GALLATIN COUNTY INTERSECTION IMPROVEMENTS

Preliminary Engineering Report

June 3, 2025
DRAFT

ALASKA RD S / CAMERON BRIDGE RD

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ALASKA RD S / E VALLEY CENTER RD


LOVE LN / DURSTON RD

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1.0. Introduction and Background

In 2022, Gallatin County developed the *Greater Triangle Area Transportation Plan*[1] (GTATP) which evaluated the transportation needs of the "triangle area" encompassing the communities of Bozeman, Belgrade, Four Corners, and Gallatin Gateway. The GTATP recommended several improvements to address safety and traffic operational concerns in the area. Shortly after the plan was completed, the Gallatin County Commission reviewed the recommendations and completed a prioritization process to determine how the county would address the recommendations with limited funding. The commission ultimately identified three intersections for further evaluation in this *Gallatin County Intersection Improvements* project, including Alaska Road South/Cameron Bridge Road, Alaska Road South/East Valley Center Road, and Love Lane/Durston Road.

The Love Lane/Durston Road intersection (pictured) is one of three intersections between Bozeman and Belgrade that has been identified for detailed evaluation of traffic and safety improvements.

Since the East Belgrade Interstate 90 (I-90) interchange was constructed in 2015, traffic volumes on Alaska Road South, which extends south of the interchange, have more than doubled and truck traffic has increased significantly. This connection once provided an easy, congestion-free route for Gallatin County residents traveling between the communities of Belgrade and Bozeman but has become increasingly popular as development continues to occur in the area. Increasing demand on this narrow two-lane county road has resulted in degraded intersection operations, increasing safety conflicts, and deteriorating pavement conditions. The corridor, along with two primary intersections along the route, **Alaska Road South/Cameron Bridge Road** and **Alaska Road South/East Valley Center Road**, were selected by the county to pursue upgrades to accommodate demand and improve safety.

For commuters between Belgrade and Bozeman, a common route involves traveling south on Alaska Road South to East Valley Center Road, east to Love Lane, then south to Huffine Lane or other connecting east-west routes including Baxter Lane and Durston Road. In 2019, a roundabout was constructed at the Love Lane/Baxter Lane intersection to address growing safety concerns. Now, the intersection of **Love Lane/Durston Road** has been identified as a priority intersection for improvements to address safety and operational concerns resulting from increased traffic volumes. In 2023, a construction detour routed a significant volume of traffic through the intersection, prompting the county to install a temporary all-way stop. In response to positive public feedback, the county decided to perpetuate the change while long-term solutions for the intersection are being investigated.

The intent of this *Preliminary Engineering Report* is to identify and evaluate potential options to address crash trends and improve traffic flow on the Alaska Road South corridor and three critical intersections located on county roads between Bozeman and Belgrade. This report presents information on existing and projected traffic conditions, a detailed safety analysis, and a thorough evaluation of alternatives for improving each intersection.

1.1. Project Area

The three project intersections are located in the triangle area of Gallatin County between the cities of Belgrade and Bozeman. Two of the intersections are located on the Alaska Road South project corridor. This area is growing rapidly as both cities continue to expand outward. With continued growth, traffic and safety concerns in the area are heightening. The project includes the Alaska Road South corridor and three key intersections to be evaluated for potential improvements, each with their own unique setting, features, and traffic and safety concerns. **Figure 1.1** shows a vicinity map of the project area.

Figure 1.1: Project Area

1.2. Past Recommendations

The GTATP predicts that high residential growth will occur on the fringes of the Belgrade and Bozeman urban boundaries with high commercial growth occurring along major highways such as Jackrabbit Lane and Huffine Lane. Moderate growth is anticipated in the infill area between Belgrade, Bozeman, and Four Corners. If development occurs in the manner projected, this growth is anticipated to have a substantial impact on the transportation system, especially on the corridors connecting the Belgrade and Bozeman areas. As development occurs and population increases, traffic operations on these corridors, and at key intersections along these corridors, are expected to worsen and the likelihood of safety conflicts are expected to increase. The following describes the concerns and recommendations originally outlined in the GTATP for the Alaska Road South corridor and project intersections.

- **<u>Alaska Road South Corridor:</u>**
  The existing roadway is narrow with deteriorating shoulders, which limits its capacity to accommodate current and future traffic demands. The GTATP recommends reconstructing the corridor to urban minor arterial standards to support increasing traffic volumes and enhance safety and reliability (MSN-3). A shared use path (SUP-9) is also envisioned along the corridor to support multimodal travel and provide non-motorist connectivity. A future extension of Alaska Road South between East Valley Center Road and Baxter Lane is also recommended to improve east-west connectivity and distribute traffic more efficiently across the local roadway network.

- **<u>Alaska Road South/East Cameron Bridge Road:</u>**
  The GTATP indicated that the two-way stop-controlled intersection of Alaska Road South/East Cameron Bridge Road has poor operations and a trend of angle crashes causing severe injuries. Given these concerns, the GTATP recommended reconfiguring the intersection as a roundabout (TSM-16) with appropriate non-motorist accommodations connecting to the future SUP on Alaska Road South.

- **<u>Alaska Road South/East Valley Center Road:</u>**
  As traffic volumes increase and development occurs in the area, additional traffic control (either a roundabout or traffic signal) is anticipated to be warranted at this intersection to help improve traffic flow and address a trend of rear-end crashes (TSM-17). Any improvements should provide pedestrian crossing accommodations to facilitate connectivity between the existing SUP on East Valley Center Road and the planned SUP on Alaska Road South.

- **Love Lane/Durston Road:**
  Durston Road approaches Love Lane from the east at a steep downgrade and continues west of the intersection into the Black Bull subdivision. The intersection has a history of crashes and general safety concerns relating to visibility, travel speeds, and intersection geometry. To address safety concerns and accommodate increasing traffic demands, the GTATP recommends flattening the grade on the east leg and reconfiguring the intersection as a roundabout (TSM-15). Past planning efforts have recommended construction of SUPs along Love Lane and Durston Road, so pedestrian accommodations at the intersection should be planned accordingly.

2.0. Existing and Projected Conditions

The following sections provide a detailed analysis of the existing and projected conditions for the project area given updated data and field investigations since completion of the GTATP. This updated analysis provides the basis for the evaluation of potential improvement options.

2.1. Physical Features

This section summarizes the physical characteristics of the roadways that comprise the project area including roadway classifications, speed limits, and adjacent land uses. These features are critical for understanding the current transportation conditions and will inform the design and planning considerations for the project.

2.1.1. Roadway Characteristics

The following sections describe the physical characteristics of the roadways that comprise the three project intersections.

ALASKA ROAD SOUTH

Alaska Road South is functionally classified by the Montana Department of Transportation (MDT) as a major collector from the eastbound I-90 ramps to the southern edge of Belgrade city limits and is classified as a local street south of city limits (within the project area). The route is considered off-system and is therefore owned and maintained by Gallatin County. For planning purposes, the GTATP classifies Alaska Road South as a minor arterial south of Belgrade city limits based on its function within the local transportation system.

North of East Valley Center Road, Alaska Road South consists of two 12-foot lanes with paved shoulders of one foot or less and steep fill slopes. The speed limit is 50 miles per hour (mph). The roadway runs north to south and is generally level with no noticeable grade. South of East Valley Center Road, the roadway is unpaved and extends approximately 0.5 miles south of the intersection, functioning as a private driveway.

The Spain Ferris Fork Ditch, an irrigation canal, runs adjacent to the east side of Alaska Road South between Frank Road and East Valley Center Road. At East Valley Center Road the canal crosses under the intersection and extends southwest away from the project area.

CAMERON BRIDGE ROAD

Cameron Bridge Road is also functionally classified as a local road by MDT but is classified as a collector roadway in the GTATP. It is owned and maintained by Gallatin County. Cameron Bridge Road has a speed limit of 35 mph and consists of two 9-foot lanes with no demarcated shoulders. The east-west roadway has generally steep side slopes but otherwise has no noticeable grade along the travel way.

EAST VALLEY CENTER ROAD

East Valley Center Road is functionally classified by MDT as a major collector. The route is also on MDT's Secondary Highway System and is therefore owned and maintained by MDT. The GTATP classifies East Valley Center Road as a minor arterial.

Throughout the project area, East Valley Center Road consists of one 12-foot travel lane in each direction with 8-foot shoulders. The speed limit is 45 mph and the terrain is flat. On the south side of the roadway, a 10-foot-wide SUP runs east to west parallel to the roadway.

LOVE LANE

Love Lane is a local street per MDT's functional classification and is therefore owned and maintained by Gallatin County. The GTATP classifies Love Lane as a minor arterial. The roadway has a speed limit of 45 mph and consists of two 10-foot travel lanes and no paved shoulders. The north-south route is generally flat but has steep side slopes.

DURSTON ROAD

MDT also classifies Durston Road as a local street, and it is owned and maintained by Gallatin County outside of Bozeman city limits. East of Love Lane, the GTATP classifies Durston Road as a minor arterial whereas west of Love Lane, Durston Road is classified as a collector roadway.

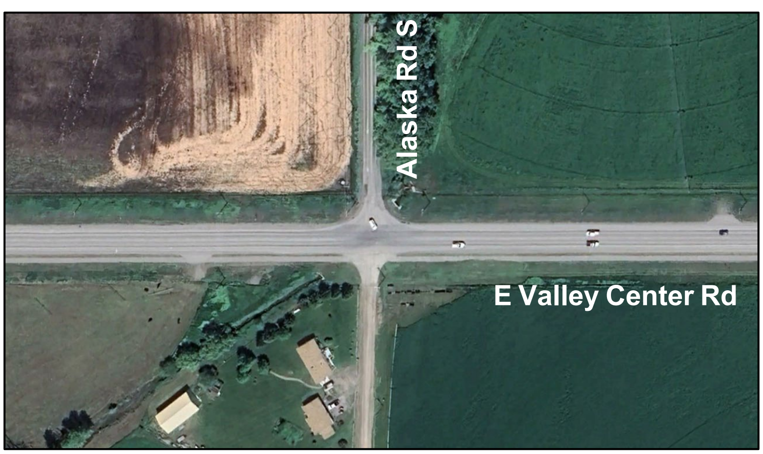
The speed limit on both legs is 45 mph. On the west side of Love Lane, Durston Road consists of two 10-foot lanes and 1-foot shoulders on either side. East of Love Lane the cross section is similar, although the paved shoulders have deteriorated significantly. The east leg approaches Love Lane at a steep downgrade but levels off west of the intersection. Steep fill slopes are generally present along the roadway throughout the project area.

2.1.2. Intersection Characteristics

The following sections describe the physical characteristics and surrounding land uses specific to each of the project intersections.

ALASKA ROAD SOUTH/CAMERON BRIDGE ROAD

The intersection is a four-legged two-way stop-controlled intersection with stop control on the east and west approaches (Cameron Bridge Road). All legs meet at 90-degree angles and allow all turning movements with no dedicated turn lanes. Gravel pits occupy the eastern quadrants of the intersection. Residential, light industrial, commercial, and agricultural land uses occupy the western quadrants.



ALASKA ROAD SOUTH/EAST VALLEY CENTER ROAD

The intersection is a four-legged two-way stop-controlled intersection with stop control on the north and south approaches (Alaska Road South), however, the southern leg is unpaved and primarily serves privately-owned land. All legs meet at 90-degree angles and allow all turning movements with no dedicated turn lanes. Residential and agricultural land uses surround the intersection.

LOVE LANE/DURSTON ROAD

The intersection has historically been configured as a standard four-legged two-way stop-controlled intersection with stop control on the east and west approaches (Durston Road). However, the traffic control was changed to all-way stop shortly after the data collection effort in 2023. All legs meet at 90-degree angles and allow all turning movements with no dedicated turn lanes. Privately-owned agricultural and residential properties surround the intersection with the Black Bull Subdivision occupying the western half of the intersection.

2.2. Data Collection and Traffic Volumes

To update and verify the traffic data from the GTATP, a supplemental data collection effort was performed in May 2023. The data collection effort consisted of turning movement counts and field observations. *Miovision* video collection units were used to collect data over a 24-hour period during a typical weekday in May 2023. This time period was selected to capture the influence of school and commuter traffic due to the proximity of the Love Lane/Durston Road intersection to Monforton School. The collected information was used to establish existing baseline conditions for this report. Detailed traffic data collected for the project intersections are included in **Appendix A**.

2.2.1. Roadway Traffic Volumes

MDT's Data and Statistics Bureau provided average annual daily traffic (AADT) counts for the roadways comprising the project intersections. The counts are typically conducted annually and adjusted to represent average daily traffic conditions. The existing AADT and percentage of commercial trucks at the count sites nearest to the project intersections are shown in **Table 2.1**.

Table 2.1: Existing Annual Average Daily Traffic

Site ID	Location	Description	2023 AADT	2024 AADT	Trucks
16-3-085	**Alaska Rd S**	South of Frank Rd	8,092	8,142	*No Data*
16-3-028	**E Valley Center Rd**	West of Alaska Rd S	6,192	6,419	7%
16-3A-036	**Love Ln**	South of Durston Rd	4,180	4,289	2%
16-3A-030	**Durston Rd**	East of Love Ln	3,560	3,408	4%

2.2.2. Intersection Turning Movement Counts

Turning movement count data were evaluated to define peaks in traffic volumes during the 24-hour collection period. The number of vehicles traveling through the intersection was summed for 15-minute intervals throughout the data collection period. As shown in **Figure 2.1**, the traffic volumes traveling through each intersection were similar in magnitude and daily distributions. There are distinct peaks that align with morning and evening commute times with slightly elevated traffic volumes during school release times. Based on the observed traffic volumes, it was determined that traffic operations would be evaluated during the AM and PM peak hours. Due to slight differences in traffic at each intersection, the peak hour conditions were evaluated based on the highest one-hour volumes at each intersection during the morning (between 7:00 and 9:00 AM) and evening (between 4:00 and 6:00 PM) peaks.

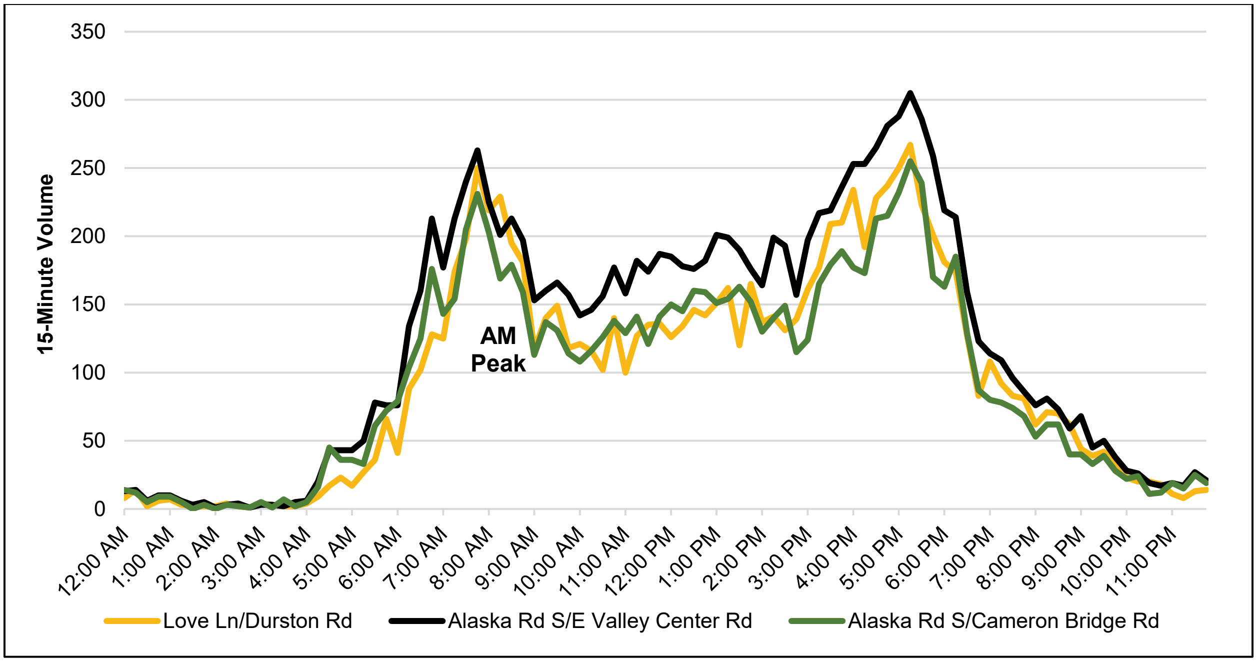


Figure 2.1: Intersection Traffic Volumes

2.2.3. Multimodal Activity

A variety of transportation users travel through each intersection daily including pedestrians, bicyclists, large trucks, and personal vehicles. There are currently only dedicated pedestrian and bicycle facilities at the Alaska Road South/East Valley Center Road intersection where there is a SUP located along the south side of East Valley Center Road. Despite a lack of dedicated facilities, there is still moderate pedestrian and bicycle use in the project area, as indicated in **Table 2.2**.

Table 2.2: Multimodal Traffic Volumes

Intersection	Vehicles	Pedestrians	Bicycles	Trucks (%)
Alaska Rd S/Cameron Bridge Rd	9,291	2	10	992 (11%)
Alaska Rd S/E Valley Center Rd	11,761	3	9	1,003 (9%)
Love Ln/Durston Rd	9,457	1	17	172 (2%)

The project intersections are also highly utilized by large trucks including farm and construction equipment due to the proximity of the intersections to gravel pits and agricultural lands. **Table 2.2** tabulates the number of trucks that passed through each intersection during the 24-hour data collection period and expresses that value as a percentage of the total vehicles traveling through each intersection. As shown in the table, roughly 10 percent of the traffic measured at the Alaska Road South intersections was documented as large trucks, whereas the Love Lane/Durston Road intersection carries comparatively lower volumes of truck traffic.

2.3. Existing Traffic Operations

An operational analysis was performed for the intersections using existing (2023) traffic data. This initial level of service (LOS) analysis was completed using *PTV Vistro 2024* software. The analysis used methodologies contained in the *Highway Capacity Manual 7th Edition*.[2] Field collected data, as discussed previously, were used as input for the analysis to represent traffic conditions on an average day. The results of the existing conditions intersection operational analysis are shown in **Figure 2.2** and **Table 2.3**. More detailed data is contained in **Appendix B**.

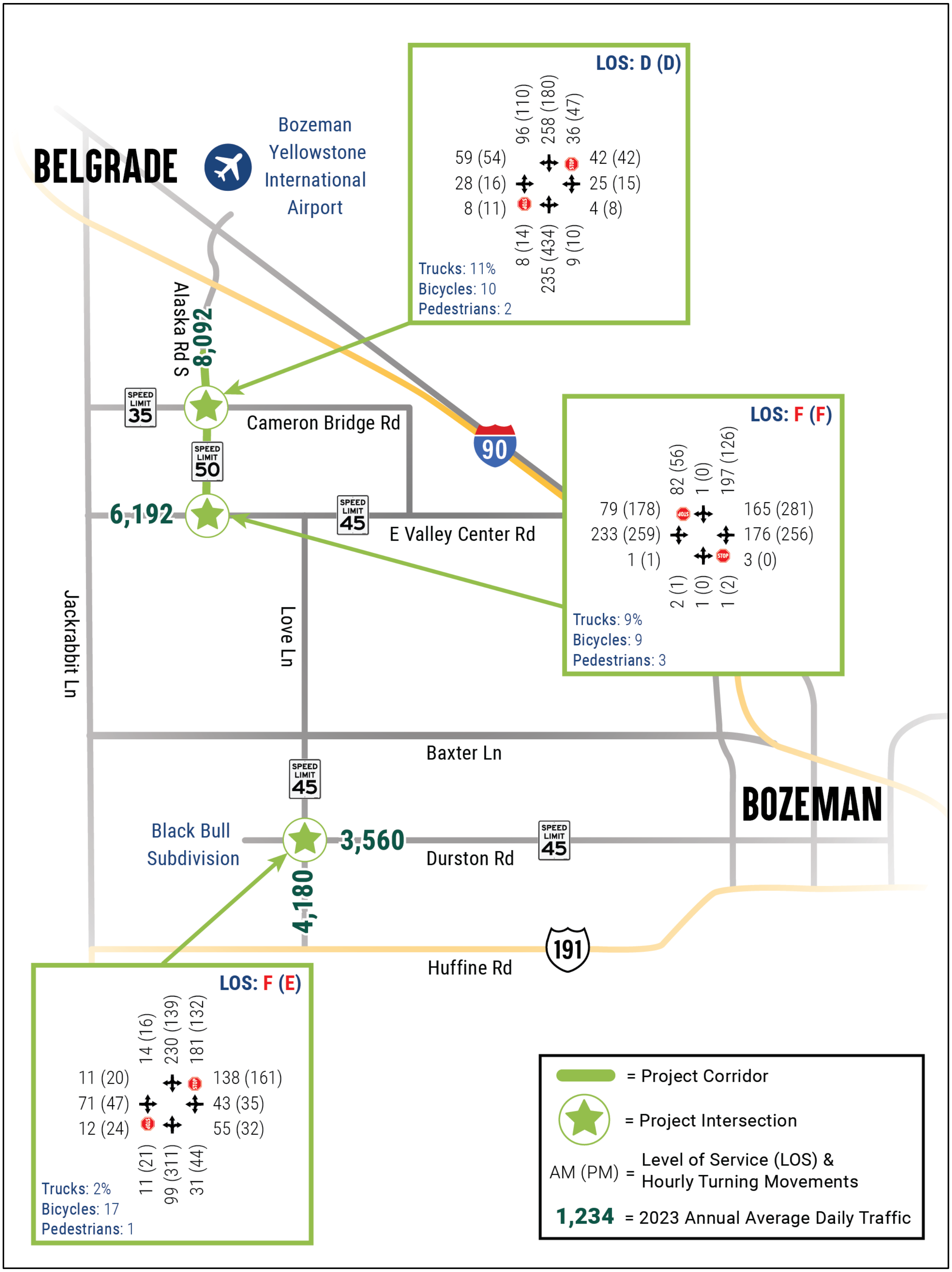


Figure 2.2: Existing Traffic Conditions (2023)

Table 2.3: Existing Intersection Operational Analysis (2023)

Intersection/ Approach	AM		PM	
	Delay (s)	LOS	Delay (s)	LOS
Alaska Rd S/Cameron Bridge Rd	**26.4**	**D**	**30.1**	**D**
Northbound (Alaska Rd S)	*0.3*	*A*	*0.2*	*A*
Southbound (Alaska Rd S)	*0.8*	*A*	*1.2*	*A*
Eastbound (Cameron Bridge Rd)	*24.8*	*C*	*27.6*	*D*
Westbound (Cameron Bridge Rd)	*15.0*	*B*	*16.4*	*C*
Alaska Rd S/E Valley Center Rd	**58.6**	**F**	**105.6**	**F**
Northbound (Alaska Rd S)	*17.2*	*C*	*21.8*	*C*
Southbound (Alaska Rd S)	*56.5*	*F*	*100.2*	*F*
Eastbound (E Valley Center Rd)	*2.1*	*A*	*3.6*	*A*
Westbound (E Valley Center Rd)	*0.1*	*A*	*0.0*	*A*
Love Ln/Durston Rd	**50.5**	**F**	**42.6**	**E**
Northbound (Love Ln)	*0.6*	*A*	*0.4*	*A*
Southbound (Love Ln)	*3.3*	*A*	*3.8*	*A*
Eastbound (Durston Rd)	*29.1*	*D*	*29.7*	*D*
Westbound (Durston Rd)	*38.1*	*E*	*26.6*	*D*

Note: For two-way stop-controlled intersections, delay and LOS values are taken from the movement with the worst (highest) value.

ALASKA ROAD SOUTH/CAMERON BRIDGE ROAD

The Alaska Road South/Cameron Bridge Road intersection is located on the fringes of the Belgrade city limits, with Alaska Road South transitioning from an urban to rural context just north of the intersection. Operational analyses indicate that the intersection currently operates at LOS D during both the AM and PM peak hours, demonstrating that the intersection is approaching capacity and experiencing degraded operations. As volumes continue to increase, the Alaska Road South/Cameron Bridge Road intersection will experience deteriorating operations and increasing delays. Under existing conditions, vehicles on the east and west approaches (Cameron Bridge Road) experience an average of 30 seconds of delay per vehicle during peak hours waiting for a gap in traffic on Alaska Road South to enter the intersection.

Overall, about 11 percent of the vehicles that travel through the intersection throughout the day are heavy vehicles, including a large proportion of trucks traveling to and from the gravel pits on Cameron Bridge Road just east of the intersection. Due to their length and weight, these vehicles require larger gaps in traffic to enter the intersection, adding to delay. During peak periods when heavy mainline volumes are present, turning vehicles on Alaska Road South may experience additional delays.

ALASKA ROAD SOUTH/EAST VALLEY CENTER ROAD

The Alaska Road South/East Valley Center Road intersection is shown to operate at LOS F during both the AM and PM peak hours, indicating failing operations. Vehicles on the southbound approach (Alaska Road South) encounter the most delay, experiencing an average of about one minute of delay per vehicle during the AM peak hour and nearly two minutes of delay during the PM peak hour. During peak hours, long queues of vehicles develop on the southbound approach and vehicles wait to enter the mainline traffic stream on East Valley Center Road.

Although traffic on East Valley Center Road typically flows freely, the absence of dedicated turn lanes often leads to congestion on the arterial. This bottleneck occurs as eastbound vehicles wait to turn left, while westbound traffic experiences slowdowns due to a high volume of right-turning vehicles.

The volumes of truck traffic, about 9 percent, also contribute to delays as the large vehicles wait for larger gaps in traffic.

LOVE LANE/DURSTON ROAD

The Love Lane/Durston Road intersection experiences extensive queuing and has a history of crashes. A construction detour in the summer of 2023 pushed more traffic through the intersection, exasperating concerns. In response, Gallatin County installed an all-way stop at the intersection to help improve operational conditions. However, the existing conditions data collection effort occurred prior to installation of the all-way stop.

With two-way stop control, the Love Lane/Durston Road intersection was shown to operate at LOS F during the AM peak hour and LOS E during the PM peak hour. Since vehicles on Love Lane generally experienced free-flow conditions, vehicles on the east and west approaches experienced the most delay. On average, vehicles on Durston Road encountered an average of 45 seconds of delay during the AM and PM peak hours. While the percentage of truck traffic at this location was lower in comparison to other project intersections (2 percent), more non-motorized activity was observed.

2.4. Projected Conditions

The project area primarily serves commuters and traffic associated with school, airport, and construction activity. While the lands surrounding the project intersections are generally rural and partially undeveloped, development activities in the area have dramatically increased in recent years, especially on the fringes of Bozeman and Belgrade city limits. As the population and commercial activity in the area continues to grow, traffic volumes are expected to increase, and traffic operations are anticipated to continue deteriorating. The following sections provide an evaluation of projected conditions for the project area out to the design year of 2045.

Development on the West Post Subdivision, adjacent to Alaska Road South, began in 2023, contributing additional residential and commercial traffic to the corridor.

2.4.1. Projected Growth

The GTATP predicted that the population in Gallatin County will increase at a compound annual rate of 2.5 percent per year over the next 20 years. This growth rate was determined in coordination with county planners based on planned and anticipated housing and commercial development in the triangle area. A blanket growth rate of 2.5 percent was applied to each intersection evaluated in the GTATP for the purposes of the long-range planning effort.

Given the projected development in the area surrounding the project intersections, it was determined that a 2.5 growth rate is conservative yet suitable for this analysis. Accordingly, the same growth rate was used to evaluate projected conditions at the project intersections over the planning horizon. Traffic conditions were assessed for both short-term (2025) and long-term (2045) conditions to understand the adequacy and longevity of the current intersection configurations and potential improvements.

2.4.2. Projected Traffic Operations

Intersection turning movement counts were projected to predict future traffic conditions for the design years of 2025 and 2045. The analysis assumes that the traffic mix and patterns seen under existing conditions will remain the same into the future while growing at a rate of 2.5 percent per year. The results of the analysis are presented in **Table 2.4**, **Figure 2.3**, and **Figure 2.4**. Detailed data are included in **Appendix C**.

Table 2.4: Projected Intersection Operational Analysis

Intersection/ Approach	Short-Term (2025)				Long-Term (2045)			
	AM		PM		AM		PM	
	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
Alaska Rd S/Cameron Bridge Rd	**29.5**	**D**	**34.4**	**D**	**703.5**	**F**	**942.5**	**F**
Northbound (Alaska Rd S)	*0.2*	*A*	*0.2*	*A*	*0.3*	*A*	*0.3*	*A*
Southbound (Alaska Rd S)	*0.7*	*A*	*1.2*	*A*	*0.8*	*A*	*1.4*	*A*
Eastbound (Cameron Bridge Rd)	*27.7*	*D*	*31.6*	*D*	*689.8*	*F*	*922.3*	*F*
Westbound (Cameron Bridge Rd)	*15.6*	*C*	*17.3*	*C*	*52.3*	*F*	*91.9*	*F*
Alaska Rd S/E Valley Center Rd	**82.9**	**F**	**159.6**	**F**	**1,381.7**	**F**	**4,817.8**	**F**
Northbound (Alaska Rd S)	*18.1*	*C*	*23.9*	*C*	*42.5*	*E*	*230.8*	*F*
Southbound (Alaska Rd S)	*80.6*	*F*	*153.4*	*F*	*1,373.7*	*F*	*4,768.2*	*F*
Eastbound (E Valley Center Rd)	*2.1*	*A*	*3.7*	*A*	*2.4*	*A*	*4.6*	*A*
Westbound (E Valley Center Rd)	*0.1*	*A*	*0.0*	*A*	*0.1*	*A*	*0.0*	*A*
Love Ln/Durston Rd	**70.9**	**F**	**50.4**	**F**	**7,083.3**	**F**	**3,970.5**	**F**
Northbound (Love Ln)	*0.6*	*A*	*0.4*	*A*	*0.7*	*A*	*0.4*	*A*
Southbound (Love Ln)	*3.3*	*A*	*3.8*	*A*	*3.5*	*A*	*4.3*	*A*
Eastbound (Durston Rd)	*34.0*	*D*	*34.9*	*D*	*5,526.5*	*F*	*3,480.3*	*F*
Westbound (Durston Rd)	*56.2*	*F*	*32.4*	*D*	*466.6*	*F*	*403.1*	*F*

Note: For two-way stop-controlled intersections, delay and LOS values are taken from the movement with the worst (highest) value.

Under short-term projected conditions, the Alaska Road South/Cameron Bridge Road intersection is shown to operate at LOS D during the AM and PM peak hours while the other two project intersections are projected to experience failing conditions (LOS F) with increasing delays. Under long-term projected conditions, all project intersections are shown to operate at LOS F during both AM and PM peak hours with average delays on the critical approaches ranging from 11 to 118 minutes. Free-flow traffic on the mainline roadways (not stop-controlled) continue to experience minimal delay.

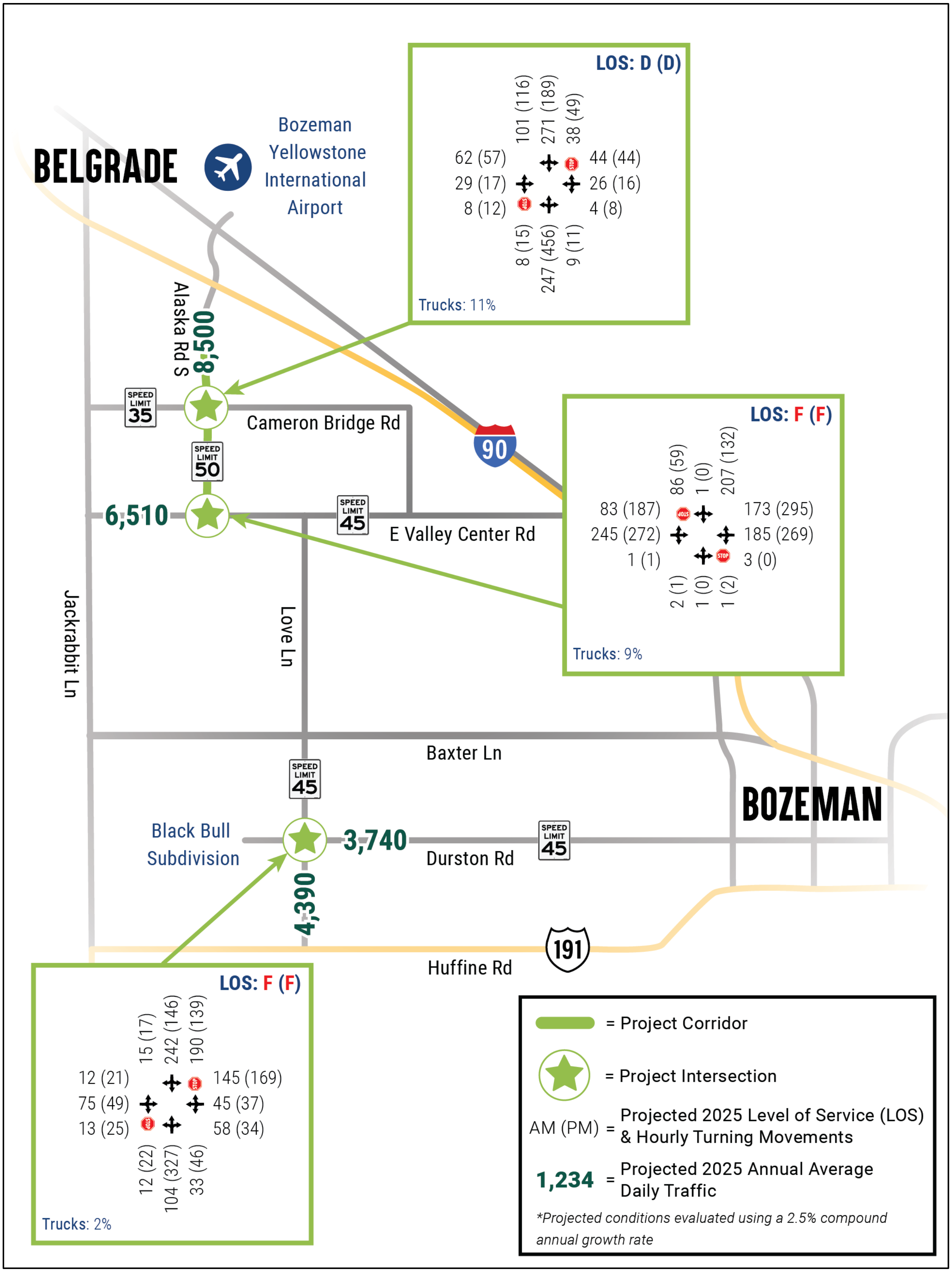


Figure 2.3: Short-Term Traffic Conditions (2025)

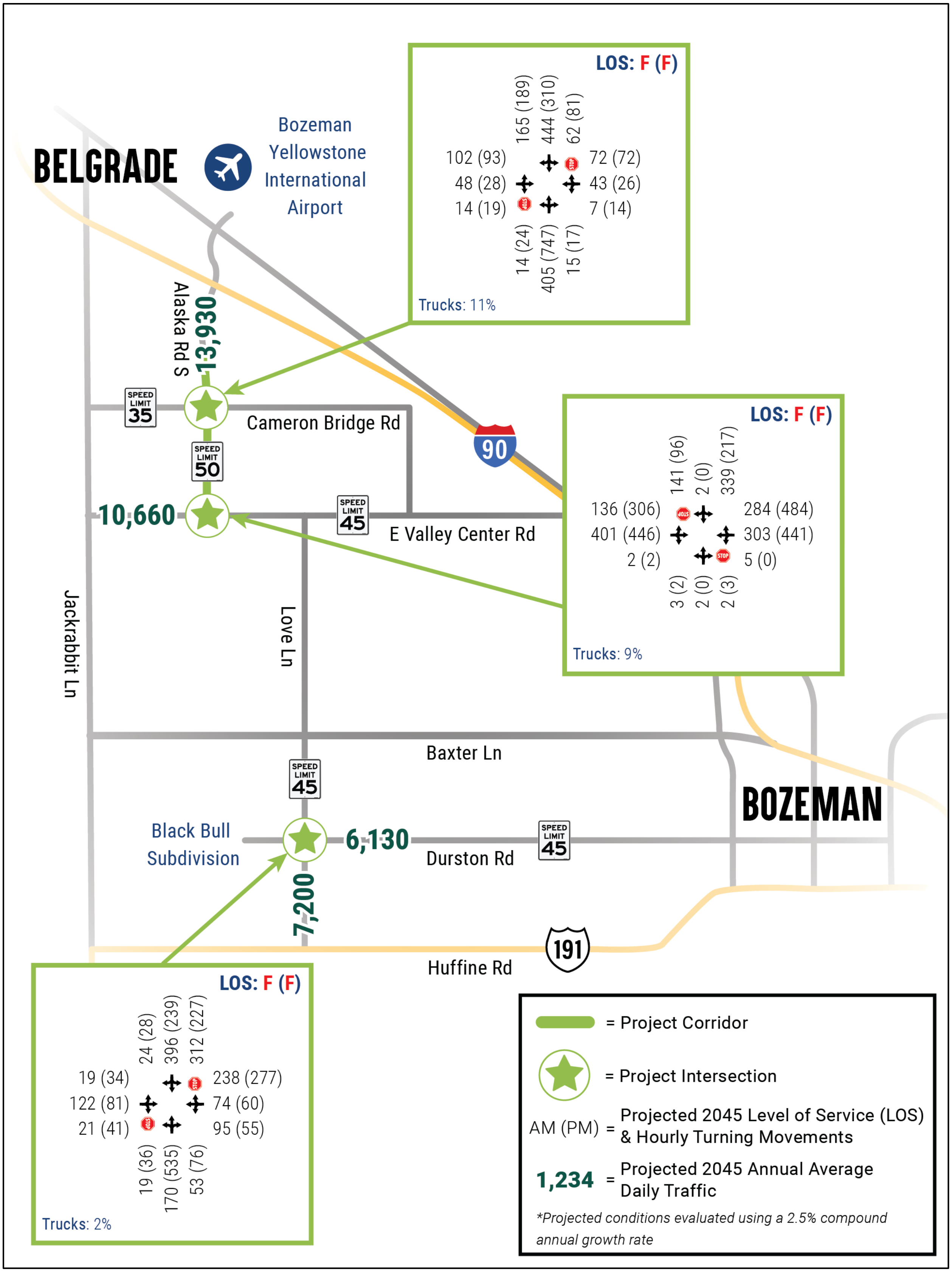


Figure 2.4: Long-Term Traffic Conditions (2045)

2.5. Safety

MDT provided crash data for the project intersections including the type, frequency, location, and severity of each crash. Crash data were provided for the 10-year period between January 1, 2012, and December 31, 2021.[1] The evaluation included all crashes occurring within 750 feet of each intersection to capture both crashes occurring directly at the intersection and crashes occurring due to traffic at the intersection. According to the MDT crash database, a total of 19 crashes occurred at the Alaksa Road South/Cameron Bridge Road intersection, 20 crashes occurred at the Alaska Road South/East Valley Center Road intersection, and 34 crashes occurred at the Love Lane/Durston Road Intersection over the 10-year time period.

The crash reports are a summation of information from the scene of the crash provided by responding officers. Some of the information contained in the crash reports may be subjective. The following sections provide an analysis of the crash data, as reported by the responding officers, to help identify crash trends and contributing factors.

2.5.1. Crash Severity

Of the 73 reported crashes, approximately three-quarters (54) caused property damage only. One fatal crash occurred during the 10-year analysis period at the Alaska Road South/Cameron Bridge Road intersection. The fatal crash was a rollover crash just south of the intersection involving an impaired driver at night under normal roadway and weather conditions. Of the remaining crashes, 10 resulted in minor injuries and 8 resulted in possible injuries. The injury-causing crashes were primarily right-angle, left-turn, and rollover crashes. **Figure 2.5** presents the distribution of crash severity.

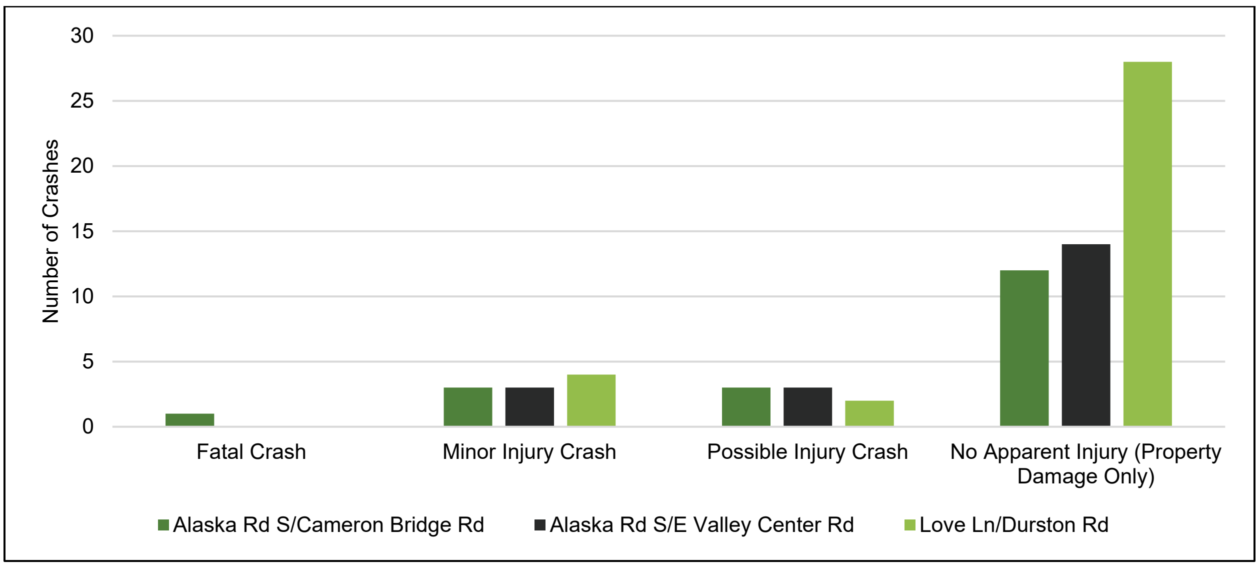


Figure 2.5: Crash Severity

[1] *Pursuant to 23 U.S.C. § 407, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of Title 23, U.S.C., or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data. This publication is not intended to waive any of the State of Montana's rights or privileges under 23 U.S.C. § 407.*

2.5.2. Crash Type

Most crashes at the project intersections involved two vehicles (52, 71% of crashes) while 6 crashes (8%) involved 3 vehicles and 15 crashes (21%) involved only one vehicle. The single vehicle crashes included roll over and fixed object crashes. The fixed objects included ditches, utility poles, traffic signs, and fences. Of the multi-vehicle crashes, the most common were rear-end (26%), right-angle (32%), and left-turn (15%) crashes. Right-angle crashes were most common at the Love Lane/Durston Road intersection while the Love Lane/Durston Road and Alaska Road South/East Valley Center Road intersection had similar numbers of rear-end crashes. Rollover crashes were only reported at the Alaska Road South intersections.

Of the 73 reported crashes, 50 (68%) occurred at the intersection, 14 (19%) were related to the intersection, and 9 (12%) were reported as non-junction crashes. The non-junction crashes were primarily fixed object crashes. **Figure 2.6** presents the distribution of crash types reported.

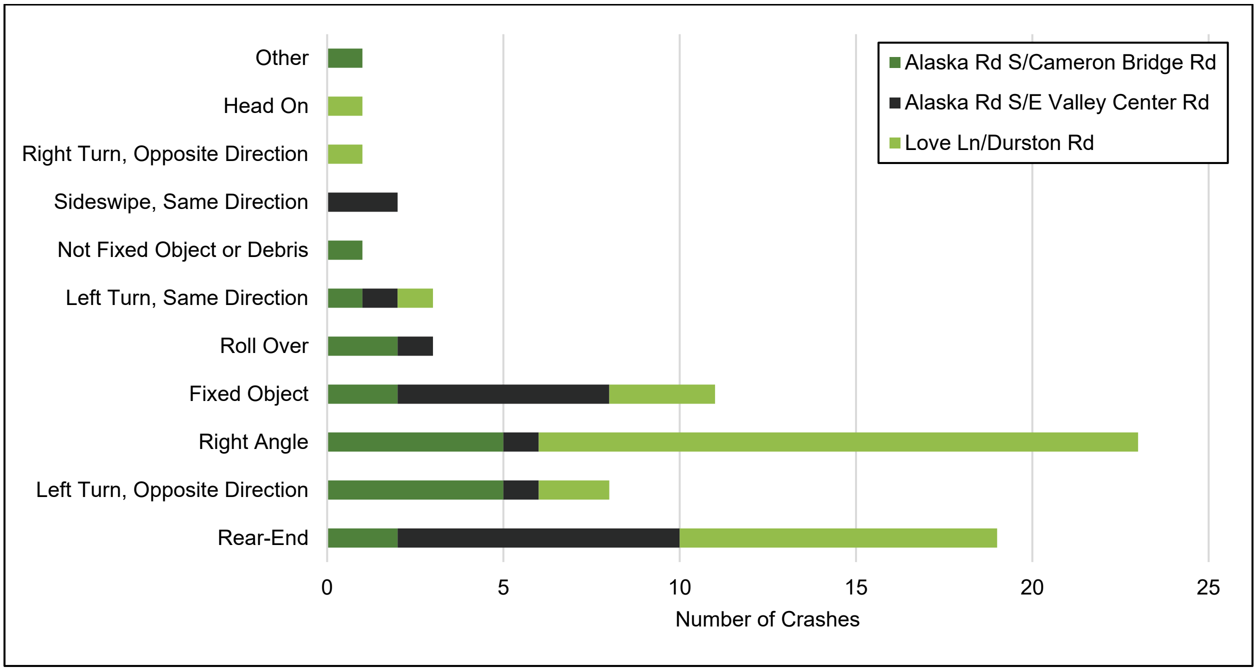


Figure 2.6: Manner of Crash

2.5.3. Crash Period

The crash records were evaluated based on the time of day, day of week, month, and year that the crashes occurred. Crashes at the three intersections increased steadily since 2012, peaked in 2019, and dropped slightly in 2020 and 2021. Crashes were more common during winter months (October through February) with spikes in crashes also observed in April, June, and August. With respect to the day of the week, most crashes were reported on Tuesdays (16), with the least number of crashes (7) occurring on Saturdays. There are generally sustained peaks in crash occurrences during the midday peak hours (11:00 AM – 12:00 PM) and in the evening peak hours (4:00 to 6:00 PM). **Figure 2.7** presents crash period data over the 10-year analysis period.

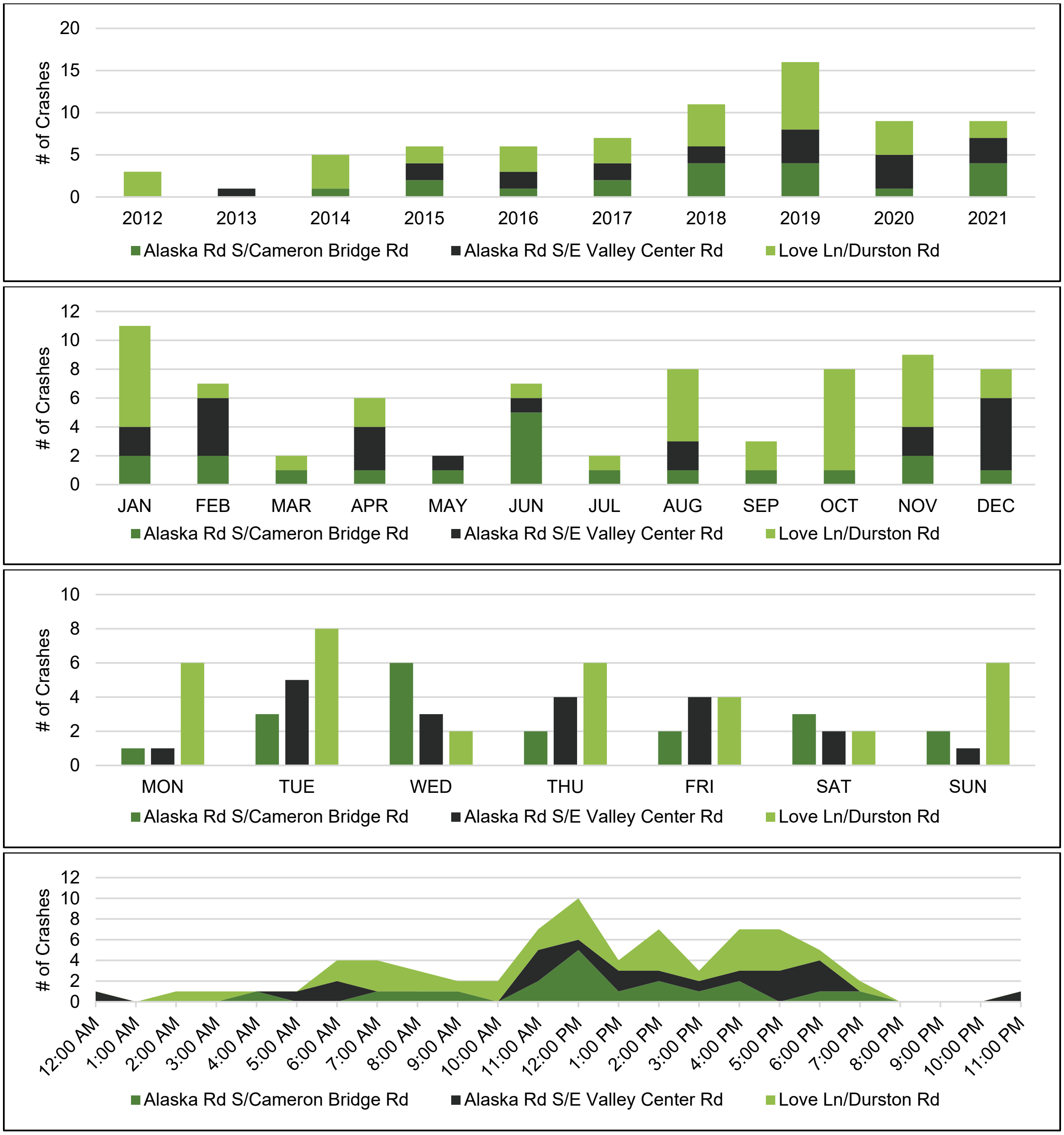


Figure 2.7: Crash Period

2.5.4. Environmental Conditions

Crash data were reviewed to evaluate trends related to environmental factors such as weather, roadway conditions, and light conditions. Most crashes occurred on a clear (26) or cloudy (36) day, while approximately 15 percent occurred with rainy (3) or snowy (8) conditions. Road conditions were dry for the majority of crashes (45), with inclement roadway conditions (ice, frost, snow) being reported for 23 crashes (32%). Most of the crashes (57) also occurred in daylight conditions with 14 occurring when it was dark outside (19%). The data indicates that some of the nighttime crashes occurred with lighting present, although none of the intersections currently have street lighting. **Figure 2.8** presents the crash distribution for environmental factors.

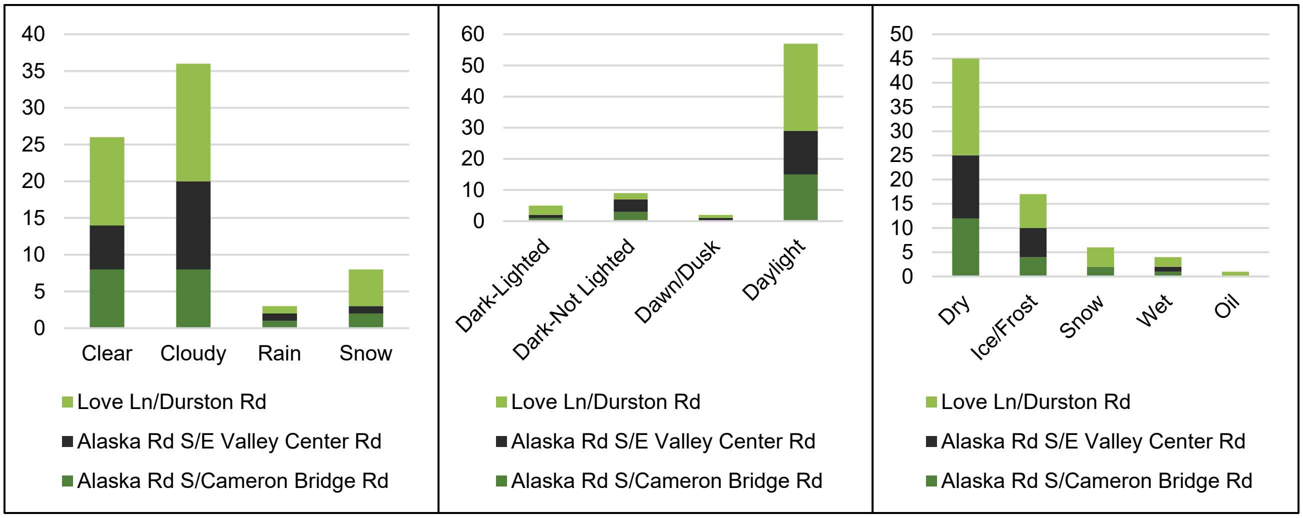


Figure 2.8: Environmental Factors

2.5.5. Contributing Factors

Of the 73 crashes reported between the three intersections, 4 of the crashes involved an impaired driver. The road condition was reported as a contributing circumstance in 23 crashes while the weather condition was a contributing factor in only 3 crashes. The reporting officer can report up to three driver actions at the time of the crash for each driver involved. The top driver actions included failure to yield right-of-way or running a stop sign (32), distracted driving (22), speeding or driving too fast for conditions (14), and following too closely (11).

2.5.6. Safety Data Trend Analysis

The following summarizes the observed crash trends specific to each of the project intersections.

<u>**ALASKA ROAD SOUTH/CAMERON BRIDGE ROAD**</u>

High travel speeds and traffic volumes on Alaska Road South can make it difficult for vehicles on Cameron Bridge Road to safely turn onto or cross Alaska Road South, especially during peak hours. The crashes that occurred at the Alaska Road South / Cameron Bridge Road intersection over the 10-year analysis period exhibited the following trends:

- 1 fatal rollover crash involving an impaired driver
- 26% of crashes were right angle crashes; 32% were left-turning crashes
- 31% of crashes occurred at night under dark lighting conditions
- 14% of vehicles involved in crashes were medium/heavy trucks
- 11% of drivers involved in crashes failed to yield right-of-way or made an improper turn; 37% of crashes involved a distracted driver

<u>**ALASKA ROAD SOUTH/EAST VALLEY CENTER ROAD**</u>

High traffic volumes on East Valley Center Road can make it difficult for vehicles to safely execute turns through the intersection, especially during peak hours. Drivers have been observed swerving around waiting vehicles and turning into inadequate gaps. Crashes occurring at the Alaska Road South / East Valley Center Road intersection over the 10-year analysis period exhibited the following trends:

- 40% of crashes were rear-end crashes; 15% were right angle or left-turning crashes
- 25% of crashes occurred at night under dark lighting conditions
- 30% of crashes occurred on icy or frost-covered roads

- 52% of vehicles were traveling southbound on Alaska Road South
- 24% of drivers swerved, over-corrected, or ran off the roadway; 35% of crashes involved a distracted driver

LOVE LANE/DURSTON ROAD

The elevation of the approach legs and fences on adjacent properties limit sight distance at the intersection. Other safety concerns include high speeds and difficulty stopping under poor road conditions. The crashes that occurred at the Love Lane / Durston Road intersection over the 10-year analysis period exhibited the following trends:

- 50% of crashes were right angle crashes; 27% were rear-end crashes
- 82% of crashes occurred during daylight hours
- 32% of crashes occurred on snowy, icy, or frost-covered roads
- 20% of drivers failed to yield right-of-way; 16% were driving too fast for conditions
- 52% of vehicles involved in crashes were traveling on Love Lane; 45% were traveling westbound on Durston Road

3.0. Alternatives Development and Evaluation

A sequential approach was used to identify, evaluate, and select a preferred alternative for each of the three project intersections. This approach was developed based on FHWA's *Intersection Control Evaluation (ICE)* process[3], but tailored to the needs of each location. The ICE process is a data-driven approach developed to objectively evaluate and screen alternatives to identify an optimal solution. For this project, the evaluation process involved the following key steps.

1. Alternatives Identification: Identify all possible alternatives that may address concerns at the intersections.
2. Phase I Evaluation: Evaluate each alternative to determine fatal flaws that warrant elimination from further consideration.
3. Phase II Evaluation: Evaluate remaining alternatives in more detail to select a preferred alternative to address identified needs.

The evaluation process and results are discussed in more detail in the following sections.

3.1. Alternatives Identification

An extensive list of improvement alternatives was developed to address identified operational and safety concerns. The alternatives included various improvements such as changes to traffic control, geometric enhancements, and implementation of enhanced warning devices. Due to the similarities between the three intersections, the same alternatives were identified and evaluated for each. The alternatives are presented in **Table 3.1**.

Table 3.1: Summary of Identified Alternatives

Alternative	General Description	Intersection-Specific Assumptions
ALT-0: No Action	• A "do nothing" approach • Used as a baseline for comparison against other alternatives	• Existing conditions remain
ALT-1: All-Way Stop	• Provide stop control on all approach legs • Maintain existing alignment and intersection geometrics • Install crosswalks and adjoining non-motorized facilities as appropriate	• All Intersections: ○ Enhanced warning devices could be installed to improve visibility
ALT-2: Turn Lanes	• Provide additional lanes to accommodate turning vehicles • Maintain existing minor leg stop control • Enhance stop control through the addition of enhanced warning and visibility devices • Install crosswalks and adjoining non-motorized facilities as appropriate	• Alaska Rd S/Cameron Bridge Rd: ○ Left-turn lanes on all legs. Dedicated westbound right-turn lane. • Alaska Rd S/E Valley Center Rd: ○ Left-turn lanes on all legs. Dedicated right-turn lanes for west- and southbound movements. • Love Ln/Durston Rd: ○ Left-turn lanes on all legs. Dedicated westbound right-turn lane.
ALT-3: Traffic Signal	• Provide additional lanes to accommodate turning vehicles • Use a traffic signal to direct and control traffic • Install crosswalks and adjoining non-motorized facilities as appropriate	• Assume the same turn lane configurations for each intersection as described in ALT-2 • Love Ln/Durston Rd: ○ The approach grade on the east leg could be modified during construction.
ALT-4: Roundabout	• Use a single-lane roundabout to direct and control traffic • Install crosswalks and adjoining non-motorized facilities as appropriate	• Love Ln/Durston Rd: ○ Reduce the approach grade on the east leg.

3.2. Phase 1 Evaluation

An initial evaluation was conducted to screen the identified alternatives for each intersection and to eliminate those exhibiting fatal flaws. Screening criteria, methodology, and results are described in the following sections. Additional screening results can be found in **Appendix D**.

3.2.1. Screening Criteria and Analysis Methodology

Four screening criteria were selected for the Phase 1 analysis based on the issues and concerns identified at the project intersections. **Table 3.2** lists the screening criteria and a description of the elements considered for each, including both qualitative and quantitative components.

Table 3.2: Phase I Screening Criteria

Alternative	Description
Safety	• Provide adequate visibility and sight distance • Reduce vehicle conflicts • Address identified crash trends
Operations	• Improve intersection performance • Reduce vehicle delay • Accommodate all users
Impacts	• Minimize impacts to the environment • Minimize impacts to adjacent land • Minimize construction impacts
Implementation	• Balance improvement benefits and cost • Reasonable project delivery timeframe • Eligible for available funding

SAFETY

Over the 10-year crash period review period (2012-2021), a total of 73 crashes were reported at the three different Gallatin County intersections: Alaska Road South/Cameron Bridge Road (19), Alaska Road South/East Valley Center Road (20), and Love Lane/Durston Road (34). These crashes included one fatal crash at the Alaska Road South/Cameron Bridge Road intersection, and a total of 10 minor injury crashes and 8 possible injury crashes between the three intersections.

Using FHWA's *Safety Performance for Intersection Control Evaluation* (SPICE) tool[4], an initial quantitative analysis was conducted to understand how changes in traffic control and roadway configuration may affect safety in comparison to historic crash trends. A summary of this initial safety analysis is provided in **Table 3.3.** As shown in the table, all four alternatives are predicted to reduce crash compared to the existing configuration. The all-way stop control alternative exhibits the lowest crash reduction potential while the roundabout exhibits the highest crash reduction potential.

Table 3.3: Safety Performance Evaluation by Traffic Control Strategy

Alternative	Crash Type	Predicted Crash Reduction (%)		
		Alaska/Cameron Bridge	Alaska/Valley Center	Love/Durston
ALT 0: No Action	Total (Fatal & Injury)	Baseline	Baseline	Baseline
ALT 1: All-Way Stop	Total (Fatal & Injury)	48% (48%)	48% (48%)	48% (48%)
ALT 2: Turn Lanes	Total (Fatal & Injury)	55% (55%)	55% (55%)	48% (48%)
ALT 3: Traffic Signal	Total (Fatal & Injury)	43% (55%)	59% (68%)	59% (67%)
ALT 4: Roundabout	Total (Fatal & Injury)	71% (87%)	71% (87%)	71% (87%)

Source: FHWA SPICE Tool

Installation of an **all-way stop** would help slow travel speeds through the intersections from all directions. However, the stop control on the major approaches can be unexpected, especially for drivers who are unfamiliar with the intersection traffic control configuration, potentially increasing the potential for rear-end conflicts or the probability of stop signs being ignored. The all-way stop also gives turning priority to one vehicle at a time, which could help reduce turning conflicts although the number of total vehicle conflict points remains the same.

Installation of additional **turn lanes** would reduce the number of total vehicle conflict points at the intersection by separating turning movements. By reducing conflict points, it is anticipated that the number of crashes per year could be marginally reduced, though the chance of crashes causing injuries remains high with two-way stop control. The addition of left-turn lanes at intersections has been shown to reduce rear-end crashes. Inclusion of enhanced warning devices could also help improve safety by increasing driver awareness.

Installation of a **traffic signal**, in conjunction with additional turn lanes, is shown to provide a slight safety benefit by reducing the total number of crashes and fatal/injury crashes compared to Alt-2. Traffic signals can help to reduce the frequency of right-angle crashes at high-volume intersections but can also result in an increased frequency of other crash types. Crashes involving left turning and opposing vehicles can also be a concern at signalized intersections depending on the signal phasing (i.e., protected versus permissive left-turns). Crashes at signalized intersections can be more severe due to red light running. Signalized intersections can, however, improve safety for pedestrians by providing dedicated walk phases.

Roundabouts provide substantial safety benefits compared to other intersection types, most notably a reduction in severe crashes. The roundabout's channelized approaches and center island help lower vehicle approach speeds and reduce the number of conflict points where vehicles cross paths, eliminating the potential for right-angle and head-on crashes. By promoting lower vehicle speeds, roundabouts also give drivers more time to react when conflicts occur and can enhance the comfort and safety of bicyclists in the travel lane. Since entering and exiting vehicles are separated, pedestrians only have to cross only one lane of traffic at a time.

OPERATIONS

Operational enhancements to the three intersections are essential to improve traffic operations and mobility for all roadway users. At present, these intersections are displaying signs of suboptimal operational performance and long vehicle delays, particularly during the peak periods. While the major roads maintain efficient operation with minimal delays, the minor roads frequently encounter prolonged delays due to difficulties in finding suitable gaps within the traffic flow. Under existing conditions, these intersections generally operate at failing LOS during peak hours. As the area experiences continued growth, it is anticipated that these intersections will continue to face worsened operational challenges.

To gain a comprehensive understanding of how different traffic control strategies impact traffic performance, an initial quantitative analysis was conducted using FHWA's *Capacity Analysis for Planning of Junctions* (Cap-X) tool[5]. This analysis employs the critical lane volume summation method to provide a planning-level capacity assessment by utilizing several metrics to assess the performance of various intersection configurations. One pivotal metric is the volume to capacity (V/C) ratio, which assesses traffic congestion by comparing the volume on the roadway to the overall capacity of the roadway. Additionally, the Cap-X tool evaluates pedestrian and bicycle accommodations for each intersection type, providing ratings ranging from Poor to Excellent. It's important to note that the Cap-X tool employs a generalized approach and does not account for site-specific or traffic-specific characteristics. A summary of the capacity analysis is presented in **Table 3.4**.

Table 3.4: Capacity Analysis by Traffic Control Strategy

Alternative	Pedestrian Accommodations	Bicycle Accommodations	2025 V/C Ratio AM (PM)	2045 V/C Ratio AM (PM)
Alaska Road South/Cameron Bridge Road				
ALT 0: No Action	Fair	Poor	0.30 (0.32)	1.86 (2.36)
ALT 1: All-Way Stop	Excellent	Poor	0.78 (0.85)	1.28 (1.40)
ALT 2: Turn Lanes	Fair	Poor	0.27 (0.27)	1.54 (1.73)
ALT 3: Traffic Signal	Good	Poor	0.33 (0.40)	0.55 (0.65)
ALT 4: Roundabout	Excellent	Good	0.34 (0.41)	0.57 (0.73)
Alaska Road South/East Valley Center Road				
ALT 0: No Action	Fair	Fair	0.84 (1.01)	3.59 (10.78)
ALT 1: All-Way Stop	Excellent	Fair	0.90 (1.06)	1.48 (1.73)
ALT 2: Turn Lanes	Fair	Fair	0.69 (0.75*)	2.46 (4.91*)
ALT 3: Traffic Signal	Good	Fair	0.36 (0.41)	0.58 (0.68)
ALT 4: Roundabout	Excellent	Good	0.33 (0.51)	0.62 (0.96)
Love Lane/Durston Road				
ALT 0: No Action	Fair	Poor	0.47 (0.20)	10.5 (6.77)
ALT 1: All-Way Stop	Excellent	Poor	0.78 (0.85)	1.28 (1.40)
ALT 2: Turn Lanes	Fair	Poor	0.34 (0.25)	1.05 (3.57)
ALT 3: Traffic Signal	Good	Poor	0.33 (0.41)	0.54 (0.68)
ALT 4: Roundabout	Excellent	Good	0.37 (0.36)	0.65 (0.68)

**Out of range for Cap-X analysis; v/c drawn from Vistro results*

The capacity analysis shows that an **all-way stop** operates with some of the highest overall V/C ratios but may provide enough capacity to accommodate traffic in the short-term by distributing intersection delays more evenly between all legs. The addition of **turn lanes** is shown to increase capacity in the short-term by separating turning movements, however, the intersections are shown to quickly exceed capacity without additional traffic control. **Traffic signals** can also improve intersection operations but will operate with the least amount of comparative delay when traffic volumes meet signal warrants. The traffic signal is shown to operate with the lowest V/C ratios in the long-term, however, induced delay will be experienced on major approaches. The **roundabout** demonstrates the second lowest V/C ratios of all options. At roundabouts, entering traffic yields to vehicles already circulating, promoting a continuous flow of traffic, reducing stop delay, and improving operational performance.

According to **Table 3.4**, the **roundabout** emerges as the most pedestrian and bicycle-friendly option, with Excellent and Good ratings, respectively. The **all-way stop** control option also exhibits Excellent pedestrian accommodations but Fair to Poor bicycle accommodations. The **traffic signal** option received a Good rating for pedestrians but Poor rating for bicycles. For all other alternatives, pedestrian accommodations were rated as Fair while bicycle accommodations were rated as Poor at all intersections except Alaska Road South/East Valley Center Road which has an existing SUP.

Large vehicles also require special accommodations to efficiently navigate intersections but are not assessed in the CAP-X analysis. Accommodations that can help improve operations and mobility for large trucks and other equipment include larger turning radii, greater horizontal/vertical clearance, longer deceleration/acceleration distances, and longer gaps in traffic to execute turning movements. In general, an **all-way stop** would reduce the time required for a large truck to wait for an acceptable gap in traffic to execute a turning movement by stopping all legs of traffic. With the addition of **turn lanes**, the intersection could be designed to ensure large trucks have adequate turning radii to be able to safely maneuver the intersection. A **traffic signal** can also be beneficial for trucks by providing ample time and space to execute turning movements. Additionally, **roundabouts** can be designed for large trucks using features such as wider entry and exit lanes, mountable curbing for vehicles with wide and/or long wheelbases, and curvature designed to allow easy truck turning movements.

IMPACTS

The proposed alternatives range from minor roadway enhancements and changes to traffic control to major intersection reconstruction. Implementation of the alternatives may result in impacts to the environment and adjacent land uses. This may include impacts to developed areas such as other adjacent parcels, the potential acquisition of right-of-way or conversion of open space to developed land, or impacts to the Spain Ferris Ditch at the Alaska Road South intersections. Substantial impacts are expected on the east leg of the Love Lane/Durston Road intersection to accommodate widening and flatten the approach grade. Impacts may be temporary during construction or may persist through the life of the project and could be irreversible. Localized, temporary traffic impacts may also be experienced during construction, including reduced speeds, roadway closures, and detours.

In general, the **all-way stop** control option only involves installation of new signage but otherwise does not require any roadway improvements aside from on-going maintenance. The installation of additional **turn lanes** would require substantial reconstruction to widen and install turn bays on each approach leg which may require the acquisition of some right-of-way from adjacent properties. The footprint of the **traffic signal** option is similar to the turn lane option but also requires the installation of utilities and the erection of a signal with possible associated lighting which could have undesirable visual and environmental impacts. The footprint of a single-lane **roundabout** would be slightly larger than the footprint of Alt-2 and Alt-3 but potentially narrower further from the intersection due to the need for only a single entry lane. The approach grade of the east leg of the Love Lane/Durston Road intersection would likely be modified during construction associated with Alt-2, Alt-3, and Alt-4.

IMPLEMENTATION

A generalized analysis of project implementation and maintenance costs was completed to perform a high-level benefit-cost analysis. Based on this evaluation, a high-level assessment of potential eligibility for various funding sources was conducted. For example, if a proposed alternative demonstrates a strong safety benefit with reasonable construction costs, it may be eligible for safety funds or a competitive grant program which may be easier to secure for a project at the intersection. The analysis also considered overall project costs as a potentially prohibitive factor. High-cost projects may also take a longer time to implement, depending on availability of funding, while low-cost improvements are generally easier to implement in the short term.

An **all-way stop** could be installed with little capital cost and essentially no construction time. Its low cost, minimal impacts, and demonstrated safety and operational performance support a favorable benefit-cost relationship in the short-term. Reconstruction of the intersection to add **turn bays** would be a substantial expense for relatively little safety or operational benefits over the long-term, resulting in a low benefit-cost ratio. However, turn bays could be installed in the short-term, with a long-term plan to install a traffic signal. The **traffic signal** option is shown to provide operational and safety benefits which are likely to be commensurate with the associated costs and impacts, indicating potential eligibility for various funding sources. **Roundabouts** typically have high benefit-cost ratios especially when implemented to address safety concerns indicating likely eligibility for many funding programs.

3.2.2. Phase 1 Screening Results

Table 3.5 provides a summary of the ICE process discussed in previous sections. The evaluation was based on results from the SPICE and CAP-X tools, as well as qualitative analyses of impacts and implementation feasibility. Each option was scored on a 0-to-4-point scale with more points being assigned for better performance. A score of 0 was considered a fatal flaw, eliminating that option from future analysis. In some cases, an option that performs well over the short-term but is unlikely to address safety and operational needs over the long-term was advanced for short-term consideration.

As shown in the table, **Alt-1: All-Way Stop** was advanced for short-term consideration at the Alaska Road South/Cameron Bridge Road and Love Lane/Durston Road intersections. Conversely, **Alt-2: Turn Lanes** was eliminated for the Alaska Road South/Cameron Bridge Road and Love Lane/Durston Road intersections but was advanced for short-term consideration at the Alaska Road South/East Valley Center Road. **Alt-3: Traffic Signal** and **Alt-4: Roundabout** were advanced for further consideration in Phase 2 for all three intersections.

Table 3.5: Phase 1 Screening Results

Alternative	2025					2045					Summary
	Safety	Operations	Impacts	Implementation	Total Score	Safety	Operations	Impacts	Implementation	Total Score	
Alaska Road South/Cameron Bridge Road											
ALT 0: No Action	2	1	4	4	**11**	1	0	4	4	**9**	**Baseline Comparison**
ALT 1: All-Way Stop	3	3	4	4	**14**	3	1	4	3	**11**	**ADVANCE** *for Short-Term Consideration*
ALT 2: Turn Lanes	3	2	2	1	**8**	3	0	2	1	**6**	**DO NOT ADVANCE**
ALT 3: Traffic Signal	2	4	2	1	**9**	3	4	2	2	**11**	**ADVANCE** *to Phase II*
ALT 4: Roundabout	4	4	2	2	**12**	4	4	2	3	**13**	**ADVANCE** *to Phase II*
Alaska Road South/East Valley Center Road											
ALT 0: No Action	0	1	4	4	**9**	0	0	4	4	**8**	**Baseline Comparison**
ALT 1: All-Way Stop	1	2	4	2	**9**	2	0	4	2	**8**	**DO NOT ADVANCE**
ALT 2: Turn Lanes	2	2	3	2	**9**	2	0	3	1	**6**	**ADVANCE** *for Short-Term Consideration*
ALT 3: Traffic Signal	2	4	3	2	**11**	3	4	3	2	**12**	**ADVANCE** *to Phase II*
ALT 4: Roundabout	4	4	2	3	**13**	3	3	2	3	**11**	**ADVANCE** *to Phase II*
Love Lane/Durston Road											
ALT 0: No Action	0	2	4	4	**10**	0	0	4	4	**8**	**Baseline Comparison**
ALT 1: All-Way Stop	2	3	4	3	**12**	2	1	4	4	**11**	**ADVANCE** *for Short-Term Consideration*
ALT 2: Turn Lanes	2	2	2	1	**7**	2	0	2	1	**5**	**DO NOT ADVANCE**
ALT 3: Traffic Signal	3	4	2	2	**11**	3	4	2	2	**11**	**ADVANCE** *to Phase II*
ALT 4: Roundabout	4	4	2	2	**12**	4	4	2	3	**13**	**ADVANCE** *to Phase II*

ALASKA ROAD SOUTH/CAMERON BRIDGE ROAD

The transitional nature of the Alaska Road South/Cameron Bridge Road intersection location, combined with heavy mainline traffic volumes, the presence of heavy trucks, high speeds, and rural infrastructure design contributes to severe safety concerns and poor operational performance. **Alt-1: All-Way Stop** was shown to provide improved operations and safety in the short-term with little capital investment or impacts but does not provide adequate capacity over the long-term. Although **Alt-2: Turn Lanes** was shown to provide increased capacity and safety benefits in the short-term, the intersection will continue to experience increasing delays over the long-term, reducing the overall cost effectiveness of the option. **Alt-3: Traffic Signal** was shown to improve operations and provide moderate safety benefits in comparison to all other options. Although a traffic signal is not anticipated to be warranted at the intersection in the short-term, it is worth considering as a long-term investment. **Alt-4: Roundabout** demonstrated the best safety performance in addition to providing adequate capacity for existing and projected traffic volumes, making it likely to be cost-effective to implement due to a favorable benefit-cost comparison.

ALASKA ROAD SOUTH/EAST VALLEY CENTER ROAD

The Alaska Road South/East Valley Center Road intersection currently operates with long delays, especially during the PM peak hour. Congestion at the intersection contributes to a history of rear-end crashes and many near-miss crashes due to impatient drivers taking inadequate gaps in traffic. **Alt-1: All-Way Stop** was shown to provide marginal safety and operational benefits in the short-term but failed to offer adequate operations in the long-term. Additionally, Alt-1 would negatively impact operations on East Valley Center Road, which is an MDT Urban Route. **Alt-2: Turn Lanes** demonstrated reasonable operational and safety performance in the short-term but is not shown to provide adequate capacity in the long-term, nor does it exhibit exceptional safety benefits relative to its impacts without the inclusion of additional traffic control. **Alt-3: Traffic Signal**, however, was shown to provide the best operational performance of all options with reasonable safety benefits under long-term conditions. **Alt-4: Roundabout** was shown to provide the best safety benefits with improved operational performance, however, this option is anticipated to approach capacity under projected long-term conditions without the inclusion of additional circulation lanes.

LOVE LANE/DURSTON ROAD

The Love Lane/Durston Road intersection presently experiences long delays and has a history of crashes due to limited sight distances, steep approach grades, high travel speeds, and generally high traffic volumes. **Alt-1: All-Way Stop Control** was installed at the intersection in 2023 in response to a construction detour. Both in the field and in the Phase 1 screening, the all-way stop demonstrated favorable operations with minimal delays. This option is anticipated to be suitable for the intersection in the short term but is projected to quickly reach capacity and will likely not meet long-term operational needs. Although **Alt-2: Turn Lanes** was shown to provide improved operations in the short-term and reduce conflicts overall, the additional capacity will not be adequate in the long-term without additional traffic control. However, the analyses showed that **Alt-3: Traffic Signal** can provide improved operations and ample safety benefits in both the short- and long-term. Similarly, **Alt-4: Roundabout** demonstrates the best safety performance, while also providing adequate capacity for existing and projected volumes and supporting a favorable benefit-cost comparison.

3.2.3. Public Outreach and Alternative Confirmation

Based on the initial Phase 1 screening, **Alt-3: Traffic Signal** and **Alt-4: Roundabout** were advanced for further analysis and refinement at each intersection. **Alt-1: All-Way Stop** was also advanced for short-term consideration at the Alaska Road South/Cameron Bridge Road and Love Lane/Durston

Road intersections. Similarly, **Alt-2: Turn Lanes** was advanced for short-term consideration at Alaska Road South/East Valley Center Road.

As part of a comprehensive outreach effort, a live virtual public meeting and in-person public open house were held in December 2023. At the outreach meetings, exhibits and informational sheets were used to present improvement concepts and the Phase 1 screening results. Interactive exercises were also used at the open house to collect community feedback on potential improvement options. To collect feedback from a broader cross section of the community, the planning team also distributed a brief survey via a project-specific website and Gallatin County's social media outlets to garner feedback on community priorities for the three intersections and solicit additional input on the various alternatives for each intersection.

The first question on the survey, which mirrored the interactive voting exercise during the public open house, asked participants to rank key topics in the order that is most important to them when evaluating potential improvements for the project intersections, while keeping in mind physical and budgetary limitations. The survey results, which closely resembled the results from the public open house, are shown in **Figure 3.1**. The community indicated that safety, followed by traffic operations, are the highest priorities when selecting intersection improvements. The remaining six topics scored similarly with the ease/speed of implementation, cost, and pedestrian and bicycle accommodations ranking slightly higher than large truck accommodations, impacts to adjacent land, and environmental impacts.

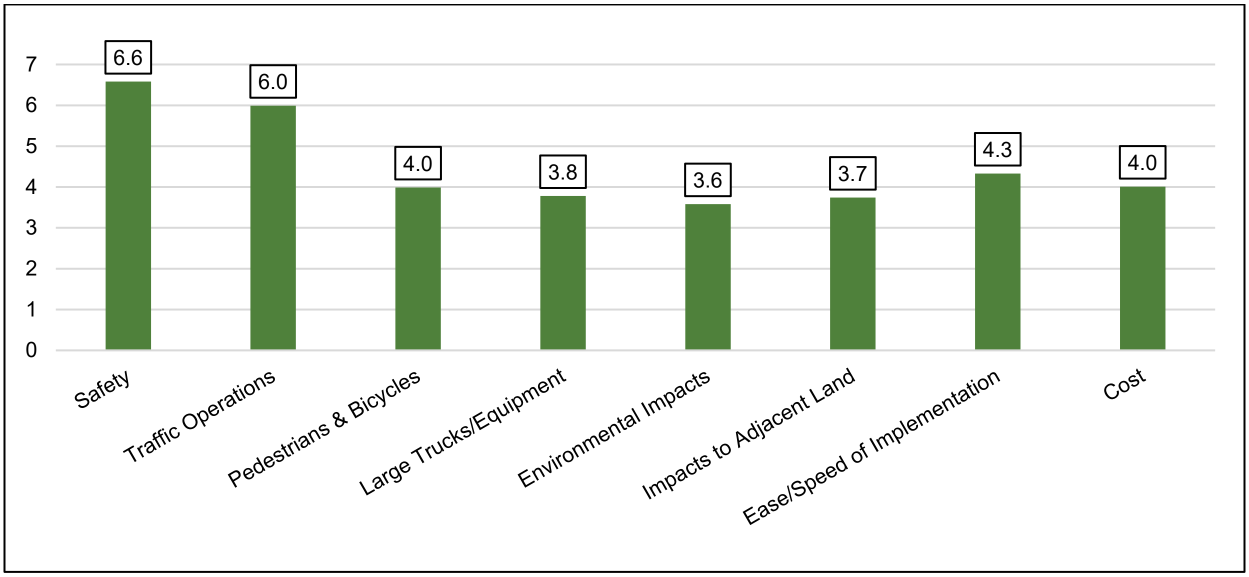


Figure 3.1: Survey Results - Community Priorities

Survey participants were then asked to indicate how they feel each of the proposed alternatives would address their concerns for each of the intersections. A comment card was given to in-person open house attendees to answer similar questions, rendering similar results to the survey. Responses ranged from Strongly Agree to Strongly Disagree. For easy comparison of the results, a composite score was developed by assigning a five-point rating to Strongly Agree selections and a one-point rating for Strongly Disagree selections. The averaged scores for each of the proposed alternatives for each intersection are shown in **Figures 3.2** through **3.4**.

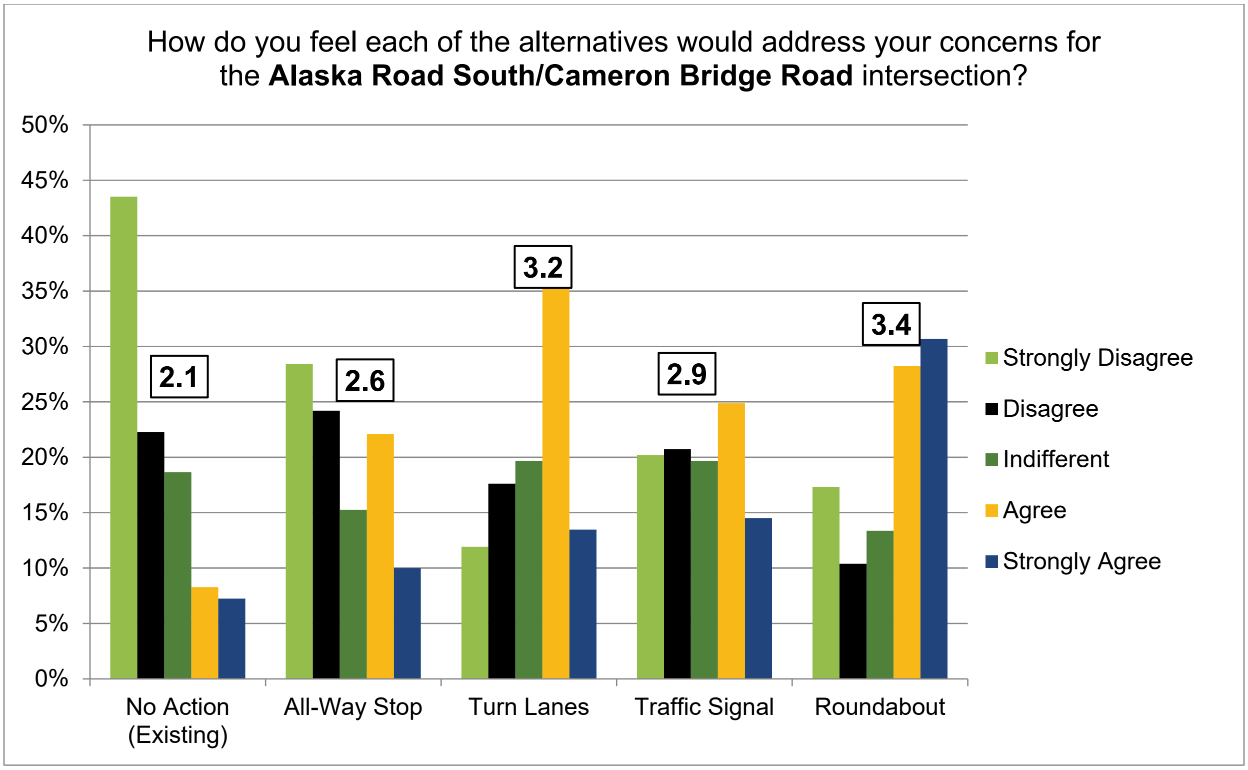


Figure 3.2: Survey Results - Alaska Rd S/Cameron Bridge Rd Community Alternative Ratings

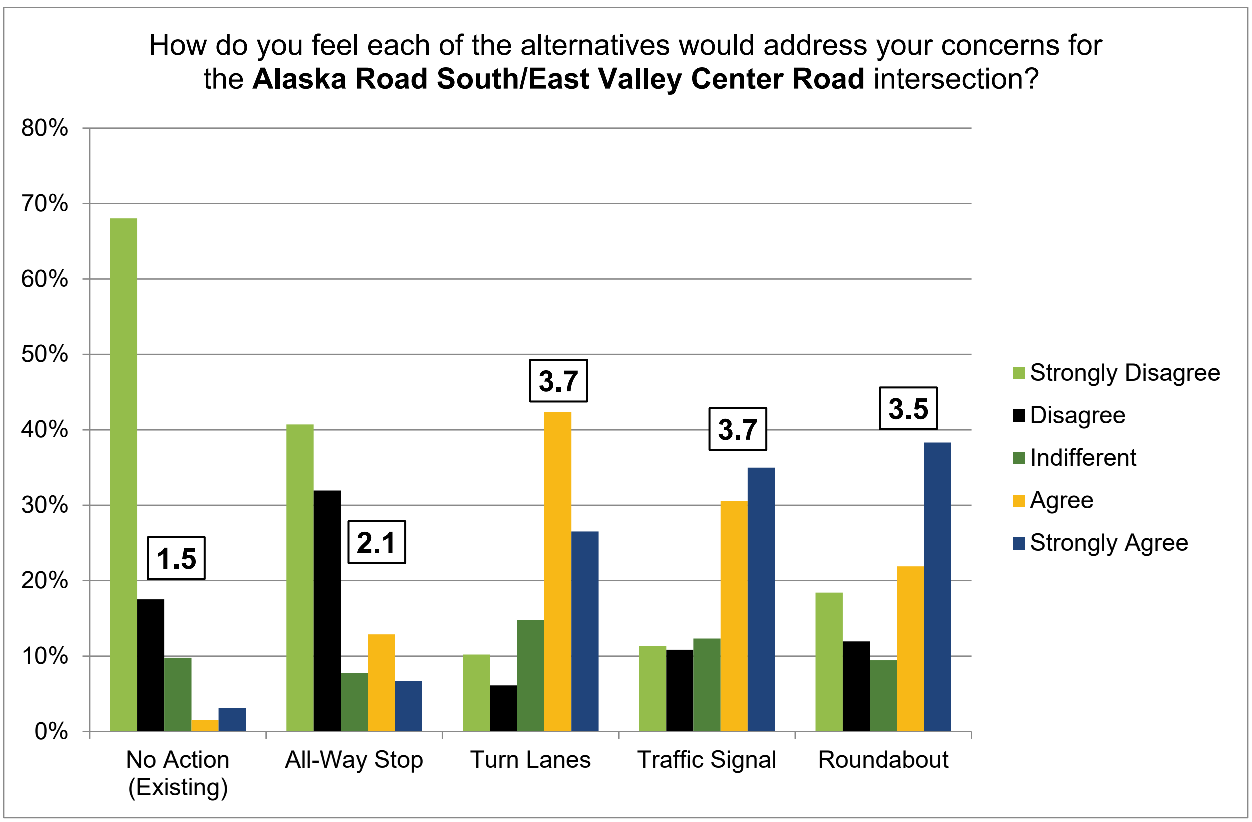


Figure 3.3: Survey Results - Alaska Rd S/E Valley Center Rd Community Alternative Ratings

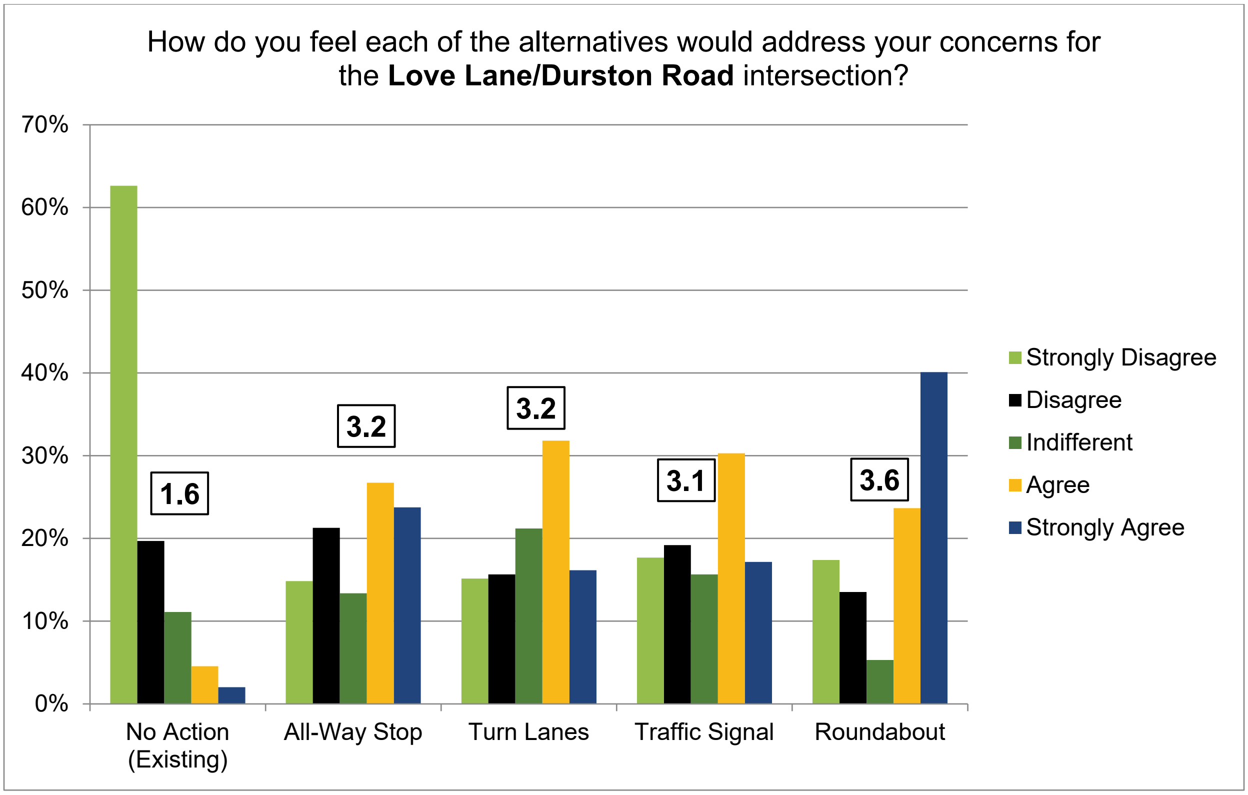


Figure 3.4: Survey Results - Love Ln/Durston Rd Community Alternative Ratings

For all three intersections, the roundabout option received the greatest number of Strongly Agree selections while the No Action option received the most Strongly Disagree selections. Based on the composite scores, the roundabout option also ranked the highest overall for the Alaska Road South/Cameron Bridge Road (3.4) and Love Lane/Durston Road (3.6) intersections. The turn lanes option was a close second (3.2) for the Alaska Road South/Cameron Bridge Road intersection while both the all-way stop and turn lane options ranked second for the Love Lane/Durston Road intersection with composite scores of 3.2. For the Alaska Road South/East Valley Center Road intersection, the traffic signal and turn lane options both received the highest composite scores (3.7), with the traffic signal option receiving a greater number of Strongly Agree selections. The roundabout option was also ranked highly for the intersection, receiving a composite score of 3.5.

A couple of open-ended questions were also provided to gather additional feedback and ensure the project team had considered all possible options for each intersection. Overall, participants stressed the desire to ensure safety and efficiency for all roadway users. Top concerns included traffic congestion, pedestrian and bicyclist safety, road damage from heavy vehicles, rapid population growth, and the need for coordinated development and transportation improvements. Other topics to consider during the evaluation process include increased enforcement, weather effects/adverse road conditions, maintenance requirements, and environmental implications. When asked if there were any other potential solutions not yet identified to address concerns at the three intersections, respondents underlined the need for public transit, pedestrian/cyclist infrastructure, and capacity upgrades to mitigate increased traffic from future developments. Overall, the community desires comprehensive solutions that prioritize safety and sustainability while accommodating future growth.

Based on community feedback, it was confirmed that the alternatives identified for the Phase 1 analysis adequately captured all possible improvement options for the project intersections. Furthermore, the traffic signal and roundabout options arose as the preferred options by the community for all intersections, with short-term consideration of all-way stop control and turn lanes also being favored. Safety and traffic operations were confirmed as the most important evaluation criterion, although accommodations for non-motorists and large trucks, implementation speed and cost, and environmental impacts also remain high priorities for the community. Accordingly, additional focus on safe speeds, wintertime safety, maintenance considerations, multimodal integration, and future growth should be incorporated into the Phase 2 analysis. Overall, the community feedback aligned well with the results of the Phase 1 analysis, confirming the process and desire to evaluate the traffic signal and roundabout options in more detail as long-term intersection improvements.

3.3. Phase 2 Evaluation

In addition to short-term considerations, both **traffic signal** and **roundabout** alternatives were carried forward into the Phase 2 analysis for all three project intersections. Lane configurations remained consistent with those evaluated in Phase 1, with one exception: the westbound right-turn lane in the signalized alternative at the Alaska Road South/Cameron Bridge Road intersection was removed. This adjustment was made due to potential impacts and the absence of sufficient right-turn volumes to justify a dedicated lane.

To facilitate a more meaningful comparison of the remaining alternatives, an in-depth analysis was conducted. This included an analysis of projected traffic operations, a detailed safety assessment, evaluation of relative impacts, and a comprehensive estimate of total construction costs. The methodology and results of this comparative analysis are outlined in the following sections.

3.3.1. Traffic Analysis

Building on the analysis conducted for the Phase 1 evaluation, the traffic signal and roundabout alternatives were modeled under projected conditions using *PTV Vistro 2024* software. This analysis method mirrors the methodology used to determine the existing and projected intersection operations for the current intersection configurations, detailed in Section 2. The analysis is based on LOS and delay, rather than V/C ratios used in the CAP-X analysis under Phase 1. Due to differences in methodology, traffic operational results may vary from those presented in Phase 1.

Table 3.6 presents the results of the *Vistro* analysis during the AM and PM peak hours under 2025 and 2045 projected year conditions, with detailed results contained in **Appendix E**.

Table 3.6: Intersection Operational Analysis

Intersection/ Approach	Short-Term (2025)				Long-Term (2045)			
	AM		PM		AM		PM	
	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
ALT 3: Traffic Signal								
Alaska Rd S/Cameron Bridge Rd	**9.3**	**A**	**8.7**	**A**	**13.8**	**B**	**14.1**	**B**
Northbound (Alaska Rd S)	*2.9*	*A*	*3.2*	*A*	*4.7*	*A*	*5.8*	*A*
Southbound (Alaska Rd S)	*3.7*	*A*	*2.9*	*A*	*7.2*	*A*	*4.8*	*A*
Eastbound (Cameron Bridge Rd)	*33.2*	*C*	*40.4*	*D*	*48.9*	*D*	*74.9*	*E*
Westbound (Cameron Bridge Rd)	*30.8*	*C*	*38.4*	*D*	*35.5*	*D*	*44.7*	*D*
Alaska Rd S/E Valley Center Rd	**10.8**	**B**	**8.0**	**A**	**15.0**	**B**	**14.3**	**B**
Northbound (Alaska Rd S)	*17.8*	*B*	*21.4*	*C*	*12.7*	*B*	*21.4*	*C*
Southbound (Alaska Rd S)	*22.4*	*C*	*25.1*	*C*	*19.3*	*B*	*33.5*	*C*
Eastbound (E Valley Center Rd)	*6.4*	*A*	*5.8*	*A*	*15.3*	*B*	*17.0*	*B*
Westbound (E Valley Center Rd)	*5.3*	*A*	*4.0*	*A*	*11.2*	*B*	*5.5*	*A*
Love Ln/Durston Rd	**11.8**	**B**	**11.8**	**B**	**14.0**	**B**	**17.7**	**B**
Northbound (Love Ln)	*3.7*	*A*	*4.4*	*A*	*6.6*	*A*	*10.9*	*B*
Southbound (Love Ln)	*5.0*	*A*	*5.4*	*A*	*10.8*	*B*	*21.1*	*C*
Eastbound (Durston Rd)	*22.1*	*C*	*22.8*	*C*	*18.8*	*B*	*18.8*	*B*
Westbound (Durston Rd)	*24.6*	*C*	*27.8*	*C*	*22.1*	*C*	*24.2*	*C*
ALT 4: Roundabout								
Alaska Rd S/Cameron Bridge Rd	**6.4**	**A**	**6.6**	**A**	**11.0**	**B**	**13.8**	**B**
Northbound (Alaska Rd S)	*6.1*	*A*	*7.8*	*A*	*10.2*	*B*	*19.6*	*C*
Southbound (Alaska Rd S)	*6.9*	*A*	*5.5*	*A*	*12.4*	*B*	*8.4*	*A*
Eastbound (Cameron Bridge Rd)	*5.4*	*A*	*4.3*	*A*	*8.9*	*A*	*6.0*	*A*
Westbound (Cameron Bridge Rd)	*5.6*	*A*	*6.0*	*A*	*8.7*	*A*	*10.7*	*B*
Alaska Rd S/E Valley Center Rd	**7.1**	**A**	**8.5**	**A**	**14.7**	**B**	**35.8**	**E**
Northbound (Alaska Rd S)	*5.8*	*A*	*6.2*	*A*	*9.1*	*A*	*9.9*	*A*
Southbound (Alaska Rd S)	*7.2*	*A*	*5.8*	*A*	*14.5*	*B*	*9.8*	*A*
Eastbound (E Valley Center Rd)	*7.6*	*A*	*7.7*	*A*	*18.0*	*C*	*18.1*	*C*
Westbound (E Valley Center Rd)	*6.6*	*A*	*10.0*	*B*	*12.0*	*B*	*59.1*	*F*
Love Ln/Durston Rd	**6.3**	**A**	**6.5**	**A**	**12.3**	**B**	**14.1**	**B**
Northbound (Love Ln)	*5.5*	*A*	*7.5*	*A*	*9.0*	*A*	*18.6*	*C*
Southbound (Love Ln)	*7.3*	*A*	*5.3*	*A*	*15.9*	*C*	*8.1*	*A*
Eastbound (Durston Rd)	*6.1*	*A*	*4.7*	*A*	*11.6*	*B*	*7.1*	*A*
Westbound (Durston Rd)	*5.2*	*A*	*7.2*	*A*	*8.0*	*A*	*16.8*	*C*

ALASKA ROAD SOUTH / CAMERON BRIDGE ROAD

For the Alaska Road South/Cameron Bridge Road intersection, the traffic signal option (ALT-3) is shown to operate at LOS A during the AM and PM peak hours under the short-term scenario. The east- and westbound approaches (Cameron Bridge Road) experience the most delay, operating at LOS C and D during the AM and PM peak hours, respectively, while the north- and southbound approaches (Alaska Road South) operate at LOS A. In the long-term, conditions worsen slightly with the overall intersection LOS degrading to LOS B, though with only a few seconds of additional delay.

Conversely, the roundabout option (ALT-4) demonstrates significantly lower delays and better LOS in the short-term scenario, with delays ranging from about 4 to 8 seconds with LOS A during both the

AM and PM peak hours. In the long-term, the intersection is shown to operate at LOS B. In the AM peak hour, the north- and southbound approaches operate at LOS B while the east- and westbound approaches operate at LOS A. In the PM, the northbound approach operates with the highest delay and LOS C, while the southbound and eastbound approaches operate with the least amount of delay.

ALASKA ROAD SOUTH / EAST VALLEY CENTER ROAD

At the Alaska Road South/East Valley Center Road intersection, the traffic signal option (ALT-3) operates at LOS B during the AM peak hour and LOS A during the PM peak hour under the short-term scenario. In the long-term scenario, the intersection operates at LOS B during both peak hours. Under all scenarios, the north- and southbound approaches experience the most delay. The east- and westbound approaches begin to experience additional induced delay as the traffic volumes increase on Alaska Road South, requiring more green time to process through the intersection.

The roundabout option (ALT-4) for this intersection shows improved operations in the short-term with LOS A during both peak hours. However, in the long-term the roundabout is shown to operate at LOS B during the AM peak hour and LOS E during the PM peak hour. In the AM, the eastbound approach is impacted by the high volume of southbound left-turning vehicles. Conversely, during the PM peak hour, the westbound approach experiences a significant amount of delay due to high volumes of westbound through and right-turning vehicles trying to process through a single lane.

LOVE LANE / DURSTON ROAD

For the Love Lane/Durston Road intersection, the traffic signal option (ALT-3) operates at LOS B in the short-term, with the Durston Road approaches experiencing the most delay and operating at LOS C during both peak hours. In the long-term, the intersection continues to operate at LOS B although some of the delay from the Durston Road approaches is distributed to the Love Lane approaches.

The roundabout option (ALT-4) for this intersection shows delays ranging from about 5 to 8 seconds in the short-term scenario, with LOS A across all peak hours. In the long-term, the intersection LOS degrades to LOS B with some of the approaches experiencing LOS C, including the southbound approach during the AM peak hour and the north- and westbound approaches in the PM peak hour.

3.3.2. Safety Analysis

Building on the safety assessment conducted for Phase 1, a more detailed evaluation was conducted to compare the two remaining alternatives for each intersection using the *FHWA Crash Modification Factors (CMF) Clearinghouse*.[6] The Clearinghouse provides relevant before/after studies developed to assess the safety benefits of specific roadway improvements. The study quality and applicability, including roadway type, area, crash type, and crash severity, is provided for each CMF.

Table 3.7 presents relevant CMFs for the traffic signal and roundabout scenarios. CMFs were selected based on study quality and applicability to the study area. The CMFs were then applied to the crashes documented at the intersections to determine the crash reduction potential of select countermeasures. Results are generalized and do not account for site-specific conditions such as traffic volumes, adjacent approaches, vehicle speeds, or driver/vehicle characteristics. The effects of individual countermeasures should be considered for distinct crash concentrations and should not be cumulatively applied. While installing multiple countermeasures may provide heightened safety benefits, it is important to avoid overstating the crash reduction potential by reporting combined results.

Table 3.7: Potential Reduction in Crashes

Alternative	Countermeasure	Study Area, Type, & Quality*	Related Crashes	CMF**	Expected Crashes After Implement. Potential Reduction in Crashes
Alaska Road South/Cameron Bridge Road					
ALT 3: Traffic Signal	Install a traffic signal[i]	• Rural • 3-leg & 4-leg stop controlled • 5 stars	Left turn crashes (6)	0.400	0.400 * 6 = 2 **Reduction of 4 left-turn crashes**
			Angle crashes (5)	0.230	0.230 * 5 = 1 **Reduction of 4 angle crashes**
			Rear-end crashes (2)	1.580	1.580 * 2 = 3 **Increase of 1 rear-end crash**
			All crashes (19)	0.560	0.560 * 19 = 11 **Reduction of 8 total crashes**
	Install a traffic signal and left turn lanes[ii]	• Rural and suburban • 3-leg & 4-leg stop controlled • 2 lane roads • 4 stars	All injury crashes (7)	0.480	0.480 * 7 = 3 **Reduction of 4 injury crashes**
			Left turn & angle crashes (11)	0.387	0.387 * 11 = 4 **Reduction of 7 left turn & angle crashes**
			Rear-end crashes (2)	0.711	0.711 * 2 = 1 **Reduction of 1 rear-end crash**
			All crashes (19)	0.561	0.561 * 19 = 11 **Reduction of 8 total crashes**
ALT 4: Roundabout	Conversion of stop-controlled intersection into single-lane roundabout[iii]	• Rural • Stop controlled • Non-interchange • 4 stars	All injury crashes (7)	0.180	0.180 * 7 = 1 **Reduction of 6 injury crashes**
			All crashes (19)	0.420	0.420 * 19 = 8 **Reduction of 11 total crashes**
Alaska Road South/East Valley Center Road					
ALT 3: Traffic Signal	Install a traffic signal[i]	• Rural • 3-leg & 4-leg stop controlled • 5 stars	Left turn crashes (2)	0.400	0.400 * 2 = 1 **Reduction of 1 left-turn crash**
			Angle crashes (1)	0.230	0.230 * 1 = 0 **Reduction of 1 angle crash**
			Rear-end crashes (8)	1.580	1.580 * 8 = 13 **Increase of 5 rear-end crashes**
			All crashes (20)	0.560	0.560 * 20 = 11 **Reduction of 9 total crashes**
	Install a traffic signal and left turn lanes[ii]	• Rural and suburban • 3-leg & 4-leg stop controlled • 2 lane roads • 4 stars	All injury crashes (6)	0.480	0.480 * 6 = 3 **Reduction of 3 injury crashes**
			Left turn & angle crashes (3)	0.387	0.387 * 3 = 1 **Reduction of 2 left turn & angle crashes**
			Rear-end crashes (8)	0.711	0.711 * 8 = 6 **Reduction of 2 rear-end crashes**
			All crashes (20)	0.561	0.561 * 20 = 11 **Reduction of 9 total crashes**
ALT 4: Roundabout	Conversion of stop-controlled intersection into single-lane roundabout[iii]	• Rural • Stop controlled • Non-interchange • 4 stars	All injury crashes (6)	0.180	0.180 * 6 = 1 **Reduction of 5 injury crashes**
			All crashes (20)	0.420	0.420 * 20 = 8 **Reduction of 12 total crashes**
Love Lane/Durston Road					
ALT 3: Traffic Signal	Install a traffic signal[i]	• Rural • 3-leg & 4-leg stop controlled • 5 stars	Left turn crashes (3)	0.400	0.400 * 3 = 1 **Reduction of 2 left-turn crash**
			Angle crashes (17)	0.230	0.230 * 17 = 4 **Reduction of 13 angle crash**
			Rear-end crashes (9)	1.580	1.580 * 9 = 14 **Increase of 5 rear-end crashes**
			All crashes (34)	0.560	0.560 * 34 = 19 **Reduction of 15 total crashes**

Alternative	Countermeasure	Study Area, Type, & Quality*	Related Crashes	CMF**	Expected Crashes After Implement. Potential Reduction in Crashes
	Install a traffic signal and left turn lanes[ii]	• Rural and suburban • 3-leg & 4-leg stop controlled • 2 lane roads • 4 stars	All injury crashes (6)	0.480	0.480 * 6 = 3 **Reduction of 3 injury crashes**
			Left turn & angle crashes (20)	0.387	0.387 * 20 = 8 **Reduction of 12 left turn & angle crashes**
			Rear-end crashes (9)	0.711	0.711 * 9 = 6 **Reduction of 3 rear-end crashes**
			All crashes (34)	0.561	0.561 * 34 = 19 **Reduction of 15 total crashes**
ALT 4: Roundabout	Conversion of stop-controlled intersection into single-lane roundabout[iii]	• Rural • Stop controlled • Non-interchange • 4 stars	All injury crashes (6)	0.180	0.180 * 6 = 1 **Reduction of 5 injury crashes**
			All crashes (34)	0.420	0.420 * 34 = 14 **Reduction of 20 total crashes**

**Intersection type indicates configuration of study intersection before treatment was implemented.*
***A CMF below 1.0 indicates a decrease in crashes, a value greater than 1.0 indicates an increase in crashes, and a value of 1.0 indicates no anticipated change in crashes. The CMF is a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure.*
[i] IDs: 325-328; Accident Modification Factors for Traffic Engineering and Its Improvements, Harkey et al., 2008.
[ii] IDs: 7968, 7971, 7976, & 7977; Safety Evaluation of Signal Installation with and without Left Turn Lanes on Two Lane Roads in Rural and Suburban Areas, Srinivasan et al., 2014.
[iii] IDs: 207 & 211; Observational Before-After Study of the Safety Effect of U.S. Roundabout Conversions Using the Empirical Bayes Method, Persaud et al., 2001.

Using the selected CMFs, installation of a traffic signal is anticipated to reduce total crashes by 44 percent with a substantial reduction in left turn and angle crashes and an increase in rear-end crashes by about 58 percent. When the traffic signal is paired with left-turn lanes, however, the total crash reduction potential is expected to be similar (44 percent) while the left turn and angle crash reduction potential is expected to decrease slightly and rear-end crashes are expected to decrease by 29 percent rather than increase. Installation of a traffic signal and left-turn lanes is also expected to decrease injury-causing crashes by approximately 52 percent.

Installation of a single-lane roundabout is expected to yield an 82 percent decrease in injury crashes and a 58 percent decrease in total crashes. Quality CMFs for specific crash types for a single-lane roundabout are not currently available.

This comparison shows that a roundabout is expected to perform better than a traffic signal in terms of reducing total crashes and injury crashes at each intersection. However, if a traffic signal is selected, inclusion of left-turn lanes could help reduce the occurrence of rear-end crashes while still decreasing left turn and angle crashes.

3.3.3. Impacts and Feasibility

Temporary, and potentially permanent, land and environmental impacts are anticipated during construction of the two alternatives. Both alternatives are also likely to require new right-of-way easements for irrigation features and other utilities, and modifications to existing access. Other factors such as cost and public feedback are also considered in this analysis. Conceptual designs of each configuration are provided in **Appendix E**. A discussion of potential impacts and feasibility for project development is provided in the following sections.

IMPACTS TO ADJACENT PROPERTIES

The impacts to adjacent properties are an important consideration when evaluating alternatives. These impacts may include effects on physical buildings, driveways, or utilities. In some cases, additional right-of-way may be required from adjacent properties to accommodate new roadway facilities or to relocate utilities. In the project area, the adjacent irrigation facilities are likely to experience significant disruption as a result of the construction efforts, which may require mitigation and/or relocation.

At Alaska Road South/Cameron Bridge Road, the signal option would result in some widening that would require new right-of-way. The widening required for turn bays can generally fit within existing right-of-way, although new right-of-way and utility easements would likely be required in all quadrants to relocate the adjacent drainage ditch and power lines. Installation of adjacent non-motorized facilities may also require additional right-of-way. The roundabout option would likely require more right-of-way. Due to the existing houses and businesses in the northwest quadrant of the intersection, the roundabout was shifted south of the existing intersection to accommodate deflection angles and adequate turning radii. Similar utility easements would be required and additional right-of-way would likely be needed for non-motorized facilities. In the roundabout option, one adjacent driveway may be impacted, but access could still be accommodated through adjacent driveways.

At Alaska Road South/East Valley Center Road, the signal option would require widening of East Valley Center Road to the north to accommodate additional turn bays. The southern edge of the roadway, including the shared use path, could substantially remain in place, except directly at the intersection where some adjustments would be necessary to accommodate signal poles. On Alaska Road South, the roadway footprint would need to be expanded to accommodate turn bays. New right-of-way and easements would likely be required for non-motorized facilities and the relocation of irrigation facilities and power lines. Impacts to the house in the southwest quadrant could be avoided. The roundabout option would also require significant right-of-way and easements. The roundabout was shifted slightly east to accommodate deflection angles without impacting the existing house in the southwest quadrant. The trees along the Spain Ferris Ditch in the northeast quadrant would be impacted as a result. Due to these shifts the existing shared use path would also likely have to be shifted slightly. Both options would not impact existing access to adjacent properties.

At the Love Lane / Durston Road intersection, both the signal and roundabout alternatives would require additional right-of-way and easements. The signal option would result in a longer reconstruction length due to the taper requirements for turn bays, leading to more widespread impacts, including the need for new right-of-way for roadway widening and slope flattening along the east leg. This option is expected to impact approximately eight driveways and would also result in significant impacts to existing features in the northwest quadrant, including the wall, pond, creek, and bull statue. In contrast, the roundabout option would require a more concentrated area of right-of-way at the intersection itself to accommodate center island circulation and necessary deflection angles on the approaches but would result in fewer impacts farther from the intersection. The roundabout is expected to impact approximately four driveways. In both options, the intersection would need to be shifted slightly east in order to avoid disturbing a fence line in the southwest quadrant, per the adjacent landowner’s request. Neither option is anticipated to restrict existing access to adjacent properties.

IMPACTS TO NON-MOTORISTS

With both traffic controls strategies, pedestrian crossings would be provided along each approach leg and connecting to existing and future non-motorized facilities. All intersections have moderate pedestrian and bicycle activity and the need for safe crossing accommodations has been noted by community members. The traffic signal alternative would include protected pedestrian crossings through pedestrian signal phasing. For the roundabout alternative, pedestrians would need to cross only one lane of traffic at a time and would have refuge within the splitter island. If additional protection for pedestrians is desired, enhanced accommodations such as a rectangular rapid flashing beacon (RRFB) or pedestrian hybrid beacon (PHB) could be installed. In both options, bicyclists could ride on the widened shoulder but would have to either take the lane at the intersection or dismount their bikes and navigate the intersection by foot. There are fewer conflict points and lanes to cross in the roundabout option compared to the signal option. If pursued, a shared use path adjacent to Alaska Road South would safely accommodate both pedestrians and bicyclists in both the signal and roundabout options.

IMPACTS TO TRUCKS

Large trucks, construction equipment, and agricultural equipment are common at the project intersections. Both the roundabout and signal alternatives would be designed to accommodate the types of trucks that are known to use the intersection. Roundabouts may include larger turning radii, mountable center aprons, and movable poles to assist large trucks. Signalized intersections typically feature larger corner turning radii and longer vehicle phase changes to accommodate these vehicles more effectively.

IMPACTS DURING CONSTRUCTION

Major reconstruction associated with installation of a traffic signal or a roundabout would impact traffic on all adjoining roadways including Alaska Road South, Cameron Bridge Road, East Valley Center Road, Love Lane, and Durston Road. Under both alternatives, temporary detours, access modifications, and single-lane directional travel may be required. Construction delays would likely be similar for the construction of either a signal or a roundabout. Although cost efficiencies may be achieved by constructing multiple intersection improvements at one time, traffic impacts may be compounded if multiple construction projects are occurring at the same time.

ESTIMATED COSTS

Planning-level cost estimates for each option are provided in **Appendix E**. In general, when comparing construction costs for roundabouts versus signalized intersections, the initial expenses can vary significantly depending on site conditions. Typically, base construction elements such as pavement, grading, and drainage are similar for both options. However, traffic signals often require additional pavement width to accommodate dedicated turn lanes, which can increase costs, especially in areas where those lanes do not already exist. On the other hand, roundabouts generally require more space at the intersection and, in constrained environments, may incur higher upfront costs due to the need for realignments and property impacts.

PUBLIC FEEDBACK

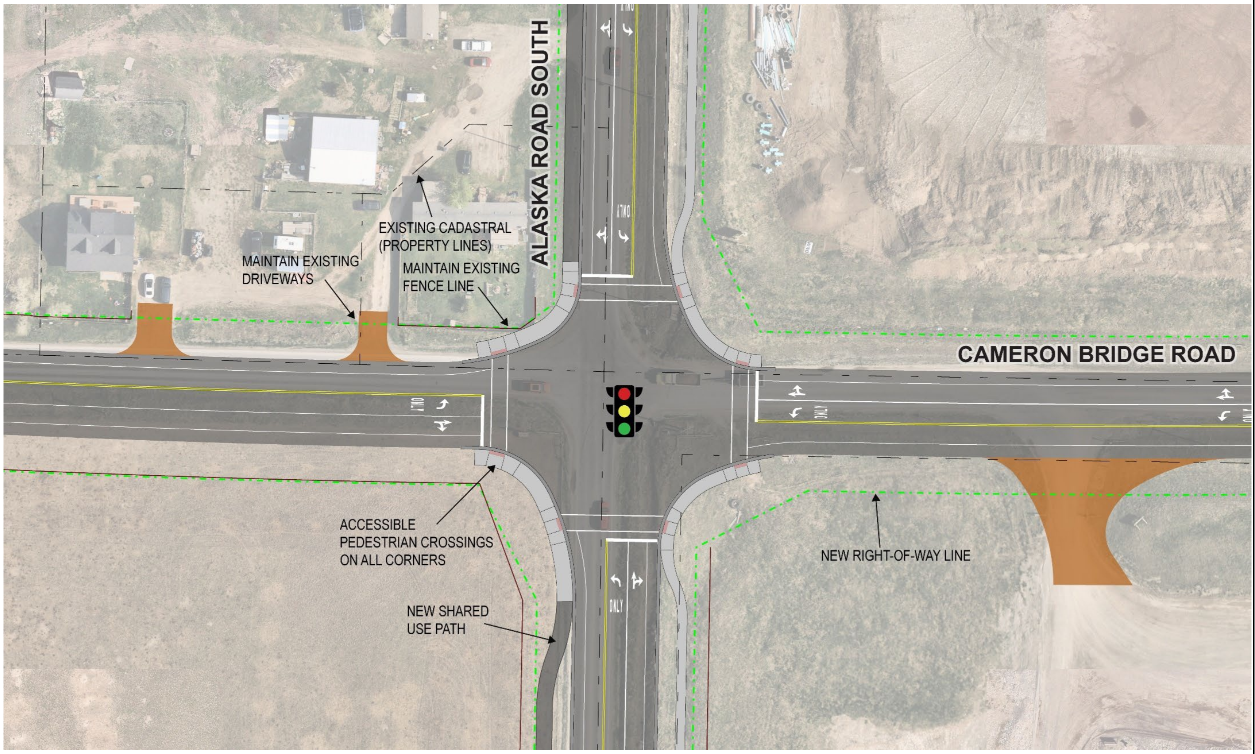
Based on the public and stakeholder feedback discussed in **Section 3.2.2**, the roundabout option was shown to be the most favorable at the Alaska Road South/Cameron Bridge Road intersection, with nearly 60% of respondents indicating they agree or strongly agree with the roundabout recommendation, compared to 40% for the signal option. At the Alaska Road South/East Valley Center Road intersection, public feedback revealed mixed support for the two alternatives. About 65% of respondents supported the signal option, while around 60% showed support for the roundabout option. At the Love Lane/Durston Road intersection, the roundabout option was favored by a larger portion of the public, with 65% of respondents indicating support, while 45% favorably supported a signal.

3.3.4. Phase 2 Evaluation Results

The traffic signal and roundabout alternatives were compared based on a detailed review of traffic operations, safety, impacts, and construction costs. The results of the evaluation are discussed on the following pages. Included is a concept plan sheet of each alternative, discussion of conditions for each criterion, and a general rating of how the alternative scored in the category.

ALASKA ROAD SOUTH / CAMERON BRIDGE ROAD

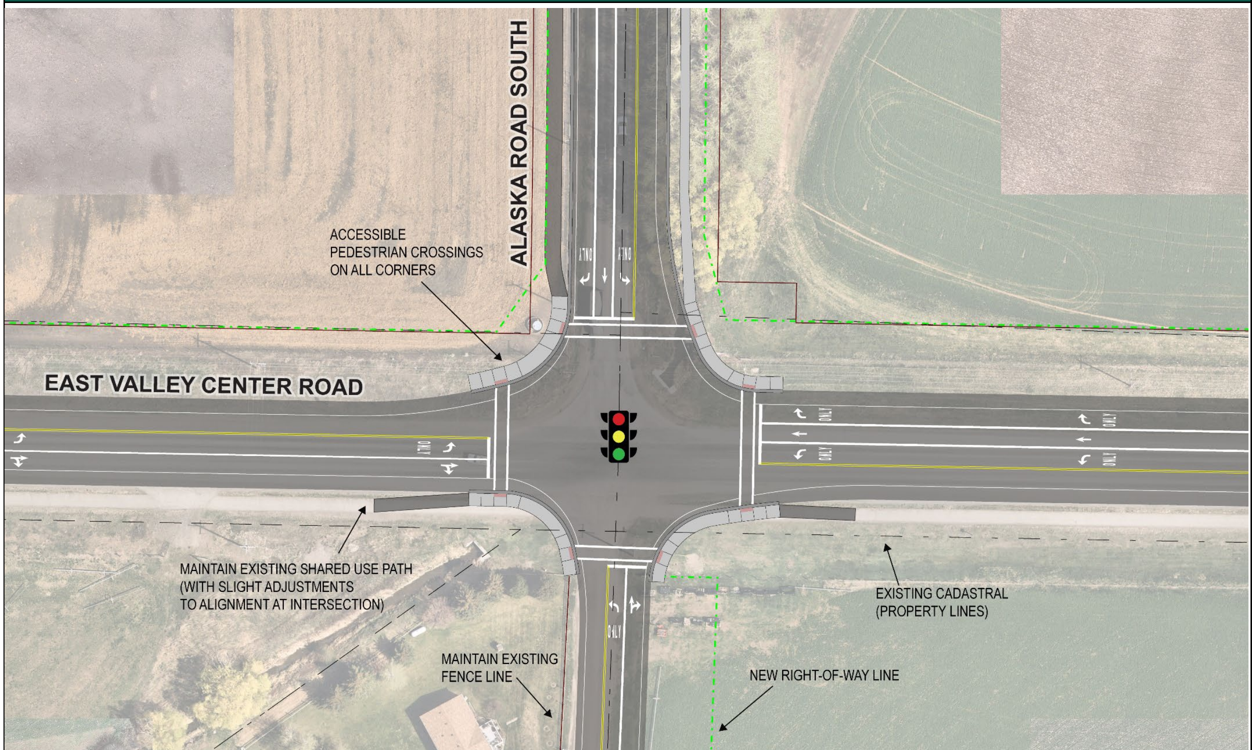
ALT-3: Signal



Traffic Operations	• LOS A (2025) with LOS C/D on Cameron Bridge Rd approaches during peak hours (30-40 seconds of delay) • LOS B (2045) with LOS D/E on Cameron Bridge Rd approaches during peak hours (35-75 seconds of delay)	
Safety Performance	• Reduction of up to 8 total crashes and 7 injury crashes	
Impacts	• Larger footprint than existing intersection, roadway footprint larger than roundabout further from the intersection to accommodate turn bays • Relocation of irrigation ditch required • Requires new right-of-way for widening, utility relocation, and non-motorist accommodations • No impacts to existing access	
Non-Motorists	• Pedestrian signal phasing and accessible crossings • Multiple travel/turn lanes for bicyclists to navigate (or SUP) • Longer crossing distances due to multiple travel/turn lanes	
Large Trucks	• Wider turning radii provided for trucks on corners • Left turn phasing can help trucks	
Public Support	• ~40% of public respondents agree/strongly agree	
Cost	• $6M - $7M • Similar construction/design cost to roundabout • On-going operational and maintenance costs for signal and related electrical systems • Shorter life span than roundabout	

ALASKA ROAD SOUTH / CAMERON BRIDGE ROAD		
ALT-4: Roundabout		
		
Traffic Operations	• LOS A (2025) on all approaches • LOS B (2045) overall, with 10-20 seconds of delay on approaches • Delay distributed more evenly across all legs	
Safety Performance	• Reduction of up to 11 total crashes and 6 injury crashes	
Impacts	• Requires more right-of-way than signal option • Avoids impacts to exiting houses • Modified access for one property, access accommodated through adjacent driveways	
Non-Motorists	• Pedestrians cross one leg at a time • One lane for bicyclists to navigate (or SUP)	
Large Trucks	• Designed to be easily navigable by large trucks, though may be difficult at first for unfamiliar drivers	
Public Support	• ~60% of public respondents agree/strongly agree	
Cost	• $6M - $7M • Similar construction/design cost to signal • Minimal ongoing maintenance costs for lighting, negligible operating costs • Longer life span than signal	

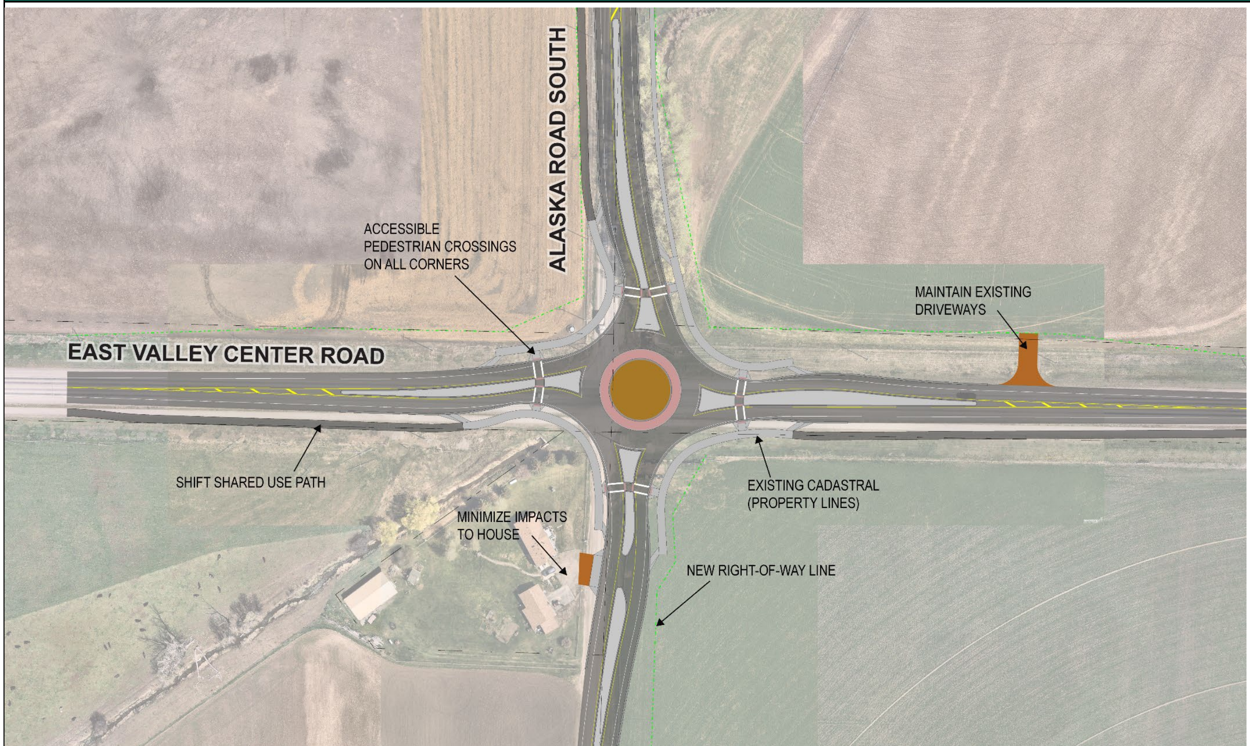
ALASKA ROAD SOUTH / EAST VALLEY CENTER ROAD		
ALT-3: Signal		



Traffic Operations	• LOS A/B (2025) with LOS B/C on Alaska Rd S approaches during peak hours (15 - 25 seconds of delay) • LOS B (2045) with LOS B/C on all approaches except westbound E Valley Center Rd during peak hours (10 - 35 seconds of delay) • Higher delays on Alaska Rd S, with increasing induced delay on E Valley Center Rd	
Safety Performance	• Reduction of up to 9 total crashes and 3 injury crashes	
Impacts	• Larger footprint than existing intersection, roadway footprint larger than roundabout further from the intersection to accommodate turn bays • Relocation of irrigation ditch required • Requires new right-of-way, primarily on the north side of E Valley Center Rd for widening and utility relocation • No impacts to existing access	
Non-Motorists	• Pedestrian signal phasing and accessible crossings • Multiple travel/turn lanes for bicyclists to navigate (or SUP) • Longer crossing distances due to multiple travel/turn lanes	
Large Trucks	• Wider turning radii provided for trucks on corners • Left turn phasing can help trucks	
Public Support	• ~65% of public respondents agree/strongly agree	
Cost	• $7M - $8M • Higher upfront construction/design cost than roundabout • On-going operational and maintenance costs for signal and related electrical systems • Shorter life span than roundabout	

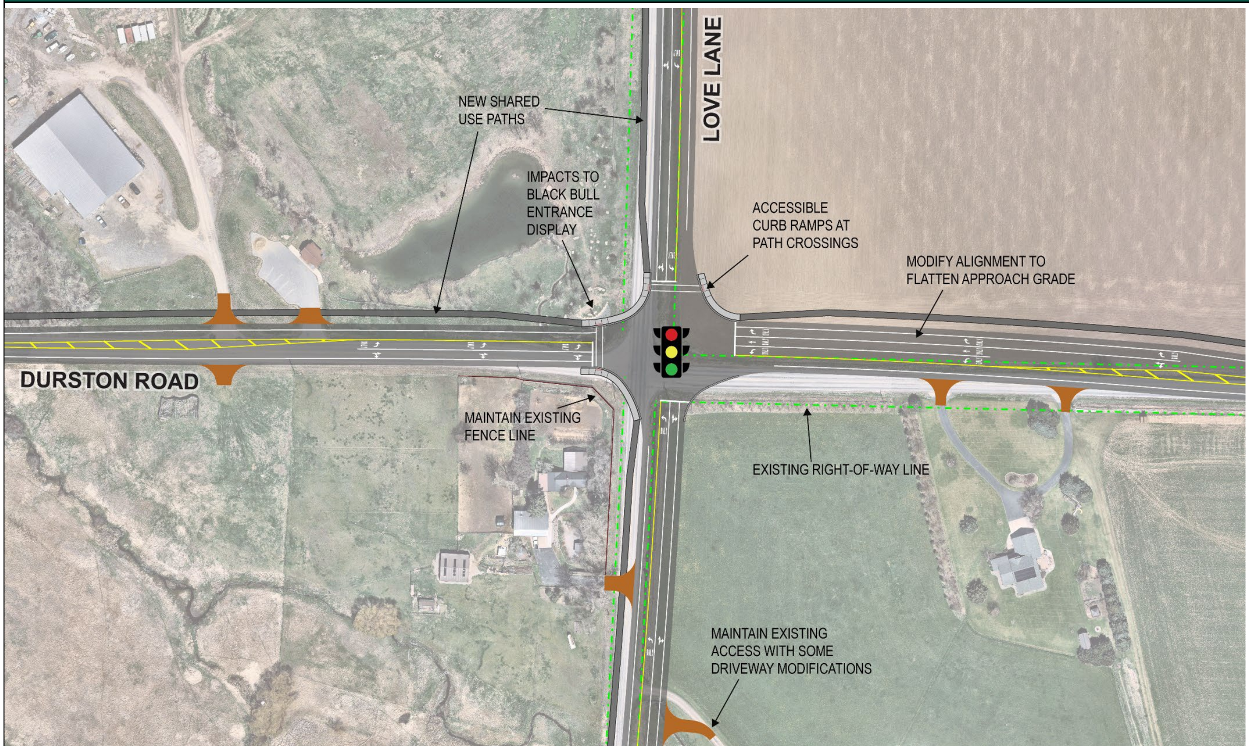
ALASKA ROAD SOUTH / EAST VALLEY CENTER ROAD

ALT-4: Roundabout



Traffic Operations	• LOS A (2025) on all approaches • 2045 LOS B (AM) and E (PM), 10 to 20 seconds of delay on all approaches except westbound approach during the PM peak hour (60 seconds of delay) due to high traffic volumes • Future PM operations could be improved with right-turn slip lane or negligible if Alaska Rd S is extended south to Hulbert Ln or Baxter Ln	
Safety Performance	• Reduction of up to 12 total crashes and 5 injury crashes	
Impacts	• Requires more right-of-way than signal option, but still avoids impacts to exiting house and accesses • Relocation of Spain Ferris Ditch required • Shared use path shifted slightly • Impacts to trees along Alaska Rd S	
Non-Motorists	• Pedestrians cross one leg at a time • One lane for bicyclists to navigate (or SUP)	
Large Trucks	• Designed to be easily navigable by large trucks, though may be difficult at first for unfamiliar drivers	
Public Support	• ~60% of public respondents agree/strongly agree	
Cost	• $5M - $6M • Lower upfront construction/design cost than signal • Minimal ongoing maintenance costs for lighting, negligible operating costs • Longer life span than signal	

LOVE LANE / DURSTON ROAD		
ALT-3: Signal		



Traffic Operations	• LOS B (2025) with 20 to 30 seconds of delay on Durston Rd (LOS C) • LOS B (2045) with LOS B and C on all approaches (10 to 25 seconds of delay) • Higher delays on Durston Rd, with increasing induced delay on Love Ln	
Safety Performance	• Reduction of up to 15 total crashes and 3 injury crashes	
Impacts	• Requires new right-of-way, larger footprint than existing intersection, roadway footprint larger than roundabout further from the intersection to accommodate turn bays & approach grade flattening on east leg • Relocation of irrigation ditch required • Impacts to the Black Bull display in the northwest quadrant, intersection shifted northeast to avoid impacts to fence line in southwest quadrant • Impacts to 8 driveways, but no impacts to existing access	
Non-Motorists	• Pedestrian signal phasing and accessible crossings • Multiple travel/turn lanes for bicyclists to navigate (or SUP) • Longer crossing distances due to multiple travel/turn lanes	
Large Trucks	• Wider turning radii provided for trucks on corners • Left turn phasing can help trucks	
Public Support	• ~45% of public respondents agree/strongly agree	
Cost	• $6M - $8M • Higher upfront cost than roundabout due to reconstruction length • On-going operational and maintenance costs for signal and related electrical systems • Shorter life span than roundabout	

LOVE LANE / DURSTON ROAD

ALT-4: Roundabout

Traffic Operations	• LOS A (2025) on all approaches • LOS B (2045) with LOS B and C on some approaches (10 to 20 seconds of delay during peak hours) • Delay distributed more evenly across all legs	
Safety Performance	• Reduction of up to 20 total crashes and 5 injury crashes	
Impacts	• Requires new right-of-way, larger footprint than existing intersection, but less further away from the intersection compared to the signal • Relocation of irrigation ditch required • Intersection shifted northeast to avoid impacts to fence line in southwest quadrant • Impacts to 4 driveways, but no impacts to existing access	
Non-Motorists	• Pedestrians cross one leg at a time • One lane for bicyclists to navigate (or SUP)	
Large Trucks	• Designed to be easily navigable by large trucks, though may be difficult at first for unfamiliar drivers	
Public Support	• ~65% of public respondents agree/strongly agree	
Cost	• $5M - $7M • Lower upfront construction/design cost than signal • Minimal ongoing maintenance costs for lighting, negligible operating costs • Longer life span than signal	

Both the signalized and roundabout alternatives for the Alaska Road South intersections offer significant improvements in traffic operations and safety compared to existing conditions. Operational performance is generally acceptable for both alternatives in the short and long term. However, the roundabout at the East Valley Center Road intersection may experience reduced efficiency during future PM peak periods. This performance could be mitigated by incorporating a right-turn slip lane, which would improve traffic flow as conditions evolve.

From a safety standpoint, both alternatives show anticipated improvements over the current configuration, but roundabouts are expected to offer greater safety benefits than a signal. While traffic signals can decrease the likelihood of right-angle collisions, they may contribute to more rear-end crashes due to sudden stops or red-light running. In contrast, roundabouts improve safety by lowering vehicle speeds and minimizing conflict points.

Both intersection types can accommodate large trucks. However, roundabouts typically require more space and right-of-way than signals. Public feedback reflects a preference for a roundabout at the Cameron Bridge Road intersection, while a slight majority favor a signal at East Valley Center Road. In terms of cost, signals are marginally more expensive due to additional widening required for turn lanes, whereas roundabouts may offer better long-term value through lower long-term maintenance.

Given the close proximity of the two intersections, their performance is interdependent. **It is recommended that decision-making be based on a corridor-wide evaluation of Alaska Road South to comprehensively address traffic shifts, design standards, pavement conditions, and ongoing safety needs**. The broader evaluation of the Alaska Road South corridor is discussed in more detail in **Section 4**.

At the Love Lane and Durston Road intersection, both alternatives yield measurable safety and operational improvements. However, the roundabout is identified as the more favorable long-term solution. Both configurations maintain acceptable levels of service through 2045, but the roundabout is projected to distribute delays more evenly and reduce overall delay compared to the signal, particularly during off-peak periods.

In terms of safety, the roundabout is projected to offer a greater reduction in crashes, including severe crashes compared to the signal option. Although both alternatives require new right-of-way and irrigation ditch relocation, the roundabout avoids broader corridor-wide impacts by maintaining a more compact footprint beyond the immediate intersection.

Financially, the roundabout is more cost-effective in the long term due to lower construction costs, reduced maintenance, and longer lifespan. Public input favors this option, with approximately 65% supporting the roundabout compared to 45% for the signal. **Considering safety, operations, cost, and community preference, the roundabout is recommended as the preferred solution for implementation at the Love Lane/Durston Road intersection.**

4.0. Alaska Road South Corridor Configuration

Building on the Phase 2 recommendations, conceptual designs were developed for the full reconstruction of the Alaska Road South corridor, extending from the West Post Subdivision to East Valley Center Road. As part of this evaluation, two options were considered: **Option 1** involves installing signals at both study intersections, while **Option 2** incorporates roundabouts at both intersections. This approach allows the county to consider not only the integration of the intersection options, but also the broader needs of the entire corridor, ensuring the design accommodates future growth and development in a cohesive and flexible manner.

In the summer of 2024, developers of the West Post Subdivision completed upgrades to Alaska Road South between Frank Road and McMillan Lane, following the recommendations outlined in the GTATP. These upgrades involved reconstructing the roadway to urban minor arterial standards (MSN-3), which include two 12’ travel lanes (one in each direction), a center two-way left turn lane, and 8’ shoulders. The GTATP envisions this route being constructed to urban standards, as it is likely to be annexed into Belgrade due to its proximity to the current city boundary. This annexation would require curb and gutter with sidewalks. However, a shared-use path is also recommended along Alaska Road South, with a portion of the path already constructed adjacent to the West Post Subdivision.

To align with current development, conserve construction costs, and allow flexibility for future growth, both corridor configurations were evaluated with curb and gutter and a shared-use path along the western edge of the roadway. It was assumed that the Spain Ferris Ditch, located on the east side of the roadway, would be shifted but remain an open irrigation ditch. If the gravel pits on the east side of the roadway are developed for future commercial or residential use, the ditches could be piped at that time, allowing for the construction of sidewalks. Conceptual drawings of the corridor configurations, along with cost estimates for each option, are included in **Appendix F**. **Table 4.1** summarizes the anticipated traffic and safety performance of both corridor configuration options as well as estimated impacts and costs.

Table 4.1: Summary of Alaska Road South Corridor Configuration Options

Estimated Impacts & Cost	Option 1: Signals	Option 2: Roundabouts
Traffic and Safety Performance		
Traffic Analysis	• Signals can be coordinated • Induced delay for mainline traffic • Peak periods may experience stop and go conditions • Queues can build up during peak periods and spill back to adjacent intersections impacting network performance • Capacity is highly dependent on signal timing optimization	• More fluid traffic flow with continuous movements (yield control) • Less likelihood of long queues • Generally lower overall delay, no induced delay especially during off-peak periods • Generally higher capacity and throughput, but one lane capacity may be limiting during peak hours
Safety Analysis	• Potential to reduce left-turn and right angle crashes, but increase rear end crashes • Risk of severe, high-speed, red-light-running conflicts • Dedicated pedestrian phasing, wait times my deter use • Bicyclists can ride on the shoulder or in the travel lane, must cross lanes to execute turning movements, or use pedestrian crossings	• Reduced number of crossing and total conflict points • Reduced speed through intersections • Reduced severity of crashes expected • Pedestrians cross one leg at a time, crossing treatments can be enhanced with RRFBs or PHBs • Bicyclists navigate the roundabout as a vehicle would

Estimated Impacts & Cost	Option 1: Signals	Option 2: Roundabouts
Estimated Impacts		
Right-of-Way and Drainage Easements	8.14 acres	8.96 acres
Construction Permits	0.26 acres	0.19 acres
Irrigation Easements	0.80 acres	0.66 acres
Utility Easements	6.68 acres	5.44 acres
Wetland and Stream Impacts	0.17 acres	0.15 acres
Aesthetics/ Environmental Impacts	• Can cause more idling, fuel consumption, and emissions • More physical infrastructure required (signs, signal poles, etc.) potentially contributing to visual clutter	• Less idling, fuel consumption, and emissions due to continuous movements • Can incorporate landscaping in the central island • Generally considered to be more aesthetic
Estimated Costs		
Design and Construction Cost (2025$)	**$34.5 M**	**$36.6 M**
Maintenance Cost/ Considerations	• On-going maintenance for signal equipment, continued adjustments/optimization required • Signals are more prone to failure or inefficiencies requiring increased maintenance (power outages, malfunctioning lights, etc.) • Costs for electricity	• Less physical infrastructure to maintain • Maintenance for required lighting/ costs for electricity • Can be more challenging to plow during the winter

Signalized intersections offer the advantage of coordinated signal timing, which can manage traffic flow across corridors. However, during peak periods, signals may induce delays for mainline traffic, resulting in stop-and-go conditions and potential queue spillbacks. This interruption in flow can contribute to driver frustration and inefficiency. In contrast, roundabouts support continuous traffic movement with fewer full stops, reducing the likelihood of long queues and generally leading to lower overall delays. That said, single-lane roundabouts may face capacity constraints during peak hours—particularly at high-volume intersections like East Valley Center Road—potentially limiting their effectiveness in those scenarios.

From a safety standpoint, signalized intersections can reduce left-turn and right-angle collisions by providing clearly defined traffic phases. However, they are more prone to rear-end crashes and red-light running incidents, which can result in severe, high-speed impacts. Roundabouts, by design, reduce conflict points, especially crossing movements, and naturally lower vehicle speeds as drivers navigate the circular layout. These characteristics are shown to decrease the severity and frequency of crashes. Both intersection types can accommodate pedestrians and bicyclists via shared-use paths and appropriate intersection crossing treatments.

Roundabouts are anticipated to require more right-of-way, approximately three-quarters of an acre more than signalized intersections. However, they require less space for construction permits, utility and irrigation easements, and wetland mitigation. In terms of environmental impact and aesthetics, roundabouts offer notable advantages. Continuous vehicle movement reduces idling, fuel consumption, and emissions, contributing to a cleaner environment. Additionally, roundabouts can be landscaped, enhancing their visual appeal and reducing roadside clutter. Signalized intersections, in contrast, require more physical infrastructure such as signal poles, wiring, and control cabinets, which can add visual clutter and contribute to greater fuel use due to frequent stops.

Estimated construction costs are approximately $34.5 million for the signalized corridor and $36.6 million for the roundabout configuration. Although roundabouts carry a slightly higher initial cost, they are typically more cost-effective over the long term due to lower maintenance demands. Signals require regular maintenance of electrical components, timing adjustments, and periodic upgrades, all of which contribute to ongoing operational costs. Roundabouts have fewer mechanical and electrical systems, resulting in reduced maintenance needs. However, they do present winter maintenance challenges, such as snow removal within the circular layout, and require adequate lighting for safety, which can add to annual upkeep costs.

4.1. Corridor Configuration Summary

Both the signalized intersection and roundabout alternatives present unique advantages and trade-offs. Signalized intersections can provide acceptable traffic performance under typical conditions; however, they carry long-term implications related to ongoing operational and maintenance requirements. Additionally, signals are more susceptible to safety issues such as rear-end collisions and red-light running, potentially leading to higher crash frequencies and more severe incidents compared to roundabouts.

In contrast, roundabouts support continuous traffic flow, which helps minimize delays and improve overall network efficiency. Roundabouts are particularly beneficial in enhancing corridor safety, as they reduce vehicular speeds and conflict points. Although roundabouts require more right-of-way and entail higher upfront design and construction costs, they tend to offer greater long-term cost-effectiveness. This is attributed to lower maintenance needs, reduced crash-related expenses, and improved traffic operations over time.

Given these considerations, and the county's commitment to improving roadway safety, the roundabout alternative is recommended as the preferred long-term solution for the Alaska Road South corridor. However, to address near-term traffic challenges and budget constraints, the county may consider implementing a signal at the East Valley Center Road intersection as an interim measure. Installing a signal at the existing configuration without extensive turn lane modifications could deliver immediate traffic relief while limiting initial construction impacts and expenditures. This phased approach would also provide valuable time to secure funding for future roundabout construction or broader corridor enhancements.

Looking ahead, full reconstruction of the Alaska Road South corridor offers the most comprehensive and cost-effective strategy. A corridor-wide upgrade would address both safety and operational concerns through consistent roadway design, integrated intersection treatments, and improved traffic flow. This approach would also unlock cost efficiencies by consolidating design, permitting, and construction efforts, resulting in overall project savings when compared to piecemeal intersection improvements.

If full corridor reconstruction is not financially feasible in the near term, the county could adopt a phased improvement plan, prioritizing critical intersections for early action. To support implementation, the county is encouraged to pursue discretionary grant funding through state or federal programs, leveraging external financial resources to accelerate improvements and meet the growing transportation needs of the region.

5.0. Additional Considerations

As future project development phases proceed for improvements to the three project intersections, a variety of additional considerations will also need to be addressed. These include design details and specific treatments for multimodal accommodations, visibility, speeds, maintenance, and impact mitigation. Final decisions on these elements will depend on the configuration ultimately selected for each intersection. The following sections discuss some areas of concern that will need further consideration during project development.

5.1. Projected Growth Assumptions

Assumptions in traffic growth and distribution were defined for the project area based on historic and anticipated future characteristics. The location, type, and design of land use development ultimately impacts the existing and future transportation system. Consideration should be given to changes in traffic patterns and characteristics when advancing recommendations. Future development and land use changes may change the travel patterns in the corridor, which may result in differing traffic operations from those projected.

This report summarizes evaluations conducted during the peak hours, representing traffic conditions during time periods with the highest volumes of traffic during a typical weekday. Due to the proximity of the intersections with respect to Belgrade and Bozeman, and the land use in the area, the peak hours represent short time periods of higher traffic volumes. The traffic is typically compressed into short peak periods. The operational issues identified during these periods may only exist during a short period and may not be a concern throughout the majority of the day.

The preferred alternatives of single lane roundabouts at each intersection exhibit some long-term capacity issues, specifically at the East Valley Center Road intersection during the PM peak period. These issues arise from the high volume of westbound traffic along East Valley Center Road trying to process through a single lane. The operational analysis indicates that during this peak period, westbound traffic volumes could approach or exceed the capacity limits of a single-lane roundabout. To address this, if traffic volumes grow as predicted, a westbound right-turn slip lane could be implemented to allow right-turning traffic to flow more freely.

Additionally, it is important to acknowledge that this analysis assumes the transportation network in Gallatin Valley will remain unchanged, with the only modification being an increase in traffic. This is, of course, unrealistic. The network will likely evolve over time. One likely change is the extension of Alaska Road South to either Hulbert Lane or Baxter Lane, as recommended in the GTATP. The introduction of parallel routes and more direct connections could significantly alter traffic patterns, necessitating an updated traffic analysis to account for these changing demands.

5.2. Non-Motorized User Treatments

Currently, the only dedicated non-motorized accommodations in the project area are a SUP along East Valley Center Road and a recently constructed SUP adjacent to the West Post Subdivision. Despite the lack of dedicated facilities at other intersections, moderate pedestrian and bicycle activity is still present, with the Love Lane/Durston Road intersection showing higher levels of non-motorized use compared to others.

Although no non-motorist-involved crashes have been reported at the project intersections over the past 10 years (2012–2021), public feedback highlights pedestrian and bicyclist safety as a key concern. To address this, GTATP envisions the construction of a SUP along Alaska Road South, Cameron Bridge Road, Love Lane, and Durston Road, along with on-street bicycle facilities on each road. As the project moves forward, the design of intersections should facilitate connections to these future facilities, aligning with the long-term vision outlined in the GTATP.

In terms of specific design elements, curb ramps and crosswalks have been incorporated into the conceptual designs, and the 8-foot wide shoulders on intersecting roadways will help ensure safe and comfortable bicycle travel. Additionally, high-visibility crossing treatments, such as RRFBs or PHBs, could be considered at high-volume crossings, such as those at East Valley Center Road, to warn on-coming motorists of pedestrians. Other potential physical improvements, including high-visibility crosswalk markings, curb extensions, pedestrian refuge islands, and crosswalk lighting, may also be necessary to enhance the safety and visibility of crossings for pedestrians and cyclists.

5.3. Intersection Visibility

Public input has highlighted the need for improved lighting at the intersections to help drivers better see the intersection and other users during dawn, dusk, and nighttime conditions. Of the 73 crashes that occurred at the intersections over the past 10 years (2012 – 2021), about one-fifth (14) occurred under dark lighting conditions. Nighttime crashes were more frequent at the Alaska Road South intersections, with 31% of crashes occurring at the Cameron Bridge Road intersection and 25% at the East Valley Center Road intersection. These trends suggest a potential need for lighting improvements at the intersections. FHWA has identified lighting as an important countermeasure to increase roadway safety and reduce crashes in low-light conditions, with studies indicating a 30 to 38% reduction in related crashes when proper lighting is implemented.[7]

In general, MDT provides highway facility lighting where justified, based on the criteria, recommendations, and principles outlined in the American Association of State Highway and Transportation Officials (AASHTO) *Roadway Lighting Design Guide* and the FHWA *Roadway Lighting Handbook*. Additionally, per the MDT *Road Design Manual*, “where raised medians are used, the roadway should be well lit, and the medians should be delineated.” Accordingly, intersection lighting is required for roundabouts.

In addition to inadequate lighting, physical features along the roadway—such as hills, trees, and fences—contribute to poor sight distance and visibility, particularly at the Love Lane/Durston Road intersection. These obstacles make it difficult for drivers to see oncoming traffic or pedestrians. Modifying the approach grade on the east leg of the Love Lane/Durston Road intersection could alleviate some visibility issues. Further improvements could involve relocating fences to clear drivers’ sight lines and conducting regular vegetation management to enhance overall visibility. In the near term, installation of flashing stop signs at the intersections could help warn drivers of the upcoming intersections. This would serve as an immediate safety measure while more comprehensive improvements are planned and implemented.

5.4. Maintenance

Improved roadway maintenance has been a significant concern raised by the public. Community members have expressed frustration with issues such as raveling shoulders, potholes, and general roadway deterioration, particularly from the wear and tear caused by heavy trucks. These concerns highlight the need for ongoing efforts to preserve the integrity of the roadway, to ensuring both safety and comfort for all users.

As traffic volumes, particularly from heavy trucks, continue to increase, maintaining and repairing the road surface will be crucial. This includes regular patching, resurfacing, and designing future improvements with a road structure that can accommodate the weight and volume of traffic.

As future improvements are planned, it will be essential to consider the maintenance needs of new non-motorized facilities, such as shared-use paths and crosswalks. These facilities will require periodic inspections, repairs, and clearing to ensure they remain safe and functional for pedestrians and cyclists. Additionally, the widened shoulders—designed to accommodate both cyclists and motorists—must be kept clear of snow, debris, and other obstructions to ensure accessibility for cyclists, especially during the winter months.

Roundabouts will also require special maintenance considerations. For example, in winter roundabouts must be properly cleared of snow and ice to ensure the safety of both vehicles and pedestrians. The compact, circular nature of roundabouts can make them more difficult to plow effectively, so planning for efficient snow removal will be essential to keep these intersections safe and operational year-round.

Another aspect of ongoing maintenance will be roadside vegetation management. Overgrown vegetation can obstruct sight lines, reduce visibility, and create hazards for drivers and pedestrians alike. Regular trimming and clearing of vegetation along roadways will be necessary to keep sightlines clear and prevent crashes at the intersections.

5.5. Vehicle Speeds

The speed limits on the intersecting roadways within the project area vary, which may contribute to concerns about inconsistent driving behavior. Specifically, Alaska Road South has a speed limit of 50 mph, while Cameron Bridge Road and East Valley Center Road have speed limits of 35 mph and 45 mph, respectively. At the Love Lane/Durston Road intersection, the speed limit on all intersecting roads is 45 mph. Feedback from the public indicates a significant concern about speed limits being disregarded, resulting in safety hazards for other roadway users. While some community members advocate for reduced speed limits, others suggest increased enforcement to deter speeding.

While enforcement efforts and changes in speed limits can help mitigate these issues, other infrastructure improvements could play a crucial role in influencing driver behavior. One such option is the implementation of traffic calming measures. These measures are designed to reduce vehicle speeds by altering the physical layout of the roadways. Strategies such as curbing, bulbouts, and narrowed lanes could encourage drivers to slow down naturally, making the roads safer for pedestrians, cyclists, and motorists alike.

Additionally, roundabouts are another effective way to promote slower speeds. Roundabouts inherently encourage drivers to reduce speed due to their tight, circular design, which can help improve safety and traffic flow at intersections. By incorporating roundabouts and other traffic calming features into the roadway design, traffic speeds can be naturally moderated, reducing the likelihood of high-speed conflicts while also creating a more predictable and safer environment for all users.

5.6. MDT Coordination

East Valley Center Road is Secondary Highway and is owned and maintained by MDT, so any proposed improvements to the Alaska Road South/East Valley Center Road would need to be coordinated through the Systems Impact Action Process (SIAP). The SIAP is a comprehensive review process that evaluates the potential impacts of external projects on the transportation system, focusing on safety, operational efficiency, and infrastructure integrity. It includes assessments such as traffic studies, environmental reviews, and coordination with MDT to ensure that any changes align with the state's transportation goals and do not negatively affect traffic flow or system performance.

6.0. Summary and Recommendations

This *Preliminary Traffic Engineering Report* presents a comprehensive evaluation of three key intersections in Gallatin County: Alaska Road South/Cameron Bridge Road; Alaska Road South/East Valley Center Road; and Love Lane/Durston Road. Located within the rapidly developing triangle area between Belgrade and Bozeman, these intersections face growing traffic and safety concerns due to accelerating regional growth and suburban expansion.

EXISTING CONDITIONS AND FUTURE PROJECTIONS

Intersection conditions were assessed through field observations and data collection in May 2023. Forecasts for 2025 and 2045 were developed using historic traffic data, land use assumptions, and projections from the *Greater Triangle Area Transportation Plan*.

Currently, the intersections exhibit moderate delays during peak hours, with particularly poor levels of service on the minor approaches due to limited acceptable gaps in mainline traffic. While mainline traffic generally flows freely, minor approaches experience significant delays during both morning and evening peaks. Without improvements, future conditions are projected to deteriorate, with failing levels of service anticipated during peak periods if existing stop-control configurations remain unchanged.

A thorough safety evaluation was also summarized in this report. As detailed in this evaluation, a total of 19 crashes occurred at the Alaksa Road South/Cameron Bridge Road intersection, 20 crashes occurred at the Alaska Road South/East Valley Center Road intersection, and 34 crashes occurred at the Love Lane/Durston Road Intersection over the 10-year review period. Of those reported crashes, one fatal crash occurred at the Alaska Road South/Cameron Bridge Road intersection. Most crashes at the project intersections involved two or more vehicles (79% of crashes) while the remaining 31% of crashes involved only one vehicle. The single vehicle crashes included roll over and fixed object crashes with ditches, utility poles, traffic signs, and fences. Of the multi-vehicle crashes, the most common were right-angle (32%), rear-end (26%), and left-turn (15%) crashes.

ALTERNATIVES EVALUATION PROCESS

Based on the identified safety and operational concerns, a thorough identification and analysis of improvement options was conducted. This process involved a tiered approach to evaluate the alternatives and determine a preferred configuration for each configuration:

1. **Alternatives Identification:** This step involved identifying all possible alternatives that could address concerns at the intersections. A list of five improvement alternatives was developed, including changes to traffic control, geometric enhancements, and implementation of enhanced warning devices. Alternatives considered included ALT-0: No Action, ALT-1: All-Way Stop, ALT-2: Turn Lanes, ALT-3: Traffic Signal, and ALT-4: Roundabout.

2. **Phase 1 Evaluation:** Each alternative was evaluated to determine fatal flaws that warranted elimination from further consideration. This phase involved screening criteria such as safety, operations, impacts, and implementation. The alternatives were scored on a 0-to-4-point scale, with more points assigned for better performance. Options that performed well in the short term but were unlikely to address long-term needs were advanced for short-term consideration.

   Based on the initial Phase 1 evaluation, the traffic signal and roundabout alternatives were advanced for further analysis and refinement at each intersection. The all-way stop option was also advanced for short-term consideration at the Alaska Road South/Cameron Bridge Road and Love Lane/Durston Road intersections. Similarly, the turn lane option was advanced for short-term consideration at Alaska Road South/East Valley Center Road.

3. **Phase 2 Evaluation:** The traffic signal and roundabout options were evaluated in Phase 2 as long-term improvement options for all three project intersections. This phase involved a detailed comparative analysis of projected traffic operations, a predictive safety analysis, consideration of relative impacts, evaluation of total construction costs and impacts, and measures of public support.

   Findings indicated that both alternatives could improve safety and operations. However, due to the proximity of Cameron Bridge Road and East Valley Center Road, a broader corridor-level evaluation of Alaska Road South was recommended to assess systemic impacts of each configuration.

   For the Love Lane/Durston Road intersection, the roundabout option emerged as the most effective long-term solution due to superior safety benefits, improved operational performance, and strong community support. A key design assumption included reconstructing the east leg to reduce approach grades.

4. **Alaska Road South Corridor Configuration:** Building on the Phase 2 recommendations, conceptual designs were developed for the full reconstruction of the Alaska Road South corridor, extending from the West Post Subdivision to East Valley Center Road. Two options were considered: Option 1 involved installing signals at both study intersections, while Option 2 incorporated roundabouts at both intersections.

   While both options offer operational improvements, Option 2 (roundabouts) was identified as the preferred alternative, offering enhanced safety and long-term cost-effectiveness. Corridor-wide reconstruction also provides opportunities for consistent roadway design, improved integration of intersections, and operational efficiencies through economies of scale.

IMPLEMENTATION STRATEGY

Looking forward, full corridor reconstruction of Alaska Road South, including roundabouts at both the Cameron Bridge Road and East Valley Center Road intersections, offers the advantage of a comprehensive approach to addressing both safety and operational issues, in addition to potentially significant cost savings compared to pursuing individual intersection improvements separately. However, if funding constraints prevent the full reconstruction, the county could prioritize individual intersection improvements as a phased approach. Additionally, as an interim measure, the county could also consider installing a traffic signal at the East Valley Center Road intersection to provide short-term relief for immediate traffic needs at a lower cost than full intersection reconstruction.

At the Love Lane/Durston Road intersection, the county installed all-way stop control as an interim improvement in the summer of 2023. The change in traffic control was well received by the community and remains in place today. While the all-way stop control has proven effective at improving traffic flow and safety, the Phase 1 evaluation demonstrated poor future performance as traffic volumes increase. Accordingly, it is recommended that the county pursue the long-term recommendation of a roundabout at the intersection, while maintaining the all-way stop control until funding for design and construction is obtained.

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