Final Report

Glacier Highway Bike & Pedestrian Improvements

Juneau, Alaska

Draft

October 2013

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EXECUTIVE SUMMARY

INTRODUCTION

This report presents analysis and recommendations for improving pedestrian and bicycle facilities of Glacier Highway within the Lemon Creek area between Sunny Drive and Vanderbilt Hill Road in Juneau, Alaska. The corridor can be identified by two distinct segments: Sunny Drive to Davis Avenue and Davis Avenue to Vanderbilt Hill Road. The segment from Sunny Drive to Davis Avenue is primarily residential, although Wal-Mart and Dzantik'i Heeni Middle School have a significant impact on travel behavior in this segment. The segment from Davis Avenue to Vanderbilt Hill Road is dominated by commercial and industrial uses.

In its original form, this one-and-a-half-mile segment of Glacier Highway was Juneau's main highway for vehicular traffic through and about town. Residential and commercial development in the Lemon Creek area grew over time, leading to greater demand for driving, walking, biking, and transit services along and across Glacier Highway. Glacier Highway served dual and sometimes conflicting roles as both the primary regional route and the local main street. With the opening of Egan Drive parallel to Glacier Highway in the 1970s to serve higher speed regional traffic, the pressure on Glacier Highway to serve regional travel subsided. It became, and remains, primarily a local access and circulation route for travel with an origin and/or destination in Lemon Creek.

Despite its current and future function, the design of Glacier Highway presently favors motor vehicle travel. Pedestrians are accommodated mostly on only one side of the highway through a sidewalk that was added back in the early 1980s, and there are few designated crossings of Glacier Highway. The posted speed limit is 40 miles per hour, but the wide roadway widths and superelevation on roadway curves tend to encourage higher-speed travel. Varying width shoulders exist on both sides, striped and signed for bikes in some areas, but the high vehicular speeds seem to discourage many cyclists based on public feedback.

Residents in Lemon Creek must use or cross Glacier Highway to go to school, shop, work, or to access public transit service. Some residents in the study area do not have access to motor vehicles, and as such are reliant upon public transit, walking, and biking for transportation purposes. While most walking trips along Glacier Highway are localized, transit and bicycle travel may be local to the Lemon Creek area or regional between Mendenhall Valley and downtown. This section of Glacier Highway is a critical link in the regional bicycle network, as Egan Drive is restricted to only motor vehicle travel in the study area. Thus, this is the only bicycle route between the Mendenhall Valley and north Juneau and the Capitol and downtown.

Stakeholder and public meetings were held early on in the project to elicit comments and opinions on the project and study corridor. The goal was to better understand the context under which alternatives

would be developed to address the travel challenges and concerns from those that regularly drive, walk, or bike along this corridor. Key areas of concern and the respective issues are as follows:

- The Renninger Street/Glacier Highway intersection serves as the main access to the Dzantik'i Heeni Middle School and experiences school-related congestion, especially for vehicles turning left from Renninger onto Glacier Highway, and for pedestrians crossing Glacier Highway to Renninger.
- The intersection of Davis Avenue and Glacier Highway is difficult for drivers due to the speed of vehicles on Glacier Highway, the lower elevation of the Davis Avenue approach relative to Glacier Highway, and the close proximity to the Lemon Creek Bridge guard rail which limits view of approaching traffic and pedestrians approaching from the south.
- There are conflicts between bicyclists and right-turning vehicles, particularly trucks, at the Anka Street/Glacier Highway intersection.
- Better lighting is needed along this corridor, particularly at pedestrian crossings.
- There is no marked route for in-bound bicyclists to cross Glacier Highway by Vanderbilt Hill/Western Auto.
- High numbers of both turning vehicles and crossing pedestrians occur at the Concrete Way intersection at lunch time.
- Encouraging industrial truck traffic to use the Vanderbilt Hill/Egan Highway intersection and avoid using Glacier Highway west of Concrete Way is both desired by residents and the preferred route of truckers.
- A sidewalk on the south side of the entire corridor is needed.

A full summary of all public comments can be found in Appendix A.

Previous studies, including City and Borough of Juneau's (CBJ) Non-Motorized Plan, were reviewed to gain help formulate potential treatments and alternatives. The Non-Motorized Plan calls for sidewalks, bike lanes, and crosswalks as the priorities for the study corridor.

Objectives were developed to achieve projects goals, which include:

- Providing safe and effective bicycle and pedestrian facilities along the length of the corridor;
- Providing safe and effective pedestrian crossings at logical locations;
- Minimizing conflict areas within the corridor for all modes;
- Creating a speed environment for motor vehicles that is compatible with and promotes bicycle and pedestrian travel;
- Identifying improvements that are cost effective; and
- Identifying improvements that have the highest likelihood of community acceptance from affected agencies, residents, and businesses.

This report summarizes the findings of the Sunny Drive to Vanderbilt Hill Drive evaluation of Glacier Highway, and includes a recommended corridor concept.

RECOMMENDED CORRIDOR CONCEPT

Three corridor visions were developed that build upon one another in terms of physical changes to the corridor. These corridor visions are:

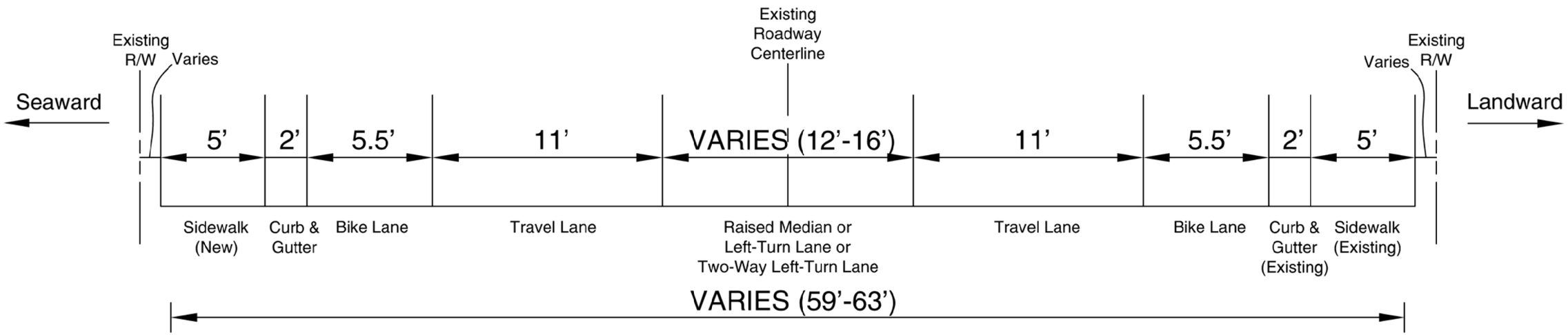
- Baseline: This vision is largely based on the scope DOT&PF developed for the corridor in order to secure funding within the Statewide Transportation Improvement Program (STIP). This vision includes a redesigned cross section with consistent width bicycle lanes and sidewalks on both sides, and narrowed travel lanes, along with proposed pedestrian crossings and limited access management.
- Enhanced Baseline: This vision builds upon the Baseline vision by additional pedestrian crossings as well as more extensive access management and a raised median for most of the corridor.
- Roundabout: This vision includes the majority of treatments proposed in the Enhanced Baseline vision plus roundabouts at four intersections: Renninger Street, Concrete Way, Anka Street, and Short Street.

The Recommended Concept for the study corridor of Glacier Highway includes treatments from all three corridor visions. Treatments were chosen to provide the most benefit within the established project budget. Not all benefits are quantifiable; therefore, a large portion of this report focuses on explaining some of the more qualitative benefits expected. Figure 1 through Figure 7 show the recommended concept.

The Recommended Concept includes 5-foot wide sidewalks, 2-foot wide curb and gutter, and 5.5-foot wide paved bike lanes (effective bike lane width of 7.5 feet) on both sides of Glacier Highway. Standard, marked crosswalks are proposed across all stop-controlled side streets. Additionally, vehicle travel lanes are narrowed from 12 to 11 feet wide. The total width of the proposed typical section varies from 59 feet to 67 feet wide, with the upper end of the range being for widening at several of the major intersections to accommodate two-stage pedestrian crossings. Illumination along both sides of Glacier Highway is also recommended for the length of the corridor, especially at pedestrian crossings and transit stops. The use of pedestrian and neighborhood scale illumination in place of more traditional highway illumination is recommended where appropriate, particularly between Renninger Street and Anka Street. Bus pullouts and shelters are proposed for all existing and new transit stops.

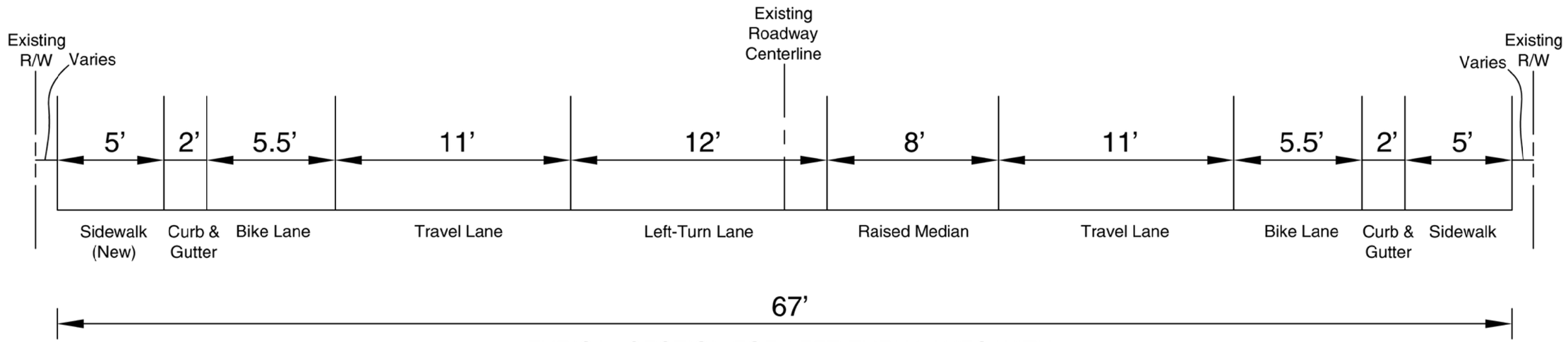
The treatments proposed in the Roundabout Vision are recommended for the segment of Glacier Highway from Whitehead Drive to Renninger Street. This includes the removal of the existing pedestrian hybrid beacon (PHB) on the east leg and the installation of an offset, high visibility crosswalk, pedestrian median refuge and rectangular rapid flashing beacons (RRFBs) on the west leg of the intersection. This crossing will keep consistency of crossing treatments throughout the corridor, reduce the impact to through vehicles on Glacier Highway as pedestrians can cross in two stages, and removes interference with the westbound left-turns into Wal-Mart. A single-lane roundabout is proposed for the intersection of Renninger Street and Glacier Highway. A roundabout at this location will help the traffic operations as well as provide an improved crossing for pedestrians. Vehicular level of service analysis shows the Renninger Street/Glacier Highway intersection operates most efficiently as

a roundabout than as a side-street stop controlled intersection. The roundabout allows the relocation of Walmart's secondary (truck loading) driveway on Glacier Highway to a new, southern leg to the intersection. The roundabout provides designated crossings for pedestrians on all legs. Each crossing has a high-visibility crosswalk and directional curb ramps. All but the Wal-Mart leg have a raised pedestrian median refuge, allowing two-stage crossings. This design results in shorter crossing distances and simpler decision-making for both pedestrians and drivers. Bicyclists would have the option of traversing the roundabout using the vehicular travel lane or circulating as a pedestrian. The existing walking path located between Wal-Mart's parking lot and Alaway Street south of Glacier Highway would be truncated, but could be tied into the crossing of the new southern leg of the roundabout. Residential driveways on the north side of Glacier Highway near the intersection are proposed to be closed and/or relocated where alternative access is available. A designated school zone, centered at Renninger Street, will include speed feedback signs and wayfinding signs for Dzantik'i Heeni Middle School.



PRIMARY TYPICAL SECTION**
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

**Typical section for Glacier Highway between Short Street and Whitehead Drive. Prior to Short Street, the typical section is the same with the exception of no seaward sidewalk. See below for the typical section for locations with median refuge islands adjacent to left-turn lanes.

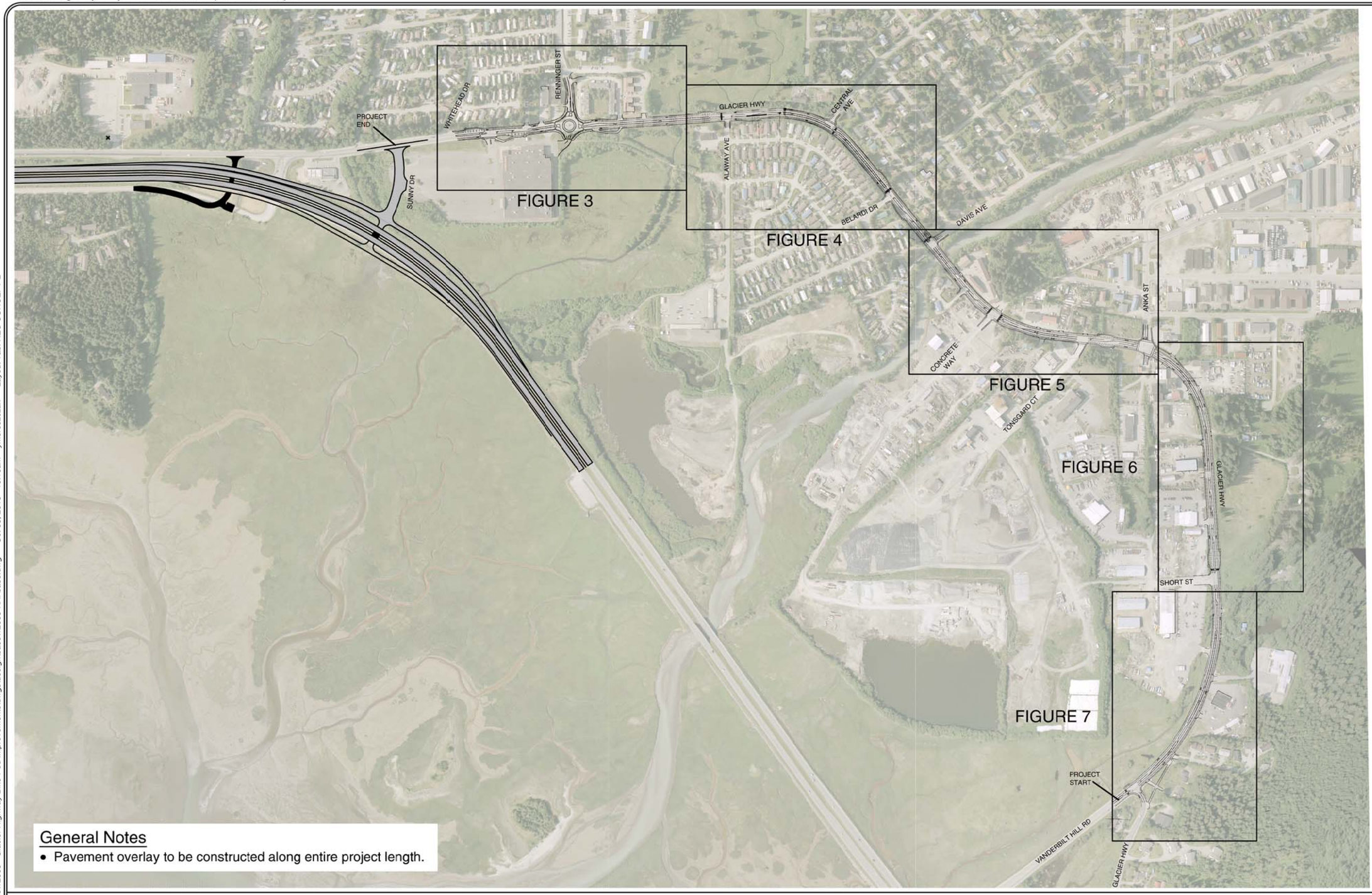


TYPICAL SECTION FOR LEFT-TURN LANES WITH
ADJACENT MEDIAN REFUGE ISLANDS
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT - TYPICAL SECTIONS
JUNEAU, ALASKA

FIGURE 1

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING

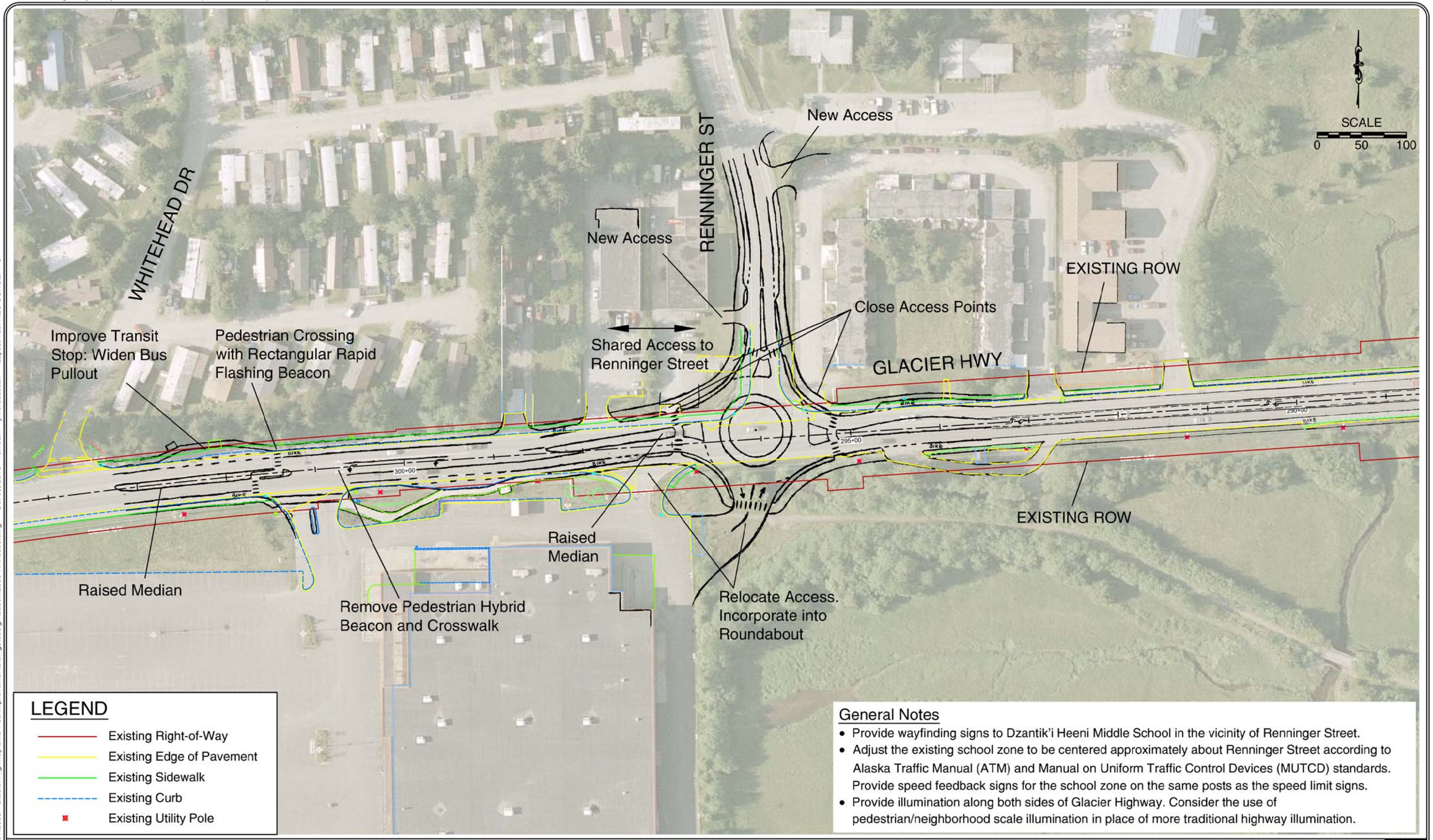


General Notes

- Pavement overlay to be constructed along entire project length.

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT - OVERVIEW
JUNEAU, ALASKA

FIGURE 2



LEGEND

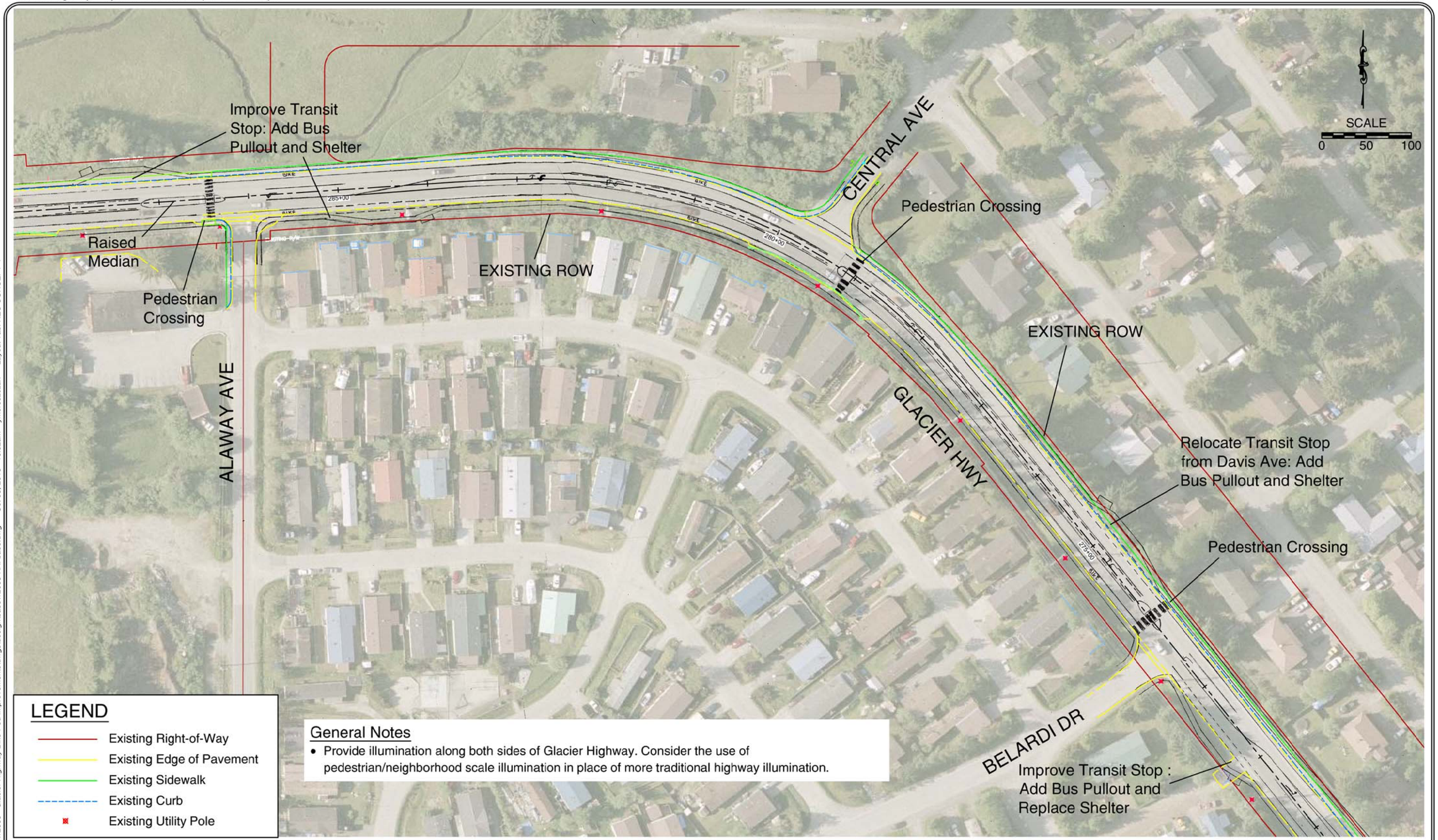
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide wayfinding signs to Dzantik'i Heeni Middle School in the vicinity of Renninger Street.
- Adjust the existing school zone to be centered approximately about Renninger Street according to Alaska Traffic Manual (ATM) and Manual on Uniform Traffic Control Devices (MUTCD) standards. Provide speed feedback signs for the school zone on the same posts as the speed limit signs.
- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT
JUNEAU, ALASKA

FIGURE 3



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT
JUNEAU, ALASKA

FIGURE 4

Raised Median

DAVIS AVE

Pedestrian Crossing with Rectangular Rapid Flashing Beacon

Explore Modifying Bridge Railing to Improve Sight Distance for Davis Ave

Left-In Only Access

EXISTING ROW

EXISTING ROW

Raised Median

Pedestrian Crossings with Rectangular Rapid Flashing Beacons

Shared Access to Concrete Way

Raised Median

Raised Median

CONCRETE WAY

GLACIER HWY

Shared Access

Close Access

Flare Entry and Exit Curbs and Reconstruct Radius Return to Improve Southbound Truck Turning Movement

ANKA ST

TONSGARD CT

Add Crosswalks and Pedestrian Signal Heads

Add Bicycle Detection in Bike Lane

SCALE
0 50 100

LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

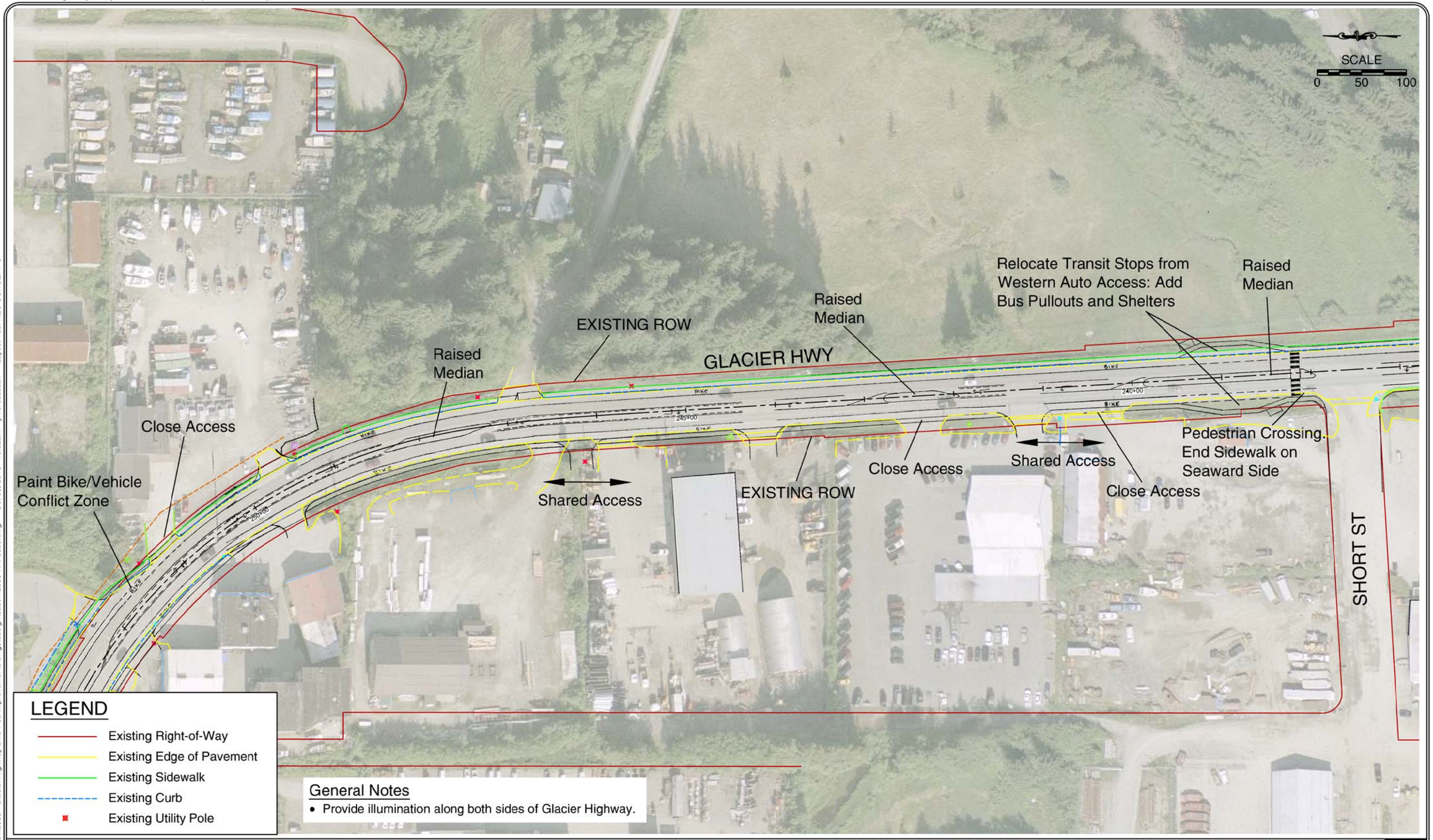
General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT
JUNEAU, ALASKA

FIGURE 5

H:\profile\12665 - Glacier Highway Bike-Ped Improvements\dwgs\design\base\12665-KAI base.dwg Oct 03, 2013 - 10:34am - ymereszczak Layout Tab: REC CONCEPT-5



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

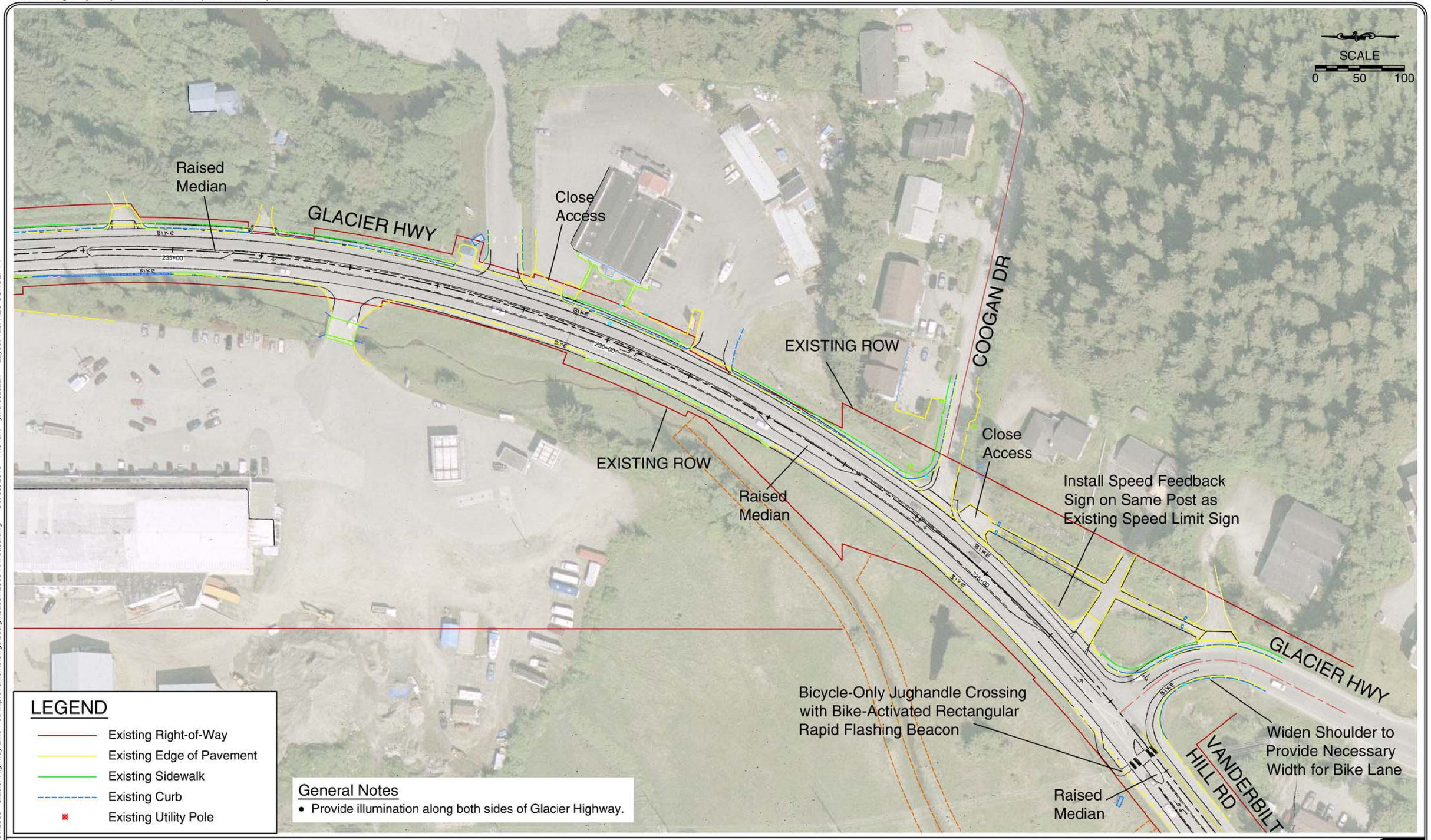
General Notes

- Provide illumination along both sides of Glacier Highway.

GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT
JUNEAU, ALASKA

FIGURE 6

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING



GLACIER HIGHWAY: RECOMMENDED CORRIDOR CONCEPT
JUNEAU, ALASKA

FIGURE 7

The treatments illustrated in the Baseline Corridor Vision are recommended for the segment of Glacier Highway from Renninger Street to Davis Avenue. These proposed treatments include construction of sidewalk on the seaward side, improved pedestrian crossings across Glacier Highway, and the improvement/relocation of several bus stops. At the intersection of Alaway Avenue, the existing standard crosswalk on the west leg across Glacier Highway is proposed to be replaced with a high-visibility crosswalk and a raised median pedestrian refuge. At the intersections of Belardi Drive and Davis Avenue, a high-visibility crosswalk and a raised median pedestrian refuge is proposed to be installed on the north leg across Glacier Highway. These treatments result in greater visibility and expectancy of pedestrian activity, reduce pedestrian exposure while crossing, and break up the task of crossing the roadway into two stages. The crossing at Davis Avenue will be further enhanced by the installation of Rectangular Rapid Flashing Beacons (RRFBs), which greatly improve motorist yielding rates. The transit stops at Alaway Avenue are proposed to be improved by adding bus pullouts and shelters. The transit stop at Davis Avenue is proposed to be relocated to north of Belardi Drive to be in close proximity to the improved pedestrian crossing. The existing transit stop on the west side of Glacier Highway south of Belardi Drive is proposed to be improved through the addition of a bus pullout and shelter.

The majority of the treatments illustrated in the Enhanced Baseline Corridor Vision are recommended for the segment of Glacier Highway from Davis Avenue to Vanderbilt Hill Road, the end of the study corridor. This includes extensive access management and the closing and consolidating of driveway access points, installing a raised median along much of the roadway, relocating bus stops, and improving intersection crossings. For access management, the proposed project recommends the following measures:

- Installing left-turn pockets on Glacier Highway for left turns into commercial properties between Davis Avenue and Concrete Way but prohibiting left turns out of driveways through the use of raised median;
- Providing shared access to Concrete Way for properties on the west side of Glacier Highway between Davis Avenue and Concrete Way;
- Providing shared access between Juneau Truss and Tyler Rental properties and consolidate two driveways into one on the west side of Glacier Highway south of Anka Street;
- Closing the northern driveway access to the Harri's property on the west side of Glacier Highway south of Anka Street, as there is another driveway access further south;
- Providing shared access between Harri's and the Liquor Barrel properties and consolidating two driveways into one on the west side of Glacier Highway south of Anka Street; and,
- Restricting left turns into and out of Lemon Creek Trail on the east side of Glacier Highway through the use of raised median.

The raised median has traffic calming effects helping to establish a more pedestrian- and bicycle-friendly environment, along with access management benefits. The transit stops at Western Auto will be relocated to the north side of Short Street. For Glacier Highway pedestrian crossings, the Recommended Concept includes:

- Concrete Avenue
    - On the west and east legs across Glacier Highway, a high-visibility crosswalk, median pedestrian refuge, and rectangular rapid flashing beacon (RRFB) will be installed.
- Anka Street
    - Standard crosswalks, pedestrian signal heads, updated curb ramps, and pedestrian actuation will be installed on the south and east legs.
    - Bicycle detection in the bike lane on the northbound approach will be installed at the intersection.
    - The weaving zone (bike/vehicle conflict zone) on the northbound intersection approach between through bicyclists and right-turning vehicles will be striped, painted, and indicated with warning signing.
    - The implementation of flare entry and exit curbs along with reconstruction of radius return will improve southbound and westbound truck turning movements.
- Short Street
    - On the north leg across Glacier Highway, a high-visibility crosswalk and a median pedestrian refuge.
- Vanderbilt Hill Road
    - A bicycle-only jughandle crossing with raised median refuge and bike-activated RRFB will be constructed on the south leg across Vanderbilt Hill Road.
    - Shoulder onto Glacier Highway will be widened to provide necessary width for bike lane.
    - A speed feedback sign will be installed on the same post as the existing speed limit sign located north of the intersection.

The treatment within the Enhanced Baseline Vision to remove superelevation is not being recommended as a part of this segment concept due to its high cost and relatively low benefit, but a pavement overlay of the entire corridor is assumed as recommended in the Statewide Transportation Improvement Program (STIP) project description.

OPERATIONAL ANALYSIS

Operational analysis was performed for the AM and PM peak hours for all corridor visions. A vehicular level-of-service (LOS) D or higher is considered acceptable for DOT&PF. All intersections were operating at LOS D or better for all of the corridor visions. Analysis indicates the intersection of Renninger Street and Glacier Highway operates most effectively as the proposed single-lane roundabout. The other study intersections, which are proposed to stay with their respective existing control types, will continue to operate at LOS D or better. Multimodal level of service was also performed for all corridor visions. It was found that the pedestrian and bicyclist link levels of service improved for all corridor visions, but transit passenger level of service remains unchanged.

SAFETY

The following provides a summary of benefits for some of the recommended treatments.

- **Pedestrian refuges** providing two-stage pedestrian and bicycle crossings has been estimated to reduce the associated crashes by 45 percent Pedestrian refuges are recommended at all marked pedestrian crossings.
- **Raised medians** reduce crossover and access-related crashes by 15 percent. Raised medians are recommended in various degrees throughout the corridor.
- **Roundabouts** converted from a two-way stop-controlled intersection to a roundabout, reduces total crashes by 30 percent and 75 percent for three-leg and four-leg intersections, respectfully. The conversion to a roundabout is recommended at the intersection of Renninger Street and Glacier Highway.
- **Speed reduction** has been documented to reduce crashes and is proposed to be achieved through raised medians (which reduce the speeds on average by 9 percent), a roundabout, and speed feedback signs.
- **Rectangular rapid flashing beacon (RRFB)** system with two-beacons has been found to increase motorist yielding to 81 percent compared to an 18 percent motorist yield rate for pedestrians at uncontrolled crossings with no beacons. RRFBs are proposed at the recommended uncontrolled marked pedestrian crossings of Davis Avenue, Concrete Way, and at the bicycle crossing at Vanderbilt Hill.

COST ESTIMATES

Table 1 provides a summary of the estimated conceptual costs for each recommended treatment, as well as an overall estimated project cost taking into account estimated percentage-based items, professional fees, but excluding right-of-way acquisition costs. More detail can be found in Appendix G, which provides the preliminary cost estimate worksheets for the recommended treatments, including a detailed breakout of roadway improvement, lump sum, and percentage-based.

Glacier Highway
Recommended Near-Term Treatments
Preliminary Cost Estimate

Breakdown of Improvement Costs

Improvement	% of Subtotal	Cost
Estimated Construction Costs		
Seaward Sidewalk + Bike Lanes		$ 1,433,000
Pavement Overlay		$ 1,091,000
Corridor-Wide Illumination (Both Sides)		$ 1,148,000
Renninger Roundabout		$ 1,563,000
Davis to Anka Access Management		$ 46,000
Anka to Vanderbilt Hill Access Management		$ 160,000
Alaway Pedestrian Crossing		$ 44,000
Central Pedestrian Crossing		$ 44,000
Belardi Pedestrian Crossing		$ 44,000
Davis Pedestrian Crossing		$ 145,000
Concrete Way Pedestrian Crossings		$ 218,000
Short St Pedestrian Crossing		$ 44,000
Vanderbilt Hill Jughandle Crossing		$ 52,000
Anka St Signal/Intersection Improvements		$ 207,000
Whitehead St Bus Pullout Improvements		$ 23,000
Alaway Bus Pullouts		$ 67,000
Belardi Bus Pullouts		$ 67,000
Short St Bus Pullouts		$ 67,000
Subtotal A (Estimated Construction Costs)		**$ 6,463,000**
Private Utility Coordination	5%	$ 323,150
Surveying	3%	$ 193,890
Mobilization	10%	$ 646,300
Subtotal B (Percentage-Based Costs)		**$ 1,164,000**
Subtotal 1 (A + B)		**$ 7,627,000**
Estimated Professional Fees (A/E/CM)	**15%**	**$ 1,145,000**
Estimated Right-of-Way Acquisition Costs		
Pending DOT&PF Feedback		
Estimated Total Cost		**$ 8,772,000**

Section 2
Introduction

INTRODUCTION

The primary goal of the Glacier Highway Bike and Pedestrian Improvement project is to improve pedestrian and bicycle facilities in and along Glacier Highway within the Lemon Creek area.

To meet the goal, a set of project objectives were developed, which includes:

- Providing safe and effective bicycle and pedestrian facilities along the length of the corridor;
- Providing safe and effective pedestrian crossings at logical locations;
- Minimizing conflict areas within the corridor for all modes;
- Creating a speed environment for motor vehicles that is compatible with and promotes bicycle and pedestrian travel;
- Identifying improvements that are cost effective; and
- Identifying improvements that have the highest likelihood of community acceptance from affected agencies, residents, and businesses.

Collaborating with the Department of Transportation & Public Facilities (DOT&PF) staff and City and Borough of Juneau (CBJ) staff, the project team developed infrastructure improvement alternatives that accomplish the primary project goal and objectives. The alternatives identify feasible, cost effective improvements that meet the future multimodal travel needs of the surrounding community's residents, businesses, and institutions. In essence, working toward a more "complete street" efficiently and safely serving a variety of user types and modes.

EXISTING STUDY AREA CHARACTERISTICS

The corridor study area is about one-and-a-half miles of Glacier Highway within the Lemon Creek area. The function of Glacier Highway for bicyclists and has multiple purposes, serving both local trips within Lemon Creek and through trips between Mendenhall Valley and downtown. Many of the residents in the study area are reliant upon public transit and non-motorized travel, thus establishing a real need for equitable access to transportation facilities in the area. These features, coupled with the fact that the high-speed Egan Drive expressway parallels this route, establishes a compelling argument for making Glacier Highway more compatible with its primary function of local circulation and pedestrian and bicycle use.

The corridor can be identified by two distinct segments: from Sunny Drive to Davis Avenue and from Davis Avenue to Vanderbilt Hill Road. The segment from Sunny Drive to Davis Avenue is primarily residential, although Wal-Mart and Dzantik'i Heeni Middle School have a significant impact on travel behavior in this segment. The segment from Davis Avenue to Vanderbilt Hill Road is dominated by commercial and industrial uses. These two segments are examined with different criteria but follow the same themes to facilitate an overall corridor alternative that meets the goals of the project.

The posted speed limit along the study corridor is 40 miles per hour (mph). The roadway is made up of two 12-foot wide lanes with a 12-foot center turn lane and varying width shoulders on both sides, striped and signed for bikes in some areas. The wide lanes combined with superelevation on the roadway curves contribute to an open, rural feel to the road, not compatible with its now more urban setting.

The corridor has a continuous sidewalk on the landward side for almost the entire length of the study corridor, except between Coogan Drive and Glacier Highway (near Twin Lakes Drive-Vanderbilt Hill Road). There is very little sidewalk present along on the seaward side, only in the northern section near the Wal-Mart and between Tonsgard Court and Anka Street. The width for bike lanes exist on both sides of Glacier Highway, although in many spots these lanes are not well defined or properly designated, particularly near intersections and driveways. The bike lane on the landward side is better defined as it has the presence of the sidewalk to help better delineate it.

There are three intersections with marked crosswalks across Glacier Highway: the main Wal-Mart Driveway, Alaway Avenue, and Anka Street. The high-visibility ("zebra-style") crosswalk at Wal-Mart Driveway is supplemented by portable pedestrian flags and an actuated pedestrian hybrid beacon, also known as a HAWK signal, and crosses Glacier Highway on the east leg. The Alaway Avenue standard crosswalk is located on the west leg of the intersection and is supplemented by portable pedestrian flags for use by crossing pedestrians. A school zone crossing sign and beacon is located on the west leg of Alaway Avenue. The intersection of Anka Street and Glacier Highway is signalized and has standard crosswalk markings on the north and west legs coupled with pedestrian countdown signal heads. Pedestrian crossing legends are not present on the approach to any of the crosswalks in the corridor. It is worth noting that pedestrians are allowed to cross at all intersections, regardless of whether they are marked or not (13 AAC 02.160 – Reference 1), unless pedestrians are specifically prohibited from crossing.

The side street approaches and many of the driveways are very wide (40 to 70 feet). Most of the side streets are stop-controlled, but lack stop bars. There are also many curbs ramps that would be considered outdated according to the latest ADA standards. Curb ramps are often not located on the opposite side of Glacier Highway at offset intersections or T-intersections.

Transit stops are found at the Wal-Mart driveway, Alaway Avenue, Davis Avenue, Tonsgard Court, Short Street, and near Western Auto. Almost all of the transit stops have shelters, except the ones at Alaway Avenue, the stop on the west side of Glacier Highway near Short Street, and the stop on the west side of Glacier Highway near Western Auto.

Stakeholder and public meetings were held early on in the project to elicit comments and opinions on the project and study corridor. The goal was to better understand the context under which alternatives would be developed to address the travel challenges and concerns from those that regularly drive, walk, or bike along this corridor. The public identified three key areas of concern: Renninger Street, Davis Avenue/Lemon Creek Bridge, and Concrete Way/Anka Street area.

Renninger Street is the primary roadway accessing Dzantik'i Heeni Middle School (DHMS) and public feedback indicated the desire for the intersection of Renninger Street and Glacier Highway to be designated as a school zone. Many students cross Glacier Highway at this intersection to get to and from school, transit stops, and Wal-Mart. Congestion occurs during DHMS's peak student arrivals and departures as vehicles and school bus traffic turn left onto and off of Renninger Street.

Davis Avenue is a difficult intersection for drivers turning onto Glacier Highway due in part to the speed of vehicles on Glacier Highway, the lower elevation of the Davis Avenue approach relative to Glacier Highway, and the close proximity of the Davis Avenue approach to the Lemon Creek Bridge with the bridge guard rail making it more difficult to see traffic and pedestrian approaching from the south. Pedestrians cross at this intersection, which does not have a marked crosswalk, to access the transit stop on Davis Avenue. Capital Transit staff expressed concern about the ability for their buses to turn onto Glacier Highway from Davis Avenue. The Lemon Creek Bridge is a choke point along the study corridor. The bridge is narrow causing bicyclists and pedestrians to feel particularly at risk.

The area from Concrete Way to Anka Street is of particular concern for large trucks and bicyclists. The intersection at Concrete Way has high levels of vehicles and pedestrians going to and from Breeze In and the industrial/commercial areas. Pedestrians often cross Glacier Highway here despite the lack of crosswalk markings. Concrete Way is particularly congested during the midday peak period. At the Anka Street intersection, bicyclists feel at risk and vulnerable entering the westbound bike lane between the through and right turning traffic due to many issues, including:

- Level of congestion for the size/geometry of area;
- Narrow bike lane;
- The number of turning movements in all directions;
- High volume of large trucks;
- The fact that trucks can't see bicyclists or pedestrians well in the dark; and
- The bicycle through-lane is the only one in Juneau striped as such and thus is confusing to drivers.

Large trucks traveling to and from gravel pits, batch plants, AEL&P, Costco, Home Depot, solid waste/landfill and other locations use Glacier Highway from Vanderbilt Hill Road/Egan Drive intersection to and from Concrete Way. Much of the large truck traffic on Glacier Highway is from Concrete Way to the east.

Other key concerns expressed by the public and stakeholders included:

- Sidewalk on seaward side of Glacier Highway;
- More regular sweeping/maintenance of the bike lanes;
- Consistent markings and width for the bicycle lanes;
- More median refuges at pedestrian crossings and better markings and lighting;
- A bike crossing at Vanderbilt Hill Road for inbound cyclists;
- Limit large truck traffic west of Concrete Way;

- More and improved street lighting, particularly at transit stops and pedestrian crossings; and,
- Reduction in the speed limit, particularly west of Davis Avenue in the more residential part of the corridor.

For more public and stakeholder feedback please see Appendix A.

To begin working toward the project objectives and the development of corridor visions and treatment recommendations, a list of potential treatments was developed and organized into three broad categories: pedestrian and bicycle facilities (longitudinal, crossing, and amenities), speed reduction, and access management. This list of treatment options is intended to ensure that all reasonable options are explored and vetted. The list can be found in Appendix B.

Section 3
Corridor Visions

CORRIDOR VISIONS

As mentioned in the introduction, the overall scope of this project is to improve bicycle and pedestrian facilities in and along Glacier Highway within the Lemon Creek area. Through discussions with DOT&PF and CBJ staff, alternatives serving to reduce vehicular speeds would help to improve pedestrian and bicycle environment. In essence, the primary goal is more broadly recognized to be providing a more complete street for Glacier Highway, one that improves access and safety for a variety of user types and modes.

Complete streets, as defined by the National Complete Streets Coalition, are designed and operated to enable safe access and mobility for all users: pedestrians, bicyclists, motorists, and transit riders of all ages and abilities (Reference 2). Complete streets are intended to facilitate and promote multiple modes of travel in a safe manner. As stated in the *Institute of Transportation Engineers (ITE) Recommended Practice, Designing Walkable Urban Thoroughfares: A Context Sensitive Approach,* a well-functioning urban thoroughfare that moves people across multiple modes depends on a clear understanding of the application of context sensitive principles (Reference 3). In the case of the study section of Glacier Highway, context sensitivity recognizes the variety of land uses surrounding the corridor and the continued use of the corridor for access to commercial and residential areas, but with a shift in the focus from an auto-centric, mobility-focused facility to one that better accommodates all modes of travel.

A pedestrian and bicycle supportive environment is defined in the ITE Recommended Practices document as a walkable (or bikeable, *inferred)* thoroughfare that provides appropriately spaced and properly sized pedestrian and bicycle components (Reference 3). In addition, this type of urban thoroughfare achieves multimodal, system-wide movement of people by promoting a high level of connectivity, with several modes functioning safely and adequately together within the context of the environment and the immediate uses along the roadway. It is essential to keep in mind that context sensitivity goes both ways; not only does the environment surrounding Glacier Highway influence its design, but the design of Glacier Highway itself will help to define and shape the adjacent land uses and facilities. This is why careful thought must be given to community priorities and what types of treatments along Glacier Highway might best achieve the overall goal of making the corridor a more multimodal facility.

With the notion of a complete street in mind and the broad lists of potential treatments in hand, three Corridor Visions were developed in an attempt to cast vision for a more complete street for Glacier Highway. The visions build one upon the other in terms of physical changes to the corridor starting with Baseline Vision, then the Enhanced Baseline Vision, and finally the Roundabout Vision. While each of these visions is unique in its own right and could be implemented as displayed, concepts from each can be combined and implemented depending on the availability of funds as well as on priority needs taking into account the technical analyses, public feedback, and cost/benefit evaluation provided in this study.

All three corridor visions will narrow the travel lanes by one foot from 11 feet to 12 feet, as well as provide defined bike lanes and continuous curb, gutter, and sidewalks on both sides of Glacier Highway. The primary typical section for Glacier Highway between Short Street and the Wal-Mart truck access is proposed to be 59-foot to 63-foot wide in total with 5-foot wide sidewalks, 2-foot wide curb and gutter, 5.5-foot bike lanes, and 11-foot travel lanes on both sides of the roadway, along with a 12- to 16-foot raised median, left-turn lane, or two-way left-turn lane as appropriate. The exception to this typical section is for locations with median refuge islands adjacent to left-turn lanes, where a 67' wide section is necessary to provide for a 12-foot wide left-turn lane and 8-foot wide raised median. No seaward sidewalk is proposed in the typical section between Short Street and Vanderbilt Hill Drive as no existing or proposed land uses necessitate such treatment. A crossing is proposed at Short Street to allow pedestrians to cross to/from the sidewalk on the landward side, providing pedestrian continuity and connectivity throughout the study section of Glacier Highway.

Each corridor vision is described in further detail in the following sections. Each treatment is described via conceptual drawings, treatment lists, and tables that provide further explanation of each included treatment.

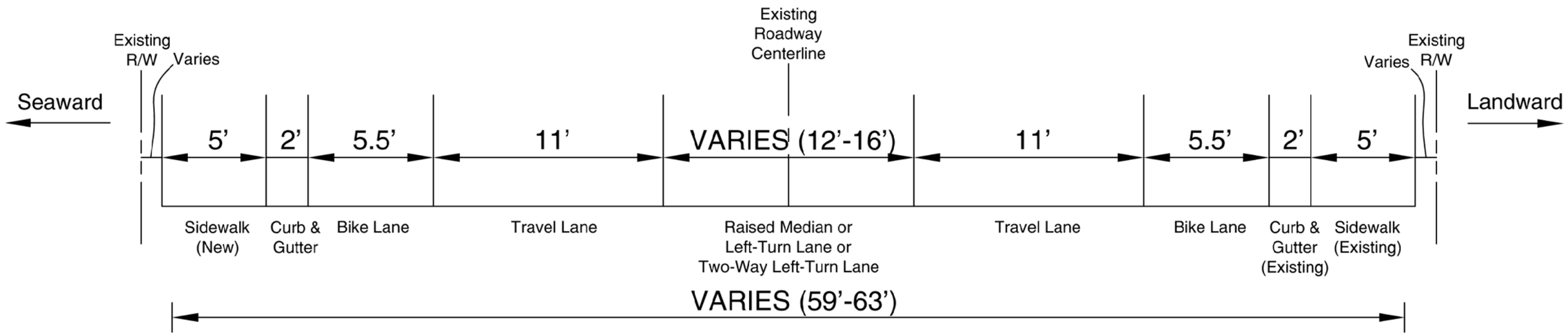
BASELINE CORRIDOR VISION

The Baseline Corridor Vision, displayed in Figure B-1 through Figure B-7 is largely based on the scope DOT&PF developed for the corridor in order to secure funding within the Statewide Transportation Improvement Program (STIP). The list below presents the treatments implemented in the Baseline Corridor Vision. Table B-1 in Appendix C presents a more detailed description of each treatment along with information on the advantages and challenges foreseen with each of these treatments to assist with the assessment of the associated benefits, risks, and costs.

Treatment concepts presented in Figure B-1 through Figure B-7 and Table B-1 are described in more detail specific to the Baseline Vision in the following:

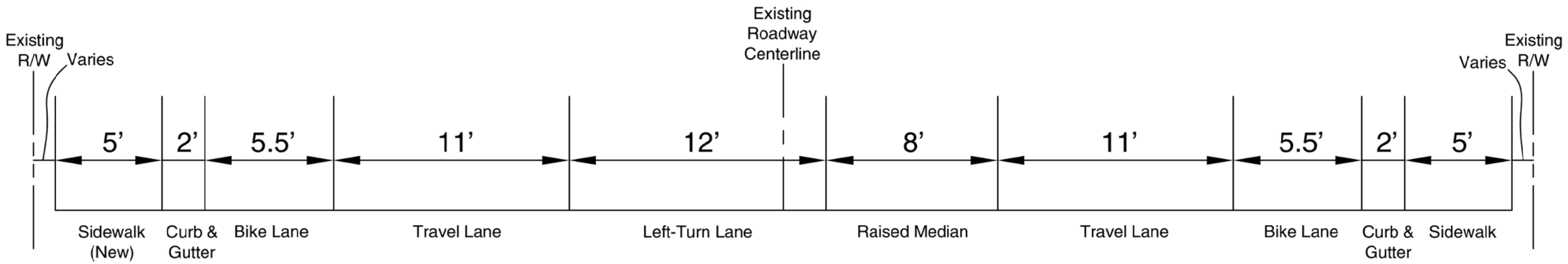
Longitudinal Treatments

- New 5-foot wide sidewalk installed on the seaward side between Renninger Street and Short Street.
- 5.5-foot wide bike lane with updated signing & striping installed on both sides of the roadway between Whitehead Drive and Vanderbilt Hill Road.
- The existing two-way left-turn lane is retained throughout the corridor with left turn pockets and pedestrian median refuges installed where improved pedestrian crossings are proposed.
- Illumination for the length of the corridor on both sides of the roadway. The use of pedestrian and neighborhood scale illumination in place of more traditional highway illumination should be considered, particularly between Renninger Street and Anka Street.



PRIMARY TYPICAL SECTION**
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

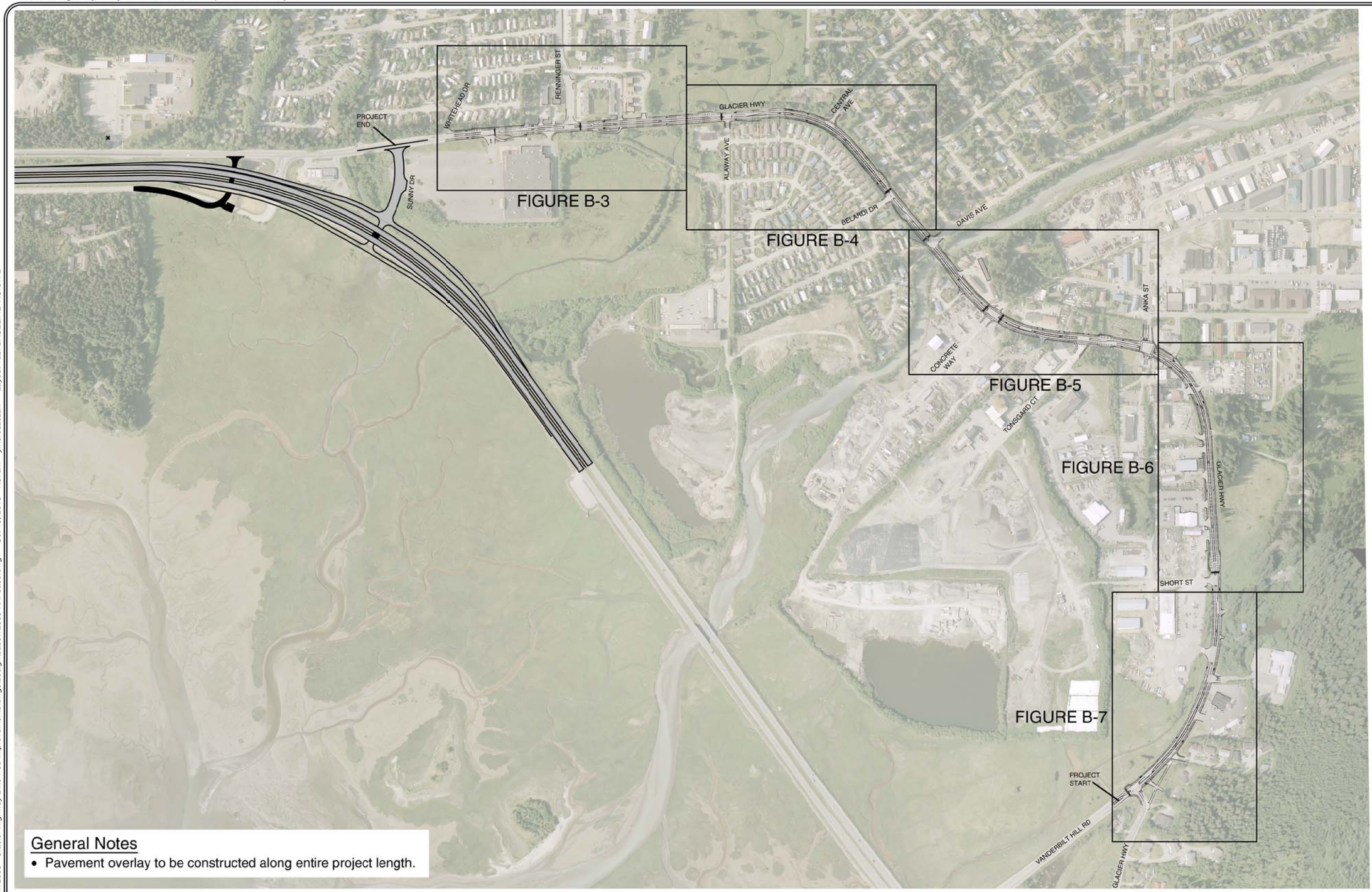
**Typical section for Glacier Highway between Short Street and Whitehead Drive. Prior to Short Street, the typical section is the same with the exception of no seaward sidewalk. See below for the typical section for locations with median refuge islands adjacent to left-turn lanes.



TYPICAL SECTION FOR LEFT-TURN LANES WITH
ADJACENT MEDIAN REFUGE ISLANDS
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

GLACIER HIGHWAY: BASELINE CORRIDOR VISION - TYPICAL SECTIONS
JUNEAU, ALASKA

FIGURE
B-1



SCALE
0 300 600

General Notes

- Pavement overlay to be constructed along entire project length.

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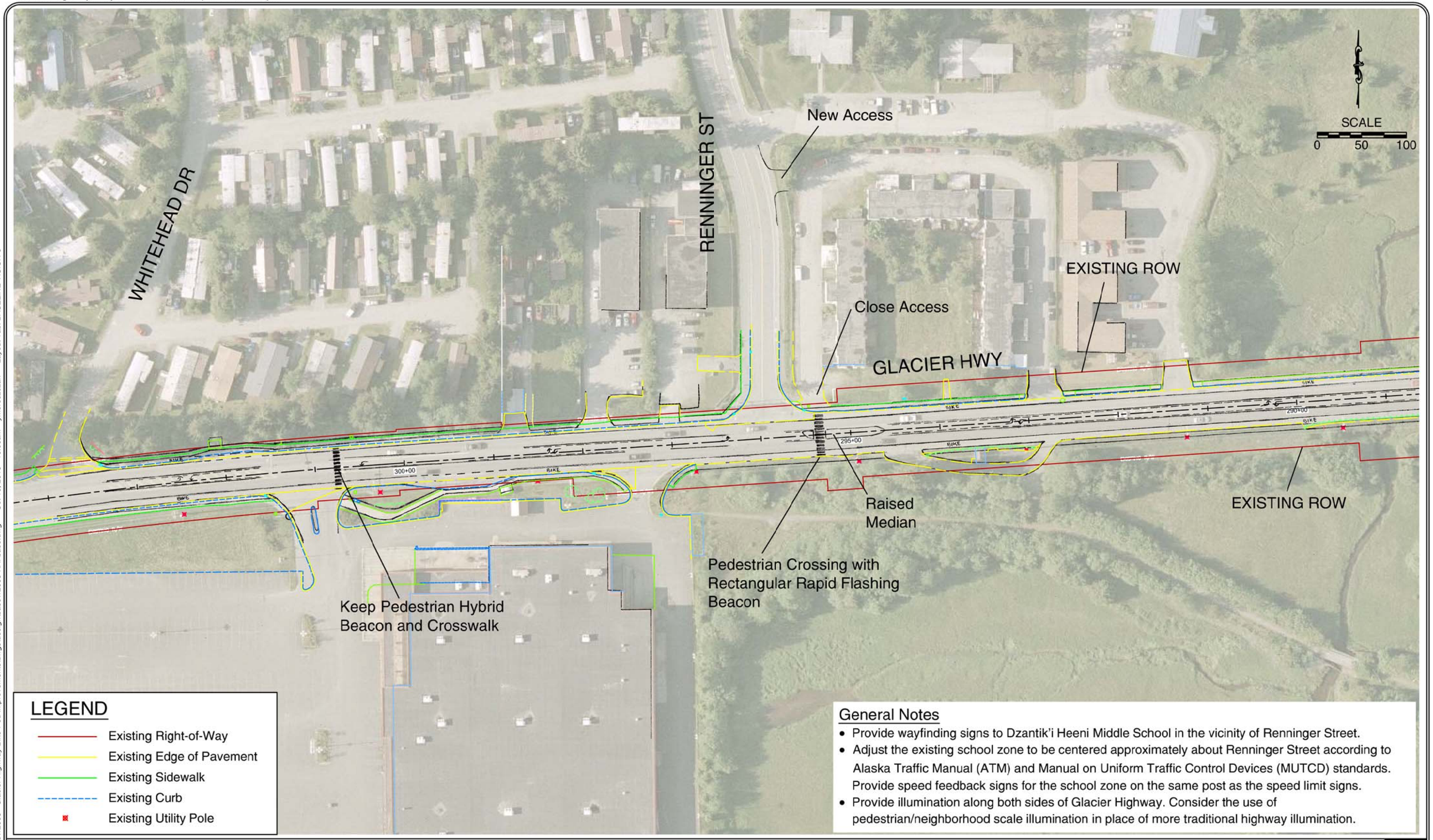
GLACIER HIGHWAY: BASELINE CORRIDOR VISION - OVERVIEW
JUNEAU, ALASKA

FIGURE **B-2**



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide wayfinding signs to Dzantik'i Heeni Middle School in the vicinity of Renninger Street.
- Adjust the existing school zone to be centered approximately about Renninger Street according to Alaska Traffic Manual (ATM) and Manual on Uniform Traffic Control Devices (MUTCD) standards. Provide speed feedback signs for the school zone on the same post as the speed limit signs.
- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE **B-3**

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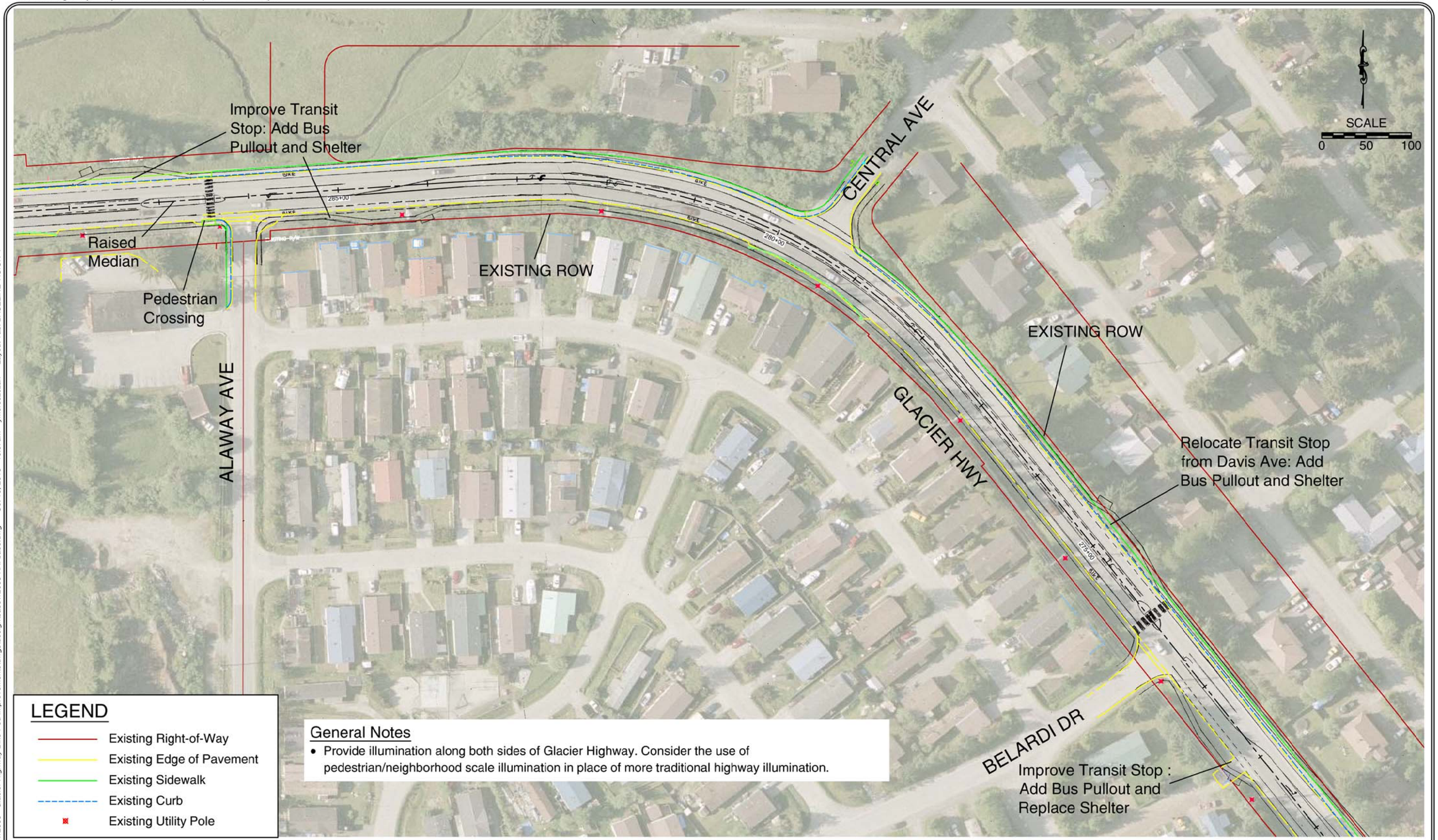


LEGEND

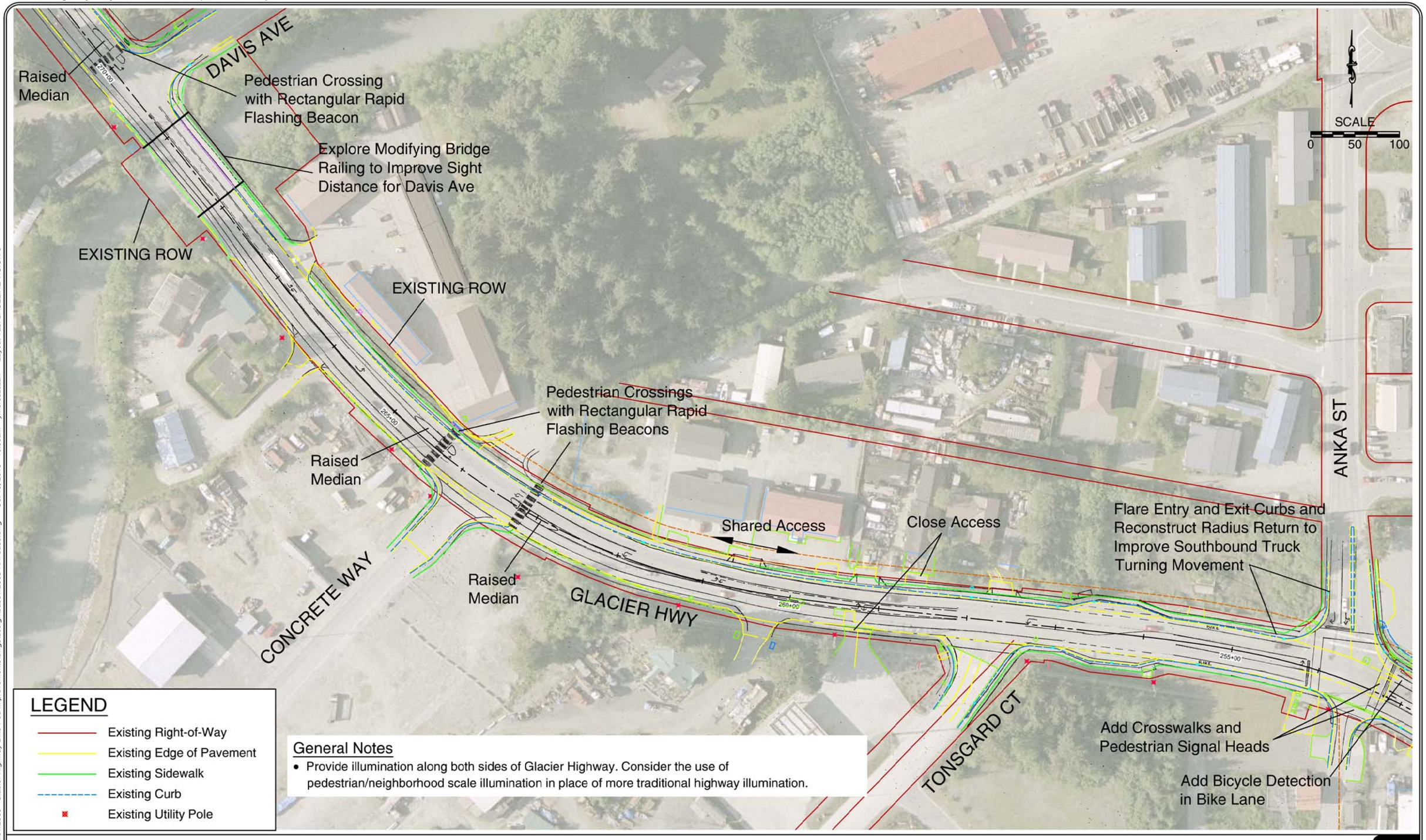
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE **B-4**



LEGEND

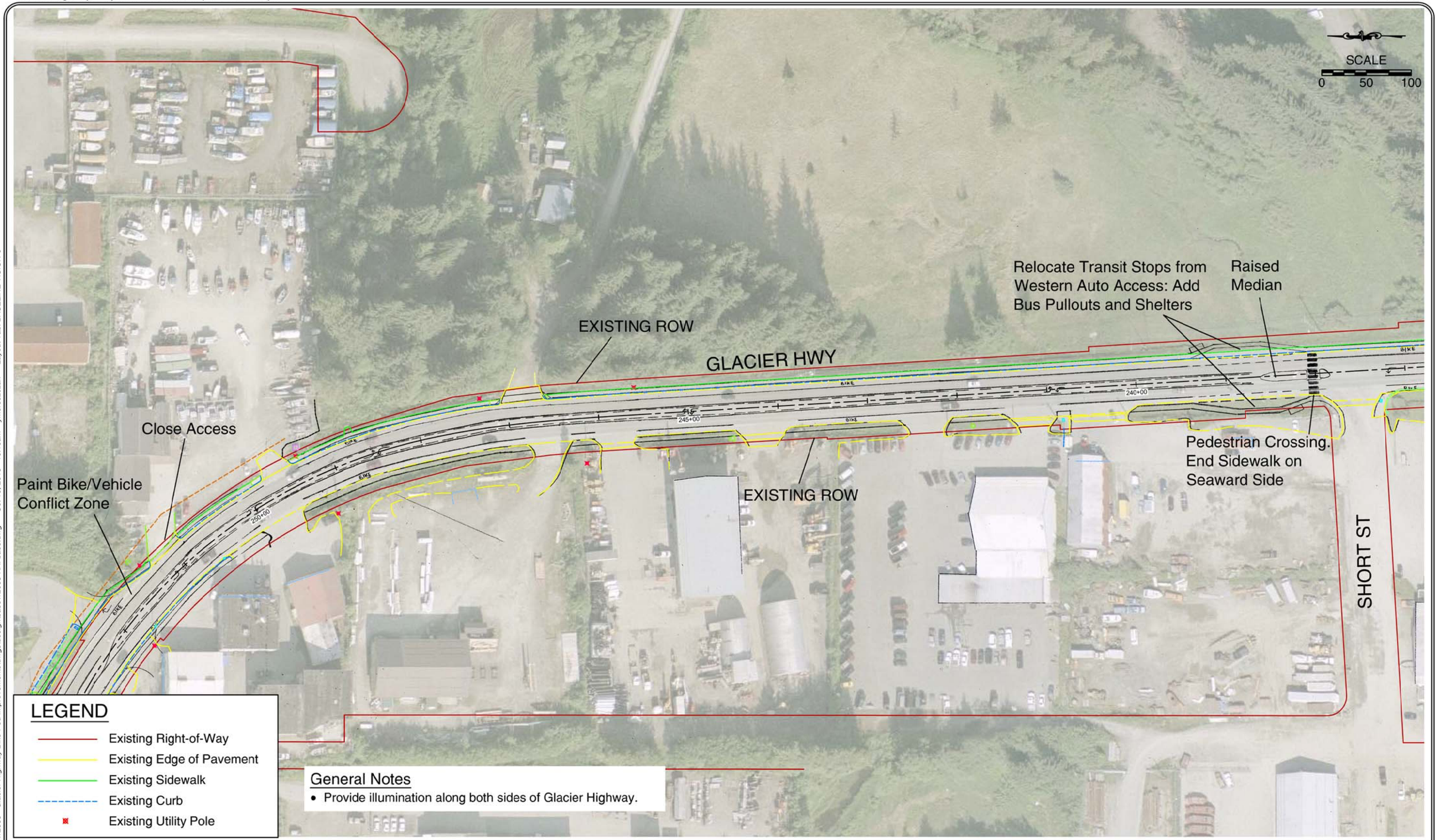
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE **B-5**



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.

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GLACIER HIGHWAY: BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE B-6

SCALE
0 50 100

GLACIER HWY

Close Access

EXISTING ROW

COOGAN DR

EXISTING ROW

Close Access

Install Speed Feedback Sign on Same Post as Existing Speed Limit Sign

GLACIER HWY

Bicycle-Only Jughandle Crossing with Bike Activated Rectangular Rapid Flashing Beacon

Widen Shoulder to Provide Necessary Width for Bike Lane

Raised Median

VANDERBILT HILL RD

LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.

GLACIER HIGHWAY: BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE B-7

Access Management

- Close the Northwood Condominium driveway on the north side of Glacier Highway just east of Renninger Street and install a new access point to Renninger Street.
- Replace the rolled curb with vertical curb on the north side of Glacier Highway between Tonsgard Court and Concrete Way and provide shared driveway access points to the commercial properties' parking lots.
- Close the gas station driveway access on the south side of Glacier Highway just west of Tonsgard Court. Vehicles can access the property from Tonsgard Court.
- Close the driveway access to the former Bobcat of Juneau on the east side of Glacier Highway south of Anka Street, as vehicles can access the property from its other driveway further south on Glacier Highway.
- Close the driveway access on the east side of Glacier Highway to the Dragon Inn Chinese Restaurant closest to Short Street, as vehicles can access the restaurant from its other driveway further south on Glacier Highway.
- Close the residential driveway access on the east side off of Glacier Highway just south of Coogan Drive near the path as there is existing driveway access provided to Coogan Drive

Bus Stop Treatments and Relocations

- Improve the transit stops at Alaway Avenue by adding bus pullouts and shelters.
- Relocate the transit stop on Davis Avenue to be on Glacier Highway to north of Belardi Drive. Install a bus pullout and shelter. Improve the existing transit stop on the west side of Glacier Highway south of Belardi Drive by adding a bus pullout and shelter.
- Relocate the transit stops from the Western Auto access to the north side of Short Street. Install bus pullouts and shelters.

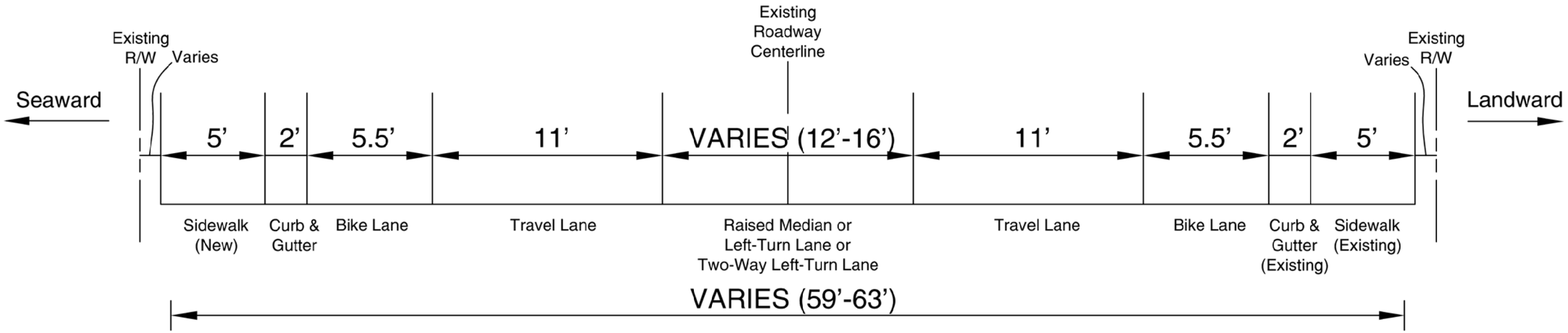
Intersection Treatments

- Install stop bars and standard, marked crosswalks at all stop-controlled intersection legs on Glacier Highway's side streets.
- Renninger Street
    - Install a high-visibility crosswalk, median pedestrian refuge, and rectangular rapid flashing beacons (RRFBs) on the east leg across Glacier Highway.
    - Install wayfinding signs to Dzantik'i Heeni Middle School.
    - Modify the existing school zone along Glacier Highway to be centered around Renninger Street. Provide speed feedback signs for the school zone mounted on the same posts as the speed limit signs.
- Alaway Avenue
    - Replace the existing standard crosswalk on the west leg across Glacier Highway with a high visibility crosswalk and a median pedestrian refuge.

- Belardi Drive
    - Install a high visibility crosswalk and median pedestrian refuge on the north leg across Glacier Highway.
- Davis Avenue
    - Install a high-visibility crosswalk, median pedestrian refuge, and rectangular rapid flashing beacon (RRFB) on the north leg across Glacier Highway.
    - Modifications to the bridge's east side bridge railing should be explored to improve sight distance for Davis Avenue.
- Concrete Way
    - Install a high-visibility crosswalk, median pedestrian refuge, and rectangular rapid flashing beacon (RRFB) on the north and south legs across Glacier Highway.
- Anka Street
    - Install standard crosswalks, pedestrian signal heads, updated curb ramps, and pedestrian actuation on the south and east legs.
    - Install bicycle detection in the bike lane on the northbound approach of the intersection.
    - The weaving zone (bike/vehicle conflict zone) on the northbound intersection approach between through bicyclists and right-turning vehicles will be striped, painted, and indicated with warning signing.
    - Implement flare entry and exit curbs along with reconstruction of radius return to improve southbound and westbound truck turning movements.
- Short Street
    - Install a high visibility crosswalk and a median pedestrian refuge on the north leg across Glacier Highway.
- Vanderbilt Hill Road
    - Construct a bicycle-only jughandle crossing with raised median refuge and bike-activated RRFB on the south leg across Vanderbilt Hill Road.
    - Widen the shoulder onto Glacier Highway to provide necessary width for bike lane.
    - Install a speed feedback sign on the same post as the existing speed limit sign located north of the intersection.

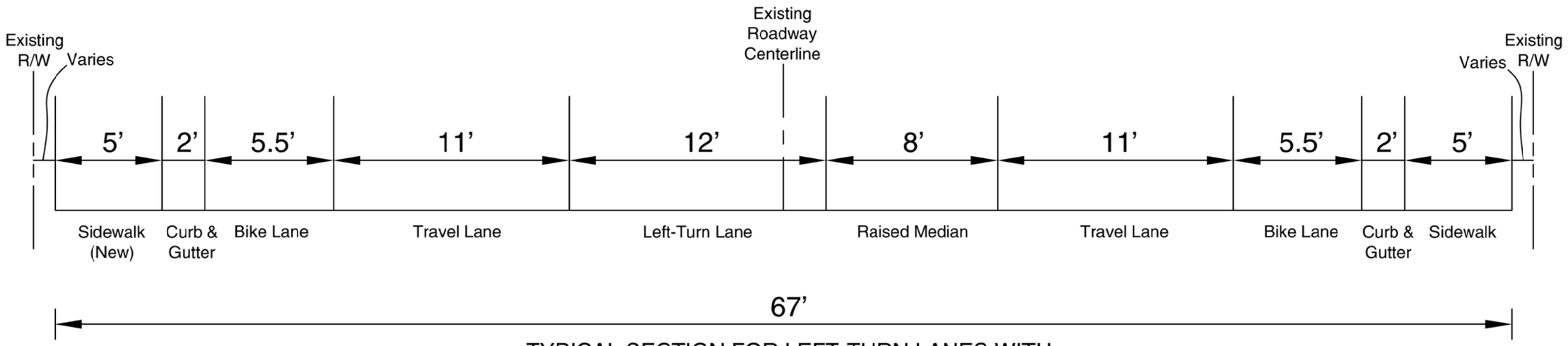
ENHANCED BASELINE CORRIDOR VISION

The Enhanced Baseline Corridor Vision, displayed in Figure E-1 through Figure E-7 builds upon the Baseline Corridor Vision with more aggressive access management and speed management treatments. Raised medians are extended throughout the corridor limiting the left turns along Glacier Highway. Because the corridor visions build on one another, the list below presents Enhanced Baseline treatment concepts and locations of treatments that are in addition to the treatments presented in the Baseline Corridor Vision. Table E-1 in Appendix C presents a more detailed description and the advantages and challenges foreseen with each treatment.



PRIMARY TYPICAL SECTION**
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

**Typical section for Glacier Highway between Short Street and Whitehead Drive. Prior to Short Street, the typical section is the same with the exception of no seaward sidewalk. See below for the typical section for locations with median refuge islands adjacent to left-turn lanes.



TYPICAL SECTION FOR LEFT-TURN LANES WITH
ADJACENT MEDIAN REFUGE ISLANDS
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION - TYPICAL SECTIONS
JUNEAU, ALASKA

FIGURE
E-1

SCALE
0 300 600

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GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION - OVERVIEW
JUNEAU, ALASKA

FIGURE E-2

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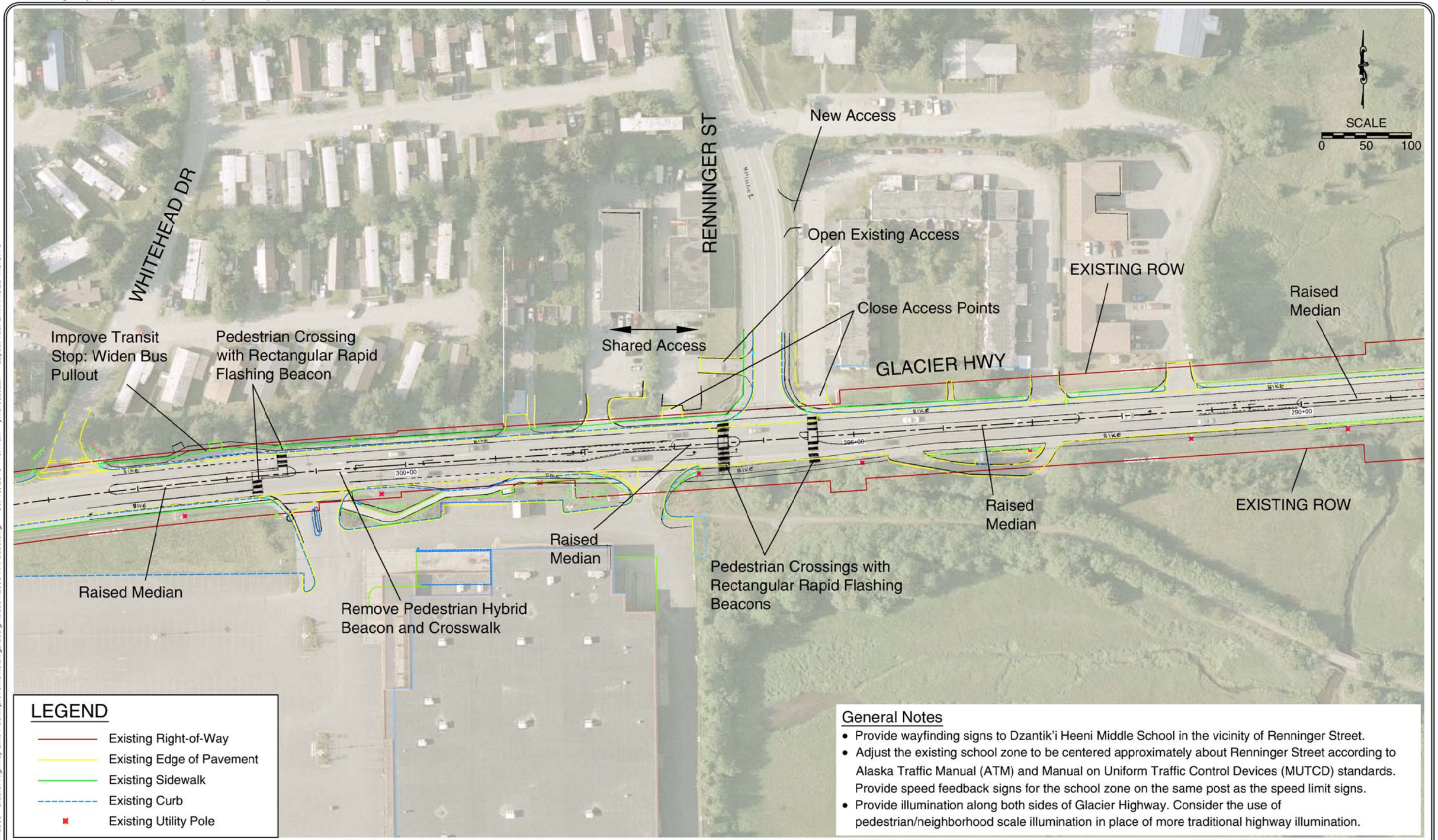


LEGEND

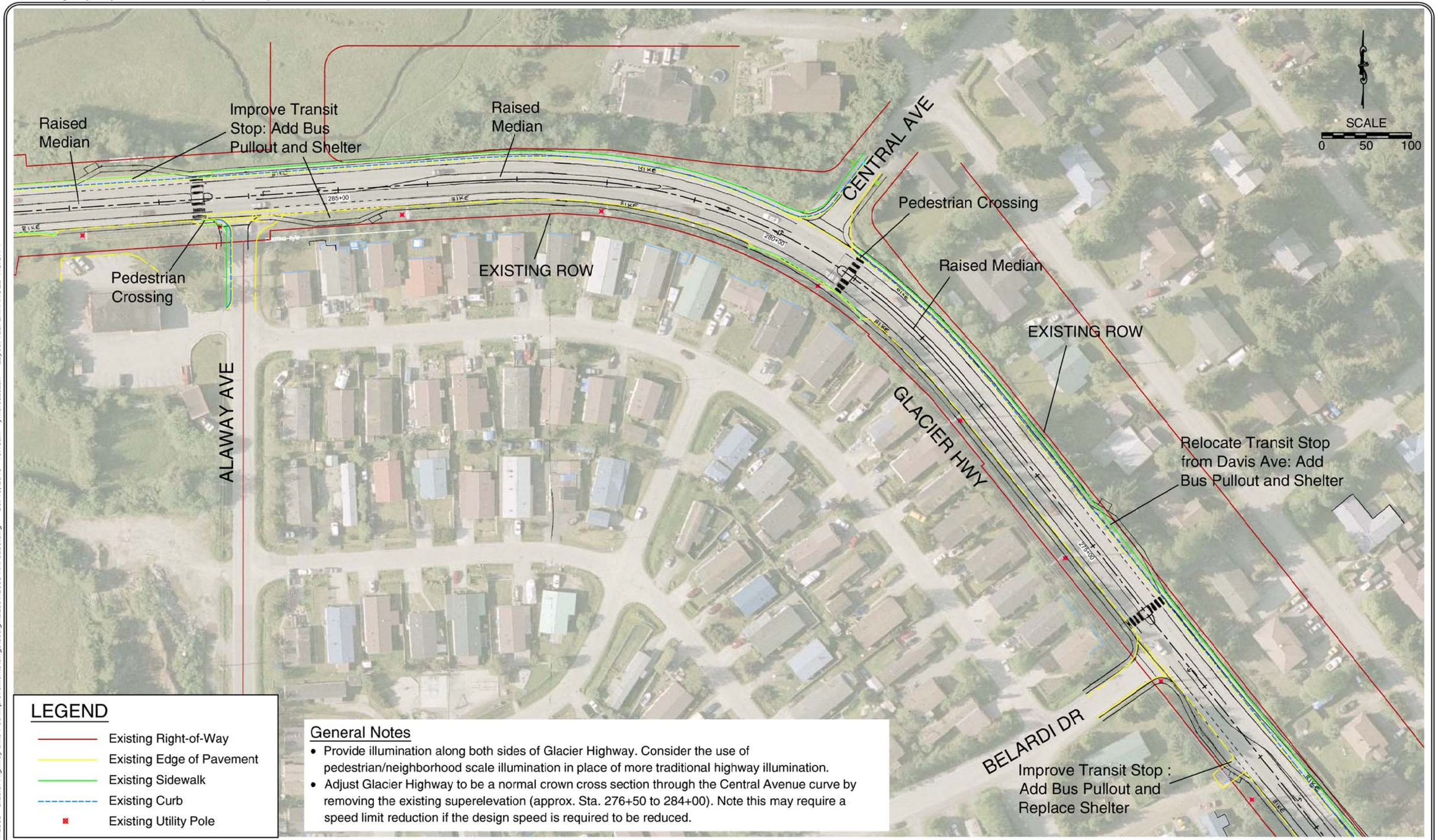
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide wayfinding signs to Dzantik'i Heeni Middle School in the vicinity of Renninger Street.
- Adjust the existing school zone to be centered approximately about Renninger Street according to Alaska Traffic Manual (ATM) and Manual on Uniform Traffic Control Devices (MUTCD) standards. Provide speed feedback signs for the school zone on the same post as the speed limit signs.
- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE **E-3**



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.
- Adjust Glacier Highway to be a normal crown cross section through the Central Avenue curve by removing the existing superelevation (approx. Sta. 276+50 to 284+00). Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE E-4

Raised Median

DAVIS AVE

Pedestrian Crossing with Rectangular Rapid Flashing Beacon

Explore Modifying Bridge Railing to Improve Sight Distance for Davis Ave

Left-In Only Access

EXISTING ROW

EXISTING ROW

Raised Median

Pedestrian Crossings with Rectangular Rapid Flashing Beacons

Shared Access to Concrete Way

Raised Median

Raised Median

CONCRETE WAY

GLACIER HWY

Shared Access

Close Access

Flare Entry and Exit Curbs and Reconstruct Radius Return to Improve Southbound Truck Turning Movement

ANKA ST

TONSGARD CT

Add Crosswalks and Pedestrian Signal Heads

Add Bicycle Detection in Bike Lane

SCALE
0 50 100

LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.
- Adjust Glacier Highway to be a normal crown cross section through the Concrete Way curve by removing the existing superelevation (approx. Sta. 258+65 to 267+35).Note this may require a speed limit reduction if the design speed is required to be reduced.
- Adjust Glacier Highway to be a normal crown cross section through the Anka Street curve by removing the existing superelevation (approx. Sta. 245+60 to 256+60).Note this may require a speed limit reduction if the design speed is required to be reduced.

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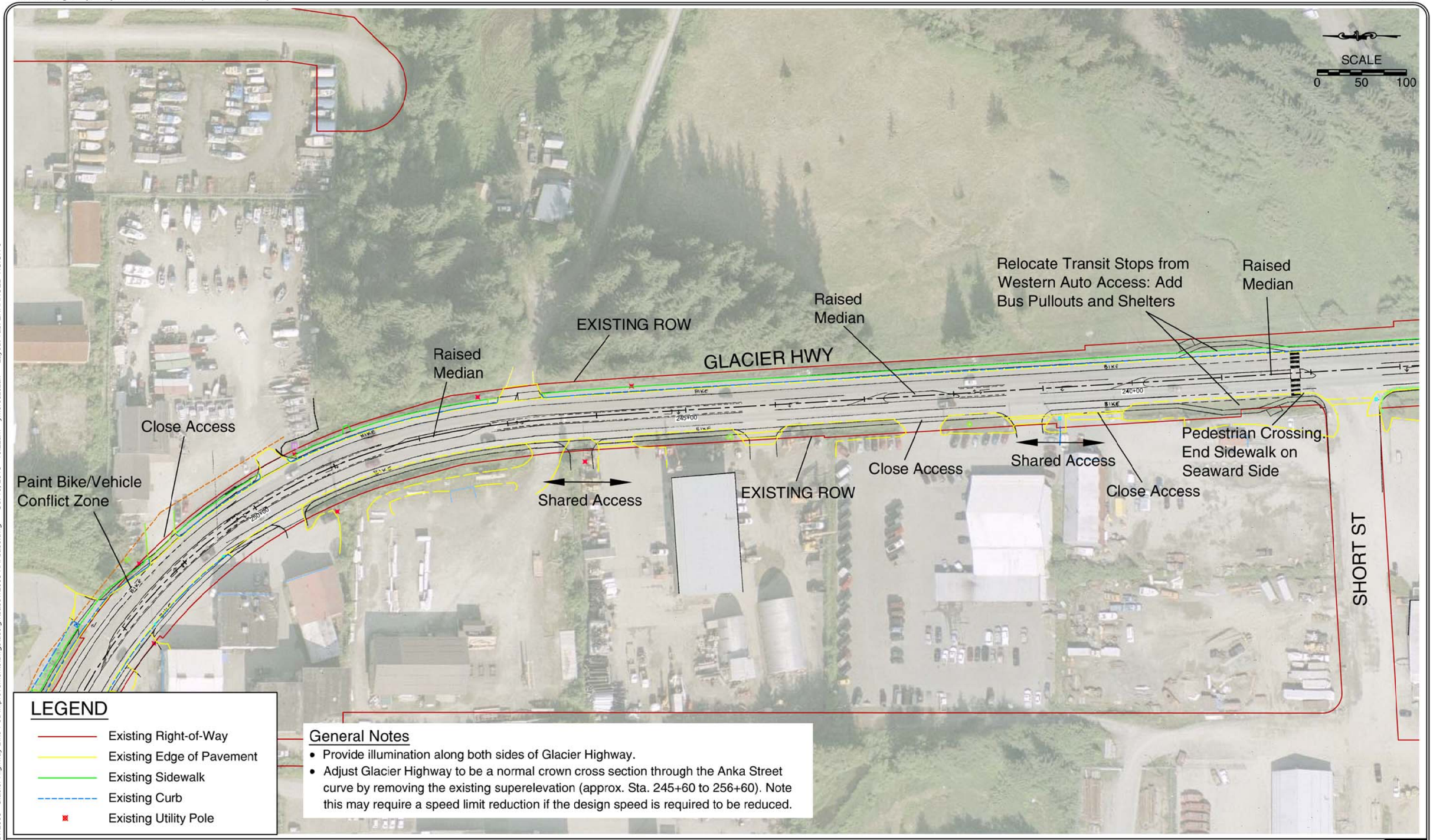
GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE E-5



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.
- Adjust Glacier Highway to be a normal crown cross section through the Anka Street curve by removing the existing superelevation (approx. Sta. 245+60 to 256+60). Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE **E-6**

SCALE
0 50 100

Raised Median

GLACIER HWY

Close Access

EXISTING ROW

COOGAN DR

EXISTING ROW

Close Access

Raised Median

Install Speed Feedback Sign on Same Post as Existing Speed Limit Sign

GLACIER HWY

Bicycle-Only Jughandle Crossing with Bike Activated Rectangular Rapid Flashing Beacon

Widen Shoulder to Provide Necessary Width for Bike Lane

VANDERBILT HILL RD

Raised Median

LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.
- Adjust Glacier Highway to be a normal crown cross section through the curve from approx. Sta. 222+50 to 236+50 by removing the existing superelevation. Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ENHANCED BASELINE CORRIDOR VISION
JUNEAU, ALASKA

FIGURE E-7

Longitudinal Treatments

- The installation of a raised median throughout much of the corridor would replace most of the two-way-left turn lane, restrict some driveway and side street access, and help reduce vehicle speeds.
- Remove superelevation (a roadway design element allowing for higher vehicle speeds on curves) at the following locations:
    - The Central Avenue curve (approximately Station 276+50 to 284+00)
    - The Concrete Way curve (approximately Station 258+65 to 267+35)
    - The Anka Street curve (approximately Station 245+60 to 256+60)
    - The curve around Coogan Drive (approximately Station 222+50 to 236+500)

Access Management

- Implement shared access between the Alpine Apartments at 6390 Glacier Highway and the apartment on the northwest corner of Renninger Street and Glacier Highway.
- Close the residential driveway access on the north side of Glacier Highway just east of Renninger Street as there is an existing driveway on Renninger Street and the proposed shared access road between Alpine Apartments and this property provides direct access from Glacier Highway.
- The raised median will prevent left turns into and out of the Northwood Condominium driveway on the north side of Glacier Highway and the pump station driveway on the south side of Glacier Highway.
- Install left-turn pockets on Glacier Highway into commercial properties between Davis Avenue and Concrete Way but prohibit left turns out of driveways through the use of raised median.
- Provide shared access to Concrete Way for properties on the west side of Glacier Highway between Davis Avenue and Concrete Way.
- Provide shared access between Juneau Truss and Tyler Rental properties and consolidate two driveways into one on the west side of Glacier Highway south of Anka Street.
- Close the northern driveway access to the Harri's property on the west side of Glacier Highway south of Anka Street, as there is another driveway access further south.
- Provide shared access between the Harri's and the Liquor Barrel properties and consolidate two driveways into one on the west side of Glacier Highway south of Anka Street.
- Left turns into and out of Lemon Creek Trail on the east side of Glacier Highway will be restricted by the proposed raised median.

Bus Stop Treatments and Relocations

- Widen the bus pullout on the north side of Glacier Highway north of Wal-Mart's primary driveway.
- No additional bus stop changes are proposed in the Enhanced Baseline Corridor Vision.

Intersection Treatments

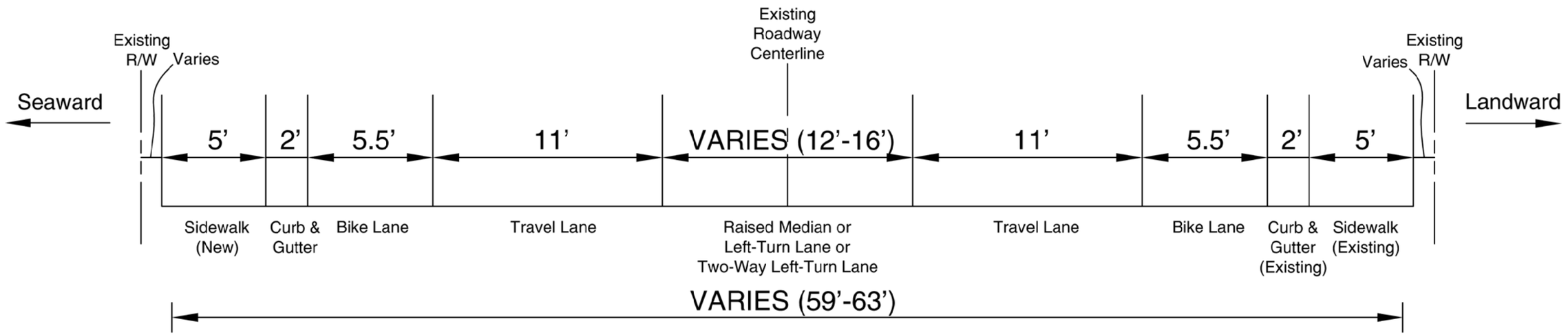
- Walmart's primary driveway
    - The existing pedestrian crosswalk across Glacier Highway and pedestrian hybrid signal on the eastern leg will be relocated to the western leg with an offset, high-visibility crosswalk, pedestrian median refuge, and RRFBs.
- Renninger Street
    - Install a high-visibility crosswalk with pedestrian median refuge and RRFB on the western leg of the intersection.
    - Install an eastbound left turn pocket on Glacier Highway.
- Central Avenue
    - Install a high-visibility crosswalk with pedestrian median refuge on the southern leg across Glacier Highway.

ROUNDABOUT CORRIDOR VISION

The Roundabout Vision, displayed in Figure R-1 through Figure R-7 most drastically changes the corridor by converting several major intersections into roundabouts and further controlling access to Glacier Highway. This vision continues to implement raised median on much of the study corridor like the Enhanced Baseline Corridor Vision. Table 5 presents the Roundabout treatment concepts and locations of treatments that are in addition to the treatments in the Baseline and Enhanced Baseline Corridor Visions.

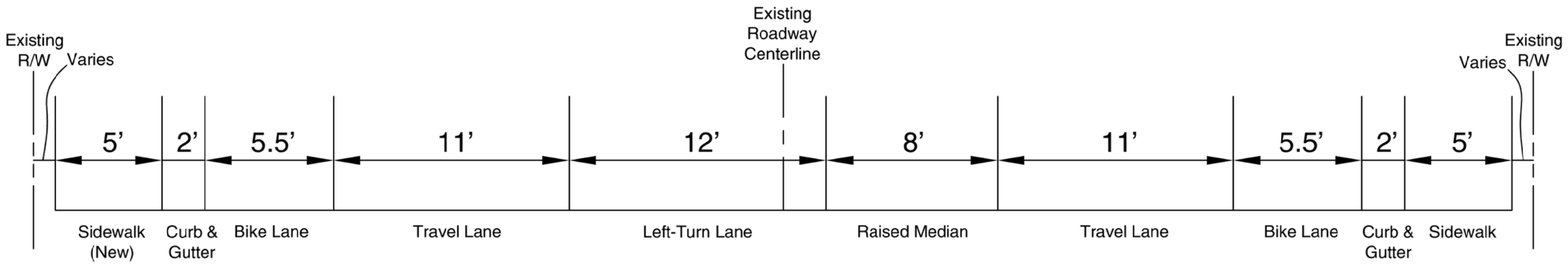
Roundabouts can provide a range of benefits for the Glacier Highway corridor. At individual intersections, they can improve side-street capacity and reduce side-street delays. Along the main street corridor (Glacier Highway), a roundabout can serve as a gateway to an area, providing more of a sense of place, and reduce vehicle speeds through vehicle path deflection accomplished via raised medians and curbs. When roundabouts are implemented in pairs or in a series along a corridor they provide an opportunity for access management. Left-turns from driveways can be restricted with minimal impact if the left-turn movement can be accommodated indirectly via a U-turn at a nearby roundabout. This vision includes roundabout pairs at the Concrete Way and Anka Street intersections as well as at the Anka Street and Short Street intersections.

The list below presents the Roundabout Corridor Vision treatment concepts and locations of treatments that are in addition to the treatments presented in the Baseline and Enhanced Baseline Corridor Visions. Table R-1 in Appendix C presents a more detailed description and the advantages and challenges foreseen with each treatment.



PRIMARY TYPICAL SECTION**
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

**Typical section for Glacier Highway between Short Street and Whitehead Drive. Prior to Short Street, the typical section is the same with the exception of no seaward sidewalk. See below for the typical section for locations with median refuge islands adjacent to left-turn lanes.



TYPICAL SECTION FOR LEFT-TURN LANES WITH ADJACENT MEDIAN REFUGE ISLANDS
Glacier Highway
Approx. Sta. 223+00 to Sta. 304+00

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION - TYPICAL SECTIONS
JUNEAU, ALASKA

FIGURE R-1

SCALE
0 300 600

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION - OVERVIEW
JUNEAU, ALASKA

FIGURE **R-2**

WHITEHEAD DR

RENNINGER ST

New Access

New Access

Shared Access to Renninger Street

Close Access Points

EXISTING ROW

GLACIER HWY

Improve Transit Stop: Widen Bus Pullout

Pedestrian Crossing with Rectangular Rapid Flashing Beacon

Raised Median

Raised Median

EXISTING ROW

Raised Median

Remove Pedestrian Hybrid Beacon and Crosswalk

Relocate Access. Incorporate into Roundabout

SCALE
0 50 100

LEGEND

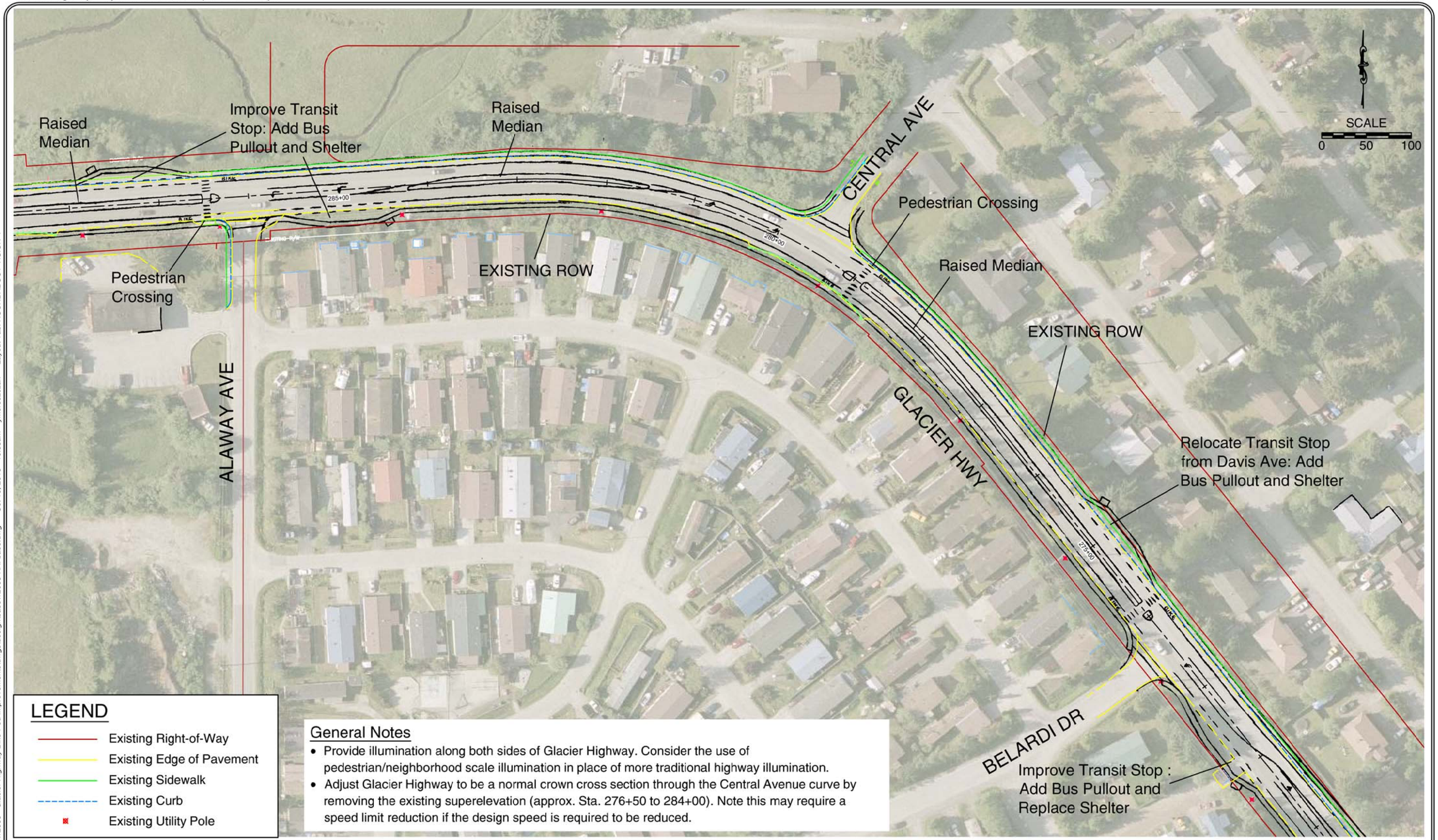
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide wayfinding signs to Dzantik'i Heeni Middle School in the vicinity of Renninger Street.
- Adjust the existing school zone to be centered approximately about Renninger Street according to Alaska Traffic Manual (ATM) and Manual on Uniform Traffic Control Devices (MUTCD) standards. Provide speed feedback signs for the school zone on the same post as the speed limit signs.
- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION
JUNEAU, ALASKA

FIGURE R-3



LEGEND

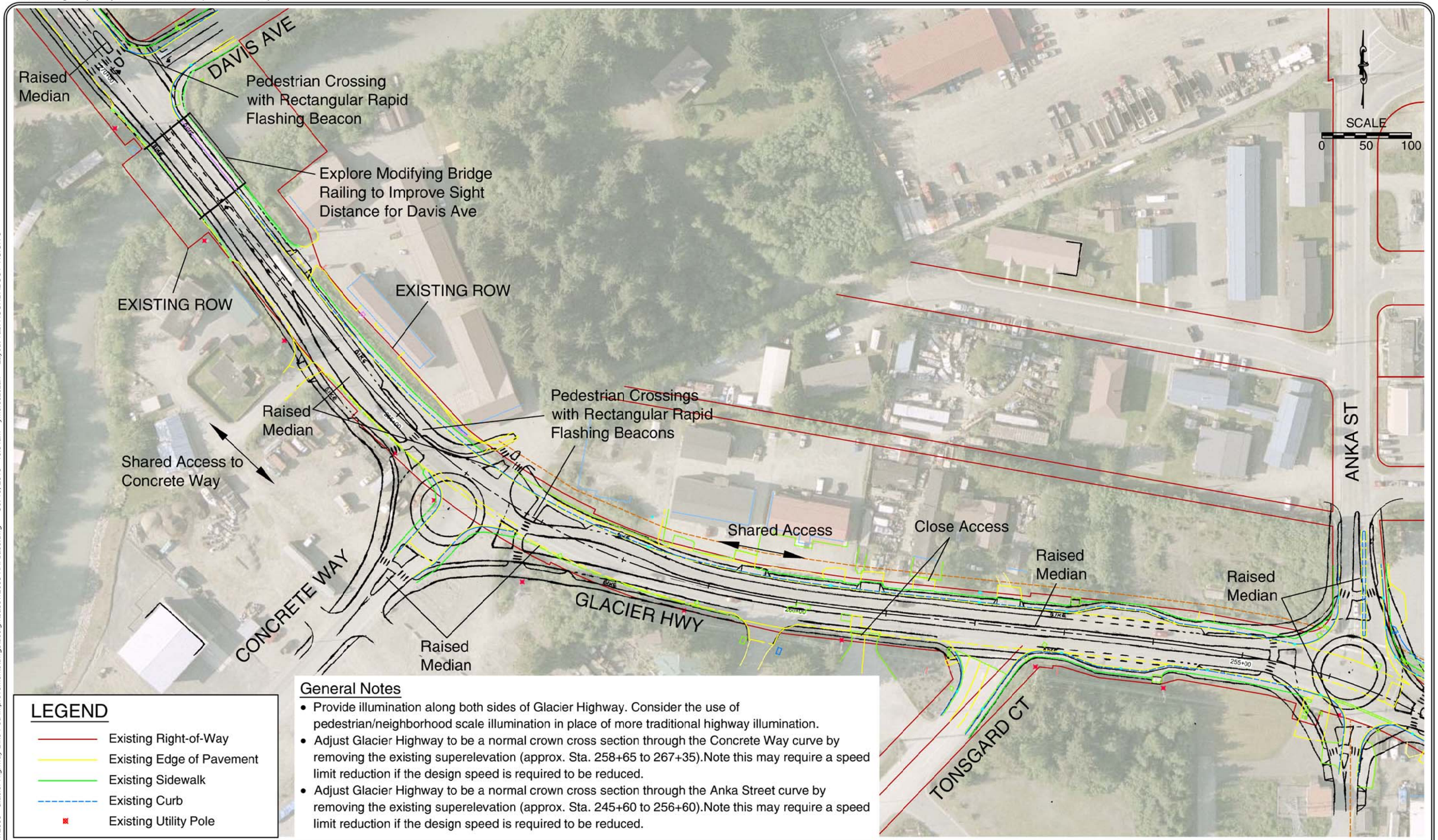
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.
- Adjust Glacier Highway to be a normal crown cross section through the Central Avenue curve by removing the existing superelevation (approx. Sta. 276+50 to 284+00). Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION
JUNEAU, ALASKA

FIGURE R-4



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

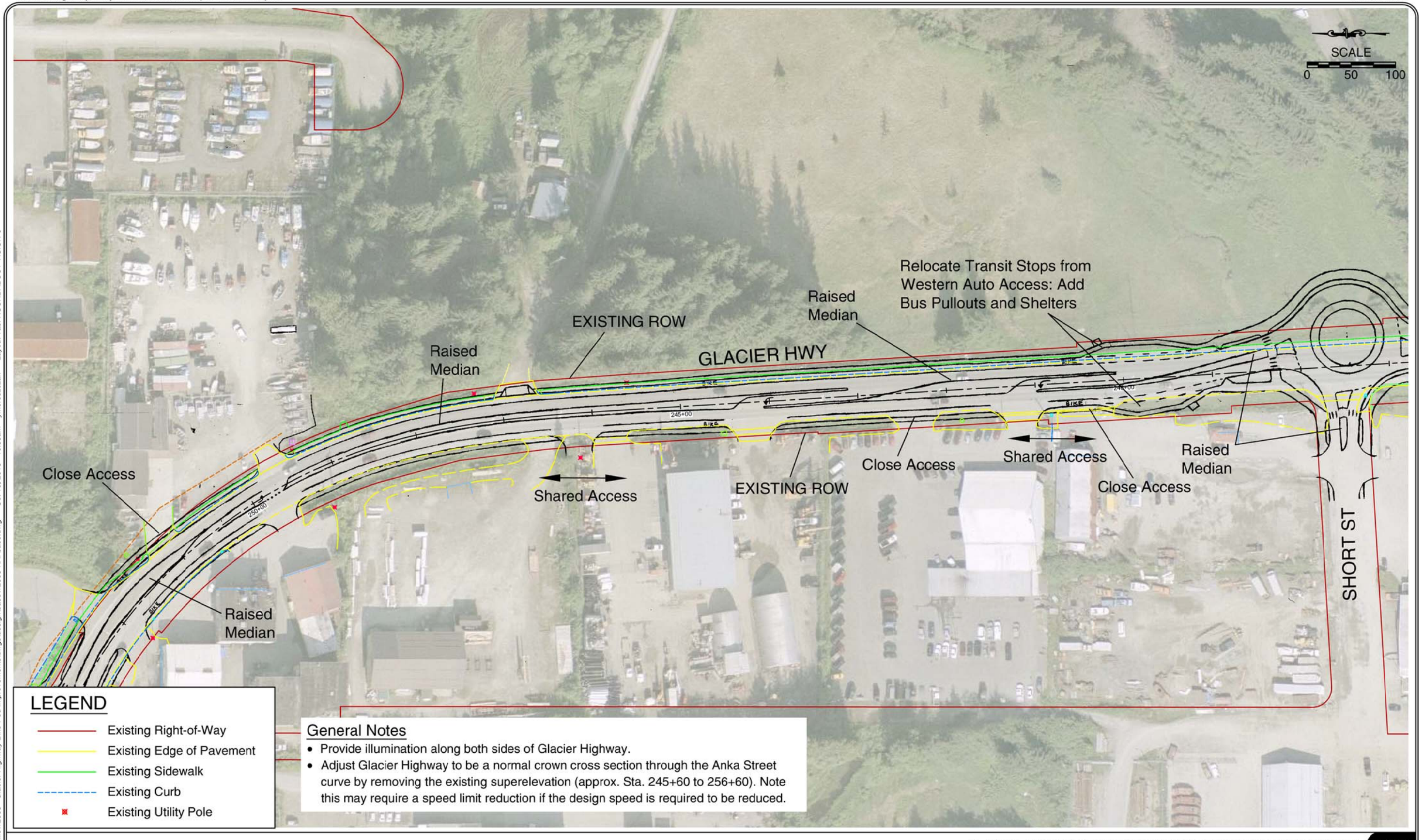
General Notes

- Provide illumination along both sides of Glacier Highway. Consider the use of pedestrian/neighborhood scale illumination in place of more traditional highway illumination.
- Adjust Glacier Highway to be a normal crown cross section through the Concrete Way curve by removing the existing superelevation (approx. Sta. 258+65 to 267+35).Note this may require a speed limit reduction if the design speed is required to be reduced.
- Adjust Glacier Highway to be a normal crown cross section through the Anka Street curve by removing the existing superelevation (approx. Sta. 245+60 to 256+60).Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION
JUNEAU, ALASKA

FIGURE R-5

H:\profile\12665 - Glacier Highway Bike-Ped Improvements\dwgs\design\base\12665-KAI base.dwg Oct 10, 2013 - 10:34am - ymereszczak Layout Tab: ROUNDABOUT VISION-5



LEGEND

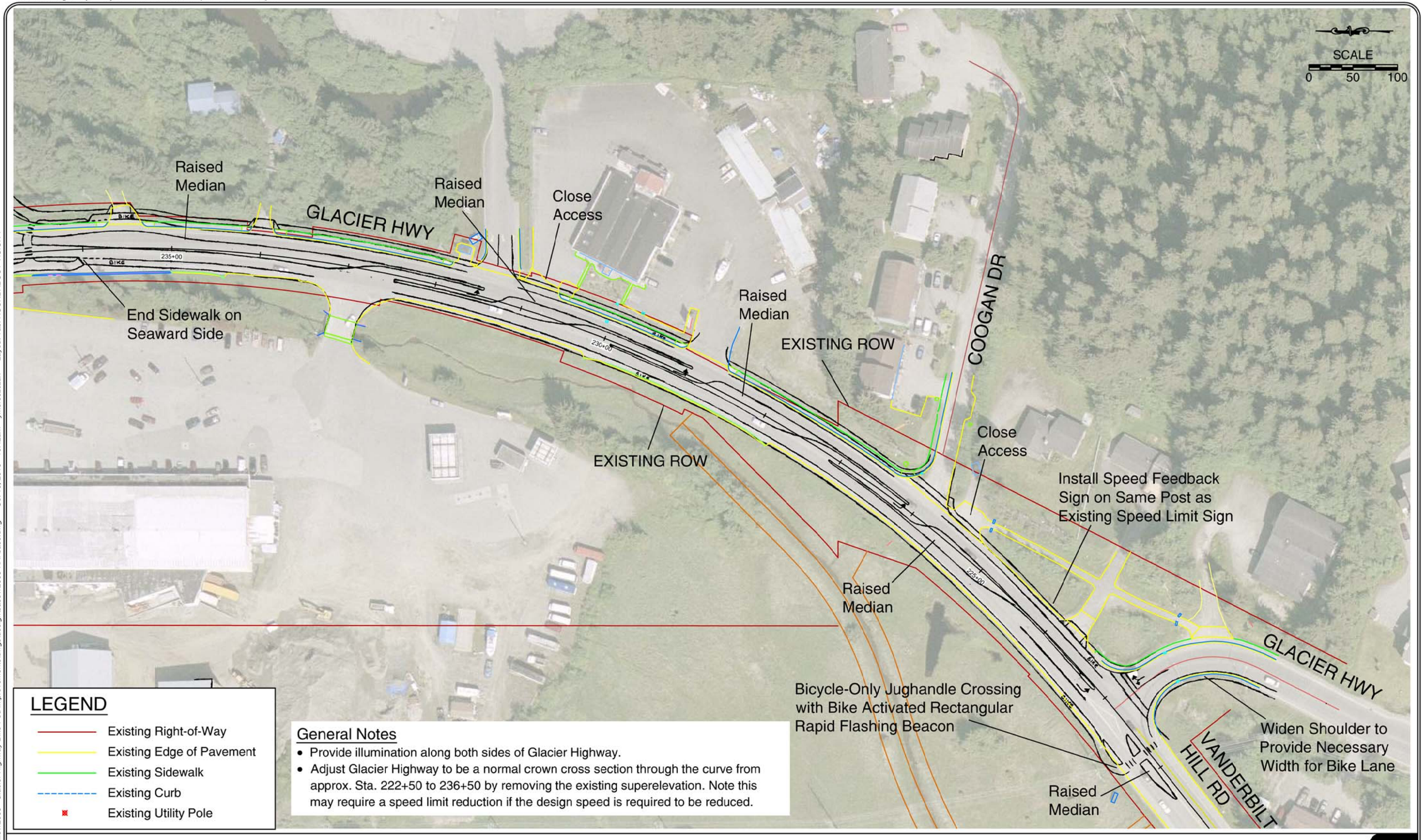
- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.
- Adjust Glacier Highway to be a normal crown cross section through the Anka Street curve by removing the existing superelevation (approx. Sta. 245+60 to 256+60). Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION
JUNEAU, ALASKA

FIGURE R-6



LEGEND

- Existing Right-of-Way
- Existing Edge of Pavement
- Existing Sidewalk
- Existing Curb
- Existing Utility Pole

General Notes

- Provide illumination along both sides of Glacier Highway.
- Adjust Glacier Highway to be a normal crown cross section through the curve from approx. Sta. 222+50 to 236+50 by removing the existing superelevation. Note this may require a speed limit reduction if the design speed is required to be reduced.

GLACIER HIGHWAY: ROUNDABOUT-FOCUSED CORRIDOR VISION
JUNEAU, ALASKA

FIGURE R-7

Longitudinal Treatments

- Raised medians and turn restrictions are generally more prevalent throughout the corridor than in the Enhanced Baseline Corridor Vision.
- Roundabouts are proposed at Renninger Street, Concrete Way, Anka Street, and Short Street and described further at each intersection.

Access Management

- Close Wal-Mart's secondary (truck loading) driveway on the west side of Glacier Highway just north of Renninger Street and relocate to provide access to the truck loading docks by way of a new, southern leg to the Renninger Street roundabout.
- Relocate the Alpine Apartments driveway access on the west side of Renninger Street north of Glacier Highway further to the north to accommodate the roundabout.
- All driveways on Glacier Highway between Renninger Street and Alaway Avenue will be right-in/right-out only.
- All driveways on Glacier Highway between Concrete Way and Anka Street will be right-in/right-out only.
- Tonsgard Court's intersection with Glacier Highway will be right-in/right-out only due to the raised median and proposed roundabouts at Concrete Way and Anka Street.
- Left-turn pockets (for left-in only movements) on Glacier Highway between Anka Street and Vanderbilt Hill Road at following driveways or intersections:
    - The former Bobcat of Juneau (south of Anka Street on east side – southern driveway)
    - Tyler Rentals (Between Anka Street and Short Street on west side – southern driveway)
    - Harri's (Between Anka Street and Short Street on west side – southern driveway)
    - The Church of Jesus Christ of Latter-Day Saints (south of Short Street on the east side)
    - The Dragon Inn Chinese Restaurant (south of Short street on east side – southern driveway)
    - Coogan Drive

  All other driveways between Anka Street and Vanderbilt Hill Drive would be right-in/right-out only due to the raised median and proposed roundabouts.

Bus Stop Relocation

- No additional bus stop changes are proposed in the Roundabout Corridor Vision.

Intersection Treatments

- Renninger Street
    - A single-lane roundabout is proposed that will include direct access to Wal-Mart's truck loading docks via the newly constructed southern leg.
    - Install high-visibility crosswalks on all four intersection legs.

  - Install median pedestrian refuges on all roundabout approaches except the southern (proposed Wal-Mart driveway) leg.
  - Remove left-turn pockets.
  - Bicyclists would have the option of traversing the roundabout using the vehicle travel lane or dismounting to use the crosswalks.
- Concrete Way
  - A single-lane roundabout is proposed that will incorporate the commercial driveway on the eastern leg of the intersection.
  - Install high-visibility crosswalks with median pedestrian refuges on all four intersection legs.
  - Install RRFBs on the Glacier Highway intersection approaches.
  - Remove left-turn pockets.
  - Bicyclists would have the option of traversing the roundabout using the vehicle travel lane or dismounting to use the crosswalks.
- Anka Street
  - A single-lane roundabout is proposed, replacing the existing traffic signal.
  - Install high-visibility crosswalks with median pedestrian refuges on all four intersection legs.
  - Vehicle approach lanes would be reduced to one lane and all turn pockets removed.
  - Bicyclists would have the option of traversing the roundabout using the vehicle travel lane or dismounting to use the crosswalks.
  - The northbound bicycle lane intersection approach would be eliminated.
- Short Street
  - A single-lane roundabout is proposed for this three-legged intersection.
  - Install high-visibility crosswalks with median pedestrian refuges on all three intersection legs.
  - Remove left-turn pockets.
  - Bicyclists would have the option of traversing the roundabout using the vehicle travel lane or dismounting to use the crosswalks.

Section 4
Detailed Vision Evaluation

DETAILED CORRIDOR VISION EVALUATION

Each of the corridor visions were evaluated for pedestrians and bicycles, multimodal level of service (MMLOS), safety, and cost in order to prioritize treatments based on effectiveness and cost efficiency in addition to addressing public comments and the project goals and objectives. The following sections delve into more detail about the benefits of the corridor visions.

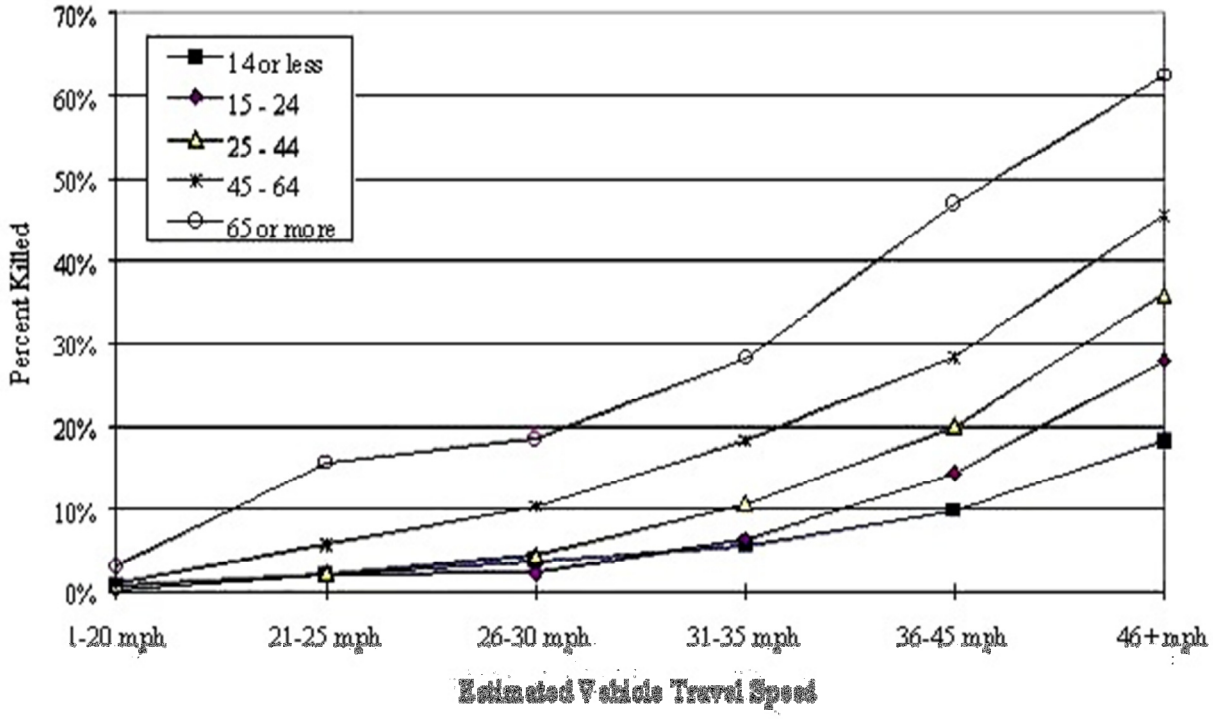
PEDESTRIAN AND BICYCLE TREATMENTS

All of the Corridor Visions include a continuous walkway on both sides of Glacier Highway separated from the traffic by a raised curb, gutter, and sidewalk. Doing so could help to prevent up to 88 percent of pedestrian fatalities due to "walking along the roadway" crashes[1]. Five-foot wide bike lanes are also proposed on both sides of Glacier Highway in all of the Corridor Visions. The addition of bike lanes on major roads has also been associated with an increase in bicyclist usage, although the amount varies from region to region depending on current bicycling use, other supportive infrastructure for bicyclists (parking, traffic calming, detection at intersections, etc.), geography, and climate.

All of the Corridor Visions include roadway design elements expected to reduce vehicle speeds. As shown in Exhibit 8, from a comprehensive study conducted in Florida of pedestrians involved in single-vehicle collisions, vehicle speed reductions generally result in exponentially lower percentages of pedestrian fatalities. Lowering vehicle speeds can also improve safety by increasing instances of collision avoidance. The Enhanced Baseline and Roundabout Corridor Visions both contain raised medians along much of the corridor, which may result in even lower vehicle speeds due to the motorists' perception of narrower travel lane widths and a subsequent reduction in pedestrian-fatalities.

[1] FHWA, *An Analysis of Factors Contributing to "Walking Along Roadway" Crashes: Research Study and Guidelines for Sidewalks and Walkways*. Report No. FHWA-RD-01-101, FHWA, Washington D.C., 2001.

Exhibit 8 Fatal Injury Rates by Vehicle Speed, by Pedestrian Ages



Source: Literature Review on Vehicle Travel Speeds and Pedestrian Injuries, US Department of Transportation, National Highway Traffic Safety Administration, October 1999.

The Roundabout Corridor Vision would generally increase motorist and pedestrian safety by slowing down motorists and reducing the number of conflict points. The splitter islands at the crossings allow pedestrians to cross one direction of traffic at a time. Cyclists have the option to enter traffic and behave as a vehicle through the roundabout or proceed as a pedestrian on the sidewalk.

Improved lighting and updated signing along the sidewalks and at crosswalks are also suggested in all of the Corridor Visions in order to improve pedestrian visibility during low-light conditions. This is particularly crucial in Alaska during the winter months when the hours of daylight are diminished. Pedestrian-scale lighting along the sidewalk provides a sense of security for pedestrians of all ages and encourages walking for more hours of the day. Lighting has advanced dramatically in recent years in terms of energy efficiency (specifically through the use of LED lamps), shielding, and aesthetics.

While planted buffers between the sidewalk and roadway are not included in this project, the bike lanes installed on both sides of the roadway would provide at least 5 feet of distance between moving vehicles and the pedestrian walkway. Doing so aids in pedestrian comfort and reduces instances of debris or splashing onto pedestrians by moving vehicles.

Wayfinding signing is proposed near Renninger Street for the Dzantik'i Heeni Middle School to provide distance and route guidance for bicyclists and pedestrians accessing the school. A school zone is proposed to be established in the area to provide more awareness of the presence of pedestrians and bicyclists. Generally, research has found that school zones in and of themselves have little effect on reducing vehicle speeds without accompanying changes in the roadway geometry. However, all

Corridor Visions include changes to the Renninger Street intersection, including the installation of median pedestrian refuges, high-visibility crosswalks, and rectangular rapid flashing beacons. In addition, duplicative driveway access points near the intersection will be closed to limit potential vehicle conflicts with pedestrians and bicyclists and speed feedback signs on the school zone sign posts are proposed.

Generally, the Corridor Visions propose closing driveway access points if they appear to be redundant. Additionally, major driveways and minor side streets are proposed to be more prominent through the use of crosswalk striping and some are proposed to be reduced in width. For pedestrians and bicyclists traveling along Glacier Highway, these changes reduce the number of conflict points with vehicles, reduce exposure while crossing driveways and side streets, and more clearly communicate the presence of driveways and side streets to all road users.

The northbound approach to the Anka Street intersection for through bicyclists currently guides them to leave the striped shoulder and position themselves in between the right turn pocket and through traffic. This weaving maneuver creates a potential conflict zone between right-turn motorists and through bicyclists. The Baseline and Enhanced Corridor Visions propose indication to motorists and bicyclists of this conflict zone through painting and striping. Options for enhancing this conflict zone could be gained through supportive signing. The City of Portland conducted a before-and-after study of painted and signed conflict zones. For bike lanes and right-turn pocket weaving areas, the study found cyclists increased their scanning behavior and motorist signaling increased significantly. However, motorist yielding rates did not change significantly[2]. It should be noted that painted bike lanes are not included in the current MUTCD. This weaving area is eliminated in the Roundabout Corridor Vision, as the right turn pocket is replaced by a single lane approach and bicyclists would proceed through the intersection at the pedestrian crossing by a cycle track.

High-visibility crosswalks at uncontrolled crossings and standard crosswalks at controlled crossings are proposed at numerous locations along the corridor. In particular, all crossings at the signalized intersection of Anka Street are proposed to be striped and installed with pedestrian signal heads, actuation, and updated curb ramps. This would reduce pedestrian delay at this intersection and improve access to the existing land uses as well as to the bus stops between Tonsgard Court and Anka Street. Other considerations such as installing Leading Pedestrian Intervals (LPIs), typically providing a head start for pedestrians, reduce conflicts between turning vehicles and pedestrians by enhancing the visibility of pedestrians in the crosswalk. According to Van Houten's study in St. Petersburg, Florida, there was generally little effect on vehicle operations from this treatment and reductions of observed conflicts between vehicles and pedestrians were significant (eliminating them completely for 34 out of

[2] William W. Hunter and Libby Thomas, University of North Carolina Highway Safety Research Center, 1998, *BikeSafe#22 – Blue Bike Lanes at Intersection Weaving Areas*, Portland, Oregon

the 41 observation sessions)[3]. Marked, standard crosswalks at stop-controlled crossings define the pedestrian path across the roadway and indicate to motorists where they should stop. High visibility crosswalks are proposed at several uncontrolled crossings along the corridor, mainly near bus stops and where there would be higher pedestrian demand. All of the uncontrolled crossings would be supplemented by pedestrian signing and median pedestrian refuges and several are enhanced by RRFBs.

Median refuges at uncontrolled crossings allow pedestrians to cross one direction of traffic at a time, reducing the complexity of crossing, and providing visual cues to motorists about the presence of pedestrians. They also provide space to install additional lighting, median signing, and beacons. Actuated rectangular rapid flashing beacons (RRFBs), proposed at many locations in the corridor visions, will further enhance pedestrian and bicyclist access at uncontrolled crossings; with RRFBs the installation type determines its effectiveness. A two-beacon system, mounted on the supplementary warning sign on the right side of the crossing, has been found to increase motorist yielding to 81-percent compared to an 18 percent motorist yield rate for pedestrians at uncontrolled crossings with no beacons. There was a further increase in motorist yield rates with a four-beacon system (with two beacons on both the right and left side of the crossing) to 88 percent. Most importantly, motorist yielding rates remained the same even a year after the RRFB installations, indicating a permanent behavioral change resulting from this treatment[4].

The jughandle crossing located across Vanderbilt Hill Road in the southbound direction to continue onto Glacier Highway would be exclusively for bicycle access, as there is no sidewalk proposed on the seaward side between Short Street and Vanderbilt Hill. Bicyclists are prohibited from riding on Vanderbilt Hill Road, so every southbound bicyclist would need to turn left onto Glacier Highway. Cyclists who are not comfortable entering traffic in order to make a left turn will have the option to use the crossing across the south leg of the intersection. The jughandle path would guide bicyclists to the crossing and easily position them to see oncoming traffic. The high-visibility crosswalk, median, and RRFB would enhance the ease and safety of this crossing and alert motorists to the presence of bicyclists.

MULTIMODAL LEVEL OF SERVICE EVALUATION

The project team used the 2010 Highway Capacity Manual (HCM) multimodal level of service analysis methodology for evaluating the bicycle and pedestrian modes of travel on Glacier Highway. The HCM provides a scientific basis for evaluating multimodal level of service (MMLOS) on urban streets for autos, bicyclists using the roadway, pedestrians, and transit riders. The MMLOS analysis method for

[3] Van Houten, R.; Retting, R.A.; Farmer, C.M.; and Van Houten, J. 2000. *Field evaluation of a leading pedestrian interval signal phase at three urban intersections*. Transportation Research Record 1734:86-92.

[4] Van Houten, R., R. Ellis, and E. Marmolejo. "The Use of Stutter Flash LED Beacons to Increase Yielding to Pedestrians at Crosswalks." Presented at the Transportation Research Board Annual Meeting, Washington, DC, 2008.

urban streets consists of a set of recommended procedures for predicting traveler perceptions of quality of service and performance measures for urban streets. The HCM method calculates a level of service (LOS) for each mode based on several inputs related to conditions along the corridor. The types of inputs considered by this analysis for bicyclists and pedestrians include peak hour traffic volumes, presence and width of sidewalks and bicycle lanes, crossing delay, and driveway and unsignalized intersection density.

The following is a list of parameters that influence the bicycle, pedestrian, and transit LOS scores.

Bicycle

- Vehicle volume in outside (right) lane
- Heavy vehicle percentage
- Vehicle speeds
- Travel lane and bicycle lane widths
- Pavement quality
- Unsignalized intersections/driveway density

Pedestrian

- Vehicle volume in outside (right) lane
- Vehicle speeds
- Presence and with of sidewalk and buffer
- Lateral separation between vehicles and pedestrians
- Crossing delay (signalized and uncontrolled)

Transit

- Number of transit stops
- Presence of stop amenities
- Frequency of buses
- On-time performance
- Number of passengers per bus
- Pedestrian link LOS

As most of the intersections along the study corridor have stop-controlled side streets, intersection delay for pedestrians and bicycles traveling along the corridor will be negligible. Therefore, this analysis focused on the link LOS for each mode. As the pedestrian features vary by roadway direction, the northbound and southbound MMLOS were determined separately. Also, since each segment of the road has different features the MMLOS of each segment was determined separately. The MMLOS for the following scenarios was evaluated: existing conditions, 2032 no-build, 2032 Baseline Corridor Vision, and 2032 Enhanced Baseline Corridor Vision. Roundabouts are not expressly considered in MMLOS methodology and link LOS under the Roundabout Corridor Vision is assumed to be substantially similar to the Enhanced Baseline Corridor Vision.

The proposed wider and more consistent bike lanes improve the bicycle link LOS for the proposed visions over the no-build scenario. The access management measures proposed in the Enhanced Baseline Corridor Vision reduce conflict points for bicyclists, which in turn improves the bicycle link LOS.

The proposed seaward sidewalk improves the southbound pedestrian link LOS for the all of the proposed corridor visions over the no-build.

The transit LOS does not substantially change under the proposed visions. Although all visions propose transit stop amenities, the impact of these improvements is small in the MMLOS procedure. The MMLOS worksheets are included in Appendix D.

SAFETY EVALUATION

The elements of each corridor vision were evaluated based on their safety impacts. First, the AASHTO *Highway Safety Manual* (HSM) crash prediction methodologies were applied to compare the traffic volume, intersection, and cross-section changes between the existing, no build, and corridor vision

alternatives. This analysis indicated the growth in volume between the existing and future analysis years is predicted to increase crash frequency on the corridor by 5.5 percent. The prediction model outputs indicate that the driveway consolidations proposed in the corridor visions would reduce crashes between 0.5 and 1.5 percent. However, these models do not account for all the proposed corridor and intersection treatments as not all treatments are measurable under HSM procedures. Therefore, the crash prediction models were supplemented with documented crash reduction factors in the DOT&PF HSIP Handbook (Reference 4) or are based on national research assembled in the FHWA CMF Clearinghouse (Reference 5).

The following sections detail the predicted crash reductions of various proposed treatments contained in the HSM. As with the limitations of the HSM crash prediction models, crash reduction factors are not available to all proposed treatments due to lack of research, so the safety benefit could not established quantitatively for all treatments. The safety performance of some treatments, such as in the case of access management features, are highly dependent on local factors, such as volumes, driveway configurations, and traffic control, that the specific crash reduction cannot be estimated.

Pedestrian Refuges

The HSIP Handbook estimates pedestrian refuges providing two-stage pedestrian and bicycle crossing reduces the associated crashes by 45 percent. Based on the crash data supplied by ADOT&PF and CBJ for the corridor from 2005 to 2009, there was an average of 0.8 pedestrian crossing crashes per year that occurred at locations proposed to be treated by pedestrian refuges. Therefore, the installation of the proposed pedestrian refuges is expected to reduce 0.4 crashes per year. The Baseline Corridor Vision proposes pedestrian refuges at seven locations while the enhanced and roundabout alternatives propose three additional locations.

Sidewalks

The HSIP handbook reports that installing a sidewalk reduces crashes involving pedestrians walking along the roadway shoulder by 75 percent. The crash data did not provide sufficient detail to determine the number of pedestrian crashes that would be treated by the installation of sidewalks.

Raised Median

Raised medians reduce crossover and access-related crashes by 15 percent per the HSIP Handbook There was an average of 0.8 such crashes per year reported along the study corridor, leading to estimated crash reduction of 0.1 crashes per year. The CMF Clearinghouse reports medians reduce fatal and injury crashes by 39 percent, or a reduction of 0.6 fatal/injury crashes per year. The Baseline Corridor Vision does not include raised median, except for short lengths at pedestrian crossing locations. The Enhanced Baseline Corridor Vision includes more continuous raised median between Wal-Mart and Davis Avenue while the Roundabout Corridor Vision proposes raised median on the vast majority of the study corridor.

Roundabouts

Research has established that converting two-way stop-controlled and signalized intersections to single-lane roundabouts reduce intersection crashes, particularly injury and fatality crashes. The HSIP Handbook reports that converting three-leg and four-leg intersections to roundabouts reduces crashes by 30 percent and 75 percent respectively, independent of intersection traffic control type. Research included in the CMF Clearinghouse distinguishes by intersection control, not number of legs, and reports that converting three- and four-leg, two-way stop controlled intersections to roundabouts reduces crashes by 39 percent. Converting signalized intersections to roundabouts is reported in the clearinghouse to reduce crashes by 26 percent.

The roundabout vision proposes single-lane roundabouts at Renninger Street, Concrete Way, Anka Street, and Short Street. The predicted crash reductions calculated using the DOT&PF HSIP estimates are shown in Table 2. No crashes were reported in the 2005-2009 crash data compiled from DOT&PF and CBJ data for the Concrete Way and Short Street intersections.

Table 2 Estimated Roundabout Crash Reduction per DOT&PF HSIP Handbook

Intersection	Crash Reduction Factor	Existing Affected Crashes/Year	Reduced Crashes/Year
Renninger Street	-30% intersection crashes	0.6	0.2
Concrete Way	-75% intersection crashes	0.0	0.0
Anka Street	-75% intersection crashes	3.85	2.9
Short Street	-30% intersection crashes	0.0	0.0

Speed Reduction

The CMF Clearinghouse reports the following crash reduction factors for reductions in roadway mean operating speed, shown in Table 3. The CMFs indicate greater speed reduction results in a larger reduction in crash frequency and injury crashes are more sensitive to operating speed.

Table 3 Mean Roadway Speed Crash Reduction

Mean Operating Speed Reduction	Injury Crash Reduction Factor	Injury Crash Reduction (crashes/year)	PDO Crash Reduction Factor	PDO Crash Reduction (crashes/year)
5%	7%	0.3	5%	0.5
10%	15%	0.9	10%	0.7
15%	22%	1.3	15%	1.1

This factor applies to the corridor visions to the degree that the proposed treatments would reduce the mean operating vehicle speed. Raised medians, such as those applied in the Enhanced Baseline and Roundabout Corridor Visions, have been shown to reduce the speeds on average by 9 percent. Removing the superelevation, as proposed in the Enhanced Baseline and Roundabout Corridor Visions, would reduce the design speed 10 to 15 percent within each of the curves on the corridor. Narrowing travel lanes, as proposed in all visions, has been shown to reduce operating speed by 7 to 20 percent.

The speed feedback signs proposed near Renninger Street and Vanderbilt Hill Road are expected to reduce operating speed by 6 mph, or 15 percent at those locations.

OPERATIONS SCREENING

Operational analysis was performed for the weekday a.m. and p.m. peak hours for all corridor visions. A vehicular level-of-service (LOS) D or higher is considered acceptable for DOT&PF. All intersections were operating at LOS D or better in the existing conditions and the year 2032 no-build scenarios.

The existing Glacier Highway configuration includes a two-way left-turn lane (TWLTL) for the length of the corridor. The proposed corridor visions reallocate this center lane with medians to varying degrees. The Baseline Corridor Vision includes pedestrian/bicycle refuges at six three-leg intersections (Renninger Street, Alaway Avenue, Belardi Drive, Davis Avenue, Short Street, and Vanderbilt Hill Road). These refuges would be positioned on the approach opposite the Glacier Highway left-turn lane. This configuration would not impact left-turns onto the side street, but would prevent two-stage gap acceptance for the side streets, reducing the capacity for left-turn movements onto Glacier Highway. The southbound left-turn movement at the Renninger Street/Glacier Highway intersection is forecast to operate at LOS E and F, during the weekday a.m. and p.m. peak hours, respectively, in the year 2032 without two-stage gap acceptance. The signalized intersection capacity worksheets are included in Appendix E

The roundabouts proposed in the Roundabout Corridor Vision are forecast to reduce side street delay at the Renninger Street and Concrete Way intersections compared to the Baseline and Enhanced Baseline Corridor Visions. Under the roundabout configuration, all movements at both intersections are forecast to operate at LOS C or better. The Anka Street intersection is forecast to operate at LOS B and C during the weekday a.m. and p.m. peak hours, respectively with a roundabout compared to the existing signalized configuration, which operates at LOS B during both peak hours.

No traffic counts were available to conduct a capacity analysis at the proposed Short Street roundabout, but field observations indicate lower side street volumes than many of the above mentioned intersections; thus, a single-lane roundabout is expected to adequately accommodate the traffic demand. The roundabout capacity worksheets are included in Appendix F.

COST ESTIMATION

Preliminary, concept-level cost estimates were developed for the three corridor visions as well as for the recommended, near-term treatments. The preliminary cost estimates for the recommended treatments are discussed in Section 5 – Recommendations. The total preliminary cost estimates for the three corridor visions are estimated as:

- Baseline Corridor Vision: $5.7M - $7.1M
    - Assumes pavement overlay along the length of the corridor.

- Enhanced Baseline Corridor Vision: $12.5M - $15.6M
    - Assumes rebuild of the pavement cross section along the length of the corridor, primarily to remove existing superelevation along horizontal curves.
- Roundabout Corridor Vision: $18.2M - $22.7M
    - Assumes rebuild of the pavement cross section along the length of the corridor, primarily for construction of the roundabout intersections and to remove existing superelevation along horizontal curves.

The cost estimates were developed based off of the corridor visions illustrated in Figures B-1 – B-7, E-1 – E-7, and R-1 – R-7. These cost estimates accounted for the following:

- Roadway Improvement Items (Unit Cost Based Items)
    - Excavation & Borrow
    - Removals
    - Pavement and subgrade
    - Curb & gutter and sidewalk
    - Medians
    - Driveways and pedestrian ramps
    - Street lighting
- Lump Sum Based Items
    - Traffic Signal
    - Active Pedestrian Treatments
    - Utility Relocations & Coordination
    - Transit Amenities
- Percentage-Based Items
    - Percent of Roadway Improvement Items
        - Storm Drainage System
        - Landscape Improvements
        - Signing & Striping
        - Private Utility Coordination
    - Percent of Roadway Improvement Items + Lump Sum Items
        - Mobilization
        - Surveying
        - Traffic Control
    - Contingency (generally assumed as 25% of Total Construction Cost)
    - Professional Fees (A/E/CM) (generally assumed as 15% of Total Construction Cost + Contingency)
- Right-of-Way Acquisition Costs

Approximate quantities were measured for the roadway improvement items based off the figures listed above. Existing infrastructure was maintained wherever plausible, particularly in relation to existing utility/street light poles and boxes, given the high costs associated with relocating these items. Unit costs for the roadway improvement items were developed through research of recent bids available on

the DOT&PF Bidtab Database (research conducted in August & October 2013). All unit cost estimates for each pay item are an average of five bids from similar types and sizes of projects. Appendix G provides the preliminary cost estimate worksheets for the three corridor visions, including a detailed breakout of roadway improvement, lump sum, percentage-based, and right-of-way acquisition costs.

Section 5
Recommendations

RECOMMENDATIONS

The priorities when developing the recommended concepts were based on the goals and objectives of the project, comments from the public, and cost efficiency within the $10.8M budget allocated for this project. As mentioned previously, the primary goal of this project is to improve pedestrian and bicycle facilities in and along Glacier Highway within the Lemon Creek area.

RECOMMENDED CORRIDOR CONCEPT

The Recommended Concept for the study corridor of Glacier Highway includes treatments from all three proposed corridor visions. The corridor will use the 59-foot to 63-foot wide typical cross section described in the Corridor Visions section including 5-foot wide sidewalks, 2-foot wide curb and gutter, 5.5-foot bike lanes (effective bike lane width of 7.5-feet), and 11-foot travel lanes on both sides of the roadway, along with a 12- to 16-foot raised median, left-turn lane, or two-way left-turn lane as appropriate. Illumination along both sides of Glacier Highway is also recommended for the length of the corridor. The use of pedestrian and neighborhood scale illumination in place of more traditional highway illumination should be considered where appropriate, particularly between Renninger Street and Anka Street.

The treatments proposed in the Roundabout Vision are recommended for the segment of Glacier Highway from Whitehead Drive to Renninger Street. This includes the removal of the existing pedestrian hybrid beacon (PBH) on the east leg and the installation of an offset, high visibility crosswalk, pedestrian median refuge and RRFBs on the west leg of the intersection. This crossing will keep consistency of crossing treatments throughout the corridor, lower the impact to through vehicles on Glacier Highway as pedestrians can cross in two stages, and removes interference with the westbound left-turns into Wal-Mart. Analysis shows that the Glacier Highway/Renninger Street intersection operates the most efficiently as a single-lane roundabout, addressing both safety and projected future capacity issues. In addition, a roundabout at Renninger Street would provide traffic calming and establish a gateway feature for the area. A roundabout will require extensive right-of-way acquisition.

The treatments illustrated in the Baseline Corridor Vision are recommended for the segment of Glacier Highway from Renninger Street to Davis Avenue. This includes the seaward sidewalk requested by the public as well as relatively low-cost improvements to improve pedestrian crossings and the transit stops.

The Enhanced Baseline Vision concepts are recommended for the segment of Glacier Highway from Davis Avenue to Vanderbilt Hill Road, the end of the study corridor. The Enhanced Baseline Corridor Vision implements access management by consolidating accesses as well as installing a raised median for a significant portion of the roadway, limiting driveways to left-in/right-in/right-out control. The raised median has traffic calming effects helping establish a more pedestrian- and bicycle-friendly environment. Pedestrian refuge islands at Concrete Way and Short Street will provide safer crossings in

areas with high pedestrian traffic. Recommended improvements at the Anka Street intersection will also create a better environment for pedestrians and bicyclists, as well as make right-turn truck turning maneuvers easier. The removal of the superelevation on the corridor's curves is not included in these cost-restricted recommendations due to the high cost of reconstructing the roadway, but a pavement overlay of the entire corridor is assumed as recommended in the project description in the STIP.

BENEFIT/COST

Preliminary cost estimates for the recommended, near-term treatments were developed based off of appropriate treatments shown in the corridor visions illustrated in Figures B-1 – B-7, E-1 – E-7, and R-1 – R-7. These cost estimates accounted for the same pay items described in Section 4 – Detailed Corridor Vision Evaluation, as appropriate for the given treatment. Table 4 provides a summary of the estimated preliminary costs for each recommended treatment, as well as an overall estimated project cost taking into account percentage-based items, professional fees, and right-of-way acquisition costs. Appendix G provides the preliminary cost estimate worksheets for the recommended treatments, including a detailed breakout of roadway improvement, lump sum, percentage-based, and right-of-way acquisition costs.

Glacier Highway
Recommended Near-Term Treatments
Preliminary Cost Estimate

Breakdown of Improvement Costs

Improvement	% of Subtotal	Cost
Estimated Construction Costs		
Seaward Sidewalk + Bike Lanes		$ 1,433,000
Pavement Overlay		$ 1,091,000
Corridor-Wide Illumination (Both Sides)		$ 1,148,000
Renninger Roundabout		$ 1,563,000
Davis to Anka Access Management		$ 46,000
Anka to Vanderbilt Hill Access Management		$ 160,000
Alaway Pedestrian Crossing		$ 44,000
Central Pedestrian Crossing		$ 44,000
Belardi Pedestrian Crossing		$ 44,000
Davis Pedestrian Crossing		$ 145,000
Concrete Way Pedestrian Crossings		$ 218,000
Short St Pedestrian Crossing		$ 44,000
Vanderbilt Hill Jughandle Crossing		$ 52,000
Anka St Signal/Intersection Improvements		$ 207,000
Whitehead St Bus Pullout Improvements		$ 23,000
Alaway Bus Pullouts		$ 67,000
Belardi Bus Pullouts		$ 67,000
Short St Bus Pullouts		$ 67,000
Subtotal A (Estimated Construction Costs)		**$ 6,463,000**
Private Utility Coordination	5%	$ 323,150
Surveying	3%	$ 193,890
Mobilization	10%	$ 646,300
Subtotal B (Percentage-Based Costs)		**$ 1,164,000**
Subtotal 1 (A + B)		**$ 7,627,000**
Estimated Professional Fees (A/E/CM)	**15%**	**$ 1,145,000**
Estimated Right-of-Way Acquisition Costs		
Pending DOT&PF Feedback		
Estimated Total Cost		**$ 8,772,000**

Section 6
References

REFERENCES

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2. National Complete Streets Coalition. http://www.smartgrowthamerica.org/complete-streets. Website accessed: January 10, 2013.

3. Bochner, B.S., et.al. Designing Walkable Urban Thoroughfares: A Context Sensitive Approach. Institute of Transportation Engineers. Washington, D.C. 2010.

4. Alaska Department of Transportation & Public Facilities (ADOT&PF). Highway Safety Improvement Program (HSIP) Handbook. http://dot.alaska.gov/stwddes/dcstraffic/assets/pdf/hsip/20130321_hsip_hdbk.pdf. Website accessed: August 6, 2013.

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Appendix A Public Comments

Glacier Highway Bicycle & Pedestrian Improvement Project

Stakeholder & Public Comment Summary

Prepared for Alaska DOT&PF
by Kittelson & Associates Inc. and
Sheinberg Associates

March 22, 2013

Glacier Highway Bicycle and Pedestrian Improvement Project Meeting and Comment Summary

Table of Contents

List of Acronyms

ADOT&PF	Alaska Department of Transportation and Public Facilities
AEL&P	Alaska Electric Light and Power
AHDC	Alaska Housing Development Corporation, Inc.
CBJ	City and Borough of Juneau
CCTHITA	Central Council of the Tlingit and Haida Indian Tribes of Alaska
CDD	Community Development Department
DHMS	Dzantik'i Heeni Middle School
HAWK	High-Intensity Activated Crosswalk
JFREE	Juneau Freewheelers
JPD	Juneau Police Department
KAI	Kittelson & Associates, Inc.
TBMP	Tourism Best Management Practices
THRHA	Tlingit-Haida Regional Housing Authority

Executive Summary

The Alaska Department of Transportation and Public Facilities (ADOT&PF) and its contractor, Kittelson & Associates, Inc (KAI), are working to identify a preferred concept design for bicycle and pedestrian improvements along Glacier Highway, between Sunny Drive by Walmart and Glacier Highway's turn toward Twin Lakes just south of Western Auto.

On February 5, 2013, ADOT&PF and KAI hosted a stakeholder meeting from 8:30 am-10:15 am, and a public meeting that evening from 5:30-7:00 pm. Public comments were accepted through February 20. The goal of all these efforts was to better understand the travel challenges and concerns from those that regularly drive, walk, or bike along this corridor.

Just under 40 stakeholders or members of the public attended one or more of these meetings (Appendix 1) and 19 comments were received during the public comment period (Appendix 3).

Glacier Highway Bicycle and Pedestrian Improvement Project Area

All attendees and commenters agreed: 1) with the project purpose and need; 2) that this road corridor is challenging for pedestrians and bicyclists; and 3) that the project is of high importance.

The 12 most frequently mentioned and significant comments are:

1. ANKA INTERSECTION/AREA. Bicyclists feel at risk and vulnerable on out-bound side of Glacier Highway before and at Anka due to level of congestion for size/geometry of area, tight space, many turning movements in all directions, big trucks (gravel, Costco, Home Depot, other), known number of accidents here, fact that trucks don't see bicyclists or pedestrians well in dark, and the bicycle through-lane here on outbound side is only one in town like this and thus confusing to all.

2. RENNINGER INTERSECTION. Make Renninger Street (instead of, or in addition, to Alaway) a Dzantik'i Heeni Middle School (DHMS) pedestrian crossing. Include this intersection within the School Zone. It is where many youth cross both to and from school, transit stops, and Walmart, and is quite congested with higher speed traffic on Glacier Highway, and with 'frustrated' vehicles and school bus traffic trying to turn left around DHMS start and end times. Add DHMS school signs on Glacier Highway is this area. Add a pedestrian activated crossing here.

3. SWEEPING/MAINTENANCE. More comments than any other topic about need for more regular sweeping and maintenance of shoulder for bicyclist safety and to reduce inhaling dust. Suggestion that state-city-private sector team up through MOAs to work together, would be good PR for all.

4. BICYCLE LANES-GENERAL. This is the only bike route between town/Douglas and the rest of the community, and thus critical for bicycle commuters. Bike lanes of consistent width should extend the entire length of the corridor on both sides of the street. It is not universally recognized that the road shoulder is for bicycling. Consistent road marking/stripes and signage are needed to indicate the Bike Route for both drivers and cyclists.

5. MEDIANS. Island medians with clear walking areas (reflectors, greenery & other delineation) in middle of road are universally supported to assist with pedestrian crossing. Need them at major crossings and at paired transit stops.

6. DAVIS INTERSECTION/LEMON CREEK BRIDGE. Davis Avenue is a difficult intersection for drivers turning onto Glacier Highway due to the low elevation of

Davis Avenue and the proximity to the Lemon Creek Bridge whose guard rail blocks sight distance. The limited sight distance blocks view of pedestrians. There are also people who cross this uncontrolled intersection to access the transit stop. The Lemon Bridge is a choke point, the bridge is narrow making bicyclists and pedestrians feel particularly at risk.

7. CONCRETE WAY INTERSECTION. The Concrete Way intersection has high levels of vehicles and pedestrians going to and from Breeze In and the industrial areas. Pedestrians often cross the road here; it is particularly congested between 11 am and 1 pm at lunch time.

8. INBOUND BIKE CROSSING BY VANDERBILT HILL/WESTERN AUTO. Inbound bicyclists don't have a marked, consistent or safe way to cross Glacier Highway after Western Auto to access the bicycle shoulder/path to town/Twin Lakes. It feels random for both bicyclists and drivers.

9. LIMIT LARGE TRUCK TRAFFIC WEST OF CONCRETE WAY. Large trucks from gravel pits, batch plant, AEL&P, and solid waste/landfill already avoid the section of Glacier Highway from Concrete Way west. Even if heading to and from the Valley practice is to use Vanderbilt Hill/Egan Drive intersection almost all the time. Thus, twin concept of traffic calming and focus on pedestrian/bicyclist use and safety from Concrete Way west, and, efforts to reduce ingress/egress points and crossings and thus maintain travel speeds from Concrete Way east, seems acceptable to most.

10. LIGHTING. Better lighting is needed along entire corridor, it is dark much of the year and pedestrians walking along, and crossing, Glacier Highway are hard to see and don't feel safe.

11. SIDEWALKS-SOUTH SIDE. Install a sidewalk on south side of Glacier Highway along entire corridor.

12. REDUCE SPEED LIMIT. There were several comments requesting that the speed limit be reduced along this corridor.

Comment Summary

This report now summarizes all comments received, by topic. Intersections are reviewed from west to east. (Appendix 2 are full stakeholder and public meeting notes.)

INTERSECTIONS (FROM NORTH TO SOUTH) (97 comments total)

Comments about problems with pedestrian and bicycle crossings that are close to an intersection are included in the comments about that intersection.

A corridor-wide concern repeated by several commenters is that left turns for vehicles are difficult throughout the entire corridor.

Sunny Drive and Glacier Highway Intersection *(2 comments total)*

1. Westbound drivers turning left at Sunny Drive onto Glacier Highway don't see bicyclists.
2. The signalized intersection at the north end of Walmart is away from pedestrian areas and not optimally located. Vehicles exiting Egan Drive onto Sunny Drive then turning left (west) onto Glacier Highway do so without looking for pedestrians.

Renninger Street and Glacier Highway Intersection *(14 comments total)*

1. The intersection of Renninger Street and Glacier Highway is a problem area because there is no crossing, no lighting, heavy vehicle and pedestrian traffic, and poor visibility for drivers to see oncoming traffic, pedestrians and bicyclists. Traffic entering/exiting Renninger Street and the adjacent housing often don't see bicyclists.
2. The HAWK light at the entrance to Walmart on Glacier Highway has improved the problem of children crossing Glacier Highway, but not fixed it. There are still youth crossing Glacier Highway in an uncontrolled manner. Children cross here both to go to and from school and to go to Walmart.
3. Drivers have difficulty turning left from Renninger Street onto Glacier Highway, especially when school starts and ends with its attendant increase in vehicle and bus traffic. The long waiting times lead to frustration and the willingness for drivers to merge into increasingly smaller gaps in traffic. Pedestrians cross through the same small gaps in traffic that drivers merge into. The school buses are large and slow and add to the traffic congestion.
4. If no major intersection changes are made, pedestrian crossings of Glacier Highway at Renninger Street should be restricted. Pedestrians should be forced to cross northward at the HAWK light at Walmart, or southward at Always Street.

5. One commenter asks to consider a roundabout at this intersection; another is unsure that a roundabout would solve the problems at this intersection.
6. Replicate the system at Floyd Dryden here: provide a push button operated red light with school crossing guard at crosswalk before and after school. The HAWK light would stop traffic on Glacier Highway when pedestrians were crossing and allow vehicles to turn off of Renninger Street onto Glacier Highway.
7. Realign the intersection to a 4-way and also reduce ingress/egress points by making Renninger Street and the southernmost entrance to Walmart one signalized intersection. These are both major traffic points and are only a few dozen feet apart. This would concentrate pedestrian crossings and make them safer. Move the bus stop on the landward side of Glacier Highway closer to this intersection.

Dzantik'I Heeni Middle School (DHMS) School Zone *(5 comments total)*

1. In order to provide immediate safety improvements in the project area, CCTHITA is offering use of two speed feedback signs for the School Zone.
2. Lots of children cross Glacier Highway outside of the School Zone; extend the School Zone.
3. The School Zone lights on Glacier Highway need to be activated from 7:00 am to 7:30 am. Elementary school students catch their school buses at this time and have to walk along Glacier Highway and cross Alaway Avenue, half the year in the dark.
4. School Zone signage locations need to be reconsidered. The current locations do not match crossing needs and confuse drivers about where it is okay to speed up.

Alaway Avenue and Glacier Highway Intersection *(4 comments total)*

1. The crosswalk at this intersection is ineffective. The red flags are an improvement to this intersection but very inadequate when it is dark or twilight. Personal experience of waiting 20 minutes with a stroller to cross this intersection at 2 pm. A crosswalk with lights should be added to this intersection.
2. On the north side of the road, across from the Alaway intersection, improve definition between people waiting to cross at the crosswalk and people waiting for the bus. Currently, when people are collected in the area it is difficult to determine their intent.

Central Avenue and Glacier Highway Intersection *(2 comments total)*

1. This is a problem area because there is no traffic signal or marked crossing, poor lighting, heavy and fast moving traffic, high pedestrian traffic, and poor visibility of oncoming vehicle and pedestrian traffic.
2. This intersection is dark and it is difficult to see crossing children.

Davis Avenue and Glacier Highway Intersection *(12 comments total, note that comments on Davis Avenue are often associated or in conjunction with the Lemon Creek bridge.)*

1. This is a very busy intersection, seems to be the busiest uncontrolled intersection in this area. This is a problem area because there is no traffic signal, marked crossing, poor lighting, heavy and fast moving traffic, high pedestrian traffic, and poor visibility of oncoming vehicle and pedestrian traffic.
2. Vehicles turning off of Davis Avenue onto Glacier Highway have views blocked and a limited sight distance due to the guard rail on Lemon Creek Bridge and elevation/grade differences between Davis Street and Glacier Highway. Raising the grade on Davis Avenue could eliminate some of the sight distance problems.
3. This intersection needs better lighting; the crossing could use bright flashing lights that get drivers attention quickly. There should be a lighted crossing at this intersection; it is a major intersection with a transit stop.
4. When the bus goes on snow route (due to conditions in Douglas) pedestrians have to cross Glacier Highway at this intersection. People must walk down Davis Avenue and cross an icy snowy street with no crosswalk and traffic coming both ways, often with limited visibility and often to walk on sidewalks that haven't been cleared. An improvement is needed to slow traffic and create gaps so pedestrians can cross.
5. Limit turning options here by either a combination of medians and safe turn lanes, or limited turning hours.
6. The combination of the Lemon Creek Bridge and the Davis Avenue intersection with Glacier Highway makes drivers do crazy things to ensure they "make it."

Lemon Creek Bridge *(8 comments total)*

1. The Lemon Creek Bridge is a choke point and dangerous for bicyclists.
2. The best option would be to widen the bridge, especially on the seaward side to accommodate a wider bike lane.
3. If the bridge can't be widened, there should some form of barrier to separate pedestrians from vehicles is needed.
4. Construct a separate bridge for bicycle use across Lemon Creek, possibly a clip on bridge.

Concrete Way and Glacier Highway Intersection *(10 comments total)*

1. The left turn from Concrete Way onto Glacier Highway is difficult with low reaction time due to the high speeds of vehicles on Glacier Highway.
2. Concrete Way intersection has a high level of traffic and is on a blind corner; there are many near accidents here. This is a problem area because there is no traffic signal, marked crossing, poor lighting, heavy and fast moving traffic, high pedestrian traffic, and poor visibility of oncoming vehicle and pedestrian traffic.

3. There are lots of children who want to cross Glacier Highway at or near its intersection with Concrete Way, but there is no pedestrian crossing. There is lots of truck traffic entering/exiting Concrete Way and the speed limit is 40 mph in this area.
4. There is a lot of congestion at this intersection, especially at lunch time. With Subway Restaurant across the street now it is a 4-way intersection. Pedestrians cross this intersection without a cross walk.
5. Limit turn options by either a combination of medians and safe turn lanes, or limited turning hours. Vehicles could be restricted from turning left from Concrete Way onto Glacier Highway from 11 am to 1 pm and 4 pm to 6 pm. The same sign would be used as at the McDonalds intersection with Glacier Highway.
6. This intersection needs better lighting. Crossing could use bright flashing lights that get drivers attention quickly.

Tonsgard Court and Glacier Highway Intersection *(3 comments total)*

1. The intersection is difficult and shares many of the same challenges as the intersection of Concrete Way and Glacier Highway. It is difficult for vehicles to make a left turn from Tonsgard Court onto Glacier Highway
2. Tonsgard Court is the only location for trucks to fuel and access to this area is needed.

Anka Street and Glacier Highway Intersection *(20 comments total)*

1. The right turn out of Anka Street onto Glacier Highway is very tight for trucks. Trucks turn left at this intersection unless they are going to Concrete Way.
2. Several comment that Anka is the most dangerous intersection in this area. There is lots of congestion and it is hard to tell what users are going to do. Bicyclists comment that this area is the scariest part of their ride. The signal alleviates some of the problems.
3. Both truck drivers and bicyclists comment that truck drivers turning right off of Anka Street onto Glacier Highway often can't see northbound bikers on Glacier Highway during times of heavy traffic. The northbound bike lane on Glacier Highway at its intersection with Anka Street feels exposed with the high truck use in the area. The northbound bike lane on Glacier Highway here is scary; it is the only one like it in Juneau and doesn't follow the local road language - motorists don't understand it.
4. The Anka Street and Glacier Highway traffic signals should have bike sensitive activation. Bikers currently have to wait for a vehicle to trigger the signal before they can cross.

5. The Anka Street intersection is too congested for the space available. The proximity of the surrounding businesses and the bus stop contribute to a significant number of pedestrians in a small space too close to the intersection. It is difficult for drivers to tell if pedestrians are standing, waiting or intending to cross.
6. Either make Anka Street a big roundabout or add a straight through street next to and behind AEL&P so gravel trucks can go straight through the light onto a new road that goes back to Concrete Way via the dump so gravel trucks, etc. do not have to make a right on to old Glacier Hwy and then an immediate
7. Realign the intersection to make it a 4-way with Anka Street extending straight through the intersection with Glacier Highway to allow truck traffic to travel straight through Glacier rather than turning right onto Glacier Highway then immediately turning left onto Concrete Way.
8. This intersection needs better lighting. Crossing could use bright flashing lights that get drivers attention quickly.
9. If no other improvements are made, limit turn options by either a combination of medians and safe turn lanes, or limited turning hours.

Short Street and Glacier Highway Intersection *(Western Auto area, 8 comments total)*

1. Pedestrians and transit users have a difficult crossing near the intersection of Short Street and Glacier Highway due to the lack of a designated pedestrian crossing area. There are many transit users who cross here to access the bus stop at Western Auto.
2. A crosswalk is needed at the intersection of Western Auto and Glacier Highway. One solution would be pedestrian activated crosswalk lights (like at Walmart). The southern limit of the Glacier Highway sidewalk could end at this crossing so that pedestrians would cross to the east side sidewalk to continue south. There is no need for a sidewalk any further since it is all wetlands on that side of the road. The west bus stop should be moved to the north side of the southern entrance to Western Auto.
3. Provide a paved refuge island near the intersection of Short Street and Glacier Highway This would provide pedestrian access to those coming from the Church of Latter Day Saints, the Chinese Palace, and Coogan Drive to the bus stop on the seaward side of the road. Consider rolled curb or other features that would minimize impacts to hard-to-maneuver industrial traffic.
4. CCTHITA and THRHA are developing a 22-unit housing complex on east side of Glacier Highway here with ingress/egress to Glacier Highway via Coogan Drive. This will add to local traffic in the area and preferred bus shelter placement.
5. Limit turn options by either a combination of medians and safe turn lanes, or limited turning hours.
6. The turn lane here has pot holes and is difficult to access for southbound bicyclists.

Vanderbilt Hill Road and Glacier Highway Intersection *(9 comments total)*

1. The intersection of Vanderbilt Hill Road and Glacier Highway is very difficult to cross for bikers. Experienced bikers can ride with traffic into the left hand turn lane, but riders with less experience often start trying to cross near Western Auto then bike on the wrong side of the road to the Vanderbilt Hill Road intersection.

   "As a bicyclist, turning left using the turn lane can be scary at this intersection due to high speed traffic on both sides of the road. Vehicles turning left onto Vanderbilt Hill Road off of Glacier Highway often don't see bicyclists."
2. After passing the Vanderbilt Hill Road intersection, bikers must once again cross Glacier Highway.
3. The bike path near this intersection is intersected with driveways and poorly defined. It is difficult to maintain and often turns into an ice rink during the winter.
4. One solution is to install a mandatory bike exit that would on the seaward side of Glacier Highway at its intersection with Vanderbilt Hill Road, which would either overpass or underpass Glacier Highway.
5. A traffic light at this intersection would slow traffic and make a safer crossing for bicyclists.

BICYCLING/BIKE LANES (36 *comments total)*

(from three stakeholders: JFREE, CBJ-CDD, DMHS; from two commenters at Public Meeting; and from written comments by N. Coffee, F. Rue, F. Moser, G. Landry, M. Hekkers, K. Maier, J. McConnochie, L. Jones, I. Gallion, K. Wiebold, L. Davis)

Bike Lanes/Route/Width

1. This is a critical bike route for commuters.
2. Bike lanes of consistent width should extend the entire length of the corridor on both sides of the street. Most commenters want wider shoulder/bike lanes through the corridor, and note that bike lanes are minimal is some areas. However, one very experienced cyclist prefers to ride in road and another is satisfied with current width. Wider bike lane needed on Lemon Creek Bridge. Bike lanes protect pedestrians from tire spray.
3. The most effective solution would be to have separated bike paths, such as on Mendenhall Loop Road, but there probably isn't sufficient right of way for this.

Vehicles and Bike or Pedestrian Conflicts

4. Vehicles traveling southbound on Glacier Highway cut into the bike lane on the sharp curve south of Anka Street. Large trucks often extend into bike lanes. Vehicles wander into bike lanes at corners and straightaways in segments D and E.

5. Vehicles turning right at intersections, such as Davis, Renninger, Central, and Anka Streets often don't see bicyclists.
6. Crossing business driveways (WalMart, Breeze In, Arrow Refuse, Western Auto) is risky for bikers as drivers try to get across before the oncoming traffic picks up and sometimes cut-off bikers.
7. Bikers and pedestrians comment that it is dangerous to share this area with large high speed truck traffic.
8. Pedestrians walk in the bike lane on the seaward side of Glacier Highway, such as near Breeze Inn; this forces bicyclists into the road.

Signage

9. It isn't universally recognized that the road shoulder is for bicycling. Consistent road marking/stripes and signage are needed to indicate the Bike Route for both drivers and cyclists. Yield to Bikes signs are needed on the Lemon Creek Bridge. Signage/maps should note this is the Valley-Town bike route.

Maintenance and Paving (also see Road Conditions and Maintenance section below)

10. The bike lane is in poor condition and poorly maintained; it is often laden with dirt, gravel, rock, dust and debris.
11. Improve the pavement for bicyclists. The paving at the seam between the road and bike lane is failing. There should be no pavement seams in the bike lanes. The entire roadway should be paved rather than just the vehicle lanes. This is especially bad at the Renninger Street area.

Other

12. If there are raised medians at the intersections, such as at the Douglas roundabout, make sure they are as straight as possible to improve efficiency for bicyclists.
13. Culvert and catch basin cover grates should be perpendicular to the sidewalk. Manhole covers should be closer to the curb and not in the middle of bike lanes.

ROAD CONDITIONS AND MAINTENANCE *(26 comments total)*

(from four stakeholders: JFREE, AHDC/Gruening Pk, CBJ-CDD, and DOT/Lindh, from four commenters during the public meeting; and from the written comments of A. King, N. Coffee, B. Dinneford, E. Olsen, F. Rue, F. Moser, I. Gallion, J. Dailey, J. McConnochie, L. Jones, L. Davis, and M. Hekkers)

1. The commercial truck traffic here leaves lots of dirt, gravel, dust and debris in the bicycle lanes that bikers must dodge, making riding in the bike lane challenging. The dust makes it difficult to see and breathe. Bicyclists are forced onto the road when

the bike lanes aren't maintained. The dirty riding shoulder contributes to flat tires for bicyclists. Industrial truck traffic spills water onto Glacier Highway and in the winter it freezes on the shoulder and road. A regular maintenance schedule is needed for the road shoulders/bike lanes/sidewalks. In the summer, Glacier Highway is littered with large rocks from the trucks and very dangerous for people in strollers and bicycles, which many area residents use as major transportation route. A sweeper should go through this corridor on a set schedule, once a week from March through October. Extending the pavement aprons onto driveways could help with this problem.

2. Pedestrians often walk in the street during the winter time because of ice and snow on the sidewalks and slippery conditions. Snow removal on pedestrian facilities has gotten better, but still needs improved.
3. More State general fund money for maintenance is needed to clean streets effectively.
4. Could the CBJ, State, and commercial/industrial truckers from the different companies in the area team up and take turns maintaining the road (for example, use the model of Trail-Mix, or Tourism Best Management Practices (TBMP), for a road sweeping program/funding).
5. I understand that ADOT&PF has concerns about pedestrian islands, as working around these islands makes snow removal less efficient. Additional sidewalks funded with federal money will create added winter maintenance obligation during times of reduced funding. Given the density of housing and the average income, I hope ADOT&PF chooses to accommodate these increases.

INDUSTRIAL TRUCK TRAFFIC AND ROUTES *(13 comments total)*

(from six stakeholders: AggPro, Channel Construction, CBJ-CDD, CCTHITA, AEL&P, JFREE; one comment during the public meeting; and written comments from I. Gallion, J. Dailey, L. Jones)

1. The difficulty of making left turns from Concrete and Tonsgard Streets onto Glacier Highway, the level of congestion, amount of turning 'local traffic' movements, and the number of pedestrians, bicyclists, and pedestrian crossings all result in current industrial truck traffic preferring to head south on Glacier Highway to access Egan Expressway at Vanderbilt Hill intersection - even if the destination is the Valley. The majority of truck traffic currently only travels south of the Lemon Creek Bridge.
2. Efforts to improve pedestrian and bicycle use and safety west of the Lemon Creek Bridge that might result in slower speeds in that area are not a significant concern of truckers since their the preferred travel routing avoids this area.

3. There is merit to making a truck route from Concrete Way to Vanderbilt Hill Road, so that all industrial truck traffic is directed to enter Egan Drive from Vanderbilt Hill Road. Efforts that improve conditions and reduce congestion for truck traffic south of the Lemon Creek Bridge are desired by businesses and utilities using large trucks. Retain 16' lanes from Tonsgard Court to Vanderbilt Hill Rd to encourage industrial truck traffic use for Egan Drive access.
4. While beyond the scope of the current project, consider working with private property owners to acquire ROW or easements and formalize the "back-door" route that trucks sometimes use to avoid Glacier Highway. At a minimum this project's design should not preclude future use of the "back door" route from Concrete Way and Tonsgard Street along dirt roads to Short Street. Consider filling some of the holes back here to improve this road connection and allow more truck use. Improving these routes would improve traffic in this area.
5. It is important for industrial truck traffic to have two access points. (SM - AEL&P)
6. A road could be constructed to allow trucks to go straight across Glacier Highway from Anka Street to access Concrete Way.

ROAD SEGMENT COMMENTS (*14 comments total)*

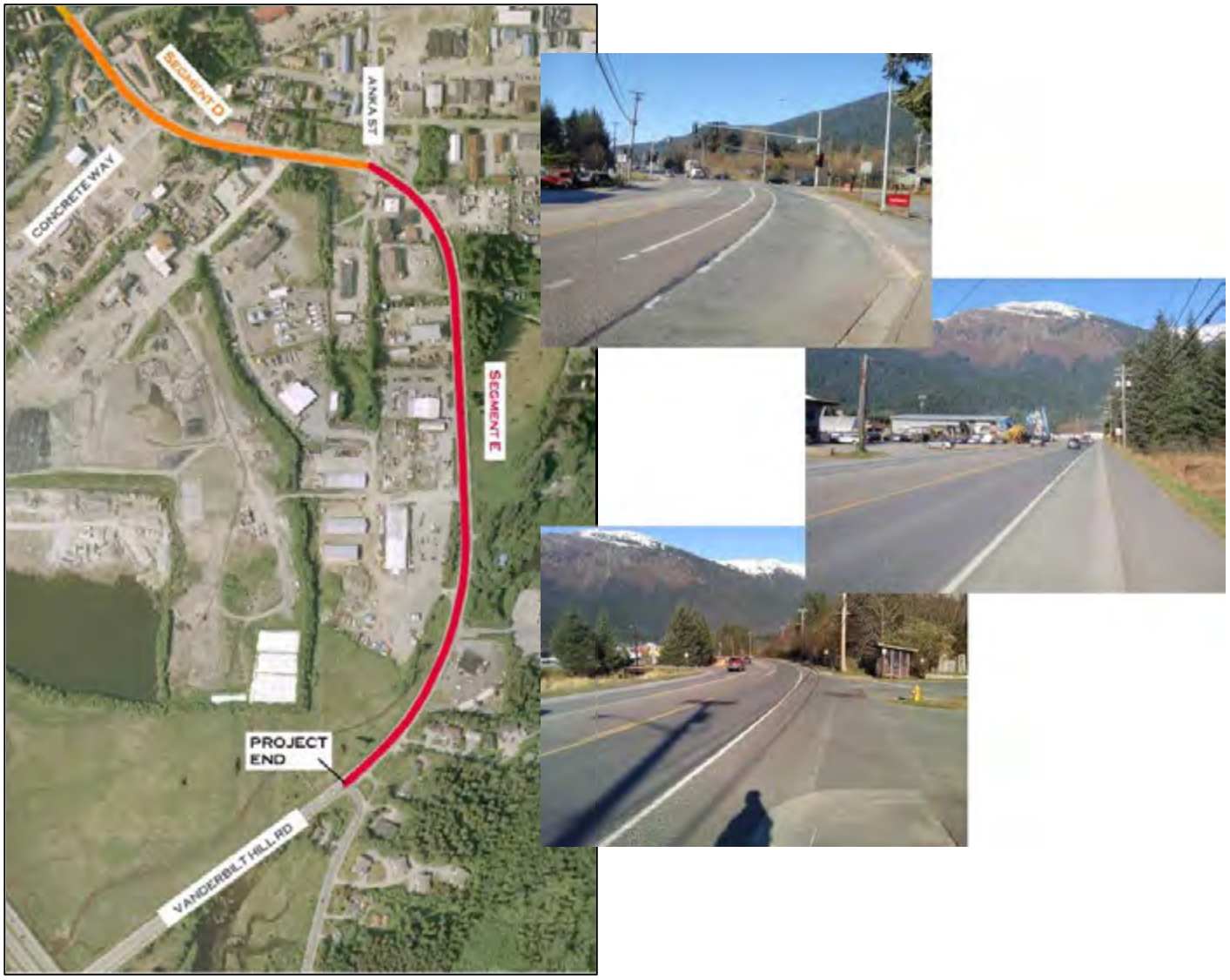
(from two stakeholders: CBJ-CDD and CCTHITA; from three public meeting commenters, and from written comments of I. Gallion and L. Jones)

Some parts of each discussion broke the project area into segments: segments A-C (Sunny Drive to Davis Avenue) and segments D-E (Concrete Way to Vanderbilt Hill/Western Auto area).

Segments A through C

1. Mid-to high-density residential development that serves lower income residents characterizes segments A-C. These residents are more likely to walk and use public transit than higher income residents. Pedestrian use is very heavy along segment A through C, and includes multiple random crossing locations; CCTHITA has serious pedestrian safety concerns here. The mix of traffic and lack of designated routings to destinations (buses, shelters, Walmart, school) is a major factor to this concern.
2. The driveways in this area are well-defined, but are sometimes roads. Can the many ingress/egress points on the north side of the Glacier Highway between Davis Street and Anka Street be consolidated and reduced?
3. The center turn lane in sections A through C is superfluous and could be taken up with a median that directs traffic and dedicated turn lanes. This allows for crossing pedestrians to have a refuge area and only cross one lane of traffic at a time even if they aren't using a marked crossing.

4. Support use of raised medians and improved crosswalk delineation, such as the HAWK light at Walmart. Pedestrian crossings between Switzer Creek Park and Concrete Way on Glacier are too few and minimally lit. Narrow Glacier Highway through lanes from 16′ to 12′ at the most (perhaps narrower), from Walmart to Tonsgard Court. This would provide traffic calming, and free up existing right-of-way for pedestrian accommodations on the seaward side of the road.



Segments D and E

1. If a signalized intersection were put in at Short Street, driveways along Glacier Highway could be eliminated and the businesses could instead be accessed from back roads. This would eliminate turning movements and consolidate the access points.
2. Space that is currently used by the center turn lane in this area could be utilized for making medians, widening bike lanes, and constructing bus pull outs.
3. Vehicles often exit driveways onto Glacier Highway without yielding to traffic.
4. Two comments suggest the speed limit should be 30 mph through this area.
5. Retain 16' lanes from Tonsgard Court to the junction with Egan Drive (approximately mp 2.517 to 3.476). This would encourage industrial traffic to use the

Vanderbilt end of Glacier Highway to access the industrial areas around Anka and Tonsgard.

6. Vehicles traveling southbound on Glacier Highway cut into the bike lane on the sharp curve south of Anka Street.

SPEED LIMIT *(10 comments total)*

(from three stakeholders: Capital Disposal, Channel Construction, CCTHITA; two commenters at Public Meeting, and written comments from A. King, B. Dinneford, D. Ingledue, J. Dailey, and K. Maier)

1. Nine comments ask for a reduction in speed limits. "Current posted speed for this roadway is too fast; CCTHITA supports traffic calming to reduce speed, especially in segments A through C, is highly residential." "In my experience (B. Dinneford) the speed limit is too high in this area with large heavy trucks pulling out, children, and a heavy traffic load." Vehicles are traveling too fast in this corridor for safe cycling. Several recommend 30 mph. This would give bikers and pedestrians more time to make crossings and would reduce noise and wind produced by industrial truck traffic. One commenter notes that there is a lot of slush in Juneau in the winter time and vehicles often drench pedestrians in the sidewalk. Slowing traffic through this area would improve this problem.
2. A commercial user favors retaining a 40 mph speed limit from Anka Street to Vanderbilt Hill Road to allow for/encourage all the truck traffic to move southward on Glacier Highway.

ILLUMINATION *(9 comments total)*

(from three stakeholders DHMS, AEL&P, and CCTHITA; from three commenters at public meeting; and from two written commenters - J. Dailey, A. King)

1. There should be general improvements to the lighting in the corridor, especially in segments A through C. It is difficult to see pedestrians crossing Glacier Highway when it is dark out, which is half the year. Lighting needs improvement along the entire corridor, especially for bicyclists. "I see it as a real concern and imminent danger to the elementary school children riding the [Harborview] bus and crossing Glacier Highway in the dark without a school light on at 7 am to stand at a dark bus stop along a route frequented by homeless folks." Also, the trees in Segment C block the light on the seaward side of Glacier Highway. Lighting is often on the opposite (south) side of the street while pedestrian use the north side.

2. Consider a lighting treatment from Davis to Walmart that is more pedestrian/neighborhood scale to both calm traffic and more importantly enhance residential/neighborhood ambiance. Lighting design from Davis to the east to Egan would be more traditional.

OTHER AND FUTURE PROJECTS/DEVELOPMENT *(9 comments total)*

1. Visual elements need to be incorporated to foster a sense of place and pride. This is one of the ugliest stretches of road in Juneau. Raised planted beds, gateway treatments and nice lighting can calm traffic and encourage users to respect each other. This area's commercial, residential and through traffic users deserve this.
2. The Juneau Comprehensive Plan is currently being updated. This is a good opportunity to unify State and CBJ projects.
3. Remember that all sewer and water lines that serve the Mendenhall Valley are beneath Glacier Highway.
4. There are plans for an elementary school to be constructed near the location of Dzantik'I Heeni Middle School. This would increase residential and pedestrian traffic in the area.
5. In the long term there are plans to build a road that connects the Davis Avenue area with Renninger Street along with housing units in this area. This could take pedestrian traffic off of Glacier Highway.
6. Allowable residential density was just increased in the wetlands area across from Western Auto from 15 to 50 dwelling units/acre to stimulate residential development in this area that is close to transit and urban services.
7. A long term idea is a new road that would start across Glacier Highway from Short Street and go to the Costco area. This would be another potential way to separate pedestrian and truck traffic.
8. CCTHITA and THRHA are in the design phase for a 22 unit housing complex that will be across from Western Auto on Coogan Drive.
9. The long range biking solution here is a bypass path between Glacier Highway and Egan Drive, which parallels Egan Drive from Vanderbilt Hill Road to the overpass. This would be better than improving this section of road for commuters. This is part of the CBJ's long term plan.

PEDESTRIAN CROSSINGS-GENERAL *(7 comments total)*

(from three stakeholders: CBJ-CDD, DHMS, and JPD; two comments during the public meeting; and written comments from I. Gallion and J. Dailey)

1. Raised medians and pedestrian refuges, such as the pedestrian crossing at Fred Meyers, function well and is a good template for crosswalks here.

2. Many express support for the use of pedestrian refuge islands in the road. The use of medians along this corridor will control smaller drive ways without impacting large intersections and also create pedestrian refuges. Pedestrian refuge islands are needed between Walmart and Tonsgard Court with designated turn lanes. The refuge islands should have curb cuts and sidewalk across the refuge island at crossing points. Also, please consider low-lying, indigenous greenery on the rest of the refuge island (perhaps moss). This combination of features would indicate to pedestrians where they should cross, and indicate to traffic where they should anticipate pedestrians. The low-lying greenery would assure that drivers could see pedestrians approaching or standing on the refuge island. Crosswalks should have blinking lights.
3. Consider use of pedestrian tunnels where appropriate.
4. Speed feedback signs are an effective traffic treatment. Bright flashing lights get driver's attention quickly.
5. One comment supports use of roundabouts in area and two comments prefer other treatment options.
6. All changes must be intuitive.

SIGNAGE *(7 comments total)*

(from two stakeholders DHMS and CCTHITA; one public meeting comment, and three written commenters -J. Dailey, F. Rue and A. King)

1. There are too many signs, some of which have been there for years and look like it. There is sign clutter. As part of the project re-organize, coordinate, and re-do signage for motorists and also for pedestrians, bicyclists and transit users.
2. Many people do not know there is a school in this area. A highly visible sign on both sides of Glacier Highway, near the Renninger Street intersection, is needed. Also, the designated School Zone on Glacier Highway doesn't include Renninger Street which causes confusion about the school's location. The School Zone signage locations do not match crossing needs or realities and seems to confuse drivers about where it is okay to speed up.
3. Need improved or additional business and retail information signage that is visible from the roadway. CCTHITA hopes to be invited to comment on any signage plan for this area.

TRANSIT *(6 comments total)*

(from two stakeholders Capital Transit and CCTHITA; and two written commenters -J. Dailey and T. Lukshin)

1. The five paired bus stops in this area serve it pretty well; specific locations of stops are adjustable to some extent.
2. Turns on and off of Davis Avenue are very difficult for buses. Perhaps Davis warrants a signal, this seems to be the busiest uncontrolled intersection in this area.
3. There are several comments about the transit stop locations near Western Auto and related uncontrolled pedestrian crossing. Ideas are to move bus stops east of the Vanderbilt/Glacier Highway intersection, or move bus stops a little north on Glacier Highway. All call for adding a formal, visible, pedestrian crossing with an island refuge, possibly in tandem with remedy for southeast bound bicyclists from Glacier Highway that need to access the bike path to Twin Lakes.
4. Upgrade all bus stops to bus shelters and, for safety reasons, install lights and include pedestrian pathways to crosswalks.
5. Buses block the bike lane when they pick up passengers. Each bus stop and shelter should be located at a pull off from the active roadway; locations lacking a turnout are the seaward side of Glacier Highway at its intersection with Davis Avenue, and at both sides of Glacier Highway near Western Auto.
6. CCTHITA is developing a 22 unit housing complex and vehicles will ingress/egress Glacier Highway opposite Western Auto from Coogan Drive; this may impact preferred bus shelter placement.

SIDEWALKS *(4 comments total)*

(from one stakeholder: DHMS, and written comments by F. Rue and I. Gallion)

1. Sidewalks are needed along the entire length of both sides of Glacier Highway in project area, although reconstructing Lemon Creek Bridge to accommodate pedestrians on the seaward side would be cost prohibitive and isn't critical. A sidewalk on the south side would provide dedicated pedestrian access to attractions on the south side, including the Western Auto shopping plaza, Breeze In, the Creekside Mobile Home Park, and WalMart.
2. Sidewalks should be as far away from the road as possible.
3. Better snow removal on pedestrian facilities is needed; pedestrians have trouble walking on slippery sidewalks in winter and are forced to walk in the road due to snow obstructions. *(also see "Road Conditions and Maintenance" Comments)*
4. Sidewalks should be made of asphalt. Concrete sidewalks have control joints that cause a rough and slow ride for bikers (new cyclists, children and slower cyclists, and strollers use the sidewalk, in addition to pedestrians).

WETLANDS/DRAINAGE (*4 comments total)*

(from one commenter at the public meeting and from three written comments by J. Dailey, D. Ingledue, I. Gallion)

1. Wetlands shouldn't be impacted during this project.
2. The small meadow in Lemon Creek (landward side of Glacier Highway between Renninger Street and Central Avenue) is the prettiest location in the area, protect it and enhance with seating – no construction here or taking here.
3. This project will have some difficult parameters to deal with such as the wetlands and Vanderbilt Creek. Maybe some type stream mitigation could be devised if there is a need to widen the road bed in that area to accommodate bicycles.
4. Construction in the Commercial Boulevard/Anka area has redirected drainage, and there is a drainage problem on the seaward side of the road. Any upgrades might be an opportunity to address these challenges.

ENFORCEMENT (*4 comments total)*

(from two stakeholders: JPD and CBJ-CDD, and written comments by F. Rue, L. Davis)

1. More enforcement is needed to monitor industrial truck traffic; industrial trucks should have to cover their loads so they don't spill material onto the side of the road. CBJ notes that there is an ordinance requiring covered trucks but enforcement is lacking due to time and funding.
2. Any improvements installed need to be intuitive for drivers. The Juneau Police Dept. (JPD) doesn't have the staff to enforce and educate new traffic devices (for example, people still do not understand what to do when HAWK lights flash red). Center medians, narrow lanes, and roundabouts are intuitive – drivers just slow down.
3. Drivers often talk on cell phones and are distracted through this corridor.

APPENDIX 1 – ATTENDANCE LISTS

February 5, 2013 Public Meeting

1. Cathy Tide
2. Chuck Tripp
3. Dean Heard
4. Don Ingledue
5. Frank Rast
6. Gerry Landry
7. Jackie Daily
8. John P. McConnochie
9. Karinne Wiebold
10. Karla Hart
11. Lance DeBernardi
12. Lin Davis
13. Mal Menzies
14. Mary A. Miller
15. Mary Ann Dierckman
16. Michael Williams
17. Mike Story
18. Nathan Coffee
19. Phil Witt
20. Steve Soenksen
21. Tim Grier
22. Valesha Patterson

February 5, 2013 Stakeholder Meeting

1. Ben Lyman – CBJ Community Development Dept. (CDD)
2. Calvin (Chip) Boord - Channel Construction
3. Darrell Wetherall - AEL&P
4. Lt. David Campbell – Juneau Police Dept.
5. Ed Foster - CBJ Streets
6. Eric Eriksen - AEL&P
7. Eric Vance - Waste Management Inc.
8. Frank Rue - Juneau Freewheelers
9. Fritz Moser - Juneau Freewheelers
10. Greg Chaney - CBJ CDD
11. Jim Scholl - Dzantik'i Heeni Middle School
12. John Bohan – CBJ Engineering
13. John Kern – CBJ Capital Transit
14. John P. McConnochie - Juneau Freewheelers
15. Kirk Duncan - CBJ Public Works
16. Molly Yerkes – Dzantik'i Heeni Middle School
17. Tamara Rowcroft - Alaska Housing Development Corp./Gruening Park
18. Tyson Lupro - Aggpro

Written Comments Received (February 5-20, 2013)

1. Amber King
2. Eric Olsen
3. Bruce Dinneford
4. Mary Miller, Central Council Tlingit and Haida Indian Tribes of Alaska (CCTHITA)
5. Don Ingledue
6. E. Hayes
7. Frank Rue
8. John P. McConnochie, Juneau Freewheelers
9. Fritz Moser
10. Gerry Landry
11. Mike Hekkers
12. Kevin Maier
13. Irene Gallion
14. Jackie Dailey
15. Karinne Wiebold
16. Laird Jones (included with CCTHITA)
17. Lin Davis
18. Nathan Coffee
19. Talitha Lukshin

ADOT&PF and Consultant Team Attending

1. Chad Howard, ADOT&PF
2. Chuck Tripp, ADOT&PF
3. David Epstein, ADOT&PF
4. Hilary Lindh, ADOT&PF
5. Jonathan Weaver, ADOT&PF
6. Lee Rodegerdts, Kittelson & Associates, Inc.
7. Yuri Mereszczak, Kittelson & Associates, Inc.
8. Gary Katsion, Kittelson & Associates, Inc.
9. Kamala Parks, Kittelson & Associates, Inc.
10. Andrew Ooms, Kittelson & Associates, Inc.
11. Barbara Sheinberg, Sheinberg Associates
12. Donovan Bell, Sheinberg Associates

APPENDIX 2 - FEBRUARY 5 MEETING NOTES

1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF)and contractor Kittelson & Associates, Inc. held a stakeholder meeting at the ADOT&PF 7-Mile office on Tuesday, February 5, 2013 from 8:30 am -10:15 am. After introductions and a brief presentation there was a round robin where each attendee voiced their top concerns. After everyone had a chance to speak, the meeting opened to general discussion of the project. There were 18 stakeholders attending this meeting.

Although some responses and feedback were given by the project team during the meeting, these notes focus on the comments, questions and concerns that were received.

2.0 Top Concerns

John Kern - Capital Transit

- Over the course of many years, 5 paired transit stops have been chosen in this project area. For the length of the corridor, this doesn't seem like very many stops, but they serve the area pretty well. These are all paired stops, meaning that there is a stop on each side of the road for all 5 locations. Specific locations of the stops may be adjustable to some extent.
- Our other concern is the turn on and off of Davis Ave. The left turns onto Glacier Hwy. are very difficult here. I'm not sure if Davis Ave. would warrant a traffic signal or not but this seems to be the busiest uncontrolled intersection in the area.

John McConnochie – Juneau Freewheelers

- The Lemon Creek Bridge is a choke point. The best solution is to widen the bridge, but I understand that this might not be within the scope of the project. If this isn't feasible, use some form of barrier to separate pedestrians and cyclists from motor vehicles. Cyclists currently have to hold your breath as they cross the bridge.
- The shoulders for the bike lanes should be widened and put on a regular maintenance schedule. There is a lot of commercial traffic that comes through here making it a gravel pit. One of the challenges of traveling this corridor is dodging around rocks and other debris.

Jim Scholl – Dzantik'i Heeni Middle School

- Bike lanes should extend entire length of corridor on both sides of the street.
- Several site council members want sidewalks to extend the entire length on both sides of the street.

- There is a sight problem and more lighting is needed along the entire corridor, especially for bicyclists.
- Install blinking lights at the crosswalks.
- We have had a lot of discussion about Renninger St. We would like to thank ADOT&PF for installing the HAWK light. This has helped the problem of children crossing Glacier Hwy., but it didn't solve it. This is especially dangerous in the winter time when the light is dim. Children still cross Glacier Hwy. without using the HAWK light. This is critical when school is let in and out because of the increased traffic, including school buses. When school is let out, it is nearly impossible to make a left hand turn from Renninger St. onto Glacier Hwy. Pedestrians and drivers become frustrated from long wait times. This increases their willingness to cross through smaller and smaller gaps in traffic. Pedestrians and vehicles often jump into that gap at the same time. The buses are big and slow and ad to the problem. If no major intersection improvements are made, it's best to restrict pedestrian access across Glacier Hwy. Somehow force pedestrians to cross at HAWK light or closer to town. This would be a great place to put in a roundabout. Traffic would have to stop less, and it would be more efficient for cars. I don't make left turns here anymore. I take a right then turn around.

Molly Yerkes – Dzantik'i Heeni Middle School – Jim has voiced our concerns.

Hilary Lindh – ADOT&PF

- When biking through corridor, especially on town side, the road isn't well maintained. Even if it isn't something that will physically knock you off your bike, there is lots of gravel and dust. The dust causes you to squint and makes it harder to breath.

Tamara Rowcroft - Alaska Housing Development Corp./Gruening Park

- We have a lot of residents who don't own cars and are on foot. I still see a lot of people who don't use marked crossing when they get off the bus. We have a lot of kids who aren't accompanied by adults who are crossing Glacier Hwy. to go to Walmart or to get to and from school. Those children take a lot of risks when crossing outside of designated areas.
- Having better bicycle access would be great.
- Sidewalks should be maintained and clear of rocks and dust to increase the safety of the area. Pedestrians often walk in the street during the winter time because the sidewalk is so icy.

Kirk Duncan - CBJ Public Works

- Inside these roads are the sewer and water lines for the entire Mendenhall Valley.

Eric Vance – Waste Management Inc.

- I echo many of these challenges. It is difficult to go to Subway. Turning left from Concrete Way onto Glacier Hwy. is also difficult. A reduction in speed would help. People often go through here at 45 or 50 mph. Your reaction time is very limited. I'm glad you are looking at this and I do think changes are needed.

Tyson Lupro – Aggpro

- We have lots of industrial truck traffic, dump trucks and concrete trucks, coming in and out of our yard all day almost every day that use Concrete Way. It is very hard to take a left out of Concrete Way onto Glacier Hwy. Our truck drivers often take a right even when heading to the valley. I know that a lot of dump truck drivers do this too. The entrance to Subway is straight across from Concrete Way. This 4 way intersection can get pretty hectic. There is no crosswalk anywhere and there are people darting back and forth. It gets pretty congested.

Ed Foster – CBJ Streets

- I would like to echo John Kern's comments about Davis Ave. This is a very busy intersection. When you are trying to turn off of Davis Ave. onto Glacier Hwy., the guard rail from the Lemon Creek Bridge blocks your view of traffic. The bridge needs to be addressed. I know it's expensive, but the bridge is a choke point and I don't know how you can improve the corridor if you don't improve the bridge.
- With the traffic at Concrete Way, and its location on a blind corner, it almost a necessity that traffic stop here. I've seen many close calls with trucks coming out of Concrete Way.

Lt. David Campbell – Juneau Police Dept.

- I echo what a lot of people are saying. Turning left throughout the entire corridor is problematic. Whatever the changes are, they need to be intuitive so there isn't a big learning curve for people. We have done lots of enforcement at the HAWK light and ADOT&PF has sent out PSAs and done other education. Watching that area now, you would think no one knows how it works. Changes are good, but need to be intuitive. From a staffing point, it doesn't work to just say that the Juneau Police Department needs to take charge in enforcement and education of a traffic improvement. We prioritize our time as follows: crimes against people, then crimes against property, and the third priority is enforcing traffic. *What is the specific problem with the HAWK?* I don't think people know the difference between a steady and flashing red. My wife stopped to let people cross at Alaway Ave., and she was scolded because stopping in the middle of the road was going to cause an accident. Even for something as basic as stopping for a pedestrian at a crosswalk, some drivers don't know the traffic laws. I like the idea of medians. I like the idea of roundabouts. The road should flow as well as possible and be intuitive as possible.

Eric Eriksen – AEL&P

- Our offices are located at the intersection of Tonsgard Ct. There is a lot of stress daily on the employees driving to and from work.
- Make general improvements to the lighting.
- There are possible loops you could create from here to Short St. or Concrete Way. The intersection at Tonsgard Ct. is a lot like that at Concrete Way.

Fritz Moser – Juneau Freewheelers

- I don't believe a roundabout would solve the problem at Renninger St. A push button would help, like they have at Floyd Dryden. That gives the cars a chance to empty out of Renninger St.
- Make sure the catch basins are bicycle appropriate.

Calvin Boord – Channel Construction

- All truck traffic could be directed from Concrete Way to Vanderbilt Hill Rd.
- Change the intersection at Concrete Way so you can only turn right from 4-6, just like at McDonalds.
- Add a crosswalk at Western Auto, move all of the bus stops down to the Twin Lakes area, and remove the busses off this section all together. Try to keep the speed the same from Anka St. to Vanderbilt Hill Rd. Western Auto is the only retail business on this stretch and is the only place that needs a crosswalk. Keep this section of Glacier Hwy. the same. That way all of the truck traffic can flow this direction and stay out the residential area.

Darrell Wetherall- AEL&P

- Eric covered my concerns well. Making a left out of Tonsgard Ct. is pretty much impossible. We can take the back exit onto Short St. but this has pot holes and is problematic for bigger trucks. This access could be improved.

Greg Chaney – CBJ CDD

- There is definitely merit in making a truck route from Lemon Creek to Vanderbilt Hill Rd.
- Our long range transportation plan has a pedestrian and bicycle path that would bypass this area, but I realize that it's beyond scope of this project.
- The pedestrian crossing at Fred Meyers is very effective. You notice it as a driver. This is a good template for how crosswalk can be handled.

Ben Lyman – CBJ CDD

- I can't say it more succinctly than what the project goals are. Use a combination of medians and pedestrian refuges. Control some driveways, but not necessarily major roads. This would help at smaller places such as, Subway, the storage units, and

Taku Graphics. There are lots of smaller driveways that have uncertainty for everyone. Some of these locations could be forced to make a right turn then double back. This would only affect a small number of people and wouldn't impact large intersections.

- Maintenance is a big concern, especially with gravel in the bike lanes. This comes back to enforcement. There are ordinances to cite a dump truck. If a truck has rock or gravel it must be covered, except if it's a mining product you don't. I don't know what rock isn't a mining material. We could make more effective ordinances. This would reduce gravel and enforcement needs.
- Install bike signs letting people know where to go. There are currently only signs for areas where biking is prohibited.
- Lighting has already been mentioned.
- CBJ has been collecting pedestrian crossing data in this area including at both Renninger St. and Central Ave.
- CBJ is looking at a couple areas near the end of Renninger St., on east side from school, for short term disposal. There are also plans for an elementary school in this area. This would increase residential and pedestrian traffic.
- Eventually there could be an access route from Davis Ave. to Renninger St., as well as housing units in the area. This could potentially take some of the school traffic off of Glacier Hwy., but again this is very long term.
- The wetlands area across from Western Auto has been for sale for a longtime. The city recently changed the residential limits from 15 units an acre to 50 units an acre in this area with the hope of stimulating residential development that is close to transit lines and urban services.
- The city has considered road across from Short St. that would join with one of the roads in the Costco area. This would be another potential way to keep truck traffic away from the residential area.

3.0 General Discussion

Question from Project Team – We have talked about whether we could keep the truck traffic to one side of Davis Ave. Is that something that would work for everybody?

Calvin (Chip) Boord – That's the way we assume it is already.

Jim Scholl – We still need to be able to accommodate school buses in the area north of Davis Ave.

Molly Yerkes – People don't know there is a school in this area unless the school zone lights are flashing. We would like there to be a sign for Dzantik'i Heeni Middle School

that everyone would see. We have 500 middle school students traveling through this area. The signs need to be on both sides of road near the intersection of Renninger St.

Eric Erikson – We need two access points for the large truck traffic. Redesigning Short St. could reprioritize an access point, but we need two.

Calvin (Chip) Boord – Tonsgard Ct. is the only place for trucks to fuel and access is necessary.

Frank Rue – Is the Anka St. traffic light adequate for trucks turning onto Glacier Hwy.?

Calvin (Chip) Boord – The right turn from Anka St. to Glacier Hwy. is tight. All of the mining comes out here from Hidden Valley and takes a right turn to Concrete Way. In the summer that route is in high use. If you've ever tried to turn off of Glacier Hwy. onto Anka St. when there is a truck taking a right onto Glacier Hwy., the truck is in your lane while trying to keep the tires off the sidewalk. The left turn isn't a problem. We don't turn left here to go to Concrete Way, but we can take this left when we are going anywhere else in town.

Frank Rue - Is the back door route from Western Auto into Concrete Way short term feasible?

Ben Lyman - Most of the driveways in the segments A through C are very well defined, and many are actually roads. The question here becomes more about crossing treatments. The center turn lane is superfluous and could easily be taken up with dedicated turn lanes, and a median that directs drivers. This eliminates the suicide lane and creates a continuous crossing for pedestrians. Even if the crossings aren't marked, at least pedestrians have a refuge where they only have to go through one lane of traffic at a time. This would affect maintenance. If there were a stalled vehicle you could presumably push the vehicle out of the road into the bike lane and still keep the traffic flowing.

Jim Scholl – The school zone on Glacier Highway doesn't cover Renninger St. and it confuses people because they think there ought to be a school within the vicinity of the school zone. If there was a sign some of this confusion would go away.

David Epstein – ADOT&PF – The HAWK isn't necessarily in a fixed position. Whether or not this is the best location for the light should be considered.

Barb Sheinberg – Always Ave. is dark and a dangerous crossing. If a sidewalk is added to the seaward side of Glacier Hwy., the location of crossings could be reconsidered.

Would the crossing at Alaway Ave. still be the best location or could it move to Renninger St.?

Frank Rue – Could the entrance of Walmart and Renninger St. be turned into one intersection? There are currently two big traffic points a few dozen feet apart. It seems like it would simplify traffic. Could trucks eventually go straight across Glacier Hwy. at Anka St. to get to Concrete Way?

Question from Project Team – Assuming that the bridge can't be improved due to budget constraints, what should we do?

Eric Vance – Can you make a separate bike bridge, such as a clip on?

Calvin (Chip) Boord – Again, restrict left turns out of Concrete Way twice a day from 11:00 am -1:00 pm and 4:00 pm – 6:00 pm.

Jim Scholl – It was mentioned that there is a sight distance problem for vehicles turning left out of Davis St. Raise the grade on Davis St.

Lee Rodegerdts – The lower grade of Davis Ave. also makes it harder for vehicles to accelerate when turning onto Glacier Hwy., especially buses.

John Kern – What is the budget for the project? There are some pretty big ticket items being mentioned.

Question from Project Team – Are there any concerns or ideas about access points, including consolidation or restrictions?

Ben Lyman – In this area there are a few alternative routes that already exist, such as Short St. Improving these alternative routes is outside the scope of this project, but in the long term it could really improve things. Say there was a signalized intersection at Short St. This is further from Anka St., although I'm not sure if it's far enough to meet ADOT&PF standards. This intersection would allow for the restriction of the other driveways off of Glacier Hwy. and instead have them accessed from the back road. This would get rid of a lot of those turning movements or at least consolidate the access points. Again, we have a continuous center turn lane here. We can't necessarily afford to widen the entire corridor here by purchasing right of way, but utilizing some of that space where it isn't needed for turning movements could be used for medians, widening bike lanes and bus turn outs.

Lt. David Campbell – I don't feel comfortable with the 4 foot bike lane in between lanes at the Anka St. intersection. This is a difficult intersection.

Ben Lyman – The bike lane at Anka is a non sequitur in Juneau and doesn't follow the local road language. If this was something that was standard in town, people would understand it. In communities with lots of bike infrastructure this is totally normal and safe. But for drivers and bikers in Juneau everyone thinks it's crazy.

Barb Sheinberg – Sheinberg Associates – When roads have been freshly striped, people feel really secure. The problem is that nothing stays freshly stripped for more than a month here given our local weather and maintenance. Is there any material we could use to provide more permanent markings?

Calvin (Chip) Boord – When Anka St. is busy, and there are trucks turning left and right onto Glacier Hwy., and there is a bike waiting between vehicles on Glacier Hwy., the driver in the right lane has a free right onto Glacier Hwy. and is not going to see the cyclist.

John Kern – Determining the prioritization of the project is going to be an important aspect. We currently make the decision to block the bike path with our busses at the transit stops due to right of way constraints. I know this is a conflict and we hear about it. If there is another alternative, which of course would require more right-of-way, we're not adverse to keeping the bike lane open.

Fritz Moser – Question : How much does a typical roundabout cost? Answer: The cost of a roundabout is dependent on a number of factors. A million dollars is a very rough guess. The size of the roundabout plays a big role in the cost.

Frank Rue – When is the Lemon Creek Bridge scheduled to be replaced?

John Kern – Question: When is the next overlay scheduled for this road section? Answer: The overlay is scheduled in this project.

Frank Rue – Maintenance doesn't have enough money to clean the streets. The issue might be with the general fund budget for maintenance.

FEBRUARY 5, 2013 MEETING NOTES

1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) and contractor Kittelson & Associates, Inc. held a public meeting at the Gruening Park Office/Recreation Room on Tuesday, February 5, 2013. An open house was held from 5:30 pm to 6:00 pm. The open house included 15 project display boards and time for discussion with the project team. A brief presentation and project overview was at 6:00 pm. After the presentation was finished there was time for questions, comments, and concerns. There were 21 members of the public attending the meeting.

Although some responses and feedback were given by the project team during the meeting, these notes focus on the comments, questions and concerns that were received.

The meeting notes are presented in chronological order. The notes are separated into each unique comment and are not associated with a commenter.

2.0 Questions, Comments and Concerns

Have you met with industrial truck users?

I live on Lemon St. in Lemon Creek. I've been here since 1998. I am an experienced runner in this area, and currently run this route around 5:30 am. I think the most dangerous intersection on this roadway is Anka St. I was running at 5:15 am with my dog, and we were both wearing strobes. I had waited for the pedestrian signal to cross the Anka St. and I was half way across the road when a food service truck came through the red light. He didn't even care. It's not just the truck drivers. Lemon Creek has turned into the industrial hub of Juneau. Costco and Home Depot are there, and everybody is in a rush. A lot of the vehicles coming out of driveways are not yielding to traffic on Glacier Hwy. and just pulling right out in front of you. The speed limit needs to be 30 mph here. In the winter I have seen truck drivers spill large amounts of water onto the road that were excavating in Lemon Creek. This freezes all over road. It's not just the truck drivers, but the moms and dads. I consider this the most dangerous intersection in Juneau.

Pedestrians could barely reach the crosswalk sign last week because of the snow build up.

The railings on the Lemon Creek Bridge are not conducive to pedestrians or vehicles coming out of Davis Ave. The railing blocks your view of everyone. The elevation on

Davis Ave. makes it difficult to see over neighboring vehicles. Consider changing the elevation here.

There should be more law enforcement here to crack down on industrial truck traffic.

I second that Anka St. is a difficult intersection. There is lots of congestion. It's hard to tell what different users are going to do.

When I'm biking to the valley on Glacier Hwy., drivers taking the free right off of Anka St. onto Glacier Hwy. often cut me off. It's hard to tell if they are going to turn sometimes.

The northbound bike lane on Glacier Hwy. at the intersection of Anka St. feels exposed with the truck traffic.

The intersection at Vanderbilt Hill Rd. is very difficult for southbound bikers. You can ride with the traffic into the turning lane, but I'm not that fast. I start looking for an opportunity to cross Glacier Hwy. as soon as I'm at Western Auto. After I cross I bike on the wrong side of the road.

I second what he said. These are the two most difficult intersections. I get nervous about the north bound bike lane at Anka St. People may not understand this bike lane and I'm afraid of getting rear ended. If this were a common treatment for bicycles in Juneau it wouldn't be a problem.

The overall lack of illumination along the entire corridor is troublesome. When it is dark it's really hard to see people crossing.

Concrete Way is troublesome. Breeze In is located here, which increases traffic. Turning onto Glacier Hwy. here is dangerous. The traffic coming from Tonsgard Ct. and Anka St. makes this area busy.

DOT has had previous projects that take land away from the wetlands. I don't want to see that small meadow in this area touched. It is the prettiest spot in Lemon Creek. I have problems with the impact on the wetlands when the overpass was constructed.

The illumination needs to be improved along this corridor. It is very dark and dangerous. The crossings at Anka St., Davis Ave., Concrete Way, and the Walmart could have better lighting. Walmart currently has a HAWK light, but I've seen other communities that have bright flashing lights that get your attention very quickly.

The flashing lights at the school zone needs to be lengthened. Children cross outside of the school zone all of the time.

The speed should be reduced all the way through this corridor.

There is too much sign clutter in this area, and some should be removed.

I think the flashing signs that show your speed compared to the speed limit are effective.

When is Concrete Way the most challenging? It is the most challenging midday. Subway is located on the other side of Glacier Hwy.

Are pedestrian tunnels or overpasses being considered?

There are lots of transit users that cross the road to catch the bus at Western Auto. This is a difficult spot.

The pathway that starts at Vanderbilt Hill Rd. is difficult to maintain. In the winter it turns into an ice rink. Keep the improvements simple here so they can be maintained. I often end up using the sidewalk here and going the long way around instead of using this path.

I don't think that it is universally recognized that the shoulder is a bike friendly place. Whether markings, signs, or paint and stripes are used, make sure people know that it is okay to bike in this area.

In Juneau, the spray from slush needs to be taken into account. It is very easy for pedestrians to get drenched by passing vehicles. This would be improved if the speed limit were decreased.

The Juneau Comprehensive Plan is currently being updated. I think this is a good opportunity to unify projects like this with the city goals.

This is a great time to add signs and educate everyone about bikers. Let everyone know that bikers have to right to be in the shoulder and in the travel lane across the bridge. A yield to bikers sign on the bridge would be an effective way to educate the community.

Even if the shoulders are well marked, the maintenance needs to be improved. Poor maintenance causes bikers to ride in the road.

The turn south of Anka St. is often cut by southbound traffic, which goes into the bike lane. I'm not sure if the road could be reshaped, but vehicles are naturally cutting the corner here.

It would be a shame to spend all of this money on improving the corridor and not improve maintenance. I know that it isn't part of this project, but it is important.

Could the Anka St. light be activated by a bike? Currently the light can't be activated by a cyclist and you have to wait for a car to come.

Is possible to attach a clip on onto the bridge, even if it were just on the seaward side of Glacier Hwy.?

Is redirecting all industrial traffic to Vanderbilt Hill Rd. being discussed?

Is there a way for businesses, CBJ and ADOT&PF to team up on maintenance efforts?

How will speed be addressed on this roadway?

Where is there enough room to construct a roundabout?

On the seaward side of Glacier Hwy. between Davis Ave. and Alaway Ave., the trees are reaching a height were they block sunlight from the road, especially in the winter. Even with the use of lighting in this stretch, the trees make it difficult to see.

30 mph is an appropriate speed limit through the industrial area.

APPENDIX 3 - WRITTEN COMMENTS RECEIVED

Central Council
Tlingit and Haida
Indian Tribes of Alaska

CENTRAL COUNCIL
Tlingit and Haida Indian Tribes of Alaska
EDWARD K. THOMAS BUILDING
9097 Glacier Highway
Juneau, Alaska 99801 - 6922

February 20, 2013

Sheinberg Associates
204 N. Franklin Street, Suite 1
Juneau, Alaska 99801

RE: Comments on the Glacier Highway Improvement

Dear Ms. Sheinberg and Alaska Department of Transportation Team:

Thank you for the opportunity to comment on the Glacier Highway Improvement Project (Wal-Mart to Western Auto) on behalf of the Central Council of Tlingit and Haida Indian Tribes of Alaska. Our Tribe represents over 28,000 members worldwide, including over 6000 residents of Juneau, many of whom reside near or transit through this important corridor.

Central Council Tribal Transportation staff has reviewed the documents presented and offers these observations:

- In general we believe that the current posted speed for this roadway is too fast. The area, especially along segment A through C is mainly residential. For this reason, we support traffic calming efforts to reduce the current posted speed.

- Pedestrian use is very heavy along segment A through C, and includes multiple random crossing locations. We have serious pedestrian safety concerns regarding these sections. The mix of traffic and lack of designated routings to destinations (buses, shelters, Wal-Mart, school) is a major factor to this concern. We support raised medians and improved cross walk delineation, such as lighted crossbars or stop lights at the Wal-Mart intersection as warranted.

- As mentioned, we support the raised medians but feel that the gateway entries and round about ideas would not contribute as nicely as some of the other great ideas in your planning.

- All bus stops should be upgraded to bus shelters. Bus shelters for safety reason should be lit and should include pedestrian pathways to crosswalks. Each bus stop and shelter should be located at a pull off from the active roadway.

- Serious consideration should be given to limiting heavy truck routing to segments D through E only and NOT permitting dump trucks and industrial or heavy load commercial carriers coming out of Lemon Creek to route along segments A through C.

- School zone signage locations need to be reconsidered. The current locations do not match crossing need and seem to confuse drivers about where it is okay to speed up.

- Need improved or added business and retail information signage visible from the roadway. We hope to be invited to comment on any signage plan for this area.

- There is a great need for overall improved illumination along the whole corridor but especially along segment A through C.

- The Anka Street intersection is too congested for the space available. Multiple entities identified this as a major safety concern area at your recent public meeting. We believe that the proximity of the surrounding businesses and the bus stop contribute to a significant number of pedestrians in a small space too close to the intersection. From a driver perspective it's difficult to know if the pedestrians are standing, waiting or intending to cross.

In order to provide an immediate safety improvement in the project area, Central Council is very interested in discussing the possibly of supplying two interactive driver activated speed limit signs for the school zone. Power would have to be supplied by CBJ or ADOT. Please pass this request on to the appropriate ADOT staff.

Be advised that Central Council is working with Tlingit & Haida Regional Housing Authority on developing a 22 unit housing complex that will be entering what is segment E opposite of Western Auto along Coogan Drive. We are in the active design phase and expect that construction will follow in the not too distant future. This may impact your preferred bus shelter placement.

We encourage the ADOT to consider having a Road Safety Audit conducted along the entire project area. Central Council is currently working with the Federal Highway Administration to conduct Road Safety Audits for road segments in Ketchikan and Saxman, if interested we could coordinate a similar effort here.

Also included are the following comments from tribal citizen Laird Jones:

- The lighted street between Sunny Drive & Wal-Mart. This street light is away from pedestrian areas so not too accessible. In addition, drivers coming off of Egan Drive turning left on Glacier Highway tend to roll past the intersection without paying attention for pedestrians.

- Pedestrian Crossing lands between Switzer Creek Park and Concrete Way on Glacier Highway are too few and minimally lit. The hand held red flags are a good start but very inadequate when dark or twilight.

- During the snowy months, pedestrians have been observed struggling staying upright with the icy and snowy sidewalks and at times have had to step in the roadway due to snow obstructions.

- Pedestrians and bike traffic having to share the area with fast moving large commercial trucks is dangerous.

- Biking through the area is a challenge as the shoulders in some areas are minimal and not kept clear of debris and crossing business driveways is risky (Wal-Mart, Breeze Inn, Arrow Refuse, Western Auto) as drivers try to get across before oncoming traffic picks up.

- And as noted at the public meeting, prompt snow removal is essential to allow pedestrians through this corridor.

We look forward to continuing working with you on this project and thanks for the opportunity to comment. If you have questions on our comments please contact me at 907.738.9305.

Sincerely,

Mary A. Miller P.E,
Tribal Transportation Director

CC: Edward K Thomas, President

Don Ingledue
4815 Glacier Hwy
Juneau, Ak. 99801
907-780-4016

Barbara Sheinberg
Sheinberg Associates
204 N. Franklin, Suite 1
Juneau, Ak. 99801

February 8, 2013

Dear Barbara,

This is a great project for the improvement of bicycle and pedestrian traffic on this roadway. It is currently one of the most difficult for bicycles and in some areas for pedestrians, of which I am both.

I have three issues, that I would like to address since they are near my home at 4815 Glacier Hwy:

1. Pedestrian Crossing between bus stops at Western Auto.

This is a most difficult crossing and is done a fair amount during the day. I think the fix is simple; a cross walk with flashing red lights on request, like at Wallmart would cure the problem. A turning lane median would also give some refuge to pedestrians although not really necessary if the red light was put in since they could make all the way across on one red light cycle. The sidewalk should end there and pedestrians would cross to the east side sidewalk to continue south. There is no need for a sidewalk any further since it is all wetlands on that side of the road. The west bus stop should be moved to the north side of the southern entrance to Western Auto.

2. Bicycle traffic southbound exiting Vanderbilt Hill Rd to Glacier Hwy. How do we get bikers from the shoulder of the road across to Glacier Hwy?

Bicycles currently must look behind and in front to cross over from Vanderbilt Hill Rd to Glacier Hwy and follow the vehicle left turning lane. If you are not an aggressive rider,(like me)you avoid that intersection all together and look for a break in traffic to get across onto the sidewalk before getting too close to that intersection. After getting to Glacier Hwy you must cross again to the right side of the road.

The best solution is to have a mandatory bike exit on the right which would take him over or under the traffic. This would be solely for bikes since there is no sidewalk at this point since it ended at Western Auto.

I have used the bike lane at the Anka St. intersection and it works well for thru traffic. A bike lane at the Vanderbilt and Glacier intersection would help, but bikers must still cross in front of thru traffic to get to the bike lane. A traffic light would slow the traffic somewhat and help make that crossing safer.

3. Current speed limit of 40MPH is too fast.

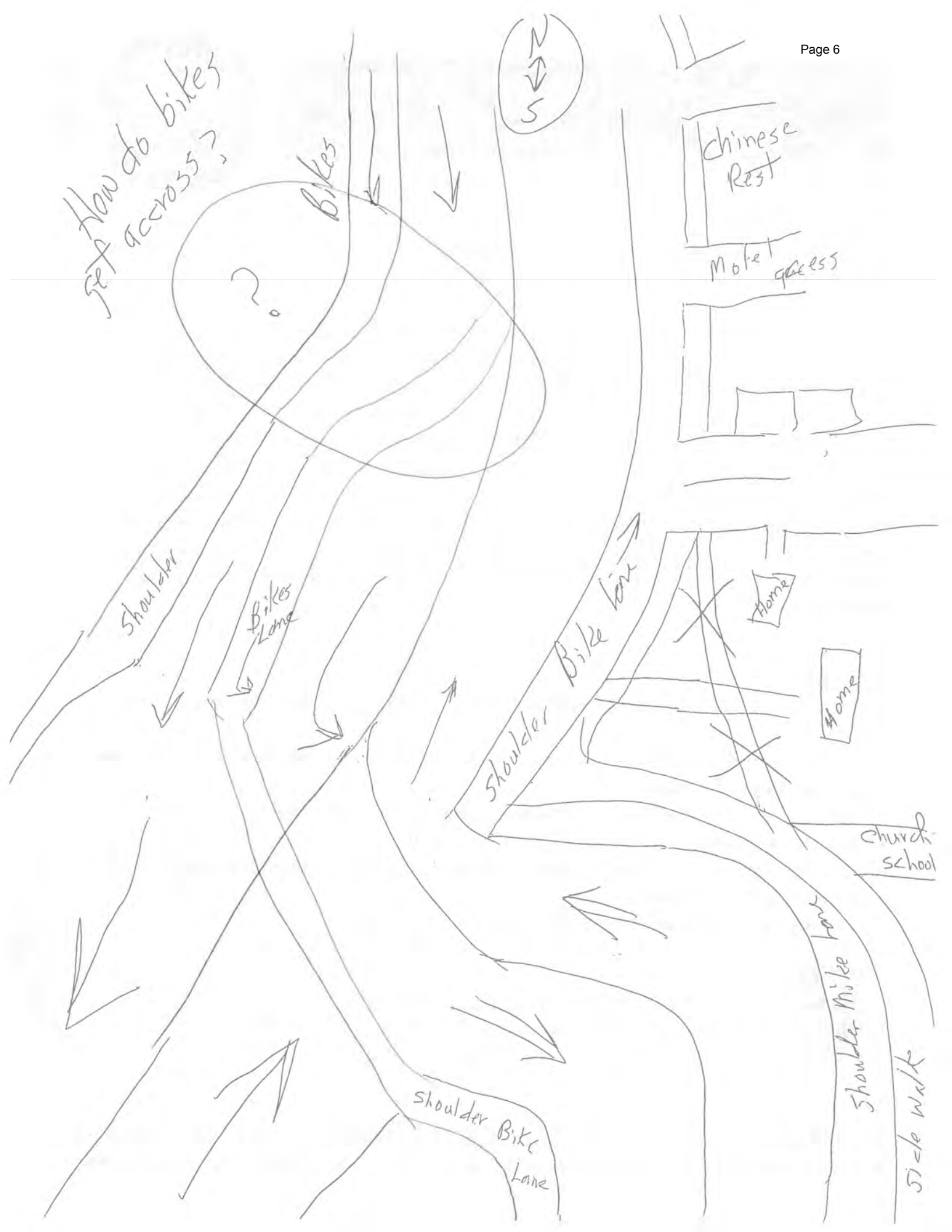
I think a 30MPH speed limit is more appropriate for this entire project area . It would give bikers and pedestrians more time to make crossings and it would lessen the noise level and truck wind . I have lost my hat a couple of times when a big truck has gone by as I walked on the sidewalk in the opposite direction.

Thanks for the opportunity to comment. I know there are some very difficult parameters to deal with such as the wet lands and Vanderbilt Creek. Maybe some type stream mitigation could be devised if there is a need to widen the road bed in that area to accommodate the bicycle dilemma.

Sincerely,

Don

Don Ingledue


How do bikes get across?
?
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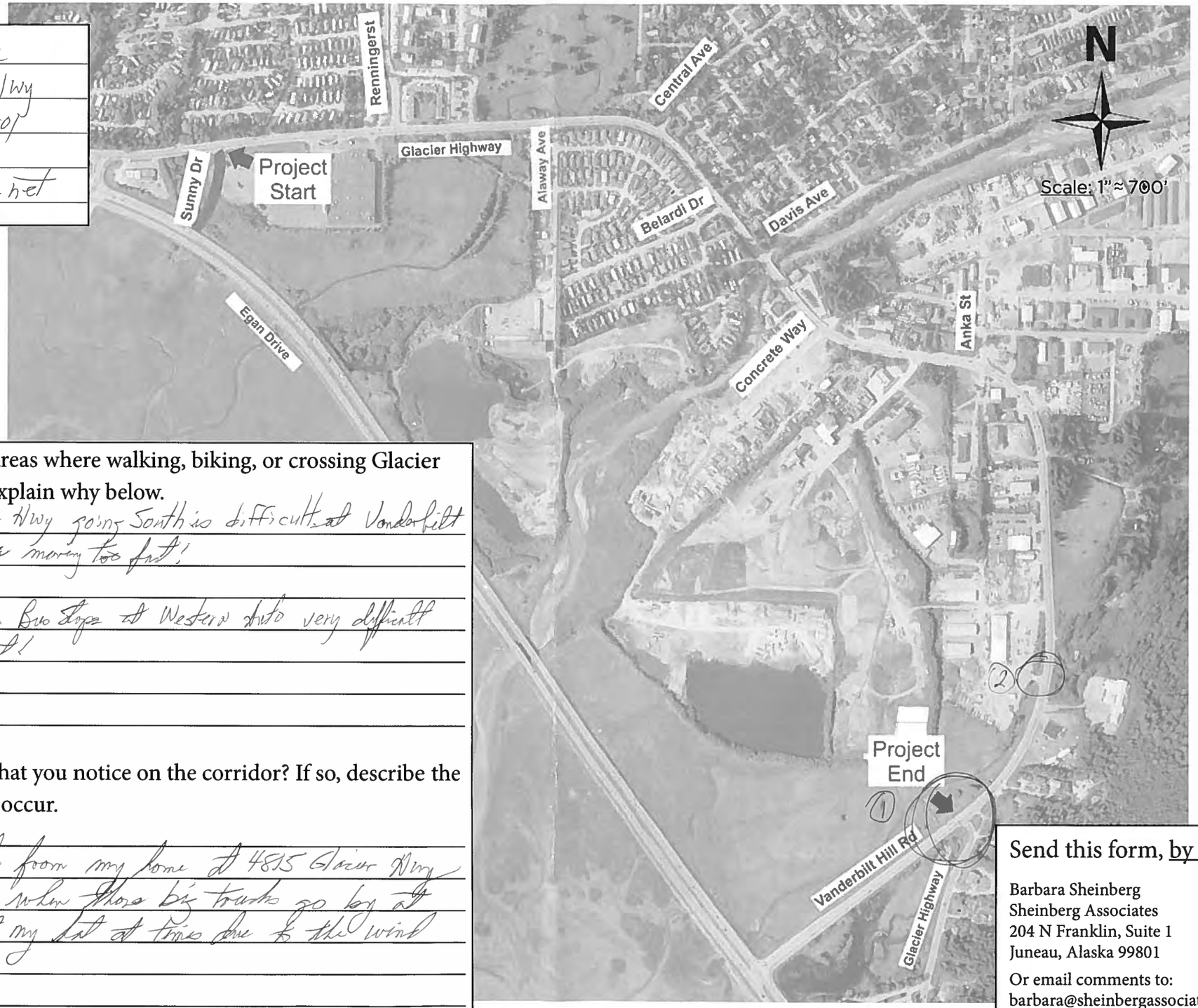
Motel access
Shoulder
Bikes Lane
shoulder Bike lane
Home
Home
Church school
Shoulder Bike lane
Side walk
shoulder Bike Lane


5' side walk
N
S
New Bus Stop
Island refuge
cross
(side walk ends)
Western Auto
walk
Bus Stop
move old Bus Stop
Wetland
Reduce speed to 30mph
Side walk
S

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: Don Ingledue
Address: 4815 Glacier Hwy
Juneau, AK 99801
Phone: 907 780 4016
Email: donpat@alaska.net



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

1) Bike access to Glacier Hwy going South is difficult at Vanderbilt Hill Rd. Traffic moving too fast!

2) Pedestrian crossing from Bus Stops at Western Auto very difficult Traffic moving too fast!

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

Walking the sidewalk from my home @ 4815 Glacier Hwy to Costco is scary when those big trucks go by @ 40 mph. I have lost my hat at times due to the wind following those trucks.

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

586-3141

To Whom It May Concern:

Thank you for the opportunity to comment on the Juneau Glacier Highway Bicycle and Pedestrian Improvements.

My comments recognize two regions of the roadway on either side of the intersection with Tonsgard. To the northwest, mid- to high-density residential development serves lower income residents. These residents are more likely to walk and use public transit than higher income residents. To the south, an industrial center has developed. The mile points below and the current conditions reference the Road Logs from January 13, 2010. A map below corresponds to color codes listed in front of the comment.

A (red line). Please consider constructing sidewalk on the south side of the road for the entire length of the project (approximately mp 1.567 to mp 3.175). A sidewalk would provide dedicated pedestrian access to attractions on the south side, including the Western Auto shopping plaza, Breeze Inn, the Creekside Mobile Home Park, and WalMart. Reconstructing Lemon Creek Bridge to accommodate pedestrians on the south side might be cost-prohibitive, and would not be necessary.

B (green line). Please consider providing pedestrian refuge islands between WalMart and Tonsgard Court (approximately mp 1.567 to 2.517) with cut-outs where vehicles need a turn lane. It would be nice for the refuge islands to have curb cuts and sidewalk across the refuge island at crossing points. Also, please consider low-lying, indigenous greenery on the rest of the refuge island (perhaps moss). This combination of features would indicate to pedestrians where they should cross, and indicate to traffic where they could anticipate pedestrians. The low-lying greenery would assure that drivers could see pedestrians approaching or standing on the refuge island.

C (green line). Narrow through lanes from 16’ to 12’ at the most (perhaps narrower), from WalMart to Tonsgard Court. This would provide traffic calming, and free up existing right-of-way for pedestrian accommodations on the south side of the road.

D (blue circle). On the north side of the road, across from the Alaway intersection, improve definition between people waiting to cross at the crosswalk and people waiting for the bus. Currently, when people are collected in the area it is difficult to determine their intent.

E (orange line). Retain 16’ lanes from Tonsgard Court to the junction with Egan Drive (approximately mp 2.517 to 3.476). This would encourage industrial traffic to use the Vanderbuilt end of Old Glacier Highway to access the industrial areas around Anka and Tonsgard.

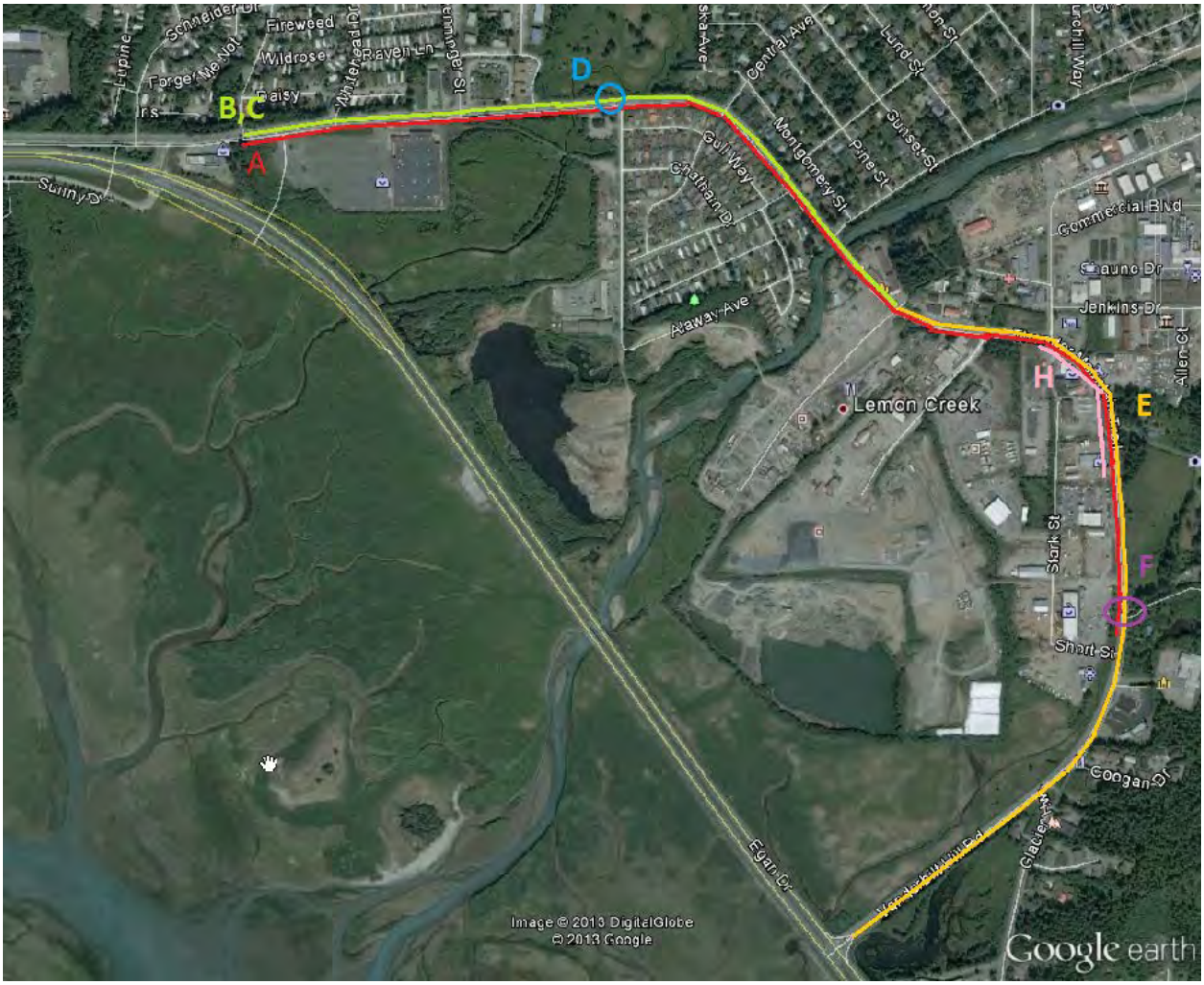
F (purple circle). Provide a paved refuge island across from Grant’s Plaza, at approximately mp 3.032. This would provide pedestrian access to those coming from the Church of Latter Day Saints, the Chinese Palace, and Coogan Drive to the bus stop on the southwest side of the road. Consider rolled curb or other features that would minimize impacts to hard-to-maneuver industrial traffic.

G. Maintain existing bike lane widths on both sides of the road. For bike commuters between downtown and the valley, this is the only option. The bike lane also distances pedestrians from tire spray.

H (pink line). Construction in the Commercial Boulevard/Anka area has redirected drainage, and there is a drainage problem on the south side of the road. Any upgrades might be an opportunity to address these challenges. Note that business impacted by the drainage issues take an active part in maintenance of the drainage ditches, with varying results.

Industrial traffic in the area frequently has knobby tires that carry rocks into the streets. The rocks come loose and eventually end up in the bike lane. The bike lane can be challenging in late summer, or when significant area construction and hauling is occurring. I am not sure there is any engineered way to address that challenge, but throw it out there in case the development team has ideas.

I understand that DOT&PF has concerns about pedestrian islands, as working around these islands makes snow removal less efficient. Additional sidewalks funded with federal money will create added winter maintenance obligation during times of reduced funding. Given the density of housing and the average income, I hope DOT&PF chooses to accommodate these increases.

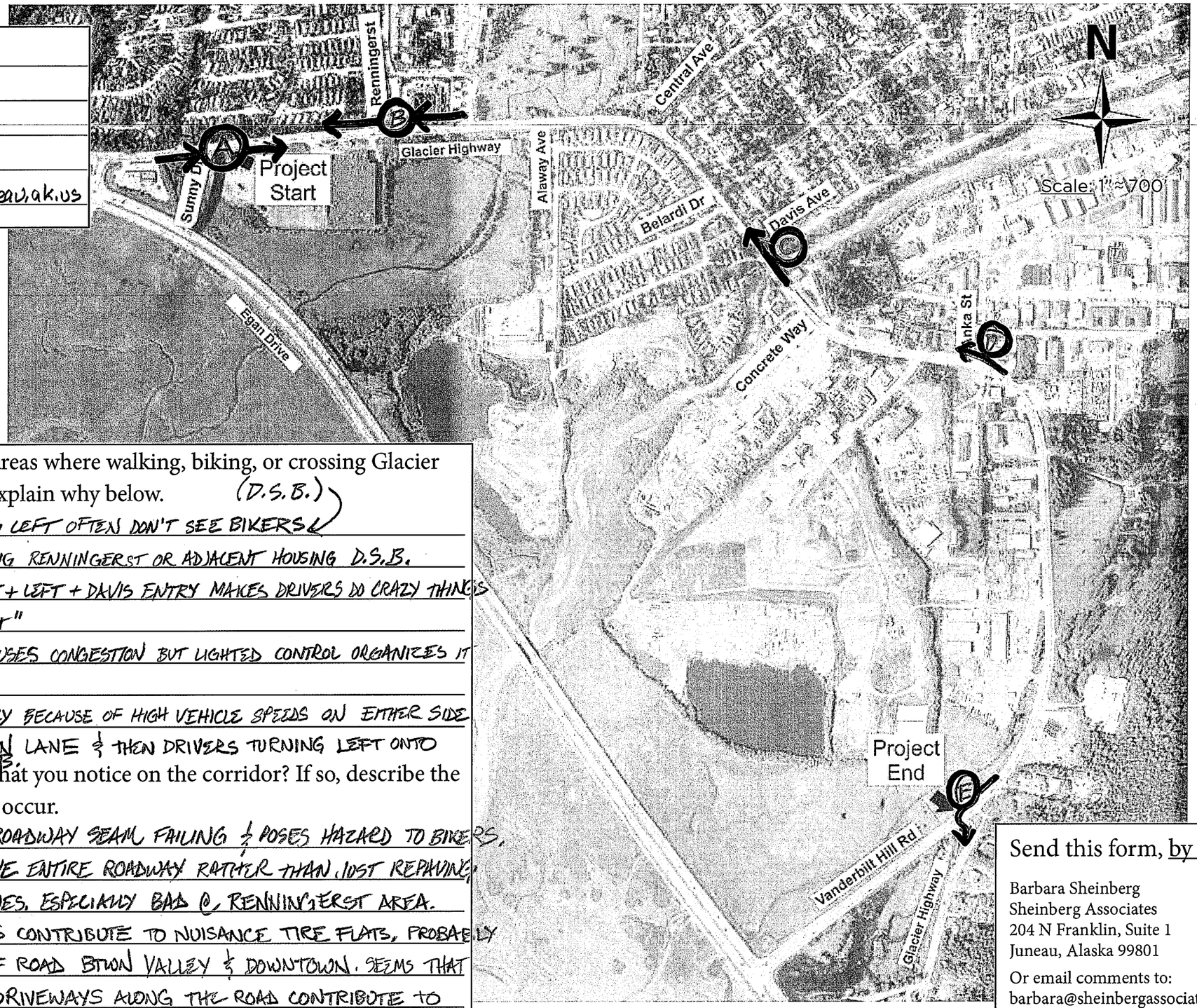


Thank you for your consideration,

Irene Gallion

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: NATHAN COFFEE
Address: 8129 PINEWOOD DR
Phone: 586-0895
Email: nathan_coffee@ci.juneau.ak.us



BIKERS PERSPECTIVE

1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below. (D.S.B.)

A.) WEST BOUND CARS TURNING LEFT OFTEN DON'T SEE BIKERS &
B.) TRAFFIC ENTERING/EXITING RENNINGER ST OR ADJACENT HOUSING D.S.B.
C.) COMBO OF BRIDGE + RIGHT + LEFT + DAVIS ENTRY MAKES DRIVERS DO CRAZY THINGS TO ENSURE THEY "MAKE IT"
D.) CROSS TRAFFIC @ ANKA CAUSES CONGESTION BUT LIGHTED CONTROL ORGANIZES IT SO IT'S NOT TOO BAD
E.) LEFT TURN CAN BE SCARY BECAUSE OF HIGH VEHICLE SPEEDS ON EITHER SIDE WHEN SITTING IN LEFT TURN LANE & THEN DRIVERS TURNING LEFT ONTO VANDERBILT ROAD D.S.B.

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

1.) PAVING @ SHOULDER TO ROADWAY SEAM FAILING & POSES HAZARD TO BIKERS. BAD IDEA JUST NOT TO PAVE ENTIRE ROADWAY RATHER THAN JUST REPAVING VEHICULAR TRAFFIC LANES. ESPECIALLY BAD @ RENNINGERST AREA.
2.) DIRTY RIDING SHOULDERS CONTRIBUTE TO NUISANCE TIRE FLATS, PROBABLY THE DIRTIEST STRETCH OF ROAD BTWN VALLEY & DOWNTOWN. SEEMS THAT A NUMBER OF UNPAVED DRIVEWAYS ALONG THE ROAD CONTRIBUTE TO THE PROBLEM. EXTENDING PAVEMENT APRONS ONTO THESE DRIVEWAYS COULD REDUCE THE PROBLEM

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

From: Nathan Coffee <Nathan_Coffee@ci.juneau.ak.us>
Date: February 7, 2013 1:50:03 PM MST
To: "'barbara@sheinbergassociates.com'" <barbara@sheinbergassociates.com>
Subject: Lemon Creek Improvments
Barbara:

Frankly, I like to see them spend money on a bypass rather than the improvements noted at meeting for I fear the improvements will just slow my passage through the corridor in question. I don't see it as being particularly unsafe, especially after bike commuting in Seattle for years, but it is the least savory part of my commute.

The most effective improvement would be to provide dueling bike lanes as are provided on Mendenhall Loop Road but imagine that there is insufficient ROW for this. Any separation that can be provided between bike and autos is good. However, raised concrete sidewalks are not good for biking as the control joints in concrete make for a rough and slower ride. If sidewalks are added they should be asphalt.

Nathan Coffee
W# (907) 586-0895
C# (907) 321-0528

Talitha Lukshin Spoken Comment – February 19

Lighting is often on the opposite side of the street than the pedestrians walk on. At Central Avenue it is dark and hard to see crossing children.

Davis Avenue should have traffic signal, pedestrian crossing, or some other way to slow traffic and allow crossing. When the buses are on the winter snow route, people have to cross the street to get to the bus stop and people have to cross street to cross Glacier Highway without any sort of crossing. Anyway to slow down traffic and create more gaps would be beneficial.

The Breeze In intersection has lots of truck traffic going to the concrete plant. There are lots of kids who like to go to Breeze In but there is no pedestrian crossing. There is a large residential area by Davis Avenue and the kids come from this area. All the vehicles come through this area at the speed limit of 40 mph.

There should be turnouts for the buses at all bus stops. They are working well at the locations that have them. The seaward side of Glacier Highway at Davies Avenue for snow route days would be a good location for one and the bus stops at Western Auto.

From: accereek@gmail.com [mailto:accereek@gmail.com] On Behalf Of Amber King
Sent: Tuesday, February 05, 2013 6:44 PM
To: Barbara@SheinbergAssociates.com
Subject: Fwd: HV/Montessori bus issues with the moving of stops on route #24 Glacier Highway Pedestrian issues

Hi Barbara,

I would have loved to be at the community meeting (as I have in the past) representing my neighborhood as well as SEAtrails, unfortunately I had to work late unexpectedly and will not make it.

I did want to forward you this pressing issue and email that I sent to the School board, Harborview Site Council and David Means of the school district, I got ZERO repsonse from it...

As you can imagine I'm pretty dismayed as I see it as a real concern and immanent danger to the children riding this bus and crossing glacier highway in the dark without a school light on at 7am to stand at a dark bus stop along a route frequented by homeless folks or street lamp.

Also what concerns me is the new LID and Eagle's edge construction that will be happening over the next few years to further disrupt access.

I'm sure you will be hearing a lot on this topic given your meeting location tonight, but I wanted to bring it to your attention, since I have been trying to get the school zone lights along glacier highway changed for over a year now to no avail.

The bus barn will not return my phone calls either!

There are a few suggestions I have for traffic and safety along this corridor....

Reduced speed for commercial vehicles to 30 mph.... at least three new crosswalks with lights.

One at Alaway and Glacier (I've stood at 2pm with a stroller in the crosswalk for over 20 minutes trying to get cars to stop and let me cross)

Davis and Glacier (near a major intersection and bus stop)

Western Auto or by the turn off to the Pioneer home... some access near that section of road. (again bus stop and no other place to cross anywhere near)

Increased street sweeping and cleaning in the summer time... Due to the commercial vehicles along the road it makes for very dangerous and unsafe conditions in summer and winter with sidewalks not cleared so people are walking in the road.

In the summer it's always littered with large rocks from the trucks and very dangerous for people in strollers and bicycles which many of the residents use as major transportation. Increased signage for crosswalks and bus stops...

If you have a presentation or other new information to present I would love to see a copy.

Cheers and best of luck,

Amber King
Amber King
SEAtrails
Secretary/Treasurer

907.209.2011
amber@seatrails.org
www.seatrails.org
Follow us on Twitter @ SEAtrails907

Let children walk with Nature, let them see the beautiful blendings and communions of death and life, their joyous inseparable unity, as taught in woods and meadows, plains and mountains and streams of our blessed star, and they will learn that death is stingless indeed, and as beautiful as life. ~John Muir
---------- Forwarded message ----------
From: Amber King <accereek@gmail.com>
Date: Thu, Jan 10, 2013 at 3:54 PM
Subject: HV/Montessori bus issues with the moving of stops on route #24
To: David Means <david_means@jsd.k12.ak.us>, dave_stoltenburg@jsd.k12.ak.us, Harborview Site Council <harborviewsitecouncil@gmail.com>
Cc: schoolboard@ci.juneau.ak.us, cbrown-mills@juneaupolice.com

Greetings,

On Monday my 1st Grade daughter was informed by a kid at her normal bus stop Gull Way and Alaway, that the bus had moved her stop down the block. She was worried and confused and walked back home to let me know.

I immediately called Harborview to ask where the new stop was and why parents were not notified. The office staff were unaware that there was a change. I then called the Bus Barn and asked for additional information. I was told that it had moved a block down Alaway and that someone would return my call to discuss it further after I told her that parents were not notified and that the school was also unaware of it. I have yet to receive that phone call...

Today I physically drove her to the spot, which is on the left hand side of the street in complete darkness in a spot near a steep ravine and in an that has an abandoned building nearby plus high derlict and homeless traffic on a old trail that goes through the woods to Walmart. My family walks our dog along this path daily and it is always an area of unease It really makes me nervous to send my seven year old to walk in the dark along that path to her bus stop now. I have been asking the district (and CBJ, DOT) to please adjust the school zone lights on Glacier highway for over a year now as there is a lot of young student traffic walking along Glacier highway to this bus stop. I believe it was moved due to issues with the building owner at the Three Professional Building as many parents wanted to wait until the bus came since it was in such a high traffic area and most of the year in darkness. This caused traffic issues and snow plowing issues for the building owner and conflict with students. If there had been better communication or action sooner this change might have been avoided but this is a very busy bus stop with anywhere from 20-30+ students boarding the bus at this first stop.

Presently the lights turn on at 8am -8:30am for Middle and High School Students but do not turn on lowering the speed limit from 40-20mph from the hours of 7:00am-7:30am when smaller less visible children are walking along Glacier Highway and attempting to use the very ineffective cross walk at Alaway Street.

My requests are these.

1. Please move the first bus stop for Route #24 on to Chatham Street, instead of Alaway, this would allow better lighting and the safety of being inside our neighborhood when the bus stops for these elementary students as well as keep traffic moving on Alaway

street which can become severely congested with traffic waiting to turn onto Glacier Highway and other smaller school bus activities.

2. Revise the current Glacier Highway School Light Zone to reflect actual student traffic from 7:00am to 7:30am and continue the 8:00am to 8:30am light schedule.

3. Make sure proper communication is in place before moving school bus stops, printed schedules, website updates and ensure student and parent communication.

Sincerely,

--

Amber King
Independent Consultant
Tel: 9072092011
Email: accereek@gmail.com

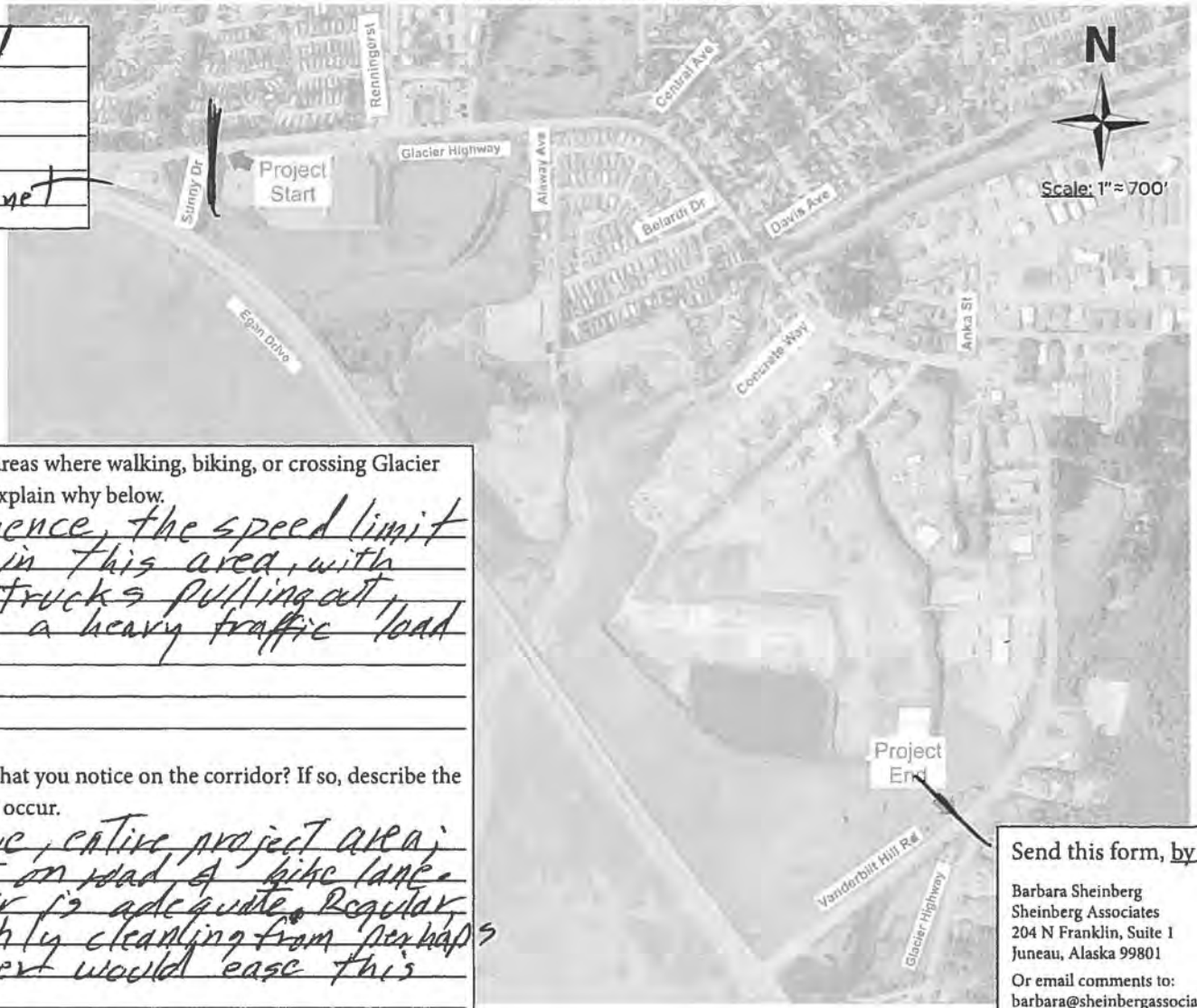
From: Eric & Vicki
To: Donovan Bell
Subject: Anka
Date: Thursday, February 14, 2013 7:37:59 PM

John McConnochie sent his email to you around to the cycle club emaillist .
good ideas.
John is right about the gravel in the road. Once the building season starts, the fill dirt trucks lose lots of gravel and dirt along that section.
I wonder if a roundabout has been considered for the GH-Anka corner where the WellsF bank is. Maybe not enough room, or too many intersecting streets? The one at the J-D bridge seems to me to work well enough despite the worries of many.
Thanks
Eric Olsen

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: Bruce Dunnford
Address:

Phone:
Email: bdinnford@gci.net



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

In my experience, the speed limit is too high in this area, with large, heavy trucks pulling out, children, & a heavy traffic load

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

One main issue, entire project area; gravel / dirt on road & bike lane. The shoulder is adequate. Regular, perhaps monthly cleaning from perhaps March – October would ease this problem.

Thanks.
BD

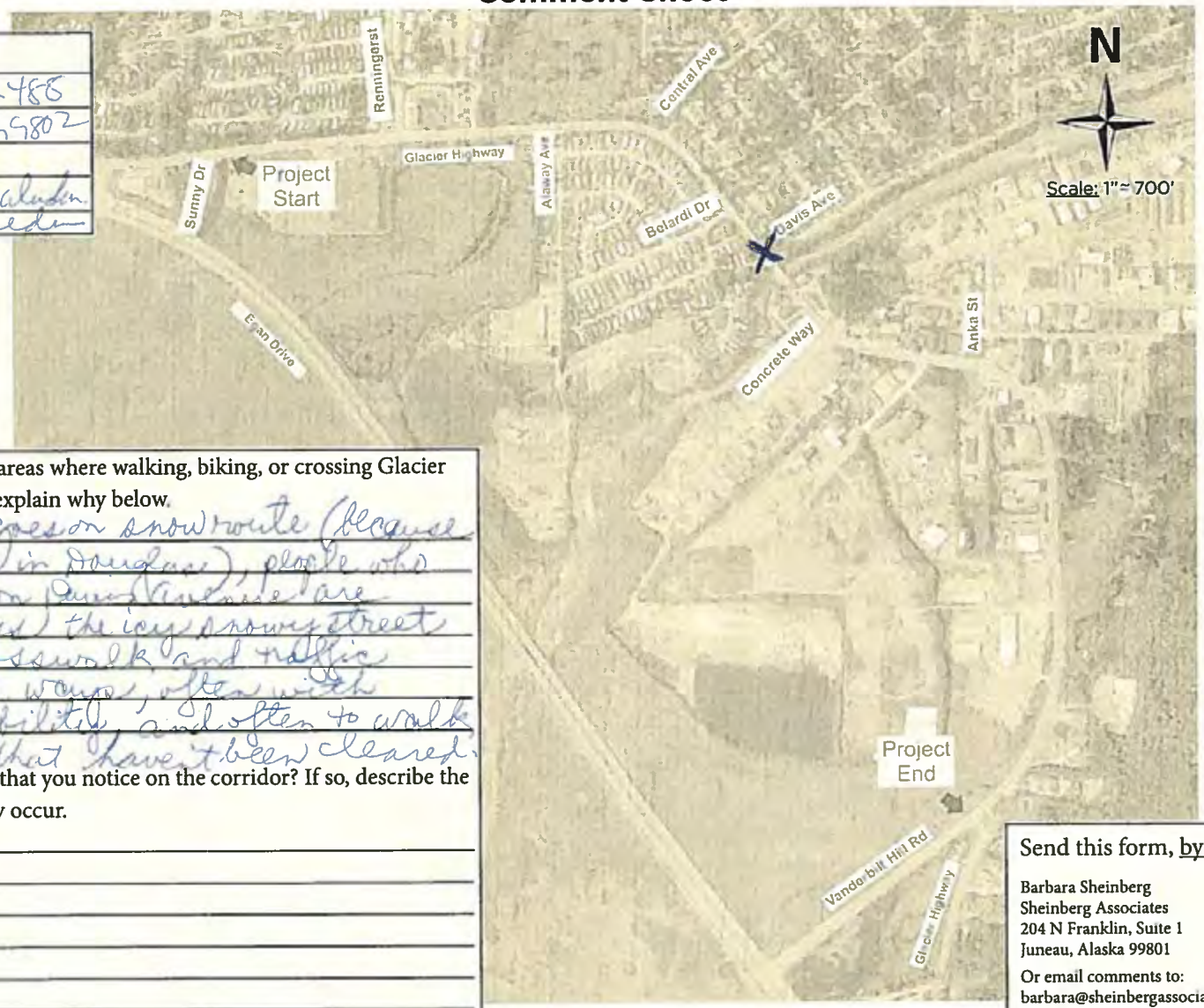
Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: Ethan Os
Address: P.O. Box 22486
Juneau AK 99802
Phone: 796 6432
Email: ehayes@uas.alaska.edu



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

When the bus goes on snow route (because of conditions in Douglas), people who need to go down Douglas are forced to cross the icy snowy street with no crosswalk and traffic coming both ways, often with limited visibility, and often to walk on sidewalks that haven't been cleared.

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

Dear Donovan,

I live on Sunny Point and ride a bicycle on this section of Old Glacier Highway most days of spring, summer and fall. And I drive it every day I am in Juneau. I really appreciate DOT focusing on this segment and improving it for cyclists, pedestrians and motorists.

For commuter type cyclists I recommend the following.

1. Wide shoulders (current ones are ok.)
2. Improve pavement.
3. Good striping and signage to inform motorists and cyclists
4. Maintenance/sweeping more than is done now.
5. Make gravel trucks cover their loads so they do not dump dangerous material onto the shoulders.

For pedestrians and local bike traffic (especially kids) do the following additional actions.

1. Separated sidewalks on both sides of the road. The further away from the road the better.
2. Signage at intersections for pedestrians, cyclists and motorists.

For everyone's sake improve the following intersections.

1. Either make Anka Street a big round about or add a straight through street next to and behind AEL&P so gravel trucks can go straight through the light onto a new road that goes back to Concrete Way via the dump so gravel trucks, etc do not have to make a right on to old Glacier Hwy and then an immediate left onto Concrete Way
2. Have Reninger St intersection be the entrance to Walmart and signalize it. It will concentrate pedestrian crossings for Walmart and the bus stop and make it easier and safer to cross. Move the north side bus stop closer to the new intersection.

For everyone's sake have limited turn options either by median strips and safe turn lanes, or limited turn hours at the following intersections.

1. Concrete Way
2. Anka if there is no other improvement.
3. Into Western Auto parking lot.
4. Reninger if there are not other improvements.
5. Davis Ave.

Thanks.

Sincerely,

Frank Rue
7083 Hendrickson Rd.
Juneau, Ak. 99801
rues@gci.net

02.14.13

Donovan Bell
Sheinberg Associates

Dear Donovan,

Firstly I would like to thank ADOT & PF, Kittelson & Associates and Sheinberg Associates for inviting the Juneau Freewheeler Bicycle Club to the Stakeholder Meeting on February 5th to hear our "Top 2" things the project team needed to know about the corridor. It is appreciated that you are engaging the stakeholders very early on in the process.

The intent of this letter is to more fully present our comments regarding the Glacier Highway Bicycle and Pedestrian Improvements in the Lemon Creek corridor.

Please find our comments, outlined briefly, below.

-Wider shoulder/bike lanes through the corridor.

-Anka Street traffic light to be bike sensitive regarding activation

-Manhole covers closer to the curb and not in the middle of the bike lane

-Make sure the paving seams are not in the bike lane

-Better lighting through the corridor.

-Culvert cover grates to be perpendicular to the sidewalk

-Widen the Lemon Creek Bridge southbound to accommodate a wider bike lane (perhaps a clip-on to the existing bridge since it will be too expensive to replace the bridge).

If you would like further clarification regarding any of the above comments please do not hesitate to contact me.

The other item I would like to address is the issue of the ongoing maintenance in this area. I know this is an operational and not a capital expense. However it would be disappointing for DOT to spend $10 million on the project to improve the biking and pedestrian safety to only have the debris problem continue thus compromising the goal of the project. I would ask that DOT, on a set schedule, have a sweeper go through the corridor once a week during the riding season, March through October.

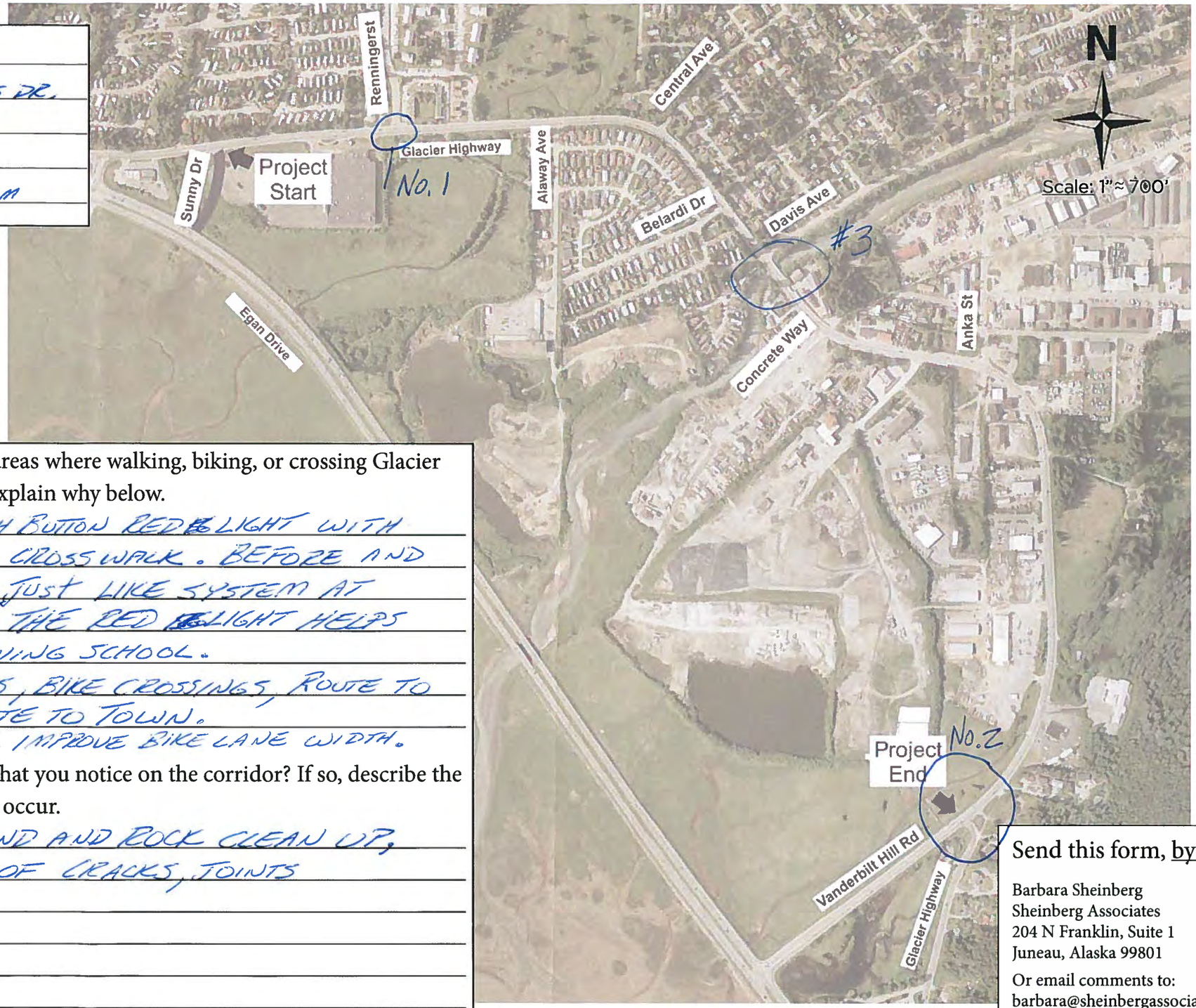
Again thank you for the opportunity to comment on this project Donovan.

Yours Sincerely

John P. McConnochie
President
Juneau Freewheelers Bicycle Club
jpm@gci.net
907-723-1876
3172 Pioneer Avenue
Juneau, Alaska 99801

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: FRITZ MOSER
Address: 3466 RICHARDS DR.
Phone: 209-9826
Email: fakufritz@msn.com



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

(#1) PROVIDE PUSH BUTTON RED LIGHT WITH SCHOOL EMPLOYEE CROSSWALK. BEFORE AND AFTER SCHOOL, JUST LIKE SYSTEM AT FLOOD DRYDEN. THE RED LIGHT HELPS WITH CARS LEAVING SCHOOL.
(#2) PROVIDE SIGNS, BIKE CROSSINGS, ROUTE TO VALLEY AND ROUTE TO TOWN.
(3) BRIDGE WIDTH, IMPROVE BIKE LANE WIDTH.

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

YES - POOR SAND AND ROCK CLEAN UP, POOR SEALING OF CRACKS, JOINTS

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

From: Gerry Landry
To: Donovan Bell; barbara@sheinbergassociates.com
Subject: Glacier Highway Bicycle and Pedestrian Improvement Plan
Date: Wednesday, February 13, 2013 5:47:02 PM

Hello Barbara and Donovan,

My brief comments apply to the entire corridor by using the “Treatment Options- Corridor Wide” on Page 4.

As an occasional bicycle commuter, I prefer to ride with traffic. Therefore signs, pavement marking, illumination and driveway treatments are my preferred option.

As a member of PRAC and the cycling community, I've received input from riders that prefer enhanced, large bike lanes, if not a separate path.

Gerry Landry
(907) 523-2895 home
(907) 321-2206 cell

From: Michael Hekkers
To: dbell@sheinbergassociates.com
Subject: Glacier highway comments
Date: Monday, February 11, 2013 11:27:16 AM

I bike from DT to UAS frequently, the entire A-E corridor, so the most important improvement is creating a bypass that parallels Egan from Vanderbilt Hill to the overpass.

There are over 3 dozen driveways, streets and turnouts between the Ferry office/DOT and the southern end where it heads toward the Pioneer Home so many opportunities for typical bike/car crashes, T-bones, and upcoming behind cars overtaking and cutting off bikers.

The issues for me biking through here mostly northbound) are
1. cars and large trucks wandering into the bike lane, not only on curves but straightaways too Sections D, E.
2. There is too much dirt and sometimes snow on the bike paths from large dump trucks/dump trucks coming out of Western Auto area, and the Dump and Gravel/Breeze In area.

3. I've also had some close calls with vehicles turning right, northbound onto Glacier Hwy from Davis, Renninger, Central, and Anka Streets.

The best thing to solve 1&2 would be to make separated bike paths, not just lanes.
If special raised medians are created at intersections, please make them as straight as possible. For example the roundabout on Douglas has bike lanes that are ineffective because they are not straight and they reduce the speed of bikes so others like myself don't use them frequently but use the road instead. Bike islands like at the SE corner of Egan and Mendenhall Loop/Glacier Spur, and Riverside/Egan are OK in terms of safety but maybe could be straighter?

I bike with flashers and wear bright/reflective clothing and I've noticed lots of "local" Lemon Creek folks do not. Are the bikers involved in crashes wearing these things?

Side note: Interestingly, my scariest part of my ride is riding on the high speed Glacier Hwy from Bro Bridge over the hill to UAS where big trucks and buses again cross into the bike lane. Biking through Lemon Creek is my least favorite part of my ride because of the high traffic volumes and reasons 1-3.

Mike Hekkers
423 Third St.
Juneau

From: Kevin K Maier
To: Donovan Bell
Cc: Barbara Sheinberg
Subject: Glacier Hwy Bike/Ped project
Date: Friday, February 08, 2013 5:04:21 PM
Attachments: 2013_02_08_16_49_04.pdf

Hi Donovan and Barb,

Sorry I couldn't make the public hearing. I support any and all of the outlined improvements for pedestrians and cyclists in this area. I've attached some specific comments, but I think fixing this area should be of the highest priority for Juneau. I think this is important not just because it's decidedly the most dangerous part of my bike commute, but given the large number of pedestrians in the area, and the socioeconomic status of the residents, I think it is simply imperative that we do something about the dismal conditions for non-motorized travel here. Thanks for your work on this project!

Please don't hesitate to contact me if you have further questions and please keep me in the loop on future developments.

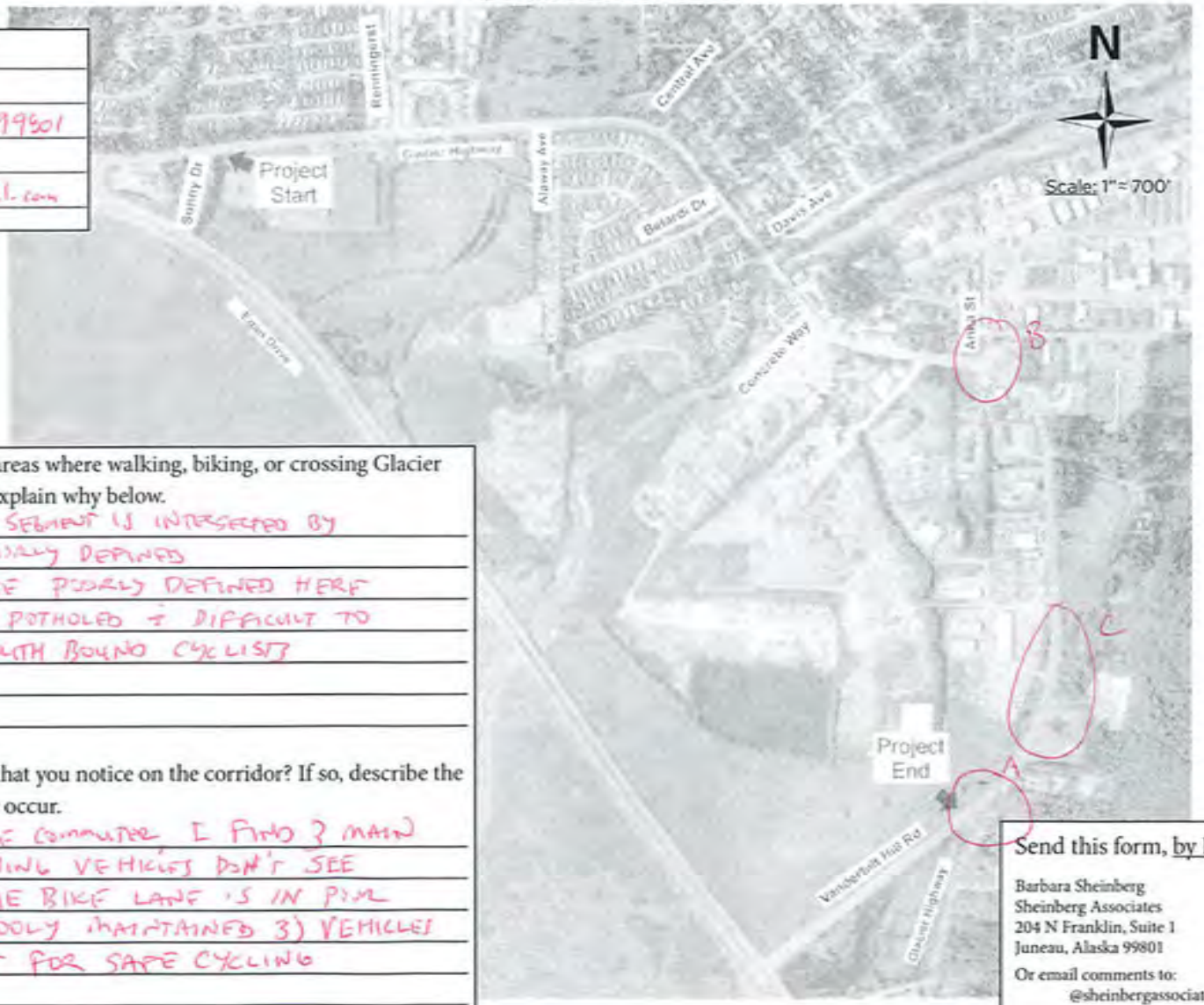
Best,

Kevin

Kevin Maier
Assistant Professor of English
University of Alaska Southeast
11120 Glacier Highway
Juneau, AK 99801
kevin.maier@uas.alaska.edu

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: KEVIN MAIER
Address: 1025 O St.
JUNEAU AK 99801
Phone: 957-0357
Email: kevinkmaier@gmail.com



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

A. THIS BIKE PATH SEGMENT IS INTERSECTED BY DRIVEWAYS & IS POORLY DEFINED
B. BIKE TURN LANE POORLY DEFINED HERE
C. TURN LANE IS POTHOLED & DIFFICULT TO ACCESS FOR SOUTH BOUND CYCLISTS

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

AS A REGULAR BIKE COMMUTER I FIND 3 MAIN ISSUES: 1) TURNING VEHICLES DON'T SEE CYCLISTS 2) THE BIKE LANE IS IN POOR CONDITIONED & POOLY MAINTAINED 3) VEHICLES TRAVEL TOO FAST FOR SAFE CYCLING

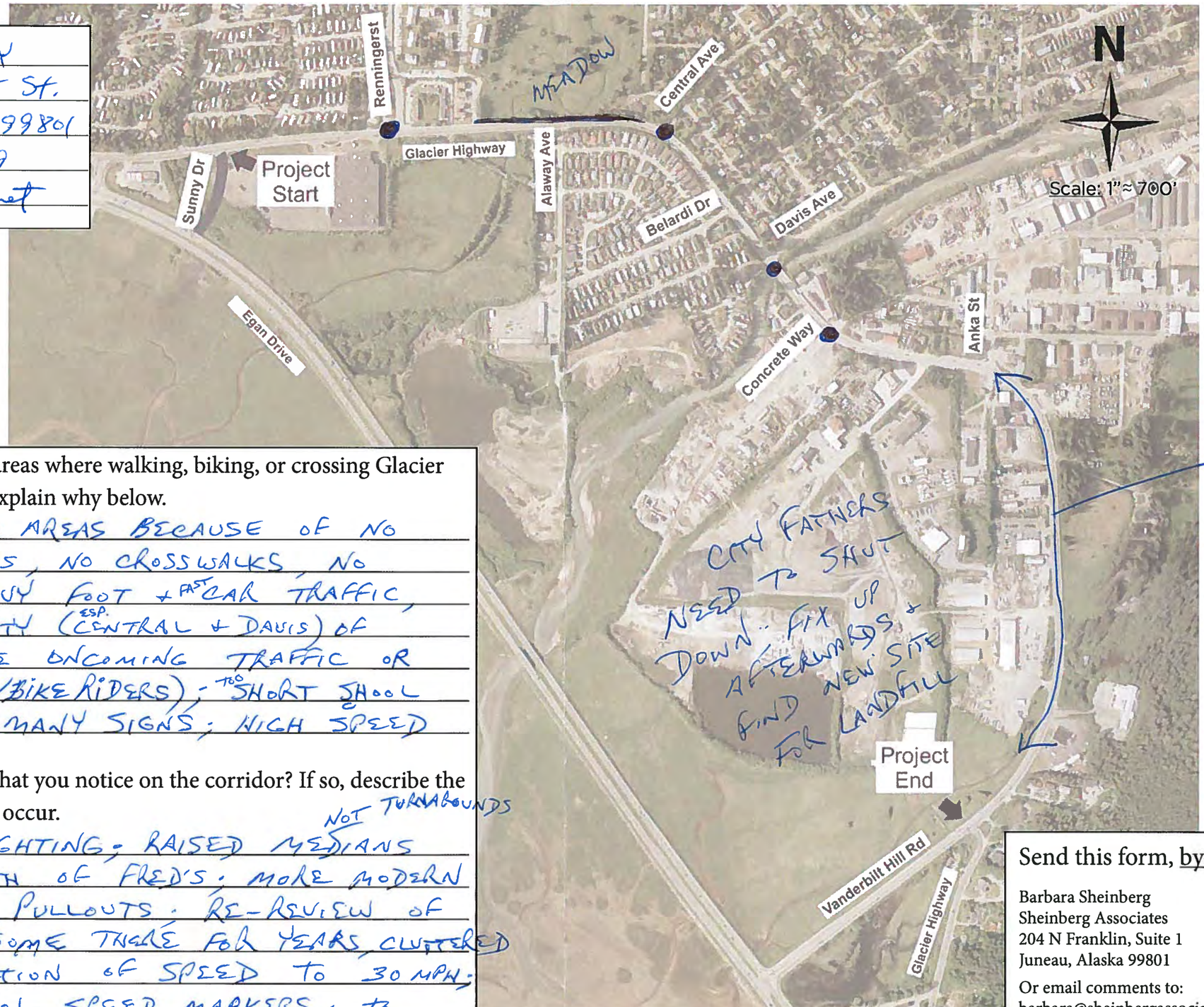
Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
@sheinbergassociates.com

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: JACKIE DAILEY
Address: 5959 SUNSET ST.
JUNEAU, AK. 99801
Phone: CELL (907) 780-4539
Email: KRCJD@gci.net



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

4 ● ARE PROBLEM AREAS BECAUSE OF NO SIGNAL LIGHTS, NO CROSSWALKS, NO LIGHTING, HEAVY FOOT + FAST CAR TRAFFIC, POOR VISIBILITY (ESP. CENTRAL & DAVIS) OF DRIVERS TO SEE ONCOMING TRAFFIC OR PEOPLE (WALKERS/BIKE RIDERS); TOO SHORT SCHOOL MARKERS; TOO MANY SIGNS; HIGH SPEED (40 MPH)

SEE MAP

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

NEED BETTER LIGHTING; RAISED MEDIANS SUCH AS SOUTH OF FRED'S; MORE MODERN BUS STOPS & PULLOUTS. RE-REVIEW OF ALL SIGNS (SOME THERE FOR YEARS, CLUTTERED LOOK); REDUCTION OF SPEED TO 30 MPH; LENGHTEN SCHOOL SPEED MARKERS; TO NOT TOUCH SMALL MEADOW LAND BUT PUT CHAIRS ALONG THERE (BEAUTIFY)

NOT TURNAROUNDS

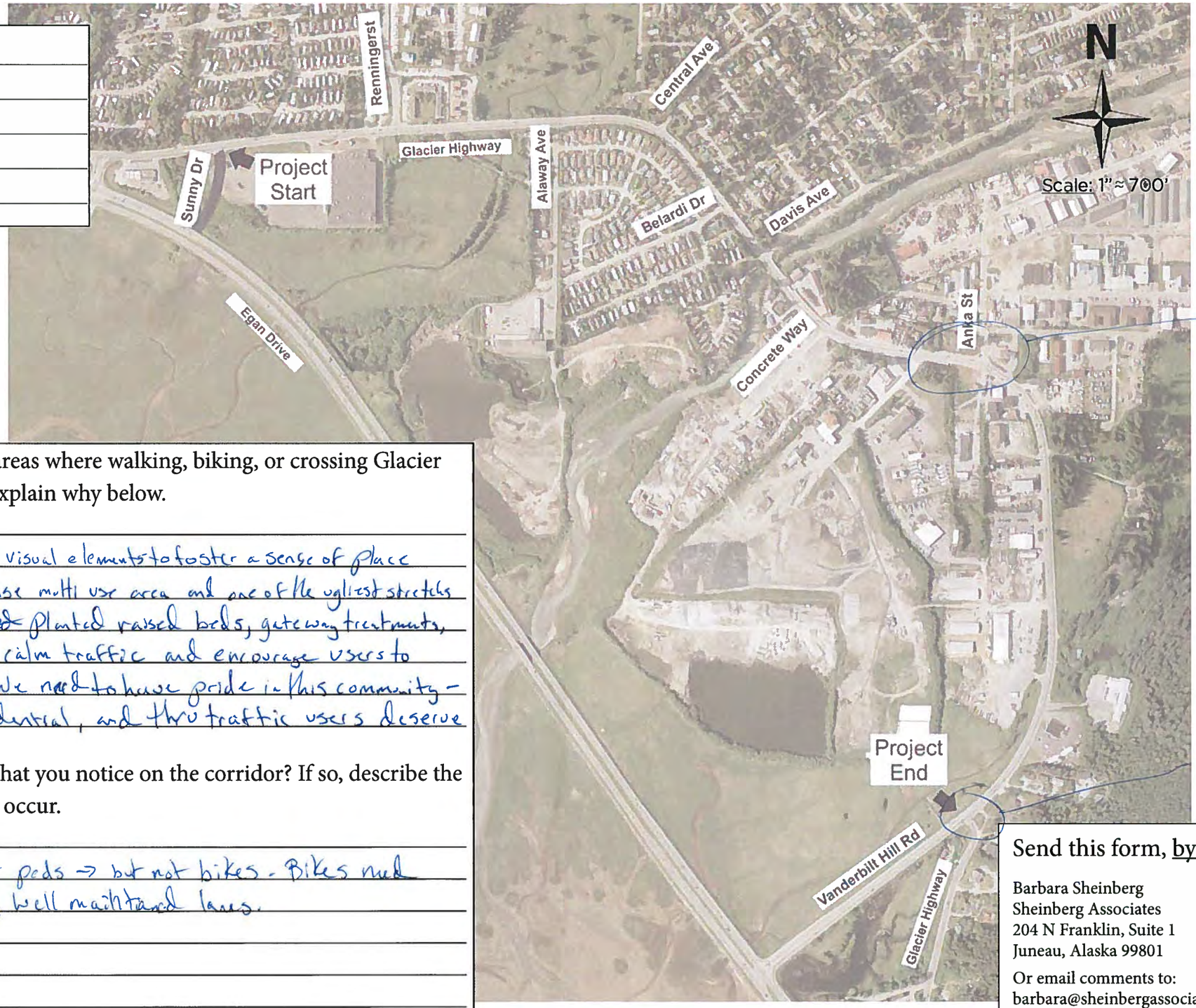
Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: Karlene Wiebold
Address: 2209 Dunn St
Juneau, AK 99801
Phone:
Email:



1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

We need to incorporate visual elements to foster a sense of place and pride. This is a dense multi use area and one of the ugliest stretches of road in Juneau. ~~Planted~~ Planted raised beds, gateway treatments, nice lighting can all calm traffic and encourage users to respect each other. We need to have pride in this community - it's commercial, residential, and thru traffic users deserve it.

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

* sidewalks are good for peds → but not bikes - Bikes need a lane. A well marked, well maintained lanes.

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

Or email comments to:
barbara@sheinbergassociates.com

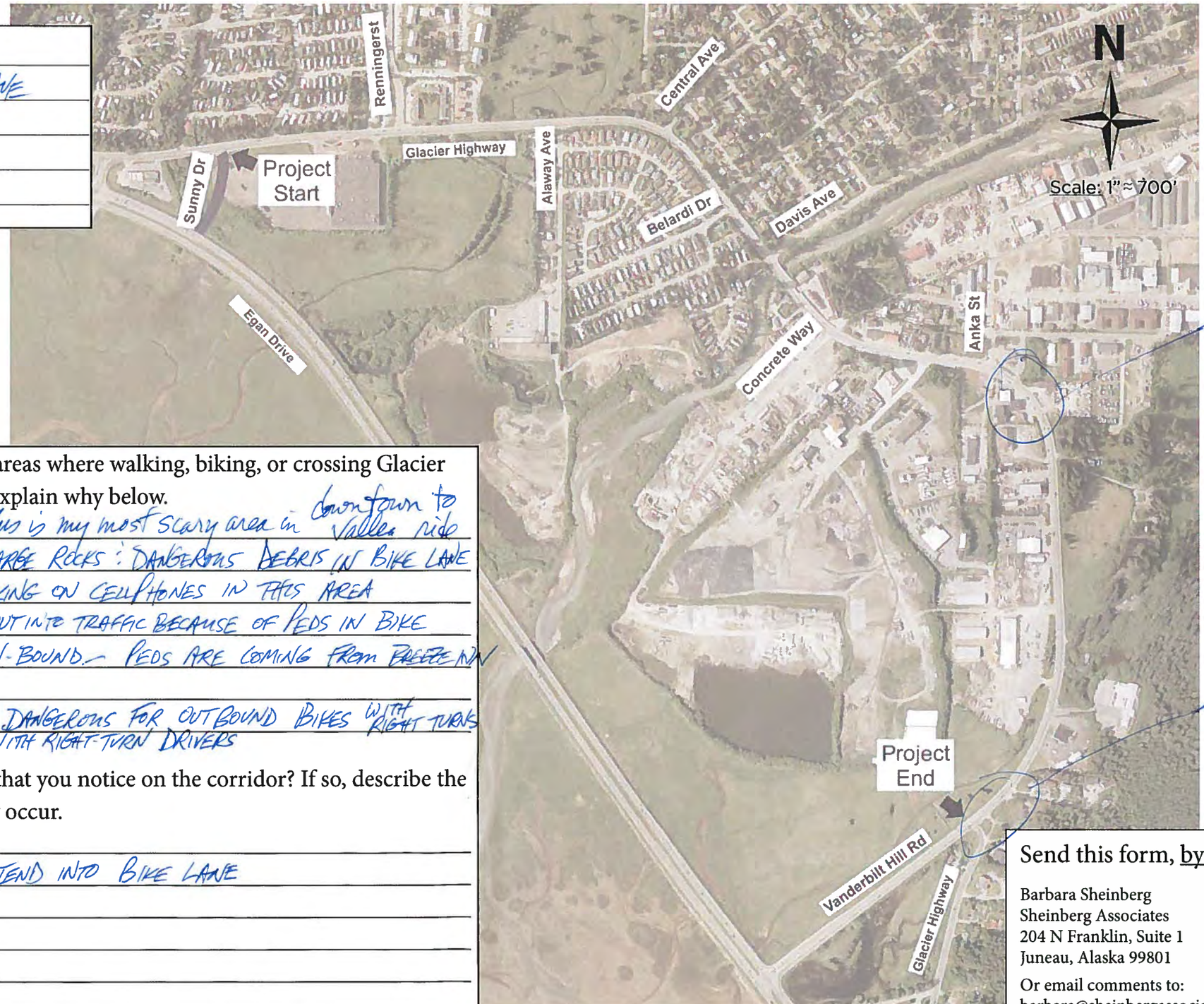
Glacier Highway Bicycle & Pedestrian Improvement Plan
Comment Sheet

Name: LIN DAVIS

Address: 3099 NOWELL AVE
JUNEAU

Phone: 586-4111

Email: molin@gci.net



INBOUND BIKE LANE FEELS NON-EXISTENT AT THIS CURVE. CARS MOSTLY drive over the fog line cut the corner.

INBOUND: How to safely get over to make left hand turn to Twin Lakes

1. Mark up the map to show areas where walking, biking, or crossing Glacier Highway is a challenge, and explain why below.

As a bike commuter this is my most scary area in downtown to Valley ride
TOO OFTEN THERE ARE LARGE ROCKS : DANGEROUS DEBRIS IN BIKE LANE
I SEE MOST DRIVERS TALKING ON CELL PHONES IN THIS AREA
I OFTEN HAVE TO GO OUT INTO TRAFFIC BECAUSE OF PEDS IN BIKE LANE WHEN I AM IN-BOUND. — PEDS ARE COMING FROM BREEZE IN
ANKA INTERSECTION VERY DANGEROUS FOR OUTBOUND BIKES WITH RIGHT TURNS HARD TO SIGNAL WITH RIGHT-TURN DRIVERS

2. Are there recurring issues that you notice on the corridor? If so, describe the issue(s) and mark where they occur.

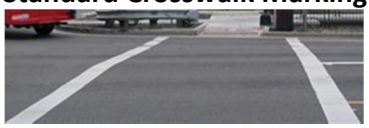
LOTS OF DUST
HEAVY TRUCKS THAT EXTEND INTO BIKE LANE

Send this form, by Febuary 18, 2013 to:

Barbara Sheinberg
Sheinberg Associates
204 N Franklin, Suite 1
Juneau, Alaska 99801

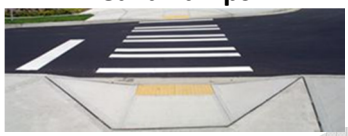
Or email comments to:
barbara@sheinbergassociates.com

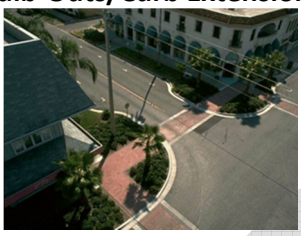
Appendix B Potential Treatment Tables

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Standard Crosswalk Marking 	Two painted or thermoplastic solid lines installed transversely across a roadway.	Defines the pedestrian path of travel across the roadway and alerts road users to the crosswalk location.	Overuse of crosswalk markings can diminish their safety impact by desensitizing road users.
High Visibility Crosswalk Markings 	Series of longitudinal painted or thermoplastic solid lines installed across a roadway. Visibility is increased when outlined by two solid transverse lines.	High visibility markings alert road users of the crosswalk at a greater distance than traditional markings.	Maintenance and installation costs are higher for high-visibility crosswalks than for standard crosswalk markings.
Raised Crosswalk 	A raised crosswalk is designed to have pedestrians cross at the same level as the sidewalk.	Provides better visibility for pedestrians and motorists. Slows down motorists.	Can be expensive. Can be difficult to navigate for large trucks, snow plows, and low ground clearance vehicles.
Textured or Ornamental Crosswalks 	The use of paint, brick pavers, or alternate paving materials to create a unique surface within the crosswalk area.	Provides a distinct sense of place. May increase the visibility and awareness of the crosswalk area.	May require additional maintenance, particularly if painted.
Shared Pedestrian-Bicycle Crossing Marking 	High-visibility crosswalk marking located side-by-side with a bike crossing, indicated by the bike pavement legend. Bike crossing may be enhanced with high-visibility paint (as shown) or colored asphalt.	Provides a separated crossing for bicyclists and pedestrians without legally requiring bicyclists to dismount. Provides warning to motorists to look for both pedestrians and bicyclists.	Maintenance and installation costs are higher than for high-visibility crosswalks or standard crosswalk markings.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Intersection Bike Lanes 	A bike lane that is striped through an intersection.	Provides continuation of a bike lane through an intersection. Provides separation of bicyclists from pedestrians at crossings without forcing bicyclists to dismount.	Additional cost and maintenance.
Painted Conflict Zones 	A portion of roadway that is colored with high-contrast paint or asphalt (typically bright green).	Indicates an area of the roadway where bicyclists and vehicles may cross paths. Increases awareness of conflict zone. Provides a clear path of travel for bicyclists.	Additional cost and maintenance.
Bike Box 	A designated area on the roadway at the head of a signalized intersection leg where bicyclists can position themselves during the red phase. The box is typically indicated with high-visibility paint and a bike pavement legend.	Increases visibility of bicyclists at intersections. Helps prevent bicycle-vehicle collisions, particularly right-hook crashes. Bicyclists may use to access left turns at the intersection.	Additional cost and maintenance. Education campaign may be needed as there may be some confusion when bicyclists approach intersections during the green phase.
Pavement Markings 	Paint or thermoplastic markings on the roadway that provide advance warning.	Increases motorist awareness of bicycle or pedestrian roadway crossing activity.	May require additional maintenance, particularly if painted.
Pedestrian Crossing & Advance Pedestrian Sign Assembly 	Retro-reflective pedestrian crossing or school crossing signs with diagonal downward pointing arrow or "ahead" plaques.	Alert road users that pedestrians may be entering the roadway. Provides advance notification to road users that pedestrians may be entering the roadway.	May increase roadway sign clutter. Additional maintenance.

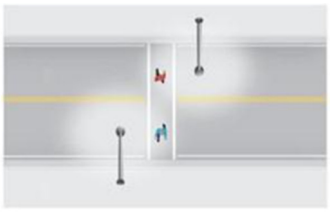
Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
In-Street Pedestrian Crossing Sign 	Retro-reflective sign placed in the median of a crosswalk.	These Alaska MUTCD-approved signs are highly visible to road users since they are near their travel path.	In-roadway signs typically require more maintenance than roadside signs.
Trail Crossing Sign 	Retro-reflective sign to indicate trail crossings.	Provides notification to road users that pedestrians or bicyclists may be entering the roadway.	May increase roadway sign clutter. Additional maintenance.
Trail Approach Treatments 	Retro-reflective bollards or posts, centerlines, and traffic control signage placed at a trail's intersection with a roadway.	Alert trail users to a roadway crossing. Channelizes trail users. Discourages unauthorized entry onto the trail by motorized vehicles.	Additional maintenance.
Trail Approach Diverter 	A raised area installed at a trail head that prevents direct access to the curb ramp at the trail's intersection with the roadway.	Forces bicyclists to slow down on approach to roadway. Channelizes trail users and alerts them to a roadway crossing Discourages unauthorized entry onto the trail by motorized vehicles.	Additional maintenance. May result in more diversion for pedestrians.
Stop Bar Marking 	Paint or thermoplastic markings on the roadway that indicate where motorists should stop.	Markings are placed so that motorists are advised to stop in advance of the pedestrian crosswalk or further back for larger vehicles turning onto the street.	Additional maintenance.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Advanced Yield Marking 	"Shark Teeth" line markings across a roadway, installed 20 to 50 feet in advance of a marked crosswalk.	Advance yield markings, accompanied by "Yield Here to Pedestrian" signs (see below), reduces the potential for multi-threat crashes by increasing pedestrian visibility.	Additional expense and maintenance.
"Yield Here to Pedestrians" Sign 	A roadside sign that accompanies Advance Yield Markings, installed at the crosswalk on both sides of the roadway.	"Yield Here to Pedestrian" signs, accompanied by advance yield markings, (see above), reduce the potential for multi-threat crashes by increasing pedestrian visibility.	Additional expense and sign clutter.
Curb Ramps 	Curb cuts for pedestrian transitions between the roadway and walkway.	Allows pedestrians with disabilities to access crosswalk. Helps bicyclist's access crosswalk.	May interfere with drainage and/or utilities. Two perpendicular ramps at each corner of an intersection are preferred to a single diagonal ramp. Additional maintenance.
High-Contrast Detectable Warning (Truncated Domes) 	A surface that is composed of an array of truncated domes and installed at transitions between protected walkways and areas where vehicles may be present.	Increases accessibility for vision-impaired pedestrians in the public right-of-way.	Additional cost and maintenance.
Median Refuge 	A protected area in the middle of the roadway for pedestrians or bicyclists to cross in stages.	Pedestrians can utilize shorter gaps in traffic due to ability to cross in stages. Provides refuge area, increasing safety of crossing. Slows vehicle speeds near crosswalk.	Right of way constraints (6' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Offset Median Refuge/Crosswalk (Danish Offset) 	A variation of a median refuge, the crosswalk is offset so that bicyclists and pedestrians travel facing opposing traffic in the median before crossing the second leg	Similar advantages as a median refuge. Encourages pedestrians and bicyclists to view traffic conditions before crossing.	Right of way constraints (8' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.
Angled Median Refuge 	A variation of a median refuge, the crosswalk is angled to address offset conditions due to roadway configurations.	Similar advantages as a median refuge. Encourages pedestrians and bicyclists to view traffic conditions before crossing. Addresses off-set intersections.	Right of way constraints (6' width minimum needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.
Bulb-Outs/Curb Extensions 	Extensions of the curbs at intersections or mid-block crossings that protrude toward the center of the roadway for at least several feet.	Shorter crossing distances for pedestrians. Increases visibility between motorists and pedestrians. Studies show an average of 7% reduction in vehicle speeds.	Used only on streets where on-street vehicle parking is present. May require changes to roadway drainage system. Additional cost and maintenance may be needed if extensions include landscaping.
Reduced Curb Radii 	Designing or retrofitting street and driveway corners with smaller radii (15 to 30 feet).	Shorter crossing distances for pedestrians. Slows vehicles turning in and out of streets and driveways. Better geometry for installing perpendicular curb ramps.	May require changes to roadway drainage system. Larger vehicles may encroach into opposing lane to make turns. Additional cost.
Pedestrian Flags  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Orange or yellow flags placed near crosswalks that pedestrians can use to cross the street.	May increase visibility of pedestrians in crosswalks.	Logistically challenging if pedestrian directional flows are not balanced. May require education program and/or monitoring program to maintain flags.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Pedestrian Actuation - Active  *Source :Kelly Blume, Kittelson & Associates, Inc*	A push button that actuates electronic pedestrian crossing aids.	Alerts motorists to pedestrian crossings and results in high motorist yield rates. Easily understood by pedestrians. May provide more crossing time for pedestrians at signalized intersections.	Cost and additional maintenance. Requires pedestrian action to operate. Locating actuation so that disabled pedestrians can use.
Pedestrian Actuation - Passive  *Source: Shawn Poynter, notawigshop.com (Knoxville, TN)*	A designated area where pedestrians wait to actuated crossing aids.	Automatically activate any electronic warning treatments.	Cost and additional maintenance. Pedestrians must use crosswalk entrance for treatment to work.
Bicyclist Actuation - Active  *Source: LADOT Bike Blog, ladotbikeblog.wordpress.com*	A push button that actuates electronic bicycle crossing aids.	Alerts motorists to bicycle crossings and results in high motorist yield rates. Easily understood by bicyclists. May provide more crossing time for bicyclists at signalized intersections.	Cost and additional maintenance. Requires bicyclists action to operate. Locating actuation so that bicyclists can use without having to dismount.
Bicyclist Actuation - Passive  *Source: Kevin Lee, Kittelson & Associates, Inc.*	A designated area where bicyclists wait to actuate crossing aids, such as in-pavement loop detectors or video camera.	Automatically activate any traffic signal or electronic crossing aid. Most vehicle loop detectors can be calibrated to detect bicyclists. Video cameras are simple to set for bicyclist detection. Increases bicyclist compliance at signalized intersections.	Cost to calibrate or install at locations with in-pavement loop detectors. Bicyclists must be positioned properly for detection to work. Additional bicyclist education may be needed for detection and positioning guidance.
In-Roadway Warning Lights  *Source: Thomas Burnham, Spot Devices, Inc.*	Actuated, embedded flashing lights that line the crosswalk and are actuated by pedestrians or bicyclists.	High visibility of pedestrian crossings for dark or dim lighting conditions. The warnings are more visible to motorists than overhead beacons.	High installation and maintenance costs. Must be replaced in the event of re-surfacing. Embedded lights may pose a hazard to bicyclist travel.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Rectangular Rapid-Flashing Beacon (RRFB)  *Source: Yuri Mereszczak, Kittelson & Associates, Inc. & FHWA*	RRFBs are user-actuated LEDs (typically two separate lights) that use an irregular flash pattern and supplement pedestrian warning signs.	RRFB are dramatically more effective at increasing road user yielding rates to pedestrians than traditional overhead beacons (FHWA, 2009). Alerts road users when pedestrians are present. Studies have shown significant increases in driver yielding compliance rates, up to 90% compliance.	Need electricity source or reliable solar power mechanism. Under interim approval by the Federal MUTCD.
Pedestrian Hybrid Beacon (HAWK)  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Pedestrian actuated hybrid beacon used to control traffic at unsignalized locations for pedestrian crossings.	A very high rate of motorists yielding to pedestrians Road users experience less delay at hybrid signals compared to other signalized intersections.	Expensive to install due to the need for equipment similar to traffic signals. Warrants need to be met.
Side-Mounted Flashing Beacon  *Source: FHWA, Efficacy of Rectangular Rapid Flash LED Beacons*	An amber, round beacon mounted on the roadside of each approach to a crosswalk that flashes when actuated by a pedestrian or bicyclist and supplements warning signs.	Increases awareness of pedestrian and bicyclist crossings. An FHWA study showed results of about 17% motorist yielding compliance to pedestrians, compared with 0% compliance before installation of the beacon	High installation and maintenance costs. Requires an electronic source or solar panels. Motorist yielding rates are significantly lower than they are for RRFBs or HAWKs.
Overhead-Mounted Flashing Beacon  *Source: FHWA, Efficacy of Rectangular Rapid Flash LED Beacons*	At least one amber, round beacon for each approach to a crosswalk installed overhead that flashes when actuated by a pedestrian or bicyclist and supplements warning signs.	Increases awareness of pedestrian and bicyclist crossings. An FHWA study showed results of about 16% motorist yielding compliance to pedestrians, a 5% increase over pre-installation conditions.	High installation and maintenance costs. Requires an electronic source or solar panels. Motorist yielding rates are significantly lower than they are for RRFBs or HAWKs.

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Illumination of Crosswalk  *Source: Los Angeles County Model Design Manual for Living Streets*	Roadway or pedestrian-scaled lighting that is located such that the entire crosswalk is illuminated.	Increased visibility of pedestrians and bicyclists in crosswalk during dark or dim lighting conditions. Increased safety and comfort for pedestrians and bicyclists.	Additional costs for installation and maintenance of light fixtures.
Pedestrian Signal Heads  *Source: James Wagner, Pedestrian and Bicycle Information Center, pedbikeimages.org*	An electronic display for pedestrians at intersections that indicate pedestrian right of way.	Provides information for pedestrians crossing the roadway. The countdown signal head provides additional information to pedestrians about time remaining to complete the crossing.	Additional costs for installation and maintenance of pedestrian signal heads.
Bicycle Traffic Signal  *Source: Danielle Peterson, Gannett*	Signal that is exclusively for bicycle movements or where a signal phase is shared with pedestrians.	Reduces conflicts between motorists and bicyclists.	Additional costs for installation and maintenance of bicyclists traffic signals. Warrants may need to be established and met.

Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Sidewalk/Walkway  *Source: Nick Foster, Kittelson & Associates, Inc.*	Path along the side of a road for walking access. Can be concrete or asphalt.	Promotes walkability. Provides a dedicated space for pedestrian travel. Separates pedestrians from vehicles.	Requires additional space and right-of-way and some maintenance.
Sidewalk Buffers  *Source: Andy Daleiden and Nick Foster, Kittelson & Associates, Inc.*	Provides a separation from the roadway for pedestrians through the use of brick pavers, landscaping, street trees, etc.	Promotes walkability and improves pedestrian safety and comfort. Creates a better sense of place for pedestrians. Provides a place for utilities and street furniture out of the pedestrian path of travel. Snow removed from sidewalk or roadway can be stored in the buffer.	Requires additional space and right-of-way. Maintenance may be necessary if vegetation or trees are planted in buffer area.
On-Street Parking  *Source: Andy Daleiden, Kittelson & Associates, Inc.* *<u>Note:</u> Also reference On-Street Parking within the Speed Reduction Treatments table*	Designated area within the street cross-section for vehicles to park. Options include parallel or angle parking (front-in or back-in).	Provides easy access to destinations and businesses. Provides a buffer for pedestrians between the travel lanes and the sidewalk. May provide additional revenue if parking charged to the user.	Requires additional space and right-of-way. Increases conflicts with bicyclists and other vehicles. A surplus of parking, particularly if uncharged to the user, encourages vehicle access and tends to discourage other modes.
Multiuse Path  *Source: Nick Foster, Kittelson & Associates, Inc.*	A trail that serves a variety of non-motorized users, such as pedestrians, joggers, equestrians, bicyclists, and skaters.	Provides low-stress access to non-motorized users for recreational and transportation purposes. Promotes non-motorized travel, particularly if trail links a variety of land uses. Politically popular.	Requires right of way or easements. Residents are sometimes wary of having trails adjacent to their property. Additional cost and maintenance. Snow plowing of trails may be necessary to maintain access.

Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Bike Lane  *Source: Ralph Bentley, Kittelson & Associates, Inc.*	Striped, solid lanes on roadways designating exclusive travel by bicyclists, paired with bicycle pavement legends. Dashed lines indicate areas where the bike lane may be entered by vehicles.	Provides separation of travel between motor vehicles and bicyclists. Appeals to a wider cross-section of bicycle users than bike routes. Promotes cycling as a mode of transportation. Does not require special snow removal equipment.	Additional right-of-way and maintenance.
Buffered Bike Lane  *Source: Kevin Lee, Kittelson & Associates, Inc.*	Conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane. Note the dashed lines.	Provides greater distance between motor vehicles and bicyclists than bike lanes. Provides a greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane. Encourages bicycling by contributing to the perception of safety among users of the bicycle network.	Buffer striping may require additional right-of-way and maintenance compared to a conventional bicycle lane.
Cycle Track  *Source: Mobo Bicycle Coop, Winter Workshop Series 2012*	A bike lane that is separated from vehicle traffic by a physical barrier, such as bollards, parked cars, a curb, or raised median.	Provides more physical separation between motor vehicles and bicyclists than bike lanes. Encourages bicycling by contributing to the perception of safety among users of the bicycle network.	Requires more right-of-way and is typically higher cost than a bike lane. Physical barriers may make snow and debris removal on cycle tracks a challenge. Additional treatments needed at intersections and driveways.
Counterflow Bike Lane  *Source: Kelly Blume, Kittelson & Associates, Inc.*	A bike lane that provides a direction of travel for bicyclists that is in the opposite direction of vehicle or other bicyclists travel.	Provides two-way access for bicyclists on one-way streets. Formalizes desired routes by bicyclists. Can help address gaps in the bike network where one-way, off-set streets are located.	Higher probability of collisions and injuries may occur with long stretches of counter-flow bike lanes.

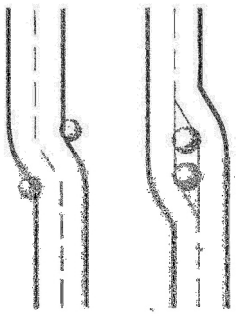
Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Sharrows  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	A pavement legend that indicates where bicyclists are supposed to position themselves in the vehicle lane.	Encourages bicycle positioning outside of the door zone when traveling next to parked vehicles Creates more awareness by motorists of the shared use and to look for bicyclists Best used with "Share the Road" signs (see below).	May require an education campaign for bicyclists and motorists. Additional cost and maintenance.
Share the Road Signs  *Source: 2009 MUTCD*	A sign indicating to motorists and bicyclists to share the vehicle lane.	Creates more awareness by motorists of the shared use and to look for bicyclists. Best used with Sharrow pavement legends (see above).	Contributes to sign clutter Additional cost and maintenance.
Road Diet/Lane Narrowing  *Source: trafficcalming.org* *<u>Note:</u> Also reference Road Diet/Lane Narrowing within the Speed Reduction Treatments table*	Eliminating or narrowing travel lanes or a center turn lane to reduce the overall width of the roadway. The extra width can also be used to accommodate bike lanes, medians, landscape buffers or wider sidewalks.	Speed reductions result in an exponential decrease to pedestrian and bicyclist collisions and injury severity. Reduced speeds enhance the walking and biking environment. Can provide adequate width to accommodate bike facilities without widening the overall width of the road.	Speed reductions may frustrate motorists. Oversize vehicles may overlap into bike lanes. If using curbs or other infrastructure to narrow, significant changes in existing physical infrastructure may result.
Rumble Strips  *Source: Kelly Blume, Kittelson & Associates, Inc.* *<u>Note:</u> Also reference Rumble Strips within the Speed Reduction Treatments table*	Successive grooves cut in the pavement. Applied to lane edges, striped medians, and transversely across travel lanes.	Provides a “buffer” between cyclists and vehicles. Provides tactile information of shoulder or bike lane when roadway covered by snow.	Increased noise pollution when vehicles pass over. May be a nuisance or hazard for bicyclists.

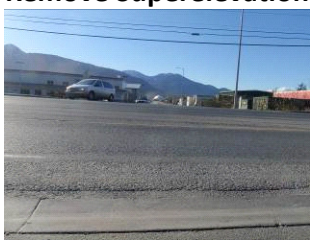
Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Roadway Illumination  *Source: Dorret Oosterhoff, Kittelson & Associates, Inc.*	Street lighting provided continually on one side or both sides of a roadway. The lighting may illuminate the roadway or walkway.	Increases night-time visibility of roadway users and animals. Increases sense of security for roadway users, particularly pedestrians, transit passengers, and bicyclists Modern LED lighting is more economical and effective than traditional electric lights.	Increases lighting pollution Significant costs for installation, operation, and maintenance.
Driveway Treatments  *Source: Laura Sandt, Pedestrian and Bicycle Information Center, www.pedbikeimages.org*	Driveways that are designed to be as narrow as possible and level with the sidewalk or other treatments such as pavers, stop signs, stop bars, etc. that delineate the vehicle-pedestrian conflict zone.	Discourages vehicle speeds into and out of driveways Indicates that motorists should look for pedestrians before proceeding through the driveway. Promotes walkability.	Additional cost to retrofit driveways. Right-of-way constraints may present a challenge to maintaining sidewalk level through the driveway.

Corridor Amenities	Description	Advantages/Effectiveness	Challenges/Impacts
Sidewalk Furniture  *Source: Kelly Blume, Kittelson & Associates, Inc.*	Benches or other seating located in a public area.	Provides resting and socializing opportunities for pedestrians. Increases community vitality and sense of security by encouraging more eyes on the street. Eases the wait for transit.	Additional cost and maintenance. May be used by vagrants.
Bike Parking - Short-Term  *Source: Amazon.com*	Bike racks that are installed such that bicyclists can secure at least one wheel and the frame with a lock. The single inverted U-rack (pictured) is the preferred design for short-term parking.	Provides a parking facility for visitors to secure their bike. Encourages the use of bicycling for transportation. Bicyclists are directed to park their bicycles in a non-obstructive manner.	Additional cost and maintenance. Program must be developed to address abandoned bicycles.
Bike Parking - Long-Term  *Source: Kelly Blume, Kittelson & Associates, Inc.*	Secure storage for bicycles that is protected from the weather. Long term parking includes lockers (pictured) and access-controlled rooms or areas.	Provides a secure parking facility for bikes for employees, residents, and transit passengers. Encourages the use of bicycling for transportation. Pay-by-the-hour lockers may generate revenue.	Additional cost and maintenance. More floor space required. Program must be developed to address abandoned bicycles.
Bike Repair Station  *Source: Kamala Parks, Kittelson & Associates, Inc.*	Bicycle repair station equipped with an air pump and some basic tools.	Encourages bicycling by providing a repair station to fix common problems. Enhances awareness and overall experience for bicyclists.	Additional cost and maintenance.
Transit Amenities  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Includes bus stop signing, benches, shelters, schedule and real time information, lighting, and landing pads.	Improves transit image. Enhances awareness and overall experience for transit users. Decreases perceived travel time by enhancing the waiting environment.	Additional cost and maintenance. Providing adequate width around amenities to meet ADA requirements can be difficult.

Corridor Amenities	Description	Advantages/Effectiveness	Challenges/Impacts
Wayfinding Signage  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Signage indicating to bicyclists and pedestrians the direction and distance to points of interest along a corridor.	Encourages walking and biking by providing access information to major attractions.	Additional cost and maintenance. Potential for sign clutter.
Bikes on Transit  *Source: Kelly Blume, Kittelson & Associates, Inc.*	Racks or storage for bicycles on transit vehicles.	Encourages biking by providing a motorized link in cases of bikeway network gaps, inclement weather, or damage to bicycle.	Additional cost and maintenance. May require an education campaign to demonstrate proper use of racks. May reduce transit travel times.

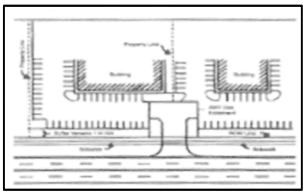
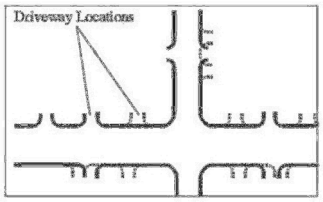
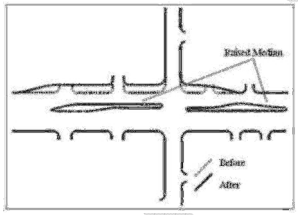
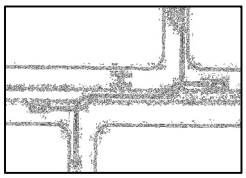
Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Speed Feedback Signs 	Electronic signs that measure and dynamically display the speed of approaching vehicles. Certain types may also be accompanied by a "SLOW DOWN" or similar message.	Average speed reductions of ~6 mph.	Speed reduction effect only present while signs are in place. Need electricity source or reliable solar power mechanism.
Optical Speed Bars[1]  *Source: FHWA- Low Cost Treatments for Horizontal Safety, Ch 7*	Transverse markings placed in and across travel lanes with the intent of increasing the optical flow of information and creating a sense of increasing speed.	Studies have shown speed reductions of 1 to 9.5 mph.	Increased maintenance costs if placed in vehicle wheel paths.
Speed Humps/Raised Intersections[1]  *Source: Lee Rodegerdts*	Abrupt change in the elevation of the road surface to create an uncomfortable feeling for drivers when traveling at high speeds.	Studies have shown speed reductions of ~22% and crash reductions of 11% to 41% for speed humps.	Can surprise drivers and cause loss of control of the vehicle. Vehicle damage can be caused if traversed at a high speed. May increase noise and air pollution.
Raised Medians[2]  *Source: Lee Rodegerdts*	Islands with vertical curbs placed between travel lanes. Can be used to create deflection in the travel path or vehicles or simply narrow the "optical width" of the roadway.	Have been found to reduce speed by an average of ~9%. Can aid in access management. Can provide a pedestrian refuge.	May increase the potential for single motor vehicle crashes. Regular maintenance is required if landscaping is provided in the medians.
Road Diet/Lane Narrowing[1]	Eliminating or narrowing travel lanes or a center turn lane to reduce the overall width of the roadway. The extra width can also be used to accommodate bike lanes, medians, landscape buffers or	Road Diet: Studies have shown speed reductions of <5 mph but up to 70% reductions in excessive speeding and 20% to 40% reductions in crashes. Lane Narrowing: Studies have reported operating speed	May have significant impacts on large and oversized vehicles. Removal of center turn lane will impact the operations and capacity of the roadway.

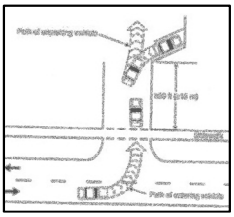
Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
 *Source: trafficcalming.org* *<u>Note:</u> Also reference Road Diet/Lane Narrowing within the Pedestrian & Bicycle Longitudinal Treatments table*	wider sidewalks.	reductions of 7% to 20%.	
Textured Pavements[1]  *Source: Lee Rodegerdts*	The use of stamped pavement or alternate paving materials to create an uneven surface for vehicles to traverse.	Appropriate for areas with major pedestrian activity and where noise is not a major concern. No quantitative data has been compiled on their speed control effectiveness.	Increase noise pollution along the roadway. Can make crossings more difficult for wheelchair users and the visually impaired.
Gateway Features[1]  *Source: Lee Rodegerdts*	Elements placed at the beginning of the transition zone that presents a visual cue to the driver that this is the point of change in roadway character. Signs, unique signal head or lighting fixtures, structures, colored pavement, etc., can all serve as gateway features.	Limited data on their effectiveness. Help with creating a "sense of place."	Structural gateway features may increase the severity of run-off-road crashes.
Chicanes/Lateral Shifts[3]  *Source: ITE traffic calming handbook Chapter 3*	Curb extensions that alternate from one side of the road to the other creating a shift in the traveled way that displaces a vehicle laterally by at least one-lane width at an angle of deflection no less than 45 degrees.	Curb extensions placed at appropriate locations can also decrease crossing distance for pedestrians. Landscaped curb extensions can beautify the street. Can accommodate on-street parking along the corridor.	Can be expensive.

Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts
Roundabouts[1]  *Source: Lee Rodegerdts*	An intersection treatment that will also decrease speed along a corridor as vehicles slow down to navigate the deflection of the road upon entry into the roundabout.	Can reduce intersection crashes and crash severity. Enable safe and efficient U-turn movements. Provide speed control.	Typically, require more right-of-way at the corners of the intersection than a signalized intersection.
Remove Superelevation  *Source: Yuri Mereszczak*	Removing the "tilt" of the road along curves and reconstructing the road with a superelevation that fits the current use and design speed of the roadway facility.	Remove the rural/high speed feel of the roadway.	Expensive, will require the road to be reconstructed.
Rumble Strips[4]  *Source: Kelly Blume, Kittelson & Associates, Inc.* *<u>Note:</u> Also reference Rumble Strips within the Pedestrian & Bicycle Longitudinal Treatments table*	Successive grooves cut in the pavement. Applied to lane edges, striped medians, and transversely across travel lanes.	Could encourage vehicles to stay within the limits of their traveled lane. Transverse rumble strips warn drivers of approaching intersections or speed limit reductions.	Can create noise pollution along the corridor.
Speed Limit Change  *Source: Lee Rodegerdts*	Changing the speed limit of the existing roadway.	If obeyed, can lower the speed of vehicles traveling on the roadway.	Should be accompanied by traffic calming measure, driver feedback treatments, reduction in design speed, and/or enforcement to be effective.
On-Street Parking  *Source: Lee Rodegerdts* *<u>Note:</u> Also reference On-Street Parking within the Pedestrian & Bicycle Longitudinal Treatments table*	Designated area within the street cross-section for vehicles to park. Options include parallel or angle parking (front-in or back-in).	Provides more parking for businesses. Communicates change in roadway nature to drivers.	May require additional right-of-way.

[1]Fehr & Peers, Traffic Calming Website
[2]Kuna Downtown Corridor Plan - Public Involvement Materials

[3]ITE Chapter 3: Toolbox of Traffic Calming Measures pp. 31-40
[4]NCHRP 613, Section 4- Treatment Descriptions

Access Management Treatments[1]	Description	Advantages/Effectiveness	Challenges/Impacts
Shared Access Points/Inter-parcel Connections[1]  *Source: Access Management Manual*	A single access point that serves two or more neighboring businesses. Inter-parcel connections join several parking lots to shared access points.	Will reduce the number of access points along the roadway, reducing the number of vehicle conflicts and likely improving safety.	Inter-parcel connections can reduce parking spaces. Possible business opposition. May not be possible until redevelopment of parcels.
Reduce Redundant Access Points[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Reduce multiple access points to a single access point where appropriate.	Will reduce the number of access points along the roadway, reducing the number of vehicle conflicts and likely improving safety. Can increase the number of parking spaces available in the businesses parking lot.	Possible business opposition. May not be possible until redevelopment of parcels.
Define Singular Access Point[1]	Replacing continuous curb cuts with one or more defined driveways.	Reduce conflict points and define vehicle paths. Creating a narrow access point could increase the number of parking spaces.	Possible business opposition. May not be possible until redevelopment of parcels.
Restrict Movements at Access Points[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Change access points to allow only right in/right out turns or right/left turn in and only right out.	Removes conflict or delay created by left turns.	Possible business opposition. May not be possible until redevelopment of parcels. Likely requires a raised median to reinforce turn restrictions.
Allow U-turns[1]	Provide a mechanism for vehicles to make U-turns at intersections or midblock locations.	Provides vehicles with alternate routes to access businesses with access restrictions.	Requires roadway widening, a jughandle, or roundabout. A large radius is required where trucks need to be accommodated.
Avoid Overlapping Left Turn Movements[1]  *Source: Access Management Manual*	Reconfigure access locations where left-turn paths conflict.	Reduce collision risk for left-turning vehicles.	Requires driveway closures, turn restrictions, or relocations.

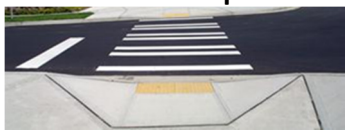
Access Management Treatments[1]	Description	Advantages/Effectiveness	Challenges/Impacts
Provide Appropriate Clearance for Parking[1]  *Source: Access Management Manual*	Provide sufficient space so entering and exiting vehicles do not conflict with parking vehicles or block the sidewalk.	Reduce off-street circulation and pedestrian conflicts. Reduces risk of a driveway queue spilling back into the roadway.	Available off-street space may be limited.
Shift Access to Side Streets/ Interparcel Connections[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Move parcel access points from main roadway to side streets.	Concentrates turning movements to intersections where traffic control is in place to manage turning movements. Decreases the number of access points and turning conflicts along the corridor.	Possible business opposition. May not be possible until redevelopment of parcels.

[1]Access Management Manual, Chapters 8-10

Appendix C Vision Specific Treatment Tables

Table B-1 Baseline Vision Treatments

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
High Visibility Crosswalk Markings 	Series of longitudinal painted or thermoplastic solid lines installed across a roadway. Visibility is increased when outlined by two solid transverse lines.	High visibility markings alert road users of the crosswalk at a greater distance than traditional markings.	Maintenance and installation costs are higher for high-visibility crosswalks than for standard crosswalk markings.	All controlled pedestrian crosswalks: Walmart Driveway, Renninger St, Alaway Ave, Belardi Dr, Davis Ave, Concrete Way, Anka St, Short St, and Vanderbilt Hill Rd bicycle crossing
Painted Conflict Zones 	A portion of roadway that is colored with high-contrast paint or asphalt (typically bright green).	Indicates an area of the roadway where bicyclists and vehicles may cross paths. Increases awareness of conflict zone. Provides a clear path of travel for bicyclists.	Additional cost and maintenance.	Anka Street intersection
Pedestrian Crossing & Advance Pedestrian Sign Assembly 	Retro-reflective pedestrian crossing or school crossing signs with diagonal downward pointing arrow or “ahead” plaques.	Alert road users that pedestrians may be entering the roadway. Provides advance notification to road users that pedestrians may be entering the roadway.	May increase roadway sign clutter. Additional maintenance.	All uncontrolled pedestrian crosswalks: Walmart Driveway, Renninger St, Alaway Ave, Belardi Dr, Davis Ave, Concrete Way, Anka St, and Short St

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Stop Bar Marking 	Paint or thermoplastic markings on the roadway that indicate where motorists should stop.	Markings are placed so that motorists are advised to stop in advance of the pedestrian crosswalk or further back for larger vehicles turning onto the street.	Additional maintenance.	All stop-controlled approaches of study intersections
Curb Ramps 	Curb cuts for pedestrian transitions between the roadway and walkway.	Allows pedestrians with disabilities to access crosswalk. Helps bicyclist's access crosswalk.	May interfere with drainage and/or utilities. Two perpendicular ramps at each corner of an intersection are preferred to a single diagonal ramp. Additional maintenance.	All marked pedestrian crosswalks: Wal-Mart Driveway, Renninger St, Alaway Ave, Belardi Dr, Davis Ave, Concrete Way, Anka St, and Short St
Median Refuge 	A protected area in the middle of the roadway for pedestrians or bicyclists to cross in stages.	Pedestrians can utilize shorter gaps in traffic due to ability to cross in stages. Provides refuge area, increasing safety of crossing. Slows vehicle speeds near crosswalk.	Right of way constraints (6' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.	All designated uncontrolled pedestrian crosswalks
Pedestrian Actuation - Active  *Source :Kelly Blume, Kittelson & Associates, Inc*	A push button that actuates electronic pedestrian crossing aids.	Alerts motorists to pedestrian crossings and results in high motorist yield rates. Easily understood by pedestrians. May provide more crossing time for pedestrians at signalized intersections.	Cost and additional maintenance. Requires pedestrian action to operate. Locating actuation so that disabled pedestrians can use.	Proposed crosswalks at Renninger Street, Davis Ave, Concrete Way, and Anka St

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Bicyclist Actuation - Active  *Source: LADOT Bike Blog, ladotbikeblog.wordpress.com*	A push button that actuates electronic bicycle crossing aids.	Alerts motorists to bicycle crossings and results in high motorist yield rates. Easily understood by bicycists. May provide more crossing time for bicyclists at signalized intersections.	Cost and additional maintenance. Requires bicyclists action to operate. Locating actuation so that bicyclists can use without having to dismount.	Vanderbilt Hill Road bicycle crossing
Bicyclist Actuation - Passive  *Source: Kevin Lee, Kittelson & Associates, Inc.*	A designated area where bicyclists wait to actuate crossing aids, such as in-pavement loop detectors or video camera.	Automatically activate any traffic signal or electronic crossing aid. Most vehicle loop detectors can be calibrated to detect bicyclists. Video cameras are simple to set for bicyclist detection. Increases bicyclist compliance at signalized intersections.	Cost to calibrate or install at locations with in-pavement loop detectors. Bicyclists must be positioned properly for detection to work. Additional bicyclist education may be needed for detection and positioning guidance.	Anka Street intersection
Rectangular Rapid-Flashing Beacon (RRFB)  *Source: Yuri Mereszczak, Kittelson & Associates, Inc. & FHWA*	RRFBs are user-actuated LEDs (typically two separate lights) that use an irregular flash pattern and supplement pedestrian warning signs.	RRFB are dramatically more effective at increasing road user yielding rates to pedestrians than traditional overhead beacons (FHWA, 2009). Alerts road users when pedestrians are present. Studies have shown significant increases in driver yielding compliance rates, up to 90% compliance.	Need electricity source or reliable solar power mechanism. Under interim approval by the Federal MUTCD.	Proposed crosswalks at Renninger Street, Davis Avenue, Concrete Way, and Vanderbilt Hill Road

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Pedestrian Hybrid Beacon (HAWK)  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Pedestrian actuated hybrid beacon used to control traffic at unsignalized locations for pedestrian crossings.	A very high rate of motorists yielding to pedestrians Road users experience less delay at hybrid signals compared to other signalized intersections.	Expensive to install due to the need for equipment similar to traffic signals. Warrants need to be met.	Baseline Concept does not remove existing HAWK at Walmart Driveway
Pedestrian Signal Heads  *Source: James Wagner, Pedestrian and Bicycle Information Center, pedbikeimages.org*	An electronic display for pedestrians at intersections that indicate pedestrian right of way.	Provides information for pedestrians crossing the roadway. The countdown signal head provides additional information to pedestrians about time remaining to complete the crossing.	Additional costs for installation and maintenance of pedestrian signal heads.	Anka Street intersection

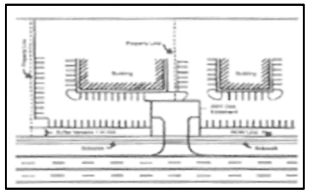
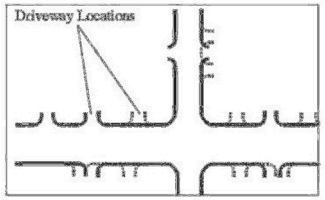
Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Sidewalk/Walkway  *Source: Nick Foster, Kittelson & Associates, Inc.*	Path along the side of a road for walking access. Can be concrete or asphalt.	Promotes walkability. Provides a dedicated space for pedestrian travel. Separates pedestrians from vehicles.	Requires additional space and right-of-way and some maintenance.	On both sides of Glacier Highway corridor-wide
Bike Lane  *Source: Ralph Bentley, Kittelson & Associates, Inc.*	Striped, solid lanes on roadways designating exclusive travel by bicyclists, paired with bicycle pavement legends. Dashed lines indicate areas where the bike lane may be entered by vehicles.	Provides separation of travel between motor vehicles and bicyclists. Appeals to a wider cross-section of bicycle users than bike routes. Promotes cycling as a mode of transportation. Does not require special snow removal equipment.	Additional right-of-way and maintenance.	On both sides of Glacier Highway corridor-wide
Road Diet/Lane Narrowing  *Source: trafficcalming.org* *<u>Note:</u> Also reference Road Diet/Lane Narrowing within the Speed Reduction Treatments table*	Eliminating or narrowing travel lanes or a center turn lane to reduce the overall width of the roadway. The extra width can also be used to accommodate bike lanes, medians, landscape buffers or wider sidewalks.	Speed reductions result in an exponential decrease to pedestrian and bicyclist collisions and injury severity. Reduced speeds enhance the walking and biking environment. Can provide adequate width to accommodate bike facilities without widening the overall width of the road.	Speed reductions may frustrate motorists. Oversize vehicles may overlap into bike lanes. If using curbs or other infrastructure to narrow, significant changes in existing physical infrastructure may result.	Corridor-wide, narrow travel lanes from 12 feet to 11 feet

Pedestrian & Bicycle Longitudinal Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Roadway Illumination  *Source: Dorret Oosterhoff, Kittelson & Associates, Inc.*	Street lighting provided continually on one side or both sides of a roadway. The lighting may illuminate the roadway or walkway.	Increases night-time visibility of roadway users and animals. Increases sense of security for roadway users, particularly pedestrians, transit passengers, and bicyclists Modern LED lighting is more economical and effective than traditional electric lights.	Increases lighting pollution Significant costs for installation, operation, and maintenance.	All concepts on both sides of Glacier Highway

Corridor Amenities	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Transit Amenities  *Source: Andy Daleiden, Kittelson & Associates, Inc.*	Includes bus stop signing, benches, shelters, schedule and real time information, lighting, and landing pads.	Improves transit image. Enhances awareness and overall experience for transit users. Decreases perceived travel time by enhancing the waiting environment.	Additional cost and maintenance. Providing adequate width around amenities to meet ADA requirements can be difficult.	All transit stops: at Alaway Ave, Davis Ave which is to be relocated to Belardi Dr, and Western Auto Access which is to be relocated to Short St

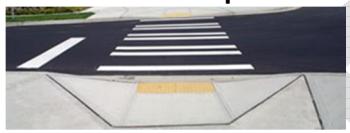
Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Speed Feedback Signs 	Electronic signs that measure and dynamically display the speed of approaching vehicles. Certain types may also be accompanied by a "SLOW DOWN" or similar message.	Average speed reductions of ~6 mph.	Speed reduction effect only present while signs are in place. Need electricity source or reliable solar power mechanism.	Renninger Street and Vanderbilt Hill Road
Raised Medians[2]  *Source: Lee Rodegerdts* Note: Road Diet/Lane Narrowing within the Pedestrian/Bicycle Treatments	Islands with vertical curbs placed between travel lanes. Can be used to create deflection in the travel path or vehicles or simply narrow the "optical width" of the roadway.	Have been found to reduce speed by an average of ~9%. Can aid in access management. Can provide a pedestrian refuge.	May increase the potential for single motor vehicle crashes. Regular maintenance is required if landscaping is provided in the medians.	All pedestrian crosswalks: Walmart Driveway, Renninger St, Alaway Ave, Belardi Dr, Davis Ave, Concrete Way, Anka St, Short St, and Vanderbilt Hill Rd bicycle crossing
Road Diet/Lane Narrowing[1]  *Source: trafficcalming.org* *<u>Note:</u> Also reference Road Diet/Lane Narrowing within the Pedestrian & Bicycle Longitudinal Treatments table*	Eliminating or narrowing travel lanes or a center turn lane to reduce the overall width of the roadway. The extra width can also be used to accommodate bike lanes, medians, landscape buffers or wider sidewalks.	Road Diet: Studies have shown speed reductions of <5 mph but up to 70% reductions in excessive speeding and 20% to 40% reductions in crashes. Lane Narrowing: Studies have reported operating speed reductions of 7% to 20%.	May have significant impacts on large and oversized vehicles. Removal of center turn lane will impact the operations and capacity of the roadway.	Corridor Wide, narrow travel lanes from 12 feet to 11 feet

[1]Fehr & Peers, Traffic Calming Website
[2]Kuna Downtown Corridor Plan - Public Involvement Materials
[3]ITE Chapter 3: Toolbox of Traffic Calming Measures pp. 31-40
[4]NCHRP 613, Section 4- Treatment Descriptions

Access Management Treatments[1]	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Shared Access Points/Inter-parcel Connections[1]  *Source: Access Management Manual*	A single access point that serves two or more neighboring businesses. Inter-parcel connections join several parking lots to shared access points.	Will reduce the number of access points along the roadway, reducing the number of vehicle conflicts and likely improving safety.	Inter-parcel connections can reduce parking spaces. Possible business opposition. May not be possible until redevelopment of parcels.	Various areas including the landward side of Glacier between Concrete Way and Anka Street
Reduce Redundant Access Points[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Reduce multiple access points to a single access point where appropriate.	Will reduce the number of access points along the roadway, reducing the number of vehicle conflicts and likely improving safety. Can increase the number of parking spaces available in the businesses parking lot.	Possible business opposition. May not be possible until redevelopment of parcels.	Various areas including the landward side of Glacier between Concrete Way and Anka Street and just after Anka Street
Shift Access to Side Streets/ Interparcel Connections[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Move parcel access points from main roadway to side streets.	Concentrates turning movements to intersections where traffic control is in place to manage turning movements. Decreases the number of access points and turning conflicts along the corridor.	Possible business opposition. May not be possible until redevelopment of parcels.	Tonsgard Court

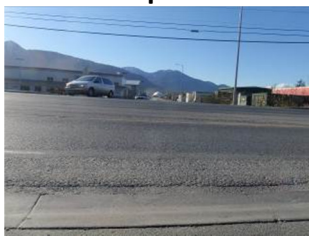
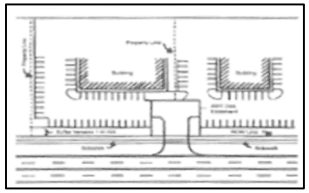
[1]Access Management Manual, Chapters 8-10

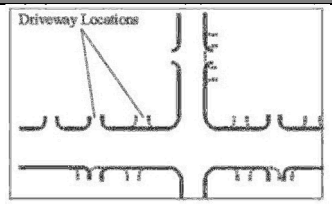
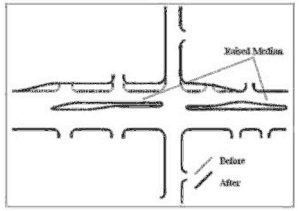
Table E-1 Enhanced Baseline Vision Additional Treatments

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
High Visibility Crosswalk Markings 	Series of longitudinal painted or thermoplastic solid lines installed across a roadway. Visibility is increased when outlined by two solid transverse lines.	High visibility markings alert road users of the crosswalk at a greater distance than traditional markings.	Maintenance and installation costs are higher for high-visibility crosswalks than for standard crosswalk markings.	• Additional crosswalks at Renninger St and one at Central Ave
Pedestrian Crossing & Advance Pedestrian Sign Assembly 	Retro-reflective pedestrian crossing or school crossing signs with diagonal downward pointing arrow or "ahead" plaques.	Alert road users that pedestrians may be entering the roadway. Provides advance notification to road users that pedestrians may be entering the roadway.	May increase roadway sign clutter. Additional maintenance.	• Additional crosswalks at Renninger St and one at Central Ave
Curb Ramps 	Curb cuts for pedestrian transitions between the roadway and walkway.	Allows pedestrians with disabilities to access crosswalk. Helps bicyclist's access crosswalk.	May interfere with drainage and/or utilities. Two perpendicular ramps at each corner of an intersection are preferred to a single diagonal ramp. Additional maintenance.	• Additional crosswalks at Renninger St and one at Central Ave

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Median Refuge 	A protected area in the middle of the roadway for pedestrians or bicyclists to cross in stages.	Pedestrians can utilize shorter gaps in traffic due to ability to cross in stages. Provides refuge area, increasing safety of crossing. Slows vehicle speeds near crosswalk.	Right of way constraints (6' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.	• Additional crosswalks at Renninger St and one at Central Ave
Offset Median Refuge/Crosswalk (Danish Offset) 	A variation of a median refuge, the crosswalk is offset so that bicyclists and pedestrians travel facing opposing traffic in the median before crossing the second leg	Similar advantages as a median refuge. Encourages pedestrians and bicyclists to view traffic conditions before crossing.	Right of way constraints (8' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.	• Relocated Walmart pedestrian crosswalk
Pedestrian Actuation - Active  *Source :Kelly Blume, Kittelson & Associates, Inc*	A push button that actuates electronic pedestrian crossing aids.	Alerts motorists to pedestrian crossings and results in high motorist yield rates. Easily understood by pedestrians. May provide more crossing time for pedestrians at signalized intersections.	Cost and additional maintenance. Requires pedestrian action to operate. Locating actuation so that disabled pedestrians can use.	• Additional crosswalk at Renninger St

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Rectangular Rapid-Flashing Beacon (RRFB)  *Source: Yuri Mereszczak, Kittelson & Associates, Inc. & FHWA*	RRFBs are user-actuated LEDs (typically two separate lights) that use an irregular flash pattern and supplement pedestrian warning signs.	RRFB are dramatically more effective at increasing road user yielding rates to pedestrians than traditional overhead beacons (FHWA, 2009). Alerts road users when pedestrians are present. Studies have shown significant increases in driver yielding compliance rates, up to 90% compliance.	Need electricity source or reliable solar power mechanism. Under interim approval by the Federal MUTCD.	• Additional crosswalk at Renninger St and relocated crosswalk at Walmart
Pedestrian & Bicycle Longitudinal Treatments	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
No additional pedestrian and bicycle longitudinal treatments				
Corridor Amenities	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
No additional corridor amenities treatments				

Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Raised Medians[1]  *Source: Lee Rodegerdts* Note: Road Diet/Lane Narrowing within the Pedestrian/Bicycle Treatments	Islands with vertical curbs placed between travel lanes. Can be used to create deflection in the travel path or vehicles or simply narrow the "optical width" of the roadway.	Have been found to reduce speed by an average of ~9%. Can aid in access management. Can provide a pedestrian refuge.	May increase the potential for single motor vehicle crashes. Regular maintenance is required if landscaping is provided in the medians.	• More extensive use to limit left turn movements. Replaces much of the two-way left-turn lane. Additionally at a left-in only accesses to the north of Concrete Way
Remove Superelevation  *Source: Yuri Mereszczak*	Removing the "tilt" of the road along curves and reconstructing the road with a superelevation that fits the current use and design speed of the roadway facility.	Remove the rural/high speed feel of the roadway.	Expensive, will require the road to be reconstructed.	• Central Avenue curve approximately Station 276+50 to 284+00 • Concrete Way curve approximately Station 258+65 to 267+35 • Anka Street curve approximately Station 245+60 to 256+60 • Curve around Coogan Drive approximately Station 222+50 to 236+500
Access Management Treatments[1]	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
Shared Access Points/Inter-parcel Connections[2]  *Source: Access Management Manual*	A single access point that serves two or more neighboring businesses. Inter-parcel connections join several parking lots to shared access points.	Will reduce the number of access points along the roadway, reducing the number of vehicle conflicts and likely improving safety.	Inter-parcel connections can reduce parking spaces. Possible business opposition. May not be possible until redevelopment of parcels.	• Just north of Short Street
Reduce Redundant Access Points[2]	Reduce multiple access points to a single access point where appropriate.	Will reduce the number of access points along the roadway, reducing the	Possible business opposition. May not be possible until	• Just north of Short Street

Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
 *Source: Regionally Significant Routes for Safety and Mobility*		number of vehicle conflicts and likely improving safety. Can increase the number of parking spaces available in the businesses parking lot.	redevelopment of parcels.	
Restrict Movements at Access Points[2]  *Source: Regionally Significant Routes for Safety and Mobility*	Change access points to allow only right in/right out turns or right/left turn in and only right out.	Removes conflict or delay created by left turns.	Possible business opposition. May not be possible until redevelopment of parcels. Likely requires a raised median to reinforce turn restrictions.	• Left-in only access at two points north of Concrete Way

[1]Kuna Downtown Corridor Plan - Public Involvement Materials
[2]Access Management Manual, Chapters 8-10

Table R-1 Roundabout Vision Additional Treatments

Pedestrian & Bicycle Crossing Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Median Refuge 	A protected area in the middle of the roadway for pedestrians or bicyclists to cross in stages.	Pedestrians can utilize shorter gaps in traffic due to ability to cross in stages. Provides refuge area, increasing safety of crossing. Slows vehicle speeds near crosswalk.	Right of way constraints (6' minimum width needed). Creates a physical barrier in the roadway. Additional cost and maintenance may be needed if median is landscaped.	• Most roundabout pedestrian crosswalks
Pedestrian & Bicycle Longitudinal Treatments	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
No additional pedestrian and bicycle longitudinal treatments				
Corridor Amenities	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
No additional pedestrian and bicycle longitudinal treatments				

Speed Reduction Treatments	Description	Advantages/Effectiveness	Challenges/Impacts	Location to be applied at:
Roundabouts[1]  *Source: Lee Rodegerdts*	An intersection treatment that will also decrease speed along a corridor as vehicles slow down to navigate the deflection of the road upon entry into the roundabout.	Can reduce intersection crashes and crash severity. Enable safe and efficient U-turn movements. Provide speed control.	Typically, require more right-of-way at the corners of the intersection than a signalized intersection.	• Renninger St, Concrete Way, Anka St, and Short St
Access Management Treatments[1]	**Description**	**Advantages/Effectiveness**	**Challenges/Impacts**	**Location to be applied at:**
Shift Access to Side Streets/ Interparcel Connections[1]  *Source: Regionally Significant Routes for Safety and Mobility*	Move parcel access points from main roadway to side streets.	Concentrates turning movements to intersections where traffic control is in place to manage turning movements. Decreases the number of access points and turning conflicts along the corridor.	Possible business opposition. May not be possible until redevelopment of parcels.	• Walmart truck access moved to be south leg of roundabout at Renninger St

[1]Access Management Manual, Chapters 8-10

Appendix D MMLOS Worksheets

Scenarios Comparison Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

		Glacier Existing PM Peak SB			Glacier Existing PM Peak NB		
		Intrsctn LOS	Link LOS	Segmnt LOS	Intrsctn LOS	Link LOS	Segmnt LOS
Segment #1	Auto	n/a	B	B	n/a	B	B
Sunny Drive	Transit	n/a	D	D	n/a	D	D
to	Bike	A	C	D	A	C	D
Renninger St	Ped	A	C	B	A	C	C
Segment #2	Auto	n/a	B	B	n/a	B	B
Renninger St	Transit	n/a	D	D	n/a	C	C
to	Bike	A	B	C	B	C	D
Central Ave	Ped	A	D	C	B	C	D
Segment #3	Auto	n/a	B	B	n/a	E	E
Central Ave	Transit	n/a	D	D	n/a	E	E
to	Bike	A	B	C	A	B	C
Davis Ave	Ped	A	D	C	A	C	C
Segment #4	Auto	n/a	C	C	n/a	C	C
Davis Ave	Transit	n/a	C	C	n/a	D	D
to	Bike	A	A	C	A	B	D
Concrete Way	Ped	A	C	C	A	C	C
Segment #5	Auto	n/a	C	C	n/a	C	C
Concrete Way	Transit	n/a	D	D	n/a	C	C
to	Bike	A	A	D	A	C	D
Tonsgard Ct	Ped	A	C	C	A	C	C
Segment #6	Auto	n/a	D	D	n/a	B	B
Tonsgard Ct	Transit	n/a	E	E	n/a	C	C
to	Bike	A	B	C	A	C	C
Anka St	Ped	A	B	C	A	C	C
Segment #7	Auto	n/a	B	B	n/a	B	B
Anka St	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	C	D
Short Street	Ped	A	D	C	A	D	C
Segment #8	Auto	n/a	B	B	n/a	C	C
Short Street	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	C	A	C	D
Glacier Highway	Ped	A	D	C	A	D	B
		Facility Score - LOS			Facility Score - LOS		
Facility	Auto	0.82 - B			0.73 - B		
	Transit	3.78 - D			3.64 - D		
	Bike	3.59 - D			3.72 - D		
	Ped	3.21 - C			3.24 - C		
		Using HCM 2010 Methodologies			Using HCM 2010 Methodologies		

Pedestrian & Bicycle LOS Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

Glacier Higway Ped- Bike Improvements
KAI Project #12665
Existing Southbound PM Peak Hour

Pedestrian LOS Calculation

Segment & Downstream Signal	Cross Street Xing Score	Cross Street Xing LOS	Segment Xing Score	Segment Xing LOS	Link LOS Score	Link LOS	RCDF	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	0.00	A	0.00	A	3.13	C	0.80	2.08	B
Segment #2	0.00	A	0.00	A	3.96	D	1.20	3.44	C
Segment #3	0.00	A	0.00	A	3.71	D	1.20	3.34	C
Segment #4	0.00	A	0.00	A	3.49	C	1.20	3.26	C
Segment #5	0.00	A	0.00	A	3.46	C	1.20	3.25	C
Segment #6	1.70	A	1.90	A	2.68	B	1.20	3.40	C
Segment #7	0.00	A	0.00	A	3.90	D	1.20	3.42	C
Segment #8	0.00	A	0.00	A	3.92	D	1.20	3.42	C
Average								3.21	C

Bicycle LOS Calculation

Segment & Downstream Signal	Mid-Seg Traffic Speed (mph)	Bicycle Travel Speed (mph)	Intersectn LOS Score	Intersectn LOS	Link LOS Score	Link LOS	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	37.1	15.0	0.00	A	2.92	C	3.65	D
Segment #2	39.7	15.0	0.00	A	2.26	B	3.33	C
Segment #3	37.2	15.0	0.00	A	2.12	B	3.38	C
Segment #4	32.3	15.0	0.00	A	1.92	A	3.46	C
Segment #5	30.1	15.0	0.00	A	1.99	A	3.84	D
Segment #6	21.4	10.7	1.92	A	2.04	B	3.25	C
Segment #7	38.7	15.0	0.00	A	2.44	B	4.07	D
Segment #8	36.1	15.0	0.00	A	2.42	B	3.24	C
Average		14.8					3.59	D

Scenarios Comparison Report

Street: Glacier Highway
Direction: SB Observer: JSM
Limits: Sunny Drive to Glacier Highway
Data collected on: 11/2012

		Glacier Future No-Build PM Peak SB			Glacier Future No-Build PM Peak NB		
		Intrsctn LOS	Link LOS	Segmnt LOS	Intrsctn LOS	Link LOS	Segmnt LOS
Segment #1	Auto	n/a	B	B	n/a	B	B
Sunny Drive	Transit	n/a	D	D	n/a	D	D
to	Bike	A	C	D	A	C	D
Renninger St	Ped	A	C	B	A	C	C
Segment #2	Auto	n/a	B	B	n/a	B	B
Renninger St	Transit	n/a	D	D	n/a	C	C
to	Bike	A	B	C	B	C	D
Central Ave	Ped	A	D	D	B	C	D
Segment #3	Auto	n/a	B	B	n/a	E	E
Central Ave	Transit	n/a	D	D	n/a	F	F
to	Bike	A	B	C	A	B	C
Davis Ave	Ped	A	D	C	A	C	C
Segment #4	Auto	n/a	C	C	n/a	C	C
Davis Ave	Transit	n/a	C	C	n/a	D	D
to	Bike	A	A	C	A	B	D
Concrete Way	Ped	A	D	C	A	D	C
Segment #5	Auto	n/a	C	C	n/a	C	C
Concrete Way	Transit	n/a	D	D	n/a	C	C
to	Bike	A	B	D	A	C	D
Tonsgard Ct	Ped	A	D	C	A	D	C
Segment #6	Auto	n/a	D	D	n/a	B	B
Tonsgard Ct	Transit	n/a	E	E	n/a	C	C
to	Bike	B	B	C	A	C	C
Anka St	Ped	A	C	C	A	D	C
Segment #7	Auto	n/a	B	B	n/a	B	B
Anka St	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	C	D
Short Street	Ped	A	D	C	A	D	C
Segment #8	Auto	n/a	B	B	n/a	C	C
Short Street	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	C	A	C	D
Glacier Highway	Ped	A	D	C	A	D	B
		Facility Score - LOS			Facility Score - LOS		
Facility	Auto	0.81 - B			0.71 - B		
	Transit	3.80 - D			3.67 - D		
	Bike	3.60 - D			3.73 - D		
	Ped	3.25 - C			3.31 - C		
		Using HCM 2010 Methodologies			Using HCM 2010 Methodologies		

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Pedestrian & Bicycle LOS Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

Glacier Higway Ped- Bike Improvements
KAI Project #12665
Future No Build Existing Southbound PM Peak Hour

Pedestrian LOS Calculation

Segment & Downstream Signal	Cross Street Xing Score	Cross Street Xing LOS	Segment Xing Score	Segment Xing LOS	Link LOS Score	Link LOS	RCDF	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	0.00	A	0.00	A	3.22	C	0.80	2.10	B
Segment #2	0.00	A	0.00	A	4.14	D	1.20	3.51	D
Segment #3	0.00	A	0.00	A	3.80	D	1.20	3.38	C
Segment #4	0.00	A	0.00	A	3.58	D	1.20	3.29	C
Segment #5	0.00	A	0.00	A	3.63	D	1.20	3.31	C
Segment #6	1.70	A	1.89	A	2.81	C	1.20	3.45	C
Segment #7	0.00	A	0.00	A	4.02	D	1.20	3.46	C
Segment #8	0.00	A	0.00	A	4.02	D	1.20	3.46	C
Average								3.25	C

Bicycle LOS Calculation

Segment & Downstream Signal	Mid-Seg Traffic Speed (mph)	Bicycle Travel Speed (mph)	Intersectn LOS Score	Intersectn LOS	Link LOS Score	Link LOS	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	36.9	15.0	0.00	A	2.95	C	3.66	D
Segment #2	39.5	15.0	0.00	A	2.34	B	3.34	C
Segment #3	37.1	15.0	0.00	A	2.16	B	3.39	C
Segment #4	32.2	15.0	0.00	A	1.96	A	3.47	C
Segment #5	29.9	15.0	0.00	A	2.07	B	3.85	D
Segment #6	21.3	10.7	2.01	B	2.10	B	3.27	C
Segment #7	38.5	15.0	0.00	A	2.48	B	4.08	D
Segment #8	36.0	15.0	0.00	A	2.45	B	3.24	C
Average		14.8					3.60	D

Scenarios Comparison Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

		Baseline Alternative PM Peak SB			Baseline Alternative PM Peak NB		
		Intrsctn LOS	Link LOS	Segmnt LOS	Intrsctn LOS	Link LOS	Segmnt LOS
Segment #1	Auto	n/a	B	B	n/a	B	B
Sunny Drive	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	B	D
Renninger St	Ped	A	C	B	A	C	C
Segment #2	Auto	n/a	B	B	n/a	B	B
Renninger St	Transit	n/a	D	D	n/a	C	C
to	Bike	A	B	C	B	C	D
Central Ave	Ped	A	C	C	B	C	D
Segment #3	Auto	n/a	B	B	n/a	E	E
Central Ave	Transit	n/a	D	D	n/a	E	E
to	Bike	A	B	C	A	A	C
Davis Ave	Ped	A	C	C	A	C	C
Segment #4	Auto	n/a	C	C	n/a	C	C
Davis Ave	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	D	A	B	D
Concrete Way	Ped	A	B	C	A	D	C
Segment #5	Auto	n/a	C	C	n/a	C	C
Concrete Way	Transit	n/a	C	C	n/a	C	C
to	Bike	A	B	D	A	B	D
Tonsgard Ct	Ped	A	C	C	A	D	C
Segment #6	Auto	n/a	D	D	n/a	B	B
Tonsgard Ct	Transit	n/a	E	E	n/a	C	C
to	Bike	A	A	C	A	B	C
Anka St	Ped	A	C	C	A	D	C
Segment #7	Auto	n/a	B	B	n/a	B	B
Anka St	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	B	D
Short Street	Ped	A	C	C	A	D	C
Segment #8	Auto	n/a	B	B	n/a	C	C
Short Street	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	C	A	B	D
Glacier Highway	Ped	A	C	C	A	D	B
		Facility Score - LOS			Facility Score - LOS		
Facility	Auto	0.79 - B			0.69 - B		
	Transit	3.65 - D			3.65 - D		
	Bike	3.62 - D			3.61 - D		
	Ped	2.97 - C			3.30 - C		
		Using HCM 2010 Methodologies			Using HCM 2010 Methodologies		

Pedestrian & Bicycle LOS Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

Glacier Higway Ped- Bike Improvements
KAI Project #12665
Baseline Southbound PM Peak Hour

Pedestrian LOS Calculation

Segment & Downstream Signal	Cross Street Xing Score	Cross Street Xing LOS	Segment Xing Score	Segment Xing LOS	Link LOS Score	Link LOS	RCDF	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	0.00	A	0.00	A	3.18	C	0.80	2.10	B
Segment #2	0.00	A	0.00	A	3.27	C	1.20	3.17	C
Segment #3	0.00	A	0.00	A	2.92	C	1.20	3.04	C
Segment #4	0.00	A	0.00	A	2.71	B	1.20	2.96	C
Segment #5	0.00	A	0.00	A	2.76	C	1.20	2.98	C
Segment #6	1.70	A	1.89	A	2.78	C	1.20	3.44	C
Segment #7	0.00	A	0.00	A	3.14	C	1.20	3.13	C
Segment #8	0.00	A	0.00	A	3.15	C	1.20	3.13	C
Average								2.97	C

Bicycle LOS Calculation

Segment & Downstream Signal	Mid-Seg Traffic Speed (mph)	Bicycle Travel Speed (mph)	Intersectn LOS Score	Intersectn LOS	Link LOS Score	Link LOS	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	36.9	15.0	0.00	A	2.51	B	3.59	D
Segment #2	37.0	15.0	0.00	A	2.57	B	3.38	C
Segment #3	36.8	15.0	0.00	A	2.39	B	3.43	C
Segment #4	32.0	15.0	0.00	A	2.19	B	3.51	D
Segment #5	29.7	15.0	0.00	A	2.29	B	3.89	D
Segment #6	21.3	10.7	1.90	A	1.66	A	3.19	C
Segment #7	38.2	15.0	0.00	A	2.71	B	4.12	D
Segment #8	35.7	15.0	0.00	A	2.68	B	3.28	C
Average		14.8					3.62	D

Scenarios Comparison Report

Street: Glacier Highway
Direction: SB Observer: JSM
Limits: Sunny Drive to Glacier Highway
Data collected on: 11/2012

		Enhanced Alternative PM Peak SB			Enhanced Alternative PM Peak NB		
		Intrsctn LOS	Link LOS	Segmnt LOS	Intrsctn LOS	Link LOS	Segmnt LOS
Segment #1	Auto	n/a	B	B	n/a	B	B
Sunny Drive	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	B	D
Renninger St	Ped	A	C	B	A	C	C
Segment #2	Auto	n/a	B	B	n/a	B	B
Renninger St	Transit	n/a	D	D	n/a	C	C
to	Bike	A	B	C	B	C	D
Central Ave	Ped	A	C	B	B	C	B
Segment #3	Auto	n/a	B	B	n/a	E	E
Central Ave	Transit	n/a	D	D	n/a	E	E
to	Bike	A	B	C	A	A	C
Davis Ave	Ped	A	C	B	A	C	C
Segment #4	Auto	n/a	C	C	n/a	C	C
Davis Ave	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	D	A	B	D
Concrete Way	Ped	A	B	B	A	D	B
Segment #5	Auto	n/a	C	C	n/a	C	C
Concrete Way	Transit	n/a	C	C	n/a	C	C
to	Bike	A	B	D	A	B	D
Tonsgard Ct	Ped	A	C	B	A	D	B
Segment #6	Auto	n/a	D	D	n/a	B	B
Tonsgard Ct	Transit	n/a	E	E	n/a	C	C
to	Bike	A	A	C	A	B	C
Anka St	Ped	A	C	C	A	D	B
Segment #7	Auto	n/a	B	B	n/a	B	B
Anka St	Transit	n/a	D	D	n/a	D	D
to	Bike	A	B	D	A	B	D
Short Street	Ped	A	C	B	A	D	B
Segment #8	Auto	n/a	B	B	n/a	C	C
Short Street	Transit	n/a	C	C	n/a	D	D
to	Bike	A	B	C	A	B	D
Glacier Highway	Ped	A	C	C	A	D	B
		Facility Score - LOS			Facility Score - LOS		
Facility	Auto	0.79 - B			0.69 - B		
	Transit	3.65 - D			3.65 - D		
	Bike	3.62 - D			3.61 - D		
	Ped	2.28 - B			2.46 - B		
		Using HCM 2010 Methodologies			Using HCM 2010 Methodologies		

Pedestrian & Bicycle LOS Report

Street: Glacier Highway Limits: Sunny Drive to Glacier Highway
Direction: SB Observer: JSM Data collected on: 11/2012

Glacier Higway Ped- Bike Improvements
KAI Project #12665
Enhanced Southbound PM Peak Hour

Pedestrian LOS Calculation

Segment & Downstream Signal	Cross Street Xing Score	Cross Street Xing LOS	Segment Xing Score	Segment Xing LOS	Link LOS Score	Link LOS	RCDF	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	0.00	A	0.00	A	3.18	C	0.80	2.10	B
Segment #2	0.00	A	0.00	A	3.27	C	0.82	2.17	B
Segment #3	0.00	A	0.00	A	2.92	C	0.82	2.09	B
Segment #4	0.00	A	0.00	A	2.71	B	0.84	2.07	B
Segment #5	0.00	A	0.00	A	2.76	C	0.86	2.14	B
Segment #6	1.70	A	1.89	A	2.78	C	1.20	3.44	C
Segment #7	0.00	A	0.00	A	3.14	C	0.80	2.09	B
Segment #8	0.00	A	0.00	A	3.15	C	1.20	3.13	C
Average								2.28	B

Bicycle LOS Calculation

Segment & Downstream Signal	Mid-Seg Traffic Speed (mph)	Bicycle Travel Speed (mph)	Intersectn LOS Score	Intersectn LOS	Link LOS Score	Link LOS	Segment LOS Score	HCM 2010 Segment LOS
Segment #1	36.9	15.0	0.00	A	2.51	B	3.59	D
Segment #2	37.0	15.0	0.00	A	2.57	B	3.38	C
Segment #3	36.8	15.0	0.00	A	2.39	B	3.43	C
Segment #4	32.0	15.0	0.00	A	2.19	B	3.51	D
Segment #5	29.7	15.0	0.00	A	2.29	B	3.89	D
Segment #6	21.3	10.7	1.90	A	1.66	A	3.19	C
Segment #7	38.2	15.0	0.00	A	2.71	B	4.12	D
Segment #8	35.7	15.0	0.00	A	2.68	B	3.28	C
Average		14.8					3.62	D

Appendix E Synchro Worksheets

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	463	9	17	321	2	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	551	11	20	382	2	11
Pedestrians				8	1	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				1	0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			563		980	566
vC1, stage 1 conf vol					558	
vC2, stage 2 conf vol					423	
vCu, unblocked vol			563		980	566
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	98
cM capacity (veh/h)			1018		485	524

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	562	20	382	13
Volume Left	0	20	0	2
Volume Right	11	0	0	11
cSH	1700	1018	1700	516
Volume to Capacity	0.33	0.02	0.22	0.03
Queue Length 95th (ft)	0	2	0	2
Control Delay (s)	0.0	8.6	0.0	12.2
Lane LOS		A		B
Approach Delay (s)	0.0	0.4		12.2
Approach LOS				B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	116	336	237	66	49	97
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	127	369	260	73	54	107
Pedestrians			2		3	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	336				926	300
vC1, stage 1 conf vol					300	
vC2, stage 2 conf vol					626	
vCu, unblocked vol	336				926	300
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	90				88	86
cM capacity (veh/h)	1232				445	743

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	127	369	333	160
Volume Left	127	0	0	54
Volume Right	0	0	73	107
cSH	1232	1700	1700	606
Volume to Capacity	0.10	0.22	0.20	0.26
Queue Length 95th (ft)	9	0	0	26
Control Delay (s)	8.3	0.0	0.0	13.1
Lane LOS	A			B
Approach Delay (s)	2.1		0.0	13.1
Approach LOS				B

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	370	41	10	263	32	11
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	425	47	11	302	37	13
Pedestrians	6				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			474		782	451
vC1, stage 1 conf vol					451	
vC2, stage 2 conf vol					331	
vCu, unblocked vol			474		782	451
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			99		93	98
cM capacity (veh/h)			1096		558	612

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	472	11	302	49
Volume Left	0	11	0	37
Volume Right	47	0	0	13
cSH	1700	1096	1700	570
Volume to Capacity	0.28	0.01	0.18	0.09
Queue Length 95th (ft)	0	1	0	7
Control Delay (s)	0.0	8.3	0.0	11.9
Lane LOS		A		B
Approach Delay (s)	0.0	0.3		11.9
Approach LOS				B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	32.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	11	370	230	5	32	46
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	14	457	284	6	40	57
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	290				771	287
vC1, stage 1 conf vol					287	
vC2, stage 2 conf vol					484	
vCu, unblocked vol	290				771	287
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				93	92
cM capacity (veh/h)	1272				551	752

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	14	457	290	96
Volume Left	14	0	0	40
Volume Right	0	0	6	57
cSH	1272	1700	1700	654
Volume to Capacity	0.01	0.27	0.17	0.15
Queue Length 95th (ft)	1	0	0	13
Control Delay (s)	7.9	0.0	0.0	11.4
Lane LOS	A			B
Approach Delay (s)	0.2		0.0	11.4
Approach LOS				B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	19	50	390	12	12	215
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	23	60	470	14	14	259
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	765	477			484	
vC1, stage 1 conf vol	477					
vC2, stage 2 conf vol	288					
vCu, unblocked vol	765	477			484	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	90			99	
cM capacity (veh/h)	560	592			1078	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	83	484	14	259
Volume Left	23	0	14	0
Volume Right	60	14	0	0
cSH	583	1700	1078	1700
Volume to Capacity	0.14	0.28	0.01	0.15
Queue Length 95th (ft)	12	0	1	0
Control Delay (s)	12.2	0.0	8.4	0.0
Lane LOS	B		A	
Approach Delay (s)	12.2	0.0	0.4	
Approach LOS	B			

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	19	422	175	38	88	49
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	20	449	186	40	94	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	227				696	206
vC1, stage 1 conf vol					206	
vC2, stage 2 conf vol					489	
vCu, unblocked vol	227				696	206
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				83	94
cM capacity (veh/h)	1342				565	834

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	20	449	227	94	52
Volume Left	20	0	0	94	0
Volume Right	0	0	40	0	52
cSH	1342	1700	1700	565	834
Volume to Capacity	0.02	0.26	0.13	0.17	0.06
Queue Length 95th (ft)	1	0	0	15	5
Control Delay (s)	7.7	0.0	0.0	12.6	9.6
Lane LOS	A			B	A
Approach Delay (s)	0.3		0.0	11.5	
Approach LOS				B	

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	420	83	40	173	1	34	0	80	3	0	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	6	433	86	41	178	1	35	0	82	3	0	3
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked												
vC, conflicting volume	179			519			754	750	476	789	792	181
vC1, stage 1 conf vol							488	488		261	261	
vC2, stage 2 conf vol							266	262		528	531	
vCu, unblocked vol	179			519			754	750	476	789	792	181
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			93	100	86	99	100	100
cM capacity (veh/h)	1396			1058			498	489	589	393	447	860

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	6	519	41	179	118	6
Volume Left	6	0	41	0	35	3
Volume Right	0	86	0	1	82	3
cSH	1396	1700	1058	1700	559	540
Volume to Capacity	0.00	0.31	0.04	0.11	0.21	0.01
Queue Length 95th (ft)	0	0	3	0	20	1
Control Delay (s)	7.6	0.0	8.5	0.0	13.2	11.7
Lane LOS	A		A		B	B
Approach Delay (s)	0.1		1.6		13.2	11.7
Approach LOS					B	B

Intersection Summary				
Average Delay	2.3			
Intersection Capacity Utilization	47.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	289	6	1	170	105	2	1	3	77	0	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.95	1.00
Satd. Flow (prot)	1802	1894		1805	1900	1577		1724			1805	1564
Flt Permitted	0.63	1.00		0.41	1.00	1.00		0.96			0.75	1.00
Satd. Flow (perm)	1197	1894		771	1900	1577		1673			1431	1564
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	214	344	7	1	202	125	2	1	4	92	0	74
RTOR Reduction (vph)	0	1	0	0	0	88	0	3	0	0	0	51
Lane Group Flow (vph)	214	350	0	1	202	37	0	4	0	0	92	23
Confl. Peds. (#/hr)	2					2	7					7
Confl. Bikes (#/hr)		1			2							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	24.0	16.0		24.0	16.0	16.0		16.5			16.5	16.5
Effective Green, g (s)	24.0	16.0		24.0	16.0	16.0		16.5			16.5	16.5
Actuated g/C Ratio	0.44	0.30		0.44	0.30	0.30		0.31			0.31	0.31
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	622	561		496	563	467		511			437	478
v/s Ratio Prot	c0.05	c0.18		0.00	0.11							
v/s Ratio Perm	0.10			0.00		0.02		0.00			c0.06	0.01
v/c Ratio	0.34	0.62		0.00	0.36	0.08		0.01			0.21	0.05
Uniform Delay, d1	9.5	16.4		8.5	15.0	13.7		13.1			13.9	13.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.5	5.1		0.0	1.8	0.3		0.0			1.1	0.2
Delay (s)	11.0	21.5		8.5	16.7	14.0		13.1			15.0	13.4
Level of Service	B	C		A	B	B		B			B	B
Approach Delay (s)		17.5			15.7			13.1			14.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	54.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	55	80	224	35	86	306
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	65	94	264	41	101	360
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	846	284			305	
vC1, stage 1 conf vol	284					
vC2, stage 2 conf vol	562					
vCu, unblocked vol	846	284			305	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	88			92	
cM capacity (veh/h)	487	760			1256	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	159	305	101	360
Volume Left	65	0	101	0
Volume Right	94	41	0	0
cSH	618	1700	1256	1700
Volume to Capacity	0.26	0.18	0.08	0.21
Queue Length 95th (ft)	25	0	7	0
Control Delay (s)	12.8	0.0	8.1	0.0
Lane LOS	B		A	
Approach Delay (s)	12.8	0.0	1.8	
Approach LOS	B			

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	430	25	69	616	4	62
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	524	30	84	751	5	76
Pedestrians	4			39	1	
Lane Width (ft)	12.0			12.0	12.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	0			3	0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			556		1464	580
vC1, stage 1 conf vol					541	
vC2, stage 2 conf vol					924	
vCu, unblocked vol			556		1464	580
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			92		98	85
cM capacity (veh/h)			1024		317	501

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	555	84	751	80
Volume Left	0	84	0	5
Volume Right	30	0	0	76
cSH	1700	1024	1700	484
Volume to Capacity	0.33	0.08	0.44	0.17
Queue Length 95th (ft)	0	7	0	15
Control Delay (s)	0.0	8.8	0.0	13.9
Lane LOS		A		B
Approach Delay (s)	0.0	0.9		13.9
Approach LOS				B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	44	408	637	23	16	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	49	453	708	26	18	59
Pedestrians					13	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	746				1285	734
vC1, stage 1 conf vol					734	
vC2, stage 2 conf vol					551	
vCu, unblocked vol	746				1285	734
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	94				95	86
cM capacity (veh/h)	862				385	419

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	49	453	733	77
Volume Left	49	0	0	18
Volume Right	0	0	26	59
cSH	862	1700	1700	411
Volume to Capacity	0.06	0.27	0.43	0.19
Queue Length 95th (ft)	5	0	0	17
Control Delay (s)	9.4	0.0	0.0	15.8
Lane LOS	A			C
Approach Delay (s)	0.9		0.0	15.8
Approach LOS				C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	389	31	13	613	42	22
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	427	34	14	674	46	24
Pedestrians	7				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			464		1156	447
vC1, stage 1 conf vol					447	
vC2, stage 2 conf vol					709	
vCu, unblocked vol			464		1156	447
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			99		89	96
cM capacity (veh/h)			1106		421	615

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	462	14	674	70
Volume Left	0	14	0	46
Volume Right	34	0	0	24
cSH	1700	1106	1700	472
Volume to Capacity	0.27	0.01	0.40	0.15
Queue Length 95th (ft)	0	1	0	13
Control Delay (s)	0.0	8.3	0.0	14.0
Lane LOS		A		B
Approach Delay (s)	0.0	0.2		14.0
Approach LOS				B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	46	365	590	19	6	39
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	49	392	634	20	6	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	655				1136	645
vC1, stage 1 conf vol					645	
vC2, stage 2 conf vol					491	
vCu, unblocked vol	655				1136	645
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	95				98	91
cM capacity (veh/h)	932				426	472

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	49	392	655	48
Volume Left	49	0	0	6
Volume Right	0	0	20	42
cSH	932	1700	1700	466
Volume to Capacity	0.05	0.23	0.39	0.10
Queue Length 95th (ft)	4	0	0	9
Control Delay (s)	9.1	0.0	0.0	13.6
Lane LOS	A			B
Approach Delay (s)	1.0		0.0	13.6
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	23	33	350	19	53	585
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	24	35	368	20	56	616
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1106	378			388	
vC1, stage 1 conf vol	378					
vC2, stage 2 conf vol	727					
vCu, unblocked vol	1106	378			388	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	95			95	
cM capacity (veh/h)	416	673			1170	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	59	388	56	616
Volume Left	24	0	56	0
Volume Right	35	20	0	0
cSH	536	1700	1170	1700
Volume to Capacity	0.11	0.23	0.05	0.36
Queue Length 95th (ft)	9	0	4	0
Control Delay (s)	12.5	0.0	8.2	0.0
Lane LOS	B		A	
Approach Delay (s)	12.5	0.0	0.7	
Approach LOS	B			

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	60	325	590	99	30	49
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	62	335	608	102	31	51
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	710				1118	659
vC1, stage 1 conf vol					659	
vC2, stage 2 conf vol					459	
vCu, unblocked vol	710				1118	659
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	93				93	89
cM capacity (veh/h)	889				426	463

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	62	335	710	31	51
Volume Left	62	0	0	31	0
Volume Right	0	0	102	0	51
cSH	889	1700	1700	426	463
Volume to Capacity	0.07	0.20	0.42	0.07	0.11
Queue Length 95th (ft)	6	0	0	6	9
Control Delay (s)	9.4	0.0	0.0	14.1	13.7
Lane LOS	A			B	B
Approach Delay (s)	1.5		0.0	13.9	
Approach LOS				B	

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	322	29	38	607	11	53	1	37	6	0	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	8	332	30	39	626	11	55	1	38	6	0	14
Pedestrians		4										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked	0.91						0.91	0.91		0.91	0.91	0.91
vC, conflicting volume	637			362			1086	1079	347	1097	1088	635
vC1, stage 1 conf vol							363	363		710	710	
vC2, stage 2 conf vol							723	715		387	378	
vCu, unblocked vol	553			362			1045	1038	347	1057	1048	551
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			84	100	95	98	100	97
cM capacity (veh/h)	927			1208			351	369	696	356	369	485

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	8	362	39	637	94	21
Volume Left	8	0	39	0	55	6
Volume Right	0	30	0	11	38	14
cSH	927	1700	1208	1700	440	438
Volume to Capacity	0.01	0.21	0.03	0.37	0.21	0.05
Queue Length 95th (ft)	1	0	3	0	20	4
Control Delay (s)	8.9	0.0	8.1	0.0	15.4	13.6
Lane LOS	A		A		C	B
Approach Delay (s)	0.2		0.5		15.4	13.6
Approach LOS					C	B

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	49.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	215	224	2	1	253	207	8	0	3	187	0	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.95	1.00
Satd. Flow (prot)	1803	1898		1805	1900	1577		1746			1805	1543
Flt Permitted	0.47	1.00		0.52	1.00	1.00		0.84			0.75	1.00
Satd. Flow (perm)	890	1898		991	1900	1577		1513			1424	1543
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	243	2	1	275	225	9	0	3	203	0	401
RTOR Reduction (vph)	0	1	0	0	0	167	0	2	0	0	0	294
Lane Group Flow (vph)	234	244	0	1	275	58	0	10	0	0	203	107
Confl. Peds. (#/hr)	2					2	13					13
Confl. Bikes (#/hr)		5			4			1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.27			0.27	0.27
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	695	490		722	490	407		403			379	411
v/s Ratio Prot	c0.09	0.13		0.00	c0.14							
v/s Ratio Perm	0.09			0.00		0.04		0.01			c0.14	0.07
v/c Ratio	0.34	0.50		0.00	0.56	0.14		0.02			0.54	0.26
Uniform Delay, d1	8.5	19.6		7.3	20.0	17.7		16.8			19.5	17.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.3	3.6		0.0	4.6	0.7		0.1			5.3	1.5
Delay (s)	9.8	23.2		7.3	24.5	18.5		16.9			24.8	19.5
Level of Service	A	C		A	C	B		B			C	B
Approach Delay (s)		16.6			21.8			16.9			21.3	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	37	122	343	45	87	322
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	41	136	381	50	97	358
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	957	406			431	
vC1, stage 1 conf vol	406					
vC2, stage 2 conf vol	551					
vCu, unblocked vol	957	406			431	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	79			91	
cM capacity (veh/h)	466	649			1128	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	177	431	97	358
Volume Left	41	0	97	0
Volume Right	136	50	0	0
cSH	595	1700	1128	1700
Volume to Capacity	0.30	0.25	0.09	0.21
Queue Length 95th (ft)	31	0	7	0
Control Delay (s)	13.6	0.0	8.5	0.0
Lane LOS	B		A	
Approach Delay (s)	13.6	0.0	1.8	
Approach LOS	B			

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	486	9	35	345	2	14
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	579	11	42	411	2	17
Pedestrians				8	1	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				1	0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			590		1079	593
vC1, stage 1 conf vol					585	
vC2, stage 2 conf vol					494	
vCu, unblocked vol			590		1079	593
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		99	97
cM capacity (veh/h)			994		450	506

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	589	42	411	19
Volume Left	0	42	0	2
Volume Right	11	0	0	17
cSH	1700	994	1700	498
Volume to Capacity	0.35	0.04	0.24	0.04
Queue Length 95th (ft)	0	3	0	3
Control Delay (s)	0.0	8.8	0.0	12.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.8		12.5
Approach LOS				B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	120	360	276	143	108	100
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	132	396	303	157	119	110
Pedestrians			2		3	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	463				1046	385
vC1, stage 1 conf vol					385	
vC2, stage 2 conf vol					661	
vCu, unblocked vol	463				1046	385
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	88				71	83
cM capacity (veh/h)	1106				412	666

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	132	396	460	229
Volume Left	132	0	0	119
Volume Right	0	0	157	110
cSH	1106	1700	1700	505
Volume to Capacity	0.12	0.23	0.27	0.45
Queue Length 95th (ft)	10	0	0	58
Control Delay (s)	8.7	0.0	0.0	17.9
Lane LOS	A			C
Approach Delay (s)	2.2		0.0	17.9
Approach LOS				C

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	444	52	6	359	52	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	510	60	7	413	60	15
Pedestrians	6				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		975	542
vC1, stage 1 conf vol					542	
vC2, stage 2 conf vol					432	
vCu, unblocked vol			572		975	542
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			99		88	97
cM capacity (veh/h)			1009		490	543

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	7	413	75
Volume Left	0	7	0	60
Volume Right	60	0	0	15
cSH	1700	1009	1700	500
Volume to Capacity	0.34	0.01	0.24	0.15
Queue Length 95th (ft)	0	1	0	13
Control Delay (s)	0.0	8.6	0.0	13.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.1		13.5
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	23	434	306	5	20	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	28	536	378	6	25	77
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	389				978	386
vC1, stage 1 conf vol					386	
vC2, stage 2 conf vol					593	
vCu, unblocked vol	389				978	386
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	88
cM capacity (veh/h)	1176				476	664

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	28	536	384	101
Volume Left	28	0	0	25
Volume Right	0	0	6	77
cSH	1176	1700	1700	605
Volume to Capacity	0.02	0.32	0.23	0.17
Queue Length 95th (ft)	2	0	0	15
Control Delay (s)	8.1	0.0	0.0	12.1
Lane LOS	A			B
Approach Delay (s)	0.4		0.0	12.1
Approach LOS				B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	25	46	438	17	8	275
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	30	55	528	20	10	331
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	889	538			548	
vC1, stage 1 conf vol	538					
vC2, stage 2 conf vol	351					
vCu, unblocked vol	889	538			548	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	90			99	
cM capacity (veh/h)	516	547			1021	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	86	548	10	331
Volume Left	30	0	10	0
Volume Right	55	20	0	0
cSH	536	1700	1021	1700
Volume to Capacity	0.16	0.32	0.01	0.19
Queue Length 95th (ft)	14	0	1	0
Control Delay (s)	13.0	0.0	8.6	0.0
Lane LOS	B		A	
Approach Delay (s)	13.0	0.0	0.2	
Approach LOS	B			

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	33	451	205	32	89	74
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	480	218	34	95	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	252				785	235
vC1, stage 1 conf vol					235	
vC2, stage 2 conf vol					550	
vCu, unblocked vol	252				785	235
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				82	90
cM capacity (veh/h)	1313				523	804

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	35	480	252	95	79
Volume Left	35	0	0	95	0
Volume Right	0	0	34	0	79
cSH	1313	1700	1700	523	804
Volume to Capacity	0.03	0.28	0.15	0.18	0.10
Queue Length 95th (ft)	2	0	0	16	8
Control Delay (s)	7.8	0.0	0.0	13.4	10.0
Lane LOS	A			B	A
Approach Delay (s)	0.5		0.0	11.8	
Approach LOS				B	

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	444	90	48	194	1	37	0	86	3	0	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	6	458	93	49	200	1	38	0	89	3	0	3
Pedestrians		1									2	
Lane Width (ft)		12.0									12.0	
Walking Speed (ft/s)		4.0									4.0	
Percent Blockage		0									0	
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked												
vC, conflicting volume	203			551			820	818	504	860	864	204
vC1, stage 1 conf vol							516	516		301	301	
vC2, stage 2 conf vol							303	302		559	563	
vCu, unblocked vol	203			551			820	818	504	860	864	204
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			92	100	84	99	100	100
cM capacity (veh/h)	1378			1029			476	468	572	363	423	840

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	6	551	49	201	127	6
Volume Left	6	0	49	0	38	3
Volume Right	0	93	0	1	89	3
cSH	1378	1700	1029	1700	539	507
Volume to Capacity	0.00	0.32	0.05	0.12	0.24	0.01
Queue Length 95th (ft)	0	0	4	0	23	1
Control Delay (s)	7.6	0.0	8.7	0.0	13.7	12.2
Lane LOS	A		A		B	B
Approach Delay (s)	0.1		1.7		13.7	12.2
Approach LOS					B	B

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	50.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	295	6	1	193	132	2	1	3	87	0	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.95	1.00
Satd. Flow (prot)	1802	1894		1805	1900	1577		1723			1805	1561
Flt Permitted	0.55	1.00		0.33	1.00	1.00		0.95			0.75	1.00
Satd. Flow (perm)	1040	1894		622	1900	1577		1668			1431	1561
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	239	351	7	1	230	157	2	1	4	104	0	82
RTOR Reduction (vph)	0	1	0	0	0	116	0	3	0	0	0	60
Lane Group Flow (vph)	239	357	0	1	230	41	0	4	0	0	104	22
Confl. Peds. (#/hr)	2					2	7					7
Confl. Bikes (#/hr)		1			2							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.27			0.27	0.27
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	733	489		626	490	407		444			381	415
v/s Ratio Prot	c0.08	c0.19		0.00	0.12							
v/s Ratio Perm	0.08			0.00		0.03		0.00			c0.07	0.01
v/c Ratio	0.33	0.73		0.00	0.47	0.10		0.01			0.27	0.05
Uniform Delay, d1	8.4	21.0		7.6	19.4	17.5		16.7			18.0	16.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.2	9.2		0.0	3.2	0.5		0.0			1.8	0.2
Delay (s)	9.6	30.2		7.6	22.6	18.0		16.8			19.8	17.2
Level of Service	A	C		A	C	B		B			B	B
Approach Delay (s)		22.0			20.7			16.8			18.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	122	203	35	107	306
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	88	144	239	41	126	360
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	871	259			280	
vC1, stage 1 conf vol	259					
vC2, stage 2 conf vol	612					
vCu, unblocked vol	871	259			280	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	82			90	
cM capacity (veh/h)	460	784			1294	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	232	280	126	360
Volume Left	88	0	126	0
Volume Right	144	41	0	0
cSH	618	1700	1294	1700
Volume to Capacity	0.37	0.16	0.10	0.21
Queue Length 95th (ft)	43	0	8	0
Control Delay (s)	14.3	0.0	8.1	0.0
Lane LOS	B		A	
Approach Delay (s)	14.3	0.0	2.1	
Approach LOS	B			

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	467	26	81	656	4	82
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	570	32	99	800	5	100
Pedestrians	4			39	1	
Lane Width (ft)	12.0			12.0	12.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	0			3	0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			602		1588	625
vC1, stage 1 conf vol					586	
vC2, stage 2 conf vol					1002	
vCu, unblocked vol			602		1588	625
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			90		98	79
cM capacity (veh/h)			984		286	472

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	601	99	800	105
Volume Left	0	99	0	5
Volume Right	32	0	0	100
cSH	1700	984	1700	458
Volume to Capacity	0.35	0.10	0.47	0.23
Queue Length 95th (ft)	0	8	0	22
Control Delay (s)	0.0	9.1	0.0	15.2
Lane LOS		A		C
Approach Delay (s)	0.0	1.0		15.2
Approach LOS				C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	50	455	682	65	68	60
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	506	758	72	76	67
Pedestrians					13	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	843				1424	807
vC1, stage 1 conf vol					807	
vC2, stage 2 conf vol					617	
vCu, unblocked vol	843				1424	807
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	93				78	82
cM capacity (veh/h)	793				349	380

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	56	506	830	142
Volume Left	56	0	0	76
Volume Right	0	0	72	67
cSH	793	1700	1700	363
Volume to Capacity	0.07	0.30	0.49	0.39
Queue Length 95th (ft)	6	0	0	45
Control Delay (s)	9.9	0.0	0.0	21.2
Lane LOS	A			C
Approach Delay (s)	1.0		0.0	21.2
Approach LOS				C

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	471	48	18	689	53	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	518	53	20	757	58	25
Pedestrians	7				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		1350	546
vC1, stage 1 conf vol					546	
vC2, stage 2 conf vol					804	
vCu, unblocked vol			572		1350	546
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			98		84	95
cM capacity (veh/h)			1009		370	541

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	20	757	84
Volume Left	0	20	0	58
Volume Right	53	0	0	25
cSH	1700	1009	1700	409
Volume to Capacity	0.34	0.02	0.45	0.20
Queue Length 95th (ft)	0	1	0	19
Control Delay (s)	0.0	8.6	0.0	16.1
Lane LOS		A		C
Approach Delay (s)	0.0	0.2		16.1
Approach LOS				C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	56	438	663	12	0	48
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	60	471	713	13	0	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	726				1311	719
vC1, stage 1 conf vol					719	
vC2, stage 2 conf vol					591	
vCu, unblocked vol	726				1311	719
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	93				100	88
cM capacity (veh/h)	886				380	432

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	60	471	726	52
Volume Left	60	0	0	0
Volume Right	0	0	13	52
cSH	886	1700	1700	432
Volume to Capacity	0.07	0.28	0.43	0.12
Queue Length 95th (ft)	5	0	0	10
Control Delay (s)	9.4	0.0	0.0	14.5
Lane LOS	A			B
Approach Delay (s)	1.1		0.0	14.5
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	26	32	414	23	52	646
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	34	436	24	55	680
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1237	448			460	
vC1, stage 1 conf vol	448					
vC2, stage 2 conf vol	789					
vCu, unblocked vol	1237	448			460	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	95			95	
cM capacity (veh/h)	382	615			1101	

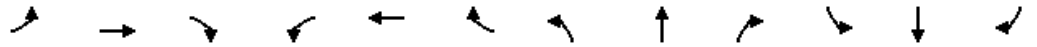
Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	61	460	55	680
Volume Left	27	0	55	0
Volume Right	34	24	0	0
cSH	483	1700	1101	1700
Volume to Capacity	0.13	0.27	0.05	0.40
Queue Length 95th (ft)	11	0	4	0
Control Delay (s)	13.5	0.0	8.4	0.0
Lane LOS	B		A	
Approach Delay (s)	13.5	0.0	0.6	
Approach LOS	B			

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	80	366	637	107	31	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	82	377	657	110	32	64
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	767				1254	712
vC1, stage 1 conf vol					712	
vC2, stage 2 conf vol					542	
vCu, unblocked vol	767				1254	712
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	90				92	85
cM capacity (veh/h)	847				384	432

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	82	377	767	32	64
Volume Left	82	0	0	32	0
Volume Right	0	0	110	0	64
cSH	847	1700	1700	384	432
Volume to Capacity	0.10	0.22	0.45	0.08	0.15
Queue Length 95th (ft)	8	0	0	7	13
Control Delay (s)	9.7	0.0	0.0	15.2	14.8
Lane LOS	A			C	B
Approach Delay (s)	1.7		0.0	14.9	
Approach LOS				B	

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	360	32	43	653	12	59	1	45	6	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	8	371	33	44	673	12	61	1	46	6	0	15
Pedestrians		3			4						4	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	690			404			1184	1182	392	1211	1193	686
vC1, stage 1 conf vol							404	404		772	772	
vC2, stage 2 conf vol							780	778		439	421	
vCu, unblocked vol	596			404			1148	1146	392	1177	1157	592
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			81	100	93	98	100	97
cM capacity (veh/h)	885			1166			321	340	659	320	340	454

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	8	404	44	686	108	22
Volume Left	8	0	44	0	61	6
Volume Right	0	33	0	12	46	15
cSH	885	1700	1166	1700	412	406
Volume to Capacity	0.01	0.24	0.04	0.40	0.26	0.05
Queue Length 95th (ft)	1	0	3	0	26	4
Control Delay (s)	9.1	0.0	8.2	0.0	16.8	14.4
Lane LOS	A		A		C	B
Approach Delay (s)	0.2		0.5		16.8	14.4
Approach LOS					C	B

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	54.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	233	255	2	1	273	227	8	0	3	218	0	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.95	1.00
Satd. Flow (prot)	1803	1898		1805	1900	1577		1748			1805	1543
Flt Permitted	0.43	1.00		0.47	1.00	1.00		0.82			0.75	1.00
Satd. Flow (perm)	824	1898		884	1900	1577		1494			1424	1543
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	277	2	1	297	247	9	0	3	237	0	434
RTOR Reduction (vph)	0	1	0	0	0	183	0	2	0	0	0	321
Lane Group Flow (vph)	253	278	0	1	297	64	0	10	0	0	237	113
Confl. Peds. (#/hr)	2					2	13					13
Confl. Bikes (#/hr)		5			4			1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.26			0.26	0.26
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	683	494		700	494	410		389			370	401
v/s Ratio Prot	c0.10	0.15		0.00	c0.16							
v/s Ratio Perm	0.10			0.00		0.04		0.01			c0.17	0.07
v/c Ratio	0.37	0.56		0.00	0.60	0.16		0.03			0.64	0.28
Uniform Delay, d1	8.4	19.7		7.2	20.0	17.5		16.9			20.2	18.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.5	4.6		0.0	5.3	0.8		0.1			8.2	1.7
Delay (s)	9.9	24.3		7.2	25.3	18.4		17.1			28.4	19.9
Level of Service	A	C		A	C	B		B			C	B
Approach Delay (s)		17.5			22.1			17.1			22.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	46	146	367	69	124	341
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	51	162	408	77	138	379
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			TWLTL			TWLTL
Median storage veh)			2			2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1101	446			484	
vC1, stage 1 conf vol	446					
vC2, stage 2 conf vol	654					
vCu, unblocked vol	1101	446			484	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	74			87	
cM capacity (veh/h)	404	616			1089	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	213	484	138	379
Volume Left	51	0	138	0
Volume Right	162	77	0	0
cSH	547	1700	1089	1700
Volume to Capacity	0.39	0.28	0.13	0.22
Queue Length 95th (ft)	46	0	11	0
Control Delay (s)	15.7	0.0	8.8	0.0
Lane LOS	C		A	
Approach Delay (s)	15.7	0.0	2.3	
Approach LOS	C			

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	486	9	35	345	2	14
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	579	11	42	411	2	17
Pedestrians				8	1	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				1	0	
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			590		1079	593
vC1, stage 1 conf vol					585	
vC2, stage 2 conf vol					494	
vCu, unblocked vol			590		1079	593
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		99	97
cM capacity (veh/h)			994		450	506

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	589	42	411	19
Volume Left	0	42	0	2
Volume Right	11	0	0	17
cSH	1700	994	1700	498
Volume to Capacity	0.35	0.04	0.24	0.04
Queue Length 95th (ft)	0	3	0	3
Control Delay (s)	0.0	8.8	0.0	12.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.8		12.5
Approach LOS				B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	120	360	276	143	108	100
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	132	396	303	157	119	110
Pedestrians			2		3	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	463				1046	385
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	463				1046	385
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				47	83
cM capacity (veh/h)	1106				224	666

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	132	396	460	229
Volume Left	132	0	0	119
Volume Right	0	0	157	110
cSH	1106	1700	1700	329
Volume to Capacity	0.12	0.23	0.27	0.70
Queue Length 95th (ft)	10	0	0	123
Control Delay (s)	8.7	0.0	0.0	37.6
Lane LOS	A			E
Approach Delay (s)	2.2		0.0	37.6
Approach LOS				E

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	444	52	6	359	52	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	510	60	7	413	60	15
Pedestrians	6				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		975	542
vC1, stage 1 conf vol					542	
vC2, stage 2 conf vol					432	
vCu, unblocked vol			572		975	542
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			99		88	97
cM capacity (veh/h)			1009		490	543

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	7	413	75
Volume Left	0	7	0	60
Volume Right	60	0	0	15
cSH	1700	1009	1700	500
Volume to Capacity	0.34	0.01	0.24	0.15
Queue Length 95th (ft)	0	1	0	13
Control Delay (s)	0.0	8.6	0.0	13.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.1		13.5
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	23	434	306	5	20	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	28	536	378	6	25	77
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		TWLTL	None			
Median storage veh)		2				
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	389				978	386
vC1, stage 1 conf vol					386	
vC2, stage 2 conf vol					593	
vCu, unblocked vol	389				978	386
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	88
cM capacity (veh/h)	1176				476	664

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	28	536	384	101
Volume Left	28	0	0	25
Volume Right	0	0	6	77
cSH	1176	1700	1700	605
Volume to Capacity	0.02	0.32	0.23	0.17
Queue Length 95th (ft)	2	0	0	15
Control Delay (s)	8.1	0.0	0.0	12.1
Lane LOS	A			B
Approach Delay (s)	0.4		0.0	12.1
Approach LOS				B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	25	46	438	17	8	275
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	30	55	528	20	10	331
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	889	538			548	
vC1, stage 1 conf vol	538					
vC2, stage 2 conf vol	351					
vCu, unblocked vol	889	538			548	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	90			99	
cM capacity (veh/h)	516	547			1021	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	86	548	10	331
Volume Left	30	0	10	0
Volume Right	55	20	0	0
cSH	536	1700	1021	1700
Volume to Capacity	0.16	0.32	0.01	0.19
Queue Length 95th (ft)	14	0	1	0
Control Delay (s)	13.0	0.0	8.6	0.0
Lane LOS	B		A	
Approach Delay (s)	13.0	0.0	0.2	
Approach LOS	B			

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	33	451	205	32	89	74
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	480	218	34	95	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	252				785	235
vC1, stage 1 conf vol					235	
vC2, stage 2 conf vol					550	
vCu, unblocked vol	252				785	235
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				82	90
cM capacity (veh/h)	1313				523	804

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	35	480	252	95	79
Volume Left	35	0	0	95	0
Volume Right	0	0	34	0	79
cSH	1313	1700	1700	523	804
Volume to Capacity	0.03	0.28	0.15	0.18	0.10
Queue Length 95th (ft)	2	0	0	16	8
Control Delay (s)	7.8	0.0	0.0	13.4	10.0
Lane LOS	A			B	A
Approach Delay (s)	0.5		0.0	11.8	
Approach LOS				B	

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	444	90	48	194	1	37	0	86	3	0	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	6	458	93	49	200	1	38	0	89	3	0	3
Pedestrians		1									2	
Lane Width (ft)		12.0									12.0	
Walking Speed (ft/s)		4.0									4.0	
Percent Blockage		0									0	
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked												
vC, conflicting volume	203			551			820	818	504	860	864	204
vC1, stage 1 conf vol							516	516		301	301	
vC2, stage 2 conf vol							303	302		559	563	
vCu, unblocked vol	203			551			820	818	504	860	864	204
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			92	100	84	99	100	100
cM capacity (veh/h)	1378			1029			476	468	572	363	423	840

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	6	551	49	201	127	6
Volume Left	6	0	49	0	38	3
Volume Right	0	93	0	1	89	3
cSH	1378	1700	1029	1700	539	507
Volume to Capacity	0.00	0.32	0.05	0.12	0.24	0.01
Queue Length 95th (ft)	0	0	4	0	23	1
Control Delay (s)	7.6	0.0	8.7	0.0	13.7	12.2
Lane LOS	A		A		B	B
Approach Delay (s)	0.1		1.7		13.7	12.2
Approach LOS					B	B

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	50.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	295	6	1	193	132	2	1	3	87	0	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.95	1.00
Satd. Flow (prot)	1802	1894		1805	1900	1577		1723			1805	1561
Flt Permitted	0.55	1.00		0.33	1.00	1.00		0.95			0.75	1.00
Satd. Flow (perm)	1040	1894		622	1900	1577		1668			1431	1561
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	239	351	7	1	230	157	2	1	4	104	0	82
RTOR Reduction (vph)	0	1	0	0	0	116	0	3	0	0	0	60
Lane Group Flow (vph)	239	357	0	1	230	41	0	4	0	0	104	22
Confl. Peds. (#/hr)	2					2	7					7
Confl. Bikes (#/hr)		1			2							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.27			0.27	0.27
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	733	489		626	490	407		444			381	415
v/s Ratio Prot	c0.08	c0.19		0.00	0.12							
v/s Ratio Perm	0.08			0.00		0.03		0.00			c0.07	0.01
v/c Ratio	0.33	0.73		0.00	0.47	0.10		0.01			0.27	0.05
Uniform Delay, d1	8.4	21.0		7.6	19.4	17.5		16.7			18.0	16.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.2	9.2		0.0	3.2	0.5		0.0			1.8	0.2
Delay (s)	9.6	30.2		7.6	22.6	18.0		16.8			19.8	17.2
Level of Service	A	C		A	C	B		B			B	B
Approach Delay (s)		22.0			20.7			16.8			18.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	122	203	35	107	306
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	88	144	239	41	126	360
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	871	259			280	
vC1, stage 1 conf vol	259					
vC2, stage 2 conf vol	612					
vCu, unblocked vol	871	259			280	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	82			90	
cM capacity (veh/h)	460	784			1294	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	232	280	126	360
Volume Left	88	0	126	0
Volume Right	144	41	0	0
cSH	618	1700	1294	1700
Volume to Capacity	0.37	0.16	0.10	0.21
Queue Length 95th (ft)	43	0	8	0
Control Delay (s)	14.3	0.0	8.1	0.0
Lane LOS	B		A	
Approach Delay (s)	14.3	0.0	2.1	
Approach LOS	B			

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	467	26	81	656	4	82
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	570	32	99	800	5	100
Pedestrians	4			39	1	
Lane Width (ft)	12.0			12.0	12.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	0			3	0	
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			602		1588	625
vC1, stage 1 conf vol					586	
vC2, stage 2 conf vol					1002	
vCu, unblocked vol			602		1588	625
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			90		98	79
cM capacity (veh/h)			984		286	472

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	601	99	800	105
Volume Left	0	99	0	5
Volume Right	32	0	0	100
cSH	1700	984	1700	458
Volume to Capacity	0.35	0.10	0.47	0.23
Queue Length 95th (ft)	0	8	0	22
Control Delay (s)	0.0	9.1	0.0	15.2
Lane LOS		A		C
Approach Delay (s)	0.0	1.0		15.2
Approach LOS				C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	50	455	682	65	68	60
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	506	758	72	76	67
Pedestrians					13	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	843				1424	807
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	843				1424	807
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				46	82
cM capacity (veh/h)	793				139	380

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	56	506	830	142
Volume Left	56	0	0	76
Volume Right	0	0	72	67
cSH	793	1700	1700	198
Volume to Capacity	0.07	0.30	0.49	0.72
Queue Length 95th (ft)	6	0	0	115
Control Delay (s)	9.9	0.0	0.0	59.3
Lane LOS	A			F
Approach Delay (s)	1.0		0.0	59.3
Approach LOS				F

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	471	48	18	689	53	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	518	53	20	757	58	25
Pedestrians	7				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		1350	546
vC1, stage 1 conf vol					546	
vC2, stage 2 conf vol					804	
vCu, unblocked vol			572		1350	546
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			98		84	95
cM capacity (veh/h)			1009		370	541

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	20	757	84
Volume Left	0	20	0	58
Volume Right	53	0	0	25
cSH	1700	1009	1700	409
Volume to Capacity	0.34	0.02	0.45	0.20
Queue Length 95th (ft)	0	1	0	19
Control Delay (s)	0.0	8.6	0.0	16.1
Lane LOS		A		C
Approach Delay (s)	0.0	0.2		16.1
Approach LOS				C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	56	438	663	12	0	48
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	60	471	713	13	0	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	None			
Median storage veh)		2				
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	726				1311	719
vC1, stage 1 conf vol					719	
vC2, stage 2 conf vol					591	
vCu, unblocked vol	726				1311	719
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	93				100	88
cM capacity (veh/h)	886				380	432

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	60	471	726	52
Volume Left	60	0	0	0
Volume Right	0	0	13	52
cSH	886	1700	1700	432
Volume to Capacity	0.07	0.28	0.43	0.12
Queue Length 95th (ft)	5	0	0	10
Control Delay (s)	9.4	0.0	0.0	14.5
Lane LOS	A			B
Approach Delay (s)	1.1		0.0	14.5
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	26	32	414	23	52	646
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	34	436	24	55	680
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1237	448			460	
vC1, stage 1 conf vol	448					
vC2, stage 2 conf vol	789					
vCu, unblocked vol	1237	448			460	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	95			95	
cM capacity (veh/h)	382	615			1101	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	61	460	55	680
Volume Left	27	0	55	0
Volume Right	34	24	0	0
cSH	483	1700	1101	1700
Volume to Capacity	0.13	0.27	0.05	0.40
Queue Length 95th (ft)	11	0	4	0
Control Delay (s)	13.5	0.0	8.4	0.0
Lane LOS	B		A	
Approach Delay (s)	13.5	0.0	0.6	
Approach LOS	B			

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	80	366	637	107	31	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	82	377	657	110	32	64
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	767				1254	712
vC1, stage 1 conf vol					712	
vC2, stage 2 conf vol					542	
vCu, unblocked vol	767				1254	712
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	90				92	85
cM capacity (veh/h)	847				384	432

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	82	377	767	32	64
Volume Left	82	0	0	32	0
Volume Right	0	0	110	0	64
cSH	847	1700	1700	384	432
Volume to Capacity	0.10	0.22	0.45	0.08	0.15
Queue Length 95th (ft)	8	0	0	7	13
Control Delay (s)	9.7	0.0	0.0	15.2	14.8
Lane LOS	A			C	B
Approach Delay (s)	1.7		0.0	14.9	
Approach LOS				B	

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	360	32	43	653	12	59	1	45	6	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	8	371	33	44	673	12	61	1	46	6	0	15
Pedestrians		3			4						4	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)					972							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	690			404			1184	1182	392	1211	1193	686
vC1, stage 1 conf vol							404	404		772	772	
vC2, stage 2 conf vol							780	778		439	421	
vCu, unblocked vol	596			404			1148	1146	392	1177	1157	592
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			81	100	93	98	100	97
cM capacity (veh/h)	885			1166			321	340	659	320	340	454

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	8	404	44	686	108	22
Volume Left	8	0	44	0	61	6
Volume Right	0	33	0	12	46	15
cSH	885	1700	1166	1700	412	406
Volume to Capacity	0.01	0.24	0.04	0.40	0.26	0.05
Queue Length 95th (ft)	1	0	3	0	26	4
Control Delay (s)	9.1	0.0	8.2	0.0	16.8	14.4
Lane LOS	A		A		C	B
Approach Delay (s)	0.2		0.5		16.8	14.4
Approach LOS					C	B

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	54.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	233	255	2	1	273	227	8	0	3	218	0	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.95	1.00
Satd. Flow (prot)	1803	1898		1805	1900	1577		1748			1805	1543
Flt Permitted	0.43	1.00		0.47	1.00	1.00		0.82			0.75	1.00
Satd. Flow (perm)	824	1898		884	1900	1577		1494			1424	1543
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	277	2	1	297	247	9	0	3	237	0	434
RTOR Reduction (vph)	0	1	0	0	0	183	0	2	0	0	0	321
Lane Group Flow (vph)	253	278	0	1	297	64	0	10	0	0	237	113
Confl. Peds. (#/hr)	2					2	13					13
Confl. Bikes (#/hr)		5			4			1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.26			0.26	0.26
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	683	494		700	494	410		389			370	401
v/s Ratio Prot	c0.10	0.15		0.00	c0.16							
v/s Ratio Perm	0.10			0.00		0.04		0.01			c0.17	0.07
v/c Ratio	0.37	0.56		0.00	0.60	0.16		0.03			0.64	0.28
Uniform Delay, d1	8.4	19.7		7.2	20.0	17.5		16.9			20.2	18.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.5	4.6		0.0	5.3	0.8		0.1			8.2	1.7
Delay (s)	9.9	24.3		7.2	25.3	18.4		17.1			28.4	19.9
Level of Service	A	C		A	C	B		B			C	B
Approach Delay (s)		17.5			22.1			17.1			22.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	46	146	367	69	124	341
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	51	162	408	77	138	379
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1101	446			484	
vC1, stage 1 conf vol	446					
vC2, stage 2 conf vol	654					
vCu, unblocked vol	1101	446			484	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	74			87	
cM capacity (veh/h)	404	616			1089	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	213	484	138	379
Volume Left	51	0	138	0
Volume Right	162	77	0	0
cSH	547	1700	1089	1700
Volume to Capacity	0.39	0.28	0.13	0.22
Queue Length 95th (ft)	46	0	11	0
Control Delay (s)	15.7	0.0	8.8	0.0
Lane LOS	C		A	
Approach Delay (s)	15.7	0.0	2.3	
Approach LOS	C			

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	486	9	35	345	2	14
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	579	11	42	411	2	17
Pedestrians				8	1	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				1	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			590		1079	593
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			590		1079	593
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		99	97
cM capacity (veh/h)			994		233	506

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	589	42	411	19
Volume Left	0	42	0	2
Volume Right	11	0	0	17
cSH	1700	994	1700	441
Volume to Capacity	0.35	0.04	0.24	0.04
Queue Length 95th (ft)	0	3	0	3
Control Delay (s)	0.0	8.8	0.0	13.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.8		13.5
Approach LOS				B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	120	360	276	143	108	100
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	132	396	303	157	119	110
Pedestrians			2		3	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	463				1046	385
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	463				1046	385
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				47	83
cM capacity (veh/h)	1106				224	666

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	132	396	460	229
Volume Left	132	0	0	119
Volume Right	0	0	157	110
cSH	1106	1700	1700	329
Volume to Capacity	0.12	0.23	0.27	0.70
Queue Length 95th (ft)	10	0	0	123
Control Delay (s)	8.7	0.0	0.0	37.6
Lane LOS	A			E
Approach Delay (s)	2.2		0.0	37.6
Approach LOS				E

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	444	52	6	359	52	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	510	60	7	413	60	15
Pedestrians	6				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		975	542
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			572		975	542
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		78	97
cM capacity (veh/h)			1009		278	543

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	7	413	75
Volume Left	0	7	0	60
Volume Right	60	0	0	15
cSH	1700	1009	1700	308
Volume to Capacity	0.34	0.01	0.24	0.24
Queue Length 95th (ft)	0	1	0	23
Control Delay (s)	0.0	8.6	0.0	20.4
Lane LOS		A		C
Approach Delay (s)	0.0	0.1		20.4
Approach LOS				C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	23	434	306	5	20	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	28	536	378	6	25	77
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	389				978	386
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	389				978	386
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				91	88
cM capacity (veh/h)	1176				272	664

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	28	536	384	101
Volume Left	28	0	0	25
Volume Right	0	0	6	77
cSH	1176	1700	1700	491
Volume to Capacity	0.02	0.32	0.23	0.21
Queue Length 95th (ft)	2	0	0	19
Control Delay (s)	8.1	0.0	0.0	14.2
Lane LOS	A			B
Approach Delay (s)	0.4		0.0	14.2
Approach LOS				B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	25	46	438	17	8	275
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	30	55	528	20	10	331
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	889	538			548	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	889	538			548	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	90			99	
cM capacity (veh/h)	314	547			1021	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	86	548	10	331
Volume Left	30	0	10	0
Volume Right	55	20	0	0
cSH	433	1700	1021	1700
Volume to Capacity	0.20	0.32	0.01	0.19
Queue Length 95th (ft)	18	0	1	0
Control Delay (s)	15.3	0.0	8.6	0.0
Lane LOS	C		A	
Approach Delay (s)	15.3	0.0	0.2	
Approach LOS	C			

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	33	451	205	32	89	74
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	480	218	34	95	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	252				785	235
vC1, stage 1 conf vol					235	
vC2, stage 2 conf vol					550	
vCu, unblocked vol	252				785	235
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				82	90
cM capacity (veh/h)	1313				523	804

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	35	480	252	95	79
Volume Left	35	0	0	95	0
Volume Right	0	0	34	0	79
cSH	1313	1700	1700	523	804
Volume to Capacity	0.03	0.28	0.15	0.18	0.10
Queue Length 95th (ft)	2	0	0	16	8
Control Delay (s)	7.8	0.0	0.0	13.4	10.0
Lane LOS	A			B	A
Approach Delay (s)	0.5		0.0	11.8	
Approach LOS				B	

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	444	90	48	194	1	37	0	86	3	0	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	6	458	93	49	200	1	38	0	89	3	0	3
Pedestrians		1									2	
Lane Width (ft)		12.0									12.0	
Walking Speed (ft/s)		4.0									4.0	
Percent Blockage		0									0	
Right turn flare (veh)												
Median type		TWLTL			None							
Median storage veh)		2										
Upstream signal (ft)					972							
pX, platoon unblocked												
vC, conflicting volume	203			551			820	818	504	860	864	204
vC1, stage 1 conf vol							516	516		301	301	
vC2, stage 2 conf vol							303	302		559	563	
vCu, unblocked vol	203			551			820	818	504	860	864	204
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			92	100	84	99	100	100
cM capacity (veh/h)	1378			1029			476	468	572	363	423	840

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	6	551	49	201	127	6
Volume Left	6	0	49	0	38	3
Volume Right	0	93	0	1	89	3
cSH	1378	1700	1029	1700	539	507
Volume to Capacity	0.00	0.32	0.05	0.12	0.24	0.01
Queue Length 95th (ft)	0	0	4	0	23	1
Control Delay (s)	7.6	0.0	8.7	0.0	13.7	12.2
Lane LOS	A		A		B	B
Approach Delay (s)	0.1		1.7		13.7	12.2
Approach LOS					B	B

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	50.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	201	295	6	1	193	132	2	1	3	87	0	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.95	1.00
Satd. Flow (prot)	1802	1894		1805	1900	1577		1723			1805	1561
Flt Permitted	0.55	1.00		0.33	1.00	1.00		0.95			0.75	1.00
Satd. Flow (perm)	1040	1894		622	1900	1577		1668			1431	1561
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	239	351	7	1	230	157	2	1	4	104	0	82
RTOR Reduction (vph)	0	1	0	0	0	116	0	3	0	0	0	60
Lane Group Flow (vph)	239	357	0	1	230	41	0	4	0	0	104	22
Confl. Peds. (#/hr)	2					2	7					7
Confl. Bikes (#/hr)		1			2							
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.5			16.5	16.5
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.27			0.27	0.27
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	733	489		626	490	407		444			381	415
v/s Ratio Prot	c0.08	c0.19		0.00	0.12							
v/s Ratio Perm	0.08			0.00		0.03		0.00			c0.07	0.01
v/c Ratio	0.33	0.73		0.00	0.47	0.10		0.01			0.27	0.05
Uniform Delay, d1	8.4	21.0		7.6	19.4	17.5		16.7			18.0	16.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.2	9.2		0.0	3.2	0.5		0.0			1.8	0.2
Delay (s)	9.6	30.2		7.6	22.6	18.0		16.8			19.8	17.2
Level of Service	A	C		A	C	B		B			B	B
Approach Delay (s)		22.0			20.7			16.8			18.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	122	203	35	107	306
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	88	144	239	41	126	360
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	871	259			280	
vC1, stage 1 conf vol	259					
vC2, stage 2 conf vol	612					
vCu, unblocked vol	871	259			280	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	82			90	
cM capacity (veh/h)	460	784			1294	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	232	280	126	360
Volume Left	88	0	126	0
Volume Right	144	41	0	0
cSH	618	1700	1294	1700
Volume to Capacity	0.37	0.16	0.10	0.21
Queue Length 95th (ft)	43	0	8	0
Control Delay (s)	14.3	0.0	8.1	0.0
Lane LOS	B		A	
Approach Delay (s)	14.3	0.0	2.1	
Approach LOS	B			

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	467	26	81	656	4	82
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	570	32	99	800	5	100
Pedestrians	4			39	1	
Lane Width (ft)	12.0			12.0	12.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	0			3	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	622					
pX, platoon unblocked						
vC, conflicting volume			602		1588	625
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			602		1588	625
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		95	79
cM capacity (veh/h)			984		108	472

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	601	99	800	105
Volume Left	0	99	0	5
Volume Right	32	0	0	100
cSH	1700	984	1700	408
Volume to Capacity	0.35	0.10	0.47	0.26
Queue Length 95th (ft)	0	8	0	25
Control Delay (s)	0.0	9.1	0.0	16.9
Lane LOS		A		C
Approach Delay (s)	0.0	1.0		16.9
Approach LOS				C

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	50	455	682	65	68	60
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	56	506	758	72	76	67
Pedestrians					13	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1096				
pX, platoon unblocked						
vC, conflicting volume	843				1424	807
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	843				1424	807
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				46	82
cM capacity (veh/h)	793				139	380

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	56	506	830	142
Volume Left	56	0	0	76
Volume Right	0	0	72	67
cSH	793	1700	1700	198
Volume to Capacity	0.07	0.30	0.49	0.72
Queue Length 95th (ft)	6	0	0	115
Control Delay (s)	9.9	0.0	0.0	59.3
Lane LOS	A			F
Approach Delay (s)	1.0		0.0	59.3
Approach LOS				F

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	471	48	18	689	53	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	518	53	20	757	58	25
Pedestrians	7				2	
Lane Width (ft)	12.0				12.0	
Walking Speed (ft/s)	4.0				4.0	
Percent Blockage	1				0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			572		1350	546
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			572		1350	546
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		64	95
cM capacity (veh/h)			1009		163	541

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	570	20	757	84
Volume Left	0	20	0	58
Volume Right	53	0	0	25
cSH	1700	1009	1700	207
Volume to Capacity	0.34	0.02	0.45	0.40
Queue Length 95th (ft)	0	1	0	45
Control Delay (s)	0.0	8.6	0.0	33.7
Lane LOS		A		D
Approach Delay (s)	0.0	0.2		33.7
Approach LOS				D

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	56	438	663	12	0	48
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	60	471	713	13	0	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	726				1311	719
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	726				1311	719
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				100	88
cM capacity (veh/h)	886				165	432

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	60	471	726	52
Volume Left	60	0	0	0
Volume Right	0	0	13	52
cSH	886	1700	1700	432
Volume to Capacity	0.07	0.28	0.43	0.12
Queue Length 95th (ft)	5	0	0	10
Control Delay (s)	9.4	0.0	0.0	14.5
Lane LOS	A			B
Approach Delay (s)	1.1		0.0	14.5
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	26	32	414	23	52	646
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	34	436	24	55	680
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1237	448			460	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1237	448			460	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	95			95	
cM capacity (veh/h)	186	615			1101	

Direction, Lane #	EB 1	SE 1	NW 1	NW 2
Volume Total	61	460	55	680
Volume Left	27	0	55	0
Volume Right	34	24	0	0
cSH	303	1700	1101	1700
Volume to Capacity	0.20	0.27	0.05	0.40
Queue Length 95th (ft)	18	0	4	0
Control Delay (s)	19.9	0.0	8.4	0.0
Lane LOS	C		A	
Approach Delay (s)	19.9	0.0	0.6	
Approach LOS	C			

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	44.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	80	366	637	107	31	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	82	377	657	110	32	64
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	767				1254	712
vC1, stage 1 conf vol					712	
vC2, stage 2 conf vol					542	
vCu, unblocked vol	767				1254	712
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	90				92	85
cM capacity (veh/h)	847				384	432

Direction, Lane #	SE 1	SE 2	NW 1	SW 1	SW 2
Volume Total	82	377	767	32	64
Volume Left	82	0	0	32	0
Volume Right	0	0	110	0	64
cSH	847	1700	1700	384	432
Volume to Capacity	0.10	0.22	0.45	0.08	0.15
Queue Length 95th (ft)	8	0	0	7	13
Control Delay (s)	9.7	0.0	0.0	15.2	14.8
Lane LOS	A			C	B
Approach Delay (s)	1.7		0.0	14.9	
Approach LOS				B	

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	360	32	43	653	12	59	1	45	6	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	8	371	33	44	673	12	61	1	46	6	0	15
Pedestrians		3			4						4	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type		TWLTL			None							
Median storage veh)		2										
Upstream signal (ft)					972							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	690			404			1184	1182	392	1227	1193	686
vC1, stage 1 conf vol							404	404		772	772	
vC2, stage 2 conf vol							780	778		455	421	
vCu, unblocked vol	596			404			1148	1146	392	1196	1157	592
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			81	100	93	98	100	97
cM capacity (veh/h)	885			1166			321	340	659	317	340	454

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	412	44	686	108	22
Volume Left	8	44	0	61	6
Volume Right	33	0	12	46	15
cSH	885	1166	1700	412	404
Volume to Capacity	0.01	0.04	0.40	0.26	0.05
Queue Length 95th (ft)	1	3	0	26	4
Control Delay (s)	0.3	8.2	0.0	16.8	14.4
Lane LOS	A	A		C	B
Approach Delay (s)	0.3	0.5		16.8	14.4
Approach LOS				C	B

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	53.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	233	255	2	1	273	227	8	0	3	218	0	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.95	1.00
Satd. Flow (prot)	1803	1898		1805	1900	1577		1748			1805	1543
Flt Permitted	0.43	1.00		0.47	1.00	1.00		0.82			0.75	1.00
Satd. Flow (perm)	824	1898		884	1900	1577		1494			1424	1543
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	277	2	1	297	247	9	0	3	237	0	434
RTOR Reduction (vph)	0	1	0	0	0	183	0	2	0	0	0	321
Lane Group Flow (vph)	253	278	0	1	297	64	0	10	0	0	237	113
Confl. Peds. (#/hr)	2					2	13					13
Confl. Bikes (#/hr)		5			4			1				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Effective Green, g (s)	32.0	16.0		32.0	16.0	16.0		16.0			16.0	16.0
Actuated g/C Ratio	0.52	0.26		0.52	0.26	0.26		0.26			0.26	0.26
Clearance Time (s)	4.5	5.0		4.5	5.0	5.0		4.0			4.0	4.0
Lane Grp Cap (vph)	683	494		700	494	410		389			370	401
v/s Ratio Prot	c0.10	0.15		0.00	c0.16							
v/s Ratio Perm	0.10			0.00		0.04		0.01			c0.17	0.07
v/c Ratio	0.37	0.56		0.00	0.60	0.16		0.03			0.64	0.28
Uniform Delay, d1	8.4	19.7		7.2	20.0	17.5		16.9			20.2	18.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	1.5	4.6		0.0	5.3	0.8		0.1			8.2	1.7
Delay (s)	9.9	24.3		7.2	25.3	18.4		17.1			28.4	19.9
Level of Service	A	C		A	C	B		B			C	B
Approach Delay (s)		17.5			22.1			17.1			22.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	46	146	367	69	124	341
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	51	162	408	77	138	379
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1101	446			484	
vC1, stage 1 conf vol	446					
vC2, stage 2 conf vol	654					
vCu, unblocked vol	1101	446			484	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	74			87	
cM capacity (veh/h)	404	616			1089	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	213	484	138	379
Volume Left	51	0	138	0
Volume Right	162	77	0	0
cSH	547	1700	1089	1700
Volume to Capacity	0.39	0.28	0.13	0.22
Queue Length 95th (ft)	46	0	11	0
Control Delay (s)	15.7	0.0	8.8	0.0
Lane LOS	C		A	
Approach Delay (s)	15.7	0.0	2.3	
Approach LOS	C			

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix F SIDRA Worksheets

MOVEMENT SUMMARY

Site: 2032 Renninger AM Single

Glacier Hwy and Renninger, 2032 AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
East: Glacier (Westbound)											
6	T	303	5.0	0.492	10.0	LOS A	2.7	71.2	0.39	0.51	27.7
16	R	157	5.0	0.492	10.0	LOS A	2.7	71.2	0.39	0.58	27.3
Approach		460	5.0	0.492	10.0	LOS A	2.7	71.2	0.39	0.54	27.6
North: Renninger (Southbound)											
7	L	119	5.0	0.292	8.0	LOS A	1.3	34.7	0.49	0.80	26.0
14	R	110	5.0	0.292	8.0	LOS A	1.3	34.7	0.49	0.64	28.1
Approach		229	5.0	0.292	8.0	LOS A	1.3	34.7	0.49	0.72	26.9
West: Glacier (Eastbound)											
5	L	132	5.0	0.555	11.2	LOS B	3.4	88.0	0.41	0.80	24.8
2	T	396	5.0	0.555	11.2	LOS B	3.4	88.0	0.41	0.50	27.0
Approach		527	5.0	0.555	11.2	LOS B	3.4	88.0	0.41	0.58	26.4
All Vehicles		1216	5.0	0.555	10.1	LOS B	3.4	88.0	0.42	0.59	26.9

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY

Site: 2032 Renninger PM Single

Glacier Hwy and Renninger, 2032 PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
East: Glacier (Westbound)											
6	T	758	5.0	0.818	21.3	LOS C	9.2	239.0	0.49	0.47	22.6
16	R	72	5.0	0.818	21.3	LOS C	9.2	239.0	0.49	0.52	22.3
Approach		830	5.0	0.818	21.3	LOS C	9.2	239.0	0.49	0.47	22.6
North: Renninger (Southbound)											
7	L	76	5.0	0.294	12.0	LOS B	1.4	35.9	0.71	0.94	24.4
14	R	67	5.0	0.294	12.0	LOS B	1.4	35.9	0.71	0.85	25.9
Approach		142	5.0	0.294	12.0	LOS B	1.4	35.9	0.71	0.90	25.0
West: Glacier (Eastbound)											
5	L	56	5.0	0.564	11.0	LOS B	3.5	92.2	0.33	0.83	24.8
2	T	506	5.0	0.564	11.0	LOS B	3.5	92.2	0.33	0.46	27.2
Approach		561	5.0	0.564	11.0	LOS B	3.5	92.2	0.33	0.50	26.9
All Vehicles		1533	5.0	0.818	16.7	LOS C	9.2	239.0	0.45	0.52	24.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY

Site: 2032 Concrete MD Single

Glacier Hwy and Concrete, 2032 MD Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Concrete (Northbound)											
3	L	53	10.0	0.254	9.2	LOS A	1.1	29.5	0.59	0.87	25.6
8	T	1	10.0	0.254	9.2	LOS A	1.1	29.5	0.59	0.70	27.8
18	R	101	10.0	0.254	9.2	LOS A	1.1	29.5	0.59	0.74	27.5
Approach		155	10.0	0.254	9.2	LOS A	1.1	29.5	0.59	0.79	26.8
East: Glacier (Westbound)											
1	L	84	5.0	0.546	10.6	LOS B	3.3	86.7	0.31	0.82	25.0
6	T	440	5.0	0.546	10.6	LOS B	3.3	86.7	0.31	0.45	27.4
16	R	22	5.0	0.546	10.6	LOS B	3.3	86.7	0.31	0.53	26.9
Approach		545	5.0	0.546	10.6	LOS B	3.3	86.7	0.31	0.51	26.9
North: Concrete (Southbound)											
7	L	15	10.0	0.059	7.1	LOS A	0.2	6.3	0.57	0.81	26.4
4	T	1	10.0	0.059	7.1	LOS A	0.2	6.3	0.57	0.63	28.9
14	R	16	10.0	0.059	7.1	LOS A	0.2	6.3	0.57	0.68	28.6
Approach		33	10.0	0.059	7.1	LOS A	0.2	6.3	0.57	0.74	27.5
West: Glacier (Eastbound)											
5	L	14	5.0	0.566	11.3	LOS B	3.5	91.6	0.38	0.83	24.8
2	T	466	5.0	0.566	11.3	LOS B	3.5	91.6	0.38	0.49	27.0
12	R	67	5.0	0.566	11.3	LOS B	3.5	91.6	0.38	0.56	26.6
Approach		547	5.0	0.566	11.3	LOS B	3.5	91.6	0.38	0.51	26.9
All Vehicles		1280	5.7	0.566	10.6	LOS B	3.5	91.6	0.38	0.55	26.9

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY

Site: 2032 Concrete PM Single

Glacier Hwy and Concrete, 2032 PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Concrete (Northbound)											
3	L	61	10.0	0.158	7.0	LOS A	0.6	17.1	0.50	0.80	26.4
8	T	1	10.0	0.158	7.0	LOS A	0.6	17.1	0.50	0.60	29.0
18	R	46	10.0	0.158	7.0	LOS A	0.6	17.1	0.50	0.65	28.6
Approach		108	10.0	0.158	7.0	LOS A	0.6	17.1	0.50	0.73	27.3
East: Glacier (Westbound)											
1	L	44	5.0	0.733	16.5	LOS C	6.4	165.2	0.44	0.79	22.8
6	T	673	5.0	0.733	16.5	LOS C	6.4	165.2	0.44	0.48	24.5
16	R	12	5.0	0.733	16.5	LOS C	6.4	165.2	0.44	0.55	24.2
Approach		730	5.0	0.733	16.5	LOS C	6.4	165.2	0.44	0.50	24.4
North: Concrete (Southbound)											
7	L	6	10.0	0.050	8.6	LOS A	0.2	5.5	0.65	0.85	25.9
4	T	1	10.0	0.050	8.6	LOS A	0.2	5.5	0.65	0.70	28.1
14	R	15	10.0	0.050	8.6	LOS A	0.2	5.5	0.65	0.74	27.8
Approach		23	10.0	0.050	8.6	LOS A	0.2	5.5	0.65	0.77	27.2
West: Glacier (Eastbound)											
5	L	8	5.0	0.405	7.9	LOS A	2.0	52.7	0.21	0.87	26.1
2	T	371	5.0	0.405	7.9	LOS A	2.0	52.7	0.21	0.44	29.0
12	R	33	5.0	0.405	7.9	LOS A	2.0	52.7	0.21	0.53	28.4
Approach		412	5.0	0.405	7.9	LOS A	2.0	52.7	0.21	0.45	28.8
All Vehicles		1273	5.5	0.733	12.8	LOS B	6.4	165.2	0.38	0.51	26.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY

Site: 2032 Anka AM Single

Glacier Hwy and Anka, 2032 AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Stark (Northbound)											
3	L	2	5.0	0.014	7.0	LOS A	0.1	1.5	0.61	0.78	26.6
8	T	1	5.0	0.014	7.0	LOS A	0.1	1.5	0.61	0.61	29.0
18	R	4	5.0	0.014	7.0	LOS A	0.1	1.5	0.61	0.65	28.7
Approach		7	5.0	0.014	7.0	LOS A	0.1	1.5	0.61	0.68	28.0
East: Glacier (Westbound)											
1	L	1	5.0	0.465	10.3	LOS B	2.5	64.5	0.51	0.87	25.3
6	T	230	5.0	0.465	10.3	LOS B	2.5	64.5	0.51	0.61	27.5
16	R	157	5.0	0.465	10.3	LOS B	2.5	64.5	0.51	0.67	27.1
Approach		388	5.0	0.465	10.3	LOS B	2.5	64.5	0.51	0.63	27.3
North: Anka (Southbound)											
7	L	104	5.0	0.222	6.6	LOS A	0.9	24.6	0.40	0.76	26.6
4	T	1	5.0	0.222	6.6	LOS A	0.9	24.6	0.40	0.52	29.4
14	R	82	5.0	0.222	6.6	LOS A	0.9	24.6	0.40	0.58	28.9
Approach		187	5.0	0.222	6.6	LOS A	0.9	24.6	0.40	0.68	27.6
West: Glacier (Eastbound)											
5	L	239	5.0	0.621	12.8	LOS B	4.2	109.5	0.43	0.76	24.1
2	T	351	5.0	0.621	12.8	LOS B	4.2	109.5	0.43	0.49	26.1
12	R	7	5.0	0.621	12.8	LOS B	4.2	109.5	0.43	0.55	25.7
Approach		598	5.0	0.621	12.8	LOS B	4.2	109.5	0.43	0.60	25.2
All Vehicles		1180	5.0	0.621	11.0	LOS B	4.2	109.5	0.45	0.63	26.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY

Site: 2032 Anka PM Single

Glacier Hwy and Anka, 2032 PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Stark (Northbound)											
3	L	9	5.0	0.027	7.8	LOS A	0.1	3.0	0.64	0.80	26.1
8	T	1	5.0	0.027	7.8	LOS A	0.1	3.0	0.64	0.66	28.4
18	R	3	5.0	0.027	7.8	LOS A	0.1	3.0	0.64	0.69	28.1
Approach		13	5.0	0.027	7.8	LOS A	0.1	3.0	0.64	0.76	26.7
East: Glacier (Westbound)											
1	L	1	5.0	0.667	16.1	LOS C	5.6	144.3	0.66	0.93	23.1
6	T	297	5.0	0.667	16.1	LOS C	5.6	144.3	0.66	0.75	24.6
16	R	247	5.0	0.667	16.1	LOS C	5.6	144.3	0.66	0.79	24.4
Approach		545	5.0	0.667	16.1	LOS C	5.6	144.3	0.66	0.77	24.5
North: Anka (Southbound)											
7	L	237	5.0	0.861	30.3	LOS D	12.8	332.8	0.90	1.11	18.8
4	T	1	5.0	0.861	30.3	LOS D	12.8	332.8	0.90	1.07	19.3
14	R	434	5.0	0.861	30.3	LOS D	12.8	332.8	0.90	1.08	19.2
Approach		672	5.0	0.861	30.3	LOS D	12.8	332.8	0.90	1.09	19.1
West: Glacier (Eastbound)											
5	L	253	5.0	0.638	14.8	LOS B	4.8	126.1	0.62	0.87	23.4
2	T	277	5.0	0.638	14.8	LOS B	4.8	126.1	0.62	0.69	25.0
12	R	2	5.0	0.638	14.8	LOS B	4.8	126.1	0.62	0.73	24.8
Approach		533	5.0	0.638	14.8	LOS B	4.8	126.1	0.62	0.77	24.2
All Vehicles		1762	5.0	0.861	21.0	LOS C	12.8	332.8	0.74	0.89	22.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Model used. Geometric Delay not included.

Appendix G Preliminary Cost Estimates

Glacier Highway
Recommended Near-Term Treatments
Preliminary Cost Estimate

Breakdown of Improvement Costs

Improvement	% of Subtotal	Cost
Estimated Construction Costs		
Seaward Sidewalk + Bike Lanes		$ 1,433,000
Pavement Overlay		$ 1,091,000
Corridor-Wide Illumination (Both Sides)		$ 1,148,000
Renninger Roundabout		$ 1,563,000
Davis to Anka Access Management		$ 46,000
Anka to Vanderbilt Hill Access Management		$ 160,000
Alaway Pedestrian Crossing		$ 44,000
Central Pedestrian Crossing		$ 44,000
Belardi Pedestrian Crossing		$ 44,000
Davis Pedestrian Crossing		$ 145,000
Concrete Way Pedestrian Crossings		$ 218,000
Short St Pedestrian Crossing		$ 44,000
Vanderbilt Hill Jughandle Crossing		$ 52,000
Anka St Signal/Intersection Improvements		$ 207,000
Whitehead St Bus Pullout Improvements		$ 23,000
Alaway Bus Pullouts		$ 67,000
Belardi Bus Pullouts		$ 67,000
Short St Bus Pullouts		$ 67,000
Subtotal A (Estimated Construction Costs)		**$ 6,463,000**
Private Utility Coordination	5%	$ 323,150
Surveying	3%	$ 193,890
Mobilization	10%	$ 646,300
Subtotal B (Percentage-Based Costs)		**$ 1,164,000**
Subtotal 1 (A + B)		**$ 7,627,000**
Estimated Professional Fees (A/E/CM)	**15%**	**$ 1,145,000**
Estimated Right-of-Way Acquisition Costs		
Pending DOT&PF Feedback		
Estimated Total Cost		**$ 8,772,000**

Glacier Highway
Seaward Sidewalk Addition & Bike Lane Striping
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	1,200	$26.50	$31,800
Borrow	cu. yd.	3,200	$25.50	$81,600
New Vertical Curb & Gutter	lin. ft.	7,200	$17.50	$126,000
New Sidewalk	sq. yd.	4,800	$59.00	$283,200
New Ped or Bike Ramp	each	36	$1,857.00	$66,852
		Subtotal A (Known)		*$589,452*
Storm Drainage System	% of Subtotal A	25%	--	$147,363
Landscape Improvement	% of Subtotal A	5%	--	$29,473
Roadway Signing & Striping	% of Subtotal A	5%	--	$29,473
Relocate Gruening Park Pump Control Bldg.	Lump Sum			$350,000
		Subtotal B (Unknown)		*$556,308*
Subtotal 1 (Subtotals A + B)				$1,145,760
Plus Contingencies	% of Total		25%	$286,440
Estimated Construction Cost				**$1,433,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$1,433,000**

Glacier Highway
Pavement Overlay
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Pavement Removal (Cold Planing)	sq. yd.	53,236	$2.50	$133,090
New Pavement	ton	6,028	$98.50	$593,758
			Subtotal A (Known)	*$726,848*
Traffic Control	% of Subtotal A	10%	--	$72,685
Roadway Signing & Striping	% of Subtotal A	10%	--	$72,685
			Subtotal B (Unknown)	*$145,370*
Subtotal 1 (Subtotals A + B)				$872,218
Plus Contingencies	% of Total		25%	$218,054
Estimated Construction Cost				**$1,091,000**
Estimated Project Cost				**$1,091,000**

Glacier Highway
Corridor-Wide Illumination on Both Sides of Glacier Hwy
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Street Lighting (Highway)**	pole	60	$15,000.00	$900,000
		Subtotal A (Known)		*$900,000*
Landscape Improvement	% of Subtotal A	2%	--	$18,000
		Subtotal B (Unknown)		*$18,000*
Subtotal 1 (Subtotals A + B)				$918,000
Plus Contingencies	% of Total		25%	$229,500
Estimated Construction Cost				**$1,148,000**
Estimated Project Cost				**$1,148,000**

**Assumes existing luminaires on utility poles are maintained

Glacier Highway
Renninger St Roundabout
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation (Cut)	cu. yd.	1,639	$13.00	$21,302
Asphalt Treated Base	ton	2,140	$79.00	$169,097
Aggregate Base	ton	2,619	$26.00	$68,088
Borrow	ton	810	$25.50	$20,655
New Pavement	ton	1,182	$98.50	$116,462
New Vertical Curb	lin. ft.	2,785	$17.50	$48,738
New Sidewalk	sq. yd.	2,527	$59.00	$149,085
Pavement Removal	sq. yd.	4,217	$2.50	$10,544
Sidewalk Removal	sq.yd.	337	$11.00	$3,705
New Ped or Bike Ramp	each	8	$1,857.00	$14,856
Street Lighting	pole	16	$15,000.00	$240,000
		Subtotal A (Known)		*$862,532*
Storm Drainage System	% of Subtotal A	12%	--	$102,090
Landscape Improvement	% of Subtotal A	7%	--	$59,553
Roadway Signing & Striping	% of Subtotal A	3%	--	$25,523
Relocate Power Transmission Pole	each	1	$200,000.00	$200,000
		Subtotal B (Unknown)		*$387,165*
Subtotal 1 (Subtotals A + B)				$1,249,697
Plus Contingencies	% of Total		25%	$312,424
Estimated Construction Cost				**$1,563,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Access Takings	Lump Sum	3	$10,000.00	$30,000
Total ROW				$30,000
Plus Contingencies	% of Total		25%	$7,500
Estimated Right-of-Way Acquisition Cost				**$38,000**
Estimated Project Cost				**$1,601,000**

Glacier Highway
Davis to Anka Access Management Improvements
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation	cu. yd.	25	$13.00	$325
Aggregate Base	ton	50	$26.50	$1,325
New Vertical Curb & Gutter	lin. ft.	300	$17.50	$5,250
Borrow	cu. yd.	0	$25.50	$0
New Pavement	ton	25	$98.50	$2,463
New Median	sq. yd.	150	$59.00	$8,850
Pavement Removal	sq. yd.	150	$2.50	$375
New Driveway	each	4	$1,280.00	$5,120
		Subtotal A (Known)		*$23,708*
Storm Drainage System	% of Subtotal A	25%	--	$5,927
Landscape Improvement	% of Subtotal A	10%	--	$2,371
Roadway Signing & Striping	% of Subtotal A	20%	--	$4,742
		Subtotal B (Unknown)		*$13,039*
Subtotal 1 (Subtotals A + B)				$36,747
Plus Contingencies	% of Total		25%	$9,187
Estimated Construction Cost				**$46,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Access Takings	Lump Sum	6	$10,000.00	$60,000
Total ROW				$60,000
Plus Contingencies	% of Total		25%	$15,000
Estimated Right-of-Way Acquisition Cost				**$75,000**
Estimated Project Cost				**$121,000**

Glacier Highway
Anka to Vanderbilt Hill Access Management Improvements
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation	cu. yd.	110	$13.00	$1,430
Aggregate Base	ton	200	$26.50	$5,300
New Vertical Curb & Gutter	lin. ft.	1,325	$17.50	$23,188
Borrow	cu. yd.	0	$25.50	$0
New Pavement	ton	50	$98.50	$4,925
New Median	sq. yd.	650	$59.00	$38,350
Pavement Removal	sq. yd.	650	$2.50	$1,625
New Driveway	each	6	$1,280.00	$7,680
		Subtotal A (Known)		*$82,498*
Storm Drainage System	% of Subtotal A	25%	--	$20,624
Landscape Improvement	% of Subtotal A	10%	--	$8,250
Roadway Signing & Striping	% of Subtotal A	20%	--	$16,500
		Subtotal B (Unknown)		*$45,374*
Subtotal 1 (Subtotals A + B)				$127,871
Plus Contingencies	% of Total		25%	$31,968
Estimated Construction Cost				**$160,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Access Takings	Lump Sum	7	$10,000.00	$70,000
Total ROW				$70,000
Plus Contingencies	% of Total		25%	$17,500
Estimated Right-of-Way Acquisition Cost				**$88,000**
Estimated Project Cost				**$248,000**

Glacier Highway
Alaway Pedestrian Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	20	$26.50	$530
New Vertical Curb & Gutter	lin. ft.	200	$17.50	$3,500
New Median	sq. yd.	90	$59.00	$5,310
Pavement Removal	sq. yd.	90	$2.50	$225
New Ped or Bike Ramp	each	2	$1,857.00	$3,714
Street Lighting (Pedestrian Scale)	pole	2	$10,000.00	$20,000
		Subtotal A (Known)		*$33,279*
Roadway Signing & Striping	% of Subtotal A	5%	--	$1,664
		Subtotal B (Unknown)		*$1,664*
Subtotal 1 (Subtotals A + B)				$34,943
Plus Contingencies	% of Total		25%	$8,736
Estimated Construction Cost				**$44,000**
Estimated Project Cost				**$44,000**

Glacier Highway
Central Pedestrian Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	20	$26.50	$530
New Vertical Curb & Gutter	lin. ft.	200	$17.50	$3,500
New Median	sq. yd.	90	$59.00	$5,310
Pavement Removal	sq. yd.	90	$2.50	$225
New Ped or Bike Ramp	each	2	$1,857.00	$3,714
Street Lighting (Pedestrian Scale)	pole	2	$10,000.00	$20,000
		Subtotal A (Known)		*$33,279*
Roadway Signing & Striping	% of Subtotal A	5%	--	$1,664
		Subtotal B (Unknown)		*$1,664*
Subtotal 1 (Subtotals A + B)				$34,943
Plus Contingencies	% of Total		25%	$8,736
Estimated Construction Cost				**$44,000**
Estimated Project Cost				**$44,000**

Glacier Highway
Belardi Pedestrian Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	20	$26.50	$530
New Vertical Curb & Gutter	lin. ft.	200	$17.50	$3,500
New Median	sq. yd.	90	$59.00	$5,310
Pavement Removal	sq. yd.	90	$2.50	$225
New Ped or Bike Ramp	each	2	$1,857.00	$3,714
Street Lighting (Pedestrian Scale)	pole	2	$10,000.00	$20,000
		Subtotal A (Known)		*$33,279*
Roadway Signing & Striping	% of Subtotal A	5%	--	$1,664
		Subtotal B (Unknown)		*$1,664*
Subtotal 1 (Subtotals A + B)				$34,943
Plus Contingencies	% of Total		25%	$8,736
Estimated Construction Cost				**$44,000**
Estimated Project Cost				**$44,000**

Glacier Highway
Davis Pedestrian Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	130	$26.50	$3,445
Asphalt Treated Base	ton	100	$79.00	$7,900
New Vertical Curb & Gutter	lin. ft.	350	$17.50	$6,125
Borrow	cu. yd.	310	$25.50	$7,905
New Pavement	ton	60	$98.50	$5,910
New Sidewalk & Median	sq. yd.	200	$59.00	$11,800
Pavement Removal	sq. yd.	120	$2.50	$300
Sidewalk Removal	sq. yd.	160	$11.00	$1,760
New Ped or Bike Ramp	each	2	$1,857.00	$3,714
Street Lighting (Pedestrian Scale)	pole	2	$10,000.00	$20,000
		Subtotal A (Known)		*$68,859*
Roadway Signing & Striping	% of Subtotal A	10%	--	$6,886
Rectangular Rapid Flashing Beacon	each	1	$40,000.00	$40,000
		Subtotal B (Unknown)		*$46,886*
Subtotal 1 (Subtotals A + B)				$115,745
Plus Contingencies	% of Total		25%	$28,936
Estimated Construction Cost				**$145,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$145,000**

Glacier Highway
Concrete Way Pedestrian Crossings
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation	cu. yd.	30	$13.00	$390
Aggregate Base	ton	260	$26.50	$6,890
Asphalt Treated Base	ton	200	$79.00	$15,800
New Vertical Curb & Gutter	lin. ft.	840	$17.50	$14,700
Borrow	cu. yd.	50	$25.50	$1,275
New Pavement	ton	200	$98.50	$19,700
New Sidewalk & Median	sq. yd.	250	$59.00	$14,750
Pavement Removal	sq. yd.	500	$2.50	$1,250
Sidewalk Removal	sq. yd.	250	$11.00	$2,750
New Ped or Bike Ramp	each	4	$1,857.00	$7,428
Street Lighting (Pedestrian Scale)	pole	4	$10,000.00	$40,000
		Subtotal A (Known)		*$124,933*
Roadway Signing & Striping	% of Subtotal A	7%	--	$8,745
Rectangular Rapid Flashing Beacon	each	1	$40,000.00	$40,000
		Subtotal B (Unknown)		*$48,745*
Subtotal 1 (Subtotals A + B)				$173,678
Plus Contingencies	% of Total		25%	$43,420
Estimated Construction Cost				**$218,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$218,000**

Glacier Highway
Short St Pedestrian Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Aggregate Base	ton	20	$26.50	$530
New Vertical Curb & Gutter	lin. ft.	200	$17.50	$3,500
New Median	sq. yd.	90	$59.00	$5,310
Pavement Removal	sq. yd.	90	$2.50	$225
New Ped or Bike Ramp	each	2	$1,857.00	$3,714
Street Lighting (Pedestrian Scale)	pole	2	$10,000.00	$20,000
		Subtotal A (Known)		*$33,279*
Roadway Signing & Striping	% of Subtotal A	5%	--	$1,664
		Subtotal B (Unknown)		*$1,664*
Subtotal 1 (Subtotals A + B)				$34,943
Plus Contingencies	% of Total		25%	$8,736
Estimated Construction Cost				**$44,000**
Estimated Project Cost				**$44,000**

Glacier Highway
Vanderbilt Hill Jughandle Crossing
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation	cu. yd.	10	$13.00	$130
Aggregate Base	ton	60	$26.50	$1,590
Borrow	cu. yd.	35	$25.50	$893
New Vertical Curb & Gutter (Median only)	lin. ft.	125	$17.50	$2,188
New Pavement	ton	15	$98.50	$1,478
New Sidewalk & Median	sq. yd.	150	$59.00	$8,850
Pavement Removal	sq. yd.	0	$2.50	$0
New Ped or Bike Ramp	each	3	$1,857.00	$5,571
Street Lighting	pole	1	$15,000.00	$15,000
		Subtotal A (Known)		*$35,569*
Landscape Improvement	% of Subtotal A	5%	--	$1,778
Roadway Signing & Striping	% of Subtotal A	10%	--	$3,557
		Subtotal B (Unknown)		*$5,335*
Subtotal 1 (Subtotals A + B)				$40,904
Plus Contingencies	% of Total		25%	$10,226
Estimated Construction Cost				**$52,000**
Estimated Project Cost				**$52,000**

Glacier Highway
Anka St Signal/Intersection Improvements
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Excavation	cu. yd.	100	$13.00	$1,300
Aggregate Base	ton	60	$26.50	$1,590
Asphalt Treated Base	ton	25	$79.00	$1,975
New Vertical Curb & Gutter	lin. ft.	200	$17.50	$3,500
Borrow	cu. yd.	0	$25.50	$0
New Pavement	ton	15	$98.50	$1,478
New Sidewalk	sq. yd.	170	$59.00	$10,030
Pavement Removal	sq. yd.	60	$2.50	$150
Sidewalk Removal	sq. yd.	100	$11.00	$1,100
New Ped or Bike Ramp	each	6	$1,857.00	$11,142
		Subtotal A (Known)		*$32,265*
Landscape Improvement	% of Subtotal A	5%	--	$1,613
Roadway Signing & Striping	% of Subtotal A	20%	--	$6,453
Traffic Signal Improvement	each	0.25	$500,000.00	$125,000
		Subtotal B (Unknown)		*$133,066*
Subtotal 1 (Subtotals A + B)				$165,331
Plus Contingencies	% of Total		25%	$41,333
Estimated Construction Cost				**$207,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$207,000**

Glacier Highway
Whitehead Dr Bus Pullout Improvement
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Asphalt Treated Base	ton	50	$79.00	$3,950
Aggregate Base	ton	50	$26.00	$1,300
Borrow	cu. yd.	0	$25.50	$0
New Pavement	ton	25	$98.50	$2,463
New Vertical Curb & Gutter	lin. ft.	135	$17.50	$2,363
New Sidewalk	sq. yd.	35	$59.00	$2,065
Sidewalk Removal	sq.yd.	30	$11.00	$330
		Subtotal A (Known)		*$12,470*
Landscape Improvement	% of Subtotal A	5%	--	$624
Bus Shelter Relocation	each	1	$5,000.00	$5,000
		Subtotal B (Unknown)		*$5,624*
Subtotal 1 (Subtotals A + B)				$18,094
Plus Contingencies	% of Total		25%	$4,523
Estimated Construction Cost				**$23,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$23,000**

Glacier Highway
Alaway Bus Pullouts
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Asphalt Treated Base	ton	100	$79.00	$7,900
Aggregate Base	ton	100	$26.00	$2,600
Borrow	cu. yd.	80	$25.50	$2,040
New Pavement	ton	50	$98.50	$4,925
New Vertical Curb & Gutter	lin. ft.	135	$17.50	$2,363
New Sidewalk	sq. yd.	35	$59.00	$2,065
Sidewalk Removal	sq.yd.	30	$11.00	$330
		Subtotal A (Known)		*$22,223*
Landscape Improvement	% of Subtotal A	5%	--	$1,111
Bus Shelter	each	2	$15,000.00	$30,000
		Subtotal B (Unknown)		*$31,111*
Subtotal 1 (Subtotals A + B)				$53,334
Plus Contingencies	% of Total		25%	$13,333
Estimated Construction Cost				**$67,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$67,000**

Glacier Highway
Belardi Bus Pullouts
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Asphalt Treated Base	ton	100	$79.00	$7,900
Aggregate Base	ton	100	$26.00	$2,600
Borrow	cu. yd.	80	$25.50	$2,040
New Pavement	ton	50	$98.50	$4,925
New Vertical Curb & Gutter	lin. ft.	135	$17.50	$2,363
New Sidewalk	sq. yd.	35	$59.00	$2,065
Sidewalk Removal	sq.yd.	30	$11.00	$330
		Subtotal A (Known)		*$22,223*
Landscape Improvement	% of Subtotal A	5%	--	$1,111
Bus Shelter	each	2	$15,000.00	$30,000
		Subtotal B (Unknown)		*$31,111*
Subtotal 1 (Subtotals A + B)				$53,334
Plus Contingencies	% of Total		25%	$13,333
Estimated Construction Cost				**$67,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$67,000**

Glacier Highway
Short St Bus Pullouts
Preliminary Cost Estimate

Breakdown of Improvement Costs				
Item	**Unit**	**Quantity**	**Unit Costs**	**Subtotal**
Asphalt Treated Base	ton	100	$79.00	$7,900
Aggregate Base	ton	100	$26.00	$2,600
Borrow	cu. yd.	80	$25.50	$2,040
New Pavement	ton	50	$98.50	$4,925
New Vertical Curb & Gutter	lin. ft.	135	$17.50	$2,363
New Sidewalk	sq. yd.	35	$59.00	$2,065
Sidewalk Removal	sq.yd.	30	$11.00	$330
		Subtotal A (Known)		*$22,223*
Landscape Improvement	% of Subtotal A	5%	--	$1,111
Bus Shelter	each	2	$15,000.00	$30,000
		Subtotal B (Unknown)		*$31,111*
Subtotal 1 (Subtotals A + B)				$53,334
Plus Contingencies	% of Total		25%	$13,333
Estimated Construction Cost				**$67,000**
Right-of-Way (Residential <1 acre)	sq. ft.	-		$0
Right-of-Way (Residential >1 acre)	sq. ft.	-		$0
Right-of-Way (Commercial)	sq. ft.	-		$0
Takings	Lump Sum			$0
Total ROW				$0
Plus Contingencies	% of Total		25%	$0
Estimated Right-of-Way Acquisition Cost				**$0**
Estimated Project Cost				**$67,000**