

Gibson Traffic Consultants, Inc.  
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# 10<sup>th</sup> Street Residences Development Traffic Impact Analysis

**Jurisdiction: City of Snohomish**

**January 2020**



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## 1. DEVELOPMENT IDENTIFICATION

Gibson Traffic Consultants, Inc. (GTC) has been retained to provide a revised traffic impact analysis for the proposed 10<sup>th</sup> Street Residences development. The initial traffic impact analysis for the 26 apartment unit application were documented in the September 2018 report. The site is now proposed to include 28 apartment units and this report documents the impacts with the two additional units. 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 10<sup>th</sup> Street Residences development is located on the south side of 10<sup>th</sup> Street just east of Avenue D. The development is proposed to consist of 28 apartment units. The proposed residential development is expected to be fully constructed and occupied by the end of 2020. However, the year 2024 has been utilized for the future analysis in this report to represent a conservative 6-year horizon period. The site is proposed to have one access to 10<sup>th</sup> Street near the east edge of the property that will align with the single-family driveway on the north side of 10<sup>th</sup> Street. A site vicinity map has been included in Figure 1.

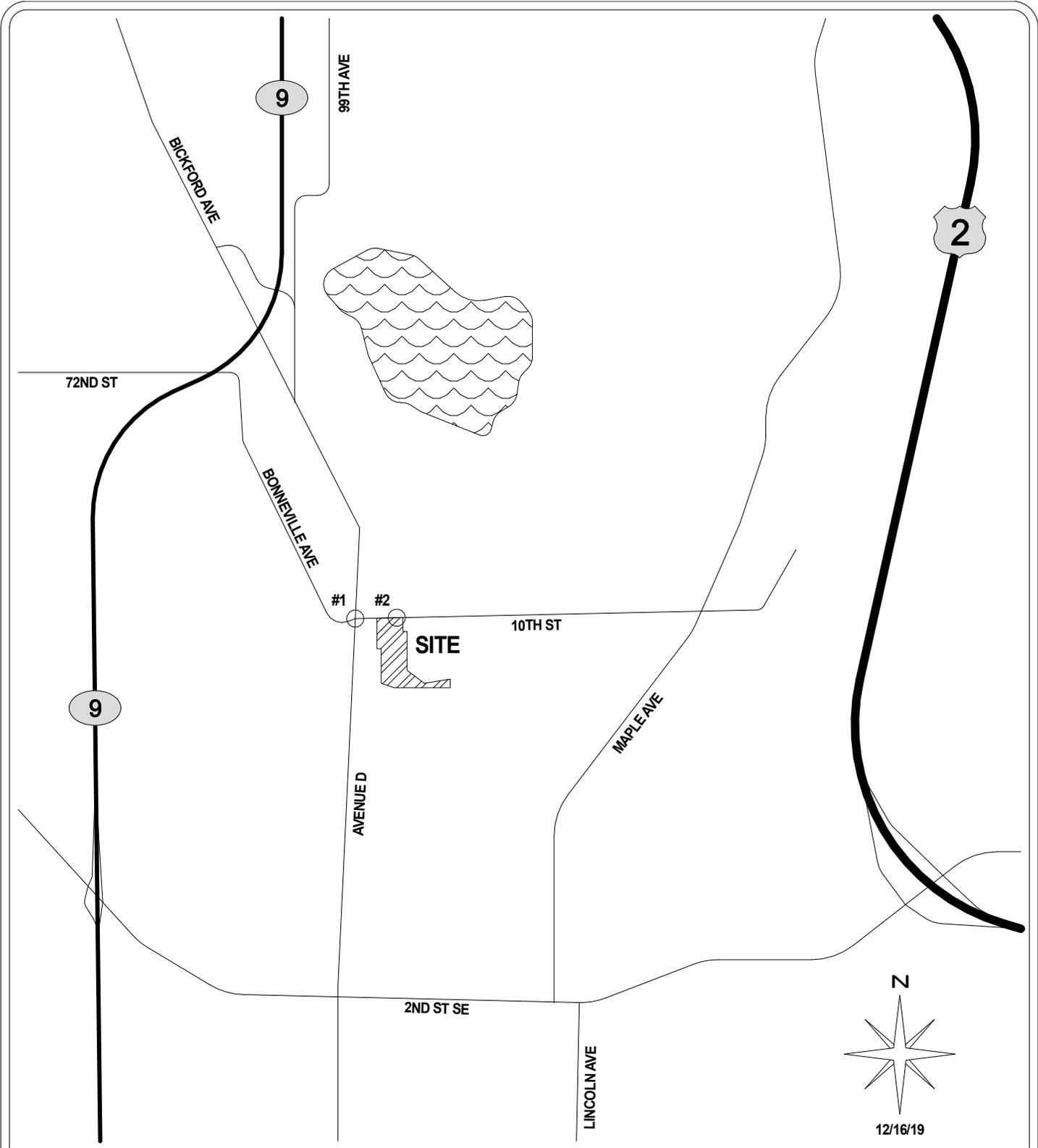
## 2. METHODOLOGY

Data contained in the Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 10<sup>th</sup> Edition (2017)* has been used for the proposed use. The distribution of trips generated by the site is based on previously approved distributions for developments within the City of Snohomish and intersection turning movement counts.

According to guidelines for traffic studies in the City of Snohomish, this traffic study contains the following elements:

- Crash Analysis
- Trip generation
- Trip distribution
- Level of service analysis
- Mitigation determination

The level of service analysis was completed for the intersection of Avenue D at 10<sup>th</sup> Street since it is the nearest main intersection and impacted by the majority of the trips from the development.



**GIBSON TRAFFIC CONSULTANTS**

**TRAFFIC IMPACT STUDY  
GTC #18-229**

**10TH STREET RESIDENCES  
28 UNITS**

**LEGEND**



**SITE LOCATION**



**STUDY INTERSECTION**

**FIGURE 1  
SITE VICINITY MAP**

**CITY OF SNOHOMISH**

The peak-hour level of service (LOS) analysis calculations were completed using the *Synchro 10.2, Build 0* software. This software applies the operational analysis methodology of the current *Highway Capacity Manual (HCM)*. Traffic congestion is generally measured in terms of level of service. In accordance with the 2010 HCM, 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 criteria is summarized in Table 1. The level of service at two-way stop-controlled intersections is based on the average delay of the worst approach. The level of service at signalized and all-way stop-controlled intersections is based on the average delay for all approaches. Geometric characteristics and conflicting traffic movements are taken into consideration when determining level of service values.

**Table 1: Level of Service Criteria for Intersections**

Level of <sup>1</sup> Service	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 <sup>2</sup>	>50	>80

The acceptable level of service for intersections within the City of Snohomish is LOS E.

Intersection analysis was completed for the intersection of Avenue D at 10<sup>th</sup> Street, a signalized intersection, based on the proximity to the development and the majority of the trips from the development impacting the intersection. The analysis has been performed for the 2018 existing conditions, 2024 baseline conditions, and 2024 future with development conditions during the PM peak-hour. The site access to 10<sup>th</sup> Street has also been analyzed for the 2024 future with development conditions only.

<sup>1</sup> **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.

<sup>2</sup> 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. CRASH ANALYSIS

GTC obtained crash data from WSDOT for the study intersection from January 1, 2013 through June 30, 2018, approximate to the latest data available. There were 31 total reported crashes in the time period requested, or approximately 5.6 crashes per year. The crash type and crash rate at the intersection is summarized in Table 2.

**Table 2: Crash Summary – Avenue D at 10<sup>th</sup> Street**

Crash Type				Total Crashes	Annual Rate (5.5 yrs)	Daily <sup>3</sup> Trips	Crash Rate per MEV <sup>4</sup>
Rear-End	At Angle	Pedestrian	Other				
14	10	2	5	31	5.6	17,860	0.85

The crash data did not identify any fatalities, including the pedestrian related crashes. Typically crashes rates below 10 crashes per year and/or 2 crashes per MEV at signalized intersections are considered acceptable. The crash rates at the intersection of Avenue D at 10<sup>th</sup> Street and the lack of fatalities are within typical ranges for signalized intersections and therefore additional crash analysis should not be required.

### 4. TRIP GENERATION

The trip generation calculations for the 10<sup>th</sup> Street Residences development are based on the average trip generation rates for Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10<sup>th</sup> Edition (2017)*. ITE Land Use Code 220, Multifamily Housing (Low Rise), has been utilized for the proposed apartment units. The trip generation of the 10<sup>th</sup> Street Residences development is summarized in Table 3.

**Table 3: Trip Generation Summary**

Use	Units	Average Daily Trips	AM Peak-Hour Trips			PM Peak-Hour Trips		
			Inbound	Outbound	Total	Inbound	Outbound	Total
Multifamily Housing	28	205	3	10	13	10	6	16

The 28 units of the 10<sup>th</sup> Street Residences development are anticipated to generate 205 new average daily trips with 13 new AM peak-hour trips and 16 new PM peak-hour trips. The trip generation calculations are included in the attachments.

<sup>3</sup> The daily trips is based on the typical ratio of 10:1 for daily:PM trips.

<sup>4</sup> MEV – Million Entering Vehicles

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## 5. TRIP DISTRIBUTION

Trip distribution and traffic assignment for the proposed residential development is based on PM peak-hour intersection count performed for the intersection of Avenue D at 10<sup>th</sup> Street and surrounding uses as well as previously approved distributions in the City of Snohomish. It is estimated that 75% of trips generated by the site will travel along Avenue D, forty-five percent to and from the south and thirty percent to and from the north. The remaining 25% of the trips generated by the site will travel to and from the east along 10<sup>th</sup> Street. A detailed trip distribution showing the AM peak-hour trips and the PM peak-hour trips is included in Figure 2.

## 6. INTERSECTION LEVEL OF SERVICE ANALYSIS

The level of service analysis for the intersection of Avenue D at 10<sup>th</sup> Street has been performed using the *Synchro 10.2 Build 0* software. The analysis uses the existing channelization at the study intersection as well as the existing peak-hour factors and heavy-vehicle factors. The 2024 baseline and 2024 future with development level of service analysis has been performed using the same parameters.

### 6.1 Turning Movement Volumes

#### 6.1.1. 2018 Existing Turning Movements

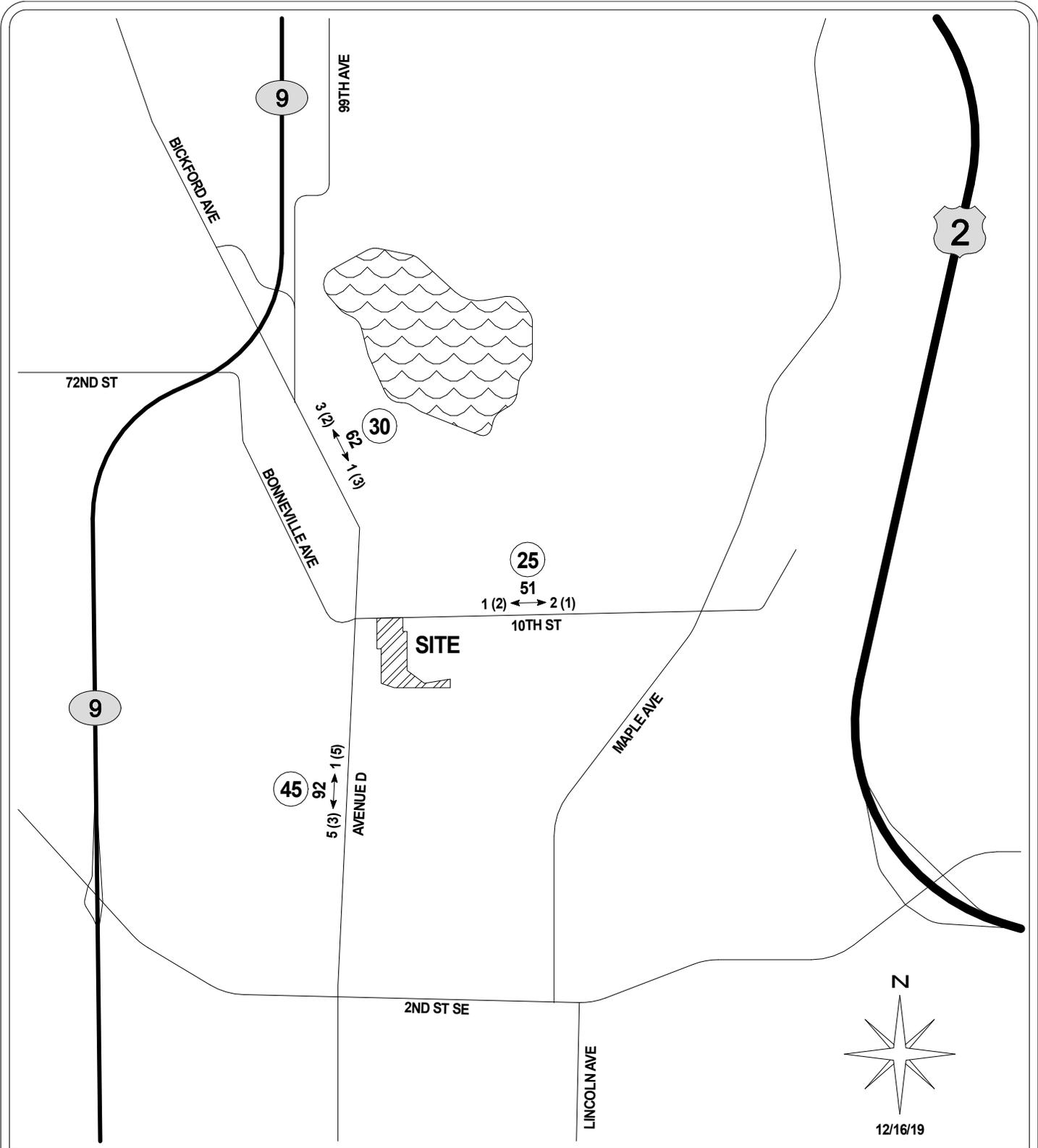
The 2018 existing count data was collected by the independent counting firm Traffic Data Gathering (TDG) on Wednesday, August 22, 2018 for the PM peak-hour. The existing turning movement volumes at the study intersection are shown in Figure 3 for the PM peak-hour. Also, the count data is included in the attachments.

#### 6.1.2. 2024 Baseline Turning Movements

The 2024 baseline turning movements have been calculated by applying a 2% annually compounding growth rate to the existing turning movements. The 2024 baseline turning movements at the study intersection are shown in Figure 4 PM peak-hour.

#### 6.1.3. 2024 Future with Development Turning Movements

The 2024 future with development turning movements have been calculated by adding the new trips generated by the development to the 2024 baseline turning movements. The volumes at the site access are based on the adjacent study intersection of Avenue D at 10<sup>th</sup> Street. The 2024 future with development turning movements are shown in Figure 5 for the PM peak-hour.



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**TRAFFIC IMPACT STUDY  
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**10TH STREET RESIDENCES  
28 UNITS**

**LEGEND**  
AWDT  
AM (PM) ←→ PEAK

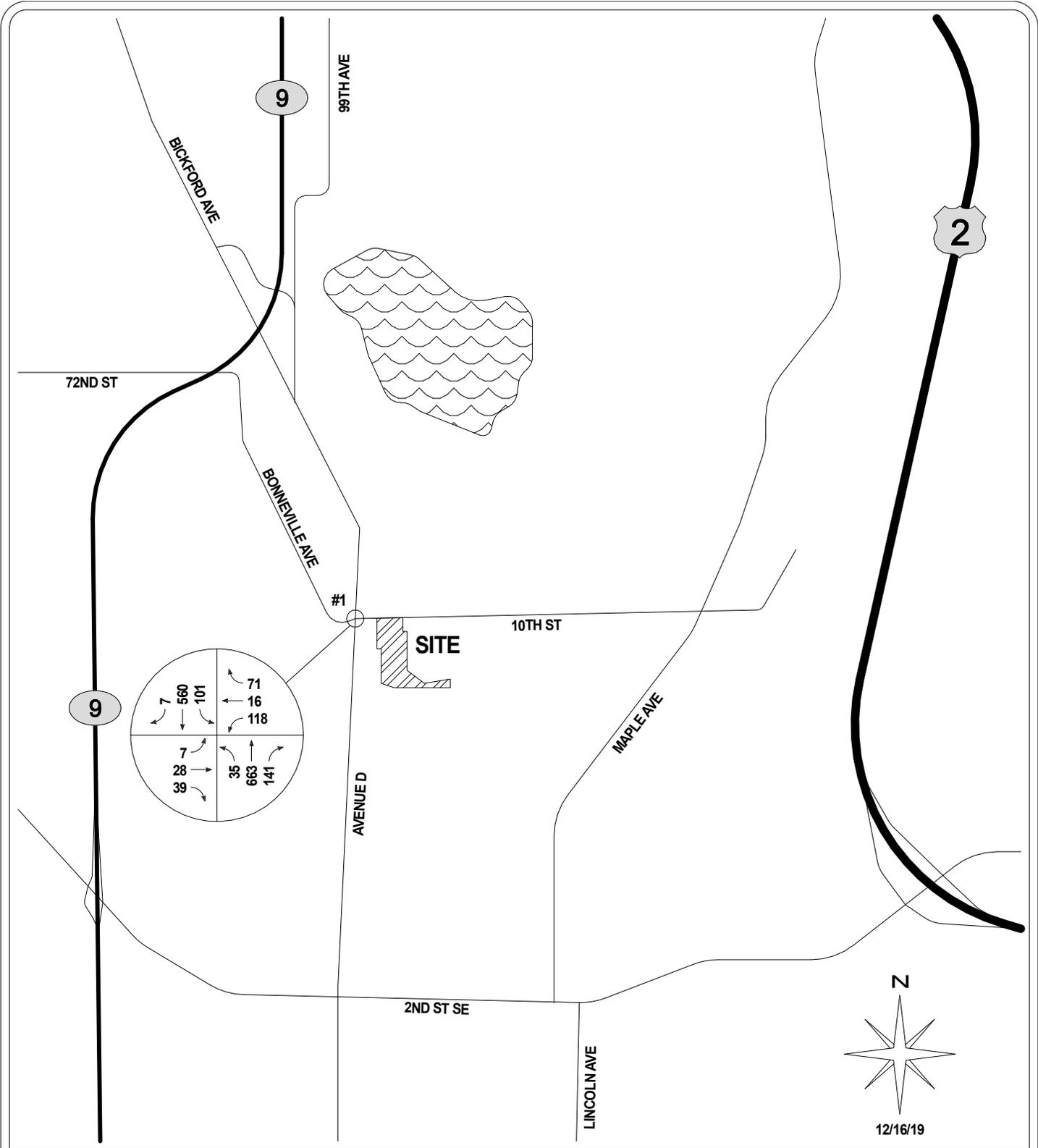
NEW DAILY TRAFFIC  
NEW AM (PM) PEAK-HOUR TRIPS



TRIP DISTRIBUTION %

**FIGURE 2  
DEVELOPMENT  
TRIP DISTRIBUTION**

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GTC #18-229**

**10TH STREET RESIDENCES  
28 UNITS**

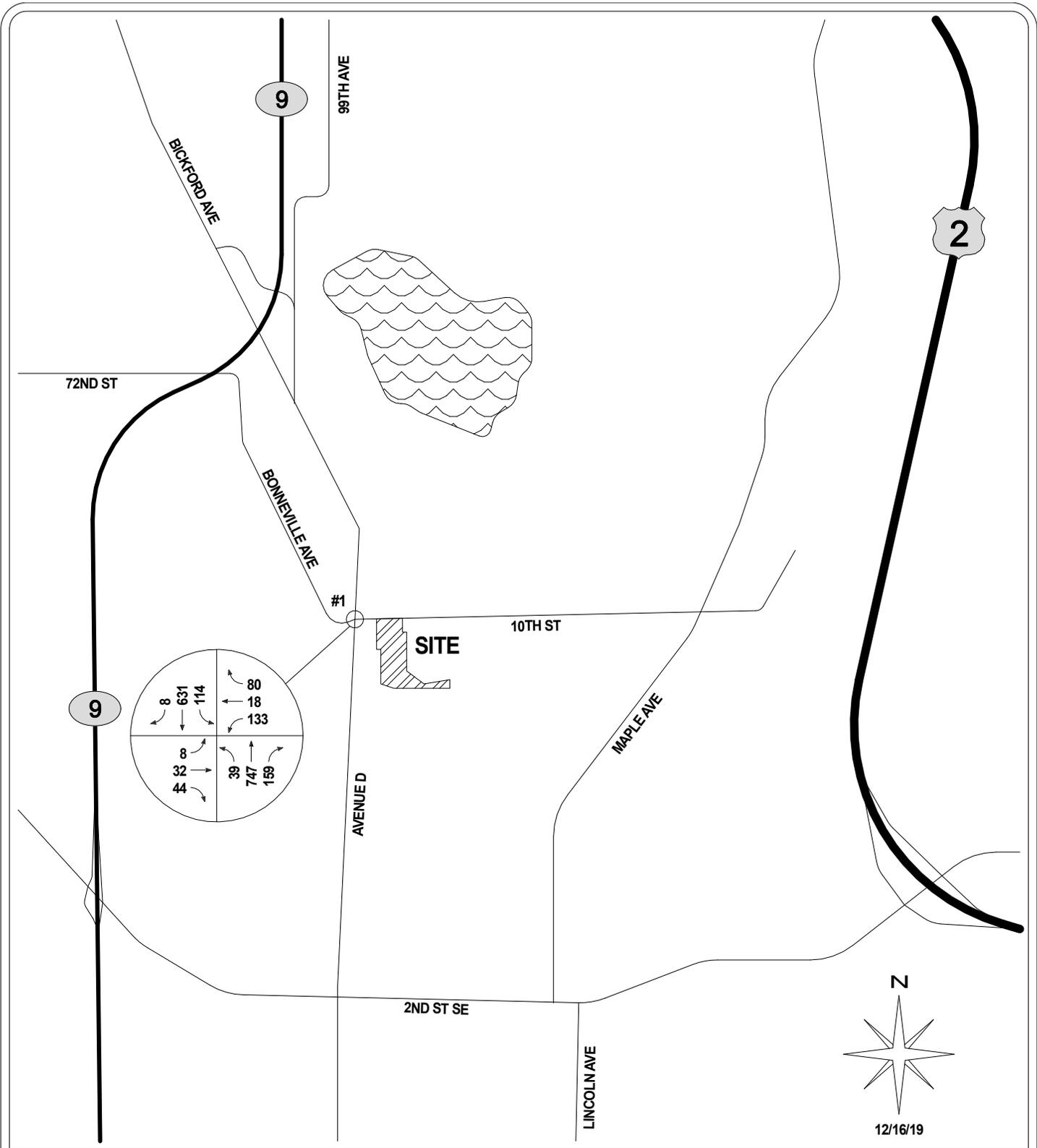
**LEGEND**

xxx →

PM PEAK-HOUR  
TURNING MOVEMENT VOLUMES

**FIGURE 3  
2018 EXISTING  
TURNING MOVEMENTS**

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**TRAFFIC IMPACT STUDY  
GTC #18-229**

**10TH STREET RESIDENCES  
28 UNITS**

**LEGEND**

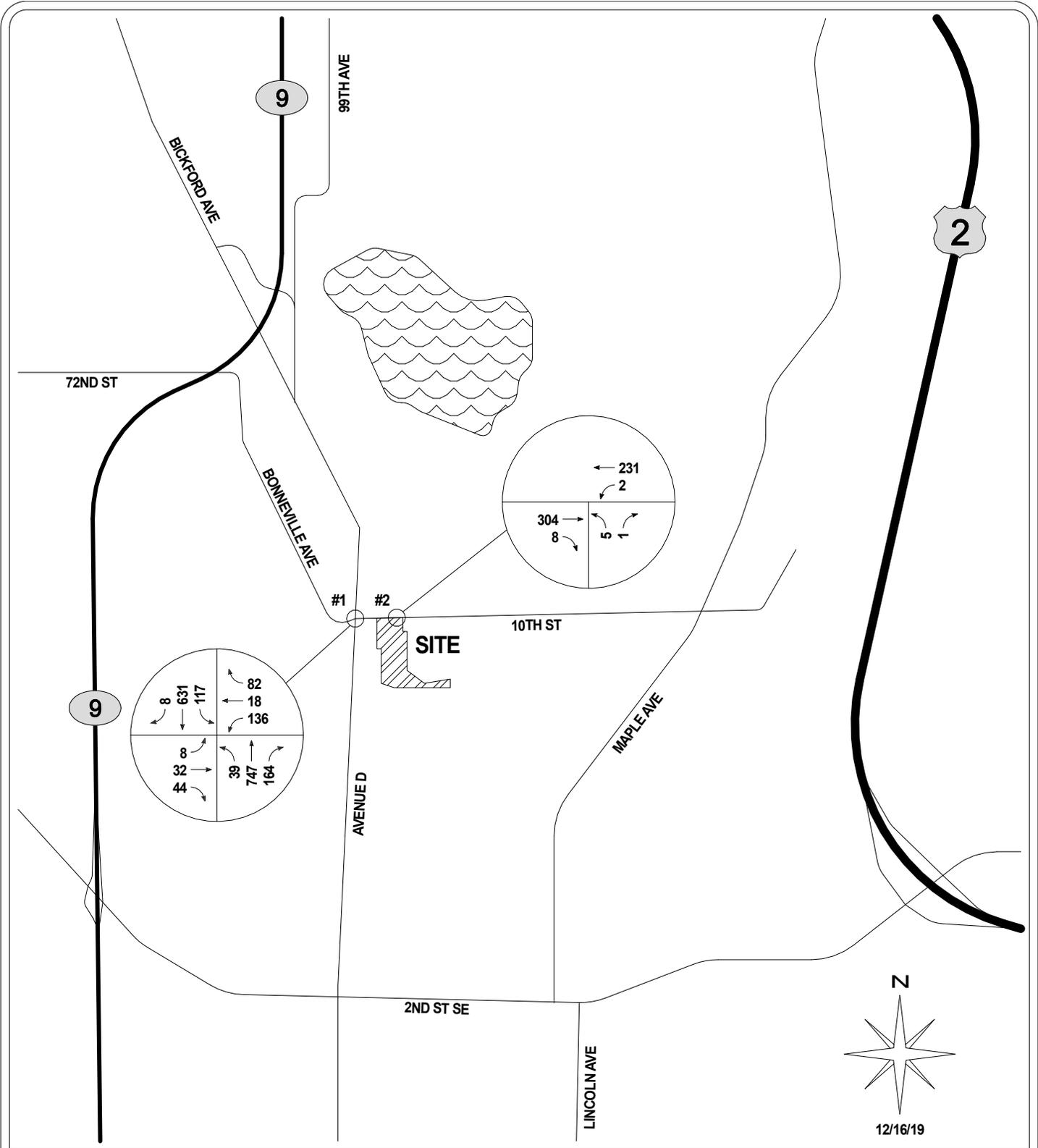
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PM PEAK-HOUR  
TURNING MOVEMENT VOLUMES

**FIGURE 4**

**2024 BASELINE  
TURNING MOVEMENTS**

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12/16/19

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GTC #18-229**

**10TH STREET RESIDENCES  
28 UNITS**

**LEGEND**

xxx →

PM PEAK-HOUR  
TURNING MOVEMENT VOLUMES

**FIGURE 5**

**2024 FUTURE  
WITH DEVELOPMENT  
TURNING MOVEMENTS**

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## 6.2 Intersection Level of Service Analysis Summary

The PM Peak-hour level of service analysis for the 2018 existing, 2024 baseline, and 2024 future with development conditions for the intersection of Avenue D at 10<sup>th</sup> Street is summarized in Table 4.

**Table 4: Intersection Level of Service Summary – PM Peak-hour**

Intersection	2018 Existing Conditions		2024 Baseline Conditions		2024 Future w/ Development Conditions	
	LOS	Delay	LOS	Delay	LOS	Delay
1. Avenue D at 10 <sup>th</sup> Street	B	17.0 sec	C	24.0 sec	C	25.0 sec
2. Site Access at 10 <sup>th</sup> Street	---	---	---	---	B	12.3 sec

The level of service analysis shows that the development is not anticipated to change the level of service of the off-site study intersection compared to 2024 baseline conditions and the intersection will continue to operate at acceptable LOS C with the development.

## 7. TRAFFIC MITIGATION FEES

### 7.1 Development-Specific Off-Site Mitigation

The development will not cause the level of service of the impacted off-site intersection to drop below the City of Snohomish's LOS E threshold during the PM peak-hour. The development should therefore not have to construct or contribute additional improvements other than required site frontage improvements and standard traffic mitigation fees.

### 7.2 City Mitigation Fee

The City of Snohomish traffic mitigation fee is \$1,603.00 per PM peak-hour trip. The 10<sup>th</sup> Street Residences development is anticipated to generate 16 new PM peak-hour trips. The trip generation will result in City of Snohomish traffic mitigation fees of \$25,648.00.

## 8. CONCLUSIONS

The 10<sup>th</sup> Street Residences development is proposed to consist of 28 apartment units. The 10<sup>th</sup> Street Residences development will generate 205 new average daily trips with 13 new AM peak-hour trips and 16 new PM peak-hour trips. Level of service analysis was conducted at the intersection of Avenue D at 10<sup>th</sup> Street, which is anticipated to operate at acceptable LOS C with the development in the horizon year. The total traffic mitigation fees for the development will be \$25,648.00, which is equivalent to \$916.00 for unit for each of the 28 apartment units.

# Crash Data

OFFICER REPORTED CRASHES THAT OCCURRED *at OR within 500 feet each direction of* THE FOLLOWING INTERSECTION IN THE CITY OF SNOHOMISH

**01/01/2013 - 06/30/2018**

*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.*

JURISDICTION	PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	REPORT NUMBER	DATE	TIME	# J	# T	# H	# S	# P I K E S	FIRST COLLISION TYPE / OBJECT STRUCK
City Street	10TH ST	1200		71	F	E	AVE D	E768360	02/01/2018	16:40	0	0	2	0	0	From opposite direction - all others
City Street	AVENUE D	1000	10TH ST					3109060	06/04/2013	12:46	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	1000	10TH ST					3137804	03/25/2013	13:41	0	0	2	0	0	Entering at angle
City Street	AVENUE D	1000	10TH ST					3478545	01/24/2015	12:06	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	1000	10TH ST					3607379	03/08/2014	04:15	0	0	2	0	0	From opposite direction - both moving - head-on
City Street	AVENUE D	1000	10TH ST					E526846	03/21/2016	12:49	1	0	2	0	0	From same direction - both going straight - both moving - rear-end
City Street	AVENUE D	1000	10TH ST					E547205	05/10/2016	19:40	0	0	2	0	0	Entering at angle
City Street	AVENUE D	1000	10TH ST					E577862	08/20/2016	00:12	1	0	1	0	0	Tree or Stump (stationary)
City Street	AVENUE D		BONNEVILLE AVE					3137849	03/13/2013	16:58	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	1000	BONNEVILLE AVE					E333694	06/10/2014	17:35	0	0	2	0	0	Entering at angle
City Street	AVENUE D	1000	BONNEVILLE AVE					E421169	04/24/2015	23:17	1	0	2	0	0	Entering at angle
City Street	AVENUE D	900		200	F	S	10TH ST	3119184	05/15/2014	14:20	1	0	3	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	900		200	F	S	10TH ST	3119207	04/15/2014	07:49	0	0	2	0	0	Entering at angle
City Street	AVENUE D			500	F	N	10TH ST	3119214	04/27/2014	11:40	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	800		0.09	M	S	10TH ST	3119288	10/15/2015	15:27	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	900		100	F	S	10TH ST	E342477	07/18/2014	16:25	2	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	1000		197	F	N	10TH ST	E494027	11/29/2015	17:39	0	0	2	0	0	From same direction - all others
City Street	AVENUE D	800		390	F	S	10TH ST	E547150	05/21/2016	12:54	1	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	800		478	F	S	10TH ST	E621270	12/02/2016	14:00	0	0	2	0	0	Entering at angle
City Street	AVENUE D	1100		452	F	N	10TH ST	E629140	01/05/2017	15:53	0	0	2	0	0	Entering at angle
City Street	AVENUE D	1000		75	F	N	10TH ST	E633197	01/14/2017	11:15	0	0	2	0	0	From same direction - both going straight - both moving - rear-end
City Street	AVENUE D	800		0.09	M	S	10TH ST	E647877	03/03/2017	12:28	1	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	900		300	F	S	10TH ST	E659472	04/07/2017	17:10	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	1000		259	F	N	10TH ST	E674159	05/23/2017	12:27	4	0	5	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	900		264	F	S	10TH ST	E697920	08/03/2017	09:56	0	0	2	0	0	Entering at angle
City Street	AVENUE D	800		384	F	S	10TH ST	E705639	08/28/2017	10:54	1	0	1	1	0	Vehicle turning right hits pedestrian
City Street	AVENUE D	800		333	F	S	10TH ST	E745041	12/08/2017	08:49	0	0	2	0	0	From same direction - both going straight - both moving - sideswipe
City Street	AVENUE D	900		300	F	S	10TH ST	E760116	12/23/2017	12:51	0	0	2	0	0	From same direction - both going straight - one stopped - rear-end
City Street	AVENUE D	900		200	F	S	10TH ST	E768741	02/03/2018	17:55	0	0	2	0	0	From opposite direction - one left turn - one straight
City Street	BONNEVILLE AVE	900	AVENUE D					E558490	06/28/2016	14:06	1	0	1	1	0	Vehicle turning left hits pedestrian
City Street	BONNEVILLE AVE	900				E	AVENUE D	2948597	02/13/2015	16:39	0	0	2	0	0	From opposite direction - one left turn - one straight

# **Trip Generation Calculations**

10th Street Residences  
 GTC #18-229

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

LAND USES	VARIABLE	ITE LU code	Gross Trips				Internal Crossover		NET EXTERNAL TRIPS BY TYPE								
			Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	Trips In+Out (Total)	IN BOTH DIRECTIONS		DIRECTIONAL ASSIGNMENTS						
									TOTAL	PASS-BY	DIVERTED LINK	NEW	PASS-BY	DIVERTED LINK	NEW		
									% of Ext. Trips	In+Out (Total)	In	Out		% of Ext. Trips	In+Out (Total)	In	Out
Multifamily Housing (Low Rise)	28 units	220	7.32	50%	50%	205	0%	0	0%	0	0	0	0	0%	205	0	0
<b>Totals</b>						205	0	0		0	0	0	0		205	0	0



10th Street Residences  
 GTC #18-229

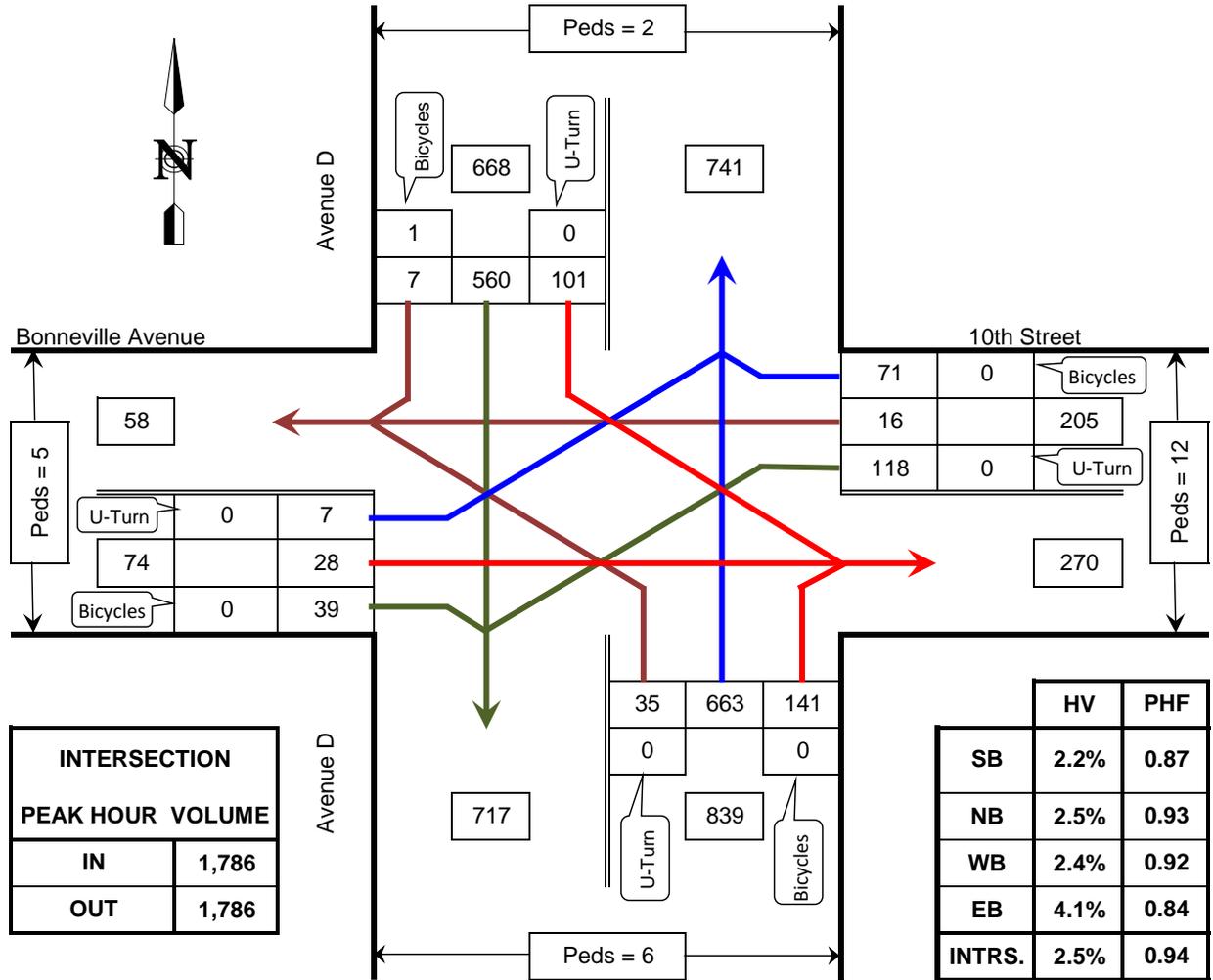
**Trip Generation for: Weekday, Peak Hour of Adjacent Street Traffic, One Hour between 4 and 6 PM  
 (a.k.a.): Weekday PM Peak Hour**

LAND USES	VARIABLE	ITE LU code	Trip Rate	Gross Trips			Internal Crossover		NET EXTERNAL TRIPS BY TYPE								
				% IN	% OUT	In+Out (Total)	% of Gross Trips	Trips In+Out (Total)	IN BOTH DIRECTIONS		DIRECTIONAL ASSIGNMENTS						
									TOTAL In+Out (Total)	PASS-BY % of Ext. Trips	In+Out (Total)	% of Ext. Trips	DIVERTED LINK	NEW In+Out (Total)	PASS-BY In Out	DIVERTED LINK In Out	NEW In Out
Multifamily Housing (Low Rise)	28 units	220	0.56	63%	37%	16	0%	0	0%	0	16	0	0	0	0	10	6
<b>Totals</b>						16	0	0	0	16	16	0	0	0	0	10	6

# **Count Data and Turning Movement Calculations**

**TURNING MOVEMENTS DIAGRAM**

4:00 PM - 6:00 PM PEAK HOUR: 4:45 PM TO 5:45 PM



PHF = Peak Hour Factor  
HV = Heavy Vehicle

**Avenue D @ 10th Street/Bonneville Avenue**

**Snohomish, WA**

COUNTED BY: TDG

DATE OF COUNT: Wed. 8/22/18

REDUCTION DATE: Thu. 8/23/18

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

# 1 Ave D at 10th St

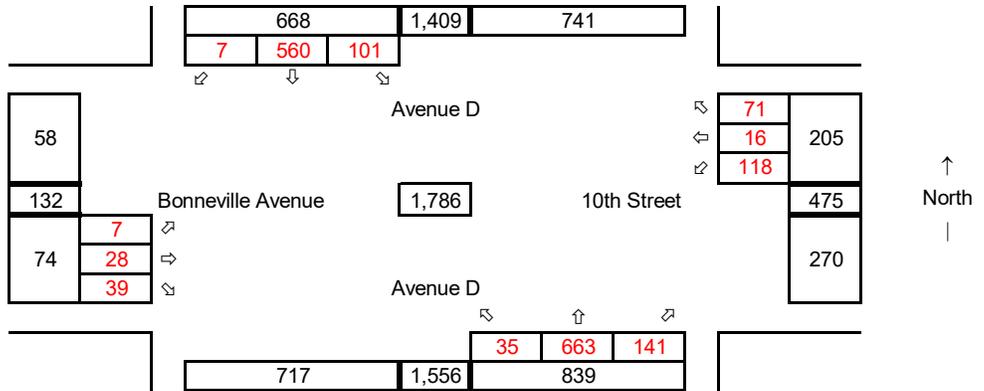
Synchro ID: 1

**Existing**

Average Weekday  
PM Peak-Hour

Year: 8/22/2018

Data Source: TDG



**Baseline**

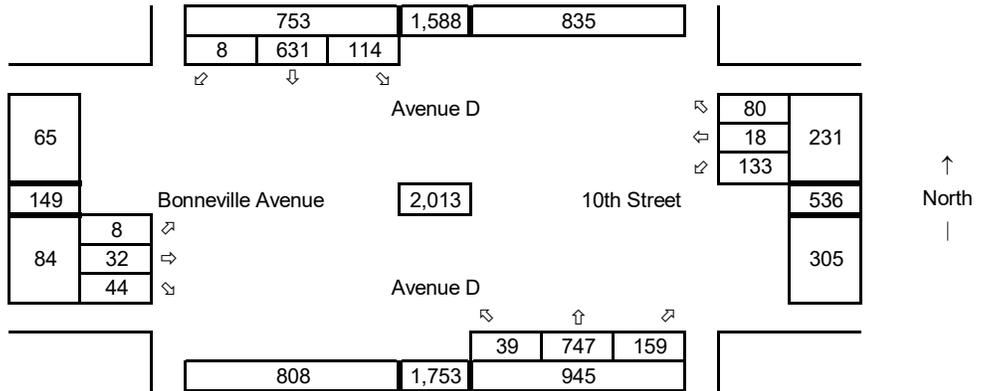
Average Weekday  
PM Peak-Hour

Year: 2024

Growth Rate = 2.0%

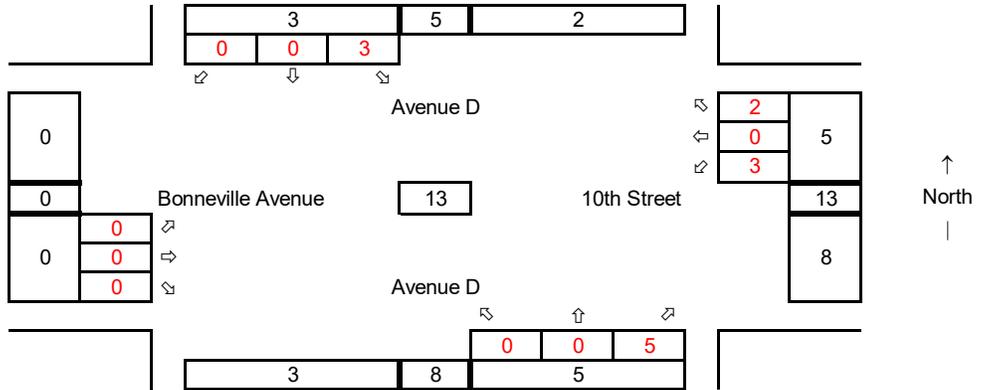
Years of Growth = 6

Total Growth = 1.1262



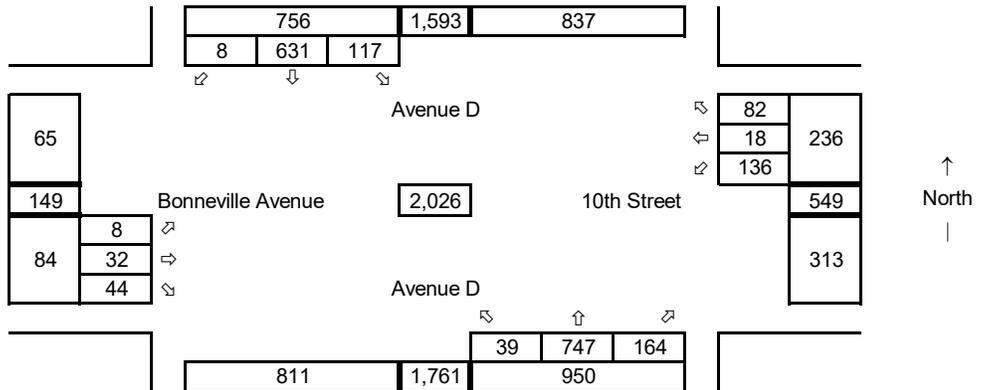
**Development Trips**

Average Weekday  
PM Peak-Hour



**Future with Development**

Average Weekday  
PM Peak-Hour



## 2 Site at 10th St

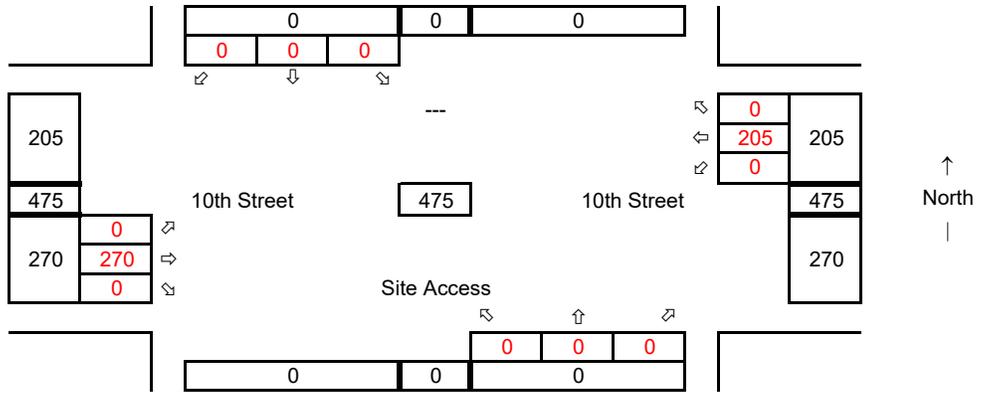
Synchro ID: 2

### Existing

Average Weekday  
PM Peak-Hour

Year: 8/22/2018

Data Source: TDG



### Baseline

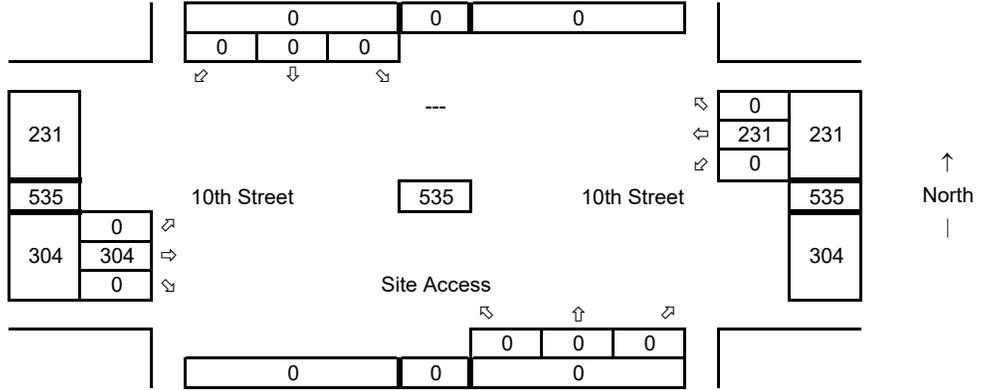
Average Weekday  
PM Peak-Hour

Year: 2024

Growth Rate = 2.0%

Years of Growth = 6

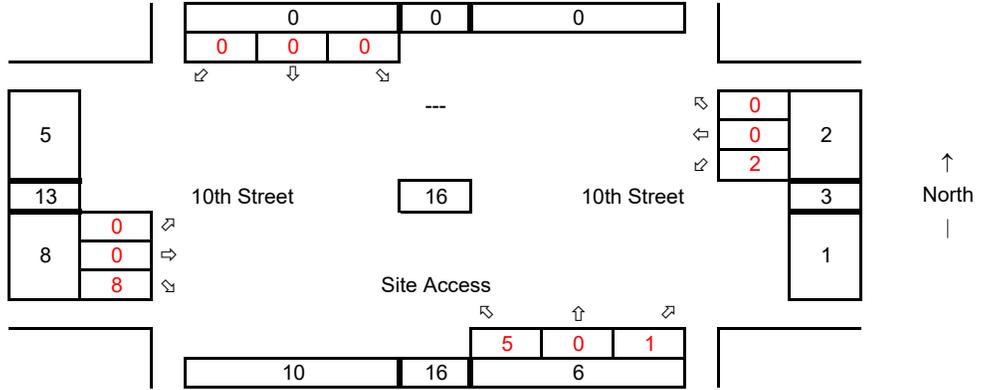
Total Growth = 1.1262



### Development Trips

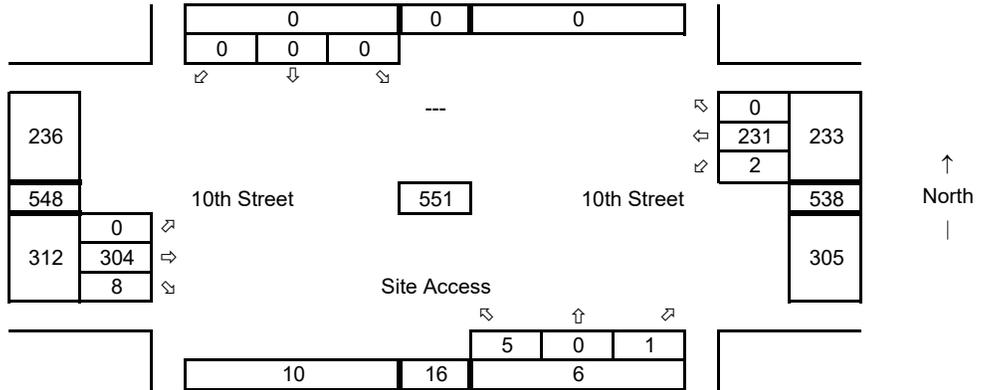
Average Weekday  
PM Peak-Hour

ACCOUNTS FOR THE  
GROSS



### Future with Development

Average Weekday  
PM Peak-Hour



# **Level of Service Calculations**



Lanes, Volumes, Timings  
1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	28	39	118	16	71	35	663	141	101	560	7
Future Volume (vph)	7	28	39	118	16	71	35	663	141	101	560	7
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	75		0	100		0	175		0
Storage Lanes	0		0	1		0	1		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
Frt		0.929			0.877			0.974			0.998	
Flt Protected		0.996		0.950			0.950			0.950		
Satd. Flow (prot)	0	1707	0	1752	1618	0	1752	1797	0	1752	1841	0
Flt Permitted		0.972		0.767			0.372			0.180		
Satd. Flow (perm)	0	1666	0	1415	1618	0	686	1797	0	332	1841	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41			76			14			1	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1044			1181			698			797	
Travel Time (s)		23.7			26.8			13.6			15.5	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	78	0	126	93	0	37	855	0	107	603	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		3.0	10.0		3.0	10.0	
Minimum Split (s)	23.0	23.0		24.0	24.0		9.5	24.0		9.5	24.0	
Total Split (s)	30.0	30.0		30.0	30.0		19.5	55.0		19.5	55.0	
Total Split (%)	28.7%	28.7%		28.7%	28.7%		18.7%	52.6%		18.7%	52.6%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	
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)		5.0		5.0	5.0		4.5	5.0		4.5	5.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effect Green (s)		12.7		12.7	12.7		57.5	52.8		60.8	56.0	
Actuated g/C Ratio		0.15		0.15	0.15		0.68	0.62		0.72	0.66	
v/c Ratio		0.27		0.59	0.30		0.07	0.76		0.31	0.49	
Control Delay		20.0		45.2	13.4		4.4	19.4		6.2	10.7	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		20.0		45.2	13.4		4.4	19.4		6.2	10.7	
LOS		B		D	B		A	B		A	B	
Approach Delay		20.0			31.7			18.8			10.0	
Approach LOS		B			C			B			B	
Queue Length 50th (ft)		17		62	8		4	299		13	162	
Queue Length 95th (ft)		56		121	49		15	#684		34	309	

Lanes, Volumes, Timings  
 1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

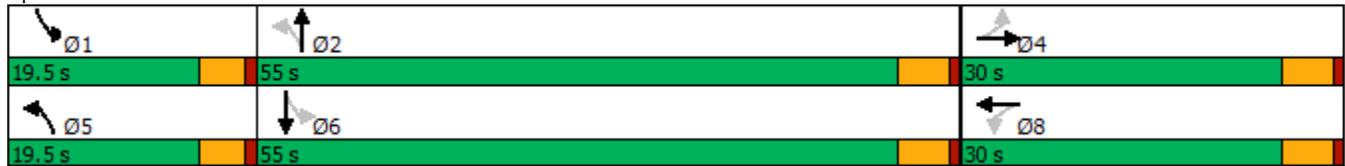
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		964			1101			618			717	
Turn Bay Length (ft)				75			100			175		
Base Capacity (vph)		523		420	534		695	1128		497	1220	
Starvation Cap Reductn		0		0	0		0	0		0	0	
Spillback Cap Reductn		0		0	0		0	0		0	0	
Storage Cap Reductn		0		0	0		0	0		0	0	
Reduced v/c Ratio		0.15		0.30	0.17		0.05	0.76		0.22	0.49	

Intersection Summary

Area Type: Other  
 Cycle Length: 104.5  
 Actuated Cycle Length: 84.5  
 Natural Cycle: 80  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.76  
 Intersection Signal Delay: 17.0  
 Intersection Capacity Utilization 74.3%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Intersection LOS: B  
 ICU Level of Service D

Splits and Phases: 1: Avenue D & Bonneville Avenue/10th Street



# Lanes, Volumes, Timings

## 1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	32	44	133	18	80	39	747	159	114	631	8
Future Volume (vph)	8	32	44	133	18	80	39	747	159	114	631	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	75		0	100		0	175		0
Storage Lanes	0		0	1		0	1		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
Frt		0.929			0.877			0.974			0.998	
Flt Protected		0.995		0.950			0.950			0.950		
Satd. Flow (prot)	0	1705	0	1752	1618	0	1752	1797	0	1752	1841	0
Flt Permitted		0.968		0.720			0.324			0.090		
Satd. Flow (perm)	0	1659	0	1328	1618	0	598	1797	0	166	1841	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		47			85			14			1	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1044			1181			698			797	
Travel Time (s)		23.7			26.8			13.6			15.5	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	90	0	141	104	0	41	964	0	121	680	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		3.0	10.0		3.0	10.0	
Minimum Split (s)	23.0	23.0		24.0	24.0		9.5	24.0		9.5	24.0	
Total Split (s)	30.0	30.0		30.0	30.0		19.5	55.0		19.5	55.0	
Total Split (%)	28.7%	28.7%		28.7%	28.7%		18.7%	52.6%		18.7%	52.6%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	
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)		5.0		5.0	5.0		4.5	5.0		4.5	5.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effect Green (s)		14.2		14.2	14.2		56.0	50.3		61.2	56.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.65	0.58		0.71	0.65	
v/c Ratio		0.29		0.65	0.31		0.09	0.91		0.49	0.57	
Control Delay		19.6		47.8	12.7		5.1	32.2		13.9	12.8	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		19.6		47.8	12.7		5.1	32.2		13.9	12.8	
LOS		B		D	B		A	C		B	B	
Approach Delay		19.6			32.9			31.0			13.0	
Approach LOS		B			C			C			B	
Queue Length 50th (ft)		20		71	9		5	409		16	206	
Queue Length 95th (ft)		62		137	51		18	#887		60	399	

2024 Baseline Conditions

Gibson Traffic Consultants, Inc. [BJL 18-229]

PM Peak-Hour

Lanes, Volumes, Timings

1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

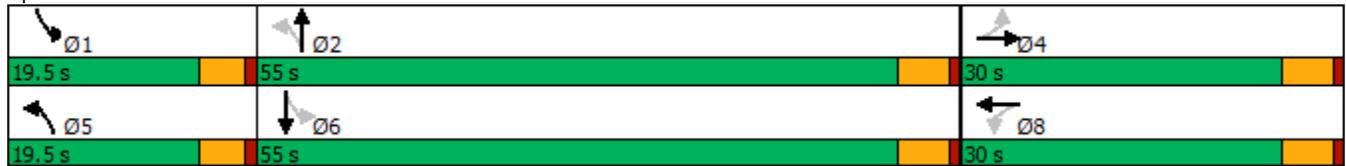
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		964			1101			618			717	
Turn Bay Length (ft)				75			100			175		
Base Capacity (vph)		518		388	533		635	1057		398	1199	
Starvation Cap Reductn		0		0	0		0	0		0	0	
Spillback Cap Reductn		0		0	0		0	0		0	0	
Storage Cap Reductn		0		0	0		0	0		0	0	
Reduced v/c Ratio		0.17		0.36	0.20		0.06	0.91		0.30	0.57	

Intersection Summary

Area Type: Other  
 Cycle Length: 104.5  
 Actuated Cycle Length: 86  
 Natural Cycle: 90  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.91  
 Intersection Signal Delay: 24.0  
 Intersection Capacity Utilization 81.4%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Intersection LOS: C  
 ICU Level of Service D

Splits and Phases: 1: Avenue D & Bonneville Avenue/10th Street



Lanes, Volumes, Timings  
 1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	32	44	136	18	82	39	747	164	117	631	8
Future Volume (vph)	8	32	44	136	18	82	39	747	164	117	631	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	75		0	100		0	175		0
Storage Lanes	0		0	1		0	1		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
Frt		0.929			0.877			0.973			0.998	
Flt Protected		0.995		0.950			0.950			0.950		
Satd. Flow (prot)	0	1705	0	1752	1618	0	1752	1795	0	1752	1841	0
Flt Permitted		0.968		0.719			0.324			0.084		
Satd. Flow (perm)	0	1659	0	1326	1618	0	598	1795	0	155	1841	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		47			87			14			1	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1044			354			698			797	
Travel Time (s)		23.7			8.0			13.6			15.5	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	90	0	145	106	0	41	969	0	124	680	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		3.0	10.0		3.0	10.0	
Minimum Split (s)	23.0	23.0		24.0	24.0		9.5	24.0		9.5	24.0	
Total Split (s)	30.0	30.0		30.0	30.0		19.5	55.0		19.5	55.0	
Total Split (%)	28.7%	28.7%		28.7%	28.7%		18.7%	52.6%		18.7%	52.6%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.5	4.0		3.5	4.0	
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)		5.0		5.0	5.0		4.5	5.0		4.5	5.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effect Green (s)		14.5		14.5	14.5		56.0	50.3		61.3	56.1	
Actuated g/C Ratio		0.17		0.17	0.17		0.65	0.58		0.71	0.65	
v/c Ratio		0.28		0.66	0.31		0.09	0.92		0.52	0.57	
Control Delay		19.5		48.2	12.5		5.2	33.8		16.4	13.0	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		19.5		48.2	12.5		5.2	33.8		16.4	13.0	
LOS		B		D	B		A	C		B	B	
Approach Delay		19.5			33.1			32.6			13.5	
Approach LOS		B			C			C			B	
Queue Length 50th (ft)		20		73	9		5	418		17	209	
Queue Length 95th (ft)		62		141	52		18	#906		68	404	

Lanes, Volumes, Timings  
 1: Avenue D & Bonneville Avenue/10th Street

10th Street Residences

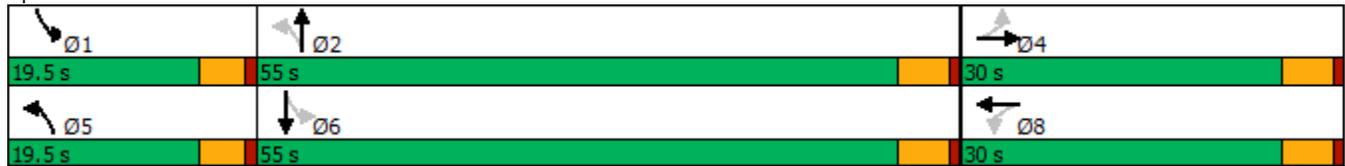
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		964			274			618			717	
Turn Bay Length (ft)				75			100			175		
Base Capacity (vph)		516		385	532		632	1050		390	1196	
Starvation Cap Reductn		0		0	0		0	0		0	0	
Spillback Cap Reductn		0		0	0		0	0		0	0	
Storage Cap Reductn		0		0	0		0	0		0	0	
Reduced v/c Ratio		0.17		0.38	0.20		0.06	0.92		0.32	0.57	

Intersection Summary

Area Type: Other  
 Cycle Length: 104.5  
 Actuated Cycle Length: 86.4  
 Natural Cycle: 90  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.92  
 Intersection Signal Delay: 25.0  
 Intersection Capacity Utilization 82.0%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Intersection LOS: C  
 ICU Level of Service E

Splits and Phases: 1: Avenue D & Bonneville Avenue/10th Street



HCM 2010 TWSC  
 2: Site Access & 10th Street

10th Street Residences

Intersection

Int Delay, s/veh 0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	304	8	2	231	5	1
Future Vol, veh/h	304	8	2	231	5	1
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, %	2	2	2	2	2	2
Mvmt Flow	330	9	2	251	5	1

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	339	0	590
Stage 1	-	-	-	-	335
Stage 2	-	-	-	-	255
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1220	-	470
Stage 1	-	-	-	-	725
Stage 2	-	-	-	-	788
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1220	-	469
Mov Cap-2 Maneuver	-	-	-	-	469
Stage 1	-	-	-	-	724
Stage 2	-	-	-	-	788

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	12.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	497	-	-	1220	-
HCM Lane V/C Ratio	0.013	-	-	0.002	-
HCM Control Delay (s)	12.3	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-