

Traffic Impact Analysis

TROMBLEY PROPERTY

Prepared for:
Trombley Hill Joint Venture

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Introduction

This traffic impact analysis (TIA) identifies potential transportation-related impacts associated with the construction of a residential development located in Monroe, WA. 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 project is located north of 134th Street SE and west of 191st Avenue SE in Monroe, WA. Figure 1 illustrates the site vicinity and surrounding streets. The proposed development would create 49 lots. There is currently one single family home and a cell tower within the development area. While the existing single family structure will be removed, the cell phone tower will remain. The cell tower will occupy one of the single lots which would not allow for a home to be constructed on that lot. Thus, the resulting development will provide 38 new single-family detached homes and 9 new single-family attached homes for a total of 47 net new homes. Two full accesses to the site via neighborhood collector roads would be provided along 134th Street SE. The preliminary site plan is included in Figure 2. The project is anticipated to be constructed and occupied by 2028.

Study Scope

As coordinated with Monroe staff and based on the anticipated vehicular impacts of the proposed project, the following intersections were selected for analysis:

1. 191st Avenue SE/134th Street SE
2. Chain Lake Road/Rainier View Road SE
3. Chain Lake Road/N Kelsey Street
4. Chain Lake Road/US 2

In addition, the two site access intersections along 134th Street SE were evaluated under future (2028) 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 (2028) 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.



Project Site Vicinity and Study Intersections

FIGURE

Trombley Project - Monroe



1



Site Plan

Trombley Project - Monroe

FIGURE

2



Existing and Future Without-Project Conditions

This section describes both existing and future (2028) 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 Table 1. Roadway functional classifications are based on the City of Monroe Transportation Master Plan.

Table 1. Roadway Network Existing Conditions Summary

Roadway	Classification	Speed Limit	# Lanes	Parking	Pedestrian Facilities	Bicycle Facilities
134th Street SE	Not Classified/Local	25 mph	2	No	Sidewalks West of Project Frontage	None
191st Avenue SE/ Rainier View Road SE	Residential Collector	25 mph	2	Yes	Intermittent Sidewalks	None
Chain Lake Road	Residential Collector/ Arterial	35 mph	2	No	Multiuse Path	Multiuse Path
N Kelsey Street	Arterial	25 mph	2	No	Sidewalks	None
US 2	Principal Arterial	35 mph	4	No	Sidewalks	None

Planned Improvements

Based on a review of the 2023-2028 City of Monroe Transportation Improvement Plan (TIP), planned improvements were identified within the vicinity of the study area. The following planned improvements were identified:

- **Chain Lake Road Phase 2B** – Mid-block rapid rectangular flashing beacon (RRFB)
- **191st Extension** – Extend 191st Avenue SE to connect at Chain Lake Road/N Kelsey Street roundabout

Neither improvement has been included in the future (2028) analysis. The Chain Lake Road Phase 2B project is not an intersection improvement and the 191st Extension is not expected to be complete before the project's opening year of 2028.

Non-Motorized Facilities

Sidewalks are currently not provided along the project frontages on 134th Street SE and 191st Avenue SE. There are intermittent sidewalks along 191st Avenue SE between the project and the multiuse path on Chain Lake Road, but no bicycle facilities connect the two locations.

Transit Service

Transit service in the study area is provided by Community Transit. The nearest bus stops to the proposed development are located more than one mile away at the intersection of Chain Lake Road-N Lewis Street/US 2. Table 2 shows the transit routes that operate within the project vicinity.

Table 2. Existing Transit Service

Route	Area Served	Approximate Operating Hours	PM Peak Headways (minutes)
270	Gold Bar Everett Station	5:30 a.m. to 7:00 a.m., 4:45 p.m. to 5:15 p.m.	10
271	Gold Bar Everett Station	6:15 a.m. to 10:30 p.m.	10

Source: Community Transit, September 2025

Note: Operating Hours and headways are approximate

Traffic Volumes

The following sections summarize existing and future (2028) without-project traffic volumes within the study area.

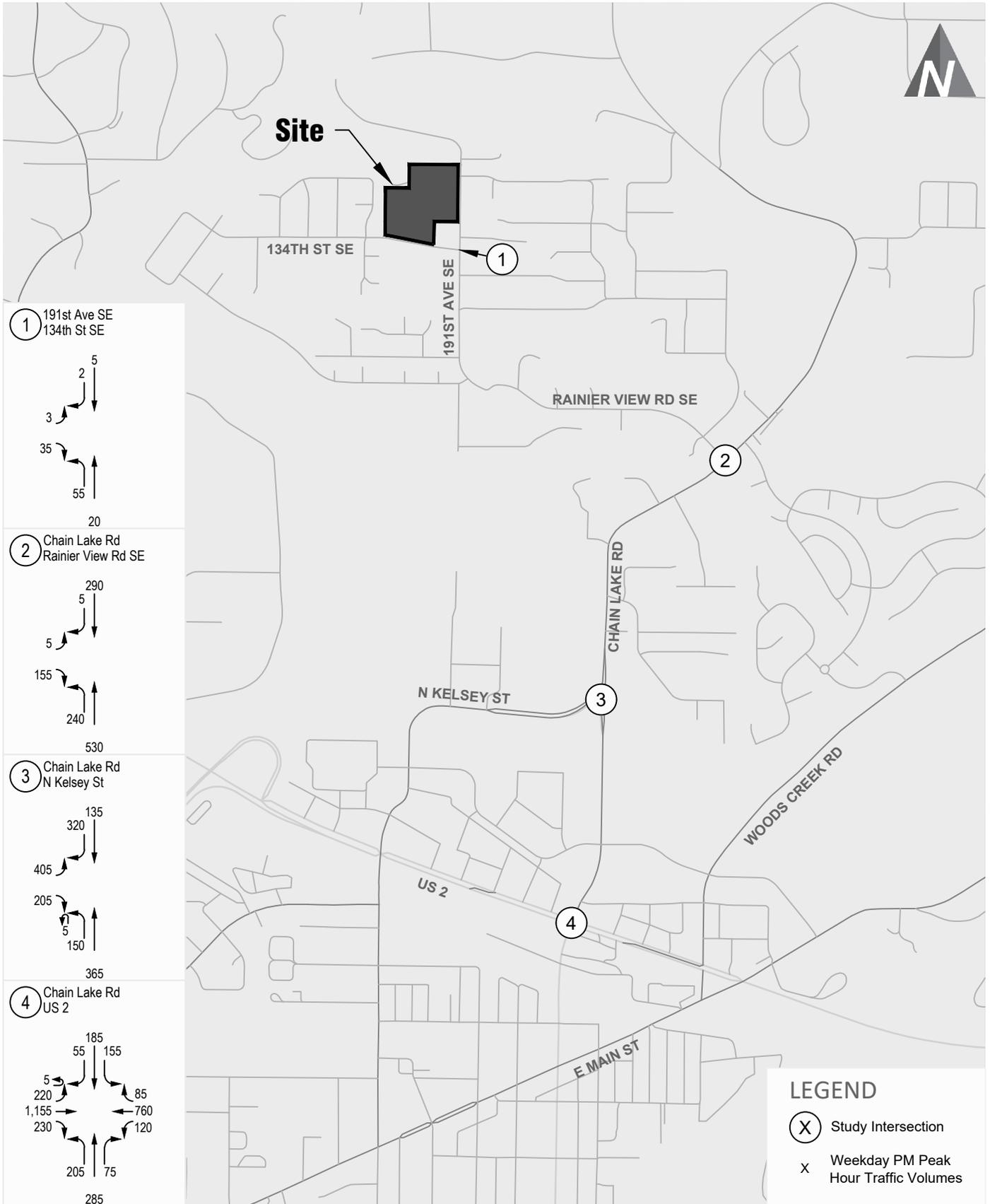
Existing

Existing weekday PM peak period (4-6 p.m.) traffic volumes were collected in September 2025. Figure 3 illustrates the existing weekday peak hour traffic volumes at the study intersections. Volumes are rounded to the nearest 5 vehicles to account for the daily fluctuations in traffic volumes. Detail traffic counts are provided in Appendix A.

Future Without-Project Traffic Volumes

Future (2028) without-project traffic volumes were forecasted by applying an annual growth rate to existing traffic volumes. An annual growth rate of 1.5 percent was applied to existing study intersection traffic volumes to forecast 2028 horizon year background traffic growth, as coordinated with City of Monroe staff. No pipeline projects were identified by City staff to be included in the without-project forecasts.

The future 2028 without-project weekday peak hour traffic volumes are shown in Figure 4.

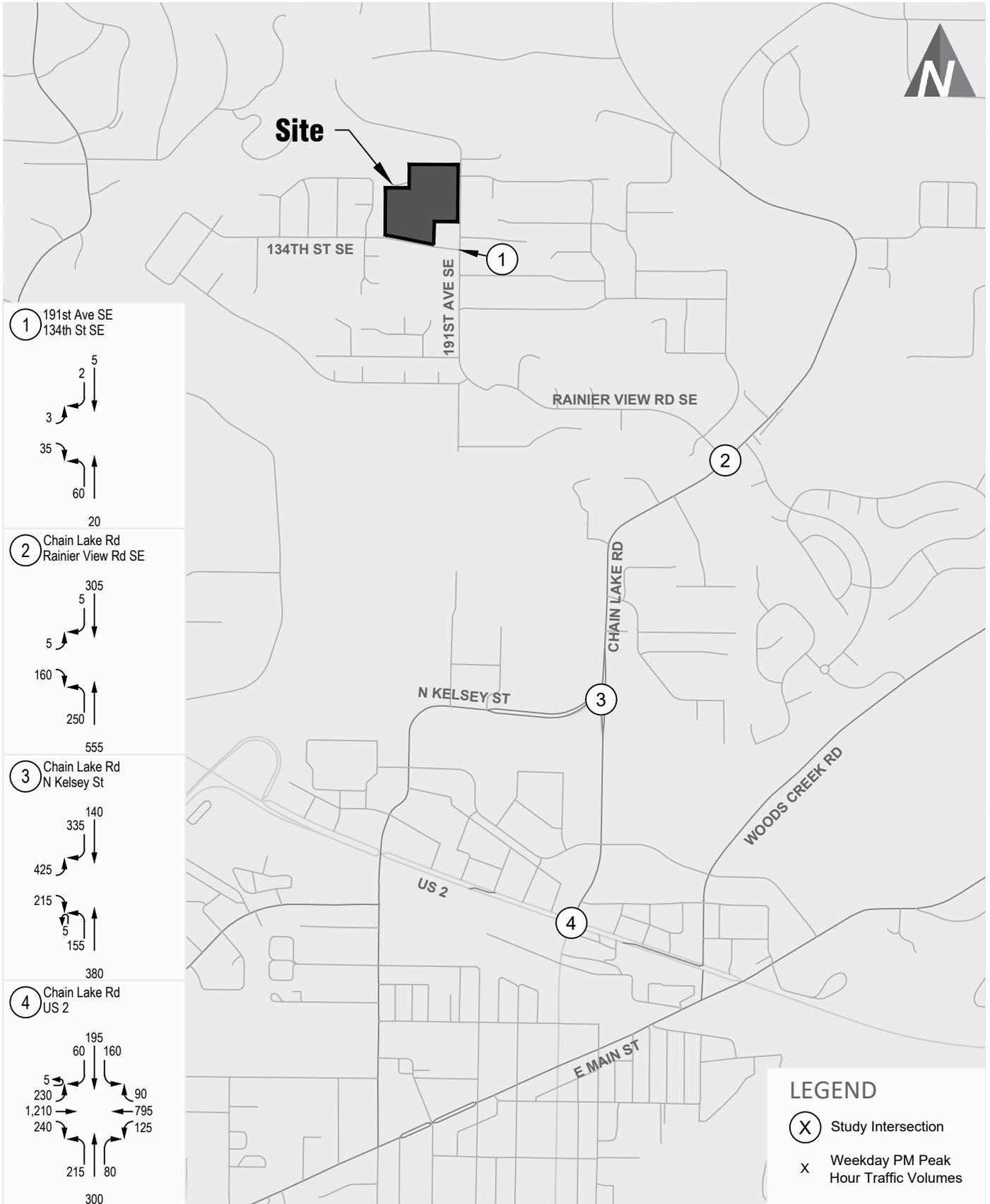


Existing Weekday PM Peak Hour Traffic Volumes

FIGURE

Trombley Project - Monroe





Future (2028) Without-Project PM Peak Hour Traffic Volumes **FIGURE 4**
 Trombley Project - Monroe

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. At unsignalized side-street, stop-controlled intersections, LOS is measured by the average delay on the worst-movement of the intersection. 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.

The City of Monroe has adopted an LOS C or better standard for collectors and a D or better standard for arterials.

Signal timing was based on existing phasing, Synchro defaults, and optimized cycle lengths and splits. Analysis parameters such as lane channelization and signal timing were maintained for future (2028) without-project conditions from existing conditions.

Weekday PM peak hour traffic operations for existing and future (2028) without-project conditions were evaluated based on the procedures identified in the *Highway Capacity Manual* (HCM 7) using *Synchro 12*. *Synchro 12* is a software program that uses HCM methodology to evaluate intersection LOS and average vehicle delay. The roundabout controlled intersection was evaluated using Sidra. Results for the existing and future without-project operations analyses are summarized in Table 3. Detailed LOS worksheets for each intersection analysis are included in Appendix C. It should be noted that the flows presented in the Sidra worksheets take peak hour factors into account, and the volumes presented in the figures throughout this TIA were used as a basis.

Table 3. Existing and Future Without-Project PM Peak Hour LOS Summary

Intersection	Traffic Control	LOS Standard	Existing			(2028) Without-Project		
			LOS ¹	Delay ²	WM ³ or V/C ⁴	LOS	Delay	WM or V/C
1. 191st Ave SE/134th St SE	TWSC	C	A	9	EB	A	9	EB
2. Chain Lake Rd/Rainier View Rd SE	TWSC	C	B	14	EB	C	15	EB
3. Chain Lake Rd/N Kelsey St	Roundabout	D	A	8	0.60	A	9	0.64
4. Chain Lake Rd-N Lewis St/US 2	Traffic Signal	D	D	46	-	D	49	-

Note: TWSC = Two-way Stop Controlled.

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 7th Edition).

2. Average delay per vehicle in seconds

3. Worst movement reported for unsignalized intersections. EB = eastbound

4. Volume-to-capacity ratio shown for roundabout intersections.

As shown in Table 3, all study area intersections operate at their respective LOS standard or better under both existing and 2028 without-project conditions.

Traffic Safety

The five most recent years of collision records (January 1, 2020 and December 31, 2024) 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.

A summary of the total and average annual number of reported collisions as well as the collisions rates at the study intersections and roadway segments adjacent to the project site are provided in Table 4.

The collision rate is representative of the number of collisions per one million entering vehicles (MEV) at each intersection. Intersections with a rate greater than 1.0 collision per MEV are typically flagged for further investigation to determine whether an adverse condition exists. As shown in the table, all study intersections are at or below 0.8 collisions per MEV.

Table 4. Five-Year Collision Summary (2020-2024)

Location	Number of Collisions					Total	Annual Average	AADT ¹	Collisions per MEV ² or MVM ³
	2020	2021	2022	2023	2024				
1. 191st Ave SE/134th St SE	0	0	0	0	0	0	0.00	1,200	0.00
2. Chain Lake Rd/Rainier View Rd SE	1	0	0	0	2	3	0.60	12,250	0.13
3. Chain Lake Rd/N Kelsey St	0	3	2	0	1	6	1.20	15,850	0.21
4. Chain Lake Rd/US 2	9	12	12	8	9	50	10.00	35,250	0.78

Source: WSDOT September 2025

1. AADT = Annual Average Daily Traffic of intersection of segment estimated based on PM peak hour traffic volumes

2. MEV = Million Entering Vehicles

3. MVM = Million Vehicles Miles

None of the 59 collisions in the study area resulted in fatalities, while 47 resulted in property damage only and 12 resulted in injury. The most common type of collision was rear end collisions, with 23 occurring at the Chain Lake Rd/US 2 intersection. Angle and sideswipe collisions each had 11 occurrences within the study area.

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 and existing uses to be removed were calculated based on trip rates using the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (12th Edition, 2025). ITEs Single-Family Detached Housing (LU #210) and Single-Family Attached Housing (LU #215) land uses were assumed for the proposed project. Similarly, Single-Family Detached Housing (LU #210) was assumed for the existing single family residence.

Table 5 shows the weekday net new off-site vehicle trips generated by the proposed project. The detailed trip generation calculations are included in Appendix D.

Table 5. Estimated Net New Weekday Vehicle Trip Generation

Land Use ¹	Size	Daily Trips	PM Peak Hour		
			In	Out	Total
Proposed					
Single-Family Detached Housing (LU #210)	39 du	580	25	15	40
Single-Family Attached Housing (LU #215)	9 du	62	3	2	5
Subtotal	48 du	642	28	17	45
Existing					
Single-Family Detached Housing (LU #210)	1 du	-10	-1	-0	-1
Net Total	47 du	632	27	17	44

Note: du = dwelling units, sf = square feet

1. Average trip rates and equations from ITE *Trip Generation Manual*, 12th Edition (2025).

As shown in Table 5, the proposed project is estimated to generate 642 weekday daily trips with 44 occurring in the PM peak hour. Because there is an existing single family residence on the project site, the project will generate 632 net new weekday daily trips with 44 net new trips occurring in the PM peak hour.

Trip Distribution & Assignment

Trip distribution patterns for the proposed uses to and from the site were based on existing traffic patterns within the study area, as coordinated with City of Monroe staff. The trip distribution for the proposed project is shown in Figure 5.

The net new peak hour project trips were assigned within the study area based on distribution for the proposed project and are also shown in Figure 5. Site generated weekday peak hour traffic volumes were added to future without-project volumes at study intersections. The resulting future (2028) with-project peak hour traffic volumes are illustrated in Figure 6.

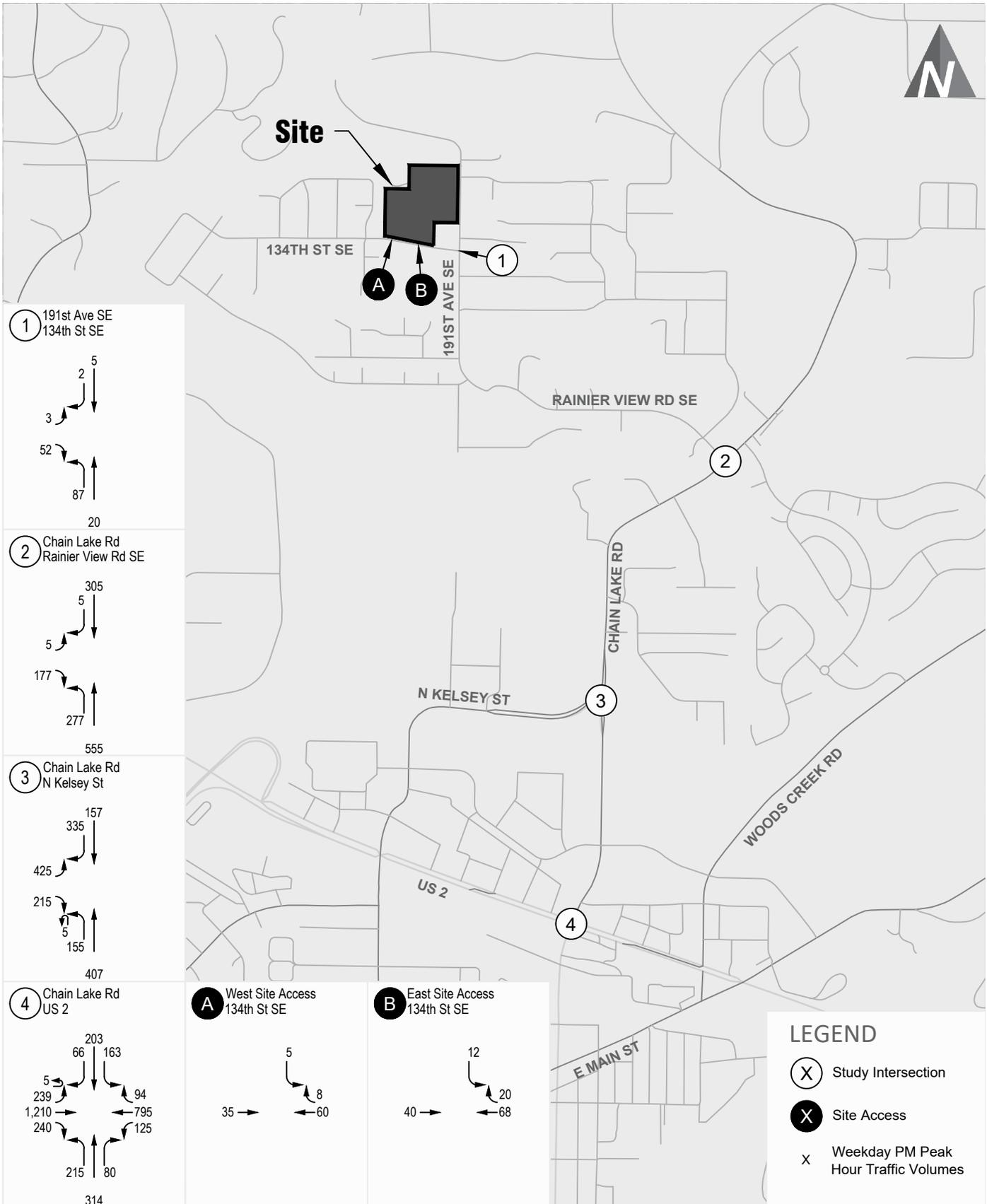


Project Trip Distribution and Assignment

Trombley Project - Monroe

FIGURE

5



Future (2028) With-Project PM Peak Hour Traffic Volumes **FIGURE**

Trombley Project - Monroe

Traffic Operations Impact

A future (2028) 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 (2028) without-project and with-project weekday peak hour traffic operations is summarized in Table 6. Detailed LOS worksheets are provided in Appendix C.

Table 6. Future (2028) Without- and With-Project Weekday Peak Hour LOS Summary

Intersection	Traffic Control	LOS Standard	(2028) Without-Project			(2028) With-Project		
			LOS ¹	Delay ²	WM ³ or V/C ⁴	LOS	Delay	WM or V/C
1. 191st Ave SE/134th St SE	TWSC	C	A	9	EB	A	9	EB
2. Chain Lake Rd/Rainier View Rd SE	TWSC	C	C	15	EB	C	16	EB
3. Chain Lake Rd/N Kelsey St	Roundabout	D	A	9	0.64	A	9	0.67
4. Chain Lake Rd-N Lewis St/US 2	Traffic Signal	D	D	49	-	D	50	-

Note: TWSC = Two-way Stop Controlled.

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 7th Edition).
2. Average delay per vehicle in seconds
3. Worst movement reported for unsignalized intersections. EB = eastbound
4. Volume-to-capacity ratio shown for roundabout intersections.

As shown in Table 6, with the addition of project traffic, all study area intersections are anticipated to operate at the same LOS with or without the proposed project. Furthermore, all intersections are projected to operate within the applicable LOS standard under both 2028 without-project and with-project conditions. As such, no improvements are required for the study area intersections.

Site Access Evaluation

Operations

Weekday PM peak hour traffic operations were evaluated at both site access intersections along 134th Street SE under future (2028) with-project conditions based on the same methodology as noted above for the off-site study intersections. The analysis showed that under 2028 with-project conditions, both site access intersections are forecast to operate at LOS A during the weekday PM peak hour (see Table 7). Detailed LOS worksheets are provided in Appendix C.

Table 7. Future (2028) With-Project Weekday Site Access Peak Hour LOS Summary

Intersection	Traffic Control	LOS Standard	(2028) With-Project		
			LOS	Delay	WM ³ or V/C ⁴
5. West Site Access/134th St SE	TWSC	C	A	9	SB
6. East Site Access/134th St SE	TWSC	C	A	9	SB

Note: TWSC = Two-way Stop Controlled.

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 7th Edition).
2. Average delay per vehicle in seconds
3. Worst movement reported for unsignalized intersections. SB = southbound
4. Volume-to-capacity ratio shown for roundabout intersections.

Sight Distance

Sight distance for the two site access intersections on 134th Street SE have been analyzed. The City of Monroe Public Works Design, Construction and Operations Standards state that intersection sight distance must be evaluated based upon the values noted on Standard Detail 331 for sight distance setback lines at controlled intersections. It should be noted that the site accesses are neighborhood collector roads and not driveways, and are therefore not subject to Standard Detail 333. Additionally, sight distance requirements must be based upon the posted speed of the crossing street. Along 134th Street SE at the project frontage, the posted speed limit is 25 mph, which requires a sight distance of 280 feet for right turns and 240 feet for left turns. Sight distance drawings are provided in Appendix E and show that intersection sight distance standards are met for both site access intersections.

Traffic Impact Fees

The project would pay traffic impact fees. As noted above, the proposed project would construct 48 homes within the 49 lots, with 39 detached and 9 attached single family homes. There is an existing single family home on site that would be removed and is not subject to traffic impact fees, resulting in the project constructing 47 net new homes. The City of Monroe updated their transportation impact fees in 2025 (per ordinance 004/2025), which lists an impact fee of \$7,426 per single family dwelling unit (1 or 2 dwelling units) and \$4,233 per multi family dwelling unit (3 or more dwelling units). The 9 attached single family homes will be in groups of 3, resulting in the multi family rate applying.

As shown in Table 8, the project's required traffic impact fee is expected to be \$320,285. The final fee will be calculated by City of Monroe at time of permit issuance.

Table 8. Traffic Impact Fee Summary

Land Use	No. of Units	Fee Rate ¹	Total Fee
Proposed			
Single Family	39	\$7,426 per unit	\$289,614
<u>Multi Family</u>	<u>9</u>	<u>\$4,233 per unit</u>	<u>\$38,097</u>
Subtotal	48		\$327,711
Existing			
Single Family	-1	\$7,426 per unit	-\$7,426
Net Total	47		\$320,285

1. Fee rates per City of Monroe ordinance 004/2025.

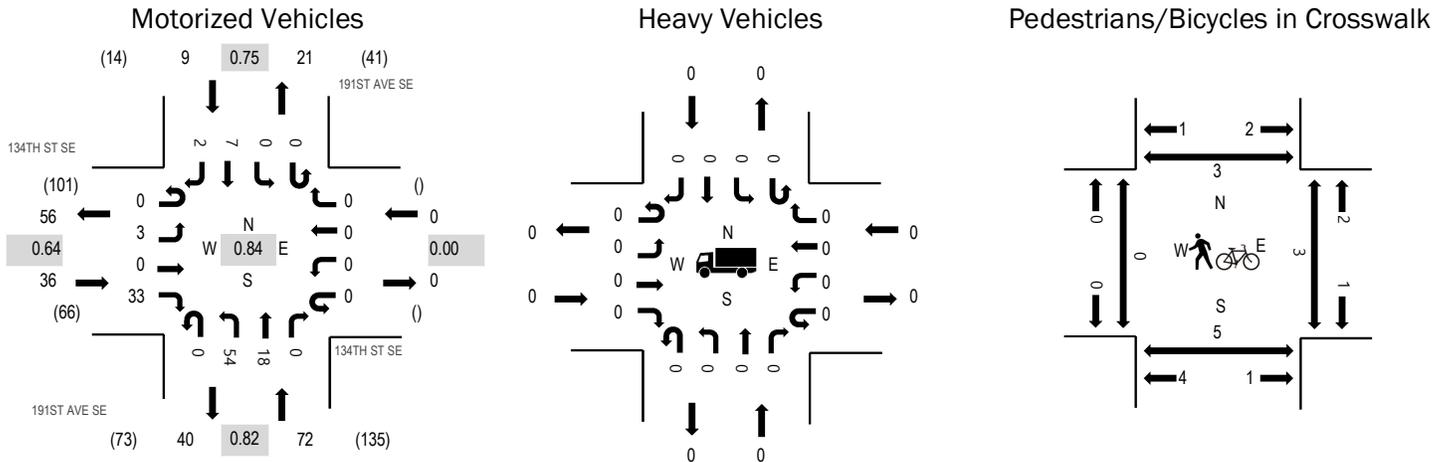
Findings and Recommendations

This traffic impact study summarizes the project traffic impacts of the proposed Trombley Property Development. General findings and recommendations include:

- The proposed development would create 49 lots. There is currently one single family home and a cell tower within the development area. While the existing single family structure will be removed, the cell phone tower will remain and is not subject to traffic impact fees. The cell tower will occupy one of the single lots which would not allow for a home to be constructed on that lot. Thus, the resulting development will provide 38 new single-family detached homes and 9 new single-family attached homes for a total of 47 net new homes.
- The development is estimated to generate 642 weekday daily trips with 44 occurring in the PM peak hour. Because there is an existing single family residence on the project site, the project will generate 632 net new weekday daily trips with 44 net new trips occurring in the PM peak hour.
- The study area intersections are anticipated to operate at their respective LOS standard or better under both 2028 without-project and with-project conditions. As such, no improvements are required for the study area intersections.
- Two full accesses to the site via neighborhood collector roads would be provided along 134th Street SE. The analysis showed that under 2028 with-project conditions, both site access intersections are forecast to operate at LOS A during the weekday PM peak hour. Sight distance requirements are also met for both site access intersections.
- The project's required traffic impact fee is expected to be \$320,285. The final fee will be calculated by City of Monroe at time of permit issuance.

Appendix A: Traffic Counts

Peak Hour



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.0%	0.64
WB	0.0%	0.00
NB	0.0%	0.82
SB	0.0%	0.75
All	0.0%	0.84

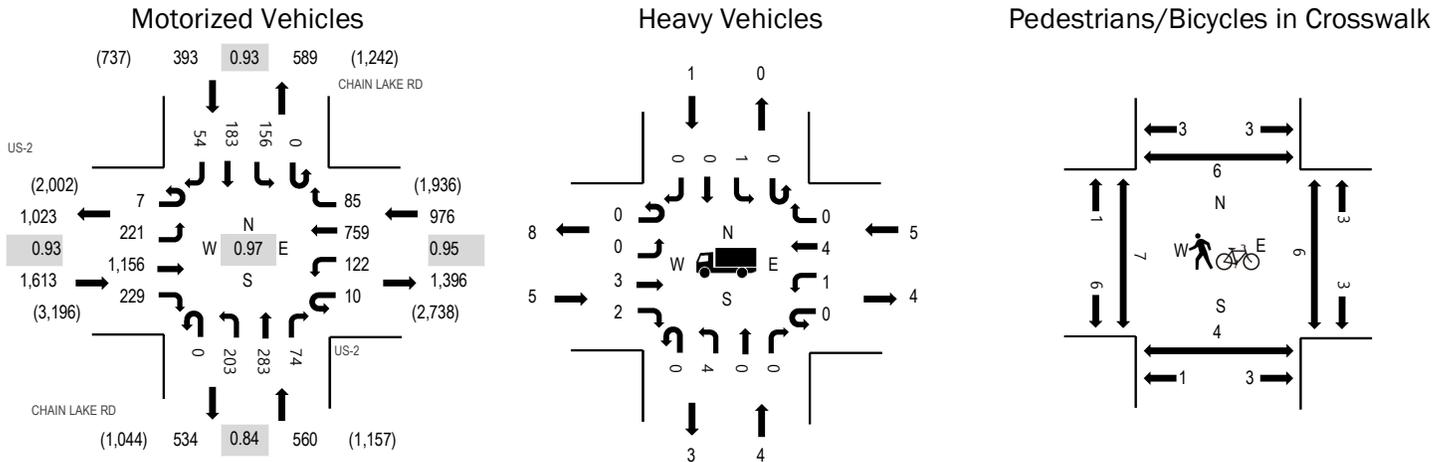
Traffic Counts - Motorized Vehicles

Interval Start Time	134TH ST SE Eastbound				134TH ST SE Westbound				191ST AVE SE Northbound				191ST AVE 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	11	0	0	0	0	0	10	2	0	0	0	1	0	24	98
4:15 PM	0	0	0	5	0	0	0	0	0	8	7	0	0	0	0	2	22	98
4:30 PM	0	0	0	10	0	0	0	0	0	9	6	0	0	0	2	0	27	111
4:45 PM	0	0	0	4	0	0	0	0	0	16	5	0	0	0	0	0	25	109
5:00 PM	0	1	0	5	0	0	0	0	0	13	4	0	0	0	1	0	24	117
5:15 PM	0	1	0	13	0	0	0	0	0	12	6	0	0	0	3	0	35	
5:30 PM	0	1	0	7	0	0	0	0	0	11	4	0	0	0	1	1	25	
5:45 PM	0	0	0	8	0	0	0	0	0	18	4	0	0	0	2	1	33	
Count Total	0	3	0	63	0	0	0	0	0	97	38	0	0	0	10	4	215	
Peak Hour	0	3	0	33	0	0	0	0	0	54	18	0	0	0	7	2	117	

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	0	0	0	4:00 PM	0	0	0	0	0	4:00 PM	0	0	1	1	2
4:15 PM	0	0	0	0	0	4:15 PM	0	1	0	1	2	4:15 PM	0	0	2	0	2
4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0	4:30 PM	0	0	0	0	0
4:45 PM	0	0	0	0	0	4:45 PM	4	1	0	0	5	4:45 PM	0	0	1	0	1
5:00 PM	0	0	0	0	0	5:00 PM	2	0	0	0	2	5:00 PM	0	4	0	1	5
5:15 PM	0	0	0	0	0	5:15 PM	0	0	0	0	0	5:15 PM	0	0	1	2	3
5:30 PM	0	0	0	0	0	5:30 PM	1	0	0	0	1	5:30 PM	0	1	1	0	2
5:45 PM	0	0	0	0	0	5:45 PM	2	0	0	0	2	5:45 PM	0	0	1	0	1
Count Total	0	0	0	0	0	Count Total	9	2	0	1	12	Count Total	0	5	7	4	16
Peak Hour	0	0	0	0	0	Peak Hour	5	0	0	0	5	Peak Hour	0	5	3	3	11

Peak Hour



Note: Total study counts contained in parentheses.

	HV%	PHF
EB	0.3%	0.93
WB	0.5%	0.95
NB	0.7%	0.84
SB	0.3%	0.93
All	0.4%	0.97

Traffic Counts - Motorized Vehicles

Interval Start Time	US-2 Eastbound				US-2 Westbound				CHAIN LAKE RD Northbound				CHAIN LAKE RD 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	1	55	271	50	3	33	165	34	0	56	97	23	0	46	51	14	899	3,532
4:15 PM	1	47	276	61	2	27	214	35	0	51	79	17	0	33	55	18	916	3,542
4:30 PM	3	59	315	59	1	29	186	13	0	48	60	17	0	28	49	12	879	3,490
4:45 PM	2	58	272	49	1	34	156	18	0	49	64	28	0	53	40	14	838	3,452
5:00 PM	1	57	293	60	6	32	203	19	0	55	80	12	0	42	39	10	909	3,494
5:15 PM	1	62	282	54	1	35	180	26	0	44	67	28	0	34	42	8	864	
5:30 PM	2	62	261	45	5	31	185	28	0	63	70	13	0	24	32	20	841	
5:45 PM	1	55	304	77	0	29	179	26	0	47	71	18	0	29	31	13	880	
Count Total	12	455	2,274	455	19	250	1,468	199	0	413	588	156	0	289	339	109	7,026	
Peak Hour	7	221	1,156	229	10	122	759	85	0	203	283	74	0	156	183	54	3,542	

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	3	4	0	9	4:00 PM	0	0	0	0	0	4:00 PM	2	3	5	1	11
4:15 PM	1	1	3	1	6	4:15 PM	0	0	0	0	0	4:15 PM	3	0	1	3	7
4:30 PM	2	2	1	0	5	4:30 PM	0	0	0	0	0	4:30 PM	1	1	1	2	5
4:45 PM	0	0	0	0	0	4:45 PM	0	0	0	0	0	4:45 PM	2	3	2	0	7
5:00 PM	2	1	1	0	4	5:00 PM	0	0	0	0	0	5:00 PM	1	0	2	1	4
5:15 PM	3	2	3	0	8	5:15 PM	0	0	0	0	0	5:15 PM	1	0	4	1	6
5:30 PM	0	1	0	0	1	5:30 PM	0	0	0	0	0	5:30 PM	0	1	1	1	3
5:45 PM	4	1	3	0	8	5:45 PM	0	0	0	0	0	5:45 PM	0	0	2	5	7
Count Total	14	11	15	1	41	Count Total	0	0	0	0	0	Count Total	10	8	18	14	50
Peak Hour	5	4	5	1	15	Peak Hour	0	0	0	0	0	Peak Hour	7	4	6	6	23

Appendix B: LOS Definitions

Highway Capacity Manual 7th 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 7th Edition* (Transportation Research Board, 2022).

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 7th Edition*, Transportation Research Board, 2022, 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 controlled. All-way stop controlled 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 7th Edition*, Transportation Research Board, 2022, 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

Intersection						
Int Delay, s/veh	6.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	3	35	55	20	5	2
Future Vol, veh/h	3	35	55	20	5	2
Conflicting Peds, #/hr	3	5	5	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	42	65	24	6	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	170	17	13	0	0
Stage 1	12	-	-	-	-
Stage 2	158	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	825	1068	1618	-	-
Stage 1	1016	-	-	-	-
Stage 2	876	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	783	1057	1611	-	-
Mov Cap-2 Maneuver	783	-	-	-	-
Stage 1	969	-	-	-	-
Stage 2	872	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	8.66	5.38	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1320	-	1029	-	-
HCM Lane V/C Ratio	0.041	-	0.044	-	-
HCM Control Delay (s/veh)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

HCM 7th TWSC
2: Chain Lake Rd & Rainier View Rd SE

Trombley Property
Existing (2025) Weekday PM Peak Hour

Intersection						
Int Delay, s/veh	3.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	5	155	240	530	290	5
Future Vol, veh/h	5	155	240	530	290	5
Conflicting Peds, #/hr	21	16	16	0	0	21
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	485	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	174	270	596	326	6

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1505	366	352	0	0
Stage 1	350	-	-	-	-
Stage 2	1156	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	135	684	1218	-	-
Stage 1	718	-	-	-	-
Stage 2	302	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	100	660	1193	-	-
Mov Cap-2 Maneuver	100	-	-	-	-
Stage 1	545	-	-	-	-
Stage 2	296	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	14.39	2.77	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1193	-	562	-	-
HCM Lane V/C Ratio	0.226	-	0.32	-	-
HCM Control Delay (s/veh)	8.9	-	14.4	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.9	-	1.4	-	-

HCM 7th Signalized Intersection Summary

4: N Lewis St/Chain Lake Rd & US 2

Trombley Property
Existing (2025) Weekday PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	225	1155	230	120	760	85	205	285	75	155	185	55
Future Volume (veh/h)	225	1155	230	120	760	85	205	285	75	155	185	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width 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
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1900	1900	1900
Adj Flow Rate, veh/h	232	1191	0	124	784	0	211	294	77	160	191	57
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	0	0	0
Cap, veh/h	244	1354		135	1128		226	859	221	228	580	488
Arrive On Green	0.14	0.38	0.00	0.08	0.31	0.00	0.06	0.31	0.31	0.06	0.31	0.31
Sat Flow, veh/h	1810	3610	1610	1795	3582	1598	3483	2815	724	3510	1900	1599
Grp Volume(v), veh/h	232	1191	0	124	784	0	211	185	186	160	191	57
Grp Sat Flow(s),veh/h/ln	1810	1805	1610	1795	1791	1598	1742	1791	1749	1755	1900	1599
Q Serve(g_s), s	12.7	30.8	0.0	6.9	19.2	0.0	6.0	8.0	8.3	4.5	7.8	2.6
Cycle Q Clear(g_c), s	12.7	30.8	0.0	6.9	19.2	0.0	6.0	8.0	8.3	4.5	7.8	2.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.41	1.00		1.00
Lane Grp Cap(c), veh/h	244	1354		135	1128		226	546	533	228	580	488
V/C Ratio(X)	0.95	0.88		0.92	0.69		0.93	0.34	0.35	0.70	0.33	0.12
Avail Cap(c_a), veh/h	244	1354		135	1128		226	546	533	228	580	488
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	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.9	29.1	0.0	46.0	30.0	0.0	46.5	26.9	27.0	45.8	26.9	25.0
Incr Delay (d2), s/veh	45.9	8.4	0.0	58.7	3.5	0.0	44.4	1.7	1.8	16.5	1.5	0.5
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	8.7	14.2	0.0	5.2	8.5	0.0	4.0	3.7	3.7	2.5	3.8	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	88.8	37.6	0.0	104.7	33.6	0.0	91.0	28.6	28.8	62.3	28.4	25.5
LnGrp LOS	F	D		F	C		F	C	C	E	C	C
Approach Vol, veh/h		1423			908			582			408	
Approach Delay, s/veh		45.9			43.3			51.3			41.3	
Approach LOS		D			D			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.0	35.0	12.0	42.0	11.0	35.0	18.0	36.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	6.5	30.5	7.5	37.5	6.5	30.5	13.5	31.5				
Max Q Clear Time (g_c+I1), s	6.5	10.3	8.9	32.8	8.0	9.8	14.7	21.2				
Green Ext Time (p_c), s	0.0	2.2	0.0	3.1	0.0	1.2	0.0	3.8				
Intersection Summary												
HCM 7th Control Delay, s/veh			45.6									
HCM 7th LOS			D									
Notes												
User approved pedestrian interval to be less than phase max green.												
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.												

Intersection						
Int Delay, s/veh	6.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	3	35	60	20	5	2
Future Vol, veh/h	3	35	60	20	5	2
Conflicting Peds, #/hr	3	5	5	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	42	71	24	6	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	182	17	13	0	0
Stage 1	12	-	-	-	-
Stage 2	170	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	812	1068	1618	-	-
Stage 1	1016	-	-	-	-
Stage 2	865	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	768	1057	1611	-	-
Mov Cap-2 Maneuver	768	-	-	-	-
Stage 1	966	-	-	-	-
Stage 2	861	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	8.67	5.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1350	-	1027	-	-
HCM Lane V/C Ratio	0.044	-	0.044	-	-
HCM Control Delay (s/veh)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

HCM 7th TWSC
2: Chain Lake Rd & Rainier View Rd SE

Trombley Property
Baseline (2028) Weekday PM Peak Hour

Intersection						
Int Delay, s/veh	3.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	5	160	250	555	305	5
Future Vol, veh/h	5	160	250	555	305	5
Conflicting Peds, #/hr	21	16	16	0	0	21
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	485	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	180	281	624	343	6

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1573	383	369	0	0
Stage 1	367	-	-	-	-
Stage 2	1206	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	123	669	1200	-	-
Stage 1	706	-	-	-	-
Stage 2	286	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	90	646	1176	-	-
Mov Cap-2 Maneuver	90	-	-	-	-
Stage 1	526	-	-	-	-
Stage 2	280	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v15.01		2.8	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1176	-	544	-	-
HCM Lane V/C Ratio	0.239	-	0.341	-	-
HCM Control Delay (s/veh)	9	-	15	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0.9	-	1.5	-	-

HCM 7th Signalized Intersection Summary
4: N Lewis St/Chain Lake Rd & US 2

Trombley Property
Baseline (2028) Weekday PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	1210	240	125	795	90	215	300	80	160	195	60
Future Volume (veh/h)	235	1210	240	125	795	90	215	300	80	160	195	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width 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
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1900	1900	1900
Adj Flow Rate, veh/h	242	1247	0	129	820	0	222	309	82	165	201	62
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	0	0	0
Cap, veh/h	244	1354		135	1128		226	856	223	228	580	488
Arrive On Green	0.14	0.38	0.00	0.08	0.31	0.00	0.06	0.31	0.31	0.06	0.31	0.31
Sat Flow, veh/h	1810	3610	1610	1795	3582	1598	3483	2806	732	3510	1900	1599
Grp Volume(v), veh/h	242	1247	0	129	820	0	222	195	196	165	201	62
Grp Sat Flow(s),veh/h/ln	1810	1805	1610	1795	1791	1598	1742	1791	1747	1755	1900	1599
Q Serve(g_s), s	13.4	33.0	0.0	7.2	20.3	0.0	6.4	8.5	8.8	4.6	8.2	2.8
Cycle Q Clear(g_c), s	13.4	33.0	0.0	7.2	20.3	0.0	6.4	8.5	8.8	4.6	8.2	2.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.42	1.00		1.00
Lane Grp Cap(c), veh/h	244	1354		135	1128		226	546	533	228	580	488
V/C Ratio(X)	0.99	0.92		0.96	0.73		0.98	0.36	0.37	0.72	0.35	0.13
Avail Cap(c_a), veh/h	244	1354		135	1128		226	546	533	228	580	488
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	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.2	29.8	0.0	46.1	30.4	0.0	46.7	27.1	27.2	45.9	27.0	25.1
Incr Delay (d2), s/veh	55.2	11.7	0.0	67.0	4.1	0.0	55.0	1.8	1.9	18.0	1.6	0.5
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	9.6	15.8	0.0	5.6	9.1	0.0	4.5	3.9	4.0	2.6	4.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	98.4	41.5	0.0	113.1	34.5	0.0	101.7	28.9	29.1	63.9	28.6	25.7
LnGrp LOS	F	D		F	C		F	C	C	E	C	C
Approach Vol, veh/h		1489			949			613			428	
Approach Delay, s/veh		50.8			45.2			55.4			41.8	
Approach LOS		D			D			E			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.0	35.0	12.0	42.0	11.0	35.0	18.0	36.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	6.5	30.5	7.5	37.5	6.5	30.5	13.5	31.5				
Max Q Clear Time (g_c+I1), s	6.6	10.8	9.2	35.0	8.4	10.2	15.4	22.3				
Green Ext Time (p_c), s	0.0	2.3	0.0	1.8	0.0	1.3	0.0	3.7				
Intersection Summary												
HCM 7th Control Delay, s/veh			49.0									
HCM 7th LOS			D									
Notes												
User approved pedestrian interval to be less than phase max green.												
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.												

Intersection						
Int Delay, s/veh	6.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	3	52	87	20	5	2
Future Vol, veh/h	3	52	87	20	5	2
Conflicting Peds, #/hr	3	5	5	0	0	3
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	62	104	24	6	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	246	17	13	0	0
Stage 1	12	-	-	-	-
Stage 2	234	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	747	1068	1618	-	-
Stage 1	1016	-	-	-	-
Stage 2	810	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	691	1057	1611	-	-
Mov Cap-2 Maneuver	691	-	-	-	-
Stage 1	945	-	-	-	-
Stage 2	806	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	8.74	6.01	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1464	-	1028	-	-
HCM Lane V/C Ratio	0.064	-	0.064	-	-
HCM Control Delay (s/veh)	7.4	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.2	-	0.2	-	-

HCM 7th TWSC
2: Chain Lake Rd & Rainier View Rd SE

Trombley Property
Future With Project (2028) Weekday PM Peak Hour

Intersection						
Int Delay, s/veh	4.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	5	177	277	555	305	5
Future Vol, veh/h	5	177	277	555	305	5
Conflicting Peds, #/hr	21	16	16	0	0	21
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	485	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	199	311	624	343	6

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1634	383	369	0	0
Stage 1	367	-	-	-	-
Stage 2	1267	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-
Pot Cap-1 Maneuver	112	669	1200	-	-
Stage 1	706	-	-	-	-
Stage 2	267	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	79	646	1176	-	-
Mov Cap-2 Maneuver	79	-	-	-	-
Stage 1	509	-	-	-	-
Stage 2	262	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	15.67	3.05	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1176	-	540	-	-
HCM Lane V/C Ratio	0.265	-	0.379	-	-
HCM Control Delay (s/veh)	9.2	-	15.7	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	1.1	-	1.8	-	-

HCM 7th Signalized Intersection Summary

4: N Lewis St/Chain Lake Rd & US 2

Trombley Property
Future With Project (2028) Weekday PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	244	1210	240	125	795	94	215	314	80	163	203	66
Future Volume (veh/h)	244	1210	240	125	795	94	215	314	80	163	203	66
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width 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
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1900	1900	1900
Adj Flow Rate, veh/h	252	1247	0	129	820	0	222	324	82	168	209	68
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	0	1	1	1	1	1	1	0	0	0
Cap, veh/h	244	1354		135	1128		226	865	216	228	580	488
Arrive On Green	0.14	0.38	0.00	0.08	0.31	0.00	0.06	0.31	0.31	0.06	0.31	0.31
Sat Flow, veh/h	1810	3610	1610	1795	3582	1598	3483	2836	707	3510	1900	1599
Grp Volume(v), veh/h	252	1247	0	129	820	0	222	203	203	168	209	68
Grp Sat Flow(s),veh/h/ln	1810	1805	1610	1795	1791	1598	1742	1791	1752	1755	1900	1599
Q Serve(g_s), s	13.5	33.0	0.0	7.2	20.3	0.0	6.4	8.9	9.1	4.7	8.6	3.1
Cycle Q Clear(g_c), s	13.5	33.0	0.0	7.2	20.3	0.0	6.4	8.9	9.1	4.7	8.6	3.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.40	1.00		1.00
Lane Grp Cap(c), veh/h	244	1354		135	1128		226	546	534	228	580	488
V/C Ratio(X)	1.03	0.92		0.96	0.73		0.98	0.37	0.38	0.74	0.36	0.14
Avail Cap(c_a), veh/h	244	1354		135	1128		226	546	534	228	580	488
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	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.3	29.8	0.0	46.1	30.4	0.0	46.7	27.2	27.3	45.9	27.1	25.2
Incr Delay (d2), s/veh	66.0	11.7	0.0	67.0	4.1	0.0	55.0	1.9	2.1	19.0	1.7	0.6
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	10.4	15.8	0.0	5.6	9.1	0.0	4.5	4.1	4.1	2.7	4.2	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	109.3	41.5	0.0	113.1	34.5	0.0	101.7	29.2	29.4	64.9	28.9	25.8
LnGrp LOS	F	D		F	C		F	C	C	E	C	C
Approach Vol, veh/h		1499			949			628			445	
Approach Delay, s/veh		52.9			45.2			54.9			42.0	
Approach LOS		D			D			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.0	35.0	12.0	42.0	11.0	35.0	18.0	36.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	6.5	30.5	7.5	37.5	6.5	30.5	13.5	31.5				
Max Q Clear Time (g_c+I1), s	6.7	11.1	9.2	35.0	8.4	10.6	15.5	22.3				
Green Ext Time (p_c), s	0.0	2.4	0.0	1.8	0.0	1.4	0.0	3.7				
Intersection Summary												
HCM 7th Control Delay, s/veh			49.8									
HCM 7th LOS			D									
Notes												
User approved pedestrian interval to be less than phase max green.												
Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.												

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	0	35	60	8	5	0
Future Vol, veh/h	0	35	60	8	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	38	65	9	5	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	74	0	-	0	108 70
Stage 1	-	-	-	-	70 -
Stage 2	-	-	-	-	38 -
Critical Hdwy	4.1	-	-	-	6.4 6.2
Critical Hdwy Stg 1	-	-	-	-	5.4 -
Critical Hdwy Stg 2	-	-	-	-	5.4 -
Follow-up Hdwy	2.2	-	-	-	3.5 3.3
Pot Cap-1 Maneuver	1538	-	-	-	895 999
Stage 1	-	-	-	-	958 -
Stage 2	-	-	-	-	990 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1538	-	-	-	895 999
Mov Cap-2 Maneuver	-	-	-	-	895 -
Stage 1	-	-	-	-	958 -
Stage 2	-	-	-	-	990 -

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	9.05
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1538	-	-	-	895
HCM Lane V/C Ratio	-	-	-	-	0.006
HCM Control Delay (s/veh)	0	-	-	-	9
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

HCM 7th TWSC
6: 134th St SE & East Site Access

Trombley Property
Future With Project (2028) Weekday PM Peak Hour

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Vol, veh/h	0	40	68	20	12	0
Future Vol, veh/h	0	40	68	20	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	43	74	22	13	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	96	0	0	128	85
Stage 1	-	-	-	85	-
Stage 2	-	-	-	43	-
Critical Hdwy	4.1	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	3.5	3.3
Pot Cap-1 Maneuver	1511	-	-	871	980
Stage 1	-	-	-	944	-
Stage 2	-	-	-	984	-
Platoon blocked, %		-	-		
Mov Cap-1 Maneuver	1511	-	-	871	980
Mov Cap-2 Maneuver	-	-	-	871	-
Stage 1	-	-	-	944	-
Stage 2	-	-	-	984	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	9.2
HCM LOS			A

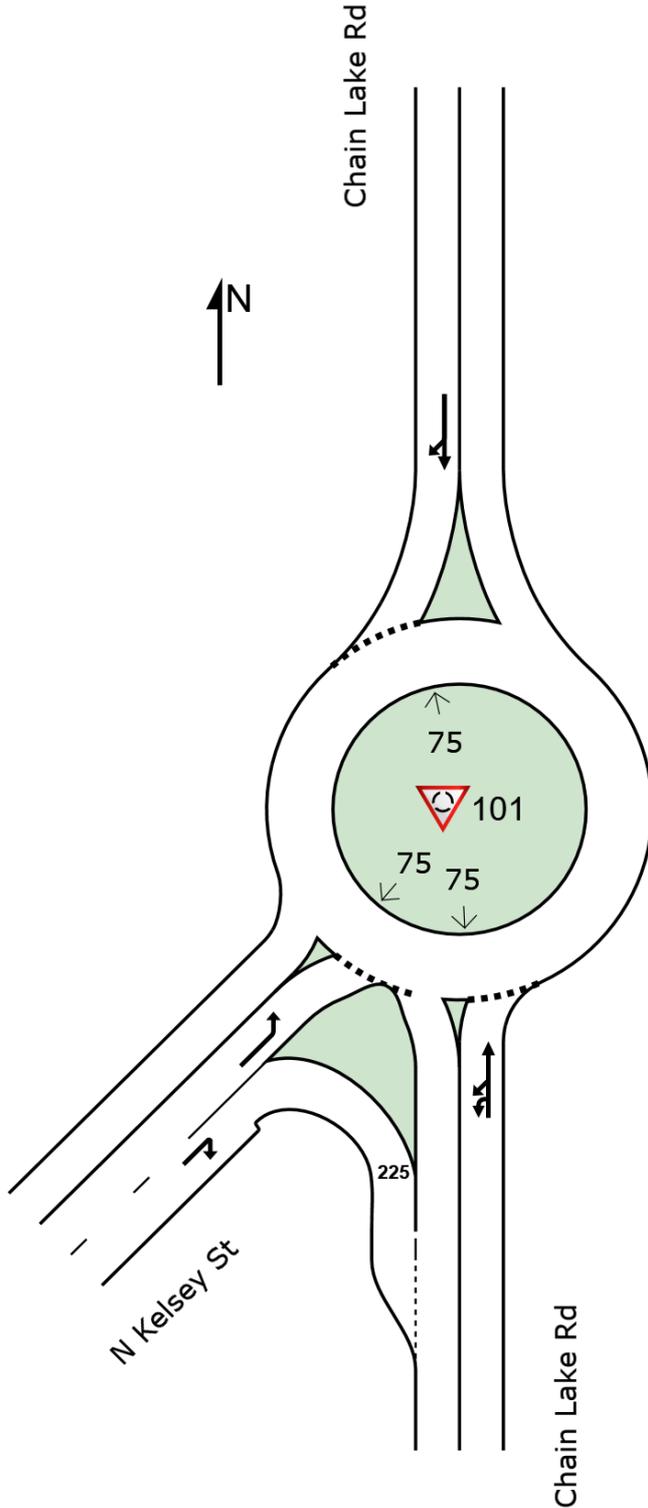
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1511	-	-	-	871
HCM Lane V/C Ratio	-	-	-	-	0.015
HCM Control Delay (s/veh)	0	-	-	-	9.2
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

SITE LAYOUT

 Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Existing)]

Trombley Property
Site Category: Existing Design
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

 Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Existing)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Trombley Property
Site Category: Existing Design
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV] veh/h	%	[Total HV] veh/h	%				[Veh.] veh	[Dist] ft				
South: Chain Lake Rd															
3u	U	All MCs	5	0.0	5	0.0	0.604	12.8	LOS B	6.0	149.2	0.76	0.73	1.14	29.0
3b	L3	All MCs	156	0.0	156	0.0	0.604	12.8	LOS B	6.0	149.2	0.76	0.73	1.14	29.0
8	T1	All MCs	380	0.0	380	0.0	0.604	12.8	LOS B	6.0	149.2	0.76	0.73	1.14	29.5
Approach			542	0.0	542	0.0	0.604	12.8	LOS B	6.0	149.2	0.76	0.73	1.14	29.4
North: Chain Lake Rd															
4	T1	All MCs	141	0.0	141	0.0	0.405	7.1	LOS A	2.5	63.2	0.44	0.23	0.44	32.7
14a	R1	All MCs	333	0.0	333	0.0	0.405	7.1	LOS A	2.5	63.2	0.44	0.23	0.44	32.7
Approach			474	0.0	474	0.0	0.405	7.1	LOS A	2.5	63.2	0.44	0.23	0.44	32.7
SouthWest: N Kelsey St															
5ax	L1	All MCs	422	0.0	422	0.0	0.339	6.0	LOS A	1.8	45.8	0.35	0.18	0.35	30.8
12bx	R3	All MCs	214	0.0	214	0.0	0.135	3.1	LOS A	0.0	0.0	0.00	0.00	0.00	36.1
Approach			635	0.0	635	0.0	0.339	5.0	LOS A	1.8	45.8	0.23	0.12	0.23	32.4
All Vehicles			1651	0.0	1651	0.0	0.604	8.1	LOS A	6.0	149.2	0.46	0.35	0.59	31.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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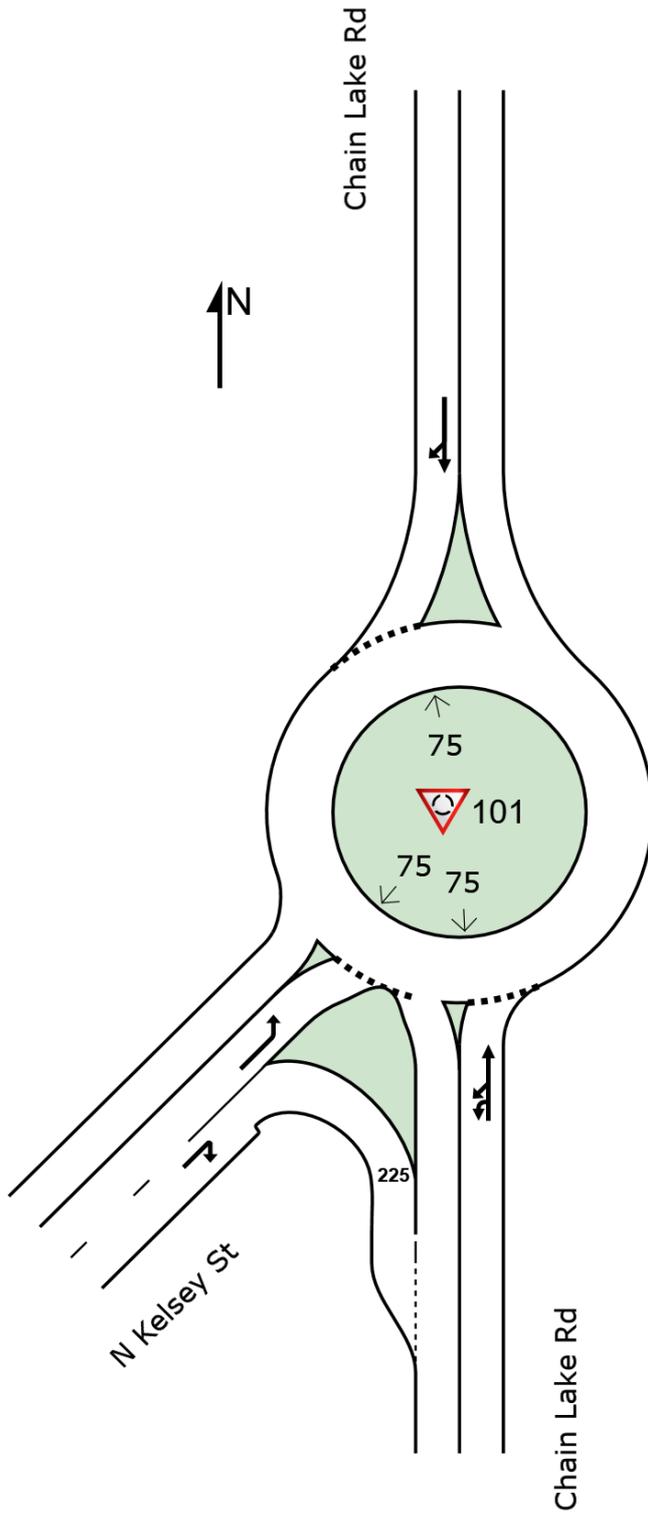
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SITE LAYOUT

Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Baseline 2028)]

Trombley Property
Site Category: Existing Design
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Baseline 2028)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Trombley Property
 Site Category: Base Year
 Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. Dist]				mph	
			veh/h		veh/h					veh	ft				
South: Chain Lake Rd															
3u	U	All MCs	5	0.0	5	0.0	0.640	14.1	LOS B	6.9	171.6	0.80	0.80	1.27	28.5
3b	L3	All MCs	161	0.0	161	0.0	0.640	14.1	LOS B	6.9	171.6	0.80	0.80	1.27	28.5
8	T1	All MCs	396	0.0	396	0.0	0.640	14.1	LOS B	6.9	171.6	0.80	0.80	1.27	29.0
Approach			563	0.0	563	0.0	0.640	14.1	LOS B	6.9	171.6	0.80	0.80	1.27	28.9
North: Chain Lake Rd															
4	T1	All MCs	146	0.0	146	0.0	0.425	7.4	LOS A	2.7	67.8	0.45	0.24	0.45	32.6
14a	R1	All MCs	349	0.0	349	0.0	0.425	7.4	LOS A	2.7	67.8	0.45	0.24	0.45	32.6
Approach			495	0.0	495	0.0	0.425	7.4	LOS A	2.7	67.8	0.45	0.24	0.45	32.6
SouthWest: N Kelsey St															
5ax	L1	All MCs	443	0.0	443	0.0	0.358	6.2	LOS A	2.0	49.3	0.36	0.19	0.36	30.8
12bx	R3	All MCs	224	0.0	224	0.0	0.142	3.2	LOS A	0.0	0.0	0.00	0.00	0.00	36.1
Approach			667	0.0	667	0.0	0.358	5.2	LOS A	2.0	49.3	0.24	0.12	0.24	32.3
All Vehicles			1724	0.0	1724	0.0	0.640	8.7	LOS A	6.9	171.6	0.48	0.38	0.64	31.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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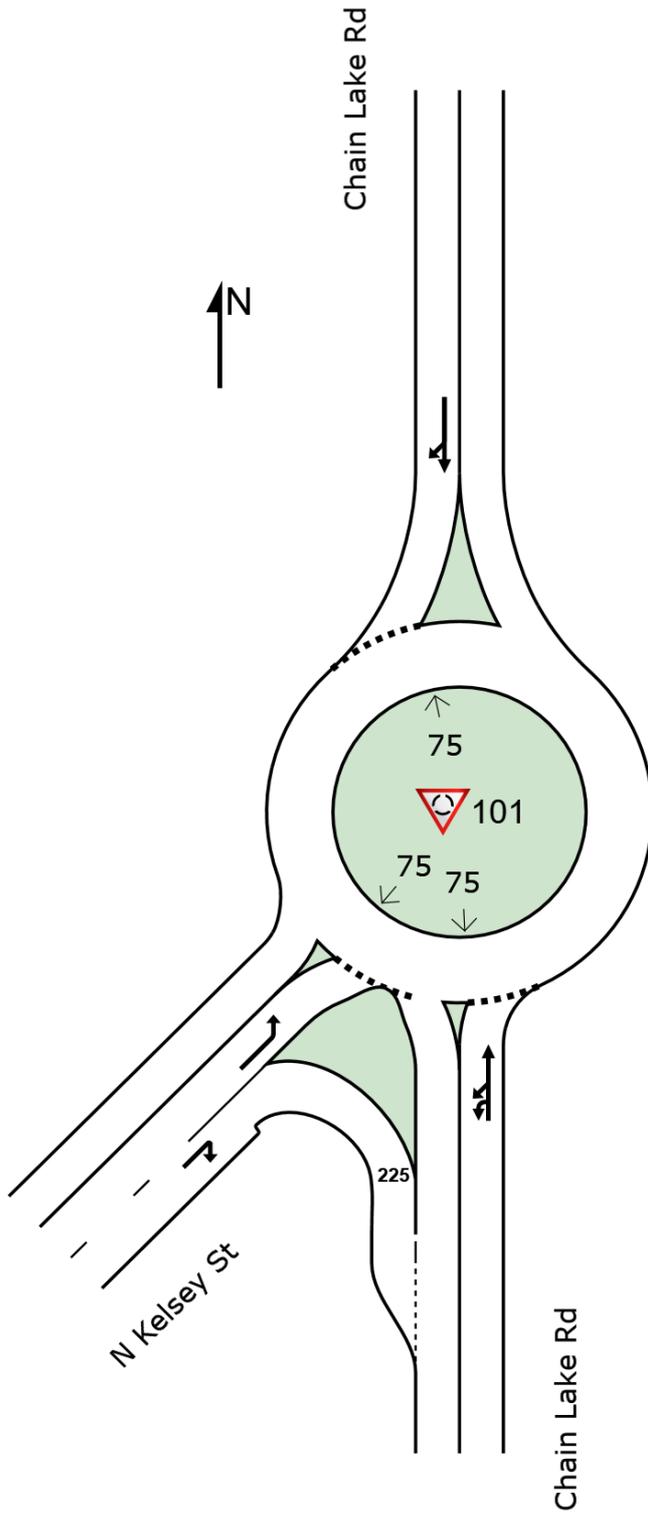
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SITE LAYOUT

Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Future With Project 2028)]

Trombley Property
Site Category: Future With Project
Roundabout

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MOVEMENT SUMMARY

Site: 101 [Chain Lake Rd/N Kelsey St (Site Folder: Future With Project 2028)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Trombley Property
 Site Category: Future With Project
 Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist]			mph	
South: Chain Lake Rd															
3u	U	All MCs	5	0.0	5	0.0	0.672	15.2	LOS C	7.9	196.8	0.83	0.85	1.38	28.2
3b	L3	All MCs	161	0.0	161	0.0	0.672	15.2	LOS C	7.9	196.8	0.83	0.85	1.38	28.2
8	T1	All MCs	424	0.0	424	0.0	0.672	15.2	LOS C	7.9	196.8	0.83	0.85	1.38	28.6
Approach			591	0.0	591	0.0	0.672	15.2	LOS C	7.9	196.8	0.83	0.85	1.38	28.5
North: Chain Lake Rd															
4	T1	All MCs	164	0.0	164	0.0	0.440	7.6	LOS A	2.9	71.7	0.46	0.25	0.46	32.5
14a	R1	All MCs	349	0.0	349	0.0	0.440	7.6	LOS A	2.9	71.7	0.46	0.25	0.46	32.5
Approach			513	0.0	513	0.0	0.440	7.6	LOS A	2.9	71.7	0.46	0.25	0.46	32.5
SouthWest: N Kelsey St															
5ax	L1	All MCs	443	0.0	443	0.0	0.364	6.4	LOS A	2.0	50.0	0.39	0.21	0.39	30.7
12bx	R3	All MCs	224	0.0	224	0.0	0.142	3.2	LOS A	0.0	0.0	0.00	0.00	0.00	36.1
Approach			667	0.0	667	0.0	0.364	5.3	LOS A	2.0	50.0	0.26	0.14	0.26	32.3
All Vehicles			1770	0.0	1770	0.0	0.672	9.3	LOS A	7.9	196.8	0.51	0.41	0.69	31.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Appendix D: Detailed Trip Generation

1.25165 Trombley Property - Monroe

<u>Proposed Use</u>										
Land Use	Setting	Size	Units	Model	Equation	Rate	Inbound %	Primary Trips		
								Inbound	Outbound	Total
Single Family Home Detached (LU 210)		39	du							
Daily	General Urban/Suburban			Equation (lin)	$T = 8.07(X) + 265.45$	-	50%	290	290	580
AM Peak Hour	General Urban/Suburban			Equation (lin)	$T = 0.67(X) + 5.59$	-	27%	9	23	32
PM Peak Hour	General Urban/Suburban			Equation (log)	$\ln(T) = 0.92 \ln(X) + 0.33$	-	62%	25	15	40
Single Family Home Attached (LU 215)		9	du							
Daily	General Urban/Suburban			Equation (lin)	$T = 6.53(X) + 3.25$	-	50%	31	31	62
AM Peak Hour	General Urban/Suburban			Rate	-	0.47	25%	1	3	4
PM Peak Hour	General Urban/Suburban			Rate	-	0.51	57%	3	2	5
Subtotal										
Daily								321	321	642
AM Peak Hour								10	26	36
PM Peak Hour								28	17	45

<u>Existing Use</u>										
Land Use	Setting	Size	Units	Model	Equation	Rate	Inbound %	Primary Trips		
								Inbound	Outbound	Total
Single Family Home Detached (LU 210)		1	du							
Daily	General Urban/Suburban			Rate	-	9.09	50%	5	5	10
AM Peak Hour	General Urban/Suburban			Rate	-	0.70	27%	0	1	1
PM Peak Hour	General Urban/Suburban			Rate	-	0.93	62%	1	0	1
Subtotal										
Daily								5	5	10
AM Peak Hour								0	1	1
PM Peak Hour								1	0	1

<u>Net New Trips</u>										
Daily								316	316	632
AM Peak Hour								10	25	35
PM Peak Hour								27	17	44

Notes:

1. Trip rates based on Institute of Transportation Engineers' (ITE) *Trip Generation Manual* (12th Edition) equation and average trip rates as shown above.

Appendix E: Sight Distance Analysis

