

# APPENDICES

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# APPENDIX A: PINCH POINT ANALYSIS SUMMARY TABLE

## South Capitol Street/Overlook Avenue Trail Pinchpoint Analysis

Location	Length	Description		Existing Conditions									Future Conditions				
				Available Width (ft)	Shoulder Width (ft)	Number of Lanes	Lane Widths (ft)	Nature of Capacity Reduction Measures	Constraints/ Comments	Existing Traffic Operations			2020 No-Build Intersection Capacity Analysis (existing geometry with forecasted traffic volumes)				
										LOS AM (PM)	Delay and Speed AM (PM)	v/c ratio or density AM (PM)	Delay and Speed AM (PM)	v/c ratio or density AM (PM)	LOS AM (PM)		
1	400 ft	Approximately 400 ft north of Overlook Avenue and Laboratory Road/I-295 NB off-ramp to the connection with Shepherd Parkway under I-295 bridge structure		7	NA	2SB-1NB & 2 SB-2NB	12-14	- None	- Bus stops - Military Base Wall - Existing 4' sidewalk	B ( C )	13.4 sec. ( 20.9 sec. )	0.47 ( 0.65 )	13.8 (21.1)	0.48 (0.70)	B ( C )		
2	200 ft	South of South Capitol Street and Defense Boulevard (S) (from curb return to approximately 200 ft to the south)		9	NA	3 SB	12	- Reduce qty of lanes - Reduce lane widths	- Military Base Wall - Bus stop - Guard Rail - Existing 4' sidewalk	B ( B )	13.6 sec. ( 15.8 sec. )	0.36 ( 0.42 )	13.8 (15.5)	0.39 (0.47)	B ( B )		
3	3,500 ft	South Capitol Street and Overlook Avenue diverge gore (from gore point to Overlook Avenue and Defense Boulevard (S) intersection located approximately 4000 ft to the south)	3.1	800 ft	from Defense Blvd./Overlook Ave to 300 ft north	12	NA	3 SB	11	- Reduce storage for Rt turn - Reduce to two lanes	- Military Base Wall	B ( C )	10.6 sec (21.8 sec)	0.45 (0.68)	10.8 (14.8)	0.45 (0.76)	B ( B )
			3.2	1,400 ft	from Overlook Ave/ I-295 gore point to 300 ft north of Defense Blvd/Overlook Ave intersection	9	NA	2 SB	11	- Reduce to one lane -Install yield control for Overlook Slightly modify how gores overlap	- Light poles, signs & utilities - Military Base Wall	B ( B )	13.6 sec (15.8 sc)	0.36 (0.42)	13.8 (15.5)	0.39 (0.47)	B ( B )
			3.3	1,300 ft	from South Capitol St/Overlook Ave. gore point to Overlook Ave/ I-295 gore point	12	NA	1 SB	23	- Reduce single lane width	- Light poles, signs & utilities - Military Base Wall -Ramp rgrs 18-19' width	A ( B )	43.6 mph (49.2 mph)	6.9 pc/mi/ln ( 16.1 pc/mi/ln )	47.4 (46.1)	9.0 (13.0)	A ( B )
4	250 ft	North of South Capitol Street and Overlook Avenue diverge gore (from gore point to approximately 400 ft north of gore point)		6	NA	3 SB lanes north of merge, to one ramp lane	11	- Reduce to two lanes	- Light poles, signs & utilities - Military Base Wall	A ( B )	43.6 mph ( 49.2 mph)	6.9 pc/mi/ln ( 16.1 pc/mi/ln )	46.8 (44.8)	6.4 (10.1)	A ( F )		
5	550 ft	South of South Capitol Street and Malcolm X Boulevard intersection (from curb return to approximately 550 ft to the south)		8	NA	2 SB lanes on ramp	11	- Reduce to one lane but bus stop will block that lane, at the north end of the ramp. Ramp ultimately merges to one lane	- Bus stop and sidewalk - Existing 4' sidewalk - Military Base Wall	B ( B )	18.7 sec. ( 13.8 sec. )	0.77 ( 0.45 )	30.7 (14.0)	0.98 (0.55)	C ( B )		
6	300 ft	Approximately 300 ft north of South Capitol Street and Malcolm X Boulevard intersection		4.5	NA	3 SB lanes on ramp	11	- Reduce taper and storage length - Reduce qty of SB Lanes	- Military Base Wall	B ( B )	18.7 sec. ( 13.8 sec. )	0.77 ( 0.45 )	30.7 (14.0)	0.98 (0.55)	C ( B )		
7	200 ft	Approximately 100 ft south of I-295 SB on-ramp merge gore to South Capitol Street		18	5	2 SB	11	- Reduce to one lane SB	- Military Base Wall	B ( C )	25.4 mph ( 22.7 mph )	--	42.3 (42.3)	-	B ( B )		
8	200 ft	Intersection of Defense Blvd (N), South Capitol St. & Firth Sterling Blvd. (Light Rail alignment 140+50)		0	NA	3 NB, 2 SB	11	- Remove NB left turn lane	- Future Light Rail Stop at Northeast corner of S.Capitol Intersection (28' train track to curb)	C ( C )	22.6 sec. ( 23.6 sec. )	0.54 ( 0.58 )	24.7 (25.8)	0.72 (0.69)	C ( C )		

**Notes:**

NB = North Bound

SB = South Bound

Trail Separation = Distance from edge of trail towards a roadway

Trail Buffer = Distance from edge of trail towards an outside obstruction

Location	Proposed Alternative A								Proposed Alternative B								Recommended Alternative
	Description	Available Width (ft)	Alternative Traffic Operations			Future 2020 Intersection Capacity Analysis			Description	Available Width (ft)	Alternative Traffic Operations			Future 2020 Intersection Capacity Analysis			
			LOS AM (PM)	Delay and Speed AM (PM)	v/c ratio or density AM (PM)	Delay and Speed AM (PM)	v/c ratio or density AM (PM)	LOS AM (PM)			LOS AM (PM)	Delay and Speed AM (PM)	v/c ratio or density AM (PM)	LOS AM (PM)			
1	- Avoid pinch point with a mid-block crossing and locate 10' trail on east side of Overlook Ave	10	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			- Retain ex. config and use existing sidewalk (could remove one NB thru lane)	7	B ( C )	13.0 sec. ( 21.3 sec. )	0.47 ( 0.66 )	13.7 (21.1)	0.49 (0.71)	B ( C )	A
2	- Reduce to two 11' lanes w/ 10' trail, 8' separation, 3' buffer	21	B ( B )	15.4 sec. ( 17.1 sec. )	0.49 ( 0.60 )	17.3 (18.0)	0.54 (0.68)	B ( B )	- Retain three 11' lanes w/ 6' trail, 4' separation, 2' buffer	12	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A or B
3	3.1 - Reduce to two 11' lanes w/ 10' trail, 10' separation, 3' buffer	23	B ( B )	10.5 sec (18.1 sec)	0.45 (0.68)	10.7 (13.3)	0.45 (0.76)	B ( B )	- Retain ex. config w/ 6' trail, 4' separation, 2' buffer	12	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A
	3.2 - Reduce to single 18' lane w/ 8' trail, 5' separation, 2' buffer	15	B ( B )	15.4 sec (17.1 sec)	0.49 (0.60)	17.3 (18.0)	0.54 (0.68)	B ( B )	- Retain ex. config w/ 6' trail, 3' separation, no buffer	9	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A
	3.3 - Reduce to 18' lane w/ 10' trail, 5' separation, 2' buffer	17	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			- Retain ex. config w/8' trail, 4' separation, no buffer	12	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A
4	- Reduce to 2 lanes w/ 10' trail, 5' separation, 2' buffer	17	A ( B )	47.1 mph ( 47.0 mph)	6.2 pc/mi/ln ( 19.1 pc/mi/ln )	46.8 (44.8)	6.4 (10.1)	A ( F )	- Retain ex. Config w/6' trail	6	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A
5	- Reduce to 18' lane w/ 8' trail, 2' buffer, 4' separation/bus stop, potentially move bus stop	14	same as existing traffic operations			30.7 (14.0)	0.98 (0.55)	C ( B )	- Retain ex. config w/ 8' trail & relocate bus stop	8	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			A
6	- Reduce storage length w/ 8'-10' trail, 1'-5' separation, 1' buffer	10	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			- Reduce to 2 lanes w/ 10' trail, 4'-8' separation/bus stop, 2' buffer	16	B ( B )	19.9 sec. ( 15.6 sec.)	0.80 ( 0.52 )	54.3 (17.8)	1.06 (0.69)	D ( B )	B
7	- Reduce to 1 lane w/ 10' trail, 9' separation, 10' buffer	29	C ( E )	23.6 mph ( 21.9 mph)	--	41.3 (41.1)	-	C ( C )	- Retain ex. config w/ 10' trail, 5' separation, 3' buffer	18	same as existing traffic operations			same as 2020 No-Build Intersection Capacity Analysis			B
8	- Reduce quantity of lanes to 2NB/ 2SB w/10' trail on westside of S.Cap.	11	C ( C )	23.0 sec. ( 23.6sec.)	0.60 ( 0.58 )	24.7 (25.8)	0.72 (0.69)	C ( C )	- Reduce quantity of lanes to 2NB/ 2SB and shift roadway east 15' w/10' trail, 2' buffer to lt rail, 13' separation/bus stop on westside of S.Cap	24	C ( C )	23.0 sec. ( 23.6sec.)	0.60 ( 0.58 )	24.7 (25.8)	0.72 (0.69)	C ( C )	A

**SOUTH CAPITOL STREET/OVERLOOK AVENUE TRANSPORTATION STUDY**

**I. INTRODUCTION**

The objective of this project is to develop a concept plan for the design of a trail alignment along South Capitol Street/Overlook Avenue in Southeast Washington, D.C. The purpose of this transportation study is to document existing, no-build, and build traffic conditions in the study area from Laboratory Road and DC Village north along Overlook Avenue/South Capitol Street to Defense Boulevard, NW and Firth Sterling Blvd. Analyses and evaluations as a part of this study provide an overview of the South Capitol Street and Overlook Avenue existing roadway geometry, traffic volumes, signal timing, phasing and travel time and delay data. An evaluation of the proposed trail design alternatives at locations along the trail alignment which create pinch points between existing features and South Capitol Street/Overlook Avenue have been analyzed to document the advantages/disadvantages of each scenario.

**II. STUDY AREA**

The study area for this project is located within the boundaries of Ward 8 in the southeast quadrant of Washington, D.C. Interstate 295 runs parallel to the South Capitol Street and Overlook Avenue on the eastern side of the corridors, Anacostia Naval Station & Boiling Air Force Base is situated to the west, and Barry Farm, St. Elizabeth’s Campus, Congress Heights, Bellevue, and Washington Highlands neighborhoods are situated to the east of the corridor.

**III. Existing Roadway Network**

Geometric data such as number of lanes, lane configuration, storage lengths, tapers and distances between intersections were field-measured and recorded. These measurements were cross-referenced to the aerial photography of the study area roadways and intersections. Additionally, traffic regulations such as turn restrictions, speed limits, and parking regulations were also noted. **Figure 1** illustrates the lane configurations at the study intersections.

Several major roadways extend through the study area and all influence the transportation network within the study area. Each is roadway with functional classification and other key characteristics of the roadway network are discussed below and summarized in **Table 1**.

*I-295 (Anacostia Freeway)* (Interstate highway) (50 mph), generally runs north-south within the study area. This I-295 section of the Anacostia Freeway also connects northeastward with the DC 295 section of the Anacostia Freeway/Kenilworth Avenue corridor, providing access to the Baltimore Washington Parkway.

*Firth Sterling Avenue* is a four-lane collector road (25 mph) that runs southwest to northeast from South Capitol Street to Howard Rd. This road is a main route for motorists and pedestrians traveling between the Anacostia Naval Support Facility, the Anacostia Metrorail station, Historic Anacostia and the Barry Farm neighborhood.

*South Capitol Street/Overlook Avenue* is classified as an expressway south of M Street and along the Frederick Douglass Memorial Bridge over the Anacostia River, where it continues south, parallel to I-295 (Anacostia Freeway). The classification of the roadway changes from expressway to minor arterial south of the South Capitol Street and Firth Sterling Avenue, SE

intersection. The posted speed limit is 35 mph north of Firth Sterling Avenue and 40 mph south of Firth Sterling Avenue.

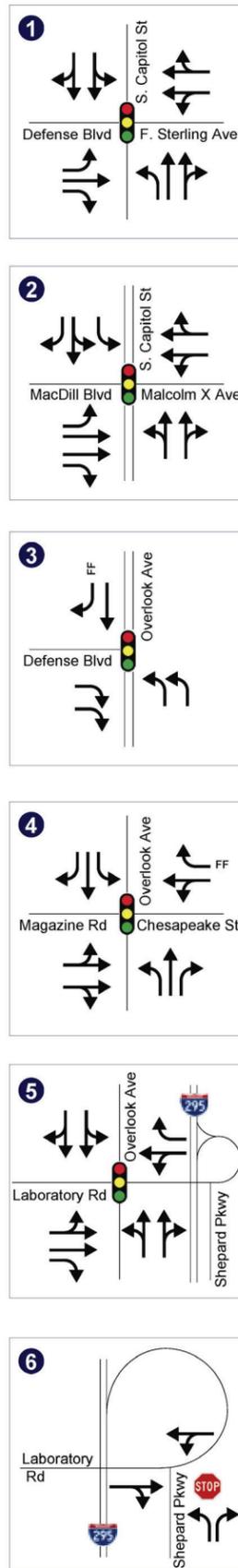
*Malcolm X Avenue* is a two to four-lane urban minor arterial (30 mph) that runs east-west and extends from 8th Street on the east, across MLK Avenue to South Capitol Street. Malcolm X connects directly with the main entrance gate of the Bolling Air Force Base at South Capitol Street. Parking is allowed on both sides of Malcolm X Avenue east of the I-295 on/off ramps.

*Defense Boulevard (South and North), MacDill Boulevard, Magazine Road, and Laboratory Road* (25 mph) are all local access and internal circulation roads connecting the Anacostia Naval Air Station and Bolling Air Force Base to South Capitol Street/Overlook Avenue.

*Chesapeake Street* is a local road (25 mph) connecting to Magazine Road and South Capitol Street at the entrance to Bolling Air Force Base.

**Table 1.** Key Characteristics of the Study Area Roadway Network

Roadway	Classification	AADT	# of Lanes	Speed Limit (mph)	Divided/ Access Control	On-street Parking
I-295 (Anacostia Freeway)	Interstate	82,000	5/6	50	Yes/Yes	No
Firth Sterling Avenue	Collector	10,500	4	25	No/No	Yes
South Capitol Street	Major Arterial	26,000	4/5	35/40	Partial/No	No
Overlook Avenue	Minor Arterial	13,000	2	25	Partial/No	No
Malcolm X Avenue	Minor Arterial	12,500	2/4	30	No/No	Yes
Defense Boulevard	Major Collector	N/A	4	25	No/No	No
MacDill Boulevard	Local	N/A	2/4	25	Partial/No	No
Magazine Road	Local	N/A	2	25	Partial/No	No
Laboratory Road	Local	N/A	2	25	Yes/No	Yes
Chesapeake Street	Local	2,200	2	25	No/No	Yes



**Figure 1. Study Area Intersection Lane Configurations**

**III. Existing Traffic Conditions**

Within the study area turning movement count data was collected at six locations on typical weekdays (i.e., Tuesday, Wednesday, Thursday) during the AM (6:30 – 9:00) and PM (4:00 - 7:00) peak periods to verify current traffic conditions. Turning movement counts consisted of left turns, through, right turns as well as pedestrian and bicycle movements for each approach in 15-minute intervals.

The six locations where traffic data was collected were:

1. Laboratory Road and Shepherd Parkway
2. Overlook Avenue and Laboratory Road/I-295 NB off-ramp
3. Overlook Avenue and Magazine Road/Chesapeake Street
4. Overlook Avenue and Defense Boulevard (S)
5. South Capitol Street and Malcolm X Avenue/MacDill Blvd.
6. South Capitol Street and Defense Boulevard (N)/ Firth Sterling Avenue

The traffic data collected we cross-referenced to previous data from various transportation studies and the District Department of Transportation’s AADT publications in order to validate the traffic volumes in the area. **Table 2** shows the peak hours at the study area intersections, and additional graphics illustrating the existing peak hour volumes can be found at the end of this study. The volumes for existing AM and PM peak hours were balanced for the consistency in the model. Overall, the directional distribution varies between approximately 55% and 70% favoring the inbound (southbound) and outbound (northbound) traffic during the AM and PM peaks, respectively. Also, within the project area there was some bicycle and pedestrian traffic at most intersections, with the heaviest peak hour pedestrian volumes occurring at the intersections of South Capitol Street at Malcolm X Avenue/ MacDill Boulevard, Overlook Avenue at Laboratory Road/ I-295 NB On/Off ramps and South Capitol Street at Defense Boulevard/Firth Sterling Avenue. Each of these intersections are adjacent to the primary entrances to the military base entrances. Attached at the end of this study are **Figures 8A** and **8B** illustrating existing AM and PM traffic volumes.

**Table 2. Traffic Volumes - Intersection Peak Hours and Peak Hour Volumes**

Intersection	AM Peak Hour (vehicular)	AM Peak Intersection Volumes vehicles/(pedestrians)/[bikes]	PM Peak Hour (vehicular)	PM Peak Intersection Volumes vehicles/(pedestrians)/[bikes]
Laboratory Road and Shepherd Parkway/I-295	6:30 – 7:30	1083 (0) [1]	4:30 – 5:30	428 (0) [0]
Overlook Avenue and Laboratory Road/I-295	6:30 – 7:30	1459 (5) [2]	4:30 – 5:30	1440 (13) [1]
Overlook Avenue and Magazine Road/	6:45 – 7:45	1393 (2) [0]	4:15 – 5:15	1198 (0) [0]
Overlook Avenue and Defense Boulevard (S)	6:30 – 7:30	1198 (0) [20]	4:30 – 5:30	1040 (1) [15]
South Capitol Street and Malcolm X Avenue/	6:30 – 7:30	2105 (27) [9]	4:00 – 5:00	2246 (11) [7]
South Capitol Street and Defense Boulevard (N) /Firth Sterling Avenue	7:00 – 8:00	2295 (6) [4]	4:00 – 5:00	2406 (8) [7]

#### IV. Intersection Capacity and Level of Service

The methodology of the Highway Capacity Manual (HCM) was used to evaluate capacity for all the intersections during the AM and PM peak hours. Performance measures of effectiveness for HCM intersection analysis include level of service, delay and volume-to-capacity ratio. The level of service (LOS) is a letter designation that corresponds to a certain range of roadway operating conditions. The levels of service range from 'A' to 'F', with 'A' indicating the best operating conditions and 'F' indicating the worst, or a failing, operating condition. The volume-to-capacity ratio (v/c ratio) is the ratio of current flow rate to the capacity of the intersection. This ratio is often used to determine how sufficient capacity is on a given roadway. Generally speaking, a ratio of 1.0 indicates that the roadway is operating at capacity. A ratio of greater than 1.0 indicates that the facility is operating above capacity as the number of vehicles exceeds the roadway capacity.

The results of the intersection capacity analysis of the existing conditions indicate that all the study intersections, five signalized intersections and one unsignalized intersection are currently performing at a level of service C or better during both peak hours. The results are summarized in **Table 3**.

**Table 3.** Summary of Existing Intersection Capacity Analysis, AM (PM)

Intersection No.	Intersection	Control	Delay (secs/veh.)	V/C Ratio	Level of Service
1	I-295 NB On/Off-ramps and Shepherd Parkway <sup>1</sup>	Stop	26.0 (10.6)	0.19 (0.07)	C (A)
2	Overlook Avenue and Laboratory Road	Signal	13.4 (20.9)	0.47 (0.65)	B (C)
3	Overlook Avenue and Magazine Road/Chesapeake Street	Signal	10.6 (11.4)	0.45 (0.68)	B (B)
4	Overlook Avenue and Defense Blvd	Signal	13.6 (14.9)	0.36 (0.41)	B (B)
5	South Capitol Street and Malcolm X Avenue	Signal	11.8 (11.5)	0.33 (0.35)	B (B)
6	South Capitol Street and MacDill Blvd	Signal	18.7 (13.8)	0.77 (0.45)	B (B)
7	South Capitol Street and Defense Boulevard (N)/ Firth Sterling Avenue	Signal	22.6 (23.6)	0.54 (0.58)	C (C)

<sup>1</sup>- Stop-controlled Intersection; Level of Service, Delay, and v/c Ratio for critical movement only

#### V. Growth of Regional Traffic

In order to account for the traffic volumes with neither origin nor destination within the study area roadways, Annual Average Daily Traffic (AADT) volumes for South Capitol Street corridor were obtained from DDOT's Traffic Volume Maps (2002, 2006, and 2007). Based on the volumes shown on the DDOT Traffic Volume Maps, the following **Table 4** was developed.

**Table 4.** AADT Volumes along Study Area Roadways

Roadway	Location	2002 AADT	2006 AADT	2007 AADT
South Capitol Street	North of Malcolm X Avenue	16,300	16,800	16,900*
South Capitol Street	South of Malcolm X Avenue	11,700	14,000	13,800
Malcolm X Avenue	East of I-295/South Capitol Street	14,500	N/A	N/A
Malcolm X Avenue	West of MLK Avenue	11,700	12,200	12,300
Overlook Avenue	North of Chesapeake Street	11,700	12,200	12,500
Firth Sterling Avenue	East of I-295/South Capitol Street	9,500	9,900	10,200
Firth Sterling Avenue	West of Howard Road	11,800	12,300	12,600

\*- DDOT Traffic Volume Map shows this volume as 25,900. The volume (16,900) shown in is presumed that DDOT Map had a typographical error, since volumes on the roadway network at other corridors in the study area seem to be stable (i.e., within 1%-5% annual increase/decrease)..

In addition to the AADT volumes shown in **Table 4**, engineering judgment was used to determine the approximated 1% annual growth rate, since the area is served by I-295 and I-395 freeways, and typically, the effect of regional growth factor is absorbed by these types of facilities, and the growth in through traffic on the local arterials are considered stable (i.e., within 1% to 2% annually). Based on the 2030 traffic forecasts included in the DDOT 11<sup>th</sup> Street Bridges EIS dated 2004, traffic on 11<sup>th</sup> Street Bridge is expected to grow approximately 33%, and regional traffic on I-295 within the vicinity is expected to grow between 9% and 18%. After evaluation of the traffic growth trends along the study area roadways, a conservative 10% growth rate (approximately 1% annual growth) was applied to the existing volumes to develop the 2020 baseline traffic volumes. In order to reflect the regional traffic characteristics, growth rates were applied to the through traffic on South Capitol Street and Overlook Avenue, not to the turning movements at the intersections along these corridors.

#### Baseline Conditions (2020)

After the growth factors were applied to the study area corridors, capacity analyses were conducted to establish the baseline conditions without background developments and future roadway and/or other geometric improvements. All of the study intersections are expected to continue operating at a LOS C or better during the AM and PM peak hours as illustrated in **Table 5**.

**Table 5.** Summary of 2020 Baseline Intersection Capacity Analysis, AM (PM)

Intersection No.	Intersection	Delay (secs/veh.)	V/C Ratio	Level of Service
1	I-295 NB On/Off-ramps and Shepherd Parkway <sup>1</sup>	26.0 (10.6)	0.19 (0.07)	C (A)
2	Overlook Avenue and Laboratory Road	13.8 (21.0)	0.48 (0.69)	B (C)
3	Overlook Avenue and Magazine Road/Chesapeake Street	10.4 (14.3)	0.45 (0.74)	B (B)
4	Overlook Avenue and Defense Blvd	13.8 (15.1)	0.38 (0.44)	B (B)
5	South Capitol Street and Malcolm X Avenue	11.8 (11.5)	0.33 (0.35)	B (B)
6	South Capitol Street and MacDill Blvd	18.7 (13.8)	0.77 (0.45)	B (B)
7	South Capitol Street and Defense Blvd (N)/ Firth Sterling Ave	23.3 (24.4)	0.57 (0.61)	C (C)

**Future Conditions/ Background Developments**

Growth within the study area and traffic volumes along South Capitol Street and Overlook Avenue are expected to be as a result of trips being generated by the planned/approved new developments and/or land use changes in the area. A detailed analysis of the proposed and approved new developments, expansions, and or additions in the study area was conducted. **Table 6** shows the nearby background developments that are included for trip generation and distribution calculations, and the trip generation characteristics obtained from The DHS Headquarters Consolidation at St. Elizabeth’s - Transportation Management Program, December 4, 2008.

All of the projected trips from the background developments were assigned to the roadway network using the trip distribution percentages as included in The DHS Headquarters Consolidation at St. Elizabeth’s - Transportation Management Program (shown in **Figure 2** extracted from the St. Elizabeths FEIS).

In addition, expected new trips for Bolling AFB are distributed to the existing gates as follows:

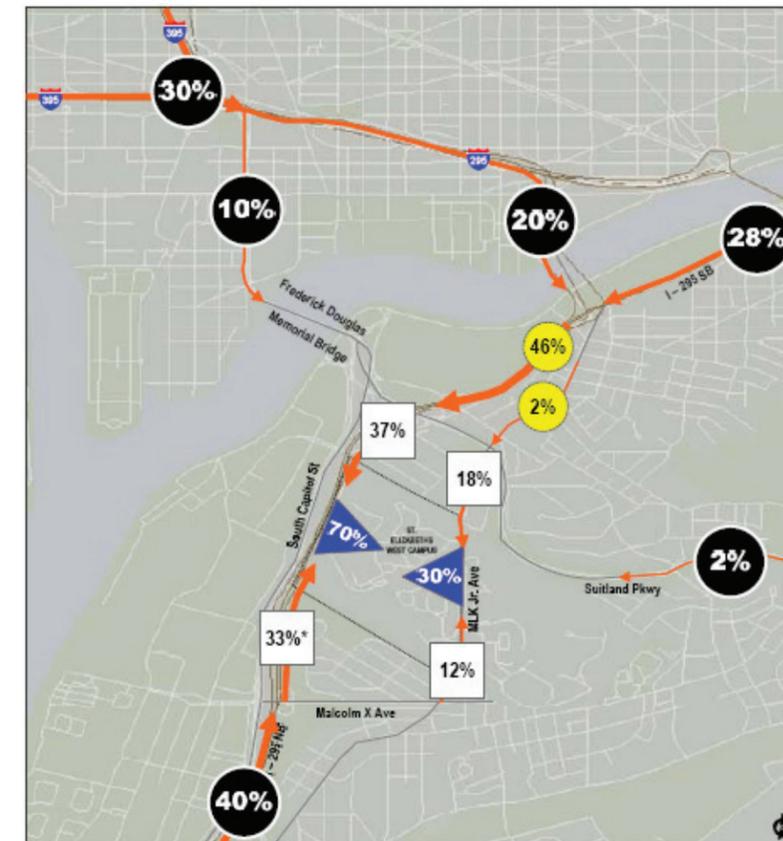
- South Capitol Street and Defense Boulevard (N)/Firth Sterling Avenue – 20%
- South Capitol Street and MacDill Blvd/Malcolm X Ave – 60%
- Overlook Avenue and Magazine Road/Chesapeake Street – 10%
- Overlook Avenue and Laboratory Road – 10%

**Table 6.** Future Conditions/ Background Development Trip Generation

Development	Land Use	ITE Code	Units	Variable	AM Peak Hour			PM Peak Hour						
					Total Trips	Entering	Exiting	Total Trips	Entering	Exiting				
Barry Farm Subdivision	Apartments	222	Dwelling	1391	443	22%	97	78%	346	507	62%	314	38%	193
Barry Farm Subdivision Trips in Study Area Network*					--	--	--	--	--	--	--	--	--	--
Bolling Air Force Base (AFB)	Government Office Complex	733	Employees	1300	793	89%	706	11%	87	1027	31%	318	69%	709
Bolling AFB Trips in Study Area Network**					397	89%	353	11%	44	514	31%	159	69%	354
St. Elizabeth’s West Campus					1532	83%	1278	16%	254	974	20%	203	79%	771
St. Elizabeth’s East Campus					349	79%	279	20%	70	243	20%	49	79%	194

\* - Trips generated by this development will use intersections that are outside of the study area

\*\* - Based on the detailed survey results and mode split analyses included in The DHS Headquarters Consolidation at St. Elizabeth’s - Transportation Management Program, December 4, 2008, 50% trip reduction (50% = 36% SOV + 3% non-AFB carpool + 10% AFB carpool + 1% drop-off) is applied to Bolling AFB trip generation to determine the number of vehicular trips.



\* Includes 28% from NB I-295 plus 5% from I-295 SB via the Malcolm X Avenue Interchange

Note: 70% of employee parking spaces will be accessed off the new West Access Road and the remaining 30% of employee parking spaces will be accessed via MLK Avenue. Employees will be assigned to park in specific locations and will be assigned to a specific gate. Security restrictions will prohibit traversing the campus. This will also ensure controlled access to specific campus gates.

**Figure 2.** Background Development Trip Distribution Percentages

### No-Build Conditions (2020)

In combination with the forecasted traffic volumes anticipated for the nearby developments, applied to the existing roadway network under existing geometry a 2020 No-build conditions evaluation was completed. Based on the results as shown in **Table 7**, all of the study intersections are expected to continue operating at LOS C or better during the AM and PM peak hours, with no noticeable deterioration in delay and v/c ratios under the 2020 No-build traffic conditions.

**Table 7.** Summary of 2020 No-Build Intersection Capacity Analysis, AM (PM)

Intersection No.	Intersection	Delay (secs/veh.)	V/C Ratio	Level of Service
1	I-295 NB On/Off-ramps and Shepherd Parkway <sup>1</sup>	27.1 (10.7)	0.20 (0.07)	C (A)
2	Overlook Avenue and Laboratory Road	13.8 (21.1)	0.48 (0.70)	B (C)
3	Overlook Avenue and Magazine Road/Chesapeake Street	10.8 (14.8)	0.45 (0.76)	B (B)
4	Overlook Avenue and Defense Blvd	13.8 (15.5)	0.39 (0.47)	B (B)
5	South Capitol Street and Malcolm X Avenue	14.0 (10.3)	0.42 (0.44)	B (B)
6	South Capitol Street and MacDill Blvd	30.7 (14.0)	0.98 (0.55)	C (B)
7	South Capitol Street and Defense Blvd (N)/Firth Sterling Ave	24.7 (25.8)	0.72 (0.69)	C (C)

### Build Conditions

A Build conditions evaluation of the study area roadway network under the proposed geometry and with the forecasted traffic volumes was completed. The build conditions analysis typically incorporates all relevant projects included within DDOT's Constrained Long Range Plan (CLRP), however since neither the 11<sup>th</sup> Street Bridge Reconstruction nor South Capitol Street Bridge Reconstruction project, which are within the study area and included in the CLRP (FY 2010-2015 Six-year Transportation Improvement Plan, approved July 15, 2009), are fully funded for construction as of the time of this study, the build conditions analyses did not include effects of these projects in the study area roadway network.

In addition, transportation improvement alternatives, as proposed in The DHS Headquarters Consolidation at St. Elizabeth's FEIS, such as interchange reconfiguration at I-295/Malcolm X Avenue interchange, access road parallel to South Capitol Street on the east side of I-295 with a frontage to the planned West Campus, and intersection improvements at the South Capitol Street/Firth Sterling Avenue, are also not included in the build conditions analyses, since neither improvement proposed in this document is funded for construction as of the time of this study. However, it should be noted that the planned and/or proposed CLRP and St. Elizabeth's FEIS improvements would potentially decrease traffic volumes within the South Capitol Street and Overlook Avenue corridors, since access to the St. Elizabeth's East and West Campus would be provided off of Firth Sterling Avenue, frontage road with access to I-295, and new ramp reconfiguration at Malcolm X Avenue.

All of the study intersections are expected to continue operating at LOS C or better during the AM and PM peak hours, with no noticeable deterioration in delay and v/c ratios, except the intersection of South Capitol Street and MacDill Boulevard, which is projected to operate at LOS D and with v/c ratio 1.06 during the AM peak hour. Deterioration of LOS at this intersection is a result of the southbound traffic (60% of the projected trips) for St. Elizabeth's East and West Campus turning left at this intersection during the AM peak hour. **Table 8** summarizes the 2020 build conditions.

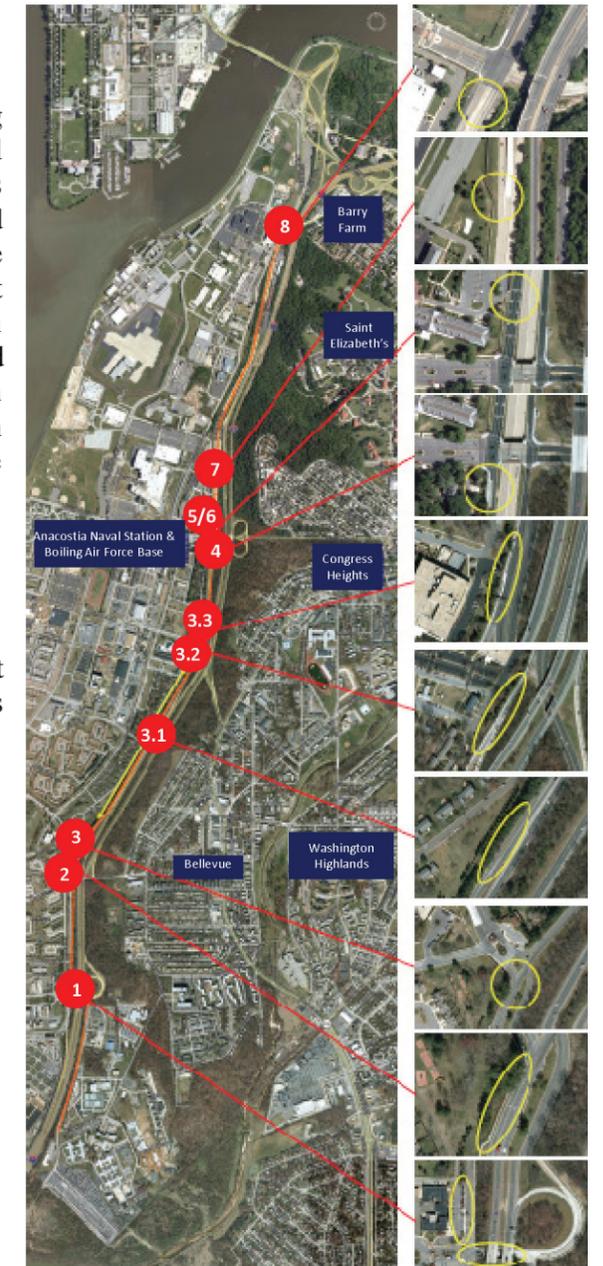
**Table 8.** Summary of 2020 Build Intersection Capacity Analysis, AM (PM)

Intersection No.	Intersection	Delay (secs/veh.)	V/C Ratio	Level of Service
1	I-295 NB On/Off-ramps and Shepherd Parkway <sup>1</sup>	27.1 (10.7)	0.20 (0.07)	C (A)
2	Overlook Avenue and Laboratory Road	13.7 (21.7)	0.49 (0.71)	B (C)
3	Overlook Avenue and Magazine Road/Chesapeake Street	10.7 (13.3)	0.45 (0.76)	B (B)
4	Overlook Avenue and Defense Blvd	17.3 (18.0)	0.54 (0.68)	B (B)
5	South Capitol Street and Malcolm X Avenue	11.6 (8.1)	0.42 (0.44)	B (A)
6	South Capitol Street and MacDill Blvd	54.3 (17.8)	1.06 (0.69)	D (B)
7	South Capitol Street and Defense Blvd (N)/Firth Sterling Ave	24.7 (25.8)	0.72 (0.69)	C (C)

### VI. Trail Alignment Pinch Point Locations

Based on the proposed trail alignment and existing field conditions along the South Capitol Street/Overlook Avenue corridor, several locations create pinch points between the existing roadway and adjacent military walls or other existing features. The following section evaluates each of the pinch point locations and identifies a recommended design alternative to provide sufficient space for the proposed trail and/or a minimum trail width within the pinch point section. Each of the pinch points are identified in **Figure 3** and described in **Table 9**. A summary of the recommended alternatives is included in **Table 19**.

**Figure 3.** Pinch Point Locations



**Table 9.** South Capitol Street Trail Pinch Points and Constraints

Pinch Point	Description	Constraint	
1	Approximately 400 ft north of Overlook Avenue and Laboratory Road/I-295 northbound off-ramp to Shepherd Parkway under I-295 bridge structure	<ul style="list-style-type: none"> <li>• Bus stops</li> <li>• Military Base Wall</li> <li>• Existing 4' sidewalk</li> </ul>	
2	South of Overlook Avenue and Defense Boulevard (S) intersection (from curb return to approximately 200 ft to the south)	<ul style="list-style-type: none"> <li>• Military Base Wall</li> <li>• Bus stop</li> <li>• Guard Rail</li> <li>• Existing 4' sidewalk</li> </ul>	
3	Overlook Avenue/ Defense Blvd intersection north to Overlook Ave/ South Capitol Street diverge gore.	3.1 From Overlook Ave/ Defense Blvd. intersection north 300 ft of the intersection	<ul style="list-style-type: none"> <li>• Military Base Wall</li> </ul>
		3.2 From 300 ft north of the Overlook Ave/Defense Blvd. intersection to Overlook Ave/ I-295 gore point.	<ul style="list-style-type: none"> <li>• Light poles, signs &amp; utilities</li> <li>• Military Base Wall</li> </ul>
		3.3 From Overlook Ave/ I-295 gore point north 1,300 ft to South Capitol St/Overlook Ave. gore	<ul style="list-style-type: none"> <li>• Light poles, signs &amp; utilities</li> <li>• Military Base Wall</li> <li>• Ramp has 18-19' width</li> </ul>
4	From Overlook Ave/ South Capitol Street gore point to approximately 400 ft north of South Capitol Street diverge gore	<ul style="list-style-type: none"> <li>• Light poles, signs &amp; utilities</li> <li>• Military Base Wall</li> </ul>	
5	South of MacDill Boulevard/ Malcolm X Ave and South Capitol Street intersection from 550-ft south of intersection to curb return.	<ul style="list-style-type: none"> <li>• Bus stop and sidewalk</li> <li>• Existing 4' sidewalk</li> <li>• Military Base Wall</li> </ul>	
6	From MacDill Boulevard/ Malcolm X Ave and South Capitol Street intersection from intersection north 300 ft.	<ul style="list-style-type: none"> <li>• Military Base Wall</li> </ul>	
7	From approximately 100 ft south of I-295 southbound on-ramp merge gore to 100 ft north of merge gore.	<ul style="list-style-type: none"> <li>• Military Base Wall</li> </ul>	
8	From Defense Blvd (N)/Firth Sterling Boulevard and South Capitol Street intersection south 200 ft (Light Rail alignment 140+50)	<ul style="list-style-type: none"> <li>• Future Trolley Stop at Northwest corner of intersection</li> </ul>	

**Table 10** summarizes the available width available at each of the pinch points and potential trail and roadway geometry/configuration alternatives.

**Table 10.** Existing and Proposed Geometry

Pinch Point	Available Width (ft)	Shoulder Width (ft)	Number of Lanes	Lane Widths (ft)	Proposed Treatment and Potential Trail Geometry		
					Alternative A	Alternative B	
1	7'	NA	2SB-1NB & 2 SB-2NB	12'-14'	Avoid pinch point with a mid-block crossing north of intersection and 10' trail on eastside of Overlook Ave.	Retain existing sidewalk/trail alignment and retain existing sidewalks (could remove one NB thru lane).	
2	9'	NA	3 SB	12'	Reduce to two 11' lanes with 10' trail, 8' separation, and 3' buffer.	Retain to three 11' lanes with 6' trail, 4' separation, and 2' buffer.	
3	3.1	12'	NA	3 SB	11'	Reduce to two 11' lanes with 10' trail, 10' separation, and 3' buffer.	Retain existing configuration with 6' trail, 4' separation, and 2' buffer.
	3.2	9'	NA	2 SB	11'	Reduce to one 18' lane with 8' trail, 5' separation, and 2' buffer.	Retain existing configuration with 6' trail, 3' separation, and no buffer.
	3.3	12'	NA	1 SB	23'	Reduce lane width to 18' with 10' trail, 5' separation, and 2' buffer.	Retain existing configuration with 8' trail, 4' separation, and no buffer.
4	6'	NA	3 SB lanes north of merge to one ramp lane	11'	Reduce to 2 lanes with 10' trail, 5' separation, and 2' buffer	Retain existing configuration with 6' trail, no separation and no buffer.	
5	8'	NA	1 SB lane and bus stop on ramp	22' (total)	Reduce ramp lane width to 18' with 8' trail, 2'buffer, 4' separation/bus stop. Potential to move bus stop to Pinch Point #6.	Retain existing configuration with 22' ramp lane width and 8' trail & relocate bus stop.	
6	4.5'	NA	3 SB lanes on ramp	11'	Reduce storage length with 8'to10' trail, 1' to 5' separation/relocated bus stop from Pinch Point #5, and 1' buffer.	Reduce to 2 lanes with 10' trail, 4' to 8' separation/relocated bus stop from Pinch Point #5, and 2' buffer.	
7	18'	5'	2 SB	11'	Reduce to 1 lane with 10' trail, 9' separation, and 10' buffer.	Retain existing configuration with 10' trail, 5' separation, and 3' buffer.	
8	0'	NA	3 NB, 2 SB	11'	Reduce quantity of lanes to 2NB and 2SB with 10' trail on west side of South Capitol Street.	Reduce quantity of lanes to 2NB and 2SB, shift roadway east 15' with 10' trail, 2' buffer to light rail and 13' separation/bus stop on west side of South Capitol Street.	

The following section discusses each pinch points and alternative analysis results based on potential mitigation measures, and **Table 11** summarizes the comparison of the future no-build and build alternative analysis results at the pinch points.

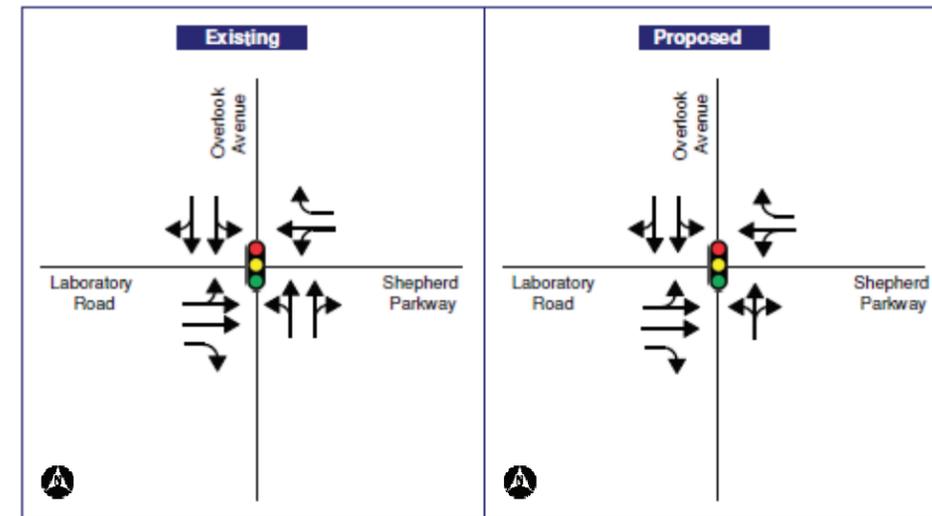
**Table 11.** Summary of Future No-build and Build Alternative Analysis Results – Pinch Points

Pinch Point	No-Build Conditions			Build Conditions-Alternative A			Build Conditions-Alternative B		
	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS
1	13.8 (21.1)	0.48 (0.70)	B (C)	Same as future no-build			13.7 (21.1)	0.49 (0.71)	B ( C )
2	13.8 (15.5)	0.39 (0.47)	B (B)	17.3 (18.0)	0.54 (0.68)	B ( B )	Same as future no-build		
3	3.1	10.8 (14.8)	0.45 (0.76)	B (B)	10.7 (13.3)	0.45 (0.76)	B ( B )	Same as future no-build	
	3.2	13.8 (15.5)	0.39 (0.47)	B (B)	17.3 (18.0)	0.54 (0.68)	B ( B )	Same as future no-build	
	3.3	47.4 (46.1)	9.0 (13.0)	A (B)	Same as future no-build			Same as future no-build	
4	46.8 (44.8)	6.4 (10.1)	A (F)	46.8 (44.8)	6.4 (10.1)	A (F)	Same as future no-build		
5	30.7 (14.0)	0.98 (0.55)	C (B)	54.3 (17.8)	1.06 (0.69)	D ( B )	Same as future no-build		
6	30.7 (14.0)	0.98 (0.55)	C (B)	Same as future no-build			54.3 (17.8)	1.06 (0.69)	D ( B )
7	42.3 (42.2)	--	B (B)	41.3 (41.1)	--	C ( C )	Same as future no-build		
8	24.7 (25.8)	0.72 (0.69)	C (C)	26.2 (25.9)	0.73 (0.69)	C ( C )	26.2 (25.9)	0.73 (0.69)	C ( C )

**Pinch Point #1 (Overlook Avenue & Laboratory Road)**

Pinch point 1 is at the intersection of Overlook Avenue and Laboratory Road. Alternative A at this location proposes to retain the existing configuration. Alternative B at this location includes eliminating one (1) northbound through lane, and changing it to one through lane with shared left and right turns; and reducing the width of southbound through lane with shared right turn from 12' to 11'. The lane configuration for the proposed alternative is illustrated in **Figure 4**. Intersection capacity analysis was performed for the proposed alternative, using the HCM methodology. The results of the alternative analysis for both AM and PM peak hours are summarized in **Table 12**.

**Figure 4.** Lane Configuration Diagram for Proposed Alternative for Pinch Point #1



**Table 12.** Comparison of Existing and Alternative Capacity Analysis at Pinch Point #1 [Overlook Avenue and Laboratory Road] AM (PM)

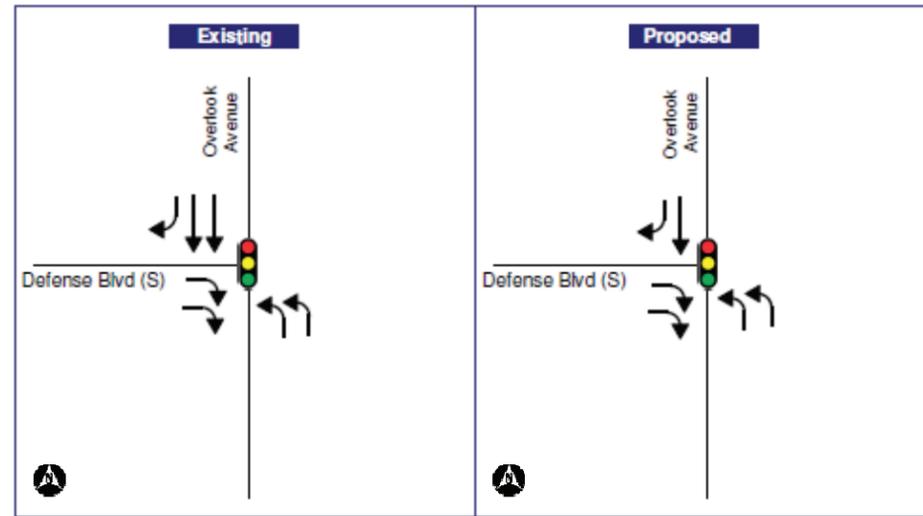
Condition	Control	Delay (sec/veh)	v/c Ratio	Level of Service
Existing	Signal	13.4 (20.9)	0.47 (0.65)	B (C)
Alternative A – retain existing configuration	Same as existing configuration			
Alternative B – retain existing configuration and eliminate one northbound thru lane on Overlook Avenue	Signal	13.0 (21.3)	0.47 (0.66)	B (C)

The results of the capacity analysis for this proposed alternative indicate that the intersection of Overlook Avenue and Laboratory Road will continue to operate at a Level of Service C or better during both AM and PM peak hours.

**Pinch Point #2 (Overlook Avenue & Defense Boulevard)**

The next identified pinch point is the intersection of Overlook Avenue and Defense Boulevard. Proposed measures for Alternative A at this intersection includes eliminating one (1) southbound through lane, and reducing the storage length for southbound right-turn lane at the intersection of Overlook Avenue and Magazine Road. The lane configuration for the proposed alternative is illustrated in **Figure 5**. Intersection capacity analysis was performed for the proposed alternative, using the HCM methodology. The results of the capacity analysis for this alternative indicate that the intersection of Overlook Avenue and Defense Boulevard will continue to operate at a Level of Service B for both AM and PM peak hours with a slightly increased delay of 15.4 sec/veh and 17.1 sec/veh during AM and PM peak hours, respectively. Alternative B consists of retaining the existing configuration, thus no further traffic analysis was performed for this alternative. The results of the alternative analyses are summarized in **Table 13**.

**Figure 5.** Lane Configuration Diagram for Proposed Alternative for Pinch Point #2



**Table 13.** Comparison of Existing and Alternative Capacity Analysis at Pinch Point #2 [Overlook Avenue and Defense Boulevard (S)] AM (PM)

Condition	Control	Delay (sec/veh)	v/c Ratio	Level of Service
Existing	Signal	13.6 (15.8)	0.36 (0.42)	B (B)
Alternative A – Eliminating one southbound through lane	Signal <sup>1</sup>	15.4 (17.1)	0.49 (0.60)	B (B)
Alternative B – retain existing configuration	Same as existing configuration			

<sup>1</sup> – Level of Service and Delay values reflect most accurate values based on optimizing the signal timing splits while maintaining same cycle lengths as under the existing conditions.

**Pinch Point #3 (Overlook Avenue/South Capitol Street gore point)**

The next identified pinch point is the section between Overlook Avenue/ South Capitol Street diverge ramp to intersection of South Capitol Street and Defense Boulevard. This section was analyzed under the following three (3) locations for their distinct characteristics and constraints.

- 3.1 - between Defense Blvd/Overlook Ave and 300 ft south of the intersection
  - Alternative A: reduce three (3) southbound lanes on Overlook Avenue to two (2) lanes to a point of approximately 300 ft south of Overlook Avenue and Defense Boulevard intersection.
  - Alternative B: retain existing configuration
- 3.2 - between Overlook Ave/ I-295 gore point to 300 ft north of Defense Blvd/Overlook Ave intersection
  - Alternative A: reduce two (2) southbound lanes on Overlook Avenue to one (1) lane, starting approximately 300 ft north of Overlook Avenue and Defense Boulevard intersection.
  - Alternative B: retain existing configuration
- 3.3 - between South Capitol St/Overlook Ave gore point and Overlook Ave/ I-295 gore point
  - Alternative A: reduce ramp lane width from 23 ft to 18 ft
  - Alternative B: retain existing configuration

Using the HCM methodology, intersection and ramp diverge capacity analysis was performed for the aforementioned three sub-segments. The results of the capacity analysis results indicate that the ramp diverge is expected to operate at a Level of Service B or better during both AM and PM peak hours under the existing and proposed conditions. Both of the analyzed intersections are expected to operate at a Level of Service C or better during both AM and PM peak hours under the existing and proposed conditions. The results of the alternatives analyses for both the AM and PM peak hours are summarized in **Table 14**.

**Table 14.** Summary of Alternatives Analysis for Pinch Point #3 [AM (PM)]

Condition	Control/ Segment	Delay (sec/veh) or Speed (mph)	v/c Ratio or Density (pc/mi/ln)	Level of Service
<b>Pinch Point 3.1</b>				
Existing	Signal	10.6 (21.8)	0.45 (0.68)	B (C)
Alternative A - reduced southbound lanes on Overlook Avenue, 300 ft south of Overlook Avenue and Defense Blvd intersection	Signal <sup>1</sup>	10.5 (18.1)	0.45 (0.68)	B (B)
Alternative B – retain existing configuration	Same as existing conditions			
<b>Pinch Point 3.2</b>				
Existing	Signal	13.6 (15.8)	0.36 (0.42)	B (B)
Alternative A - reduced southbound lanes on Overlook Avenue, 300 ft north of Overlook Avenue and Defense Blvd intersection	Signal <sup>1</sup>	15.4 (17.1)	0.49 (0.60)	B (B)
Alternative B – retain existing configuration	Same as existing conditions			
<b>Pinch Point 3.3</b>				
Existing	Ramp Diverge	47.6 (46.8)	7.9 (11.9)	A (B)
Alternative A - reduced ramp lane width	Same as existing conditions			
Alternative B – retain existing configuration	Same as existing conditions			

<sup>1</sup> – Level of Service and Delay values reflect most accurate values based on optimizing the signal timing splits while maintaining same cycle lengths as under the existing conditions.

**Pinch Point #4 (Overlook Avenue/ South Capitol Street gore point to 400’ north)**

Pinch point 4 is the Overlook Ave/ South Capitol Street diverge to approximately 400 ft north of diverge. This location is constrained with utility poles, military base wall, signage, and limited right-of-way. Alternative A includes reducing the three (3) southbound lanes on South Capitol Street to two (2) lanes. This modification would accommodate a 10-ft trail, 5-ft separation area, and 2-ft buffer zone. The results of the capacity analysis for this alternative indicate that the diverge ramp at South Capitol Street to Overlook Avenue will continue to operate at a Level of Service A during both peak hours. Alternative B consists of retaining the existing configuration, thus no further traffic analysis was performed for this alternative. The results of the analysis is compared with existing conditions are summarized in **Table 15**.

**Table 15.** Comparison of Existing and Alternative Capacity Analysis Results for Pinch Point #4

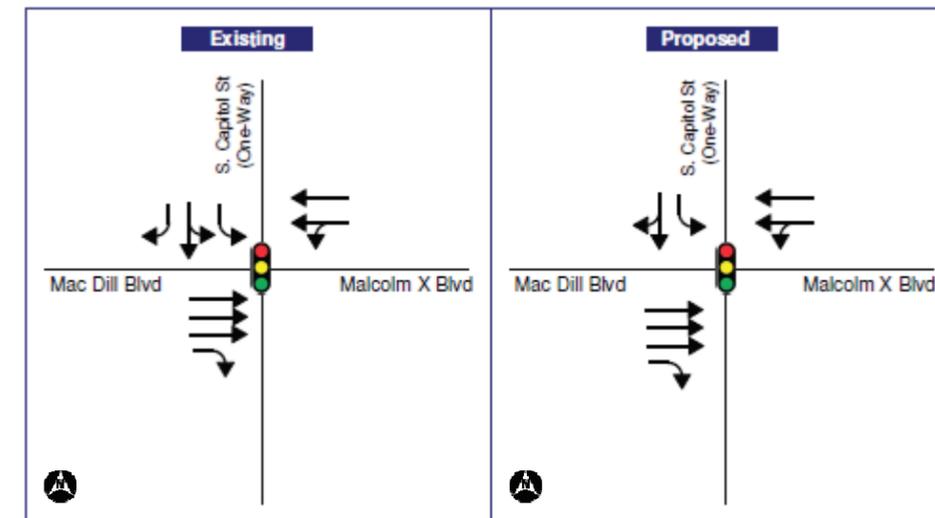
Condition	Qty of Lanes	Speed [mph] AM (PM)	Density [pc/mi/ln] AM (PM)	LOS AM (PM)
Existing	3	47.1 (45.7)	6.2 (9.6)	A (A)
Alternative A – reduce to two lanes	2	47.1 (45.7)	6.2 (9.6)	A (A)
Alternative B – retain existing configuration	Same as existing conditions			

**Pinch Point #5 (South Capitol Street & MacDill Blvd./Malcolm X Ave. south of intersection)**

The next identified pinch point is the segment to the south of South Capitol Street and MacDill Boulevard/Malcolm X Avenue intersection (approximately 750 ft). This location is constrained due to the combination of the bus stop located at the southwestern quadrant of the intersection (southbound - far side), and limited right-of-way along the segment. South Capitol Street southbound ramp lane is 22 ft wide and is shared with the bus stop. Alternative A at this pinch point includes reducing the existing ramp lane width from 22 ft to 18 ft and providing an 8-ft trail alignment with a 2-ft buffer, and 4-ft separation/bus stop area. Reducing the ramp lane width from 22 ft to 18 ft would not change the capacity of the ramp; therefore, no further analysis was performed for this alternative. Alternative B includes retaining the existing lane configuration and providing an 8-ft trail alignment with limited separation/buffer zone by delineating the lane where the bus stop is located, and, therefore, no further analysis was performed for this alternative.

WMATA bus routes A9, W13, W14, P17, P18, and p19 run along South Capitol Street within the study area and they make scheduled stops at the subject bus stop. Bus route A9 runs with 10/15-minute headways during AM commuter hours and approximately 20/30-minute headways during PM commuter hours. The bus routes W13 and W14 run with 60-minute headways during both AM and PM commuter hours. Under either alternative scenario, the bus stop will be shared with the vehicular travel lane. Although not quantifiable with traditional analysis methodologies, there could be minimal interference expected under Alternative A, while the buses intermediately stop for loading and unloading passengers with a minimal dwelling time (i.e., 60 sec or less) at the bus stop.

**Figure 6.** Lane Configuration Diagram for Proposed Alternative at Pinch Point #5



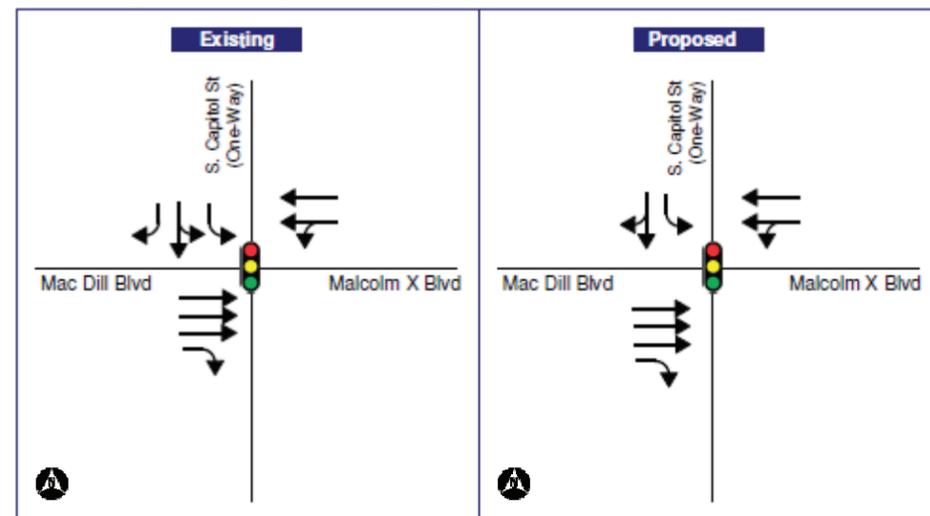
Even though traffic forecast and the recommended geometric improvements for the trail alignment do not bring this intersection to a failing level of service, it should be noted that if implemented the proposed improvements included in the St. Elizabeth’s FEIS (i.e., I-295/Malcolm X Avenue interchange, access road parallel to South Capitol Street on the east side of I-295 with a frontage to the planned West Campus, and intersection improvements at the South Capitol Street/Firth Sterling Avenue) would alleviate 100% of the southbound left-turn traffic volumes at this intersection and divert these volumes to the new I-295/Frontage Road. Approximately 50 trips (10% of the 30% of total projected trips for St. Elizabeths East and West Campus traffic) would also be expected to use South Capitol Street and Firth Sterling Avenue intersection, which would not affect the operations or efficiency of this intersection under existing or proposed lane configurations. Capacity analysis results with the above scenario indicate that South Capitol Street and Firth Sterling Avenue intersection is expected to operate at LOS C with 24.2 seconds delay and 0.59 v/c ratio, during the AM peak hour.

**Pinch Point #6 (South Capitol Street & MacDill Blvd./Malcolm X Ave. north of intersection)**

The next identified pinch point is north of the MacDill Boulevard/Malcolm X Avenue and South Capitol Street intersection. At this location, right-of-way is limited due to the proximity of the military base wall to the roadway therefore limiting the area needed for the trail alignment and the separation/buffer zone. The proposed mitigation measure for this constraint includes reducing the cross-section of the southbound approach from three (3) lanes to two (2) lanes and reconfiguring the intersection to accommodate one (1) left-turn lane and one (1) through/right-turn shared lane, as shown in Figure 7. This modification would allow the accommodation of a 10-ft trail, 9-ft separation area, and 3-ft buffer zone.

An intersection capacity analysis was performed for the proposed alternative, using the HCM methodology. The results of the capacity analysis for this alternative indicate that the intersection of South Capitol Street and Malcolm X Avenue will continue to operate at a Level of Service B for both AM and PM peak hours with a slightly increased delay of 19.9 sec/veh and 15.6 sec/veh during AM and PM peak hours, respectively. The results of the alternative analysis are summarized in Table 16.

**Figure 7.** Lane Configuration Diagram for Proposed Alternative at Pinch Point #6



**Table 16.** Comparison of Existing and Alternative Capacity Analysis at Pinch Point #6 [MacDill Blvd/Malcolm X Ave and South Capitol Street] AM (PM)

Condition	Control	Delay (secs/veh.)	v/c Ratio	Level of Service
Existing	Signal	18.7 (13.8)	0.77 (0.45)	B (B)
Alternative A – Reduce vehicle turning lane storage length	Same as existing conditions			
Alternative B – Change southbound through and shared left turn lane to through and shared right turn lane	Signal	19.9 (15.6)	0.80 (0.52)	B (B)

**Pinch Point #7 (Malcolm X Ave to I-295 merge ramp)**

The next pinch point is the weaving segment between the exit ramp from South Capitol Street to Malcolm X Ave and the I – 295 southbound merge ramp to South Capitol Street. A capacity analysis for this weaving segment was performed by reducing the cross-section of existing weaving lanes from four (4) lanes to three (3) lanes for Alternative A. The results of the capacity analysis for this alternative indicate that the weaving segment between I-295 Southbound merge ramp to South Capitol Street and the exit ramp from South Capitol Street to Malcolm X Avenue would operate at a Level of Service B or better during both peak hours. Alternative B consists of retaining the existing configuration, thus no further traffic analysis was performed for this alternative. The results of the analysis for this proposed segment is compared with the analysis for existing conditions and summarized in **Table 17**.

**Table 17.** Comparison of Existing and Alternative Capacity Analysis Results for Pinch Point #7

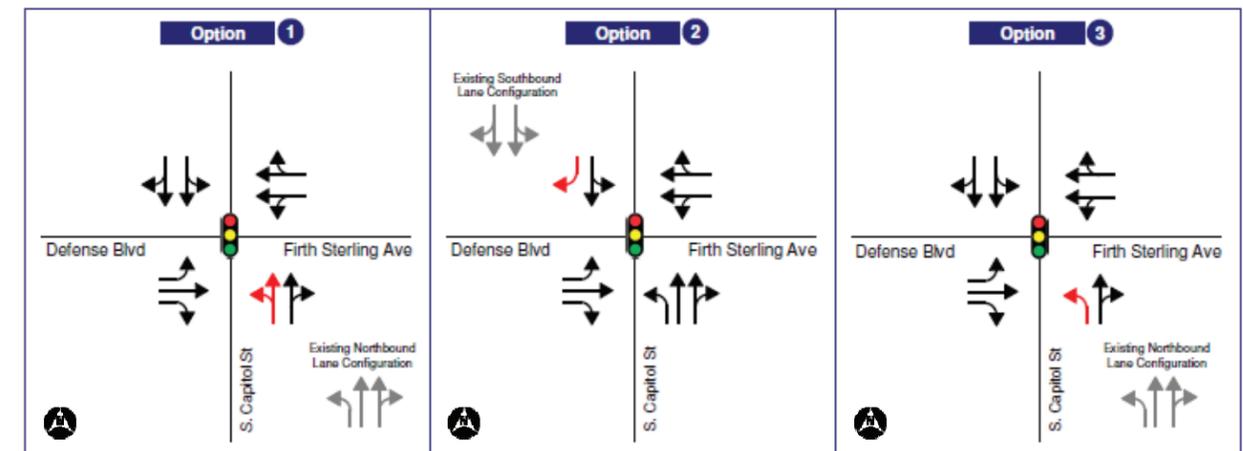
Condition	No. of Weaving	Speed [mph]	LOS AM (PM)
Existing	4	43.3 (42.5)	A (B)
Alternative A – reduce to one lane	3	42.6 (41.5)	B (B)
Alternative B – retain existing configuration	Same as existing conditions		

**Pinch Point #8**

Based on the results of the existing conditions analysis, two different alternatives with three traffic operations options were proposed at the intersection of South Capitol Street and Defense Boulevard (N)/ Firth Sterling Avenue. The proposed traffic operations for both alternatives are the same, thus each option could apply to either design alternative. The three traffic options proposed are as follows:

1. Option 1: This alternative includes eliminating the northbound exclusive left-turn lane, and changing it to two through lanes with shared left and right turns.
2. Option 2: This alternative includes eliminating one southbound through lane, and changing it to one through lane with a shared left-turn lane.
3. Option 3: This alternative includes eliminating one northbound through lane, and changing it to one through lane with a shared right-turn.

The lane configuration for each of the proposed alternatives is illustrated in **Figure 8**. Intersection capacity analysis was performed for the proposed three alternatives, using the HCM methodology. The results of the capacity analysis for the options indicate that the intersection of South Capitol Street and Defense Boulevard (N)/Firth Sterling Avenue would operate at a Level of Service C for both AM and PM peak hours under all three options. However, based on the Synchro analysis results, northbound through movements under Option 3 during the AM and southbound through movements under Option 2 during the PM peak hour show increased v/c ratios, which would indicate significantly increased queuing. This condition was also confirmed in the SimTraffic simulations under these alternatives. The results of the alternatives analyses for both the AM and PM peak hours are summarized in **Table 18**.



**Figure 8.** Pinch Point #8 Lane Configuration Diagrams for Proposed Options

**Table 18.** Summary of Alternatives Analysis for South Capitol Street and Defense Boulevard AM (PM)

OPTION	Control	Delay (secs/veh.)	v/c Ratio	Level of Service
Option 1- Eliminating northbound left-turn lane	Signal	23.0 (23.6)	0.60 (0.58)	C (C)
Option 2- Eliminating one southbound through lane	Signal	22.5 (30.8)	0.54 (0.85)	C (C)
Option 3- Eliminating one northbound through lane	Signal	28.8 (24.1)	0.82 (0.58)	C (C)

**Table 19** summarizes the intersections with each pinch point alternative and **Table 20** summarizes the comparison of the existing and alternative analysis results at the pinch points.

**Table 19.** Summary of Existing and Alternative Analysis Results – Intersections

Int No.	Intersection	Existing Conditions			Alternative A			Alternative B		
		Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio	LOS	Delay (sec/veh)	V/C Ratio	LOS
Int # 1	I-295 NB On/Off-ramps and Shepherd Parkway	26.0 (10.6)	0.19 (0.07)	C (A)	Same as existing			Same as existing		
Int # 2	Overlook Avenue and Laboratory Road	13.4 (20.9)	0.47 (0.65)	B (C)	Same as existing			13.0 (21.3)	0.47 (0.66)	B (C)
Int # 3	Overlook Avenue and Magazine Road/Chesapeake Street	10.6 (11.4)	0.45 (0.68)	B (B)	10.5 (18.1)	0.45 (0.68)	B (B)	Same as existing		
Int # 4	Overlook Avenue and Defense Blvd	13.6 (14.9)	0.36 (0.41)	B (B)	15.4 (17.1)	0.49 (0.60)	B (B)	Same as existing		
Int # 5	S.Capitol Street and Malcolm X Avenue	11.8 (11.5)	0.33 (0.35)	B (B)	Same as existing			Same as existing		
Int # 6	S.Capitol Street and MacDill Blvd	18.7 (13.8)	0.77 (0.45)	B (B)	Same as existing			19.9 (15.6)	0.80 (0.52)	B (B)
Int # 7	S.Capitol Street and Defense Blvd (N)/ Firth Sterling Avenue	22.6 (23.6)	0.54 (0.58)	C (C)	Same as existing			Same as existing		

**Table 20.** Summary of Existing and Alternative Analysis Results – Pinch Points

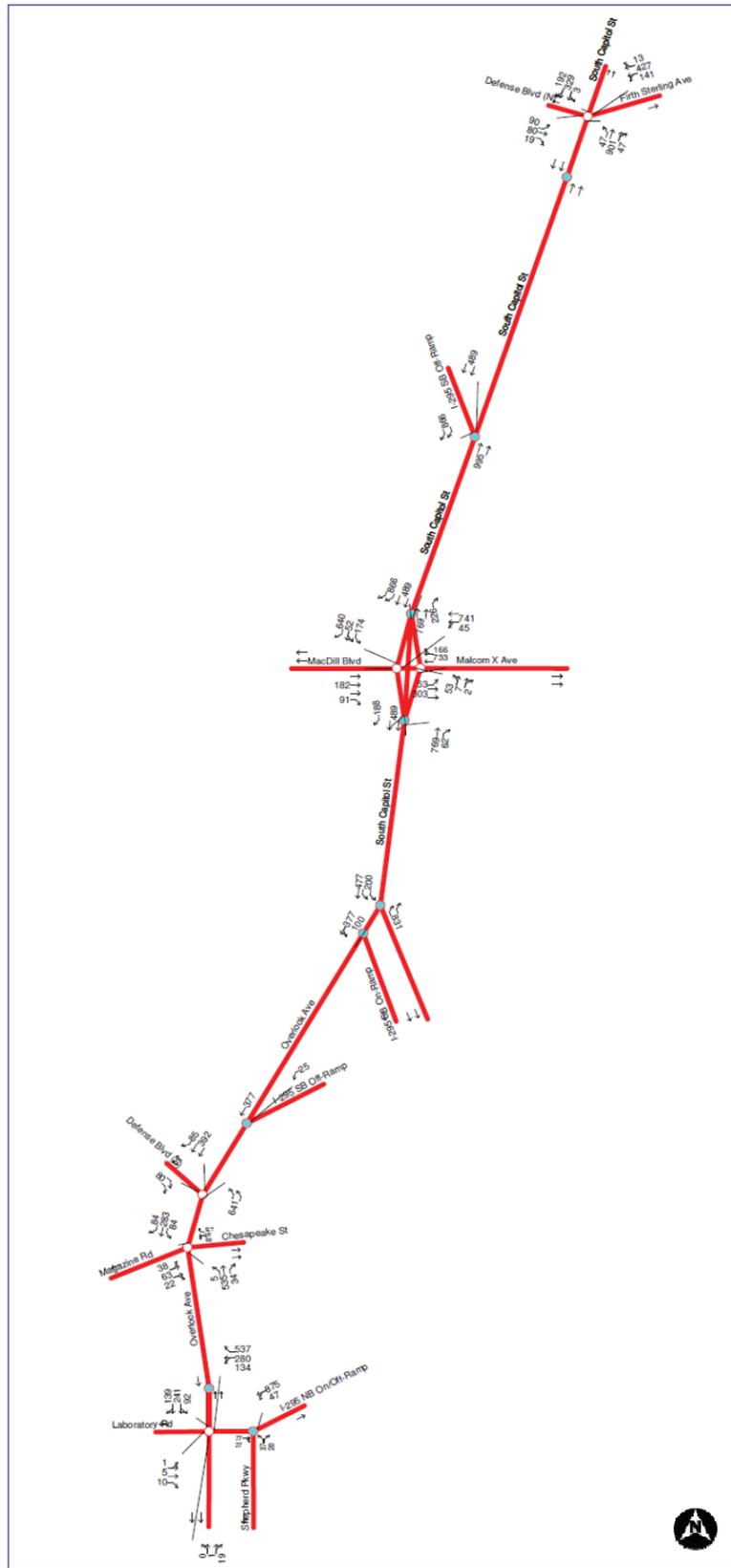
Pinch Point No.	Existing Conditions			Alternative A			Alternative B			
	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS	Delay (sec/veh) or Speed (mph)	V/C Ratio or Density (pc/mi/ln)	LOS	
1	13.4 (20.9)	0.47 (0.65)	B (C)	Same as existing			13.0 (21.3)	0.47 (0.66)	B (C)	
2	13.6 (15.8)	0.36 (0.42)	B (B)	15.4 (17.1)	0.49 (0.60)	B (B)	Same as existing			
3	3.1	10.6 (21.8)	0.45 (0.68)	B (C)	10.5 (18.1)	0.45 (0.68)	B (B)	Same as existing		
	3.2	13.6 (15.8)	0.36 (0.42)	B (B)	15.4 (17.1)	0.49 (0.60)	B (B)	Same as existing		
	3.3	47.6 (46.8)	7.9 (11.9)	A (B)	Same as existing			Same as existing		
4	47.1 (45.7)	6.2 (9.6)	A (A)	47.1 (45.7)	6.2 (9.6)	A (A)	Same as existing			
5	18.7 (13.8)	0.77 (0.45)	B (B)	19.9 (15.6)	0.80 (0.52)	B (B)	Same as existing			
6	18.7 (13.8)	0.77 (0.45)	B (B)	Same as existing			19.9 (15.6)	0.80 (0.52)	B (B)	
7	43.3 (42.5)	--	A (B)	42.6 (41.5)	--	B (B)	Same as existing			
8	22.6 (23.6)	0.54 (0.58)	C (C)	23.0 (23.6)	0.60 (0.58)	C (C)	23.0 (23.6)	0.60 (0.58)	C (C)	

**VII. Recommended Alternatives Summary**

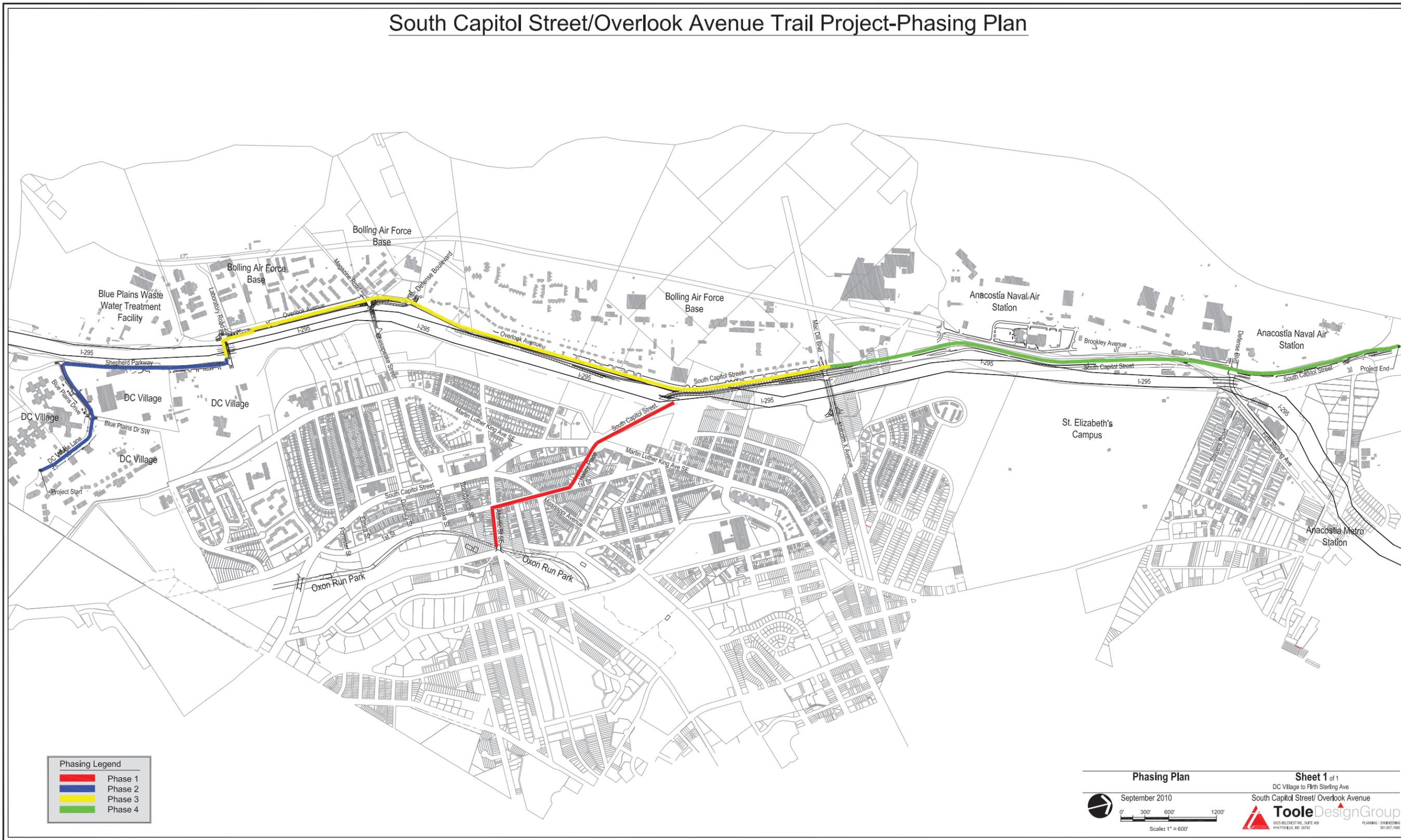
Based on the analysis results, the following **Table 21** shows the recommended alternatives for the study area pinch points:

**Table 21.** Recommended Alternatives

Pinch Point	Description	Alternative A	Alternative B	Preferred Alternative						
1	Approximately 400 ft north of Overlook Avenue and Laboratory Road/I-295 northbound off-ramp to Shepherd Parkway under I-295 bridge structure	- Avoid pinch point with a mid-block crossing and locate 10' trail on east side of Overlook Ave	- Retain existing configuration and use existing sidewalk [could remove one NB through lane]	A						
2	South of Overlook Avenue and Defense Boulevard (S) intersection (from curb return to approximately 200 ft to the south)	- Reduce to two 11' lanes with 10' trail, 8' separation, and 3' buffer	- Retain three 11' lanes with 6' trail, 4' separation, and 2' buffer	A						
3	3.1 From Overlook Ave/ Defense Blvd. intersection north 300 ft of the intersection	- Reduce to two 11' lanes with 10' trail, 10' separation, 3' buffer	- Retain existing configuration with 6' trail, 4' separation, 2' buffer	A						
	3.2 From 300 ft north of the Overlook Ave/Defense Blvd. intersection to Overlook Ave/ I-295 gore point.	- Reduce to single 18' lane with 8' trail, 5' separation, and 2' buffer	- Retain existing configuration with 6' trail, 3' separation, and no buffer	A						
	3.3 From Overlook Ave/ I-295 gore point north 1,300 ft to South Capitol St/Overlook Ave. gore	- Reduce to 18' lane with 10' trail, 5' separation, and 2' buffer	- Retain existing configuration with 8' trail, 4' separation, and no buffer	A						
4	From Overlook Ave/ South Capitol Street gore point to approximately 400 ft north of South Capitol Street diverge gore	- Reduce to 2 lanes with 10' trail, 5' separation, and 2' buffer	- Retain existing configuration with 6' trail, no separation and no buffer	A						
5	South of MacDill Boulevard/ Malcolm X Ave and South Capitol Street intersection from 550-ft south of intersection to curb return.	- Reduce to 1 lane with 8' trail, 2' buffer, 4' separation/bus stop, relocate bus stop to Pinch Point #6	- Retain existing configuration w/ 8' trail and relocate bus stop	A						
6	From MacDill Boulevard/ Malcolm X Ave and South Capitol Street intersection from intersection north 300 ft.	- Reduce storage length with 8'-10' trail, 1'-5' separation/relocated bus stop from Pinch Point #5, and 1' buffer	- Reduce to 2 lanes with 10' trail, 4'-8' separation/bus stop relocated from Pinch Point #5, and 2' buffer	B						
7	From approximately 100 ft south of I-295 southbound on-ramp merge gore to 100 ft north of merge gore.	- Reduce to 1 lane with 10' trail, 9' separation, and 10' buffer	- Retain ex. configuration with 10' trail, 5' separation, and 3' buffer	B						
8	From Defense Blvd (N)/Firth Sterling Boulevard and South Capitol Street intersection south 200 ft (Light Rail alignment 140+50)	- Reduce quantity of lanes to 2NB/ 2SB and shift roadway east 15' w/10' trail, 2' buffer to Light Rail, 13' separation/bus stop on west side of S. Capitol Street		A						
		<table border="1"> <thead> <tr> <th>Option 1</th> <th>Option 2</th> <th>Option 3</th> <th>Preferred Alternative</th> </tr> </thead> <tbody> <tr> <td>Eliminate NB left-turn lane</td> <td>Eliminate one SB through lane</td> <td>Eliminate one NB through lane</td> <td>Option 1</td> </tr> </tbody> </table>	Option 1	Option 2	Option 3	Preferred Alternative	Eliminate NB left-turn lane	Eliminate one SB through lane	Eliminate one NB through lane	Option 1
Option 1	Option 2	Option 3	Preferred Alternative							
Eliminate NB left-turn lane	Eliminate one SB through lane	Eliminate one NB through lane	Option 1							



South Capitol Street/Overlook Avenue Trail Project-Phasing Plan



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Phasing Legend	
<span style="color: red;">█</span>	Phase 1
<span style="color: blue;">█</span>	Phase 2
<span style="color: yellow;">█</span>	Phase 3
<span style="color: green;">█</span>	Phase 4

**Phasing Plan** **Sheet 1 of 1**

September 2010 DC Village to Firth Sterling Ave  
South Capitol Street/ Overlook Avenue

Scale: 1" = 600'

**Toole Design Group**  
PLANNING | ENGINEERING

# APPENDIX D: COST ESTIMATE

South Capitol Trail Project		Total Estimated Cost
Summary		
Phase 1: Interim connection between Oxon Run Park and South Capitol Street	\$	100,000.00
Phase 2: Trail segments within DC Village	\$	400,000.00
Phase 3: Trail segment between Laboratory Road/Shepherd Parkway and Malcolm X Blvd.	\$	3,100,000.00
Phase 4: Trail segment between Malcolm X Blvd and Firth Sterling Ave.	\$	2,100,000.00
	<b>Total: <sup>1</sup></b>	<b>\$ 5,700,000.00</b>

<sup>1</sup> Includes Planning, Permitting, Design & Construction for all 4 Phases of the South Capitol Street Trail Project.

Phase 1 South Capitol Trail Project							
Description: Proposed interim connection between Oxon Run Park and South Capitol Street.							
Item No.	Item	Length (lf)	Thickness (")	Qty	Units	Unit Price	Total Price
1	Thermoplastic Pavement Symbols (Sharrow Symbol)	2,475		20	EA	\$ 300.00	\$ 6,000.00
Subtotal							\$ 6,000.00
<b>Phase 1: Supplemental Costs</b>							
2	Maintenance of Traffic (Low - 5%)			1	LS	\$ 300.00	\$ 1,000.00
3	Project Approvals & Permitting (Low - 5%)			1	LS	\$ 300.00	\$ 1,000.00
Subtotal							\$ 8,000.00
4	Mobilization (10%)			1	LS	\$ 800.00	\$ 800.00
Subtotal							\$ 8,800.00
5	Construction Contingency (25%)					\$ 3,000.00	\$ 3,000.00
Subtotal							\$ 11,800.00
6	Design & Planning Cost (Low - 10%)					\$ 2,000.00	\$ 2,000.00
Subtotal							\$ 2,000.00
<b>Total Estimated Cost for Phase 1</b>							<b>\$ 100,000.00</b>

Phase 2 South Capitol Trail Project							
Description: Proposed trail segments within DC Village between connection to Oxon Cove Park and Shepherd Parkway/ Laboratory Road.							
** Cost estimate only includes trail improvements, and does not include full site development or road reconstruction.*							
Item No.	Item	Length (lf)	Thickness (")	Qty	Units	Unit Price	Total Price
1	Asphalt Surface Course (proposed trail) [10' width]	4,050	2" thickness	600	TON	\$ 60.00	\$ 36,000.00
2	Asphalt Base Course (proposed trail) [10' width]	4,050	2" thickness	600	TON	\$ 60.00	\$ 36,000.00
3	Aggregate Base Course (proposed trail) [10' width + 1' extension]	4,050	6" thickness	900	CY	\$ 50.00	\$ 45,000.00
4	Excavation (proposed trail) [10' width]	4,050	10" depth	1,300	CY	\$ 20.00	\$ 26,000.00
5	Trail Markings & Signage			5,000	LF	\$ 1.30	\$ 6,500.00
6	Crosswalk Pavement Marking			4	EA	\$ 200.00	\$ 800.00
Subtotal							\$ 160,000.00
<b>Phase 2: Supplemental Costs</b>							
7	Drainage and E&S (Low - 5%)			1	LS	\$ 8,000.00	\$ 8,000.00
8	Maintenance of Traffic (Low - 5%)			1	LS	\$ 8,000.00	\$ 8,000.00
9	Utility Modifications (Low - 5%)			1	LS	\$ 8,000.00	\$ 8,000.00
10	Project Approvals & Permitting (Low - 5%)			1	LS	\$ 8,000.00	\$ 8,000.00
Subtotal							\$ 200,000.00
11	Mobilization (10%)			1	LS	\$ 20,000.00	\$ 20,000.00
Subtotal							\$ 220,000.00
12	Construction Contingency (25%)					\$ 55,000.00	\$ 55,000.00
Subtotal							\$ 280,000.00
13	Design & Planning Cost (Low - 10%)					\$ 28,000.00	\$ 28,000.00
Subtotal							\$ 28,000.00
<b>Total Estimated Cost for Phase 2</b>							<b>\$ 400,000.00</b>

Phase 3 South Capitol Trail Project							
Description: Proposed trail segments primarily along Overlook Avenue/South Capitol Street between Shepherd Parkway/ Laboratory Road and Malcolm X Blvd.							
Item No.	Item	Length (lf)	Thickness (")	Qty	Units	Unit Price	Total Price
<b>Trail Improvements</b>							
1	Asphalt Surface Course (proposed trail) [10' width]	9,150	2" thickness	1,200	TON	\$ 60.00	\$ 72,000.00
2	Asphalt Base Course (proposed trail) [10' width]	9,150	2" thickness	1,200	TON	\$ 60.00	\$ 72,000.00
3	Aggregate Base Course (proposed trail) [10' width + 1' extension]	9,150	6" thickness	1,900	CY	\$ 50.00	\$ 95,000.00
4	Excavation (proposed trail) [10' width]	9,150	10" depth	2,900	CY	\$ 20.00	\$ 58,000.00
5	Trail Markings & Signage			10,000	LF	\$ 1.30	\$ 13,000.00
Subtotal Trail Improvements							\$ 310,000.00
<b>Pinch Point #1</b>							
6	Demolition of Pavement/ Excavation	6,500	10" depth	300	CY	\$ 20.00	\$ 6,000.00
7	Concrete Curb and Gutter			800	LF	\$ 45.00	\$ 36,000.00
8	Concrete Sidewalk (proposed) [6' width]	200	4" thickness	1,000	SF	\$ 5.00	\$ 5,000.00
9	Remove/Relocate Drainage Inlet			1	EA	\$ 500.00	\$ 500.00
10	Intersection Pavement Markings & Signage <sup>1</sup>			1	EA	\$ 5,000.00	\$ 5,000.00
11	Curb Ramp			10	EA	\$ 400.00	\$ 4,000.00
12	Crosswalk Pavement Marking			12	EA	\$ 200.00	\$ 2,400.00
13	Pedestrian Signal Head			8	EA	\$ 5,000.00	\$ 40,000.00
14	Street Trees			14	EA	\$ 300.00	\$ 4,200.00
15	Low-Impact Development Area <sup>2</sup>			3,000	SF	\$ 30.00	\$ 90,000.00
16	Landscaping (Misc.)			1	EA	\$ 500.00	\$ 500.00
17	Signal Timing Modifications (Overlook Ave + Laboratory Road)			1	LS	\$ 5,000.00	\$ 5,000.00
Subtotal Pinch Point #1							\$ 198,600.00
<b>Pinch Point #2</b>							
18	Demolition of Pavement/ Excavation	3,500	10" depth	200	CY	\$ 20.00	\$ 4,000.00
19	Concrete Curb and Gutter			410	LF	\$ 45.00	\$ 18,450.00
20	Concrete Sidewalk (proposed) [6' width]	10	4" thickness	35	SF	\$ 5.00	\$ 175.00
21	Intersection Pavement Markings & Signage <sup>1</sup>			1	EA	\$ 5,000.00	\$ 5,000.00
22	Curb Ramp			2	EA	\$ 400.00	\$ 800.00
23	Crosswalk Pavement Marking			1	EA	\$ 200.00	\$ 200.00
24	Pedestrian Signal Head			2	EA	\$ 5,000.00	\$ 10,000.00
25	Guardrail (remove & reset)			410	LF	\$ 30.00	\$ 12,300.00
26	Signal Timing Modifications (Overlook Ave + Defense Blvd)			1	LS	\$ 5,000.00	\$ 5,000.00
Subtotal Pinch Point #2							\$ 55,925.00
<b>Pinch Point #3.1</b>							
27	Demolition of Pavement/ Excavation	7,250	10" depth	300	CY	\$ 20.00	\$ 6,000.00
28	Concrete Curb and Gutter			850	LF	\$ 45.00	\$ 38,250.00
29	Concrete Sidewalk (proposed) [6' width]	10	4" thickness	50	SF	\$ 5.00	\$ 250.00
30	Curb Ramp			2	EA	\$ 400.00	\$ 800.00
31	Crosswalk Pavement Marking			1	EA	\$ 200.00	\$ 200.00
32	Pedestrian Signal Head			2	EA	\$ 5,000.00	\$ 10,000.00
33	Signal Timing Modifications (Overlook Ave + Defense Blvd)						
inc in Pinch Point #2							
Subtotal Pinch Point #3.1							\$ 55,500.00
<b>Pinch Point #3.2</b>							
34	Demolition of Pavement/ Excavation	5,930	10" depth	200	CY	\$ 20.00	\$ 4,000.00
35	Concrete Curb and Gutter			1,105	LF	\$ 45.00	\$ 49,725.00
36	Pavement Markings & Signage (minor) <sup>3</sup>			1	EA	\$ 2,500.00	\$ 2,500.00
Subtotal Pinch Point #3.2							\$ 56,225.00
<b>Pinch Point #3.3</b>							
37	Demolition of Pavement/ Excavation	11,500	10" depth	400	CY	\$ 20.00	\$ 8,000.00
38	Concrete Curb and Gutter			1,500	LF	\$ 45.00	\$ 67,500.00
39	Pavement Markings & Signage (minor) <sup>3</sup>			1	EA	\$ 2,500.00	\$ 2,500.00
40	Remove/Relocate Drainage Inlet			4	EA	\$ 500.00	\$ 2,000.00
Subtotal Pinch Point #3.3							\$ 80,000.00
<b>Pinch Point #4</b>							
41	Demolition of Pavement/ Excavation	11,000	10" depth	400	CY	\$ 20.00	\$ 8,000.00
42	Concrete Curb and Gutter			11,000	LF	\$ 45.00	\$ 495,000.00
43	Remove/Relocate Drainage Inlet			2	EA	\$ 500.00	\$ 1,000.00
44	Guardrail (remove & reset)			160	LF	\$ 30.00	\$ 4,800.00
Subtotal Pinch Point #4							\$ 508,800.00
<b>Pinch Point #5</b>							
45	Demolition of Pavement/ Excavation	3,500	10" depth	200	CY	\$ 20.00	\$ 4,000.00
46	Concrete Curb and Gutter			700	LF	\$ 45.00	\$ 31,500.00
47	Concrete Sidewalk (proposed) [6' width]	20	4" thickness	80	SF	\$ 5.00	\$ 400.00
48	Curb Ramp			2	EA	\$ 400.00	\$ 800.00
49	Crosswalk Pavement Marking			1	EA	\$ 200.00	\$ 200.00
50	Pedestrian Signal Head			4	EA	\$ 5,000.00	\$ 20,000.00
51	Remove/Relocate Drainage Inlet			2	EA	\$ 500.00	\$ 1,000.00
52	Intersection Pavement Markings & Signage <sup>1</sup>			1	EA	\$ 5,000.00	\$ 5,000.00
53	Signal Timing Modifications (South Capitol St. + Malcolm X Ave.)			1	LS	\$ 5,000.00	\$ 5,000.00
Subtotal Pinch Point #5							\$ 67,900.00
Subtotal							\$ 1,340,000.00
<b>Phase 3: Supplemental Costs</b>							
54	Drainage and E&S (Moderate - 10%)			1	LS	\$ 134,000.00	\$ 134,000.00
55	Maintenance of Traffic (Moderate - 8%)			1	LS	\$ 107,200.00	\$ 107,200.00
56	Utility Modifications (Moderate - 10%)			1	LS	\$ 134,000.00	\$ 134,000.00
57	Project Approvals & Permitting (Moderate - 8%)			1	LS	\$ 107,200.00	\$ 107,200.00
Subtotal							\$ 1,830,000.00
58	Mobilization (10%)			1	LS	\$ 183,000.00	\$ 183,000.00
Subtotal							\$ 2,020,000.00
59	Construction Contingency (25%)					\$ 505,000.00	\$ 505,000.00
Subtotal							\$ 2,530,000.00
60	Design & Planning Cost (Moderate - 20%)					\$ 506,000.00	\$ 506,000.00
Subtotal							\$ 506,000.00
<b>Total Estimated Cost for Phase 3</b>							<b>\$ 3,100,000.00</b>

<sup>1</sup> Intersection Improvements - Assumed pavement markings, and signage.  
<sup>2</sup> Low-Impact Development Areas - Assumed average cost of \$30.00/sf, based on the need for water control structures, curbing, and underdrains.  
<sup>3</sup> Pavement Markings & Signage (minor) include markings & signage along linear segment of roadway.

Phase 4							
South Capitol Trail Project							
Description: Proposed trail segments along South Capitol Street between Malcolm X Blvd. and Firth Sterling Ave.							
Item No.	Item	Length (lf)	Thickness (")	Qty	Units	Unit Price	Total Price
<b>Trail Improvements</b>							
1	Asphalt Surface Course (proposed trail) [10' width]	8,400	2" thickness	1,100	TON	\$ 60.00	\$ 66,000.00
2	Asphalt Base Course [proposed trail] (10' width)	8,400	2" thickness	1,100	TON	\$ 60.00	\$ 66,000.00
3	Aggregate Base Course [proposed trail] (10' width + 1' extension)	8,400	6" thickness	1,800	CY	\$ 50.00	\$ 90,000.00
4	Excavation [proposed trail] (10' width)	8,400	10" depth	2,600	CY	\$ 20.00	\$ 52,000.00
5	Trail Markings & Signage			8,400	LF	\$ 1.30	\$ 10,920.00
<b>Subtotal</b>							<b>\$ 290,000.00</b>
<b>Pinch Point #6</b>							
6	Demolition of Pavement/ Excavation	5,350	10" depth	200	CY	\$ 20.00	\$ 4,000.00
7	Concrete Curb and Gutter			520	LF	\$ 45.00	\$ 23,400.00
8	Concrete Sidewalk (proposed) [6' width]	11	4" thickness	65	SF	\$ 5.00	\$ 325.00
9	Remove/Relocate Drainage Inlet			2	EA	\$ 500.00	\$ 1,000.00
10	Curb Ramp			2	EA	\$ 400.00	\$ 800.00
11	Pedestrian Signal Head			4	EA	\$ 5,000.00	\$ 20,000.00
12	Signal Timing Modifications (South Capitol Street + Malcolm X Ave)					inc. in Pinch Point #5	
<b>Subtotal Pinch Point #6</b>							<b>\$ 49,525.00</b>
<b>Pinch Point #7</b>							
13	Guardrail (remove & reset)			410	LF	\$ 30.00	\$ 12,300.00
<b>Subtotal Pinch Point #7</b>							<b>\$ 12,300.00</b>
<b>Pinch Point #8</b>							
14	Demolition of Pavement/ Excavation	3,000	10" depth	100	CY	\$ 20.00	\$ 2,000.00
15	Concrete Curb and Gutter			600	LF	\$ 45.00	\$ 27,000.00
16	Textured Asphalt/Pavers			2,300	SF	\$ 8.00	\$ 18,400.00
17	Remove/Relocate Drainage Inlet			2	EA	\$ 500.00	\$ 1,000.00
18	Intersection Pavement Markings & Signage <sup>1</sup>			1	EA	\$ 5,000.00	\$ 5,000.00
19	Curb Ramp			2	EA	\$ 400.00	\$ 800.00
20	Crosswalk Pavement Marking			4	EA	\$ 200.00	\$ 800.00
21	Pedestrian Signal Head			8	EA	\$ 5,000.00	\$ 40,000.00
22	Street Trees			6	EA	\$ 300.00	\$ 1,800.00
23	Landscaping (Misc.)			1	EA	\$ 500.00	\$ 500.00
24	Signal Timing Modifications (South Capitol Street + Firth Sterling Ave)			1	LS	\$ 5,000.00	\$ 5,000.00
<b>Subtotal Pinch Point #8</b>							<b>\$ 102,300.00</b>
<b>Subtotal</b>							<b>\$ 460,000.00</b>
<b>Phase 4: Supplemental Costs</b>							
25	Drainage and E&S (Moderate - 10%)			1	LS	\$ 46,000.00	\$ 46,000.00
26	Maintenance of Traffic (Moderate - 8%)			1	LS	\$ 36,800.00	\$ 36,800.00
27	Utility Modifications (Moderate - 10%)			1	LS	\$ 46,000.00	\$ 46,000.00
28	Project Approvals & Permitting (Moderate - 8%)			1	LS	\$ 36,800.00	\$ 36,800.00
<b>Subtotal</b>							<b>\$ 1,250,000.00</b>
29	Mobilization (10%)			1	LS	\$ 125,000.00	\$ 125,000.00
<b>Subtotal</b>							<b>\$ 1,380,000.00</b>
30						Construction Contingency (25%)	\$ 345,000.00
<b>Subtotal</b>							<b>\$ 1,730,000.00</b>
31						Design & Planning Cost (Moderate - 20%)	\$ 346,000.00
<b>Total Estimated Cost for Phase 4</b>							<b>\$ 2,100,000.00</b>

## APPENDIX E: DESIGN CRITERIA TABLE

Criteria	Recommended	Recommended Range	Minimum	Considerations
Design Speed	18 mph	12 to 18 mph	12 mph min.	Topography, user volumes and abilities
Trail Width	10-feet	10 to 14 feet At intersections with heavy queuing, widen path to provide additional capacity	8-feet and 6-feet under rare occurrences	Bicycle/ pedestrian user volumes, user safety, maintenance vehicle width (7-ft)
Trail Cross Slope	1%	0.5% to 2%	5% Max per AGODA <sup>1</sup> 2% Max per PROWAG <sup>2</sup>	Topography - Minimum Cross Slope Transitions 5-feet per 1% change in slope
Horizontal Alignment			Min. Curve Radius: 27-feet min. at 12 mph 36-feet min. at 14 mph 47-feet min. at 16 mph 60-feet min. at 18 mph	Topography
Vertical Alignment	0 to 5% slope		5% max any distance <sup>2</sup> 8.3% max up to 200-feet <sup>1</sup> 10% max up to 30-feet <sup>1</sup> 12.5% max up to 10-feet <sup>1</sup> 3% max for unpaved surface trails <sup>1</sup>	Adjacent topography
Stopping Sight Distance	$S = \frac{V^2}{30(f+/-G)} + 3.67V$  S = stopping distance V = velocity (mph) f = friction coeff. (0.16) G = grade (ft/ft)	Per AASHTO Guidelines <sup>3</sup>		Vertical alignment
Clearance (vertical)	10-feet	10-feet or greater	8-feet under constrained conditions	Maintenance & emergency vehicle access
Trail/Road Separation	5-feet	5-feet or greater	Less than 5-feet requires physical barrier railing separation	Roadway speeds adjacent to trail
Trail Buffer	3-feet	3 to 5-feet	Min. 2-feet graded area with max 6:1 slope for clearance from lateral obstructions. Min. 1-foot clearance where railings or fences are used.	Adjacent obstructions
Grading & Drainage (Adjacent to Trail)	Match adjacent topography to greatest extent possible while providing adequate drainage	Provide grading sufficient for sheet flow wherever possible or if necessary a side ditch of suitable dimension on uphill side of trail to intercept slope's drainage. Where necessary provide culvert and catch-basins.		Adjacent topography and drainage conditions
Trail Surfaces	Hard, all weather pavement surfaces (Asphalt or Concrete)			Adjacent facilities to provide universal access, maintenance

<sup>1</sup> U.S. Access Board Architectural Barriers Act Accessibility Guidelines for Outdoor Developed Areas (AGODA) (2007)

<sup>2</sup> U.S. Access Board Public Rights-Of-Way Accessibility Guidelines (PROWAG) (2005)

<sup>3</sup> AASHTO Guide for the Development of Bicycle Facilities (AASHTO) (1999)

