

Eagle River Interchanges Study

AKSAS #51897



Google Image – Artillery Road Interchange



Google Image – Hiland Road Interchange

Eagle River Interchanges Study

Alaska Department of Transportation & Public Facilities

Contents

List of Figures	3
List of Tables.....	3
Summary	4
Study Area.....	5
Existing Transportation Infrastructure	6
Problem Statement	8
Transportation Demand and Level of Service	11
Concepts Considered	12
Conclusions & Recommendations	27

List of Figures

Figure 1 – Vicinity Map	5
Figure 2 – Hiland Road Existing Conditions	9
Figure 3 - Artillery Road Existing Conditions	10
Figure 4 - Hiland Road Concept H1	15
Figure 5 - Hiland Road Concept H1	16
Figure 6 - Hiland Road Concept H2	17
Figure 7 – Hiland Road Concept H3.....	18
Figure 8 – Hiland Road Concept H3.....	19
Figure 9 – Hiland Road Concept H4	20
Figure 10 - Artillery Road Concept A1	21
Figure 11 - Artillery Road Concept A2	22
Figure 12 - Artillery Road Concept A3	23
Figure 13 - Artillery Road Concept A4	24
Figure 14 – Artillery Road Concept A5	25
Figure 15 – Farm Avenue Concept F1	26
Figure 16 – Level of Service Defined	30

List of Tables

Table A – Level of Service, No action	12
Table B – Level of Service, Intersections, Build concepts	12
Table C – Level of Service, On-ramp Merge, Build concepts	13
Table D – Level of Service, On-ramp Merge, Glenn Highway widening	13
Table E – Preliminary Cost Estimates by Concept	28

Summary This document was developed in response to a legislative request to solve traffic problems at two existing Eagle River interchanges. The interchanges studied are the Hiland Road Interchange which accesses Eagle River Loop, and the Artillery Road Interchange which accesses the central business district of Eagle River. The purpose of this study is to document the existing conditions and problems at the Eagle River interchanges, analyze expected future conditions, describe potential solutions, and present a range of planning level cost estimates. Two other sources of public complaint, the discontinuity of the pathway at the interchanges and the lack of developed Park & Ride facilities at Hiland Road, are also described.

The term “level of service” is used throughout this report to describe traffic at specific locations. The concept of level-of-service (LOS) has been developed to correlate actual or projected traffic volume data to numerical and subjective descriptions of traffic performance at intersections, along freeway segments, and at interchanges. Level-of-service is a term used to qualitatively describe roadway and intersection traffic operations using “letter grades” ranging from A (best) to F (worst). Refer to Figure 16, page 30, for a more thorough explanation of LOS.

Morning traffic merging onto the southbound Glenn Highway from Hiland Road and Artillery Road currently experiences Level of Service (LOS) D during the AM peak hour. Traffic modeling used for the current 2035 Metropolitan Transportation Plan predicts an increase in traffic volumes on the Glenn Highway of approximately 100% by 2035. PD&E analysis indicates a 60% increase in traffic will result in LOS F for AM traffic merging onto the southbound Glenn Highway from both the Hiland Road and Artillery Road interchanges, as well as for PM traffic merging onto the northbound Glenn Highway from Hiland Road. The DOT&PF Traffic & Safety Section reports the morning southbound merge onto the highway from Hiland Road and Artillery Road and the evening congestion on the northbound off-ramp at Artillery Road are the primary sources of public complaint about the Eagle River Interchanges.

Based on Level of Service analysis, none of the proposed interchange improvement concepts offer long term reductions in traffic congestion for Eagle River commuters. Regardless of proposed improvements to the ramps and intersections, with increasing traffic volumes on the Glenn Highway, the highway will not have the capacity to absorb the increasing volume traffic entering from Eagle River. Only increased capacity on the Glenn Highway through construction of additional lanes offers long term benefits of improved level of service. Independent of this study, the 2011 Metropolitan Transportation Plan update proposes to construct such additional lanes on the Glenn Highway through Eagle River.

Study Area

The community of Eagle River is approximately 12 miles north of downtown Anchorage, on the Glenn Highway. Eagle River accesses the Glenn Highway at three interchanges, Hiland Road, Artillery Road, and North Eagle River. The Glenn Highway carries commuters from the Mat-Su Valley and Eagle River/Chugiak to Anchorage employment destinations (including Downtown, Midtown, the U-Med district, and Joint Base Elmendorf Richardson.) Daily traffic on the Glenn Highway south of Eagle River averaged 51,535 in 2009 counts; north of Eklutna it averaged 28,495 vehicles daily. Glenn Highway traffic exhibits a large directional split, with the majority of traffic southbound in the morning and northbound in the evening.



Glenn Highway, Seward Highway to Parks Highway

Glenn Highway, Hiland Road Interchange to North Eagle River Interchange

Figure 1 – Vicinity Map

Existing Transportation Infrastructure



The Hiland Road Interchange is located south of Eagle River at approximately MP 12 of the Glenn Highway. There are single-lane on-ramps and off-ramps northbound and southbound, in a diamond configuration with offset northbound ramps. The Hiland Bridge crosses the Glenn Highway in an east/west direction; it has two lanes with a left turn lane for traffic turning southbound, and a sidewalk/ pathway on its north edge. All intersections at ramps are unsignalized. West of the Glenn Highway, Eagle River Loop, sometimes also called Hiland, ends at the entrance to the regional landfill. A gravel park and ride lot is

located outside the landfill gate. The northbound off-ramp is offset to the east of the northbound on-ramp; directly across from the northbound off-ramp is a dead-end frontage road leading to the Correctional Center and the Alaska State Parks campground. A paved pathway from Anchorage, along the west side of the Glenn Highway, crosses Hiland Road and the southbound off-ramp at grade, to cross the Glenn Highway on the bridge. The path then crosses the northbound on-ramp at grade and turns northbound down the frontage road. East of the northbound off-ramp, Hiland becomes the four-lane divided Eagle River Loop, connecting to Eagle River Road.

The southbound Glenn Highway on-ramp receives significant use by commuters from Eagle River traveling to Anchorage, Joint Base Elmendorf Richardson, and destinations farther south. Southbound drivers merging onto the highway experience delays of nearly 30 seconds during their morning peak hour commute.



Turn lane to southbound on-ramp, Hiland Rd



Southbound on-ramp, Hiland Rd Interchange



The Artillery Road Interchange is located near the central business district of Eagle River, at approximately MP 13 ½ of the Glenn Highway. There are single-lane on-ramps and off-ramps northbound and southbound in a partial cloverleaf configuration. Intersections with Artillery Road are unsignalized. Artillery Road crosses the Glenn Highway in an east/west direction. The Artillery Road Bridge is two lanes, with shoulders and a sidewalk on its north edge. West of the southbound ramps, Artillery Road serves only a few businesses and a small residential area. East of the Glenn Highway, Artillery Road joins with the

Old Glenn Highway and Eagle River Road in a signalized intersection, connecting to the center of the community of 23,000. The northbound off-ramp free-right carries the majority of the traffic onto eastbound Artillery Road, where it divides between the Old Glenn Highway to the north and Eagle River Road to the south and east.

The Artillery Road interchange experiences heavy traffic during peak operating hours. Commuter traffic utilizes this interchange to travel north or south on the Glenn Highway and for access to downtown Eagle River and adjacent residential and commercial areas. Morning commuters mainly use the southbound Glenn Highway on-ramp for travel to Anchorage; this traffic converges with traffic from the Mat-Su Valley and smaller communities north of Eagle River when entering the highway. Evening traffic uses the northbound off-ramp; queues and lengthy delays form on the Glenn Highway and at the Eagle River Road/Artillery Road Intersection. The northbound off-ramp experiences evening congestion largely because of the short distance between the ramp and the Eagle River Road intersection.



Southbound on-ramp, Artillery Road Interchange, 8:00 AM, off-peak hour.

The North Eagle River Interchange is located at approximately MP 15 ½ of the Glenn Highway. The North Eagle River southbound on-ramp currently carries only 35-40% of the volume carried by either of the other two interchanges, and thus is not studied in this report. Future traffic growth may require a re-examination of the North Eagle River interchange.

Problem Statement

Morning traffic at the Hiland Road and Artillery Road interchanges causes long queues on southbound Glenn Highway on-ramps, feeder roads, and the Glenn Highway itself. Eagle River traffic attempting to merge with Glenn Highway commuter traffic causes system congestion, slowdown, and occasional failure. Traffic is generally bumper to bumper on the Glenn Highway into Anchorage in the morning peak hour. Evening traffic can also back up onto the highway as northbound off-ramps at the interchanges occasionally cannot accommodate the traffic flow exiting the highway. In both the evening and morning peak hours, drivers can experience extensive delays and frustration, which may contribute to crashes on this section of the Glenn Highway. The purpose of this study is to document the existing conditions and problems at the Eagle River interchanges, analyze expected future conditions, and describe a range of potential solutions with planning level cost estimates. It is not the goal of this report to examine the entire range of possible solutions; this would not be possible without substantial additional traffic modeling.

The **Hiland Road** southbound on-ramp carries approximately 1,300 vehicles during the AM peak hour, according to counts conducted by DOT&PF staff. During the PM peak hour, the northbound off-ramp also carries about 1,300 vehicles. Nevertheless, level of service (LOS) is currently at C or better for all major turning movements. In the morning, LOS falls to F only for the small number of drivers turning left from the southbound Glenn Highway off-ramp, and to D for the small number turning left from the northbound off-ramp.

According to Central Region Traffic & Safety, the morning southbound merge onto the Glenn Highway is the primary source of public complaint about the Eagle River Interchanges. Traffic arrives at the southbound on-ramp in tight groups created by upstream traffic signals. With 1,300 vehicles entering the Glenn Highway from the Hiland Road southbound on-ramp during the AM peak hour, analysis indicates the LOS for merging traffic falls to D. Likewise, though the number of vehicles is less than 100, PM traffic on the northbound on-ramp from Hiland Road also experiences LOS D. **Refer to Figure 2.**

The **Artillery Road** southbound on-ramp carries nearly 1,100 vehicles during the AM peak hour, and the northbound off-ramp at Artillery Road carries over 1,200 during the PM peak hour. LOS is currently at C or better for all major movements. (LOS falls to E for the small number of vehicles northbound in the AM on the frontage road west of the highway; LOS falls to D in the AM for the small number of vehicles southbound on Cross Street, and in the PM for the small number of vehicles turning left or continuing north from the northbound off-ramp. LOS falls to F in the AM for the small number of vehicles turning left or continuing north from the northbound off-ramp.) During the AM peak hour, traffic arrives at the southbound on-ramp in tight groups created by upstream signals. With 1,100 vehicles from the Artillery Road southbound on-ramp during the AM

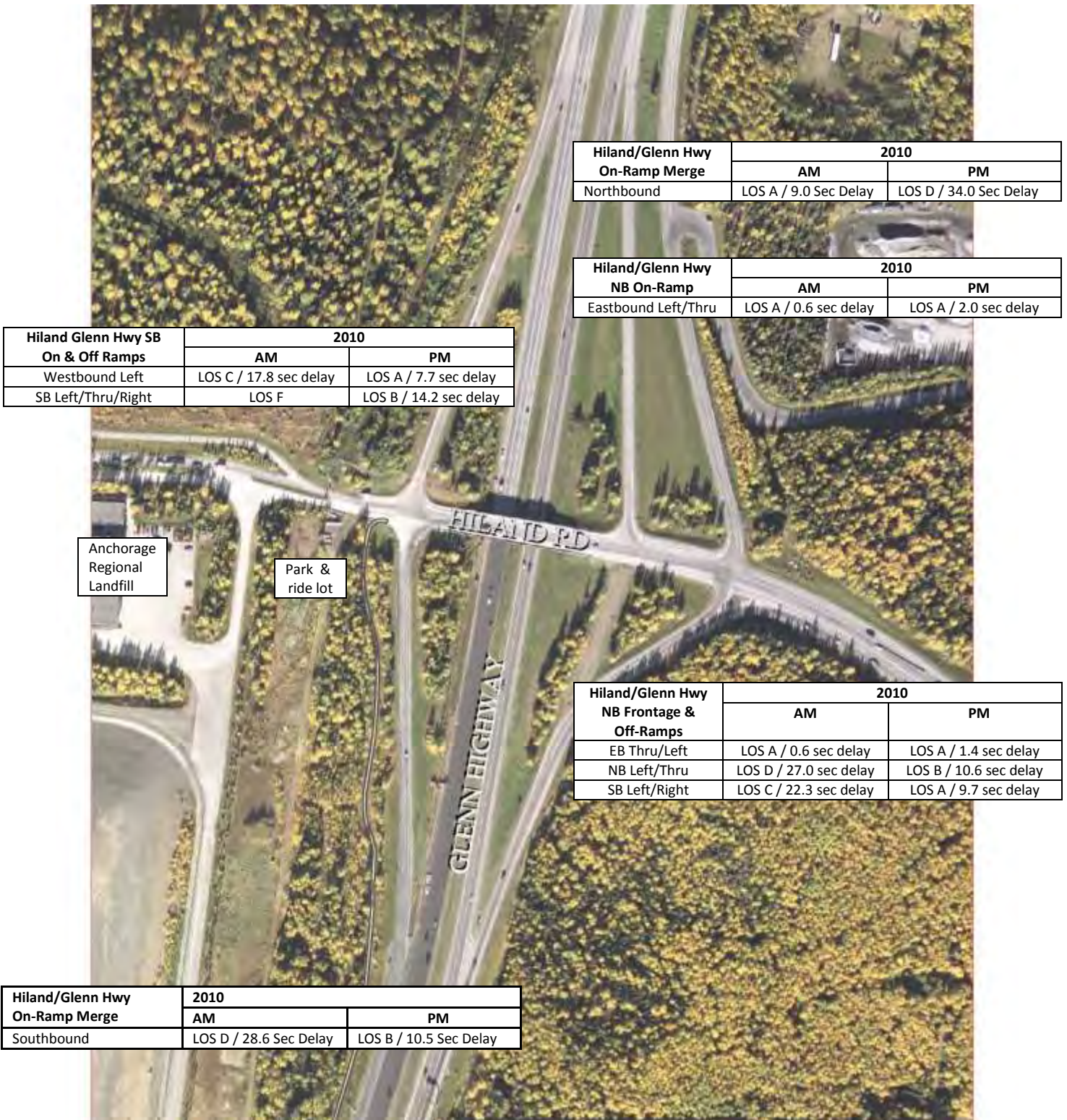


Figure 2 –Hiland Road Interchange Existing Conditions

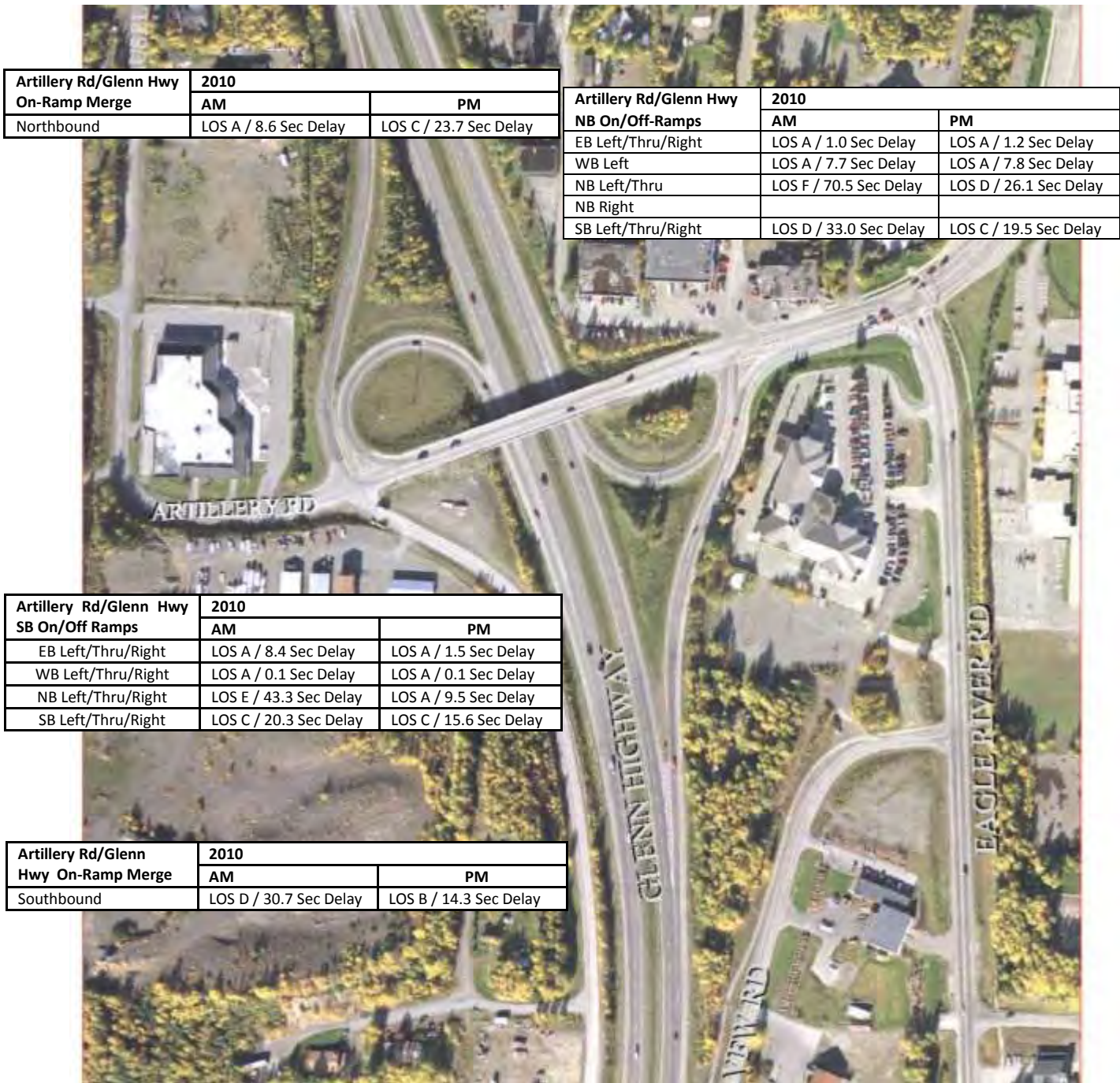


Figure 3 - Artillery Road Interchange Existing Conditions

peak hour, analysis of the merge indicates the LOS falls to D. Traffic on the northbound off-ramp turning right is nominally unrestricted, but is impacted by the downstream signalized intersection of Artillery Road with Eagle River Road. Level of service at the signalized intersection is B during the PM peak. However, traffic is complicated by several factors: 1) four or five cars waiting to turn

left or cross Artillery road block the left lane of the ramp, and 2) the right lane becomes right-turn-only on Artillery road, and 3) the queue length of 300 feet exceeds the 200' distance between the ramp and the intersection. With 1600 vehicles trying to get to the through lane on Artillery Road and 400 to the right turn lane, the weave creates more severe congestion that the LOS analysis would indicate. **Refer to Figure 3.**

Two other sources of public complaint at the Hiland Road interchange are the discontinuity of the pathway, and the lack of developed Park & Ride facilities. As previously noted, the paved pathway from Anchorage through Eagle River crosses Hiland Road at grade between the interchange and the Regional Landfill gate, and crosses the southbound off-ramp and the northbound on-ramp at grade. It is unlikely that the pathway can be totally separated from traffic without new bridges or tunnels. Signalization of the intersections may solve at least part of the problem. A small gravel parking area utilized by park and ride commuters and car poolers is located between the interchange and the landfill gate is. The parking area is frequently filled beyond capacity. The area occupied by this lot will likely be required for interchange improvements; a new location for parking may be needed.



Pathway at Hiland southbound off-ramp



Parking at Hiland Interchange

Transportation Demand and Level of Service (LOS)

Based on analysis of historic traffic counts, PD&E staff project an increase of approximately 60% by 2033 for the AM and PM peak hours at the Hiland Road and Artillery Road interchanges. Traffic forecasts used for the AMATS MTP Update (completed for the Seward Highway-Glenn Highway Connection) predict an increase in traffic of approximately 100% at all three Eagle River interchanges by 2035.

The concept of level-of-service (LOS) has been developed to correlate actual or projected traffic volume data to numerical and subjective descriptions of traffic performance at intersections, along freeway segments, and at interchanges. Level-of-service is a term used to qualitatively describe

roadway and intersection traffic operations using “letter grades” ranging from A (best) to F (worst).

At the Eagle River interchanges, the AM peak hour southbound merges present more significant problems than the intersections. PD&E analysis indicates the AM peak southbound on-ramp merge from Artillery Road will reach LOS F by 2023, and the AM peak southbound merge from Hiland Road will reach LOS F by 2025. (Refer to Table A) The northbound PM merge from Hiland is predicted to reach LOS F by 2016, though this movement involves a relatively small number of vehicles. The failure of the on-ramps is due not to the design of the ramps, but rather to the volume of traffic on the Glenn Highway, and the lack of capacity on the highway to absorb the entering traffic. The intersection of Artillery Road and Eagle River Road presents the most significant intersection problem based on the volume of traffic affected and the fact that it backs up onto the northbound off-ramp in the afternoon.

Table A. Level of Service, No action

	2010 No action	2023 No action	2025 No action	2033 No action
Hiland Rd SB On-ramp Merge AM Peak	LOS D		LOS F	
Artillery Road SB On-ramp Merge, AM Peak	LOS D	LOS F		
Artillery Road NB Off-ramp at Eagle River Rd, PM Peak	LOS B	LOS C		LOS E*

*As previously discussed, the effect on congestion here is more severe than the LOS alone would indicate.

Analysis indicates that level of service (LOS) is currently at C or better for all major turning movements at both existing interchanges. LOS falls to E or F for a small number of vehicles making certain turns during peak hours. Level of Service is falling as traffic volumes increase over time. Concepts proposed by this study fail to prevent LOS from declining to F before 2033. Refer to Table B, and to drawings, pages 15-19, 21-24, and 26.

Table B. Intersection Level of Service, Build concepts

Proposed Improvement	2010 Existing	2010 Build	2023 Build	2033 Build
Concept H1, Hiland Rd AM peak				
From NB off-ramp, left/thru	LOS D	LOS D	LOS E	LOS F
Concept H2, Hiland Rd AM peak				
From NB off-ramp, left/thru	LOS D	LOS D	LOS E	LOS F
Concept A1, Artillery Rd AM peak				
From SB off-ramp, left/thru/rt	LOS C	LOS C	LOS F	LOS F
From NB Frontage, left/thru/rt	LOS E	LOS E	LOS F	LOS F
Concept A2 Artillery Road AM Peak				
Artillery Road at Eagle River Rd	N/A	LOS B	LOS D	LOS F

LOS was analyzed for the build concepts that attempted to improve the southbound on-ramp merge during the AM peak. Refer to Table C. Analysis indicates that the LOS for the merge can be improved for the short term with on-ramp improvements. But because the LOS on this merge is controlled by the highway rather than the ramp, without additional highway capacity, LOS will reach F at essentially the same time as it would with no action.

Table C. Merge Level of Service, Build concepts

On-ramp Merge, SB AM Peak	2010 Existing	2010 Build	2022 Build	2023 Build	2026 Build
Concept H1, Hiland Rd at Glenn Hwy	LOS D	LOS A			LOS F
Concept H2, Hiland Rd at Glenn Hwy	LOS D	LOS B	LOS F		
Concept A1, Artillery Road at Glenn Hwy	LOS D	LOS A		LOS F	
Concept A2, Artillery Road at Glenn Hwy	LOS D	LOS B		LOS F	

The Glenn Highway projects now proposed through Eagle River by the Metropolitan Transportation Plan would widen the highway to four lanes in each direction in the long term. PD&E analysis indicates that extension of the third lane to Artillery Road would improve the level of service to LOS D for the for the morning southbound merge at Artillery. Construction of the third and fourth through-lanes, with no other improvements, would immediately improve LOS for the southbound on-ramp merges to LOS B. With these additional lanes, the critical morning southbound merge would be LOS B for Artillery Road and LOS C for Hiland Road in 2033. Refer to Table D, and to drawings, pages 20 and 25.

Table D. Merge Level of Service, Glenn Highway widening only

On-ramp Merge, SB AM Peak	2010 Existing	2010 w/3 lanes each direction on Glenn	2010 w/4 lanes each direction on Glenn	2033 w/4 lanes each direction on Glenn
	Level of Service/Delay (Sec)			
Hiland Rd at Glenn Hwy On-ramp Merge	LOS D / 28.6	LOS D / 28.6	LOS B/17.1	LOS C /21.3
Artillery Rd/Glenn Hwy On-Ramp Merge	LOS D / 30.7	LOS C / 23.1	LOS B/15.2	LOS B /19.8

Concepts Considered

Build Concepts

Numerous concepts to improve existing interchanges have been examined. At Hiland Road, concepts studied included a two-lane southbound on-ramp, a jughandle southbound on-ramp, and a southbound flyover. Artillery Road concepts included a two-lane southbound on-ramp,

relocation of the northbound off-ramp, roundabouts at the ramps, and a complete reconfiguration including a southbound flyover. The construction of an additional interchange north of Artillery road was examined. Refer to Figures 4 – 15, pages 14 – 25. Most alternatives show short term improvements in Level of Service for some movements; none of the alternatives solve all of the problems. Widening of the Glenn Highway, as proposed in the MTP (LRTP) and illustrated in Figures 9 and 14 (pages 20 and 25,) would significantly improve the LOS for the AM southbound merge even in 2033.

Travel & Transportation Management

In any further study, consideration should be given to travel and transportation management as well as build concepts.

- **Travel Demand Management (TDM)**

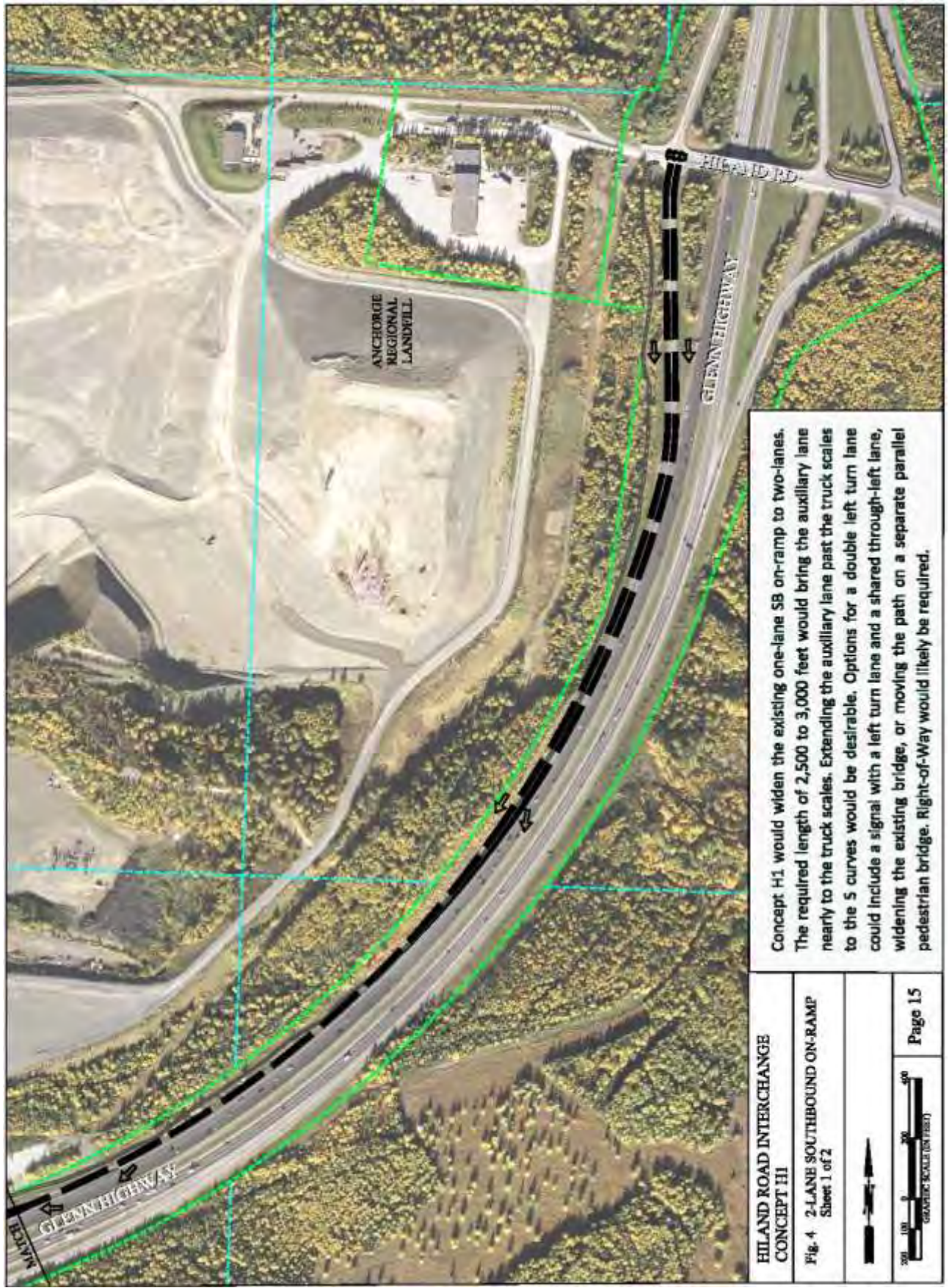
TDM strategies influence travel behavior and demand. These strategies seek to improve system performance by reducing the demand for single occupancy vehicle trips. Strategies already in use include encouraging carpooling, transit use, and bicycling. Improvements to park & ride lots, bus stops, and pathways could improve safety and reduce the number of vehicles using the interchanges, but likely would not be a stand-alone solution to the congestion problem.

- **Transportation System Management (TSM)**



TSM strategies are designed to achieve the best possible performance from the existing transportation system. Strategies include intersection improvements, signal improvements, lengthening turn lanes, and restriping to add lanes within the existing pavement width. TSM strategies might provide useful low-cost solutions at least for the short term. On-ramp metering has been shown to be an effective means of increasing freeway merge capacity. A 2000 Minnesota Department of Transportation (MnDOT) study concluded that the benefits to the traveling public were 15 times greater than the cost of the ramp metering system. Ramp metering has not been universally accepted by the public, however.

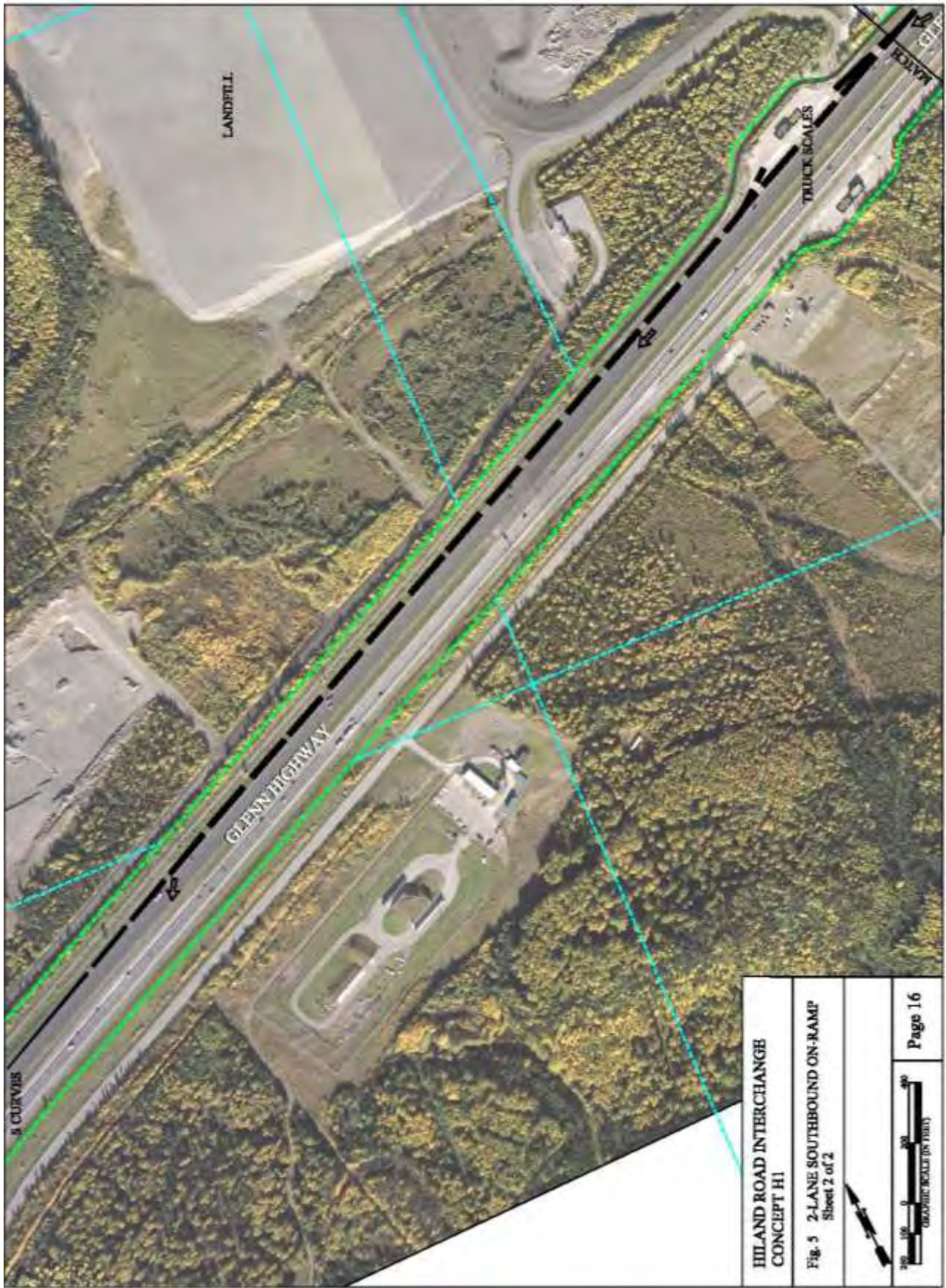
- **Intelligent Transportation Systems (ITS)**

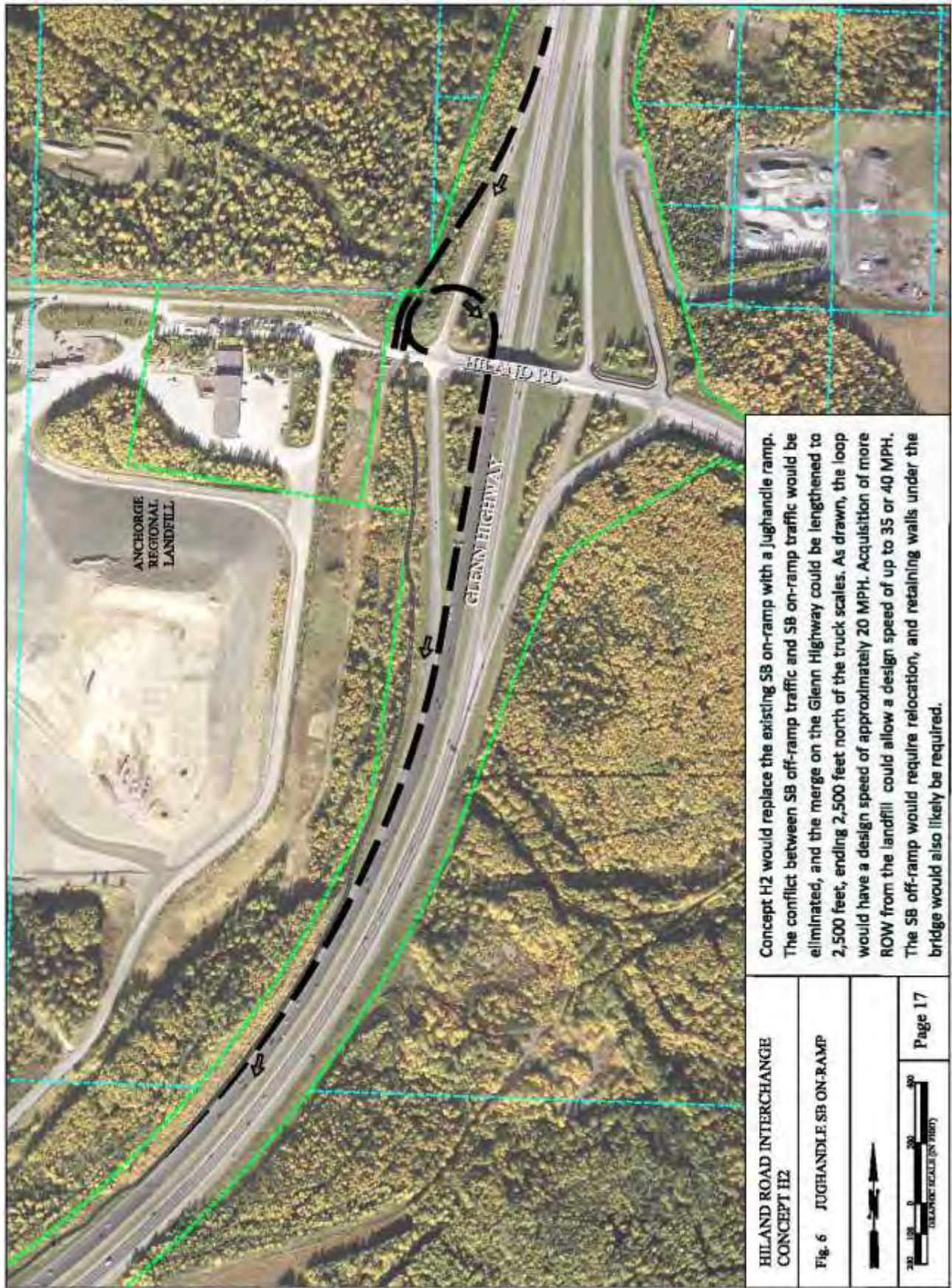
The Federal Highway Administration funded a 2009 project by the University of Virginia Center for Transportation Studies (UVA CTS) to build upon ramp metering to improve the efficiency and safety of freeway merges using Intellidrive. Intellidrive will enable wireless communications among vehicles, highway infrastructure, and travelers' personal communications devices. This freeway merge assistance system will use algorithms for lane control, gap-responsive on-ramp signaling, and merging control.



Concept H1 would widen the existing one-lane SB on-ramp to two-lanes. The required length of 2,500 to 3,000 feet would bring the auxiliary lane nearly to the truck scales. Extending the auxiliary lane past the truck scales to the 5 curves would be desirable. Options for a double left turn lane could include a signal with a left turn lane and a shared through-left lane, widening the existing bridge, or moving the path on a separate parallel pedestrian bridge. Right-of-Way would likely be required.

HILAND ROAD INTERCHANGE CONCEPT H1	
Fig. 4 2-LANE SOUTHBOUND ON-RAMP Sheet 1 of 2	
	
	
Page 15	





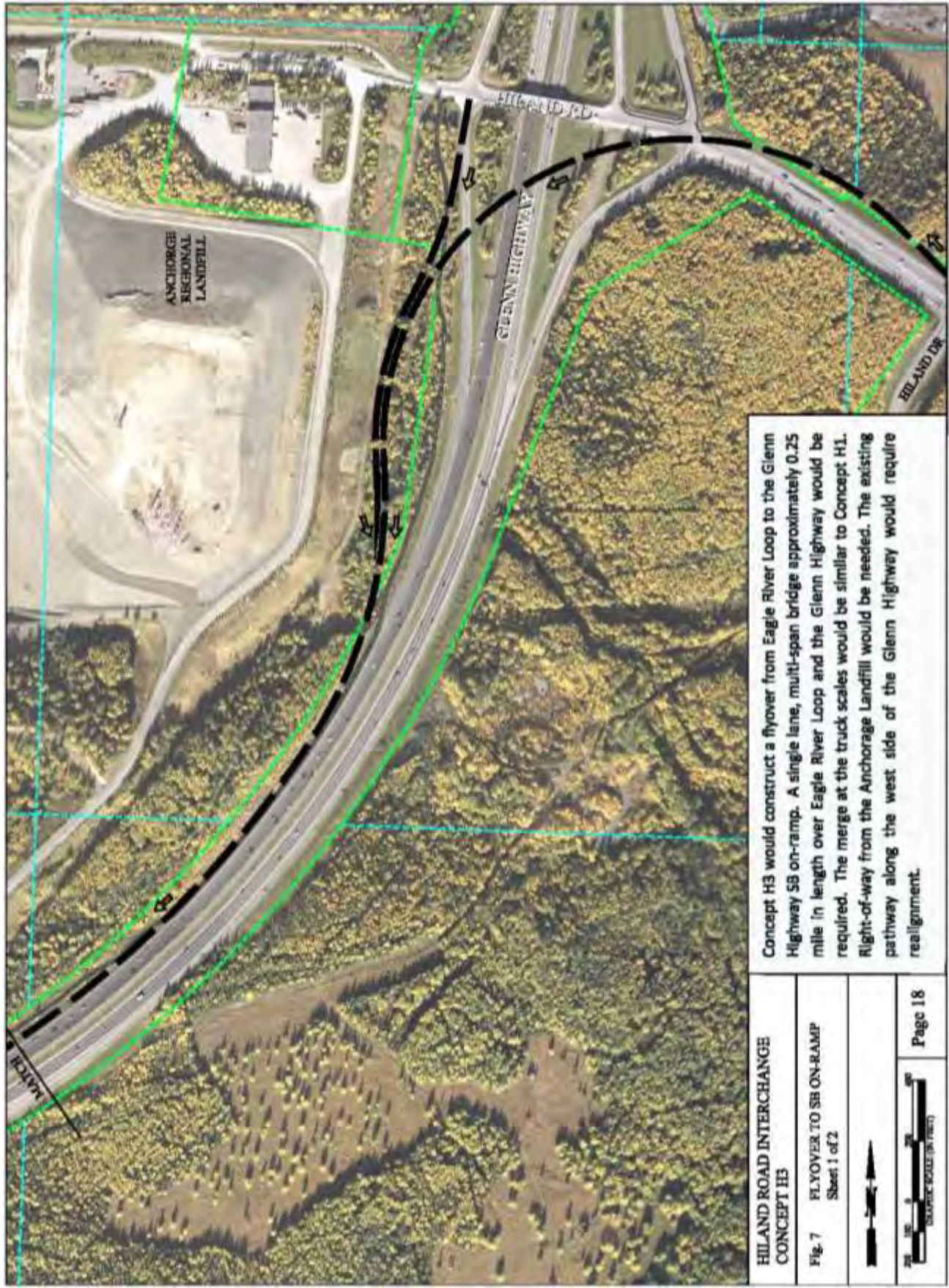
**HILAND ROAD INTERCHANGE
CONCEPT H2**

Fig. 6 JUGHANDLE SB ON-RAMP



 Page 17

Concept H2 would replace the existing SB on-ramp with a jughandle ramp. The conflict between SB off-ramp traffic and SB on-ramp traffic would be eliminated, and the merge on the Glenn Highway could be lengthened to 2,500 feet, ending 2,500 feet north of the truck scales. As drawn, the loop would have a design speed of approximately 20 MPH. Acquisition of more ROW from the landfill could allow a design speed of up to 35 or 40 MPH. The SB off-ramp would require relocation, and retaining walls under the bridge would also likely be required.

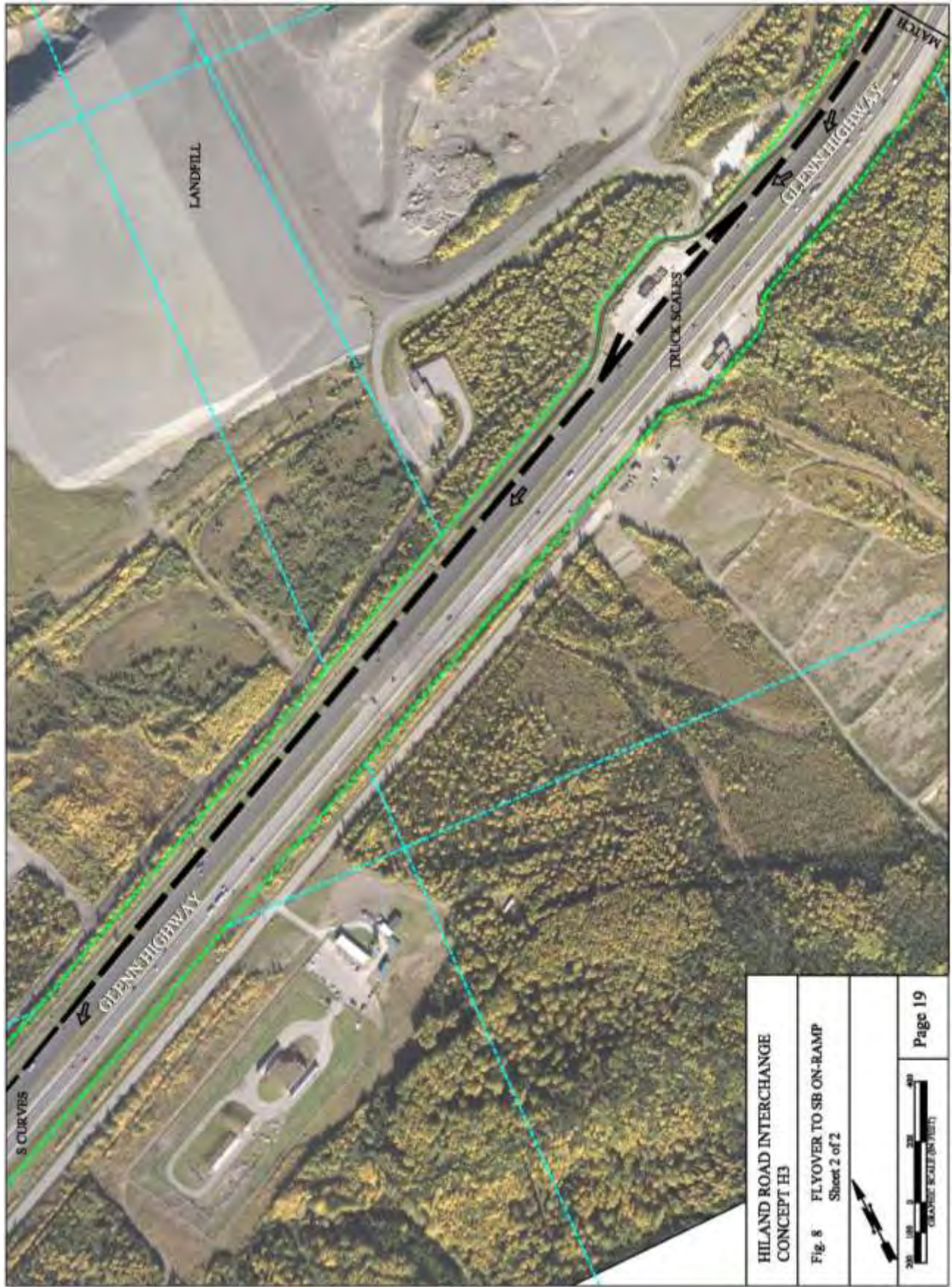


Concept H3 would construct a flyover from Eagle River Loop to the Glenn Highway SB on-ramp. A single lane, multi-span bridge approximately 0.25 mile in length over Eagle River Loop and the Glenn Highway would be required. The merge at the truck scales would be similar to Concept H1. Right-of-way from the Anchorage Landfill would be needed. The existing pathway along the west side of the Glenn Highway would require realignment.

**HILAND ROAD INTERCHANGE
CONCEPT H3**

Fig. 7 FLYOVER TO SB ON-RAMP
Sheet 1 of 2





**HILAND ROAD INTERCHANGE
CONCEPT H3**



Fig. 8 FLYOVER TO SB ON-RAMP
Sheet 2 of 2

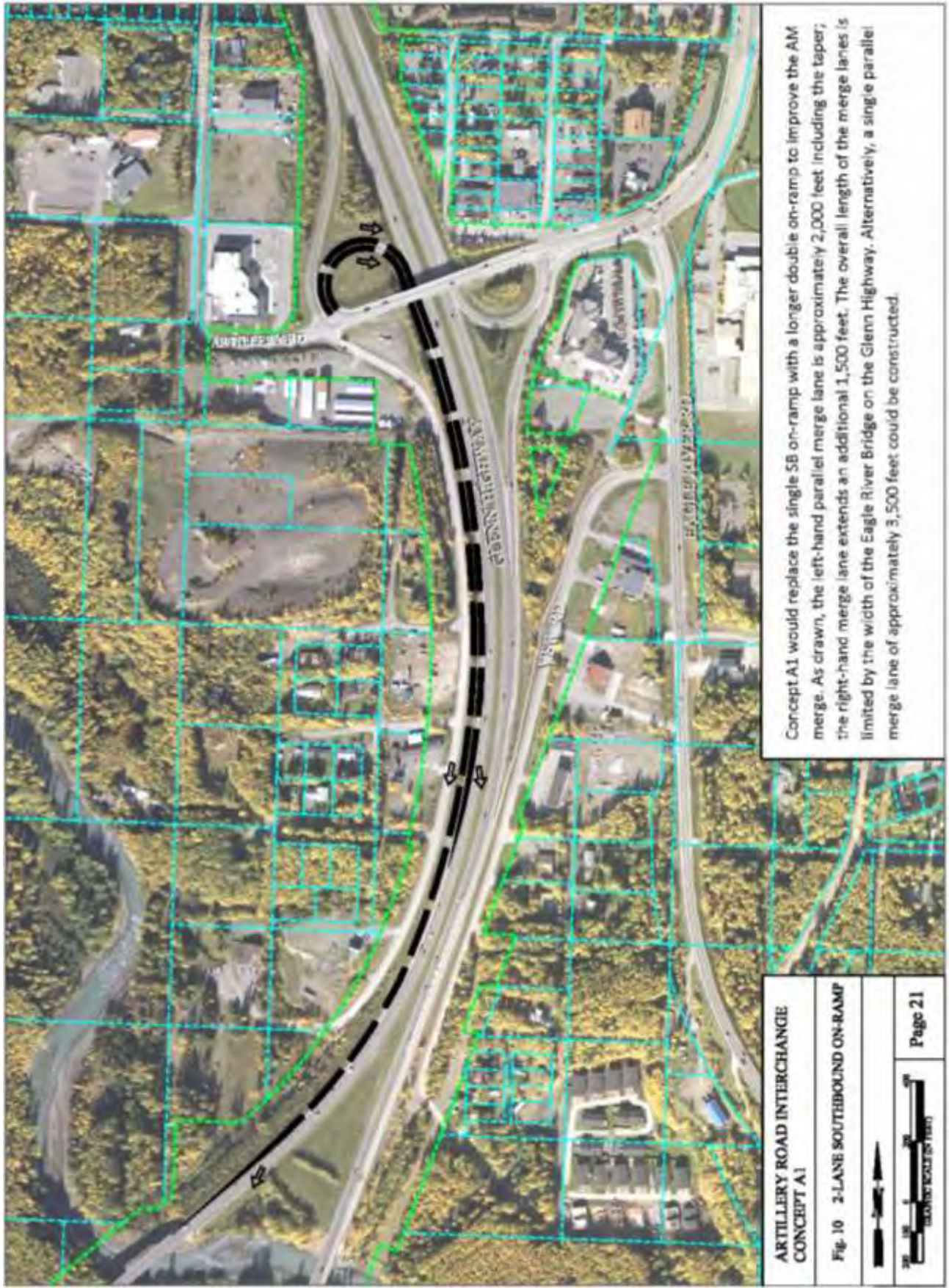
200 0 200 400
GRAPHIC SCALE (IN FEET)

Page 19



Concept H4 assumes widening the Glenn Highway to four lanes in each direction through Eagle River, per the current MTP (LRTP) updates. The bridge would likely be replaced by a longer and wider span. Ramps would be modified to accommodate the extra lanes. Additional modifications to the interchange and adjacent intersections might also be completed at that time, but are not illustrated here.

HILAND ROAD INTERCHANGE CONCEPT H4	
Fig. 9 GLENN HIGHWAY WIDENING METROPOLITAN TRANSPORTATION PLAN	
	
	
Page 20	



**ARTILLERY ROAD INTERCHANGE
CONCEPT A1**

Fig 10 2-LANE SOUTHBOUND ON-RAMP

0 100 200
FEET (NOT SCALE)

Page 21

Concept A1 would replace the single SB on-ramp with a longer double on-ramp to improve the AM merge. As drawn, the left-hand parallel merge lane is approximately 2,000 feet including the taper, the right-hand merge lane extends an additional 1,500 feet. The overall length of the merge lanes is limited by the width of the Eagle River Bridge on the Glenn Highway. Alternatively, a single parallel merge lane of approximately 3,500 feet could be constructed.



**ARTILLERY ROAD INTERCHANGE
CONCEPT A2**

Fig. 11 NB OFF-RAMP & ROUNDABOUTS




Concept A2 would replace the existing NB off-ramp with a new two-lane off-ramp connecting to Eagle River Road at a signalized intersection south of Artillery Road. There would be a double left turn lane and a free right turn onto Eagle River Road. The existing Artillery Road/Eagle River Road/Old Glenn Highway Intersection would be reconfigured to allow free flowing traffic from Eagle River Road to the Old Glenn Highway. Roundabouts could be constructed to improve the left turns at either or both ends of the Artillery Road bridge. For the SB on-ramp, a single parallel merge lane of up to 3,500 feet would be constructed, or a double on-ramp similar to Concept A1 could be constructed. Acquisition of privately owned property would be required.



**ARTILLERY ROAD INTERCHANGE
CONCEPT A3**

Fig. 12 NB OFF-RAMP RECONFIGURATION

0' 100' 200' 300' 400'
SCALE BAR (IN FEET)

Page 23

Concept A3 would replace the NB on-ramp with a new two-lane off-ramp configured to merge with Eagle River Road in both directions. The existing Artillery Road/Eagle River Road/Old Glenn Highway Intersection would be reconfigured to allow free flowing traffic from Eagle River Road to the Old Glenn Highway. The SB on-ramp would be lengthened up to 3,500 feet to improve the AM merge.



Concept A4 is a complete reconfiguration of the interchange similar to Concept A3, providing a double NB off-ramp with a direct connection to the Old Glenn Highway, plus a flyover from the Old Glenn Highway to the SB on-ramp, and a higher speed NB on-ramp. The existing SB on-ramp would also be retained.

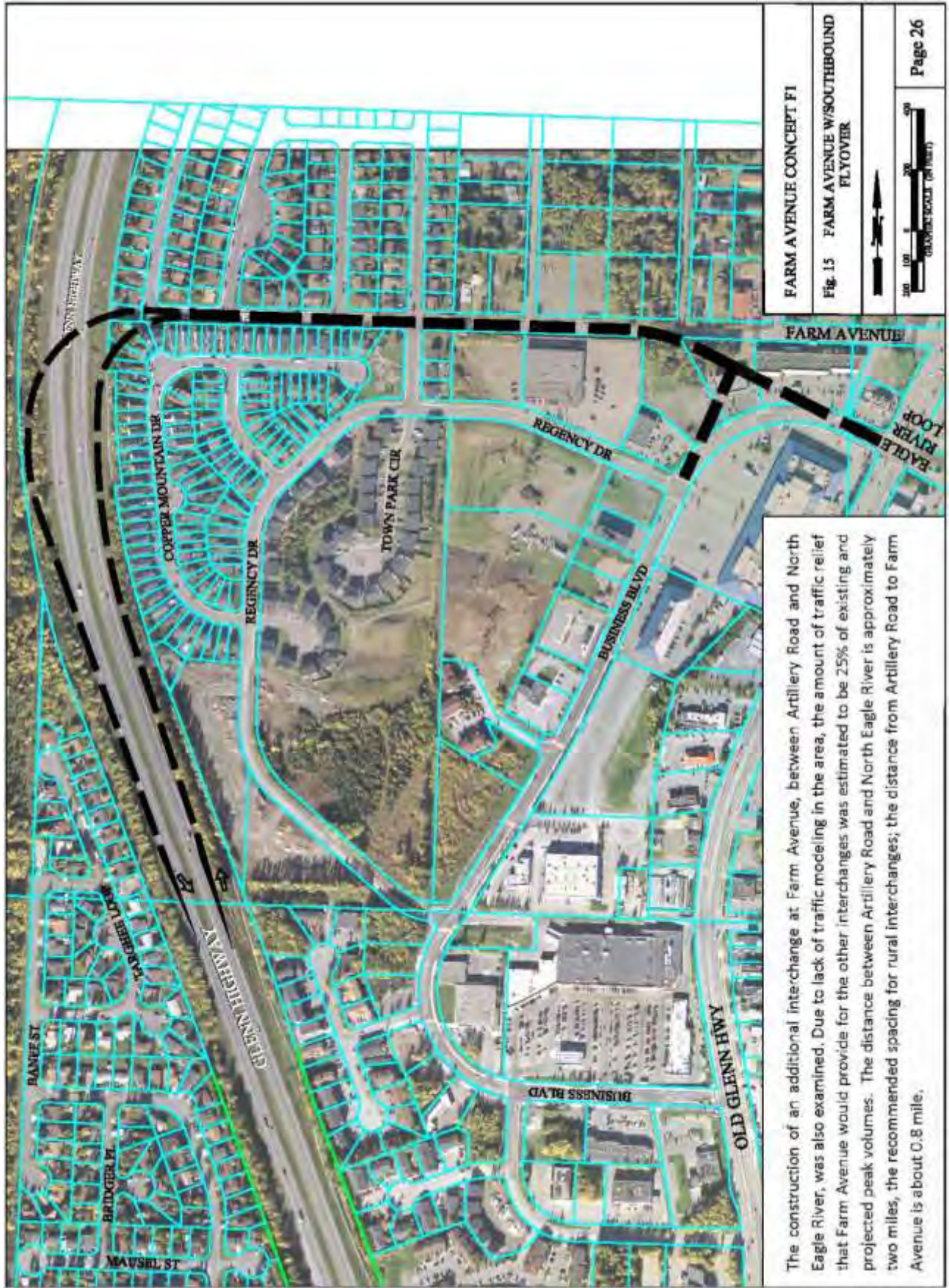
**ARTILLERY ROAD INTERCHANGE
CONCEPT A4**

Fig. 13 RECONFIGURATION W/ FLYOVER

0 100 200 300 400 500
FEET (OR METERS)

Page 24





The construction of an additional interchange at Farm Avenue, between Artillery Road and North Eagle River, was also examined. Due to lack of traffic modeling in the area, the amount of traffic relief that Farm Avenue would provide for the other interchanges was estimated to be 25% of existing and projected peak volumes. The distance between Artillery Road and North Eagle River is approximately two miles, the recommended spacing for rural interchanges; the distance from Artillery Road to Farm Avenue is about 0.8 mile.

Conclusions & Recommendations

Without additional capacity on the highway, LOS for the critical southbound merge will reach “F” at essentially the same time with the proposed interchange improvements as it would with no action. Based on Level of Service analysis, none of the proposed interchange improvement concepts offer long term reductions in traffic congestion for Eagle River commuters. Regardless of proposed improvements to the ramps and intersections, with increasing traffic volumes on the Glenn Highway, the highway will not have the capacity to absorb the increasing volume traffic entering from Eagle River. Only increased capacity on the Glenn Highway through construction of additional lanes offers long term congestion relief.

Of the concepts offering short term improvements, extension of the southbound on-ramps at both interchanges is likely to be the most cost effective action for short term improvement. Refer to Table E for preliminary cost estimates. The preliminary LOS analysis is on file. Level of Service (LOS) analysis done for this study predicts only how a range of improvements at isolated locations could perform individually. Extensive additional traffic modeling would be required to predict how the system as a whole would operate.

Originating with a legislative request to study specific solutions for state-funded construction, this study originally assumed the existing number of lanes on the Glenn Highway remains unchanged. The MTP (LRTP) includes projects to widen the Glenn Highway through Eagle River. Additional freeway lanes would improve the LOS for traffic merging onto the freeway and additional lanes on the bridges would improve LOS at the intersections with the intersecting roads. Additional right of way costs would increase overall project cost. Any interchange improvement projects undertaken should accommodate future Glenn Highway lanes planned in the MTP.

Southbound on-ramp extension at the Hiland Road Interchange may exacerbate merge issues at the southbound truck scales; mandatory in-motion weighing or restriction of truck traffic during morning peak traffic could resolve this. A southbound jughandle on-ramp at Hiland Road could also reduce the conflict at the truck scales, but could require closure of the interchange during construction.

Central Region Traffic & Safety section believes that roundabouts could solve the left turn issues at Artillery Road; a detailed analysis of roundabouts is beyond the scope of this project. Additional traffic modeling is recommended to determine if a new interchange at Farm Road would be beneficial. All solutions should also address pathway discontinuity and the park and ride lot.

A comprehensive study would be required to evaluate these various components, including interchange improvements and highway widening, as a complete system.

Table E. Planning Level Cost Estimates by Concept

Concept H1, Hiland Road 2-lane SB on-ramp	Costs in \$1,000s
Preliminary engineering	\$890
Right-of-way	\$110
Utilities (design & construction)	\$100
Construction	\$8,800
Total	\$9,900

Concept H2, Hiland Road Jughandle SB on-ramp	Costs in \$1,000s
Preliminary engineering	\$860
Right-of-way	\$110
Utilities (design & construction)	\$470
Construction	\$8,800
Total	\$10,230

Concept H3, Hiland Road Flyover SB on-ramp	Costs in \$1,000s
Preliminary engineering	\$3,100
Right-of-way	\$70
Utilities (design & construction)	\$1,390
Construction	\$36,200
Total	\$40,760

Concept A1, Artillery Rd 2-lane SB on-ramp	Costs in \$1,000s
Preliminary engineering	\$860
Right-of-way	\$220
Utilities (design & construction)	No est.
Construction	\$8,270
Total	\$9,340

Concept A2, Artillery Rd NB off-ramp & roundabouts	Costs in \$1,000s
Preliminary engineering	\$1,800
Right-of-way	\$5,840
Utilities (design & construction)	No est.
Construction	\$20,700
Total	\$28,340

Concept A3, Artillery Rd NB off-ramp reconfiguration & lengthened SB on-ramp	Costs in \$1,000s

Preliminary engineering	\$1,430
Right-of-way	\$680
Utilities (design & construction)	No est.
Construction	\$14,200
Total	\$16,310







Concept A4, Artillery Rd Reconfiguration with flyover	Costs in \$1,000s
Preliminary engineering	\$2,000
Right-of-way	\$6,850
Utilities (design & construction)	No est.
Construction	\$21,600
Total	\$30,450

Concept F1, Farm Avenue SB flyover	Costs in \$1,000s
Preliminary engineering	\$3,000
Right-of-way	\$1,870
Utilities (design & construction)	
Construction	\$29,500
Total	\$34,370

Concepts H4 & A5, Glenn Hwy widening (w/o HOV lane north of Artillery Rd)	Costs in \$1,000s
Preliminary engineering	\$17,800
Right-of-way	\$11,570
Utilities (design & construction)	\$8,130
Construction	\$145,000
Total	\$182,500

Figure 16. Level of Service Defined

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service provided by the system. For this reason, the concept of level-of-service (LOS) has been developed to correlate actual or projected traffic volume data to numerical and subjective descriptions of traffic performance at intersections, along freeway segments, and at interchanges. Level-of-service is a term used to qualitatively describe roadway and intersection traffic operations using “letter grades” ranging from A (best) to F (worst).

			
<p>LOS A Represents the best operating conditions and is considered free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.</p>	<p>LOS B Represents reasonably free-flowing conditions but with some influence by others.</p>	<p>LOS C Represents a constrained constant flow below speed limits, with additional attention required by the drivers to maintain safe operations. Comfort and convenience levels of the driver decline noticeably.</p>	<p>LOS D Represents traffic operations approaching unstable flow with high passing demand and passing capacity near zero, characterized by drivers being severely restricted in maneuverability.</p>
			
<p>LOS E Represents unstable flow near capacity. LOS E often changes to LOS F very quickly because of disturbances (road conditions, accidents, etc.) in traffic flow.</p>	<p>LOS F Represents the worst conditions with heavily congested flow and traffic demand exceeding capacity, characterized by stop-and-go waves, poor travel time, low comfort and convenience, and increased accident exposure.</p>		