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APPENDIX A: ANILCA 810(A) ANALYSIS

SUBSISTENCE - SECTION 810(a) OF ANILCA
SUMMARY EVALUATION AND FINDINGS

I. INTRODUCTION

This section was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). It summarizes the evaluation of potential restrictions to subsistence that could result from the Denali National Park Vehicle Management Plan (VMP).

II. THE EVALUATION PROCESS

Section 810(a) of ANILCA states:

> "In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands . . . the head of the federal agency . . . over such lands . . . shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be affected until the head of such Federal agency -
>
> (1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 805;
>
> (2) gives notice of, and holds, a hearing in the vicinity of the area involved; and
>
> (3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions."

ANILCA created new units and additions to existing units of the National Park System in Alaska. Denali National Park and Preserve was created by ANILCA Section 202(3)(a):

> "The park additions and preserve shall be managed for the following purposes, among others: To protect and interpret the entire mountain massif, and additional scenic mountain peaks and formations; and to protect habitat for, and populations of, fish and wildlife, including, but not limited to, brown/grizzly bears, moose, caribou, Dall sheep, wolves, swans and other waterfowl; and to provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities."

Title I of ANILCA established national parks for the following purposes:

> "... to preserve unrivaled scenic and geological values associated with natural landscapes; to provide for the maintenance of sound populations of, and habitat for, wildlife species of inestimable value to the citizens of Alaska and the Nation, including those species dependent on vast relatively undeveloped areas; to preserve in their natural state extensive unaltered arctic tundra, boreal forest, and coastal rainforest ecosystems to protect the resources related to subsistence needs; to protect and preserve historic and archeological sites, rivers, and lands, and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on free-flowing rivers; and to maintain opportunities for scientific research and undisturbed ecosystems."

> "... consistent with management of fish and wildlife in accordance with recognized scientific principles and the purposes for which each conservation system unit is established, designated, or expanded by or pursuant to this Act, to provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so."

The potential for significant restriction must be evaluated for the proposed action's effect upon "... subsistence uses and needs, the availability of other lands for the purposes sought to be achieved and other alternatives which would reduce or eliminate the use. . . ." (Section 810(a))

III. PROPOSED ACTION ON FEDERAL LANDS

The VMP proposes 3 alternatives. Alternative A is the no action alternative. Alternative B proposes to optimize access to the park by pre-booking and filling busses. Alternative C proposes to maximize visitor opportunities by offering a wider range of access choices. All alternatives are described in detail in the environmental impact statement and all alternatives provide a range of tools to manage vehicular traffic on the Denali Park Road. Customary and traditional subsistence use on NPS lands will continue as authorized by Federal law and regulations under all alternatives.

IV. AFFECTED ENVIRONMENT

Subsistence uses within Denali National Park and Preserve are permitted in accordance with ANILCA. Section 202(3)(a) of ANILCA allows local residents to engage in subsistence uses in the ANILCA additions to the park where such uses are traditional in accordance with the provisions in Title VIII. Lands within former Mount McKinley National Park are closed to subsistence uses.

A regional population of approximately 300 eligible local rural residents qualifies for subsistence use of park resources. Resident zone communities for Denali National Park and Preserve are Cantwell, Minchumina, Nikolai, and Telida. By virtue of their residence, local rural residents of these communities are eligible to pursue subsistence activities in the new park additions. Local rural residents who do not live in the designated resident zone communities, but who have customarily and traditionally engaged in subsistence activities within the park additions, may continue to do so pursuant to a subsistence permit issued by the Park Superintendent.

The National Park Service realizes that Denali National Park and Preserve may be especially important to certain communities and households in the area for subsistence purposes. The resident zone communities of Minchumina (population 22) and Telida (population 11) use park and preserve lands for trapping and occasional moose hunting along area rivers. Nikolai (population 122) is a growing community and has used park resources in the past. Cantwell (population 147) is the largest resident zone community for Denali National Park and Preserve, and local residents hunt moose and caribou, trap, and harvest firewood and other subsistence resources in the new park area.

The main subsistence species, by edible weight, are moose, caribou, furbearers, and fish. Varieties of subsistence fish include coho, king, pink, and sockeye salmon. Burbot, dolly varden, grayling, lake trout, northern pike, rainbow trout, and whitefish are also among the variety of fish used by local people. Beaver, coyote, land otter, weasel, lynx, marten, mink, muskrat, red fox, wolf, and wolverine are important furbearer resources. Rock and willow ptarmigan, grouse, ducks, and geese are important subsistence wildlife resources.

The National Park Service recognizes that patterns of subsistence use vary from time to time and from place to place depending on the availability of wildlife and other renewable natural resources. A subsistence harvest in any given year many vary considerably from previous years because of such factors as weather, migration patterns, and natural population cycles. However, the pattern is assumed to be generally applicable to harvests in recent years with variations of reasonable magnitude.

V. SUBSISTENCE USES AND NEEDS EVALUATION

To determine the potential impact on existing subsistence activities, three evaluation criteria were analyzed relative to existing subsistence resources that could be impacted.

The evaluation criteria are

- the potential to reduce important subsistence fish and wildlife populations by (a) reductions in numbers; (b) redistribution of subsistence resources; or (c) habitat losses;
- the affect the action might have on subsistence fishing or hunting access; and
- the potential to increase fishing or hunting competition for subsistence resources.

The potential to reduce populations:

Provisions of ANILCA and federal and state regulations provide protection for fish and wildlife populations within Denali National Park and Preserve.

Any changes in traffic patterns on the road will be prefaced by a monitoring plan outlined in this environmental impact statement. Impacts to wildlife are not anticipated; however, the Before After Control Impact (BACI) monitoring program will be in place to ensure impacts are identified quickly and remedied. The alternatives would not adversely affect the distribution or migration patterns of subsistence resources. Therefore, no change in the availability of subsistence resources is anticipated as a result of the implementation of this proposed action.

Restriction of Access:

Denali National Park and Preserve is managed according to federal legislative mandates, NPS regulations, NPS management policies, and the park's general management plan.

Alternative 1 (No Action), the status quo would not significantly limit or restrict access to subsistence resources in Denali National Park and Preserve.

Alternative 2 (Optimizing Access), =will not change, limit or restrict the access of subsistence users to natural resources within the ANILCA additions of Denali National Park or Denali National Preserve. Federal and non conflicting state regulations assure the continued viability of fish and wildlife populations.

Alternative 3 (Maximizing Visitor Opportunities), will not change, limit, or restrict the access of subsistence users to natural resources within the ANILCA additions of Denali National Park or Denali National Preserve. Federal and non conflicting state regulations assure the continued viability of fish and wildlife populations.

Increase in Competition:

Alternative 1 (No-Action alternative), maintaining the status quo, would not result in increased competition for fish, wildlife, or other resources that would significantly impact subsistence users in Denali National Park and Preserve.

Alternative 2 (Optimizing Access)would not result in increased competition for fish, wildlife, or other resources that would significantly impact subsistence users in Denali National Park and Preserve. Federal and non-conflicting state regulations assure the continued viability of particular fish or wildlife populations. If it is necessary to restrict the taking of fish and wildlife to assure the continued viability of a fish or wildlife population or the continuation of subsistence uses of such population, subsistence uses are given a priority over other consumptive uses.

Alternative 3 (Maximizing Visitor Opportunities) would not result in increased competition for fish, wildlife, or other resources that would significantly impact subsistence users in Denali National Park and Preserve. Federal and non-conflicting state regulations assure the continued viability of particular fish or wildlife populations. If it is necessary to restrict the taking of fish and wildlife to assure the continued viability of a fish or wildlife population or the continuation of subsistence uses of such population, subsistence uses are given a priority over other consumptive uses.

If, and when, it is necessary to restrict taking, subsistence uses are the priority consumptive users on public lands of Alaska and will be given preference on such lands over other consumptive uses (ANILCA, Section 802(2)).

Continued implementation of provisions of ANILCA should mitigate any increased competition, however significant, from resource users other than subsistence users. Therefore, the proposed action is not expected to adversely affect resource competition.

VI. AVAILABILITY OF OTHER LANDS

Choosing a different alternative would not decrease the impacts to park resources for subsistence. The preferred alternative is consistent with the mandates of ANILCA, including Title VIII, and the NPS Organic Act.

VII. ALTERNATIVES CONSIDERED

The alternatives considered for this project were limited to the lands along the park road. The alternatives are A) continue the existing conditions (No Action); B) optimizing access; and C) maximizing visitor opportunities. None of the alternatives propose changes to the road or any lands.

VIII. FINDINGS

This analysis concludes that the action alternatives would not result in a significant restriction of subsistence uses.

APPENDIX B: ESTIMATED COSTS FOR VEHICLE MANAGEMENT PLAN ALTERNATIVES

(NOTE: Although some expenses would not be incurred annually, and some expenses could change year to year, average annual costs for vehicle management activities will be developed by dividing the total cost by the life of the plan—assumed to be 20 years for the purposes of these calculations. All estimates are in 2011 dollars)

ALTERNATIVE A: NO ACTION			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
Resource Management Activities	**Staff** • 0.5 FTE (GS-11) and 1 seasonal (G-5) per year to continue monitoring of sheep gap spacing, nighttime traffic, and collection of wildlife observation data from buses. Approximately $65,000 per year. **Equipment** • Approximately $1,500 per year to maintain traffic counters used for monitoring sheep gap spacing and nighttime traffic levels. • One new handheld computer ($2,500 each) every other year.	$1,350,000	$67,500
Interpretive/ Educational Activities	**Staff** <u>Concessioner evaluation program:</u> • Coaches (2 Subject to Furlough FTE @ GS-09) to work with concessioner for driver training and evaluation, @ approximately $65,000 per coach annually • Evaluation program supervisor (part time responsibility for GS-11), @ approximately $30,000 annually <u>Kantishna Experience</u> • 2 to 4 rangers (GS-07) for the Kantishna Experience @ $23,000 per interpreter annually • Supervisor for Kantishna Experience program (part time responsibility for GS-11) @ $5,000 annually **Equipment and Materials** • Computers, equipment, training, and travel @ approximately $10,500 annually for both the concessioner evaluation and Kantishna experience.	$4,430,000 -- $5,350,000	$221,500-- $267,500

ALTERNATIVE A: NO ACTION			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
Concessions Management Activities	**Staff** • One Concessions Management Specialist (GS-11), already part of the existing staff, will be the Park Project Manager who will assist Regional and WASO staff and contractors in the development of the prospectus,(including operating plan and maintenance plan), evaluation of bids, selection, contract award and implementation of new contract. Approximately $90,000 annually. • Existing Concessions Management staff (2.5 FTE @ GS-7, 9, 11) will perform ongoing monitoring for contract compliance @ approximately $160,000 annually	$5,000,000	$250,000
Maintenance and Operations	**Staff** • 11 FTE for road maintenance activities, @ approximately $1,600,000 per year • 5 FTE for facility preventative maintenance, component replacement and repair, @ approximately $325,000 per year **Equipment, Materials, and Other Costs** *Maintenance* • Gravel surface needs: approximately 7,000 cubic yards per year @ $30/cubic yard ($210,000 per year) • Dust palliative: approximately $310,000 per year ($120,000 per year for the palliative, and $190,000 for equipment rental and labor) • Janitorial services at Denali Visitor Center, Eielson Visitor Center, and rest areas, including garbage contracts, janitors, sewer pump drivers, roadside rest stop crews for 7 days a week coverage, cleaning supplies ($1,000,000 per year) • Facility preventative maintenance, component replacement and repair ($175,000 per year) *Operations* • Employee transportation to Toklat: employees drive POVs; no cost • Employee transportation to Wonder Lake: employees drive POVs; no cost	$72,400,000	$3,620,000
	TOTAL COSTS	$83,180,000-$84,100,000	$4,159,000-$4,205,000

ALTERNATIVE B: OPTIMIZING ACCESS			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
Resource Management Activities	**Staff** 2 FTE (GS-7 and GS-11) and 3 seasonals (G-5) per year @ approximately $200,000 annually to: • Run traffic model, • Conduct BACI study (includes collaring activities), • Collect wildlife observations, hiker wait-times, and crowding data at wildlife rest stops by placing park staff equipped with hand-held computers on concessioner buses. • Monitoring vehicles at wildlife stops, rest stops, veiwsheds; nighttime traffic; sheep gaps. • Conduct visitor surveys **Traffic Model** One time cost to develop new, more flexible to tool which would initially be run in parallel with the current tool before replacing it completely. • $130,000 for development of new modeling tool (through agreements) • $25,000 to purchase necessary software to run current tool • $5,000 to purchase software for new tool **GPS Units** One time costs include: • 155 units @ $1495 each ($231,725) • Installation and maintenance @ $85 per unit ($13,175) Annual operating costs: • Monthly satellite service at $55/month for 65 GPS ($42,900 annually) • Annual suspension fee for satellite service ($11,625 annually) • Replacement units, 2 per year @$1495 each ($2990 annually) • Installation and maintenance ($1,700 annually)	$6,345,200	$317,260
	BACI Studies These studies would be conducted not more frequently than every 4 years, and no more than 3 times over life of the plan. Each study would include collaring 20 bears and 20 sheep with the following breakdown in costs:		

ALTERNATIVE B: OPTIMIZING ACCESS			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
	• Refurbish 40 GPS collars @ $1800 per unit ($72,000 per study) • Aviation work for Sheep captures ($20,000 per study) • Aviation work for bear captures ($60,000 per study) • Data analysis ($10,000 study) The BACI study also includes follow-up visitor surveys which will be done every 3-4 years through the Visitor Survey Program • Visitor Surveys ($20,000 per study, occurring every 3-4 years)		
	Additional Equipment • Approximately $1,500 per year to maintain traffic counters used for monitoring sheep gap spacing and nighttime traffic levels. • One new handheld computer ($2,500 each) every other year. • One vehicle @ $6,000 per year		
Interpretive/ Educational Activities	**Staff** <u>Concessioner evaluation program:</u> • Same as alternative A (2 coaches per year @ approximately $65,000 per coach and 1 supervisor per year @ approximately $30,000) <u>Kantishna Experience</u>: • Same as alternative A (2 to 4 rangers per year for the Kantishna Experience @ $23,000 per interpreter and 1 supervisor per year @ approximately $5,000) <u>Personal and non-personal interpretive program:</u> • 1 media specialist (GS-11) @ $85,000 for initial development (year 1); and $45,000 for subsequent years. NOTE: It should be assumed that electronic media would be updated annually, with the podcasts/stories/activities created to highlight trending park issues, providing new opportunities. Printed materials could be revised approx. every 5 years. • 1 seasonal Education Specialist (GS-09) @ $25,000	$12,680,000--$13,600,000	$634,000--$680,000

ALTERNATIVE B: OPTIMIZING ACCESS			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
	per year for initial youth activity development and subsequent revisions • 8 seasonal Interpreters (GS-07) to ensure Denali Visitor Center operating hours are sufficient to meet tour schedules; approximately $23,000 per interpreter annually. • 1 Supervisor (GS-11) for seasonal program @ approximately $90,000 annually.		
	Equipment and Materials • One time cost for equipment/software needed to create electronic and printed media ($30,000) • Printing/shipping: approximately $50,000 annually. • General equipment/supplies (vehicles, etc.): approximately $15,000 annually. • Same as alternative A for the concessioner evaluation and Kantishna experience (e.g., $10,500 annually for computers, equipment, training, and travel)		
Concessions Management Activities	**Staff** • Same as alternative A (1 Concessions Management Specialist and 2.5 FTE for development of the prospectus,(including operating plan and maintenance plan), evaluation of bids, selection, contract award , implementation of new contract, and monitoring for contract compliance). Approximately $250,000 annually. • Additional staff time, not to exceed 0.5 FTE (GS-11), may be needed to perform additional analysis to develop operating plan @ approximately $45,000 every 5 years. • 4 additional Seasonal Staff (GS-4) for Savage River check station @ $18,000 each per year to provide 24-7 coverage.	$5,009,000--$6,441,500	$250,450--$322,075
	Equipment • 2 new workstations for additional FTEs @ $750.00 per workstation • 3 (2 on site, and 1 for back-up) Savage Cameras @ $2,500.00 per camera as alternative to staffing Savage River check station 24-7. • Automated access gate at Savage @ $ $75,000.00 as an alternative to staffing or cameras at Savage Check station.		

ALTERNATIVE B: OPTIMIZING ACCESS			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
Maintenance and Operations	**Staff** • Same as alternative A for road maintenance (11 FTE @ approximately $1,600,000 per year) assuming increased road maintenance (due to increased number of buses) could be accomplished with adequate road crew staffing through continued project funding. • Same as alternative A for facility preventative maintenance, component replacement and repair (5 FTE @ approximately $325,000), plus 1 additional seasonal WG-7 maintenance worker ($24,500 per year) due to increased wear and tear associated with potential increase in visitor and bus numbers.	$77,376,000	$3,868,800
	Equipment, Materials, and Other Costs *Maintenance* • Gravel surface needs: Same as alternative A ($210,000 per year), plus 13% potential increase in bus numbers would increase gravel surface needs by 810 cubic yards annually (810 cys X $50/cy placed = $40,500 per year). Assumes hauling and placing of surfacing material only and that project funding continues to fund daylabor crews and gravel extraction. Assumes gravel processing by contract in conjunction with FHWA road repair projects. • Dust Palliative: Same as alternative A ($310,000 per year), plus 13% potential increase in bus numbers would increase dust palliative needs by 13 tons annually (approximately $9,369 per year). Assumes additional product only and crews are paid by continuing project funds. • Janitorial services: Same as alternative A ($1,000,000 per year), plus potential increase in visitors would increase need for janitorial services at Denali Visitor Center, Eielson Visitor Center, and rest areas ($19,283 per year). • Facility Preventative maintenance, component replacement, and repair: Same as alternative A ($175,000 per year), plus increase in facility preventative maintenance, component replacement and repair due to increased wear and tear ($21,032 per year for additional maintenance and repair materials and component renewal for Denali Visitor Center, Teklankia Rest Stop, Toklat		

ALTERNATIVE B: OPTIMIZING ACCESS			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
	Contact station and Eielson Visitor Center). • One GSA vehicle needed for Eielson Visitor Center maintenance ($7,600 per year) *Operations* • Employee transportation to Toklat: shuttle system including bus rental and driver (runs 4 times per week) or 15 passenger van with 2 drivers (roundtrip 7 days per week) ($40,000 per year) • Employee transportation to Wonder Lake: fly to Kantishna (4 flights / week = $32,000 per year) or shuttle to Toklat and commute to Wonder Lake in government vehicle • Dedicated Housing at Toklat ($79000, annually). Loss of housing revenue. This assumes NPS eliminates all employee travel and provides housing in addition to transportation for employees needed to staff NPS operations in the WD. • Employees commute on own time or government time? (6% loss in overall WD operational efficiency or 11% for maintenance division alone. Based on total WD staff of 50 employees, 25 of which leave every week and travel on Gov't time. Average 5 hrs travel/week for 17 weeks = 2125 hours divided by a total of 34000 staff hours. Overall WD operational inefficiency drops to 3% (5.5% for maintenance div. alone) on 8 on/6 off schedule.		
TOTAL COSTS		$101,410,200--$103,762,700	$5,070,510--$5,188,135

ALTERNATIVE C: MAXIMIZING VISITOR OPPORTUNITIES			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
Resource Management Activities	**Staff** Same as alternative B ($200,000 per year) **Traffic Model** Same as alternative B ($160,000 one time cost) **GPS Units** One time costs same as alternative B ($244,900) Annual operating costs same as alternative B ($59,215 per year) **BACI Studies** As with alternative B, these studies would be conducted not more frequently than every 4 years, and no more than 3 times over life of the plan: • approximately $162,000 per bear and sheep study • Visitor Surveys ($20,000 per year, occurring every 3-4 years) **Additional Equipment** Same as alternative B (approximately $10,000 per year)	$6,345,200	$317,260
Interpretive Activities	**Staff** <u>Concessioner evaluation program:</u> Same as alternative A (2 coaches per year @ approximately $65,000 per coach and 1 supervisor per year @ approximately $30,000) <u>Kantishna Experience</u>: Same as alternative A (2 to 4 rangers per year for the Kantishna Experience @ $23,000 per interpreter and 1 supervisor per year @ approximately $5,000) <u>Personal and non-personal interpretive program:</u> Same as alternative B (1 media specialist @ $85,000 in year , and $45,000 for subsequent years; 1 seasonal Education Specialist @ $25,000 per year, 8 seasonal Interpreters @ approximately $23,000 per interpreter annually; and one Supervisor @ approximately $90,000 annually), plus 4 seasonal interpreters for off-bus activities (approximately @3,000 per interpreter per year.	$14,720,000--$15,640000	$736,000--$782,000

ALTERNATIVE C: MAXIMIZING VISITOR OPPORTUNITIES			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
	Equipment and Materials • Same as alternative B (approximately $30,000 upfront investment and $75,500 annually), plus an additional $10,000 per year for general equipment and supplies		
Concessions Management Activities	**Staff** • Same as alternative B (1 Concessions Management Specialist and 3 FTE for development of the prospectus,(including operating plan and maintenance plan), evaluation of bids, selection, contract award , implementation of new contract, and monitoring for contract compliance; 4 seasonal staff for Savage River check station). Approximately $322,000 annually. **Equipment** • 2 new workstations for additional FTEs @ $750.00 per workstation • 3 (2 on site, and 1 for back-up) Savage Cameras @ $2,500.00 per camera as alternative to staffing Savage River check station 24-7. • Automated access gate at Savage @ $ $75,000.00 as an alternative to staffing or cameras at Savage River check station	$5,009,000--$6,441,500	$250,450--$322,075
Maintenance and Operations	**Staff** Same as alternative B, including 11 FTE @ approximately $1,600,000 per year for road maintenance (assuming increased road maintenance (due to increased number of buses) could be accomplished with adequate road crew staffing through continued project funding) and 5 FTE for approximately $325,000 per year for facility preventative maintenance, component replacement and repair. **Equipment, Materials, and Other Costs** *Maintenance* • Gravel Surface Needs: Same as alternative A ($210,000 per year), plus 9% potential increase in bus numbers would increase gravel surface needs by 560 cubic yards per year (560 cys X $50/cy placed = $28,000 annually). Assumes hauling and placing of surfacing material only and that project	$74,095,000	$3,404750

ALTERNATIVE C: MAXIMIZING VISITOR OPPORTUNITIES			
Activities	**Assumptions**	**Total Cost**	**Average Annual Costs**
	funding continues to fund daylabor crews and gravel extraction. Assumes gravel processing by contract in conjunction with FHWA road repair projects. • Dust palliative: Same as alternative A ($310,000 per year), plus 9% pontential increase in bus numbers would increase dust palliative needs by 9 tons/year (approximately $6,500 annually) Assumes additional product only and that crews are paid by continuing project funds. • Janitorial Services: Same as alternative A (approximately $1,000,000 per year), plus potential increase in visitors would increase need for janitorial services at Denali Visitor Center, Eielson Visitor Center, and rest areas, including waste and garbage hauling, and would require more cleaning supplies ($15,000 per year) • Facility preventative maintenance, component replacement: Same as alternative A (approximately $175,000 per year), plus increase in facility preventative maintenance, component replacement and repair due to increased wear and tear ($16,000 per year for additional maintenance and repair materials and component renewal for the Denali Visitor Center, Teklanika Rest Stop, Toklat Contact station and Eielson Visitor Center). *Operations* • Employee transportation to Toklat: via POV during low traffic volume = no cost • Employee transportation to Wonder Lake: via POV during low traffic volume = no cost *Teklanika Investments (for off-bus activities)* • One-time costs for building new ADA-compliant 6-foot wide, 3,300 linear foot upland loop trail ($177,000). • One-time costs for building new 15,000 square foot parking addition to Teklanika Rest Stop for 5 additional buses ($208,000)		
TOTAL COSTS		$100,169,200--$102,521,700	$5,008,460--$5,126,085

APPENDIX C:

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National Park Service
U.S. Department of the Interior

Denali National Park and Preserve
Alaska

Adaptive Management and Monitoring Strategy for the Vehicle Management Plan and EIS

April 2011

Contents

Introduction

The goal of the adaptive management strategy for the Denali Park Road Vehicle Management Plan is to protect the exceptional condition of the park's resources and values and to preserve the high quality visitor experience through informed, proactive and transparent management. There are two objectives associated with this goal that relate to management of natural resources: 1) manage the transportation system to ensure protection of wildlife populations, wildlife habitat, and the processes and components of the park's natural ecosystem, and 2) manage the transportation system to ensure protection of wilderness character, wilderness resource values, and wilderness recreational opportunities.

Adaptive management is a process that promotes an experimental approach to management and flexible decision making that can be adjusted as results of management actions are monitored and better understood (Prato 2008). We need adaptive management because the outcomes of most management actions are shrouded in uncertainty and unpredictability due to environmental variability or incomplete knowledge of system dynamics. The action alternatives in the Vehicle Management Plan and Environmental Impact Statement require that an adaptive management strategy be implemented and monitoring studies conducted. The strategy outlined here is designed to detect changes to important resource conditions that may be caused by changing the transportation system on the Park Road and to provide park managers with a method to adaptively manage traffic to address any effects. The value of an adaptive management strategy to assess resource impacts on the Park Road is that the expected performance of the managed system may be greatly improved by reducing uncertainty about possible effects on resources. The prospect of substantially improving decision making justifies the cost of monitoring and assessment.

Since 2006, Denali National Park and Preserve has been conducting a series of scientific studies to better understand the relationships between traffic patterns on the Park Road and the physical, biological and social environment. Collectively called the Road Capacity Study, the purpose has been to provide scientific support for Park Road traffic levels that would not impede wildlife populations along the Park Road corridor (Phillips et al. 2010) and would maintain visitor satisfaction (Manning and Hallo 2010). These studies have lead to the development of a four tiered approach to the adaptive management strategy. The first tier includes a set of indicators with quantitative standards associated with them designed primarily to regulate the numbers of vehicles on the Park Road in such a way that natural resources are protected and the visitor experience is preserved. The other tiers, described in more detail below, are designed to

ensure that the chosen indicators and standards are protecting natural resources and preserving the visitor experience. If results from tiers two, three or four suggest that there are changing conditions for natural resources or the visitor experience attributable to the amount of vehicles on the Park Road, adaptive management actions may include a range of options from adjusting traffic schedules and vehicle numbers to a return to the previous traffic system. If monitoring detects impacts to the high priority indicators of fundamental park resources, managers may respond with either adjustments to the schedule or a decrease in traffic levels.

An additional part of the Road Capacity Study involved equipping all concessioner buses and many other vehicles traveling the Park Road with GPS units to collect detailed information on their movement. From these data, a micro-simulation model was developed that would enable the park to test how different schedules may meet the standards set for the indicators (Morris et al. 2010). Any proposed traffic volume or schedule would be first tested in this model and adjusted such that, based on simulations, it appears to meet the standards. Upon implementation of a new traffic volume and schedule, monitoring would be conducted as described below to ensure that the standards are being met. An adaptive management approach would be taken with the initiation of any of the action alternatives involving comprehensive monitoring programs for both resource condition and visitor satisfaction to ensure no degradation in these areas (Fig. 1).

Given the inherent uncertainty in this system, implementation of either action alternative would be done in phases, building up to the full increase in traffic volume suggested possible by the simulation model. Of the full increase over current levels considered possible, only a portion of that difference in traffic volumes would be realized at any one time, and the impacts monitored and analyzed before additional increases are attempted. Each phase will last at least 2 years to fully understand the impacts of increased traffic to natural resources and visitor experience.

A number of social and wildlife parameters will be monitored as part of this strategy. Because natural resource systems operate at multiple temporal and spatial scales and involve interactions among many component systems, the strategies for monitoring and management response actions for indicators will vary. As mentioned above, there are currently four tiers of resource and visitor experience parameters that will be evaluated as part of this process (Table 1). Figure 1 depicts how these parameters fit into the proposed adaptive management strategy for traffic patterns and volume on the Park Road.

Overview of four tiers of resource and visitor experience parameters

Tier 1

The first tier includes indicators with specified standards which are associated with traffic levels and traffic patterns on the Park Road. These indicators and their associated standards will initially limit traffic volumes on the Park Road, though further limitations may result from the higher-tiered parameters. Monitoring tools will allow resource managers to summarize and assess these indicators frequently (multiple times a season) to adjust traffic levels or schedules in a timely fashion, primarily between seasons but with some ability to respond within a season. Predictive modeling will allow for more informed analysis of potential impacts to these indicators prior to implementation of any transportation changes, so the uncertainty associated with these indicators is relatively low. These indicators include crowding standards for the number of vehicles at wildlife stops, in a viewscape, and at a rest area; the spacing of vehicles to ensure time for sheep crossings, restrictions to night-time traffic volumes, and restrictions to large (80,000 GVWR or greater) vehicle traffic. A seventh indicator, amount of time hikers wait along the road for pick-up by a bus, will not impact vehicle numbers specifically but will define the allocation between tour and transit buses.

Tier 2

Second tier parameters assess natural resource/wilderness conditions, and visitor satisfaction that will be monitored long term specifically to address the impacts of traffic on important resources and visitor experience. These are monitoring programs that are not part of the NPS Inventory and Monitoring program but rather are conducted specifically for wildlife along the road corridor and for monitoring visitor satisfaction. Monitoring would occur at intervals appropriate to the scale of the information collected (generally every 1 – 5 years). Data collected may need to be synthesized with additional information (i.e. tier 3 and 4 parameters) to make conclusions about the source of impacts. Tier 2 parameters include the distribution and number of wildlife sightings of large mammals along the road and visitor satisfaction with factors such as vehicle crowding levels and wildlife sightings.

Tier 3

Third tier parameters will be evaluated using an experimental design. A Before-After, Control-Impact (BACI) study design will be employed which is based on the principle that if two locations (control and impact) are monitored before and after a human-

caused disturbance (in this case an experimental change in the transportation system) the impact location may show a different pattern after the disturbance than the control site (Underwood 1994, Smith 2002). BACI studies measure the change in the differences among sites between the two time periods (before and after impact) rather than only measuring the overall magnitude of difference between the sites, thereby controlling for differences unrelated to the impact of interest. Consequently, park managers can attribute resource impacts to the management action if after the action, the magnitude of these difference values changes significantly from the observations before the action. Indicators evaluated using this experimental design will be assessed using discrete studies that will be implemented before and after any change in the transportation system and each will be of limited time duration. These parameters will not be subject to long term monitoring. Indicators include movement rates of grizzly bears and Dall sheep when crossing the Park Road, the distribution of bear inactive periods relative to the road, and the probability and timing of sheep crossings.

Tier 4

Fourth tier parameters are those resources already being monitored by long-term inventory and monitoring programs that may help evaluate trends observed in tier 1-3 indicators and parameters. By following trends seen in wildlife populations monitored throughout the park, managers should be able to better tease apart traffic impacts from other possible factors affecting populations. Parameters include long-term monitoring of wolves, caribou, moose and Dall sheep population numbers and distribution, wildlife-visitor incident records and distribution and number of breeding birds.

Additional studies may be implemented to address the potential confounding effects of climate change. It may be necessary to conduct research or other information gathering to be able to separate the impacts of climate change or other large-scale directional changes from those associated with the transportation plan.

Table 1. Indicators and other metrics being considered to limit vehicles on the Denali Park Road and to monitor natural resource condition following the implementation of the Vehicle Management Plan. A Before-After-Control-Impact study is planned whereby data collected before implementation will be compared to data collected after implementation to ensure that there are no significant changes. Some data would be collected every year (annual frequency) while other data would be collected less frequently. Data are divided into Tiers that describe their source, frequency of collection and how they are used in evaluating the natural resource condition.

TIER 1: indicators with specific mechanistic links and standards associated with traffic levels and scheduling on the Park Road

Indicator	Description
Sheep gap spacing	Provide gaps in traffic (periods of no traffic) to occur each hour for a minimum duration of time at critical sheep migration corridors.
Night-time traffic	Manage the amount of traffic allowed to travel the road at night to minimize impacts on day-time wildlife sightings.
Large vehicle traffic	Manage the amount of large vehicles (80,000 GVWR or greater) throughout the day to minimize impacts on wildlife sightings
Number of vehicles at a wildlife stop	Manage the number of vehicles at wildlife stops primarily through traffic volume and scheduling, incorporate driver behavior secondarily.
Number of vehicles in a Viewscape	Manage the number of vehicles visible in iconic viewscapes through traffic volume and scheduling.
Number of vehicles at rest stops	Manage the number of vehicles at rest stops based on the design standards and capacity of the individual facilities.
Hiker wait time	Maintain a minimum wait time for hikers along the road to be picked up by a bus by providing adequate transit service.

TIER 2: natural resource and wilderness conditions that will be monitored long term specifically to address the impacts of traffic on important resources

Metric	Description of data collection
% chance of seeing a grizzly bear on road trip	Data collected by bus drivers using SLCD panels from 2007 – current. Written observation data collected by bus drivers from 1996-2007. From 2010 to current, focused effort by park staff to ride buses and collect wildlife observation data.
% chance of seeing "big 5" on road trip	Data collected by bus drivers using SLCD panels from 2007 – current. Written observation data collected by bus drivers from 1996-2007. From 2010 to current, focused effort by park staff to ride buses and collect wildlife observation data.
Distribution of wildlife sightings (spatially and temporally)	Data collected by bus drivers using SLCD panels from 2007 – current. Written observation data collected by bus drivers from 1996-2007. From 2010 to current, focused effort by park staff to ride buses and collect wildlife observation data.
Visitor Satisfaction	The VSP tool would be used to ensure continued high levels of satisfaction. It would be implemented along with the post-impact BACI study and would continue to be conducted every 2-4 years.

TIER 3: parameters that will be evaluated using a Before-After, Control-Impact (BACI) experimental design.

Metric	'Before' Data	Proposed 'After' Data
Timing and location of Dall sheep and grizzly bear crossings (remote)	GPS collaring studies conducted in 2006 (grizzly bears) and 2007 (Dall sheep). Draft reports are available.	GPS collaring studies will be repeated once the Vehicle Management Plan and new Concession Contract/s are initiated

Timing and location of Dall sheep and grizzly bear crossings (by observation)	Road study staff observations and, from 2010 to current, focused effort by park staff to ride buses and collect wildlife observation data.	Road study staff observations and, from 2010 to current, focused effort by park staff to ride buses and collect wildlife observation data.
Movement rate of bears and sheep when crossing or "near" Park Road	GPS collaring studies conducted in 2006 (grizzly bears) and 2007 (Dall sheep). Draft reports are available.	GPS collaring studies will be repeated once the Vehicle Management Plan and new Concession Contract/s are initiated
Distribution of bear inactive periods relative to road	GPS collaring studies conducted in 2006 (grizzly bears) and 2007 (Dall sheep). Draft reports are available.	GPS collaring studies will be repeated once the Vehicle Management Plan and new Concession Contract/s are initiated
Probability and timing of sheep crossings	GPS collaring studies conducted in 2006 (grizzly bears) and 2007 (Dall sheep). Draft reports are available.	GPS collaring studies will be repeated once the Vehicle Management Plan and new Concession Contract/s are initiated
Distribution of bears and sheep	GPS collaring studies conducted in 2006 (grizzly bears) and 2007 (Dall sheep). Draft reports are available.	GPS collaring studies will be repeated once the Vehicle Management Plan and new Concession Contract/s are initiated

TIER 4: data collection for resources already being monitored by long-term inventory and monitoring programs

Metric	**Description of data collection**
Monitoring for population size and demographic parameters for:	
Dall sheep	Prior to 2008, sheep censuses in Denali were irregular and composed primarily of ground surveys obtaining information on age and sex composition as well as population size. These data collection

	efforts were supplemented with infrequent aerial surveys. Since 2008, the Central Alaska Network has been developing and implementing standardized methods for aerial sheep surveys that will rotate among Denali, Wrangell - St. Elias National Park and Preserve and Yukon – Charley Rivers National Preserve (NPS 2009).
Wolves	At least one wolf in each pack of wolves within Denali National Park and Preserve is kept either radio- or GPS/ARGOS collared and the pack's locations and sizes are monitored multiple times throughout the year. Annual population counts are estimated through these data to monitor the population (Meier 2009). In 2011, additional collars were placed on wolves within each pack to provide more detailed information on survival and movements for different age classes. This collaring may be continued.
Caribou	Denali Caribou Herd censuses occur annually for population size, calf production, calf recruitment, adult female survival, herd composition and herd location and distribution. Since 1986, approximately 50 adult female caribou within the herd have carried radio collars to assist in the collection of these data (Adams and Roffler 2009). Since 2007, approximately 50 adult male caribou from the Denali herd have been radio-collared and located periodically throughout the year. In addition, the implementation of 20 GPS collars on Denali caribou from 2010 – 2013 will provide more fine-scale data on caribou distribution and movements.
Moose	Aerial population census surveys for moose are conducted in Denali approximately every 3 years. The most recent survey, conducted in 2008, suggested a population size of 1279 moose in the survey area on the north side of the range (Owen and Meier 2009). Because moose surveys depend on snow cover and are conducted in early winter, they do not provide information on moose distribution during the season when the Park Road is open.

Figure 1. Flow chart depicting the adaptive management strategy proposed by Denali to manage traffic patterns and volumes along the Park Road. A set of five indicators and standards will initially limit traffic along the Park Road (purple boxes). No degradation of natural resource condition (blue and peach boxes) or visitor experience (yellow boxes) would be ensured through proposed monitoring strategies and these may further limit the number of vehicles on the Park Road.

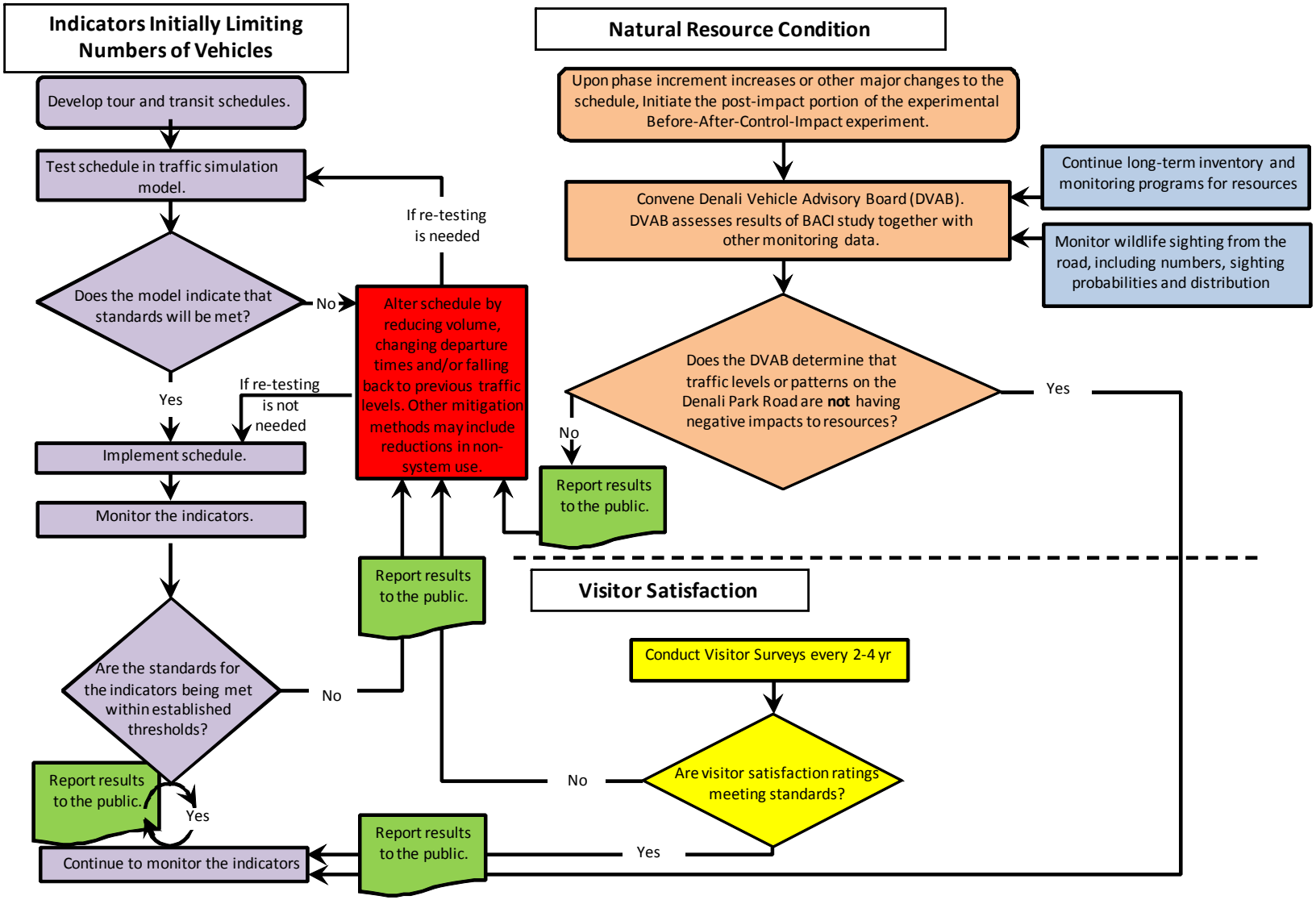


Table 2. Summary of proposed standards for the seven Tier 1 indicators of the Vehicle Management Plan and Environmental Impact Statement. Wildlife viewing subzone 1 extends from the Savage River Check Station to the Teklanika Bridge. In Alternative B, wildlife viewing subzone 2 extends from the Teklanika Bridge to the Old Park Boundary north of Wonder Lake. In Alternative C, wildlife viewing subzone 2 extends from the Teklanika Bridge to the Eielson Visitor Center and from the Wonder Lake Campground 'Y' to the Old Park Boundary north of Wonder Lake. Wildlife viewing subzone 3 is only proposed in alternative C and would extend from the Eielson Visitor Center to the Wonder Lake Campground 'Y'. Bus operating hours are from approximately 6 am to 10 pm. Many of the standards (number of vehicles at wildlife stops and in viewscapes, sheep gaps and hiker wait time) incorporate a 5 year average to allow for aberrant years. Monitoring results will be reported to the public annually, however, for these standards, the park would only be considered out of compliance with the standard if it was below the minimum value reported for each standard, or if a 5 year average was below the desired (higher percentage) condition. For example, for the number of vehicles at a wildlife stop in wildlife viewing subzone 1, the park would be considered out of compliance with the standards if one year had fewer than 70% of stops with 3 or fewer vehicles, or if a 5 year average was less than 75% of stops with 3 or fewer vehicles.

	Standards		
Indicator	Wildlife Viewing Subzone 1	Wildlife Viewing Subzone 2	Wildlife Viewing Subzone 3
Number of vehicles at a wildlife stop	At least 75% of wildlife stops will have 3 or fewer vehicles, averaged over 5 years. No one year will have less than 70% of wildlife stops with 3 or fewer vehicles.	At least 75% of wildlife stops will have 2 or fewer vehicles, averaged over 5 years. No one year will have less than 70% of wildlife stops with 2 or fewer vehicles.	At least 75% of wildlife stops will have 1 or fewer vehicles, averaged over 5 years. No one year will have less than 70% of wildlife stops with 1 or fewer vehicles.
	At least 90% of wildlife stops will have 4 or fewer vehicles, averaged over 5 years. No one year will have less than 85% of wildlife stops with 4 or fewer vehicles.	At least 90% of wildlife stops will have 3 or fewer vehicles, averaged over 5 years. No one year will have less than 85% of wildlife stops with 3 or fewer vehicles.	At least 90% of wildlife stops will have 2 or fewer vehicles, averaged over 5 years. No one year will have less than 85% of wildlife stops with 2 or fewer vehicles.
	At least 95% of wildlife stops will	At least 95% of wildlife stops will have	At least 95% of wildlife stops will

	have 5 or fewer vehicles, averaged over 5 years. No one year will have less than 90% of wildlife stops with 5 or fewer vehicles.	4 or fewer vehicles, averaged over 5 years. No one year will have less than 90% of wildlife stops with 4 or fewer vehicles.	have 3 or fewer vehicles, averaged over 5 years. No one year will have less than 90% of wildlife stops with 3 or fewer vehicles.
Number of vehicles in a viewscape	At least 85% of the time during bus operating hours, there will be 3 or fewer vehicles visible in the Mile 26 viewscape, averaged over 5 years. No one year will have less than 80% of the time during bus operating hours having 3 or fewer vehicles visible in the Mile 26 viewscape.	At least 85% of the time during bus operating hours, there will be 2 or fewer vehicles visible in the Miles 55 and 62 viewscapes, averaged over 5 years. No one year will have less than 80% of the time during bus operating hours having 2 or fewer vehicles visible in the Miles 55 and 62 viewscapes.	At least 85% of the time during bus operating hours, there will be 1 or fewer vehicles visible in the Mile 68 viewscape, averaged over 5 years. No one year will have less than 80% of the time during bus operating hours having 1 or fewer vehicles visible in the Mile 68 viewscape.
	At least 95% of the time during bus operating hours, there will be 4 or fewer vehicles visible in the Mile 26 viewscape, averaged over 5 years. No one year will have less than 90% of the time during bus operating hours having 4 or fewer vehicles visible in the Mile 26 viewscape.	At least 95% of the time during bus operating hours, there will be 3 or fewer vehicles visible in the Miles 55 and 62 viewscapes, averaged over 5 years. No one year will have less than 90% of the time during bus operating hours having 3 or fewer vehicles visible in the Miles 55 and 62 viewscapes.	At least 95% of the time during bus operating hours, there will be 2 or fewer vehicles visible in the Mile 68 viewscape, averaged over 5 years. No one year will have less than 90% of the time during bus operating hours having 2 or fewer vehicles visible in the Mile 68 viewscape.
Number of vehicles parked at one time at:			
Teklanika rest stop	No more than 12 buses at one time with a total of no more than 16 vehicles		

Toklat rest stop		No more than 11 buses at one time with a total of no more than 16 vehicles	
Eielson Visitor Center		No more than 10 buses at one time with a total of no more than 19 vehicles	
Sheep Gap Spacing	Milepoint 21.6 will have at least a 10 minute gap in traffic every hour with a 95% success rate (23 of 24 hours with gaps) averaged over 5 years. No one year will have less than a 90% success rate (22 of 24 hours).	Milepoints 37.6, 52.8 and 60.6 will have at least a 10 minute gap in traffic every hour with a 95% success rate (23 of 24 hours with gaps) averaged over 5 years. No one year will have less than a 90% success rate (22 of 24 hours).	Milepoint 68.5 will have at least a 10 minute gap in traffic every hour with a 95% success rate (23 of 24 hours with gaps) averaged over 5 years. No one year will have less than a 90% success rate (22 of 24 hours).
Night-time traffic	There will be an average 3 vehicles or fewer per hour (total westbound and eastbound) passing any of the traffic counters west of Savage between 10 pm and 6 am, with never more than 6 vehicles in any one hour.		
Large vehicle traffic	There will never be more than 4 vehicles (total westbound and eastbound) larger than 80,000 lbs gross vehicle weight rating (GVWR) in any one hour passing any of the traffic counters west of Savage. This limit will undergo further analysis to ensure it does not impact wildlife sightings the following morning and will be lowered if an impact is detected.		
Hiker Wait Time	At least 75% of hikers will have wait times of less than 30 minutes for pick-up by a bus, averaged over 5 years. No one year will have less than 70% of hikers with wait times of less than 30 minutes.		

	At least 95% of hikers will have wait times of less than 60 minutes for pick-up by a bus, averaged over 5 years. No one year will have less than 93% of hikers with wait times of less than 60 minutes.
	At least 99% of hikers will have wait times of less than 90 minutes for pick-up by a bus, averaged over 5 years. No one year will have less than 98% of hikers with wait times of less than 90 minutes.

Tier 1: Indicators Limiting the Number of Vehicles on the Park Road

Of the seven tier 1 indicators identified, six of them would ultimately limit the volume of traffic past the Savage Check Station on the Denali Park Road. Three of them are designed to protect wildlife by controlling sheep gap spacing, night-time traffic and large vehicle traffic volumes. The other three would protect the visitor experience by limiting the numbers of vehicles at wildlife stops, in viewscapes and at rest stops. The seventh indicator (hiker wait time) is designed to ensure a viable transit system and would not ultimately influence the number of vehicles allowed on the road but would influence the allocation of those vehicles between tour and transit services. The standards for these indicators are summarized in Table 2.

Numbers of Vehicles at Wildlife Stops, in Viewscapes and at Rest Stops

As part of the Road Capacity Study, researchers from the University of Vermont conducted qualitative visitor surveys in 2006 to identify factors that are important to visitor satisfaction and that would make for readily measurable indicators. While a number of indicators were identified that were important to the visitor experience, three that related specifically to vehicle crowding on the road were considered. The selected factors were the number of vehicles at wildlife stops, in iconic viewscapes and at rest stops. Quantitative surveys were then conducted in 2007 resulting in the development of social norm curves (Manning 2007, Manning and Hallo 2009, in press) to help the park understand how current crowding levels related to visitor perceptions. For these surveys, visitor reactions were discerned to increasing numbers of vehicles. Visitors were shown a series of photos of the same scene with increasing numbers of buses and asked to score each photo from 4 (very acceptable) to -4 (very unacceptable). Social normative curves were fit to the results to identify visitor reactions to different crowding levels and provide guidance to park management in setting standards. For the numbers of vehicles parked at one time at the Teklanika and Toklat rest stop and at the Eielson Visitor Center park management has decided to use the design standards of those facilities to determine the number of vehicles parked at one time.

Standards

The over-arching goal for setting these standards is to maintain or improve the current condition, or to maintain numbers of vehicles at these locations similar to or less than what they are currently. Several sources of data were considered in developing these standards, including results of visitor surveys (Manning and Hallo 2010), staff observations of the Park Road (Phillips and Borg 2011), and results of the traffic model.

Results of the social normative curves developed by Manning and Hallo (2010) indicate visitor acceptance of different crowding levels (Table 3). From 2007-2010 the Denali Park Road Capacity Study collected information on numbers of vehicles at wildlife stops, in viewscapes and at rest stops/visitor center. In addition, the Minnesota Traffic Observatory was requested to assess the conditions for the day on which their model is based (July 25, 2007) using a combination of actual GPS location data for the buses and the traffic model.

Table 3. Results from the 2007 quantitative visitor surveys (Manning and Hallo 2010). Denali management considered three levels of visitor-perceived crowding to be the range of values to consider for standards. 'Preference' is the level of vehicle crowding visitors reported being what they would prefer to see; 'typically seen' is the level visitors reported as being most representative of what they saw on their trip out the road (based on staged photographs they were shown); and 'acceptable' is the 50th percentile of the distribution of the curves, whereby 50% of people found that level of crowding acceptable and 50% found it unacceptable. The scenic rest stop area for this study was Polychrome, which is no longer in existence as a rest stop.

	Norm Standard Levels (number of buses)		
Crowding Indicator	Preference	'Typically Seen'	Acceptable
Scenic Rest Stop Area	2.24	3.57	5.48
Iconic Road	2.43	3.80	5.95
Alternate Road	2.17	3.51	5.68
Wildlife Encounter	1.75	3.06	4.85

Number of vehicles stopped at the same location to view wildlife

The current average number of vehicles stopped at wildlife sightings has ranged from 1.58 to 1.69 over the last 4 years based on staff observations (Table 4). These values

represent only stops to observe wildlife with at least one vehicle present (i.e. when road study staff observe wildlife with no other vehicles present, these occurrences are not included). In these observations, typically at least 50% of the wildlife stops have only one vehicle present. 75% of the wildlife stops have one or two vehicles present. The maximum value reported in staff observations is 7 and this value occurs approximately 1 % of the time (Table 4). In their assessment of current condition, the Minnesota Traffic Observatory estimates the average number of vehicles at wildlife stops to be 0.70. Their estimated maximum is 8 vehicles, occurring much less than 1 % of the time (Table 4).

When these results are place in context with the visitor survey results, the park is generally achieving 'preference' more than 75% of the time, achieving the perceived 'typically seen' more that 90% of the time and 'acceptable' more that 95% of the time (Table 5). With a desire to preserve this distribution, whereby most stops will have 2 or fewer vehicles but some stops will have 3 or more, the park is proposing the gradient of standards as presented in Table 2 (see pages 9 – 11) and achieve these values over a 5 year time period to allow for aberrant years. Monitoring results will be reported to the public annually, however, the park would only be considered out of compliance with the standard if the results are below the minimum value reported for each standard, or if a 5 year average was below the desired (higher percentage) condition (Table 2).

Table 4. Mean and maximum numbers of vehicles at wildlife stops based on the exponential distribution of the data estimated by the Minnesota Traffic Observatory (MTO) and observed Denali National Park and Preserve (DNPP) staff.

	Mean	Maximum	Sample Size
2007 - MTO	0.70	8	30 simulations
2007 – DNPP Staff	1.58	6	65
2008 – DNPP Staff	1.69	6	91
2009 – DNPP Staff	1.64	7	68
2010 – DNPP Staff	1.59	7	333

Table 5. Proportion of wildlife viewing stops that have equal to or fewer vehicles. For example, for the combined data, 89% of observed wildlife stops had 3 or fewer vehicles present. Data in the columns labels 2007 – 2010 are from wildlife stops observed by the Road Capacity Study. Column labeled 'Combined' are an average of the 4 yr of Road Capacity Study data. Column labeled 'Model/GPS' are results of the traffic model for the current condition. Gray lines highlight where the results of the Manning and Hallo (2010) study are in reference to the data collected by the Road Capacity Study or generated by the traffic model, with the assumption that the 'observing bus' was not counted in the visitor surveys (i.e. one bus has been added to the Manning and Hallo (2010) results for comparison purposes).

	# of Vehicles	2007	2008	2009	2010	Combined	Model/GPS
	1	0.52	0.47	0.50	0.54	0.52	0.79
	2	0.77	0.76	0.75	0.77	0.77	0.96
Preference	2.75 including observing bus						
	3	0.92	0.88	0.91	0.88	0.89	0.99
	4	0.97	0.90	0.93	0.95	0.94	1.00
'Typically seen'	4.06 including observing bus						
	5	0.98	0.97	0.96	0.98	0.97	1.00
Acceptable	5.85 including observing bus						
	6	1.00	1.00	0.99	0.99	0.99	1.00
	7			1.00	1.00	1.00	1.00
	8						1.00

Number of vehicles visible at one time in scenic viewscapes

There was good agreement with the Minnesota Traffic Observatory (MTO) results and staff observations for each of the viewscapes (Tables 6, 7 and 8). Both staff observations

and MTO results were recorded the same way: every 2 minutes the number of vehicles in the viewscape, from specified start and end points were recorded, hence zeros are frequent. However, as zeros occur with high frequency during off-peak times (overnight), their inclusion can bias the average low, so the decision has been made to use data only when there is a vehicle present (Tables 6, 7 and 8). Again, similar to how the standards for wildlife stops were developed, the park is recommending different levels of crowding to protect the predominance of very low levels of crowding currently observed (Table 2, see pages 9-11) and achieve these values over a 5 year time period to allow for aberrant years. Monitoring results will be reported to the public annually, however, the park would only be considered out of compliance with the standard if the results are below the minimum value reported for each standard, or if a 5 year average was below the desired (higher percentage) condition (Table 2).

Table 6. Proportion of observed time that equal to or fewer vehicles are observed in the Mile 26 viewscape. For example, when there is a vehicle present (excluding 'zero' observations) 97% of the time there are 3 or fewer vehicles in the viewscape. Data are from staff observation for the Road Capacity Study. Gray lines highlight where the results of the Manning and Hallo (2010) study are in reference to the data collected by the Road Capacity Study or generated by the traffic model, with the assumption that the 'observing bus' was not counted in the visitor surveys (i.e. one bus has been added to the Manning and Hallo (2010) results for comparison purposes). The Mile 26 viewscape was not part of the Manning and Hallo (2010) study; however the visitor preference values for the 'alternative road' viewscape were applied here.

	Excluding 'zero' observations	
	Vehicles	STAFF OBS
	1	0.53
	2	0.87
	3	0.97
Preference	3.17 including observing vehicle	
	4	0.99
'Typically seen'	4.51 including observing vehicle	

	5	1.00
	6	1.00
Acceptable	6.68 including observing vehicle	

Table 7. Proportion of observed time that equal to or fewer vehicles are observed in the Mile 55 viewscape. For example, when there is a vehicle present (excluding 'zero' observations) 92% of the time there are 3 or fewer vehicles in the viewscape. Data are from staff observation for the Road Capacity Study. Gray lines highlight where the results of the Manning and Hallo (2010) study are in reference to the data collected by the Road Capacity Study or generated by the traffic model, with the assumption that the 'observing bus' was not counted in the visitor surveys (i.e. one bus has been added to the Manning and Hallo (2010) results for comparison purposes).

	Excluding 'zero' observations	
	Vehicles	STAFF OBS
	1	0.57
	2	0.80
	3	0.92
Preference	3.17 including observing vehicle	
	4	0.97
'Typically seen'	4.51 including observing vehicle	
	5	0.99
	6	1.00
Acceptable	6.68 including observing vehicle	

Table 8. Proportion of observed time that equal to or fewer vehicles are observed in the Mile 62 viewscape. For example, when there is a vehicle present (excluding 'zero' observations) 93% of the time there are 3 or fewer vehicles in the viewscape. Data are from staff observation for the Road Capacity Study. Gray lines highlight where the results of the Manning and Hallo (2010) study are in reference to the data collected by the Road Capacity Study or generated by the traffic model, with the assumption that the 'observing bus' was not counted in the visitor surveys (i.e. one bus has been added to the Manning and Hallo (2010) results for comparison purposes).

	Excluding 'zero' observations	
	Vehicles	STAFF OBS
	1	0.50
	2	0.84
	3	0.93
Preference	3.43 including observing vehicle	
	4	0.96
'Typically seen'	4.80 including observing vehicle	
	5	1.00
	6	1.00
Acceptable	6.95 including observing vehicle	

Number of vehicles parked at any one time at rest stops and at the Eielson Visitor Center

For the Teklanika and Toklat rest stops and the Eielson Visitor Center, park management recommends using the design standards for the parking lots for each of those facilities as the standards for numbers of vehicles parked at any one time (Table 2, see pages 9-11).

Monitoring strategy - Alternative A (no action)

- Vehicles at wildlife stops, in viewscapes and at rest stops. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. It would be anticipated that the current condition would be maintained and no monitoring for numbers of vehicles at wildlife stops, in viewscapes, or at rest stops and the Eielson Visitor Center would be conducted.

Monitoring strategy - Action Alternatives B & C

- Number of vehicles stopped at the same site to view wildlife. This indicator would be monitored both remotely and directly. For remote monitoring, all buses (concessioner and inholder) and NPS vehicles would be equipped with GPS units that will store and transmit data for each trip. In addition, other Park Road users would be issued GPS units on a voluntary basis. These data would be analyzed at the end of the season to ensure numbers of vehicles at any given wildlife stop do not exceed the standard. For direct monitoring, staff would periodically monitor wildlife stops using set protocols from both government vehicles and concessioner buses to ensure the standard and is not exceeded and/or the success rate is being met. Both the direct and indirect data would be used to determine if the standard is being exceeded. If the standard is not being met, mitigation steps would include changes to the schedule, removal of buses from the schedule, or stepping the system back to the level it was last operating at without exceeding the standards. These changes would occur between seasons.

- Number of vehicles visible at one time in scenic viewscapes. The units of the standard would be the number of vehicles visible in a designated length of the Park Road at any given time. Four viewscapes have been identified where the viewscape contains one or more miles of the Park Road. The exact length of road visible for each viewscape varies. These viewscapes occur at approximately Miles 26, 55, 62 and 68. These values would be averaged over days, weeks, months and or the season.

  This indicator would be monitored both remotely and directly. For remote monitoring, all buses (concessioner and inholder) and NPS vehicles would be equipped with GPS units that would store and transmit data for each trip. In addition, other Park Road users would be issued GPS units. For professional photographers and commercial filming crews, these units would be required as a condition of their permit. These data would be analyzed at the end of the season

to ensure numbers of vehicles visible in scenic viewscapes do not exceed the standard. For direct monitoring, staff would periodically monitor viewscapes using established protocols to ensure the standard is not exceeded. Both the direct and indirect data would be used to determine if the standard is being exceeded. If the standard is not being met, mitigation steps would include changes to the schedule, removal of buses from the schedule, or stepping the system back to the level it was last operating at without exceeding the standards. These changes would occur between seasons.

- Number of vehicles parked at any one time at rest stops and at the Eielson Visitor Center. The units of the standard would be the number of vehicles parked at a rest stop or the Eielson Visitor Center at any given time. The rest stops are Teklanika and Toklat. The standards set will vary between the three sites as each has different design capacities for their facilities. As with wildlife stops, to allow for unexpected events, it is possible the park will set a desired success rate that would allow the standard to be exceeded a small number of times before management action is taken.

  This indicator would be monitored both remotely and directly. For remote monitoring, all buses (concessioner and inholder) and NPS vehicles would be equipped with GPS units that would store and transmit data for each trip. In addition, other Park Road users would be issued GPS units on a voluntary basis. These data would be analyzed at the end of the season to ensure numbers of vehicles parked at rest stops or at the Eielson Visitor Center at any one time do not exceed the standard. For direct monitoring, staff would monitor parking areas at the rest stops and the Eielson Visitor Center using both government vehicles and by riding concessioner buses to ensure the standard is not exceeded. Both the direct and indirect data would be used to determine if the standard is being exceeded. If the standard is not being met, mitigation steps would include changes to the schedule, removal of buses from the schedule, or stepping the system back to the level it was last operating at without exceeding the standards. These changes would occur between seasons.

Sheep Gap Spacing

Results of the Road Capacity Study (Phillips et al. 2010) combined with earlier studies (Tracy 1977, Singer and Beattie 1986, Burson et al. 2000) suggest that while there is no strong evidence of mechanistic relationships between traffic volumes or patterns and

wildlife distribution or movements that would lead to clear indicators and standards, there are hints of negative relationships that warrant caution before implementing changes to the current traffic levels. The clearest negative impacts detected were in the ability of Dall sheep to move across the Park Road and reductions in sightings of large mammals along the road corridor following periods of high night-time traffic levels (Phillips and Borg 2011).

In 2007, 20 Dall sheep were outfitted with GPS collars and 18 of those provided location data throughout that season (mid-May to mid-September). Results of that study demonstrated that sheep move farther away from the road at higher traffic volumes, suggesting that increases in traffic volume may impede them further. If the sheep maintain farther distances from the road, this could reduce the amount of habitat available for foraging, which is most relevant during the spring when sheep frequently cross the road and vegetation has not yet emerged at higher elevations (Putera and Keay 1998, Dalle-Molle and Van Horn 1991, Phillips et al. 2010). As a result the park is proposing an indicator which would require that a gap in traffic occur each hour for a minimum length of time. There are critical locations along the road corridor that are known crossing points and these would be monitored to ensure that the gap is occurring. Any proposed schedule will first be run through the traffic simulation model to test if it is likely to provide the desired gaps in traffic.

Standard

The results of the 2007 study corroborated what has been shown in other studies: that Dall sheep are inhibited from crossing the road at high traffic levels. Putera and Keay (1998) observed that in periods of no traffic, Dall sheep readily crossed the Park Road. Times to cross the road were 2, 3 and 13 minutes, with an average of 6 minutes (Putera and Keay 1998, their Table 8). Based on these observations, the standard for this indicator is a 10 minute gap in traffic at key sheep crossing locations (Miles 21.6, 37.6, 52.8, 60.6, 68.5) with a 95% success rate for each crossing location, in other words, each location will have the gap at least 23 out of every 24 hours, averaged over 5 years to allow for aberrant years. However, no year will have less than a 90% success rate (22

out of every 24 hours). Monitoring will be ongoing and results will be reported to the public annually, however, in a given year, the park will not be out of compliance with the standard unless the success rate is less than 90%, or a 5 year average is less than a 95% success rate. The 10 minute Dall sheep gap spacing offers the best likelihood of balancing the need to not disrupt the migratory pattern of the less habituated sheep groups with the desire to not unnecessarily restrict traffic and thus displace visitors.

While sheep migrations are seasonal, the intention is to maintain the sheep gaps throughout the season. Maintaining these gaps throughout the system is important for ensuring that standards are not violated in the critical migration crossing while maintaining a smooth traffic flow. There are three reasons for maintaining the gaps throughout the season in decreasing order of importance. 1) Uncertainty as to the exact variation in timing of migration or foraging movements especially in the light of climate changes. 2) There are other species that must cross the road and are affected by traffic and they have experienced historically a traffic level which has allowed at least one 10 minute gap in vehicles an hour. Significant uncertainty exists about the relationship between traffic and these species. 3.) Having a system which varies based on the presence of sheep would require significantly increased complexity to maintain and would probably require continual radio-tracking of sheep, which presents unacceptable risks.

Monitoring strategy - Alternative A (no action)

- Sheep Gap Spacing. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. However, as the Road Capacity Study has highlighted an issue with sheep crossing, it is likely that 10 minute gaps would still be required under this alternative and schedule adjustments would be made to achieve these gaps.

Monitoring strategy - Action Alternatives B & C

- Sheep Gap Spacing. This indicator would be monitored both remotely and directly. For remote monitoring, all buses (concessioner and inholder) and NPS vehicles would be equipped with GPS units that store and transmit data for each trip. In addition, other Park Road users, such as professional photographers and commercial filming crews, Kantishna inholders and their visitors, researchers, etc., would be issued GPS units on a voluntary basis. These data would be analyzed to ensure that the standard for hourly gaps in traffic is being met. For direct monitoring, staff would periodically monitor critical sheep crossing sites during peak traffic times to ensure the standard is not being exceeded. Both the

direct and indirect data would be used to determine if the standard is being exceeded. If the standard is not being met, mitigation steps would include changes to the schedule, removal of buses from the schedule, or stepping the system back to the level it was last operating at without exceeding the standards. These changes would occur between seasons.

Night-time Traffic Levels

Currently, concession buses are on the restricted section of the road from approximately 6 am to 10 pm, with normal night-time traffic levels outside of these hours being very low (0-2 vehicles per hour based on traffic counters). While it is unclear what the exact relationship is between this period of low traffic and wildlife behavior along the road corridor, analyses have shown that unusually high night-time traffic levels have a strong correlation with decreased wildlife sightings the following morning (Phillips and Borg 2011). As a result, Denali will limit the numbers of vehicles driving through wildlife sensitive areas during the night-time hours (10 pm to 6 am) to preserve and protect day-time wildlife sightings.

Standard

There will be an average of three or fewer vehicles per hour (total westbound and eastbound) passing any of the traffic counters west of Savage between 10 pm and 6 am, with never more than six vehicles in any one hour.

Monitoring strategy - Alternative A (no action)

- Night-time traffic levels. Under this alternative, the current level of 10,512 vehicles per season would be maintained and the contractor traffic, which operates principally at night, would continue to not be counted within the 10,512 limit. Also under this alternative, Denali would not establish indicators and standards. However, given that the Road Capacity Study has identified that high night-time traffic volumes result in decreased wildlife sightings, it is likely that mitigation efforts would be taken to limit night-time traffic and influence behavior of large vehicles (i.e. reduce speed and brake noise). Wildlife sightings data would continue to be collected from the buses.

Monitoring strategy - Action Alternatives B & C

- Night-time traffic levels. This indicator would be monitored remotely using traffic counters at several locations along the Park Road. These data would be used to determine if the standard is being exceeded.

Large Vehicle Traffic

One of the uncertainties relating to the relationship between night-time traffic and morning wildlife sightings is the specific impact of large vehicles (larger than a 80,000 gross vehicle weight rating). There is concern that large vehicles will have a similar impact at any time of day due to the nature and behavior of these vehicles in that they produce more noise and dust; and likely move more quickly when passing wildlife than do visitor buses that stop to view the wildlife. Modifications to vehicle speed and behavior may help to mitigate these impacts. Additionally, Denali may limit the numbers of large vehicles driving through wildlife sensitive areas during all hours of the day to reduce impacts to wildlife and preserve wildlife sighting opportunities.

Due to the uncertainties surrounding the current data, additional studies will be carried out in the upcoming years, and adjustments may be made to the standards based on new information (Table 2).

Standard

For vehicles larger than 80,000 lbs gross vehicle weight rating (this does not include concessioner buses), there will never be more than four vehicles in any one hour (total westbound and eastbound) passing any of the traffic counters west of Savage at any time of day. This limit will undergo further analysis to ensure it does not impact wildlife sightings the following morning and will be lowered if an impact is detected.

Monitoring strategy - Alternative A (no action)

- Large vehicle traffic levels. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. However, given that the Road Capacity Study has identified that high night-time traffic volumes, and, potentially, large vehicles in general result in decreased wildlife sightings, it is likely that mitigation efforts would be taken to limit this type of traffic and influence behavior of large vehicles (i.e. reduce speed and brake noise). Wildlife sightings data would continue to be collected from the buses.

Monitoring strategy - Action Alternatives B & C

- Large vehicle traffic levels. This indicator would be monitored remotely using traffic counters at several locations along the Park Road. These data would be used to determine if the standard is being exceeded.

Tier 1: Indicator Monitoring the Effectiveness of the Transit System

Hiker Wait Time

Effectiveness of the transportation system in serving the needs of visitors can be measured by looking at two domains; the ability of visitors entering the park to acquire a seat on a bus and the wait time for hikers reboarding buses to exit the park. Controlling the wait time for hikers requires adequate numbers of buses passing by in a given hour along the full length of the road and for these buses to have room on them to pick up additional passengers. Because of this, wait time for hikers is also an effective indicator for the ability of visitors to acquire a seat into the park.

Hiker wait times that begin to consistently approach or exceed the standard are an indication that there is not adequate transit service and additional buses would be added to the schedule at the times when there is need. Unlike the current General Management Plan and subsequent amendments, this plan will not specify an allocation of concessioner buses between tour and transit (i.e. the current seasonal limits of 2089 tour buses, 3394 transit buses, and 550 annual buses that can be allocated at the Superintendent's discretion). The purpose of not defining this allocation is to maintain flexibility in the system to respond to changing visitor demands. This plan expressly states that transit needs will be prioritized over tours and that transit service will be maintained to a level that meets the standard for hiker wait time. If an increase in transit service is necessary it may be balanced by a decrease in tour services if that is required for compliance with the standards controlling the number of buses on the road.

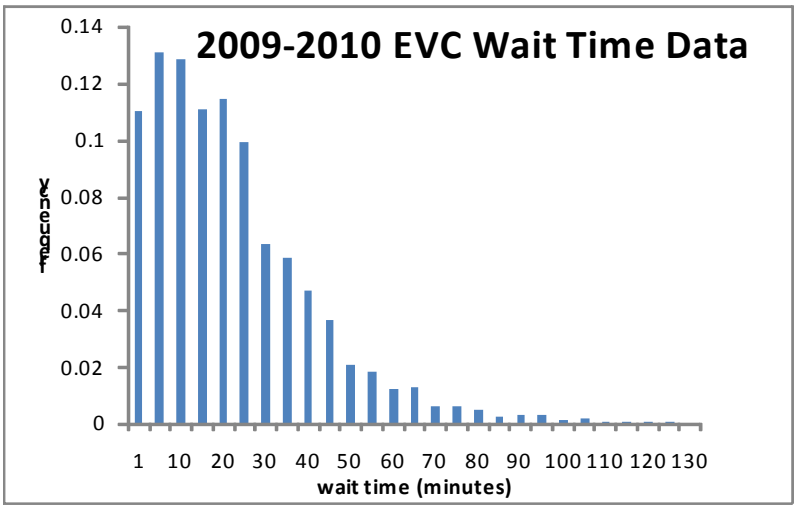
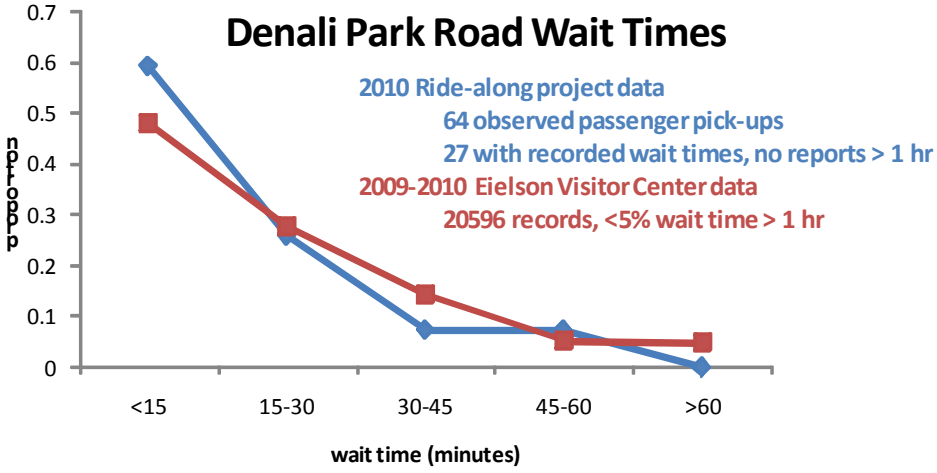


Figure 2. Distributions of wait time for passengers waiting for an east-bound bus at the Eielson Visitor Center. The arithmetic mean of the distribution is 22.5 minutes, the median is 20 minutes.

Figure 3. Comparison of reported wait times from the Eielson Visitor Center data and data collected by NPS staff riding buses.



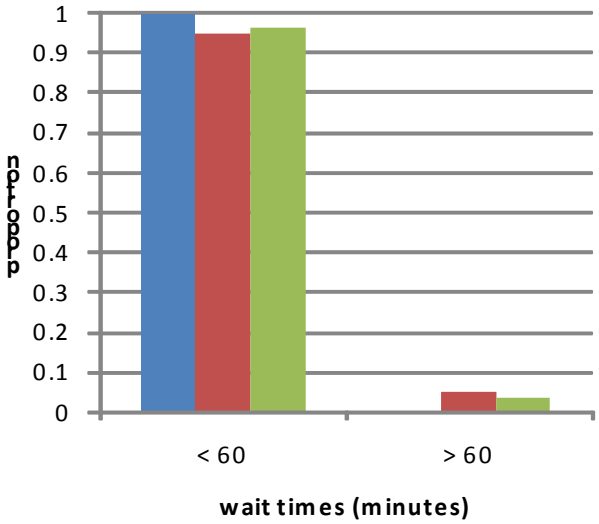


Figure 4. Comparison of reported wait times from the Eielson Visitor Center data (red bar; N = 20596), data collected by NPS staff riding buses (blue bar; N = 27), and data collected by concessioner bus drivers (green bar; N = 5388). Bus driver data is collected only as a yes/no answer to waiting more than one hour.

Standard

Park managers had three sources of data for the current distribution of hiker wait times: data collected by the concessioner at the Eielson Visitor Center (Fig. 2, 3 & 4), data collected by the concessioner bus drivers as they pick up hikers (Fig. 3 & 4); and data collected by NPS staff while riding buses (Fig. 4). As an additional consideration in determining the standard, the current bus transportation contract requires the fleet operator to maintain a one hour or less time period for passengers waiting along the Park Road west of Mile 20. Based on an analysis of the data and the current contract requirement, park management recommends standards as described in Table 2 and achieve these values over a 5 year time period to allow for aberrant years. Monitoring results will be reported to the public annually, however, the park would only be considered out of compliance with the standard if the results are below the minimum value reported for each standard, or if a 5 year average was below the desired (higher percentage) condition (Table 2).

Monitoring strategy - Alternative A (no action)

- Hiker Wait Time. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. The operating plan of the current concession contract requires that the transit system operate in a demand responsive manner to hikers waiting along the Park Road for pickup. The NPS standard is to provide transportation within one hour to all passengers waiting along the Park Road west of Mile 20. The Concessioner is required to monitor wait times on an ongoing basis, providing necessary response as needed. The NPS and the Concessioner continually monitor and respond to delays in wait time. When the NPS standard is not expected to be met, the Concessioner may elect to provide additional buses within the parameters of the allocation system. Furthermore, in response to not meeting the NPS standard, the Concessioner may be required to provide additional bus service within 2 hours of notice.

Monitoring strategy - Action Alternatives B & C

- Hiker Wait Time. Denali would require the operator of the transportation system to monitor wait times on an ongoing basis along the Park Road by having bus drivers record how long hikers waited along the road for pick-up. Compliance with this requirement would be tested by the park with spot checks.

Data collected through this monitoring would be forwarded to the Commercial Services Division on a regular basis and analyzed for compliance with the standard. If hiker wait times are not in compliance with the standard, mitigation would include leaving more empty seats on buses leaving the Wilderness Access center and/or adding buses to the schedule. The latter may conflict with the visitor crowding standards and would only be implemented if it would not cause those indicators to be out of compliance with their standards. Mitigation efforts to ensure compliance with the standards controlling the number of buses on the road would include the use of 'deadheads' or empty buses whose behavior would minimize impacts to the crowding standards. If additional buses on the road would negatively impact compliance with the other standards, allocations would be moved from the tour system to the transit system to ensure hiker wait times. This reallocation can only happen between seasons.

Comprehensive Monitoring Strategies to Ensure Traffic Levels Do Not Negatively Impact Natural Resources or Visitor Experience

Natural Resource Condition

The park is proposing a comprehensive monitoring program combined with a formal Before-After-Control-Impact (BACI) study (Underwood 1994, Smith 2002) to ensure that there would be no increased impacts to wildlife along the Park Road as a result of increased levels of traffic or changes in traffic patterns. The experimental BACI study would involve repeating the satellite telemetry studies of movement and behavior of grizzly bears and Dall sheep to determine if there have been changes attributable to changes in traffic patterns or volume. These data would be combined with the longer-term time series data from the Tiers two and four level parameters (Table 1).

Detecting differences attributable to changes in traffic volumes or patterns will be complex and hence Denali is proposing to convene a Denali Vehicle Advisory Board (DVAB) which will be composed of agency and academic scientists. Following the BACI studies, the DVAB will consider all of the available data to determine if there have been detrimental or potentially detrimental impacts on the park's natural resources as a result of traffic volumes or patterns on the Park Road. Any one metric may show a change after implementation of this plan, but this alone may not be indicative of a problem associated with traffic levels and so the data will be looked at by the DVAB as a

whole. The park will also allow for the flexibility to add or remove metrics to Tiers 2 through 4 parameters (Table 1) based on recommendations by the DVAB.

Monitoring strategy - Alternative A (no action)

- Natural Resource Condition. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. While ongoing monitoring of some of the metrics listed in Table 1 would continue, they would not explicitly be used to detect impacts to resources.

Monitoring strategy - Action Alternatives B & C

- Tier two parameters. Observations of wildlife along the road corridor would be made on a regular basis by both park staff and bus drivers, including information on group size, age and sex composition when possible, and distance from the road. These data will be analyzed to monitor, among other things, wildlife sighting probabilities and distributions along the Park Road (Table 1). These data collection efforts would be ongoing.

- Tier three parameters. Upon a major change in traffic volume or patterns, the BACI study would be initiated. This would first occur with implementation of either of the action alternatives and an increase in traffic that is based on what the simulation model indicates is possible over current levels. Simulations currently suggest that an increase of approximately 10% (see Appendix X) of the current allocation of concession buses is possible while still meeting standards, although further modeling may find a more efficient schedule that would allow higher levels of traffic. Given current visitation rates and projections, it is unlikely that the concessioner would be able to realize a 10% increase by implementation in 2015. However, the park would allow up to this 10% increase in 2015. Following the increase in traffic, satellite telemetry studies of grizzly bears and Dall sheep would be reinitiated. Results of this study and the time-series of Tier two and four data would be analyzed by the DVAB to detect detrimental impacts of the traffic on natural resources along the road corridor. Potential detrimental impacts would include evidence of animals increasingly avoiding the road corridor as detected through wildlife sightings data and habitat use studies. Following analysis of results from this study, the DVAB would make recommendations for any further increases in traffic it considered to be possible. The DVAB may also recommend no further increases in traffic or decreases in traffic if detrimental impacts are detected. The BACI study may again be initiated

following additional increases in traffic, with results assessed by the DVAB. Similarly, if no detrimental impacts are detected, additional increases may follow as proposed by the DVAB, potentially accompanied by BACI studies until full implementation of the traffic levels suggested possible by the traffic model. Alternatively, if detrimental impacts are detected at any point in the BACI study, the traffic system would be stepped back to the previous level at which no impact was detected. It is likely that the BACI study would be repeated to determine if the reduction in traffic was effective at mitigation the impact to resources.

- Tier four parameters. These are parameters currently being monitored by the NPS Inventory and Monitoring program and include population surveys for caribou, moose, Dall sheep and wolves along with the collection of certain demographic and distribution data. These data collection efforts would be ongoing.

Visitor Satisfaction

The Visitors Services Project (VSP) was created to enable parks to detect specific causes of people being satisfied or unsatisfied with their visit to the park. The surveys ask visitors a suite of questions designed to provide managers with scientific information that can then be used to identify issues and improve services. Denali conducted a VSP survey in 2006 and overall 93% of visitors surveyed rated the quality of services, facilities and recreational opportunities as good or very good. It is anticipated that this level of satisfaction will remain the same or increase with the implementation of one of the action alternatives.

Monitoring strategy - Alternative A (no action)

- Visitor satisfaction. Under this alternative, the current level of 10,512 vehicles per season would be maintained and Denali would not establish indicators and standards. While visitor satisfaction surveys would continue to be administered as required, the results would not be compared to standards as an indicator and standards approach is not part of this alternative.

Monitoring strategy - Action Alternatives B & C

- Visitor satisfaction.The VSP tool would be used to ensure continued high levels of satisfaction. It would be first initiated along with the post-impact BACI study and would continue to be implemented every 2-4 years. If surveys indicate a decreased satisfaction with crowding levels along the road, the park may initiate new focused visitor surveys similar to the 2006 and 2007 surveys (Manning et al

2010) to determine if visitor preferences have changed. The park may also remove buses from the schedule, or step the system back to the level it was last operating at with a high level of visitor satisfaction. These changes would occur between seasons.

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APPENDIX D: TRAFFIC MODEL RESULTS

COMPARING TENTATIVE NUMBERS OF BUSES ON THE DENALI PARK ROAD BETWEEN ALTERNATIVES A, B AND C

Introduction

Since 2006, Denali National Park and Preserve has been conducting a series of scientific studies to better understand the relationships between traffic patterns on the park road and the physical, biological and social environment. Collectively called the Road Capacity Study, the purpose has been to provide scientific support for park road traffic levels that would not impede wildlife populations along the park road corridor (Phillips et al. 2010) and would maintain visitor satisfaction (Manning and Hallo 2010). These studies have lead to the development of a four tiered approach to the adaptive management strategy (appendix C). The first tier includes a set of indicators with quantitative standards associated with them designed primarily to regulate the numbers of vehicles on the park road in such a way that natural resources are protected and the visitor experience is preserved. The Tier 1 indicators that impact the number of concessioner buses allowed on the park road are 1) number of vehicles at a wildlife stop, 2) number of vehicles at rest stops and the Eielson Visitor Center, 3) number of vehicles in established viewscapes, 4) gaps in traffic at Dall sheep crossing locations. Three additional Tier 1 indicators, night-time traffic, large vehicle traffic and hiker wait times, are designed to further protect natural resources, the visitor experience, and visitor access.

A part of the Road Capacity Study involved equipping all concessioner buses and many other vehicles traveling the park road with GPS units to collect detailed information on their movement. From these data, a micro-simulation model was developed that would enable the park to test how different schedules may meet the standards set for the indicators (Morris et al. 2010). As outlined in appendix C, any proposed traffic volume or schedule would be first tested in this model and adjusted such that, based on simulations, it appears to meet the standards.

The traffic simulation model was used to test sample schedules for action alternatives B and C, based on their descriptions of service offerings in Chapter 2 of this environmental impact statement, for compliance with the standards set for following Tier 1 indicators 1) number of vehicles at a wildlife stop, 2) number of vehicles at rest stops and the Eielson Visitor Center, 3) number of vehicles in established viewsheds, 4) gaps in traffic at Dall sheep crossing locations.

Limitations of the Model

One limitation of the model is how non-bus vehicles are handled and the restrictions on these vehicles proposed in alternative B, such as eliminating recreational vehicle camping at Teklanika, could not be incorporated into the model. Hence the numbers are initial estimates. It is possible that a more optimized schedule can be achieved that would allow for additional concessioner buses. It is also possible that the traffic levels listed may not achieve the standards once the schedule is run in reality, potentially resulting in fewer concessioner buses.

Results for Alternative B

For alternative B, a schedule was found that the model output indicated would meet the standards for all of the indicators listed above. This schedule had 87 concessioner buses departing from the

Savage Check Station per day, with 30 short tours (with a destination of the Teklanika Rest Stop), 22 long tours (seven with a destination of the Toklat Rest Stop, 13 with a destination of the Eielson Visitor Center, and 2 with a destination of Kantishna), and 35 transit/camper buses (with destinations of Teklanika Rest Stop, Toklat Rest Stop, Eielson Visitor Center, Wonder Lake Campground and Kantishna).

Results for Alternative C

For alternative C, a schedule was found that the model output indicated would meet standards for all of the indicators listed above. This schedule had 85 concessioner buses departing from the Savage Check Stations per day, with 43 premium tours (24 with destinations to the Teklanika Rest Stop, 5 with destinations to the Toklat Rest Stop, 12 with destinations to the Eielson Visitor Center, and 2 with destinations to Kantishna), four specialty tours with destinations of either Toklat Rest Stop or the Eielson Visitor Center, 16 economy tours with destinations of either the Teklanika Rest Stop or the Eielson Visitor Center, and 22 transit/camper buses. The transit buses only went as far as the Eielson Visitor Center, and a loop shuttle was incorporated into the model to provide transit access as far as Kantishna.

For both of the action alternatives, a total of 10 inholder lodge buses were included in the daily schedule, four making day trips and six that started in Kantishna, making round trips to transport overnight guests.

Comparison of Action Alternatives (B and C) to the No-action Alternative (A)

For comparison, Denali's general management plan and subsequent amendments to that document currently impose daily limits of 30 Tundra Wilderness Tours (destinations of either Toklat at Mile 53 or Stoney Overlook at Mile 62), 23 Denali Natural History Tours (destination of Primrose at Mile 17) and 36 Visitor Transportation System (VTS) buses (turn-around points at Toklat, Eielson Visitor Center, Wonder Lake and Kantishna). Currently, the Kantishna Experience tour is falls under the VTS allocation. This results in a maximum of 89 concessioner bus trips on the road in any given day. The concessioner cannot run these volumes everyday however, as there are seasonal limits of 2,089 Tundra Wilderness Tours and 3394 Visitor Transportation System buses, plus 550 that fall in the category of "superintendent's discretion." Historically, 400 of these discretionary buses have been allocated to the Tundra Wilderness Tours; however, there is no limit to this number under the general management plan. Therefore, for the purpose of comparing alternative A to alternatives B and C, we assume that all of the 550 superintendent's discretion allocation could be assigned to the Tundra Wilderness Tours, making the seasonal Tundra Wilderness Tour limit 2,639. The Denali Natural History Tour has no seasonal limits.

NOTE: In the following comparisons, the Visitor Transportation System is also referred to as "transit" to be consistent with action alternative descriptions.

Extrapolating Daily Bus Numbers to Seasonal Bus Numbers and Seating Capacity

Under the new adaptive management approach proposed in this environmental impact statement, Denali is proposing that the maximum number of concessioner buses that can be run on a given day while meeting the standards and while the full length of the park road is open be allowed, which would allow for an increase in concessioner buses over the current GMP limits (Table A) even though the daily limits may actually be lower. Modified schedules would be run in the early part of the season as the road opens.

Due to weather, snow clearing operations and road condition, the park road is not open all the way to Kantishna for concessioner bus traffic during the entire season. From the start of the season (the Saturday before Memorial day) to May 31, the road is only open to the Toklat Rest Stop, from June 1 to June 7 the road is open as far as the Eielson Visitor Center, and from June 8 to the end of the season (the second Thursday after Labor Day) the road remains open to Kantishna (depending on the weather). Allowing partial schedules from the start of the season to June 7, action alternatives B and C result in similar levels of increases in seasonal numbers of buses (see Table A and Fig. A).

In terms of seat availability, the following assumptions were made to arrive at values for the alternatives:

- All buses except camper buses have 52 seats, 44 if the bus has a wheel chair lift. Hence, the 53rd seat currently in the Tundra Wilderness Tour buses was eliminated.
- Camper buses have 28 seats in alternatives A and C. If a camper bus service is maintained in alternative B, a 52- or 44-seat bus would still be used.
- In alternative C, a row of seats would be removed from the premium tour buses to allow for more leg room; this would leave those buses with 48 seats—40 if the bus has a wheelchair lift.
- For all alternatives, 50% of transit and economy tour buses have wheelchair lifts, 10% of premium tour buses have wheelchair lifts. This difference is reflective of how the system is run currently. The current Tundra Wilderness Tours and Denali Natural History Tours are pre-booked and the concessioner knows ahead of time when a wheelchair lift equipped bus will be required (approximately 10% of the time). Alternatively, the VTS/transit system allows walk-in, last-minute bookings; hence, approximately 50% of the VTS/transit buses in the schedule have wheelchair lifts to meet unexpected demand.
- Occupancy rates were assumed to be 100% for all tours, premium and economy; 70% for the alternative A and B transit; and 50% for the alternative C transit.

Given the assumptions above, alternative B results in substantially higher seating capacity over alternative C (see table B).

Conclusions

These were only sample schedules used to test how well the two action alternatives could meet the standards for the proposed Tier 1 indicators. Actual daily numbers and allocations between the services also are likely to change and will be based on visitor demand. Schedules were found with similar numbers of buses for each alternative that could meet these standards, although alternative B suggested slightly higher numbers of buses over alternative C. This difference is magnified when actual seating capacity is compared between the two action alternatives. Given the description of services and increased comfort of alternative C, the seating capacity for that alternative is considerable lower than that of alternative B.

Table A. Current seasonal limits (alternative A) compared to alternatives B and C given and average season length = 111 days, average season length to Eielson = 108 days, and an average season length to Kantishna = 101 days. These numbers are reflective of the full schedules (87 buses per day for alternative B and 85 buses per day for alternative C) over 101 days and modified, reduced schedules for the 10 days prior to the road being open to Kantishna.

ALTERNATIVE B

Bus type	Alternative A seasonal allocation	Alternative B	% change
Transit (including Economy Tour)	3394	3714	9.4
Short tour (Teklanika)	2553 (DNHT)	3330	30.4
Long Tours	2639	2422	-8.2
		Overall change	+10.2%

ALTERNATIVE C

Bus type	Current seasonal allocation	Alternative C	% change
Transit	3394	2370	-30.2
Loops	N/A	909	N/A
Economy Tour	N/A	1770	22.0[1]
Teklanika Tour	2553 (DNHT)	2664	4.3
Other Premium Tours	2639	2530	-4.1
		Overall change	+8.7%[2]

1 combined transit and economy tours for alternative C compared to transit only in alternative A.
2 Not including Eielson to Kantishna Loop service.

Table B. Seating capacity: current seasonal limits (alternative A) compared to alternatives B and C. These numbers are reflective of the following assumptions:

- In alternatives A and B, all buses (except campers) have a 52 seat capacity, 44 if wheel chair accessible[1]
- For alternative C, the premium tours will have more leg room, and thus only a 48 seat capacity, 40 if wheel chair accessible
- Camper buses for alternatives A and C have a 28 seat capacity
- 50% of all transit and economy tour buses (except campers) are wheel chair accessible (all alternatives)
- 10% of all premium tour buses are wheel chair accessible (all alternatives)
- Occupancy rate on the transit/campers for alternatives A and B is 70%
- Occupancy rate on the transit/campers for alternative C is 50%
- Occupancy rate on all tours is 100%

ALTERNATIVE B

Bus Type	Alt A seat Capacity	Alt B Seat Capacity	% Change
Transit	102432	113184	10.5
Short tour (Teklanika)	130714 (DNHT)	170496	30.4
Long Tours	135117	124006	-8.2
		Overall change	+10.7%

ALTERNATIVE C

Bus Type	Alt A Seat Capacity	Alt C Seat Capacity	% Change
Transit	102432	52175	-49.1
Economy Tour	N/A	84960	33.9[2]
Teklanika Tour	130714 (DNHT)	125741	-3.8
Other Premium Tours	135117	119416	-11.6
		Overall change	+3.8%

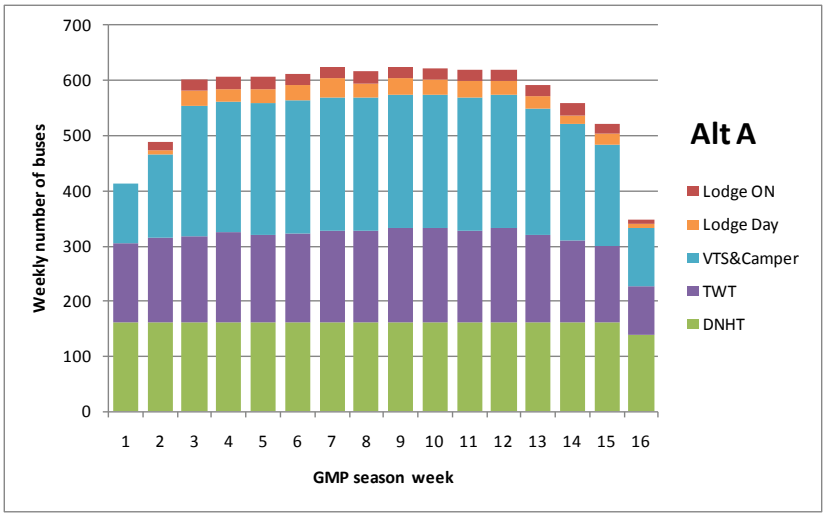
DNHT=Denali Natural History Tour

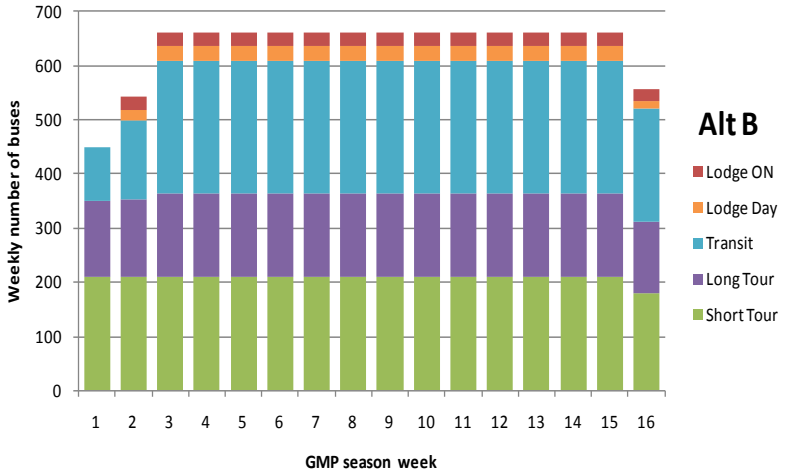
1 As of 2011, 52 passenger buses will be able to travel to Kantishna; previously the road standards limited the size of the buses to 44-passenger buses. The numbers presented here are comparing alternatives B and C to alternative A (using the current seasonal limits and the new bus seating capacity numbers) and not necessarily what the "current" pre-2011 condition was.

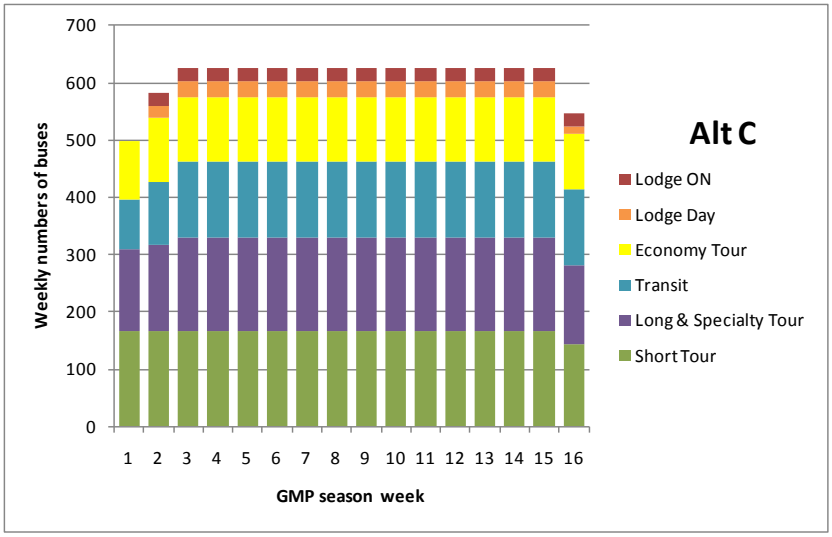
2 Combined transit and economy tours for alternative C compared to transit only in alternative A does not include the Eielson to Kantishna Loop service.

Figure A on next page. Distribution of buses on the Denali Park Road across the season for each alternative. The general management plan season dates of 2007 were used as an example; week 16 only had 6 days in it, which accounts for the drop in numbers for that week in alternatives B and C. For alternative A, 23 Denali Natural History Tour buses were run each day. A typical seasonal distribution of Tundra Wilderness Tour buses was used in alternative A, similar to what was run in 2007, totaling the full potential possible for buses under the no action alternative (2089 + 550).

Figure A. Number of Weekly Buses in the Various Alternatives







TWT – Tundra Wilderness Tour

DNHT – Denali Natural History Tour

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