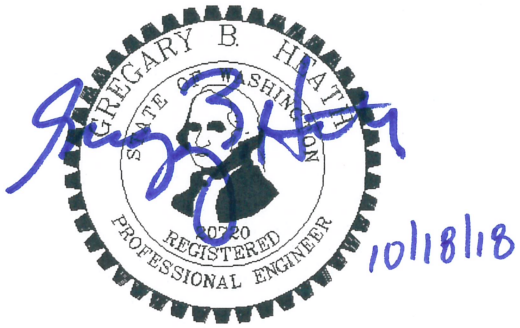
CKCB MADISON AVENUE
TRAFFIC IMPACT ANALYSIS

City of Bainbridge Island, WA



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CKCB MADISON AVENUE
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1. PROJECT DESCRIPTION

This report summarizes anticipated traffic impacts related to the proposed CKCB Madison Avenue project in the City of Bainbridge Island. The project consists of constructing 8 one-bedroom apartment units and 2 townhouses for a total of 10 net new dwelling units on an undeveloped parcel: 262502-3-078-2006. The site area comprises approximately 0.39 acres and resides under an Urban Shoreline Designation situated on the east side of Madison Avenue South. Access to the site is proposed via one new driveway from Madison Avenue South to a below-grade parking garage. Figure 1 on the following page shows the general site location and roadway network serving the vicinity. A site plan for of the project is given on Figure 2.

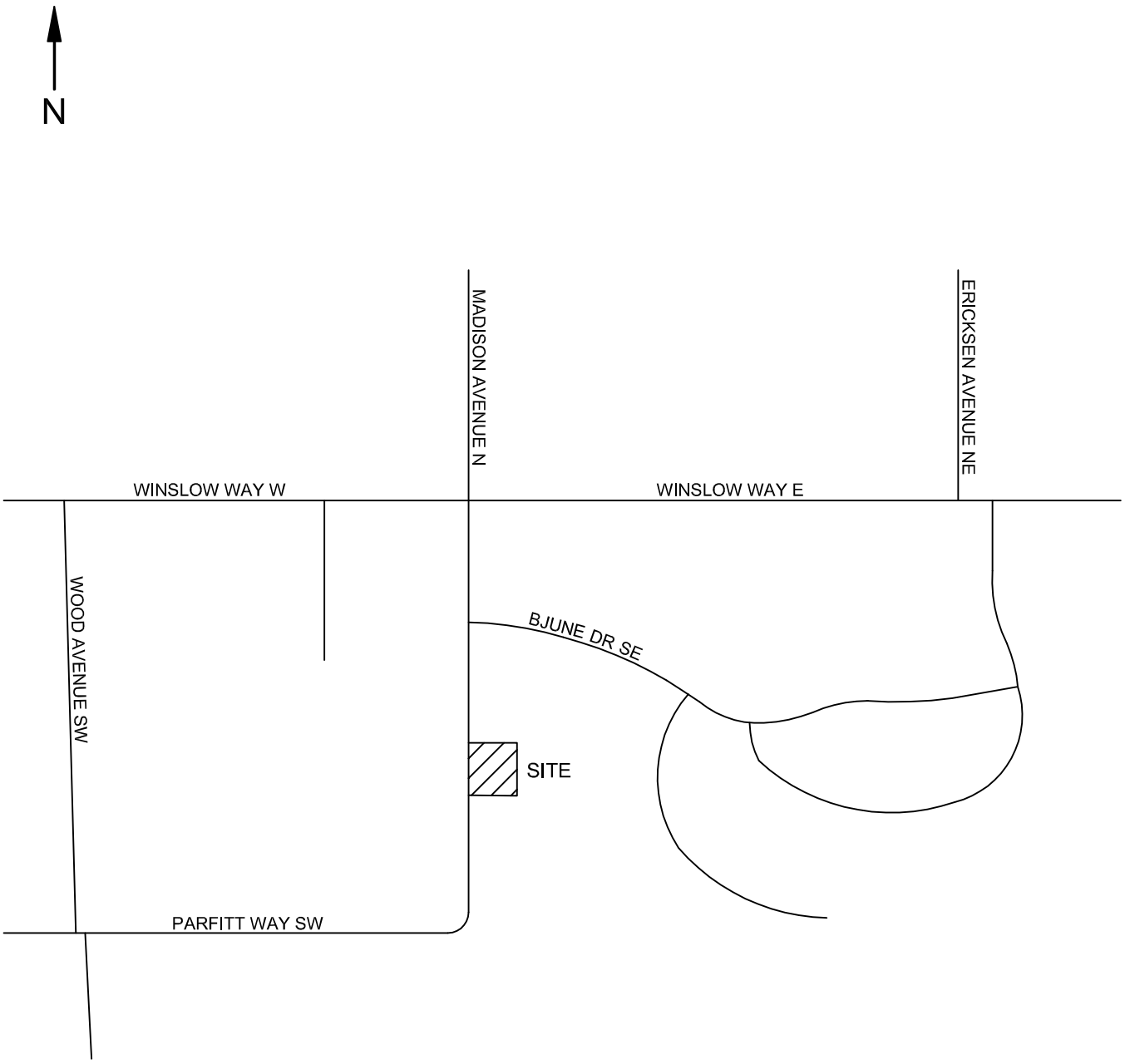
2. EXISTING CONDITIONS

2.1. Existing Roadway Characteristics

The street network serving the proposed project consists of a variety of roadways. Characteristics for these roadways vary with respect to lane widths, grades, speeds, and function. The major roadways surrounding the site are listed and described below.

Madison Avenue S./N.: is a north-south, two-lane collector south of Winslow Way and a two- to three-lane secondary arterial to the north. The road cross-section near the site consists of one 10-foot wide travel lane in each direction and 4-foot wide paved shoulders. Curb, gutter, and sidewalk are available along either direction. The roadway has a posted speed limit of 25 mph in the vicinity. No on-street parking opportunities are offered south of Winslow Way.

Winslow Way W./E.: is an east-west, two-lane collector and local access west of Madison Avenue and a two-lane secondary arterial to the east. Travel lanes vary from 10-12 feet in width and the roadway has a posted speed limit of 20 mph in the vicinity. Painted bike sharrows are found on the roadway east of Madison Avenue. Curb, gutter, and sidewalk are available in either direction. On-street parking is offered as head-in angle and parallel.



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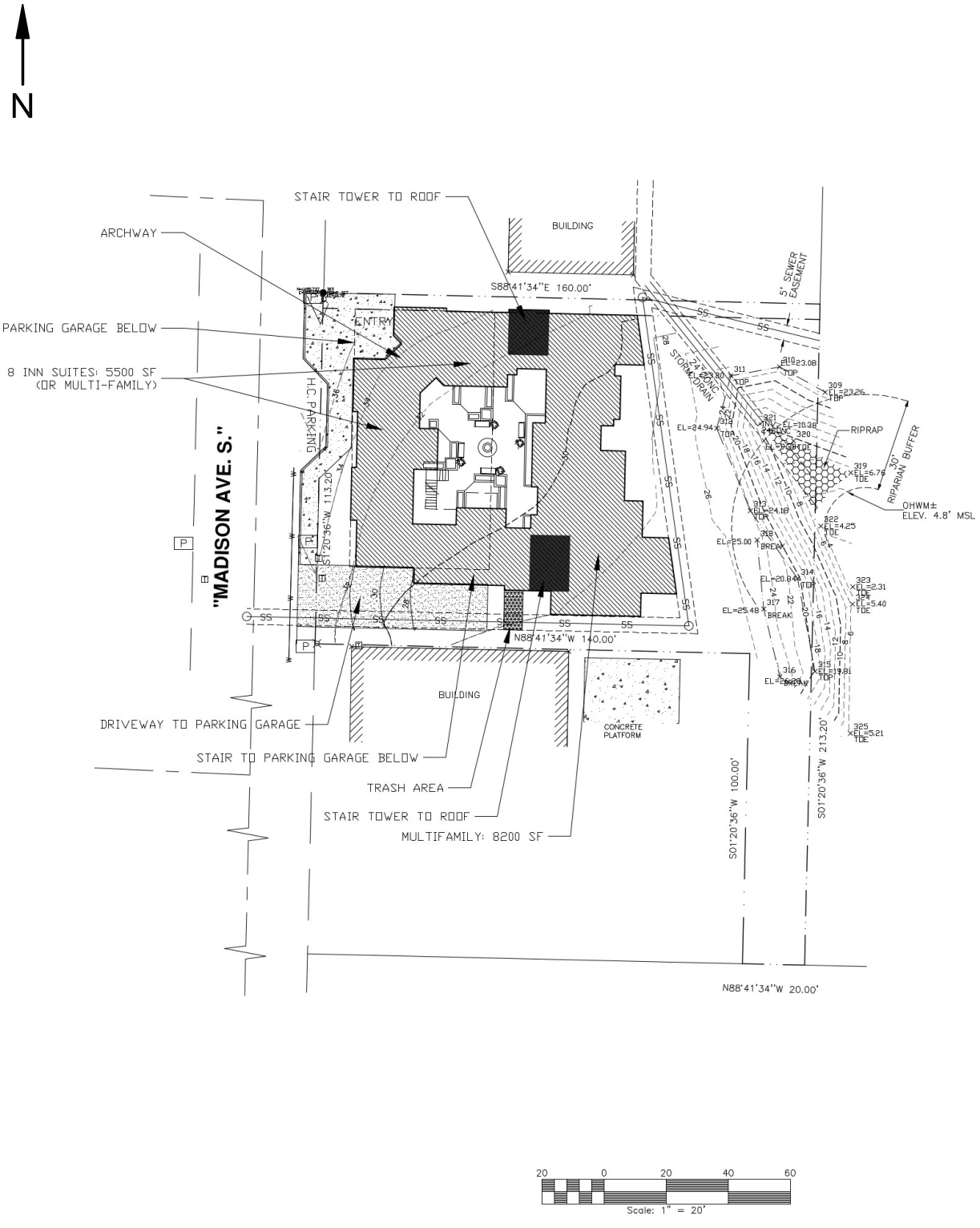
VICINITY MAP & ROADWAY SYSTEM
FIGURE 1



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SITE PLAN
FIGURE 2

2.2. Transit Service

A review of the Kitsap Transit system indicates transit service is provided in the area. The nearest bus stops are approximately 0.25 miles walking distance or less to the project site. The northern most bus stop is located on Madison Avenue North at the Bainbridge Island City Hall and is served via Routes 90, 98, & 99. The northwest bus stop is located at the Winslow Way West/Wood Avenue SW intersection and is served via Route 97. The northeast bus stop is located on Winslow Way East at the Town & County Market and is served via Routes 90, 97, 98, & 99. Refer to the Kitsap Transit Routed Buses schedule for detailed Route information.

Moreover, the Bainbridge Island Ferry Terminal is less than one mile east with respect to the project site. Given the proximity to multiple transit routes servicing the surrounding areas and the ability for nearby ferry transport, a reduction in overall project traffic is anticipated.

2.3. Access Driveway Safety

Access to the site is proposed via one new driveway entrance on Madison Avenue South. Assessments of driveway sight distance are based on AASHTO's *Green Book* (2011), standards for outbound movements. Based on the 25 mph posted speed limit on Madison Avenue, 240 and 280 feet of unobstructed sight distance are needed for project traffic to safely enter Madison Avenue. Preliminary measurements of the approximate access location indicate sight distance requirements are met with lines of sight exceeding 300 feet in either direction. No safety issues are identified with the proposed access location.

2.4. Non-Motorist Traffic

The surrounding vicinity currently offers non-motorist facilities in the form of complete sidewalk networks, marked pedestrian crossings, and bicycle lanes/sharrows. Furthermore, a continuous sidewalk path is available from the project frontage to the nearest public transit routes. The downtown nature of the area and proximity to local amenities is anticipated to encourage non-vehicular modes of transportation.

2.5. Roadway Improvements

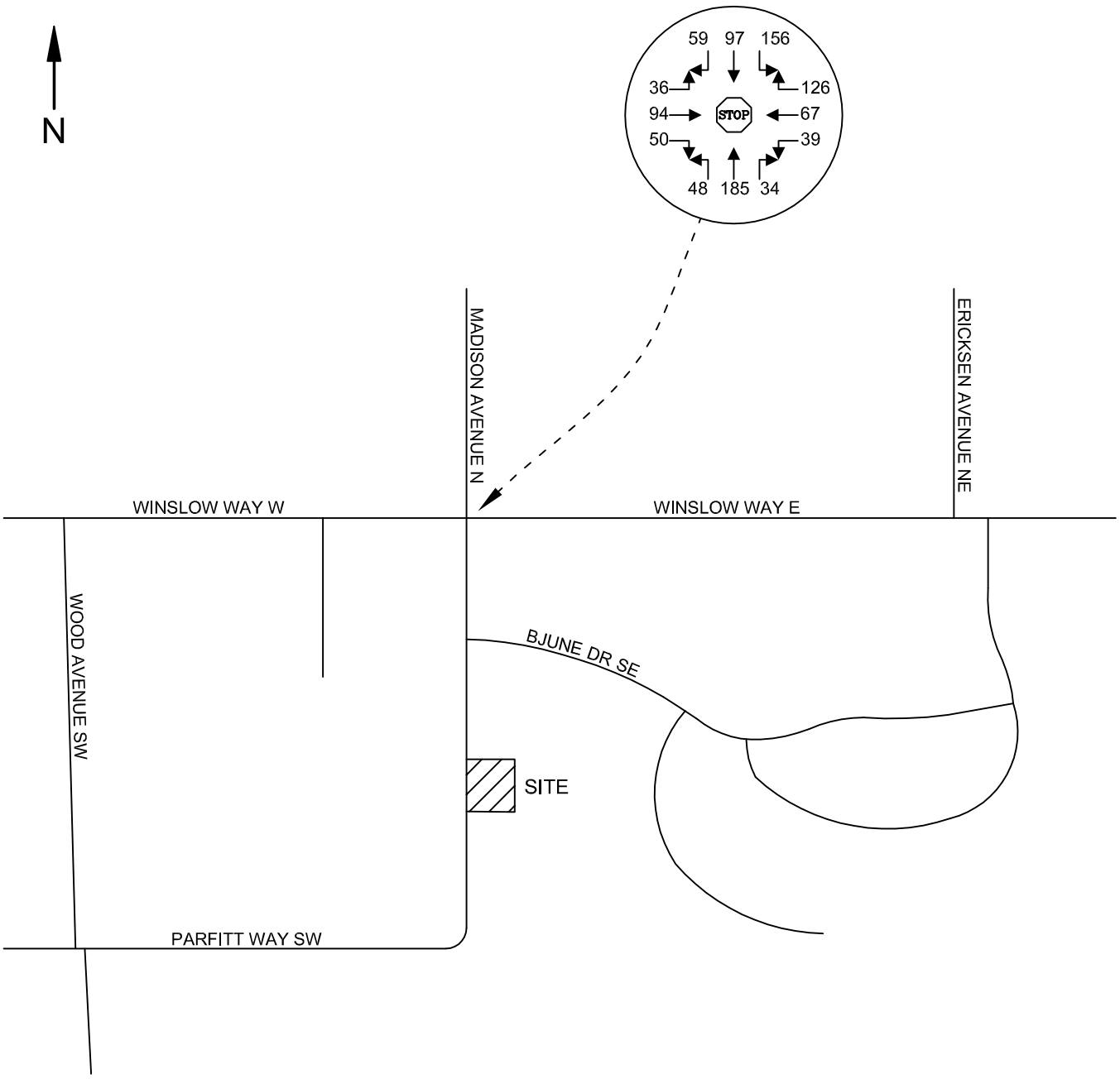
A review of the 2017 to 2022 City of Bainbridge Island Capital Improvement Program indicates an improvement project is planned in the vicinity.

Wyatt Way Reconstruction Phase 1

This scope of this project intends to reconstruct and improve the existing Wyatt Way segment from Madison Avenue to Lovell Avenue. Included are sidewalk and bicycle facilities on both sides of the street and capacity improvements to the intersection of Wyatt Way/Madison Avenue. Intersection improvements are planned with either signalization or a roundabout.

2.6. Existing PM Peak Hour Volumes and Travel Patterns

Field data for this study was obtained and collected in January of 2018 at the primary intersection of interest – Madison Avenue/Winslow Way. The traffic count was taken during the 4:00 PM – 6:00 PM timeframe which generally reflects the highest levels of congestion with respect to traffic and delays during a 24 hours period. The busiest one-hour is then derived from the two-hour field count, known as the peak hour, and is used for analysis to depict “worst case” conditions. Figure 3 on the following page shows the existing weekday PM peak hour volumes at the intersection of Madison Avenue/Winslow Way.



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EXISTING PM PEAK HOUR VOLUMES
FIGURE 3

3. FUTURE TRAFFIC CONDITIONS

3.1. Trip Generation

Trip generation is used to determine the magnitude of project impacts on the surrounding street system. This is denoted by the quantity or specific number of new trips that enter or exit a project during a designated time period, such as a specific peak hour or an entire day. Data presented in this report was taken from the Institute of Transportation Engineer's publication *Trip Generation*, 10th Edition. The designated land use for the proposed project is defined as Multifamily Housing – Low-Rise (LUC 220). Table 1 below summarizes the estimated new trips. Included are the average weekday daily traffic (AWDT) and the AM and PM peak hours. Refer to the appendix for trip generation output.

Table 1
Project Trip Generation

Land Use	Size (Dwelling Units)	AWDT	AM Peak-Hour Trips			PM Peak-Hour Trips		
			In	Out	Total	In	Out	Total
Multi-Family	10	73	1	4	**5**	4	2	**6**

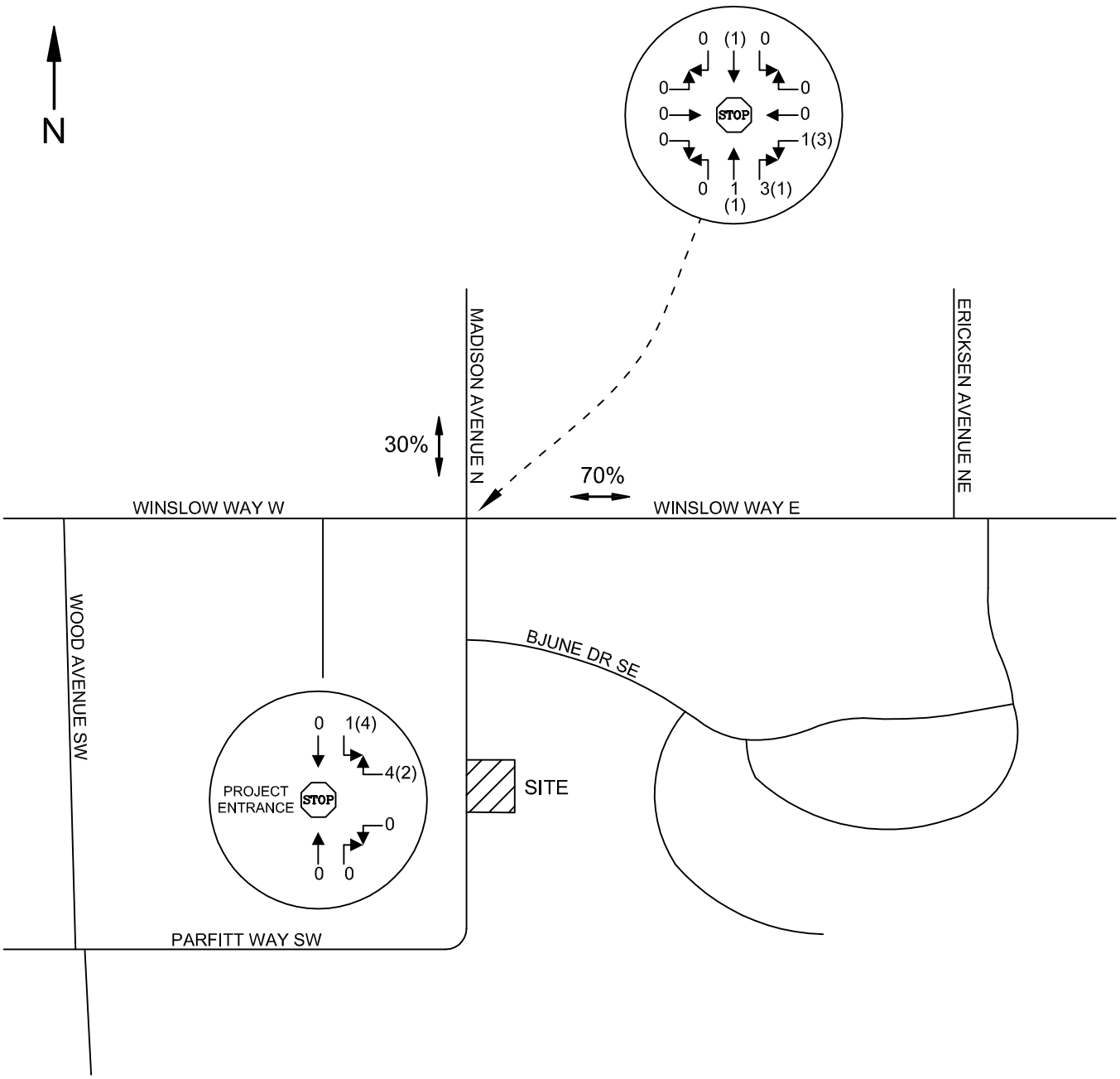
Based on Table 1 above the project is anticipated to generate 5 new trips in the AM and 6 new trips in the PM peak hours of travel. However, given the nature of the surrounding area, availability or pedestrian and bicycle facilities, and proximity to transit, actual observed daily and peak hour trips are anticipated to be lower.

3.2. Distribution & Assignment

Trip distribution describes the process by which project trips are dispersed on the roadway network surrounding the site. The specific destinations and origins of the generated traffic primarily influences the key intersections, which will effectively receive the bulk of project impacts. Peak hour trips generated by the project are anticipated to follow the general patterns shown in Figure 4 on the following page. Distribution percentages are based on existing travel patterns and the location of nearby major roadways.

3.3. Future Peak Hour Volumes

A horizon year of 2020 was used for future traffic delay analysis to reflect conditions at the time of project buildout. A long-term horizon year of 2035 was used to assess, if any, potential adverse impacts to the intersection of study. Forecast background volumes were derived by applying a one percent annual compound growth rate to the existing volumes shown on Figure 3. This growth rate has been determined appropriate for the area and has been used in similar projects in the past. In addition, a number of nearby approved projects have been included as pipeline volumes. Projects include: Madison Grove, Wallace Cottages, Madison Place, Madison Landing, Wyatt Apartments, and Madrona Townhomes. Pipeline volumes traveling through the study intersection are shown in Figure 5. Forecast 2020 peak hour volumes are presented in Figure 6; Forecast 2035 peak hour volumes are presented in Figure 7.



PROJECT TRIP GENERATION

AM PEAK HOUR TRIPS	PM PEAK HOUR TRIPS
INBOUND: 1 VPH	INBOUND: (4) VPH
OUTBOUND: 4 VPH	OUTBOUND: (2) VPH

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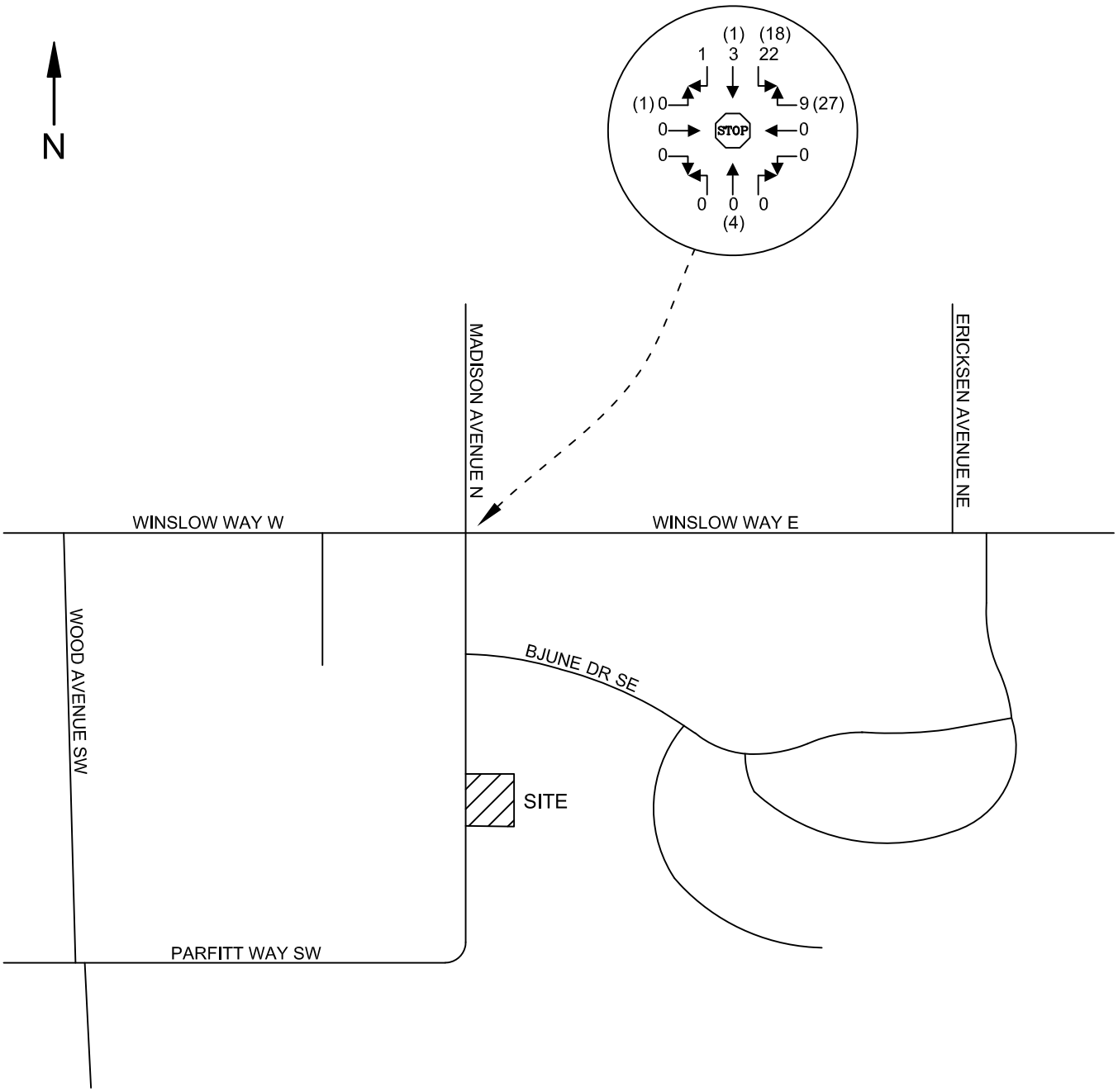
PEAK HOUR TRIP DISTRIBUTION
FIGURE 4



AM PEAK HOUR VOLUMES
(PM PEAK HOUR VOLUMES)

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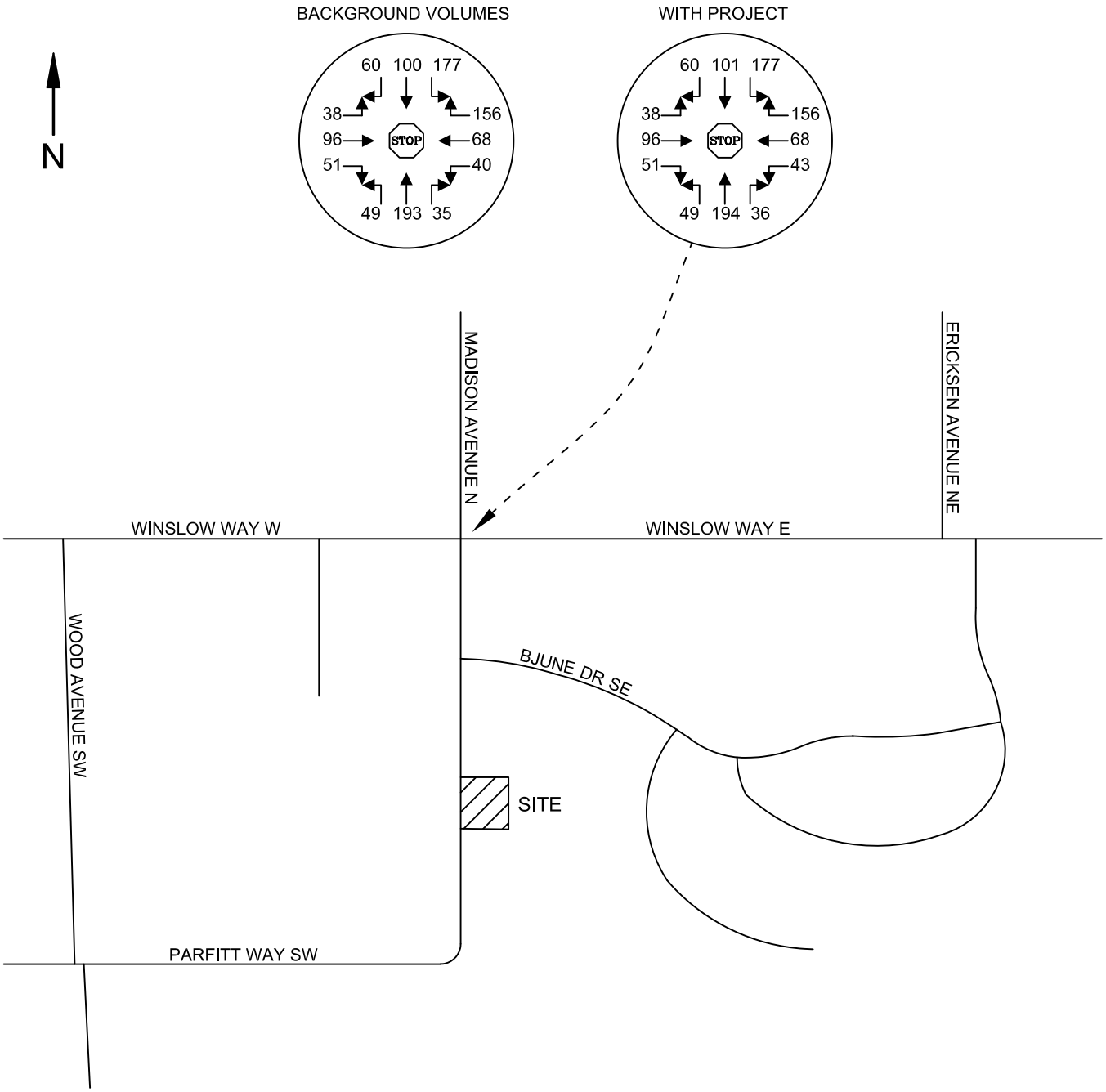
PIPELINE VOLUMES
FIGURE 5



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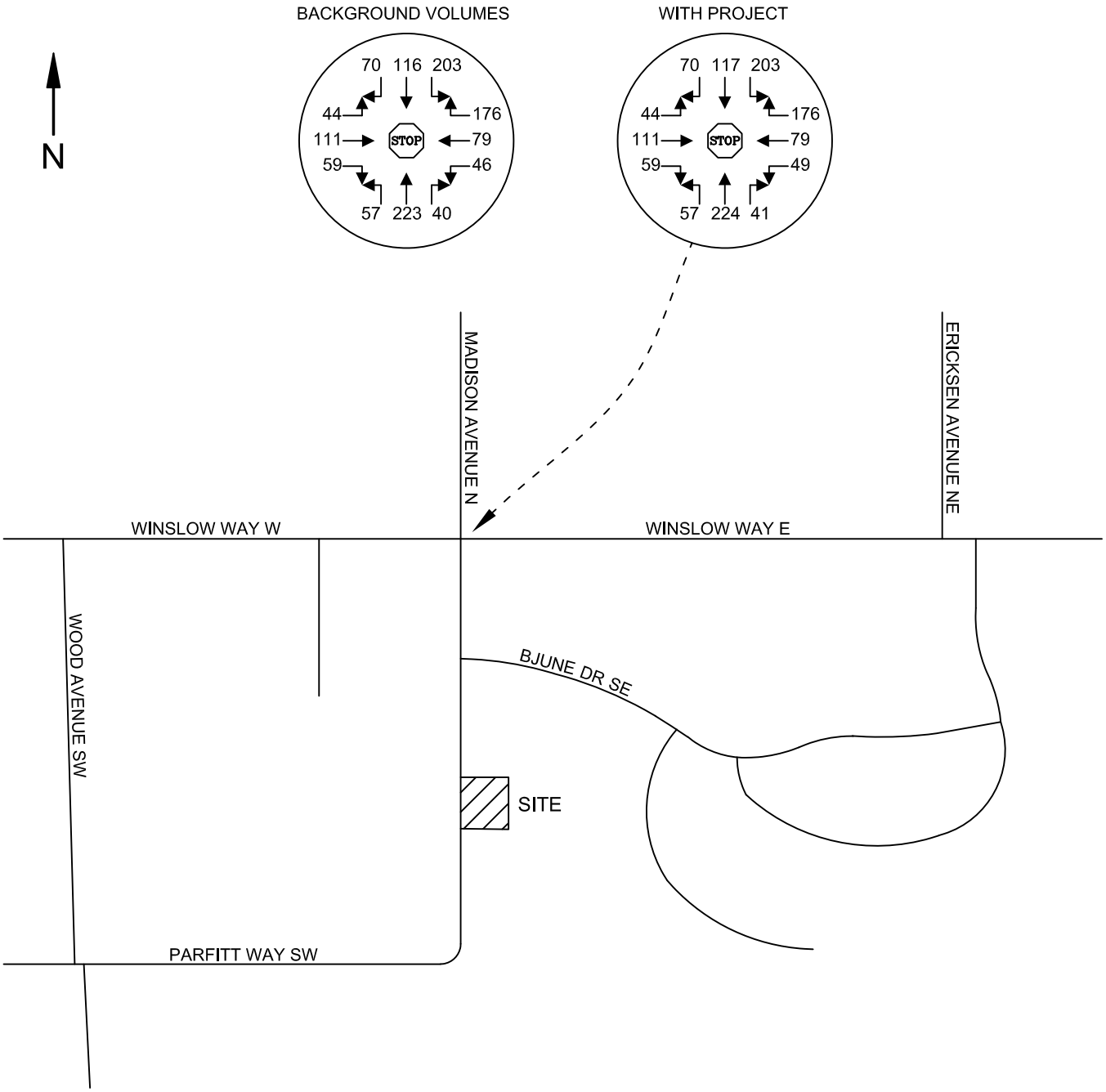
FORECAST 2020 PM PEAK HOUR VOLUMES
FIGURE 6



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FORECAST 2035 PM PEAK HOUR VOLUMES
FIGURE 7

3.4. Future Level of Service

Peak hour delays were determined through the use of the *Highway Capacity Manual* 6th Edition. Capacity analysis is used to determine level of service (LOS) which is an established measure of congestion for transportation facilities. The range[1] for intersection level of service is LOS A to LOS F with the former indicating the best operating conditions with low control delays and the latter indicating the worst conditions with heavy control delays. Detailed descriptions of intersection LOS are given in the 2016 Highway Capacity Manual. Level of service calculations were made through the use of the Synchro 10 analysis program. Table 2 below portrays existing and forecast 2020 and 2035 peak hour delays for the key intersection of Madison Avenue/Winslow Way.

Table 2

Peak Hour Level of Service

Delays Given in Seconds per Vehicle

					With Project Traffic			
			Existing		2020		2035	
Intersection	**Control**	**Time Period**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**
Madison Avenue / Winslow Way	AWSC	PM Peak Hour	B	13.5	B	14.9	C	19.1

AWSC: All-Way Stop Control

Existing delays and forecast 2020 delays with project traffic are anticipated to operate with mild delays in the overall LOS B range. Delays are shown to increase to LOS C for the forecast 2035 conditions. All scenarios are shown to operate to City of Bainbridge LOS D or better standards for arterial roadways. Overall the intersection has the existing and forecast capacity to support the incoming project's vehicular demand.

[1] *Signalized Intersections - Level of Service*

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	> 10 and ≤20
C	> 20 and ≤35
D	> 35 and ≤55
E	> 55 and ≤80
F	> 80

Stop Controlled Intersections – Level of Service

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	> 10 and ≤15
C	> 15 and ≤25
D	> 25 and ≤35
E	> 35 and ≤50
F	> 50

Highway Capacity Manual, 6th Edition

4. SUMMARY

The CKCB Madison Avenue project plans on constructing 10-units of multi-family on an undeveloped parcel (262502-3-078-2006) in the City of Bainbridge Island. The project site is located on the east side of Madison Avenue South and south of Bjune Drive SE. A site plan is presented on Figure 2 and indicates one new driveway access on Madison Avenue South to a below-grade parking garage.

The general vicinity offers non-motorist facilities with complete sidewalk networks and bicycle lanes along with nearby public transit routes. Based on ITE data, 5 AM and 6 PM peak hour trips may be expected without accounting for the anticipated utilization of nearby transit. Forecast 2020 and 2035 PM peak hour delay analyses project delays to operate with acceptable level of service at LOS B and LOS C, respectively. Based on the analysis provided, no off-site mitigation is identified at this time.

CKCB MADISON AVENUE
TRAFFIC IMPACT ANALYSIS

APPENDIX

Multifamily Housing (Low-Rise)
(220)

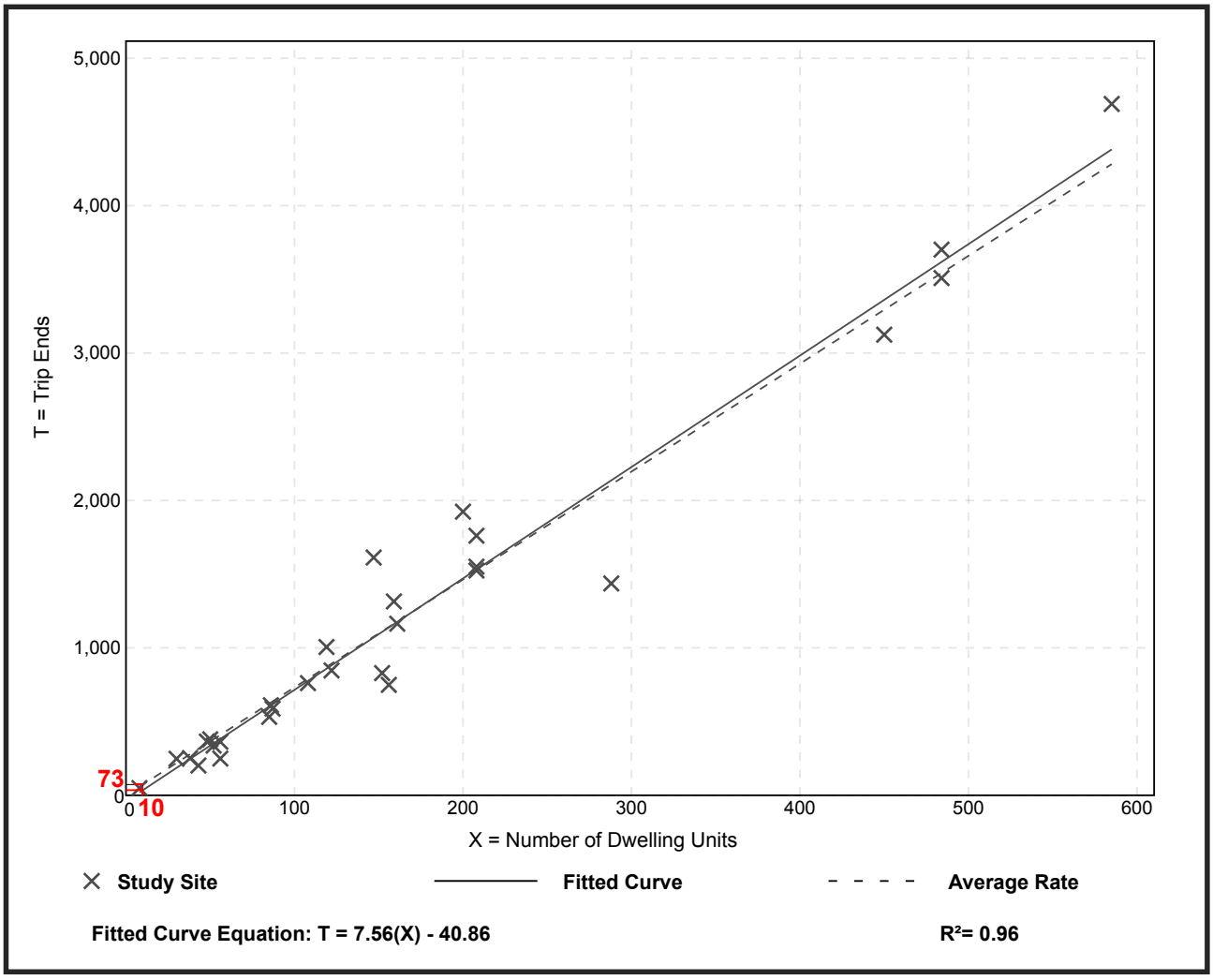
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



Trip Generation Manual, 10th Edition ● Institute of Transportation Engineers

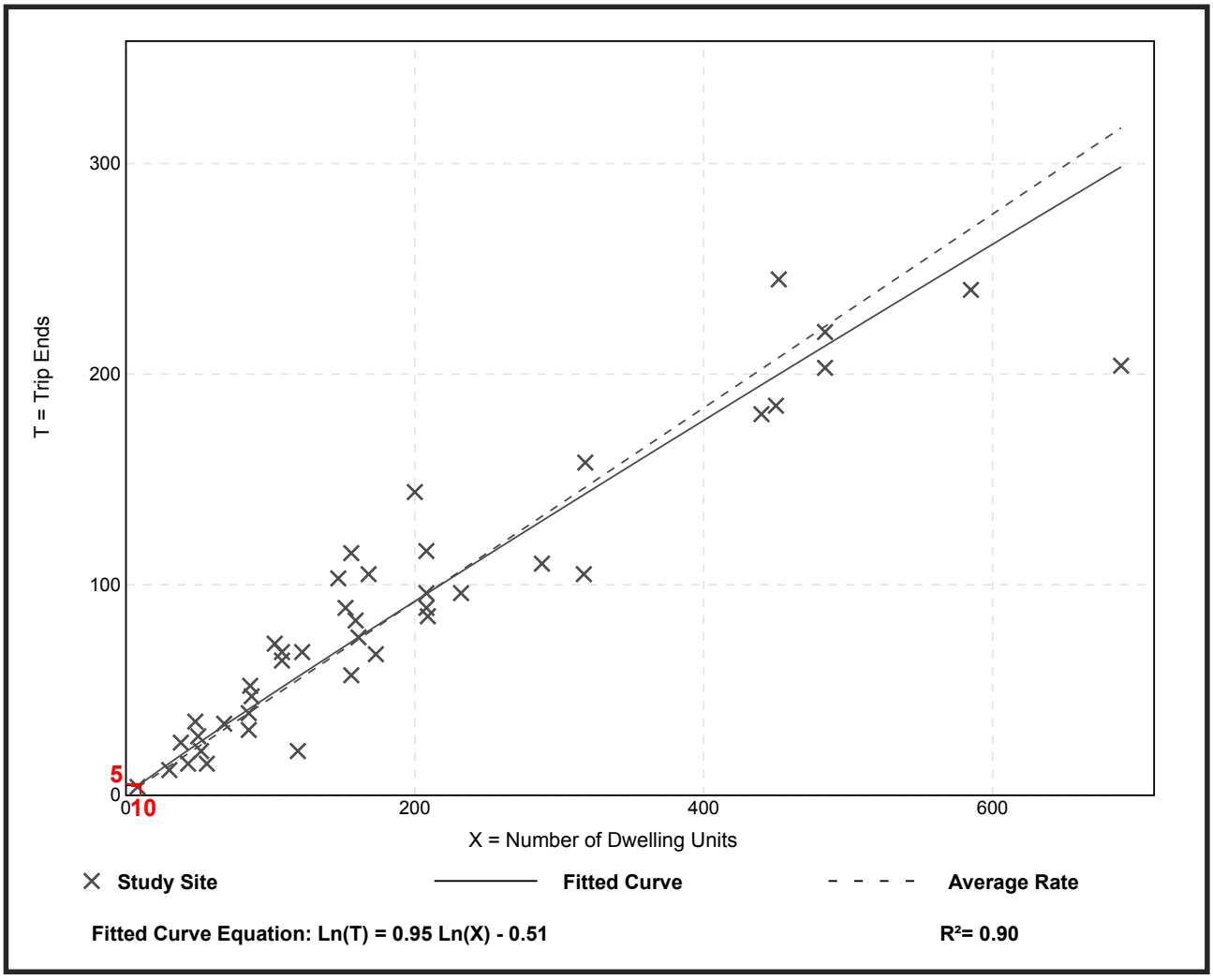
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 42
Avg. Num. of Dwelling Units: 199
Directional Distribution: 23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



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Multifamily Housing (Low-Rise)
(220)

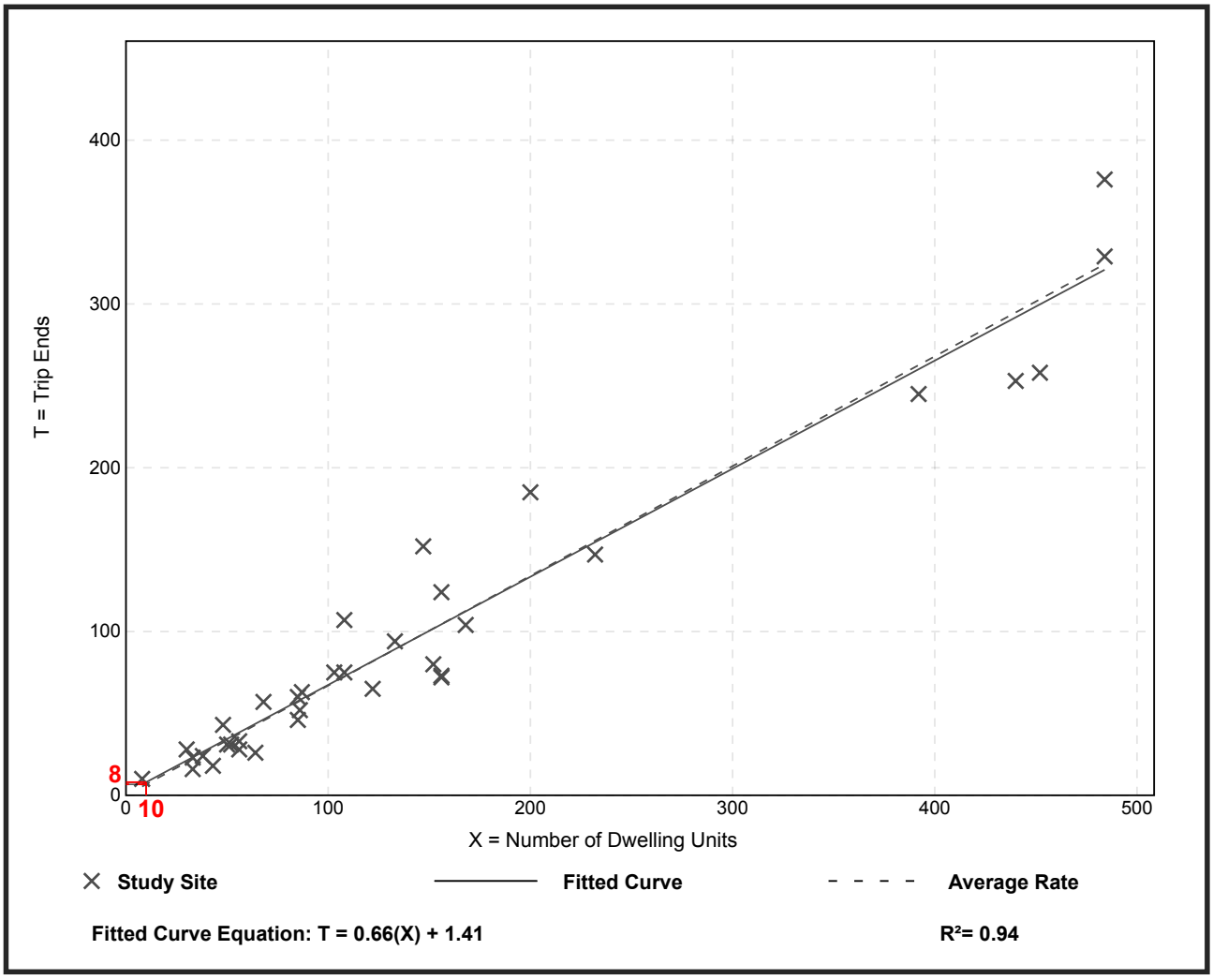
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
PM Peak Hour of Generator

Setting/Location: **General Urban/Suburban**
Number of Studies: 35
Avg. Num. of Dwelling Units: 146
Directional Distribution: 59% entering, 41% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.67	0.41 - 1.25	0.14

Data Plot and Equation

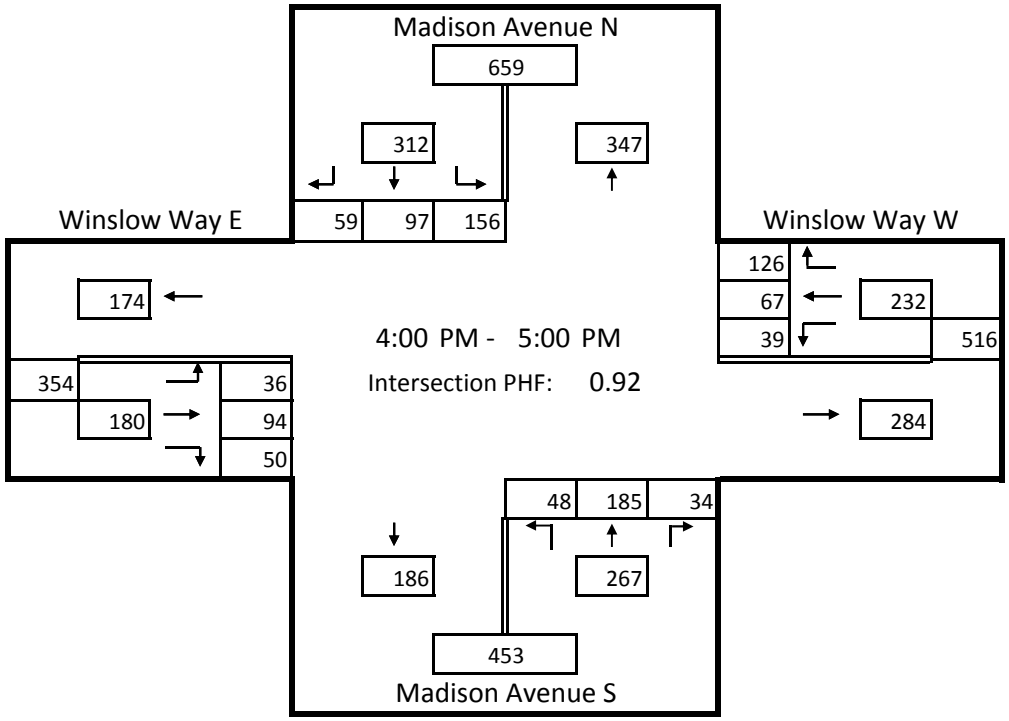


Trip Generation Manual, 10th Edition ● Institute of Transportation Engineers

Heath & Associates, Inc.
2214 Tacoma Road
Puyallup, WA 98371

Project Name: **CKCB Madison Avenue**
Intersection: Madison Avenue & Winslow Way
Jurisdiction: Bainbridge Island
Date of Count: 1/25/2018
Project Number: 4057

Time Period	Soutbound Madison Avenue N				Westbound Winslow Way W				Northbound Madison Avenue S				Eastbound Winslow Way E				
	HV	R	T	L	HV	R	T	L	HV	R	T	L	HV	R	T	L	Total
4:00 PM	0	17	25	50	0	30	18	9	0	11	50	13	0	15	20	10	268
4:15 PM	0	11	29	45	0	29	17	10	0	6	52	10	0	12	19	7	247
4:30 PM	0	16	21	30	0	38	19	10	0	7	39	10	0	9	28	12	239
4:45 PM	0	15	22	31	0	29	13	10	0	10	44	15	0	14	27	7	237
5:00 PM	0	12	17	46	0	37	16	16	0	9	44	7	0	9	19	6	238
5:15 PM	0	9	23	45	0	38	16	6	0	9	29	10	0	7	20	12	224
5:30 PM	0	8	18	29	0	40	15	8	0	4	29	9	0	5	12	7	184
5:45 PM	0	7	17	27	0	30	9	10	0	9	33	5	0	9	9	9	174
Total	0	95	172	303	0	271	123	79	0	65	320	79	0	80	154	70	1,811
Peak Hour	**4:00 PM to 5:00 PM**																Total
Peak Total	0	59	97	156	0	126	67	39	0	34	185	48	0	50	94	36	991
Heavy Veh.	0.0%				0.0%				0.0%				0.0%				
PHF	0.85				0.87				0.90				0.92				



Intersection	
Intersection Delay, s/veh	13.5
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	36	94	50	0	39	67	126	0	48	185	34
Future Vol, veh/h	0	36	94	50	0	39	67	126	0	48	185	34
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	1	1	1	2	1	1	1	2	1	1	1
Mvmt Flow	0	39	102	54	0	42	73	137	0	52	201	37
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	2
HCM Control Delay	13.9	11.3	16.6
HCM LOS	B	B	C

Lane	NBLn1	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	18%	20%	37%	0%	100%	0%
Vol Thru, %	69%	52%	63%	0%	0%	62%
Vol Right, %	13%	28%	0%	100%	0%	38%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	267	180	106	126	156	156
LT Vol	48	36	39	0	156	0
Through Vol	185	94	67	0	0	97
RT Vol	34	50	0	126	0	59
Lane Flow Rate	290	196	115	137	170	170
Geometry Grp	6	6	7	7	7	7
Degree of Util (X)	0.524	0.369	0.224	0.232	0.328	0.291
Departure Headway (Hd)	6.501	6.795	7.008	6.106	6.966	6.187
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	551	524	508	582	514	577
Service Time	4.586	4.894	4.803	3.9	4.752	3.973
HCM Lane V/C Ratio	0.526	0.374	0.226	0.235	0.331	0.295
HCM Control Delay	16.6	13.9	11.8	10.8	13.2	11.5
HCM Lane LOS	C	B	B	B	B	B
HCM 95th-tile Q	3	1.7	0.9	0.9	1.4	1.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	156	97	59
Future Vol, veh/h	0	156	97	59
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	1	1	1
Mvmt Flow	0	170	105	64
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	12.3
HCM LOS	B

Intersection	
Intersection Delay, s/veh	14.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	38	96	51	43	68	156	49	194	36	177	101	60
Future Vol, veh/h	38	96	51	43	68	156	49	194	36	177	101	60
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1
Mvmt Flow	41	104	55	47	74	170	53	211	39	192	110	65
Number of Lanes	0	1	0	0	1	1	0	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	1
HCM Control Delay	15	12.1	18.9	13.6
HCM LOS	B	B	C	B

Lane	NBLn1	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	18%	21%	39%	0%	100%	0%
Vol Thru, %	70%	52%	61%	0%	0%	63%
Vol Right, %	13%	28%	0%	100%	0%	37%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	279	185	111	156	177	161
LT Vol	49	38	43	0	177	0
Through Vol	194	96	68	0	0	101
RT Vol	36	51	0	156	0	60
Lane Flow Rate	303	201	121	170	192	175
Geometry Grp	6	6	7	7	7	7
Degree of Util (X)	0.577	0.402	0.246	0.302	0.39	0.317
Departure Headway (Hd)	6.846	7.191	7.335	6.421	7.297	6.519
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	528	501	490	560	493	551
Service Time	4.888	5.238	5.081	4.166	5.04	4.263
HCM Lane V/C Ratio	0.574	0.401	0.247	0.304	0.389	0.318
HCM Control Delay	18.9	15	12.5	11.9	14.7	12.3
HCM Lane LOS	C	B	B	B	B	B
HCM 95th-tile Q	3.6	1.9	1	1.3	1.8	1.4

Intersection	
Intersection Delay, s/veh	19.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	44	111	59	49	79	176	57	224	41	203	117	70
Future Vol, veh/h	44	111	59	49	79	176	57	224	41	203	117	70
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1
Mvmt Flow	48	121	64	53	86	191	62	243	45	221	127	76
Number of Lanes	0	1	0	0	1	1	0	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	1
HCM Control Delay	18.8	14.1	27.5	16.3
HCM LOS	C	B	D	C

Lane	NBLn1	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	18%	21%	38%	0%	100%	0%
Vol Thru, %	70%	52%	62%	0%	0%	63%
Vol Right, %	13%	28%	0%	100%	0%	37%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	322	214	128	176	203	187
LT Vol	57	44	49	0	203	0
Through Vol	224	111	79	0	0	117
RT Vol	41	59	0	176	0	70
Lane Flow Rate	350	233	139	191	221	203
Geometry Grp	6	6	7	7	7	7
Degree of Util (X)	0.72	0.507	0.307	0.373	0.483	0.401
Departure Headway (Hd)	7.41	7.841	7.946	7.028	7.877	7.095
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	487	458	451	509	457	504
Service Time	5.489	5.928	5.727	4.809	5.658	4.875
HCM Lane V/C Ratio	0.719	0.509	0.308	0.375	0.484	0.403
HCM Control Delay	27.5	18.8	14.2	14	17.9	14.6
HCM Lane LOS	D	C	B	B	C	B
HCM 95th-tile Q	5.7	2.8	1.3	1.7	2.6	1.9