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Main Brook Townhomes
Traffic Impact Analysis

Jurisdiction: City of Monroe

September 2017

GTC #17-194

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1. DEVELOPMENT IDENTIFICATION

Gibson Traffic Consultants, Inc. (GTC) has been retained to provide a traffic impact analysis for the proposed Main Brook Townhomes development to address the City of Monroe, Snohomish County and Washington State Department of Transportation (WSDOT) traffic impacts. Brad Lincoln, responsible for this report and traffic analysis, is a licensed professional engineer (Civil) in the State of Washington and member of the Washington State section of ITE.

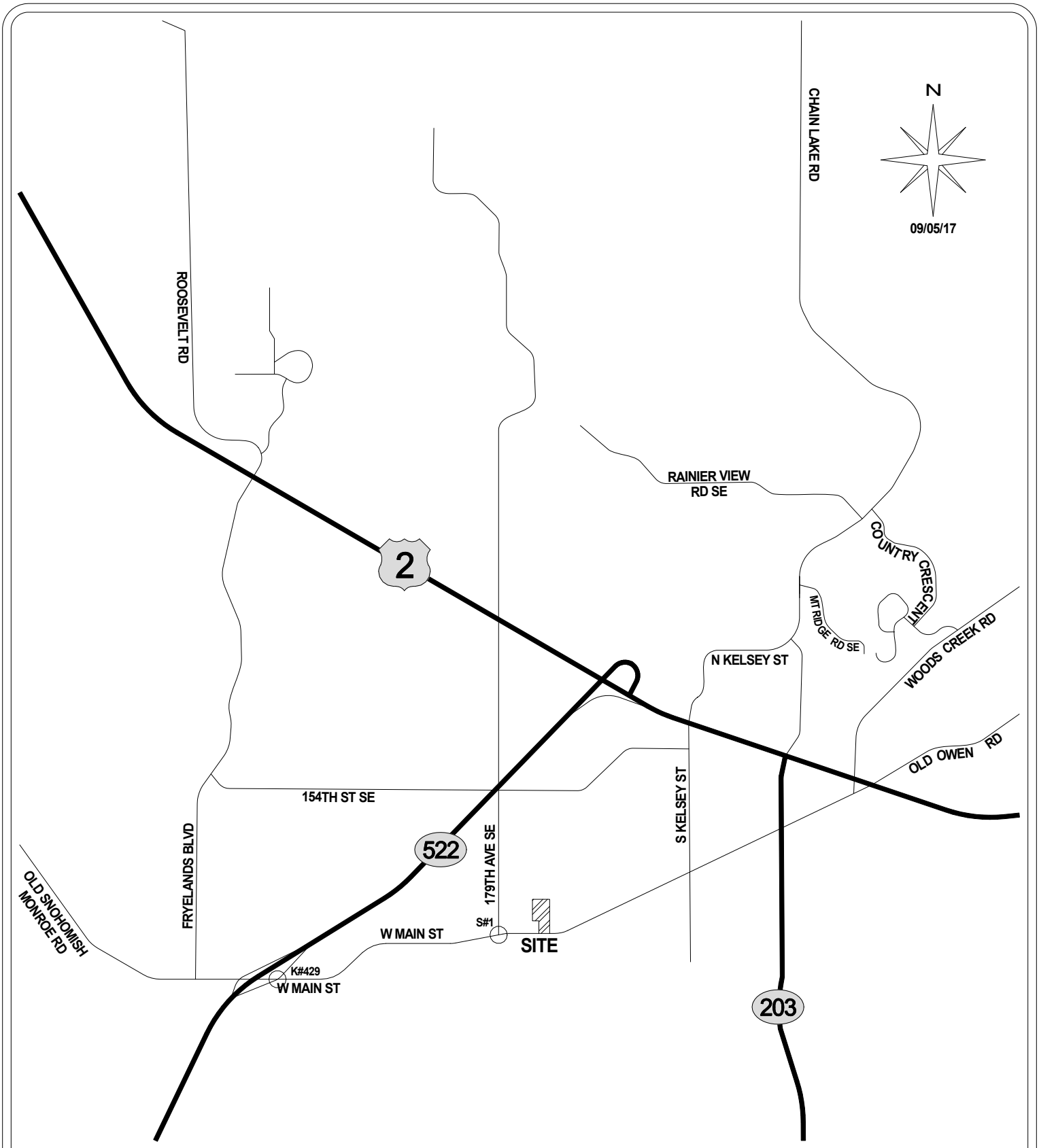
The Main Brook Townhomes development is proposed to consist of a total of 18 standalone residential townhouse units and 4,160 square feet (SF) of medical office. The development site is located on the north side of W Main Street, west of Dennis Way. The development is proposing to utilize an existing access onto W Main Street. site vicinity map has been included in Figure 1.

2. METHODOLOGY

Trip generation calculations for the Main Brook Townhomes development have been performed utilizing average trip generation data contained in the Institute of Transportation Engineers' (ITE) *Trip Generation, 9th Edition (2012)*. The distribution of trips generated by the site is based on approved distributions for similar developments in the site vicinity.

Intersection level of service analysis has been performed based on typical analysis requirements of the City of Monroe and analysis performed for similar developments in the site vicinity. Level of service analysis has been performed for the intersection of W Main Street at 179th Avenue SE.

Congestion at intersections is generally measured in terms of level of service (LOS). In accordance with *Highway Capacity Manual: 2010 Edition (HCM)* by the Transportation Research Board, road facilities and intersections are rated between LOS A and LOS F, with LOS A being free flow and LOS F being forced flow or over-capacity conditions. The level of service at signalized, roundabout and all-way stop-controlled intersections is based on the average delay of all approaches. The level of service for two-way stop-controlled intersections is based on average delays for the stopped approach with the highest delay. Geometric characteristics and conflicting traffic movements are taken into consideration when determining level of service values. A summary of the intersection level of service criteria is included in Table 1.



GIBSON TRAFFIC CONSULTANTS

TRAFFIC IMPACT STUDY
GTC #17-194

MAIN BROOK TOWNHOMES
18 TOWNHOUSE UNITS
4,160 SF OF MEDICAL OFFICE

CITY OF MONROE

LEGEND

	DEVELOPMENT SITE
S#XXX	STUDY INTERSECTION
K#XXX	KEY INTERSECTION

FIGURE 1

SITE VICINITY MAP

Table 1: Level of Service Criteria for Intersections

Level of Service[1]	Expected Delay	Intersection Control Delay (Seconds per Vehicle)	
		Unsignalized Intersections	Signalized Intersections
A	Little/No Delay	≤10	≤10
B	Short Delays	>10 and ≤15	>10 and ≤20
C	Average Delays	>15 and ≤25	>20 and ≤35
D	Long Delays	>25 and ≤35	>35 and ≤55
E	Very Long Delays	>35 and ≤50	>55 and ≤80
F	Extreme Delays[2]	>50	>80

The City of Monroe has a level of service threshold of LOS C for collector road intersections and LOS D for arterial road intersections. The level of service analysis has been performed utilizing the *Synchro 9.1, Build 912* software.

The City of Monroe also has an interlocal agreement with Snohomish County to provide turning movements at Snohomish County key intersections impacted with 3 or more directional peak-hour trips on an approach or departure and for traffic mitigation fees.

[1] **Source:** *Highway Capacity Manual* 2010.

LOS A: Free-flow traffic conditions, with minimal delay to stopped vehicles (no vehicle is delayed longer than one cycle at signalized intersection).
LOS B: Generally stable traffic flow conditions.
LOS C: Occasional back-ups may develop, but delay to vehicles is short term and still tolerable.
LOS D: During short periods of the peak hour, delays to approaching vehicles may be substantial but are tolerable during times of less demand (i.e. vehicles delayed one cycle or less at signal).
LOS E: Intersections operate at or near capacity, with long queues developing on all approaches and long delays.
LOS F: Jammed conditions on all approaches with excessively long delays and vehicles unable to move at times.

[2] When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection.

3. TRIP GENERATION

The trip generation calculations for the Main Brook Townhomes development are based on the average trip generation rates for ITE Land Use Code (LUC) 210, Single-Family Detached Housing and LUC 720, Medical/Dental Office. The trip generation for the Main Brook Townhomes development is summarized in Table 2.

Table 2: Trip Generation Summary

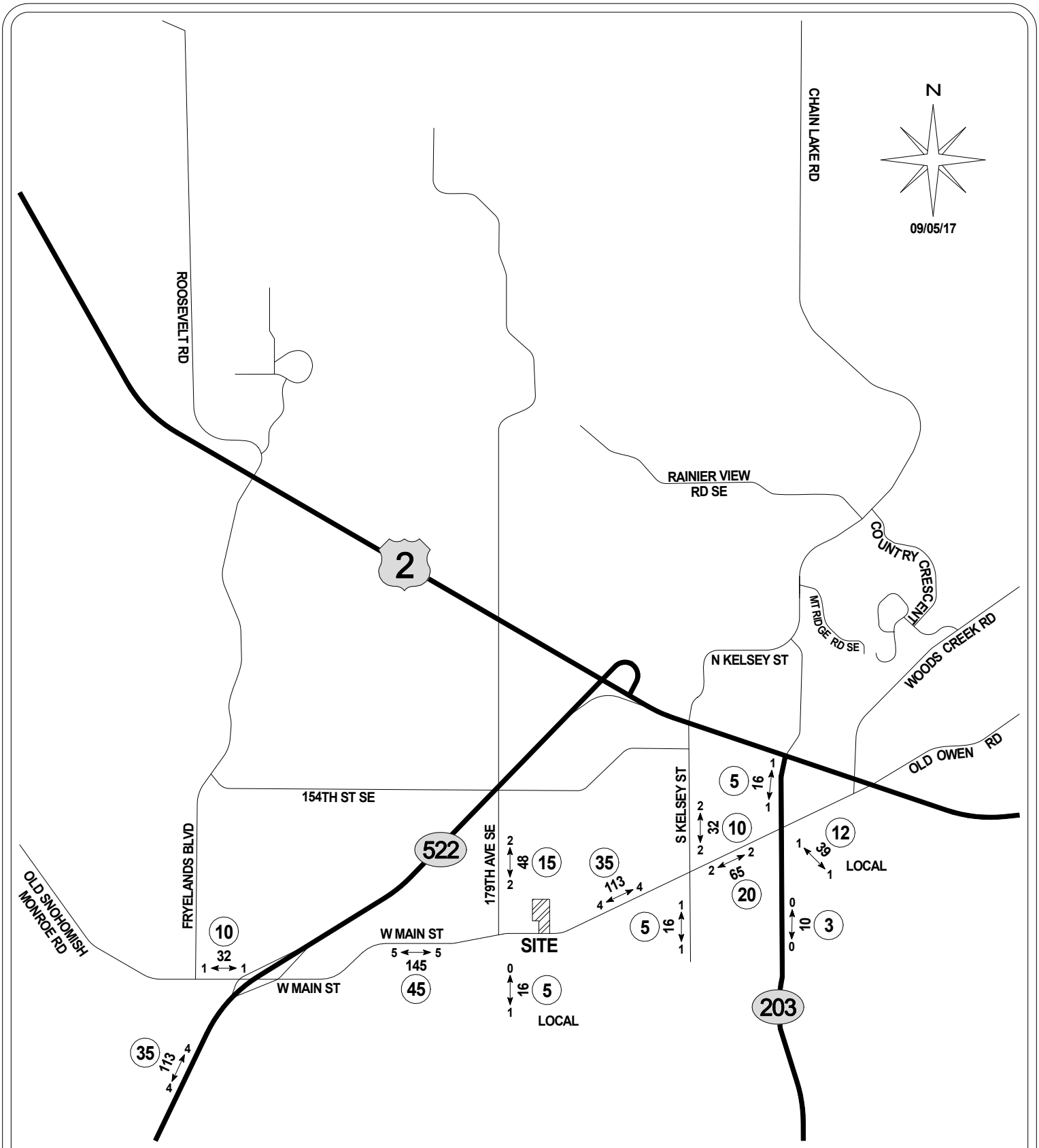
ITE Land Use Code Use Size	Average Daily Trips	AM Peak-Hour Trips			PM Peak-Hour Trips		
		Inbound	Outbound	Total	Inbound	Outbound	Total
LUC 210 Single-Family Detached 18 Units	171.36	3.38	10.12	13.50	11.34	6.66	18.00
LUC 720 Medical/Dental Office 4,160 SF	150.30	7.85	2.09	9.94	4.16	10.69	14.85
NEW TRIPS	**321.66**	**11.23**	**12.21**	**23.44**	**15.50**	**17.35**	**32.85**

The Main Brook Townhomes development is anticipated to generate 321.66 average daily trips with 23.44 AM peak-hour trips and 32.85 PM peak-hour trips. Trip generation calculations are included in the attachments.

4. TRIP DISTRIBUTION

The distribution of trips generated by the Main Brook Townhomes development is based on previously approved traffic studies for developments conducted in the site vicinity. It is anticipated that 45% of the development's trips will travel to and from the west along W Main Street. Approximately 35% of the development's trips will travel to and from the east along W Main Street. It is estimated that 15% of the development's trips will travel to and from the north along 179th Avenue SE. The remaining 5% of the development's trips will be local trips. Detailed distributions are included in Figure 2 for the AM peak-hour and Figure 3 for the PM peak-hour.

The interlocal agreement with Snohomish County requires key intersections impacted with 3 or more directional peak-hour trips on any approach or departure to be shown. The Main Brook Townhomes development will impact 1 Snohomish County key intersection during the AM and PM peak-hours. The key intersection impacts are shown in detail in the attachments of this report. Snohomish County's trip distribution policies state that trips along US-2 do not need to be distributed west of 88th Street SE. Development trips on US-2 are expected to be through-trips at 88th Street SE. Development trips traveling to and from the south along SR-522 are anticipated to travel to and from King County.



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MAIN BROOK TOWNHOMES
18 TOWNHOUSE UNITS
4,160 SF OF MEDICAL OFFICE

CITY OF MONROE

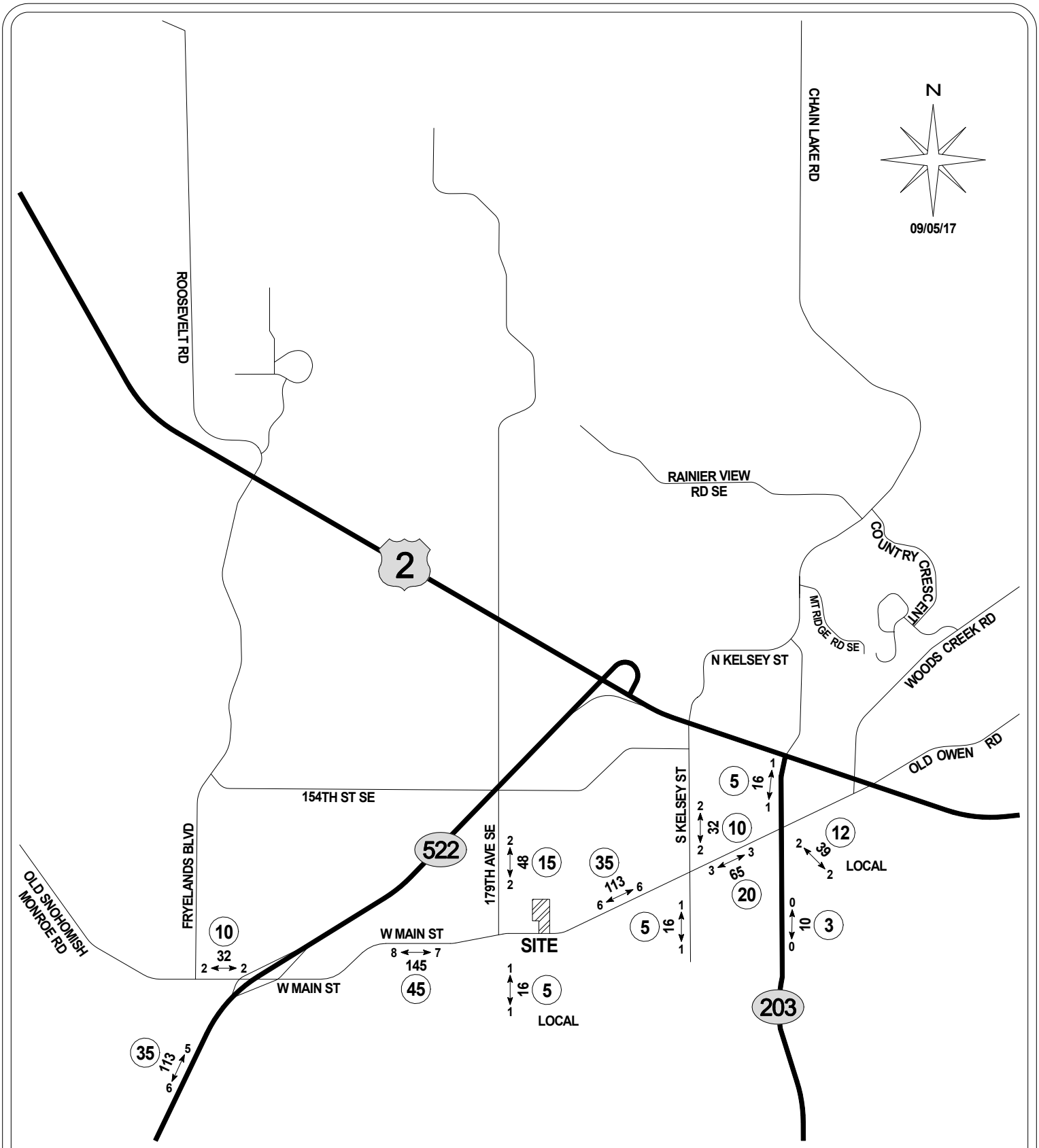
LEGEND

AWDT
AM ⟷ PEAK — NEW SITE TRAFFIC (DAILY/PEAK-HOUR)

XX — TRIP DISTRIBUTION %

FIGURE 2

DEVELOPMENT TRIP DISTRIBUTION AM PEAK-HOUR



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AWDT
PM ⟷ PEAK — NEW SITE TRAFFIC (DAILY/PEAK-HOUR)

XX — TRIP DISTRIBUTION %

FIGURE 3

DEVELOPMENT TRIP DISTRIBUTION PM PEAK-HOUR

5. INTERSECTION LEVEL OF SERVICE ANALYSIS

The intersection of W Main Street at 179th Avenue SE has been analyzed as part of this report based on typical requirements of the City of Monroe. This is the only major intersection impacted with 10 or more development PM peak-hour trips. There are no WSDOT intersections that are anticipated to be impacted with 25 PM peak-hour trips, which is the WSDOT threshold for intersections that do not have fee-based improvements.

5.1 Turning Movement Volumes

The existing turning movements at the study intersections were counted by the independent count firm of Traffic Data Gathering (TDG). The counts were performed between 4:00 PM and 6:00 PM, the typical PM peak-period. The turning movement counts were collected on August 29, 2017. The 2017 existing turning movements at the study intersections are shown in Figure 4.

The future volumes have been calculated for the year 2027, a 10-year horizon period. The 2027 baseline turning movements have been calculated by applying a 2% annually compounding growth rate. The 2027 baseline turning movements at the study intersections are shown in Figure 5.

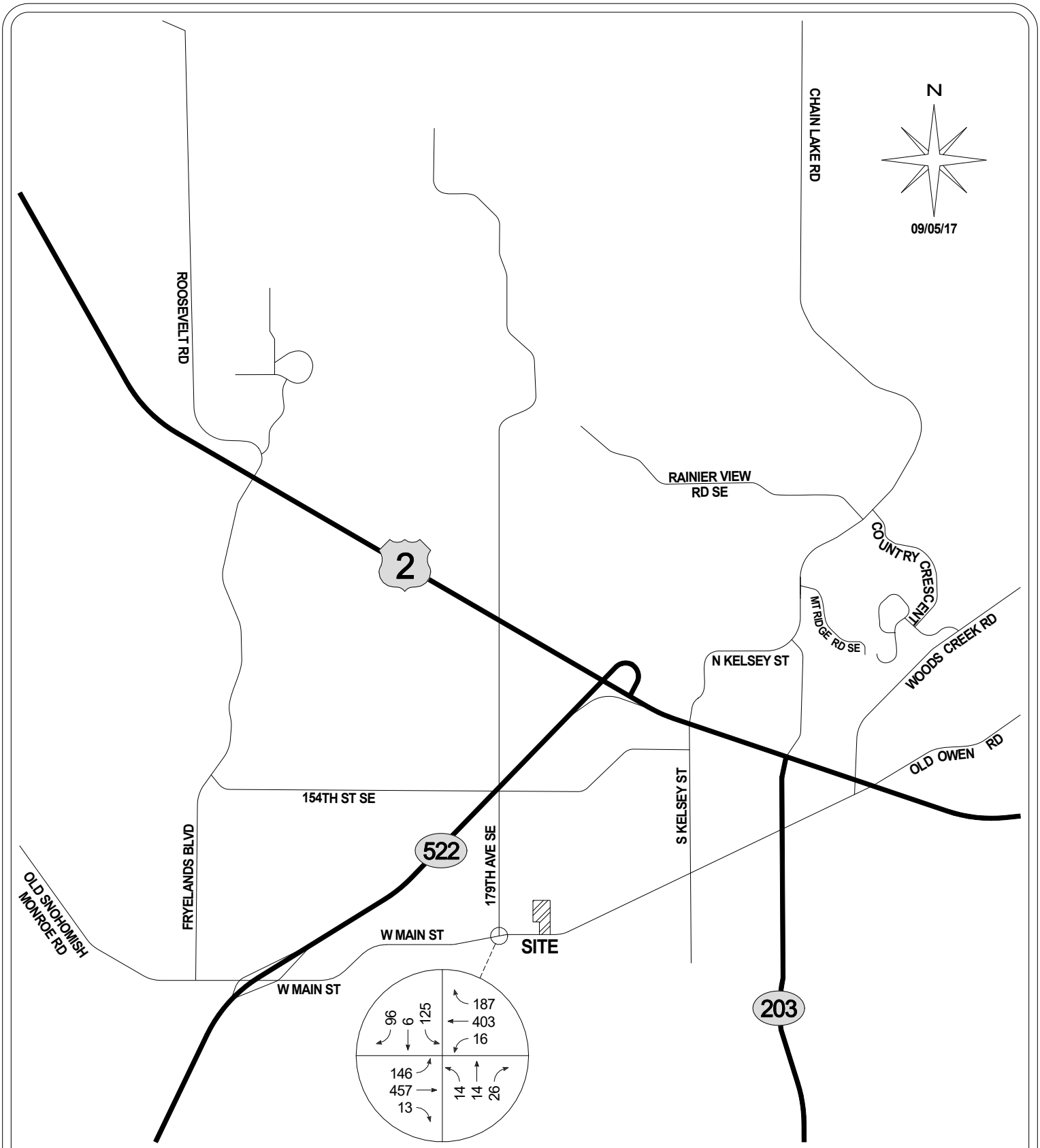
The 2027 future with development turning movements were calculated by adding the development's turning movements to the 2027 baseline turning movements. The 2027 future with development turning movements are shown in Figure 6.

The existing turning movement counts and turning movement calculations are included in the attachments.

5.2 Intersection Level of Service Results

The level of service analysis has been performed utilizing the existing control, channelization, peak-hour factors and heavy-vehicle factors. The signal timing was optimized in the 2027 baseline conditions and then utilized for the 2072 future with development conditions. The study intersection is located along W Main Street which is classified as a minor arterial and therefore has a level of service threshold of LOS D.

The level of service analysis shows that the study intersection will operate at acceptable LOS B under the existing conditions and the 2027 baseline conditions; and will operate at acceptable LOS C with the addition of the Main Brook Townhomes Development. The level of service results for the study intersections are summarized in Table 3.



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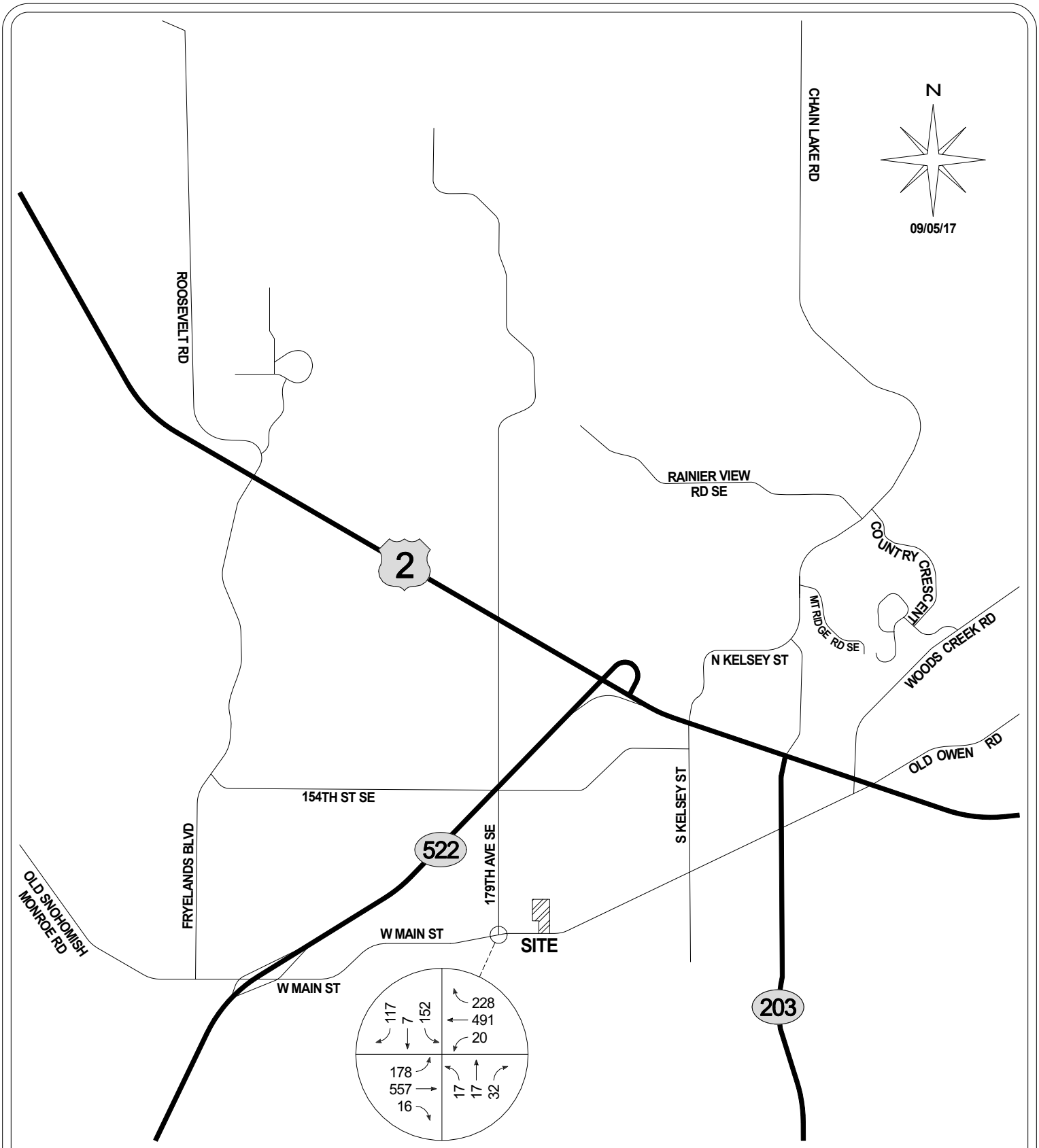
XXX → PM PEAK-HOUR TURNING MOVEMENT VOLUMES

FIGURE 4

2017 EXISTING TURNING MOVEMENTS



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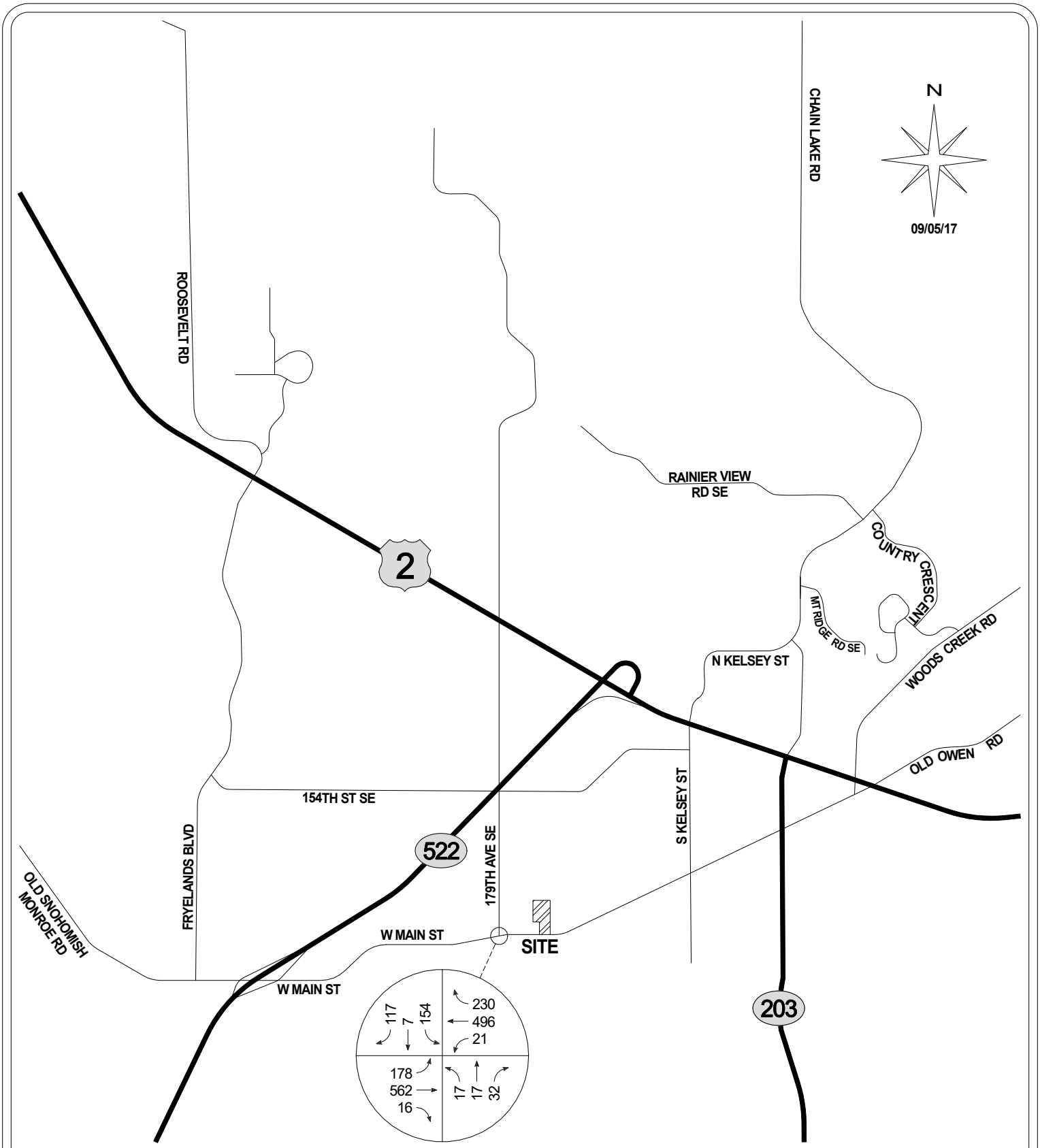
XXX → PM PEAK-HOUR TURNING MOVEMENT VOLUMES

FIGURE 5

2027 BASELINE TURNING MOVEMENTS



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XXX → PM PEAK-HOUR TURNING MOVEMENT VOLUMES

FIGURE 6

2027 FUTURE WITH DEVELOPMENT TURNING MOVEMENTS

Table 3: Intersection Level of Service Summary

Intersection	Control	Existing Conditions		2027 Baseline Conditions		2027 Future Conditions with Development	
		LOS	Delay	LOS	Delay	LOS	Delay
1. W Main Street at 179th Avenue SE	Signalized	B	14.7 sec	C	21.4 sec	C	21.7 sec

The level of service calculations are included in the attachments.

6. COLLISION HISTORY

Collision data was provided by WSDOT for the 5-year period from January 1, 2012 through December 31, 2016 at the study intersection. There were 5 collisions at the study intersection, with two rear-end collisions, two at-angle and one opposite direction collision. With a PM peak-hour volume of 1,503 vehicles and assuming a standard k-factor of 10, the study intersection has a collision rate per million entering vehicles of approximately 0.18. Collision rates below 1.0 are typically considered normal to low rates and therefore the intersection should not be considered to have a significant collision history.

7. TRAFFIC MITIGATION FEES

The Washington Growth Management Act and Revised Code of Washington 82.02.050(2) authorize local jurisdictions to establish proportionate share traffic mitigation fees in order to fund capital facilities, such as roads and intersections. The Main Brook Townhomes development is located within the City of Monroe, which has established traffic mitigation fees. The City of Monroe also has interlocal agreements with Snohomish County and WSDOT for traffic mitigation fees.

7.1 City of Monroe

The City of Monroe has established a traffic mitigation fee schedule. The fee for single-family residential units is $3,459.00 per unit and the fee for medical office is $12.35 per gross square foot. The 18 new units and 4,160 SF of the Main Brook Townhomes development will have City of Monroe traffic mitigation fees of $62,262.00 for the residential units and $51,376.00 for the medical office. The Main Brook Townhomes development will have a total City of Monroe mitigation fee of $113,638.00. It should be noted that these fees may not vest and may be higher when the building applications are pulled.

7.2 Snohomish County

The City of Monroe and Snohomish County have an interlocal agreement that provides for the payment of traffic mitigation for impacts to Snohomish County roadways by City of Monroe developments. Traffic mitigation fees are based on predetermined area impacts or impacts to actual improvement projects. The trip distribution shows that the Main Brook Townhomes development will not impact any Snohomish County improvement projects in the Transportation Needs Report with three directional PM peak-hour trips. According to Section 3(a)2 of the S*nohomish County Traffic Worksheet and Traffic Study Requirements for Developments in the City of Monroe*, City of Monroe developments are only required to pay traffic mitigation fees for improvements in the Transportation Needs Report impacted with three directional peak-hour trips. The Main Brook Townhomes development is therefore not required to pay traffic mitigation fees to Snohomish County.

7.3 WSDOT

The City of Monroe and WSDOT have an interlocal agreement that provides for the payment of traffic mitigation fees. The interlocal agreement states that development only has a "significant adverse impact" if the development contributes 25 or more trips to a WSDOT intersection. The Main Brook Townhomes development will not impact any WSDOT intersections with 25 peak-hour trips during the AM or PM peak-hours. The Main Brook Townhomes development is therefore not required to pay traffic mitigation fees to WSDOT.

8. CONCLUSIONS

The Main Brook Townhomes development is proposed to consist of 18 new single-family residential units and 4,160 SF of medical office. The development is anticipated to generate 321.66 new average daily trips with 23.44 new AM peak-hour trips and 32.85 new PM peak-hour trips. The level of service analysis shows that the study intersection is anticipated to operate at an acceptable level of service. Additionally, the study intersection has a collision rate per million entering vehicles of less than 1.0. The Main Brook Townhomes development will have City of Monroe traffic mitigation fees of $113,638.00. The development will not meet the thresholds for paying traffic mitigation fees to Snohomish County or WSDOT.

Trip Generation Calculations

A

Main Brook Townhomes
GTC #17-194

Trip Generation for: **Weekday**
(a.k.a.): **Average Weekday Daily Trips (AWDT)**

									NET EXTERNAL TRIPS BY TYPE											
									IN BOTH DIRECTIONS						DIRECTIONAL ASSIGNMENTS					
			Gross Trips				Internal Crossover		TOTAL	PASS-BY		DIVERTED LINK		NEW	PASS-BY		DIVERTED LINK		NEW	
LAND USES	VARIABLE	ITE LU code	Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	Trips In+Out (Total)	In+Out (Total)	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In+Out (Total)	In+Out (Total)	In	Out	In	Out	In	Out
Single-Family Detached	18 units	210	9.52	50%	50%	171.36	0%	0.00	171.36	0%	0.00	0%	0.00	171.36	0.00	0.00	0.00	0.00	85.68	85.68
Medical/ Dental Offices	4.160 KSF	720	36.13	50%	50%	150.30	0%	0.00	150.30	0%	0.00	0%	0.00	150.30	0.00	0.00	0.00	0.00	75.15	75.15
Totals						321.66		0.00	321.66		0.00		0.00	321.66	0.00	0.00	0.00	0.00	160.83	160.83

Main Brook Townhomes
GTC #17-194

Trip Generation for: **Weekday, Peak Hour of Adjacent Street Traffic, One Hour between 7 and 9 AM**
(a.k.a.): **Weekday AM Peak Hour**

									NET EXTERNAL TRIPS BY TYPE											
									IN BOTH DIRECTIONS						DIRECTIONAL ASSIGNMENTS					
			Gross Trips				Internal Crossover		TOTAL	PASS-BY		DIVERTED LINK		NEW	PASS-BY		DIVERTED LINK		NEW	
LAND USES	VARIABLE	ITE LU code	Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	Trips In+Out (Total)	In+Out (Total)	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In+Out (Total)	In+Out (Total)	In	Out	In	Out	In	Out
Single-Family Detached	18 units	210	0.75	25%	75%	13.50	0%	0.00	13.50	0%	0.00	0%	0.00	13.50	0.00	0.00	0.00	0.00	3.38	10.12
Medical/ Dental Offices	4.160 KSF	720	2.39	79%	21%	9.94	0%	0.00	9.94	0%	0.00	0%	0.00	9.94	0.00	0.00	0.00	0.00	7.85	2.09
Totals						23.44		0.00	23.44		0.00		0.00	23.44	0.00	0.00	0.00	0.00	11.23	12.21

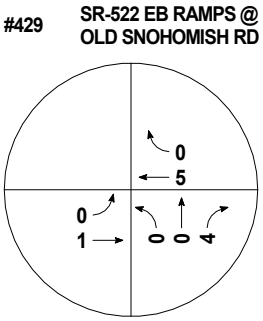
Main Brook Townhomes
GTC #17-194

Trip Generation for: **Weekday, Peak Hour of Adjacent Street Traffic, One Hour between 4 and 6 PM**
(a.k.a.): **Weekday PM Peak Hour**

									NET EXTERNAL TRIPS BY TYPE											
									IN BOTH DIRECTIONS						DIRECTIONAL ASSIGNMENTS					
			Gross Trips				Internal Crossover		TOTAL	PASS-BY		DIVERTED LINK		NEW	PASS-BY		DIVERTED LINK		NEW	
LAND USES	VARIABLE	ITE LU code	Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	Trips In+Out (Total)	In+Out (Total)	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In+Out (Total)	In+Out (Total)	In	Out	In	Out	In	Out
Single-Family Detached	18 units	210	1.00	63%	37%	18.00	0%	0.00	18.00	0%	0.00	0%	0.00	18.00	0.00	0.00	0.00	0.00	11.34	6.66
Medical/ Dental Offices	4.160 KSF	720	3.57	28%	72%	14.85	0%	0.00	14.85	0%	0.00	0%	0.00	14.85	0.00	0.00	0.00	0.00	4.16	10.69
Totals						32.85		0.00	32.85		0.00		0.00	32.85	0.00	0.00	0.00	0.00	15.50	17.35

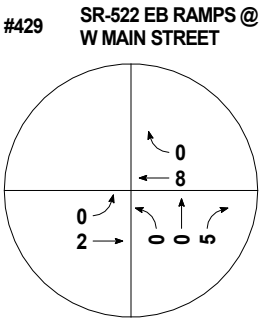
Snohomish County Key Intersection Impacts

B



AM PEAK-HOUR

PM PEAK-HOUR



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4,160 SF OF MEDICAL OFFICE

CITY OF MONROE

LEGEND

XXX → PEAK-HOUR TURNING MOVEMENT VOLUMES

FIGURE B1

DEVELOPMENT
KEY INTERSECTION VOLUMES
AM & PM PEAK-HOURS

AM Peak-Hour Key Intersection Volumes

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
#429: W Main St at SR-522 NB Ramps	0	1	N/A	N/A	5	0	0	0	4	N/A	N/A	N/A

PM Peak-Hour Key Intersection Volumes

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
#429: W Main St at SR-522 NB Ramps	0	2	N/A	N/A	8	0	0	0	5	N/A	N/A	N/A

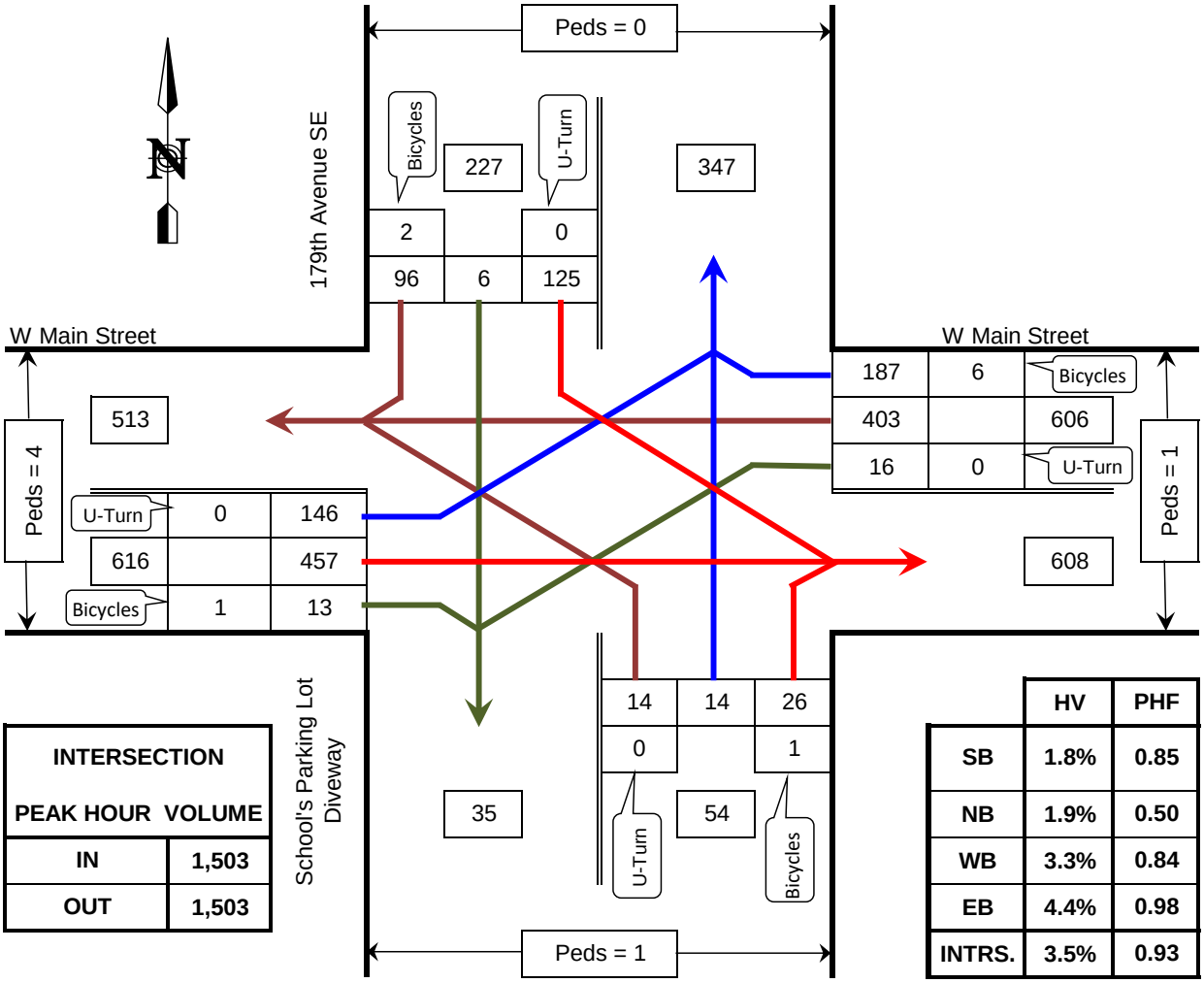
Counts and Turning Movement Volumes

C

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

4:00 PM - 6:00 PM PEAK HOUR: 4:15 PM TO 5:15 PM



INTERSECTION PEAK HOUR VOLUME	
IN	1,503
OUT	1,503

	HV	PHF
SB	1.8%	0.85
NB	1.9%	0.50
WB	3.3%	0.84
EB	4.4%	0.98
INTRS.	3.5%	0.93

PHF = Peak Hour Factor
HV = Heavy Vehicle

179th Avenue SE @ W Main Street

Monroe, WA

COUNTED BY: VT/CN

DATE OF COUNT: Tue. 8/29/17

REDUCED BY: CN

TIME OF COUNT: 4:00 PM - 6:00 PM

REDUCTION DATE: Wed. 8/30/17

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: 179th Avenue SE @ W Main Street
Monroe, WA

DATE OF COUNT: Tue. 8/29/17
TIME OF COUNT: 4:00 PM - 6:00 PM

COUNTED BY: VT/CN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON 179th Avenue SE							FROM SOUTH ON School's Parking Lot Diveway							FROM EAST ON W Main Street							FROM WEST ON W Main Street							INTERVAL TOTALS
	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	1	0	27	0	14	1	0	0	0	1	1	2	0	2	4	0	2	108	45	1	0	8	0	44	101	3	348
04:30 PM	0	0	1	0	33	1	33	0	0	0	0	0	1	0	0	0	8	0	2	104	39	0	1	8	0	36	108	4	361
04:45 PM	0	2	1	0	27	1	21	0	0	0	0	4	1	3	0	0	2	0	7	89	34	0	0	7	0	35	118	2	342
05:00 PM	0	0	2	0	36	3	24	0	0	0	0	6	9	12	1	1	5	0	3	90	57	1	0	4	0	33	119	5	397
05:15 PM	0	0	0	0	29	1	18	1	1	1	0	4	3	11	0	5	5	0	4	120	57	3	0	8	0	42	112	2	403
05:30 PM	0	0	2	0	27	0	19	0	0	0	0	4	1	2	1	0	1	0	0	111	31	0	1	7	0	34	92	0	321
05:45 PM	0	0	0	0	24	0	22	0	0	0	0	0	2	1	0	0	9	0	0	122	36	1	1	7	0	28	101	0	336
06:00 PM	0	1	4	0	25	0	27	0	0	0	0	1	1	2	0	2	4	0	1	95	39	1	0	2	0	41	98	0	330
PEAK HOUR TOTALS	0	2	4	0	125	6	96	1	1	1	0	14	14	26	1	6	20	0	16	403	187	4	1	27	0	146	457	13	INTERSECTION
ALL MOVEMENTS				227							54							606							616				1503
% HV			1.8%							1.9%							3.3%							4.4%					3.5%
PEAK HOUR FACTOR				0.85							0.50							0.84							0.98				0.93

HV = Heavy Vehicle
PHF = Peak Hour Factor

4:00 PM - 6:00 PM PEAK HOUR: 4:15 PM TO 5:15 PM

REDUCED BY: CN

DATE OF REDUCTION: 8/30/2017

ROLLING HOUR COUNT

	FROM NORTH ON 179th Avenue SE							FROM SOUTH ON School's Parking Lot Diveway							FROM EAST ON W Main Street							FROM WEST ON W Main Street							INTERVAL TOTALS
TIME INTERVAL	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	Peds	Bicycle	HV	U-Turn	Left	Thru	Right	
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM - 5:00 PM	0	2	5	0	123	5	92	1	0	0	0	11	12	17	1	3	19	0	14	391	175	2	1	27	0	148	446	14	1448
4:15 PM - 5:15 PM	0	2	4	0	125	6	96	1	1	1	0	14	14	26	1	6	20	0	16	403	187	4	1	27	0	146	457	13	1503
4:30 PM - 5:30 PM	0	2	5	0	119	5	82	1	1	1	0	18	14	28	2	6	13	0	14	410	179	4	1	26	0	144	441	9	1463
4:45 PM - 5:45 PM	0	0	4	0	116	4	83	1	1	1	0	14	15	26	2	6	20	0	7	443	181	5	2	26	0	137	424	7	1457
5:00 PM - 6:00 PM	0	1	6	0	105	1	86	1	1	1	0	9	7	16	1	7	19	0	5	448	163	5	2	24	0	145	403	2	1390
4:00 PM - 6:00 PM Total:	0	3	11	0	228	6	178	2	1	1	0	20	19	33	2	10	38	0	19	839	338	7	3	51	0	293	849	16	2838

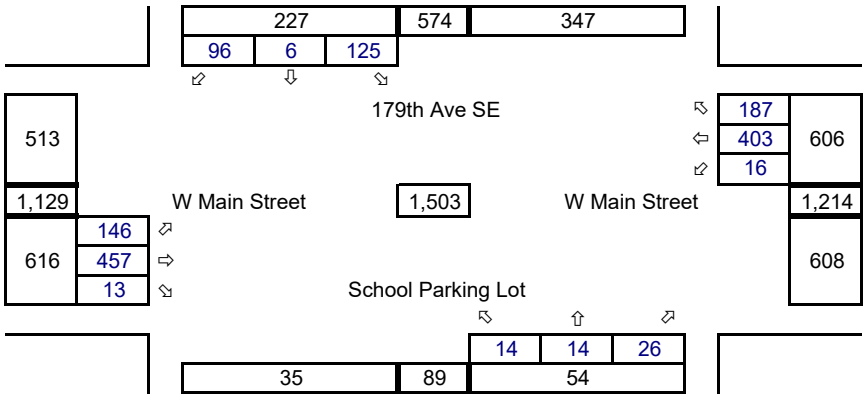
1 179th St SE at W Main St

Synchro ID: 1

Existing
Average Weekday
PM Peak Hour

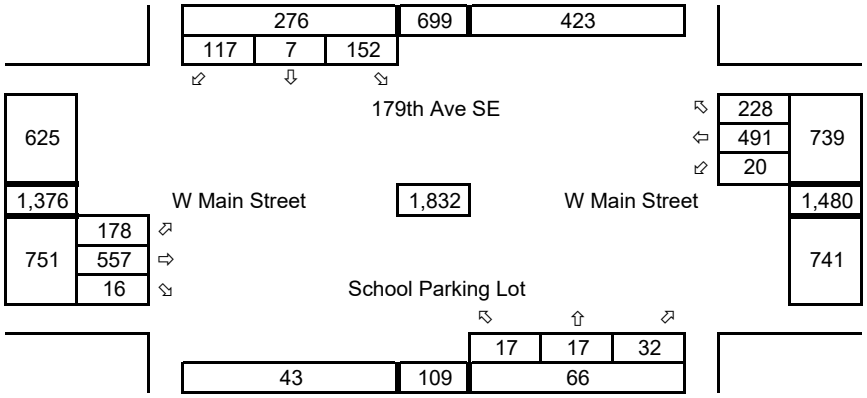
Year: **8/29/17**

Data Source: TDG

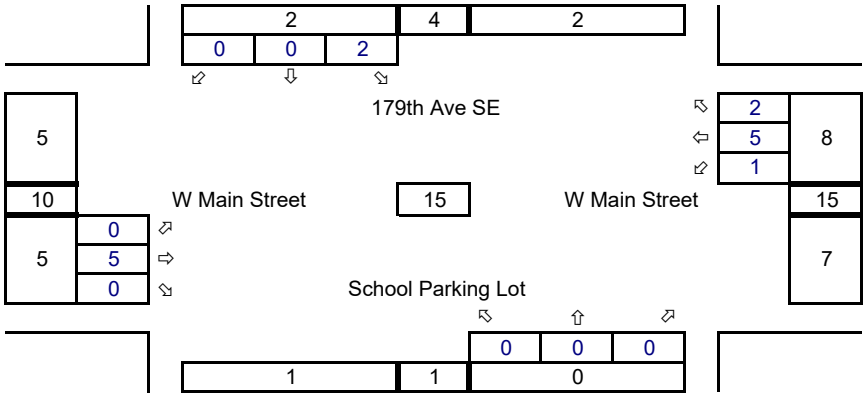


Future without Project
Average Weekday
PM Peak Hour

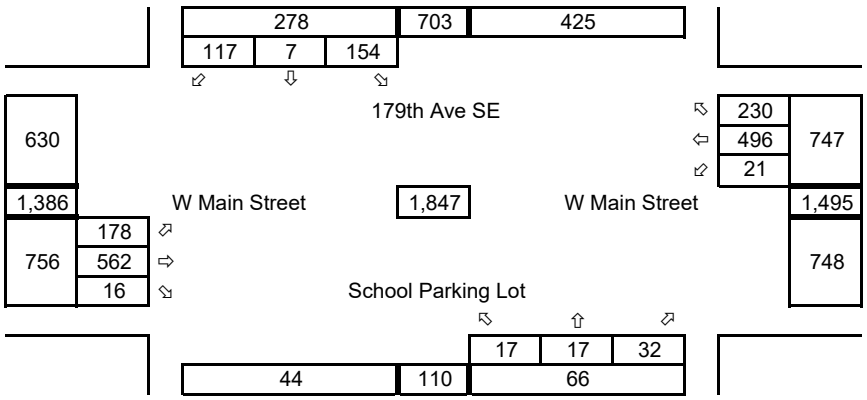
Year: 2027
Growth Rate = 2.0%
Years of Growth = 10
Total Growth = 1.2190



Total Project Trips
Average Weekday
PM Peak Hour



Future with Project
Average Weekday
PM Peak Hour



Level of Service Calculations

D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	146	457	13	16	403	187	14	14	26	125	6	96
Future Volume (vph)	146	457	13	16	403	187	14	14	26	125	6	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	50		0
Storage Lanes	1		0	1		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		1.00	0.99			0.99		1.00	0.97	
Frt		0.996			0.952			0.935			0.858	
Flt Protected	0.950			0.950				0.987		0.950		
Satd. Flow (prot)	1736	1818	0	1736	1725	0	0	1667	0	1736	1521	0
Flt Permitted	0.234			0.464				0.914		0.719		
Satd. Flow (perm)	427	1818	0	847	1725	0	0	1540	0	1311	1521	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			30			28			103	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		560			425			524			366	
Travel Time (s)		12.7			9.7			11.9			8.3	
Confl. Peds. (#/hr)			1	1			4		1	1		4
Confl. Bikes (#/hr)			1			6			1			2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	157	505	0	17	634	0	0	58	0	134	109	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	10.0	39.4		9.6	39.0		41.0	41.0		41.0	41.0	
Total Split (%)	11.1%	43.8%		10.7%	43.3%		45.6%	45.6%		45.6%	45.6%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5			4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	38.6	37.6		34.2	29.0			11.7		11.7	11.7	
Actuated g/C Ratio	0.64	0.62		0.57	0.48			0.19		0.19	0.19	
v/c Ratio	0.40	0.44		0.03	0.75			0.18		0.53	0.29	
Control Delay	7.7	8.9		4.8	19.0			14.9		31.2	8.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay	7.7	8.9		4.8	19.0			14.9		31.2	8.3	
LOS	A	A		A	B			B		C	A	
Approach Delay		8.6			18.7			14.9			20.9	

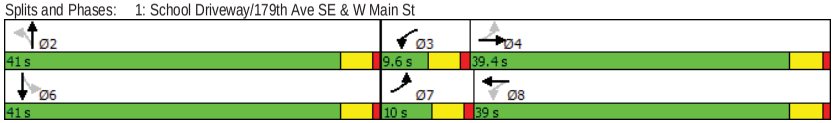
2017 Existing Conditions.syn
1: School Driveway/179th Ave SE & W Main St
Main Brook Townhomes (17-194)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS		A			B			B			C	
Queue Length 50th (ft)	18	71		2	163			9		46	2	
Queue Length 95th (ft)	46	230		9	326			37		98	38	
Internal Link Dist (ft)		480			345			444			286	
Turn Bay Length (ft)	100			100						50		
Base Capacity (vph)	396	1179		558	1026			967		814	984	
Starvation Cap Reductn	0	0		0	0			0		0	0	
Spillback Cap Reductn	0	0		0	0			0		0	0	
Storage Cap Reductn	0	0		0	0			0		0	0	
Reduced v/c Ratio	0.40	0.43		0.03	0.62			0.06		0.16	0.11	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 60.2
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 14.7 — Intersection LOS: B
Intersection Capacity Utilization 65.7% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: School Driveway/179th Ave SE & W Main St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	557	16	20	491	228	17	17	32	152	7	117
Future Volume (vph)	178	557	16	20	491	228	17	17	32	152	7	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	50		0
Storage Lanes	1		0	1		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		1.00	0.99			0.99		1.00	0.97	
Frt		0.996			0.952			0.934			0.859	
Flt Protected	0.950			0.950				0.987		0.950		
Satd. Flow (prot)	1736	1818	0	1736	1726	0	0	1664	0	1736	1520	0
Flt Permitted	0.136			0.403				0.909		0.796		
Satd. Flow (perm)	248	1818	0	736	1726	0	0	1530	0	1451	1520	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			38			34			126	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		560			425			524			366	
Travel Time (s)		12.7			9.7			11.9			8.3	
Confl. Peds. (#/hr)			1	1			4		1	1		4
Confl. Bikes (#/hr)			1			6			1			2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	191	616	0	22	773	0	0	70	0	163	134	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	14.5	55.9		9.6	51.0		24.5	24.5		24.5	24.5	
Total Split (%)	16.1%	62.1%		10.7%	56.7%		27.2%	27.2%		27.2%	27.2%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5			4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	51.2	48.0		42.0	36.7			14.0		14.0	14.0	
Actuated g/C Ratio	0.69	0.64		0.56	0.49			0.19		0.19	0.19	
v/c Ratio	0.52	0.53		0.05	0.89			0.22		0.60	0.35	
Control Delay	12.0	10.9		5.1	30.8			18.9		39.9	9.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay	12.0	10.9		5.1	30.8			18.9		39.9	9.6	
LOS	B	B		A	C			B		D	A	
Approach Delay		11.1			30.1			18.9			26.2	

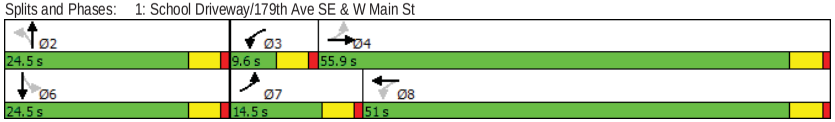
2027 Baseline Conditions.syn
1: School Driveway/179th Ave SE & W Main St
Main Brook Townhomes (17-194)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS		B			C			B			C	
Queue Length 50th (ft)	27	114		3	295			15		73	3	
Queue Length 95th (ft)	82	313		11	#589			51		145	49	
Internal Link Dist (ft)		480			345			444			286	
Turn Bay Length (ft)	100			100						50		
Base Capacity (vph)	379	1320		486	1140			454		407	517	
Starvation Cap Reductn	0	0		0	0			0		0	0	
Spillback Cap Reductn	0	0		0	0			0		0	0	
Storage Cap Reductn	0	0		0	0			0		0	0	
Reduced v/c Ratio	0.50	0.47		0.05	0.68			0.15		0.40	0.26	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 74.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 21.4 — Intersection LOS: C
Intersection Capacity Utilization 78.4% — ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: School Driveway/179th Ave SE & W Main St



Gibson Traffic Consultants, Inc. [SF]
2027 Baseline Conditions
PM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	562	16	21	496	230	17	17	32	154	7	117
Future Volume (vph)	178	562	16	21	496	230	17	17	32	154	7	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	50		0
Storage Lanes	1		0	1		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		1.00	0.99			0.99		1.00	0.97	
Frt		0.996			0.952			0.934			0.859	
Flt Protected	0.950			0.950				0.987		0.950		
Satd. Flow (prot)	1736	1818	0	1736	1726	0	0	1664	0	1736	1520	0
Flt Permitted	0.134			0.399				0.909		0.793		
Satd. Flow (perm)	245	1818	0	728	1726	0	0	1530	0	1446	1520	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			38			34			126	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		560			425			524			366	
Travel Time (s)		12.7			9.7			11.9			8.3	
Confl. Peds. (#/hr)			1	1			4		1	1		4
Confl. Bikes (#/hr)			1			6			1			2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	191	621	0	23	780	0	0	70	0	166	134	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	14.5	55.9		9.6	51.0		24.5	24.5		24.5	24.5	
Total Split (%)	16.1%	62.1%		10.7%	56.7%		27.2%	27.2%		27.2%	27.2%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5			4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	51.8	48.5		42.6	37.3			14.2		14.2	14.2	
Actuated g/C Ratio	0.69	0.64		0.56	0.49			0.19		0.19	0.19	
v/c Ratio	0.53	0.53		0.05	0.89			0.22		0.61	0.35	
Control Delay	12.3	11.0		5.1	31.2			19.0		40.5	9.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay	12.3	11.0		5.1	31.2			19.0		40.5	9.6	
LOS	B	B		A	C			B		D	A	
Approach Delay		11.3			30.5			19.0			26.7	

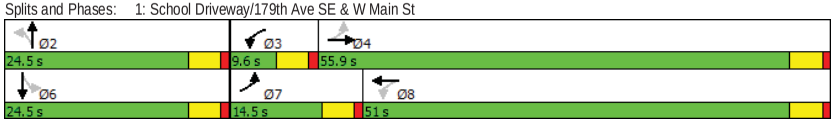
2027 Future with Development Conditions.syn
1: School Driveway/179th Ave SE & W Main St
Main Brook Townhomes (17-194)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS		B			C			B			C	
Queue Length 50th (ft)	27	118		3	304			15		77	3	
Queue Length 95th (ft)	83	316		11	#598			51		148	49	
Internal Link Dist (ft)		480			345			444			286	
Turn Bay Length (ft)	100			100						50		
Base Capacity (vph)	375	1317		483	1127			449		401	512	
Starvation Cap Reductn	0	0		0	0			0		0	0	
Spillback Cap Reductn	0	0		0	0			0		0	0	
Storage Cap Reductn	0	0		0	0			0		0	0	
Reduced v/c Ratio	0.51	0.47		0.05	0.69			0.16		0.41	0.26	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 75.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 21.7 — Intersection LOS: C
Intersection Capacity Utilization 78.8% — ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: School Driveway/179th Ave SE & W Main St



Gibson Traffic Consultants, Inc. [SF]
2027 Future with Development Conditions
PM Peak Hour

Collision Data

E

OFFICER REPORTED CRASHES THAT OCCURRED ON ALL ROADS IN THE CITY OF MONROE

01/01/2012 - 12/31/2016

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.

PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	A / B	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# BIKES	FIRST COLLISION TYPE / OBJECT STRUCK
W MAIN ST		179TH AVE SE		E160334	02/23/2012	10:42	Possible Injury	1	0	2	0	0	Entering at angle
W MAIN ST	17900	179TH AVE SE		E368142	10/19/2014	10:20	No Injury	0	0	2	0	0	From opposite direction - one left turn - one straight
W MAIN ST	17900	179TH AVE SE		E476532	10/01/2015	14:25	No Injury	0	0	2	0	0	Entering at angle
W MAIN ST	17900	179TH AVE SE		E503321	01/07/2016	16:14	Possible Injury	1	0	2	0	0	From same direction - both going straight - one stopped - rear-end
W MAIN ST	17900	179TH AVE SE		E577186	08/22/2016	14:53	Possible Injury	1	0	2	0	0	From same direction - both going straight - one stopped - rear-end