# Existing Alignment Issues

STERLING
HIGHWAY MILE POST 45 TO 60
ALASKA

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| DEIS | Draft Environmental Impact Statement |
| DOT&PF | Alaska Department of Transportation and Public Facilities |
| EIS | Environmental Impact Statement |
| FHWA | Federal Highway Administration |
| MP | Milepost |
| NHS | National Highway System |
| SEIS | Supplemental Environmental Impact Statement |

# SUMMARY

The Milepost (MP) 49-50.5 section of the Sterling Highway, just west of the community of Cooper Landing, Alaska, presents an unusual engineering challenge. Steep terrain and the proximity of the Kenai River combine to force the existing highway into a curving alignment that does not meet current highway standards. Because of recurring questions about continued use of the existing alignment, this paper focuses on this specific section and compiles and summarizes information from several sources into one place. The MP 49-50.5 area is identified as an area of particular concern for several interrelated reasons:

- The curves and widths do not meet current standards.
- The slopes are steep.
- The soils, with associated ground water and local climatic conditions, are prone to sliding and collapse.
- The river, a popular state park, is immediately adjacent.
- There is little or no room to improve the road width or curves.

Several alternatives have been considered in this area but not carried forward. Multiple engineers at the Alaska Department of Transportation and Public Facilities (DOT&PF) and various consulting firms, working over 30 years,

- have determined that the engineering constraints in this area are too great for standard engineering solutions, and
- have recommended against large earth cuts and large walls that would be required in this short section of highway.

It is unlikely that a professional engineer would put his or her seal on any design that required cuts and walls to the extent needed. For these reasons, DOT&PF currently is considering only alternatives that avoid the MP 49-0.5 area, as recommended by the engineers.

A second area of concern is the Cooper Landing community, where any improvement to meet current standards would create large property and community character impacts in the small community. The alternatives under consideration all would avoid the primary area and vary in their use or avoidance of the secondary area of concern. All current alternatives do use substantial portions of the existing alignment.

# 1.0 INTRODUCTION

## 1.1 Report Organization

This section (Section 1.0) provides background and defines terms. The rest of the report pinpoints the primary area of concern with the existing alignment (Section 2.0), focuses on the identified problems in this area (Section 3.0), and explains the status of alternatives in this area (Section 4.0). Substantial end notes expand on project background, the project development process, and origins of the terms “3R” and “4R” that have been used in discussion of the existing alignment.

## 1.2 Project Background

### *1.2.1 Project Purpose and Alternatives*

The Alaska Department of Transportation and Public Facilities (DOT&PF) has recognized for more than 30 years that transportation problems on the Sterling Highway in the Cooper Landing vicinity need resolution. A narrow, tightly winding road coupled with multiple community and recreation destinations create transportation problems. Improvement is meant to resolve three interrelated transportation problems or needs, as expressed in Chapter 1 of the Sterling Highway Milepost (MP) 45-60 Supplemental Environmental Impact Statement:

- Need 1: Reduce Highway Congestion.
- Need 2: Meet Current Highway Design Standards.
- Need 3: Improve Highway Safety.

The highway was constructed around 1950 to serve the traffic, vehicles, and Kenai Peninsula population at that time and has received little upgrade since. The purpose of the project is to bring the highway from a 1950s-era alignment and design up to current standards for a rural principal arterial to efficiently and safely serve through-traffic, local community traffic, and traffic bound for recreation destinations in the area, both now and in the future. In achieving this purpose, DOT&PF and the Federal Highway Administration (FHWA) desire to serve the traveling public while doing their part to protect the Kenai River corridor.

The Sterling Highway is part of the National Highway System (NHS) and the Interstate Highway System, but in the greater Cooper Landing area it also functions like a rural collector road. The NHS serves as the essential connector between population centers, economic centers, and intermodal centers (such as airports, shipping ports, and ferry terminals) of the state. The Sterling Highway is the only road link between the western portion of the Kenai Peninsula and the rest of Alaska's and the nation's road system, and it also serves numerous local destinations that have become established along the highway in and near Cooper Landing. The result is considerable turning movements, slow speeds, and the NHS being used for local trips which inhibits the function of the NHS for through-traffic. Official performance measures for rural principal arterials are not achieved, including average travel speed. Sections on either end of this project have been improved, leaving a gap in the highway function.

To satisfy the project purpose, DOT&PF proposes four "build" alternatives, each of which is located partly on the existing highway alignment but departs for varying lengths to create a section of all-new alignment that avoids various impacts. See Figure 1. Avoiding some impacts, however, inevitably creates other impacts. DOT&PF also is analyzing the "no build" alternative.

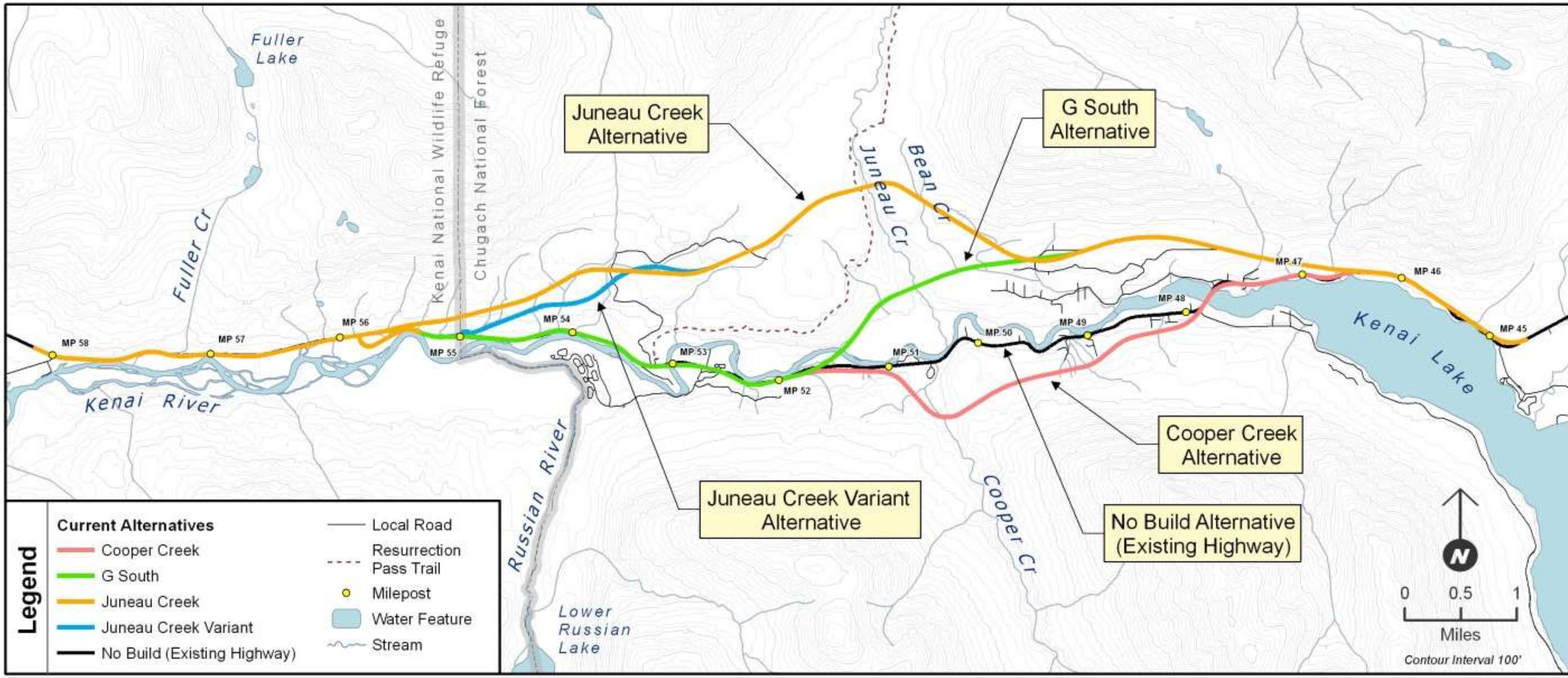


**Figure 1: Alternatives under consideration in the supplemental draft environmental impact statement**

One recurring question from agencies and the public has been why there is no "build" alternative that uses the existing alignment throughout the entire length of the project. Alternatives that would make minor or large changes but remain exclusively on the existing alignment were analyzed in 2001-2003 and set aside as "not reasonable" transportation alternatives under FHWA's National Environmental Policy Act guidance. Because questions about these options continue to recur, this document addresses the issues of the existing alignment and compiles in one place the thinking that went into those options.

### *1.2.2 Issues in the Project Area*

DOT&PF and the FHWA first published a draft environmental impact statement (EIS) for the Sterling Highway MP 37-60 Project in 1982 (DOT&PF 1982). Land management complications and lack of an easy solution resulted in no timely publication of a final EIS or decision. DOT&PF and FHWA issued another draft EIS (DEIS) in 1994 (DOT&PF 1994). Again, the lack of an easy solution in the area of the Cooper Landing community and westward resulted in no final decision in that area. Instead, DOT&PF and FHWA separated what had been one project into two projects, MP 37-45 and MP 45-60, each of which was determined to have independent utility. FHWA issued a final decision for the 37-45 project, and DOT&PF completed construction in 2000. At that time, DOT&PF and FHWA initiated a new supplemental EIS (SEIS) specifically for MP 45-60, and it has been underway since—attempting to resolve the multiple difficult issues. Among the issues are the following:

- Topographic and landscape constraints, such a steep mountain slopes, avalanche paths, unstable silty glacial soils and rock in some areas, groundwater and wetlands in some places, and the dynamic serpentine Kenai River with eroding banks and floods.
- The Kenai River Special Management Area—the river below ordinary high water (managed as a state park), its five species of salmon and fish and wildlife habitat, its scenic beauty, its commercial importance, and its popularity, particularly at its confluence with the Russian River.
- Unresolved land status issues associated with Alaska Native land claims on federal lands in the area.
- Archaeological and cultural sites that overlap Chugach National Forest and the Kenai National Wildlife Refuge that may be eligible for National Historic Landmark status.
- Wildlife movement, habitat, and feeding in the area, especially for the Kenai Peninsula brown bear and moose, and other species such as Dall sheep.
- Unresolved land transfers from the federal government to the State of Alaska for statehood entitlements, and from the State to the Kenai Peninsula Borough for borough entitlements—lands that in the future may be developed for homes and businesses.
- Federal Wilderness land status within the Kenai National Wildlife Refuge.
- Recreational importance of the area:
    - World class sports fishing on the Kenai and Russian Rivers.
    - Multiple trails, including the Resurrection Pass National Recreation Trail, the Bean Creek historic trail, and the Stetson Creek historic trail.
    - The Russian River Campground and Cooper Creek Campground.

    - Designated recreation areas, including the Juneau Falls Recreation Area and Kenai River Recreation Area.
    - The Russian River Ferry.
    - The Cooper Landing, Sportsman's Landing, and Jim's Landing boat launches, and access to them.
- The Cooper Landing community—homes, vacation cabins, businesses, and community facilities, and movement of pedestrians and traffic within the community.

Significant public recreation areas, wildlife refuges, parks, and cultural sites all are protected by Section 4(f) of the federal Department of Transportation Act. The law says federally funded transportation projects shall not use land from protected properties unless there is no prudent and feasible alternative. The entire Kenai River valley is full of overlapping cultural sites and districts, recreation sites, the Refuge, and the river (a park). In addition, much of the area is important habitat and contains animal movement corridors, and large areas are private property or potential future private property.

These are the issues that have caused delays in completing a supplemental EIS and reaching a decision. It is clear there is no perfect solution that will work well both to avoid impacts to the surroundings and provide for good function of the highway into the future. The remainder of this document addresses the issues specifically related to use of the existing alignment, with a focus on topographic and geotechnical constraints.

### *1.2.3 The Sterling Highway in Context*

The 142-mile Sterling Highway was completed in 1950 and was later designated as part of the NHS. See end notes for detail on the NHS.[i] Alaska Highway 1 is the Sterling Highway beginning in Homer and passing through Anchorage (as the Seward and Glenn Highways), Glenallen, and Tok to connect with the Alaska Highway and, through Canada, with the remainder of the NHS in the Lower 48 states. See Figure 2. The section between Soldotna and Anchorage that passes through Cooper Landing and the project area is Interstate A3, part of the Eisenhower Interstate System.

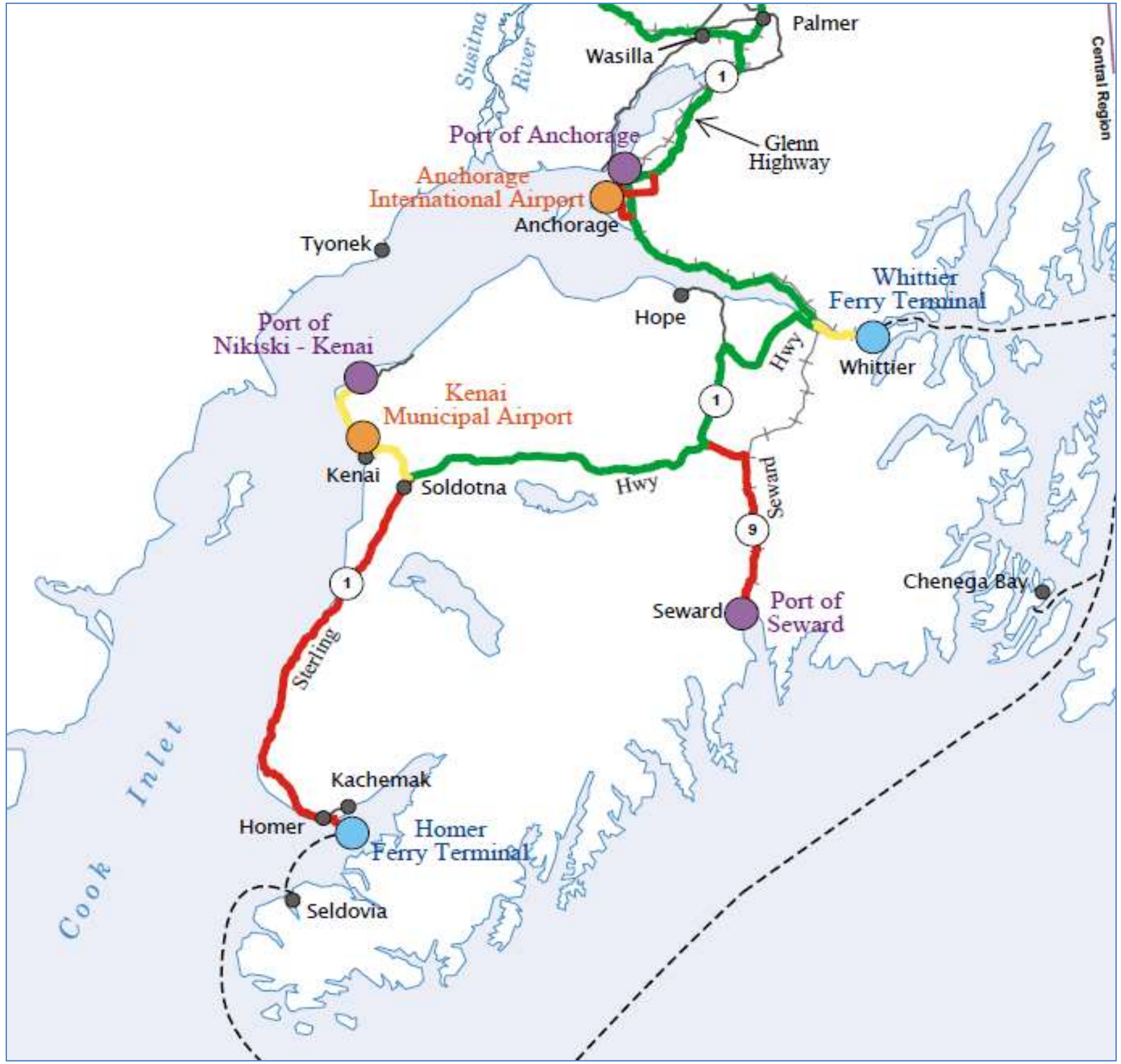


**Figure 2: National Highway System (red) and Interstate Highway System (green), Kenai Peninsula, Alaska, with major intermodal connections (ferries, airports, ports)**

As part the NHS and Interstate system, all improvements are expected to meet standards laid out for the functional classification of the roadway in *A Policy on Geometric Design of Highways and Streets*, published by the American Association of State Highway and Transportation Officials (AASHTO), as supplemented by the DOT&PF *Highway Preconstruction Manual* (both manuals are updated periodically). In this case, the functional classification of the Sterling Highway is Rural Principal Arterial. Less formally, this means "rural highway" as distinguished from smaller roads.

### *1.2.4 Definitions of 3R, 4R, and Existing Alignment*

Federal-aid highway funding has evolved from the 1950s to today. See end notes[ii] for detail. Originally, the federal government sought to identify and *construct* a national system of main highways. This became the National Highway System and the Eisenhower Interstate System of which the Sterling Highway is a part. As the original constructed portions of the highway system began to need repairs, Congress expanded funding to allow for *rehabilitation, restoration, and resurfacing* in addition to initial construction. This became known as "3R." Later still, Congress authorized *reconstruction* projects—known as "4R." The Sterling Highway at Cooper Landing physically predates the designation of the national system of highways, but it was designated later as part of the NHS and Interstate Highway system. Because it is an existing highway, work on it is either classified as 3R or 4R—either repaving with minor other upgrades, or complete reconstruction, including potential to move to a new alignment. There are gray areas between 3R and 4R. A substantial 3R project can involve reconstructing the road foundation, adding passing lanes and shoulders, and other elements but typically remains very close to the existing alignment and largely within the existing right-of-way. A 4R approach theoretically could mean completely rebuilding the road but remaining entirely within an existing right-of-way. The main aim of this report is to recap what has actually been done for the Sterling Highway in attempting to stay on the existing alignment, regardless of 3R and 4R distinctions.

## 2.0 EXISTING ALIGNMENT—PINPOINTING THE AREAS OF CONCERN

DOT&PF typically upgrades any road on its existing alignment unless there are substantial problems that require consideration of a change in the alignment. Using the existing alignment usually is less expensive and typically creates less environmental impact. In the MP 45-60 project area, transportation planners and engineers attempted to keep highway improvements on the existing alignment. The 1982 and 1994 DEISs focused largely on the existing alignment. Most of the 14 miles of existing alignment between MP 44.5 and MP 58.5 present no particularly unusual engineering challenges. Therefore, among the build alternatives, engineers have made substantial use of the existing alignment.

The only segment of the existing alignment not used by any build alternative is the MP 48-51 segment—about three miles. Project engineers have consistently wrestled with a couple of geographically small but complex areas along this portion of the existing alignment. This area is addressed in an April 1983 DOT&PF internal geotechnical engineering memorandum (Narusch 1983) and a 1989 Reconnaissance Engineering Geology Report (Fritz 1989), both quoted below. The primary area of concern is more specifically identified in a June 2003 memorandum (Grigg and Sheahan 2003) as MP 49-50.5.

This area, shown in Figure 3, is at the western extent of the Cooper Landing community. The existing Sterling Highway follows the base of a steep slope throughout this area. In three areas, the existing highway is located immediately adjacent to bends of the Kenai River. This stretch includes seven curves:

1. A broad curve at about MP 49.1
2. A curve at about MP 49.2
3. A sharp curve on the outside of a river bend at about mile 49.4
4. A sharp curve at about mile 49.6
5. A broad curve at about mile 49.9
6. A sharp curve at about mile 50.2
7. A curve at about mile 50.6

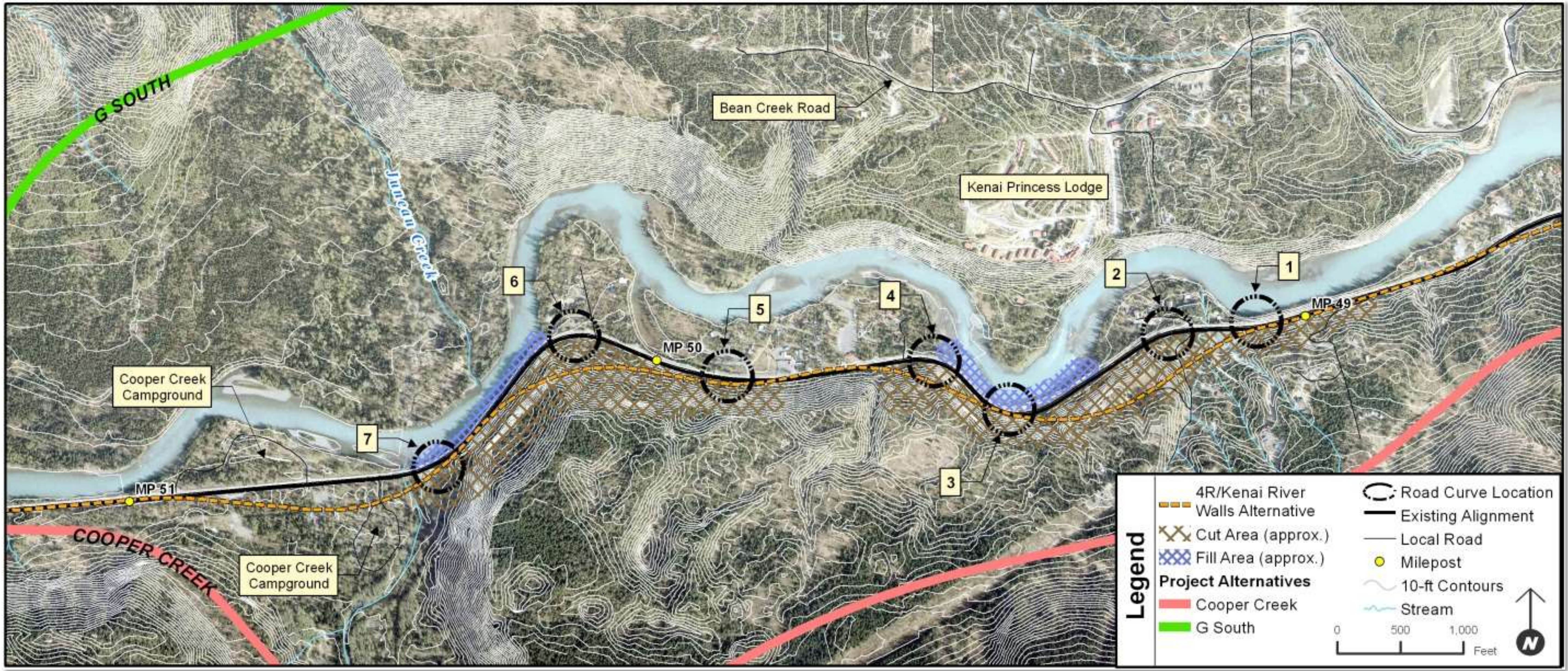


**Figure 3: The MP 49-50.5 area on the Sterling Highway**

The curves are the result of topography, and the topography is the result of the Kenai River cutting down through the valley bottom and mountain slopes over time. The interaction of the river flow and the undulations of the banks have created a meandering glacial river, gradually eroding away material from the banks. The lower mountain slopes are steep—in this area, apparently created by the river itself cutting into the slopes—and the existing highway in this area follows the base of the slope exactly.

There are two interrelated problems in this area: (1) The marginal soils that form the steep slopes south of the highway, and (2) the highway design, including curves, lane widths, and other measures that do not meet standards. Each of these is described in the following paragraphs.

**Marginal Soils.** The river is at about elevation 420 feet, and the slopes on the south side of the river rise steeply to a bench at elevations of 600-700 feet. At the inside of curve 3, the slope rises directly from elevation 428 feet to elevation 600 feet, and between curves 6 and 7 the slope rises even more steeply from elevation 411 feet to elevation 620 feet.

Near curve 3, the 1989 geotechnical engineering memorandum notes two overlapping areas of concern:

> (1) A cutbank rises approximately 45 feet above the road to the right (editor's note: looking east)…. The exposed face shows silty sandy gravel and cobbles, underlain by discontinuous layers and lenses of sandy silt, fine sand, and sandy gravel. The upper 10 feet of the exposure is nearly vertical and is actively eroding. Above the cut the vegetation slope rises quite steeply at about a 40% grade. The ditch below this cutbank requires rock fences and frequent cleaning.
>
> (2) The existing right backslopes … consist of predominantly silty sandy gravel and cobbles, with scattered and discontinuous lenses of stratified sandy gravel and sandy silt. The backslopes all through this interval are gullied, actively raveling, with substantial undercutting of the overburden at the top of the cuts, and show much debris on the slopes.
>
> Recommendation: This interval…was addressed in the previously mentioned memo dated April 25, 1983….This alignment, near the existing roadway, is not recommended for design or construction.
>
> *-Reconnaissance Engineering Geology Report, Sterling Highway MP 37-60, Aug. 1989*

In the area of curves 6 and 7, the same report indicates the following:

> The existing right backslope is a high, actively eroding slope composed of crossbedded fine gray and tan sands, pinched out beds of fine sand, and thin layers of well sorted sandy gravel and gravel. These sediments appear to be fluvial sediments. Till deposits of subangular to subrounded gray silty sandy gravel and cobbles are also present. The actively raveling cutslopes extend to more than 60 feet above the roadway, lying at nearly 1:1 [ed. note: this is a "100%" slope, or 45-degree angle]. Debris in the ditch and bent tree trunks attest to the downslope creep. Some water seepage was evident at the top of the cutbank, beneath the surface organic mat. No bedrock was evident anywhere on or around this steep bank….This particular proposed cut was addressed in a memo dated April 25, 1983…. It was recommended that this cut not be attempted.
>
> *-Reconnaissance Engineering Geology Report, Sterling Highway MP 37-60, Aug. 1989*

As further indicated in descriptions below of the 3R and Kenai River Walls (4R) alternatives, these areas have always been an issue.

**HighwayDesign.** Highway standards have been developed over time to "provide operational efficiency, comfort, safety, and convenience for the motorist" (AASHTO 2004). Consistency is part of driver comfort and safety, and it is DOT&PF's goal to create a more consistent highway system by bringing all segments of highways to current standards. Most segments of the Seward and Sterling highways have been improved; the Cooper Landing area is a complex area that has not seen substantial improvement.

In the project area, the mountains and river created the topography, and the existing highway curves are a response to the topography, but they do not meet the standard minimum curve radius of 1,340 feet for a curve that can be safely negotiated at the recommended standard design speeds (60 mph). The following table indicates the curve radius of each curve in the MP 49-50.5 area and the approximate safe speed of such a curve, from the AASHTO manual *A Policy on Geometric Design of Highways and Streets* (2004).

**Curves in the Existing Sterling Highway MP 49-50.5 Area**

| Curve | Approx. hwy. mile | Curve radius (feet)* | Approx. speed rating (mph) |
|---|---|---|---|
| **1** | 49.1 | 1,432 | 63 |
| **2** | 49.2 | 716 | 47 |
| **3** | 49.4 | 441 | 38 |
| **4** | 49.6 | 478 | 40 |
| **5** | 49.9 | 2,292 | 73 |
| **6** | 50.2 | 498 | 42 |
| **7** | 50.6 | 955 | 53 |

For comparison, the minimum curve radius required for a 60 mph design speed is 1,340 feet. This would be the minimum to meet current standards.

Curves 2, 4, and 6 are curves with poor sight distance—that is, they are sharp curves around bulges in the steep slopes, and drivers cannot see ahead to hazards in the road. Curves 2, 3, 4, 6, and 7 do not meet current radius-of-curve and superelevation-of-curve standards for a rural principal arterial (the Sterling Highway's functional classification). The design criteria for the Sterling Highway project, based on current standards, includes a 60 mph design speed (down from the 70 mph desirable design speed for rural principal arterials in recognition of rolling terrain) and the minimum curve radius to match this speed. Because the existing curves do not meet standards, for safety DOT&PF has field tested these areas and posted yellow advisory speed signs to reflect the speed that most vehicles can safely negotiate these curves.

Lane widths throughout much of the project area also are not to current standards. In this area, the lanes are 11.5 feet wide (23 feet total), and the pavement width is 24 feet, leaving 6-inch paved "shoulders." The design criteria for the project is 12-foot lanes and 8-foot shoulders.

Clear zones are the wider, open areas beyond the lanes. These areas are to be constructed at a moderate grade and without obstacles. These areas are meant to provide vehicles that accidently leave the road adequate space to recover without crashing into an object or rolling over. They also help to give drivers necessary sight distance around curves for seeing hazards and provide open areas in which drivers can more readily see animals or pedestrians moving toward the roadway, and allow time to react. In this area, clear zones likely never were delineated. The current clear zone standard is 30 feet. Existing widths are far below current standards, except perhaps where a guardrail is used to help prevent vehicles from leaving the roadway at all.

**Secondary Area of Concern.** Another area of transportation concern exists in Cooper Landing proper. In this area, long portions of the existing right-of-way are very narrow (65 feet), and both recent and historic buildings are built very close to the existing highway. Multiple driveways and stretches where driveways blend together into continuous pulloff areas mean vehicles enter and leave the highway continuously and somewhat randomly, creating potential hazards both for those traveling the highway and for those turning onto or off of the highway. In this area, there is not an identified problem with soils or engineering feasibility, and not many curves. However, as in the primary area of concern discussed above, flattening curves and widening the highway would be the primary engineering solutions. Adding lanes or frontage roads to allow through traffic and turning traffic to function better on the same road, adding shoulders and clear zones for safety, and relocating the existing path all would mean adding width. Consolidating and clearly defining driveway access points also would help (DOT&PF has worked toward this goal during 2013 repaving). There is little space to widen the highway or consolidate driveways; for about 2,600 feet, the existing right-of-way is 65 feet wide. To accommodate two 12-foot lanes and the required 30-foot clear zones requires 84 feet, not counting the slope of the fill of the highway embankment or any cuts on the uphill side of the road, and not counting any additional lanes, frontage roads, or pathway. The engineering solution in this area would be to widen the highway right-of-way substantially, but widening would substantially alter the community character and alter the viewshed, impacting private homes, businesses, and property over a large percentage of the community.

**Conclusions.** As further described in Sections 3.0 and 4.0, the MP 49-50.5 area is identified as an area of particular concern for several interrelated reasons:

1. The curves and widths do not meet current standards.
2. The slopes are steep.
3. The soils, with associated ground water and local climatic conditions, are prone to sliding and collapse.
4. The river is immediately adjacent.
5. There is little or no room to improve the road width or curves.

A second area of concern is the Cooper Landing community, where any improvement to meet current standards would create large impacts to the community.

# 3.0 ISSUES ASSOCIATED WITH ALL ALTERNATIVES IN THE MP 49-50.5 AREA

For the 1982 DEIS, the 1994 DEIS, and the current supplemental DEIS efforts, DOT&PF has taken a hard look at ways to use the existing alignment in the MP 49-50.5 area, and at alternative ways to skirt around this area. The 30 years that have elapsed mean that new engineers have come to the project and examined the old issues. Engineers have consistently recommended against trying to construct additional width through the MP 49-50.5 area.

The 1982 DEIS showed extensive cuts in the problem areas and included an alternative (the "A-line") that crossed meandering bends of the Kenai River multiple times to avoid this area. Under that "A" alternative, according to the DEIS, the existing road between curves 6 and 7 "would be obliterated and revegetated." To remain on the existing alignment, the DEIS indicated that curve 1 would be essentially eliminated and curve 2 pulled to the south, creating a large hillside cut. Curve 3 was flattened by creating a large retaining wall in the Kenai River; at least one full lane would be built in the river. Curve 4 and the area between curves 6 and 7 resulted in two other cuts at least as large. A long stretch of fill in the Kenai River would also have occurred between curves 6 and 7.

All curves generally were to be designed for a vehicle speed of 60 mph. DOT&PF examined an exception to its minimum design speed as a concession to the complexity of this area and examined 50 mph curves through this section only, allowing for less cut into the hillside and less fill into the Kenai River. However, the cuts and fills still were very large. The 50 mph "B-1" alignment also did not avoid the fill in the river.

Following publication of the 1982 DEIS, an April 1983 engineering memorandum prepared by the DOT&PF Materials office (Narusch 1983) reported on a new examination of the area—a similar but reengineered alignment with a 55 mph design speed. The memo stated the following about the attempted alignment in the MP 49 to MP 50.5 area:

> Based on the following data and considerations, it is the recommendation of this office that the proposed cuts from Station 1668 to Station 1685 and from Station 1702 to Station 1712 on the 55 m.p.h. 'BA' line for subject project not be attempted.
>
> Literature pertaining to large cuts in glacial materials similar to that in the Cooper Landing area reveal that such cuts are rarely attempted in areas with the type of climatic conditions prevalent in the vicinity of Cooper Landing…. Because of the silty glacial soils, the magnitude of the cuts, the precipitation and runoff potential, the effects of freezing and thawing, and the difficulty of revegetating glacial soils on north facing slopes, the proposed cuts will pose an extreme exposure to (several) risks.
>
> \- DOT&PF geotechnical memorandum 1983

The memo went on to list and describe the following landslide and related risk issues:

1. Mud flows
2. Slumps and/or shear type failures of the earth materials
3. Surficial failures of the materials

Further, the memo described several "construction problems":

1. Likely mud flow failures after construction—"it is doubtful that lasting repairs could be successfully accomplished."

2. Water known to occur in layers in the cut area, which "could cause extensive erosion of soils and slumping of soils where the water seeps out of the cut slope."
3. Material removed would be unusable waste: 1.04 million cubic yard of material covering 54+ acres 12 feet deep. And it would be difficult for the construction contractor to handle.
4. "It is unlikely that runoff during construction can be controlled sufficiently to prevent silt laden water from entering the Kenai River."
5. Revegetation "will not produce satisfactory and lasting results in the glacial soils."

The memo also described maintenance problems, including material falling or sliding down the slope into the ditch and onto the road, and inability to access the high slopes for "inevitable maintenance."

The memo summary indicated that this area has "a variety of problems" These problems were noted as:

> …very serious both individually and in combination. Because of geotechnical considerations and the hazards to the traveling public and the environment it is recommended that alternatives to the major cuts on the "BA" alignment be actively sought.

The 1989 geotechnical report (DOT&PF 1989) primarily echoed the 1983 report, and recommended no cut in this area. By that time, DOT&PF had "actively sought" an alternative that stayed entirely on the north side of the river and was located well to the north—an early version of the Juneau Creek Alternative.

The 1994 DEIS said generally of the existing alignment (no build alternative): "cuts have been made into unstable slopes where erosion conditions are severe. Mud slumpage and tree debris regularly fill ditches. Travel speeds are reduced along the curving alignment." The DEIS carried forward the "3R Alternative" and the early Juneau Creek Alternative. For the 3R Alternative in the primary problem area, it showed two large retaining walls on the uphill side of the 3R Alternative—"a 0.21 mile long binwall" near MP 49.5 (curves 3-4 area) and "a 0.25 mile long binwall" near MP 50 (curves 6-7 area).

For the current supplemental DEIS effort, in January 2001, R&M Consultants prepared a geotechnical memorandum that addressed the soils in this area as part of an assessment of the Cooper Creek Alternative. The memo stated:

> Fine-grained glacial soils have been observed throughout the project area. These include glacial till, glaciolacustrine (lake) sediments, and fine-grained units of glacial-fluvial (river) material. The high bench between MP 48 and MP 50.5 appears to consist of glacial tills overlain by a cap of coarser-grained glaciofluvial material up to about 50 feet thick. The glacial tills range from sandy gravel with relatively low silt content to nonplastic silts. High plasticity (editor's note: clay-like) lacustrine deposits were not noted along the Cooper Creek alignment. However, there were only limited soil exposures and (editor's note: based on observations across the river) this plastic material may be present.
>
> A larger slope failure along Cooper Creek, adjacent to the highway, has exposed layered fine-grained glaciofluvial soils composed of non-cohesive silt and very fine sands, overlying relatively coarse-grained silty sandy gravels. The slope failure appears to have

> been caused by undermining of the natural slope. The fine-grained glaciofluvial soils had eroded, forming a large fan at the bottom of the slope. Silt was observed flowing into Cooper Creek and silt fence was noted along the creek.
>
> Several unstable slopes observed along the existing highway between approximate Mileposts 40 and 50.5 were referenced in a DOT&PF report in 1983….These unstable slopes appear to have been undermined and thus oversteepened many years ago….Most of the geotechnical risks in (the bluff behind this area) involve the fine-grained soils…..

The current SDEIS effort at the time of alternatives screening (HDR 2003) re-examined several alternatives centered on this specific area:

- The Kenai River Alternative, which would have built four new bridges over the Kenai River and one over lower Juneau Creek to avoid this area to the north—essentially the same concept as the "A-line" proposed in 1982.
- The Kenai River Walls Alternative, which would have met existing standards by staying as close as possible to the existing alignment and using "soil nail walls" in an effort to alleviate the problems of unprotected large cuts, as cited in the 1983 geotechnical engineering memorandum. A new analysis by HDR Alaska, Inc. (Grigg and Sheahan 2003), discussed in Section 4.3 below, further underlined the issues raised above.
- The Cooper Creek Alternative, which would avoid this area by climbing up on the bench to the south and creating a high bridge over Cooper Creek.

In addition, the alternatives screening process examined other alternatives that would have avoided this area:

- The "G" alternatives, which avoid this area and the entire community of Cooper Landing to the north and create a new bridge over the Kenai River a half mile west of the MP 49-50.5 area.
- The Juneau Creek alternatives, which avoid crossing to the south side of the river altogether.

The next section discusses the status of those alternatives that were designed to stay on the existing alignment.

# 4.0 STATUS OF EXISTING-ALIGNMENT ALTERNATIVES

## 4.1 Existing Alignment: No Build Alternative

**Description of the No Build Alternative**. The majority of the Sterling Highway is narrow, having only one- or two-foot wide shoulders through the project corridor—and in some cases, no shoulder. It has a low speed alignment and follows valley walls, often situated at the toe of steep slopes, virtually on top of river banks. Some curves on the Sterling Highway, including the MP 49-50.5 area, are consistent with design speeds of 35 and 40 mph. The curving alignment limits traffic capacity by reducing opportunities for safe passing. This is a problem as slow moving vehicles, especially in the busy summer months, result in long lines of traffic. Motorists, who generally have been traveling for long distances, may become frustrated and take chances in passing. Accidents occur and can completely close the highway for extended periods.

A level of service analysis (Lounsbury & Associates 2011) indicated LOS D and E in the design year 2035.

Summer traffic congestion is typical. Through much of the area, the road parallels the Kenai River. Visitors park vehicles along the road, especially near the confluence of the Russian River, reducing the effective width of the traveled way. Vehicles often merge with higher speed through-traffic in areas where sight distance is limited, creating a risk and reducing overall highway speeds. Narrow shoulders pose serious concerns for vehicular emergency pulloffs and pedestrian safety in Cooper Landing and near the Russian River around Sportsman's Landing where recreation users are concentrated.

The 1994 DEIS reported on a crash analysis for years 1988 through 1992. That analysis showed that the curve at the Bean Creek Road intersection (MP 47.5) had nine crashes, which was higher than expected. There were 40 moose road kills between years 1988 and 1992. Three roadway segments between MP 48-50, MP 55-56, and MP 57-59 (representing a total of 3.74 miles) were within the State's top 25 percentile moose crash rate per million vehicle miles. The 2013 Crash Analysis (draft, still in production) provides updated but similar data.

**Status of the No Build Alternative in the SDEIS.** The No Build Alternative will be carried throughout the supplemental DEIS for full analysis. It is considered the basis for comparison of the other alternatives, and it is considered reasonable to choose the No Build Alternative and retain the status quo of the existing highway. However, it is acknowledged that the No Build Alternative does not satisfy the project purpose and need.

## 4.2 Existing Alignment: 3R Alternative

**Description of the 3R Alternative.** The 1994 3R Alternative was created for the MP 37-60 project area, not just the 45-60 project area. The segment between Quartz Creek (MP 45) and Skilak Lake Road (MP 58) looked at preserving the driving surface and analyzing accident crash clusters for cost-effectiveness and safety enhancing solutions temporarily (about 10 years) until the whole project could be reconstructed.

The 1994 3R Alternative would have rehabilitated the existing Sterling Highway primarily on the existing alignment, with minimal improvements to highway geometry (curves, etc.). The two-lane highway would have had a total 36-foot surface width; two 12-foot travel lanes and shoulders six feet wide. There would have been 12-foot passing lanes with a 4-foot shoulder provided in several locations: MP 44-45, MP 51.5-52.5, and MP 55-56. Left-turn lanes would have been constructed at high-use intersections, including Bean Creek Road and Sportsman's Landing. Vehicle pulloffs would have been provided as appropriate. A separated pedestrian safety path was included from MP 45 to MP 55; at pinch points between the bluff and the river, such as the MP 49-50.5 area of concern, this pathway would have been placed immediately behind a guardrail, making the total road and path width about 42-44 feet. This is 18-20 feet wider than the existing road and would have required several large cuts in the MP 49-50.5 area:

- A wall 750 feet long just west of MP 49 (curve 1 area)
- A wall 1,109 feet long on the outside of the bend across from the Kenai Princess Lodge, around MP 49.5 (curves 3-4 area).
- A wall 1,320 feet long just east of Cooper Creek and directly across the Kenai River from the mouth of Juneau Creek, near MP 50.5 (curves 6-7 area).

Other cuts and retaining walls along the edge of the Kenai River would have been required, but these three were the largest.

In the Cooper Landing community, the 1994 EIS described a "north-side frontage road," but it was not illustrated. The frontage road would have separated through traffic (NHS traffic) from local-access traffic visiting Cooper Landing homes and businesses. It is not clear how such a frontage road was envisioned to function (frontage roads more typically exist on both sides of a highway), but any frontage road would presumably be at least the width of the existing highway (24 feet), and the entire 36-foot width of the new 3R highway would have needed to be adjacent to it as well, indicating a total of about 60 feet of pavement width through the center of Cooper Landing, where the entire right-of-way is 65 feet wide. The 60 feet is pavement width only and does not count embankment width, clear zones, and separation requirements between the two roads, pathway, lighting etc. The 1994 DEIS did illustrate a need to purchase new right-of-way along both sides of the existing right-or-way in the MP 48-49 area through the Cooper Landing community.

The bridges at Cooper Landing, Cooper Creek, and Schooner Bend would have been resurfaced but not widened or replaced, making these bridges points of reduced traffic speed.

Elements of a 3R design are in part determined by the safety performance of the existing facility. The actual accident rate for each vertical and horizontal curve is compared to the statistically expected accident rate. When the actual exceeds the predicted rate, improvements are considered. Using this criterion, one low-speed curve—at the Bean Creek Road intersection (MP 47.5)—was determined to warrant improvements under the 3R Alternative. None of the other curves had exhibited accident rates higher than the predicted level. Consequently, improvements to their alignments were not proposed, and other substandard curves would have remained sub-standard.

Environmental impacts included loss of approximately 5 acres of wetlands, and all highway traffic would have continued to be routed through the Cooper Landing community. In addition, the functional life of this alternative was up to 10 years shorter than a new construction or re-construction (4R) alternative, and the 1994 DEIS acknowledged the likely need to further upgrade the highway after about 10 years.

Project costs in 1993 dollars, not including mitigation, were estimated at $29.8 million.

**Status of the 3R Alternative in the Current Supplemental DEIS.** The 3R Alternative was not carried forward for full evaluation in the supplemental DEIS because it did not satisfy the project purpose and need. This determination was based on road geometry: curves, shoulder widths, and clear zones that would have remained deficient. A May 2003 document entitled "Alternative Evaluation: Evaluation Criteria and Alternatives Analysis" stated that the 3R Alternative was "no longer a viable alternative because it would not improve highway geometrics to current standards or adequately improve traffic flow through the Cooper Landing Area." Because the alternative would not meet "current rural principal arterial standards," by definition it would not meet the purpose and need and was therefore not put through the additional screening analysis that was the subject of that document.

Besides the purpose and need issues, the long/high cuts in the unstable soils were not recommended based upon past geotechnical evaluation (see Sections 2.0 and 3.0, above) and the geotechnical evaluation done for the current project. The analysis of the Kenai River Walls Alternative (discussed below in Section 4.3) made clear that there were considerable technical obstacles in the MP 49-50.5 area associated with the large cuts proposed for any alternative that required widening of the road in this area. The issues of cutting into the bluff were the same for the 3R Alternative as for the Kenai River Walls Alternative. The walls would be similarly high (exact heights are not documented in the 1994 DEIS) in the same questionable soils.

The 3R Alternative would provide a short term fix of the roadway surface, and spot repairs at a single accident/crash location that exceeded the predicted value. The current purpose and need statement identifies a desire to improve the Sterling Highway to "rural principal arterial" standards, and the 3R improvement is not consistent with the NHS system requirements. The purpose to serve through-traffic, local community traffic, and traffic bound for recreation destinations, now and in the future, would be accommodated within the local community, but the through-traffic and local traffic would be competing for the same roadway or would have required a frontage road. Construction of a frontage road would effectively result in the purchase and relocation of the very businesses the frontage road would have been intended to serve.

The 1994 DEIS stated that it would be likely that some additional improvements may be required within 10 to 15 years after construction of this alternative. It was expected that the pavement would serve for approximately 10 years, and that follow-on improvements could range from another 3R project to full reconstruction. In short, it had been acknowledged at the time that the 3R Alternative would be unlikely to result in long-term resolution of the identified traffic problems in and near the community. And, although it was carried forward at that time as a "reasonable" alternative for a short-term fix, geotechnical information had recommended against such alignments. For the current supplemental EIS effort, at the time of the 2003 alternatives screening, the 3R Alternative was not considered to be on par with the other alternatives, which all were full reconstruction options (4R) with a design life of at least 20 years.

For all these reasons, the 3R Alternative is not fully evaluated in the current supplemental DEIS.

## 4.3 Existing Alignment: Kenai River Walls Alternative (4R)

**Description of the Kenai River Walls Alternative.** To address the question of using the existing alignment while meeting the project purpose and need, DOT&PF developed the Kenai River Walls Alternative, providing the 4$^{th}$ 'R' to *reconstruct* the Sterling Highway along the existing alignment. The design criteria met current rural principal arterial standards, the same as the other alternatives. The Walls alternative alignment is shown on Figure 3 above and in Figure 4 in Section 4.4.

At the time of development of the initial alternatives around 2001, preliminary design documents indicated all alternatives were based on two 12-foot lanes and "8- to 10- foot shoulders," with early engineering indicating that engineers used wider shoulders or accounted for an adjacent pathway, using a total pavement width of 44 feet. Passing lanes and refinements were to be added later for reasonable alternatives during preliminary engineering refinements (R&M Consultants, 2001). The Kenai River Walls Alternative closely followed the existing alignment, but it included upgrades to all horizontal and vertical road curves to meet current standards.

The Kenai River Walls Alternative employed walls meant to support embankment fills and minimize impact to the river, and meant to stabilize uphill cuts necessary to reduce curves and improve sight distances. Multiple wall types were examined, with "soil nail walls" holding the most promise for the size of cuts proposed. There were three major walls between MP 49 and 50.5 with maximum heights of 132 feet, 135 feet, and 165 feet, with potential to be as high as 200 feet.

The Kenai River Walls Alternative was conceptualized as a variation on the Kenai River Alternative (also originally known as the "A-line" from the 1982 DEIS). That alignment crossed the Kenai River with four new bridges in close succession across bends of the river, plus a new bridge over Juneau Creek near its mouth. The environmental impacts to the Kenai River and its surroundings, along with the construction costs of so many bridges, made this alternative rate poorly with the public, agencies, and project engineers. (It was found to be not reasonable in the 2003 alternatives screening process). The Kenai River Walls Variant was intended to remain on the existing alignment and create no new bridges over the Kenai River. As with other alternatives, the Walls alternative would have replaced the existing Cooper Landing Bridge at Kenai Lake and the Schooner Bend Bridge.

Approximately 2.6 acres of wetlands and 185 acres of vegetated habitats would have been impacted directly. Roadway widening and wall construction would have displaced wildlife in these habitats and increased the fragmentation of habitat and the interruption of migration corridors. Line-of-sight and visibility would be improved and could help to reduce the occurrence of animal/vehicle collisions.

Construction costs were estimated to be $120 million in the 2003 document. The annual wall maintenance costs were expected to be substantial, adding $97,570 per year (approximately 10% of construction costs over a 50-year design life). Overall annual maintenance costs were $205,090.

**Status of the Kenai River Walls Alternative in the EIS.** A substantial examination of wall solutions found just as many problems with walls as open cut slopes. With wall heights of 165 feet (and potentially as high as 200 feet), the walls would be the height of an 16- to 20-story building, in the range of the Captain Cook Hotel western tower and the Atwood State Office Building,[1] both in downtown Anchorage.

A June 2003 "Soil Nail Walls Assessment, Mileposts 49-50.5" (Grigg and Sheahan 2003) examined the engineering feasibility of supporting the large cuts with a wall. A team of multiple consulting engineers assessed the soil nail walls concept and concluded

> there is no precedent for a wall system of this type and magnitude, particularly for use with the heights proposed. The highest known wall is less than 100 feet. The team does not consider the Soil Nail Wall concept to be technically well suited and cost-effective for the site.
>
> *-Soil Nail Walls Assessment, June 2003*

The memo further stated reasons as follows:

> The HDR team recommends that this type of wall should not be considered for use in the KR-W alignment, particularly not for wall heights tentatively presented. This recommendation is based on the following significant issues:

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[1] http://skyscraperpage.com/cities/?buildingID=37117

- Proposed wall heights (165 feet, 132 feet, and 135 feet [west to east]) are 1½ to 2 times higher than any Soil Nail Wall built to date.
- Cuts may be as tall as 200 feet and would present considerable geotechnical risk.
- The excavation of 1.5 million cubic yards has not been addressed.
- Considering costs of inflation, Alaska price impacts, and uncertainties for soil conditions and heights above any soil nail wall currently designed and built, the wall costs are estimated as much as $154.00 per sf for a cost of $63.6 mill. This does not include the cost of excavation mentioned above.
- The in situ soil properties are unknown.
- The global stability of the bluffs and the stability of high Soil Nail Walls on the bluffs are unknown.
- Constructability and safety are concerns because of the closeness of existing traffic on the road, which is the only road to the Kenai Peninsula.
- The proximity of the proposed walls to the Kenai River and the potential for a catastrophic failure of exposed slopes resulting in material entering the river during construction.

*-Soil Nail Walls Assessment, June 2003*

This was followed by a Sept. 2003 HDR memo reporting further detail on Soil Nail Walls built in Mississippi and internationally, and arrived at the same conclusion (not "technically well suited" and "not cost effective for the site").

The Sept. 30, 2003 Recommendation memorandum reported on 10 preliminary alternatives that had been evaluated against criteria of purpose and need, physical environment, social environment, transportation factors, and cost. The Kenai River Walls Alternative was one of the ten alternatives screened. DOT&PF solicited and received agency and public comment on the evaluation. The recommendation regarding the Kenai River Walls Alternative was as follows:

> Preliminary technical investigations have given rise to substantial engineering feasibility concerns, including the risk of failure of the high walls. Such failure could threaten the Kenai River and the traveling public. Other engineering challenges are associated with the potentially unstable material in areas where there would be large cuts and major wall construction. Maintaining use of the existing highway during construction poses a substantial challenge. Also, there is a lack of material disposal sites for the approximately 1.5 million cubic yards of excess material that would result from excavation for this alternative. The Kenai River Walls Alternative is considered unreasonable because of the unusual engineering challenges, high life cycle costs, potential impacts to the Kenai River and associated natural resources and recreational uses, impacts to cultural resources and private properties, and its relatively poor level of service for traffic in the design year 2025. This alterative is not recommended for further analysis in the SDEIS.

In the second area of concern, within Cooper Landing, through-traffic and local traffic would not be separated nor access driveways minimized, as suggested by AASHTO and by the Alaska Preconstruction Manual for arterials. Traffic impacts would result during the peak summer season from failure of the reconstructed highway to provide separation (e.g., route around the area of concern, or provide frontage roads). Local access would be maintained where possible, although driveways might be moved or combined; if access could not be provided, acquisition of property would be necessary. Without separation of through-traffic and local traffic, access to and within the community would become less convenient as traffic increased over time, and improvement in freight movement would be limited.

Traffic impacts during construction would include closing at least one lane of the highway and intermittent complete closures. Moderate to severe delays could result from construction through the narrow Cooper Landing corridor and through the MP 49-50.5 walls area during the summer tourist season. The complications of construction in the constricted area between the river and the steep, unstable mountain slopes suggests the need for a temporary road around much of the MP 49-50.5 area to accommodate traffic during construction, but there is no good option for locating such a detour.

The Alternatives chapter of the supplemental EIS discusses the Kenai River Walls Alternative as one of the alternatives considered under the National Environmental Policy Act and found not reasonable. Because it was found not reasonable, it is not fully analyzed in the EIS.

## 4.4 Other Alternatives and Avoidance of the MP 49-50.5 Area

### *4.4.1 Alternatives Examined to Avoid the MP 49-50.5 Area*

DOT&PF has examined several alternatives specifically meant to *avoid* the S curves, steep slopes of marginal material, and the river in the MP 49-50.5 area. See Figure 4.

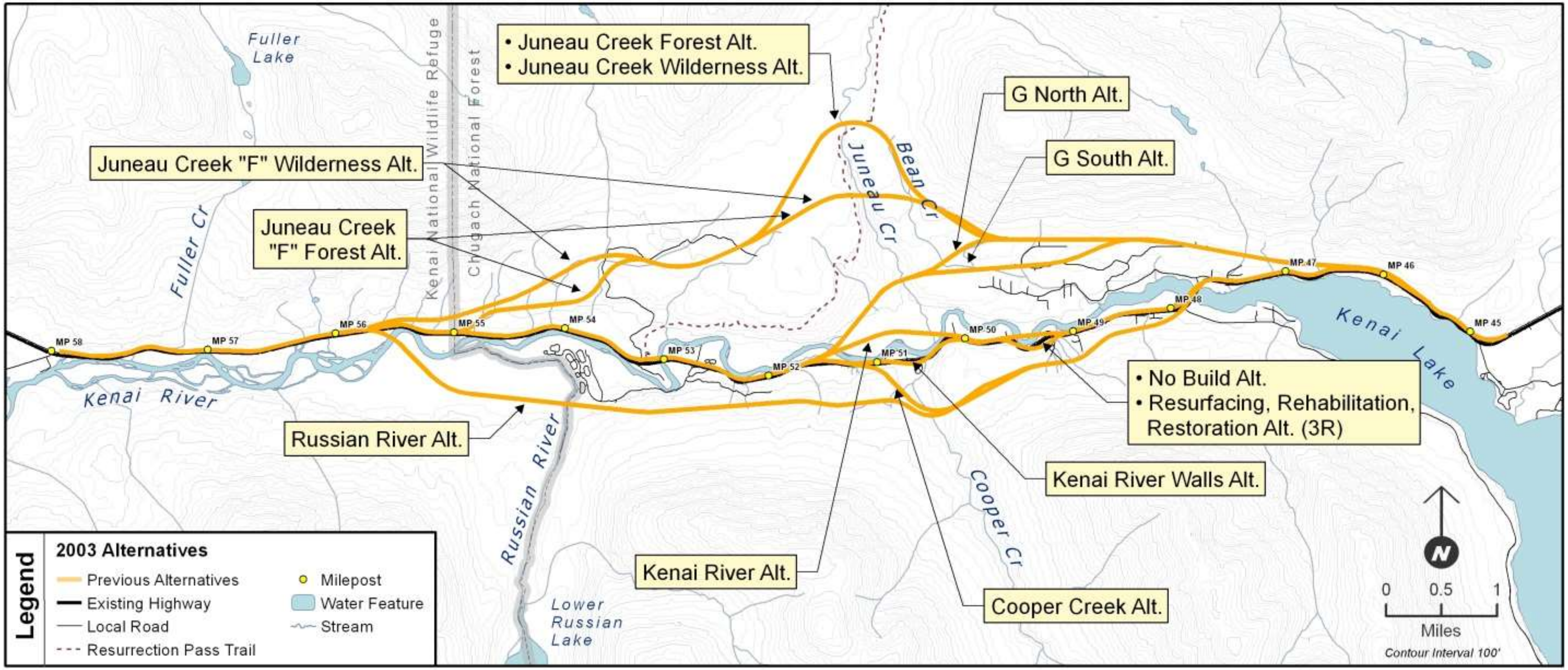


**Figure 4: Alternatives considered in the current supplemental EIS process**

Most the alternatives shown in the figure were found to be not reasonable and were not carried forward for full analysis in the draft supplemental EIS. However, several of them, as shown in Figure 1, have been carried forward. Briefly, the status of the most pertinent alternatives that avoid the MP 49-50.5 area is as follows.

- The Kenai River Alternative: Found not reasonable in the 2003 alternatives screening largely because of impacts to the Kenai River (four new bridges, plus replacement of the two existing bridges), and not carried forward in the supplemental EIS for full analysis. This alternative used about 12 miles of the existing 14-mile alignment.
- The Cooper Creek Alternative: Found reasonable and carried forward for full evaluation in the supplemental EIS. The Cooper Creek Alternative uses about 11 miles of the existing 14-mile alignment.
- The "G" alternatives: The G South Alternative, which avoids the MP 49-50.5 area and the entire community of Cooper Landing to the north, was found reasonable and is fully evaluated in the supplemental EIS. The G South Alternative uses about 8.8 miles of the existing 14-mile alignment.
- The Juneau Creek Alternative and Juneau Creek Variant Alternative: These alternatives were found reasonable and both are carried forward for full analysis in the supplemental EIS. The Juneau Creek Alternative uses about 4.7 miles of the existing 14-mile alignment, and the Juneau Creek Variant Alternative uses about 5.5 miles.

# 5.0 CONCLUSION

In conclusion, DOT&PF has examined continued use of the existing alignment multiple times over 30 years or more, using multiple roadway engineers and geotechnical engineers both inside the agency and among the consulting community, and the conclusion has been consistent. In the MP 49-50.5 area, engineers identified unacceptable risks and complications of widening the highway on its existing alignment in this area. Elsewhere, on the other 12.5 miles of the existing alignment, engineering issues are manageable using standard and proven engineering techniques, and alternatives are being evaluated that use virtually all other portions of the existing alignment. Within the community of Cooper Landing, while there is not the same risk of landslide or other severe physical limitation, use of the existing alignment is unreasonable because of the number of driveways to homes and businesses and the lack of space to accommodate a widened highway-right-of way; in this area, to create a highway that met the purpose and need would require substantial property impacts resulting in major impacts to much of the business area of Cooper Landing.

The issues in the MP 49-50.5 area are considered the most important for the following reasons:

- Any solution to the substandard curves would require large cuts in the hillside.
- The hillside soils are suspected to contain fine-grained soils that would slide when saturated.
- The hillside is known to contain layers where water exists that would seep out at any cut in the hillside.
- If cut, the hillside would require walls to stabilize the soils.

- Internationally, walls have not been built at the heights required here in such poor soils, combined with a wet environment with frequent freeze-thaw cycles.
- The amount of soil to be removed from this one concentrated area could be 1.5 million cubic yards, presenting logistical problems beyond those considered normal or reasonable, and soil removal and wall construction while keeping the highway open would present extraordinary costs.
- Continual release of silt into the Kenai River or catastrophic failure of the slope onto the highway or into the Kenai River would be possible despite the best efforts of the engineers – an unacceptable risk.

Alaska law requires professional engineers, including those overseeing designs of roads and structural walls designed to hold back earth, to be specially trained and registered, and to stamp and sign design drawings with their own professional engineering stamp. The Alaska Administrative Code states:

> A registrant may…approve and seal only design documents and surveys that are safe for public health, property and welfare in conformity with accepted architecture, engineering, land surveying, and landscape architecture standards in Alaska.
>
> -12 AAC 36.185(a)(2)

In short, in the MP 49-50.5 area it may be difficult to complete a final design on the existing alignment that registered professional engineers would stamp and certify as safe in conformance with accepted engineering standards.

For this reason, DOT&PF has presented alternatives that avoid the MP 49-50.5 area, as recommended by the engineers, but that use varying lengths of the existing alignment.

- The Cooper Creek Alternative avoids the primary area of concern (MP 49-50.5) to the south. It does not entirely avoid the second area of concern within the community of Cooper Landing. It uses about 11 miles of the 14-mile existing alignment.
- The G South Alternative avoids both areas of concern entirely by routing to the north. It uses about 8.8 miles of the existing alignment.
- The Juneau Creek Variant Alternative avoids both areas of concern entirely by routing to the north. It uses about 5.5 miles of the existing alignment.
- The Juneau Creek Alternative avoids both areas of concern entirely by routing to the north. It uses about 4.7 miles of the existing alignment.

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# 7.0 NOTES

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# 1.0 [i] END NOTES:

# 2.0 THE STERLING HIGHWAY AND THE PROJECT DEVELOPMENT PROCESS FOR 3R AND 4R PROJECTS

These notes describes the typical project development process of the Alaska Department of Transportation and Public Facilities (DOT&PF) and addresses how state project engineers decide whether a project is to be a Rehabilitation, Restoration, Resurfacing project ("3R") or Rehabilitation, Restoration, Resurfacing, and *Reconstruction* project ("4R"). The information includes substantial history from the Federal Highway Administration (FHWA) online history pages regarding the federal Highway Trust Fund and project development process information from the *Alaska Preconstruction Manual* (DOT&PF, updated periodically).

## 2.1 Highway Trust Fund

The federal Highway Trust Fund, established originally in the 1956 Highway Revenue Act, is a dedicated source of money established to construct and expand a federally-funded highway system throughout the United States and its territories. The primary mission was to construct transportation facilities in accordance with uniform standards, which would provide for a familiar, consistent infrastructure network across the nation. As the highway system developed, highway planners and decision makers would designate a particular location for a new highway, or would designate a stretch of existing roadway, that would be constructed to the adopted standards.

For many years, federal monies were limited to new construction of the highway system, or reconstruction of old state or country roads to highway standards; preservation and maintenance of the system once built was the responsibility of the state highway agencies. By 1975 it became evident that many sections of the existing federally-funded highway system were reaching the ends of their design lives, and the rate of deterioration was exceeding the state funding available for preservation.

In recognition of the problem, Congress passed the *1976 Federal-Aid Highway Act* and broadened the term "construction" to include "resurfacing, restoration, and rehabilitation" (3R) to develop a program that provided for cost-effective improvements and enhanced highway safety (23 USC 101(a)). The intent of this legislation was to permit the use of federal funding to rehabilitate present highways to extend their useful life spans without necessarily improving their existing geometrics.

The *1982 Surface Transportation Assistance Act* reemphasized the safety aspect by stating that 3R projects "...shall be constructed in accordance with standards that preserve and extend the service life of the highways and enhance highway safety." The principal objective of a 3R project, then, is to restore the structural integrity of the existing roadway, thereby preserving and extending the useful life of the facility. The primary goals of 3R projects are to provide a better riding surface, increase safety, and improve operating conditions, to the extent practical without full reconstruction (building an entirely new road in the place of or instead of the old road). The existing right-of-way was expected to be adequate to accomplish these 3R improvements, but in some cases, easements or minor right-of-way acquisitions were allowed. Economic considerations were a major factor in determining the scope of a 3R project. When funding permitted, construction of new connections within the national network of primary highways or reconstruction of older sections to bring them to current standards (4R) was recognized as the principal goal of the highway network.

## 2.2 National Highway System

The Interstate Highway System was authorized in 1956, a network of controlled-access roadways across the nation (including Alaska and Hawaii) for the movement of people and goods. FHWA mandated the adoption of universal standards by the state highway agencies, and the American Association of State Highway Officials (AASHO, now "AASHTO," for Highway *and Transportation* Officials) defined a set of standards for these roadways. This network was expanded to include intermodal connectors and other principal arterials, and is now known as the National Highway System (NHS).

NHS routes serve as the essential connectors between the population centers, economic centers, military bases, and intermodal centers (such as airports, shipping ports, and ferry terminals). In Alaska, the Seward and Sterling Highways are NHS routes and are the only road links between the Kenai Peninsula and the rest of the Alaska and the rest of the NHS.

The 142-mile Sterling Highway, completed in 1950, was later designated as part of the NHS system. Alaska Highway 1 is the Sterling Highway beginning in Homer and passing through Anchorage (as the Seward and Glenn Highways), Glenallen, and Tok to connect with the Alaska Highway and, through Canada, with the remainder of the NHS in the Lower 48 states. The section between Soldotna and Anchorage that passes through Cooper Landing and the project area is Interstate A3, part of the original Eisenhower Interstate System.

As such, all formal improvements are expected to meet the AASHTO standards (*A Policy on Geometric Design of Highways and Streets*, updated periodically) for the functional classification of the roadway, as supplemented by the DOT&PF current edition of the *Highway Preconstruction Manual*. In this case, the functional classification of the Sterling Highway is Rural Principal Arterial. Less formally, this means "rural highway" as distinguished from smaller roads.

### *2.2.1 Project Determination*

Once state transportation planners and engineers determine a segment of highway has problems beyond those addressed by normal maintenance, it is entered into the planning process to confirm need and is ranked for priority. At the same time, DOT&PF management makes a determination about the level of available funding and degree of improvement–a 3R or 4R project. In short, they are asking whether this part of the highway system can get by with a surfacing replacement with spot improvements, or a whether major reconstruction of the whole segment is required. This decision is usually based upon accident history, traffic demand, and public concern, among other factors.

### *2.2.2 Design Decisions*

Typically, highway designs are dictated by the functional classification, anticipated future traffic counts, and recent crash reports. DOT&PF memorializes these in two documents; the *Project Design Designations* (functional class and traffic counts) and the *Project Design Criteria* (design standards). Once approved, these form the basis of all future design alternatives.

Usually a 3R project is a short term fix until enough funding can be identified for the longer term repair. Generally speaking, 20-year design traffic projections are applied only to full reconstruction projects (4R), while 10-year traffic volumes are applied to 3R projects. Alaska law [AS 19.10.160(b)] mandates that new projects or major upgrades estimated to cost less than $5 million must be designed to adequately serve planned future traffic for at least 10 years; projects estimated to cost $5 million or more must be designed to adequately serve planned future traffic for at least 20 years.

A 3R project focuses on the wearing surface to extend driving comfort, and engineers will review accident data over the previous 10 years to see if there were crash locations or clusters where special effort should be made to improve the road. Historical accident rates are compared against predicted accident rates, and costs for repairs are reviewed in an analysis of cost-effectiveness. Cost-effective safety improvements may be included in the 3R design package.

A 4R project uses traffic counts and traffic projections to determine the typical section (number of lanes) for the work, and the road classification (such as Rural Principal Arterial) dictates the standards by which the design will be prepared.

### *2.2.3 Controlled Access*

Another DOT&PF consideration during preliminary design is the difficult balance of *mobility* versus *access*. The major purpose of the arterial system is to provide efficient mobility on a region-wide scale. Roadways of lesser classifications (for example, collectors) connected to the arterial provide the *access* component for the traffic, distributing traffic from the arterial through collectors to local streets and individual driveways. Arterial highways emphasize movement of traffic and often provide full control of access.[i] Full control of access typically means that DOT&PF may purchase access rights from adjacent landowners to prohibit connection to the highway and that DOT&PF designates only specific connections to other highways or cross streets. Typically, such connections are made only via off-ramps and on ramps to allow for adequate acceleration and deceleration—again avoiding safety problems and maintaining the flow of through traffic as the priority.

By minimizing the side conflicts or interference with the through trips, a higher level of service can be provided by arterial highways. Effective access management can increase capacity 25-45 percent, decrease crash rates by up to 50 percent, reduce fuel consumption by 35 percent, and reduce travel time and delay by 40-60 percent when compared with similar uncontrolled roadways (National Highway Institute 2002). AASHTO says that failure to manage access is the major cause of highway obsolescence, and recommends access control on any new facility where the likelihood of development exists. To prevent future congestion from uncontrolled access, and to reduce the need for future costly highway reconstruction, a new corridor typically is protected with the controlled-access designation.

The goal therefore for any new portions of the Sterling Highway in the MP 45-60 project area is to establish full control of access to restrict the development of driveways and side streets that might otherwise connect to the highway over time. Such controls of access were not established when the existing Sterling Highway was constructed in the 1950s. As result, the existing highway through the Cooper Landing community and nearby recreational facilities developed numerous conflict points which raise the risk of crashes and create unwanted delays, which creates part of the foundation for the purpose and need for this project.

# 3.0 [ii] END-NOTES: BACKGROUND REGARDING 3R AND 4R PROJECTS

## 3.1 Definitions of 3R, 4R, and Existing Alignment

The existing alignment of the Sterling Highway is a known entity—a road with a specific width, number of lanes, shoulders, speed limits signs, curves, hills, and so on. However, "use of the existing alignment" as an alternative for this project could mean more than one thing. The following outlines the transportation engineering options, with reference to the *Alaska Preconstruction Manual* (DOT&PF 2005), which throughout distinguishes between standards[ii] for "construction or reconstruction" projects and Alaska DOT&PF performance standards for "rehabilitation" projects, which are defined as 3R projects. Further discussion of the history of 3R and 4R terminology and concepts appears in the Appendix.

## 3.2 No Build Alternative

The No Build Alternative is the option of retaining the existing alignment exactly as it is. The width, lanes, shoulders, speeds, curves and other elements of Sterling Highway as it is today would remain. Continued maintenance is assumed, including repaving at long intervals (example: every 10 years) and bridge replacement at still longer intervals (bridge design life typically is 50 years or more). From a new-construction standpoint, the No Build Alternative is the option of doing nothing. By law, doing nothing is a reasonable alternative and is analyzed thoroughly in the EIS along with any "build" alternatives.

### *3.2.1 Resurfacing, Rehabilitation, and Restoration—3R*

"RRR" or "3R" stands for "resurfacing, rehabilitation, and restoration." This designation comes from a series of federal highway funding laws. According to FHWA online history pages,[ii] Congress added 3R projects to the definition of the types of "construction" that would be funded by the federal government in the Federal Aid Highway Act of 1976. Instead of funding only new construction, the act provided funding for resurfacing, rehabilitating, or restoring an existing highway. As defined in the *Alaska Preconstruction Manual* (DOT&PF 2005), 3R means "an interim maintenance or restoration of an existing roadway on the same alignment (or) modified alignment to the performance standards (3R) of the *Preconstruction Manual.*" This is more fully defined in a 3R chapter:

> Rehabilitation (3R) projects consist of resurfacing, restoration, and rehabilitation of an existing roadway on the same alignment or modified alignment. The principal object of a 3R project is to restore the structural integrity of the existing roadway, thereby extending the service life of the facility… Generally, a 3R project consists of repaving or the asphalt paving of an existing gravel surface. It can also include drainage improvements and reconstruction of the structural section. Safety enhancements include improvement of deficient geometry[ii] identified by a performance criterion found in this section (of the *Preconstruction Manual*). Capacity enhancements include the addition of truck climbing lanes, passing lanes, and slow moving vehicle lanes. Turnouts may be added as safety enhancements where driver fatigue or sightseeing are factors in accidents.

The 1994 Sterling Highway draft EIS presented an alternative called simply the "3R Alternative." It was in the context of a project with longer project limits (MP 37 to MP 60, rather than 45-60).

## 3.3 Reconstruction—the 4th R

In the Federal Aid Highway Act of 1981, Congress added "Reconstruction" of existing federal-aid highways to the construction actions that could be funded. This typically included rebuilding existing highways to add lanes or interchanges—much more major work to existing highways than is allowed under "3R." As defined in the *Alaska Preconstruction Manual* (DOT&PF 2005), reconstruction is "a major highway improvement that completely rebuilds an existing roadway, or constructs a roadway on a new alignment, to the contemporary design standard of the *AASHTO A Policy on the Geometric Design of Highway and Streets 2001*, and the *Alaska Preconstruction Manual*."

The Cooper Creek, G South, Juneau Creek, and Juneau Creek Variant alternatives (the reasonable "build" alternatives investigated in the Sterling Highway SEIS) all are considered to be 4R alternatives. They would completely reconstruct a portion of the Sterling Highway that is about 14 miles long. Long portions would be located directly on the existing alignment, but each of the build alternatives would depart from the existing alignment for varying distances—3 to 9 miles, depending on the alternative. The process of determining alternatives for the SEIS included another 4R alternative that remained substantially on the existing alignment for all 14 miles—the Kenai River Walls Alternative. The Walls alternative is described in the main body of the memo.