



# North High Street Planning Analysis

October 2020



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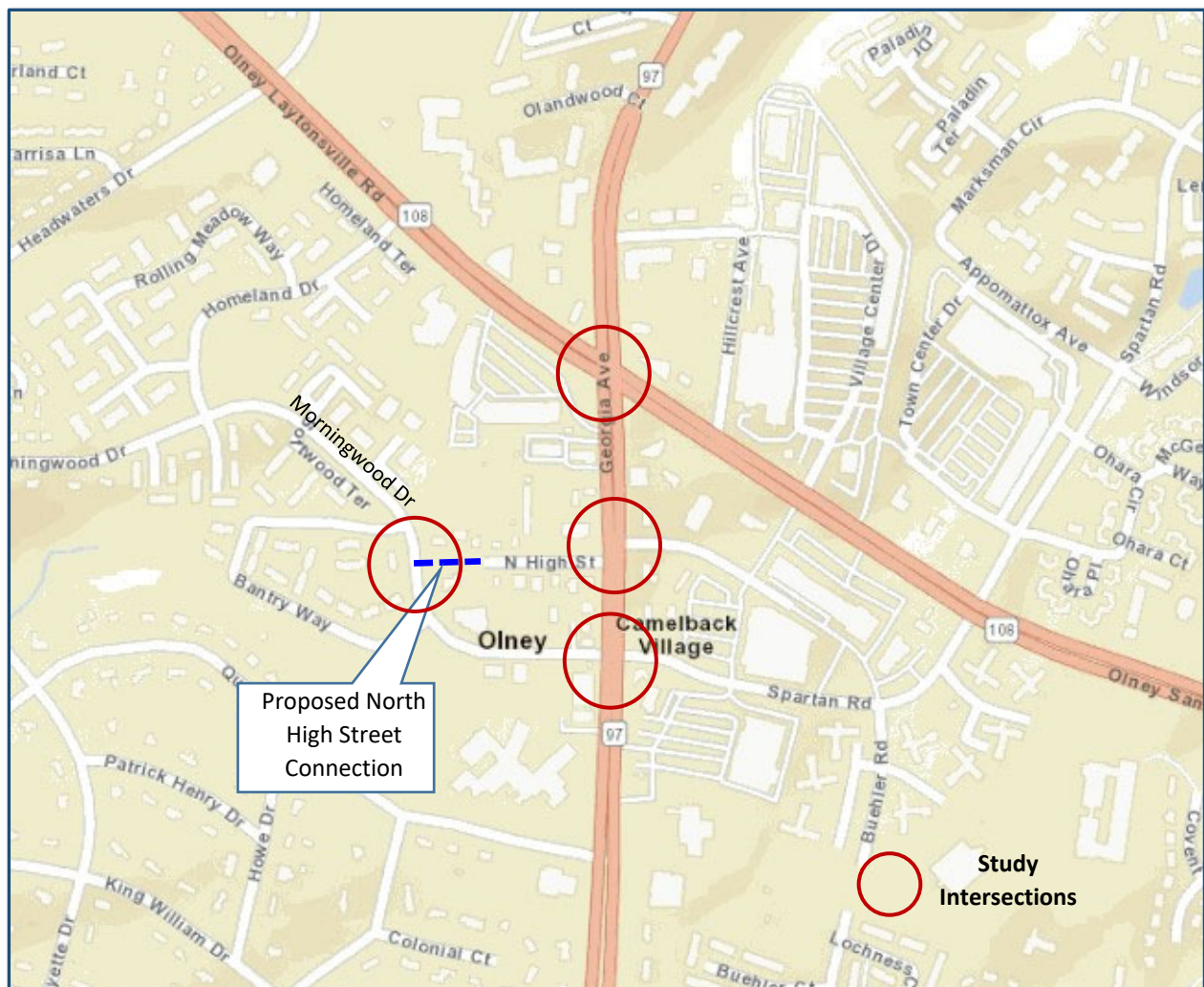


## 1 Introduction

The Montgomery County Department of Transportation (MCDOT) requested Gannett Fleming, Inc. to evaluate the feasibility of connecting North High Street with Morningwood Drive in Olney. This connection was a recommendation in the Transportation Plan in the 2005 Olney Master Plan. The master plan chapter described North High Street as an essential connection for providing vehicular and pedestrian connectivity between the Olney Town Center and the adjoining residential community. Also, the Greater Olney Civic Association (GOCA) asked MCDOT to study an alternative route for people to get in and out of the Olney Town Center businesses safely from and to Georgia Ave (MD 97) and/or MD 108.

This study conducts a traffic analysis for the adjacent roadways and intersections, especially along the Georgia Avenue corridor, to determine the impacts/benefits of providing this connection with traffic data collected from field observations/counts, MCDOT, and MDOT State Highway Administration (SHA).

**Figure 1: North High Street Study Area**



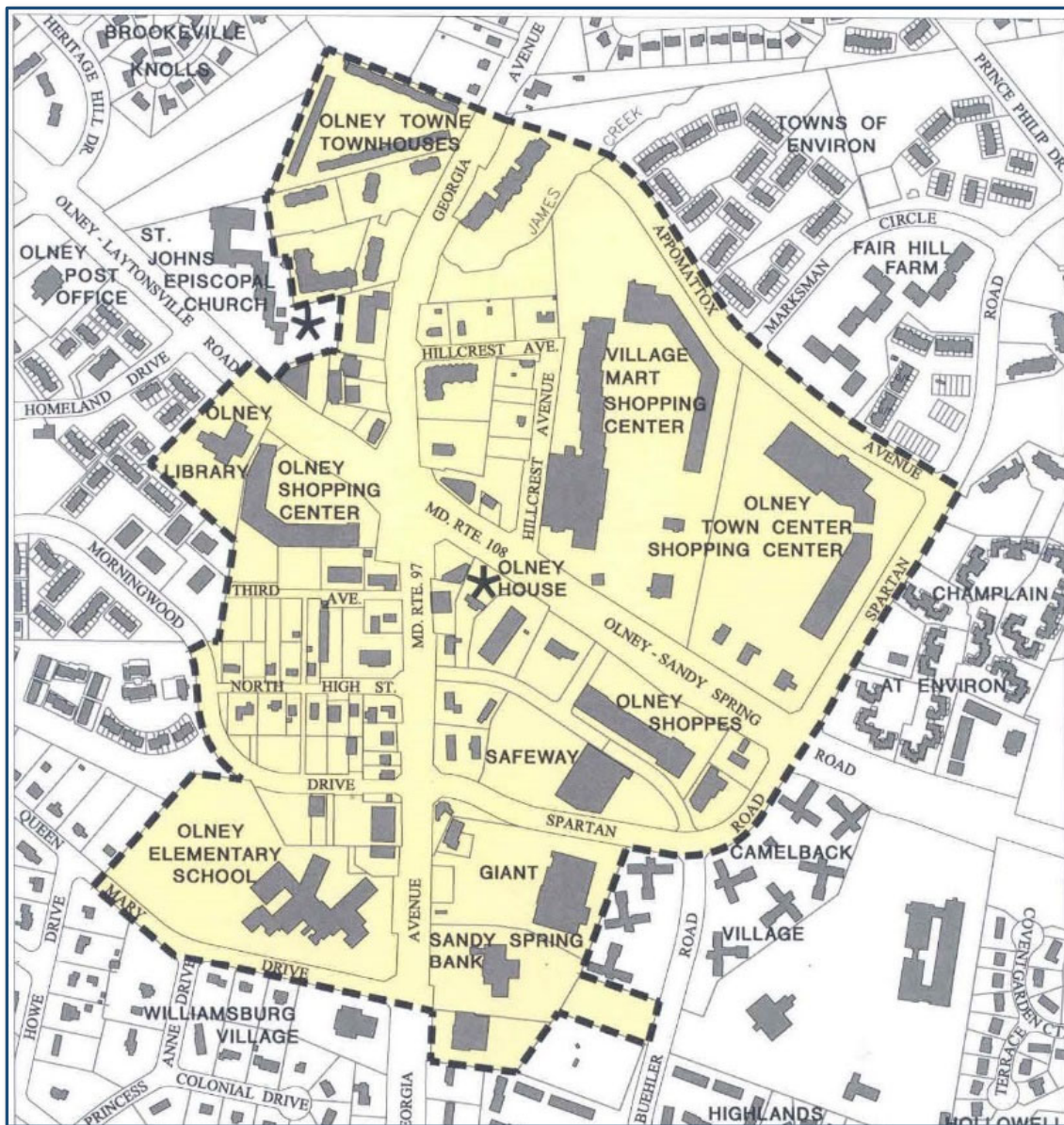




## 2 Study Area

The Olney area is located in northeastern Montgomery County, Maryland, and North High Street and the MD 97 corridors are located in the Olney Town Center boundary. The Olney Town Center, as identified in the 2005 Olney Master Plan, is a commercial area around the intersection of MD 97 and MD 108. The analysis network for this study includes three intersections along Georgia Avenue (MD 97): MD 97 and MD 108, MD 97 and North High Street/Buehler Road, and MD 97 and Morningwood Drive/Spartan Road. Figure 1 and Figure 2 present the location of the study area and Olney Town Center boundary, respectively.

**Figure 2: Olney Town Center Boundary**



Source: 2005 Olney Master Plan, MNCPPC, 2005



### 3 Existing Condition

MD 97 (Georgia Avenue) is a divided four-lane road that traverses the Olney Town Center area in the north-south direction, and is classified as Major Highway within this area in the Olney Master Plan. The speed limit along the MD 97 corridor is posted at 30 mph in both directions. There are numerous business accesses along both sides of the MD 97 corridor. MD 108 (Olney Road) is also classified as Major Highway within this area, traversing the Olney Town Center in the east-west direction. The posted speed limit along MD 108 is also 30 mph.

Morningwood Drive is classified as a Primary Residential Road, traversing the southwest quadrant of the southern Olney area, and provides an access toward MD 97 to the residential community. Much of the section between MD 97 and North High Street is commercial in nature. 30-mph speed limit signs are posted along Morningwood Drive in both directions.

Spartan Road is a Business District Road in the southeast quadrant of the Olney Town Center area, connecting MD 97 and MD 108. Buehler Road is a local two-lane road, traversing the southeast Town Center and connecting MD 97 and Spartan Road. Spartan and Buehler Roads provide access to the commercial community on the east side of MD 97.

Approximately 600-feet in length, North High Street is a currently an access road for businesses west of MD 97, including the McDonald's restaurant, an auto/tire shop, dental office, gas station, and several residential houses at the west end. A stairway for pedestrians is placed between North High Street and Morningwood Drive, with North High Street level elevated above Morningwood Drive level (see Figure 3).

**Figure 3: Stairway between North High Street and Morningwood Drive Looking East**



The existing corridor and intersection conditions were field reviewed on February 19, 2020 (*see the photos in Appendix A*).





The intersection of MD 97 and MD 108 is the center of the Olney Town Center area. In the morning peak period, the southbound queues on MD 97 were observed to back up beyond Hillcrest Avenue. The eastbound queues on MD 108 backed up beyond the Olney Shopping Center entrance. In the afternoon peak period, the northbound queues on the MD 97 occasionally extended beyond Buehler Road.

North High Street and Buehler Road form an offset four-leg Stop-controlled intersection on the corridor. A left turn out from North High Street to MD 97 north is challenging due to the heavy southbound traffic on MD 97, especially in the morning peak period, but is being made with cooperative yielding by the southbound traffic when queues from Morningwood Drive are backing up. Since the North High Street approach has a relatively wider width of approximately 35 feet, most of left turning vehicles are waiting separately from the right turning vehicles, forming two lanes. Left turns out from Buehler Road are not allowed with a Right Turn Only sign, and left turns from southbound MD 97 to Buehler are also prohibited via signing and the lack of a left turn lane.

The intersection of MD 97 and Morningwood Drive/Spartan Road is the source of some traffic queueing for MD 97 corridor traffic, particularly in the afternoon peak period. The northbound queues were observed to extend back to King William Drive, and occasionally beyond. The southbound queues mostly back up beyond North High Street in the morning peak period. It was seen that in the morning, traffic entering and exiting the Dunkin restaurant interfered with the outside lane of traffic on the southbound approach on MD 97.

Pedestrian activities were seen at each of the study intersections during the field survey. Public bus and school bus traffic were seen along MD 97, MD 108, and Spartan Road in the peak periods.

## 4 Traffic Analysis

Turning movement counts were collected on January 9, 2020 at the intersections of MD 97 at North High Street/Buehler Road and Morningwood Drive at the steps for North High Street (**Appendix B**). For the other study intersections, their turning movement counts were obtained from the MDOT SHA I-TMS website. The count data show that the weekday morning and afternoon peak periods in this area generally occur between 8:00 and 9:00 AM; and between 4:15 and 5:15 PM.

Traffic signal timing data for the signalized intersections of MD 97/MD 108 and MD 97/Morningwood Drive/Spartan Road were obtained for analysis from MCDOT (**Appendix C**). The analysis volumes based on the counts for the study intersections have been assigned to the network, as presented in Figure 4 and Figure 5. Pedestrian and bicycle volumes are also shown in Figure 6 and Figure 7. The raw peak hour volume data diagrams are presented in Appendix D.

Figure 4: Existing Peak Hour Traffic Volumes - AM

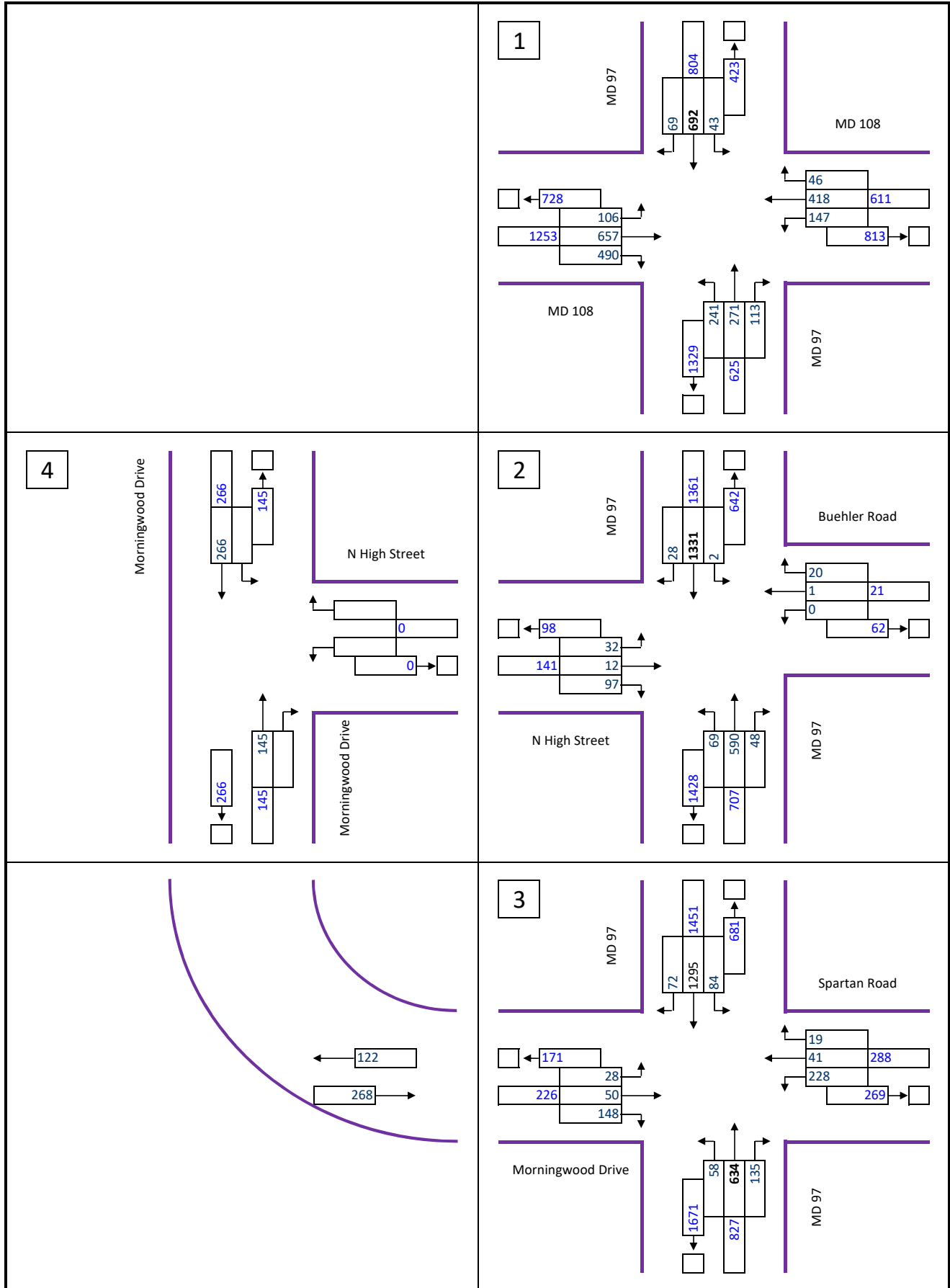


Figure 5: Existing Peak Hour Traffic Volumes - PM

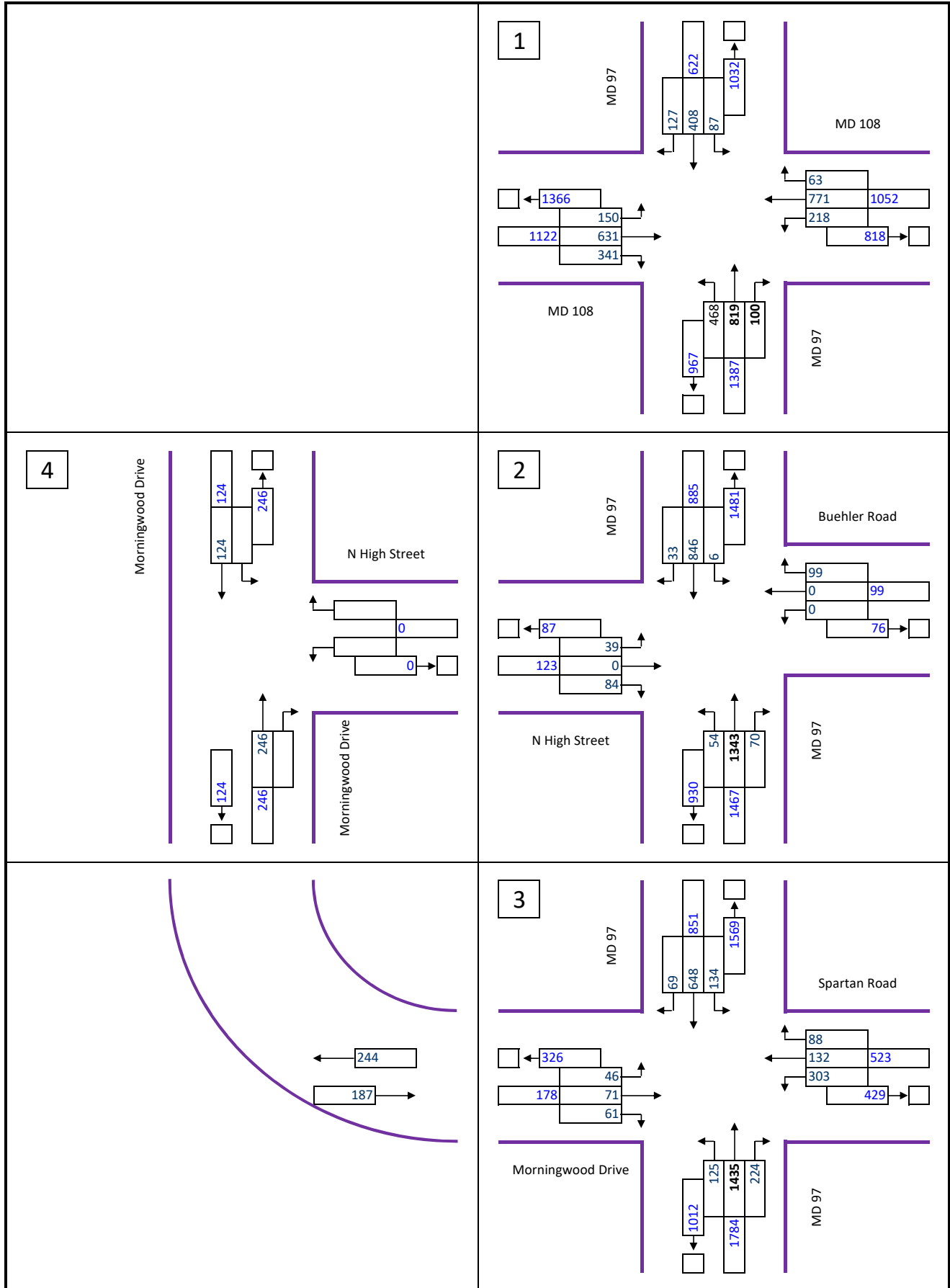


Figure 6: Existing Pedestrian and Bicycle Volumes - AM (8-9 AM)

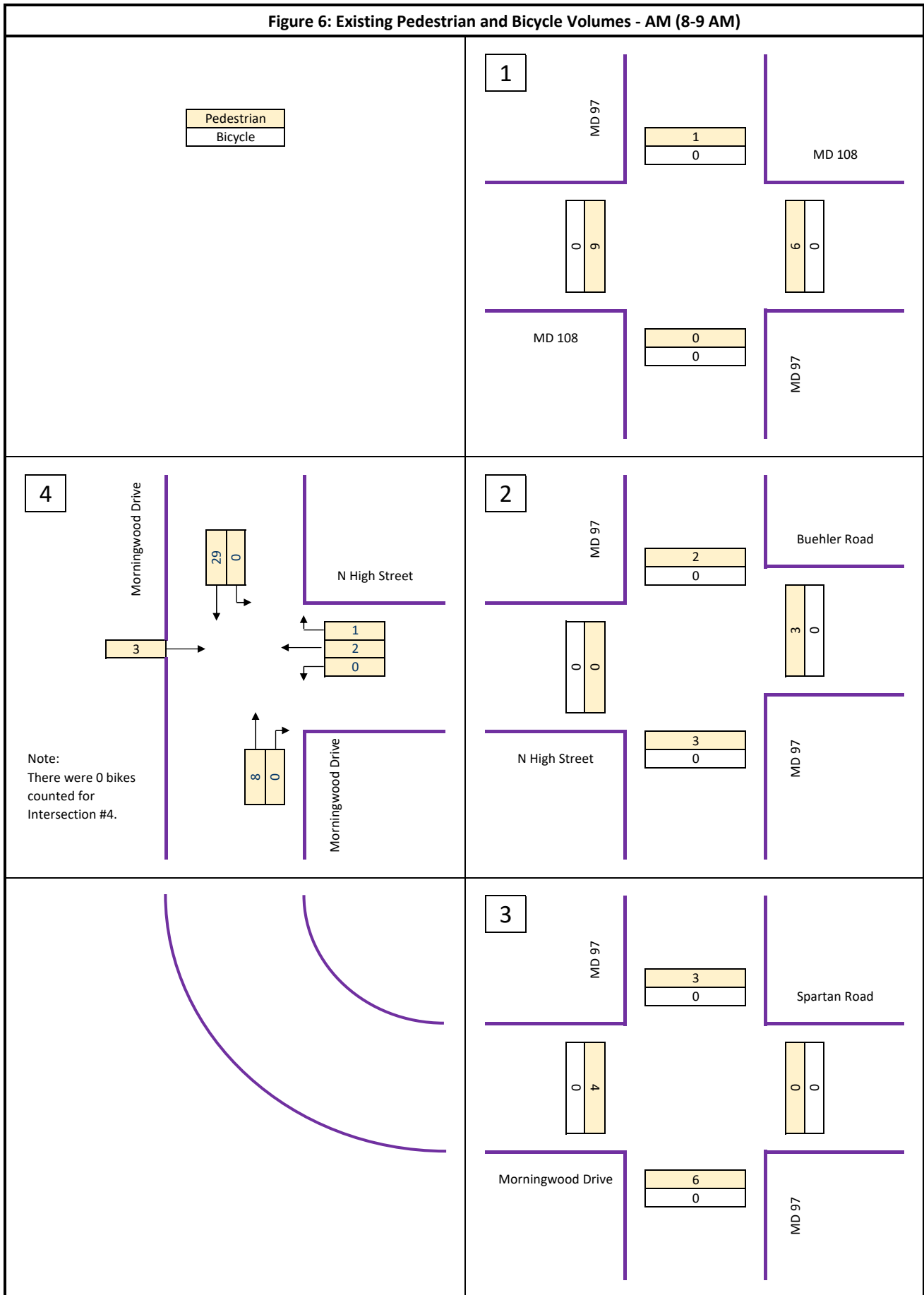
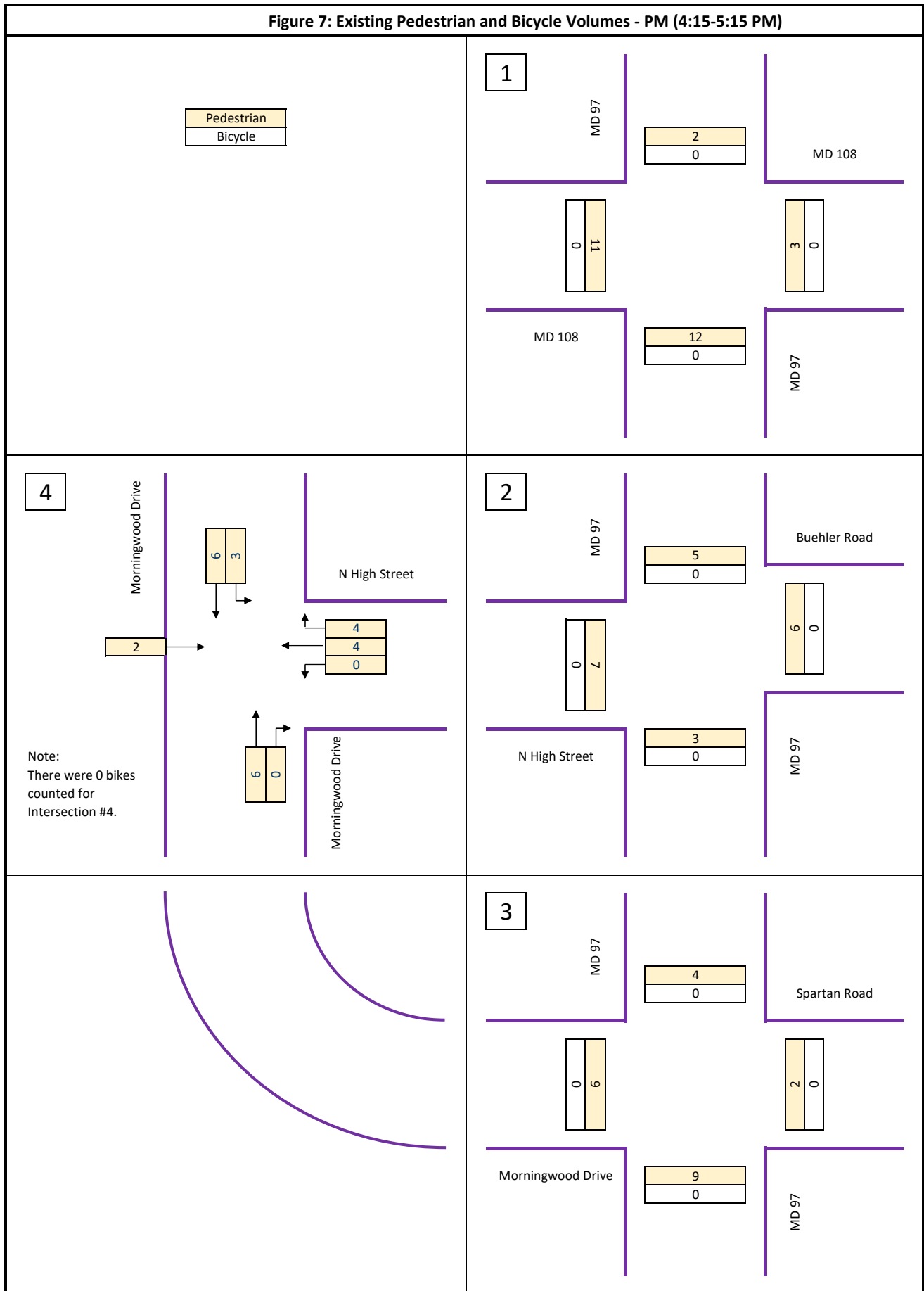




Figure 7: Existing Pedestrian and Bicycle Volumes - PM (4:15-5:15 PM)





#### 4.1 Existing Traffic Condition

The current traffic condition was analyzed with the existing peak hour volumes by the Synchro-HCM method to determine levels of service (LOS) and average vehicle delay based on Highway Capacity Manual (HCM) methodologies. The analysis model shows that the current traffic condition operates acceptably along the MD 97 corridor. Table 1 indicates that the intersections operate at an overall LOS of D or better during both the morning and afternoon weekday peak hours, which satisfy the LATR/LATIP guidelines for intersection operations. The Morningwood Drive and Spartan Road approaches showed LOS F and LOS E, respectively, in the peak period models.

Also, this study calibrated the AM and PM Synchro/SimTraffic model with travel time measurements in the field. The calibrated models were used to evaluate the existing traffic and North High Street connection condition. Details of the model calibration are provided in Appendix E. Queue results at each intersection by the SimTraffic simulation are summarized in Table 2. The queue lengths simulated generally match queue observations at the field. Synchro and SimTraffic reports are provided in Appendix F.

**Table 1: LOS Analysis Summary – Existing**

Intersections	Approach	Existing			
		AM		PM	
		LOS	Delay	LOS	Delay
MD 97 & MD 108  Signalized	<b>Overall</b>	<b>D</b>	<b>48.7</b>	<b>D</b>	<b>52.2</b>
	EB	D	44.1	D	47.2
	WB	D	37.9	D	51.0
	NB	D	54.4	D	54.1
	SB	E	59.4	E	59.2
MD 97 & N High Street/ Beuhler Road  Unsignalized	<b>Overall</b>	-	-	-	-
	EB	D	25.4	B	12.8
	WB	B	10.6	B	12.5
	NB	A	1.3	A	0.4
	SB	A	0.0	A	0.1
MD 97 & Morningwood Drive/ Spartan Road  Signalized	<b>Overall</b>	<b>C</b>	<b>33.2</b>	<b>D</b>	<b>49.7</b>
	EB	F	80.8	F	80.9
	WB	E	67.4	E	79.9
	NB	C	21.2	D	44.7
	SB	C	25.8	D	35.3



Table 2: Queue Analysis Summary by SimTraffic Simulation – Existing

Intersections	Dir.	Mvmt.	Storage (ft)	Existing AM		Existing PM	
				Max. Queue (ft)	Avg. Queue (ft)	Max. Queue (ft)	Avg. Queue (ft)
MD 97 & MD 108	EB	L	170	245	83	245	130
	EB	T	820	396	224	471	244
	EB	R	340	380	183	191	56
	WB	L	390	204	82	397	134
	WB	T	720	212	116	457	292
	WB	TR	720	209	108	428	275
	NB	L	380	196	116	345	219
	NB	T	510	134	54	413	239
	NB	TR	510	168	60	434	265
	SB	L	125	175	75	175	98
	SB	T	940	502	340	343	189
	SB	R	265	290	58		
MD 97 & N High Street/Beuhler Road	EB	LT	50	100	52	88	41
	EB	R	440	258	79	152	55
	WB	LTR	440	36	18	142	58
	NB	L	95	93	32	52	17
	NB	T	260	52	2	33	1
	NB	TR	260	4		16	1
	SB	LT	510	184	48	148	22
	SB	TR	510	207	58	129	20
MD 97 & Morningwood Drive/Spartan Road	EB	L	75	124	41	124	58
	EB	TR	850	340	156	268	132
	WB	L	960	210	139	637	357
	WB	TR	240	122	48	300	218
	NB	L	155	152	38	280	142
	NB	T	1400	298	156	1545	1136
	NB	TR	1400	277	153	1457	1098
	SB	L	75	125	59	125	103
	SB	T	260	312	259	282	231
	SB	TR	260	312	281	286	239

Note: Shading highlights queues that exceed their storage.



### 4.2 Diversion Traffic with North High Street Connection

When North High Street is connected to Morningwood Drive, this study forecasted local traffic diversions using the following assumptions:

1. 10% of traffic to/from MD 97 south at Morningwood Drive will divert to North High Street.
2. 25% of traffic to/from MD 97 north at Morningwood Drive will divert to North High Street.
3. Two-thirds of the above diverted volumes will travel to/from the north at Morningwood Drive at North High Street, and one-third to/from the south at Morningwood Drive.
4. 5% of current traffic to MD 97 north at the Morningwood/MD 97 intersection are traveling to the North High Street/McDonald's business area, and are then going back to their origin. This traffic will access using the connected North High Street from/to Morningwood Drive north.

Based on the above assumptions (which are based on a review of the local network but not an Origin-Destination Study), an average of 50 vehicles in each of the peak hour periods are estimated to use the new connection. These traffic diversions result in minor reductions in turning traffic volumes at the MD 97/Morningwood Drive intersection. These assumptions would not change the MD 97/MD 108 intersection volumes. Figure 8 and Figure 9 show the peak hour vehicular traffic volumes when Morningwood Drive traffic is diverted to the North High Street. Details of traffic diversions for each assumption are provided in Appendix D.

### 4.3 Analysis Results with Traffic Diversion

Table 3 shows the LOS and delay results of the intersections by the Synchro-HCM model for this diversion condition. The model results indicate that with the traffic diversion, the delay impacts on the MD 97 study intersections would be minimal. The average delays on the eastbound North High Street approach at MD 97 and the individual approaches of the MD 97/Morningwood Drive/Spartan Road intersection would change by less than 1.5 seconds with no degradation in LOS compared to the Existing condition.

Also as presented in Table 4, no significant queue changes from the SimTraffic model were simulated with the diversion condition. The change pattern in queue lengths is similar to the delay change pattern. The eastbound maximum queue on the Morningwood Drive approach was simulated to reduce from 340 feet to 276 feet in the morning peak period, while the eastbound maximum queue on the North High Street approach was simulated to slightly increase from 258 feet to 276 feet in the same period. Northbound queues on MD 97 approaching the Morningwood signal increase slightly due to the added traffic staying on MD 97 to access North High Street with the diversion of traffic. Additional analysis would be needed to resolve the existing operational issues at the MD 97/Morningwood Drive intersection pertaining to long northbound queues in the evening peak which are not related to connecting North High Street to MD 97. The Synchro and SimTraffic outputs are provided in Appendix F.

At the new intersection of Morningwood Drive and North High Street, the intersection approaches are forecast to operate at LOS B or better with minimal traffic queues.

Figure 8: AM Peak Hour Traffic Volumes with North High Street Connection

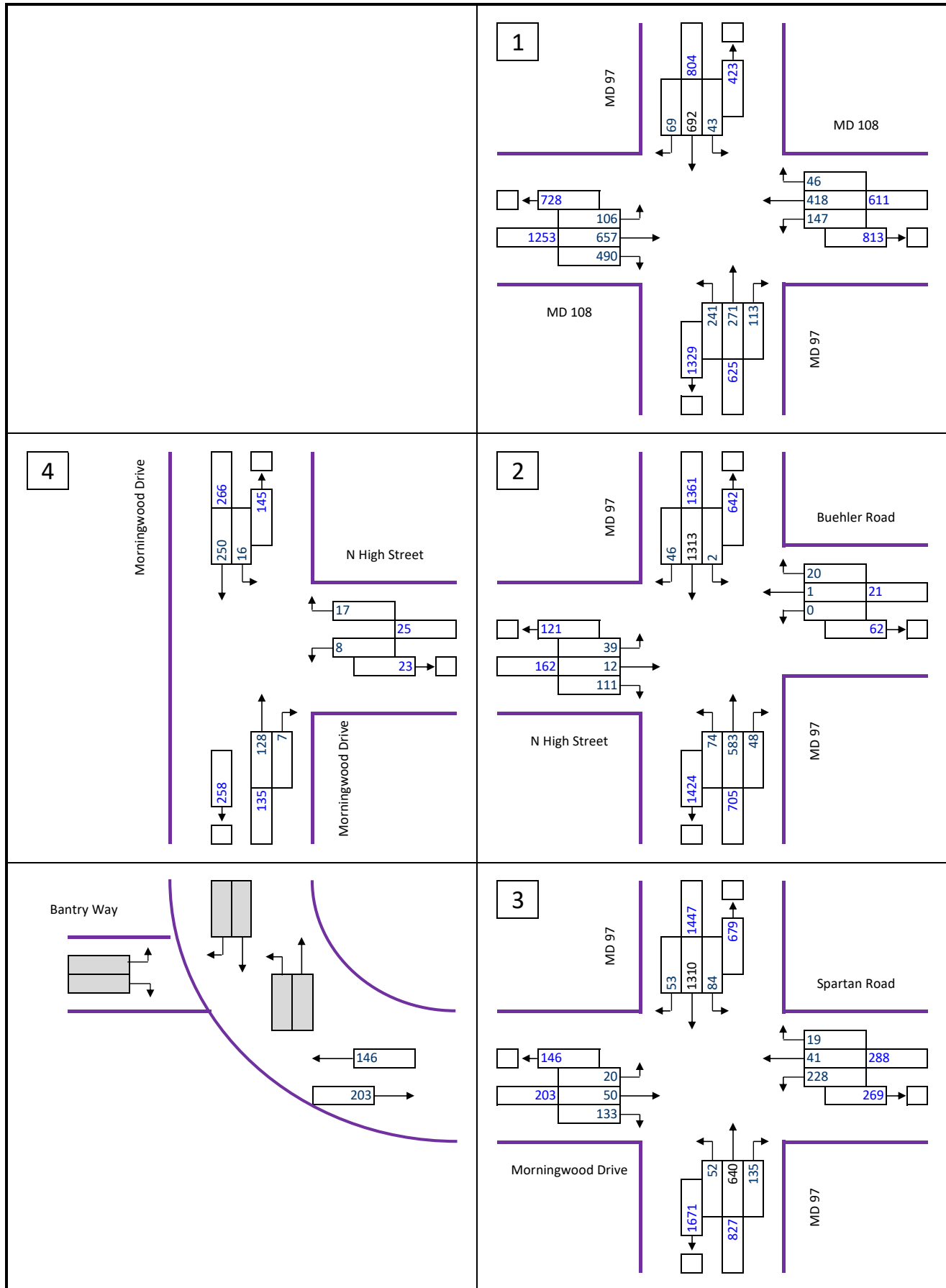


Figure 9: PM Peak Hour Traffic Volumes with North High Street Connection

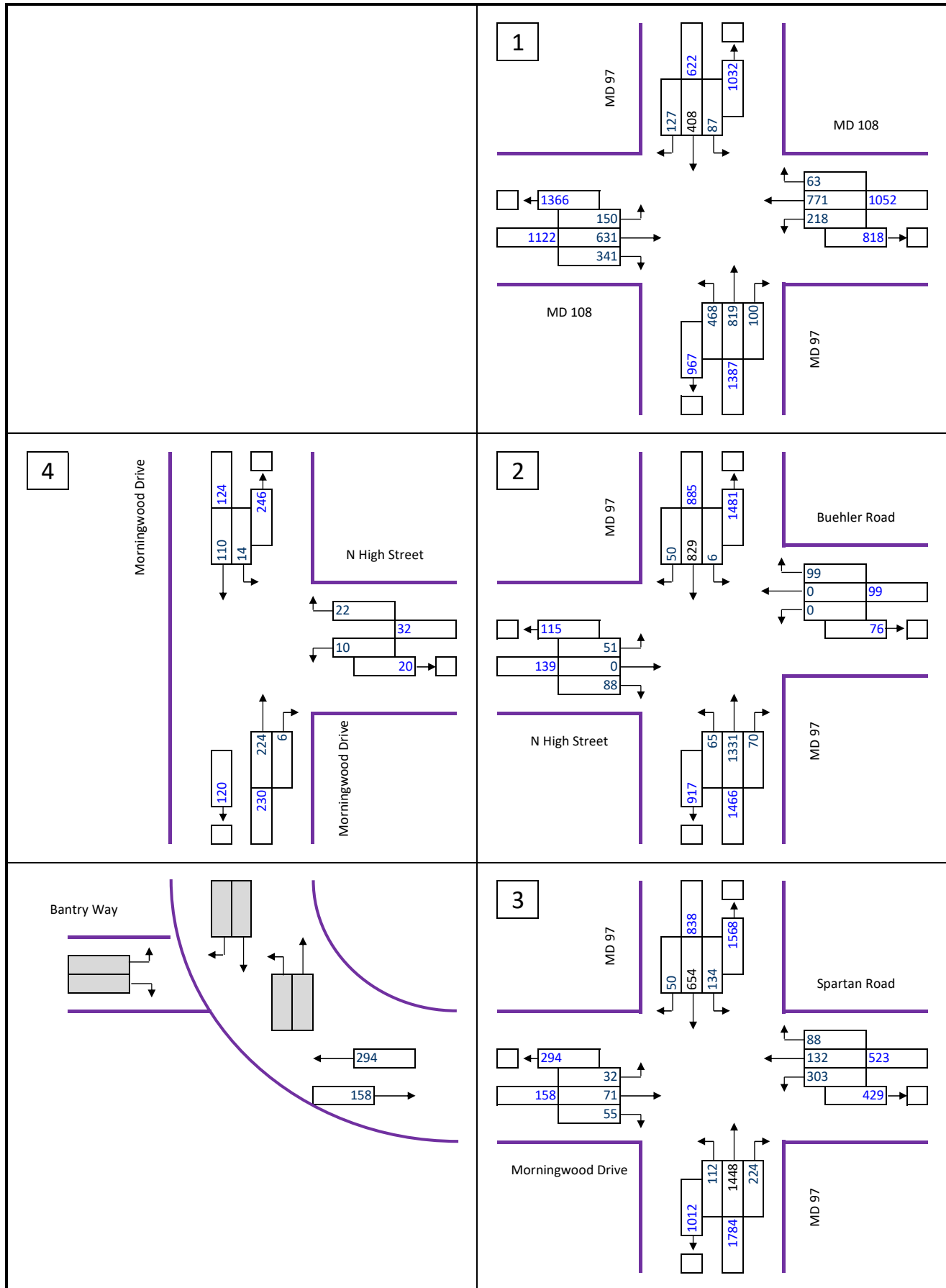






Table 3: LOS Analysis Summary – Diversion Scenario

Intersections	Approach	Existing with Diversion			
		AM		PM	
		LOS	Delay	LOS	Delay
MD 97 & MD 108  Signalized	<b>Overall</b>	<b>D</b>	<b>48.8</b>	<b>D</b>	<b>52.1</b>
	EB	D	44.1	D	47.2
	WB	D	37.9	D	51.0
	NB	D	54.6	D	53.8
	SB	E	59.4	E	59.2
MD 97 & N High Street/ Beuhler Road  Unsignalized	<b>Overall</b>	-	-	-	-
	EB	D	26.7	B	13.5
	WB	B	10.6	B	12.6
	NB	A	1.4	A	0.4
	SB	A	0.0	A	0.1
MD 97 & Morningwood Drive/ Spartan Road  Signalized	<b>Overall</b>	<b>C</b>	<b>32.0</b>	<b>D</b>	<b>49.9</b>
	EB	E	79.6	F	80.8
	WB	E	67.4	E	79.0
	NB	C	20.8	D	45.7
	SB	C	24.7	C	34.9
Morningwood Drive & N High Street  Unsignalized	<b>Overall</b>	-	-	-	-
	EB	-	-	-	-
	WB	A	10.0	B	10.3
	NB	A	0.0	A	0.0
	SB	A	0.5	A	1.0



Table 4: Queue Analysis Summary by SimTraffic Simulation – Diversion Scenario

Intersections	Dir.	Mvmt.	Storage (ft)	Existing AM with Diversion		Existing PM with Diversion	
				Max. Queue (ft)	Avg. Queue (ft)	Max. Queue (ft)	Avg. Queue (ft)
MD 97 & MD 108	EB	L	170	245	73	245	130
	EB	T	820	402	212	368	225
	EB	R	340	383	186	243	69
	WB	L	390	157	59	364	136
	WB	T	720	226	126	489	294
	WB	TR	720	220	116	449	284
	NB	L	380	194	111	384	230
	NB	T	510	131	51	427	230
	NB	TR	510	189	67	436	256
	SB	L	125	175	63	175	99
	SB	T	940	565	324	308	195
	SB	R	265	232	50		
MD 97 & N High Street/Beuhler Road	EB	LT	50	99	67	98	48
	EB	R	440	276	129	166	59
	WB	LTR	440	35	17	179	64
	NB	L	95	109	40	78	22
	NB	T	260	75	5	37	2
	NB	TR	260	6		43	3
	SB	LT	510	241	45	111	21
	SB	TR	510	223	47	112	20
MD 97 & Morningwood Drive/Spartan Road	EB	L	75	122	25	124	39
	EB	TR	850	276	132	240	113
	WB	L	960	200	140	586	345
	WB	TR	240	143	50	296	213
	NB	L	155	165	40	279	120
	NB	T	1400	293	170	1538	1209
	NB	TR	1400	302	150	1544	1182
	SB	L	75	125	53	125	107
	SB	T	260	301	250	283	239
	SB	TR	260	322	272	288	245
Morningwood Drive & N High Street	WB	LR	630	39	16	45	18
	SB	LT	620	40	3	40	3



### 5 Design Challenges for North High Street Connection

Potential design issues with the North High Street connection to Morningwood Drive were noted in the field survey. Morningwood Drive has relatively sharp horizontal curves north and south of the proposed North High Street connection, which can cause a sight distance concern. Figure 10 and Figure 11 show the roadway alignment north and south of the connection where the distance issue should be reviewed in design.

With the current posted speed limit and design speed of 30 mph, the intersection sight distance per AASHTO sight distance guidance should be at least 331 feet for the left turn from North High Street to Morningwood Drive, and 290 feet for the right turn. Figure 12 shows sight triangles from an 'imaginary car' looking from an extended North High Street connecting to Morningwood Drive.

Looking left from North High Street, the required minimum sight line potentially cuts into the hillside and white picket fence shown on Figure 10. Looking right from North High Street, the needed sight line could cut through a wooded area and fence as well (Figure 11). Additionally, before the end of the sightline is the start of parking lane allowed along Morningwood Drive, creating another visual obstruction.

North High Street itself would have to be lowered eight to nine feet to tie into Morningwood Drive. This reconstruction and grade change would likely reach back to at least where the dark lines of 'modeled new road' on the figure begin to start lowering the profile. This construction would have effects to both the driveways / access to the two properties at the end of North High Street and possibly the next two driveways as well.

Roadway signing, pavement markings, sidewalks, lighting, parking, and roadway alignment and width related to the North High Street connection will be addressed in detail during the design phase of the project.



**Figure 10: Morningwood Drive looking south from North High Street Steps**

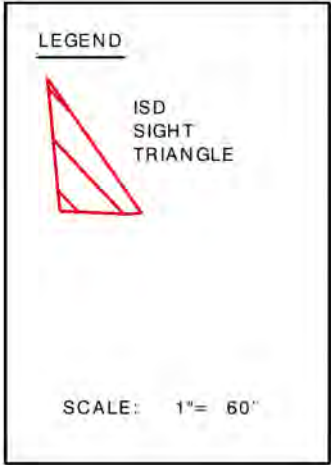


**Figure 11: Morningwood Drive looking north from North High Street Steps**





Figure 12 Sight Distance Analysis



PASSENGER VEHICLE ISD LEFT TURN TO MORNINGWOOD DR.

$ISD = 1.47V_{maj}t_g$   
 $ISD = 331$  Intersection sight distance (length of leg of sight triangle along major road. (ft)  
 $V_{major} = 30$  Design speed of major road (mph)  
 $t_g = 7.5$  Time gap for minor road vehicle to enter major road (s)  
(Reference: AASHTO 2018 Table 9-6 pg.9-44)

NEEDED ISD = 331'

PASSENGER VEHICLE ISD RIGHT TURN TO MORNINGWOOD DR.

$ISD = 1.47V_{maj}t_g$   
 $ISD = 331$  Intersection sight distance (length of leg of sight triangle along major road. (ft)  
 $V_{major} = 30$  Design speed of major road (mph)  
 $t_g = 6.5$  Time gap for minor road vehicle to enter major road (s)  
(Reference: AASHTO 2018 Table 9-8 pg.9-47)

NEEDED ISD = 290'





## 6 Crash Data Analysis

The Montgomery County Crash Reporting dataset provides general information about each reported crash and details of all traffic collisions occurring on roadways within Montgomery County, as collected via the Automated Crash Reporting System (ACRS) of the Maryland State Police, and reported by the Montgomery County Police, Gaithersburg Police, Rockville Police, or the Maryland-National Capital Park Police.

This study compiled the dataset for the latest five years (2015-2019) for the study segment along MD 97 from Morningwood Drive/Spartan Road to MD 108. Table 5 presents traffic crashes and severity trends over the latest 5 years. 57 crashes occurred during the latest five years in this section. The number of total crashes increased by 13% per year over the five years. On average, eleven reported crashes occurred every year in the corridor segment. Approximately 20% of the crashes resulted in injury crashes. Details of the crash data are provided in **Appendix G**.

**Table 5: MD 97 Corridor Reported Traffic Crash Severities (2015-2019)**

Year	2015	2016	2017	2018	2019	Total	Avg.	%	Increase Rate (per Yr.)
Fatal Crashes	-	-	-	-	-	-	-	-	-
Injury Crashes	2	3	3	2	1	11	2	19.3	-15.9%
Property Damage Crashes	6	11	10	7	12	46	9	80.7	18.9%
Total	8	14	13	9	13	57	11	100.0	12.9%

Based on the mile points where each crash was reported to occur, the 57 crashes were sorted by location. As shown in Table 6, most of the crashes occurred at the two signalized intersections along the corridor (88%). Approximately one-half occurred at MD 97/MD 108. The North High Street/Buehler Road intersection had a higher percentage (43%) of injury crashes than for the other two signalized intersections.

**Table 6: MD 97 Corridor Reported Crashes by Location (2015-2019)**

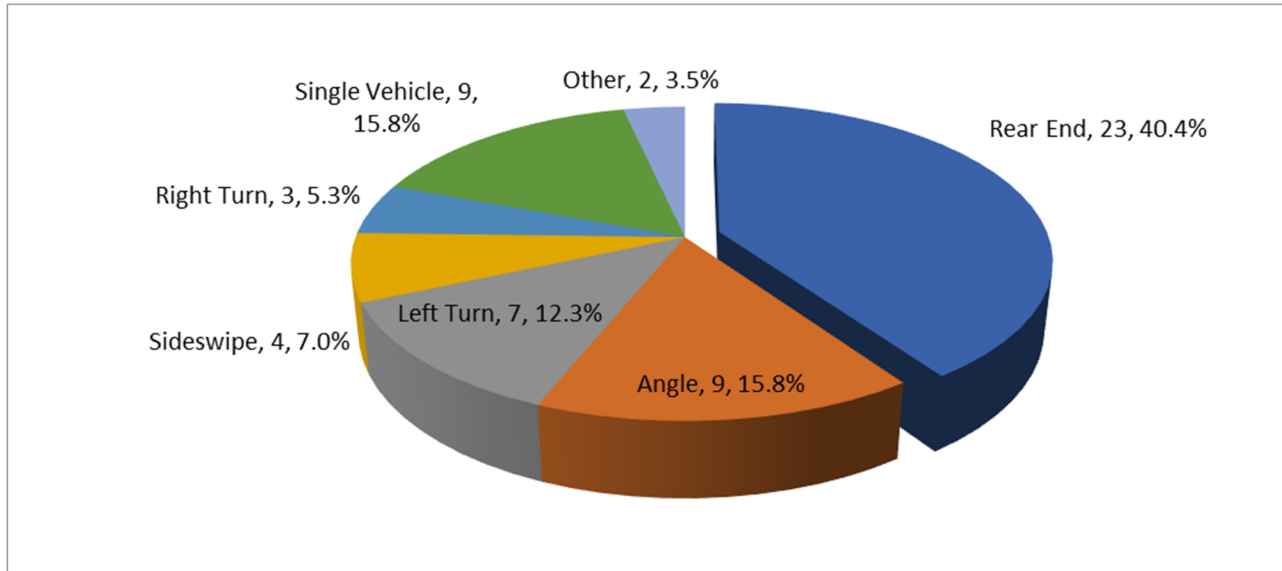
Intersections	Total Crashes	%	Injury Crashes	% of Total
At Georgia Ave. at Morningwood Dr./Spartan Rd.	21	36.8%	5	24%
At North High St./Buehler Rd.	7	12.3%	3	43%
At MD 108	29	50.9%	3	10%
Total	57	100.0%	11	100%

Note: Some of crash locations in this table can be different from Figure 12, because this table is based on the mile point, while Figure 12 crash locations were pointed based on the XY coordinate information in the data set.





As shown in Figure 13, the most frequent collision type in the study section was Rear End (40.4%), followed by Single Vehicle and Angle (15.8%) and Left Turn (12.3%). No pedestrians were reported to be involved in any of the crashes. One bicyclist-involved crash occurred at the North High Street intersection.



**Figure 13: Study Section Reported Crashes by Collision Type (2015-2019)**

Table 7 presents fixed objects struck in Single Vehicle collisions. One-third of the Single Vehicle collisions were Curb collisions.

**Table 7: Fixed Objects in Single Vehicle Crashes (2015-2019)**

	Curb	Light Support Pole	Sign Support Pole	Building	Tree Shrubbery	Other	Total
Crashes	3	1	1	1	1	2	9
%	33.3%	11.1%	11.1%	11.1%	11.1%	22.2%	100.0%

Table 8 shows temporal patterns for the corridor crashes. Approximately 56% of total crashes occurred between 3 PM and midnight. Wednesday had the highest number of crashes of the days of week. The winter and fall month periods had a higher number of crashes than for the other seasonal periods.



Table 8: Temporal Crash Patterns (2015-2019)

Time of Day	00-06	06-9	9-12	12-15	15-18	18-21	21-24	Total
Crashes	3	6	9	7	11	10	11	57
%	5%	11%	16%	12%	19%	18%	19%	100%
Day of Week	Sunday	Monday	Tuesday	Wed.	Thursday	Friday	Sat.	Total
Crashes	7	8	6	13	11	8	4	57
%	12%	14%	11%	23%	19%	14%	7%	100%
Month	Dec.-Feb.	March-May	June-August	Sep.-Nov.	-	-	-	Total
Crashes	17	12	11	17	-	-	-	57
%	30%	21%	19%	30%	-	-	-	100%

Table 8 provides crashes by weather, roadway surface, and light conditions. Dark Light and Wet surface accounted for 39% and 21%, respectively, of a total of the 5-year crashes. The percentage of Wet Surface crashes is very close to the Maryland Statewide average (21%), shown in a latest MDOT SHA crash report, and the percentage of Dark Light is relatively higher than for the Maryland Statewide average (31%).

Table 9: Crashes by Weather, Surface, and Light Condition (2015-2019)

Weather	Clear	Cloudy	Raining	Foggy	N/A, Other	Total
Crashes	35	7	7	1	7	57
%	61.4%	12.3%	12.3%	1.8%	12.3%	100.0%
Surface	Dry	Wet	Snow	Ice	N/A	Total
Crashes	41	12	1	1	2	57
%	71.9%	21.1%	1.8%	1.8%	3.5%	100.0%
Light	Day Light	Dark Light	Dawn	Dusk	-	Total
Crashes	31	22	3	1	-	57
%	54.4%	38.6%	5.3%	1.8%	-	100.0%

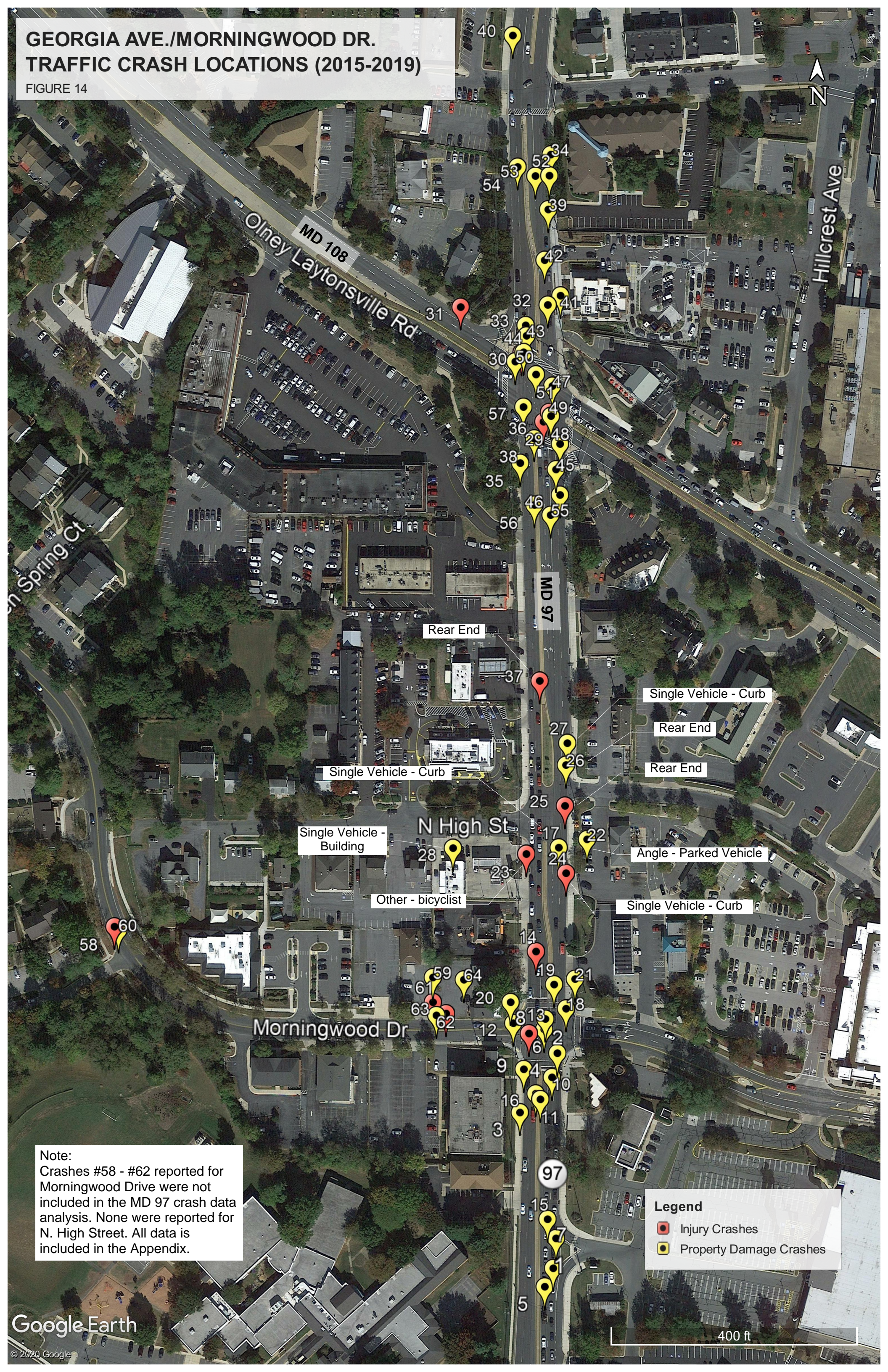
Figure 14 presents the crash locations identified in the crash data, based on the latitude and longitude coordinate data. In cases where the location data appeared to map unrealistically, their mile points were considered to locate those on the map.

Nine of the crashes occurred in the vicinity of the MD 97/North High Street intersection, with four of those being injury crashes. As most of the crashes were Rear End collisions or collisions with fixed objects it does not appear that at this time that there are many crashes occurring due to turns being made to and from North High Street. Turning volumes at the intersection will increase with the connection to Morningwood Drive and left turns into and out of Buehler Road are currently prohibited.



GEORGIA AVE./MORNINGWOOD DR.  
TRAFFIC CRASH LOCATIONS (2015-2019)

FIGURE 14



Note:  
Crashes #58 - #62 reported for Morningwood Drive were not included in the MD 97 crash data analysis. None were reported for N. High Street. All data is included in the Appendix.

- Legend**
- Injury Crashes
  - Property Damage Crashes





## Appendices