



Maintenance of Traffic Analysis

MD 195 over Sligo Creek and Sligo Creek Parkway

October 31, 2013

Prepared for:
Maryland State Highway Administration
Office of Structures

Prepared by:



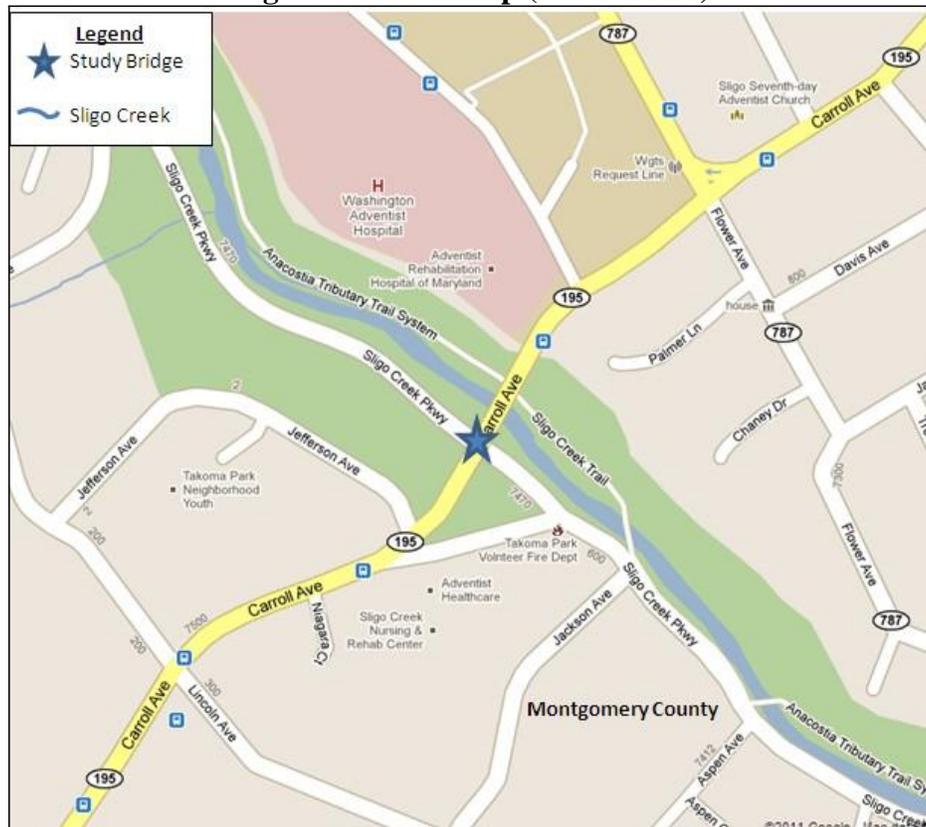
Sabra, Wang & Associates, Inc.

I. INTRODUCTION

A. Background

This report summarizes the results of a traffic analysis performed to evaluate the proposed traffic control strategy for the superstructure replacement and the substructure rehabilitation on the MD 195 Bridge over Sligo Creek Parkway (structure #15033) in the City of Takoma Park as it relates to traffic impact and traffic control costs. The study bridge is immediately adjacent to the Washington Adventist Hospital. The bridge and surrounding area are shown in **Figure 1**.

Figure 1 – Area Map (Not to Scale)



The existing bridge was built in 1932 and accommodates two 12-ft lanes of traffic, one in the northbound direction and one in the southbound direction. The bridge is also accommodated with sidewalks on each side which are approximately 5 ft each. MD 195 has an approximate average daily traffic (ADT) of 7,500 vehicles at the bridge. The structure is currently rated as 4/4/5 (deck/super-structure/sub-structure) according to the Maryland State Highway System online bridge inventory. The bridge will be replaced and the substructure will be rehabilitated.

B. Objective

The primary objective of the analysis described below is to evaluate and justify the proposed construction alternative for the replacement of the bridge superstructure as it relates to traffic impact and safety. Measures of effectiveness include: travel time, delay, and level of service for traffic operations.

C. Proposed Maintenance of Traffic Strategy

After meeting and coordinating with the City of Takoma Park, Washington Adventist Hospital, Montgomery County Ride On Transit, and the Maryland-National Capital Park & Planning Commission (M-NCPPC), the following maintenance of traffic strategy was developed:

- Close all lanes on the bridge and detour all vehicular traffic.
- Maintain pedestrian traffic with a temporary pedestrian bridge constructed adjacent to the existing bridge.
- Passenger cars will be assumed to detour along two routes, as shown in **Figure 2**:

Detour Route 1: via Old Carroll Ave., Sligo Creek Parkway, Maple Ave., Maplewood Ave., and Flower Ave.

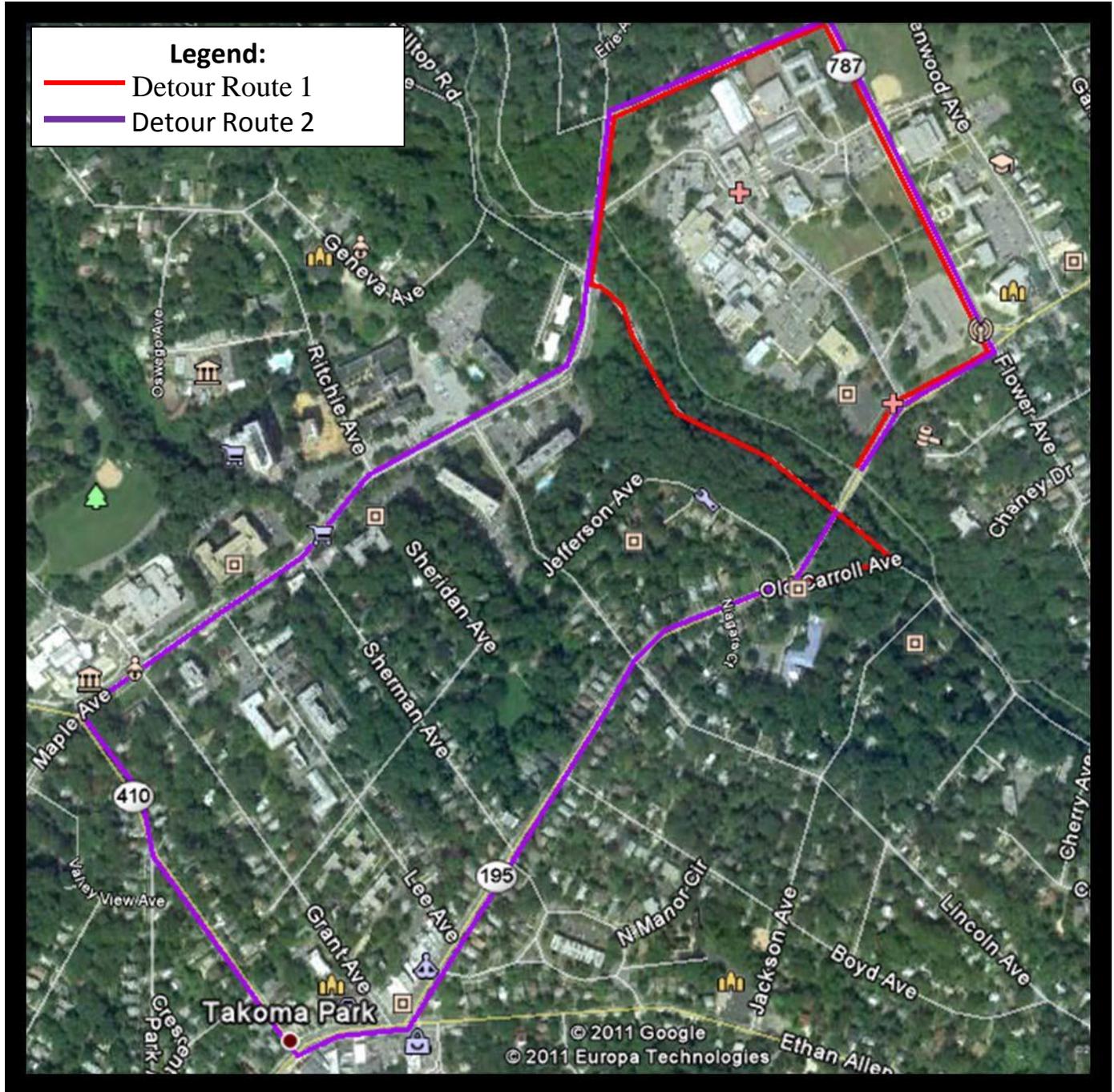
Detour Route 2: via MD 195 (Carroll Ave. and Ethan Allen Ave.), MD 410 (Philadelphia Ave.), Maple Ave., Maplewood Ave., and Flower Ave.

Currently, proposed Detour Route 1 cannot be signed because Sligo Creek Parkway is closed to motorized traffic on Sundays and thus detour signing would be potentially confusing to drivers. However, drivers with local knowledge of the area would be anticipated to use this route, particularly in the northbound direction, since the initial northbound turn for Detour Route 1 is well south of the point of bridge closure. SHA, working with the City of Takoma Park, will request that Sligo Creek Parkway, between Old Carroll Avenue and Maple Avenue, remain open to motorized traffic on Sundays for the duration of the bridge closure. If this is approved by M-NCPPC, then Detour Route 1 will be signed.

Detour Route 2 is currently proposed to be the signed detour route because each of the roadways it follows is open to motor vehicles at all times.

- Trucks will be detoured separately via MD 410 (Philadelphia Avenue), MD 320 (Piney Branch Road), and MD 193 (University Avenue), shown in **Figure 3** because of an existing weight restriction on the Maple Ave. bridge over Sligo Creek. The option of using MD 650 (New Hampshire Avenue) as a truck detour was discarded due to congestion along that road during peak hours and because of a left turn prohibition from westbound MD 193 onto southbound MD 195.
- Montgomery County Ride On Transit has indicated their buses will follow Detour Route 1. In the event that the request to open Sligo Creek Parkway to motorized traffic on Sundays is not approved by M-NCPPC, other routing options for Sundays will need to be considered.
- Several bridge construction activities are expected to require temporary flagging operations on Sligo Creek Parkway below the bridge during off-peak hours. Because of lighter traffic volumes during off-peak hours, no analysis is assumed to be necessary for the flagging operations.
- Access to the Sligo Creek Trail, which runs parallel to and north of Sligo Creek Parkway and Sligo Creek, will be maintained at all times.

Figure 2: Proposed Detour Routes



II. STUDY AREA

The study area consists of the following intersections and interconnecting roadways in the City of Takoma Park:

- MD 195 (Carroll Ave.) at Flower Ave. (formerly MD 787)
- MD 195 (Carroll Ave.) at Washington Adventist Hospital Entrance
- Sligo Creek Parkway at Old Carroll Avenue

- MD 195 (Carroll Ave.) at Old Carroll Ave./Jefferson Ave.
- MD 410 (Ethan Allen Ave) at MD 195 (Carroll Ave.) / Grant Ave.
- MD 195 (Carroll Ave.) at MD 410 (Philadelphia Ave.
- MD 410 (Philadelphia Ave.) at Maple Ave.
- Maple Ave. at Sherman Ave.
- Maple Ave. at Ritchie Ave.
- Maple Ave. at Lincoln Ave.
- Sligo Creek Pkwy. at Maple Ave./Hilltop Rd.
- Sligo Creek Pkwy. at Maple Ave./Washington Adventist Hospital entrance
- Maple Ave. at Maplewood Ave.
- Flower Ave. at Maplewood Ave.
- Flower Ave. at Pedestrian Signal (South of Division St.)

MD 195 is a 2.5 mile, two-lane urban minor arterial within the City of Takoma Park that runs in a northeast-southwest direction. MD 195 is classified as running in a north-south direction according to the SHA's Highway Location Reference. It connects to Cedar Street, NW in Washington, D.C. at its southern terminus and to MD 320 (Piney Branch Rd) at its northern end. A short 0.21-mile segment of the route between Flower Ave. and Garland Ave. is under municipal maintenance by the City of Takoma Park. The posted speed limit is 25 mph in both the northbound and southbound directions within the study area. Horizontal curves exist immediately north and south of the study bridge. Adjacent land use is primarily residential, with some medical and light industrial complexes nearby. There is a bus stop for Montgomery County Northbound Bus Routes 12 and 13 immediately north of the bridge. The nearest signalized intersection is MD 195 at Flower Ave., 0.12 miles north of the study bridge.

Sligo Creek Parkway is a two-lane minor arterial running in a southeast-northwest direction parallel to Sligo Creek. It is owned by the M-NCPPC, who makes engineering decisions regarding its use, but maintained by the Montgomery County Department of Transportation. It connects MD 650 (New Hampshire Avenue) on the southeast end to MD 193 on the northwest end. The posted limit under the MD 195 bridge is 25 miles per hour. Trucks are not allowed on the parkway and it is closed to all traffic on Sundays between Old Carroll Ave. and MD 320.

The **Washington Adventist Hospital** is a medical complex with three main access points. The south entrance is located 250' north of the study bridge along MD 195, the northwest entrance is from Sligo Creek Parkway, and the northeast entrance is from Flower Avenue. The hospital is proposing to move to a new 201-bed location in White Oak at a yet-undetermined time in the coming years, but the hospital must receive a certificate of need from the Maryland Health Care Commission before the move can proceed as planned. If the move is approved, the current Takoma Park campus would remain open with a 40-bed behavioral health unit, rehabilitation services, maternity services for low-income women, a health center, physician offices, and outpatient services, including a primary care clinic, according to current plans.

The intersection of MD 195 and Flower Ave. has Opticom detection for emergency vehicle actuation. The Montgomery County Fire and Rescue and Takoma Park Volunteer Fire Department No. 2 have an entrance on the south side of the MD 195 at MD 410 (Philadelphia Road) intersection.

Several Montgomery County Transit Ride-On buses use roadways within the study area. Routes 12 and 13 enter the south end of the study area via MD 195, cross the study bridge, and turn north on Flower Ave. Routes 17 and 18 enter the north end of the study area via MD 195, turn north into the Washington Adventist Hospital entrance just north of the study bridge, continue south on Maple Ave, and then diverge east or west on MD 410. Routes 16 and 25 also pass through at least one study area intersection, as does WMATA route F4.

III. EXISTING CONDITIONS ANALYSIS

A. Existing Traffic Volumes

Thirteen (13) hour traffic counts were obtained from the State Highway Administration (SHA) for all the intersections along the detour route with either stop control or signal control. Existing counts from SHA were used if collected in 2009 or later. If no counts existed that were more current than 2009, new counts were performed during the month of June 2011. Additionally, the intersection of MD 195 and the Washington Adventist Hospital entrance was counted by Johnson, Mirmiran and Thompson (JMT) for a 24-hour period on March 14, 2013, but since the volumes counted were only negligibly different (slightly higher for some movements and lower for others), the earlier counts were retained for purposes of peak hour analysis. Intersection peak hour traffic volumes were used as a conservative starting point and then balanced up to conservatively account for the array of dates counts were performed. A 48-hour volume count of MD 195 across the study bridge was also obtained from SHA. These baseline traffic volumes are shown in **Figure 4**.

The 24-hour count of the Washington Adventist Hospital Driveway to MD 195 immediately north of the subject bridge was examined to determine the percentage of hospital traffic using the bridge that would be impacted by the closure. The total traffic volume on the driveway was 4,734 vehicles for the day. Of these, 80% were turns to and from MD 195 to the north which would have continuing direct access to the hospital and would not need to be detoured during construction.

During 2012, several traffic access restrictions in the Sligo Park Hills Community and Ritchie Avenue Neighborhood were implemented to reduce through traffic from going through the neighborhoods. Most notably, access restrictions were placed on Hilltop Road, Park Valley Road, Ritchie Avenue, and Geneva Avenue. The access restriction signing is shown in **Figure 5**. In addition to the access restrictions, the Montgomery County Department of Transportation is currently planning to close and replace the Park Valley Road Bridge over Sligo Creek.. SHA is coordinating with Montgomery County to avoid having both projects occur simultaneously. However, for the purposes of this study, traffic flow was modeled for the situation where both bridges were closed and under construction. These restrictions and bridge closure are anticipated to have already diverted additional traffic through several intersections along the proposed detour routes by the time of their implementation, including intersections along Maple Avenue, MD 410 (Philadelphia Avenue), and Sligo Creek Parkway. Traffic redirected due to the access restrictions and the Park Valley Road closure was assumed to have a 50-50 distribution between two routes. One route follows MD 320 (Piney Branch Road) and Sligo Creek Parkway while the other follows MD 320 (Piney Branch Road), MD 410 (Philadelphia Avenue), and Maple Ave.

Figure 4: Baseline Turning Movement Traffic Volumes

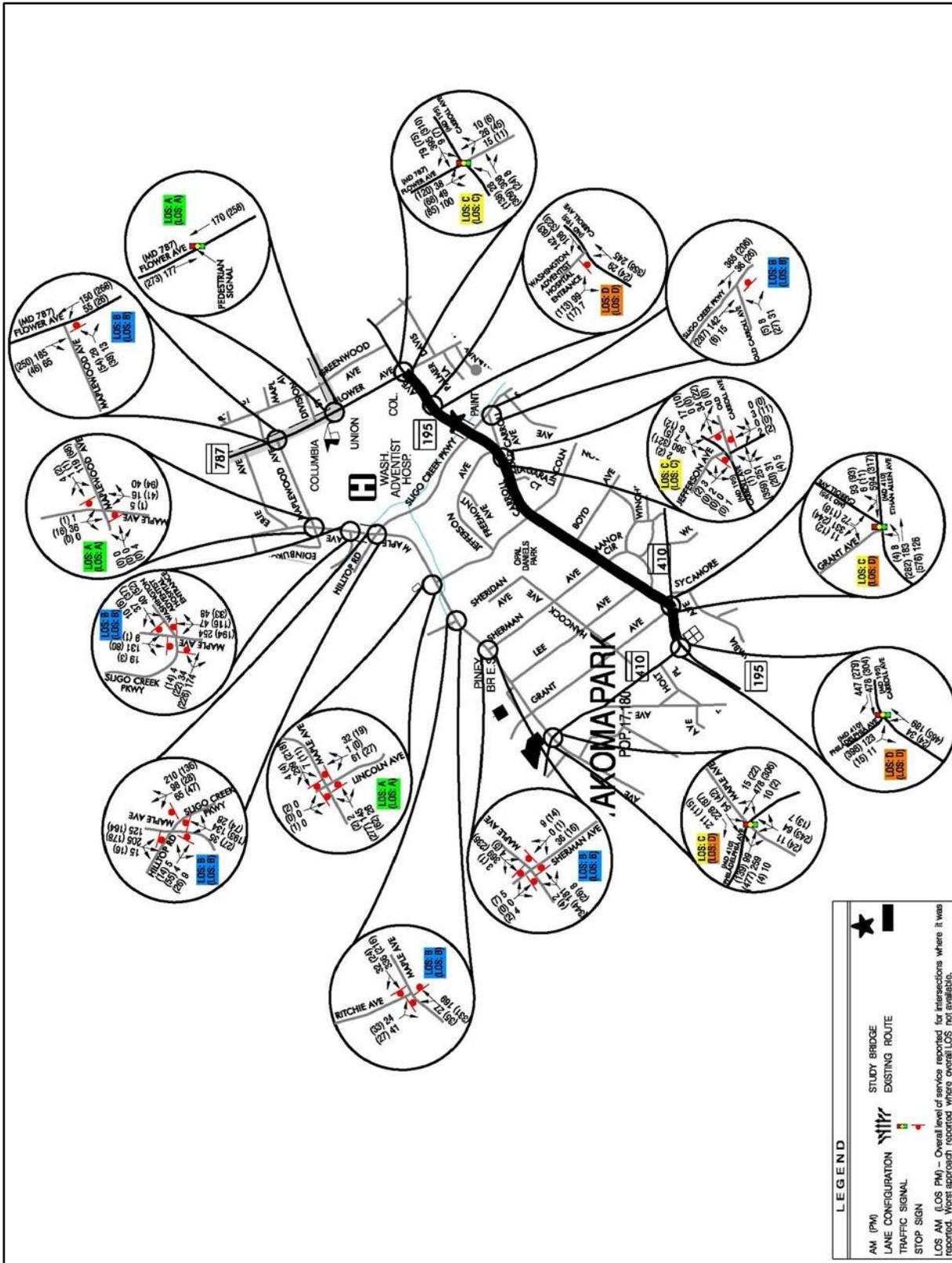
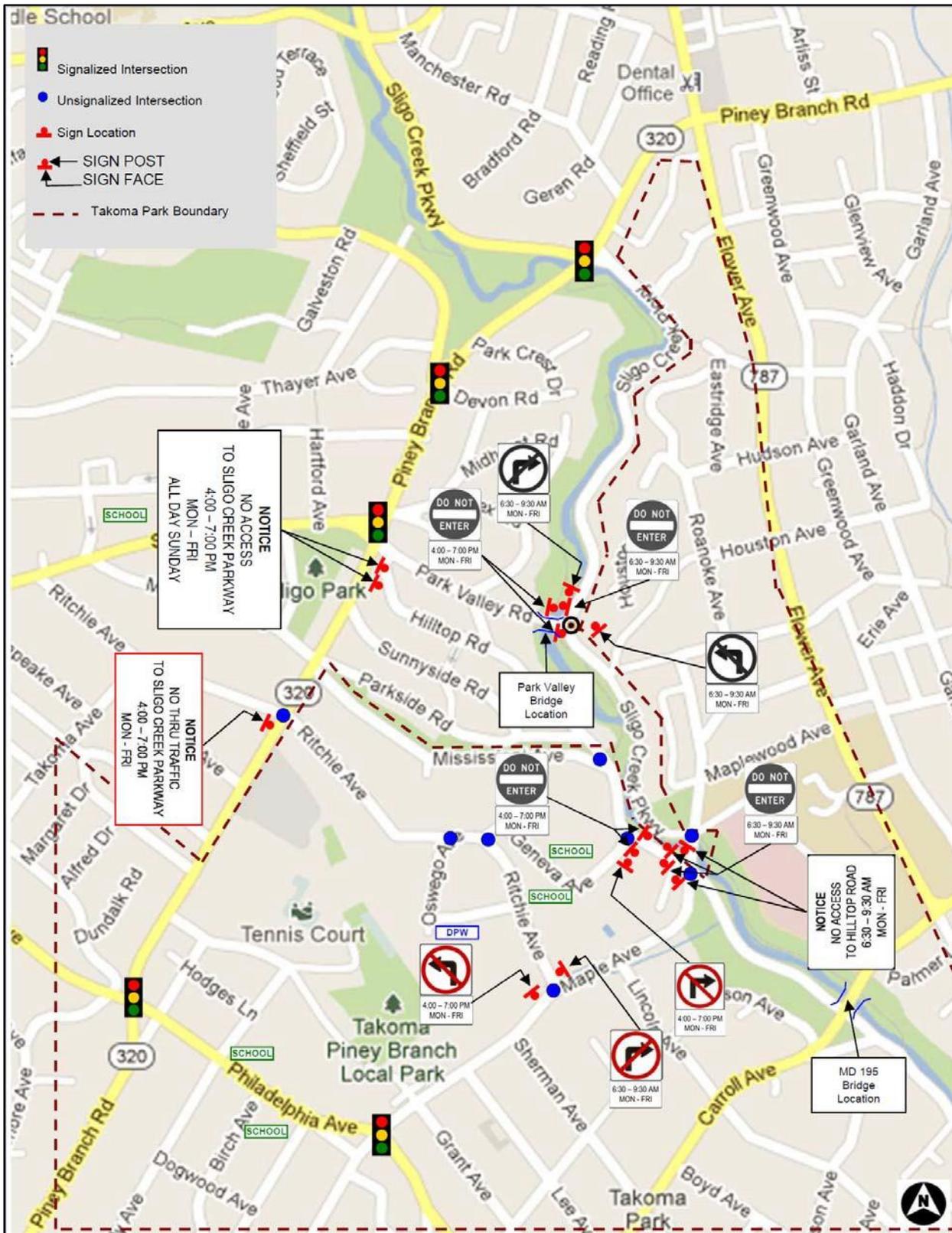


Figure 5: Access Restrictions & Location of Park Valley Road Planned Bridge Closure



However, volumes in the peak hour and peak direction that will be redirected due to the Park Valley Road over Sligo Creek bridge closure are the same volumes that have presumably already been redirected due to the recent access restrictions on Park Valley Road. Therefore, the additional, cumulative effects of this bridge closure are only in the off-peak direction. Additionally, the 50% portion of the traffic volume redirected due to the Park Valley Road restrictions and closure which would use MD 320 (Piney Branch Road) and Sligo Creek Parkway rejoin their original route before entering the study network and therefore would not change conditions at any of the intersections that are the subject of this study.

Figure 6 illustrates the changes in traffic volumes estimated for each intersection throughout the study area based on the access restrictions shown in Figure 5 and the Park Valley Road temporary bridge closure. Adjusting the baseline traffic volumes of Figure 4 by adding or subtracting the volumes of traffic shown in Figure 6 resulted in the estimated existing traffic volumes, as shown in **Figure 7**.

B. Field Observations

Field observations were performed by a traffic engineer to identify geometric issues such as sight distance constraints along the detour routes. Additional overall observations on pavement conditions, pavement markings, signage, unusual movements or behavior, overall physical conditions of traffic control devices, traffic patterns, pedestrian/bicycle facilities, and lighting were also noted.

Overall, the pavement conditions of the traveled way appear to be acceptable upstream and downstream of the bridge and along the detour route. The surface of the bridge appears to be fairly worn; many potholes are present on each travel lane. The sidewalks are also in very poor condition with many cracks and pieces missing. It should be noted there is no sidewalk on the east side past the southern end of the bridge. **Figure 8** shows the poor condition of the sidewalk near the bridge. **Figure 9** shows the northbound and southbound approaches to the study bridge. Illumination is provided along the whole length of the proposed detour routes except for the portion along Sligo Creek Parkway. The study bridge has pedestrian lighting along both sides.

Neither MD 195 nor Sligo Creek Parkway is designated as a bicycle route within the study area. However, the Sligo Creek Trail is a hiker/biker trail that runs alongside Sligo Creek Parkway and goes under the study bridge as well. Consideration must be taken into account to make proper provisions for safety of users of this trail.

In addition to the main entrance to Washington Adventist Hospital on MD 195 mentioned previously, an entrance to the Adventist Healthcare Sligo Creek Nursing & Rehabilitation Center is approximately 300' south of the study bridge at Old Carroll Avenue.

Figure 10 is a simple condition diagram showing the bridge dimensions and nearby bus stops. Detour routes were driven the entire length in both directions and checked for intersections with constrained sight distance. The intersections of Old Carroll Ave. at Sligo Creek Parkway and Maplewood Avenue at Flower Avenue were observed to have limited sight distances for maneuvers looking left from a stop-controlled approach.

Figure 8: Sidewalk on northbound side of the study bridge

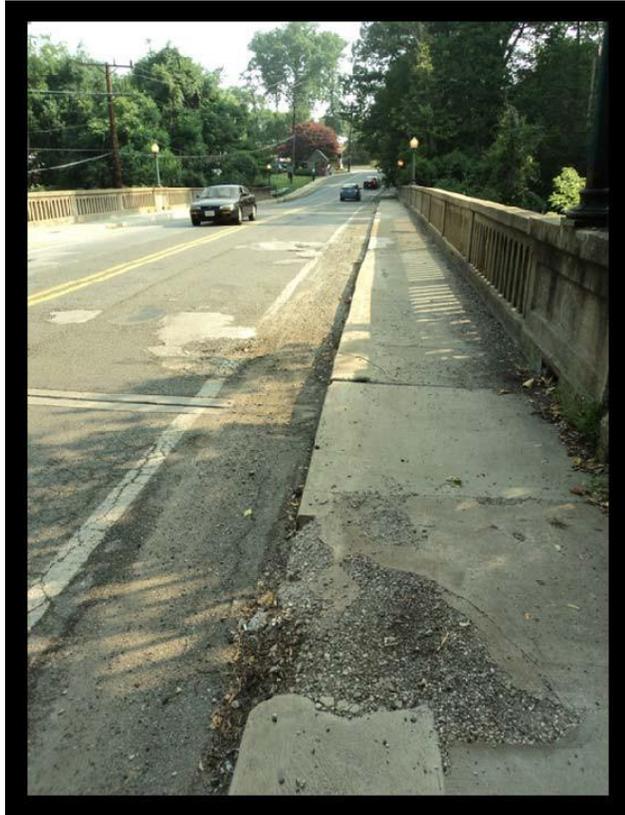
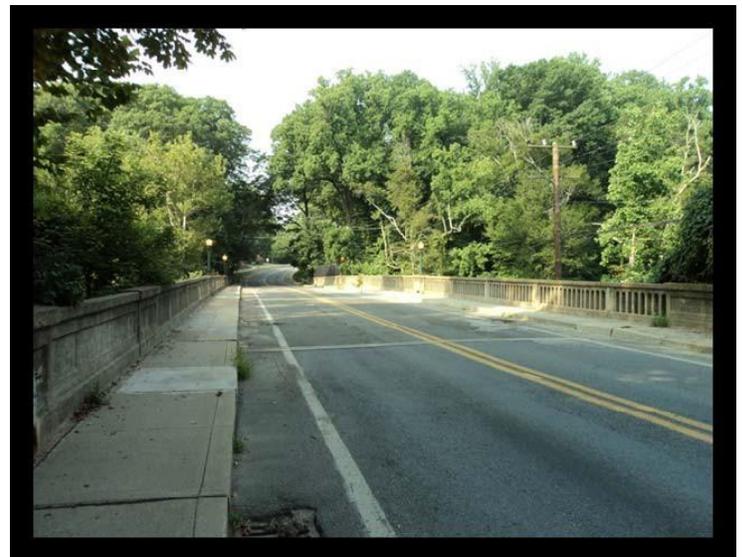


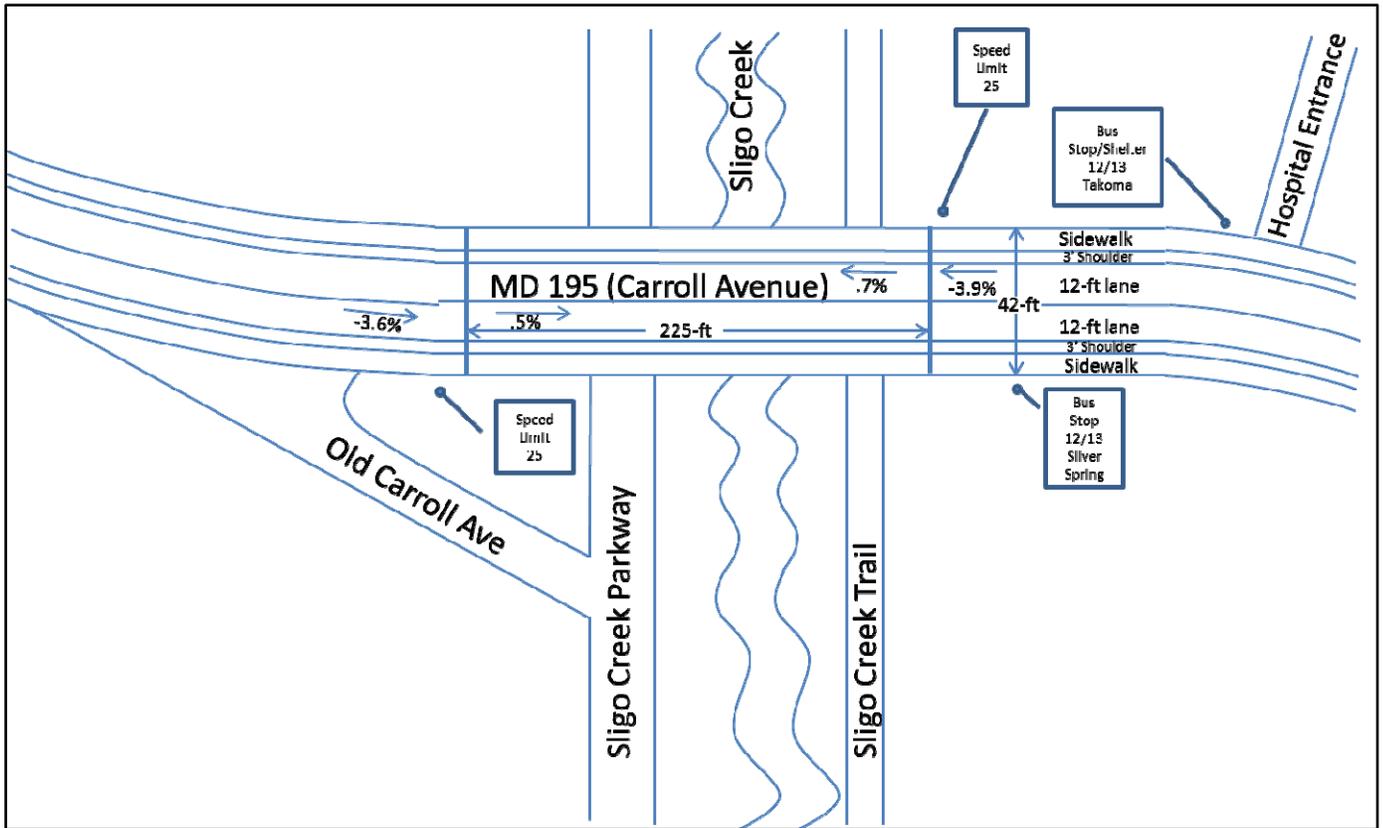
Figure 9: Northbound (top) and Southbound (bottom) Approaches to the MD 195 Study Bridge



Figures 11 and 12 are photos taken from the driver’s position looking in the direction of the constrained sight distance at these two intersections. On Sligo Creek Parkway, trees on the inside of the horizontal curve west of the intersection cause the constrained sight distance. Along Flower Ave., parked vehicles on the edge of the roadway and a row of shrubs on private property close to the northwest intersection corner limit the available sight distance.

The speed limits on all roads along the detour routes are 25 mph. Assuming a design speed of 30 mph, the required sight distance for left turns onto a two-lane roadway is 335’ and for right turns is 290’, based on AASHTO’s *A Policy on Geometric Design of Highways and Streets* (Exhibit 9-55 and Exhibit 9-58). Field measurements showed sight distance looking left at Sligo Creek Parkway from Old Carroll Ave. to be approximately 138’ and sight distance looking left at Flower Ave. from Maplewood Ave. to be approximately 185’. All field measurements of existing sight distance assume that after coming to a complete stop, drivers may pull forward to a driver’s eye position 14.5 feet behind the edge of the nearest travel lane in order to maximize available sight distance.

Figure 10 – Condition Diagram showing Bridge Dimensions and Nearby Bus Stops



Travel Times

Existing travel time studies were performed during the AM and PM peak hour for each of the detour routes on Thursday, July 21, 2011. Three runs in each direction were recorded for each detour route. The existing average measured travel times in each direction are shown in **Table 1** for both MD 195 and the two proposed detour routes. The existing route to cross the bridge was considered to be from the intersection of MD 195 at MD 410 (Philadelphia Avenue) to MD 195 at Flower Ave. We would expect these travel times to be about 10% longer during the non-summer months when schools are in session, based on seasonal ADT adjustment factors.

C. Existing Conditions Crash Analysis

The Maryland State Highway Administration Office of Traffic and Safety, Traffic Development and Support Division provided crash history data for MD 195 for a five-year period ranging from January 1, 2006 through December 31, 2010. Crash data was reviewed for the total length of the bridge on MD 195, which is about 0.20 miles long. Crash data was also reviewed on Sligo Creek Parkway from 250' north of the structure to 250' south of the structure. Data for the following intersections along the detour routes were also reviewed:

Figure 11: Sight distance looking left (northwest) along Sligo Creek Pkwy from Old Carroll Ave.



Figure 12: Sight distance looking left (north) along Flower Ave. from Maplewood Ave.



Table 1: Existing Field Measured Travel Times AM (PM) Peak Hour, min:sec

Route	Direction	
	NB	SB
MD 195 from MD 410 (Philadelphia Ave.) to Flower Ave.	2:28 (2:19)	2:54 (2:58)
Detour Route 1 (via Sligo Creek Parkway)	4:33 (4:27)	4:46 (5:10)
Detour Route 2 (via Philadelphia Ave.)	4:48 (5:35)	5:02 (5:11)

- Maple Avenue at Maplewood Avenue
- MD 195 (Carroll Avenue) at Old Carroll Avenue / Jefferson Avenue
- MD 195 (Carroll Avenue) at MD 410 (Ethan Allan Avenue) / Grant Avenue
- MD 195 (Carroll Avenue) at MD 410 (Philadelphia Ave)
- MD 195 (Carroll Avenue) at Flower Avenue
- MD 410 (Philadelphia Avenue) at Maple Avenue
- Flower Avenue at Maplewood Avenue

No police reported accidents were found at the following locations:

- MD 195 @ Washington Adventist Hospital entrance
- Flower Avenue @ Pedestrian Signal (South of Division Street)
- Sligo Creek Parkway @ Maple Avenue/Hilltop Road
- Sligo Creek Parkway @ Maple Avenue/Washington Adventist Hospital
- Sligo Creek Parkway @ Old Carroll Avenue
- Maple Avenue @ Lincoln Avenue
- Maple Avenue @ Sherman Avenue
- Maple Avenue @ Ritchie Avenue

The data provided showed a total of 27 crashes and indicated the most prevalent type of crash was rear end collisions, constituting 44% of all collisions. There were no fatalities reported during the study period.

A few noteworthy crash patterns are outlined below:

- The intersection of MD 195 (Carroll Avenue) at Ethan Allen Ave (MD 410) had a rear-end collision from each approach besides Grant Ave.
- The intersection of MD 410 (Philadelphia Avenue) at MD 195 (Carroll Avenue) had a total of seven collisions, with five of those being rear-end collisions. Of those five collisions, four were traveling northbound on MD 195 (Carroll Avenue). Horizontal curvature on the northbound approach just prior to the signal could contribute to the incidence of northbound rear-end crashes, though sight distance to the signal heads appears to be adequate.
- MD 195 (Carroll Avenue) at Flower Avenue had a total of six accidents. Of those six accidents, three were rear-end collisions.
- MD 410 at Maple Avenue had three total crashes. One of these involved a pedestrian.
- There was one angle collision at the intersection of Flower Avenue at Maplewood Avenue where the sight distance constraint described earlier could have been a contributing factor.
- There was one opposite direction crash on Sligo Creek Parkway near the bridge.

D. Existing Conditions Capacity Analysis

Synchro files were developed by Sabra, Wang, & Associates for the study area. The signal timings used were provided by the Maryland State Highway Administration Office of Traffic and Safety. These files were updated for the study intersections using the existing traffic volumes shown in Figure 7. Highway Capacity Manual (HCM) analyses were performed on the study network under existing conditions to determine the baseline capacity utilization for later comparison to the proposed detours. The HCM method evaluates the intersection level of service (LOS) and volume-to-capacity (v/c) ratio. A capacity analysis LOS is defined by the HCM as a “qualitative measure describing operational conditions within a traffic stream.” Levels of service range from *A* to *F* where *A* represents optimal conditions and *F* represents saturated or failing conditions.

Table 2 summarizes the results of the HCM analyses under existing conditions.

The results for the westbound approach at the intersection of MD 410 (Ethan Allen Ave.) at Sycamore Avenue were used for the intersection of MD 195 at MD 410 (Ethan Allen Ave.) because due to the close spacing of these signals and signal phasing, few, if any, vehicles will stop between these intersections. This approach fails during the AM peak hour. All other approaches are operating at a LOS E or better.

E. Modeled Travel Time

Travel times were developed from the Synchro model based upon delay and travel length. It should be noted that these times are higher than the field-measured times because the existing volumes were balanced up to be conservative when developing the baseline traffic volumes. Hence, the calculated delay is greater than what was experienced in the field. Synchro calculated existing travel times are shown in **Table 3**.

IV. MAINTENANCE OF TRAFFIC CONDITIONS ANALYSIS

A. Detour Conditions Traffic Reassignment

Given the choice of two detour routes, the route drivers would prefer was assumed to be Detour Route 1 because of its shorter length. However, preliminary analyses showed that either route would experience a failing level of congestion at key locations if 100% of the detoured traffic were assumed to follow it.

Traffic volumes for movements prohibited by the proposed bridge closure were redistributed throughout the study network based on several assumptions. These assumptions were based on existing traffic count data in the study network and assumed driver behavior. The following are some of the assumptions used to redistribute network volumes, as shown in **Figure 13**:

Assignment between Detour Routes 1 and 2:

- The percentage of traffic following Detour Routes 1 and 2 was estimated independently for each direction and peak hour. For initial estimates, Detour Route 1 was assumed to be preferred by drivers due to its shorter length, but the percentage of drivers using it was lowered in an iterative process until the resulting delays at intersections along it were

reduced to acceptable levels. This step was intended to mimic the equilibrium that traffic

Table 2: Existing Conditions Capacity Analysis Results – AM (PM) Peak Hour

Intersection / Approach	Type of Control	Delay / Vehicle (sec)	V/C Ratio	Level of Service
<i>MD 195 at Jefferson Ave. / Old Carroll Ave.</i> ¹	<i>2-Way Stop</i>	<i>1.4 (1.1)</i>	<i>N/A⁴ (N/A⁴)</i>	<i>N/A³ (N/A³)</i>
EB Jefferson Avenue	Stop	15.0 (17.7)	0.02 (0.01)	C (C)
WB Old Carroll Avenue	Stop	14.8 (15.1)	0.14 (0.12)	B (C)
NB MD 195	Perm. LT	0.0 (0.0)	0.00 (0.00)	A (A)
SB MD 195	Perm. LT	0.2 (0.4)	0.01 (0.01)	A (A)
<i>Old Carroll Ave. at Sligo Creek Parkway</i>	<i>1-Way Stop</i>	<i>1.3 (1.1)</i>	<i>N/A⁴ (N/A⁴)</i>	<i>N/A³ (N/A³)</i>
EB Old Carroll Avenue	Stop	10.3 (10.7)	0.06 (0.05)	B (B)
NB Sligo Creek Parkway	Perm. LT	0.9 (1.1)	0.03 (0.02)	A (A)
<i>MD 410 (Ethan Allen Ave.) at MD 195</i>	<i>Signal</i>	<i>32.4 (35.6)</i>	<i>0.74 (0.71)</i>	<i>C (D)</i>
<i>MD 195 at MD 410 (Philadelphia Ave.)</i>	<i>Signal</i>	<i>36.9 (41.3)</i>	<i>0.52 (0.74)</i>	<i>D (D)</i>
<i>MD 410 (Philadelphia Ave.) at Maple Ave.</i>	<i>Signal</i>	<i>33.0 (63.4)</i>	<i>0.80 (0.90)</i>	<i>C (E)</i>
<i>Maple Ave. at Sherman Ave.</i>	<i>4-Way Stop</i>	<i>12.8 (11.9)</i>	<i>N/A² (N/A²)</i>	<i>B (B)</i>
<i>Maple Ave. at Ritchie Ave.</i>	<i>3-Way Stop</i>	<i>12.5 (12.1)</i>	<i>N/A² (N/A²)</i>	<i>B (B)</i>
<i>Maple Ave. at Lincoln Ave.</i>	<i>4-Way Stop</i>	<i>11.5 (11.1)</i>	<i>N/A² (N/A²)</i>	<i>B (B)</i>
<i>Maple Ave. at Sligo Creek Pkwy./Hilltop Road</i>	<i>4-Way Stop</i>	<i>15.0 (13.9)</i>	<i>N/A² (N/A²)</i>	<i>B (B)</i>
<i>Maple Ave. at Sligo Creek Pkwy./Washington Adventist Hospital</i>	<i>4-Way Stop</i>	<i>11.5 (11.3)</i>	<i>N/A² (N/A²)</i>	<i>B (B)</i>
<i>Maple Ave. at Maplewood Ave.</i>	<i>2-Way Stop</i>	<i>5.7 (3.1)</i>	<i>N/A⁴ (N/A⁴)</i>	<i>N/A³ (N/A³)</i>
EB Maplewood Ave.	Stop	8.5 (0.0)	0.00 (0.00)	A (A)
WB Maplewood Ave.	Stop	9.8 (9.6)	0.15 (0.09)	A (A)
NB Maple Ave.	Perm. LT	0.6 (0.1)	0.00 (0.00)	A (A)
SB Maple Ave.	Perm. LT	0.2 (0.4)	0.00 (0.00)	A (A)
<i>Flower Ave. at Maplewood Ave.</i>	<i>1-Way Stop</i>	<i>2.0 (2.2)</i>	<i>N/A⁴ (N/A⁴)</i>	<i>N/A³ (N/A³)</i>
EB Maplewood Ave.	Stop	12.0 (13.6)	0.08 (0.19)	B (B)
NB Flower Ave.	Perm. LT	2.4 (0.9)	0.05 (0.02)	A (A)
<i>Flower Ave. at Pedestrian Signal</i>	<i>Signal</i>	<i>0.4 (0.7)</i>	<i>0.11 (0.18)</i>	<i>A (A)</i>
<i>MD 195 (Carroll Ave.) at Flower Ave.</i>	<i>Signal</i>	<i>28.1 (32.5)</i>	<i>0.68 (0.71)</i>	<i>C (C)</i>
<i>MD 195 (Carroll Ave.) at Washington Adventist Hospital</i>	<i>1-Way Stop</i>	<i>3.4 (4.1)</i>	<i>N/A⁴ (N/A⁴)</i>	<i>N/A³ (N/A³)</i>
EB MD 195	Perm. LT	1.3 (0.8)	0.04 (0.03)	A (A)
SB Hospital Entrance	Stop	25.2 (26.8)	0.39 (0.47)	D (D)

1 – Intersection has too many legs for HCM analysis.

2 – Based on highest lane group v/c ratio of approach.

3 – HCM does not report approach v/c for three- or four-way stop intersections

4 – HCM only reports an intersection LOS at all-way stops.

5 – HCM does not report an overall v/c for any type of un-signalized intersection.

Table 3: Synchro Calculated Existing Travel Times

Direction	Time (sec)	
	AM	PM
Northbound	3:48	3:47
Southbound	3:39	3:45

would be expected to reach after the first few days of the road closure, with traffic on the shortest route diverting to the longer route until delays dissipate and the perceived travel time between the two routes becomes approximately equal.

- The intersections of Old Carroll Ave at Sligo Creek Parkway and Maple Ave at Sligo Creek Parkway/Hilltop Road were assumed to be the critical intersections for determining the percentage of vehicles that would choose each route.

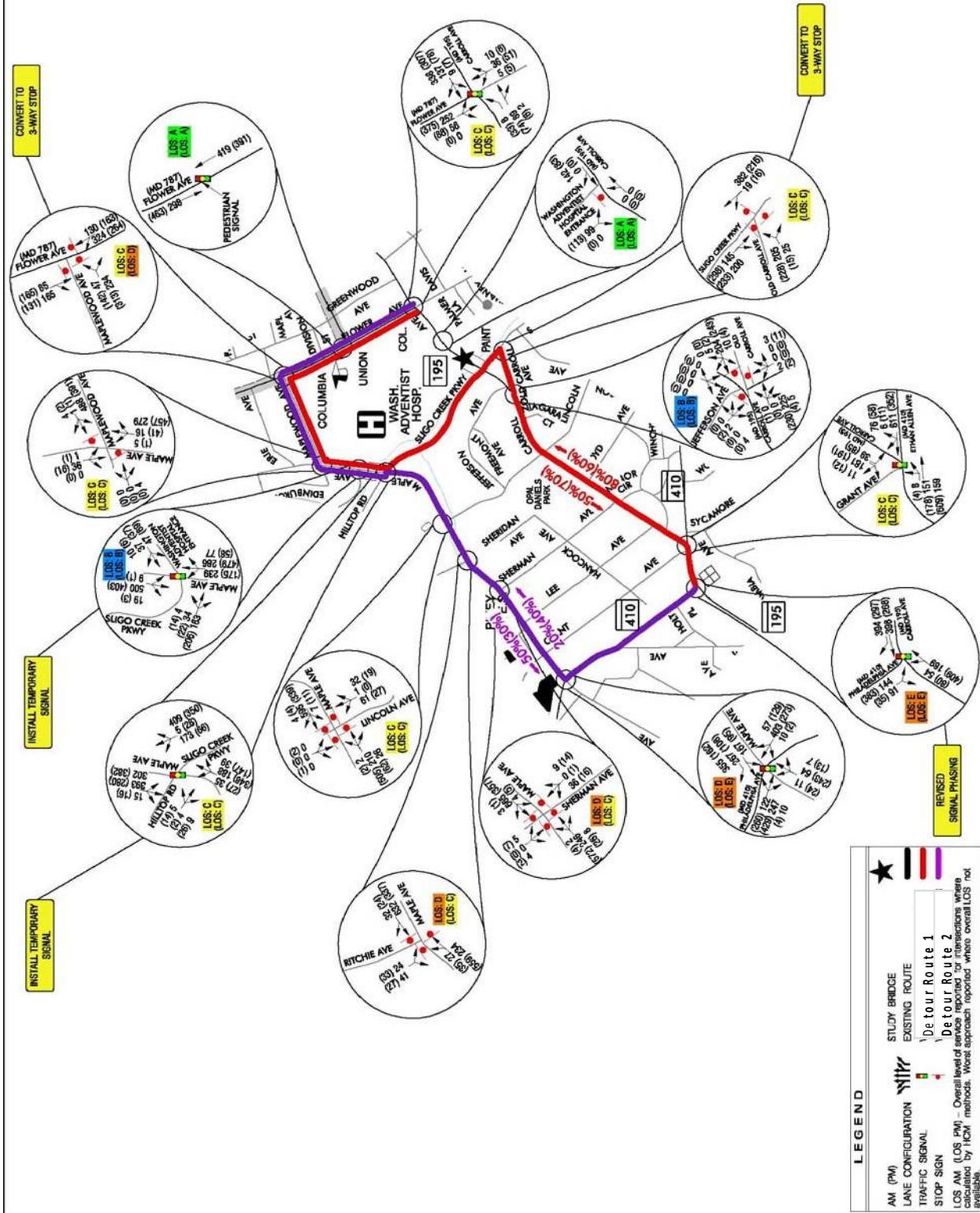
Northbound Direction

- For the northbound direction, the stop sign control at the intersection of Old Carroll Ave. at Sligo Creek Parkway was determined to control the amount of traffic that would follow this detour.
- It was assumed that as many northbound drivers as possible would use Detour Route 1 until the northeast-bound approach at the Old Carroll Ave. at Sligo Creek Parkway intersection approached the threshold between LOS D and LOS E. Once at this threshold, the remaining traffic was assumed to use Detour Route 2.
- The LOS D/E threshold was chosen rather than an LOS E/F threshold because the limited sight distance for turning left from this intersection, as documented earlier, was considered to hold potential for degrading operations and/or driver comfort levels beyond what the HCM methods predict.
- During the AM peak hour, 80% of northbound detoured vehicles would therefore use Detour Route 1 (via Sligo Creek Parkway) and the remaining 20% would use Detour Route 2 (via Philadelphia Avenue).
- During the PM peak hour, 60% of northbound detoured vehicles would use Detour Route 1, while the remaining 40% would use Detour Route 2.

Southbound Direction

- For the southbound direction, a similar iterative assignment of traffic between the two detour routes was conducted. As with the northbound direction, drivers were assumed to prefer Detour Route 1 (via Sligo Creek Parkway) until the point at which capacity problems would begin to occur along the detour route. The critical intersection was determined to be Maple Avenue at Sligo Creek Parkway. Left turning detour volumes were increased until the LOS was better than F and the volume to capacity ratio for every approach was less than or equal to 1.00.

Figure 13: Equilibrium Detour Traffic Volumes with Access Restrictions & Temporary Improvements



During the AM peak hour, the split was assumed to be 50% for each route in the southbound direction. During the PM peak hour, 70% of southbound detoured vehicles were assumed to use Detour Route 1, with 30% using Detour Route 2.

MD 195 at Flower Avenue Intersection

- During both peak hours, southbound traffic on Flower Avenue turning right at the MD 195 intersection were assumed to turn right at Maplewood Avenue instead. This would require advance detour signing that still leaves the roadway ahead on Flower Avenue open and which, therefore, may not be effective in the initial days of the detour at getting drivers to follow it.
- Drivers at the intersection of MD 195 at Flower Avenue that would otherwise go southbound over the bridge on MD 195 were assumed to go northbound on Flower Avenue and follow the detour route.

MD 195 at Washington Adventist Hospital Entrance

- Drivers exiting from the Washington Adventist Hospital driveway on MD 195 which would otherwise go southbound across the bridge would instead turn left from the Washington Adventist Hospital entrance on Maple Ave.
- Drivers going northbound on MD 195 and turning left at the Washington Adventist Hospital entrance would instead follow the detour route and enter at the Washington Adventist Hospital entrance on Maple Ave.

MD 195 south of Bridge Closure

- It was assumed that 10% of the northbound traffic normally using the MD 195 is generated along the various local roads between Old Carroll Ave. and MD 410 (Ethan Allen Avenue). It was assumed this traffic would instead turn south on MD 195 and follow the detour route.
- All northbound drivers assigned to use Detour Route 1 would turn from MD 195 onto Old Carroll Avenue immediately prior to the bridge closure and follow the detour route along Sligo Creek Parkway.
- Drivers turning left from westbound Sligo Creek Parkway onto Old Carroll Avenue and then turning right at MD 195 will continue straight along Sligo Creek Parkway and follow the detour route.
- Traffic entering the network on MD 195 from the south that would normally use the study bridge was distributed between the following movements proportionally to the existing volumes:
 - Westbound right turns onto MD 195 from MD 410 (Ethan Allen Ave.) would instead continue along MD 195 and turn right onto MD 410 (Philadelphia Ave.) and then turn right onto Maple Avenue
 - Northbound left turns onto MD 195 at MD 410 (Ethan Allen Ave.) that originate from MD 195 south of MD 410 (Philadelphia Ave.) would instead turn left at MD 410 (Philadelphia Ave.) and then turn right onto Maple Avenue.
 - Northbound left turns onto MD 195 at MD 410 (Ethan Allen Ave.) that originate on MD 410 (Philadelphia Ave.) would instead turn left at Maple Ave. directly from MD

410 (Philadelphia Avenue).

Various combinations of improvements were tested with preliminary capacity analysis in Synchro for each of the detour routes, including:

- Conversion of one-way stop and two-way stop intersections to all-way stop control at Flower Avenue and Maplewood Ave. and/or Old Carroll Ave. at Sligo Creek Parkway
- Conversion of all-way stop intersections on Maple Ave. to two-way stop control
- Modifications to signal phasing at the existing signalized intersection of MD 195 at MD 410 (Philadelphia Ave.)
- Construction of temporary signals at the intersections of Maple Ave. at Sligo Creek Pkwy/Hilltop Rd. and Maple Ave. at Sligo Creek Pkwy/Washington Adventist Hospital entrance

B. Detour Conditions Capacity Analysis

Traffic was split between the two routes according to the above percentages and all intersections were modeled first under current conditions with no improvements. Where approaches failed at signalized intersections based on existing timing, intersection splits and offsets were optimized for the detour routes to minimize delay. As lingering deficiencies in traffic operations were identified, improvements were tested and implemented in the model until a set of final improvements judged to be the best-case scenario for implementation of the detours was arrived upon. **Table 4** shows the results of the HCM analysis with these improvements, which will be described in greater detail later. Figure 13 also illustrates color-coded LOS for each intersection.

Though all intersections would operate at LOS E or better overall, some failing conditions at individual intersection approaches would still persist even with the improvements noted. They include:

- The westbound approach at MD 410 (Ethan Allen Ave.) at MD 195 (Carroll Ave.) would fail in the AM and PM peak hours.
- The eastbound approach at MD 195 at MD 410 (Philadelphia Avenue) would fail in the AM and PM peak hours.

Table 4: Proposed Maintenance of Traffic Capacity Analysis with Improvements

Intersection / Approach	Type of Control	Delay / Vehicle (sec)	V/C Ratio	Level of Service
MD 195 at Jefferson Ave. / Old Carroll Ave.¹	2-Way Stop	5.4 (5.8)	N/A⁴ (N/A⁴)	N/A³ (N/A³)
EB Jefferson Avenue	Stop	9.1 (10.7)	0.01 (0.00)	A (B)
WB Old Carroll Avenue	Stop	11.1 (11.4)	0.29 (0.33)	B (B)
NB MD 195	Perm. LT	0.0 (0.0)	0.00 (0.00)	A (A)
SB MD 195	Perm. LT	0.0 (0.0)	0.00 (0.00)	N/A (N/A)
Old Carroll Ave. at Sligo Creek Parkway	3-Way Stop	15.0 (19.0)	N/A⁴ (N/A⁴)	C (C)
EB Old Carroll Avenue	Stop	13.4 (14.1)	0.42 (0.45)	B (B)
NB Sligo Creek Parkway	Stop	17.2 (12.3)	0.64 (0.39)	C (B)
SB Sligo Creek Parkway	St	13.5 (24.2)	0.53 (0.79)	B (C)
MD 410 (Ethan Allen Ave.) at MD 195	Signal	23.6 (22.7)	0.61 (0.64)	C (C)
MD 195 at MD 410 (Philadelphia Ave.)	Signal with Split Phasing	71.4 (66.7)	0.63 (0.89)	E (E)
MD 410 (Philadelphia Ave.) at Maple Ave.	Signal	45.7 (68.9)	0.91 (0.99)	D (E)
Maple Ave. at Sherman Ave.	4-Way Stop	26.4 (19.6)	N/A² (N/A²)	D (C)
Maple Ave. at Ritchie Ave.	3-Way Stop	25.3 (20.3)	N/A² (N/A²)	D (C)
Maple Ave. at Lincoln Ave.	4-Way Stop	20.8 (17.2)	N/A² (N/A²)	C (C)
Maple Ave. at Sligo Creek Pkwy./ Hilltop Road	Temp. Signal	27.0 (27.4)	0.73 (0.77)	C (C)
Maple Ave. at Sligo Creek Pkwy./ Washington Adventist Hospital	Temp. Signal	14.0 (18.8)	0.75 (0.77)	B (B)
Maple Ave. at Maplewood Ave.	2-Way Stop	13.5 (8.6)	N/A⁴ (N/A⁴)	N/A³ (N/A³)
EB Maplewood Ave.	Stop	8.5 (0.0)	0.00 (0.00)	A (A)
WB Maplewood Ave.	Stop	22.6 (19.9)	0.74 (0.65)	C (C)
NB Maple Ave.	Perm. LT	0.2 (0.0)	0.00 (0.00)	A (A)
SB Maple Ave.	Perm. LT	0.2 (0.5)	0.00 (0.00)	A (A)
Flower Ave. at Maplewood Ave.	3-Way Stop	16.7 (26.8)	N/A⁴ (N/A⁴)	C (D)
EB Maplewood Ave.	Stop	13.0 (29.4)	0.46 (0.81)	B (D)
NB Flower Ave.	Stop	21.9 (31.0)	0.74 (0.81)	C (D)
SB Flower Ave.	Stop	11.5 (16.7)	0.39 (0.55)	B (C)
Flower Ave. at Pedestrian Signal	Signal	0.5 (0.9)	0.26 (0.30)	A (A)
MD 195 (Carroll Ave.) at Flower Ave.	1-Way Stop	28.9 (29.9)	0.67 (0.73)	C (C)
MD 195 (Carroll Ave.) at Washington Adventist Hospital	1-Way Stop	N/A - Temporarily no intersecting traffic		

- 1 – Intersection has too many legs for HCM analysis.
- 2 – Based on highest lane group v/c ratio of approach.
- 3 – HCM does not report approach v/c for three or four-way stop intersections
- 4 – HCM only reports an intersection LOS at all-way stops.
- 5 – HCM does not report an overall v/c for any type of unsignalized intersection.

Improvements Needed for Detour Operations

The improvements that would be needed for a full vehicular detour of the MD 195 bridge over Sligo Creek Parkway, as incorporated into the analysis reported in Table 4, are described in greater detail as follows:

➤ *MD 195 at MD 410 (Ethan Allen Ave.) & MD 195 at MD 410 (Philadelphia Ave.)*

The intersections of MD 195 at MD 410 (Ethan Allen Avenue) and MD 195 at MD 410 (Philadelphia Avenue) are nearly at capacity and are part of a cluster of three intersections on one controller. Therefore, it is difficult to solve one intersection's failures without sacrificing the other intersections' performance. To solve these problems involved changing phasing and optimizing the cycle length and splits.

At the MD 195 at MD 410 (Philadelphia Avenue) intersection, the phasing for the eastbound and westbound approaches along MD 195 would need to be converted from the existing concurrent phasing with permitted eastbound left turns to split phasing with eastbound and westbound movements running during separate intervals. This is important when increasing the number of eastbound left turns due to the detour, since there is only a single lane on the eastbound approach and any permitted left turns block through traffic.

The temporary phasing changes will require minor traffic signal modifications at the intersection of MD 195 and MD 410 (Philadelphia Avenue) to change the number of signal heads (4 section heads for north-south split phasing versus the existing 3-section heads for permitted left turn phasing).

After optimizing the cycle length and splits for the new phasing scenario, it was possible to improve all approaches for the cluster to volume-to-capacity ratios at or below 1.00. This means that there should not be cycle failures and queues should not grow. Nonetheless, some approaches would still experience LOS F delay in part because of the longer cycle length needed to accommodate all three intersections that are part of the cluster.

➤ *Maple Avenue at MD 410 (Philadelphia Ave.)*

The southbound approach at the intersection of Maple Avenue at MD 410 (Philadelphia Ave) would fail during the PM peak hour under detour conditions in the absence of other changes. Optimizing the cycle length and splits would improve the intersection from an overall LOS E to LOS D during the PM peak. The AM peak hour would operate at LOS D and so existing signal timing was retained. No hardware changes will be required at this location.

➤ *Maple Avenue at Hilltop Rd/Sligo Creek Parkway and Maple Avenue at Sligo Creek Parkway/Washington Adventist Hospital*

The intersections of Maple Avenue at Hilltop Rd/Sligo Creek Parkway and Maple Avenue at Sligo Creek Parkway/Washington Adventist Hospital would fail under

detour conditions as well without any improvements. Since these intersections are currently four-way stops, temporary signals were modeled for these intersections to reduce delay. For both the AM and PM peak hours, 90 second cycle lengths are recommended for each intersection.

At these intersections, both the signed and unsigned detour routes converge, and the effects of both the access restrictions and the potential Park Valley Road Bridge closure were factored into the analysis. The two intersections are also located less than 200 feet apart from each other, which in combination with the narrow bridge between them and the limited width for any turning bays causes further complications.

In order to get these intersections to perform best they were modeled with individual signal timing during the AM peak hour and as a signal cluster during the PM peak hour. Splits were optimized to minimize delay. Although Highway Capacity Manual analysis shows acceptable results during each peak hour as shown in Table 4, the HCM does not fully take into account the interaction between these two closely-spaced signals. Running simulations using SimTraffic software showed some fairly significant queuing problems as there is little storage space between the intersections, which does not allow each movement to fully utilize its green time.

There are also significant volumes along both Sligo Creek Parkway and Maple Avenue. Left turning traffic on Maple Avenue may block the movement of through traffic since there is not enough width on Maple Avenue, which is restricted by the width of the bridge over Sligo Creek, to provide dedicated left turn lanes even in a temporary configuration. There may be enough width inside the intersection to store one or two left turning vehicles while through traffic passes by on the right. In any case, the intersections of Maple Avenue with Sligo Creek Parkway/Hilltop Road and Sligo Creek Parkway/Washington Adventist Hospital entrance are expected to have queuing that could become significant during both the AM and PM peak hours unless drivers elect to use other routes.

➤ *Maplewood Avenue at Flower Avenue*

The eastbound Maplewood Avenue approach at this intersection would fail during the PM peak hour under detour conditions without further improvements. To solve this problem, the intersection was modeled as a three-way stop. Making this intersection a three-way stop would reduce delay on the eastbound approach, with tolerable increases in delay for Flower Avenue traffic.

Travel Times

Additional travel time along the detour routes is expected to increase as the detour is longer than the existing route and delay is significant at some of the affected intersections. For drivers using Detour Route 1, the total extra travel time assuming an average speed of 25 mph and incorporating the additional delay at the intersections along the detour route is estimated to be 1:50 during the AM peak hour and 2:32 during the PM peak hour in the northbound direction. Additional delay

would be approximately 1:55 and 1:59 for the southbound detour direction.

For drivers using Detour Route 2, the total extra travel time, also assuming an average speed of 25 mph and incorporating the additional delay at the intersections along the detour route would be 4:14 during the AM peak hour and 4:17 during the PM peak hour in the northbound direction. Delays would be approximately 3:48 during the AM peak hour and 4:16 during the PM peak hour in the southbound direction. These estimates of delay represent travel time over and above the Synchro-calculated existing travel times shown previously in Table 3.

C. Considerations for Maintenance of Traffic Design

Impacts to Local Businesses

MD 195 (Carroll Avenue) between MD 410 (Philadelphia Avenue) and Flower Ave. is mainly residential with the exception of the southernmost end of the segment, where several shops and businesses are located. These businesses include an auto repair shop, gas station, dry cleaners, restaurant, salon, and grocery store. Several of these businesses may rely to a degree on pass-by traffic to generate business. The proposed traffic control approach is estimated to maintain about 65% of present traffic volumes along this segment of roadway during both peak hours.

Emergency Management Services

SHA Office of Structures staff met with the Station Commander for Montgomery County Fire Station 2-Takoma Park on April 19, 2013. The Station does service significant areas north of the bridge and averages about 6 calls per day to the Washington Adventist Hospital. The hospital is typically accessed from the entrance at MD 195, but the Station Commander indicated using the rear entrance off of Maple Ave. should not be an issue. The overall response and feedback received from the Station Commander was that closing the bridge during construction would increase response time, but that the proposed detour would be manageable with sufficient notice and coordination.

Coordination meetings have been held with staff from Washington Adventist Hospital. One of the concerns raised by the Hospital was the potential for transit buses using the Hospital Drive as a detour route. This concern has been addressed with Maryland RideOn Transit as the #12 and #13 buses will use Detour Route 1.

Bus Routing

Two bus routes would be directly affected by the MD 195 bridge construction and would have to be detoured through alternate routes. The #12 and #13 RideOn bus routes travel along MD 195 and Flower Avenue between the Takoma and Silver Spring Metro stations. Seven bus stops would have to be temporarily eliminated if the buses were to follow the signed Detour Route 2 along MD 410 and Maple Avenue, negatively impacting transit riders in the neighborhood. Maryland RideOn Transit confirmed in June 2013 that its buses would use Detour Route 1. The intersection of Old Carroll Avenue and Sligo Creek Parkway would be temporarily

converted to a 3-way stop controlled intersection to improve sight distance.

However, Sligo Creek Parkway is open only to pedestrians and bicyclists on Sundays, so this route would be unavailable for motorized traffic. Since the #13 bus is a weekday only service, only the #12 route would be affected. The Sunday routing of the #13 bus will be dependent on if approval can be obtained for keeping Sligo Creek Parkway open on Sundays. Additionally during inclement winter weather, other route and stop modifications may be made as is typical of many RideOn routes to avoid steeper grades on Old Carroll Road. Representatives from M-NCPPC have also reviewed the project and determined that weekday and Saturday bus traffic would be acceptable on Sligo Creek Parkway.

RideOn bus routes 16 and 25 and WMATA route F4 would be impacted indirectly by the bridge closure. These routes do not cross the bridge, but do travel through intersections along the detour routes, so buses on these routes may encounter additional delay, to the same extent as other traffic, due to increased traffic on the detour roadways.

School buses currently pick up and drop off children at stops in the vicinity of the bridge over Sligo Creek. However, all existing stops could continue to be served if buses detour along Old Carroll Avenue and Sligo Creek Parkway. The Sunday closure of Sligo Creek Parkway would not affect school buses since they operate exclusively on weekdays.

Advance Variable Message Signs

Based on expected congestion along Maple Avenue, it is recommended that the detour plan for the project include advance variable message sign (VMS) messaging well north and south of the study area indicating “**MD 195 CLOSED @ SLIGO CR**” / “**USE ALT. ROUTES**”. Sketch level analysis indicated that a 25% reduction in traffic along Maple Avenue versus the volumes shown in Figure 13 would result in acceptable operations both in terms of the SimTraffic simulations as well as the HCM results. Since this percent reduction equates to only 175 peak hour trips in each direction, it is estimated that if half of these trips were to divert to MD 320 and half to MD 650 to bypass MD 195, the resulting increase in congestion on those routes would be negligible relative to their existing high volumes.

Bridge Closure/Road Closure Temporary Sign Design

Detour Route 1 is the most direct route for much of the traffic using MD 195, especially for traffic in the northbound direction. Thus, it is the route most likely to be used by northbound vehicles in the initial days following the bridge closure regardless of whether or not it is signed because it begins within sight of the point at which MD 195 would be closed.

Community input was received that to prevent any traffic from using Jefferson Avenue instead of Old Carroll Avenue to bypass the bridge closure, the traffic control plan

should include a closure of Jefferson Avenue at MD 195, making it effectively a temporary cul-de-sac with access only from its western end at Lincoln Avenue.

During detailed design it should be determined whether full-closure of Jefferson Avenue at its intersection with MD 195 would make turning around at the end of the temporary cul-de-sac too difficult for the largest vehicles expected to need access, presumably small delivery trucks. It is likely that inbound access to Jefferson Avenue could be restricted with barricades while providing “Do Not Enter” and/or “One-Way” signing to allow egress for local traffic.

Both detours in the southbound direction and Detour Route 2 in the northbound direction rely on drivers following posted detour signs that would redirect them onto the detour where “Bridge Closed XX Feet [or Miles] Ahead” signs would be posted, but well in advance of the actual “Road Closed” signs. Such detour routes often experience problems in the first few days after a road closure is set up, with some drivers not noticing or ignoring the “Bridge Closed Ahead” signs and proceeding to the point of closure.

The effect of such driver inattention will likely be over-utilization of Detour Route 1 and under- utilization of Detour Route 2 in the northbound direction in the initial days of detour implementation, with potential capacity problems and spillback along Detour Route 1 resulting. Likewise in the southbound direction, some traffic may proceed on MD 195 south past Flower Avenue and then enter the Washington Adventist Hospital entrance upon reaching the point of closure. However, experience with past detours of this nature dictates that after this initial experience, drivers will remember the delay caused by the work zone and follow the detour signing as proscribed.

In the southbound direction, the typical “Road Closed to Thru Traffic” sign will be modified to read “Road Closed Except Hospital Traffic” to minimize any inadvertent detouring through the hospital parking lot. Other standard temporary signing will be designed to a size and level of redundancy intended to minimize such navigation errors resulting in cut-through traffic or imbalanced use of the detour routes, but navigation errors can seldom be eliminated completely.

Temporary Parking Restrictions

An increased volume of detour traffic along Maplewood Avenue will necessitate a temporary parking restriction be imposed. Currently, parking is restricted to residents with a permit only for Area 4 from 5 AM to 7 pm Monday-Friday. Actual parking use appears to be somewhat limited, with scattered use on either side of the street. It is recommended that for avoidance of potential sideswipe conflicts between detour traffic and/or parked cars that all parking be temporarily prohibited at all times on the south side of the street for the duration of the detour, and that only the north side of the street be retained for all permit parking.

Temporary No Outlet Signing

Feedback received from the community indicated concern over drivers ignoring both the posted detour (Detour Route 2) and the un-posted detour intended for familiar drivers (Detour Route 1) and instead turning onto neighborhood streets without a direct outlet. A review of the local network was undertaken, and it was determined that temporary orange diamond-shaped “No Outlet” warning signs with supplemental “Local Traffic Only” may be posted for the following locations:

- Flower Avenue, southeast of MD 195
- Lincoln Avenue, southeast and northwest of MD 195
- Lincoln Avenue, southeast of Maple Avenue
- Boyd Avenue, southeast of MD 195
- Sherman Avenue, northwest of MD 195
- Sherman Avenue, southeast of Maple Avenue
- Lee Avenue, northwest of MD 195
- Lee Avenue, southeast of Maple Avenue
- Grant Avenue, southeast of Maple Avenue
- Maple Avenue, north of Maplewood Avenue
- Edinburgh Lane, west of the Maple Avenue/Maplewood Avenue intersection

Though outlets will actually exist for each of these streets, the use of this signing is justified based on the expectation that these narrow streets would not safely accommodate any significant volume of detour traffic seeking to avoid the intended detours.

V. EVALUATION OF MOBILITY THRESHOLDS

The SHA has developed mobility thresholds to aide in determining if work zone impacts are acceptable. These thresholds are presented in the *Work Zone Lane Closure Analysis Guidelines* (November 2006), and the relevant thresholds for arterial roadways are reproduced in **Table 5**. **Table 6** summarizes the evaluation of the mobility thresholds.

As indicated in Table 6, the proposed traffic control meets the travel time mobility threshold. It comes close to meeting the intersection mobility threshold, but would still have unsignalized intersections with approach delays just over 30 seconds and signalized intersections with delays over 45 seconds that were previously a LOS A, B, or C under existing conditions.

Table 5. Mobility Thresholds for Arterials

Signalized Intersections	
Existing Level of Service	Mobility Threshold
A, B or C	Maximum LOS D Control delay < 45 seconds
D	Maximum increase in Control delay of 30%
E	Maximum increase in Control delay of 30%, or Control delay < 80 seconds
F	No increase in Control delay
Unsignalized Intersections	
Existing Level of Service	Mobility Threshold
A, B, or C	Maximum LOS D Control delay < 30 seconds
D	Maximum increase in Control delay of 30%
E	Maximum increase in Control delay of 30%, or Control delay < 50 seconds
F	No increase in Control delay
Arterials	
Existing Travel Time	Mobility Threshold
T	Travel time cannot increase more than 15 minutes (Maximum of T+15)

Table 6. Evaluation of Mobility Thresholds

Proposed Maintenance of Traffic	
Intersection Mobility Threshold Met?	No
Travel Time Mobility Threshold Met?	Yes

VI. SUMMARY

Based on the analyses presented in this report, the maintenance of traffic strategy proposed is expected to be accommodated along the proposed detour routes with significant, but not excessive delays if the proposed, temporary improvements described herein are implemented:

- Temporary traffic signal for Maple Avenue at Hilltop Road/Sligo Creek Parkway
- Temporary traffic signal for Maple Avenue at Sligo Creek Parkway/Washington Adventist Hospital entrance
- Revision of signal phasing at MD 195 at MD 410 (Philadelphia Ave.)
- Temporary 3-way stop for Sligo Creek Parkway at Old Carroll Ave.
- Temporary 3-way stop for Flower Ave. at Maple Ave.

The maintenance of traffic plan for the detours should include the following key elements:

- Advance Variable Message Signs well north and south of the study area indicating “**MD 195 CLOSED @ SLIGO CR**” / “**USE ALT. ROUTES**”
- Temporary closure of Jefferson Avenue to westbound traffic at the MD 195 intersection
- “Road Closed Except Hospital Traffic” signing on MD 195 at Flower Avenue
- Temporary parking restrictions on the south side of Maplewood Avenue
- “No Outlet” Signing at various locations to discourage cut-through detour traffic on narrow, residential streets