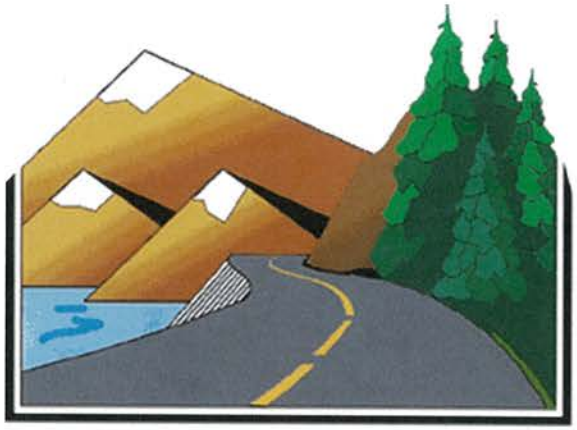
Preliminary Engineering Report



STERLING
HIGHWAY MILE POST 45 TO 60
ALASKA

Prepared for:

State of Alaska
Department of Transportation and
Public Facilities

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
DOT&PF	Alaska Department of Transportation & Public Facilities
ADT	Average Daily Traffic
BOP	Beginning of Project
cy	Cubic Yards
DHV	Design Hourly Volume
EOP	End of Project
ft.	Feet
K	Thousand
KNWR	Kenai National Wildlife Refuge
k-value	Rate of Vertical Curvature per Change in Grade
Max.	Maximum
Min.	Minimum
MP	Milepost
M.S.	Material Site
PCM	*Alaska Preconstruction Manual*
Pg	Page
QCR	Quartz Creek Road
ROW	Right-of-Way
SLR	Skilak Lake Road
w/o	Without

EXECUTIVE SUMMARY

The Sterling Highway Milepost 45 to 60 Project includes the area between just east of the Quartz Creek Road intersection and just west of the Skilak Lake Road intersection. This report summarizes the preliminary design for the following project alternatives: Cooper Creek, G South, Juneau Creek, and Juneau Creek Variant, shown in Figure A.

All build alternatives consist of a two-lane highway with paved shoulders, passing lanes, and turning lanes. All travel lanes, right-turn lanes, and passing lanes are designed to be 12 feet wide with left-turn lanes 16 feet wide; shoulders are designed to be 8 feet wide. Fill slopes are designed at 6:1 to provide a reasonable recovery zone for errant vehicles. In locations where this 6:1 slope is impractical or impossible due to various design considerations, a 2:1 slope is provided with guardrail due to the adjacent untraversable sideslope. Riprap is also provided in some of these locations to protect the road from erosion.

In some locations, retaining walls have been incorporated into the design in an effort to minimize sliver cuts, maintain slope limits within the existing right-of-way (ROW), limit impacts to cultural resources, limit impacts to the Kenai River, and reduce large cuts and fills.

The Cooper Creek Alternative diverges from the existing highway the farthest south of the three build alternatives. From west to east, the alignment crosses a proposed replacement bridge at Schooner Bend, then crosses a proposed new bridge structure over Cooper Creek before crossing a proposed replacement bridge over the outlet of Kenai Lake (Cooper Landing Bridge). From the Cooper Landing Bridge, the alignment rejoins the existing Sterling Highway just east of the Bean Creek Road intersection, with minor alignment improvements included between Bean Creek Road and Quartz Creek Road. The Cooper Creek Alternative is expected to have the highest cost for ROW acquisition, utility relocation, and the second-highest estimated construction cost of the build alternatives.

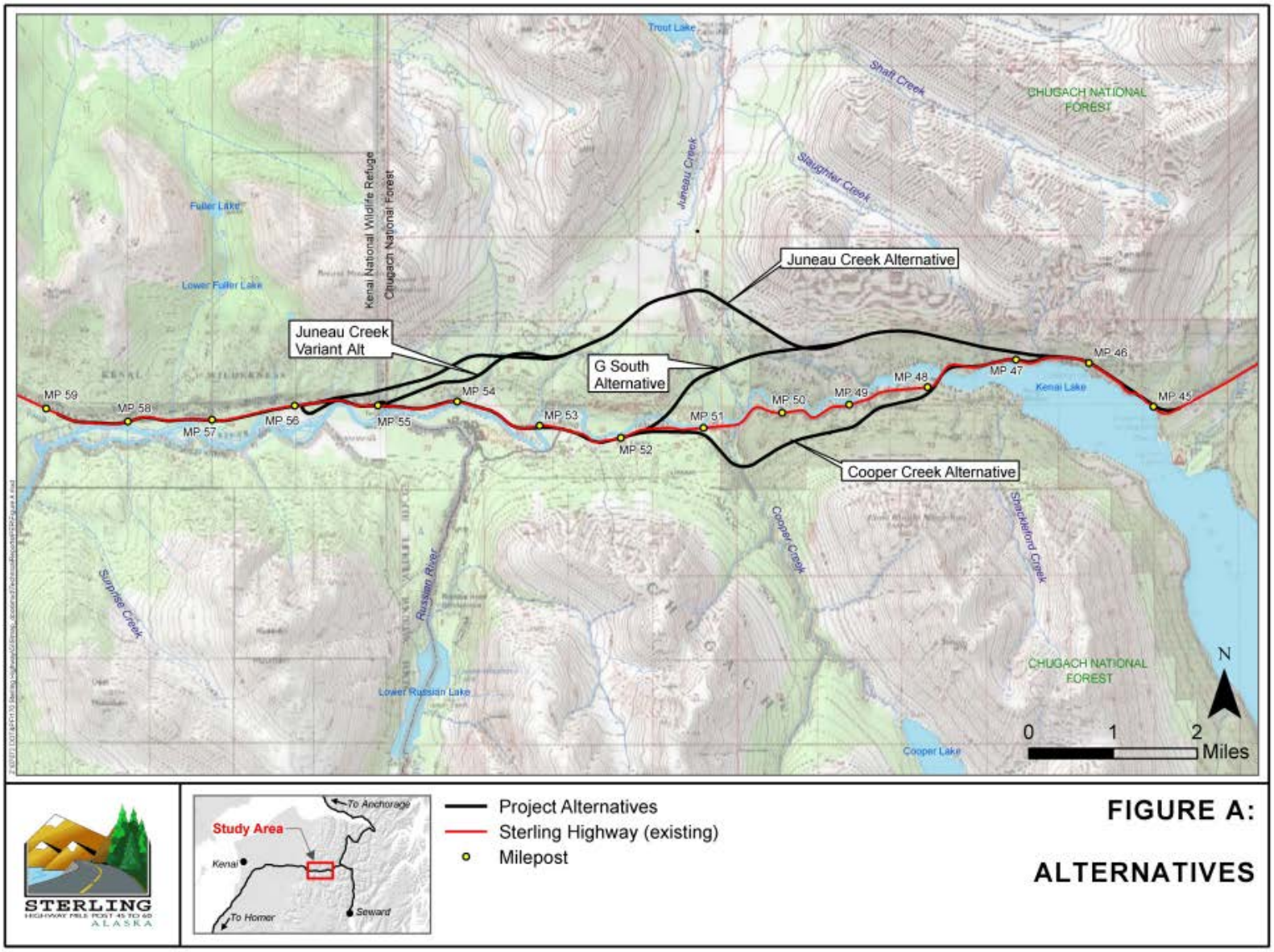
The G South Alternative alignment is identical to the Cooper Creek Alternative until both cross the proposed replacement bridge structure at Schooner Bend, at which point the G South Alternative alignment diverges north. The alternative then crosses proposed new bridges over the Kenai River and Juneau Creek. The alignment rejoins the existing roadway alignment approximately 1 mile east of the Cooper Landing Bridge, with minor alignment improvements to east of the Quartz Creek Road intersection. This alternative is expected to have similar ROW acquisition and utility relocation cost when compared to the Juneau Creek Alternative and Juneau Creek Variant Alternative. Construction cost for the G South Alternative is estimated to be the highest of the three build alternatives.

The Juneau Creek Alternative is the northernmost alternative. The alignment diverges from the G South and Cooper Creek alignments approximately 1.2 miles west of Sportsman's Landing, climbing out of the Kenai River valley and crossing a proposed new bridge structure over Juneau Creek below the Juneau Creek Falls before rejoining the G South Alternative, where both alignments are identical until the eastern project terminus. The Juneau Creek Alternative is expected to have similar ROW acquisition and utility relocation costs when compared to the G South Alternative and the Juneau Creek Variant Alternative. The Juneau Creek Alternative also has the lowest estimated cost of construction. The alternative impacts the Kenai National Wildlife Refuge (KNWR) and a portion of Federally designated Wilderness.

The Juneau Creek Variant Alternative was developed to avoid impacts to Federally designated Wilderness. The alignment diverges from the Cooper Creek and G South alignments approximately 0.8 mile west of Sportsman's Landing, approximately at the KNWR eastern boundary. It includes a small bridge structure over a loop ramp that connects to the existing Sterling Highway before climbing out of the Kenai River valley and rejoining the Juneau Creek Alternative west of the proposed new Juneau Creek Bridge. From there, the alignments are identical to the east project terminus. This alternative is similar to the Juneau Creek Alternative with respect to ROW acquisition and utility relocation costs; however, it is estimated to have higher construction cost than the Juneau Creek Alternative, but lower cost than the Cooper Creek and G South alternatives.

Table ES-1: Project Construction Costs by Alternative (millions of dollars)

Cost Feature	Alternatives			
	Cooper Creek	**G South**	**Juneau Creek**	**Juneau Creek Variant**
Basic roadway costs	$92.6	$92.3	$96.5	$97.6
Bridge and structure costs	$78.5	$89.2	$52.4	$55.8
Contingency (20%) and construction administration (15%)	$65.0	$69.0	$56.6	$58.3
Construction Subtotal	**$236.2**	**$250.4**	**$205.4**	**$211.6**
Permitting , design, utility, right-of-way, Indirect Cost Allocation Plan (ICAP)	$54.5	$53.1	$44.2	$45.4
Grand Total	**$290.7**	**$303.5**	**$249.6**	**$257.0**


Juneau Creek Alternative
Juneau Creek Variant Alt
G South Alternative
Cooper Creek Alternative
MP 59
MP 58
MP 57
MP 56
MP 55
MP 54
MP 53
MP 52
MP 51
MP 50
MP 49
MP 48
MP 47
MP 46
MP 45
Trout Lake
Shaft Creek
CHUGACH NATIONAL FOREST
Juneau Creek
Slaughter Creek
Fuller Lake
Lower Fuller Lake
Kenai National Wildlife Refuge
Chugach National Forest
Kenai Lake
Sunrise Creek
Russian River
Lower Russian Lake
Cooper Creek
Shackleford Creek
Cooper Lake
N
0 1 2 Miles
STERLING
HIGHWAY MILE POST 45 TO 60
ALASKA
Study Area
To Anchorage
Kenai
To Homer
Seward
Project Alternatives
Sterling Highway (existing)
Milepost
FIGURE A:
ALTERNATIVES

1.0 INTRODUCTION

The Sterling Highway Milepost (MP) 45 to 60 Project begins at MP 45, just east of the Quartz Creek Road (QCR) intersection and ends at MP 58, just west of the Skilak Lake Road (SLR) intersection. This report (supplemented by the plans attached in Appendix A) summarizes the preliminary design for the Cooper Creek, G South, Juneau Creek, and Juneau Creek Variant alternatives, as shown in Figure A. This report is based on a Preliminary Engineering Memorandum prepared for the Cooper Creek, G South, and Juneau Creek alternatives in March 2006 by R&M Consultants, Inc. This Preliminary Engineering Report and associated drawings have been developed following the standard engineering procedures of stationing the project west to east (from Skilak Lake Road to Quartz Creek Road).

2.0 ALIGNMENT INFORMATION

Design of the build alternatives was based on the Alaska Department of Transportation and Public Facilities (DOT&PF) 1994 *Sterling Highway MP 37-60 Draft Environmental Impact Statement and Section 4(f) Evaluation*, R&M Consultants, Inc. 2006 *Preliminary Engineering Memorandum, Sterling Highway, MP 45-60,* preliminary and conceptual engineering documents created in 1989 and 1991, and subsequent geotechnical evaluations of an early variation of the Juneau Creek Alternative (Juneau Creek Crossing "F" Alternative).

The Cooper Creek and G South alternatives, from the west project terminus to the location where they depart from the existing Sterling Highway, are based upon conceptual drawings created in 1989 for the Kenai River Alternative (an earlier considered and dismissed alternative).

The Juneau Creek Alternative is based upon conceptual drawings and preliminary engineering created in 1991 for the Juneau Creek Alternative, Wilderness Variant, with a deviation at the location of the Juneau Creek crossing.

The Juneau Creek Variant Alternative is the same as the Juneau Creek Alternative with a deviation between Sportsman's Landing and Station 1554+13. It was designed to avoid Federal Wilderness in the Kenai National Wildlife Refuge (KNWR).

Modifications during preliminary engineering included revising alignments to conform to current design criteria; incorporating turning and passing lanes; and incorporating preliminary geotechnical recommendations into the design. Horizontal and vertical alignments were revised to minimize wetland impacts as well as to reduce cut and fill quantities, retaining wall heights, and impacts to the Kenai River.

Geotechnical information utilized in preliminary engineering and analysis included:

- *1989 Sterling Highway MP 37-60 Preliminary Location Study*, DOT&PF;
- *1989 Sterling Highway MP 37-60 Engineering Geology and Soils Report*, DOT&PF;
- *1991 Reconnaissance Geotechnical Report*, Sterling Highway MP 37–60 (Alternative 5), DOT&PF;
- *2001 Preliminary Geotechnical Memo, Cooper Creek Alternative, Sterling Highway MP 45–60,* R&M Consultants, Inc.;
- 2004 General field observations, R&M Consultants, Inc.; and

- *2005 Preliminary Rock Stability Investigation, Sterling Highway MP 45 to 60, Juneau Creek Crossing "F" Alternative*, R&M Consultants, Inc.

Cultural resource information utilized in preliminary engineering and analysis included:

- *2010 Archeological Field Survey of the Sterling Highway Project Milepost 45 to 60*, Cultural Resource Consultants LLC

Traffic analysis information used in preliminary engineering and analysis included:

- 2003 Sterling Highway MP 45 to 60, *Traffic Analysis Memorandum*, HDR Alaska, Inc.
- 2011 Sterling Highway MP 45 to 60, *2011 Traffic Study Update Draft*, Lounsbury & Associates, Inc.

3.0 DESIGN CRITERIA

The design criteria for this project conform to the DOT&PF January 1, 2005 *Alaska Preconstruction Manual* (PCM) and to the American Association of State Highway and Transportation Officials (AASHTO) guidelines. Design criteria used for preliminary engineering and analysis are included below, in Table 1.

Table 1: Project Design Criteria

Element	Value	Source
Functional Classification	Rural Principal Arterial	AASHTO 2004, pg. 8
Design Year	2043	
Present Year ADT	2,950 (AADT)	Sterling Hwy MP 45-60, 2014 Traffic Study Update
Design Year ADT	4,000 (AADT)	Sterling Hwy MP 45-60, 2014 Traffic Study Update
Design Hourly Volume (DHV)	800 (100HV)	Sterling Hwy MP 45-60, 2014 Traffic Study Update
Directional Split (%D)	65/35	Sterling Hwy MP 45-60; 2002 Traffic Data Col. Rpt
Trucks (%T)	18	Sterling Hwy MP 45-60, Traffic Data Collection Rpt.
Pavement Design Year	2043	Alaska Flexible Pavement Design Manual, Section 2.1
Design Vehicle	AASHTO WB-67	Memo 6/1/00, Duane Doerflinger, DOT&PF
Design Speed/Terrain	60 mph/Mountainous	AASHTO 2004, pg. 67/231
Stopping Sight Distance Passing Sight Distance	570 ft. (minimum) 2135 ft. (minimum)	AASHTO 2004, pg. 445, Exhibit 7-1
Allowable Grade Max/Min	6% Maximum / (0%)	AASHTO 2004, pg. 446, Exhibit 7-2 / pg. 236
Min. Radius of Curvature	1340 ft. (minimum) (6% Superelevation)	AASHTO 2004, pg. 147, Exhibit 3-15
Minimum K Value for Vertical Curves	Crest: 151 (minimum) Sag: 136 (minimum)	AASHTO 2004, pg. 272, Exhibit 3-73 AASHTO 2004, pg. 277, Exhibit 3-75

Element	Value	Source
Number of Roadways	One	
Width of Traveled Way	24 ft. (two 12 ft. lanes)	AASHTO 2004, pg. 448, Exhibit 7-3
Width of Shoulders	8 ft.	AASHTO 2004, pg. 448, Exhibit 7-3
Surface Treatment	Asphalt Concrete (AC)	
Side Slopes Ratios	Foreslopes 4:1 (Max. w/o Guardrail) Backslopes 2:1 (Outside Clear Zone)	PCM Section 1130
Degree of Access Control	Access management/Partial control in acquisition areas	
Illumination	Major Intersections	1984 AASHTO Informational Guide for Roadway Lighting, Memo ADOT&PF 1/21/1999
Curb Usage and Type	None	
Bicycle Provisions	Shoulders	PCM Section 1210
Pedestrian Provisions	Shoulders	
Passing Lane Width	12 ft.	
Vertical Clearance	16.5 ft.	PCM Section 1130, Table 1130-1
Clear Zone	30 ft.	PCM Section 1130, Table 1130-2

4.0 TYPICAL SECTION

Each preliminary build alternative consists of a two-lane highway with paved shoulders, passing lanes, and turning lanes.

- Travel lanes are 12 feet wide
- Passing lanes are 12 feet wide
- Paved shoulders are 8 feet wide
- Typical fill sections: 6:1 foreslopes for 22 feet, then “barn roof” to 2:1 slopes
- Typical cut sections: 6:1 foreslopes for 22 feet, then 2:1 backslopes
- Typical guardrail sections: 2:1 fill slopes or 1.5:1 riprap slopes
- Ditch depths are 3.7 feet
- Maximum retaining wall height in fill sections is approximately 40 feet
- Maximum retaining wall height in cut sections is approximately 40 feet
- Typical rock excavation sections have 4:1 foreslopes for 14 feet, then 10 feet flat bottom ditch and 0.25:1 rock cut slopes

Rock typical sections were developed following the guidance of previous reports and memos.

Retaining walls were conceptually designed with a 10:1 batter.

Typical sections for each alternative can be found in Appendix A.

4.1 Lane Widths

Roadway lane widths are influential to the safety and comfort of driving. Following the guidance of the AASHTO Green Book, 2001 Chapter 4, travel lanes have been designed to be 12 feet wide. This will provide desirable clearance for opposing traffic and increase the level of service of the new roadway. All passing lanes have also been designed to be 12 feet wide, following AASHTO guidelines.

4.2 Shoulders

The shoulder is the "portion of the roadway contiguous with the traveled way that accommodates stopped vehicles, emergency use, and lateral support of the sub-base, base, and surface courses" as defined by the AASHTO Green Book, 2001 Chapter 4. For this project it has also been designed to safely accommodate bicycle and pedestrian traffic. As this project involves a rural arterial in mountainous terrain, it is acceptable to utilize shoulder widths less than the AASHTO preference of 10 feet. With that in mind, a shoulder width of 8 feet has been selected, which provides the adequate separation from traffic and sufficient width, with rumble strips, for safe bicycle and pedestrian use.

4.3 Sideslopes

Sideslopes are "designed to ensure roadway stability and to provide a reasonable opportunity for recovery for an out-of-control vehicle" according to AASHTO. A vehicle can negotiate a slope of 6:1 or less with a high chance of recovery, and thus is the desirable sideslope ratio. Where practical, 6:1 sideslopes have been provided in the design of the alternatives to provide a reasonable recovery area prior to the transition to a more cost-effective 2:1 slope. On more significant fills, a 2:1 fill slope, protected by guardrail, has been incorporated into the design to reduce earthwork quantities as well as to reduce impacts to area resources.

5.0 INTERSECTIONS

Major intersection design for the build alternatives incorporates left and right turn lanes. Turning lanes have been designed according to AASHTO Green Book recommendations, which advise 12 feet of lane width be used on right-turn lanes and 16 feet of width on left-turn lanes to accommodate desirable separation from opposing through-traffic.

The major intersections include:

- Skilak Lake Road (tee intersection for all build alternatives, approximately Station 1235+00)
- Sportsman's Landing (tee intersection, Cooper Creek and G South alternatives, approximately Station 1433+20; grade separated intersection, Juneau Creek Variant Alternative , approximately Station 1431+00)
- Russian River Campground (4-way intersection, Cooper Creek and G South alternatives, approximately Station 1556+40)
- Snug Harbor Road/Existing Sterling Highway (4-way intersection, Cooper Creek Alternative, approximately Station 1803+00)
- Bean Creek Road (tee intersection, Cooper Creek Alternative, approximately Station 1819+50)

- Quartz Creek Road (tee intersection, all alternatives, approximate station varies from 1957+00 to 1965+00)
- All intersections linking the existing Sterling Highway to the build alternatives (tee intersections; stations vary depending on alternative)

6.0 TRAFFIC ANALYSIS

Traffic analysis was performed by HDR Alaska, Inc. and Lounsbury & Associates, Inc. Additional traffic information is included in the *Sterling Highway MP 45 to 60, Traffic Analysis Memorandum* (2003) and *2014 Traffic Study Update* (Feb. 2014).

7.0 BRIDGE STRUCTURES

Bridge design information is included in the *Sterling Highway MP 45 to 60, Preliminary Bridge Structure Technical Report* prepared by HDR Alaska, Inc. in August 2010. Geotechnical investigations were limited to a preliminary rock stability field investigation where the Juneau Creek Alternative crosses the Juneau Creek Canyon.

8.0 EARTH RETAINING STRUCTURES

Locations where retaining wall structures are recommended have been identified through the preliminary design process. Specific structure types have not yet been selected or designed. Further geotechnical investigation will be required prior to final retaining wall type determination and design.

9.0 BUILD ALTERNATIVES

Stationing for the four build alternatives begins at Station 1225+00, just west of the Skilak Lake Road intersection, and ends just east of the Quartz Creek Road intersection (end of project station varies with the three build alternatives). Each build alternative follows an identical alignment, essentially along the existing highway, from the beginning of project (Station 1225+00) to Station 1365+00 (approximately 1.2 miles west of Sportsman's Landing).

At Station 1365+00, the Juneau Creek Alternative alignment diverges north from the existing highway and climbs out of the river valley. The Juneau Creek Alternative Variant diverges from the Juneau Creek Alternative at approximately Station 1386+86, veering in a more easterly direction before rejoining the Juneau Creek Alternative alignment at approximately Station 1554+13.

Between Stations 1365+00 and 1595+00, the Cooper Creek and G South alternatives are identical, continuing along the existing highway corridor. At Station 1595+00, the alignment for the G South Alternative diverges to the north, crossing the Kenai River and climbing out of the river valley. Just east of Station 1595+00, the Cooper Creek Alternative diverges south from the existing roadway corridor, crossing Cooper Creek while climbing out of the river valley. The Cooper Creek Alternative then rejoins the existing highway corridor at the Cooper Landing Bridge, then closely follows the existing highway corridor to the east project terminus. The Juneau Creek, Juneau Creek Variant, and G South alternatives all horizontally rejoin at approximately Juneau Creek Alternative Station 1748+00 and follow identical alignments from this station to the east project terminus.

9.1 Build Alternatives (Cooper Creek, G South, Juneau Creek, and Juneau Creek Variant)

Station 1225+00 to Station 1365+00 (SLR to approximately 1.2 miles west of Sportsman's Landing)

Each build alternative follows an identical alignment from the west project terminus (Station 1225+00) to Station 1365+00. This segment of roadway is bounded by the Kenai River to the south and steep mountain slopes to the north.

Retaining walls have been incorporated into the design in an effort to minimize sliver cuts and maintain slope limits within the existing ROW. Retaining walls have been identified for use in the following locations (see Table 2):

Table 2: Project Design Retaining Wall Locations (Build Alternatives)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1258+00, LT	1259+25, LT	34	22	125	Upslope
1261+50, LT	1262+50, LT	35	20	100	Upslope
1265+00, LT	1272+50, LT	26	16	750	Upslope
1288+50, LT	1289+00, LT	4	4	50	Upslope
1348+50, LT	1351+00, LT	5	4	250	Upslope

In the following locations (see Table 3), guardrail with a 2:1 fill slope is recommended to minimize impacts to wetlands, sloughs, small streams, and the Kenai River. Riprap revetment structures have also been incorporated at some of these locations to protect the roadway from river and stream erosion.

Table 3: Project Design Guardrail Locations (Build Alternatives)

Station From	Station To	Guardrail	Length (ft.)	Riprap Revetment
1252+00, RT	1255+00, RT	Yes	300	No
1255+00, RT	1268+00, RT	Yes	1300	Yes
1268+00, RT	1275+50, RT	Yes	750	No
1275+50, RT	1281+50, RT	Yes	600	Yes
1281+50, RT	1285+50, RT	Yes	400	No
1285+50, RT	1291+00, RT	Yes	550	Yes
1291+00, RT	1294+00, RT	Yes	300	No
1304+50, RT	1307+50, RT	Yes	300	No
1307+50, RT	1313+00, RT	Yes	550	Yes
1313+00, RT	1316+00, RT	Yes	300	No

The alignments cross Fuller Creek near Station 1290+40. This creek currently crosses under the existing highway, flowing west along the south toe of the existing roadway slope. In consideration of the proposed

roadway widening and subsequent new toe of slope, the existing streambed will need to be redirected at the toe of the proposed slope on the south side of the new alignment approximately between Stations 1287+00 and 1290+00.

Traffic analysis has identified the need for passing lanes in this segment of roadway. There will be a 0.7-mile-long eastbound passing lane between Stations 1298+76 and 1336+00, as well as a 0.75-mile-long westbound passing lane between Stations 1321+76 and 1362+00.

At Station 1365+00, the Juneau Creek Alternative diverges north and begins to climb out of the river valley. The Cooper Creek, G South, and Juneau Creek Variant alternatives all follow identical alignments, continuing along the existing highway corridor.

Horizontal adjustments were incorporated into the alignments in 2011 to minimize impacts to the U.S. Fish and Wildlife Visitor Contact Station, and to avoid any impacts to the parking area on the west side of the facility. The horizontal curve at STA 1235+66.76 was adjusted from an initial radius of 3,000 feet to a radius of 1,340 feet, still within the original 60-mph design criteria. The entrance bearing in this location was not adjusted. The exit bearing was slightly modified to minimize impacts. The resulting alignment is within the existing ROW, and the Visitor Contact Station parking is located completely outside the new highway's footprint. All three alternatives are coincident in this location; therefore, updates were made to each alignment.

9.2 Cooper Creek and G South Alternatives

Station 1365+00 to Station 1595+00 (approximately 1.2 miles west of Sportsman's Landing to approximately 1.2 miles west of Cooper Creek)

Both the Cooper Creek and G South alternatives follow identical alignments between Stations 1365+00 and 1595+00. Bounded by the Kenai River to the south and steep mountain slopes to the north between Stations 1365+00 and 1464+00, both alignments utilize retaining walls to avoid sliver cuts and maintain slope limits within the existing ROW where possible. In some areas, 2:1 slopes, protected by guardrail and riprap, have been incorporated into the design in an effort to minimize impacts to wetlands, sloughs, small streams, and the Kenai River. Between Stations 1464+00 and 1595+00, the corridor has diverged from the steep mountain slopes.

To minimize both impacts to the Kenai River and sliver cuts and to maintain slopes within the existing ROW, retaining walls are used in the following locations (see Table 4):

Table 4: Project Design Retaining Wall Locations (Cooper Creek and G South Alternatives)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1370+00, LT	1377+50, LT	12	7	750	Upslope
1399+25, LT	1399+75, LT	5	5	50	Upslope
1404+50, LT	1408+00, LT	18	12	350	Upslope
1405+50, RT	1409+00, RT	10	8	350	Downslope
1409+75, LT	1410+75, LT	30	26	100	Upslope
1414+50, LT	1415+50, LT	25	15	100	Upslope

The use of a revetment structure along the north bank of the river between Stations 1404+50 and 1410+75 could reduce costs and slope stability concerns with respect to the required upslope and downslope retaining structures. Further geotechnical investigations as well as hydraulic and hydrologic analysis will be needed for this location to develop a final design recommendation.

In the following locations (see Table 5), guardrail with a 2:1 fill slope has been used to minimize impacts to wetlands, sloughs, small streams, and the Kenai River. Riprap revetment structures have also been incorporated at some of these locations to protect the roadway from river and stream erosion.

Table 5: Project Design Guardrail Locations (Cooper Creek and G South Alternatives)

Station From	Station To	Guardrail	Length (ft.)	Riprap Revetment
1363+00, RT	1366+00, RT	Yes	300	No
1366+00, RT	1383+50, RT	Yes	1750	Yes
1385+50, RT	1387+00, RT	Yes	150	No
1387+00, RT	1391+50, RT	Yes	450	Yes
1391+50, RT	1394+50, RT	Yes	300	No
1400+50, RT	1403+50, RT	Yes	300	No
1403+50, RT	1405+50, RT	Yes	200	Yes
1405+50, RT	1409+00, RT	Yes	350	No
1409+00, RT	1415+00, RT	Yes	600	Yes
1415+00, RT	1427+50, RT	Yes	1250	No
1435+50, RT	1438+50, RT	Yes	300	No
1438+50, RT	1452+00, RT	Yes	1350	Yes
1452+00, RT	1454+50, RT	Yes	250	No
1565+00, LT	1568+00, LT	Yes	300	No
1568+00, LT	1571+50, LT	Yes	350	Yes

Station From	Station To	Guardrail	Length (ft.)	Riprap Revetment
1571+50, LT	1575+00, LT	Yes	350	No

Traffic analysis has identified the need for passing lanes in this segment of roadway. There will be a 0.6-mile-long eastbound passing lane between Stations 1459+56 and 1490+10 and a 0.6-mile-long westbound passing lane between Stations 1488+00 and 1520+00.

The proposed bridge replacement at Schooner Bend, between Stations 1531+00 and 1534+25, will be at a skew angle. This bridge will be located approximately 80 feet downstream from the existing bridge site. The skew and relocation is to facilitate desirable roadway geometrics and to move the structure away from an existing eroding bend in the Kenai River. The existing bridge will be used by traffic during construction and will be removed following completion of the new bridge.

9.3 Cooper Creek Alternative

Station 1595+00 to Station 1983+45 (approximately 1.2 miles west of Cooper Creek to QCR)

At Station 1595+00, the alignments for the Cooper Creek and G South alternatives diverge. The Cooper Creek Alternative diverges south, climbs out of the river valley, and crosses Cooper Creek with a proposed new bridge structure. After crossing Cooper Creek, the alignment follows a natural bench before rejoining the existing highway at the Cooper Landing Bridge, after which the alignment closely follows the existing highway corridor to the east project terminus.

To develop desirable intersection geometrics with the existing Sterling Highway and minimize environmental impacts, the Cooper Creek Alternative diverges south at Station 1595+00. Between Stations 1595+00 and 1630+00, the alignment parallels the existing corridor. At Station 1626+50 a 1.8-mile-long eastbound passing lane begins, ending at Station 1722+80.

At 1633+10 the alignment again turns south, following a natural bench to the proposed replaced Cooper Creek Bridge. The proposed bridge location is approximately one-half mile upstream from the existing bridge. Upslope and downslope retaining walls will be required.

Between Stations 1675+00 and 1700+00, the proposed alignment cuts through the east bluff of Cooper Creek Canyon. These cut slopes have been designed at 2:1 and will reach a height of 180 feet in some locations. The longitudinal length of cut required is approximately 2,500 feet. Preliminary design assumed that bedrock will not be encountered; however, further geotechnical investigation will be required prior to final sideslope design in this location.

Field investigation observed material slides and flowing soils at Stations 1750+00 and 1765+00, 350 feet right. The materials in these slides exhibit thixotropic properties, resulting in serious concerns regarding groundwater and surface water and slope stability. Further geotechnical investigation will be required prior to final design.

A 2.1-mile-long westbound passing lane begins at Station 1690+00, approximately 1,500 feet east of the Cooper Creek Bridge, ending at Station 1800+00, the Snug Harbor Road intersection.

The Cooper Landing Bridge at the outlet of Kenai Lake is 78 feet wide, accommodating two 12-foot through lanes, one 16-foot center turn lane, one 12-foot westbound right turn lane, two 8-foot shoulders, and one 6-foot pedestrian path.

To minimize large cuts and fills and to maintain slope limits within the existing ROW, retaining walls are used in the following locations (see Table 6):

Table 6: Project Design Retaining Wall Locations (Cooper Creek Alternative)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1641+00, RT	1642+50, RT	22	18	150	Upslope
1659+50, RT	1667+50, RT	33	20	800	Upslope
1662+50, LT	1667+50, LT	39	29	500	Downslope
1893+50, LT	1895+50, LT	19	17	200	Upslope
1916+00, LT	1918+50, LT	12	8	250	Upslope
1946+00, RT	1947+50, RT	10	9	150	Downslope

There will be a 0.7-mile-long eastbound passing lane between Stations 1884+80 and 1919+80 as well as a 1.2-mile-long westbound passing lane between Stations 1901+80 and 1963+00.

The Cooper Creek Alternative ends at Station 1983+45, just east of the Quartz Creek Road intersection.

9.4 G South Alternative

Station 1595+00 to Station 1822+00 (approximately 1.2 miles west of Cooper Creek to approximately 2.9 miles east of Juneau Creek)

At Station 1595+00 the G South Alternative alignment diverges north, crossing the Kenai River with a proposed new bridge structure before climbing out of the river valley and crossing Juneau Creek with a proposed new bridge structure. The alternative rejoins the Juneau Creek Alternative at Station 1822+00 after which the alignments are identical to the east project terminus.

West of the proposed Juneau Creek Bridge, at approximately Station 1654+00 left, there will be a 2:1 cut slope that is 220 feet high. East of the Juneau Creek Bridge, from approximately Station 1670+00 to 1690+00, the 2:1 cut slope on the left (north) side of the roadway looking upstation (east) is approximately 70 feet high. The longitudinal length of cut required is approximately 2,000 feet. Preliminary design assumed that bedrock will not be encountered in this area; however, further geotechnical investigation will be required prior to final sideslope design in this location.

A 2.2-mile-long eastbound passing lane is located between Stations 1616+00 and 1730+00.

Between Stations 1751+00 and 1821+75, the G South and Juneau Creek alternatives follow the same horizontal alignment. To achieve balanced earthwork, the vertical alignment for the G South Alternative is approximately 10 feet higher than the Juneau Creek alignment.

9.4.1 Mitigation

A Forest Service road and the Bean Creek Trail would be crossed by the proposed alignment within 1,000 feet of each other near Station 1701+00. To eliminate one of these crossings, they have been combined into a single, grade separated crossing near Station 1696+00, where the highway will be constructed in a fill section. An underpass consisting of a structural culvert or bridge, wide enough to allow for a two-way traffic and trail use, will be erected to allow both modes of traffic to pass beneath the highway unimpeded. Both the Bean Creek Trail and Forest Service road will require minor realignments to connect to the grade separation.

9.5 Juneau Creek and Juneau Creek Variant Alternatives

Station 1365+00 to Station 1386+86 (approximately 1.2 miles west of Sportsman's Landing to approximately 0.8 mile west of Sportsman's Landing)

The Juneau Creek and Juneau Creek Variant alternatives follow identical alignments between Stations 1365+00 and 1386+86. At Station 1386+86, the Juneau Creek alignment diverges north, while the Juneau Creek Variant alignment continues on the same horizontal alignment as both the Cooper Creek and G South alternatives.

9.5.1 Mitigation

The existing Bean Creek Trail would be crossed by the proposed Juneau Creek and Juneau Creek Variant alternatives at approximately Station 1645+00. Crossing here would require a pedestrian grade separation, most likely beneath the highway. To save the cost of grade-separating the trail at its current location, the trail would be diverted to the west approximately 700 feet, passing beneath the Juneau Creek Bridge. This solution preserves the continuity of the Bean Creek Trail and takes advantage of the shelf against the east abutment of the Juneau Creek Bridge to grade-separate the highway from the trail.

The Forest Service road crossing at Station 1572+00 coincides with a cut on the proposed highway. To maintain continuity, a grade separated underpass and alignment adjustments have been incorporated to cross the main highway down station at approximately 1580+00 where the terrain presents a fill condition on the highway. At this location a structural culvert or bridge wide enough to allow for a two–way traffic and trail use will be erected to allow traffic on the Forest Service road to pass beneath the highway unimpeded.

The Resurrection Trail running along the west side of Juneau Creek is also presented with an intersection at the proposed highway (Station 1633+00). Similar to the Bean Creek Trail on the opposite side of the Juneau Creek drainage, space is provided adjacent to the bridge abutment for continuation of the Resurrection Trail. Due to the popularity of the trail and the anticipated increase in foot traffic from the vicinity of the Juneau Creek Bridge to the trail, a parking area at Station 1624+00 has been added with access to the trail.

9.6 Juneau Creek Alternative

Station 1386+86 to Station 1822+00 (approximately 0.8 mile west of Sportsman's Landing to 2.9 miles east of Juneau Creek)

At Station 1386+86, the Juneau Creek Alternative diverges north from the existing highway and begins to climb out of the river valley. The alignment continues to climbs up the hillside to a proposed new bridge structure over Juneau Creek before rejoining the G South and Cooper Creek alternatives at Station 1822+00, after which the alignments are identical until the east project terminus.

The Juneau Creek Alternative alignment, except where it deviates and crosses the Juneau Creek Canyon downstream from the falls, is based on the 1991 Juneau Creek Alternative, Wilderness Variant.

To minimize large cuts and fills and to prevent fill from covering the existing roadway, as well as to minimize impacts to adjacent resources, retaining walls are used in the following locations (see Table 7):

Table 7: Project Design Retaining Wall Locations (Juneau Creek Alternative)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1368+00, LT	1377+50, LT	18	11	950	Upslope
1399+50, RT	1405+50, RT	35	20	600	Downslope
1405+00, LT	1409+00, LT	19	13	400	Upslope

There will be a 4.25-mile-long eastbound passing lane between Stations 1386+00 and 1610+00 and a 3.0-mile-long westbound passing lane located between Stations 1583+00 and 1743+00. There will also be a 0.6-mile-long eastbound passing lane from Station 1740+00 to Station 1770+00.

The bridge across Juneau Creek was originally sited to avoid a Federal land withdrawal in the vicinity of the Juneau Creek Falls. A field reconnaissance trip during the summer of 2004 revealed a recent landslide at the then-proposed bridge site. A preliminary rock stability investigation was conducted with the goal of identifying a more stable crossing location. The investigation led to the recommendation that the alignment be relocated to cross the creek at a right angle, approximately 600 feet north of the originally proposed crossing location. Crossing sites near the Juneau Creek Falls were not considered to avoid impacts to the surrounding recreation site.

Between Stations 1751+00 and 1821+75, the G South and Juneau Creek alternatives follow the same horizontal alignment.

Station 1822+00 to Station 1977+45 (approximately 2.9 miles east of Juneau Creek to QCR)

From Station 1822+00 to the east project terminus (QCR, Station 1977+45), the Juneau Creek and G South alternatives are identical horizontally and vertically, but are addressed separately due to the different stationing associated with each alternative.

Between Stations 1822+00 and 1856+00, the roadway is fully benched into the hillside to avoid large fill quantities and minimize differential settlement. The vertical alignment has been designed to minimize cuts to a large alluvial fan located between Stations 1857+00 and 1882+00.

Locating the intersection with the existing Sterling Highway at Station 1867+50 provides the opportunity to construct the proposed roadway on top of the existing highway through the existing avalanche chute from Station 1878+00 to the east project terminus. This will limit major ROW impacts between Stations

1889+00 and 1895+00 and eliminate the need to construct two roadways, reducing earthwork and retaining structures.

To minimize large cuts and fills, maintain slope limits within the existing ROW, and minimize impacts to private property, retaining walls are used in the following locations (see Table 8):

Table 8: Project Design Retaining Wall Locations (Juneau Creek Alternative)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1825+50, RT	1827+00, RT	21	17	150	Upslope
1830+50, RT	1833+50, RT	37	14	300	Upslope
1873+50, RT	1877+50, RT	37	25	400	Downslope
1887+00, LT	1889+00, LT	14	12	200	Upslope
1911+50, LT	1912+00, LT	6	6	50	Upslope
1939+50, RT	1941+50, RT	13	11	200	Downslope

Two westbound passing lanes, one 1.4 mile long from Station 1780+95 to Station 1856+30 and another 1.1 mile long from Station 1891+86 to Station 1949+26, are located along this section of the alternative.

The Juneau Creek Alternative ends just east of the Quartz Creek Road intersection at Station 1977+45.

9.6.1 Mitigation

The Forest Service road at Station 1505+00 crosses the proposed highway as the roadway prism transitions from fill to cut. To maintain continuity of the Forest Service road, its alignment has been adjusted to cross at approximately Station 1503+00, where the terrain presents a fill condition on the highway. At this location a structural culvert or bridge wide enough to allow for a two-way traffic and trail use will be erected to allow traffic on the Forest Service road to pass beneath the highway unimpeded. This undercrossing requires significant realignment of the existing Forest Service road, and the existing crossing is more conducive to allowing for an overpass on the existing alignment. Either option can be incorporated to allow for grade separated continuity of the road. Both options are shown in Appendix A.

9.7 Juneau Creek Variant Alternative

Station 1386+86 to Station 1554+13 (approximately 0.8 mile west of Sportsman's Landing to approximately 2.4 miles east of Sportsman's Landing)

The Juneau Creek Alternative crosses a portion of Federal Wilderness within KNWR just east of where the alternative begins to diverge from the other alignments. Variations of the Juneau Creek Alternative were analyzed in the effort to avoid impacts to Wilderness; during this investigation, additional cultural resource sites were identified in the area. The Juneau Creek Variant Alternative was designed to avoid impacts to Wilderness and minimize impacts to known cultural sites in the area. Juneau Creek Variant Alternative diverges from the Juneau Creek Alternative alignment at Station 1386+86, where the original alternative begins to climb the hill to the north. The Juneau Creek Variant Alternative alignment begins to

climb out of the river valley at Station 1417+50, closely following existing topography in an effort to reduce large cuts and fills, before rejoining the Juneau Creek Alternative at Station 1554+13.

Access to Sportsman's Landing is maintained from the existing Sterling Highway via a loop ramp intersecting the Juneau Creek Variant alignment at approximately Station 1431+00. Between Stations 1433+00 and 1434+50, the design includes a bridge structure overcrossing the loop ramp.

To minimize large cuts and fills, limit impacts to cultural resource sites, and maintain slope limits within the existing ROW, retaining walls are used in the following locations (see Table 9):

Table 9: Project Design Retaining Wall Locations (Juneau Creek Variant Alternative)

Station From	Station To	Maximum Height (ft.)	Average Height (ft.)	Length (ft.)	Remarks
1368+00, LT	1377+50, LT	18	11	950	Upslope
1399+50, RT	1405+50, RT	35	20	600	Downslope
1404+50, LT	1408+50, LT	19	13	400	Upslope

There will be a 4.25-mile-long eastbound passing lane between Station 1386+00 and Juneau Creek Alternative Station 1610+00.

The Juneau Creek Variant Alternative rejoins the Juneau Creek Alternative at Station 1554+13.

9.7.1 Mitigation

For the Juneau Creek Variant Alternative, the driveway from the existing Sterling Highway to the Sportsman's Landing parking lot was adjusted to minimize impacts to the existing parking lot. The new driveway was designed to allow for the least amount of alteration to the existing traffic flow and parking layout. Traffic using the new driveway will enter the area in relatively the same location, use the same pay booth, and follow the same traffic flow currently being used at the site.

10.0 EARTHWORK

Usability of in-situ material was estimated through general field observations and preliminary geotechnical reports and memoranda. The preliminary engineering and earthwork balancing process resulted in alignments that minimized impacts and achieved an earthwork balance between the usable cut material and required fill quantities. Earthwork balance is based on the following assumptions:

- Most till cuts will produce 50 percent usable material. (In a few isolated locations, 75 percent of the material will be usable and in a few other isolated locations, none of the till material will be usable.)
- Shrinkage factor for till material is 17 percent.
- Excavated rock is not suitable for riprap, aggregate, or Selected Material, Type A.
- Excavated rock is 93 percent usable as Selected Material, Types B and C and has a 7 percent swell factor.

- Selected Material, Type A, riprap, and all aggregates will need to be imported from an off-site source or from a contractor-developed borrow source within the project limits.

The following geotechnical information was utilized for estimating the location and types of materials that might be encountered (rock or till):

- Sterling Highway, MP 37 to MP 60, Preliminary Location Study, 1989;
- Reconnaissance Engineering Geology Report, Sterling Highway MP 37-60, August 1989;
- Reconnaissance Geotechnical Report, Sterling Highway MP 37-60 (Alternative 5), October 1991;
- Field observations, summer of 2004

Percentage of usable material is conceptual and is based on reasonable judgment and general field observations; no field sampling or additional geotechnical investigations were conducted.

Earthwork balancing on the Juneau Creek, Juneau Creek Variant, and G South alternatives considers the inability to haul material across Juneau Creek. Earthwork balancing on the Cooper Creek Alternative requires moving material across the Cooper Creek Canyon. This can be achieved with a contractor-constructed access roadway with an approximate grade of 10 to 12 percent. Estimated earthwork quantities are shown in the following tables (see Table 10 through Table 13):

Table 10: Earthwork Balancing for Cooper Creek Alternative

Embankment	SLR to Cooper Creek	Cooper Creek to QCR	Total (BOP to EOP)
Selected Material, Type A	175,000 cy	140,000 cy	315,000 cy
Selected Material, Type B	240,000 cy	170,000 cy	410,000 cy
Selected Material, Type C	835,000 cy	810,000 cy	1,645,000 cy
Total Embankment	**1,250,000 cy**	**1,120,000 cy**	**2,370,000 cy**
Excavation			
Rock Excavation	105,000 cy	810,000 cy	915,000 cy
Classified Excavation	465,000 cy	1,710,000 cy	2,175,000 cy
Total Excavation	**570,000 cy**	**2,520,000 cy**	**3,090,000 cy**
Borrow			
Aggregate for Base and AC	67,000 cy	50,000 cy	117,000 cy
Borrow, Type A	175,000 cy	140,000 cy	315,000 cy
Borrow, Type B	135,000 cy	0 cy	135,000 cy
Borrow, Type C	600,000 cy*	0 cy	115,000 cy**
Total Borrow	**977,000 cy***	**190,000 cy**	**682,000 cy**
Excess Material (Usable)	0	485,000 cy	0 cy**
Waste Material (Unusable)	185,000 cy	980,000 cy	1,165,000 cy

SLR = Skilak Lake Road, QCR = Quartz Creek Road
* Material could be hauled from the large cut on the east side of the canyon reducing the borrow quantity by 485,000 cubic yards.
** Includes moving 485,000 cubic yards of Selected Material, Type C across the Cooper Creek Canyon.

Table 11: Earthwork Balancing for G South Alternative

Embankment	SLR to Juneau Creek	Juneau Creek to QCR	Total (BOP to EOP)
Selected Material, Type A	175,000 cy	130,000 cy	305,000 cy
Selected Material, Type B	235,000 cy	160,000 cy	395,000 cy
Selected Material, Type C	628,000 cy	1,340,000 cy	1,945,000 cy
Total Embankment	**1,038,000 cy**	**1,630,000 cy**	**2,645,000 cy**
Excavation			
Rock Excavation	105,000 cy	865,000 cy	970,000 cy
Classified Excavation	845,000 cy	1,565,000 cy	2,410,000 cy
Total Excavation	**950,000 cy**	**2,430,000 cy**	**3,380,000 cy**
Borrow			
Aggregate for Base and AC	65,000 cy	47,000 cy	112,000 cy
Borrow, Type A	175,000 cy	130,000 cy	305,000 cy
Borrow, Type B	125,000 cy	0 cy	125,000 cy
Borrow, Type C	230,000 cy	0 cy	210,000 cy
Total Borrow	**595,000 cy**	**177,000 cy**	**752,000 cy**
Excess Material (Usable)	0 cy	0 cy	30,000 cy
Waste Material (Unusable)	375,000 cy	825,000 cy	1,200,000 cy

SLR = Skilak Lake Road, QCR = Quartz Creek Road

Table 12: Earthwork Balancing for Juneau Creek Alternative

Embankment	SLR to Juneau Creek	Juneau Creek to QCR	Total (BOP to EOP)
Selected Material, Type A	175,000 cy	140,000 cy	315,000 cy
Selected Material, Type B	230,000 cy	175,000 cy	405,000 cy
Selected Material, Type C	975,000 cy	1,305,000 cy	2,280,000 cy
Total Embankment	**1,380,000 cy**	**1,620,000 cy**	**3,000,000 cy**
Excavation			
Rock Excavation	530,000 cy	980,000 cy	1,510,000 cy
Classified Excavation	960,000 cy	1,245,000 cy	2,205,000 cy
Total Excavation	**1,490,000 cy**	**2,225,000 cy**	**3,715,000 cy**
Borrow			
Aggregate for Base and AC	66,000 cy	50,000 cy	116,000 cy
Borrow, Type A	175,000 cy	140,000 cy	315,000 cy
Borrow, Type B	0 cy	0 cy	0 cy
Borrow, Type C	240,000 cy	0 cy	240,000 cy
Total Borrow	**481,000 cy**	**190,000 cy**	**671,000 cy**
Excess Material (Usable)	0 cy	35,000 cy	35,000 cy
Waste Material (Unusable)	470,000 cy	670,000 cy	1,140,000 cy

SLR = Skilak Lake Road, QCR = Quartz Creek Road

Table 13: Earthwork Balancing for Juneau Creek Variant Alternative

Embankment	SLR to Juneau Creek	Juneau Creek to QCR	Total (BOP to EOP)
Selected Material, Type A	185.000 cy	140,000 cy	325,000 cy
Selected Material, Type B	235,000 cy	175,000 cy	410,000 cy
Selected Material, Type C	1,150,000 cy	1,305,000 cy	2,455,000 cy
Total Embankment	**1,570,000 cy**	**1,620,000 cy**	**3,190,000 cy**
Excavation			
Rock Excavation	720,000 cy	980,000 cy	1,700,000 cy
Classified Excavation	1,075,000 cy	1,245,000 cy	2,320,000 cy
Total Excavation	**1,795,000 cy**	**2,225,000 cy**	**4,020,000 cy**
Borrow			
Aggregate for Base and AC	68,000 cy	50,000 cy	118,000 cy
Borrow, Type A	365,000 cy	140,000 cy	505,000 cy
Borrow, Type B	0 cy	0 cy	0 cy
Borrow, Type C	430,000 cy	0 cy	430,000 cy
Total Borrow	**863,000 cy**	**190,000 cy**	**1,053,000 cy**
Excess Material (Usable)	0 cy	35,000 cy	35,000 cy
Waste Material (Unusable)	635,000 cy	670,000 cy	1,305,000 cy

SLR = Skilak Lake Road, QCR = Quartz Creek Road

10.1 Potential Borrow Sites

Potential borrow sites identified are conceptual and are based on surface observations only. Detailed subsurface geotechnical investigations are necessary to identify quantity and quality of material and limits of all potential borrow sites.

An old borrow site at the Fuller Lake Trailhead, Station 1301+00 left, could potentially yield 120,000 cubic yards of aggregate and Selected Material, Type A. If this site is developed, the existing trailhead at this location could be reconstructed to provide additional parking and possibly camping and rest facilities; however, this site has been eliminated from consideration due to being located within the Intensive Management area of KNWR.

An old borrow site at Station 1384+00 left (where the power transmission line crosses the existing highway) could potentially yield 450,000 cubic yards of aggregate and Selected Material, Type A; however, this site has been eliminated from consideration due to being located within the Intensive Management area of KNWR.

An existing material site (M.S. 21-2-043-1) located on the north side of the road at MP 69 of the Sterling Highway could also be a viable material source. An investigation in July 1978 estimated 350,000 cubic yards of material remained in the site. It is our understanding that a road project in the early 1980s used some material and an upcoming project, Sterling Highway MP 60 to 79, will also use this material site. Judging by the topography and borelogs, expanding the site north could potentially yield enough additional material to fulfill the requirements of the west half of the Sterling Highway MP 45–60 Project; however, this site has been eliminated from consideration due to being located within the Intensive Management area of KNWR.

In 1979, an area in the vicinity of the Resurrection Pass Trailhead was identified to have a sufficient amount of suitable material to be a major source for this project. It was also determined this area could be mined in a manner that would create an area suitable for a campground. Preliminary investigations determined this area could potentially produce 320,000 cubic yards of material. If the investigation was expanded it is possible this area could produce a much higher volume of quality material. This area could potentially yield sufficient material to fulfill the requirements for the west half of this project; however this site has been eliminated from consideration due to its close proximity to the Resurrection Pass trailhead, and recreational area.

Field observations and the Mineral Materials Survey of the Seward and Glacier Ranger Districts Road Corridor, Chugach National Forest, Alaska, May 1997, indicate small material sites are very likely to be encountered within the roadway prism of the western segment of the Juneau Creek Alternative. These sites will be identified during design and staging and use of materials will be specified in the contract documents.

10.2 Potential Waste Sites

Areas identified as potential waste areas are conceptual and based on anticipated volume of waste for each alternative. The areas selected were also based on the earthwork balancing assumptions and utilize existing topography while minimizing impacts to area resources. Two waste material sites are available at MP 34.6 and 33.2 of the Seward Highway with available space. These sites may be used for disposal of excess (waste) materials generated during construction that are not suitable for use within the project. Final waste material sites will be identified during design and construction.

10.2.1 Cooper Creek Alternative

East of the intersection with the existing Sterling Highway, Stations 1621+00 to 1642+00 left and right, a 20-acre area has been identified as a disposal area for approximately 325,000 cubic yards of material; however, the area on the left has been eliminated from consideration due to wetland and cultural or historic site impacts. The remaining area on the right is 5 acres and is available to dispose 150,000 cubic yards of waste material.

East of the Cooper Creek Bridge on top of the bluff between Stations 1685+00 and 1702+00, left, a 46-acre area has been identified as a disposal area for approximately 1.2 million cubic yards of material.

10.2.2 G South Alternative

West of the proposed Juneau Creek Bridge, between Stations 1641+00 and 1662+00, right, a 28-acre waste area has been identified as a disposal area for approximately 700,000 cubic yards of material.

Between Stations 1672+00 and 1695+00, right, a 27-acre waste area has been identified as a disposal area for approximately 1 million cubic yards of material.

Between Stations 1804+00 and 1819+00, right, a 13-acre waste area has been identified as a disposal area for approximately 450,000 cubic yards of material; however, this area has been eliminated from consideration due to wetland and private property impacts.

A disposal area near Station 1725+00, left, was considered but then eliminated from consideration due to unfavorable impacts. This area was identified to potentially dispose of 1 million cubic yards of material, but is not recommended due to the wetland impacts and potential impacts to the headwaters of Bean Creek.

10.2.3 Juneau Creek and Juneau Creek Variant Alternatives

Between Stations 1506+00 and 1525+00, left, a 20-acre waste area has been identified as a disposal area for approximately 650,000 cubic yards of material.

Near Station 1535+00, left and right, an area was identified to potentially dispose of 75,000 cubic yards of material, but then eliminated from consideration due to wetland impacts and the relatively small disposal volume.

East of the proposed Juneau Creek Bridge site, between Stations 1655+00 and 1671+00, left, a 20-acre waste area has been identified as a disposal area for approximately 700,000 cubic yards of material; however, this area has been eliminated from consideration due to wetland and stream impacts.

Between Stations 1692+00 and 1708+00, right, a 27-acre waste area has been identified as a disposal area for approximately 1 million cubic yards of material. A 2,200-foot-long temporary access road along an existing logging road will be improved and used to access the waste site.

A disposal area near Station 1725+00, left, was identified to potentially dispose of 1,000,000 cubic yards of material, but was eliminated from consideration due to wetland impacts and potential impacts to the headwaters of Bean Creek.

A disposal area near Station 1810+00, right, was identified to potentially dispose of 400,000 cubic yards of material, but was eliminated from consideration due to wetland and property impacts.

11.0 STAGING AREAS

Staging areas for the construction office and bridge construction are conceptually identified. For each alternative, the construction office will be located near the Quartz Creek Road intersection or, as an alternative, could be located in the material site at Sterling Highway MP 40, approximately 4 miles east of the Quartz Creek Road intersection.

Selection of potential staging areas is based on anticipated area of need, traffic control concerns, wetland impacts, environmental impacts, and the natural topography.

11.1 Cooper Creek and G South Alternatives

Schooner Bend Bridge Potential Staging Area: 1.6 acres on the west side of the river located within proposed ROW, and 1.0 acre on the east side of the river located within proposed ROW.

11.2 Cooper Creek Alternative

Cooper Creek Bridge Potential Staging Area: 3.9 acres between the west abutment and the toe of the east bluff and 1.0 acre on the east side of Cooper Creek on top of the bluff.

Cooper Landing Bridge, Potential Staging Area: all staging will be within the existing ROW.

11.3 G South Alternative

Proposed Kenai River Bridge Potential Staging Area: 1.0 acres adjacent to the existing highway and 5.7 acres spanning across the Kenai River, including a temporary bridge across the Kenai River.

Proposed Juneau Creek Bridge, West Side, Potential Staging Area: A 3,100-foot-long access road and a 5.2-acre staging area including a temporary bridge over Juneau Creek.

Proposed Juneau Creek Bridge, East Side, Potential Staging Area: An 8-acre staging area located at the top of the east bluff.

11.4 Juneau Creek and Juneau Creek Variant Alternatives

Proposed Juneau Creek Bridge, West Side, Potential Staging Area: A 6.3-acre staging area away from the bridge site and an 8.4-acre staging area within the ROW adjacent to the bridge site.

Proposed Juneau Creek Bridge, East Side, Potential Staging Area: An 11.4-acre staging area immediately adjacent to the bridge site then paralleling the roadway skirting the wetlands on the south side of the road.

12.0 CONSTRUCTION SEQUENCING

Construction sequencing and phasing for the Sterling Highway MP 45–60 Project considers overall project length, project costs, material availability, haul routes, bridge construction, and impassable topography. The existing highway and bridges will remain open to traffic during construction, although night closures will be necessary for the construction. Construction of the Cooper Creek Alternative will have the greatest impact to the traveling public due to the length of existing highway that will be reconstructed under this alternative. Conversely, the majority of the Juneau Creek Alternative will be constructed away from the existing highway, causing the least impact to the traveling public. Haul routes will use the proposed roadway embankment as much as possible, but it will be necessary to use portions of the existing highway as a haul route for each build alternative. The Cooper Creek Alternative will use the existing highway to the greatest extent and the Juneau Creek Alternative will use the existing highway the least.

12.1 Cooper Creek Alternative

The Cooper Creek Alternative can be constructed in two separate phases. The first phase, from Skilak Lake Road to the east side of the Cooper Creek Canyon (Station 1695+00), provides the necessary balance of materials to construct the roadway embankment and includes construction of a new bridge near Schooner Bend and the new Cooper Creek Bridge. At the completion of this phase, the existing bridge near Schooner Bend will be removed.

One potential material site has been identified that could supply the Selected Material, Type A, and the aggregates necessary for this phase of the project: a potential source near the Resurrection Pass Trailhead,

Station 1510+00, left. In addition, the contractor might be able to locate and develop a material site within the same area designated as a potential waste area located on the east side of Cooper Creek.

Access to the east abutment of the Cooper Creek Bridge will be via a temporary bridge over Cooper Creek and an access road up the east side of the canyon. Areas for the project office and materials will be located in the same area as the Cooper Creek Bridge staging area, although the bridge staging area may need to be increased slightly to provide additional room for the project offices and material staging.

Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

The second phase will begin at Station 1695+00 and continue to Quartz Creek Road. Material generated from the large rock cuts north of Kenai Lake will be hauled and used for embankment construction between Station 1695+00 and the Cooper Landing Bridge. This phase also includes construction of a new Cooper Landing Bridge at the outlet of Kenai Lake. At the completion of this phase, the existing Cooper Landing Bridge will be removed.

Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

12.2 G South Alternative

The G South Alternative can be constructed in two separate phases. The first phase, from Skilak Lake Road to the west abutment of the proposed Juneau Creek Bridge, includes the construction of a new bridge near Schooner Bend and the new Kenai River Bridge. Suitable fill material excavated from the large cut between the proposed Kenai River and Juneau Creek bridges will be hauled across a temporary bridge over the Kenai River and used to construct the new roadway embankment. Waste material will be back-hauled and placed in the waste area. At completion of this phase both the temporary bridge and the existing bridge near Schooner Bend will be removed.

One borrow area has been identified that could supply the Selected Material, Type A, and aggregates for the road segment west of the Juneau Creek crossing: a potential source near the Resurrection Pass Trailhead, Station 1510+00, left. In addition, the contractor might be able to locate and develop a material site in the same area designated as a potential waste area located on the west side of Juneau Creek.

Areas for the project office and materials will be located in the same area as the proposed Kenai River Bridge staging area, although the bridge staging area will need to be increased slightly to provide additional room for the project offices and material staging.

Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

The second phase will be from the west abutment of the proposed Juneau Creek Bridge to Quartz Creek Road and will include constructing the Juneau Creek Bridge. Material generated from the large rock cuts north of Kenai Lake will be hauled and used for embankment construction throughout this segment. Construction of the Juneau Creek Bridge can begin no sooner than one season after the start of the first phase and will need to be closely coordinated with the first phase construction sequencing. Access to the west abutment and the western segment of the bridge site will be via the new roadway embankment and either the new bridge or the temporary bridge. Detailed coordination between contractors will be required.

Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

12.3 Juneau Creek and Juneau Creek Variant Alternatives

The Juneau Creek and Juneau Creek Variant alternatives can be constructed using two separate construction phases. The first phase is from Skilak Lake Road to the west abutment of the proposed Juneau Creek Bridge. If desired, the first phase could be broken into two segments: Skilak Lake Road to one mile west of Sportsman's Landing (Station 1399+00), and Station 1399+00 to the Juneau Creek crossing. Breaking the first phase into two segments requires importing an additional 100,000 cubic yards of borrow material to construct the Skilak Lake Road to Station 1399+00 embankment and wasting 100,000 cubic yards of excess material in the Station 1399+00 to the Juneau Creek crossing segment.

Two borrow areas have been identified that could supply the Selected Material, Type A, and the aggregates necessary for the road segment west of the Juneau Creek Bridge; a potential source near the Resurrection Pass Trailhead, Station 1510+00, left.

The project office and material staging areas will be located at the borrow site and in select areas along the new alignment, within the existing ROW.

Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

The second phase will be from the west abutment of the proposed Juneau Creek Bridge to Quartz Creek Road and will include constructing the Juneau Creek Bridge. Material generated from the large rock cuts north of Kenai Lake will be hauled and used for embankment construction throughout this segment. Construction of the Juneau Creek Bridge can begin no sooner than one season after the start of the first phase and will need to be closely coordinated with the first phase construction sequencing. Access to the west abutment and the western segment of the bridge site will be via the new roadway embankment. Detailed coordination between contractors will be required. Traffic will be maintained on the existing highway during construction of this segment. Night closures will be necessary.

13.0 RIGHT-OF-WAY AND ACCESS CONTROL

ROW impacts were minimized by adjusting the horizontal and vertical alignments, using guardrail and 2:1 fill slopes, and placing retaining walls in specific locations. For each alternative, the cut and fill slopes are maintained within the existing ROW from the west project terminus (Station 1225+00) to Station 1400+00.

The greatest ROW impacts occur where build alternatives leave the existing roadway corridor. For additional detail, please see the *Updated Conceptual Stage Relocation Study*, prepared by HDR Alaska, Inc., 2011.

Regulating access is called "access control" and is categorized as full control of access, partial control of access, access management, and driveway/entrance regulations. Access control is necessary to preserve the level of service and safety of the roadway. If access control is not established and managed, roadside businesses and driveways can become major factors in reducing capacity (level of service), increasing crash potential, and eroding the mobility function of the facility.

13.1 Cooper Creek Alternative

The Cooper Creek Alternative requires a new ROW corridor to be acquired between Stations 1636+00 and 1801+00. For this segment of roadway, it is recommended that access control be established and acquired at the time of ROW acquisition.

13.2 G South Alternative

The G South Alternative requires a new ROW corridor to be acquired between Stations 1612+00 and 1865+00. For this segment of roadway, it is recommended that access control be established and acquired at the time of ROW acquisition.

13.3 Juneau Creek and Juneau Creek Variant Alternatives

The Juneau Creek and Juneau Creek Variant alternatives each require a new ROW corridor to be acquired between Stations 1408+00 and 1857+00. For this segment of each roadway, it is recommended that access control be established and acquired at the time of ROW acquisition.

14.0 UTILITY IMPACTS

Chugach Electric maintains the power distribution lines, Homer Electric maintains the power transmission line, and TelAlaska maintains the telephone lines in the project area. Telephone lines are currently strung on power distribution poles, and both copper and fiber optic communication lines exist within the corridor. TelAlaska replaced telephone lines (copper and fiber) between the Cooper Landing Bridge and Sunrise during the summer of 2005. These telephone lines were placed underground in the same corridor as the power poles.

14.1 Cooper Creek Alternative

The Cooper Creek Alternative impacts power transmission line, power distribution lines, and telephone lines. The identified conflicts and needed actions are:

- Station 1498+00 left - Relocate distribution and telephone - one pole
- Stations 1624+00 to 1640+00 right, 1,750 feet - Relocate distribution and telephone - five poles
- Station 1803+00 - Raise distribution and telephone lines - two poles
- Station 1862+25 left - Relocate distribution and telephone - one pole
- Stations 1880+00 to 1907+00 - Relocate distribution and telephone - eight poles
- Stations 1805+00 to 1905+00 – Relocate (underground) copper and fiber optic communication lines
- Stations 1717+00 to 1727+00 - Raise transmission line
- Stations 1740+00 to 1750+00 - Raise transmission line and relocate one tower

14.2 G South Alternative

The G South Alternative impacts power distribution lines and telephone lines. The identified conflicts and needed actions are:

- Station 1498+00 left - Relocate distribution and telephone - one pole
- Stations 1850+00 to 1895+00 right - Relocate distribution - 12 poles

- Stations 1850+00 to 1900+00 - Relocate (underground) copper and fiber optic communication lines

14.3 Juneau Creek and Juneau Creek Variant Alternatives

The Juneau Creek and Juneau Creek Variant alternatives impact power distribution lines. The identified conflicts and needed actions are:

- Stations 1850+00 to 1895+00 right - Relocate distribution - 12 poles
- Stations 1850+00 to 1900+00 - Relocate (underground) copper and fiber optic communication lines

15.0 CONSTRUCTION COSTS

Construction cost estimates for the build alternatives (see Table 14) are based on 2014 unit prices. ROW acquisition costs were updated to 2014 prices and were determined based on information contained within the *Sterling Highway MP 45 to 60 Conceptual Stage Relocation Study* and *Assessment of Right-of-Way Acquisition Report* (prepared by HDR Alaska, Inc., Oct. 2011) and assumed neutral growth in the real estate market from 2006 to present. Bridge structure cost estimates for the Juneau Creek and Juneau Creek Variant alternatives are based on the average cost of seven different bridge options as determined in the *Sterling Highway MP 45 to 60, Preliminary Bridge Structure Technical Report*, prepared by HDR Alaska, Inc. in August 2011 and have been escalated to 2014 prices. (Costs broken down by bid item for the roadway sections are shown in Appendix B).

Table 14: Projected Project Construction Costs

CONSTRUCTION COSTS				
	Cooper Creek	**G South**	**Juneau Creek**	**Juneau Creek Variant**
Basic Roadway Costs	$92,642,216	$92,296,914	$96,450,164	$97,564,734
Bridge and Structure Costs	$78,514,225	$89,177,625	$52,392,926	$55,799,980
Contingency (20%)	$34,231,288	$36,294,908	$29,768,618	$30,672,943
Construction Administration (15%)	$30,808,159	$32,665,417	$26,791,756	$27,605,648
Construction Total	$236,195,889	$250,434,864	$205,403,464	$211,643,305
Permitting (2%)	$4,723,918	$5,008,697	$4,108,069	$4,232,866
Design (12%)	$28,343,507	$30,052,184	$24,648,416	$25,397,197
Utility Costs	$2,000,000	$700,000	$700,000	$700,000
ROW	$5,572,795	$2,896,601	$2,877,323	$2,812,634
Subtotal	$276,836,109	$289,092,346	$237,737,273	$244,786,002
ICAP (5%)	$13,841,805	$14,454,617	$11,886,864	$12,239,300
Grand Total	**$290,700,000**	**$303,500,000**	**$249,600,000**	**$257,000,000**

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Appendix A
Build Alternative Plan Sets

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Appendix B
Cost Estimate Summary Sheets

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Appendix **C**
Traffic Study

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Appendix D

Bridge Structures Technical Report

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Appendix **E**
Updated Conceptual Stage Relocation Study

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Appendix F

Geotechnical Reconnaissance Report

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