RECONNAISSANCE STUDY

SEWARD HIGHWAY ROUTE DEVELOPMENT PLAN

ANCHORAGE, AK
DOT&PF Project No. Z545200000
Federal Project No. NH-0A31(052)

JANUARY 2017

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January 2017

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AADT	Annual Average Daily Traffic
ACS	Alaska Communications
ADT	Average Daily Traffic
AGR	Annual Growth Rate
ARRC	Alaska Railroad Corporation
AASHTO	American Association of State Highway and Transportation Officials
AWMP	Anchorage Wetlands Management Plan
BCY	Bank Cubic Yard
CEA	Chugach Electric Association
CSP	Chugach State Park
DEC	Department of Environmental Conservation
DNR	Alaska Department of Natural Resources
DOT&PF	Alaska Department of Transportation and Public Facilities
EFH	Essential Fish Habitat
FHWA	U.S. Department of Transportation, Federal Highway Administration
ft.	foot
GCI	GCI Communications Corp
HSIP	Highway Safety Improvement Program
KPB	Kenai Peninsula Borough
kV	kilovolt
LEDPA	least environmentally damaging practicable alternative
LWCF	Land and Water Conservation Fund
MADT	Monthly Average Daily Traffic
MB	Map Book
MOA	Municipality of Anchorage
M&O	Maintenance and Operations
MP	Milepost
mph	miles per hour
NMFS	National Marine Fisheries Service
NRHP	National Register of Historic Places
PDO	Property Damage Only
PLO	Public Land Order
PTR	Permanent Traffic Recorder
RCSP	Rabbit Creek Shooting Park
ROW	right-of-way
U.S.	United States
USACE	U.S. Army Corps of Engineers

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1 INTRODUCTION

1.1 Reconnaissance Study

The State of Alaska Department of Transportation and Public Facilities (DOT&PF) is conducting a reconnaissance study to evaluate improvements to mobility and safety of motorized and non-motorized traffic on the Seward Highway from the Alyeska Highway intersection (Milepost [MP] 90) to the Rabbit Creek Interchange (approximately MP 118) (Figure 1).

Figure 1: Project Location

This Reconnaissance Study report was prepared in accordance with the DOT&PF Preconstruction Manual. The findings of this Reconnaissance Study will guide future decisions and provide information to DOT&PF on potential alternatives for improvements to the Seward Highway between Anchorage and Girdwood.

1.2 Purpose and Need

As the only highway connection between Anchorage and the Kenai Peninsula, the Seward Highway is vital to community connection, commerce, recreation, and tourism. Long-range planning should aim to provide a high degree of mobility as well as accommodate local access along the project corridor. The highway should have sufficient capacity, meet appropriate design standards, and provide appropriate access management to safely allow free-flowing traffic at highway speeds.

Anchorage is Alaska's largest city, with an estimated 2015 population of 298,908.[1] The Seward Highway connects Anchorage with Seward, a community of 2,740. It also connects Anchorage to some of the Kenai Peninsula's largest incorporated cities and critical ports and airports through a junction with the Sterling Highway. These are important termini recognized by the State as intermodal facilities and key to the statewide economy. The ports connected to Anchorage by the Seward Highway and Sterling Highway include the ports of Whittier, Seward, and Homer, which handled a combined 1.2 million tons of freight and 324,569 cruise ship passengers in 2013.[2,3] Incorporated cities served by the Sterling Highway include the communities of Kenai, Soldotna, Nikiski and Homer. The Alaska Department of Labor and

Photo 1: Cars Pulled Over to View Wildlife at Windy Corner

[1]Department of Labor and Workforce Development. 2016. Population Estimates. Accessed on April 16 2016. Available at: http://live.laborstats.alaska.gov/pop/index.cfm

[2]USACE (U.S. Army Corps of Engineers). 2015. Navigation Data Center: Waterborne Commerce Statistics Center. July 31, 2015. Accessed on January 26 2016. Available at: http://www.navigationdatacenter.us/wcsc/webpub13/webpubpart-4.htm

[3]Alaska Department of Commerce, Community, and Economic Development. 2014. Commercial Passenger Vessel Excise Tax. Available at: https://www.commerce.alaska.gov/web/Portals/6/pub/TourismResearch//00%20CPV%20Report%20FINAL.pdf. Accessed on February 7 2016.

Workforce Development estimates the Kenai Peninsula Borough (KPB) population at 57,763 people in 2015. For KPB residents, the Seward Highway provides access to advanced medical care, fuel, and other services located in Anchorage. Anchorage is the origin for 37 percent of the estimated 400,000 tourists that visit the Kenai Peninsula each year.[4]

Safety conflicts on the highway increase with unrestricted access, roadside parking, multi-modal demand, and variations in speed associated with sightseeing versus through traffic. Current travel demand on the highway exceeds the capacity of a two-lane rural highway in the summer months and volumes are predicted to increase. While the focus of this study is the corridor between Anchorage and Girdwood, the improved mobility will benefit everyone that is served by or uses this highway. Maintained highway speeds and minimized travel time between intermodal cities and ports benefits the statewide economy and overall citizen prosperity.

Appendix A provides the map book companion to this Reconnaissance Study. To provide context, map book sheets are referenced in **bold green text (Map Book [MB] XX)** where referenced.

2 EXISTING CONDITIONS

The Seward Highway is part of the National Highway System and is functionally classified as a principal arterial interstate from MP 125.34 (Ingra Street in Anchorage) to MP 36.5 (intersection with the Sterling Highway on the Kenai Peninsula). It continues as a non-interstate principal arterial from MP36.5 to MP 0.0 (Railway Avenue in Seward). The Sterling Highway extends south from the intersection at MP 36.5, connecting to major incorporated and intermodal cities and ports such as Kenai, Soldotna, Nikiski, and Homer.

The Seward Highway generally has two lanes between MP 90 and MP 117.6. Much of the corridor winds along the mountainside and has limited passing opportunities, except the southernmost segment between Bird and Girdwood which has been widened to include 4.4 miles of passing lanes for northbound traffic and 3.5 miles of passing lanes for southbound traffic.

[4]Schwartz, Dan. 2013. Tourism steady, Peninsula still a recreation draw. Peninsula Clarion, February 28, 2013. Available at: http://peninsulaclarion.com/trends/2013-02-28/tourism-steady-peninsula-still-a-recreation-draw

North of MP 117.6, the highway is a controlled-access, high volume freeway with two lanes for each direction of travel divided by a median. DOT&PF and the Alaska Railroad Corporation (ARRC) have overlapping rights-of-way (ROW) and share drainage facilities throughout the project area (Figure 2).

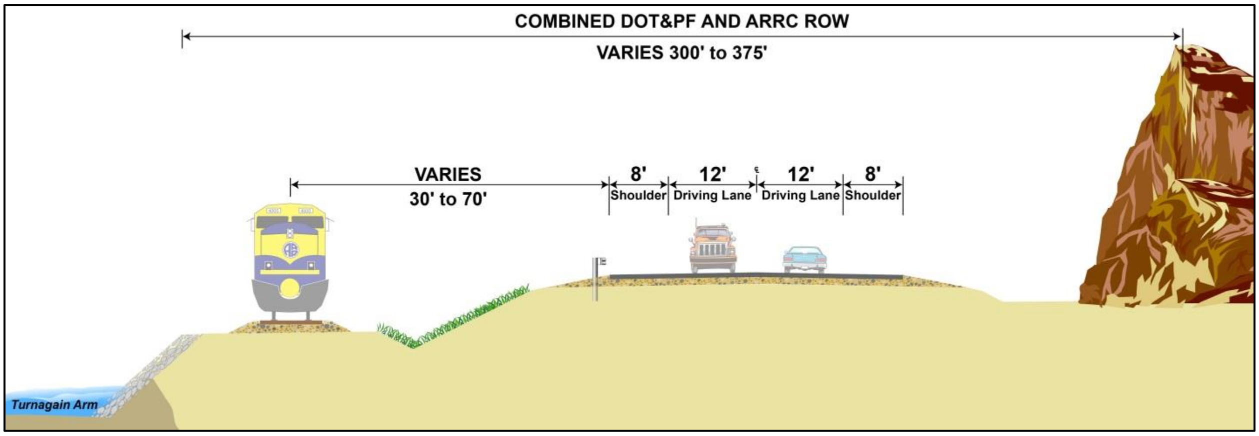


Figure 2: Simplified Existing Typical Section, Looking North

2.1 Bridges

Existing highway bridges are located as shown in Table 1. All other creeks and drainages cross the road through culverts.

Table 1: Existing Highway Bridge Locations

Water body	MP	Bridge number	Year of construction
Glacier Creek	89.7	0639	1966
Tidewater Slough	90.5	0640	1995
Bird	101.4	0643	1982
Indian	102.9	0644	1982

Source: 2013 Bridge Inventory Report, DOT&PF Bridge Section
Notes: MP – Milepost

2.2 Alaska Railroad Corporation

ARRC has a single mainline track between Girdwood and Rabbit Creek, with sidings at Girdwood (**MB 1**), Bird Point (**MB 6 to MB 7**), Indian (**MB 13**), Rainbow (**MB 17**), and Potter Marsh (**MB 23**). ARRC operates freight trains on a year-round basis to serve the ports of

Whittier and Seward, and seasonally operates up to 10 passenger trains per day between Girdwood and Anchorage. 2013 ridership was 158,778.

Two at-grade public vehicular/rail crossings are located in the study area. The first is at Girdwood (DOT&PF Maintenance/Toadstool Turnpike, **MB 1**). The second is at the Rabbit Creek Shooting Park (RCSP) (**MB 25**). Several other (authorized access only) gated at-grade crossings exist for utility, ARRC, or avalanche control purposes.

Photo 2: ARRC Engine Adjacent to Turnagain Arm

A grade separation exists at Bird Point (**MB 6 to MB 7**) where the Seward Highway crosses over the ARRC mainline.

2.3 Land Use and Right-of-Way

Chugach State Park (CSP) borders approximately 90 percent of the corridor on both sides and is zoned as Public Lands and Institutions. The only exceptions are the short stretches of private lands in the communities of Girdwood (**MB 1**), Bird (**MB 11**), Indian (**MB 13**), and Rainbow (**MB 17**), and the private lands north of the weigh station. Most of the privately-owned land is zoned R-11 Residential, with 35-foot height restrictions on structures and limitations on removing natural vegetation.

Generally, the existing transportation corridor consists of a 300-foot-wide highway Public Land Order (PLO) ROW and a 200-foot-wide ARRC ROW that are each centered on their respective alignments and partially overlap for the majority of the corridor. The ROW for the road consists of PLO easements, in addition to any additional ROW that may have been purchased as part of past projects to allow for the construction, operation, and maintenance of the highway. DOT&PF is allowed to permit utilities within their ROW. The ARRC 200-foot-wide ROW is exclusive to the railroad's purposes and allows ARRC to construct, operate, and maintain the railroad facilities as necessary, in addition to granting permits for utilities that can be located within their ROW.

2.4 Recreational Facilities

Roadside facilities along the Seward Highway provide access to CSP for a wide variety of recreational uses, including wildlife/scenic viewing, trail access, bicycling, windsurfing (and other forms of marine recreation), fishing, rock climbing, hiking, biking, and camping. Dozens of access points to recreational facilities are located along the project corridor, most which are roadside facilities located on or adjacent to park land and are operated and maintained by Alaska Department of Natural Resources (DNR). Access to recreational facilities will need to be addressed on a project-by-project basis. Additional facilities may be necessary based on the access management principles applied to the project corridor.

Photo 3: Trailhead Facilities along Turnagain Arm`

2.5 Utilities

Buried and overhead utilities run within and parallel to the DOT&PF ROW. These utilities are owned and maintained by Alaska Communications (ACS), Chugach Electric Association (CEA), ENSTAR, and GCI Communications Corp. (GCI). ARRC generates revenue from utility use within their ROW.

2.6 Geology and Topography

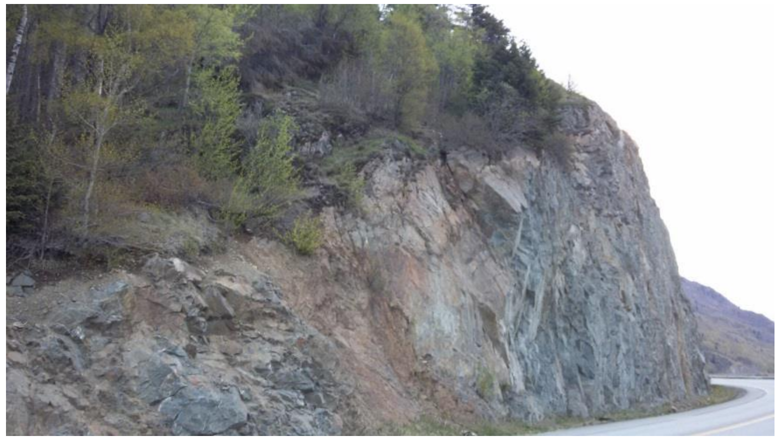


Photo 4: Rock Cut at MP 109

Steep terrain is located adjacent to the roadway for the majority of the project corridor, and rock cuts with relatively narrow ditches are prevalent from MP 104 to MP 115. Bedrock consists of the McHugh Complex to the west of the Eagle River Thrust Fault near Falls Creek (MP 106) and the Valdez Group to the east. The McHugh Complex consists primarily of greywacke, mafic rocks, and chert along the project corridor and the Valdez Group consists primarily of greywacke turbidites, black argillite, and minor pebble to cobble conglomerate.[5] The soils within the corridor generally consist of estuarine deposits and irregular glacial, glaciofluvial, and colluvial deposits. Overburden thickness varies. Fill is present as part of the road and railroad embankments.

2.7 Rock and Ice Fall

Rock and ice fall along the Seward Highway, specifically between MP 104 and MP 115, has been occurring for years. Some rock fall events are single rocks (generally cobble-sized to small boulders) that land in the ditch, shoulder, or lane. Some rock fall events are larger that completely cover the shoulder, lane, or the entire road. The FFY 16 Highway Safety Improvement Program Candidate Description and Cost Estimate for Turnagain Arm (Seward Highway MP 104-115) Rock Fall Hazard Mitigation provides additional information on rock fall and ice fall in the project corridor.

[5]Bradley, Dwight C. and Miller, Marti L. 2006. Field Guide to South-Central Alaska's Accretionary Complex, Anchorage to Seward. U.S. Geological Survey.

2.8 Wetlands

Intertidal wetlands are located adjacent to the highway for the majority of the project corridor. Numerous impounded wetlands are located between the roadway embankment and the Chugach Mountains. The largest and most prominent of these impounded wetlands is Potter Marsh; the 564-acre marsh was created by the construction of the railroad embankment in 1917 and now provides valuable habitat for many bird species.

3 TRAFFIC AND SAFETY ANALYSIS

3.1 Existing Traffic

The Average Annual Daily Traffic (AADT) along the Seward Highway between the Rabbit Creek Interchange and Girdwood was approximately 8,400 to 13,900 vehicles per day in 2013, with higher volumes located on the northern end of the corridor. This AADT is generally within the range that would typically be accommodated with a two-lane rural highway with some strategically placed passing lanes. However, since the Seward Highway serves as the primary tourist and in-state recreational route between the Anchorage metropolitan area and the Kenai Peninsula, the daily traffic volumes during the summer months (May through September) are well above the AADT. Drivers during the highest traffic July weekends experience volumes of approximately 22,000 vehicles per day at Potter Marsh. These seasonal peaks reach traffic volumes that are as high as any two-lane road in Alaska, by ADT inspection, and are as busy as Anchorage's busier multilane arterials on a volume per lane basis.

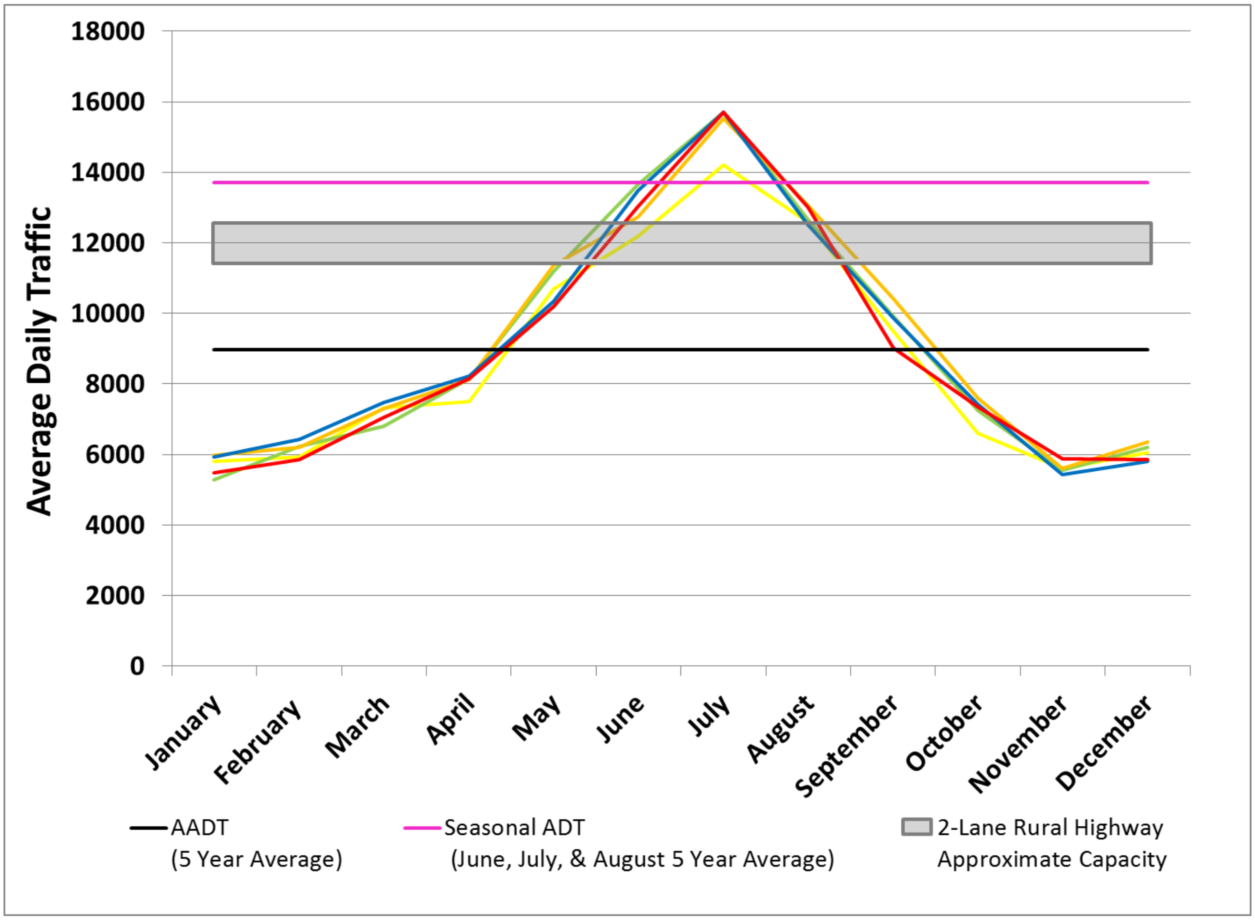
Due to the magnitude and duration of the seasonal fluctuations, a seasonal Average Daily Traffic (ADT) is recommended for use as a Design Day in planning and designing a highway corridor that will meet the needs of users for a greater portion of the year. The ADT for June, July, and August from 2008 through 2012 was divided by the ADT for all months from 2008 through 2012 to calculate a seasonal adjustment factor of 1.5. The Design Day traffic volumes were calculated by applying the seasonal adjustment factor to the AADT. Use of a seasonal design volume is consistent with AASHTO's recommendations for highways with high seasonal peaks.[6] Design Day traffic volumes range from 21,300 vehicles at the Rabbit Creek Interchange in Anchorage to 12,900 vehicles at the Alyeska Highway intersection in Girdwood.

The approximate capacity of a two-lane rural highway ranges from 11,500 to 12,500 ADT based on Exhibit 15-5 of the Highway Capacity Manual 6th Edition.[7] This range assumes a level of service of D and rolling to level terrain. These capacity thresholds are also evident from observed local examples. Similar two-lane highway segments of the Parks Highway and Knik-Goose Bay Road are high conflict, high congestion corridors that can reach daily volumes exceeding 20,000 vehicles per day and have seen high crash rates, particularly when traffic volumes exceed 16,000 vehicles per day.[8] Other roads such as the Palmer/Wasilla Highway, Seldon Road, Kenai Spur Highway, and Kalifornsky Beach Road have been targeted for capacity improvements where daily volumes exceed 12,000 vehicles per day.[8] As shown in Figure 3, the seasonal ADT is well above the AADT range that is typically considered the capacity of a rural two-lane highway.

[6]American Association of State Highway and Transportation Officials (AASHTO). 2011. *A Policy on Geometric Design of Highways and Streets*. Washington D.C.

[7]Transportation Research Board. 2016. *Highway Capacity Manual 6th Edition.* Washington D.C.

[8]Based on discussions with DOT&PF Traffic Engineer.



Sources: DOT&PF Central Region Traffic Volume Reports, 2008-2012

Figure 3: Seward Highway at Potter Marsh Monthly Average Daily Traffic (MADT) (2008 – 2012) & Five Year Average AADT Volumes (2008 – 2012)

The 2008 to 2012 five year average AADT drops down to 5,500 between Girdwood and Portage. Between Portage and the intersection with Hope Road, AADT further drops to 3,900. With a seasonal multiplier, the Design Day traffic volumes (8,300 vehicles) south of Alyeska Highway are within the capacity of a two-lane highway, but will still experience peak periods of congestion where passing lanes or slow vehicle turnouts may be necessary.

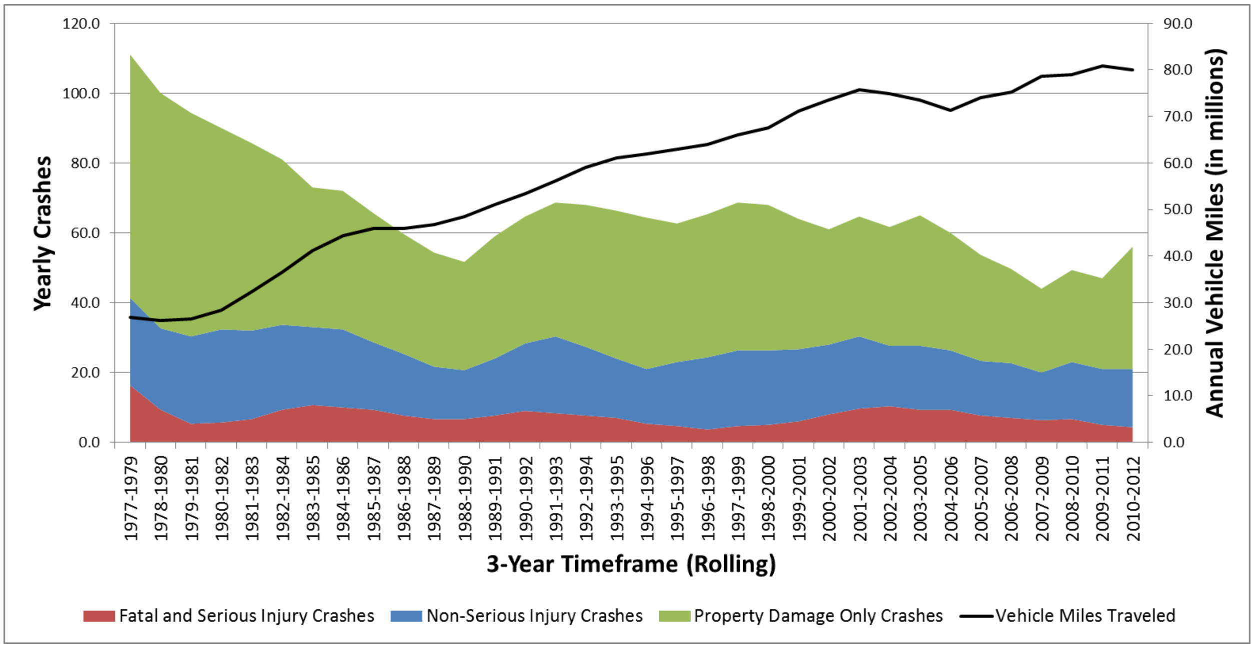
3.2 Crash Data

Seward Highway between Girdwood and Anchorage is one of four designated safety corridors in Alaska. Safety corridors receive targeted funding, planning, design, enforcement, and education efforts to resolve the elevated rate of severe crashes (i.e., crashes resulting in serious injuries or fatalities) in the corridor. The safety corridor efforts are audited each year to determine: 1) the effectiveness of the measures and 2) if additional measures are needed. Decommissioning of the safety corridor is considered annually as part of the audit. Since 2006, $19.8 million has been spent on Seward Highway projects, either improving safety or repairing existing infrastructure. The safety corridor mitigation measures are considered interim safety measures until more permanent engineering measures are constructed.

One of the goals of this study is to identify permanent solutions that would reduce crashes to a level that eliminates the need for the safety corridor. Because crashes are related to a variety of environmental conditions and human factors that vary from year-to-year and situation-to-situation, looking at a variety of factors when analyzing crash data can result in valuable insights into potential safety concerns and trends.

A prior resource for the study corridor is the 2013 Safety Corridor Audit, which showed a 32 percent decrease in fatal or serious injury crashes between May 2006 and 2011 for this section of the Seward Highway (MP 87 to MP 117). However, when considered on their own, fatal crashes actually increased 17 percent per hundred million vehicle miles travelled during the same time period. The safety corridor audit notes that fatal crash data can be volatile due to the small yearly sample and recommends combined fatal and serious injury crashes as a performance indicator.

Additional planning-level safety analysis was completed for this Reconnaissance Study and evaluated the crashes that have occurred in this section of the Seward Highway (MP 89.32 to MP 114.49) since 1977. Because of the variability from year-to-year, a three-year rolling average was evaluated for the corridor as a whole and is shown in Figure 4 along with the annual vehicle miles traveled (VMT).

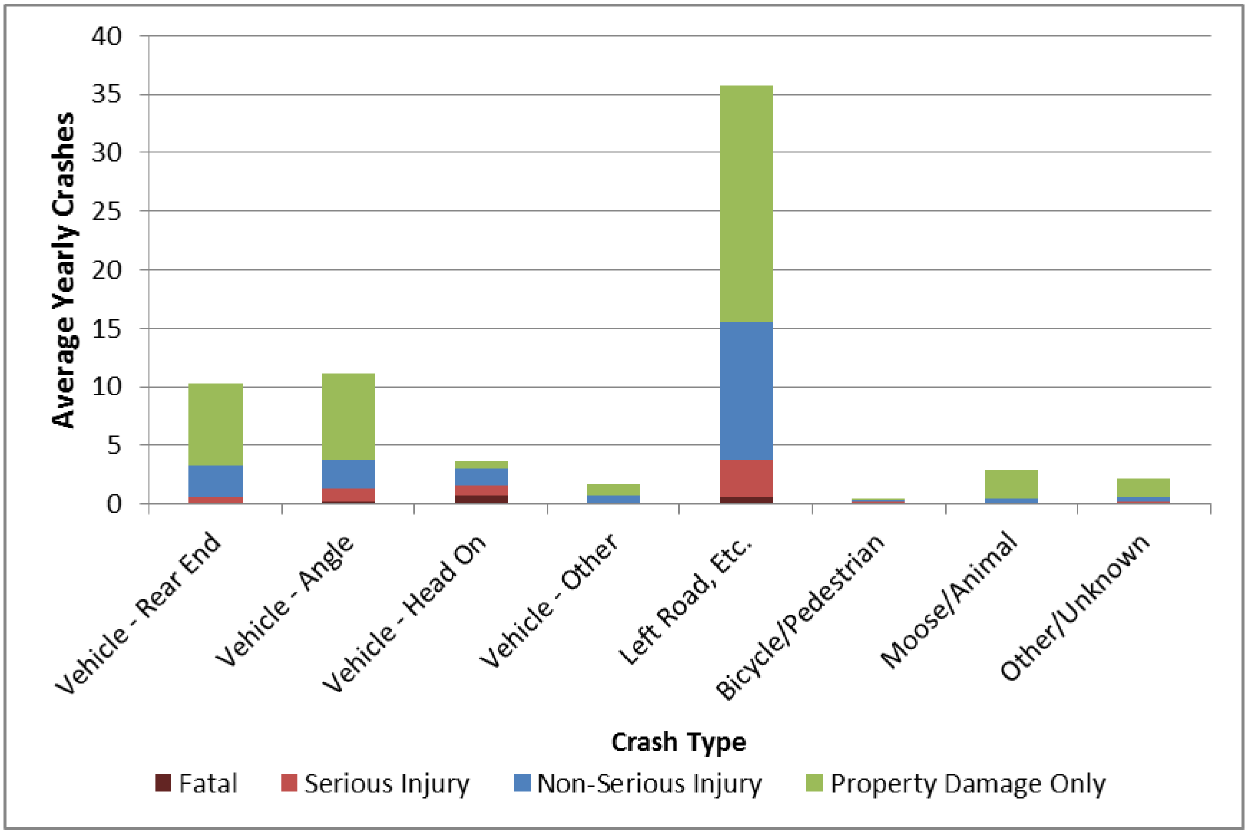


Source: Raw crash data (1977 to 2012) provided by DOT&PF.
VMT calculated from data in DOT&PF Annual Traffic Volume Reports

Figure 4: Seward Highway, Potter Marsh to Girdwood Yearly Crash and VMT Trends from 1977 to 2012

As shown in Figure 4, the steepest decline in crashes occurred between 1977 and 1990, which is even more significant because VMT was increasing at the same time. VMT continued to steadily increase through 2004 and then leveled off and dipped slightly before experiencing a slow increase that leveled off again in 2012. In the early 1990's, non-serious injury and property damage only (PDO) crashes saw a steep increase, while fatal and serious injury crashes had a minor increase. Around 1992, total crashes leveled off with some minor fluctuations through the year 2005, while fatal and serious injury crashes experienced a gradual decline until around 1997 when they began to increase. From 2006 to the most recent year of crash data included in the analysis (i.e., 2012), fatal and all injury crashes have been gradually declining again, but PDO crashes began to rise again in 2010.

To continue to improve safety along the study corridor, it is important to understand the types of crashes that are occurring. Figure 5 shows the average yearly crashes by crash type and severity from 1977 to 2012. Over half of the crashes that occurred along the study corridor included vehicles that left the roadway and either hit an object (e.g., ditch, embankment, guardrail, other fixed object, etc.) or overturned. These types of crashes are typically categorized based on the object they hit once they leave the roadway, but for the purposes of this planning level report, they have all been grouped together. Crashes involving a vehicle hitting a bicycle or pedestrian are uncommon but have the greatest severity, with half of these crashes resulting in a fatality or serious injury (seven out of 14 crashes).



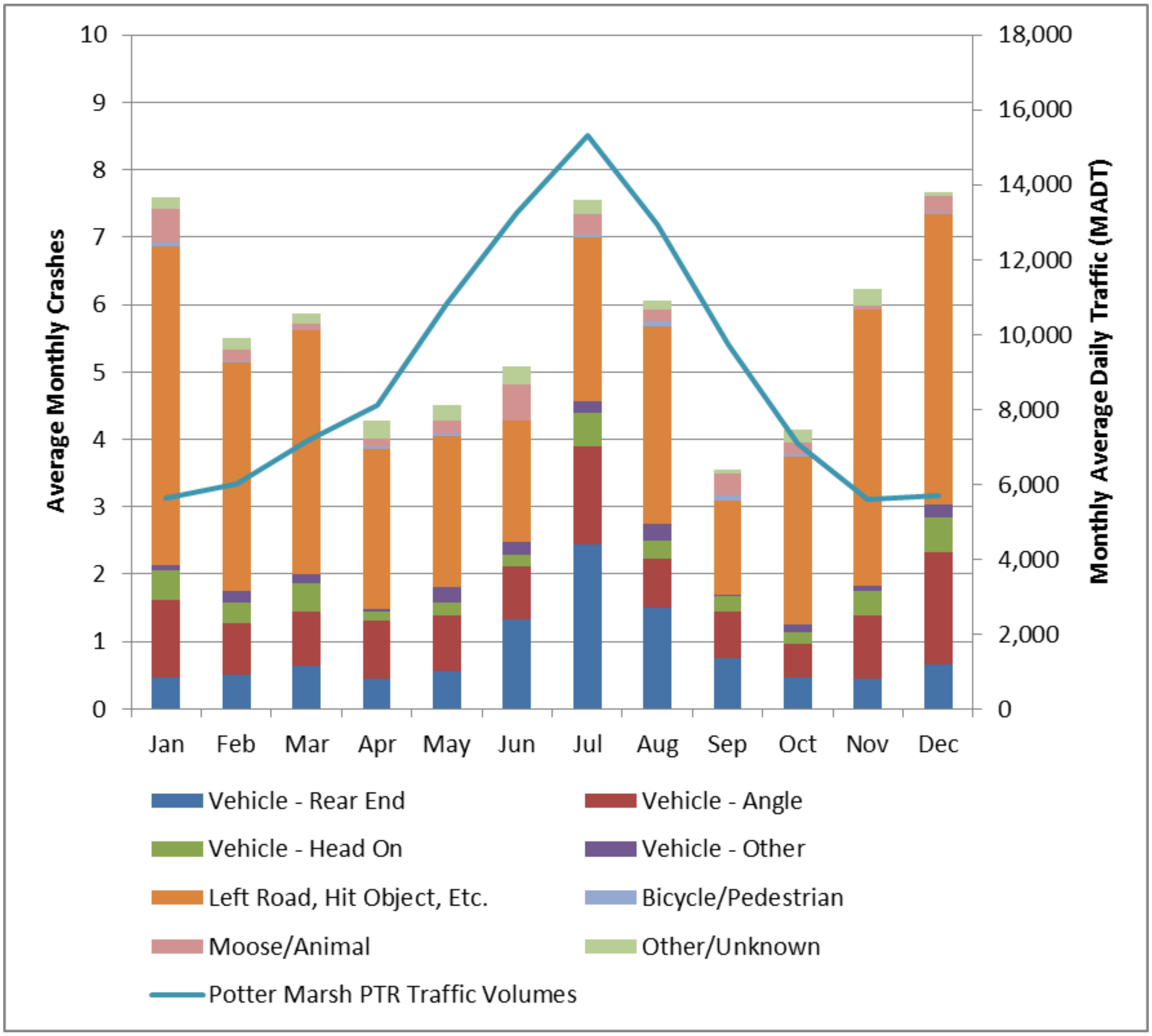
Source: Raw crash data (1977 to 2012) provided by DOT&PF.

Figure 5: Seward Highway MP 89-117 Average Yearly Crashes by Type and Severity, 1977-2012

Head on crashes are another type of crash that resulted in a disproportionately high number of fatalities and severe injuries. Almost half of head on crashes resulted in a fatality or serious injury, and even though they comprised only five percent of all reported crashes between 1977 and 2012, they accounted for 46 percent of the corridor's fatalities (approximately one person per year) and 22 percent of the serious injuries (approximately two people per year). The highway segment near the Alyeska Highway intersection was the most common location where head on crashes occurred; however, almost all of the head-on crashes at this location resulted only in property damage or a non-serious injury. The stretch of highway between Windy Corner and Indian was another common location for head on crashes, with nearly half these crashes resulting in a fatality or serious injury.

Monthly crash trends were also evaluated for the study corridor and are shown in Figure 6 along with the monthly average daily traffic (MADT) at the Potter Marsh Permanent Traffic Recorder (PTR), which is on the western boundary of the study corridor and is a good source of seasonal traffic trends for the corridor. When the data from 1977 to 2012 was averaged, the months of January, July, and December experienced a similar number of crashes (approximately 7.5 crashes per month), while September had the fewest crashes (3.5 crashes on average). Between April and October, the overall crash trends generally followed a similar trend as the MADT. However, the winter months experienced a much higher proportion of crashes, as indicated by the high crash numbers in January and December even though volumes were less than half of those in July. The fatal and serious injury crashes more closely followed MADT trends.

Past data indicates that vehicles leaving the roadway and either hitting an object (e.g., ditch, embankment, guardrail, other fixed object, etc.) or overturning occurred all year but the rate was 50 to 100 percent higher during the winter months. The three locations with the greatest concentration of these crashes include the first curve west of the Alyeska Highway (MP 90.0 and 90.1), the curve on the eastern side of Windy Corner (MP 105.0), and the curve on the western side of Beluga Point (MP 109.8). Unsafe speed was a common contributing circumstance, particularly at the first curve west of the Alyeska Highway. Snow and ice were also common roadway surface conditions for many of these crashes, particularly near Beluga Point.



Source:	Raw crash data (1977 to 2012) provided by DOT&PF. Potter Marsh PTR volumes from DOT&PF Annual Traffic Volume Reports (2000 to 2012).
Notes:	PDO – Property damage only MADT – Monthly Average Daily Traffic

Figure 6: Seward Highway MP 89-117 Monthly Crash Trends, 1977-2012

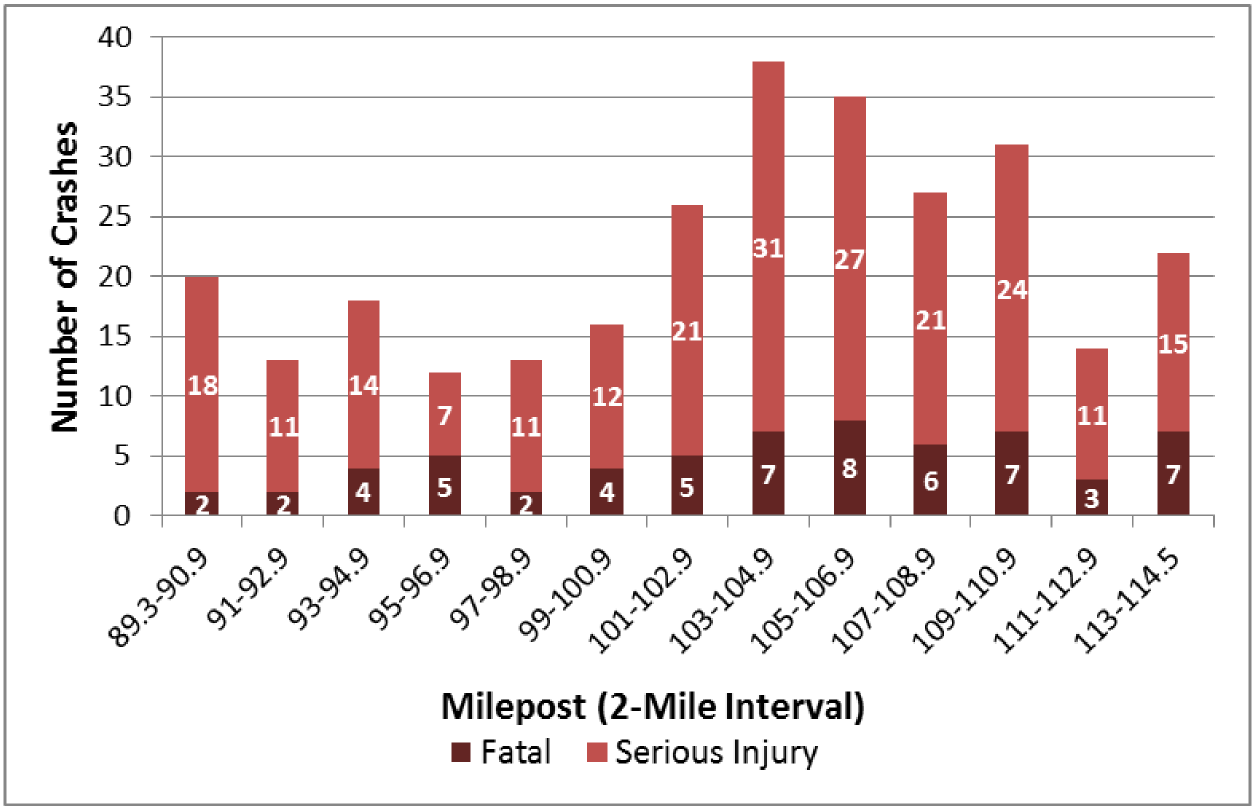
Angle crashes were the second most common crash types, and they experienced peaks in December and July, followed by January and November. These are mostly winter months but also include the height of the summer tourist season. Angle crashes occurred primarily at major intersections and high volume recreational access locations. The Alyeska Highway intersection experienced the greatest number of angle crashes, followed by the Bird Creek

Campground/Sawmill Road intersection and the McHugh Creek Trailhead and Day Use Area. These locations and peak months suggest that angle crashes are related to winter and summer recreational traffic. A few contributing factors include unsafe speeds, inattention, improper lane changes, and the failure to yield.

Rear end crashes followed a similar trend as MADT volumes, with the highest number occurring in July and the fewest number occurring in April, October, and November. A common trend for the rear end crashes is that many of them occurred at recreational destinations and viewpoint access locations, with a particularly large concentration at McHugh Creek. Most recreational destinations and turnouts do not have turn lanes so drivers must decelerate in the travel lane wait for an acceptable gap. The number and frequency of rear end collisions increased particularly in July during the peak tourist and recreational travel demand period.

While the discussion above has identified locations where certain crash types are prevalent, it is also helpful to consider the distribution of crashes along the corridor. Figure 7 shows the fatal and serious injury crashes from 1977 to 2012 by two-mile intervals. The greatest number of fatal and serious injury crashes occurred between milepost 101 and 111. This is the section between Bird and McHugh Creek where there are numerous recreational accesses and turnouts, despite the narrow space for the road between the exposed rock face on the north and Turnagain Arm on the south.

Based on the crash analysis in this report, corridor-wide mitigation efforts that reduce rear-end, head-on, and roadway departure crashes and severity provide the greatest opportunity for safety improvements. Roadway departures, whether resulting in a fixed object collision or a run off the road crash, remain the most prevalent crash type within the corridor. Segments with higher densities of scenic turnouts and driveways, such as near Rainbow (**MB 17**) and Beluga Point (**MB 19**), provide opportunities to mitigate rear-end and angle crashes through access management projects.



Source: Raw crash data provided by DOT&PF.

Figure 7: Seward Highway, Potter Marsh to Girdwood Crash Summary from 1977 to 2012

3.3 Year 2065 Forecasted Traffic

The objective of this Reconnaissance Study is to provide DOT&PF with long term planning that will guide transportation decisions in the corridor and not delay or modify on-going projects that are in progress. A long design life is desirable due to the high cost of construction, utility relocation, shore protection, and ROW acquisition associated with the corridor. Accordingly, a 50-year planning horizon was selected for this Seward Highway Reconnaissance Study. The projected AADT volumes for the segments of the Seward Highway were calculated using the historical annual growth rate (AGR) average from 1998 to 2012, which was about one percent. The AGR was applied to the AADT for each segment of the corridor, and the results were averaged. Table 2 shows the forecasted traffic volumes along the Seward Highway used in this Reconnaissance Study. Over the 50-year planning horizon this growth rate equates to about a 70 percent increase in the AADT. Based on this estimate, the AADT will exceed planning-level capacity thresholds for a two-lane highway by about 2030-2035. A four-lane highway would be needed to accommodate the AADT estimates beyond 2035.

Table 2: Seward Highway Forecasted Traffic

Segment (#)	2013		2030		2050		2065	
	AADT	Design Day	AADT	Design Day	AADT	Design Day	AADT	Design Day
Rabbit Creek (1)	13,900	21,300	16,500	25,200	20,100	30,700	23,500	36,000
Potter Marsh (2)	10,400	16,000	12,300	18,800	15,000	23,000	15,500	23,800
Indian/Bird (3)	9,500	14,600	11,300	17,200	13,700	21,000	15,500	23,800
Girdwood (4)	8,400	12,900	9,900	15,200	12,100	18,600	14,000	21,500
Portage (5)	5,600	8,600	6,600	10,100	8,100	12,400	9,500	14,600

Notes: Shaded values exceed the approximate capacity of a 2-lane rural highway.
Design Day is seasonally adjusted using a factor of 1.5 to reflect summertime (June, July, and August) Average Daily Traffic (ADT). Values may differ marginally due to rounding.

4 DESIGN STANDARDS

Project design criteria and guidelines used in this planning-level analysis are included in **Appendix B**.

Design criteria will be developed on a project-by-project basis and may be modified at DOT&PF's discretion to accommodate site-specific environmental or design elements. For the purposes of this report, the most important criteria are the number of lanes and design speed. A 65 miles per hour (mph) design speed was used for the entire corridor length.

5 DESIGN CONCEPT

Road improvements considered in this study are designed to improve safety and mobility, provide local access, reduce congestion along the project corridor, and keep people and goods moving between incorporated cities and critical ports and airports at highway speeds. The design concept screening processes considered a four-lane divided highway along the existing alignment as well as two bridge concepts.[10] The first bridge concept considered a two-lane bridge across Turnagain Arm from McHugh Creek at MP 112 to Gull Rock, a cape located northwest of Hope. The concept included a four-lane divided highway from the Rabbit Creek Interchange to the bridge at McHugh Creek, an extension of Hope Road to the bridge, and a new two-lane highway connecting the bridge to Sterling Highway through the Kenai National Wildlife Refuge. The second bridge concept considered a two-lane bridge across Turnagain Arm from Bird Point at MP 96 to Sniper's Point on the south side of Turnagain Arm, connecting to Hope Road at MP 8. The second bridge concept included a four-lane divided highway from the Rabbit Creek Interchange to the bridge at Bird Point.

Both bridge concepts were ultimately eliminated from further consideration. Preliminary traffic analysis found that, even with a bridge, projected 2065 Design Day traffic volumes between Potter Marsh and Girdwood will exceed the capacity of a two-lane rural highway, indicating that there is need for extending a four-lane divided highway to Girdwood regardless of the construction of a bridge. The bridge concepts also introduce more complex constructability and environmental concerns. The four-lane divided highway concept has the additional benefit of being compatible with incremental construction. A total cost comparison was not performed due to the differing termini of the three concepts, but the bridge concepts were not found to be cost effective for the specific termini of Anchorage to Girdwood. A total cost comparison would require an analysis of projected improvements between Anchorage and Sterling for all three concepts. Further discussion of the eliminated bridge concepts can be found in **Appendix C** and **Appendix D.**

The design concept that is the focus of this study consists of a four-lane divided highway between Girdwood and the Rabbit Creek Road Interchange. The concept includes realigning the railroad mainline where necessary to construct four highway lanes, and completion of the separated multi-use path the full length of the corridor. The proposed four-lane cross-section is shown in Figure 7 and a typical section is in **Appendix E.** Exceptions to the typical section were

[10]Turnagain Arm Crossing concept drawings dating to 1944 are on file at the UAA Archives. See **Appendix C** for further discussion of previous Turnagain Arm Crossing studies and concepts.

allowed where the existing rail and pathway facilities could be maintained while preserving the intent of this four-lane concept.

The typical section consists of two 12-foot travel lanes in each direction. A 40-foot median that slopes to a depth of 3 feet separates the travel directions (Figure 8). The cross-section includes widened shoulders with each direction having a 12-foot right shoulder and an 8-foot left shoulder. ARRC's centerline would be relocated at least 43 feet from the edge of roadway pavement to provide adequate space between the roadway and the rail alignment for a future second track. As part of future projects, DOT&PF may choose to narrow specific elements of the cross-section, such as median and shoulder widths, in an effort to reduce costs or avoid environmental or ROW impacts. However, for the purpose of this Reconnaissance Study, the desirable, larger footprint typical cross-section was chosen to present a full view of potential conflicts and costs.

A ditch will be used to route drainage between the road and the railroad. On the water side of the track, coastal riprap will protect the new alignment from wave action and erosion. This section was adapted from the typical section that was engineered for the Seward Highway Windy Corner project (**MB 14 to MB 16**), and could include slight modifications when applied to the full length of the study corridor. For planning-level purposes, it is considered to be a close approximation with the primary exception being the proposed multi-use path that is included on the land side of the concept alignment. The path is located outside of the highway clear zone (30 feet from the edge of the pavement) with a 3-foot depressed median between the path and the roadway.

Where the typical section requires a cut slope into the existing hillside, a 0.5H:1V (horizontal:vertical) side slope is assumed for rock cut slopes with a 20-foot-wide rock catchment between the pathway and the rock face. Where the cut slope exceeds 60 feet in height, the rock catchment will be widened to 30 feet. As traffic volumes increase and greater conflict occurs, there is a corresponding need for greater management of access, particularly at high turning movement locations. To meet this need, the design concept includes interchanges at Girdwood (**MB 1**), Bird (**MB 11**), Indian (**MB 13**), and Potter Marsh (**MB 25**).

Between MP 90 and MP 96, the railroad tracks are located on the land side of the road alignment. For the majority of this segment no new multi-use path is proposed due to the existing Indian to Girdwood bike path. A cross-section for this segment of the project corridor is shown in Figure 9.

Plan sheets showing the proposed alignment and slope limits for the four-lane typical section are included in **Appendix A**.

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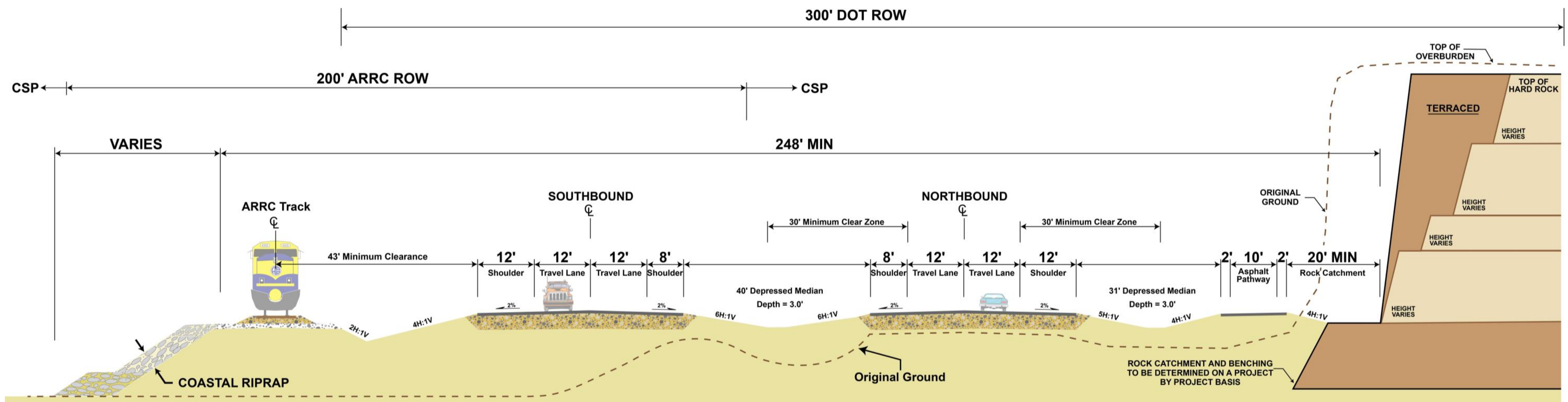

Figure 8: Proposed Four-Lane Divided Highway and Separated Pathway Concept

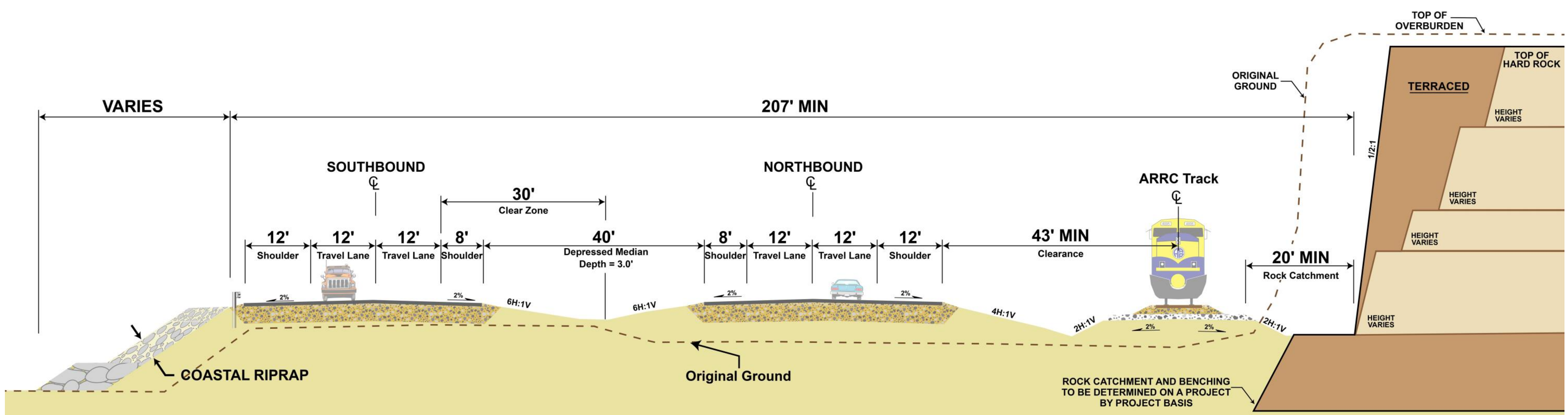

Figure 9: Bird Point to Girdwood Cross-Section

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5.1 Cross-Section Alternatives

Figures 10 and 11 show alternative cross-sections with a reduced 30-foot depressed median and a 10-foot barrier median, respectively. These alternatives may be used in select locations to minimize impacts and reduce costs. The 30-foot median cross-section shown in Figure 10 was used to generate the cost estimate for the route segment from MP 111 to MP 114 to reduce high quantities of rock cut anticipated at that location. The use of the 10-foot barrier median would further reduce rock cut and fill but would further limit access by restricting left-turns and requiring a U-turn to access destinations on the opposite side of the highway.

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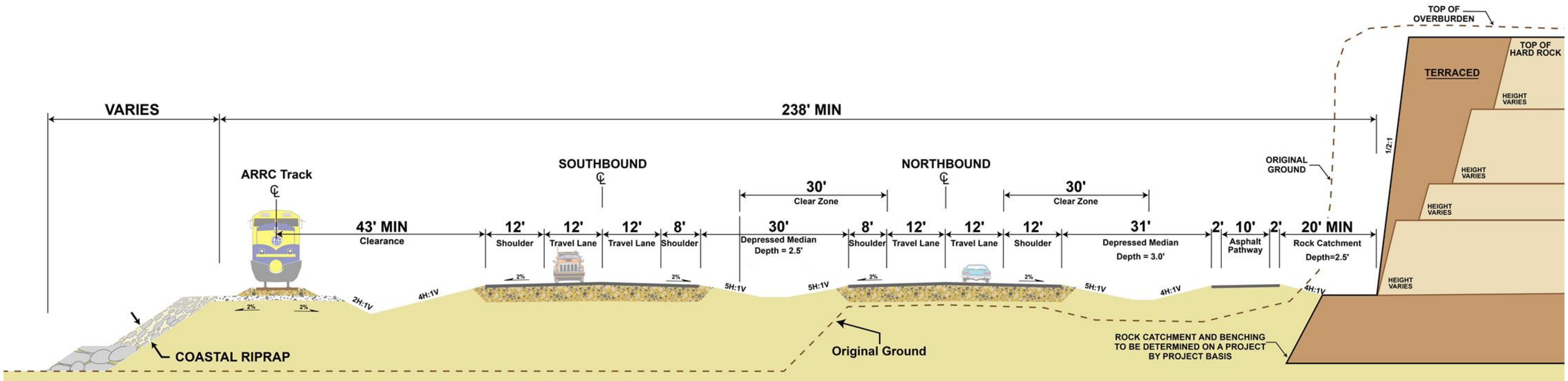

Figure 10: 30-foot Median Cross-Section, MP 111-114

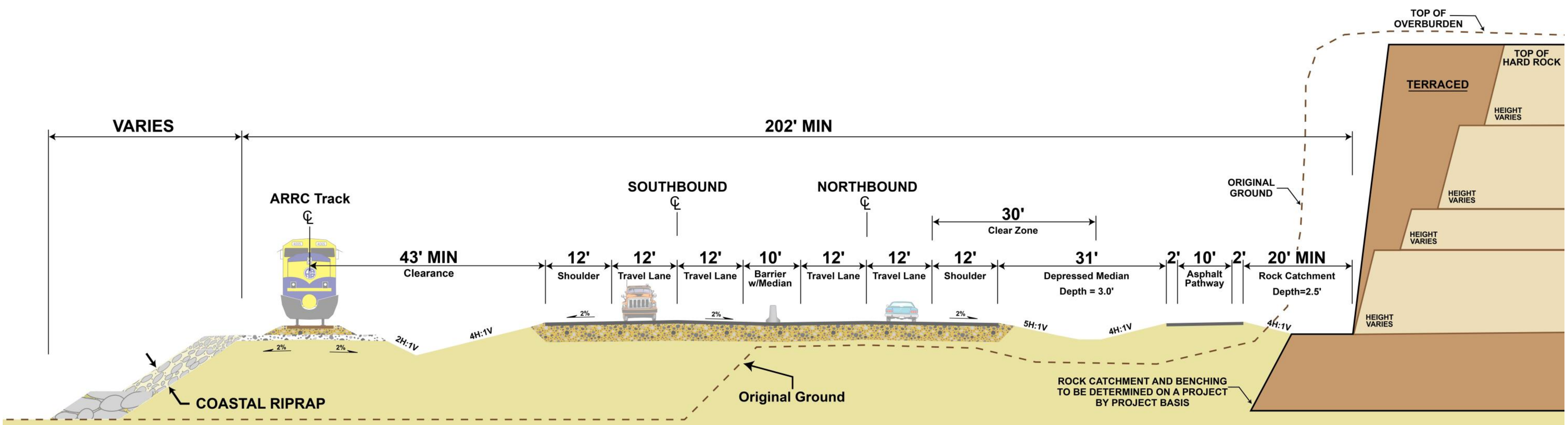

Figure 11: Barrier Median Cross-Section

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5.2 Alignment Alternatives

5.2.1 Tunneling

In locations where the mountainside and existing roadway extend into the inlet, tunneling through these points has been suggested as an alternative to open cut as a means of preserving the scenic beauty of the corridor. Tunneling has the primary advantage of allowing for improved horizontal curvature of the highway and maintaining the scenic character of the coastline. However, unless the existing alignment around the points is preserved for diversion of oversize vehicles, tunneling has the primary disadvantage of limiting vertical clearance over the highway which currently has no limitations between Anchorage and Seward. As the Seward Highway is the only land route to the Kenai Peninsula, the alternative for oversize loads would be via barge. The minimum and desirable tunnel cross-sections as defined by the American Association of State Highway and Transportation Officials (AASHTO) are shown below in Figures 12 and 13.[11] Tunnels may also reduce the scenic value of the corridor for motorists due to obstruction of the view and reduced access to the scenic overlooks at those locations. Access to the scenic overlooks would be evaluated on a project by project basis to ensure consistency with the CSP Management Plan and corridor-wide access management principles.

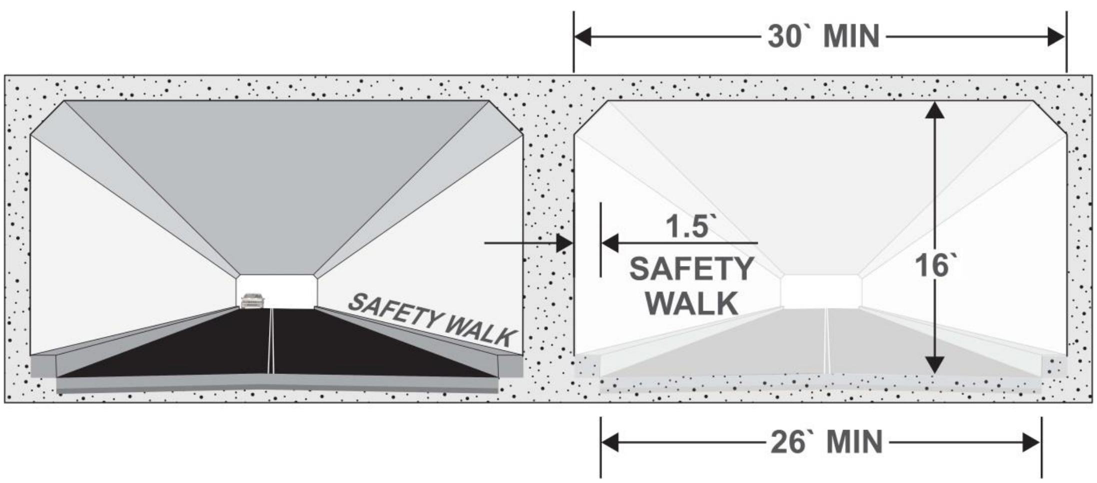

Figure 12: Minimum Tunnel Cross-Section

[11] AASHTO. 2011. *A Policy on Geometric Design of Highways and Streets*. Washington D.C.

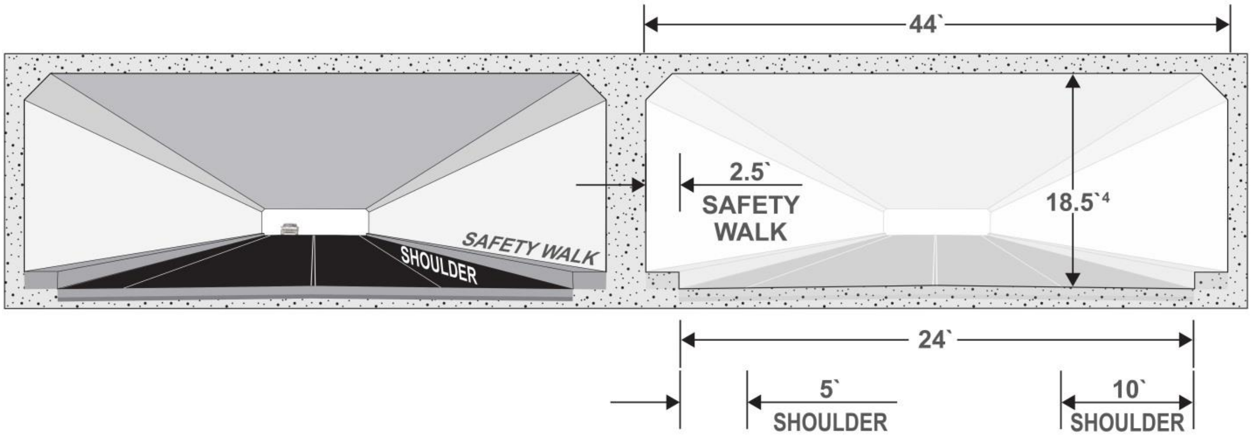

Figure 13: Desirable Tunnel Cross-Section[12]

The minimum cross-section has an estimated unit cost of $49 thousand per linear foot and the desirable cross-section has an estimated unit cost of $54 thousand per linear foot.[13] These costs assume conventional tunneling methods, including drilling and blasting, cut and cover, and sequential excavation. Actual costs will vary depending on ground conditions such as rock mass quality and sheer zones. Poor rock quality or difficult ground would increase ground support requirements and the cost of tunnel construction. Three possible tunnel locations are discussed below. Due to tunnel lengths that exceed 1,000 feet, all of these tunnel options would require complex air handling systems to keep the tunnels properly ventilated.

5.2.1.1 MP104: Indian Point

A possible tunnel alignment through Indian Point is shown in Figure 14. This alternative alignment would follow a larger horizontal curve radius than the primary alignment. The alternate alignment as shown would result in a tunnel with a length of approximately 1,500 feet. The tunnel would cost an estimated $73.5 to $81 million dollars.

[12]18.5-foot recommended minimum clearance since this is the only overland route to the Kenai Peninsula.

[13]Roastami, J. et al. 2012. "Planning level tunnel cost estimation based on statistical analysis of historical data". Tunnelling and Underground Space Technology 33 (2013) 22-33.

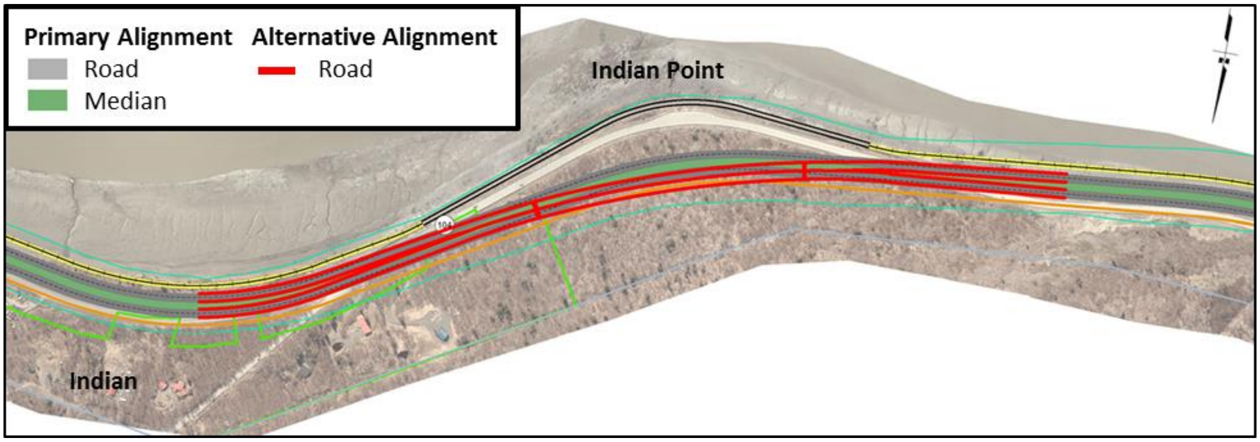

Figure 14: Indian Point Tunnel Alignment Alternative

5.2.1.2 MP 109: Rainbow Point

The tunnel alignment through Rainbow Point in Figure 15 follows the same alignment as the primary alignment. The alternative alignment as shown would result in a tunnel with a length of approximately 1,000 feet. The tunnel would cost an estimated $49 to $54 million dollars.

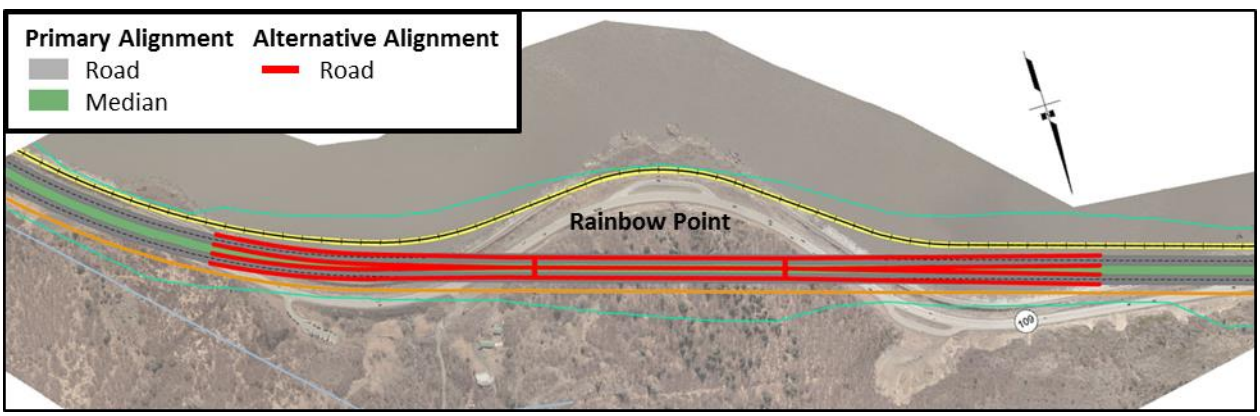

Figure 15: Rainbow Point Tunnel Alignment Alternative

5.2.1.3 MP 110: Beluga Point

A tunnel alignment through Beluga Point as shown in Figure 16 would allow for significant straightening of the highway alignment. The alignment as shown would result in a tunnel with a length of approximately 3,000 feet. The tunnel would cost an estimated $147 to $162 million dollars.

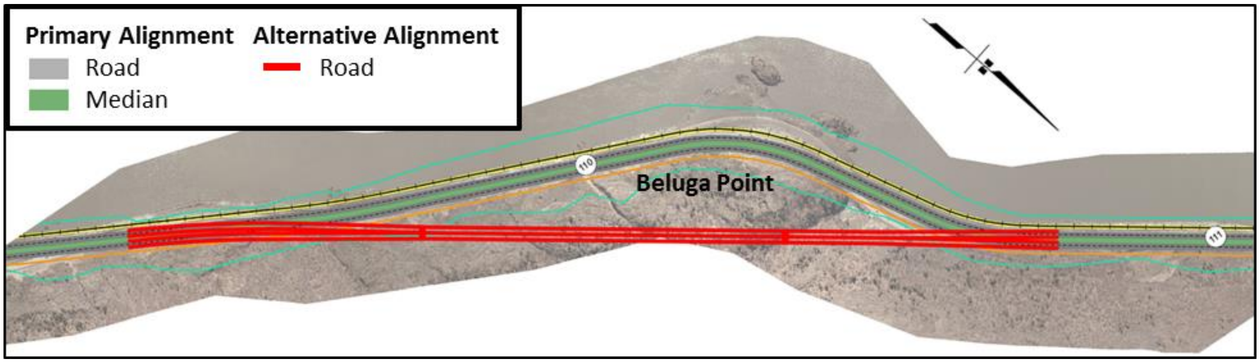

Figure 16: Beluga Point Tunnel Alignment Alternative

5.2.2 Potter Marsh

The primary concept alignment along Potter Marsh (**MB 23 to MB 25**) avoids the placement of fill in Potter Marsh as the marsh provides high quality bird habitat and is part of the Anchorage Coastal Wildlife Refuge, which borders both sides of Seward Highway along Potter Marsh. The existing road embankment is used to provide frontage road access to the Potter Creek Trailhead and Potter Valley Road. The concept also includes a multi-use path on the existing road embankment. The railroad alignment is unchanged and the new four-lane highway is located outside the existing railroad embankment in Turnagain Arm. Two possible alternatives to the primary concept alignment are discussed below. Both alternatives would require evaluation to determine how to maintain access to CSP and Anchorage Coastal Wildlife Refuge recreation resources in a manner consistent with the access management principles applied along the project corridor.

5.2.2.1 Existing Alignment

An alternative to the primary concept alignment is shown in Figure 17. The alternative concept alignment follows the existing road alignment, minimizing total wetland fill in the Anchorage Coastal Wildlife Refuge. The widening of the existing road embankment to accommodate four divided lanes and a multi-use path would require placement of fill in Potter Marsh. In some locations the railroad embankment would be shifted into Turnagain Arm, requiring placement of fill in the intertidal mudflats.

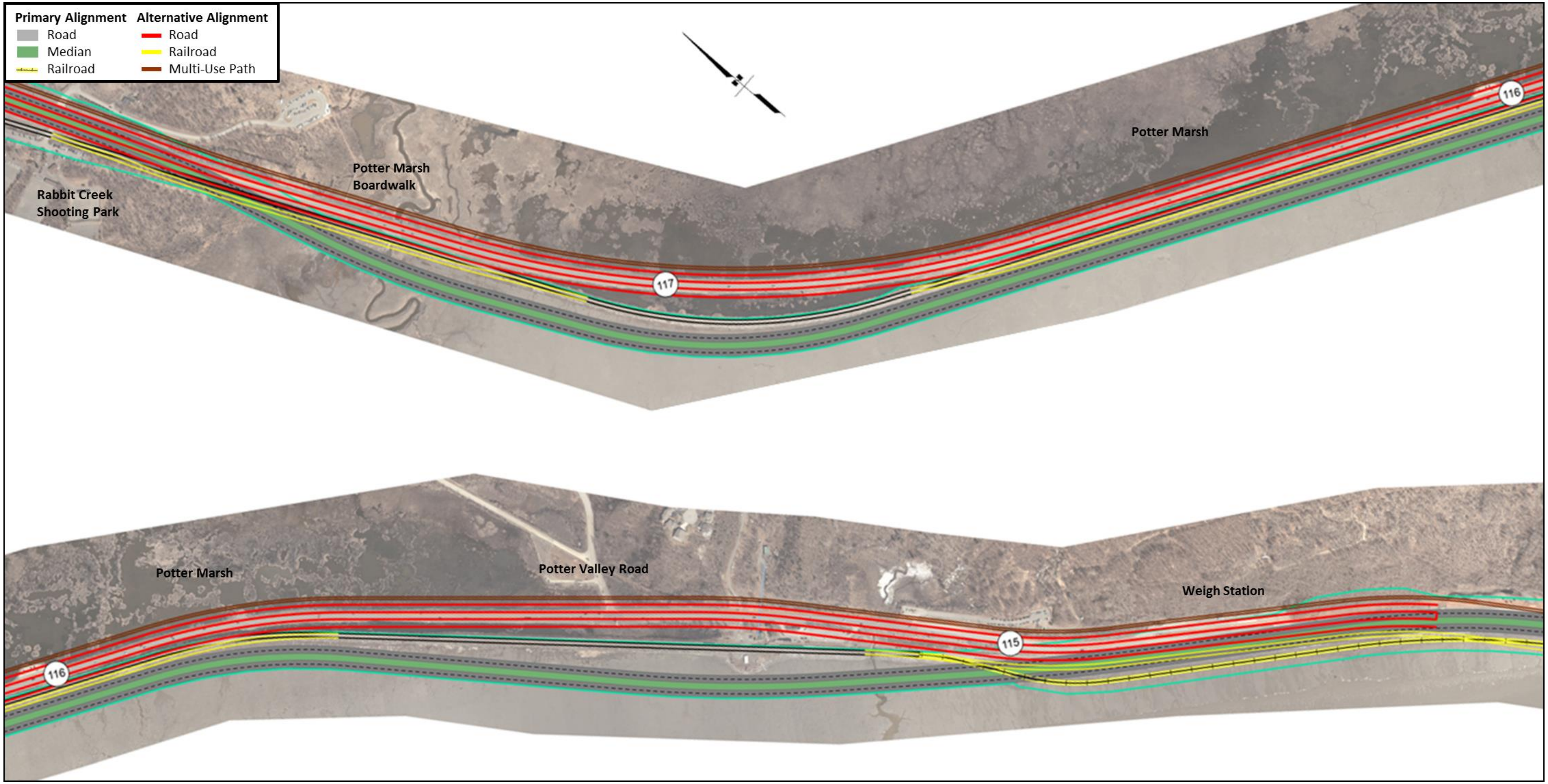

Figure 17: Potter Marsh Existing Alignment Alternative

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5.2.2.2 Old Seward Highway

An additional alternative to the primary concept alignment is shown in Figure 18. This concept splits traffic around Potter Marsh, directing southbound traffic along the existing alignment and northbound traffic along the Old Seward Highway. This alternative minimizes wetland fill as the existing roadway embankment would not require significant widening. However, this alternative would create significant access management issues due to the presence of residential neighborhoods along the Old Seward Highway.

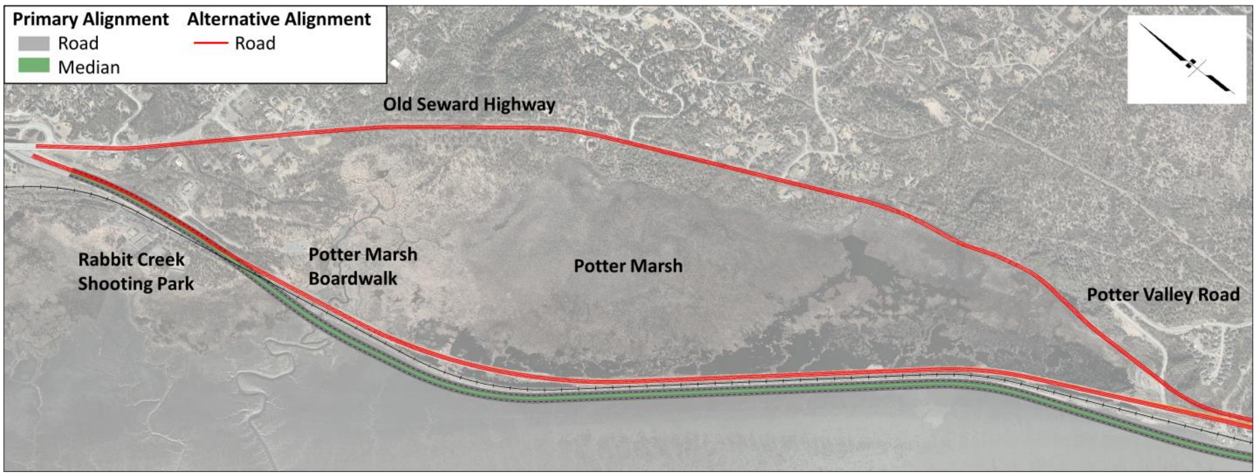

Figure 18: Potter Marsh Old Seward Highway Alternative

6 DESIGN CONSIDERATIONS

Details on design criteria and guidelines are included in **Appendix B**. The alignment shown on the plan sheets in **Appendix A** was used in conjunction with prior stakeholder interviews to solicit:

- Potential concerns from stakeholder agencies (e.g. DNR and ARRC),
- Options that may reduce the environmental impacts,
- Corridor features and considerations that would impact the alignment, and
- Constructability concerns and issues.

A summary of DOT&PF staff interviews concerning the Seward Highway is included in **Appendix F** and a summary of comments by DOT&PF section/division is included in **Appendix G**. The corridor design considerations are summarized for the following topic areas.

6.1 Railroad Alignment and Considerations

Because of the close proximity of the rail and highway facilities and the overlapping ROWs, ARRC will be an important partner in corridor development. ARRC's main concerns are anticipated to be:

- Embankment protection from tidal and wave forces, particularly where the tracks are relocated farther into Turnagain Arm;
- Maintaining or improving longitudinal grade of the mainline, without significant elevation changes;
- Improving horizontal alignment by reducing curvature where possible;
- Reducing public access/trespass to the tracks;
- Maintaining required clear zones per the ARRC standards;
- Implementation of avalanche mitigation;
- Installation of centralized traffic control;
- Maintenance of current facilities, especially the Girdwood Depot and all sidings; and
- Accommodating (or at least not precluding) expressed desires for future railroad improvements such as:
    - The ability to add a continuous or intermittent second track throughout the corridor;

- Extension of the Rainbow siding south through Windy Corner (**MB 16 to MB 17**); and
- Extension of the Brookman Siding at Bird Point (**MB 6 to MB 7**) north and south.

6.2 Land Use

6.2.1 Chugach State Park Development

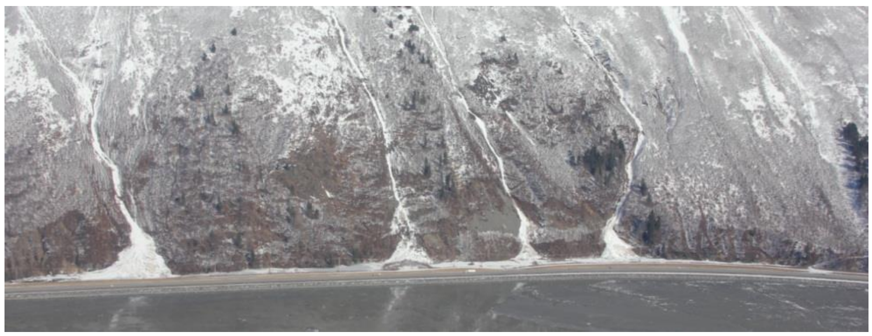

Photo 5: Avalanche Risk
DOT&PF and ARRC have traditionally worked together to mitigate avalanche risk along the route. Photo: William Evans.

As the agency responsible for owning, operating, and maintaining CSP, DNR support will be critical to the success of future development along the Seward Highway. As previously documented, approximately 90 percent of the corridor length is adjacent to CSP lands on both sides of the road/rail alignment. The CSP Management Plan (DNR, 2016), the CSP Access Plan Public Review Draft (DNR, 2010), and the CSP Trail Management Plan (DNR, 2016), include 29 trailhead and campground improvement projects proposed along the Seward Highway between MP 90 to MP 118. Working together, DOT&PF and DNR will more cost effectively build their respective improvement projects, reduce their overall environmental impacts, and be better stewards of scarce project funds.

DNR has used Land and Water Conservation Fund Grant Program (LWCF) funds for land acquisition and improvements in the CSP. One of the results of this funding is that any conversion of park lands to a non-recreation use must be substituted with equal-value recreational properties. Since the vast majority of the transportation corridor is bordered on both sides by the CSP, park land must be used to widen or improve the ROW. The process for converting land from LWCF for federally funded projects requires compliance with Section 4(f) of the United States (U.S.) Department of Transportation Act of 1966 and 6(f) of the LWCF Act of 1965.

The prior agreement between the entities (DOT&PF, DNR and ARRC) that participate in the LWCF conversion process can provide context on how this process may work in the future. Recognizing the limitations of the LWCF lands, the State Legislature adopted findings and policy under Chapter 116 State Legislative Assembly 2000, effective June 7, 2000, authorizing "…grants or conveyances of interests in public land among the [Parties] to relocate or widen the Seward Highway, to relocate railroad facilities, and to relocate adjacent utility facilities from Potter Station to Girdwood…". Pursuant to this policy, these three entities have created and implemented multiple agreements to recognize and institute a cooperative set of guidelines to accomplish the needed improvements along this corridor. Specifically, a now-expired memorandum of agreement, signed in October of 2001, recognized that future improvements to the transportation corridor would be necessary due to its function as the sole link between Anchorage and the Kenai Peninsula for both DOT&PF and ARRC. The parties involved established a framework to make necessary improvements a reality. The original intent of the 2001 agreement was to accomplish the proposed projects in phases within the ten-year term of the agreement.

Though this agreement has expired, the framework set out in the 2001 memorandum of agreement for acquisition of ROW could be similar for the conversion and replacement of park lands in the MP 90 to MP 117 corridor.

6.2.2 Rabbit Creek Shooting Park

RCSP is located at MP 117.7 and is owned and operated by ADF&G. Access Alternative 4 in **Appendix H** shows a possible design concept to provide revised access to RCSP that would be consistent with the new alignment and limited access.

6.2.3 Anchorage Coastal Wildlife Refuge

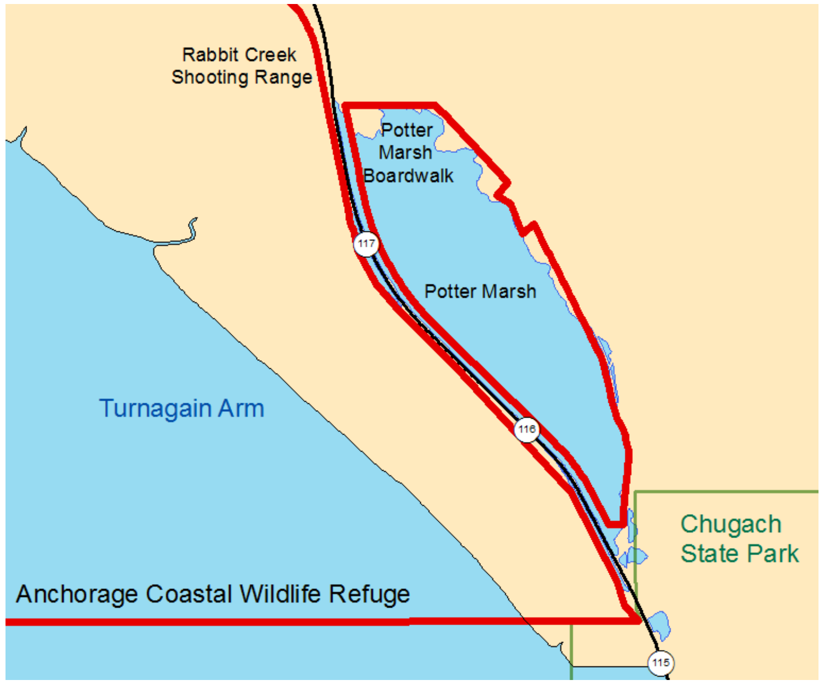

Figure 19: Anchorage Coastal Wildlife Refuge

The project corridor is bordered on both sides by the Anchorage Coastal Wildlife Refuge where the alignment passes Potter Marsh (Figure 19). The Anchorage Coastal Wildlife Refuge was created by the Alaska Legislature in 1988. The Anchorage Coastal Wildlife Refuge Management Plan (ADF&G, 1991) identifies the purposes of the refuge as the maintenance and enhancement of fish and wildlife populations and their habitat as well as the use and enjoyment of Alaskans.

6.3 Access Management and Safety

The primary function of major transportation facilities, like the Seward Highway, is improve the region's economic wellbeing by moving people and goods over long distances at higher speeds from city to city or port to port. The ability to move traffic quickly along the corridor decreases as the number of access points onto the corridor increases. Lower level facilities like local roads and side streets provide a high level of access but lower mobility. These roads operate at lower speeds which makes it safer to enter and exit the road from side streets and driveways but results in slower traffic movement. Access management is necessary to balance mobility and access in a manner that preserves the safety of transportation facilities while providing the intended level of mobility based on the road's functional class (Figure 20). The Seward Highway facilitates commerce, tourism, recreation, and community connection, requiring an access management strategy that serves local and recreational needs while maintaining highway travel speeds for long-distance traffic.

Access management restricts the number of places where vehicles can access these facilities, by limiting driveways and closely-spaced cross roads. Reducing the number of places where vehicles enter the corridor from driveways and side streets reduces the potential for crashes and allows traffic to flow through the corridor without interruption. By managing access points, the roadway capacity is increased, crashes are reduced, and motorist travel time is shortened. Access management along the Seward Highway reduces travel time between major destinations such as Anchorage, Seward, Soldotna, Kenai and Homer as well as intermediate destinations such as Girdwood and the Hope Road junction.

One of the most challenging issues to address on this project will be determining the level of access management to apply in the corridor. Presently, the highway has minimal access management other than limiting driveways through the DOT&PF approach road permit process. In spite of the increasing need for access management from a safety and mobility standpoint, the highway has historically had almost unlimited access from adjacent areas. Drivers commonly pull over wherever they desire for viewpoints or corridor access, increasing the risk of rear end, angle and sideswipe crashes. Transitioning the existing two-lane highway to a four-lane, divided, controlled-access facility would require a well-designed access management strategy and a coordinated and clearly communicated access management plan, so that stakeholders and motorists endorse the plan and understand the benefits of access management and how to access CSP and the communities along Turnagain Arm.

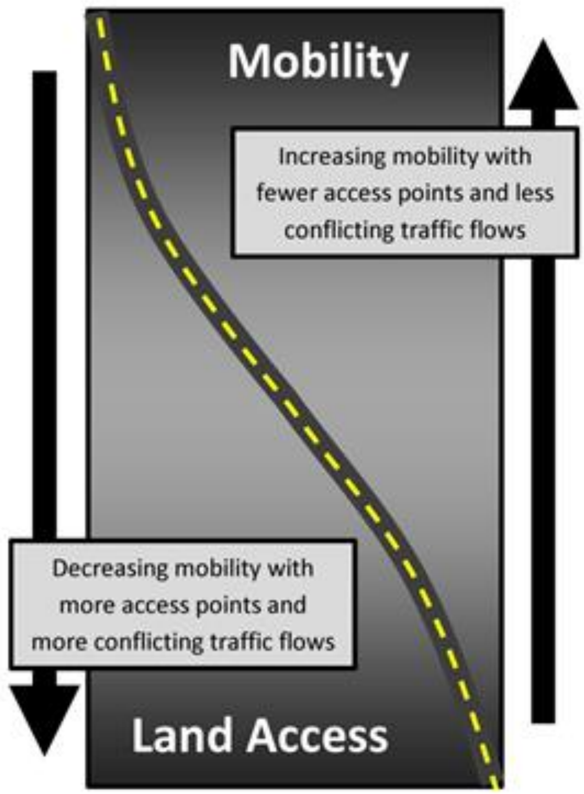

Figure 20: Access Management

DOT&PF has established access standards in the Highway Preconstruction Manual, Chapter 1190. These standards minimize direct access to arterials, especially when alternate access is available. See **Appendix I** for the Draft Parks Highway Access Development Plan as a guide access development plan.

Access management measures may include the following:

- Increasing the distance between intersecting roadways and driveways. This will improve the flow of traffic through reduced congestion and reduced conflicts between turning traffic and through-traffic. This will also improve safety by increasing the decision time between conflicts, and reducing roadside obstacles associated with driveways.
- Consolidation of existing driveways and use of frontage road systems to reduce the number of direct access points.
- Limiting or eliminating uncontrolled pull-offs, particularly those without auxiliary lanes to enable traffic to exit and enter the highway at/near highway speeds.
- Use of interchanges and exit/entrance ramps at major intersections.

This design concept also mitigates head-on collisions by dividing the opposing directions of traffic with a depressed median. The depressed median has a crash modification factor of 0.4 for serious injury and fatal head-on accidents, equating to an estimated 60 percent reduction in serious injury crashes. This crash modification factor was developed by DOT&PF for the Parks Highway Safety Corridor (MP 44.5-52.3) Median & Lighting Highway Safety Improvement Program (HSIP) nomination package (13CR09) based on a review of Highway Safety Manual crash reduction factors and crash history on past projects.

6.4 Turning Movements

One of the safety concerns in the Seward Highway corridor is the differential in speeds between various users. Freight haulers and other commuter traffic to Girdwood and/or the Kenai Peninsula are more likely to be traveling at posted or higher speeds. Tourists and recreational traffic are often traveling slower to look for access opportunities and to enjoy the driving experience that this scenic corridor offers. Designing a facility that safely and efficiently accommodates multiple driver types is key to a successful four-lane controlled-access highway. Multilane highways with auxiliary lanes in the form of dedicated left- and right-turn lanes prioritize the flow of through traffic and improve safety for all motorists by separating traffic traveling at different speeds. Future analysis of the four-lane concept should consider the number and location of access points and whether auxiliary lanes are needed at those locations. Two-way left-turn lanes and non-traversable raised or depressed medians are effective means to regulate access and reduce crashes. Consistent access treatments communicate desired behavior and expectations to motorists.

6.5 Interchanges

As part of the proposed concepts, interchanges are considered at Alyeska Highway in Girdwood (**MB 1**), Bird (**MB 11**), Indian (**MB 13**), and Potter Marsh (**MB 23**) to minimize the turning movement conflicts at the highest volume access locations within the corridor. Concept drawings are in **Appendix H**. In conjunction with the interchange design, improved development of adjacent local street systems/frontage roads would minimize direct access driveways from the highway to recreational and private land uses. At-grade intersections may be considered as interim options for projects along this corridor. While not developed as part of this study, additional interchanges or controlled access ramps at locations such as Picnic Rock (MP 114), Beluga Point (MP 110), Rainbow (MP 109), Indian Point (MP 104), and Bird Point (MP 96) would be desirable to provide turn-around points and safer access to recreational facilities (see Figure 21).

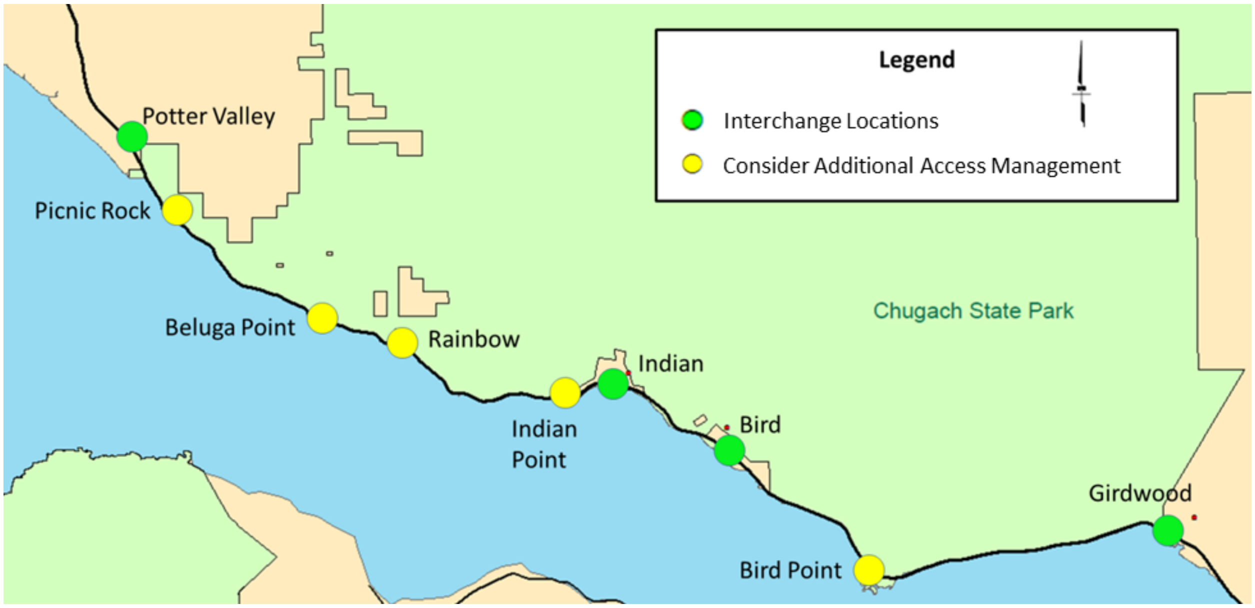

Figure 21: Potential Interchange Locations

6.6 Soil Conditions

Cuts within the native soils, including rock cuts, will likely have slopes of 2H:1V. Rock cuts steeper than 2H:1V are present in the corridor, but usually result in persistent rock fall and degradation of the slopes. Design alternatives will consider ways to stabilize unstable slopes. Where ROW or other restrictions require the use of steeper slopes on soil, rock catchment ditches and possibly other stabilization measures will be needed. The possibility of benching rock cuts may be evaluated on a project-by-project basis to create or preserve wildlife habitat.

6.7 Material Sites

The DOT&PF material site inventory shows several historic material sites within or near the project corridor (Table 3).

Table 3: Historic Material Sites

Site Number	Name	MP	Surface Owner	Subsurface Owner	Estimated Quantity (BCY)
MS 31-2-042-1		101	DNR	State of Alaska	40,000
MS 31-2-035-1		100.5	MOA	MOA	20,000
MS 31-2-021-1	Bird Flats	98	DNR	State of Alaska	100,000
MS 32-2-022-1	Bird Point Quarry	96	DNR	State of Alaska	900,000
MS 32-2-023-1		92	DNR	State of Alaska	50,000
MS 31-2-008-1		91.5	DNR	State of Alaska	5,000
MS 501-395-1		90	Chugach Rock Corp.	DOT&PF	60,000
MS 31-2-027-1	Virgin Creek Pit	89	DOT&PF	State of Alaska	210,000
MS 31-2-017-1		88	DNR	State of Alaska	130,000
MS 31-2-032-1	Kerns Slide Pit No. 2	87	DNR	State of Alaska	210,000
MS 31-2-003-1	Kerns Slide Pit No. 1	87	DNR	State of Alaska	400,000
Total					**2,125,000**

Sources: DOT&PF. 2016. Material Site Inventory.
Notes: BCY – Bank Cubic Yards

In addition to the sites listed above, development of new material sites could serve specific projects. Historically, material sites are evaluated, permitted, and developed on a per project basis. Any potential material sources would require a case-by-case evaluation of quality and quantity of material to determine its suitability for use on future projects. Reaching agreement on the location of material sources can be one of the biggest hurdles for a project because of visual impacts, habitat and wildlife impacts, the complexity of permitting CSP land for use as a material source, and other sensitive issues. Each project must facilitate DOT&PF and DNR agreement on material sources that:

- Are consistent with the management goals for CSP,
- Satisfy the permitting requirement for permitting use of LWCF lands,
- Minimize environmental and visual impacts to the corridor,
- Facilitate future road/rail realignments, and

- Provide rock quality and quantity to maintain a cost-effective project.

A long term, multi-project perspective that could make more efficient use of material sites and reduce overall impacts on CSP should be considered when individual projects are identifying, permitting, and developing a material source. Based on the concept plans shown in **Appendix A**, the rock cut and fill to achieve a four-lane cross-section are expected to vary between 10 and 20 million cubic yards. Balancing the cut and fill needs may not be practicable on a per project basis, but would be much more feasible when evaluating the corridor as a whole. Initial analysis indicates that the total cut for the corridor would be sufficient to meet fill needs. Locations with high volumes of anticipated cut include MP 109, MP 111, and MP 113 to MP 114. Use of rock fall sites as material sources would allow for the additional benefit of eliminating rock fall danger. The ability to develop material sources at locations that would have the dual purpose of supplying material and excavating material for a future project would reduce overall project costs and avoid impacts to CSP that would otherwise not be necessary from an overall corridor perspective.

Decisions on the number and location of material sites for projects in progress such as the Seward Highway MP 105 to MP 107 (**MB 14 to MB 16**) and Seward Highway MP 99 to MP 105 (**MB 9 to MB 14**) could be the first step in this process.

6.8 Right-of-Way Acquisition

The majority of the land within the Seward Highway transportation corridor is owned by the State of Alaska, but managed by DOT&PF, DNR, and ARRC. DNR manages the lands within CSP. Because LWCF funding was used for acquiring, managing, and improving CSP land, Section 6(f) policies apply and any ROW acquisition, including areas of material borrow, must be replaced with lands of equal recreational and monetary value. Both DOT&PF and ARRC intend to fully utilize use their respective 300- foot-wide and 200-foot-wide ROWs for future improvements. A total ROW corridor width of 500 feet would be optimum along the entire transportation corridor. However, given the limited space within the corridor, the ROW for the road and railroad overlap. In areas where the existing rail alignment results in greater separation from the new four-lane highway alignment, the total ROW will be wider.

6.9 Utilities

The existing utilities in the corridor and the anticipated relocations are shown in Table 4.

Table 4: Anticipated Utility Relocations

Utility	Asset	Relocation Beginning	Relocation End	Map Book Sheet(s) Appendix A
ACS	Fiber optic cables	16 miles at various locations		
CEA	25kV overhead electric	MP 90.9	MP 95.2	1-3
	25kV and 115kV overhead electric	MP 98	MP 99	8-9
	115kV overhead electric	MP 102.2	MP 102.6	12
ENSTAR	8" pipeline	MP 115.5	MP 118	23-25
		MP 90.9	MP 103	1-12
GCI	0.500 cable and fiber optic cables	MP 90	MP102.5	1-12
		MP 115.2 rail crossing		23

6.10 Hydrology

Hydrologic and hydraulic design considerations are one of the key project-specific design challenges. Common issues encountered in the corridor are summarized below. Applying consistent criteria and lessons learned from adjacent projects could reduce maintenance and reduce overall costs.

Photo 6: Seward Highway Adjacent to Potter Marsh Impacts on Potter Marsh and Turnagain Arm will need to be mitigated.

- Embankment fill into Turnagain Arm will need to consider protection against erosion due to scour caused by current-induced shear stresses, ice picking, and wave action. Developing a typical section that is resistant to these forces and documenting shortcomings is critical to minimizing the Department's and ARRC's maintenance costs.

- Numerous culverts and bridges for stream crossings (many requiring fish passage design) and highway drainage would need to be replaced or lengthened due to the widened road and railroad section. Coordination is needed to make sure that both agencies apply similar standards to the same streams/channels.

- Roadside hydrology attracts uses such as obtaining drinking water from springs, viewing scenic water falls, and ice climbing on various seeps along the route. Maintaining or eliminating access to attractions will need to be assessed.

A flood hazard permit is required from the Municipality of Anchorage (MOA) to place fill material within the 100-year floodplain of Turnagain Arm, Indian Creek, or Bird Creek. Dewatering may be expected at numerous locations along the project corridor due to the presence of wetlands located adjacent to the existing embankment, a high water table, and the roadway’s low elevation above sea level.

6.11 Environmental Considerations

The project is located in a scenic corridor (designated National Scenic Byway, All-American Road, and State of Alaska Scenic Byway) with abundant high-quality aesthetic features including the Chugach Mountains, Kenai Mountains, and Turnagain Arm.

6.11.1 Historic Resources

If federal funding is used, improvements will be subject to Section 106 review under the National Historic Preservation Act of 1966. The review process will assess which sites are eligible for listing in the National Register of Historic Places (NRHP), and determine measures to mitigate adverse effects. Review will also be necessary under the Alaska Historic Preservation Act. To avoid

Photo 7: Potter Section House

development delays, it is important that a comprehensive review be started early in the development process. Twenty-five documented extant historic sites and seven known prehistoric sites are located within or adjacent to the project corridor. Beluga Point, Potter Section House, and the Indian Valley Mine are already listed on the NRHP. Two additional historic sites and one prehistoric site are eligible for inclusion in the NRHP. One prominent historic resource that may be impacted by the project is the Alaska Railroad. The design concept would require the relocation of portions of the mainline, which the Advisory Council on Historic Preservation may consider an adverse effect.

6.11.2 Wetlands and Waters of the U.S.

The MOA has mapped Waters of the U.S., including freshwater wetlands, in the Anchorage Wetlands Management Plan (AWMP). The AWMP designates wetlands ranging from “A” to “C.” “A” wetlands have the highest resource values and the most protection, and “C” wetlands have the lowest wetland resource values and thus are the most developable. Waters not mapped by the MOA include intertidal mudflats and tidal waters in Turnagain Arm.

Photo 8: Potter Marsh
Potter Marsh is a designated “A” wetland

Section 404 of the Clean Water Act requires permit authorization to discharge dredged or fill material into Waters of the U.S., including wetlands. Section 10 requires approval prior to the accomplishment of any work in, over, or under navigable Waters of the U.S. The Secretary of the Army has delegated permitting authority to the U.S. Army Corps of Engineers (USACE). The project would involve the placement of fill in navigable Waters of the U.S., including wetlands requiring authorization from the USACE (See Table 5).

Table 5: Preliminary Estimate of Impact to Waters of the U.S.

"A" Wetlands (Acres)	"B" Wetlands (Acres)	"C" Wetlands (Acres)	Intertidal Mudflats (Acres)	Tidal Waters (Acres)
0.99	4.02	2.34	18.02	283.77

The USACE's permitting process involves pre-application consultation (for major projects), formal project review, and decision making. The permit decision must comply with U.S. Environmental Protection Agency's Section 404(b)(1) guidelines, which allows the USACE to only permit the least environmentally damaging practicable alternative (LEDPA).

Obtaining Section 404 and Section 10 permits authorizing discharge of fill into Waters of the U.S. requires compensatory mitigation to offset adverse project impacts. Compensatory mitigation obligations may be satisfied by obtaining mitigation credits from one or more mechanism (listed in order of USACE preference): mitigation bank, in-lieu fee program, or permittee-responsible. The proposed project could use credits from a USACE approved mitigation source to compensate for unavoidable impacts to Waters of the U.S. Evaluating the wetland impacts of the corridor as a whole rather than on a per-project basis would allow for banking of credits between projects and a more efficient use of funds. Coordination between projects could also increase the ease of the permitting process.

6.11.3 Wildlife

The Cook Inlet Distinct Population Segment of the beluga whale (*Delphinapterus leucas*) has been federally listed as endangered since 2008. The entirety of the Turnagain Arm is designated critical habitat for this population. The endangered Western Distinct Population of the Stellar sea lion (*Eumetopias jubatus*) is also present in Cook Inlet, but no known haul-outs or rookeries are in the upper Cook Inlet, and individuals are not known to be present in Turnagain Arm.

Harbor seals (*Phoca vitulina*), harbor porpoises (*Phocoena phocoena*), and killer whales (*Orcinus orca*) are known to enter Turnagain Arm. While not depleted, populations are protected under the Marine Mammal Protection Act.

Three known eagle nests are located near the project corridor, and a pre-construction survey would be necessary to locate unknown nests in the area. Construction impacts on Bald Eagles would need to be mitigated/permitted.

Anadromous fish resources are present in 13 streams crossing the project corridor. Under an agreement with the Alaska Department of Fish and Game (2001), DOT&PF agreed that new and reinstalled culverts in fish-bearing waters would be designed and constructed to provide fish passage. The entirety of Turnagain Arm is designated Essential Fish Habitat (EFH) for all five Pacific salmon species and serves as a migratory corridor for salmon and eulachon, but is not considered EFH for any non-salmonid marine fishes or shellfish.

The large animal species commonly found along the project corridor are moose, Dall sheep, mountain goats, brown bears, and black bears. Dall sheep concentrate near Windy Corner between late spring and fall, making it a popular viewing location. Bird Valley is a known wintering area for moose.

Photo 9: Dall Sheep on Cliffs Above Windy Corner
Windy Corner is a popular location for Dall sheep viewing

6.11.4 Permitting

The following environmental permits and agency approvals may be required:

- USACE Section 404 and Section 10 permits for fill in Waters of the U.S.,
- Department of Environmental Conservation (DEC) Section 401 Water Quality Certification,
- DEC Alaska Pollutant Discharge Elimination System General Permit for Construction Activities,

- Section 106 Consultation with the State Historic Preservation Office and native entities under the National Historic Preservation Act,
- Section 7 Consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) under the Endangered Species Act,
- MOA Flood Hazard Permit,
- Consultation with the NMFS regarding conservation measures to minimize impacts to EFH,
- ADF&G Fish Habitat Permit, and
- Consultation with the DNR, CSP, and the United States Department of the Interior regarding the Section 4(f) Evaluation and the 6(f) conversion process under the LWCF.

7 COORDINATION WITH OTHER PROJECTS

Several safety and mobility improvement projects are currently underway in the project corridor. Existing conditions will change as these projects are completed.

- The Alyeska Highway Intersection Improvements project will design and construct a divided intersection at MP 90 of the Seward Highway. This project will address immediate safety concerns with the current two-lane highway configuration, but will be designed to accommodate an eventual four-lane highway as well.[14]
- The Seward Highway MP 75 to MP 90 Bridge Replacements project will replace eight bridges on the Seward Highway between MP 75 and MP 90, and will replace deteriorated pavement. The project is largely located outside of the area of interest for this Reconnaissance Study, with the exception of possible grade separations at the

[14]DOT&PF. 2012. State of Alaska Capital Project Summary Enacted FY 2013. Accessed on August 13 2014. Available at: https://www.omb.alaska.gov//ombfiles/13_budget/Trans/Enacted/2013proj54158.pdf

intersection of the Alyeska Highway and Seward Highway. The project has an estimated completion date in 2019.[15]

- MP 99 to MP 105 Bird to Indian Improvements Project:
    - The MP 99 to MP 100 Improvements project recently constructed approximately one mile of 12-foot-wide passing lane as an extension of the northbound passing lane that previously ended at MP 98.8.[16]
    - The scope of the MP 100 to MP 105 Improvements project includes resurfacing the existing road, construction of a multi-use bike and pedestrian trail between Indian Road and Indian Creek, replacement of the Indian Creek Bridge (#0644) and rehabilitation of the Bird Creek Bridge (#6043). The project will also include HSIP upgrades at the intersection with Boretide Road near MP 103.1 in Indian, and at the intersection with Sawmill Road near MP 100.8 in Bird. Improvements will include the construction of turn lanes. The current estimated completion date for this project is in 2018.[17]

[15]DOT&PF. 2014. State of Alaska Capital Project Summary Enacted FY 2015 Accessed on August 13 2014. Available at: https://www.omb.alaska.gov//ombfiles/15_budget/Trans/Enacted/2015proj54157.pdf

[16]DOT&PF. 2016. Seward Highway 100 to 105. Accessed on April 21 2016. Available at: http://sewardhighway100-105.com/faqs/

[17]DOT&PF. 2016. Seward Highway 100 to 105. Accessed on April 21 2016. Available at: http://sewardhighway100-105.com/faqs/

- The MP 105 to MP 115 Passing Lanes project includes the construction of turn lanes and alternating passing lanes, realignment of sections of the roadway, construction of new pullouts, improvements to the safety of existing pullouts, and widening of the highway shoulders to eight feet. The first phase of this project will be the MP 105 to MP 107 Windy Corner project, with construction scheduled to begin in 2018 pending funding availability.[18]

Photo 10: Windy Corner Project Location

8 PROJECT IDENTIFICATION AND COST ESTIMATE

Various projects within the study corridor were identified and are summarized below. While these projects work together to achieve the overall corridor goals of improved safety and mobility, they also each have utility specific to the project and logical termini. These projects largely follow the logic/rationale for past project limits within the corridor. The projects were given a priority ranking. The ranking was based on historical crash data, operations and maintenance concerns, extending the divided four-lane concept, and access management. Figure 22 shows the project termini and priority ranks.

[18]DOT&PF. 2016. Seward Highway MP 105-107 Windy Corner. Accessed on April 21 2016. Available at: http://www.dowlhkm.com/projects/windycorner/index.html

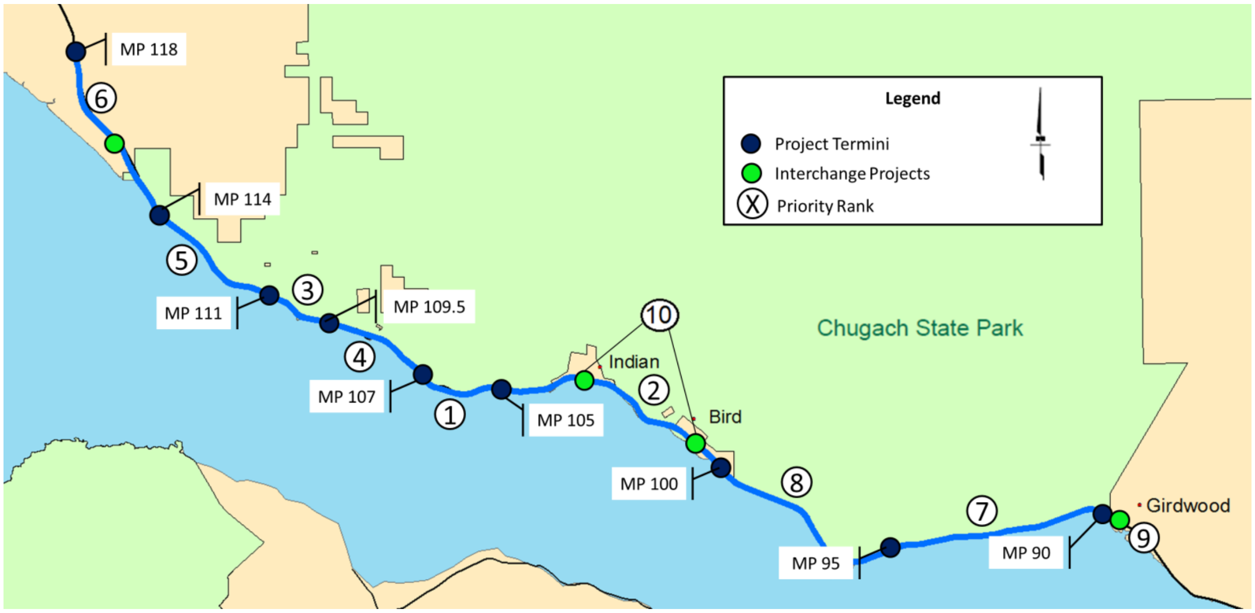

Figure 22: Project Termini

1) Seward Highway, Windy Corner Divided Highway (MP 105 –MP 107): This project (**MB 14 to MB 16**) runs around Windy Corner. It is ranked first on the project priority list. The Windy Corner Project is ongoing and is scheduled to begin construction in 2017. This section of the study route experiences the second highest serious injury and fatal crash rates in the corridor. Curve radii that do not meet current standards and vehicles traveling slowly or that parked on the shoulder to view sheep and other wildlife also contribute to the number of crashes. In addition, MP 106.1 is an area of concern to M&O due to chronic rockfall that spills onto the highway and has been approved as HSIP eligible for possible rockfall treatment beyond routine project work. The estimated cost for the project is $72 million.

2) Seward Highway, Bird and Indian Divided Highway (MP 100 –MP 105): This project (**MB 10 to MB 14**) runs through the communities of Bird and Indian. It is ranked second on the project priority list. The Seward Highway MP 100-105 project is ongoing in this section of the corridor but the scope of that project and the scope of this priority two project are not aligned and may need to be completed as two separate projects. MP 100-105 of the highway experiences the highest serious injury and fatal crash rates in the

corridor. With more than thirty driveways in this stretch, through traffic is frequently disrupted by turning traffic. The estimated cost for the project is $128 million.

3) Seward Highway, Beluga Point Divided Highway (MP 109.5 –MP 111): This project (**MB 18 to MB 19**) runs around Beluga Point. It is ranked third on the project priority list. Curve radii around the point do not meet current standards, and this length of highway experiences the third highest serious injury and fatal crash rates in the corridor. Beluga Point Scenic Overlook is also located on this section of highway and uncontrolled traffic entering and exiting the highway contributes to the crash rate. The estimated cost for the project is $54 million.

4) Seward Highway, Rainbow Point Divided Highway (MP 107 –MP 109.5): This project (**MB 16 to MB 18**) runs around Rainbow Point. It is ranked fourth on the project priority list. The curve radii around the point do not meet current standards and an intersection with Rainbow Valley Road is located at MP 108.5, both of which contribute to high serious injury and fatal crash rates on this section of the study route. In addition, MP 108 and MP 109 to MP 109.5 are areas of concern to M&O due to rockfall that spills onto the highway. MP 109 has been approved as HSIP eligible for possible rockfall treatment beyond routine project work. The estimated cost for the project is $99 million.

5) Seward Highway, Beluga Point to Potter Valley Divided Highway (MP 111 –MP 114): This project (**MB 19 to MB 22**) runs between Beluga Point and Potter Valley. It is ranked fifth on the project priority list and is a high priority for reducing M&O costs. MP 111 to MP 112 and MP 113 are areas of concern for rockfall. MP 113 has been approved as HSIP eligible for possible rockfall treatment beyond routine project work. MP 113 is also an area of concern for icefall in the winter. This section of the study area lacks passing lanes and experiences higher congestion due to the popular McHugh Creek and Beluga Point recreation sites. The estimated cost for the project is $113 million.

6) Seward Highway, Potter Marsh Divided Highway and Interchange (MP 114 –MP 118): This project (**MB 22 to MB 25**) runs along Potter Marsh and is the highest volume segment of the corridor. It is the segment where the divided four-lane traffic transitions to

the slower two-lane highway south of the Rabbit Creek Interchange. It is ranked sixth on the project priority list. High crash rates are a concern on this section of the study route, primarily at the Potter Valley Road/Seward Highway intersection where an interchange is proposed to provide access management. This segment traverses Potter Marsh (part of the Anchorage Coastal Wildlife Refuge), one of the most sensitive environmental areas in the corridor. Access modifications would also be likely at the RCSP. The estimated cost for the project is $104 million.

7) Seward Highway, Girdwood to Bird Point Divided Highway (MP 90 –MP 95): This project (**MB 1 to MB 6**) extends the four-lane concept from Girdwood to Bird Point. The project termini were selected due to the consistent proposed cross-section and existing conditions along this stretch of the study route. It is ranked seventh on the project priority list. Its low placement on the list is due to its relatively low crash rate and straight alignment as well as low congestion levels compared to other sections of the study route. The estimated cost for the project is $58 million.

8) Seward Highway, Bird to Bird Point Divided Highway (MP 95 –MP 100): This project (**MB 6 to MB 10**) runs around Bird Point. It is ranked eighth on the project priority list, the lowest of the four-lane concept projects. MP 95-100 has the lowest rate of serious injury and fatal crashes in the study corridor and has three to four lanes for the majority of its length. The passing lanes end at the project terminus at MP 100. The estimated cost for the project is $82 million.

9) Alyeska Highway/ Seward Highway Grade Separation: This project (**MB 1**) is located at the intersection of Alyeska Highway and Seward Highway. Girdwood is the destination or origin for a large percentage of the vehicles on the study route (about four thousand vehicles per day). This interchange will improve the safety of vehicles entering or exiting the highway at Alyeska Highway. It is ranked ninth on the project priority list. The estimated cost for the project is $40 million.

10) Seward Highway, Bird and Indian Access Management: This project (**MB 10 to MB 13**) is located in the communities of Bird and Indian. It is ranked tenth on the project priority

list. Interchanges with improved frontage roads in these communities will improve the safety of vehicles entering or exiting the highway as well as reduce congestion. The estimated cost for the project is $80 million.

Table 6 summarizes the preliminary projects, their priority ranking and their approximate associated cost. These order of magnitude costs do not take into account environmental permitting and mitigation, land acquisition, and other non-standard roadway elements.

Table 6: Projects within the Study Corridor

Location	Priority Rank	Cost	Cross-section	Description
MP 90-MP 95	7	Per mile: $11M Total: $58M	40 ft. median divided highway	Girdwood to Bird Point
MP 95- MP 100	8	Per mile: $17M Total: $82M	40 ft. median divided highway	Bird to Bird Point
MP 100- MP 105	2	Per mile: $29M Total: $128M	40 ft. median divided highway	Bird and Indian
MP 105- MP 107	1	Per mile: $33M Total: $72M	40 ft. median divided highway	Windy Corner
MP 107- MP 109.5	4	Per mile: $40M Total: $99M	40 ft. median divided highway	Rainbow to Rainbow Point
MP 109.5- MP 111	3	Per mile: $38M Total: $54M	40 ft. median divided highway	Beluga Point
MP 111- MP 114	5	Per mile: $36M Total: $113M	30 ft. median divided highway	Beluga Point to Potter Valley
MP 114- MP 118	6	Per mile: $18M Interchange: $40M Total: $104M	40 ft. median divided highway	Potter Valley and Potter Marsh
Girdwood	9	Interchange: $40M	N/A	Girdwood Interchange
Bird and Indian	10	Interchanges: $80M	N/A	Bird and Indian Interchanges

The estimated cost for the entire route as a whole is $830 million. For context, Alaska's entire U.S. Department of Transportation, Federal Highway Administration (FHWA) spending authority for Fiscal Year 2014 was $431 million, according to FHWA funding tables.

9 CONCLUSION

This Reconnaissance Study provides a first step toward developing a plan for MP 90 to MP 118 of the Seward Highway that prioritizes enhanced operations and improved safety, while protecting the recreational importance and aesthetic qualities of the corridor. This is especially important along this section of the Seward Highway, which provides back country access for Alaska’s largest community. This Reconnaissance Study is intended to guide transportation decisions in the Seward Highway corridor by identifying an overall corridor vision for improved mobility, improved safety, and greater access management. This vision will be accomplished by ensuring that the individual projects that are on-going, planned, and yet to be nominated, are coordinated and aligned to provide a consistent message for the public, regulatory and resource agencies, and other stakeholders. The result will be more streamlined project development and more efficient use of project funding.

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