APPENDIX C: ROAD MANAGEMENT

BACKGROUND INFORMATION

A road into the interior of Denali was proposed early in the park's history by park managers and supporters. The primary goal was to provide visitors with an improved means of access to experience the scenic vistas and to enjoy the abundant wildlife for which the park had been established.

The National Park Service entered into an agreement with the Alaska Road Commission (ARC) whereby the ARC would build and maintain the park road following NPS guidelines and using NPS funds. Road construction began in 1921–22 when a wagon trail was brushed out from park headquarters at McKinley Park Station to Savage River. The road to Savage River was completed in 1925. The road and bridges to Toklat were completed by 1931, and by 1938 the entire road to Kantishna had been constructed.

The original park road reflected the technologies then available for construction in a remote Alaskan wilderness. Road planners and builders anticipated small traffic volumes since the park was accessible only by rail. The road wound sinuously through the mountains and across the tundra, taking advantage of vistas and overlooks whenever and wherever possible. Topography and terrain dictated the route. The road followed the features of the land rather than using large bank cuts and slope fills to overcome them. Construction occurred using the materials at hand. This process led to a primitive, low speed road located in a wild and pristine land.

Access to the park became easier through the years, and visitor use increased. The Denali Highway was completed by the late 1950s, making it possible to drive to the park. While this was still an arduous journey that typically took 1½ days from Anchorage, the increasing number of vehicles provided a preview of the significant increase in traffic that would occur with a direct link to the proposed George Parks Highway between Anchorage and Fairbanks.

Based on increasing traffic and the projected growth, the Bureau of Public Roads began upgrading and widening the park road in the 1960s. Widespread public opposition resulted, led by Olaus Murie who stated that "This drastic rebuilding of the old road shows an obsessive regard for superhighway standards and a lack of appreciation for the spirit of this northern wilderness (Murie 1965)." The "wilderness feel" of a trip on the park road had become an integral part of the visitor experience. In response to public opposition, construction was halted in 1968, but not before the road had been widened and paved to the Savage River and widened in preparation for possible paving to the Teklanika River. Road work since then has been concentrated on bridge replacements, road maintenance and spot improvements in troublesome areas.

The park implemented a visitor transportation system (VTS) in 1972 in anticipation of the large increase in traffic that would result from completion of the George Parks Highway between Anchorage and Fairbanks that same year. Private automobiles were restricted on the road beyond the Savage River to visitors traveling to campgrounds, Kantishna property owners, and other special permits.

The visitor transportation and concessioner tour bus systems expanded significantly to accommodate increasing numbers of visitors through the years. Concerns about the effects of increased traffic on wildlife as well as safety issues resulting from two-way travel on a narrow road led to restrictions on the overall number and types of traffic in the 1986 *General Management Plan*. Even with these restrictions, the increasing volume and weight of traffic, or traffic loading, had become an issue because of the historically inadequate level of annual road maintenance and because of the increasing weight of vehicles, especially buses.

In 1982 the National Park Service started a road rehabilitation program to address road maintenance and improvements. Years of traffic and maintenance had removed almost all surface materials down to the road base, making it difficult to maintain the road through grading alone. Many sections had become difficult to negotiate because of wear, washouts and a rough surface. Some sections had actually become more narrow because of erosion and wear.

The five year program started in 1982 proposed to "maintain the road on its current alignment" with provisions for rehabilitating the existing gravel surface through the placement of additional gravel fines. Grade raises were proposed in specific areas, and an effort was made to reclaim the originally established width in areas narrowed by erosion and wear. However, the program plan stated that "widening of the road would not be undertaken as a general rule."

Material sources for road rehabilitation were identified and the volumes of gravel available from each were specified. However, material from these sources proved unsuitable in many cases. The rehabilitation effort was stopped after three years because of the lack of gravel and because of public and staff concerns over the apparent change in the character of the road. Road character was viewed as integral to the visitor experience.

DENALI NATIONAL PARK ROAD CHARACTER AND PURPOSE

The Denali National Park road serves a variety of functions over its approximately 88-mile length. It provides visitors of all abilities an opportunity to travel by vehicle through and access a rugged wilderness area, observing wildlife interactions in natural habitat as well as outstanding scenery. It provides circulation and access to public and administrative facilities, and it helps meet the ANILCA requirements for reasonable access to private property in the Kantishna hills.

The character of the park road and its relationship with the landscape through which it passes are an integral part of the visitor experience at Denali. As visitors travel west into the park, they experience a transition in environment from urban to rustic to primitive. The road itself is part of this transition. The first 15 miles of road, to Savage River, is a dual purpose facility. It must efficiently handle large volumes of traffic traveling in and out of the park and between various facilities in the entrance area. It provides the visitor an opportunity to see and experience the park resources without the need to interface with the public transportation system. It also serves as a conduit for vehicles traveling into the more remote areas of the park.

The next segment of the road, between the Savage and Teklanika Rivers, is a transition zone. The driving surface changes from pavement to gravel. Efficient traffic flow is not the only function of the road; allowing the visitor to experience the landscape is of increasing importance.

West of the Teklanika River, the landscape and the road change. Rolling terrain gives way to steep mountains and rugged canyons. The park road changes from a uniform width, two-lane facility to a variable width one-lane road with two-lane sections and pullouts. At this point, the landscape and the character of the road become integral parts of the park experience. The sinuous path emphasizes the dramatic terrain. Engineered structures such as bridges are used only as necessary to protect the resource or preserve the road. Signs and related items are kept to a minimum. The character of the road is in keeping with the character of the land: a primitive, low-speed road located in a wild and pristine land.

CURRENT CONDITIONS

The visitor transportation system and the traffic limits established in the 1986 *General Management Plan* have been largely successful in achieving their purposes of protecting both the outstanding visitor experience and the unique resources of the park. Trained and experienced bus drivers are able to safely negotiate a road that has seen minimal changes since it was first constructed 60 years ago. However, the road structure is currently subject to a burden for which it was never intended.

By 1980 several road studies had referenced the road's structural condition. The 1994 *Road System Evaluation* attempted to quantify structural needs. These studies were all surface only inspections, and in 1995 the first geotechnical assessment of the road was made, including subsurface investigation, sampling and analysis. This investigation showed that the road was originally constructed by the methods then available and for the vehicles common at the time. Requirements for buses used today could not have been anticipated. The road was built almost entirely with the native soils on site, often burying organic layers in the process. It did not include a constructed base or sub-base structure, and it was not mechanically compacted except at the surface. Problems most frequently identified by the assessment include poor subsurface drainage, saturable silts and clays (often with organics) in the roadbed, and low density soils in the roadbed. The constructed surface ranges in thickness from 4 to 8 inches east of the Teklanika River and from 2 to 6 inches west of the river. The constructed surface is mainly composed of native soil borrow rather than processed aggregates.

A number of previous road studies have recommended relatively extensive changes to road width and alignment to address perceived traffic safety concerns. Studies done in 1994 and 1995 narrowed the concern to the repeatedly identified lack of adequate safe passing locations west of mile 68. Lack of appropriately spaced passing areas prevents bus drivers from being able to plan and stage safe passes as they do east of mile 68. Studies also found that in some locations the problem was inadequate sight distance rather than inadequate road width.

The road is currently subject to a traffic load that considerably exceeds its structural capacity. This has resulted in gradual but continuous degradation of the road. Along with inadequate annual surface maintenance, this threatens both road character and road reliability. In alternatives C, D, and E of this development concept plan, the National Park Service proposes to address this problem through subsurface investigation, continued sampling and analysis, and a program to improve road structural capacity as outlined below.

ROAD REPAIRS AND MAINTENANCE

Methods

A proposed action common to all alternatives is that the National Park Service become more proactive in dealing with road repairs and maintenance. Site plans would be developed to provide an optimum design and to most effectively use gravel resources before initiating a repair project.

The following methods would be incorporated into site planning and repair:

Install Adequate Subgrade Drainage Systems: Systems to be used include trenching to design grades for site drainage and installation of curtain, french, and lateral drainways through the roadway or lateral sections as part of the road subgrade. Designs may also include geofabric, geogrid, pipes, or other engineering materials. Repair depths may range from under 5 to over 15 feet depending on site conditions, as long as there is free drainage to daylight.

Structural Repairs (including road edge stability repair): Structural repairs would include digging out and removing unsuitable subgrade and surface materials; installing geofabrics, geogrids, fillers, binders, or other engineering materials where called for by the site conditions; and proper compaction of the road section being repaired.

Use Adequate Surface Material: Surface material that has an adequate bearing capacity and resistance to wear would be used for road maintenance and repair projects.

Proposed Road Improvement Projects

Road improvement projects needed have been identified through onsite investigation by park staff and in consultation with bus drivers. Projects are listed in priority order to provide general guidelines and to demonstrate the types of failures along the park road that are most in need of repair. Lower priority projects may need to be moved up on the list if road conditions deteriorate further.

The level of repair to correct the deficiencies identified would vary with each alternative, ranging from minor repairs to treat the immediate problem in alternative C to more thorough, proactive repairs in alternative E.

Priority 1: Correct Safety Concerns. The highest priority road improvement projects are repairs needed to maintain visitor safety on the park road. These projects include improving site distance, providing an adequate road surface for vehicles to pass in opposite directions, improving road surface friction, and repairs to culvert crossings and curve superelevations in certain locations. Projects would be selected from the following list of examples, which would be updated at least once each year based on changing conditions. A project design would be completed and subsequently implemented for each specific project within the road sections identified below. None of the alternatives calls for systematic repair of the entire section identified; rather individual projects would be designed and implemented within the section listed.

Improve Site Distance and Provide for Safe Vehicle Passing: Examples at miles 38, 43.5, 68, 68.8, 73.0, 74.8-74.9, 77.6-77.7, 77.9, 79.4, 79.6, 80.3, 81.1, 81.3, 81.8, 83.2, 84.5, 87.1-87.2, 87.8

These points have become narrower than nearby sections of the road because of inadequate preventative maintenance, and these areas also contain blind curves. Repairs are required to provide a safer, more uniform road surface, and proposed work would not change the overall road alignment in these areas. Site distance can be improved in many cases by reducing the slope of cutbanks.

Improve Road Surface Friction: Examples at miles 67–69

Points within this section of the road are known as the "greasy corners" because of high clay content in the road surface, and they constitute a traffic safety hazard. Repair methods would include providing and maintaining an adequate gravel surface by hauling in new material from the proposed gravel source on Moose Creek.

Repair Culvert Crossings: Examples at miles 39–43 and 53–60

Scallops are found at culverts at several points within these sections. These culverts need to be lengthened and the adjacent road sections repaired to provide a safer, more uniform road surface. The overall road alignment in these sections would not be affected.

Repair Curve Superelevations: Examples at miles 41–43.

At points along this section of the park road the transverse (side-to-side) slope is too great, resulting in a safety concern. This would be corrected by adding surface material.

Priority 2: Repair Existing Structural Failures and Sections in Imminent Danger of Structural Failure. Repairs to correct structural failures are required in areas which, if left untreated, could soon threaten traffic safety. These structural failures include shear failures, slumps, active pumping of the road surface, road surface rutting, inadequate subgrade drainage, and surface cracking. As with priority 1, actual repair projects would be selected from the following list of examples, which would be updated at least once each year based on changing conditions. A project design would be completed and subsequently implemented for specific areas within the road sections listed below.

Repair Shear Failures and Slumps: Examples at miles 37.5–38

Evidence of these structural failures includes concentric or block shear cracking in the road surface followed by subsidence. Although these failures threaten traffic safety, they are small enough to be corrected by upgrading the road structure.

Repair Active Road Surface "Pumping" and Road Surface Rutting: Examples at miles 17–18, 31.5–34, 38–40, 48–49, 50–52

"Pumping" of the road surface is attributable to inadequate, poorly drained subgrade material which produces a boil of saturated subgrade material at the surface. Road surface rutting results because of this inadequate, poorly drained condition and because of traffic loading.

Inadequate Subgrade Drainage: Examples at miles 17–18, 23–25, 31.5–34, 45.5, 50–52, 61–63, 68–76, 85–88

Areas within these sections of the road need site-specific drainage systems. Subgrade drainage is essential to providing adequately designed repairs to the road structure. Installation of site-specific drainage systems such as curtain drains can in some cases provide necessary structural stability.

Priority 3: Repair Documented Structural Problems. This category includes areas where structural problems are known to exist and which, if left untreated, would result in structural failure. It also includes sections along the park road where structural problems could be occurring but where more information is needed before designing a repair project. As with priority 1 and 2 projects, actual repair projects would be selected from the following list of examples, which would be updated at least once each year based on changing conditions.

Surface Cracking: Examples at miles 17–18, 23–25, 31.5–34, 38–40, 45.5, 48–49, 50–52, 61–63, 68–76, 85–88

At certain points within these sections of the park road, checkerboard cracking or "alligatoring" appears on the surface as a symptom of potential structural failure. This condition indicates repetitive vertical flexing and horizontal shear in the subgrade soils and can be corrected by hauling in new material.

Grade Raises: Examples at miles 31.5–34.2, 36–37, 70.4–72.1

Grade raises averaging between 12 and 18 inches are required at certain points within these sections of the park road to achieve adequate subdrainage and repair subgrade problems. In places the terrain is so flat and the present road surface so low that achieving adequate subdrainage and structural integrity is not possible without elevating the surface. Specific sites needing improvements would be selected based on the overall grade of the road in the area and the surrounding terrain.

Annual Review and Subsequent Environmental Compliance

Internal review of the priority projects listed above would provide the flexibility to move a project or projects from one priority level to another either within a season or between seasons. All major projects (nonemergency and not routine maintenance) must have a project design that is subject to internal review. Projects would be approved by the park superintendent based on the following criteria:

1. If listed within the DCP alternative selected and using the general methods outlined above, a project can be approved based on the environmental analysis in this DCP/EIS and pending any necessary cultural resources compliance.

2. Projects not specifically listed above but determined to be at the same priority level because of changing conditions may also be approved after internal review and upon completion of any necessary cultural resources compliance.

3. Projects in lower priority categories than those included in the alternative selected will require public notification before being initiated. This notification may be informal (such as a newsletter) for projects that fit within the general guidelines outlined above. Further environmental compliance such as a site-specific environmental assessment would be necessary when the proposed project calls for new or different methods than identified above, alternative gravel sources, or significantly higher quantities of gravel than other high priority projects.

GRAVEL SOURCES

The *Development Concept Plan/Environmental Impact Statement* for the entrance area and road corridor amends the *Gravel Acquisition Plan* to allow use of gravel from in-park sources for structural and geometric repairs and other improvements. The National Park Service would continue to investigate alternative materials and evolving technologies to minimize gravel requirements in maintenance activities. Information on proposed new gravel extraction sites is provided below.

Teklanika River

The proposed site is located downstream from the Teklanika bridge in an alluvial floodplain near the Teklanika campground and would be reached from the campground road. Techniques developed for the Toklat River source would be applied at this renewable source. Available quantities are expected to be somewhat less than from the Toklat River, and additional information on feasibility is needed before development of this new source.

Extraction Methods. Extraction methods and procedures within river sites would be developed and followed similarly to the current "Toklat River Standard Operating Procedures" found within the *Gravel Acquisition Plan*. Design parameters include:

1. Design gravel excavations as mirror images of and connected to bends in the natural channels. The length, width, depth, and slope of the excavated channels must match the natural channel segments.

2. Excavation proceeds downstream to upstream. The final scrape must open the excavated mirror channel to flow from the natural channel.

3. Locate excavations in areas where sediment deposition is likely.

4. Limit the total volume of stream bed material removed by an individual excavation to the site-specific constraints caused by yearly depositions. Extraction is also limited to no more than 2,500 cubic yards per scrape, with no more than three excavations per season. These limits are to be re-evaluated periodically and do not necessarily apply to other sites.

5. Excavations are limited to low water periods.

6. Monitor both short- and long-term effects on the river upstream and downstream of the excavation areas. Long-term monitoring includes annual level surveys of the existing cross section system.

7. Gravel excavation operations in the flood plain could result in the incidental discharge of fill material, which requires an individual section 404 permit.

Moose Creek Terrace

There are alluvial, colluvial and terrace gravels suitable for development along the Moose Creek road between the North Face Lodge and the boundary of Liberty claim # 23 approximately 2 miles upstream. The proposed site is approximately 1 mile southeast of the North Face Lodge. It was originally identified and considered as a high priority for development in the *Denali Road Improvement Study* of February 1984. It is not visible from the park road. Approximately 166,000 cubic yards are estimated to be available from this site.

Extraction Methods. The Moose Creek terrace site would be an open pit gravel excavation. Access roads would comply with existing constraints, including possible spanning of anadromous streams with arch culverts where necessary to protect fisheries. Pit dimensions would include adequate floor space for efficient operation of the plant, safe trucking operations, and stockpile areas for raw and processed materials. Organics and undesirable overburden would be stripped and stockpiled on site for future reclamation and rehabilitation work. Excavations would follow site-specific development plans. The following mitigation measures would be implemented:

1. Provide for adequate pit drainage to prevent erosion.

2. Control noise by scheduling operating hours and use water for dust suppression.

3. Prevent pollution by using chemical toilets, bear proof trash containers, and petroleum spill prevention kits. A spill prevention plan would be in place and practiced onsite.