MEMORANDUM

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FROM:	Sam Tyler, P.E. and Austin Zavala, P.E., Project Engineers DOWL
DATE:	March 25, 2025
SUBJECT:	Project No. CFHWY00917 / Federal No. 0A16055 Glenn Highway and Hiland Road Interchange Improvements – Alternative Selection Memorandum

INTRODUCTION

On behalf of the State of Alaska Department of Transportation and Public Facilities (DOT&PF), DOWL, LLC performed alternatives analysis to support the Glenn Highway and Hiland Road (Glenn-Hiland) Interchange Improvements project near Eagle River (Figure 1). This memorandum provides a summary of DOWL's analysis conclusions.

The existing interchange at Glenn Highway and ERLR has long been a bottleneck during morning commute hours, causing significant delays and frustrations for travelers heading southbound toward Anchorage. DOT&PF plans to retrofit this interchange while utilizing the existing bridge to meet the project goals including improving operations, capacity, and safety for all users (motorized and non-motorized).

Figure 1: Project Location and Vicinity

The primary objectives include:

- Improve Lane Utilization: Encourage or direct drivers to utilize both existing westbound through lanes on Eagle River Loop Road (ERLR) to alleviate congestion during peak morning hours.
- Queuing Mitigation: Address queuing issues on ERLR that begin at the southbound Glenn Highway entrance ramp entrance and extend through the Wolf Den Drive intersection, east of the interchange, to minimize traffic backups and delays. Daily morning peak queues stretch at least 1.2 miles, and can sometimes reach Briggs Bridge, over 2 miles long.

- Enhanced Highway Merging: Improve the efficiency and capacity of highway merging by modifying the southbound Glenn Highway entrance ramp geometry and lane configuration.
- Improve Operations throughout the Interchange: Propose improvements that also reduce delay for all interchange access points, including VFW Road, Anchorage Landfill, southbound Glenn Highway exit ramp (aka, Eagle View Drive), and northbound Glenn Highway exit ramp.
- Compatibility with Future Bridge Replacement: The selected alternative should be compatible with the future bridge's cross-section and elevation, requiring minimal geometric updates.
- Transit and Active Transportation Considerations: The selected alternative should improve or maintain the existing level of safety, accessibility, route efficiency, and mobility for these users.
- Maintenance Improvements: Propose bridge preservation solutions that extend the usable lifespan of the existing bridge and reduce future maintenance efforts.

EXISTING CONDITIONS

Functional Classification

A roadway's functional classification indicates the type of service it is intended to provide, with general safety, speed, capacity, access, and mobility goals. The project roadways' functional classifications are:

- **Glenn Highway** – Interstate Highway
- **Eagle River Loop Road** – Minor Arterial
- **Hiland Road** – Major Collector
- **VFW Road** – Minor Collector
- **Wolf Den Drive** – Minor Collector
- **Eagle View Drive** – Local

Motorized Traffic

Traffic operations performance analysis of the interchange determined critical traffic flow deficiencies because of lane utilization imbalance. With morning traffic peak from 7:00 a.m. to 9:00 a.m., the lane utilization imbalance for westbound traffic on ERLR causes traffic to back up (i.e., long queues) in the leftmost westbound lane (Figure 2) during the morning peak over one mile to the east daily on weekdays. Given the excessive queue on ERLR, there are insufficient gaps between westbound vehicles during the morning peak. The critical movements currently experiencing excessive delay are the Glenn Highway exit ramps (including Eagle View Drive), Landfill approach, and VFW Road. Traffic at these movements are unable to enter ERLR without provided courtesy gaps.

Figure 2: A.M. peak-hour traffic queue on ERLR, looking east

Non-Motorized and Transit Facilities

An 11-foot-wide multi-use path crosses Glenn Highway on the north side of the bridge between VFW Road and the Municipality of Anchorage (MOA) Landfill (Figure 3). The multi-use path also connects the Park & Ride to the Glenn Highway path (Figure 4). Marked crosswalks are provided for the uncontrolled crossing at the northbound Glenn Highway entrance ramp and for the stop-controlled legs at the ERLR

and southbound Glenn Highway ramps intersection. The shoulders of ERLR are classified as a paved shoulder bicycle facility. Marked crosswalks with pedestrian signal heads are provided for the north-, west-, and south legs of ERLR at the Wolf Den Drive/Hiland Road intersection. Wolf Den Drive has sidewalks on both sides of the road. A wide shoulder is provided on the east side of VFW Road which connects to a separated pathway a half mile up VFW Road.

Figure 3: Transit Routes and Non-Motorized Facilities

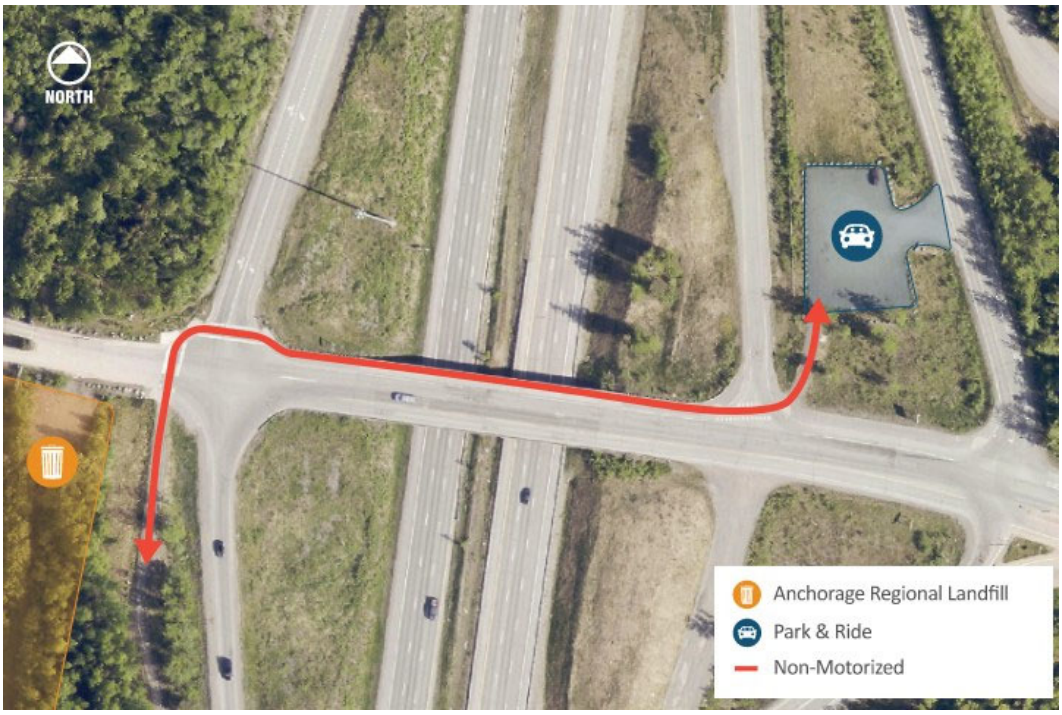

Figure 4: Multi-Use Pathway Connection from Park & Ride to Glenn Highway Pathway

ALTERNATIVES OVERVIEW

Alternatives development began with the project team identifying potential solutions that aligned with the project's goals and objectives, as outlined in the introduction. The team adopted an iterative approach to determine concepts that offered maximum value while minimizing costs and impacts. These concepts included near-term improvements that were compatible with long-term enhancements. The initial concepts were shared at an Interchange Planning Workshop on April 30, 2024, to present a wide array of concepts and gather input from key stakeholders. After the workshop, feasible concepts were analyzed in the Draft Traffic Analysis Report (Kinney 2024), which covered a range of primary and supplemental concepts, including some that did not resolve issues as standalone solutions. The viable concepts were refined into three primary alternatives, which were then presented at an Alternative Design Charette, along with findings from the Draft Traffic Analysis Report and critical factors, such as Level of Service (LOS), vehicle delay, anticipated construction costs, safety analysis, utility impacts, and right-of-way (ROW) impacts. These factors are summarized in the Alternatives Comparison Matrix (Table 2) at the end of this section.

Alternative 1 – No Build

Alternative 2 – Double Left Turn

Alternative 2 includes converting the existing ERLR westbound through lane on the bridge to a combination left-turn and through-lane. Overhead lane signage would guide drivers to use both lanes for left turns (see Figure 5). The two left-turn lanes would merge in a zipper formation into a single travel lane on the entrance ramp before reaching the southbound Glenn Highway. This existing tapered entrance ramp would be converted to a parallel ramp style and extended along Glenn Highway to merge with traffic prior to the weigh station.

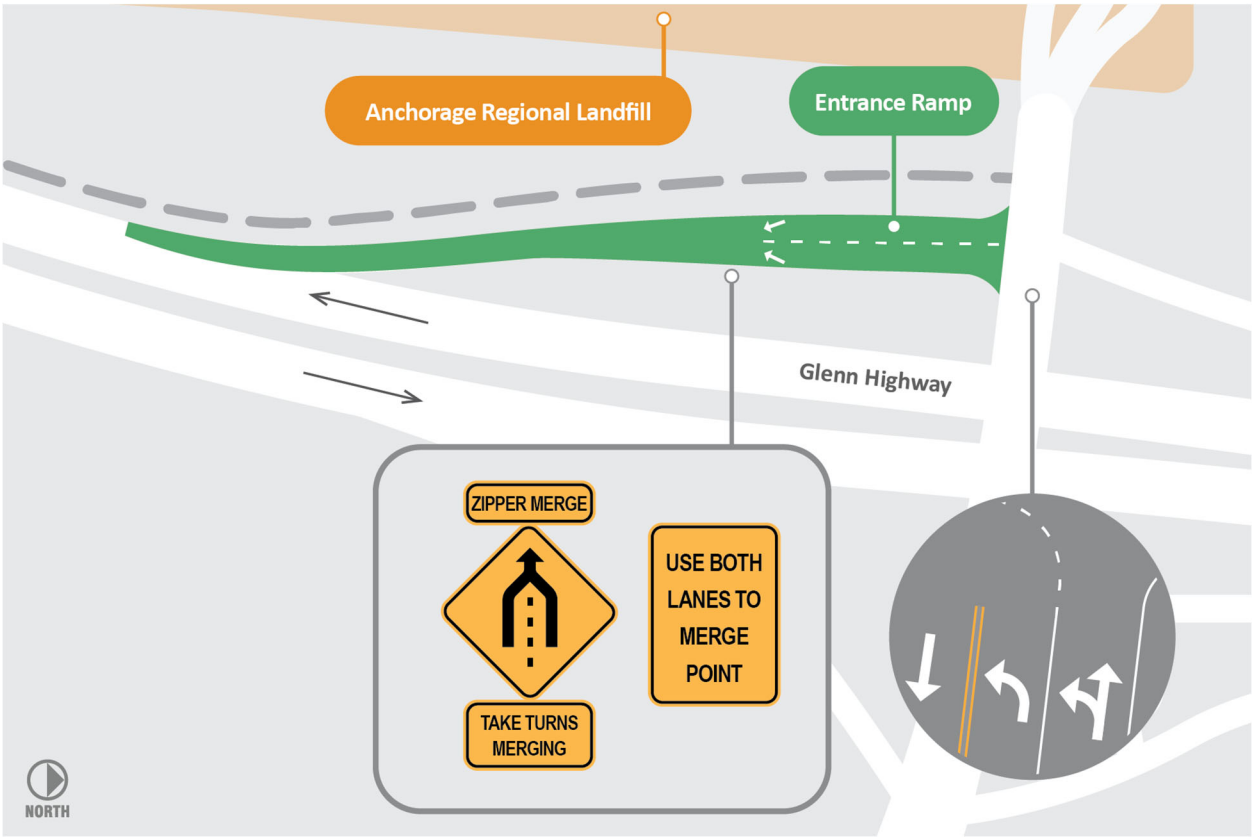

Figure 5: Double left turn (Alternative 2)

Benefits of Alternative 2:

- No impacts to ROW and utilities.
- No foreseeable risks to the project development schedule.
- Lowest cost compared to other primary alternatives.
- Least impacts to traffic during construction.

Drawbacks of Alternative 2:

- Does not address operational deficiencies or reduce crash risk at other intersections along ERLR.
- Does not improve truck operations.
- Does not improve existing pedestrian crossings, active transportation, or transit facilities.

Alternative 3 – Two-Lane Loop Ramp

Alternative 3 would construct a dual-lane loop-style southbound entrance ramp. Single-lane loop ramps are a well-known ramp style for Alaska drivers (Figure 6); however, Alaska does not currently have any dual-lane loop ramps. This alternative would allow ERLR traffic heading to Anchorage to move freely onto the ramp from both westbound lanes with no turning conflicts. The inside westbound lane would be converted from a through lane to a combination through-right lane.

A grade-separated pedestrian and bicycle tunnel connecting to the existing pathway would need to be constructed under the west intersection to enhance non-motorized safety. This would remove the need for non-motorized users to cross heavy traffic flow during the morning peak period and free-flow right turn vehicles traveling roughly 35 mph, regardless of the time of day.

Per the AASHTO Policy on Geometric Design of Highways and Streets, or "Green Book," (GB, 7th ed.), standard two-lane loop ramp inside radii should be no less than 180 feet. However, recent studies documented in the NCHRP 227 and using AASHTO minimum turn radius given the chosen maximum superelevation at 25 mph suggests smaller radii may be warranted. Other state agencies have tightened up two-lane entrance loop ramps to 125 feet as minimum and 160 feet as desired to limit ROW impacts.

Non-motorized crash risk and severity have been reduced at other single-lane loop ramps in Anchorage by installing a smaller entrance curve radius, typically 60 feet, to reduce vehicle speeds; however, this would counteract the intended reduction in geometric delay, resulting in similar ramp entrance speeds currently experienced by vehicles making the left-turn onto the southbound on-ramp.

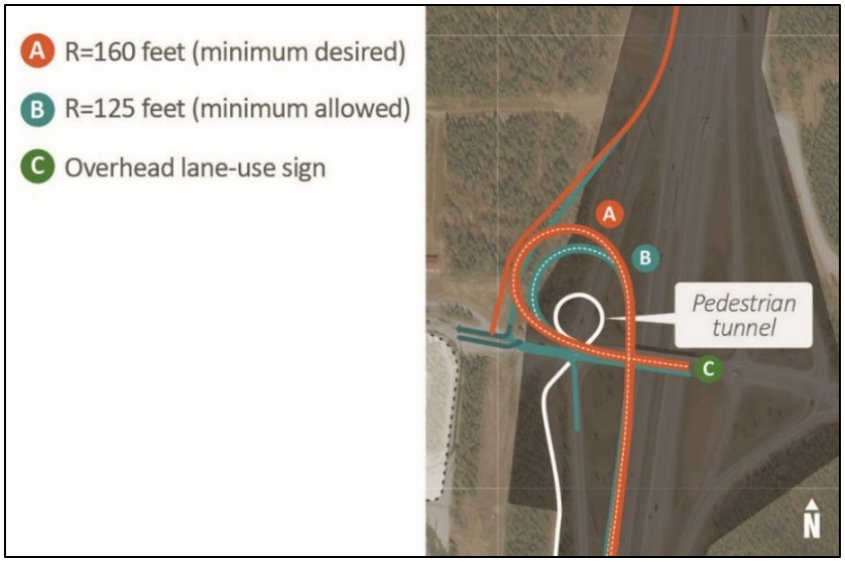

Figure 6: Two-lane loop ramp (Alternative 3)

Benefits of Alternative 3:

- Enhance west-to-southbound capacity.
- Provides a grade-separated pedestrian crossing.
- Less impacts to traffic during construction than Alternative 4 (divergabout).

Drawbacks of Alternative 3:

- Does not improve operations or safety for users on the east side of the interchange, including VFW Road and the Wolf Den Drive signalized intersection.
- Requires major utility relocations (e.g., 20-inch gas main, pedestal 'farm', and overhead power transmission line).
- Involves multiple full and partial land acquisitions from Joint Base Elmendorf-Richardson (JBER) and the Municipality of Anchorage (MOA).
- Likely to cause significant schedule delays due to the complexity of right-of-way acquisition and utility agreements.
- Higher budget implications due to the cost of the pedestrian tunnel, ROW acquisitions, long southbound two-lane off-ramp realignment, major earthwork required for the southbound off-ramp realignment and loop ramp installation, major utility impacts, and retaining wall along the west bridge abutment to accommodate the new two-lane on-ramp width.
- Likely requires vehicles to perform an atypical merge, occurring on the loop ramp since two lanes, a shoulder, and painted gore won't fit between the bridge abutment and existing southbound Glenn Highway outside lane. If two on-ramp lanes could fit, which would likely require infeasible modifications to the west bridge abutment, reconstructing the existing southbound on-ramp merge area would be necessary since the loop ramp's two-lane merge length would extend beyond the existing southbound ramp entrance to meet design standards.

Alternative 4 – Diverging Diamond Interchange with Roundabouts (Divergabout)

Alternatives 2 and 3 were developed using an incremental approach, focusing on addressing the most significant traffic issues. However, the analysis revealed Alternatives 2 and 3 would not address certain key issues and thus Alternative 4 was developed to explore the goal of improving traffic operations at additional intersections along ERLR.

Alternative 4 is a diverging diamond interchange with roundabouts, otherwise known as a divergabout or 'crossover roundabout' (Figure 7). This concept has not been introduced in Alaska, but functions well in other areas of the U.S. In fact, crossover roundabouts solve well-known diverging diamond interchange (DDI) issues with frontage roads since the roundabouts provide drivers with more destination options at the node intersections than a standard DDI with signals. For example, a DDI with signals doesn't allow through movement for users that need to access a frontage road on the opposite side of the node intersection, while roundabouts do allow this movement. Furthermore, a two-way frontage road can also be tied into the roundabout at the interchange node, highlighting another shortfall of a DDI with signals and the advantage of the crossover roundabouts in terms of access, especially for emergency responder and oversize load user groups.

Regarding the Glenn Highway southbound entrance ramp, a two-lane parallel entrance ramp would significantly improve vehicle merging during peak traffic hours. However, due to the weigh station being located about 2,750 feet downstream from the interchange, a standard-length two-lane parallel entrance ramp would not be feasible without interfering with the weigh station exit ramp. To mitigate this, clear zipper merge signage and maximizing the two-lane cross-section's length is proposed to enhance lane utilization and facilitate smoother vehicle merging before transitioning into an extended single-lane parallel entrance ramp. Proper spacing between the highway entrance and weigh station exit ramps is essential to allow for safe vehicle weaving. If the ramps are positioned too closely near the weigh station, the risk of crashes could increase, particularly between oversized vehicles exiting the highway and

vehicles entering the interchange. It's also not recommended to connect the on-ramp merge lane with the weigh station exit ramp as an auxiliary lane because this would likely increase the frequency of non-freight vehicles unintentionally entering the weigh station at high speeds.

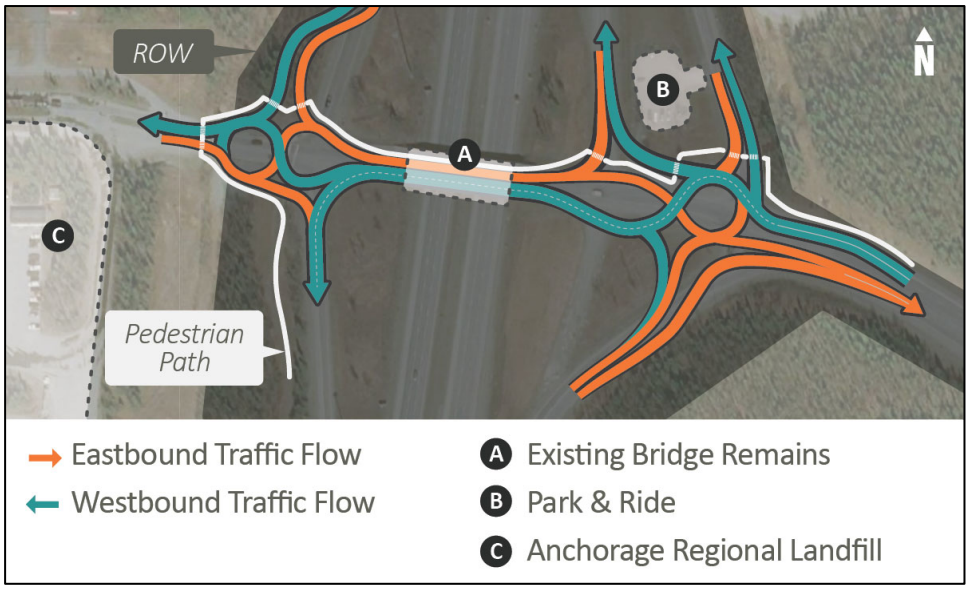

Figure 7: Divergabout (Alternative 4)

As shown in Table 1, all movements through the roundabouts meet the minimum LOS.

Table 1: 2050 Divergabout peak hour operations

Movement		AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound	Left	19	C	10	A
	Thru	19	C	10	A
	Right	22	C	14	B
Westbound	Left	26	E	6	A
	Thru	29	E	9	B
	Right	6	A	4	A
Northbound	Left	7	A	8	A
	Thru	4	A	4	A
	Right	0	Free	0	Free
Southbound	Left	16	C	6	A
	Thru	22	C	13	B
	Right	3	A	3	A
Southbound VFW	Left	14	B	6	A
	Thru	14	B	6	A
	Right	18	C	10	A

Benefits of Alternative 4:

- Improves operations and performance on both sides of the interchange, including the VFW and Wolf Den Drive intersections.
- Improves safety at both ramp intersections by substantially reducing vehicular conflict points.
- Reduces or eliminates costly utility impacts to the 20-inch gas main and overhead power transmission lines.

- Avoids full parcel acquisitions from JBER, preventing associated schedule delays.
- Enhances non-motorized safety by providing pedestrian refuges and single-lane crossings at each roundabout leg.
- Compatible with future bridge replacement after its design life.
- Effectively addresses the project's identified purpose and objectives for long-term success.
- Costs less than Alternative 3 (dual-left loop on-ramp).

Drawbacks of Alternative 4:

- Requires a small partial right-of-way acquisition at the MOA landfill entrance.
- Contra-flow vehicle movement on bridge is a less-familiar design to Alaskans.
- More costly than Alternative 2 (double left).

ALTERNATIVES MATRIX

The Alternatives Scoring Matrix (Table 2) was populated based on criteria of most advantageous outcome (best outcome), improvement (positive change from current state), no improvement (no change from current state), or worse condition (decline from the current state).

Table 2: Alternatives Comparison Matrix

		(Alt 1)	(Alt 2)	(Alt 3)	(Alt 4)
	Evaluation Criteria	**No Build (2050)**	**Double Left**	**Dual-Lane Loop Ramp**	**Divergabout**
	Operations & Capacity				
LOS	Glenn Highway SB Exit Left	F	F	A	C
	Glenn Highway NB Exit Left	F	E	E	A
	VFW SB Left/Right	F	F	F	B
	ERLR at Wolf Den WB Thru	F	F	F	F
Delay (sec/veh)	Glenn Highway SB Exit Left	1830	102	9	24
	Glenn Highway NB Exit Left	301	41	41	7
	VFW SB Left/Right	76	54	54	14
	ERLR at Wolf Den WB Thru	326	74	74	74
	Improved Lane Utilization	No	Yes	Yes	Yes
	Accommodates Truck Traffic	Yes	Yes	Yes	Yes
	Accommodates Oversized Vehicles	Yes	Yes	Yes	Yes
	Safety Performance				
	Reduces Turning Conflicts	No	No	Yes	Yes
	Improves Non-Motorized Conflicts	No	No	Yes	Yes
	Impacts				
	Minimizes ROW Impacts	Yes	Yes	No	Yes
	Reduces Utility Impacts	Yes	Yes	No	Yes
	Reduces Environmental Impact	No	No	No	No
	Cost Effective				
	Alternative Cost	N/A	$4.9M	$15.8M	$12.8M

Worse Condition

No Improvement

Improvement

Most Advantageous

FINDINGS

The following summarizes the alternatives analysis findings:

- Alternatives 1, 2, and 3 do not meet the project's goals and objectives for all critical movements.
- Alternative 2 will have below minimum level of service (LOS D) at all critical movements while slightly improving the Glenn Highway northbound Exit Left to a LOS E. Per AASHTO GB Table 2-3 (7th ed.), the minimum LOS along an arterial or collector is LOS D.
- Alternative 3 will improve the Glenn Highway southbound Exit Left to a LOS A and reduce the Wolf Den Drive intersection westbound thru movement delay; however, no other movements will be improved.
- Alternative 4 has the greatest LOS improvement and brings all critical movements up to a LOS C or better except the Wolf Den Drive intersection westbound thru movement; however, the delay is significantly improved from 380 sec/veh to 70 sec/veh.
- Besides the No-Build (Alternative 1), Alternative 2 is the lowest cost alternative, but it may be viewed in a negative light from the public due to multiple previous studies in the project area and minimal improvements resulting from those studies.
- Alternatives 1 and 2 do not improve truck-turning movements. Alternative 3 slightly improves truck operations through the interchange given the dual-lane loop ramp directs traffic onto the southbound Glenn Highway without competing with landfill egress traffic, reducing the landfill traffic delay. Alternative 4 gives trucks increased priority through the interchange and improves Glenn Highway northbound to southbound U-turn movements.
- Alternatives 3 and 4 improve pedestrian access within the project area. Alternative 2 was kept at a no improvement rating because the existing crossings would be maintained. Alternative 3 improvements include replacing the Glenn Hiland southbound crossing with a pedestrian tunnel. While Alternative 4 increases the total eastbound to westbound lane crossings by one, from 7 to 8, the divergabout reduces crossing width from two opposing lanes at one time to only one lane at a time by adding pedestrian refuges. Furthermore, the roundabout designs promote slower vehicle speeds exiting the roundabouts at each crosswalk.
- Alternative 4 most comprehensively meets the project's goals and objectives and will accommodate future interchange developments.

PROJECT FEEDBACK

After alternatives development, the project team presented to three community councils, the Chugiak Birchwood Eagle River Rural Road Service Area (CBERRRSA), and hosted a public open House. The following is a summary of the public feedback received from these meetings:

- Clear overhead guide signage could help encourage the use of both westbound lanes.
- Drivers may need time to adjust to navigating a divergabout; however, most of this traffic consists of users that drive this corridor daily and would become accustomed to it.
- Suggestions included extending the southbound entrance ramp to improve merging onto the Glenn Highway and concerns about congestion moving further south on the Glenn Highway.
- A suggestion was made to reduce the speed limit along ERLR to 35 miles per hour (mph).
- A suggestion was made to prioritize completing the Artillery interchange first, improve the Wolf Den signalized intersection by replacing it with a roundabout, and consider traffic that backs up onto the Glenn Highway from the Fort Richarson D Street gate.
- Support was expressed for the non-motorized protection offered by the dual loop ramp alternative (Alternative 3).

- Concerns were raised regarding the cost and utility impacts of the dual loop ramp alternative (Alternative 3).
- Concerns were raised that the heavy westbound movement on ERLR would only be able to enter the east roundabout if someone in the roundabout provided a courtesy gap; however, other movements aren't heavy enough during the A.M. peak to cause an unacceptable LOS for the westbound vehicles.

In advance of the Open House an Alternatives Selection Charette was held on December 5th, 2024. The charette included DOT&PF staff from Environmental, Traffic, ROW, Highway Design, and key stakeholders including MOA traffic, MOA Solid Waste Service (SWS) and Anchorage Metropolitan Area Transportation Solutions (AMATS) staff. This meeting was to obtain input to support the technical evaluations and decision making for the project.

All meetings resulted in overall positive feedback, with consensus that the divergabout offers more benefits than other alternatives.

Following the Open House, the project team met with Bike Anchorage, Alaska Trucking Association (ATA), MOA SWS, and MOA Public Transportation Department (PTD) in February 2025.

Bike Anchorage offered the following feedback:

- Appreciation for considering non-motorized users within each alternative and the focus on safety over increasing traffic speed.
- Concerns about improving driver education to prevent confusion, especially regarding signaling and obeying speed limits within the divergabout alternative.
- Understanding that a pedestrian undercrossing wasn't feasible with the divergabout alternative due to the length and cost required to span under the entire west roundabout weighed against the non-motorized safety improvements gained by the pedestrian refuges at each crosswalk.

ATA shared the following comments:

- All oversized vehicles (width or height) obtaining a permit are typically rerouted up-and-over, bypassing the bridge over Glenn Highway.
- Vehicles taller than 15 feet are considered oversized, with additional permitting required for those taller than 17 feet.
- A two-trailer, 100-foot-long vehicle (WB-92D) is typically the largest vehicle using the interchange.
- The U-turn from northbound to southbound Glenn Highway needs to accommodate two-trailer vehicles when a truck is turned around by the weigh station. The divergabout best accommodates this movement by allowing trucks to bypass both roundabouts.
- A truck design speed of 15-20 mph is preferred, but reducing the design speed to 5-10 mph is not a concern and could improve safety.

SWS shared the following comments:

- They plan to convert all payments to weight based which may lead to excessive queuing during special events.
- Planned SWS improvements are planned to be completed in 2026 and do not require private utility relocations.
- Concerns with larger vehicles making the Glenn Highway northbound exit ramp left movement onto the bridge potentially get struck by traffic accelerating out of the east roundabout.
- Approximately 70% of vehicles enter the landfill gate are commercial vehicles.

PTD shared the following comments:

- They suggest creating a new bus stop with a pullout and acceleration lane on the northbound Glenn Highway entrance ramp as well as a bus stop on the east side of the existing unofficial Park & Ride lot on VFW Road.
- The existing gravel parking lot in the northwest interchange quadrant used by bike and transit commuters is not officially a Park & Ride, as it is not owned or maintained by PTD. It was built by MOA SWS to mitigate safety issues and conflicts with vehicles existing the landfill when it was located in the southwest interchange quadrant.
- They support the divergabout alternative if transit buses can efficiently and safely serve the unofficial Park & Ride lot in the northeast corner of the interchange.

CONCLUSION

All design alternatives may improve the lane utilization on ERLR when paired with improvements to the southbound Glenn Highway on-ramp; however, only the divergabout alternative improves the minor approaches LOS to the appropriate threshold per AASHTO guidelines. While the dual left and dual lane loop ramp alternatives improve the westbound movement, they do not fix operational deficiencies at the other intersections within the project limits. Consequently, **the divergabout is the preferred alternative** as it accommodates westbound volume and improves lane utilization with overhead signage, two left-turn lanes onto the southbound entrance ramp, and an extended two-lane cross-section on the entrance ramp with a parallel merge; improves non-motorized safety with additional refuge areas for pedestrians with single-lane crossings; has a lower cost than Alternative 3 which has lower benefits; reduces or eliminates high-cost and major utility impacts; reduces ROW acquisition needs; and is supported by the public and stakeholders.

Cc:

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