TRANSPORTATION PLANNERS AND ENGINEERS

Heritage Crossing

Transportation Impact Assessment

Final

Prepared for

2291463 Alberta Ltd.

Date

September 2022

Project Number

02-22-0118

CORPORATE AUTHORIZATION

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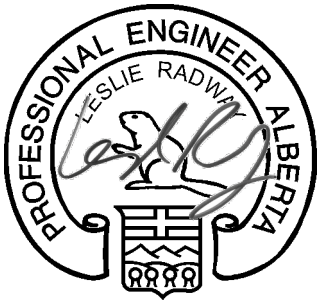
APEGA Permit #:	P13898		



Engineer's Stamp

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TABLE OF CONTENTS

EXHIBITS

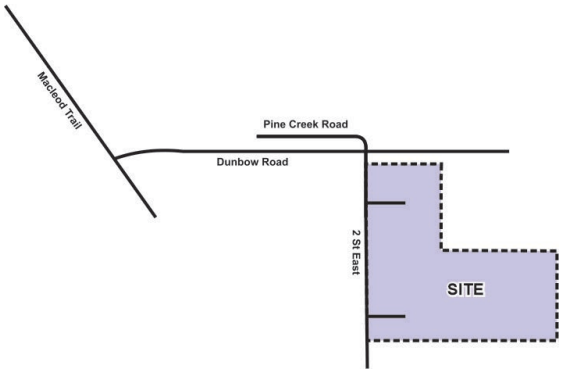
FIGURES

TABLES

1. EXECUTIVE SUMMARY

2291463 Alberta Ltd. is seeking a land use redesignation for a site located in the southeast quadrant of 2 Street E & Dunbow Road. The proposed development will include a total of approximately 153 residential units.

Foothills County requested a Transportation Impact Assessment (TIA) to review the traffic impacts of the proposed development. Findings and recommendations are summarized below.



1.1 Trip Generation

Proposed development densities, phasing, and forecasted trip generation is summarized in **Table 1.1**.

Table 1.1: Trip Generation

HORIZON	USE	DENSITY	TOTAL TRIP GENERATION	
			AM Peak Hour	PM Peak Hour
Opening Day (2024)	25% of Full Build Out		25	35
		TOTAL		
Long Term (10 and 25 Years)	Single Family	89	62	89
	Duplex	44	31	44
	Seniors Housing	20	5	6
		TOTAL	98	139

1.2 Findings & Recommendations

Study findings and recommendations are described in **Table 1.2**.

Table 1.2: Findings & Recommendations

SECTION		FINDINGS
Sight Distance		Study area intersections meet minimum sight distance requirements.
Intersection Analysis	Background	The southbound to eastbound left turn at 2 Street E/Dunbow Road currently operates at capacity during the weekday PM peak hour. It is recommended that the County consider accelerating their planned re-alignment of Heritage Lake Road to limit the north leg of the intersection to Fire Station access. With this improvement in place, the intersections will operate within acceptable capacity parameters under both Existing and Opening Day conditions as well as at the 10 Year Horizon. The anticipated County improvements to widen Dunbow Road to 4-lanes and the implementation of signalization or a roundabout at 2 Street E will adequately accommodate 25 Year Horizon conditions.
	After Development	No further improvements beyond those identified for Background Traffic accommodation will be required to adequately accommodate site generated traffic.
Roadway Analysis	Background	With the inclusion of planned improvements implemented by the County, all roadways will accommodate future background traffic.
	After Development	The addition of site traffic will not affect the classification, cross section or surface treatment of Dunbow Road. The addition of site traffic results in the need to upgrade 2 Street from Dunbow Road to the south access to a 9 metre paved surface.
Warrants	AT intersection	The Dunbow Road/2 Street E intersection will require a Type IVb to accommodate the traffic at the 10 Year Full Development Horizon. The closure of the north leg to all but Fire Station traffic and the addition of the balance of the site generated traffic result in the need for a modification to the Type IVb configuration to create a mirror image but with the current EBLT lane replaced with a WBLT lane. The anticipated County improvements to widen Dunbow Road to 4-lanes and the implementation of either signalization or a roundabout at 2 Street E will adequately accommodate 25 Year Horizon conditions.
	Illumination	Delineation illumination is currently provided at the Dunbow Road/2 Street E intersection. This level of illumination will continue to be satisfactory at the Opening Day and 10 Year Horizon. The anticipated County improvements to widen Dunbow Road to 4-lanes and the implementation of either signalization or a roundabout at 2 Street E will result in requisite upgrades to intersection lighting.

2. INTRODUCTION

2.1 Scope of Work

Based on discussions with the Foothill County (**Appendix A**), the scope of work for this study was confirmed to include the following:

Development Trip Generation

- *Trip Generation* – Calculate development trips based on industry standards (ITE Trip Generation).
- *Trip Assignment* – Assign development trips to the network based on existing travel patterns.

Traffic

- *Horizons* – Review traffic conditions for:
  - Existing
  - Opening Day (2024)
  - Long Term (10-Year, 25-Year)
- *Intersection Capacity* – Complete weekday peak hour analysis at:
  - 2 Street E & Dunbow Road
  - 2 Street E & Access Locations (only at 25-Year Horizon)
- *Recommendations* – Identify improvements required to support background or development traffic.

Roadway Characteristics

- Establish road surface and cross-sections for all horizons
- Review Illumination Warrant for the intersection of 2 Street E at Dunbow Road

2.2 Site Context

The site is located in Foothills County and is bounded by Dunbow Road to the north and 2 Street E to the west. The site context is illustrated in **Figure 2.1**.

2.3 Additional Background Information

In March 2022, Watt Consulting Group (Watt) completed a functional study for Dunbow Road between Deerfoot Trail and Macleod Trail[1]. The study included the assumed development of 800 new residential units within this stretch of road and provided an access management plan for Dunbow Road. The access management plan provided potential staging plans and timing of improvements along Dunbow Road and identified intersection control options as roundabouts and also as signalized intersections. This study was

[1] Dunbow Road – Deerfoot Trail to Macleod Trail, Functional Planning Study, Watt Consulting Group, March 7, 2022.

approved by Foothills County in June 2022, but without a decision regarding the type of intersection control to be implemented.

The next steps for the County would be to present the report as part of public consultation component. The County would then decide whether to proceed with the signalization or roundabout options. Both of these two options were therefore assumed to be in place at the 25 Year Horizon and both were assessed in this study.

The County also indicated that the priority would be to go forward with improvements on the west end of Dunbow Road, which would include 2 Street E. These improvements would see Heritage Lake Road (located between Macleod Trail and 2 Street E) extended south to connect directly to Dunbow Road. In conjunction with the new connection, the north leg of the 2 Street E at Dunbow Road intersection would be limited to access for the Heritage Pointe Fire Station. The timing of this improvement was not specified by the County, but it was assumed for the purpose of this TIA to be in place by the 10-Year Horizon.

It is understood that at some point in the future that the north leg of 2 Street E may provide access for additional residential development and that this would be addressed as part of that future development. It was therefore beyond the scope of this study.

In summary, then, the network assumptions utilized in this study assumed the following:

- Opening Day: Network as per existing.
- 10 Year Horizon: Heritage Lake Road re-aligned, with the north leg of 2 Street E closed to traffic other than the Fire Station.
- 25 Year Horizon: Signalization or roundabout at the Dunbow Road/2 Street E intersection, and the widening of Dunbow Road to 4-lanes.

It is noted that the scope of the Watt functional study of Dunbow Road contained forecasts for both the 10 and 25 Year Horizons. However, those forecasts were limited to the PM peak hour. As such, the analysis of the 10 and 25 Year Horizons in this TIA were also limited to the PM peak hour.

Exhibit 2.1

Site Context

3. DEVELOPMENT

The site plan is illustrated in **Figure 3.1**.

Figure 3.1: Site Plan

3.1 Densities

Proposed development uses, phasing, and densities are summarized in **Table 3.1**.

Table 3.1: Proposed Densities

HORIZON	LAND USE	DENSITY
Opening Day (2024)	Residential	25% of development
Long Term (10 and 25-Years)	Single Family Residential	89 units
	Duplex Residential	44 units
	Seniors (detached) Residential	20 units

3.2 Trip Generation

The approved trip generation rates used in this analysis are summarized in **Table 3.2**. The trip generation rates are based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual (10th Edition)* and industry standards.

Table 3.2: Trip Generation Rates

USE	AM PEAK HOUR			PM PEAK HOUR			DATA SOURCE
	Trip Rate	In	Out	Trip Rate	In	Out	
Single family / Duplex Residential	0.7 per unit	*20%*	*80%*	1.0 per unit	*66%*	*34%*	Industry Standards
Seniors (detached) Residential	0.24 per unit	33%	67%	0.30 per unit	61%	39%	ITE 251

The expected full build-out development generated trips are summarized in **Table 3.3**. For the purpose of analysis, it was assumed that full build out would occur by the 10 Year Horizon, with 25% of that in place by Opening Day in 2024.

Table 3.3: Vehicle Trip Generation

HORIZON	USE	DENSITY	AM PEAK HOUR			PM PEAK HOUR		
			Total	In	Out	Total	In	Out
Build Out	Single Family	89 units	62	12	50	89	59	30
	Duplex	44 units	31	6	25	44	29	15
	Seniors	20 units	5	2	3	6	4	2
		TOTAL	98	20	78	139	91	48

3.3 Trip Distribution

Vehicle trips were distributed based on existing traffic patterns as observed by Bunt during traffic counts undertaken in 2022. The trip distribution used in this study is illustrated in **Exhibit 3.1**.

3.4 Access

Access to the development will be provided from 2 Street E. All vehicle trips were assigned to the two access points.

The resulting development generated traffic volumes are illustrated in **Exhibit 3.2** & **Exhibit 3.3** for the Opening Day and Long-Term 10/25 Year horizons, respectably.

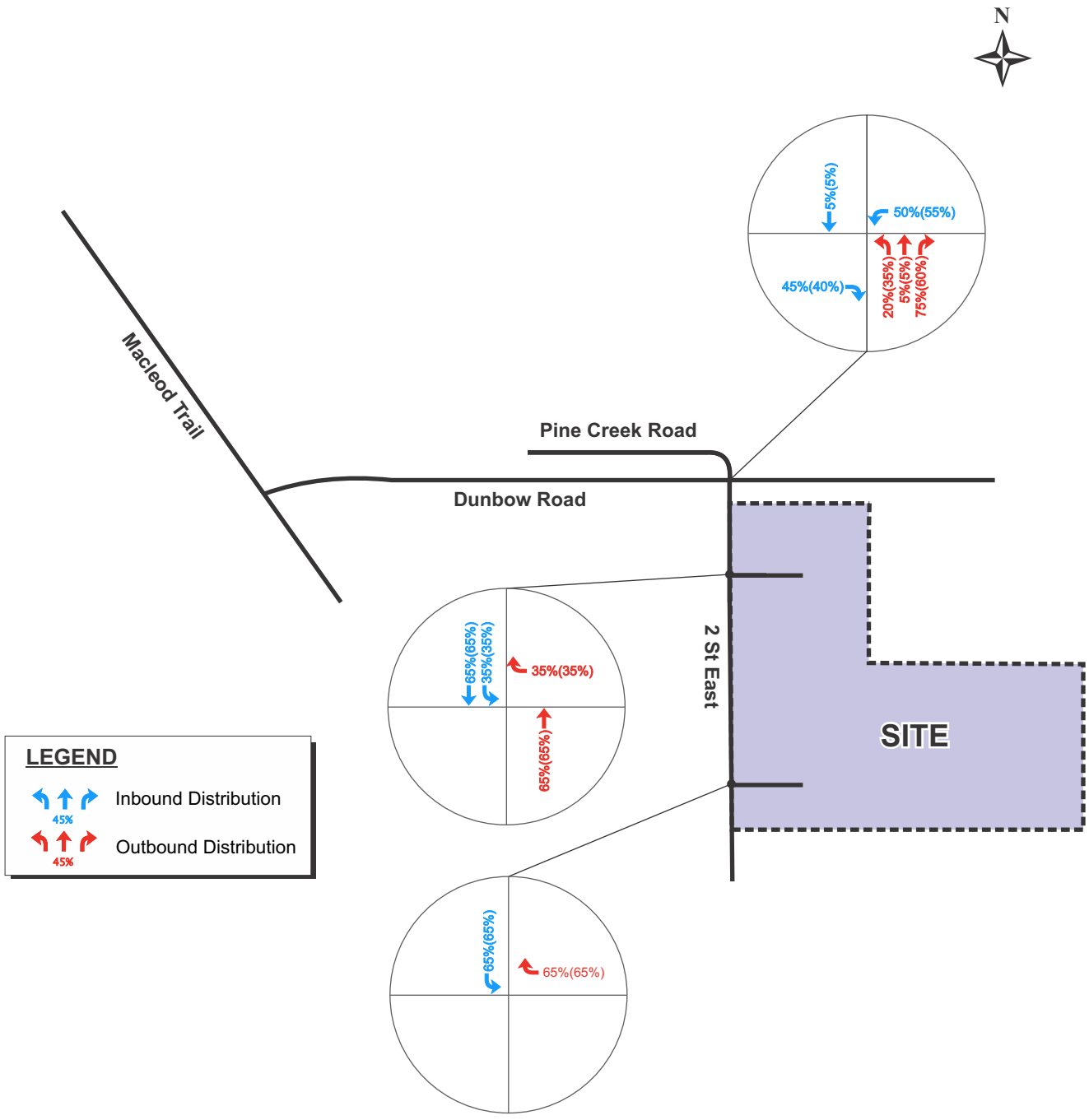


Exhibit 3.1

Site Traffic Distribution

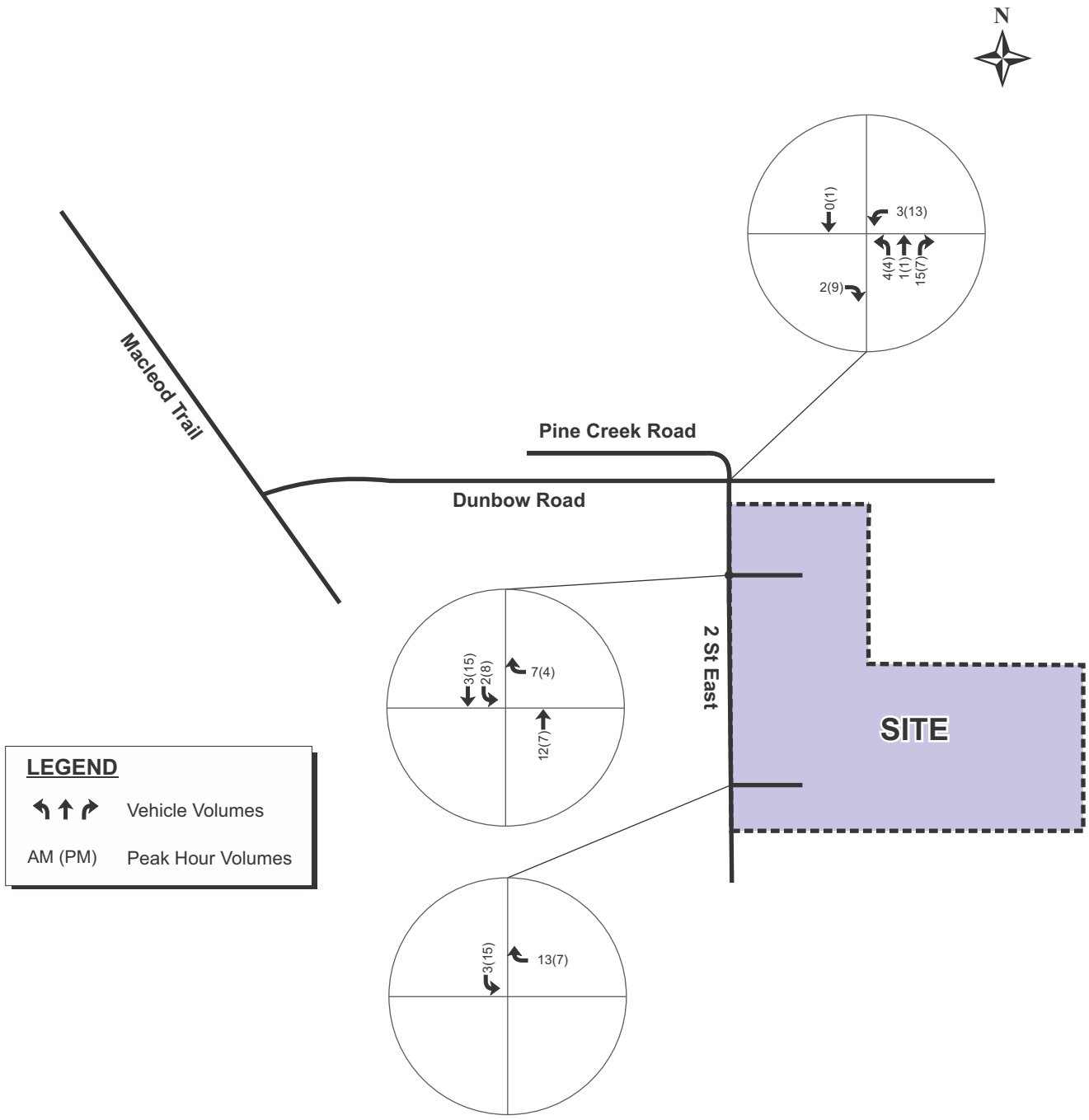


Exhibit 3.2

Opening Day Site Traffic Volumes

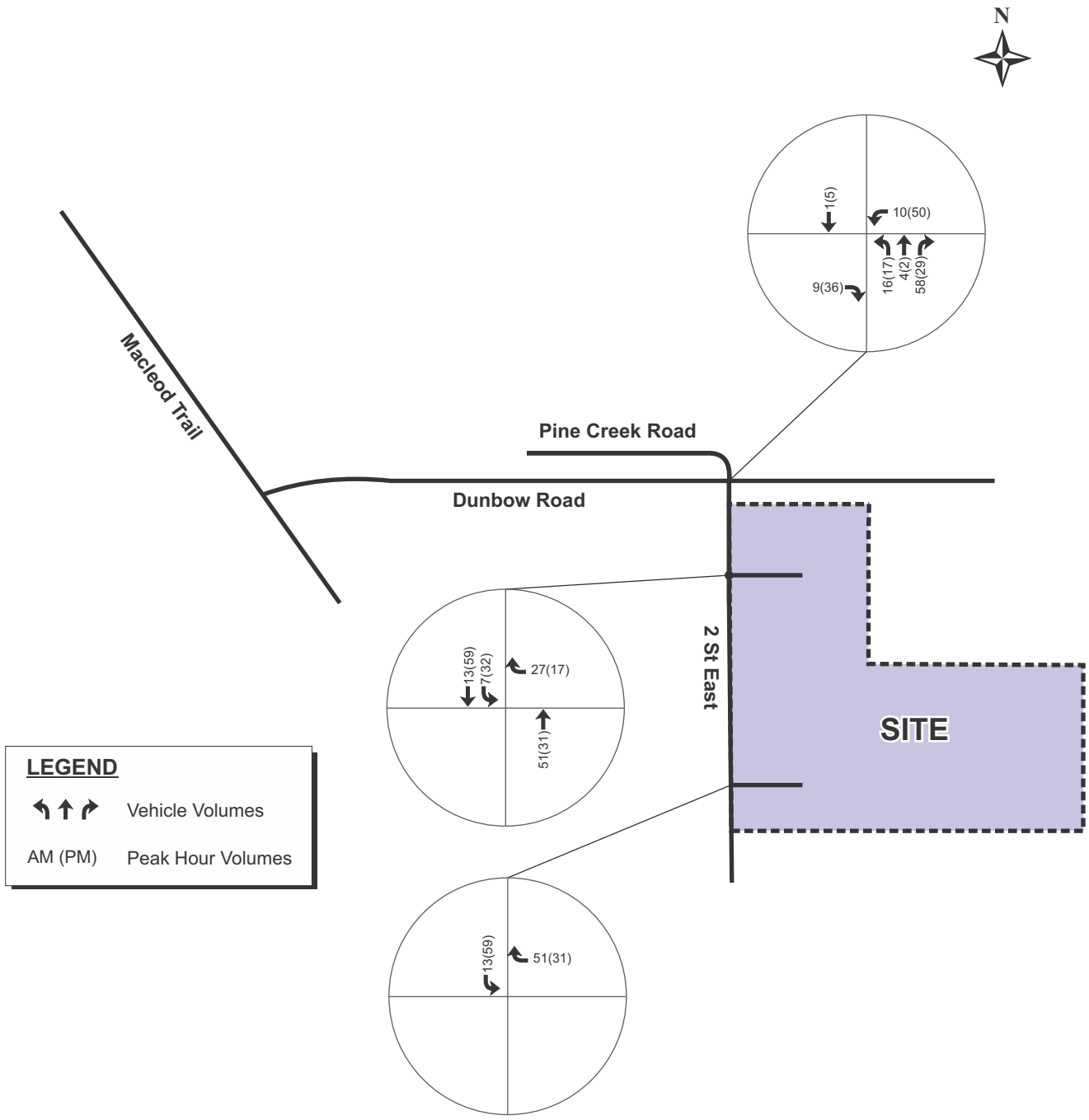


Exhibit 3.3

Full Build Out Site Traffic Volumes

4. TRAFFIC CONDITIONS

4.1 Road Network

The characteristics of roadways near the site are summarized in Table 4.1

Table 4.1: Existing Roadway Characteristics

ROADWAY	CLASSIFICATION	CROSS-SECTION		POSTED SPEED	FACILITIES	
		# Lanes	Median		Shoulder	Illumination
Dunbow Road	Major Collector	2	No	80 km/h	Yes	No
2 Street E	Hamlet Standard Road	2	No	50 km/h	Yes	No

4.2 Intersections

Existing intersection configurations and controls at study intersections are illustrated in **Exhibit 4.1**.

4.3 Sight Distance

A sight distance review was undertaken for the proposed development access intersections along 2 Street E based on Table 7 of Foothills County's Rural Approach Standards Policy[2]. The minimum sight distance for a road with a posted speed of 50 km/h is 90 metres. The sight distance for both accesses was found to exceed 90 metres. As such, minimum requirements will be met.

4.4 Volumes

4.4.1 Existing

Traffic counts at Dunbow Road/2 Street E used in this study are summarized in **Table 4.2**. The original count completed by Bunt on June 30, 2022 was compared to a Watt count completed on July 19, 2019. Most of the observed 2022 traffic volumes aligned with the 2019 Watt count, as expected, except for the westbound through (WBT) movement, which was 700 vehicles per hour (vph) higher in 2022 than had been observed in 2019. This was felt to be a possible outlier, and so additional counts were completed by Bunt on July 11(spot count) and July 21(full two-hour count), 2022 to validate the data set. These also found the WBT to be considerably higher than the 2019 volumes, and although substantial, the repeated appearance of a significant variance confirmed the appropriateness of the volume. To this end, the resulting WBT peak volumes was assessed as and utilized as 560 vph.

During the spot count on July 11th, observations were also made with respect to local travel patterns. Regional traffic from southbound Deerfoot Trail appeared to be using Dunbow Road as a route to access the communities of Legacy and Walden located north of the study area on Macleod Trail (no access to Legacy or Walden is available directly from Deerfoot Trail). Although not specifically confirmed through full trip traces, vehicles appeared to travel southbound on Deerfoot Trail, then west along Dunbow Road and then north on Highway 2A / Macleod Trail to then turn right onto 210 Avenue SE to access Legacy and Walden.

[2] Rural Approach Standard Policy, Policy Number ADC-RAS-1, Approved September 1, 2011.

While this was a high-level observation (no specific data collected) a cursory review of expected travel times on Google Maps for this alternative regional route was completed in conjunction with the observations. This confirmed that Google Maps directions recommend this route as it seems to provide a more consistent and/or shorter travel time than the Stoney Trail to Macleod Trail/2A via Highway 22X route during the PM peak hour. It is expected that the number of drivers utilizing this alternative route would vary based on the prevalence of construction and/or crashes along Stoney Trail. In time, as more development occurs along Dunbow Road with increased intersection control (signals or roundabouts), this route will may become less attractive to this through traffic, which could reduce the WBT volumes on this road. However, for the purpose of analysis they were assumed to remain.

Interestingly, a comparison of Alberta Transportation (AT) 2019 and 2020 traffic counts (100th Highest Hour) along Dunbow Road at Macleod Trail and Deerfoot Trail did not appear to reflect the same increase in traffic. It is therefore postulated that the use of this route may have increased as more of Legacy and Walden has developed and/or that construction activity may have been more prevalent in 2022 than had been the case in 2019 or 2020. Regardless, the higher traffic volumes as counted by Bunt in 2022 were used in this study and are summarized in Table 4.2. Traffic count data is included in **Appendix B**.

Table 4.2: Data Collection Summary

INTERSECTION	COUNT DATE	DAY OF WEEK	SOURCE
2 Street SE & Dunbow Road	2022/06/30	Thursday	Bunt & Associates
2 Street SE & Dunbow Road	2022/07/21	Thursday	Bunt & Associates

4.4.2 Future Background Traffic

Future background traffic is traffic that would be present on the road network in future years due to ambient growth regardless of the development of the site. This traffic is representative of yearly growth on the roadways as well as other residential, commercial, or industrial developments that have been approved in the area.

The background volumes for the 10-Year and 25-Year Horizons were obtained from the approved Watt functional study of Dunbow Road. The Watt study included 800 new residential units in the vicinity of Dunbow Road (400 north of Dunbow Road and 400 to the south). While the County indicated that residential units in the subject site could be assumed as part of the 400 units, a more conservative approach of layering the site traffic due to the Heritage Crossing development was assumed to be adequate for the purpose of this analysis.

For the Opening Day (2024) a nominal 2% growth rate was applied to the east and westbound through movements along Dunbow Road.

Background traffic volumes used in the analysis are illustrated in **Exhibit 4.3** (Opening Day) and **Exhibit 4.4** (Long Term 10 and 25 Year) Horizons.

4.4.3 After Development

Development generated traffic volumes (Exhibit 3.2) were added to Background traffic volumes to develop After Development traffic volumes as illustrated in **Exhibit 4.5** (Opening Day) and **Exhibit 4.6** (Long Term 10 and 25 Year) Horizons.

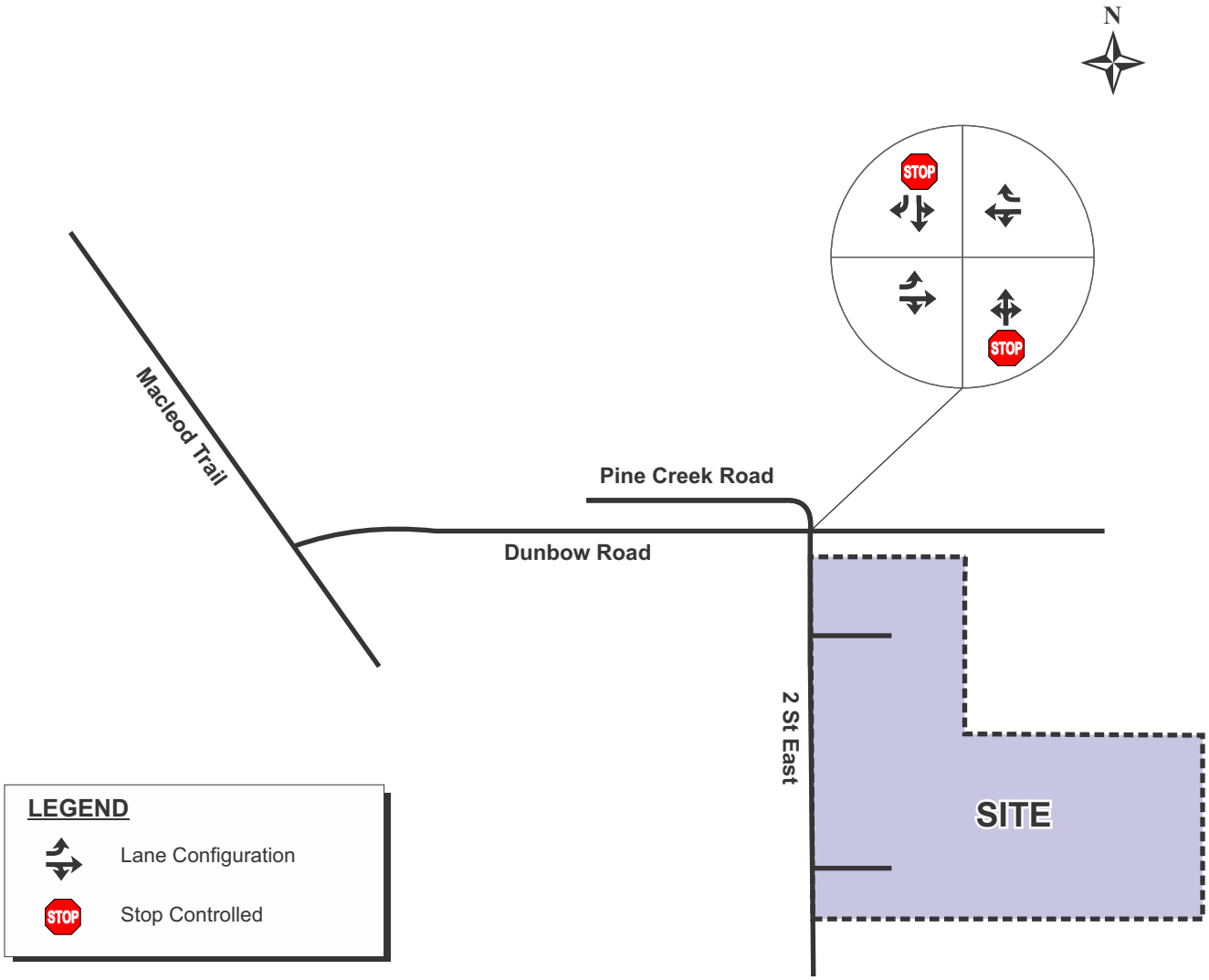


Exhibit 4.1

Existing Intesection Configurations

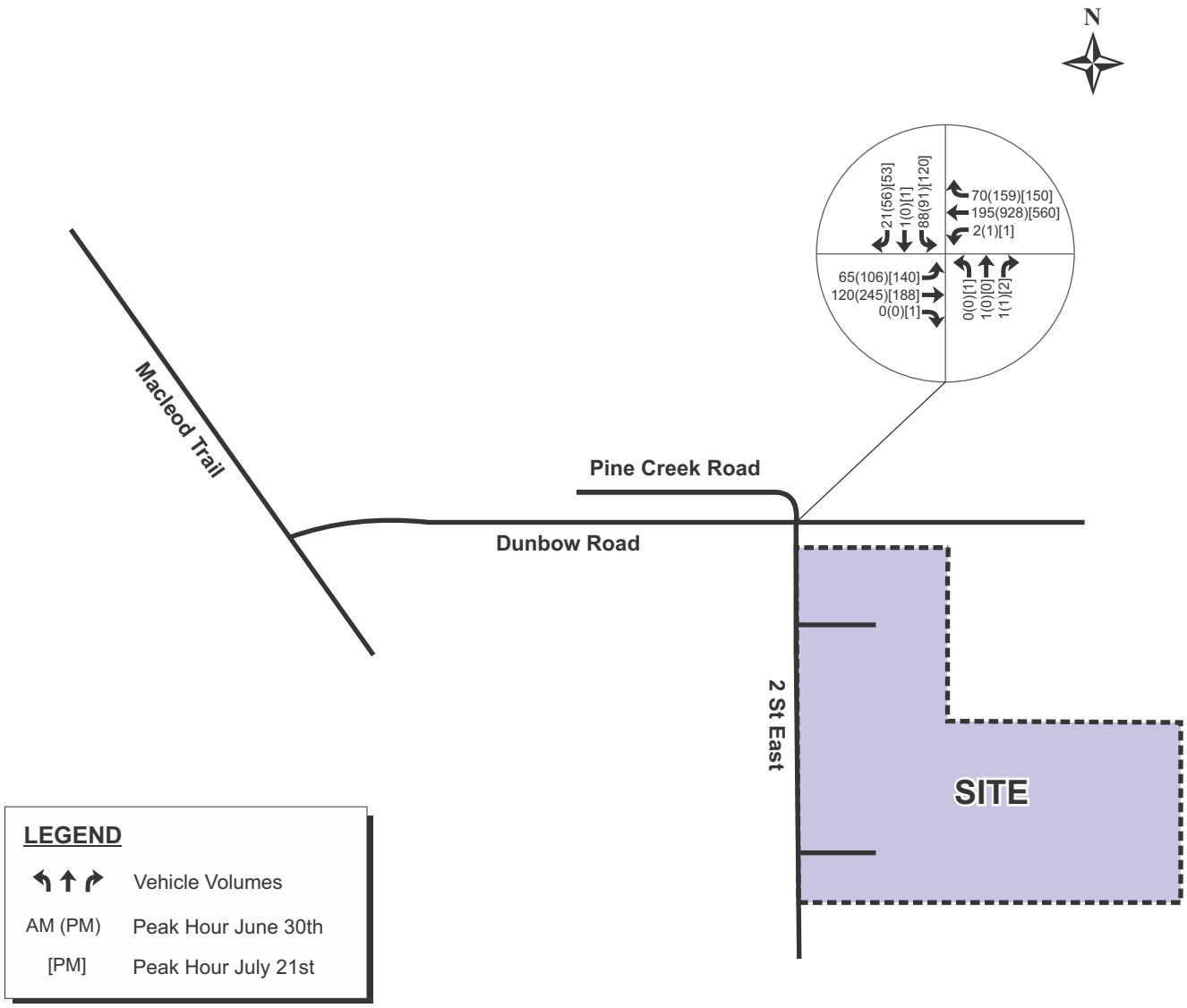


Exhibit 4.2

Existing Traffic Volumes

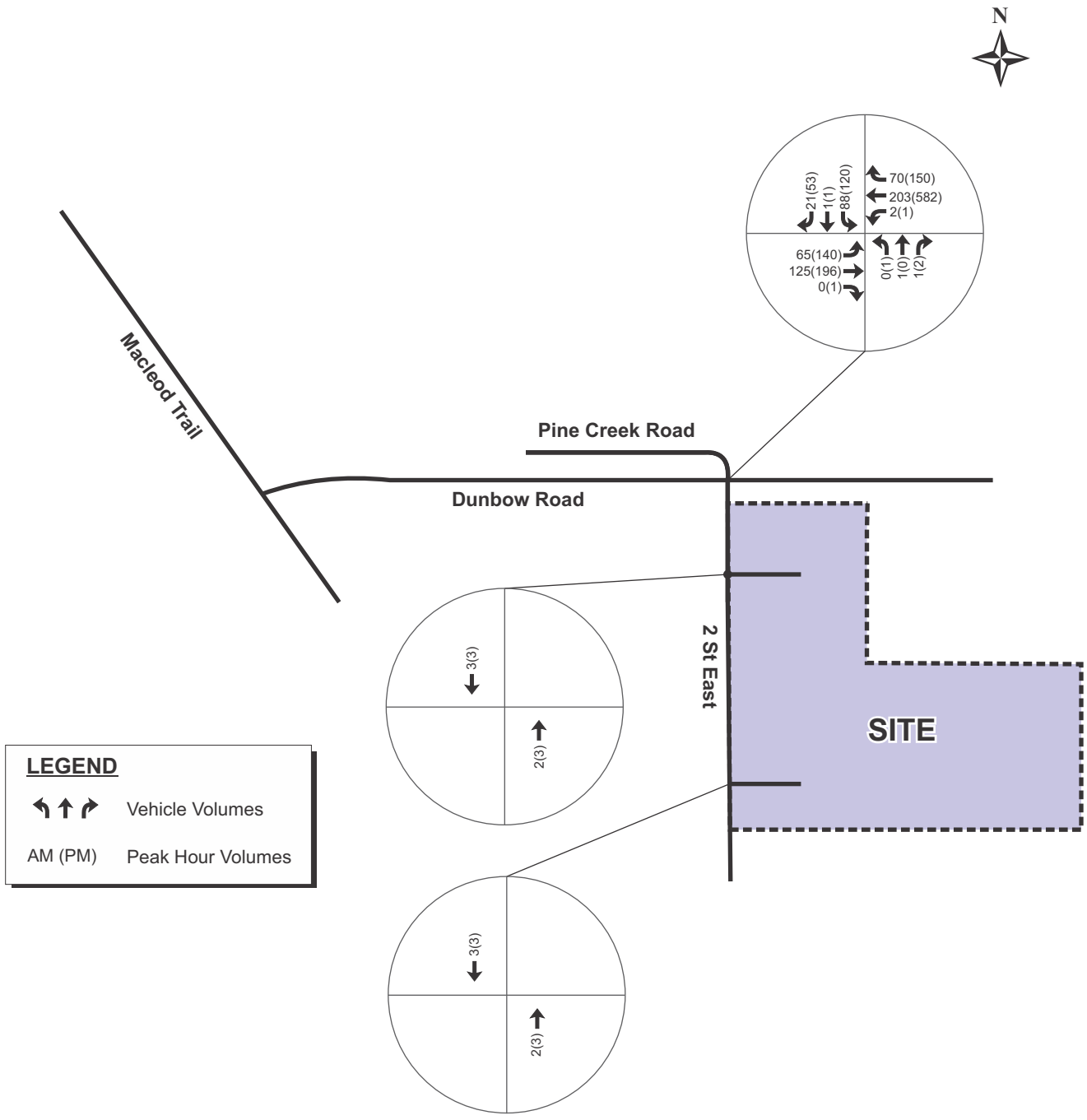


Exhibit 4.3

Opening Day Background Volumes

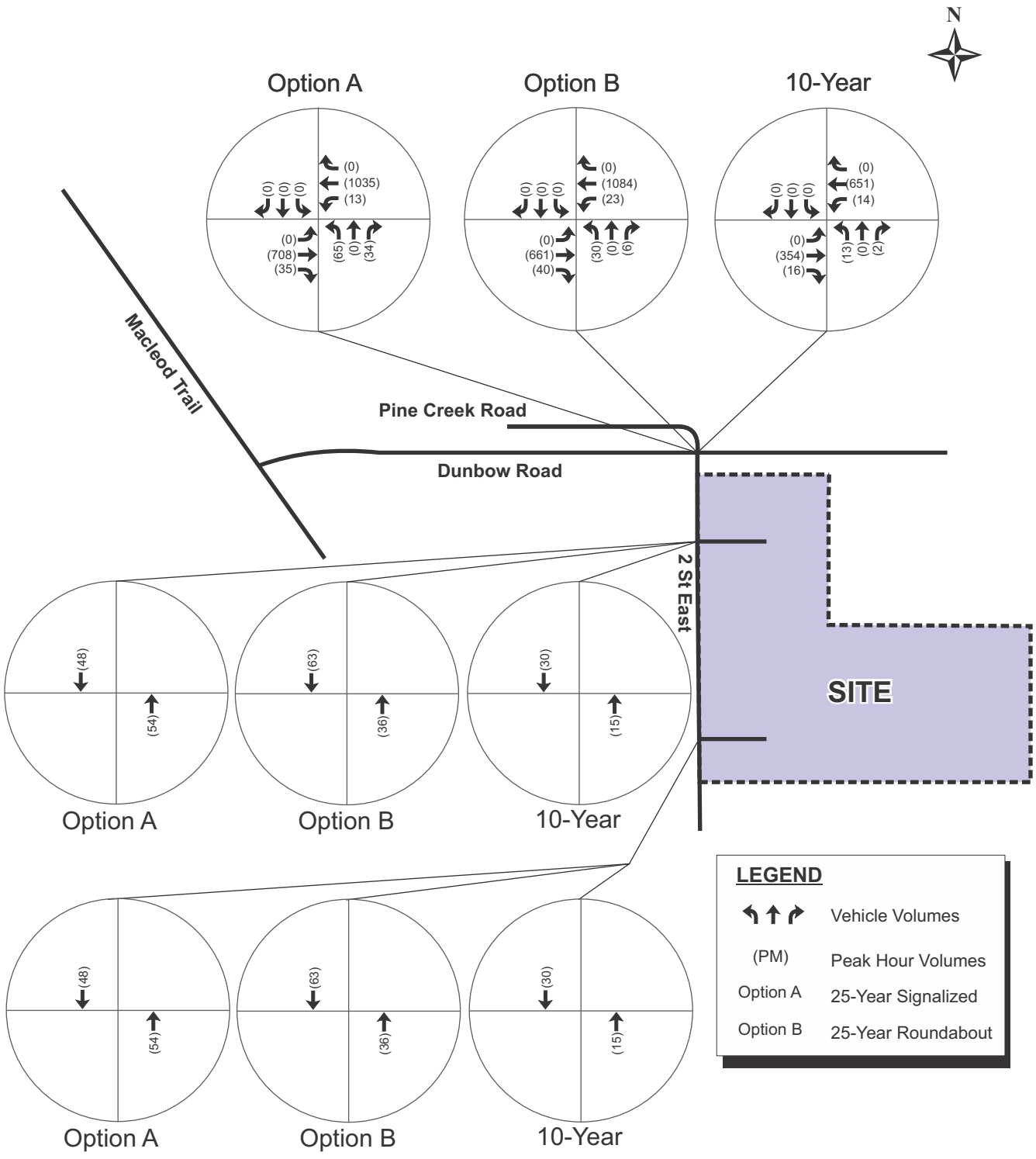


Exhibit 4.4

Long Term Background Volumes

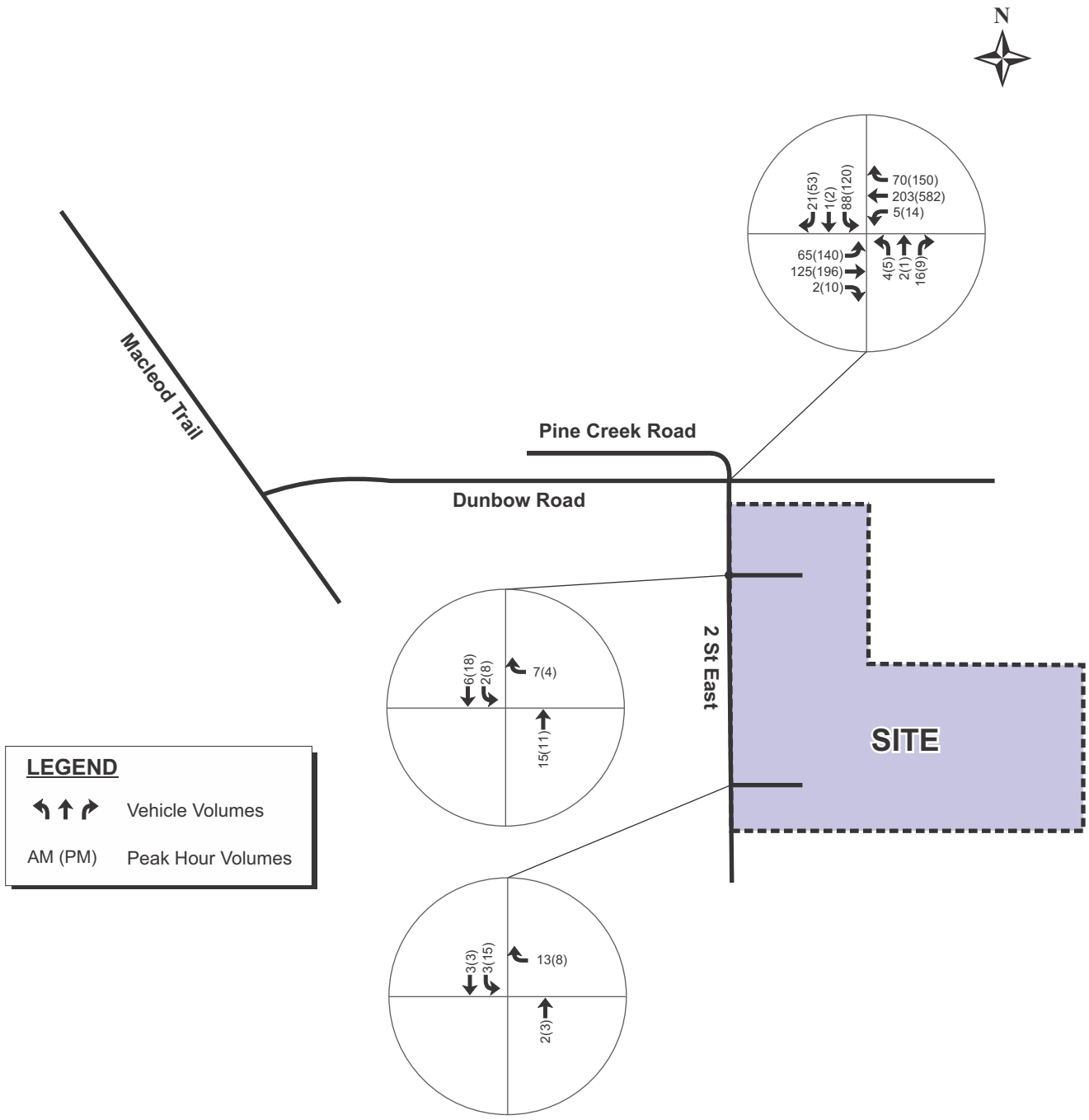


Exhibit 4.5

Opening Day After Development Traffic Volumes

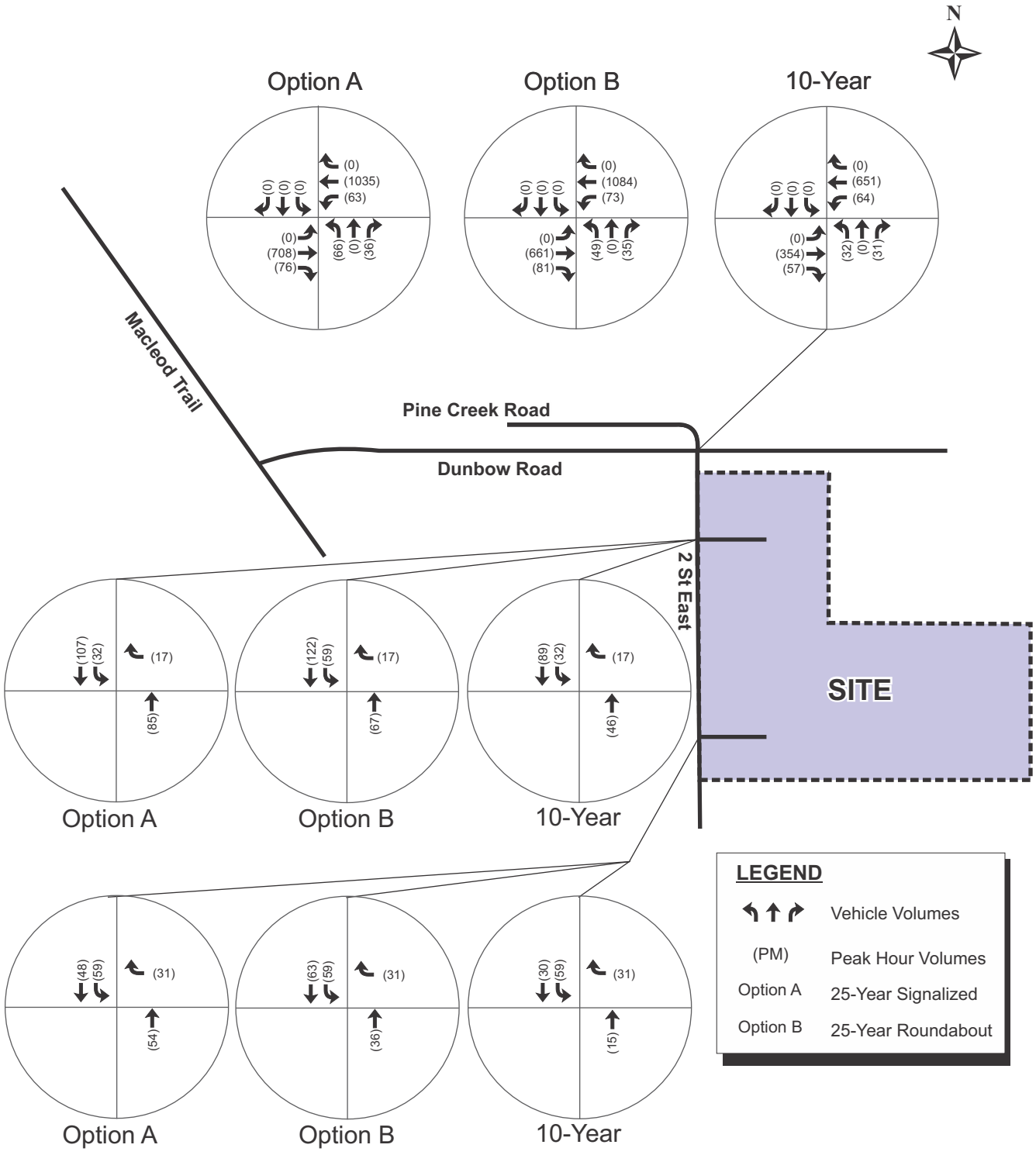


Exhibit 4.6

Long Term After Development Traffic Volumes

4.5 Intersection Analysis

Synchro 9.2 traffic analysis software was used to review intersection operational conditions based on the methods outlined in the Highway Capacity Manual 2000. Traffic operations were assessed using the performance measures of volume-to-capacity (v/c) and Level of Service (LOS).

The volume-to-capacity (v/c) ratio of an intersection movement represents the ratio between the demand volume and available capacity. AT guidelines accept a v/c ratio of 0.85 or less. The Level of Service (LOS) rating is based on average vehicle delays ranging from LOS A (minimal delay) to LOS F (significant delay). AT guidelines accept an overall LOS C at highway access intersections with a LOS D on any single approach at full-build out.

Sidra 9.0 traffic analysis software was used to review roundabout intersection operational conditions based on the methods outlined in the Highway Capacity Manual. Traffic operations were assessed using the performance measures of volume-to-capacity (v/c) and Level of Service (LOS).

The volume-to-capacity (v/c) ratio of an intersection represents the ratio between the demand volume and available capacity. A v/c ratio 0.90 or less is acceptable and represents optimized conditions. The Level of Service (LOS) rating is based on average vehicle delays ranging from LOS A (minimal delay) to LOS F (significant delay).

Intersection capacity analysis was completed for the following scenarios:

- Background
  - Existing
  - Opening Day (2024)
  - 10 Year Horizon
  - 25 Year Horizon
- After Development
  - Opening Day (2024)
  - 10 Year Horizon
  - 25 Year Horizon

The analysis is completed as per Alberta Transportation TIA guidelines with a saturation flow rate of 1900 vehicles per hour and a peak hour factor of 0.92. The analysis uses a minimum hourly volume of 5 vehicles per movement for the Long Term horizon. The volume to capacity (v/c) ratio, level of service, average control delay (in seconds), and 95th percentile queue (in metres) are summarized in this report. Synchro output reports are provided in **Appendix C**.

As noted earlier, the network assumptions used in the base analysis included the following:

- Opening Day: Network as per existing.
- 10 Year Horizon: Heritage Lake Road re-aligned, with the north leg of 2 Street E closed to traffic other than the Fire Station.
- 25 Year Horizon: Signalization or roundabout at the Dunbow Road/2 Street intersection, and the widening of Dunbow Road to four core lanes.

4.5.1 Background Analysis

Existing and Opening Day Background Conditions

Existing intersection analysis is summarized in **Table 4.3** based on the intersection configurations illustrated in Exhibit 4.1 and volumes illustrated in Exhibit 4.2.

Table 4.3: Existing Intersection Analysis

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
2 Street E & Dunbow Road *(N/S Stop Control)*	EBL	1	0.06	A	8.1	<5	0.18	B	10.2	6
	EBTR	1	0.08	A	0.0	<5	0.12	A	0.0	<5
	WBLT	1	<0.02	A	0.1	<5	<0.02	A	0.0	<5
	WBR	1	0.04	A	0.0	<5	0.10	A	0.0	<5
	NB	1	<0.02	B	11.3	<5	<0.02	C	17.4	<5
	SBLT	1	0.21	B	14.8	7	0.85	F	93.6	46
	SBR	1	0.03	A	9.6	<5	0.12	B	13.5	<5
	Overall		-	*A*	*3.7*	-	-	*B*	*11.1*	-

Opening Day Background intersection analysis is summarized in **Table 4.4** based on the volumes illustrated in Exhibit 4.3 and the existing intersection layout.

Table 4.4: Opening Day Background Intersection Analysis

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
2 Street E & Dunbow Road *(N/S Stop Control)*	EBL	1	0.06	A	8.1	<5	0.18	B	10.3	6
	EBTR	1	0.08	A	0.0	<5	0.13	A	0.0	<5
	WBLT	1	<0.02	A	0.1	<5	<0.02	A	0.0	<5
	WBR	1	0.04	A	0.0	<5	0.10	A	0.0	<5
	NB	1	<0.02	B	11.4	<5	<0.02	C	18.1	<5
	SBLT	1	0.21	C	15.1	7	0.90	F	109.2	50
	SBR	1	0.03	A	9.7	<5	0.12	B	13.8	<5
	Overall		-	*A*	*3.7*	-	-	*B*	*12.4*	-

The Existing and Opening Day analysis showed the southbound left turn (SBLT) movement to operate at capacity without consideration of site generated traffic. This suggests that the County may wish to accelerate the improvement to re-align Heritage Lake Road and to limit the north leg of 2 Street E to Fire Station Access.

Additional analysis was then completed with the north leg of the Dunbow Road/2 Street E intersection being only used by the Fire Hall, essentially revising the intersection (operationally) to a T-intersection as outlined in the approved Watt study. It was assumed that this improvement would be completed in conjunction with the re-alignment of Heritage Lake Drive to Dunbow Road.

Table 4.5: Opening Day Background Intersection Analysis - Revised Layout

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR v/c	AM PEAK HOUR LOS	AM PEAK HOUR Delay	AM PEAK HOUR Queue	PM PEAK HOUR v/c	PM PEAK HOUR LOS	PM PEAK HOUR Delay	PM PEAK HOUR Queue
2 Street E & Dunbow Road *(NB Stop Control)*	EB	1	0.14	A	0.0	<5	0.20	A	0.0	<5
	WB	1	<0.02	A	0.0	<5	<0.02	A	0.0	<5
	NB	1	<0.02	B	0.1	<5	<0.02	C	16.0	<5
	Overall		-	*A*	*0.1*	-	-	*A*	*0.1*	-

The results of this improved condition are summarized in Table 4.5. It can be seen that the issue related to the SBLT is resolved with the intersection improvement. It is therefore recommended that the County consider accelerating this improvement with or without consideration of the site that is the subject of this study.

Long Term Background Conditions

Long Term Background intersection analysis is summarized in **Table 4.6** based on the volumes illustrated in Exhibit 4.4. for the 10 and 25 Year horizons, respectively.

As noted earlier, the 10 Year Horizon assumed the re-alignment of Heritage Lake Road to be in place, with the north leg of 2 Street SE used only by the Fire Hall; and the 25 Year Horizon further assumed 4-lanes on Dunbow Road as well as the inclusion of signalization or a roundabout at the 2 Street E intersection.

Table 4.6: 10-Year Background Intersection Analysis

INTERSECTION	MOVEMENT & LANES		PM PEAK HOUR v/c	PM PEAK HOUR LOS	PM PEAK HOUR Delay	PM PEAK HOUR Queue
2 Street E & Dunbow Road *(N/S Stop Control)*	EB	1	0.24	A	0.0	<5
	WB	1	<0.02	A	0.3	<5
	NB	1	0.07	C	21.2	<5
	Overall		-	*A*	*0.5*	-

Table 4.7: 25-Year Background Intersection Analysis

INTERSECTION	MOVEMENT & LANES		PM PEAK HOUR v/c	PM PEAK HOUR LOS	PM PEAK HOUR Delay	PM PEAK HOUR Queue
2 Street E & Dunbow Road *(Signalized)*	EB	2	0.35	A	4.4	23
	WB	2	0.52	A	5.7	39
	NB	1	0.20	C	21.2	15
	Overall		-	*A*	*5.6*	-
2 Street E & Dunbow Road *(Roundabout)*	EB	2	0.29	A	5.3	12
	WB	2	0.46	A	7.4	23
	NB	1	0.06	A	6.3	<5
	Overall		-	*A*	*6.6*	-

The results of the Long Term Horizon analysis at the 10 and 25 Year Horizons confirmed that with the inclusion of the improvements noted, the study area intersection would be expected to continue to operate within acceptable capacity parameters, and that It would do as either a signalized intersection or a roundabout.

4.5.2 After Development

Opening Day

Opening Day After Development intersection analysis is summarized in **Table 4.8** based on the volumes illustrated in Exhibit 4.5. It is noted that the site access locations have only been analyzed as part of the full build-out scenario at the 25-Year horizon as approved by the County.

Table 4.8: Opening Day After Development Intersection Analysis

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
2 Street E & Dunbow Road *(N/S Stop Control)*	EBL	1	0.06	A	8.1	<5	0.18	B	10.3	6
	EBTR	1	0.08	A	0.0	<5	0.13	A	0.0	<5
	WBLT	1	<0.02	A	0.2	<5	<0.02	A	0.3	<5
	WBR	1	0.04	A	0.0	<5	0.10	A	0.0	<5
	NB	1	0.03	B	10.3	<5	0.06	C	20.5	<5
	SBLT	1	0.23	C	15.8	7	0.98	F	134.4	55
	SBR	1	0.03	A	9.7	<5	0.12	B	13.8	<5
	Overall		-	*A*	*4.0*	-	-	*B*	*14.8*	-
2 Street E & Dunbow Road *(Improved Intersection; NB Stop Control)*	EB	1	0.14	A	0.0	<5	0.21	A	0.0	<5
	WB	1	<0.02	A	0.2	<5	<0.02	A	0.0	<5
	NB	1	0.04	B	10.5	<5	0.05	C	15.8	<5
	Overall		-	*A*	*0.5*	-	-	*A*	*0.5*	-

The results of this analysis confirmed that the addition of the Opening Day site traffic on the existing road network does not have a significant effect on the capacity results. The intersection of Dunbow Road/2 Street E operates in a manner similar to what would be the case without consideration of site traffic. The analysis also showed that with the recommended improvement identified in the Background analysis to accelerate the re-alignment of Heritage Lake Road and to limit the north leg of 2 Street E to Fire Station Access, the intersection would then operate well within acceptable capacity parameters.

Long Term

Long Term After Development intersection analysis is summarized in **Table 4.9** & **Table 4.10** based on the volumes illustrated in Exhibit 4.6.

Table 4.9: 10-Year After Development Intersection Analysis

INTERSECTION	MOVEMENT & LANES		PM PEAK HOUR v/c	LOS	Delay	Queue
2 Street E & Dunbow Road *(N/S Stop Control)*	EB	1	0.26	A	0.0	<5
	WB	1	0.06	A	1.6	<5
	NB	1	0.26	C	22.9	8
	Overall		-	*A*	*2.6*	-

Table 4.10: 25-Year After Development Intersection Analysis

INTERSECTION	MOVEMENT & LANES		PM PEAK HOUR v/c	LOS	Delay	Queue
2 Street E & Dunbow Road *(Signalized)*	EB	2	0.37	A	4.6	28
	WB	2	0.60	A	7.0	51
	NB	1	0.34	B	18.3	20
	Overall		-	*A*	*6.6*	-
2 Street E & Dunbow Road *(Roundabout)*	EB	2	0.32	A	5.8	13
	WB	2	0.49	A	7.9	26
	NB	1	0.14	A	7.3	5
	Overall		-	*A*	*7.1*	-
2 Street E & Access 1 *(WB Stop Control)*	WB	1	0.02	A	8.9	<5
	NB	1	0.05	A	0.0	<5
	SB	1	0.02	A	1.9	<5
	Overall		-	A	1.7	-
2 Street E & Access 2 *(WB Stop Control)*	WB	1	0.03	A	8.8	<5
	NB	1	0.03	A	0.0	<5
	SB	1	0.04	A	4.2	<5
	Overall		-	A	3.8	-

The results of the Long Term analysis show the study intersections to operate well within acceptable capacity parameters with the assumed Background network improvements in place along Dunbow Road.

4.6 Roadway Classification

To review roadway classifications and capacities, daily vehicle traffic volumes were calculated and compared to available environmental guidelines. Environmental guidelines represent the desired daily volume range for a roadway, whereas the actual physical capacity can be higher.

Background daily volumes were determined by applying a standard factor of 10 to observed or forecast PM peak hour volumes. The resulting daily volume analysis is summarized in **Table 4.11**.

Table 4.11: Daily Volume Analysis - 25 Year Long Term Horizon

ROADWAY	EXISTING		LONG TERM (25 YEAR)	
	CLASSIFICATION	DAILY VOLUME	CLASSIFICATION	DAILY VOLUME
Dunbow Road	Major Collector	10,000 vpd	Major Collector	18,000 to 19,000 vpd
2 Street E	Hamlet Road	100 vpd	Foothills Standard	2,000 to 2,500 vpd

Dunbow Road is classified as Major Collector as per the approved Watt study. It is assumed that as part of the upgrade to 4 lanes at the 25 Year horizon, the road structure will be built to accommodate the expected daily traffic. The additional daily traffic due the proposed development is expected to increase the overall daily volume by approximately 1000 vehicles per day (vpd) which does not change the requirements associated with Dunbow Road.

Based on discussions with the County, 2 Street is currently classified as a Hamlet Standard Road under current Foothills guidelines but with a larger right-of-way (ROW) of 30 metres. The Hamlet Road standard includes 7.0 metres of pavement, 8.8 metre subgrade and 20 metre ROW. By comparison, on-site measurements by Bunt confirmed that 2 Street E currently provides approximately 7.7 to 8.25 metres of pavement with 8.5 to 9.3 metres of subgrade within a 30 metre ROW within the vicinity of the site.

Based on discussions with Foothills, the threshold for upgrading a Hamlet Road such as 2 Street E is 750 VPD. At this threshold the requirement calls for an upgrade to a 9.0 metre paved surface with approximately 10.8 metre of subgrade within a 30 metre ROW.

The Opening Day daily volumes forecast on 2 Street E are expected to be less than 500 vpd and therefore 2 Street E will not be required to be upgraded for Opening Day. The upgrade to the full Foothills Standard noted above (9.0 metre pavement on a 10.8 metre subgrade) will be required to be in place prior to full build out of the site once daily volumes exceed 750 vpd. This will need to be monitored as part of development applications beyond Opening Day. This upgrade will extend from the south site access north to Dunbow Road.

4.7 Warrants

4.7.1 Intersection Turn Warrants

The intersection of Dunbow Road/2 Street E was assessed for Opening Day and 10 Year Horizon conditions, given that the 25 Year Horizon was assumed to see the intersection operating as a signalized intersection or roundabout per the Watt study for Dunbow Road.

Intersection type warrants were performed at 2 Street E for the Opening Day and 10-Year horizons.

All analyses followed the process outlined in the AT *Highway Geometric Design Guide*.

The AT intersection warrant analysis is used at unsignalized at-grade intersections to determine if a left turn is required to eliminate interference caused by standing vehicles waiting to turn or a right turn lane is required to reduce obstruction to through movements. Alberta Transportation intersection turning warrants are included in **Appendix D**.

Right Turn Warrants

The AT exclusive right turn lane warrant for a two-lane undivided highway states that three separate conditions should generally be met in order to warrant the need for such a lane. These criteria are:

- Average Annual Daily Traffic (AADT) volumes on the main road are greater than or equal to 1,800 vehicles per day (vpd);

- The intersected road exhibits daily traffic volumes greater than or equal to 900 vpd; and
- The right turn movement in question is greater than or equal to 360 vpd.

Left Turn Warrants

According to AT guidelines, the following two conditions should generally be met to warrant the need to construct an exclusive left turn taper and/or by-pass through lane on a two-lane highway:

- The peak hour opposing traffic volumes are greater than or equal to 100 vpd; and
- A minimum of five percent of advancing traffic is left turning during the peak hour periods.

Today the intersection of 2 Street E and Dunbow Road operates as a modified Type IVb intersection per AT guidelines with a separate eastbound left turn lane, plus a westbound right turn lane and acceleration lanes for the southbound right and left movements. This lane configuration was assumed to remain for the Opening Day horizon.

At the 10 Year horizon assumed that the improvements to Dunbow Road as outline in the Watt study are in place.

AT intersection turn warrants confirmed the following:

- Existing and Opening Day Background: The existing Type IVb intersection configuration satisfies the warrant requirements.
- Opening Day After Development: This was found to be unaffected by the addition of site generated traffic. The exiting modified Type IVb continues to be sufficient.
- 10 Year Horizon, Background: Assuming the inclusion of the re-alignment of Heritage Lake Road and the closure of 2 street E north of Dunbow Road to all but fire station traffic, the intersection would continue to be adequately serviced as a Type IVb.
- 10 Year Horizon, Full Development: The closure of the north leg to all but Fire Station traffic and the addition of the balance of the site generated traffic result in the need for a modification to the Type IVb configuration to create a mirror image but with the current EBLT lane replaced with a WBLT lane.

The standard AT drawing showing a typical Type IVb intersection are contained in **Appendix D**.

The issue at this location is the overlapping impacts of the growth in Background traffic on Dunbow Road, the planned re-alignment of Heritage Lake Road and the corresponding closure of 2 Street E north of Dunbow to all but Fire Station Traffic, and the new traffic added by the subject site. Once the re-alignment is complete, the needs at the Dunbow Road/2 Street E intersection change, ultimately requiring the current eastbound left turn lane to be replaced with a westbound left turn lane. A cursory review of the intersection suggests that there is sufficient pavement width in the vicinity of the intersection to mirror image the geometry to accommodate the 10-Year Horizon with full development of the subject site. It is also noted that this would be an interim improvement that would be in place only until Dunbow Road is upgraded to 4-lanes and the intersection either signalized or replaced with a roundabout. The intersection of Dunbow Road/4 Street E will need to be considered when developing the westbound left turn taper,

with the understanding that the Watt study has proposed a right in / right out at this location in the future. Today, the existing eastbound right lane essentially begins at this intersection.

4.7.2 Illumination Warrant

An illumination warrant was completed at the Dunbow Road/2 Street E intersection based on the Transportation Association of Canada (TAC) *Illumination of Isolated Rural Intersections* guide. The warrant for illumination is used to determine if lighting at an intersection is required based on several different factors such as geometrics, operations, environmental issues, and collision history.

Currently the 2 Street E/Dunbow Road intersection is currently illuminated with delineation lighting. As such, the warrant was completed to determine whether interim upgrades to this lighting would be required prior to the intersection being ultimately signalized or developed as a roundabout. In the case of signalization or a roundabout, full illumination would be included as part of the upgrade as a matter of course.

TAC guidelines state full illumination is warranted at unsignalized intersections where a total score of 240 or more points is achieved. Partial or delineation lighting may be considered at intersections with a score of 120 points or more (partial illumination if 80/120 points achieved in Geometric score; delineation lighting if 120+ points achieved overall).

The illumination warrant results are summarized in **Table 4.12** and are attached in **Appendix D**.

Table 4.12: Illumination Warrant Summary

INTERSECTION	HORIZON	ILLUMINATION SCORE	COMMENT
2 Street E & Dunbow Road	Opening Day Background	161	Delineation Lighting Warranted
	Opening Day	161	Delineation Lighting Warranted
	10 Year Background	81	Not warranted
	10 Year	141	Delineation Lighting Warranted

The illumination warrant review indicates that delineation lighting is warranted at the Opening Day and 10 Year horizon, which is currently in place today. The 10 Year background was not warranted due shift of traffic on the north leg to Heritage Lake Drive, which was the driving factor for the warrant being met. It is noted that no crash data was available for this location, nor was it highlighted as an issue by Foothills. A sensitivity analysis was undertaken to understand how many nighttime crashes per year would have to occur to warrant full lighting. If 3 or more nighttime crashes occurred per year full lighting would be required.

Since the development of the subject site will not materially affect the warrant for illumination at this intersection, the current delineation lighting is adequate to accommodate the interim condition until such time as the intersection is upgraded to a signal or a roundabout. Note that if crash conditions result in sufficient crashes to warrant additional illumination, then the County may wish to upgrade the illumination, with or without consideration of site generated traffic.

APPENDIX A

Scope of Work

Leslie Radway

From: Leslie Radway
Sent: Tuesday, June 14, 2022 4:38 PM
To: Jeff Edgington
Subject: Re: Heritage Crossing - TIA Scope

Great. Thanks!

From: Jeff Edgington <Jeff.Edgington@FoothillsCountyAB.ca>
Sent: Tuesday, June 14, 2022 4:32 PM
To: Leslie Radway <lradway@bunteng.com>
Subject: RE: Heritage Crossing - TIA Scope

Seems correct .

From: Leslie Radway <lradway@bunteng.com>
Sent: June 14, 2022 4:18 PM
To: Jeff Edgington <Jeff.Edgington@FoothillsCountyAB.ca>
Subject: Heritage Crossing - TIA Scope

Hi Jeff - Following up from our conversation this morning. Based on our discussion, I have put together what I see the as the main analysis points in the TIA.

- Opening Day + Site based on the existing network to check whether we need to upgrade anything at the intersection of 2nd Street / Dunbow Road today.
- Opening Day, 10 Year and 25 Year daily volume check on 2nd Street using Watt's numbers plus our site to see if we need to upgrade the road now, or in 10 years, or at 25 years.
- 25 Years + Site on the Watt long term network to check whether or not the 2nd Street intersection is materially affected.
- Review access intersections along 2nd Street at the 25 year horizon. Volumes will be provided at these access intersections for all horizons, but since there is very little traffic on 2nd Street south of Dunbow, if they operate at 25-year, they will operate at the other horizons.
- Review of the cross-section of 2nd Street (south of Dunbow Road) and recommend required improvements.

Adding all of our site traffic to the long term, maybe double counting some but if we do that and all continues to function at appropriate levels, that will provide the County with that extra surety.

I think this covers the key points. Please review and get back to me with any questions or comments.

thank-you

Leslie

Leslie Radway, P.Eng. | Transportation Engineer

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w www.bunteng.com

Calgary | Edmonton | Kelowna | Vancouver | Victoria

APPENDIX B

Traffic Data

Intersection Turning Movement Count Summary: 2 Street East & Dunbow Road

N/S Road: 2 Street East
E/W Road: Dunbow Road
Count Date: June 30, 2022 Thursday
Weather: Clear
Road Condition: Dry
Project #: 02-22-0118

AM Peak Hour: 8:00 AM to 9:00 AM
Mid-day Peak Hour: 11:30 AM to 12:30 PM
PM Peak Hour: 5:00 PM to 6:00 PM

PHF (AM Peak Hour): 0.82
PHF (Mid-day Peak Hour): 0.89
PHF (PM Peak Hour): 0.91

	2 Street East												Dunbow Road																			
	Northbound (South Leg)						Southbound (North Leg)						Westbound (East Leg)						Eastbound (West Leg)								Pedestrians				Cyclists			
Time Starting	Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right		Total Vehicle		West	East	North	South				
	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	5 Min	Hourly	Side	Side	Side	Side	NB	SB	WB	EB
7:00	0	0	0	0	0	0	23	1	0	0	2	0	0	0	27	3	5	1	7	1	26	2	0	0	98		0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	11	1	0	0	5	0	0	0	32	3	5	1	6	4	34	4	0	0	106		0	0	0	0	0	0	0	0
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7:45	0	0	0	0	0	0	27	2	1	0	6	0	0	0	46	6	8	0	11	1	43	0	0	0	151	480	0	0	0	0	0	0	0	0
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2 Hour Total	0	0	1	0	2	0	170	8	2	0	35	4	2	0	322	37	89	12	91	13	239	17	0	0			0	0	0	0	0	0	0	0
		0		1		2		178		2		39		2		359		101		104		256		0	1044									
Peak Hour Total	**0**	**0**	**1**	**0**	**1**	**0**	**85**	**3**	**1**	**0**	**18**	**3**	**2**	**0**	**177**	**18**	**62**	**8**	**59**	**6**	**114**	**6**	**0**	**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
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		2		2		2		221		3		85		0		377		207		191		334		0	1424									
Peak Hour Total	**0**	**1**	**0**	**1**	**1**	**1**	**112**	**3**	**0**	**1**	**39**	**7**	**0**	**0**	**198**	**12**	**102**	**5**	**90**	**6**	**167**	**5**	**0**	**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
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Peak Hour Total	**0**	**0**	**0**	**0**	**1**	**0**	**89**	**2**	**0**	**0**	**52**	**4**	**1**	**0**	**905**	**23**	**158**	**1**	**102**	**4**	**235**	**10**	**0**	**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
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6 Hour Total	**1**	**1**	**2**	**1**	**4**	**1**	**578**	**26**	**5**	**2**	**206**	**21**	**4**	**0**	**1967**	**102**	**585**	**25**	**469**	**35**	**975**	**66**	**1**	**0**			**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**
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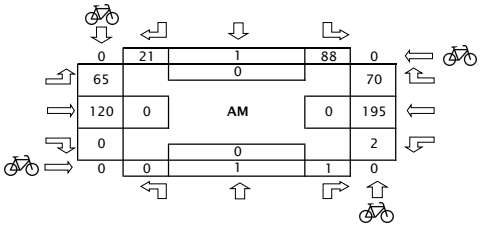
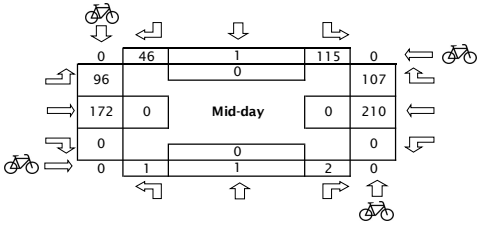
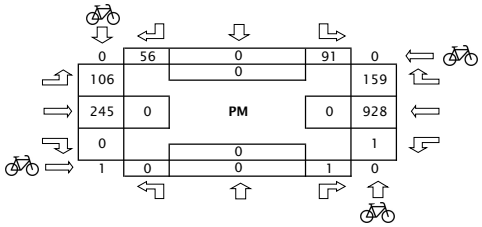
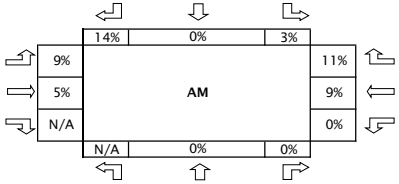
Peak Hour Volumes

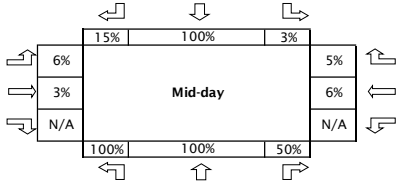


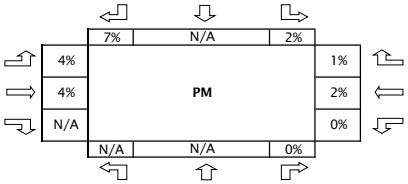




Heavy Vehicle Percentage







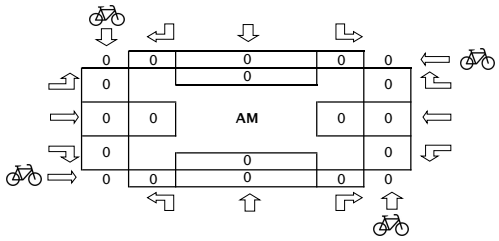
Intersection Turning Movement Count Summary: 2 Street East & Dunbow Road

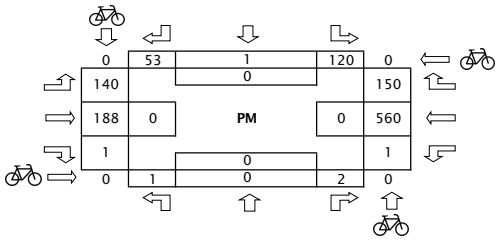
N/S Road: 2 Street East
E/W Road: Dunbow Road
Count Date: July 21, 2022 Thursday
Weather: Sunny
Road Condition: Dry
Project #: 02-22-0118

AM Peak Hour: to
PM Peak Hour: 4:30 PM to 5:30 PM
PHF (AM Peak Hour):
PHF (PM Peak Hour): 0.96

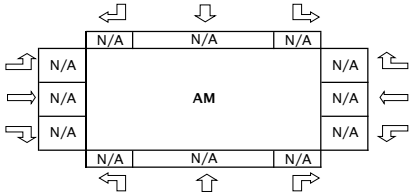
	2 Street East								Dunbow Road																					
	Northbound (South Leg)						Southbound (North Leg)						Westbound (East Leg)						Eastbound (West Leg)								Pedestrians				Cyclists			
	Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right		Total Vehicle		West	East	North	South				
Time Starting	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	5 Min	Hourly	Side	Side	Side	Side	NB	SB	WB	EB
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Hour Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	0		0		0		0		0		0		0		0		0		0		0		0		0									
Peak Hour Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	0		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**			**0**								
16:00	0	0	0	0	0	0	33	4	0	0	10	1	0	0	55	5	29	2	27	1	39	3	0	0	209		0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	31	1	0	0	8	2	0	0	76	4	26	1	32	3	48	1	1	0	234		0	0	0	0	0	0	2	0
16:30	0	0	0	0	2	0	29	2	0	0	14	0	0	0	116	5	43	3	33	1	49	5	0	0	302		0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	36	3	0	0	13	2	1	0	137	6	29	0	37	1	46	4	0	1	316	1061	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	29	0	0	0	10	2	0	0	138	5	35	2	33	0	41	0	0	0	295	1147	0	0	0	0	0	0	0	0
17:15	1	0	0	0	0	0	19	2	1	0	11	1	0	0	147	6	38	0	35	0	43	0	0	0	304	1217	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	25	3	0	0	10	0	1	0	103	3	31	1	43	0	43	3	0	0	266	1181	0	0	0	0	0	0	0	0
17:45	1	0	0	0	0	0	33	1	0	0	10	0	1	0	77	5	38	1	44	0	33	4	2	0	250	1115	0	0	0	0	0	0	0	0
2 Hour Total	2	0	0	0	2	0	235	16	1	0	86	8	3	0	849	39	269	10	284	6	342	20	3	1			0	0	0	0	0	0	2	0
	2		0		2		251		1		94		3		888		279		290		362		4		2176									
Peak Hour Total	**1**	**0**	**0**	**0**	**2**	**0**	**113**	**7**	**1**	**0**	**48**	**5**	**1**	**0**	**538**	**22**	**145**	**5**	**138**	**2**	**179**	**9**	**0**	**1**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1		**0**		**2**		**120**		**1**		**53**		**1**		**560**		**150**		**140**		**188**		**1**			**1217**								
4 Hour Total	**2**	**0**	**0**	**0**	**2**	**0**	**235**	**16**	**1**	**0**	**86**	**8**	**3**	**0**	**849**	**39**	**269**	**10**	**284**	**6**	**342**	**20**	**3**	**1**			**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**
	2		**0**		**2**		**251**		**1**		**94**		**3**		**888**		**279**		**290**		**362**		**4**			**2176**								

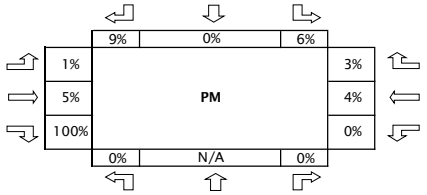
Peak Hour Volumes





Heavy Vehicle Percentage





APPENDIX C

Synchro & SIDRA Reports

MOVEMENT SUMMARY

Site: 101 [Background (Site Folder: 10 Year)]

PM Peak
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: 2 Street E														
3	L2	13	0.0	14	0.0	0.018	4.1	LOS A	0.1	0.5	0.46	0.31	0.46	43.4
18	R2	2	0.0	2	0.0	0.018	4.1	LOS A	0.1	0.5	0.46	0.31	0.46	43.8
Approach		15	0.0	16	0.0	0.018	4.1	LOS A	0.1	0.5	0.46	0.31	0.46	43.5
East: Dunbow Road														
1	L2	14	0.0	15	0.0	0.558	8.9	LOS A	4.7	37.0	0.15	0.04	0.15	42.4
6	T1	651	5.0	708	5.0	0.558	9.0	LOS A	4.7	37.0	0.15	0.04	0.15	48.5
Approach		665	4.9	723	4.9	0.558	9.0	LOS A	4.7	37.0	0.15	0.04	0.15	48.3
West: Dunbow Road														
2	T1	354	5.0	385	5.0	0.310	5.6	LOS A	1.7	13.8	0.10	0.03	0.10	51.7
12	R2	16	0.0	17	0.0	0.310	5.4	LOS A	1.7	13.8	0.10	0.03	0.10	44.3
Approach		370	4.8	402	4.8	0.310	5.6	LOS A	1.7	13.8	0.10	0.03	0.10	51.5
All Vehicles		1050	4.8	1141	4.8	0.558	7.7	LOS A	4.7	37.0	0.14	0.04	0.14	49.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Full Development (Site Folder: 10 Year)]

PM Peak
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: 2 Street E														
3	L2	32	0.0	35	0.0	0.075	4.6	LOS A	0.3	2.4	0.48	0.37	0.48	44.7
18	R2	31	0.0	34	0.0	0.075	4.6	LOS A	0.3	2.4	0.48	0.37	0.48	44.8
Approach		63	0.0	68	0.0	0.075	4.6	LOS A	0.3	2.4	0.48	0.37	0.48	44.8
East: Dunbow Road														
1	L2	64	0.0	70	0.0	0.611	10.1	LOS B	5.6	44.0	0.27	0.10	0.27	41.1
6	T1	651	5.0	708	5.0	0.611	10.2	LOS B	5.6	44.0	0.27	0.10	0.27	47.1
Approach		715	4.6	777	4.6	0.611	10.2	LOS B	5.6	44.0	0.27	0.10	0.27	46.7
West: Dunbow Road														
2	T1	354	5.0	385	5.0	0.363	6.4	LOS A	2.1	16.8	0.26	0.12	0.26	50.9
12	R2	57	0.0	62	0.0	0.363	6.3	LOS A	2.1	16.8	0.26	0.12	0.26	43.3
Approach		411	4.3	447	4.3	0.363	6.4	LOS A	2.1	16.8	0.26	0.12	0.26	50.1
All Vehicles		1189	4.2	1292	4.2	0.611	8.6	LOS A	5.6	44.0	0.28	0.12	0.28	47.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Background (Site Folder: 25 Year)]

PM Peak
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: 2 Street E														
3	L2	30	0.0	33	0.0	0.061	6.3	LOS A	0.2	1.8	0.60	0.56	0.60	41.3
18	R2	6	0.0	7	0.0	0.061	6.3	LOS A	0.2	1.8	0.60	0.56	0.60	42.0
Approach		36	0.0	39	0.0	0.061	6.3	LOS A	0.2	1.8	0.60	0.56	0.60	41.4
East: Dunbow Road														
1	L2	23	0.0	25	0.0	0.461	7.3	LOS A	2.9	23.0	0.18	0.06	0.18	43.7
6	T1	1084	5.0	1178	5.0	0.461	7.4	LOS A	2.9	23.0	0.18	0.06	0.18	49.9
Approach		1107	4.9	1203	4.9	0.461	7.4	LOS A	2.9	23.0	0.18	0.06	0.18	49.8
West: Dunbow Road														
2	T1	661	5.0	718	5.0	0.289	5.3	LOS A	1.4	11.4	0.12	0.04	0.12	52.0
12	R2	40	0.0	43	0.0	0.289	5.2	LOS A	1.4	11.4	0.12	0.04	0.12	44.4
Approach		701	4.7	762	4.7	0.289	5.3	LOS A	1.4	11.4	0.12	0.04	0.12	51.7
All Vehicles		1844	4.7	2004	4.7	0.461	6.6	LOS A	2.9	23.0	0.17	0.06	0.17	50.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

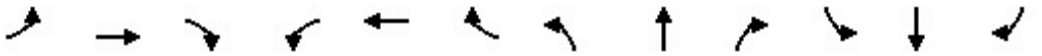
Site: 101 [Full Development (Site Folder: 25 Year)]

PM Peak
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: 2 Street E														
3	L2	49	0.0	53	0.0	0.143	7.3	LOS A	0.6	4.3	0.63	0.63	0.63	41.4
18	R2	35	0.0	38	0.0	0.143	7.3	LOS A	0.6	4.3	0.63	0.63	0.63	42.1
Approach		84	0.0	91	0.0	0.143	7.3	LOS A	0.6	4.3	0.63	0.63	0.63	41.7
East: Dunbow Road														
1	L2	73	0.0	79	0.0	0.489	7.8	LOS A	3.2	25.3	0.25	0.11	0.25	42.9
6	T1	1084	5.0	1178	5.0	0.489	7.9	LOS A	3.2	25.3	0.25	0.11	0.25	49.2
Approach		1157	4.7	1258	4.7	0.489	7.9	LOS A	3.2	25.3	0.25	0.11	0.25	48.9
West: Dunbow Road														
2	T1	661	5.0	718	5.0	0.321	5.8	LOS A	1.6	12.9	0.24	0.12	0.24	51.4
12	R2	81	0.0	88	0.0	0.321	5.7	LOS A	1.6	12.9	0.24	0.12	0.24	43.7
Approach		742	4.5	807	4.5	0.321	5.8	LOS A	1.6	12.9	0.24	0.12	0.24	50.8
All Vehicles		1983	4.4	2155	4.4	0.489	7.1	LOS A	3.2	25.3	0.26	0.13	0.26	49.3

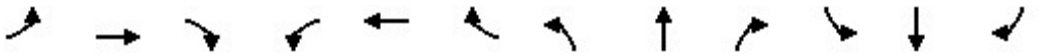
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	120	0	2	195	70	0	1	1	88	1	21
Future Volume (Veh/h)	65	120	0	2	195	70	0	1	1	88	1	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	130	0	2	212	76	0	1	1	96	1	23
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	288			130			512	564	130	490	488	212
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	288			130			512	564	130	490	488	212
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.1	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.5	4.0	3.4
p0 queue free %	94			100			100	100	100	79	100	97
cM capacity (veh/h)	1235			1468			441	412	925	464	455	799

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	71	130	214	76	2	97	23
Volume Left	71	0	2	0	0	96	0
Volume Right	0	0	0	76	1	0	23
cSH	1235	1700	1468	1700	570	464	799
Volume to Capacity	0.06	0.08	0.00	0.04	0.00	0.21	0.03
Queue Length 95th (m)	1.5	0.0	0.0	0.0	0.1	6.2	0.7
Control Delay (s)	8.1	0.0	0.1	0.0	11.3	14.8	9.6
Lane LOS	A		A		B	B	A
Approach Delay (s)	2.9		0.1		11.3	13.8	
Approach LOS					B	B	

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	38.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	188	1	1	560	150	1	0	2	120	1	53
Future Volume (Veh/h)	140	188	1	1	560	150	1	0	2	120	1	53
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	152	204	1	1	609	163	1	0	2	130	1	58
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	772			205			1178	1282	204	1121	1120	609
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	772			205			1178	1282	204	1121	1120	609
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	82			100			99	100	100	16	99	88
cM capacity (veh/h)	848			1378			128	137	841	155	171	482

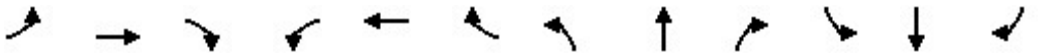
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	152	205	610	163	3	131	58
Volume Left	152	0	1	0	1	130	0
Volume Right	0	1	0	163	2	0	58
cSH	848	1700	1378	1700	294	155	482
Volume to Capacity	0.18	0.12	0.00	0.10	0.01	0.85	0.12
Queue Length 95th (m)	5.2	0.0	0.0	0.0	0.2	45.3	3.3
Control Delay (s)	10.2	0.0	0.0	0.0	17.4	93.6	13.5
Lane LOS	B		A		C	F	B
Approach Delay (s)	4.3		0.0		17.4	69.0	
Approach LOS					C	F	

Intersection Summary				
Average Delay	11.1			
Intersection Capacity Utilization	62.9%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	213	1	2	273	1	1
Future Volume (Veh/h)	213	1	2	273	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	232	1	2	297	1	1
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			238		544	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			238		544	242
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1335		499	795

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	233	299	2
Volume Left	0	2	1
Volume Right	1	0	1
cSH	1700	1335	613
Volume to Capacity	0.14	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.1	10.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.1	10.9
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	125	0	2	203	70	0	1	1	88	1	21
Future Volume (Veh/h)	65	125	0	2	203	70	0	1	1	88	1	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	136	0	2	221	76	0	1	1	96	1	23
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	297			136			526	579	136	504	503	221
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	297			136			526	579	136	504	503	221
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.1	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.5	4.0	3.4
p0 queue free %	94			100			100	100	100	79	100	97
cM capacity (veh/h)	1225			1461			431	404	918	453	446	790

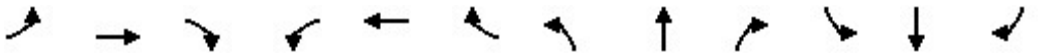
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	71	136	223	76	2	97	23
Volume Left	71	0	2	0	0	96	0
Volume Right	0	0	0	76	1	0	23
cSH	1225	1700	1461	1700	561	453	790
Volume to Capacity	0.06	0.08	0.00	0.04	0.00	0.21	0.03
Queue Length 95th (m)	1.5	0.0	0.0	0.0	0.1	6.4	0.7
Control Delay (s)	8.1	0.0	0.1	0.0	11.4	15.1	9.7
Lane LOS	A		A		B	C	A
Approach Delay (s)	2.8		0.1		11.4	14.1	
Approach LOS					B	B	

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	39.0%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	213	3	5	273	6	16
Future Volume (Veh/h)	213	3	5	273	6	16
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	232	3	5	297	7	17
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			240		550	244
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			240		550	244
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	98
cM capacity (veh/h)			1333		493	794

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	235	302	24
Volume Left	0	5	7
Volume Right	3	0	17
cSH	1700	1333	674
Volume to Capacity	0.14	0.00	0.04
Queue Length 95th (m)	0.0	0.1	0.9
Control Delay (s)	0.0	0.2	10.5
Lane LOS		A	B
Approach Delay (s)	0.0	0.2	10.5
Approach LOS			B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	29.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	125	2	5	203	70	4	2	16	88	1	21
Future Volume (Veh/h)	65	125	2	5	203	70	4	2	16	88	1	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	136	2	5	221	76	4	2	17	96	1	23
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	297			138			534	586	137	527	511	221
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	297			138			534	586	137	527	511	221
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.1	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.5	4.0	3.4
p0 queue free %	94			100			99	99	98	78	100	97
cM capacity (veh/h)	1225			1458			425	399	917	429	440	790

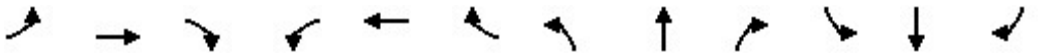
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	71	138	226	76	23	97	23
Volume Left	71	0	5	0	4	96	0
Volume Right	0	2	0	76	17	0	23
cSH	1225	1700	1458	1700	698	429	790
Volume to Capacity	0.06	0.08	0.00	0.04	0.03	0.23	0.03
Queue Length 95th (m)	1.5	0.0	0.1	0.0	0.8	6.9	0.7
Control Delay (s)	8.1	0.0	0.2	0.0	10.3	15.8	9.7
Lane LOS	A		A		B	C	A
Approach Delay (s)	2.8		0.1		10.3	14.7	
Approach LOS					B	B	

Intersection Summary				
Average Delay	4.0			
Intersection Capacity Utilization	39.3%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	316	2	1	732	2	2
Future Volume (Veh/h)	316	2	1	732	2	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	343	2	1	796	2	2
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			350		1152	354
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			350		1152	354
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1215		219	689

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	345	797	4
Volume Left	0	1	2
Volume Right	2	0	2
cSH	1700	1215	332
Volume to Capacity	0.20	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	16.0
Lane LOS		A	C
Approach Delay (s)	0.0	0.0	16.0
Approach LOS			C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	196	1	1	582	150	1	0	2	120	2	53
Future Volume (Veh/h)	140	196	1	1	582	150	1	0	2	120	2	53
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	152	213	1	1	633	163	1	0	2	130	2	58
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	796			214			1212	1316	214	1154	1153	633
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	796			214			1212	1316	214	1154	1153	633
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	82			100			99	100	100	11	99	88
cM capacity (veh/h)	830			1368			120	130	832	146	163	467

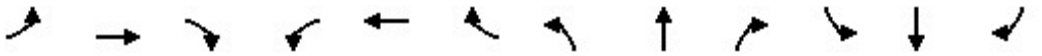
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	152	214	634	163	3	132	58
Volume Left	152	0	1	0	1	130	0
Volume Right	0	1	0	163	2	0	58
cSH	830	1700	1368	1700	279	147	467
Volume to Capacity	0.18	0.13	0.00	0.10	0.01	0.90	0.12
Queue Length 95th (m)	5.3	0.0	0.0	0.0	0.3	49.4	3.4
Control Delay (s)	10.3	0.0	0.0	0.0	18.1	109.2	13.8
Lane LOS	B		A		C	F	B
Approach Delay (s)	4.3		0.0		18.1	80.1	
Approach LOS					C	F	

Intersection Summary				
Average Delay	12.4			
Intersection Capacity Utilization	64.5%	ICU Level of Service		C
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	316	12	14	732	6	9
Future Volume (Veh/h)	316	12	14	732	6	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	343	13	15	796	7	10
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			361		1186	360
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			361		1186	360
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	99
cM capacity (veh/h)			1204		206	684

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	356	811	17
Volume Left	0	15	7
Volume Right	13	0	10
cSH	1700	1204	350
Volume to Capacity	0.21	0.01	0.05
Queue Length 95th (m)	0.0	0.3	1.2
Control Delay (s)	0.0	0.3	15.8
Lane LOS		A	C
Approach Delay (s)	0.0	0.3	15.8
Approach LOS			C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	196	10	14	582	150	5	1	9	120	2	53
Future Volume (Veh/h)	140	196	10	14	582	150	5	1	9	120	2	53
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	152	213	11	15	633	163	5	1	10	130	2	58
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	796			224			1244	1348	218	1190	1191	633
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	796			224			1244	1348	218	1190	1191	633
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	82			99			96	99	99	4	99	88
cM capacity (veh/h)	830			1357			113	123	826	135	153	467

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	152	224	648	163	16	132	58
Volume Left	152	0	15	0	5	130	0
Volume Right	0	11	0	163	10	0	58
cSH	830	1700	1357	1700	248	135	467
Volume to Capacity	0.18	0.13	0.01	0.10	0.06	0.98	0.12
Queue Length 95th (m)	5.3	0.0	0.3	0.0	1.6	54.7	3.4
Control Delay (s)	10.3	0.0	0.3	0.0	20.5	134.4	13.8
Lane LOS	B		A		C	F	B
Approach Delay (s)	4.2		0.2		20.5	97.6	
Approach LOS					C	F	

Intersection Summary				
Average Delay	14.8			
Intersection Capacity Utilization	65.7%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	354	16	14	651	13	2
Future Volume (Veh/h)	354	16	14	651	13	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	385	17	15	708	14	2
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			407		1142	404
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			407		1142	404
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		94	100
cM capacity (veh/h)			1158		219	646

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	402	723	16
Volume Left	0	15	14
Volume Right	17	0	2
cSH	1700	1158	239
Volume to Capacity	0.24	0.01	0.07
Queue Length 95th (m)	0.0	0.3	1.7
Control Delay (s)	0.0	0.3	21.2
Lane LOS		A	C
Approach Delay (s)	0.0	0.3	21.2
Approach LOS			C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	354	57	64	651	32	31
Future Volume (Veh/h)	354	57	64	651	32	31
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	385	62	70	708	35	34
Pedestrians	5			5	5	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			452		1274	426
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			452		1274	426
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		80	95
cM capacity (veh/h)			1115		173	628

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	447	778	69
Volume Left	0	70	35
Volume Right	62	0	34
cSH	1700	1115	269
Volume to Capacity	0.26	0.06	0.26
Queue Length 95th (m)	0.0	1.6	8.0
Control Delay (s)	0.0	1.6	22.9
Lane LOS		A	C
Approach Delay (s)	0.0	1.6	22.9
Approach LOS			C

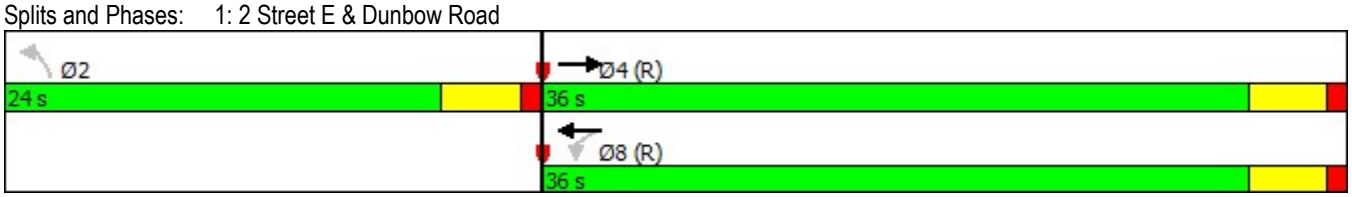
Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	708	35	13	1035	47	7
Future Volume (vph)	708	35	13	1035	47	7
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor	1.00			1.00	0.99	
Frt	0.993				0.982	
Flt Protected				0.999	0.959	
Satd. Flow (prot)	3379	0	0	3398	1765	0
Flt Permitted				0.944	0.959	
Satd. Flow (perm)	3379	0	0	3211	1758	0
Satd. Flow (RTOR)	12				8	
Confl. Peds. (#/hr)		5	5		5	5
Confl. Bikes (#/hr)		1				1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	0%	0%	5%	0%	0%
Adj. Flow (vph)	770	38	14	1125	51	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	808	0	0	1139	59	0
Number of Detectors	1		1	1	1	
Detector Template	Thru		Left	Thru	Left	
Leading Detector (m)	4.0		2.0	4.0	2.0	
Trailing Detector (m)	2.0		0.0	2.0	0.0	
Detector 1 Position(m)	2.0		0.0	2.0	0.0	
Detector 1 Size(m)	2.0		2.0	2.0	2.0	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Turn Type	NA		Perm	NA	Perm	
Protected Phases	4			8		
Permitted Phases			8		2	
Detector Phase	4		8	8	2	
Switch Phase						
Minimum Initial (s)	15.0		15.0	15.0	10.0	
Minimum Split (s)	23.5		23.5	23.5	23.5	
Total Split (s)	36.0		36.0	36.0	24.0	
Total Split (%)	60.0%		60.0%	60.0%	40.0%	
Maximum Green (s)	31.5		31.5	31.5	19.5	
Yellow Time (s)	3.5		3.5	3.5	3.5	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	4.5			4.5	4.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		C-Min	C-Min	Min	
Walk Time (s)	8.0		8.0	8.0	8.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Pedestrian Calls (#/hr)	0		0	0	0	
Act Effct Green (s)	41.0			41.0	10.0	
Actuated g/C Ratio	0.68			0.68	0.17	
v/c Ratio	0.35			0.52	0.20	
Control Delay	4.4			5.7	21.2	
Queue Delay	0.0			0.0	0.0	
Total Delay	4.4			5.7	21.2	
LOS	A			A	C	
Approach Delay	4.4			5.7	21.2	
Approach LOS	A			A	C	
Queue Length 50th (m)	15.8			27.0	5.2	
Queue Length 95th (m)	22.9			38.4	14.1	
Internal Link Dist (m)	126.0			126.0	126.0	
Turn Bay Length (m)						
Base Capacity (vph)	2312			2194	576	
Starvation Cap Reductn	0			0	0	
Spillback Cap Reductn	0			0	0	
Storage Cap Reductn	0			0	0	
Reduced v/c Ratio	0.35			0.52	0.10	

Intersection Summary	
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 24 (40%), Referenced to phase 4:EBT and 8:WBTL, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.52	
Intersection Signal Delay: 5.6	Intersection LOS: A
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 1: 2 Street E & Dunbow Road

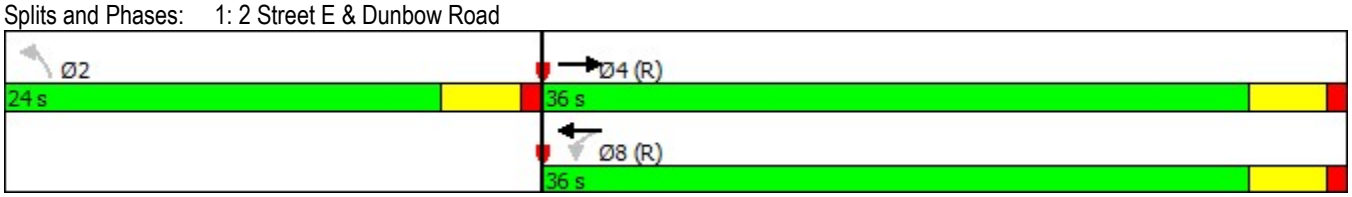


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	708	76	63	1035	66	36
Future Volume (vph)	708	76	63	1035	66	36
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor	1.00			1.00	0.99	
Frt	0.985				0.953	
Flt Protected				0.997	0.969	
Satd. Flow (prot)	3355	0	0	3399	1725	0
Flt Permitted				0.857	0.969	
Satd. Flow (perm)	3355	0	0	2921	1719	0
Satd. Flow (RTOR)	29				39	
Confl. Peds. (#/hr)		5	5		5	5
Confl. Bikes (#/hr)		1				1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	0%	0%	5%	0%	0%
Adj. Flow (vph)	770	83	68	1125	72	39
Shared Lane Traffic (%)						
Lane Group Flow (vph)	853	0	0	1193	111	0
Number of Detectors	1		1	1	1	
Detector Template	Thru		Left	Thru	Left	
Leading Detector (m)	4.0		2.0	4.0	2.0	
Trailing Detector (m)	2.0		0.0	2.0	0.0	
Detector 1 Position(m)	2.0		0.0	2.0	0.0	
Detector 1 Size(m)	2.0		2.0	2.0	2.0	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Turn Type	NA		Perm	NA	Perm	
Protected Phases	4			8		
Permitted Phases			8		2	
Detector Phase	4		8	8	2	
Switch Phase						
Minimum Initial (s)	15.0		15.0	15.0	10.0	
Minimum Split (s)	23.5		23.5	23.5	23.5	
Total Split (s)	36.0		36.0	36.0	24.0	
Total Split (%)	60.0%		60.0%	60.0%	40.0%	
Maximum Green (s)	31.5		31.5	31.5	19.5	
Yellow Time (s)	3.5		3.5	3.5	3.5	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	4.5			4.5	4.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		C-Min	C-Min	Min	
Walk Time (s)	8.0		8.0	8.0	8.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Pedestrian Calls (#/hr)	0		0	0	0	
Act Effct Green (s)	40.7			40.7	10.3	
Actuated g/C Ratio	0.68			0.68	0.17	
v/c Ratio	0.37			0.60	0.34	
Control Delay	4.6			7.0	18.3	
Queue Delay	0.0			0.0	0.0	
Total Delay	4.6			7.0	18.3	
LOS	A			A	B	
Approach Delay	4.6			7.0	18.3	
Approach LOS	A			A	B	
Queue Length 50th (m)	16.6			30.7	7.4	
Queue Length 95th (m)	27.1			50.6	19.2	
Internal Link Dist (m)	126.0			126.0	126.0	
Turn Bay Length (m)						
Base Capacity (vph)	2283			1980	585	
Starvation Cap Reductn	0			0	0	
Spillback Cap Reductn	0			0	0	
Storage Cap Reductn	0			0	0	
Reduced v/c Ratio	0.37			0.60	0.19	

Intersection Summary	
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 24 (40%), Referenced to phase 4:EBT and 8:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 6.6	Intersection LOS: A
Intersection Capacity Utilization 73.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: 2 Street E & Dunbow Road



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	17	85	0	32	107
Future Volume (Veh/h)	0	17	85	0	32	107
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	18	92	0	35	116
Pedestrians	5		5			5
Lane Width (m)	3.5		3.5			3.5
Walking Speed (m/s)	1.2		1.2			1.2
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						150
pX, platoon unblocked						
vC, conflicting volume	288	102			97	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	288	102			97	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			98	
cM capacity (veh/h)	685	951			1503	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	18	92	151
Volume Left	0	0	35
Volume Right	18	0	0
cSH	951	1700	1503
Volume to Capacity	0.02	0.05	0.02
Queue Length 95th (m)	0.5	0.0	0.6
Control Delay (s)	8.9	0.0	1.9
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	1.9
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	25.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	31	54	0	59	48
Future Volume (Veh/h)	0	31	54	0	59	48
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	34	59	0	64	52
Pedestrians	5		5			5
Lane Width (m)	3.5		3.5			3.5
Walking Speed (m/s)	1.2		1.2			1.2
Percent Blockage	0		0			0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						400
pX, platoon unblocked						
vC, conflicting volume	249	69			64	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	249	69			64	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			96	
cM capacity (veh/h)	707	992			1545	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	34	59	116
Volume Left	0	0	64
Volume Right	34	0	0
cSH	992	1700	1545
Volume to Capacity	0.03	0.03	0.04
Queue Length 95th (m)	0.9	0.0	1.0
Control Delay (s)	8.8	0.0	4.2
Lane LOS	A		A
Approach Delay (s)	8.8	0.0	4.2
Approach LOS	A		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	24.0%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

Warrants

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Dunbow Road	Main Road
2 Street E	Minor Road
Foothills County	City/Town

Date August 1, 2022
Other Background, Opening Day (2024)

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)			5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	80				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	10500	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	4600	4	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	80
Signalization Warrant	Descriptive		30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
				Operational Factors Subtotal		**135**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	4	4	5	Maximum of 4 quadrants	OK	20
				Environmental Factor Subtotal		**20**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR CROSS STREET TRAFFIC

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	135
Environmental Factor Subtotal	20
Collision History Subtotal	0
TOTAL POINTS	**161**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Dunbow Road	Main Road
2 Street E	Minor Road
Foothills County	City/Town

Date August 1, 2022
Other Opening Day (2024)

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)			5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	80				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	11000	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	4600	4	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	80
Signalization Warrant	Descriptive		30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
				Operational Factors Subtotal		**135**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	4	4	5	Maximum of 4 quadrants	OK	20
				Environmental Factor Subtotal		**20**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR CROSS STREET TRAFFIC

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	135
Environmental Factor Subtotal	20
Collision History Subtotal	0
TOTAL POINTS	**161**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Dunbow Road	Main Road
2 Street E	Minor Road
Foothills County	City/Town

Date August 1, 2022
Other Background, 10 Year

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)			5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	80				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	10000	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	450	0	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	0
Signalization Warrant	Descriptive		30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
				Operational Factors Subtotal		**55**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	4	4	5	Maximum of 4 quadrants	OK	20
				Environmental Factor Subtotal		**20**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	55
Environmental Factor Subtotal	20
Collision History Subtotal	0
TOTAL POINTS	**81**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Dunbow Road	Main Road
2 Street E	Minor Road
Foothills County	City/Town

Date August 1, 2022
Other Full Build Out, 10 Year

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)			5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	80				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	11000	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	1850	3	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	60
Signalization Warrant	Descriptive		30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
				Operational Factors Subtotal		**115**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	4	4	5	Maximum of 4 quadrants	OK	20
				Environmental Factor Subtotal		**20**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	115
Environmental Factor Subtotal	20
Collision History Subtotal	0
TOTAL POINTS	**141**

TABLE 3: RIGHT TURN LANE

HIGHWAY DESIGN SPEED (km/h)	LENGTH AND TAPER RATIO "TR" OF RIGHT TURN TAPER (m)	LENGTH OF PARALLEL LANE "PI" ** (m)		LENGTH AVAILABLE FOR DECELERATION: LANE + TAPER	DECELERATION LENGTH REQUIRED BASED ON DESIGN SPEED	STORAGE LENGTH PROVIDED BY STANDARD TREATMENT
		RIGHT TURN LANE NOT + WARRANTED	RIGHT TURN LANE + WARRANTED			
50	87.5 at 25:1	0	0	87.5	70	17.5
60	87.5 at 25:1	0	10	97.5	90	7.5
70	87.5 at 25:1	0	35	122.5	110	12.5
80	87.5 at 25:1	10	50	137.5	130	7.5
90	87.5 at 25:1	10	65	152.5	150	2.5
100	87.5 at 25:1	10	85	172.5	170	2.5
110	140.0 at 40:1	20	100	240 ⚠1	190	50
120	140.0 at 40:1	20	100	240	210	30
130	140.0 at 40:1	30	110	250	215	35

** ADJUST PARALLEL LANE LENGTH FOR GRADE EFFECT.
+ SEE RIGHT TURN LANE REQUIREMENTS IN SECTION D.7.7

TABLE 2: LEFT TURN LANE

HIGHWAY DESIGN SPEED km/h	LENGTH AND TAPER RATIO "TB" OF BYPASS LANE (m)	PARALLEL DECELERATION LANE "P2" ** (m)	LENGTH AVAILABLE FOR DECELERATION ½ TAPER+LANE	DECELERATION LENGTH REQUIRED BASED ON DESIGN SPEED	STORAGE LENGTH PROVIDED BY STANDARD TREATMENT
50	140 at 40:1	20	90	70	20
60	140 at 40:1	35	105	90	15
70	140 at 40:1	55	125	110	15
80	140 at 40:1	80	150	130	20
90	210 at 60:1	70	175	150	25
100	210 at 60:1	85	190	170	20
110	210 at 60:1	100	205	190	15
120	210 at 60:1	120	225	210	15
130	210 at 60:1	125	230	215	15

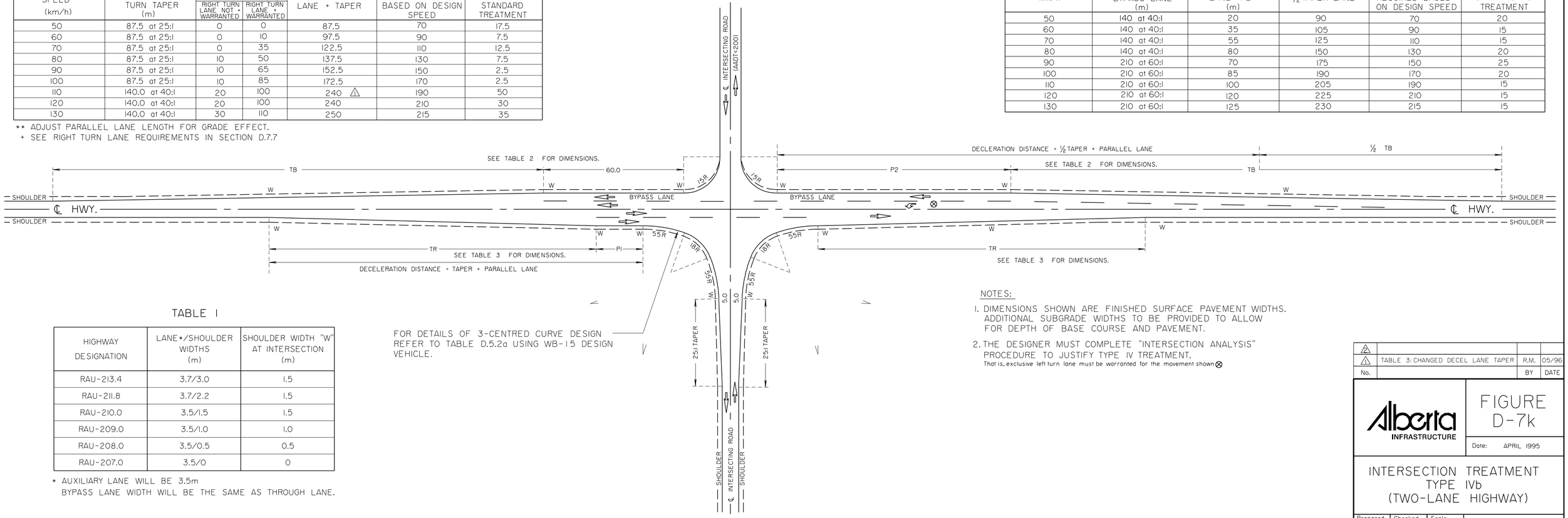


TABLE 1

HIGHWAY DESIGNATION	LANE*/SHOULDER WIDTHS (m)	SHOULDER WIDTH "W" AT INTERSECTION (m)
RAU-213.4	3.7/3.0	1.5
RAU-211.8	3.7/2.2	1.5
RAU-210.0	3.5/1.5	1.5
RAU-209.0	3.5/1.0	1.0
RAU-208.0	3.5/0.5	0.5
RAU-207.0	3.5/0	0

* AUXILIARY LANE WILL BE 3.5m
BYPASS LANE WIDTH WILL BE THE SAME AS THROUGH LANE.

FOR DETAILS OF 3-CENTRED CURVE DESIGN REFER TO TABLE D.5.2a USING WB-15 DESIGN VEHICLE.

NOTES:

1. DIMENSIONS SHOWN ARE FINISHED SURFACE PAVEMENT WIDTHS. ADDITIONAL SUBGRADE WIDTHS TO BE PROVIDED TO ALLOW FOR DEPTH OF BASE COURSE AND PAVEMENT.
2. THE DESIGNER MUST COMPLETE "INTERSECTION ANALYSIS" PROCEDURE TO JUSTIFY TYPE IV TREATMENT.
That is, exclusive left turn lane must be warranted for the movement shown ⊗

No.		BY	DATE
⚠2			
⚠1	TABLE 3: CHANGED DECEL LANE TAPER	R.M.	05/96

Alberta INFRASTRUCTURE

FIGURE D-7k

Date: APRIL 1995

INTERSECTION TREATMENT TYPE IVb (TWO-LANE HIGHWAY)

Prepared By: R.T.	Checked By: B.K.	Scale: N.T.S.	PAGE D-133

Graphics File: debd7k.man

TRANSPORTATION PLANNERS AND ENGINEERS

Heritage Crossing

Traffic Review

Final

Prepared for

2291463 Alberta Ltd.

Date

May 29, 2023

Project Number

02-22-0118

CORPORATE AUTHORIZATION

Prepared By:	Gloria Shu, EIT	Bunt & Associates Engineering Ltd.
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	Jason Dunn, P.Eng.	

Date: 2023-05-29

Project #: 02-22-0118

Status: Final

APEGA Company Permit to Practice

Engineer's Stamp

This document entitled "Heritage Crossing Traffic Review" was prepared by Bunt & Associates for the benefit of the client to whom it is addressed, in support of their Land Use Redesignation application to Foothills County. The analysis and conclusions/recommendations in the report reflect Bunt & Associates' best professional judgment in light of the knowledge and information available to Bunt & Associates at the time of preparation.

Foothills County shall be entitled to rely on this report for the specific purpose for which it was prepared. Foothills County may provide copies of the report to Foothills County Council, Foothills County Employees, and Foothills County Regulatory Boards, each of whom shall also be entitled to rely on this report in their official capacities for the specific purpose for which the report was prepared. Foothills County may also provide copies of the report to external governmental bodies having jurisdiction related to the project for which it was prepared.

Any use made of this report by a third party beyond those specifically noted here, or any reliance on or decisions based on it by any such third party, are the responsibility of such third parties. Bunt & Associates accepts no responsibility for damages, if any, suffered by such third parties as a result of decisions made or actions based on this report.

TABLE OF CONTENTS

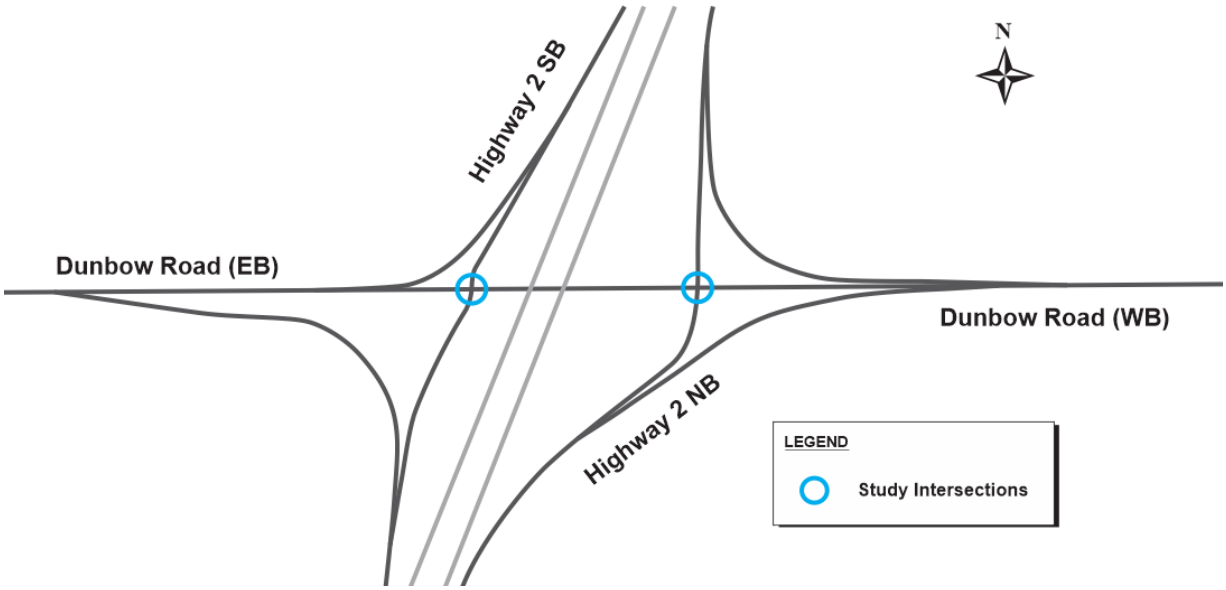
EXHIBITS

TABLES

1. EXECUTIVE SUMMARY

Bunt and Associates was retained by 2291463 Alberta Ltd. to undertake a Transportation Impact Assessment (TIA) for the Heritage Crossing Development, located in the Foothills County. The proposed development is for 153 residential units. The findings of the TIA were presented in the Heritage Crossing Transportation Impact Assessment Report[1].

Alberta Transportation and Economic Corridors has requested that an additional study be undertaken to evaluate whether signalization of Highway 2 East & Dunbow Road interchange is required. The purpose of this memorandum was to assess the impact of local traffic growth and determine the approximate horizon for traffic signal implimentation. The findings and recommendations are summarized in **Table 1.1**.



[1] Heritage Crossing Transportation Impact Assessment Report, Bunt and Associates, September 2022

Table 1.1: Findings & Recommendations

SECTION		FINDINGS
Highway 2 SB & Dunbow Road	Background	Study intersection is expected to operate acceptably at all horizons.
	After Development	Study intersection is expected to operate acceptably at all horizons.
Highway 2 NB & Dunbow Road	Background	Northbound Left (NBL) movement is expected to operate with extended delays by 2042 but signalization is not warranted either at 2042 or 2047.
	After Development	Northbound Left (NBL) movement is expected to operate with extended delays by 2032, but signalization is not warranted.

2. INTRODUCTION

Bunt and Associates was retained to undertake a Transportation Impact Assessment (TIA) for the Heritage Crossing Development, located in Foothills County. The proposed development is for 153 residential units. The findings of the TIA were initially presented in the Heritage Crossing Transportation Impact Assessment Report.

As part of the review process, Foothills County circulated the report to Alberta Transportation and Economic Corridors (ATEC) for their review.

ATEC requested that supplementary analysis to the previous TIA report be undertaken, with the purpose of determining the approximate time horizon that signalization is warranted at Highway 2 & Dunbow Road interchange off-ramp intersections.

2.1 Scope of Work

Based on discussions with the ATEC (**Appendix A**), the scope of work for this study includes the following:

- Use the existing count from the ATEC website.
- Grow the movements at 2% pa (linear) at 5-year intervals for the next 25 years.
- Review the background and after development scenarios for each 5-year interval.
- Identify if the ramp intersections on Dunbow Road require signalization at any of these horizons.
- Provide the information to ATEC in a technical memo.

3. TRAFFIC CONDITIONS

Existing intersection configurations are illustrated in **Exhibit 3.1**.

3.1 Volumes

3.1.1 Future Background Traffic

The 2022 background volumes were obtained from the ATEC website, and a nominal 2% growth rate was applied to all movements within the intersection. Background traffic volumes used in the analysis are illustrated in **Exhibit 3.2** (2027 Background traffic volumes), **Exhibit 3.3** (2032 Background traffic volumes), **Exhibit 3.4** (2037 Background traffic volumes), **Exhibit 3.5** (2042 Background traffic volumes) and **Exhibit 3.6** (2047 Background traffic volumes).

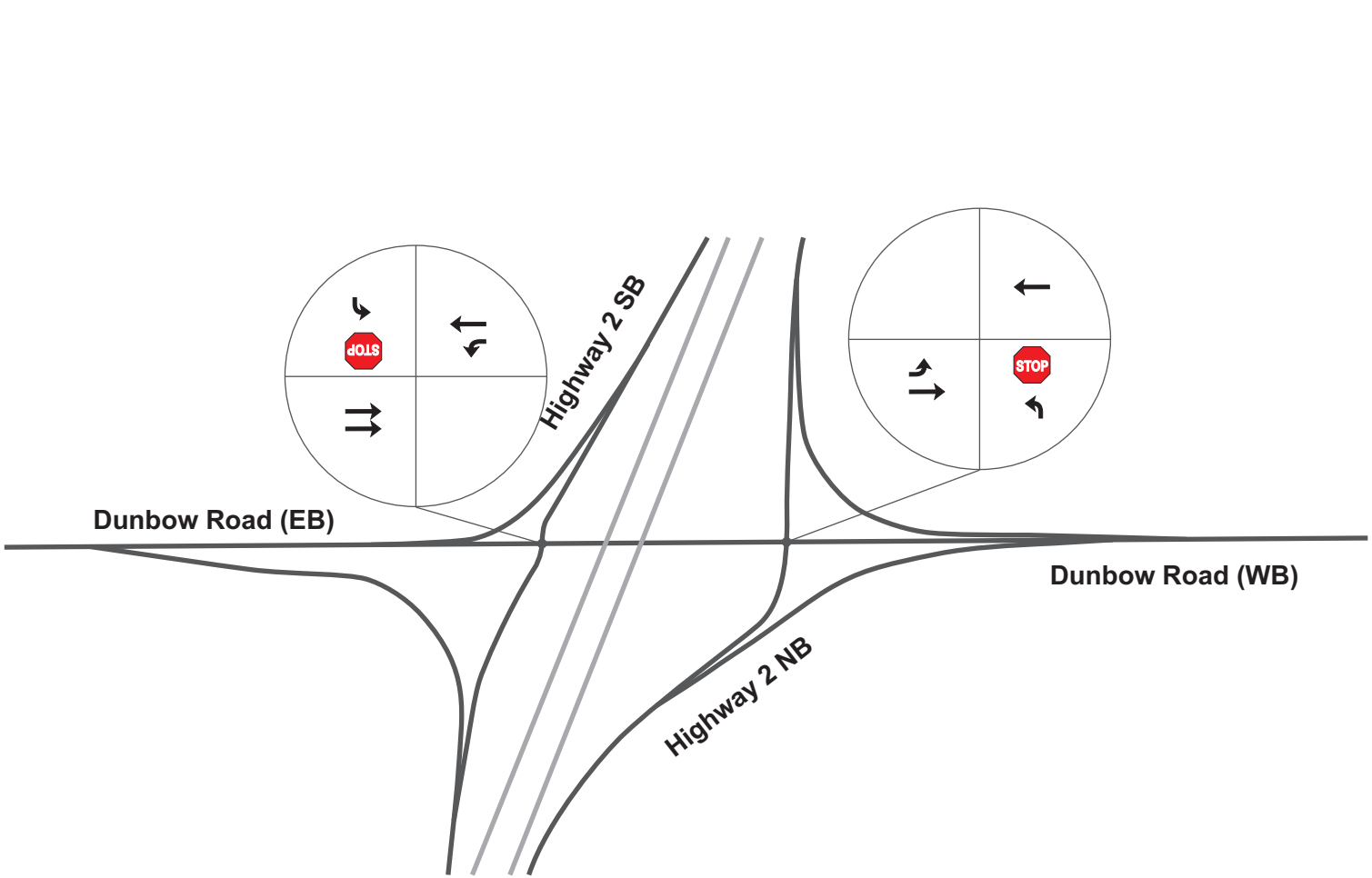


Exhibit 3.1

Existing Intersection Configuration

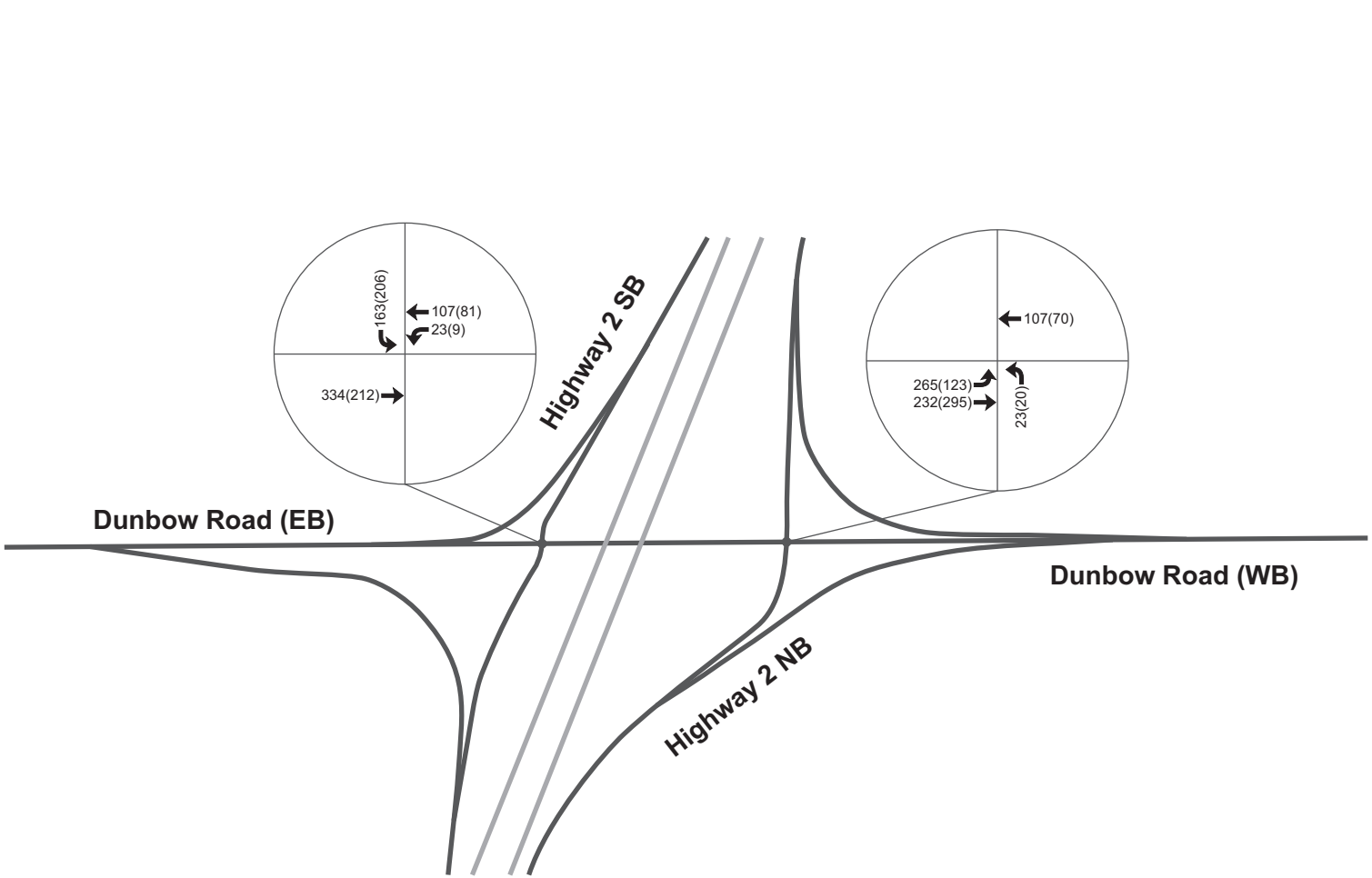


Exhibit 3.2

2027 Background Traffic Volumes

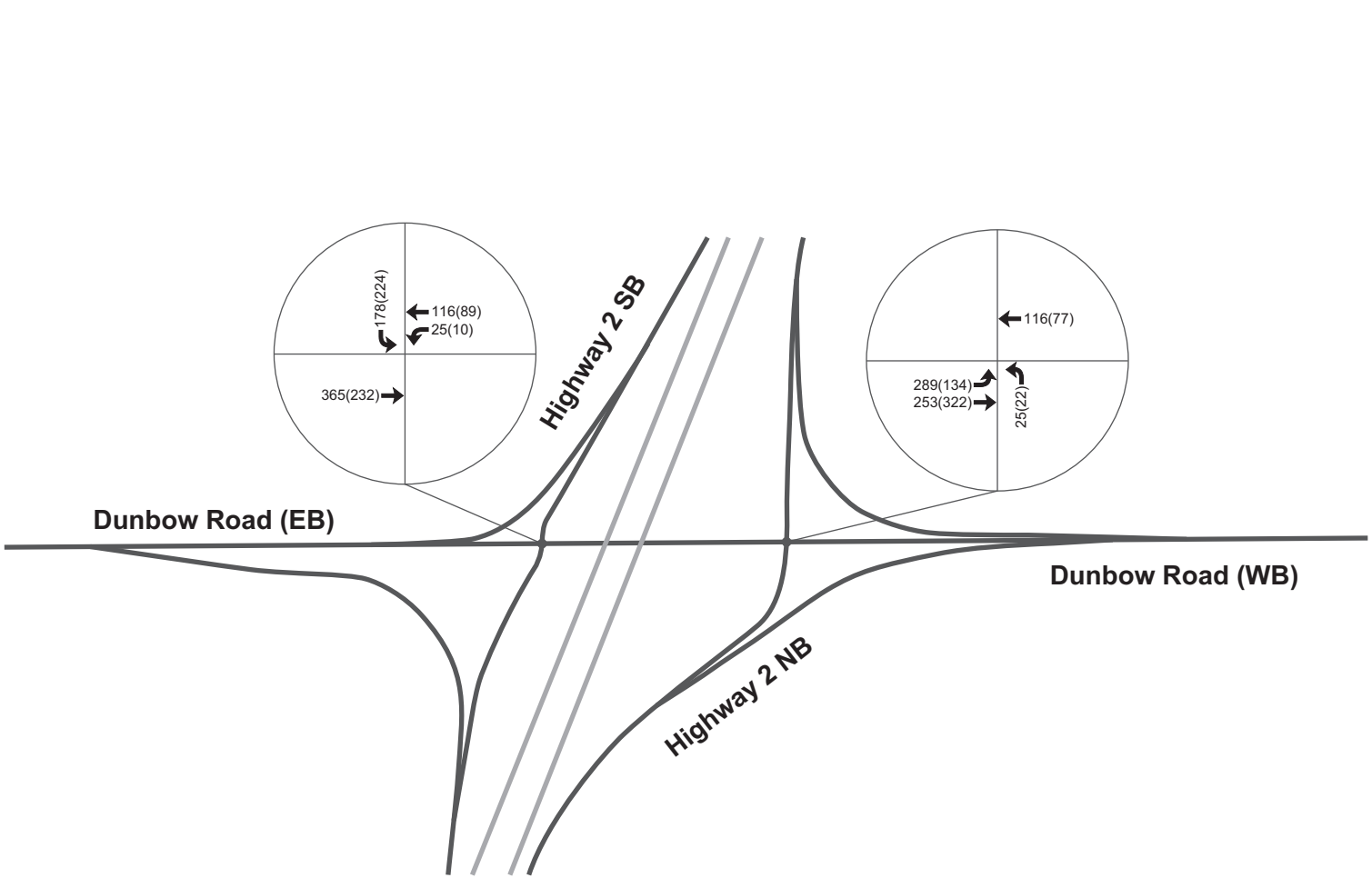


Exhibit 3.3

2032 Background Traffic Volumes

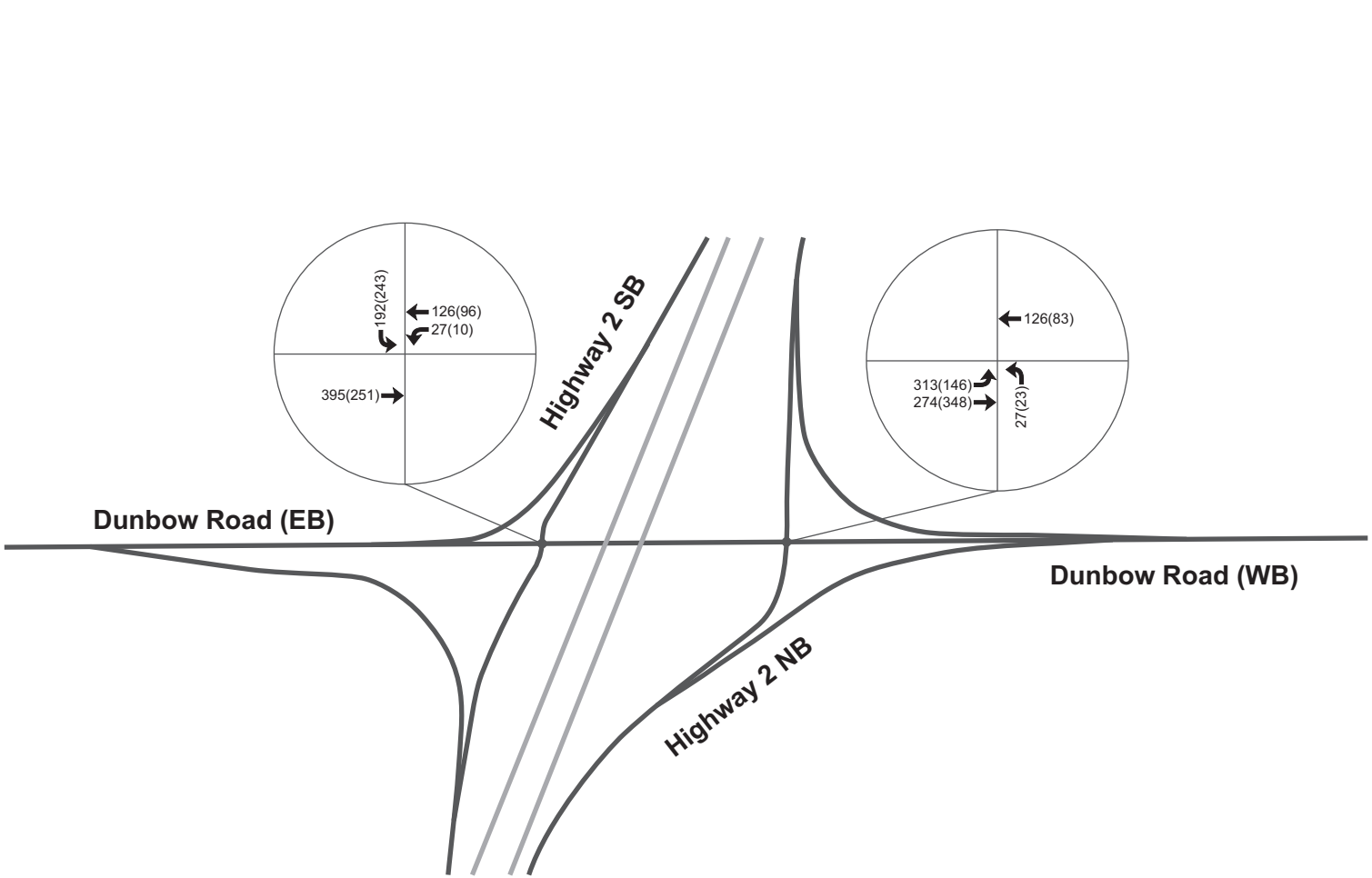


Exhibit 3.4

2037 Background Traffic Volumes

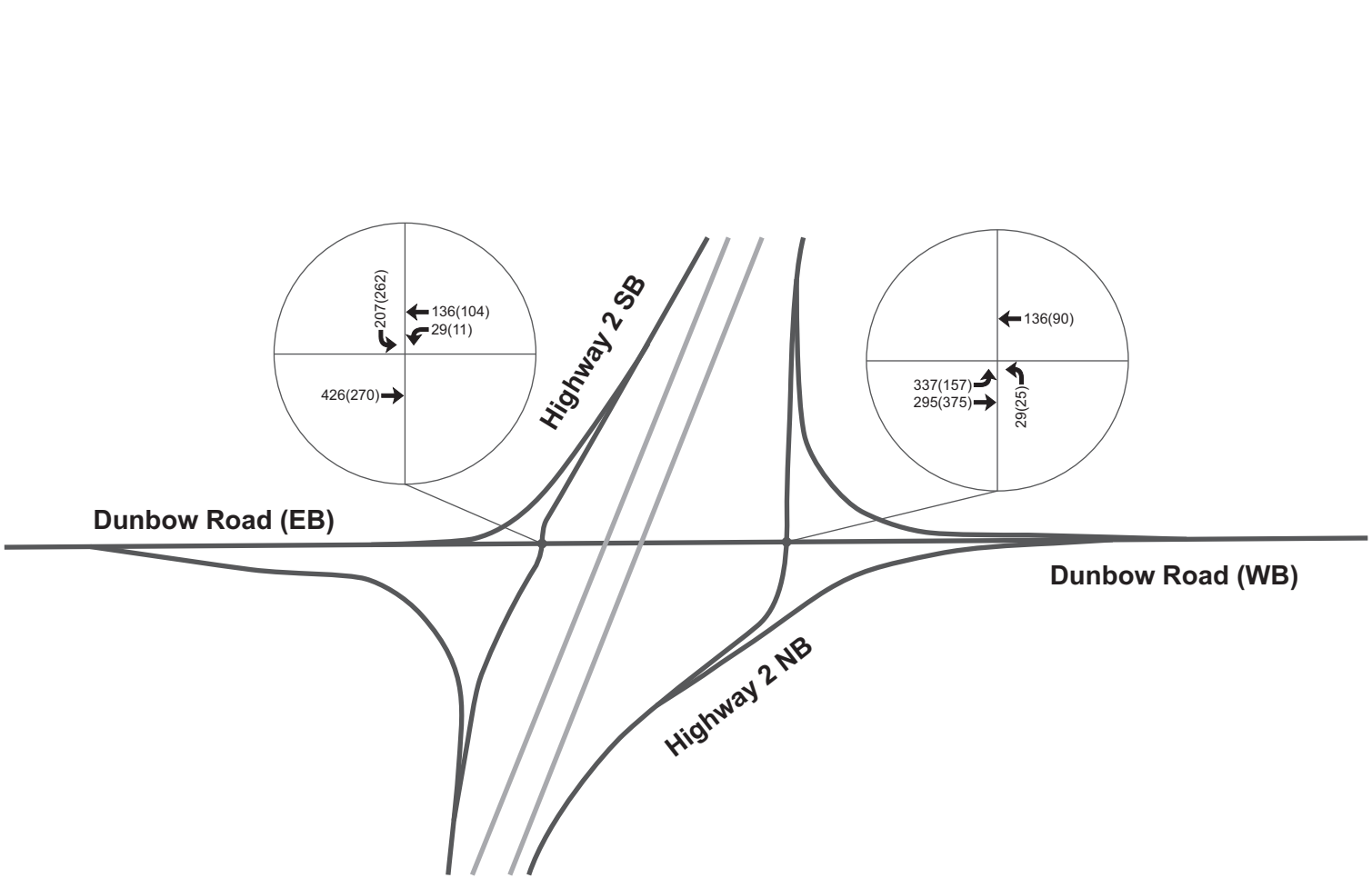


Exhibit 3.5

2042 Background Traffic Volumes

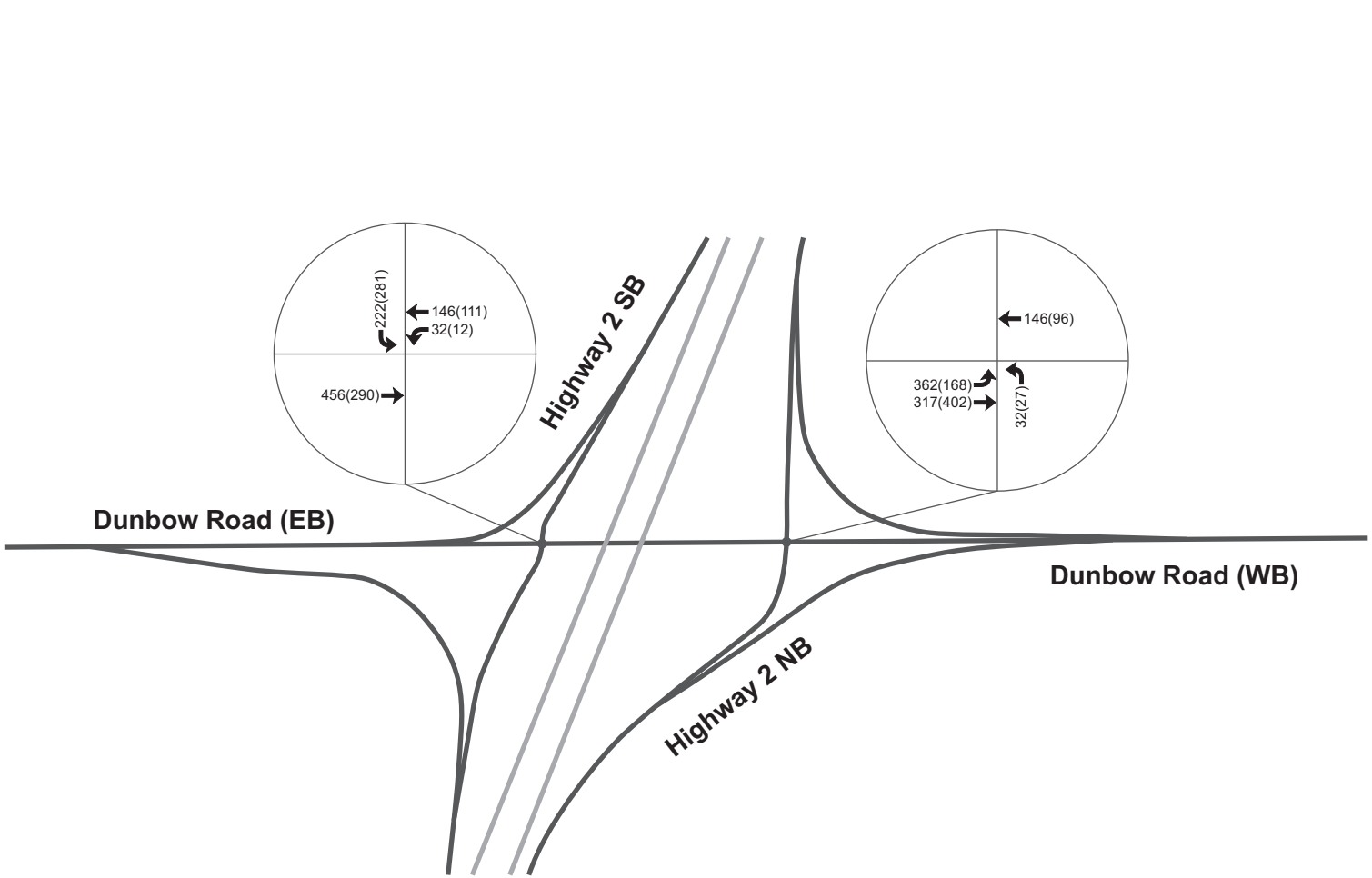


Exhibit 3.6

2047 Background Traffic Volumes

3.1.1 After Development

Development generated traffic from the TIA report was adjusted based on the distribution obtained from ATEC's counts. The traffic was then split into two intersections according to the available movements at each intersection.

Site traffic (**Exhibit 3.7**) was added to Background traffic to develop "After Development" traffic volumes as illustrated in **Exhibit 3.8** (2027 After Development traffic volumes), **Exhibit 3.9** (2032 After Development traffic volumes), **Exhibit 3.10** (2037 After Development traffic volumes), **Exhibit 3.11** (2042 After Development traffic volumes) and **Exhibit 3.12** (2047 After Development traffic volumes).

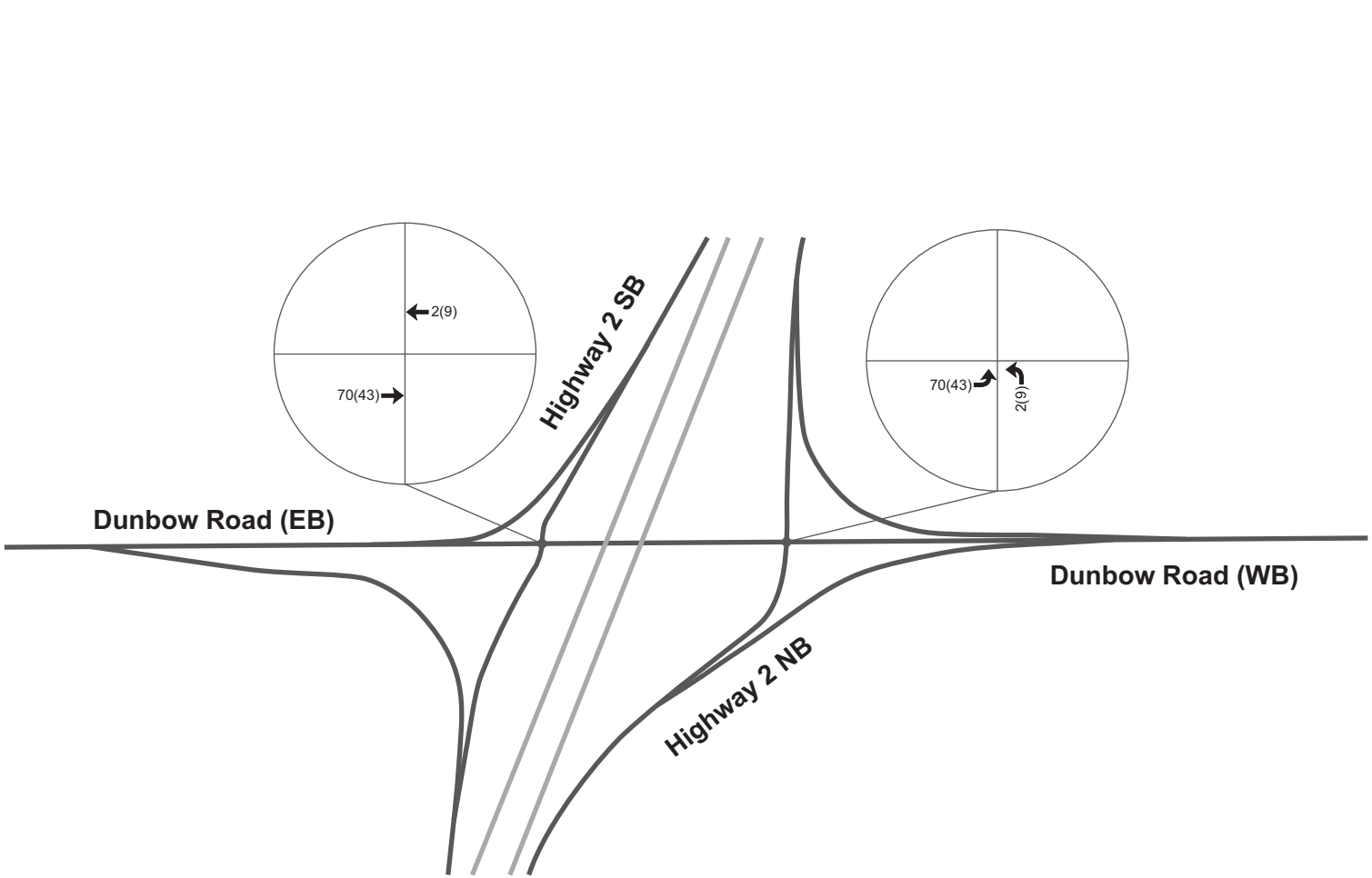


Exhibit 3.7

Site Traffic Volumes

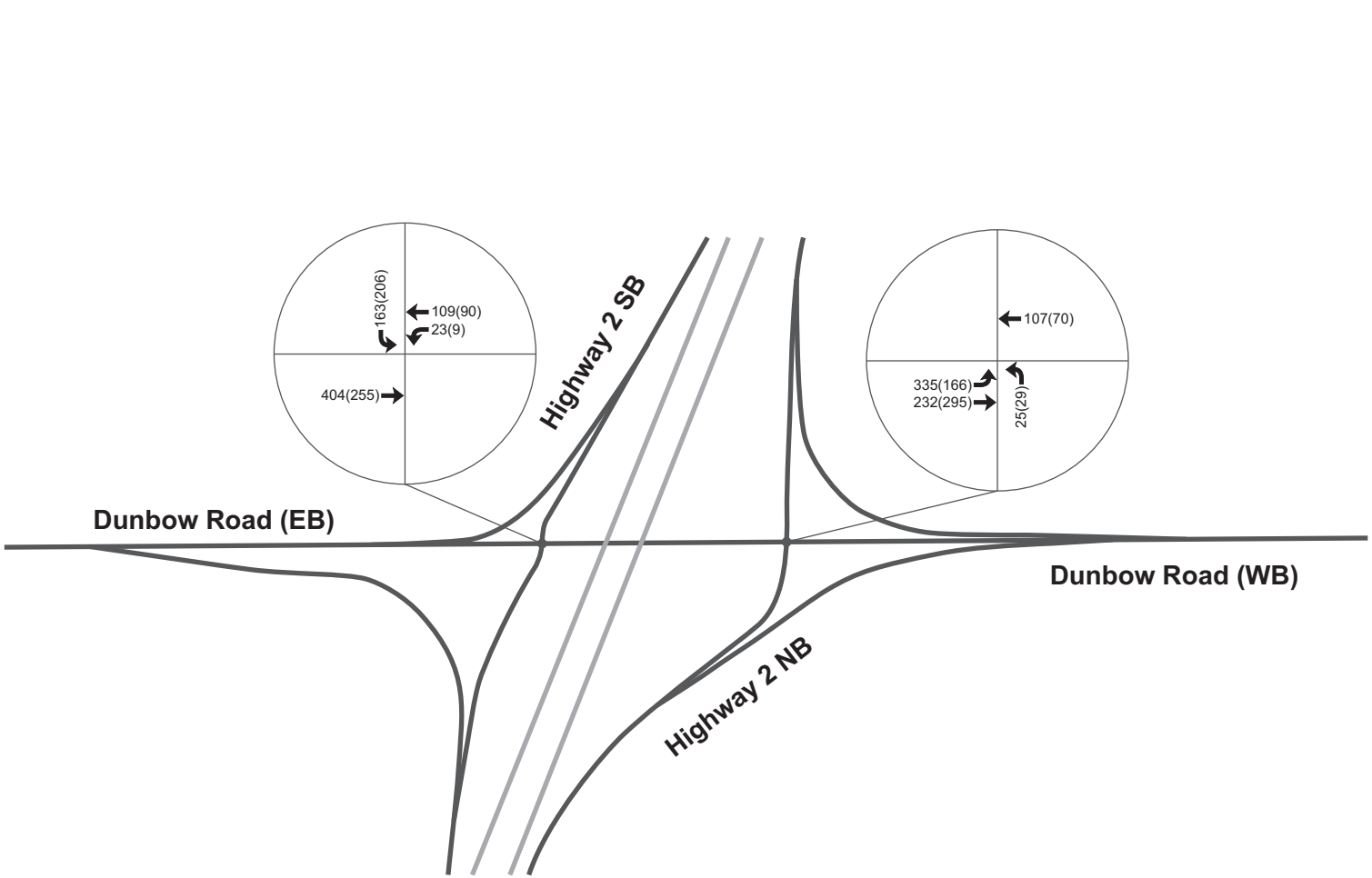


Exhibit 3.8

2027 After Development Traffic Volumes

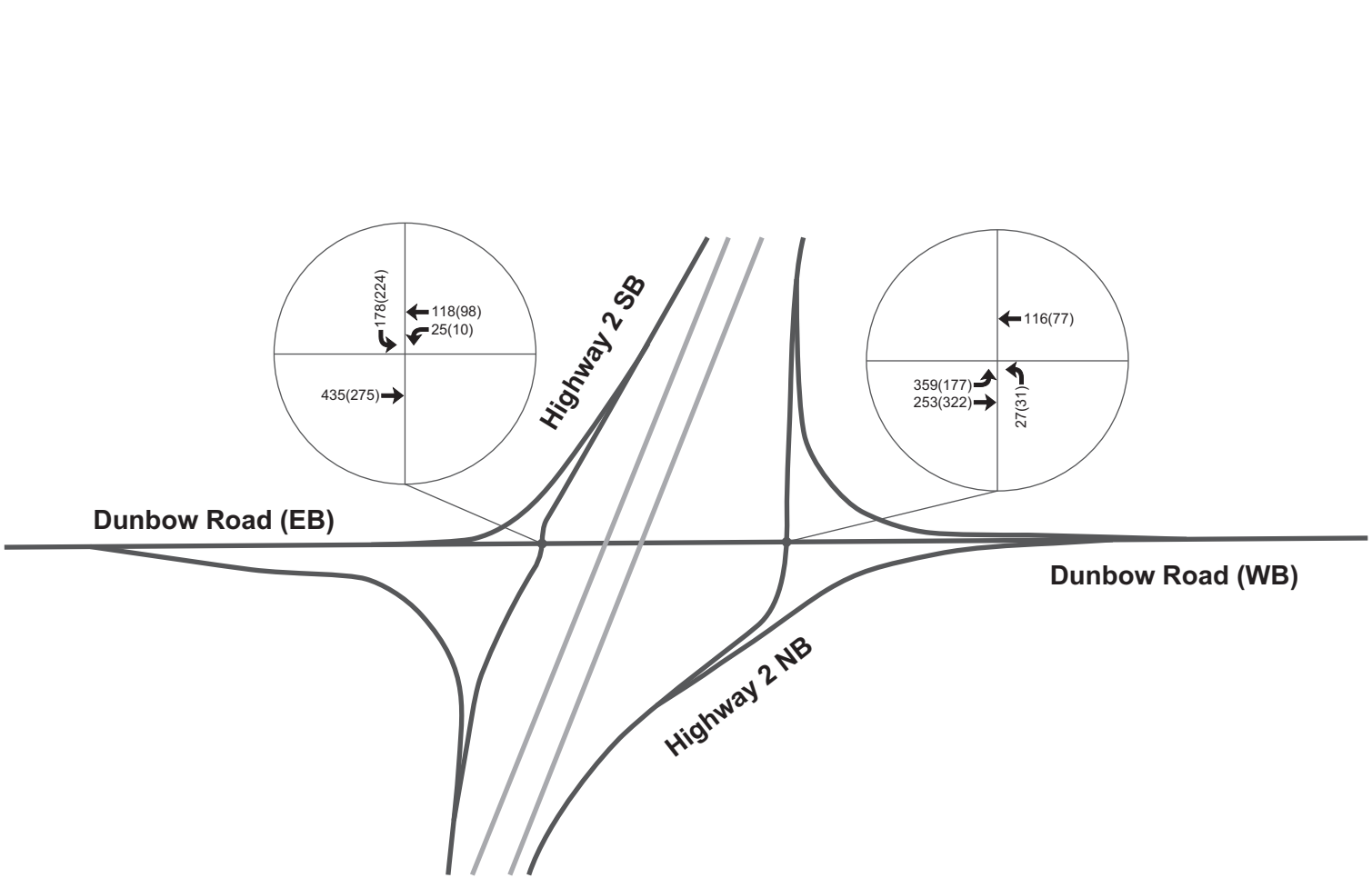


Exhibit 3.9

2032 After Development Traffic Volumes

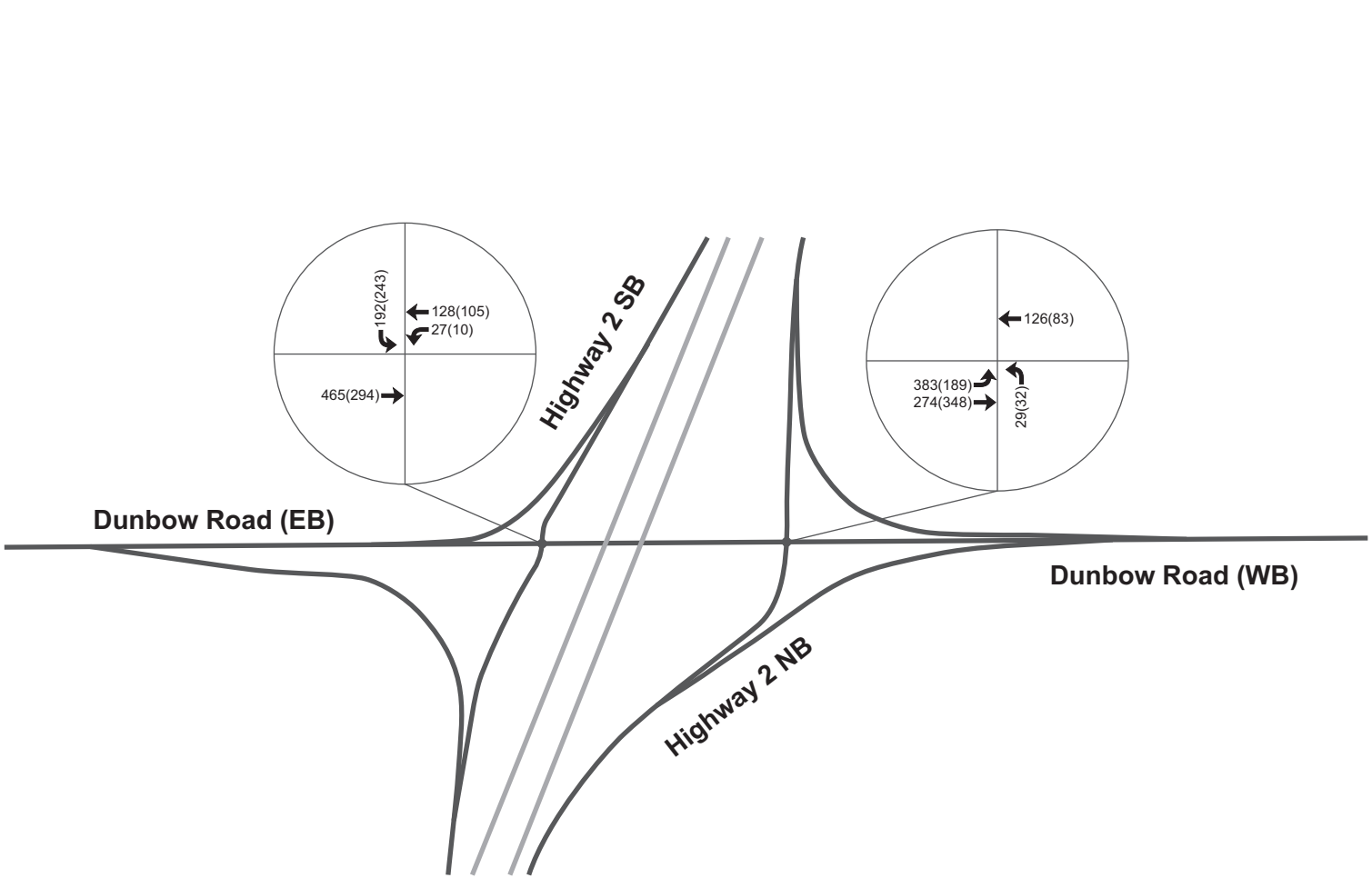


Exhibit 3.10

2037 After Development Traffic Volumes

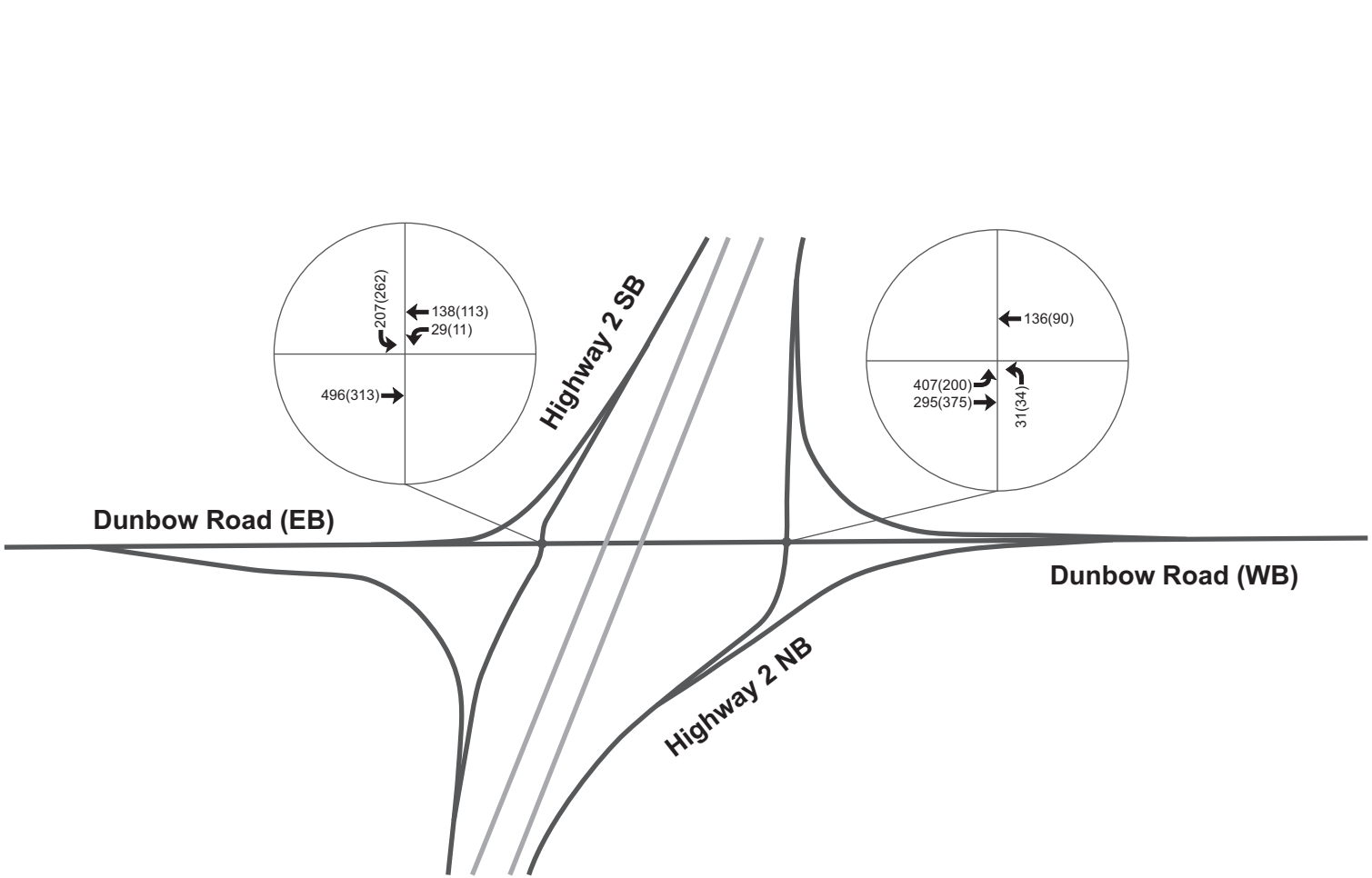


Exhibit 3.11

2042 After Development Traffic Volumes

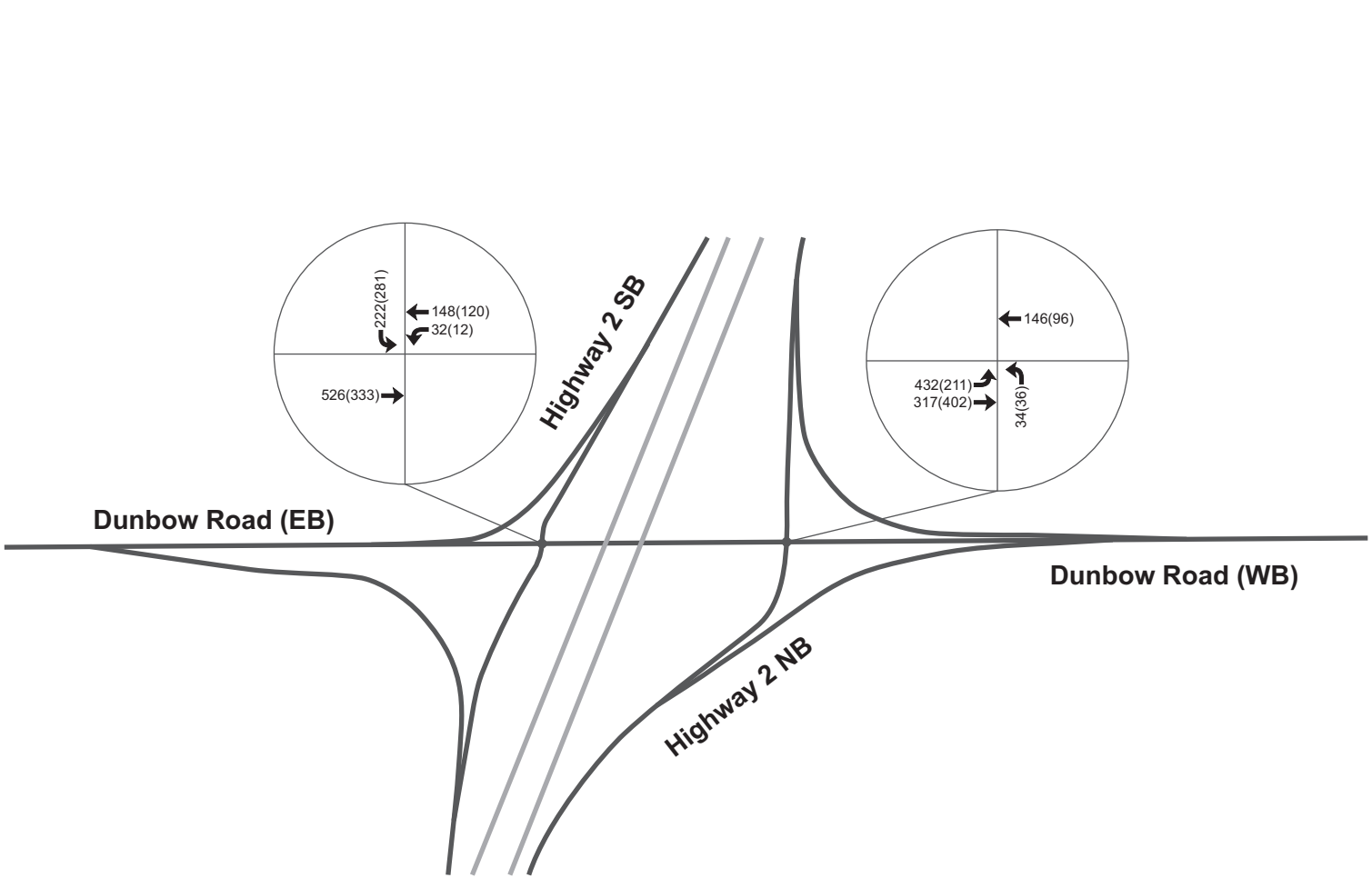


Exhibit 3.12

2047 After Development Traffic Volumes

3.2 Intersection Analysis

Synchro 11 traffic analysis software was used to assess intersection operating conditions based on the methods outlined in the Highway Capacity Manual 2000. Traffic operations were assessed measures of effectiveness of volume-to-capacity (v/c) ratio, Level of Service (LOS) and 95th percentile queue length.

The volume-to-capacity (v/c) ratio of an intersection movement represents the ratio between the demand volume and available capacity. ATEC accepts a v/c ratio of 0.85 or less. The Level of Service (LOS) rating is based on average vehicle delays ranging from LOS A (minimal delay) to LOS F (significant delay). ATEC accepts an overall LOS C at highway access intersections with a LOS D on any single approach at full build-out.

Intersection capacity analysis was completed for the following horizons:

- Background
  - 2027
  - 2032
  - 2037
  - 2042
  - 2047
- After Development
  - 2027
  - 2032
  - 2037
  - 2042
  - 2047

The analysis is completed as per ATEC's TIA guidelines with a saturation flow rate of 1900 vehicles per hour and a peak hour factor of 0.92. The analysis uses a minimum hourly volume of 5 vehicles per movement in all horizons. The volume to capacity (v/c) ratio, level of service, average control delay (in seconds), and 95th percentile queue (in metres) are summarized in this report. Synchro output reports are provided in **Appendix C**.

3.2.1 Background Analysis

Table 3.1: Background Intersection Analysis - 2027

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.11	A	0	<5	0.07	A	0	<5
	WBL	1	0.02	A	8	<5	<0.02	A	8	<5
	WBT	1	0.07	A	0	<5	0.05	A	0	<5
	SBL	1	0.31	B	15	11	0.32	B	13	11
	Overall		-	*A*	*4.0*	-	-	*A*	*5.2*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.20	A	9	6	0.09	A	8	<5
	EBT	1	0.15	A	0	<5	0.19	A	0	<5
	WBT	1	0.07	A	0	<5	0.04	A	0	<5
	NBL	1	0.12	C	25	<5	0.06	C	16	<5
	Overall		-	*A*	*4.3*	-	-	*A*	*2.5*	-

Table 3.2: Background Intersection Analysis - 2032

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.12	A	0	<5	0.07	A	0	<5
	WBL	1	0.02	A	9	<5	<0.02	A	8	<5
	WBT	1	0.07	A	0	<5	0.06	A	0	<5
	SBL	1	0.36	C	16	14	0.36	B	14	13
	Overall		-	*A*	*4.3*	-	-	*A*	*5.4*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.22	A	9	7	0.10	A	8	<5
	EBT	1	0.16	A	0	<5	0.21	A	0	<5
	WBT	1	0.07	A	0	<5	0.05	A	0	<5
	NBL	1	0.15	D	29	<5	0.08	C	18	<5
	Overall		-	*A*	*4.5*	-	-	*A*	*2.5*	-

Table 3.3: Background Intersection Analysis - 2037

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.13	A	0	<5	0.08	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	8	<5
	WBT	1	0.08	A	0	<5	0.06	A	0	<5
	SBL	1	0.41	C	17	16	0.47	B	14	16
	Overall		-	*A*	*4.7*	-	-	*A*	*5.8*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.24	A	9	8	0.11	A	8	<5
	EBT	1	0.18	A	0	<5	0.22	A	0	<5
	WBT	1	0.08	A	0	<5	0.05	A	0	<5
	NBL	1	0.19	D	34	6	0.09	C	19	<5
	Overall		-	*A*	*4.7*	-	-	*A*	*2.6*	-

Table 3.4: Background Intersection Analysis - 2042

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.14	A	0	<5	0.09	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	8	<5
	WBT	1	0.09	A	0	<5	0.07	A	0	<5
	SBL	1	0.47	C	20	20	0.44	C	15	19
	Overall		-	*A*	*5.2*	-	-	*A*	*6.2*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.26	A	9	9	0.11	A	8	<5
	EBT	1	0.19	A	0	<5	0.24	A	0	<5
	WBT	1	0.09	A	0	<5	0.06	A	0	<5
	NBL	1	0.24	E	42	8	0.10	C	21	<5
	Overall		-	*A*	*5.1*	-	-	*A*	*2.7*	-

Table 3.5: Background Intersection Analysis - 2047

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.15	A	0	<5	0.09	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	8	<5
	WBT	1	0.09	A	0	<5	0.07	A	0	<5
	SBL	1	0.53	C	22	25	0.49	C	17	22
	Overall		-	*A*	*6.0*	-	-	*A*	*6.7*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.28	A	9	10	0.12	A	8	<5
	EBT	1	0.20	A	0	<5	0.26	A	0	<5
	WBT	1	0.09	A	0	<5	0.06	A	0	<5
	NBL	1	0.31	F	52	10	0.12	C	23	<5
	Overall		-	*A*	*5.5*	-	-	*A*	*2.8*	-

The Background analysis showed the northbound left turn (NBL) movement of Highway 2 NB / Dunbow Road intersection is expected to operate at LOS E by 2042 and LOS F by 2047.

Signal warrant analysis was completed for the candidate study intersection based on Transportation Association of Canada (TAC) Traffic Signal and Pedestrian Signal Head Warrant Handbook (2014). A score of 100 points or more indicates a traffic signal is warranted. 6- hour raw traffic volumes were obtained from ATEC and used for the analysis, and they were calculated by applying the observed 6-hour volume factors in the traffic counts. 6-hour factor of 3.09 is obtained for Highway 2 / Dunbow Road intersection. The results of signal warrant analysis are summarized in **Table 3.6,** and details are included in **Appendix D**. It is noted that due to low northbound left volumes, there will be no more than 1 vehicle queue, though that one vehicle may experience up to 52 seconds delay.

Table 3.6: Signal Warrant Analysis

INTERSECTION	HORIZON	SIGNAL SCORE			COMMENT
		Total	Vehicle	Pedestrian	
Highway 2 NB & Dunbow Road	2042 Background	33/100	33	0	Not Warranted
	2047 Background	38/100	38	0	Not Warranted

Signalization at Highway 2 NB / Dunbow Road intersection is not warranted in either horizon.

3.2.2 After Development

Table 3.7: After Development Intersection Analysis - 2027

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.13	A	0	<5	0.08	A	0	<5
	WBL	1	0.02	A	9	<5	<0.02	A	8	<5
	WBT	1	0.07	A	0	<5	0.06	A	0	<5
	SBL	1	0.34	C	16	12	0.33	B	13	12
	Overall		-	*A*	*3.8*	-	-	*A*	*4.9*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.25	A	9	8	0.12	A	8	<5
	EBT	1	0.15	A	0	<5	0.19	A	0	<5
	WBT	1	0.07	A	0	<5	0.04	A	0	<5
	NBL	1	0.17	D	33	<5	0.11	C	19	<5
	Overall		-	*A*	*5.1*	-	-	*A*	*3.2*	-

Table 3.8: After Development Intersection Analysis - 2032

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.14	A	0	<5	0.09	A	0	<5
	WBL	1	0.02	A	9	<5	<0.02	A	8	<5
	WBT	1	0.08	A	0	<5	0.06	A	0	<5
	SBL	1	0.39	C	17	15	0.38	B	14	14
	Overall		-	*A*	*4.2*	-	-	*A*	*5.2*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.27	A	9	9	0.13	A	8	<5
	EBT	1	0.16	A	0	<5	0.21	A	0	<5
	WBT	1	0.07	A	0	<5	0.05	A	0	<5
	NBL	1	0.22	E	40	7	0.13	C	21	<5
	Overall		-	*A*	*5.4*	-	-	*A*	*3.3*	-

Table 3.9: After Development Intersection Analysis - 2037

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR				PM PEAK HOUR			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.15	A	0	<5	0.09	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	8	<5
	WBT	1	0.08	A	0	<5	0.07	A	0	<5
	SBL	1	0.44	C	19	18	0.42	B	15	17
	Overall		-	*A*	*4.7*	-	-	*A*	*5.6*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.29	A	9	10	0.14	A	8	<5
	EBT	1	0.18	A	0	<5	0.22	A	0	<5
	WBT	1	0.08	A	0	<5	0.05	A	0	<5
	NBL	1	0.28	E	49	9	0.14	C	23	<5
	Overall		-	*A*	*5.8*	-	-	*A*	*3.4*	-

Table 3.10: After Development Intersection Analysis - 2042

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR v/c	AM LOS	AM Delay	AM Queue	PM PEAK HOUR v/c	PM LOS	PM Delay	PM Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.16	A	0	<5	0.10	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	8	<5
	WBT	1	0.09	A	0	<5	0.07	A	0	<5
	SBL	1	0.50	C	21	23	0.47	C	16	20
	Overall		-	*A*	*5.3*	-	-	*A*	*6.1*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.31	A	9	11	0.15	A	8	<5
	EBT	1	0.19	A	0	<5	0.24	A	0	<5
	WBT	1	0.09	A	0	<5	0.06	A	0	<5
	NBL	1	0.35	F	61	11	0.17	C	25	<5
	Overall		-	*A*	*6.2*	-	-	*A*	*3.4*	-

Table 3.11: After Development Intersection Analysis - 2047

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR v/c	AM LOS	AM Delay	AM Queue	PM PEAK HOUR v/c	PM LOS	PM Delay	PM Queue
Highway 2 SB & Dunbow Road *(SB Stop Control)*	EBT	2	0.17	A	0	<5	0.11	A	0	<5
	WBL	1	0.03	A	9	<5	<0.02	A	9	<5
	WBT	1	0.09	A	0	<5	0.08	A	0	<5
	SBL	1	0.57	C	25	28	0.52	C	18	24
	Overall		-	*A*	*6.1*	-	-	*A*	*6.7*	-
Highway 2 NB & Dunbow Road *(NB Stop Control)*	EBL	1	0.33	A	9	12	0.15	A	8	<5
	EBT	1	0.20	A	0	<5	0.26	A	0	<5
	WBT	1	0.09	A	0	<5	0.06	A	0	<5
	NBL	1	0.45	F	81	15	0.20	D	28	6
	Overall		-	*A*	*7.0*	-	-	*A*	*3.6*	-

The After Development analysis showed the northbound left turn (NBL) movement at Highway 2 NB / Dunbow Road intersection is expected to operate with up to 40 seconds delay by 2032. Similar results were obtained for 2037, 2042 and 2047 post development traffic conditions.

Signal warrant analysis was completed for this movement using TAC's Traffic Signal and Pedestrian Signal Head Warrant Handbook (2014). 6- hour raw traffic volumes were obtained from ATEC and used for the analysis, and they were calculated by applying the observed 6-hour volume factors in the traffic counts. 6-hour factor of 3.09 is obtained for Highway 2 / Dunbow Road intersection. The results of signal warrant analysis are summarized in **Table 3.12,** and details are included in **Appendix D**.

Table 3.12: Signal Warrant Analysis

INTERSECTION	HORIZON	SIGNAL SCORE Total	Vehicle	Pedestrian	COMMENT
Highway 2 NB & Dunbow Road	2032 After Development	32/100	32	0	Not Warranted
	2037 After Development	36/100	36	0	Not Warranted
	2042 After Development	42/100	42	0	Not Warranted
	2047 After Development	47/100	47	0	Not Warranted

Signalization at Highway 2 NB / Dunbow Road intersection is not warranted in all After Development horizon.

4. SUMMARY & CONCLUSION

4.1 Background

Northbound left turn (NBL) movement of Highway 2 NB / Dunbow Road intersection is expected to operate with longer delays by 2042. Signalization of Highway 2 NB / Dunbow Road intersection is not warranted at all horizons due to Background traffic alone. Highway 2 SB / Dunbow Road intersection is expected to operate acceptably in all Background horizons.

4.2 After Development

Northbound left turn (NBL) movement of Highway 2 NB / Dunbow Road intersection is expected to operate with delays by 2032. However, signalization at Highway 2 NB / Dunbow Road intersection is not warranted in all After Development horizons. Highway 2 SB / Dunbow Road intersection is expected to operate acceptably in all After Development horizons.

Conclusion

Though the northbound left turn movement may experience some delays, the queue length is in order of one vehicle due to low traffic volume and therefore, signalization of the intersections is not warranted and not recommended.

APPENDIX A

Scope of Work

From:	Jason Dunn
To:	Gloria Shu
Subject:	FW: Heritage Crossing - Hwy 2 / Dunbow Road Interchange Review
Date:	May 19, 2023 10:41:28 AM
Attachments:	image001.png

FYI

Jason Dunn, P.Eng. | Associate

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Suite 113, 334 11th Avenue SE, Calgary, AB T2G 0Y2
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From: Trevor Richelhof <Trevor.Richelhof@gov.ab.ca>
Sent: Tuesday, May 16, 2023 9:25 AM
To: Jason Dunn <jdunn@bunteng.com>
Cc: Jerry Lau <Jerry.Lau@gov.ab.ca>; Kristi Beunder <Kristi@twpplanning.com>
Subject: RE: Heritage Crossing - Hwy 2 / Dunbow Road Interchange Review

Hi Jason, scope looks good.
Thanks,

Trevor Richelhof CET, RPP, MCIP
Development and Planning Technologist / Acting Infrastructure Manager
Southern Region, Construction & Maintenance Division
Ministry of Transportation and Economic Corridors
Government of Alberta

Classification: Protected A

From: Jason Dunn <jdunn@bunteng.com>
Sent: Monday, May 15, 2023 12:01 PM
To: Trevor Richelhof <Trevor.Richelhof@gov.ab.ca>
Cc: Jerry Lau <Jerry.Lau@gov.ab.ca>; Kristi Beunder <Kristi@twpplanning.com>
Subject: Heritage Crossing - Hwy 2 / Dunbow Road Interchange Review

Trevor,

Further to our discussion on May 12, 2023, I have confirmed with Foothills County that there are no other current proposed developments that are either approved or under review, that aren't already

known to ATEC.

Therefore for the scope of this review, I proposed the following:

1. Use the existing count from the ATEC website.
2. Grow the movements at 2% pa (linear) at 5 year intervals for the next 25 years.
3. Review the background and after development scenarios for each 5 year interval.
4. Identify if the ramp intersections on Dunbow Road require signalisation at any of these scenarios.
5. Provide the information to ATEC in a technical memo.

Please let me know if this scope is acceptable.

Regards

Jason Dunn, P.Eng. | Associate

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APPENDIX B

ATEC Traffic Data

Reference Number:
10000020

Intersection of:
2 & DUNBOW RD 32-21-29-401500000

North On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	19,044	91.0%
B: Recreational Vehicle	196	0.9%
C: Bus	21	0.1%
D: Single Unit Truck	561	2.7%
E: Tractor Trailer Unit	1,108	5.3%
AADT	**41,860**	
ASDT	48,090	

2022 AADT / ASDT Estimates

Leg AADT Volumes

41,860
6,020 5,540
33,740

Total Entering Volume: **43,580**

From North

	20,930		
	Right	Thru	Left
	2,260	**####**	**2,070**
A	2,203	###	1,997
B	3	230	6
C	4	16	2
D	35	412	58
E	15	1,211	7

To North

20,930	
A	###
B	196
C	21
D	561
E	1,108

To West

3,010	
A	2,938
B	6
C	4
D	47
E	15

From East

2,770		
Left	Thru	Right
110	**590**	**2,070**
100	579	2,011 A
1	3	15 B
0	0	0 C
9	8	40 D
0	0	4 E

West On: Dunbow Rd

	Volume	%
A	2,938	97.6%
B	6	0.2%
C	4	0.1%
D	47	1.6%
E	15	0.5%
AADT	**6,020**	
ASDT	6,920	

East On: Dunbow Rd

Vehicle Type		
A	2,673	96.5%
B	10	0.4%
C	2	0.1%
D	77	2.8%
E	8	0.3%
AADT	**5,540**	
ASDT	6,360	

From West

	3,010		
	Left	Thru	Right
	2,260	**590**	**160**
A	2,199	577	154
B	3	4	0
C	3	0	0
D	42	8	4
E	13	1	2

To East

2,770	
2,673	A
10	B
2	C
77	D
8	E

To South

16,870	
A	###
B	231
C	16
D	425
E	1,213

From South

	16,870		
	Left	Thru	Right
	160	**####**	**110**
A	156	###	99
B	0	178	0
C	0	18	0
D	4	479	11
E	0	1,091	0

South On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	14,985	88.8%
B: Recreational Vehicle	231	1.4%
C: Bus	16	0.1%
D: Single Unit Truck	425	2.5%
E: Tractor Trailer Unit	1,213	7.2%
AADT	**33,740**	
ASDT	38,740	

ABBREVIATIONS:

AADT: Annual Average Daily Traffic. Average daily traffic expressed as vehicles per day for the period from January 1 to December 31 (inclusive), 365 days.

ASDT: Average Summer Daily Traffic. Average daily traffic expressed as vehicles per day for the period from May 1 to September 30 (inclusive), 153 days.

NOTE:
Coloured line thickness corresponds to turning movement volume.

Reference Number:
10000020

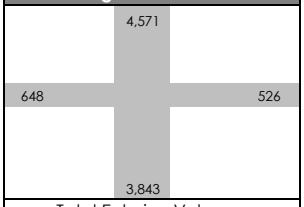
Intersection of:
2 & DUNBOW RD 32-21-29-401500000

North On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	4,050	88.6%
B: Recreational Vehicle	40	0.9%
C: Bus	0	0.0%
D: Single Unit Truck	163	3.6%
E: Tractor Trailer Unit	318	7.0%
AM	**4,571**	

2022 AM 100th Highest Hour Estimates

Leg AM Volumes



Total Entering Volume: **4,794**

From North

	Right	Thru	Left
	216	**1,810**	**148**
A	206	1,564	139
B	0	23	0
C	0	0	0
D	7	63	7
E	3	160	2

2,174

To North

	2,397
A	2,141
B	17
C	0
D	86
E	153

To West

	313
A	303
B	0
C	0
D	7
E	3

From East

	Left	Thru	Right	
	21	**76**	**207**	
A	21	76	195	A
B	0	0	0	B
C	0	0	0	C
D	0	0	10	D
E	0	0	2	E

304

West On: Dunbow Rd

	Volume	%
A	624	96.3%
B	0	0.0%
C	0	0.0%
D	14	2.2%
E	10	1.5%
AM	**648**	

East On: Dunbow Rd

Vehicle Type		
A	496	94.3%
B	0	0.0%
C	0	0.0%
D	24	4.6%
E	6	1.1%
AM	**526**	

From West

	Left	Thru	Right
	241	**63**	**31**
A	234	56	31
B	0	0	0
C	0	0	0
D	2	5	0
E	5	2	0

335

To East

	222
A	204
B	0
C	0
D	14
E	4

To South

	1,862
A	1,616
B	23
C	0
D	63
E	160

From South

	Left	Thru	Right
	21	**1,949**	**11**
A	21	1,712	9
B	0	17	0
C	0	0	0
D	0	74	2
E	0	146	0

1,981

South On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	3,358	87.4%
B: Recreational Vehicle	40	1.0%
C: Bus	0	0.0%
D: Single Unit Truck	139	3.6%
E: Tractor Trailer Unit	306	8.0%
AM	**3,843**	

NOTE:
Coloured line thickness corresponds to turning movement volume.

Reference Number:
10000020

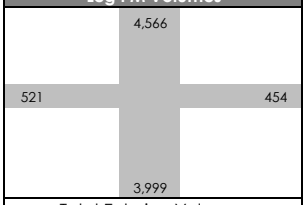
Intersection of:
2 & DUNBOW RD 32-21-29-401500000

North On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	4,264	93.4%
B: Recreational Vehicle	59	1.3%
C: Bus	6	0.1%
D: Single Unit Truck	69	1.5%
E: Tractor Trailer Unit	168	3.7%
PM	4,566	

2022 PM 100th Highest Hour Estimates

Leg PM Volumes



Total Entering Volume: **4,770**

From North

	Total	Right	Thru	Left
	2,712	224	2,301	187
A		224	2,151	184
B		0	39	1
C		0	0	0
D		0	29	2
E		0	82	0

To North

	1,854
A	1,705
B	19
C	6
D	38
E	86

To West

	298
A	296
B	1
C	0
D	1
E	0

From East

	Total	Left	Thru	Right
	175	8	56	111
A		8	54	110
B		0	1	1
C		0	0	0
D		0	1	0
E		0	0	0

West On: Dunbow Rd

	Volume	%
A	517	99.2%
B	1	0.2%
C	0	0.0%
D	3	0.6%
E	0	0.0%
PM	521	

East On: Dunbow Rd

Vehicle Type	Volume	%
A	447	98.5%
B	3	0.7%
C	0	0.0%
D	4	0.9%
E	0	0.0%
PM	454	

From West

	Total	Left	Thru	Right
	223	112	81	30
A		110	81	30
B		0	0	0
C		0	0	0
D		2	0	0
E		0	0	0

To East

	279
A	275
B	1
C	0
D	3
E	0

To South

	2,339
A	2,189
B	39
C	0
D	29
E	82

From South

	Total	Left	Thru	Right
	1,660	18	1,631	11
A		18	1,485	10
B		0	18	0
C		0	6	0
D		0	36	1
E		0	86	0

South On: 2

Vehicle Type	Volume	%
A: Passenger Vehicle	3,702	92.6%
B: Recreational Vehicle	57	1.4%
C: Bus	6	0.2%
D: Single Unit Truck	66	1.7%
E: Tractor Trailer Unit	168	4.2%
PM	3,999	

NOTE:
Coloured line thickness corresponds to turning movement volume.

APPENDIX C

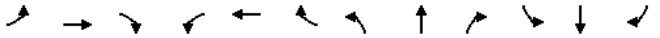
Synchro Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	334	0	23	107	0	0	0	0	163	0	0
Future Volume (vph)	0	334	0	23	107	0	0	0	0	163	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected				0.950						0.950		
Satd. Flow (prot)	0	3400	0	1785	1879	0	0	0	0	1684	0	0
Flt Permitted				0.950						0.950		
Satd. Flow (perm)	0	3400	0	1785	1879	0	0	0	0	1684	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		183.6			250.0			210.6			190.7	
Travel Time (s)		13.2			18.0			15.2			13.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	5%	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%
Adj. Flow (vph)	0	363	0	25	116	0	0	0	0	177	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	363	0	25	116	0	0	0	0	177	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.6%		ICU Level of Service A	
Analysis Period (min) 15			

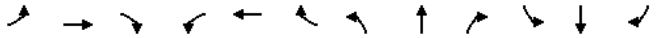
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	232	0	0	107	0	23	0	0	0	0	0
Future Volume (vph)	265	232	0	0	107	0	23	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected	0.950						0.950					
Satd. Flow (prot)	1733	1740	0	0	1879	0	1785	0	0	0	0	0
Flt Permitted	0.950						0.950					
Satd. Flow (perm)	1733	1740	0	0	1879	0	1785	0	0	0	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		250.0			206.2			204.3			183.4	
Travel Time (s)		18.0			14.8			14.7			13.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	288	252	0	0	116	0	25	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	288	252	0	0	116	0	25	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.6%		ICU Level of Service A	
Analysis Period (min) 15			



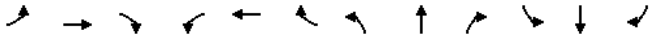
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	212	0	9	81	0	0	0	0	206	0	0
Future Volume (vph)	0	212	0	9	81	0	0	0	0	206	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected				0.950						0.950		
Satd. Flow (prot)	0	3535	0	1716	1824	0	0	0	0	1750	0	0
Flt Permitted				0.950						0.950		
Satd. Flow (perm)	0	3535	0	1716	1824	0	0	0	0	1750	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		183.6			250.0			210.6			190.7	
Travel Time (s)		13.2			18.0			15.2			13.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	4%	3%	0%	0%	0%	0%	2%	0%	0%
Adj. Flow (vph)	0	230	0	10	88	0	0	0	0	224	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	230	0	10	88	0	0	0	0	224	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 30.6%		ICU Level of Service A	
Analysis Period (min) 15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	123	295	0	0	70	0	20	0	0	0	0	0
Future Volume (vph)	123	295	0	0	70	0	20	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected	0.950						0.950					
Satd. Flow (prot)	1750	1860	0	0	1824	0	1785	0	0	0	0	0
Flt Permitted	0.950						0.950					
Satd. Flow (perm)	1750	1860	0	0	1824	0	1785	0	0	0	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		250.0			206.2			204.3			183.4	
Travel Time (s)		18.0			14.8			14.7			13.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	134	321	0	0	76	0	22	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	134	321	0	0	76	0	22	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

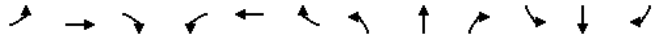
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 30.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	365	0	25	116	0	0	0	0	178	0	0
Future Volume (Veh/h)	0	365	0	25	116	0	0	0	0	178	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	397	0	27	126	0	0	0	0	193	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	126			397			577	577	198	378	577	126
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	126			397			577	577	198	378	577	126
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			98			100	100	100	64	100	100
cM capacity (veh/h)	1473			1173			397	420	816	535	420	907

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	198	198	27	126	193
Volume Left	0	0	27	0	193
Volume Right	0	0	0	0	0
cSH	1700	1700	1173	1700	535
Volume to Capacity	0.12	0.12	0.02	0.07	0.36
Queue Length 95th (m)	0.0	0.0	0.6	0.0	13.1
Control Delay (s)	0.0	0.0	8.1	0.0	15.5
Lane LOS			A		C
Approach Delay (s)	0.0		1.4		15.5
Approach LOS					C

Intersection Summary					
Average Delay	4.3				
Intersection Capacity Utilization	35.4%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	289	253	0	0	116	0	25	0	0	0	0	0
Future Volume (Veh/h)	289	253	0	0	116	0	25	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	314	275	0	0	126	0	27	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	126			275			1029	1029	275	1029	1029	126
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	126			275			1029	1029	275	1029	1029	126
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	78			100			85	100	100	100	100	100
cM capacity (veh/h)	1454			1300			178	185	769	178	185	930

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	314	275	126	27
Volume Left	314	0	0	27
Volume Right	0	0	0	0
cSH	1454	1700	1700	178
Volume to Capacity	0.22	0.16	0.07	0.15
Queue Length 95th (m)	6.6	0.0	0.0	4.2
Control Delay (s)	8.2	0.0	0.0	28.8
Lane LOS	A			D
Approach Delay (s)	4.3		0.0	28.8
Approach LOS				D

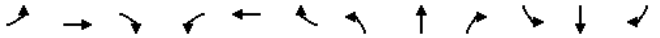
Intersection Summary					
Average Delay	4.5				
Intersection Capacity Utilization	35.4%	ICU Level of Service		A	
Analysis Period (min)	15				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	232	0	10	89	0	0	0	0	224	0	0
Future Volume (vph)	0	232	0	10	89	0	0	0	0	224	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected				0.950						0.950		
Satd. Flow (prot)	0	3535	0	1716	1824	0	0	0	0	1750	0	0
Flt Permitted				0.950						0.950		
Satd. Flow (perm)	0	3535	0	1716	1824	0	0	0	0	1750	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		183.6			250.0			210.6			190.7	
Travel Time (s)		13.2			18.0			15.2			13.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	4%	3%	0%	0%	0%	0%	2%	0%	0%
Adj. Flow (vph)	0	252	0	11	97	0	0	0	0	243	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	252	0	11	97	0	0	0	0	243	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 32.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	134	322	0	0	77	0	22	0	0	0	0	0
Future Volume (vph)	134	322	0	0	77	0	22	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected	0.950						0.950					
Satd. Flow (prot)	1750	1860	0	0	1824	0	1785	0	0	0	0	0
Flt Permitted	0.950						0.950					
Satd. Flow (perm)	1750	1860	0	0	1824	0	1785	0	0	0	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		250.0			206.2			204.3			183.4	
Travel Time (s)		18.0			14.8			14.7			13.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	146	350	0	0	84	0	24	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	146	350	0	0	84	0	24	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

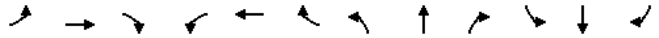
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 32.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	395	0	27	126	0	0	0	0	192	0	0
Future Volume (Veh/h)	0	395	0	27	126	0	0	0	0	192	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	429	0	29	137	0	0	0	0	209	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	137			429			624	624	214	410	624	137
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	137			429			624	624	214	410	624	137
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	59	100	100
cM capacity (veh/h)	1459			1141			367	394	797	507	394	893

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	214	214	29	137	209
Volume Left	0	0	29	0	209
Volume Right	0	0	0	0	0
cSH	1700	1700	1141	1700	507
Volume to Capacity	0.13	0.13	0.03	0.08	0.41
Queue Length 95th (m)	0.0	0.0	0.6	0.0	16.0
Control Delay (s)	0.0	0.0	8.2	0.0	17.0
Lane LOS			A		C
Approach Delay (s)	0.0		1.4		17.0
Approach LOS					C

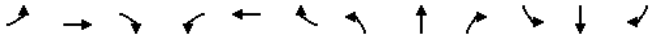
Intersection Summary				
Average Delay	4.7			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	313	274	0	0	126	0	27	0	0	0	0	0
Future Volume (Veh/h)	313	274	0	0	126	0	27	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	340	298	0	0	137	0	29	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	137			298			1115	1115	298	1115	1115	137
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	137			298			1115	1115	298	1115	1115	137
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	76			100			81	100	100	100	100	100
cM capacity (veh/h)	1441			1275			153	160	746	153	160	917

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	340	298	137	29
Volume Left	340	0	0	29
Volume Right	0	0	0	0
cSH	1441	1700	1700	153
Volume to Capacity	0.24	0.18	0.08	0.19
Queue Length 95th (m)	7.4	0.0	0.0	5.4
Control Delay (s)	8.3	0.0	0.0	34.0
Lane LOS	A			D
Approach Delay (s)	4.4		0.0	34.0
Approach LOS				D

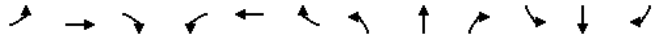
Intersection Summary				
Average Delay	4.7			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	251	0	10	96	0	0	0	0	243	0	0
Future Volume (Veh/h)	0	251	0	10	96	0	0	0	0	243	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	273	0	11	104	0	0	0	0	264	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	104			273			399	399	136	262	399	104
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104			273			399	399	136	262	399	104
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	60	100	100
cM capacity (veh/h)	1500			1273			537	537	893	665	537	937

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	136	136	11	104	264
Volume Left	0	0	11	0	264
Volume Right	0	0	0	0	0
cSH	1700	1700	1273	1700	665
Volume to Capacity	0.08	0.08	0.01	0.06	0.40
Queue Length 95th (m)	0.0	0.0	0.2	0.0	15.2
Control Delay (s)	0.0	0.0	7.9	0.0	13.9
Lane LOS			A		B
Approach Delay (s)	0.0		0.8		13.9
Approach LOS					B

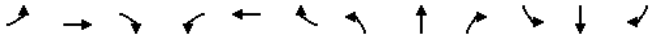
Intersection Summary				
Average Delay	5.8			
Intersection Capacity Utilization	33.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	146	348	0	0	83	0	23	0	0	0	0	0
Future Volume (Veh/h)	146	348	0	0	83	0	23	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	159	378	0	0	90	0	25	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	90			378			786	786	378	786	786	90
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	90			378			786	786	378	786	786	90
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			100			91	100	100	100	100	100
cM capacity (veh/h)	1505			1192			287	292	673	287	292	973

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	159	378	90	25
Volume Left	159	0	0	25
Volume Right	0	0	0	0
cSH	1505	1700	1700	287
Volume to Capacity	0.11	0.22	0.05	0.09
Queue Length 95th (m)	2.8	0.0	0.0	2.3
Control Delay (s)	7.7	0.0	0.0	18.7
Lane LOS	A			C
Approach Delay (s)	2.3		0.0	18.7
Approach LOS				C

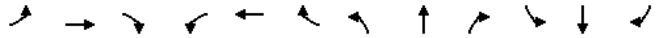
Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	33.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	426	0	29	136	0	0	0	0	207	0	0
Future Volume (Veh/h)	0	426	0	29	136	0	0	0	0	207	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	463	0	32	148	0	0	0	0	225	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	148			463			675	675	232	444	675	148
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148			463			675	675	232	444	675	148
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	53	100	100
cM capacity (veh/h)	1446			1109			336	367	777	478	367	878

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	232	232	32	148	225
Volume Left	0	0	32	0	225
Volume Right	0	0	0	0	0
cSH	1700	1700	1109	1700	478
Volume to Capacity	0.14	0.14	0.03	0.09	0.47
Queue Length 95th (m)	0.0	0.0	0.7	0.0	19.8
Control Delay (s)	0.0	0.0	8.3	0.0	19.1
Lane LOS			A		C
Approach Delay (s)	0.0		1.5		19.1
Approach LOS					C

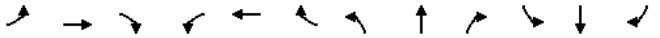
Intersection Summary					
Average Delay	5.2				
Intersection Capacity Utilization	39.2%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	337	295	0	0	136	0	29	0	0	0	0	0
Future Volume (Veh/h)	337	295	0	0	136	0	29	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	366	321	0	0	148	0	32	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	148			321			1201	1201	321	1201	1201	148
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148			321			1201	1201	321	1201	1201	148
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	74			100			76	100	100	100	100	100
cM capacity (veh/h)	1427			1250			131	139	724	131	139	904

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	366	321	148	32
Volume Left	366	0	0	32
Volume Right	0	0	0	0
cSH	1427	1700	1700	131
Volume to Capacity	0.26	0.19	0.09	0.24
Queue Length 95th (m)	8.2	0.0	0.0	7.2
Control Delay (s)	8.4	0.0	0.0	41.2
Lane LOS	A			E
Approach Delay (s)	4.5		0.0	41.2
Approach LOS				E

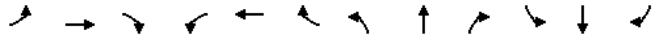
Intersection Summary					
Average Delay	5.1				
Intersection Capacity Utilization	39.2%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	270	0	11	104	0	0	0	0	262	0	0
Future Volume (Veh/h)	0	270	0	11	104	0	0	0	0	262	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	293	0	12	113	0	0	0	0	285	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	113			293			430	430	146	284	430	113
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	113			293			430	430	146	284	430	113
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	56	100	100
cM capacity (veh/h)	1489			1251			510	516	880	642	516	925

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	146	146	12	113	285
Volume Left	0	0	12	0	285
Volume Right	0	0	0	0	0
cSH	1700	1700	1251	1700	642
Volume to Capacity	0.09	0.09	0.01	0.07	0.44
Queue Length 95th (m)	0.0	0.0	0.2	0.0	18.2
Control Delay (s)	0.0	0.0	7.9	0.0	15.0
Lane LOS			A		C
Approach Delay (s)	0.0		0.8		15.0
Approach LOS					C

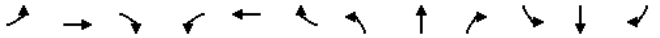
Intersection Summary					
Average Delay	6.2				
Intersection Capacity Utilization	35.3%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	157	375	0	0	90	0	25	0	0	0	0	0
Future Volume (Veh/h)	157	375	0	0	90	0	25	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	171	408	0	0	98	0	27	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	98			408			848	848	408	848	848	98
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	98			408			848	848	408	848	848	98
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			100			90	100	100	100	100	100
cM capacity (veh/h)	1495			1162			259	266	648	259	266	963

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	171	408	98	27
Volume Left	171	0	0	27
Volume Right	0	0	0	0
cSH	1495	1700	1700	259
Volume to Capacity	0.11	0.24	0.06	0.10
Queue Length 95th (m)	3.1	0.0	0.0	2.8
Control Delay (s)	7.7	0.0	0.0	20.5
Lane LOS	A			C
Approach Delay (s)	2.3		0.0	20.5
Approach LOS				C

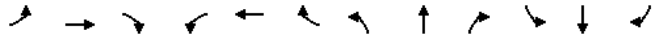
Intersection Summary					
Average Delay	2.7				
Intersection Capacity Utilization	35.3%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	456	0	32	146	0	0	0	0	222	0	0
Future Volume (Veh/h)	0	456	0	32	146	0	0	0	0	222	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	496	0	35	159	0	0	0	0	241	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	159			496			725	725	248	477	725	159
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	159			496			725	725	248	477	725	159
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	47	100	100
cM capacity (veh/h)	1433			1078			309	342	758	451	342	864

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	248	248	35	159	241
Volume Left	0	0	35	0	241
Volume Right	0	0	0	0	0
cSH	1700	1700	1078	1700	451
Volume to Capacity	0.15	0.15	0.03	0.09	0.53
Queue Length 95th (m)	0.0	0.0	0.8	0.0	24.7
Control Delay (s)	0.0	0.0	8.5	0.0	21.8
Lane LOS			A		C
Approach Delay (s)	0.0		1.5		21.8
Approach LOS					C

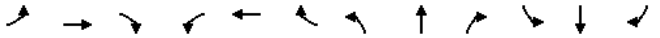
Intersection Summary				
Average Delay	6.0			
Intersection Capacity Utilization	41.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	362	317	0	0	146	0	32	0	0	0	0	0
Future Volume (Veh/h)	362	317	0	0	146	0	32	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	393	345	0	0	159	0	35	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	159			345			1290	1290	345	1290	1290	159
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	159			345			1290	1290	345	1290	1290	159
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	72			100			69	100	100	100	100	100
cM capacity (veh/h)	1414			1225			111	119	702	111	119	892

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	393	345	159	35
Volume Left	393	0	0	35
Volume Right	0	0	0	0
cSH	1414	1700	1700	111
Volume to Capacity	0.28	0.20	0.09	0.31
Queue Length 95th (m)	9.2	0.0	0.0	9.8
Control Delay (s)	8.5	0.0	0.0	51.5
Lane LOS	A			F
Approach Delay (s)	4.5		0.0	51.5
Approach LOS				F

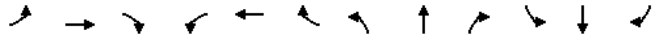
Intersection Summary				
Average Delay	5.5			
Intersection Capacity Utilization	41.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	290	0	12	111	0	0	0	0	281	0	0
Future Volume (Veh/h)	0	290	0	12	111	0	0	0	0	281	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	315	0	13	121	0	0	0	0	305	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	121			315			462	462	158	304	462	121
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	121			315			462	462	158	304	462	121
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	51	100	100
cM capacity (veh/h)	1479			1228			484	494	866	620	494	914

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	158	158	13	121	305
Volume Left	0	0	13	0	305
Volume Right	0	0	0	0	0
cSH	1700	1700	1228	1700	620
Volume to Capacity	0.09	0.09	0.01	0.07	0.49
Queue Length 95th (m)	0.0	0.0	0.3	0.0	21.7
Control Delay (s)	0.0	0.0	8.0	0.0	16.3
Lane LOS			A		C
Approach Delay (s)	0.0		0.8		16.3
Approach LOS					C

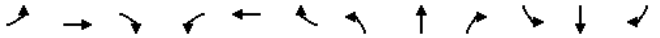
Intersection Summary				
Average Delay	6.7			
Intersection Capacity Utilization	36.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	168	402	0	0	96	0	27	0	0	0	0	0
Future Volume (Veh/h)	168	402	0	0	96	0	27	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	183	437	0	0	104	0	29	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	104			437			907	907	437	907	907	104
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104			437			907	907	437	907	907	104
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			100			88	100	100	100	100	100
cM capacity (veh/h)	1488			1134			234	244	624	234	244	956

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	183	437	104	29
Volume Left	183	0	0	29
Volume Right	0	0	0	0
cSH	1488	1700	1700	234
Volume to Capacity	0.12	0.26	0.06	0.12
Queue Length 95th (m)	3.4	0.0	0.0	3.3
Control Delay (s)	7.8	0.0	0.0	22.5
Lane LOS	A			C
Approach Delay (s)	2.3		0.0	22.5
Approach LOS				C

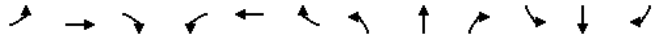
Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	36.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	401	0	23	117	0	0	0	0	163	0	0
Future Volume (Veh/h)	0	401	0	23	117	0	0	0	0	163	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	436	0	25	127	0	0	0	0	177	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	127			436			613	613	218	395	613	127
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	127			436			613	613	218	395	613	127
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			98			100	100	100	66	100	100
cM capacity (veh/h)	1472			1134			374	401	792	521	401	906

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	218	218	25	127	177
Volume Left	0	0	25	0	177
Volume Right	0	0	0	0	0
cSH	1700	1700	1134	1700	521
Volume to Capacity	0.13	0.13	0.02	0.07	0.34
Queue Length 95th (m)	0.0	0.0	0.5	0.0	12.0
Control Delay (s)	0.0	0.0	8.2	0.0	15.4
Lane LOS			A		C
Approach Delay (s)	0.0		1.4		15.4
Approach LOS					C

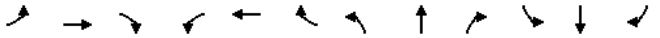
Intersection Summary				
Average Delay	3.8			
Intersection Capacity Utilization	36.2%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	304	260	0	0	114	0	26	0	0	0	0	0
Future Volume (Veh/h)	304	260	0	0	114	0	26	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	330	283	0	0	124	0	28	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	124			283			1067	1067	283	1067	1067	124
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	124			283			1067	1067	283	1067	1067	124
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	77			100			83	100	100	100	100	100
cM capacity (veh/h)	1457			1291			166	173	761	166	173	932

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	330	283	124	28
Volume Left	330	0	0	28
Volume Right	0	0	0	0
cSH	1457	1700	1700	166
Volume to Capacity	0.23	0.17	0.07	0.17
Queue Length 95th (m)	7.0	0.0	0.0	4.7
Control Delay (s)	8.2	0.0	0.0	31.0
Lane LOS	A			D
Approach Delay (s)	4.4		0.0	31.0
Approach LOS				D

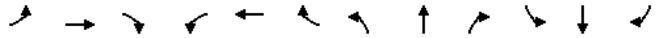
Intersection Summary				
Average Delay	4.7			
Intersection Capacity Utilization	36.2%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	253	0	9	126	0	0	0	0	206	0	0
Future Volume (Veh/h)	0	253	0	9	126	0	0	0	0	206	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	275	0	10	137	0	0	0	0	224	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	137			275			432	432	138	294	432	137
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	137			275			432	432	138	294	432	137
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	65	100	100
cM capacity (veh/h)	1459			1271			509	515	892	631	515	893

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	138	138	10	137	224
Volume Left	0	0	10	0	224
Volume Right	0	0	0	0	0
cSH	1700	1700	1271	1700	631
Volume to Capacity	0.08	0.08	0.01	0.08	0.35
Queue Length 95th (m)	0.0	0.0	0.2	0.0	12.8
Control Delay (s)	0.0	0.0	7.9	0.0	13.8
Lane LOS			A		B
Approach Delay (s)	0.0		0.5		13.8
Approach LOS					B

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	31.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	147	312	0	0	103	0	32	0	0	0	0	0
Future Volume (Veh/h)	147	312	0	0	103	0	32	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	160	339	0	0	112	0	35	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	112			339			771	771	339	771	771	112
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	112			339			771	771	339	771	771	112
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			100			88	100	100	100	100	100
cM capacity (veh/h)	1478			1231			293	297	708	293	297	947

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	160	339	112	35
Volume Left	160	0	0	35
Volume Right	0	0	0	0
cSH	1478	1700	1700	293
Volume to Capacity	0.11	0.20	0.07	0.12
Queue Length 95th (m)	2.9	0.0	0.0	3.2
Control Delay (s)	7.7	0.0	0.0	18.9
Lane LOS	A			C
Approach Delay (s)	2.5		0.0	18.9
Approach LOS				C

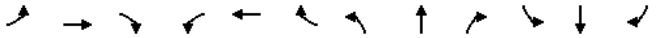
Intersection Summary				
Average Delay	2.9			
Intersection Capacity Utilization	31.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	432	0	25	126	0	0	0	0	178	0	0
Future Volume (vph)	0	432	0	25	126	0	0	0	0	178	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected				0.950						0.950		
Satd. Flow (prot)	0	3400	0	1785	1879	0	0	0	0	1684	0	0
Flt Permitted				0.950						0.950		
Satd. Flow (perm)	0	3400	0	1785	1879	0	0	0	0	1684	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		183.6			250.0			210.6			190.7	
Travel Time (s)		13.2			18.0			15.2			13.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	5%	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%
Adj. Flow (vph)	0	470	0	27	137	0	0	0	0	193	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	470	0	27	137	0	0	0	0	193	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.0%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	328	281	0	0	123	0	28	0	0	0	0	0
Future Volume (vph)	328	281	0	0	123	0	28	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected	0.950						0.950					
Satd. Flow (prot)	1733	1740	0	0	1879	0	1785	0	0	0	0	0
Flt Permitted	0.950						0.950					
Satd. Flow (perm)	1733	1740	0	0	1879	0	1785	0	0	0	0	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		250.0			206.2			204.3			183.4	
Travel Time (s)		18.0			14.8			14.7			13.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	357	305	0	0	134	0	30	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	357	305	0	0	134	0	30	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	

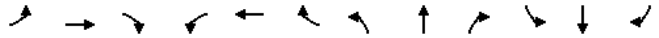
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.0%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	273	0	10	134	0	0	0	0	224	0	0
Future Volume (Veh/h)	0	273	0	10	134	0	0	0	0	224	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	297	0	11	146	0	0	0	0	243	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	146			297			465	465	148	316	465	146
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	146			297			465	465	148	316	465	146
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	60	100	100
cM capacity (veh/h)	1448			1247			482	493	878	609	493	881

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	148	148	11	146	243
Volume Left	0	0	11	0	243
Volume Right	0	0	0	0	0
cSH	1700	1700	1247	1700	609
Volume to Capacity	0.09	0.09	0.01	0.09	0.40
Queue Length 95th (m)	0.0	0.0	0.2	0.0	15.3
Control Delay (s)	0.0	0.0	7.9	0.0	14.8
Lane LOS			A		B
Approach Delay (s)	0.0		0.6		14.8
Approach LOS					B

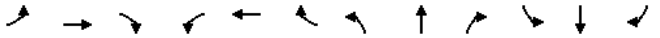
Intersection Summary					
Average Delay	5.3				
Intersection Capacity Utilization	33.3%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	158	339	0	0	110	0	34	0	0	0	0	0
Future Volume (Veh/h)	158	339	0	0	110	0	34	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	172	368	0	0	120	0	37	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	120			368			832	832	368	832	832	120
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	120			368			832	832	368	832	832	120
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			100			86	100	100	100	100	100
cM capacity (veh/h)	1468			1202			265	271	682	265	271	937

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	172	368	120	37
Volume Left	172	0	0	37
Volume Right	0	0	0	0
cSH	1468	1700	1700	265
Volume to Capacity	0.12	0.22	0.07	0.14
Queue Length 95th (m)	3.2	0.0	0.0	3.8
Control Delay (s)	7.8	0.0	0.0	20.8
Lane LOS	A			C
Approach Delay (s)	2.5		0.0	20.8
Approach LOS				C

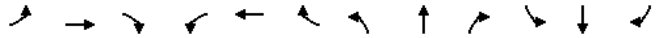
Intersection Summary					
Average Delay	3.0				
Intersection Capacity Utilization	33.3%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	462	0	27	136	0	0	0	0	192	0	0
Future Volume (Veh/h)	0	462	0	27	136	0	0	0	0	192	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	502	0	29	148	0	0	0	0	209	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	148			502			708	708	251	457	708	148
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148			502			708	708	251	457	708	148
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	55	100	100
cM capacity (veh/h)	1446			1073			319	352	755	468	352	878

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	251	251	29	148	209
Volume Left	0	0	29	0	209
Volume Right	0	0	0	0	0
cSH	1700	1700	1073	1700	468
Volume to Capacity	0.15	0.15	0.03	0.09	0.45
Queue Length 95th (m)	0.0	0.0	0.7	0.0	18.1
Control Delay (s)	0.0	0.0	8.4	0.0	18.8
Lane LOS			A		C
Approach Delay (s)	0.0		1.4		18.8
Approach LOS					C

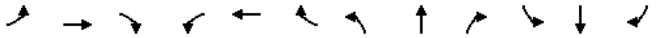
Intersection Summary					
Average Delay	4.7				
Intersection Capacity Utilization	39.8%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	352	302	0	0	133	0	30	0	0	0	0	0
Future Volume (Veh/h)	352	302	0	0	133	0	30	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	383	328	0	0	145	0	33	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	145			328			1239	1239	328	1239	1239	145
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	145			328			1239	1239	328	1239	1239	145
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	73			100			73	100	100	100	100	100
cM capacity (veh/h)	1431			1243			122	130	718	122	130	908

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	383	328	145	33
Volume Left	383	0	0	33
Volume Right	0	0	0	0
cSH	1431	1700	1700	122
Volume to Capacity	0.27	0.19	0.09	0.27
Queue Length 95th (m)	8.7	0.0	0.0	8.2
Control Delay (s)	8.4	0.0	0.0	45.1
Lane LOS	A			E
Approach Delay (s)	4.5		0.0	45.1
Approach LOS				E

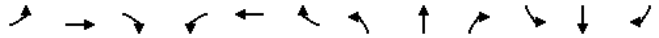
Intersection Summary					
Average Delay	5.3				
Intersection Capacity Utilization	39.8%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	292	0	10	141	0	0	0	0	243	0	0
Future Volume (Veh/h)	0	292	0	10	141	0	0	0	0	243	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	317	0	11	153	0	0	0	0	264	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	153			317			492	492	158	334	492	153
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	153			317			492	492	158	334	492	153
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	55	100	100
cM capacity (veh/h)	1440			1226			461	476	865	592	476	872

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	158	158	11	153	264
Volume Left	0	0	11	0	264
Volume Right	0	0	0	0	0
cSH	1700	1700	1226	1700	592
Volume to Capacity	0.09	0.09	0.01	0.09	0.45
Queue Length 95th (m)	0.0	0.0	0.2	0.0	18.3
Control Delay (s)	0.0	0.0	8.0	0.0	15.9
Lane LOS			A		C
Approach Delay (s)	0.0		0.5		15.9
Approach LOS					C

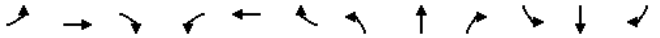
Intersection Summary					
Average Delay	5.7				
Intersection Capacity Utilization	34.9%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	365	0	0	116	0	35	0	0	0	0	0
Future Volume (Veh/h)	170	365	0	0	116	0	35	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	185	397	0	0	126	0	38	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	126			397			893	893	397	893	893	126
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	126			397			893	893	397	893	893	126
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	87			100			84	100	100	100	100	100
cM capacity (veh/h)	1460			1173			239	247	657	239	247	930

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	185	397	126	38
Volume Left	185	0	0	38
Volume Right	0	0	0	0
cSH	1460	1700	1700	239
Volume to Capacity	0.13	0.23	0.07	0.16
Queue Length 95th (m)	3.5	0.0	0.0	4.4
Control Delay (s)	7.8	0.0	0.0	22.9
Lane LOS	A			C
Approach Delay (s)	2.5		0.0	22.9
Approach LOS				C

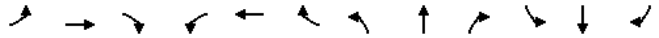
Intersection Summary					
Average Delay	3.1				
Intersection Capacity Utilization	34.9%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	493	0	29	146	0	0	0	0	207	0	0
Future Volume (Veh/h)	0	493	0	29	146	0	0	0	0	207	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	536	0	32	159	0	0	0	0	225	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	159			536			759	759	268	491	759	159
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	159			536			759	759	268	491	759	159
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	49	100	100
cM capacity (veh/h)	1433			1042			292	328	736	441	328	864

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	268	268	32	159	225
Volume Left	0	0	32	0	225
Volume Right	0	0	0	0	0
cSH	1700	1700	1042	1700	441
Volume to Capacity	0.16	0.16	0.03	0.09	0.51
Queue Length 95th (m)	0.0	0.0	0.8	0.0	22.6
Control Delay (s)	0.0	0.0	8.6	0.0	21.4
Lane LOS			A		C
Approach Delay (s)	0.0		1.4		21.4
Approach LOS					C

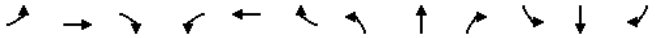
Intersection Summary					
Average Delay	5.3				
Intersection Capacity Utilization	41.7%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	376	323	0	0	143	0	32	0	0	0	0	0
Future Volume (Veh/h)	376	323	0	0	143	0	32	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	409	351	0	0	155	0	35	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	155			351			1324	1324	351	1324	1324	155
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	155			351			1324	1324	351	1324	1324	155
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	71			100			66	100	100	100	100	100
cM capacity (veh/h)	1419			1219			104	112	697	104	112	896

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	409	351	155	35
Volume Left	409	0	0	35
Volume Right	0	0	0	0
cSH	1419	1700	1700	104
Volume to Capacity	0.29	0.21	0.09	0.34
Queue Length 95th (m)	9.6	0.0	0.0	10.5
Control Delay (s)	8.6	0.0	0.0	56.0
Lane LOS	A			F
Approach Delay (s)	4.6		0.0	56.0
Approach LOS				F

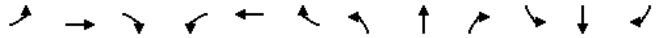
Intersection Summary					
Average Delay	5.7				
Intersection Capacity Utilization	41.7%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	311	0	11	149	0	0	0	0	262	0	0
Future Volume (Veh/h)	0	311	0	11	149	0	0	0	0	262	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	338	0	12	162	0	0	0	0	285	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	162			338			524	524	169	355	524	162
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	162			338			524	524	169	355	524	162
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	50	100	100
cM capacity (veh/h)	1429			1204			437	456	852	571	456	861

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	169	169	12	162	285
Volume Left	0	0	12	0	285
Volume Right	0	0	0	0	0
cSH	1700	1700	1204	1700	571
Volume to Capacity	0.10	0.10	0.01	0.10	0.50
Queue Length 95th (m)	0.0	0.0	0.2	0.0	22.2
Control Delay (s)	0.0	0.0	8.0	0.0	17.4
Lane LOS			A		C
Approach Delay (s)	0.0		0.6		17.4
Approach LOS					C

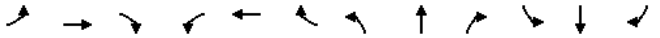
Intersection Summary					
Average Delay	6.3				
Intersection Capacity Utilization	36.4%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	181	392	0	0	123	0	37	0	0	0	0	0
Future Volume (Veh/h)	181	392	0	0	123	0	37	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	197	426	0	0	134	0	40	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	134			426			954	954	426	954	954	134
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	134			426			954	954	426	954	954	134
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	86			100			81	100	100	100	100	100
cM capacity (veh/h)	1451			1144			215	225	633	215	225	920

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	197	426	134	40
Volume Left	197	0	0	40
Volume Right	0	0	0	0
cSH	1451	1700	1700	215
Volume to Capacity	0.14	0.25	0.08	0.19
Queue Length 95th (m)	3.8	0.0	0.0	5.3
Control Delay (s)	7.9	0.0	0.0	25.5
Lane LOS	A			D
Approach Delay (s)	2.5		0.0	25.5
Approach LOS				D

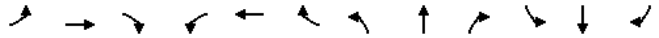
Intersection Summary					
Average Delay	3.2				
Intersection Capacity Utilization	36.4%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	523	0	32	156	0	0	0	0	222	0	0
Future Volume (Veh/h)	0	523	0	32	156	0	0	0	0	222	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	568	0	35	170	0	0	0	0	241	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	170			568			808	808	284	524	808	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	170			568			808	808	284	524	808	170
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.3
p0 queue free %	100			97			100	100	100	42	100	100
cM capacity (veh/h)	1420			1014			269	306	719	416	306	851

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	284	284	35	170	241
Volume Left	0	0	35	0	241
Volume Right	0	0	0	0	0
cSH	1700	1700	1014	1700	416
Volume to Capacity	0.17	0.17	0.03	0.10	0.58
Queue Length 95th (m)	0.0	0.0	0.9	0.0	28.4
Control Delay (s)	0.0	0.0	8.7	0.0	24.9
Lane LOS			A		C
Approach Delay (s)	0.0		1.5		24.9
Approach LOS					C

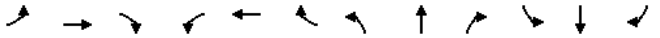
Intersection Summary					
Average Delay	6.2				
Intersection Capacity Utilization	43.6%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	401	345	0	0	153	0	35	0	0	0	0	0
Future Volume (Veh/h)	401	345	0	0	153	0	35	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	436	375	0	0	166	0	38	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	166			375			1413	1413	375	1413	1413	166
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	166			375			1413	1413	375	1413	1413	166
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	69			100			57	100	100	100	100	100
cM capacity (veh/h)	1406			1195			89	96	676	89	96	884

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	436	375	166	38
Volume Left	436	0	0	38
Volume Right	0	0	0	0
cSH	1406	1700	1700	89
Volume to Capacity	0.31	0.22	0.10	0.43
Queue Length 95th (m)	10.7	0.0	0.0	14.1
Control Delay (s)	8.7	0.0	0.0	73.2
Lane LOS	A			F
Approach Delay (s)	4.7		0.0	73.2
Approach LOS				F

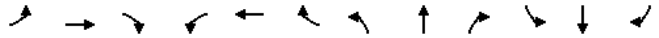
Intersection Summary					
Average Delay	6.5				
Intersection Capacity Utilization	43.6%	ICU Level of Service		A	
Analysis Period (min)	15				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	331	0	12	156	0	0	0	0	281	0	0
Future Volume (Veh/h)	0	331	0	12	156	0	0	0	0	281	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	360	0	13	170	0	0	0	0	305	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	170			360			556	556	180	376	556	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	170			360			556	556	180	376	556	170
tC, single (s)	4.1			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	45	100	100
cM capacity (veh/h)	1420			1181			415	437	838	551	437	851

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	180	180	13	170	305
Volume Left	0	0	13	0	305
Volume Right	0	0	0	0	0
cSH	1700	1700	1181	1700	551
Volume to Capacity	0.11	0.11	0.01	0.10	0.55
Queue Length 95th (m)	0.0	0.0	0.3	0.0	26.8
Control Delay (s)	0.0	0.0	8.1	0.0	19.3
Lane LOS			A		C
Approach Delay (s)	0.0		0.6		19.3
Approach LOS					C

Intersection Summary				
Average Delay	7.1			
Intersection Capacity Utilization	38.1%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	192	419	0	0	129	0	39	0	0	0	0	0
Future Volume (Veh/h)	192	419	0	0	129	0	39	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	209	455	0	0	140	0	42	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	140			455			1013	1013	455	1013	1013	140
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	140			455			1013	1013	455	1013	1013	140
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	86			100			78	100	100	100	100	100
cM capacity (veh/h)	1443			1116			195	206	609	195	206	913

Direction, Lane #	EB 1	EB 2	WB 1	NB 1
Volume Total	209	455	140	42
Volume Left	209	0	0	42
Volume Right	0	0	0	0
cSH	1443	1700	1700	195
Volume to Capacity	0.14	0.27	0.08	0.22
Queue Length 95th (m)	4.1	0.0	0.0	6.3
Control Delay (s)	7.9	0.0	0.0	28.5
Lane LOS	A			D
Approach Delay (s)	2.5		0.0	28.5
Approach LOS				D

Intersection Summary				
Average Delay	3.4			
Intersection Capacity Utilization	38.1%	ICU Level of Service		A
Analysis Period (min)	15			

APPENDIX D

Signal Warrants

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2032 AD

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

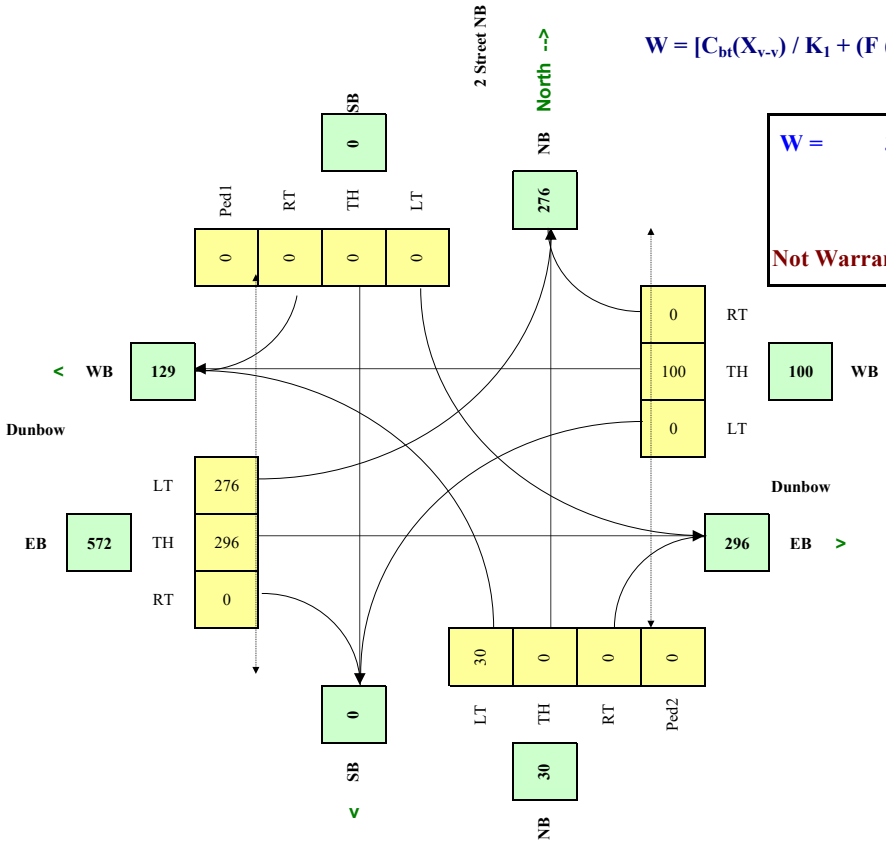
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	179							597		1658	1776		0	0	0	0
Total (6-hour peak)	179	0	0	0	0	0	0	597	0	1,658	1,776	0	0	0	0	0
Average (6-hour peak)	30	0	0	0	0	0	0	100	0	276	296	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	32	32	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2037 AD

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

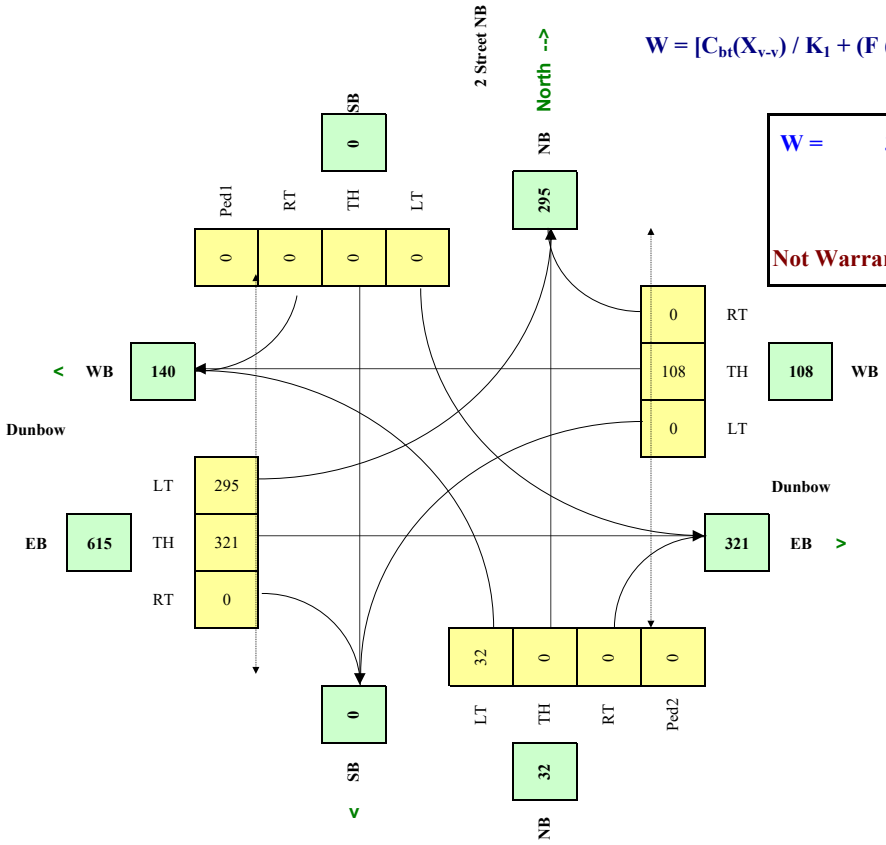
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	191							647		1767	1924		0	0	0	0
Total (6-hour peak)	191	0	0	0	0	0	0	647	0	1,767	1,924	0	0	0	0	0
Average (6-hour peak)	32	0	0	0	0	0	0	108	0	295	321	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	36	36	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2042 AD

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

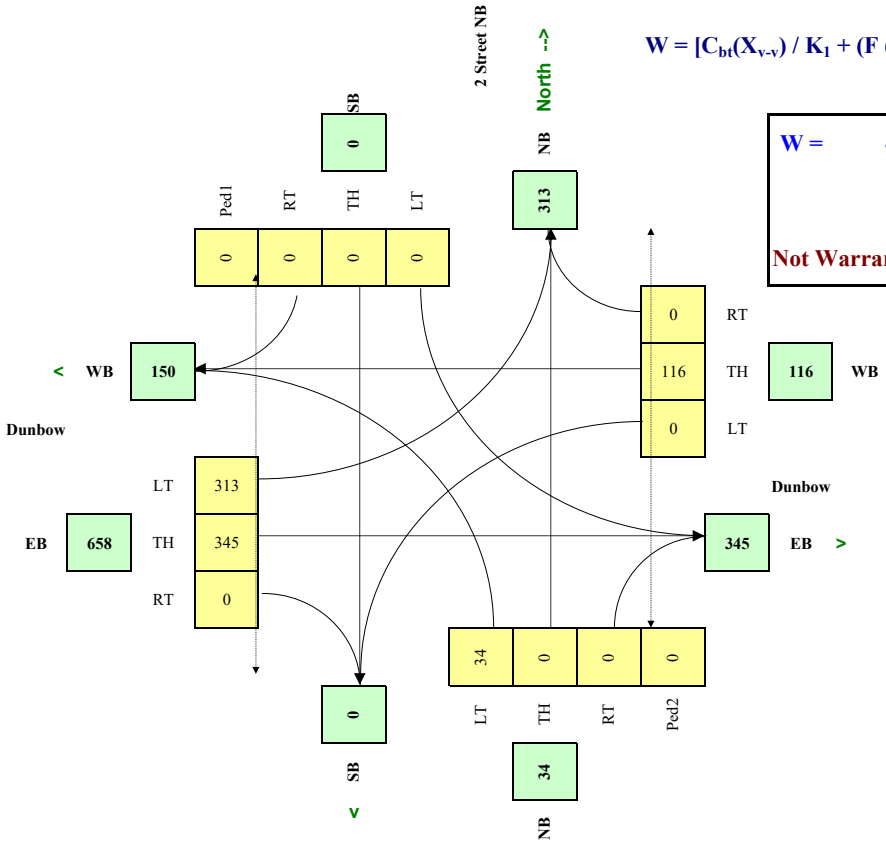
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	203							696		1876	2072		0	0	0	0
Total (6-hour peak)	203	0	0	0	0	0	0	696	0	1,876	2,072	0	0	0	0	0
Average (6-hour peak)	34	0	0	0	0	0	0	116	0	313	345	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	42	42	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2042 BG

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

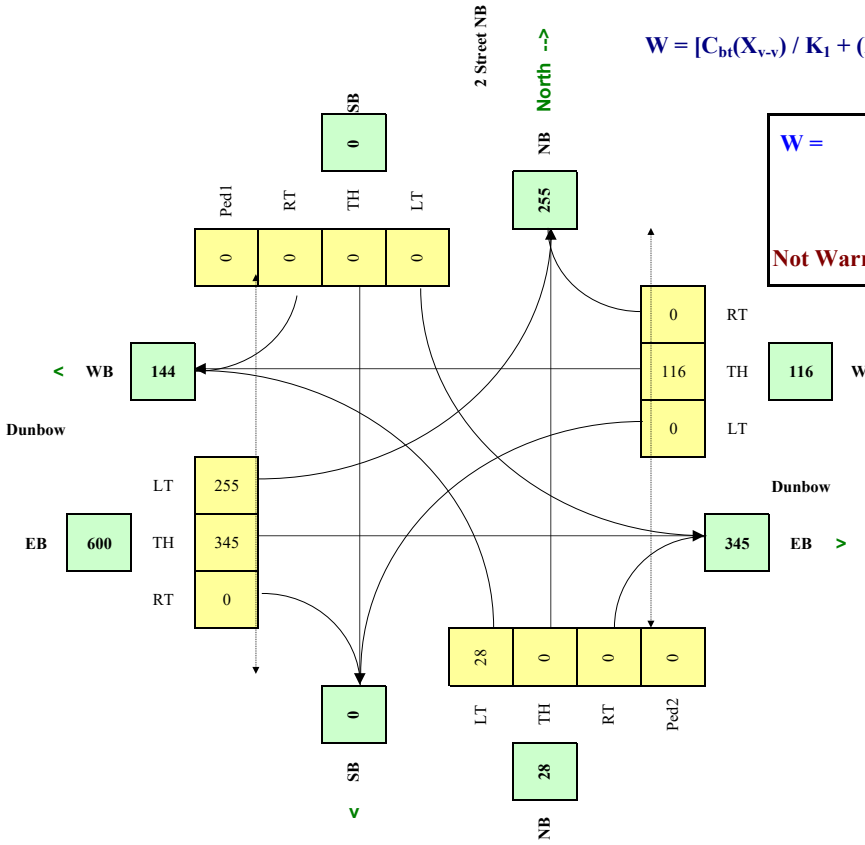
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	169							696		1527	2072		0	0	0	0
Total (6-hour peak)	169	0	0	0	0	0	0	696	0	1,527	2,072	0	0	0	0	0
Average (6-hour peak)	28	0	0	0	0	0	0	116	0	255	345	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	33	33	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2047 AD

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

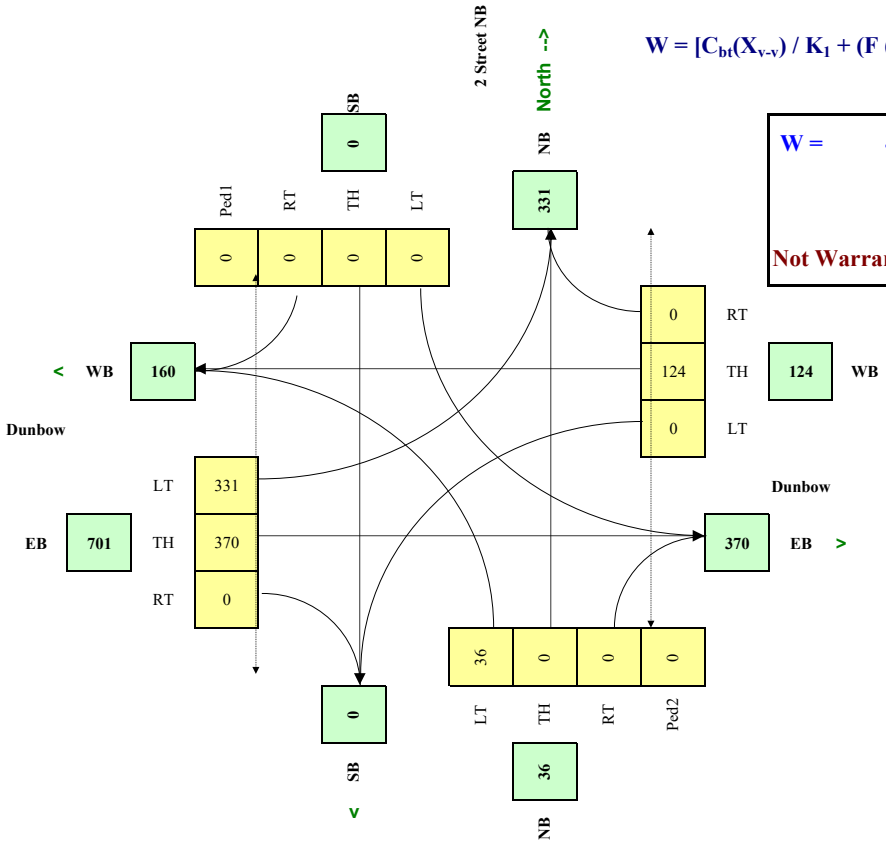
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	215							746		1985	2220		0	0	0	0
Total (6-hour peak)	215	0	0	0	0	0	0	746	0	1,985	2,220	0	0	0	0	0
Average (6-hour peak)	36	0	0	0	0	0	0	124	0	331	370	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	47	47	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

Traffic Signal Warrant Analysis

Main Street (name)	Dunbow	Direction (EW or NS)	EW
Side Street (name)	2 Street NB	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2047 BG

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	
City:	Foothills County
Analysis Date:	2023-05-25
Count Date:	2022 Oct 19, Wed
Date Entry Format:	yyyy-mm-dd

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Dunbow	WB			1					1
Dunbow	EB	1		1					1
2 Street NB	NB	1							
2 Street NB	SB								

Are the 2 Street NB NB right turns significantly impeded by through movements? (y/n) n

Are the 2 Street NB SB right turns significantly impeded by through movements? (y/n) y

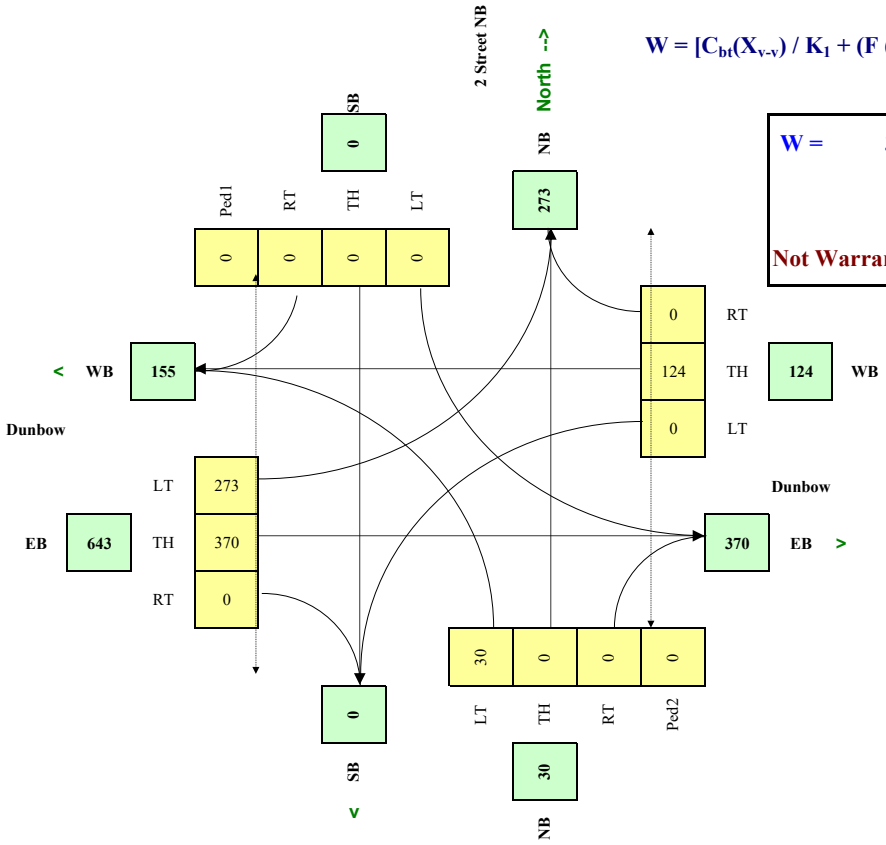
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	22,766
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Dunbow	EW	80	2.0%	n	5.0
2 Street NB	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
3.09*(AM+PM)	181							746		1636	2220		0	0	0	0
Total (6-hour peak)	181	0	0	0	0	0	0	746	0	1,636	2,220	0	0	0	0	0
Average (6-hour peak)	30	0	0	0	0	0	0	124	0	273	370	0	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	38	38	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

NAVAGRAH
landscape architecture + urban design

HERITAGE CROSSING

L1 - OPEN SPACE MASTER PLAN
L2 - DETAIL PLAN 1
L3 - DETAIL PLAN 2
L4 - MAIN ENTRY ELEVATION
L5 - NORTH PROPERTY LINE TRANSITION
L6 - NORTH PROPERTY LINE TRANSITION ALONG STORMWATER POND
L7 - DETAIL ELEVATIONS

HERITAGE CROSSING | OPEN SPACE MASTER PLAN

NAVAGRAH
landscape architecture + urban design

Legend

- 1.5m Wide Concrete Sidewalk
- 2m Wide Asphalt Pathway
- Sod
- 0.9m Height Farm Fence
- Trees

1 - Refer to L2 for Detail 1 Plan
2 - Refer to L3 for Detail 2 Plan
3 - Stormwater Pond
4 - 2m Wide Asphalt Pathway
5 - Residential Area
6 - Bridge to Cross ER
7 - ER
8 - Grass Berm with Tree Buffer Planting
9 - Rain Garden
10 - Triangle Park
11 - View Point with Seating
12 - Property Line
13 - Entry Feature with Planting (Refer to L4, L7 for Details)

HERITAGE CROSSING | DETAIL PLAN 1

NAVAGRAH
landscape architecture + urban design

Key Plan

Legend

- Sod
- Trees
- Shrubs
- Perennials

1. Residential Area
2. Park Entry
3. Entry Feature
4. Grass Berm with Planting
5. Boulevard Trees
6. Kids Play Area
7. 2m Wide Asphalt Pathway
8. Green Open Space/ Winter Skating Area
9. ER
10. Planting Bed
11. Crosswalk
12. 1.5m Wide Concrete Sidewalk

0 5 10
METERS

N

HERITAGE CROSSING | DETAIL PLAN 2

NAVAGRAH
landscape architecture + urban design

Key Plan

Legend

- Sod
- Trees
- Shrubs
- Perennials
- Bench
- Property Line

1. Main Entry
2. Entry Feature
3. Residential Area
4. Boulevard Trees
5a. 1.5m Wide Concrete Sidewalk
5b. 2m Wide Asphalt Pathway
6. Planting Bed
7. Grass Berm
8. Grass Berm with Planting
9. Pickle ball Court
10. Community Board
11. Corner Plaza
12. Seating Node
13. Crosswalk

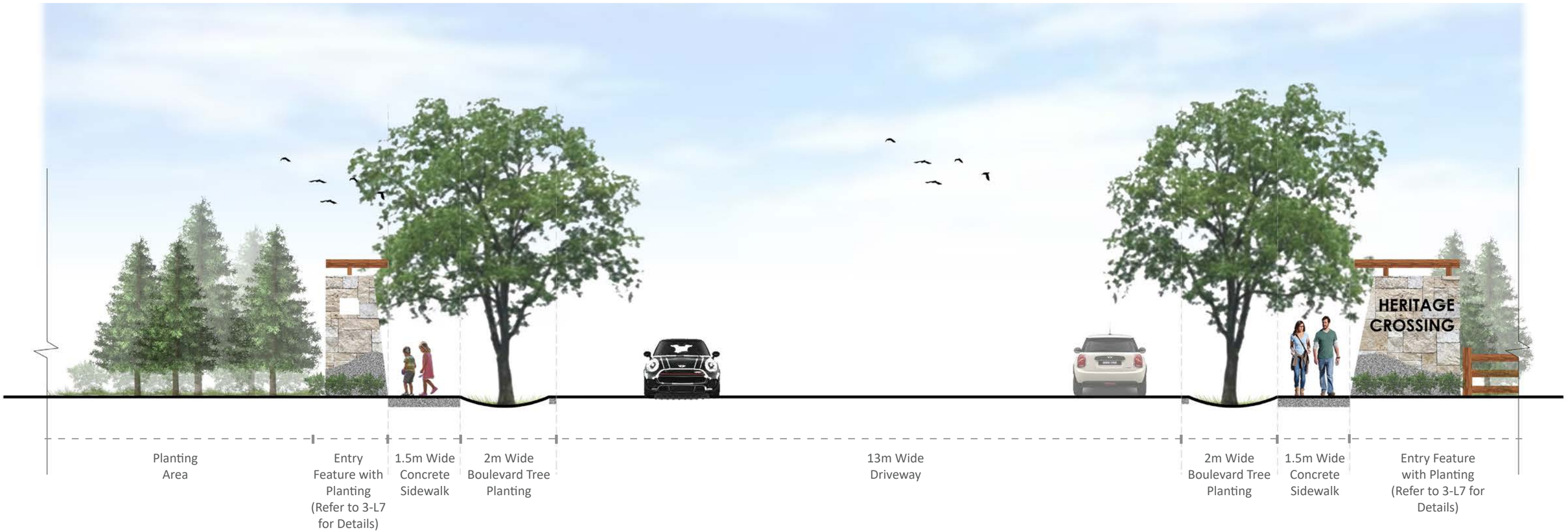
HERITAGE CROSSING | MAIN ENTRY ELEVATION

NAVAGRAH
landscape architecture + urban design

Key Plan

0 1 2 4
Meters

Section 1 - 1



HERITAGE CROSSING | NORTH PROPERTY LINE TRANSITION

NAVAGRAH
landscape architecture + urban design

Key Plan

N

0 2 4 8
Meters

Section 2 - 2

HERITAGE CROSSING | NORTH PROPERTY LINE TRANSITION ALONG STORMWATER POND

NAVAGRAH
landscape architecture + urban design

Key Plan

N

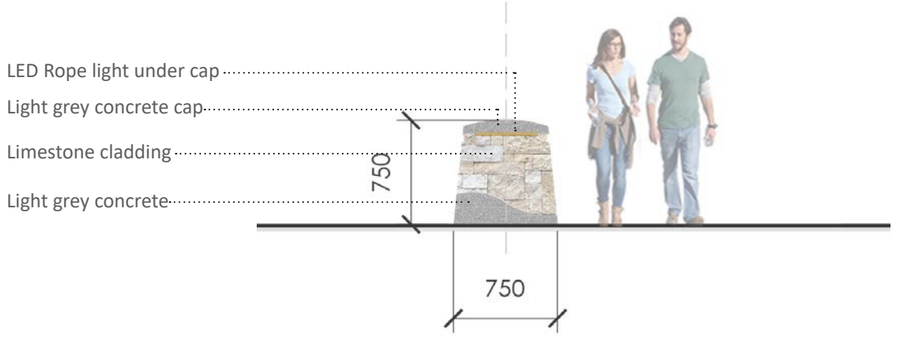
0 1 2 4
Meters

Section 3 - 3

HERITAGE CROSSING | DETAIL ELEVATIONS

NAVAGRAH
landscape architecture + urban design

DETAIL 1 - BOLLARD



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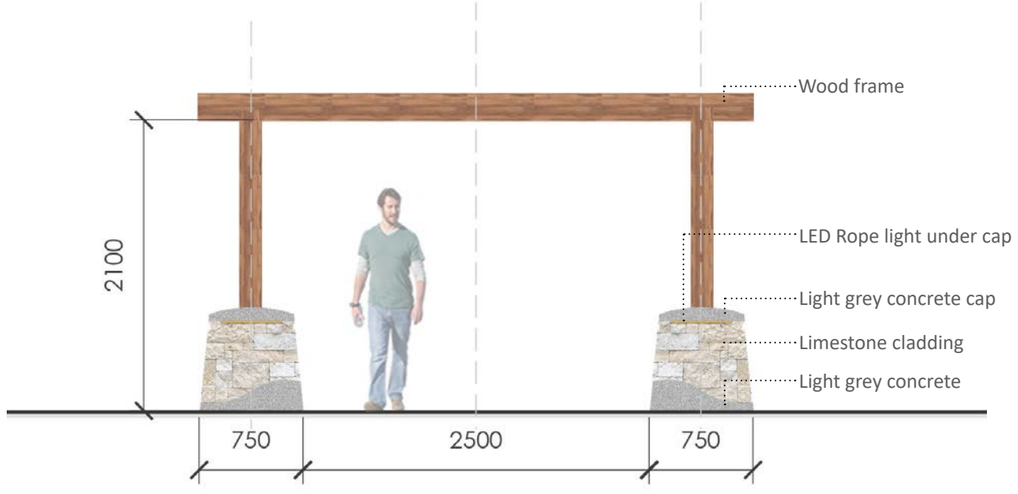
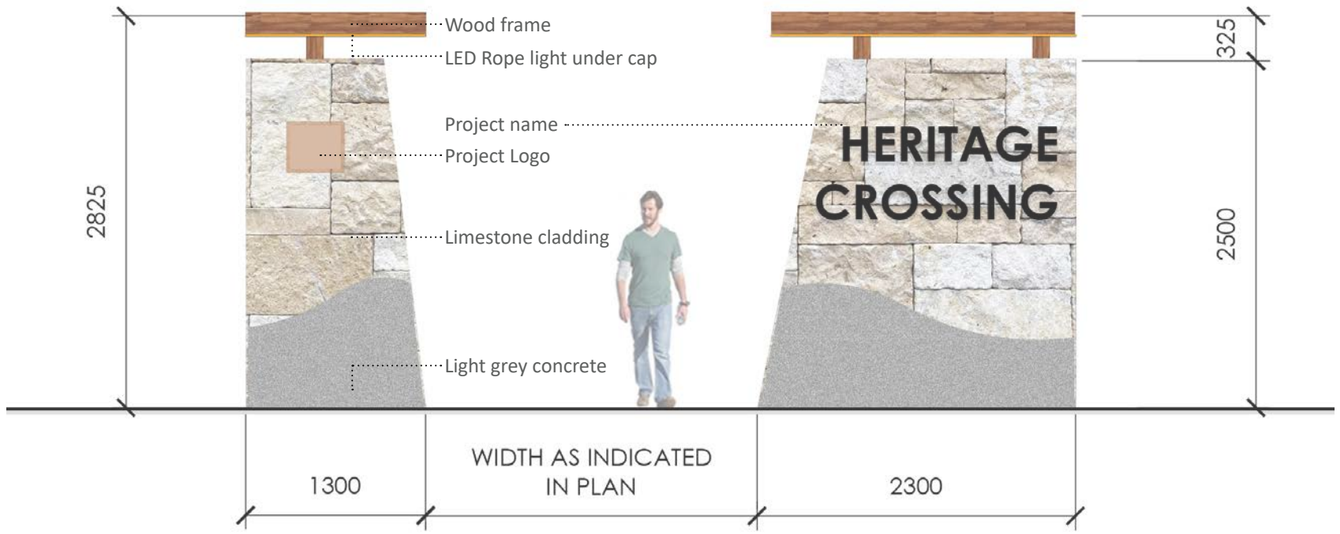


DETAIL 3 - ENTRY FEATURE



* NOTE: Dimensions in millimeters

Associated Engineering | 75 YEARS

REPORT

Township Planning + Design Inc.

Foothills County ASP
Conceptual Design Report

JANUARY 2022

A Carbon Neutral Company

CANADA BEST MANAGED COMPANIES Platinum member

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

Township Planning + Design Inc. (the Client) on behalf of 2291463 Alberta Ltd. (the Owner) retained Associated Engineering (AE) to provide a preliminary servicing report for the water, sanitary, and storm systems to be included in an Area Structure Plan (ASP) submission to Foothills County.

2 BACKGROUND

The Owner is developing an ASP for a parcel of land located south of Dunbow Road, between 2 Street and 8 Street E. The 15.81 ha land is proposed to be the Heritage Pointe South residential development. This report represents a conceptual servicing plan that identifies the deep utility servicing requirements for the subject lands.

Additionally, the Client provided the Residential Development Site Plan, and the Storm Management Plan with the accommodated runoff generated by the sub-catchment area for the storm system assessment.

The natural topography of the subject lands slope from south to north, and drain to a natural draw that runs south to north through the site. Elevations within the site range between 1061m and 1052.5m, with an average slope on the site of 2%. A separate stormwater management plan was developed by LGN Consulting Engineering Ltd. The stormwater management plan defines the post development stormwater management requirements for the site.

3 DEEP UTILITY SERVICING

Land uses in the proposed ASP include singe-family and multi-family developments, municipal and environmental reserve, roadways, and other utility rights-of-way. Based on the proposed land use, there will be an estimated 156 residential units, with an average assumed occupancy of 2.7 persons per unit. The total forecasted population of the development is 421 people.

The proposed development will be serviced by the existing Foothills water and wastewater systems operated by Corix Utilities. The new service area is proposed to connect to the existing infrastructure that services Heritage Pointe.

Table 3-1
Land Use Statistics

Total Site Area	**16.78 ha**		
Subdivided Parcel	**0.97 ha**		
Net Developable Area	**15.81 ha**		
Land Use		**Units**	**Population**
Single Family (HR)	5.15 ha	94	254
Multi-Family (RMF)	1.72 ha	42	113
Multi-Family (RMF)	0.99 ha	20	54
Environmental Reserve (ER)	1.35 ha	-	-
Municipal Reserve (MR)	3.84 ha	-	-
Public Utility Lot (PUL)	0.57 ha	-	-
Roads	2.14 ha	-	-
Roads Dedication	0.07 ha	-	-
Total	15.83 ha	156	421

4 POTABLE WATER SERVICING

Water Servicing for the ASP area will require installation of new water mains within the proposed roadways and utility right-of-way within the concept plan area. Two offsite water main connections will be required to connect to the existing Heritage Pointe water system. These offsite water mains will create a looped water main that will be sized to provide sufficient capacity to meet the normal operating needs of the system as well as the fire protection requirements for the development. Options for potential water main connection locations are shown on **Figure 1** in **Appendix A**.

Connection 1: One water main connection is required northwest of the ASP area at the intersection of 2 St E and Dunbow Rd. Construction of the new water main would be completed along the existing right-of-way on 2 St E, and connect to the existing water main in Dunbow Road. The construction would have limited impact on motoring traffic in the area.

Connection 2, Option 1: The first option for the second looped connection would be an extension of the watermain east through private lands to 8th Street East, then turning north to connect to the existing water main north of Dunbow Road. Portions of the work would need to be installed by trenchless methods. The first segment would be under the environmental reserve on the east end of the development. The second trenchless segment would be under Dunbow Road. Easements and/or land acquisitions would be required to protect the utility right-of-way of the proposed water main.

Connection 2, Option 2: The second connection could be routed north through the site, past the proposed storm pond, and across the private lands to the north. The watermain could be installed by trenchless methods to eliminate impacts to the private lands that are crossed north of the site. Easements and/or land acquisitions would be required to protect the utility right-of-way of the proposed water main.

The proposed water distribution system is shown on **Figure 1**. The water tie-in connections to the existing water system are shown on **Figure 4**. Both figures are located in **Appendix A**.

4.1 Water Demands

Water demands were estimated based on the proposed land uses, and the assumed design population described in previous sections. A design demand of 370 l/s per capita was used for planning purposes. Peaking factors were applied to calculate maximum day and peak hour flow rates, these are summarised in **Table 4-1**.

Table 4-1
Design Water Demands

Water Demand Scenario	Design Flow
Design Population	421
Average Day Demand	1.8 l/s
Maximum Day Demand Peaking Factor	2.9
Maximum Day Demand	5.2 l/s
Peak Hour Factor	4.0
Peak Hour Demand	7.2 l/s

4.2 Fire Protection Requirements

For the fire protection assessment, it was assumed that a 1.5 coefficient for a wood frame construction and a maximum above-ground floor area of 4,800 ft^2. This should be reviewed during the design phase for the development. The form of development and design requirements should be clarified at that time.

The preliminary estimate for the required fire flow for the Heritage Pointe South development is 6,305 L/min (105 L/s) for a duration of 2.0 hours, as indicated in the Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection (2019 Draft).

The number of hydrants and the space between them should be determined during the detail design stage. The FUS recommends a maximum spacing of hydrants in multi-family residential areas of 90 m and in single family residential areas of 180 m.

4.3 Water Distribution System Storage Requirements

Storage requirements related to the proposed development were calculated based on the design flows in **Table 4-2**. The calculations follow the requirements laid out in the Alberta Environment and Parks Standards and Guidelines, Part 2:

S = A + B + (the greater of C or D)

where S = Total storage requirement, m^3
A = Fire storage, m^3
B = Equalization storage (approximately 25% of projected maximum daily design flow), m^3
C = Emergency storage (minimum of 15% of projected average daily design flow), m^3
D = Disinfection contact time (T10) storage to meet the CT requirements, m^3 *(not calculated for this report)*

Table 4-2
Impact on Potable Water Storage Requirements

Storage Requirement	Volume (m^3)
Fire Storage	757 m^3
Equalization Storage (0.25 x Max Day Demand)	113 m^3
Emergency Storage (0.15 x Average Day Demand) *	68 m^3
Total[1]	**937 m^3**

Note [1]: Does not include disinfection contact time storage requirements.

4.4 Recommendations

The design of the servicing for the development should proceed based on the criteria defined in this report and in cooperation with the utility service providers. At the time of the development of this report, the predicted design flows for the potable water system are not expected to cause the existing water system to operate outside of its' existing capacity. This should be verified with the utility provider at the time of design to identify any changes to the system, and whether or not upgrades to the existing system are required.

The viability of any proposed water main alignments will require further assessment at the design stage in terms of constructability (e.g. site investigation, geotechnical conditions, trenchless methods, etc.), infrastructure costs, possible negotiations and agreements with affected private landowners, utility providers and approvals by Foothills County.

5 SANITARY SEWER SERVICING

Sanitary Sewer Servicing for the ASP area will require installation of new sanitary sewers within the proposed roadways and utility right-of-way within the concept plan area. The servicing concept also includes two lift stations that will pump sewage collected in gravity mains to the existing wastewater system in Heritage Pointe. The area has been divided into two sewerage catchments.

1) **Sanitary Catchment Area 1** will flow by gravity to a low point east of the multi-family site located in the central part of the site. A small lift station will be constructed to handle flows from the upstream development. Lift Station 1 is proposed to pump west via forcemain to the high point of Sanitary Catchment Area 2 (West Entrance).

2) **Sanitary Catchment Area 2** will flow by gravity to the low point of the site located at the corner of Dunbow Road and 2nd St E. A lift station will be constructed to handle flows from catchment 1 and 2. The upstream gravity system will need to accommodate these flows as well. Lift Station 2 will pump sewage off site to the Heritage Pointe Development. The forcemain is proposed to run along Dunbow Road, and ultimately crossing Dunbow Road at 8th Street E. The proposed forcemain will connect to the existing system at Ranche Drive and Heaver Gate, to avoid potential capacity constraints in the upstream existing system. The final connection point within the existing system is to be identified during detailed design.

To minimize impacts along Dunbow Road, construction of the forcemain should be installed by horizontal directional drilling to avoid impacts to traffic along the busy road. Easements and/or land acquisitions would be required to protect the utility right-of-way of the proposed water main.

For the tie-in to the existing gravity system in Heaver Gate, a temporary access and traffic deviation will be required. Communication with private landowners is also required, as there will be a temporary disturbance during the installation.

The proposed sanitary sewer system is shown on **Figure 2**. The sanitary tie-in connections to the existing sanitary system are shown on **Figure 4**. Both figures are located in **Appendix A**.

5.1 Sanitary Sewage Generation

Sewage generation rates were estimated based on the proposed land uses, and the assumed design population described in previous sections. A design average dry weather flow rate of 250 l/s per capita was used for planning purposes. Peaking factors were applied to calculate peak dry weather flow rates. Inflow and infiltration allowances were included based on 0.28 l/s/ha for the net developable area. These are summarized in **Table 5-1**.

Table 5-1
Design Sewage Generation

	Area 1	Area 2
Number of lots	93	63
Estimate Residential Population	251	170
Per Capita Residential Design Flow (L/c/d)	250 l/c/d	250 l/c/d
Harmon's Peaking Factor	4.11	4.17
Design contributing population	0.25	0.17
Peak Dry Weather Flow (L/s)	2.99 l/s	2.05 l/s
Contributing Area (ha)	9.30 ha	5.60 ha
I&I Contibution (L/s/ha)	0.28 l/s/ha	0.28 l/s/ha
I&I Contibution (L/s)	2.60 l/s	1.57 l/s
Peak Wet Weather Flow (L/s)	5.59 l/s	3.62 l/s
Lift Station Flow	5.59 l/s[1]	9.21 l/s[2]

Note [1]: Lift Station 1 Peak Flow

Note [2]: Lift Station 2 Peak Flow

5.2 Recommendations

The design of the servicing for the development should proceed based on the criteria defined in this report and in cooperation with the utility service providers. At the time of the development of this report, the design flows are predicted to be greater than the existing capacity of the closest connection points in the existing Heritage Pointe sewer system. As a result, it is recommended that the connection to the existing system be completed at the intersection of Ranche Drive and Heaver Gate, subject to final confirmation of the capacity of the system at that location.

Two lift stations will be required to service the development lands. The second lift station will pump the sewage from the development area to the Heritage Pointe system upstream of the existing Wastewater Treatment Plant (WWTP).

The viability of any proposed sanitary sewer mains and force main alignments will require further assessment at the design stage in terms of constructability (e.g. site investigation, geotechnical conditions, trenchless methods, etc.), infrastructure costs, possible negotiations and agreements with affected private landowners, as well as utility providers and approvals by Foothills County.

6 STORM SEWER SERVICING

The stormwater management system concepts presented are based the Stormwater Management Plan by LGN Consulting Engineering Ltd. The Stormwater Management Plan outlines the drainage concepts that will be implemented in the development. The stormwater management system will follow a traditional dual drainage system with a minor pipe system and a designed overland drainage system that incorporates the roads, curbs, and other designed overland flow paths as well as stormwater management facilities. Catchment boundaries were defined in the Stormwater Management Plan, divided into the North Pond, and South Pond areas.

The proposed stormwater management system is shown on **Figure 3** in **Appendix A**.

6.1 North Pond Catchment

The stormwater runoff boundary along the north pond of the development includes the western portion of the site and is divided at the high point of the site. An area of 4.8 ha will drain to the north dry pond through the major and minor systems, before release to the downstream drainage system.

Design criteria that will be used for the stormwater management system includes:

- Area drainage to a dry pond before discharging offsite,
- An oil grit separator will be required upstream of the pond,
- 70 l/s/ha for minor system flows.

The proposed dry pond facility will generally be designed to meet the following criteria:

- Upstream Drainage Area: 4.88 ha
- Active Storage, Volume: 2,612 m^3
  Depth: 1.5 m
- Freeboard Elevation 1055.3 m
- Approximate HWL: 1055.0 m
- Pond Bottom: 1053.5 m
- Design detention release rate of 22.9 l/s

The north pond outlet will be connected to the existing ditch located on the south side of Dunbow Road. Construction of the pond outlet will require a control structure that will limit the offsite discharge to the defined design release rate. The outlet to the ditch will require erosion protection. Easements and/ or land acquisitions would be required to protect the utility right of way of the proposed water main. The final arrangement for the discharge will be subject to municipal, Environmental Protection and Enhancement Act, and Water Act approvals.

6.2 South Pond Catchment

The stormwater runoff boundary along the north pond of the development includes the western portion of the site and is divided at the high point of the site. An area of 9.2 ha will drain to the north dry pond through the major and minor systems, before release to the downstream drainage system.

Design criteria that will be used for the stormwater management system includes:

- Area drainage to a dry pond before discharging offsite.
- An oil grit separator will be required upstream of the pond.
- 70 l/s/ha for minor system flows.

The proposed wet pond facility will generally be designed to meet the following criteria:

- Upstream Drainage Area: 9.2 ha
- Permanent Pool: Volume: 1,561 m^3
  Depth below water line: 2.5 m
- Active Storage: Volume: 4,526 m^3
  Depth Above NWL: 2.0 m
- Freeboard Elevation 1,053.8 m
- Approximate HWL: 1,053.5 m
- Pond NWL: 1,051.5 m
- Pond Bottom: 1,053.5 m
- Design detention release rate of 43.2 l/s

South Pond Outlet Option 1: The south pond outlet could be to the existing overland flow path that runs through the proposed development. The flow path continues across the private lands north of the site, ultimately discharging to the ditch on Dunbow Road.

South Pond Outlet Option 2: The south pond outlet could be to the existing natural drainage channel at the east edge of the development site. The flow path continues across the private lands north of the site, running through a culver under Downbow Road.

Construction of the pond outlet will require a control structure that will limit the offsite discharge to the defined design release rate. The outlet will require erosion protection. Easements and/or land acquisitions would be required to protect the utility right-of-way of the proposed storm outlet. Each agreement will need to protect the outlet drainage path from alteration or removal. The final arrangement for the discharge will be subject to Municipal, Environmental Protection and Enhancement Act, and Water Act approvals.

7 SHALLOW UTILITIES

It is expected that the shallow utility needs of the development (natural gas, electrical, communications and cable) will be provided by an extension of existing infrastructure in the area. Utility providers in the area should be engaged during subsequent planning and design to determine specific utility requirements onsite, as well as potential upgrades to offsite infrastructure that may be required to support the development.

8 CONCLUSIONS

The Heritage Pointe South development will require the expansion and extension of water and wastewater infrastructure to adequately service the proposed development. The extensions of these systems will be completed in cooperation with the utility provider and will be subject to comprehensive review of downstream capacities. The extension of the proposed water mains and looping within the system will provide adequate supply for both consumption and fire protection. The construction of the tow lift station and its related forcemains will allow the development to connect to the existing system at a point where there is sufficient capacity to convey the flows to the existing wastewater treatment plant.

The proposed stormwater management system will connect to existing natural drainage infrastructure. The proposed stormwater management plan will mitigate the effects of increased impervious surface area on the run-off rates and volumes downstream.

As the development commences, the preliminary and detailed designs should be completed in general accordance with this report. The design criteria and considerations contained in this report should form the basis of these designs. All work will be subject to the review of the relevant authorities, and further assessment at the design stage in terms of constructability (e.g. site investigation, geotechnical conditions, trenchless methods, etc.), infrastructure costs, possible negotiations and agreements with affected private landowners, utility providers and approvals.

CLOSURE

This report was prepared for the Township Planning + Design Inc. as a guideline that provides the Client and the Owner with a conceptual design and future design criteria for the residential development of Heritage Pointe South.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Alberta Ltd.

John Crawford, C.E.T.
Project Manager

Adam McDonald, P.Eng.
Project Engineer

APPENDIX A - FIGURES

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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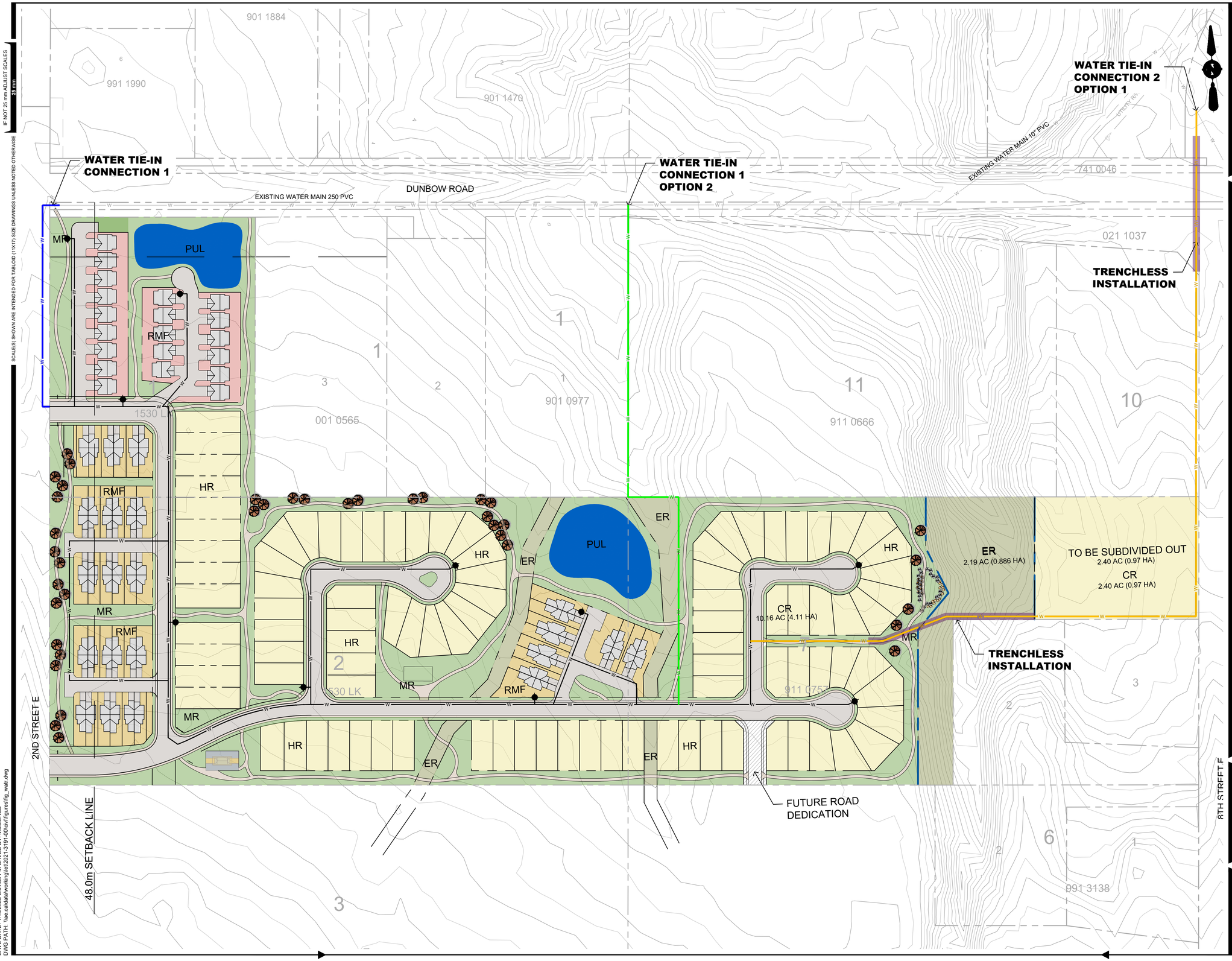

LEGEND

- EXISTING WATER MAIN
- PROPOSED WATER MAIN
- PROPOSED FIRE HYDRANT
- PROPOSED OFFSITE WATER MAIN CONNECTION
- PROPOSED OFFSITE WATER MAIN LOOPING CONNECTION OPTION 1
- PROPOSED OFFSITE WATER MAIN LOOPING CONNECTION OPTION 2
- TRENCHLESS INSTALLATION

FIGURE 1

2291463 ALBERTA LTD
HERITAGE POINTE SOUTH

CIVIL
WATER SYSTEM SERVICING

AE PROJECT No.	2021-3191-00
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APPROVED	A McDONALD
DATE	2022JAN18
REV	A
DESCRIPTION	ISSUED FOR DESIGN REPORT

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25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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991 1990
ILITY R/W
011 1507
901 1479
UTILITY R/W (6M)
741 0046
DUNBOW ROAD
021 1037

SANITARY FORCEMAIN
TIE IN @ RANCHE DR
AND HEAVER GATE
SEE FIGURE 4

SANITARY CATCHMENT
AREA 2

SANITARY CATCHMENT
AREA 1

MR
PUL
RMF
HR
ER
CR
10.16 AC (4.11 HA)
LS #1

ER
2.19 AC (0.886 HA)

TO BE SUBDIVIDED OUT
2.40 AC (0.97 HA)
CR
2.40 AC (0.97 HA)

1530 LK
001 0565
901 0977
911 0666
911 0753
991 3138
731 581
911 1775

2ND STREET E

48.0m SETBACK LINE

FUTURE ROAD
DEDICATION

LEGEND

PROPOSED GRAVITY MAIN	SS
FLOW DIRECTION	►
PROPOSED MANHOLE	S
PROPOSED FORCE MAIN	FM
PROPOSED LIFT STATION	LS #1 □

FIGURE 2

2291463 ALBERTA LTD
HERITAGE POINTE SOUTH

CIVIL
SANITARY SEWER SERVICING

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NORTH POND OUTLET

NORTH DRY POND

DUNBOW ROAD

NATURAL DRAINAGE DRAW

NATURAL DRAINAGE DRAW

SOUTH WET POND

SOUTH POND OUTLET OPTION 1

SOUTH POND OPTION 2

ER
2.19 AC (0.886 HA)

TO BE SUBDIVIDED OUT
2.40 AC (0.97 HA)

CR
2.40 AC (0.97 HA)

CR
10.16 AC (4.11 HA)

2ND STREET E

48.0m SETBACK LINE

FUTURE ROAD DEDICATION

LEGEND

- PROPOSED GRAVITY MAIN
- FLOW DIRECTION
- PROPOSED MANHOLE
- PROPOSED MINOR STORM CATCHMENT AREAS

FIGURE 3

2291463 ALBERTA LTD
HERITAGE POINTE SOUTH

CIVIL
STORMWATER MANAGEMENT SERVICING

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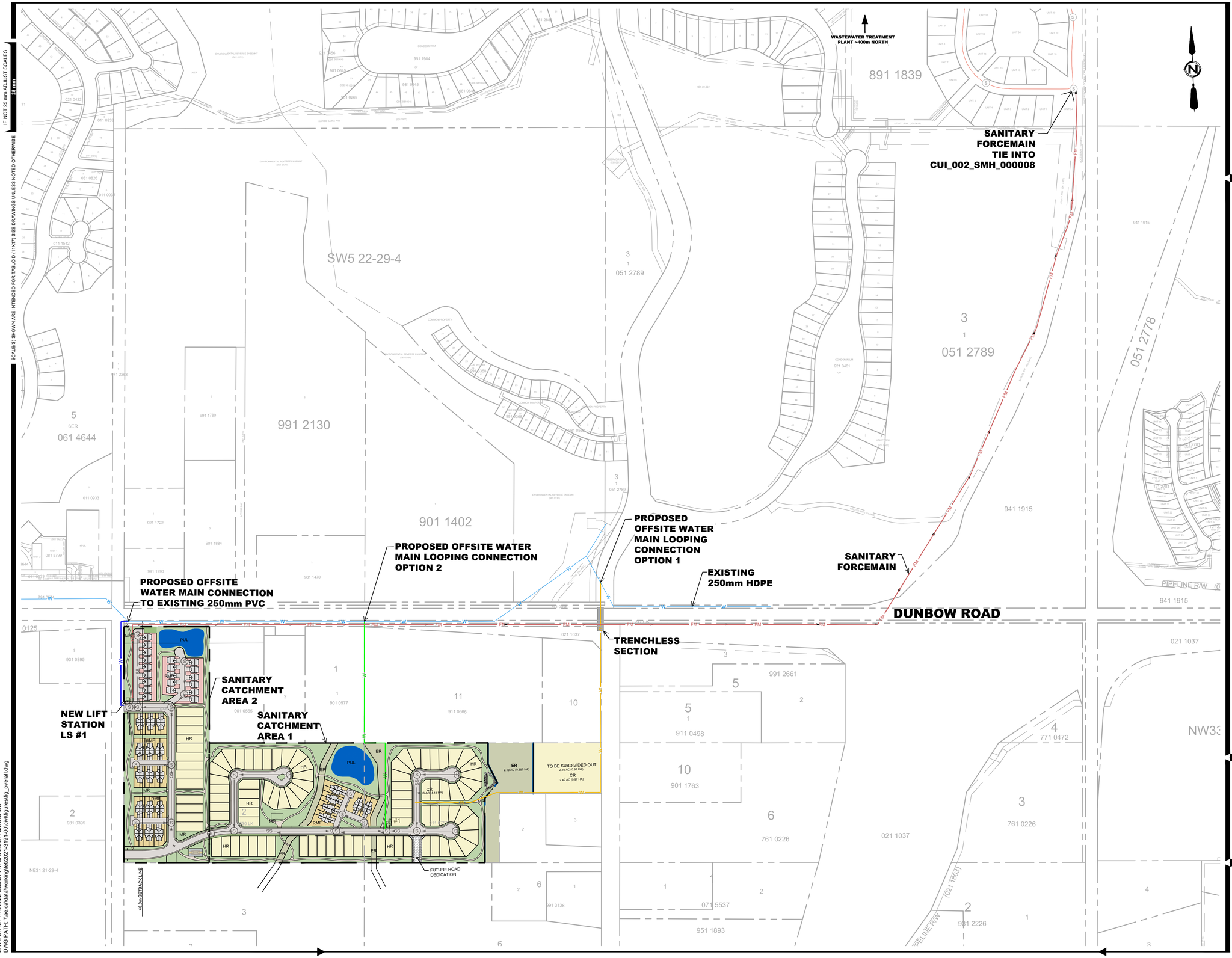

LEGEND

- PROPOSED GRAVITY MAIN — SS
- FLOW DIRECTION
- PROPOSED MANHOLE — S
- PROPOSED FORCE MAIN — FM
- PROPOSED LIFT STATION — LS #1
- PROPOSED OFFSITE WATER MAIN CONNECTION — W
- PROPOSED OFFSITE WATER MAIN LOOPING CONNECTION OPTION 1 — W
- PROPOSED OFFSITE WATER MAIN LOOPING CONNECTION OPTION 2 — W

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FIGURE 4

2291463 ALBERTA LTD
HERITAGE POINTE SOUTH

CIVIL
DEEP UTILITY SERVICING
TIE IN CONNECTIONS

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