

District Department of Transportation

UPPER BEACH DRIVE MANAGEMENT PLAN- Traffic Study

June 2022



Traffic Study

Traffic Engineering and Safety Division

EXECUTIVE SUMMARY

Since the 1970s, the National Park Service (NPS) has closed Upper Beach Drive NW to through traffic between Broad Branch Road NW and the Maryland State Line (approximately six miles) on weekends and federal holidays. In consultation with the District Government, NPS made the closure full time by including all weekdays beginning in April 2020 to provide park visitors and District residents unrestricted access to roads for exercise and recreational opportunities during COVID-19 pandemic.

The full-time closure has proven popular with the recreating public, created safe nonmotorized connections across a portion of the city, and filled a key gap in the regional trail network. Therefore, on June 1, 2021, the Council of the District of Columbia (D.C. Council) voted on a resolution asking the NPS to extend the closure permanently. The Montgomery County Council followed up with a resolution supporting the NPS closure and the continuance of weekend closures of a 2.7-mile section of Upper Beach Drive in Maryland. In response to the D.C. Council's resolution, the District Department of Transportation (DDOT) leadership has agreed to help the NPS study traffic impacts and implement mitigations associated with the proposed weekday closure. A section of Upper Beach Drive from Wise Road NW to West Beach Drive NW (approximately 700 feet) will stay open for providing the fundamental connections to the nearby communities.

This June 2022 report is a revision to the original draft report dated October 2021. A new traffic study was conducted because the original modeling did not incorporate four major projects that could potentially impact traffic volumes in the study area. These projects include:

- The recently completed 16th Street Bus Lane project from H Street NW to Arkansas Avenue NW.
- The pipeline bus lane project along the Georgia Avenue NW corridor from Barry Place NW to the Maryland State Line (presently the section south of Barry Place is completed and a study of the center section up to Kansas Avenue NW is ongoing).
- The approved alternative C along Connecticut Avenue NW which would eliminate the reversible lanes and provide safety improvement including protected bike lanes.
- The ongoing study by the National Park Service to eliminate the reversible lanes along Rock Creek and Potomac Parkways.

These projects have been examined and assessed in this revision to provide a more accurate and comprehensive understanding of the impacts of the Upper Beach Drive closure.

How much traffic uses Upper Beach Drive?

Motorists use Upper Beach Drive NW as a north-south connector to travel from the center of the District to Maryland and as an east-west connector across the northern portion of the District. In general, traffic volumes near the Upper Beach Drive are relatively low compared to southern portions near the National Zoo. Traffic counts collected pre-COVID show the following volumes on sections of Upper Beach Drive:

PRE-COVID UPPER BEACH DRIVE TRAFFIC VOLUMES (2019)

	Average Daily Traffic (vpd)	AM (PM) Peak Hour Volume (vph)	
		Northbound	Southbound
Broad Branch Road to Joyce Road NW	5,500	50 (425)	350 (100)
Joyce Road to Wise Road NW	8,500	150-175 (450-500)	500-650 (225-325)
West Beach Drive to Maryland State Line	7,000	175 (225)	300 (375)

Where will the motorists travel if Upper Beach Drive is closed on weekdays?

If NPS closes Upper Beach Drive during weekdays, motorists are expected to divert to several different roadways in the area. This has the potential to create delay, especially during peak travel periods. Due to impact of the COVID-19, no new traffic counts were collected in early 2021. The analysis used the pre-COVID turning movement counts conducted in 2019, when Upper Beach Drive was open. Travel demand forecasts were performed for the year 2045 based on the Metropolitan Washington Council of Governments (MWCOG) travel demand model to estimate growth and diversions. The model was modified to include multimodal projects, such as the recently constructed 16th Street Bus Lane project, the approved Georgia Avenue Bus Lane project, the approved Connecticut Avenue Reversible Lane and Safety Improvement project, and the potential reversible lane removal project along Rock Creek and Potomac Parkway. Traffic analysis was performed for both AM and PM peak periods for the options that Upper Beach Drive open, closed and closed with mitigations under 2019 and 2045 conditions. Assumed diversions were as follows:

As show, most through trips are expected to divert to 16th Street NW. Traffic volumes will also increase on other streets, although to a lesser extent, particularly Pinehurst Parkway, Military Road NW, Utah Avenue NW and 23rd Street NW. Routes may vary, especially if motorists use navigation apps such as Waze or Google Maps.

UPPER BEACH DRIVE TRAFFIC DIVERSION (BASE YEAR 2019 AND HORIZON YEAR 2045)

Roadway	Year	AM (PM) Peak Hour Volume (vph)	
		Northbound	Southbound
16 th Street NW	2019	<25-125 (175-275)	150-350 (50-200)
	2045	50-175(200-375)	200-425(100-250)
Oregon Avenue NW	2019	<50(175)	125-175 (100)
	2045	75(200)	175-200(125)
Blagden Avenue NW	2019	<25 (175)	150 (25)
	2045	<50(200)	200(75)
Broad Branch Road NW	2019	<50(200-225)	150 (50)
	2045	50(225)	175(75)

¹-Assume Upper Beach Drive open from Wise Road NW to West Beach Drive NW

What Improvements can be Implemented to Mitigate the Impacts on other Roadways?

The analysis points to several mitigation measures if Upper Beach Drive NW is closed on weekdays to mitigate delay during peak period travel, improve safety, and discourage speeding in residential neighborhoods. These include new and adjusted traffic signals, safety improvements, and traffic calming inside and outside Rock Creek Park:

- 16th Street NW and Blagden Avenue NW - Signalize intersection
- 16th Street NW - Modify signal timings including signal offsets at the 16th Street NW at the Missouri Avenue NW/ Military Road ramp intersections
- Military Road NW Westbound to Glover Road NW Southbound (only AM peak period) - Provide left turn phasing.
- Upper Beach Drive NW at Blagden Avenue NW - Provide a three way stop as a short-term solution and ultimately signalize as operations warrant.
- Upper Beach Drive NW & Broad Branch NW, Beach Drive NW & Wise Road NW and Beach Road NW & West Beach Drive NW - upgrade signing and pavement markings.
- Implement Traffic Calming on Chestnut Street NW (Completed).

There are other suggested mitigations which could be implemented in conjunction with available funding and neighborhood approval. In addition, it is recommended that Ross

Drive NW could follow the same closure strategy recommended for the Upper Beach Drive, because it is not designed for high traffic volumes and could become a major diversion route through the park.

Will these improvements totally mitigate the increase in traffic?

Based on 2019 and 2045 volumes, these improvements will improve operations, however conditions will remain worse compared to the same level of operations as if Upper Beach Drive were open. The traffic study showed that if Upper Beach Drive (north of Broad Branch Road NW) is closed, peak period travel time on 16th Street NW will increase between 2.5 minutes to 4.5 minutes and speeds will reduce by up to 4 to 6 miles per hour in the peak direction in the base year. East-west travel times would increase for motorists that typically use Bingham Road NW to Beach Drive NW to Sherrill Road NW by about one to five minutes, depending upon the location of the origin and destination and time of day. These findings assume implementation of proposed mitigations.

In 2045, the difference in additional travel time will increase to 7.5 minutes in the peak hour peak direction. This will mean that travel times especially along 16th Street NW will increase by over 50% in the peak direction, and the off-peak direction would see relatively small increases. Six additional intersections in the AM peak hour and four in the PM peak hour will be reduced by at least one LOS to a E or F of the total 25 studied intersections.

In the year 2045, the proposed mitigation measures improve the following locations during the AM peak hour:

- Reducing approximately 60 seconds of delay per vehicle at Military Road NW & Glover Road NW & Oregon Avenue NW intersection.
- Improving Blagden Avenue NW approach to Beach Drive NW delay queues by over 1,500 feet.
- Improving LOS at the 16th Street NW & Fort Stevens Drive NW intersection from a LOS E to LOS D.
- Slightly reduces travel time on 16th Street NW southbound.

During the PM peak hour, proposed mitigation measures will reduce impacts over the closed condition by:

- Reducing delay at 16th Street NW and Alaska Avenue NW intersection by over 15 seconds of delay per vehicle.
- Improving the operation at the Beach Drive & Blagden Avenue NW intersection to LOS A.
- Providing motorists with easier access to 16th Street NW from Blagden Avenue NW with the overall intersection still operating at LOS B.

2019 AND 2045 AM(PM) SUMMARY TABLE OF TRAFFIC OPERATIONS

	Base Year-2019						Horizon Year-2045					
	Upper Beach Dr. Open		Upper Beach Dr. Closed		Closed with Mitigation		Upper Beach Dr. Open		Upper Beach Dr. Closed		Closed with Mitigation	
	Delay*	LOS	Delay*	LOS	Delay*	LOS	Delay*	LOS	Delay*	LOS	Delay*	LOS
16th St & Colorado Ave, NW	42 (29)	D (C)	69 (39)	E (D)	68 (41)	E (D)	71 (51)	E (D)	102 (67)	F (E)	101 (69)	F (E)
16th St & Military Rd WB Ramp, NW	33 (13)	C (B)	71 (22)	E (C)	72 (15)	E (B)	57 (14)	E (B)	91 (29)	F (C)	91 (17)	F (B)
16th St & Van Buren St, NW North	14 (14)	B (B)	61 (15)	E (B)	61 (14)	E (B)	39 (14)	D (B)	100 (20)	F (B)	100 (19)	F (B)
16th St & Alaska Ave, NW (North)	17 (32)	B (C)	17 (60)	B (E)	17 (49)	B (D)	26 (66)	C (E)	27 (101)	C (F)	27 (87)	C (F)
16th St & Blagden Ave, NW ¹	>200 (>200)	F (F)	>200 (>200)	F (F)	16 (10)	B (A)	>200 (>200)	F (F)	42 (11)	D (B)	42 (11)	D (B)
Military Rd & Oregon/Glover Rd, NW	110 (25)	F (C)	171 (51)	F (D)	107 (51)	F (D)	172 (39)	F (D)	236 (81)	F (F)	175 (75)	F (E)
Beach Dr & Blagden Ave, NW ²	>200 (>200)	F (F)	>200 (>200)	F (F)	100 (24)	F (C)	>200 (108)	F (F)	>173 (61)	F (F)	30 (9)	C (A)

1- Assumes signalization with closure 2- Assumes three way stop in base year and signalization by 2045

* - seconds per vehicle

What if Upper Beach Drive was only closed during certain times of the year or during certain hours?

Two time of year closure alternatives were suggested, which are:

- From April 1st to September 30th, or
- from Memorial Day to Labor Day.

Traffic volumes in April, May and September are similar to the remainder of the year, therefore from a traffic standpoint this would cause the same levels of congestion as during the late fall/winter/early spring. The Memorial Day to Labor Day period volumes are reduced by about 10% which would mean less congestion would be anticipated during that time.

A third - time of day (9:30 AM to 3:00 PM) closure alternative has also been analyzed, which is identified to have limited impacts to traffic. However, it would present issues with pedestrian/bicyclist expectancy of when traffic would be on Upper Beach Drive and the maintenance/cost of implementing this daily operation.

Is there any advantage of closing Upper Beach Drive at Joyce Road NW?

Reducing the closure limits will provide some traffic benefit. The limited closure will reduce traffic along Blagden Road NW, through the Crestwood neighborhood and along Broad Branch Road which is anticipated to already see an increase in traffic due to the elimination of the reversible lanes on Connecticut Avenue NW versus a total closure. The section of 16th Street NW will also have slightly lower volumes. Although, this section carries the lowest volumes on Upper Beach Drive.

With this closure more motorists will use the 16th Street & Missouri Avenue NW intersection, making this location, the key point of congestion along 16th Street NW. This alternative would not relieve traffic in the Barnaby Woods area or along roadways north of Military Road NW. Keeping the north section of 16th St (north of Military Road NW) open, on the other hand, would bring more benefit in terms of traffic.

Is there a preference?

The decision to close the Upper Beach Drive will need to evaluate the users of Rock Creek Park, the surrounding neighborhoods, and the travelling public. The permanent all year closure is especially impactful when several previously listed transit or bicycle oriented multi-modal safety enhancement projects are constructed along the parallel corridors. The concerns are as follows:

- Additional travel time of approximately 7.5 minutes in the peak hour peak direction.
- Additional congestion cost of over \$18 million dollars annually.
- Over a 50% increase in emissions in the peak hour, peak direction.
- Six additional intersections operating at LOS E or F in the AM peak hour and four in the PM peak hour although one intersection will improve with the closure.
- Additional traffic on the local and collector streets in the Barnaby Woods area of northwest DC plus streets.
- The ability to provide east-west connections for school access.
- The Federal Highway Administration (FHWA) is starting the process to design the reconstruction Ross Drive NW, Wise Road NW, Wise Road NW, West Beach Drive NW, Ridge Road NW, Glover Road NW, Bingham Drive NW, Ross Drive NW and Morrow Drive NW which all tie into Upper Beach Drive. The reconstruction will require either one way or two-way detours which will further impact traffic operations on other roadways in the area.

If NPS chooses to close the roadway during weekdays, the preference would be for the closure to take place from Memorial Day to Labor Day or when schools are not in session. From a traffic standpoint, a mid-day closure would be acceptable, but this may affect the expectations of the Rock Creek Park users, and would increase the operation efforts from the park. The summertime closure would minimize traffic impacts while providing additional multi-modal access to Rock Creek Park during the peak season.

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1 INTRODUCTION

Beach Drive NW is the main road through Rock Creek Park in the northwest area of the District. The road serves both as an access road to the park and a commuter route for motorists. In response to COVID-19 and the limited opportunities for persons to do activities along with less traffic on the roadway network, the road was closed from Broad Branch Road NW to the Maryland State Line on weekdays. This section of roadway is referred to as Upper Beach Drive. This was for approximately 4.4 miles while the remaining portion of the roadway from Rock Creek and Potomac Parkway to Broad Branch Road NW remained open. A small 625-foot section of Upper Beach Drive from Wise Road NW to West Beach Drive NW remained open to facilitate east-west movements in the District. The closure occurred in April 2020 and allowed more pedestrians and bicyclists to use the section of roadway.



A small 625-foot section of Upper Beach Drive from Wise Road NW to West Beach Drive NW remained open to facilitate east-west movements in the District. The closure occurred in April 2020 and allowed more pedestrians and bicyclists to use the section of roadway.

This study is a revision to the October 2021 draft report and reflects changes in future projects that impact the results in the original draft report. This study is being performed in response to a request from the Council of the District of Columbia and the Montgomery County Council to have Upper Beach Drive closed for various times and in various sections. For the section from Broad Branch Road NW to the Maryland State Line except for the portion between Wise Avenue NW and West Beach Drive NW this would include:

- Full time Closures
- Part-time Closure from April 1 to September 30
- Part-time Closure from Memorial Day to Labor Day
- Open during the peak periods on weekdays (6:30 -9:30 AM and 3:30 -6:30 PM) and closed the remainder of times on weekdays and closed on weekends

The other option from a roadway network standpoint is:

- Closed from Joyce Road NW to the Maryland State Line except for the section from Wise Road NW to West Beach Drive NW

This study evaluates the impacts with normal traffic (pre-Covid19, schools in session) volumes for the full time closure since this represents the worst-case scenario. Mitigation measures needed to the other roadways in the network if the closure is made permanent are identified.

2 BASELINE CONDITIONS

2.1 Study Area and Background

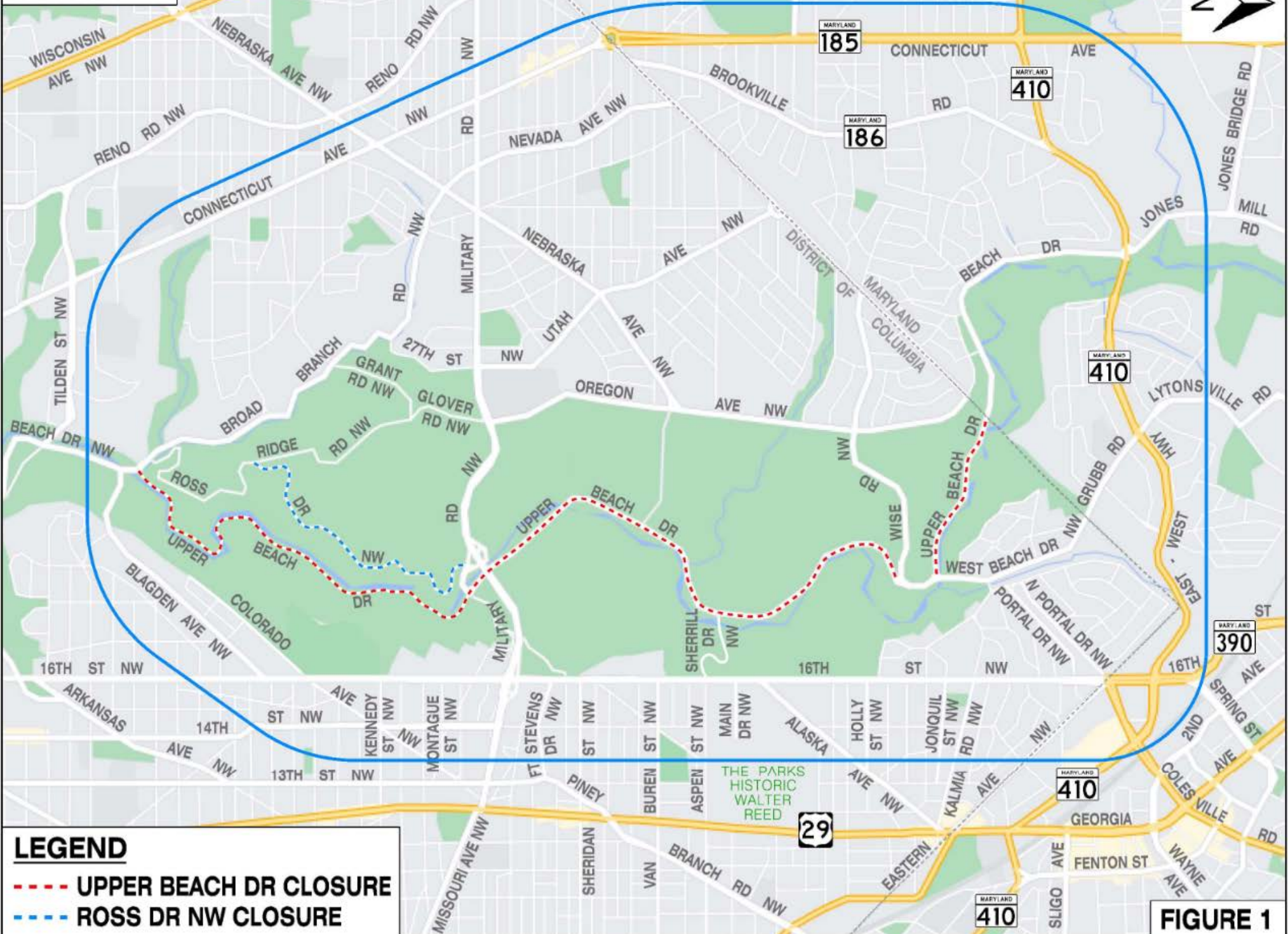
Beach Drive NW/Upper Beach Drive is located in the northwest section of Washington, DC within Rock Creek Park. The part of Upper Beach Drive for this study starts at Broad Branch Road NW/Blagden Avenue NW and continues north to the Maryland line. Upper Beach Drive is a two lane road with a 25 mph speed limit and carries mostly north-south traffic. It is a closed section roadway with no shoulders. The road generally parallels Rock Creek and there are numerous parking areas/picnic areas located along the route that serve as access points to the park. There are several pedestrian crosswalks and some horse crossing locations along this road. At some locations along Upper Beach Drive, there is an adjacent bike/pedestrian trail separated from Upper Beach Drive and at other locations bicyclists have to share the road with vehicular traffic. On the section of Upper Beach Drive from Broad Branch Road NW to the Maryland line, there are five unsignalized intersections, which are internal to the park:

1. Upper Beach Drive and Joyce Road NW (Four-way stop controlled) – This is the southern most intersection on this section of Upper Beach Drive and is south of Military Road NW
2. Upper Beach Drive and Bingham Drive NW (T-type intersection, stop condition on Bingham Drive NW) – Bingham Drive NW connects to Oregon Avenue NW but is gated on the Oregon Avenue NW end, thus it mostly serves as an access road to Picnic Area 12 of Rock Creek Park.
3. Upper Beach Drive and Sherrill Drive NW (T-type intersection, stop condition on Sherrill Drive NW) – The Sherrill Drive NW approach is stop controlled. Sherrill Drive NW connects to 16th Street NW.
4. Upper Beach Drive and Wise Road NW (T-type intersection, 3-way stop controlled) – Wise Road NW connects to Oregon Avenue NW.
5. Upper Beach Drive and West Beach Drive NW (T-type intersection, 3 way stop controlled) – West Beach Drive NW connects to Primrose Road NW/Grubb Road NW which connects to MD 410 (East-West Highway).

Directly adjacent to Upper Beach Drive is Military Road NW, which passes over Upper Beach Drive. There are three ramps to/from Military Road NW (from Military Road NW eastbound, from Military Road NW westbound and to Military Road NW westbound) via Joyce Road NW. Joyce Road NW ties into 16th Street NW and Ross Drive NW. Ross Drive NW is presently closed to traffic.

The study area is shown in Figure 1.

STUDY AREA



LEGEND

- - - UPPER BEACH DR CLOSURE
- - - ROSS DR NW CLOSURE

FIGURE 1

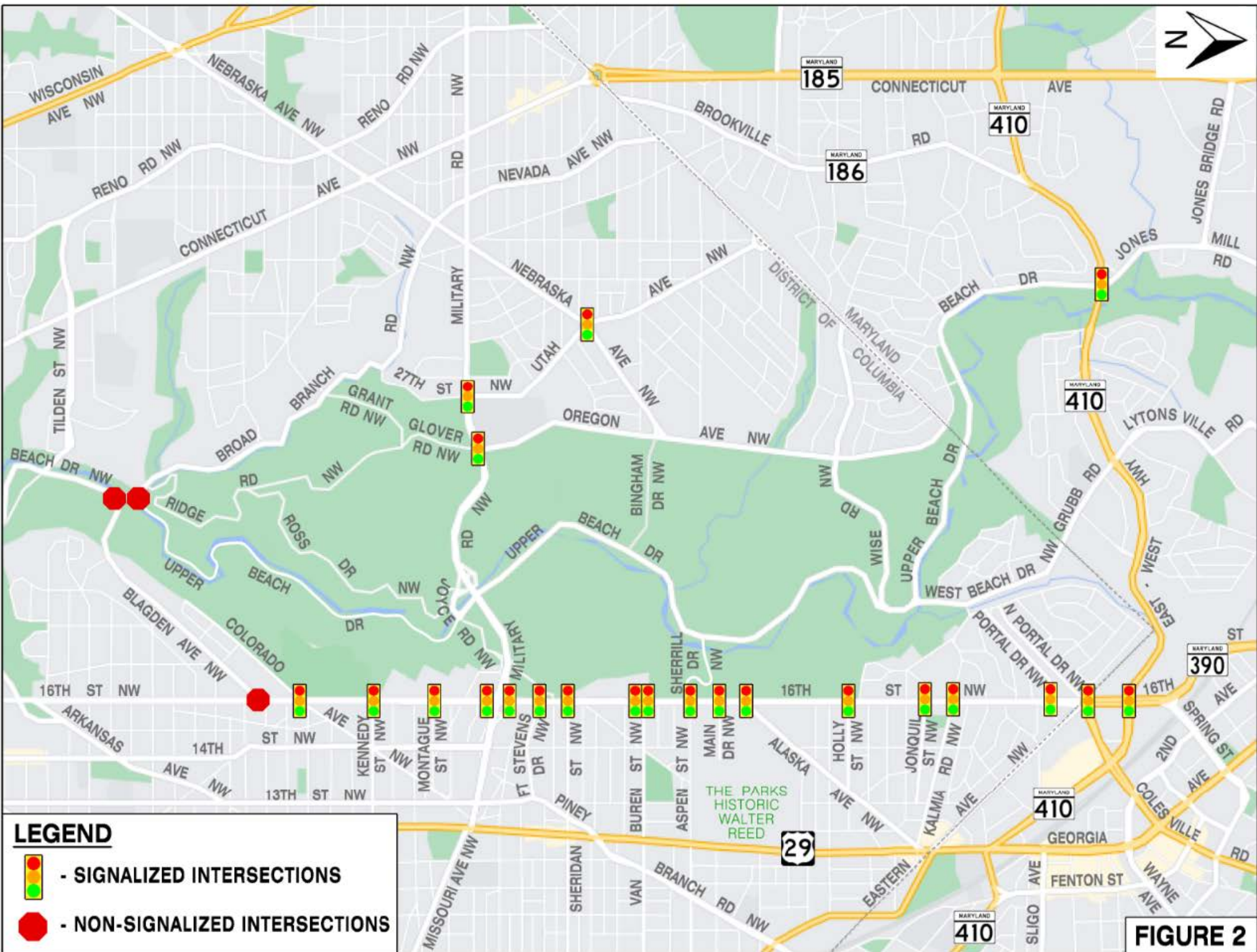
The closure of Upper Beach Drive from Broad Branch NW to the Maryland line will divert traffic to adjacent roads in the area. From a review of traffic patterns, various intersections were identified to be analyzed as part of this study. The study area intersections are mainly signalized locations. This is not meant to include where all traffic would divert but represents the intersections expected to experience the highest changes in volume. The study intersections are as follows and are shown in **Figure 2**:

STUDY AREA INTERSECTIONS

1. 16th Street NW at Blagden Avenue NW
2. 16th Street NW and Colorado Avenue NW
3. 16th Street NW and Kennedy Street NW
4. 16th Street NW and Montague Street NW
5. 16th Street NW and Missouri Avenue NW/Military Road Eastbound Ramp NW
6. 16th Street NW and Military Road NW Westbound Ramp
7. 16th Street NW and Fort Stevens Drive NW
8. 16th Street NW and Sheridan Street NW
9. 16th Street NW and Van Buren Street NW (South Intersection)
10. 16th Street NW and Van Buren Street NW (North Intersection)
11. 16th Street NW and Aspen Street NW
12. 16th Street NW and Walter Reed Hospital
13. 16th Street NW and Alaska Avenue NW
14. 16th Street NW and Holly Street NW
15. 16th Street NW and Jonquil Street NW
16. 16th Street NW and Kalmia Road NW
17. 16th Street NW and Portal Drive NW
18. 16th Street NW and Eastern Avenue/Colesville Road (Multiple Intersections)
19. MD 390 and MD 410
20. Beach Drive NW and Blagden Avenue NW
21. Upper Beach Drive and Broad Branch Road NW
22. Military Road NW and Oregon Avenue NW/Glover Road NW
23. Military Road NW and 27th Street NW
24. Utah Avenue NW and Nebraska Avenue NW
25. Beach Drive and MD 410

2.2 Roadway Reconstruction

Beach Drive NW was experiencing severe roadway deterioration. In order to rectify the situation, a project was undertaken by the National Park Service (NPS) in conjunction with the Federal Highway Administration (FHWA) to reconstruct the roadway. Due to the width of the roadway ranging from approximately 19 to 22 feet wide and the need to do full depth reconstruction of the roadway within the existing footprint, it was decided that the reconstruction would take place by closing the roadway in sections and detouring traffic, pedestrians, and bicyclists. The reconstruction was split up into the following sections:



- Stage 1: Shoreham Avenue NW to Tilden Street NW (The 500-foot section from the ramps to Klingle Road NW to Piney Branch Parkway did remain open during all stages)
- Stage 2: Tilden Street NW to Joyce Road NW with the section from Tilden Street NW to Broad Branch Rd NW being completed first.
- Stage 3: Broad Branch Road NW to Joyce Road NW
- Stage 4: Joyce Road NW to the Maryland State Line (The approximate 625-foot section between Wise Road NW and West Beach Drive NW remained open during most of the construction on this portion of the roadway)

Construction commenced in September 2016 and was completed in September 2019. The following are the approximate time frames for each Stage:

- Stage 1: September 2016 to August 2017
- Stage 2: August 2017 to January 2018
- Stage 3: January 2018 to July 2018
- Stage 4: July 2018 to October 2019

The NPS and FHWA during this time monitored traffic volumes and operations of vehicles, pedestrians, and bicyclists during each stage of construction to address any issues. This included during various stages of construction the operation of Piney Branch Road at Beach Drive (two-way versus three-way stop), converting Beach Drive at Tilden Street NW/Park Road NW to a multi-way stop, the location of multi-way stop signs and lane markings on Cathedral Avenue NW, the closure of Morrow Drive NW by the Park Police and the conversion of Missouri Avenue NW eastbound to a double left turn lane to 16th Street northbound. Numerous public outreach meetings were held. Traffic, pedestrian, and bicycle counts were taken at critical locations throughout the study area during each stage.



2.3 Geometry

The following is a description of the primary roadway geometry within the study area:

Beach Drive NW/ Upper Beach Drive: Beach Drive NW/Upper Beach Drive is a closed section roadway with a 25-mph speed limit and is classified as a minor arterial. This road in the study area traverses generally north-south through Rock Creek Park from Shoreham Road NW to MD 410. The study area is from Blagden Avenue NW to MD 410. There are numerous parking areas/picnic areas located along the route that serve as access points to the park. There are several pedestrian crosswalks and some horse crossing locations along this road. At some locations along Beach Drive NW/ Upper Beach Drive there is an adjacent bike/pedestrian trail separated while other locations bicyclists share the road with vehicular traffic. There are four all-

way stop intersections on Upper Beach Drive in the study area. Even before COVID-19, Upper Beach Drive is normally closed on the weekend from Broad Branch Road NW to the Maryland line.

Ridge Road NW: Ridge Road NW is classified as a local road inside Rock Creek Park. It is a two-lane curb section with a 25-mph speed limit. The geometric alignment of this road has numerous horizontal curves. There are some pedestrian crosswalks and equestrian crossing signs along the route. Ridge Road NW connects to Military Avenue NW after changing to Glover Road NW. The intersection of Glover Road NW/Oregon Avenue NW and Military Road NW is a signalized intersection.

16th Street NW: 16th Street NW is classified as a principal arterial and runs north-south on the east side of Rock Creek Park. It is a four-lane roadway with a raised concrete median in most areas. At major intersections, the raised concrete median is removed to provide a left turn lane. There are sidewalks on each side of the road separated by a grass area from the roadway. There are numerous pedestrian crosswalks along the route. The speed limit is posted at 30 mph. Several of the intersections are signalized including Colorado Avenue NW, Kennedy Street NW, Montague Street NW, Missouri Avenue NW/Military Road NW eastbound ramp, Military Road NW westbound ramp, Fort Stevens Drive NW, Sheridan Street NW, Van Buren Street NW, Aspen Street NW, Alaska Avenue NW, Holly Street NW, Kalmia Road NW, Portal Drive NW/Eastern Avenue NW, and MD 410). Also, there is a HAWK signal at Jonquil Street NW. The street is well utilized by buses with numerous bus stops.

Oregon Avenue NW: This roadway runs from Military Road NW to Western Avenue NW and is classified as a collector road. It forms the western boundary of Rock Creek Park. It is a two-lane road with a 25-mph speed limit. There is an all-way stop at the intersection of Northampton Street NW, Nebraska Avenue NW, Tennyson Street NW, Oregon Knolls Drive NW, Wise Road NW, and at Western Avenue NW.

27th Street NW: 27th Street NW is classified as a local road that connects Broad Branch Road NW to Utah Avenue NW. It is a narrow two-lane road south of Military Road NW with no posted speed limit. There are no passing centerline markings on the entire length. On the north side of Military Road NW, the road changes to Utah Avenue NW north of Newlands Street NW. In this section, the roadway widens out to approximately 42 feet. St Johns College High School is located north of Military Road NW.

Utah Avenue NW: This roadway is classified as a collector and runs from 27th Street NW to Western Avenue NW at the Maryland line. It is a two-lane street with on street parking. The speed limit is posted at 25 mph and the centerline is marked for no passing. The road traverses through a residential area with sidewalks on both sides. There is a traffic signal at the intersection of Nebraska Avenue NW. There is an all way stop at the intersections of Rittenhouse Street NW and at Tennyson Street NW. There are several bus stops along Utah Avenue NW.

Western Avenue NW: The part of Western Avenue NW in the study area traverses from Utah Avenue NW to Oregon Avenue NW. This road is classified as a collector road. This is approximately 34 feet wide two-lane road through a residential neighborhood with on street

parking. The centerline is marked for no passing and the speed limit is posted at 25 mph. There is a sidewalk on the south side of this road. There are all way stops at Aberfoyle Place NW, at Chestnut Street NW, and at Oregon Drive NW.

Blagden Avenue NW/Colorado Avenue NW: These roads are classified as collector roads. Blagden Avenue NW is a two lane, closed section street with a 25-mph speed limit. There are sidewalks on some sections of the street. There are all way stops at Mathewson Drive NW, at Allison Street NW, and at 17th Street NW. Blagden Avenue NW is stop controlled at Upper Beach Drive. There is also on street parking in some areas. Colorado Avenue NW is a two-lane street through a residential area on the south side. Rock Creek Park is located on the north side of the road. It has a 25-mph speed limit and no passing pavement markings. Various cross streets tie Blagden Avenue NW and Colorado Avenue NW which are one block apart.

Military Road NW: This road is classified as a principal arterial. The part of Military Road NW in the study area is from the intersection of Utah Avenue NW/27th Street NW to 16th Street NW. This part is a four-lane, divided highway. Left turn lanes are developed at the major intersections. There are sidewalks on each side of Military Road NW between 27th Street NW and Oregon Avenue NW and this section also has some bus stops. There is an interchange with Upper Beach Drive/Joyce Road NW in Rock Creek Park. The speed limit is posted at 35 mph. The intersection of Military Road NW with Oregon Avenue NW/ Glover Road NW is signalized. An interchange occurs at 16th Street NW. The eastbound off ramp connects with Missouri Avenue NW and a ramp from Joyce Road NW.

Ross Drive NW: Ross Drive NW traverses through Rock Creek Park between Ridge Road NW and Joyce Road NW. This is narrow two-lane roadway. There are various trail and equestrian crossings along the roadway. The speed limit is 25 mph. Ross Drive NW is presently closed to traffic.

Broad Branch Road NW: The southern limit of the proposed closure of Upper Beach Drive is at Broad Branch Road NW. Broad Branch Road NW is a two-lane roadway from Beach Drive NW to Linnean Road NW. It intersects with Ridge Road NW, Glover Road NW and 27th Street NW. The roadway is classified as a minor collector.

2.4 Field Observations

Field observations were conducted during the AM and PM peak periods to examine operations in the study area both before and during the time of the study. The following is a summary of the findings:

AM Peak Period

Beach Drive NW/ Upper Beach Drive

- On Beach Drive NW southbound queues formed from the signal at Beach Drive NW at Tilden Street NW/ Park Road NW extending through the Blagden Avenue NW and Broad Branch Road NW intersections. On Blagden Avenue NW, queues can extend past Mathewson Drive NW to as far as Allison Street NW. Motorists are given courtesy

gaps to access Beach Drive NW. Broad Branch Road NW eastbound motorists queue for about 10 vehicles at the stop sign and when Beach Drive NW was open southbound queues extend about 15 vehicles north of Broad Branch Road NW.

- Northbound traffic is light with motorists flowing at or above the speed limit.
- Motorists on Beach Drive southbound south of MD 410 turn right on to Pinehurst Parkway and Wyndale Road to access Western Avenue NW and points south and west.

16th Street NW/ MD 390:

- 16th Street NW southbound motorists experienced stop and go traffic throughout the corridor.
- There are long queues at the intersection at the intersection of MD 390 and MD 410 in the westbound direction and for the eastbound MD 410 left turn.

Military Road NW:

- Left turning motorists from Military Road NW westbound to Glover Road NW southbound was a high-volume movement. During certain cycles, left turning motorists would queue into the through lane.
- There was a lot of activity of parents dropping off children at St Johns College High School both on 27th Street NW and Oregon Avenue NW. Overall from these two crossroads, motorists mostly cleared in one cycle.
- Traffic volumes are high on Military Road NW westbound with long queues forming at the intersection of Oregon Avenue NW/ Glover Road NW to the Upper Beach Drive bridge. Occasionally, queues from the 27th Street NW intersection would extend almost to Oregon Avenue NW/ Glover Road NW intersection in the westbound direction.
- Eastbound traffic was relatively light.

Western Avenue NW

- There was stop and go traffic from Pinehurst Parkway NW east intersection to Chestnut Avenue NW from 7:30 to 8:45 AM on a regular weekday. Occasionally queues extended on to Chestnut Avenue NW on the highest volume days with Oregon Avenue NW closed.

MD 186 (Brookville Road)

- Southbound traffic experienced stop and go conditions from the multi-way stops at Woodbine Street, Taylor Street, Raymond Street and Primrose Street.

PM Peak Period

Beach Drive NW/ Upper Beach Drive

- Beach Drive NW/Upper Beach Drive operates with little congestion from Piney Branch Parkway north in the PM peak period. Queues are relatively minor at all multi-way stops. Blagden Avenue NW westbound in the PM peak period has much lower traffic volumes but motorists do wait a fair amount of time due to the northbound traffic free flowing and the left turning traffic from Upper Beach Drive southbound to Blagden Avenue NW. Maximum queues were about eight vehicles. Motorists using Blagden

Avenue NW either accessed 16th Street NW from the unsignalized Blagden Avenue NW intersection or used streets such as 17th Street NW or 18th Street NW to access the signalized intersection at Colorado Avenue NW. All motorists cleared at the intersection from Colorado Avenue NW.

- Motorists along the Western Avenue NW area to get north on Upper Beach Drive make illegal left turns at Pinehurst Parkway, Wyndale Road and Leland Street.

16th Street NW/ MD 390:

- Northbound 16th Street NW experiences stop and go conditions from south of Kennedy Street NW to Aspen Street NW. The northbound queues can extend to past Colorado Avenue NW on a high-volume traffic weekday. The signals at the Missouri Avenue NW/Military Road NW eastbound ramps are a key point of congestion. Once through the intersections at Military Road NW intersection, traffic still moves slow, but speeds increase following Aspen Street NW. Additional congestion occurs near the Blair Circle (MD 384(Colesville Road)) intersection.
- At times, Maryland 390 queues at MD 410 extended to Colesville Road. Maryland 410 motorists also experienced long queues with about 25 vehicles being stored.

Military Road NW:

- Queues along Military Road NW can extend from the signal at 14th Street NW toward the Beach Drive NW overpass. A high number of motorists would exit from Military Road NW to the ramps to 16th Street NW/ Missouri Avenue NW. The lane configuration for the left turn from Military Road NW ramps/ Missouri Avenue NW was adjusted during the Beach Drive NW project for a double left turn movement but motorists will sometime queue on to the mainline of Military Road NW. The off-ramp merges with traffic from Joyce Road NW along this section of Missouri Avenue NW. Motorists making the left are stopped at the Military Road NW westbound ramp intersection which limits the number of motorists that can clear.
- Overall traffic operations at Military Road NW/27th Street NW and Military Road NW/Oregon Avenue NW showed some delay but not major congestion.

MD 410/ MD 186 (Brookville Road)

- MD 410 experienced stop and go conditions from Bradley Lane to Taylor Street. Motorists at all approaches of MD 410 at Beach Drive/Jones Bridge Road experienced significant queues. On MD 410 westbound traffic extended past MD 186. Fifteen vehicle queues were observed on MD 410 eastbound and Jones Bridge Road southbound. Upper Beach Drive northbound at MD 410, despite being closed at the Maryland State Line, motorists still had to wait multiple cycles to clear the intersection. The volume was caused by motorists using roads such as Pinehurst Parkway.

2.5 Traffic Volumes

2019 Existing Volumes (Before Closure)

Traffic volume data was gathered from multiple sources for the study area. This included from count data that was continuously occurring as part of monitoring traffic for the reconstruction of Beach Drive NW/Upper Beach Drive, from the DDOT traffic signal system data

and from the Maryland State Highway Administrations traffic monitoring database. Most counts were from 2017-2019. New counts could not be performed due to the closure of Beach Drive NW/Upper Beach Drive and COVID-19 traffic volume impacts.

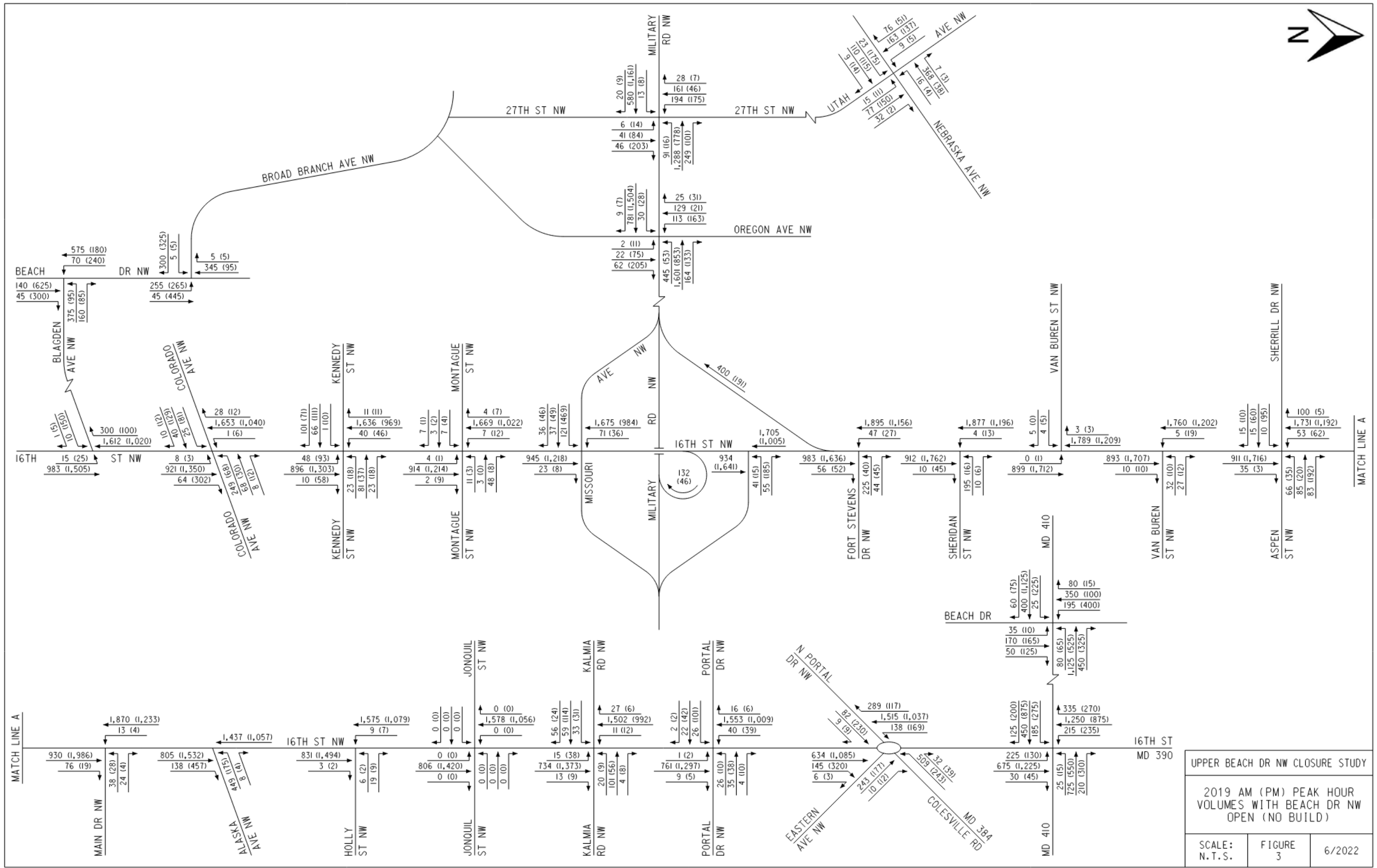
Traffic volumes along Upper Beach Drive NW vary depending on the section of roadway. The average daily traffic (ADT) volumes range from approximately 5,500 vehicles per day (vpd) between Broad Branch Road NW and Joyce Road NW to over 12,000 vpd on the section from Wise Road NW to West Beach Drive NW. North of Joyce Road NW most sections carry about 7,000 to 8,000 vpd except for the area between Wise Road NW and West Beach Drive NW. Traffic volumes during the AM and PM peak hours are higher north of Joyce Road NW versus south of Joyce Road NW. The ADT, AM and PM peak hour volumes along Upper Beach Drive are shown in Table 1.

TABLE 1. PRE-COVID UPPER BEACH DRIVE TRAFFIC VOLUMES (BASE YEAR 2019)

	Average Daily Traffic (vpd)	AM (PM) Peak Hour Volume (vph)	
		Northbound	Southbound
Broad Branch Road to Joyce Road NW	5,500	50 (425)	350 (100)
Joyce Road to Wise Road NW	8,500	150 (450-500)	500-650 (225-325)
Wise Road to West Beach Drive NW	12,000	200 (650)	850 (450)
West Beach Drive to Maryland State Line	7,000	175 (225)	300 (375)

The highest volume of traffic for other roadways in the study area is along 16th Street NW. This roadway has an ADT of approximately 29,000 to 34,000 vpd. Other roadways in the area with volumes over 20,000 vpd include Military Road NW and Maryland 410. Blagden Avenue NW, Broad Branch Road NW, Oregon Avenue NW, 27th Street NW, West Beach Drive NW all have ADT's of approximately 5,000 vpd to 8,000 vpd. Utah Avenue NW and Joyce Road NW to the west of Upper Beach Drive carry slightly less than 5,000 vpd. Ross Drive has an ADT of about 800 vpd.

The highest directional volume in the AM peak hour is Military Road NW westbound through Rock Creek Park with approximately 2,000 vehicles per hour with a slightly less volume eastbound in the PM peak hour. The highest north-south volume in the AM peak hour is along 16th Street NW southbound ranging from approximately 1,500 to 1,900 vph while PM peak hour volumes northbound are in the 1,300 to 2,000 vph range. Roads with volumes of 300 to 650 vph in the AM or PM peak hour, peak direction include Broad Branch Road NW, Blagden Avenue NW, 27th Street NW and West Beach Drive NW. On Ross Drive NW, most motorists use the roadway southbound in the AM peak hour (180 vph) pre-closure. The existing traffic volumes are shown in Figure 3.



UPPER BEACH DR NW CLOSURE STUDY

2019 AM (PM) PEAK HOUR VOLUMES WITH BEACH DR NW OPEN (NO BUILD)

SCALE: N.T.S.	FIGURE 3	6/2022
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3 FUTURE CONDITIONS

3.1 Scenarios

Two scenarios for 2019 and two scenarios for the 2045 conditions were evaluated. This assumed full closure of Upper Beach Drive from Broad Branch Road NW to the Maryland State Line, except for the portion between Wise Road NW and West Beach Drive NW as shown in Figure 1. There are other options of limited closures (e.g., Broad Branch Road NW to Joyce Road NW) but this report assumed a worse case condition of the entire section closed. The four scenarios analyzed included:

- Scenario 1: Base Year -2019 Traffic with Upper Beach Drive open from Broad Branch Rd NW to the Maryland State Line.
- Scenario 2: Base Year-2019 Traffic with Upper Beach Drive closed from Broad Branch Rd NW to the Maryland State Line except for Wise Road NW to West Beach Drive NW.
- Scenario 3: Horizon Year- 2045 Traffic with Upper Beach Drive open from Broad Branch Rd NW to the Maryland State Line
- Scenario 4: Horizon Year-2045 Traffic with Upper Beach Drive closed from Broad Branch Rd NW to the Maryland State Line except for Wise Road NW to West Beach Drive NW

Scenarios 3 and 4 are revised from the previous report completed in October 2021. These two scenarios included the construction of a bus lane on 16th Street NW south of Arkansas Avenue NW as well as the pipeline bus lane project along Georgia Avenue NW to the Maryland State Line. Additional projects included the Connecticut Avenue NW reversible lane removal and safety improvement project and the potential Rock Creek and Potomac Parkway reversible lane removal project.

Scenario 1: Pre-COVID Volumes with Upper Beach Drive Open- Broad Branch Road to Maryland State Line (Base Year-2019)

This is defined as the existing traffic condition with Upper Beach Drive open the entire length.

Scenario 2: Pre-COVID Volumes with Upper Beach Drive Closure- Broad Branch Road to Maryland State Line (Base Year-2019)

During the reconstruction of Upper Beach Drive, various sections of the roadway were closed. The FHWA during each stage of construction monitored traffic and directed traffic counts to be performed at key intersections. This included along Upper Beach Drive and throughout the roadway network where motorists used alternative routes. This count data was used as a basis for the reassignment of volumes since it represents the actual travel patterns motorists followed during the closure of Upper Beach Drive.

The closure of Upper Beach Drive through Rock Creek Park from Broad Branch Road NW to the Maryland line will shift the Upper Beach Drive traffic to adjacent roads. Since Upper Beach Drive is a north-south road, it is projected that most of the shifted traffic will use 16th Street NW to Blagden Road NW/Colorado Avenue NW on the east side of Upper Beach Drive and either Oregon Avenue NW/Glover Road NW/Grant Road NW or Utah Avenue NW/27th Street NW to Broad Branch Road NW on the west side of Upper Beach Drive. Other roadways that will experience increases in volumes include Military Road NW, Connecticut Avenue NW, Maryland 186, and several lower volume roadways. There will be some volume decreases on roadways that tie into Upper Beach Drive such as West Beach Drive NW. In the state of Maryland, there are projected increases on MD 410, MD 186 (Brookville Road), and various local streets that tie into Beach Drive NW. The larger changes are summarized in Table 2.

TABLE 2. PRE-COVID UPPER BEACH DRIVE TRAFFIC DIVERSION (BASE YEAR 2019)

	AM (PM) Peak Hour Volume (vph)	
	Northbound	Southbound
16 th Street NW	<25-125 (175-275)	150-350 (50-200)
Oregon Avenue NW	<50 (175)	125-175 (100)
Blagden Avenue NW	<25 (175)	150 (25)
Broad Branch Road NW	<50 (200-225)	150 (50)

AM Peak Hour

Traffic volumes were reassigned during the AM peak hour throughout the roadway network to reflect the closing of Upper Beach Drive. The following describes the anticipated major adjustments in volumes:

Blagden Road NW/16th Avenue NW- The southbound traffic on Blagden Avenue NW is projected to increase by approximately 150 vehicles per hour (vph). On 16th Avenue NW the southbound traffic increases by approximately 175 vph between Blagden Avenue NW and Missouri Avenue NW, by about 250-350 vph between Missouri Avenue NW and MD 384 (Colesville Road). Projected increases to northbound traffic on 16th Avenue NW range up to 135 vph with the largest increase occurring towards the Maryland line.

Oregon Avenue NW/Glover Road NW/Grant Road NW/Broad Branch Road – Other roadways which will experience an increase in traffic volumes are along the Oregon Avenue NW/ Glover Road NW/ Ridge Road NW and Broad Branch Road NW corridors. Volumes are anticipated to increase from approximately 125-175 vph on each of these roadways in the southbound direction.

Utah Avenue NW/27th Street NW/Broad Branch Road NW – On Utah Avenue NW the southbound volume will increase by approximately 100 vehicles.

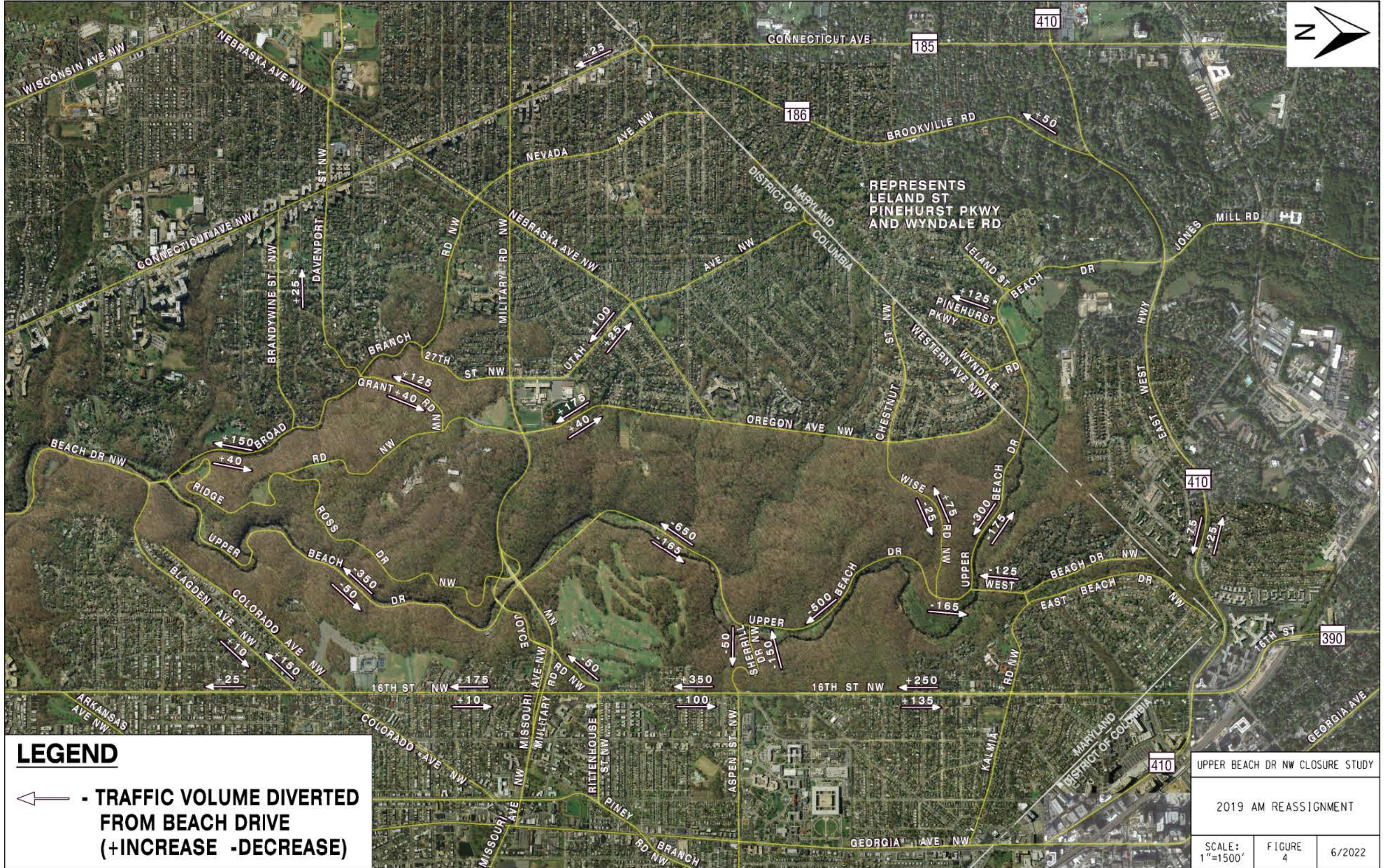
Connecticut Avenue NW – The Connecticut Avenue corridor is anticipated to see a minor increase in volume (less than 100 vehicles per hour).

MD 410 and MD 186 (Brookville Road) – In Maryland, the volumes are anticipated to increase on eastbound and westbound MD 410 with Beach Drive closed. Motorists will also use westbound MD 186 (Brookville Road) as an alternative route with about 50 additional vehicles on that section of roadway.

Pinehurst Parkway, Wyndale Road, Leland Street, Western Avenue NW, and Chestnut Street NW – Motorists will continue to use Beach Drive in Montgomery County south of MD 410 and then turn on roadways such as Pinehurst Parkway, Wyndale Road and Leland Drive which is prohibited in the AM peak period. These motorists will funnel on to other roads such as Western Avenue NW and Chestnut Street NW to Utah Avenue NW or Oregon Avenue NW to continue south. Combined between these roadways, it is anticipated that about 125 motorists will choose this route.

The reassignment of traffic volumes from Beach Drive NW are shown in Figure 4 for the AM peak hour volumes.





LEGEND

← - TRAFFIC VOLUME DIVERTED FROM BEACH DRIVE (+INCREASE -DECREASE)

UPPER BEACH DR NW CLOSURE STUDY

2019 AM REASSIGNMENT

SCALE: 1"=1500'	FIGURE 4	6/2022
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PM Peak Hour

Motorists in the PM peak hour will find alternative routes to using Upper Beach Drive if the roadway is closed. This includes the following anticipated changes to the traffic patterns:

Blagden Road NW/16th Avenue NW- One of the major roadways that will experience increases in traffic volume is along Blagden Avenue NW to 16th Street NW and then continuing along 16th Street NW. Along Blagden Avenue NW, northbound volumes are expected to increase by approximately 125 vph. On 16th Avenue NW northbound, volume increases are anticipated to be in the range of 175 to 275 vph. Since Upper Beach Drive is less directional in the PM peak, southbound volumes along 16th Street NW are projected to increase by 50 to 200 vph with the largest increases closer to the Maryland line.

Oregon Avenue NW/Glover Road NW/Grant Road NW/Broad Branch Road NW – An additional 225 vph is anticipated to use Broad Branch Road NW versus when Upper Beach Drive was open to traffic to the Maryland line. Traffic will fan out from there on to other roadways including Grant Road NW and Glover Road NW and ultimately up to Oregon Avenue NW. Oregon Avenue NW is projected to have approximately 175 vph more northbound and 100 vph increase southbound.

Connecticut Avenue NW – Along the Connecticut Avenue NW corridor, slight increases in traffic volumes should occur with Upper Beach Drive closed. Some traffic will travel through the Forest Hills area and others using roads such as Davenport Street NW and Brandywine Street NW to access MD 186(Brookville Road), 27th Street NW or Grant Road NW. Volume increases should be relatively light on those roadways/areas.

MD 410 and MD 186(Brookville Road) – MD 410 eastbound and westbound are projected to increase by 150 and 100 vehicles respectively. MD 186 Brookville Road volumes will increase slightly both eastbound and westbound.

Pinehurst Parkway, Wyndale Road, Leland Street, Western Avenue NW, and Chestnut Street NW– As in the AM peak period, motorists will ignore the turn restrictions of streets that tie into Beach Drive north of the Maryland line. This includes making the left turn from Pinehurst Parkway, Wyndale Road and Leland Street to cut through the northwest area of the District to reach Upper Beach Drive. Volumes are anticipated to be in the area of 75-100 vph combined for these three roadways. In order to access those roadways, streets such as Western Avenue NW and Chestnut Avenue NW will be used.

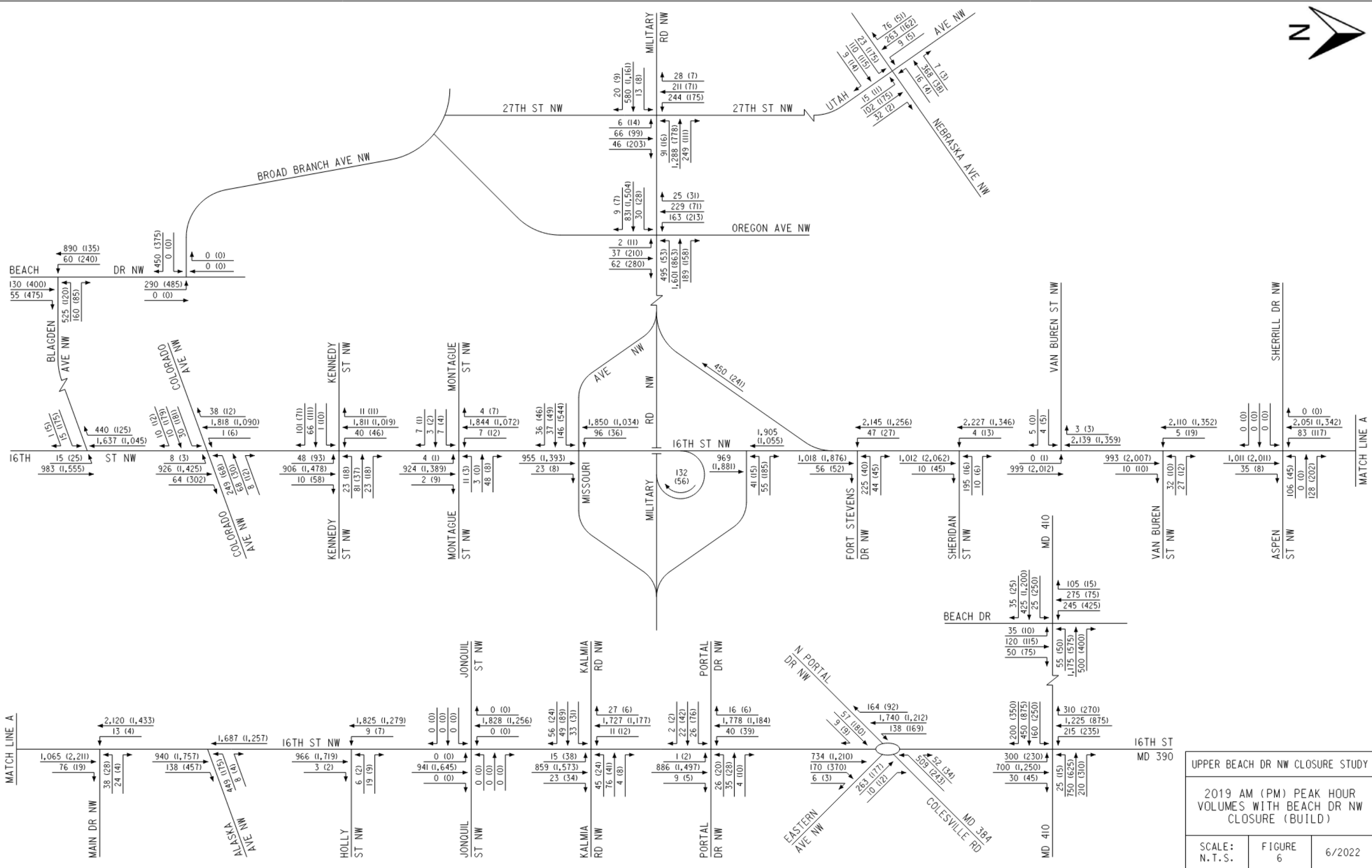
The resignation of traffic in the PM peak hour is shown in Figure 5. The total AM and PM peak hour volumes are depicted in Figure 6.



LEGEND

← - TRAFFIC VOLUME DIVERTED FROM BEACH DRIVE (+INCREASE -DECREASE)

UPPER BEACH DR NW CLOSURE STUDY		
2019 PM REASSIGNMENT		
SCALE: 1"=1500'	FIGURE 5	6/2022



3.2 Future Volumes

Travel demand forecasts were developed for the year 2045 which is the furthest out year for the Metropolitan Washington Council of Governments (MWCOG) travel demand forecasting model. A base year model run was performed to compare 2017 model volumes with 2017 actual roadways along roadways in the study area. Future 2045 model runs were performed. The model includes the proposed 2045 roadway and transit network along with the projected socio-economic data for that year. The 2045 model was run for the two scenarios with Upper Beach Drive open to the Maryland State Line and with it closed from Broad Branch Road NW to the Maryland State Line on weekdays.

Scenario 3: Horizon Year - 2045 Volumes with Upper Beach Drive Open

Scenario 3 incorporates four major projects. These projects are:

- The recently completed 16th Street Bus Lane project from H Street NW to Arkansas Avenue NW.
- The pipeline bus lane project along the Georgia Avenue NW corridor from Barry Place NW to the Maryland State Line (presently the section south of Barry Place is completed and a study of the center section up to Kansas Avenue NW is on-going).
- The approved alternative C along Connecticut Avenue NW which would eliminate the reversible lanes and provide safety improvement including bike lanes.
- The study by the National Park Service to eliminate the reversible lanes along Rock Creek and Potomac Parkways.

Traffic volumes were developed for the year 2045 with Beach Drive NW/Upper Beach Drive open from Shoreham Road NW to the Maryland State Line. A two-part process was used to develop the volumes. The volumes on the major roads which are utilized by more regional traffic plus local traffic were based on a refined volume from the MWCOG model runs. It was assumed that virtually no growth would occur on local streets (e.g., Van Buren Street NW, Holly Street NW) since the streets are fully developed.

The model runs produced volumes on an average daily traffic (ADT) basis and for AM and PM peak hours. This included the four projects. Connecticut Avenue NW and Georgia Avenue NW are expected to see decreases in the average daily traffic volumes along those roadways due to capacity reductions. The other roadways in the network the growth will vary depending on the road and the section. On an ADT basis, traffic volumes on most roadways would be anticipated to grow between 5 and 20%. The AM and PM model growth shows a smaller percentage for many of these roadways. The reason for this is that many of these roadways are operating at or near capacity and therefore only incremental growth can occur. Traffic will spread out over a longer period causing a higher level of congestion in the shoulder hours (those times around the peak hour) than occurred previously.

The four projects were incorporated into the model runs to develop traffic volumes on an average daily traffic (ADT) basis and for AM and PM peak hours. Each road and each section of roadway are anticipated to grow at different rates with different volumes of traffic diverging to and from the area based on the roadway. Table 4 shows the impact to traffic volumes that the four projects in 2045 would have on volumes on particular roadways. Traffic volumes spread out

through the system that minimizes the impacts to any individual roadway but overall will lead to more congestion on a number of roadways.

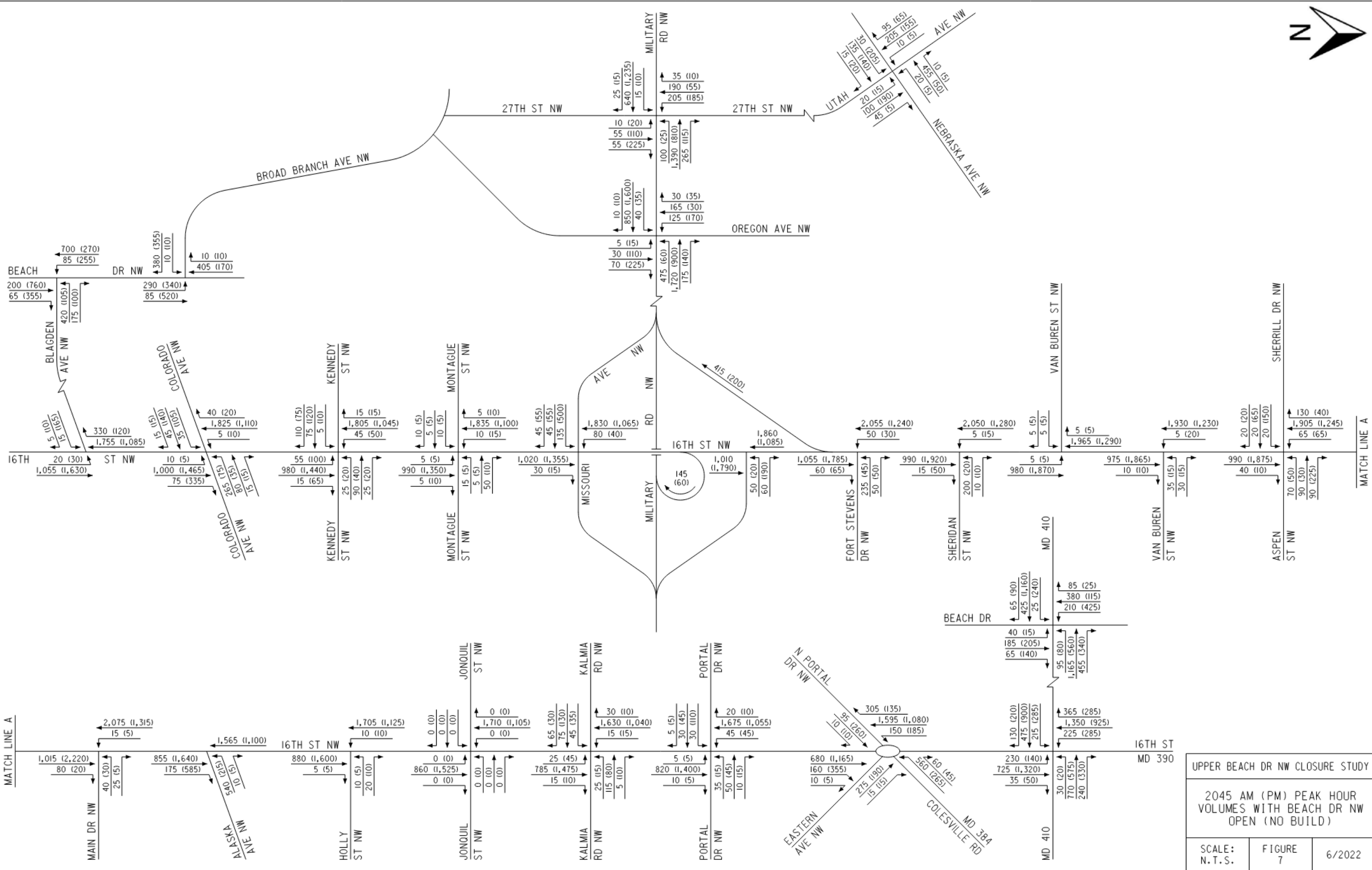
TABLE 4. HORIZON YEAR-2045 AVERAGE DAILY TRAFFIC VOLUME REASSIGNMENT - UPPER BEACH DRIVE OPEN

Roadway	South of Military Road NW		South of Wise Avenue NW	
	ADT Reductions vpd	ADT Additions vpd	ADT Reductions vpd	ADT Additions vpd
Connecticut Avenue NW	6,200	N/A	2,500	N/A
Georgia Avenue NW	4,500	N/A	4,200	N/A
16 th Street NW	N/A	1,100	N/A	800
Wisconsin Avenue NW	N/A	1,200	N/A	600
Broad Branch Rd NW	N/A	700	N/A	N/A
Beach Drive NW	N/A	700	N/A	600
North Capital Street	N/A	1,900	N/A	N/A
New Hampshire Avenue NW	N/A	200	N/A	800
Kansas Avenue NW	N/A	200	N/A	N/A
Massachusetts Avenue NW	N/A	600	N/A	N/A
Oregon Avenue NW/Utah Avenue NW	N/A	N/A	N/A	500
Piney Branch Road	N/A	N/A	N/A	400
Riggs Road NW	N/A	N/A	N/A	500
Outside Area/Other Roadways	N/A	3,000	N/A	2,500

The construction of the four projects will increase traffic on Upper Beach Drive. Table 5 identifies the anticipated peak hour volumes in 2045. These volumes are shown in Figure 7.

TABLE 5. HORIZON YEAR -2045 UPPER BEACH DRIVE TRAFFIC VOLUMES

	AM (PM) Peak Hour Volume (vph)	
	Northbound	Southbound
Broad Branch Road to Joyce Road NW	95(530)	415(180)
Joyce Road to Wise Road NW	225(500-600)	675-800(275-375)
Wise Road to West Beach Drive NW	275(875)	1000(600)
West Beach Drive NW to Maryland State Line	255(290)	385(460)



UPPER BEACH DR NW CLOSURE STUDY		
2045 AM (PM) PEAK HOUR VOLUMES WITH BEACH DR NW OPEN (NO BUILD)		
SCALE: N.T.S.	FIGURE 7	6/2022

Scenario 4: Horizon Year-2045 Volumes with Upper Beach Drive Closed

The final scenario involves the closure of Upper Beach Drive from Broad Branch Road NW to the Maryland State Line except for the section between Wise Avenue NW and West Beach Drive NW. Traffic volumes were reassigned from Upper Beach Drive on to other roadways in the area. The reassignment was based on comparing the changes in the existing volumes during the Upper Beach Drive closures during the period when reconstruction of the roadway was taking place and reviewing the MWCOG model with Upper Beach Drive NW closed to evaluate where traffic would divert to in the network. The roadways that are anticipated to experience change in volumes either with additional traffic or with a reduction in volume are shown in Table 6.

TABLE 6. HORIZON YEAR-2045 AVERAGE DAILY TRAFFIC VOLUME REASSIGNMENT UPPER BEACH DRIVE CLOSED

Roadway	South of Military Road NW		South of Wise Avenue NW	
	ADT Reductions vpd	ADT Additions vpd	ADT Reductions vpd	ADT Additions vpd
Connecticut Avenue NW	5,500	N/A	1,800	N/A
Georgia Avenue NW	4,000	N/A	3,600	N/A
16 th Street NW	N/A	3,200	N/A	4,000
Wisconsin Avenue NW	N/A	1,400	N/A	900
Broad Branch Rd NW	N/A	3,000	N/A	N/A
Beach Drive NW	6,300	700	9,300	500
North Capital Street	N/A	1,900	N/A	N/A
New Hampshire Avenue NW	N/A	400	N/A	1,000
Kansas Avenue NW	N/A	300	N/A	N/A
Massachusetts Avenue NW	N/A	600	N/A	N/A
Oregon Avenue NW/Utah Avenue NW	N/A	N/A	N/A	3,100
Piney Branch Road NW	N/A	N/A	N/A	800
Riggs Road NW	N/A	N/A	N/A	800
Outside of Area/Other Roadways	N/A	3,700	N/A	4,100

Traffic volumes were reassigned to the study area network intersections. Table 7 depicts the increases in volumes along these roadways.

TABLE 7. HORIZON YEAR- 2045 TRAFFIC VOLUMES INCREASES DUE TO UPPER BEACH DRIVE CLOSURE

	AM (PM) Peak Hour Volume (vph)	
	Northbound	Southbound
16 th Street NW	50-175(200-375)	200-425(100-250)
Oregon Avenue NW	75(200)	175-200(125)
Blagden Avenue NW	<50 (200)	200(75)
Broad Branch Road NW	50(225)	175(75)

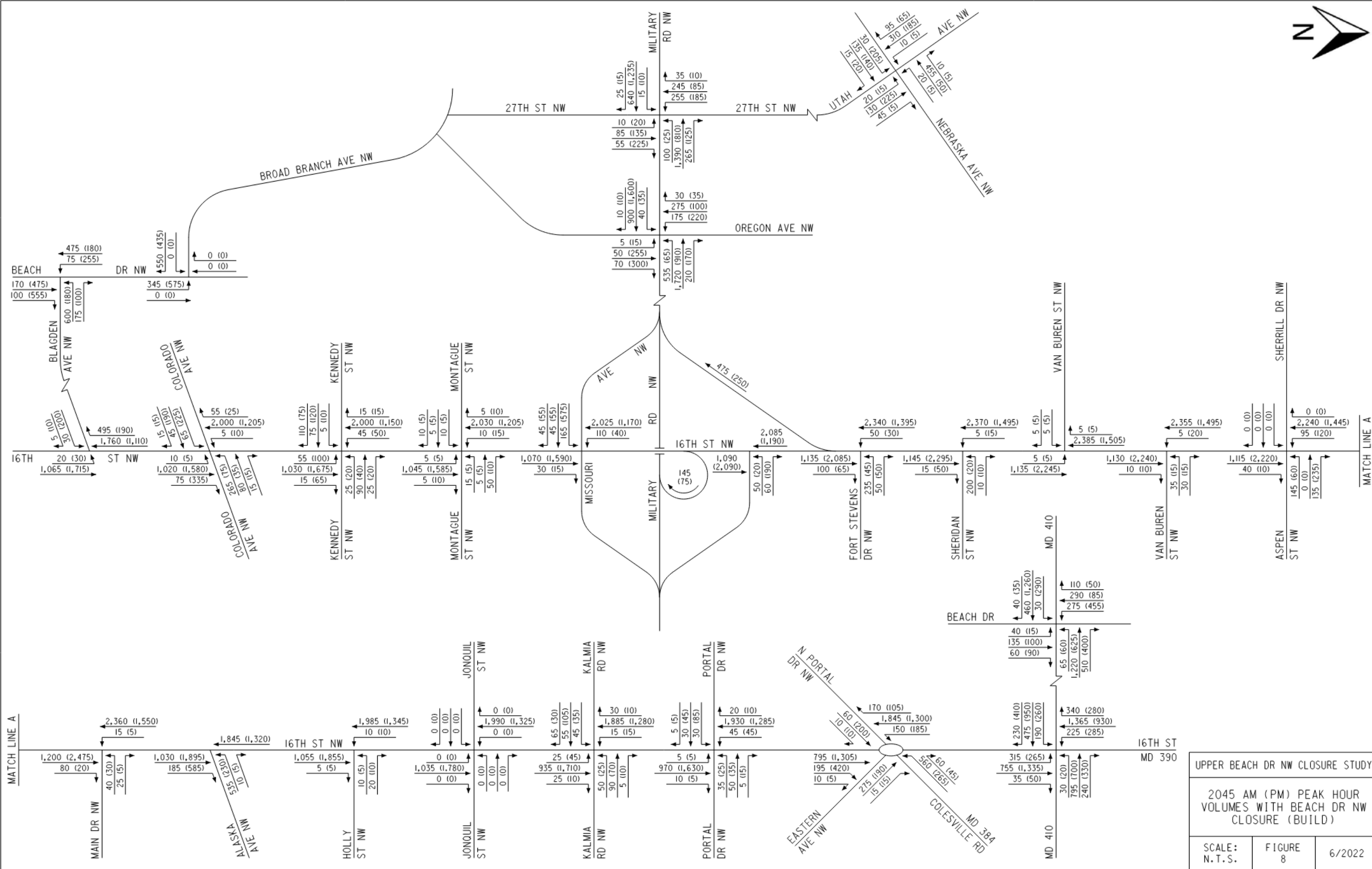
Several other roadways in the study area will have increases of 100 vph or less. MD 410 and Military Road NW are anticipated to experience the highest increase in east-west traffic volumes increasing by greater than 100 vehicles. The 2045 AM and PM peak hour volumes with Upper Beach Drive closed are shown in Figure 8.

3.3 Operational Analysis

Traffic analysis was conducted using the pre-COVID 2019 existing and the 2045 projected volumes for the study area. The analysis was performed for the conditions of Upper Beach Drive open, and Upper Beach Drive closed from Broad Branch Road NW to the Maryland line except for the section between Wise Avenue NW and West Beach Drive NW. Traffic simulation modeling of the corridor was conducted using Synchro for the signalized and unsignalized intersections. The models included the roadway geometry, volumes, and signal timings. The signal timings for intersections within the District were provided from the DDOT signal system models while the timings in Maryland were provided by the Maryland Department of Transportation State Highway Administrations’ Office of Traffic and Safety (OOTs).

A) Level of Service, Travel Time and Queueing Analysis

The Highway Capacity Manual (HCM) outputs were used to determine the level of service (LOS) for the signalized intersections. The results of the analysis for the four scenarios during the AM and PM peak hours are shown in Table 8-15. Travel time analysis was performed for the 16th Street NW corridor. The results of that analysis are shown in Table 16. Tables 17-22 identify the queueing analysis. Synchro files have been included separately.



UPPER BEACH DR NW CLOSURE STUDY		
2045 AM (PM) PEAK HOUR VOLUMES WITH BEACH DR NW CLOSURE (BUILD)		
SCALE: N.T.S.	FIGURE 8	6/2022

TABLE 8. 16TH ST NW TRAFFIC ANALYSIS (AM PEAK) AND DELAY (SEC/VEH)

Intersection	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
16 th St and Colorado Ave NW	42.4	D	0.98	69.2	E	1.07	68.5	E	1.07	70.5	E	1.09	101.7	F	1.18	100.8	F	1.18
16 th St and Kennedy St NW/Morrow Dr NW	10.4	B	0.81	16.2	B	0.88	11.5	B	0.9	17.6	B	0.9	39.8	D	0.99	28.1	C	1
16 th St and Montague Street NW	7.7	A	0.68	8.7	A	0.75	8.6	A	0.75	8.9	A	0.75	13.5	B	0.83	13.4	B	0.83
16 th St and Missouri Ave NW/Military Rd EB Ramp (South)	7.0	A	0.7	7.2	A	0.78	7.7	A	0.78	7.6	A	0.77	8.2	A	0.85	8.7	A	0.85
16 th St and Military Rd WB Ramp NW (North)	33.2	C	0.88	71.4	E	0.98	72.5	E	0.98	56.9	E	0.96	90.7	F	1.05	91.8	F	1.05
16 th St and Fort Stevens Dr NW	13.1	B	0.94	34.6	C	1.04	23.6	C	1.04	23.6	C	1.01	61.3	E	1.12	49.6	D	1.12
16 th Street and Sheridan St NW	17.4	B	0.93	50.8	D	1.08	50.9	D	1.08	28.9	C	1.01	69.8	E	1.14	69.8	E	1.14
16 th St and Van Buren St NW (South)	8.3	A	0.78	10.7	B	0.94	10.7	B	0.94	9.4	A	0.86	14.2	B	1.04	14.2	B	1.04
16 th St and Van Buren St NW (North)	14.1	B	0.87	61.3	E	1.03	61.3	E	1.03	39.4	D	0.98	100.3	F	1.15	100.4	F	1.15
16 th St and Aspen St NW	18.0	B	0.87	14.9	B	0.91	15.3	B	0.91	22.6	C	0.97	24.1	C	1.02	24.5	C	1.02
16 th St and Walter Reed Ent NW	4.9	A	0.73	5.5	A	0.82	5.5	A	0.82	6.6	A	0.81	7.2	A	0.91	7.2	A	0.91
16 th St and Alaska Ave NW	16.6	B	0.78	17.4	B	0.89	17.4	B	0.89	25.9	C	0.88	27.4	C	0.99	27.4	C	0.99
16 th St and Holly St NW	7.3	A	0.64	10.9	B	0.74	10.9	B	0.74	8.7	A	0.7	15.3	B	0.81	15.3	B	0.81
16 th St and Jonquil St NW	4.3	A	0.62	6.0	A	0.73	6.0	A	0.73	5.1	A	0.68	7.4	A	0.8	7.4	A	0.8
16 th St and Kalmia Rd NW	14.7	B	0.73	15.8	B	0.81	15.8	B	0.81	17.8	B	0.83	20.8	C	0.91	20.8	C	0.91
16 th St and Portal Dr NW	7.7	A	0.62	9.0	A	0.7	9.0	A	0.7	8.9	A	0.68	10.8	B	0.77	10.8	B	0.77
16 th St and North Portal Dr NW	8.4	A	0.84	9.4	A	0.88	9.4	A	0.88	10.7	B	0.92	10.2	B	0.91	10.2	B	0.91

	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
Intersection	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
16 th St, Eastern Ave and Colesville Rd NW	32.8	C	0.61	36.3	D	0.66	21.7	C	0.47	28.5	C	0.66	30.0	C	0.68	30.0	C	0.68
16 th St and Colesville Rd (NB)	23.2	C	0.44	21.7	C	0.47	36.3	D	0.66	24.4	C	0.48	22.7	C	0.51	22.7	C	0.51
16 th St and Colesville Rd (SB)	15.5	B	0.48	16.5	B	0.47	16.5	B	0.52	16.3	B	0.54	16.8	B	0.56	16.8	B	0.56

TABLE 9. MILITARY RD NW TRAFFIC ANALYSIS (AM PEAK) AND DELAY (SEC/VEH)

	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
Intersection	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
27 th St and Military Rd NW	19.6	B	0.9	24.9	C	1	23.3	C	1	46.7	D	1	62.1	E	1.1	61.3	E	1.1
Military Rd, Oregon Ave and Glover Rd NW	110.0	F	1.4	171.1	F	1.7	107.0	F	1.2	172.3	F	1.6	236.0	F	2.1	175.4	F	1.5
Utah Ave and Nebraska Ave NW	23.5	C	0.7	26.0	C	0.8	26.0	C	0.8	46.5	D	0.8	79.0	E	1.1	79.0	E	1.1

TABLE 10. MD 410 TRAFFIC ANALYSIS (AM PEAK) AND DELAY (SEC/VEH)

Intersection	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Closed			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/ Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/ Mitigation		
	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
MD 410 and Beach Drive	24.7	C	0.7	23.1	C	0.7	23.1	C	0.7	30.8	C	0.7	30.0	C	0.8	30.0	C	0.8
MD 410 and MD 386	40.4	D	0.9	42.8	D	0.9	42.8	D	0.9	50.3	D	1.0	63.1	E	1.0	63.1	E	1.0

TABLE 11. BLAGDEN AVE NW – TRAFFIC ANALYSIS (AM PEAK) AND DELAY (SEC/VEH)

Intersection	Base Year - 2019						Horizon Year - 2045					
	Upper Beach Dr. Open		Upper Beach Dr. Closed		Upper Beach Dr. Closed w/Mitigation		Upper Beach Dr. Open		Upper Beach Dr. Closed		Upper Beach Dr. Closed w/Mitigation	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
16 th St and Blagden Ave, NW (stop controlled)	>200	F	>200	F	N/A	N/A	>200	F	N/A	N/A	N/A	N/A
16 th St and Blagden Ave, NW (signalized)	N/A	N/A	N/A	N/A	15.6	B	N/A	N/A	42.1	D	42.1	D
Blagden Ave and Beach Drive NW (Blagden stop controlled)	>200	F	>200	F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Blagden Ave and Beach Drive NW (3 way stop)	N/A	N/A	N/A	N/A	99.8	F	>200	F	173.3	F	173.3	F
Blagden Ave and Beach Drive NW (signalized)	N/A	N/A	N/A	N/A	25.4	C	27.1	C	29.6	C	29.6	C

TABLE 12. 16TH ST NW TRAFFIC ANALYSIS (PM PEAK) AND DELAY (SEC/VEH)

Intersection	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
16 th St and Colorado Ave NW	29.4	C	0.82	39.4	D	0.93	41.4	D	0.93	50.6	D	0.9	67.3	E	1.06	69.5	E	1.06
16 th St, Kennedy St and Morrow Dr NW	9.0	A	0.68	9.5	A	0.76	9.3	A	0.76	9.8	A	0.75	11.1	B	0.85	11.6	B	0.85
16 th St and Montague St NW	7.3	A	0.5	7.2	A	0.57	5.2	A	0.57	7.7	A	0.56	7.9	A	0.66	5.6	A	0.66
16 th St and Missouri Ave/ Military Rd EB ramp NW (South)	20.4	C	0.76	29.4	C	0.86	30.5	C	0.88	25.0	C	0.84	36.1	D	0.97	36.7	D	0.97
16 th St and Military Rd WB Ramp NW (North)	12.7	B	0.77	22.0	C	0.87	14.8	B	0.87	15.8	B	0.84	44.5	D	0.97	30.8	C	0.96
16 th St and Fort Stevens Dr NW	7.9	A	0.72	14.9	B	0.81	5.5	A	0.81	10.7	B	0.78	41.2	D	0.9	12.4	B	0.9
16 th St and Sheridan St NW	8.5	A	0.73	17.6	B	0.85	20.9	C	0.85	11.1	B	0.80	45.3	D	0.94	48.3	D	0.94
16 th St and Van Buren St NW (South)	5.7	A	0.88	26.4	C	1.02	26.4	C	1.02	15.5	B	0.96	66.7	E	1.14	66.7	E	1.14
16 th St and Van Buren St NW (North)	14.1	B	0.76	14.9	B	0.89	14.3	B	0.89	13.9	B	0.84	20.2	C	1	19.7	B	1.00
16 th St and Aspen St NW	39.9	D	1.07	32.3	C	0.99	32.4	C	0.99	88.1	F	1.33	62.7	E	1.12	62.7	E	1.12
16 th St and Walter Reed Ent NW	4.3	A	0.80	4.4	A	0.89	4.4	A	0.89	6.9	A	0.89	22.2	C	0.99	22.1	C	0.99
16 th St and Alaska Ave NW	31.7	C	0.92	60.2	E	1.02	48.6	D	1.02	65.8	E	1.05	101.2	F	1.16	87.5	F	1.16
16 th St and Holly St NW	11.1	B	0.61	11.8	B	0.70	12	B	0.7	11.0	B	0.66	12.5	B	0.76	13.2	B	0.76
16 th St and Jonquil St NW	6.2	A	0.61	16.4	B	0.71	16.5	B	0.71	8.7	A	0.66	33.8	C	0.77	33.9	C	0.77
16 th St and Kalmia Rd NW	11.3	B	0.69	11.3	B	0.77	11.3	B	0.77	13.0	B	0.76	13.2	B	0.84	13.2	B	0.84
16 th St and Portal Dr NW	5.8	A	0.63	5.4	A	0.68	5.4	A	0.68	6.7	A	0.69	6.6	A	0.75	6.6	A	0.75
16 th Street and North Portal Dr NW	11.7	B	0.60	9.4	A	0.64	10.3	A	0.64	13.2	B	0.64	10.3	B	0.71	10.3	B	0.71

	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
Intersection	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
16 th St, Eastern Ave and Colesville Rd NW	23.6	C	0.78	27.1	C	0.80	27.1	C	0.8	27.9	C	0.86	32.9	C	0.88	32.9	C	0.88
16 th St and Colesville Rd (NB)	8.8	A	0.47	8.2	A	0.50	8.2	A	0.5	9.1	A	0.50	8.5	A	0.54	8.5	A	0.54
16 th St and Colesville Rd (SB)	20.6	C	0.31	20.7	C	0.36	20.7	C	0.36	20.8	C	0.33	21.1	C	0.39	21.1	C	0.39

TABLE 13. MILITARY RD NW TRAFFIC ANALYSIS (PM PEAK) AND DELAY (SEC/VEH)

	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/Mitigation		
Intersection	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
27 th St and Military Rd NW	23.1	C	0.9	23.2	C	0.9	30.6	C	0.9	30.5	C	1.0	32.3	C	1.0	32.8	C	1.0
Military Rd, Oregon Ave and Glover Rd NW	25.4	C	0.9	50.9	D	1.2	50.9	D	1.2	39.2	D	1.0	80.5	F	1.4	75.4	E	1.4
Utah Ave and Nebraska Ave NW	21.2	C	0.5	21.0	C	0.6	21.0	C	0.6	21.1	C	0.6	32.7	C	0.7	32.7	C	0.7

TABLE 14. MD 410 TRAFFIC ANALYSIS (PM PEAK) AND DELAY (SEC/VEH)

	Base Year - 2019									Horizon Year - 2045								
	Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/ Mitigation			Upper Beach Dr. Open			Upper Beach Dr. Closed			Upper Beach Dr. Closed w/ Mitigation		
Intersection	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
MD 410 and Beach Drive	46.0	D	0.9	47.9	D	0.9	47.9	D	0.9	63.7	E	1.0	63.5	E	1.0	63.5	E	1.0
MD 410 and MD 386	40.7	D	0.9	44.2	D	1.0	44.2	D	1.0	51.9	D	1.1	56.2	E	1.1	56.2	E	1.1

TABLE 15. BLAGDEN AVE NW – TRAFFIC ANALYSIS (PM PEAK) AND DELAY (SEC/VEH)

	Base Year - 2019						Horizon Year - 2045					
	Upper Beach Dr. Open		Upper Beach Dr. Closed		Upper Beach Dr. Closed w/Mitigation		Upper Beach Dr. Open		Upper Beach Dr. Closed		Upper Beach Dr. Closed w/ Mitigation	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
16 th St and Blagden Ave NW (stop controlled)	>200	F	>200	F	N/A	N/A	>200	F	N/A	N/A	N/A	N/A
16 th Street and Blagden Ave NW (signalized)	N/A	N/A	N/A	N/A	10.0	A	N/A	N/A	10.7	B	10.7	B
Blagden Ave and Beach Drive NW (Blagden stop controlled)	125.0	F	74.5	F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Blagden Ave and Beach Drive NW (3 way stop)	N/A	N/A	N/A	N/A	23.6	C	108.0	F	60.7	F	60.7	F
Blagden Ave and Beach Drive NW (signalized)	N/A	N/A	N/A	N/A	8.4	A	35.8	D	9.4	A	9.4	A

TABLE 16. TRAVEL TIME ANALYSIS- 16TH STREET NW CORRIDOR – MARYLAND STATE LINE TO BLAGDEN AVENUE NW

Peak	Volume Year	Direction	Scenario	Travel Time	Arterial Speed	Increase in Travel Time	Reduction in Speed
				(min)	(mph)		
AM	Base Year-2019	NB	Open	9.4	19.2	N/A	N/A
			Closed	9.6	18.8	2%	-2%
			Closed w/Mitigation	9.6	18.7	3%	-3%
		SB	Open	10.0	18.2	N/A	N/A
			Closed	14.8	12.3	48%	-32%
			Closed w/ Mitigation	14.6	12.4	47%	-32%
	Horizon Year-2045	NB	Open	9.5	18.9	N/A	N/A
			Closed	9.8	18.4	2%	-3%
			Closed w/ Mitigation	9.8	18.3	3%	-3%
		SB	Open	12.9	14.1	N/A	N/A
			Closed	20.0	9.1	55%	-35%
			Closed w/ Mitigation	20.3	9.0	57%	-36%
PM	Base Year-2019	NB	Open	9.5	18.9	N/A	N/A
			Closed	12.6	14.3	32%	-24%
			Closed w/ Mitigation	12.0	14.9	27%	-21%
		SB	Open	9.5	18.9	N/A	N/A
			Closed	9.6	18.6	2%	-2%
			Closed w/Mitigation	9.6	18.6	2%	-2%
	Base Year-2045	NB	Open	11.9	15.1	N/A	N/A
			Closed	20.5	8.8	72%	-42%
			Closed w/ Mitigation	19.2	9.4	61%	-38%
		SB	Open	9.6	18.7	N/A	N/A
			Closed	9.9	18.0	4%	-4%
			Closed w/ Mitigation	9.8	18.1	3%	-3%

TABLE 17. 16TH STREET NW 95TH PERCENTILE QUEUEING AT SELECTED INTERSECTIONS (FEET)

Intersection	Lane Group	Base Year -2019 Open		Base Year-2019 Closed		Base Year-2019 Closed w/ Mitigation		Horizon Year -2045 Open		Horizon Year -2045 Closed		Horizon Year-2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
North Portal Dr NW	SBL	1	0	1	0	1	0	1	0	m1	0	m1	0
	SBT/R	517	22	584	61	584	61	604	48	141	382	141	382
Eastern Ave and Colesville Rd NW	NBT	296	431	296	540	296	540	321	522	321	#766	317	#766
	NBR	41	70	40	91	40	91	42	85	43	m117	43	m117
Colesville Rd NW (NB)	NBT/T/R	98	30	97	26	97	26	102	43	105	m32	105	m32
Colesville Rd NW (SB)	SBT	328	201	361	236	361	236	366	216	392	269	392	369
Kalmia Rd NW	NBL	m18	m0	m13	m0	m13	m0	25	m0	m#58	m0	m#58	m0
	NBT/R	199	0	201	m0	201	m0	200	m0	201	m0	201	m0
	SBL	m18	m7	m1	m6	m1	m6	m2	m10	m2	m8	m2	m8
	SBT/R	78	464	100	587	100	587	93	490	#983	661	#983	661
Alaska Ave NW	NBT/R	158	#1071	165	m#1258	165	m#1227	156	m#1256	167	m#1259	167	m#1221
	SBT	51	454	122	453	122	453	84	451	m#308	451	m#308	56
Aspen Ave NW	NBT/R	312	236	350	m#1026	359	m#1026	351	#941	414	m#1008	414	m#1008
	SBL	m18	34	m4	#170	m4	#171	m3	52	m4	m#164	m4	m#160
	SBT/R	17	132	57	151	57	128	45	135	#1031	176	#1031	76
Sheridan Ave NW	NBT/R	105	30	112	m#961	m114	#1089	m106	m#40	m114	m#972	m117	m#1146
	SBL	m18	m22	m1	m19	m1	m19	m1	m22	m1	m17	m1	m17
	SBT	#931	522	#1248	567	#1248	567	#1089	557	#1374	568	#1374	568

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal

TABLE 18. 16TH STREET NW AT MISSOURI AVENUE/ MILITARY ROAD NW EB RAMP 95TH PERCENTILE QUEUEING (FEET)

Intersection	Lane Group	Base Year - 2019 Open		Base Year-2019 Closed		Base Year-2019 Closed w/Mitigation		Horizon Year- 2045 Open		Horizon Year - 2045 Closed		Horizon Year - 2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
16th St NW and Missouri Ave NW/Military Rd EB Ramp (South)	EBL (Missouri Ave/ Military Rd EB Ramp NW)	131	#437	146	#517	146	#517	150	#485	165	#567	165	#567
	EBT/R (Missouri Ave/ Military Rd EB Ramp NW)	129	#449	144	#521	144	#521	146	#495	165	#568	165	#568
	NBT/T/R (16th St NW)	208	66	214	168	218	255	252	81	274	258	273	#668
	SBL (16th St NW)	m2	m1	m2	m1	m2	m1	m2	m1	m2	m1	m23	m3
	SBT/R (16th St NW)	m22	15	m21	16	m21	16	m25	18	m23	20	m22	95
16th St NW and Missouri Ave NW/Military Rd WB Ramp (North)	WBL/T/R (Military Rd WB Ramp NW)	m47	m105	m47	m118	m47	m122	m62	m125	m62	m132	m62	m140
	NBT (16th St NW)	55	m588	66	m#925	66	m667	61	m758	75	m#1082	75	m#995
	SBT/R (16th St NW)	m#258	109	m#248	173	m#1137	172	m#260	156	m#1027	250	m#261	286
16th St and Colorado Ave NW	NBL (16th St NW)	m8	m0	m8	m0	m7	m0	m11	m1	m10	m1	m8	m1
	NBT/R (16th St NW)	396	#952	398	#1015	235	#1021	441	#1085	447	#1192	452	#1194
	SBL (16th St NW)	m0	m4	m0	m3	m0	m3	m1	m5	m1	m5	m1	m5
	SBT/R (16th St NW)	#979	298	m#1022	337	m#1102	300	m#1034	337	m#1043	367	m#1120	391
	NEL (Colorado Ave NW)	40	100	45	216	45	216	51	127	83	#291	83	#291
	NET/R (Colorado Ave NW)	58	154	58	154	58	154	68	170	71	196	71	196
	SWL (Colorado Ave NW)	m#320	m72	m#329	m72	m#329	m72	m#368	m83	m#368	m86	m#368	m86
	SWT/R (Colorado Ave NW)	m76	m33	m76	m33	m76	m33	m92	m39	m92	m39	m92	m39

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal

TABLE 19 – 16TH STREET AND BLAGDEN AVENUE NW 95TH PERCENTILE QUEUES (FEET)

Intersection	Lane Group	Base Year -2019 Open		Base Year-2019 Closed		Base Year-2019 Closed w/Mitigation		Horizon Year-2045 Open		Horizon Year-2045 Closed		Horizon Year-2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
16th St and Blagden Ave NW	NBL (16th St NW)	4	3	6	3	m8	m0	9	4	14	4	m10	m1
	NBT (16th St NW)	0	0	0	0	165	6	0	0	0	0	178	21
	SBT/R (16th St NW)	0	0	0	0	m73	297	0	0	0	0	m68	288
	NEL/R (Blagden Ave NW) ¹	11	>2,000	43	>2,000	33	227	81	>2,000	245	>2,000	55	280

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal
¹-Simtraffic queues for unsignalized conditions

TABLE 20 – MILITARY ROAD, OREGON AVENUE AND GLOVER ROAD, NW 95TH PERCENTILE QUEUES (FEET)

Intersection	Lane Group	Base Year-2019 Open		Base Year-2019 Closed		Base Year -2019 Closed w/Mitigation		Horizon Year-2045 Open		Horizon Year-2045 Closed		Horizon Year -2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Military Rd and Oregon Ave / Glover Rd NW	EBL (Military Rd NW)	m13	m10	m11	m10	m11	m6	m15	m12	m12	m12	m13	m10
	EBT/R (Military Rd NW)	m228	m#597	m216	m#596	m#413	m#678	m210	m#591	m193	m#582	m295	m#555
	WBL (Military Rd NW)	#544	#102	#390	#96	#562	31	#627	#112	#743	#116	#710	#114
	WBT/R (Military Rd NW)	#1020	#416	#1041	#390	#1003	#390	#1127	#456	#1565	#481	#1144	#438
	NBL/T/R (Glover Rd NW)	48	165	59	#342	60	310	58	209	79	#464	76	#475
	SBL/T/R (Oregon Ave NW)	251	#196	#395	#373	#406	#373	#332	#233	#597	#439	#575	#448

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal

TABLE 21 – NEBRASKA AVENUE AND UTAH AVENUE, NW 95TH PERCENTILE QUEUES (FEET)

Intersection	Lane Group	Base Year-2019 Open		Base Year-2019 Closed		Base Year-2019 Closed w/Mitigation		Horizon Year- 2045 Open		Horizon Year- 2045 Closed		Horizon Year- 2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Nebraska Ave and Utah Ave NW	SEL/T/R (Utah Ave NW)	104	75	#207	88	#207	88	#169	89	#268	106	#268	106
	NWL/T/R (Utah Ave NW)	50	72	62	83	62	83	79	92	#241	109	#241	109
	NEL/T/R (Nebraska Ave NW)	70	#207	70	#207	70	#207	73	#208	92	#261	92	#261
	SWL/T/R (Nebraska Ave NW)	#248	26	#248	26	#248	26	#332	32	#332	32	#332	32

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal

TABLE 22 – BEACH DRIVE NW AT BLAGDEN AVENUE NW 95TH PERCENTILE QUEUES (FEET)

Intersection	Lane Group	Base Year-2019 Open		Base Year-2019 Closed		Base Year-2019 Closed w/ Mitigation		Horizon Year-2045 Open		Horizon Year-2045 Closed		Horizon-Year 2045 Closed w/Mitigation	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
2 way stop	WBL	458	241	871	179	N/A	N/A	>2000	#1983	>2000	721	N/A	N/A
	WBR	166	107	160	102	N/A	N/A	158	173	144	165	N/A	N/A
	NBT	-	-	-	-	N/A	N/A	-	-	-	-	N/A	N/A
	NBR	-	-	-	-	N/A	N/A	-	-	-	-	N/A	N/A
	SBL	36	116*	35	108*	N/A	N/A	45	139*	38	134*	N/A	N/A
	SBT	-	-	-	-	N/A	N/A	-	-	-	-	N/A	N/A
3 way stop	WBL	162	59	307	61	307	61	291	56	>2000	76	N/A	N/A
	WBR	108	52	158	50	158	50	146	63	125	64	N/A	N/A
	NBT	66	722	64	147	64	147	87	803	78	457	N/A	N/A
	NBR	48	260	47	155	47	155	49	200	57	230	N/A	N/A
	SBL	165	90	100	97	100	97	176	101	164	100	N/A	N/A
	SBT	183	80	160	63	160	63	290	99	#375	91	N/A	N/A
Signal	WBL	406	132	530	160	N/A	N/A	484	153	588	224	588	224
	WBR	159	97	156	84	N/A	N/A	163	118	152	143	152	143
	NBT	101	302	109	162	N/A	N/A	151	682	169	343	169	343
	NBR	40	168	41	120	N/A	N/A	46	247	80	207	80	207
	SBL	108	123	93	115	N/A	N/A	108	147	121	138	121	138
	SBT	303	130	#367	79	N/A	N/A	#384	301	#383	215	#383	215

- indicates that the volume for the 95th percentile queue exceeds capacity
M-indicates the volume for the 95th percentile queue is metered by an upstream signal
*Left turn queue exceeds available storage

The traffic analysis showed that intersections within the study area operated better in both 2019 and 2045 with Upper Beach Drive open. In the AM peak hour, most intersections remained at the same level of service (LOS) while some saw decreases in operation. The following were the major changes in 2019:

AM Peak Hour

- 16th Street NW and Colorado Avenue NW- LOS D to E
- 16th Street NW and Military Road NW westbound ramp- LOS C to E
- 16th Street NW and Van Buren Road NW (North)- LOS B to E
- Military Road NW and Oregon Avenue NW/Glover Road NW- 60 second increase in vehicle delay
- 16th Street NW and Blagden Avenue NW currently operates at LOS F and delays will increase with Upper Beach Drive closed.

PM Peak Hour

- 16th Street NW and Alaska Avenue NW- LOS C to E
- Military Road NW and Oregon Avenue NW/Glover Road NW- LOS C to D
- 16th Street NW and Blagden Avenue NW currently operates at LOS F and delays will increase with Upper Beach Drive closed.

In 2045, comparable results were shown from the analysis with Upper Beach Drive open providing better operations. The major changes in operation in 2045 are as follows:

AM Peak Hour

- 16th Street NW and Colorado Avenue NW- LOS E to F
- 16th Street NW and Military Road NW westbound ramp- LOS E to F
- 16th Street NW at Sheridan Street NW-LOS C to E
- 16th Street NW and Van Buren Road NW (North)- LOS D to F
- Military Road NW at 27th Street NW-LOS D to E
- Utah Avenue NW at Nebraska Avenue NW- LOS D to E

PM Peak Hour

- 16th Street NW at Colorado Avenue NW-LOS D to E
- 16th Street NW at Van Buren Street NW-LOS A to E
- 16th Street NW and Alaska Avenue NW- LOS E to F
- 16th Street NW and Aspen Street NW- LOS F to E
- Military Road NW and Oregon Avenue NW/Glover Road NW- LOS D to E

The travel time analysis was conducted to review operations along 16th Street NW from the Maryland line to Blagden Avenue NW. The major changes between Upper Beach Drive open and closed between Broad Branch Road NW and the Maryland State Line:

Base Year 2019

- AM Southbound- Approximately an additional 4.5 minutes of travel time and speeds reduced by about 6 mph
- PM Northbound- Approximately an additional 3 minutes of travel time and speeds reduced by about 4 mph

Horizon Year 2045

- AM Southbound- Approximately an additional 7.5 minutes of travel time and speeds reduced by over 5 mph
- PM Northbound- Approximately an additional 7.5 minutes of travel time and speeds reduced by 0 mph

Along 16th Street NW, the travel times in the model versus travel times in the field are about the same or slightly lower than the observed field observations. This is a highly used bus corridor, so transit stops delay all vehicles. In addition, occasionally there will be vehicles parked either temporarily or long term that further deteriorate operations for traffic and transit vehicles. For example, in the PM peak period, when a vehicle parks near Sheridan Street NW queues can extend to Colorado Avenue NW. Points of congestion include the Missouri Avenue NW/ Military Road NW ramps on through the Van Buren Street NW intersection in the PM peak period. Signal timing adjustments can assist some but especially at the clustered intersections it is difficult to make major adjustments.

In addition to north-south travel times a review was performed of east-west travel times. This was related to the closure of motorists that travel from Bingham Road NW to Upper Beach Drive to Sherill Road NW and the reverse movement. The increase in travel time will vary for that movement depending upon the time of day. This showed that motorists performing that movement would experience an increase of one to five minutes depending on the origin and destination of the trip. It should be noted this movement will be made slightly quicker with the reopening of Oregon Avenue NW. The Wise Road NW to West Beach Drive NW connection will remain open to facilitate that movement.

The notable changes in queueing between with Upper Beach Drive open and closed were identified for 2045. The queue lengths that changed significantly include:

AM Peak Hour

- 16th Street NW southbound at Kalmia Road NW- 890 additional feet
- 16th Street NW southbound at Aspen Avenue NW- 985 additional feet
- 16th Street NW southbound at Sheridan Street NW – 285 additional feet
- Military Road NW westbound at Oregon Avenue NW/ Glover Road NW- 440 additional feet
- Oregon Avenue NW southbound at Military Road NW- 245 additional feet

PM Peak Hour

- 16th Street NW northbound at Colesville Road- 245 additional feet
- 16th Street NW southbound at North portal Drive NW- 330 additional feet
- 16th Street NW northbound at Sheridan Avenue NW-1,100 additional feet

- 16th Street NW northbound at Missouri Avenue NW/ Military Road NW eastbound ramp- 365 additional feet
- Glover Road NW northbound at Military Road NW- 265 additional feet
- Oregon Avenue NW southbound at Military Road NW- 215 additional feet

B) Environmental Impacts

The closure of Upper Beach Drive will force motorists to operate in more congested conditions. This has an impact from an environmental standpoint. An analysis was performed along the 16th Street NW corridor to determine the changes that would occur from the amount of fuel consumed, CO, NOx and VOC Emissions. This is shown in Table 23.

TABLE 23. 2045 16TH STREET NW ENVIRONMENTAL IMPACT SUMMARY

Time Period	Direction	Scenario	Fuel Consumed (gal)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)
AM Peak Hour	NB	Upper Beach Drive Open	198	13.9	2.7	3.2
		Upper Beach Drive Closed w/Mitigation	227	15.9	3.1	3.7
	SB	Upper Beach Drive Open	504	35.2	6.9	8.2
		Upper Beach Drive Closed w/Mitigation	777	54.3	10.6	12.6
PM Peak Hour	NB	Upper Beach Drive Open	449	31.4	6.1	7.3
		Upper Beach Drive Closed w/Mitigation	698	48.8	9.5	11.3
	SB	Upper Beach Drive Open	239	16.7	3.3	3.9
		Upper Beach Drive Closed w/Mitigation	286	20.0	3.9	4.6

As seen from Table 23, all environmental measures along 16th Street NW are worse with Upper Beach Drive closed. In the peak hour, peak direction the levels of CO, NOx and VOC are over 50% higher. The off-peak direction has a much smaller difference in both the AM and PM peak hours. This amounts to approximately a 15% increase in pollution levels.

C) Cost Impacts

There is a cost associated with congestion. The cost is based on the additional travel time that motorists and commercial vehicles wait in traffic. Analysis was performed taking into account the volume of traffic, the percentage of commercial vehicles, the average vehicle occupancy, the increase in travel time and number of hours that congestion occurs. The increase in travel time was based on the results from the traffic simulation modeling. Cost were developed on a yearly basis. The annual cost of the additional congestion along 16th Street NW amounted to \$18.5 million on a yearly basis.

3.4 Time Period Evaluation

The closure of Upper Beach Drive could occur in different time periods throughout the day or the year. This includes:

- Part-time Closure from April 1 to September 30
- Part-time Closure from Memorial Day to Labor Day
- Open during the peak periods on weekdays (6:30-9:30 AM and 3:00 -6:30 PM) and closed the remainder of times on weekdays and closed on weekends

Traffic volumes were gathered on an hourly basis to identify the how volumes varied through different months of the year and time of day. The automated traffic recorder station (ATR) at 16th Street NW near the Maryland State Line was not functional. Therefore, it was decided to use the Georgia Avenue NW ATR station near the Maryland State Line for the data. Georgia Avenue NW is one of the projects where traffic is anticipated to divert away from so this will be a viable comparison. The issue was the latest data was from the 2015/2016 time period. This data was analyzed to determine how traffic volumes vary based on the time of year. This showed the following:

- Traffic volumes in March and May are within 2% in the AM peak hour southbound for both the peak hour and peak period.
- May volumes were higher than October volumes along Georgia Avenue northbound in the PM peak hour and PM peak period.
- July volumes along Georgia Avenue NW were lower than either March, May or October volumes. This ranged from about 8% to 10% in the AM and PM peak hour and peak period.

Traffic volumes from 10:00 AM to 3:00 PM are much lower and the diverted volume from a Beach Drive closure would have minimal impacts to the other roadways in the network. Table 24 shows the detoured volumes from Upper Beach Drive between Broad Branch Road NW and Joyce Road NW in the off-peak hours.

TABLE 24. UPPER BEACH DRIVE TRAFFIC VOLUMES OFF-PEAK HOURS (BASE YEAR 2019)

	Southbound (vph)	Northbound (vph)
10:00 AM to 11:00 AM	145	80
11:00 AM to 12:00 Noon	125	85
12:00 Noon to 1:00 PM	95	130
1:00 PM to 2:00 PM	95	140
2:00 PM to 3:00 PM	90	225

The issue with a mid-day closure is both from an Upper Beach Drive user expectancy and from a resource standpoint. A pedestrian or bicyclist at 3:00 PM would need to realize that vehicular traffic would now be sharing the road with these persons. Also, personnel would need to make the change every day at 9:30 AM and again at 3:00 PM during each weekday or an automated gate/camera system would need to be installed.

Also, from a roadway network standpoint a smaller section of Upper Beach Drive could be closed. This would be from:

- Joyce Road NW to the Maryland State Line except for the section from Wise Road NW to West Beach Drive NW

The opening of Upper Beach Drive from Broad Branch Road NW to Joyce Road NW will provide some benefit versus the total closure of Upper Beach Drive. This is because any section of roadway that is open provides an alternative for motorists and reduces traffic volumes on another roadway such as 16th Street NW. The disadvantage is this is the area of the lowest traffic volume along Upper Beach Drive. There are alternative routes such as Glover Road NW which has adequate capacity. This would provide some relief along 16th Street NW but the movement from Missouri Avenue NW/Military Road Eastbound off ramp will increase meaning this will become the major congestion point of the system. Traffic will likely queue on to the mainline of Military Road NW in the PM peak hour. The closure would still increase traffic in the Barnaby Woods area on northwest DC and along the 16th Street NW corridor north of Military Road NW among other roads.



4 MITIGATION MEASURES

4.1 Recommended Improvements

If it is decided to close Upper Beach Drive on all weekdays, various improvements are recommended to be implemented to mitigate some of the traffic impacts. These include:

- A) Initially Provide a Three Way Stop at Beach Drive NW at Blagden Avenue NW and Ultimately Signalize the Intersection

The closure of Upper Beach Drive north of Broad Branch Road NW will increase the traffic along Blagden Avenue NW. In fact, in the AM peak hour volumes along Blagden Avenue NW approaching Beach Drive NW will exceed volumes on Upper Beach Drive. In order to mitigate delay for motorists along Blagden Avenue NW, a three-way stop should be provided.

A three-way stop warrant analysis was previously performed for the intersection. The analysis showed that criteria C for the minimum volume requirements were met for the intersection. During the time of this study, the section of Beach Drive NW from Shoreham Road NW to Klinge Road NW was closed to traffic which may have influenced volumes at this intersection. Because of this, a signal warrant analysis was not performed (Note: this section has reopened during certain periods at the end of September). From previous counts, it appears that the four-hour volume warrant could be met. Ultimately, signalization should be installed at this location.

- B) Upgrade Signing and Pavement Markings at the Intersections of Upper Beach Drive/ Broad Branch Road NW, Upper Beach Drive/Wise Road NW and Upper Beach Drive/West Beach Drive NW

The signing and pavement markings for the intersections of Upper Beach Drive with Broad Branch Road NW, Wise Road NW and West Beach Road NW were established as t-intersections with through movements for Upper Beach Drive. Since these locations will become two way stop controlled intersections with no through movements, revisions should be made to the pavement marking and signing to reflect this new configuration. It is suggested that delineators be used in the short term and NPS decide if they want to do something more permanent long term to direct motorists to the proper lane. At the intersection of Broad Branch Road NW and Upper Beach Drive, there is a pedestrian crossing on the east leg. To address the interaction of motorists turning left with pedestrians crossing the street, practical options include placing a rectangular rapid flashing beacon (RRFB), a raised crosswalk or installing a two-way stop-controlled intersection. The stop-controlled intersection is only viable if the intersection of Upper Beach Drive and Blagden Avenue NW is converted to a three-way stop. If the Beach Drive NW and Blagden Avenue NW intersection is stop controlled or is converted to a signal, the queues from Upper Beach Drive northbound at Broad Branch Road NW would extend into this intersection.

C) Provide Left Turn Phasing for Military Road NW Westbound to Glover Road NW

The volume for the movement from Military Road NW to Glover Road NW has over 400 vehicles in the AM peak hour. With Beach Drive NW closed this volume would be projected to increase. Traffic at times will queue from the left turn lane into the through lane. Based on the DDOT criteria for implementation of left turn phasing the cross product exceeds 100,000. This means the movement qualifies for protected/permitted phasing, but this should not be implemented in the PM peak period due to its implications to traffic operations on Military Road NW.

D) Modify Signal Offsets at 16th Street NW at the Military Road NW Ramp Intersections

An adjustment should be made to the offsets between the signals on 16th Street NW between the Missouri Avenue NW/ Military Road NW eastbound off ramp with the 16th Street NW/ Military Road westbound ramp intersection. Motorists making the left turn movement from Missouri Avenue NW/Military Road NW eastbound ramp from the start of their green time should be given some green time to clear out 16th Street NW northbound traffic plus some of the left turning motorists, so the remaining left turning motorists have a place to store. This will facilitate more motorists clearing with the anticipated increase due to the closure.

E) Modify Signal Timings on 16th Street NW

The closure of Upper Beach Drive will increase travel times and delay at most intersections along 16th Street NW, with particular impacts identified at key constrained locations (e.g., 16th Street NW and Missouri Avenue NW/Military Rd NW, and 16th Street NW and Colorado Ave, NW). It would not be feasible to increase the cycle length without impacting the cross-street access and pedestrian wait times at the intersections. A slight improvement can be obtained by adjusting signal timings at selected intersections which do have some split flexibility. However, this will not mitigate the total delay increase caused by traffic diversions due to the closure. Intersections this could occur at would be 16th Street NW and Fort Stevens Drive, NW, and 16th Street NW and Van Buren St NW.

F) Implement Traffic Calming on Chestnut Street NW (Completed)

Traffic calming has been completed on Chestnut Street NW. This project consists of installing four speed tables with two located between Western Avenue NW and 32nd Street NW and two between 32nd Street NW and Oregon Avenue NW. These will assist in lowering speeds along this section of Chestnut Street NW.

G) Signalize the 16th Street NW and Blagden Avenue NW Intersection

With Upper Beach Drive closed to the north of Broad Branch Road NW, an increase in traffic will occur traffic on Blagden Avenue NW. Motorists northbound will mostly desire to travel to 16th Street NW. They have the option of using the unsignalized intersection of Blagden Avenue NW or turning on to 17th Street NW or 18th Street NW to Colorado Avenue NW. The intersection of Blagden Avenue NW and 16th Street NW meet the four-hour volume warrant for the installation of a traffic signal. It is recommended this intersection be signalized and

various traffic calming measures be provided. At the intersection, right turn hardening is proposed for the 16th Street NW southbound to Blagden Avenue NW movement and modifications to the 16th Street NW northbound left turn lane should be implemented which were developed in a previous DDOT study should be included with the signalization.

H) Permit Ross Drive NW to Remain Closed to Traffic but Allow for the Roadway to Be Reopened if Needed in the Future

Ross Drive NW would only be used by a small number of motorists if Upper Beach Drive would remain closed, therefore it is recommended the roadway remain closed. Although, this closure should not be made permanent. If traffic operations or other occurrences (e.g., reconstruction of Ridge Road NW, flooding along Broad Branch Road NW) this could be reopened to traffic. This roadway does provide an alternative for motorists to travel to/from Broad Branch Road NW. If Upper Beach Drive were only closed from Joyce Road NW to the Maryland line, then this should not be an issue. The opening of Ross Drive NW would provide a little relief to the Military Road NW and Oregon Avenue NW/Glover Road NW intersection, so it is suggested that traffic be monitored initially at this location.

The location of the recommended improvements is shown in Figure 9. If the closure occurs only during the summer the timing modifications along 16th Street NW should not be implemented initially. It would be recommended that a traffic count take place at 16th Street NW and Blagden Avenue NW intersection during the closure times to see if signal warrants are met.

4.2 Suggested Improvements

Various other improvements are suggested, but not required, to be evaluated as follows:

A) Provide Minor Improvements to Broad Branch Road NW, Grant Road NW, and Ridge Road NW

Volumes along these roadways will increase with the potential closure of Beach Drive NW. These roadways are in fair condition. At a minimum, it would be preferred to patch the potholes along the roadways and reinstall center lines in certain areas

B) Perform Tree Trimming

Various locations in northwest portion of the District need tree trimming to better observe signal or stop signs. This includes at Blagden Avenue NW southbound at 17th Street NW, Chestnut Avenue NW at Wise Avenue NW, 16th NW at Van Buren Street NW northwest quadrant, Utah Avenue NW at 31st Place NW southbound, along Western Avenue NW westbound approaching Chestnut Avenue NW and on Linnean Avenue NW northbound at Davenport Street NW.



C) Provide Pavement Marking and Signing Improvements

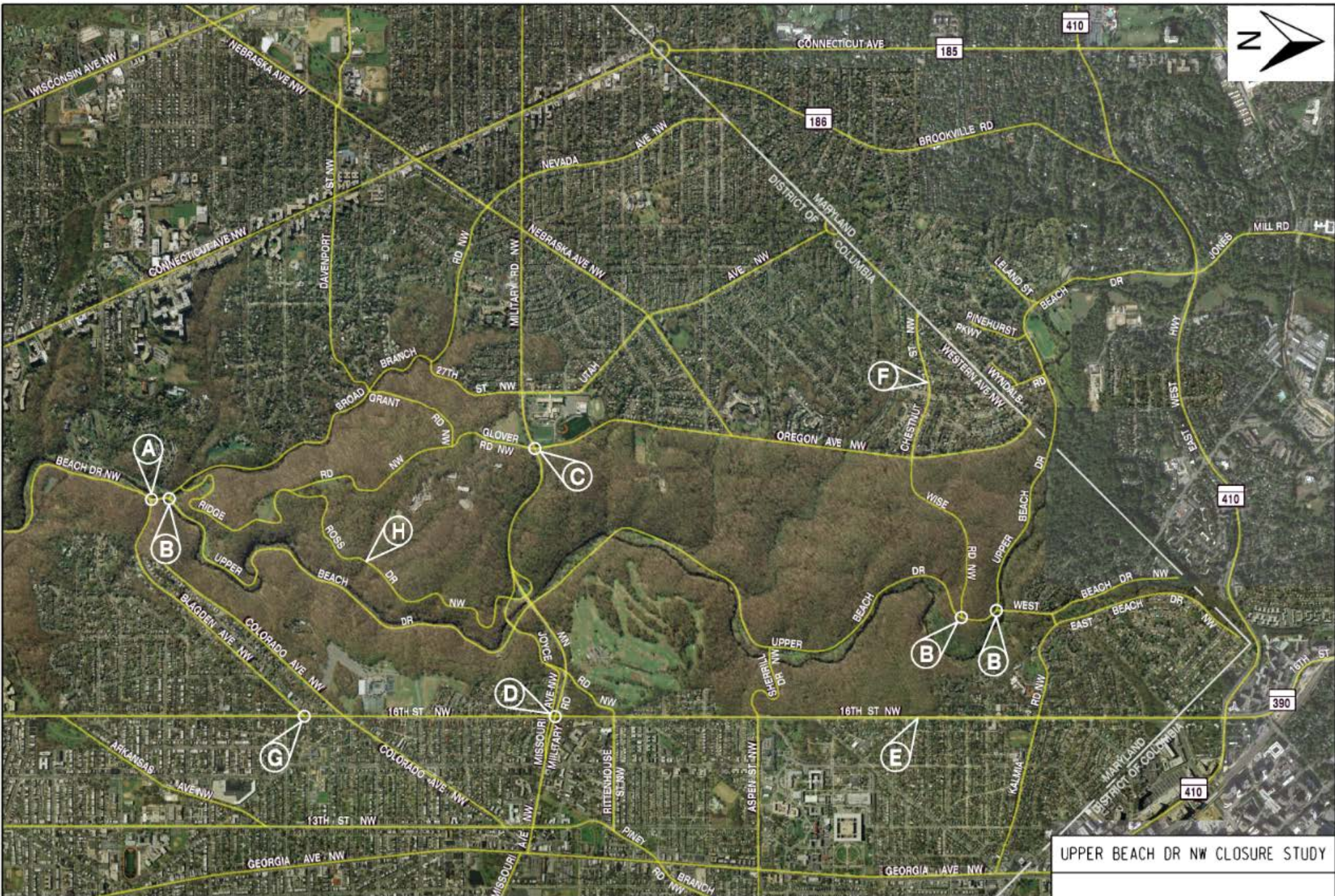
Several locations could benefit from modifications to the signing and pavement markings. This includes:

- Adding a Stop Ahead sign on Grant Road NW southbound approaching Broad Branch Road NW. Also add all way plaque to stop sign at the intersection.
- Cleaning the stop ahead sign on Blagden Road NW northbound approaching Mathewson Drive NW.
- Adding a Stop Ahead sign on Western Avenue NW eastbound approaching Aberfoyle Place NW.
- Placing stop ahead markings on Western Avenue NW westbound before Aberfoyle Place NW.
- Provide high visibility crosswalk or at a minimum upgrade existing crosswalk pavement marking on Western Avenue NW at Cummings Lane NW.
- Placing sign on Military Road NW eastbound ramp to Missouri Avenue NW identifying traffic can use both lanes for left turn to 16th Street NW before the merge from Joyce Road NW.
- Adjusting the speed limit 25mph sign on Brandywine Street NW westbound opposite 30th Street NW that is parallel to the roadway.
- Review and relocate pedestrian crossing signs along Utah Avenue between 31st Place NW to Tennyson Street NW.
- Adjust bus sign and stop sign on Western Avenue NW westbound so that the bus sign does not block stop sign.
- Consider doubling up on stop signs on Brandywine Street NW westbound at Linnean Avenue NW, 30th Street NW and 31 Street NW.



D) Consider Traffic Calming Measures

There will be minor traffic volume increases with the closure of Upper Beach Drive along roadways such as Utah Avenue NW, Western Avenue NW, Blagden Avenue NW, Pinehurst Parkway, Leland Road and Wyndale Road. For Pinehurst Parkway, Leland Road, Daniel Road and Wyndale Road consideration should be given to installing speed humps, but this would need to be accomplished in accordance with Montgomery County guidelines. Bulb-outs could be provided in combination with marked parking lanes along Western Avenue NW and Utah Avenue NW. Possible locations for bulb-outs on Western Avenue NW include Cummings Lane NW (east side) and Greenvale Street NW (east side and northwest quadrant). Locations along Utah Avenue NW include Newlands Street NW, Northampton Street NW, Rittenhouse Street NW (north side and southwest quadrant) and 31st Place NW. Blagden Avenue NW southbound could be marked for a parking lane from 16th Street NW to Allison Street NW.



- (A)** PROVIDE A THREE-WAY STOP INITIALLY AND SIGNALIZE LONG-TERM
- (B)** UPDATE SIGNING AND PAVEMENT MARKINGS AT INTERSECTIONS
- (C)** PROVIDE LEFT-TURN PHASING FROM MILITARY RD NW WB TO GLOVER RD NW SB

- (D)** MODIFY SIGNAL OFFSETS AT MILITARY RD NW NB RAMP INTERSECTIONS
- (E)** MODIFY SIGNAL TIMINGS ON 16TH ST NW

- (F)** IMPLEMENT TRAFFIC CALMING ALONG CHESTNUT ST NW (COMPLETED)
- (G)** SIGNALIZE THE 16TH ST NW AT BLAGDEN AVE NW INTERSECTION
- (H)** ROSS DR NW TO REMAIN CLOSED

UPPER BEACH DR NW CLOSURE STUDY

RECOMMENDED MITIGATION MEASURES

SCALE: 1"=2200'	FIGURE 9	6/2022
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5 CONCLUSION

The potential closure of Upper Beach Drive permanently on weekdays will change traffic patterns in the area. Several roadways will experience an increase in volumes especially Blagden Avenue NW, Broad Branch Road NW, 16th Street NW, Military Road NW and Oregon Avenue NW. In addition, several other roadways will encounter minor increase in volumes. The increase in volume will lead to slower travel times and more delay at most intersections in the study area. Besides intersections along 16th Street NW, the intersection of Military Road NW and Oregon Avenue NW will be the most impacted by the closure. Options exist to close the roadway either from April 1st through September 30th, Memorial Day to Labor Day, during the peak periods or close only the section from Broad Branch Road NW to Joyce Road NW.

The following improvements are recommended if Upper Beach Drive is closed:

- Upper Beach Drive NW at Blagden Avenue NW - provide a three way stop as a short-term solution and ultimately signalize as operations warrant.
- Upper Beach Drive NW & Broad Branch NW, Beach Drive NW & Wise Road NW and Beach Road NW & West Beach Drive NW - upgrade signing and pavement markings
- Military Road NW Westbound to Glover Road NW southbound (only AM peak period) - provide left turn phasing.
- 16th Street NW - modify signal timings including signal offsets at the 16th Street NW at the Missouri Avenue NW/ Military Road ramp intersections
- Implement Traffic Calming on Chestnut Street NW. (completed)
- 16th Street NW and Blagden Avenue NW - signalize intersection
- Permit Ross Drive NW to remain closed to traffic but allow for the roadway to be reopened if needed in the future.

In addition, the following improvements are suggested:

- Provide various minor improvements to Broad Branch Road NW, Grant Road NW, and Ridge Road NW.
- Perform tree trimming.
- Provide pavement marking and signing improvements.
- Consider traffic calming measures.

Various multi-modal projects are either under construction or planned that will further reduce capacity in the area. Key considerations with these projects impacting a full-time year-round closure by 2045 include:

- Additional travel time of approximately 7.5 minutes in the peak hour peak direction.
- Additional congestion cost of over \$18 million dollars annually.
- Over a 50% increase in emissions in the peak hour, peak direction.
- Six additional intersections operating at LOS E or F in the AM peak hour and four in the PM peak hour although one intersection will improve with the closure.

During all time periods the Upper Beach Drive closure would affect local residents in the northwest DC area by:

- Increasing traffic on the local streets in the Barnaby Woods area of northwest DC plus streets such as Utah Avenue NW, Western Avenue NW and Oregon Avenue NW.
- The ability to provide east-west connections for school access.

There will be additional traffic impacts to the local area roadways when FHWA reconstructs Wise Road NW, Upper Beach Drive NW, Bingham Road NW, Ross Drive NW, Glover Road NW, Morrow Drive NW and Ridge Road NW. In order to reconstruct the roadways, there will most likely be one or two-way detours during that time. The project is presently starting the design process.

The recommendation is to limit the closure of Upper Beach Drive from either Memorial Day to Labor Day or when schools are not in session. Traffic volumes are lower during this time of year which should allow less impacts to the roadway network. The other option is to limit the closure to the mid-day time period but this could increase the NPS' daily operation efforts and may affect the Rock Creek Park users for knowing the hours that traffic would be allowed on Upper Beach Drive. This recommendation provides a balance of providing additional accessibility to Rock Creek Park when it is most utilized with minimizing the impacts to surrounding neighborhoods.