a planning perspective. The majority of roads used for recreation (see responses to the recreation questions) are also used for subsistence. In some cases, people using the road system for subsistence purposes hunt in areas close to the roads. In other cases, they use the roads for access to the general area and hike some distance into the forest. Other types of traditional uses of animal and plant species in the vicinity of the road system include cedar bark stripping and berry picking. These types of activities vary by region.

Civil Rights and Environmental Justice

The existing ML 3, 4, and 5 road system facilitates economic activities, including timber harvest, recreation and tourism, and mining, as well as nontimber forest products and subsistence. Costs include those associated with planning, constructing, maintaining, and decommissioning roads, as well as non-priced costs, such as the potential for decreased water quality and habitat fragmentation. It is difficult at the Forest-level to assess whether certain groups of people are disproportionately affected by the existing road system. Financial costs associated with maintaining the existing system are, for example, borne by the federal government. Other localized costs, such as those that may be associated with increased subsistence use, decreased water quality, and habitat fragmentation, that have the potential to disproportionately affect specific groups of people need to be assessed at the project level.

Road management does have the potential to disproportionately affect different groups of people. In the case of subsistence, for example, the decision to upgrade a road from ML 2 to ML 3 could have the effect of increasing competition at particular sites and displacing Alaska Native or low income populations that presently use the area. Road development in close proximity to traditional use areas could disproportionately affect groups that value those areas by increasing access. Conversely, a decision to downgrade a road could disproportionately affect disabled and elderly people who would no longer be able to access an area.

STEP 5 – DESCRIBING OPPORTUNITIES AND SETTING PRIORITIES

To assess the problems and risks posed by the current road system, the IDT evaluated the management scheme for the current road system with a number of tools, including road system mapping; Road Management Objectives developed from GIS and databases; capital investment and road maintenance budget projections; Forest cost guides; an extensive number of photos of road features; and the RCS database. In addition to the issues-driven opportunities described below, the IDT sees the opportunity for area or landscape scale road analysis at the ranger district level to set priorities and schedules for acquiring detailed condition and risk information for all MLs. These analyses can also be used as an opportunity to review and update GIS road and MAP layers for consistency with current use. Review of the data layers used for the current Tongass Roadless Area Evaluation SEIS indicates that some ML 1 and 2 roads are not in the roads layer used in this analysis. In addition, some MAP layer attributes appeared inconsistent with other information used in this analysis, thus, reflecting the need to update GIS layers on a regular basis.

Marine Access

The Shoreline Outfitter Guide Draft EIS covering the northern ranger districts observed that four boats servicing large groups (12 or more people; likely derived from cruise ships) are limited in available access points to the Forest because of the need to maintain schedules and the need for MAPs that can accommodate larger boats. One representative of the cruise industry suggested that the industry feels squeezed between increasing demand for the use of the Forest and the environmental documentation process, which they feel is biased towards preservation interests, which prefer to limit the amount of access and development favored by the industry. Although shopping remains the number one on-shore activity, there is a demand for wild country activities, such as hiking, climbing, wildlife viewing (especially bear), and fishing. Many additional ports of call other than Ketchikan, Juneau, Skagway, and Sitka are attractive for cruise ships of 60 to 150 passengers. Mitkof Island has been referred to as the “undiscovered Alaska” regarding cruise ships.

Alaska State ferry using the Alaska Marine Highway

The Southeast Alaska Transportation Plan (Alaska DOT & PF 1999) made a number of recommendations for improving the year-round transportation in the region. The recommendations focused primarily on new terminals for the State's ferry fleet, additional types of ferries, and modifications in the frequency and service routes. The plan also made recommendations for some new and upgraded roads, primarily as access to the new ferry terminals. The Southeast Conference, a nonprofit corporation that advances the collective interests of the people, communities and businesses in Southeast Alaska, are in the initial stages of discussing additional transportation options that could be incorporated into the Southeast Alaska Transportation Plan. These options would also include new port facilities, as well as associated road improvements. The roads, ferry routes, and ferry terminals under consideration by the Southeast Conference can be found in Figure 2 through Figure 12.

The MAPs under Forest Service jurisdiction that could enhance regional transportation opportunities are listed in Table 6. They have been selected because capital improvements have been proposed, they are associated with roads that could be improved to ML 3, 4, or 5 status to enhance public access to National Forest System lands and facilities, and are included in the Southeast Alaska Transportation Plan or Southeast Conference discussions.

Roads in Old-Growth LUD

Approximately 129 miles of ML 3 roads are located in the Old-Growth Habitat LUD. TLMP direction states that roads in this LUD are to be avoided if reasonable alternate routes are available. These roads were examined to determine if they are currently needed for community connectivity, special use, recreation, or subsistence access. None of these roads could be identified to be considered for closing.

Deferred Maintenance Budgeting Needs

Deferred maintenance is maintenance that was not performed when it should have been or when it was scheduled and, therefore, put off or delayed for a future period. When

Table 6. Tongass Marine Access Points Proposals for Additional Cruise Ship and Ferry Passenger for Forest-based Activity and Community Access.

Marine Access Point	Ranger District	Affected Roads	Function	SE Alaska Transportation Plan	Southeast Conference	Forest Service Capital Investment
Blind Slough	Petersburg	Forest Highway 7	New AMH ferry terminal	In Final Plan	Under Consideration	Cabin
Coffman Cove	Thorne Bay	23, 30, 3030295	Small ferry terminal (30 car ferries)	In Final Plan	Under Consideration	
Eight Fathom Bight	Hoonah	8580	Potential small tourist ship access			Cabin
False Island	Sitka	7540	Access off Chatham Strait	Preliminary study		Field Camp
Hamilton Bay	Petersburg	6000	New Kake AK ferry terminal			
Mud Bay	Sitka	7590	Kruzof Island small tourist boat access			Cabin
Sitkoh Bay	Sitka	7548	Access to Chatham Strait	Preliminary study		
Whitestone Harbor	Hoonah	85304	Direct ferry service from Juneau to Hoonah		Under Consideration	Cabin
Fools Inlet	Wrangell	6265, 6270	Proposed So. Wrangell Is. AK ferry terminal	In Final Plan	Under Consideration	

allowed to accumulate without limits or consideration of useful life, deferred maintenance leads to deterioration of performance, an increase in the costs to repair, and a decrease in asset value. Similar to annual maintenance costs, deferred maintenance is categorized as critical and noncritical and related to the Forest's mission, health and safety, and resource protection.

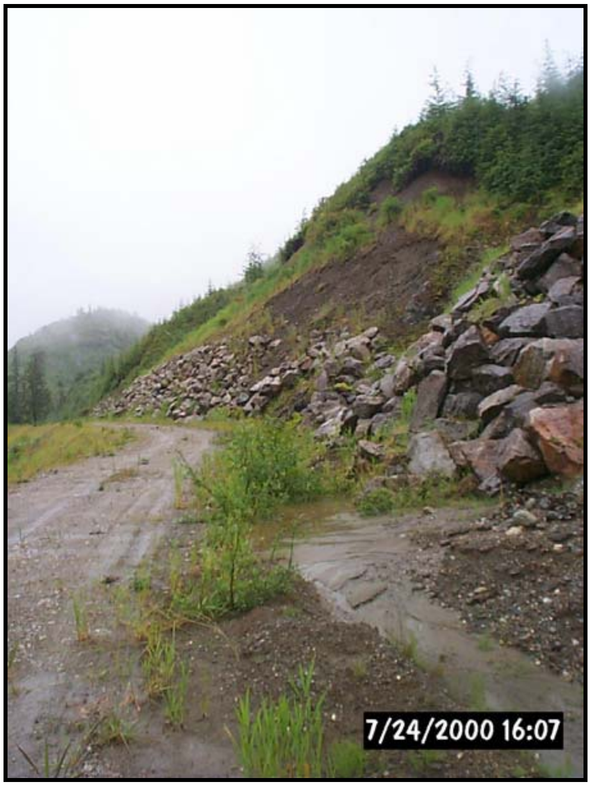
Most deferred maintenance items are related to resource protection. This includes all drainage, stream crossing, and fish passage work, and seeding (both hydroseeding and dry) of exposed soils. Items related to the Forest's mission include most deferred surface and roadway maintenance, maintenance of structures (MAPs, docks, floats, and ramps), and some signage (e.g., guide signs, boundary signs). Items related to health and safety include maintenance on turnouts, signage (e.g., regulatory signs, warning signs, and mile markers), brushing, and debris clearing.

Discussions with Forest staff and analysis of the RCS database suggest that substantial road maintenance has been deferred. The IDT queried the RCS database and applied per item cost estimates to develop an independent cost estimate for evaluation of the Forest's deferred maintenance budgeting needs for ML 3, 4, and 5 roads. The evaluation was conducted in two areas related to resource protection and the Forest mission: drainage and road stability problems (i.e., surface and roadway problems) and fish passage. Most drainage problems and fish passage are considered critical. Road stability issues are mostly noncritical (unless related to drainage).

Drainage and Road Stability

Drainage and road stability problems become critical when there is moderate to high risk that sediment could be delivered to a fish bearing stream or to a non-fish bearing stream that has the ability to transport sediment to fish bearing stream segments. The following types of road problems were queried from the RCS database:

- Surface erosion
- Standing or running water
- Ditch plugging
- Cut and fill slope erosion
- Inlet and outlet erosion (bank and fill-slope protection, energy dissipater, or outlet pool needed)
- Relief ditch and stream crossing problems (cut- and fill-slope slumping or sliding, inadequate capacity, sediment accumulation, improper installation, etc.)



Riprap to control a cut-slope failure

Not all problem types in the database were used in the analysis because they were rarely observed (e.g., stream abutment erosion, road rutting) or difficult to quantify (e.g., brush encroachment). Cost assumptions for fixing each of these problems were based upon the R10 Road Maintenance Cost Guide.

The results of the analysis (Table 7, including assumptions) suggested the total deferred cost for fixing drainage and road stability problems would be approximately $14.4 million. Most of these deferred costs (approximately $12.2 million) were related to fixing cut- and fill-slope problems. Of the remaining deferred costs, surface erosion ($573,120), stream crossing problems ($423,524), standing or running water ($388,000), and ditch plugging ($362,487) were highest.

Fish Passage

Fish passage at road-stream crossings is an important issue on the Tongass. Forest-wide, 715 culverts (or about 0.55 culverts per mile; 67 percent of surveyed culverts with complete assessments) are considered to have passage problems on ML 3, 4, and 5 roads (see Appendix E, Question AQ(10) for summary by ranger district). An additional 177 culverts with incomplete survey information may have problems. Assuming similar problem rates, this would mean approximately 890 that do not pass fish. However, many of the culverts that do not pass fish are overflow culverts. They only operate during periods of high flow, augmenting the flow provided by primary culverts that do pass fish; therefore, the number of culverts identified as having passage problems does not correspond to the number of road-stream crossings without adequate fish passage. Still, the need for culvert upgrades is an important component of the deferred road maintenance budget. The costs for correcting passage problems at a specific culvert are difficult to predict with high precision. Survey, design, and construction for fixing complex passage problems have recently been estimated to cost $25,000 to $100,000 with an average cost of about $36,000. At the lower end of the range, culverts would be re-engineered or replaced with a larger or different type of culvert. At the upper end, a culvert would be replaced by a bridge. The total costs to the Forest for ML 3, 4, and 5 roads are estimated to be approximately $32.1 million. Using this average cost, the deferred costs for solving all passage problems at ML 3, 4, and 5 road-stream crossings could be as high as $30 million. Currently, the Forest is developing a methodology for prioritizing the effort needed to upgrade culverts that includes an understanding of the amount of fish habitat affected by culverts with passage problems. The road analysis IDT concurs with this approach for addressing this issue, recognizing that upgrades will require a number of years to implement. Prioritization of effort for resolving passage issues for ML 3, 4, and 5 roads should be conducted in tandem with ML 2 roads. The IDT recommends that the Forest develop a timetable for completing upgrades as soon as practicable.

Summary of Deferred Maintenance Costs

The deferred maintenance costs developed during the regular 2001 budgeting process are displayed in Table 8. The total deferred costs are $32.4 million for ML 3, 4, and 5 roads for the Forest, about 46.9 percent of the total deferred costs for the Forest's road system. Of this, approximately $32.1 million are allocated under Forest mission and resource protection categories. This is about 27 percent lower than the $44.3 million the IDT calculated for fixing selected passage, drainage, and road stability problems. Considering that many maintenance items could not be considered in their analysis, the IDT believes that the $32.1 million figure is a substantial underestimate of deferred maintenance cost, especially considering that deferred maintenance for fixing passage problems could cost nearly this much alone. The IDT is also concerned that over 94 percent of the budget has been categorized as noncritical. Most drainage and all passage problems are considered critical in the R10 Year 2000 Road Maintenance Cost Guide. The current analysis suggests that a much higher proportion of deferred costs should be considered critical.

Capital Improvement Costs

The Forest has estimated $735.3 million of capital improvement that could be implemented in the Tongass. All of these costs are noncritical. Approximately 80 percent of the costs would be to further the Forest's mission.

Table 7. Estimated Deferred Maintenance Costs for ML 3, 4, and 5 Roads Based on RCS Database and the 2000 Road Maintenance Cost Guide.

	Number of Occurrences per Ranger District								
Problem Feature	**Craig**	**Hoonah**	**Juneau**	**Peters-burg**	**Sitka**	**Thorne Bay**	**Wrangell**	**Total**	**Total Cost**
Cut-slope erosion location	80	11	3	385	7	146	159	791	$ 10,536,208
Fill-slope erosion location	29	4	-	49	2	13	26	123	$ 1,638,374
Subtotal:									**$ 12,174,581**
Maintenance costs:									
Hydroseed beside road - station	*$ 71*	*station*							
Slide/Slump Removal - Endhaul	*$ 30*	*cubic yard*							
Buttress Cut Slope	*$10,223*	*each*							
Estimate 100 cy endhaul per occurrence; Avg. length of occurrence = 98 ft or 1 station									
Assume fill-slope erosion is approximately equivalent in scale and cost in most cases									
Major cut slope or fill slope erosion may warrant a case specific cost estimate									
Ditch erosion location	1	3	-	17	4	19	10	54	
Subtotal:									**8,251.90**
Maintenance costs:									
New Ditch - Common Material	*$ 153*	*station*							
Ditch Plugging Evident and/or	180	10	2	173	38	329	222	954	$ 362,487
Sediment Accum. in Culvert	2	8	1	61	25	23	59	179	$ 45,770
Subtotal:									**$ 408,257**
Maintenance costs:									
Clean ditch	*$ 2,248*	*mile*							
Find and Clean Culverts	*$ 256*	*each*							
Avg length = 294 ft. Clean equal amount on each end (300 ft) =894 ft or 0.169 mile									
Assume clean ditch & culvert									

Note: Cost per Item Assumptions are in Italics.

Table 7. Estimated Deferred Maintenance Costs for ML 3, 4, and 5 Roads Based on RCS Database and the 2000 Road Maintenance Cost Guide. (Continued)

	Number of Occurrences per Ranger District								
Problem Feature	**Craig**	**Hoonah**	**Juneau**	**Peters-burg**	**Sitka**	**Thorne Bay**	**Wrangell**	**Total**	**Total Cost**
Standing or running surface water		6	3	18	14	28	125	194	
Subtotal:									**$ 388,000**
Maintenance costs:									
replace culvert or new ditch	*$2,000*	*occurrence*							
Assume sometimes replace culvert & sometimes new ditch									
Surface erosion location	4	22	2	103		51	17	199	
Subtotal:									**$ 573,120**
Maintenance costs:									
Replace Surface	*75650*	*mile*							
Avg length = 67'. Replace equal amount of avg. on each end									
*201 ft / 5,280ft per mi*75,650 per mi =*	*2880*	*per occurrence*							
Hydraulic Flows Exceed Capacity	0	1	0	13	1	2	78	95	
Subtotal:									**$ 184,585**
Maintenance costs:									
replace culvert	*$ 1,943*	*each*							
Assume replacement size on average is 18-24" CMP									
Inlet / Outlet Erosion Problems	145	72	90	83	225	128	95	838	
Subtotal:									**$ 222,908**
Maintenance costs:									
riprap culvert	*$ 266*	*each*							

Note: Cost per Item Assumptions are in Italics.

Table 7. Estimated Deferred Maintenance Costs for ML 3, 4, and 5 Roads Based on RCS Database and the 2000 Road Maintenance Cost Guide. (Continued)

	Number of Occurrences per Ranger District								
Problem Feature	**Craig**	**Hoonah**	**Juneau**	**Peters-burg**	**Sitka**	**Thorne Bay**	**Wrangell**	**Total**	**Total Cost**
Stream Crossing Problems									
hydraulic flows exceed capacity	7	8	26	17	15	0	5	78	$ 151,554
fill slump or slide	1	0	0	17	0	3	8	29	$ 14,500
improper installation	5	29	26	11	37	0	15	123	$ 184,500
stream in ditch	4	2	34	0	0	1	4	45	$ 11,970
sediment accum in culvert	0	16	1	34	4	16	40	111	$ 55,500
sediment accum in ditch	1	3	1	3	0	0	3	11	$ 5,500
Subtotal:									**$ 423,524**
Maintenance costs:									
hydraulic flows exceed capacity	*$ 1,943*	*each*							
fill slump or slide	*$ 500*	*each*							
improper installation	*$ 1,500*	*each*							
stream in ditch	*$ 266*	*each*							
sediment accum in culvert	*$ 500*	*each*							
sediment accum in ditch	*$ 500*	*each*							
Grand Total:							**Total Cost:**		**$ 14,383,227**

Note: Cost per Item Assumptions are in Italics.

Table 8. Deferred Maintenance Costs for Roads from the 2001 Deferred Maintenance Report.

	Critical Costs ($)				Noncritical Costs ($)				
Maintenance Level	Forest Mission	Health & Safety	Resource Protection	Subtotal	Forest Mission	Health & Safety	Resource Protection	Subtotal	Total
1	177,371	1	889,858	1,067,230	2,901,994	961	11,994,282	14,897,238	15,964,467
2	467,968	4	2,248,143	2,716,115	3,380,856	1,276	14,601,113	17,983,245	20,699,359
3	536,069	22	1,300,062	1,836,153	13,144,298	176,904	15,780,479	29,101,681	30,937,834
4	16,948		30,915	47,863	700,141	2,051	720,743	1,422,936	1,470,799
ML 3-4 Subtotal	553,017	22	1,330,977	1,884,016	13,844,439	178,955	16,501,222	30,524,617	32,408,633
Total ML 1-4	1,198,356	26	4,468,978	5,667,360	20,127,289	181,193	43,096,617	63,405,099	69,072,460
Percent ML 3-4 w/in Category	46.1%	82.9%	29.8%	33.2%	68.8%	98.8%	38.3%	48.1%	46.9%
Percent ML 3-4 of ML 3-4 Total	1.7%	0.0%	4.1%	5.8%	42.7%	0.6%	50.9%	94.2%	100.0%

Table 9. Capital Improvement Costs for Roads from the 2001 Deferred Maintenance Report.

Maintenance Level	Critical Costs ($)				Noncritical Costs ($)				Total
	Forest Mission	Health & Safety	Resource Protection	Subtotal	Forest Mission	Health & Safety	Resource Protection	Subtotal	
1	0	0	0	0	1,096,099	205,190	116,294	1,417,583	1,417,583
2	0	0	0	0	62,811,847	8,188,420	7,844,101	78,844,367	78,844,367
3	0	0	0	0	417,453,208	55,020,026	46,166,778	518,640,013	518,640,013
4	0	0	0	0	109,100,702	13,637,586	13,637,586	136,375,875	136,375,875
ML 3, 4 Subtotal	0	0	0	0	526,553,910	68,657,613	59,804,365	655,015,888	655,015,888
Total 1-4	0	0	0	0	590,461,856	77,051,223	67,764,759	735,277,838	735,277,838
Percent ML 3-4 w/in Category	0.0%	0.0%	0.0%	0.0%	89.2%	89.1%	88.3%	89.1%	89.1%
Percent ML 3-4 of ML 3-4 Total	0.0%	0.0%	0.0%	0.0%	80.4%	10.5%	9.1%	100.0%	100.0%

Public Roads

It is appropriate for the unique relationship between the Tongass and the State of Alaska to provide adequate and safe access for the residents of Southeast Alaska, to operate much of the arterial portion of the road system as "public roads" that meet the safety standards of 23 CFR 1230.3. NFS roads are not generally considered public roads, because they may be closed for resource-related reasons. The essence of this special designation is a traveling surface for all classes of vehicles, full regulatory, warning, and direction signage, and a safe travel way (i.e., elimination of roadside hazards and adequate sight distance). Based on a review of the ML 3, 4, and 5 road system and its use by the public, the IDT recommends that the Forest consider designating 197.9 miles of road as public roads and upgrading them as needed to reflect this status. These roads are listed in Table 10.

Table 10. ML 3, 4, and 5 Roads Recommended for Designation as Public Roads.

Ranger District	Road Name	Route Number	Miles
Hoonah	Hoonah Gypsum	8530	28.9
Thorne Bay	East Prince of Wales	3000000	64.2
Thorne Bay	Coffman Tie	2300000	4.4
Thorne Bay	Coffman Cove Loop	3030000	19.3
Thorne Bay	North Prince of Wales	2000000	61.1
Thorne Bay	Twin Island Lake	2700000	6.1
Thorne Bay	Neck Lake	2500000	3.6
Thorne Bay	Shaheen	2050000	8.6
Thorne Bay	Loop	2050200	1.1
Thorne Bay	Tuxekan Passage	2054000	0.6
Total			**197.9**

Road Segments Proposed for Transfer To The State

There is a proposal for construction of a new ferry terminal in Fools Cove on Wrangell Island. Other locations for a ferry terminal on Wrangell Island may also be considered in addition to Fools Cove. A new ferry terminal would expand the Alaska Marine Highway and increase the level of traffic on Wrangell Island. The terminal could also be used by the Inter-Island Ferry Authority and provide transit to the mainland at the Cleveland Peninsula or to the mainland via Bradford Canal. If this proposed ferry terminal is implemented, the Forest may want to consider discussing with the State of Alaska the feasibility of transferring Road 6270 and portions of Road 6270 (approximately 24.4 miles in total) to the State for inclusion in the State Highway System.

ML 2 or ML 3 Road Segments to Upgrade or Downgrade

District-level road analysis with an appropriate level of public involvement can be an effective method of ensuring that operational and objective maintenance levels are in balance with existing and expected future levels of road use. Examination of Table 3 and Figures 2 through 12 suggest that different ranger districts in the Forest have somewhat disparate views on appropriate designation of ML 3 versus ML 2 roads. For example, the Ketchikan Ranger District has about 333 miles of ML 1, 2, 3, 4, and 5 roads yet only 0.8 mile (less than 1 percent) are ML 3 roads. In contrast, other districts range between having 11 percent to 63 percent of all roads designated as ML 3. Some of these differences reflect local differences in use of roads to link communities and how communities use the roads for recreation, subsistence, and other non-timber uses. However, some of the differences are also likely to be due to a mismatch between the type of use a road receives (or is designated) and its maintenance level. The appropriate balance is best identified at the district level.

Base annual maintenance, costs for ML 2 roads ($806/mile) are about 29 percent less than local ML 3 roads ($1,138/mile). Consequently, downgrading roads that do not receive sufficient use to support a ML 3 designation can represent annual savings. Table 11 identifies 48.7 miles of road that the Petersburg Ranger District identified for downgrading to either ML 1 or ML 2 status. In addition, the IDT identified 87.1 miles of ML 3 road used primarily for timber harvest and timber management activities in other districts that could be considered for downgrading to ML 2 (Table 12). However,

Table 11. ML 3 Roads Downgraded to ML 2 or ML 1 by the Petersburg Ranger District.

Route No.	Route Name	OPML[1/]	OBML[2/]	Length (mi)
43010	SPRING	2	1	0.9
43036	LIZZY	2	1	0.4
45602	HIGH BALL	2	1	0.5
46090	JIGGLE	2	1	1.1
46092	SELECTION	2	1	2.1
6205	PAN CREEK	2	1	1.2
6210	PAINT	2	1	1.2
6212	BOUNDARY	2	1	1.1
6282	SUMNER PASS	2	1	4.4
6317	CAPE STRAIT	2	2	7.4
6317	CAPE STRAIT	1	2	2.1
6304	LOST ROAD	2	1	0.4
6405	UPPER ROWAN BAY	1	2	3.0
6409	NORTHEAST KUIU	2	1	3.6
6410	KADAKE BAY	2	1	2.2
6411	RIDGE TOP	2	1	0.8
6414	WHISTLE PUNK	2	1	0.2
6423	UPPER PILLAR BAY	2	1	0.5
6425	DEAN CREEK	2	2	4.8
6425	DEAN CREEK	2	1	1.1
6431	PILLAR BAY	2	1	1.5
6437	BEAVER POND	2	2	5.6
6437	BEAVER POND	2	1	0.8
6441	CEDAR BIGHT	2	1	1.7
Total				48.4

1/ OPML = Operational Maintenance Level
2/ OBML = Objective Maintenance Level

deferred maintenance is still needed on these roads recommended for downgrading. These recommendations can be a starting point for individual districts to determine an appropriate balance between the different road maintenance levels.

A number of roads have a ML 2 status but appear to receive sufficient use and, therefore, warrant upgrading to ML 3 status. The IDT identified 71.8 miles of road that should be considered for an upgrade in status, which will offset to some degree the downgrading of other roads. These roads are listed in Table 13. When combined with roads recommended for downgrading from ML 3 to ML 2, a net downgrading of 15.3 miles of road would occur. This represents approximately $14,176 to $53,162 of base annual maintenance cost savings to the Forest, depending upon whether the ML 3 roads are local, collector, or arterial roads. In combination with the roads identified by the Petersburg Ranger District, the total savings would be $24,403 to $82,597.

Table 12. ML 3 Roads Recommended for Downgrading to ML 2.

Ranger District	Road Name	Route Number	Miles
Hoonah	8 Fathom Camp	8577	0.9
Hoonah	Mud River	8582	1.9
Hoonah		85811	4.2
Hoonah	Wassachusetts Cove	8513	6.6
Hoonah	Kennel Creek	8519	2.4
Hoonah	Iyoutug	8534	3.6
Hoonah	SLB	8578	6.3
Sitka	Corner Bay	7540CB	7.7
Sitka	COB	7520	2.8
Wrangell	Mussel Shell	6540	10.6
Wrangell	Anita Bay Access	6541	0.5
Wrangell	Burnett Inlet	6547	1.2
Wrangell	Wrangell Is.	6271	0.6
Wrangell	HighBush	50040	1.3
Wrangell	Salamander	50050	1.2
Wrangell		50051	3.6
Wrangell		50052	1
Wrangell	Lost Joe	50054	1.9
Wrangell	Big Hollow	50060	4.2
Wrangell		6578	0.8
Wrangell	NW Zarembo Connection	6588	3.2
Wrangell	Zarembo Lake	6592	5.8
Wrangell	S Zarembo Connection	6594	1.6
Wrangell	Stikine Strait	6597	2.2
Wrangell		52016	0.6
Wrangell		52019	2.4
Wrangell	Nowhere	52020	0.4
Wrangell	Deer Lake	52021	2.6
Wrangell		52022	3.7
Wrangell		52023	0.6
Wrangell	Zarembo North	52031	0.7
Total			**87.1**

Table 13. ML 2 Roads Recommended for Upgrading to ML 3.

Ranger District	Route Number	Route Name	Length in Miles
Craig	2120050		1.7
Hoonah	8544	NEKA-HUMPBACK	2.1
Petersburg	6256	THOMAS BAY	4.1
Petersburg	6360	HENRYETTA	0.7
Petersburg	6400	ROWAN BAY CAMP	0.2
Sitka	7520	TRAP BAY	10.0
Sitka	7576	HARBOR MOUNTAIN	0.8
Thorne Bay	1427000	HECETA ISLAND SPUR A	0.6
Thorne Bay	1444000	WEST PORT ALICE	4.9
Thorne Bay	1520000	EDNA BAY	13.9
Thorne Bay	1525000	EAST EDNA BAY TTF	5.8
Thorne Bay	1530000	SHIPLEY BAY	7.4
Thorne Bay	2000000	NORTH PRINCE OF WALES ROAD	14.4
Thorne Bay	2000860	MEMORIAL BEACH	1.3
Thorne Bay	2000866	MEMORIAL BEACH SPUR 6	0.4
Thorne Bay	2054305	NORTH STANEY	0.7
Thorne Bay	3000490	WHALE PASS WEST SIDE TTF	0.8
Thorne Bay	3025000		1.2
Thorne Bay	3030295	COFFMAN COVE	0.5
Total			**71.8**

RCS Database Improvements

The RCS database is a tremendous asset to the Tongass National Forest that allows road engineers, fish biologists, and water resource specialists[1] to monitor the environmental effects of roads and identify and prioritize road maintenance needs. For the database to be useful and cost effective, the following items are important:

- Specialists should be confident in the quality of the data.
- The collected data should be meaningful.
- The database should be accessible and easy to use.
- The database should be regularly updated.

The RCS database has grown substantially since first implemented in 1994 and the Forest is close to having complete initial survey information on all open roads in its

[1] For example, hydrologists, fluvial geomorphologists, and water quality specialists.

jurisdiction. This is a major accomplishment that the Forest can be proud of. The database occupies over 60 MB of electronic storage and has over 100,000 records, which are maintained in 9 Excel spreadsheets, one per ranger district. The Forest plans to transfer the database into a more robust database software package in the near future. The IDT concurs with this recommendation to make the database easier to use and maintain. The IDT also recommends that the data structure be updated at that time so that the database utilizes multiple related tables rather than a single table structure.

Based upon its use of the database for this roads analysis and discussions with Forest Service Staff that use the database, the IDT has some additional recommendations the Forest should consider:

- Conduct a statistical analysis of the database to discern crew- and/or district-level differences in problem frequency rates.
- Implement a Quality Assurance/Quality Control (QA/QC) process.
- Create a survey of staff using, or potentially using, the database.
- Build in the ability to estimate maintenance costs.

Summarization of some of the RCS data fields suggested that large differences might be present among the districts in the frequency of certain problem types. A detailed statistical analysis would be useful in discerning true differences and help to identify potential systematic biases in data collection or omission that could be corrected in a QA/QC process. The analysis could also help in identification of thresholds for determining critical road segments with a high frequency of problems. The Forest currently has a training module for conducting road surveys, which helps in maintaining consistency in data collection. Development of a formal QA/QC process may result in the implementation of additional measures that would improve data quality.

The 2001 Transportation System Maintenance Handbook (FSH 7709.58, USDA Forest Service 2002) identifies 64 data elements included in the RCS database. A survey of staff that use the database may help in determining the importance of these elements, identification of additional elements that are not currently collected, and identification of how the data is accessed and used. Field measurement of data elements is expensive and time-consuming. Collection of data not used, or rarely used, in identifying road maintenance needs or environmental effects has low cost-effectiveness. The statistical analysis suggested above may also help in identifying types of problems that are rarely observed and should have low priority for data collection efforts. Understanding how staff uses the data can also help in developing the database structure and user interface.

The RCS database can be expanded to include cost information that can be tied to specific problem types. The database could then be used to help estimate maintenance costs.

References

Alaska Department of Labor (DOL). 2001. Southeast Region: Industry Employment Estimates – 1995 to Present. Nonagricultural Wage and Salary Employment estimates by industry for Southeast Alaska: 1995 to present. Alaska Department of Labor and Workforce Development, Research and Analysis Section. Available at http://www.labor.state.ak.us/research/emp_ue/se95prs.htm.

Alaska Department of Transportation and Public Facilities. 1999. Southeast Alaska Transportation Plan. Division of Statewide Planning, Juneau, Alaska. 110 pp.

Alaska Department of Transportation and Public Facilities. 2001. Amendment One to the Southeast Alaska Transportation Plan. Division of Statewide Planning, Juneau, Alaska. 21 pp.

Alaska Division of Community & Business Development, 2001. 2000 Southeast Alaska Commercial Recreation Survey, Preliminary Draft Report, February 2001.

Bowker, J.M. 2001 outdoor recreation by Alaskans: projections for 2000 through 2020. General Technical Report PNW-GTR-527. Portland, Oregon. USDA Forest Service, Pacific Northwest Research Station. 22pp. Available at http://www.fs.fed.us/pnw/pubs/gtr527.pdf.

Flanders, L.S. and J. Cariello. 2000. Tongass Road Condition Survey Report. Technical Report No. 00-7. Alaska Department of Fish and Game, Juneau, Alaska.

Franklin, J. F. 1993. Preserving biodiversity: species, ecosystems or landscapes? *Ecological Applications* 3: 202-205.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road Construction and Maintenance. Pp 297-323 *in* Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, W.R. Meehan, ed. American Fisheries Society Special Publication 19, Bethesda Maryland. 751 p.

U.S. Department of the Interior. 1998. Common Definitions of Facilities Maintenance and Construction Terms. *In* Facilities Maintenance Assessment and Recommendations, prepared for the USDI Interior Planning, Design and Construction Council. Washington, D.C.

USDA Forest Service. 2001a. National Visitor Use Monitoring Results, Region 10, Tongass National Forest. Preliminary draft report. November.

USDA Forest Service. 1992. Southeast Chichagof Project Area Final Environmental Impact Statement, Alaska Pulp Corporation Long-Term Timber Sale Contract. Tongass National Forest, Alaska Region. R10-MB-187a,b,c,d,e. September.

USDA Forest Service. 1996. Upper Caroll Timber Sale Record of Decision and Final Environmental Impact Statement. Tongass National Forest, Alaska Region. R10-MB-332. October.

USDA Forest Service. 1997. Tongass Land and Resource Management Plan Revision. Tongass National Forest, Alaska Region. R10-MB-338dd.

USDA Forest Service. 1997. Tongass Land Management Plan Revision Final Environmental Impact Statement. Tongass National Forest, Alaska Region. R10-MB-338a,b,c,e,f,g,h.

USDA Forest Service. 1999. Roads Analysis: Informing Decisions about Managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.: U.S. Dept. of Agriculture Forest Service. 222 p.

USDA Forest Service. 2001. Emerald Bay Timber Sale Record of Decision and Final Environmental Impact Statement. Tongass National Forest, Alaska Region. R10-MB-427. October.

USDA Forest Service. 2001. Shoreline Outfitter/Guide Draft Environmental Impact Statement. Tongass National Forest, Alaska Region. R10-MB-425.

USDA Forest Service. 2002. Tongass Land Management Plan Revision Draft Supplemental Environmental Impact Statement for Roadless Area Evaluations for Wilderness Recommendations. Tongass National Forest, Alaska Region. R10-MB-450.

Wolfe, M.D. 1982. The relationship between forest management and landsliding in the Klamath Mountains of northwestern California. Earth Resources Monograph 11. USDA Forest Service, Pacific Southwest Region, San Francisco, California.

APPENDIX A

LAWS AND REGULATIONS FOR ROADS OPERATIONS

Laws, Rules, Regulations, and Policy guiding the National Forest Road System.
Forest Service Manual: 7701.3 - Transportation System Management

Title 36, Code of Federal Regulations, Part 212 (36 CFR Part 212). Establishes requirements for the administration of the forest transportation system, including roads, trails, and airfields, and for the provisions for acquisition of rights-of-way. Describes a minimum road system and requires a science-based roads analysis to plan the road system and to set funding priorities.

Surface Transportation Assistance Act of 1978 as amended (23 U.S.C. 101a, 201-205, Pub. L 95-599 and 97-424). Supersedes the Forest Highway Act of 1958 (Pub. L. 85-767). Authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads, (now referred to as NFS roads), and trails (amended by Pub. L. 97-424); and limits force account project size for forest roads. Establishes the Federal Lands Highway Program.

Title 23, Code of Federal Regulations, Part 1230 (23 CFR Part 1230). These rules promulgated by the Federal Highway Administration establish standards for highway safety. (Applies to Maintenance Level [ML] 3 and above roads, i.e., Forest Development Roads that are eligible for "public road" monies.)

Title 36, Code of Federal Regulations, Part 223 (36 CFR Part 223). These rules establish policy and procedures for Forest Service timber purchaser road construction related to timber appraisals and contracts.

Forest Service Manual (FSM): 7703.1 - Road Management

In accordance with 36 CFR 212.5(b)(1), when managing NFS roads, responsible officials are to:

1. Address both the access benefits and ecological costs of road-associated effects.

2. Give priority to reconstructing and maintaining needed roads and decommissioning unneeded roads, or, where appropriate, converting them to less costly and more environmentally beneficial other uses.

3. Use a roads analysis process (FSM 7712.1) to ensure that road management decisions are based on identification and consideration of social and ecological effects. See FSM 7712.13 for guidance on the scope and scale of roads analysis required

4. Add new roads only where resource management objectives and benefits are clearly demonstrated and where long-term funding obligations have been carefully considered (FSM 7703.2, para. 3).

Road Management Objective (RMO) – Defines the intended purpose of a road based on resource and access management needs as determined through land management planning; contains operation and management criteria for existing roads; and contains design, operation, and maintenance criteria for new roads. RMOs integrate the following:

1. Road Classification: Public, Private, or Forest Development Road

2. Functional Class: Arterial, Collector, or Local

3. Traffic Service Level: A, B, C, or D

4. Maintenance Level: 1, 2, 3, 4, or 5

APPENDIX B

MAINTENANCE LEVEL DEFINITIONS

MAINTENANCE LEVEL DEFINITIONS

1. Maintenance Level Descriptions. MLs 1 through 5 are described in the following paragraphs. These apply to both operational and objective MLs. The operational ML describes the current level and type of use on a road. The objective ML describes the desired future ML based upon the expected type of use the road will receive.

Roads assigned to MLs 2, 3, 4, and 5 are either constant service roads or intermittent service roads during the time they are open to traffic.

Level 1. Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normality given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate." Roads receiving ML 1 may be of any type, class, or construction standard, and may be managed at any other ML during the time they are open for traffic. However, while being maintained at ML 1, they are closed to vehicular traffic, but they still may be open and suitable for nonmotorized uses.

Level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars, or (2) accept or discourage high clearance vehicles.

Level 3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this ML are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced; however, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is "encourage"; however, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Level 5. Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is "encourage."

2. Management Decisions. The distinction between MLs is not always sharply defined. Some parameters overlap two or more different MLs.

Selected MLs are based on the best overall fit of the parameters for the road in question. In those situations where the parameters do not indicate a definite selection, use the desired level of user comfort and convenience as the overriding criteria to determine the maintenance use level. Manage roads assigned operational MLs 3, 4, and 5 in accordance with the requirements of the Highway Safety Act of 1966 (P.L. *89-564).* See FSM 7730 for management direction.

APPENDIX C

TRAFFIC MANAGEMENT SERVICE LEVEL DEFINITIONS

Service Feature	Traffic Management Service Level	
	A	B
Flow	The flow is free with adequate parking facilities.	Congested during heavy traffic, such as during peak logging or recreation.
Volumes	Uncontrolled; will accommodate the expected traffic volumes.	Occasionally controlled during heavy use periods.
Vehicle Types	Mixed; includes the critical vehicle and all vehicles normally found on public roads.	Mixed; includes the critical vehicle and all vehicles normally found on public roads.
Critical Vehicle	Clearances are adequate to allow free travel. Overload permits are required.	Traffic controls needed where clearances are marginal. Overload permits are required.
Safety	Safety features are a part of the design.	High priority in design. Some protection is accomplished by traffic management.
Traffic Management	Normally limited to regulatory, warning, and guide signs and permits.	Traffic is employed to reduce traffic volume and conflicts.
User Costs	Minimize; transportation and efficiency is important.	Costs are generally higher than A because of slower speeds increased delays.
Alignment	Design speeds is the predominant factor within feasible topographic limitations.	Alignment is influenced more strongly by topography than by speed and efficiency.
Road Surface	Stable and smooth with little or no dust, considering the normal season of use.	Stable for the predominant traffic for the normal use season. Periodic dust control for heavy use or environmental reasons. Smoothness is commensurate with the design speed.

Service Feature	Traffic Management Service Level	
	C	D
Flow	Flow is interrupted by limited passing facilities, or slowed by the road condition.	Flow is slow or may be blocked by an activity. Two-way traffic is difficult and may require backing to pass.
Volumes	Volume is erratic; frequently controlled as the capacity is reached.	Volume is intermittent and usually controlled. Volume is also limited to that associated with the single purpose.
Vehicle Types	Vehicle types are controlled mix; accommodates all vehicle types including the critical vehicle. Some use may be controlled to vehicle types.	Single use; not designed for mixed traffic. Some vehicles may not be able to negotiate. Concurrent use traffic is restricted.
Critical Vehicle	Special provisions may be needed. Some vehicles will have difficulty negotiating some segments.	Some vehicles may not be able to negotiate. Loads may have to be off-loaded and walked in.
Safety	Most protection is provided by management.	The need for protection is minimized by low speeds and strict traffic control.
Traffic Management	Traffic controls are frequently needed during periods of high use by the dominant resource activity.	Traffic management is used to discourage or prohibit traffic other than that associated with the single purpose.
User Costs	User cost is not important; efficiency of travel may be traded for lower construction cost.	Not considered.
Alignment	Generally dictated by topographic features and environmental factors. Design speeds are generally low.	Dictated by topography, environmental factors, and the design and critical vehicle limitations. Speed is not important.
Road Surface	May not be stable under all traffic or weather conditions during the normal use season. Surface rutting, roughness, and dust may be present, but controlled for only environmental or investment protection.	Rough and irregular travel with low clearance vehicle is difficult. Stable during dry conditions. Rutting and dusting controlled for soil and water protection.

APPENDIX D

INVENTORY OF ROADS

CURRENT MAINTENANCE LEVEL 3, 4 AND 5 ROADS
UNDER FOREST SERVICE JURISDICTION
AND
NON-FOREST SERVICE JURISDICTION

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
74511	ANGOON WORK CENTER	3	3	L	IMP	Admiralty	B	0.2
8460	GREEN'S CREEK MINE	3	3	L	IMP	Admiralty	B	14.2
2000240		3	3	L	AGG	Craig		0.4
2000250		3	3	L	AC	Craig		0.1
2000250		3	3	L	AGG	Craig		0.1
2000251		3	3	L	AC	Craig		0.0
2014000	WEST TROCADERO	3	2	C	IMP	Craig	C	3.0
2025000	ROAD TRAIL	3	3	C	IMP	Craig	D	1.8
2100000	DOG SALMON	3	2	A	IMP	Craig	B	7.0
2100000	DOG SALMON	3	2	A	IMP	Craig	B	7.7
2100000	DOG SALMON	3	2	A	IMP	Craig	B	2.5
2100000	DOG SALMON	3	2	A	IMP	Craig	B	5.0
2100368	DOG SALMON FISH PASS	3	2	L	IMP	Craig	D	0.1
2120000	KINA COVE	3	2	C	IMP	Craig	C	4.3
2120000	KINA COVE	3	2	C	IMP	Craig	C	3.5
2120000	KINA COVE	3	2	C	IMP	Craig	C	3.3
2122000	TWELVEMILE CREEK EAST RIDGE	3	1	C	IMP	Craig	D	0.5
2135000	WEST RIDGE	3	2	C	IMP	Craig	C	5.9
2135500	CABIN CREEK	3	1	L	IMP	Craig	D	3.1
2135500	CABIN CREEK	3	1	L	IMP	Craig	D	3.2
2140000	LOG DUMP	3	2	C	IMP	Craig	C	0.6
2140000	LOG DUMP	3	2	C	IMP	Craig	C	0.7
2140200	POLK CAMP	3	2	L	IMP	Craig	C	0.1
2150000	EAST POLK INLET	3	2	C	IMP	Craig	D	8.0
2150000	EAST POLK INLET	3	2	C	IMP	Craig	D	1.4
2150000	EAST POLK INLET	3	2	C	IMP	Craig	D	0.4
2150200		3	1	L	IMP	Craig	D	2.8

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
2150300		3	2	L	IMP	Craig	D	0.7
2150400	POLK CREEK	3	2	L	IMP	Craig	D	2.8
2150500		3	2	L	IMP	Craig	D	0.6
2150600		3	2	L	IMP	Craig	D	2.8
2150600		3	1	L	IMP	Craig	D	2.5
8502	GAME CREEK	3	3	A	IMP	Hoonah	B	10.7
8508	NF FRESHWATER	3	3	A	IMP	Hoonah	B	15.4
8510	FRESHWATER BAY	3	2	C	IMP	Hoonah	C	11.7
8513	WASCHUSSETTS COVE	3	3	C	IMP	Hoonah	C	6.6
8519	KENNEL CREEK	3	3	L	IMP	Hoonah	D	2.4
8530	HOONAH GYPSUM	3	3	A	IMP	Hoonah	B	20.6
8530	HOONAH GYPSUM	3	3	A	IMP	Hoonah	B	4.5
8530	HOONAH GYPSUM	3	3	A	IMP	Hoonah	B	3.8
85304	WHITESTONE HARBOR	3	3	C	IMP	Hoonah	C	3.1
8534	IYOUKTUG	3	3	C	IMP	Hoonah	C	3.6
8570	LONG ISLAND TIE	3	3	C	IMP	Hoonah	C	1.2
8570	LONG ISLAND TIE	3	3	C	IMP	Hoonah	C	0.9
8577	8 FATHOM CAMP	3	3	C	IMP	Hoonah	C	0.9
8578	15 MILE	3	3	C	IMP	Hoonah	C	2.0
8579	SALT LAKE BAY	3	3	C	IMP	Hoonah	C	4.4
8579	SALT LAKE BAY	3	3	C	IMP	Hoonah	C	2.1
8579	SALT LAKE BAY	3	3	C	IMP	Hoonah	C	0.8
8580	NEKA MUD	3	3	C	IMP	Hoonah	B	2.5
8580	NEKA MUD	3	3	C	IMP	Hoonah	B	10.6
85811		3	3	C	IMP	Hoonah	C	4.2
8582	MUD RIVER	3	3	L	IMP	Hoonah	D	1.9
8410	KENSINGTON MINE ROAD	3	3	L	IMP	Juneau	D	2.0

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
8411	JUALIN MINE ROAD	3	3	L	IMP	Juneau	C	5.4
8426	RANGER STATION	5	5	L	AC	Juneau	B	0.2
8429	EAGLE BEACH	4	4	L	AGG	Juneau	B	0.2
8436	HERBERT GLACIER PARKING LOT	3	3	L	IMP	Juneau	B	0.1
8450	AUKE VILLAGE CAMPGROUND	4	4	L	AGG	Juneau	B	0.3
8451	LENA COVE	4	4	L	NAT	Juneau	B	0.2
8453	MENDENHALL LAKE	4	4	L	P	Juneau	B	0.4
8454	HERBERT RIVER ROAD	3	3	L	IMP	Juneau	B	0.8
8456	MGVC PARKING LOT 1	5	5	L	AC	Juneau	B	0.1
8457	MGVC PARKING LOT 2	5	5	L	AC	Juneau	B	0.1
8458	MENDENHALL CAMPGROUND	4	4	L	AGG	Juneau	B	1.2
8488	HOBART BAY	3	3	C	AGG	Juneau	C	6.3
8498	LAURA CREEK	3	1	C	AGG	Juneau	D	1.3
8000000	BEHM CANAL	4	4	A	AC	Ketch/Mist	C	1.1
8000010	SIGNAL CREEK CAMPGROUND	4	4	L	AC	Ketch/Mist	C	0.4
8000012	SIGNAL CREEK CG SPUR	4	4	L	AC	Ketch/Mist	C	0.1
8000015	3CS CAMPGROUND	4	4	A	AC	Ketch/Mist	C	0.1
8000017	GRASSY POINT PARKING	4	4	L	AC	Ketch/Mist	C	0.0
8000020	WARDLAKE PICNIC	4	3	L	AC	Ketch/Mist	C	0.1
8000025	LAST CHANCE CAMPGROUND	4	4	L	AC	Ketch/Mist	C	0.3
8000030	CONNELL LAKE PICNIC	3	3	L	AC	Ketch/Mist	C	0.0
8000030	CONNELL LAKE PICNIC	3	3	L	IMP	Ketch/Mist	C	0.6
8005000	WHITE RIVER ROAD	3	3	C	PIT	Ketch/Misty	C	0.2
40000	FROOT LOOPS	3	3	C	PIT	Petersburg	C	5.3
40007	UPPER BRUIN	3	2	L	PIT	Petersburg	D	1.0
40100	BLIND RIVER RAPIDS PARK. AREA	5	5	L	BST	Petersburg	A	0.1
40101		3	3	C	PIT	Petersburg		0.1

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
40900	PRD FRAM ST HOUSING COMPOUND	4	4	L	AGG	Petersburg	A	0.0
43003	PORTAGE BAY ADMIN SITE	3	3	L	PIT	Petersburg	D	0.3
43010	SPRING	3	1	L	PIT	Petersburg	D	0.9
43036	LIZZY	3	1	L	PIT	Petersburg	D	0.4
45601	LOW BALL	3	2	L	PIT	Petersburg	D	3.6
45601	LOW BALL	3	2	L	PIT	Petersburg	D	1.0
45602	HIGH BALL	3	1	L	PIT	Petersburg	D	0.5
45803		3	2	L	PIT	Petersburg		1.4
45806		3	3	L	PIT	Petersburg		0.6
45806		3	3	L	PIT	Petersburg		1.0
45808	SCREWDRIVER	3	3	L	PIT	Petersburg	D	2.6
46042	FLOAT ROAD	3	3	L	PIT	Petersburg	C	0.1
46090	JIGGLE	3	1	L	PIT	Petersburg	D	1.1
46092	SELECTION	3	1	L	PIT	Petersburg	D	1.6
46095	ROWAN SOUTH	3	3	L	PIT	Petersburg	D	0.5
46096	SHORTY	3	2	L	PIT	Petersburg	D	3.9
46155	KADAKE TRAILHEAD	3	3	L	PIT	Petersburg		0.1
46341	THREEMILE BOAT RAMP	3	3	L	PIT	Petersburg		0.1
46355	RABBLE	3	2	L	PIT	Petersburg	D	2.1
46420	CONTRAVERSY	3	2	L	PIT	Petersburg	D	1.2
46449	FXF II	3	2	L	PIT	Petersburg	D	0.1
6000	SEAL POINT	3	3	C	AGG	Petersburg	C	1.0
6030	GOOSE LAKE	3	3	C	AGG	Petersburg	C	13.3
6031	GOOSE COVE	3	2	C	PIT	Petersburg	C	3.4
6031	GOOSE COVE	3	2	C	PIT	Petersburg	C	9.7
6031	GOOSE COVE	3	2	C	PIT	Petersburg	C	1.2
6032	BOHEMIA SOUTH	3	2	C	PIT	Petersburg	C	1.6

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
6040	KAKE ROAD	3	3	A	AGG	Petersburg	C	8.6
6040	KAKE ROAD	3	3	A	PIT	Petersburg	C	2.3
6040	KAKE ROAD	3	3	A	AGG	Petersburg	C	1.1
6040	KAKE ROAD	3	2	L	PIT	Petersburg	D	2.6
6100	MUD	3	3	L	PIT	Petersburg	D	2.9
6204	FREDERICK	3	3	C	PIT	Petersburg	B	8.9
6205	PAN CREEK	3	1	L	PIT	Petersburg	D	1.2
6208	FRENCHY	3	3	L	PIT	Petersburg	D	3.1
6209	TWIN	3	3	L	PIT	Petersburg	C	4.8
6210	PAINT	3	1	L	PIT	Petersburg	D	1.2
6212	BOUNDARY	3	1	L	PIT	Petersburg	D	1.1
6232	CANYON CREEK	3	3	L	PIT	Petersburg	D	0.6
6234	BLIND RIVER RECREATION AREA	3	3	L	BST	Petersburg	B	0.2
6235	THREE LAKES LOOP	3	3	C	AGG	Petersburg	B	0.5
6235	THREE LAKES LOOP	3	3	C	AGG	Petersburg	B	3.2
6235	THREE LAKES LOOP	3	3	C	AGG	Petersburg	B	17.4
6238	OHMER CREEK CAMPGROUND	3	3	L	AGG	Petersburg	B	0.3
6241	DRY STRAIT	3	3	C	PIT	Petersburg	C	9.4
6245	WOODPECKER ROAD	3	3	C	AGG	Petersburg	C	4.8
6245	WOODPECKER ROAD	3	3	C	PIT	Petersburg	C	6.7
6245	WOODPECKER ROAD	3	2	C	PIT	Petersburg	D	6.5
6246	WEST FORK OMHER CREEK	3	3	L	PIT	Petersburg	D	0.3
6246	WEST FORK OMHER CREEK	3	2	L	PIT	Petersburg	D	1.1
6252	POINT AGASSIZ CONNECTION	3	3	L	PIT	Petersburg	C	4.1
6256	THOMAS BAY	3	3	C	PIT	Petersburg	C	2.4
6256A	MUDDY RELOCATE	3	3	C		Petersburg		1.6
6257	THOMAS BAY FLOAT	3	3	L		Petersburg		0.2

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
6282	SUMNER PASS	3	1	L	PIT	Petersburg	D	1.7
6285	WOODPECKER COVE	3	3	L	PIT	Petersburg	C	0.2
6314	KEKU STRAIT	3	3	C	AGG	Petersburg	C	4.0
6314	KEKU STRAIT	3	3	C	PIT	Petersburg	C	2.9
6314S	KEKU STRAIT	3	3	C	PIT	Petersburg	C	5.0
6314S	KEKU STRAIT	3	3	C	PIT	Petersburg	C	8.7
6317	CAPE STRAIT	3	3	C	PIT	Petersburg	C	7.5
6319	GOOSE CREEK	3	3	C	PIT	Petersburg	C	11.0
6323	MISSIONARY MOUNTAIN	3	3	L	PIT	Petersburg	D	1.4
6326	MARBLE KNOBS	3	3	L	PIT	Petersburg	D	7.4
6326	MARBLE KNOBS	3	3	L	PIT	Petersburg	D	0.7
6328	JASPER HIGH	3	3	C	PIT	Petersburg	D	1.9
6328	JASPER HIGH	3	3	C	AGG	Petersburg	D	6.0
6350	MITCHELL-TONKA	3	3	C	PIT	Petersburg	C	17.9
6352	GELCH-DE	3	3	C	PIT	Petersburg	D	11.1
6401	BULL BUCK	3	2	L	PIT	Petersburg	D	1.0
6402	KUIU MAINLINE	3	3	A	PIT	Petersburg	B	6.7
6402	KUIU MAINLINE	3	3	A	PIT	Petersburg	B	15.8
6402	KUIU MAINLINE	3	3	A	PIT	Petersburg	B	8.9
6402	KUIU MAINLINE	3	1	A	PIT	Petersburg	B	0.4
6403	LEDGE LAKE	3	1	L	PIT	Petersburg	D	0.4
6404	ROWAN BAY	3	3	C	PIT	Petersburg	B	4.4
6407	UPPER ROWAN	3	3	C	PIT	Petersburg	C	6.5
6409	NORTHEAST KUIU	3	1	L	PIT	Petersburg	D	2.9
6410	KADAKE BAY	3	1	L	PIT	Petersburg	D	2.2
6411	RIDGE TOP	3	1	L	PIT	Petersburg	D	0.8
6413	SOUTH FORK SAGINAW	3	2	L	PIT	Petersburg	D	2.1

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
6414	WHISTLE PUNK	3	1	L	PIT	Petersburg	D	0.1
6415	KUIU CONNECTION	3	3	C	PIT	Petersburg	C	13.1
6415	KUIU CONNECTION	3	3	C	PIT	Petersburg	C	5.0
6418	UPPER SAGINAW BAY	3	2	L	PIT	Petersburg	D	0.3
6423	UPPER PILLAR BAY	3	1	L	PIT	Petersburg	D	0.5
6425	DEAN CREEK	3	3	L	PIT	Petersburg	D	4.7
6425	DEAN CREEK	3	1	L	PIT	Petersburg	D	1.1
6428	EAST FORK KADAKE CREEK	3	3	L	PIT	Petersburg	D	3.4
6430	ROWAN CREEK	3	2	L	PIT	Petersburg	D	2.0
6431	PILLAR BAY	3	1	L	PIT	Petersburg	D	1.5
6434	3-MILE ARM	3	3	C	PIT	Petersburg	C	6.0
6437	BEAVER POND	3	3	L	PIT	Petersburg	D	1.0
6437	BEAVER POND	3	2	L	PIT	Petersburg	D	4.6
6437	BEAVER POND	3	1	L	PIT	Petersburg	D	0.7
6441	CEDAR BIGHT	3	1	L	PIT	Petersburg	D	1.7
6449	RIDGE ROAD	3	2	L	PIT	Petersburg	D	3.6
6453	ROWAN VIEW	3	2	L	PIT	Petersburg	D	0.3
6461	EAGLE ISLAND	3	3	L	PIT	Petersburg	D	3.0
6461	EAGLE ISLAND	3	2	L	PIT	Petersburg	D	4.0
6462	UPPER 3	3	2	L	PIT	Petersburg	D	1.6
6478	SECLUSION HARBOR	3	3	L	PIT	Petersburg	D	0.6
7511	SITKA WORK CENTER	4	4	L	AGG	Sitka	B	0.1
7512	SITKA DOCK DRIVE WAY	4	4	L	AGG	Sitka	B	0.1
7513	STARRIGAVIN CAMPGROUND	4	4	L	AGG	Sitka	B	0.8
7514	RESIDENCE ACCESS	4	4	L	AC	Sitka	B	0.2
7520	TRAP BAY	3	3	C	IMP	Sitka	C	2.8
7540CB	CORNER BAY MAIN LINE	3	3	C	IMP	Sitka	C	7.7

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
7540FI	FALSE ISLAND	3	3	C	IMP	Sitka	A	14.3
7546	FLORENCE BAY	3	3	C	IMP	Sitka	C	7.9
7551	CORNER BAY SPUR	3	3	A	IMP	Sitka	B	0.3
75511	CORNER BAY WORK CENTER	3	3	L	IMP	Sitka	C	0.4
7569	SAWMILL CREEK CAMPGROUND	4	4	L	IMP	Sitka	B	0.3
7576	HARBOR MOUNTAIN	3	3	C	AGG	Sitka	B	3.3
7577	BLUE LAKE	4	4	C	AGG	Sitka	B	2.3
7581	STARRIGAVIN PG	4	4	L	AGG	Sitka	B	0.2
7598	CASCADE CREEK TRAILER CO	4	4	L	AGG	Sitka	B	0.1
7598	CASCADE CREEK TRAILER CO	4	4	L	AGG	Sitka	B	0.1
8578	15 MILE	3	3	C	IMP	Sitka	C	4.3
8579	SALT LAKE BAY	3	3	C	IMP	Sitka	C	1.6
1435000	EAGLE CREEK	3	3	C	IMP	Thorne Bay	C	0.3
2000000	NORTH PRINCE OF WALES ROAD	4	4	A	AGG	Thorne Bay	B	8.3
2000000	NORTH PRINCE OF WALES ROAD	3	4	A	AGG	Thorne Bay	B	11.5
2000000	NORTH PRINCE OF WALES ROAD	3	4	A	AGG	Thorne Bay	B	10.0
2000000	NORTH PRINCE OF WALES ROAD	3	4	A	AGG	Thorne Bay	B	6.4
2000000	NORTH PRINCE OF WALES ROAD	3	3	A	AGG	Thorne Bay	C	8.3
2000000	NORTH PRINCE OF WALES ROAD	3	3	A	AGG	Thorne Bay	C	8.3
2030000	LAKE ELLEN ROAD	3	3	C	IMP	Thorne Bay	C	5.8
2030000	LAKE ELLEN ROAD	3	2	C	IMP	Thorne Bay	D	3.5
2030700	L E D-SPUR	3	2	L	IMP	Thorne Bay	D	3.7
2030790	L.E. C-SPUR	3	3	L	IMP	Thorne Bay	C	0.7
2030792	LAKE NO. 3 CAMPGROUND	3	3	L	IMP	Thorne Bay	C	0.1
2050000	SHAHEEN	3	3	C	IMP	Thorne Bay	C	8.5
2050000	SHAHEEN	3	3	C	IMP	Thorne Bay	C	1.3
2050000	SHAHEEN	3	3	C	IMP	Thorne Bay	D	1.4

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
2050000	SHAHEEN	3	3	C	IMP	Thorne Bay	C	6.1
2050000	SHAHEEN	3	3	C	IMP	Thorne Bay	C	5.8
2050050	SADDLE SPUR	3	2	L	IMP	Thorne Bay	D	5.2
2050100	FORKS	3	1	L	IMP	Thorne Bay	D	2.7
2050200	LOOP	3	3	L	IMP	Thorne Bay	C	1.1
2050300	TWIN SPUR	3	2	L	IMP	Thorne Bay	D	3.0
2050300	TWIN SPUR	3	1	L	IMP	Thorne Bay	D	5.2
2050505	STANEY CREEK SO CAMPGROUND	3	3	L	PIT	Thorne Bay	C	0.1
2050600	NORTH TWIN	3	2	L	IMP	Thorne Bay	D	2.4
2050700	TWIN MOUNTAIN NORTH SLOPE	3	2	L	IMP	Thorne Bay	C	2.5
2051000	FRONT SPUR	3	2	C	IMP	Thorne Bay	C	5.9
2051000	FRONT SPUR	3	2	C	IMP	Thorne Bay	D	0.2
2051100	SOUTH NOSSUK	3	1	L	IMP	Thorne Bay	D	2.5
2052000	UPPER LOG JAM	3	2	C	IMP	Thorne Bay	C	3.8
2054000	TUXEKAN PASSAGE	3	3	C	IMP	Thorne Bay	C	7.4
2054200	OX BOW CREEK	3	2	L	IMP	Thorne Bay	D	2.9
2054300	STANEY CREEK CAMPGROUND	3	3	L	IMP	Thorne Bay	C	1.2
2056000	LOG	3	2	C	IMP	Thorne Bay	C	2.5
2056100	RABBIT EARS LAKE	3	1	L	IMP	Thorne Bay	C	2.7
2056200	LOG SPUR ONE	3	1	L	IMP	Thorne Bay	D	1.7
2057000	BRUSH	3	2	C	IMP	Thorne Bay	C	4.0
2057200	BRUSH HILL	3	2	L	IMP	Thorne Bay	D	0.8
2057300		3	2	L	IMP	Thorne Bay	D	2.4
2058000	GUTCHI CREEK	3	2	C	IMP	Thorne Bay	C	4.7
2058400	SLOW CREEK	3	2	L	IMP	Thorne Bay	D	0.2
2058400	SLOW CREEK	3	2	L	IMP	Thorne Bay	D	0.2
2058400	SLOW CREEK	3	2	L	IMP	Thorne Bay	D	0.9

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
2059000	ROCK POINT	3	2	C	IMP	Thorne Bay	C	4.3
2059300		3	2	L	PIT	Thorne Bay	D	2.4
2059400	ROCK POINT HILLTOP	3	2	L	IMP	Thorne Bay	D	1.8
2060000	TUXEKAN NARROWS	3	3	C	IMP	Thorne Bay	C	2.7
2060500		3	3	L	PIT	Thorne Bay	B	0.2
2079000	PINE POINT	3	2	C	IMP	Thorne Bay	C	2.7
2079000	PINE POINT	3	1	C	IMP	Thorne Bay	D	4.0
2080000	BIG CREEK	3	2	C	IMP	Thorne Bay	C	3.4
2080000	BIG CREEK	3	1	C	IMP	Thorne Bay	D	0.6
2082000	DUCK	3	2	C	IMP	Thorne Bay	C	2.1
2082000	DUCK	3	2	C	IMP	Thorne Bay	D	0.1
2083000	BUSTER CREEK	3	2	C	IMP	Thorne Bay	C	4.8
2083000	BUSTER CREEK	3	1	C	IMP	Thorne Bay	D	0.3
2084000	BUSTER RIDGE	3	2	C	IMP	Thorne Bay	C	3.3
2085000	ALDER CREEK	3	2	C	IMP	Thorne Bay	C	4.7
2085000	ALDER CREEK	3	2	C	IMP	Thorne Bay	C	0.6
2092000	LABOUCHERE BAY	3	2	C	IMP	Thorne Bay	C	3.4
2300000	COFFMAN TIE	3	3	A	AGG	Thorne Bay	C	4.4
2360000	FISH CITY	3	2	C	IMP	Thorne Bay	C	4.5
2360300		3	2	L	IMP	Thorne Bay	D	0.7
2360400		3	2	L	IMP	Thorne Bay	D	1.3
2500000	NECK LAKE	3	3	A	AGG	Thorne Bay	C	3.6
2505000	SOUTH NECK LAKE HILLS	3	2	C	IMP	Thorne Bay	D	4.7
2700000	TWIN ISLAND LAKE	3	3	A	IMP	Thorne Bay	D	6.1
2710000	TWIN ISLAND 10	3	2	C	IMP	Thorne Bay	D	4.1
2720000	CAVERN LAKE	3	2	C	IMP	Thorne Bay	D	4.3
2730000	EXCHANGE COVE LOOP	3	2	C	IMP	Thorne Bay	C	3.5

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	B	1.4
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	C	5.1
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	C	10.7
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	C	5.6
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	C	5.0
3000000	EAST PRINCE OF WALES	3	3	A	AGG	Thorne Bay	B	5.3
3000000	EAST PRINCE OF WALES	3	3	A	AGG	Thorne Bay	D	4.0
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	D	4.9
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	D	2.9
3000000	EAST PRINCE OF WALES	3	3	A	IMP	Thorne Bay	C	9.3
3000000	EAST PRINCE OF WALES	3	3	A	AGG	Thorne Bay	C	6.6
3000000	EAST PRINCE OF WALES	3	3	A	AGG	Thorne Bay	C	3.4
3000020	EAGLE NEST CAMPGROUND ROAD	3	3	L	AGG	Thorne Bay	B	0.7
3000025		3	3	L	AGG	Thorne Bay	B	0.1
3000130	USFS DRIVE	3	3	L	PIT	Thorne Bay	C	0.2
3000134	FEDERAL WAY	3	3	L	IMP	Thorne Bay	C	0.3
3000179	SANDY BEACH CG	3	3	L	PIT	Thorne Bay	C	0.0
3010000	EAST CONTROL LAKE	3	1	C	IMP	Thorne Bay	D	0.5
3013000	RUSH PEAK RIDGE	3	1	C	IMP	Thorne Bay	D	4.1
3013200	RUSH PEAK WEST VALLEY	3	1	L	IMP	Thorne Bay	D	2.3
3013200	RUSH PEAK WEST VALLEY	3	1	L	IMP	Thorne Bay	D	0.7
3015000	NORTH THORNE RIVER	3	2	C	IMP	Thorne Bay	D	3.8
3015100	WEST FALLS CREEK	3	1	L	IMP	Thorne Bay	D	2.6
3015600	ECHO SPUR	3	1	L	IMP	Thorne Bay	D	3.7
3015600	ECHO SPUR	3	1	L	IMP	Thorne Bay	D	0.4
3015600	ECHO SPUR	3	1	L	IMP	Thorne Bay	D	0.1
3016000	HONKER	3	1	C	IMP	Thorne Bay	D	6.6

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
3018000	DEER CREEK MID-VALLEY	3	3	C	IMP	Thorne Bay	D	3.4
3018200	SLIDE CREEK	3	1	L	IMP	Thorne Bay	D	5.1
3018500	BOTTOM OF THE HILL	3	2	L	IMP	Thorne Bay	D	2.3
3020000	SAL CREEK	3	2	C	IMP	Thorne Bay	D	4.5
3020000	SAL CREEK	3	2	C	IMP	Thorne Bay	D	0.1
3026000	NORTH WALL	3	1	C	IMP	Thorne Bay	C	4.8
3026000	NORTH WALL	3	1	C	IMP	Thorne Bay	C	0.3
3030000	COFFMAN COVE LOOP	3	3	C	AGG	Thorne Bay	C	4.6
3030000	COFFMAN COVE LOOP	3	3	C	AGG	Thorne Bay	C	3.8
3030000	COFFMAN COVE LOOP	3	3	C	AGG	Thorne Bay	C	6.9
3030000	COFFMAN COVE LOOP	3	3	C	AGG	Thorne Bay	C	4.0
3030100	EAGLE CREEK	3	1	L	PIT	Thorne Bay	D	3.2
3030105	LUCK LAKE ACCESS	3	2	L	PIT	Thorne Bay	D	0.2
3030200	CANYON SPUR	3	2	L	IMP	Thorne Bay	D	3.0
3030300	LUCK POINT NO BEACH SLOPE	3	1	L	PIT	Thorne Bay	D	3.4
3030300	LUCK POINT NO BEACH SLOPE	3	1	L	PIT	Thorne Bay	D	0.9
3030400	CHUM CREEK WEST BANK	3	1	L	PIT	Thorne Bay	D	3.0
3030500	LAKE BAY	3	1	L	IMP	Thorne Bay	D	4.8
3030500	LAKE BAY	3	1	L	IMP	Thorne Bay	D	0.8
3030600	UPPER COFFMAN CREEK	3	2	L	PIT	Thorne Bay	D	3.1
3030700	THUMPETER LAKE	3	2	L	PIT	Thorne Bay	D	8.4
3030700	THUMPETER LAKE	3	2	L	PIT	Thorne Bay	D	0.2
3030850	SWEET COVE SPUR TWO	3	3	L	IMP	Thorne Bay	D	0.6
3035000	WOLF PUP	3	2	C	IMP	Thorne Bay	C	6.4
3035000	WOLF PUP	3	2	C	IMP	Thorne Bay	C	2.0
3035100	LOG JAM RIDGE	3	1	L	PIT	Thorne Bay	D	3.0
3035200	LOG JAM LAKE SPUR TWO	3	1	L	IMP	Thorne Bay	D	2.2

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
3036000	LOG JAM	3	2	C	IMP	Thorne Bay	D	2.5
3036000	LOG JAM	3	1	C	IMP	Thorne Bay	D	0.3
3036600		3	1	L	IMP	Thorne Bay	D	1.3
3060000	SNOOSE CREEK	3	1	C	IMP	Thorne Bay	D	0.8
3060000	SNOOSE CREEK	3	1	C	IMP	Thorne Bay	D	2.4
3062000	TWIN ISLAND CREEK EAST RIDGE	3	1	C	IMP	Thorne Bay	D	2.1
3065000	WHALE PASS	3	2	C	IMP	Thorne Bay	C	0.7
3065000	WHALE PASS	3	2	C	IMP	Thorne Bay	C	1.2
50033	ANITA VIEW	3	3	L	PIT	Wrangell	C	0.3
50040	HIGHBUSH	3	3	L	PIT	Wrangell	D	0.2
50040	HIGHBUSH	3	3	L	PIT	Wrangell	D	1.1
50050	SALAMANDER	3	3	L	PIT	Wrangell	C	1.2
50051		3	3	L	PIT	Wrangell	D	0.0
50051		3	3	L	PIT	Wrangell	D	1.5
50051		3	3	L	PIT	Wrangell	D	2.1
50052		3	3	L	PIT	Wrangell	D	1.0
50054	LOST JOE	3	3	L	PIT	Wrangell	C	1.9
50060	BIG HOLLOW	3	3	L	PIT	Wrangell	C	4.2
50999	RANGER STATION	4	4	L	AGG	Wrangell	A	0.0
51421	WEST MOSMAN INLET	3	3	L	PIT	Wrangell	D	0.4
52000	ROOSEVELT HARBOR	3	3	L	PIT	Wrangell	D	0.2
52001	DEEP BAY TTF ACCESS	3	3	L	PIT	Wrangell	D	0.4
52016		3	3	L	PIT	Wrangell	D	0.6
52019		3	3	L	PIT	Wrangell	D	2.4
52020	NOWHERE	3	3	L	PIT	Wrangell	D	0.4
52021	DEER LAKE	3	3	L	PIT	Wrangell	D	2.6
52022		3	3	L	PIT	Wrangell	D	3.7

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
52023		3	3	L	PIT	Wrangell	D	0.6
52031	ZAREMBO NORTH	3	3	L	PIT	Wrangell	C	0.7
6259	PATS CREEK	3	3	C	PIT	Wrangell	C	5.2
6265	MCCORMICK CREEK	3	3	C	AGG	Wrangell	B	14.5
6267	NEMO	3	3	C	PIT	Wrangell	C	13.9
6270	FOOLS INLET	3	3	C	AGG	Wrangell	C	9.9
6271	LONG LAKE	3	3	L	PIT	Wrangell	D	0.6
6299	THOMS CREEK	3	3	C	AGG	Wrangell	C	8.9
6540	MUSSEL SHELL	3	3	C	PIT	Wrangell	C	10.6
6541	ANITA BAY ACCESS	3	3	L	PIT	Wrangell	D	0.5
6547	BURNETT INLET	3	3	L	PIT	Wrangell	D	1.2
6578		3	3	L	PIT	Wrangell	D	0.8
6585	WEST ZAREMBO	3	3	C	PIT	Wrangell	C	8.3
6585	WEST ZAREMBO	3	3	C	PIT	Wrangell	C	3.5
6588	NORTHWEST ZARENBO CONNECTION	3	3	L	PIT	Wrangell	C	3.2
6590	SAINT JOHNS	3	3	C	PIT	Wrangell	C	0.3
6590	SAINT JOHNS	3	3	C	PIT	Wrangell	C	12.4
6590	SAINT JOHNS	3	3	C	PIT	Wrangell	C	18.5
6590	SAINT JOHNS	3	3	C	PIT	Wrangell	C	11.2
6592	ZAREMBO LAKE	3	3	L	PIT	Wrangell	D	1.5
6593	METER BIGHT	3	3	L	PIT	Wrangell	D	4.3
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	0.3
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	0.0
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	0.2
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	0.0
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	1.1
6594	SOUTH ZAREMBO CONNECTION	3	3	C	PIT	Wrangell	C	0.0

Table D1. Current Maintenance Level 3, 4 and 5 Roads Under Forest Service Jurisdiction by Ranger District

Route Number	Route Name	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length (Miles)
6597	STIKINE STRAIT	3	1	C	PIT	Wrangell	C	2.2
9951	WEST GATE	3	3	C	IMP	Yakutat	C	4.3
9955	EAST GATE	3	3	L	IMP	Yakutat	C	3.3
9957	SAWMILL COVE	3	3	C	IMP	Yakutat	C	0.8
9963	CANNON BEACH	3	3	C	IMP	Yakutat	B	2.4
9964	YAKUTAT ADMINISTRATIVE SITE	3	3	L	IMP	Yakutat	B	0.5
9966	STRAWBERRY POINT	3	3	C	IMP	Yakutat	B	0.6
9976	BROKEN RIDGE ROAD	3	3	C	IMP	Yakutat	C	1.3
9977	YAKUTAT WORK CENTER ROAD	3	3	L	IMP	Yakutat	B	0.1

Table D2. Mainline Roads Under Other Jurisdiction or Ownership

Route Number	Route Name	Jurisdiction	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length in Miles
1080000		S		2		IMP	Craig	D	0.2
1080000		S		2		IMP	Craig	D	0.1
2024050				C			Craig		1.4
2024100	INDIAN CREEK	S				IMP	Craig		1.7
2122310	TWELVEMILE CREEK THREE TEN	P				IMP	Craig		2.2
2122311	TWELVEMILE CREEK UPPER EAST	P				IMP	Craig		1.9
2122320	TWELVEMILE CREEK UPPER WEST	P				IMP	Craig		1.8
2122400	TWELVEMILE CREEK EAST SLOPE	P				IMP	Craig		1.1
913	HYDABURG HIGHWAY	S				BST	Craig		14.4
913	HYDABURG HIGHWAY	S				BST	Craig		7.9
924	CRAIG-KLAWOCK-HOLLIS ROAD	S				AC	Craig		10.5
924	CRAIG-KLAWOCK-HOLLIS ROAD	S				AC	Craig		7.1
924	CRAIG-KLAWOCK-HOLLIS ROAD	S				AC	Craig		12.2
924	CRAIG-KLAWOCK-HOLLIS ROAD	S				AC	Craig		0.6
929	BIG SALT- THORNE BAY ROAD	S				AGG	Craig		15.7
929	BIG SALT- THORNE BAY ROAD	S				AGG	Craig		12.7
929	BIG SALT- THORNE BAY ROAD	S				AGG	Craig		4.3
9TH STREET	9TH STREET	L				AC	Craig		0.1
BOKAN1		P					Craig		2.6
BOKAN2		L					Craig		0.4
BOKAN3		L					Craig		0.2
KINACOVE		P				PIT	Craig		3.1
SODA BAY	SODA BAY ROAD	P				PIT	Craig		0.3
SODA BAY	SODA BAY ROAD	P				PIT	Craig		0.0

Table D2. Mainline Roads Under Other Jurisdiction or Ownership

Route Number	Route Name	Jurisdiction	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length in Miles
8540	WESTPORT MAINLINE	P			A		Hoonah		7.7
8541	WESTPORT / NEKA	P			C	IMP	Hoonah	C	1.2
8560	SNETTISHAM	S			C		Juneau		2.5
FH2(SH7)	ROAD TO ECHO COVE	S			A		Juneau		27.0
FH31	NORTH DOUGLAS ISLAND	S			A		Juneau		12.0
FH37	MENDENHALL GLACIER	S			A		Juneau		1.4
HWY7	EGAN DRIVE TO SOUTH DOUGLAS	S			A		Juneau		12.1
HWY7	EGAN DRIVE TO SOUTH DOUGLAS	S			A		Juneau		3.0
S937		S					Petersburg		3.8
7578	STARRIGAVIN CREEK			C			Sitka		1.1
FH11	SITKA STARRGAVIN TO SMC GATE	S			A		Sitka		1.0
FH11	SITKA STARRGAVIN TO SMC GATE	S			A		Sitka		5.0
FH11	SITKA STARRGAVIN TO SMC GATE	S			A		Sitka		6.5
FH11	SITKA STARRGAVIN TO SMC GATE	S			A		Sitka		1.8
FH11	SITKA STARRGAVIN TO SMC GATE	S			A		Sitka		0.2
KATLIAN	KATLIAN	L				AC	Sitka		0.8
1445385	EAST WARM CHUCK	UNK			L	PIT	Thorne Bay		0.6
1445396	HECETA SECOND GROWTH 96	UNK				PIT	Thorne Bay		0.0
1500000	CAPE POLE	P				PIT	Thorne Bay		3.2
1500993	ELCAP PRIVATE LAND	P				IMP	Thorne Bay		0.6
2000970	PORT PROTECTION DOCK	SLR				PIT	Thorne Bay		0.2

Table D2. Mainline Roads Under Other Jurisdiction or Ownership

Route Number	Route Name	Jurisdiction	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length in Miles
2030960		SLR				PIT	Thorne Bay		0.9
2030961		SLR				PIT	Thorne Bay		0.3
2079010	SALMON CREEK HEADWATERS						Thorne Bay		0.0
2122300	TWELVEMILE CREEK WEST SLOPE	P					Thorne Bay		1.4
2900000_1.19L		P				PIT	Thorne Bay		1.2
2900000_1.19L		P				PIT	Thorne Bay		0.2
2900000_1.19L		P				PIT	Thorne Bay		0.7
925	NORTH PRINCE OF WALES ROAD	S				AGG	Thorne Bay		7.2
925	NORTH PRINCE OF WALES ROAD	S				AGG	Thorne Bay		7.8
EDNA1		L					Thorne Bay		0.1
EDNA2		L					Thorne Bay		0.0
EDNA3		L					Thorne Bay		0.2
EDNA4		L					Thorne Bay		0.2
EDNA5		L					Thorne Bay		0.3
EDNA6		L					Thorne Bay		0.2
EDNA7		L					Thorne Bay		0.6
ELCAP1		P				PIT	Thorne Bay		1.1
ELCAP2		P				PIT	Thorne Bay		0.0
ELCAP5		P				PIT	Thorne Bay		0.2
ELCAP5		P				PIT	Thorne Bay		0.0
ELCAP5						PIT	Thorne Bay		0.0
ELCAP7		P				PIT	Thorne Bay		0.0

Table D2. Mainline Roads Under Other Jurisdiction or Ownership

Route Number	Route Name	Jurisdiction	Operational Maintenance Level	Objective Maintenance Level	Class	Surface	Ranger District	Traffic Service Level	Length in Miles
KASAAN ROAD	KASAAN ROAD	L				AGG	Thorne Bay		5.6
KASAAN ROAD	KASAAN ROAD	L				AGG	Thorne Bay		4.9
KASAAN ROAD	KASAAN ROAD	L				AGG	Thorne Bay		5.6
KASAAN ROAD	KASAAN ROAD	L				AGG	Thorne Bay		0.9
MINE							Thorne Bay		0.1
SANDY_BEACH	SANDY BEACH ROAD	L				AGG	Thorne Bay		0.6
SANDY_BEACH	SANDY BEACH ROAD	L				AGG	Thorne Bay		0.1
SANDY_BEACH	SANDY BEACH ROAD	L				AGG	Thorne Bay		0.6
WHALE_PASS1		L				PIT	Thorne Bay		0.3
WHALE_PASS2		L				PIT	Thorne Bay		0.2
WHALE_PASS3		L				PIT	Thorne Bay		0.1
WHALE_PASS4		L				PIT	Thorne Bay		0.0
WHALE_PASS5		L				PIT	Thorne Bay		0.2
WHALE_PASS9		L				PIT	Thorne Bay		0.0
6216	RESERVOIR	P			L		Wrangell		0.7
6217	GARBAGE DUMP HILL	P			L		Wrangell		1.5
S943	ZIMOVIA	S				AC	Wrangell		1.8
SPUR_ROAD	SPUR_ROAD	L					Wrangell		1.1
9967	COAST GAURD	S			C	IMP	Yakutat	C	2.7
AIRPT RD	YAKUTAT AIRPORT ROAD	S			A		Yakutat		3.7
FH10	YAK. ROAD TO DANGEROUS RIVER	S			A		Yakutat		29.6

APPENDIX E

QUESTIONS AND ANSWERS
FOR ECOLOGICAL, SOCIAL, AND ECONOMIC CONSIDERATIONS

Appendix E. Questions and Answers

The following are answers to the questions posed in FS-643. All of the questions have been modified slightly to reflect the scale of a Forest-wide roads analysis, which is focused on Maintenance Level (ML) 3, 4, and 5 roads. Some questions have also been combined and are so noted.

Ecosystem Functions and Processes (EF)

EF (1). What ecological attributes would be affected by ML 3, 4, and 5 road construction in currently unroaded areas?

The Tongass National Forest includes very large undeveloped land areas, with several portions of the Forest consisting of contiguous roadless areas that exceed one million acres and represent large, unfragmented blocks of wildlife habitat. Many of the Tongass roadless areas represent wildlife habitats, ecosystems, and visual character that exist nowhere else in the National Forest System (NFS), such as coastal islands facing the open Pacific, extensive beaches on inland saltwater, old-growth temperate rain forests, ice fields, and glaciers.

The Tongass includes both Inventoried Roadless Areas and Unroaded Areas. Inventoried Roadless Areas are typically larger than 5,000 acres and meet minimum requirements for consideration as a wilderness area under the Wilderness Act. Unroaded Areas are less than 5,000 acres in size, but they have sufficient size and configuration to protect the inherent characteristics associated with its roadless condition (e.g., the area is an island). Excluding wilderness, there are approximately 9.7 million acres included in 110 inventoried roadless areas (including legislated LUD II) on the Tongass. Congress has designated approximately 6.6 million acres of land throughout the Tongass National Forest as Wilderness, National Monument, or LUD II lands. In combination, wilderness and roadless areas account for more 90 percent of the Tongass. This scale of habitat protection is not possible elsewhere in the NFS, except on the Chugach National Forest.

The ecosystem most at risk by resource management of the Tongass is the old-growth forest ecosystem. Old-growth forests are ecosystems distinguished by old and typically large trees and related structural attributes. The biological diversity associated with these forests is only beginning to be recognized and described. In addition to the plants, wildlife, and aquatic species that are most often associated with old-growth forests, invertebrate biota, creatures essential to ecosystem function through such processes as nitrogen fixation and decomposition, may account for more than an estimated 90 percent of the species diversity of old-growth forests in the Pacific Northwest (Franklin 1993).

Road construction in unroaded areas affects old-growth forests by contributing to forest fragmentation, direct removal of forest habitat, and ongoing disturbance to old-growth dependent wildlife (e.g., marten, goshawk, and marbled murrelet) because of increased access by humans. In addition, once an area is roaded, it is no longer available for consideration as Wilderness.

EF (2). To what degree does the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, fire, etc? What are the potential effects of such introductions?

Roads may influence the spread of exotic organisms in two ways. First, roads provide a corridor for the transport of exotic species into new areas. In addition, the cleared area that comprises a road right-of-way provides suitable habitat for many species of invasive plants, including noxious weeds. Weedy plant species may be unpalatable to native wildlife, may crowd out native plant species, or may have other undesirable effects on native species and ecosystems. Exotic insects or diseases may wreak havoc with plant or animal populations that have not developed resistance. Exotic animals may prey on native species, or compete with them for food and other resources.

At the moment, invasive plants have not become a widespread problem on the Tongass National Forest. Several invasive species have become established in some areas, however. These species include the following:

- Japanese knotweed, in the road systems near Kake and Petersburg. This species is also present in a gravel pit near Kake. Incautious use of material from this pit could lead to the distribution of knotweed throughout that particular road system.
- Tansy ragwort on the Ketchikan and Prince of Wales Island road systems.
- Garlic mustard—a very aggressive species that can lead to major changes in understory vegetation—has appeared in the Juneau area.
- Canada thistle has appeared in the region, possibly brought in through horticultural stock. It may be eradicable now, but impossible to remove two years from now.
- Reed canarygrass was seeded for erosion control, and it is now spreading into wetlands in the Petersburg Ranger District and in the vicinity of Twin Lakes.

The Tongass National Forest is in a unique position to control the road-based spread of invasive plants before they become widespread. Implementation of contractual clauses designed to prevent the introduction or spread of noxious weeds by contractors and permittees would be a necessary element of any control program. While herbicides are not in general use throughout the Forest, they are sometimes used for eradication of noxious weeds. In addition, Forest Service policy (FSM 2081.03) requires a determination of the risk of introducing or spreading noxious weeds for any ground-disturbing action. Assessment of noxious weeds prevalence and eradication options should be assessed during watershed and project-level road analyses.

Exotic diseases are not a problem on the Tongass National Forest. A few exotic insect species have come in to the region (e.g., woolly aphid, spruce aphid), possibly carried by vehicles travelling through Canada. None, however, has become established. This may be because the wet climate interferes with the reproductive success of these species, or perhaps because little wood is imported into southeast Alaska compared to other parts of the country. Pathologists and entomologists are ever vigilant, and are particularly concerned about exotic pests arriving on container ships.

No problems with invasive animal species have been identified on the Forest. The northern pike, however, poses a potential threat. Pike is a native species north of the

Alaska Range, and is found south of Yakutat only in Pikes Lake. More recently, pike were introduced to the Post Office Ponds located in Yakutat. Further introductions of this piscivorous species into southeastern Alaska, could have a severe adverse effect to anadromous fisheries, particularly sockeye.

EF (3). To what extent do the presence, type, and location of roads contribute to the control of insects, diseases, and parasites?

The control of insects, diseases, or parasites is not an issue of great concern on the Tongass National Forest. No control efforts are underway, thus roads do not play a role in any such efforts.

EF (4). How does the road system affect ecological disturbance regimes in the area?

The primary agent of large-scale disturbance on the Tongass National Forest is windthrow. Throughout the Forest, periodic windstorms have resulted in the blowdown of large patches of trees. Roads have little influence on the distribution of windthrow. In general, road rights-of-way are too narrow to cause any significant increase in the susceptibility of neighboring trees to wind.

Although fire has been a major factor in shaping vegetative conditions in other forests, it is not a primary factor within the Tongass National Forest due largely to the annual rainfall in Southeast Alaska. Most fires within this region tend to spread very slowly and burn deeply. Ninety-two percent of the fires recorded from 1958 to 1988 started from unattended recreational fires, with the average size of all fires comprising less than 7 acres (USDA Forest Service 1997a). The risk of fire during road building and subsequent human use activities is of concern, however, fire disturbance within the Tongass has been small and isolated in the past.

Roads may also influence small-scale ecological disturbance patterns in two ways. First, trees wounded by machinery during road construction are more susceptible to infection by decay-causing fungi. Second, hemlock canker (which kills seedlings and saplings, and some lower branches of mature trees) is more common along roads. The latter may be related to the opening caused by the road, as hemlock canker is also found in openings along stream courses.

EF (5). What are the adverse effects of noise caused by developing, using, and maintaining ML 3, 4, and 5 roads?

Noise created during the development, use, and maintenance of roads can have an adverse effect to people and wildlife near the activity sites. People are affected when forest roads are located near developed areas, including communities and recreational sites. Many people value the forest for its ability to provide solitude and the opportunity to view nature in a pristine condition. Consideration of the location and seasonal use of recreation sites is important when planning new road construction.

For wildlife species, the extent of adverse effects due to noise is dependent upon the species in question and the frequency, timing, and loudness of the noise. For the most part, adverse effects are limited to disruption of normal activities such as foraging or breeding. If such disruption occurs during a key period in an animal's life cycle, the results can be particularly severe. Examples of adverse effects of noise during key periods include the following:

- Bears (brown and black) must significantly increase their caloric intake during late summer in order to store up enough energy to survive the winter. Critical feeding areas include streams that support large populations of spawning salmon areas that are often the focus of human recreation and resource development activities. Bears dislocated by human presence and noise in these areas may not be able to consume enough salmon to survive a harsh winter.

- During later winter and early spring, snow accumulations force deer to collect in low-elevation valley bottoms to find forage. Already suffering from thermal stress and a low-quality diet, deer are especially vulnerable to disturbance during this period. Large expenses of energy to escape noise may increase an animal's susceptibility to starvation, disease, or predation.

- Frequent loud noise in the vicinity of active breeding sites (e.g., bald eagle or goshawk nests, gray wolf dens) can result in lower fecundity if time and energy are spent locating and rebuilding new sites. In some cases, disturbance may result in temporary or permanent abandonment of young.

In some situations, the adverse effects of road-related noise disturbance may be comparatively minor. For instance, the noise-producing activity may be short lived (e.g., maintenance or construction noise), or individuals may become acclimated to the presence of noise.

Road-related noise—and its impact to wildlife—is more likely to be significant on roads that connect communities or that extend from the larger communities, because the frequency of road use is likely to be higher. In contrast, roads connected to a single marine access point with no associated community would have a low risk of adverse effects from noise related to road use. Consequently, ML 3, 4, and 5 road systems with a higher risk of noise effects to wildlife include the systems in north and south Prince of Wales Island, Wrangell Island, and Mitkof Island.

Aquatic, Riparian Zone, and Water Quality (AQ)

AQ (1). How and where does the ML 3, 4, and 5 road system modify the surface and subsurface hydrology of the area?

Roads can affect the hydrology of watersheds in several ways. Roads create strips of non-vegetated compacted soil across the landscape. Roads constructed through wetland areas may block or reroute flow patterns through the wetland. Precipitation that falls on road surfaces will collect in drainage systems (primarily ditches and culverts) and flow into streams and wetlands more quickly as runoff instead of infiltrating into soils. Road drainage systems can also act as an extension of the stream network, increasing the density of concentrated surface flow, which can result in changes to the natural hydrologic regime. Roads constructed across slopes require excavation into the slope and can intercept water flowing through the soil near the surface and route it into the stream network. Areas that would have higher susceptibility to hydrologic impacts from roads include areas with high road and/or stream crossing densities, areas where roads are constructed in or near water bodies or wetlands, and roads constructed with outdated or improper engineering methods. The extent to which roads modify surface and subsurface hydrology occurs within the Tongass National Forest is best determined at watershed or project specific scales.

AQ (2). How and where does the ML 3, 4, and 5 road system generate (contribute) surface erosion?

Most surface erosion associated with roads occurs during construction and during the period when side slopes stabilize and revegetate. Erosion associated with roads is dependent on several factors including: the material used to surface the road, slope, soil type, traffic levels, proximity to streams, and climatic conditions. Native surfaced roads contribute more sediment than either gravel or paved surfaces. Most roads in the Tongass National Forest have gravel surfaces. With increasing traffic levels, particularly with heavy vehicles such as logging equipment, native surfaced roads can contribute significant amounts of sediment. The type of soil the road is built on significantly affects the strength and erodibility of the soil. The proximity of a road to a stream may not increase its erodibility, but increases the likelihood that sediment eroded from a road prism will be transported into the stream system. The climate can affect the amount of erosion from roads through freeze-thaw cycles, the magnitude of spring melt or rain-on-snow events, and the probabilities associated with extreme precipitation events.

FS-643 recommends that the most appropriate scale for addressing this question is at the watershed and larger scales. The Forest is developing the information infrastructure needed to address this question. In 1994, the Forest, in collaboration with the Alaska Department of Fish and Game and the Alaska Department of Environmental Conservation, began development of the Road Condition Survey (RCS) database (ADF&G 2000). The database allows the Forest to monitor the condition of its roads and provide information needed for prioritizing maintenance and improvements.

A query of the RCS database indicated that cut-slope or fill-slope erosion occurred more frequently than road surface erosion. Instances of surface erosion occurred on ML 3, 4, and 5 roads at a frequency of 0.16 per mile of road surveyed with an average length of road affected of 61 feet (maximum of 1,100 feet). In contrast, cut-slope or fill-slope erosion occurred at a frequency of 0.72 instances per mile of road surveyed with an average length of 98 feet (maximum 3,800 feet). The database does not indicate whether an observed problem delivers sediment to a stream. Consequently, it is unclear whether these maintenance problems would adversely affect water quality or fish habitat. Nevertheless, the results suggest that site-specific erosion problems should be examined during project-level road analyses.

AQ (3). How and where does the road system affect mass wasting?

Forest roads have the potential to increase the frequency of shallow-rapid landslides and debris torrents. Shallow-rapid landslides typically occur on steep, water-saturated soils. Furniss (1991) citing Wolf (1982) reported that "The most common causes of road-related mass movements are improper placement and construction of road fills, inadequate road maintenance, insufficient culvert sizes, very steep hillslope gradient, placement or sidecast of excess materials, poor road location, removal of slope support by undercutting and alteration of slope drainage by interception and concentration of surface and subsurface water."

Information from the RCS database described above can also be useful for identifying road features that have may contributed to a higher risk of future mass wasting events. FS-643 recommends that the most appropriate scale for addressing this question is the watershed and subbasin scales.

AQ (4). How and where do road stream crossings influence local stream channels and water quality?

Road-stream crossings influence local stream channels and water quality by contributing coarse road fill material, fine sediment, and chemical pollutants to streams, and by causing changes in stream hydrology. Existing roads may have road-stream crossings designed before current standards and be at risk during flood events. Road-stream crossings can become major sources of coarse and fine sediment to stream systems if culvert failures occur during a flood event. Road crossings usually involve filling the floodplain and portions of the active stream channel where the road crosses, causing a constriction in flows at that point and potentially altering the geomorphic processes in the channel above and below the crossing. Road-stream crossings also are a common location for the delivery of fine sediment from road surface, cut-slope, and fill-slope erosion. Road-stream crossings (in addition to drainage relief culverts) are commonly used to drain water that collects on the road during rainfall, which can modify the frequency and magnitude of peak flow events, which in turn are an important factor in channel formation. Similar to the delivery of fine sediments, pollutants such as oil, anti-freeze, or fuel from vehicles can be delivered to streams at road-stream crossings.

Road-stream crossing influences and chemical pollutant delivery to surface waters is best assessed at the watershed or project scale. Information from the RCS database can be useful for identifying where road-stream crossings occur and where road erosion problems occur. At the watershed scale, the density of road-stream crossings (all MLs) can be used as a risk factor for stream health.

AQ (5). How and where does the road system create potential for pollutants, such as chemical spills, oils, de-icing salts, or herbicides, to enter surface waters?

Non-point pollution from toxic chemicals transported on forest roads for commercial use or forestry is not considered a forest-wide issue of importance. Herbicides are rarely used during silvicultural prescriptions and only two large-scale mines are in operation on the Forest: Green Creek Mine and Calder Mine. The Kensington Mine is not currently operating. Occasionally, herbicides are used on a site-specific basis to eradicate noxious weeds (see answer to Question 3 above). Use of the Forest road system for transporting these chemicals should be assessed on a project-level scale. Vehicle-related chemicals (oil, fuel, etc.) are discussed under Question 4, above.

AQ (6). How and where is the road system "hydraulically connected" to the stream system (proximity)? How do the connections affect water quality and quantity, i.e., delivery of sediments and chemicals, thermal increases, elevated peak flows?

Roads built near water bodies and road/stream crossings increase the risk of changes to the hydrologic characteristics of an area. Road drainage systems act as an extension of the surface drainage system, and can also intercept near surface flow and route it onto the surface. Typical effects include increases in peak flows for short-recurrence interval floods, a shorter duration between the precipitation event and the peak, and likelihood of road-related erosion entering streams. See answers to Questions AQ 1 and AQ 4.

Roads effectively increase the drainage density in a water shed by interception of rainfall and subsurface flow, which is then routed to ditches and streams; concentration of flows through road surfaces and ditches; and diversion or water from existing flowpaths (Gucinski et al. 2000). Potential effects on smaller basins include increases in peak flows for short-recurrence interval floods, a shorter duration between the precipitation event and the peak (Harr et al. 1975, Jones and Grant 1996), and the likelihood of road-related erosion entering streams (Gucinski et al. 2000). Several of the studies were conducted in western Oregon document these effects, and while some of the watershed characteristics may be different from the Tongass National Forest, the processes would be similar. What downstream beneficial uses of water exist in the area? What changes in uses and demand are expected over time? How are they affected or put at risk by ML 3, 4, 5 road derived pollutants?

The beneficial uses of water include domestic water supply, freshwater and marine fauna (including fish, shellfish, and wildlife), and contact (e.g., swimming) and non-contact (e.g., boating) recreation. Many of the larger communities (Ketchikan, Juneau, Petersburg, etc.) have municipal watersheds that are protected in order to maintain high water quality for domestic water supplies. Enacted Municipal Watersheds include 45,242 acres in the Tongass National Forest and 1.1 miles of ML 1 road. Consequently, the ML 3, 4, and 5 road network has no effect on these watersheds. Smaller communities or areas not serviced by Municipal Watersheds may draw water from a variety of sources. The effects of roads on these water supplies should be evaluated at the project-level.

The types of beneficial uses of water are not likely to change in the future. However, demand for these uses could increase or decrease depending upon population levels. Increasing populations could lead to increased need for, or expansion of, centralized domestic water supply and distribution in communities. Increased populations and increased levels of tourism could also result in increased demand for recreation, hunting, and gathering activities that rely on high water quality. Frequently, access to areas used for recreation, hunting, or gathering in Southeast Alaska occurs through use of the NFS road system. Consequently, road derived pollutants such as fine sediment, oil, and grease are likely to increase and decrease in parallel with demand for the beneficial uses of water. Areas with higher traffic levels have a higher risk of have road-derived pollutants.

Waterbodies listed as water quality limited under Section 303(d) of the Clean Water Act are categorized by the State of Alaska using a four-tier system. Tier 1 waterbodies require assessments that verify that pollution and controls are in-place or needed. Tier 2 waterbodies have had completed assessments and require a waterbody recovery plan or Total Maximum Discharge Load calculation. Tier 3 waterbodies need on-going monitoring. Tier 4 waterbodies are not water quality limited and require no further action. The 1998 303(d) list for Alaska included 29 sites that were Tier 1 through Tier 3. Of the 21 Tier 1 sites, 11 were for debris in marine waters at marine access points (MAPs, formerly known as log transfer facilities), and two were related to timber harvest activities (including roads). None of the three Tier 2 sites were directly or indirectly related to road activities and one Tier 3 site was related to timber harvest activities. Consequently, MAPs are one of the major transportation infrastructure facilities related to water quality limited waterbodies. Roads are also a contributory factor in some watersheds, but primarily related to the local ML 1 and 2 roads used in timber harvests, which are the focus of watershed- and project-level roads analysis.

AQ (7). How and where does the ML 3, 4, and 5 road system affect wetlands?

Roads constructed across wetlands require fill material, which results in a net loss of wetland area and concomitant reduction of the values and functions of the wetland. Fill may also affect surface or subsurface hydrology. In some cases ponding may occur on the upstream side of the roadbed; in others, coarse fill may act as a drainage conduit, reducing saturation of soils in the vicinity of the roadway. Traffic on roads is a potential vector for introduction and spread of noxious weeds and other invasive non-native plant species.

Road construction on the Tongass National Forest has avoided wetland areas to the extent practicable. In recent practice, most rare wetland types (e.g., rich fen, estuarine, tall emergent sedge) are avoided outright. Other types (e.g., muskeg, forested wetlands) cannot be avoided without incurring considerable costs. The Watershed Conservation Practices Handbook (FSH 2509.25) provides measures to protect wetlands. During project-level analyses, opportunities to reduce the effects of the road system on wetlands include the following:

- Relocate roads out of wetland areas.
- Where relocation is not an option, use measures to restore the hydrology of the wetland. Examples include raised prisms with diffuse drainage such as French drains.
- Set road-stream crossing bottoms at natural levels of wet meadow surfaces.

AQ (8). How does the ML 3, 4, and 5 road system alter physical channel dynamics, including isolation of floodplains; constraints or channel migration; and the movement of large wood, fine organic matter, and sediment?

Extensive areas within the Forest are wetlands. Permanent road construction in these areas requires filling the wet areas, which affects hydrologic flow patterns. Anytime a road is built within the floodplain of a stream (e.g., at road-stream crossings), it will affect the ability of the channel to migrate, isolate portions of the floodplain, and constrict flow through that location. Stream crossings also can limit the movement of woody debris.

As a coarse index to assess the influence ML 3, 4, and 5 roads on stream channels, the length of road within 100 feet of Class 1 and 2 streams was summarized for each of the ranger districts in the Forest (Table E1). Class 1 and 2 streams were selected because they are fish-bearing and include channel types that are highly sinuous or have relatively broad floodplains. Consequently, they would have a higher risk of adverse effects from nearby roads. A 100-foot distance was chosen because it is the standard AHMU buffer distance for fish-bearing streams. The results indicate that about 6 percent of the ML 3, 4, and 5 road system is within 100 feet of Class 1 or 2 roads. The majority of this road length is at road-stream crossings. The Thorne Bay and Petersburg Ranger Districts have the highest length with 32.8 miles and 17.7 miles, respectively.

Table E1. Length of ML 3, 4, or 5 Road within 100 feet of a Class 1 or 2 Stream.

Ranger District	Length (mi)	Percent of ML3, 4, and 5 System
Admiralty Is. National Monument	0.3	3.1%
Craig	4.1	5.4%
Hoonah	5.1	4.5%
Ketchikan	0.4	11.0%
Juneau	1.0	4.1%
Petersburg	17.7	5.1%
Sitka	4.2	8.5%
Thorne Bay	32.8	7.8%
Wrangell	6.5	4.1%
Yakutat	0.4	3.0%
Forest-wide Total	72.3	6.0%

AQ (9). How and where does the ML 3, 4, 5 road system restrict the migration and movement of aquatic organisms?

The Tongass National Forest uses information contained with the RCS database to assess the suitability of culverts to pass juvenile salmon during a 2-day period surrounding peak flow events. This is a State of Alaska criterion, which is more conservative (i.e., results in a higher passage flow requirement for a given culvert) than the 4-day period required under the Forest Plan. The use of juvenile salmon and trout passage as a criterion for overall passage condition is a precautionary approach to fish passage because identified problem culverts may readily pass adult fish and may pass juveniles during other periods.

Surveyed culverts have been placed in one of four categories:

- Red – The culvert does not meet flow requirements.
- Green – The culvert meets flow requirements.

- Gray – The culvert requires additional hydraulic modeling to assess its condition.
- Assessment Data Incomplete – Additional field measurements required for assessment.

Table E2 summarizes the status of survey culverts by ranger district. Forest-wide, 715 culverts (or about 0.55 culverts per mile; 67 percent of surveyed culverts with complete assessments) are considered to have passage problems on ML 3- 5 roads. The Thorne Bay Ranger District has the highest number of culverts with identified problems, but also has the largest amount of ML 3, 4, and 5 roads. On a per road mile basis, the Sitka Ranger District has the highest frequency (0.24 per mile) of passage problems on anadromous Class I streams. The Craig Ranger District has the highest frequency of passage problems on Class 2 Streams (0.62 per mile) and Class 1 and 2 streams combined (0.76 per mile). The Craig Ranger District also has the highest percentage of culverts with passage problems (80.6 percent) for complete assessments. In contrast, the Petersburg Ranger District has the lowest frequency of passage problems on Class 1 streams (0.09 per mile) and the Sitka Ranger District has the lowest frequency for Class 2 streams (0.37 per mile). The Hoonah Ranger District has the lowest percentage of culverts with passage problems (46.4 percent) for complete assessments.

Many of the culverts that do not pass fish are overflow culverts. They only operate during periods of high flow, augmenting the flow provided by the primary culverts. Therefore, the number of culverts identified as having passage problems does not directly correspond to the number of roads without adequate fish passage. Still, these results suggest that fish passage is a significant problem in the Forest. The Forest has recognized this issue and is addressing it through the development of the RCS database and through the implementation of a program to upgrade problem culverts. Currently, the Forest is developing a methodology for prioritizing upgrading effort that includes an understanding of the amount of fish habitat affected by culverts with passage problems. The need for culvert upgrades is an important component to the road maintenance funding.

Table E2. Summary of Fish Passage Category by Ranger District and AHMU Class for ML 3, 4, and 5 (Operational or Objective) Roads.										
		Passage Category							Complete Assessment (Red or Green)	
Ranger District	AHMU Stream Class	Assessment Data Incomplete (#)	Gray (#)	Green (#)	Red (#)	Grand Total	No. Red Per Mile		% Green	% Red
Craig	1	0	4	10	11	25	0.14		47.6	52.4
	2	4	2	4	47	57	0.62		7.8	92.2
	Total	4	6	14	58	82	0.76		19.4	80.6
Hoonah	1	2	4	33	10	49	0.10		76.7	23.3
	2	4	3	27	42	76	0.41		39.1	60.9
	Total	6	7	60	52	125	0.51		53.6	46.4
Juneau	1	2	2	1	0	5	0.00		100.0	0.0
	Total	2	2	1	0	5	0.00		100.0	0.0
Petersburg	1	8	24	66	35	133	0.09		65.3	34.7
	2	14	32	51	162	259	0.43		23.9	76.1
	Total	22	56	117	197	392	0.53		37.3	62.7
Sitka	1	1	9	14	14	38	0.24		50.0	50.0
	2	1	3	4	22	30	0.37		15.4	84.6
	Total	2	12	18	36	68	0.61		33.3	66.7
Thorne Bay	1	20	24	78	85	207	0.18		47.9	52.1
	2	17	31	27	190	265	0.40		12.4	87.6
	Total	37	55	105	275	472	0.58		27.6	72.4
Wrangell	1	2	12	19	30	63	0.18		38.8	61.2
	2	10	5	18	67	100	0.41		21.2	78.8
	Total	12	17	37	97	163	0.60		27.6	72.4
Grand Total	1	35	79	221	185	520	0.14		54.4	45.6
	2	52	78	132	530	792	0.41		19.9	80.1
	Total	85	155	352	715	1307	0.55		33.0	67.0

AQ (10). How does the ML 3, 4, and 5 road system affect shading, litterfall, and riparian plant communities?

Roads located in riparian areas can reduce levels of shading and litter fall to the aquatic system by eliminating vegetation along the road right-of-way. However, with the exception of stream crossings, few stream-parallel roads are located in riparian areas on the Forest (see answer to Question 7 above). The level of roads in the riparian zone within the Forest area is unlikely to have a substantial adverse effect to aquatic species.

AQ (11). How and where does the ML 3, 4, and 5 road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species?

There are no at-risk aquatic species in the project area.

AQ (12). How and where does the ML 3, 4, and 5 road system facilitate the introduction of non-native aquatic species?

Introduction of non-native aquatic species is possible primarily through two vectors: fishermen using non-native species as bait and non-native species transported inadvertently on watercraft. Neither of these vectors is considered to be important in Southeast Alaska because all known freshwater sport-fisheries use artificial tackle (spin or fly gear) or local live bait. In addition, most watercraft used in Southeast Alaska traveling by vehicle between freshwater lakes or rivers remain within the region, which include the same freshwater species. Consequently, roads are unlikely to contribute significantly to non-native aquatic species introductions.

Roads could facilitate intentional plantings of non-native species. Northern pike is a native species north of the Alaska Range, but has been found south of Yakutat only in Pikes Lake. It is unknown whether its presence in Pikes Lake is natural or from human introduction. More recently, pike were introduced to the Post Office Ponds located in Yakutat. Further introductions of this piscivorous species into southeastern Alaska, could have a severe adverse effects to anadromous fisheries.

AQ (13). To what extent does the ML 3, 4, and 5 road system overlap with areas of exceptionally high aquatic diversity or productivity, or areas containing rare or unique aquatic species or species of interest?

The Forest does not have any rare or unique aquatic species of special interest. Numerous short streams and few large rivers typify Southeast Alaska, except on the mainland where some larger rivers, such as the Stikine River, may be present. Low gradient channel types (e.g., estuarine, floodplain, and palustrine) are typically the most productive for anadromous salmon, cutthroat trout, and Dolly Varden trout. Southeast Alaska has a robust commercial, sport, and subsistence fishery for these species. Identification of the effects of roads on specific high production streams should occur at the watershed or Ranger District level of analysis.

Terrestrial Wildlife (TW)

TW (1). What are the direct effects of the ML 3, 4, and 5 road system on terrestrial species habitat?

Direct effects of roads on wildlife habitat consist primarily of habitat loss and fragmentation. Road construction typically entails the conversion of existing habitat (primarily late-successional coniferous forest on the Tongass National Forest; see Question AQ 8 for a discussion of roads and wetland habitat) into more or less permanent openings. For roads with a cleared right-of-way of 18 feet, this amounts to approximately 2.2 acres of habitat loss per mile of road. The approximately 1,210 miles of ML 3, 4, and 5 roads on the Tongass National Forest thus equate to more than 2,500 acres of habitat loss. The effects of this loss are distributed over a vast area, however, and comprise approximately 1/100 of 1 percent of total the area of the Forest. Similarly, the proportion of forested habitat that has been affected by fragmentation due to roads is relatively small, and is offset by the availability of large blocks of unfragmented habitat throughout the Forest.

One possible source of concern is the amount of road that occurs in LUDs where road construction is discouraged. Approximately 129 miles (10 percent) of ML 3, 4, and 5 roads on the Forest occur in areas that have been designated as Old Growth Reserves, where TLMP standards and guidelines allow road construction only where no other options are available. Many of these roads were built prior to the development of LUDs. Review of these roads suggests that none are currently suitable for consideration for decommissioning. More than half of the roads in Old-Growth Reserves occur on the Thorne Bay and Petersburg Ranger Districts.

TW (2). How does the ML 3, 4, and 5 road system facilitate human activities that affect habitat?

Roads may facilitate human activities that affect the quantity and quality of habitat for wildlife species. Effects may include the removal of structures (e.g., snags and logs) that provide nesting or foraging substrate, habitat loss due to human-caused fires, and destruction of habitat by trampling. None of these effects has been identified as a resource concern on a Forest-wide basis. This issue is best addressed at the project scale.

Roads can also facilitate human activities that have the potential to improve habitat quality for some species. This may become increasingly important in areas that received a high level of logging during a relatively short period (e.g., the Staney Creek area on Prince of Wales Island, where about 11,000 acres of forest was cut during a period of roughly 5 years). In the next two or three decades, a large proportion of the forest in some areas will enter the stem exclusion stage, reducing the availability of forage and likely reducing the ability of the area to support deer and other wildlife species. It may be important to maintain access to such areas and allow some silvicultural management (e.g., thinning) to open up the canopy and encourage understory plant growth.

TW (3). How does the ML 3, 4, and 5 road system affect legal and illegal human activities (trapping, hunting, poaching, harassment, etc.)? What are the effects on wildlife species?

The primary concern with roads and wildlife on the Tongass National Forest is one of accessibility. A high road density allows a greater number of people into an area with few places for animals to hide, increasing the risk of overexploitation through hunting or trapping. Indeed, this has already occurred in few places on Prince of Wales Island, where the road system is particularly dense. An example is the Staney Creek area, where extensive logging and road system development have affected local wolf populations. Biologists with the ADF&G have documented the obliteration of wolf packs from this watershed, with subsequent recolonization from populations in an adjacent Old-Growth Reserve. Thus, the Staney Creek area appears to represent a population sink.

Deer are another key species for which road system development is a concern. By one estimate, a deer population at carrying capacity could support an annual harvest by hunters of up to about 10 percent of winter carrying capacity. At this level, the population would remain stable and hunter satisfaction (in terms of success compared to effort) would remain fairly high (Flynn and Suring 1993). When harvest approaches 20 percent of carrying capacity, hunter satisfaction may diminish and the harvest may be unsustainable over time, particularly in areas with high predator populations. Increased hunter access associated with road development may lead to increased harvest levels and subsequent population decreases.

Marten are easily trapped and can be overharvested as well. Forest management activities resulting in increased access may result in an elevated potential for overtrapping. New roads provide additional access for trappers and may indirectly cause increased harvests. Road development is of greatest concern in old-growth forest at lower elevations (below 1,500 feet), especially in coastal and riparian areas. In addition, mountain goats and black bears can be over-hunted in areas where an extensive road system facilitates human access into the habitats (particularly old-growth forest) with which they are associated. Forest-wide standards and guidelines for these species provide for site-specific analysis to assess and minimize disturbance and access to meet management objectives.

Brown bears are also susceptible to increased mortality associated with human activity associated with roads. Panelists convened for the 1997 TLMP EIS determined that landscapes providing roadless refugia from human disturbance would provide the highest likelihood of maintaining viable long-term brown bear populations. Another key element for brown bears is the minimization of disturbance at key feeding areas (low-elevation valley bottoms and salmon streams) during the critical late-summer season. These are often the same areas of highest human use and most intense resource development activities.

There is some concern over how some guidelines for wolf management have been implemented in TLMP. For instance, TLMP recommends a maximum open road density of 0.7 mi/mi^2 to protect wolf population viability. The research on which this recommendation was based, however, used models that looked at all roads, not just those that are open to vehicular traffic. This includes closed roads, roads that are open only to ATVs, and roads that are open only to pedestrian traffic. By looking only at open roads, TLMP guidelines may underestimate the effects of roads in any particular geographic area.

Another concern is the geographic area in which road density guidelines are applied. Most wolf activity on the Tongass National Forest occurs below 1,200 feet elevation. These lower-elevation areas produce the most deer per square mile, and are thus the most attractive to wolves. Not coincidentally, these areas also have high timber volumes. Roads built to gain access to valuable timber are also bringing people in to the areas of greatest value to the wolves. Project-level analyses of road density should focus on areas below 1,200 feet, to get a clearer picture of the effects to wolves in the areas that they're actually using.

Roads play an essential yet paradoxical role in subsistence hunting. Roads provide access to hunting and fishing areas, an attribute that is highly valued by local residents. Indeed, any proposals to close or decommission roads in some areas may run afoul of certain subsistence access provisions of ANILCA. At the same time, roads into rural areas can improve access for non-local sport hunters, who may reduce the availability of the animals on which subsistence hunters rely.

TW (4). How does the ML 3, 4, and 5 road system directly affect unique communities or special features in the area?

This question is best addressed at the project level, and is not suited to a Forest-level analysis. Karst features represent the most significant unique communities or special features in the landscape that comprises the Tongass National Forest. The TLMP contains provisions for the minimization of road construction karst areas, and for the mitigation of adverse effects where road construction is unavoidable.

Economics (EC)

EC (1). How does the ML 3, 4, and 5 road system affect the agency's direct cost and revenues? What changes in the road system will increase net revenue to the agency by reducing cost, increasing revenues, or both?

This question is concerned with project-specific financial efficiency analysis. This type of analysis assesses whether the revenues generated by a project or program exceed the associated costs. It can also be used to assess whether changing the status quo will result in an increase in net revenue. Net revenue is calculated by subtracted all payments made by the Forest Service (costs) from the gross revenues generated by those payments. It is not possible to perform a financial efficiency analysis on the existing ML 3, 4, and 5 road system because data on revenues are not collected in a way that allows them to be assigned to specific roads with any degree of accuracy. This absence of data on revenues also means that it is not possible to assess the changes in net revenue that would be associated with changes in the existing system.

Cost data for road maintenance are available. Base maintenance costs for NFS roads on the Tongass are presented in Table E3. These base costs are adjusted by a locality factor and a use factor to obtain maintenance costs for specific roads. The locality factor accounts for increased costs due to items such as availability of equipment and mobilization. The use factor accounts for differences in maintenance needs based on the amount and type of use on a given road.

Table E3. Base Annual Maintenance Costs

Maintenance Level[1]	Base Cost ($/Mile)[2]
1	169
2	806
3	1,138
3, 4, and 5 Arterials and Collectors	2,051

Notes:
[1] The difference between a ML 3 Local and a ML 3, 4, and 5 Arterial and Collector is determined by the type of surfacing and the way the road is managed.
[2] These costs exclude the costs for base course replacement and surface rock replacement.

EC (2). How does the ML 3, 4, and 5 road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society (local economy)?

Economic efficiency analysis assesses whether a specific investment produces more aggregate economic value than it costs. Economic efficiency analysis addresses both priced and non-priced costs and benefits. Priced costs and benefits include the costs of planning, constructing, maintaining, and decommissioning roads and revenues from receipts from commodities. Non-priced benefits include recreation experiences provided free of charge and passive use values. Non-priced costs include decreased water quality and habitat fragmentation.

This roads analysis assesses the road system as a whole rather than a specific investment issue. It is not possible to perform a economic efficiency analysis on the existing ML 3, 4, and 5 road system because data on revenues and non-priced costs and benefits are not collected or available in a way that allows them to be assigned to specific roads with any degree of accuracy. However, this road analysis does address the consequences of the existing road system by considering each issue in turn. These issues include recreation, commodity production, water production, wildlife, ecosystem functions and processes, and aquatic, riparian zone, and water quality.

EC (3). How does the ML 3, 4, and 5 road system affect the distribution of benefits and costs among affected people?

The benefits and costs associated with the existing road system include both priced and non-priced consequences. Although it is not possible to quantify all of these costs and benefits at this scale, it is possible to consider their distribution in general terms. The costs and benefits associated with the road system include effects on employment and income, as well as effects on use and non-use values.

In terms of employment and income, wood products, recreation and tourism, and mining are the main economic sectors affected by the road system. Wood products employment is affected to the extent that the existing road system facilitates timber harvest. Although it is difficult to project where the employment associated with a particular timber sale will be concentrated, wood products employment tends to be concentrated in the communities located in the south part of the forest, with the region's major operators located in Ketchikan, Wrangell, and Craig/Klawock. Other smaller operators tend to be concentrated on Prince of Wales Island. One exception to this is the Whitestone Southeast Logging Co. located in Hoonah (USDA Forest Service 2002). It should also be noted that approximately 35 percent of those employed in the Southeast Alaska wood products sector in 1994 did not reside in the region.

It is also difficult to assess the effects of the existing ML 3, 4, and 5 road system on recreation and tourism-related employment. Recreation and tourism-employment is difficult to identify using published employment data because recreation and tourism-related activities are distributed over a number of standard economic sectors, mainly retail trade and services. Much of the growth in recreation and tourism-related employment in recent years has been associated with increases in cruise ship visitors. Data compiled at the Borough/Census Area level for 1999 suggests that lodging, restaurant, and recreation services employment (a common indicator of recreation and tourism employment) accounted for 11 percent of total employment in Southeast Alaska. Viewed as a share of total employment, recreation and tourism employment was relatively overrepresented in Haines Borough (22 percent) and the North Complex (an aggregate of the Angoon-Hoonah-Skagway Census Area and Yakutat Borough) (19.4 percent) and underrepresented in Wrangell-Petersburg Census Area (6.9 percent). Lodging, restaurant, and recreation services employment accounted for 9.7 to 10.9 percent of total employment in the other boroughs and census areas in Southeast Alaska (USDA Forest Service 2002). Approximately 55 percent of those employed in the Southeast Alaska recreation and tourism sector in 1994 did not reside in the region.

Two ML 3 roads located in the Berners Bay area north of Juneau were constructed for mine access. The Kensington mine is not currently active, but the road receives some mine-related use (see MM 1). Approximately 318 workers were directly employed by the mining industry in 1999. The majority of this employment was concentrated in the city and borough of Juneau, which accounted for 295 jobs or approximately 93 percent of the total. Prince of Wales-Outer Ketchikan Census Area accounted for 21 mining jobs (Alaska DOL 2001). Approximately 33 percent of those employed in the Southeast Alaska mining sector in 1994 did not reside in the region.

In terms of direct use, the majority of ML 3, 4, and 5 roads tend to be used for recreation and subsistence with use primarily by local residents or visitors from other parts of the region. Use of the ML 3 roads on the Thorne Bay Ranger District, for example, is thought to be primarily by local residents with about half the non-local users thought to come from Ketchikan. Local communities are, however, promoting tourism on Prince of Wales Island and the road system may prove attractive to visitors. As noted above, the majority of the remaining sawmills in Southeast Alaska are located in the south portion of the Forest.

The distribution of benefits and costs is discussed in more detail in the discussions by resource area presented elsewhere in this analysis.

Commodity Production

Timber Management (TM)

TM (1). How do ML 3, 4, and 5 road spacing and location affect logging system feasibility?

The watershed or finer scale is most appropriate for addressing this question. Generally, ML 3, 4, and 5 roads do not directly affect road spacing and location or logging system feasibility on the Forest. Logging feasibility is directly affected by the presence or absence of roads. However, ML 1 and 2 roads can provide adequate access. A road does not need to be maintained as a Level 3 road in order to provide adequate access for feasible logging systems.

TM (2). How does the ML 3, 4, and 5 road system affect managing the suitable timber base and other lands?

ML 3, 4, and 5 roads are not required on the Forest to provide collector or arterial roads that access the suitable timber base. ML 1 and 2 roads best serve this objective. Detailed access planning should be addressed at the watershed scale or finer.

TM (3). How will the ML 3, 4, and 5 road system affect access to timber stands needing silviculture treatment?

The majority of ML 3, 4, and 5 roads on the Forest do not function as a means of primary access to timber stands needing silvicultural treatment. ML 1 and 2 roads best serve this objective. Detailed access planning should be addressed at the watershed scale or finer.

Minerals Management (MM)

MM (1). How does the ML 3, 4, and 5 road system affect access to locatable, leasable, and salable minerals?

The Tongass National Forest has substantial mineral deposits including gold, silver, molybdenum, zinc, lead, and limestone. Currently two major mines are active, including the Greens Creek Mine and the Calder Mine. The Kensington Gold Mine obtained needed permits in 1997, but economic factors resulted in the need to substantially change the approach to processing the ore and treating waste products. Consequently, the mine is not currently active, but may begin production in the near future if all needed permits or permit modifications are obtained. The Quartz Hill Mine is estimated to have about 12 percent of the world’s molybdenum supplies, but the mine has not been found to be economically feasible under the current market. Access to the Quartz Hill Mine is by a private road reached from a MAP. Access to the Greens Creek, Calder, and Kensington Mines is primarily by barge or boat to a MAP, which services a local road system. The ML 3 road from the MAPs at Hawk Inlet and Young Bay to access the Greens Creek Mine is under NFS jurisdiction.

Access is certainly an important factor considered during mine exploration and the feasibility for developing a mine. Many of the areas of known mineral reserves currently have limited or no road access and other areas have only limited exploration due, in part, by the difficulty in access. The need for ML 3, 4, and 5 roads for mine production and mineral exploration is best considered on a project-specific basis.

Range Management (RM)

RM (1). How does the ML 3, 4, and 5 road system affect access to range allotments?

There are no range allotments in the Tongass National Forest.

Water Production (WP)

WP (1). How does the ML 3, 4, and 5 road system affect access, construction, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes?

Water diversions, impoundments, and water distribution on the Tongass National Forest are usually related to municipal watersheds or hydroelectric power generation and the affects of roads are best assessed at the watershed- or project-level scales.

WP (2). How does ML 3, 4, and 5 road development and use affect water quality in municipal watersheds?

See Riparian Zone Question 7.

WP (3). How does the ML 3, 4, and 5 road system affect access to hydroelectric power generation?

The affects of roads on hydroelectric power generation is best assessed at watershed- or project-level scales.

Special Forest Products (SP)

SP (1). How does the ML 3, 4, and 5 road system affect access for collecting special forest products?

Special Forest Products are defined as products derived from non-timber biological resources that are used for subsistence, personal, spiritual, educational, commercial, and scientific use. These resources include, but are not limited to mushrooms, boughs, Christmas trees, bark, ferns, moss, burls, berries, cones, conks, herbs, roots, and wildflowers. Forest roads allow broader access to people gathering these resources. In particular, the ML 3, 4, and 5 roads allow people to travel farther distances to gather resources at prime locations. Traveling to these locations may result in higher competition for these resources (and possible conflict between local and visiting users), but it may also allow some people to utilize resources they would be less likely or unable to gather near their community.

Special-Use Permits (SU)

SU (1). How does the ML 3, 4, and 5 road system affect managing special use permit communications sites, concessionaires, utility corridors, etc.?

ML 3, 4, or 5 roads may be appropriate in situations where concessionaires (both for existing sites and future development or expansion) may require that an existing road be built, maintained at, or upgraded to a ML 3 or higher standard to safely accommodate passenger vehicle travel to these sites. Most existing recreation special use areas are based on access via salt water. There may me a need for ML 3, 4, and 5 roads to provide adequate access to recreation sites and resorts in the future, as tourism plays a greater role in the Southeast Alaskan economy. Generally, ML 1 and 2 roads can adequately access communications sites and utility corridors. The most appropriate analysis scale is the watershed or finer.

General Public Transportation (GT)

GT (1). How does the ML 3, 4, and 5 road system connect to public roads and provide primary access to communities?

All roads outside of communities were initially forest roads. Higher use roads, especially those connecting communities to Alaska Marine Highway terminals became state routes (i.e., public roads). Local residents use roads for driving for pleasure, hunting access (deer and moose), and subsistence uses. “Subsistence” is variously defined, but it is generally supported as a long-term right.

GT (2). How does the ML 3, 4, and 5 road system connected blocks of land in other ownership to public roads (ad hoc communities, subdivisions, in-holdings, etc.)?

Public roads are closely associated with communities. There are isolated in-holdings with access to the forest development road system.

GT (3). How does the ML 3, 4, and 5 road system affect roads with shared ownership (RS 2477, cost share, and prescriptive rights? FLPMA, FRTA, and DOT easements?

There are no shared ownership roads, but a few private roads have FLPMA easements across federal lands (to private cabins, resorts, etc.)

GT (4). How does the ML 3, 4, and 5 road system address the safety of users?

Most vehicle accidents can be largely attributed to alcohol use and/or overdriving for conditions or designed use. Mixed traffic/underage driver/non-street legal vehicle issues are growing. Very few accidents are because of the condition of the road and/or lack of traffic safety items (e.g., guardrails, approach rails.)

Administrative Use (AU)

AU (1). How does the ML 3, 4, and 5 road system affect access needed for research, inventory, monitoring?

The forest service has responsibility for resource management on NFS lands. The road system is necessary for this administration.

AU (2). How does the ML 3, 4, and 5 road system affect investigative or enforcement activities?

The road system is the primary access for investigation and enforcement of timber theft, fish and game related activities, occupancy and abandonment of facilities, and vandalism. Law enforcement vehicles are frequently ferried to other islands for enforcement work.

Protection (PT)

PT (1). How does the ML 3, 4, and 5 road system affect fuels management?

Roads provide access for dying yellow cedar salvage. However, wildfires and fuels build-up is rarely an issue within the Tongass National Forest because of high levels of precipitation.

PT (2). How does the ML 3, 4, and 5 road system affect the capacity of agencies to suppress wildfires?

Most fires are small in size, the result of marine or shoreline recreation activities, primarily escaped campfires. Most fires are reported by passing boats or ships, but suppression equipment is mostly road based.

PT (3). How does the ML 3, 4, and 5 road system affect risk to firefighters and to public safety?

The road system enhances firefighter access but does not contribute greatly to the public's safety from wildfire.

PT (4). How does the ML 3, 4, and 5 road system contribute to airborne dust emissions resulting in reduced visibility and human health concerns?

Dust is a localized problem during rainless periods. Southeast Alaska is rated as "attainment" for particulates under the National Ambient Air Quality Standards.

Roaded and UnRoaded Recreation[1] (Matt)

RR/UR (1). Is there now or will there be in future excess supply or excess demand for ML 3, 4, and 5 roaded or unroaded recreation opportunities?

The Tongass National Forest has the potential to provide a wide variety of recreation settings. The Recreation Opportunity Spectrum (ROS) has been developed to help identify, quantify, and describe these settings. The ROS system portrays the appropriate combination of activities, settings, and experience expectations along a continuum that ranges from highly modified to primitive environments. Seven classifications are identified along this continuum:

- Urban (U)
- Rural (R)
- Roaded Natural (RN)
- Roaded Modified (RM)
- Semi-primitive Motorized (SPM)
- Semi-primitive Non-motorized (SPNM)
- Primitive (P)

A general Forest-wide inventory of the ROS classification was made in 1989, and is periodically updated. This inventory was updated to reflect current conditions as part of the roadless area inventory update that was conducted for the Tongass Draft Supplemental EIS in 2002 (USDA Forest Service 2002). Figure E1 shows the recreation opportunities available on the Tongass by ROS class. Approximately 62 percent of the Forest is allocated to the Primitive ROS, with a further 19 percent allocated to SPNM. The recreation analyses conducted for the 1997 Tongass Land and Resource Management Plan EIS and the 2002 Tongass SEIS indicate that Forest-wide there is presently an excess supply of unroaded recreation opportunities. The supply of unroaded recreation opportunities was estimated to be 1,489,000 Recreation

[1] The Recreation questions listed in FS-643 consist of five questions that address unroaded recreation opportunities (UR1 through UR5). The same five questions are then asked in the context of roaded recreation opportunities (RR1 through RR5). The following section combines these questions into one set of five questions.

Visitor Days (RVDs) in 2001, while demand was estimated to be 706,000 RVDs. An RVD is 12 hours of recreation use by one individual. Supply of unroaded recreation opportunities is expected to continue to exceed demand over the next decade (USDA Forest Service 2002; Table 3.4-16).

Lands allocated to the SPM ROS class comprise approximately 8 percent of the Forest. Demand presently exceeds supply for the opportunities afforded by this setting and is expected to continue to do so in the future. The supply of SPM opportunities was estimated to be 1,821 RVDs in 2001, with an estimated demand of 2,117 RVDs. This type of setting may be located within one-half mile of roads that are open and maintained for passage by high clearance and four-wheel drive vehicles (ML 2) and provide access for recreation opportunities and facilities. Access to SPM settings is via motorized and non-motorized trails and Traffic Service Level (TSL) D roads, although some TSL C roads provide access to and through the area.[2] Access to SPM settings is provided via ML 1 or 2 roads not ML 3, 4, and 5 roads.

Lands allocated to the RN, RM, R, and U ROS classes comprise the remaining 12 percent of the Forest. The supply of these opportunities was estimated to be 3,006 RVDs in 2001, with an estimated demand of 653 RVDs. Supply is expected to continue to exceed demand over the next decade. All forms of access and travel may occur in RN settings, with access typically via passenger vehicle. RM settings are accessed by Forest roads maintained to MLs 2, 3, and 4 and available for public use. Access to R settings is primarily by passenger vehicle, while access to U settings is motorized, often with mass transit supplements.

[2] TSL C roads are characterized by sinuous alignments to reduce construction costs with surfaces that may not be stable under all traffic or weather conditions. TSL D roads are generally constructed for a single purpose and traffic is discouraged for other purposes. TSL D surfaces and alignments are rough and irregular requiring very low speeds (USDA Forest Service 1997).

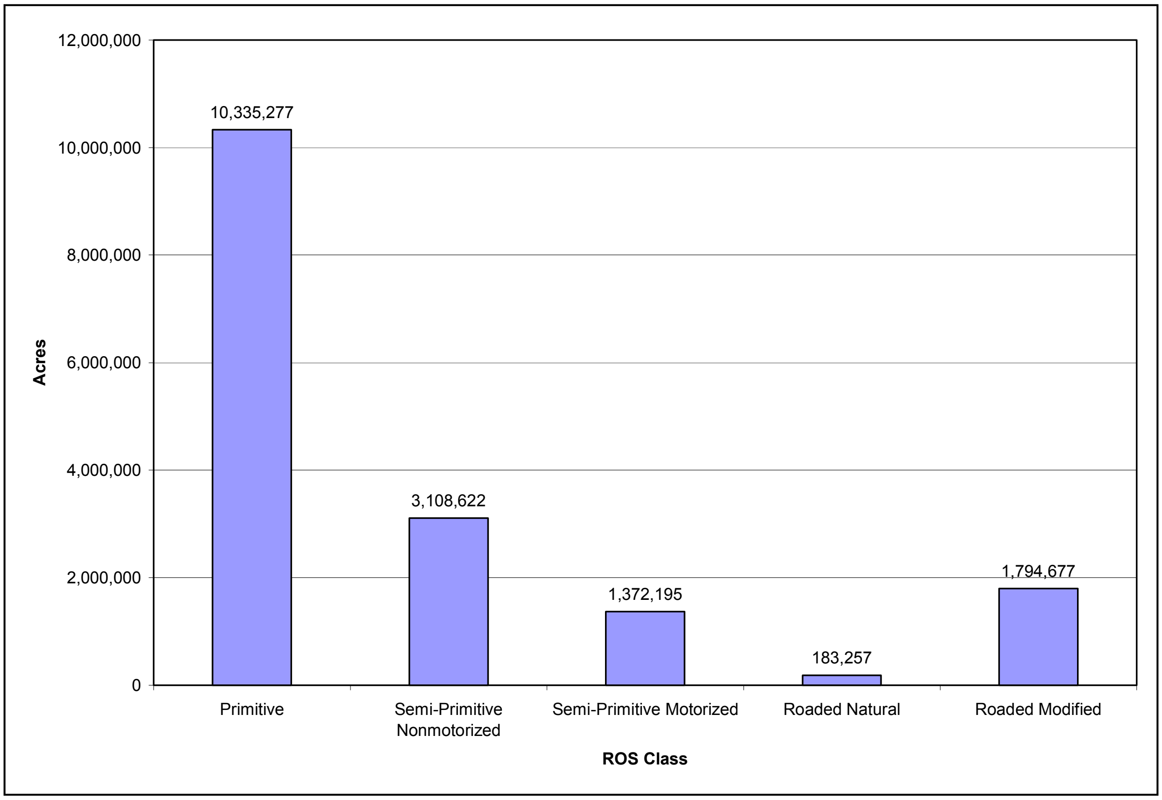


Figure F1. ROS Classes on the Tongass National Forest

RR/UR (2). Is developing new ML 3, 4, and 5 roads into unroaded areas, decommissioning of existing ML 3, 4, and 5 roads, or changing the maintenance of existing ML 3, 4, and 5 roads causing substantial changes in the quality, quantity, or type of roaded and unroaded recreation opportunities?

As noted in response to the preceding question, Forest-wide, the supply of roaded and unroaded recreation opportunities presently exceeds demand. Viewed at the Forest level, new road development has not affected the quantity or type of unroaded recreation opportunities. These types of effects are more likely to occur at the local level and are more appropriately dealt with as site-specific analyses warrant.

RR/UR (3). What are the adverse effects of noise and other disturbances caused by developing, using, and maintaining roads on the quality, quantity, and type of ML 3, 4, and 5 roaded and unroaded recreation opportunities?

This is not a programmatic issue. These types of adverse effects are more appropriately dealt with at the project-level.

RR/UR (4). Who participates in ML 3, 4, and 5 roaded and unroaded recreation in the areas affected by constructing, maintaining, and decommissioning roads?

Community road systems are limited, but heavily used for access to recreation sites and attractions near local communities. Existing community road systems that include ML 3, 4, and 5 roads are primarily located near the larger communities of

Juneau, Sitka, Petersburg, and Wrangell. The majority of the roads surrounding Ketchikan are non-Forest Service roads. There is an extensive road system connecting the small communities on Prince of Wales Island, and systems developing near the communities of Hoonah and Kake. ML 3, 4, and 5 roads comprise a large share of these roads. There is no interconnecting highway system between islands or between communities on the mainland.

Roads exist in other locations where timber harvest has taken place. Independent tourists and local users from other parts of Southeast Alaska, as well as local residents, use road systems that are accessible from the Alaska Marine Highway System (ferries) or from a community for recreational purposes. Roads in locations where there are no communities or interconnecting access to the Alaska Marine Highway System (ferries) receive relatively low levels of recreation use, primarily by local residents. However, recreation-related vehicle use has been growing on some remote islands, including Zarembo and Etolin Islands and isolated systems on Kuiu and Kupreanof Islands. While the total amount of recreation use on these islands is low, it can be heavy at times, such as during hunting seasons.

Forest-wide recreation use statistics were last compiled in 1996. Various problems were associated with the methods employed to collect these data. In order to address some of these issues, the Alaska Region of the Forest Service (Region 10) began participating in the Forest Service's National Visitor Use Monitoring (NVUM) program in 2000. Visitor use data were collected from 649 people surveyed on the north third of the Tongass National Forest. A preliminary report based on the results of this survey estimated that there were between 6 million and 10.5 million visits (an estimated 8.2 million visits with an error rate of plus or minus 27.5 percent) to the Tongass National Forest in 2000 (USDA Forest Service 2001a). These preliminary results indicated that at least 61 percent of visitors surveyed were Southeast Alaska residents.

The number of visitors to Southeast Alaska has increased significantly over the past decade with the number of cruise ship passengers visiting Juneau more than doubling, increasing from approximately 237,000 in 1990 to 632,000 in 2000. Other ports in Southeast Alaska, including Ketchikan, Skagway, and Haines, also experienced net increases in passenger volumes over this period. Sitka and Wrangell were exceptions to this general trend with absolute decreases in passenger volumes during the latter half of the 1990s. Shore excursions have become an integral part of the cruise ship experience, providing increased revenues for ship operators and opportunities for local entrepreneurs. Much of this activity has been concentrated at major ports of call (such as Ketchikan, Juneau, or Skagway). Several mid-size cruise operators are, however, now active in the region, often taking their customers to places bypassed by the larger ships (USDA Forest Service 2002).

There has also been a significant increase in the number of outfitter/guide clients on the Tongass. Outfitter/guide use information compiled for the shoreline areas on the north part of the Tongass from 1994 to 1999 shows a dramatic increase in outfitter/guide use in shoreline areas, with the number of outfitter/guide clients increasing from approximately 1,550 in 1994 to 14,096 in 1999 (USDA Forest

Service 2001b). A survey of commercial recreation businesses conducted throughout Southeast Alaska in 2000 found that 73 percent of the businesses surveyed had experienced an increase in the number of clients they serve since 1995 (Alaska Division of Community & Business Development [DCBD] 2001). Cruise ship passengers accounted for 41 percent of total clients for all of the surveyed businesses, ranging from 22 percent of clients for businesses with fewer than 200 clients a year to 91 percent of clients for businesses with more than 10,000 clients a year.

The following paragraphs briefly describe the recreation use of ML 3, 4, and 5 roads by ranger district.

There are no ML 3, 4, and 5 roads on the Yakutat Ranger District.

Almost all recreationists using the ML 3 roads on the Hoonah Ranger District come from Hoonah or the Whitestone Logging Camp, although some Juneau residents ferry over their trucks to hunt in the fall. The majority of recreation use occurs on the road systems that extend east and south from Hoonah. The road systems by Mud Bay and Salt Lake Bay are primarily used for subsistence.

ML 3 roads on the Sitka Ranger District are located on Chichagof Island, south of Tenakee Inlet and north of Peril Strait. The majority of users of these roads come from Tenakee Springs. There are also two short lengths of ML 3 and ML 4 roads located adjacent to Sitka leading to Harbor Mountain and the Blue Lake Campground, respectively. These roads are primarily used by Sitka residents and visitors to the area.

The two ML 3 roads located on Berners Bay in the Juneau Ranger District were constructed for mine access. The Kensington Mine is not currently active, but the road receives some mine-related use. The Jualin Mine is no longer active and the associated access road receives occasional use by hikers and bikers.

ML 3 roads in the Petersburg Ranger District are located on Mitkof, Kupreanof, and Kuiu Islands. These roads are used by recreationists for access, as well as driving for pleasure. The road system on Mitkof Island is particularly heavily used for recreation.

ML 3 roads in the Wrangell Ranger District are concentrated on Wrangell and Zarembo Islands. There is also a ML 3 road extending west across Etolin Island from Anita Bay. The heaviest recreation use on the Wrangell Ranger District occurs on the Nemo Loop road system on Wrangell Island. Several developed recreation sites are located along this loop, as well as a trail with saltwater access. Use is primarily by Wrangell residents. The roads on Zarembo Island are used primarily for subsistence and recreational hunting, as well as timber hauling. The road system on Etolin Island is mainly used for timber hauling.

There is an extensive network of ML 3 roads located throughout the Thorne Bay Ranger District. In addition, a section of ML 4 road extends the State-owned Thorne Bay Road to Naukati Bay. Road 3030 is a ML 3 road that serves Coffman Cove. The majority of use on most other roads is for recreation and subsistence. Roads that provide access to fishing holes are used heavily by anglers and bear hunters, while roads that go into alpine areas are used by deer hunters. All of these roads were built originally for timber access, but currently receive little or no use for timber hauling. There are, however, a number of sales presently under contract on the Thorne Bay Ranger District that would be accessed via the existing road system. These include the Big Bob, Wolf Pup, and Log Jam sales.

The ML 3 roads located between Trocadero Bay and Polk Inlet in the Craig Ranger District were built about 15 to 20 years ago, mainly for logging. Today, these roads are used primarily for recreation, including fishing, hunting, and some dispersed camping. Polk Inlet and Twelvemile Arm are the primary destinations. There are several developed recreation sites along this road system, an accessible trail at Pass Lake and a wildlife viewing area at Dog Salmon Creek. Most use of the road system is by local residents, but the number of out-of-area users is growing steadily.

There are two short sections of ML 4 and 5 roads located in the Ketchikan Ranger District. These sections are located on the south side of Ward Lake Road. There is also a short section of ML 3 road near White River that links two sections of non-Forest Service roads. The majority of the roads in the Ketchikan Ranger District are non-Forest Service roads.

RR/UR (5). What are these participants' attachments to the area, how strong are their feelings, and are alternative opportunities and locations available?

Many residents of Southeast Alaska place a high value on the quality and availability of outdoor recreation opportunities in the region. This is evidenced by the fact that the proportion of Alaskan residents who participate in outdoor activities is generally much higher than elsewhere in the United States (Bowker 2001). Many local residents engage in dispersed recreation activities on NFS lands and adjacent saltwater.

The supply of alternate opportunities and locations is not a programmatic issue. These issues are more appropriately dealt with at the project level.

Passive-Use Value (PV)

PV (1). Do areas planned for ML 3, 4, and 5 road construction, closure, or decommissioning have unique physical or biological characteristics, such as unique natural features and threatened and endangered species?

This is not a programmatic issue. These types of issues are more appropriately dealt with at the project-level.

PV (2). Do areas planned for road construction, closure, or decommissioning have unique cultural, traditional, symbolic, sacred, spiritual, or religious significance?

This is not a programmatic issue. These types of issues are more appropriately dealt with at the project-level. Roads Analysis questions SI (4) and SI (9) address these issues at the Forest scale. It is also worth noting that traditional, symbolic, sacred, spiritual, and religious values are not passive use values (see the discussion in response to Question 4 below).

PV (3). What, if any, groups of people (ethnic groups, subcultures, etc.) hold cultural, symbolic, spiritual, sacred, traditional, or religious values for areas planned for road entry or road closure?

This is not a programmatic issue. These types of issues are more appropriately dealt with at the project-level. Roads Analysis questions SI (4) and SI (9) address these issues at the Forest scale. Again, it is worth noting that traditional, symbolic, sacred, spiritual, and religious values are not passive use values.

PV (4). How does the ML 3, 4, and 5 road system affect passive use values on the Tongass National Forest?[3]

As described in the Roads Analysis handbook (USDA Forest Service 1999), passive use value is "a value or benefit people receive from the existence of a specific place, condition, or thing, independent of any intention, hope, or expectation of active use." This type of value includes existence and bequest values. Existence value represents the value or benefit that individuals obtain from simply knowing that a specific place, condition, or thing exists, independent of their active use. Bequest value is the value or benefit received because a place, condition, or thing is available to pass onto future generations.

Passive use values are typically associated with natural resources, such as endangered and threatened species, pristine wilderness, unusual geological or natural conditions, or unique cultural heritage resources. They are rarely associated with developed areas or infrastructure elements, such as roads. While it is possible that some individuals may value the existence of roads on the Tongass independent of their use, it is reasonable to assume that these values, if they exist, would be lower than those associated with natural resources. As a result, development of the existing ML 3, 4, and 5 road system likely led to a reduction in the overall passive use value held for the Tongass National Forest. This would be likely to occur because road construction and especially road construction to facilitate timber harvest results in a loss of undeveloped and wild areas. It is, however, important to note that the Forest-wide standards and guidelines outlined in the 1997 Forest Plan minimize the potential adverse effects of new roads on fish and wildlife and cultural resources.

Social Issues (SI)

SI (1). What are people's perceived needs and values for ML 3, 4, and 5 roads? How does ML 3, 4, and 5 road management affect people's dependence on, need for, and desire for roads?

The Tongass National Forest encompasses an island archipelago that extends almost 500 miles south to north. The surrounding marine waters are a major component of the transportation infrastructure. Facilities that provide water to land to water access are a key component of all existing road systems and the overall transportation infrastructure in Southeast Alaska communities. The Southeast Alaska Transportation Plan (Alaska Department of Transportation and Public Facilities 1999; 2001), for example, emphasizes additional ferry service and road construction and upgrades that

[3] To place in the context of a Forest-wide roads analysis, this question has been reworded from FS-643, which is "Will constructing, closing, or decommissioning roads substantially affect passive-use value?"

together facilitate an integrated regional transportation system. The majority of the ML 3 and 4 roads on the Tongass were constructed for timber harvest and the majority of the existing miles do not directly link communities with one another. There are some exceptions to this, but the majority of the roads are used for recreation and subsistence access.

SI (2). What are people's perceived needs and values for access? How does ML 3, 4, and 5 road management affect peoples dependence on, need for, and desire for access? What is the perceived social and economic dependency of a community on an unroaded area versus the value of that unroaded area for intrinsic existence and symbolic values?[4]

The 1997 Tongass Land Management Plan (TLMP) Revision FEIS identifies an annual allowable sale quantity (ASQ) of 267 million board feet (MMBF) for Alternative 11, the selected alternative. This figure was revised downward slightly to 259 MMBF in the TLMP Roadless Area Evaluation for Wilderness Recommendations Draft SEIS (USDA Forest Service 2002). The ASQ is the maximum quantity of timber that may be scheduled from suitable lands on the entire Forest for a 10-year period. It is a ceiling not a future sale level projection or target. Nevertheless, meeting this ASQ in the near future would involve scheduling timber sales in roadless areas and would involve developing new roads and maintaining existing ones. Although roads of ML 3, 4, and 5 are not necessary for accessing timber in most parts of the Forest (see the response to the Timber questions), the ASQ and associated road construction provide some indication of the perceived need of communities in the region for access for commodity production. This need has, however, been disputed by people who reside in Southeast Alaska, as well as elsewhere in the United States.

A review of public comment received on timber sale proposals for roadless areas throughout the Forest suggests that some members of local communities support road development in roadless areas for timber harvest, while others do not. Relatively few comments received on these documents were in favor of logging and road building in roadless areas. This does not necessarily mean that fewer people in the region support road building in roadless areas than oppose it, it is simply a reflection of the perspectives of those who commented on the proposed projects. People supporting road building stated that road building improved recreation opportunities and was good or at least not detrimental for subsistence. In the case of the Upper Carroll Timber Sale (USDA Forest Service 1996), for example, some commenting stated that the people residing in the area wanted more roaded recreation opportunities and that road connections between Ketchikan, Shelter Cove, Shrimp Bay, and Fire Cove would benefit local communities.

Those opposing road development associated with specific sales were concerned with the effects of road building on fish and wildlife habitat, scenic values, recreation and

[4] Questions 2 and 7 from FR-643 have similar themes and are, therefore, addressed together. The Forest Service guidance (FR-693, USDA Forest Service 1999) suggests that question 2 is intended to address perceptions of the importance of access for natural resources or roaded recreation and contrast these with perceptions that access is detrimental to wildlife, unroaded recreation, etc. Question 7 is intended to address the values that people hold for unroaded areas with respect to the potential economic contribution they offer from a resource development (timber, minerals, roaded access) perspective and contrast this with the contribution they provide in an undeveloped state (solitude, quiet, refugia for plants and animals).

tourism, subsistence, heritage resources, domestic water sources, and karst. Some commenting on the Southeast Chichagof Timber Sale (USDA Forest Service 1992), for example, stated that roads would create easy access for motorized hunting and would be detrimental to deer populations and villagers who hunt by hiking. Public comments received on the Emerald Bay Timber Sale (USDA Forest Service 2000) indicated that the project, which included road construction, would have negative effects on subsistence, ecotourism, public recreation, old growth reserves, and hunting and trapping. Similar comments were received for the majority of timber sale EISs on the Tongass over the past decade.

Intrinsic existence values are discussed in the passive use value section.

SI (3). How does the ML 3, 4, and 5 road system affect access to paleontological, archaeological, and historic sites?

The Tongass National Forest maintains a cultural resource management program to identify, evaluate, preserve, and protect significant cultural resources on a Forest-wide and project-specific level in compliance with the National Historic Preservation Act, as amended, as well as a number of other acts and implementing regulations. Impacts to cultural resources may result from public access, natural forces, or project-related activities. Public use may affect cultural resource sites through inadvertent damage caused by compaction and other ground-disturbing activities, as well as vandalism, such as relic collection, defacement, and theft. Protection of significant sites from public use includes establishment of public education programs, maintaining confidentiality about site locations, monitoring, and directing public use away from the most vulnerable areas.

Access to paleontological, archaeological, and historical sites via road provides opportunities for protection and interpretation for public education and enjoyment. It also increases the potential risk of detrimental effects associated with public use. In cases where active educational and interpretive programs are established it is also necessary to implement measures to protect against vandalism.

The existing road system provides access to cultural resources sites in some locations. Areas where access to cultural sites is a concern include Auke Bay on the Juneau Ranger District and Petrogyth Beach by downtown Wrangell. However, these areas are not accessed by Forest Service roads. Access problems elsewhere on the Forest include old canneries and mining sites on Prince of Wales Island where people go looking for historic artifacts. ML 3 roads provide access to these areas.

Issues associated with potential effects upon cultural resources sites are dealt with on a project-by-project basis.

SI (4). How does the ML 3, 4, and 5 road system affect cultural and traditional uses (such as plant gathering and access to traditional and cultural sites) and American Indian Treaty rights? What are traditional uses of animal and plant species in the area of analysis?[5]

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[5] Questions 4 and 9 from FR-643 are addressed together in this response. It is important to understand what the traditional uses are (Question 9 from FR-643) before trying to assess how they are affected by the road system (Question 4).

For many rural Alaskans, subsistence hunting, fishing, trapping, and gathering natural resources provides needed food and supplements rural incomes. Subsistence is also viewed by many, especially Southeast Alaska's Native communities, as a lifestyle that preserves cultural customs and traditions, reflecting deeply held attitudes, values, and beliefs.

Eighty-five percent of rural Southeast Alaska households harvest subsistence food, with almost one-third of households obtaining at least half of their food from their own harvest activities. The 1988 Tongass Resource Use Cooperative Survey (TRUCS) identified 42 different resource categories that were harvested for personal use. Subsistence resources include wildlife, waterfowl, marine mammals, salmon and other finfish, invertebrates, and plants.

Sitka black-tailed deer comprised 21 percent of total subsistence harvest by Southeast Alaska residents in 1987, measured in pounds. Salmon and other finfish comprised 21 and 24 percent of total subsistence harvest by rural residents in 1987, respectively.

The availability of subsistence resources is not uniform across the Forest and subsistence use varies by community. Edna Bay subsistence resource hunters gathered the most resources, measured in pounds per capita, while Skagway residents gathered the least (USDA Forest Service 1997).

Subsistence use historically occurred where access to the resources cost less in energy than the resources gathered provided, with the majority of gathering activities occurring in easily-accessed areas. Development of road systems allowed a movement out into new resource areas that were previously relatively difficult to access. The traditional household deer hunting areas mapped in the 1997 TLMP (USDA Forest Service 1997), for example, show that the road system is extensively used for subsistence use. This is particularly the case on Prince of Wales Island.

Under the Alaska National Interest Lands Conservation Act (ANILCA), the Forest Service is required to maintain reasonable access to NFS lands for rural residents who depend upon subsistence. Increased road access can result in greater opportunities for subsistence hunting, but may also lead to greater competition and decreases in the populations of the species on which rural residents depend. Perspectives on the effects of the road system on subsistence vary by user and location. Some groups using the Zarembo Island road system, for example, have expressed interest in seeing more new roads and letting the older roads grow in. In other areas, users would rather not see any new roads in an effort to minimize competition for key hunting sites. More specific effects associated with road development are more appropriately assessed at the project level.

The majority of Forest Service staff interviewed as part of this analysis stated that it is often difficult to distinguish between recreation and subsistence use from a planning perspective. The majority of roads used for recreation (see responses to the recreation questions) are also used for subsistence. In some cases, people using the road system for subsistence purposes hunt in areas close to the roads. In other cases, they use the roads for access to the general area and hike some distance into the forest.

Other types of traditional uses of animal and plant species in the vicinity of the road system include cedar bark stripping and berry picking. These types of activities vary by region. Cedar bark stripping is, for example, evident on the Craig Ranger District along the road to Hydaburg. Cedar bark gathering in the Sitka Ranger District, by contrast, tends to take place in areas that are accessible by boat.

SI (5). How are ML 3, 4, and 5 roads that constitute historic sites affected by road management?

None of the roads on the Tongass are considered historic sites under the National Historic Preservation Act. There are several travel routes on the Tongass that have historic significance but none of these routes are followed by ML 3, 4, and 5 roads.

SI (6). How is community social and economic health affected by ML 3, 4, and 5 road management (e.g., lifestyles, businesses, tourism industry, infrastructure maintenance)?

Changes to a road system may affect local land uses, such as subsistence and recreation, as well as the regional economy through effects on natural resource-based industries, such as wood products and recreation and tourism. These effects are more appropriately assessed at the project-level.

SI (7). What is the perceived social and economic dependency of a community on an unroaded area versus the value of that unroaded area for intrinsic existence and symbolic values?

See Question SI2.

SI (8). How does ML 3, 4, and 5 road management affect wilderness attributes, including natural integrity, natural appearance, opportunity for solitude, and opportunities for primitive recreation?

There are 19 wildernesses on the Tongass that include a total of 5.8 million acres. There are very few ML 3, 4, or 5 roads located in close proximity to these areas. The closest ML 3 road to wilderness is located approximately 3 miles northeast of the Tebenkof Bay Wilderness at its closest point and shielded from the wilderness by intervening topography and vegetation. This and other ML 3, 4, and 5 roads on the Tongass are unlikely to have significant effects on wilderness attributes in the 19 designated wildernesses.

ML 3, 4, and 5 roads do, however, have the potential to affect the wilderness attributes of roadless areas by generating noise and dust, providing access, and affecting the natural integrity of the general area. The Tongass Wilderness Evaluation SEIS (USDA Forest Service 2002) identified 115 roadless areas that totaled approximately 9.7 million acres. Close proximity to a road may affect the eligibility of a roadless area for consideration for wilderness designation. Road construction within a roadless area would also have a detrimental effect on the area's wilderness attributes and prevent it from being designated wilderness. Decommissioning a road in an otherwise undeveloped area may allow the area to be designated roadless and considered for wilderness designation in subsequent evaluations.

The effects of road management on the wilderness attributes of specific areas is more appropriately addressed at the project level.

SI (9). What are traditional uses of animal and plant species in the area of analysis?

See Question SI4.

SI (10). How does ML 3, 4, and 5 road management affect people's sense of place?

The roads analysis guidance (USDA Forest Service 1999) describes "sense of place" as the "character of an area and the meaning people attach to it." This refers to specific places and is more suited to a project-specific analysis. In general, it is apparent that changes in road management have the potential to affect the sense of place that certain groups attribute to particular areas and road systems. In the case of recreation, for example, if the decision is made to upgrade a road from ML 2 to ML 3 more and different users might begin to use the area as access is improved. This could change the character of the area for existing users and affect their sense of place. Downgrading the ML of a road may have the opposite effect restricting the use of an area or road system by particular groups.

Civil Rights and Environmental Justice (CR)

CR (1). How does the ML 3, 4, and 5 road system, or its management, affect certain groups of people (minority, ethnic, cultural, racial, disabled, and low-income groups)?

As noted in response to SI (6), the road system and its management has significant effects on community social and economic health. The response to EC (3) provides a general overview of the distribution of benefits and costs among affected people. Thirteen of Southeast Alaska's 32 communities had Alaska Native populations that comprised a larger share of total population than the regional average (17 percent) in 2000. Alaska natives comprised a particularly large share of total population in Angoon (82 percent), Hoonah (61 percent), Hydaburg (85 percent), Kake (67 percent), Klawock (51 percent), Metlakatla (82 percent), and Saxman (66 percent), all considered traditional Native communities. Communities with a larger percent of households below the poverty line than the regional average in 1990 (5.8 percent) included Edna Bay, Port Protection, Meyers Chuck, and Hydaburg (USDA Forest Service 2002).

The existing ML 3, 4, and 5 road system facilitates economic activities including timber harvest, recreation and tourism, and mining, as well as nontimber forest products and subsistence. Costs include those associated with planning, constructing, maintaining, and decommissioning roads, as well as non-priced costs, such as decreased water quality and habitat fragmentation. It is difficult at the Forest-level to assess whether certain groups of people are disproportionately affected by the existing road system. Financial costs associated with maintaining the existing system are, for example, borne by the federal government. Other localized costs, such as those potentially associated with increased subsistence use, decreased water quality, and habitat fragmentation, that have the potential to disproportionately affect specific groups of people need to be assessed at the project level.

Road management does have the potential to disproportionately affect different groups of people. In the case of subsistence, for example, the decision to upgrade a road from ML 2 to ML 3 could have the effect of increasing competition at particular sites and displacing Alaska Native or low income populations that presently use the area. Road development in close proximity to traditional use areas could disproportionately affect groups that value those areas through increasing access. Conversely, a decision to downgrade a road could disproportionately affect disabled and elderly people who would no longer be able to access an area.

References

Gucinski, H, M. Furniss, R. Ziemer, and M. Brookes. 2000. Forest Roads: A Synthesis of Scientific Information. USDA Forest Service.

Harr, R, W. Harper, J. Krygier, F. Hseih. 1975. Changes in storm hydrographs after road building and clear-cutting in the Oregon Coast Range. Water Resources Research. 11(3):436-444.

Jones, J. and G. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resources Research. 32(4):959-974.