

## MEMORANDUM

<b>Date:</b>	November 26, 2024	<b>TG:</b>	1.21101.00
<b>To:</b>	Mark Sandal – City of Lynden		
<b>From:</b>	Brent Turley, PE – Transpo Group Jessica Lambert, PE – Transpo Group		
<b>CC:</b>	Kassi Leingang, PE – Transpo Group		
<b>Subject:</b>	Intersections of Concern – Analysis Summary		

The following memorandum summarizes the analyses completed for twelve intersections of concern throughout the City of Lynden. This memorandum includes additional observations that occurred in late Fall 2024.

### Methodology

The following sections summarize the methodology utilized for the intersection analysis including the traffic volumes and forecasting, traffic operations, and traffic safety. In addition, intersections were also observed during peak conditions.

#### ***Traffic Volumes and Forecasts***

Existing weekday PM peak hour traffic volumes were collected at the study intersections in June 2024. Forecast 2045 volumes were developed utilizing an average annual growth rate of 1.5 percent based on anticipated local growth in the Whatcom Council of Governments (WCOG) travel demand model. The 2045 analysis year is consistent with the current WCOG future model year. Existing (2024) and future (2045) volumes are summarized in Attachment A.

#### ***Vehicular Traffic Operations***

Traffic operations for existing and forecast conditions were evaluated at the study intersections based on the procedures identified in the *Highway Capacity Manual 7th Edition* (2022) and were evaluated using *Synchro 12* for signalized and stop controlled intersections. *Sidra 9* was utilized for the evaluation of roundabout analysis. Existing signal timing dial cards were obtained from the City of Bellingham, who manages signal operations.

The operational characteristics of an intersection are determined by calculating the intersection level of service (LOS). At unsignalized side-street, stop-controlled intersections, LOS is measured by the average vehicle delay on the worst-movement of the intersection. At signalized and roundabout intersections, LOS is measured based on weighted average vehicle delay and reported as a whole for the intersection. Traffic operations and average vehicle delay for an intersection can be described qualitatively with a range of LOS A through LOS F, with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. In the City of Lynden, LOS D or better is acceptable for traffic signals and roundabout intersections, and LOS E for stop-control intersections.

In addition, queuing analysis was conducted that estimates the average and 95th-percentile queue length in feet. The 95th-percentile queue represents the “maximum” queue for design purposes, though there is a 5 percent probability that the queue may longer given identical analysis conditions.

## ***Traffic Safety***

Collision records for the five-year period between 2019 and 2023 were reviewed for collisions reported at the study intersections. Historical safety data were obtained from the Washington State Department of Transportation (WSDOT) for the period of January 1, 2019, to December 31, 2023. A review of collision history was performed to identify potential safety issues for vehicles, pedestrians, and cyclists.

## ***Peak Hour Observations***

Traffic conditions were observed at most study locations on August 8, 2024 during the afternoon and evening time period. Findings from those observations are noted in the analysis below. Additional observations were conducted in late Fall 2024 as well.

## **Downtown Intersections**

An analysis of eight key intersections in downtown Lynden were evaluated with respect to operations, queuing, and safety to understand current issues and opportunities for improvement. The analysis focused on current 2024 traffic operations. Of the eight study intersections in the downtown area, four are closely spaced signals though signal timing is currently not coordinated and run with different cycle lengths. This can potentially lead to inefficient movements between the intersections. The intersections and their traffic control are listed below and shown in Figure 1.



*Figure 1 Downtown Study Intersections*

1. Depot Road/3rd Street/Main Street – Signal
2. 1st Street/Main Street – Two-Way Stop-Control
3. 7th Street/Grover Street – Two-Way Stop-Control
4. 3rd Street/Grover Street – Signal
5. 1st Street/Grover Street – Signal
6. 7th Street/Front Street – Two-Way Stop-Control
7. 1st Street/Front Street – Signal
8. 1st Street/Riverview Road – Two-Way Stop-Control

### ***Vehicular Traffic Operations***

Weekday PM peak hour traffic operations for existing conditions are summarized in Table 1. As shown in Table 1, the intersections currently operate at LOS B or better during the PM peak hour and meet City of Lynden LOS standards. LOS worksheets are provided in Attachment B. However, observations in late Fall 2024 indicate extensive traffic queues at the 1st Street/Grover Street, which indicate operations are likely worse in the Fall compared to June 2024.

**Table 1. Existing Weekday PM peak Hour LOS Summary**

Intersection	LOS Standard	Existing Weekday PM Peak Hour		
		LOS <sup>1</sup>	Delay <sup>2</sup>	WM <sup>3</sup>
1. Depot Rd/3rd St/Main St	D	A	7	-
2. 1st St/Main St	E	B	13	EB
3. 7th St/Grover St	E	B	14	SB
4. 3rd St/Grover St	D	A	8	-
5. 1st St/Grover St	D	B	20	-
6. 7th St/Front St	E	B	14	NB
7. 1st St/Front Street	D	B	11	-
8. 1st St/Riverview Rd	E	B	13	EB

1. Level of service, based on 2010 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Worst movement reported for unsignalized side-street stop-controlled intersections.

In addition to intersection operations queueing was reviewed for select intersections along Grover Street and 1st Street where past queueing issues were noted by City staff. The average and 95th-percentile queueing for those intersections is summarized in Table 2.

As shown in Table 2, 95th-percentile queue lengths are currently accommodated within the available storage. However, the analysis shows that the 1st Street/Grover Street intersection has two movements that are approaching the available storage length: northbound through-right and eastbound through-right. Slight fluctuations in traffic volumes could result in longer queues backing into the adjacent upstream intersections. Peak hour observations confirm that the northbound queueing at 1st Street/Grover Street can be problematic (see below). Queueing worksheets are provided in Attachment C.

**Table 2. Existing Weekday PM peak Hour Queuing Summary at Select Intersections**

Intersection/Direction	Storage Length/Link Distance (ft)	Average Queue Length <sup>1,2</sup>	95th-Percentile Queue Length <sup>1,2,3</sup>
<b>3rd St/Grover St</b>			
<i>Eastbound Left</i>	85	40	80
<i>Eastbound Through-Right</i>	240	75	135
<i>Westbound Left</i>	90	10	35
<i>Westbound Through-Right</i>	255	75	140
<i>Northbound</i>	280	35	70
<i>Southbound</i>	620	65	120
<b>1st St/Grover St</b>			
<i>Eastbound Left</i>	95	10	50
<i>Eastbound Through-Right</i>	240	140	230*
<i>Westbound Left</i>	165	50	95
<i>Westbound Through-Right</i>	670	65	125
<i>Northbound Left</i>	50	30	75*
<i>Northbound Through-Right</i>	295	155	270*
<i>Southbound</i>	280	40	100
<b>1st St/Front Street</b>			
<i>Eastbound Left-Through</i>	260	65	110
<i>Eastbound Right</i>	150	10	35
<i>Westbound</i>	730	75	135
<i>Northbound Left</i>	150	35	85
<i>Northbound Through-Right</i>	920	100	185*
<i>Southbound Left</i>	100	10	35
<i>Southbound Through-Right</i>	290	80	145
<b>1st St/Riverview Rd</b>			
<i>Northbound</i>	2,745	20	45
<i>Eastbound</i>	445	5	40

1. Average and 95th percentile queue length in feet rounded to the nearest 5.

2. Queueing results based on SimTraffic simulation results.

3. Queueing marked with "\*" were observed to be much longer in Fall 2024. See Intersection Observation section.

## Intersection Observations

In addition to the intersection analysis, observations were conducted at these downtown study intersections during the PM peak period. Observations are summarized for each intersection below:

### 1. Depot Road/3rd Street/Main Street

Observations indicated that northbound and eastbound volumes were low with minimal queuing of 1 to 2 vehicles. Longer queues were observed along the westbound and southbound approaches with 4 to 5 vehicles maximum. The longest queue observed was in the southbound direction and was over 10 vehicles. The queue was able to clear in two light cycles. Higher truck volumes were also observed at this intersection primarily along the north and east legs of the intersection.

### 2. 1st Street/Main Street

Minimal queuing was observed at this intersection. Higher truck activity was observed making a northbound left and eastbound right turning movement.

### **3. 7th Street/Grover Street**

No operational issues were observed, with the majority of vehicles traveling east/west with low turning volumes to/from the minor stop-controlled 7th Street approaches.

### **4. 3rd Street/Grover Street**

Most vehicles were observed traveling east/west along the corridor. Eastbound and westbound queuing along Grover Street was observed to be a maximum of 4 to 6 vehicles but would clear every light cycle. Lower volumes observed on the north and south legs (3rd Street). Queues along 3rd Street were 2 to 4 vehicles but no issues were observed. On-street parking along 3rd Street was not observed to cause any substantial queueing issues, in part due to the lower volumes on the roadway.

In Fall 2024, southbound delays and associated queues were extensive because of eastbound spillback from the 1st Street/Grover Street intersection. Even with green signal times, southbound left-turning traffic would not be able to proceed. In some cases, southbound right-turning traffic was observed to use local business parking circulation to bypass congestion.

### **5. 1st Street/Grover Street**

Observations at the 1st Street/Grover Street intersection indicated extensive northbound queuing along 1st Street extending beyond Front Street. Eastbound queuing of 10 to 12 vehicles were also observed and typically cleared in 2 signal cycles. The majority (approximately 64 percent) of northbound vehicles queuing during the PM peak hour were making right-turns onto Grover Street. Observations also indicate that larger trucks (over SU-30) would have a difficult time making a westbound right-turn from Grover Street to 1st Street. Queueing issues in the downtown area seem to be related, in part, to poor signal coordination between the signals.

In Fall 2024, eastbound queues were observed to extend all the way back to 4th Street, which impacts the major intersection at 3rd Street. Related to this queue, traffic was observed at 2nd Street traveling northbound through the intersection in a potentially unsafe manner: eastbound traffic queues would obscure westbound traffic sight lines and near misses were observed. Along Grover Street, the traffic queues would spill back to Front Street, and beyond to Riverview Road. Northbound left-turning vehicles were frequently blocked from accessing the left-turn lane at the signal due to extensive queues. For eastbound or northbound traffic at 1st Street/Grover Street, it was typically that vehicles required 2 or more signal cycles to travel through the corridor.

### **6. 7th Street/Front Street**

No operational issues were observed, with the majority of vehicles traveling east/west with low turning volumes to/from the stop-controlled 7th Street minor approaches.

### **7. 1st Street/Front Street**

At the 1st Street/Front Street intersection, queueing was observed to extend south from the 1st Street/Grover Street intersection. When northbound queues fill the segment of 1st Street between Grover and Front Street, many northbound vehicles turn right onto eastbound Front Street to bypass the 1st Street/Grover Street intersection.

In Fall 2024, this intersection was impacted by northbound traffic queues extending back from the 1st Street/Grover Street intersection. This caused northbound queues to extend back to Riverview Road in some cases.

### **8. 1st Street/Riverview Road**

Minimal queuing was observed at this intersection; however, when vehicles were observed making a northbound left-turn from 1st Street to Riverview Road vehicles wishing to go through were observed trying to maneuver around turning vehicles but lacked available roadway width to do so. This could lead to unsafe or undesirable motorist behaviors.



In Fall 2024, northbound traffic queues were observed all the way back from the 1st Street/Front Street intersection.

## ***Traffic Safety***

Table 3 summarizes that the number of collisions reported over the five-year period reviewed. As shown in Table 3, the intersection with the most reported collisions was the 1st Street/Grover Street intersection with a total of 10 or an annual average of 2. The majority (73 percent) of collisions resulted in property damage only with no fatalities were reported.

Additionally, there were two pedestrian/bicycle related collisions reported. Both occurred at the 7th Street/Front Street intersection.

The most common type of reported collision reported was angle collision followed by rear-end collisions. Angle type collisions occur where one vehicle is making a left-turning maneuver, and the other vehicle is going straight typically when one vehicle didn't grant right-of-way to the other vehicle. Rear-end type collisions are common at signalized intersections where vehicle speeds can change frequently. There is no obvious pattern in the collision data, and frequency and type of collisions does not raise specific safety concerns.

**Table 3. Five-Year Collision Summary**

Intersection	Number of Collisions					Total	Annual Average
	2019	2020	2021	2022	2023		
Depot Rd/3rd St/Main St	0	0	0	2	1	3	0.60
1st St/Main St	0	3	1	0	0	4	0.80
7th St/Grover St	0	0	0	0	0	0	0.00
3rd St/Grover St	3	1	1	1	2	8	1.60
1st St/Grover St	1	1	2	5	1	10	2.00
7th St/Front St	0	1	1	0	0	2	0.40
1st St/Front Street	2	0	2	1	2	7	1.40
1st St/Riverview Rd	1	0	2	0	0	3	0.60

1. Level of service, based on 2010 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Worst movement reported for unsignalized side-street stop-controlled intersections.

## ***Recommendations for Downtown Intersections***

The following provides a summary of recommendations for downtown Lynden intersections with identified issues:

### **Consider Coordination of Downtown Signals**

As noted previously, the downtown signals operations could benefit from better coordination with traffic signals. In addition to setting each signal to the same cycle length, there are a variety of technologies to better coordinate signals. This would likely be the lowest cost solution to improve overall traffic flow and shorten extensive queues within the downtown area.

### **Consider Changes to Protected Left-Turn Phasing**

Several of the intersections have protected left-turn phases during the signal cycle. Traffic operations analysis suggests that these phases could be removed or set to protected/permitted operations. This would allow more green time for other phases which would decrease problematic queues. Another option is to run protected phases during certain times of the day, such as school

release periods. Any phasing changes would have to be weighed against possible safety benefits that protected phasing provides for crossing pedestrians.

### **Consider Right-Turn Lanes**

It was noted that there is significant northbound right-turning traffic at 1st Street/Grover Street as well as 1st Street/Front Street. One or both could benefit from separate northbound right-turn lane. Assuming no signal timing changes, the turn lane at 1st Street/Grover Street may need to be as long as 125 feet (half the block). However, in conjunction with signal coordination, the storage length could be reduced. Alternatively, a northbound right-turn lane could be constructed at the 1st Street/Front Street intersection allowing eastbound vehicles to by-pass the 1st Street/Grover Street intersection.

### **Add Left-Turn Lane at 1st Street/Riverview Road**

While current left-turn volumes may be minor, provision of a northbound left-turn lane should be added at the 1st Street/Riverview Road intersection. This would increase safety, reduce delays, and support lower stress mobility in the area. This improvement would likely increase traffic at the 7th Street/Front Street intersection, but not enough to prompt intersection control changes.

### **Consider Changes to Better Facilitate Truck Movements**

The geometry of the 1st Street/Grover Street intersection was reviewed for modifications that could be made to better accommodate turning truck traffic. The truck turning analysis showed that a truck making a westbound right-turn would have a conflict with the southbound lane. Curb modifications could be made to the northeast corner of the intersection to include a truck apron and better accommodate truck turning maneuvers, while also adding a southbound left-turn lane. This would add capacity to the intersection and improve overall operations. Improvements at the intersection would likely result in the removal of some on-street parking along 1st Street north of Grover Street. The existing truck maneuver and new concept design are provided in Attachment D (two exhibits). Any changes to channelization for truck movements would need to be coordinated with changes to the traffic signals as mentioned previously.

The current truck route to/from the south and east of Lynden is via Grover Street, 1st Street, and 3rd Street. Other designated truck routes in the area include Nooksack Avenue and Bender Road. An alternative to modification at the intersection could include changes to the designated truck routes; however, truck turning maneuvers may be difficult at other intersections along Grover Street east of 1st Street due to narrow lane widths and tight corners.

## **Berthusen Road/Birch Bay Lynden Road Intersection**

Operations at the Berthusen Road/Birch Bay Lynden Road intersection were reviewed for existing conditions and forecast 2045 conditions. The following sections summarize the volumes, traffic operations, and safety review for the intersection.

### ***Vehicular Traffic Operations***

Existing and future 2045 traffic operations are summarized in Table 4. LOS worksheets are provided in Attachment B.

**Table 4. Berthusen Road/Birch Bay Lynden Road LOS Summary**

Scenario/Traffic Control	LOS Standard	Weekday PM Peak Hour		
		LOS <sup>1</sup>	Delay <sup>2</sup>	V/C <sup>3</sup> or WM <sup>4</sup>
Existing 2024 – Two-Way Stop Control	E	C	21	SB
Future 2045 – Two-Way Stop Control	E	F	100	SB
Future 2045 – Signal	E	A	7	-
Future 2045 – Single Lane Roundabout	E	A	6	0.44

1. Level of service, based on 2010 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Volume-to-capacity ratio reported for signalized intersections.

4. Worst movement reported for unsignalized side-street stop-controlled intersections.

As shown in Table 4, the intersection currently operates at LOS C with approximately 21 seconds of delay. With increases in background growth the intersection is forecast to degrade to LOS F. Implementation of either a signal or a single lane roundabout would improve the future operations to LOS A with minimal delay. Under the signal option, no modifications were made to the channelization. Based on the analysis a signal with no additional turn lanes or a single lane roundabout would meet LOS standards under forecast 2045 weekday PM peak hour conditions.

### **Traffic Safety**

There were no reported collisions at the Berthusen Road/Birch Bay Lynden Road intersection.

### **Recommendations**

The City should plan on improvements being needed at this intersection sometime in the future. A single-lane roundabout would likely be a better option than a signal for this area, for safety and maintenance reasons as well as land use context. The City should consider preserving right-of-way particularly on the northern corners of the intersection. Separate left-turn lanes for eastbound or southbound traffic could be interim improvements.

## **Guide Meridian Road/Bay Lyn Drive Intersection**

Operations at the Guide Meridian Road (SR 539)/Bay Lyn Drive intersection was reviewed for existing and forecast 2045 conditions. Intersection spacing was also reviewed in the area. The Bay Lyn Drive intersection with Guide Meridian Road is approximately 645 feet from the Birch Bay Lynden Road intersection to the north. Intersection spacing and physical constraints at the intersection limit improvement options as development occurs along Bay Lyn Drive west of Guide Meridian Road.

In this area, Guide Meridian Road is classified as an urban other principal arterial and a managed access highway class 3 facility by WSDOT. Based on the managed access classification of the roadway, the desired minimum intersection spacing is 2,640 feet (1/2 mile).<sup>1</sup> WSDOT standards specify that intersection spacing of less than 2,640 feet may be allowed only when no reasonable alternative access exists. Bay Lyn Road is classified as a local street by the City of Lynden.

The following sections summarize the volumes, traffic operations, and safety review for the intersection as well as potential improvements to support development in the area.

<sup>1</sup> *Washington State Department of Transportation Design Manual*, October 2023, Section 540.03(3)(b)(1)



## Vehicular Traffic Operations

The intersection is a three-leg intersection with a stop on the minor (Bay Lyn Drive) approach. There are also a number of driveways along the east side of Guide Meridian Road near this intersection. The operations are summarized in Table 5. LOS worksheets are provided in Attachment B.

**Table 5. Guide Meridian Road (SR 539)/Bay Lyn Road LOS Summary**

Scenario/Traffic Control	LOS Standard	Weekday PM Peak Hour		
		LOS <sup>1</sup>	Delay <sup>2</sup>	WM <sup>3</sup>
Existing 2024 – Two-Way Stop Control	E	C	15	EB
Future 2045 – Two-Way Stop Control	E	C	24	EB

1. Level of service, based on 2010 Highway Capacity Manual methodology.  
2. Average delay in seconds per vehicle.  
3. Worst movement reported for unsignalized side-street stop-controlled intersections.

As shown in Table 5, the intersection currently operates at LOS C with approximately 15 seconds of delay. With increases in general background growth the intersection is forecast to continue to operate at LOS C with approximately 24 seconds of delay. However, if more intensive development occurs along Bay Lyn Road, the number of turning vehicles could increase dramatically necessitating possible intersections improvements.

Observations at the Guide Meridian Road (SR 539)/Bay Lyn Road intersection indicate that current difficulty making an eastbound left-turn may reduce the number of turns at the intersection. The left-turn is a difficult movement with high delay and few gaps in northbound/southbound traffic. Data collected at the intersection showed only 15 vehicles made the eastbound left-turn during the PM commute peak hour. Potential left-turning traffic may be diverting to Brich Bay Lynden Road through on-site commercial access roadways.

Over 100 vehicles were observed making a northbound left-turn into the site. The intersection analysis results showed that the 95th percentile queue is less than one vehicle for any of the approaches. The higher number of northbound left-turns onto Bay Lyn Road is due in part to the right-in/right-out restrictions at commercial driveway to the north.

## Traffic Safety

Collision records show that there were 7 reported collisions at the Guide Meridian Road/Bay Lyn Road intersection. Of the 7 reported collisions, 5 resulted in property damage-only with 2 injury-related collisions. There were no reported fatalities. Collision types were approach-turn (3), angle (3), and rear-end (1), with most of those associated with left-turns to/from Bay Lyn Road.

## Recommendations

As development occurs east of the intersection, exiting left-turn access from Bay Lyn Road could become difficult. Due to intersection spacing along Guide Meridian Road (SR 539) the addition of a signal at the intersection would likely not be allowed. Additionally, due to physical constraints from buildings and driveways on the east side of Guide Meridian Road (SR 539), a two-lane roundabout may also not be feasible.

## Consider Southbound U-Turn Route

Providing a dedicated southbound U-turn location just north of the City limits at Guide Meridian Road would provide a safer way for eastbound Bay Lyn Road traffic to access northbound Guide Meridian Road. This may be in coordination with installing C-curb to limit eastbound left-turns directly at the intersection.

### Consider a Two-Stage Left-Turn

This concept would require close coordination with properties on the east side of Guide Meridian Road between Birch Bay Lynden Road and the southern City Limits. C-curb would be added to most sections along this corridor restricting left-turn access into or out of side properties at specific locations (in other words, convert the unrestricted two-way left-turn lane to turn pockets). At the Bay Lyn Road intersection, eastbound left-turn vehicles would be allowed temporarily pause in the center lane (southbound left-turns prohibited at this location), before merging into northbound traffic. A more defined northbound U-turn movement could be added at the Birch Bay Lynden Road intersection to improve mobility that may be lost due to access restrictions.

### Consider Improved Connecting Roads

This option assumes redevelopment of some properties on the east side of the Guide Meridian Road corridor. A new local road could be added between Guide Meridian Road in vicinity of Bay Lyn and the Kok Road/19th Street intersection vicinity. This new road would benefit redevelopment and City local access for properties on the east side of the corridor and allow for more access restrictions along Guide Meridian Road. This would indirectly support the other two options mentioned above.

## British Columbia Avenue/Grover Street Intersection

The British Columbia Avenue/Grover Street intersection is currently a four-way intersection with stops on the minor (British Columbia Avenue) approaches. Discussion with City staff indicate there are safety concerns at the intersection, namely that drivers are failing to make the eastbound through movement and have driven on to private property at the southeast corner of the intersection. In response, concrete blocks have been placed at the edge of the property and chevron turn signs to both the eastbound and westbound approaches to the intersection have been placed to indicate the bend in the road, see Figure 2 and Figure 3, respectively.



*Figure 2 Example of Concrete Block and Turn Arrow Located at Intersection*



*Figure 3 Treatments at Corner of Intersection*



## ***Vehicular Traffic Operations***

Intersection operations indicate that the intersection currently operates at LOS C with approximately 16 seconds of delay on the southbound approach. Under forecast 2045 the intersection is forecast to operate at LOS C with 23 seconds of delay in the southbound direction. LOS worksheets are provided in Attachment B.

## ***Traffic Safety***

Three collisions were reported over the five-year period from 2019-2023. All resulted in property damage only with no reported fatalities and occurred in 2022. There is no obvious pattern in the reported collision data. However, the primary issue at this intersection was related to one specific major crash into a property (and the building structure) at the corner. This is the primary motivation for identifying potential improvements. There is an existing streetlight at the intersection, so it is unlikely that poor lighting is a safety concern.

## ***Recommendations***

In addition to or as a replacement for the current concrete blocks and chevron signs the City could consider the concepts listed below. These concepts could be combined into a broader solution. Concept design figures of each concept are provided in Attachment E.

### **Consider High Visibility Signs/Markings**

Consider an update to the roadway channelization markings and provide updated signage improvements. Channelization improvements would include enhanced lane markings through the intersection. Updated signs could include increasing the size of the current curve warning signs to the 48-inch sign type. The addition of red flags to the top of the sign and/or an amber warning beacon above the sign could further increase the visibility of the signs.

### **Consider Curb Extensions on South Side**

This concept adds the installation of a curb extension on the south side of the road on both sides of the intersection. The curb extension provides more definition to the vehicle travel lanes, and a vertical curb to reinforce proper movements. Additional vertical elements (concrete barriers, planters, reflector poles, etc.) could be also considered.

### **Consider Curb Realignment on North Side**

This concept allows for further realignment of east-west lanes by modifying the curb line on the northwest corner of the intersection.

## **Line Road/Aaron Drive Intersection**

The Line Road/Aaron Drive intersection was evaluated for the installation of an all-way stop. City staff mentioned concerns by local residents of excessive vehicle speeds along the Line Road corridor. Volume, vehicle classification, and speed data were collected along Line Road for one 24-hour period in June 2024. The following sections summarize the operational characteristics of the intersection as well as the traffic safety and all-way stop warrant review.

## ***Traffic Speeds and Operations***

Both Line Road and Aaron Drive are classified by the City of Lynden as collectors and have a posted speed limit of 25 mph. The data collected showed the average speed along Line Road was 26 mph with an 85th-percentile speed of 31 mph. This suggests that traffic speeds are operating more consistent with a 30-mph roadway.

The intersection currently operates at LOS B with 11 seconds of delay on the westbound approach. The intersection is located approximately 600 feet north of a middle school. It is noted that data were collected while school was not in session and operations at the intersection are likely worse when school is in session. However, traffic operations would not likely degrade significantly (below LOS E) while school is in session. LOS worksheets are provided in Attachment B.

### ***Traffic Safety***

At the Line Road/Aaron Drive intersection four collisions were reported. One collision was reported each year except for 2023 when no collisions were reported. Of the four reported collisions two resulted in property damage only and two resulted in possible injuries with no reported fatalities. The collision history did not suggest any specific safety concerns.

### ***All-Way Stop Control Warrants***

The five all-way stop control warrants from the Manual on *Uniform Traffic Control Devices (MUTCD) 11th Edition*, December 2023 were reviewed. The warrants include:

- A. Crash Experience
- B. Sight Distance
- C. Transition to Signal Control or Transition to Yield Control at a Circular Intersection
- D. 8-Hour Volume
- E. Other Factors

Each of the five warrants are summarized in the following sections.

#### **Warrant A: Crash Experience**

The MUTCD crash experience warrant notes an all-way stop control can be installed at a four-leg intersection where there have been five or more reported collisions in a 12-month period or six or more reported collisions in a 36-month period that were of a type susceptible to correction by the installation of all-way stop control. Based on the number of reported collisions, the intersection does not meet the crash experience warrant.

#### **Warrant B: Sight Distance**

All-way stop control may be installed at an intersection where sight distance on the minor-road approaches controlled by a stop sign is not adequate for a vehicle to turn onto or cross the major (uncontrolled) road safely. Based on a review of the intersection sight distance characteristics, this warrant is not met.

#### **Warrant C: Transition to Signal Control**

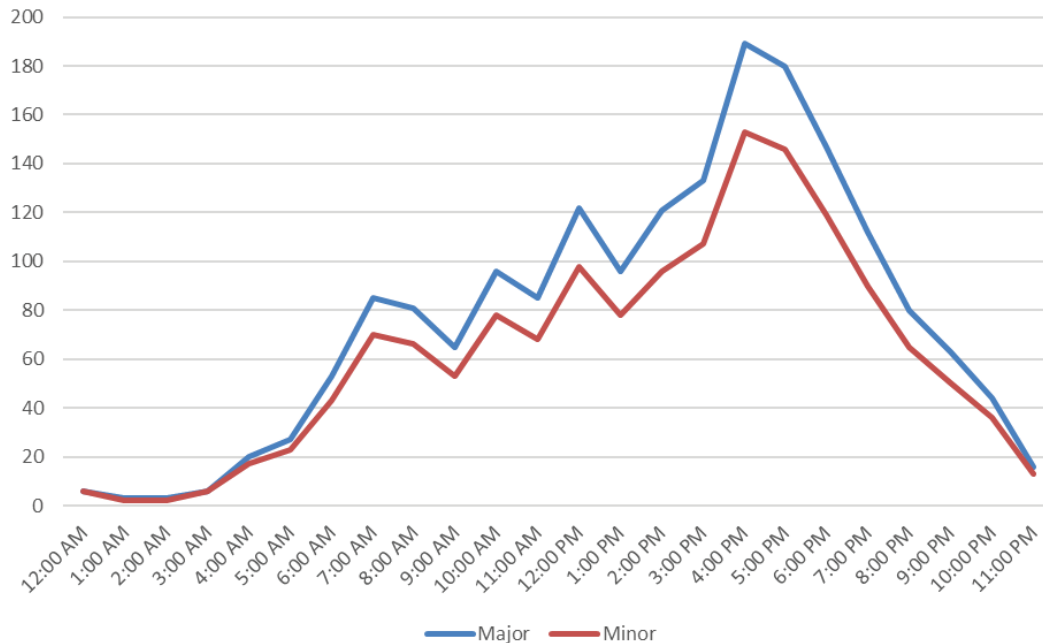
All-way stop control may be installed at locations where all-way stop control is an interim measure that can be installed to control traffic while arrangements are being made for the installation of a traffic signal. A traffic signal is not planned for this intersection, so this warrant is not met.

#### **Warrant D: 8-Hour Volumes**

This warrant is based on traffic volumes being high enough on both the major road and minor road approach for 8 hours of a typical weekday. Major street approaches need 300 vehicles per hour, and minor street approaches need 200 vehicles per hour.



Utilizing the intersection turning movement and 24-hour counts collected at the intersection, a daily distribution of the traffic volumes was developed. The daily distribution of traffic volumes for the major and minor approaches is summarized in Figure 4.



*Figure 4 Daily Distribution of Intersection Traffic Volumes*

As shown in Figure 4, there is no time period where the major (Line Road) or minor (Aaron Drive) approach exceed 300 or 200 vehicles in an hour, respectively. Even with the consideration of the school traffic it is unlikely that the volume increase would be enough over the 8-hour period to meet the warrants. The 24-hour traffic data are provided in Attachment F.

### **Warrant E: Other Factors**

All-way stop control may be installed at an intersection if it is needed due to factors not addressed in other warrants. Such other factors may include, but are not limited to:

- A. The need to control left-turn conflicts,
- B. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where all-way stop control would improve traffic operational characteristics of the intersection, or
- C. Where pedestrian and/or bicyclist movements support the installation of all-way stop control.

There are limited left-turning conflicts at the intersection; however, both roadways are classified as collectors with similar design and an all-way stop would improve the operational characteristics of the intersection. Given the proximity to the school the all-way stop would also support pedestrian and bicycle movements.

### **All-Way Stop Warrant Summary**

An all-way stop control could be installed based on “Warrant E: Other Factors” supporting the intersection of two collectors and pedestrian/bicycle volumes in a neighborhood proximate to a middle school.

## **Recommendations**

The following are recommendations related to the Line Road/Aaron Drive intersection. They could be combined in some cases. Speeds are slightly elevated on Line Road so some level of traffic calming would be desirable.

### **Coordinate with School-Related Improvements to the South**

City staff mentioned the desire to improve connectivity and safety near Lynden Middle School to the south along Line Road. Some of the potential improvements at that location may involve a level of traffic calming that may help mitigate traffic speeds further to the north along Line Road as well. Improvements to the south could offset any needs for improvements at this intersection.

### **Consider Installing All-Way Stop Control**

The installation of all-way stop control would be relatively inexpensive. From the perspective of traffic calming, the all-way stop control is typically not the best option because non-compliance will increase over time if no perceived need is felt by motorists. However, this roadway does meet a warrant for all-way stop control for roadway network and non-motorized considerations. The turning movement volumes also suggest a fairly balanced vehicle demand from the “major” and “minor” approaches, supporting a balanced control from each approach as well.

### **Consider Installing a Mini Roundabout**

The mini roundabout works effectively the same as an all-way stop control, but without requiring every vehicle to stop. Mini roundabouts can be effective at reducing vehicle speeds at intersections and they can be designed to be mountable for accommodating larger vehicles, as needed. This is different than a “traffic circle” which are typically used only in local street settings (not collector streets).

### **Consider Enhanced Crosswalk Options**

Raised crosswalks, speed tables, or speed cushions are common traffic calming treatments and could be a good solution for this type of roadway. There are several marked crosswalks along Line Road; so, raising them could be a good option and may help calm traffic. If additional traffic calming is desired, speed tables could be added between the crosswalks; however, Whatcom Transit Authority has at least one route that uses Line Road. If there are concerns with the buses navigating the raised crosswalks and/or speed tables, then speed cushions could be used instead. Speed cushions allow for larger vehicles, such as buses and fire trucks, to essentially bypass these traffic calming measures.

### **Consider Speed Radar Feedback Signs**

These have mixed preferences among different agencies but have been used to provide feedback to drivers. This treatment can lose some effectiveness over time but is a good way to increase driver’s attention to their speed.