

Traffic Operational Analysis Report

VIRGINIA AVENUE TUNNEL RECONSTRUCTION PROJECT

September 2013



TRAFFIC OPERATIONAL ANALYSIS REPORT

**VIRGINIA AVENUE TUNNEL
RECONSTRUCTION PROJECT
WASHINGTON, DC**

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Prepared by

CLARK/PARSONS, JOINT VENTURE

100 M Street SE, Suite 1200

Washington, DC 20003

Phone: 202-775-3300. Fax: 202-775-3420

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ACRONYMS AND ABBREVIATIONS

BID	Business Improvement District
COG	Metropolitan Washington Council of Governments
DC	District of Columbia
DDOT	District Department of Transportation
EB	Eastbound
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
LOS	Level of Service
mph	Miles per hour
MOEs	Measures of Effectiveness
MOT	Maintenance of Traffic
NB	Northbound
RFK Stadium	Robert F. Kennedy Stadium
SB	Southbound
TDM	Transportation Demand Management
TMC	Turn Movement Counts
TMP	Transportation Management Plan
V/C	Volume-to-Capacity Ratio
WB	Westbound
WMATA	Washington Metropolitan Area Transit Authority

1 INTRODUCTION

CSX railroad is proposing to reconstruct and widen the Virginia Avenue Tunnel to accommodate two rail tracks from 11th to 2nd Streets SE. The improvement to create a new two-track tunnel will be constructed using a cut-and-cover method; this is anticipated to close Virginia Avenue SE (south of I-695/Southeast Freeway) from 2nd to 9th Streets SE during the construction.

During the proposed closure of Virginia Avenue SE, the north-south movements along 3rd Street SE, 4th Street SE, 7th Street SE, 8th Street SE, and 11th Street SE will be maintained via temporary decking; this will maintain north-south circulation of vehicular, pedestrian, and bike traffic on these five roadways. Temporary decking will also be constructed along 5th Street SE to maintain pedestrian and bike traffic only. The intersections of Virginia Avenue at 2nd Street SE and at 5th Street SE will be closed during the construction period. The 6th Street SE/Navy Yard/Nationals Park exit from I-695/Southeast Freeway will remain open. During Phase 1¹ (1A and 1B), existing movements for this off-ramp will be maintained; however, during Phase 2², all traffic will be detoured north onto 6th Street SE. Additionally, the 8th Street SE on-ramp to I-295 southbound will be closed to reconstruct the ramp as part of the 11th Street Bridge reconstruction project; portions of that project are anticipated to be occurring during the same timeframe as the Virginia Avenue Tunnel project. Traffic formerly using the 8th Street SE ramp will be detoured to the I-295 southbound on-ramp at the M/11th Streets SE intersection during the reconstruction. The 9th Street SE on-ramp to the Southeast Freeway will be closed permanently as part of the 11th Street Bridge reconstruction project. Traffic will be diverted to the same ramp as the 8th Street SE ramp, and a new ramp will be constructed at 12th Street SE to maintain the connection to SE Freeway. The changes for the 8th Street SE, 9th Street SE, and 11th Street SE ramps are expected to occur regardless of the Virginia Avenue Tunnel project; the individual impacts of changes to these ramps are related to the 11th Street Bridge project.

Depending on the tunnel reconstruction alternative selected (see **Section 3.1** for further details regarding the tunnel alternatives), the reconstructed Virginia Avenue could open as early as September 2016 or as late as January 2018, based on the current draft construction schedule.

The purpose of this study is to analyze the traffic conditions during the construction and to recommend actions regarding potential traffic detours due to the closure of Virginia Avenue SE. A common horizon year of 2016 was used for the analysis throughout this report. The analysis includes:

¹ Applicable to Alternative 2 and 3

² Applicable to Alternative 2, 3, and 4

- Existing (2012) and future (2016) transportation conditions at study intersections assuming the sections of Virginia Avenue described above are not closed, to serve as the baseline for comparison.
- Detour options for the traffic coming from the Southeast Freeway off-ramp onto 6th Street SE during the proposed Virginia Avenue closure.
- Future (2016) transportation conditions at the study intersections assuming the sections of Virginia Avenue described above are closed and the traffic detour plans described above are implemented.
- Consideration of the 11th Street Bridge project's phasing and roadway closures.
- Consideration of the M Street Diversion Sewer project.

The overall project is bound by the following roadways:

- South Capitol Street to the west;
- Pennsylvania Avenue SE to the north;
- 11th Street SE to the east; and
- M Street SE to the south.

For purposes of this traffic operations analysis, the northern boundary extends only to G Street SE, with the exception of along 6th Street SE where it extends to D Street SE; the same western, southern, and eastern boundaries as cited above were used. The smaller study area was used as the project will have minimal, if any, traffic impacts north of G Street. Key study area intersections, representing locations where traffic was counted and where analysis was performed, are shown on **Figure A-1** in **Appendix A**. Note that for this report, all figures are included in Appendix A.

2 EXISTING CONDITIONS

2.1 ROADWAY CHARACTERISTICS

Table 2-1 presents the characteristics of the roadways within the study area, including the District of Columbia Department of Transportation (DDOT) roadway functional classifications.

Table 2-1. Roadway Characteristics

ROADWAY NAME	FUNCTIONAL CLASS	NUMBER OF LANES *	PARKING	SIDEWALKS	BIKE LANE
Virginia Avenue SE Eastbound (from New Jersey Avenue SE to 4 th Street SE)	Local	1 lane each direction	Yes	Yes	No
Virginia Avenue SE Eastbound (from 4 th Street SE to 9 th Street SE)	Collector	2 lanes (EB)	Yes	Yes	No
Virginia Avenue SE Westbound (from 7 th Street SE to 3 rd Street SE)	Collector	2 lanes (WB)	Yes	Yes	No
South Capitol Street	Principal Arterial	3 lanes each direction	No	Yes	No
M Street SE	Minor Arterial	3 lanes each direction	Yes	Yes	No
G Street SE	Local Road	1 lane each direction	Yes	Yes	No
I Street SE	Collector	3 lanes (WB)	Yes	Yes	No
3 rd Street SE	Local Road	1 lane each direction	Yes	Yes	No
4 th Street SE	Collector	1 lane (SB)	Yes	Yes	Yes
5 th Street SE	Local Road	1 lane (NB)**	Yes	Yes	No
6 th Street SE	Local Road	1 lane (NB)	Yes	Yes	Yes
7 th Street SE	Local Road	1 lane each direction	Yes	Yes	No
8 th Street SE	Minor Arterial	1 lane each direction	Yes	Yes	No
11 th Street SE	Minor Arterial	2 lanes each direction	Yes	Yes	No

* turn lanes not included in lane tally. For example, 5th/6th Street SE as it passes under the Southeast Freeway has additional turn lanes that are not shown in this table.

** section from M to K Streets SE is two-way.

As seen in **Table 2-1**, the major corridors in the study area are South Capitol Street and M Street SE. Virginia Avenue SE is located both south and north of the Southeast Freeway and operates as an east-west one-way pair or couplet. The key roadways are discussed in more detail below.

VIRGINIA AVENUE SE

Virginia Avenue SE runs southeast from 2nd Street SE to 9th Street SE within the study area. This street is a two-lane collector, and carries traffic coming from the Southeast Freeway off-ramp onto 11th Street SE. Much of the traffic that exits the freeway is destined to the office and other employment centers located to the north of M Street SE. The intersections with 2nd, 3rd, 4th, and 9th Streets SE are controlled by stop signs. The intersections with 5th/6th, 7th, and 8th Streets SE are signalized. Parking is provided via variable-rate meters. The land use immediately to the south of Virginia Avenue SE is residential medium density.

SOUTH CAPITOL STREET

South Capitol Street is a two-way principal arterial that runs north-south within the study area. South Capitol Street has three lanes operating in each direction. The posted speed limit is 25 miles per hour (mph) to the north of M Street SE. This corridor serves as the major commuter route from the Southeast Freeway off-ramp onto the M Street SE corridor, as well as to the Nationals Park. The southbound traffic from the freeway is controlled by a traffic signal at the merge point with South Capitol Street. The northbound traffic weaves across several lanes to reach the freeway ramps. The primary land use to the east and west of South Capitol is commercial/office high density in the study area.

M STREET SE

M Street SE is an arterial that runs east-west within the study area. M Street SE has three lanes operating in each direction with a posted speed limit of 25 mph. The majority of the intersections along the corridor are signalized. M Street SE crosses South Capitol Street at a grade-separated interchange. The interchange signal is controlled by a single traffic signal controller. At the interchange, on-street parking is permitted on the southern leg of southbound South Capitol Street. Parking is available via variable-rate meters on the east of South Capitol Street and M Street SE. Parking is not permitted during baseball games. Part of the land use on M Street SE is high density commercial/office to the west of 4th Street SE, and residential medium density to the east of 4th Street SE. South of the M Street is predominantly federal office facilities.

I STREET SE

I Street SE, a three-lane collector, runs one-way westbound to the north of the Southeast Freeway from 8th to 4th Streets SE within the study area. On-street/restricted parking is allowed. The land use to the north of I Street SE in the study area is residential medium density.

TRAFFIC CONTROL

The primary traffic control devices at the larger intersections within the study area are traffic signals, while the lesser intersections are under stop-control. Stop-control intersections are in two forms: all-way stop-control or two-way stop-control. The former is where all approaches, regardless of the number of approaches, must stop: i.e., the 7th/G Streets SE intersection. Two-way stop-control occurs when the major movements do not stop (though left turns yield right-of-way to oncoming traffic) and the minor movements must stop; stop-controlled intersections

along M Street SE, such as 5th and 7th Streets SE, are examples. Traffic control devices are shown in **Figure A-2**.

2.2 PARKING

On-street parking restrictions vary within the study area. In general, parking is restricted to two hours, unless allowed by residential permit. Some roadways also include the prohibition of on-street parking during rush hours as the parking lane is used as a travel lane during rush hours. On several blocks, no signage exists to indicate whether parking is prohibited or if there are restrictions on time allowed for parking. **Figure A-3** shows the parking restrictions on study area streets.

Within the study area, there are a number of surface lots open to the general public for use as daily parking. Many of these lots are also used for stadium parking. There are two parking structures at the Nationals Park baseball stadium, but are dedicated for ballpark patrons only. A number of the surface lots are slated for as future development sites so will be unavailable in future years. **Figure A-4** presents the parking lots (both surface and structured) and **Table 2-2** presents the tally of parking spaces at these lots open to the public.

Table 2-2. Parking Lots Open to the Public

Red Lots = 1,704 spaces		Green lots = 934 spaces		Orange Lots = 604 spaces	
B	598	H	198	T	73
C	597	J	60	U	73
F	296	K	100	W	458
M	96	L	126		
N	117	HH	450		
Total Tally = 3,242 spaces					

* Note that Nationals parking map refers to Lot G; however, Lot G was converted to the Fairgrounds, a town square consisting of food and crafts stalls. A similar map from JDland.com also shows Lot G being available. Lot G is not included with the above tally. Lot H is underground parking.

2.3 NATIONALS PARK

The Nationals Park baseball stadium is located on South Capitol Street between N Street SE and Potomac Avenue SE. South Capitol Street is one of the access corridors to the Nationals Park. Parking lots, as described above, are often used as parking for National baseball games. A Transportation Demand Management (TDM) program was developed for the ballpark to increase the efficiency of the transportation network and to increase the use of alternative transportation modes. The Nationals no longer provide shuttle services to the Robert F. Kennedy (RFK) Stadium parking lots. The designated parking lots for Nationals games are presented in the previous section.

2.4 FRIDAY EVENING PARADES, MARINE BARRACKS, 8TH AND I STREETS SE

The Evening Parade, a concert by the U.S. Marine Band, Silent Drill Team & Bugle Corps, is held Friday evening (8:00 PM) during the summer (May through August) at the Marine Barracks located at 8th and I Streets SE Washington, DC. Guests can park at Maritime Plaza, where a free shuttle service is provided to and from the Barracks.

2.5 PEDESTRIAN AND BICYCLISTS

While the economic recession affected redevelopment of the study area, the pace of construction is increasing within the Capitol Riverfront. Walking, bicycling, and transit usage are prominent modes of travel within the study area; these modes are expected to continue growing and become an increasingly important aspect of mobility and quality of life. Some of the key areas experiencing high levels of pedestrian activity include:

- Around the two Navy Yard Metrorail Station entrances, located along M Street SE at both New Jersey Avenue SE and Half Street SE.
- Between the Navy Yard complex and three points to the north: 1) the parking lot opposite the Isaac Hull gate (located between 5th and 7th Streets SE); 2) the Marine Barracks (along 7th Street SE); and 3) Barracks Row (along 8th Street SE).
- Between the Navy Yard Metrorail Station (New Jersey Avenue entrance) and both the US Department of Transportation Complex and the Navy Yard complex.

There are pedestrian traffic flows between the various activities centers and bus stops within the area (as described below in **Section 2.6**). The area is generally well-served with marked pedestrian crosswalks at intersections, as presented in **Figure A-5**. Most, but not all, crosswalks at the signalized intersections include countdown pedestrian signal heads.

Bicycle activity will continue to grow within the area as it redevelops and as the expansion of the Capital Bikeshare program within the study area further increases bicycle travel. Four roadways have on-street bike lanes and a few others are designated as bike routes. Currently there are four Capital Bikeshare stations within the area, and these stations are linked with others in the area. **Figure A-6** presents the on-street bike lanes, bike paths, and Capital Bikeshare station locations, as well as bus stops.

2.6 TRANSIT

Figure A-7 presents the bus routes operating in the study area that have stops within or immediately adjacent to the study area; **Figure A-6** includes the bus stops within the area. Routes passing through the study area, such as those along the Southeast Freeway, are not shown if they do not have stops within the study area. Washington Metropolitan Area Transit Authority (WMATA) operates most bus service within the study area and is continually reviewing its bus operations and updates service as they deem necessary. Recent changes in this area include modification of the timetable (i.e., adjustment of headways) and routing (i.e., which roadways buses use). A major change that WMATA completed earlier this year, with no relation to this project, was to consolidate the P1, P2, and P6 routes into a single route. As of July 9, 2012, WMATA bus routes in the study area include:

- Route P6 (Anacostia-Eckington Line) operates along M Street SE during weekday and weekends. The AM peak period headway ranges between 15 to 20 minutes, while the PM peak headway ranges between 15 to 20 minutes. WMATA combined the P1, P2, and P6 routes on June 17, 2012 as part of its route restructuring.

- Routes 90, 92, and 93 (U Street-Garfield Line) operate within the study area along 8th Street SE and M Street SE during weekdays and weekends. The headways range from 8 minutes to 20 minutes during the peak hours.
- Routes V7, V8, and V9 (Minnesota Avenue M Street Line) operate along M Street SE during weekdays and weekends. The headways vary between 8 minutes and 15 minutes.
- Routes A42, A46, and A48 operate along M Street SE during weekdays and weekend as an afterhours service when Metrorail is not operating. These routes link the Archives and L'Enfant Plaza Metrorail Stations to the Anacostia area of Washington, DC.
- Route A9, which skirts the southwest corner of the study area, provides rush hour service, with varying headways between 10 and 20 minutes, from southern Anacostia to L'Enfant Metrorail Station, and travels along South Capitol Street and M Street SW.

In addition to WMATA, the DC Circulator operates two routes within the study area:

- Union Station - Navy Yard: This route links Union Station with the Navy Yard Metrorail Station. Buses travel down 8th Street SE to M Street SE, then to 1st Street SE, and then to New Jersey Avenue SE, stopping at the Navy Yard Metrorail Station, where buses then return to the Union Station via M Street SE and 8th Street SE. Headways are approximately 10 minutes.
- Potomac Avenue – Skyland: This route links Potomac Avenue Metrorail Station to the Skyland area in Anacostia. It travels along M Street SE and 8th Street SE within the study area. Headways are approximately 10 minutes.

Other operators also run commuter bus services in the area, such as OmniRide, which links Prince William County to Washington, DC and the Navy Yard. The Navy Yard Metrorail Station, served by the Green Line, is the only rail station within the study area. Service on the Green Line averages every 6 minutes during peak periods, while in the off-peak, service averages every 12 minutes. Capitol South (1st/C Streets SE) and Eastern Market (Pennsylvania Avenue/7th Street SE) Stations are located just to the north of the study area; these rail stations are served by both the Orange and Blue Lines.

2.7 DATA COLLECTION AND PEAK HOUR VOLUME

Turn movement counts (TMC) at intersections were performed in February and March 2012 at 30 study area intersections, and vehicle classification counts were performed at five locations. The count locations are shown on **Figure A-1** in **Appendix A**. The count locations were selected to include major intersections with high volumes of traffic (relative to the study area) and where traffic shifts (increases or decreases) could result from this project. Other locations were not selected as they are less likely to be affected by the project, or were locations where traffic volumes are low. The TMC were performed for three hours in the AM peak period (between 6:00 and 9:00 AM) and three hours in the PM peak period (between 3:30 and 6:30 PM). The raw intersection TMC data is presented in **Appendix B**. From the counts, the single highest (peak) hour was extracted for each intersection. The counts for each intersection were entered into an Excel spreadsheet, and adjacent intersections were balanced. For intersection pairs with non-

counted intersections between them, counts were not balanced. For example, the intersection at Half Street SE is located between the intersections at South Capitol Street and First Street SE, so the counts at these intersections were not balanced. If no intermediate major intersection or access points existed, then the departing volumes at one intersection were balanced with the approaching volume at the downstream intersection. The process was to use the higher of the two volumes, and adjust the other locations proportionately to the volumes. This process is necessary because counts were conducted on different days and traffic volumes can vary somewhat from day to day. The resulting Existing Conditions (Year 2012) AM and PM balanced volumes are presented in **Appendix C**.

2.8 2012 EXISTING CONDITIONS

AM and PM peak hour signal timing plans (Plan 5 and Plan 6, respectively) were obtained from DDOT for use in this study. The provided timing plans included all intersections within Wards 5 and 6, so was edited to include only study area intersections. The networks were then reviewed for accuracy in terms of the lane channelization during the peak hours. The networks were revised to reflect observed conditions, if necessary. The balanced volumes were entered into the network, and signal timings were as noted in the timing data provided (the signals were not optimized using the analysis software). The Measures of Effectiveness (MOEs), which consist of delay, volume-capacity (V/C) ratio, and Level of Service (LOS), were extracted from Synchro using the Highway Capacity Manual (HCM) Signals report. This report format follows the HCM procedures. **Table 2-3** presents the overall intersection MOEs for Existing Conditions.

Several intersections are closely spaced intersections that are controlled by one traffic signal controller to ensure smooth progression between each signal. DDOT's Synchro files were used as a base for this analysis and several locations are coded as multiple intersections that are closely spaced. Synchro reports LOS for each location individually, even though it is controlled by one traffic signal controller. These locations, as shown in **Figure A-8** and **Figure A-9**, are at South Capitol Street at I Street SE (including the on-ramp from the Southeast Freeway) and Virginia Avenue SE at 8th Street SE/access to the 11th Street Bridge.

In general, overall operations at most signalized intersections are acceptable (LOS D or better), except at two locations: M Street SE and the southbound off-ramp from South Capitol Street (AM peak hour), and westbound Virginia Avenue SE at 3rd Street SE/on-ramp to the Southeast Freeway (PM peak hour). At other intersections, individual approaches may operate at undesirable LOS, while the overall intersection LOS is acceptable. The full MOE table is presented in **Appendix D**; this appendix includes all scenarios analyzed. Also contained in Appendix D are the Synchro HCM Signals and HCM Unsignalized reports, which follow the HCM procedures.

Table 2-3. Existing Conditions MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.4	0.57	B	15.4	0.63	B
South Capitol Street and I (Eye) Street SE (Right)	18.1	0.68	B	17.3	0.47	B
Ramps from freeway at South Capitol Street SB	33.3	0.65	C	26.9	0.56	C
South Capitol Street at M Street SE - SB Intersection	152.4	0.89	F	21.4	0.43	C
South Capitol Street at M Street SE - NB Intersection	15.3	0.52	B	21.9	0.49	C
M Street SE at 1 st Street SE	15.7	0.36	B	15.8	0.37	B
M Street SE at New Jersey Avenue SE	13.4	0.24	B	12.1	0.32	B
M Street SE at 3 rd Street SE	6.0	0.19	A	9.9	0.24	A
M Street SE at 4 th Street SE	20.1	0.29	C	12.5	0.24	B
M Street SE at 8 th Street SE	18.2	0.52	B	13.3	0.49	B
M Street SE at 9 th Street SE	10.7	0.31	B	13.9	0.52	B
M Street SE at 11 th Street SE	20.0	0.55	C	42.6	0.73	D
Virginia Avenue SE EB at 5 th Street SE	34.8	0.10	C	37.4	0.21	D
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	16.6	0.51	B	14.6	0.40	B
Virginia Avenue SE EB at 7 th Street SE	6.0	0.25	A	17.2	0.42	B
Virginia Avenue SE EB at 8 th Street SE	34.7	0.29	C	42.5	0.33	D
Virginia Avenue SE ramp at 8 th Street SE	12.4	0.30	B	12.7	0.41	B
I (Eye) Street SE at 8 th Street SE	18.9	0.49	B	19.2	0.48	B
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	7.6	0.37	A	10.1	0.52	B
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	6.9	0.44	A	27.0	0.34	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	29.1	0.45	C	17.4	0.39	B
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	33.6	0.78	C	81.5	1.12	F
G Street SE at 8 th Street SE	9.1	0.29	A	11.4	0.38	B
M Street SE at Isaac Hall Avenue SE	4.1	0.28	A	23.2	0.52	C

Delay is measured as average delay in seconds per vehicle. LOS is a qualitative measure of the intersection's operational performance and is based on average delay.³

Several unsignalized intersections are located within the study area, as presented in **Table 2-4**. The operational analysis of the unsignalized intersections indicate that most study area intersections operate at acceptable LOS, with the exception of the southbound approach of 7th Street SE to M Street SE, where one of the lane groups operates at LOS F in the AM and LOS E in the PM. Field observations confirmed poor operations on this approach.

³ The level of service (LOS) characterizes the operating conditions at the intersections in terms of delay. In general, LOS can be characterized as follows: A = free flow; B = reasonably free flow; C = stable flow; D = approaching unstable flow; E = unstable flow; F = forced or breakdown flow.

Table 2-4. Existing Conditions MOEs - Unsignalized intersections

Intersection Name	Lane Group	AM Peak Hour				PM Peak Hour			
		by Lane Group		by Intersection		by Lane Group		by Intersection	
		Delay	LOS	Delay	HCM LOS	Delay	LOS	Delay	HCM LOS
M Street SE at 7 th Street SE	EB	0.9	A	14.8	N/A*	2.5	A	4.6	N/A*
	WB	0.0	A			0.0	A		
	NB	N/A	N/A			N/A	N/A		
	SB	56.3	F			45.0	E		
Virginia Avenue SE at 2 nd Street SE	EB	6.8	A	7.2	A	6.8	A	6.9	A
	WB	7.4	A			7.3	A		
	NB	6.7	A			6.7	A		
	SB	7.3	A			0.0	A		
Virginia Ave SE at 3 rd Street SE, S of Freeway	EB	9.9	A	3.8	N/A*	15.5	C	1.9	N/A*
	WB	12.3	B			14.2	B		
	NB	0.5	A			0.1	A		
	SB	1.7	A			3.4	A		
Virginia Ave SE at 4 th Street SE, S of Freeway	EB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WB	N/A	N/A			N/A	N/A		
	NB	N/A	N/A			N/A	N/A		
	SB	N/A	N/A			N/A	N/A		
Virginia Ave SE at 9 th Street SE	EB	7.2	A	7.2	A	7.7	A	7.7	A
	WB	N/A	N/A			N/A	N/A		
	NB	7.3	A			7.7	A		
	SB	N/A	N/A			N/A	N/A		
G Street SE at 4 th Street SE	EB	7.8	A	9.9	A	8.0	A	9.3	A
	WB	8.3	A			8.2	A		
	NB	N/A	N/A			N/A	N/A		
	SB	10.2	B			9.7	A		
G Street SE at 6 th Street SE	EB	8.6	A	12.3	B	8.4	A	10.0	A
	WB	8.9	A			8.6	A		
	NB	13.2	B			10.7	B		
	SB	N/A	N/A			N/A	N/A		
G Street SE at 7 th Street SE	EB	7.8	A	8.0	A	8.5	A	8.9	A
	WB	8.1	A			8.6	A		
	NB	8.0	A			9.5	A		
	SB	7.9	A			8.4	A		
E Street SE at 6 th Street SE	EB	8.6	A	11.4	B	8.4	A	9.6	A
	WB	8.4	A			7.9	A		
	NB	12.3	B			10.1	B		
	SB	N/A	N/A			N/A	N/A		
D Street SE at 6 th Street SE	EB	8.8	A	11.2	B	8.3	A	9.9	A
	WB	8.5	A			7.9	A		
	NB	12.0	B			10.4	B		
	SB	N/A	N/A			N/A	N/A		

Gray shading indicates approach does not exist, purple shading indicates that analysis of this intersection configuration is not possible per HCM procedures. Field observations indicate acceptable operations. * The HCM procedures do not calculate an overall LOS for two-way stop controlled intersections.

2.9 2016 TRAFFIC FORECAST

The year 2016 was chosen as the analyses year for the various stages of construction. This is because the construction for Alternatives 2 and 3 is anticipated to be completed in 2016. While individual phases may be complete before 2016, it represents the worse-case analysis year because traffic is expected to increase each year within the study area based on its redevelopment. From 2012 to 2016, it is anticipated that over **7.7 million square feet of development** will be constructed and occupied in the study area. This redevelopment consists of new, or renovated, residential complex, office buildings, retail, hotel and mixed-uses. For this study, the Capitol Riverfront Business Improvement District (BID) was contacted to obtain data on the size, types and locations of each development, the year the project is expected to be completed, and the number of parking spaces (where such data was available). Because some individual site information is considered confidential at this time, individual site information is not included in this report. Overall, the area, during this period will add:

- over 4.1 of million square feet of office space,
- over twenty thousand office employees (assuming 200 square feet per employee),
- over 2,600 new residential units,
- over 400,000 square feet of retail space, and
- nearly 400 new hotel rooms.

The information provided was used to calculate the number of trips that would be generated by each development. The process used included the following steps:

- Use Institute of Transportation Engineers (ITE) standard trip generation rates for each development to estimate AM and PM peak hour trips (standard rates)⁴.
- Apply factors to the above trips to account for trip reductions of retail trips to reflect pass-by trips (i.e. a trip that was already in the area that would make a stop in the middle of the overall trip – such as stopping at the store on the way from work to home).
- Use the ITE parking generation rates to estimate standard daily parking trips to compare against the actual parking spaces being provided at each development and to generate a parking ratio between the demand and supply.
- Develop adjusted trip generation rates reflecting reduced motor vehicle trips rates due to the study area's high transit mode split based on high levels of transit service (Metrorail and bus services), limited parking provided in new developments, and reflecting the fact that the mixed-use character of the study area promotes trips that are made by walking (resident-work) or alternative modes. The reductions used to develop the vehicle trip generation rates were validated against other studies and reports ^{5,6}.

⁴ Trip Generation Manual, 2008. Institute of Transportation Engineers, Washington DC. 8th Edition.

⁵ Transportation Impact Analysis Guidelines for Environmental Review, October 2002. The Planning Department, City and County of San Francisco.

⁶ Crediting Low-Traffic Development, August 2005. Nelson/Nygaard Consulting Associates, San Francisco.

- Review the trip generation that will likely develop for AM and PM site trips, considering that the likely vehicle trip generation is lowered by mixed-use development and high quality transit services, and is constrained by available parking. It is important to note that the number of overall person-trips generated by the new development reflects all of the expected development; the number of vehicle trips is constrained by the factors cited above.

Based on the analysis of this study, new study area development was estimated to generate more than 3,000 vehicle trips in to and out of the study area in the AM peak hour, while during the PM peak hour, it would generate more than 3,800 vehicle trips. Site traffic for each development was distributed onto the roadway network for both AM and PM conditions.

In addition to new trips on the network based on study area development, a modest increase in “background” traffic was assumed to reflect general growth in traffic from beyond the study area. For the background traffic, a growth rate of 0.5 percent per year was assumed. The distributed site trips and the background growth were layered onto the Existing Conditions volumes to develop the total 2016 No-Build volumes. No-Build Conditions AM and PM peak hour volumes are presented in **Appendix C**.

2.10 2016 NO-BUILD CONDITIONS

The AM and PM Existing Conditions Synchro models were used as the base for the 2016 No-Build analysis, and the No-Build volumes, as described in the previous section, were input into the networks. Signal timing plans were not optimized in this step. The purpose of performing No-Build analysis is to provide a benchmark to compare the various construction stages in terms of whether any degradation of LOS occurs. The MOEs were extracted from Synchro using the HCM Signals report. **Table 2-5** presents the MOEs for No-Build Conditions. One thing to note, as discussed in the next chapter, is that the M Street Diversion Sewer project is expected to reduce the number of lanes on M Street SE from three per direction to two per direction between 7th and 11th. This will impact several signalized intersections. For that reason, Synchro analysis was done at those intersections assuming both a two-lane and a three-lane scenario. A two-lane M-Street will be in place during Phase 1 of the CSX Virginia Avenue Tunnel project.

Table 2-5. 2016 No-Build Conditions MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.7	0.79	B	15.8	0.70	B
South Capitol Street and I (Eye) Street SE (Right)	20.4	0.75	C	23.8	0.60	C
Ramps from freeway at South Capitol Street SB	155.4	1.02	F	48.0	0.74	D
South Capitol Street at M Street SE - SB Intersection	520.5	1.76	F	61.8	0.70	E
South Capitol Street at M Street SE - NB Intersection	88.0	0.84	F	146.5	1.22	F
M Street SE at 1 st Street SE	57.8	0.84	E	83.6	0.96	F
M Street SE at New Jersey Avenue SE	16.4	0.47	B	15.2	0.60	B
M Street SE at 3 rd Street SE	8.2	0.39	A	14.6	0.59	B
M Street SE at 4 th Street SE	20.2	0.46	C	16.2	0.55	B
M Street SE at 8 th Street SE *	18.6	0.71	B	21.4	0.79	C
M Street SE at 9 th Street SE *	13.3	0.50	B	17.5	0.66	B
M Street SE at 11 th Street SE *	23.9	0.70	C	139.1	1.05	F
Virginia Avenue SE EB at 5 th Street SE	35.1	0.12	D	47.0	0.36	D
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	17.6	0.53	B	11.5	0.44	B
Virginia Avenue SE EB at 7 th Street SE	6.2	0.27	A	17.7	0.46	B
Virginia Avenue SE EB at 8 th Street SE	32.1	0.32	C	47.3	0.38	D
Virginia Avenue SE ramp at 8 th Street SE	12.0	0.33	B	15.4	0.50	B
I (Eye) Street SE at 8 th Street SE	19.1	0.52	B	20.1	0.53	C
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	8.4	0.39	A	12.0	0.56	B
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	7.2	0.46	A	28.3	0.37	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	30.3	0.47	C	22.6	0.42	C
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	46.2	0.84	D	125.4	1.26	F
G Street SE at 8 th Street SE	9.1	0.31	A	10.9	0.42	B
M Street SE at Isaac Hall Avenue SE	5.3	0.45	A	17.5	0.60	B
<i>M Street reduced to two lanes due to Diversion Sewer project</i>						
<i>M Street SE at 8th Street SE **</i>	<i>18.6</i>	<i>0.71</i>	<i>B</i>	<i>136.9</i>	<i>1.10</i>	<i>F</i>
<i>M Street SE at 9th Street SE **</i>	<i>13.3</i>	<i>0.50</i>	<i>B</i>	<i>15.0</i>	<i>0.85</i>	<i>B</i>
<i>M Street SE at 11th Street SE **</i>	<i>23.9</i>	<i>0.70</i>	<i>C</i>	<i>139.1</i>	<i>1.05</i>	<i>F</i>

* assumes three lanes per direction on M Street

** assumes two lanes per direction on M Street

Although No-Build volumes increase significantly over Existing Conditions, most signalized intersections will continue to operate at acceptable LOS. However, the number of intersections operating at undesirable LOS increases from two to five over Existing Conditions. Those intersections which are expected to operate at undesirable LOS in 2015 are listed below (the time period in which undesirable LOS occurs is shown in parentheses).

- Ramps from freeway at Southbound South Capitol Street (AM)
- South Capitol Street ramps at M Street (AM and PM)

- M Street SE at 11th Street SE (PM) *note intersection being upgraded as part of the 11th Street Bridge project, configuration will change
- Virginia Avenue WB at 3rd Street north of SE Freeway (PM)

This degradation of service levels as compared to Existing Conditions is due to the redevelopment in this area, and is not caused by either the Virginia Avenue Tunnel project or other roadway construction projects within the area. The M Street Diversion Sewer project (which is slated for completion in mid-2014) will temporarily reduce the number of lanes on M Street from three to two per direction. This will have impact on eastbound M Street during the PM peak period, as most of the increase in delay at the intersections is due to the Diversion Sewer project.

No-Build analysis was also performed at Study Area unsignalized intersections; a summary of the results is included in **Table 2-6**. The findings are that most intersections would operate at acceptable LOS, with the exception of the southbound approach of 7th Street SE to M Street SE. For this intersection, the lane group LOS is F for both time periods, and the delay for the lane group has increased over Existing Conditions. As indicated above, this reduction in service levels is caused by the increased development in the area, and not related to this project. It indicates that with increased delay, a signal may be warranted in the future. The full MOE tables are presented in **Appendix D**.

Table 2-6. 2015 No-Build Conditions MOEs – Unsignalized intersections

Intersection Name	Lane Group	AM Peak Hour				PM Peak Hour			
		by Lane Group		by Intersection		by Lane Group		by Intersection	
		Delay	LOS	Delay	HCM LOS	Delay	LOS	Delay	HCM LOS
M Street SE at 7 th Street SE	EB	1.0	A	75.3	N/A	2.3	A	3.5	N/A
	WB	0.0	A			0.0	A		
	NB								
	SB	357.3	F			37.3	E		
Virginia Avenue SE at 2 nd Street SE	EB	6.9	A	7.1	A	6.8	A	6.9	A
	WB	7.5	A			7.3	A		
	NB	6.8	A			6.7	A		
	SB	7.4	A			0.0	A		
Virginia Ave SE at 3 rd Street SE, S of Freeway	EB	11.9	B	4.4	N/A	18.4	C	2.0	N/A
	WB	13.6	B			16.2	C		
	NB	0.6	A			0.1	A		
	SB	1.1	A			2.8	A		
Virginia Ave SE at 4 th Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 9 th Street SE	EB	7.2	A	7.2	A	7.8	A	7.7	A
	WB								
	NB	7.3	A			7.7	A		
	SB								
G Street SE at 4 th Street SE	EB	7.9	A	10.0	B	8.1	A	9.8	A
	WB	8.4	A			8.3	A		
	NB								
	SB	10.4	B			10.3	B		
G Street SE at 6 th Street SE	EB	8.6	A	12.6	B	8.6	A	10.9	B
	WB	8.9	A			8.8	A		
	NB	13.6	B			11.8	B		
	SB								
G Street SE at 7 th Street SE	EB	7.9	A	8.1	A	8.9	A	9.5	A
	WB	8.3	A			8.9	A		
	NB	8.1	A			10.3	B		
	SB	8.1	A			8.8	A		
E Street SE at 6 th Street SE	EB	8.7	A	11.7	B	8.6	A	10.4	B
	WB	8.5	A			8.1	A		
	NB	12.6	B			11.0	B		
	SB								
D Street SE at 6 th Street SE	EB	8.9	A	11.4	B	8.5	A	10.8	B
	WB	8.5	A			8.1	A		
	NB	12.3	B			11.4	B		
	SB								

Gray shading indicates approach does not exist, purple shading indicates that analysis of this intersection configuration is not possible per HCM procedures. The HCM procedures do not calculate an overall LOS for two-way stop controlled intersections.

3 CONSTRUCTION AND ULTIMATE CONDITIONS TRAFFIC ANALYSIS

3.1 RECONSTRUCTION OF THE TUNNEL

Currently, there are four alternatives for the reconstruction of the tunnel:

1. **No-Build Alternative (Alternative 1):** The tunnel would not be rebuilt under this alternative. However, the railroad would continue to operate trains through the tunnel and at some point, emergency or unplanned major repairs or rehabilitation could be required to this critical, aging infrastructure that might prove equally or even more disruptive to the community than the Build Alternatives.
2. **Alternative 2:** This alternative involves rebuilding the existing Virginia Avenue Tunnel. It would be rebuilt with two tracks and enough vertical clearance to accommodate double-stack intermodal container freight trains. It would be in generally the same location, except aligned approximately seven feet to the south of the existing tunnel center line. It would be rebuilt using protected open trench construction methods. During construction, freight trains would be temporarily routed through a protected open trench outside the existing tunnel (runaround track). The runaround track would be to the south of the existing tunnel. It would be parallel to the existing tunnel and would be below street level. Safety measures such as securing fencing would be used to prevent pedestrians and cyclists from accessing the runaround track.
3. **Alternative 3:** This alternative involves replacing the existing Virginia Avenue Tunnel with two new permanent tunnels constructed sequentially. Each new tunnel would have a single track with enough vertical clearance to allow double-stack intermodal container freight trains. A new parallel south side tunnel would be built first as trains continue operating in the existing Virginia Avenue Tunnel. After the south side tunnel is completed, train operations would switch over to the new tunnel and the existing Virginia Avenue Tunnel would be demolished and rebuilt. With the exception of operating in a protected open trench for approximately 230 feet immediately east of the 2nd Street portal (within the Virginia Avenue SE segment between 2nd and 3rd Streets SE), trains would operate in enclosed tunnels throughout construction under Alternative 3. Throughout most of the length, the two tunnels would be separated by a center wall. This center wall would be the new centerline of the two tunnels, and it would be aligned approximately 25 feet south of the existing tunnel centerline, between 2nd and 9th Streets SE. Due to new columns associated with the rebuilt 11th Street Bridge, the tunnels would be separated on the east end resulting in two single-track openings at the east portal.
4. **Alternative 4:** This alternative would result in a new tunnel with a center partition wall separating two permanent single tracks. The new partitioned tunnel would have

enough vertical clearance to allow double-stack intermodal container freight trains. It would be aligned approximately 17 feet south of the existing tunnel's centerline. The new partitioned tunnel would be built using protected open trench construction methods. Safety measures such as secure fencing would be used to prevent pedestrians and bikers from accessing the protected open trench. The rebuild would occur 'online' meaning that during the period of construction, the protected open trench would accommodate both construction activities and train operations. Maintaining safe and reliable temporary train operations is a more complicated endeavor under Alternative 4 than under the other two Build Alternatives because of the online rebuild approach.

A draft schedule has been prepared for each of the three build alternatives above, as presented in **Table 3-1**. For each of these alternatives, work will begin on the new south track first; once completed, train traffic will be diverted onto the newly constructed track. At that time, work will demolish the existing track and the new north track will be constructed in its place. After the north track is finished and the tunnel is completed, Virginia Avenue SE roadway and other disturbed areas will be restored. Construction documents refer to work on the south track as Phase 1 and the north track as Phase 2.

Table 3-1: Construction Phasing for the Three Alternatives

Alternative	South Track Start	North Track Start	Estimated Completion
Alternative 2	Q3 2013	Q3 2014	Q4 2016
Alternative 3		Q2 2015	Q4 2016
Alternative 4		Q1 2016	Q1 2018

Note: Alternative 1 is the No-Build Alternative. Schedule is as of July 30, 2012 and is subject to change.

3.2 CONSTRUCTION PHASES AND ULTIMATE CONFIGURATION

Preliminary construction sequencing and phasing plans indicate several short-term detours, along with three longer phases of construction that would require detours over extended periods of time. Because the short-term detours would last less than two weeks each, traffic analysis for these were not performed. Detailed analysis was performed to ascertain the effects of the three longer phases of construction. In addition, consideration and analysis of the effects of the 11th Street Bridge project and the M Street Diversion Sewer project (described in **Section 3.2.1**), including closures of ramps, was performed for this analysis.

During the short-term detours of two weeks or less, pedestrians may need to be detoured to other north-south roadways in order to construct the temporary decking. In the long-term phases, the pedestrian movements crossing Virginia Avenue SE will be maintained as the temporary decking will include a sidewalk. Following construction (Ultimate Conditions), the area will be restored, including full pedestrian access.

With the potential project roadway closures, WMATA bus routes will not be affected as no routes currently use Virginia Avenue SE within the study area. When the temporary decking is constructed for 8th Street SE, minimal impacts would occur to bus traffic as the lanes on 8th Street SE are temporary reduced in width to allow for the construction of the temporary decking.

3.2.1 OTHER PROJECTS IN AREA

Two major projects occur within the study area: the 11th Street Bridge Project and the M Street Diversion Sewer Project. The former is the reconstruction of: the 11th Street Bridge over the Anacostia River; its tie-in to Interstate 295, Anacostia Freeway, and Martin Luther King Jr. Avenue to the south; and its tie-in to the Southeast Freeway and M and 12th Streets SE to the north. The M Street Diversion Sewer Project is reconstructing the sewer line between 7th and Water Streets SE and constructing the tie-in into a new sewer line. This project requires closing one travel lane in each direction on M Street SE between 7th and 11th Streets SE. The schedule of key maintenance of traffic (MOT) stages of both projects are described in **Table 3-2**.

Table 3-2: Stages of Other Projects within the Study Area

Project Stage	Duration
11th Street Bridge (as of June 4, 2012)	
8 th Street Ramp (Ramp E-2)	Existing ramp closes January 2013, new ramp opens to traffic May 2014, when Ramp A-2 opens
9 th Street Ramp	Close permanently January 2013
New connector from the Southeast Freeway to 11 th Street (Ramp D-4)	Opens to traffic in summer of 2014
New connector to Southeast Boulevard	Opens to traffic in summer 2014
11 th Street reconstruction over the Southeast Freeway	January 2013 to March 2015, note that one lane in each direction maintained at all times.
M Street Sewer Replacement (as of May 11, 2012)	
Project closes a lane in each direction from just west of 7 th Street to east of 9 th Street, detailed schedule is not yet defined, but project duration is Summer 2012 to Summer 2014. During this time, there will be a series of lane shifts as the new sewer line and diversion structures are constructed.	

Note: Project schedules as listed above are subject to revisions as those project move forward.

3.2.2 SHORT-TERM DETOURS

Short-term temporary detours would occur in short duration on 3rd, 5th, and 7th Streets SE for the construction of the temporary bridge decking over the work zone of the temporary detouring train track (Alternative 2 only), as well as the new tunnels and the existing tunnel that will be demolished. The short-term detours will occur before Phase 1A begins (as described in **Section 3.2.3**). The temporary decking for 4th, 8th, and 9th Streets SE will be constructed one at a time so that only one of these roadways would be affected at any given time. The temporary decking along 11th Street SE will be constructed in two stages, with final sequencing to be determined in coordination with the 11th Street Bridge project. Constructing the decking in two stages will allow 11th Street SE to remain open, though it will be reduced to one lane in each direction (i.e., total cross-section reduced from four to two lanes). Once the temporary decking is completed, this portion of 11th Street SE will be opened to four lanes of traffic. Note that the 11th Street Bridge project, a separate project being constructed by others, will include in two stages: demolishing the bridge located just north of the temporary decking over the Southeast Freeway, and building a new structure. During that time, that project will keep two lanes of traffic open on 11th Street SE during the AM and PM peak periods. Once that project is completed, there will be four lanes of traffic on 11th Street SE.

3.2.3 PHASE 1A

MOT Phase 1A is currently proposed to start in the third quarter of 2013 and last until the mid-second quarter of 2014; final timing will depend on the timeline of the 11th Street Bridge project. At this time, it is understood that the 8th and 9th Street SE ramps would be closed prior to the start of Phase 1A. Those closures would shift traffic from 8th Street SE at Virginia Avenue SE down to M Street SE so that traffic can access the ramp to the outbound bridge at 11th Street SE. When the 8th Street SE ramp opens (Ramp E-2 per 11th Street Bridge MOT), there will be further changes in traffic patterns in the study area.

The currently proposed schedule identifies the following actions as occurring during Phase 1A. The actions are also applicable to latter phases (Phase 1B and Phase 2) unless described differently in subsequent sections.

- Virginia Avenue SE from 2nd to 5th Streets SE and from 8th to 9th Streets SE will be closed; traffic on these roads would divert to the parallel K and L Streets SE.
- L Street SE between 8th and 9th will be converted to two-way operations.
- Virginia Avenue SE intersections at 2nd and 5th Streets SE are completely closed.
- Virginia Avenue SE from the Southeast Freeway off-ramp to 8th Street SE is reduced to one travel lane with one emergency vehicle drop lane. The signal timing at the ramp termini would be modified to retain the pedestrian interval crossing Virginia Avenue SE.
- 3rd, 4th, 5th, 7th, and 8th Streets SE remain open to northbound/southbound traffic.
- Existing pedestrian movements along 3rd, 4th, 5th/6th, 7th, and 8th Streets SE are retained as the temporary decking will include a walkway.
- As no WMATA buses travel on the roadways that will be closed for the construction of the temporary decking, there are no impacts to transit.

Phase 1A is applicable to Alternative 2 and 3. Because Alternative 4 requires complete closure of Virginia Avenue SE (the tunnel roof is demolished in this phase), Phase 1A is not applicable.

3.2.4 PHASE 1B

MOT Phase 1B is similar to Phase 1A, except that the 8th Street SE ramp will be opened to traffic. In Phase 1B, traffic that had to detour to M Street SE and 11th Street SE due to the 11th Street Bridge project closing the 8th Street SE ramp, can now resume their normal traffic pattern and use the new Ramp E-2. This will reduce traffic volumes on M Street SE compared to Phase 1A.

Alternative 2 and Alternative 3 have different completion dates of Phase 1: Alternative 2 in the third quarter of 2014 and Alternative 3 in the second quarter of 2015. The difference in traffic between the Phase 1 and Phase 2 is that Ramp D-4 opens after Alternative 2 Phase 1B finishes. That ramp will provide direct access for the Southeast Freeway to 11th Street SE; prior to this point, traffic destined to 11th Street SE would exit at the off-ramp to Virginia Avenue SE and travel along Virginia Avenue SE to 8th Street SE, M Street SE, and 11th Street SE. This pattern would lower volumes along Virginia Avenue SE and 8th and M Streets SE as compared to Phase

1A. For Alternative 3, the traffic analysis assumed that Ramp D-4 will not have opened, thereby resulting in a worst-case analysis scenario. This means that Phase 1A and 1B are identical for Alternative 2 and 3. Because Alternative 4 requires complete closure of Virginia Avenue SE, Phase 1B is not applicable.

3.2.5 PHASE 2

For MOT Phase 2, Virginia Avenue SE on the south side of the Southeast Freeway is completely closed. Phase 2 will begin upon the completion of Phase 1B from Alternative 2 and 3 (2014 Quarter 3 and 2015 Quarter 2 respectively). However, due to the construction methods proposed for Alternative 4, Virginia Avenue SE will be complete closed throughout the tunnel reconstruction. The tunnel roof and south wall will be demolished prior to construction of the south track. During this phase:

- Virginia Avenue SE on the north side of the Southeast Freeway would be converted to two-way operations from 6th to 8th Streets SE. The westbound movement would be reduced to one lane, while the eastbound movement would be two lanes from 6th Street SE to 7th Street SE, then one lane to 8th Street SE. The following describes the geometrics for traffic coming off the ramp, after passing under the freeway:
 - Destined southbound, traffic would turn right onto Virginia Avenue SE (north side of the freeway), then turn right at either 7th or 8th Streets SE to head southbound.
 - The existing eastbound Virginia Avenue SE movements that turn left onto 7th or 8th Streets SE would continue north on 6th Street SE during this phase. The analysis carried all diverted traffic on 6th Street SE from Virginia Avenue SE to D Street SE to gauge the worst-case scenario for this roadway. Because of this assignment, volumes on 7th and 8th Streets SE would decrease. In reality, some of the traffic would turn onto east-west roadways (G, F, and D Streets SE, or North Carolina Avenue SE) to reach their destinations, so the most realistic scenario would be represented by conditions somewhere between the No-Build scenario and Phase 2 scenario. Testing the traffic patterns in this manner additionally allows for a determination as to whether temporary measures are needed along 6th Street SE to accommodate the worst-case traffic diversions.
 - Along eastbound Virginia Avenue SE where two-way operation would be implemented, no left turns were permitted at 7th or 8th Streets SE. It was assumed that southbound 7th Street SE at Virginia Avenue SE (north side of the freeway) would not be permitted to turn left (same as for existing conditions).

3.2.6 ULTIMATE (POST-CONSTRUCTION) CONDITIONS

Once the tunnel is reconstructed, the temporary rail track will be demolished and Virginia Avenue SE (south side of the freeway) will be rebuilt. Based on DDOT input, several proposed changes to Virginia Avenue SE to enhance the urban environment and traffic operations were analyzed:

- The intersections of Virginia Avenue SE at 5th Street SE and off-ramp/6th Street SE would be combined into a single intersection with a 3-phase traffic signal. This configuration would look similar to that of the southbound South Capitol Street at the ramp from M Street SE and N Street SE.
- The existing one-way operation of Virginia Avenue SE from 8th to 9th Streets SE would be converted to two-way operations.
- The block of 4th Street SE from Virginia Avenue SE to I Street SE, on the south side of the Southeast Freeway, would be converted to two-way operations. This would allow for access from the development bounded by Virginia Avenue SE, 4th Street SE, 5th Street SE, and K Street. Under the existing conditions, a driveway connects to I Street SE, just west of where I Street SE terminates at eastbound Virginia Avenue SE. Converting the above-described section of 4th Street SE to two-way operations maintains that connection.
- Operational testing will be done to determine whether the number of lanes on Virginia Avenue SE could be reduced as follows:
 - Reduce between 4th to 5th Streets SE as one-lane;
 - Retain the off-ramp through-only lane and a shared through-left lane configuration; and
 - Reduce Virginia Avenue SE to two lanes from the off-ramp to 7th Street SE and to three lanes from 7th to 8th Streets SE.

3.2.7 EMERGENCY VEHICLES

Emergency vehicles will be impacted slightly by the detours put into place by this project and the adjacent 11th Street Bridge project. The M Street Diversion Sewer project will not impact emergency vehicle routing as at least two lanes are maintained at all times on M Street SE. Detours will affect emergency vehicles routing by no more than several blocks, depending on actual routes selected by the responders. To maintain fire and rescue access to the various parcels, temporary access roads will be provided as currently proposed:

- The property bounded by Virginia Avenue SE and 3rd, 4th, and I Streets SE will have temporary access constructed off of 3rd and 4th Streets SE to connect to the existing fire lane in the middle of the property.
- The Cappers Senior property, bounded by Virginia Avenue SE and 5th and K Streets SE, and the existing fire lane on the east side of the property, adjacent to the Marine Barracks' athletic field, will be impacted with the closure of Virginia Avenue SE to the north. A temporary access road will be constructed along the north face of the building, to connect the existing fire lane to 5th Street SE.

Other properties in the area are not affected to the degree that additional temporary access roadways would be needed. The Transportation Management Plan (TMP) that is being prepared as part of this project will address emergency access in further detail, including necessary coordination with emergency services.

3.3 TRAFFIC ANALYSIS OF MOT PHASES

Traffic operational analysis was not performed for the short-term detours as each roadway is closed only for short periods during the construction of the temporary decking. Analysis was performed for Phases 1A, 1B, and 2. The road closures are described in the previous section. For each scenario, traffic was reassigned to other routes to reach their same destinations; volumes for each scenario are presented in **Appendix C**.

3.3.1 PHASE 1A

Traffic was detoured in this manner:

- Virginia Avenue SE traffic from 5th Street SE to the west was diverted onto K Street SE.
- Virginia Avenue SE traffic from 8th to 9th Streets SE was diverted to 8th Street SE to turn onto L Street SE.

The adjustments were completed to the traffic and operational analysis was performed at those intersections for which volumes changed; all other intersection LOS would remain the same as in the No-Build Alternative. For this analysis, signal timing plans were not optimized. **Table 3-3** presents the MOEs for Phase 1A; the full MOE table is presented in **Appendix D**.

Table 3-3. 2016 Phase 1A MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.7	0.79	B	15.8	0.70	B
South Capitol Street and I (Eye) Street SE (Right)	20.4	0.75	C	23.8	0.60	C
Ramps from freeway at South Capitol Street SB	155.4	1.02	F	48.0	0.74	D
South Capitol Street at M Street SE - SB Intersection	520.5	1.76	F	61.8	0.70	E
South Capitol Street at M Street SE - NB Intersection	88.0	0.84	F	146.5	1.22	F
M Street SE at 1 st Street SE	57.8	0.84	E	83.6	0.96	F
M Street SE at New Jersey Avenue SE	16.4	0.47	B	15.2	0.60	B
M Street SE at 3 rd Street SE	8.2	0.39	A	14.6	0.59	B
M Street SE at 4 th Street SE	20.2	0.46	C	16.2	0.55	B
M Street SE at 8 th Street SE	49.7	0.82	D	151.9	1.35	F
M Street SE at 9 th Street SE	16.3	0.56	B	27.3	0.88	C
M Street SE at 11 th Street SE	24.1	0.71	C	234.4	1.85	F
Virginia Avenue SE EB at 5 th Street SE	N/A			N/A		
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	31.7	0.69	C	21.8	0.64	C
Virginia Avenue SE EB at 7 th Street SE	20.3	0.76	C	35.3	0.85	D
Virginia Avenue SE EB at 8 th Street SE *	N/A			N/A		
Virginia Avenue SE ramp at 8 th Street SE *	17.6	0.52	B	40.5	0.70	D
I (Eye) Street SE at 8 th Street SE	19.1	0.52	B	20.1	0.53	C
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	8.4	0.39	A	12.0	0.56	B
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	7.2	0.46	A	28.3	0.37	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	30.3	0.47	C	22.6	0.42	C

Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	46.2	0.84	D	125.4	1.26	F
G Street SE at 8 th Street SE	9.1	0.31	A	10.9	0.42	B
M Street SE at Isaac Hall Avenue SE	5.3	0.45	A	17.5	0.60	B

Un-shaded cells indicate locations that changed from No-Build as traffic is diverted. Blue shading indicates no change from No-Build conditions; red shading indicates that intersection does not exist during Phase 1A.

* During Phase 1A, these two intersections are combined into a single intersection. Note that during this phase, the 11th Street Bridge project has closed the on-ramp; all other movements at the combined intersection are permitted. Traffic destined to the ramp is still permissible.

Overall, there were six intersections in which volumes changed. Three intersections had either undesirable overall LOS E or F, or some approaches at several intersections had undesirable LOS in either both peak hours or just the PM peak hour. The off-ramp at 6th Street SE had undesirable queue lengths on the ramp. For these cases, signal timings were optimized, and results are as follows:

- At the off-ramp from the Southeast Freeway at 6th Street/Virginia Avenue SE, signal optimization reduces queue lengths from 990 and 715 feet in the AM/PM peak hours, respectively, to 675 and 510 feet. This prevents any queue spillback onto the freeway and provides better operations for the off-ramp.
- At eastbound Virginia Avenue SE at 8th Street SE, signal optimization improves the intersection delay to 33.7 seconds/vehicle and to LOS C, with no approaches at LOS E or F.
- The delay and LOS of the M/8th Streets SE intersection is undesirable in the PM peak hour; however, this is due to the M Street Diversion Sewer project reducing the number of lanes on M Street SE. Note that the LOS is also undesirable in the No-Build conditions (with two lanes on M Street SE per direction). In the AM with signal optimization, the intersection improves to a delay of 31.9 seconds/vehicle and LOS C, with no approaches at LOS E or F.
- The delay and LOS of the M/11th Streets SE intersection is undesirable in the PM peak hour; however, this is due to the ongoing construction work of the 11th Street Bridge project. Note that this intersection is also at LOS F in the No-Build conditions. Signal optimization provides marginal benefit to reducing the delay.

Based on the above, it is recommended that a modification to the signal timing plan for these locations be considered. Analysis was also performed at the study area unsignalized intersections, as presented in **Table 3-4**. Analysis indicates with the diversion of traffic, the unsignalized intersections will continue to perform at acceptable LOS.

Table 3-4. 2016 Phase 1A Conditions MOEs – Unsignalized intersections

Intersection Name	Lane Group	AM Peak Hour				PM Peak Hour			
		by Lane Group		by Intersection		by Lane Group		by Intersection	
		Delay	LOS	Delay	HCM LOS	Delay	LOS	Delay	HCM LOS
M Street SE at 7 th Street SE	EB	1.0	A	75.3	N/A	2.3	A	3.5	N/A
	WB	0.0	A			0.0	A		
	NB	N/A	N/A			N/A	N/A		
	SB	357.3	F			37.3	E		
Virginia Avenue SE at 2 nd Street SE	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 3 rd Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 4 th Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 9 th Street SE	EB	N/A				N/A			
	WB								
	NB								
	SB								
G Street SE at 4 th Street SE	EB	7.9	A	10.0	B	8.1	A	9.8	A
	WB	8.4	A			8.3	A		
	NB	N/A	N/A			N/A	N/A		
	SB	10.4	B			10.3	B		
G Street SE at 6 th Street SE	EB	8.6	A	12.6	B	8.6	A	10.9	B
	WB	8.9	A			8.8	A		
	NB	13.6	B			11.8	B		
	SB	N/A	N/A			N/A	N/A		
G Street SE at 7 th Street SE	EB	7.9	A	8.1	A	8.9	A	9.5	A
	WB	8.3	A			8.9	A		
	NB	8.1	A			10.3	B		
	SB	8.1	A			8.8	A		
E Street SE at 6 th Street SE	EB	8.7	A	11.7	B	8.6	A	10.4	B
	WB	8.5	A			8.1	A		
	NB	12.6	B			11.0	B		
	SB	N/A	N/A			N/A	N/A		
D Street SE at 6 th Street SE	EB	8.9	A	11.4	B	8.5	A	10.8	B
	WB	8.5	A			8.1	A		
	NB	12.3	B			11.4	B		
	SB	N/A	N/A			N/A	N/A		

Gray shading indicates approach does not exist. Un-shaded cells indicate locations that changed from No-Build as traffic is diverted. Blue shading indicates no change from No-Build conditions; red shading indicates that intersection does not exist during Phase 1A. The HCM procedures do not calculate an overall LOS for two-way stop controlled intersections.

3.3.2 PHASE 1B

During this phase, the 11th Street Bridge project would reopen the 8th Street SE ramp (Ramp E-2). Traffic that had diverted to 8th/M Street SE intersection to 11th Street SE to cross over the 11th Street Bridge in Phase 1A can now use this ramp. This would reduce volumes at the 8th and M Streets SE, but change the behavior of drivers at the 8th Street SE/Virginia Avenue SE/ramp intersection. Operational analysis was performed at those intersections for which volumes changed. For this analysis, signal timing plans were not optimized. **Table 3-5** presents the MOEs for Phase 1B; the full MOE table is presented in **Appendix D**.

Table 3-5. 2016 Phase 1B MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.7	0.79	B	15.8	0.70	B
South Capitol Street and I (Eye) Street SE (Right)	20.4	0.75	C	23.8	0.60	C
Ramps from freeway at South Capitol Street SB	155.4	1.02	F	48.0	0.74	D
South Capitol Street at M Street SE - SB Intersection	520.5	1.76	F	61.8	0.70	E
South Capitol Street at M Street SE - NB Intersection	88.0	0.84	F	146.5	1.22	F
M Street SE at 1 st Street SE	57.8	0.84	E	83.6	0.96	F
M Street SE at New Jersey Avenue SE	16.4	0.47	B	15.2	0.60	B
M Street SE at 3 rd Street SE	8.2	0.39	A	14.6	0.59	B
M Street SE at 4 th Street SE	20.2	0.46	C	16.2	0.55	B
M Street SE at 8 th Street SE	23.3	0.75	C	135.0	1.16	F
M Street SE at 9 th Street SE	13.5	0.50	B	14.7	0.81	B
M Street SE at 11 th Street SE	24.1	0.71	C	238.8	1.85	F
Virginia Avenue SE EB at 5 th Street SE	N/A			N/A		
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	31.7	0.69	C	21.8	0.64	C
Virginia Avenue SE EB at 7 th Street SE	20.3	0.76	C	35.3	0.85	D
Virginia Avenue SE EB at 8 th Street SE*	N/A			N/A		
Virginia Avenue SE ramp at 8 th Street SE*	22.4	0.57	C	51.1	0.82	D
I (Eye) Street SE at 8 th Street SE	19.1	0.52	B	20.1	0.53	C
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	8.4	0.39	A	12.0	0.56	B
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	7.2	0.46	A	28.3	0.37	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	30.3	0.47	C	22.6	0.42	C
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	46.2	0.84	D	125.4	1.26	F
G Street SE at 8 th Street SE	9.1	0.31	A	10.9	0.42	B
M Street SE at Isaac Hall Avenue SE	5.3	0.45	A	17.5	0.60	B

Un-shaded cells indicate locations that changed from Phase 1A as traffic is diverted. Blue shading indicates no change from No-Build conditions, green shading indicates no change from Phase 1A, and red shading indicates that intersection does not exist during Phase 1B.

Overall, three intersections had either undesirable overall LOS E or F, or some approaches at several intersections have undesirable LOS in both peak hours or just the PM peak hour. The off-ramp at 6th Street SE had undesirable queue lengths on the ramp. For these cases, signal timings were optimized, and results are as follows:

- At the off-ramp from the Southeast Freeway at 6th Street/Virginia Avenue SE, signal optimization reduces queue lengths from 990 and 715 feet in the AM/PM peak hour, respectively, to 675 and 510 feet. This prevents any queue spillback onto the freeway and provides better operations for the off-ramp (same conditions as in Phase 1A).
- At eastbound Virginia Avenue SE at 8th Street SE, signal optimization improves intersection delay to 38.6 seconds/vehicle and the LOS is maintained at D, with no approaches at LOS E or F. Note that Ramp E-2 is reopened by the 11 Street Bridge project.
- The delay and LOS of the M/8th Streets SE intersection is undesirable in the PM peak hour; however, this is due to the M Street Diversion Sewer project reducing the number of lanes on M Street SE. Note that the LOS is also undesirable in the No-Build conditions (with two lanes on M Street SE per direction). In the AM with signal optimization, the intersection improves to a delay of 25.8 seconds/vehicle and LOS C, with no approaches at LOS E or F.
- The delay and LOS of the M/11th Streets SE intersection is undesirable in the PM peak hour; however, this is due to the ongoing construction work of the 11th Street Bridge project. Note that this intersection is also at LOS F in the No-Build conditions. Signal optimization provides marginal benefit to reducing the delay.

Based on this, it is recommended that a modification to the signal timing plan for these four locations be considered. As the volumes do not change at unsignalized intersections from Phase 1A to Phase 1B, no new analysis was performed (see **Table 3-4** under Phase 1A).

3.3.3 PHASE 2

During this phase, compared to the previous phases for Alternatives 2 and 3, Virginia Avenue SE (between 5th and 8th Streets SE on the south side of freeway) would be closed. Alternative 4 is different in terms of construction sequence; as that alternative's construction sequence starts west to east, portions of Virginia Avenue SE will be closed in stages. Until the tunnel reconstruction reaches 5th Street SE, Virginia Avenue SE between 5th and 8th Streets SE will remain open for traffic, but once the tunnel reconstruction reaches 5th Street SE, Virginia Avenue SE will be closed.

For Phase 2, all traffic on the off-ramp at 6th Street SE will be diverted to the intersection of westbound Virginia Avenue/6th Street SE. Virginia Avenue SE (north side of the Southeast Freeway) will be converted to two-way operations as described in the previous section. Vehicles formerly performing left turn movements at 7th or 8th Streets SE are assumed to continue as through movements at Virginia Avenue/6th Street SE. Vehicles formerly performing right turn movements at 7th or 8th Streets SE are assumed to turn right at Virginia Avenue/6th Street SE and travel eastbound to 7th or 8th Streets SE where they will make a right turn at either intersection. Note that the analysis assumes that no left turns are permitted for eastbound traffic at 7th or 8th Streets SE.

At about the location where Phase 2 changes begin, the 11th Street Bridge project has opened a new ramp (Ramp D-4) from the Southeast Freeway. This ramp will connect to 11th Street SE,

along which vehicles may travel south to reach the local bridge over the Anacostia River. This benefits Virginia Avenue SE as the current pattern for vehicles destined to the local bridge is to exit onto Virginia Avenue SE at the off-ramp at 6th Street SE, travel along Virginia Avenue SE to 8th Street SE, M Street SE, and 11th Street SE. Ramp D-4 will divert these vehicles away from Virginia Avenue SE. AM and PM peak hour counts (from this study) at intersections along the path described above were examined against counts from a previous study⁷ for the same locations. The previous study counts were performed prior to the existing travel path being implemented, so by examining the difference in counts, an approximation can be developed of vehicles that would divert to the new facility. The AM peak hour counts indicate that very little change in volumes along that path occurred, so for the purpose of the analysis, no change in volume was assumed. This would represent the worst-case scenario for the analysis. The analysis of the differences in traffic counts indicates that, for the PM peak hour, approximately 200 to 300 vehicles would divert. For purpose of the analysis, 200 vehicles were diverted since using the lower end of the range would represent the worst-case scenario for Virginia Avenue SE.

Operational analysis was performed at those intersections for which volumes changed. For this analysis, signal timing plans were not optimized. Table 3-6 presents the MOEs for Phase 2; the full MOE table is presented in **Appendix D**.

⁷ **DRAFT** TRAFFIC ANALYSIS REPORT VIRGINIA AVENUE ROAD CLOSURE, prepared by AECOM, December 2009.

Table 3-6. 2016 Phase 2 MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.7	0.79	B	15.8	0.70	B
South Capitol Street and I (Eye) Street SE (Right)	20.4	0.75	C	23.8	0.60	C
Ramps from freeway at South Capitol Street SB	155.4	1.02	F	48.0	0.74	D
South Capitol Street at M Street SE - SB Intersection	520.5	1.76	F	61.8	0.70	E
South Capitol Street at M Street SE - NB Intersection	88.0	0.84	F	146.5	1.22	F
M Street SE at 1 st Street SE	57.8	0.84	E	83.6	0.96	F
M Street SE at New Jersey Avenue SE	16.4	0.47	B	15.2	0.60	B
M Street SE at 3 rd Street SE	8.2	0.39	A	14.6	0.59	B
M Street SE at 4 th Street SE	20.2	0.46	C	16.2	0.55	B
M Street SE at 8 th Street SE	23.9	0.71	C	20.1	0.69	C
M Street SE at 9 th Street SE	11.4	0.42	B	17.8	0.63	B
M Street SE at 11 th Street SE	24.4	0.73	C	163.1	1.28	F
Virginia Avenue SE EB at 5 th Street SE	N/A			N/A		
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	12.9	0.4	B	12.8	0.3	B
Virginia Avenue SE EB at 7 th Street SE	N/A			N/A		
Virginia Avenue SE EB at 8 th Street SE	N/A			N/A		
Virginia Avenue SE ramp at 8 th Street SE	1.8	0.52	A	3.1	0.50	A
I (Eye) Street SE at 8 th Street SE	35.7	0.71	D	23.8	0.49	C
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	55.3	0.65	E	23.3	0.72	C
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	41.1	0.96	D	25.1	0.51	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	30.3	0.47	C	22.6	0.42	C
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	46.2	0.84	D	125.4	1.26	F
G Street SE at 8 th Street SE	12.7	0.31	B	16.5	0.39	B
M Street SE at Isaac Hall Avenue SE	5.3	0.45	A	17.5	0.60	B

Un-shaded cells indicate locations that changed from Phase 1 as traffic is diverted. Blue shading indicates no change from No-Build conditions and red shading indicates that intersection does not exist during Phase 2.

Overall, the operational analysis indicates that three intersections had either undesirable overall LOS E or F, or some approaches at several intersections have undesirable LOS in either or both peak hours. For these cases, signal timings were optimized, and results are as follows:

- For the two-way Virginia Avenue SE, signal optimization is needed to accommodate the eastbound Virginia Avenue SE movement at three intersections:
 - At I Street at Virginia Avenue/8th Street SE, signal optimization improves intersection delay to 16.6 seconds/vehicle and LOS to B in the AM. For PM conditions, delay/LOS improves to 17.3/B.
 - At I Street at Virginia Avenue/7th Street SE, signal optimization improves intersection delay to 9.6 seconds/vehicle and LOS to A in the AM. For PM conditions, delay/LOS improves to 21.5/C.

- At I Street at Virginia Avenue/6th Street SE, signal optimization improves intersection delay to 35.6 seconds/vehicle and maintains LOS D (note: intersection was just above the LOS C/D threshold) in the AM. For PM conditions, delay/LOS improves to 21.9/C.
 - No approach would operate at LOS E or F.
- The M Street Diversion Sewer project is completed prior to the commencement of Phase 2, so M Street SE has been restored to its original state. At the intersection with 8th Street SE, no issues exist for the PM peak hour as all approaches are LOS D or better. In the AM peak hour, southbound approach is at LOS E, so signal optimization would improve the overall delay and LOS to 21.6/C with all approaches at LOS C or better.
- The 11th Street Bridge project is slated to be completed by fourth quarter 2015. The analysis for this report assumes a pre-completion configuration of M and 11th Streets SE intersection. Once that project is completed, the operations of the M and 11th Streets SE intersection would improve over the analysis presented in this section.

Analysis was also performed at the study area unsignalized intersections at which the volumes changed due to trip redistribution. **Table 3-7** presents the results of the analysis. Analysis indicates with the diversion of traffic, the unsignalized intersections will continue to perform at acceptable LOS. As indicted above, traffic on eastbound Virginia Avenue SE formerly turning left onto 7th or 8th Streets SE would be a through movement at Virginia Avenue/6th Street SE (north side), and it was assumed that this diverted traffic would be a northbound through movement at all study area intersections along 6th Street SE within the study area. This assumes the worst-case scenario for traffic volumes along these intersections. In all likelihood, traffic will begin to disperse at each intersection along 6th Street SE. The analysis shows that even with assuming all northbound traffic being diverted to northbound 6th Street SE, all study area intersections will remain at acceptable LOS, and that the northbound approaches are LOS D or better.

Table 3-7. 2016 Phase 2 Conditions MOEs – Unsignalized intersections

Intersection Name	Lane Group	AM Peak Hour				PM Peak Hour			
		by Lane Group		by Intersection		by Lane Group		by Intersection	
		Delay	LOS	Delay	HCM LOS	Delay	LOS	Delay	HCM LOS
M Street SE at 7 th Street SE	EB	1.0	A	75.3	N/A	2.3	A	3.5	N/A
	WB	0.0	A			0.0	A		
	NB	N/A	N/A			N/A	N/A		
	SB	357.3	F			37.3	E		
Virginia Avenue SE at 2 nd Street SE	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 3 rd Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 4 th Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 9 th Street SE	EB	N/A				N/A			
	WB								
	NB								
	SB								
G Street SE at 4 th Street SE	EB	7.9	A	10.0	B	8.1	A	9.8	A
	WB	8.4	A			8.3	A		
	NB	N/A	N/A			N/A	N/A		
	SB	10.4	B			10.3	B		
G Street SE at 6 th Street SE	EB	9.1	A	21.2	C	9.5	A	26.4	D
	WB	9.5	A			9.9	A		
	NB	23.5	C			30.5	D		
	SB	N/A	N/A			N/A	N/A		
G Street SE at 7 th Street SE	EB	8.2	A	8.1	A	9.5	A	9.9	A
	WB	8.2	A			9.1	A		
	NB	7.8	A			10.7	B		
	SB	8.2	A			9.1	A		
E Street SE at 6 th Street SE	EB	9.1	A	15.8	C	9.3	A	18.4	C
	WB	8.9	A			8.8	A		
	NB	17.3	C			20.2	C		
	SB	N/A	N/A			N/A	N/A		
D Street SE at 6 th Street SE	EB	9.3	A	15.1	C	9.2	A	20.0	C
	WB	8.9	A			8.8	A		
	NB	16.6	C			21.7	C		
	SB	N/A	N/A			N/A	N/A		

Gray shading indicates approach does not exist. Un-shaded cells indicate locations that changed from No-Build as traffic is diverted. Blue shading indicates no change from No-Build conditions, purple shading indicates that analysis of this intersection configuration is not possible per HCM procedures, and red shading indicates that intersection does not exist during in Phase 2. The HCM procedures do not calculate an overall LOS for two-way stop controlled intersections.

3.3.4 2016 ULTIMATE CONDITIONS

The AM and PM No-Build Conditions Synchro models were used as the base for the analysis of the 2016 Ultimate Conditions. Prior to the conclusion of this project, the ramp at 8th Street SE would have been reopened to traffic by the 11th Street Bridge project, but the 9th Street SE ramp would be removed. Traffic formerly using that ramp would use M Street SE to reach the intersection of M/12th Streets SE, where vehicles would turn left to reach the new ramp onto Southeast Boulevard to reach the Sousa Bridge. When Virginia Avenue SE (south side of the freeway) is reconstructed, it is proposed that the number of lanes along Virginia Avenue SE be reduced. The initial-tested configuration is as follows:

- The intersections of Virginia Avenue SE at 5th Street SE and off-ramp/6th Street SE are combined into a single intersection (3-phase signal). This would look similar to the configuration of southbound South Capitol Street at the ramp from M Street SE and N Street SE.
- The existing one-way operation of Virginia Avenue SE from 8th to 9th Streets SE would be converted to two-way operations.
- The block of 4th Street SE from Virginia Avenue SE to I Street SE, on the south side of the freeway, would be converted to two-way operations.
- Reduce the number of lanes on Virginia Avenue SE to accommodate more parking or additional green-space as follows:
 - Reduce between 4th to 5th Streets SE as one-lane;
 - Retain the off-ramp through-only lane and a shared through-left lane configuration; and
 - Reduce Virginia Avenue SE to two lanes from the off-ramp to 7th Street SE and to three lanes from 7th to 8th Streets SE.

The MOEs were extracted from Synchro using the HCM Signals report. **Table 3-8** presents the MOEs for the 2016 Ultimate Conditions; the full MOE table is presented in **Appendix D**.

Table 3-8. 2016 Ultimate Conditions MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	11.7	0.79	B	15.8	0.70	B
South Capitol Street and I (Eye) Street SE (Right)	20.4	0.75	C	23.8	0.60	C
Ramps from freeway at South Capitol Street SB	155.4	1.02	F	48.0	0.74	D
South Capitol Street at M Street SE - SB Intersection	520.5	1.76	F	61.8	0.70	E
South Capitol Street at M Street SE - NB Intersection	88.0	0.84	F	146.5	1.22	F
M Street SE at 1 st Street SE	57.8	0.84	E	83.6	0.96	F
M Street SE at New Jersey Avenue SE	16.4	0.47	B	15.2	0.60	B
M Street SE at 3 rd Street SE	8.2	0.39	A	14.6	0.59	B
M Street SE at 4 th Street SE	20.2	0.46	C	16.2	0.55	B
M Street SE at 8 th Street SE	21.3	0.70	C	20.6	0.67	C
M Street SE at 9 th Street SE	11.5	0.42	B	15.3	0.81	B
M Street SE at 11 th Street SE*	24.1	0.71	C	125.0	1.00	F
Virginia Avenue SE EB at 5 th Street SE	N/A			N/A		
SE Freeway off-ramp at 6 th Street SE/EB Virginia Avenue SE	19.4	0.59	B	18.3	0.44	B
Virginia Avenue SE EB at 7 th Street SE	6.3	0.32	A	19.6	0.45	B
Virginia Avenue SE EB at 8 th Street SE	31.7	0.36	C	31.5	0.63	C
Virginia Avenue SE ramp at 8 th Street SE	7.9	0.40	A	6.3	0.60	A
I (Eye) Street SE at 8 th Street SE	19.2	0.52	B	21.9	0.54	C
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	8.4	0.39	A	12.0	0.56	B
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	7.2	0.46	A	28.3	0.37	C
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	30.3	0.47	C	22.6	0.42	C
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	46.2	0.84	D	125.4	1.26	F
G Street SE at 8 th Street SE	9.0	0.32	A	10.9	0.42	B
M Street SE at Isaac Hall Avenue SE	5.3	0.45	A	17.5	0.60	B

* M/11th Street SE intersection will be reconfigured by the 11th Street Bridge project (by others); final consideration of traffic analysis lies with that project. Blue shading indicates no change from No-Build Conditions. Red shading indicates intersection does not exist, as this intersection is combined with the off-ramp at 6th Street /Virginia Avenue SE eastbound to form a new intersection.

The analysis of Virginia Avenue SE for 2016 Ultimate Conditions indicates that operations will be acceptable for the desired configuration as described above. However, operational analysis for 2040 conditions also needs to be considered to determine whether the initial-tested configuration would work. The 2040 analysis is presented in the next chapter. The analysis confirms that the configuration listed below will maintain LOS D or better for all approaches (results shown in **Table 3-9**), as followed:

- Eastbound Virginia Avenue SE approach to 6th Street SE should be a minimum of two lanes;
- Eastbound Virginia Avenue SE from 6th to 7th Streets SE, and from 7th to 8th Streets SE, should be a minimum of three lanes; and

- A new signal timing plan is needed for the intersection of Virginia Avenue SE/8th Street SE/on-ramp.

Table 3-9. 2016 Ultimate Conditions MOEs – Optimized – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
Virginia Avenue EB at 7 th Street	5.5	0.3	A	17.3	0.5	B
Virginia Avenue EB at 8 th Street	15.4	0.4	B	18.4	0.6	B
Virginia Avenue ramp at 8 th Street	8.0	0.4	A	8.7	0.6	A
M Street at 8 th Street	17.4	0.7	B	-	-	-
M Street at 11 th Street	-	-	-	87.4	1.0	F

M Street at 8th Street SE does not require signal optimization in the PM peak hour; M Street at 11th Street SE does not require signal optimization in the AM peak hour. M/11th Street SE intersection will be reconfigured by the 11th Street Bridge project (by others); final consideration of traffic analysis lies with that project.

Since the 2016 traffic indicates that not all the lanes are needed, it is proposed that the lanes be constructed but striped out. At the time when traffic conditions warrant it, the striped out lanes would then be opened to traffic. In the interim period, the lanes could be used as parking lanes. In the Ultimate Conditions for unsignalized conditions, the volumes and geometry would not change from No-Build Conditions, with the exception of the Virginia Avenue/9th Street SE intersection, as that ramp is removed by the 11th Street Bridge project. Refer to **Table 2-6** in the No-Build section for the MOEs of unsignalized intersections.

4 LONG TERM TRAFFIC CONSIDERATIONS

The purpose of the 2040 analysis is to determine the ultimate configuration for Virginia Avenue SE. As described in the previous chapter, the desire is to reduce the number of lanes on Virginia Avenue SE (south side of the Southeast Freeway) to the extent possible while providing acceptable levels of services.

4.1 HORIZON YEAR FORECASTS

The horizon year for the long term analysis for Virginia Avenue SE is the year 2040. Data from the Metropolitan Washington Council of Governments (COG) model was used to develop the growth rate for the area; this model provides forecasts for 5-year increments. Based on Capitol Riverfront BID estimates, an additional 9 million square feet of development will be constructed in the area east of South Capitol Street by 2020. Using the same study area trip generation rates, the development would generate an additional 3,500 trips in the AM and 5,000 trips in the PM (combined total into and out of the study area). When added to the total study area trips into and out of the study area, a 5-year growth rate of 35 percent in the AM and 54 percent in the PM was estimated. Specific development estimates beyond 2020 have not yet been quantified by the BID for the study area. The COG model was used to determine traffic growth rate on study area roadways from 2020 to 2040 conditions. For both AM and PM, the model indicates an average growth rate for the study area roadways of approximately 10 percent, or 0.5 percent annual growth (compounded linearly). Average factors of 1.4 and 1.6 were used to project the 2015 AM and PM volumes, respectively, to 2040 conditions.

4.2 2040 NO-BUILD ANALYSIS

Traffic analysis was performed for 2040 No-Build Conditions, and 2040 volumes were entered into Synchro networks, as described in the previous section. The signal timings and intersection offsets were optimized. The No-Build Conditions analysis assumes that improvements to Virginia Avenue SE do not occur; improvements are discussed in the next section. **Table 4-1** presents the results of the analysis for signalize intersections; the full MOE table is presented in **Appendix D**.

Table 4-1. 2040 MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
South Capitol Street and I (Eye) Street SE (Left)	61.3	1.20	E	82.4	1.35	F
South Capitol Street and I (Eye) Street SE (Right)	100.4	1.17	F	57.3	1.09	E
Ramps from freeway at South Capitol Street SB	395.2	1.36	F	233.5	1.19	F
South Capitol Street at M Street SE - SB Intersection	689.2	3.94	F	127.3	1.09	F
South Capitol Street at M Street SE - NB Intersection	217.6	1.12	F	311.1	1.25	F
M Street SE at 1 st Street SE	88.4	1.11	F	200.0	1.54	F
M Street SE at New Jersey Avenue SE	25.1	0.70	C	86.5	1.14	F
M Street SE at 3 rd Street SE	13.5	0.56	B	93.0	1.07	F
M Street SE at 4 th Street SE	24.2	0.76	C	28.6	0.86	C
M Street SE at 8 th Street SE	72.1	1.03	E	97.1	1.27	F
M Street SE at 9 th Street SE	34.2	0.75	C	95.1	1.18	F
M Street SE at 11 th Street SE*	123.8	1.14	F	532.3	2.00	F
Virginia Avenue SE EB at 5 th Street SE	36.7	0.20	D	126.8	0.62	F
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	132.4	0.85	F	47.4	0.75	D
Virginia Avenue SE EB at 7 th Street SE	6.0	0.43	A	34.3	0.78	C
Virginia Avenue SE EB at 8 th Street SE	23.2	0.61	C	70.7	0.80	E
Virginia Avenue SE ramp at 8 th Street SE	12.6	0.51	B	44.8	0.89	D
I (Eye) Street SE at 8 th Street SE	40.8	0.92	D	138.6	1.27	F
I (Eye) Street SE at Virginia Avenue SE WB/7 th Street SE	11.8	0.62	B	102.5	1.03	F
I (Eye) Street SE and Virginia Avenue SE WB at 6 th Street SE	12.4	0.74	B	179.4	0.62	F
Virginia Avenue SE WB at 4 th Street SE north of SE Freeway	107.9	0.77	F	122.3	0.75	F
Virginia Avenue SE WB at 3 rd Street SE north of SE Freeway	313.6	2.25	F	693.6	2.94	F
G Street SE at 8 th Street SE	10.4	0.51	B	13.9	0.72	B
M Street SE at Isaac Hall Avenue SE	7.9	0.67	A	85.1	1.10	F

* This intersection is being reconfigured by the 11th Street Bridge Project. That project is responsible for the ultimate configuration of the intersection. Depending of ultimate configuration, MOEs will likely change.

The analysis shows that, assuming trip patterns mirror existing patterns; congestion is likely to occur at multiple intersections within the study area. Analysis was also performed for the study area unsignalized intersections, and the results are presented in **Table 4-2**.

Table 4-2. 2040 No-Build Conditions MOEs – Unsignalized intersections

Intersection Name	Lane Group	AM Peak Hour				PM Peak Hour			
		by Lane Group		by Intersection		by Lane Group		by Intersection	
		Delay	LOS	Delay	HCM LOS	Delay	LOS	Delay	HCM LOS
M Street SE at 7 th Street SE	EB	1.8	N/A	2211.0	N/A	13.1	N/A	587.4	N/A
	WB	0.0	N/A			0.0	N/A		
	NB								
	SB	Err	F			Err	F		
Virginia Avenue SE at 2 nd Street SE	EB	7.0	A	7.4	A	6.9	A	7.1	A
	WB	7.8	A			7.5	A		
	NB	7.1	A			6.9	A		
	SB	7.5	A			0.0	A		
Virginia Ave SE at 3 rd Street SE, S of Freeway	EB	16.9	C	6.5	N/A	62.1	F	5.0	N/A
	WB	22.0	C			34.0	D		
	NB	0.6	A			0.2	A		
	SB	1.3	A			3.9	A		
Virginia Ave SE at 4 th Street SE, S of Freeway	EB	N/A				N/A			
	WB								
	NB								
	SB								
Virginia Ave SE at 9 th Street SE *	EB	N/A				N/A			
	WB								
	NB								
	SB								
G Street SE at 4 th Street SE	EB	8.7	A	16.6	C	9.7	A	20.7	C
	WB	9.4	A			9.7	A		
	NB								
	SB	18.1	C			24.0	C		
G Street SE at 6 th Street SE	EB	9.9	A	51.7	F	10.6	B	35.3	E
	WB	10.9	B			11.8	B		
	NB	62.9	F			45.4	E		
	SB								
G Street SE at 7 th Street SE	EB	8.8	A	9.3	A	12.0	B	17.1	C
	WB	9.6	A			12.4	B		
	NB	9.5	A			22.8	C		
	SB	9.1	A			12.4	B		
E Street SE at 6 th Street SE	EB	10.2	B	36.1	E	10.2	B	24.5	C
	WB	10.3	B			9.7	A		
	NB	43.6	E			29.1	D		
	SB								
D Street SE at 6 th Street SE	EB	10.8	B	31.2	D	10.0	A	29.1	D
	WB	10.2	B			9.5	A		
	NB	38.1	E			33.7	D		
	SB								

* Intersection does not exist in 2040, due to changes as part of the 11th Street Bridge project (by others).

Long term analysis shows that delays will increase at multiple intersections to undesirable LOS, caused by the growth in local and regional traffic, and not due to any particular transportation

project. Operational performance should be periodically reviewed by DDOT, and DDOT will determine whether signals should be installed to improve operational performance.

4.3 TRAFFIC ANALYSIS OF VIRGINIA AVENUE

The goal for reconstructing Virginia Avenue SE is to match the number of travel lanes to demand and to allow remaining rights-of-way to be used for other purposes such as trails, parking, etc. An initial configuration for analysis is described below. **Table 4-3** presents the MOEs for the long term conditions of Virginia Avenue; the full MOE table is presented in Appendix D. Note that only locations at which the volumes changed were analyzed.

- The intersections of Virginia Avenue SE at 5th Street SE and off-ramp/6th Street SE are combined into a single intersection (3-phase signal). This would look similar to the configuration of southbound South Capitol Street at the ramp from M Street SE and N Street SE.
- The existing one-way operation of Virginia Avenue SE from 8th to 9th Streets SE would be converted to two-way operations. The block of 4th Street SE from Virginia Avenue SE to I Street SE, on the south side of the freeway, would be converted to two-way operations.
- The number of lanes on Virginia Avenue SE would be reduced as follows:
 - Reduce between 4th to 5th Streets SE as one-lane;
 - Retain the off-ramp through-only lane and a shared through-left lane configuration; and
 - Reduce Virginia Avenue SE to two lanes from the off-ramp to 7th Street SE and to three lanes from 7th to 8th Streets SE.

Table 4-3. 2040 Ultimate Conditions MOEs – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	137.3	0.97	F	55.0	0.90	E
Virginia Avenue SE EB at 7 th Street SE	19.4	0.69	B	60.2	1.02	E
Virginia Avenue SE EB at 8 th Street SE	17.4	0.61	B	41.9	0.78	D
Virginia Avenue SE ramp at 8 th street SE	18.1	0.66	B	37.0	0.89	D

Results of the analysis of the desired long term configuration indicate that additional lanes are needed to accommodate demand at several intersections, as follows:

- Eastbound Virginia Avenue SE approach to 6th Street SE should be two lanes;
- Eastbound Virginia Avenue SE from 6th to 7th Streets SE should be three lanes; and
- A new signal timing plan is needed for the intersection of Virginia Avenue SE/8th Street SE/on-ramp.

Table 4-4. 2040 Ultimate Conditions MOEs – Optimized – Signalized Intersections

Intersection Name	AM Peak Hour			PM Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
SE Freeway off-ramp at 6 th Street SE/Virginia Avenue SE EB	89.1	0.9	F	30.9	0.8	C
Virginia Avenue SE EB at 7 th Street SE	7.2	0.5	A	22.0	0.9	C
Virginia Avenue SE EB at 8 th Street SE	15.9	0.6	B	35.6	0.7	D
Virginia Avenue SE ramp at 8 th street SE	13.5	0.5	B	33.6	0.9	C

Table 4-4 above shows that, with optimized timings and additional lanes, all intersections except for the intersection of the off-ramp/Virginia Avenue SE/6th Street SE in the AM peak hour would operate at acceptable LOS. Additional improvements, such as potentially adding a third lane at the signal to provide a separate left turn lane of the off-ramp traffic, would be needed long term to improve operations to acceptable LOS. This would require a long term study to quantify the exact improvements, and preparation of necessary documentation to Federal Highway Administration (FHWA).

4.4 COMMENTARY ON ADJOINING ROADWAY OPERATIONS

Currently, 4th Street SE is one-way with a bike lane as well as a parking lane on each side of the roadway. This area is a Zone 6 parking permit area; on-street parking for others is limited to two-hours during the day, and no parking is permitted during baseball stadium events. There is the potential to convert 4th Street SE from one-way to two-way operations. South of I Street SE, 4th Street SE is 33 feet wide from face-of-curb to face-of-curb. The cross-section includes a parking lane on both sides of the roadway, a bike lane, and one southbound travel lane. If 4th Street SE was to be converted to two-way operations, the parking lane on one side of the roadway would have to be eliminated (there would also be some additional space between the travel lane and the curb). Two-way traffic with parking on both sides is not feasible within the current curb-to-curb distance.

The block of 4th Street SE from Virginia Avenue SE to I Street SE, on the south side of the freeway, would be converted to two-way operations. This would be done to allow for access from the development bounded by Virginia Avenue SE, 4th Street SE, 5th Street SE, and K Street SE. Under the existing conditions, a number of properties within this development have a driveway that connects to I Street SE, just west of where I Street SE terminates at eastbound Virginia Avenue SE. Converting the above-described section of 4th Street SE to two-way operations maintains that connection to Virginia Avenue SE. This conversion will require the parking spaces located on the east side of 4th Street SE to be removed, which amounts to four spaces. The reconstruction of eastbound Virginia Avenue SE will include new parking spaces, which would compensate for this loss.

Likewise on 4th Street SE, north of westbound Virginia Avenue SE, the roadway width is 42 feet wide. The cross-section includes a parking lane on both sides of the roadway, a bike lane, and one southbound travel lane. Two-way operations are possible in this location; however, this would require removal of one parking lane in order to maintain the on-street bike lane. The

provision of two-way traffic, a bike lane, and parking on both sides is not feasible within the current curb-to-curb distance.

For accommodating pedestrian traffic, converting the operations to two-way flow may decrease safety over the short-term as pedestrians and motorists need a period of time to become familiar with the new traffic pattern. A longer-term benefit to pedestrians in one-way operations is that the number of potential conflict points with vehicular traffic is lower than with two-way operations. This is because pedestrians do not have to watch for traffic in both directions, and potential hazards are from one side only. If 4th Street SE is converted to two-way operations, pedestrians may have a relatively higher risk for the short-term until they become fully familiar with the new traffic pattern.

For accommodating parking, the supply would decrease for area residents and their visitors. The effects of converting 4th Street SE to two-way operations will need to consider these safety and parking impacts in addition to other transportation and community concerns.

4.5 I STREET EXTENSION

DDOT is exploring options to extend I Street SE to 5th/6th Streets SE to connect directly to Virginia Avenue SE. This change is being considering as part of an overall concept for a continuously connected I Street SW/SE that would extend from Maine Avenue SW to 5th Street SE, with I Street extending onto eastbound Virginia Avenue SE⁸. One of the benefits of providing a continuous I Street corridor is that it provides a more fully integrated and complete grid system, including the potential for an alternative continuous east-west route to M Street SW/SE. Detailed intersection analysis was not performed as part of the review of operations, but rather a qualitative assessment of the benefits and issues associated with this change was completed. A memorandum of the study is attached in **Appendix E**.

⁸ Note that the construction of a block of I Street SE that would close the current gap between 2nd Street SE and New Jersey Avenue SE is being performed as part of redevelopment associated with a new apartment building.

5 CONCLUSIONS AND RECOMMENDATIONS

The traffic operational analysis indicates that the proposed closure of Virginia Avenue SE in three construction stages will not adversely impact traffic operations, provided that the signal timing plans are modified for key intersections in each phase. For the Ultimate Conditions (post-construction), the number of travel lanes on Virginia Avenue SE can be reduced, which would increase the number of parking spaces and/or increase the availability of green space along the roadway.

Pedestrian and bicycle connectivity may be disrupted during the short-term (one to two week) detours while temporary decking is constructed for several north-south streets crossing Virginia Avenue SE. In these cases, pedestrians and bicyclists would be detoured to other north-south routes. During the three longer term phases, full pedestrian and bicycle movements for north-south will be maintained. At the end of the project (the Ultimate Conditions), all pedestrian and bicycle movements will be restored to their original patterns.

5.1 EXISTING CONDITIONS

The Existing Conditions analysis indicates that three intersections do not operate at acceptable LOS (LOS D or better). These include the two signalized intersections are located are M Street SW/southbound off-ramp from South Capitol Street (AM peak hour), and westbound Virginia Avenue SE at 3rd Street SE/on-ramp to the Southeast Freeway. At other intersections, individual approaches may operate at undesirable LOS, but overall intersection LOS would be at D or better.

5.2 2016 NO-BUILD CONDITIONS

The analysis indicates that most study area intersections will operate at acceptable LOS, even as the area continues to redevelop. However, the number of signalized intersections operating at undesirable LOS will increase from two to five over Existing Conditions. These intersections are listed below, with the peak period where operations would be undesirable shown in parentheses.

- Ramps from the Southeast Freeway at southbound South Capitol Street (AM).
- South Capitol Street at M Street SE – SB Intersection (AM and PM).
- South Capitol Street at M Street SE – NB Intersection (AM and PM).
- M Street SE at 1st Street SE (AM and PM).
- M Street SE at 11th Street SE (PM). Note that the intersection is being upgraded as part of the 11th Street Bridge project, during which the configuration will change.
- Virginia Avenue SE WB at 3rd Street SE, north of the Southeast Freeway (PM).

It is important to note that this degradation of LOS for the 2016 No-Build conditions is due to continued developed in the study area, and not due to this project or other roadway projects in the area.

5.3 CONSTRUCTION PHASES

The short-term detours phase will have some impact to traffic as 3rd and 7th Streets SE will be closed temporarily to allow for construction of the temporary decking. These roadways will not be closed at the same time. Other temporary decking at 4th, 5th, 8th, 9th, and 11th Streets SE will be constructed to maintain at least one-lane in each direction. Nighttime closures may be possible, but as traffic volumes are much lower in the nighttime, the impacts are negligible.

The north-south routes will be maintained during the three long term phases, and the eastbound off-ramp will be maintained.

Concurrently to this project, the 11th Street Bridge project will permanently close the 9th Street SE ramp, and close the 8th Street SE ramp for as long as a year as the new ramp is constructed. The M Street Diversion Sewer project will reduce the number of lanes on M Street SE as the sewer lines are constructed. The analysis for this project considers those ramp closures and lane closures.

5.3.1 PHASE 1A

This phase, which closes Virginia Avenue SE from 2nd to 5th Streets SE, and from 8th to 9th Streets SE, would reduce the number of travel lanes on Virginia Avenue SE to two lanes, but no significant traffic impacts were identified. Traffic using Virginia Avenue SE to the west of 5th Street SE is diverted to K or L Streets SE. Note that the 11th Street Bridge project closes the 8th Street SE ramp (Ramp E-2) for reconstruction, and permanently closes the 9th Street SE ramp. Those actions divert traffic to the 8th and M Streets SE intersection. It is recommended that signal timing plans be modified to improve operations at impacted intersections. This is applicable to Alternatives 2 and 3.

5.3.2 PHASE 1B

For this phase, the 11th Street Bridge project would reopen the 8th Street SE ramp (Ramp E-2). Slight changes in operations would occur along 8th and M Streets SE. It is recommended that signal timing plans be modified to improve operations at impacted intersections. This is applicable to Alternatives 2 and 3.

5.3.3 PHASE 2

Virginia Avenue SE on the south side of the Southeast Freeway would be closed during this stage, and all traffic from the freeway ramp would be diverted to turn left at the end of the ramp, where it would then pass under the freeway to the intersection of Virginia Avenue SE/6th Street SE (north side of the freeway). Virginia Avenue SE (north side of the freeway) would be converted to two-way operations from 6th to 8th Streets SE. Vehicles would then be able to turn right at 7th or 8th Streets SE to reach their destinations as before. Signal timing plans modifications would be needed at the three Virginia Avenue SE intersections to the north of the freeway to accommodate the two-way operations. This is applicable to Alternatives 2, 3, and 4.

5.4 ULTIMATE STATE

The traffic analysis shows that the number of travel lanes can be reduced on Virginia Avenue SE. Both 2015 and 2040 conditions were assessed. This benefits the study area as new parking spaces could be constructed and/or there could be an increase in green space. As the intersections are reconfigured, new signal timing plans should be implemented. The recommended configuration for Virginia Avenue SE:

- The intersections of Virginia Avenue SE at 5th Street SE and off-ramp/6th Street SE are combined into a single intersection (3-phase signal). From a visual appearance, this would look similar to the configuration of southbound South Capitol Street, ramp from M Street SE and N Street SE. The off-ramp retains its through-only lane and a shared through-left lane configuration.
- The existing one-way operation of Virginia Avenue SE from 8th to 9th Streets SE would be converted to two-way operations. The number of lanes on Virginia Avenue SE could be reduced:
 - For the short-term, the number of lanes needed from 4th to 5th Street SE is one, but eventually, a left turn lane is needed at the intersection to accommodate the long term growth in the area. Therefore it is recommended to construct the left turn lane, but stripe it out until needed.
 - Reduce the number of lanes on Virginia Avenue SE to three from the off-ramp to 8th Street SE. In the interim years, the section from the off-ramp to 7th Street SE needs two lanes; during this period, the third lane could be a temporary parking lane, with the long term intention of becoming a travel lane during the peak periods.

Improvements described above would benefit pedestrians and cyclists as facilities are improved and crossing distances across Virginia Avenue SE are shortened.

5.5 NATIONALS PARK OPERATIONS

This project will have no impact to the game-day operations, as traffic operations to South Capitol Street and M Street SE near the ballpark are not impacted from the Virginia Avenue Tunnel Project. Some traffic may exit at the 6th Street SE off-ramp from the Southeast Freeway; this traffic can use the same detours as regular traffic. The short-term closures will occur during the third quarter of 2013, so some increase in travel time may be felt by the ballpark patrons if they travel in this area. As the construction progresses, the Construction Team should provide updated information of the construction activities, so that the Nationals Park executives and others can provide ballpark patrons with appropriate information.

5.6 FRIDAY EVENING PARADES, MARINE BARRACKS, 8TH AND I STREETS SE

The Evening Parade, a concert by the U.S. Marine Band, Silent Drill Team & Bugle Corps, is held Friday evening (8:00 PM) during the summer (May through August) at the Marine Barracks located at 8th and I Streets SE, Washington, DC 20390-5000. Guests can park at Maritime Plaza, where a free shuttle service is provided to and from the Barracks. The temporary decking on 7th and 8th Streets SE would not be constructed at the same time, so 8th

Street SE would be fully operational when 7th Street SE is closed for that temporary decking. When 8th Street SE is reduced in lane-width for construction of the temporary decking, 7th Street SE would be open. Slight increases in travel time may result to the Parade's guests.

5.7 TRANSIT OPERATIONS

As no WMATA buses travel on the roadways that will be closed for the construction of the temporary decking, there are no impacts to transit.

5.8 OTHER MOT ISSUES

Coordination with the 11th Street Bridge project is important as both projects close different segments of roadways at various stages. The M Street Diversion Sewer project has plans to reduce the number of lanes on M Street SE from 10th to 7th Streets SE to two lanes in each direction. The construction phases for the Virginia Avenue SE reconstruction project will not impact the 11th Street Bridge project, or the M Street Diversion Sewer project. If the Virginia Avenue Tunnel project modifies the MOT sequencing/plans due to unexpected conditions in the field, the Construction Team should inform the construction teams of the other projects. Likewise, if either of the other projects modifies its MOT sequencing/plans, they should inform the Virginia Avenue Tunnel Construction Team so this project can make necessary adjustments if needed. DDOT should ensure that any signal timing plans adjustments are incorporated as needed to ensure smooth traffic operations between the various areas under reconstruction.

A FIGURES

Figure A-1: Location of Counts within the Study Area

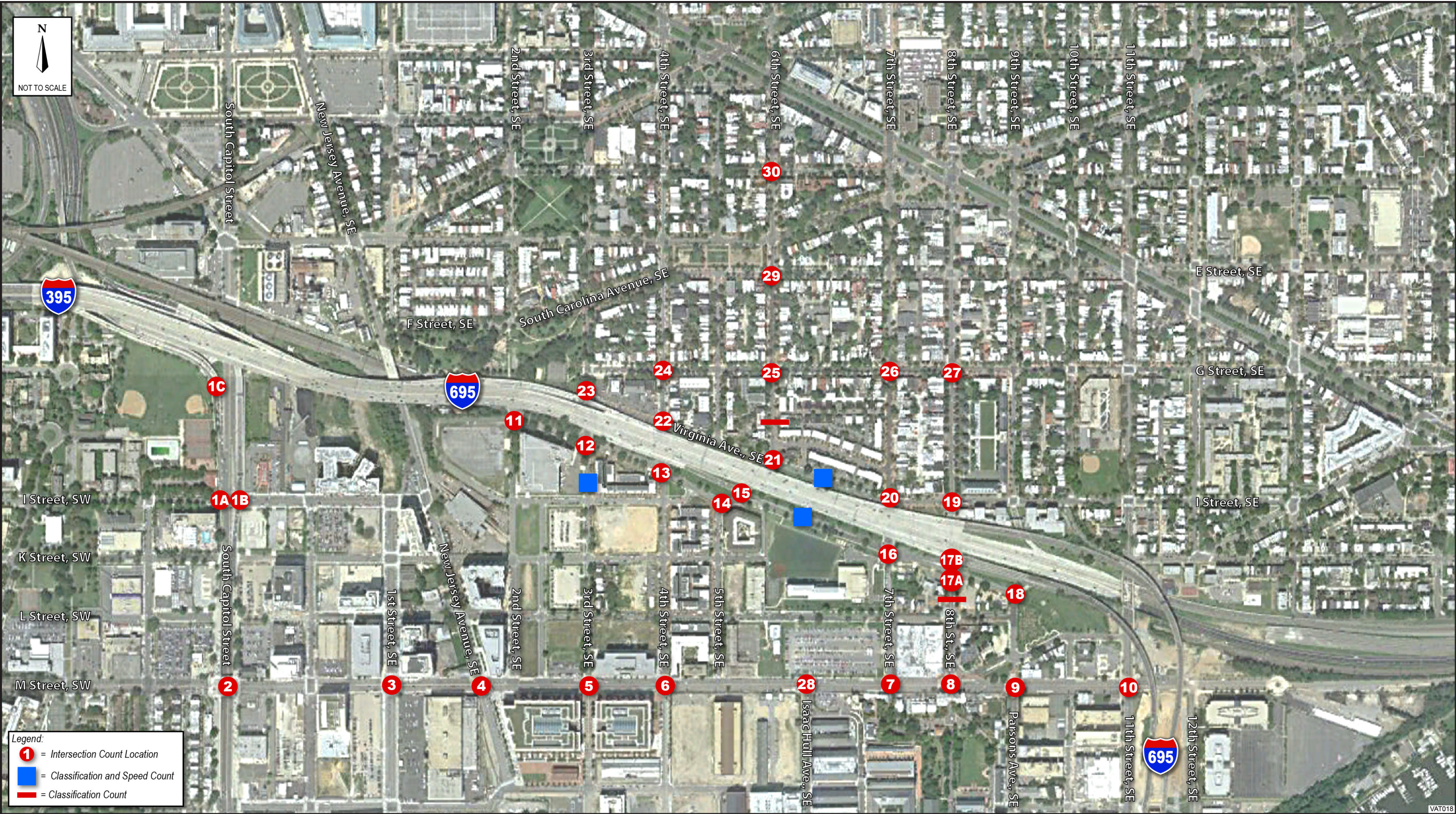


Figure A-2: Traffic Control Devices



Figure A-3: On-Street Parking and Restrictions

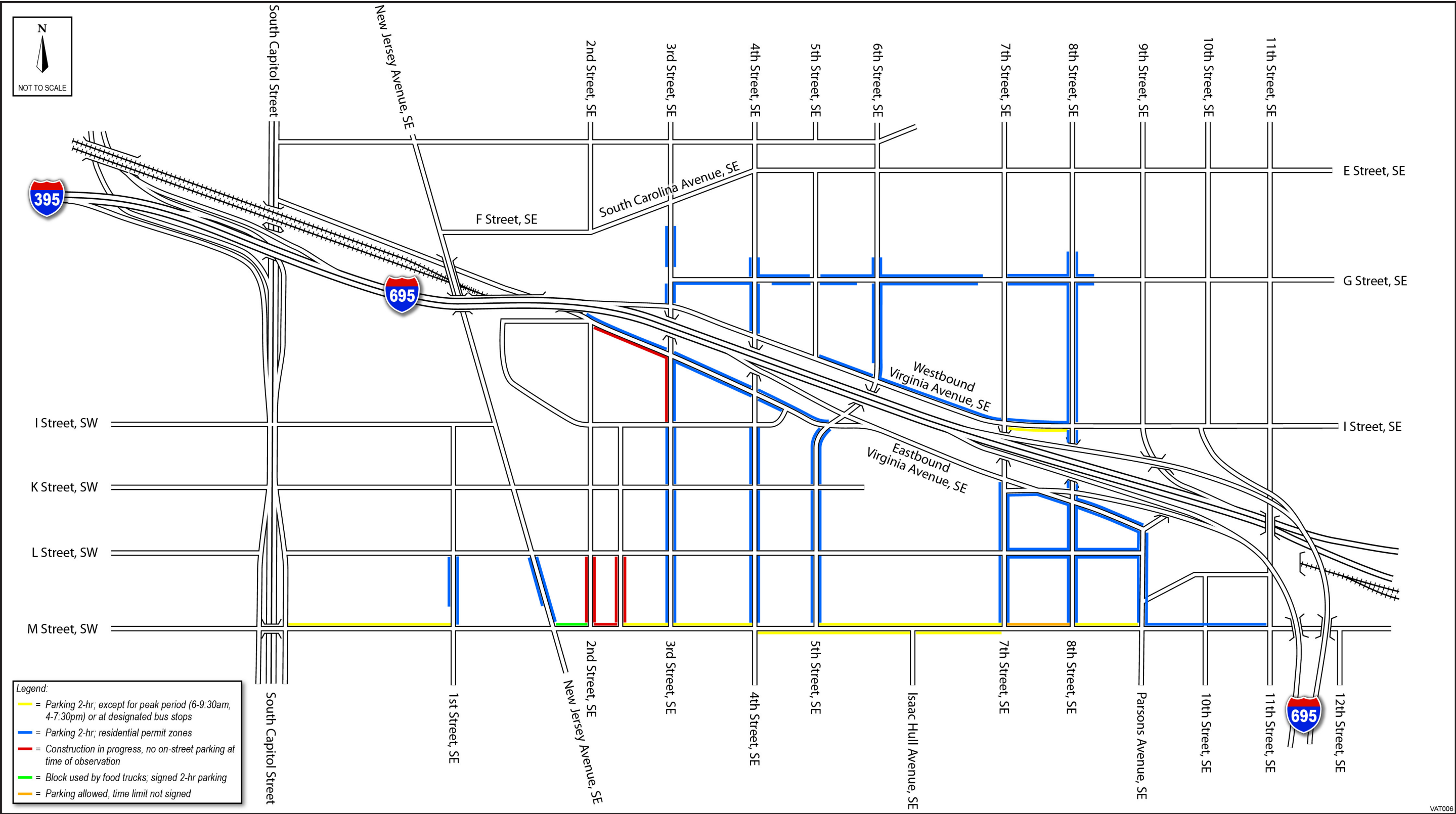


Figure A-4: Nationals Ballpark Parking Lots



Figure A-5: Marked Crosswalks



Figure A-6: Bike Lanes and Bus Stops



Figure A-7: Bus Routes Serving the Study Area

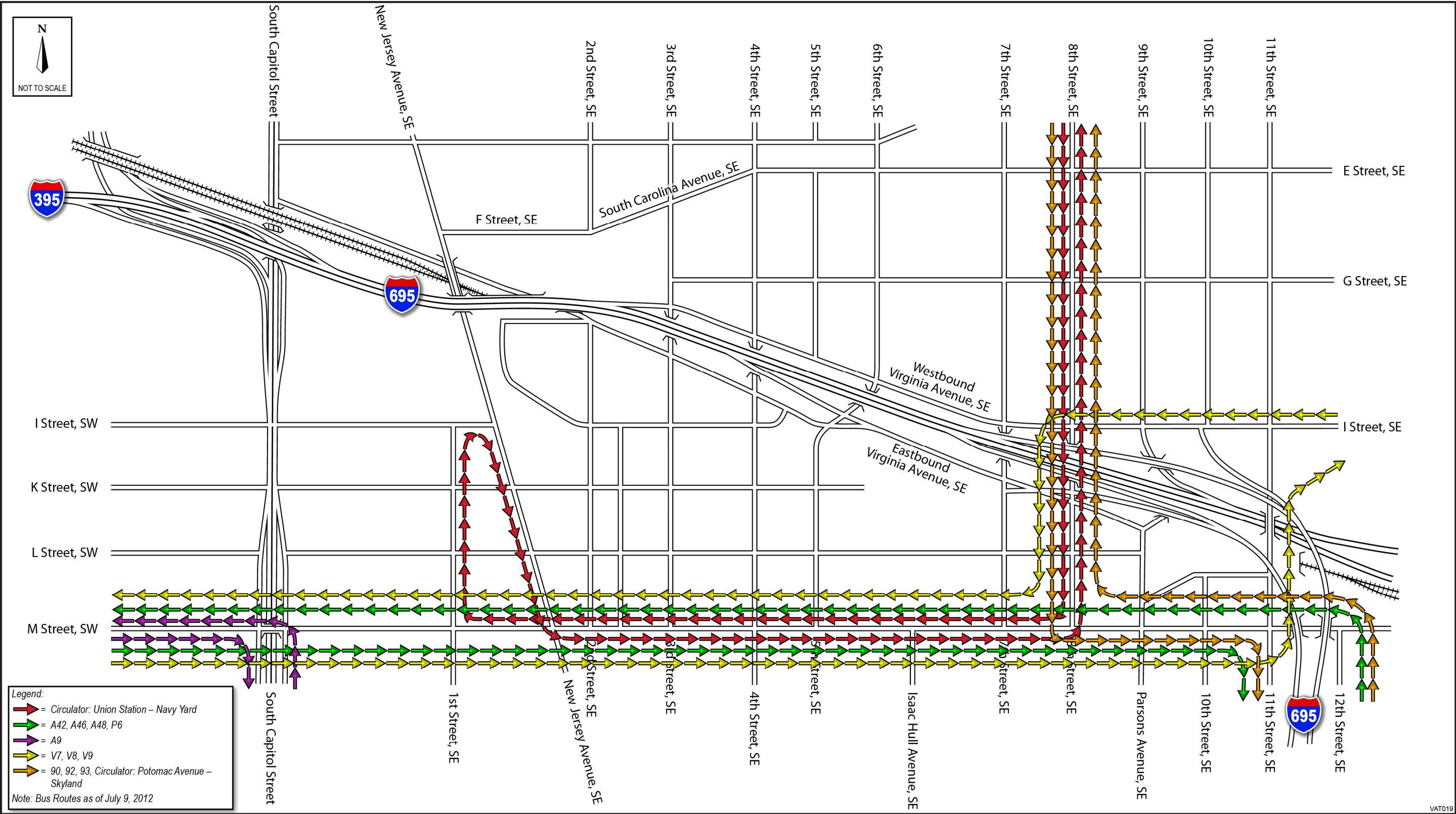


Figure A-8: Aerial view of South Capitol Street at I Street (including ramp from SW Freeway) and Snapshot of Synchro Network



Figure A-9: Aerial view of Eastbound Virginia Avenue at 8th Street (including ramp from SW Freeway) and Snapshot of Synchro Network



Appendices

B, C, and D

Not

Included

E I STREET EXTENSION

Extension of I-Street – List of Benefits and Issues

2012-October-09

Background

The purpose of this memorandum is to summarize issues and potential benefits related to the possible extension of I Street SE to 5th/6th Streets SE to connect directly to Virginia Avenue, SE. DDOT is considering this change as part of an overall concept for a continuously connected I Street SW/SE that would extend from Maine Avenue SW to 5th Street SE, with I Street extending onto eastbound Virginia Avenue. [Note that the construction of a block of I Street SE that would close the current gap between 2nd Street SE and New Jersey Avenue SE is being performed as part of redevelopment associated with a new apartment building.] One of the benefits of providing a continuous I Street is that it provides a more fully integrated and complete grid system (including the potential for an alternative continuous east-west route to M Street SW/SE). Two possible ways to extend I Street were assessed as part of this effort:

1. Extending I Street to 5th Street as the fourth leg of the intersection, while maintaining the geometry proposed originally for the intersection, or
2. Extending I Street to 5th Street, and terminating Virginia Avenue at I Street (reverse of existing configuration).

This technical brief develops the pros/cons of both configurations.

1) Extending I Street to 5th Street as the fourth leg of the intersection

Pros:

- Both Virginia Avenue and I Street connect to 5th Street, thereby removing the need for vehicles to perform dog-leg maneuvers.
- More closely matches the original L'Enfant plan.

Cons:

- A four ring signal (which would be required for adding an additional leg to the intersection) tends to result in high delays; of particular concern is the effect of this additional delay on the intersection leg that serves as the off-ramp from the interstate. FHWA would require any modifications to the intersection to favor the offramp, such that the conditions on the ramp to be as good as or better than conditions in the pre-reconfiguration state.
 - A new signal timing plan would be needed but, as noted above, it needs to ensure that the offramp does not spill back onto the interstate. The off-ramp intersection leg currently has a significant portion of the green time (more than 60%).
 - The pedestrian “walk” and “flash don’t walk” intervals may require significant portions of the green time for adequate crossing times, thereby reducing green

time for the off-ramp. This may drive the need for a longer cycle length at this location, but such a change would impact other signals in the area because of the need to maintain a uniform cycle length for progression between signals.

- Loss of green space compared to the originally proposed configuration.
- There would be a loss of existing green space in front of the housing development between 4th and 5th if I Street was extended.

A schematic of the intersection and its phasings is presented at the end of this brief for the 4-phase split ring layout.

2) Extending I Street to 5th Street, and terminating Virginia Avenue at I Street

Pros:

- A three ring signal is more likely to be sufficient at the intersection, with the west leg of Virginia Avenue terminating at I Street.
- Volumes are minimal on Virginia Avenue; as such, the impacts would be negligible to traffic.
- This option would preserve more green space than the other configuration.

Cons:

- Virginia Avenue is not continuous; thereby not matching the original L'Enfant plan.
- Although there is more green space, all of it would be on the north side of I Street, requiring people to cross the street to access the green space.
 - Note that the originally proposed configuration, which ends I Street at 4th Street, increases the green space compared to the existing configuration and this space is south of the roadway.
 - There would be a loss of existing green space in front of the housing development between 4th and 5th if I Street was extended.

A schematic of the intersection and its phasings is presented at the end of this brief for the 3-phase split ring layout.

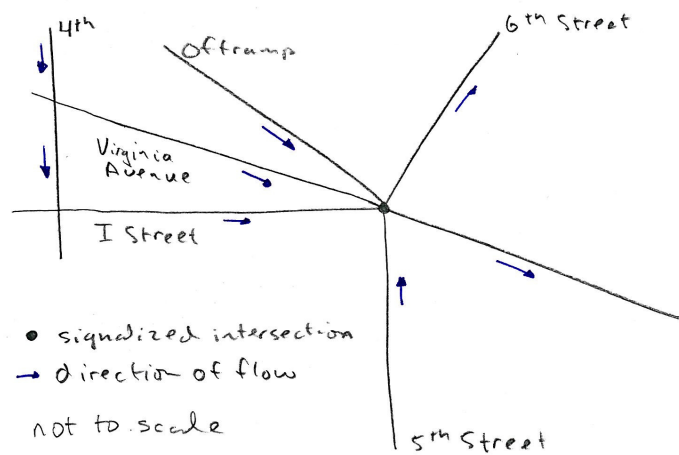
Summary

Extending I Street to 5th Street will have its benefits, as overall circulation in the areas south of the I-695/Southeast Freeway may be improved. There are issues and resulting consequences to the change. The tie-in of the offramp will remain the critical piece, as FHWA would require that any geometric and operational changes at the intersection to favor the offramp traffic so to prevent queue spillback onto the freeway. The list of issues contained in this brief should be considered in moving the concept of extending I Street forward. It is important to note that detailed traffic analysis has not yet been completed.

Potential roadway configurations and signal phasing

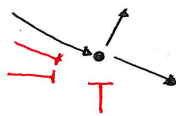
4-phase split ring

- assumes both Virginia Avenue and I Street connect to 5th.

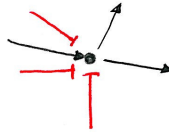


Phasing for 4-phase split ring

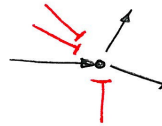
① offramp phase



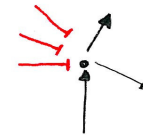
② Virginia Avenue phase



③ I Street phase



④ 5th Street phase

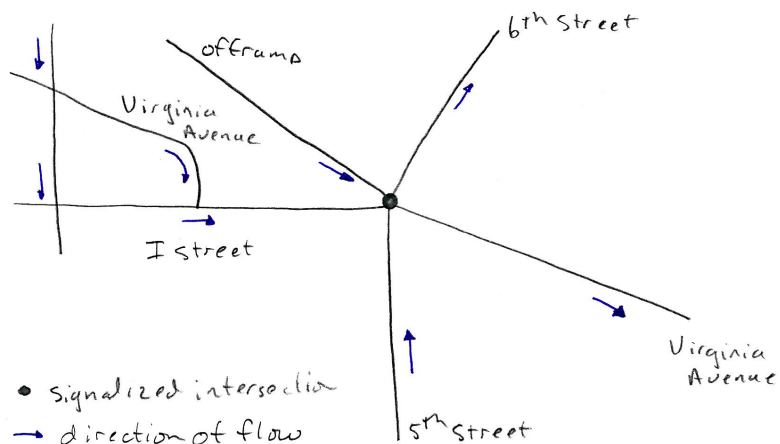


→ movement

— approach under red phase

3-phase split ring

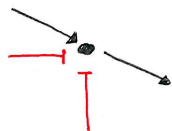
- assumes Virginia Avenue to end at I Street



not to scale

Phasing for 3-phase split ring

① off-ramp phase



② I Street phase



③ 5th Street phase



→ movement

— approach under red phase

CLARK/PARSONS, JOINT VENTURE

100 M Street SE, Suite 1200
Washington, DC 20003
Phone: 202-775-3300 • Fax: 202-775-3420

Virginia Avenue Tunnel Reconstruction Project
Traffic Operational Analysis Report, September 2013
ERRATA SHEET – April 2014

The *Traffic Operational Analysis Report* in support of the Virginia Avenue Tunnel Reconstruction Project in Washington, DC was prepared in September 2013. The following table identifies errata from the September 2013 report and associated replacement text.

Location (<i>Modification</i>)	Original Text	Replacement Text
Page 1-1, 2 nd Paragraph, 1 st Sentence <i>(Add 5th Street SE to sentence)</i>	During the proposed closure of Virginia Avenue SE, the north-south movements along 3rd Street SE, 4th Street SE, 7th Street SE, 8th Street SE, and 11th Street SE will be maintained via temporary decking; this will maintain north-south circulation of vehicular, pedestrian, and bike traffic on these five roadways.	During the proposed closure of Virginia Avenue SE, the north-south movements along 3rd Street SE, 4th Street SE, 5th Street SE, 7th Street SE, 8th Street SE, and 11th Street SE will be maintained via temporary decking; this will maintain north-south circulation of vehicular, pedestrian, and bike traffic on these six roadways.
Page 1-1, 2 nd Paragraph, 2 nd and 3 rd Sentences <i>(Delete 2nd sentence; remove 5th Street SE from 3rd sentence.)</i>	Temporary decking will also be constructed along 5th Street SE to maintain pedestrian and bike traffic only. The intersections of Virginia Avenue at 2nd Street SE and at 5th Street SE will be closed during the construction period.	The intersection of Virginia Avenue at 2nd Street SE will be closed during the construction period.
Page 3-3, Section 3.2.2, 3 rd Sentence <i>(Remove 9th Street SE from sentence.)</i>	The temporary decking for 4th, 8th, and 9th Streets SE will be constructed one at a time so that only one of these roadways would be affected at any given time.	The temporary decking for 4th and 8th Streets SE will be constructed one at a time so that only one of these roadways would be affected at any given time.
Page 5-2, Section 5.3, 3 rd Sentence <i>(Remove 9th Street SE from sentence.)</i>	Other temporary decking at 4th, 5th, 8th, 9th, and 11th Streets SE will be constructed to maintain at least one-lane in each direction.	Other temporary decking at 4th, 5th, 8th, and 11th Streets SE will be constructed to maintain at least one-lane in each direction.

