

Traffic Impact Analysis

MCALLISTER SPRINGS

Prepared for:
DR Horton

September 2022

Prepared by:



12131 113th Avenue NE, Suite 203
Kirkland, WA 98034-7120
Phone: 425-821-3665
www.transpogroup.com

1.22178.00

Table of Contents

Introduction	1
Project Description.....	1
Study Scope.....	1
Existing and Future Without-Project Conditions.....	4
Roadway Network.....	4
Non-Motorized Facilities	5
Transit Service	5
Traffic Volumes	5
Traffic Operations	8
Traffic Safety.....	8
Project Impacts	10
Trip Generation	10
Trip Distribution & Assignment	10
Traffic Operations Impact	13
Findings and Recommendations	14

Appendix

Appendix A: Traffic Counts	Appendix D: Trip Generation Calculations
Appendix B: LOS Definitions	Appendix E: Model Plot
Appendix C: LOS Worksheets	

Figures

Figure 1.	Site Vicinity and Study Intersections	2
Figure 2.	Preliminary Site Plan	3
Figure 3.	Existing Weekday PM Peak Hour Traffic Volumes	6
Figure 4.	Future (2026) Without-Project Weekday PM Peak Hour Traffic Volumes	7
Figure 5.	Project PM Peak Hour Trip Distribution and Assignment.....	11
Figure 6.	Future (2026) With-Project Weekday PM Peak Hour Traffic Volumes	12

Tables

Table 1.	Existing Conditions Summary	4
Table 2.	Existing and Future Without-Project PM Peak Hour LOS Summary	8
Table 3.	Five-Year Collision Summary (2017-2021)	9
Table 4.	Trip Generation Summary – Weekday PM Peak Hour	10
Table 5.	Future Without-Project and With-Project PM Peak Hour LOS Summary	13

Introduction

This traffic impact analysis (TIA) identifies potential transportation-related impacts associated with the construction of the residential development proposed east of Marvin Rd SE near 22nd Ave SE, located in the Urban Growth Area of Thurston County. As necessary, mitigation measures are identified that would reduce or offset significant transportation related impacts that the project may have on the surrounding transportation system.

Project Description

The proposed development is located in Thurston County within the City of Lacey's Urban Growth Area along the east side of Marvin Road SE. Figure 1 shows the site vicinity of the proposed project. The proposed project includes the development of a total of 182 residential units comprised of up to 51 townhomes and 131 single-family units. Access to the site is proposed via Marvin Road SE in alignment with Terri Court SE. A connection to the adjacent development to the north is also included with future options for connectivity to parcels south and west of the site. A preliminary site plan is shown on Figure 2. The project is anticipated to be constructed and occupied by 2026.

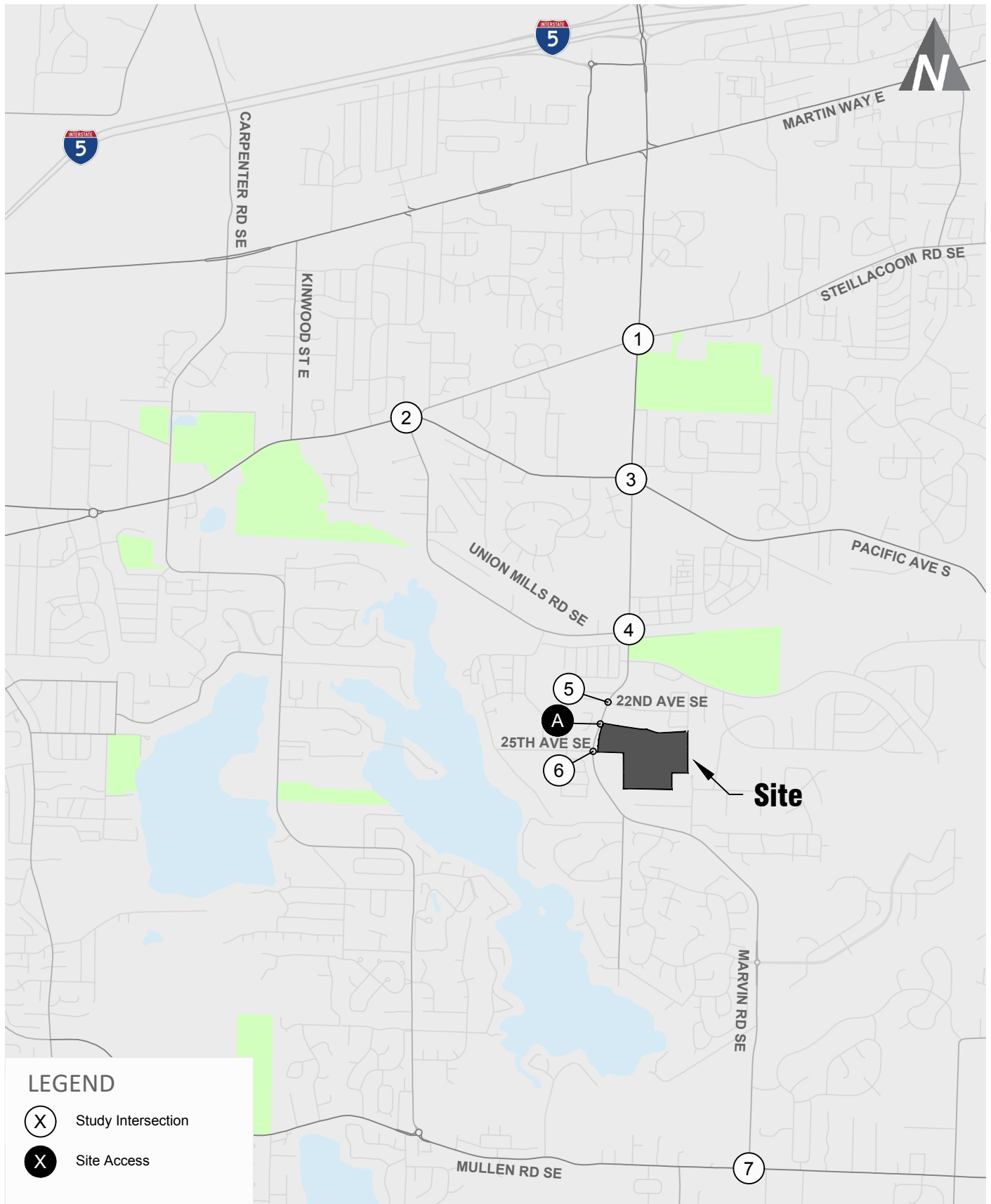
Study Scope

Given the project is located within the Urban Growth area, coordination occurred with both Thurston County and City of Lacey to identify the scope of work for this analysis. The following off-site intersections were selected for analysis:

1. Marvin Rd SE/Steilacoom Rd SE
2. Union Mills Rd SE/Pacific Ave SE
3. Marvin Rd SE/Pacific Ave SE
4. Marvin Rd SE/Union Mills Rd SE
5. Marvin Rd SE/22nd Ave SE
6. Marvin Rd SE/25th Ave SE
7. Marvin Rd SE/Mullen Rd SE

In addition, a site access along Marvin Road SE and Terri Court SE was evaluated under future (2026) with-project conditions.

The scope of the analysis included a review of existing and future without-project conditions in the vicinity of the project site under weekday PM peak hour conditions. This report includes a review of the surrounding street system, transit service, non-motorized facilities, existing and future without-project weekday peak hour traffic volumes, traffic operations, and traffic safety. Future (2026) with-project conditions were estimated by adding site-generated traffic to future without-project volumes. The project's impacts on the surrounding transportation system were identified by comparing the future with-project conditions to the future without-project conditions.

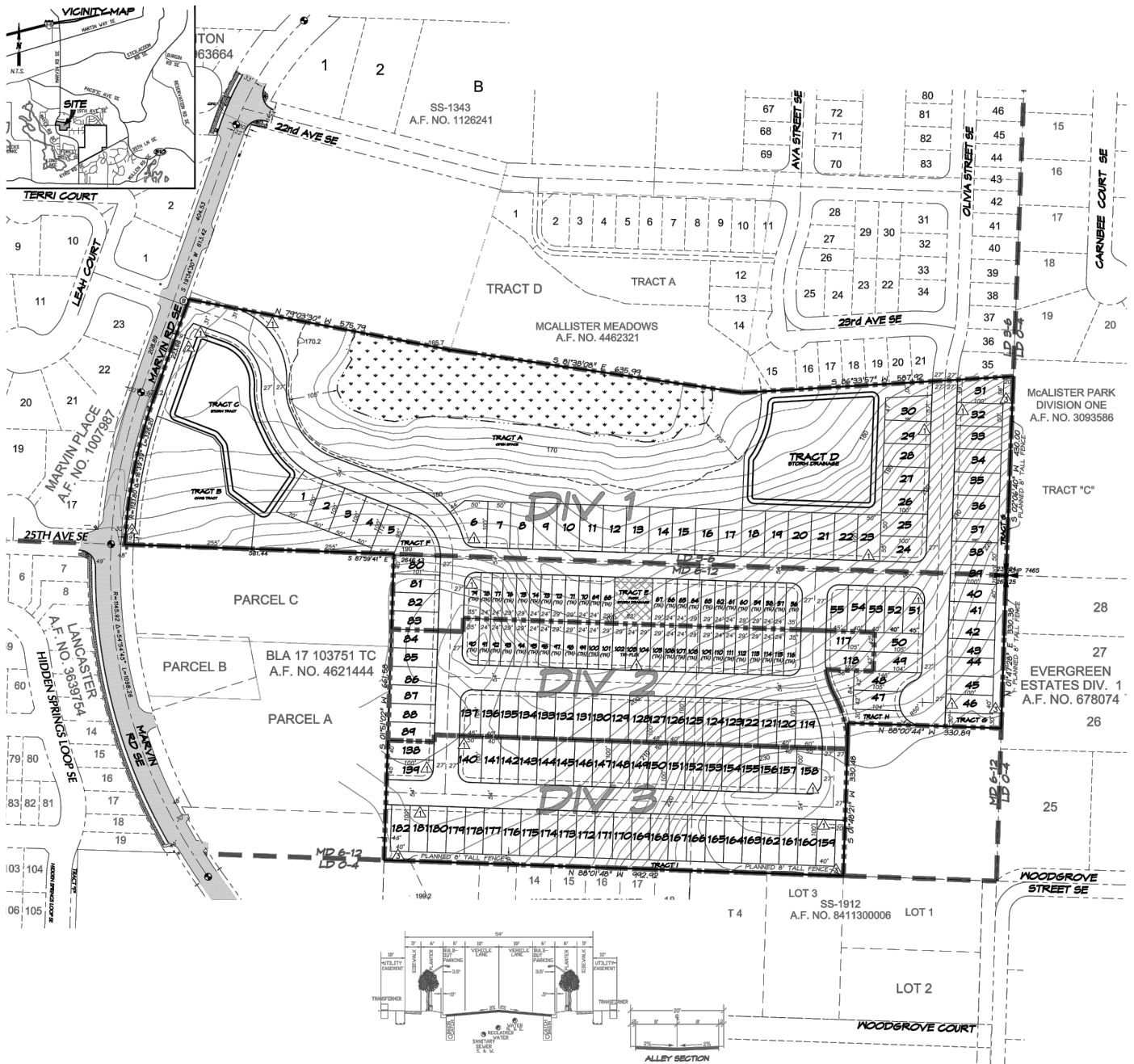


Site Vicinity and Study Intersections

McAllister Springs

FIGURE

1



Preliminary Site Plan

McAllister Springs

FIGURE

2

transpogroup 

Existing and Future Without-Project Conditions

This section describes both existing and future (2026) without-project conditions within the identified study area. Characteristics are provided for the roadway network, non-motorized facilities, transit service, traffic volumes, traffic operations, and traffic safety.

Roadway Network

The following sections describe the existing street network within the vicinity of the proposed project and anticipated changes resulting from planned improvements.

Existing

The primary roadways within the study area and their characteristics near study intersections are described in reference to City of Lacey Functional Classification Plan described in Table 1.

Table 1. Existing Conditions Summary

Roadway	Street Classification	Speed Limit	No. of Lanes	Pedestrian Facilities	Bicycle Facilities
Marvin Rd SE (SR 510) ^{1,3}	Arterial	35/40	5/3 ²	Partial Sidewalks	None
Steilacoom Rd SE	Boulevard	35	3	Sidewalks	None
Pacific Ave SE (SR 510) ³	Arterial	40	2	None	None
Union Mills Rd SE	Boulevard	35	2	None	None
22nd Ave SE	Local	25	2	Sidewalks	None
25th AVE SE	Local	25	2	Sidewalks	None
Mullen Rd SE	Arterial	35	2	None	None

1. Posted speed limit is 35 mph between Steilacoom Rd SE to Union Mills Rd SE and 40 south of Union Mills Rd E
2. 5 lanes are present from Steilacoom Rd SE to Pacific Ave SE and reduced to 3 afterwards
3. SR 510 runs Marvin Rd SE from Steilacoom Rd SE and to east of Pacific Ave SE

Planned Improvements

A review of the *Thurston County 2023-2028 Transportation Improvement Plan (TIP)* shows there are multiple planned improvements that would be started or completed by 2026 in the vicinity of the proposed project. The planned improvements within the study area are primarily along Marvin Road. These include three phases as described below:

- **Marvin Road Upgrade Phase 1 (22nd Ave to Union Mills Rd) & Marvin Road Upgrade Phase 3 (Union Mills Rd to Pacific AVE)** – This will include adding sidewalks, streetlights, and traffic controls on Marvin Road from 22nd Ave to Pacific Ave. Roundabouts will be added to sections along this road to help traffic flow more freely. The improvements will reduce traffic delays and crashes and improve safety for cyclists and walkers.
- **Marvin Road Upgrade Phase 2 (Mullen Rd Intersection)** – This includes a roundabout at the intersection of Marvin Rd and Mullen Rd. The roundabout will provide for safer and more efficient turning movements as traffic increases. The project will also improve safety for walkers and cyclists.

Based on further coordination with the City, the roundabouts for the intersections of Marvin Road SE/Union Mills Rd SE and Marvin Road SE/Mullen Road SE are funded and will be completed prior to the 2026 horizon year. These two improvements were included in the future conditions operations analysis.

Non-Motorized Facilities

No sidewalks are provided in the close vicinity of the project site however, Marvin Road SE provides intermittent sidewalks along the study area. Signalized crossings are provided at the intersections of Marvin Rd SE/Steilacoom Rd SE and Marvin Rd SE/Pacific Ave SE.

Transit Service

Transit service in the study area is provided by Intercity Transit. The nearest bus stops to the proposed development are located at the site access intersection of Marvin Rd SE/Terri Ct SE. This stop is served by Route 67 with service between Pacific at Bowker, Lake Forest at Fordham, and TriLake Dr. at TriLake Loop with hourly headways throughout the days on both the weekdays and weekends.

Traffic Volumes

The following sections summarize existing and future (2026) without-project traffic volumes within the study area.

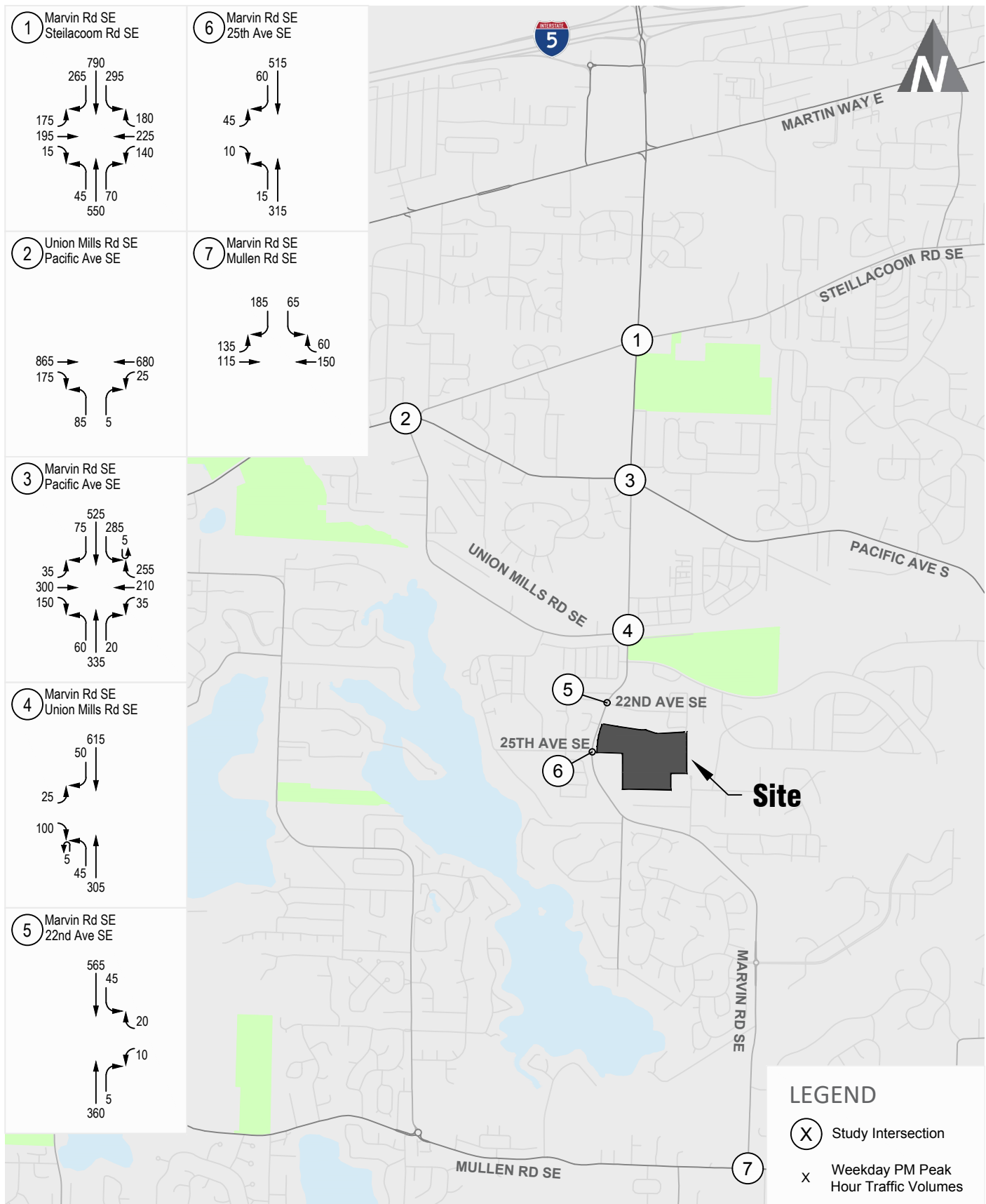
Existing

Existing weekday PM peak period (4-6 p.m.) traffic volumes were collected in June 2022 and August 2022. The estimated existing weekday PM peak hour traffic volumes are shown on Figure 3. Volumes are rounded to the nearest 5 vehicles to account for the daily fluctuations in traffic volumes. Detailed traffic counts are provided in Appendix A.

Future Without-Project Traffic Volumes

Future (2026) without-project traffic volumes are comprised of background traffic growth, and traffic generated from the planned “pipeline” developments. An annual growth rate of 4.0 percent was applied, through coordination with City and County staff. The annual growth rate was applied to the existing study intersection traffic volumes to estimate 2026 horizon year background traffic growth. Traffic from specific pipeline development projects in the vicinity was provided by City and County staff.

The forecast future 2026 without-project weekday peak hour traffic volumes are shown in Figure 4.



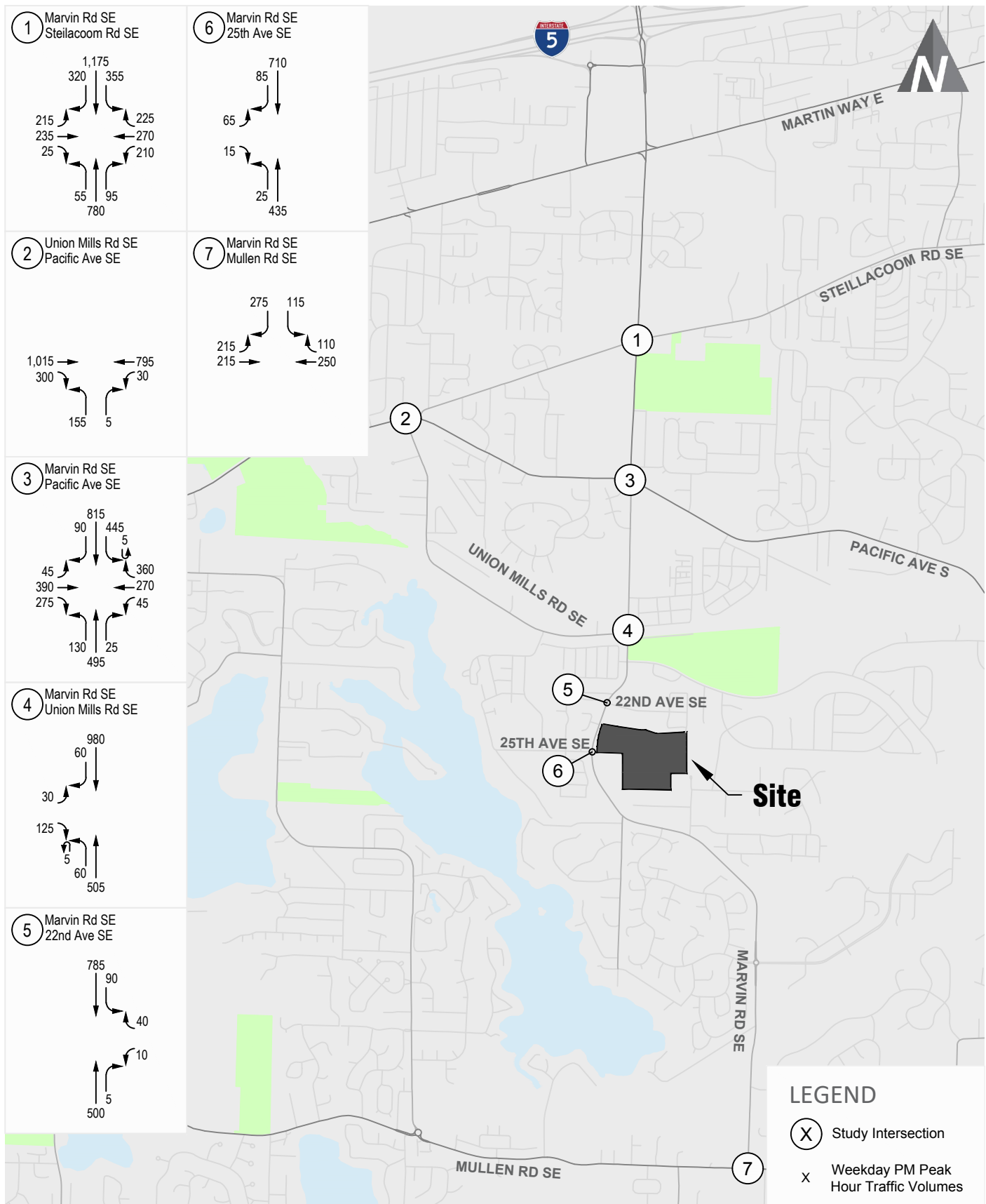
Existing Weekday PM Peak Hour Traffic Volumes

McAllister Springs

transpogroup **7**

FIGURE

3



Future (2026) Without-Project Weekday PM Peak Hour Traffic Volumes

FIGURE

McAllister Springs

transpogroup 

4

Traffic Operations

The operational characteristics of an intersection are determined by calculating the intersection level of service (LOS). At signalized, all-way stop controlled, and roundabout-controlled intersections, LOS is measured in average control delay per vehicle and is reported using the intersection delay. Traffic operations and average vehicle delay can be described qualitatively with a range of levels of service (LOS A through LOS F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. Appendix B contains a detailed explanation of LOS criteria and definitions.

Signal timing was optimized at the intersections based on the existing and future volumes. Analysis parameters such as lane channelization were maintained for future (2026) without-project conditions from existing conditions except for Marvin Rd SE/Union Mills Rd SE and Marvin Rd SE/Mullen Rd SE. The future 2026 conditions include the installation of roundabouts for traffic control at the intersections of Marvin Rd SE/Union Mills Rd SE and Marvin Rd SE/Mullen Rd SE.

Weekday PM peak hour traffic operations for existing and future (2026) without-project conditions were evaluated based on the procedures identified in the *Highway Capacity Manual* (HCM 2016) using *Synchro 11* for stop-controlled and signalized intersections. *Synchro 11* is a software program that uses HCM methodology to evaluate intersection LOS and average vehicle delay. The roundabouts were evaluated using *SIDRA Intersection 9*, and the WSDOT SIDRA protocol was followed to implement the correct parameters and environment factors. Results for the existing and future without-project operations analyses are summarized in Table 2. Detailed LOS worksheets for each intersection analysis are included in Appendix C.

Table 2. Existing and Future Without-Project PM Peak Hour LOS Summary

Intersection	Current Traffic Control / Future Traffic Control	Existing			2026 Without-Project		
		LOS ¹	Delay ²	v/c WM ³	LOS	Delay	v/c WM
1. Marvin Rd SE/Steilacoom Rd SE	Signal	B	18	-	D	47	-
2. Union Mills Rd SE/Pacific Ave SE	Signal	B	14	-	B	15	-
3. Marvin Rd SE/Pacific Ave SE	RAB	A	7	0.363	A	10	0.646
4. Marvin Rd SE/Union Mills Rd SE	TWSC / RAB	C	17	EB	A	6	0.909
5. Marvin Rd SE/22nd Ave SE	TWSC	B	12	WB	B	14	WB
6. Marvin Rd SE/25th Ave SE	TWSC	B	15	EB	C	20	EB
7. Marvin Rd SE/Mullen Rd SE	TWSC / RAB	B	14	SB	A	7	0.388

Note: RAB = roundabout, TWSC = two way stop controlled.

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 6th Edition)

2. Average delay per vehicle in seconds

3. Volume-to-capacity ratio shown for roundabout intersections. Worst Movement shown for stop controlled intersections

As shown in Table 3, all intersections are operating at LOS D or better under existing conditions during the PM peak hour. Under future (2026) without-project conditions, all intersection will continue to operate at LOS D or better during the PM peak hour.

Traffic Safety

The five most recent years of collision records (January 1, 2017 to December 31, 2021) provided by the Washington State Department of Transportation (WSDOT) were reviewed within the study area to identify any existing traffic safety issues at the study intersections and along the roadway segments adjacent to the project site accesses. A summary of the total and average annual number of reported collisions at the study intersections and roadway segment adjacent to the project site are provided in Table 3.

Table 3. Five-Year Collision Summary (2017-2021)

Location	Number of Collisions					Total	Annual Average	Collisions per MEV ¹
	2017	2018	2019	2020	2021			
<u>Intersection</u>								
1. Marvin Rd SE/Steilacoom Rd SE	9	3	2	2	5	21	4.2	0.39
2. Union Mills Rd SE/Pacific Ave SE	2	1	0	0	0	3	0.6	0.09
3. Marvin Rd SE/Pacific Ave SE	6	2	5	4	4	21	4.2	0.50
4. Marvin Rd SE/Union Mills Rd SE	0	1	0	0	0	1	0.2	0.05
5. Marvin Rd SE/22nd Ave SE	1	0	0	0	0	1	0.2	0.05
6. Marvin Rd SE/25th Ave SE	0	0	0	0	0	0	0.0	0.00
7. Marvin Rd SE/Mullen Rd SE	0	2	2	0	2	6	1.2	0.46

Source: WSDOT September 2022

Under 23 U.S. Code § 409 and 23 U.S. Code § 148, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

1. MEV = Million Entering Vehicles at an intersection location.

The off-site study intersections had a total of 51 collisions from 2017 to 2021 between the seven study intersections with highest annual average being 4.2 collision over the recent five-year period at the intersections of Marvin Rd SE/Steilacoom Rd SE and Marvin Rd SE/Pacific Ave SE. All of the collisions per MEV were below 1.00. The most common collision type at the intersections were rear end collisions which resulted mostly in property damage only (PDO). Of all collisions there were 38 PDO, 15 injuries and 0 fatalities. Rear end collisions are common with stop and go traffic such as at stop control or signalized intersections. There were no collisions reported involving pedestrian or bicyclist throughout the five years. Overall, no existing safety issue needing further reviewed were identified based on the data.

Project Impacts

The following sections summarize the proposed project's impacts on the surrounding street system. First, traffic volumes generated by the proposed project are estimated and then distributed and assigned to adjacent roadways within the study area. Next, project trips are added to future without-project traffic volumes and the potential impact to traffic operations are identified. Site-specific items are also discussed.

Trip Generation

Trip generation for the proposed project was based on established trip rates published in the Institute of Transportation Engineers (ITE) Trip Generation Manual (11th Edition, 2021). For the proposed land use, the Single-Family Attached Housing (LU 215) and Single-Family Detached Housing (LU 210) were used. Table 4 summarizes the resulting PM peak hour vehicle trip generation for the proposed project. Detailed trip generation calculations are provided in Appendix D.

Table 4. Trip Generation Summary – Weekday PM Peak Hour

<u>Land Uses</u>	Size	Rate	New Trips		
			In ²	Out ²	Total
<u>Proposed</u>					
Single-Family Detached Housing (LU #210)	131 du	0.94	77	46	123
Single-Family Attached Housing (LU #215)	51 du	0.57	17	12	29
Total			94	58	152

Note: du = dwelling units.

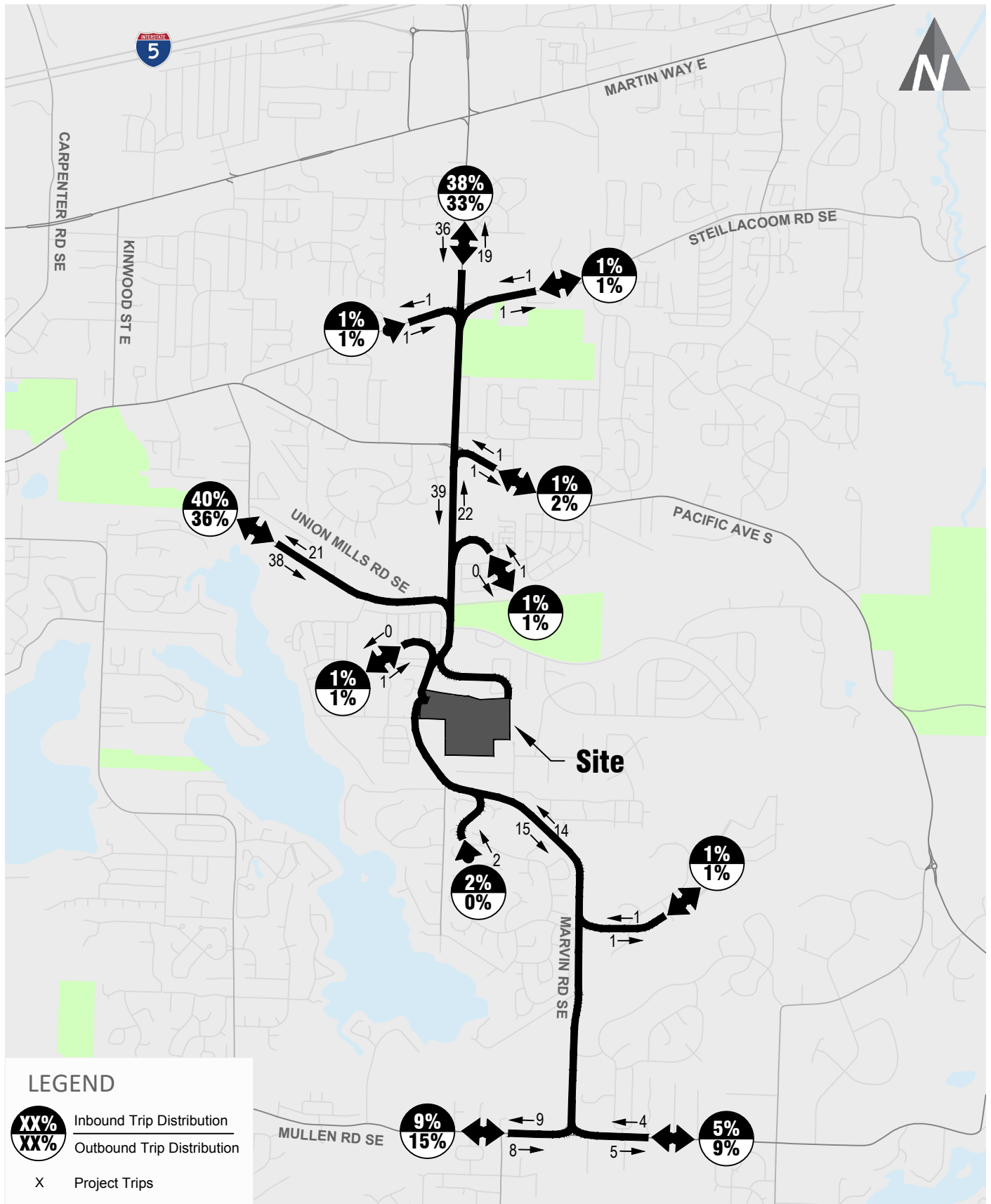
1. Average trip rates from ITE Trip Generation Manual, 11th Edition (2021).

As shown in Table 4 the proposed development is anticipated to generate 152 net new trips to the area during the weekday PM peak hour, 94 of which will be inbound trips and 58 outbound trips.

Trip Distribution & Assignment

The Thurston County Regional Traffic Demand model was utilized to identify trip distribution patterns in the area. A model plot for the site was provided by the City and specific trips from the project were assigned to the roadway network. This information was reviewed and approved by County and City staff during the scoping efforts. The trip distribution and assignment are displayed in Figure 5. The model plot is included in Appendix E.

To calculate future (2026) with-project traffic volumes, PM peak hour project trips were added to the future (2026) without-project traffic volumes. The future (2026) with-project volumes are displayed in Figure 6.

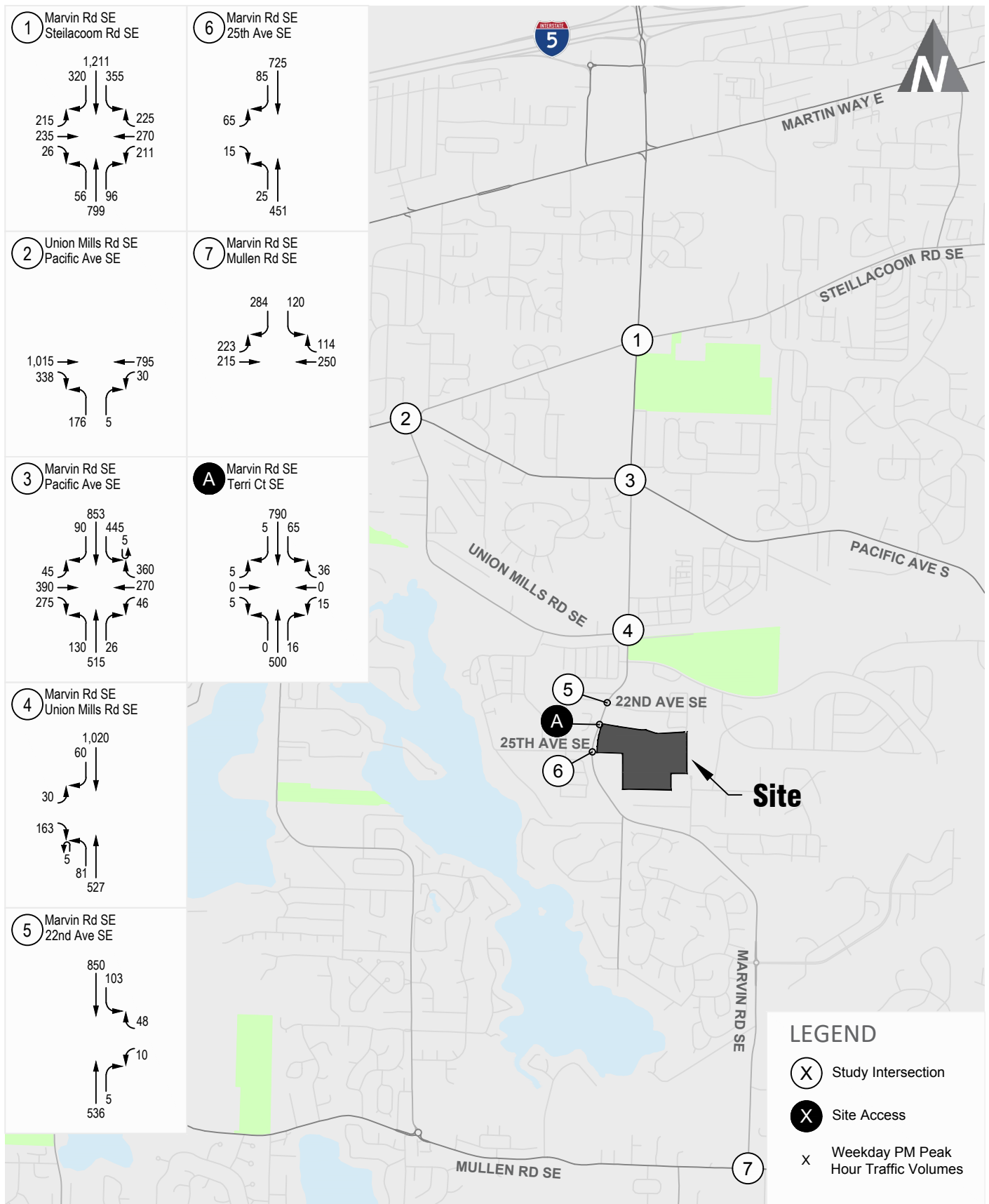


Project PM Peak Hour Trip Distribution and Assignment

FIGURE

McAllister Springs

transpogroup **7**



Future (2026) With-Project Weekday PM Peak Hour Traffic Volumes

FIGURE

Traffic Operations Impact

A future (2026) with-project level of service analysis was conducted for the weekday peak hour to analyze traffic impacts of the proposed project. The same methodologies were applied as described for existing and future without-project conditions. All intersection parameters such as channelization, intersection control, and signal timing were consistent with those used in the evaluation of future without-project conditions. A comparison of future (2026) without-project and with-project weekday peak hour traffic operations is summarized in Table 5. Detailed LOS worksheets are provided in Appendix C.

Table 5. Future Without-Project and With-Project PM Peak Hour LOS Summary

Intersection	Future Traffic Control	2026 Without-Project			2026 With-Project		
		LOS ¹	Delay ²	v/c WM ³	LOS	Delay	v/c WM
1. Marvin Rd SE/Steilacoom Rd SE	Signal	D	47	-	D	49	-
2. Union Mills Rd SE/Pacific Ave SE	Signal	B	15	-	B	16	-
3. Marvin Rd SE/Pacific Ave SE	RAB	A	10	0.646	A	10	0.665
4. Marvin Rd SE/Union Mills Rd SE	RAB	A	6	0.909	A	9	0.963
5. Marvin Rd SE/22nd Ave SE	TWSC	B	14	WB	C	15	WB
6. Marvin Rd SE/25th Ave SE	TWSC	C	20	EB	C	21	EB
7. Marvin Rd SE/Mullen Rd SE	RAB	A	7	0.388	A	7	0.402
8. Marvin Rd SE/Terri Ct SE (Site Access)	TWSC	-	-	-	D	33	EB

Note: RAB = roundabout TWSC= two way stop controlled

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 6th Edition)

2. Average delay per vehicle in seconds.

3. Volume-to-capacity ratio shown for roundabout intersections. Worst Movement shown for stop-controlled intersections

As shown in Table 5, the study intersections are all forecast to operate at the same LOS levels with the project relative to without-project conditions during both the weekday PM peak hour, with the exception of Marvin Rd SE/22nd Ave SE. This intersection was operating at the LOS B threshold and the additional one second of delay degraded the intersection from LOS B to LOS C, which continues to operate at an acceptable level of service. The site access at the intersection of Marvin Rd SE/Terri Ct SE at full build-out is forecast to operate at LOS D as shown in Table 5, which also meets the county requirement of LOS D or better. Based on the acceptable Levels of Service forecast at the off-site and on-site study intersections, there are no mitigations required for the project.

Findings and Recommendations

This traffic impact analysis summarizes the project traffic impacts of the proposed McAllister Springs development. General findings and recommendations include:

- The proposed project would construct 51 townhomes and 131 single-family units and is anticipated to generate 152 net new trips during the PM peak hour.
- All off-site study intersections would meet the City of Lacey's LOS D or better standard not triggering any mitigation.
- Access to the site would be provided via an stop-controlled intersection of Marvin Rd SE/Terri Ct SE. The site driveway is forecast to operate at LOS D or better during the weekday PM peak hour.
- The proposed project will be required to pay Traffic Impact Fees to mitigate impacts to planned transportation improvement projects in the area. Thurston County and the City of Lacey will calculate the specific fees after review of the project application.

Appendix A: Traffic Counts

Location: 1 MARVIN RD SE & STEILACOOM RD SE PM

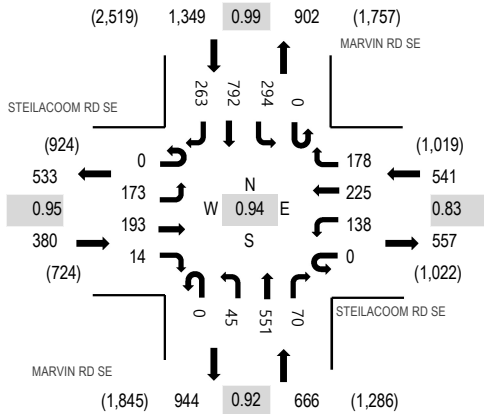
Date: Tuesday, August 2, 2022

Peak Hour: 05:00 PM - 06:00 PM

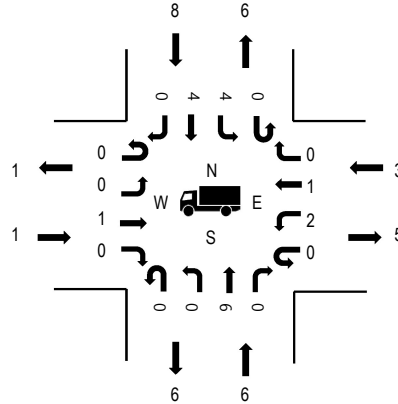
Peak 15-Minutes: 05:45 PM - 06:00 PM

Peak Hour

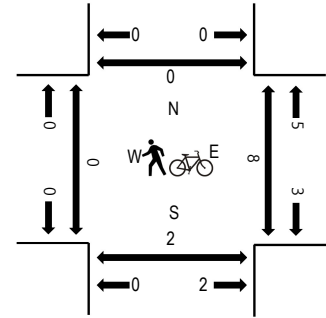
Motorized Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.3%	0.95
WB	0.6%	0.83
NB	0.9%	0.92
SB	0.6%	0.99
All	0.6%	0.94

Traffic Counts - Motorized Vehicles

Interval Start Time	STEILACOOM RD SE Eastbound				STEILACOOM RD SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	46	34	1	0	16	45	34	0	5	134	17	0	41	169	49	591	2,612
4:15 PM	0	39	45	3	0	29	43	37	0	3	135	21	0	62	193	42	652	2,747
4:30 PM	0	40	45	3	0	47	64	47	0	1	103	18	0	57	198	38	661	2,776
4:45 PM	0	44	40	4	0	35	36	45	0	9	151	23	0	62	203	56	708	2,864
5:00 PM	0	44	40	6	0	41	62	32	0	0	142	20	0	72	199	68	726	2,936
5:15 PM	0	43	51	4	0	25	41	41	0	4	132	8	0	70	209	53	681	
5:30 PM	0	41	48	3	0	34	53	50	0	16	142	23	0	72	203	64	749	
5:45 PM	0	45	54	1	0	38	69	55	0	25	135	19	0	80	181	78	780	
Count Total	0	342	357	25	0	265	413	341	0	63	1,074	149	0	516	1,555	448	5,548	
Peak Hour	0	173	193	14	0	138	225	178	0	45	551	70	0	294	792	263	2,936	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	1	7	1	6	15	4:00 PM	0	1	0	0	1	4:00 PM	0	0	0	0	0
4:15 PM	1	2	1	4	8	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	0	1	0	1	2	4:30 PM	0	1	0	0	1	4:30 PM	0	0	0	0	0
4:45 PM	0	3	2	1	6	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	0	0	2	2	4	5:00 PM	0	0	1	0	1	5:00 PM	0	1	3	0	4
5:15 PM	0	4	0	5	9	5:15 PM	0	0	0	0	0	5:15 PM	0	0	1	0	1
5:30 PM	1	0	1	1	3	5:30 PM	0	0	0	0	0	5:30 PM	0	0	3	0	3
5:45 PM	0	2	0	0	2	5:45 PM	0	0	0	0	0	5:45 PM	0	1	1	0	2
Count Total	3	19	7	20	49	Count Total	0	2	1	0	3	Count Total	0	2	8	0	10
Peak Hour	1	6	3	8	18	Peak Hour	0	0	1	0	1	Peak Hour	0	2	8	0	10

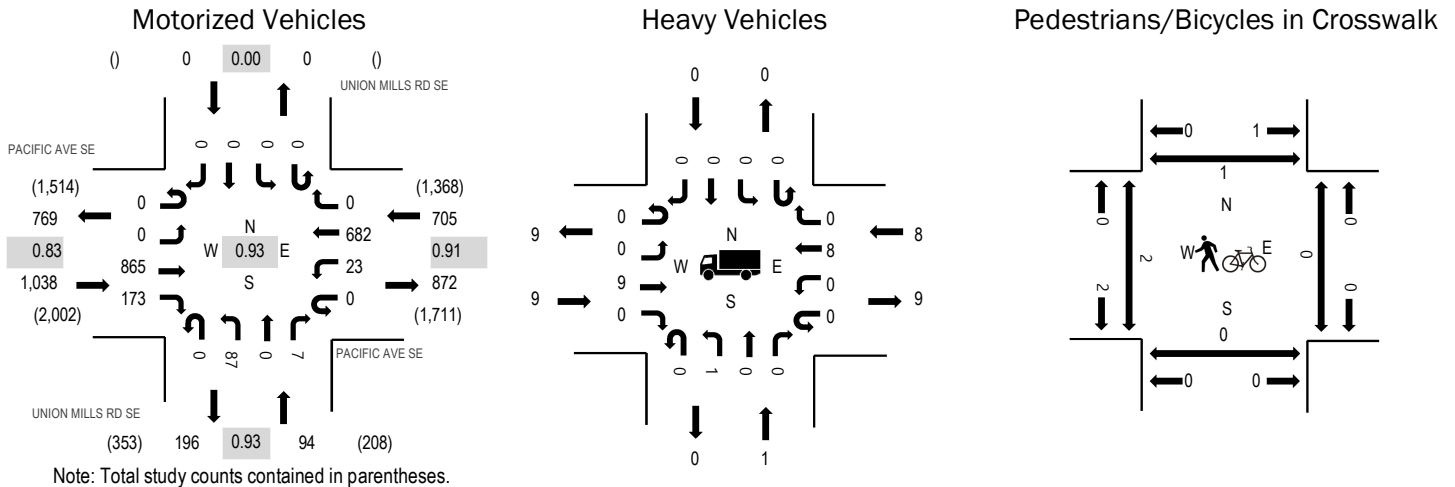
Location: 2 UNION MILLS RD SE & PACIFIC AVE SE PM

Date: Tuesday, August 2, 2022

Peak Hour: 04:45 PM - 05:45 PM

Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour



	HV%	PHF
EB	0.9%	0.83
WB	1.1%	0.91
NB	1.1%	0.93
SB	0.0%	0.00
All	1.0%	0.93

Traffic Counts - Motorized Vehicles

Interval Start Time	PACIFIC AVE SE Eastbound				PACIFIC AVE SE Westbound				UNION MILLS RD SE Northbound				UNION MILLS RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	0	191	41	0	5	160	0	0	28	0	4	0	0	0	0	429	1,750
4:15 PM	0	0	216	29	0	2	164	0	0	30	0	1	0	0	0	0	442	1,781
4:30 PM	0	0	206	43	0	5	157	0	0	25	0	7	0	0	0	0	443	1,835
4:45 PM	0	0	206	31	0	6	169	0	0	22	0	2	0	0	0	0	436	1,837
5:00 PM	0	0	188	48	0	5	188	0	0	30	0	1	0	0	0	0	460	1,828
5:15 PM	0	0	258	56	0	4	162	0	0	14	0	2	0	0	0	0	496	
5:30 PM	0	0	213	38	0	8	163	0	0	21	0	2	0	0	0	0	445	
5:45 PM	0	0	210	28	0	4	166	0	0	15	0	4	0	0	0	0	427	
Count Total	0	0	1,688	314	0	39	1,329	0	0	185	0	23	0	0	0	0	3,578	
Peak Hour	0	0	865	173	0	23	682	0	0	87	0	7	0	0	0	0	1,837	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	3	0	2	0	5	4:00 PM	1	1	0	0	2	4:00 PM	0	0	0	1	1
4:15 PM	2	0	3	0	5	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	0	0	2	0	2	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	1	1
4:45 PM	2	0	1	0	3	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	3	0	3	0	6	5:00 PM	0	0	0	0	0	5:00 PM	0	0	0	1	1
5:15 PM	1	1	2	0	4	5:15 PM	0	1	0	0	1	5:15 PM	1	0	0	0	1
5:30 PM	3	0	2	0	5	5:30 PM	1	0	0	0	1	5:30 PM	1	0	0	0	1
5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	14	1	15	0	30	Count Total	2	2	0	0	4	Count Total	2	0	0	3	5
Peak Hour	9	1	8	0	18	Peak Hour	1	1	0	0	2	Peak Hour	2	0	0	1	3

Location: 3 MARVIN RD SE & PACIFIC AVE SE PM

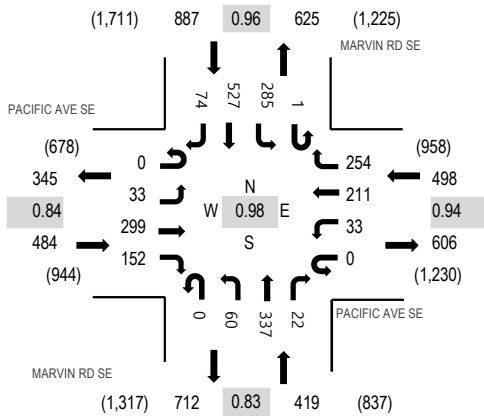
Date: Tuesday, August 2, 2022

Peak Hour: 04:45 PM - 05:45 PM

Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour

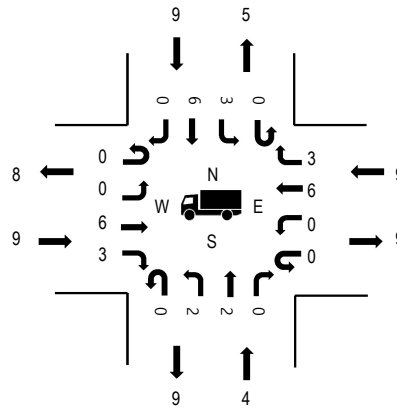
Motorized Vehicles



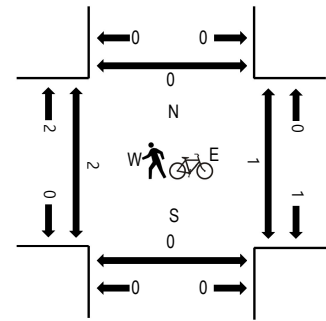
Note: Total study counts contained in parentheses.

	HV%	PHF
EB	1.9%	0.84
WB	1.8%	0.94
NB	1.0%	0.83
SB	1.0%	0.96
All	1.4%	0.98

Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Traffic Counts - Motorized Vehicles

Interval Start Time	PACIFIC AVE SE Eastbound				PACIFIC AVE SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	10	69	26	0	12	56	47	0	16	82	5	1	61	94	13	492	2,194
4:15 PM	0	11	85	32	0	5	54	66	0	16	88	3	0	77	120	16	573	2,287
4:30 PM	0	13	67	34	0	12	44	46	0	16	71	19	0	78	148	16	564	2,282
4:45 PM	0	6	72	28	0	7	51	60	0	8	84	6	0	75	147	21	565	2,288
5:00 PM	0	10	75	42	0	10	52	61	0	12	80	7	1	68	149	18	585	2,256
5:15 PM	0	10	91	47	0	9	57	59	0	20	71	3	0	71	112	18	568	
5:30 PM	0	7	61	35	0	7	51	74	0	20	102	6	0	71	119	17	570	
5:45 PM	0	10	85	18	0	1	49	68	1	10	87	4	0	71	102	27	533	
Count Total	0	77	605	262	0	63	414	481	1	118	665	53	2	572	991	146	4,450	
Peak Hour	0	33	299	152	0	33	211	254	0	60	337	22	1	285	527	74	2,288	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	2	1	5	3	11	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	1	3	3	3	10	4:15 PM	0	0	0	0	0	4:15 PM	0	0	2	0	2
4:30 PM	0	0	2	1	3	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0
4:45 PM	3	0	1	2	6	4:45 PM	0	1	0	0	1	4:45 PM	0	0	0	0	0
5:00 PM	3	0	3	2	8	5:00 PM	0	0	0	0	0	5:00 PM	1	0	1	0	2
5:15 PM	0	3	4	3	10	5:15 PM	0	0	0	0	0	5:15 PM	1	0	0	0	1
5:30 PM	3	1	1	2	7	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	2	2	1	0	5	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	14	10	20	16	60	Count Total	0	1	0	0	1	Count Total	2	0	3	0	5
Peak Hour	9	4	9	9	31	Peak Hour	0	1	0	0	1	Peak Hour	2	0	1	0	3

Location: 4 MARVIN RD SE & UNION MILLS RD SE PM

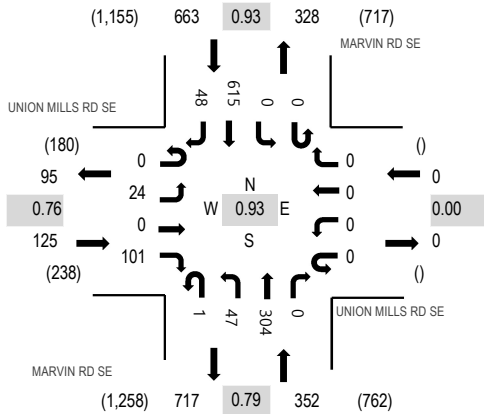
Date: Tuesday, August 2, 2022

Peak Hour: 04:30 PM - 05:30 PM

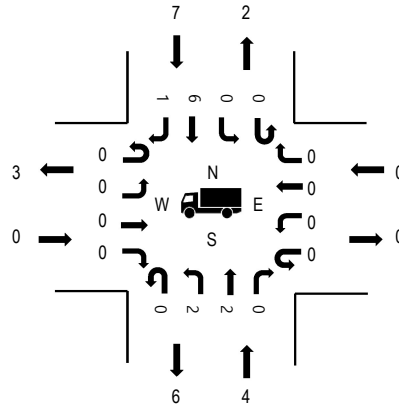
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour

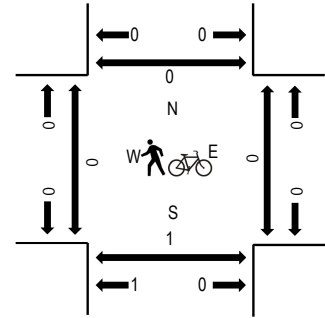
Motorized Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.0%	0.76
WB	0.0%	0.00
NB	1.1%	0.79
SB	1.1%	0.93
All	1.0%	0.93

Traffic Counts - Motorized Vehicles

Interval Start Time	UNION MILLS RD SE Eastbound				UNION MILLS RD SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	9	0	33	0	0	0	0	0	15	78	0	0	0	99	12	246	1,066
4:15 PM	0	3	0	24	0	0	0	0	0	16	87	0	0	0	118	11	259	1,125
4:30 PM	0	4	0	22	0	0	0	0	1	14	75	0	0	0	160	15	291	1,140
4:45 PM	0	4	0	24	0	0	0	0	0	10	79	0	0	0	142	11	270	1,135
5:00 PM	0	6	0	24	0	0	0	0	0	13	83	0	0	0	172	7	305	1,089
5:15 PM	0	10	0	31	0	0	0	0	0	10	67	0	0	0	141	15	274	
5:30 PM	0	11	0	13	0	0	0	0	0	12	111	0	0	0	133	6	286	
5:45 PM	0	3	0	17	0	0	0	0	0	4	87	0	0	0	104	9	224	
Count Total	0	50	0	188	0	0	0	0	1	94	667	0	0	0	1,069	86	2,155	
Peak Hour	0	24	0	101	0	0	0	0	1	47	304	0	0	0	615	48	1,140	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	0	1	0	4	5	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	0	2	0	3	5	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	0	0	0	1	1	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0
4:45 PM	0	1	0	2	3	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	0	1	0	3	4	5:00 PM	0	0	0	0	0	5:00 PM	0	0	0	0	0
5:15 PM	0	2	0	1	3	5:15 PM	0	0	0	1	1	5:15 PM	0	1	0	0	1
5:30 PM	0	1	0	3	4	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	0	1	0	0	1	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	0	9	0	17	26	Count Total	0	0	0	1	1	Count Total	0	1	0	0	1
Peak Hour	0	4	0	7	11	Peak Hour	0	0	0	1	1	Peak Hour	0	1	0	0	1

Location: 5 MARVIN RD SE & 22ND AVE SE PM

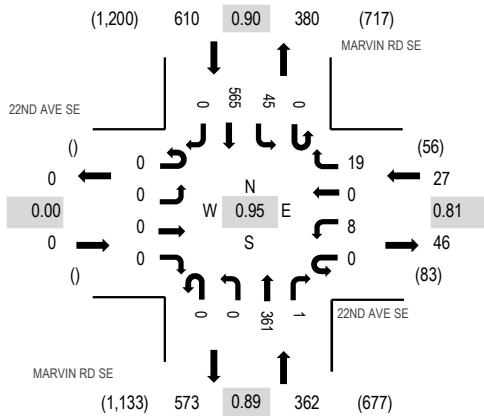
Date: Wednesday, June 1, 2022

Peak Hour: 05:00 PM - 06:00 PM

Peak 15-Minutes: 05:15 PM - 05:30 PM

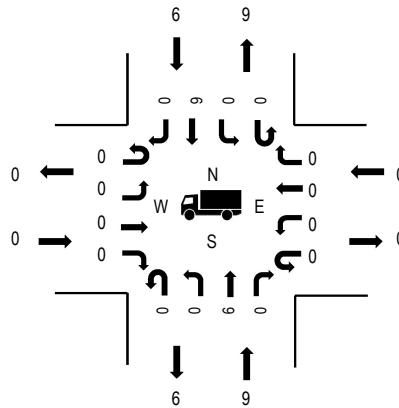
Peak Hour

Motorized Vehicles

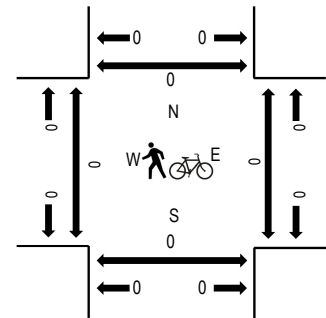


	HV%	PHF
EB	0.0%	0.00
WB	0.0%	0.81
NB	2.5%	0.89
SB	1.0%	0.90
All	1.5%	0.95

Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Traffic Counts - Motorized Vehicles

Interval Start Time	22ND AVE SE Eastbound				22ND AVE SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	0	0	0	0	1	0	6	0	0	79	1	0	10	151	0	248	934
4:15 PM	0	0	0	0	0	1	0	6	0	0	82	0	0	11	144	0	244	938
4:30 PM	0	0	0	0	0	1	0	5	0	0	76	1	0	7	126	0	216	957
4:45 PM	0	0	0	0	0	1	0	8	0	0	75	1	0	6	135	0	226	990
5:00 PM	0	0	0	0	0	0	0	5	0	0	98	0	0	11	138	0	252	999
5:15 PM	0	0	0	0	0	1	0	5	0	0	83	0	0	14	160	0	263	
5:30 PM	0	0	0	0	0	5	0	4	0	0	79	0	0	12	149	0	249	
5:45 PM	0	0	0	0	0	2	0	5	0	0	101	1	0	8	118	0	235	
Count Total	0	0	0	0	0	12	0	44	0	0	673	4	0	79	1,121	0	1,933	
Peak Hour	0	0	0	0	0	8	0	19	0	0	361	1	0	45	565	0	999	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	0	7	0	11	18	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	0	4	0	1	5	4:15 PM	0	0	0	0	0	4:15 PM	0	1	0	0	1
4:30 PM	0	3	1	1	5	4:30 PM	0	0	0	0	0	4:30 PM	0	1	0	0	1
4:45 PM	0	1	0	1	2	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	0	3	0	3	6	5:00 PM	0	0	0	0	0	5:00 PM	0	0	0	0	0
5:15 PM	0	4	0	1	5	5:15 PM	0	0	0	0	0	5:15 PM	0	0	0	0	0
5:30 PM	0	2	0	2	4	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	0	24	1	20	45	Count Total	0	0	0	0	0	Count Total	0	2	0	0	2
Peak Hour	0	9	0	6	15	Peak Hour	0	0	0	0	0	Peak Hour	0	0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

Location: 6 MARVIN RD SE & TERRIS CT SE PM

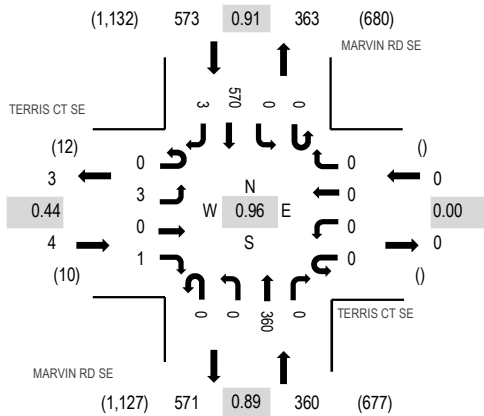
Date: Wednesday, June 1, 2022

Peak Hour: 05:00 PM - 06:00 PM

Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour

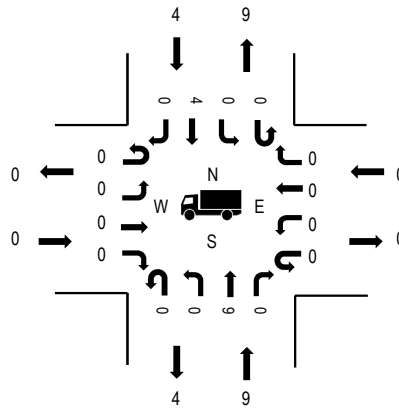
Motorized Vehicles



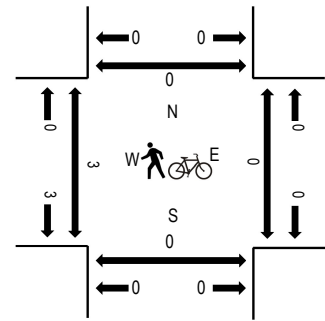
Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.0%	0.44
WB	0.0%	0.00
NB	2.5%	0.89
SB	0.7%	0.91
All	1.4%	0.96

Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Traffic Counts - Motorized Vehicles

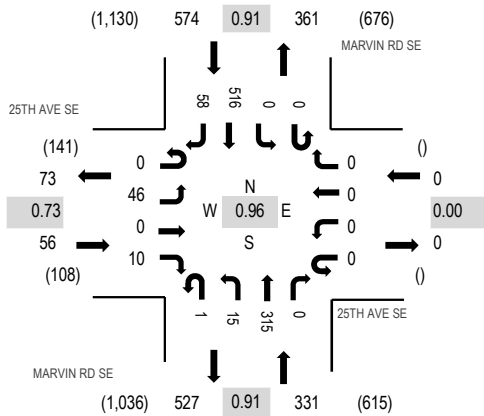
Interval Start Time	TERRIS CT SE Eastbound				TERRIS CT SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	0	0	0	0	0	0	0	0	1	82	0	0	0	151	0	234	882
4:15 PM	0	3	0	1	0	0	0	0	0	1	78	0	0	0	145	2	230	886
4:30 PM	0	0	0	1	0	0	0	0	0	0	77	0	0	0	124	3	205	901
4:45 PM	0	0	0	1	0	0	0	0	0	1	77	0	0	0	133	1	213	928
5:00 PM	0	0	0	1	0	0	0	0	0	0	97	0	0	0	138	2	238	937
5:15 PM	0	0	0	0	0	0	0	0	0	0	84	0	0	0	161	0	245	
5:30 PM	0	1	0	0	0	0	0	0	0	0	78	0	0	0	153	0	232	
5:45 PM	0	2	0	0	0	0	0	0	0	0	101	0	0	0	118	1	222	
Count Total	0	6	0	4	0	0	0	0	0	3	674	0	0	0	1,123	9	1,819	
Peak Hour	0	3	0	1	0	0	0	0	0	0	360	0	0	0	570	3	937	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	0	7	0	10	17	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	0	5	0	0	5	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	1	3	0	2	6	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0
4:45 PM	0	1	0	1	2	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	0	3	0	2	5	5:00 PM	0	0	0	0	0	5:00 PM	3	0	0	0	3
5:15 PM	0	4	0	1	5	5:15 PM	0	0	0	0	0	5:15 PM	0	0	0	0	0
5:30 PM	0	2	0	1	3	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	1	25	0	17	43	Count Total	0	0	0	0	0	Count Total	3	0	0	0	3
Peak Hour	0	9	0	4	13	Peak Hour	0	0	0	0	0	Peak Hour	3	0	0	0	3

Peak Hour

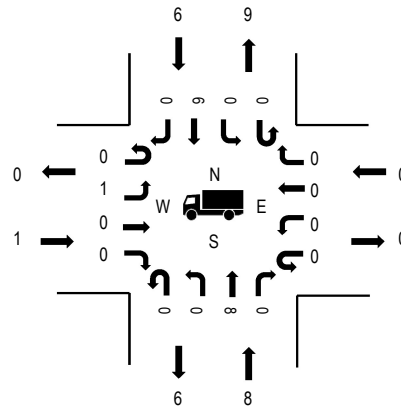
Motorized Vehicles



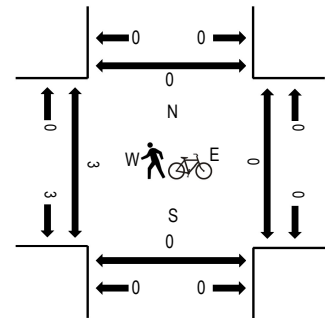
Note: Total study counts contained in parentheses.

	HV%	PHF
EB	1.8%	0.73
WB	0.0%	0.00
NB	2.4%	0.91
SB	1.0%	0.91
All	1.6%	0.96

Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Traffic Counts - Motorized Vehicles

Interval Start Time	25TH AVE SE Eastbound				25TH AVE SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	10	0	3	0	0	0	0	0	0	74	0	0	0	136	15	238	892
4:15 PM	0	17	0	3	0	0	0	0	0	2	63	0	0	0	130	15	230	904
4:30 PM	0	5	0	4	0	0	0	0	0	2	70	0	0	0	109	17	207	925
4:45 PM	0	7	0	3	0	0	0	0	0	4	69	0	0	0	121	13	217	957
5:00 PM	0	13	0	6	0	0	0	0	0	3	88	0	0	0	123	17	250	961
5:15 PM	0	11	0	1	0	0	0	0	0	8	70	0	0	0	148	13	251	
5:30 PM	0	10	0	2	0	0	0	0	1	3	69	0	0	0	141	13	239	
5:45 PM	0	12	0	1	0	0	0	0	0	1	88	0	0	0	104	15	221	
Count Total	0	85	0	23	0	0	0	0	1	23	591	0	0	0	1,012	118	1,853	
Peak Hour	0	46	0	10	0	0	0	0	1	15	315	0	0	0	516	58	961	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	1	6	0	9	16	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	1	3	0	1	5	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	0	3	0	2	5	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0
4:45 PM	0	1	0	1	2	4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0
5:00 PM	0	3	0	3	6	5:00 PM	0	0	0	0	0	5:00 PM	3	0	0	0	3
5:15 PM	1	3	0	1	5	5:15 PM	0	0	0	0	0	5:15 PM	0	0	0	0	0
5:30 PM	0	2	0	2	4	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	3	21	0	19	43	Count Total	0	0	0	0	0	Count Total	3	0	0	0	3
Peak Hour	1	8	0	6	15	Peak Hour	0	0	0	0	0	Peak Hour	3	0	0	0	3

Location: 8 MARVIN RD SE & MULLEN RD SE PM

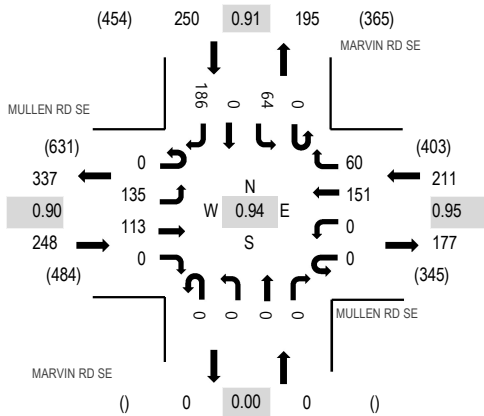
Date: Tuesday, August 2, 2022

Peak Hour: 04:30 PM - 05:30 PM

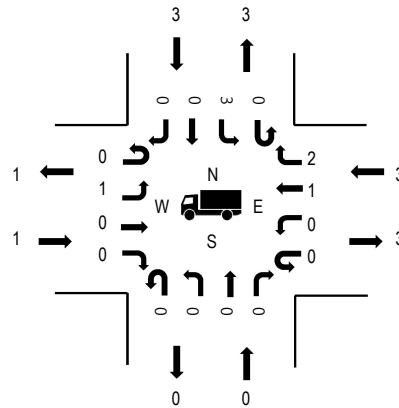
Peak 15-Minutes: 04:30 PM - 04:45 PM

Peak Hour

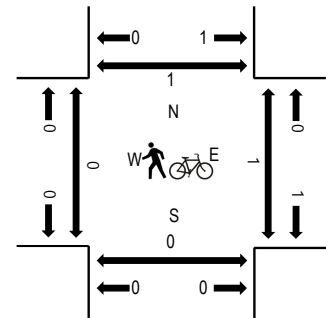
Motorized Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.4%	0.90
WB	1.4%	0.95
NB	0.0%	0.00
SB	1.2%	0.91
All	1.0%	0.94

Traffic Counts - Motorized Vehicles

Interval Start Time	MULLEN RD SE Eastbound				MULLEN RD SE Westbound				MARVIN RD SE Northbound				MARVIN RD SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	33	30	0	0	0	29	16	0	0	0	0	0	16	0	33	157	680
4:15 PM	0	25	28	0	0	0	47	10	0	0	0	0	0	16	0	35	161	694
4:30 PM	0	33	36	0	0	0	37	18	0	0	0	0	0	19	0	45	188	709
4:45 PM	0	28	27	0	0	0	33	17	0	0	0	0	0	17	0	52	174	677
5:00 PM	0	31	26	0	0	0	43	15	0	0	0	0	0	14	0	42	171	661
5:15 PM	0	43	24	0	0	0	38	10	0	0	0	0	0	14	0	47	176	
5:30 PM	0	37	28	0	0	0	31	8	0	0	0	0	0	15	0	37	156	
5:45 PM	0	32	23	0	0	0	42	9	0	0	0	0	0	12	0	40	158	
Count Total	0	262	222	0	0	0	300	103	0	0	0	0	0	123	0	331	1,341	
Peak Hour	0	135	113	0	0	0	151	60	0	0	0	0	0	64	0	186	709	

Traffic Counts - Heavy Vehicles, Bicycles on Road, and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Bicycles on Roadway					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	0	0	3	2	5	4:00 PM	0	0	0	0	0	4:00 PM	0	0	0	0	0
4:15 PM	0	0	1	0	1	4:15 PM	0	0	0	0	0	4:15 PM	0	0	0	0	0
4:30 PM	0	0	1	1	2	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	1	1
4:45 PM	0	0	0	1	1	4:45 PM	1	0	0	0	1	4:45 PM	0	0	1	0	1
5:00 PM	0	0	1	0	1	5:00 PM	0	0	0	0	0	5:00 PM	0	0	0	0	0
5:15 PM	1	0	1	1	3	5:15 PM	0	0	0	0	0	5:15 PM	0	0	0	0	0
5:30 PM	1	0	2	0	3	5:30 PM	0	0	0	0	0	5:30 PM	0	0	0	0	0
5:45 PM	0	0	1	0	1	5:45 PM	0	0	0	0	0	5:45 PM	0	0	0	0	0
Count Total	2	0	10	5	17	Count Total	1	0	0	0	1	Count Total	0	0	1	1	2
Peak Hour	1	0	3	3	7	Peak Hour	1	0	0	0	1	Peak Hour	0	0	1	1	2

Appendix B: LOS Definitions

Highway Capacity Manual 2010/6th Edition

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 1 summarizes the LOS criteria for signalized intersections, as described in the *Highway Capacity Manual 2010* and 6th Edition (Transportation Research Board, 2010 and 2016, respectively).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F ¹	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop and two-way stop control. All-way stop control intersection LOS is expressed in terms of the weighted average control delay of the overall intersection or by approach. Two-way stop-controlled intersection LOS is defined in terms of the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns. This approach is because major-street through vehicles are assumed to experience zero delay, a weighted average of all movements results in very low overall average delay, and this calculated low delay could mask deficiencies of minor movements. Table 2 shows LOS criteria for unsignalized intersections.

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	0 – 10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F ¹	>50

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

1. If the volume-to-capacity (v/c) ratio exceeds 1.0, LOS F is assigned an individual lane group for all unsignalized intersections, or minor street approach at two-way stop-controlled intersections. Overall intersection LOS is determined solely by control delay.

Appendix C: LOS Worksheets

HCM 6th Signalized Intersection Summary

1: Marvin Rd SE & Steilacoom Rd SE

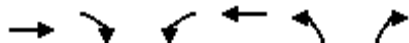
McAllister Springs
Existing PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	195	15	140	225	180	45	550	70	295	790	265
Future Volume (veh/h)	175	195	15	140	225	180	45	550	70	295	790	265
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	186	207	16	149	239	191	48	585	74	314	840	282
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	1	1	1
Cap, veh/h	245	586	45	419	324	259	265	1598	202	433	1314	441
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	973	1741	135	1166	963	770	506	3196	403	780	2628	881
Grp Volume(v), veh/h	186	0	223	149	0	430	48	327	332	314	572	550
Grp Sat Flow(s),veh/h/ln	973	0	1875	1166	0	1733	506	1791	1809	780	1791	1718
Q Serve(g_s), s	6.5	0.0	4.9	6.1	0.0	12.0	4.2	6.1	6.2	21.3	12.9	12.9
Cycle Q Clear(g_c), s	18.5	0.0	4.9	11.0	0.0	12.0	17.2	6.1	6.2	27.5	12.9	12.9
Prop In Lane	1.00		0.07	1.00		0.44	1.00		0.22	1.00		0.51
Lane Grp Cap(c), veh/h	245	0	631	419	0	583	265	895	904	433	895	859
V/C Ratio(X)	0.76	0.00	0.35	0.36	0.00	0.74	0.18	0.37	0.37	0.73	0.64	0.64
Avail Cap(c_a), veh/h	245	0	631	419	0	583	265	895	904	433	895	859
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.5	0.0	13.7	17.9	0.0	16.1	16.4	8.4	8.4	17.2	10.1	10.1
Incr Delay (d2), s/veh	19.6	0.0	1.6	2.4	0.0	8.1	1.5	1.2	1.1	10.1	3.5	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	0.0	2.1	1.7	0.0	5.5	0.6	2.2	2.2	4.6	4.9	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.1	0.0	15.3	20.2	0.0	24.2	17.9	9.6	9.6	27.4	13.6	13.8
LnGrp LOS	D	A	B	C	A	C	B	A	A	C	B	B
Approach Vol, veh/h	409			579			707			1436		
Approach Delay, s/veh	28.9			23.2			10.1			16.7		
Approach LOS	C			C			B			B		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	32.0			23.0			32.0			23.0		
Change Period (Y+Rc), s	4.5			4.5			4.5			4.5		
Max Green Setting (Gmax), s	27.5			18.5			27.5			18.5		
Max Q Clear Time (g_c+I1), s	19.2			20.5			29.5			14.0		
Green Ext Time (p_c), s	2.9			0.0			0.0			1.4		
Intersection Summary												
HCM 6th Ctrl Delay	18.0											
HCM 6th LOS	B											

HCM 6th Signalized Intersection Summary

2: Union Mills Rd SE & Pacific Ave SE

McAllister Springs
Existing PM Peak Hour



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	↵
Traffic Volume (veh/h)	865	175	25	680	85	5
Future Volume (veh/h)	865	175	25	680	85	5
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	930	188	27	731	91	5
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1
Cap, veh/h	1330	269	244	1612	664	591
Arrive On Green	0.45	0.45	0.45	0.45	0.37	0.37
Sat Flow, veh/h	3051	597	508	3676	1795	1598
Grp Volume(v), veh/h	563	555	27	731	91	5
Grp Sat Flow(s), veh/h/ln	1791	1763	508	1791	1795	1598
Q Serve(g_s), s	12.6	12.6	2.3	7.1	1.7	0.1
Cycle Q Clear(g_c), s	12.6	12.6	14.9	7.1	1.7	0.1
Prop In Lane		0.34	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	806	793	244	1612	664	591
V/C Ratio(X)	0.70	0.70	0.11	0.45	0.14	0.01
Avail Cap(c_a), veh/h	806	793	244	1612	664	591
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.0	11.0	17.0	9.5	10.5	10.0
Incr Delay (d2), s/veh	5.0	5.1	0.9	0.9	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	5.0	0.3	2.4	0.6	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	16.0	16.1	17.9	10.4	10.9	10.0
LnGrp LOS	B	B	B	B	B	A
Approach Vol, veh/h	1118			758	96	
Approach Delay, s/veh	16.1			10.7	10.8	
Approach LOS	B			B	B	
Timer - Assigned Phs	2			4		8
Phs Duration (G+Y+Rc), s	23.0			27.0		27.0
Change Period (Y+Rc), s	4.5			4.5		4.5
Max Green Setting (Gmax), s	18.5			22.5		22.5
Max Q Clear Time (g_c+I1), s	3.7			14.6		16.9
Green Ext Time (p_c), s	0.2			4.4		2.5
Intersection Summary						
HCM 6th Ctrl Delay			13.8			
HCM 6th LOS			B			

MOVEMENT SUMMARY

 **Site: 3 [Marvin Rd SE & Pacific Ave SE (Site Folder: Existing)]**

McAllister Springs
Site Category: Existing PM Peak Hour
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total HV] veh/h %		DEMAND FLOWS [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. Dist] veh ft		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Marvin Rd SE														
3	L2	60	1.0	61	1.0	0.215	13.2	LOS B	1.3	33.0	0.69	0.74	0.69	34.9
8	T1	335	1.0	342	1.0	0.215	6.6	LOS A	1.4	36.2	0.68	0.69	0.68	35.5
18	R2	20	1.0	20	1.0	0.215	6.8	LOS A	1.4	36.2	0.68	0.66	0.68	34.7
Approach		415	1.0	423	1.0	0.215	7.6	LOS A	1.4	36.2	0.68	0.70	0.68	35.4
East: Pacific Ave SE														
1	L2	35	2.0	36	2.0	0.248	11.1	LOS B	1.1	27.8	0.49	0.56	0.49	36.2
6	T1	210	2.0	214	2.0	0.248	5.0	LOS A	1.1	27.8	0.49	0.56	0.49	36.1
16	R2	255	2.0	260	2.0	0.235	5.2	LOS A	1.1	26.7	0.47	0.63	0.47	35.4
Approach		500	2.0	510	2.0	0.248	5.5	LOS A	1.1	27.8	0.48	0.59	0.48	35.8
North: Marvin Rd SE														
7u	U	5	1.0	5	1.0	0.362	13.8	LOS B	2.3	58.7	0.55	0.68	0.55	35.3
7	L2	285	1.0	291	1.0	0.362	11.4	LOS B	2.3	58.7	0.55	0.68	0.55	34.5
4	T1	525	1.0	536	1.0	0.362	5.0	LOS A	2.4	61.5	0.53	0.56	0.53	36.0
14	R2	75	1.0	77	1.0	0.362	5.4	LOS A	2.4	61.5	0.53	0.52	0.53	35.2
Approach		890	1.0	908	1.0	0.362	7.1	LOS A	2.4	61.5	0.54	0.59	0.54	35.4
West: Pacific Ave SE														
5	L2	35	2.0	36	2.0	0.363	12.0	LOS B	1.7	44.3	0.64	0.64	0.65	35.8
2	T1	300	2.0	306	2.0	0.363	5.8	LOS A	1.7	44.3	0.64	0.64	0.65	35.7
12	R2	150	2.0	153	2.0	0.220	6.9	LOS A	0.9	22.6	0.60	0.80	0.60	35.0
Approach		485	2.0	495	2.0	0.363	6.6	LOS A	1.7	44.3	0.63	0.69	0.64	35.5
All Vehicles		2290	1.4	2337	1.4	0.363	6.8	LOS A	2.4	61.5	0.57	0.63	0.57	35.5

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:21:28 PM

Project: M:\22\11.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

HCM 6th TWSC
4: Marvin Rd SE & Union Mills Rd SE

McAllister Springs
Existing PM Peak Hour

Intersection							
Int Delay, s/veh	1.9						
Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Traffic Vol, veh/h	25	100	5	45	305	615	50
Future Vol, veh/h	25	100	5	45	305	615	50
Conflicting Peds, #/hr	0	1	0	1	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	None
Storage Length	0	-	-	0	-	-	-
Veh in Median Storage, #	0	-	-	-	0	0	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	1	1	1	1	1
Mvmt Flow	27	108	5	48	328	661	54

Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1113	690	-	716	0	0
Stage 1	689	-	-	-	-	-
Stage 2	424	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	4.11	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	2.209	-	-
Pot Cap-1 Maneuver	233	449	-	889	-	-
Stage 1	502	-	-	-	-	-
Stage 2	664	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	233	448	~-10	~-10	-	-
Mov Cap-2 Maneuver	363	-	-	-	-	-
Stage 1	501	-	-	-	-	-
Stage 2	663	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	17.2		0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	+	-	428	-	-
HCM Lane V/C Ratio	-	-	0.314	-	-
HCM Control Delay (s)	-	-	17.2	-	-
HCM Lane LOS	-	-	C	-	-
HCM 95th %tile Q(veh)	-	-	1.3	-	-

Notes			
~: Volume exceeds capacity	\$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	20	360	5	45	565
Future Vol, veh/h	10	20	360	5	45	565
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	3	3	1	1
Mvmt Flow	11	21	379	5	47	595
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1071	382	0	0	384	0
Stage 1	382	-	-	-	-	-
Stage 2	689	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	247	670	-	-	1180	-
Stage 1	694	-	-	-	-	-
Stage 2	502	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	237	670	-	-	1180	-
Mov Cap-2 Maneuver	362	-	-	-	-	-
Stage 1	694	-	-	-	-	-
Stage 2	482	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	12.3	0		0.6		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	- 522		1180	-	
HCM Lane V/C Ratio	-	- 0.06		0.04	-	
HCM Control Delay (s)	-	- 12.3		8.2	-	
HCM Lane LOS	-	- B		A	-	
HCM 95th %tile Q(veh)	-	- 0.2		0.1	-	

HCM 6th TWSC
6: Marvin Rd SE & 25th Ave SE

McAllister Springs
Existing PM Peak Hour

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	45	10	15	315	515	60
Future Vol, veh/h	45	10	15	315	515	60
Conflicting Peds, #/hr	3	3	3	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	1	1
Mvmt Flow	47	10	16	328	536	63
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	934	574	602	0	-	0
Stage 1	571	-	-	-	-	-
Stage 2	363	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	295	518	975	-	-	-
Stage 1	565	-	-	-	-	-
Stage 2	704	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	289	515	972	-	-	-
Mov Cap-2 Maneuver	411	-	-	-	-	-
Stage 1	554	-	-	-	-	-
Stage 2	702	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	14.7	0.4		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	972	-	427	-	-	
HCM Lane V/C Ratio	0.016	-	0.134	-	-	
HCM Control Delay (s)	8.8	-	14.7	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0	-	0.5	-	-	

HCM 6th TWSC
7: Mullen Rd SE & Marvin Rd SE

McAllister Springs
Existing PM Peak Hour

Intersection						
Int Delay, s/veh	6.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	135	115	150	60	65	185
Future Vol, veh/h	135	115	150	60	65	185
Conflicting Peds, #/hr	1	0	0	2	2	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	1	1
Mvmt Flow	144	122	160	64	69	197
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	226	0	-	0	606	195
Stage 1	-	-	-	-	194	-
Stage 2	-	-	-	-	412	-
Critical Hdwy	4.1	-	-	-	6.41	6.21
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	2.2	-	-	-	3.509	3.309
Pot Cap-1 Maneuver	1354	-	-	-	462	849
Stage 1	-	-	-	-	841	-
Stage 2	-	-	-	-	671	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1351	-	-	-	407	847
Mov Cap-2 Maneuver	-	-	-	-	407	-
Stage 1	-	-	-	-	743	-
Stage 2	-	-	-	-	670	-
Approach	EB	WB		SB		
HCM Control Delay, s	4.3	0		14.1		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1351	-	-	-	661	
HCM Lane V/C Ratio	0.106	-	-	-	0.402	
HCM Control Delay (s)	8	0	-	-	14.1	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.4	-	-	-	1.9	

HCM 6th Signalized Intersection Summary

1: Marvin Rd SE & Steilacoom Rd SE

McAllister Springs

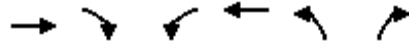
Future (2026) Without Project PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	235	25	210	270	225	55	780	95	355	1175	320
Future Volume (veh/h)	215	235	25	210	270	225	55	780	95	355	1175	320
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	229	250	27	223	287	239	59	830	101	378	1250	340
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	1	1	1
Cap, veh/h	176	618	67	381	346	288	130	1649	201	304	1433	382
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	0.51	0.51	0.51
Sat Flow, veh/h	891	1685	182	1110	944	786	323	3211	391	606	2791	744
Grp Volume(v), veh/h	229	0	277	223	0	526	59	463	468	378	793	797
Grp Sat Flow(s),veh/h/ln	891	0	1867	1110	0	1730	323	1791	1811	606	1791	1744
Q Serve(g_s), s	6.8	0.0	8.3	14.0	0.0	20.7	7.8	12.7	12.7	25.8	29.0	30.7
Cycle Q Clear(g_c), s	27.5	0.0	8.3	22.3	0.0	20.7	38.5	12.7	12.7	38.5	29.0	30.7
Prop In Lane	1.00		0.10	1.00		0.45	1.00		0.22	1.00		0.43
Lane Grp Cap(c), veh/h	176	0	685	381	0	634	130	919	930	304	919	895
V/C Ratio(X)	1.30	0.00	0.40	0.59	0.00	0.83	0.45	0.50	0.50	1.24	0.86	0.89
Avail Cap(c_a), veh/h	176	0	685	381	0	634	130	919	930	304	919	895
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	0.0	17.7	26.0	0.0	21.6	35.3	12.0	12.0	28.7	15.9	16.3
Incr Delay (d2), s/veh	170.0	0.0	1.8	6.5	0.0	11.9	11.1	2.0	1.9	134.0	10.5	12.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.5	0.0	3.7	4.2	0.0	9.9	1.5	5.0	5.1	16.8	13.0	13.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	206.0	0.0	19.4	32.4	0.0	33.5	46.3	13.9	13.9	162.7	26.5	29.2
LnGrp LOS	F	A	B	C	A	C	D	B	B	F	C	C
Approach Vol, veh/h	506			749			990			1968		
Approach Delay, s/veh	103.8			33.2			15.9			53.8		
Approach LOS	F			C			B			D		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	43.0			32.0			43.0			32.0		
Change Period (Y+Rc), s	4.5			4.5			4.5			4.5		
Max Green Setting (Gmax), s	38.5			27.5			38.5			27.5		
Max Q Clear Time (g_c+I1), s	40.5			29.5			40.5			24.3		
Green Ext Time (p_c), s	0.0			0.0			0.0			1.4		
Intersection Summary												
HCM 6th Ctrl Delay	47.2											
HCM 6th LOS	D											

HCM 6th Signalized Intersection Summary

2: Union Mills Rd SE & Pacific Ave SE

McAllister Springs
Future (2026) Without Project PM Peak Hour



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱		↱	↑↑	↱	↱
Traffic Volume (veh/h)	1015	300	30	795	155	5
Future Volume (veh/h)	1015	300	30	795	155	5
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	1091	323	32	855	167	5
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1
Cap, veh/h	1427	417	197	1880	584	519
Arrive On Green	0.52	0.52	0.52	0.52	0.32	0.32
Sat Flow, veh/h	2812	795	383	3676	1795	1598
Grp Volume(v), veh/h	714	700	32	855	167	5
Grp Sat Flow(s),veh/h/ln	1791	1722	383	1791	1795	1598
Q Serve(g_s), s	18.9	19.5	4.4	8.9	4.2	0.1
Cycle Q Clear(g_c), s	18.9	19.5	23.9	8.9	4.2	0.1
Prop In Lane		0.46	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	940	904	197	1880	584	519
V/C Ratio(X)	0.76	0.77	0.16	0.45	0.29	0.01
Avail Cap(c_a), veh/h	940	904	197	1880	584	519
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.3	11.4	20.9	8.9	15.1	13.7
Incr Delay (d2), s/veh	5.8	6.4	1.8	0.8	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	7.5	0.5	3.0	1.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.0	17.8	22.7	9.7	16.3	13.7
LnGrp LOS	B	B	C	A	B	B
Approach Vol, veh/h	1414			887	172	
Approach Delay, s/veh	17.4			10.2	16.2	
Approach LOS	B			B	B	
Timer - Assigned Phs	2		4		8	
Phs Duration (G+Y+Rc), s	24.0		36.0		36.0	
Change Period (Y+Rc), s	4.5		4.5		4.5	
Max Green Setting (Gmax), s	19.5		31.5		31.5	
Max Q Clear Time (g_c+I1), s	6.2		21.5		25.9	
Green Ext Time (p_c), s	0.4		6.5		2.9	
Intersection Summary						
HCM 6th Ctrl Delay			14.7			
HCM 6th LOS			B			

MOVEMENT SUMMARY

 **Site: 3 [Marvin Rd SE & Pacific Ave SE (Site Folder: Future WoP)]**

McAllister Springs

Site Category: Future (2026) Without-Project PM Peak Hour

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Marvin Rd SE														
3	L2	130	1.0	133	1.0	0.451	18.2	LOS B	3.6	90.9	0.91	0.99	1.04	32.3
8	T1	495	1.0	505	1.0	0.451	10.6	LOS B	4.0	100.3	0.93	0.93	1.01	33.9
18	R2	25	1.0	26	1.0	0.451	10.4	LOS B	4.0	100.3	0.94	0.90	1.00	33.5
Approach		650	1.0	663	1.0	0.451	12.1	LOS B	4.0	100.3	0.93	0.94	1.01	33.5
East: Pacific Ave SE														
1	L2	45	2.0	46	2.0	0.392	12.1	LOS B	2.0	51.0	0.66	0.67	0.68	35.6
6	T1	270	2.0	276	2.0	0.392	6.0	LOS A	2.0	51.0	0.66	0.67	0.68	35.5
16	R2	360	2.0	367	2.0	0.389	6.0	LOS A	2.0	52.0	0.65	0.72	0.66	35.0
Approach		675	2.0	689	2.0	0.392	6.4	LOS A	2.0	52.0	0.65	0.70	0.67	35.3
North: Marvin Rd SE														
7u	U	5	1.0	5	1.0	0.619	16.8	LOS B	6.0	152.3	0.80	0.88	0.94	34.0
7	L2	445	1.0	454	1.0	0.619	14.4	LOS B	6.0	152.3	0.80	0.88	0.94	33.3
4	T1	815	1.0	832	1.0	0.619	7.3	LOS A	6.2	157.4	0.79	0.79	0.88	35.1
14	R2	90	1.0	92	1.0	0.619	7.6	LOS A	6.2	157.4	0.78	0.77	0.87	34.4
Approach		1355	1.0	1383	1.0	0.619	9.7	LOS A	6.2	157.4	0.79	0.82	0.90	34.4
West: Pacific Ave SE														
5	L2	45	2.0	46	2.0	0.646	15.3	LOS B	4.5	113.5	0.87	1.01	1.13	34.7
2	T1	390	2.0	398	2.0	0.646	9.2	LOS A	4.5	113.5	0.87	1.01	1.13	34.7
12	R2	275	2.0	281	2.0	0.540	10.1	LOS B	3.0	76.8	0.82	0.97	1.01	33.3
Approach		710	2.0	724	2.0	0.646	9.9	LOS A	4.5	113.5	0.85	0.99	1.08	34.2
All Vehicles		3390	1.4	3459	1.4	0.646	9.5	LOS A	6.2	157.4	0.80	0.85	0.91	34.3

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:21:26 PM

Project: M:\2211.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

MOVEMENT SUMMARY

 **Site: 4 [Marvin Rd SE & Union Mills Rd SE (Site Folder: Future WoP)]**

McAllister Springs

Site Category: Future (2026) Without-Project PM Peak Hour

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] ft				
						v/c	sec							mph
South: Marvin Rd SE														
3u	U	5	3.0	5	3.0	0.487	12.4	LOS B	4.4	111.0	0.25	0.41	0.25	37.9
3	L2	60	1.0	65	1.0	0.487	9.9	LOS A	4.4	111.0	0.25	0.41	0.25	37.1
8	T1	505	1.0	543	1.0	0.487	3.8	LOS A	4.4	111.0	0.25	0.41	0.25	37.0
Approach		570	1.0	613	1.0	0.487	4.6	LOS A	4.4	111.0	0.25	0.41	0.25	37.0
North: Marvin Rd SE														
4	T1	980	1.0	1054	1.0	0.909	5.5	LOS D	20.5	516.1	0.93	0.50	0.93	35.0
14	R2	60	1.0	65	1.0	0.909	5.8	LOS D	20.5	516.1	0.93	0.50	0.93	34.0
Approach		1040	1.0	1118	1.0	0.909	5.6	LOS A	20.5	516.1	0.93	0.50	0.93	35.0
West: Union Mills Rd SE														
5	L2	30	2.0	32	2.0	0.467	22.6	LOS C	3.8	96.0	1.00	1.06	1.16	30.8
12	R2	125	2.0	134	2.0	0.467	16.8	LOS B	3.8	96.0	1.00	1.06	1.16	29.9
Approach		155	2.0	167	2.0	0.467	17.9	LOS B	3.8	96.0	1.00	1.06	1.16	30.1
All Vehicles		1765	1.1	1898	1.1	0.909	6.3	LOS A	20.5	516.1	0.72	0.52	0.73	35.1

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:21:27 PM

Project: M:\22\1.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

HCM 6th TWSC
5: Marvin Rd SE & 22nd Ave SE

McAllister Springs
Future (2026) Without Project PM Peak Hour

Intersection						
Int Delay, s/veh	1.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	40	500	5	90	785
Future Vol, veh/h	10	40	500	5	90	785
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	3	3	1	1
Mvmt Flow	11	42	526	5	95	826
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1545	529	0	0	531	0
Stage 1	529	-	-	-	-	-
Stage 2	1016	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	127	554	-	-	1042	-
Stage 1	595	-	-	-	-	-
Stage 2	353	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	115	554	-	-	1042	-
Mov Cap-2 Maneuver	237	-	-	-	-	-
Stage 1	595	-	-	-	-	-
Stage 2	321	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	14.4	0		0.9		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		437	1042	
HCM Lane V/C Ratio	-	-		0.12	0.091	
HCM Control Delay (s)	-	-		14.4	8.8	
HCM Lane LOS	-	-		B	A	
HCM 95th %tile Q(veh)	-	-		0.4	0.3	

HCM 6th TWSC
6: Marvin Rd SE & 25th Ave SE

McAllister Springs
Future (2026) Without Project PM Peak Hour

Intersection						
Int Delay, s/veh	1.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	65	15	25	435	710	85
Future Vol, veh/h	65	15	25	435	710	85
Conflicting Peds, #/hr	3	3	3	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	1	1
Mvmt Flow	68	16	26	453	740	89
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1296	791	832	0	-	0
Stage 1	788	-	-	-	-	-
Stage 2	508	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	179	390	801	-	-	-
Stage 1	448	-	-	-	-	-
Stage 2	604	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	172	388	799	-	-	-
Mov Cap-2 Maneuver	305	-	-	-	-	-
Stage 1	432	-	-	-	-	-
Stage 2	602	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	20.3	0.5		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	799	-	318	-	-	
HCM Lane V/C Ratio	0.033	-	0.262	-	-	
HCM Control Delay (s)	9.7	-	20.3	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0.1	-	1	-	-	

MOVEMENT SUMMARY

 **Site: 7 [Marvin Rd SE & Mullen Rd SE (Site Folder: Future WoP)]**

McAllister Springs

Site Category: Future (2026) Without-Project PM Peak Hour

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
East: Mullen Rd SE														
6	T1	250	1.0	272	1.0	0.362	5.1	LOS A	2.2	54.4	0.46	0.53	0.46	36.6
16	R2	110	1.0	120	1.0	0.362	5.2	LOS A	2.2	54.4	0.46	0.53	0.46	35.5
Approach		360	1.0	391	1.0	0.362	5.1	LOS A	2.2	54.4	0.46	0.53	0.46	36.2
North: Marvin Rd SE														
7	L2	115	1.0	125	1.0	0.388	11.4	LOS B	2.4	60.9	0.53	0.65	0.53	35.9
14	R2	275	1.0	281	1.0	0.388	5.5	LOS A	2.4	60.9	0.53	0.65	0.53	34.7
Approach		390	1.0	406	1.0	0.388	7.3	LOS A	2.4	60.9	0.53	0.65	0.53	35.0
West: Mullen Rd SE														
5	L2	215	0.0	219	0.0	0.380	10.5	LOS B	2.5	61.6	0.37	0.56	0.37	35.8
2	T1	215	0.0	234	0.0	0.380	4.2	LOS A	2.5	61.6	0.37	0.56	0.37	35.7
Approach		430	0.0	453	0.0	0.380	7.2	LOS A	2.5	61.6	0.37	0.56	0.37	35.7
All Vehicles		1180	0.6	1250	0.6	0.388	6.6	LOS A	2.5	61.6	0.45	0.58	0.45	35.7

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:21:27 PM

Project: M:\22\1.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

HCM 6th Signalized Intersection Summary

1: Marvin Rd SE & Steilacoom Rd SE

McAllister Springs

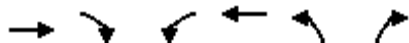
Future (2026) With Project PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	235	26	211	270	225	56	799	96	355	1211	320
Future Volume (veh/h)	215	235	26	211	270	225	56	799	96	355	1211	320
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	229	250	28	224	287	239	60	850	102	378	1288	340
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	1	1	1
Cap, veh/h	176	615	69	380	346	288	123	1651	198	297	1443	373
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	0.51	0.51	0.51
Sat Flow, veh/h	891	1678	188	1109	944	786	312	3217	386	594	2812	727
Grp Volume(v), veh/h	229	0	278	224	0	526	60	473	479	378	810	818
Grp Sat Flow(s),veh/h/ln	891	0	1866	1109	0	1730	312	1791	1812	594	1791	1748
Q Serve(g_s), s	6.8	0.0	8.3	14.1	0.0	20.7	6.4	13.1	13.1	25.4	30.2	32.1
Cycle Q Clear(g_c), s	27.5	0.0	8.3	22.4	0.0	20.7	38.5	13.1	13.1	38.5	30.2	32.1
Prop In Lane	1.00		0.10	1.00		0.45	1.00		0.21	1.00		0.42
Lane Grp Cap(c), veh/h	176	0	684	380	0	634	123	919	930	297	919	897
V/C Ratio(X)	1.30	0.00	0.41	0.59	0.00	0.83	0.49	0.51	0.51	1.27	0.88	0.91
Avail Cap(c_a), veh/h	176	0	684	380	0	634	123	919	930	297	919	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	0.0	17.7	26.0	0.0	21.6	36.1	12.1	12.1	28.9	16.2	16.7
Incr Delay (d2), s/veh	170.0	0.0	1.8	6.6	0.0	11.9	13.3	2.1	2.0	146.4	11.9	15.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.5	0.0	3.7	4.2	0.0	9.9	1.5	5.2	5.2	17.4	13.8	14.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	206.0	0.0	19.5	32.6	0.0	33.5	49.4	14.1	14.1	175.3	28.1	31.7
LnGrp LOS	F	A	B	C	A	C	D	B	B	F	C	C
Approach Vol, veh/h	507			750			1012			2006		
Approach Delay, s/veh	103.7			33.3			16.2			57.3		
Approach LOS	F			C			B			E		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	43.0			32.0			43.0			32.0		
Change Period (Y+Rc), s	4.5			4.5			4.5			4.5		
Max Green Setting (Gmax), s	38.5			27.5			38.5			27.5		
Max Q Clear Time (g_c+I1), s	40.5			29.5			40.5			24.4		
Green Ext Time (p_c), s	0.0			0.0			0.0			1.3		
Intersection Summary												
HCM 6th Ctrl Delay	48.9											
HCM 6th LOS	D											

HCM 6th Signalized Intersection Summary

2: Union Mills Rd SE & Pacific Ave SE

McAllister Springs
Future (2026) With Project PM Peak Hour



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱		↱	↑↑	↱	↱
Traffic Volume (veh/h)	1015	338	30	795	176	5
Future Volume (veh/h)	1015	338	30	795	176	5
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	1091	363	32	855	189	5
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	1	1
Cap, veh/h	1384	453	186	1880	584	519
Arrive On Green	0.52	0.52	0.52	0.52	0.32	0.32
Sat Flow, veh/h	2730	863	369	3676	1795	1598
Grp Volume(v), veh/h	736	718	32	855	189	5
Grp Sat Flow(s),veh/h/ln	1791	1708	369	1791	1795	1598
Q Serve(g_s), s	19.9	20.7	4.7	8.9	4.8	0.1
Cycle Q Clear(g_c), s	19.9	20.7	25.4	8.9	4.8	0.1
Prop In Lane		0.51	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	940	897	186	1880	584	519
V/C Ratio(X)	0.78	0.80	0.17	0.45	0.32	0.01
Avail Cap(c_a), veh/h	940	897	186	1880	584	519
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.5	11.7	22.1	8.9	15.3	13.7
Incr Delay (d2), s/veh	6.5	7.5	2.0	0.8	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.0	8.1	0.5	3.0	2.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.9	19.1	24.1	9.7	16.7	13.7
LnGrp LOS	B	B	C	A	B	B
Approach Vol, veh/h	1454			887	194	
Approach Delay, s/veh	18.5			10.2	16.7	
Approach LOS	B			B	B	
Timer - Assigned Phs						
	2		4		8	
Phs Duration (G+Y+Rc), s	24.0		36.0		36.0	
Change Period (Y+Rc), s	4.5		4.5		4.5	
Max Green Setting (Gmax), s	19.5		31.5		31.5	
Max Q Clear Time (g_c+I1), s	6.8		22.7		27.4	
Green Ext Time (p_c), s	0.4		6.1		2.3	
Intersection Summary						
HCM 6th Ctrl Delay			15.5			
HCM 6th LOS			B			

MOVEMENT SUMMARY

 **Site: 3 [Marvin Rd SE & Pacific Ave SE (Site Folder: Future WP)]**

McAllister Springs
Site Category: Future (2026) With-Project PM Peak Hour
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Marvin Rd SE														
3	L2	130	1.0	133	1.0	0.467	18.5	LOS B	3.8	96.4	0.92	1.00	1.07	32.2
8	T1	515	1.0	526	1.0	0.467	10.9	LOS B	4.2	107.0	0.94	0.94	1.04	33.7
18	R2	26	1.0	27	1.0	0.467	10.7	LOS B	4.2	107.0	0.94	0.92	1.03	33.4
Approach		671	1.0	685	1.0	0.467	12.4	LOS B	4.2	107.0	0.93	0.95	1.05	33.4
East: Pacific Ave SE														
1	L2	46	2.0	47	2.0	0.399	12.2	LOS B	2.1	52.6	0.67	0.69	0.70	35.5
6	T1	270	2.0	276	2.0	0.399	6.1	LOS A	2.1	52.6	0.67	0.69	0.70	35.5
16	R2	360	2.0	367	2.0	0.394	6.1	LOS A	2.1	53.2	0.66	0.73	0.68	35.0
Approach		676	2.0	690	2.0	0.399	6.5	LOS A	2.1	53.2	0.66	0.71	0.69	35.2
North: Marvin Rd SE														
7u	U	5	1.0	5	1.0	0.637	17.1	LOS B	6.5	163.3	0.82	0.89	0.97	34.0
7	L2	445	1.0	454	1.0	0.637	14.7	LOS B	6.5	163.3	0.82	0.89	0.97	33.2
4	T1	853	1.0	870	1.0	0.637	7.6	LOS A	6.7	169.3	0.80	0.80	0.92	35.0
14	R2	90	1.0	92	1.0	0.637	7.8	LOS A	6.7	169.3	0.80	0.78	0.90	34.3
Approach		1393	1.0	1421	1.0	0.637	9.9	LOS A	6.7	169.3	0.81	0.83	0.93	34.4
West: Pacific Ave SE														
5	L2	45	2.0	46	2.0	0.665	15.7	LOS B	4.7	119.4	0.88	1.02	1.16	34.5
2	T1	390	2.0	398	2.0	0.665	9.6	LOS A	4.7	119.4	0.88	1.02	1.16	34.4
12	R2	275	2.0	281	2.0	0.558	10.5	LOS B	3.2	80.7	0.83	0.98	1.04	33.1
Approach		710	2.0	724	2.0	0.665	10.3	LOS B	4.7	119.4	0.87	1.01	1.11	33.9
All Vehicles		3450	1.4	3520	1.4	0.665	9.8	LOS A	6.7	169.3	0.82	0.87	0.94	34.2

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:10:19 PM

Project: M:\2211.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

MOVEMENT SUMMARY

 **Site: 4 [Marvin Rd SE & Union Mills Rd SE (Site Folder: Future WP)]**

McAllister Springs
Site Category: Future (2026) With-Project PM Peak Hour
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Marvin Rd SE														
3u	U	5	3.0	5	3.0	0.523	12.4	LOS B	5.0	126.9	0.26	0.42	0.26	37.8
3	L2	81	1.0	87	1.0	0.523	10.0	LOS A	5.0	126.9	0.26	0.42	0.26	37.0
8	T1	527	1.0	567	1.0	0.523	3.9	LOS A	5.0	126.9	0.26	0.42	0.26	36.9
Approach		613	1.0	659	1.0	0.523	4.7	LOS A	5.0	126.9	0.26	0.42	0.26	36.9
North: Marvin Rd SE														
4	T1	1020	1.0	1097	1.0	0.963	8.1	LOS E	29.3	739.6	1.00	0.60	1.04	34.8
14	R2	60	1.0	65	1.0	0.963	8.3	LOS E	29.3	739.6	1.00	0.60	1.04	33.8
Approach		1080	1.0	1161	1.0	0.963	8.1	LOS A	29.3	739.6	1.00	0.60	1.04	34.7
West: Union Mills Rd SE														
5	L2	30	2.0	32	2.0	0.659	33.7	LOS C	6.4	161.9	1.00	1.15	1.42	26.8
12	R2	163	2.0	175	2.0	0.659	27.9	LOS C	6.4	161.9	1.00	1.15	1.42	26.1
Approach		193	2.0	208	2.0	0.659	28.8	LOS C	6.4	161.9	1.00	1.15	1.42	26.2
All Vehicles		1886	1.1	2028	1.1	0.963	9.1	LOS A	29.3	739.6	0.76	0.59	0.82	34.3

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:18:16 PM

Project: M:\22\1.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

HCM 6th TWSC
5: Marvin Rd SE & 22nd Ave SE

McAllister Springs
Future (2026) With Project PM Peak Hour

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	48	536	5	103	850
Future Vol, veh/h	10	48	536	5	103	850
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	3	3	1	1
Mvmt Flow	11	51	564	5	108	895
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	1678	567	0	0	569	0
Stage 1	567	-	-	-	-	-
Stage 2	1111	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	106	527	-	-	1008	-
Stage 1	572	-	-	-	-	-
Stage 2	318	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	95	527	-	-	1008	-
Mov Cap-2 Maneuver	210	-	-	-	-	-
Stage 1	572	-	-	-	-	-
Stage 2	284	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	15.1	0	1			
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	418	1008	-	
HCM Lane V/C Ratio	-	-	0.146	0.108	-	
HCM Control Delay (s)	-	-	15.1	9	-	
HCM Lane LOS	-	-	C	A	-	
HCM 95th %tile Q(veh)	-	-	0.5	0.4	-	

HCM 6th TWSC
6: Marvin Rd SE & 25th Ave SE

McAllister Springs
Future (2026) With Project PM Peak Hour

Intersection						
Int Delay, s/veh	1.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	65	15	25	451	725	85
Future Vol, veh/h	65	15	25	451	725	85
Conflicting Peds, #/hr	3	3	3	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	1	1
Mvmt Flow	68	16	26	470	755	89
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1328	806	847	0	-	0
Stage 1	803	-	-	-	-	-
Stage 2	525	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	171	382	790	-	-	-
Stage 1	441	-	-	-	-	-
Stage 2	593	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	164	380	788	-	-	-
Mov Cap-2 Maneuver	298	-	-	-	-	-
Stage 1	425	-	-	-	-	-
Stage 2	591	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	20.8	0.5		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	788	-	311	-	-	
HCM Lane V/C Ratio	0.033	-	0.268	-	-	
HCM Control Delay (s)	9.7	-	20.8	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0.1	-	1.1	-	-	

MOVEMENT SUMMARY

 Site: 7 [Marvin Rd SE & Mullen Rd SE (Site Folder: Future WP)]

McAllister Springs
Site Category: Future (2026) With-Project PM Peak Hour
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
East: Mullen Rd SE														
6	T1	250	1.0	272	1.0	0.368	5.1	LOS A	2.2	55.8	0.47	0.54	0.47	36.5
16	R2	114	1.0	124	1.0	0.368	5.3	LOS A	2.2	55.8	0.47	0.54	0.47	35.4
Approach		364	1.0	396	1.0	0.368	5.2	LOS A	2.2	55.8	0.47	0.54	0.47	36.2
North: Marvin Rd SE														
7	L2	120	1.0	130	1.0	0.402	11.4	LOS B	2.5	64.1	0.54	0.66	0.54	35.9
14	R2	284	1.0	290	1.0	0.402	5.5	LOS A	2.5	64.1	0.54	0.66	0.54	34.7
Approach		404	1.0	420	1.0	0.402	7.4	LOS A	2.5	64.1	0.54	0.66	0.54	35.0
West: Mullen Rd SE														
5	L2	223	0.0	228	0.0	0.388	10.5	LOS B	2.5	63.6	0.39	0.57	0.39	35.7
2	T1	215	0.0	234	0.0	0.388	4.3	LOS A	2.5	63.6	0.39	0.57	0.39	35.7
Approach		438	0.0	461	0.0	0.388	7.3	LOS A	2.5	63.6	0.39	0.57	0.39	35.7
All Vehicles		1206	0.6	1277	0.6	0.402	6.7	LOS A	2.5	64.1	0.46	0.59	0.46	35.6

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

Intersection and Approach LOS values are based on average delay for all movements (v/c not used).

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 9.0 | Copyright © 2000-2020 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: THE TRANSPO GROUP | Licence: NETWORK / 1PC | Processed: Wednesday, September 21, 2022 4:18:17 PM

Project: M:\22\1.22178.00 - McAllister Springs\Traffic Analysis\Traffic Operations\Sidra\PM peak hour 22178.sip9

HCM 6th TWSC
8: Marvin Rd SE & Teri Ct SE

McAllister Springs
Future (2026) With Project PM Peak Hour

Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	0	5	15	0	36	0	500	16	65	790	5
Future Vol, veh/h	5	0	5	15	0	36	0	500	16	65	790	5
Conflicting Peds, #/hr	3	0	3	0	0	0	3	0	0	0	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	3	3	3	1	1	1
Mvmt Flow	5	0	5	16	0	38	0	521	17	68	823	5
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1517	1503	832	1497	1497	533	831	0	0	538	0	0
Stage 1	965	965	-	530	530	-	-	-	-	-	-	-
Stage 2	552	538	-	967	967	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.13	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.227	-	-	2.209	-	-
Pot Cap-1 Maneuver	99	123	372	102	124	551	797	-	-	1035	-	-
Stage 1	309	336	-	536	530	-	-	-	-	-	-	-
Stage 2	522	526	-	308	335	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	87	115	370	95	115	549	795	-	-	1035	-	-
Mov Cap-2 Maneuver	87	115	-	95	115	-	-	-	-	-	-	-
Stage 1	308	313	-	536	530	-	-	-	-	-	-	-
Stage 2	485	526	-	283	312	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	32.6		25.5		0		0.7					
HCM LOS	D		D									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	795	-	-	141	228	1035	-	-				
HCM Lane V/C Ratio	-	-	-	0.074	0.233	0.065	-	-				
HCM Control Delay (s)	0	-	-	32.6	25.5	8.7	-	-				
HCM Lane LOS	A	-	-	D	D	A	-	-				
HCM 95th %tile Q(veh)	0	-	-	0.2	0.9	0.2	-	-				

Appendix D: Trip Generation Calculations

1.22178.00 - McAllister Springs

<u>Proposed Use</u>												
Land Use	Setting	Size	Units	Model	Equation	Rate	Units	Inbound %		Total Net New		
										Inbound	Outbound	Total
Single-Family Attached Housing (LU 215)		51 du										
Daily				Rate	-	7.20	per du	50%		184	184	368
AM Peak Hour				Rate	-	0.48	per du	31%		7	17	24
PM Peak Hour				Rate	-	0.57	per du	57%		17	12	29
Single Family Home (LU 210)		131 du										
Daily				Rate	-	9.43	per du	50%		618	618	1,236
AM Peak Hour				Rate	-	0.70	per du	26%		24	68	92
PM Peak Hour				Rate	-	0.94	per du	63%		77	46	123
<u>Subtotal</u>												
Daily										802	802	1,604
AM Peak Hour										31	85	116
PM Peak Hour										94	58	152

<u>Net New Trips</u>												
Daily										802	802	1604
AM Peak Hour										31	85	116
PM Peak Hour										94	58	152

Notes:

1. Trip rates based on Institute of Transportation Engineers' (ITE) *Trip Generation* 11th Edition equation and average trip rate as shown above.

Appendix E: Model Plot

